ADB

Technical Assistance Report (Workshop Proceedings)

Project Number: 9308-REG
Regional Technical Assistance
September 2019

International Forum on Low Carbon Development For Cities

Acting Together for Low Carbon, Livable, and Prosperous Cities

Seoul, Republic of Korea, 2–5 September 2019

Key Messages and Outcomes

Asian Development Bank

ABBREVIATIONS

ADB	–	Asian Development Bank
B2B	–	business-to-business
BAU	–	business-as-usual
BRT	–	bus rapid transit
CAREC	–	Central Asia Regional Economic Cooperation
CBI	–	Climate Bonds Initiative
CEA	–	Clean Energy Investment Accelerator
DMC	–	developing member country
EV	–	electric vehicle
GDP	–	gross domestic product
GHG	–	greenhouse gas
GIS	–	geographic information system
GPC	–	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
GPS	–	global positioning system
HVAC	–	heating, ventilation, and air conditioning
ICT	–	information and communications technology
IOT	–	internet of things
LEED	–	Leadership in Energy and Environmental Design
MDB	–	multilateral development bank
MRV	–	monitoring, reporting, and verification
MW	–	Mega Watt
NDC	–	nationally determined contribution
NEDO	–	New Energy and Industrial Technology Development Organization
OECD	–	Economic Co-operation and Development
PPA	–	power purchase agreement
PPP	–	public-private partnership

RETA	–	regional technical assisstance
SDG	–	Sustainable Development Goal
TOD	–	transit oriented development
UNFCCC	–	United Nations Framework Convention on Climate Change

CONTENTS

I. CONTEXT

1. **The Climate Agenda**: The 2030 Sustainable Development Goals (SDGs), together with the Paris Agreement in 2015, have laid out a roadmap for countries to implement comprehensive climate action across all levels and sectors. However, the prospects of developing synergies and co-benefits depend on how far systematic changes get implemented. Cities play an important role because local targets need to be adopted by city-level stakeholders, and successfully implemented thereafter through actions by urban service providers (such as transport, energy, water, and urban housing). All of these are necessary to build thriving communities of households, industries, commercial establishments and the overall ecosystem.

2. The urgency to adopt systemic thinking arises because the Paris Agreement has specified very ambitious targets in terms of global temperature goals: holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change. Additionally, the Agreement aims to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development.[1]

3. Implementing the global targets on climate change is a commitment by all countries through their respective nationally determined contributions (NDCs) and requires complementary actions on two fronts. The first set of actions requires mitigating the harmful effects of excessive fossil fuel consumption taking place in the country. The second set of actions is to build resilience in local communities, so that the gains from economic development are not disrupted through climate-induced disasters (such as sea level rise, storm surges, floods, and droughts).

4. The next big challenge requires measurable sectoral targets to be achieved over the next 10 to 20 years to transform energy, agricultural, urban, and industrial systems that undergird modern economies and today are heavily reliant on fossil fuels as energy sources. Success in achieving each of these targets is influenced by public policies, ongoing technological and social innovations (notably through the digital revolution), and the intensity of engagement by non-state actors and ordinary citizens.

5. The realism of a country's commitment to its NDCs depends on the extent of the detailed articulation of the synergies and co-benefits of climate actions as understood by ordinary citizens, local community, and municipal organizations because local ownership of the global agenda is essential. This complex, systemic focus requires working through both vertical and horizontal alignments of climate and sectoral policies. The former describes seamless collaboration between sectoral ministries, departments, and bureaus to achieve climate goals, and the latter describes the improved delivery of the complement of urban services to citizens, who are the ultimate beneficiaries of climate actions. Achieving the desired climate actions requires implementing public policies that avoid sectoral silos in service delivery and an integrated approach to disaster risk reduction.

6. **ADB Strategy 2030**: The strategy commits the organization to support member developing countries (DMCs) to effectively responding to the SDGs and climate goals, while eradicating extreme poverty and achieving "a prosperous, inclusive, resilient, and sustainable Asia and the

[1] United Nations Convention on Climate Change. 2015. *Paris Agreement*. Paris

Pacific."[2] While the strategy recognizes the importance of green and resilient infrastructure to promote economic growth, it also emphasizes the significance of ensuring inclusive economic growth, such that all members of society benefit equitably. Implementation of Strategy 2030 requires integrating ADB's expertise across sectors and themes, so that the complex challenges of addressing climate mitigation and adaptation are facilitated through systems thinking and cross-sectoral collaboration during implementation.

7. However, several challenges remain. The urban population in Asia is projected to rise to 55%, or about 2.5 billion people living in urban areas, by 2030. Many of these will be young people in search of employment and incomes. This massive increase will put enormous pressures on urban services, affordable housing, and jobs. With the future of work and industrial jobs affected by technology disruptions, the youth face uncertain job prospects because they often lack skills necessary to benefit from the jobs created by the sharing economy. The alternative of working in low-income, informal sector vocations makes the odds very long on whether these persons can break out of urban poverty during their lifetimes. Instead, living in appalling slums and squatter settlements, many urban residents are perpetually poor citizens who face daunting economic, social, and environmental challenges. In 2014, slums in DMC cities housed 431 million persons, and many reside in flood plains of rivers and coastal areas vulnerable to storm surges from typhoons and cyclones.

8. This crush of population, huge increases in the number of cars and two-wheelers bought by a rising middle class, and severe urban infrastructure service deficits have generated severe problems of traffic congestion and air, land, and water pollution in all Asian DMC cities. Environmental degradation affects all sections of society, and, paradoxically, creates political pressures for systemic urban reforms that could be harnessed because the co-benefits to the climate agenda are complementary. These reforms include developing mobility solutions to chaotic traffic, searching for clean energy alternatives, and taking actions to improve the quality of life and well-being for all citizens through green interventions, such as promoting green spaces through urban forestry, parks, and gardens, exploring nature-based solutions, and so on. These pressures have also increased the receptivity of DMC city stakeholders to learn and apply lessons from successful interventions that improved citizens' well-being in the advanced cities of the world.

9. **The Seoul Forum**: The International Forum on Low Carbon Development for Cities was held on September 2-5, 2019, in Seoul, Republic of Korea. It was organized as part of ADB's regional technical assistance project, Promoting Low-Carbon Development in Central Asia Regional Economic Cooperation (CAREC) Program Cities (9308-REG). The forum was organized, and the agenda was designed, in the following context:

10. First, climate-induced impacts result in economic losses that often reverse years of benefits from economic growth and poverty reduction. The Intergovernmental Panel on Climate Change's *Special Report on Global Warming of 1.5°C* has highlighted the urgency of taking mitigative actions that are transformative in nature, so that communities are safeguarded against devastating losses in the future.

[2] Asian Development Bank. 2018. *Strategy 2030 - Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific*. Manila.

11. Second, ADB, as a trusted partner, reliable financier, knowledge provider, and convener of strategic partners, is committed to supporting DMCs as they design and implement programs that tackle climate change and build climate and disaster resilience as the core pillars of ADB's Strategy 2030.

12. Third, engaging at the city level is critical because cities consume 80% of energy and 75% of global greenhouse gas emissions. Already more than half the world's population resides in cities, and in the decades ahead the proportion will continue to grow. The impacts of climate-induced disasters will disproportionately affect communities because of the density of populations and dependence on built infrastructure. Urban systems need to adapt to the changing profile of climate-related risks on geographies and natural resources.

13. Fourth, the Seoul Forum provided a venue to share knowledge on systems thinking, notably by learning how to consolidate efforts that enable national policymakers and city leaders to adopt holistic and integrated approaches to develop climate actions. These included sharing ideas on innovative concepts, solutions, and tools, including the role of social innovations in driving low carbon solutions.

II. KEY MESSAGES FROM THE FORUM

A. Enabling environment for transformative change

"Some of the perceived barriers can be transformed into enablers. … Take the example of the typical city resident. Such a person elects decision makers, is often a deal maker and could in some situations be a troublemaker. Key is for this person to understand the implications of climate change, on how it affects his or her life, and what can be done to address the concerns." — Niclas Svenningsen, UNFCCC Global Climate Action

14. The enabling environment for low carbon transformation requires a suitable policy environment from the national government, along with support from citizens, to implement the transition from a high carbon economy to a zero-carbon city. The challenges arise from the fact that there are no blueprints for such a transformation. Each community needs to develop its own strategy on how to shape and implement a systemwide low carbon transformation because many of the proposed actions may be disruptive in the short run.

15. One part is building an awareness of the emerging opportunities that improve the quality of life and strengthen resilience to future natural disasters through a process of continuously learning and communicating the gains from implementing a low carbon strategy. Cultural and social engagements play a significant role in developing a common understanding of the way ahead.

16. Another part consists of ensuring that planning regulations respond to specific local concerns. For example, promoting e-mobility through electrification of the public transport system could meet resistance from car and two-wheeler owners. Proposed solutions need to provide alternatives that are better than the current arrangement.

17. Cities such as Seoul and Yokohama have been changing the urban narrative from physical redevelopment aimed at addressing deficits in housing and infrastructure services to promoting an urban regeneration that is much more people-focused and describes efforts to improve the quality of life for residents. Equally important is the availability of a transparent reporting and disclosure mechanism on achievements and failures.

B. Solutions for low carbon cities

"Policy and planning actions were required at various levels—at a city government level, at the citizens level, among industrial and commercial enterprises—while formulating a plan to eliminate the greenhouse gas footprint of energy. Shaping low carbon cities is not a self-directed process and requires an integrated approach." — Manfred Fischedick, Wuppertal Institute

18. Clean energy promotion in buildings and transportation is being tested and validated through consumers in more advanced cities through a variety of drivers, ranging from economic reasons, to pressures faced by industries from shareholders, to the growth of the sharing economy. Stakeholders in DMCs can learn about solutions that worked and apply this knowledge to develop city-specific policies.

19. Government policies in DMCs are already favorably disposed to promoting green energy. However, many of the details have to be worked out at the city or industry level. In more

advanced cities, net metering is widely practiced, and successfully promotes clean energy because wind and solar power have become cost-competitive with fossil fuels. Technological advances in ground-based heating are also improving the prospects of clean heating in cities with cold winters, but implementing these programs at scale requires working out the details.

20. Many large multinational corporations with significant presences in developing countries are interested in switching over to clean energy because of shareholder pressure, even if this means investing in distributed systems. These offer opportunities to promote public–private partnerships between the government, electricity distribution companies managing the grid, and off-grid entrepreneurs.

21. Overall, with changes in technology and the digitization of the economy, energy management systems could potentially be a valuable instrument to promote clean energy solutions. In addition, an opportunity exists in developing countries where cities are still being built to introduce best practices that lower the energy footprint while also improving the quality of the stakeholder experience. The major barriers to efficient buildings are institutional and behavioral rather than technical or financial, and these can be tackled through increasing global and cross-sector collaboration through certification programs such as Leadership in Energy and Environmental Design (LEED), customized to local demand.

22. A key driver for promoting low carbon transport actions is widespread local support for mobility reforms in which travel quality attributes (such as convenience) are preferred over personal vehicle usage (a car or a two-wheeler) by city-level stakeholders. With the increased frustration caused by slow-moving traffic and air pollution, many city-level stakeholders can be persuaded to accept the benefits of alternative mobility solutions such as public transportation and pedestrianization, provided the time, cost and health benefits are demonstrably much larger than commuting to and from work in private vehicles.

23. A well-conceived set of mobility solutions fully incorporates the city stakeholders' concerns. For example, Seoul's bus reforms, including route rationalization and dedicated median bus lanes in all radial corridors, were made possible because of credible assurances by the city to all commuters that the resultant changes would improve the quality of the commuting experience. These changes were undergirded by an information and communications technology (ICT) infrastructure that objectively tracks and discloses performance attributes that matter to citizens, such as reductions in commute time, last-mile connections, and better information on overcrowding or availability of empty seats, along with regulatory enforcement, such as photographic enforcement of road segregation, parking reforms, improvements in road safety, and so on.

24. The transition to e-buses or fuel-cell buses is facilitated by the shared economy, made possible by the easy availability of data that could be utilized to mobilize collective action for change to green mobility solutions. Electric vehicle architecture is modular, and 70% of the costs lie in software, establishing charging stations, and swapping batteries. Fleet operations could be much more efficiently managed by subcontracting cost centers to entities best suited to managing specific areas of expertise, upgrades, extended warranties, and so on. Real-time vehicle performance data and analytics can track the effectiveness with which mobility solutions meet demand from citizens.

C. Innovative concepts in finance and technology

"The Climate Bonds Initiative has already established green bonds standards that are well accepted by international investors, leading to the issuance of green bonds worth about $120 billion in eight sectors with potentials for low carbon development." — Alan Meng, Climate Bonds Initiative

25. Significant investments will be required in renewable energy generation, in the automobile sector, in greening the building stock, and in industrial processes that today rely on fossil fuels as energy sources. In addition, hundreds of large plants, notably coal-fired power plants, will have to be shut down before the end of their design life to save on greenhouse gas emissions. Innovations in technology and financing are important to bridge these gaps.

26. ADB estimates that additional funding of $22.5 trillion will be required between now and 2030 to meet emission reductions and adaptation programs in the Asia-Pacific region. The scale of investments needed to honor NDCs greatly exceeds the public finances available. Design of green financing mechanisms is necessary to increase the level of financial flows (from banking, microcredit, insurance, and investment) from the public, private, and not-for-profit sectors to climate-friendly development.

27. While the markets have a lot of liquidity, the reality is that climate investments in developing countries are still perceived as risky unless a set of risk reduction measures calms down investor risk perceptions. Financiers need to integrate climate finance products to develop concrete and viable low carbon investments. Equally important is to develop monitoring and impact assessment methodologies that are acceptable to all stakeholders.

28. The idea of a hydrogen economy replacing the carbon economy as the source of clean energy has been under active policy consideration for more than a century. While the technology has not yet reached a level of maturity to make it competitive with fossil fuels, there are several promising pilots that are demonstrating the possibility of replacing the fuel stock on transportation, stationary sources, and storage. Many more applications are available in the industrial sector, particularly using hydrogen as feedstock for the chemical and steel industries. Fuel cells have several advantages; such cells provide clean and quiet energy. These technologies are also efficient and a stable supply of energy, 24 hours a day, 7 days a week. They can be installed with very limited land compared with photovoltaics and wind farms.

29. The prospects for expansion appear very good as the supply price starts declining. In Japan, the New Energy and Industrial Technology Development Organization (NEDO), a government agency responsible for promoting technology innovations, is supporting the private sector, including original equipment manufacturers, in setting up targets for producing fuel-cell vehicles, with details on how costs will be reduced over time. These include establishing hydrogen filling stations and subsidies to produce fuel-cell vehicles.

30. Overall, with technological breakthroughs, hydrogen is the ideal energy source, but many challenges remain that require substantial government support. Yokohama is a good example of how to promote integrated approaches that engage all stakeholders. Regulatory requirements are critical because technology innovations alone cannot drive the economy.

31. New technologies supported by a digital infrastructure are also opening up several business opportunities in solid waste management. For example, solid waste collection and conveyance system could benefit from blockchain technology, and the solid waste disposal arrangements through advances in in gasification and incineration technologies that are enabling the reuse of methane and other GHGs as renewable energy sources. A remaining challenge is how to recycle rare earths and other high-value materials that are available in electronic equipment but difficult to extract in a cost-effective manner.

D. Tools and data for low carbon actions

"An important intervention in Seoul was substantial investments in Information and Communications Technology (ICT) infrastructure to integrate city level sectoral datasets for improving the effectiveness of infrastructure service delivery, notably the quality of mass transit systems in the city."— Sangbum Kim, Vice Mayor of Seoul Metropolitan Government and Deputy Secretary General of CityNet

32. ICT tools can help urban policy makers, planners, and city-level stakeholders get a better appreciation of how to promote low carbon development. Low carbon outcomes are measurable utilizing tools such as the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories* (GPC), which quantifies the various sources of carbon emissions, works with city stakeholders to establish sectoral and sub-sectoral objectives, and tracks and discloses to what extent the planned objectives were in fact achieved. New York City has been implementing a low carbon development plan since 2007, with the eventual reduction of emissions by 30% by 2030 compared with the 2007 baseline. There are also sectoral level digital data platforms that provide a complementary function. For example, in many countries energy management systems have been established as digital platforms that provide data analytic support and compliance tracking of the extent to which energy systems have been optimized. An energy management system could incentivize organizations to achieve targets and benchmarks considered important for policy.

33. Overall, open access to data greatly enlarges the understanding of communities, investors, and local firms in the potential for improving performance at the city level in terms of achieving low carbon outcomes. With the ubiquity of low-cost sensors, digital data platforms are able to collate data from rain gauges, wind stations, and rivers to develop forecasting models to manage disaster risks as well as develop disaster response strategies. The example of Mobike illustrated how sensors connected through the IOT, combined with big data analytics, enabled the roll-out of last-mile connectivity by providing bicycles for hire in cities.

34. Big data analytics has obvious advantages for low carbon planning and implementation, but an essential element is to collaborate with the government. However, the government should take care not to "over supervise" for the business to thrive. Encouraging open data platforms is also important so that there is maximum transparency and data applications promote energy efficiency while also protecting individual privacy.

35. One of the successful tools the Seoul Metropolitan Government uses to maintain open communications between the city government and communities is a framework for open communications, both online and offline. This multichannel communication has strengthened citizen engagement in Seoul. It has strengthened the role of social innovations in promoting low carbon development, and promoted a two-way dialogue between the Seoul Metropolitan Government and the community with websites, radio stations, billboards, and subway and bus

advertisement spaces that had been previously used exclusively to inform and promote the municipal government's work to citizens.

36. Social innovations at the community level play a very important role, such as building ownership of the agenda, notably by ensuring that local priorities and concerns are fully reflected in a climate action plan. The experience from the Jakarta urban climate village program in Indonesia indicated that a road map for reduction in GHG targets at the *kampung* (village) level leads to hundreds of local champions at the *kampung* or neighborhood level who help the local communities internalize behaviors that are good for the climate while also greening the communities.

37. Damage and destruction to infrastructure because of natural events is estimated at $390 billion a year, which implies that a substantial part of the built infrastructure in cities is already exposed to weather-related risks. In the future, this exposure will only grow. An alternative strategy of building resilience could pay off handsomely. Resilience is not just the physical resilience of built structures but also the social and institutional aspects of resilience. Equally important is to undertake a comprehensive risk assessment that includes measures to reduce risks and manage residual risks in a sustainable manner.

38. In Rotterdam, The Netherlands, for example, only 40% of the urban area is public space. The city adopted an integrated approach that combines interactive modeling with intensive citizen consultations to balance the blue (water) and green (climate mitigation) agendas. These have included utilizing rooftops to slow down the flow of water to the ground, 'water squares' that combine functions aimed at retaining water when there is heavy rainfall, while also retaining the areas as public spaces when the water has drained. In this context, various adaptation support tools are available for urban land and water management. The models enable planners to undertake flood hazard analysis and identify mitigative measures, including how large the sponge area should be and including other ecosystem-based adaptation measures that could be recommended. These include the integration of nature-based solutions that are more suitable for climate adaptation than investing in gray infrastructure (such as pipes and concrete).

III. WORKSHOP AGENDA AND SUMMARIES OF INDIVIDUAL SESSIONS

A. Workshop agenda

Day 1 : 2 September 2019, Monday

08:00 – 09:00 *Registration of Participants*

09:00 – 10:00 **Opening Plenary**

High-level officials from the host country and supporting organizations will set the scene depicting the relevance of low carbon city development to the Climate Change Agenda and recent developments in global low carbon policies relevant to Asian Development Bank (ADB) developing member countries.

Welcome Remarks

- **Won-soon Park**, Mayor of Seoul Metropolitan Government (via video) with a short introduction by **Ambassador Yim Geun-hyeong,** Seoul Metropolitan Government

Opening Remarks

- **M. Teresa Kho,** Deputy Director General, East Asia Department, Asian Development Bank
- **Vijay Jagannathan,** Secretary General of CityNet

Keynote Speeches

- **Manfred Fischedick**, Vice President, Wuppertal Institute
- **Niclas Svenningsen**, Manager, UNFCCC Global Climate Action

10:00 – 10:20 *Coffee/Tea Break*

10:20 – 12:00 **Session 1: Roundtable on Enabling Environment and Challenges for Integrated Systemwide Low Carbon Transformation**

Moderator: **Ralf Schüle**, Co-Head of Research Unit Urban Transitions of the Wuppertal Institute, Wuppertal Institute for Climate, Environment, Energy

Presentations on Transformation Efforts

- Creating New Opportunities Driven by Coal Phase-Out (Energy Transformation, Industry/Economic Structure Changes, etc.) by **Ralf Schüle**, Co-Head of Research Unit Urban Transitions of the Wuppertal Institute, Wuppertal Institute for Climate, Environment, Energy
- Toward a Low-Carbon City: Seoul's Integrated Approach by **Sangbum Kim**, former Vice Mayor of Seoul Metropolitan Government and Deputy Secretary General of CityNet
- Moving Toward Cities of the Future: City Level Cooperation Toward Smart City Development by **Toru Hashimoto**, Executive Director on Development Cooperation, City of Yokohama
- Green Circular Cities Coalition by **Yun (Yvonne) Yang**, Program Officer, ICLEI-Local Governments for Sustainability, East Asia Secretariat

Moderated Discussion

- **Xuedu Lu,** Lead Climate Change Specialist, East Asia Department, ADB
- **Giovanni Capannelli**, Country Director at Kazakhstan Resident Mission, ADB
- **Manfred Fischedick**, Vice President, Wuppertal Institute
- **Niclas Svenningsen,** Manager, UNFCCC Global Climate Action
- **Shu Zhu,** Regional Director & China Representative, ICLEI East Asia Secretariat
- **Bi Lei,** Director, Digital Economy Department, Shenyang Municipal Development and Reform Commission

Rapporteur's Summary

12:00 – 13:15 *Lunch Break*

13:15 – 14:45 **Session 2: Clean Energy and Sustainable Buildings for Low Carbon City**

Moderator: **Chun Xia-Bauer,** Coordinator for International Energy Policy and Systems Transition, Wuppertal Institute for Climate, Environment, Energy

- Renewable Energy Policy in Mongolia: From FIT to Auction by **Jambaa Lkhagva,** Energy Regulatory Commission, Mongolia
- Clean Energy Investment Accelerator by **Evan Scandling**, Director of Advisory & Business Development - Southeast Asia, Allotrope Partners
- Multi-Energy Systems by **Mikael Jakobsson**, Executive Director, Asia Pacific Urban Energy Association
- Development of Green Energy in Fengxi New City, Xi'an by **Liu Hongtao**, General Manager of Energy Development Company of Fengxi New City, Xixian New Area, Shaanxi Province
- Green Buildings for Everyone Within This Generation by **Andy To,** Managing Director, North Asia, U.S. Green Building Council & Green Business Certification Inc.
- Sustainability in Action: BROAD's Low Carbon Life and Technologies by **Juliet Jiang**, Senior Vice President, BROAD Group, PRC

Discussion and Rapporteur's Summary

14:45 – 15:00 *Coffee/Tea Break*

15:00 – 16:15 **Session 3: Low Carbon Transport Options in Mega-Cities**

Moderator: **O.P. Agarwal**, CEO, World Resources Institute (WRI) India

- Seoul Transport Reform – Policy and ICT by **Ki-Joon Kim**, Principal Transport Specialist, Transport Sector Group, Sustainable Development and Climate Change Department, ADB
- Greening the Fleet by **Ching Yuen (Joseph) Ma**, Deputy General Manager, Shenzhen Bus Group Co., Ltd.
- Hydrogen Buses by **Alan Kneisz**, Business Development Director, Hydrogenics Corporation
- A Segmented Approach to Clean Mobility Solutions for 1.2 Billion+ Indians by **Sanjay Krishnan**, Co-Founder and CEO, Lithium Urban Technologies
- Pedestrian Policies and Practices of Seoul by **Junsoo Ahn**, Deputy Director, Sidewalk Management Team, City of Seoul

Discussion and Rapporteur's Summary

16:15 – 17:30	**Session 4: How ICT-Based Systems Encourage Low Carbon Development** Moderator: **Kim Sangbum**, former Vice Mayor of Seoul Metropolitan Government • Greenhouse Gas Data Management for Cities by **Wee Kean Fong,** Deputy Director, WRI China • Smart Energy Management Systems by **Mikael Jakobsson**, Executive Director, Asia Pacific Urban Energy Association • Pudong Flood Early Warning System by **Weijun Zhang**, Founder, Ewaters Environmental Science & Technology • Sustainable City with Mobike by **Qin Hao**, Senior Sustainability Expert, Meituan Bike Discussion and Rapporteur's Summary
17:30 – 18:30	Bilateral Meetings/Evening Break
18:30 – 20:00	Evening Reception Hosted by Asian Development Bank **M. Teresa Kho**, Deputy Director General, East Asia Department, ADB
Day 2：3 September 2019, Tuesday	
9:00 – 10:15	**Session 5: Roundtable on Green Finance and Innovative Financing** Moderator: **Sujata Gupta**, Director, East Asia Department, ADB • Setting the Scene – Climate Finance Needed to Reach the Paris Target by **Niclas Svenningsen**, Manager, UNFCCC Global Climate Action • Climate Bonds Initiative: Green Bond for Low Carbon City Development by **Alan Meng**, Green Bond Analyst, Climate Bonds Initiative • Financing Energy Efficiency in Europe and U.S.A. by **Matthew Ulterino**, Programme Manager, UNEP Finance Initiative • Innovative PPP Models for Republic of Korea's Transport Projects by **Hyeon Park**, Dean and Professor, International School of Urban Sciences, University of Seoul Discussion and Rapporteur's Summary
10:15 – 10:30	*Coffee/Tea Break*

10:30 – 11:45 **Session 6: Advanced Low Carbon Technologies**

Moderator: **Toru Hashimoto**, Director, Development Cooperation Department, City of Yokohama

- Hydrogen Economy – Urban Hydrogen Concepts in Transport, Energy, Building (Fuel Cell CCHP), and Industry in Germany by **Manfred Fischedick**, Vice President, Wuppertal Institute
- Fuel Cells as a Clean Distributed Generation Solution by **Hoon Sub Song**, Deputy General Manager, Business Strategy Team, Doosan Fuel Cell
- Funding and Support for Deployment of Hydrogen and Fuel Cells – Japan's Perspective by **Eiji Ohira**, Director General, Fuel Cell and Hydrogen Technology Group, New Energy and Industrial Technology Development Organization (NEDO)
- Yokohama's Hydrogen Societies Initiatives by **Yuki Murai,** Manager, Project Promotion Division, Climate Change Policy Headquarters, City of Yokohama
- Waste-to-Energy for Cleaner Fuel, Power, and Heat by **Henrik Selstam**, CEO, ScandGreen Energy

Discussion and Rapporteur's Summary

11:45 – 12:45 *Lunch Break*

12:45 – 17:30 **Site Visit: Seoul Energy Dream Center**

Eco Tour with Stories (14:00 – 16:00)

- Energy Dream Center—solar facility, geothermal and rainwater facility, etc.
- Hydrogen Station - introducing the principles of hydrogen fuel cells and hydrogen cars
- Mapo Resource Recovery Facility – features resource recycling, waste recycling process and junk arts

Day 3: 4 September 2019, Wednesday

09:00–10:15 **Session 7: Climate Adaptation**

Moderator: **Virinder Sharma,** Senior Urban Development Specialist, Sustainable Development and Climate Change Department, ADB

- Blue-Green Solutions in Sponge Cities and Roofscape Program in Rotterdam by **Thuy Do**, Adviser, Water Strategy and Development, Municipality of Rotterdam
- Adaptation Support Tool and Urban Land and Water Management by **Frans van de Ven**, Team Leader, Urban Land & Water Management, Deltares
- Synergies Between the Green and Blue Agendas by **Vijay Jagannathan,** Secretary General of CityNet and Senior Fellow, WRI
- Good Practice Guidelines on Climate Resilient Infrastructure Design and ADB's Climate Risk Management Efforts by **Arghya Sinha Roy,** Senior Climate Change Specialist, Sustainable Development and Climate Change Department, ADB

Discussion and Rapporteur's Summary

10:15 – 10:30 *Coffee/Tea Break*

10:30 – 11:45 **Session 8: Social Innovation for Low-Carbon and Sustainable City Development**

Moderator: **Niclas Svenningsen**, Manager, UNFCCC Global Climate Action on Setting the Scene and Climate Neutral Now

- Co-creation for Urban Renewal - Experience from China by **Ling Huang**, Professor and Doctoral Supervisor, Faculty of Architecture & Urban Planning, Chongqing University
- Green Zone and Climate Village in Jakarta by **Aisa Tobing**, Senior Adviser to the Governor of Jakarta, Deputy Secretary General, CityNet
- National GHG Reduction through Hooxi by **Youree Lee**, Co-Founder & CEO of W-Foundation and CBO of PeerTec
- Building Urban Resilience of Vulnerable Communities: UCCRTF Experience by **Virinder Sharma,** Senior Urban Development Specialist, Sustainable Development and Climate Change Department, ADB
- Socially Inclusive Low-Carbon Motivation Mechanism by **Wang Wenqiang,** President of Jiangxi Sino-Carbon Technology Co., Ltd.

Discussion and Rapporteur's Summary

11:45 – 12:15	**Session 9: Low Carbon Pilot City Efforts** Moderator: **Wee Kean Fong**, Deputy Country Director, WRI China • Changsha-Zhuzhou-Xiangtan Cluster Low Carbon Development Efforts by **Allen Zhang**, President, Hunan Innovative Low Carbon Center and ADB Consultant for Changsha-Zhuzhou-Xiangtan Cluster • Xiangtan Low Carbon City Sector Development Program by **Na Won Kim**, Senior Environment Specialist, East Asia Department, ADB • Ulaanbaatar Low Carbon Development Efforts by **Zolzaya Enkhtur**, Climate Change and Project Management Consultant for Mongolia, ADB • Clean Technology Fund Project Implementation by **Kenzhekhan Abuov**, Project Officer, ADB Resident Mission in Kazakhstan • Nur-sultan Low Carbon Development Efforts by **Aigerim Akiltayeva**, Climate Change and Project Management Consultant for Kazakhstan, ADB
12:15 – 12:20	Closing Remarks **Sujata Gupta**, Director, East Asia Department, ADB
12:20 – 13:20	*Lunch Break*
13:20 –17:00	**Site Visit:** • **Seoul Traffic Operation and Information Service** – Seoul Intelligent Transport System including smart card, bus management system, bus information system, Seoul-style BRT • **Cheonggyecheon Stream Walk-about** – This urban renewal project was the catalyst of revitalization in downtown Seoul. Cheonggyecheon became a center for cultural and economic activities.
Day 4: 5 September 2019, Thursday	
	Site Visit:
08:00 – 12:00	• **Seonam Sewage Treatment Center** – Unique wastewater treatment technologies that result to high methane content, biogas and biomethane plants from sewage
14:00 – 17:00	• **Sudokwon Landfill Site** – Eco-friendly landfill management, landfill gas electicity generation, leachate treatment, Dream Park

B. Summaries of individual sessions

39. **Won-soon Park**, mayor of Seoul Metropolitan Government, welcomed participants to the forum and described the various ways Seoul has shared its policymaking process, experience, and know-how on intelligent transportation, water supply, sewage, and energy with cities around the world, particularly those in developing countries (via video). The International Forum on Low-Carbon Development for Cities that ADB is organizing was a great opportunity for participants to learn how Seoul Metropolitan Government implemented such a comprehensive program. Mayor Park welcomed the idea of building an international network that champions low carbon, livable, and prosperous cities that responded to urban development, environment, and climate change challenges. He thanked ADB for the efforts put in to make this event happen and wished all participants a very productive stay in Seoul.

40. **Ambassador Geun-hyeong Yim**, Seoul Metropolitan Government, elaborated on the messages from Mayor Park. Seoul used to have many urban problems, even as late as the 1980s, some of which are quite typical of developing cities of Asia. The city administration had to simultaneously tackle many challenges brought about by the growth in urban population as a result of the dramatic economic development in Korea. For example, many residents were living in substandard housing, there were severe traffic congestion problems, and air and water pollution affected the health and well-being of citizens, apart from causing environmental damage to the wider ecosystem.

41. The experience had three important lessons: strong political will was necessary to support systematic planning, intensive community engagement ensured that the population endorsed the development strategy, and public–private partnerships generated the scale of investments necessary to serve the urban economy. An example of the three aspects coalescing was the demolition of a heavily used freeway that was generating air pollution in the central business district and its replacement by the Cheonggyecheon River, which provides a sylvan environment at the heart of the city. The important lessons from this example are that actions to reduce air pollution and congestion require political leadership; short-term disruptions that citizens face can be managed if these stakeholders are persuaded of the long-term benefits in terms of improvements in their quality of life. A key requirement was to develop mobility solutions that were superior to utilizing private cars on the earlier freeway. Yim welcomed participants to join the various site visits Seoul Metropolitan Government had organized so that they could observe first-hand on how various challenges were addressed.

Opening remarks

42. **Sujata Gupta**, director for Sustainable Infrastructure, East Asia Department, ADB, welcomed participants to the forum. She complimented the host city on the various low carbon innovations visible on the drive from the airport, such as a wind turbine, the bus rapid transit system, and just the ability to breathe clean air. Participants could not only benefit from the successes but also learn from the errors of the past. She described how, in recent decades, the Asia-Pacific region has experienced significant increases in the number, intensity, and impact of extreme weather events. These climate-induced impacts resulted in significant economic losses and reversed years of economic gains in these countries. Current trends in emissions will take us beyond the 1.5°C limit, leading to irreversible losses to fragile ecosystems around many cities. Transformative actions that foster an integrated approach to tackle both the mitigation goals and enable cities to build resilience at the required scales require a different quality of governance and policymaking than in the past.

43. Asia has the world's largest cities; the trend toward urbanization in Asia will add another 1.3 billion people to the 2.2 billion people already living in cities around the world and contribute to disproportionately high greenhouse gas emissions. To avoid jeopardizing economic growth and pursuing sustainable and inclusive growth, cities in DMCs should be moved into low carbon development pathways. This will help the DMCs achieve their NDCs and perhaps even do better. Cities among DMCs are exposed to climate risk because many are in coastal or low-lying areas that are adversely affected by climate shocks, such as extreme weather events (floods, droughts, storm surges, sea level rise, etc.).

44. Participants in this forum are in leadership positions, and therefore could benefit from the sessions as well as the site visits that were designed with the support of the Seoul Metropolitan Government. While low carbon transformation is a long-term process, consolidating efforts from all actors in a society can expedite the process. Holistic and integrated approaches that transcend sectoral silos to achieve the desired reductions in carbon footprints are recommended. Applying systems thinking that recognizes the complex, interrelated nature of policies and carbon impacts is necessary for achieving low carbon city transformation. Gupta then thanked the Seoul Metropolitan Government, CityNet, and all other contributors for their valuable inputs to the forum.

45. **Vijay Jagannathan**, secretary general of CityNet, explained that after the Paris Climate Agreement, many national leaders are appreciating the importance of localizing climate change through appropriate policies and investments. Even as late as 2017, 80% of energy was derived from fossil fuels. Cities are driven by energy consumption, not only directly in the form of coal-based electricity generation, but also indirectly, in the use of refined petroleum products that fuel cars, buses, and trucks. Although renewable energy is becoming important, the reality is that it is barely 5% of the total energy consumed by human consumption, industrial production, and transportation.

46. How can carbon dependency be reduced from this 80% reliance on fossil fuels to a level that is in line with the global 1.5°C pathway by 2030 (that the global greenhouse gas emissions should be about half of the current levels), which is barely 10 years away? This is made more complicated by the fact that cities in Asia are growing richer, and communities are buying two-wheelers, cars, and electrical appliances and building new homes, which add to total energy consumption. The answer lies in localizing discussions of energy use, so that citizens take the leadership in developing solutions. No matter if it is climate change or SDGs, when the issues are localized, citizens can begin appreciating the economic benefits of proposed changes, whether these promote climate mitigation or build resilience to future events.

47. On the positive side, lowering of costs is taking place in wind, solar power, and energy storage devices. New developments are accelerating the relevance of modern technologies. Rooftop solar has become competitive. Battery storage, electric cars, and innovations in heating technology and in building energy efficiency have become viable business opportunities. Another positive sign is the benefits of the digital revolution. Digitization leads to better management because data can be objectively collected, analyzed, and disclosed. It can assist with the design of measures to promote energy efficiency, with the undertaking of planning measures that promote a city-wide transition from high carbon to low carbon economic activities (notably in urban transportation), and finally support a decarbonization program that drastically eliminates the role of fossil fuels between 2030 and 2050. Cities in many countries belonging to the Organisation for Economic Co-operation and Development (OECD), such as Seoul, are

already transitioning to low carbon urbanization while ensuring a better quality of life for their citizens. One can be reasonably optimistic that total decarbonization in these cities between 2030 and 2050 is feasible. There is no reason why participants at the forum cannot aspire to similar goals for their cities.

Keynote speeches

48. **Manfred Fischedick**, vice president, Wuppertal Institute, and **Niclas Svenningsen**, manager, United Nations Framework Convention on Climate Change (UNFCCC) Global Climate Action, delivered keynote speeches. Fischedick recalled his past visits to Seoul as a member of the Seoul International Energy Advisory Council established by Mayor Park six years ago. Those visits enabled him to get a better understanding of the transition process of a city toward a low carbon pathway, as exemplified by Seoul. He also complimented the quality of discussions on low carbon transformation needs and challenges that took place at the CAREC forum in Beijing, China, in December 2018.

49. One of the messages was the importance of recognizing that policy and planning actions were required at various levels—at a city government level, at the citizen level, among industrial and commercial enterprises— while a plan was being formulated to eliminate the greenhouse gas footprint of energy. Shaping low carbon cities is not a self-directed process and requires an integrated approach. While the urgency of actions cannot be understated, changing the energy system requires systematic planning and implementation over the next few decades. More integrated approaches require the resolution of conflicts, after understanding the trade-offs in promoting low carbon development. These can be resolved in a culture that promotes continuous learning among all stakeholders because there is no blueprint available.

50. Shaping the transition process requires a new form of thinking or management that incorporates various perspectives of city-level stakeholders. It would be helpful to build synergies with the SDG dialogues because many of the issues are common, particularly, appreciation of the key role played by cultural and social processes. For example, to keep global warming to 1.5°C, climate protection has come back into the political agenda because of the heightened awareness among young people.

51. Equally significant is the remarkable technological progress in renewable energy generation, with waste-to-energy projects and wind energy costs becoming competitive with fossil-fuel-based electricity generation.

52. Climate protection actions need to be harmonized with other sustainable development goals, so that cities become resilient, livable, and inclusive. The best place to start is to understand the cultural perspectives (*Eigenart* in German) that define specific characteristics of each city, because these define underlying values, how economic power is distributed, the extent of social cohesion, and the ease or difficulty in achieving a low carbon vision.

53. Svenningsen described his role as working with *non-party* stakeholders such as the private sector, cities, and civil society to achieve global climate action targets established by the Paris Agreement. This blueprint for global climate action aims to keep global warming below 2°C above preindustrial levels, with the target of keeping global warming within 1.5°C if possible. Achieving the ambitious targets set for 2030 and 2050, respectively, requires deep transformation in how we build our cities, how we produce energy, how we manage waste, how we organize transport, and how we support industrial transformation. Such a transition requires

an “all-hands-on-deck” approach, with citizens, public officials, civil society, industries, and services all working together.

54. Some perceived barriers can be transformed into enablers. Take the example of the typical city resident. Such a person elects decision makers, is often a deal maker, and could, in some circumstances, be a troublemaker. It is key that this person understand the implications of climate change, how it affects his or her life, and what can be done to address concerns. Education, training, public access to information, and participation are fundamentally important to secure citizen support, so that a successful transition to a low carbon pathway will take place.

55. A second requirement is to build collaboration among the various stakeholder groups, which often function in sectoral silos. Cross-sectoral cooperation is necessary for implementing a systematic approach that tracks how actions in one sector can impact another sector through spillover effects. For example, solutions for clean transport work well when urban mobility planning, road safety, and bus charging stations have been implemented as a part of an e-transportation program.

56. A third enabler or challenge is in selecting an appropriate time horizon. Reshaping a city’s climate profile requires several years of implementation of well-thought-out plans. If these programs are dictated by the exigencies of annual budgets focusing on annual budget cycles, the likelihood of achieving long-term low carbon goals becomes unpredictable. The New Climate Economy report has estimated that transitioning to a low carbon sustainable grow path could deliver a direct economic gain of $26 trillion dollars up to 2030, compared with a business-as-usual scenario, in 65 million new low carbon jobs. Subsidy reform—removing fossil fuel subsidies and adding carbon pricing—is estimated to add an estimated $2.8 trillion in increased government revenues. This is more than the total gross domestic product (GDP) of India today.[3]

Summaries of Individual Sessions

Session 1: Roundtable on enabling environment and challenges for integrated systemwide low carbon transformation

57. The moderator of the first session, **Ralf Schüle**, welcomed the speakers, who shared their perspectives on what is meant by adopting a systems approach to promote low carbon cities. He explained that a systems approach has two aspects. The first aspect is learning about how infrastructure and technologies can be connected for low carbon development for which actors need to collaborate with each other—government, nongovernment actors, and the private sector can be incentivized to collaborate systematically with each other. The other aspect is for systems to have resilience to adapt to a changing world and to emerging and unanticipated crises, both climate and other local concerns such as housing shortages, pandemics, and pollution, to name just a few.

58. **Sangbum Kim**, vice mayor of the Seoul Metropolitan Government until 2013 and currently deputy secretary general of CityNet, shared his experiences serving the city for 30 years. In the 1950s, after the Korean War, Seoul city had a population of 1 million, but today it is 10 times the size. The dominant theme in the first three decades was urban redevelopment to meet the

[3] Data cited from: The Global Commission on the Economy and Climate (2018) Unlocking the inclusive growth story of the 21st Century: Accelerating Climate Actions in urgent times.

business and housing needs of the fast-expanding city. While the focus was on redeveloping the cityscape to a modern city, much of the cultural and built heritage was unfortunately lost in the planning and implementation process. By 2000, the pattern of urban development appeared unsustainable: commuting time had increased for all citizens and traffic congestion and severe air pollution affected the quality of life of urban residents.

59. The city thereafter began focusing on urban regeneration rather than urban redevelopment. As many as 131 projects were launched, aimed at improving the quality of life and the physical environment for Seoul residents. A second intervention that played a catalytic role was substantial investments in ICT infrastructure to integrate city-level sectoral datasets for improving the effectiveness of infrastructure service delivery, notably the quality of mass transit systems in the city. A third example, which Kim described as a vertical integration approach, was the "*one less nuclear plant*" campaign, which promoted renewable energy and energy efficiency as a way to reduce the city's energy consumption by 6 million tons of oil equivalent and achieve 20% energy independence at the local level. Lessons from these three examples have been incorporated in the current focus to develop integrated solutions that utilize a digital platform to monitor objectively how far low carbon outcomes from transport, energy, water and waste management programs go to meeting agreed goals for greenhouse gas reductions.

60. The second presenter, **Toru Hashimoto** of Yokohama, proposed that while growing cities face common problems of air and water pollution, waste management, traffic congestion, smell, etc., transformational changes are necessary if a city is to respond to new challenges and investment opportunities. For example, like Seoul, Yokohama faced a rapid increase in population from the 1950s and a decline in jobs in some of the traditional industries (ship building, heavy engineering, etc.) that had provided many of the high-paying jobs. City leaders had to articulate transformative solutions for urban regeneration. Six projects were identified to fast track these solutions. Three of these redevelopment projects were in the center of the city and attracted large enterprises such as Nissan, LG, and other multinational corporations. Minato Mirai served as the anchor of the redevelopment process, and today has become an internationally recognized convention center. In the north, Kohoku New Town was incrementally developed, and in the south, the Kanazawa area was developed for mixed use, including an amusement park.

61. Yokohama has promoted city-to-city and business-to-business collaboration in the Asia-Pacific region through its international liaison department, Y-Port, and the Yokohama Urban Solutions Agency. Hashimoto explained that there is no universal approach to low carbon development in cities because people's attitudes, local government structures, and municipal and national laws differ widely from country to country. However, through city-to-city collaboration, Y-Port develops a reference point on a city's top priorities for which Yokohama businesses can contribute sustainable solutions. For example, the city of Cebu in the Philippines faced a significant solid waste problem, and Y-Port was able to connect the city with waste to energy firms that invested in low carbon solutions acceptable to Cebu. The key point was that the way of handling urban issues in a "smart way" required developing a master plan with Cebu city officials and delivering results on the ground.

62. **Yun (Yvonne) Yang** of ICLEI - Local Governments for Sustainability described how integrated systemwide transformation can take place by promoting circular economy ideas. She gave the example of rooftops in office buildings in The Netherlands that have been repurposed for urban agriculture. Farm produce is purchased conveniently by the office workers from the building itself, and thereby reduces the carbon footprint of shipping produce from farms to stores,

and the travel costs of shoppers. However, she pointed out that there were still many institutional challenges because laws and regulations were rigid about how food wastes should be thrown away once past the mandated expiry dates. Food wastes have the potential of being transformed into a valuable resource if circular economy ideas are incorporated in the legislation so that food wastes can be mined to extract valuable resources. She gave the example of a nongovernmental organization WaterNet, which has been extracting phosphates from wastewater and using these for fertilizers. This successful pilot program triggered discussions on changing household sewage collection systems from just capturing wastewater to extracting resources of economic value.

63. One policy challenge in promoting systems thinking for circular economy promotion is the difficulty in getting various government departments to work together. Collaboration, leadership, and organizational changes are required to connect all dots. ICLEI has promoted the Green Circular Cities Coalition for identifying challenges and finding solutions that focus on developing road maps for renewable energy and resource recycling. Peer learning, mentoring, and capacity-building support are all required.

64. Five panelists—Giovanni Capannelli, Xuedu Lu, Manfred Fischdeick, Niclas Svenningsen, and Shu Zhu—briefly shared their insights on the ideas presented by the speakers.

65. **Capannelli** described how ADB is helping the city of Nur-Sultan in Kazakhstan launch a city-wide low carbon strategy. In his view, a systems approach is feasible when the city leaders have figured out the level of ambition and how to integrate various sectoral efforts and have effectively communicated the strategy being pursued to residents. His advice to the *Akimat* is to be bold and set ambitious targets, such as the city aiming to achieve 100% decarbonization by 2050. Thereafter, city leaders need to incentivize sectoral institutions to work differently, and in particular, to leverage existing institutions. For example, the Kazakhstan government has established the Astana International Finance Center as a finance hub for infrastructure investments. The Astana International Finance Center can attract the required international expertise only if the quality of life in the city meets international benchmarks. On the third point of communications, civil society organizations and nongovernmental organizations need to be engaged in the decision-making process on how to mobilize technologies and funding based on the information available.

66. **Lu** suggested that any low carbon plan needs to be preceded by strong political will that lays the groundwork for planning a low carbon strategy. Working out details of the enabling environment with appropriate policy reforms could be followed by developing a road map on how to expand low carbon investments. Performance needs to be objectively monitored, along with adequate training for officials and the public.

67. **Fischdeick** suggested that for a systems approach, ambitious low carbon targets need to be set, a road map on how to achieve targets established, and progress in terms of achieving short-term and long-term goals closely monitored. Low carbon city development could benefit through synergies with other similar programs, such as circular economy development and any ongoing “smart city” initiatives. There are benefits from learning from pilot programs to scale up and encourage active participation by enterprises and companies as a part of the transformation process. Another key requirement is retaining the narrative of promoting low carbon, livable, and prosperous cities through excellent cooperation between local and national levels of government.

Session 2: Buildings

68. **Jambaa Lkhagva** of the Energy Regulatory Commission, Mongolia, spoke about the renewable energy policies of the country. Mongolia has set a target to reduce greenhouse gases by 14% by 2030. Mongolia is abundant in renewable energy sources, especially wind and solar, and given the availability of land, could potentially greatly expand wind and solar power. One of the challenges is to quickly substitute renewable energy for coal that currently provides the feedstock for electricity and for heating. Changes in procurement systems and introduction of net metering are expected to greatly improve the offtake of renewable energy in the country.

69. **Evan Scandling** of Allotrope Partners spoke about the Clean Energy Investment Accelerator (CEA) program, which recognizes that while national governments and city governments have substantial renewable energy goals, there are other drivers, such as commercial and industrial demands for clean energy. The CEA supports actions that complement policy decisions aimed at promoting clean energy by enlarging the renewable energy market by tapping unmet demand. For example, in Vietnam about 50 gigawatt hours of installed power generation capacity needs to be doubled over the next 10 years. The situation is similar across developing countries. The demand for clean energy is also growing because many of the corporate enterprises are not only large energy users but also being instructed by their boards to green their production process. The CEA functions as an intermediary to help these firms procure more and more renewable energy supply in cities mediated through governments' renewable energy programs.

70.The CEA's work can be summarized as three Ps. The first P describes the purchaser—who is purchasing the electricity, who is using that electricity, and who is willing to transition from fossil fuel-based power to green power. These are corporations, industrial parks, factories, shopping centers, etc. The CEA convenes a renewable energy buyer group that brings together these corporations that are learning about their menu of options and helps them procure renewables in that country. The second P is the renewable energy project developers and investors, and the third P describes the policy maker—government entities that are responsible for renewable energy policy. For example, in Vietnam the demand for green power from the corporate sector is high, but the current electricity market is not conducive to rapid expansion to green power. The CEA has engaged the government to work out a better mechanism for increasing the supply of green energy. For example, off-site wheeling renewables from the solar power plant or a wind plant in one province, situated many kilometers away from the demand source (a factory wanting to increase green power usage). So far approximately 300 MW of off-site B2B PPA deals were concluded. There is a draft policy for rooftop solar, which has been submitted to the government. At the start of 2019 there was about 20 megawatts (MW) of rooftop solar in the country. The generation has expanded to 200 MW and is expected to grow to 500 MW by the end of 2019.

71.The CEA has a 10-step process that begins by reviewing potential sites, analyzing electricity data, providing support through the feasibility study process, and documenting the key requirements for the procurement process. The aggregation leads to good results; in Columbia, aggregating industry buyers for sourcing rooftop solar power led to a 24% cost reduction that could not have been obtained if firms had adopted a one–by-one process.

72. **Mikael Jakobsson** from Smart Energy Management Systems described the Asia-Pacific Urban Energy Association as an interlocutor between member companies and local governments on energy issues. By 2030, more than 60% of the people will live in cities, and the

question is how smart district energy systems can be promoted while leveraging digitalization and electrification. Some characteristics important for the energy systems include: flexibility, in terms of response to different amounts of electricity demand, and ability to be flexible in terms of development over time; intelligent control systems for energy management that use good underlying engineering concepts; and integration of different aspects such as heating, cooling, power, gas, etc. The energy systems should also be fully engaged with urban planning processes. Smart energy systems should also be efficient, reliable, and safe. The multidimensional nature of smart energy systems also brings into focus the increasing relevance of distributed heating and power generation because of distributed clean energy generation.

73. **Liu Hongtao** from Fengxi New City Energy Development Co., Ltd. described renewable energy projects in Xian, China, a city that has developed very rapidly but is still dependent on coal for heating and electricity generation, causing severe air pollution in the winter months. The Fengxi energy company was established to provide integrated energy service as well as a healthy building environment. A hole was dug down to 2,000, even 3,000 meters, in the earth and a metal pipe installed so that the water, heated to about 80 degree Celsius, could provide heating supply to 20,000 square meters. This clean and sustainable renewable energy source provides the heating supply for commercial buildings, resident buildings, schools, and hospitals. By next year, about 220 million square meters are expected to receive this heat.

74. **Andy To** from the US Green Building Council explained how, since the launch of the Leadership in Energy and Environmental Design (LEED) certification program, more than 98,000 commercial projects and 1.6 million residential units from 175 countries around the world have participated in the certification program. Every day, more than 3 million square feet of buildings are certified under LEED. Other green building systems, such as the China green building rating system, are also promoting green buildings as instruments to combat climate change.

75. With changed regulations and stricter building energy usage rules, the energy intensity of new buildings is going down. This gives comfort that the ambitious targets set will be achieved. The remaining challenge is that 28% of total carbon emissions under business-as-usual scenario requires taking active measures to reduce the carbon emissions of existing buildings. For example, the Jinmao Tower is a 4,200-meter, super tall building located in Shanghai, and in the past six year the building has been reducing its energy consumption and carbon emissions at a rate of 3% per year without adversely affecting energy services to residents. Three takeaway points from this presentation were: First, by 2030, cities will account for 73% of world energy consumption, and buildings will account for more than 50% of the energy consumption (90% for Hong Kong). Second, 75% of the urban infrastructure, including buildings that will exist in 2050, has not been built and presents huge opportunities to the policymaker to shape resource-efficient cities. Third, 90% of the existing building stock in most large cities will still be in use in 2050 (like the Jinmao example), making it imperative to improve the efficiency of existing buildings. Tracking and improving performance is the future of the green building agenda.

76. **Juliet Jiang** from the Broad Group shared the experience at the Shanghai Expo, in which her company supplied the air conditioning for 250 pavilions using natural gas, biogas, waste heat, or solar power. Broad has created a low carbon future in 80 countries and has developed the first flue gas air conditioning that is 200% higher in energy efficiency compared with traditional air conditioning systems with zero carbon emissions. In Gurgaon, India, the company is building an energy-efficient system for 46 units, with a payback of less than three years.

Session 3: Low carbon transport options in mega-cities

"The shared economy has disrupted many of our previous assumptions about how cities provide services to their citizens. Rather than working through sectoral verticals, consumer demand in terms of clean solutions can be tapped as an alternative to a poorly functioning hydrocarbon economy." — Sanjay Krishnan, Lithium Urban Technologies

77. **O.P. Agarwal** from World Resources Institute moderated the session, which was opened by **Ki-joon Kim** of ADB, who spoke of his experiences working in the Seoul Metropolitan Government. Kim pointed out that Asia is witnessing a rapid multiplication of mega-cities (with more than 20 million in population), having mega problems. These cities have emerged through a combination of historical, political, and industrial policy decisions taken by national governments. They also arise because of conscious decisions made by planning agencies, such as taking the advice of Robert Moses to design New York City's infrastructure primarily for automobiles. By contrast, Tokyo designed roads and rail together, while Beijing has witnessed the fastest growth in automobiles, although three decades ago the city was known for its 9 million bicycles.

78. The administrative area of the Seoul Metropolitan Government has a population of 10 million, although another 15.5 million commute from satellite towns. The city has witnessed a transition from trams and buses to cars and public rail over this period. Public transportation reform has been discussed and debated for a long time, but today the modal share of subways and buses is 60%. A key factor that made this transition possible was bus reforms, including route rationalization and dedicated median bus lanes in all radial corridors. Reforms have been undergirded by the ICT infrastructure, which tracks a wide range of transport-related outcomes ranging from tracking empty seats to photo enforcement of road segregation. Median bus lanes have been enforced in all radial corridors. Ridership in public transport consequently increased with more time saved for the average commuter.

79. The next speaker, **Joseph Ma** from Shenzhen Bus Group Co., Ltd., described the process of the electrification of the bus fleet that began in Shenzhen 10 years ago. By 2017, 1,7000 electric buses and 23,000 electric taxis had replaced the entire gasoline-powered transportation fleet. In the coming five years, autonomous buses are expected to become common in the metropolitan area. Digital technology is playing a major part in ensuring dynamic management of services, with maximum safety and convenience. The estimated diesel emissions savings are 157,900 tons of carbon dioxide equivalent saved in the megacity. Overall, a total of 446,590 tons for carbon dioxide and 2,453 tons for other pollutant emission have been reduced for 6,053 electric vehicles in the city every year. A management model for a pure electric taxi business combining original equipment manufacturers and operators has also been successfully launched.

80. **Alan Kneisz** from Hydrogenics Corporation spoke next on hydrogen-powered buses. Since the Osaka G-20 summit in June 2019, hydrogen buses have received considerable publicity, and are experiencing rapid growth. The expectation is that hydrogen will eventually power e-vehicles through the ongoing advances in fuel-cell technology. Pilot tests have already been successfully launched; a fuel-cell train was commissioned in Germany, and the estimate is that the cost savings are a third of the costs of overhead lines required by conventional electric engines. Hyundai has prototyped a hydrogen-fuel-cell car. The fuel cell's power density is greater and the car's weight is less than that of electric vehicles. Reuse and charging are only

between three to five minutes. However, currently buses powered by fuel cells are still expensive, costing about $200,000; this is expected to decline to competitive levels with e-buses.

81. **Sanjay Krishnan** from Lithium Urban Technologies highlighted the fact that the shared economy has disrupted many previous assumptions about how cities provide services to their citizens. Rather than working through sectoral verticals, consumer demand in terms of clean solutions can be tapped as an alternative to a poorly functioning hydrocarbon economy. The urban economy can no longer be segmented into mobility, energy, education, health, and other sectors. Instead, we will see the emergence of tightly coupled markets for what people do in cities—live, work, play, etc. At the same time, as cities get bigger, distinct local neighborhoods will emerge as an important factor in markets. Science and scale are driving down prices of renewables, most notably of energy storage costs. Electric vehicle architecture is modular, and with a whole new ecosystem compared with fossil fuel transportation solutions; 70% of electric vehicle cost is software, swapping batteries, and charge architecture. Leasing or selling e-vehicles can be different because vehicles have infinite life. The choices need to be based on data-driven approaches that enable good understanding of causality.

82. Deconstructing e-vehicle cost structures, the costs of the battery and power electronics make up more than half the total costs, highlighting the fact that fleet operations can be more efficiently managed by subcontracting cost centers to entities best suited to manage their respective areas of expertise. Examples include battery swapping, life cycle cost guarantees, refresh upgrades extended warranties etc. Equally important is the necessity to collect, compile, and disclose real-time vehicle performance data and analytics to be able to determine causality and correlations, between man and machine, to help curate and manage solutions better. Krishnan also emphasized the importance of retaining focus on spatial aspects, so that mobility solutions could adequately meet the demand from citizens.

83. **Juhnsoo Ahn** from the Seoul Metropolitan Government described sidewalk pedestrian polices in Seoul. The focus of the Seoul Metropolitan Government is to complement the well-developed public transportation infrastructure with sidewalks that enable pedestrians to walk comfortably. Pedestrianization policies, well implemented, could promote a walking culture that discourages cars. Several actions have been taken, including constructing sidewalks to be as flat as possible, lowering curbs for blind pedestrians, licensing street vendors, and expanding sidewalks and bicycle lanes by reducing car lanes. The walking environment is improved by replacing asphalt in sidewalks by block concrete and prohibiting the entry of cars on Sundays, when cultural events are organized in some of the large plazas in the city.

84. **Agarwal** closed the session by describing the Rahagiri day program in Indian cities, in which time some important streets are closed to vehicular traffic and opened up to pedestrians for about 6 to 7 hours. Rahagiri ensures that these streets can be supplemental playgrounds and cultural centers. By 2016 more than 70 cities had adopted this model.

Session 4: How ICT-based systems encourage low carbon development

85. Wee Kean Fong from World Resources Institute introduced the topic by introducing the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories* (GPC), which had been introduced to city officials in Nur-Sultan in Kazakhstan and Ulaanbaatar in Mongolia through the regional technical assistance–sponsored training program. The methodology involved inventorying the sources of carbon emissions, working with city leaders to identify

targets for reducing emissions from the city, and developing specific actions to achieve the emission reduction targets. He gave the example of New York City's successful ongoing implementation of its low carbon development plan. The process began with the city first completing its greenhouse gas inventory in 2007; after several simulations the city finalized targets based on analysis of contributing factors (such as building retrofits, transportation, etc.). Thereafter the city announced its action plan aimed at achieving a 30% reduction in emissions by 2030 compared with the 2007 baseline.

86. A critical part of the exercise was to ensure data quality, so that the integrity of the effort was safeguarded. In many developing countries' cities there are data challenges, particularly as real-time data on emissions is usually not available. An important requirement is to break down aggregative data as much as possible. For example, the transportation emissions data for Chengdu city was complemented by more detailed sub-sectoral analysis for public transit, private vehicles etc. These data analyses enabled a better understanding of subsectors that were contributing to increased emissions. He emphasized that undertaking a greenhouse gas inventory was not a one-time process but had to be collected and collated on a continuous basis.

87. Fong gave the example of Hong Kong, which had completed its 2005 baseline greenhouse gas inventory and targeted a 26-36% reduction by 2025. Data analysis, however, indicated that while energy intensity was dropping, the greenhouse gas intensity of emissions was increasing in the buildings sector, which had been experiencing a huge expansion in capital stock because of increased economic growth.

88. **Mikael Jakobsson**'s presentation explained the evolution of energy management systems. These digital platforms supported the development of policies, procedures, and processes that enhance energy performance. They provide a variety of functions as computer-aided tools for monitoring, control, and optimization of energy systems. Historical data and real-time sensor and geographic information system (GIS) data enable effective analysis and forecasting of the entire energy system. This is made possible by combining different kinds of calculation modules, supported by big data analytics and artificial intelligence through machine learning. The energy management system could incentivize organizations to achieve targets, such as competing for the European energy award. Overall, open access to data greatly enlarges the engagement of communities, investors, and local firms in developing low carbon solutions.

89. **Weijun Zhang** from Ewaters Environmental Science & Technology described the early warning system that has been developed to ensure water safety for 6 million people living in eastern Shanghai, a catchment area of about 1,400 square kilometers that frequently experiences flooding. The early warning system has collated all the relevant data collected from rain gauges, wind stations and river data, developed forecasting models, and utilized big data analytics to identify risks for managing risks, disaster response strategies, etc. Technology applications through GIS–based computer modeling can animate rainfall data and predict pipe performance. By linking the data platform to weather forecasts, accurate assessments of low-lying communities' vulnerability to floods, typhoons, etc., are possible.

90. **Qin Hao** of Mobike explained how his company has been able to leverage big data analytics to greatly increase shared bicycle ridership in China. Mobike was founded in 2015, but acquired in 2018 by Meituan, a publicly listed multi-service company based in Hong Kong. Mobike reintroduced bikes in cities. Between 2016 and 2017 use of bikes has increased rapidly, resulting in reduced daily car usage in these cities and reduced carbon emissions. The data

collected by the firm have been extensively analyzed using big data analytics to better understand how people travel, particularly for distances less than 1 km.

91. Mobike combines the bicycle with IOT technology to enable service users to unlock the bike, ride anywhere in the city, and park anywhere. The service offered covers different aspects of daily life, ranging from commuting to work and performing domestic chores to leisure activities. Mobike has greatly improved last-mile coverage in areas where access to public transportation is limited, and enabled cities to improve public transit services. For example, Tianjin city was able to get a better understanding of places where people park their vehicles, and consequently locate public transit stops that met commuter needs. ICT technology has played an important role in ensuring that the services Mobike offers mirror the needs of communities. The company is also socially conscious, recycling old tires into playgrounds and recycled parts as much as possible. For example, designers have successfully converted old bikes to much-sought-after furniture.

92. At the end of the presentations there was a discussion on how best to utilize ICT for low carbon development. Big data analytics had obvious advantages for low carbon planning and implementation, but an essential element is to collaborate with the government. However, the government should take care not to “over supervise” for the business to thrive. Encouraging open data platforms is also important so that there is maximum transparency and data applications promote energy efficiency. Illustrating from the Shanghai experience, Weijun Zhang said that digital data served many purposes, ranging from building drainage systems to optimizing investments before building the infrastructure, as well as after building the infrastructure. Data belong to everyone and stakeholder engagement and access to data is very important. For example, bike sharing promoted by Mobike is supported by the entire community. Open data doesn’t mean everything has to be open; there has to be an eye on privacy.

Session 5: Roundtable on green finance and innovative financing

93. **Niclas Svenningsen** described the Paris Climate Accord as a blueprint for actions agreed by national governments to achieve the global climate goals. It requires signatories to enhance the implementation of the policies, strategies, regulations and action plans and the climate change actions with respect to both mitigation and adaptation. Some countries are in a better position to achieve the targets than others, and this is where countries are expected to help each other. In order to achieve the goals by 2050, ambitious low carbon goals have to be achieved in the automobile sector, building stock, and in industries. Additional investment costs will therefore be substantial. Today, the annual global investments in new energy infrastructure is $1.85 trillion. If we are going to turn that into low carbon investments and have a low carbon infrastructure by 2050, this amount should increase to $2.8 trillion. ADB estimates that between now and 2030, $22.5 trillion dollars will be required to meet emission reductions and adaptation programs in the Asia-Pacific region. In summary, the scale of investments needed for NDC implementation greatly exceeds the public finances available.

94. While the markets have a lot of liquidity, the reality is that climate investments in developing countries are still perceived as risky unless a set of risk reduction measures calms down investor risk perceptions. Financiers need to integrate climate finance products to develop concrete and viable low carbon investments. Equally important is to develop monitoring and impact assessment methodologies that are acceptable to all stakeholders.

95. **Alan Meng** of the Climate Bonds Initiative (CBI), based in London, explained the role of his organization in attracting innovative green financing to cities and countries. CBI has already established green bonds standards that are well accepted by international investors, leading to the issuance of green bonds worth about $120 billion in eight sectors with potentials for low carbon development. The process followed involves rigorous analysis of:

- Use of proceeds
- Evaluation of process, criteria, or standards
- Management of proceeds—funds earmarked to make it transparent
- Allocation of proceeds and how climate goals were achieved.

96. CBI has built relationships with regulators, policymakers, pension funds, asset managers, investment bankers, and market intermediaries such as data providers through credible analysis of market trends. For example, in China, CBI is a member of the Green Finance Committee established by China's central bank. CBI has worked with the central bank in Brazil and with the Astana International Finance Center in Kazakhstan to develop green bond markets in those countries.

97. So far city-level participation has been mainly in the advanced OECD countries in low carbon development in the transportation, energy, buildings, and water sectors. CBI also tracks and reports on how the funds have been utilized. These reports include whether the funds were utilized to finance green infrastructure assets, whether there was a strict adherence to green criteria of standards during project selection, and whether adequate measures were in place to prevent contamination of the fund. By 2018 the global green bond issuance had just reached US$170 billion—a quadrupling of engagement in just four years. Among developing countries, China has issued green bonds worth US$300 billion, with 32 percent of the money allocated to renewable energy followed by 25 percent allocated to low carbon transport and 19 percent to low carbon buildings.

98. **Matthew Ulterino** described the Finance Initiative of the UN Environment Programme, which was a network of private sector players committed to support expansion of green investments. His presentation focused on how finance for energy efficiency improvements was being accessed. He also described the European Commission action plan on sustainable finance for buildings that required the applicant to be in the top 15 percent of energy performance in either the local or national market. A second category consists of activities that contribute to the transition to a zero carbon economy or a net zero economy. Another interesting observation he made was on a research finding of an inverse correlation between energy performance of a building and the default rate for mortgages against that building in the United Kingdom and the United States.

99. **Hyeon Park** from the International School of Urban Sciences, University of Seoul, described the policies in Korea aimed at attracting private investments in infrastructure. So far 18 metro and rail projects have been implemented in Korea; the former describes intra-urban projects and the latter are city- to-city projects. Public–private partnerships (PPPs) were encouraged after the PPP law was enacted in 1994. Twelve metro lines are in operation, four are under construction, and two are under design and development with a total investment of $28 billion. His conclusion was that performance was mixed. Private investors raised funds from the market at higher costs than the government. Often estimates of ridership were optimistic, thereby requiring the government to compensate the shortfalls in revenues. Overall, $14.4 billion in investments by the private sector represented 61 percent of the resources, with the balance coming from

budgetary sources including a construction subsidy and municipal equity in the form of land acquisition. Once a contract was signed, the PPP price was 1.3 times higher than the price from a state-owned institution such as Korail. He concluded that while there is a clear potential for the PPP to enlarge the fiscal space of the government, a failure to accurately assess the ridership demand for the service resulted in revenue shortfalls that ended up as contingent liabilities of the government.

100. During discussions, Meng clarified that most cities mobilizing green bonds were from OECD countries. However, recently the Shanxi government issued municipal green bonds. The lack of developing country city participation can be attributed to lack of awareness of local leaders, citizens, and communities. Overall, in Korea transportation projects have had mixed results, with the profile of roads projects similar to rail projects.

Session 6: Advanced low carbon technologies

101. The session focused on presenting the trends in new advanced technologies for low carbon development, with case studies from Europe, Japan, and Korea.

102. **Manfred Fischdeick** clarified that the idea of promoting a hydrogen economy has been in discussion for a long time, particularly in transportation, the stationary sector, and in storage. Applications in transportation are close to becoming commercially available. For example, in Germany fuel-cell buses using hydrogen are available in Cologne and Wuppertal, and some trains are also based on fuel-cell technology. Overall, Japan and Korea have been more advanced in their applications of fuel cells based on hydrogen in their transportation sector.

103. Although the policy framework is supporting the introduction of fuel cells, the number of vehicles is still low. Stationary applications are still pilot programs, including fuel cells for heating systems. Overall, many more applications have taken place in the industrial sector, particularly using hydrogen as feedstock for the chemical and steel industries whenever an industry has pledged to be carbon free by 2050.

104. The advantage of a hydrogen-based fuel system is that it can be stored and transported, and therefore complements the variability of electricity generation from renewable sources. The main question is how to get this new source to be competitive in Germany. One idea being discussed is to install electrolysis systems in the islands of the North Sea. Another idea is to buy hydrogen from countries with high solar radiation, with ports such as Rotterdam becoming a strategic hub for Europe.

105. **Hoon Sub Song** described the role of the company he works for, Doosan, in promoting low carbon innovations by utilizing fuel cells to produce clean distributed energy, and also to produce heat and water. Fuel cells have several advantages, notably as a clean and quiet energy provider. These technologies are also efficient and a stable supply of energy, 24 hours a day, 7 days a week. Third, fuel cells can be installed with very limited land compared with photovoltaics and wind farms. The prospects for expansion appear very good as the supply price starts declining.

106. **Eiji Ohira** from the New Energy and Industrial Technology Development Organization (NEDO) explained the role of NEDO in promoting a national research and development program in Japan aimed at expanding the use of fuel cells. NEDO supports the private sector, including original equipment manufacturers in setting up targets for producing fuel-cell vehicles, with

details on how costs will be reduced over time. These include establishing hydrogen filling stations and subsidies to produce fuel-cell vehicles. The first mass production of distributed generation of electricity based on fuel cells is also taking place, with 5 MW generated for the Tokyo Olympic games 2020. By 2030, 5 million homes will be powered by this technology. Apart from these domestic incentives, a key requirement is developing an international supply chain for liquefied hydrogen. Japan is also cooperating with the Australian government to produce hydrogen from brown coal and transported.

107. **Yuki Murai** from the City of Yokohama spoke of Yokohama' s plans and efforts. The City of Yokohama has an ambitious plan to achieve zero greenhouse gas emissions by 2050, in which adoption of a hydrogen economy is an important pillar. The first initiative is in promoting the introduction of cell vehicles through subsidies, which has resulted 112 fuel-cell-powered buses in the city. From 2020 on, the city requires all public vehicles be based on low carbon or zero carbon technology. Currently Yokohama has 13 fuel-cell vehicles and a fuel-cell bus is being introduced very soon. The city is also supporting the construction of six more commercial filling stations through subsidies amounting to 325 million yen from the national and prefecture government; currently there are six commercial stations in the city.

108. In addition, the city is promoting the dissemination of stationary fuel cells by providing subsidies for household fuel cells. Currently there are about 16,000 household fuel cells in the city, and the city is working to spread their use through business and industrial type fuel cells. A fuel cell of 200 kilowatts will be installed in the new city hall (to be completed in 2020), and a hydrogen-based autonomous energy supply system will be installed in the port area.

109. Another initiative is promoting a hydrogen supply chain demonstration project that works with some private companies and the national government by manufacturing carbon dioxide–free hydrogen. The city is also anticipating reductions in the price of hydrogen in the future and is studying the implications of these trends on the carbon economy of the city. A big part of the effort is to raise public awareness on the usefulness and safety of switching to hydrogen from fossil fuels. This includes providing up-to-date information to all stakeholders, households, commercial and industrial establishments, so that citizens are ready to make the switch when hydrogen becomes cost-competitive.

110. **Henrik Selstam** from ScandGreen Energy spoke about wastes being resources in the wrong place. His company's efforts have been directed at converting wastes into clean energy sources. On average, an individual generates between 1 and 1.5 kilograms of waste every day, of which about 150 grams consist of plastics. The challenge is how to utilize the different fractions of these wastes into alternative uses, and the incentives depend on the spot prices of a fraction at a given day. For example, if the spot price for plastics is low, the waste could be converted to refuse-derived fuels, but if the price is high, the waste could be recycled into plastics as long the plastics wastes are not too dirty. Nonferrous metals often have spot prices of €900 per ton, and therefore potentially generate a high income if recycled.

111. As far as biomass is concerned, gasification is an option if the moisture content has been reduced. Thermal gasification is a well-tested technology and could offer cost-effective solutions. The resultant gas is usually a combination of hydrogen and carbon monoxide. Those two together could be sent to a fuel cell or used as a clean synthetic fuel. Incineration has lower efficiency than gasification, with more ash, while the latter improves recycling of wastes. Selstam elaborated that there are several scalable versions of gasification plants installed

around the world. Pyrolysis is also like gasification, except that decomposition takes place at a fairly high temperature (400 to 600 degree Celsius), and it is a shorter route to synthetic diesel.

112. The presentations were followed by a lively question and answer session. Was hydrogen cost-competitive with other choices? The response was not yet, because when hydrogen is shipped, costs go up considerably. The cost structure also depends on how hydrogen is produced. Technology innovations will reduce costs in the long run.

113. Hydrogen has only a third of the calorific value of natural gas. Resource-rich countries therefore do not have the incentives that Japan and Korea have to convert fuel to hydrogen. However, industrial processes generate considerable volumes of hydrogen that can be utilized to promote a hydrogen-based economy.

114. Waste collected is declining in many cities, and the quality of refuse- derived fuels is an issue. Regulatory requirements are critical because technology innovations alone cannot drive the economy.

115. Overall, with technological breakthroughs, hydrogen is the ideal energy source, but many challenges remain that require substantial government support. Yokohama is a good example of how to promote integrated approaches that engage all stakeholders.

Session 7: Climate adaptation

116. **Thuy Do** from the Municipality of Rotterdam explained how the city of Rotterdam has been dealing with climate adaptation. Rotterdam is between 2 and 6 meters below sea level; it is protected by an inner dyke system. Water from rainfall, land subsidence from high ground water tables, and sea level rise collectively pose challenges for urban planners in designing resilience. The climate adaptation strategy needs to develop a robust system that acknowledges that flooding cannot be completely avoided in both public and private spaces. The city has adopted an integrated approach that combines interactive modeling with intensive citizen consultations to balance the blue and green agendas. Three concepts lie at the heart of the strategy:

- Build respecting nature,
- Utilize multifunctional design criteria so that the available space is used concurrently for many functions, and
- Design with water.

117. Rooftops have been designed to slow down the flow of water to the ground. Rotterdam already has about 300,000 square meters of green roofs in Rotterdam and the expansion is accelerating. The water square is another concept that combines functions aimed at retaining water when there is heavy rainfall, while functioning as a public space when the water has drained. Private property has also been mobilized because the city has only 40% of the old public area, which is not enough to meet the climate adaptation needs. The key takeaway is that climate adaptation starts with blue and green considerations being important for every one of us.

118. **Frans van de Ven** of Deltares spoke about the various adaptation support tools developed for urban land and water management. Flooding is likely to be exacerbated by fluvial, pluvial, and groundwater-based factors. Storage of flood waters becomes important as well, so that cities are not overwhelmed by sudden influx of waters. In this context, China has been promoting the “sponge city” idea as a way retain and detain storage instead of draining water

rapidly out of the city. The models enable planners to undertake flood hazard analysis and identify mitigative measures, including (if adopted) how large the sponge area should be and adding including other ecosystem-based adaptation measures that could be recommended. The latter involves the integration of nature-based solutions that are more suitable for climate adaptation than investing in gray infrastructure (such as pipes and concrete). The adaptation support tool enables finding out what can be done where and evaluating the costs and benefits of various remedial actions. The toolbox estimates the water retention capacity, peak flow reduction through groundwater recharge, and the costs of implementation and maintenance. A version of the tool is currently being used in New Orleans, Louisiana, to evaluate how much room for the river is necessary, along with water retention infrastructure in this low-lying city.

119. **Vijay Jagannathan** emphasized that resilience to climate change is as important as low carbon development because climate-induced disasters could greatly damage a city's built infrastructure. The green and the blue agendas are therefore closely linked to each other and need to be incorporated in the planning process. He illustrated this point with an example from Hyderabad in India, a city that is a major global information technology hub now experiencing rapid urbanization. That urbanization is coming at the expense of a natural ecosystem that relied on a network of 150 lakes that retained water from the annual monsoons approximately of four months' duration a year, and recharged aquifers within the city. With the growth of built-up areas, many of these lakes have experienced reductions in water inflows, deterioration in water quality because of untreated effluents from urban drains, and even the filling up of catchment areas. Aquifers are also no longer being adequately recharged, and the city is increasingly relying on more and more expensive water supply options that involve inter-basin transfers of water supply. The alternative option of advocating nature-based solutions and using digital technologies to track improvements in water quality are now being seriously pursued by city authorities. If green funds are available, new models of public–private partnerships could be promoted in which the operator amortizes the capital costs of investments by charging a service fee to the city to maintain water quality and quantity to levels specified in the contract. These ideas are still in the planning stage, but if implemented could lead to a city acquiring more sponge city characteristics that earlier speakers talked about.

120. **Arghya Singha Roy** from the Sustainable Development and Climate Change Department, ADB, explained how damage and destruction to infrastructure because of natural events is estimated at $390 billion a year, and this implies that a substantial part of the built infrastructure is already exposed to weather-related risks. In the future, this exposure will only grow. An alternative strategy of building resilience could pay off handsomely. In this context, ADB has a long-term strategy for 2030 that has identified climate and disaster resilience as one of the priority areas of focus. The strategy requires projects to promote resilience in infrastructure through a combination of gray and green interventions. Resilience is not just physical resilience of built structures but also the social and institutional aspects of resilience. Equally important is to undertake a comprehensive risk assessment that includes measures to reduce risks and manage residual risks in a sustainable manner.

121. The Asia-Pacific region faces serious climate risks in the future that will impact the functioning of infrastructure. Data shows that already infrastructural damage is around $390 billion a year. But there are new opportunities available as well. Infrastructure should not create new risks, and new infrastructure should be designed to build resilience. The World Bank showed that $1 investment yields $4 of benefits. The ADB 2030 Strategy prioritizes climate and resilience as one of its priority areas. Operations have to be aligned with the Paris Agreement. The rationale for resilient infrastructure is very persuasive in terms of two aspects:

- How to promote resilience of infrastructure—so that any investment supported through ADB financing is resilient to current and future risks, and
- How to design a combination of green and gray solutions that strengthens resilience to extreme climate events.

122. The concept of resilience is not only physical or structural resilience but also has to deal with social, institutional, and ecosystem aspects of resilience. Uncertainty of future events is the problem—while one has to be careful not to overbuild, measures have to be included that manage residual risks of damage because of extreme climate events.

123. Resilience in project design should be accompanied with building capacity among colleagues to design solutions to improve the decision-making process. In this context, the larger enabling environment including the capacity in the government to use data to make appropriate decisions on policies and investments, requires highlighting before finance can be sought. Scaling up resilience therefore requires having the right kind of knowledge base that includes awareness of how the entire ecosystem is impacted. As investment requirements are large, the private sector has to be "crowded in." The discussions centered on questions of how to promote multifaceted approaches to resilience, including the issue of adequate upstream analysis of options and scenarios.

124. As for cost-effectiveness: who pays? Can there be viable insurance markets? The answer depends on how well risks are managed because insurance companies will participate only if cities have adopted strategies that minimize future risks through actions that reduce risks (such as ensuring that no one lives in flood plains), transfer risks that can be better managed by the market, and identify how catastrophic risks will be mitigated. There are risk reduction measures that people should take by themselves, perhaps with government support to implement low-cost climate-proof solutions (such as strengthening buildings and rooftops to floods and storm surges). Other resilience measures are expensive and may require government and private sector participation. Digital technology helps get better information, which if shared with communities can help develop a comprehensive framework for risk management. Where it costs more, solutions can be bundled through market-based solutions. The key point is that each city should have in place a suite of tools that enables improved management of climate risks.

125. These actions require building institutional capacity at every level of government. Most important is having the right kind of knowledge base to understand risk. What is the nature of risk today, and how does the profile change over time with climate-induced events? Apart from assessing risks for project investments, the entire urban system is reviewed from a resilience perspective, and remedial measures taken aimed at minimizing risks, encouraging risk transfer to the private sector where feasible, and specifications on who bears the residual risks. A lot more upstream work is necessary on how countries can design policies that promote resilience and undertake investments well suited for future climate risks.

Session 8: Social innovation for low-carbon and sustainable city development

126. **Ling Huang** from Chongqing University presented the research her team has conducted in urban community regeneration in Yuzhong district of Chongqing for the past 10 years. The objective was to investigate how innovative social governance could regenerate community values in the built environment of a city. The district has an area of 20 square kilometers, with a

population density of 30,000 persons per square kilometer, an aging population (30% of people are more than over 60 years old), public spaces fragmented by urbanization, and outdated facilities to promote cultural events. The cooperation and regeneration platform was established to make an inventory of community assets, social assets, and human assets in the district. A community map provided the information necessary to develop a regeneration strategy to guide residents to participate, ensure adequate community public space to restore the culture, and to promote social interactions. The result was engagements with the local government, enterprises, and other institutions to develop community regeneration in the district that serves as a model for mountainous cities in Chongqing and in the western region of China.

127. Aisa Tobing, a Senior Adviser to the Governor of Jakarta, presented an example from Jakarta city, where social innovation has focused on *kampung*-level (community-level) interventions that complement physical investment programs. The Jakarta urban climate village develops a road map for reduction in greenhouse gas emissions at the *kampung* level. So far 200 climate *kampungs* have been engaged in the process, of which 53 climate *kampung* have prepared local climate action plans aimed at increasing their adaptive capacities and building low carbon communities. The actions focus on improving the quality of life, along with social innovations to promote low carbon development. Champions have been identified and provided training for capacity building. Collaboration has included partnerships with civil society organizations. The actions include setting up waste banks; implementing solid waste management actions that focus on reducing, recycling, and reusing wastes; and improving livelihood opportunities, green medicine, and urban farming. Waste to energy projects on a small scale, improving urban mobility through pedestrianization and greater use of bicycles, and regulating car and two-wheeler traffic within the community have also helped reduce congestion and air pollution. Social awareness of the importance of promoting a low carbon society has been greatly enhanced. One of the interesting results has been the active engagement of women and children in this process of greening the community.

128. **Yuree Lee** explained how the W-Foundation, a nonprofit charity based in Korea and established in 2015, is sharing knowledge about climate and the environment with the public to build support for climate-friendly solutions. An example of a social innovation was the successful campaign launched to replace plastic bottles with paper boxes through Hooxi water. The strategy adopted is to partner with governments, other international organizations such as UNFCCC, academia, corporate and other public ambassadors (influential public figures) to spread knowledge on environmental and climate issues. These partnerships have led to championing focused on nature conservation, sustainability, and climate action. W-Foundation has also been active as an international relief organization, with its “emergency squad” dispatched to natural disasters. The organization’s music videos are aired on various MTV channels, National Geographic, and in many Korean TV broadcasts with messaging on climate issues. K-pop stars have utilized public concerts to share concerns on climate. Hooxi is the foundation’s campaign name; it is available as a mobile application similar to Instagram that encourages participants to upload green actions taken to reduce greenhouse gases or promote climate resilience. The platform also serves to educate children on climate issues. W Green Pay rewards actions taken to promote climate-friendly actions with monetary compensations.

129. **Virinder Sharma** from ADB explained how ADB leverages its Urban Climate Change Resilience Trust Fund resources to promote climate-friendly solutions. This trust fund, with $150 million contributed by UK and Swiss government bilateral funds and the Rockefeller Foundation, aims to support two million people to achieve climate friendly solutions in 25 cities, selected across the eight DMCs of ADB. The objective of the support is to reduce risks for the poor from

climate change impacts through better planning and climate resilient infrastructure with social innovations. The funding is attached to ongoing ADB loans so that the impacts are maximized in terms of larger infrastructure that is being constructed in those communities. The focus has been on empowering the urban poor with better decision support tools and knowledge sharing on climate change risks they may be facing.

130. Communities become beneficiaries or end users, but only after becoming equal stakeholders with governments to plan and engage in infrastructure resilience planning. Workshops for community-level participation have led to changes in project design while also influencing the way large infrastructure projects are implemented. City-led initiatives include (from the Philippines) multipurpose evacuation centers, some bioengineering and nature-based solutions, community-based and -managed water supply systems, and rainwater harvesting. There is no top-down wish list, and instead a much more community-driven process of identifying priority investment areas. ADB projects have included more cross-sectoral issues, such as urban poverty, and trying to build for the people who are most vulnerable to floods and typhoons. Climate adaptation is much more complicated than mitigation because of the uncertainty about what is going to happen in terms of the return periods of natural disasters. There are trade-offs between mitigation adaptation and being more prepared, ensuring well-functioning early warning systems are critical inputs to climate proofing that are not expensive but require full community awareness and collective action.

131. During the discussions, Lee was asked to clarify how her organization uses the blockchain technology. She responded by stating that purchasing from the Hooxi website enables the organization to retrieve cryptocurrency through the e-commerce platform. She also clarified that her organization has been sponsored by many corporations in Korea. Utilizing blockchain technology for social good and supporting greenhouse gas reduction has also been appreciated.

132. Ling Huang clarified that her efforts were to improve the communications between communities and local governments. Community engagement is still a new idea in China, and is becoming increasingly important in guiding how cities should redevelop.

133. Tobing mentioned that in Indonesia corporates are required to spend 5% of profits in corporate social-responsibility-related investments, and these funds are useful in supporting more activities in climate kampungs.

Session 9: Low carbon pilot city efforts

134. **Wee Kean Fong** briefly described the CAREC regional technical assistance (RETA) project that is supporting five cities in China, Mongolia, and Kazakhstan in planning systemic changes that are transformational in nature and lead to low carbon development and invited team members working in the cities to summarize the status of the projects.

135. **Aigerim Akiltayeva** gave an update on the project status in Nur-Sultan (known earlier as Astana). The city has adverse weather conditions, particularly in the winter months when the temperature could go down to -40 degrees Celsius, and homes are dependent on coal-fueled combined heat and power plants (which accounts for like about 60 percent of total greenhouse emissions). The second major source of greenhouse emissions is transport including municipal and private transport, which is about 30%. The municipal government of Nur-Sultan is planning to switch from coal to gas as the fuel source and also introduce more gas fuel transport by 2024. These actions will significantly reduce the city’s emissions. There are plans to also introduce

electric vehicles, although the numbers are not significant enough to make a difference. The team is working with the local government to develop a low carbon strategy until 2050. This includes identifying the major greenhouse gas emission sectors and working with city authorities to recommend actions to be taken in the near term, medium term, and long term to reduce greenhouse gas emissions.

136. **Nawon Kim** from ADB explained how the city will benefit from a Canadian innovation utilizing a block heater connected to an electric outlet that enables car batteries to be recharged without idling the engine during very cold nights (a practice that currently generates a considerable volume of emissions in winter months). A timer ensures that the car is heated before the driver gets in.

137. **Zolzaya Enkhtur** gave an update on the CAREC project in Ulaanbaatar city. The problem is exacerbated by air pollution from the informal settlements where raw coal is used for heating during the long winter months from October to March. The Mongolian government has released two regulations, one banning raw coal burning in Ulaanbaatar city from this year, and a second regulation banning 5,000 heat-only-boilers, which are also entirely based on coal as feedstock. These actions are aimed at changing long-standing behaviors with the clean coal replacement. The team is exploring different possible options by which the local government can support national policies in promoting low carbon development. The city has very good data on the air pollution and on different emission sources. Through the smart card system being used by the bus transit company, there is also very good information that can be utilized to optimize bus routes and thereby reduce the carbon footprint of public transit. Different types of green energy and heating are also being investigated. A training event organized with project financing brought together different stakeholders from the city, who showed a willingness to develop a GHG inventory system.

138. *Alan Zhang* presented the progress made in Changsha, Zhuzhou, and Xiangtan (Chang-Zhu-Tan) in Hunan Province, China, forming the core growth area of provincial economic development. Chang-zhu-tan city cluster has 20% of the population but generates 40% of the province’s GDP. The three cities are located within 20 kilometers of each other, and the province would like to exploit the synergies from this contiguity. The work so far has estimated the emission peaking year after simulating various emission peaking targets. Of the three cities, Xiangtan is receiving ADB financing to implement its low carbon development plan.

139. **Nawon Kim** described the ADB support for low carbon development of Xiangtan city through integrated planning that engages the different sectors and bureaus to work collaboratively. The project combines two different modalities, one as an investment project, and another as undertaking complementary policy reforms to support systemic changes necessary to launch a low carbon trajectory. The project is supporting urban transport system improvement, nonmotorized vehicles such as bicycles, and encouraging pedestrianization through easier walkability. Another area of support is for green building promotion. The project team is also working with Deltares to improve the city’s resilience to water risks. All the above actions will be managed through a digital data platform that will track energy management, building energy management as well as actions taken to manage weather-related risks better. With this data being available, users can access different information to make lifestyle changes that promote healthy, green living.

IV. ACCELERATING THE COURSE OF CHANGE

A. The role of ADB

140. ADB's role as a trusted development partner is to offer DMCs services that can be combined. ADB will add value to its DMCs by combining finance, knowledge, and acting as a convener of partnerships. Through customized support, CAREC cities can access technical assistance and investments aimed at delivering integrated solutions that result in low carbon outcomes. In addition, as exposure of city infrastructure to destruction and damage through climate-induced events are increasing, ADB is committed to building resilience in DMC cities as a priority area of focus. The Strategy 2030 requires projects to promote resilience in infrastructure through a combination of gray and green interventions. Resilience is not just physical resilience of built structures but also the social and institutional aspects of resilience. An equally important emphasis is to undertake a comprehensive risk assessment that includes measures to reduce risks and manage residual risks in a sustainable manner. Resilience in project design will be accompanied with building capacity among colleagues to design solutions to the improve decision-making process. In this context, the larger enabling environment, including the capacity in the government to use data to make appropriate decisions on policies and investments, requires highlighting before finance can be sought. ADB's climate change trust funds make funding available to design appropriate interventions to manage climate risks better, with a special emphasis on reducing risks for the poor from climate change impacts through social innovation, good decision support tools, and knowledge sharing

B. Next Steps

141. The CAREC RETA will develop low carbon city investment plans in the five project cities of Changsha, Xiangtan, Zhuzhou (in China), Ulaanbaatar (in Mongolia) and Nur-Sultan (in Kazakhstan). ADB is also financing an investment operation, which is in advanced stages of project preparation for low carbon development of Xiangtan city through integrated planning that engages the different sectors and bureaus to work collaboratively. The project combines two different modalities, one as an investment project, and another as undertaking complementary policy reforms to support systemic changes necessary to launch a low carbon trajectory. The project is supporting urban transport system improvement, nonmotorized vehicles such as bicycling, and encouraging pedestrianization through easier walkability. Another area of support is for green building promotion. The project team is also working to improve the city's resilience to water risks. All the above actions will be managed through a digital data platform that will track energy management, building energy management as well as actions taken to manage weather-related risks better. With these data available, users can access different information to make lifestyle changes that promote healthy, green living.

SPEAKERS' PROFILES

Won-Soon Park

MAYOR
SEOUL METROPOLITAN GOVERNMENT

Won-soon Park is currently in his third term as mayor of the Seoul Metropolitan Government. He was elected as Seoul's 35th mayor in 2011 and was then re-elected in 2014 and 2018.

Prior to his election as mayor, he served as executive director of The Beautiful Foundation from 2002 to 2010, and as secretary general of the People's Solidarity for Participatory Democracy from 1995 to 2002. He also served as district attorney at Daegu District Prosecutor's Office.

As a human rights lawyer and social activist, Mayor Park has been recognized for his exemplary work, having received several awards including the 10th Manhae Award (activist category) and the Philippines Magsaysay Award (public service category) in 2006; Activist of the Year Award from Citizen's News and the Citizen's Award for contributing to the people in 2003; and the Volunteer Award from the Seoul Bar Association in 2002.

Mayor Park obtained his international law diploma from the London School of Economics. For his undergraduate studies, he majored in history at Dankook University.

Geun-hyeong Yim

AMBASSADOR FOR INTERNATIONAL RELATIONS
SEOUL METROPOLITAN GOVERNMENT

Geun-hyeong Yim was appointed as ambassador for international relations to the Seoul Metropolitan Government in January 2018. As foreign policy adviser to the mayor of Seoul, he advises on the city's international relations and diplomatic policies.

Earlier in his career, Yim joined the Ministry of Foreign Affairs after having passed the High Diplomatic Service Examination in 1981. He served as a diplomat for several years in Europe. He also held the posts of deputy director-general and director-general of European Affairs in succession and served as an ambassador in the Kingdom of Denmark and in Hungary in 2008 and 2014, respectively. In 2017, he was granted the Commander's Cross of the Order of Merit of Hungary for his contribution to promoting Korea–Hungary relations.

Some of the main areas of his focus are smart city policies and climate change response. He strongly believes city-to-city cooperation is essential to resolving key issues on the global agenda.

M. Teresa Kho

DEPUTY DIRECTOR GENERAL
EAST ASIA DEPARTMENT
ASIAN DEVELOPMENT BANK

M. Teresa Kho is the deputy director general of the East Asia Department, covering operations in the People's Republic of China and Mongolia.

Prior to this, she was ADB's country director in India (2013–2016) and country director in Bangladesh (2012–2013).

Kho was director of South Asia Urban Development and Water (2010–2011) and director of the Office of Cofinancing Operations (2008–2010).

Kho joined ADB in 1997 and worked in various departments, including Budget, Personnel, and Management Systems Department; Office of the Vice President Finance and Administration; South Asia Department; and Private Sector Operations Department.

Before joining ADB, Kho spent 12 years in the US private sector, performing finance, treasury, and audit functions for Fortune 500 companies.

A U.S. national, Kho obtained an MBA from Stanford University, California, U.S.A., in 1991 and a BA in economics from the University of Notre Dame, Indiana, U.S.A. in 1983.

Vijay Jagannathan

SECRETARY GENERAL
CITYNET

Vijay Jagannathan comes from the World Bank where he was sector manager for infrastructure in the East Asia and Pacific region. He was responsible for an annual lending program of about $5 billion in the urban, water, transport, and energy sectors. Jagannathan has been also associated with the Asia-Pacific Economic Cooperation–led green growth and green finance initiatives. He has worked in the infrastructure, environment, and urban development sectors in his 24 years in the bank. Prior to that, he spent 10 years in the Indian Administrative Service.

Jagannathan is an economist by training, with a PhD from Boston University. His dissertation on the informal markets for the poor was published by Oxford University Press in 1987 and recognized as one of the Outstanding Academic Books of the Year by the American Library Association. He has published extensively on water, urban development, agricultural development, and environmental issues. Jagannathan currently serves as a senior fellow at the World Resources Institute and has been a consultant with the Green Climate Fund. He is a member of the United Nations Sustainable Development Group for Urban Issues and is working closely with the New Climate Economy initiative. He is also a member of the Expert Panel advising the Chinese Government on sustainable ecological civilizations. Jagannathan was elected as Secretary General of CityNet at the 2013 CityNet Seoul Congress and re-elected at the 2017 CityNet Colombo Congress.

Manfred Fischedick

VICE PRESIDENT
WUPPERTAL INSTITUTE

Manfred Fischedick is vice president of the Wuppertal Institute. He has 20 years of experience in systems analysis. Among others, his working fields include GHG mitigation strategies and multicriteria evaluation; renewable energies and their integration; system innovation and transformation scenario analysis; national, regional, and urban climate policies and roadmapping; low carbon urban infrastructure analysis; and low carbon technology assessment and forecasting. He is adviser to the EU and the German government as well as the state of North Rhine-Westphalia, and companies of various sectors. Moreover, he has been engaged in low carbon urban development in Asia. He is also a member of the Seoul International Scientific Advisory Council.

Niclas Svenningsen

MANAGER
GLOBAL CLIMATE ACTION
UNFCCC

Niclas Svenningsen is the manager for the Global Climate Action team in the UNFCCC Secretariat (UN Climate Change). In this capacity, he is responsible for the development and implementation of UN Climate Change's work with nonparty stakeholders to take action to help governments reach the well-below-2-degrees-Celsius target set in the Paris Agreement. This includes a wide-ranging cooperation and coordination with climate action initiatives across a range of sectors and topics; tracking and reporting of climate action commitments by private sector and civil society; and outreach and support, including to youth, for awareness raising, education, training, and public participation in the climate action agenda.

Niclas previously worked in the United Nations Environment Programme (UNEP), where he was in charge of the climate neutral strategy of the UN system, as well as for the implementation of UNEP's programmes for sustainable buildings, urban development, and sustainable procurement. He also spent 10 years at UNEP's regional office for Asia and the Pacific in Bangkok, where he managed a range of different technical support programmes. Niclas has a background in civil engineering and environmental law from Lund University in Sweden.

Sujata Gupta

DIRECTOR
EAST ASIA DEPARTMENT – SUSTAINABLE INFRASTRUCTURE DIVISION
ASIAN DEVELOPMENT BANK

Sujata Gupta is the Sustainable Infrastructure director of the East Asia Department of ADB. She joined ADB in 2003 and has worked in ADB's public and private sectors as well as for resource mobilization from development partners. Prior to her current position, Sujata was the director, Office of Cofinancing Operations (2013–2017), South Asia head and principal investment specialist, Private Sector Operations Department (2007–2012), and senior energy specialist with the South-East Asia Department (2003–2007).

Sujata has a PhD in economics from the London Business School, University of London, and master's and bachelor's degrees in business economics/economics from the University of Delhi. Sujata has over 29 years of experience in ADB's public and private sector operations, and in research and consulting in the areas of climate change, renewable energy, energy economics and policy, and sustainable use of natural resources.

Before joining ADB, Sujata was senior fellow and director of the Policy Analysis Division, at TERI (then the Tata Energy Research Institute), New Delhi. She has also worked as a visiting researcher at the International Institute of Applied System Analysis in Austria. She was a member of the United Nations (UNFCCC) Clean Development Mechanism (CDM) Methodologies for Baselines and Monitoring Panel (2002–2005), and a co-coordinating lead author for the Second, Third, Fourth, and Fifth Assessment Reports of the Intergovernmental Panel on Climate Change.

Aigerim Akiltayeva

CLIMATE CHANGE AND PROJECT MANAGEMENT SPECIALIST (CONSULTANT)
ASIAN DEVELOPMENT BANK

Aigerim Akiltayeva is currently engaged as a climate change and project management specialist with ADB under the regional technical assistance project, "Promoting Low-Carbon Development in CAREC Program Cities." She has completed her bachelor's degree in Energy Engineering with a first-class diploma at the University of Leeds in the United Kingdom. Akiltayeva successfully designed a group project, "Hydrogen Production via Steam Reforming of Natural Gas" at the University of Leeds. She also conducted various laboratory experiments in solar energy, filtration, natural gas, and other climate change and energy engineering related matters. Her design projects include critical review of Kazakhstan's policies for meeting the Kyoto Agreement, efficient plastic recycling, wind characteristics of electricity production in rural areas, and solar production. Aigerim previously worked at Turkuaz Machinery Kazakhstan for Rolls Royce Power Systems MTU-engines and natural gas generators brand. She has extensive experience working with international organizations, such as UNDP, SE4ALL, and IRENA during the International Exhibition Astana EXPO-2017 in Kazakhstan, where she helped organize their thematic pavilions under the exhibition theme, “Future Energy.” While working for ADB, Aigerim works extensively on climate change and renewable energy potential projects in Kazakhstan. She is currently involved in developing the Strategy of Low Carbon Development-2050 for Nur-Sultan, as well as assisting in Clean Technology Fund projects being implemented in the city. She is also a member of the public speaking and leadership club, Toastmasters International, where she achieved the highest recognition award Distinguished Toastmaster.

Aisa Tobing

SENIOR ADVISER TO THE GOVERNOR OF JAKARTA
DEPUTY SECRETARY GENERAL

Tobing is a city planner and senior adviser to the governor at the Jakarta Research Council since 2013. She has been appointed as the chairman of the Climate Change Task Force for Jakarta and serves as special staff for urban and environmental management, particularly focused on low carbon city programs. Since 2007, she has been involved and active in several international network and organizations, such CityNet in the Asia-Pacific region and C40 Climate Leadership Group.

Aisa has been working in the public sector for Jakarta Capital City Government. During this time, she has been appointed to lead several agencies within the administration, including serving as the director of the International Cooperation Bureau, the director of the Information Technology and Communication Management Office, head of Environmental Management, and head of the Government Affairs Division on the Planning Board.

Aisa obtained her bachelor’s degree in regional and city planning from Bandung Institute of Technology and her master’s degree in international development and appropriate technology from the University of Pennsylvania in Philadelphia, Pennsylvania, U.S.A. She completed her doctoral degree in the University of Indonesia with her research, “Spatial Planning Model and the Climate Mitigation Strategy Toward a Sustainable Low Carbon City.”

Alan Kneisz

BUSINESS DEVELOPMENT DIRECTOR
HYDROGENICS CORPORATION

Alan Kneisz is business development director at Hydrogenics Corporation, a global provider of advanced hydrogen fuel cell and electrolysis solutions.

In his role, Alan has been at the forefront of hydrogen technology deployments by developing megawatt fuel-cell power systems, renewable energy applications, energy storage, hydrogen fueling, back-up power, and hydrogen transport solutions. This includes the largest fuel-cell bus fleets in China, as well as providing technical assistance for better understanding of planning for a hydrogen economy with the government, OEMs, NGOs, and other private institutions globally.

Alan has extensive experience implementing green technologies into practical applications throughout the Asia-Pacific region and Australia with private and government institutions and has become a thought leader in promoting the hydrogen economy across the region, speaking at close to 10 conferences every year to explain the advantages of the hydrogen economy.

Alan Xiangrui Meng

GREEN BOND ANALYST/PROJECT MANAGER (CHINA)
CLIMATE BONDS INITIATIVE

Alan Xiangrui Meng is a green bond analyst and China project manager based in Climate Bonds Initiative's London office. He leads the data analysis on the global green bond market, supports the data partner programme on several green bond indices, and provides research on green bond policies. He is a member of the UN Sustainable Stock Exchange Initiative's Green Finance Advisory Group.

