Developing Low-Carbon and Carbon-Neutral Cities in the People's Republic of China and Mongolia

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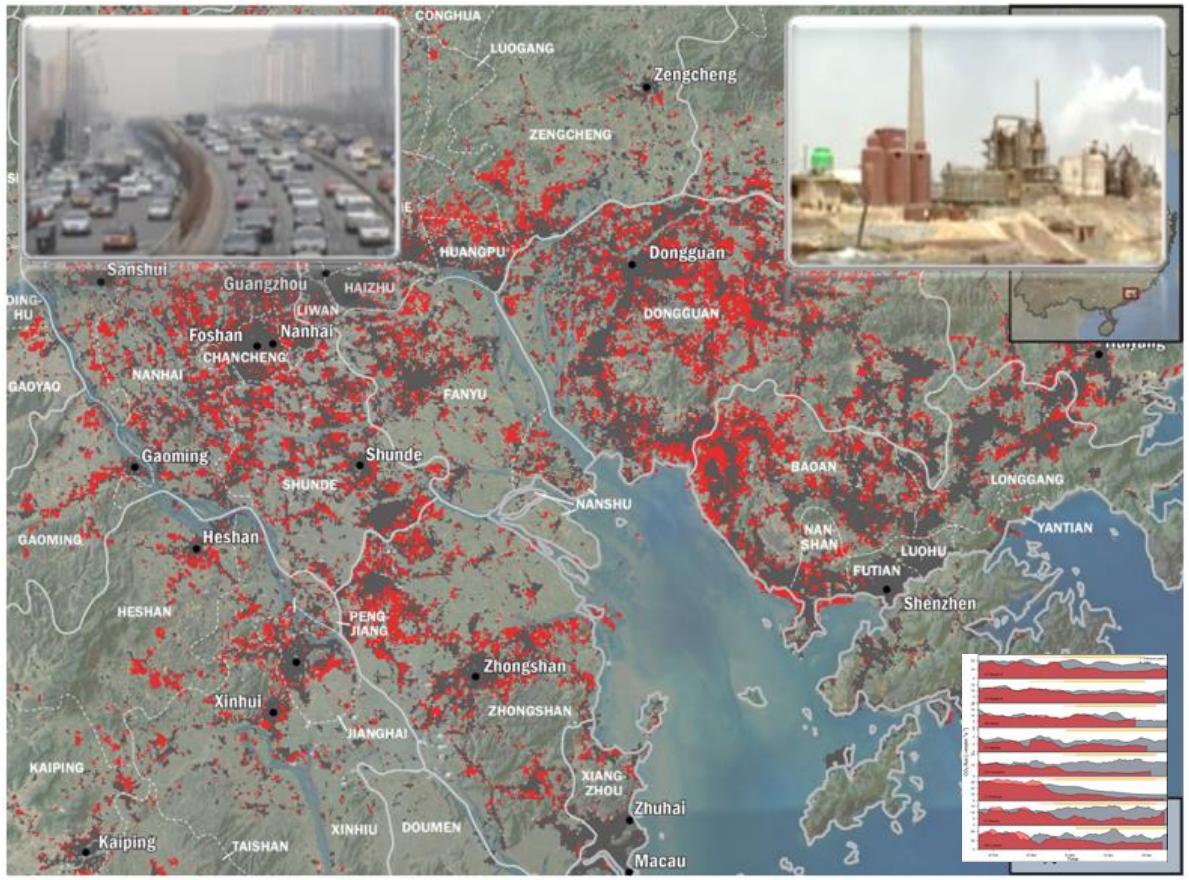
1. Key Challenges and Concepts

Key Challenges: Cities are Main Emitters and Need to Deliver Solution

- **Inertia** of physical, procedural, institutional and behavioral patterns - against the urgency of the much needed profound transformation.
- **Urban patterns** are often carbon-intensive and retrofitting faces many barriers and is costly.
- Existing public and private assets are based on **linear carbon-intensive economy**.
- Institutional and commercial **practices**
- **Departmentalization** (silos) against needed cross-sector collaboration.
- Individual and community **behavior** and environmental lifestyle options

Inertia, political and social willingness and cost of transformational change against the urgency of the cause to stop CC and brace against impacts
(PRC largest contributor, strong commitments, NDCs)



