Sustainable Food
Webinar Series
Rural Development and Food Security (Agriculture) Thematic Group

ADB

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RDFS TG – CCDRM TG – ESG – ADB-PRC RKSI Joint Webinar

Rural Prosperity with Carbon Neutrality and Food Security

24 March 2021

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Rural Prosperity with Carbon Neutrality and Food Security

Speakers

James Lynch
Director General, East Asia Department, ADB

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Chief, Rural Development and Food Security (Agriculture) Thematic Group, ADB

Jiahua Pan
Member of the Academic Board, Chinese Academy of Social Sciences (CASS)

Yongping Zhai
Chief of Energy Sector Group, SDCC, ADB

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Chief of the Climate Change and Disaster Risk Management Thematic Group concurrently Director, SDCD, ADB

Arthur Hanson
International Council Member for China Council for International Cooperation on Environment & Development

Kevin Chen
Qushi Chair Professor and International Dean, China Academy for Rural Development, Zhejiang University and Senior Research Fellow and Head of East and Central Asia Office, IFPRI

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Rural Prosperity with Carbon Neutrality and Food Security

Opening Remarks

James Lynch
Director General,
East Asia Department,
Asian Development Bank (ADB)

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Rural Prosperity with Carbon Neutrality and Food Security

Guest Speaker

Jiahua Pan

Member of the Academic Board, Chinese Academy of Social Sciences (CASS)

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Rural Prosperity with Carbon Neutrality and Food Security

24 March 2021

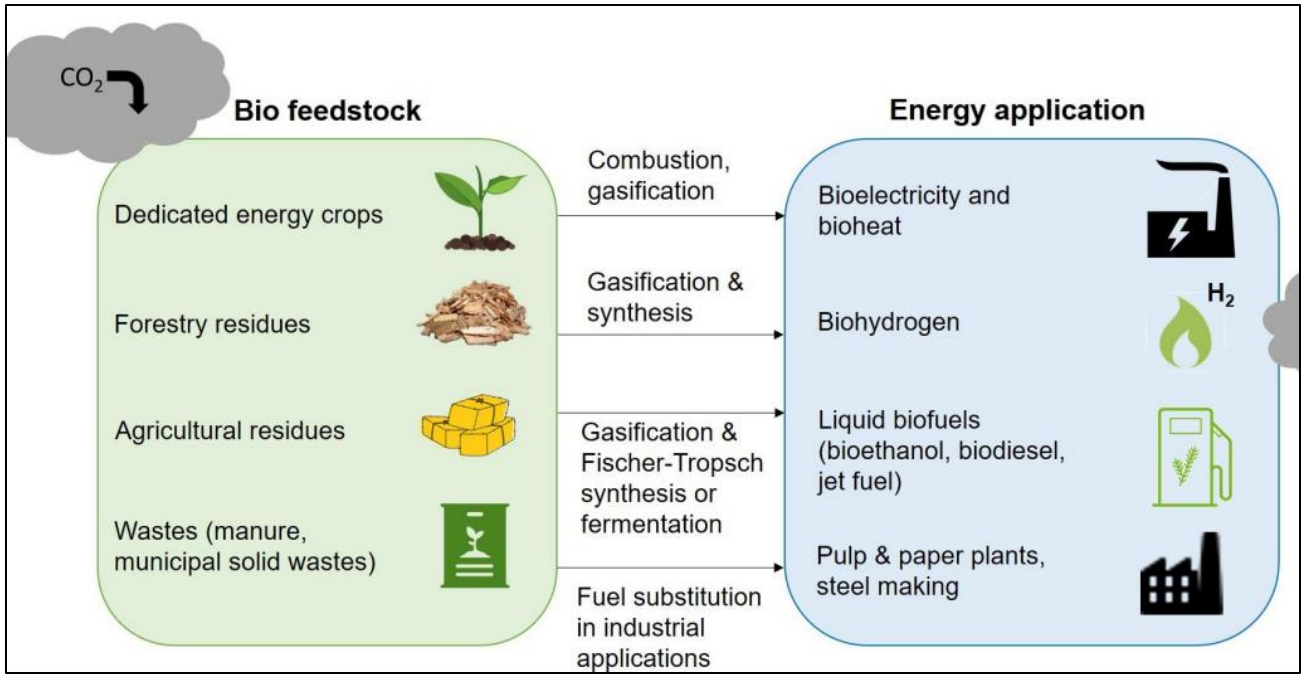
PAN Jiahua
Think Tank of Eeco-Civilization Research, Chinese Academy of Social Sciences
Institute of Eco-Civilization Studies, Beijing University of Technology