Allen Zhang

PRESIDENT/CONSULTANT
HUNAN INNOVATIVE LOW CARBON CENTER/ASIAN DEVELOPMENT BANK

Fan Zhang (Allen) is an expert in environmental economy and one of the pioneer Chinese experts on carbon asset development. Since 2004, Allen has gained extensive experience in carbon asset development and carbon finance. Allen worked as China Chief Representative at the Carbon Capital Management Inc. in Japan from 2008 to 2010. Since 2010, Allen has been the Managing Director of Innovative Carbon Investment Co., Ltd. In 2013, Allen established the Hunan Innovative Low Carbon Center together with a group of carbon finance experts, which was endorsed by the Hunan DRC. Since then, he has been the president of the Center.

Andy To

MANAGING DIRECTOR, NORTH ASIA
U.S. GREEN BUILDING COUNCIL (USGBC)
GREEN BUSINESS CERTIFICATION INC. (GBCI)

Andy To joined USGBC and GBCI as managing dIrector, North Asia, in January 2018. He leads the business operations of the two organizations, with an aim to facilitate the growth of LEED green building certification (developed and owned by USGBC) and GBCI's sustainability programs in the region. Prior to this role, Andy was the managing director for CBRE Asset Services in Greater China, a leading global commercial real estate consultancy and investment company. Besides supervising the property management and consultancy services for over 300 projects, Andy established a LEED consultancy team of over 10 people as an industry pioneer back in 2014. His team turned a 9-million-square-meter space into LEED-certified space in 3 years.

Andy has more than 30 years of experience in the property and asset management industry with particular focus on properties and facilities in Hong Kong, Shanghai, Beijing, and China's growth market. He also has had working experience with renowned real estate developers such as Kerry Properties and Sino Estates Management Limited.

Andy obtained his master of science in real estate degree from Hong Kong University and his diploma in business administration from Hong Kong Shue Yan University. He is a member of the Royal Institute of Chartered Surveyors; full member of the Chartered Institute of Building, UK; corporate member of the Chartered Institute of Housing, UK; and member of the Hong Kong Institute of Housing.

Arghya Sinha Roy

SENIOR CLIMATE CHANGE SPECIALIST (CLIMATE CHANGE ADAPTATION)
ASIAN DEVELOPMENT BANK

Arghya Sinha Roy has been working on disaster resilience related issues since 2003. From 2004 to 2012, he worked with the Asian Disaster Preparedness Center on strengthening capacities of countries to integrate disaster risk management considerations into development processes. Since 2012, Arghya has been working with ADB, in supporting the implementation of ADB's disaster risk management policy and plan. Arghya has been involved in projects related to risk-sensitive urban development, infrastructure resilience, strengthening community disaster resilience; and post-disaster recovery and reconstruction. In 2019, Arghya has taken up the position of climate change adaptation specialist within ADB, where his focus is to support ADB in increasing investments in climate-resilient development.

Bi Lei

DIRECTOR, DIGITAL ECONOMY DEPARTMENT
SHENYANG MUNICIPAL DEVELOPMENT AND REFORM COMMISSION

Bilei is director of the Digital Economy Department of Shenyang Municipal Development and Reform Commission. He obtained a PhD from Tsinghua University and was previously in charge of green, low carbon, and circular development and greenhouse gas emissions control. For several years now, Bilei has been working on establishing local carbon emission trading system of Shenyang city, planning major low carbon projects, and undertaking research on green finance systems. He organized the Shenyang Energy Consumption and Carbon Emission Management International Forum in 2013 and 2016. At present, Bilei is in charge of smart city, including smart energy, and smart environment protection, among others.

Ching Yuen (Joseph) Ma

DEPUTY GENERAL MANAGER
SHENZHEN BUS GROUP CO., LTD.

Joseph (Joe) Ma is an urban planner with more than 30 years of experience in both the public and private sectors gained in the United Kingdom, Hong Kong, mainland China, and other Asian countries. His extensive and myriad international experience covers strategic development and policy studies, large-scale planning and development projects, new town and urban regeneration developments, and railway, transportation, and infrastructure investments, as well as leisure, recreation, and tourism projects.

He is an eminent fellow of the Royal Institute of Chartered Surveyors, member of the Royal Town Planning Institute, a registered Professional Planner (Hong Kong), and a Member of the Hong Kong Institute of Architectural Conservationists. Joe is currently holding the post of Deputy General Manager in the Shenzhen Bus Group, in charge of international development, procurement, finance, and advertisement. A major accomplishment since joining Shenzhen Bus is the successful procurement of some 6,000 electric buses and 4,700 electric taxis resulting in Shenzhen Bus Group becoming the first fully and largest electric-powered public vehicle operator in the world. Joe Ma represents Shenzhen Bus Group in all international marketing, development, and exchange activities. He also sits on the global Bus Committee and Taxi and Ride-Hailing Committee of the Union Internationale des Transports Publics. He has been a regular guest speaker in several global public transportation conferences and forums.

Chun Xia-Bauer

COORDINATOR FOR INTERNATIONAL ENERGY POLICY AND SYSTEMS TRANSITION
WUPPERTAL INSTITUTE FOR CLIMATE, ENVIRONMENT, ENERGY

Chun Xia-Bauer is the coordinator for International Energy Policy and Systems Transition at the Wuppertal Institute for Climate, Environment and Energy in Germany. She has been working for over 10 years in the field of environmental governance, sustainable low carbon city development, and building energy efficiency and green building. Xia-Bauer has been leading various international cooperation projects with special focus on Asian countries. She has a PhD in environmental governance, a master of science in renewable energy management, and a master of science in integrated assessment.

Eiji Ohira

DIRECTOR GENERAL, FUEL CELL AND HYDROGEN TECHNOLOGY GROUP
NEW ENERGY AND INDUSTRIAL TECHNOLOGY DEVELOPMENT ORGANIZATION (NEDO)

Eiji Ohira is the director general of the New Energy and Industrial Technology Development Organization (NEDO)'s Fuel Cell and Hydrogen Group within the Advanced Battery and Hydrogen Technology Department. In this capacity, he is responsible for the overall strategy, execution, and coordination of NEDO's research, development and demonstration projects on fuel cells and hydrogen.

He has also coordinated fuel-cell and hydrogen activities with international stakeholders, through the International Energy Agency's Technology Collaboration Program, and International Partnership for Hydrogen and Fuel Cells in the Economy.

He joined NEDO in 1992, just after graduation from the Tokyo University of Science. He served as a visiting scholar at the Massachusetts Institute of Technology in 1997–1998. Before taking up his current position in April 2013, he served in several positions, including Representative at NEDO Asian Representative Office, Director of the Energy Storage Technology Division.

Evan Scandling

DIRECTOR OF ADVISORY & BUSINESS DEVELOPMENT – SOUTHEAST ASIA
ALLOTROPE PARTNERS

Evan has more than a decade of experience advising, developing and managing clean energy businesses, projects and programs around the world. Based in Southeast Asia since 2012, he has primarily focused on on- and off-grid decentralized solar PV in the Mekong Region. In his current role with Allotrope Partners, Evan co-leads the Clean Energy Investment Accelerator program in Southeast Asia, focusing on improving and increasing opportunities for procurement of clean energy by large energy users such as commercial and industrial business as well as cities and municipalities. He also contributes to Allotrope's other advisory work in the region, with an emphasis on commercial and industrial renewable energy strategy and implementation. Prior to joining Allotrope, Evan was the Myanmar country director of a regional solar project developer.

Frans H.M. Van de Ven

TEAM LEADER, URBAN LAND & WATER MANAGEMENT
DELTARES

Frans van de Ven is team leader of Urban Land & Water Management at Deltares, The Netherlands' institute for delta technology. He is associate professor in urban water management at the Faculty of Civil Engineering and Geosciences of Delft University of Technology.

Together with his colleagues in both organizations, he is working on attractive, flood-robust and climate-resilient, subsidence-free cities, while aiming at reduction of the environmental footprint of urban systems. This includes research into: (1) improved concepts for resilient urban land and water management; (2) better methods for engineering urban water systems and for control of water quantity, water quality, demands and supply; and (3) urban planning and design support tools to implement these improved concepts and methods in urban planning, design, operation and management.

His major fields of expertise include:

- Sustainable urban land and water management systems;
- Making the most out of urban surface water, groundwater, stormwater runoff, parks, and green infrastructure;
- Effectiveness, planning, and design of blue-green infrastructure;
- Climate resilience of urban areas; adaptation strategies and urban planning support systems; improving urban land and water system modeling for adaptation planning;

- Urban water, green and public health—controlling pathogenic organisms and vectors; heat stress control and blue-green infrastructure;
- Thermal energy from water; surface water as solar heat collector and as evaporative cooler; and
- Transition management to realize more sustainable systems of urban land and water management.

Giovanni Capannelli

COUNTRY DIRECTOR OF THE KAZAKHSTAN RESIDENT MISSION
ASIAN DEVELOPMENT BANK

Giovanni Capannelli has been serving as the country director of ADB's Kazakhstan Resident Mission since September 2016. Prior to this appointment, he was principal economist in ADB's Central and West Asia Department, special adviser to the dean of the ADB Institute in Tokyo and held various other positions since he joined the bank in 2002. Previously, he worked for the Bank of Italy in Tokyo. He served as professor of regional economic integration at the University of Malaya in Kuala Lumpur, Malaysia, and taught economics in three universities in Japan. He holds a PhD and a Master's degree in economics, both from Hitotsubashi University in Tokyo, Japan, and a bachelor's degree in economics from Bocconi University in Milan, Italy.

Hao Qin

SENIOR SUSTAINABILITY EXPERT
MEITUAN BIKE

Hao Qin is the senior sustainability expert in Meituan Bike (Mobike). His work focuses on reducing the environmental footprint of bikes and improving the sustainable development of sharing bikes in different cities. His responsibility includes Meituan Bike's life cycle management project, cycling infrastructure/network planning, and smart city implementation schemes. By working closely with various departments in Meituan Bike and external stakeholders, including government, universities and research institutions, he and his colleagues in Meituan Bike aim to improve the overall sustainability of the city life.

Hao is also a licensed architect in mainland China and a LEED AP. Before joining Meituan Bike, he was the Project Director in Oval Partnership Ltd., a Hong Kong-based international architecture design firm. His practice covers a variety of projects from small scale facilities to large urban regeneration and mixed-use projects, especially large transit oriented development (TOD) projects. Prior to that, he worked as a lecturer and postdoctoral fellow researcher at the University of Hong Kong, where he got his PhD. His research area includes sustainability, smart city, and low carbon building/city that embraces multidisciplinary knowledge and techniques including building energy modeling, computational fluid dynamic, parametric design, big data, and GIS.

Henrik Selstam

CEO
SCANDGREEN ENERGY, SWEDEN

Henrik Selstam completed a master of science in engineering physics at Chalmers, Sweden. An entrepreneur with a background in the information technology industry, he established a venture capital business investing in high-tech solutions in green energy and fertilizing technology. He has a wide and robust global network in science and start-ups. With 18 years' industrial work, he gained a broad experience in analyzing energy systems and finding efficient solutions. He founded several industrial projects, such as RCO2 and Quantafuel.

ScandGreen Energy offers innovative, financially viable, and efficient solutions to reduce pollution generated by municipal solid waste, as well as agricultural residues, forestall or stock breeding activities. It offers minimal possible environmental impact at optimal investment. ScandGreen Energy solutions include power production, thermal energy, synthetic fuels, fertilizers and other products.

Hoon Sub Song

DEPUTY GENERAL MANAGER, BUSINESS STRATEGY TEAM, DOOSAN FUEL CELL
DOOSAN CORPORATION

Hoon Sub Song is currently working for the Business Strategy Team of Doosan Fuel Cell. He is in charge of the fuel cell technology development strategy and is also leading new product development related to hydrogen energy. Song obtained his PhD in chemical engineering from the University of Waterloo in Canada. Since then, he has been working on the development of next-generation clean energy generation technologies and also organizing several international collaboration projects in the field of clean energy research as a research scientist for the federal government of Canada, Natural Resources Canada.

Hyeon Park

PROFESSOR AND DEAN, INTERNATIONAL SCHOOL OF URBAN SCIENCES
UNIVERSITY OF SEOUL

Hyeon Park is professor and dean of the International School of Urban Sciences (ISUS) at the University of Seoul. Before he joined ISUS in August 2013, he served as executive director of the Public and Private Infrastructure Investment Management Center of Korea Development Institute (KDI). While he was working at KDI for more than 13 years, he contributed to improving public investment management, including public–private partnerships (PPPs) in Korea. He carried out project appraisals for nearly 30 infrastructure projects, including PPP projects. He also conducted several researches on methodologies of project appraisal, including contingent valuation method, multicriteria decision making, and value for money test on PPP projects. He worked as a senior evaluation specialist, seconded to the Independent Evaluation Department of ADB, from February 2009 to February 2011.

He obtained his BA in economics at Seoul National University, and his PhD in planning at the University of Southern California. He is a member of advisory committees to the Minister of Strategy and Finance and served as a member of the National PPP Steering Committee and the Public Investment Management Committee of the Ministry of the Economy and Finance.

Jambaa Lkhagva

DIRECTOR, ENERGY MARKET RESEARCH AND COOPERATION DIVISION
ENERGY REGULATORY COMMISSION, MONGOLIA

Jambaa Lkhagva has been working in the fields of energy regulation and renewable energy for more than 10 years. He is the director of the Energy Market Research and Cooperation Division of the Energy Regulatory Commission of Mongolia. The ERC is mandated to regulate energy generation, transmission, distribution, and the dispatching and supply of energy by issuing licenses and setting all types of energy tariffs in the country.

Prior to this role, Jambaa was a research engineer at the Ministerial Task Team on the Asian Super Grid Initiative of the Ministry of Energy. HIs responsibilities included developing the Mongolian roles in the northeast Asian super grid, energy connectivity, and conduct of studies on various scenarios for electricity generation and transmission in Mongolia.

He began his career at the Ministry of Fuel and Energy in January 2008 as a specialist. From September 2009 to February 2014, he was officer of renewable energy in the Energy Authority. Said government implementing agency is mandated to deal with issues of supplying electricity to consumers in remote villages using renewable energy hybrid systems, such as small-scale solar photovoltaic systems plus wind turbines plus diesel generators.

Jambaa earned a BS in nuclear technology from the National University of Mongolia in 2006 and an MS in international energy policy, economy, from Seoul National University in 2014.

Juliet Jiang

SENIOR VICE PRESIDENT
BROAD GROUP, PRC

Juliet Jiang is the senior vice president of BROAD Group. She joined BROAD and founded BROAD International in 1998 and was its chief executive officer (CEO) for 12 years. In 2010 Jiang established BROAD Clean Air International and BROAD Sustainable Building International, acting as CEO.

In 2010, she contributed to the successful establishment of COP16 BROAD Pavilion Cancun and invited Mexican President Felipe Calderon to inaugurate the pavilion with his well-known speech “A New Revolution in the Architectural Industry.”

As its senior vice president since 2012, Jiang has represented BROAD Group in several international conferences on energy conservation and green buildings. BROAD Group grabbed international headlines for 6 stories in one day (BROAD Pavilion at EXPO Shanghai), 15 stories in one week (New Ark Hotel), 30 stories in 15 days (T30 Hotel), and 57-stories (Mini Sky City) in 19 days. BROAD developed core tubular stainless steel (termed Bcore) slab, which is an ultimate structural material, converting the thin into the rigid, the decayed into the eternal. Bcore slabs can be used not only in buildings, bridges, highways, but also in cars, aircraft, and wind power that construct low carbon cities.

Junsoo Ahn

DEPUTY DIRECTOR, SIDEWALK MANAGEMENT TEAM
CITY OF SEOUL

Junsoo started his career as deputy director at the Seoul Metropolitan Government (SMG) in 2010. He served in the Engineering Review Division, Urban Planning Division, Urban Management Division, River Management Division before he went to the United States to pursue his graduate studies in urban planning. He obtained a master's degree in city and regional planning at Clemson University in South Carolina, U.S.A., and holds a bachelor's degree in civil engineering from Yonsei University in South Korea. He is currently leading the Sidewalk Management Team in the Pedestrian Policy Division of SMG.

Kenzhekhan Abuov

PROJECT OFFICER, KAZAKHSTAN RESIDENT MISSION
ASIAN DEVELOPMENT BANK

Kenzhekhan Abuov is a project officer working at the Kazakhstan Resident Mission, Central and West Asia Department of ADB. He is working closely with the Government of the Republic of Kazakhstan in various sectors such as water, agriculture, renewable energy, and environment as well as social sector development. He processed and managed various technical assistance and coordination with the executive agencies loan projects relating to water and agriculture sectors. He is also involved in ongoing low carbon city development projects in Kazakhstan, promoting sustainable development of the city of Nur-Sultan. He has more than seven years of experience in regional cooperation in Central Asia, working with different government agencies and participating in the establishment of the first economic corridor development project. Prior to joining ADB, he worked in different ministries of the Government of Kazakhstan, including the Ministry of Tourism Development, Ministry of Economy and Budget Planning, and Ministry of Social Protection, responsible for policy and strategy development. He holds a master's degree in public policy from the Korea Development Institute School of Public Policy and Management in the Republic of Korea and bachelor's degree in economics from Zhezkazgan University in Kazakhstan.

Ki-Joon Kim

PRINCIPAL TRANSPORT SPECIALIST
ASIAN DEVELOPMENT BANK

Kim has more than 30 years of professional experience and academic research in the transport sector. He studied urban planning and transport planning in Korea, the United States, and the United Kingdom.

His experience covers both transport research projects and consulting work. He was involved in major urban reform projects in Seoul, including the Seoul Bus Reform, Cheongaechon River Rehabilitation, City Plaza Design, the Seoul Central Business District Pedestrianization Project, and several projects that involved demolitions of flyovers and elevated urban expressway in Seoul.

Since he joined ADB in 2010, he has been working on sustainable urban transport projects, intelligent transport systems, road safety, transport modeling, low carbon transport policy, and climate change and new transport technology. He managed several public bus rapid transit projects in East Asia and was involved in developing sustainable transport action plans for many cities in Asia and Pacific. For the past three years, he has been working on electric vehicle studies for ADB member countries covering 20 countries.

Ling Huang

PROFESSOR AND DOCTORAL SUPERVISOR,
FACULTY OF ARCHITECTURE & URBAN PLANNING
CHONGQING UNIVERSITY

Ling Huang is a professor and doctoral supervisor of the Faculty of Architecture & Urban Planning, Chongqing University, and director of the Institute of Community Development and Urban Regeneration, CQU Planning and Design Co. Ltd, China. She is also a member of the Urban Regeneration Academic Committee, Urban Planning Society of China (UPSC); the Residential Planning Academic Committee, UPSC; the Social Geography Academic Committee, Chinese Sociological Association; Chongqing Municipal Expert Database on Social Stability Risk Assessment, and a scholar of the Penn Institute of Urban Research, University of Pennsylvania. Her main research fields include community development and urban regeneration, community planning and urban design, urban sociology, and urban spatial culture. Since 2010, she has taken the lead in carrying out urban community regeneration and community development planning in Chongqing and presided over more than 20 urban community research and practice projects. She has hosted and participated in a number of key research and development programs of the Ministry of Science and Technology, National Natural Science Foundation of China, foundation and frontier projects of Chongqing Natural Science Foundation, and local government departments, among others. She has published more than 70 papers in the domestic and international academic journals or international conference, completed three books (*Study on Urban Spatial Cultural Structure*, *Green City Planning and Practices in Asian Cities*, and *Theories of Human Settlements in Mountainous Regions*) and three teaching materials (*Urban Sociology* [2nd edition], and An Introduction to Urban Planning [an urban design course]). Her research and planning practice achievements have won the first prize of science and technology progress of the Ministry of Education, the second prize of theory and policy research of the Ministry of Civil Affairs, the second and third prizes of national urban and rural planning excellent design, and the first and second prize of Chongqing urban and rural planning excellent design.

Liu Hongtao

GENERAL MANAGER
SHAANXI XIXIAN NEW AREA FENGXI NEW CITY ENERGY DEVELOPMENT CO., LTD.

Liu obtained his PhD in business administration from Xi’an Jiaotong University. Since 2017, he has been the general manager of Shaanxi Xixian New Area Fengxi New City Energy Development Co., Ltd.

In the past 10 years, Liu has developed and executed energy projects in Fengxi New Area, optimizing district energy systems and promoting sustainable urban energy in Xi’an. He has designed and operated medium-deep geothermal energy noninterference clean heating technology on several projects and has published more than 30 papers focusing on clean energy utilization and energy economics.

Matthew Ulterino

PROGRAMME MANAGER
UNEP FINANCE INITIATIVE

Matthew, an urban planner and specialist in green cities, has been a consultant and researcher for more than 20 years working from New York, Melbourne, and London. He is presently a programme manager at the UNEP Finance Initiative where he works with leading private investors and banks on innovative strategies and practices for the finance and management of sustainable property. Prior to that, he was involved in the UN-Habitat Energy Efficiency in Buildings in East Africa initiative, advising on finance instruments for green buildings and distributed renewable energy, and was a contributing researcher and author on multiple projects addressing green urban growth and green economy of cities from the London School of Economics' LSE Cities research institute. Ulterino has presented at numerous forums on green building rating tools, green property retrofits, building energy efficiency, and distributed renewable energy.

Mikael Jakobsson

EXECUTIVE DIRECTOR
ASIA PACIFIC URBAN ENERGY ASSOCIATION

Mikael Jakobsson is the managing director of NXITY, a consulting company originated from Sweden. Jakobsson is a graduate civil engineer with a master's degree in HVAC/energy from the Royal Institute of Technology in Sweden. Jakobsson has more than 20 years of experience in project management and energy engineering, with specialist knowledge in design- and operation optimization of multi-energy systems including thermal and hydraulic steady-state and transient-state analysis of complex thermal energy systems.

In the past 10 years, Jakobsson has developed and executed some 70 energy projects in the Asia-Pacific region, whereof the majority are in China. Jakobsson started his career working as an analyst, for the Finnish state-owned energy enterprise Fortum, optimizing the district energy systems in Stockholm, Sweden.

Jakobsson is also engaged as the executive director of the Asia Pacific Urban Energy Association, an initiative of International Institute for Energy Conservation promoting sustainable urban energy in the Asia-Pacific region.

Na Won Kim

SENIOR ENVIRONMENT SPECIALIST
ASIAN DEVELOPMENT BANK

Na Won Kim is a senior environment specialist working at the Sustainable Infrastructure Division, East Asia Department of the Asian Development Bank. She processed and implemented a wide range of technical assistance and loan projects relating to clean and renewable energy, emissions trading, energy labeling system, and sustainable transport, among others. Currently, she is focusing on low carbon city development projects in the People's Republic of China, Mongolia, and Kazakhstan, promoting systems thinking, integrated solutions, collaborative and coherent climate actions at various sectors, and preventive approach to enhance resilience and active governance to engage and activate all stakeholders. She has more than 19 years of experience in the field of sustainable development, sustainable production and consumption, system innovation, climate change, environmental policy and governance. Prior to joining ADB, she worked at various organizations including Alberta Environment, the UNEP, Institute for Global Environmental Strategies, and UNDP/Zero Emission Research Initiatives. She holds a master's of science degree in environmental policy and management from the International Institute for Industrial Environmental Economics at Lund University in Sweden.

O.P. Agarwal

CEO
WORLD RESOURCES INSTITUTE INDIA

O.P. Agarwal is currently the CEO of World Resources Institute India. He was a member of the Administrative Service in India from 1979 to 2007. He held several positions with the national and state government of Assam, including joint secretary in charge of urban transport in the national Ministry of Urban Development and secretary for transport in the State of Assam. He was the principal author of the National Urban Transport Policy for the country, which was adopted in 2006 and has remained the key document guiding urban transport investments since then. He has worked in the World Bank for six years as its global urban transport adviser in Washington DC. He has been with the World Resources Institute since June 2017.

He has written several papers on urban transport policy and governance issues. His recent book, *Emerging Paradigms in Urban Mobility Planning, Financing and Implementation*, was published by Elsevier.

He has a PhD in transport economics from the Indian Institute of Technology, Delhi, and a master's degree in transportation from the Massachusetts Institute of Technology.

Ralf Schüle

CO-HEAD OF RESEARCH UNIT URBAN TRANSITIONS
WUPPERTAL INSTITUT

Ralf Schüle is the co-head of Research Unit Urban Transitions of the Wuppertal Institute. He studied sociology, political sciences, and economics and holds a PhD in sociology. He is a leading expert in low carbon urban transformation and strategic planning of urban sustainability paths along the whole policy cycle and covering most relevant sectors (e.g., energy supply, buildings, transport) at the national and local levels. He has 12 years of experience working in this field in Germany, across Europe, and China.

Sangbum Kim

RESEARCH PROFESSOR
UNIVERSITY OF SEOUL

Kim studied economics at University of Seoul and got his doctorate in 2005.

He worked at the Seoul city government for 30 years. In 2011, he temporarily left public office to take on the role of president at Seoul Institute, which is an urban solution think-tank of the Seoul city government. He retired as vice mayor in June 2014.

His specialization is transportation and regional industry development. He was involved in majority of the projects that transformed Seoul into a global city. Financing the subway construction, bus reform, ITS projects, including the Traffic Operation and Information Service (TOPIS), and the developing member country project, which constituted constructing high-tech media industrial parks from 2000 to 2012, were his major contributions. Moreover, his efforts spanning 10 years of replacing diesel bus engines with gas engines greatly contributed to reducing air pollution level in Seoul. He invited CityNet Headquarters to Seoul during his term as vice mayor.

After his retirement, he went on to teach urban issues at the University of Seoul. He is actively involved in opportunities of sharing experiences with many foreign cities' employees through lectures and forums. He also serves CityNet to share his experiences about urban solutions with officials of member cities.

Sanjay Krishnan

CO-FOUNDER AND CEO
LITHIUM URBAN TECHNOLOGIES

Sanjay Krishnan is the co-founder and CEO of Lithium Urban Technologies.

Lithium is a pioneer in sustainable urban mobility, operating the most productive electric vehicle (EV) fleet globally and the largest commercial EV fleet outside China. Lithium is India's first zero emission transport service, with its fleet of about 400 EVs, clocking more than 2 million km per month, 90% powered by renewables. Lithium's goal is to make 1 billion kilometer of urban journeys renewable-powered and emission-free in the next five years.

Krishnan has more than two decades of global experience in strategic advisory and technology at Andersen Consulting and Honeywell International. He also worked for the Mittal family office, having undertaken transactions in oil and gas, steel, and mining. He was part of the founding team at India.com and was instrumental in establishing India's first organized curb-side taxi service.

Krishnan is an electrical engineer and a National Talent Scholar.

Shu Zhu

REGIONAL DIRECTOR & CHINA REPRESENTATIVE
ICLEI EAST ASIA SECRETARIAT

Shu Zhu is regional director of ICLEI East Asia Secretariat and also serves as ICLEI's China Representative. He has extensive experience in sustainable development and regional cooperation. Previously, he held a leadership position at the UNDP Secretariat for Greater Tumen Initiative, an intergovernmental economic cooperation mechanism between China, Mongolia, Republic of Korea, and the Russian Federation, where he led the successful expansion of the organization and its programs. He was also a journalist and editor at the *People's Daily* and a senior manager at Telstra. He holds an Erasmus Mundus Joint Master in Comparative Local Development from University of Regensburg, University of Trento, and Corvinus University of Budapest.

Thuy Do

ADVISER, WATER STRATEGY AND DEVELOPMENT
MUNICIPALITY OF ROTTERDAM

Having graduated from the Delft University of Technology with water resources management specialization, Thuy pursues her career in a position of water management adviser in both a consultancy company and a water board in The Netherlands. She is now a senior adviser in water management and climate adaptation in the city of Rotterdam. She is actively involved in a number of Rotterdam's strategic programs, including climate adaptation, environmental vision, and circularity. She represents the view of the cities in The Netherlands in developing the National Delta Plan on Spatial Adaptation at the Ministry of Infrastructure and Water Management. Her experiences focus on the development of spatial adaptation knowledge and its implementation in Dutch urban areas. The program requires close collaboration among various stakeholders. She has been engaging in City Deal Climate Adaptation and Connecting Delta Cities, C40's Climate Adaptation Academy, to exchange knowledge and develop best practices among cities.

Toru Hashimoto

EXECUTIVE DIRECTOR, DEVELOPMENT COOPERATION DEPARTMENT
CITY OF YOKOHAMA

Toru Hashimoto is in charge of the Yokohama Partnership of Resources and Technologies (Y-PORT) program. Y-PORT is a public–private partnership that endeavors to deliver knowledge and cutting-edge technology for urban solutions. He was instrumental in initiating collaborations under the City Partnership Program with the World Bank and in concluding the Memorandum of Understanding between ADB and the City of Yokohama with regard to urban management solutions. Before joining the City of Yokohama, he took technical as well as managerial positions within the World Bank and the Asian Development Bank Institute. He was educated in the University of Tokyo, Asia Institute of Technology, and Massachusetts Institute of Technology in urban planning, engineering, and human settlements.

Virinder Sharma

SENIOR URBAN DEVELOPMENT SPECIALIST
ASIAN DEVELOPMENT BANK

Virinder Sharma has a lead role in managing delivery, maintaining strategic relationships, and providing technical and advisory support to the ADB and to the UK Department for International Development. He is leading a team of 10 technical professionals and managing the implementation of 60 projects under the ADB-administered multidonor $150 million Urban Climate Change Resilience Trust Fund.

Sharma is a sustainable development professional with more than 25 years of experience in designing, planning, executing, and monitoring programmes on climate change, renewable energy, environment, urban development and rural livelihoods.

He has worked in India, Kenya, and the Philippines and has managed development projects in the UK, Australia, China, and Nepal.

Sharma is an Indian national, having obtained his PhD from Newcastle University in the United Kingdom and Panjab University in India.

Wee Kean Fong

DEPUTY COUNTRY DIRECTOR
WORLD RESOURCES INSTITUTE CHINA

Wee Kean Fong is the deputy China country director at WRI. WRI China currently has five major programs – climate change, energy, sustainable cities, water, and green finance. As deputy country director, Fong plays an important role in strategic planning, fundraising, and communications for these programs while overseeing WRI China's operations. He also serves as the acting director for WRI's China Climate Program that offers support to provinces and cities on low carbon roadmap analyses, city climate action planning, and greenhouse gas data analysis and tracking. Under his global portfolio, Fong is a senior adviser for a global initiative on subnational low carbon transition that focuses on supporting cities and regions to measure greenhouse gas emissions, set emissions reduction targets, and plan and implement actions. Among his recent publications is the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, which provides a standardized framework to enable cities to measure, report, and track greenhouse gas emissions consistently and comprehensively.

Weijun Zhang

FOUNDER
EWATERS ENVIRONMENTAL SCIENCE & TECHNOLOGY

Weijun Zhang is the founder of Ewaters Environmental Science & Technology, which mainly focuses on high-end technological applications in water systems.

For the past 25 years, Weijun has been at the forefront of computer modeling in river basin, urban water, stormwater, and wastewater management areas. He has extensive experience in delivering intelligent and integrated solutions with the latest water information technology, model integration with geographic information system and telemetry data, real-time modeling, and OpenMI application, particularly in a wide range of Innovyze and DHI software products.

Weijun has undertaken high-level technical management and business development roles in both China and New Zealand. His advanced water information integration and modeling technology has benefited a number of clients in terms of making cost-effective decisions and influencing water management software solutions in the regions where he has been based.

Wenqiang Wang

PRESIDENT
JIANGXI SINOCARBON TECHNOLOGY CO., LTD.

Wang Wenqiang is one of the founders of Sino-Carbon Innovation & Investment Co. Ltd. (SCII), a Beijing-based consultancy group on low carbon development, with 31 subsidiary companies. At SCII, Wang is responsible for low carbon research and innovation business, including carbon finance model innovation, low carbon city design and engineering, and carbon management consulting, among others. Some of these efforts generated publications on sustainability and energy efficiency, including carbon markets; CDM methodology guidelines; and CDM project development and practices in China.

Xuedu Lu

LEAD CLIMATE CHANGE SPECIALIST
ASIAN DEVELOPMENT BANK

Xuedu Lu, PhD, joined ADB in 2010. He is a lead climate change specialist at the East Asia Department of ADB, working on low carbon development, low carbon technology, carbon trade, climate finance, and climate change business, among others. Prior to joining ADB, Lu has taken on the roles of deputy director general of the National Climate Center; co-director of Joint Lab of Climate Economic under the China Meteorological Administration and Chinese Academy of Social Sciences; member of the executive board of Clean Development Mechanism under the Kyoto Protocol; deputy head of the Global Environment Office of the Ministry of Science and Technology; director of the Department of Social Development under the Ministry of Science and Technology; member of the China Economy Council; and adjunct professor of Tianjin University and Tongji University. As a member of the Chinese delegation, he was engaged in the negotiations on the UN Framework Convention on Climate Change and Kyoto Protocol from 1996 to 2010.

Youree Lee

CO-FOUNDER AND CEO/CBO
W-FOUNDATION/PEERTEC

A philanthropist and an entrepreneur, Lee is the co-founder and CEO of W-Foundation, chief business official at Actwo Technologies of Peer, and an adjunct professor at Hanyang University School of Business.

W-Foundation is an international nonprofit organization and one of the most active nonprofits accredited by the Korean government.

Peer (peer.com) is a blockchain group composed of financial services (GDAC.com), blockchain financial technology (Actwo Technologies), media (Blockinpress.com), industry hub (Upground.com), technology laboratory (Actwo Lab), research center (Finector.com), POS/validator (Hashtower.com), and global forum (Deconomy.com).

Recognized as a pioneer in bringing blockchain to social finance, Lee led the launch of the blockchain currency W Green Pay for Hooxi, a global nature conservation campaign organized by W-Foundation and its public and private sector partners, including UNFCCC.

Lee has extensive investment and corporate banking experience at Macquarie and Sumitomo Mitsui Banking Corporation, covering infrastructure and renewable energy project financing and relationship management.

She received her PhD, MA, and BA in international business from Ewha Womans University and teaches business, strategy and finance at Ewha Womans University and Hanyang University.

Yuki Murai

MANAGER, PROJECT PROMOTION DIVISION, CLIMATE CHANGE POLICY HEADQUARTERS
CITY OF YOKOHAMA

Yuki Murai studied information science in the university.

Since 2014, he has been a project officer in the Climate Change Policy Headquarters of the City of Yokohama. He is in charge of the Yokohama Smart City Project.

Yun (Yvonne) Yang

PROGRAM OFFICER
ICLEI EAST ASIA SECRETARIAT

Yvonne Yang has devoted herself to supporting cities being circular. She aims to facilitate global cities in East Asia and worldwide shifting toward the circular economy. With her interdisciplinary background in greenhouse gas mitigation, spatial planning, and economics, Yvonne has an interest in integrating different schools of thought to solve sustainable challenges in cities. Yvonne joined the ICLEI East Asia Secretariat to initiate the “Green Circular Cities Coalition.” To assist cities to learn from peers and frontrunners, the coalition organizes capacity-building activities and events for local government officials. The coalition works with partners to provide technical assistance and to inspire circular urban innovation.

Zolzaya Enkhtur

CLIMATE CHANGE AND PROJECT MANAGEMENT SPECIALIST (CONSULTANT)
ASIAN DEVELOPMENT BANK

Zolzaya Enkhtur is working as a climate change and project management specialist for ADB regional technical assistance on low carbon development. She has completed her master's degree in environmental science and natural resources management and worked extensively on various environmental and sustainable projects in Mongolia since 2010. She previously worked as a senior projects officer at Capital City's Environmental Agency to expand cooperation opportunities with international organizations to meet the commitments of green development policy and climate policy of the city of Ulaanbaatar. She is also working on a broader communications program to encourage behavior change and awareness within her Climate Campaign nongovernmental organization (NGO). Climate Campaign is a consultancy and advocacy NGO based in Ulaanbaatar, Mongolia. Enkhtur conducts and promotes policy-relevant analysis to help drive green growth in Mongolia. Her NGO offers integrated carbon-reducing sustainable growth solutions for policymakers and practitioners at the national, subnational, and community levels in the field of low carbon city policy. Climate Campaign's previous creative advocacy and media campaigns include Me to We, Creative 100, 3R to 5R, and Youth4Climate.

LIST OF PARTICIPANTS

A. Developing member countries

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Cai	Hongjin	Director of Air and Ecological Environment Division	Jilin Ecological and Environment Bureau	China
Chen	Zizhen	Director of Air, Environment and Climate Change Division	Changsha Ecological and Environment Bureau	China
Chen	Xiaodong	Deputy Director	Qingdao Ecological and Environment Bureau (Shandong)	China
Chen	Mingyang	Senior Engineer, Center for Energy and Climate Change	Sichuan Academy of Environment Planning and Policy	China
Chen	Peizhong	Associate Consultant	Taiyuan Science and Technology Bureau	China
Chen	Chen	Project and Institutional Coordinator	Xiangtan Low Carbon City Sector Development Project	China
Chen	Yi	Principal Staff	Hunan Department of Ecology and Environment	China
Chen	Guangyang	Investigator	Hunan Department of Ecology and Environment	China
Deng	Rongxing	Director, Foreign Capital Division	Hunan Development and Reform Commission	China
Deng	Weiping	Director, Foreign Capital Division	Hunan Department of Finance	China
Dong	Nanya	Cap and Emission Management Division	Chongqing Ecology and Environment Bureau	China
Feng	Lina	Principal Staff of Climate Division	Qinghai Department of Ecology and Environment	China
Gan	Jin	Officer	Chengdu Environment Protection Publicity and Education Center	China
He	Xiaomei	Secretary	Tieluchong Community	China

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Hu	Lihua	Deputy Director, Publicity, Education and International Cooperation	Hunan Department of Ecology and Environment	China
Huang	Jun	-	Qingdao Ecology and Environment Bureau	China
Huang	Wen	Low Carbon Staff	Tieluchong Community	China
Huo	Jieguo	Deputy Director	Jilin Ecological and Environment Bureau	China
Jiu	Xian	-	Xining	China
Jiang	Hongbin	Deputy Director	Chenzhou Ecology and Environment Bureau	China
Le	Xiaoyan	Sr. Engineer	Ningbo Scientific Research and Design Institution of Environment Protection	China
Lei	Can	Principal Staff, Air Division	Wuhan Ecology and Environment Bureau	China
Li	Fan	Climate Change Division	Tianjin Ecology and Environment Bureau	China
Li	Zhang	Deputy Director, General Division	Zhejiang Department of Ecology and Environment	China
Li	Guisheng	Director of General Division	Jiaxing Ecology and Environment Bureau	China
Liu	Yingjie	Deputy Director	Changsha Ecology and Environment Bureau	China
Liu	Xinmin	Deputy Director, Policy Research Institution For Environment and Economy	Sichuan Academy of Environmental Sciences	China
Liu	Qian	Deputy Director, Climate Change Division	Chengdu Ecology and Environment Bureau (Sichuan)	China
Liu	Wenchao	Deputy Director, Division of Atmosphere	Shenyang Academy of Environmental Sciences	China
Lu	Fengle	-	Hangzhou Ecology and Environment Bureau (Zhejiang)	China
Luo	Zhihong	Deputy Director	Baise Ecology and Environment Bureau	China
Mo	Fengjial (JANE)	-	HLICC	China

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Shen	Feng	Director, Climate Change Division	Jiangxi Department of Ecology and Environment	China
Shi	Xingzhi	Doctor	Zhejiang Pollution Allowance Trade Center	China
Shi	Zhufang	Project Coordinator-	World Resources Institute (WRI)	China
Sun	Yonghe	Director, Air and Environment Division	Jinhua Ecology and Environment Bureau	China
Tang	Wei	Senior Engineer	Hangzhou Institute of Environmental Protection Science	China
Tan	Huaisheng	Director, Resource and Environment	Hunan Development and Reform Commission	China
Wang	Congying	Climate Change Division	Jiangxi Department of Ecology and Environment	China
Wang	Junjie	-	Hunan Development and Reform Commission	China
Wang	Wenqiang	Climate Change Division	Jiangxi SinoCarbon Technology Corporation	China
Wang	Huaiqing	Vice Director	Jiangxi Climate Center	China
Wang	Ligang	Executive Vice Mayor	People's Government of Taiyuan Municipality	China
Wang	Huaiqing	-	Jiangxi Province	China
Wang	Xing	Chief of General Section	Chongqing Resource and Environment Exchange Center	China
Wu	Wanzhou	Director, Climate Change and Regional Cooperation	Department of Ecology and Environment (Guangxi Zhang Autonomous Region)	China
Wu	Junhong	Doctor	Zhejiang Development Planning Consulting	China
Wu	Jian	Deputy Director, Air Division	Quzhou Ecology and Environment Bureau	China
Xu	Jun	-	Chongqing Group	China
Xiong	Jihai	Director, Institution of Energy Research	Jiangxi Academy of Sciences	China

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Xiong	Ying	Officer, Economic Trade and Foreign Capital Division	Changsha Development and Reform Commission	China
Xu	Jun	Cadre, Cap and Emission Management Division	Chongqing Ecology and Environment Bureau	China
Yang	Yanli	Associate Researcher, Qingdao Institution of Bioenergy and Bioprocess Technology	Chinese Academy of Sciences	China
Yang	Binping	Director	Chengdu Academy of Environmental Sciences	China
Yu	Chen	Deputy Director	Wuhan Vehicle Exhaust Pollution Control Administration center	China
Yu	Xingang	Director of Solid Waste and Chemicals Division	Jilin Department of Ecology and Environment	China
Zhang	Jiutian	Project Coordinator	Beijing Normal University	China
Zhang	Ning	Senior Engineer	Tianjin Academy of Environmental Sciences	China
Zhang	Min	Director, Climate Change Division	Qinghai Department of Ecology and Environment	China
Zhang	Fan	Chairman	Innovative Low Carbon Center, Hunan	China
Zhou	She	Deputy Principal Staff	Jiangxi Ecology and Environment Bureau	China
Zhu	Shijia	Staff, General Division	Quzhou Ecology and Environment Bureau	China
Zhu	Yiting	Professor	Hunan University	China
Zhuang	Yushi	President	Jilin Provincial Academy of Environmental Sciences	China
Arif	Arifullah	Director, Planning and Policy	Ministry of Urban Development and Land	Afghanistan
Bakhshi	Md. Sulaiman	Financial Resources Specialist for Climate Change Projects	National Environment Protection Agency	Afghanistan
Raheemi	Md. Samim	Acting Director, Strategic Planning	Ministry of Transport	Afghanistan
Tokhi	Md. Edris	Director, Environmental Health	Kabul Municipality	Afghanistan

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Abdulov	Imran	Deputy Director, National Meteorology Department	Ministry of Ecology and Natural Resources	Azerbaijan
Imamaliyev	Ayaz	Head of Documentation and Citizens Appeals	Office of the Mayor, Baku City	Azerbaijan
Mikayilov	Nijat	Sr. Advisor, International Cooperation Department	Ministry of Transport, Communication and High Technologies	Azerbaijan
Quluyev	Akif	Deputy Mayor	Sumgait City	Azerbaijan
Rzayev	Elnur	First Deputy Head	Ganja City Executive Power	Azerbaijan
Salahov	Eldar	Head, International. Cooperation and Protocol Department	State Committee for City Building and Architecture	Azerbaijan
Beruashvili	Mariam	Head, Environmental Management Bureau	Department of Environmental Protection	Georgia
Dididze	Giorgi	Head, Regional and Mountainous Areas Development Department	Ministry of Regional Development and Infrastructure	Georgia
Goksadze	Elene	Head, Analysis and Planning	Ministry of Economy and Sustainable Development	Georgia
Javakhishvili	Maia	Deputy Head, Environment and Climate Change Department	Ministry of Environment Protection and Agriculture	Georgia
Shalikashvili	Mamuka	Head, Infrastructure Policy and Development Partners Relations Division	Ministry of Regional Development and Infrastructure	Georgia
Amantayeva	Gaukhar	Protection and Nature Management	Çity of Shymkent	Kazakhstan
Assylbekov	Sabyr	Chief Expert, Climate Policy and Green Technology Department	Ministry of Ecology, Geology and Natural resources	Kazakhstan
Dzhumadildaye	Abdimanap	Deputy Head Environmental	Akimat of NurSultan	Kazakhstan
Kaldybekov	Azamat	Deputy Head, Green Economy Division	Akimat	Kazakhstan
Sembayev	Diyas	Member	Working Group on Government and ICT, Public Finance and Public Information	Kazakhstan
Smirnov	Andrey	Head, Infrastructure Sector Unit	Office of the Prime Minister	Kazakhstan

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Solovyova	Aigul	Chairwoman	Association of Ecological Organizations	Kazakhstan
Tanabayev	Musa	Division Head, Environmental	Akimat of NurSultan	Kazakhstan
Temirgaliyeva	Kuralay	Head, Project Development Group	JSC under the Almaty City Administration	Kazakhstan
Asanov	Aibek	Head, External Aid Efficiency Monitoring Division	Ministry of Economy	Kyrgyz Republic
Basylbekova	Nargiza Talasbekovna	Chief Specialist, Finance and Strategic Development Department	Ministry of Transport and Roads	Kyrgyz Republic
Bekbolotov	Jusup Zamirovich	Chief Specialist, Analysis, Pricing and External Relations	State Agency on Architecture, Construction, and Housing and Communal Services	Kyrgyz Republic
Kasymov	Erdenet Jyrgalbekovich	Specialist, PPP and Program Assistance, International Cooperation Department	Ministry of Finance	Kyrgyz Republic
Topchubaev	Asylbek Amanovich	Vice Mayor	Osh City	Kyrgyz Republic
Tulobaev	Balbak Zarlykovich	Chief of Staff	Bishkek City Mayor's Office	Kyrgyz Republic
Anjim	Enkhbold	Senior Officer, Transport and Auto Transport Policy Implementation Department	Ministry of Roads and Transportation	Mongolia
Baatar	Zolzaya	Officer, Cooperation and Partnership	Governor's Office of Ulaanbaatar	Mongolia
Bayarsaikhan	Molor	Transportation Advisor	Citizens Representative Council of Ulaanbaatar	Mongolia
Dolgorsuren	Saruul	Manager, National Designated Authority for GCF	Ministry of Environment and Tourism	Mongolia
Ganbaatar	Enkhtuvshin	Officer in Charge, Power Generation, Policy and Planning Department	Ministry of Energy	Mongolia
Khurelbaatar	Bulgaa	Deputy Director	Ulaanbaatar Public Transport Agency	Mongolia
Lkhagva	Jambaa	Director, Energy Market and International Cooperation	Energy Regulatory Commission	Mongolia

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Sumiya	Ariuntsetseg	Specialist, Development Policy and Planning	Ulaanbaatar Governor's Office	Mongolia
Tsog	Anand	Climate Change Officer, Department of CC and International Cooperation	Ministry of Environment and Tourism	Mongolia
Tsog-ochir	Ankhbayar	Second Secretary Department of Multilateral Cooperation	Ministry of Foreign Affairs	Mongolia
Atif	Hummera	Section Officer	Economic Affairs Division	Pakistan
Baloch	Md. Yasheen Shar	Joint Secretary	Ministry of Housing and Works	Pakistan
Durrani	Shahzad Hameed Khan	Joint Secretary	Ministry of Climate Change	Pakistan
Shah	Rahman	Section Officer	Economic Affairs Division	Pakistan
Dodikhudo	Firuz	Assistant Secretary of the First Deputy Prime Minister		Tajikistan
Kholiczoda	Jaloliddin	Assistant Secretary of the Prime Minister		Tajikistan
Normurodzoda	Firdavs	Main Specialist, Department of Strategic Planning and Reforms	Executive Office	Tajikistan
Qodirov	Sayfullo	Deputy Head, Deputy of Land Transport	Ministry of Transport	Tajikistan
Sadurov	Saidismon	Head, Department of State Oversight of the Use and Use Protection of the Atmosphere Air	Committee for Environment and Natural Protection	Tajikistan
Zikriyozoda	Suhrob	Head, Department of Industry and Infrastructure Fields	Ministry of Economic Development and Trade	Tajikistan
Amangeldiyev	Arslan	Sr. Specialist, Control over the Municipal Improvement of Ashgabat	Municipality of Ashgabat	Turkmenistan
Arsalov	Nazar	Deputy Head	Main Directorate of Finance and Economy of Ashgabat	Turkmenistan
Ashyrov	Pavlan	Sr.Specialist, Export of Electricity Power Division	"Turkmenenergy" Ministry of Energy	Turkmenistan

LAST NAME	FIRST NAME	POSITION	AGENCY	COUNTRY
Kurbanov	Vepa	Head, Main Directorate of Finance and Economy of Lebap Province	Ministry of Finance and Economy	Turkmenistan
Mamiyev	Patyshaguli	Sr. Specialist, Foreign Economic Relations Department	Turkmen Motor Transport Agency	Turkmenistan
Saryyev	Yusup	Head, Department of Environment Protection of Balkan Province	Ministry of Agriculture and Environmental Protection	Turkmenistan
Abdujalilov	U	Head of Department	State Committee on Ecology	Uzbekistan
Akhmadov	Khasan Ugli	Leading Specialist	Ministry of Construction	Uzbekistan
Khikmatov	Alijon	Head, Department of Forecasting and Tariff Policy in Heating Sector	Ministry of Housing and Communal Services	Uzbekistan
Mamadaliev	Salokhiddin	Main Economist, Tariff Policy and Reformation of Public Enterprises Department	Ministry of Finance	Uzbekistan

B. Speakers

LAST NAME	FIRST NAME	POSITION	AGENCY
Agarwal	O.P.	CEO	World Resources Institute India
Ahn	Junsoo	Deputy Director, Sidewalk Management Team	City of Seoul
Do	Thuy	Adviser, Water Strategy and Development	Municipality of Rotterdam
Fischedick	Manfred	Vice President	Wuppertal Institute
Wee Kean	Fong	Deputy Country Director	World Resources Institute China
Hashimoto	Tory	Executive Director, Development Cooperation Department	City of Yokohama
Huang	Ling	Professor and Doctoral Supervisor, Faculty of Architecture and Urban Planning	Chongqing University
Jacobsson	Mikael	Executive Director	Asia Pacific Urban Energy Association
Jagannathan	Vijay	Secretary General	CityNet
Jiang	Juliet	Senior Vice President	Broad Group, PRC

LAST NAME	FIRST NAME	POSITION	AGENCY
Kneisz	Alan	Business Development Director	Hydrogenics Corporation
Krishnan	Sanjay	Co-Founder And CEO	Lithium Urban Technologies
Lee	Youree	Co-Founder and CEO/CBO	W-Foundation/Peertec
Lei	Bi	Director, Digital Economy Department	Shenyang Municipal Development and Reform Commission
Liu	Hongtao	General Manager	Shaanxi Xixian New Area Fengxi New City Energy Development Co., Ltd.
Meng	Alan	Green Bond Analyst/Project Manager (China)	Climate Bonds Initiative
Murai	Yuki	Manager, Project Promotion Division, Climate Change Policy Headquarters	City of Yokohama
Ohira	Eiji	Director General, Fuel Cell and Hydrogen Technology Group	New Energy and Industrial Technology Development Organization (NEDO)
Park	Hyeon	Professor and Dean, International School of Urban Sciences	University of Seoul
Qin	Hao	Senior Sustainability Expert	Meituan Bike
Sangbum	Kim	Research Professor	University of Seoul
Scandling	Evan	Director of Advisory and Business Development – Southeast Asia	Allotrope Partners
Schule	Ralf	Co-Head of Research Unit Urban Transitions	Wuppertal Institute
Selstam	Henrik	CEO	Scandgreen Energy, Sweden
Song	Hoon Sub	Deputy General Manager, Business Strategy Team, Doosan Fuel Cell	Doosan Corporation
Svenningsen	Niclas	Manager	Global Climate Action UNFCC
To	Andy	Managing Director, North Asia	U.S. Green Building Council (USGBC) Green Business Certification Inc. (GBCI)
Tobing	Aisa	Senior Adviser to the Governor of Jakarta Deputy Secretary General	CityNet
Ulterino	Matthew	Program Manager	UNEP Finance Initiative

LAST NAME	FIRST NAME	POSITION	AGENCY
Ven	Frans van de	Team Leader, Urban Land and Water Management	Deltares
Xiaobauer	Chun	Coordinator for International Energy Policy and Systems Transition	Wuppertal Institute for Climate, Environment, Energy
Yang	Yun (Yvonne)	Program Officer	ICLEI East Asia Secretariat
Yuen (Joseph) MA	Ching	Deputy General Manager	Shenzhen Bus Group Co., Ltd.
Zhang	Wenjun	Founder	Ewaters Environmental Science and Technology
Zhu	Shu	Regional Director and China Representative	ICLEI East Asia Secretariat

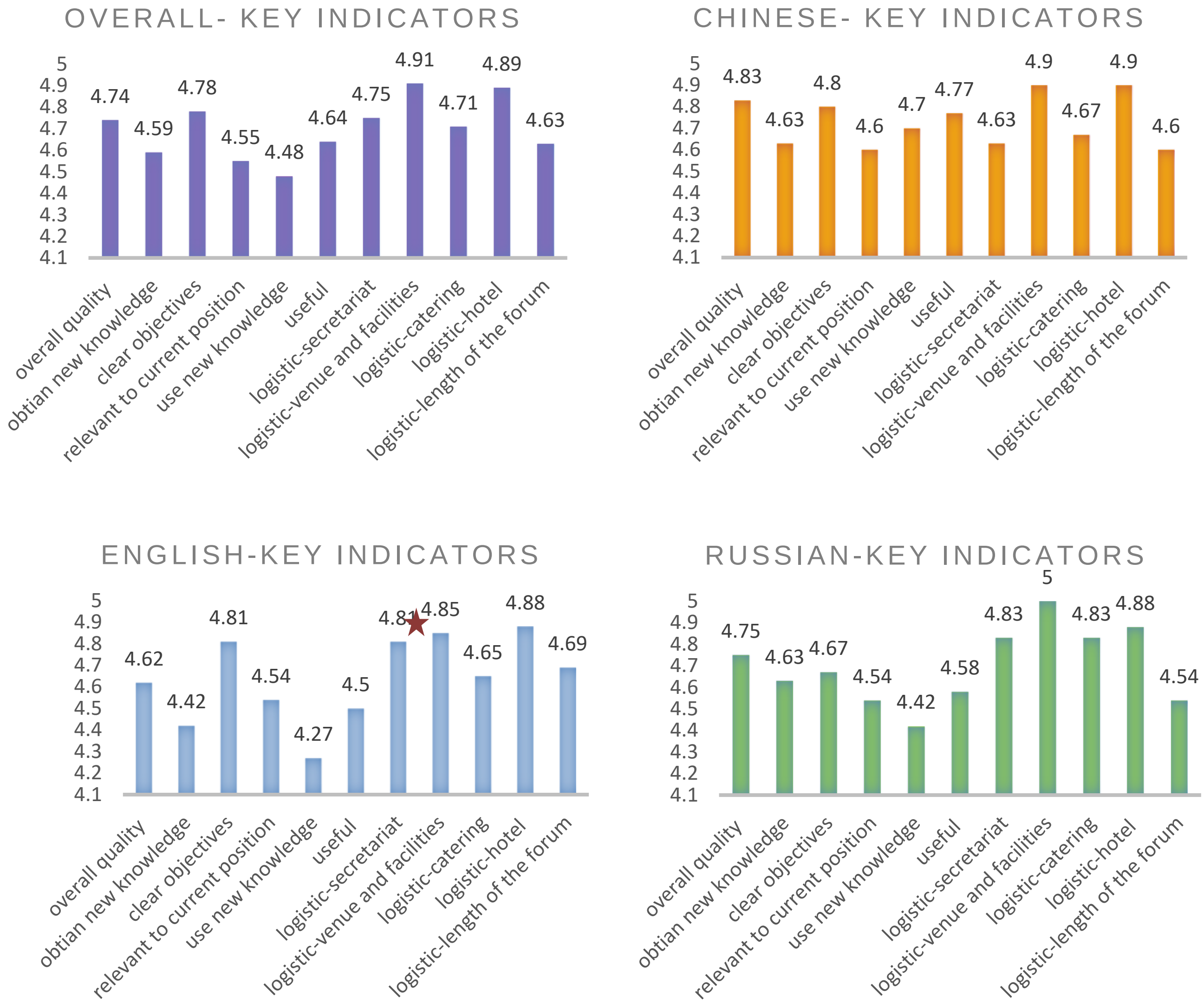
FEEDBACK FROM PARTICIPANTS

Evaluation forms were distributed in Chinese, English, and Russian on the third day of the conference. Feedback was received from 80 participants; 30 were in Chinese, 26 in English, and 24 in Russian.

A. Overall quality of the forum

Based on feedback received, participants reported very high satisfaction on the Forum. Ranking from 1 to 5, the average score of each indicator is above 4.4. Marked with a star is the best indicator earning the top score (logistic - venue and facilities), while the indicator about using new knowledge in work gets the lowest score.

For the Chinese respondents, relatively lower satisfaction was reported with “relevant to current position” and “length of the forum”; English respondents gave lower evaluation on “obtain new knowledge” and “use new knowledge”; Russian respondents also did not think high of “obtain new knowledge” and “relevant to current position.”



Feedbacks by indicators

B. Other Feedbacks

1. Which presentation/session did you find the most useful? (Top 3, rank in frequency)

- Session 5: Roundtable on Green Finance and Innovative Financing
- Session 7: Climate Adaptation
- Session 3: Low Carbon Transport Options in Mega-Cities

2. How will you apply the knowledge gained from this workshop to your work?

Since the participants are from different institutions, there are many ways of applying the knowledge into practice. Some government officials who are in-charge of planning policies said they would submit a report to the government and apply the knowledge gained from the forum to the policymaking and implementing process. Others who are responsible for project management said they would put the ideas to the implementation of the projects.

3. Do you have any comments or suggestions on the presentations of the speakers/resource persons?

Most participants spoke highly regarding the speakers, moderators. and the presentations. They agreed that the speakers are experienced and professional, and the presentations are interesting, informative, and useful. Some suggested to add more implementation details to presentations.

4. Do you have any comments or suggestions that would help us improve future events? (a) Duration, (b) Quality of the discussions, (c) Participant mix, (d) Facilitation, (e)Presentation contents

Many participants suggested a shorter duration of the forum, fewer speakers per session, with more in-depth presentations, and more time for panel discussion and Q&A sessions. As for the participants mix, gender equality should be given more attention. The contents of presentations are generally good, but more cases and videos are preferred.

5. What subjects/themes would you like the organizers to address in its future events?

Green financing, green transport, waste management, local community engagement, clean energy technology.

6. Do you have other comments or suggestions?

Overall, the forum was interesting, informative, and fruitful. Some additional suggestions:

- The Q&A session would be more efficient if application like *slido* could be used, so the participants can submit their questions and the moderator could pick several questions which are the most relevant to be mentioned and discussed.
- Slide handouts should be provided to the participants in advance.

C. Site visits

This forum had several site visits, including a half-day visit to Seoul Energy Dream Center on Day 2, a half-day visit to Seoul Traffic Operation and Information Service Center and Cheonggyecheon Stream on Day 3, and a whole-day visit to Seonam Sewage Treatment Center and Sudokwon Landfill Site on Day 4.

157 participants joined the first site visit on Day 2, including 75 Chinese speaking, 43 Russian speaking and 39 English speaking participants. At the Energy Dream Center, which is known as a role model for zero energy building construction, participants visited its advanced solar facility, geothermal and rainwater facility, and other renewable energy applications. In the Hydrogen Fueling Station, participants were introduced how hydrogen is produced from methane in landfills and then used to generate electricity and fuel cells for cars. In Mapo Resource Recovery Facility, where garbage waste is incinerated, participants were shown how recycled thermal energy is captured and recycled for various services including district heating and creating a clean and comfortable environment.

115 participants joined the second site visit on Day 3, including 45 Chinese speaking, 42 Russian speaking, and 28 English speaking participants. At Seoul Traffic Operation and Information Service (TOPIS), participants were shown the Seoul Intelligent Transport System with real time on-site information obtained through surveillance cameras, which enables the city to efficiently manage the interval between buses, relieve congestion and take timely action in

case of an accident. Participants also visited the Cheonggyecheon Stream, lauded as a major success in urban renewal and an international example in promoting a more eco-friendly urban design. Thanks to the Restoration Project, Cheonggyecheon now becomes a center for cultural and economic activities.

The third site visit attracted a total of 105 participants, including 33 Chinese speaking, 42 Russian speaking, and 30 English speaking participants. At the Seonam Sewage Treatment Center, participants were introduced its unique sewage treatment technologies that result to high methane content, biogas and biomethane plants from sewage. At the Sudokwon Landfill Site, a world-class waste treatment complex, participants had a chance to understand its environment-friendly landfill management processes about how they generate energy from waste and how they turn landfills into environmental attractions (Dream Park).

The survey did not extend to seeking feedback on site. Based on informal feedback from Chinese city participants and some English speakers, the three site visits received generally positive feedbacks, while some suggestions included:

- Consider the travel restriction of Chinese officials, whose business trips in one foreign country are limited within five days. Due to this constraint, many Chinese participants missed the last day site visit.
- Incorporate more knowledge/experience sharing about management and process, with less time for technology introduction and facility tour.
- Divide the site visit into basic and advanced levels. Some industrial experts think the introduction is too basic for them.
- Provide introduction about the Cheonggyecheon Stream when participants walked around the stream, otherwise they don’t know its history, significance, and features.

PRESENTATION HAND-OUTS

Opening Plenary

ADB

2nd International Forum on Low Carbon Development for Cities | Seoul | 2-5 September 2019

Opening Remarks

Sujata Gupta
Director, East Asia Department
Asian Development Bank

Climate Change and Its Impacts to Sustainable Development

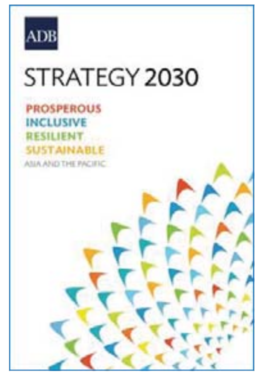
- Climate-induced impacts resulted in significant economic loss
- IPCC's Special Report on Global Warming of 1.5 °C urges increased and transformative climate actions

ADB

ADB Strategy 2030

Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability;

Making cities more livable;



Role of Cities in Climate Actions

- Cities consume 80% of the world's energy and contribute to 75% of global GHG emissions
- Cities are key to achieving NDC targets under the Paris Agreement.

ADB

Towards Low Carbon Transformation

- Consolidated efforts can expedite low carbon transformation
- Holistic and integrated approaches can reinforce climate actions
- Systems thinking can result to effective low carbon city transformation

ADB

Challenges to Making Cities Livable, Low Carbon, and Climate Resilient

- Rapidly growing cities are challenged to provide sustainable, low carbon, resilient infrastructure
- Right policies and incentives are needed to scale up climate investment and mainstream transformative interventions

ADB

Objectives of the Forum

- To present innovative concepts, solutions, and tools
- To underscore how social innovation can drive low carbon and sustainable city development
- To reinforce ADB's role as trusted partner, reliable financier, knowledge provider, and convener of strategic partners for low carbon city development efforts

ADB

Our Partners

CITYNET
THE REGIONAL NETWORK OF LOCAL AUTHORITIES FOR THE MANAGEMENT OF HUMAN SETTLEMENTS

allotrope PARTNERS

APUEA
Asia Pacific Urban Energy Association

BROAD GROUP
远大集团

重庆大学
CHONGQING UNIVERSITY

OPEN YOKOHAMA

CLEAN ENERGY INVESTMENT ACCELERATOR

Climate Bonds INITIATIVE

Deltares
Enabling Delta Life

DOOSAN

Our Partners

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FENGXI ENERGY

湖南省联创低碳经济发展中心
Innovative Low Carbon Center, Hunan

HYDROGENICS
SHIFT POWER | ENERGIZE YOUR WORLD

I.C.L.E.I
Local Governments for Sustainability
East Asia

Lithium
Tomorrow's Transportation Today

美团
Meituan

MONGOLIA ENERGY REGULATORY COMMISSION

NEDO

Peertec

Gemeente Rotterdam

ScandGreen Energy

SEOUL METROPOLITAN GOVERNMENT

Our Partners

沈阳市发展和改革委员会
Shen Yang Municipal Development And Reform Commission

深圳巴士集团
SHENZHEN BUS

U.S. GREEN BUILDING COUNCIL
USGBC

UNEP FINANCE INITIATIVE

United Nations
Climate Change

서울시립대학교
UNIVERSITY OF SEOUL

W FOUNDATION

WORLD RESOURCES INSTITUTE

Wuppertal Institut

Thank you

Wuppertal Institut

How to combine the climate issue with other development targets
(Integrated) Multi target approach needed

Key note presentation :

Prof. Dr. Manfred Fischedick
Vice President
Wuppertal Institute

Seoul
September 3rd, 2019

Overview and central thesis

- The climate change topic is without any doubt an burning issue - urgent need for action
- Protecting the climate requires (amongst others) a complete change of the energy system – however there are many more underlying drivers for an energy system transformation
- Sustainable development needs more than protecting the climate -> Sustainable Development Goals
- Interactions between climate protection in form of synergies and trade offs have to be considered carefully
- Shaping the transition process to a sustainable system will follow certain phases and requires continuous learning as well as political and societal engagement at different levels
- Shaping transition process to a sustainable system requires a new form of thinking/management (future literacy): (Integrative) Multi-target approach reflecting different dimensions and change of perspectives needed (from technological to cultural/political perspective) – particularly in cities

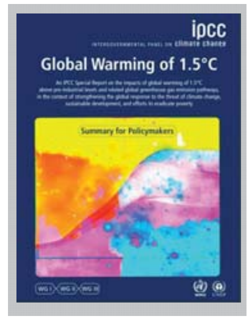
The climate change topic is without any doubt an burning issue - urgent need for action

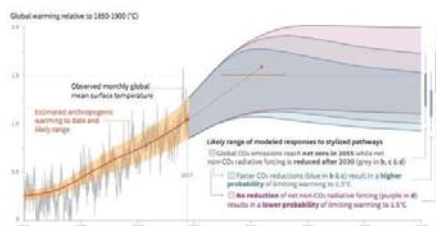
UN climate change panel says 'unprecedented' action needed to prevent temperature rise

- Preventing global temperatures from rising beyond a tough target in the Paris Climate Agreement will take "unprecedented" action, a UN panel says.
- Temperature rise will surpass 1.5 degrees Celsius above pre-industrial levels without a "rapid and far-reaching" transition in energy, industry and transportation.
- The much-anticipated report paints a bleak picture of the world's ability to prevent potentially catastrophic impacts of climate change.

Tom DiChristopher | @tdichristopher
Published 8 Hours Ago

BUSINESS JOURN





Getty Images

The climate change topic is without any doubt an burning issue - urgent need for action

Klimadiskussion mit Politikern in Wuppertal
24. Mai 2019 um 07:11 Uhr | Lesedauer: Eine Minute

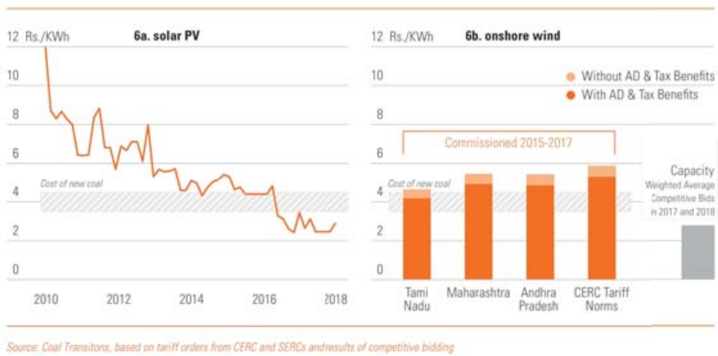
Symbolfoto: dpa. Foto: dpa/Peter Zschunke

- Worldwide attention helps to get things on the political and societal agenda – however solving the issue is for sure no easy sledding ("Selbstgänger")

Protecting the climate requires (amongst others) a complete change of the energy system – however there are many more underlying drivers for an energy system transformation

Siginificant cost reduction of renewable energy technologies enables fast energy system transformation in developed and developing countries

Renewables costs versus new coal in India
(Levelised cost, Rs/Kwh)

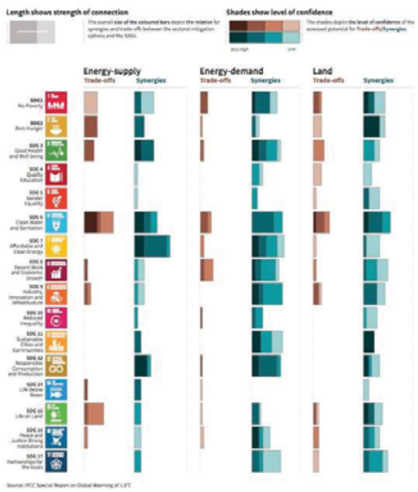


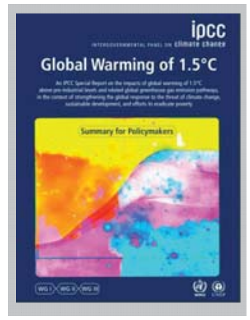
Sustainable development needs more than protecting the climate

Sustainable Development Goals

Interactions between climate protection in form of synergies and trade offs have to be considered carefully

Indicative linkages between mitigation options and sustainable development

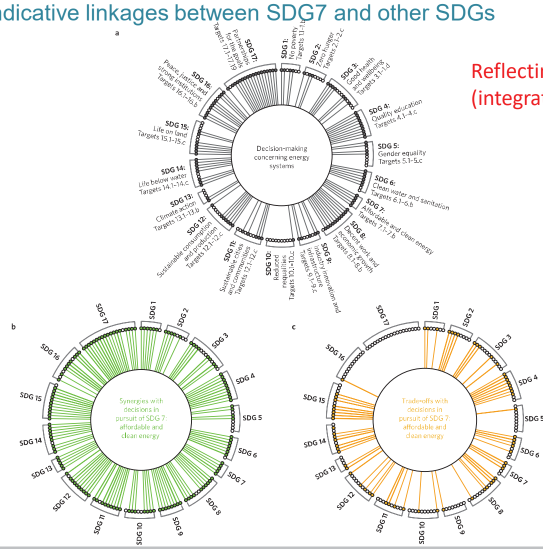




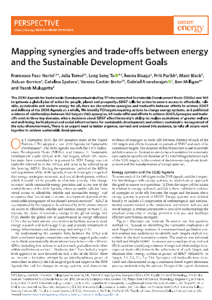
Reflecting the various interactions -> (integrated) Multi target approach needed

Interactions between energy system transformation (following SDG 7: affordable and clean energy) and the SDGs targets

Indicative linkages between SDG7 and other SDGs

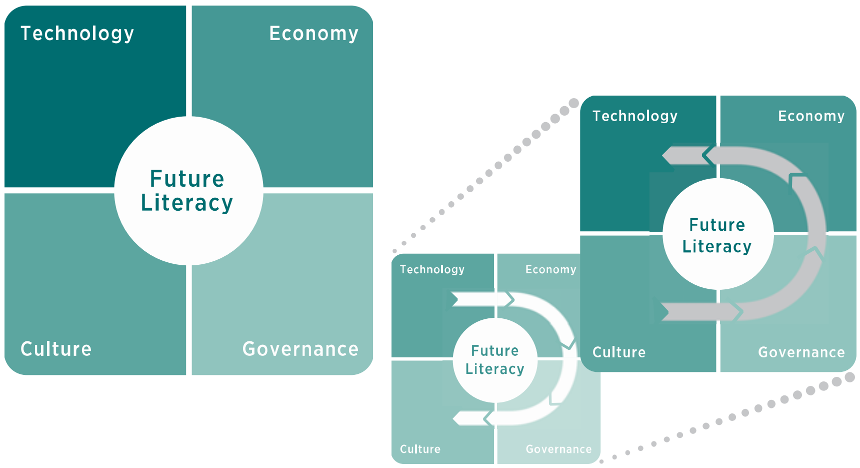


Reflecting the various interactions -> (integrated) Multi target approach needed



Shaping transition process to a sustainable system requires a new form of thinking/management (future literacy)

(Integrative) Multi-target approach reflecting different dimensions and change of perspectives needed (from technological to cultural/political perspective)



…..particularly in cities with their specific characteristics („Eigenart“)

Shaping transition process to a sustainable system requires a new form of thinking/management (future literacy)

(Integrative) Multi-target approach reflecting different dimensions and change of perspectives needed (from technological to cultural/political perspective)

Reflecting the diversity („Eigenart“) of cities is relevant with regard to: cultural background, underlying values, economic power, creativity, social cohesion, innovation capacities, transformation experience etc.

Oval Maidan Park: Mumbai, Indien

Bibliothek: Kopenhagen, Dänemark

CSD: Kopenhagen, Dänemark

…..there is no silver bullet and no blueprint that works for all cities: tailor made approach needed

The good news at the end – transformation is possible and sometimes even faster than expected

Transformation is possible and sometimes even faster than expected

Transformation might go rather quickly under certain favourite conditions – no need to be to pessimistic?

New York 5th Avenue: the great horse manure crises 1894 and the impacts

Photo: Fifth Ave NYC on Easter Morning 1900 Source: US National Archives from (Wikipedia)

1900: Where is the car?

1913: Where is the horse?

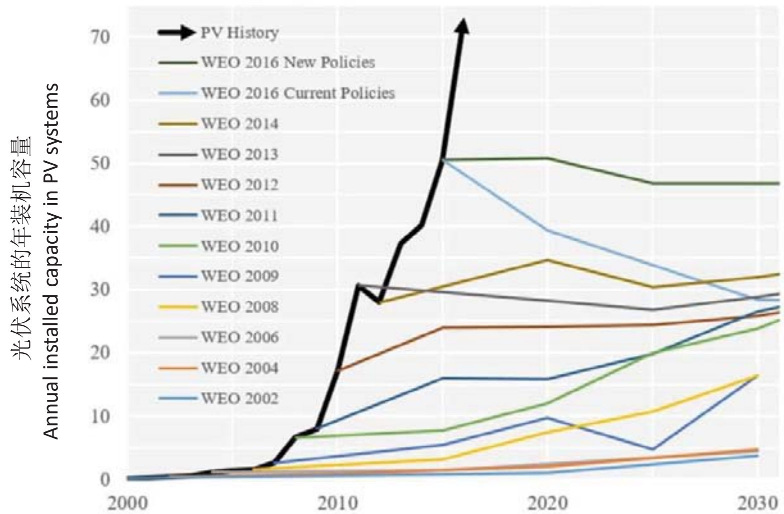
Photo: Easter 1913, New York, Fifth Avenue looking north. George Grantham Bain Collection

Source: shorpy.com

Are air quality issues and climate change in combination with shrinking costs of EVs (incl. batteries) the horse droppings of today?

Transformation is possible and sometimes even faster than expected

Market deployment of renewable energies has been signifcantly underestimated by IEA World Energy Outlooks



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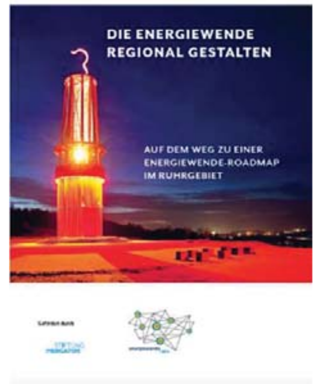
Thank you for your attention!

2nd International Forum
on Low Carbon Development for Cities
Millennium Seoul Hilton Seoul, Republic of Korea
2-5 September 2019

Paths to a Green Economy

Creating New Opportunities driven by coal phase-out

Ralf Schüle
Timon Wehnert



Paths to a Green Economy

###Russian translation

Overview

1. Coal regions in Germany
   Some structural data
2. How to deal with coal regions under transition?
3. Five Innovation Paths
   The example of the Ruhr area
4. Challenges of Managing Regional Sustainability

Disparities between East and West Germany (2015)

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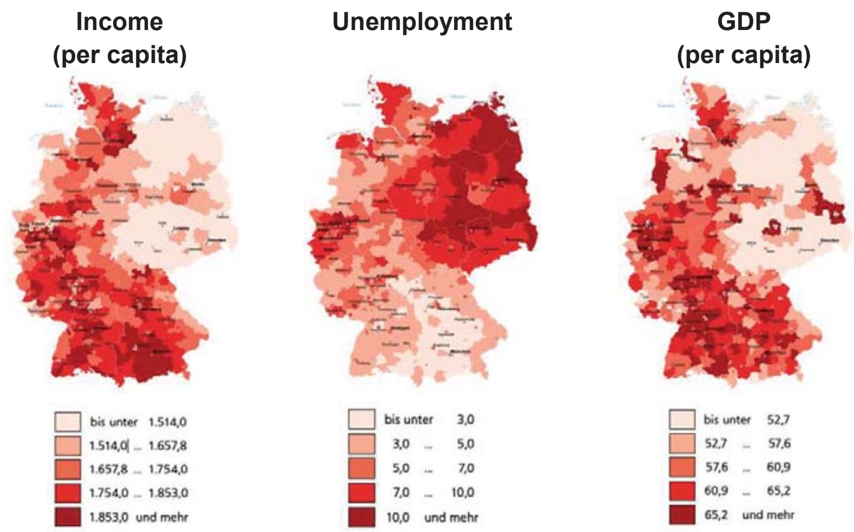

http://library.fes.de/pdf-files/wiso/12390.pdf

GDP per capita
and lignite mining areas in Germany

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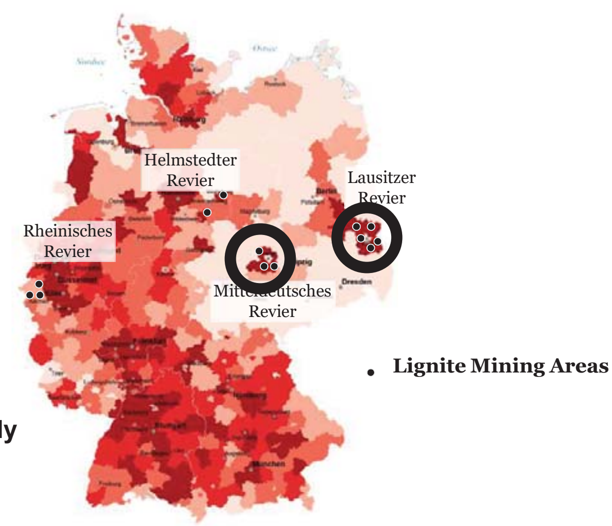

Phase-out of coal:

Lignite mining is important for structurally weak regions from an economc point of view

Jobs in the coal sector over the time in Germany

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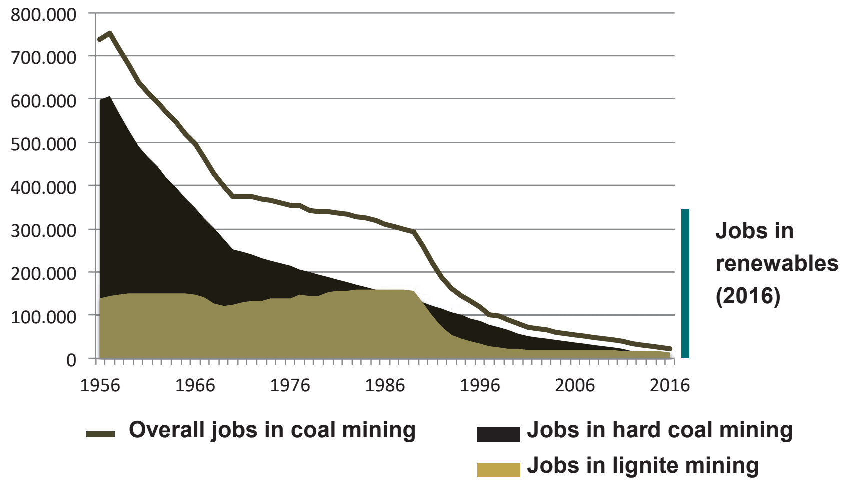

Coal mining jobs decreased from over 750,000 to less than 21,000 in 2016.
This was driven by purely economic reasons.

Source: own calculations based on Statistik der Kohlenwirtschaft e.V. (2016a, 2016b, 2017)

Overview

1. **Coal regions in Germany**
   Some structural data
2. **How to deal with coal regions under transition?**
3. **Five Innovation Paths**
   The example of the Ruhr area
4. **Challenges of Managing Regional Sustainability**

How to deal with coal regions under transition?

- **Phasing-out coal?**
  - ➔ A question of WHEN not IF
- **Economoic view:**
  - ➔ Energy Transition pays
  - ➔ Social costs of mining
  - ➔ Job losses small
- **Phase-out roadmap guidance for:**
  - ➔ investment and innovation
  - ➔ education and job-choices
- **But great challenges for the regions!**
  - ➔ Equity and wealth distribution is crunch issue for "Energiewende"

How to deal with coal regions under transition?

- **Top down planning vs. bottom up initiating**

→ **"**Magic term":
Perspectivic
Incrementalism

Ruhr area: IBA Emscher Park (1989-1999)
Selected project sites

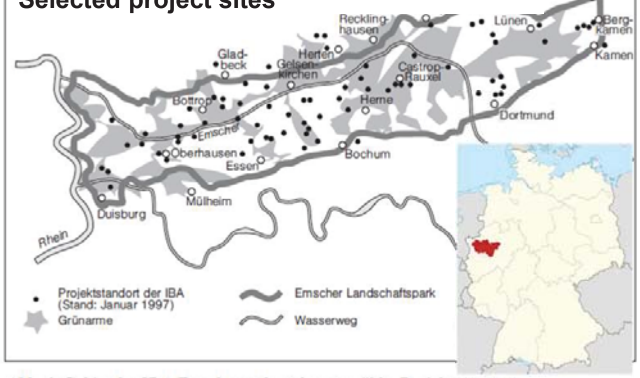

Abb. 6: Gebiet der IBA Emscherpark und ausgewählte Projektstandorte
Quelle: veränderte Skizze nach IBA 1996, S. 20-21

How to deal with coal regions under transition?

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Five perspectives of regional innovation paths and regional transition

1. Urban Structures
2. Economic Structures
3. Infrastructures
4. Industrial Landscapes
5. Image and Identity

Overview

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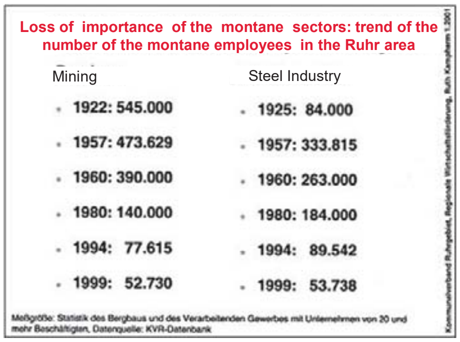
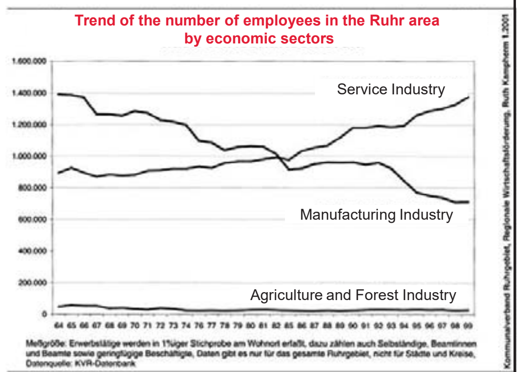
Introduction to the Region
Economic Structural Change





- From 128 mines in 1960,
  7 in operation in 2008
- Termination of state subsidies in 2018
- Loss of population and labor force since 1960, shrinking region

Innovation Path 1
Structural Change as City Transformation

The Ruhr Metropolitan Region is positioning worldwide as competence region for socially acceptable and culturally engaged metropolitan transformation.

REGIONALVERBAND RUHR

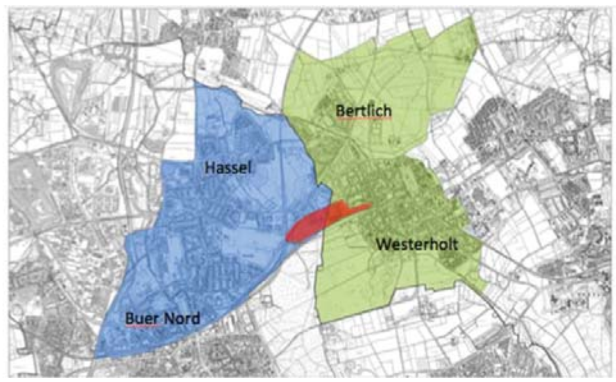
- **Region: IBA Emscher Park (1989-1999)**
- **Essen: European Capital of Cultural (2010)**
- **Essen: European Green Capital (2017)**
- **Region: Green Decade (2017-2027)**

  - **2018 phasing out of coal mining**
  - **2020 finishing of Emscher reconstruction**
  - **2022 KlimaExpo.NRW and klimametropole RUHR 2022**
  - **2027 International Garden Exhibition**

Innovation Path 1

Structural Change as City Transformation

Example: Gelsenkirchen und Herten



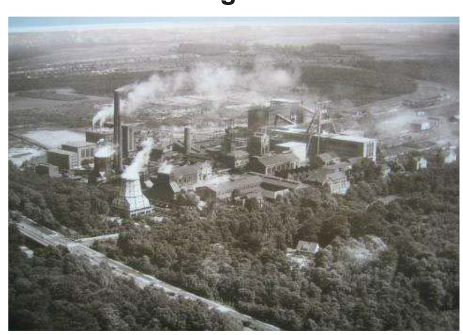
Innovation Path 1

Structural Change as City Transformation

Example: Gelsenkirchen und Herten

Rural History

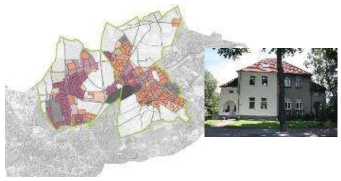
Industrial Heritage



Innovation Path 1

Structural Change as City Transformation

Example: Gelsenkirchen und Herten



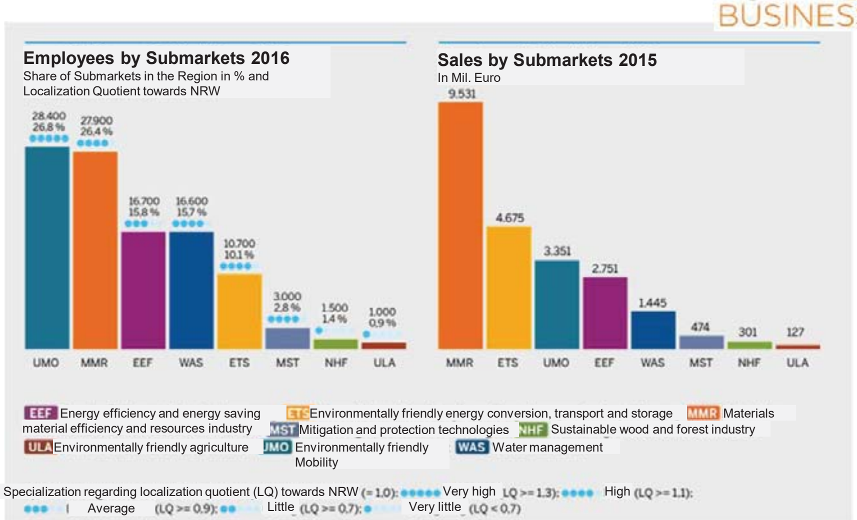
Future of a Garden City:
Energetic urban restoration of residential areas

Conversion as Experiment:
High quality living on an old mining area

Spacial and touristic development :
Avenue of Change

Innovation Path 2

Strengthening the Environmental Economy in Ruhr Area



Innovation Path 3
District Heating Map of the Ruhr Area

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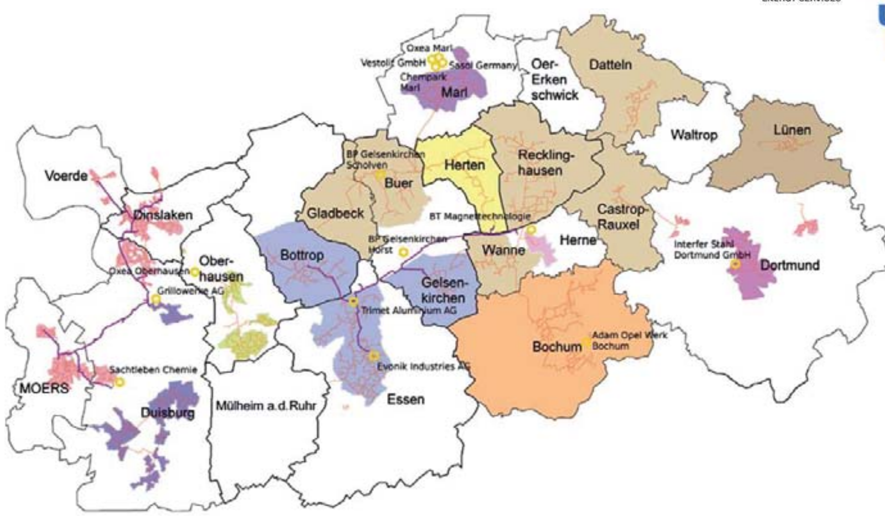
steag ENERGY SERVICES

uniper



Innovation Path 4
Improving the Industrial Landscape

Wuppertal Institut

EMSCHER LIPPE GENOSSENSCHAFT EGLV VERBAND

Concept

- Connection of industrial culture, nature and leisure
- New usage of industrial buildings as leisure facilities
- Preservation of cultural heritage, creation of new creative spaces

Innovation Path 4

Example: Site Conversion in Dortmund

- Soil removal, artificial lake, „Phoenix-Lake“
- Living and working at the waterfront
- Functional mix, passive house standard

Source: Blossey 2011

Innovation Path 5

From Ruhr Area to the Metropolis Ruhr

Image change: from coal to culture, from furnace to high-tech

Prospects:
green and blue metroplitan area

Innovation Path 5

Prospects: from grey to green and blue

Wuppertal Institut

ESSEN 2017 European Green Capital

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Challenges of Managing Regional Sustainability

Strengths

- High-quality educational and research landscapes and spectacular cultural buildings and cultural events
- Industrial culture: the waste dumps have been greened and aesthetically upgraded, coal mines and industrial sites have been transformed into museums and leisure facilities, the mine as a World Heritage Site
- High quality residential and leisure facilities on the water
- Cross-city and mostly international and global oriented development strategies in business, culture and regional development

Challenges of Managing Regional Sustainability

Weaknesses

- Heavily indebted cities with low transition dynamics
- Plants shutdown and locally ongoing high unemployment, especially in the Emscher zone
- Increase in inner regional disparities (North-South difference)
- Limited temporal external financing of strategic projects
- Different interests, different priorities of the economy, civil society and politics in the future planning

Discussion

Your Questions are very welcome!

Thank you for your Attention!

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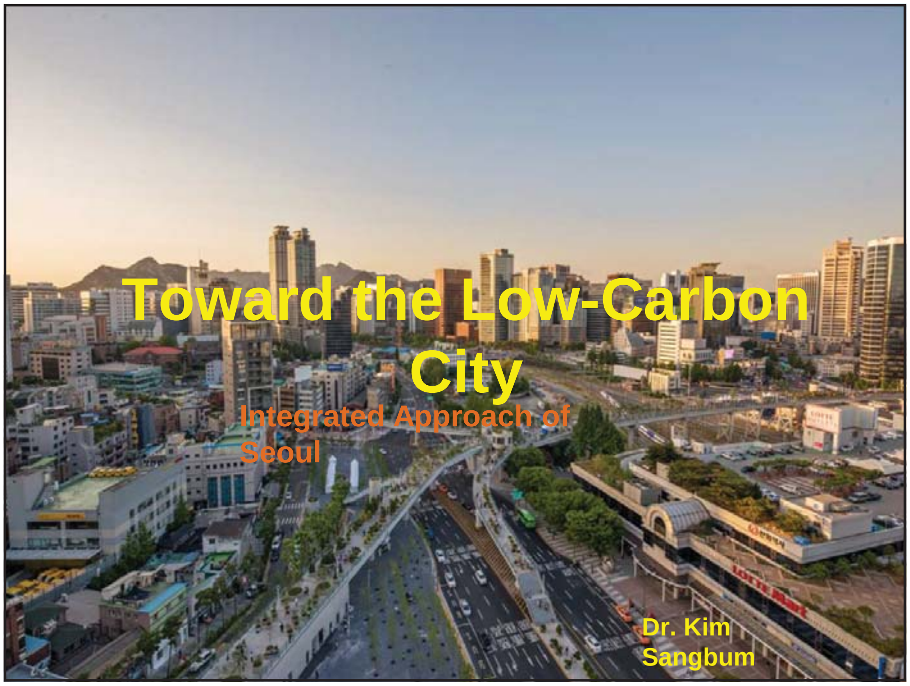
timon.wehnert@wupperinst.org



1. Seoul

Global City after 70 years' modernization

Start from ruin in 1953

Experienced the fastest population growth : 1 million(1953) ⇒10 million(1988)

2. Process

Mostly dependent on Redevelopment Projects by private sector

Gain : modernized function / Lose : identity and sustainability

- Housing : demolish 140,000 → construct 290,000
- Office : 260 zones were redeveloped(size : average 50,800㎡/zone)

Conflicts and alienation
in the process of development

3. Seoul at 2000

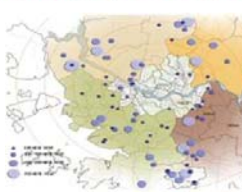
Urban Sprawl

- Commuting distance(2000 – 2015) : 10km ⇒ 30km
- Congestion cost(2005 – 2015) : 6 billion ⇒ 9.4 billion USD

Unsustainable Future

- CO_2 emission(2005) : 50 million ton
- Air pollution(2002) : PM_{10}(76 μg/m³) / $PM_{2.5}$(40 μg/m³)

Policy Change for sustainable required



4. Policy Synchronization

Harmonize urban plan with other policies

Urban Plan : Redevelopment ⇒ Regeneration oriented

2012-2014 — Initial planning
Established urban regeneration plan

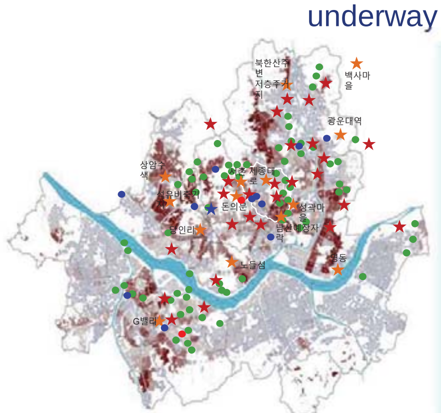
2014-2015 — Establishment of foundation
Created Urban Regeneration Headquarters
Enacted Ordinance

2015-present — Implementation of pilot projects
Apply Seoul-style regeneration concepts

Industrial regeneration (Again Sewoon Project)

Across Seoul

Urban regeneration projects in 131 locations are now underway



★ Revitalization Area Urban Regeneration	27 locations	(14.6㎢)
★ Seoul-style Urban Regeneration	14 locations	(7.6㎢)
● Residential Environment Management	77 locations	(4.2㎢)
● Urban Revitalization Project	11 locations	(2㎢)
● Settlement Village Project	2 locations	(0.1㎢)

5. Integration with ICT

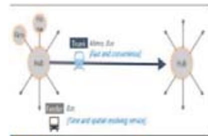
Integrated Mass Transit System

Smart Card

TOPIS : monitor and control traffics

Big Data : developed routes of night bus service
※ Analyzed 3 billion taxi-call data

Modal Share of Mass Transit : 60.6% ⇒ 65%



6. Vertical Integration : One Less Nuclear Plant

April 2012 : Declaration

Target : reduce energy consumption by 6 million TOE
achieve 20% of energy independence

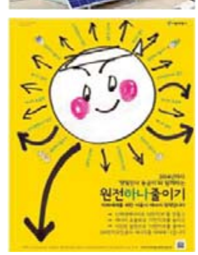
Strategy : Save, Efficient Use and Production

Efforts integration with citizens and NGOs

Major Program : Energy Independent Village
Mileage Incentive Program
Retrofit Program
Solar Energy Production

Achievement(2017) : 4.7million TOE
equivalent to 2.35 Nuclear Plants

100 Energy Independent Villages

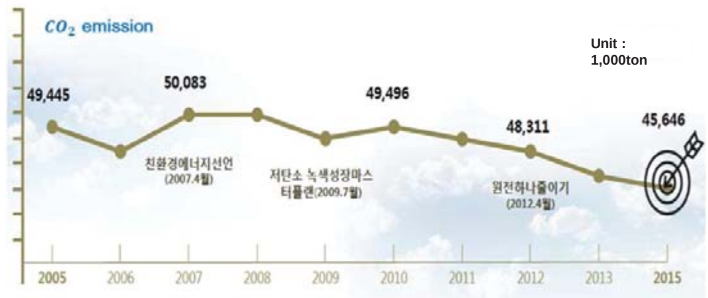


7. Achievement for Low Carbon

A. CO_2 emission

Target : 20% reduction compared with 2005 by 2020

Performance : 10% reduction



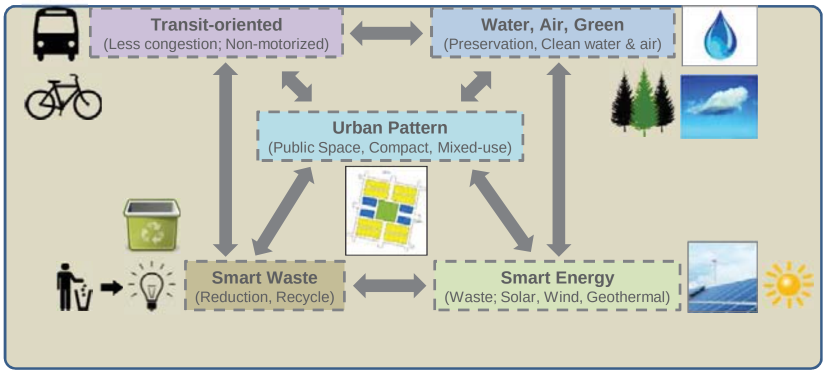
B. Production of Solar Energy for energy independence

Target(2022) : produce 1GW solar energy / 1 million housings with solar cell

Performance(2018) : 233MW / 162 thousand housings

8. Future of Seoul

Smart City Approach : Low Carbon City through integrated solution



Moving towards Cities of the Future

City Level Cooperation towards Smart City Development

Toru Hashimoto
Executive Director on Development Cooperation
City of Yokohama

Profile of Yokohama

Location of Yokohama

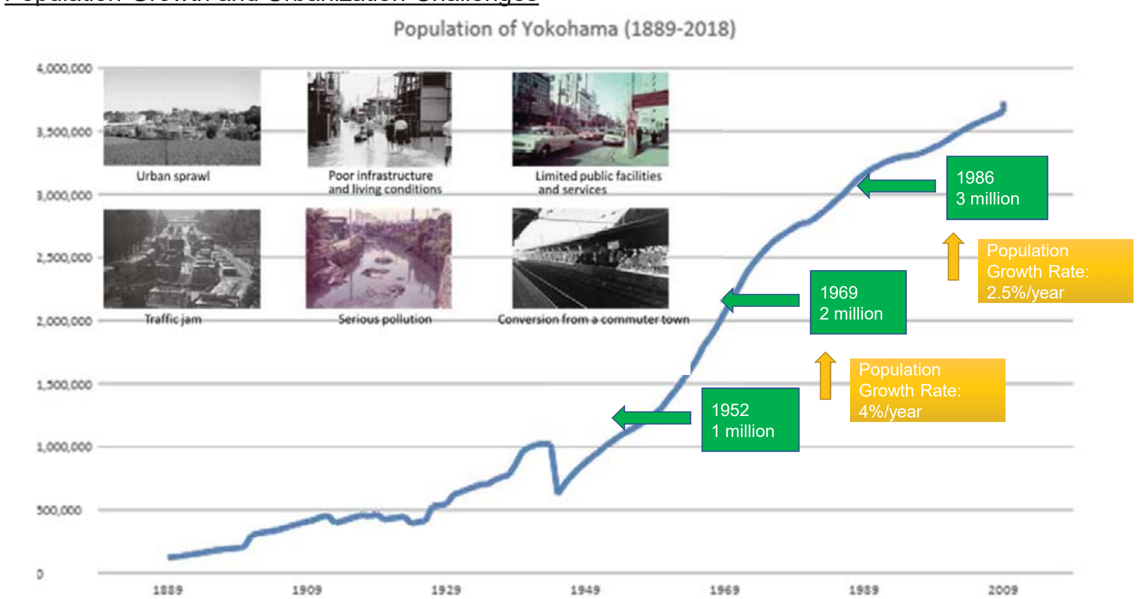
Population:

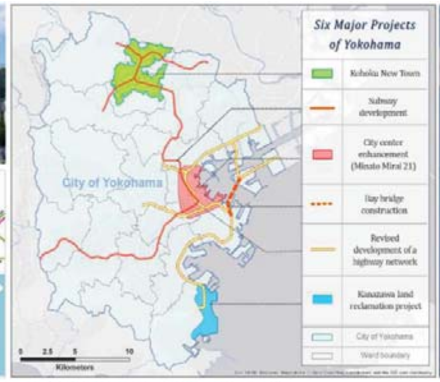
Population: **3.74 million**

Residents of other nationalities: about 100,000 from more than 150 countries and regions

Rapid Growth Period

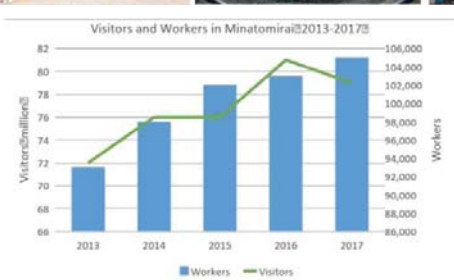
Population Growth and Urbanization Challenges





The Six Major Projects	Name of Project
Urban developments for improving economic functionality & livability	Minato Mirai 21 and other city center enhancement
	Kohoku New town
	Kanazawa reclamation
Transportation developments for enhancing mobility (and creating a landmark)	Subway network development
	Expressway network
	Yokohama Bay bridge

Continuously evolving city: Minatomirai



Economic Ripple Effect to City of Yokohama:
Approx. 18 billion USD annually

Y-PORT
Yokohama Partnership of Resources and Technologies

Y-PORT CENTER
Yokohama Urban Smart Solution

Packaging Yokohama's strength → Export overseas

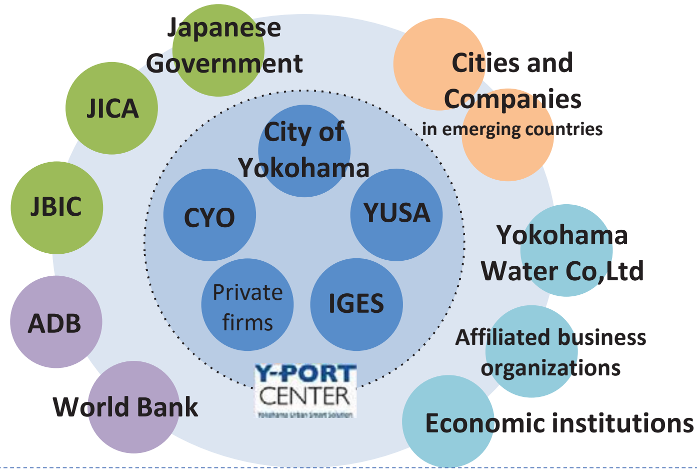
Public sector experience in City Development


Private sector technologies and services


Y-PORT CENTER
Yokohama Urban Smart Solution

Platform for exporting Yokohama's city development expertise as a comprehensive package, established by the city's International Affairs Bureau in 2011

Establishing a knowledge hub 《Y-PORT Center》



- providing best available urban solutions through dialogue
- gaining support from the government of Japan and donor agencies

YUSA Member Companies

Cooperation Agreement between YUSA and City of Yokohama, 2017

Y-PORT Project Case of Cebu(Sludge)

Before　Project

After　Project

Y-PORT CENTER
Yokohama Urban Smart Solution

Before　Project

After　Project

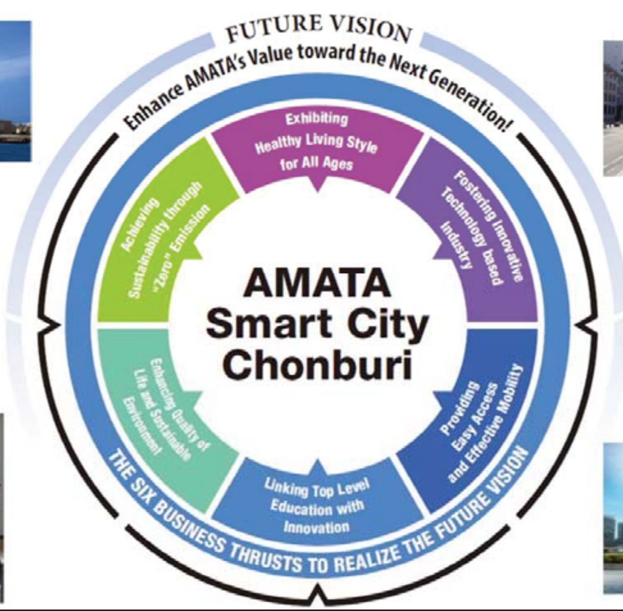
Y-PORT CENTER
Yokohama Urban Smart Solution

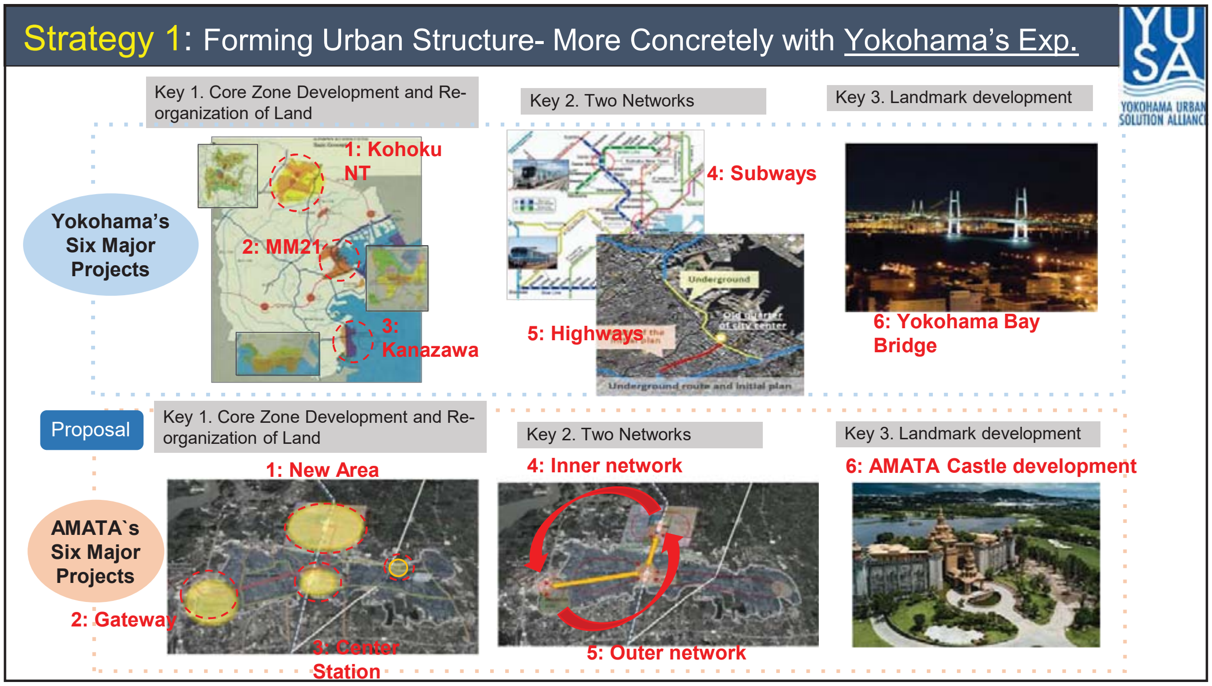
THE PROJECT FOR ACCELERATING DEVELOPMENT OF SMART CITY -Phase 1

Phase1 study：

Jan to Oct 2018

Strategy 2: Enhancing Six Business Thrusts




Strategy 1: Forming Urban Structure- More Concretely with Yokohama's Exp.
YOKOHAMA URBAN SOLUTION ALLIANCE
Yokohama's Six Major Projects
Key 1. Core Zone Development and Re-organization of Land
1: Kohoku NT
2: MM21
3: Kanazawa
Key 2. Two Networks
4: Subways
5: Highways
Underground
Key 3. Landmark development
6: Yokohama Bay Bridge
Proposal
AMATA`s Six Major Projects
Key 1. Core Zone Development and Re-organization of Land
1: New Area
2: Gateway
3: Center Station
Key 2. Two Networks
4: Inner network
5: Outer network
Key 3. Landmark development
6: AMATA Castle development


YOKOHAMA URBAN SOLUTION ALLIANCE
Ministry of Economy, Trade and Industry Feasibility Study
Perspective Drawings:
Gateway Area of AMATA Smart City Chonburi

Asia Smart City Conference (ASCC)

8th ASCC will be held in Yokohama in **October 8th - 11th, 2019**

OPEN YOKOHAMA

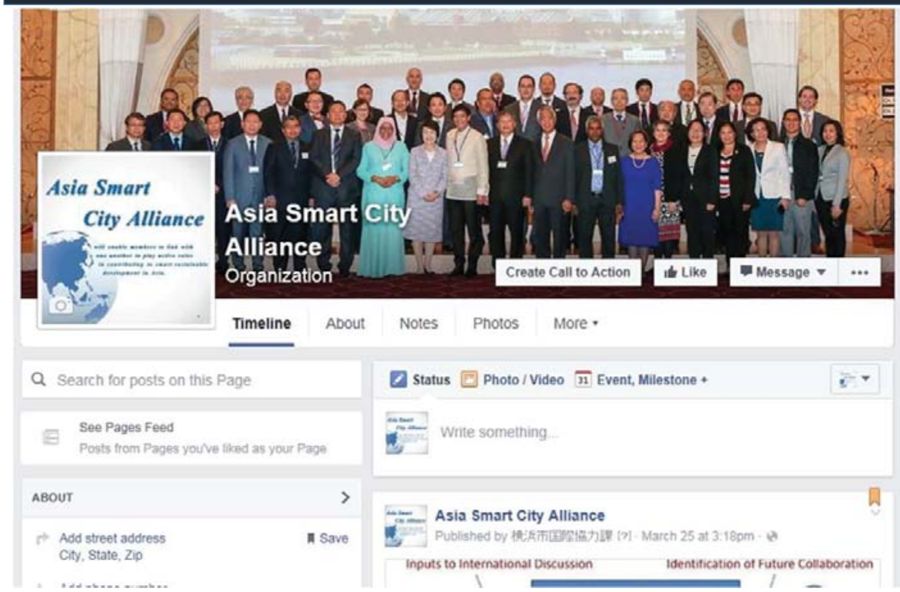
Collaborative Conferences
Held at Same Date & Venue

ASCN High Level Meeting
The ASEAN Smart Cities Network (ASCN) is a collaborative platform where cities from ten ASEAN Member States (AMS) work towards the common goal of smart and sustainable urban development.