MAP 3: URBAN EXPANSION IN THE PEARL RIVER DELTA, CHINA 2000-2010

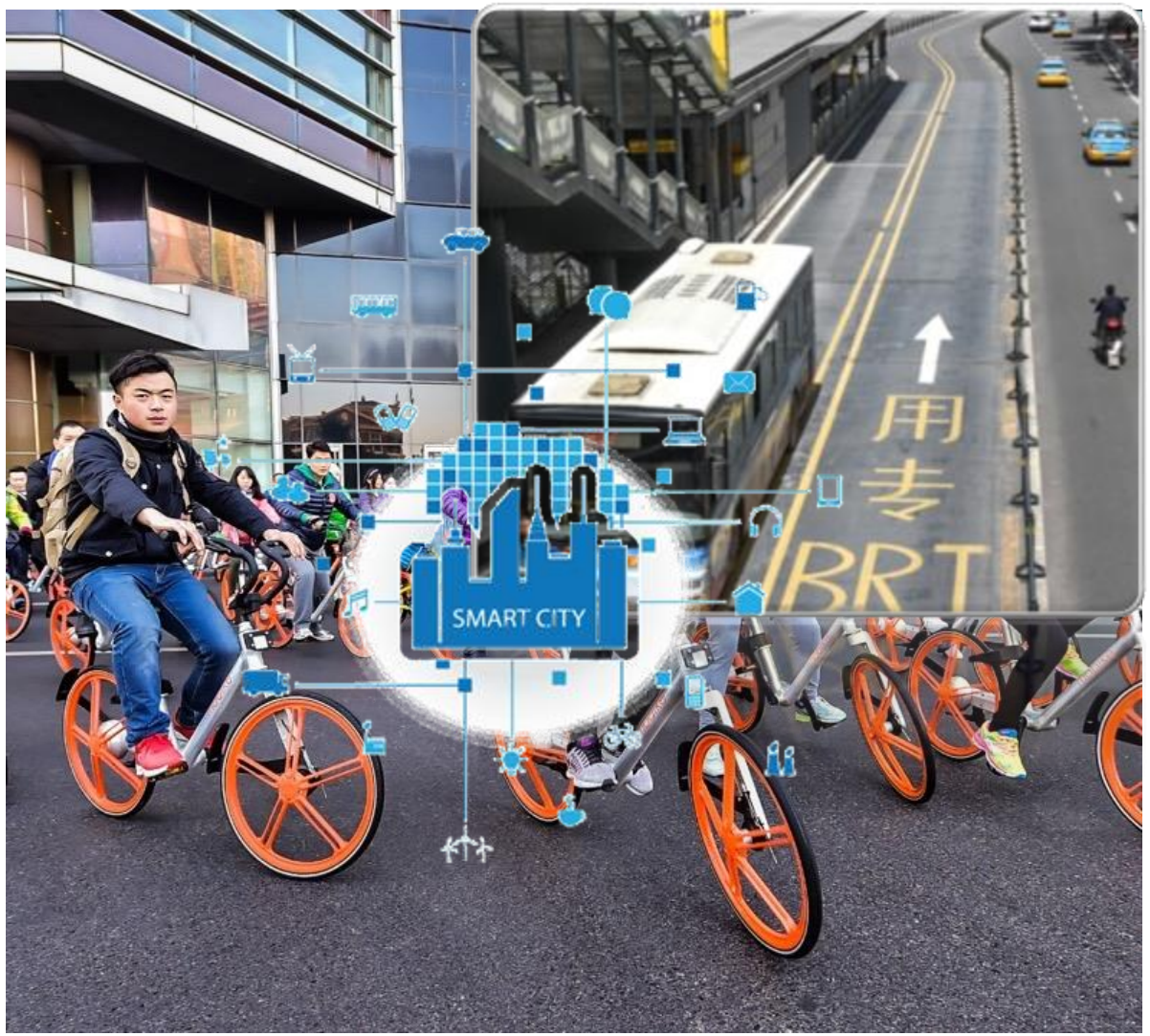
URBAN EXTENT c 2000 URBAN EXTENT c 2010

China's Pearl River Delta urban area has surpassed Tokyo.

Source: Maps produced by University of Wisconsin-Madison, Sept. 2013; Administrative boundaries from University of Michigan - China Data Center

Low-Carbon, Carbon-Neutral Cities: Integrated Actions Across Sectors

- **Implementing national policies** and commitments (i.e. NDCs, carbon peaking and neutrality by 2030 and 2060 respectively) in and for cities, their industries, transport, energy systems, buildings and utilities **requires cross-sector integration**
- **Low-carbon urban planning** (co-location of residential, commercial, jobs and green spaces) and urban patterns (compact city and transit-access) reducing transport and energy demand
- **Low-carbon energy systems**, renewables and smart grids, energy-efficient infrastructure, districts, facilities and buildings
- **Low-carbon transport systems**, public transport, non-motorized transport, renewable-powered vehicles, sharing of vehicles and pooling of trips
- **Low-carbon utilities** and solid waste management
- **Low-carbon lifestyles and behavior**



Climate-Resilience: Benefits from Integrating Adaptation with Mitigation

- **Integration of** planning and investments in climate **mitigation and adaptation creates added benefits** (many measures contribute to both if well-considered)
- Transit-oriented development compact city principles contribute to both
- Well-planned and intelligently designed multifunctional green spaces and resilience networks contribute to both

Given the rapidly and more severely changing climate it is imperative to build resilience and protect the low-carbon infrastructure investments from disasters

Circular Economy Zero-Waste Cities: Eco-Efficiency beyond Mitigation

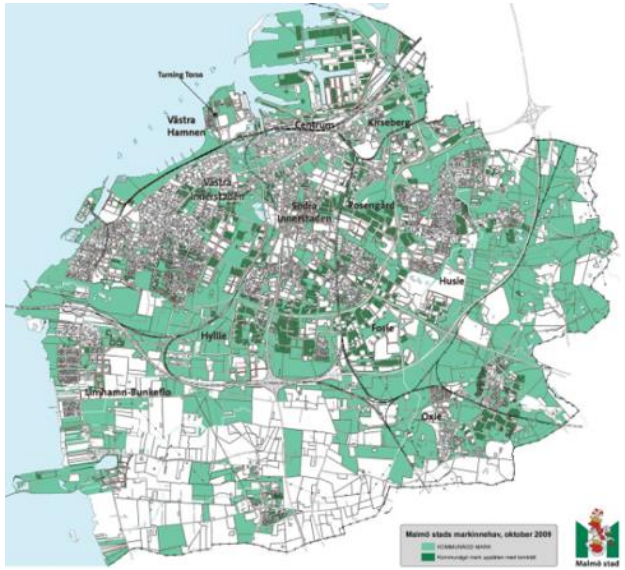
- Economic and urbanization model is linear with resource extraction, carbon-intensive production and distribution, consumption, and disposal.
- PRC Circular Economy Law (2009) and 14th Five-year Plan (2021-2025).
- Need mindset change and effective enablers to implement existing laws and programs for developing a green circular economy with zero-waste cities internalizing in the valuation of resources and products, including land.
- ADB TA CEZWC:

Transforming to a local and global circular economic system designing out waste is essential for ecological sustainability, biodiversity protection, clean oceans and will contribute to low-carbon development

2. International Case for Integrated Low-Carbon City

International Case: **City of Malmo**, Sweden - Zero-Carbon by 2030

- All municipal operations 100% renewable energy by 2030
- All public vehicles on biofuel, hydrogen or electricity (including plug-in hybrids), build charging stations
- improve public transport, streets for walking, bike-sharing, 490 kilometers bicycle lanes - bikes used for every 4th trip
- redesign of neighborhoods supplied exclusively with renewable energy, houses built with sustainable materials, green roofs to absorb rainwater, clean the air and provide insulation, which prevents heatwaves and serves as a habitat for migratory birds
- Visible energy with solar panels and urban wind mills
- Energy efficient buildings: 'passive house standard' with annual energy consumption of 45 kWh/m2.



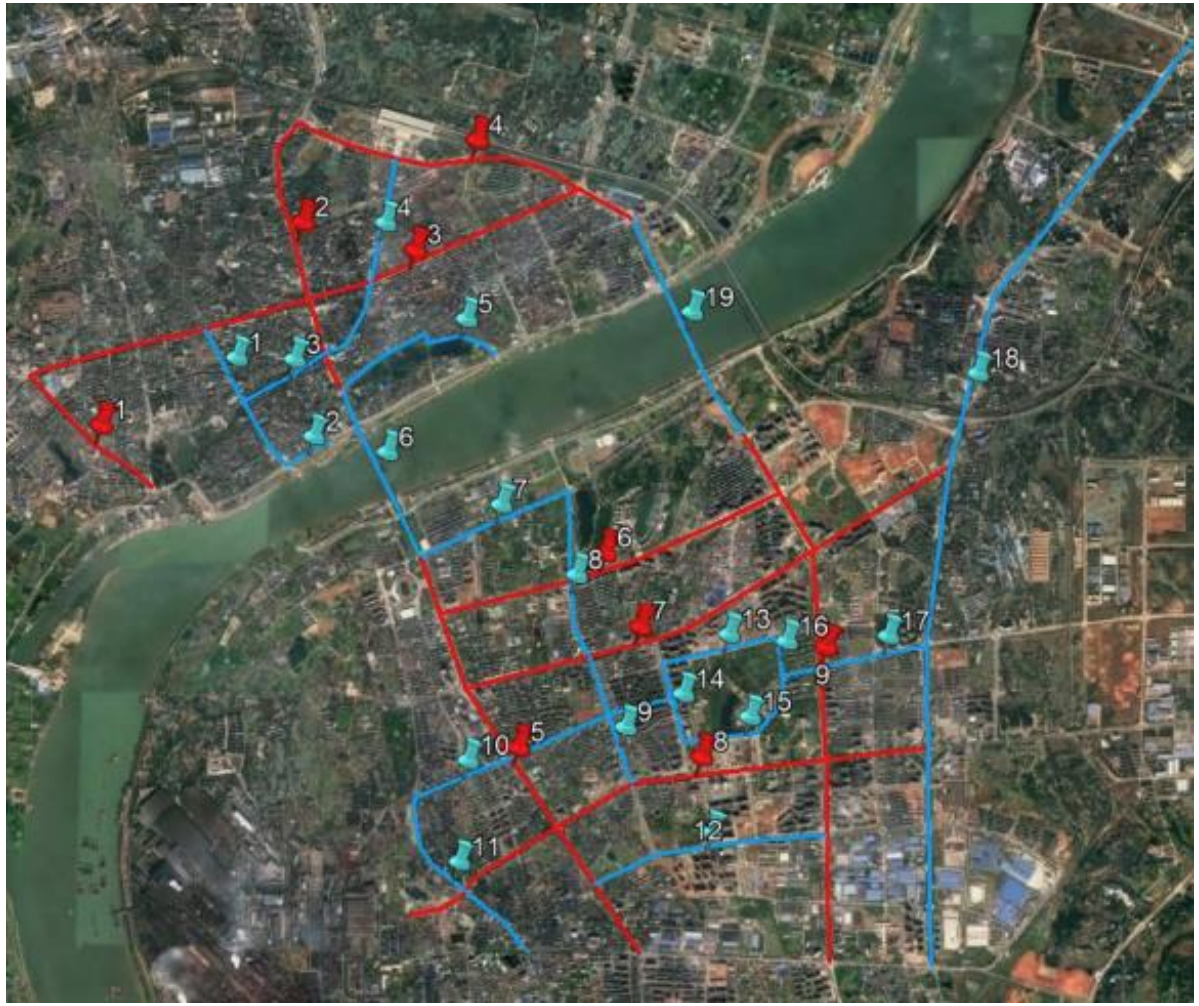
3. ADB Low-Carbon City Projects in the PRC