Rural Vitality and Sustainability

- Rural: rural region; rural economy, rural lifestyle, rural culture?
- IPCC terminology:
  - More physical side of rural areas: Land Use, Land Use Change and Forestry (LULUCF) in the 1990s
  - More sectoral focus of rural region: Agriculture, Forestry, and Other Land Uses (AFOLU) in 2010s
- Rural development for rural vitality:
  - Long term: prosperity
  - Mitigation: carbon neutrality, not noly for rural region, but also for urban areas
  - Adaptation: food security, climate resilient system for sustainable food production, a healthy and mutually reinforcing water-food-energy nexus

CARBON NEUTRALITY

Rural regions have the advantage of, not only the space for solar and wind as zero carbon energy, but also the potential to generate carbon neutral bio-energy.

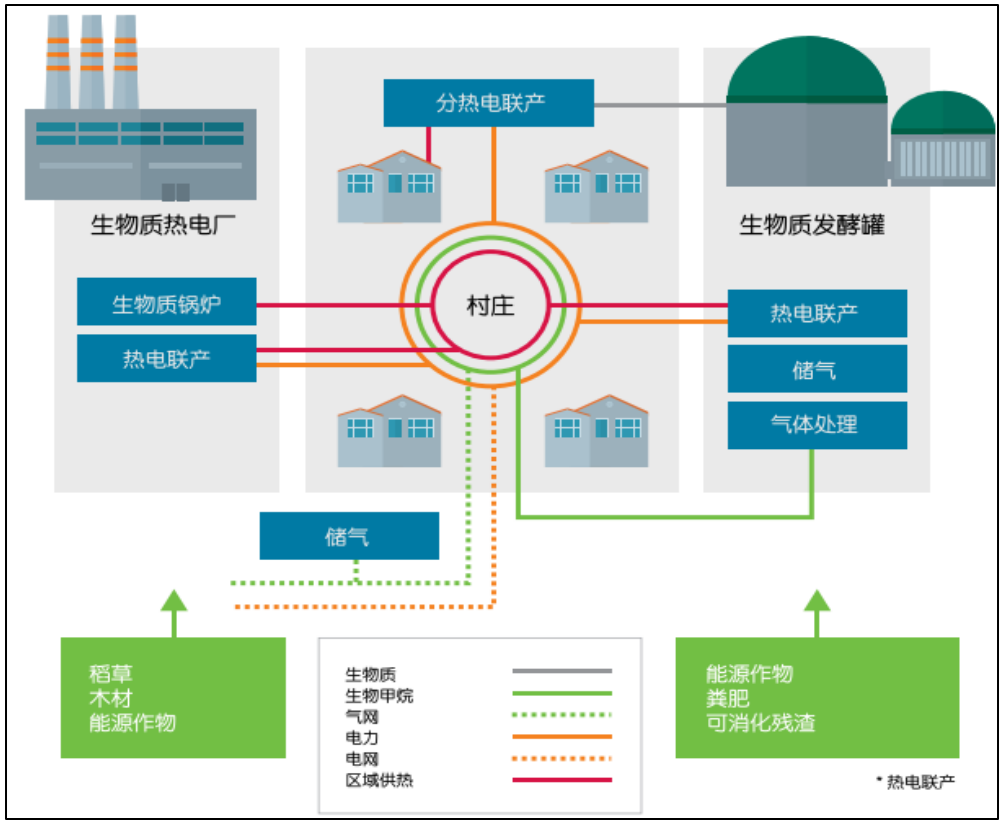


All the carbon fixed in vegetation comes from the atmosphere and goes back to nature. Carbon associated with LULUCF and AFOLU is in general neutral.