Launch Meeting of the GSCA
The Global Smart City Alliance (GSCA) will proudly form on October 9th. This efforts adopted by the G20 Ministerial Statement on Trade and Digital Economy in Tsukuba.

G20 2019 JAPAN

Networking through Asia Smart City Alliance(ASCA)

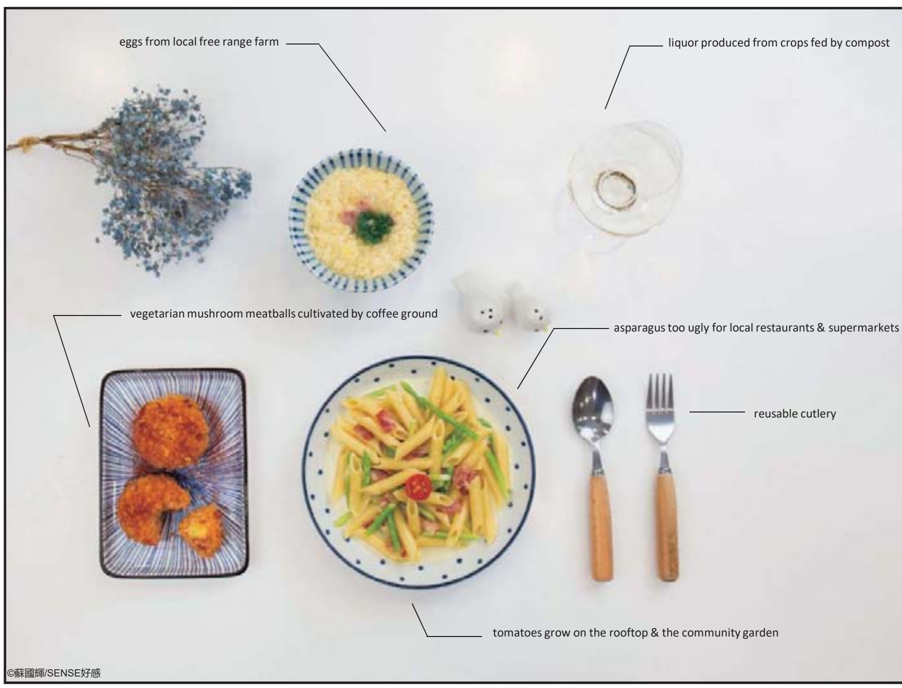


Integrated System-wide Transformation
Circular Economy in Cities

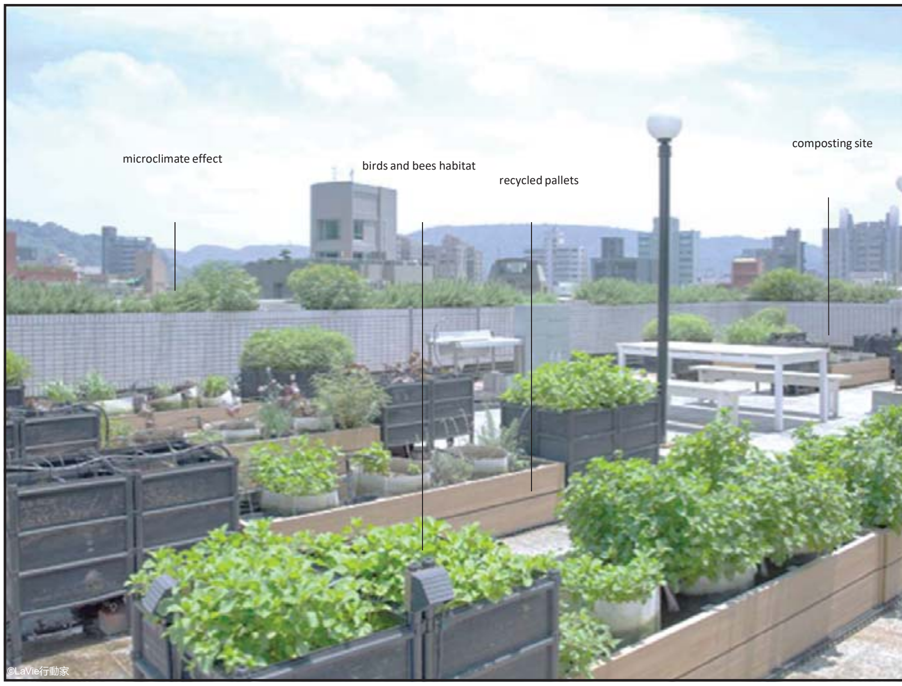
ICLEI East Asia Secretariat

Yvonne Yang

2019.09 SEOUL, REPUBLIC OF KOREA



- LOW CARBON
- BIODIVERSITY
- ZERO WASTE
- INCLUSIVENESS



- REGULATION
- OWNERSHIP
- SAFETY
- FINANCIAL MECANISM

- REGULATION
- COST
- RESPONSIBILITY

- REGULATION
- SAFETY
- FINANCIAL MECANISM

- REGULATION

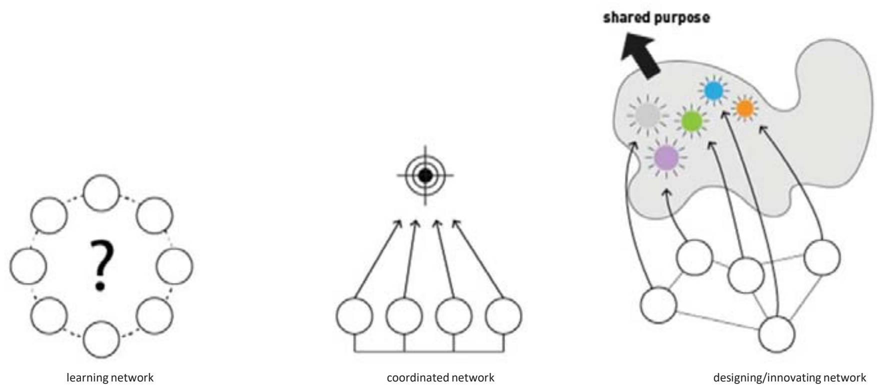
"A system is a set of related components that work together in a particular environment to perform whatever functions are required to achieve the system's objective."

~Donella Meadows

@unschools | @leylaacaroglu

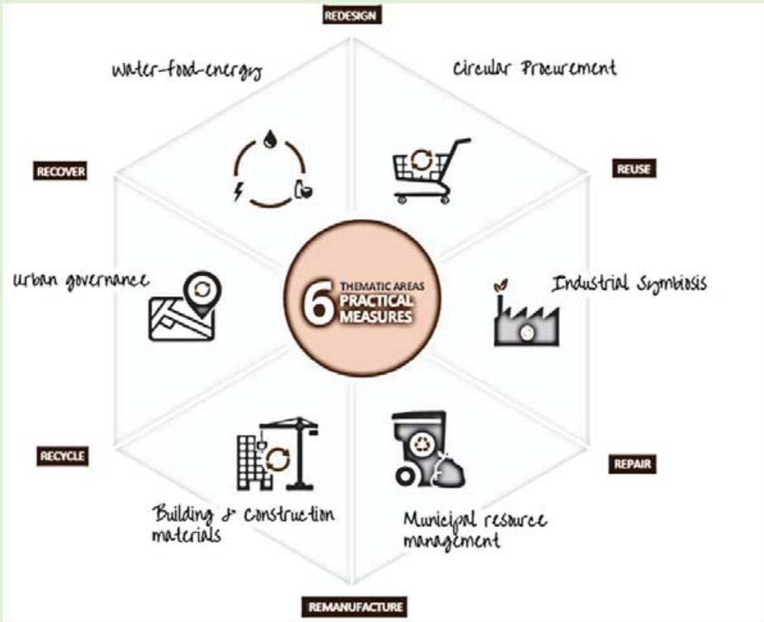
UNSCHOOL

- COLLABORATION
- LEADERSHIP
- INNOVATION



Green Circular Cities Coalition

https://bit.ly/2KmTAcO



- Bonn | Germany
- Turku | Finland
- Changchun | China
- Datong | China
- Yokohama| Japan
- Nagano | Japan

- Circle Economy | Netherlands
- Ellen MacArthur Foundation | UK
- TOMRA | Norway
- Chinese Association of Circular Economy | China

THANK YOU

CONTACTS

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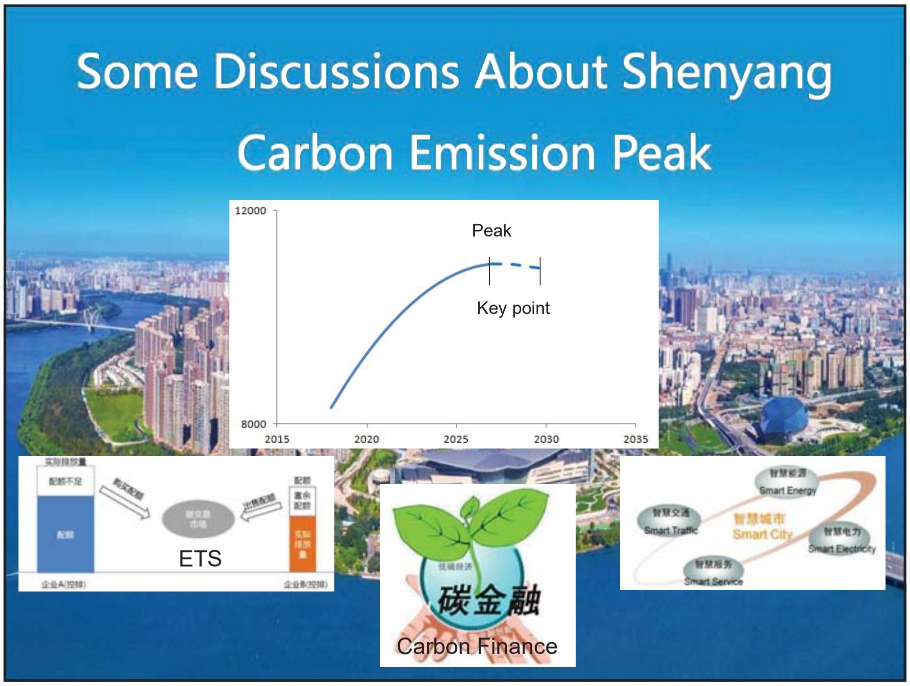
yun.yang@iclei.org | +82 70-8857-0799
Skype: yvonneyunyang



Some Discussions About Shenyang
Carbon Emission Peak
12000
8000
2015
2020
2025
2030
2035
Peak
Key point
实际排放量
配额不足
配额
购买配额
出售配额
ETS
企业A(控排)
企业B(控排)
碳金融
Carbon Finance
智慧能源
Smart Energy
智慧交通
Smart Traffic
智慧城市
Smart City
智慧电力
Smart Electricity
智慧服务
Smart Service

Session 2: Clean Energy and Sustainable Buildings for Low Carbon City

RENEWABLE ENERGY POLICY IN MONGOLIA

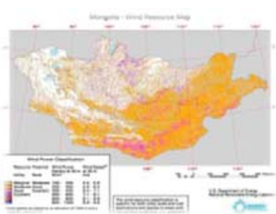
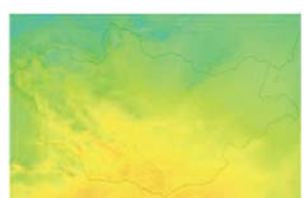
Feed-in tariff to Auction

JAMBAA Lkhagva

DIRECTOR,
Research and Cooperation division
Energy Regulatory Commission

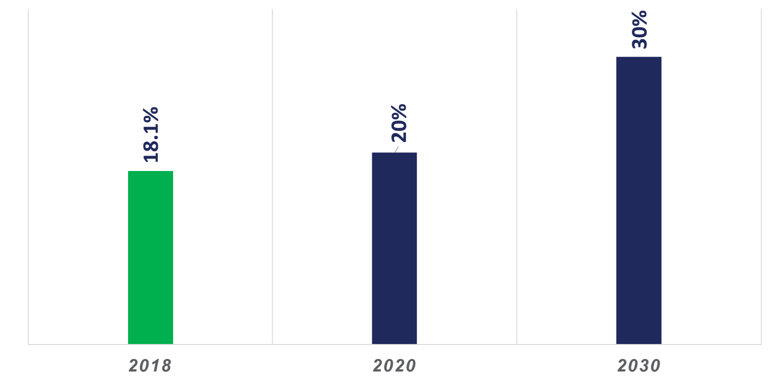
Seoul
September, 2019

RENEWABLE ENERGY RESOURCE

HYDRO ENERGY	WIND ENERGY	SOLAR ENERGY
		
3800 small and big streams and rivers in Mongolia. Hydro power potential about **6417.7 MW** It would produce **56.2 billion kWh** of electric energy in a year.	Wind resources assessment made by NREL (USA). Good-to-excellent wind resources equivalent to **1,100 GW** of wind electric potential. Potentially deliver over **2.5 trillion kWh** per year	Annual average amount of solar energy is 1,400 kWh/m^2/y with solar intensity of 4.3-4.7 kWh/m^2 per day. Total annual radiation intensity equals to **$2.2*10^6$ TW**.

Source: Ministry of Energy, NREL (USA), IRENA

RENEWABLE ENERGY TARGET

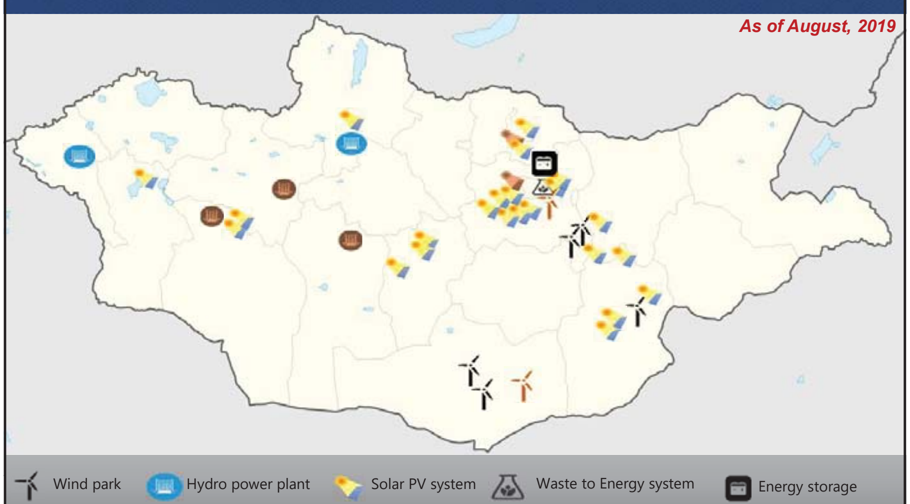


In the State policy on energy, the targets of renewables share in total installed capacity to reach at 20% by 2020, 30% by 2030.

As of end of 2018, total **240.4** MW **(18.1%)** of Renewable energy systems (wind, solar and hydro) are in operation.

Source: Energy Regulatory Commission

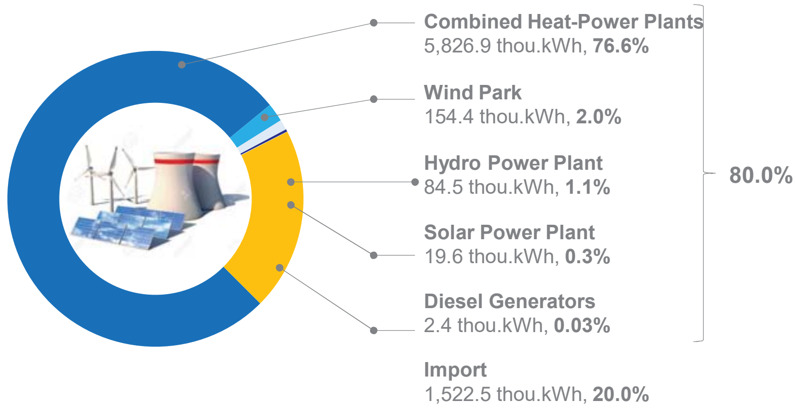
RENEWABLE ENERGY PROJECTS IN OPERATION AND PLANNED



Solar energy-747 MW, Wind energy-602.4 MW, Hydro energy-217.4 MW, Waste to Energy-32 MW, Energy Storage-50MW

TOTAL: **1648.8 MW**

ELECTRICITY PRODUCTION & INSTALLED CAPACITY



Installed Power Capacity
1,239.5 MW

CHPs: ***1,090.0 MW, 88.0%***
REN: ***146.4 MW, 11.8%***
Deisel: ***2.3 MW, 0.2%***

Installed Heat capacity
5,522.9 MW

CHPs: 3,932.3 MW, 71.2%
AHS: 348.8 MW, 6.3%
Aimag HS: 1,241.7 MW, 22.5%

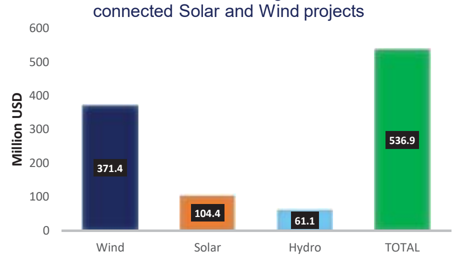
MAIN POLICY DOCUMENTS

Key Documents

№	Document	Approved/ Last Update	Contents
Legal Framework			
1	Energy Law of Mongolia	2001/2015	Regulate matters relating to energy generation, transmission, distribution, dispatching and supply activities, construction of energy facilities and energy consumption that involve utilization of energy resources & Tariff, License
2	Renewable Energy Law of Mongolia	2007/2015/**2019**	Regulate generation and supply of energy utilizing renewable energy sources & Tariff, License
3	Concession Law	2010	Establish the framework for granting concessions to private investors to use existing infrastructure facilities owned by the state, and to construct new infrastructure facilities for the purpose of providing services to the general public
4	Investment Law	2013	Protect the legal rights and interests of investors in the territory of Mongolia, to establish a common legislative guarantee for investment, to stabilize the tax environment.
Key Policy Documents			
5	Infrastructure Development Program of Southern Gobi	2010	Plans and actions to develop infrastructure for strategic mineral deposits in Gobi area
6	State Policy on Energy	2015	Government Policy for energy sector development for 2015-2030

INVESTMENT IN RENEWABLE ENERGY

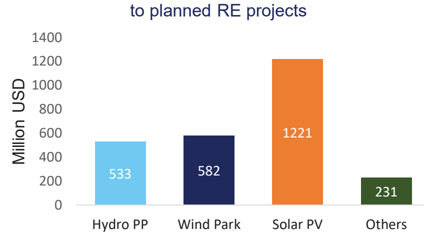
Investments in grid connected Solar and Wind projects



Total **$536.9 million** of investments have been made in Renewable energy projects under FiT mechanism in Mongolia since 2007

The planned projects are expected to attract **$2,567 million** investment totally.

Total estimated investments to planned RE projects



Source: Energy Regulatory Commission

RENEWABLE ENERGY LAW AMENDMENT

"The Parliament of Mongolia approved the amendments to the Renewable Energy Law (the "Amendments") on 6 June 2019"

- **Auction/competitive procurement mechanism introduced:** competitive procurement for construction of renewable energy plants to be connected to the central energy grid, by taking into consideration relevant technical conditions and capabilities, and electricity tariff offers made by potential project developers.

- **Upper cap of tariffs for electricity generated by solar and wind power resources set**

Wind 8.0 - 9.5 U.S. cents per kWh
Solar 15.0 - 18.0 U.S. cents per kWh

Cost of Solar PV project has been dropped dramatically for last few years as well as wind park

Wind up to 8.5 U.S. cents per kWh
Solar up to12.0 U.S. cents per kWh

- **Regulations and tariffs for Distributed Renewable Energy Resource/Net metering are introduced:** Households and companies are now allowed to install solar PV system and wind generator at their facilities and sell excess electricity to grid at higher tariff.

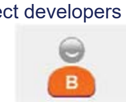
- **Project implementation guarantee:** To reduce delay risks in completion of renewable energy plants in the projected timeframe.

RENEWABLE ENERGY LAW AMENDMENT

In recent years, renewable energy auction/tendering mechanism are considered as the best way to select/support renewable energy projects in the around world.

RENEWABLE ENERGY TENDERING

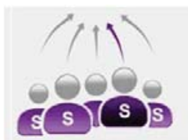
A buyer /Government/ announces an amount of electricity /kWh/ to buy per year and the project location and offers risk mitigation plans and terms of PPA to Renewable energy project developers



BUYER

Announce amount of electricity to buy per year.

LICENSES + AGREEMENTS.



INVESTORS/DEVELOPERS

Compete on selling price

Project will awarded to developer that offered the lowest selling price.

This mechanism helps both buyer and developer to mitigate project risks in order to reduce selling price.

REASONABLE PRICE + FIXED INCOME

THANK YOU FOR YOUR ATTENTION

CLEAN ENERGY INVESTMENT ACCELERATOR

Harnessing Private Sector Demand and Catalyzing Clean Energy Deployment In Key Emerging Markets

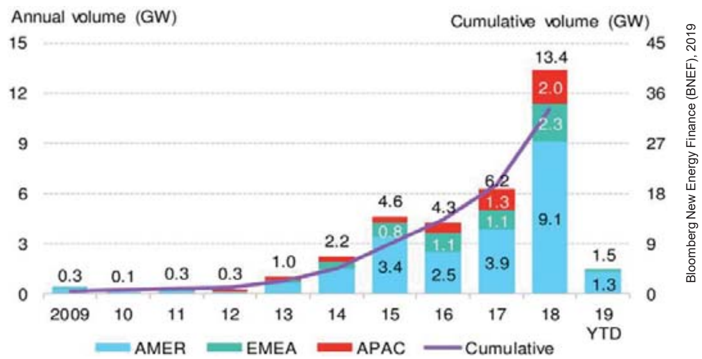
allotrope PARTNERS — WORLD RESOURCES INSTITUTE — NREL NATIONAL RENEWABLE ENERGY LABORATORY

The Challenge: Growing Energy Demand and Plans for Coal Build-Out

- **Installed power generation capacity in Southeast Asia more than doubled** from 2000 to 2016 (~ 240 GW as of 2016)
- **70% growth in energy use in Southeast Asia's industrial sector** from 2000 to 2016 – with massive growth expected to continue.
  - e.g. ~50% of Vietnam's electricity consumption from commercial and industrial facilities
- **160 gigawatts of new coal capacity** by 2040 planned in Southeast Asia, largely to meet growing commercial and industrial demand.
  - e.g. 50GW to 130GW: Vietnam's projected power generation capacity increase by 2030

Renewable Energy Market Analysis, www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_Market_Southeast_Asia_2018.pdf.
Southeast Asia Energy Outlook 2017, www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_SoutheastAsiaEnergyOutlook.pdf.

Cost-Competitive Renewables & Surging Corporate Demand for Clean Power



- RE100: 191 global companies committed
  - 200+ TWh of clean energy demand by 2030
  - 100+ GW of new installed clean energy generation capacity

RE 100

SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

CDP

DISCLOSURE INSIGHT ACTION

CLEAN ENERGY INVESTMENT ACCELERATOR

Clean Energy Investment Accelerator (CEIA)

is an innovative public-private partnership focused on improving opportunities for corporate clean energy purchasing

CLEAN ENERGY INVESTMENT ACCELERATOR

The CEIA is co-led by:

- **World Resources Institute (WRI),**
- **Allotrope Partners**
- **U.S. National Renewable Energy Laboratory (NREL)**

We work across emerging markets, including Mexico, Colombia, Vietnam, Indonesia, and the Philippines.

WORLD RESOURCES INSTITUTE

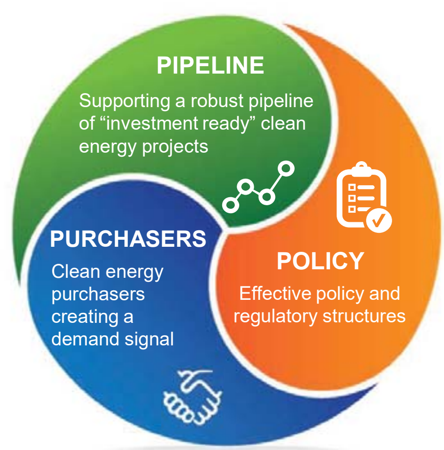
allotrope PARTNERS

NREL NATIONAL RENEWABLE ENERGY LABORATORY

The CEIA is funded and supported by key donors, including:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

P4G Partnering for Green Growth and the Global Goals 2030



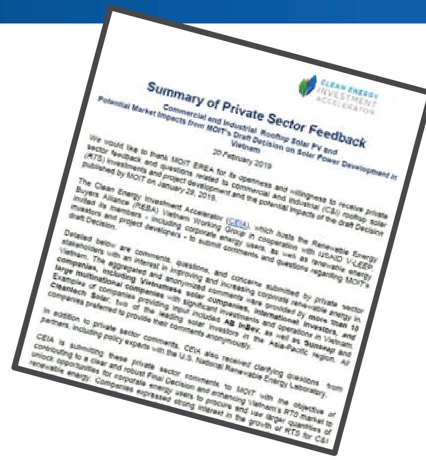
Purchasers:
Creating a Corporate Clean Energy Demand Signal

- Renewable Energy Buyers Working Groups established in each market, held on quarterly basis
- Engaging both corporate energy users and RE project developers, investors and lenders
- Bringing cohesive, collective private sector voice and messages to government entities (utilities, regulators, ministries)
- A blend of policy and regulatory learning, as well as RE-focused technical assistance and training

Renewable Energy Buyers Working Group Vietnam, March 2019

Policy:
Amplifying Private Sector Voices to Improve RE Investment Landscape

“DPPA Declaration” Delivered to Ministry of Industry and Trade, Vietnam



Corporate energy user and RE developer/investor feedback regarding draft National Solar Regulation, Vietnam

Pipeline:
Supporting a Pipeline of Investment-Ready Projects via Aggregation

Reaching economies of scale through aggregated procurements can create benefits for all parties:

- Stronger interest from solar vendors, investors and lenders
- More favorable contractual terms and low costs of financing
- Lower overall lifetime costs, whether as a capital investment or lease price
- Cheaper renewables-based electricity

CEIA partners with a variety of “aggregators” to bring together pools of clean energy buyers, for example:

Local and Global Companies	Industrial Parks	Business Associations	Municipalities
Mega Market, adidas, Heineken	AMATA	ANDI National Business Association of Colombia	City of Santa Rosa Laguna

Pipeline:
Supporting Pools of RE Buyers Through the RFP/Procurement Process

CLEAN ENERGY INVESTMENT ACCELERATOR

01 Initiate Partnership
Company signs CEIA Letter of Interest
Company assigns point of contact for project activities

02 Gather and Analyze Data
Company provides data to CEIA
CEIA analyzes data and shares results with Company

03 Narrow the Pool
Companies host pre-feasibility site visits
CEIA uses clear criteria to narrow project pool to most viable sites

04 Finalize the Pool
CEIA presents analysis to Companies and outlines RE procurement options
Companies confirm participation in the pool

05 Issue RFP
CEIA issues Request for Proposals (RFP) to qualified developers
Companies confirm dates for site visits

06 Bidders Visit Sites
Companies host site visits for group of interested developers

07 Bid Evaluation
CEIA team conducts technical review of bids and identifies qualified finalists

08 Assessing Options
Companies participate in meetings with CEIA to discuss results of analysis
CEIA helps Companies assess options and key considerations

09 Decision Reached
CEIA facilitates interviews between Companies and finalist bidders
Companies make final decision and enter contract negotiations

10 Clean Energy Unlocked!
Companies' projects reach financial close and clean energy is installed
CEIA captures lessons learned for replication and scaling

Colombia Case Study: Aggregation Driving Costs Down

CLEAN ENERGY INVESTMENT ACCELERATOR

CEIA in Colombia demonstrated an aggregated rooftop solar PV approach in 2018

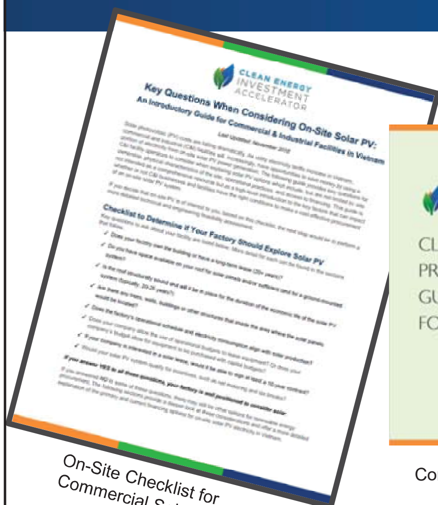
- 10 solar vendors submitted proposals for a 5MW aggregated pool of 7 industrial facilities.
- Demonstrated that solar bids can beat utility rates, offering financially attractive contracts to corporate energy users.

CEIA demand aggregation approach can reduce final cost of solar energy

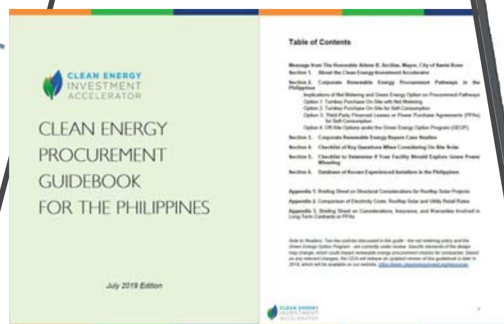
- Proposals from solar vendors showed **an average of 15% savings per site from aggregation** (5-25% range).
- **Project costs driven down 24%** by CEIA: from estimated $1,290/kW to $976/kW after aggregation.

PV Installed Cost Comparison	$/kW installed
Colombia* < 1 MW	$1,659
Colombia* 1 MW - 10 MW	$1,290
CEIA Aggregated Procurement Price*** (5 MW)	$976

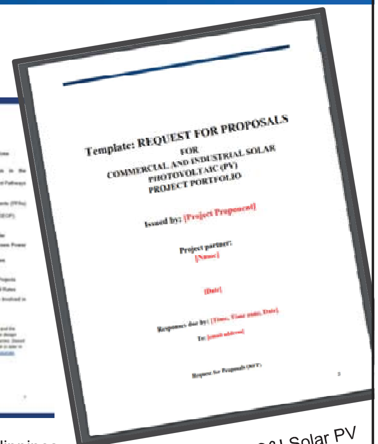
Tools to Support Corporate Purchasing of RE



On-Site Checklist for Commercial Solar PV



Corporate Clean Energy Procurement Guidebook: Philippines



RFP Template for C&I Solar PV

THANK YOU

Evan Scandling
Lead – Vietnam, Clean Energy Investment Accelerator
Director of Advisory & Business Development - Southeast Asia, Allotrope Partners
ers@allotropepartners.com

APUEA
Asia Pacific Urban Energy Association

Multi-energy Systems (MES) and Integrated solutions for diverse consumer demands

2nd International Forum on Low Carbon Development for Cities

Mikael Jakobsson

Executive Director, APUEA

Managing Director, NXITY

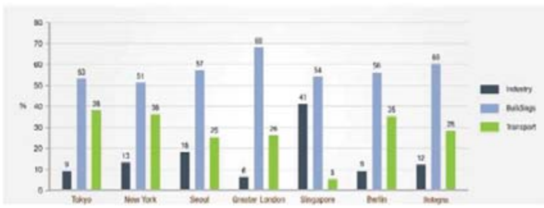
Seoul, 2nd September 2019

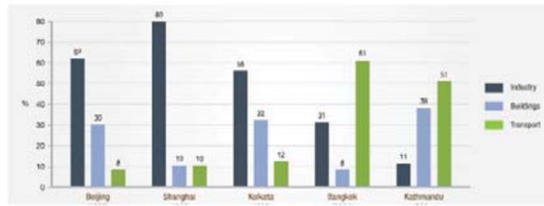
Supported by

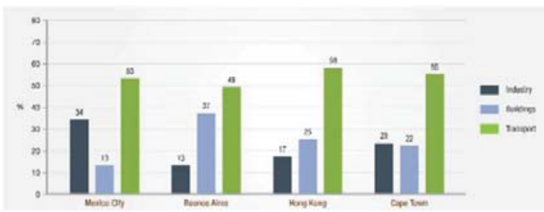
DBDH EUROHEAT & POWER INTERNATIONAL DISTRICT ENERGY ASSOCIATION IIEC

Current and Future Megacities (2015 – 2030)

Sectoral Energy Consumption







Within cities, the proportion of energy use by various sectors differ by economy.

Cities in Asia Pacific region require different urban energy solutions depending on climate and dominant sectoral consumption:

- Singapore – Buildings
- Shanghai – Industry
- Bangkok – Transport

Indisputable trends in the energy sector

- *Urbanization*
- De-centralization
- De-carbonization
- Digitalization
- Electrification (and liberalization of electricity markets)

What is the future of energy systems?

"Smart Energy" characteristics

Planning → Design → Procurement / Equipment Supply → Construction & Installation → Commissioning → O&M

Flexible
Flexibility is the key for demand responses in a Smart Energy system, and to cope with future expansion, implementation and variations.

Intelligent
Innovative engineering solutions, in combination with intelligent planning and control tools is the foundation to collect, analyze, visualize and optimize the Smart Energy system.

Integrated
Integration between different energy infrastructure, through cross-sectoral planning paves the way for Smart Energy systems.

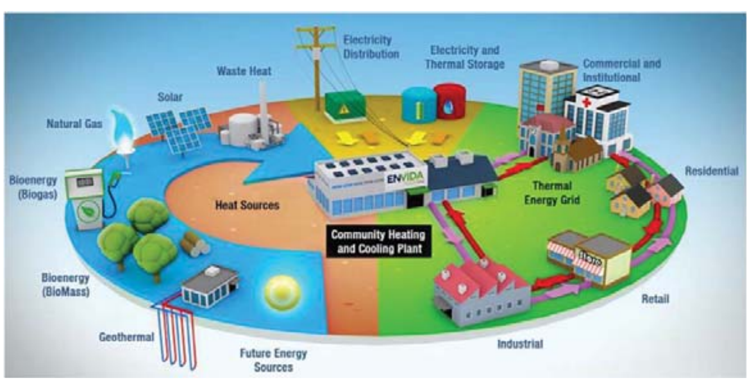
Efficient
By utilizing local resources and efficient solutions, along the entire energy system value chain, remarkable global efficiency can be achieved.

Competitive
A smart energy system must be financial viable and competitive with alternative technologies, often through OPEX/CAPEX advantages and increased life-span.

Reliable and Safe
Reliability and Safety are fundamental requirements to satisfy customers and earn the confidence and trust for a sustainable energy system.

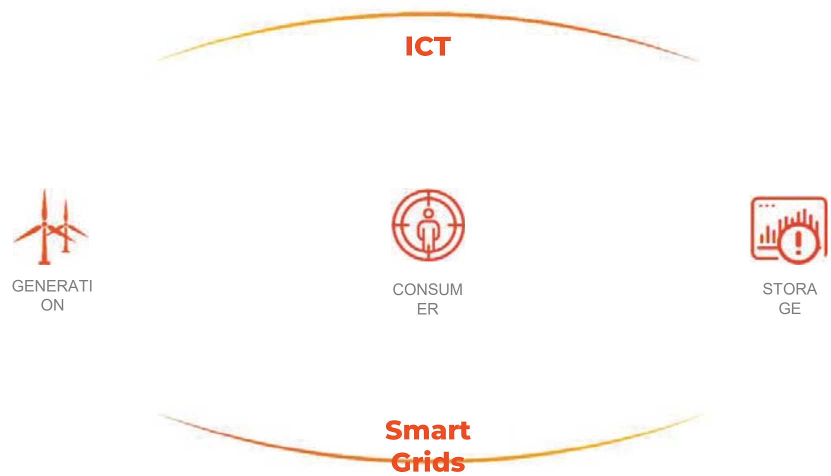
Development of Energy Systems and Services

Distributed → Centralized → Centralized + Distributed → **Integrated**



Generation driven → Demand driven → **End-consumer driven**

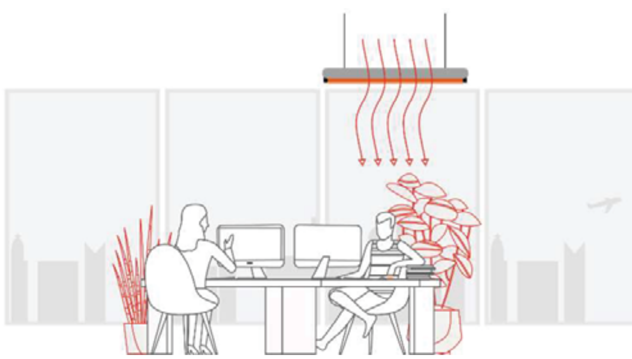
ICT – the new "Energy Grid"



Digital transformation has put users at the center, and their demands are changing

Customer demands

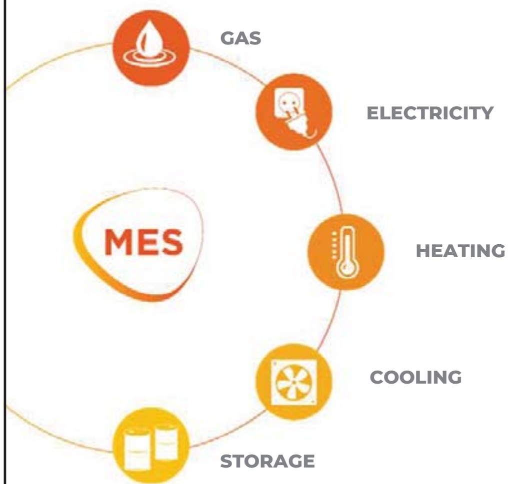
- Affordability
- Simplicity
- Flexibility
- Reliability
- Safety
- Low-carbon foot print

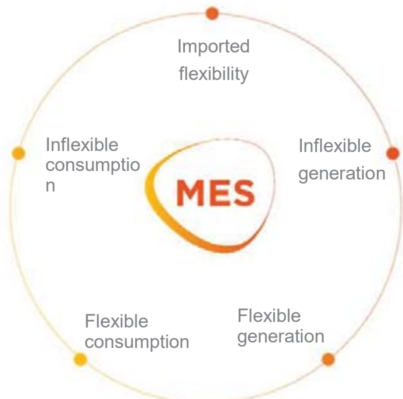


Energy Solutions

- Smart Energy / Multi-Energy Systems
- Energy IoT
- Energy Management
- …

What is Multi Energy System (MES)?





Examples of Multi Energy Systems

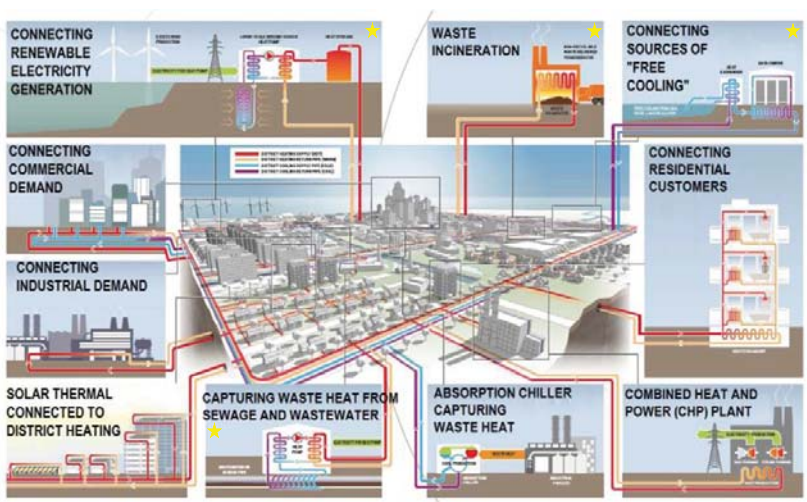


Illustration: UNEP – District Energy in Cities Initiative (DES)

- Biomass
- Wind power
- Solar power and heat
- Geothermal heat
- Excess heat from industries
- Thermal storages
- Free cooling

- District Heating
- District Cooling
- Distributed Energy CHP/CCHP
- Smart Grids
- …

Challenges and Opportunities

Challenges / Lessons learned

- Terminologies and buzzwords
- Regulatory differences
  - Market regulations
  - Economic regulations
  - Social regulations
- Geographic diversity
- Need for cross-sectoral planning
- High initial costs (front-loaded investments)
- Lack of incentives and regulations
- Customer protection in terms of pricing and quality of services
- Experience gaps along the project value chain
- Delayed load ramp-up and occupation ratio

Opportunities

- Increased energy efficiency by 25%–50%
- Not-in-kind solutions
- Long lifespan of up to 50 years (low maintenance cost and improved management)
- Increased public and governmental awareness – Global initiatives (inc. APUEA and UNEP DES)
- A wide range of suitable technologies for projects with different pre-conditions
- Huge market potential (Not least for CBD/TOD areas, Industries and Industry zones, Airports, Hospitals and Data Centers)
- Recognized energy supply concept globally
- Financing and Business models are available

Asia Pacific Urban Energy Association (APUEA)

The Asia Pacific Urban Energy Association (APUEA) is an initiative of International Institute for Energy Conservation (IIEC), supported by Euroheat & Power and Danish Board of District Heating (DBDH).

Rationale:

- Similar Associations in North America and Europe but none in Asia Pacific region
- IIEC approached by development agencies and industry stakeholders to host an Association

IIEC is a not-for-profit organization established in 1984 with a mission to promote sustainable energy in developing and emerging economies. The APUEA fits with IIEC's mission and propose to host the Association at its Asia Regional Office in Bangkok

Mission

To actively promote the development of sustainable urban energy systems in the Asia Pacific region.

Objectives:

To be a platform that:

- Convenes cross-sectoral stakeholders focusing on sustainable urban energy;
- Promotes market development for sustainable urban energy systems;
- Shares global and regional experiences and best practices; and
- Support sustainable urban energy project alliances.

THANK YOU

Asia Pacific Urban Energy Association

www.apuea.org

Development of Green Energy in Fengxi New City

Liu Hongtao
General Manager
Energy Development Company of Fengxi New City

XIXIAN NEW AREA 西咸新区

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Fengxi Energy Brief

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西咸新区

Xi'an, Starting Point of Silk Road

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Fengxi Energy Brief

Integrated energy services

Healthy building environment operation

Smart grid construction and operation

History & Progress of Green Energy Development

1. Medium-deep Non-Interference Geothermal Energy Cleaning Heating Technology

Concept of Green Development | **Low Carbon City** | **Abundant geothermal resources**

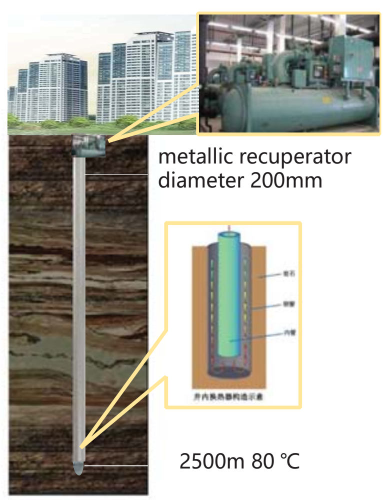
- Coal gas central heating
- Shallow ground source heat pump technology
- Natural gas cold heat and power triple supply

»

- **Medium-deep non-interference Geothermal Energy Cleaning Heating Technology**

1. Medium-deep Non-Interference Geothermal Energy Cleaning Heating Technology

This technique is to drill a 200mm hole with the depth of 2000-3000m down to the earth, install a closed metal double-pipe heat exchanger in the drilling hole which filled with heat transferring medium, explore heating energy through circulated flow medium inside the heat exchanger, then supply heat to the buildings by a heat pump. Transfer heat without taking underground water by which avoid the problems of groundwater drainage, tail water thermal pollution or high pressure recharge.



XIXIAN NEW AREA 西咸新区

1. Medium-deep non-interference Geothermal Energy Cleaning Heating Technology

Distributed Characteristic
A heat-transfer hole with 2500 meters depth can meet the heating demand of buildings with 15-18 thousand square meters.

High Energy Efficiency
One degree of electricity transfers 7 to 8 degrees of heat from the ground

Non-Interference
Characterize as “taking heat without taking the underground water resource”

Zero Emission
zero-emission of carbon dioxide,as well as no waste gas, waste liquid or waste residue.

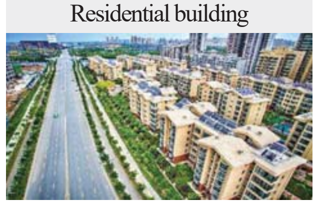
Sustainability
long-term operation without attenuation

1. Medium-deep non-interference Geothermal Energy Cleaning Heating Technology

The service object

Commercial Building

Residential building



School

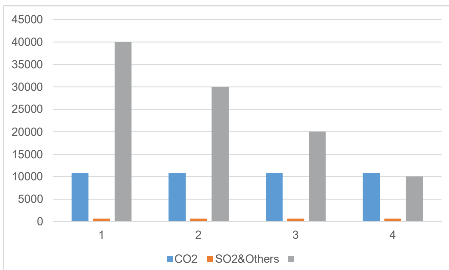
Currently, there are more than 10 million square meters of heating area adopting this technology.

Another 6 million square meters will be put into use this winter.

Heating area using this technology is expected to more than 10 million square meters by 2020.

2. Successful Program of Green Energy Development

It is estimated that in a 4 months heating season , taking 10 million ㎡ of buildings using medium-deep non- interference geothermal energy heating technology as an example which will reduce CO_2 emissions to 430,000 tons, SO_2, nitrogen oxidation and others pollutants to 2,544 tons, the annual ecological compensation equals to plan 3.56 million trees.



XIXIAN NEW AREA 西咸新区

(1) Fengxi Experimental Primary School

- The first Nine-year compulsory education school in Xixian New Area
- Total area of 40,000 ㎡.
- Solar photovoltaic panels are equiped on the roof facilates the daily electricity usage in school
- Extra electricity transmits to national grid

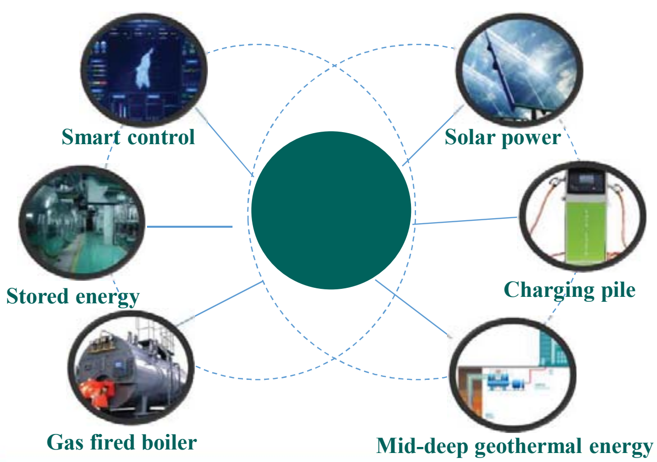
XIXIAN NEW AREA 西咸新区

(2)The Second affiliated Hospital of Shanxi Traditional Chinese Medicine University

- The total construction area is 230,000 ㎡
- Providing cooling and heating, domestic hot water and medical steam.

(3) Green city -- Headquarter Economic Zone

- **Integrated Innovation —— Multi-energy Complementary and Integrated Optimization**



Heating + Cooling+Hot water
+ Integrated power services

High energy efficiency and
high system integration

(4) Western China Science & Technology Innovation Harbour Integrated Energy Supply Project

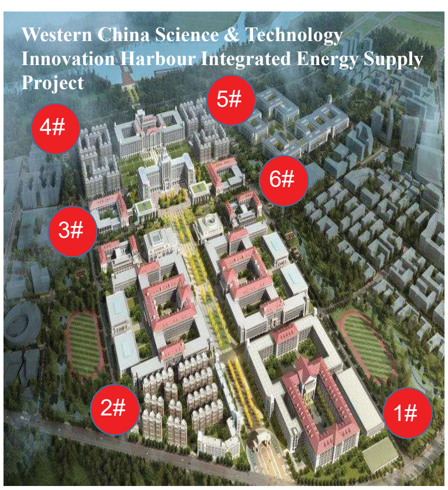
It is the new campus of Xi'an Jiaotong University with no bound of walls , serves as innovation-driven platform, R&D highland, and wisdom harbor of Shaanxi， undertakes the mission of strengthing our nation.

- It covers an area of 3.34 million square meters
- 23 national laboratories
- 25,000 researchers
- 10,000 faculty members

- 6 comprehensive energy supply stations
- Energy service area is1.59 million square meters
- Energy services include Heating , Cooling,Hot water

XIXIAN NEW AREA 西咸新区

(4) Western China Science & Technology Innovation Harbour Integrated Energy Supply Project



Heating : Mid-deep non-interference geothermal heating system

Cooling: Water chiller+ Dual operating heat pump unit

Hot Water: Gas boiler+ Mid-Deep Non-Interference Geothermal Heating System

XIXIAN NEW AREA 西咸新区

03

Green Energy Internet & Green Finance

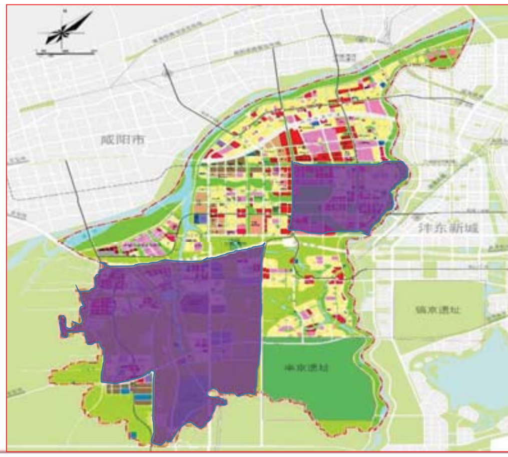
Massive wasted electricity generated by abandoned wind power

Developing district energy projects aim at reducing carbon emissions and increasing renewable energy utilization

XIXIAN NEW AREA 西咸新区

Green Energy Internet& Green Finance

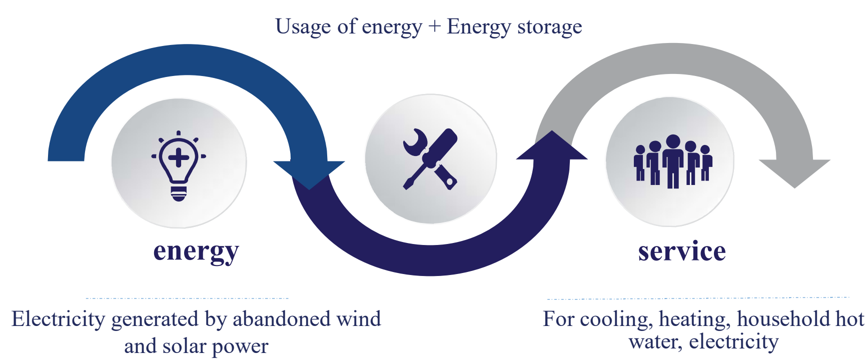
pilot project of incremental power distribution network



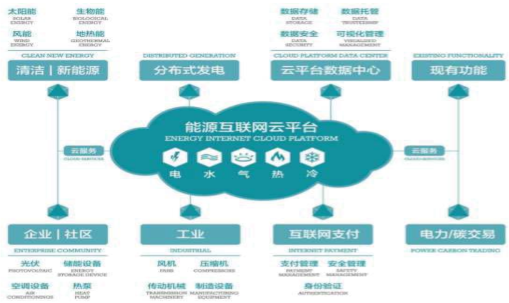
In 2018, Fengxi New City entitled as a pilot zone of the national power system reform, which allows us to build district transmission and distribution power network, authrizes electricity transactions and sales in this zone.

Green Energy Internet& Green Finance

- By supplying cooling and heating we take the initiative to adjust the peak and vally of the power grid, absorb the abandoned wind and solar power to optimize renewable energy utilization in Shaaxi province and its neighboring provinces



Green Energy Internet& Green Finance



System status monitoring and data visualization

Intelligent data analysis to achieve predictive maintenance on equipment

Smart control accurately matches with supply and demand

Open platform facilities supply and demand in transaction

XIXIAN NEW AREA 西咸新区

Green Energy Internet& Green Finance

Asian Development Bank | World Banck | 中国建设银行 China Construction Bank | HUAXIA BANK 华夏银行

- Issued 120 million US dollars bonds overseas
- Issuance of the first batch of green municipal platform Bonds of 1.67 billion yuan
- Urban Development and Construction Fund with a total scale of 10.2 billion yuan
- The largest urbanization fund of National Construction Bank's scales to 6 billion yuan
- Issued the China's first special bond for the construction of underground pipe gallery with 500 million yuan

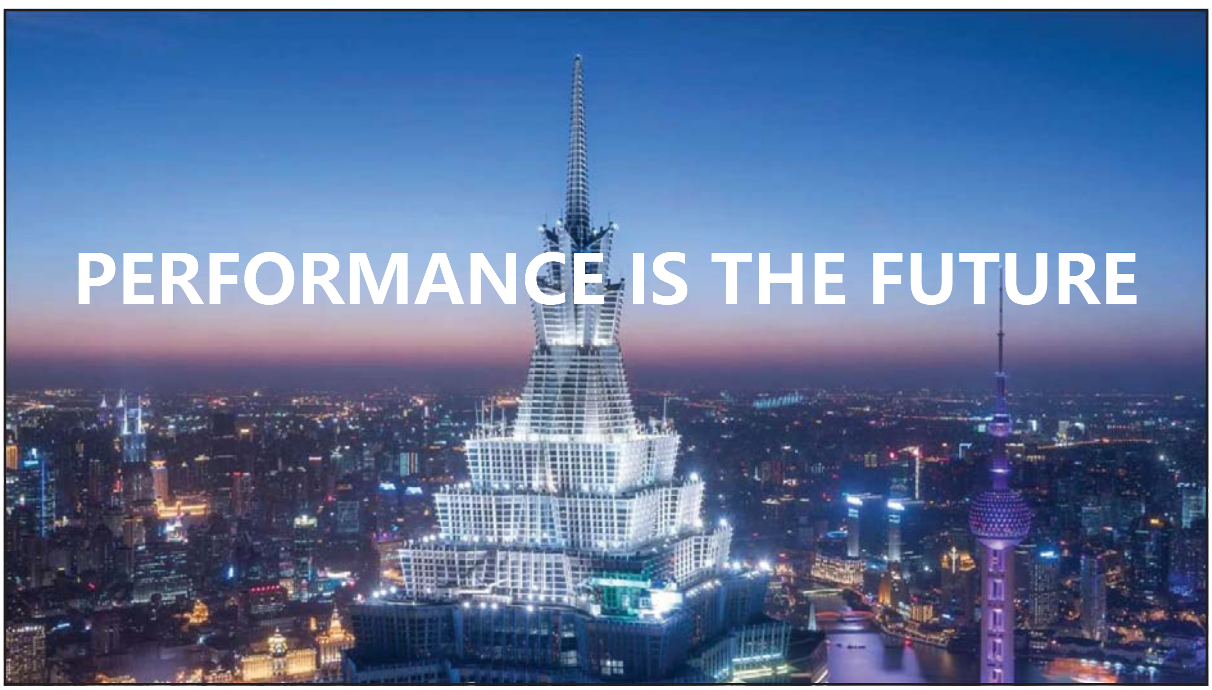
XIXIAN NEW AREA 西咸新区

Conclusion

In the future, we will share technologies, establish businesses & financial cooperations to work together with outstanding enterprises in promoting green energy revolution as well as build a beautiful China with lucid waters and lush mountains by joint hands of the globe!

XIXIAN NEW AREA 西咸新区

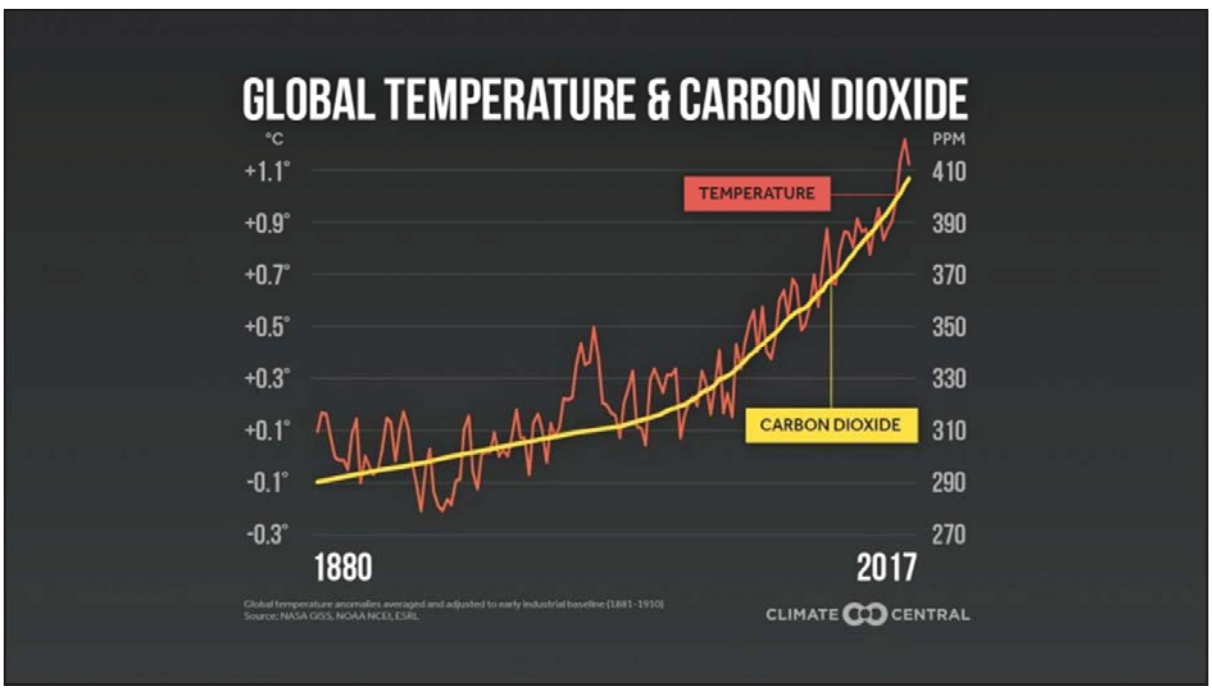

U.S. GREEN BUILDING COUNCIL
USGBC
Andy To
Managing Director, North Asia
U.S. Green Building Council


PERFORMANCE IS THE FUTURE


让我们这一代每个人体验绿色建筑
GREEN BUILDINGS
FOR EVERYONE WITHIN
THIS GENERATION

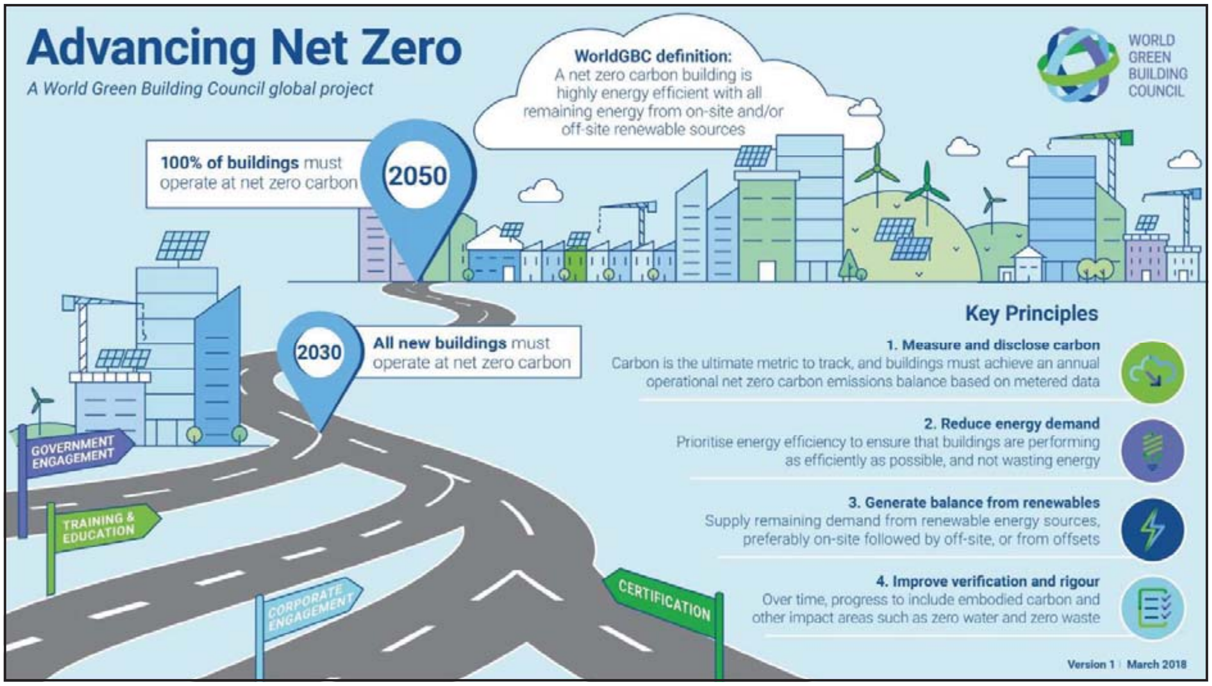

Histroy of Green Building
1972
1st Global Environmental conference in Stockholm
斯德哥尔摩世界环境会议
1987
WCED：concept of "sustainable development"
"世界环境与发展委员会" 提出"可持续发展"的概念。
1993
Establishment of USGBC
成立美国绿色建筑委员会
1995
Establishment of Robeco SAM, a basic assessment body for the DJSI
成立道琼斯可持续发展指数的基础评估机构RobecoSAM。
2000
LEED™ comes out
能源与环境设计先锋(LEED) 评级体系问世。
LEED
2003
The World Bank launched the Equator Principle
世界银行发起赤道原则。
2006
Annan launched the PRI
安南启动"负责任的投资原则"
2007
Establishment of GRESB
成立全球房地产可持续发展基准。
2019
S&P Dow Jones Indices launched the Green Real Estate Index Serie
标准普尔道琼斯指数推出绿色房地产指数系列


LEED in Worldwide
LEED
175
Countries & Territories
98,000+
Commercial Projects
3 Million+
square feet certified LEED daily
LEED PROFESSIONAL CREDENTIAL
201,000+
LEED Professionals
12,000+
Members


GLOBAL TEMPERATURE & CARBON DIOXIDE
°C
+1.1°
+0.9°
+0.7°
+0.5°
+0.3°
+0.1°
-0.1°
-0.3°
PPM
410
390
370
350
330
310
290
270
TEMPERATURE
CARBON DIOXIDE
1880
2017
Global temperature anomalies averaged and adjusted to early industrial baseline (1881-1910)
Source: NASA GISS, NOAA NCEI, ESRL
CLIMATE CENTRAL

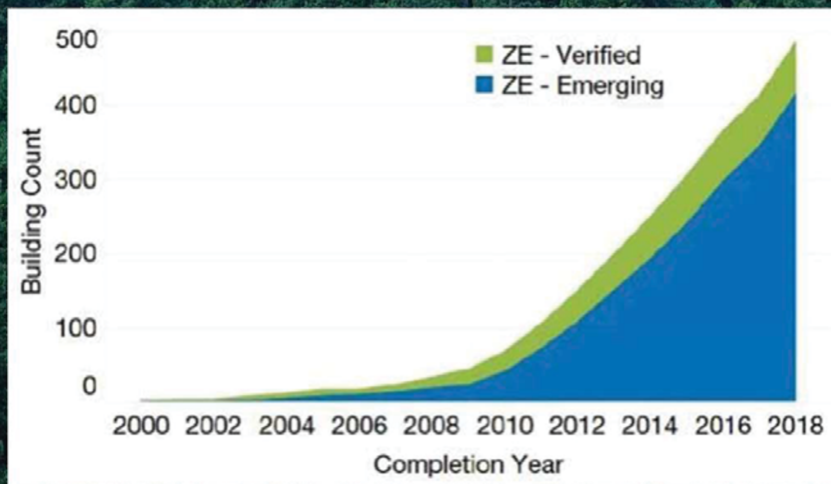

1.5 °C


ZERO
#AdvancingNetZero @WorldGBC

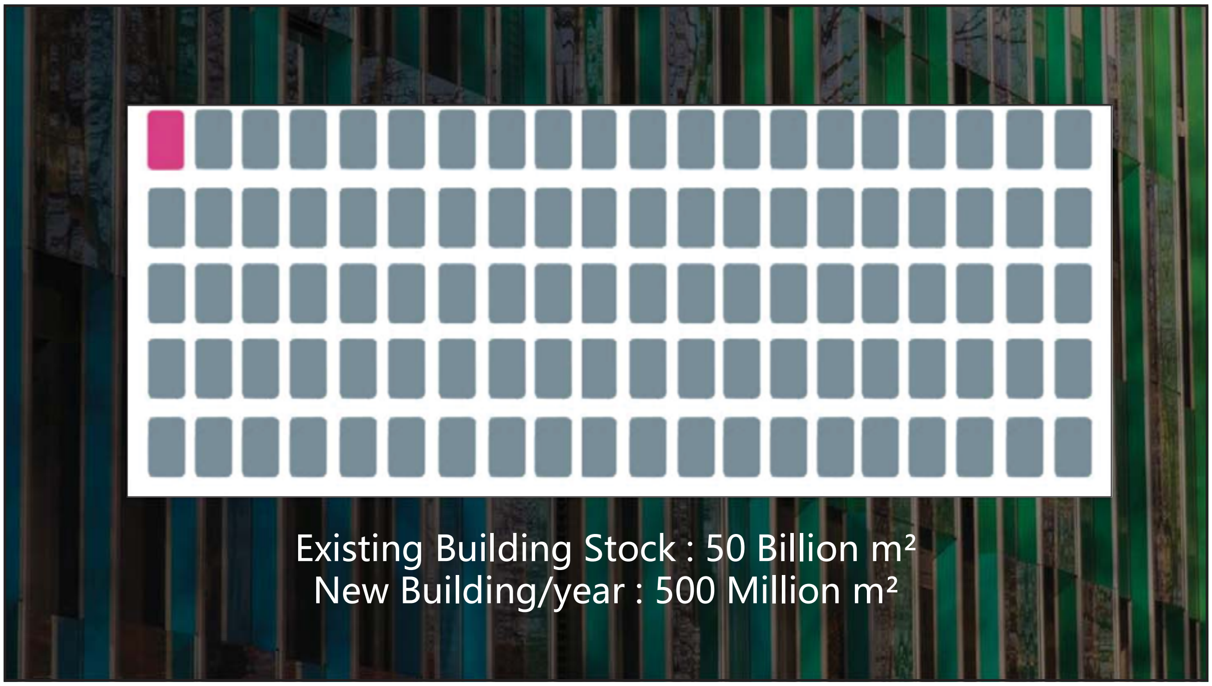

Advancing Net Zero
A World Green Building Council global project
WorldGBC definition:
A net zero carbon building is highly energy efficient with all remaining energy from on-site and/or off-site renewable sources
WORLD GREEN BUILDING COUNCIL
100% of buildings must operate at net zero carbon
2050
2030
All new buildings must operate at net zero carbon
GOVERNMENT ENGAGEMENT
TRAINING & EDUCATION
CORPORATE ENGAGEMENT
CERTIFICATION
Key Principles
1. Measure and disclose carbon
Carbon is the ultimate metric to track, and buildings must achieve an annual operational net zero carbon emissions balance based on metered data
2. Reduce energy demand
Prioritise energy efficiency to ensure that buildings are performing as efficiently as possible, and not wasting energy
3. Generate balance from renewables
Supply remaining demand from renewable energy sources, preferably on-site followed by off-site, or from offsets
4. Improve verification and rigour
Over time, progress to include embodied carbon and other impact areas such as zero water and zero waste
Version 1 | March 2018

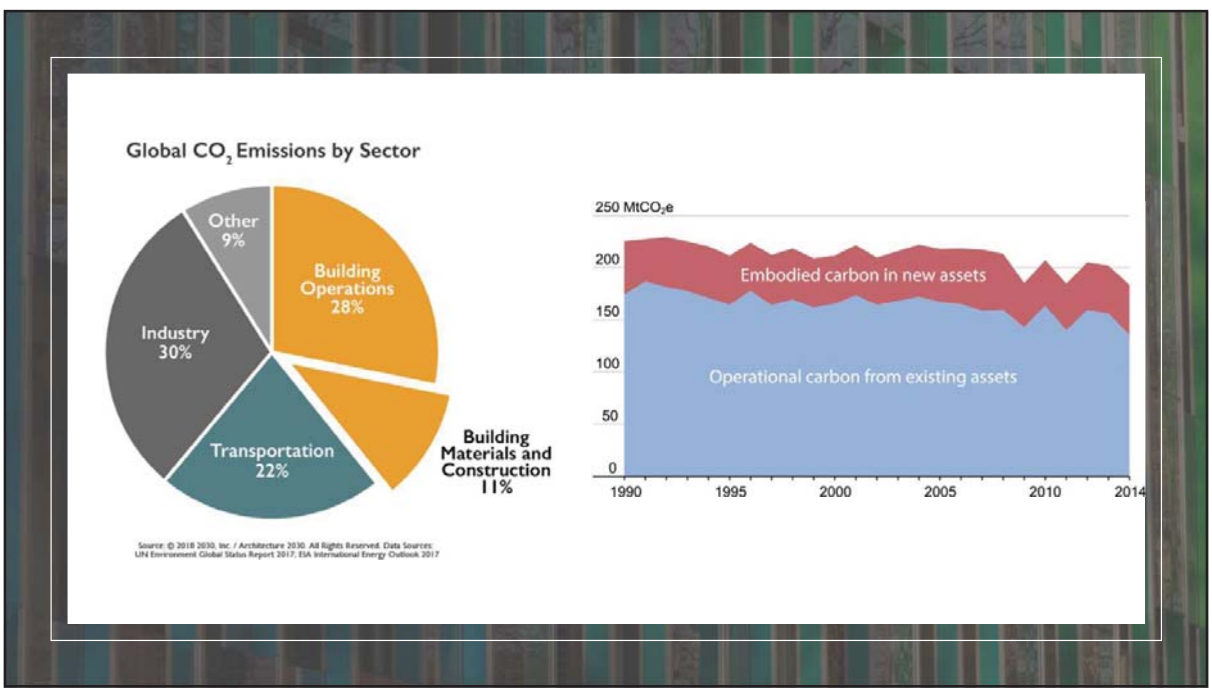

Timeline for green architecture
completion
1993
1996
1998
2000
2001
2003
2004
2007
2010
2011
2012
2013
Covers environmental performance (primary energy consumption, CO2 emissions, CASBEE, LEED), environmental methods, and methods for validating their performance
Primary energy consumption (1st year after completion) [MJ/m2·year]
2500
2000
1500
1000
500
0
1911
1559
2257
1500
1695
1750
812
1430
1326
950
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015

Zero Energy Building Growth

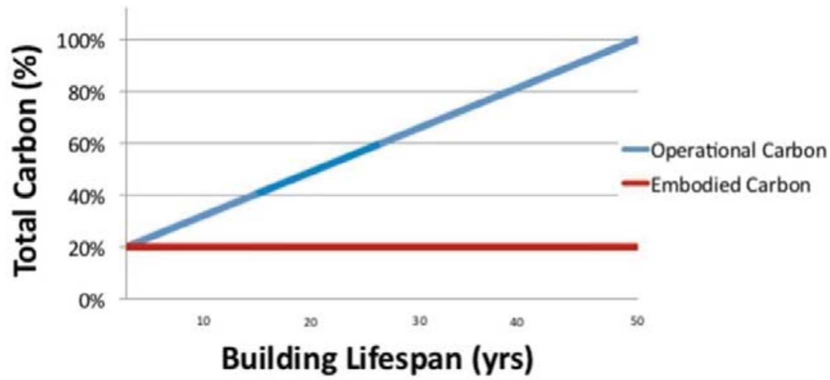


SOURCE: NEW BUILDING INSTITUTE

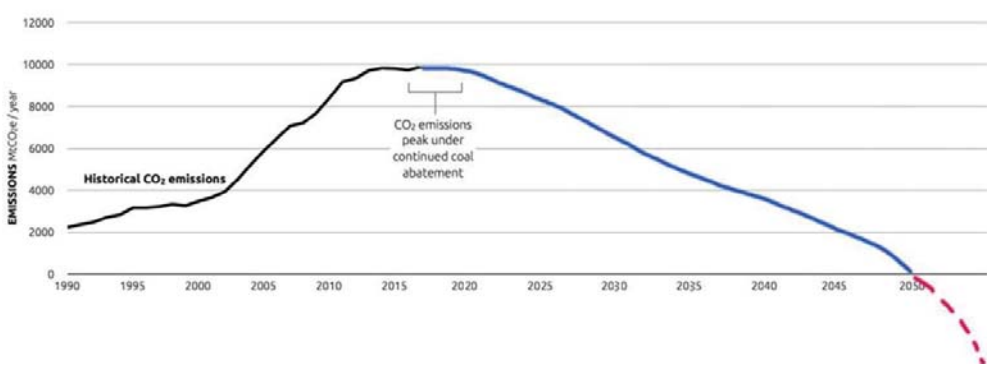

Existing Building Stock : 50 Billion m²
New Building/year : 500 Million m²

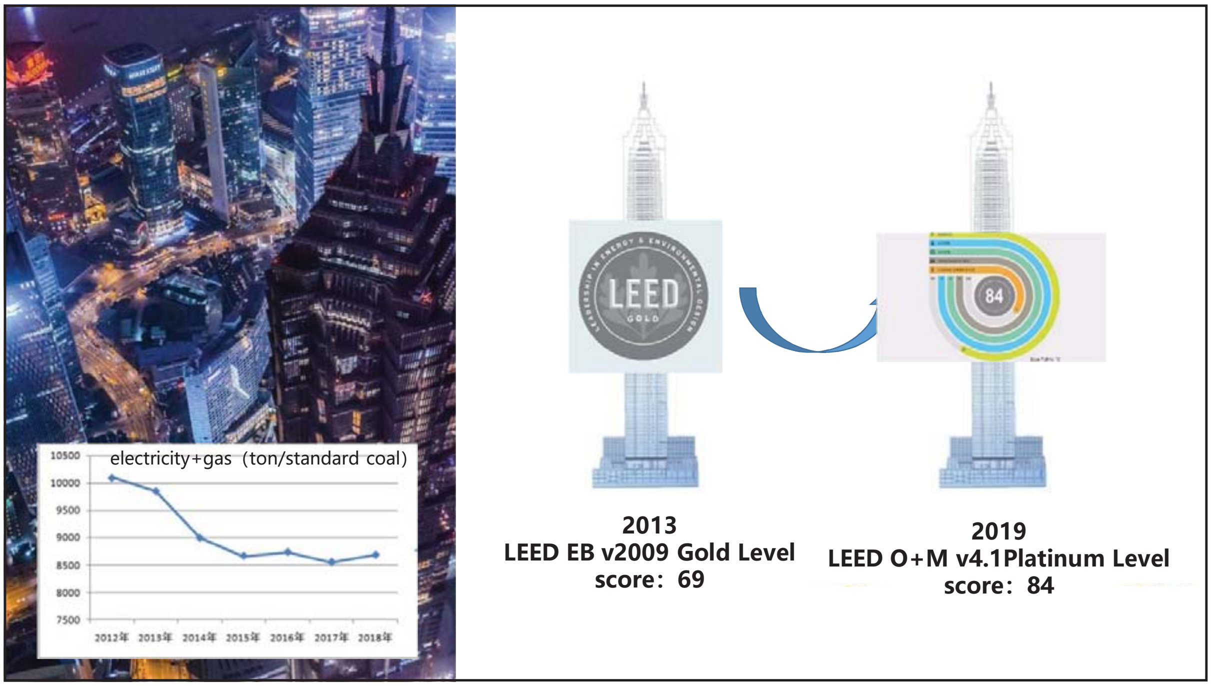

Global CO2 Emissions by Sector
Other 9%
Building Operations 28%
Industry 30%
Transportation 22%
Building Materials and Construction 11%
Source: © 2018 2030, Inc. / Architecture 2030. All Rights Reserved. Data Sources: UN Environment Global Status Report 2017; EIA International Energy Outlook 2017
250 MtCO2e
200
150
100
50
0
Embodied carbon in new assets
Operational carbon from existing assets
1990
1995
2000
2005
2010
2014

Today's Carbon Trend



Performance is the Future – Existing Building




electricity+gas（ton/standard coal)
10500
10000
9500
9000
8500
8000
7500
2012年
2013年
2014年
2015年
2016年
2017年
2018年
84
2013
LEED EB v2009 Gold Level
score：69
2019
LEED O+M v4.1Platinum Level
score：84


Beijing
576 LEED programs;
58 EB programs
Shanghai
1,136 LEED programs;
75 EB programs
New York
2,992 LEED programs;
462 EB programs
EB 15.44%
Chicago
1,862 LEED programs;
321 EB programs
EB 17.24%


Takeaway – 3
Facts
1
By 2030, cities will account for 73 percent of world energy use. In most cities, buildings account for more than half of this consumption.
2
75 percent of the urban infrastructures that will exist in 2050 hasn’t been built yet, presenting a huge opportunity to shape more resource-efficient cities.
3
90 percent of the existing building stock in the world will be still be in use in 2050, so enhancing performance of exiting buildings is critical in reducing energy & water use and carbon emissions.


THANK YOU
Andy To
Managing Director, North Asia
U.S. Green Building Council
U.S. GREEN BUILDING COUNCIL
USGBC

Sustainability in Action

On BROAD Low Carbon Life & Technologies

Juliet Jiang, Senior VP of BROAD Group

Sep.2, 2019

1km^2 BROAD Town is wholly owned by BROAD Group

Eco-BROAD Farm

BROAD Town Data

Green Land & Fish Pond Space: 680,000 m2

Pesticide & Fertilizer Utilization Rate: 0% since 1999

Detergent Utilization Rate: 0% replaced by dietary alkali

Food Organic Rate: 80% mainly from BROAD Town and BSB (Broad Sustainable Building) Town

Garbage Categories: 8

Virgin Forest:148,000 m2

Man-made Plants: 90 species

Wild Plants: 120 species

Advanced Wild Animals: 10 species

Resident Birds & Migrant Birds: 80 species

Eco-BROAD Group

Cereals & Oil
processing plant

Reverse Osmosis (RO)
Water Plant

8 kinds of
garbage classifications

Low carbon bonuses to employees without cars since 2009

BROAD Key Low Carbon Businesses

Non-electric air conditioning cuts CO2 emissions, mitigates climate change

air products extend human life by 30 years
Enhance human health

Core tubular stainless steel (CTS or Bcore) slab is an ultimate light weight structural material, transforming the world's construction & transportation industry from the root

24 world's first inventions

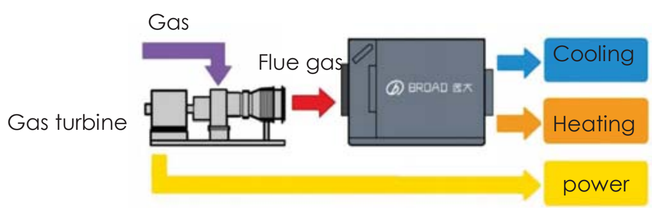
1. The world's first floating-ball controlled, pressure-free hot water boiler (1989)
2. China's first non-electric direct-fired air conditioner (DFA) (1992)
3. The world's largest production lines & biggest testing platform for non-electric A/Cs (since 1996)
4. The world's No.1 seller of non-electric A/Cs by sales volume (since 1996)
5. The world's first three-in-one non-electric A/C, providing cooling, heating, and hot water (1994)
6. The world's first non-electric A/C equipped with a plate heat exchanger (1997)
7. The world's first non-electric exhaust-fired A/C (1999)
8. The world's first exhaust, waste hot water, or natural gas powered non-electric A/C (2001)
9. The world's first non-electric A/C with no vacuum pump used throughout its operation life (2006)
10. The world's first zero-resistance inverter-controlled water distribution system for central A/C (2003)
11. The world's first global networking monitoring system of central A/C (1996)
12. China's first to implement "Energy Management Contract" for central A/C (2005)
13. The world's first non-electric A/C manufacturer with its complete product range passing the European and American quality and safety certifications (1999)
14. China's first DFA national standard (2001)
15. The world's only indoor unit with an electrostatic cleaner (2005)
16. The world's only air purifier with the functions of electrostatic cleaning and oxygen deficiency monitoring (2006)
17. The world's only clean fresh air machine that can filter 99.9% of PM2.5 and recover 80% of the heat (2008)
18. The world's only mobile phone that can detect PM2.5 level (2009)
19. China's first thoroughly- renovated community with 15 cm thermal insulation and 3-paned windows (since 2008)
20. The world's first factory-made building with a construction speed of 3 floors per day, 5X energy efficiency, and 100X cleaner air (2009)
21. The world's only ultra-light and ultra-strong structural technology that replaces honey comb slab with core tubular stainless steel slab (CTS slab) (2016)
22. The world's only hot air copper brazing technology for CTS slab (2017)
23. The world's only CTS slab building (2017)
24. The world's only CTS slab bridge (2018)

BROAD is in 80+ countries

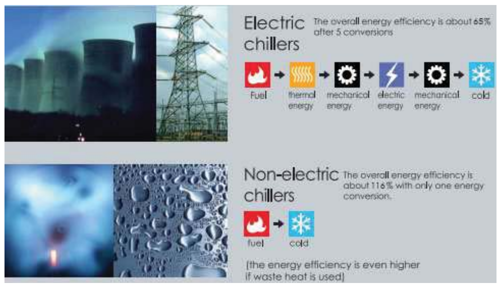
the world's first
flue gas air conditioning in 1999

energy efficiency 200% higher

CO^2 emissions 0%



It is called CHP(cooling-heating-power) System



The biggest global district cooling project

DLF Cyber City, New Delhi (46 units, 270MW in total)

Oil saving yearly: 137,000 t

CO2 emissions cut:410,000 t annually

Equals 22 million tree planting

Payback:1.5 years

15 old buildings were converted into energy efficient ones at BROAD Group

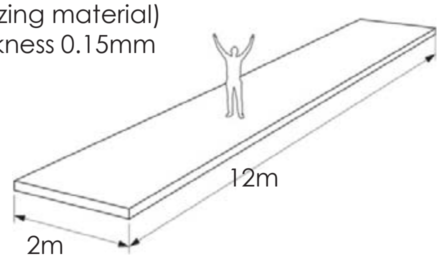
（energy efficency enhanced 80%, payback less than 3 years）

Disruptive Bcore Slab with copper brazing

240m²/4h

Core Tubes: diameter 22~133mm
thickness0.15~1.5mm

Copper Foil
(brazing material)
thickness 0.15mm



The Bcore Building

Rendering for The Sound of Nature (300F)

The 16 F office building is to be built in one week

Bcore Slab Applications

Bcore Bridge

Bcore vehicle

Bcore ship

Note: BROAD will only serve as a material supplier

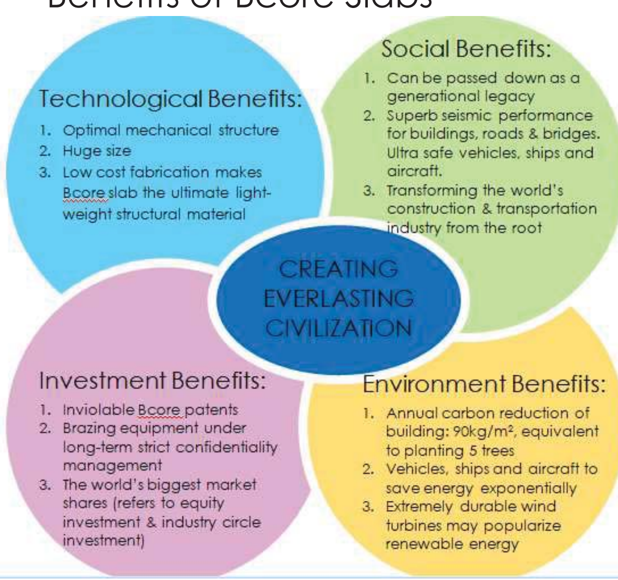
Bcore Slab Applications

Bcore Wind Turbine

Bcore aircraft

Note: BROAD will only serve as a material supplier

Benefits of Bcore Slabs



Welcome to BROAD Group!
To see is to believe!

Thank you!

bsbs@broad.net

Session 3: Low Carbon Transport Options in Mega-Cities

WORLD RESOURCES INSTITUTE

LOW CARBON TRANSPORT OPTIONS IN MEGA CITIES

O.P. AGARWAL

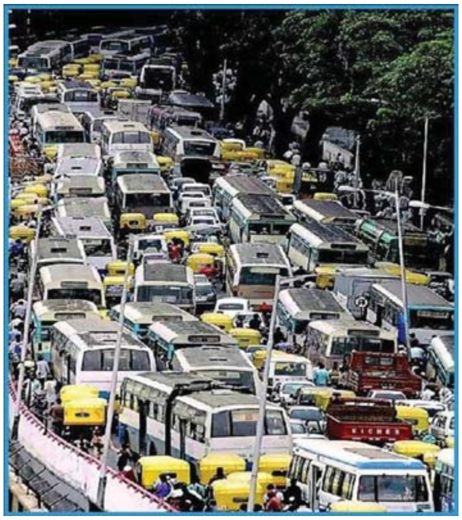
CEO, WRI India

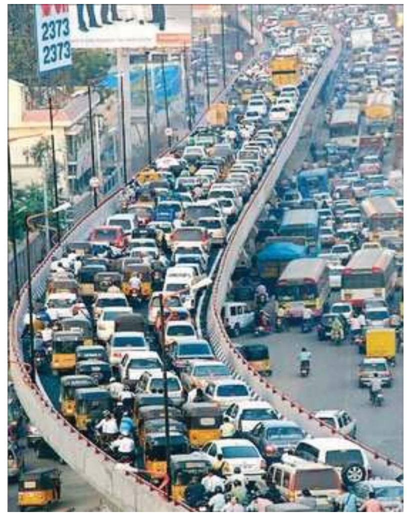
2nd International Forum for Low Carbon Cities

Seoul – 2-5 September 2019

The problem in Mega Cities

WRI INDIA





Impact of endless road expansion

Courtesy Transfuture.net

We can not "build" our way out of congestion

It's Not Just Cars . . .

. . . and Not Just Congestion

Air pollution is estimated to cause around 800,000 deaths in urban areas every year. *WHO*

Transport accounts for around 14% of human-created GHG emissions. *BBC, 2009*

Every hour, 40 people under the age of 25 die in road accidents around the world. *WHO*

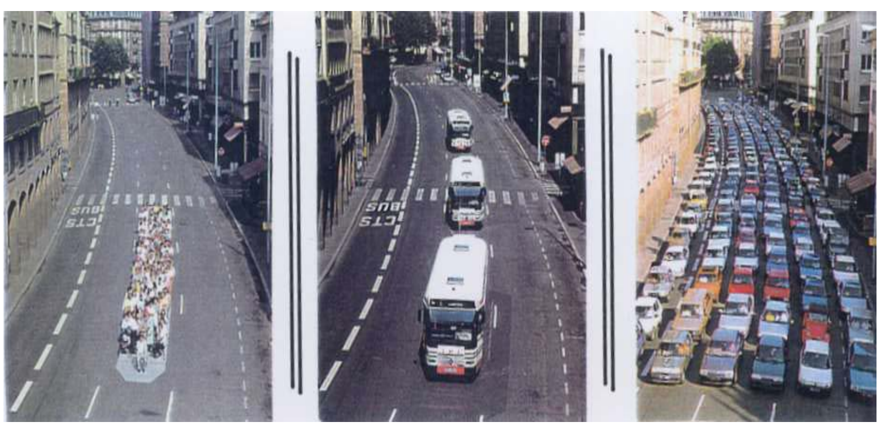
Traffic accidents cause 1.2 million deaths each year. *WHO, 2010*

Air Pollution

627,426 premature deaths every year in India

http://www.topnews.in/law/files/delhi-pollution.jpg

Resource efficient transport systems



Public Transport and Non-motorized modes need emphasis

Megacity transport solutions need

- Holistic thinking – not a piecemeal approach
- Focusing on demand — not just on supply
- Think of moving people — not vehicles
- Consider clean or alternative technologies

- **Car free day in India - Raahgiri**

WRI INDIA | SUSTAINABLE CITIES

Raahgiri Day – Car free day

Engaging Communities to bring about change

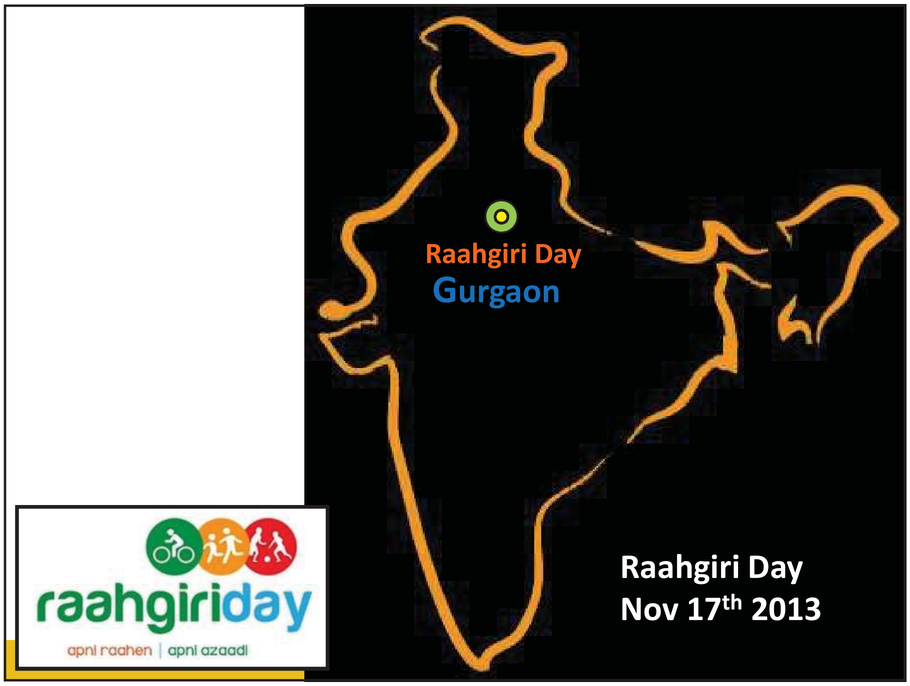
Motivated by several global best practices

Broadway, New York City

Orchard Road, Singapore

Giving streets back to the people

raahgiriday
GURGAON
apni raahen | apni azaadi


Raahgiri Day
Gurgaon
raahgiriday
apni raahen | apni azaadi
Raahgiri Day
Nov 17th 2013


CP
M
GALLERIA
DLF CITY CLUB
N
For details
www.raahgiriday.com
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PARK
MARRIOTT
COURTYARD
SUSHANT LOK,
VYAPAAR KENDRA
RENT
HUDA CITY
METRO
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Press Conference to Launch Raahgiri

Stakeholder Consultation

Digital Media

Website, Social Networking Page ……

PRINT MEDIA

On street promotions

Billboards, Hoardings, Pamphlets

Nov 17

GURGAON RECLAIMS ITS STREETS

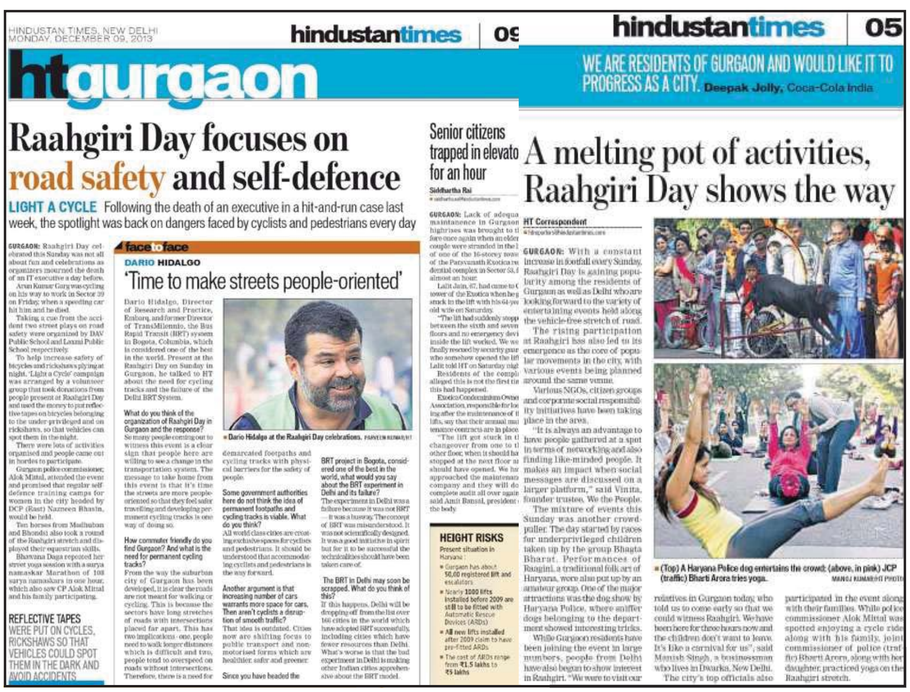
The first Raahgiri Day in the city saw hundreds take to the streets of Gurgaon and indulge in various car-free outdoor activities

Natasha Khurana

For once, Gurgaon streets were filled with more people than cars. Several people from all age groups took to the streets of Gurgaon on Raahgiri Day, participating in activities like walking, cycling and skating. Braving the nip in the air, people engaged in various outdoor activities from 7am on Sunday. Many kids were seen skating, cycling, playing cricket and with frisbees, while others chose to perform zumba, engage in cross fit training and even running with their friends.

"I have taken three rounds of the stretch already on my cycle and I feel so happy, because when you see so many people doing their own thing freely, it makes Gurgaon look like an eco-friendly city. The only bad thing is that many people who should have, didn't turn up," said Divya, a Class VII student at Heritage School.

Chief Guest Alok Mittal, Commissioner of Police, who also cycled a stretch of four kilometres along with other cyclists, said, "Although I don't cycle every day, my idea of staying fit involves adequate intake of food and a brisk walk, along with the conscientiousness to stay fit. I am very happy to be a part of this exciting initiative which we are planning to



HINDUSTAN TIMES, NEW DELHI
MONDAY, DECEMBER 09, 2013

hindustantimes | 09

htgurgaon

Raahgiri Day focuses on road safety and self-defence

LIGHT A CYCLE Following the death of an executive in a hit-and-run case last week, the spotlight was back on dangers faced by cyclists and pedestrians every day

GURGAON: Raahgiri Day celebrated this Sunday was not all about fun and celebrations as organizers mourned the death of an IT executive a day before.

Arun Kumar Garg was cycling on his way to work in Sector 39 on Friday, when a speeding car hit him and he died.