Selected ADB PRC Projects Contributing to Low-Carbon Development

Beijing-Tianjin-Hebei Air Qualty Improvement Program (low-carbon industry transformation and fuel switch projects, etc.)
Jilin Yanji Low-Carbon Climate-Resilient Healthy City Project (green public transport and non-motorized transport, etc.)
Xiangtan Low-Carbon Transformation Sector Development Program (policies and low-carbon transport, etc.)
Hubei-Yichang Sustainable Urban Transport Project (bus-rapid transit, road safety and maintenance projects)
Heilongjiang Green Urban and Economic Revitalization Project (transformation coal-based to diversified green cities)
Heilongjiang Energy Efficient District Heating Project (efficient system centralization and renewable energy generation)
Nanjing Qinhuai River Environmental Improvement Project (river rehabilitation, recreational greenway, reduces travel)
Water supply and wastewater management projects (water and energy efficient utilities, treated wastewater reuse)
Solid waste management projects: (increased recycling rates and decreased landfilling, and private sector partnerships)
Mining and land remediation and wetland rehabilitation projects: reuse of brownfields, benefits from inert energy savings

Xiangtan Low-Carbon Transformation Sector Development Program

- Low-carbon and resilient transport infrastructure from car- to people-centered, enhancing safety, inclusiveness, and resilience.
- More than 60 km of urban roads with bus lanes and priority lanes; upgraded bus stops, safe, improved walking and cycling facilities.
- Enhanced green space as ecosystem-based adaptation.
- Energy- and water-efficient buildings, distributed energy systems to generate power, heating, and cooling; and intelligent building energy (and utility) management systems (BEMS).
- Information and knowledge platforms for informed decision-making and behavior change.
- Low-carbon transformation policy reforms adopted.
- Annual Carbon emission reduction: 337,000 tons.



PRC: Jilin Yanji Low-Carbon Climate-Resilient Healthy City Project

Integrated Solution to make Yanji more livable.

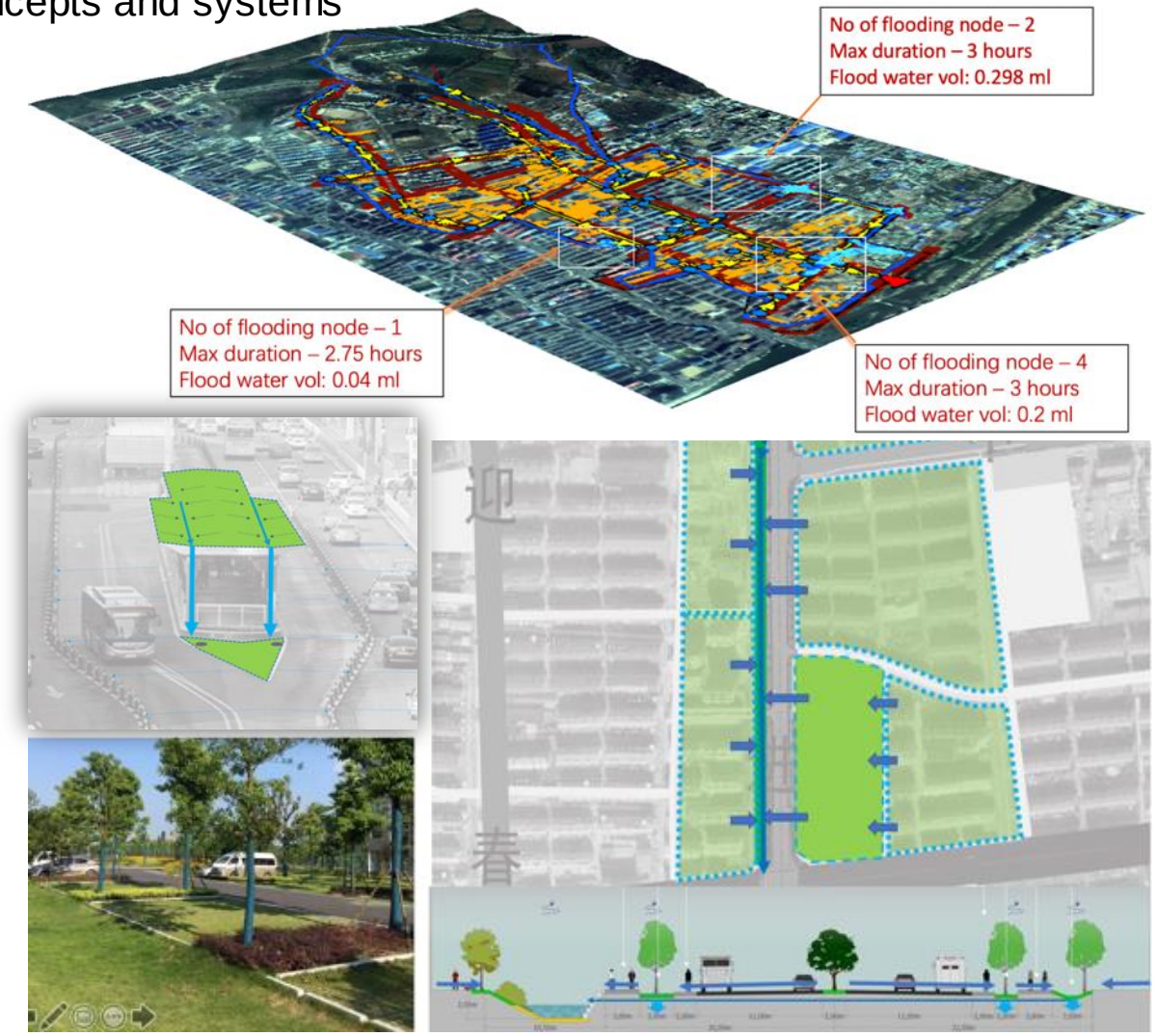
- Integrated urban planning following ”compact city” and “transit-oriented development” (TOD) principles reduces the need for transport
- First bus rapid transit (BRT) line in the city
  Connects all city functions, residential, commercial and industrial areas with clean energy buses
- Improved bicycle and pedestrian networks and new small streets and green links promoting non-motorized transport mode share increase
- Linear green parks as green infrastructure also for local recreation, reducing travel need
- Improved water supply and wastewater management, conserving water and energy.
- Improved health outcomes, environment and healthy lifestyles and safe links to schools and hospitals, promoting walking and cycling.