Green plants have dual contributions to climate change:

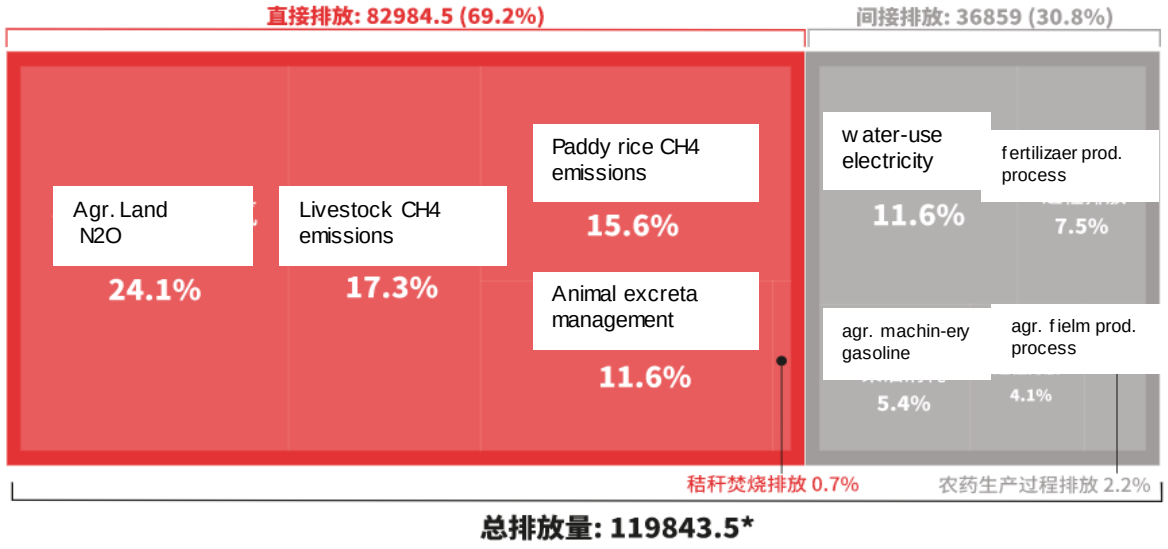
- **mitigation:** biochar, bioethanol, biodiesel, biohydrogen, bio-electricity
- **adaptation :** climate resilience

Rural village, rural community, rural human settlements using bio-energy: zero carbon economy, completely carbon neutral



Fraunhofer ISI.; IFEU; IREES (2019):《德国可持续供热方案研究——最佳实践及中国的适用性分析》卡尔斯鲁厄、海德堡 Frank Scholwin, Johan Grope, Angela Clinkscales, Stephan Bowe德国沼气、废弃物管理与能源研究所，2020.德国国际合作机构 Torsten Fritsche, Köthener Str.2 柏林10963

2014: GHG Emissions fromthe agriculture sector
Unit: 10,000 CO2 equi.



* 百分比表示占总排放量的比例。
直接排放数据来源:《中华人民共和国气候变化第二次两年更新报告》, 2018
间接排放数据来源:作者计算

China's agr. emission reduction potential(10,000 CO2 eq)

减排潜力分解	万吨二氧化碳当量
straw thermal cracking	50000
soil management	14667
reduced fertilizer application	1835

数据来源：据作者们计算

农作物秸秆制成的工业化生物炭。图片来源：程琨、潘根兴

Agricultural carbon emissions? Energy, carbon sink, carbon neutrality

- Biomass energy: energy utilization, energy conversion, energy substitution. Crop straw in China reaches more than 1 billion tons per year. 60% of the straw (20% is discarded, 40% of the consumed part is directly returned to the field): Carbonized into biomass char base fertilizer through thermal cracking and the potential carbon sink is as high as 500 million tons of carbon dioxide equivalent, which can neutralize 60% of agricultural greenhouse gas emissions in China.
- Bio-organic fertilizer: reduce emissions instead of chemical fertilizer, improve soil and increase soil carbon sequestration
- N2O and CH4 in Agriculture and animal husbandry (paddy fields, animal husbandry): carbon neutral with limited potential.