Taking a cue from the accident two street plays on road safety were organized by DAV Public School and Laxmi Public School respectively.

To help increase safety of bicycles and rickshaws plying at night, 'Light a Cycle' campaign was arranged by a volunteer group that took donations from people present at Raahgiri Day and used the money to put reflective tapes on bicycles belonging to the under-privileged and on rickshaws, so that vehicles can spot them in the night.

There were lots of activities organised and people came out in hordes to participate.

Gurgaon police commissioner, Alok Mittal, attended the event and promised that regular self-defence training camps for women in the city headed by DCP (East) Nazneen Bhasin, would be held.

Ten horses from Madhuban and Bhondsi also took a round of the Raahgiri stretch and displayed their equestrian skills.

Bhawana Daga repeated her street yoga session with a surya namaskar Marathon of 108 surya namaskars in one hour, which also saw CP Alok Mittal and his family participating.

REFLECTIVE TAPES WERE PUT ON CYCLES, RICKSHAWS SO THAT VEHICLES COULD SPOT THEM IN THE DARK AND AVOID ACCIDENTS

face to face

DARIO HIDALGO

'Time to make streets people-oriented'

Dario Hidalgo, Director of Research and Practice, Embarq, and former Director of TransMilenio, the Bus Rapid Transit (BRT) system in Bogota, Columbia, which is considered one of the best in the world. Present at the Raahgiri Day on Sunday in Gurgaon, he talked to HT about the need for cycling tracks and the failure of the Delhi BRT System.

Dario Hidalgo at the Raahgiri Day celebrations. PARVEEN KUMAR/HT

What do you think of the organization of Raahgiri Day in Gurgaon and the response?
So many people coming out to witness this event is a clear sign that people here are willing to see a change in the transportation system. The message to take home from this event is that it's time the streets are more people-oriented so that they feel safer travelling and developing permanent cycling tracks is one way of doing so.

How commuter friendly do you find Gurgaon? And what is the need for permanent cycling tracks?
From the way the suburban city of Gurgaon has been developed, it is clear the roads are not meant for walking or cycling. This is because the sectors have long stretches of roads with intersections placed far apart. This has two implications - one, people need to walk longer distances which is difficult and two, people tend to overspeed on roads without intersections. Therefore, there is a need for demarcated footpaths and cycling tracks with physical barriers for the safety of people.

Some government authorities here do not think the idea of permanent footpaths and cycling tracks is viable. What do you think?
All world class cities are creating exclusive spaces for cyclists and pedestrians. It should be understood that accommodating cyclists and pedestrians is the way forward.

Another argument is that increasing number of cars warrants more space for cars. Then aren't cyclists a disruption of smooth traffic?
That idea is outdated. Cities now are shifting focus to public transport and non-motorised forms which are healthier, safer and greener.

Since you have headed the BRT project in Bogota, considered one of the best in the world, what would you say about the BRT experiment in Delhi and its failure?
The experiment in Delhi was a failure because it was not BRT — it was a busway. The concept of BRT was misunderstood. It was not scientifically designed. It was a good initiative in spirit but for it to be successful the technicalities should have been taken care of.

The BRT in Delhi may soon be scrapped. What do you think of this?
If this happens, Delhi will be dropping off from the list over 160 cities in the world which have adopted BRT successfully, including cities which have fewer resources than Delhi. What's worse is that the bad experiment in Delhi is making other Indian cities apprehensive about the BRT model.

Senior citizens trapped in elevato[r] for an hour

Siddhartha Rai

GURGAON: Lack of adequa[te] maintanence in Gurgaon highrises was brought to t[he] fore once again when an elder[ly] couple were stranded in the l[ift] of one of the 16-storey towe[rs] of the Parsvnath Exotica re[si]dential complex in Sector 53, f[or] almost an hour.

Lalit Jain, 67, had came to [the] tower of the Exotica when he [got] stuck in the lift with his 64-ye[ar] old wife on Saturday.

"The lift had suddenly stopp[ed] between the sixth and seven[th] floors and no emergency devi[ce] inside the lift worked. We we[re] finally rescued by security guar[ds] who somehow opened the lift," Lalit told HT on Saturday nigh[t].

Residents of the compl[ex] alleged this is not the first tim[e] this had happened.

Exotica Condominium Owne[rs] Association, responsible for lo[ok]ing after the maintenance of t[he] lifts, say that their annual mai[n]tenance contracts are in place.

"The lift got stuck in t[he] changeover from one to t[he] other floor, when it should ha[ve] stopped at the next floor a[nd] should have opened. We ha[ve] approached the maintenan[ce] company and they will do [a] complete audit all over again," said Amit Bansal, president [of] the body.

HEIGHT RISKS

Present situation in Haryana:

- Gurgaon has about 50,00 registered lift and escalators
- Nearly 1000 lifts installed before 2009 are still to be fitted with Automatic Rescue Devices (ARDs)
- All new lifts installed after 2009 claim to have pre-fitted ARDs
- The cost of ARDs range from ₹1.5 lakhs to ₹5 lakhs

hindustantimes | 05

WE ARE RESIDENTS OF GURGAON AND WOULD LIKE IT TO PROGRESS AS A CITY. **Deepak Jolly,** Coca-Cola India

A melting pot of activities, Raahgiri Day shows the way

HT Correspondent

GURGAON: With a constant increase in footfall every Sunday, Raahgiri Day is gaining popularity among the residents of Gurgaon as well as Delhi who are looking forward to the variety of entertaining events held along the vehicle-free stretch of road.

The rising participation at Raahgiri has also led to its emergence as the core of popular movements in the city, with various events being planned around the same venue.

Various NGOs, citizen groups and corporate social responsibility initiatives have been taking place in the area.

"It is always an advantage to have people gathered at a spot in terms of networking and also finding like-minded people. It makes an impact when social messages are discussed on a larger platform," said Vinita, founder trustee, We the People.

The mixture of events this Sunday was another crowd-puller. The day started by races for underprivileged children taken up by the group Bhagta Bharat. Performances of Raagini, a traditional folk art of Haryana, were also put up by an amateur group. One of the major attractions was the dog show by Haryana Police, where sniffer dogs belonging to the department showed interesting tricks.

While Gurgaon residents have been joining the event in large numbers, people from Delhi have also begun to show interest in Raahgiri. "We were to visit our relatives in Gurgaon today, who told us to come early so that we could witness Raahgiri. We have been here for three hours now and the children don't want to leave. It's like a carnival for us", said Manish Singh, a businessman who lives in Dwarka, New Delhi.

The city's top officials also participated in the event along with their families. While police commissioner Alok Mittal was spotted enjoying a cycle ride along with his family, joint commissioner of police (traffic) Bharti Arora, along with her daughter, practiced yoga on the Raahgiri stretch.

(Top) A Haryana Police dog entertains the crowd; (above, in pink) JCP (traffic) Bharti Arora tries yoga. MANOJ KUMAR/HT PHOTO

तीसरी राहगिरी में मस्ती के साथ बढ़े राहगीर

दस हजार के पार पहुंची राहगिरों की संख्या, कई बड़े नाम भी पहुंचे लोगों के बीच

भास्कर न्यूज | गुड़गांव

सड़क की राहगिरी में इस बार मस्ती के साथ राहगिरों में भी इजाफा देखने को मिला। अकेले आने वाले राहगिरी फैमिली के साथ पहुंचे तो, युवाओं की टोलियां भी इस समूह से जुड़ती दिखाई दीं। संडे की सुबह साइबर सिटी की सड़कों पर बने माहौल ने शहर की बेहतरीन तस्वीर पेश की। ट्रैफिक पुलिस और लोगों के सहयोग से शहर में चल रही संडे की राहगिरी में इस बार लोगों को बेहतरीन रिस्पांस देखने को मिला। जिसमें हजारों की तादाद में लोग दूर-दराज से शहर में पहुंचे। राहगिरी को खास बनाने के लिए डॉग शो से लेकर, डांसिंग कंपीटिशन, पेंटिंग कंपीटिशन और क्विज प्रतियोगिता तक आयोजित कराई गई जिसमें लोगों ने बढ़चढ़ कर हिस्सा लिया।

बुजुर्गों की चौपाल से हुई नई पहल

सुबह लोगों के जमावड़े के बहाने शहर की समस्या और भावी संभावनाओं की चर्चा करने के लिए सीनियर सिटीजन कैफे के नाम से बुजुर्गों की चौपाल जमाई

गुड़गांव. राहगिरी कार्यक्रम में बीच सड़क पर योगा करती महिलाएं।

गुड़गांव. राहगिरी कार्यक्रम के तहत साइकिलिंग का मजा लेते लोग।

IN CAMPAIGNING FOR NON-MOTORIZED TRANSPORT, GURGAONITES REDISCOVER "TOGETHER TIME"

Raahgiri revives the family spirit

Safety audit of busy city roads soon

Top bureaucrat to cycle 30km from Delhi to Raahgiri venue

TIMES NEWS NETWORK

Gurgaon: Organizers of Raahgiri Day have recently readied a proposal for setting up cycling corridors that will connect some residential colonies to the venue, thus enabling visitors to cycle down every Sunday. But there are some enthusiasts, like S K Lohia, the joint secretary at the ministry for urban development, who would hit the saddle regardless of facilities.

Lohia said he will be cycling down all the way from central Delhi to the Raahgiri venue in Gurgaon this Sunday, taking active commuting to whole new levels. "I will be starting from a point near Connaught Place and it will be a 30km-long ride from there on," Lohia told TOI.

Being the national project ... port project, Lohia has worked as an evangelist for non-motorized transport in this country, railing against the 'chauffeur-driven view of things.'

He is also an avid cyclist, choosing his bicycle over the official transport to get to work. ... this is not the first time I am going for a long-distance ride. But yes, this time I have decided to venture a little further than usual," he said.

Lohia, who attended his first Raahgiri Day only a few weeks ago, said he has also announced his decision to ride to Gurgaon on his Facebook page, inviting other cycling enthusiasts from the capital.

Raahgiri Day, since its inception, has received active support from Gurgaon's official brass as

> This is not the first time I am going for a long-distance ride. But yes, this time I have decided to venture a little further than usual
>
> S K LOHIA
> Joint secretary, UD ministry

raahgiriday

MY FAMILY LOVES RAAHGIRI DAY

Manish Paul

GURGAON'S 10am ROCK CONCERT AT RAAHGIRI

Is 10am in the winter too early to attend a Euphoria concert? Gurgaon's Raahgirs don't think so

Pics: Ajay Kumar Gautam

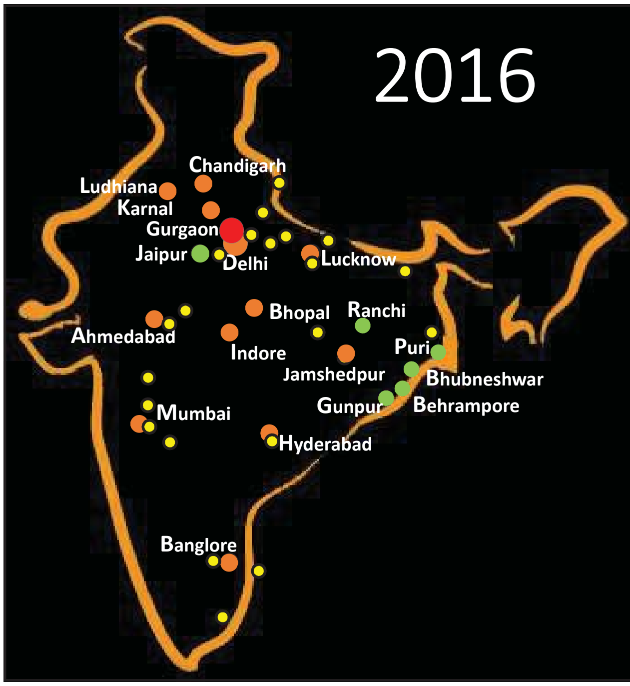
raahgiriday

Natasha Khurana

Palash Sen

POWER GAMES


Mumbai
Bangalore
Delhi



raahgiriday
CYCLE DAY
HAPPY streets
OUR ROADS. OUR WAY.
हिन्दुस्तान मस्ती मार्ग
equal streets
A Citizens' Movement

Business Impact – Connaught Place, Delhi

raahgiriday Vs Non Raahgiri Sunday

↑41%	↑71%	↑83%
Timings	Sales	Foot Fall
Started opening early	Reported increase in sale	Increased customers

Thank You

WRI INDIA

2nd International Forum on Low Carbon Development for Cities
"Acting Together for Low Carbon, Livable, and Prosperous Cities"

Millennium Seoul Hilton, Seoul, Republic of Korea
2-5 September 2019

Session 3: Low Carbon Transport Options in Mega-Cities

SEOUL TRANSPORT REFORM
- POLICY AND ICT -

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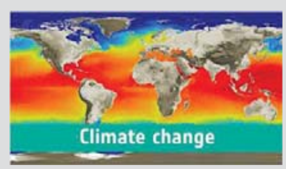
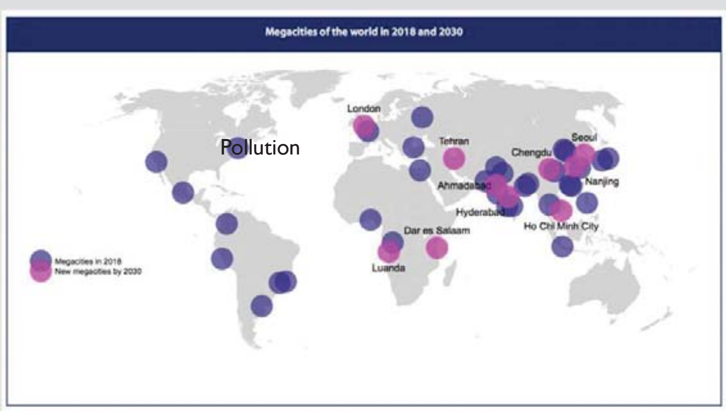
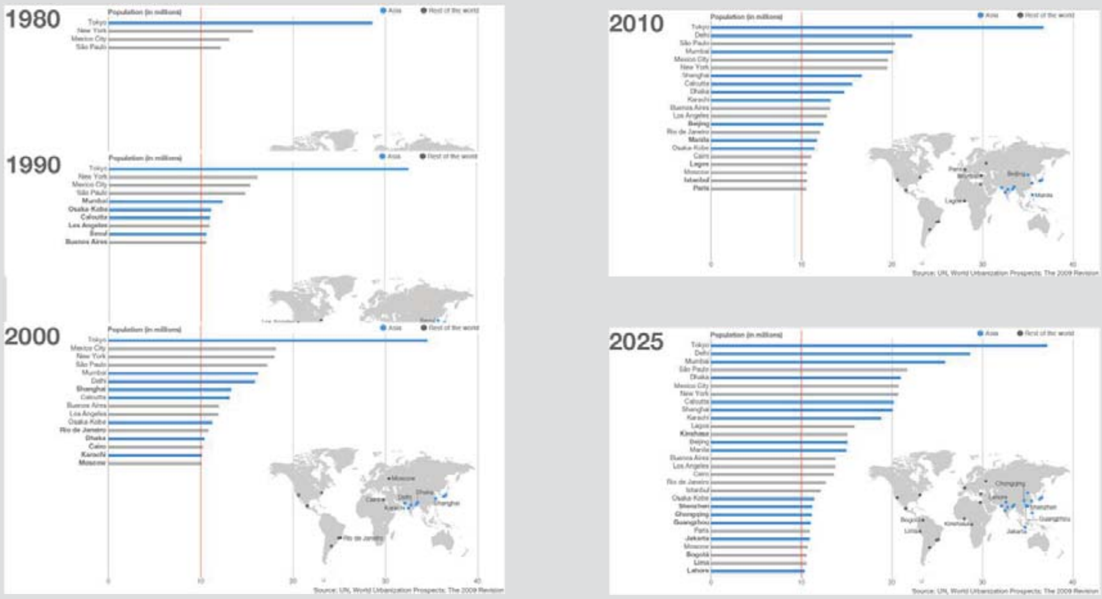
FIGHTING POVERTY IN ASIA AND THE PACIFIC

Mega Cities = Mega Problems
Priority is Important





Merge of Mega-Cities



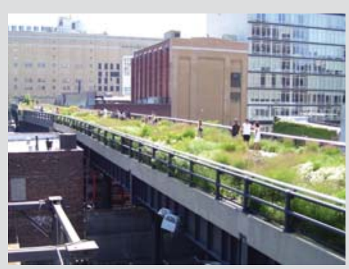
Questions :

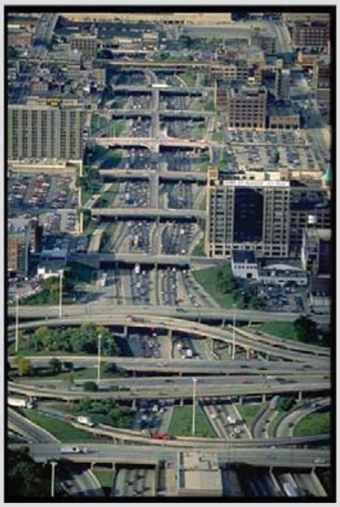
1. Why Cities grow so Big ?
2. Why Mega City merges in particular regions/economies
3. What is the role of transport policy & Infrastructure in Mega Cities



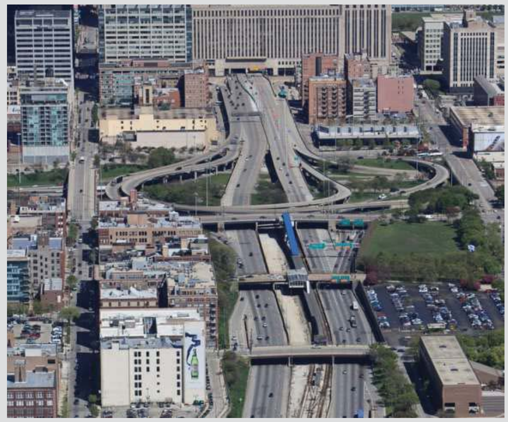
New York

New York City



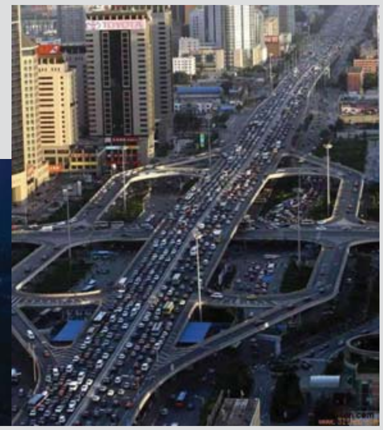


Chicago



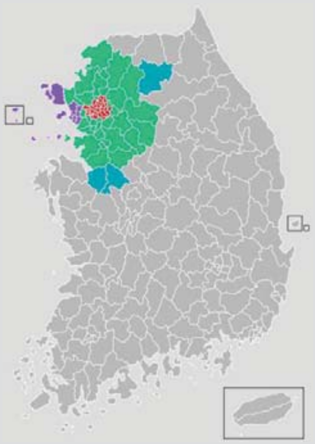
Tokyo

Beijing



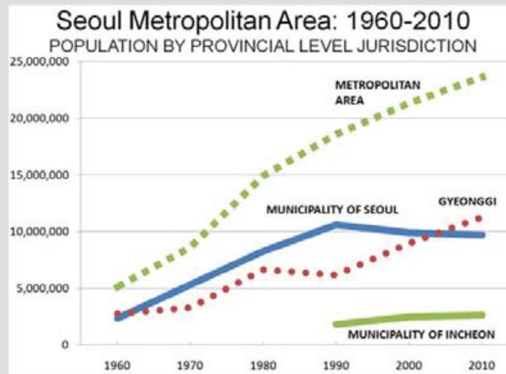
Case of Seoul Capital Area

Seoul Capital Area



Red: Seoul, Violet: Incheon, Green: Gyeonggi-do, Blue: other areas connected by rapid transit

Population (2016)	
• Seoul City	**10 Million**
• Metro[1]	**25,5 Million**
• % of South Korea's total pop	~50% (51 million)



The Past

1950s

- Korean War (1950-1953)
- War restoration work started
- Walk, bicycle dominant travel patterns

1960s

- Urbanization and industrialization
- Migration from rural to urban areas
- Bus dominant travel patterns

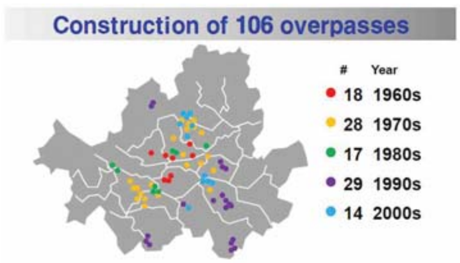
1970s

- Over-concentration of population in Seoul
- First subway line built in Seoul in 1974
- Still bus dominant travel patterns
- Gradual increase in car ownership

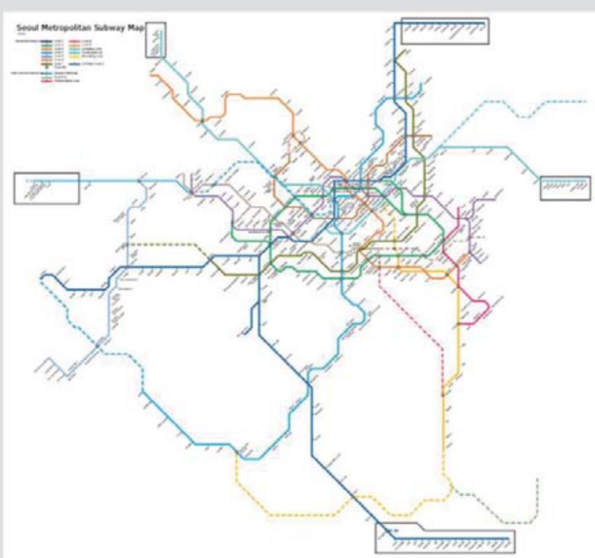
1980s

- Increase in subway passengers
- Decline in the number of bus passengers
- Car ownership (one million in 1985)
- Traffic impact assessment (TIA)
- Transportation system management (TSM)

Road Expansion + Capacity Increase + Traffic Management
Seoul



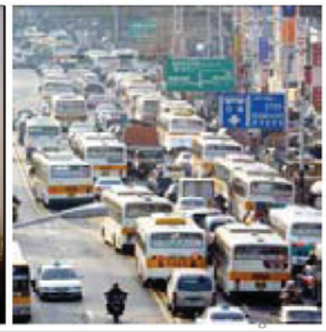
Urban Rail from 1974



Line name	Stations	Total Km	Opening Year	Last Extension
Line 1	98	200.6	1974	2010
Line 2	51	60.2	1980	1996
Line 3	44	57.4	1985	2010
Line 4	48	72.1	1985	2000
Line 5	51	52.3	1995	1996
Line 6	38	35.1	2000	2001
Line 7	51	57.1	1996	2012
Line 8	17	17.7	1996	1999
Line 9	38	40.6	2009	2018
AREX	14	63.8	2007	2018
Gyeongui–Jungang Line	55	121.7	2005	2017
Gyeongchun Line	24	81.3	2010	2016
Bundang Line	37	55.3	1994	2018
Suin Line	14	19.9	2012	2016
Ui LRT	15	11.4 km	2017	-
Shinbundang Line	13	31.0 km	2011	2016
Incheon Line 1	29	29.4 km	1999	2009
Incheon Line 2	27	29.1 km	2016	-
EverLine	15	18.1 km	2013	-
U Line	15	11.1 km	2012	-
Gyeonggang Line	11	54.8 km	2016	-
Seohae Line	12	23.4 km	2018	-

1990s

- Emerging sustainable development paradigm
- Severe air pollution due to traffic congestion
- Congestion charging system was introduced
- Car ownership (ten million in 1997)
- Eight subway lines (287 km) in Seoul were completed



POPULATION & VEHICLES

Population: doubled

1970: 5.4 million

1990: 10.9 million

2007: 10.4 million

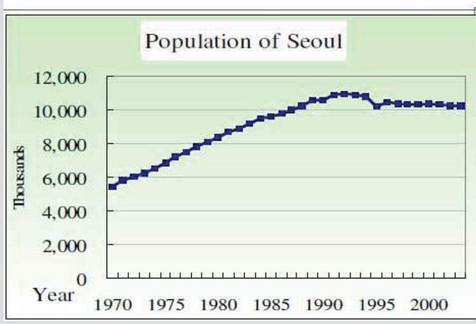
Registered vehicles: 46 times

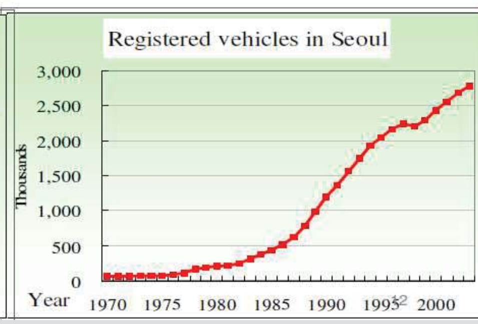
1970: 60,000

1990: 1.2 million

2007: 2.9 million

Population density: 17,000 persons/km^2

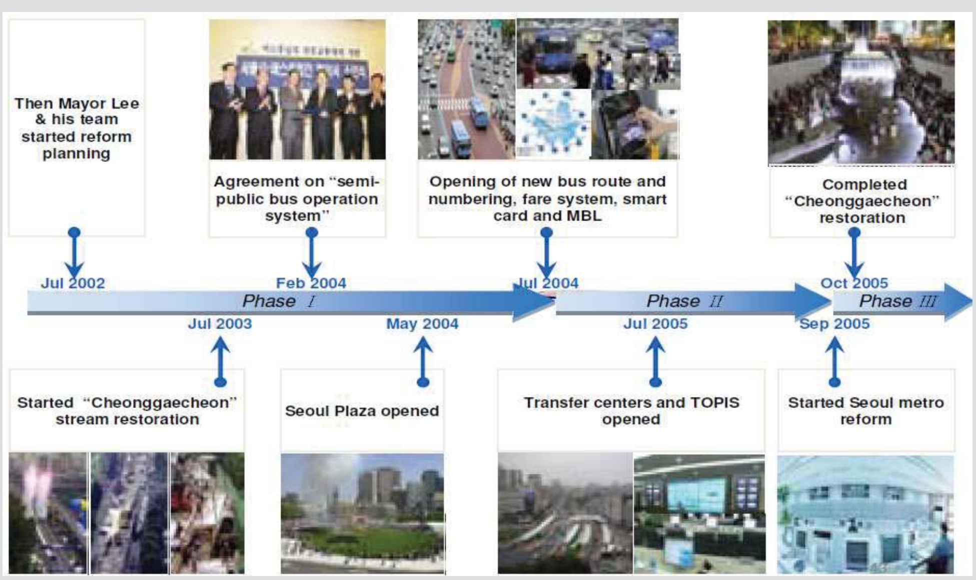




MODE SHARE

	Bus	Subway	Bus + subway	Passenger car	Taxi	Others
2000	28.3	35.3	63.6	19.1	8.8	8.5
2001	27.6	36.5	64.1	18.7	8.4	8.8
2002	26.8	37.8	64.6	18.4	8.0	9.0
2003	27.6	35.0	62.6	25.0	7.3	5.1
2004	26.3	35.7	62.0	26.4	6.6	5.0
2005	26.8	35.9	62.7	26.3	6.2	4.9
2006	27.6	34.7	62.3	26.3	6.3	5.1

Seoul City Reform Brief



Seoul City Reform Brief : Median Bus Lane

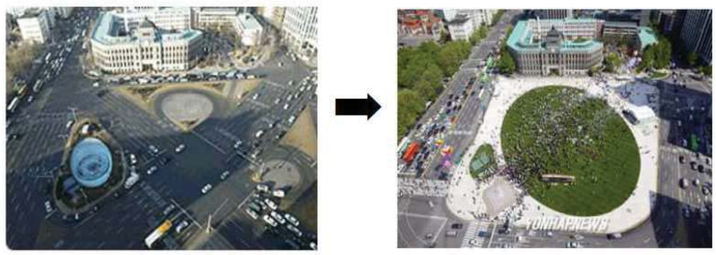
Seoul City Reform Brief : Removal of Large Flyovers

Chonggaecheon

Seoul Station Flyover

Reduce Through Traffic
In the CBD
(65%)

Seoul City Reform Brief : Removal of Large Flyovers

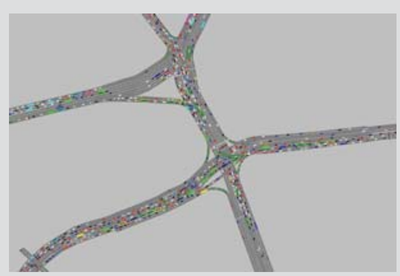


Before and After Seoul Plaza Renovation

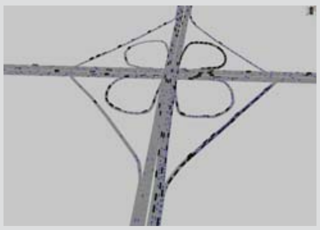
Before and After Gwanghwamun Square Renovation

Public Space

Seoul City Reform Brief : Removal of Flyovers



Seoul City Reform Brief : All Day Bus Only on Expressway No. 1



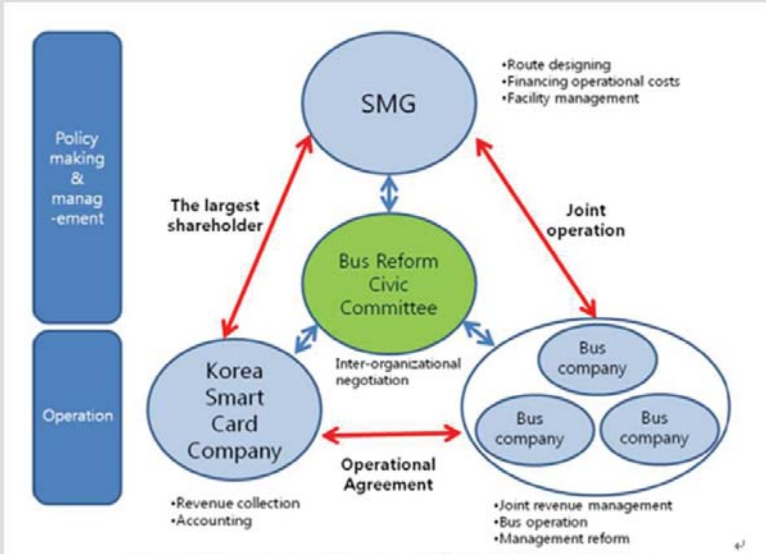
Transport Reform 3 main Tasks

Management
- Scientific Transport Planning
- Distance-Based Fare Integration
- Route Restructuring
- Unified Fare System, Free Transfers

Infrastructure
- Quality Bus Stops
- Dedicated Lanes
- Safe, Low-Emission Buses
- Pedestrian-friendly Policies(TDM)
- Easy Transfers

Technology
- Smart Card System
- Bus Management System(TOPIS)
- Transport Information System(TIS)

Bus Reform: Structure



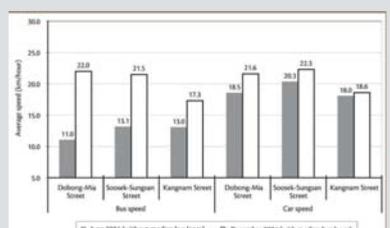
<Figure 3> Organizational Structure and Roles for the Bus Reform

Bus Reform : Impact

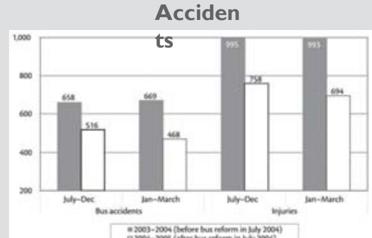
CITIZEN SATISFACTION SURVEY

		Jul-Dec 2003	Jul-Dec 2004	Jan-Jun 2005	Jan-Jun 2006
Citizen satisfaction (%)	Total (%)	-	45.6	69.0	84.1
	Bus (%)	-	-	58.9	85.5
	Subway(%)	-	-	79.1	90.2
Citizen satisfaction (10 scale)	Bus + subway	5.15	5.30	5.55	5.62
	Bus	4.75	4.85	5.64	5.68
	Subway	5.99	6.08	6.29	6.31
	Taxi	4.72	4.96	4.72	4.87

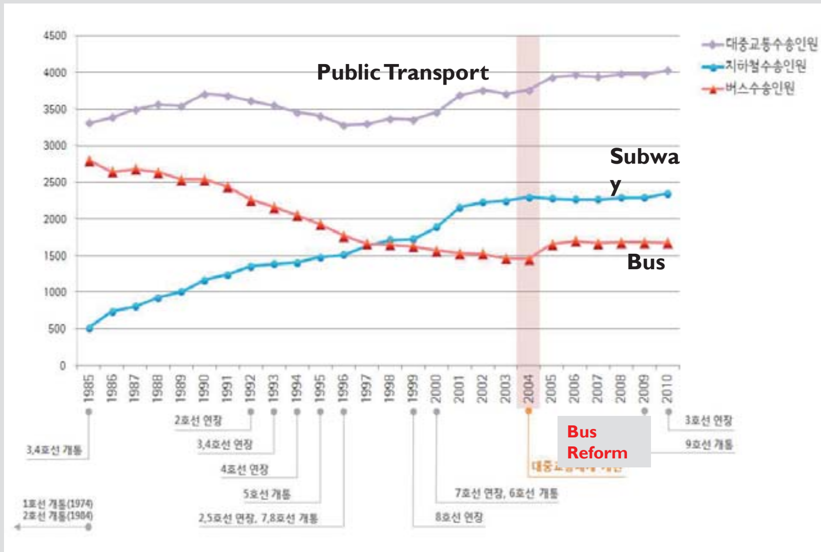
Speed



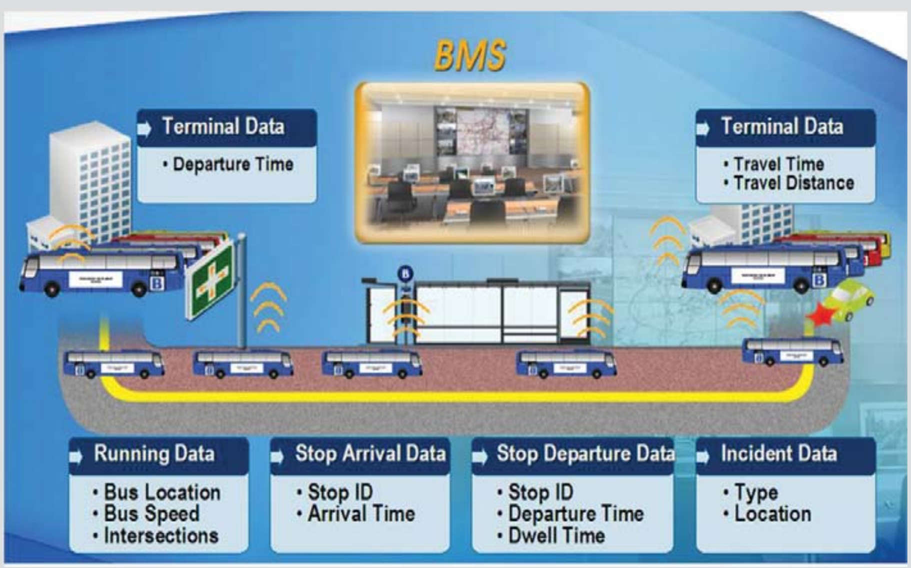
Acciden
ts



Bus Reform : Impact



Bus Management System



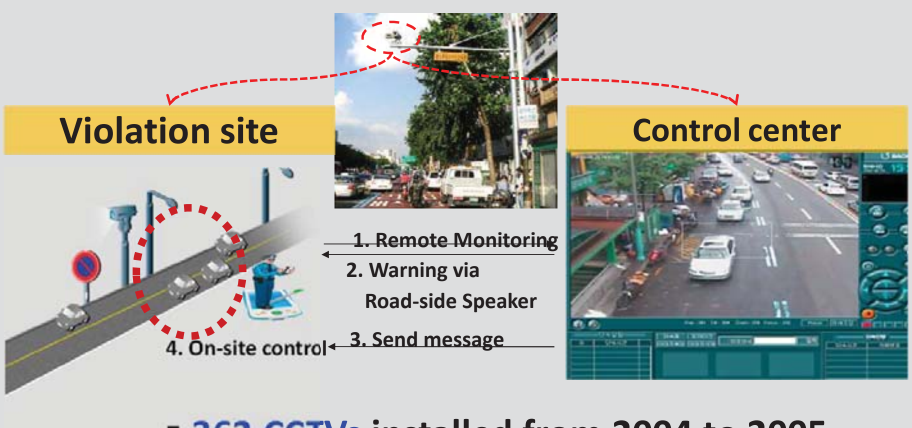
PAYMENT FOR PUBLIC TRANSPORT

BUS INFORMATION SYSTEM

Enforcement: Surveillance Cameras

Enforcement by camera on bus

Enforcement : Remote Surveillance



- 362 CCTVs installed from 2004 to 2005

Controlling illegal operation/parking/stopping at bus only lane

Monitoring cars with their plate number

(Seoul Transport OPeration & Information Service)

Seoul Mobility Management Center.
@B3 of City hall

Transport Reform Result
For High Quality Services

1. Network effect → Increase ridership (13%)
2. Travel Time Saving
3. Cost down, Triple win(P-G-O)
4. Transparency improvement, Reliability
5. Reduce Accident → 27.6% down
6. Technology upgrade – ICT, Easy to use

Thank You

KI-JOON KIM

Principal Transport Specialist

Sustainable Development and Climate Change Department

Asian Development Bank

WWW.ADB.ORG

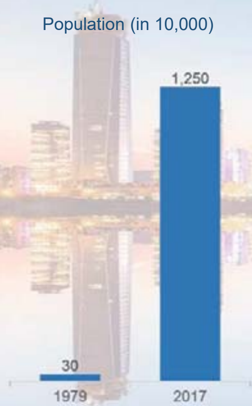
KJKIM@ADB.ORG

Electrification of Bus and Taxi Fleet
The Shenzhen Bus Group Experience

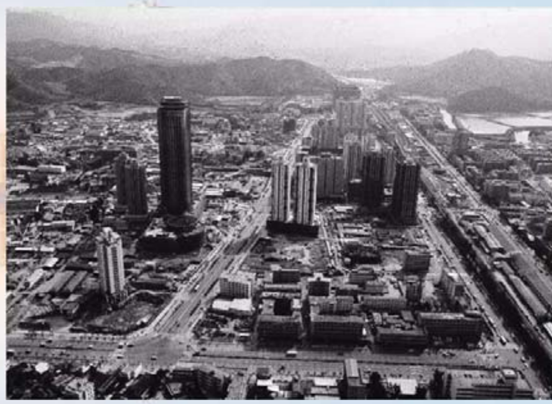
SHENZHEN BUS

Joe Ma
Deputy General Manager
Shenzhen Bus Group

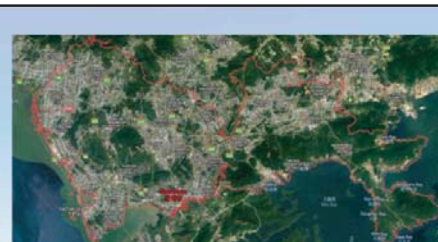
Shenzhen SEZ Since 80’



Shenzhen SEZ Since 80’



Shenzhen SEZ Present



Shenzhen City Limit

Population: 13 Million

Area: 1990 km^2

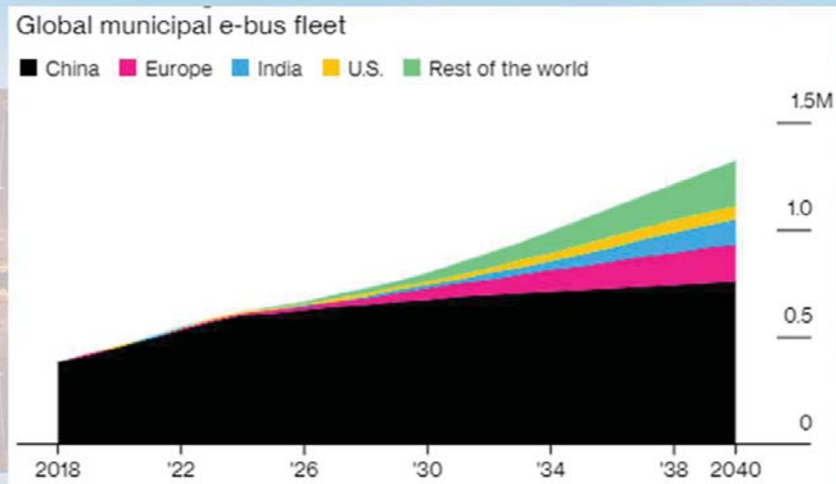
GDP: $350 Billion

Ranked 1st in Business Environment In China

Colleges & Universities: 18

Transportation: 1 Airport
9 Passenger/Freight Ports
6 Train Stations
7 Boarder Check Points (Only city in China with Sea, Air and Land checkpoints)
8 Metro Lines
977 Bus Routes w/ over 10k Buses
20K Taxis

About Electric Buses



Source: BloombergNEF's “Electric Vehicle Outlook 2019”

About SZBG

BBC StoryWorks & UITP
<Shenzhen – An Electric Megacity>

About SZBG

Largest new energy public transportation operator in the world

- *Taxi*
- *Urban Bus*
- *Custom Bus*
- *Micro Bus*
- *School Bus*
- *Tour Bus*
- *Cross-border Bus*
- *Cross-border Truck*
- *Vehicle-rental*

About SZBG

Company Assets

Staff：28,000

Fleet Size：12,275

Urban buses：6053　Taxis：5549
Cross-border, ondemand and tour vehicles：673

Annual passenger capacity:
800,000,000 person-times

Charging stations：101

Chargers:1,717

Depots: 1,018,000 sq.m

Self-owned station area: 310,000 ㎡
Rented station area: 708,000 ㎡

Shenzhen Tong
Shenzhen All-purpose Card

40 million cards
12 million active users
annual transaction amount of RMB 6 billion

Process of Electrification

BUS

- **In May 08 -** 10 hybrid buses.
- **In July 11 -** 137 electric buses.
- **In June 17 -** 6053 buses became electric buses.

TAXI

- **In May 10 -** 50 electric taxis.
- **In Dec. 17 -** 3,056 electric taxis.
- **In Dec. 18 -** Shenzhen taxi electrified.

CHARGING

- **In June 10 -** first charging station.
- **In Apr. 16 -** "grid-type fast charging" technology.
- **In Dec. 18 -** 333 chargers for taxis.

Benefits of Electric Buses

Technical Standardisation of Electric Buses

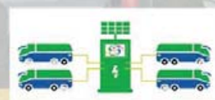
Minimal vehicle maneuvering

Flexible charging

Land efficiency

One charger/ 4 buses

Full use of trough period electricity



- 10.5-metre buses
- DC fast charging
- Patented grid chargers

Technical Standardisation of Electric Buses

Intelligent Dispatch Centre

E-bus maintenance

Charging service

Electric Taxis

- SZBG owns 2 taxi companies
- 6,050 taxis
- 21.3% of the total taxis (22,000) in the city
- Taxi chargers: 333

Pengcheng Electric Taxi

- First pure electric taxi company in the world
- Current Chair Unit of UITP
- Management model for pure electric taxi business combining OEM and operator
- Global media and commercial interest – visits by Hillary Clinton and Warren Buffett.

Comprehensive Charging Stations

One-stop stations to serve the passengers, drivers and taxis

For consumer
- Convenience services
- Other onboard services
- Discover other needs

For driver
- One-stop taxi fleet
- Driver dining service
- Driver life leisure

For taxis
- Charging service
- Maintenance services
- Power storage

On-Demand Bus

Start time: 2016

Line: 1650

App- based Customer/Commuters

Service mode： Fixed route, fixed time (peak hour) , Fixed fare

40 Seats / bus

On-Demand Bus

7 Cities

70% Attendance rate

500K Registered users

1650 Lines

1602 Passengers per 1000 km

50K Active users per day

U+ Minibus

Shekou Shenzhen & Shangli Pingxiang

10 Seats

Running time: Off peak

Dynamic route

No fixed Route

No fixed schedule

U+ Minibus

Shekou Shenzhen

Area	3 km × 3 km
Vehicles	5 (10 seats)
Operating time	7 a.m. – 10 p.m.
Max orders/day	284
Max passengers/day	335
Waiting time (avg.)	5.23 min
Detour ratio (avg.)	1.26

Shangli Pingxiang

Area	3 km × 5 km
Vehicles	5 (10 seats)
Operating time	7 a.m. – 7 p.m.
Max orders/day	305
Max passengers/day	361
Waiting time (avg.)	6.20 min
Detour ratio (avg.)	1.31

Autonomous Driving Technologies

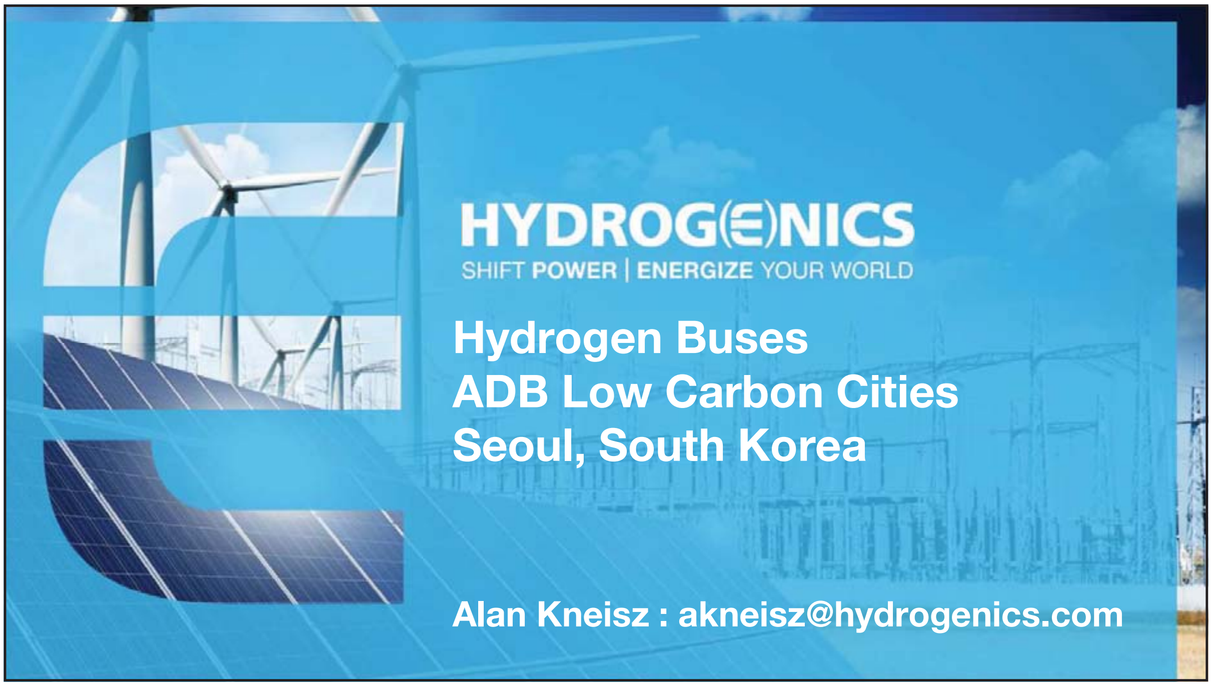
SHENZHEN BUS

+

HAYLION 海梁科技 Technologies

An Autonomous Driving Bus Trails that Operated over 20,000km without Incidents under Harsh Weather Conditions


Thank You!



HYDROGEN EVOLUTION IS…

- Evolving the Electric Vehicle to a more advanced, easier to use and environmentally friendly transportation using Fuel Cells
- Evolving Renewable energy to capture any excess energy via Electrolysis to create Hydrogen and balance grids with Power to Gas
- The HYDROGEN EVOLUTION IS….

HYDROGENICS

HYDROGENICS
SHIFT POWER | ENERGIZE YOUR WORLD

70 years of experience in delivering top-tier hydrogen solutions

Leading **PEM stack** and system technology, including unmatched **power density** in a single stack (3MW)

Only global company with leading technology in both **electrolyzers** and **fuel cells**

Zero-emission technology

Over **2,000 fuel cell** and **500 electrolyzer** installations around the world

Supplied equipment for **60+ fueling stations**

Serving customers in **100+ countries** around the world

Publicly traded: **NASDAQ** (HYGS) and **TSX** (HYG)

Over **145 patents**

Our Principal Product Lines

HyPM
Fuel Cell Power Modules

- Robust and flexible platform for zero-emission **Mobility/Transportation** applications
- Track record of superior performance and durability
- Fully customizable

HyPM and HyPM-R
Fuel Cell Power Modules and Rack Systems

- Suitable for **Critical and Back-Up Power** applications
- Unlimited scalability to meet runtime needs

HySTAT™
Alkaline Electrolyzers

- Suitable for industrial hydrogen **Generation**, energy **Storage** and **Fueling**
- World leading market share
- Industrial standard

HyLYZER™
PEM Electrolyzers

- Suitable for industrial hydrogen **Generation**, energy **Storage** and **Fueling**
- Worlds most power dense stack with the smallest footprint
- Scalable to 50MW, 100MW+

Helping Our Customers Achieve New Milestones

Our products and solutions are helping customers and industries achieve new milestones

TRANSPORTATION

First hydrogen powered public service train
First multi-passenger, hydrogen powered all-electric airplane
First hydrogen fuel cell powered medium-duty delivery trucks
Largest hydrogen powered bus fleet in China

FUELING

First hydrogen fueling station in Scotland
First hydrogen fueling station in Sweden
First hydrogen fueling station in Norway
First hydrogen fueling station in Canada

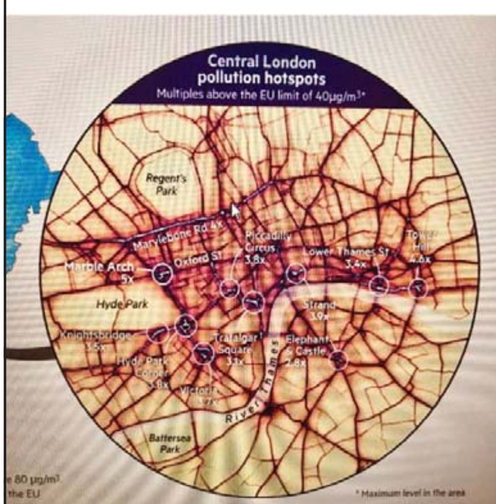
ENERGY GENERATION, STORAGE, CRITICAL AND BACK-UP POWER

First and largest Power-to-Gas facility in the world
First Hydrogen-to-Power project at a MW-scale
First hydrogen injection into pressurized natural gas infrastructure
First telecom UPS with electrolyser

IN DEVELOPMENT

Largest PEM electrolysis plant in the world
First hydrogen fueling station in South East Asia
First hydrogen powered high-speed ferry in the USA

Urban Air Pollution in Cities is Mainly Transport



Hyundai Nexo Cleans over 900kg of clean air in a month

HYDROGEN HEAVY DUTY APPLICATIONS

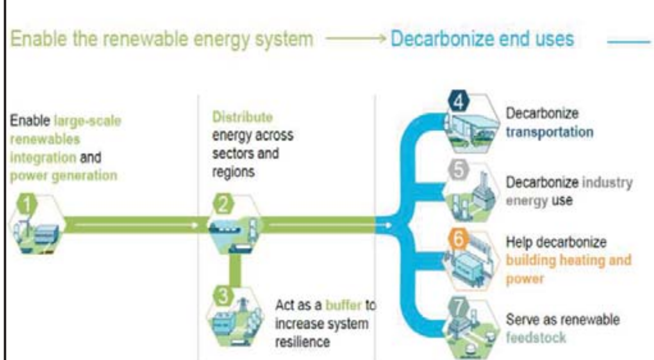
Fuel Cell Advantages

- Extend Range of Vehicle: 30kw FC module
  - Bus from 120-220km to 330 to 450km range
  - Logistic Vehicle from 200km to over 450km
  - Passenger Car from 250km to over 600km
- Fast recharging of 3 to 7 minutes
- Better temperature tolerant with heat and cold
- Hydrogen Trains: 1/3 the cost of Electric train ?
- More environmental :
  - Easier and Better recycling Capability
  - Green H2 has lowest carbon emissions of any vehicle
- Less Charging stations and infrastructure
- Greater cost reductions over time
- Supported by all major companies globally with the Hydrogen Council
- Allows for usages of wasted energy in the grid and renewables

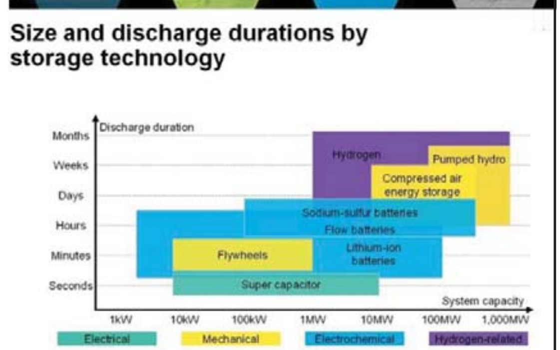
Fuel Cell Vs Battery and Combustion

Attribute	Electric	Combustion Engine	Fuel Cells
Zero Emissions			
Extended Runtime			
Fast Fueling			
Quiet Drive			
High Efficiency			
Route Flexibility			
Renewable Capable			
Maintenance			

Hydrogen Energy Density and Hydrogen Council Goals

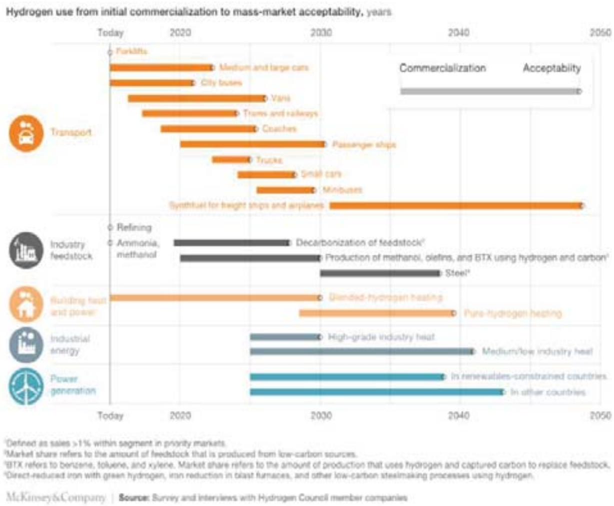


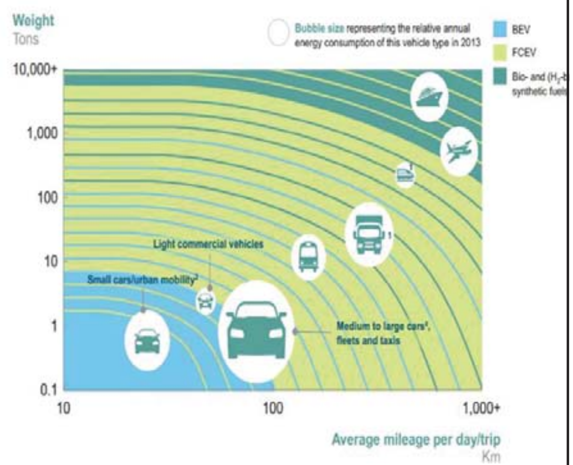
Hydrogen Council 2050 Goals



Source: Bloomberg New Energy Finance. Note: system capacities and discharge durations are based on general use, rather than technical limitations

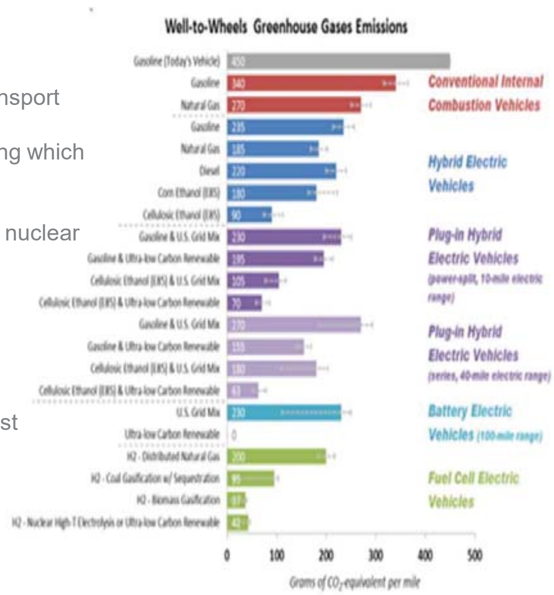
Hydrogen Commercialization Trends





Why HYDROGEN and PEM Fuel Cells

- Current battery technology cannot support Heavy Duty Transport
- Batteries have major precious metals concerns and recycling which are not present with Fuel cells
- Renewables have excess power in most markets, also coal, nuclear have excess power which can be utilized
  - Ex: 5GWH in Germany alone in excess
- Transporting H2 is getting better and better and cheaper ex. LOHC, Ammonia
- Auto industry supports Hydrogen Fuel cells as the lowest cost powertrain with volume ($40 USD target per Kw)
  - Toyota, Hyundai, Honda, Daimler, Audi, Mecedes, etc…
-



Fleet Vehicles: first step to maximize investments in Fueling

- Fleet vehicles are the most logical step to maximize investment in hydrogen fueling
- Why Fleets ?
    - China: approx. 15 stations with 1500 FCEV
    - Japan: approx. 120 stations with 2000 FCEV
- Fueling Stations are approx. $500k to 3 million USD per station
- Allows centralization with large excess power

HYDROGEN URBAN TRANSIT BUSES

Urban Transit Buses

FCEV Fleet Projects for Bus and Trucks : USA

CEC and DOE Heavy Duty Fuel Cell Vehicle Projects, California

- New Flyer fuel cell bus
- Hydrogenics' Celerity bundled with Siemens ELFA drive

California References

- Various projects at the ports including heavy duty references
- Class 6 and Class 8 trucks projects

CEC and DOE Heavy Duty Fuel Cell Vehicle Projects, California

- Freightliner fuel cell truck
- Hydrogenics' Celerity bundled with Siemens ELFA drive

DOE, United Parcel Service Project, California

- 17 UPS fuel cell delivery vans powered by Hydrogenics
- BEV + FC Range extender configuration

China FC Buses

Leadership In China

- Hydrogenics leading all FC suppliers with over 130 confirmed buses running and approved in Chinese government our leading HD30 platform in OEM's Foton and Yutong

Bus Fleets

- Bus fleets currently running using partnership with SinoHytec in Beijing in Zhangjikou
- **Currently 75 buses running in one fleet, largest globally**

SinoHytec, China

- Cooperation with SinoHytec with hundreds of HD30 delivered
- Systems co-development and supply of FC power systems

Blue-G New Energy Science and Technology Corporation, China

- Contract for 1000 units Fuel Cell Bus Power Modules and License agreement
- Delivery over next 2-3 years

Rail, Truck and Plane Projects – Europe

Alstom, Germany

- World's first commercial contract for hydrogen fuel cell trains
- 10-year agreement, contract value > €50M

ALSTOM

E-Trucks Europe

- Integrating garbage trucks with HyPM™HD30s
- Three different DAF platform truck variants

ASKO, Trondheim

- Norway's largest grocery wholesaler
- 4 Trucks of 27 tons
- Supplying four (4) complete 90kW fuel cell power systems
- Including H2 storage, power electronics and controls

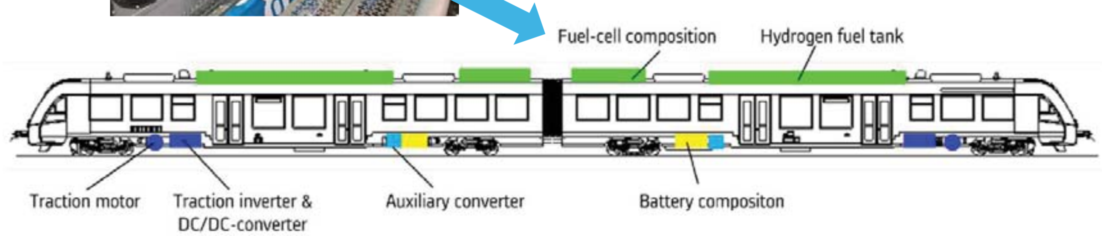
DLR German Aerospace

- Project GO4H2
- 11 HyPM™ HD10 units delivered for next aircraft project

DLR nip

Alstom: Zero-Emission Regional Trains

- **Primary energy from fuel cells 800k range**
- **Intermediate storage from Li-ion batteries**
  - **For additional acceleration**
  - **For recuperative breaking energy**
- **Combined drive and energy storage system**



Heavy Commercial & Municipal Fleets – Public Sanitation Vehicles





HyMUVE	
Location	Basel, CH
Vehicle	Bucher-Schoerling City-Cat
Fuel Cell	2 Projects: (1) HD16, (1) HD20
Project	HyMUVE
Integrator	EMPA


Rotopress APU	
Location	Berlin, Germany
Vehicle	FAUN / Mercedes-Benz
Fuel Cell	HD16 G1
Project	BSR / Rotopress APU
Integrator	Heliocentris

FC Garbage Truck	
Location	Kanagawa, Japan
Vehicle	Flatfield
Fuel Cell	(1) HD30
Project	FC Garbage Truck
Integrator	Flatfield

LIFE´nGrabHy	
Location	Eindhoven NL, Veldhoven BE
Vehicle	(2) DAF
Fuel Cell	HD30
Project	EC Life'nGrabHy
Integrator	E-Trucks

Groeningen	
Location	Groeningen, NL
Vehicle	DAF
Fuel Cell	HD30
Project	Groeningen
Integrator	E-Trucks

Heavy Commercial & Municipal Fleets – Freight Trucks





NAC FC APU	
Location	Palm Springs California, USA
Vehicle	Peterbuilt Class 8
Fuel Cell	(2) HD12
Project	DOD FC APU
Integrator	Hydrogenics, SWI

LINDE TRAILH2	
Location	Germany
Vehicle	Mercedes-Benz
Fuel Cell	HD12
Project	LH2 HRS FC APU
Integrator	Hydrogenics, Linde Gas

LA/LONG BEACH PORT TRUCKS	
Location	Los Angeles, California, USA
Vehicle	Class 8
Fuel Cell	(2) HD16
Project	TTSA, Port of LA and Long Beach
Integrator	Vision Industries

LA/LONG BEACH PORT TRUCKS	
Location	Los Angeles, California, USA
Vehicle	Freightliner
Fuel Cell	HD30
Project	TTSA, Port of LA and Long Beach
Integrator	Hydrogenics, Siemens

ASKO/SCANIA TRUCKS	
Location	Trondheim, Norway
Vehicle	(4) SCANIA 27-ton
Fuel Cell	90 kW
Project	ASKO
Integrator	H2: Hydrogenics FC: Hydrogenics BEV: SCANIA

Next Generation Heavy Duty

- Hydrogenics has announced the Worlds First Passenger Hydrogen powered plane with Alakai called Skai
- Alaka'i Technologies, this week unveiled a liquid-hydrogen-powered, five-passenger electric aircraft will be more efficient and powerful than the battery-powered aircraft
- Led by veterans of NASA, Raytheon, Airbus, Boeing, and the Department of Defense, unveiled a mock-up of the six-rotor aircraft, called Skai, in Los Angeles at the offices of BMW Designworks,
- Able to fly for up to four hours and cover 400 miles on a single load of fuel, which can be replenished in 10 minutes at a hydrogen fueling station.
- https://www.youtube.com/watch?v=uhMP5237dGA

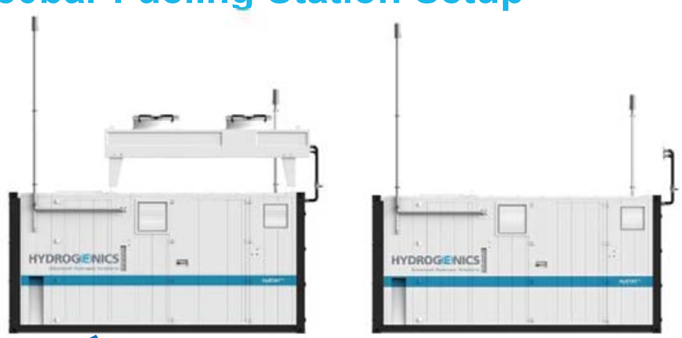
Hydrogen Fueling Solutions

Hydrogenics has supplied zero-emission solutions to over 60 fueling stations –

- Production capabilities from 20kg to over 1,000 kg per day
- 350 and 700 bar stations
- Fully interconnected systems for easy installations
- Designed for clean, onsite hydrogen production or delivered hydrogen
- Built to the highest safety standards

Zero-emission fueling for clean mobility solutions

350bar Fueling Station Setup

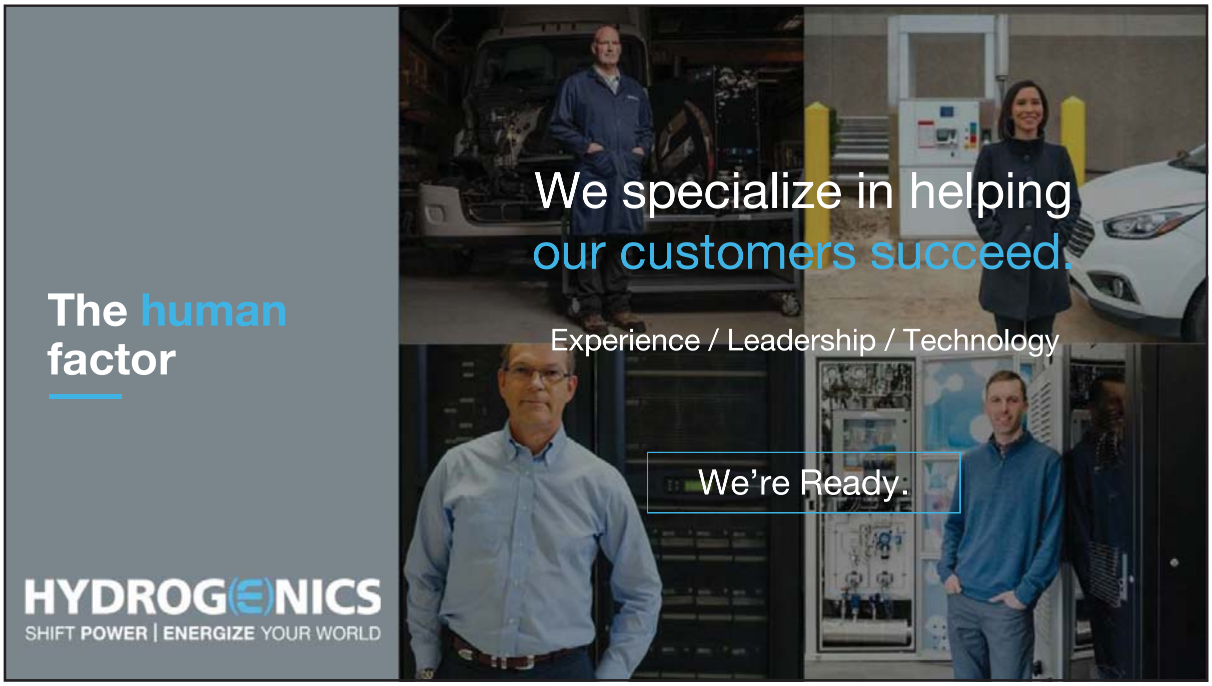


Module 1: Electrolyser (21,32, 65, 97 or 130kg/day)

Module 2: Compression (cooling), (storage) and Storage management system

350 bar Dispenser

- Hydrogen quality: **Fuel Cell Grade (99,998%)**
- Fill type: **According to SAEJ 2601 requirements**
- Consumption: **65 kWh/kg H2 produced**
- **Fully interconnected and centrally controlled**

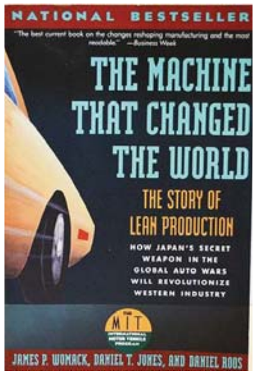


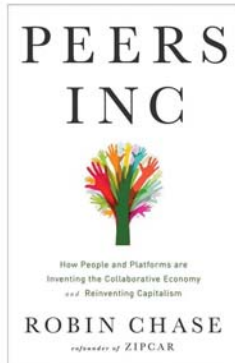
The human
factor
We specialize in helping
our customers succeed.
Experience / Leadership / Technology
We're Ready.
HYDROGENICS
SHIFT POWER | ENERGIZE YOUR WORLD

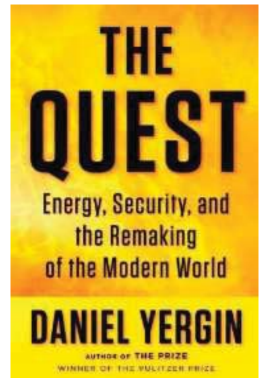

A segmented approach to clean mobility solutions for 1.2B+ Indians
Lithium
Tomorrow's Transportation Today
2nd International Forum on Low Carbon Development for Cities
Lithium Urban Technologies Private Limited
Tomorrow's Transportation. Today
September 2019
Lithium Urban Technologies Private Limited - Private and Confidential
Lithium


Lithium in numbers
Largest 100% EV fleet in the world outside China
India's largest charging network
Proved financial viability of EVs
Backed by IFC and LGT Capital
IFC
LGT
950+
FLEET SIZE
500+
DC+AC CHARGERS
~81,000,000
ELECTRIC KMS
~17,000 MT
CO_2e ABATED
10,000+
DAILY TRIPS
23,000+
DAILY PAX
250+
KMS / CAR / DAY
2.3/ride
AVG. OCCUPANCY
17M kWh
ENERGY REPLACED
90%
RENEWABLES POWERED
25+
CLIENTS
7
CITIES
200,000+ hrs
DRIVER TRAINING
100%
VERIFIED DRIVERS
0
FATALITIES
0.0000017
ACCIDENT PER KM
5,000+
FAMILIES INTRODUCED TO BANKING
1,500+
FAMILIES WITH HEALTH INSURANCE
EBITDA +ve
SINCE M10
DISRUPTING THE MOBILITY MARKET WITH
Unlimited mileage | Analytics driven high productivity fleet | Future proofed | Multi-year zero escalation
BE RESPONSIBLE
Winner FT/IFC Awards 2019
ISO 26000

The Change







renewables inflection | energy security | storage | shared eco

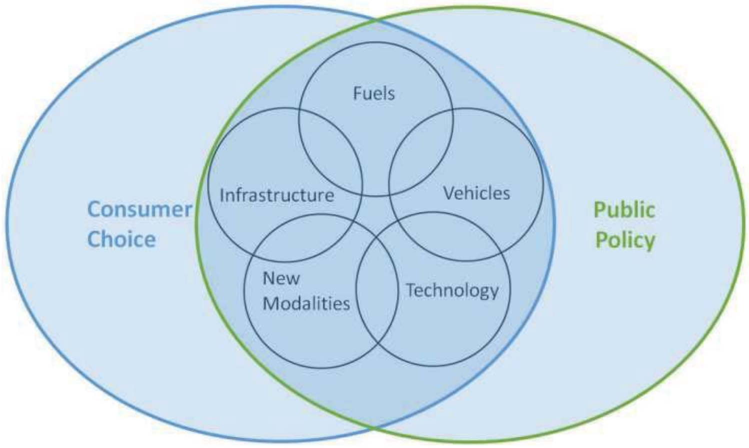
Key Tenets

the future of urban public transportation will be driven by 4 key tenets

Clean | Distributed | Shared | Connected

companies that build solutions that incorporate these tenets will be front-runners in the urban transport market.

The Vectors

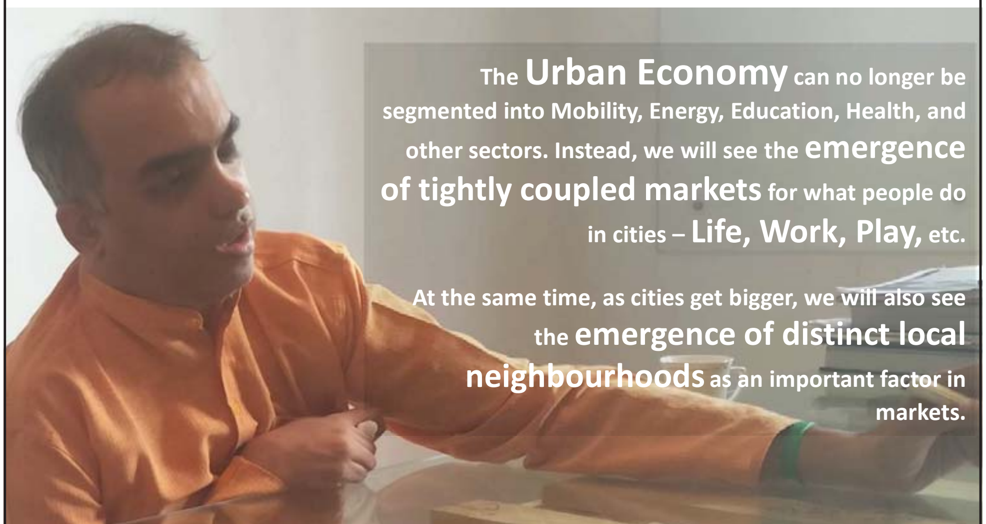


Uncertainty x Pace of Change
emotional | physical | financial | technological

Consumption : The Generational Shift

access | availability | flexible | cost effective | personalized | reach | safety

Defining Urban Futures

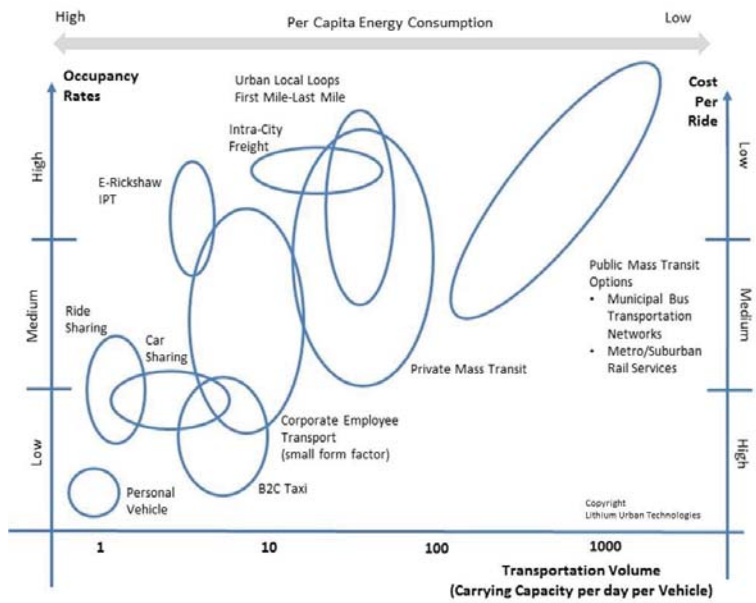


services + products will need to cater to this shift in demographic & consumption

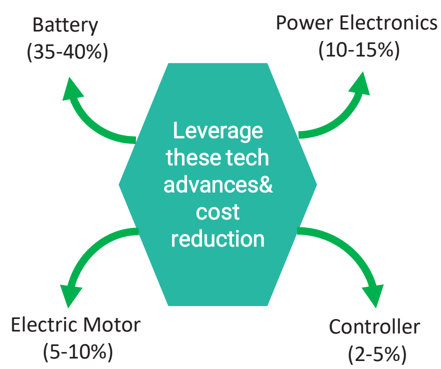
The Opportunity for India

breaking the basic proportionality of price and distance

Urban Mobility Energy Landscape

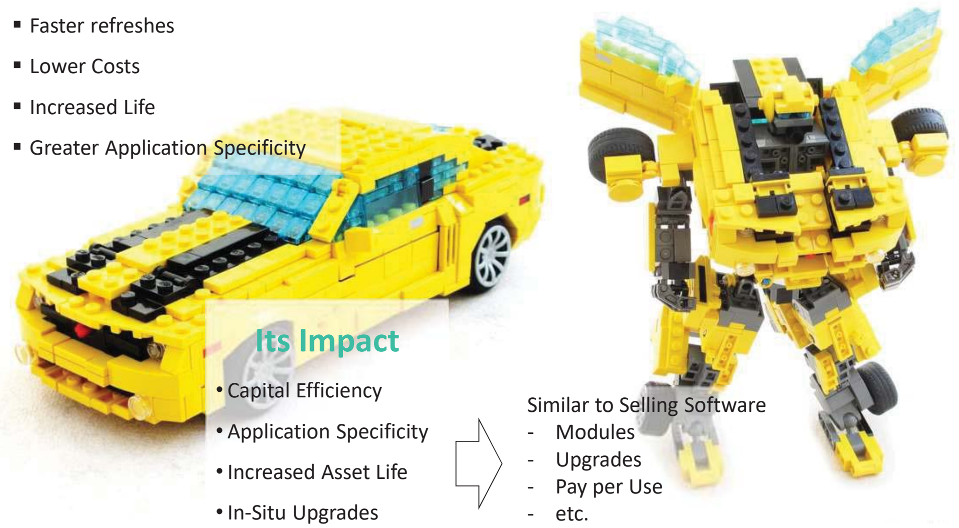


EV Architecture



a mobile phone on wheels = Software + COTs + app customization
design approach | modularity | customization | ecosystem play | operating system

Exploit the EV Modularity



- Faster refreshes
- Lower Costs
- Increased Life
- Greater Application Specificity

Its Impact

- Capital Efficiency
- Application Specificity
- Increased Asset Life
- In-Situ Upgrades

Similar to Selling Software
- Modules
- Upgrades
- Pay per Use
- etc.

modularity is key for rapid adaptations = don't approach EV design as ICE

Maximizing Energy Efficient Miles

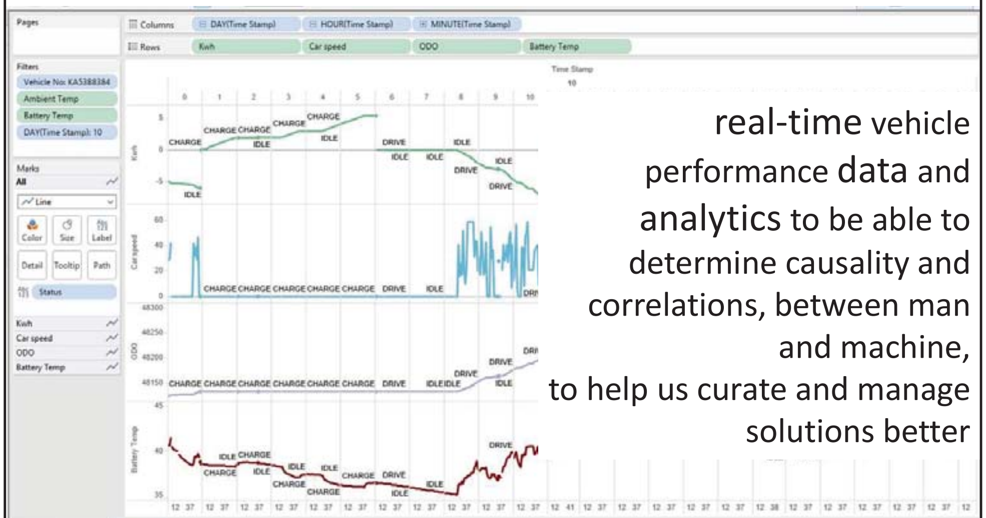
to understand **Urban Mobility** and how **Technology** best addresses those needs.

Optimizing fleet and infrastructure for various duty cycle requirements that is **Customer Centric,** more **Productive** and **Energy Efficient**

Demand Zoning & Management | Range Estimation | Fleet Management & Optimisation | Driver Performance Management | Asset (Vehicle + Charging Station) Performance Management

configuring the vehicle to the application duty cycle

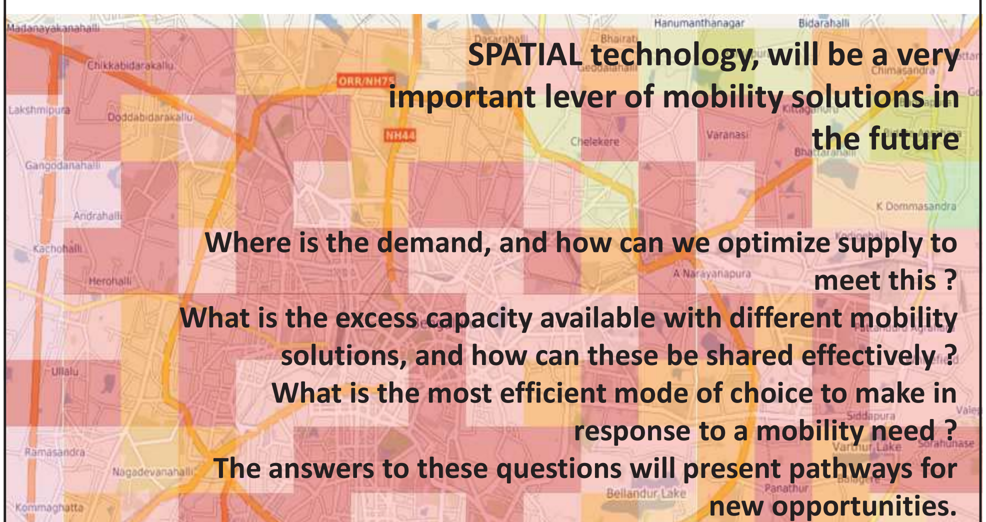
Data Drives Solution Curation



real-time vehicle performance data and analytics to be able to determine causality and correlations, between man and machine, to help us curate and manage solutions better

determining causality for faster pdca cycles

Data Drives Solution Curation



SPATIAL technology, will be a very important lever of mobility solutions in the future

Where is the demand, and how can we optimize supply to meet this ?
What is the excess capacity available with different mobility solutions, and how can these be shared effectively ?
What is the most efficient mode of choice to make in response to a mobility need ?
The answers to these questions will present pathways for new opportunities.

solutions will win and not products

The EV Ecosystem Play

Service Provider – Market Segments

Corporate Employee Transportation	Fixed Point to Point	Car Sharing	Mass Transit	Intra-City Freight
Consumer Kerb-Side	Local Loop	Ride Sharing	BRTS	Last Mile

+

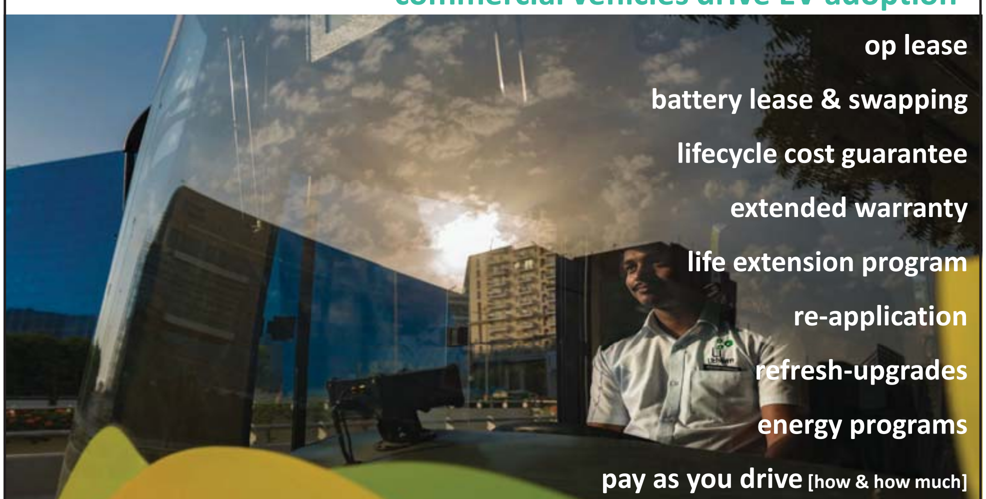
System Integration

Charging Infra	Batteries	Electricity	Technology
Co-Design & Usability	Battery Choice & Integration	Subscription based Energy service schemes	Fleet Management
Charge Payment Program/ Subscription based Services	Battery Leasing	PPAs with / Investment in renewable energy	Data Aggregator / Data Hose
	Battery 2nd life Application Deployment		Battery management services
			Advanced booking of charging stations

critical to the success is the ecosystem play
create | different | vibrant

Financing

commercial vehicles drive EV adoption



creating new financing structures critical to the success in EV market share

Lithium

Tomorrow's Transportation Today.

thank you

Sanjay Krishnan | sanjay@project-lithium.com

Pedestrian Policies and Practices of Seoul

2nd International Forum on Low Carbon Development for Cities
Sep 2, 2019

Pedestrian Policy Division
Seoul Metropolitan Government

Improving Physical Environment

걷자,서울

1. Pavement Management

- Maintain Flatness
- Fix Before Complaints

걷자,서울

2. Blind Friendly Crosswalk

- Braille Block
- Low Curb

3. Power Line Underground

건자,서울

- Street Beautification
- Safer Environment
- Expanding Effective Width

걷자,서울

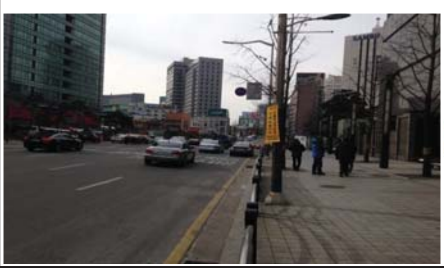
4. Legalizing Street Vendors

- Standard for the Street Vendors
- Street Occupying Fee

걷자,서울

5. Road Diet – City Center

- Reduce the Number of the Car Street
- Expand Sidewalk and/or Designate Bicycle Lanes




퇴계로 1단계
중심상업지역
인쇄 및 사진 특화
인쇄 및 사진 특화
중부시장
동대문 패션타운
관광문화특구
동대문
역사문화공원
광희동 사거리
일반주거지역
퇴계로2가
교차로
애완견거리
오토바이거리
퇴계로 2단계 대상지
(퇴계로2가~광희동사거리)
L = 1.5km
서애길
일반주거지역
상업지역
퇴계로 1단계
남산예장자락
예술통
남산한옥마을
서울로7017
일반주거지역
서울로 7017


사직로·율곡로
돈화문로
대학로
세종대로
우정국로
삼일대로
창경궁로
종로·새문안로
통일로
청계천로
을지로
장충단로
창경궁로
동호로
서소문로
남대문로
충무로
소공로
퇴계로
기완료('15~'17)
단 기('18~'19)
중 기('20~'22)
장 기('22~)


Gwang-hwa-moon Plaza Project
Before


Gwang-hwa-moon Plaza Project
After
KYOBO

Gwang-hwa-moon Plaza Project

Plan

6. Road Diet – Residential Neighborhood

걷자,서울

- Reduce the Car Lanes
- Expand Sidewalk

7. Walking Environment Improvement District

건자,서울

- **Urban Planning Tool for Safer and More Comfortable Walking**
- **Block Pavement, Building Sidewalk, Removing Obstacles**

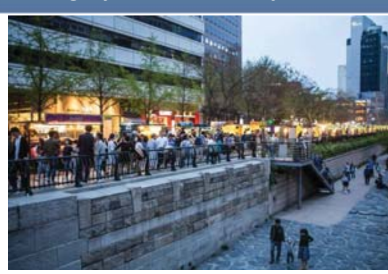
Promoting Walking Culture

1. Car Free Festival

걷자,서울

- Restrict Cars
- Sejong-Dae-Ro (10am~7pm Every Sunday in Apr, May, Jun, Sep, Oct)

- Chung-Gye-Chun-Ro (Every Weekend)



- Duk-Soo-Goong-Gil (11am~2pm Every Weekday, 10am~5pm Saturday)

2. Let's Walk Festival

걷자,서울

- Every Year since 2013
- 20,000 Participants
- Sep 29, 2019 8am~12pm

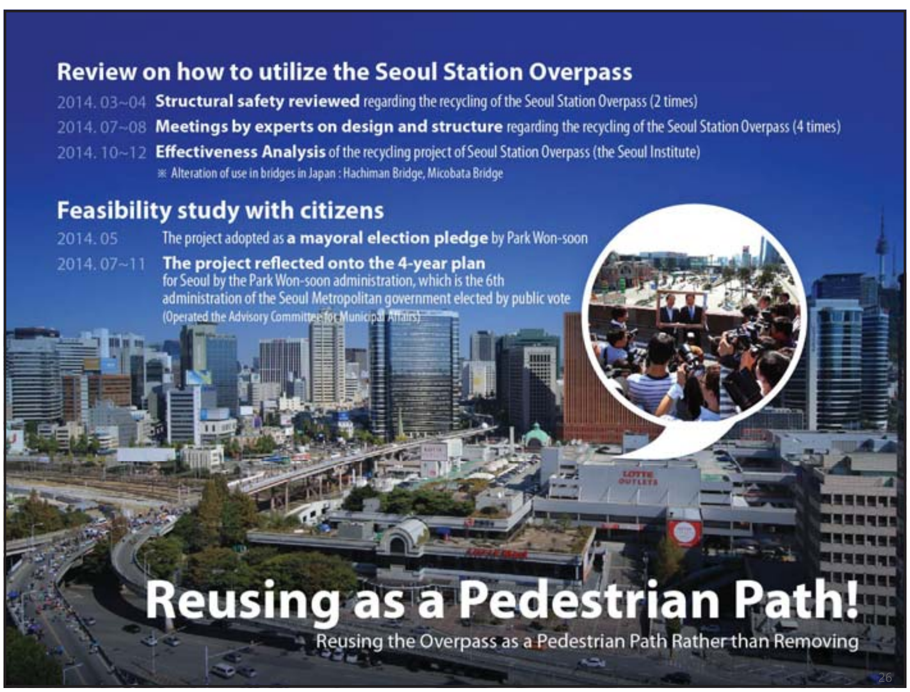
Seoullo 7017

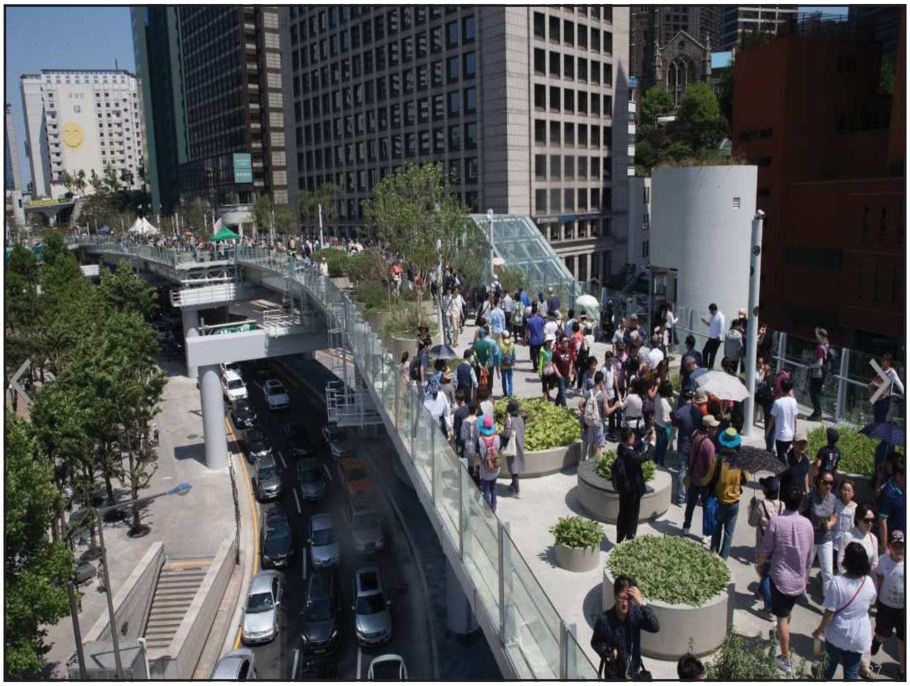
New Landmark
For Walking City


2015_ Seoul Station Overpass
23


2017_ Seoul Station Overpass
The design by Winy Mass, the winning design in the International Design Competition
for the Renewal of the Seoul Station Overpass, has been discussed and developed
Resulting in pedestrian paths which will
re-connect the East and West with nearby areas


Landmark Walking Project– "Seoullo"
IV
From Road for Cars in the 1970's to "Walking Path" for People in 2017
Safety Grade D to dismantle the Seoul Station Overpass
2006. 12 Precision safety diagnosed as grade D
2008. 05 An alternative bridge constructed linking to North District of Seoul Station
2009. 12 The demolition of the Seoul Station Overpass initiated along with North District of Seoul Station
Safety concern on the overpass presented
2012. 01 Precision safety diagnosis resulting in grade D (remaining life of 3 years)
2014. 01 Safety concern about the overpass presented (floor plate concrete detached)
2014. 02 Early demolition of the Seoul Station Overpass reviewed
Citizen's Safety First!


Review on how to utilize the Seoul Station Overpass
2014. 03~04 Structural safety reviewed regarding the recycling of the Seoul Station Overpass (2 times)
2014. 07~08 Meetings by experts on design and structure regarding the recycling of the Seoul Station Overpass (4 times)
2014. 10~12 Effectiveness Analysis of the recycling project of Seoul Station Overpass (the Seoul Institute)
※ Alteration of use in bridges in Japan : Hachiman Bridge, Micobata Bridge
Feasibility study with citizens
2014. 05 The project adopted as a mayoral election pledge by Park Won-soon
2014. 07~11 The project reflected onto the 4-year plan for Seoul by the Park Won-soon administration, which is the 6th administration of the Seoul Metropolitan government elected by public vote
(Operated the Advisory Committee for Municipal Affairs)
Reusing as a Pedestrian Path!
Reusing the Overpass as a Pedestrian Path Rather than Removing
26



THANK YOU

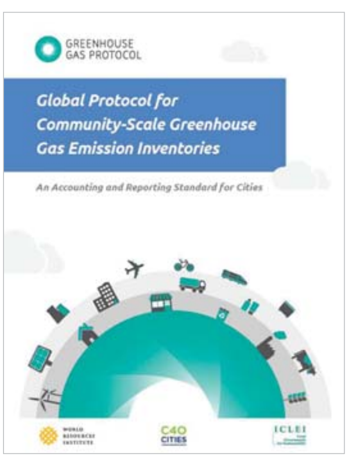
Session 4: How ICT-Based Systems Encourage Low Carbon Development

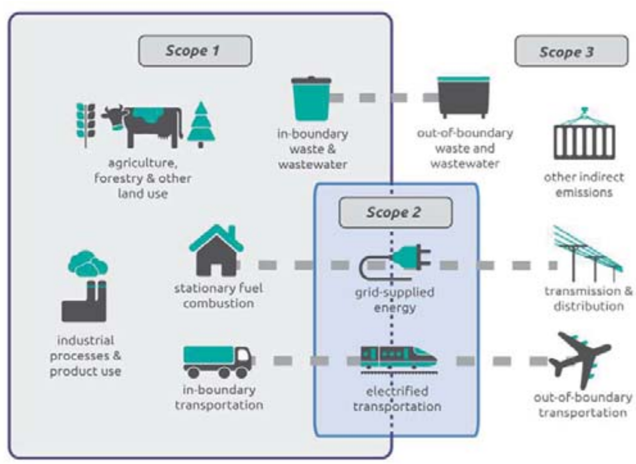
WORLD RESOURCES INSTITUTE

Data for Action

Dr. Fong Wee Kean
Deputy Director, WRI China

GHG inventories





Source: GHGP

WORLD RESOURCES INSTITUTE

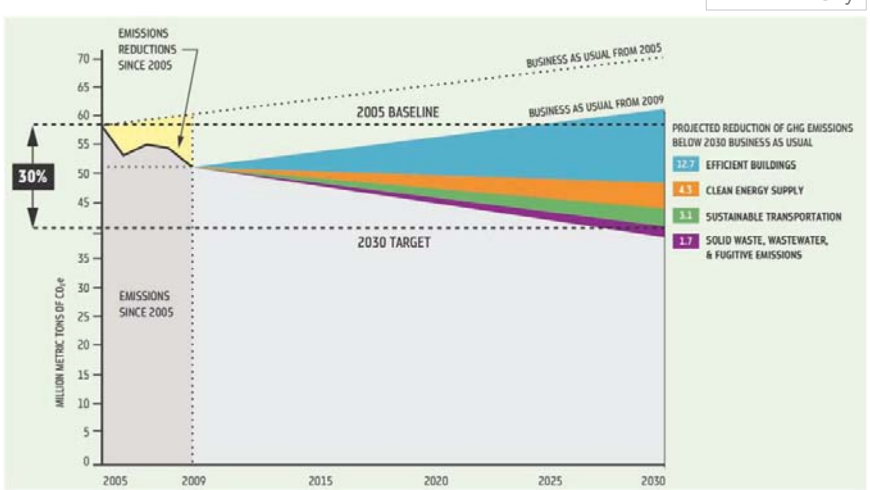
Evidence-based climate action planning

You can't manage what you can't measure

Graphic: WRI

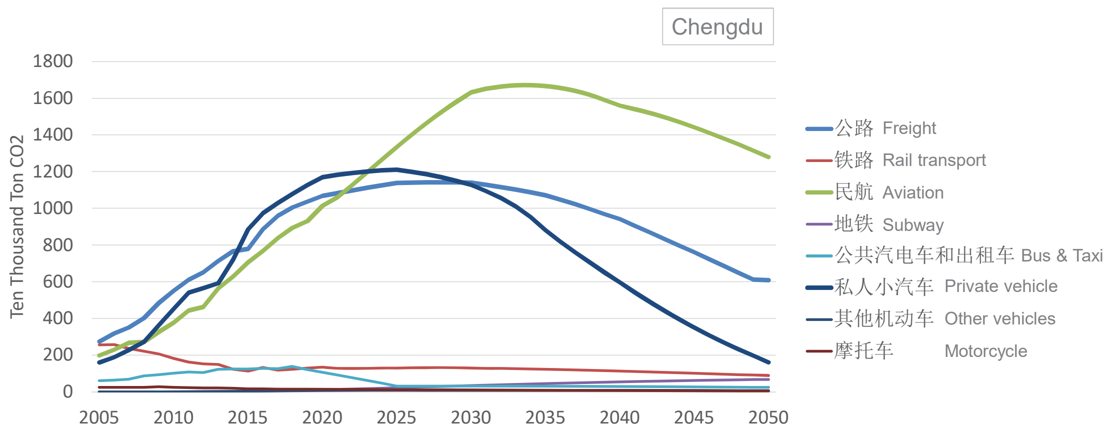
Target setting

New York City



Source: New York City

Subsector scenario analysis



Source: WRI (unpublished)

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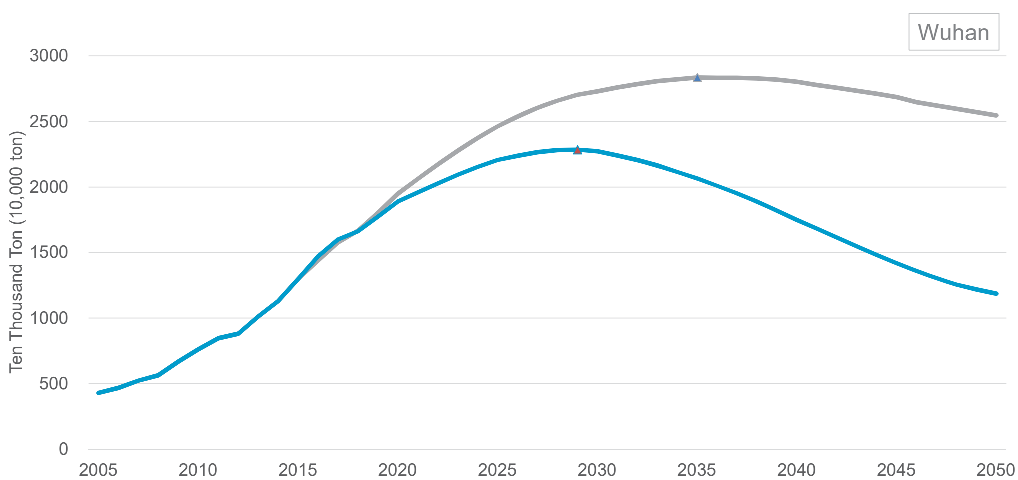
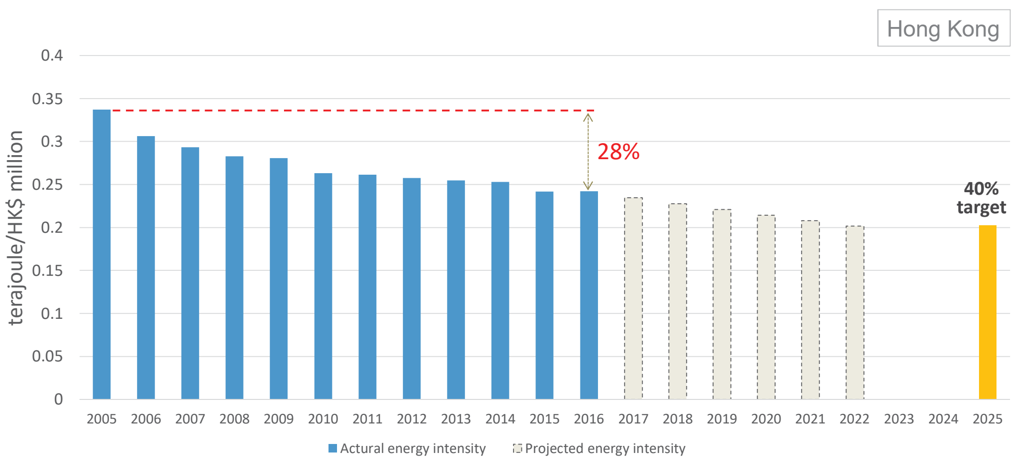
Target evaluation



Source: WRI

WORLD RESOURCES INSTITUTE

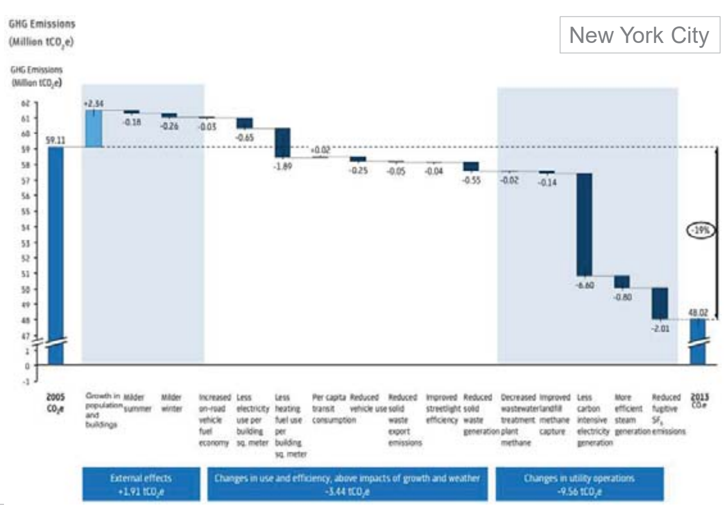
Progress tracking



Source: Calculated using data from Census and Statistics Department and the Energy Statistics Annual Report.