Source: Asian Development Bank Project Documents

PRC: Jilin Yanji Low-Carbon Climate-Resilient Healthy City Project

Improved resilience through application of advanced design concepts and systems

- ADB Project Loan $130 million of $260 million total investment, approved 2019, under implementation
- Climate financing total: $229.31 million; **$82.22 million mitigation** and $147.09 million adaptation.
- Carbon emission reduction
  Reduces 60,708 tons of carbon emissions annually mainly by replacing diesel buses with clean energy buses and BRT reducing use of private vehicles.
- Advanced tools integrating planning & design
  Systemically **integrates climate mitigation and adaptation** and gray infrastructure and green sponge city infrastructure to enhance resilience and uses opportunities of integrating with transport infrastructure
- Smart water supply system
  Improves resilience, water safety and security, **conserving 4.8 million m3 of water resources annually**, identifies non-revenue water, smart water meters

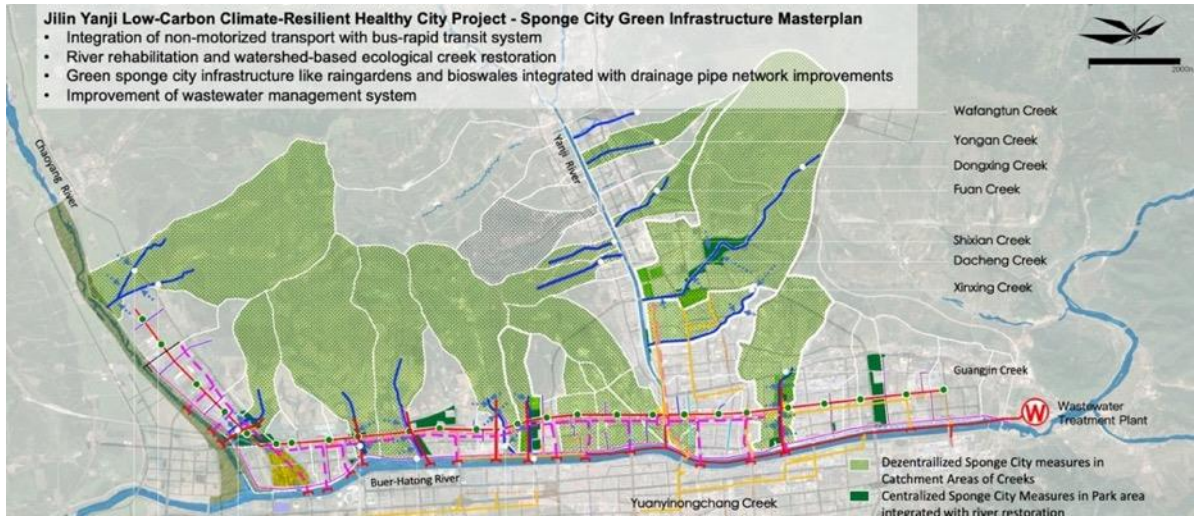


PRC: Jilin Yanji Low-Carbon Climate-Resilient Healthy City Project

Improved resilience through integration of gray and green infrastructure, and transport infrastructure

Integrating adaptation also creates mitigation benefits: Sponge City Green Infrastructure

- Based on watersheds and integrated with BRT line and green space and small street systems.
- Integrates new green infrastructure with improving and changing drainage pipe system
- integrates opportunities of green sponge city infrastructure to reduce urban flooding
- River rehabilitation and flood risk management with green river edges
- Combined actions will increase resilience and improve protection against urban and river flooding



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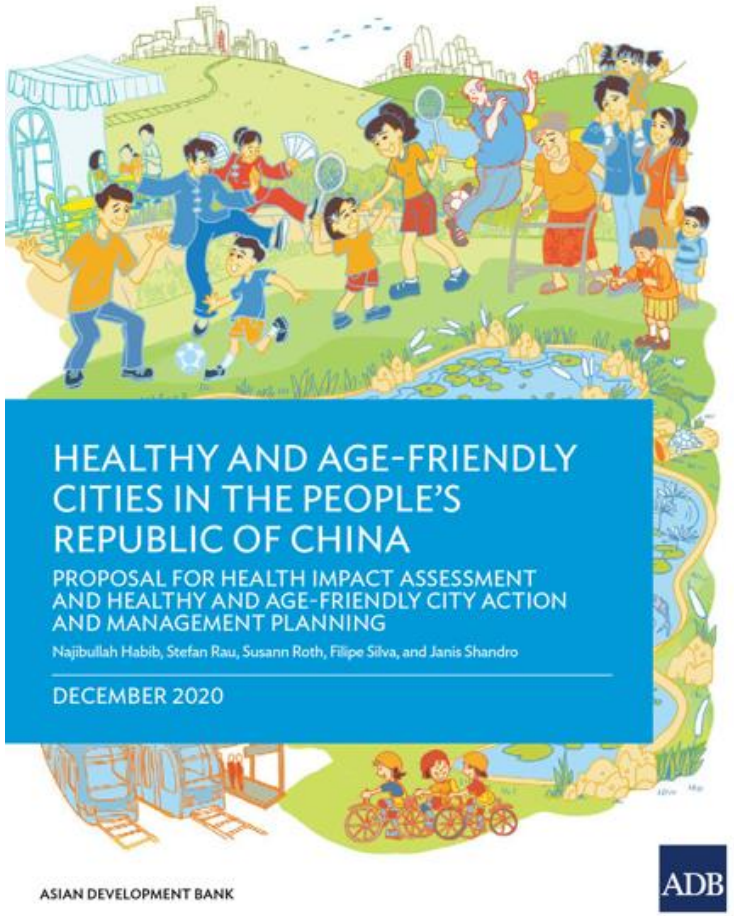
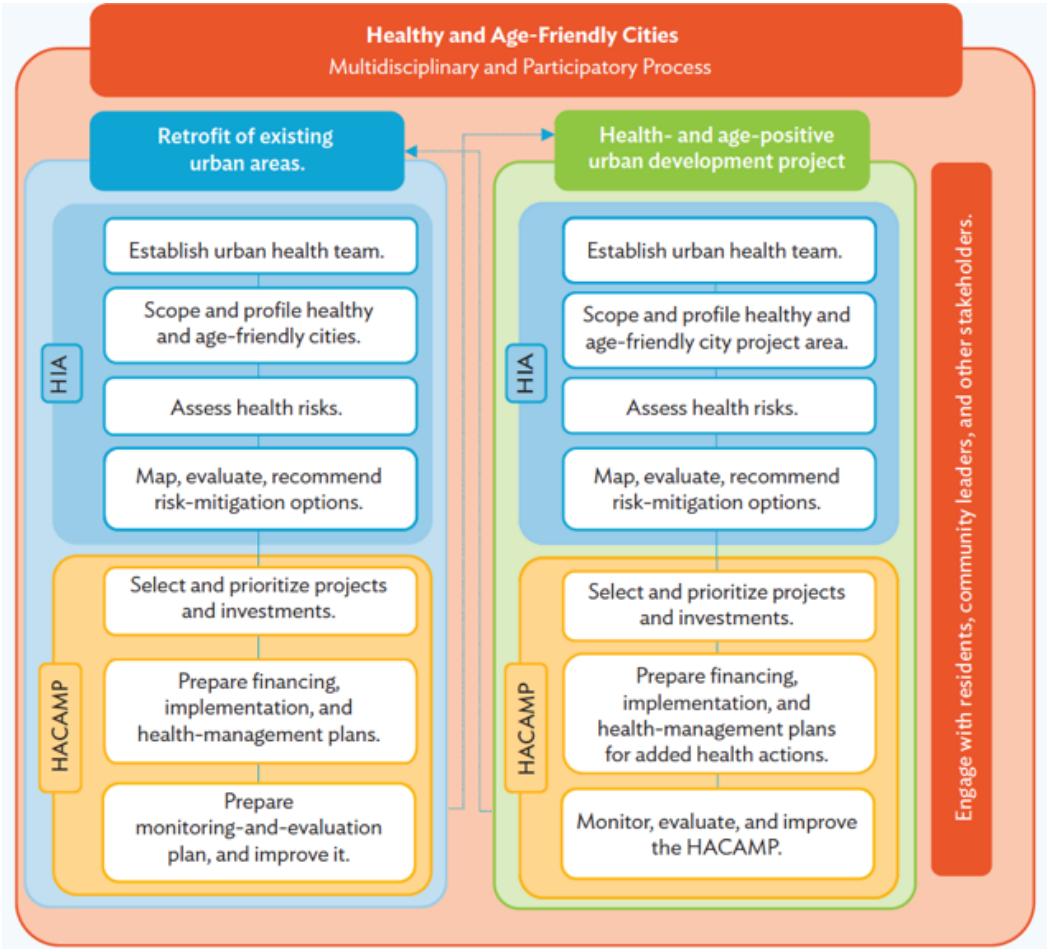
Source: Asian Development Bank Project Documents

PRC: Jilin Yanji Low-Carbon Climate-Resilient Healthy City Project

Integration contributes to positive health outcomes

- HIA: Health Impact Assessment
- HACAMP: Healthy and Age-Friendly City Action and Management Plan
- Specific health benefits enhanced, and additional investments identified and included
- Economic benefits of health impacts quantified





Heilongjiang Green Urban and Economic Revitalization Project

- **Catalyze economic transformation to non-coal future** of four coal-based cities in East Heilongjiang and an urban transformation from dirty coal-mining cities to livable, green and clean and attractive cities.
- **Non-coal diversification roadmap and support to green SMEs with BDS financing through FIL** promoting women-owned and/or managed SMEs.
- **Urban transformation from dirty coal cities to clean and well-serviced cities**, making the cities livable and attractive for current and future residents and companies through infrastructure, services and green spaces (central heating energy efficiency, low-carbon urban transport, bus priority lanes, sidewalk widening and greening, bicycle lanes, green buses
- **Mining remediation strategies and pilot projects** cleaning up and make available polluted sites from more than 60 years of coal-mining.

4. Eco-District Solution for Low-Carbon Urban Development

Ulaanbaatar Green Affordable Housing and Resilient Urban Renewal Sector Project

SUB-STANDARD URBAN AREAS…

- Cities produce about 70% of all GHG emission and pollution
Within cities, 40% to 65% of total GHG emissions are from buildings and transport

- Among 2 billion urban dwellers in Asia, more than 25% leave in sub-standard urban areas need to be changed into livable, resilient, and energy efficient urban areas while they densify or extend due to the lack of adequate affordable housing.

… IN ULAANBAATAR

Ulaanbaatar: 1.4 million population (Mongolia: 3 million)
Ger areas: 840,000 population; 60% of the City; 30% of the country

- No heating network, inefficient individual stove burning low quality coal and energy efficient housing causing high CO2 emission and air pollution in winter

- Open pit latrines system leading to severe soil pollution

- Limited access to water, supplied by water kiosks

- Poor drainage, absence of green buffer zone, and dirt roads exacerbating flood events in summer

- Lack of public space, social facilities and business opportunities

- **Continue to grow (migration + natural growth) due to lack of sustainable strategy, infrastructure, and affordable alternative**
- **High vulnerability to climate change, highly emitting, highly polluting**

LOW CARBON URBAN RENEWAL…

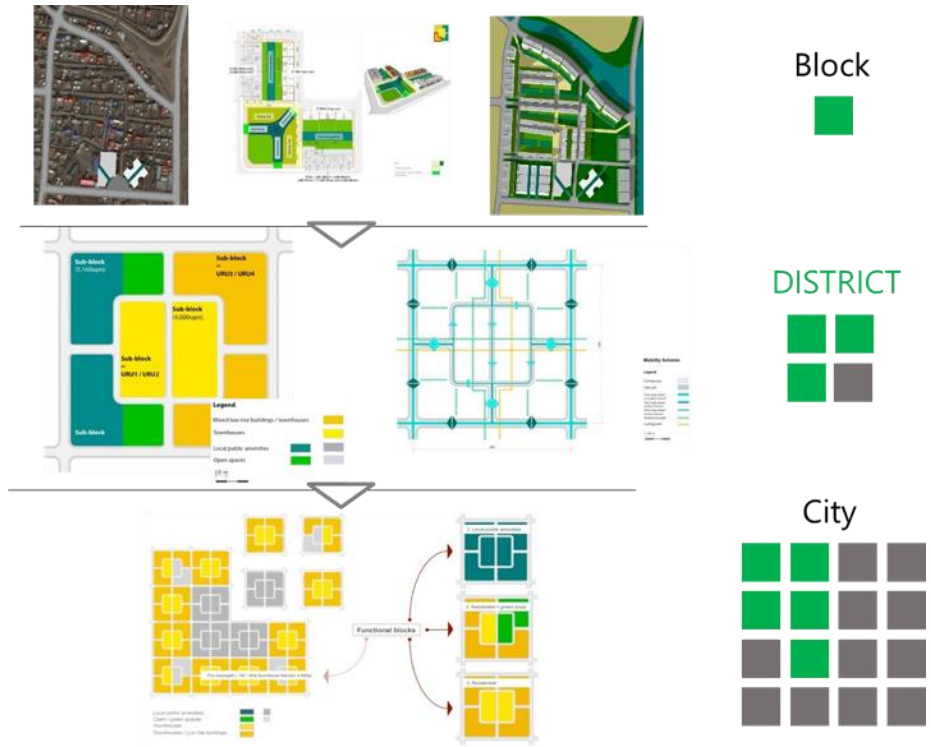
How to transform highly polluting and emitting vulnerable and sub-standard peri-urban of Ulaanbaatar city into low-carbon and resilient urban that will provide access to green affordable housing units?