WORLD RESOURCES INSTITUTE

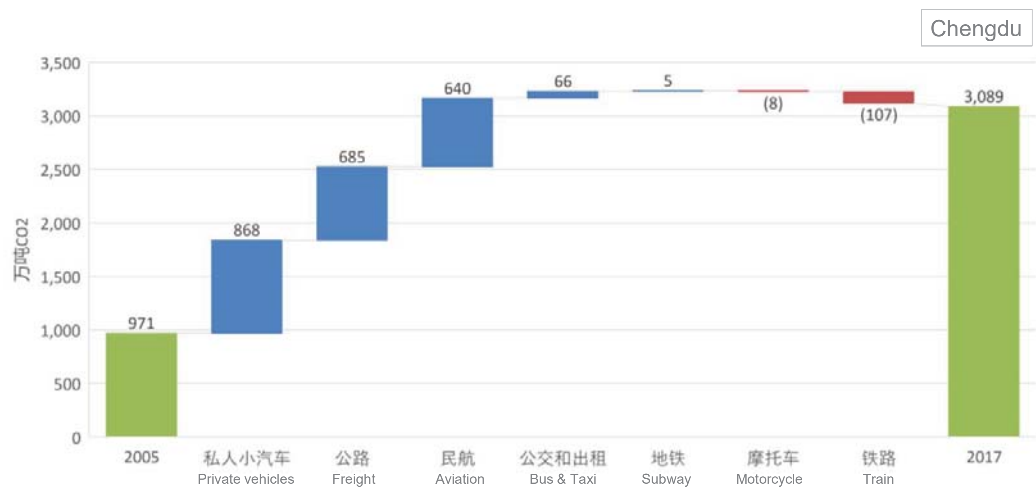
Action evaluation



Source: New York City

WORLD RESOURCES INSTITUTE

Action evaluation



Source: WRI (unpublished)

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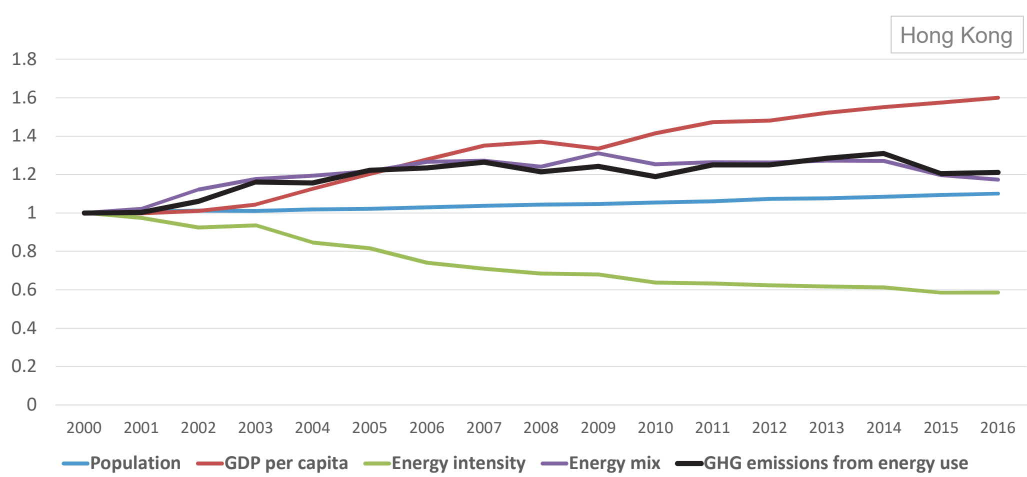
Driving force analysis



Source: Population and GDP are from Census and Statistics Department, Energy consumption are primary energy consumption data from the Energy Statistics Annual Report, GHG emissions are from Environment Protection Bureau, other parameters are calculated based the above data.

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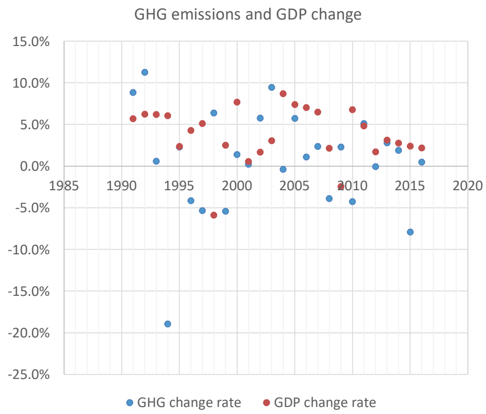
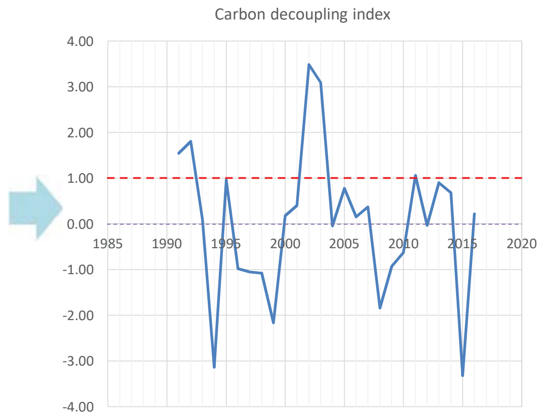
Carbon decoupling rate analysis

Hong Kong

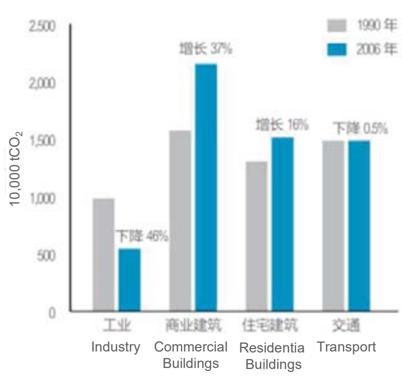


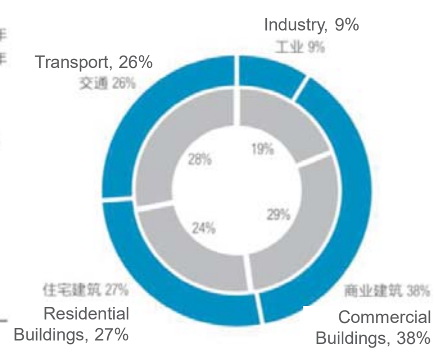


Source: Calculated using data from Census and Statistics Department, Energy Statistics Anural Report, Environment Protection Bureau.

Identifying action

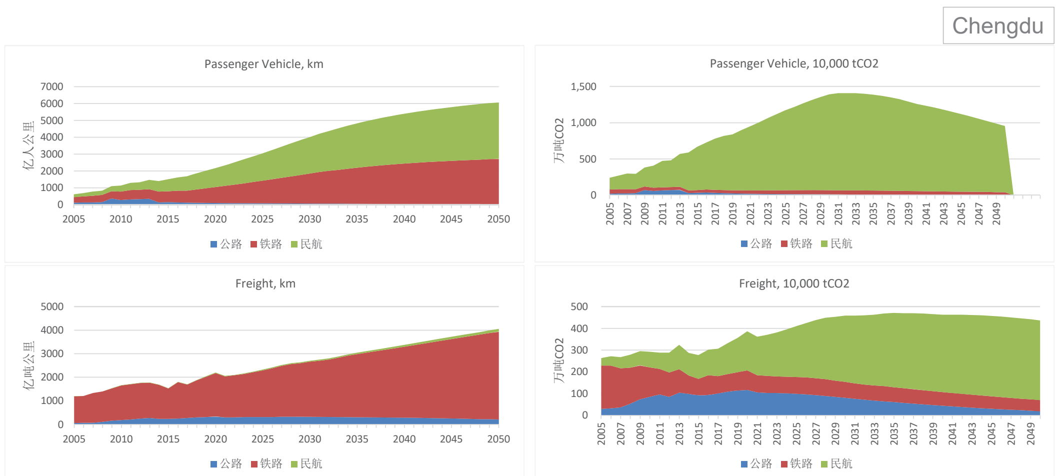
Tokyo





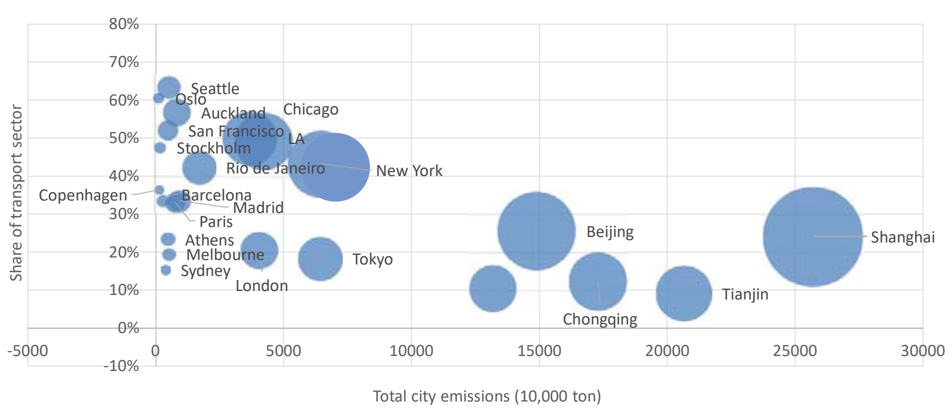
Source: WRI

Mitigation potential analysis



Source: WRI (unpublished)

Comparing with other cities



Source: WRI (unpublished)

Conclusion

GHG data can be used for what aspects of low carbon planning?

- Scenario analysis
- Target setting
- Progress tracking
- Identifying action
- Performance evaluation

What are required to use GHG data for supporting decision-making?

- Annual GHG data
- Accurate activity data
- Granular data
- Relevance
- Short time lag
- Consistency
- Data analysis

What are required to develop good GHG inventories?

- Government buy-in
- Statistical data
- Inter-agency coordination
- Capacity building

Source: WRI

APUEA
Asia Pacific Urban Energy Association

Smart Energy Management System

2nd International Forum on Low Carbon Development for Cities

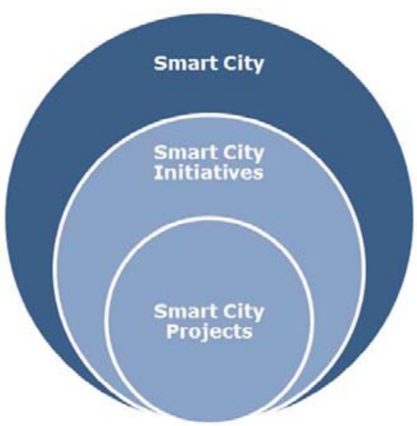
Mikael Jakobsson
Executive Director, APUEA / Managing Director, NXITY

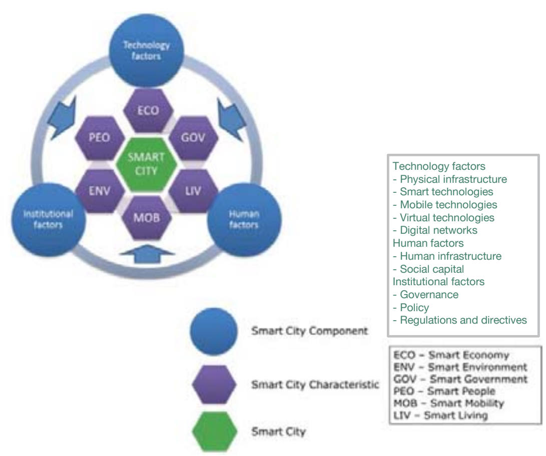
Seoul, 2nd September 2019

Supported by

DBDH EUROHEAT & POWER INTERNATIONAL DISTRICT ENERGY ASSOCIATION IIEC

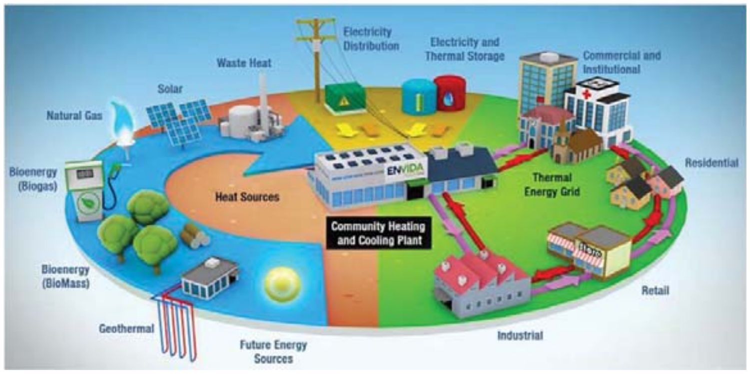
What is a Smart City?





What is Smart Energy?

Distributed → Centralized → Centralized + Distributed → **Integrated**



Generation driven → Demand driven → **End-consumer driven**

What is (Smart) Energy Management System?

- Framework for an organization to achieve continual improvement of Energy performance (inc. Cities)
- Computer-aided tool for Monitoring, Control and Optimize an Energy system

Energy Management Systems (EnMS)

European Energy Award

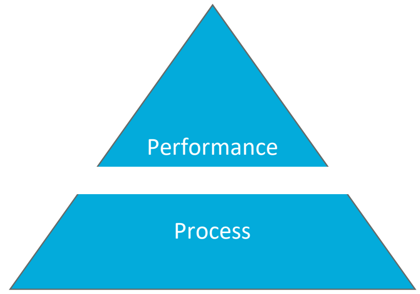
A Quality Management System for Energy-related Activities in Municipalities, recognized as an implementation tool within the "Covenant of Mayors" by the European Commission

CoM and SEAP

Covenant of Mayors (CoM) initiative and developed Sustainable Energy Action Plans (SEAPs) to cut CO_2 emissions by at least 20 % by 2020.

ISO 50001

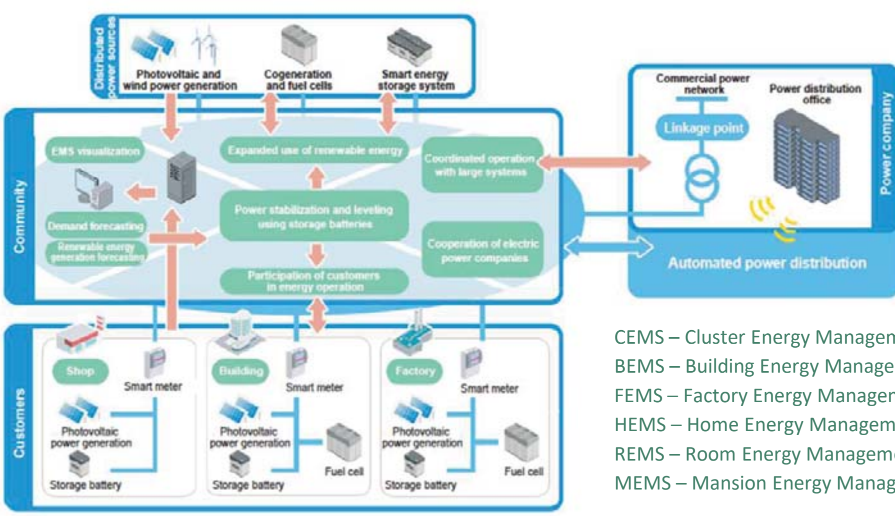
Energy management system framework with requirements and guidance for use.



International Organization for Standardization

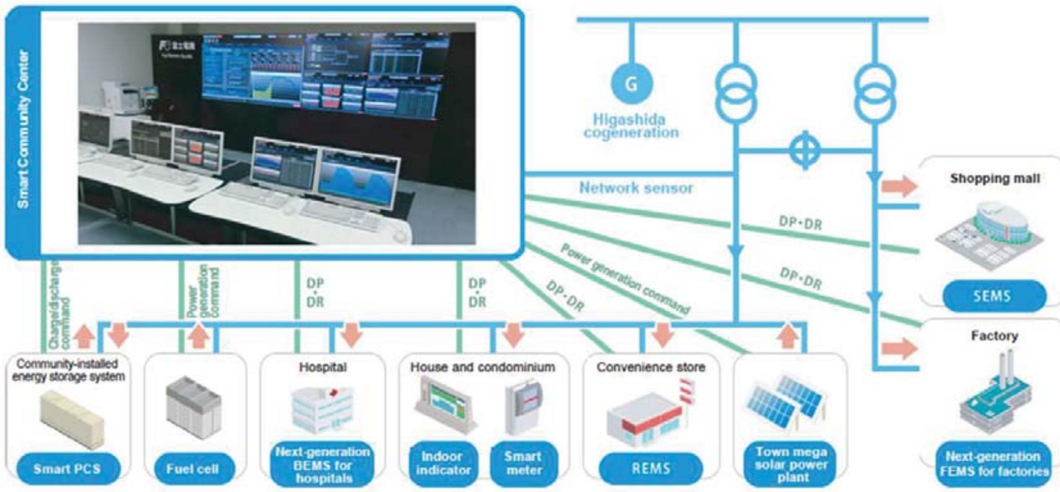
european energy award

Energy Management System (EMS)

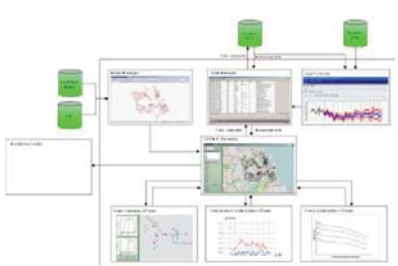


CEMS – Cluster Energy Management System
BEMS – Building Energy Management System
FEMS – Factory Energy Management System
HEMS – Home Energy Management System
REMS – Room Energy Management System
MEMS – Mansion Energy Management System

Community Energy Management System (CEMS)



The future of EMS



THANK YOU

Asia Pacific Urban Energy Association

www.apuea.org

宜水环境科技
Ewaters Environmental Science&Technology

Introduction to the Shanghai Pudong New District Urban Flood Warning System

Weijun ZHANG

Seoul, Korea

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2019 2nd international Forum on Low Carbon Development For Cites

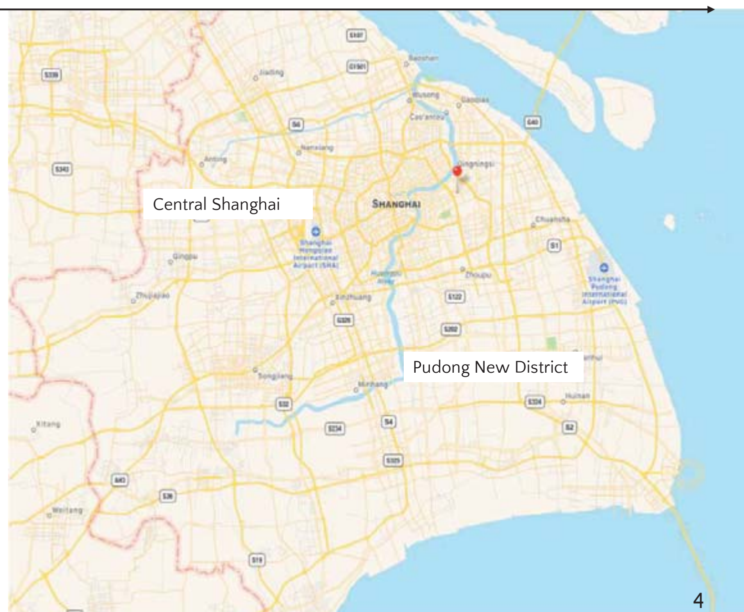
CONTENTS

1 Project background

Project Site –Pudong New District of Shanghai

The metropolitan area to the east of Huang Pu River of Shanghai, with the following main features:

- 1400km2
- 6m people
- Under rapid development
- Terrain （3.0-4.5m）
- Costal line 46km
- Dense of River network



① Challenge of flooding

Flat terrain, locked by the major Huangpu River and coastal line, leads to increasing threats in dealing with extreme weather conditions, storm surge, as well as climate change.

① Challenges of drainage operation and management

Rapid urbanization causing stormwater risks

- **Very Complicated drainage network servicing rapidly developing city.**
- **Challenges to be consistent with Smart City and Urban Security.**
- **Major infrastructures play important role in system operation optimization.**

Infrastructures are aging and getting more complicated

- **Urban expansion, limited drainage pipeline construction space, high construction and maintenance cost, especially in central city, the improvement of drainage system capacity will depend more on operation and optimal scheduling.**

Time to maximize the value of assets by means of IT

- **ICT essential to maximize the value of information, understanding the data owned Capability to process and operate Big data analysis, to improve quality of decision making.**
- **Intelligent drainage network model to analyze and predict system performance with real time data becomes essential.**

2 Objectives and System Design

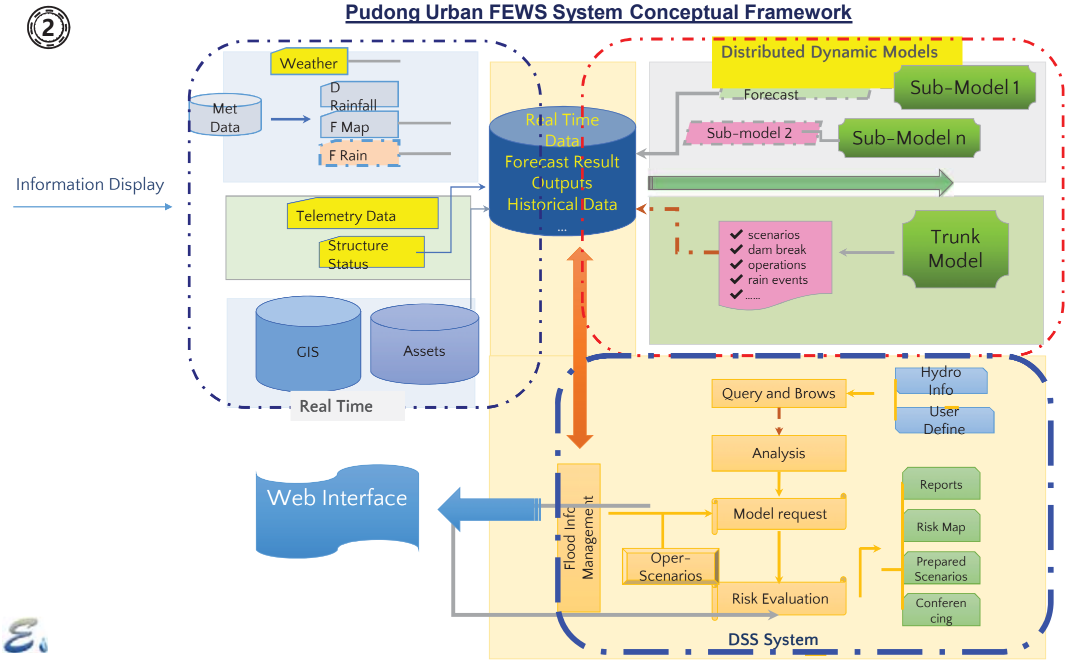
2 Data to knowledge for decision making

- Hot topics on Smart City/ Big data/Intelligent water Management in China.
- Telemetry Systems are well developed, huge amount of data available.
- The central CBD and a number towns were flooded twice in 2015, but struggled to use the data efficiently , and to help make good decisions.
- Time to develop a good framework to integrate all available data and intelligent solutions.
- Improve the quality of technical outputs for decision making
- **Develop applications with FEWS was considered the right choice**

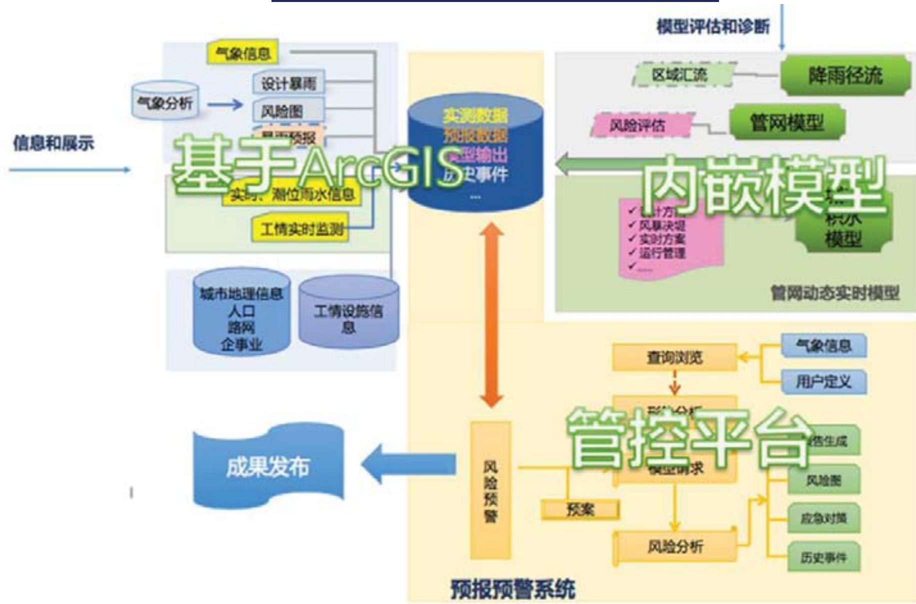
System Development Works

- Framework, functionality design
- Data Integration of meteorology, river& tide level, Pumps and gates
- Conversion and quality check
- Existing Mike model conversion to Sobek
- Urban SW 1D+2D model development
- Model calibration
- Development, operational testing
- Installation and training and support

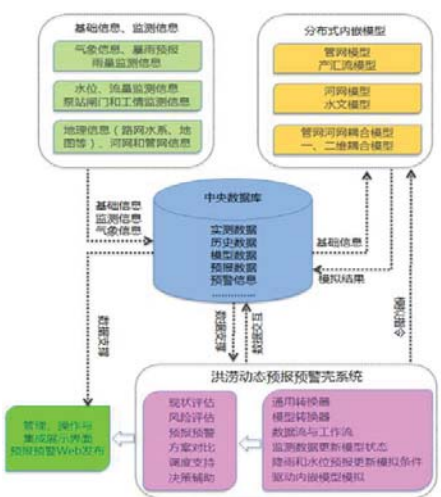
Pudong Urban FEWS System Conceptual Framework



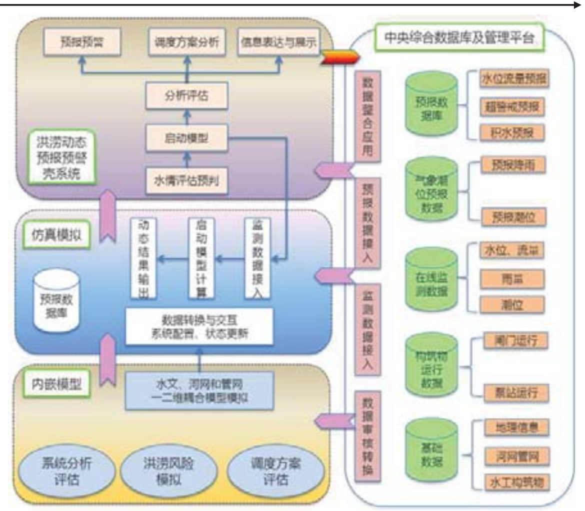
基于FEWS的浦东洪涝预警预报系统技术框架



Workflow design



Internal data flow design



Forecasting and early warning workflow design

② Operational Modes

Normal

- Information query, conditional query, statistics, reports
- Real-time infographic presentation
- Dynamic presentation of contour lines
- Facility status display

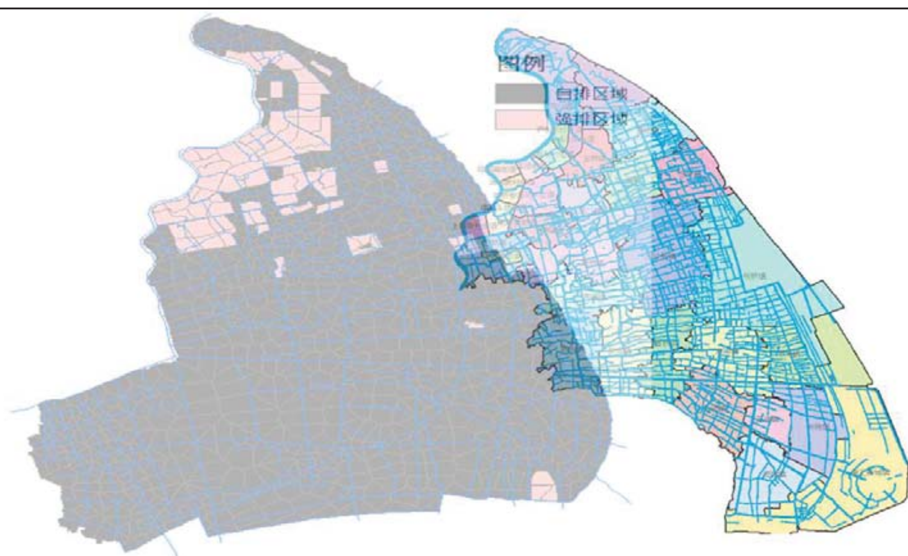
Critical

- Forecast of rainfall trend and development trend
- Forecast of storm surge trend and development trend
- Current trends vs plans
- Current trends vs historical events
- Possible extent, scope and risk assessment

Emergency

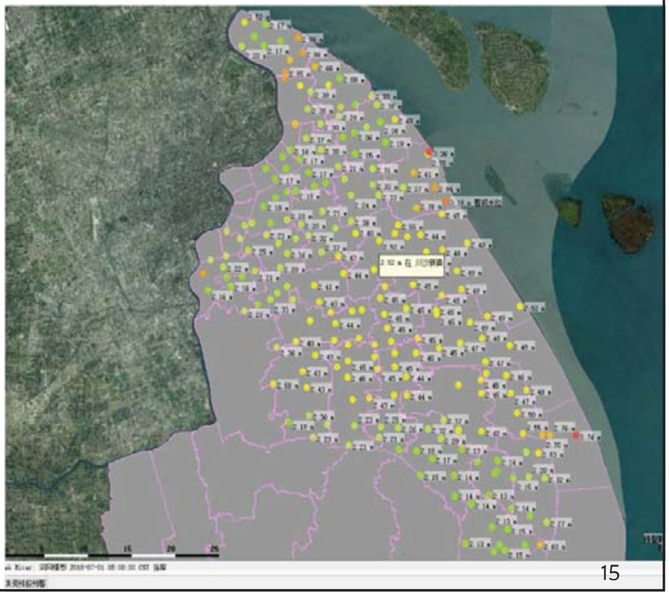
- Prepare and export data for storm forecasting and models
- Prepare and export data for pump station, sluice and scheduling
- Start real-time simulation
- Read and process forecast results
- Dynamic risk assessment and display; impact/flooding area
- Impacted facilities/Units and water depth
- Demonstration point/water depth forecasting of point of interest/water level process and water depth

② System Boundaries

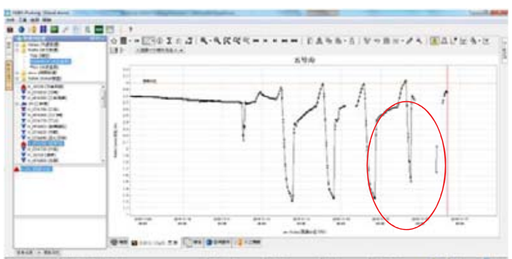


② Integration of real time measured data

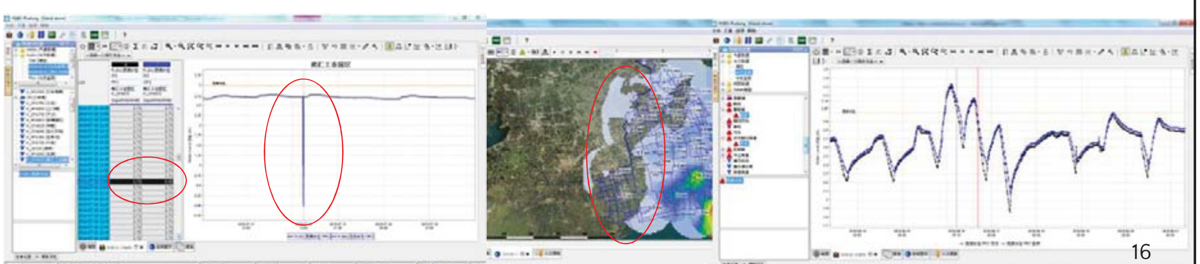
- 120+ Rain gauges
- 15 Wind stations
- 18 tidal sites
- 56 river level site
- 14 flow sites
- 300+sites of interests



② Date process model



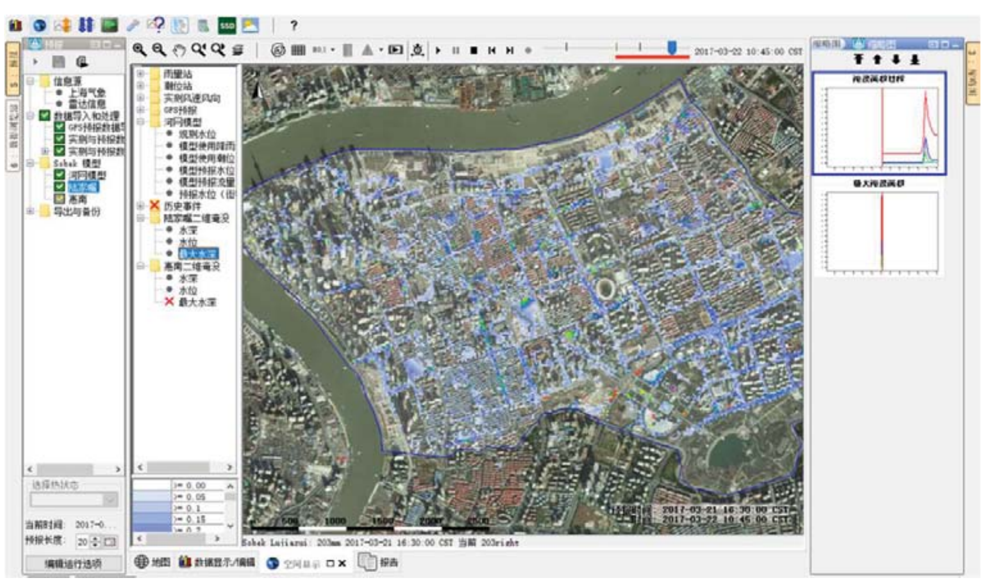
- Missing data
- Suspected data
- Data flag
- Better data for model upgrade of initial condition



② Sobek 1D River model

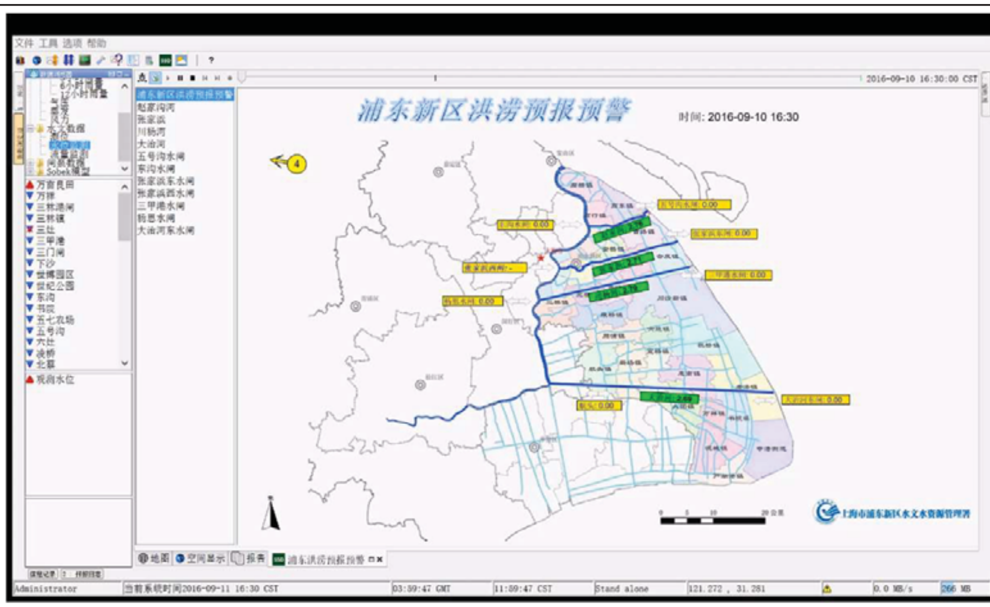
- Whole Pudong plus fengxian and minhang together(2200km^2)
- 884 Rivers with 8173 cross sections
- 1673 catchments including 77 pumps drainage sub
- 58 pumps and gates
- 59 rainfall stations
- 13 tide sites

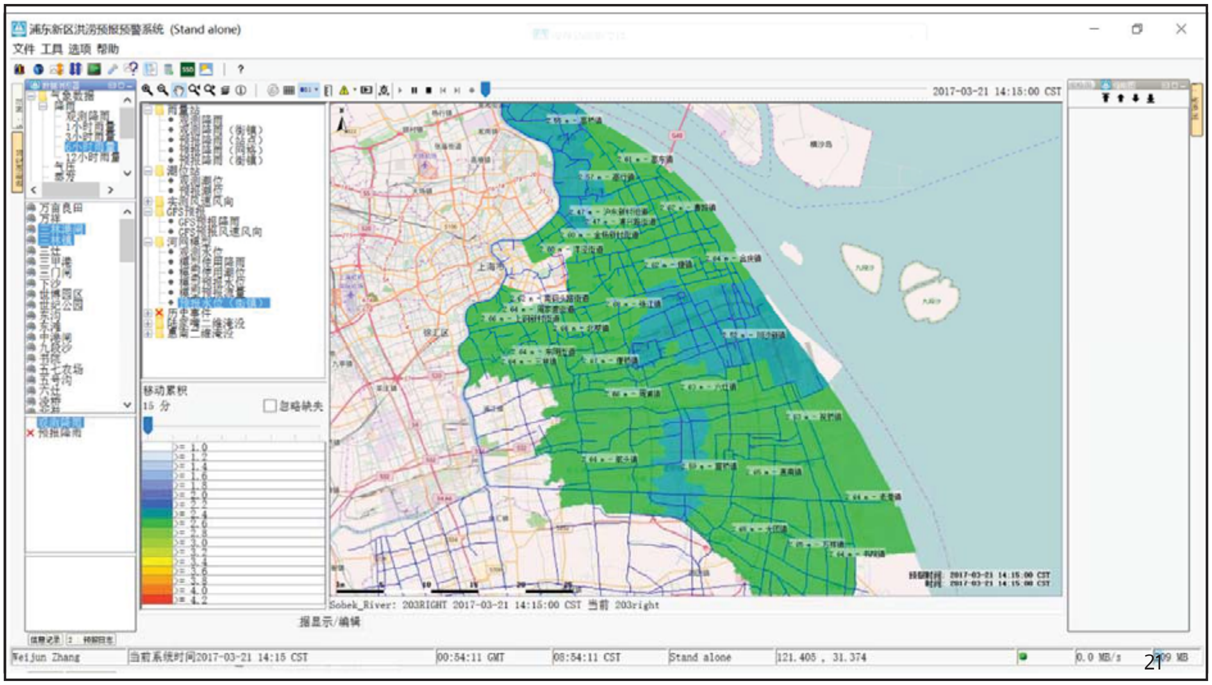
② Sobek Urban 1D-2D Pipe model

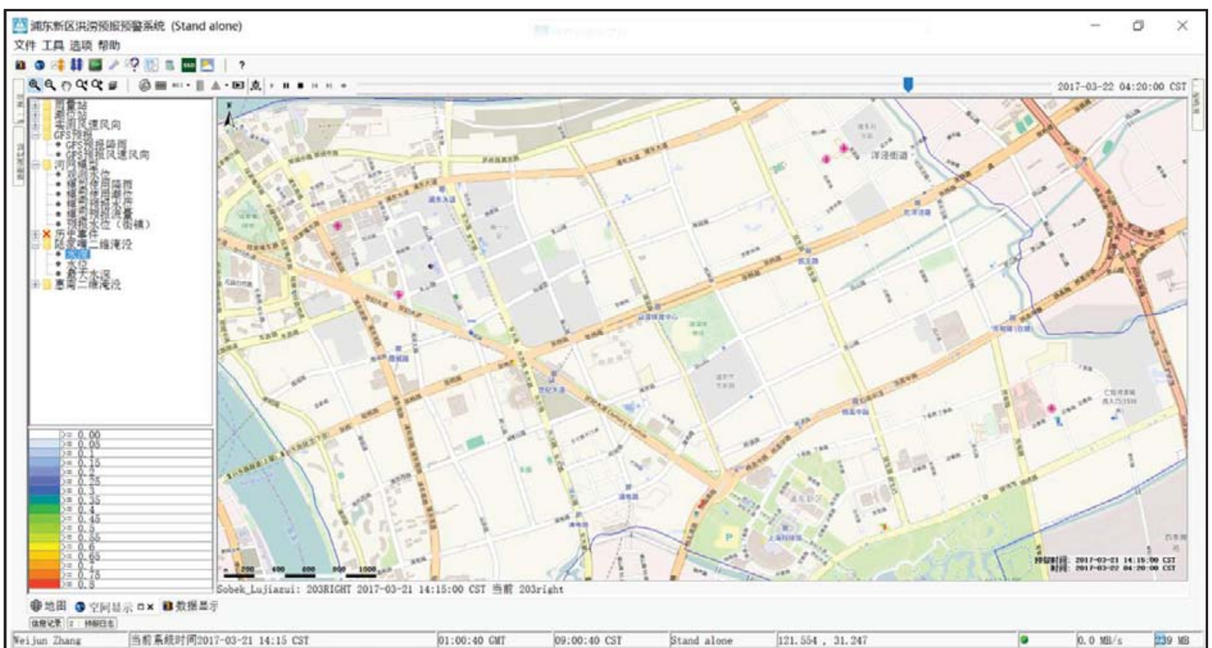


3 Phase I deliverables

3 System Overall SCADA Display




浦东新区洪涝预报预警系统 (Stand alone)
文件 工具 选项 帮助
2017-03-21 14:15:00 CST
移动累积
15 分
忽略缺失
Sobek_River: 203RIGHT 2017-03-21 14:15:00 CST 当前 203right
Weijun Zhang
当前系统时间2017-03-21 14:15 CST
00:54:11 GMT
08:54:11 CST
Stand alone
121.405 , 31.374


浦东新区洪涝预报预警系统 (Stand alone)
文件 工具 选项 帮助
2017-03-22 04:20:00 CST
Sobek_Lujiazui: 203RIGHT 2017-03-21 14:15:00 CST 当前 203right
地图
空间显示
数据显示
Weijun Zhang
当前系统时间2017-03-21 14:15 CST
01:00:40 GMT
09:00:40 CST
Stand alone
121.554 , 31.247

Major system components

- Connection to Telemetry data through WISKI
- Connection with Met Services Forecast
- 2200 km² river model 2200 km²
- 2 Urban SW 1D&2D models
- Various decision support tools produced by information integration technologies

4 Future development

3 Future development

- The system is regularly launched to train operational staff, collect model error samples for big data analysis
- Model calibration has been continuously improved
- Further analysis on system performance to produce knowledge for planning and operational decisions
- Improvements on Result presentation and functionalities on Information dissemination with mobile apps

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Sustainable city with Mobike

Hao Qin, Mobike senior sustainability expert

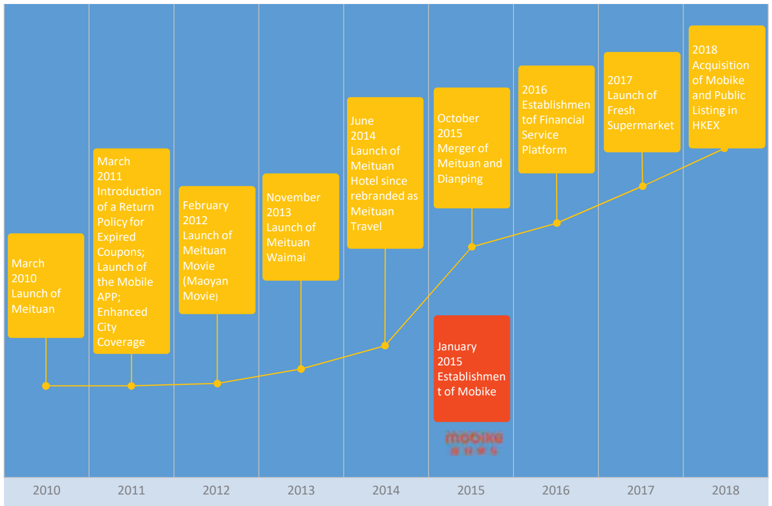
美团

OUR MISSON

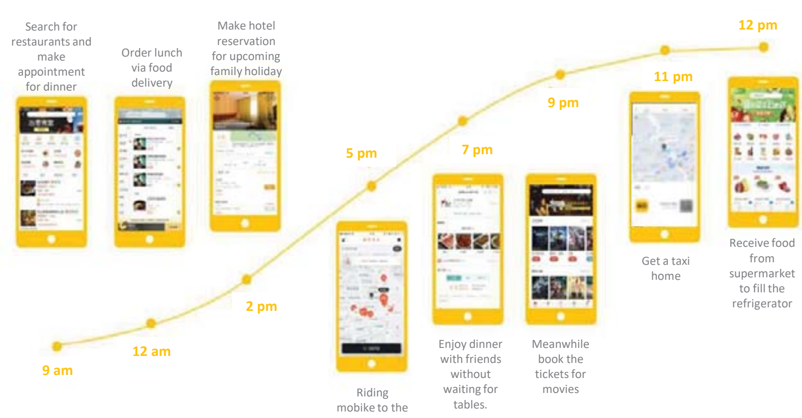
WE HELP PEOPLE

EAT BETTER LIVE BETTER

Our History



One day with Meituan



A leading e-commerce platform of life services in China

Ranked No.1 among multiple sub-sectors in the industry

美团

420 million
Total number of annual transaction users over the past twelve months till June 30, 2019

5.90 million
Total number of active merchants on the platform over the past twelve months till June 30, 2019

#1
GMV of in-store Dinning

#1
Order volume of Food Delivery

25.5
Average number of transactions per user over the past twelve months till June 30, 2019

1.49 billion rmb
Net profit in the second quarter of 2019

#1
Amount of Room Nights Reserved

#1
Sales of Tickets for Entertainment and Attractions

2085 million
Total number of transactions for take-away catering in the second quarter of 2019.

94 million
The amount of hotel reservation room nights in the second quarter of 2019

#1
Sales of Movies Tickets

#1
Market Shares of Comprehensive Category

Reintroduce the bikes to the city

Innovation of Mobike

美团

Bike

Smart lock withGPS

AI+big data

Preferred location

Easy to use

美团

Find/Reserve

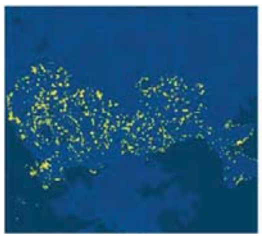
Unlock

Ride

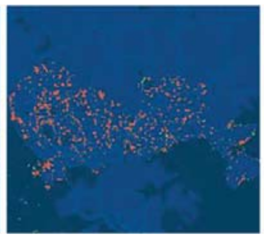
Lock

Extend the coverage of public transportation

Cover 99.34% of area that public transportation was difficult to reach



Area has low accessibility of pubic transportation

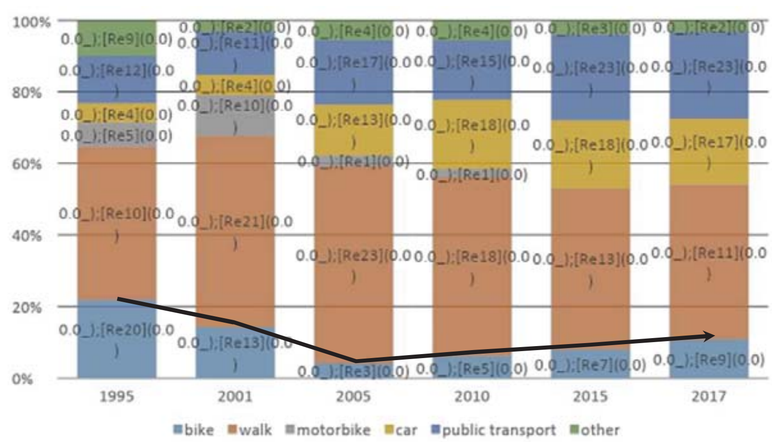


Extended coverage with mobike

Resulting area with low accessibility

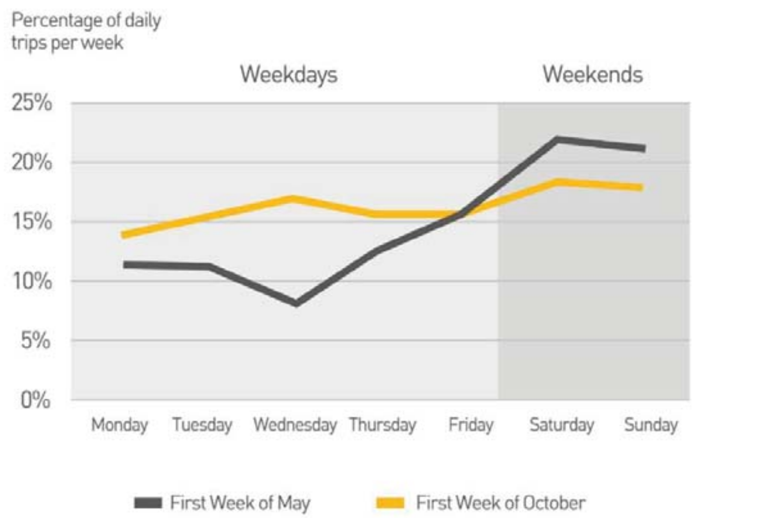
Data of Shenzhen

Change the decreasing trend of bike trips



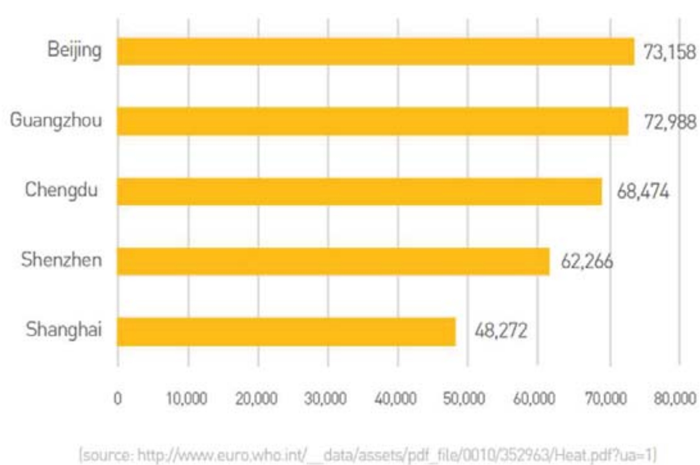
Data of Shenzhen

Encouraging people to cycling



Data of Singapore

Reduce carbon emission



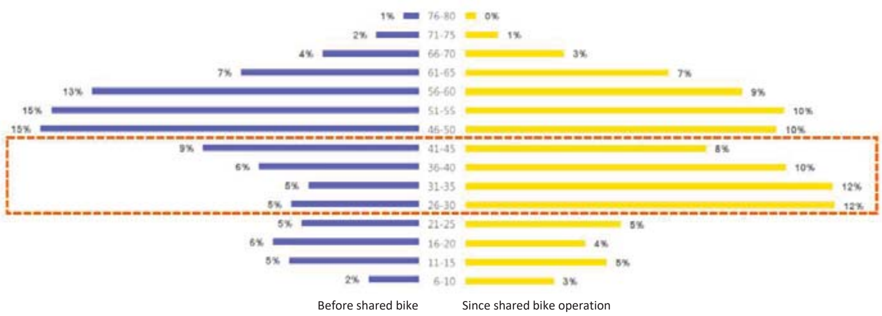
Detecting vehicle illegal parking events

Provides equal opportunity

Change cycling demography

美团

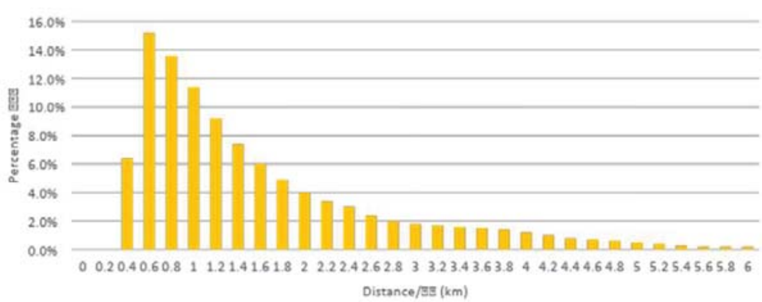
Demography of bicycle rider



Understand how long people travel?

美团

Data of Tianjin



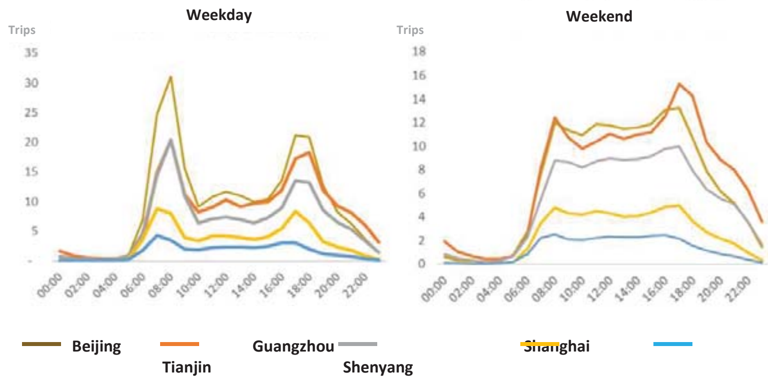
Majority of travel distance is between

Tianjin **0.4-1.6 km**

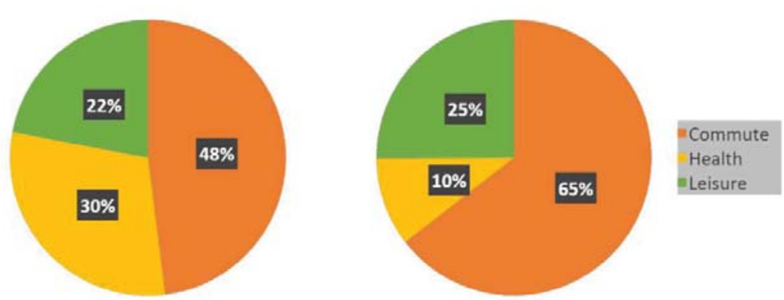
Longest average trip duration

Sydney **23 min**

Understand when people travel



Understand why people travel

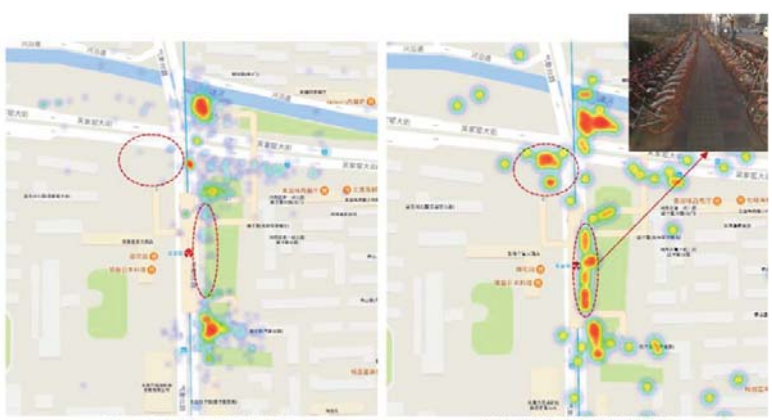


Data of Singapore

Data of Tianjin

Cycling network analysis

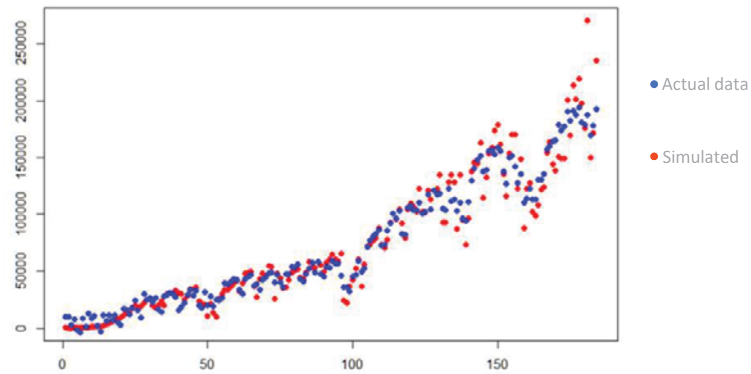
Parking area analysis



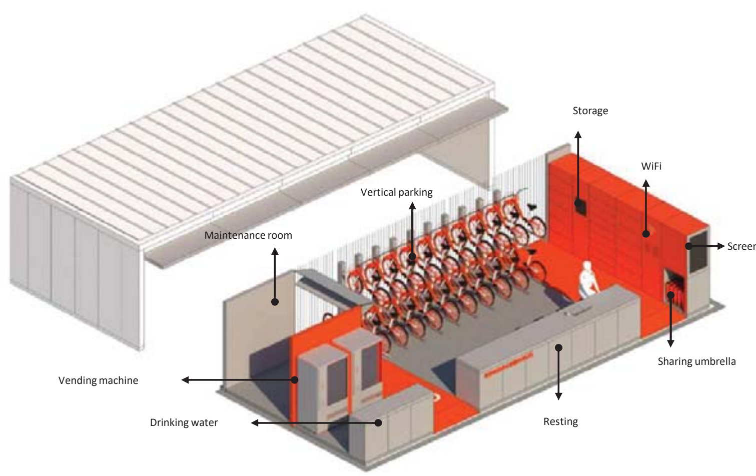
Parking area used by users

Vacant parking area

Demand analysis based on AI



Smart parking location

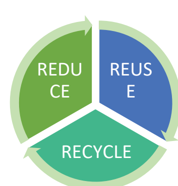


Smart parking location

美团

Life cycle management

美团



- Avoid over provision of bikes
- Durable bike is more sustainable
- Life cycle tracking of bike during operation
- Easy repair design

- Compatible bike parts design
- Standardized reuse process
- Reuse bike parts, including but not limited；
  - Smart lock
  - Tire and rim group
  - PV panel

- Accurate GPS for locating the bikes
- Tire recycled by supplier
- Magnesium rim recycled by supplier
- Waste no more, all the aluminum, steel and plastic are recycled by recycling company

Life cycle management

SMART AND ACCURATE
LIFE CYCLE MANAGEMENT

TRACEABLE COMPONENTS MAINTENANCE HISTORY

Life cycle management

Over 1,060,000
Tire recycled

Life cycle management

Over **1,260,000** SMART LOCK Recycled

Collaborating with Meituan Blue Mountain Project

Collaborating with Meituan Blue Mountain Project

美团

2000 Mobike equipped with fenders made from recycled lunch boxes were put on the market in 2019

Work with designers to upcycle the bike scrap

美团

Work with supplier (Dow) to recycle the tires

美团

A playground using recycled materials from tiresis donated to Yan'an Wanhua School

Thank you

美团

United Nations Framework Convention on Climate Change

Climate Finance Needed to Reach the Paris Target

2nd International Forum on Low Carbon Development for Cities
Seoul, Rep of Korea, 2-5 September 2019

UNFCCC Secretariat

Financing in the Paris Agreement

- Blueprint for climate action
- Country level ownership through Nationally Determined Contributions (NDC)
- Paris Agreement:
  - *Decides that, in the implementation of the Agreement, financial resources provided to developing countries should enhance the implementation of their policies, strategies, regulations and action plans and their climate change actions with respect to both mitigation and adaptation…*

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

What is it we need to finance?

Energy sector example:

By 2050

- ❑ 95% of electricity to be low carbon
- ❑ 7 of 10 cars electric (1 of 100 today)
- ❑ Entire building stock retrofitted
- ❑ Industry CO_2 intensity reduced by 80%

Actual investment needs?

- ❑ The Paris Agreement refers to USD 100 BN per year as the floor for climate finance to developing countries, until 2025
- ❑ Not based on what is needed. There is no set number!
- ❑ Only for energy: annual global investments need to increase from USD 1.85 to 2.80 trillion per year until 2050
- ❑ In developing Asia, infrastructure investments projected for 2016-2030 needs to increase from 22.5 to 26.0 trillion if climate mitigation and adaptation are included.
- ❑ UNFCCC finance mechanisms:
  - Standing Committee on Finance
  - Biannual submissions
  - Green Climate Fund & Global Climate Fund (WB).

Costs, but also savings

Benefits from climate transition:

- For example: SDG 7 (energy access)
  - Baseline scenario is USD 60 billion / year between 2016 and 2030.
  - Transformation scenario, including SDG USD 225 billion during the same timeframe.
  - Savings of USD 120 billion annually in investments related to combatting air pollution for good health and well-being (SDG 3).

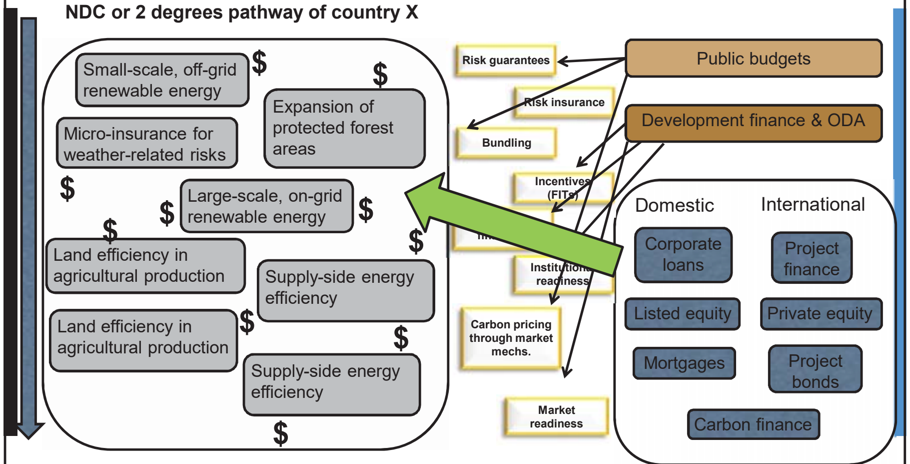
Translate from macro- to micro economics

- The scale of investments required for NDC implementation far exceeds public finance.
- Unlock other (private) sources of finance…
- … by building an attractive investment climate for green investments.

Where is the money?

- Private sector financing outpaces public by a factor XX
- Real interest rates for risk free investments = 0
- So how do we reduce the risks for climate investments?

Connecting the dots



From here to there

- Understand that this is shifting and adding invetsments, not only adding funds.
- Political will & long-term vision
- Understanding of challenges & opportunities
- Know-how / skilled work force
- Technical access
- Basic infrastructure
- Risk reduction mechanisms
- Transparency & cooperation

UNFCCC dialogue on finance

Demand

- ✓ Integrate climate financing in national plans. Broad buy-in
- ✓ Develop concrete and focussed investment priorities
- ✓ Build capacity in local institutions for climate finance.
- ✓ Unlock private finance sources.
- ✓ Policy to shift from fossil investments to clean investments

Supply

- ✓ Streamline and coordinate finance architecture across donor countries and MDBs
- ✓ Develop workable monitoring and impact assessment methodologies
- ✓ Climate proof all investment portfolios

United Nations Framework Convention on Climate Change

Thank You!

UNFCCC Secretariat

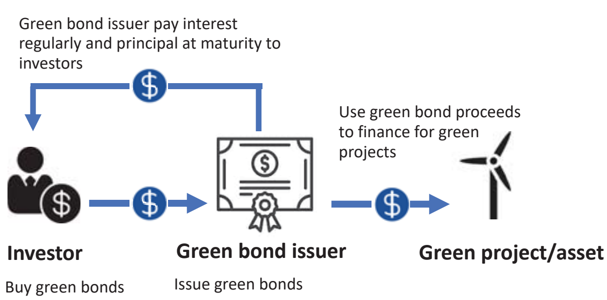
Green bonds and low carbon city development

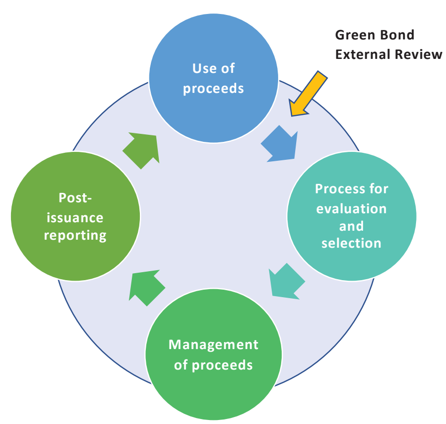
Alan Meng, Climate Bonds Initiative

Seoul, September 2019

What is a green bond?

A green bond is a debt security that is issued to raise capital specifically to support climate related or environmental projects.

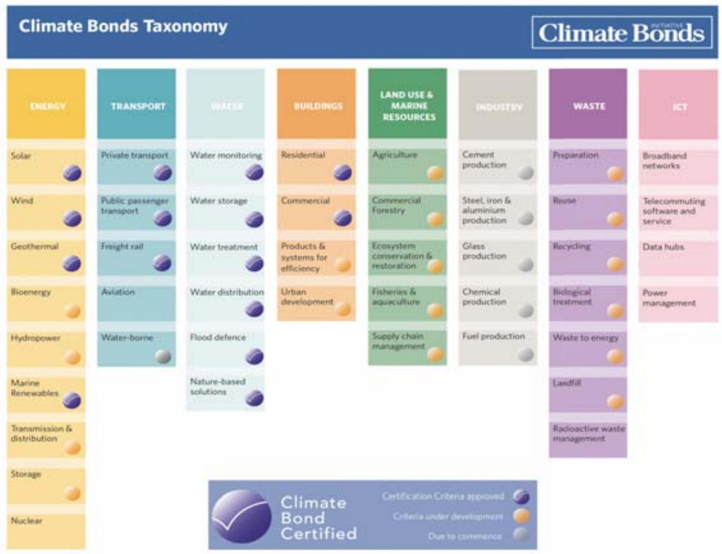




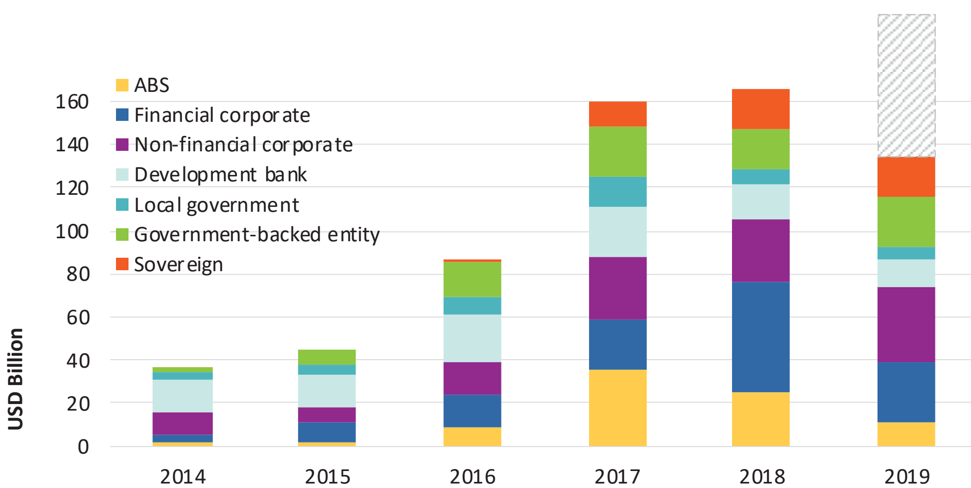
Climate Bonds

Eligible green assets

- Renewable energy
- Low carbon transport
- Water
- Low carbon buildings
- Land use and marine resources
- Industry
- Waste
- ICT

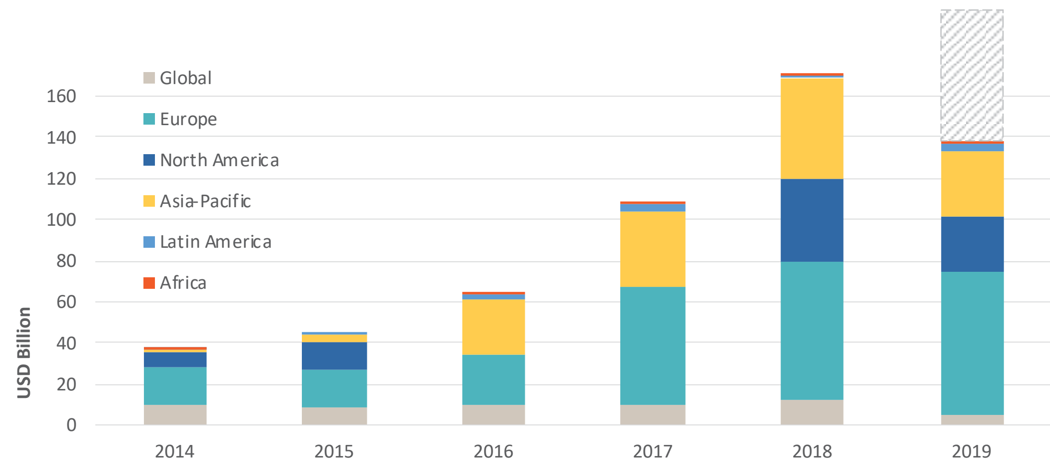


Evolution of the global green bonds market



Data source: Climate Bonds Initiative

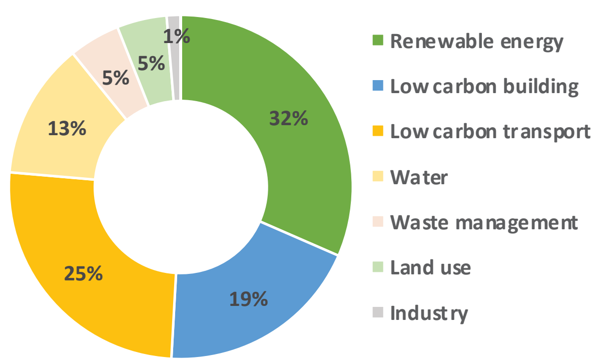
European issuance is strong but Asian volumes are rising



Data source: Climate Bonds Initiative

Low carbon infrastructure financed by green bonds

- Green bonds issued by sovereign government, local government, government-backed entity and development bank are largely financing for public green infrastructures.
- The cumulative amount has reached to USD 300 billion.
- Renewable energy, certified green buildings and low carbon transport, such as metro, light rail and intercity rail are the most popular assets to be financed.



Data source: Climate Bonds Initiative

Sovereign, local government & gov-backed green bond issuers

Sovereign government:

12 countries, 23 bonds, a total of $48.2bn

Belgium, Chile, Fiji, France, Hong Kong SAR of China, Indonesia, Ireland, Lithuania, Netherlands, Nigeria, Poland, Seychelles

Local government:

148 cities and municipal agencies, 14 countries, 284 bonds, a total of $45bn

Examples: **France**: Île-de-France, City of Paris; **Sweden**: City of Stockholm, City of Gothenburg; **Japan:** Tokyo Metropolitan Government; **Australia:** Queensland Treasury Corporation, Treasury Corp New South Wales, Treasury Corp Victoria; **USA:** City of Los Angele, City of Ashville, City of Puget Sound, City of Tacoma, City of Venice; **South Africa**: City of Johannesburg; **Canada**: Province of Québec, City of Ottawa

Government-backed entities:

114 issuers; 32 countries, 262 bonds, a total of $85.9bn

Examples: **China:** Beijing Infrastructure Investment, Wuhan Metro, Beijing Enterprises Water; **UK**: Transport for London; **USA**: DC Water; **Republic of Korea:** K-Water; **India**: IREDA; **Vietnam:** Ho Chi Minh City Finance

Data source: Climate Bonds Initiative

How to issue a green city bond

1. Identify qualifying green projects/assets
2. Arrange independent review
3. Set up tracking and reporting
4. Issue the green city bond
5. Monitor use of proceeds and report annually

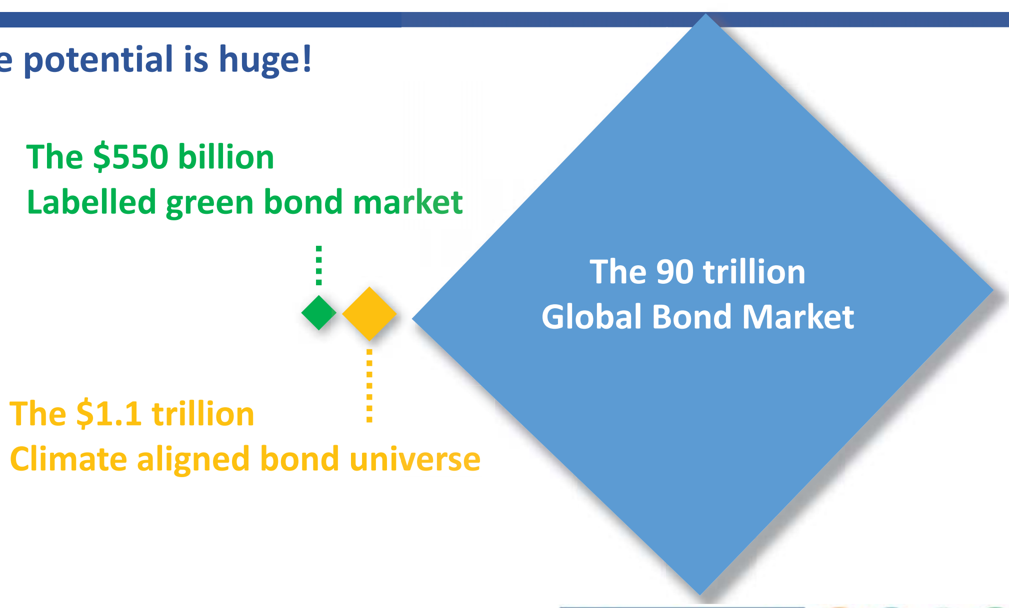
Climate Bonds INITIATIVE

Benefits for issuing a green city bond

- Access to low-cost debt capital markets
- Investor diversification
- Marketing of climate change plans
- Increased collaboration between financial and environmental departments
- Connecting with citizens’ environmental concerns

Climate Bonds INITIATIVE

The potential is huge!



Climate Bonds INITIATIVE

Climate Bonds
Initiative

www.climatebonds.net

September 2019
Seoul

Financing Energy Efficiency & Carbon Emissions Reductions in Buildings (EU & US)

Matthew Ulterino
Property Investment Project Coordinator
UNEP Finance Initiative

UN Finance Initiative

Overview

- Established in 1992 by the private sector to push finance innovation for sustainable development
- 240+ members globally from banking, investment and insurance industries
- Seeks systemic shift toward low-carbon, resilient, equitable, and resource-efficient assets and businesses
- Visit www.unepfi.org to learn more

European Commission Action Plan on Sustainable Finance

UNEP FINANCE INITIATIVE

The European Commission's Action Plan on Financing Sustainable Growth identified three objectives:

1. **Reorient capital flows** towards sustainable investment in order to achieve sustainable and inclusive growth
2. **Manage financial risks** stemming from climate change, resource depletion, environmental degradation and social issues; and
3. **Foster transparency** and long-termism in financial economy activity.

Developing a Taxonomy is one of ten action areas.

Reports available:
https://ec.europa.eu/info/publications/sustainable-finance-teg-taxonomy_en#190618

EU Sustainable Finance Taxonomy

UNEP FINANCE INITIATIVE

IS	IS NOT
A list of economic activities and relevant criteria	A rating of good or bad companies
Flexible to adapt to different investment styles and strategies	A mandatory list to invest in
Based on latest scientific and industry experience	Making a judgement on the financial performance of an investment – only the environmental performance
Dynamic, responding to changes in technology, science, new activities and data	Inflexible or static

EU Sustainable Finance Taxonomy

Type of activity	Technical screening criteria	Examples
1) Activities that are already low carbon. Already compatible with a 2050 net zero carbon economy	Likely to be stable and long-term	• Zero emissions transport • Near to zero carbon electricity generation • Afforestation
2) Activities that contribute to a transition to a zero net emissions economy in 2050 but are not currently operating at that level.	Likely to be subject to regular revision, tending towards zero emissions.	• Building renovation; • Electricity generation <100g CO2/kWh • Cars <50g CO2/km
3) Activities that enable those above.	Likely to be stable and long-term (if enabling activities that are already low carbon) or subject to regular revision tending to zero (if enabling activities that contribute to transition but are not yet operating at this level).	• Manufacture of wind turbines • Installing efficient boilers in buildings

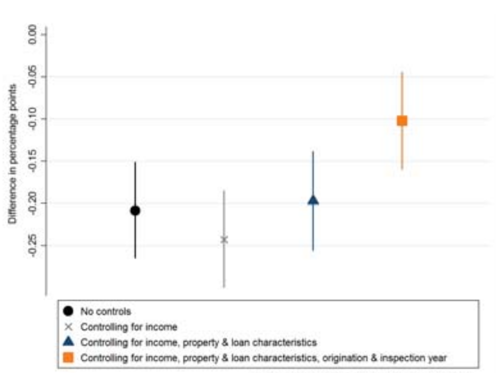
Value of Green to Lenders and Investors

Evidence to support green loans: lower default risk of underlying assets

- Bank of England research linking energy efficiency of residential properties and mortgage defaults

Graph: difference in mortgage arrears (high energy efficiency vs low energy efficiency)

Efficiency based on EPC rating



Loan origination between 2008–2017 / 1.8 million data points

Value of Green to Lenders and Investors

Attracting investor capital to green mortgage backed securities

- Fannie Mae Green MBS
  - Single asset security against multifamily residential loans
  - Energy Star certification
  - Approximately $35 billion issued since 2012
- Natixis / Ivanhoe / Callahan 'green CMBS tranche'
  - Manhattan commercial office refinance
  - Based on LEED Platinum Certificate for Existing Buildings
- Obvion 'green' STORM covered bond
  - Residential mortgages – top 15% / 30% in energy performance
- European Mortgage Federation Energy Efficient Mortgages Initiative and Energy Efficiency Data Protocol and Portal
  - Planned covered bond
  - Standard approach to 'green tagging'

UNEP FINANCE INITIATIVE

Thank you

Comments or questions?

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UNEP FINANCE INITIATIVE

2nd International Forum on Low Carbon Development for Cities: Acting Together for Low Carbon, Livable, and Prosperous Cities, Sep 2019

Innovative PPP Models for Republic of Korea's Transport Projects

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Number and Total Investment of PPP Metro/Rail Projects

- Projects by phases of project implementation

	No	Total investment (bill KRW)
Operation	12	1,6045
Construction	4	6,858
Design development	2	5,607
total	18	28,510

- Projects by project initiation and contract type

		No	Total investment (bill KRW)
Solicited	BTO	6	11,527
	BTL	5	5,469
	Sub total	11	16,997
Unsolicited	BTO	7	11,513
total		18	28,510

Source: PIMAC(2019), 2018 Annual Report.

Overview of Korea's PPP

The Phases of the PPP Framework by PPP Act

	Period	Characteristics
Phase I	1968–1994	▪ PPP projects based on individual laws (Road Act, Port Act, etc)
Phase II	1994–1998	▪ 'The Act on Promotion of Private Capital Investment in Social Overhead Capital'
Phase III	1999–2004	▪ 'The Act on Private Participation in Social Overhead Capital' • Establishing **PIMAC**, Improving the Korea **Infrastructure Credit Guarantee Fund** (ICGF) system, granting buyout rights • Positive government support for vitalizing private investment(including **MRG** program) • Encouraging **unsolicited proposals**
Phase IV	2005–Now	▪ Revision of 'the Act on Private Participation in Infrastructure' • Introduction of **BTL** scheme as a new method • Strengthened fiscal disciplines including introduction of **VfM test**

Key Delivery Challenges against Implementation of PPP after Legislation

- Lack of detailed rules and regulation and implementation
  - Step by step implementation guide was not in place
  - No clear and consistent criteria on PPP project selection
  - No guidelines for risk allocation and violation of risk allocation principle
  - Unnecessary regulations to protect government officials from future audit and inspection
- Limited capacity in the public sector
  - Conventional procurement preferred to PPP
  - PPP requires additional skills for project management such as legal transaction and financial analysis
- No strong private sector, in particular, financial institution
  - No experience of long-term project financing scheme
  - PF requires capacity to appraise long financial viability on non-recourse or limited-recourse basis.

Revision of the PPP Act in 1999 to Promote PPP

- The Korean government wanted to promote PPP market in the wake of Asian Financial Crisis in 1997-98
- Risk allocation
  - Consistent and explicit rule of risk allocation
  - MRG (Minimum Revenue Guarantee) clause introduced
  - Early termination payment clause
  - Foreign exchange volatility risk mitigated (80~120% fluctuation)
  - SOC Credit Guarantee Fund
- Unsolicited proposal
  - Streamlining implementation procedure of unsolicited proposal
  - Bonus point (max 10%) awarded at the bidding stage
- PPP unit, PICKO (□ PIMAC in 2005)
  - Technical assistance to PPP project implementation organizations
    - Documentation for RFP, bidding, and negotiation
  - Policy advisory in formulation of PPP policies
  - Theoretical and practical research on PPP
  - PPP market promotion by inducing FDI

Sources of Infrastructure Funding

- Conventional sources
  - General taxes
  - User charge
  - Sovereign Bonds / SOE bonds
    (Foreign Aids)
- Transport tax (1993. 12.)□ Transport, Environment and Energy Tax
  - Tax on gasoline and diesel earmarked for the revenue of Transport Facility Special Account (Gasoline: 529 Won /liter)
  - Tax and surcharge accounts for 50%+ of consumer price
- PPP (1994. 8.)
- Value capture
  - A fraction of development gains, mainly land value increase is used to finance new infrastructure

Financing Sources of PPP Metro Projects (BTO Contracts)

Phase	No	Length (km)	Investment					
			total	private	National subsidy		Local subsidy	value capture
					Construction	Land acquisit'n		
Operation	7	596.4	11,356	7,191	1,734	324	885	1,223
Construction	3	26.7	3,074	1,680	194	168	703	330
Total	10	623.1	14,430	8,870	1,929	492	1,587	1,553
Proportion			100.0%	61.5%	13.4%	3.4%	11.0%	10.8%

Source: MoLIT(2018), 2016 Handbook of Rail Affairs

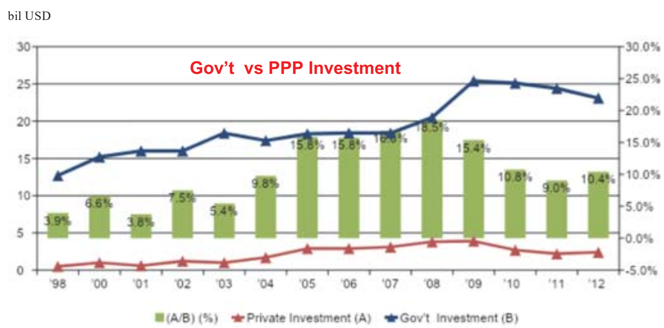
Performance of PPP Metro Projects

Why PPP? Its Potential Benefits

- Fiscal Space
  - Faced with budget constraint, government can take PPP as a financial option to fill the infrastructure gap timely.
- Fiscal Efficiency
  - Minimizing LCC (Life Cycle Costs) by integrating DBFO (Design-Build-Financing-Operation) works into a single contract
  - Little possibility of cost and time overruns (Little optimism bias)
  - Risk allocation: Allocate to the party who is better able to handle it
  - Resource allocation through market mechanism (bankability)
  - Mobilizing the innovation in technology and management of private sector
- Quality Service
  - Private operators tend to be more responsive to preference of consumers
  - A fraction of government payment is subtracted as a penalty when operators do not meet pre-specified output quality
- Reform the Public Sector
  - Competition between public and private parties
  - Provide expertise and experience not readily available in public agencies

Expanded Fiscal Space

- **PPP has alleviated the government's burden on infrastructure investment from 4% to 18.5% per year (Average: 10.7% per year)**
  - The promotion of PPP has helped ease constraints on the government's financial resources, enabling it to secure resources for other sectors



Source: KDI PIMAC, Internal data
A : Private investment involvement in SOC sector, covering central government BTO projects, local government BTO projects more than 200B KRW or with 30B more national fund and BTL rail projects
B : Annual budget in transportation and regional development sector, The Five-year National Fiscal Management Plan

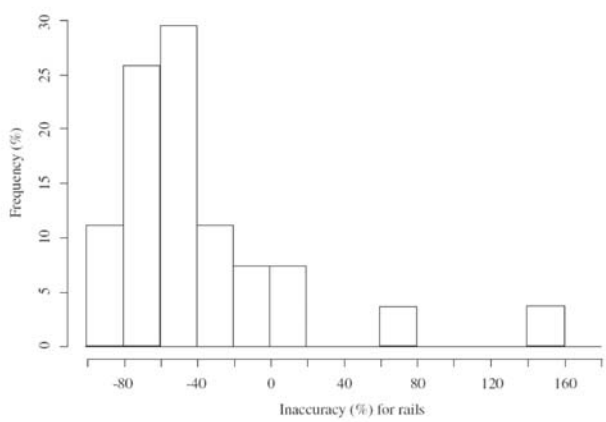
Criticism against PPP in Korea

- PPP undermines fiscal efficiency
  - MRG payment has resulted in excessive fiscal burden
  - Future liabilities of BTL projects
  - Too much incentives to private parties
- Low political acceptance of PPP mainly because of high tariff
  - The toll of PPP road is about 1.3 times higher than government road operated by SOE (Korea Expressway Corporation)
  - The tariff of waste water treatment increases with expansion of PPP facilities

Inaccuracy of Demand Forecast for Selected PPP Metro Projects

Project		2007	2008	2009	2010	2011	2012	2013	2014	2015
ICN airport	contract	207,421	226,642	248,294	248,294	492,982	518,568	534,427	549,535	
	actual	13,212	16,606	20,111	27,517	89,099	134,257	157,894	176,258	190,147
	a/c (%)	6.4	7.3	8.1	11.1	18.1	25.9	29.5	32.1	
Metro 9	contract			165,625	192,952	220,279	223,193	231,257	239,606	
	actual			121,753	172,480	194,630	222,320	241,848	253,196	441,140
	a/c (%)			73.5	89.4	88.4	99.6	104.6	105.7	
Euijung bu	contract						79,049	89,589	98,472	108,205
	actual						14,912	15,609	21,166	31,995
	a/c (%)						18.9	17.4	21.5	29.6

Appendix: Inaccuracy of Demand Forecast (%)



Source: Flyvbjerg,B.(2006)
Calculated from 24 rail projects from various countries

Concluding Remarks

- There are potential advantages of PPP to improve fiscal efficiency as well as expand fiscal space. However, the benefits are not always materialized
- The PPP is justified when it not only expands fiscal space but only increases the value of tax payer's money.
  - Korea's experience of PPP demonstrates the importance of keeping balanced between market promotion and fiscal discipline in the practice of PPP policy.
  - Risk sharing and unsolicited proposal are useful for PPP promotions. But those measured should be taken with care.
- The PPP metro project needs additional care because of its huge size and high risk in demand forecasting.

Session 6: Advanced Low Carbon Technologies

Wuppertal Institut

Hydrogen Economy
Urban hydrogen concepts in transport, energy, buildings (fuel cell CHP), and industry in Germany

Presentation :

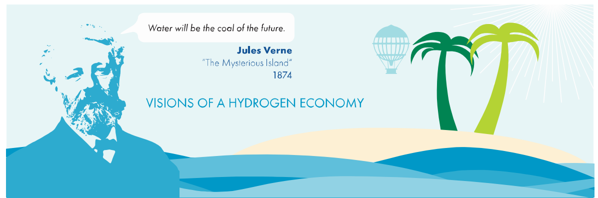
Prof. Dr. Manfred Fischedick
Wuppertal Institut

September, 3rd 2019

Introduction

Vision of a hydrogen economy is not new

Old dream but now in a phase with realistic implementation chances



Almost since its discovery, hydrogen has played an important part in contemporary visions of the future, especially in relation to the energy industry and locomotion.

As early as 1874, the French science fiction writer Jules Verne (1828 – 1905) in his novel "L'Île mystérieuse" (The Mysterious Island) saw hydrogen and oxygen as the energy sources of the future. In his vision, hydrogen would be obtained by the breaking down of water (via electrolysis). Water, resp. hydrogen, would replace coal, which at the time was the dominant energy source in the energy supply industry.

In the 1960s, the successful use of hydrogen as a rocket propellant and of fuel cells to operate auxiliary power units in space – especially in the context of the US Saturn/Apollo space travel programme – provided further impetus to the fantasies surrounding hydrogen. Also in the 1960s, first passenger cars were fitted with fuel cells as basic prototypes resp. technology demonstrators.

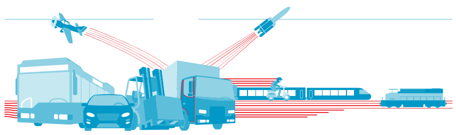
During the 1970s, under the impression of dwindling and ever more expensive fossil fuels, the concept of a (solar) hydrogen economy was developed, with H_2 as the central energy carrier. Since the 1990s, hydrogen and fuel cells have made huge technical progress in the mobility sector. After the turn of the century, not least against the background of renewed global raw material shortages and increasingly urgent questions of sustainability, the prospects for a hydrogen economy were considered once again (Rifkin 2002).

More recently, the focus has increasingly been on hydrogen's role in a national and global energy transition. Within this context, the value added of hydrogen (from renewable energies via electrolysis) in an increasingly electrified energy world has also been subject to discussion. Nevertheless, an important role is envisaged for hydrogen – especially as a clean, storable and transportable energy store – in an electricity-based energy future (Nitsch 2003; Ball/Wietschel 2009).

Use cases of hydrogen and (selected) experiences in Germany

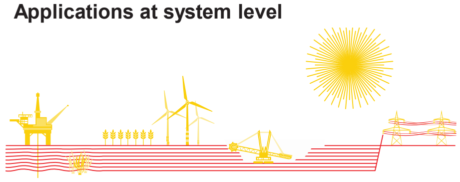
Use cases of hydrogen and (selected) experiences in Germany

Mobility applications

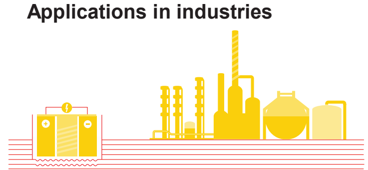


Stationary applications

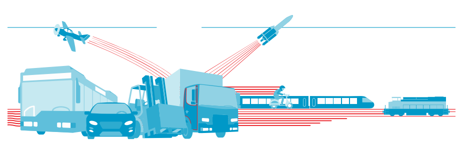
Applications at system level



Applications in industries

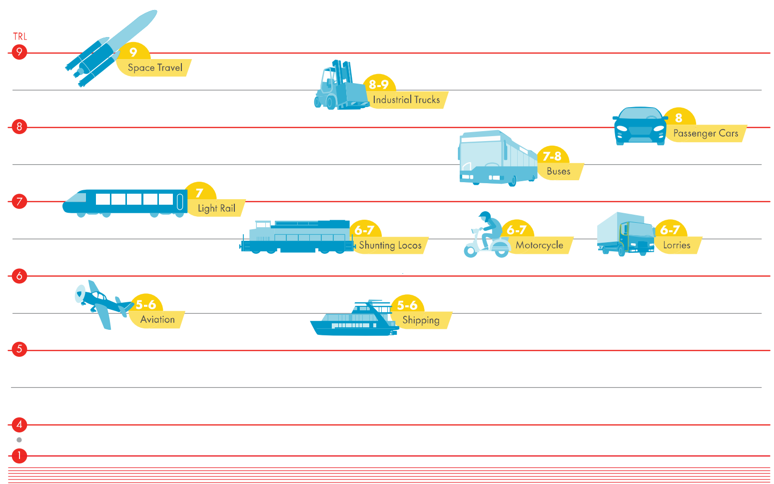


Mobility applications



Mobility applications

Broad range of options with different status (Technology Readiness Level)



Mobility applications in Germany

Fuel Cells used for mobility purposes in busses and trains

Recent developments :

- Regional Transport Company in Cologne (RK) ordered 30 FC busses and Wuppertaler Stadtwerke (WSW) ordered 10 FC busses
- Biggest contract in this area at European level
- Start of operation in spring 2019
- Busses are produced in Belgium (Koningshooikt)
- WSW implemented own supply structure for hydrogen (electrolyser connected to waste incineration plant
- First experience with fuel cell trains in northern part of Germany (substitute for diesel driven engines)

WSW

RK Regionalverkehr Köln GmbH

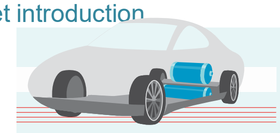
Erster Wasserstoffzug in Schleswig-Holstein

Premiere im Norden: Zwischen Neumünster und Kiel ist am Montag erstmals ein mit Wasserstoff angetriebener Zug unterwegs gewesen. Mit an Bord war Verkehrsminister Buchholz. (01.10.2018) **mehr**

Brennstoffzellenzug: Premiere mit hohen Erwartungen

Wassertropfen statt Ruß: Der weltweit erste mit Wasserstoff angetriebene Zug ist in Bremervörde zur Premierenfahrt gestartet. Heute folgt der Linienverkehr für "Coradia iLint". (17.09.2018) **mehr**

Mobility applications in Germany
Fuel Cell Vehicles still at the very beginning of market introduction



- Fuel cell car production clearly dominated by Asian companies (list of FC vehicles in series production)

Modell	Markteinführung	Reichweite (km).	V_{max} (km/h)	kW (PS)	Beschleun. 0 auf 100 km/h (s)	Maximales Drehmoment	Verbrauch (H_2) kombiniert in kg/100 km	Tankinhalt in kg	jährliche Produktion (Stand)
Honda FCX Clarity[1]	2008 (1. Generation)	650	165	44 (60)			0,87	1,78/2,09	
Hyundai ix35 FCEV[2][3]	2013	594	160	100 (136)	12,5	300	0,95	5,64	
Toyota Mirai[4][5]	2014	500	175	114 (155)	9,6	335	0,76	5	ca. 3.300 (2017)[6]
Honda Clarity Fuel Cell[7]	2016 (2. Generation)	650	165	130 (176)	9	300	0,77	5	
Renault Kangoo Z.E. H2[8]	2017	290	130	44 (60)			0,87	1,78/2,09	
Hyundai Nexo[9][10]	2018	756	179	120 (163)	9,5	395	0,84	6,33	
Mercedes-Benz GLC F-Cell[11]	Dezember 2018	437 plus 49 (Batterie)	160	147 (200)		350	0,97 (19 kWh elektrisch)	4,4 plus 9,3 kWh (Batterie)	
StreetScooter H2 Panel Van[12]	ab 2020	500	120	122 (166)				6	

Mobility applications in Germany
Fuel Cell Vehicles still at the very beginning of market introduction

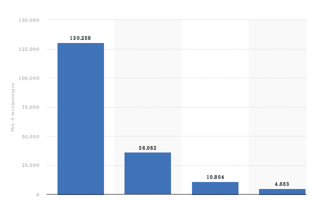
- In Germany mainly Mercedes (and BMW) are active and follow the technology line

Mercedes GLC F-Cell

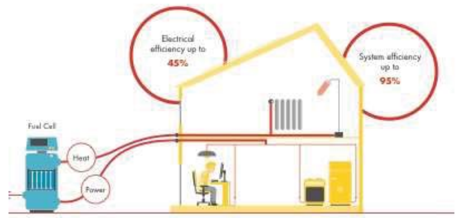
Der GLC kombiniert zwei Energiespeicher: eine 90 PS starke Brennstoffzelle sowie einen Akku, der 100 kW beisteuert und das Auto zum Plug-in Hybriden macht. Batterieelektrisch sind nach NEFZ-Norm 50 Kilometer drin, 4,4 Kilogramm Wasserstoff bringen knapp 440 weitere Kilometer Reichweite. Beide schicken ihre Energie zu einem 211 PS starken Elektromotor, der die Hinterachse antreibt.

Mercedes GLC F-Cell.

- German government supports market introduction by up to 21,000 € per vehicle
- FC car fleet is however still very small (at the beginning of 2019 only FC 392 cars have been registered and were on the road – in comparison to a total car fleet > 40 Mio. cars)



Stationary applications



Stationary applications in Germany

Fuel Cells for stationary applications so far not in the focus – pilot and demonstration plants as well as first market offers

PROJECT DETAILS

Operation of 100 micro-cogeneration plants

PROJECT TARGET

Installation of various types of equipment in the field of micro-cogeneration (Stirling engine, Otto engine, fuel cell) as a comprehensive field test in Bottrop. Scientific support to optimise and support the introduction of energy-effficient gas-plus-application technologies. A secondary aim is the development and assessment of technology concepts which are adapted to the future application situation for the new building area but in particular also for the existing building stock and are highly efficient as regards primary energy.

InnovationCity Ruhr
Modellstadt Bottrop

Produktdetails zur Brennstoffzellenheizung

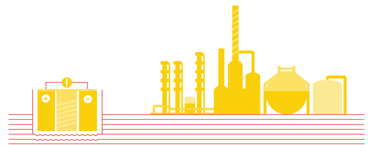
Details zur Vitovalor PT2 von Viessmann:

- Parallele Erzeugung von Strom und Wärme zur Minimierung der Stromkosten und zunehmende Unabhängigkeit vom Strompreis
- Integrierter Strom- und Gaszähler
- Brennstoffzelle: 750 Wel, 1 kWth; Gesamtwirkungsgrad 90 % (Hi); Elektrischer Wirkungsgrad 37 %
- Gas-Brennwertmodul: bis 18,9 kW oder 25,2 kW; (Trinkwasser bis 30 kW); Nutzungsgrad 98 % (Hs)
- Innovative Zukunftstechnologie
- Platzsparende Bauweise – benötigt nur 0,65 m² Aufstellfläche
- Leiser, komfortabler und intelligenter Betrieb
- Fernbedienung und Abruf von aktuellen Daten per App möglich

→ Weitere Details zur Vitovalor PT2 (/de/pk/heizung/brennstoffzellen-heizung/vitovalor.html)

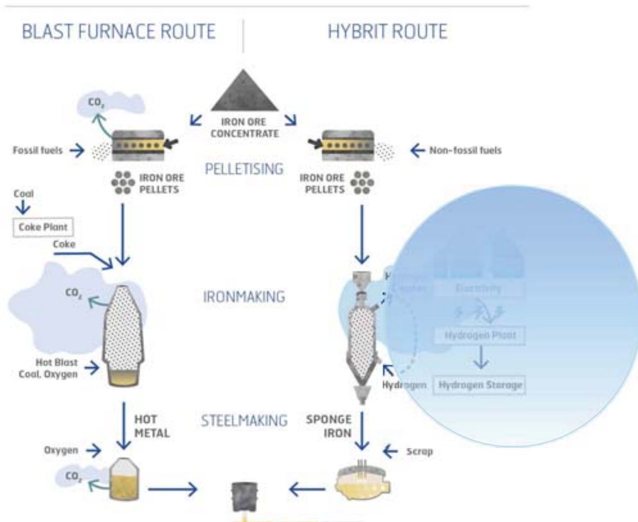
- Pilot and demonstration program 100 small scale CHP plants (incl. fuel cells) in Innovation City Ruhr
- First market offers from professional companies (cooperation between energy utilities and manufacturer of heating systems)
- Market wins dynamic (based on financial support from government > 5,000 fuel cell systems have been ordered since 2016; cf. with > 200,000 in Japan)

Applications in industry



Applications in industry in Germany

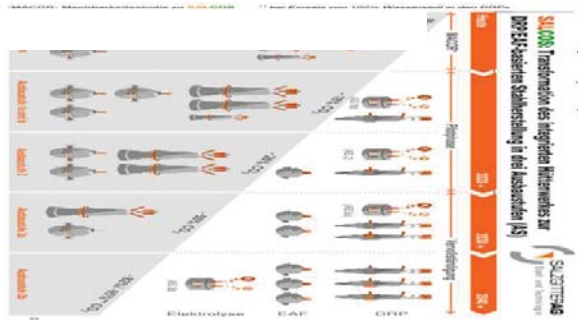
Example: Steel making today and tomorrow (blast furnance -> hydrogen based steel making (direct reduction process))



Applications in industry in Germany

Example: Steel making today and tomorrow (blast furnance -> hydrogen based steel making (direct reduction process))

- Concrete plans for step by step change of steel making process of major German steel companies (e.g. Thyssen Krupp Steel, Salzgitter AG)



Applications in industry in Germany

Example: Blending of fuels with hydrogen to cover EU CO_2-standards in refineries

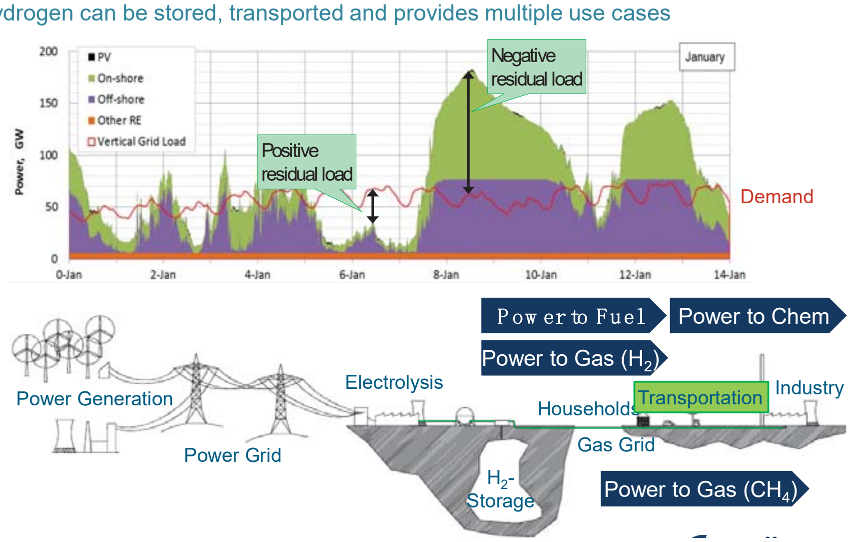
Refinery in Lingen (Emsland)

- BP and Uniper, together with the Fraunhofer Institute for Systems and Innovation Research ISI, submit project outline for the "Real-world laboratories energy transition" competition
- The planned project envisages the integration of renewable energy in the form of hydrogen into the transport sector
- Power-to-gas technology (PtG) in refinery processes (PtGtR) makes a positive contribution to the energy transition

Use of hydrogen from a systems perspective

Hydrogen as an option for sector coupling and potential answer for the intermittency of renewable energy (electricity) supply

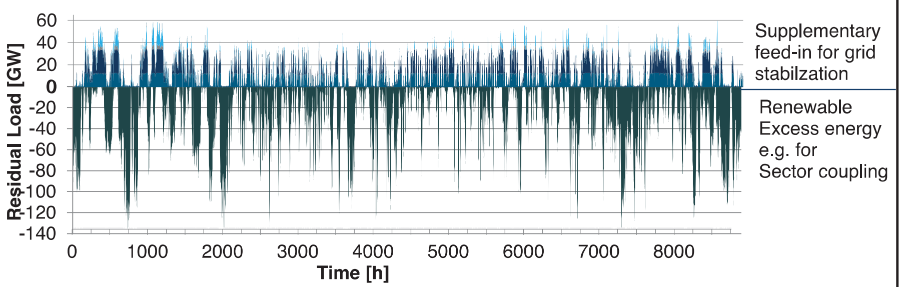
Hydrogen can be stored, transported and provides multiple use cases



Hydrogen as an option for sector coupling and potential answer for the intermittency of renewable energy (electricity) supply

Hydrogen can be stored, transported and provides multiple use cases

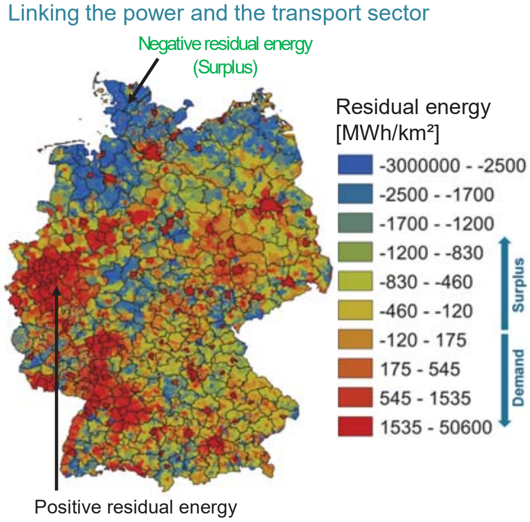
Growing fluctuations in the load curve over time (potential status in 2050 in Germany)

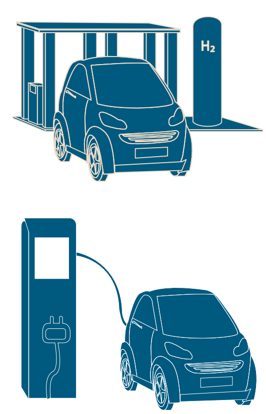


Back-up power production with gas turbines needed
- First fed with natural gas
- Later fed by hydrogen

Hydrogen as an option for sector coupling and potential answer for the intermittency of renewable energy (electricity) supply

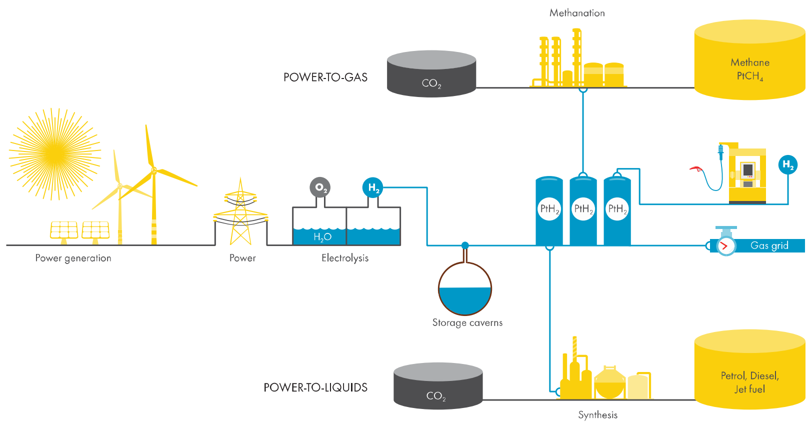
Linking the power and the transport sector





Use of hydrogen from a systems perspective in Germany (focus PtX)

Hydrogen as basis for provision of synthetic gas/fuels or substitute for natural gas in the gas grid via Power to x-technologies



Use of hydrogen from a systems perspective in Germany (focus PtX)

Hydrogen as basis for provision of synthetic gas/fuels or substitute for natural gas in the gas grid via Power to x-technologies

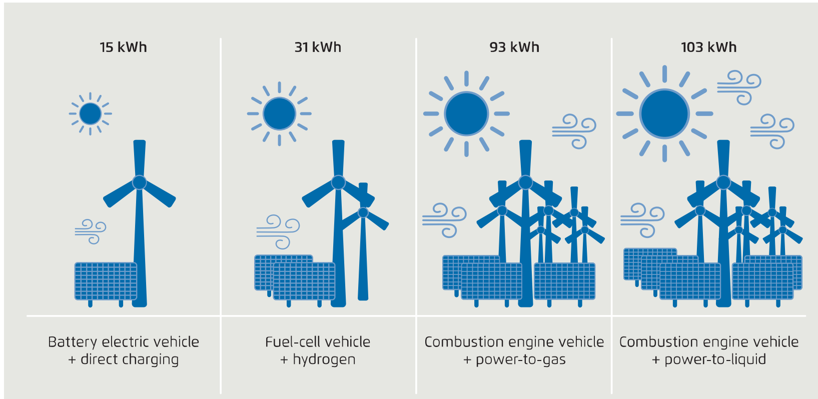
Altmaier verkündet Gewinner im Ideenwettbewerb ‚Reallabore der Energiewende‘: „Wir wollen bei Wasserstofftechnologien die Nummer 1 in der Welt werden“

In bundesweit 20 Reallaboren erproben Unternehmen künftig v.a. neue Wasserstofftechnologien im industriellen Maßstab und in realer Umgebung.