GCF DRIVERS OF CHANGE ➢ Transformational Planning & Programming ➢ Catalyzing Climate Innovation ➢ Mobilization of Finance as Scale ➢ Expansion & Replication of Knowledge

… USING ECO-DISTRICT APPROACH

Integrated planning and development process, and **complete solution** at the neighborhood level to build up **citywide sustainability** and **green development**

- **Combination** of public policy, catalytic investments from local government and utilities, private sector and communities' participation
- **Bridge the gap** between green policy objectives and practical investments
- **Appropriate scale** for step-by-step implementation and to enhance neighborhood urban and environmental solutions



IN SYNERGIES WITH INFRASTRUCTURE EXPANSION PROGRAM

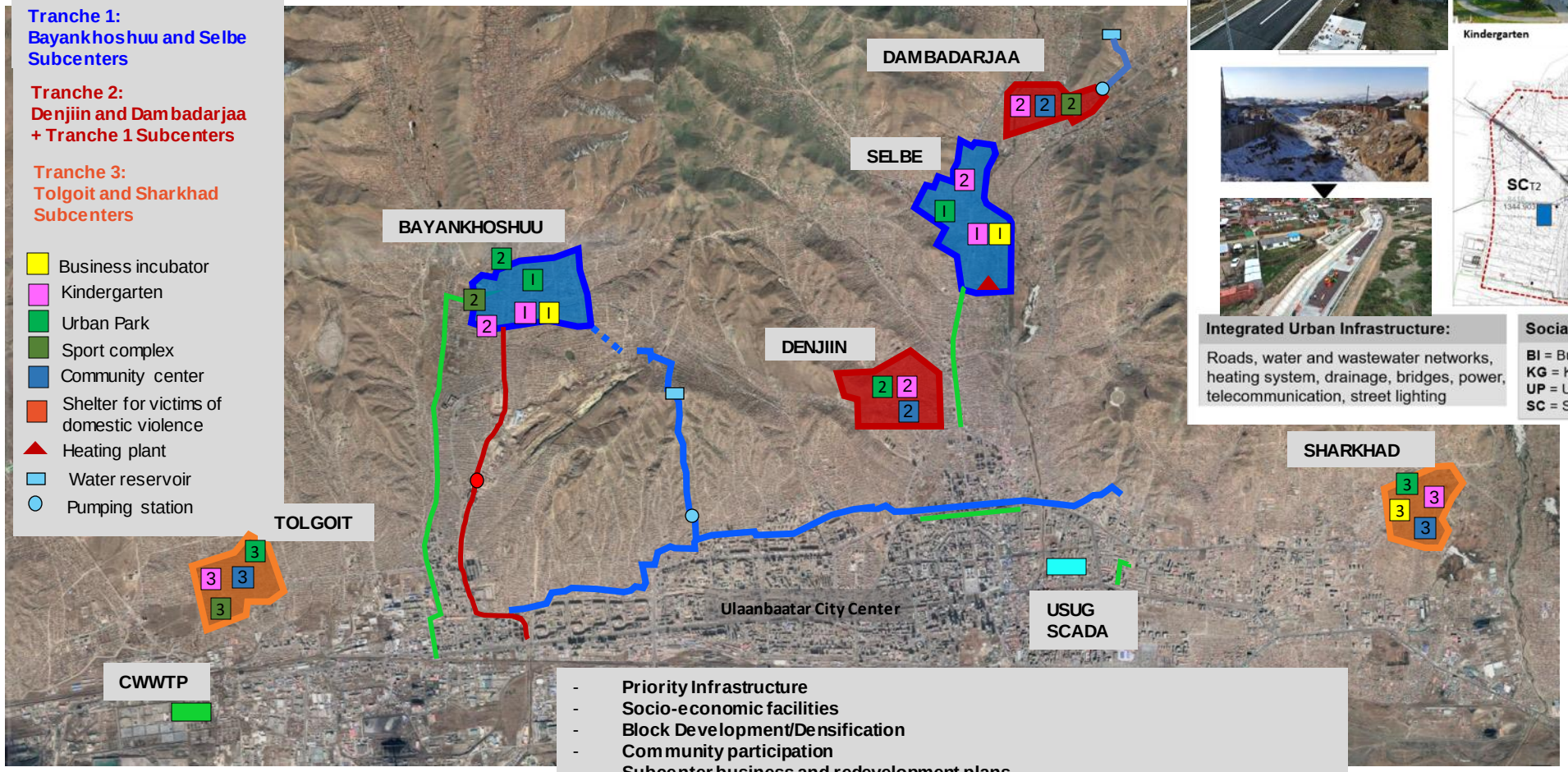
Ulaanbaatar Urban Services and Ger Areas Development Investment Program

Tranche 1:
Bayankhoshuu and Selbe Subcenters

Tranche 2:
Denjiin and Dambadarjaa + Tranche 1 Subcenters

Tranche 3:
Tolgoit and Sharkhad Subcenters

- Business incubator
- Kindergarten
- Urban Park
- Sport complex
- Community center
- Shelter for victims of domestic violence
- Heating plant
- Water reservoir
- Pumping station



- Priority Infrastructure
- Socio-economic facilities
- Block Development/Densification
- Community participation
- Subcenter business and redevelopment plans
- Improvement USUG operation and CWWTP rehabilitation

BAYANKHOSHUU SUBCENTER

Integrated Urban Infrastructure:
Roads, water and wastewater networks, heating system, drainage, bridges, power, telecommunication, street lighting

Social Facilities:
BI = Business Incubator
KG = Kindergarten
UP = Urban Park
SC = Sport Complex

T1 = TRANCHE 1
T2 = TRANCHE 2

Green Affordable housing core subproject

ADB | European Investment Bank

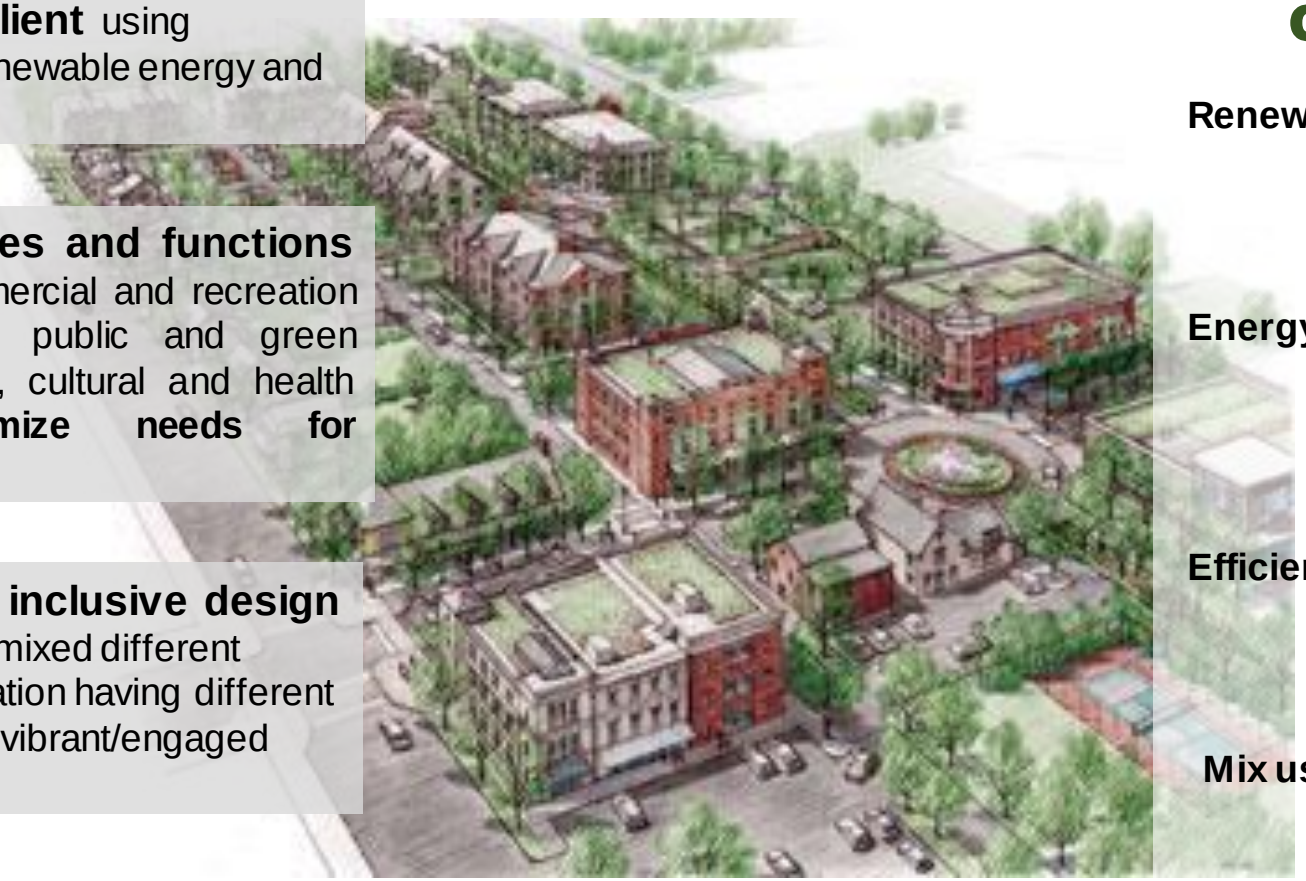
Investment Program	$ million
ADB	163.7
MUB	96.0
EIB	60.3
Total program	320.0

Eco-District Principles

Green and resilient using implementable renewable energy and energy efficient

Mixed land uses and functions (residential, commercial and recreation functions; ample public and green space; education, cultural and health facilities) **minimize needs for transportation**

Social mix and inclusive design (urban areas that mixed different category of population having different income level) and vibrant/engaged communities



- Attractive for communities: Quality of life, Social integration, and Affordable
- Attractive for real estate developers: Reasonable Net Profit Value
- In line with City master and local plans, and urban regulation

GREEN FEATURES

Renewable Energy

- **Passive Solar Design**
- **PV (Photo Voltaic) Panels, Wind**

Energy Efficiency

- **High efficiency isolation system** based on Mongolian Norm and Regulation "Thermal Performance of Buildings"

Efficient land use planning

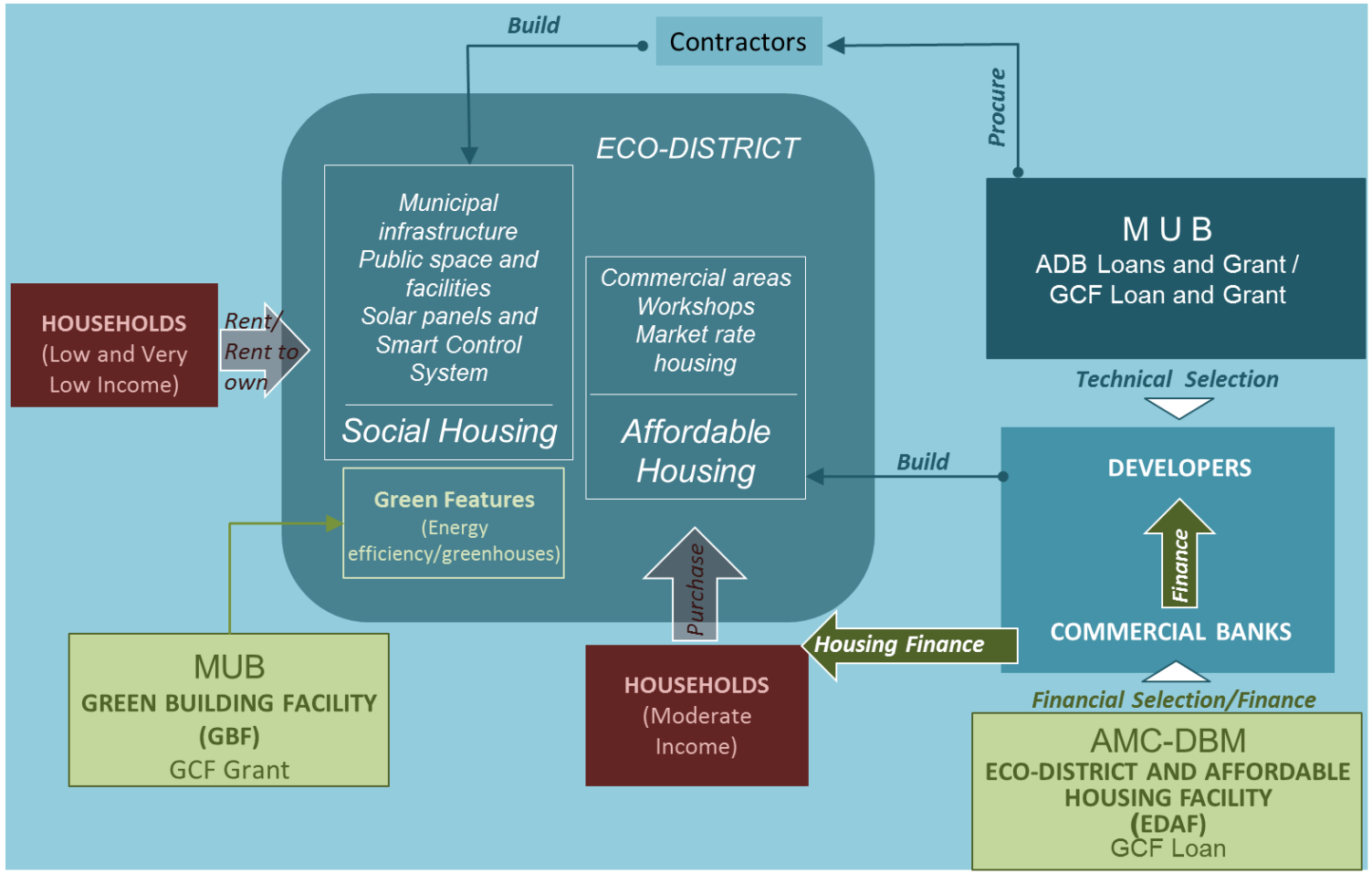
- **Compact design**
- **Shape and building orientation**