Hydrogen as an option for sector coupling

Reflecting the efficiency losses hydrogen based mobility is less efficient than electric vehicles but much better than synthetic (renewable based) fuels

Amount of renewable energy required for various powertrain and fuel combinations (per 100 km) Figure 6.1



来源: Agora Energiewende 2017

Hydrogen supply structures – how to get sufficient and competitive hydrogen

Hydrogen supply structures

Hydrogen supply structure will most likely require a new way of thinking (e.g. big offshore wind farms dedicated to provide hydrogen)

North Sea Wind Power Hub

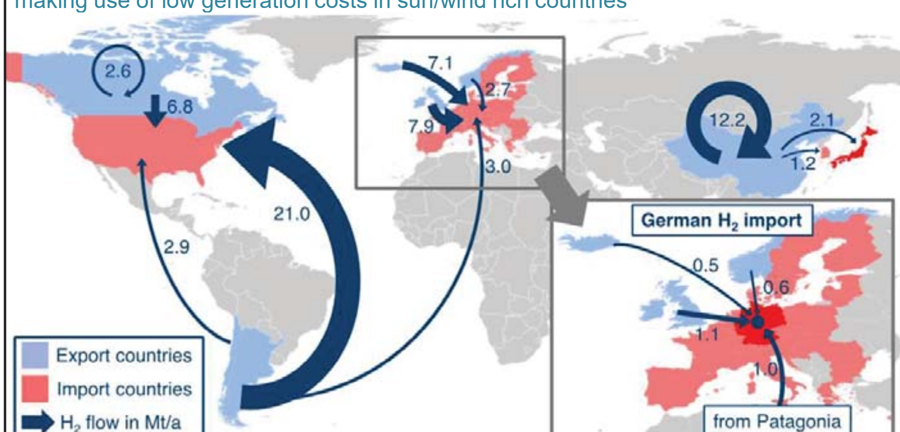
Project partner:
TenneT TSO B.V. (Niederlande)
Energinet.dk (Dänemark)
TenneT TSO GmbH (Deutschland)
Gasunie (Niederlande)
Port of Rotterdam (Niederlande)

- Artificial island in the North Sea (6 sqare kilometers)
- Crossroad for offshore wind parks (30 GW installed capacity) and interconnectors for the European electricity trading market
- Starting point for delivering either electricity or hydrogen to neighbouring countries

Sonne Wind & Wärme 5/2017, S.20 „Oase in der Nordsee“
https://northseawindpowerhub.eu/wp-content/uploads/2017/11/Concept-Paper-3-Hub-as-an-Island.pdf

Hydrogen supply structures

Hydrogen supply structure will be most likely based on global commodity streams making use of low generation costs in sun/wind rich countries

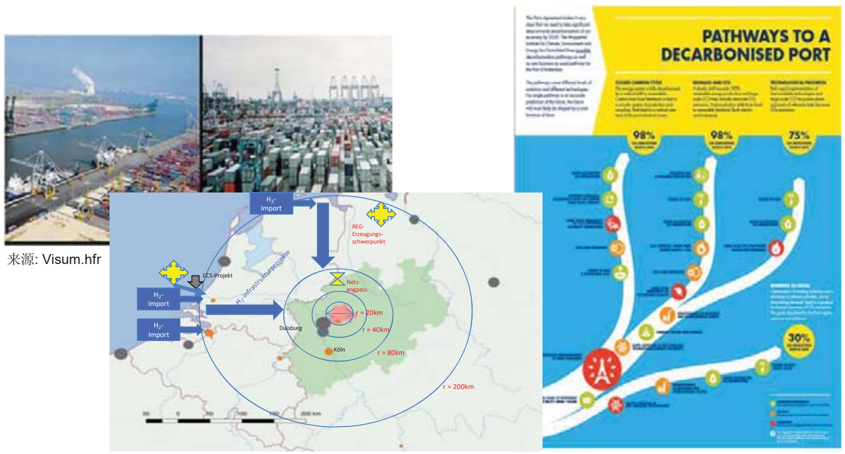


	Germany	Japan	EU	USA	Canada	China	South Korea
Demand in Mt/a (75% Scenario)	3.14	2.05	17.58	30.61	2.55	12.22	1.15
Import LCOH in €/kg (*)	4.66	4.81	4.67	4.34	4.66	4.71	4.77

Hydrogen supply structures

Ports will play important role - existing oil based hubs (e.g. ports) could become a future hub for clean fuels embedded in own low carbon strategy

Example: Port of Rotterdam in the Netherlands with direct connection to Germany



来源: Visum.hfr

Hydrogen supply structures

…and how to support – simply via conversion of existing natural gas grid and extension of already existing hydrogen pipeline system

Existing hydrogen pipelines

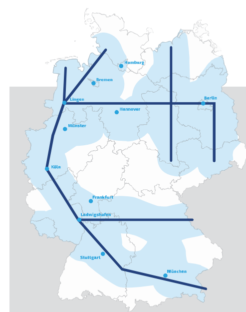
North Rhine Westphalia

Eastern Germany

Hydrogen supply structures

…and how to support – simply via conversion of existing natural gas grid and extension of already existing hydrogen pipeline system

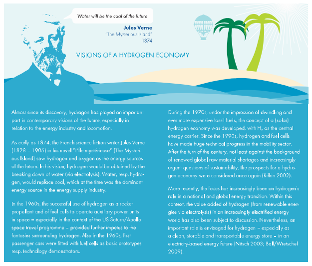
GetH2 project – consortium (electricity and gas utilities, research institutions) set starting point to build up a hydrogen infrastructure in Germany via conversion of existing natural gas grid



Conclusion

Vision of a hydrogen economy is not new

Old dream but now in a phase with realistic implementation chances and growing political support and public attention



Almost since its discovery, hydrogen has played an important part in contemporary visions of the future, especially in relation to the energy industry and locomotion.

As early as 1874, the French science fiction writer Jules Verne (1828 – 1905) in his novel "L'Île mystérieuse" (The Mysterious Island) saw hydrogen and oxygen as the energy sources of the future. In his vision, hydrogen would be obtained by the breaking down of water (via electrolysis). Water, resp. hydrogen, would replace coal, which at the time was the dominant energy source in the energy supply industry.

In the 1960s, the successful use of hydrogen as a rocket propellant and of fuel cells to operate auxiliary power units in space – especially in the context of the US Saturn/Apollo space travel programme – provided further impetus to the fantasies surrounding hydrogen. Also in the 1960s, first passenger cars were fitted with fuel cells as basic prototypes resp. technology demonstrators.

During the 1970s, under the impression of dwindling and ever more expensive fossil fuels, the concept of a (solar) hydrogen economy was developed, with H_2 as the central energy carrier. Since the 1990s, hydrogen and fuel cells have made huge technical progress in the mobility sector. After the turn of the century, not least against the background of renewed global raw material shortages and increasingly urgent questions of sustainability, the prospects for a hydrogen economy were considered once again (Rifkin 2002).

More recently, the focus has increasingly been on hydrogen's role in a national and global energy transition. Within this context, the value added of hydrogen (from renewable energies via electrolysis) in an increasingly electrified energy world has also been subject to discussion. Nevertheless, an important role is envisaged for hydrogen – especially as a clean, storable and transportable energy store – in an electricity-based energy future (Nitsch 2003; Ball/Wietschel 2009).

Federal Ministry for Economic Affairs and Energy

Deutschland

Altmaier kündigt Wasserstoffstrategie des Bundes an

28. Juni 2019, 11:33 Uhr / Quelle: AFP

Düsseldorf (AFP) Bundeswirtschaftsminister Peter Altmaier (CDU) hat noch für dieses Jahr eine Wasserstoffstrategie des Bundes angekündigt. Zuvor werde die Bundesregierung in sogenannten Reallaboren der Energiewende Innovationen im industriellen Maßstab umsetzen, kündigte Altmaier in der "Wirtschaftswoche" an. "Noch im Sommer werden wir die ausgewählten Projektideen bekanntgeben." Die technische Realisierung könne dann ab 2020 starten.

Vision of a hydrogen economy is not new

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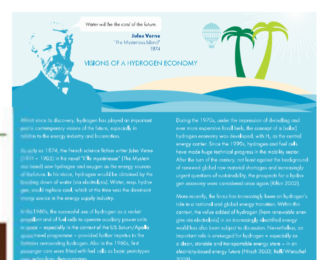
Berliner Morgenpost

ENERGIE

Brandenburg will Vorreiter für Wasserstoffwirtschaft werden

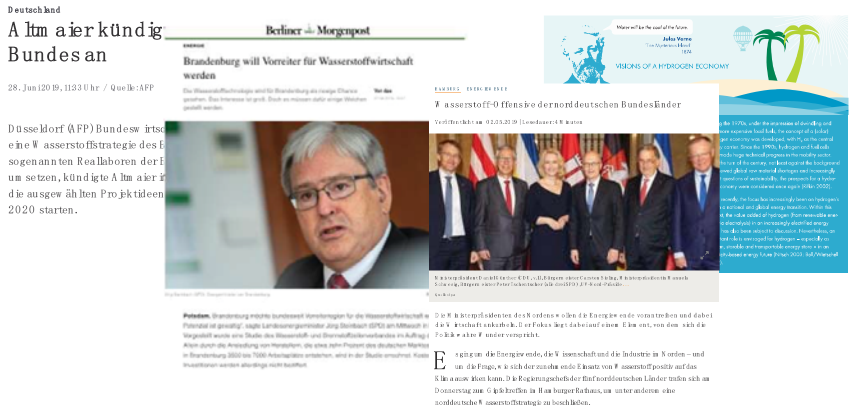
Die Wasserstofftechnologie wird für Brandenburg als riesige Chance gesehen. Das Interesse ist groß. Doch es müssen dafür einige Weichen gestellt werden.

Potsdam. Brandenburg möchte bundesweit Vorreiterregion für die Wasserstoffwirtschaft werden. "Das Potenzial ist gewaltig", sagte Landesenergieminister Jörg Steinbach (SPD) am Mittwoch in Potsdam. Vorgestellt wurde eine Studie des Wasserstoff- und Brennstoffzellenverbandes im Auftrag des Ministeriums. Allein durch die Ansiedlung von Herstellern, die etwa zehn Prozent des deutschen Marktes bedienten, könnten in Brandenburg 3600 bis 7000 Arbeitsplätze entstehen, wird in der Studie errechnet. Kosten für notwendige Investitionen werden allerdings nicht beziffert.


Water will be the coal of the future.
Jules Verne
"The Mysterious Island"
1874
VISIONS OF A HYDROGEN ECONOMY

Vision of a hydrogen economy is not new

Old dream but now in a phase with realistic implementation chances and growing political support and public attention



…however Japan and Korea are without any doubt forerunner with regard to shaping a hydrogen economy

Vision of a hydrogen economy is not new

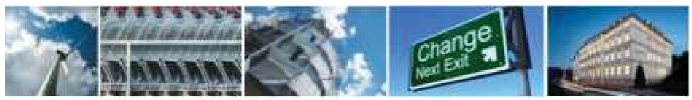
Old dream but now in a phase with realistic implementation chances and growing political support and public attention

„The time is right to tap into hydrogen's potential to play a key role in a clean, secure and affordable energy future." IEA 2019

The IEA has identified four near-term opportunities to boost hydrogen on the path towards its clean, widespread use.

1. Make industrial ports the nerve centres for scaling up the use of clean hydrogen.
2. Build on existing infrastructure, such as millions of kilometres of natural gas pipelines.
3. Expand hydrogen in transport through fleets, freight and corridors.
4. Launch the hydrogen trade's first international shipping routes.

Thank you very much for your attention



(주)두산

Fuel cells as a Clean Distributed Generation Solution

2nd International Forum on Low Carbon Development for Cities
Asia Development Bank

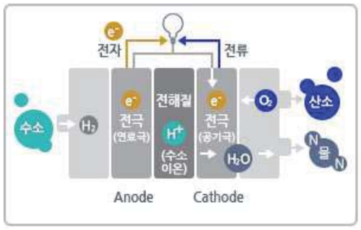
Millennium Seoul Hilton
Seoul, South Korea
September 3rd, 2019

Dr. Hoon Sub Song
Business Strategy Team
Doosan Fuel Cell

CONTENTS

WHAT IS FUEL CELL?

Produce electricity, heat and water through electrochemical reactions such as oxidation and reduction of hydrogen and oxygen



Anode

- Hydrogen supply electrode
- Hydrogen separated into ions and electrons
- Hydrogen ions move to Cathode via electrolyte

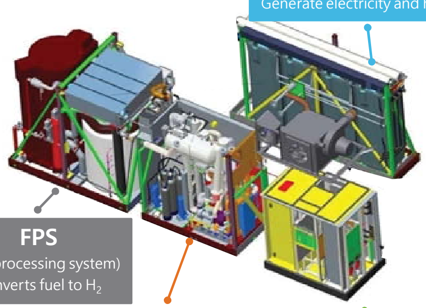
Electrolyte

- A substance that can only pass ions, not electrons

Cathode

- Air supply electrode
- Hydrogen ions and electrons are combined with oxygen
- Reaction produces heat and water

DOOSAN FUEL CELL SPECIFICATIONS



PSS
(Power supply system)
Generate electricity and heat

FPS
(Fuel processing system)
Converts fuel to H_2

TMS/WTS
(Thermal mgt/ water treatment system)
Maintain the thermal balance
Generates hot water (120°C, 60°C)

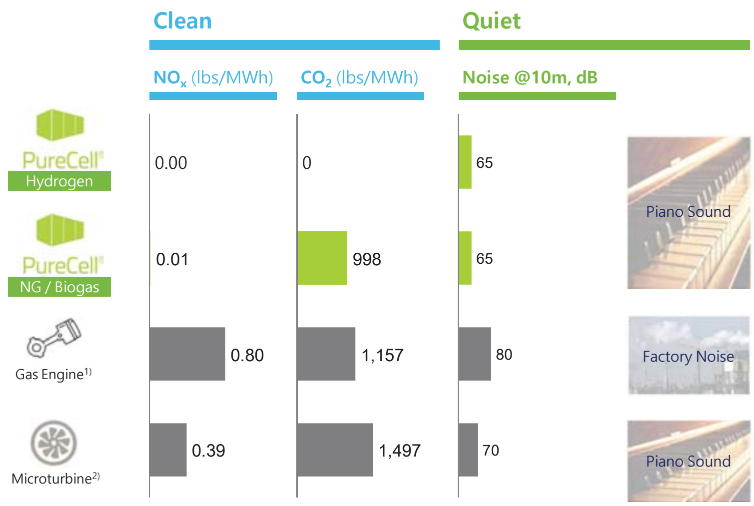
ESM
(Electrical system module)
Converts DC to AC

Technical specifications

	NG	H2
Size	• 8.3 x 2.5 x 3.0 m	
Electrical Output	• 440 kW	
Heat Output	• HG (120°C) • LG (60°C)	• HG (120°C) • LG (60°C)
Efficiency	• Total : 90% –E : 43% –H : 47%	• Total : 90% –E : 48% –H : 42%

- Ultralow CO_2 and air emissions
- Low noise and vibration

CLEAN AND QUIET

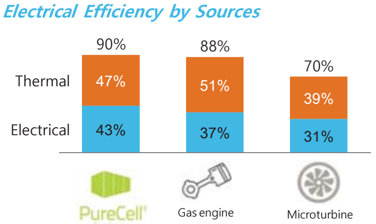


1) 600kW (Source: DOE)
2) 320kW (Source: DOE)

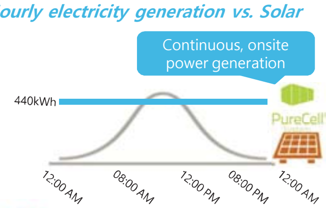
EFFICIENT & STABLE SUPPLY OF ENERGY

Higher efficiency and stability

Electrical Efficiency by Sources

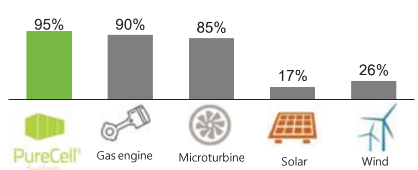


Hourly electricity generation vs. Solar

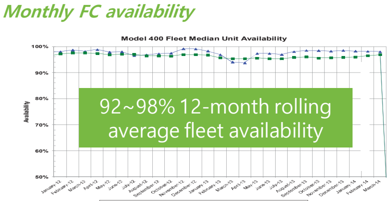


Superior availability

Availability by Sources



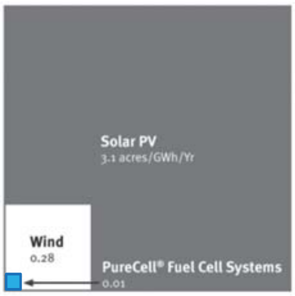
Monthly FC availability



FLEXIBLE INSTALLATION

Superior space efficiency

Fuel cells require 300x less land than solar PV



Installation Flexibility

The container box sized module (8.3m x 2.5m x 3.0m) can be installed virtually everywhere

Multi-story / Multi-megawatt

Indoor

Rooftop

PRODUCT PORTFOLIO

Natural gas / Biogas Model

Currently available

Hydrogen Model

Currently available

H_2 from renewables

H_2 from facilities

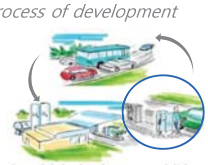
LPG Model

Currently available

Remote area or islands apart from the central grid

Tri-Gen Model/ SMR for HRS

In the process of development



Power electric vehicle, hydrogen vehicle, and the nearby residents at once

FUEL CELL APPLICATIONS

Application	Main driver of using fuel cells	Usage	Major Clients
Hospitals Data Centers	*Sustainable, 24/7 resilient, and safeguards quality patient care / server secure*	• Own use	NHS, Saint Francis Hospital and Medical Center, First National Bank One with You.
Universities Buildings	*Sustainable, resilient, and quiet*	• Own use • Excess energy sold to nearby areas	UCONN, RIT, 360 state, Hilton
Municipals Utilities	*Low-emission energy*	• Nearby areas	Aberdeen City Council, KHNP
O&Gs	*Byproduct Hydrogen utilization*	• Own use • Nearby areas	Hanwha, Total

CONTENTS

- **Fuel Cell Overview**
- **Doosan Fuel Cell Overview**

Key Figures (2018)

$18.2B **Revenue**
- Global: $12.3B (60% of total)

39.4K **Employees**
(KOR + Global)

DOOSAN CORPORATION
- **Fuel Cell BG**
- Electro-Materials BG
- Industrial Vehicle BG
- Mottrol BG

**BG : Business Group*

DOOSAN HEAVY INDUSTRIES
Power solutions and generation equipment

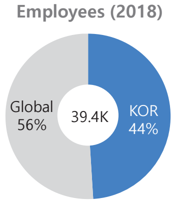
DOOSAN INFRACORE / BOBCAT
Construction equipment, portable power and hydraulic components

DOOSAN CONSTRUCTION
Civil and architectural works and oil and gas plant equipment manufacture

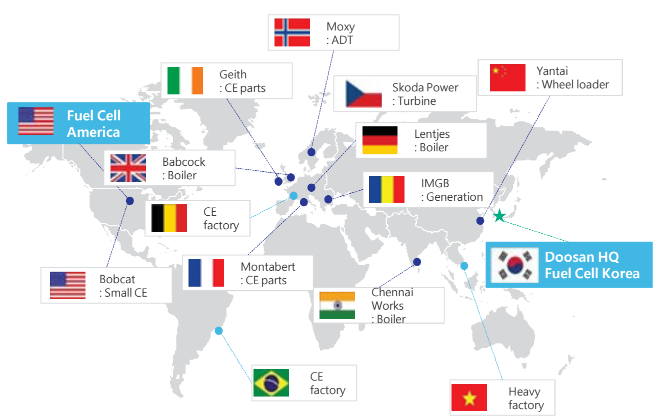
DOOSAN ENGINE
Wide range of engines of all sizes to generate for a variety of industrial uses

DOOSAN GROUP GLOBAL PRESENCE

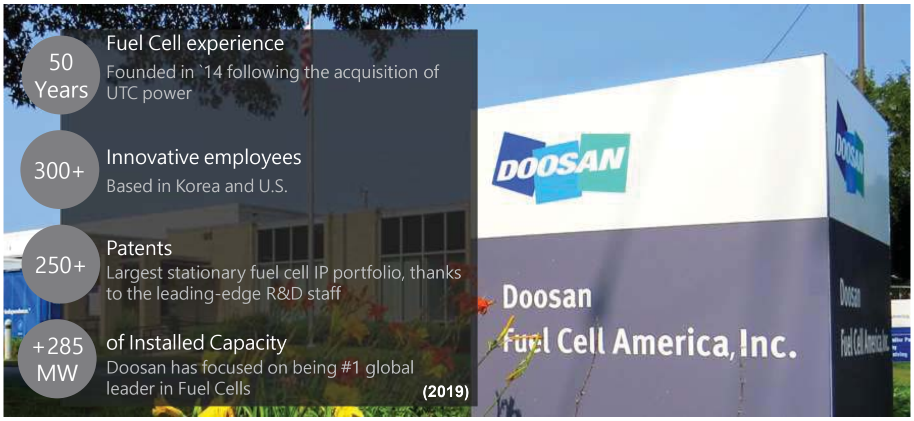
Employees (2018)



- ✓ Overseas affiliate 36
- ✓ Overseas entity 109



DOOSAN FUEL CELL

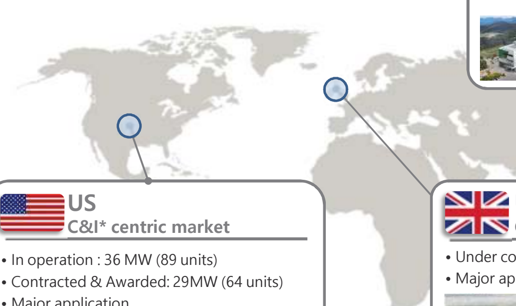


- **50 Years** — Fuel Cell experience: Founded in `14 following the acquisition of UTC power
- **300+** — Innovative employees: Based in Korea and U.S.
- **250+** — Patents: Largest stationary fuel cell IP portfolio, thanks to the leading-edge R&D staff
- **+285 MW** — of Installed Capacity: Doosan has focused on being #1 global leader in Fuel Cells

(2019)

GLOBAL PureCell 400® FLEET

In operation : 170 MW (395 units)
Under construction : 227 MW (514 units)

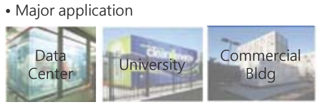


Korea
Utility centric market

- In operation : 134 MW (306 units)
- Under construction : 197 MW (447 units)
- Major application - Utilities

US
C&I* centric market

- In operation : 36 MW (89 units)
- Contracted & Awarded: 29MW (64 units)
- Major application



UK
C&I* centric market

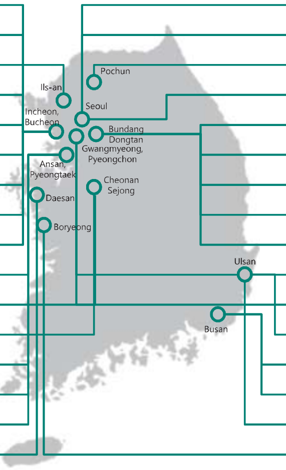
- Under construction : 1.2 MW (3 units)
- Major application

* Commercial & Industrial buildings *2019.4.29*

KOREA PureCell 400® FLEET

Total 331 MW (753 units)		
	Operation	134 MW (306 units)
	Under Construction/ Contracted	197 MW (447 units)

- SK IPC Hydrogen (2019, 0.44MW) H_2
- KHNP Songrim (2020, 39.60MW)
- E.W Power Ilsan 4 (2018, 5.28MW)
- W Power West Incheon 2 (2016, 5.72MW)
- S Power New Incheon 2 (2019, 18.48MW)
- S Power New Incheon 3 (2019, 20.24MW)
- W Power New Incheon 3 (2019, 18.04MW)
- M Power Incheon 1 (2019, 15.84MW)
- GS Power Bucheon (2019, 10.56MW)
- PTES 1/2 (2013/18, 3.08MW each)
- W Power Cheongsu (2019, 5.28MW)
- M Power Sejong (2019, 5.28MW)
- Eugene Oseong (2018, 9.68MW)
- Petroconergy Baegot (2017, 6.16MW)
- S.E Ansan (2014, 2.64MW)
- Hanwha Daesan (2020, 50.16MW) H_2



- SK E&S Gangdong (2020, 19.8MW)
- Lotte Tower (2013, 0.80MW)
- Pochun Private (2017, 0.44MW)
- Park One (2020, 0.88MW)
- S.E Bundang 2 (2013, 3.08MW)
- S.E Bundang 3 (2016, 5.72MW)
- S.E Bundang 4 (2018, 16.72MW)
- S.E Bundang 5 (2018, 5.72MW)
- KDHC Dongtan (2018, 11.44MW)
- GS Power Anyang (2011, 4.8MW)
- Samchully Gwangmyeong (2017, 2.64MW)
- SK Gas Ulsan (2018, 0.44MW) LPG
- KHNP BGE (2017, 30.8MW)
- Busan I.F.C (2014, 0.40MW)
- Booksam spa (2019, 0.88MW)
- M Power Boryeong (2017, 7.48MW)

MANUFACTURING FACILITY

120 MW production facility
with over 50 years of manufacturing experience

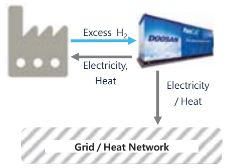
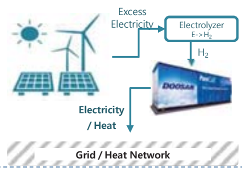
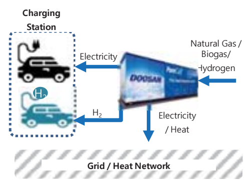
1ST FACTORY Conneticut, U.S.
60MW production facility

2nd FACTORY Iksan, Korea
60MW production facility

World-Class Quality System
Leveraging aerospace legacy

- Automated cell stack fabrication and assembly
- Long term strategic suppliers
- State-of-the-art factory performance test
- ISO 9001 & ISO 14001 Certified

NEW APPLICATIONS

	Description		Advantages
By-product H_2 from chemical plants	• Vent-off H_2 from Petrochemical plants etc. can be utilized to supply captive energy by using FC		• Commercial utilization of excess H_2 • 'Zero' emission • Improved Air Quality
Power To Power	• Hydrogen is produced with the electricity from the renewables then the hydrogen can be used to generate electricity with fuel cell		• Compliment intermittency • Improved flexibility options (hydrogen can be stored)
Tri-Gen			• Better financial stability • Reduced Carbon • Improved Air Quality

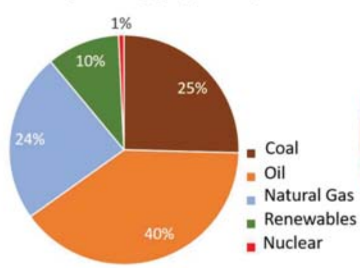
2nd International Forum on Low Carbon Development for Cities

Japan's activity on hydrogen energy

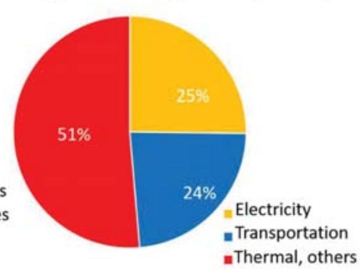
3 September, 2019
Eiji Ohira
New Energy and Industrial Technology Development Organization (NEDO)

Background: Japan's Energy Situation

Primary Energy (2016)

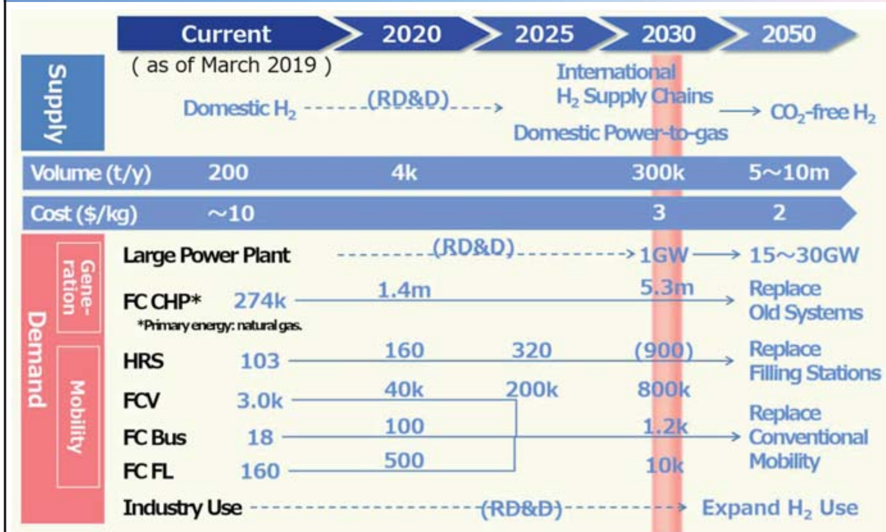


Energy Consumption (2016)

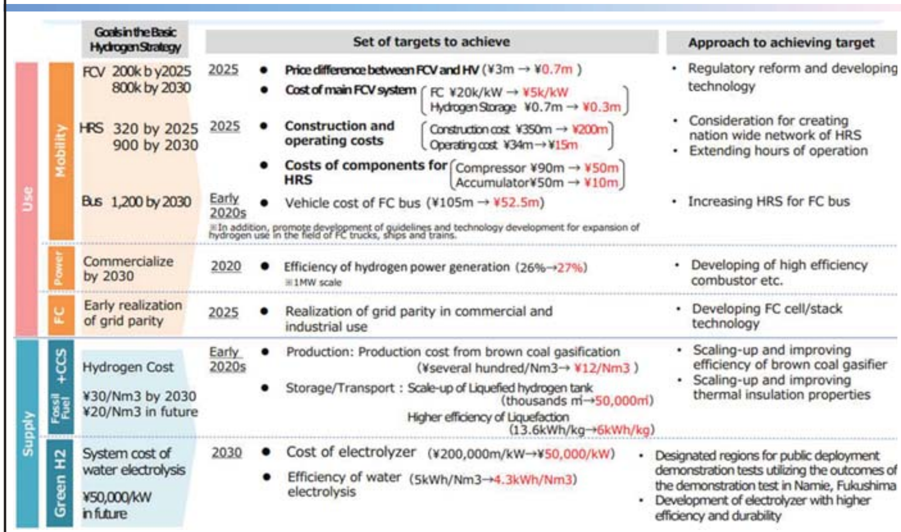


- **Target**;
  - ✔ Reducing GHGs
    ▲26% in 2030 / ▲80% in 2050
  - ✔ Increasing self-sufficiency rate
    around 40% (in 2030)
- **Measures**;
  - ✔ Energy saving
  - ✔ Renewable energy
  - ✔ Nuclear energy
  - ✔ CCS + Thermal power
  - ✔ Hydrogen

Policy: “Basic Hydrogen Strategy”



Action Plan: “Strategic Roadmap for HFC”



Current status of Fuel Cell application

Residential Fuel Cell "Ene-Farm" (Launched in 2009)

0.7kW Power + Hot water:
total efficiency > 90%

314k unit = 220 MW as of June 2019

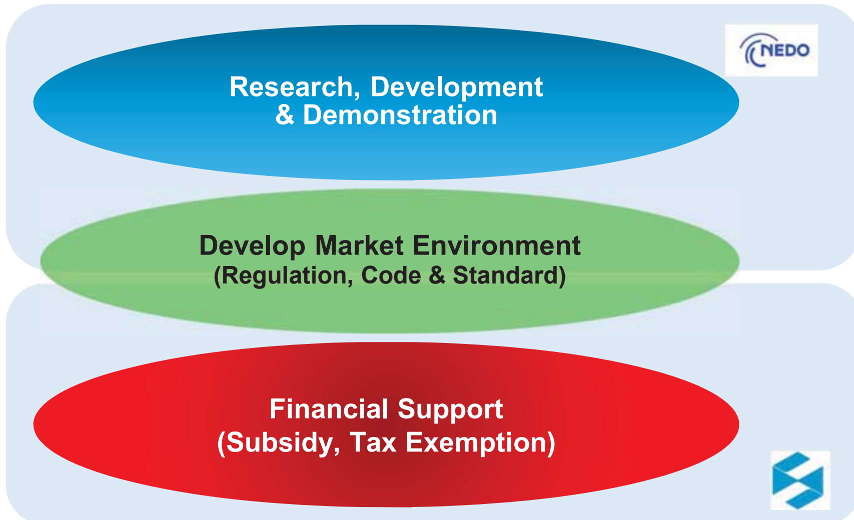
for Commercial Use (Launched in 2017)

Kyocera: 3kW SOFC

MHPS "MEGAMIE": 250 kW

Current status of Fuel Cell application

Policy Measures for introducing New Technology



Current METI/NEDO budget related hydrogen

Subsidy: operated by METI

(1) Stationary fuel cell: JPY 5.2 billion (US$ 48 million)
(2) Hydrogen Refueling Station: JPY 10 billion (US$ 92 million)
(3) Clean Energy Vehicle: JPY 16 billion (US$ 148 million)
- for BEV, PHEV, Clean Diesel, FCV

R&D, D: operated by NEDO

(1) Fuel Cell: 3.8 billion (US$ 35 million)
(2) Hydrogen Refueling Station: JPY 3 billion (US$ 28 million)
(3) Hydrogen Energy System: 17.7 billion (US$ 163 million)
- Hydrogen Gas Turbine, Hydrogen Transport, Electrolysis, Power to Gas, etc.

Current Direction of NEDO's Program

First Step: Promoting fuel cell application

Fuel Cells:

(1) PEFC: for mobility

- Target: 0.03-0.1 g-PGM/kW (depend on durability), 50,000 hrs. life time (commercial vehicle), Power Density:> 4kW/L (in 2030)
- Focusing on basic research to accelerate material / MEA development
- Improving productivity

(2) SOFC: for stationary use

- Complete co-generation model (> 50%) by 2017
- New target: >60% efficiency (mono-generation)

Hydrogen Refueling Station:

Reducing CAPEX / OPEX

- To address regulatory reform on FCV/HRS in Japan
  ex. Unmanned operation with remote monitoring, Risk assessment on HRS, etc.
- Developing low cost equipment (incl. Electro-chemical compressor, polymers, etc.)

Current Direction of NEDO's Program

Second Step: Develp H2 demand & Integrate w/ energy system

Hydrogen Supply Chain / Gas Turbine:

- Developing combustor for Hydrogen Gas Turbine
  Control of combustion for low NOx, back fire, etc.
- Realizing large scale hydrogen supply chain
  Hydrogen carriers for long distance transportation

Power to Gas:

- Developing System Technology
  System Operation, Energy management, Demand response
- Improving electrolysis technology
  Analyzing reaction mechanism, develop lifetime evaluation, etc. (Alkaline, PEM, SOEC)

RD&D: Scaling-up

1MW H_2 Gas-Turbine Demo Plant

Japan-Australia H_2 Supply Chain Project

FH2R

10MW Electrolysis PtG Demo

NEDO

Thank you!

Yokohama's "Hydrogen Society" Initiatives

Climate Change Policy Headquarters,
City of Yokohama

Zero Carbon Yokohama

OPEN YOKOHAMA

- Overview of Yokohama
- Plan of Japan
- Plan of Yokohama
- Efforts of Yokohama

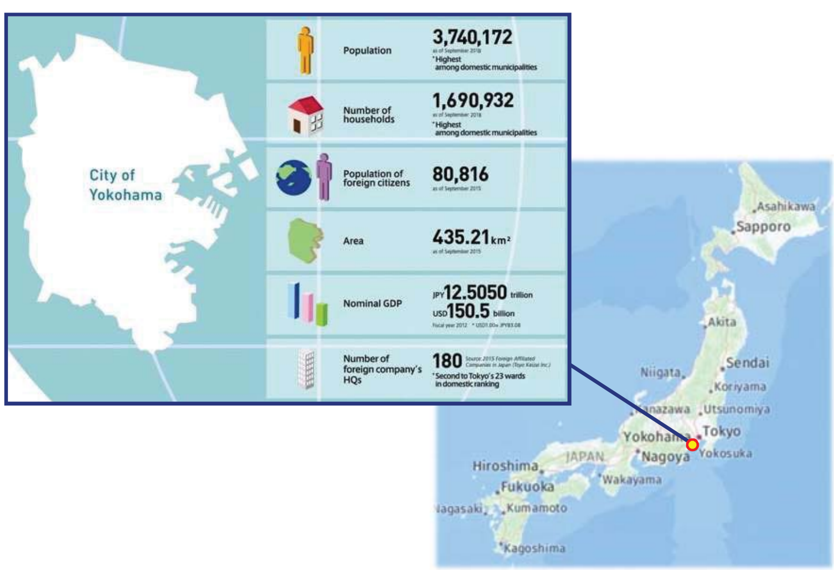
Overview of Yokohama

Plan of Japan

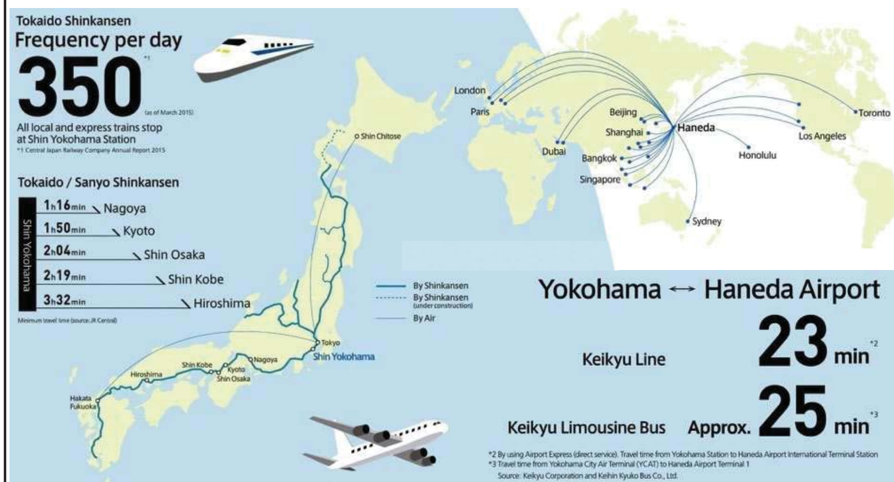
Plan of Yokohama

Efforts of Yokohama

Overview of Yokohama



Overview of Yokohama



Overview of Yokohama

TATSUNO

CHIYODA CORPORATION

JXTGエネルギー

YNU 横浜国立大学 YOKOHAMA National University

Overview of Yokohama

Plan of Japan

Plan of Yokohama

Efforts of Yokohama

Significance of utilization of "hydrogen"

1． Energy conservation / Low carbon

- Because high energy efficiency is realized by utilizing fuel cell, we can significantly save energy. Since carbon dioxide is not discharged at the utilization stage, it can be energy that does not emit carbon dioxide by utilizing hydrogen derived from renewable energy or by combining CCS* at the time of production.

*CCS: Recovery and storage of carbon dioxide

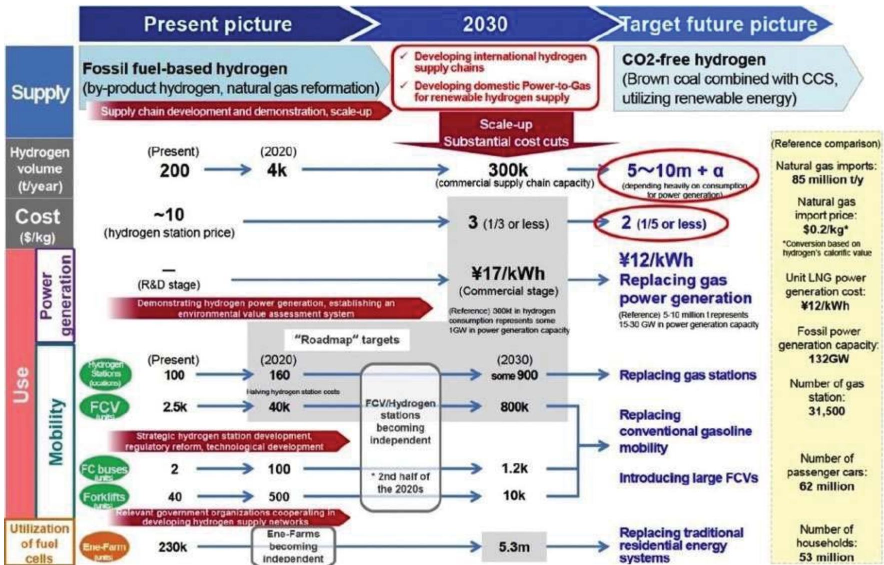
2． Disaster-resistant town development · Diversification of energy supply sources

- Stationary fuel cells and fuel cell vehicles / buses can be used as emergency power supplies
- It can be manufactured from various primary energy sources such as unused energy such as by-product hydrogen and crude oil-associated gas, renewable energy, etc. There is a possibility that it will be added to the choice of energy other than fossil fuel in the future.

3． Industry Promotion / Regional Revitalization

- The base of fuel cell related industry is wide and Japan has strong competitiveness
- In hydrogen production, it is also possible to utilize regional resources such as renewable energy.Therefore, there is a possibility that it will lead to local areas.

Plan of Japan（Basic Hydrogen Strategy）



- Overview of Yokohama
- Plan of Japan
- **Plan of Yokohama**
- Efforts of Yokohama

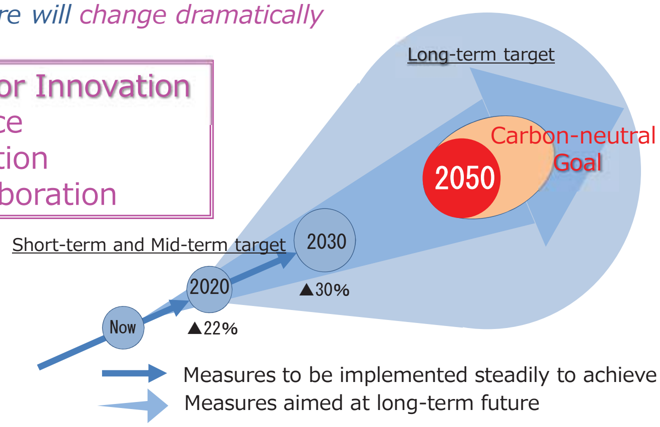
Plan of Yokohama

Yokohama city Action Plan for Global Warming Countermeasures

Yokohama City's Aim : Zero Carbon Yokohama

Social structure will change dramatically

● Points for Innovation
①Choice
②Creation
③Collaboration



Zero Carbon
Yokohama

Plan of Yokohama

Yokohama city Action Plan for Global Warming Countermeasures

- Positioning the future image "town that is skillfully using renewable energy" and promote the utilization of hydrogen energy to realize a hydrogen society with a view to the future.
- Major measures
  - Examination of digestion gas increase using MBT (Mechanical Biological Treatment) system
    - Accept the city's biomass to sewage facilities and increase digestion gas as a raw material of hydrogen by methane fermentation utilizing the existing digestion tank
  - Promoting of surface use of hydrogen etc.,
  - Promoting of construction of hydrogen stations
  - Promoting of diffusion of fuel cell vehicles (FCV)
  - Promoting of diffusion of fuel cell bus

Overview of Yokohama

Plan of Japan

Plan of Yokohama

Efforts of Yokohama

Efforts of Yokohama

① Promoting of introduction of fuel cell vehicles

- Fuel cell vehicles
- Fuel cell bus

② Promoting construction of hydrogen refueling stations

- Hydrogen refueling stations

③ Promoting dissemination of stationary fuel cells

- Residential fuel cells (Ene-Farm)
- Fuel cells of industrial or commercial use

④ Keihin Project (Low-Carbon Hydrogen Supply Chain Demonstration Project)

⑤ Public awareness

⑥ Information transmission and cooperation

① Promoting introduction of fuel cell vehicles

Fuel cell vehicles

- Introduced 13 fuel cell vehicles in total for public vehicles
  Planning to introduce three vehicles in FY2019.
  In principle, EV or PHV or FCV will be introduced as public vehicles from FY 2020.
  All public vehicles will be next generation vehicles by FY 2030.
- Implemented subsidies for purchasing FCV for citizens and business operators.
  ・Budget in FY2019 : 250,000 yen (2,300 USD) per car × 60
    ※ Total subsidies of Japan, Kanagawa prefecture and Yokohama city is 2.97 million yen (27,700USD)
    ※ MIRAI:6.7million yen(62,500USD)（Tax excluded）
- About 100 fuel cell vehicles spread in the city (at Jul.2018)

Fuel cell bus

- With the "Rugby World Cup 2019™" as the opportunity, plan to introduce the FC bus to the Yokohama municipal bus in FY2019.

Public vehicle（FCV）

FC-Bus "SORA"
(Source: TOYOTA)

② Promoting construction of hydrogen refueling stations

Hydrogen stations

- Six* commercial hydrogen refueling stations are developed and operated.（Stationary type is 4, mobile type is 2 and simple type is 1.）
  * highest among domestic municipalities.
- Implementation of construction cost for promotion
  Budget in 2019 : Stationary type 40million yen (373,000 USD), mobile type 1.2million yen (11,200USD),simple type 10million yen (93,300USD)

Yokohama's Hydrogen Refueling Stations

<Stationary type>
① Asahi Ward (opened Feb 2015)
② Izumi Ward (opened Feb 2015)
③ Minami Ward (opened Mar 2016)
④ Kohoku Ward (opened Mar 2017)
<Mobile type>
⑤ Naka Ward (opened Nov 2015)
⑥ Tsuzuki Ward (opened Feb 2016)
<Simple type>
● Tsurumi Ward (opened Mar 2018)

◆ Hydrogen production & shipping center（Naka Ward)
※ Hydrogen is supplied to stations inside and outside the city
★ City Hall

Stationary type : Tsunashima Hydrogen Station
Source: JXTG Energy Co., Ltd.

Mobile type : Oosanbashi Hydrogen Station

Simple type : Renewable Energy Hydrogen Station (Kanagawa Prefecture)

③ Promoting dissemination of stationary fuel cells

Residential fuel cells (Ene-Farm)

- Approximately 16,000 residential fuel cells (Ene-Farm) are using in the city (at the end of Mar 2018)
- Implemented subsidies for purchasing Ene-Farm for citizens. (Budget in 2019 : 30,000yen(280USD) per unit ×300)

Residentia fuel cells (Ene-Farm)
(Source: Tokyo Gas Co., Ltd.)

Fuel cells of industrial or commercial use

- Commercial fuel cells (200KW) will be introduced in the new city hall building to be used from 2020
- Hydrogen-based Autonomous Energy Supply System has been set in Yokohama Port Cargo Center (Y-CC) for a demonstration experiment in an energy management and usage energy in case of disasters.
- Implemented subsidies for purchasing commercial fuel cells. (Budget in 2019 : 100,000yen(930USD) per 1KW,total is up to 2.5million yen per unit)

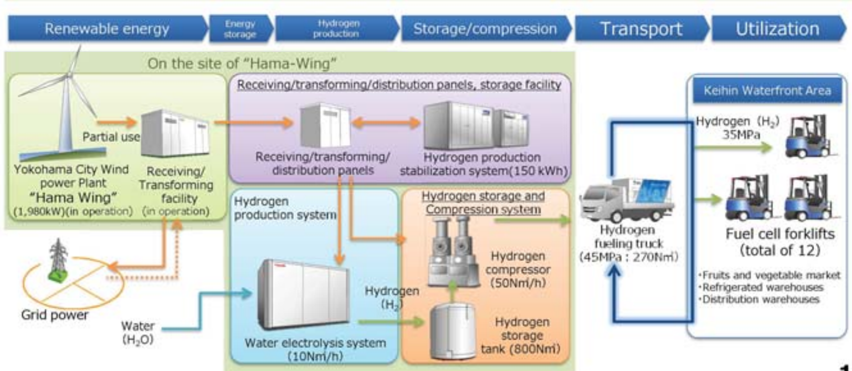
New City Hall

Hydrogen-based Autonomous Energy Supply System
(Source : Toshiba Energy Systems Co., Ltd.)

④ Keihin Project
(Low-Carbon Hydrogen Supply Chain Demonstration Project)

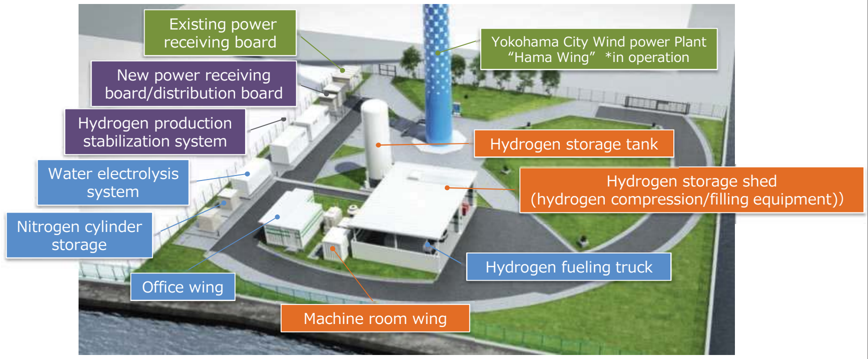
The project intends to carry out a demonstration of the supply chain through the storage and delivery of low-carbon hydrogen produced at the Yokohama Wind Power Plant (Hama Wing) to power fuel cell forklifts, thereby contributing to future regional development and global warming countermeasures.
【 Ministry of the Environment commissioned project 】

環境省 Ministry of the Environment



④ Keihin Project
(Low-Carbon Hydrogen Supply Chain Demonstration Project)

Model of Hama Wing site premises



④ Keihin Project
(Low-Carbon Hydrogen Supply Chain Demonstration Project)

Specific items to be verified by the project

The business case for hydrogen supply chains and future expansion to other regions will be verified, through cost analysis and measurement of the project's contribution to global warming countermeasures.

- Hydrogen cost

  The demonstration project will use evaluations of current conditions (demonstration project costs) to examine future courses of action required to reduce hydrogen costs, including verification of savings from economies of scale and identification of the steps needed to implement deregulation.

  The project will also examine the development of a promotional and deployment model through technological innovation, as well as the development of full-scale supply chains, based on projections of needs in 2030.
- CO2 emissions reductions

  The project aims to construct a low-carbon hydrogen supply chain that can reduce overall CO2 emissions by about 80% when compared with conventional approaches.

  The project will examine measures for further reducing CO2 emissions.

⑤ Public awareness

In cooperation with neighboring municipalities etc., we conducted test drive and exhibition of fuel cell vehicles at various events such as public awareness event of next-generation automobile etc.

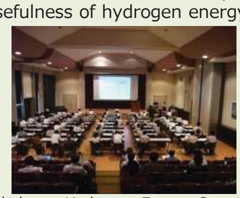
Creation of a leaflet for easy understanding of hydrogen energy

Participation in the planning of portal site on hydrogen energy

⑤ Public awareness

Yokohama Hydrogen Energy Council

Participate in industry-academia-government collaborative organization "Yokohama Hydrogen Energy Council" which aim to create "Kanagawa model for safe hydrogen energy" by returning research results on reliability, safety and usefulness of hydrogen energy to society



Yokohama Hydrogen Energy Council Establishment Commemoration Seminar

A
Yokohama National University
- Green Hydrogen Research Center
- Risk symbiosis society Creation center

Yokohama Hydrogen Energy Council
Planning of events for awareness raising activity

I
- JXTG Energy Co., Ltd.
- Iwatani Sangyo Co., Ltd.
- Chiyoda Corporation Construction Co., Ltd.
- Tokyo Gas Co., Ltd.
- Toshiba Energy Systems & Solutions Corporation
- Nissan Motor Co., Ltd.
- Hitachi, Ltd.

G
- Kanagawa pref.
- Yokohama city
- Kawasaki city
- Sagamihara city

Show Room (suiso terrace)

JXTG Nippon Oil & Energy Corporation opened a show room named "suiso terrace" at Yokohama Tsunashima Hydrogen Station.

Source: JXTG Nippon Oil & Energy Corporation

⑥ Information transmission and cooperation


ICHS2015 YOKOHAMA
(International Conference on Hydrogen Safety)


IPHE2018 YOKOHAMA

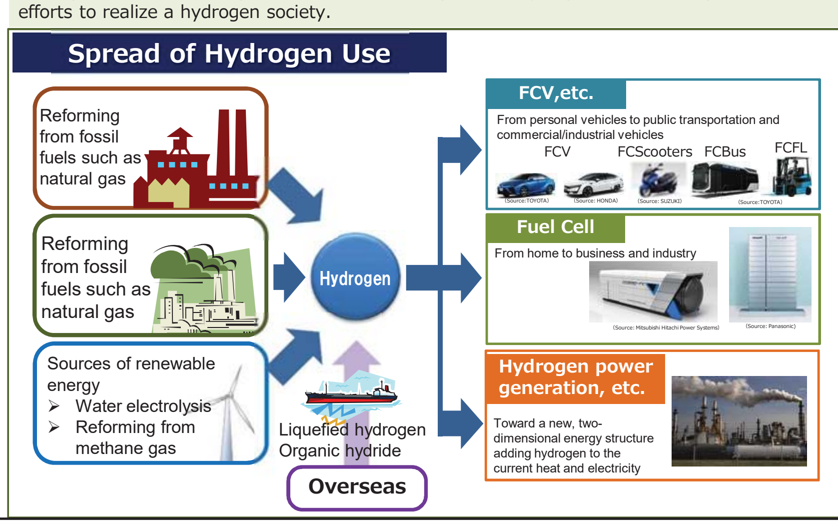

The 6th China(Shanghai) International Technology Fair 2018


Facility tour

Spread of Hydrogen Use

The technology of companies and expertise of universities in Yokohama possess great potential for each of the stages in manufacturing, transporting/storing and using hydrogen

In cooperation with all of you, such as the country, related groups, etc., we will proceed efforts to realize a hydrogen society.



SDGs

SDGs FutureCity Yokohama

Vision

Realizing a city that creates new value and prosperity through its economy, culture, and the arts, With the environment at its heart.

Zero Carbon Yokohama

Chinatown

Minato Mirai

Yokohama Port Opening Memorial Hall

Thank you for your attention.

Yamate Diplomat's House

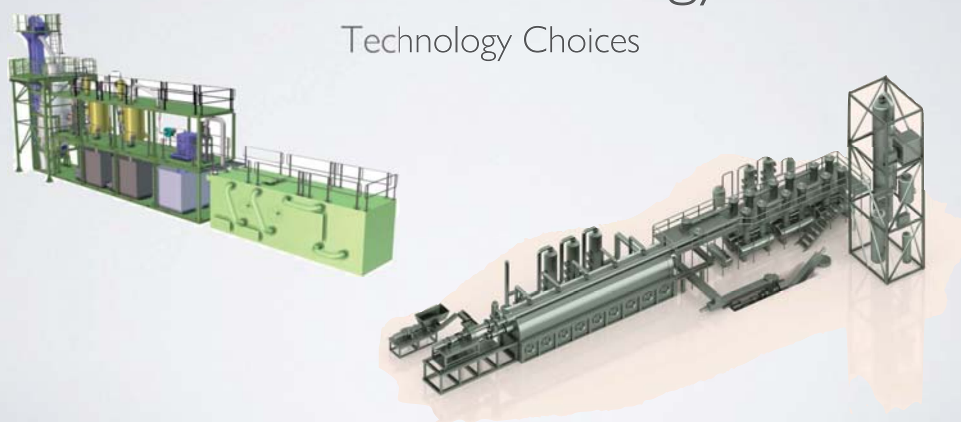
Sankeien Garden

Zoorasia Yokohama

Scandgreen Energy AB

Waste to Energy

Technology Choices



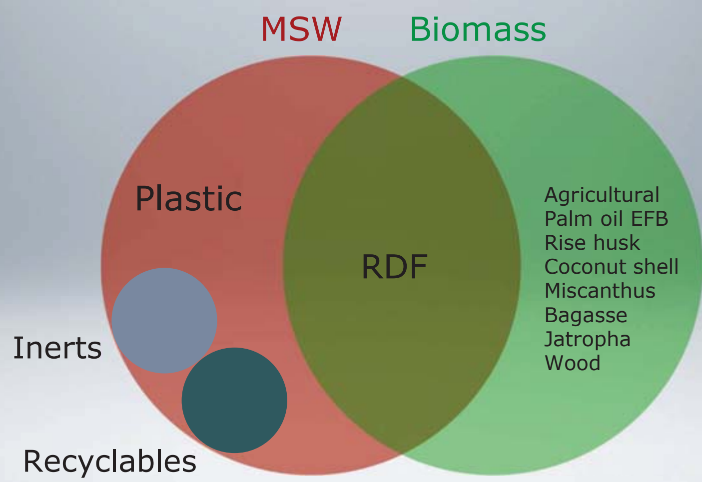
WHAT TO DO WITH THE WASTE?

Bury it!

Burn it!

Don’t talk about it!

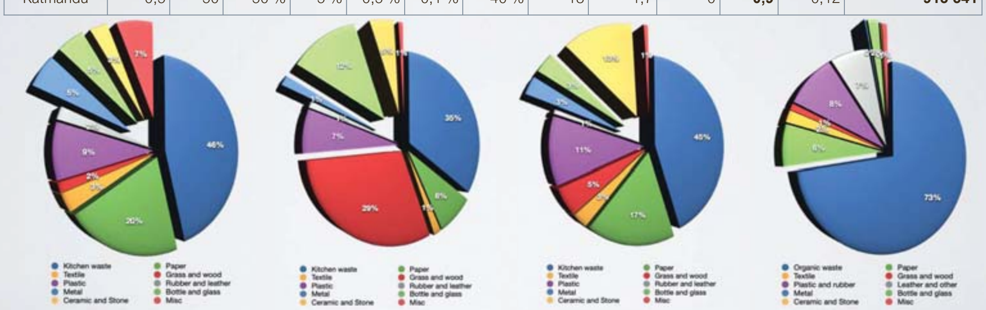
WHAT IS WASTE?



Waste is a resource in the wrong place

Different markets, different needs

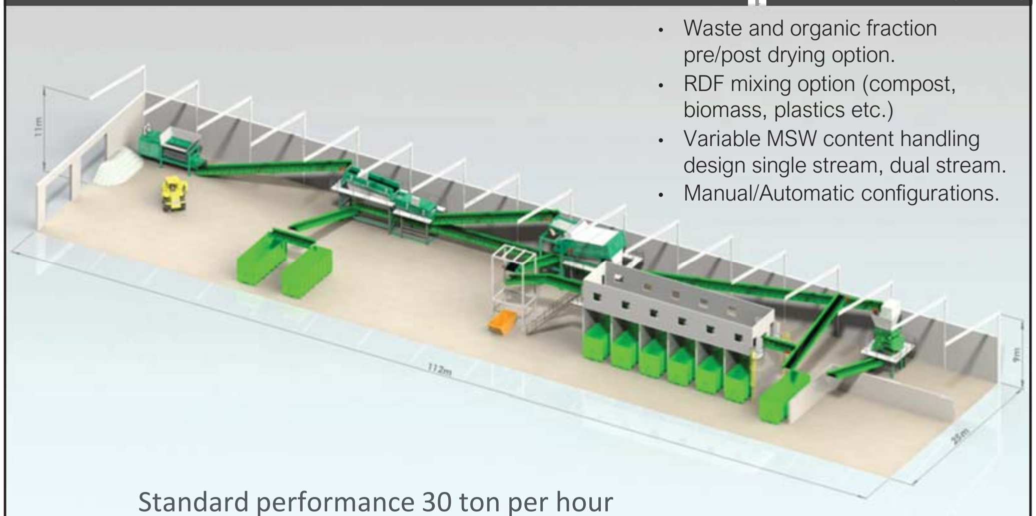
Market	MSW rate	MSW	Collect	Inerts	FE	NF	Water	Ener.	Heat	Price	Electr	Price	Revenue
	kg/cap/d	*tpd*			*$180*	*$1000*		*MJ/kg*	*MW*	*USD*	*MW*	*USD*	*USD per year*
Athens	1,1	110	90 %	15 %	2,6 %	0,3 %	30 %	21	8,4	0,02	**4,5**	0,2	**8 728 134**
Sofia	1	100	80 %	19 %	1,2 %	0,3 %	30 %	20	6,1	0,02	**3,3**	0,2	**6 409 006**
Montevideo	0,9	90	70 %	19 %	2,6 %	0,3 %	30 %	20	4,8	0	**2,6**	0,17	**3 637 826**
Katmandu	0,5	50	50 %	5 %	0,5 %	0,1 %	40 %	18	1,7	0	**0,9**	0,12	**913 541**



Athens **Sofia** **Montevideo** **Katmandu**

Standard Materials Recovery Facility (MRF)

The Solution:
Materials Processing Facility



- Waste and organic fraction pre/post drying option.
- RDF mixing option (compost, biomass, plastics etc.)
- Variable MSW content handling design single stream, dual stream.
- Manual/Automatic configurations.

Standard performance 30 ton per hour
Annual nominal capacity 150 000 tonnes

Recycle, upcycle or recover energy?

The Waste Problem:
Plastics

We convert this to gas and liquid fuels without emissions.

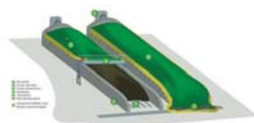
We turn organics into compost or combustibles

MSW

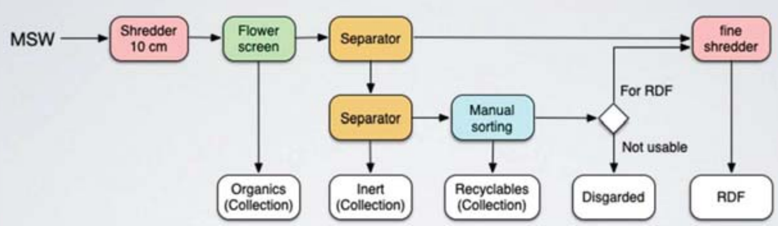
MRF/Separation

CSR (WDF) | Organics | Recyclables

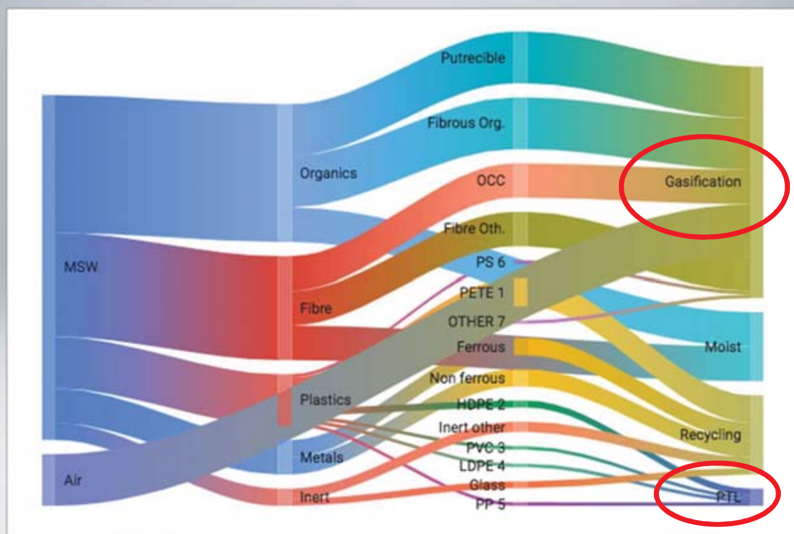
Biochemical treatment (for compost and/or combustibles for gasification etc.)



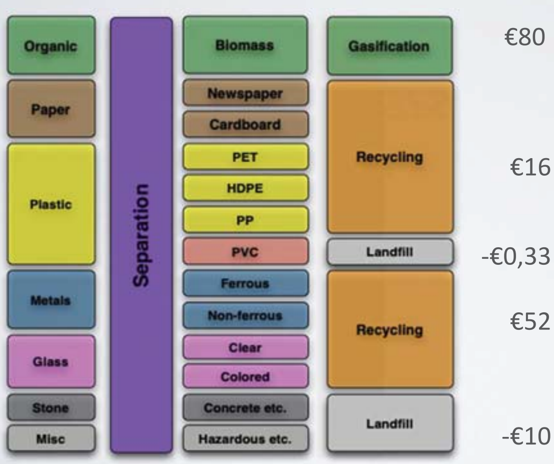
MSW SORTING



The key to waste treatment is in the sorting



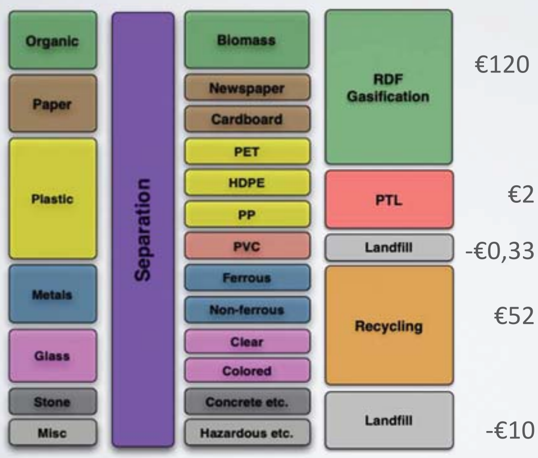
Case study; recycling focus



RDF reforming:

Total €138
per ton waste

RDF gasification & plastic pyrolysis



RDF reforming:

Total €164
per ton waste

THERMAL GASIFICATION

GASIFICATION vs. COMBUSTION/INCINERATION

- Studies has shown that Gasification is superior to Combustion in regards to Environmental Gases
- Gasification with Generator Set has a higher efficiency than Combustion with Steam Turbine
- Syngas is superior as a waste product since it could be used as fuel as well as raw material
- Gasification assumes waste assortment which improves recycling
- Gasification units could be built in modules and are relatively small. For Electricity units conventional gas generators could be used. Combustion uses complex Steam Turbine generators.

THERMAL GASIFICATION VERSUS INCINERATION

THERMAL GASIFICATION
Temperature ~1100°C
Oxygen starved
Creates fuel and commercial solids

INCINERATION
Temperature ~600–800°C
Oxygen injected
Creates exhaust and toxic solids

CO	C carbon	**CO_2**
H_2	H hydrogen	**H_2O**
N_2	N nitrogen	**NO_x**
inert sulfides	S sulphur	**SO_x**
	O oxygen	**O_3**

THERMAL DOWNDRAFT GASIFICATION

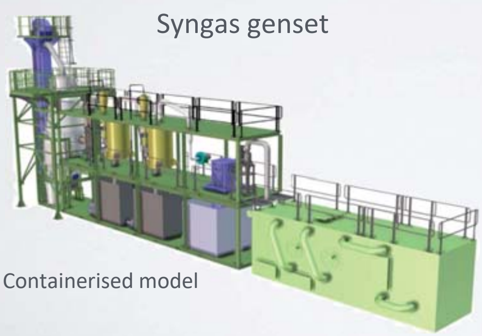
EUROPEAN MAKE WITH MATERIAL RECOVERY AND RDF PRODUCTION

Modularised design
with 250 kWe output

See link for video of MRF and gasification: https://youtu.be/5hv0pKuCchQ

MODULARISED GASIFIERS

Syngas genset



Containerised model

500 kW Slovakia

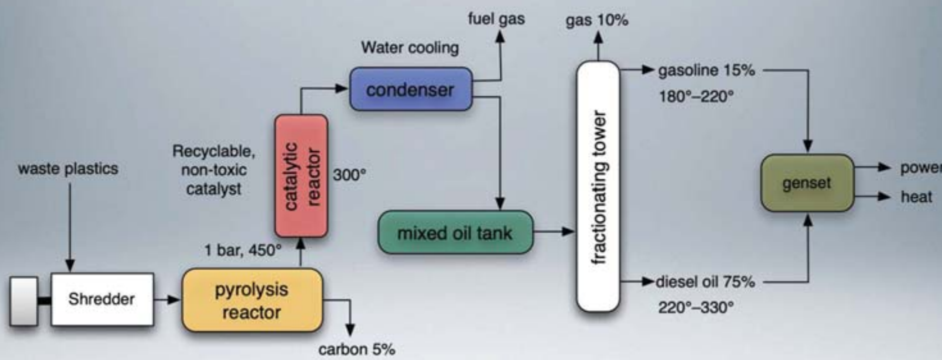
PTL plastic-to-liquid fuels

- Complement to RDF gasification
- Better use of plastic waste (CO_2 neutral)
- Shorter route to synthetic diesel
- Shorter return of investment - low entry threshold
- In operation Q2 2016

From Theory to Practice

First installation
Navojoa, Mexico

PLASTIC REFORMING



MODIFIED PYROLYSIS

Drop-in Diesel

intertek
Total Quality. Assured.

REPORT OF ANALYSIS

Date of Report	APRIL 11TH, 2017
Intertek Reference Number	MX01146-0000569
Vessel Name	NOT APPLICABLE
Port / Terminal	NOT APPLICABLE
Report Number	LAC-0474/17
Client Reference Number	NOT APPLICABLE

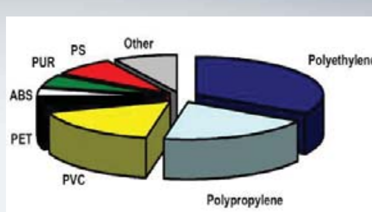
Customer Name	
Customer Address	
Customer Sample Description	
Sampling Place	
Drawn by	
Analyzed by	
Witnessed by (*)	
Submitted by	
Sample ID (Identification of the Sample Depending of the Customer)	DIESEL D3 (MUESTRA #03)
Sample Number (Sequencing of Samples)	MX01146-0000569-C
Date and Time of Sample	MARCH 28TH, 2017 From: NOT DATA To: NOT DATA
Date and Time of Reception	APRIL 07TH, 2017 16:00
Date and Time of Analysis	APRIL 10TH TO 11TH,2017 From: 09:30 To: 11:00

Diesel EN590 compliant
15–55 % less NOx
Less than 1 ppm SOx

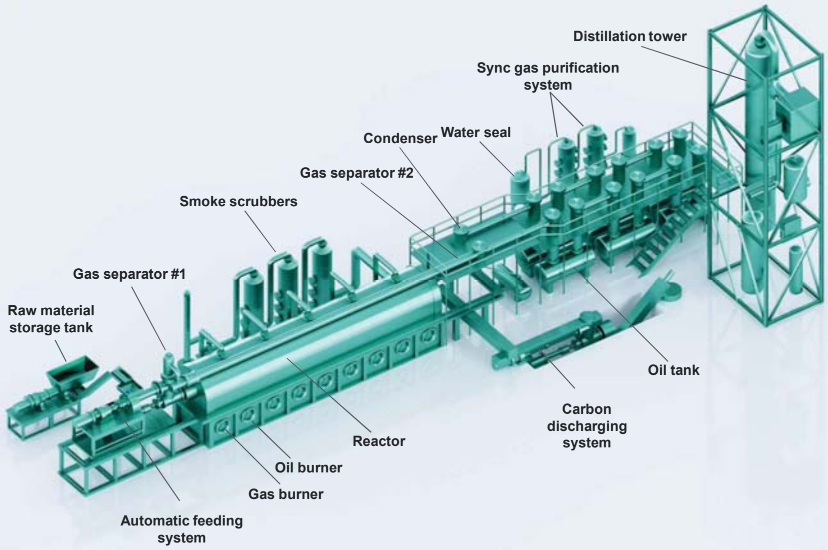
No.	Test Description	Method	Specification	Units	Results
1	KINEMATIC VISCOSITY AT 40°C (+)	ASTM D 445-15a	1,9 - 4,1	mm^2/S	2,008
2	FLASH POINT (+)	ASTM D 93-16	45 MIN.	°C	62,0
3	SULFUR CONTENT (+)	ASTM D 5453-16	500 MAX.	mg/kg	144
4	INITIAL BOILING POINT (+)	ASTM D 86-15	TO REPORT	°C	168,4
	AT 10% (+)	ASTM D 86-15	275 MAX.	°C	202,9
	AT 50% (+)	ASTM D 86-15	TO REPORT	°C	255,5
	AT 90% (+)	ASTM D 86-15	345 MAX.	°C	302,5
	FINAL BOILING POINT (+)	ASTM D 86-15	TO REPORT	°C	333,0
	PCT. RECOVERED (+)	ASTM D 86-15	TO REPORT	-	98,4
	PCT. RESIDUE (+)	ASTM D 86-15	TO REPORT	-	1,4
5	DENSITY AT 15°C (+)	ASTM D 4052-15	TO REPORT	kg/L	0,825 6
	SPECIFIC GRAVITY AT 60°/60° (+)	ASTM D 4052-15	TO REPORT	-	0,826 0
6	CETANE INDEX (+)	ASTM D 976-06 (2016)	45 MIN.	-	52,93

PLASTIC SORTING

65-80 % of waste plastic can be used for pyrolysis



CONTINUOUS PTL



Landfill leachate treatment

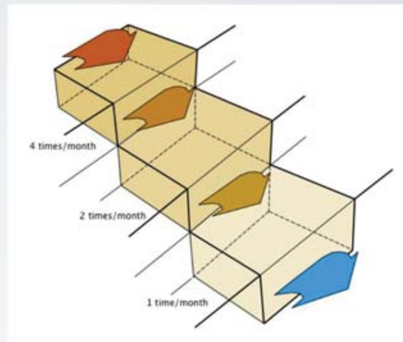
A leachate is any liquid that extracts soluble or suspended solids through which it has passed.

Leachate from a landfill varies widely in composition depending on the age of the landfill and the type of waste that it contains, ***but all landfills have leachate***.

ScandGreen Energy has together with RB Miljø developed a natural filter material based on peat moss, called **PBM**.

- PBM is a non-toxic, all natural, 100% organic, lab-tested, field proven, industrial absorbent that is economical, efficient, non-abrasive, non-toxic, non-leaching and in its natural state is already biodegraded. The inherent capillary action of the activated peat provides a powerful wicking action and encapsulates oils, solvents, heavy metals, pesticides, herbicides and all other organic chemicals on contact.
- PBM suppresses vapors and absorbs hydrocarbons on land or water, in dry or wet conditions, and does not require specially trained technicians or high tech equipment for handling or disposing of the spent peat.
- PBM that is used will not leech or discharge used pollutants, making it clean and easy to handle.
- PBM that is used can be incinerated or disposed of in landfills or land farmed with no detrimental effects to the environment.
- PBM is the ideal host for use in the microbial degradation/bio-remediation of contaminated land. It also contains HAC, a natural organic catalyst that accelerates the process of microbial degradation bringing the soil back to its original condition in a fraction of the usual time frame.
- PBM as an energy source contributes 19,5 MJ/kg excluding absorbed hydrocarbons, and burns to a residue of less than 2% of it's original volume.

LANDFILL LEACHATE TREATMENT



Contaminant	Input kg/m3	Output kg/m3	Absorb ratio
Fe (iron)	3,02	0,071	98 %
Zn (zink)	0,146	0,025	83 %
Cu (copper)	0,192	0,066	66 %
Cd (cadmium)	0,000448	0	100 %
SO_4 (sulphate)	13,4	0	100 %
Carbon hydrates	7,3	0	100 %
pH	2,6	7,54	8,15

Leachate filters in terrass tranche.
Each filter compartment will be replaced with intervals depending on the leachate contamination.

LANDFILL LEACHATE

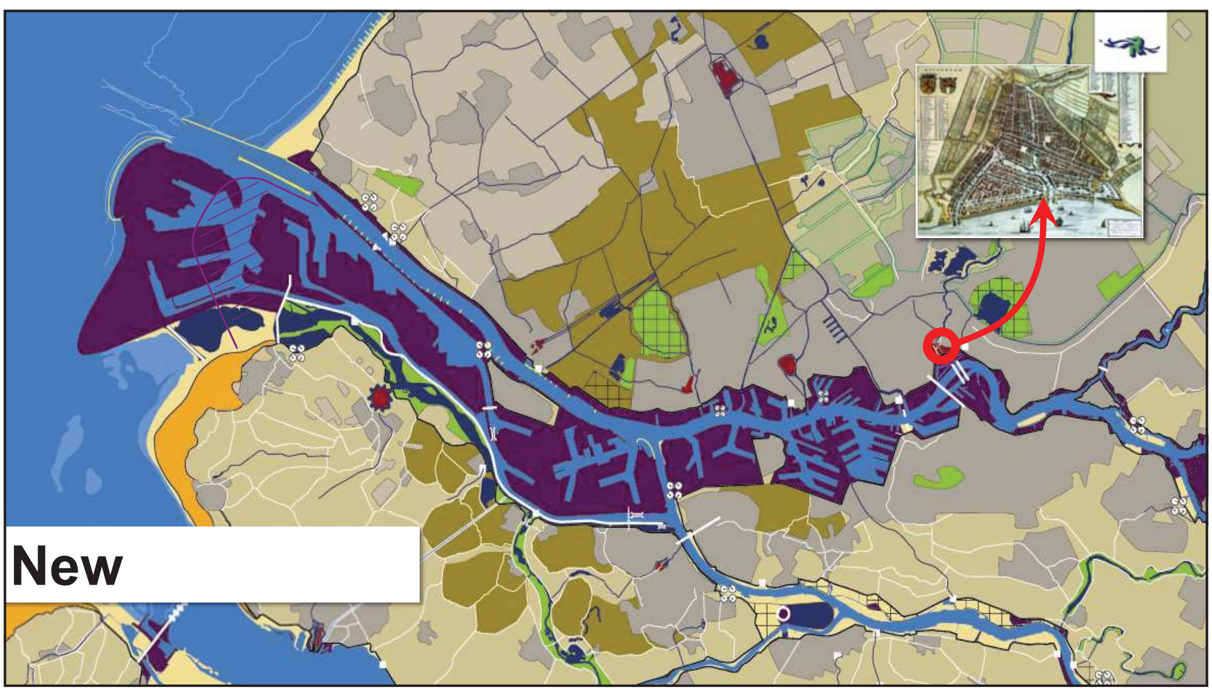
Organic contaminants in landfill leachate in Germany

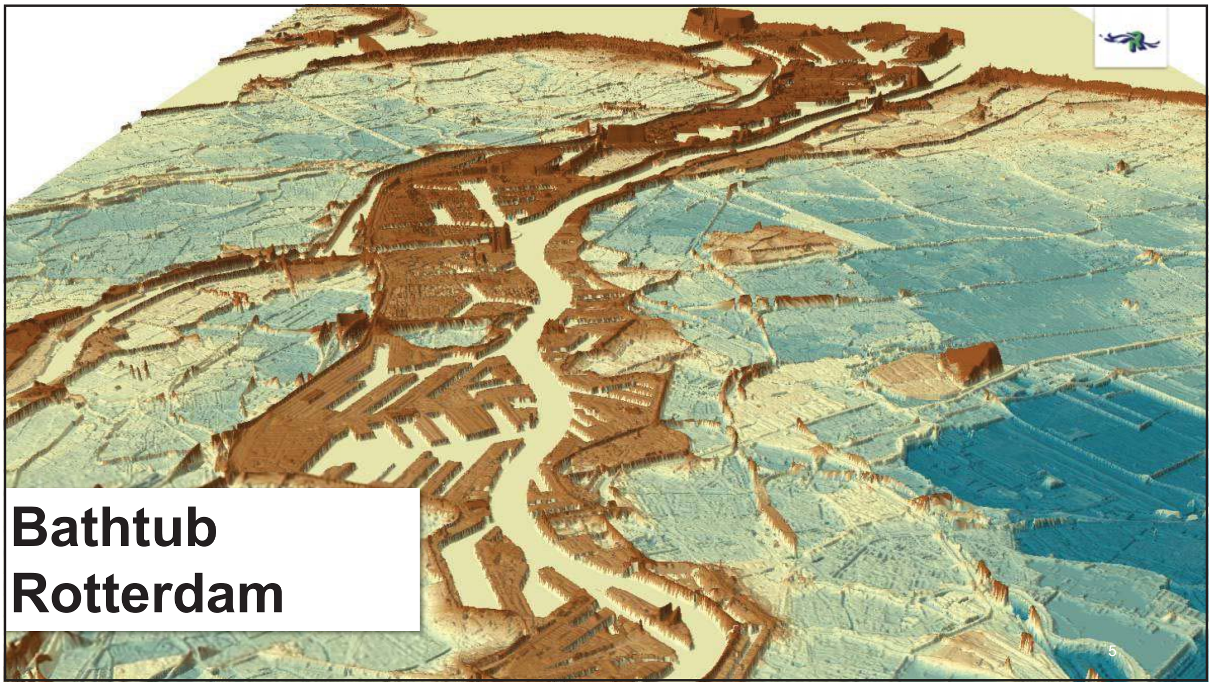
Parameter	Frequency of detection (%)[a]	Concentration (µg/L)	
		Mean	*Maximum*
Tetrachloroethene	70.4	56.1	6,500
Trichloroethene	55.6	1,010	128,000
cis-1,2-Dichloroethene	30.1	22,100	411,000
Benzene	29.1	141	1,800
1,1,1-Trichlorethane	22.8	16.5	270
m/p-Xylene	22.8	39.9	447
Trichloromethane	22.0	76.2	2,800
1,2-Dichloroethane	18.8	107	210
Chloroethene (VC)	17.7	1,690	12,000
Toluene	16.5	73.2	911
Dichloromethane	14.9	38,100	499,000
Tetrachloromethane	14.4	1.2	23
4-Methylphenol (*p*-cresol)	13.7	42.0	283
Chlorobenzene	12.9	52.9	388
2-Methylphenol (*o*-cresol)	12.9	10.0	63
1,2-Dichlorobenzene	12.2	1.4	6.6
1,4-Dichlorobenzene	12.2	31.9	265
Naphthalene	12.1	2.2	13
Ethylbenzene	11.3	32.2	160
o-Xylene	9.5	13.8	69
2,4,6-Trichlorophenol	8.9	3.2	24
3,5-Dimethylphenol	8.1	16.2	61
Phenol	8.1	2.2	5.6
1,3-Dichlorobenzene	7.8	11.5	74
trans-1,2-Dichloroethene	7.5	57.1	135
Isopropylbenzene (cumol)	5.6	2.4	4.7
1,1-Dichloroethane	5.4	52.7	110
Acenaphthene	4.8	6.3	32
2,4-Dichlorophenol	4.8	3.5	17
3-Chlorophenol	4.8	12.7	23
p-Cymol[*p*-$CH_3C_6H_4CH(CH_3)_2$]	4.4	1.9	3.5
2-Ethyltoluene	4.4	0.6	1.0
2,4,5-Trichlorophenol	3.9	7.1	31
1,3,5-Trimethylbenzene	3.3	1.7	4.0
Phenanthrene	3.2	1.5	4.4
Tribromomethane	3.1	3.0	6.0


Climate adaptation in
Rotterdam Urban design
Thuy Do
Public Works
City of Rotterdam


Rotterdam
delta city

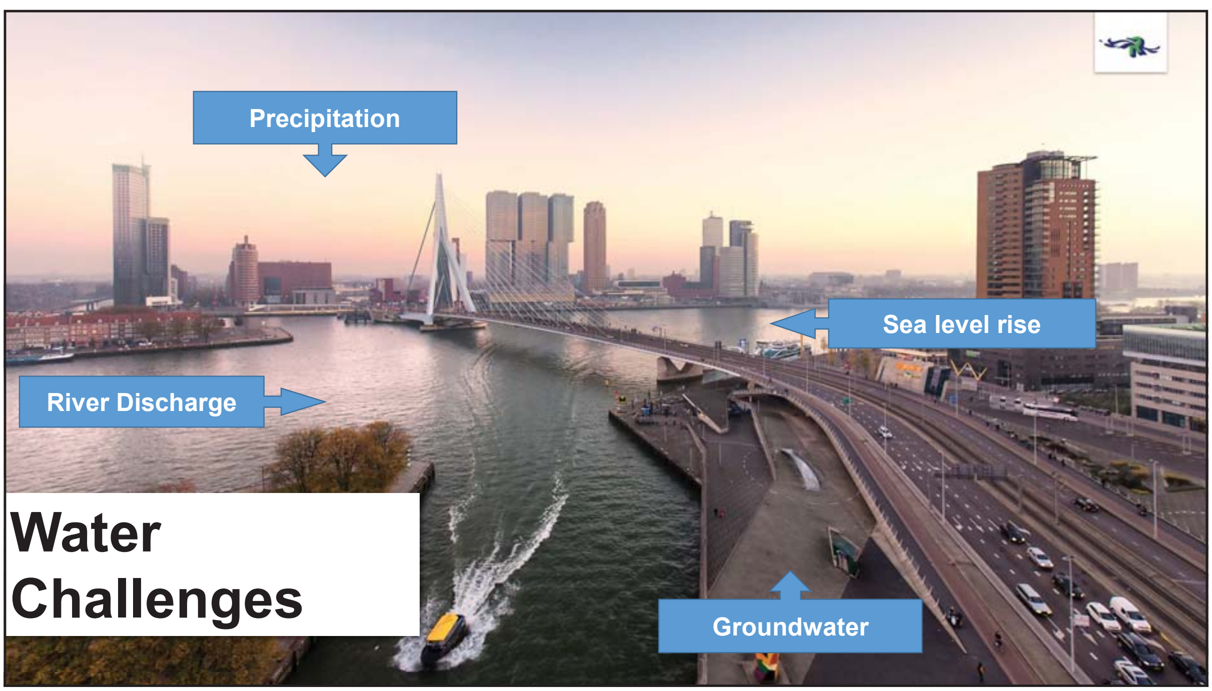

1270
1854
ROTTERDAM
Old

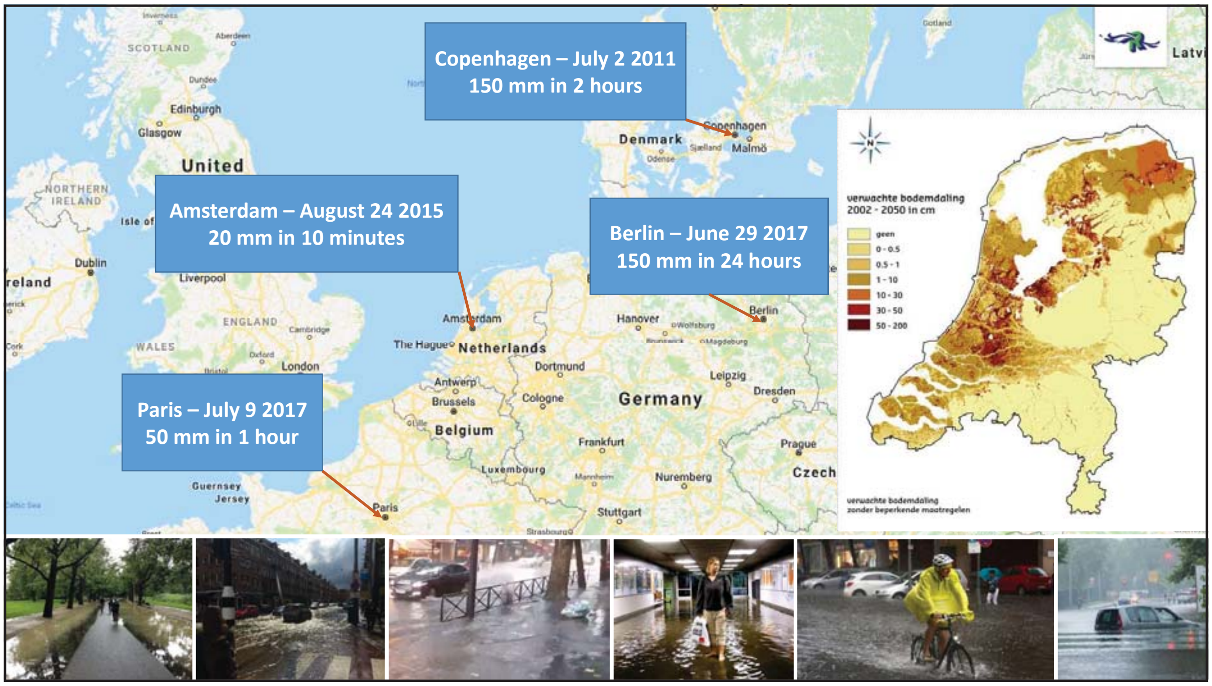

New

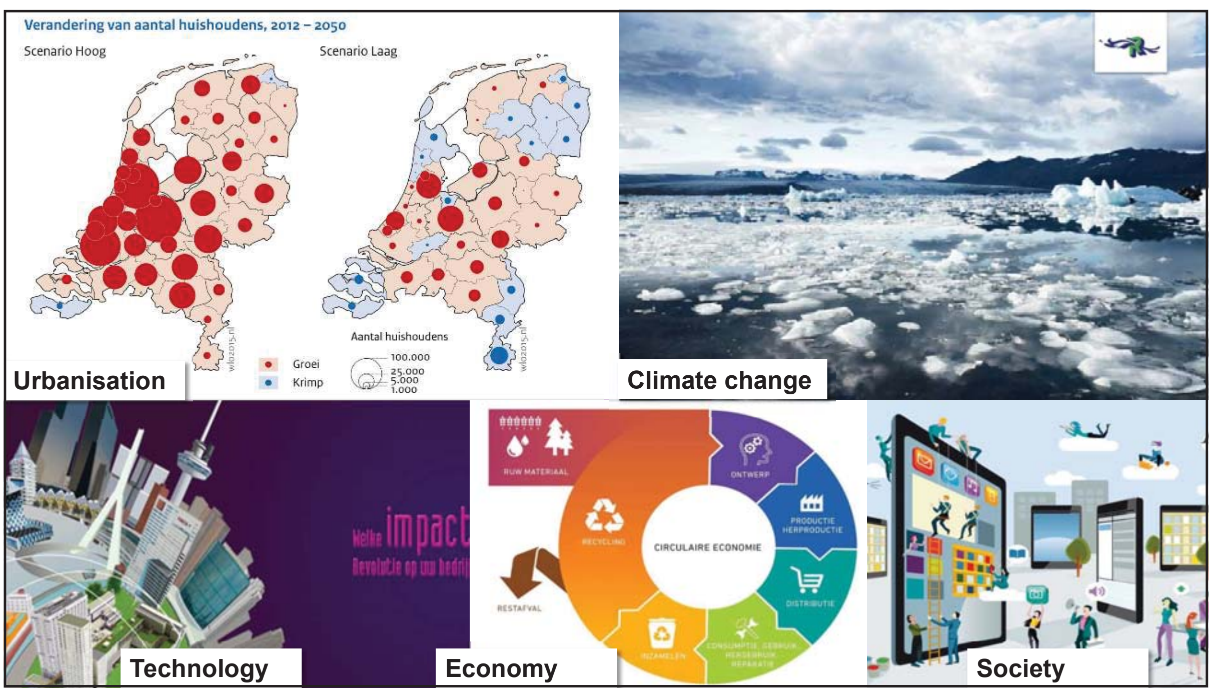

Bathtub
Rotterdam
5


Old
HANDEL

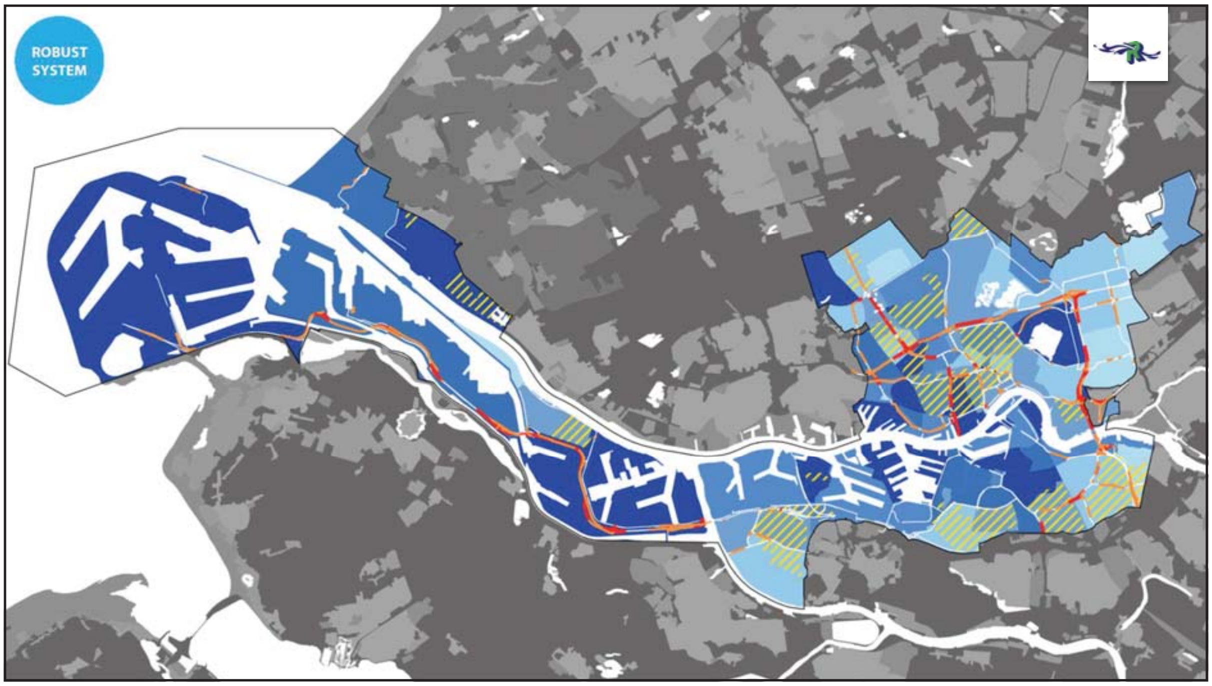

New

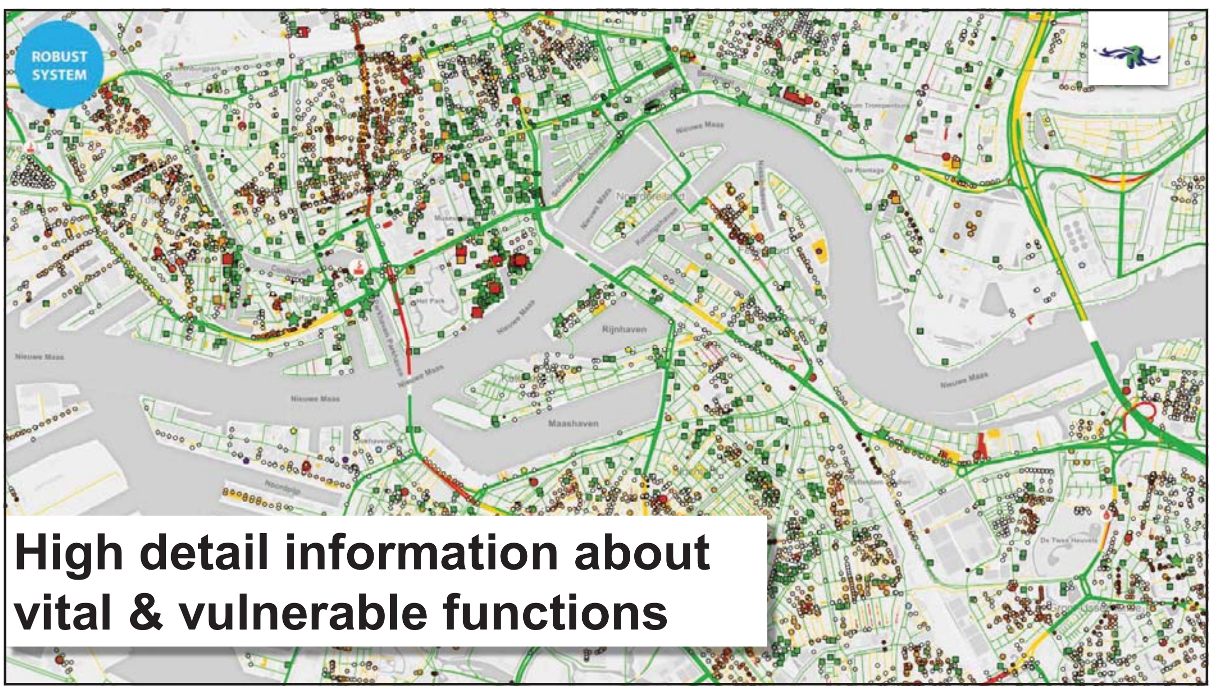

Precipitation
Sea level rise
River Discharge
Water Challenges
Groundwater

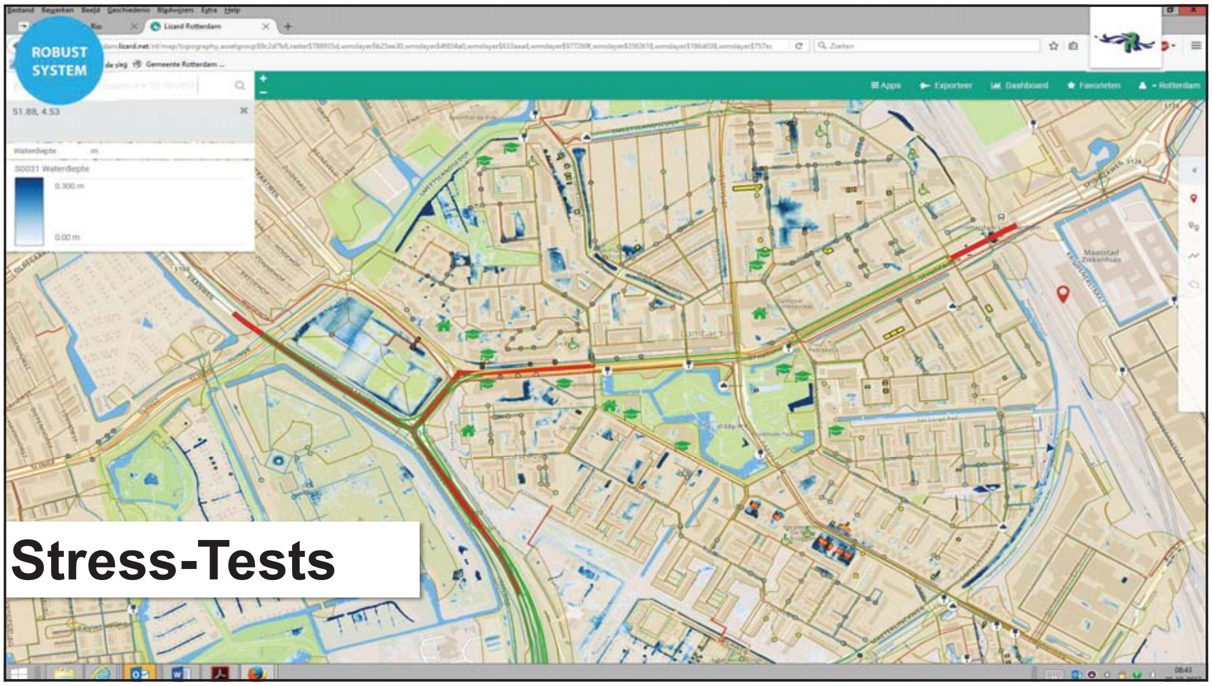

Copenhagen – July 2 2011
150 mm in 2 hours
Amsterdam – August 24 2015
20 mm in 10 minutes
Berlin – June 29 2017
150 mm in 24 hours
Paris – July 9 2017
50 mm in 1 hour
verwachte bodemdaling
2002 - 2050 in cm
geen
0 - 0.5
0.5 - 1
1 - 10
10 - 30
30 - 50
50 - 200
verwachte bodemdaling
zonder beperkende maatregelen