Mix used

- **Maximize green space**
- **Reduce the need for transportation** and promote non-motor transportation

Energy Performance Monitoring System (green and smart)

Integrated Financing /Design /Institutional Mechanism



Modality: Sector loan with FI component, PPPP mechanism, mobilizing green finance and leveraging private sector investments

- Total cost: **$570.1** million
- Including climate finance (loan and grant from GCF) and **50% financing from private sector** (leveraging commercial banks, developers and beneficiaries' investments)

Source	Amount (USD million)
Asian Development Bank	80.0
Green Climate Fund	145.0
GCF (grant)	50.0
GCF (concessional loan)	95.0
HLT Fund (grant)	3.0
Commercial banks/DBM	111.4
Developers	131.8
Beneficiaries	63.9
Municipality of Ulaanbaatar	35.0
Total	570.1

Green, Energy Efficient, Inclusive and Integrated Design

- **Innovative urban PPPP (Public, Private, People Partnership),** financial and institutional integrated mechanism leveraging financing from public sector, beneficiaries, commercial banks and real estate developers to deliver eco-district urban solution
- **Innovative climate financial intermediary** to leverage private sector resources and support the construction of affordable green housing units and production of green mortgage to support access to the green housing units
- **Green Building facility** will provide performance-based grants through to qualified private developers for climate change mitigation and adaptation features
- **Smart system** for renewable energy and building performance control and monitoring
- **Design-based process** allowing green and public space, inclusive design, urban farming, low-carbon planning and architecture
- **Innovative Voluntary Land Swapping Mechanism** that will provide housing solution to all residents for in situs redevelopment
- **Sector loan** for model replication

Figure 22. Overall BKH Site Plan (B-15 & N-4 sites)

Outcome, Benefits, and Climate Impact

10,000 housing units (55% affordable, 15% social, and 30% market rate units) and redevelop **100 hectares** of *ger* areas into **ecodistricts**

Improve the regulatory and enforcement framework for climate responsive urban planning, green building, and affordable housing.

Transformational impacts:

- Policies and capacity building conducive to energy efficiency and resilience in buildings (EDGE Standard, urban planning, green building code);
- Efficient supply chains for renewable energy systems and energy efficient construction technics and materials;
- Green banking policies; and
- Climate responsive and inclusive urban planning.

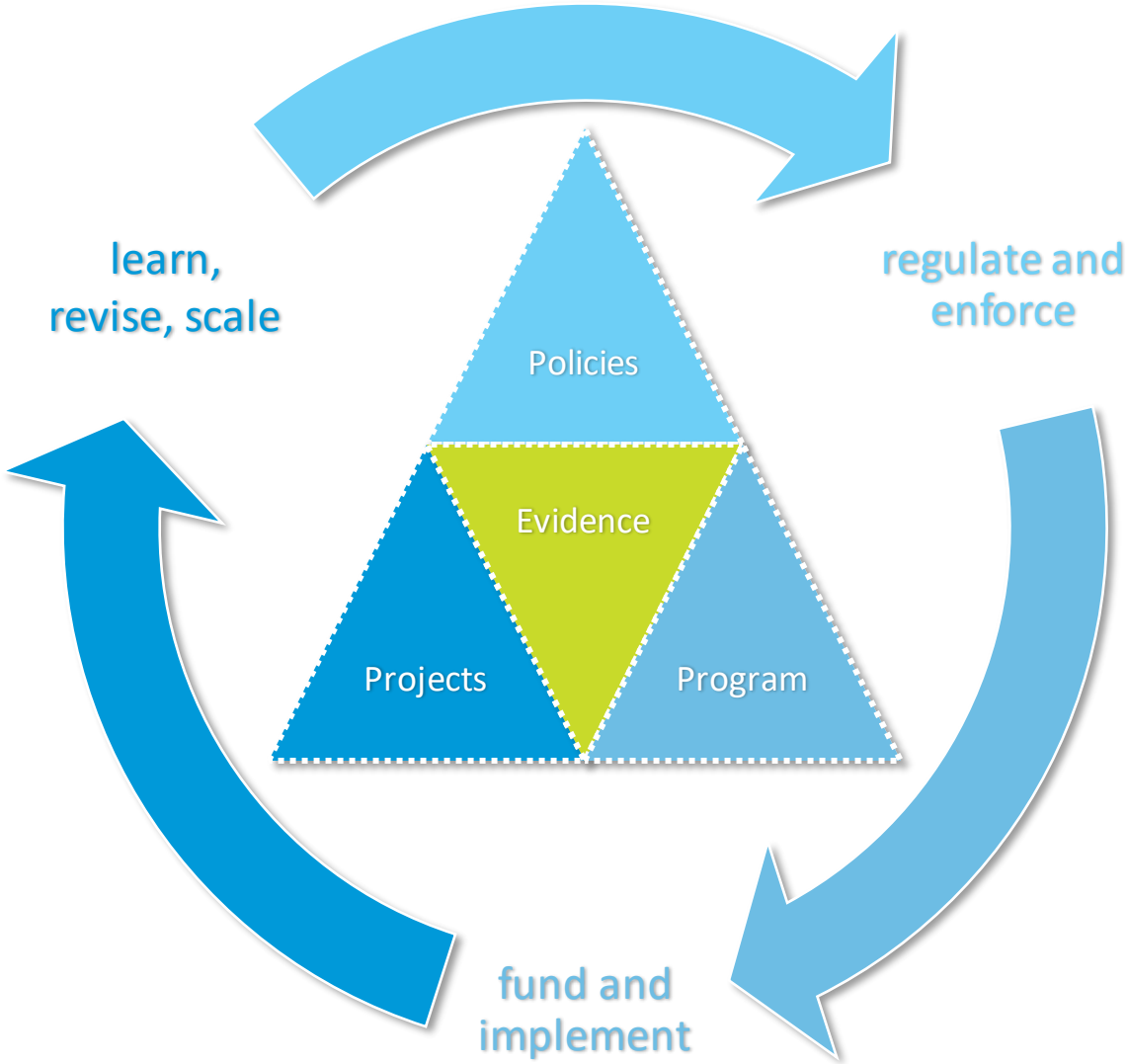
Climate change cross cutting impacts

Mitigation: GHG emission reductions, Direct: 8 million tCO2e and Total (including indirect – replications effect): 39.59 million tCO2e.

Adaptation: 100,000 total direct beneficiaries and 1,000,000 total direct and indirect beneficiaries from reduced climate change vulnerability;

5. Conclusions

Unleash Transfomation: Learn, Scale, Iterate and Integrate Across Levels



6. Discussion

Wuhan Tiandi Mixed-use Development (WHTD) is the first district-scale commercial development in China awarded the Leadership in Energy & Environmental Design Neighbourhood Development (LEED®–ND) Pilot Gold certification. With a site area of 48ha, WHTD embraces high quality retails, restaurants, hotels, grade-A offices, live-work residence and public amenities. The total gross floor area of approximately 1,500,000m² is planned to accommodate a population of 20,000.

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Thank you.

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