Verandering van aantal huishoudens, 2012 – 2050
Scenario Hoog
Scenario Laag
Aantal huishoudens
100.000
25.000
5.000
1.000
Groei
Krimp
Urbanisation
Climate change
Technology
Economy
Society
CIRCULAIRE ECONOMIE

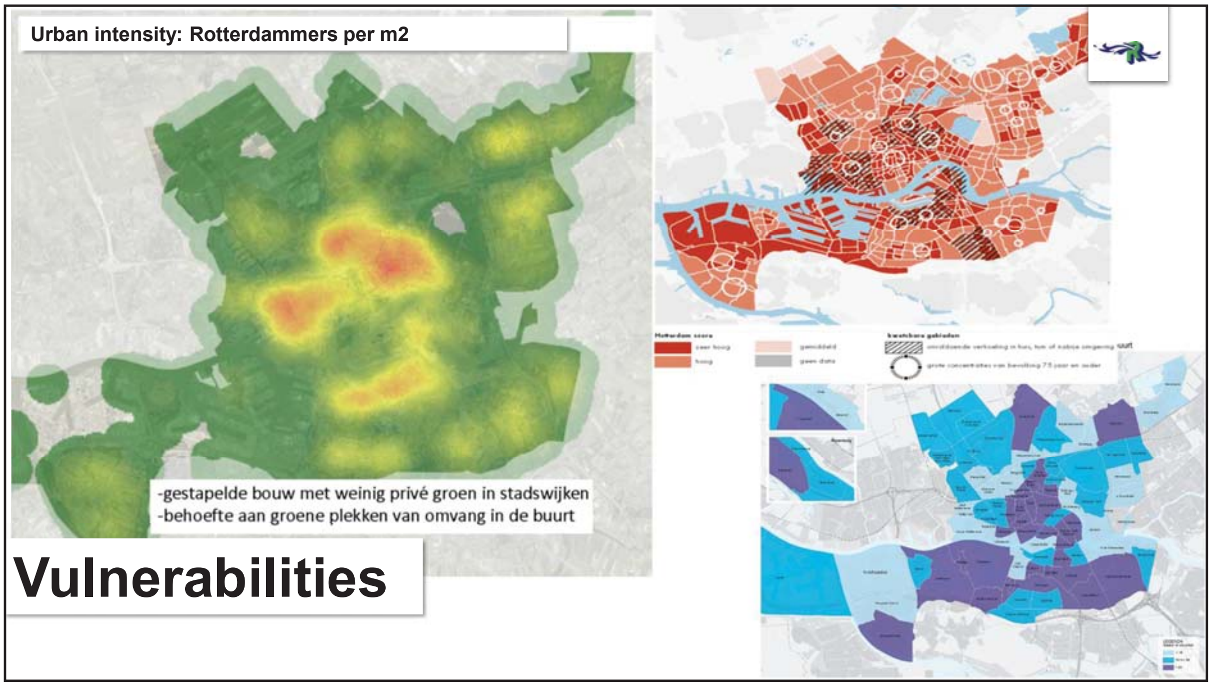
National Deltaplan Spatial Adaptation

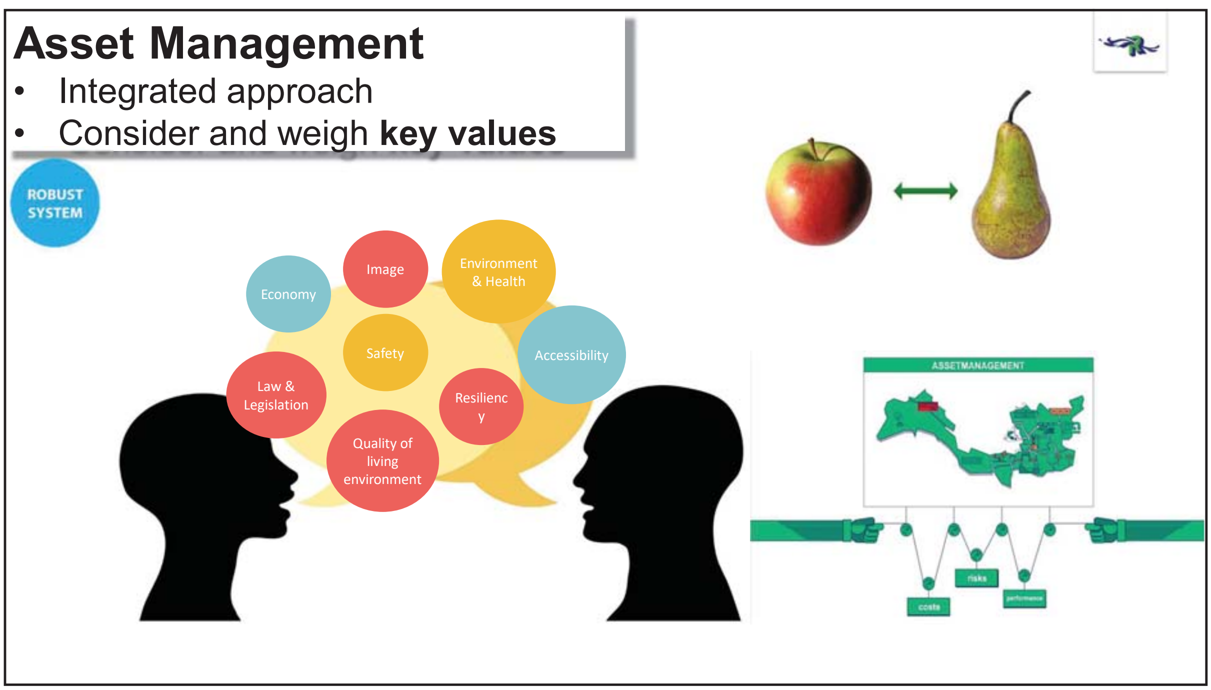

ROBUST
SYSTEM


ROBUST
SYSTEM
Nieuwe Maas
Rijnhaven
Maashaven
High detail information about
vital & vulnerable functions


ROBUST SYSTEM
Stress-Tests


ROBUST SYSTEM
blue label
A
B
C
D
E
Risk labels

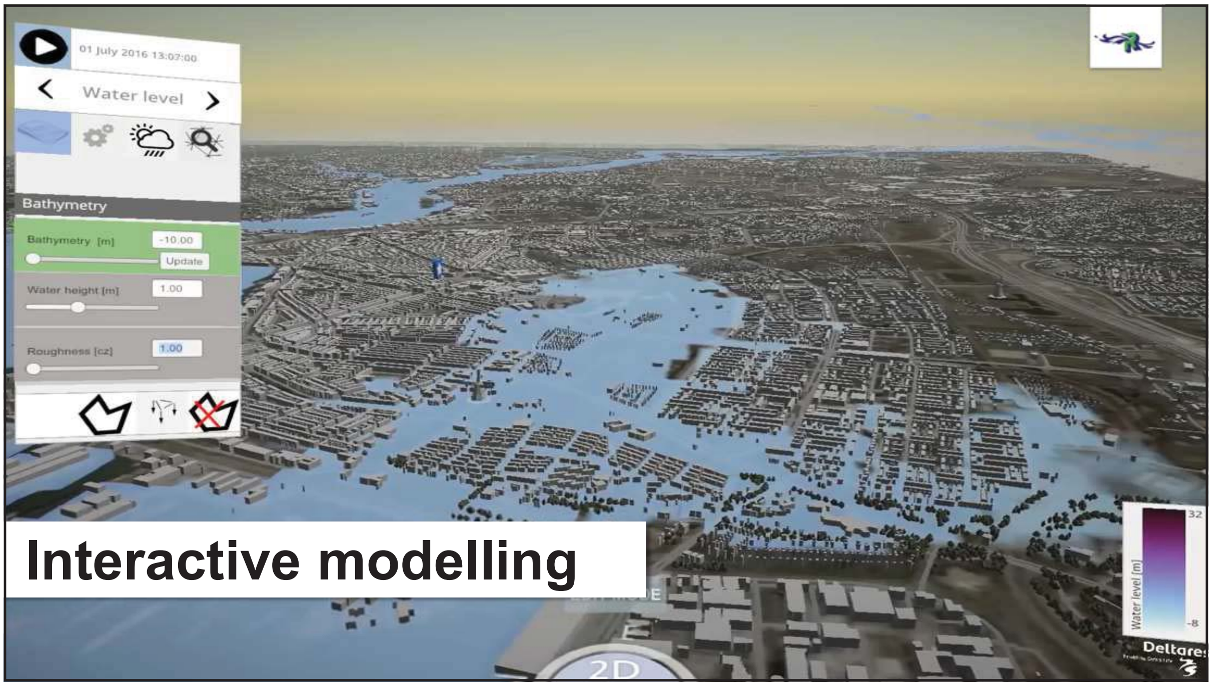

Urban intensity: Rotterdammers per m2
-gestapelde bouw met weinig privé groen in stadswijken
-behoefte aan groene plekken van omvang in de buurt
Vulnerabilities


Asset Management
• Integrated approach
• Consider and weigh **key values**
ROBUST SYSTEM
Economy
Image
Environment & Health
Safety
Accessibility
Law & Legislation
Resilienc y
Quality of living environment
ASSETMANAGEMENT
risks
costs
performance

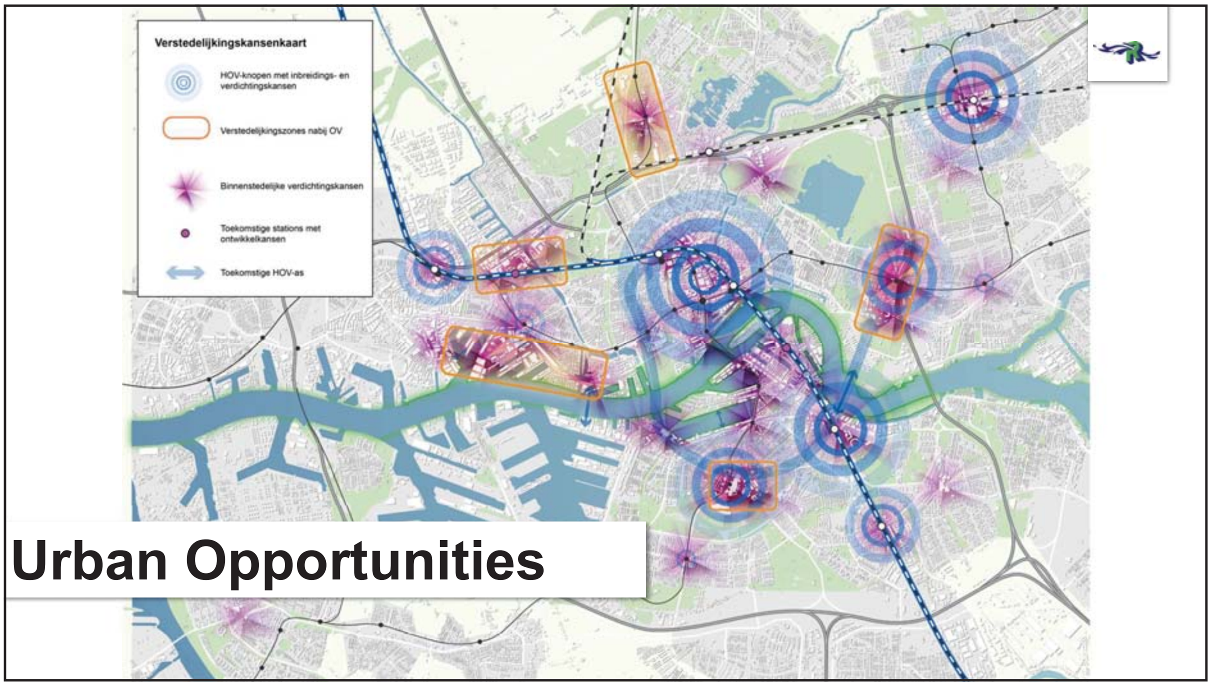
ROBUST SYSTEM

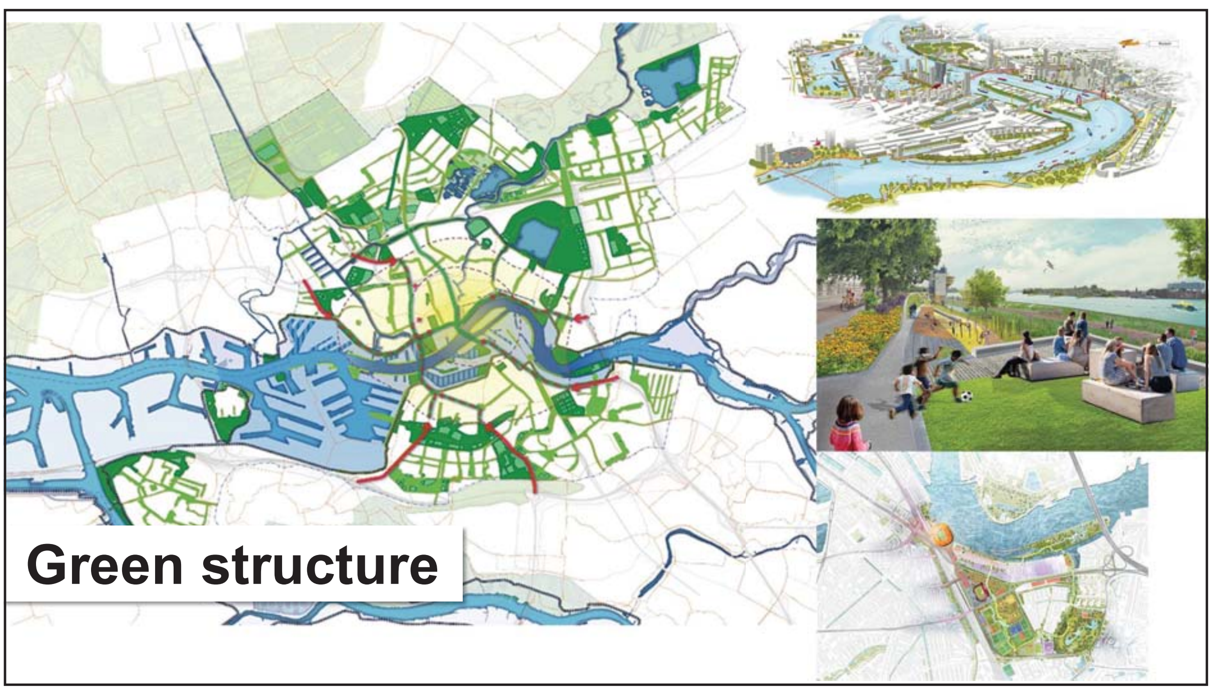
Rotterdam key values

- Quality of living environment
- Environment & Health
- Resiliency
- Economy
- Law and legistation
- Accessibility
- Safety
- Image


01 July 2016 13:07:00
Water level
Bathymetry
Bathymetry [m]
-10.00
Update
Water height [m]
1.00
Roughness [cz]
1.00
Interactive modelling
2D
32
Water level [m]
-8
Deltares


ADAPTATION
ROBUST SYSTEM
oudsbehoeftekaart Openbare Werken
Basiskaart
Delen
Afdrukken
Meten
Over
Content
Legenda
Legenda
Onderhoudsbehoefte Riolering
Integraal korte termijn
Singulier Korte termijn
Integraal lange termijn
Singulier lange termijn
11e jaar
Onderhoudsbehoefte groen en spelen (punt)
Bomen
Groenprojecten
Speelplaatsen
Onderhoudsbehoefte Wegen
Boezemkades
Fietspaden
Hoofdinfra
Natuursteen
Overig asfalt
Paden in parken
Partieel onderhoud elementen
Plan ahead
Beschoeiingen
Persleidingen
1 januari 1970 - 1 januari 1975
esri


Verstedelijkingskansenkaart
HOV-knopen met inbreidings- en verdichtingskansen
Verstedelijkingszones nabij OV
Binnenstedelijke verdichtingskansen
Toekomstige stations met ontwikkelkansen
Toekomstige HOV-as
Urban Opportunities


Green structure

Roofscapes

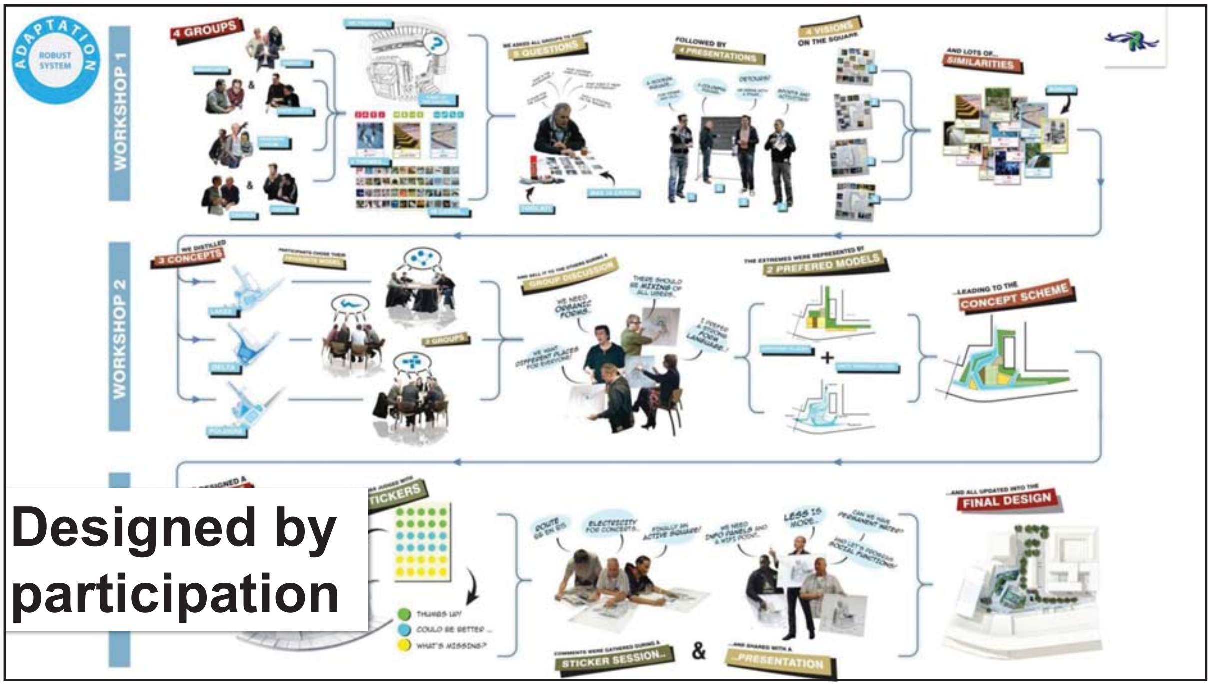
Integrated Design

Water storage Robert Fruinstraat Rotterdam

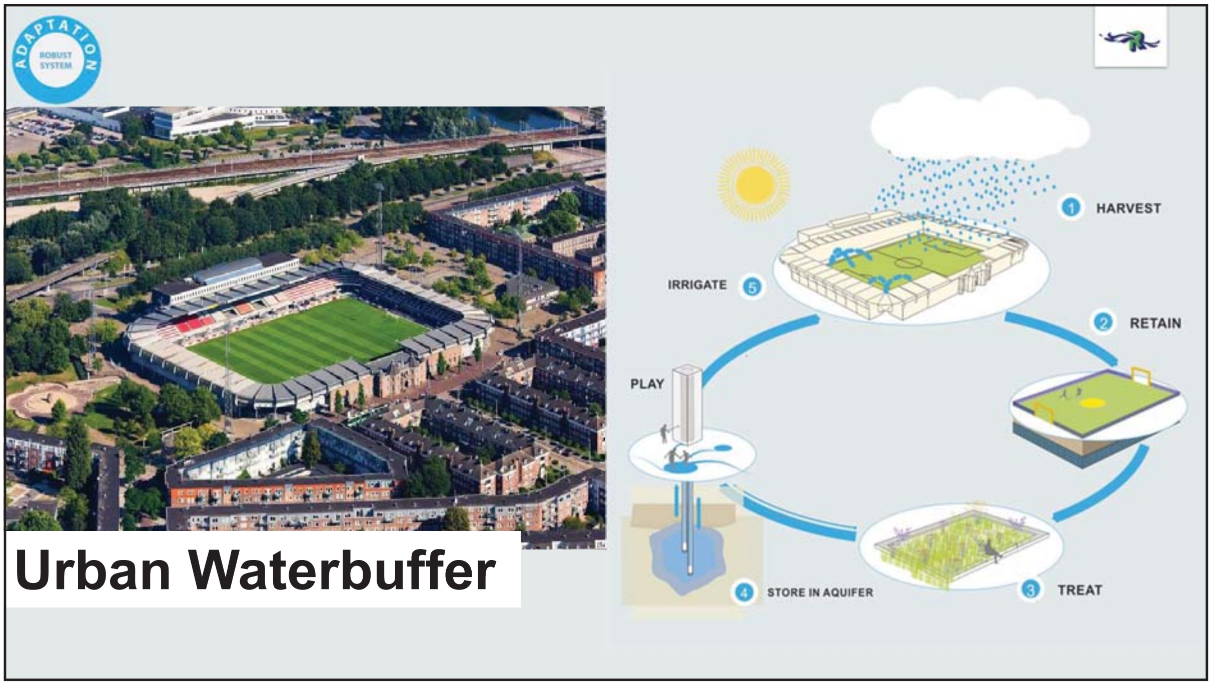
https://youtu.be/XJ0MOeP6bWI

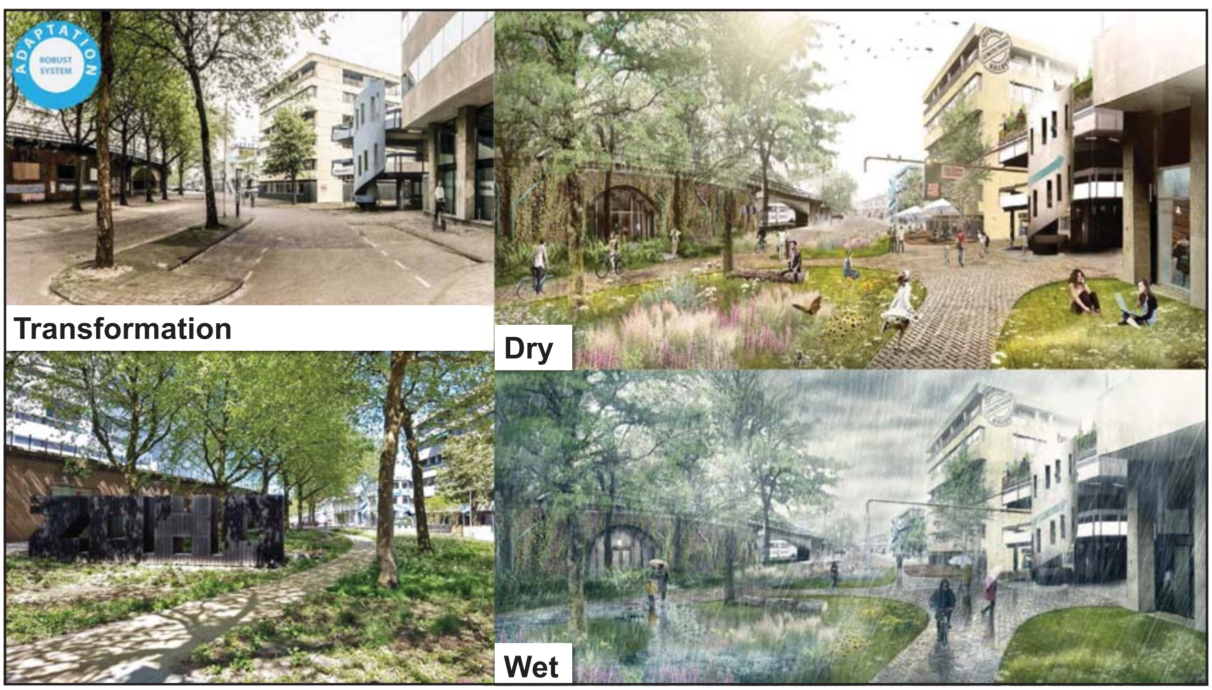

ADAPTATION
ROBUST SYSTEM
Multifunctional design


ADAPTATION
ROBUST SYSTEM
Urban Design
with water


ADAPTATION
ROBUST SYSTEM
WORKSHOP 1
4 GROUPS
8 QUESTIONS
4 PRESENTATIONS
4 VISIONS
SIMILARITIES
WORKSHOP 2
3 CONCEPTS
LAKES
DELTA
POLDERS
3 GROUPS
GROUP DISCUSSION
2 PREFERED MODELS
CONCEPT SCHEME
TICKERS
FINAL DESIGN
STICKER SESSION...
&
...PRESENTATION
Designed by participation


ADAPTATION
ROBUST SYSTEM
Underground storm water retention
© Field Factors
1. Buffer
2. MUW voorzuivering
3. Voordrukbuis
4. Aquifer


ADAPTATION
ROBUST SYSTEM
Urban Waterbuffer
1 HARVEST
2 RETAIN
3 TREAT
4 STORE IN AQUIFER
5 IRRIGATE
PLAY

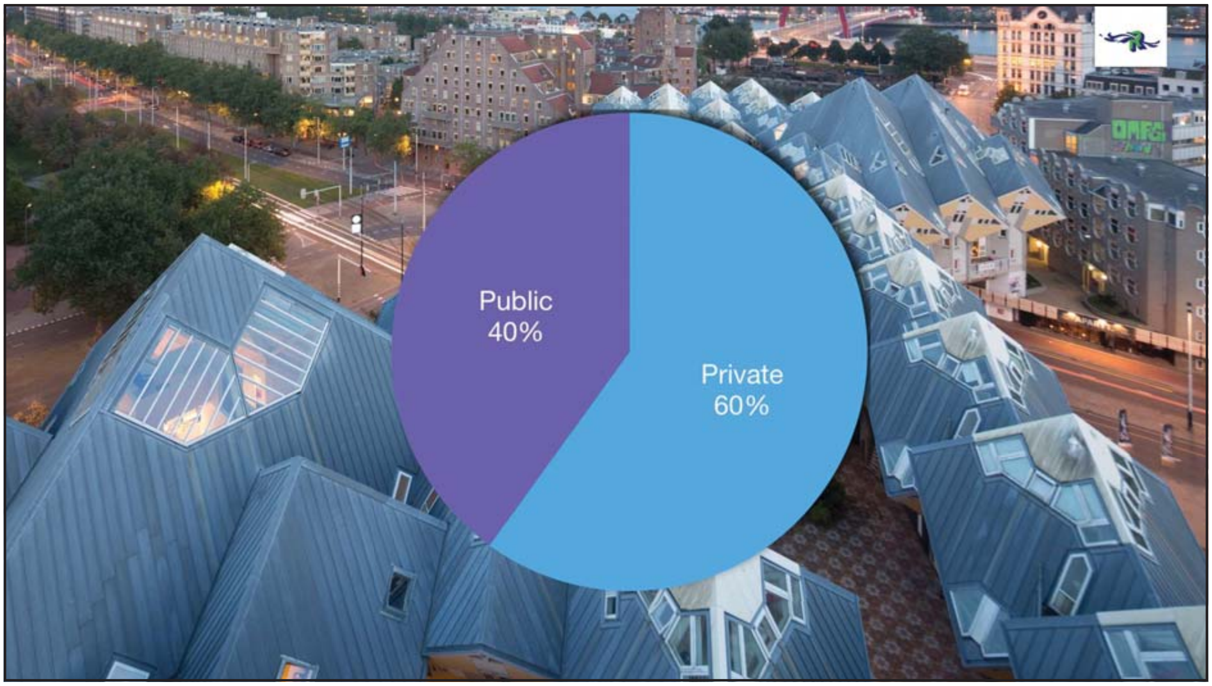

ADAPTATION
ROBUST SYSTEM
Transformation
Dry
Wet

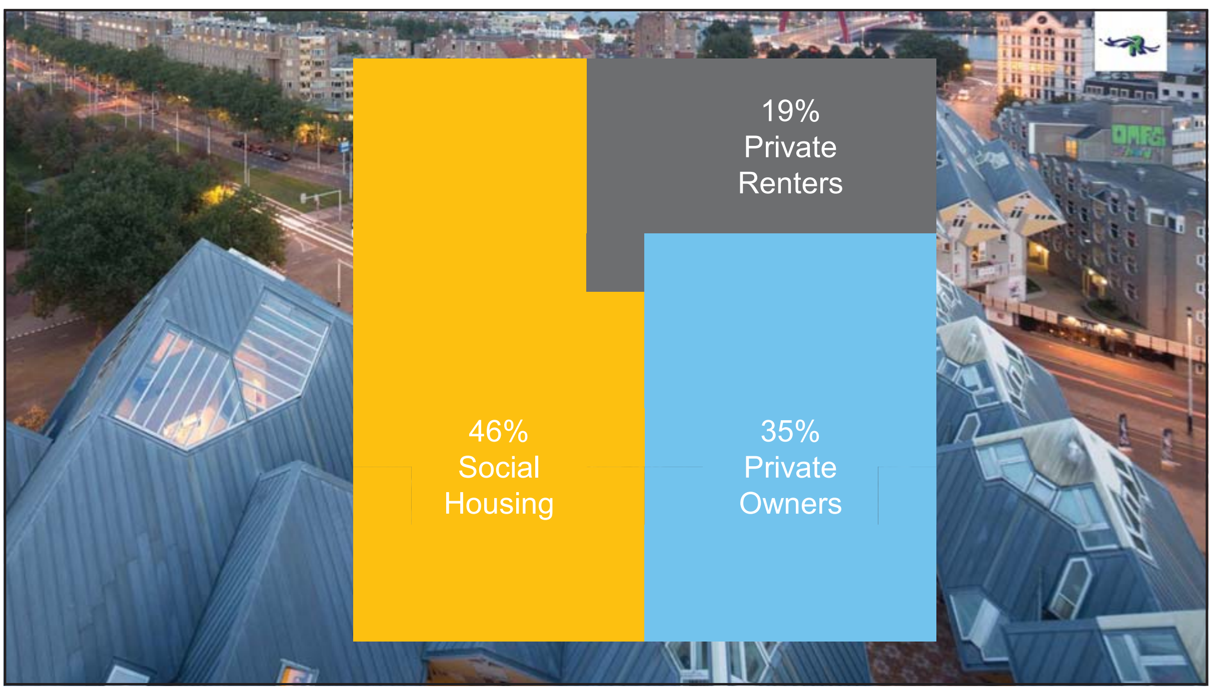

ADAPTATION
ROBUST SYSTEM
Permeable Pavement

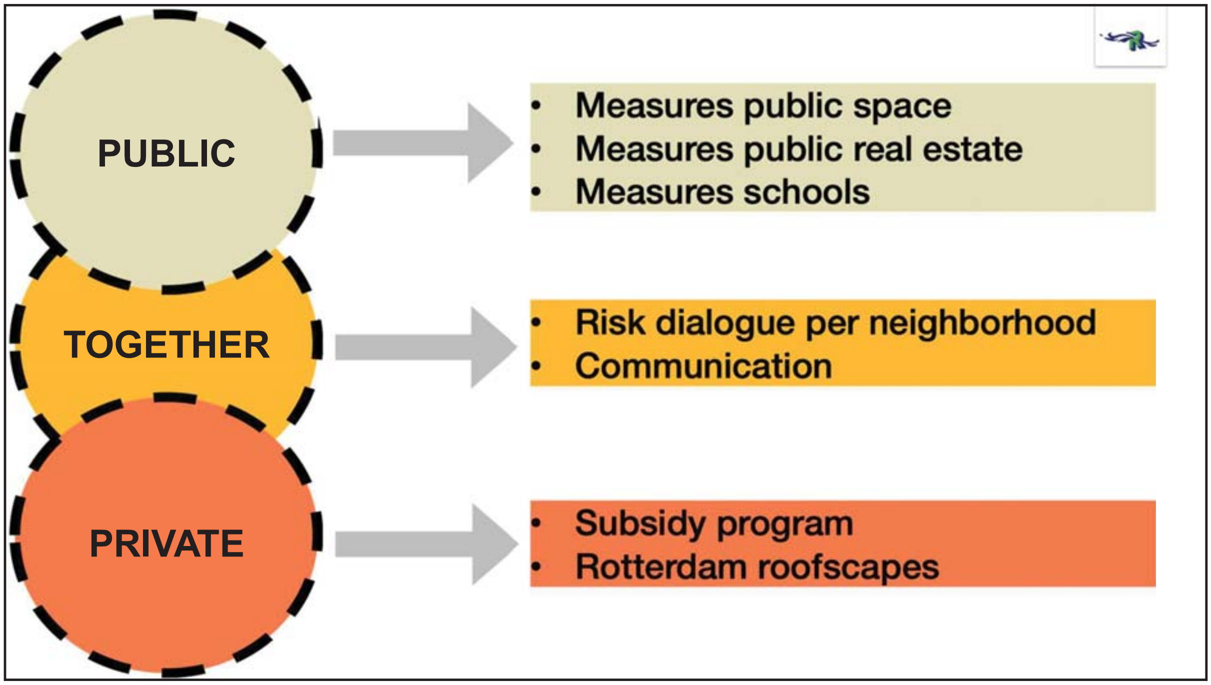

ADAPTATION
ROBUST SYSTEM
Water Square

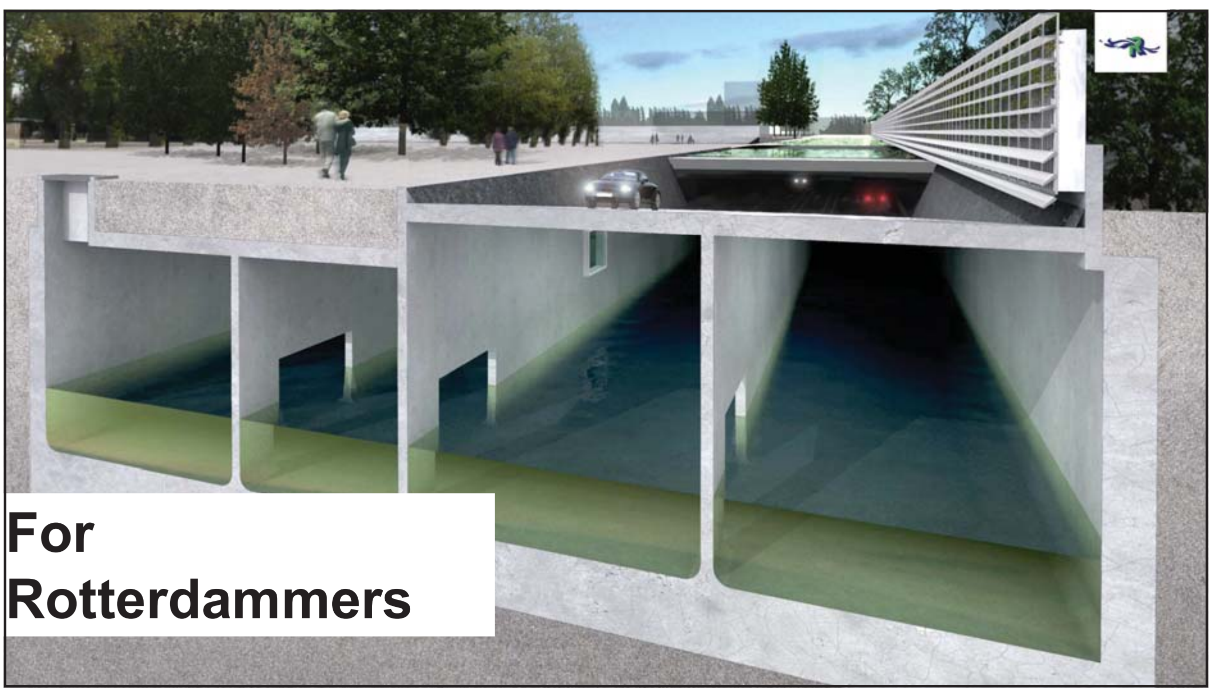

During rain


Daily use


Public
40%
Private
60%

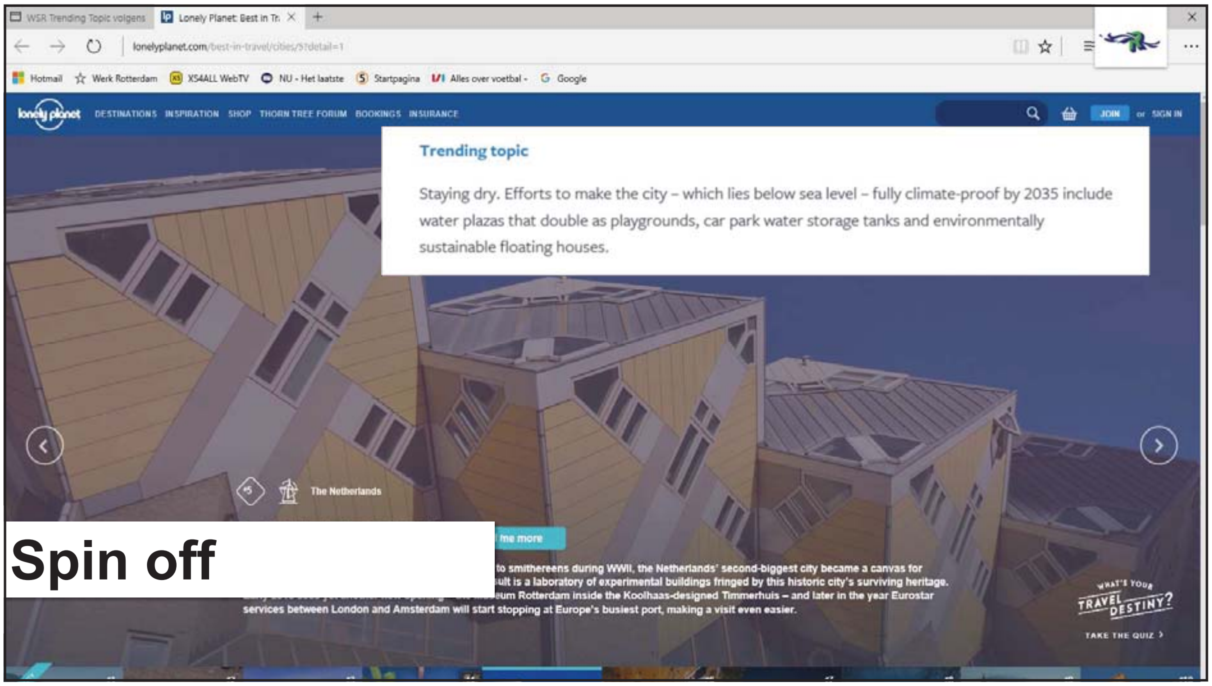

19%
Private
Renters
46%
Social
Housing
35%
Private
Owners


PUBLIC
TOGETHER
PRIVATE
• Measures public space
• Measures public real estate
• Measures schools
• Risk dialogue per neighborhood
• Communication
• Subsidy program
• Rotterdam roofscapes


For
Rotterdammers


With
Rotterdammers


By
Rotterdammers


WSR Trending Topic volgens
Lonely Planet: Best in Tr
lonelyplanet.com/best-in-travel/cities/5?detail=1
Hotmail
Werk Rotterdam
XS4ALL WebTV
NU - Het laatste
Startpagina
Alles over voetbal -
Google
lonely planet
DESTINATIONS
INSPIRATION
SHOP
THORN TREE FORUM
BOOKINGS
INSURANCE
JOIN
or
SIGN IN
Trending topic
Staying dry. Efforts to make the city – which lies below sea level – fully climate-proof by 2035 include water plazas that double as playgrounds, car park water storage tanks and environmentally sustainable floating houses.
The Netherlands
me more
to smithereens during WWII, the Netherlands' second-biggest city became a canvas for
sult is a laboratory of experimental buildings fringed by this historic city's surviving heritage.
eum Rotterdam inside the Koolhaas-designed Timmerhuis – and later in the year Eurostar
services between London and Amsterdam will start stopping at Europe's busiest port, making a visit even easier.
WHAT'S YOUR TRAVEL DESTINY?
TAKE THE QUIZ
Spin off


Questions?

http://english.jschina.com.cn/23261/201804/t20180411_5281612.shtml

Adaptation Support Tools for Urban Land and Water Management and Room for River

Dr ir Frans H M van de Ven

Session 9: Climate Adaptation

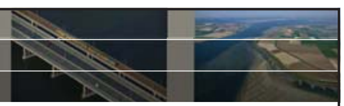
2nd International Forum on Low Carbon Development for Cities

"Acting Together for Low Carbon, Livable, and Prosperous Cities"

Seoul, Republic of Korea, 2-5 September 2019

1 October 2019

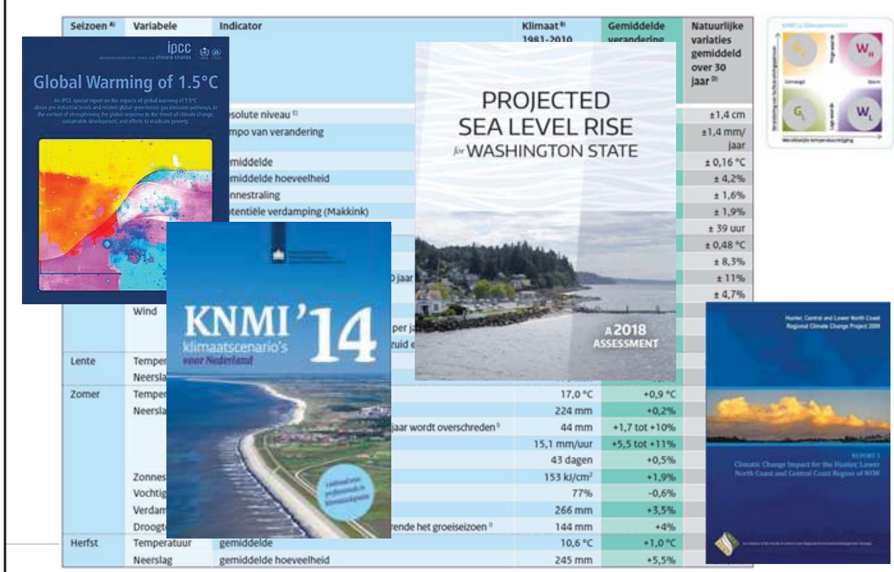
Overview



- Our flooding challenges
- Solution strategy
- Adaptation planning and design
- Adaptation Support Tool
- Room for the River

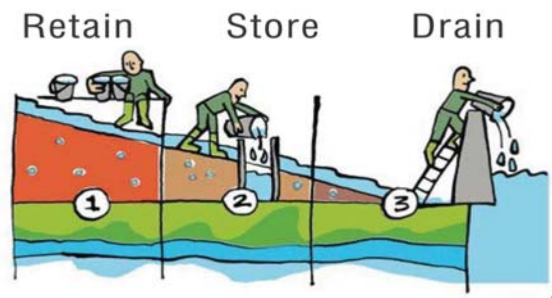
Flooding (coastal, fluvial, pluvial, groundwater)

..while climate changes, sea level rises, …



Solution strategy #1: Retain & Store!

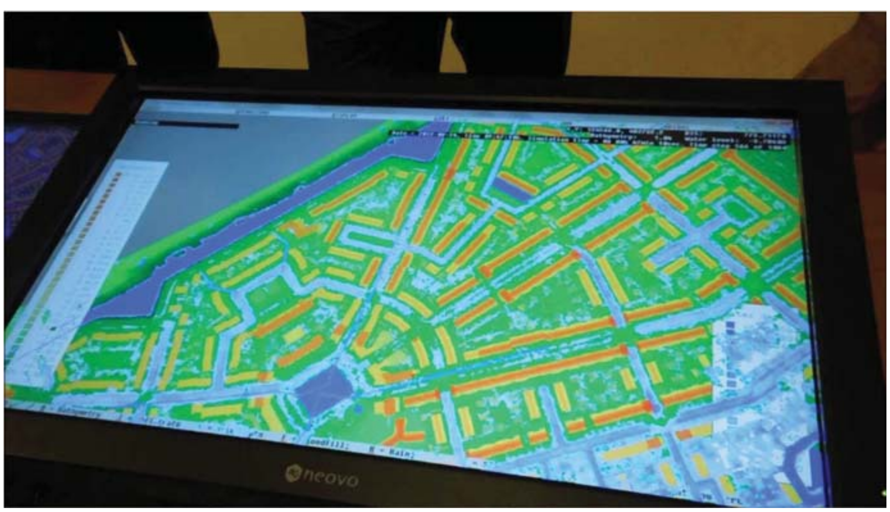
Re-/Detain and Store at the source
to avoid overloading the drainage capacity and flooding



De Urbanisten

http://www.chinadaily.com.cn/opinion/2017-09/26/content_32491069.htm

'Sponge size' assessment



hydrologic / hydraulic modelling to assess water retention assignment

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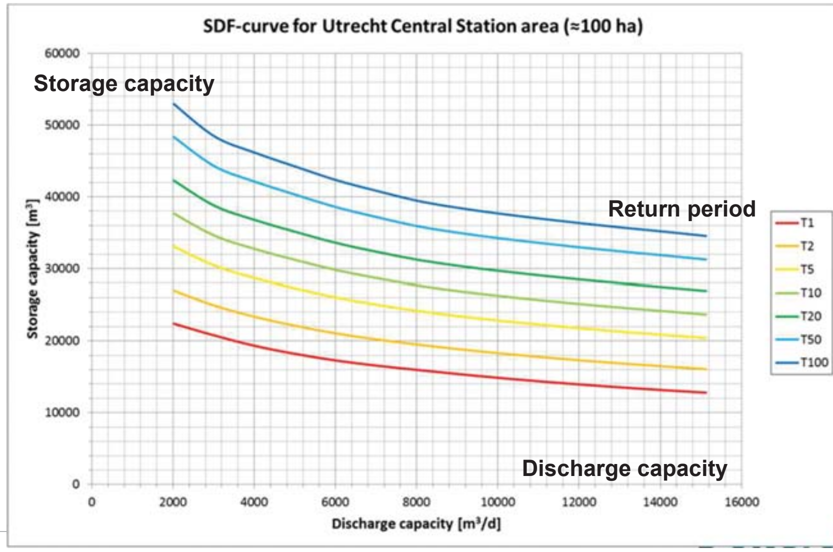
Stormwater retention assignment



Lots of measures can be taken

http://www.urbangreenbluegrids.com/design-

Blue-green measures preferred over grey ones

Grey measures → **Blue-green measures**

less space, subsurface → *more space, visible, multi-functional*

rigid, public investment → *flexible and cost-effective*

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Collaborative planning required for blue-green

experts from many disciplines + local stakeholders

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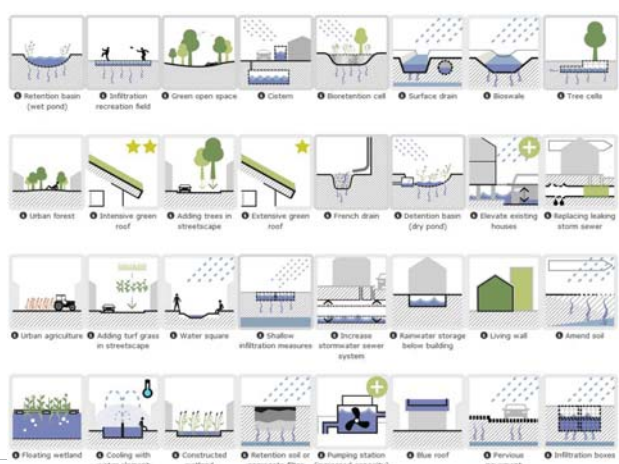
Adaptation Support Tool
to find out what can be done where & how effective that is

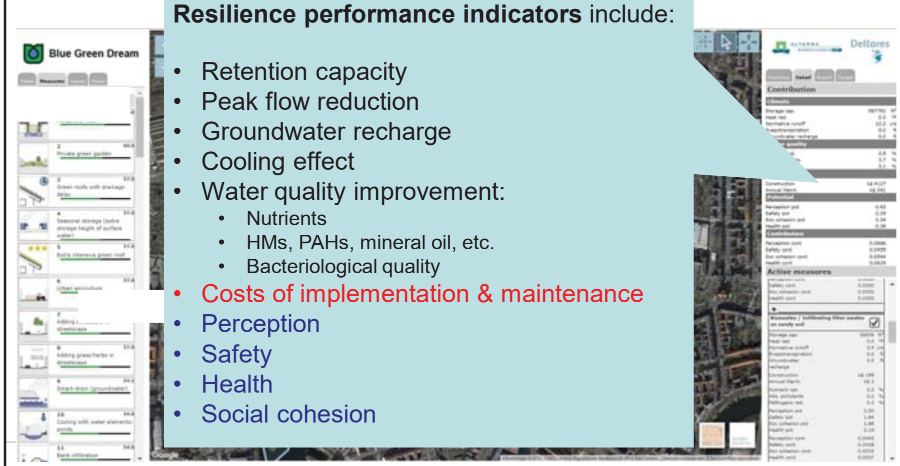
Adaptation Support Tool to see

- what can be done
- where, and how effective that is



Adaptation Support Tool

Van de Ven, Frans H.M., Robbert P.H. Snep, Stijn Koole, Reinder Brolsma, Rutger van der Brugge, Joop Spijker, Toine Vergroesen (2016). Adaptation Planning Support Toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders, Environmental Science & Policy, http://dx.doi.org/10.1016/j.envsci.2016.06.010



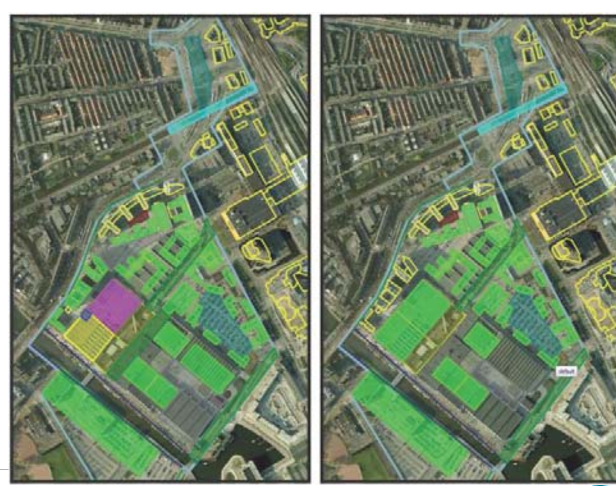
Resilience performance indicators include:

- Retention capacity
- Peak flow reduction
- Groundwater recharge
- Cooling effect
- Water quality improvement:
  - Nutrients
  - HMs, PAHs, mineral oil, etc.
  - Bacteriological quality
- Costs of implementation & maintenance
- Perception
- Safety
- Health
- Social cohesion

Results of AST workshops :

Compare performance of alternative plans

Utrecht - Beurskwartier



Van de Ven, F.H.M., P. Bosch, R.J. Brolsma, J.J. Kok, E.S. van der Meulen, F.E. Schasfoort, C.L. ten Velden, A.J.J. Vergroesen (2016) Green, comfortable, attractive and climate resilient Utrecht Centre-West area : Smart Sustainable Districts – deep dive Utrecht opportunity 3. Deltares/TNO report 1220357, http://publications.deltares.nl/1220357_000.pdf

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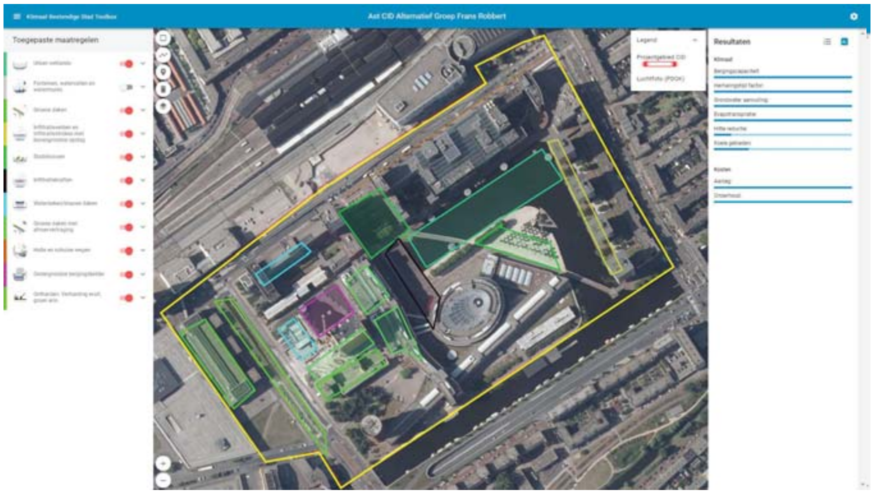
Adaptation Support Tool 2.0

Toolbox Climate Resilient City www.crctool.org



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Creating urban resilience together

The New Orleans - Adaptation Support Tool

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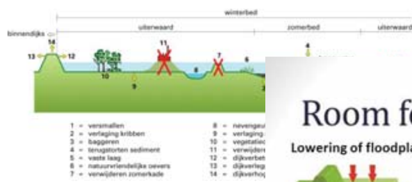
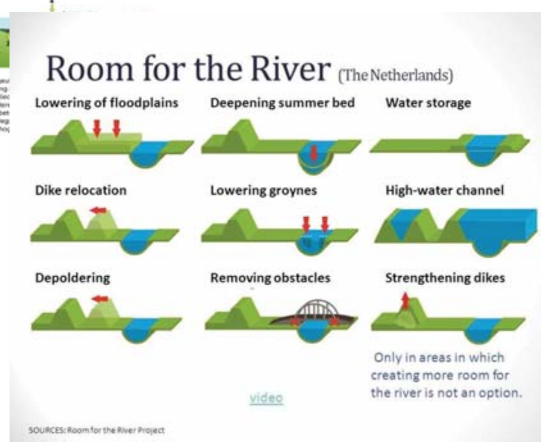
Room for the River





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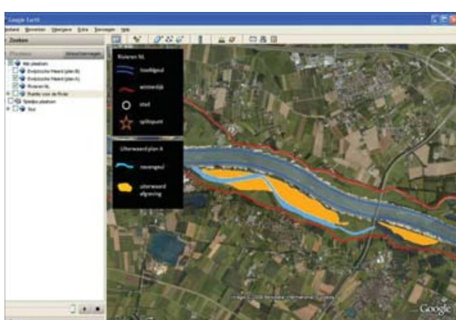
Room for the River projects

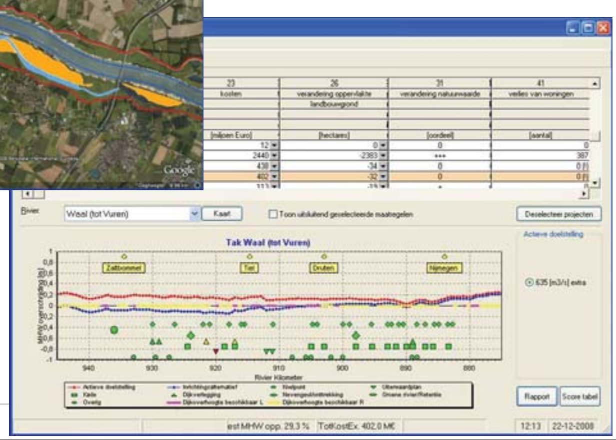
Room for the River projects

Bommelerwaard/ Loevestein

Blauwe Kamer Rhenen

Toolbox Room for the River





Conclusion

- On site retention is key to avoid local and downstream flooding
- This storage requires space
- This space can be used multi-functional and provide services
- These functions and services bring many more benefits, economic, social and emotional, in addition to retention
- Blue-green, ecosystem based adaptation measures provide all this
- Selection of measures is a multi-disciplinary spatial planning problem
- Planning support toolboxes help planning and decision making

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Closing

Thank you for your attention!

Frans H.M. van de Ven
frans.vandeven@deltares.nl
+31 6 5183 5010

TU Delft

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Deltares is a **not-for-profit, independent and internationally operating research and specialist consultancy institute**, incorporating advanced expertise on water, soil and infrastructure issues.

Deltares is at the forefront in the global development, distribution and application of expert knowledge and software **(open source, freeware, open knowledge sources,...)**

The Netherlands – the lowlands

Synergies between the Green and Blue Agendas: Some Emerging Ideas from WRI Research

N. Vijay Jagannathan
Secretary General, Citynet and Senior Fellow
World Resources Institute

Climate Mitigation and Climate Adaptation

Green Agenda

- Growing cities are major emitters of GHGs through energy generated by fossil fuels
- Green spaces being replaced by built-up areas
- Low Carbon Development creates significant co-benefits in terms of quality of life and air quality improvements

Blue Agenda

- Hydrological cycle disrupted by built-up areas, affecting surface water and groundwater flows
- Water pollution further affects regeneration capabilities of water bodies
- Water risks through floods, droughts and intense rainfall affects quality of life

WORLD RESOURCES INSTITUTE

Example from Hyderabad city, India
Synergy between the Green/Blue Environment

Highlights of Hyderabad Metropolitan Area

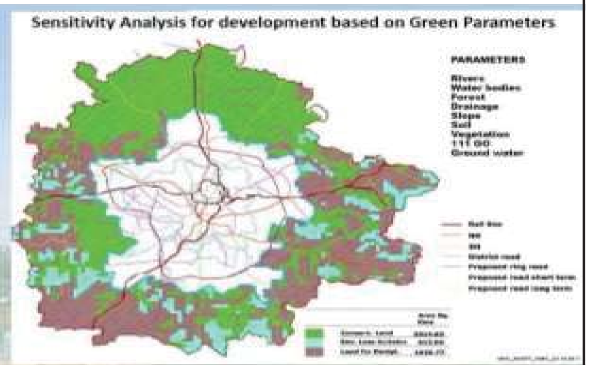
The 'City of Lakes' is also acquiring the image of 'Garden City' & 'Green City'.

- The Green fly-over concept introduced for the first time in India.
- Making use of the existing landscape and natural rocky out crops, 15 rockeries are being developed in the 2.1 kms stretch.
- Landscaped gardens parks and recreation areas have also been developed around the lakes, along the roads etc. which falls within BPPA area.

:LEGISLATION :

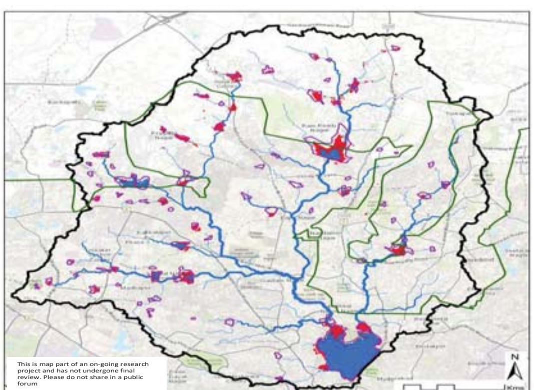
AP Water & Trees Act2002 and Rules

1. Ground Water Protection Measures
2. Surface Water Protection Measures
3. Tree Protection Measures

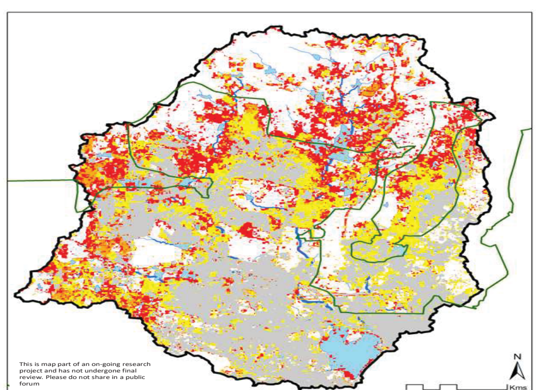


WORLD RESOURCES INSTITUTE

Built-up areas affect Groundwater Recharge



Surface water loss in the Hussain Sagar watershed



Urban development (since 1990) in the Hussain Sagar watershed

Every decision to augment water supply results in higher energy costs + GHG Spike

For Hyderabad:

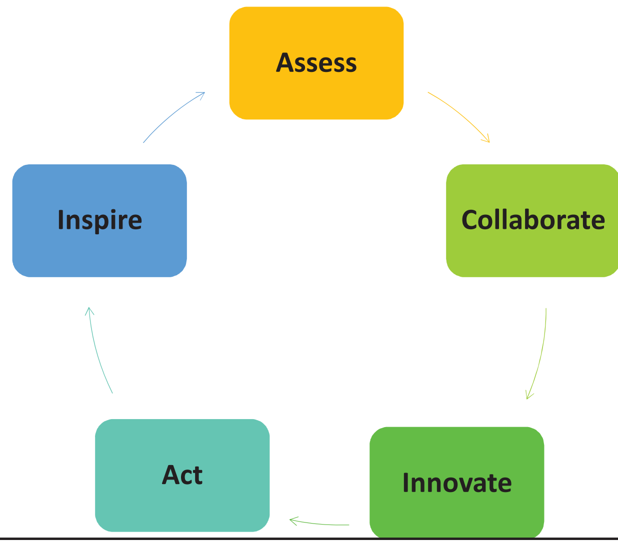
- One kiloliter of bulk water from River Krishna (at a distance of 120 km) is five times greater than the cost of sourcing from local lakes at less than 15 km.
- Drop in groundwater in the city worsens as a result of increased runoff and reduced infiltration as the built-up areas rapidly expand

Source: Presentation by M.G. Krishna 2008 for Hyderabad

Opportunity costs of tapping new water sources: Example from Chennai, India

Source	Cost (Rupees/m3)	Quantity available (MLD)	Comments
Existing sources	2.5	100	Rainwater recharge improves yield
Recycled treated wastewater	60	10	Green co-benefits (methane capture, urban forestry, industrial demand
River Krishna	**3**	**300**	**High Energy costs, GHG implications**
Tanks/aquifers	3	300	Rainwater recharge improves yield
Palar river	8	10	Reduced availability to farmers
Veeranam tank	15	80	Rainwater recharge improves yield
Desalination	**55**	**1200**	**High energy costs, GHG implications**

Theory of Change: Adopt a Systems Approach



Urban Blue-Green Solutions

- Restoration and conservation of urban water bodies and associated ecosystem
- Rain Water Harvesting
- Artificial Aquifer Recharge
- Blue-Green Infrastructure
- Flood Plain and Catchment Protection
- Ecological Solutions for Polluted Water Bodies
- Water Sensitive Urban Planning and Development

Why Blue-Green Solutions?

System Efficiency

Can provide multiple services like flood control, groundwater recharge, water security, water quality improvement etc. simultaneously

Lower costs

Requires lower investment than traditional grey infrastructure solutions; operation and maintenance costs are also lower

Increased liveability

Increases liveability condition by offering co-benefits such as health improvement, micro-climate control, recreational benefits and overall economic productivity

Value Proposition

Three Pillars

- Leverage Technology
- Incentivize Innovations through creative PPPs + Finance Leverage
- Build on stakeholder engagement for Quality of Life Focus

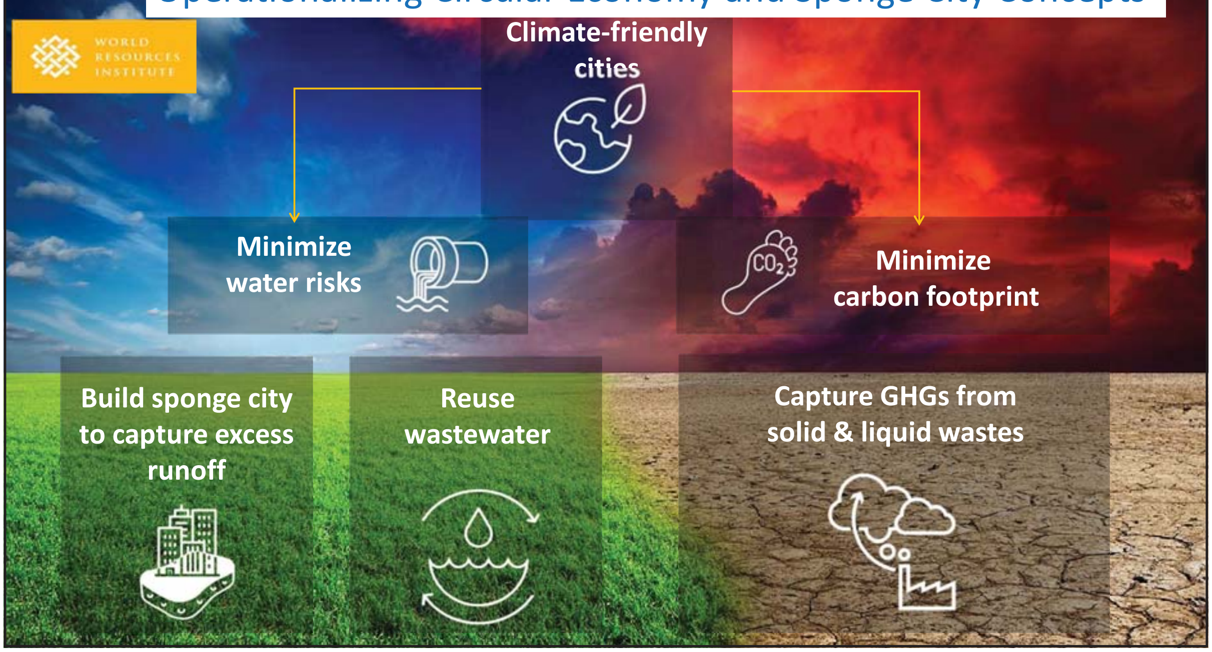
Disruptive Solutions

- No longer uni-functional ('build') and uni-disciplinary ('engineering') bureaucracy that Commands and Controls
- Water Supply agencies partner with water users, tech innovators to massively increase sector investments
- Provide leaders with measurable outcomes that reduce water risks and minimize pollution costs, reported transparently

Green + Blue = Smart City Goals

Balance built and natural environment, regulate air, water and land pollution, improve quality of life

Operationalizing Circular Economy and Sponge City Concepts



Leverage Synergy between the Green and Blue Water Agenda

Water with Large GHG Footprint → Very Costly to Economy + Society

Trans-basin water diversion

Desalination

Recyclable resources → Green Funds

Treated wastewater

Methane capture from sludge and organic wastes

Local water sources → Regulations

Surface water

Groundwater

A Blue Water Economy Example: Zhuzhou City Sponge City Construction Plan

- By 2020 more than 20% of the urban built-up area will meet the sponge city construction target requirements
  - More than 70% rainwater targeted for effective control;
- By 2030, more than 80% of the urban built-up area will meet the construction target requirements
  - The annual total runoff control rate will reach 80%.

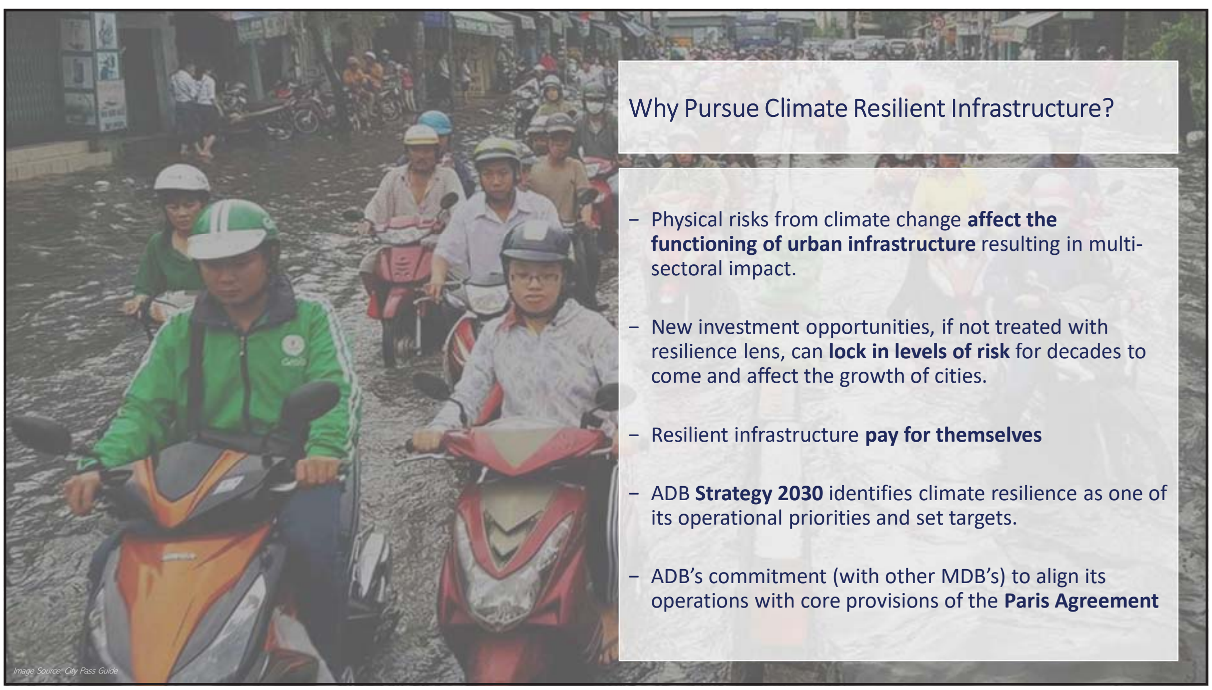
WORLD RESOURCES INSTITUTE

Questions?

Climate Resilient Infrastructure: ADB Approach

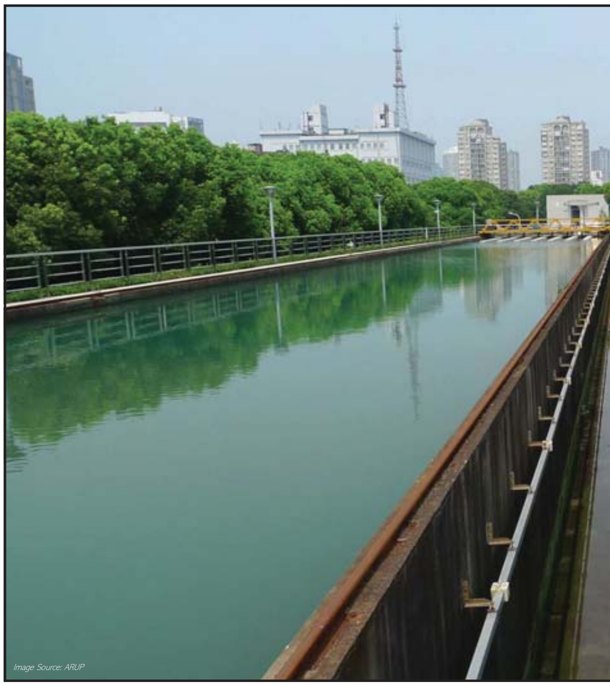
Session 9: Climate Adaptation
International Forum on Low Carbon Development for Cities
September 2019, Seoul

Arghya Sinha Roy, Senior Climate Change Specialist, ADB



Why Pursue Climate Resilient Infrastructure?

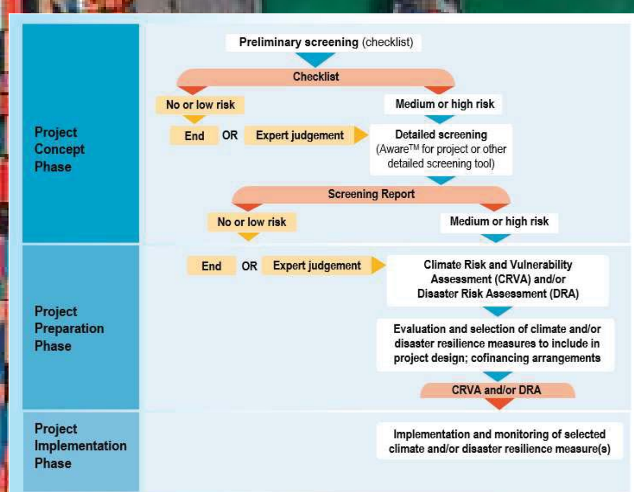
- Physical risks from climate change **affect the functioning of urban infrastructure** resulting in multi-sectoral impact.
- New investment opportunities, if not treated with resilience lens, can **lock in levels of risk** for decades to come and affect the growth of cities.
- Resilient infrastructure **pay for themselves**
- ADB **Strategy 2030** identifies climate resilience as one of its operational priorities and set targets.
- ADB's commitment (with other MDB's) to align its operations with core provisions of the **Paris Agreement**



ADB's Approach to Climate Resilient Infrastructure

- Promote:
  - Increasing **resilience of** infrastructure
  - Increasing **resilience through** infrastructure
- Adopt an **integrated approach** to resilience factoring physical, social, ecosystem-based and financial aspects.
- Systematically apply **climate risk management framework** to screen, assess, and incorporate adaptation measures in infrastructure project design
- Enhance **capacity** of countries to use climate risk information in decision-making for infrastructure

Application of Climate Risk Management Framework




Enabling Environment for Climate Resilient Infrastructure
– Access to **climate information** – development of regional public good
– **Policy and regulation** – update building codes, engineering design standards, procurement and maintenance procedures
– **Access to finance** – facilitate access to concessional development and climate finance and unlocking private sector finance
– Leveraging **knowledge and part**nership –develop tools and guidance for improved decision making for investments in adaptation
Photo Source: Pond5


Moving Forward: Scaling Up Resilient Infrastructure
– Strengthen **knowledge base** on impacts of cascading risks on infrastructure systems and investment chain
– Extending climate risk management **upstream and downstream of project preparation**
– Facilitate **private sector engagement** in strengthening infrastructure resilience at scale
Image Source: ADB

Session 8: Social Innovation for Low-Carbon and Sustainable City Development

2nd International Forum on Low Carbon Development for Cities

"Acting Together for Low carbon, Livable, and Prosperous Cities"

ADB

General Idea and Action planning of Urban Community Regeneration at Yuzhong District, Chongqing, China

Prof. HUANG Ling

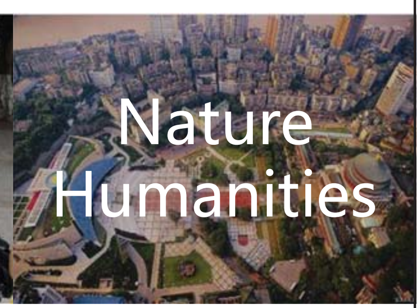
FACULTY OF ARCHITECTURE AND URBAN PLANNING,CHONGQING UNIVERSITY

Email: hwawa1025@vip.163.com

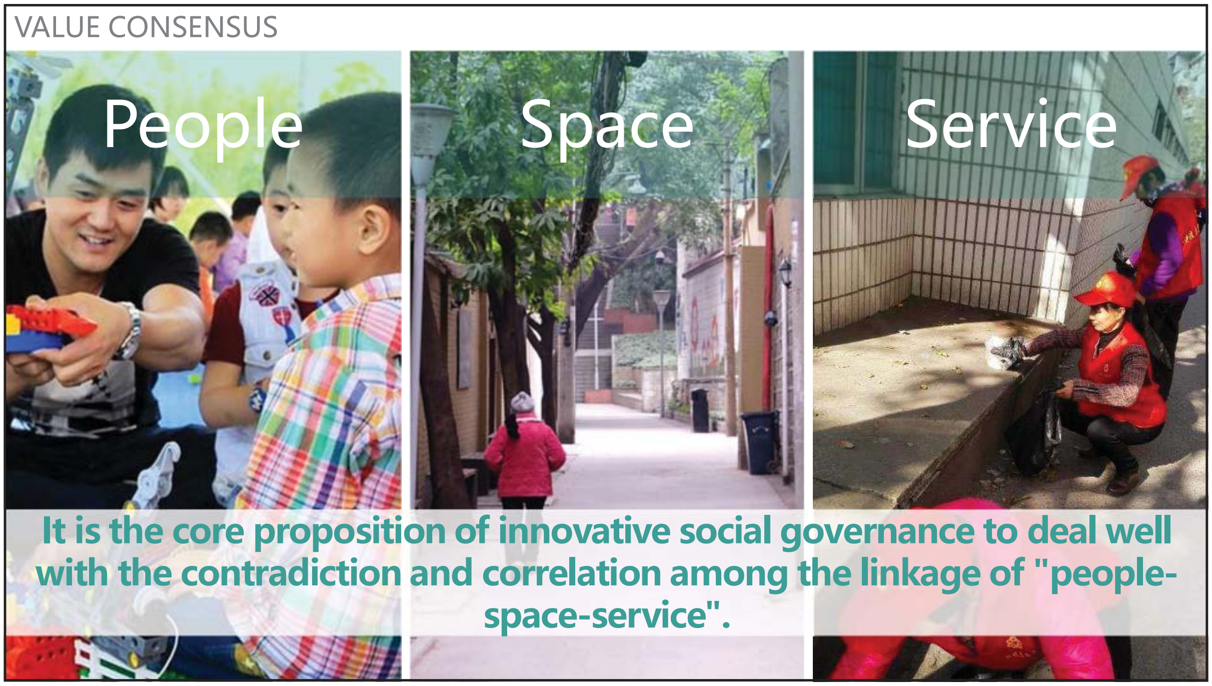
9/4/2019 Seoul

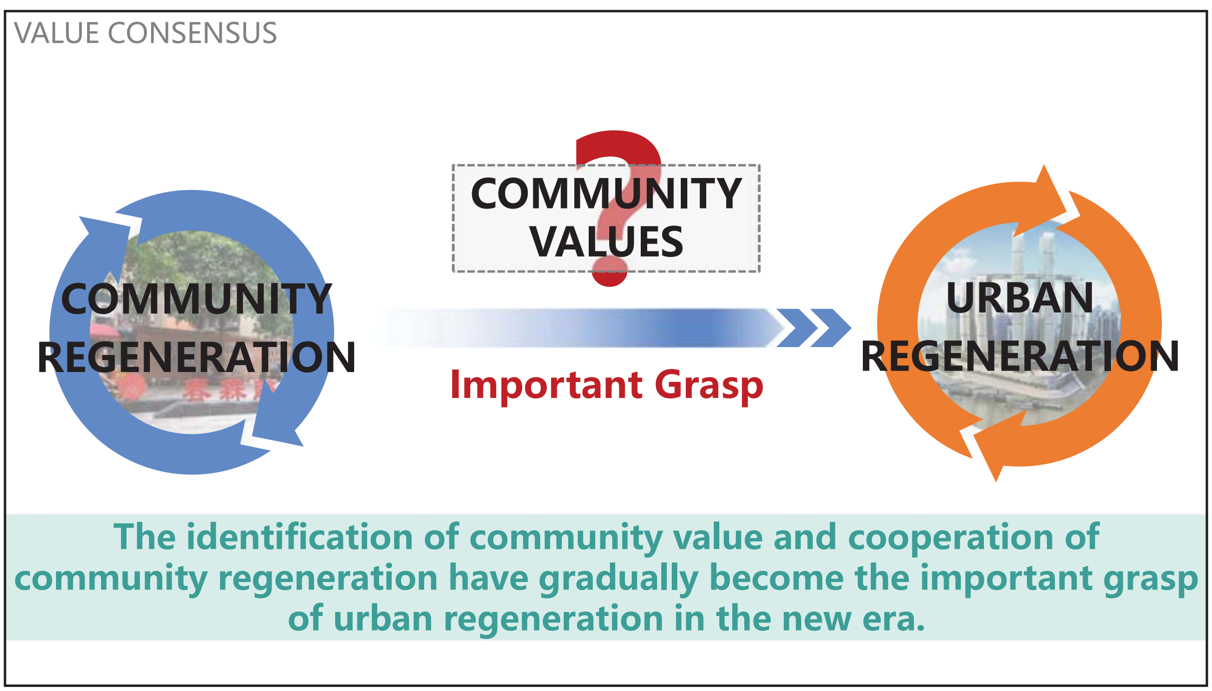
CONTENTS

VALUE CONSENSUS



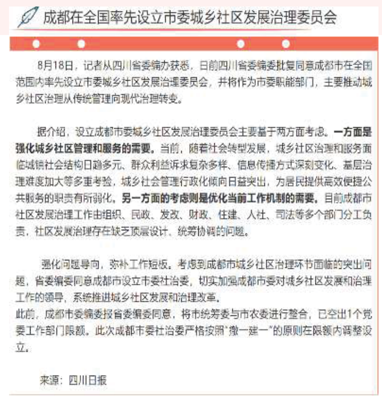
**Co-creation、Co-construction and Co-sharing
of the High quality, vibrant and livable community**


VALUE CONSENSUS
People
Space
Service
It is the core proposition of innovative social governance to deal well with the contradiction and correlation among the linkage of "people-space-service".


VALUE CONSENSUS
COMMUNITY VALUES
COMMUNITY REGENERATION
Important Grasp
URBAN REGENERATION
The identification of community value and cooperation of community regeneration have gradually become the important grasp of urban regeneration in the new era.

Responsibility Planner system, Beijing

Community Planner system, Shanghai



Community development governance council, Chendu

In China, there are different local approaches with the different local economic, cultural development level.

Phase 1: Germination stage (2010-2013)

- Comprehensive community environmental improvement

Phase 2: Rise stage (2013-2016)

- Community policy research
- Pilot community planning

Phase 3: Developing stage (2016-Present)

- Community regeneration
- Urban quality improvement
- Community action planning

2010 2011 2012 2013 2014 2015 2016 2017 2018 ......

Cunliang Planning	New-type Urbanization	City Work Conference	The 13rd Five-year Plan	Habitat Ⅲ	Improve Urban and Rural Community Governance
2012	2014	2015	2016	2016	2017

In Chongqing, it has experienced 3 phrases on urban community regeneration.

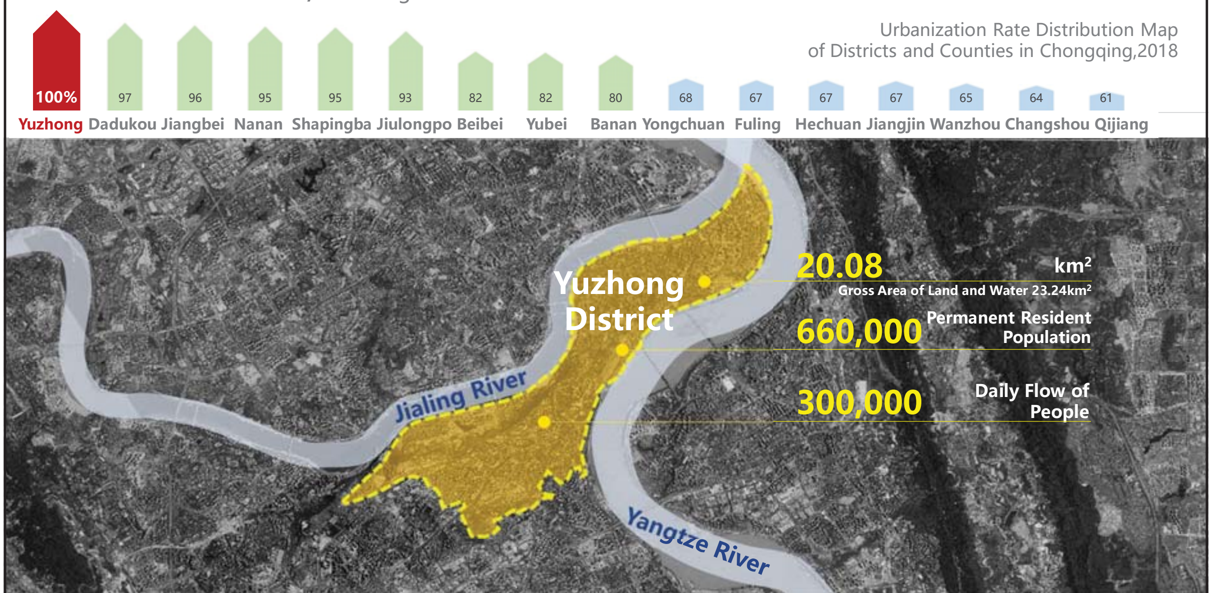
PROJECT COGNITION

Overview / Issues / Opportunity

PROJECT COGNITION / Yuzhong District Overview

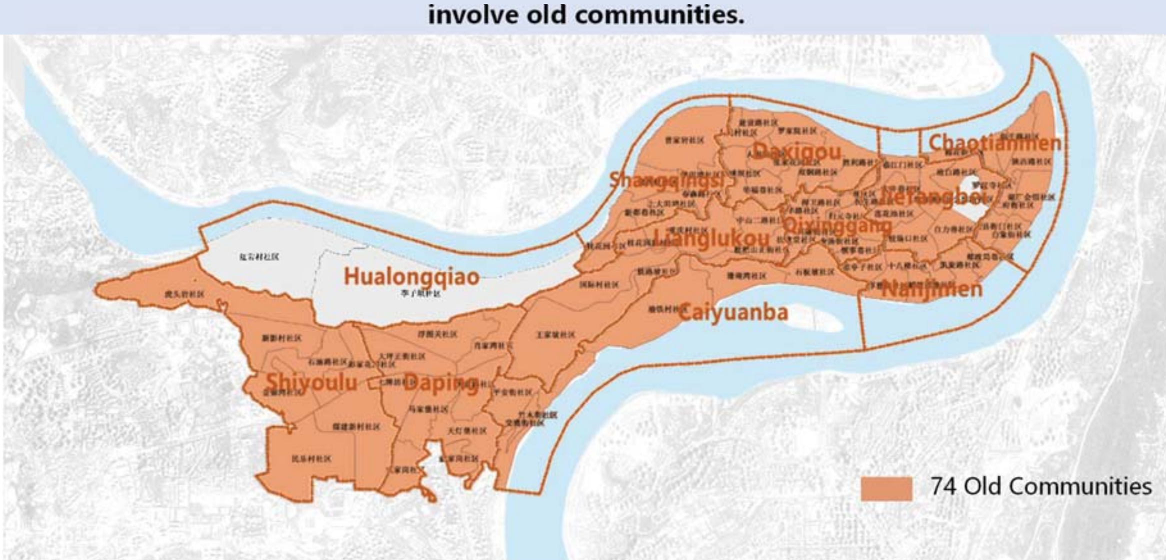
“重镇天开巴子国，大城山压禹王宫。”——Late Qing Dynasty, ZHAO XI, *CHONGQING*

PROJECT COGNITION / Yuzhong District Overview



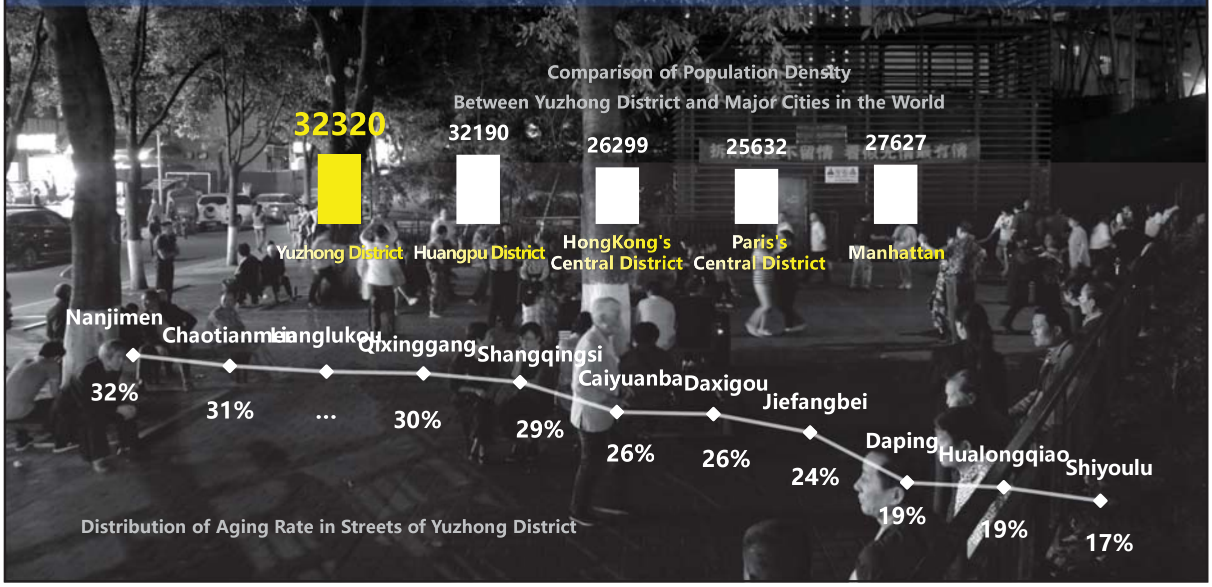
PROJECT COGNITION / Yuzhong District Overview

There are 11 sub-district offices in the district, with a total of 77 communities, 74 of which involve old communities.



PROJECT COGNITION / Community Dilemma

■ High Population Density,Serious Aging Problem

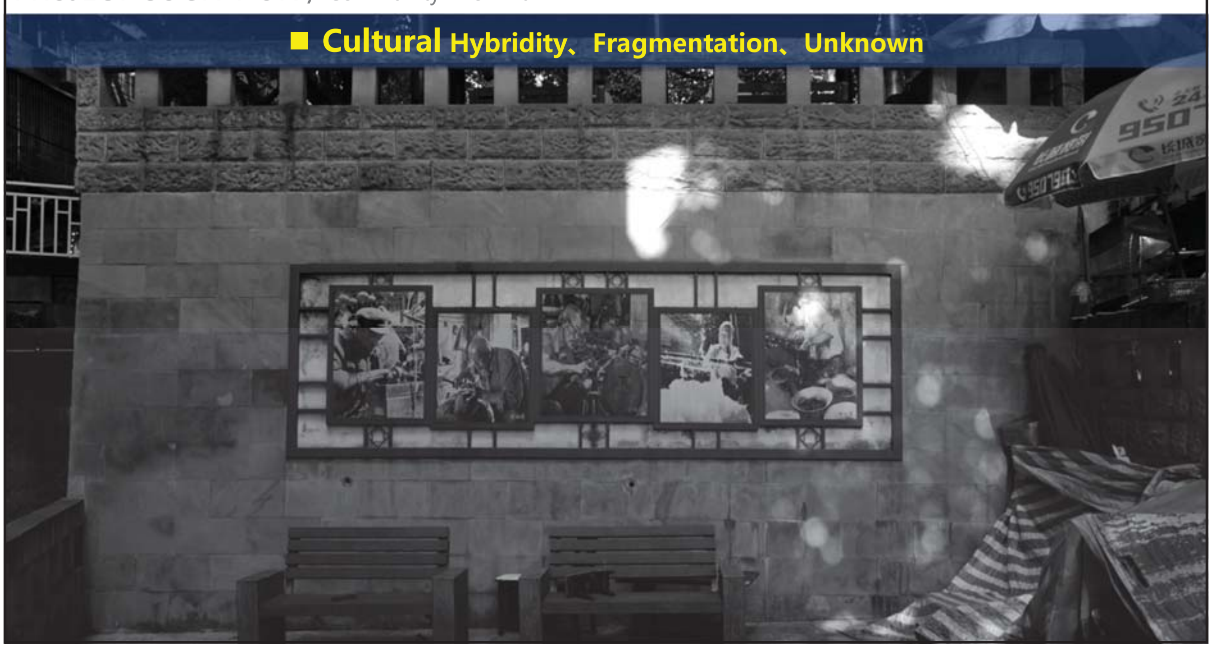


PROJECT COGNITION / Community Dilemma

■ Broken Space、Poor Connection

PROJECT COGNITION / Community Dilemma

PROJECT COGNITION / Community Dilemma



PROJECT COGNITION / Community Dilemma

■ Service Governance、Uneven Supply and Demand

PROJECT COGNITION / Development Opportunity

According to the 13th Five-Year Plan of Yuzhong District, its communities are facing the opportunity of all-round development and promotion.

the 13th Five-Year Plan
Yuzhong District
Yuzhong District People's Government Chongqing

Highlighting the historical and cultural features and humanistic care. Insisting on improving people's livelihood and urban renewal as a whole. Promoting the integration of shantytown renovation and cultural, business and tourism development. Carrying out community planning and implementing old communities renewal.

- **INNOVATIVE DEVELOPMENT**
- **HARMONIOUS DEVELOPMENT**
- **GREEN DEVELOPMENT**
- **OPEN DEVELOPMENT**
- **SHARING DEVELOPMENT**
- **GOVERNANCE PROMOTION**

COLLABORATIVE PLANNING

Planning Process / Concepts / Contents

The project took 3 years to complete, using the "Asset-Based" Community Development concept to establish a precise collaborative renewal platform.

- **2016** — Research on the Overall Idea of Community Regeneration of Yuzhong District,Chongqing — Development and Reform Commission
- **2017** — Action Planning of Characteristic Old Communities Renewal in Daxigou Street — Sub-district Office
- **2018** — Monographic Study on Community Scale Adjustment of Yuzhong District,Chongqing — Civil Affairs

Concept and Methods

- "Asset-Based" Community Development Concept
- Precise Collaborative Regeneration Platform

Planning Contents

- Community Assets Survey, Assessment and Database Construction Based on Stock Potential Excavation
- Community Classification, Screening and Regeneration Strategy Based on Asset Comprehensive Assessment
- Community Scale Adjustment Based on "People-Space-Service" Comprehensive Governance Promotion
- Participatory Community Regeneration Action Planning Based on Cultural Renaissance of Public Space

COLLABORATIVE PLANNING / Planning Content 1

Comprehensively sort out the state, characteristics and problems of community assets.

On-the-spot Investigation,covering 11 streets,77 communities.

Community Development Interview, forming interview transcripts 178 pages.

Assets Survey

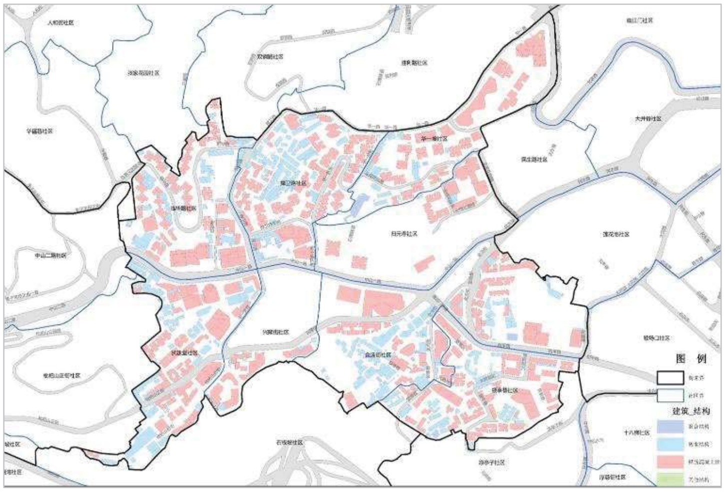
PHYSICAL ASSETS	HUMAN ASSETS
Topography & Geomorphology	Long-term Type
Environment Quality	Short-term Type
Greening Condition	Occasionality
Weather Condition	Positive Asset Index
Medical Facility	Negative Asset Index
Educational Facility	
Sports Facility	
Cultural Facility	
Welfare Facility	**SOCIAL ASSETS**
Commercial Facility	Social Network
Traffic Condition	Association Participation
Public Space	Community Attachment
Unused Space	Community Cohesion
Street Space	Local Social Interaction
Underground Space	Direct Trust
Building Distribution	Indirect Trust

Assets Classification

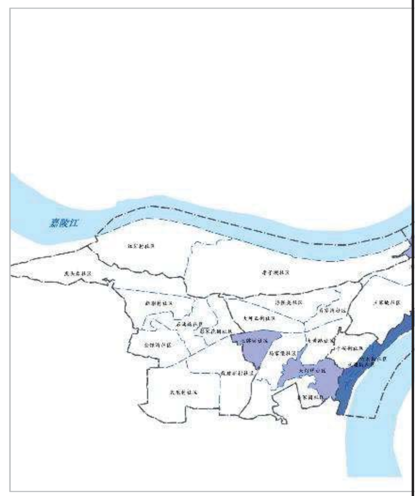
GIS Database of Community Assets

COLLABORATIVE PLANNING / Planning Content 1

Mapping: Community Asset Map、Demand Map、Problem Map



Community Asset Map

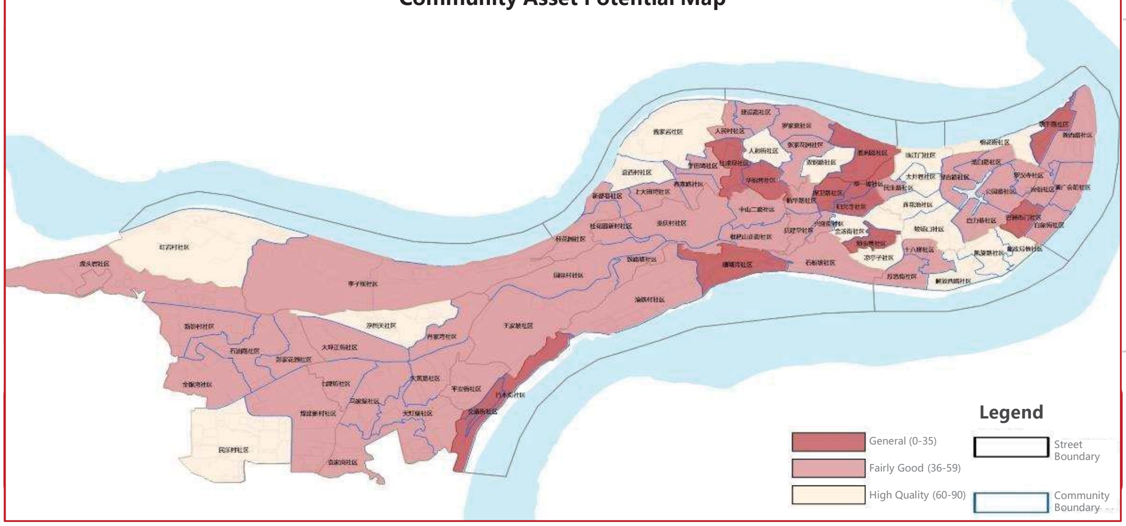


Community

COLLABORATIVE PLANNING / Planning Content 1

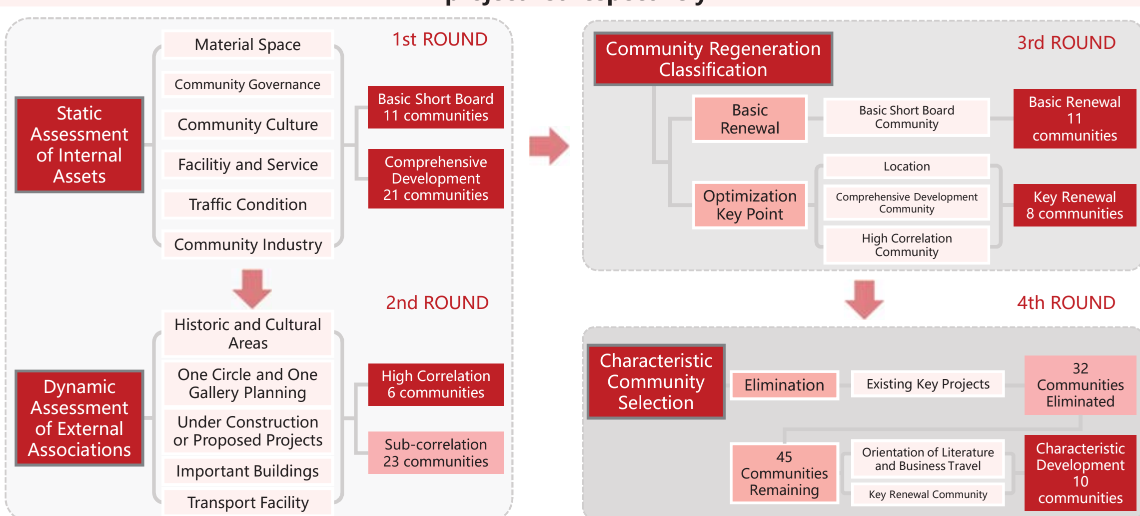
Community Status Asset Evaluation System

Community Asset Potential Map



COLLABORATIVE PLANNING / Planning Content 2

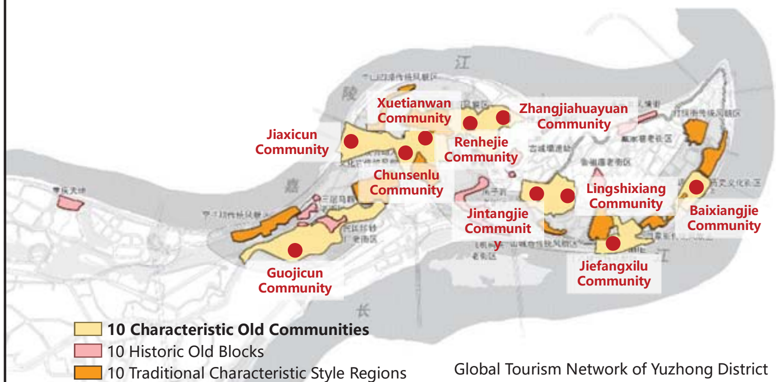
After 4 rounds of selection, we established the overall strategy of community renewal, which is "focus on the characteristics and pay equal attention to the bottom line", and customized the renewal plan and project list respectively



COLLABORATIVE PLANNING / Planning Content 2

"Focus on Characteristics"：Building 10 characteristic old communities, connecting 10 historic old streets and 10 traditional characteristic style regions in Yuzhong District, and building a universe tourism network.

Characteristic Old Community: An urban aboriginal community with historical culture, mountain scenery and urban life



Global Tourism Network of Yuzhong District

Construction Standards of Characteristic Old Communities

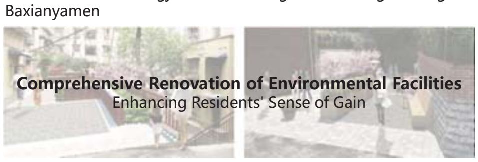
STRATEGY	CONTENTS
Excavating Community Cultural Assets	Identify community cultural assets, protect and utilize, activate and revitalize community cultural assets.
Planning Community Cultural Tourism Route	Systematically building communities' scattered cultural assets, organically linking mountain city's old communities with traditional tourism routes of old blocks, makes it to be a supplement and display of the city style.
Improving the Quality of Public Space	Sort out communities' unused public space, renew and build them according to the actual needs of residents to activating the vitality of space, and formulate public space management measures to ensure the sustainable use and renewal of public space.
Enhancing service facilities	Strengthen the construction and management of community pension facilities and parking facilities; introduce community smart services to build online community life service platform; innovate and create movable cultural landscape.
Promoting Community Autonomy Management	Actively cultivate their own community services; introduce non-profit community service organizations; strengthen the government purchasing services.
Unified Planning and Classified Implementation	The government is responsible for overall planning and unified implementation of community renovation, but for projects involving property units such as parking garage renovation, it is suggested that government should give relevant policies to encourage property units to practice. The timing of community construction needs to be combined with the progress of major functional projects around it.

COLLABORATIVE PLANNING / Planning Content 2

"Improving Bottom Line"：For the 11 communities that need basic renewal urgently, the renewal standards and project lists are formulated to improve the quality of community life as a whole.

The internal asset conditions are relatively backward, and the basic projects needs to be renewaled urgently.

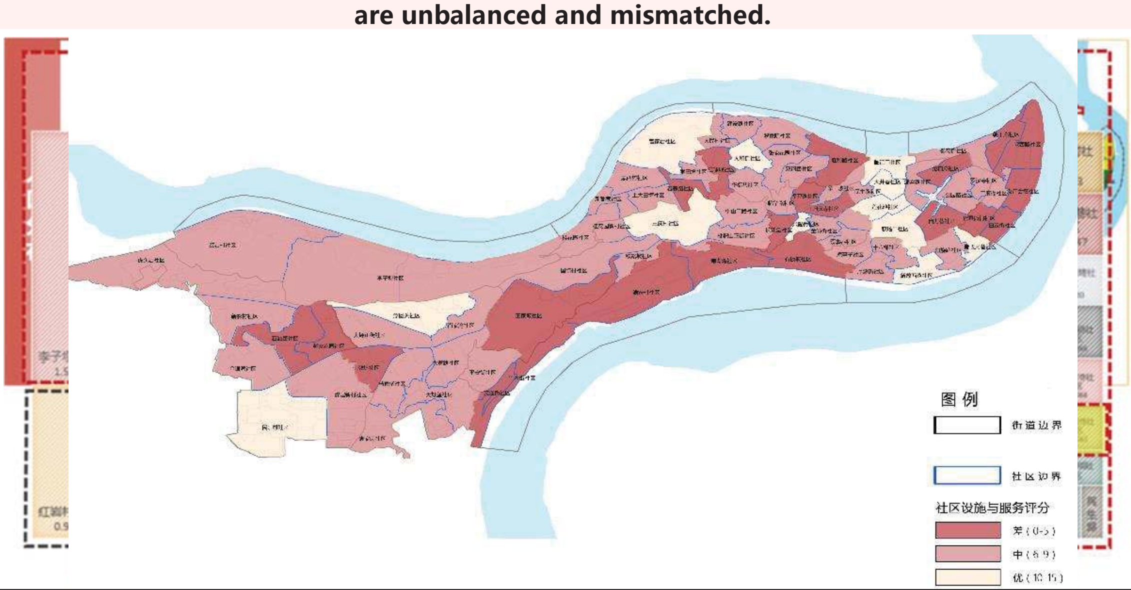
Chaoqianlu、Guiyuansi、Lingshixiang、Hanweilu、Huayipo、Shanhuwan、Jiaotongjie、Zhumuxiang、Huafuxiang、Shenglilu、Baxianyamen



Community Name	List of Community Basic Regeneration Projects				
	Physical Space	Social Governance	History & Culture	Facility & Service	Transportation
朝千路社区	1.增加公共活动空间和景观绿化，提升空间品质	1.建立绩效长效机制 2.提高居民参与社区治理服务的积极性	爱幼和邻里互助文化 2.培育社区文化组织，开展丰富多彩的文化活动	1.增加社区养老服务设施	1.加强停车管理
巴县衙门社区	1.增加公共活动空间 2.加强对水产市场的环境整治，加快搬迁	1.建立绩效长效机制 2.提高居民参与社区治理服务的积极性	1.培育发扬社区尊老爱幼和邻里互助文化 2.培育社区文化组织，开展丰富多彩的文化活动	1.部分建筑增设电梯	1.新增停车位，并加强停车管理
归元寺社区	1.逐步更新市政管网	1.优化流动人口管理措施	1.加强文物保护，如归元寺、巴蛮子广场	1.老旧住宅增设电梯、雨棚等设施 2.着力提升养老服务水平 3.适量增加生活服务设施	1.新增停车设施，并加强停车管理
领事巷社区	1.居民楼外立面加固 2.提升公共空间品质、增加绿化和小品设施，加强景观营造 3.对放牛巷片区进行改造更新	1.鼓励社区企事业单位参与社区治理，提高共驻共建能力	1.加强对德国领事馆和中国民主革命同盟旧址的保护和利用	1.增加养老服务设施，提升社区养老服务水平 2.逐步更新市政管网	1.新增停车设施，并加强停车管理
捍卫路社区	1.对社区破败的老旧楼宇进行综合整治 2.提升居住空间品质、增加绿化和小品设施，加强景观营造	1.围绕居民的生活需求，努力提高服务质量	1.加强对中苏文协旧址的保护修缮工作	1.逐步更新市政管网等基础服务设施	1.新增停车设施，并加强停车管理
华一坡社区	1.提升居住空间品质、增加绿化和小品设施，加强景观营造	1.增强社区居委会与辖区居民、辖区单位和社会组织之间的联系，促进社区共驻共建	无	1.增加楼宇及公共空间的无障碍设施 2.逐步更新市政管网等基础服务设施	1.新增停车设施，并加强停车管理
珊瑚湾社区	1.改造珊瑚公园铺地 2.合理利用闲置空地，如将社区 127-106	1.构建信息网络平台，建立绩效长效机制 2.加大对社区弱势群	1.加强码头文化营造	1.新建菜市场 2.加强对垃圾中转站	无

PLANNING CONTENT 3
Community Scale Adjustment Based on "People-Space-Service" Comprehensive Governance Promotion

The population distribution, spatial scale and service supply in Yuzhong district's community are unbalanced and mismatched.



COLLABORATIVE PLANNING / Planning Content 3

Establishing the Index System of Community Scale Assessment, creating the basic concepts of "Demand for Community Management Services" and "Community Service Circle".

The Actual Demand for Community Management Services

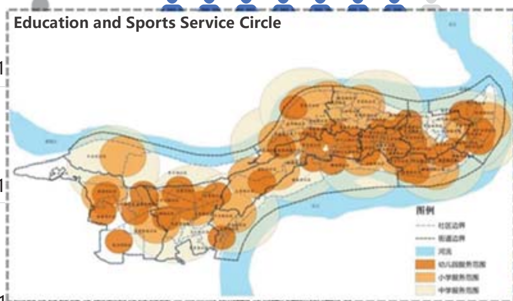
Take the demand for management services of an ordinary permanent population (non-vulnerable groups and non-key personnel) as "**Unit Demand**".

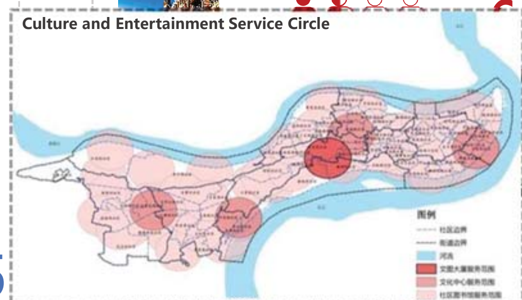
Actual Demand for Management Services for Specific Population in Community

Community Service Circle

Scope of Community Public Service Supply

Actual Demand for Management Services for Specific Affairs in Community



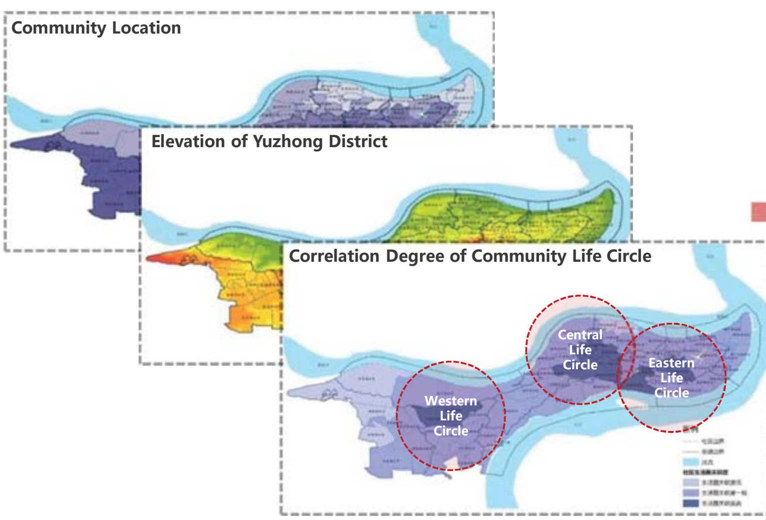


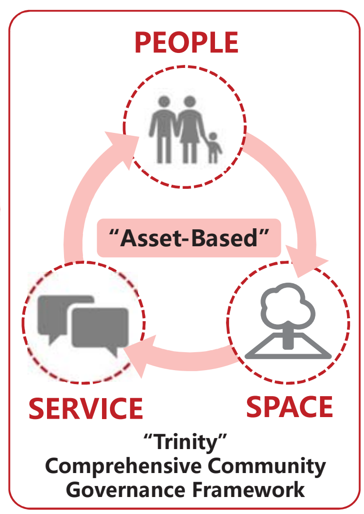
an ordinary permanent population

an ordinary permanent population

COLLABORATIVE PLANNING / Planning Content 3

Establishing the framework of "People-Space-Service" community comprehensive governance promotion in Yuzhong District, combined with the concept of Community Life Circle.





COLLABORATIVE PLANNING / Planning Content 3

Criteria of Community Scale Classification in Yuzhong District

Community Classification

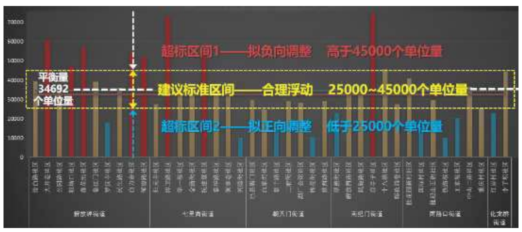
Level Ⅰ: Jiefangbei Street、Qixinggang Street

Level Ⅱ: Chaotianmen Street、Nanjimen Street、Qixinggang Street、Caiyuanba Street、Shangqingsi Street、Daxigou Street

Level Ⅲ: Hualongqiao Street、Shiyoulu Street、Daping Street

Actual Demand Scale

It is suggested that the actual demand standard should fluctuate reasonably between **25000-45000 units**, and that communities above or below this standard should make positive/negative adjustments.

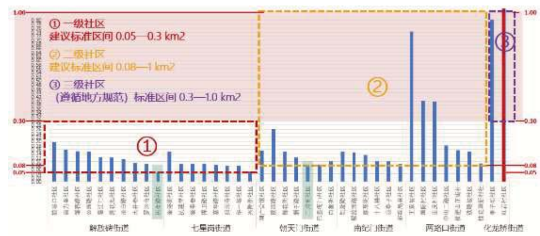


Spatial Scale

Level Ⅰ: Recommended Standard Interval **0.05-0.3km²**

Level Ⅱ: Recommended Standard Interval **0.08-1km²**

Level Ⅲ: Recommended Standard Interval **0.3-1km²**

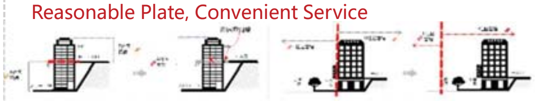


COLLABORATIVE PLANNING / Planning Content 3

Principle of Community Scale Adjustment in Yuzhong District

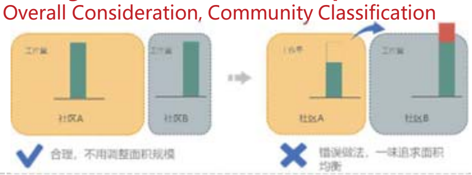
①Division Principle

Reasonable Plate, Convenient Service



②Average Service Volume Principle

Overall Consideration, Community Classification

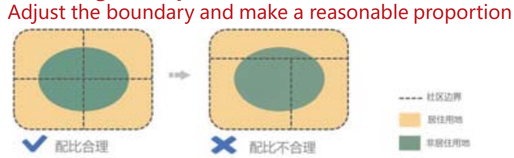


③Quantification Principle

Collecting data and updating dynamically

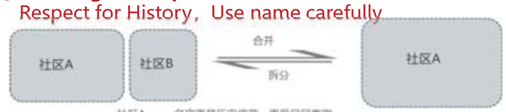
④Matching Principle

Adjust the boundary and make a reasonable proportion



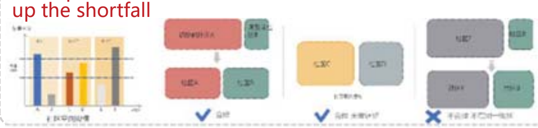
⑤Naming Principle

Respect for History，Use name carefully



⑥Increase-Decrease Principle

Respect Present Situation, Subtract the excess and make up the shortfall



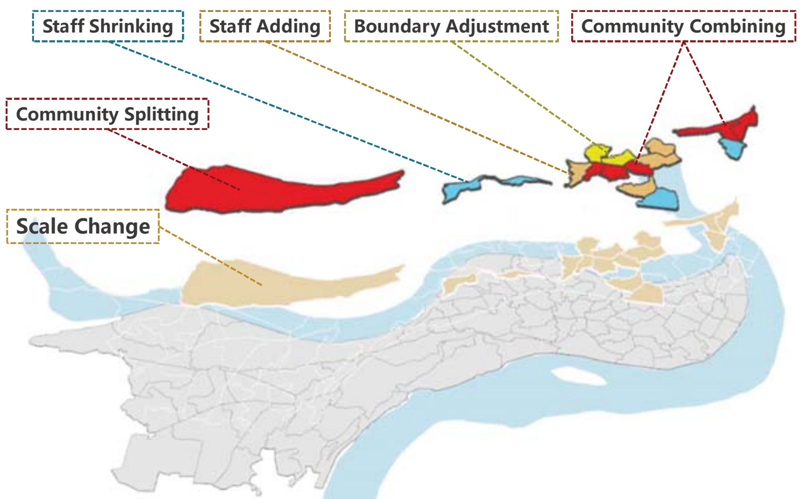
COLLABORATIVE PLANNING / Planning Content 3

Suggestions on the Adjustment of Community Scale and Personnel Allocation

Separation / Combination
5 communities involved
Xinglongjie、Jintangjie、Chaoqianlu、Mianhuajie、Liziba

Personnel Turnover
8 communities involved
Lianhuachi、Dajingxiang、Luohansi、Hanweilu、Kangjiantang、Liangtingzi、Houcijie、Tielupo

Boundary Adjustment
2 communities involved
Hanweilu、Guiyuansi



PLANNING CONTENT 4
Participatory Community Renewal Action Planning Based on Cultural Renewal of Public Space

COLLABORATIVE PLANNING / Planning Content 4

10 characteristic old communities involve 6 sub-districts in Yuzhong District.

Culture Leads Public Life

Daxigou Street
Renhejie
Zhangjiahuayuan

Old Street Tourism Cultural Characteristics

Chaotianmen Street
Baixiangjie

New Diplomatic World International community

Lianglukou Street
Guojicun

Anti-Japanese War Street Old Lane of Mother City

Qixinggang Street
Jintangjie
Lingshixiang

Cultural Characteristics Community Life

Shangqingsi Street
Xuetianwan
Chunsenlu
Jiaxicun

Anti-Japanese War Culture Lower City Area

Nanjimen Street
Jiefangxilu

COLLABORATIVE PLANNING / Planning Content 4

Community Public Space Construction and Community Culture Restoration
Community Residents + Community Organizations

Working Together With Community Residents

Community Public Space Construction


Cultural Fitness Park Renewal of Renhejie Community · Before


Cultural Fitness Park Renewal of Renhejie Community · After

Community Culture Restoration

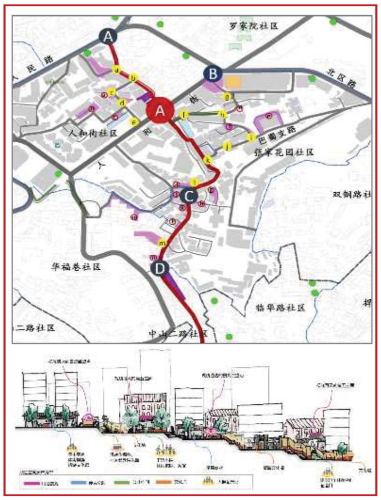

Former Site of Zhongfa School Renewal · Before


Former Site of Zhongfa School Renewal · After

COLLABORATIVE PLANNING / Planning Content 4

Combing the prototype of community living space in Mountainous Cities

Linear Space + Node Space + Unused Space



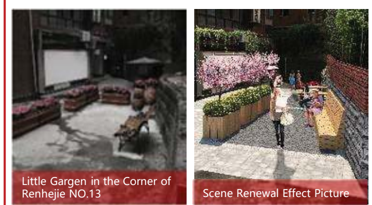
Linear Space

Node Display Planning of Former Site of Zhongfa School

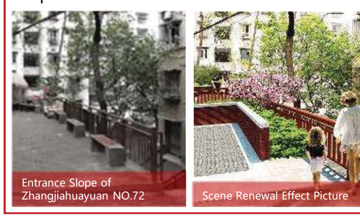
Node Display Planning of Red Army Building

Node Space

Corner



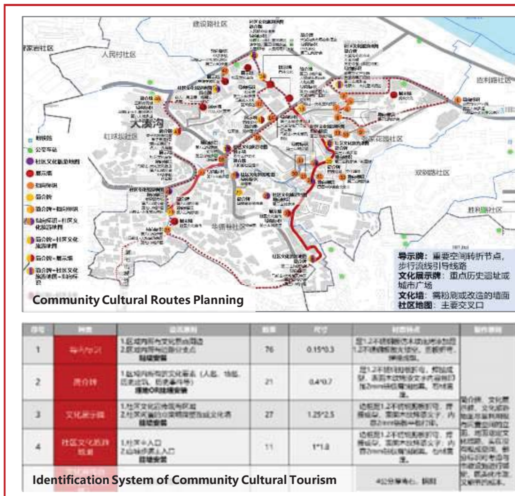
Slope



Unused Space

COLLABORATIVE PLANNING / Planning Content 4

Community Scene Planning and Design: Community Cultural Routes + Community Living Routes

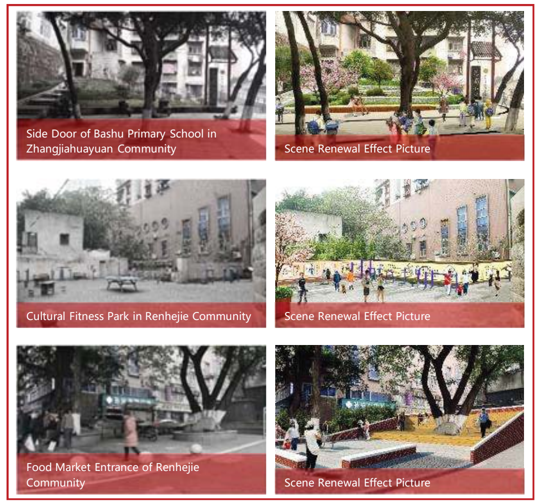


Community Cultural Routes

Community Living Routes

COLLABORATIVE PLANNING / Planning Content 4

Community Scene Planning and Design: Community Cultural Scene + Community Living Scene



Community Cultural Scene

Community Living Scene

SUMMARY & REFLECTION

Outcome Composition / Planning Innovation / Implementation Feedback

SUMMARY & REFLECTION / Outcome Composition

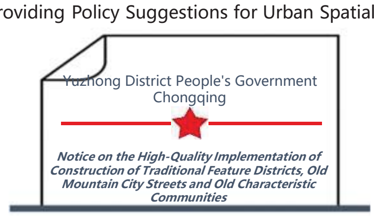
Research on the Overall Idea of Community Regeneration	Monographic Study on Community Scale Adjustment	Action Planning on Characteristic Old Communities Regeneration	Annex of Basic Research
Reflections on Community Development	Current Situation on Community Scale Adjustment	Renhejie Community	General Survey of Streets and Communities
Basic Concept of Community Development	Necessity of Adjustment	Zhangjiahuayuan Community	Present Situation Investigation on Community Assets
Community Assets Survey	Basis and Methods of Adjustment	Hongqiuba Community	Records on Focus Discussion of Multi-party
Idea Research on Community Renewal	Assessment on Community Scale	Planning on Cultural Routes	Demand statistics on Community Governance
Cases Analysis of Community Renewal	Standard of the Scale and Adjustment Suggestion		Weights Survey on Staff Affairs
			Relevant Issues on Community Service

SUMMARY & REFLECTION / Outcome Composition

Two implementation policies of urban regeneration in the 13th Five-Year Plan of Yuzhong District were incorporated into *the Urban Promotion Action Plan of Chongqing*

Construction of 10 Characteristic Old Communities,2017

Providing Policy Suggestions for Urban Spatial Environment Renewal in Yuzhong District.



Suggestions on Community Scale Adjustment,2018

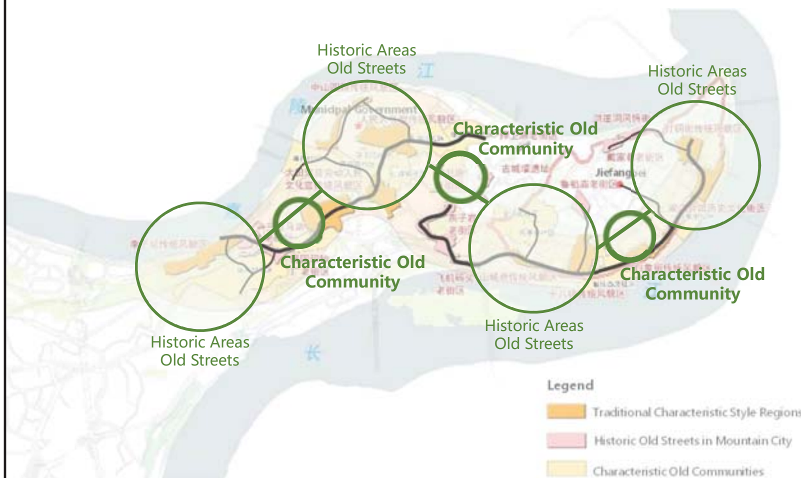
Adjusting the Path of Fine Governance of Urban Community by Balancing Demand and Supply.

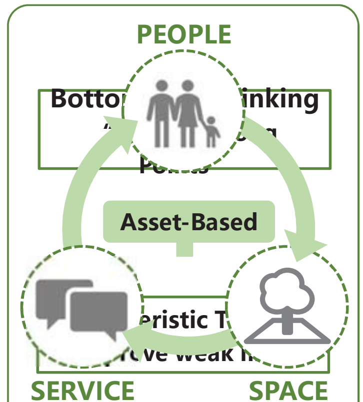
Urban Promotion Action Plan of Chongqing, 2019

- URBAN PLANNING
- URBAN CONSTRUCTION
- URBAN MANAGEMENT
- URBAN TRANSPORTANTION
- INFRASTRUCTURE
- ECOLOGICAL CONSTRUCTION
- HUMANISTIC SPIRIT
- PUBLIC SERVICE
- TECHNICAL INNOVATION

SUMMARY & REFLECTION / Concept Innovation

Integrating Community Regeneration into the Overall Framework of Urban Regeneration; Establishing a Trinity Community Comprehensive Governance Evaluation System of "People-Space-Service"

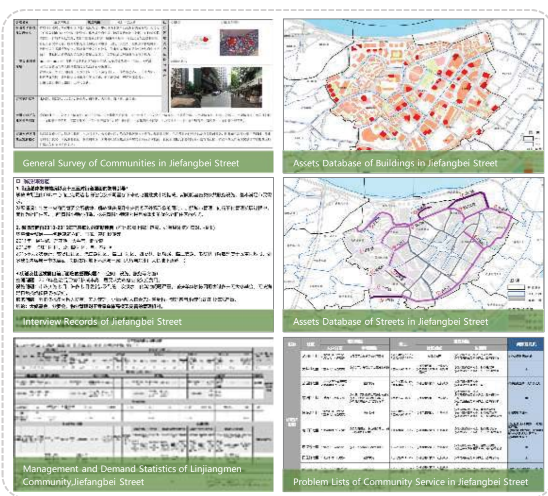




Trinity Community Comprehensive Governance Framework

SUMMARY & REFLECTION / Method Innovation

Using GIS platform and Mapping Analysis to further optimize and improve the planning methods of community renewal in Mountain City



Research Analysis and Database Establishment

- Assessment Methods of Community Assets
- Evaluation Methods of Demand and Supply of Community Services
- Scene Building Methods of Community Public Space
- Methods of Community Cultural Routes Planning
- Methods of Community Governance Planning

Toolbox of Mountain City Community Renewal Planning

SUMMARY & REFLECTION / Mechanism Innovation

Accurately build a multi-department, cross-industry, interdisciplinary and long-term renewal collaboration platform for the government, universities, communities, enterprises and society.

Long-term Mechanism of Community Renewal and Collaboration

SUMMARY & REFLECTION / Affirmations of Multi-party

After the implementation, many media have reprinted the reports, and the social sectors response is good.

Many media actively reported the progress of community regeneration

Relevant departments highly recognize the role of planning outcomes.

2nd International Forum on Low Carbon Development for Cities

"Acting Together for Low carbon, Livable, and Prosperous Cities"

ASSET-BASED

REGIONAL OVERALL PLANNING

CULTURE GUIDANCE

PEOPLE-ORIENTED REGENERATION

Better Community, Better Life!
We are on the way!

Prof. HUANG Ling
FACULTY OF ARCHITECTURE AND URBAN PLANNING,CHONGQING UNIVERSITY
Email: hwawa1025@vip.163.com

9/4/2019 Seoul

CITYNET
THE REGIONAL NETWORK OF LOCAL AUTHORITIES FOR THE MANAGEMENT OF HUMAN SETTLEMENTS

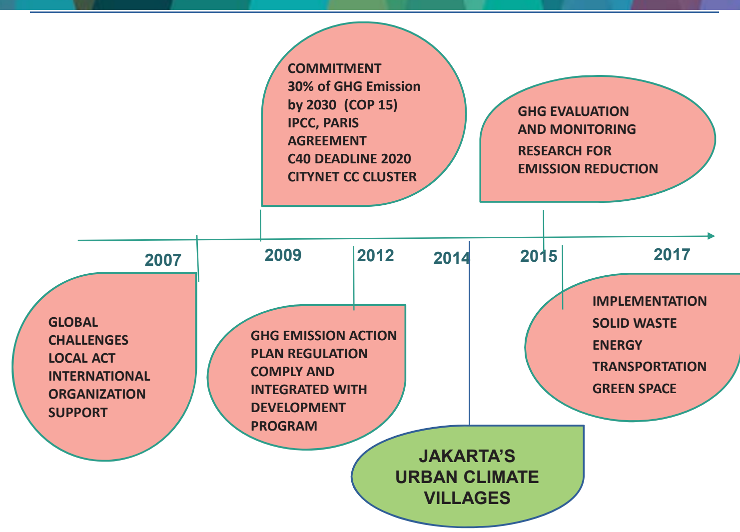
BUILDING COMMUNITY FOR LOW CARBON SOCIETY
CASE: JAKARTA'S URBAN CLIMATE VILLAGES (KAMPONG)

IMPROVING SOCIETY PARTICIPATION TOWARD SUSTAINABILITY

- **Background**
- **The Objectives**
- **Strategies**
- **Action Plan**
- **Program Implementation**
- **Social Innovation**
- **Conclusion**

DR. AISA TOBING
DEPUTY SECRETARY OF CITYNET

BACKGROUND



BACKGROUND

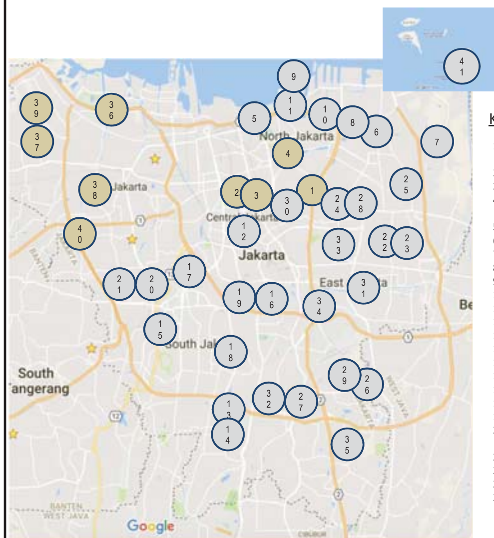
The action plan aims to reduce GHG emissions and build resilience to the impacts of climate change, through:

- **Develop a roadmap towards GHG emissions neutrality by 2050 and formulate emissions reduction targets for 2030**
- **Shows how Jakarta will adapt and increase resilience to the impacts of current climate change and its future impacts with predictions and scenarios**
- **Develop a plan that provides broad benefits for the community, environment and economy throughout the city, including *a plan for around 200 Climate Kampong***
- **Develop methods for implementing GHG mitigation action plans and climate change adaptation by Collaborating with various partners who are concern with climate change**

THE OBJECTIVES

- **The number of Climate Villages in Jakarta is 53 locations (from the planned 200 locations by 2020)**
- Local Community (Sub District Level) have made continuous adaptation and mitigation efforts on climate change and accelerated the achievement of climate action targets
- Increasing the involvement of community will strengthen adaptive capacity on climate change impacts and reduction of greenhouse gas emissions
- Building a Low Carbon society in the City throughout the Local Communities as approached in the Urban Climate Villages (Kampongs)

LOCATION OF URBAN CLIMATE VILLAGE PROGRAM IN JAKARTA



Keterangan lokasi:

1. RW 03 Kel. Cempaka Putih Timur, Jakarta Pusat
2. RW 03 Kel. Cikini, Jakarta Pusat
3. RW 01 Kel. Cikini, Jakarta Pusat
4. RW 10 Kel Cempaka Putih Barat, Jakarta Pusat
5. RW 06 Kel. Kebon Kosong
6. RW 03 Kelapa Gading TImur
7. RW 01 Rorotan
8. RW 03 Kelapa Gading Barat
9. RW 11 Warakas
10. RW 04 Sungai Bambu
11. RW 01 Sunter Jaya
12. RW 02 Guntur Setiabudi
13. RW 04, Lenteng Agung
14. RW 09, Lenteng Agung
15. RW 06, Gandaria Selatan
16. RW 03, Rawajati, Pancoran
17. RW 01, Rawa Barat
18. RW 05, Jatipadang
19. RW 05, Mampang Prapatan
20. RW 07, Kebayoran Lama Selatan
21. RW 08, Petukangan Selatan
22. RW 02, Malakasari
23. RW 03, Malakasari
24. RW 07, Jati, Pulogadung
25. RW 01, Cakung Barat
26. RW 02, Cibubur
27. RW 09, Ciracas
28. RW 011, Jati, Pulogadung
29. RW 04, Bambu Apus, Cipayung
30. RW 01, Utan Kayu Selatan
31. RW 12, Cipinang Melayu, Makasar
32. RW 07, Baru, Ps. Rebo
33. RW 10, Cipinang Muara, Jatinegara
34. RW 01, Cililitan, Kramatjati
35. RW 03, Kelurahan Munjul, Cipayung
36. Rusun Cinta Kasih, Cengkareng
37. RW 03, Duri Kosambi, Cengkareng
38. Taman Aries, Kembangan
39. RW 04, Perum Merpati, Kalideres
40. RW 04, Komplek Damkar, Joglo
41. RW 04 Pulau Panggang, Kep Seribu Utara
42. RW 02 Ulujami
43. RW 04 Kembangan Utara
44. Komp. DLH Cengkareng
45. RW 02 Rawasari
46. RW 08 Rawasari
47. RW 02 Papanggo
48. RW 02 Warakas

STRATEGIES

- Encourage the real action of communities to increase the awareness and to carry out the mitigation and adaptation activities of climate change.
- Reduce GHG emissions (GHG) from GHG reduction potential, such as transportation, waste, and energy in small scale community level
- Increase of community resilience to adapt climate change
- Increase of a quality of life & socio-economic community
- *Building the Community* through development *of Social Innovation for Low Carbon Society*

CLIMATE ACTION PLAN

STEERING (FACILITATE)

- Encouraging this program to become a priority and mandatory activity for all districts and related agencies
- Providing Award and Incentives to the achievement of this program
- Become Key Performance Indicator for all District/Sub District, Community Organization and related agency.
- Preparing the 2018-2022 master plan of this program as well as the budgeting based for in supporting this program activities.
- Integrating all program activities between official agencies

BUILDING CAPACITY

- Strengthening institutional implementation of this program
- Increasing the intensity of mentoring and friendly guidance for all district for related official agency, community leaders, volunteers and other stakeholders in the development of this program

CLIMATE ACTION PLAN

COLLABORATION

- Strengthening a partnership with stakeholders including Business, academician, media, environmentalist, community leaders to mobilize this program
- Socialization, increase understanding and awareness of the benefits of climate change action
- Conducting comparative studies, competition between Climate Kampongs
- Invite other financial supporting such as CSR to facilitate and develop the Climate Kampong
- Developing economic potential and benefits as a result of the activities of this program, such Urban farm, Medicine Herb, Walkable eco-tourism Kampung
- Form a Low Carbon society organization in the form of “a Cooperative” as a business entities that have members of the community based on cooperative principles as well as people's economic and family based

CLIMATE PROGRAM IMPLEMENTATION (Waste)

Composting

3R

Waste separation

Plastic waste reuse for planting

CLIMATE PROGRAM IMPLEMENTATION (Waste Bank)

CLIMATE PROGRAM IMPLEMENTATION (Grennery)

Planting in the yard

Buiopore Absorption Hole

Medicine herb planting

Rain water Harvesting and planting

CLIMATE PROGRAM IMPLEMENTATION (Economic Benefit)

Waste Compos Production

CLIMATE PROGRAM IMPLEMENTATION (Urban Mobility)

Goal

Encourage the existence of walkable neighbourhood which prioritize pedestrians, cyclists, and public transport users.

Locations

Three pilot projects

RW 01 Sunter Jaya, North Jakarta | RW 01 Cikini, Central Jakarta | RW 05 Mampang Prapatan, South Jakarta

- **Creating pedestrian & bike – friendly neighborhood**
- **Increasing the sense of belonging for every improvements made**
- **Doing capacity building & transfer knowledge to the people**
- **Established the collaborative environment**
- **Emphasized the direct role of women & children within the process**

Source: ITDP

CLIMATE PROGRAM IMPLEMENTATION (Walkable eco-tourism kampong)

Festifal Kampong

Local event to celebrate and appreciate the improvements made by the locals. Time to find collaborators

Child-Friendly Alley

Source: ITDP

CLIMATE PROGRAM IMPLEMENTATION (Walkable eco-tourism kampong)

Traffic & parking management alley

Source: ITDP

Methode

Introduction → Identification → Mapping → Ideas & Recommen-dation → Implementation

Introduction
- Meetings

Identification
- Discussions, interviews, field survey, travel diary
- Scoring

Mapping
- Participatory mapping, documentation, and issue confirmation
- Analysis

Ideas & Recommen-dation
- Local initiative collection
- Improvement concept discussions
- Strategies

Implementation
- Phasing
- Do

Identification
Sticker and Drawings






for kids

Identification
Perception Discussion






women and men group meetings

Mapping

Participatory mapping with women group

Conducted by UN Women and was helped by ITDP

SOCIAL INNOVATION

- *Empowering the Community* through development *of Low Carbon Society and Involved them to achieve the target of GHG emission*
- *Set up the Mechanism of green community* activities such living with an efficient and renewable energy and low carbon footprint. Not only physical program but also increase of a quality of life & socio-economic community
- *Increasing the awareness and participation of the community* for low carbon activities and the importance of climate activities for sustainability where one of the goal of the Climate Program is to be sustainability, “the lower carbon in a city, the more sustainability of the city”
- Establishment “a Low Carbon Society” as a place for Collaboration or *Stakeholders to be involved*
- Local communities will be involved, trained, enhanced and sense of belonging to the Climate program

CONCLUSION

- The climate program create some models (waste, economic benefit, walk and bike mobility, energy efficient) that managed by Local Community Organization in Climate Kampongs to give a positive contribution to Climate mitigation for CO_2 emission (Reduction of GHG Emission) and sustainability
- A Model could be replicability and up scale in other green zones (Climate kampongs) and other Cities as well
- Implement "*a Special Program*" as a replicable project, Upscale, and Prototype to help fill gaps to long-term urban development challenges as one of the scope of Climate Change
- Low Carbon society that has been formed with a cooperative institution will be sustainable (Cooperatives are business entities that have members of the community based on cooperative principles as well as people's economic movements based on the principle of family).

THANK YOU

CITYNET
THE REGIONAL NETWORK OF LOCAL AUTHORITIES FOR THE MANAGEMENT OF HUMAN SETTLEMENTS

W-Foundation

HOOXI App & W Green Pay (WGP)

Youree Lee Ph.D.
Co-founder and CEO of W-Foundation
CBO of PeerTec

September 4th, 2019

Discussion Material for Session 9: Social Innovation for Low-Carbon City Development

AGENDA

W-Foundation

"W" in W-Foundation stands for Wisdom for Future

SOLUTION FOR NATURE

A — **A private, non-governmental, non-profit organization established in 2012**, designated as a philanthropic "donation organization" by the Ministry of Strategy and Finance of South Korea.

B — **Believes in partnerships**, in which individuals, corporations and organizations contribute their unique resources to build and sustain a broad-based effort to make a difference for our shared future.

C — **Committed to driving awareness and support** for individual and collective actions needed for natur e

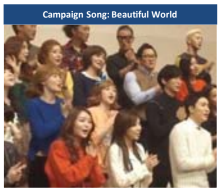
conservation, climate action and relief for refugees impacted by climate change and natural disasters.

D — **Dedicated to projects focused on nature conservation, sustainability and climate action**, with emphasis on building public awareness, research, field investigation and immediate relief.

Relief for Climate Refugees & Victims of Disasters

- **W-FOUNDATION** operates the Global Climate Refugee Fund (GCRF)
- **GCRF** Provides **immediate relief and sustainable recovery and development assistance** to refugees impacted by climate change and natural disasters

Campaign Song: Beautiful World



Raise public awareness through publicity campaigns, including the production of global campaign songs and videos supported by top stars

- Raise public awareness
- Secure localized operational support
- Act decisively
- Provide immediate relief
- Support sustainable recovery and development

Partnership with The Philippine Red Cross

Work with public authorities of the countries in need to **secure localized operational support and act decisively** to reach affected communities

Relief for Typhoon Haiyan

Relief for Xe-Pian Xe-Namnoy Dam Collapse

Provide immediate relief, including emergency clothing, drinking water, medical care, and other urgent requirements to support communities in developing countries that are impacted by climate change, natural disasters, and environmental degradations caused or exacerbated by anthropogenic actions

Rebuilding of School in Trishuli Region, Nepal

Rebuilding Ternate Community in Philippines

Support sustainable recovery and development of the impacted communities by developing longer term projects focused on education, renewable energy, female empowerment, localized medical care, community rejuvenation, supply of potable water, among others and securing the requisite funding

Sustainable Humanitarian Aid for Communities at Risk

W-FOUNDATION works with corporate and institutional partners to:

- Provide **on-going humanitarian aid to communities** beset by environmental degradation
- Contribute to **equitable social progress and better standards of life** for developing communities

HOOXI Water for Cambodian Villages with Contaminated Ground Water

Free Mobile Medical Care Bus with in Cambodia Targeting Female Garment Industry Workers and Remote Villagers in Rural Regions of Cambodia

Solar Panel Lighting Installation in Remote Cambodian Villages

Medical Supplies for Attapeu Province, Laos

Installation of Water Supply Facility in Kisarawe Village, Tanzania

HOOXI Campaign for Greenhouse Gas Emission Reduction

- Focuses on raising **public awareness on climate change** and its impact on earth
- Encourages individuals to **reduce Greenhouse Gas (GHG) emissions** by taking climate actions in their daily lives

Conferences, Forums and Seminars

Public Events and Educational Festivals

Campaign Songs & Celebrity Ambassadors

Celebrity Supporters of W-Foundation's HOOXI Campaign

[Some of the Participating Celebrity Honorary Ambassadors]

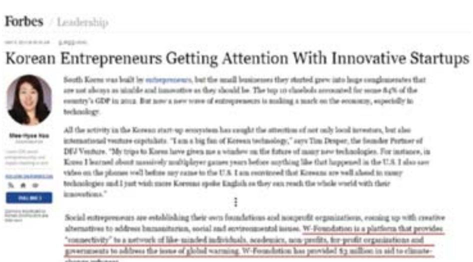
Yoon Il-Sang (composer), Kim Yoo-Jung, Jang Hyuk, Max Changmin, Choi Si-Won, Kim Tae-Woo, Ailee, Donghae, Baek Sung-Hyun, Seo Moon-Ta k,

Han Go-Eun, Kwon Hyuk-Soo, Brian, Eddy Kim, Eru, Shim Hyung-Tak, IOI, Alberto Mondi, Tylar, Ye Jung-Hwa, and more

200+ Korean celebrities including K-POP stars are honorary ambassadors of W-Foundation

Media Coverage of W-Foundation's Activities & Growth

- One of the **most active philanthropic non-profits in Korea** with wide support among ordinary citizens
- Recognized as a **leading proponent for broad-based climate action to mitigate climate change**



Forbes / Leadership

Korean Entrepreneurs Getting Attention With Innovative Startups

W-Foundation is a platform that provides "connectivity" to a network of like-minded individuals, academics, non-profits, for-profit organizations and governments to address the issue of global warming. W-Foundation has provided $3 million in aid to climate-change refugees.

- May 9, 2014 -

연예인 홍보대사만 200여명… 이 비영리단체의 성장 비결은?

The Chosun Daily, one of major daily papers in Korea, reported on W-Foundation as the fastest growing non-profit organization in South Korea.

- Oct. 14, 2014 -

AGENDA

Launch of HOOXI App & W Green Pay (WGP)

What is HOOXI App?

- Supports the HOOXI Campaign
- Provides a user-friendly mobile platform for mass public outreach
- Mobilizes and incentivizes app users to perform Greenhouse Gas (GHG) reduction missions
- Calculates each user's accumulated monthly mission points
- Distributes WGP rewards to users every month

What is W Green Pay (WGP)?

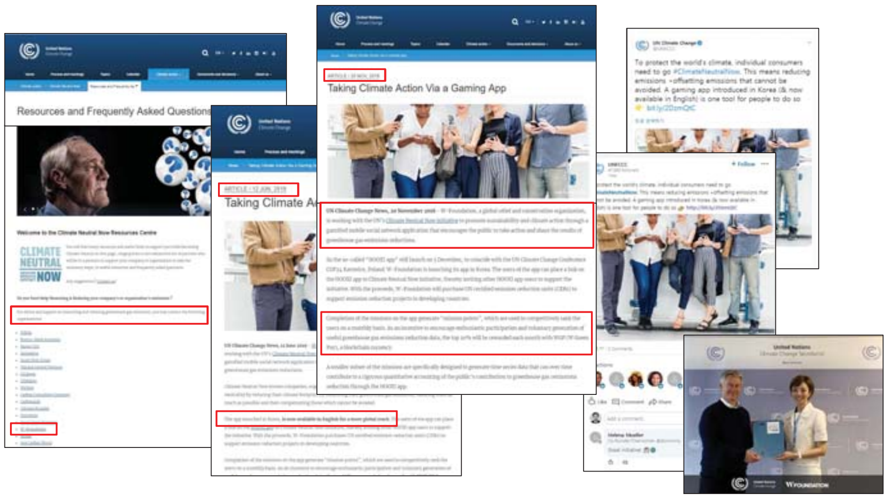
- ERC-20 compliant blockchain currency
- Tokenized monthly reward for users performing and reporting GHG reduction missions on the HOOXI App
- Distributed to top 20% of users on a monthly basis

- Released in Oct 2018 as a closed beta launch to the W-Foundation community
- Opened to the public on Dec 5, 2018 in an open beta launch
- Officially launched on Mar 8, 2019 with upgraded social media functionalities
- "Mall-in-App" HOOXI Mall launched and stocked with eco-friendly products
- Global launch in May 2019 with English, Chinese and Japanese capabilities
- WGP listed and traded on GDAC Exchange, Huobi Korea and KuCoin
- WGP rewards distributed every month from Jan 25, 2019

In Partnership with UN Climate Change

United Nations Climate Change

- **Partnered with UN Climate Change Secretariat** on the launch and subsequent promotion of the HOOXI App
- Working with the Secretariat **to promote and motivate climate actions among individual citizens & groups**



Media Coverage of HOOXI App and W Green Pay (WGP)

- Highlighted by the Korean press as **a unique case of mainstream philanthropic organization promoting the use of blockchain technology**
- Widely recognized for **innovative use of blockchain technology to support its mission to mitigate climate change** while establishing a **compelling use case for blockchain currency**


Biz&CEO

"미션 성공하면 온실가스가 감축돼요"— 환경문제, 블록체인 접목해 해결

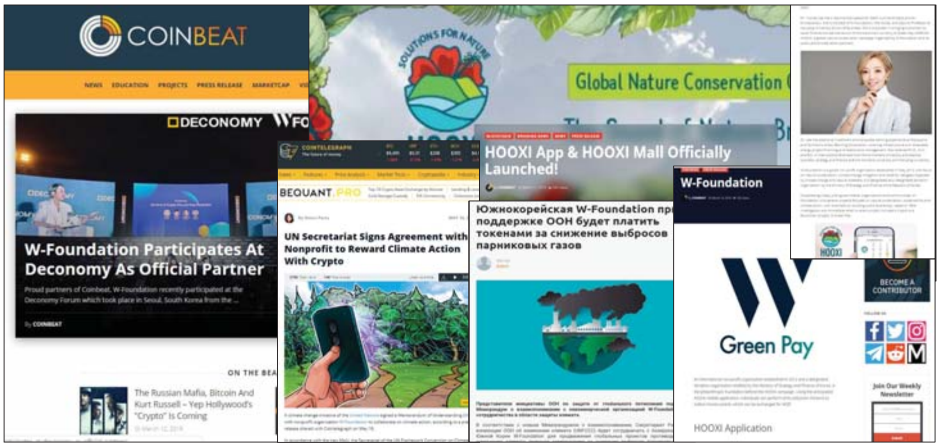
환경 살리는 '착한 블록체인' … 칭찬은 코인으로 드려요

"환경 지키면 암호화폐로 보상… 생활 속 활용사례 증명"

'HOOXI' 앱 베타서비스 출시– 대국민 온실가스 감축운동 프로젝트 '순항'

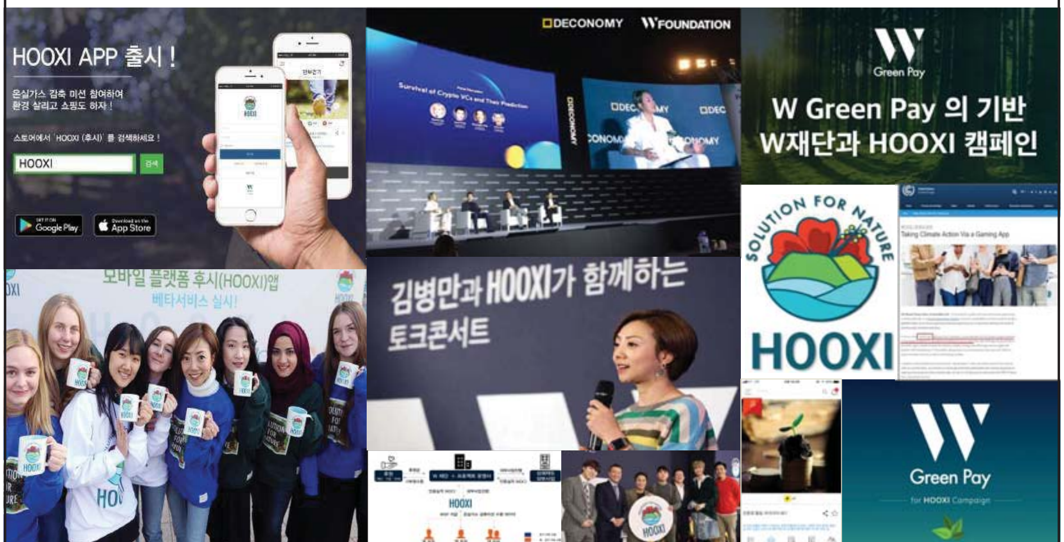
Global Media Coverage on HOOXI App and W Green Pay

- Received **wide interest from the global blockchain media** on the HOOXI App & WGP reward concept
- Emerged as **a key project among the Korean blockchain community**



Our Core Mission Remains Unchanged Since 2012

Utilizing & Promoting Blockchain Technology for Social Good



AGENDA

1 W-FOUNDATION

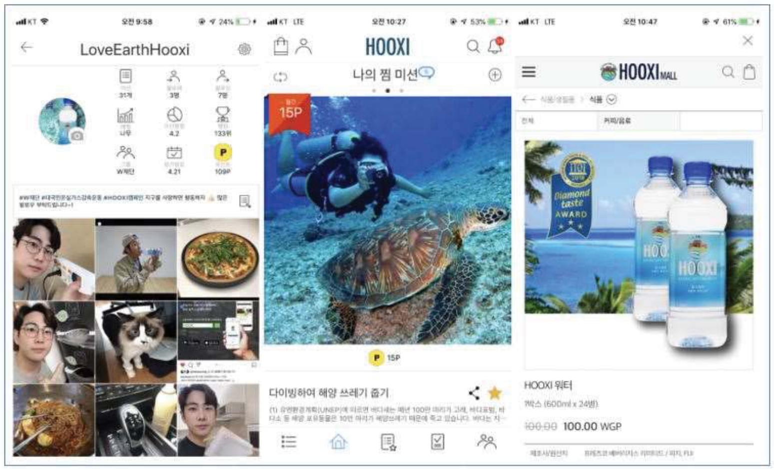
2 BLOCKCHAIN FOR SOCIAL GOOD

3 USER EXPERIENCE AND TOKEN UTILITY

4 NEXT STEPS

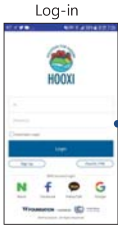
HOOXI App, HOOXI Missions & HOOXI Mall

- HOOXI App is the operating platform of W-Foundation's HOOXI Campaign to reduce GHG emissions
- Innovative climate action incentivization platform based on fun climate missions and compelling token utility
- 100,000+ app users performing climate actions everyday and contributing to climate change mitigation!



Landing Page: Climate Mission Feed Page

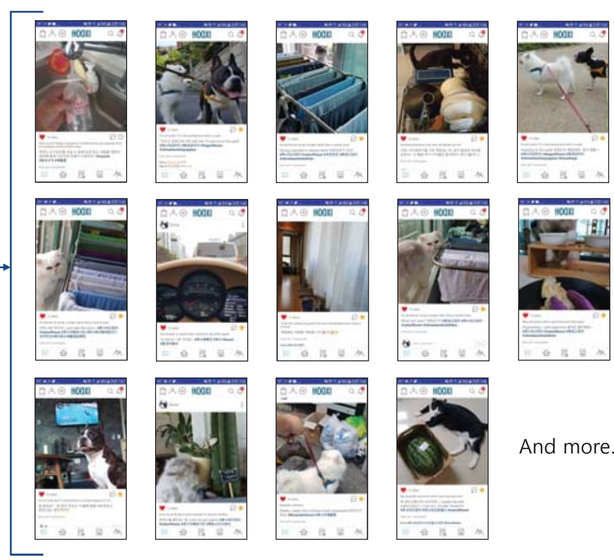
Log-in



- Co-branded with UN Climate Change Secretariat
- Accessed with indigenous ID and Password
- Also can be accessed with Naver, Facebook, Kakao Talk and Google accounts

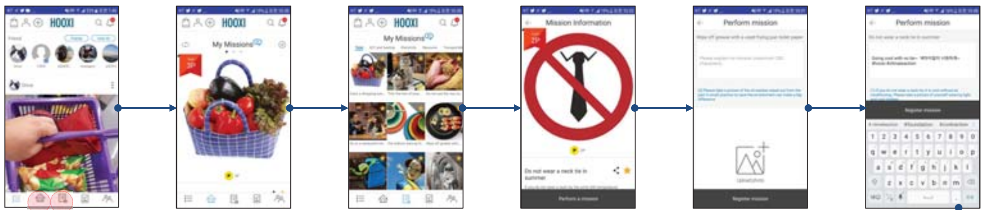
Landing Page

- User lands on climate mission feed page
- User can check out missions performed by the user, friends or all users
- Navigation is done by scrolling down the screen, similar to Instagram
- Users can Like, Bookmark, Comment or Message (similar to Telegram, WeChat and WhatsApp)

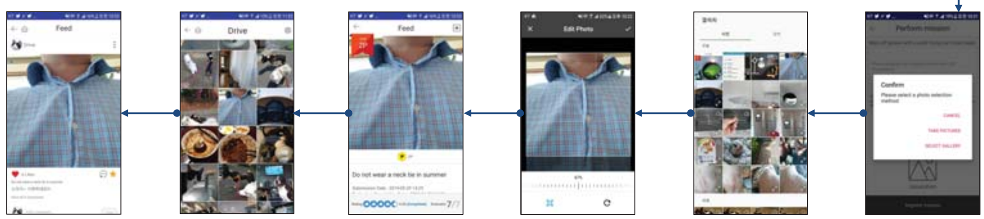


And more...

Performing Climate Action Missions



- Navigate to Mission Catalog
- Select Mission Type (Groupings)
- Review available missions
- Select a mission
- Mission entry screen opens up
- Type in mission description and hashtags



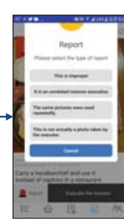
- Select method of uploading mission picture (Photo)
- In this case, select a suitable photo from the gallery
- Edit the photo and confirm to upload the photo
- Check mission evaluation in progress (by other users)
- Successful missions remain in the feed
- Interact with other users referencing missions in the feed (similar to interactions on Instagram)

Evaluating Other Users' Missions

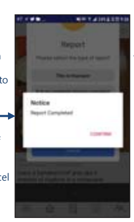
- Tap mission evaluation icon

- Review other user's mission

- Users can check previous evaluators' points as reference, when deciding their own evaluation points
- Evaluation activity itself generates mission points for the evaluator
- This systematizes incentives for users to provide self-imposed internal discipline of checks and balances as both mission performers and mission evaluators, while at the same time competing against one another for mission points

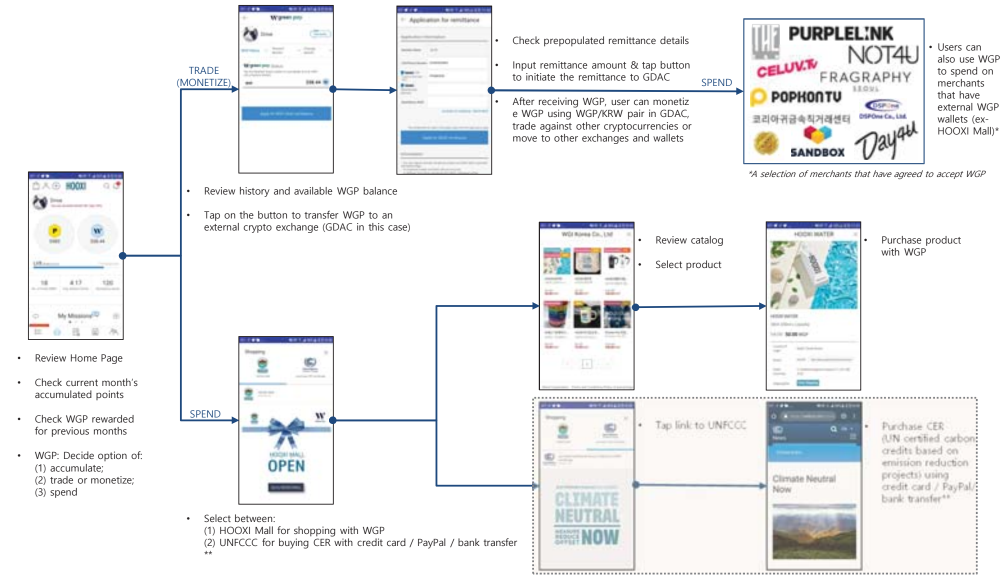


- When users spot an abuser, they can report the incident to the administrator
- Given the gravity of the process, user is given the choice to reconsider and cancel the abuse report



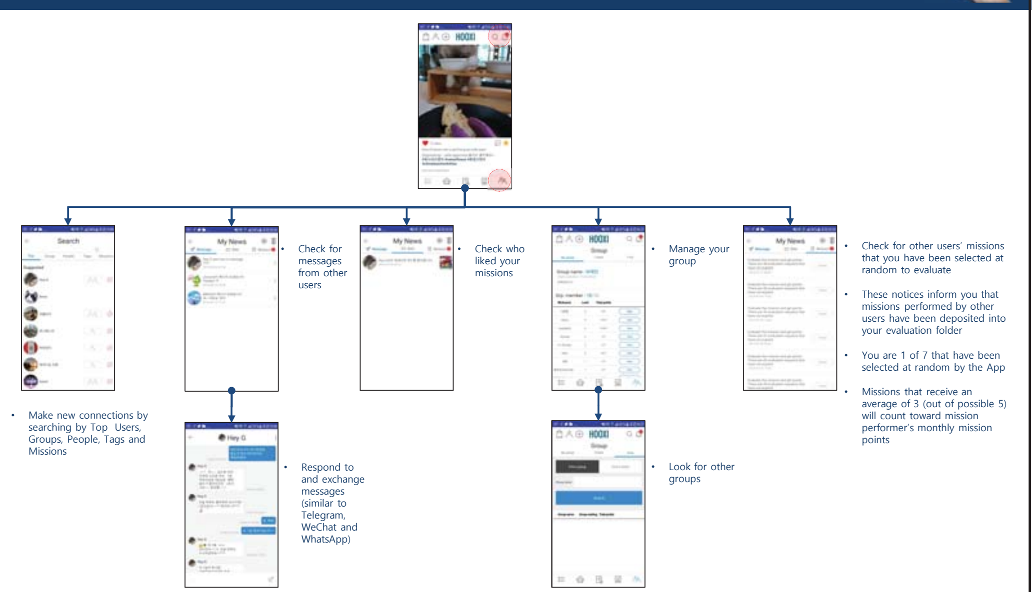
- User is asked to confirm the completion of the abuse report every time it is initiated

Utilizing WGP Rewards to Trade or Spend

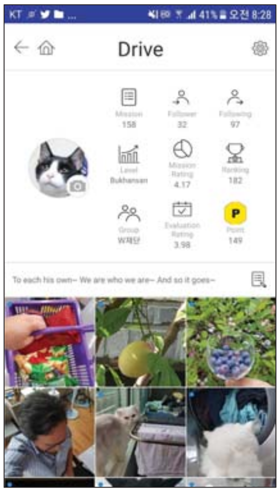


***WGP pre-clearing mechanism being introduced to facilitate pre-funding of user's fiat account to cover credit card / PayPal / bank transfers*

Community Connections – Search & Alert Functions



Managing Relationships - My Account Page



- Main portal for keeping track of user's relationships with other users
- Provides data on demand for:
  - All missions performed (successful and failed missions combined)
  - Tracking of who is following whom
  - Monthly rankings
  - Current month's mission points
  - Group affiliations
  - Average mission points
  - Average evaluation points
  - Accumulated accomplishment level (i.e. Seed to Earth in 16 levels)

AGENDA

1 W-FOUNDATION

2 BLOCKCHAIN FOR SOCIAL GOOD

3 USER EXPERIENCE AND TOKEN UTILITY

4 NEXT STEPS

Further Project Developments in 2019 & Beyond

- **WGP Royalty Program**
  Provide compelling benefits to WGP holders based on size and duration of their holdings
- **WGP Cash Points (WCP) Program**
  Facilitate pre-clearing of WGP holdings into WGP Cash Points backed by 1-to-1 reserve in KRW
- **WGP Philanthropic Donation Program**
  Provide a mechanism for WGP holders to donate their WGP or WCP holdings to W-Foundation on a designated basis, which upon clearing into KRW can be put toward pre-selected beneficiary causes, such as giving to other charities, buying certified emission reduction units, backing specific projects, and more
- **Carbon Footprint Calculator Module in HOOXI App**
  Incorporate and link a carbon footprint calculator module to a selection of designated mission programs (i.e. a selection of missions that are performed and validated on a preset interval over a period of time)
- **Programme of Activities (PoA) Methodology Development**
  Leverage the HOOXI App to develop and implement a subset of climate action missions that in aggregate qualify for PoA methodology under Clean Development Mechanism (CDM)
- **Distributed Ledger Technology in Carbon Offset Markets**
  Work with industry and public sector institutions on initiatives to apply distributed ledger technology to the carbon offset market

T H A N K   Y O U

URBAN CLIMATE CHANGE RESILIENCE TRUST FUND

Asian Development Bank

Building Urban Resilience of Vulnerable Communities: UCCRTF Experience

Dr. Virinder Sharma
Senior Urban Development Specialist, ADB

Seoul, September 2019
2nd International Forum on Low Carbon Development for Cities

Urban Climate Change Resilience Trust Fund (UCCRTF)

$150m 2014-2022

The ROCKEFELLER FOUNDATION

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Economic Affairs SECO

UKaid
from the British people

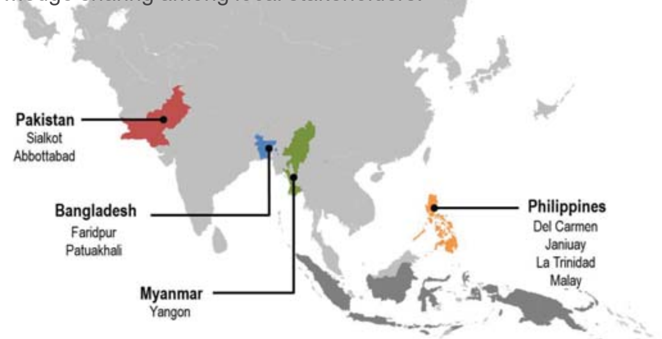
Build resilience of **2 million people in 25 cities**

Reduce **risks to poor from climate change impacts** through better planning and climate resilient infrastructure

Focus on 8 countries: Bangladesh, India, Pakistan, Nepal, Myanmar, Vietnam, Indonesia and Philippines

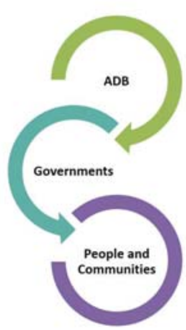
Building Resilience at Community Level
Community-led Initiatives (CLI) in Five+ Countries

- Enhance the resilience of communities to climate change through community-led projects.
- Empower urban poor communities, esp. women and youth, to have increased voice in designing and prioritizing resilience interventions.
- Improve community resilience building through better decision support tools and knowledge sharing among local stakeholders.



Community-led Initiatives
Inclusive Planning and Decision-Making Approach

Top-Down Approach



Communities as beneficiaries, end users

Community-Led Approach

Stage 1 PLAN & ENGAGE
- Platform for coordination and working – government, communities and stakeholders
- Community-led problem identification and assessment
- Participatory resilience planning, project design and selection

Stage 2 CAPACITATE & IMPLEMENT
- Empower and build capacities of communities and stakeholders
- Community-led project implementation
- Community monitoring and accountability

Stage 3 SUSTAIN & INTEGRATE
- Community-managed model for operation, maintenance and sustainability of CLP
- Local ownership and institutionalization of CLPs and CRPs
- Replication

Communities as active participants in every step of the process

Community-Led Initiatives
Resilience Academy Workshop : A Vehicle for community planning

Bangkok, March 2017
- Abbottabad
- Sialkot
- Faridpur
- Mandalay
- Vinh Yen
- Hue
- Makassar

Manila, June 2017
- Del Carmen
- Janiuay
- Malay
- La Trinidad

Yangon, September 2018

Pakistan, December 2018
- Abbottabad
- Mardan
- Kohat
- Peshawar
- Sahiwal
- Sialkot

Resilience Academy Workshop

Day 1	Day2	Day 3
1. Where are we now?	2. Where do we want to be?	3. How do we get there?

Day 1
- **Opening**
- Session 1 Shocks and Stresses
- Session 2 City Assets and Vulnerability Maps
- Session 3 Resilience Values
- **Site Visits**

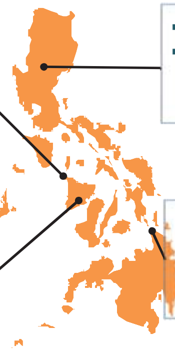
Day2
- Session 4 Resilience Approaches and Project Ideas
- Session 5 Project Design
- Session 6 Resilience Project Outcomes and Indicators
- **Expert Dialogues**

Day 3
- Session 7 Stakeholders and Engagement Strategy
- Session 8 City Presentations
- **City Dialogues**
- **Reflections and Closing**

Community-Led Initiatives
Proposed Community Led Projects (Philippines)

La Trinidad, Benguet
- Flood Drainage Improvement Project
- Rehabilitation of water filtration plant to provide additional irrigation to farmers during dry months

Malay, Aklan
- Multipurpose Evacuation Center
- Bio-engineering mitigation measures for floods and landslides
- Tree planting in riverbanks and watershed



Del Carmen, Surigao Del Norte
- Recovery and Recycling Facility (Recycling Center, MRF, Composting Facility)
- Water assessment study
- Strengthening solid waste management and water service delivery to the community.

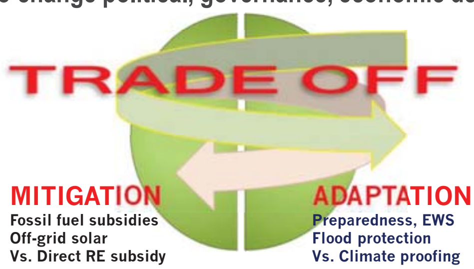
Janiuay, Iloilo
- Community Managed Water Supply System
- Rainwater harvesting facility as alternative source of water
- Tree planting campaign (native trees)

Social Innovation through CLIs to build Resilience at Community level : Key Reflections

- No Top down wish list. Who decides and who benefits? Build "ATE"
- Communities "make evidence based decisions" to identify vulnerable people, their problems, solutions.
- Complement urban services by strengthening delivery at grassroots and pooling local resources.
- Need for institutionalizing CLI in urban planning and infrastructure delivery to build community resilience.

Adaptation- Mitigation- Co-benefits/Synergy or Trade offs and Barriers

- MIT: collective action, global public good, GHG metrics
- ADA: Site, context specific, cross cutting – No/Low regret actions
- Mainstreaming CC is fine but will not deliver transformation
- Need for transformative ADA and MIT to avoid lock-in
- Cost-effectiveness: costs now and benefits in future
- Urgency to change political, governance, economic decisions



LIVABLE CITIES

Asian Development Bank

Thank you

https://www.livablecities.info/

vsharma@adb.org


Socially-Inclusive Low-Carbon Motivation Mechanism
Every little contribution counts.
SinoCarbon


Contents
1. About SinoCarbon
2. Our Services
3. Solutions
SinoCarbon

1. About SinoCarbon

Vison & Approach

(1) What We're Doing

SinoCarbon is committed to promoting social awareness of green and low-carbon development through technology innovations. Providing socially-inclusive low-carbon advisory services for small and micro organizations such as enterprises, institutions and communities, SinoCarbon motivates the realization of innovative business and management, popularization of low-carbon consciousness, as well as the enhancement of brand value and social responsibility.

(2) Our Vision

Technology Enabler

SinoCarbon drives drive green and low-carbon businesses that everyone can participate in through enabling technologies.

Awareness Promoter

SinoCarbon arouses the public awareness of green development in an enjoyable and interactive way, advocates the low-carbon concept, and practices a green lifestyle.

Units Mobilizer

SinoCarbon mobilizes every and each small and micro organizations for the improvement of environment.

(3) Our Approaches

Small and micro organization’ s low carbon management tool

- Calculation of organizational/ individual emission reductions
- Emission reductions-carbon credits conversion
- Credits appreciation Services

Scenario and resources development

- Scenario and service customization
- Up- and down- stream resource development
- Business landscape building

Socially-inclusive low-carbon motivate mechanism platform

- Tool-platform transfer
- Extensive participation of companies
- Enrichment of upstream and downstream resources
- Realization of business landscape

2. Our Services

Socially-Inclusive Low-Carbon Motivation Mechanism

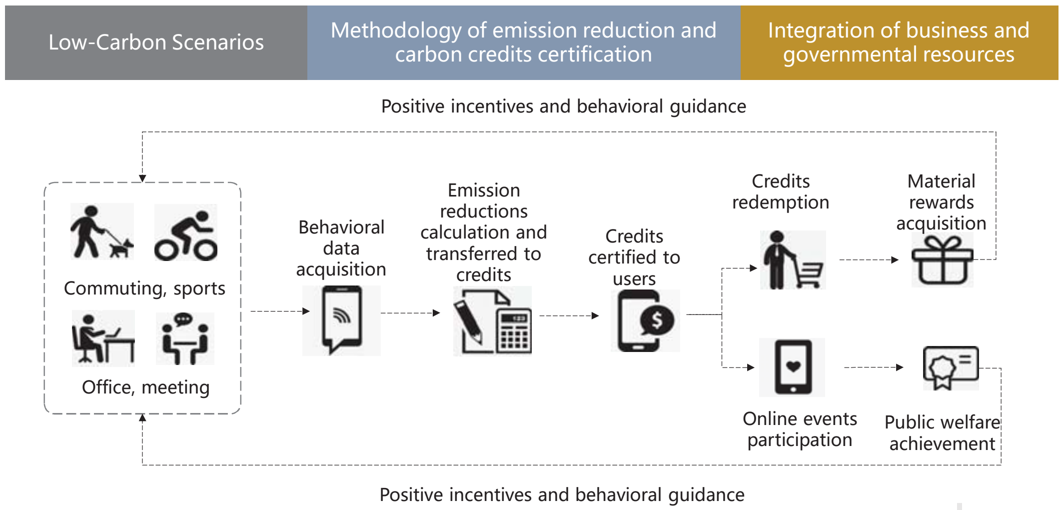
SinoCarbon

(1) Briefing on Our Services

SinoCarbon provides customized services on internet-inclusive motivation mechanism, data analysis, and a coordinated process of product operation, for small and micro enterprises, organizations or local governments with low-carbon concept informing, green brand building, and green business innovation needs.

- **Enterprise-Level**: Green Business Solutions
- **Community-Level**: Green Campus/Community Solutions
- **City-Level**: urban new energy vehicle solutions, carbon sink poverty reduction solutions

(2) Core Service Logic



(3) Design Rationale

Core Service Logic	Green scenario establishment	Green behavior quantification	Green credits redemption
User interface	Green transportation Green meeting Green education Green games	Methodology of emission reduction calculation in different scenarios	Green markets Green public welfare ......
Operating platform	Front end process management Data management	Methodology management Interface management	Credits appreciation management User management

(4) Service Display

- **"Green Avic Trust"**

"Green Avic Trust" is a tailored service for Avic Trust to promote low-carbon behavior of employees, create a green corporate culture, and enhance the efficiency of unions and employee satisfaction through the form of green benefits.

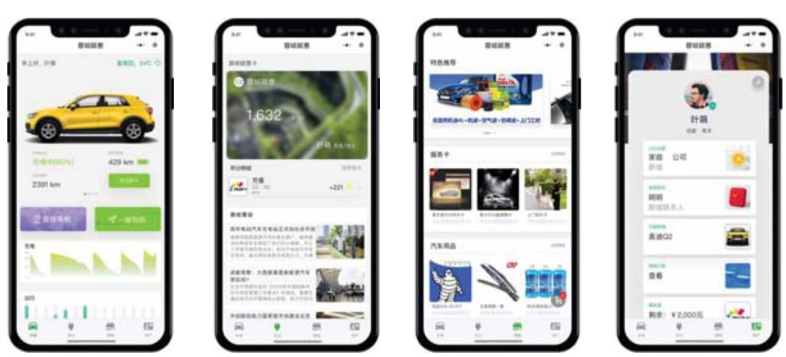
- **"Green Guanshang District"**

"Green Guanshang District" is a specialized interactive product for residents of Zhongxin Community, Guanshang District, Kunming City, which encourages users to practice the green lifestyle and drive local businesses to participate jointly in the socially-inclusive low-carbon motivate mechanism

(4) Service Display

- **"socially-inclusive low-carbon motivate mechanism in Chengdu City"**

The mini program is a tailored service for Chengdu City, based on the new energy vehicle scenario, with the characteristics and advantages of mobile Internet products, providing incentives for users of Chengdu to use new energy vehicles. Through the enjoyable and interactive way, the mini program increases the public willingness to use new energy vehicles, promotes low-carbon life, and contributes to the popularization of green and low-carbon awareness of the whole society.



(5) Our Achievements

Socially-inclusive low-carbon motivate mechanism is a pilot of the green and low-carbon field in the era of Internet technology, driven by technology, enhanced by everyone's action and enterprise joint participation to promote the popularization of green environmental awareness.

3. Solutions

Take the Chengdu pilot project as an example

(1) Main Problems in Local Pilots

- From the consequences, the mechanism plays a significant role in encouraging the public to perform low-carbon behaviors, and has achieved positive social response and emission reduction benefits. But the mechanism is unsustainable. Reflected in three aspects :

Unsustainable Design 1
Major demands come from government departments, therefore unable to form a mutually beneficial situation.

Unsustainable Funds 2
Government funds are the only financial source. No operational mechanism for self-sustaining.

Unsustainable Implementation 3
Promote by project management, lack of professional and systematic product operation team.

Fail to identify and apply the core value

B to C

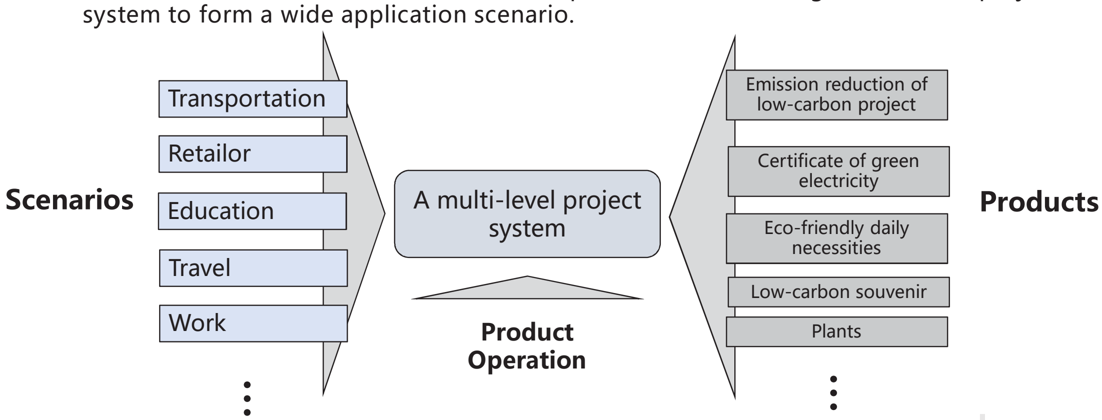
Internet+

Big Data

Platform Model

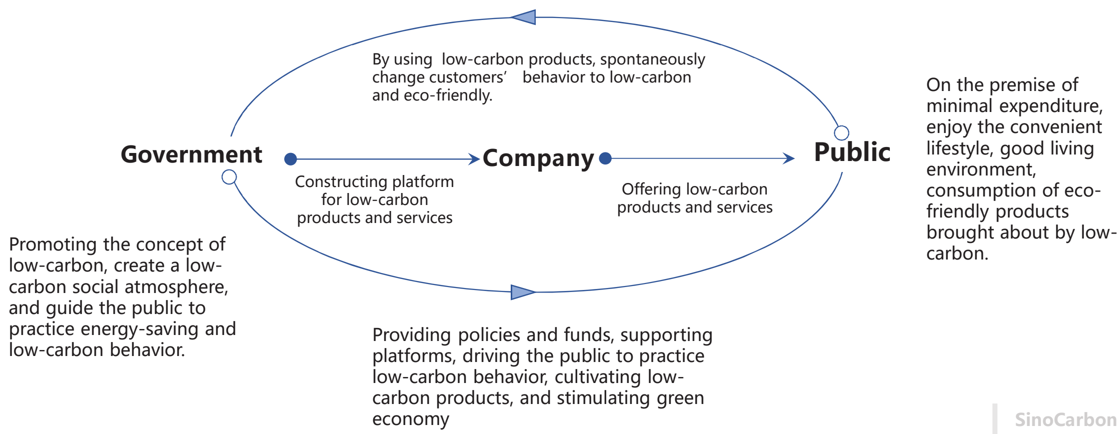
(2) Core Ideas of the Chengdu Polit Project

- Establish special operation entity, replace project management with product operation, and carry out overall management of internet products
- From the two dimensions of scenarios and products, constructing a multi-level project system to form a wide application scenario.



(2) Core Ideas of the Chengdu Polit Project

- Introducing commercial organizations, and linking the demands of the government and the public through "a scenario demonstration project to drive a low-carbon product", therefore a win-win model of mutual benefit among the government, enterprises and the public is established to solve the problem of "unsustainable design".



(3) Using Advantages to Support Construction and Product Operation of Chengdu Project

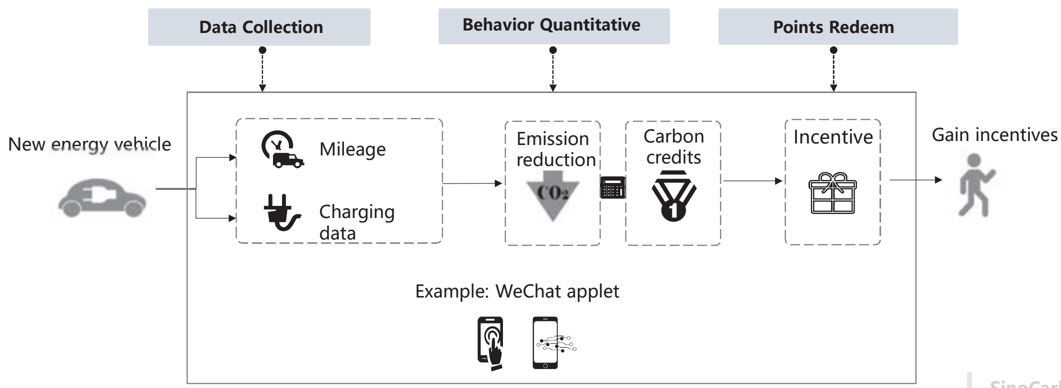
First, bringing the advantage of top-level design into full play, and forming the operation plan while applying it to the mechanism's top-level design.

Second, exerting accumulated experiences during the development of the app to assist the offline and online product operation of Chengdu project.

Third, Bring the advantage of the company's layout on the national network into full play to assist Chengdu to promoting and replicating products to various places, and forming influential Internet + low-carbon products.

(4) Overall Design of New Energy Vehicle Project

The purpose is to provide support for the development and operation of public low-carbon application scenarios in Chengdu's demonstration project, to form a low-carbon application scenario with the theme of "new energy vehicle use", to provide incentives for Chengdu's use of new energy vehicles, to promote the public's willingness to use new energy vehicles, and to guide the public to voluntarily practice green and low-carbon mode of travel.



(5) Main Implementation Contents of New Energy Vehicle Demonstration Project

Methodology of Carbon Emission Record	Improving Operational Implementation Scheme	Developing WeChat applet	Preparing start-up activities for the demonstration projects
Connecting with Chengdu New Energy Vehicle Supervision Platform, and determining data acquisition standards and calculation parameters of carbon emission reduction. Promote methodology.	Improving the implementation plan of project operation on the existing basis. Reporting data after discussion and determination.	Developing the WeChat applet within a month after the implementation plan has been determined to support the operation of the project.	Inviting Municipal leaders to participate in the project start-up activities to verify the reliability of the WeChat applet.

(6) The Scheme of New Energy Vehicles Project Operation Activity

Start-up Period

- Inclusive of charging station.
- Inclusive of daily mileage.

Promotion Period

- Optimizing travel during rush hours.
- Low-carbon special travel line.
- Interaction of user community.

Complement Period

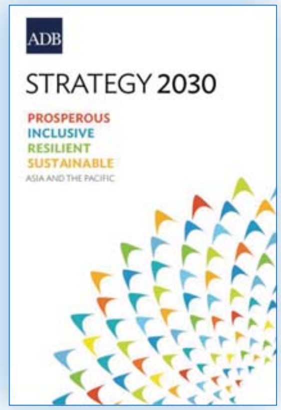
- Looking for the best energy saving driver.
- Holding competitive activities and redeem credits.
- Exploring the double integral system combine with the inclusive incentive of new energy vehicles.

Session 9: Low Carbon Pilot City Efforts

ADB Strategy 2030

Key operational priorities:

- Addressing remaining poverty and reducing inequalities;
- Accelerating progress in gender equality
- Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability
- Making cities more livable,
- Promoting rural development and food security
- Strengthening governance and institutional capacity
- Fostering regional cooperation and integration



ADB Strategy 2030 (2)

- Expanding private sector operations
- Catalyzing and mobilizing financial resources
- Strengthening knowledge services

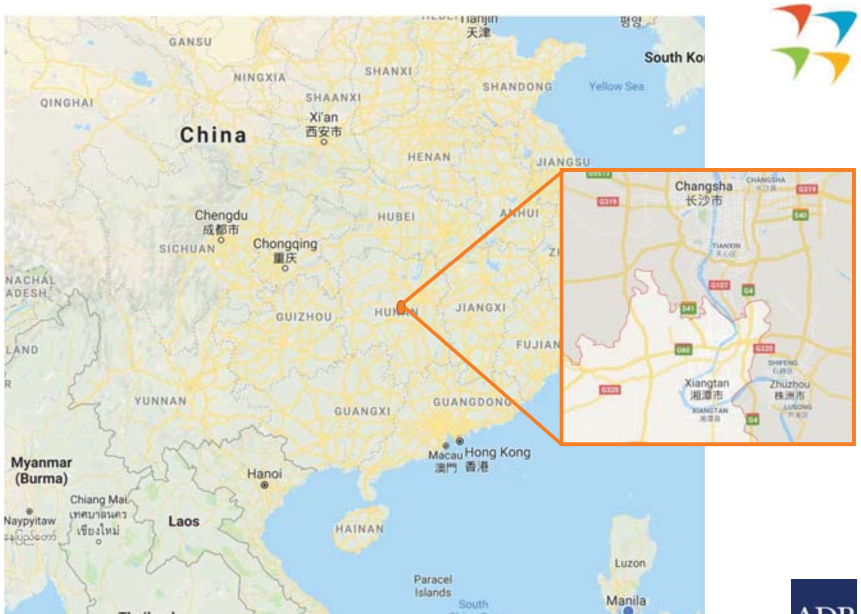
- ADB will strengthen ***customized support*** specific to local circumstances, promote the use of **innovative technologies**, and deliver **integrated solutions** by combining expertise across a range of sectors and themes.

ADB

Xiangtan Low-Carbon Transformation Sector Development Program
(=project +policy lending modalities)

Through low carbon city development projects at ADB, we promote integrated and comprehensive approach of all these efforts.

ADB



ADB

Low-Carbon Development
(working definition)

LC Development refers to 'sustainable development' grounded in *systems-thinking* and guided by quantifiable indicators of GHG emissions, which *encourages integrated city* planning, collaborative and *coherent sector development*, *resilience* improvement by taking *preventive approach*, and active governance through engaging and activating all stakeholders by providing the *right incentives*.

Important Features for Low Carbon Transformation

Transformation is a long-term process, can be expedited through…

- **All actors** (governments, business, citizens) to be engaged and activated for **actions**
- **Actions** shall be carried out **with ease**
- **Better infrastructure** for low-carbon actions
- **Right Incentives** suitable to different types of actors:
  - ✓ Business: $$
  - ✓ Consumers: $, peer pressure,
  - ✓ Government: intended actions/commitment
- **Information and knowledge** to drive **behavior changes**

Rationales for SDP Design

All actors | Actions with ease | Incentives | Information and knowledge

Project loan

Low-Carbon and Climate Resilient Infrastructure

+

ICT Platform for
Informed decision making

Policy and Governance Reforms

Green Public Procurement
+Sectoral policy reforms

Policy-based loan

Clear signal to Market

Behavior changes; Leverage **private investment** to low carbon technology and business

Xiangtan Low-Carbon SDP

- Output 1: Integrated, low-carbon urban **transport** system established.
- Output 2: Green and low-carbon **building** promoted through piloting quantifiable certification. (1st hospital with IFC's EDGE certification).
- Output 2: Green or blue-green infrastructure expanded for better **resilience to climate change**.
- Output 3: Enabling systems based on information and **communications technology** for informed decision-making installed. (transport, energy, building, environment, flood warning, low-carbon behavior/lifestyle.)
- Output 4: Low-carbon transformation **policy reforms** adopted for various **incentives to activate** all actors

"ADB will reinforce our roles as trusted partner, reliable financier, knowledge provider, and a convener of strategic partner for your low carbon city development efforts."

Thank you ☺

Na Won Kim: nawonkim@adb.org

ADB

Low Carbon Development of Nur-Sultan city

Kenzhekhan Abuov, Project Officer, Kazakhstan Resident mission, CERW ADB

Priority Investment Low Carbon projects

Pre-technical feasibility using Clean Technology Fund

1. Saving fuel & Clean Air Project

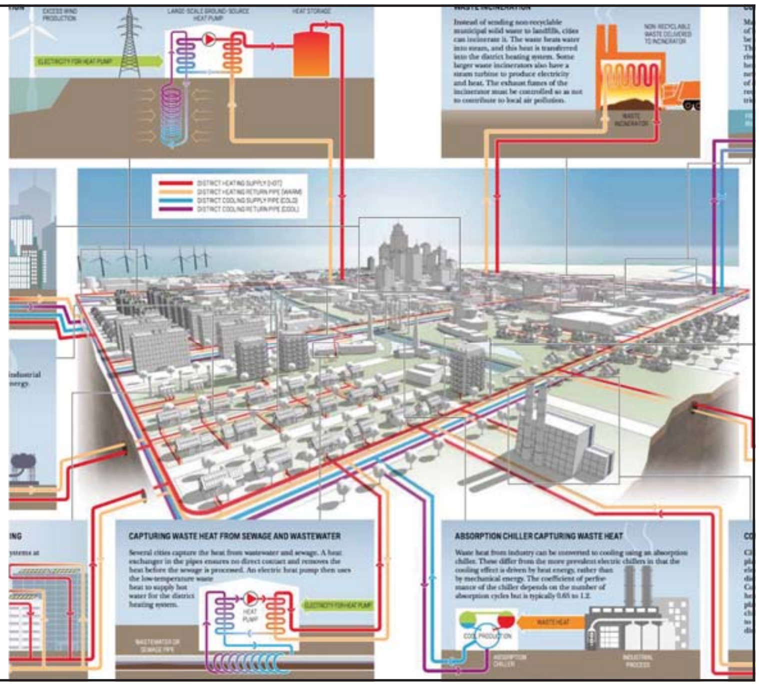
- Current situation: Vehicle engines are running in cold winter to prevent frozen batteries being frozen.
- Block heater technology: Simple plug-in connection will save fuel and reduce emissions from engine running
- https://www.youtube.com/watch?v=OccDOM_3qd8&app=desktop#searching

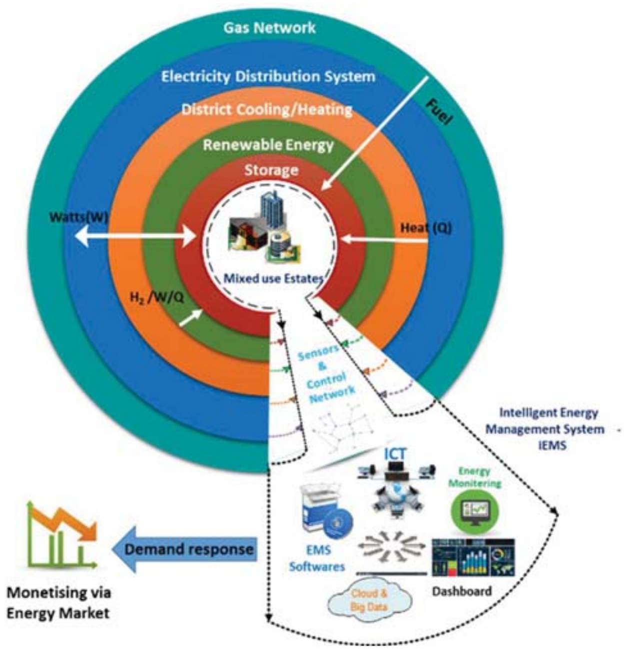
Block heaters vs Remote starter

- Block heaters are simple electric heating elements that can warm up car engine through a number of different methods. Basically a block heater prevents the coolant from freezing, and it can also stop the oil from turning into tar in extremely cold temperature.
- Remote starters simply get a car running ahead of time, which warms up a car engine and also interior for comfort. Remote starters will lead to engine wear and generate emissions when a car is no in-use.

2. Upgrading district heating (DH) at sub-urban districts

- Sub-urban districts in Astana reply on heavily polluting old heating-only boilers.
- Modernizing district heating systems in sub-urban districts in Astana will support better livelihood in those poor districts.
- Range of energy efficient low-carbon features will be assessed to confirm feasibility and suitability





3. Smart energy management system

- Computer-aided tool for monitoring, control and optimization of energy system for continuous improvement
- Smart management of EMS at various levels
- Possibility to use multi-energy management

4. Deposit-Refund System

•Waste collection is the most difficult and expensive part of waste management system.

•Container deposit legislation mandates that a refund is given when reusable packaging is returned.

•Deposit-refund system enables collection of recyclable waste easy, encourages public awareness and behaviors changes on waste issue.

•Installing deposit-refund machines at supermarkets shows great success, rather than creating a separate waste collection center.

5. Waste-to-Energy

•Solutions for solid community waste

•**Thermal gasification** has low emissions, modular application and low capital and operational costs.

•Thermal gasification can generate hot synthetic gas, that produce power and heat.

•**Plastic modification,** using pyrolysis can produce diesel fuel from plastic

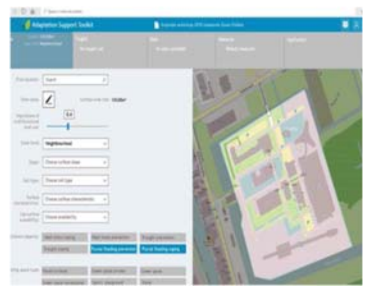
•Dieisel compliant EN590

•15–55 % less NOx

- Less than 1 ppm SOx

6. **Adaptation Solutions Tool to support Ecosystem-based adaptation (EbA) measures for flood control in Astana**

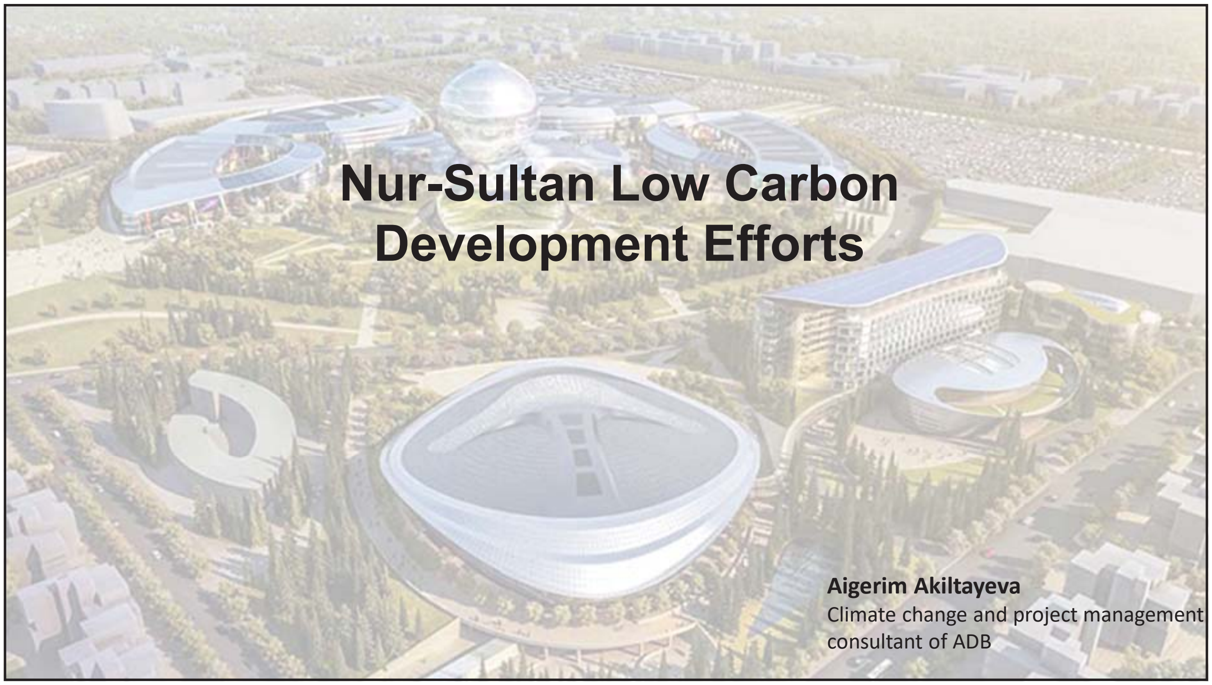
- Climate induced risks like flood became more frequent and intensified. Using scientific data and social-economic analysis, high risk and vulnerable areas and suitable Ecosystem-based adaptation (EbA) measures can be assessed and determined using ICT-based mapping tool.
- https://youtu.be/XaFJGTfiing



Ecosystem-based adaptation (EbA) measures

- Ecosystem-based adaptation (EbA) measures using urban water (blue) infrastructure with green assets and ecosystem services are effective measures for flood control, drought mitigation, heat stress reduction, and carbon sink
- Adding grass/trees in street, green roofing, green facades, filtration trench, porous pavement, rainwater retention pond, urban garden/agriculture, water roof, and infiltration field are some examples that provide a carbon sink, cooling effect, and water conservation among others.
- These will also provide co-benefits like aesthetic quality, recreational and restorative capacity, improved local air quality, and health benefits.

Nur-Sultan Low Carbon Development Efforts



Aigerim Akiltayeva
Climate change and project management consultant of ADB

Kazakhstan and Nur-Sultan location

Source: Google maps (2019) and Mapping data of the State Institution "Department of Architecture, Urban Development and Land Relations of Nur-Sultan”.

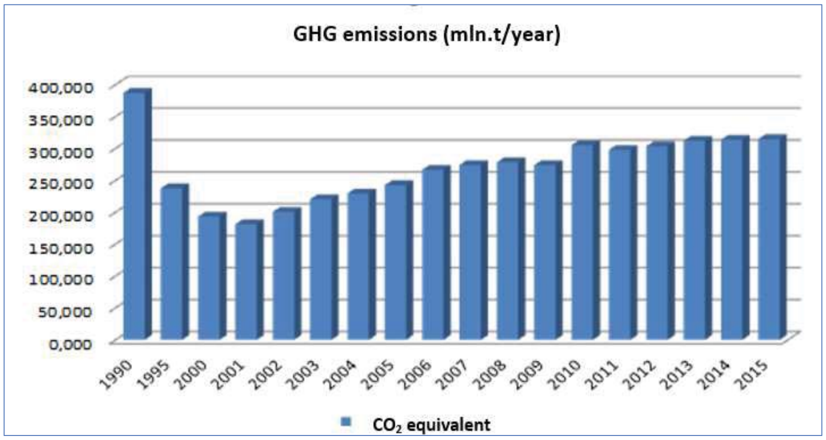
Outline

- Kazakhstan profile
- Nur-Sultan profile
- National and city-level policies
- Low Carbon Activities
- ADB RETA summary

Country profile - Kazakhstan

Geographical location	Central Asia
Land area	2.725 million km²
Population	18 543 295 people
Type of climate	Sharply continental with large temperature amplitudes and relatively dry
GHG emissions profile (CO_2 eq.)	300.9 mln. t. (2015 year inventory)
Key emitter sectors	Energy intensive industries, transport sector, housing-utility services

Kazakhstan GHG emissions dynamics (1990-2015)



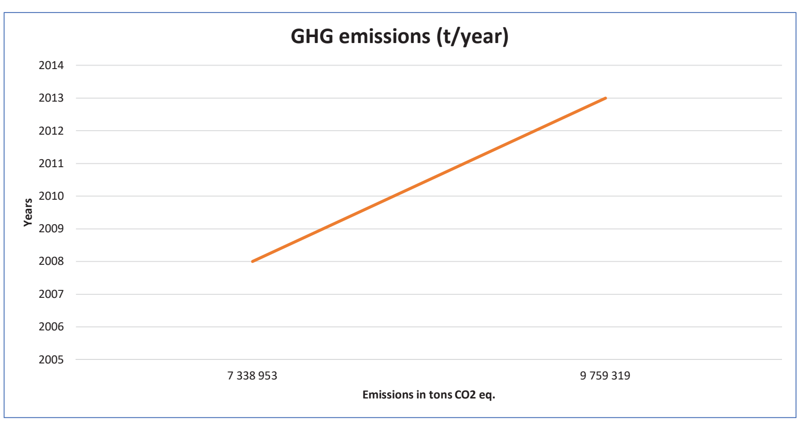
Intended Nationally Determined Contribution - Kazakhstan

- Kazakhstan submitted its INDC in UNFCCC Paris Conference in December 2015 with the ultimate goal to ensure the global temperature rise does not exceed 2C.
- The unconditional target is to reduce GHG emissions by 15% by 31st December 2030 relative to the base year.
- The conditional target is to decrease GHG emissions by 25% by 31st of December 2030 compared to the base year, in case there are additional international investments involved.

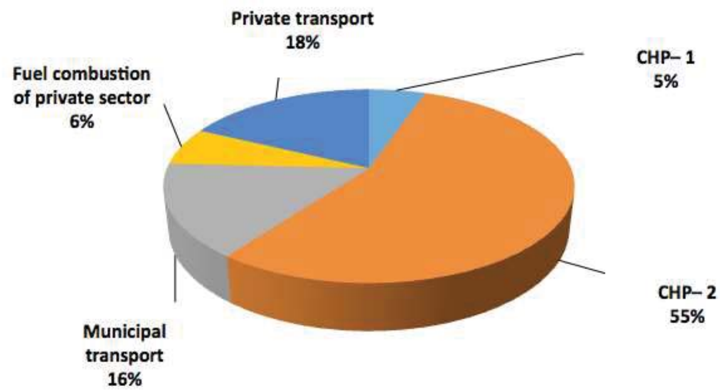
City Profile – Nur-Sultan

Geographical location	Northern part of Kazakhstan on the bank river of Ishym
Land area	797.33 km^2
Population	1 104 100 people
Type of climate	Sharply continental. The summer is hot and dry and the winter is cold and long. The 2nd coldest capital in the world.
Temperature	Average summer temperature = 20C Average winter temperature = – 15C Summer temperature might reach up to 40C and winter temperature to -50C.
Districts	4 districts (Almaty, Saryarka, Yesil, Baikonur)
GHG emissions profile	9.8 mln. t. (2013 year inventory)
Key emitter sectors	CHPs, housing utilities sector, transport

GHG emissions dynamics of Nur-Sultan (2008-2013)



Total GHG emissions from heat and power generation in Nur-Sultan (2017)



Source: A. Cherednichenko. Energy analysis of Nur-Sultan. 2018

Kazakhstan's policy documents in improving the environment conditions

- **Green concept economy**
  - Increasing the efficiency of resources use (water, land, biological, etc.) and their management
  - Modernization of existing and construction of new infrastructure
  - Improving the well-being of the population and the quality of the environment through cost-effective ways to mitigate the pressure on the environment
  - Improving national security, including water security
- **Strategy of Development "Kazakhstan – 2050"**
  - Global energy security
  - Proper management of resources, accumulation of income, development of new technologies
- **100 concrete steps**
  - **Step 50.** Reorganization of the electric power industry. Introduction of the "single buyer" model. This step will benefit by smoothing differences in electricity tariffs between regions.
  - **Step 51.** Strengthening regional electricity companies will improve the reliability of energy supply, reduce the cost of electricity transmission in the regions and reduce the cost of electricity for consumers.
  - **Step 52.** Introduction of new tariff policies in electrical power industry, which will stimulate investments in the industry.
  - **Step 59.** Attracting strategic investors in the sphere of energy saving through the internationally recognized mechanism of energy-service contracts.

Nur-Sultan's policy documents in improving the environment conditions

- **Development program of Nur-Sultan city for the period of 2016 – 2020**
  - ➢Goal 5. City of a favorable ecological environment. The overall objective of the policy document in terms of the GHG reduction measures is to maintain clean environment.

➢In the framework of the Development Program, a comprehensive action plan of improving the environment has been created

- **Strategy of Nur-Sultan Development until 2050 –** in the process
- Strategy of Low Carbon Development until 2050 – in the process

Comprehensive action plan of improving the environment of Nur-Sultan for 2018-2020

1. Reduction of pollutant emissions to the air from stationary sources
2. Reduction of pollutant emissions to the air from mobile sources
3. Development of the Green Belt and landscaping
4. Management of waste production and recycling
5. Regulation of water resources
6. Public awareness campaigns
7. Monitoring the state of city environment
8. **Strategy of Low Carbon Development of Nur-Sultan until 2050**

Low Carbon activities in Nur-Sultan

- Gasification of the city until 2024
- Introducing Electric Vehicles – 25 EVs
- Increasing the length of bike lanes and bikes sharing
- Forests and carbon sinks (the total area of trees cover - 1 635,87 ha)
- Pilot projects in improving the energy efficiency of residential apartments
- Introducing pilot project of block heater technology
- EXPO-2017 legacy – introducing small-scale RES for lighting and bus stops

RETA: Promoting low-carbon development in CAREC Program cities

- Nur-Sultan is the first pilot city of low-carbon development in Central Asia
- RETA supports Nur-Sultan municipal government to develop the Strategy of Low Carbon development until 2050
- GHG inventory system is recommended to be established for monitoring and implementing effective GHG emissions reduction measures
- Within RETA, 7 projects in Nur-Sultan city will be developed under Clean Technology Fund (energy, waste, transport)

CAREC RETA outputs

1. Sustainable data management systems for greenhouse gas data assessed and enhanced at city level
2. Recommended investment road maps for low-carbon economic growth at selected cities developed
3. A source book on successful practices and measures driving low-carbon economic development at city level developed and disseminated
4. Capacity building workshops for low-carbon city development among CAREC countries