中国农业如何助力碳中和减肥减碳、养地固碳，中国农业如何助力碳中和？ 程琨 潘根兴 中外对话， 2021年1月25日

The role of forests in addressing climate change

carbon sink (short-term) < **biomass energy** (sustainable production) < **climate adaptation** (biodiversity protection, soil productivity improvement, water and soil conservation, resilience improvement)

Total forest area in China is 22.04462 million hectares, the forest stock is 17.56 billion M^3, the total forest vegetation biomass in China is **18.802 billion tons**, and the **total carbon storage is 9.186 billion tons**. p.2

National forests each year: water conservation is 628.95 billion m3; soil consolidation is 8.748 billion tons; fertilizer retention is 462 million tons; absorption of air pollutants is 40 million tons; dust retention is 6.158 billion tons; **carbon sequestration is 434 million tons/yr**; the amount of released oxygen is 1.029 billion tons (p.76)

国家林业和草原局，2019. 《中国森林资源报告（2014-2018）》，中国林业出版社，北京。451pp.

Project location	Manner	Acreage (ha)	timespan(yr)	Total carbon sink (tCO_2)	tCO_2/ha.yr
Northwest Sichuan, 5 counties (28 villages, 四川西北理县等5县21乡28村, pp.107-145)	Afforestation and reforestation of degraded land	2251.8	20（2007-2026）	460063	10.21
South west Sichuan, 5 counties(27 villages, 四川西南甘洛等5县17乡27村, pp.146-177)	Afforestation and reforestation of destructed land	4196.8	30（2011-2041）	1206435	9.58
Tengcong, Yunan Province (6 villages, 云南腾冲县3乡6村（林场）, pp.178-206)	small-scale afforestation	467.7	30（2007-2036）	151971	10.83
Jinghong county, Yunan (16 villages, 云南西双版纳景洪等3县8乡16村, pp.207-227)	bamboo stands	3582.34	30（2010-2039）	634472	5.90（51.6）

Carbon sequestration CDM projects case illustration: land availibility: small scale, fragmented, poor conditions; total amount sequestrated: limited; annual per unit amount of sequestration: small. but restoration of ecological functions: a great necessity

吕植（主编）、马剑、张小全、唐才富（副主编）2014年12月。《中国森林碳汇实践与低碳发展》，北京大出版社。pp.295。

Urban development requires external zero-carbon energy

Rural revitalization, zero-carbon development
Self-sufficient zero-carbon economy pattern

Food security: the food-land-energy-water nexus issue

Rural carbon neutrality does have implications for food security as water-food-land-energy nexus complicates the interactions

Carbon Neutrality versus Food Security

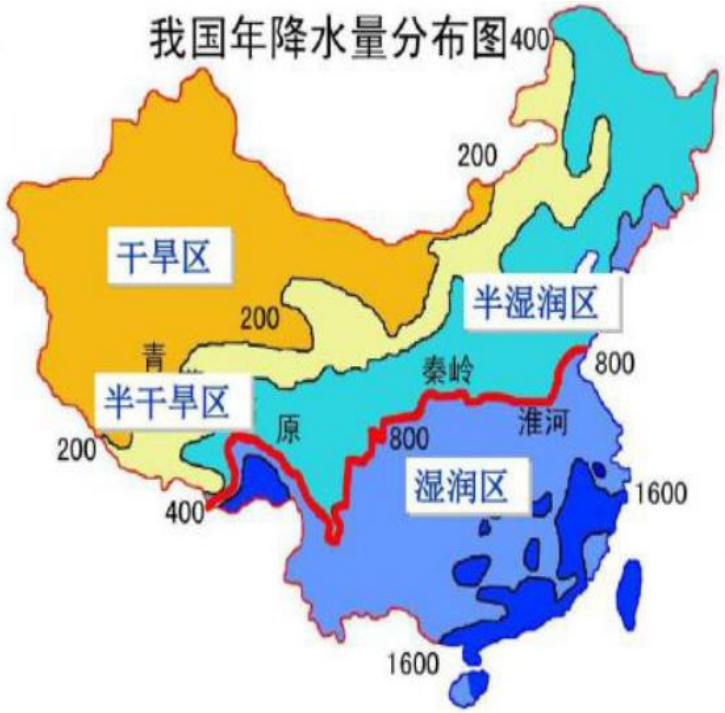
Water-Land-Energy Nexus Issue

- Land for energy (solar, wind, bio-energy): positive for mitigation, likely negative for climate resilience; competing for food security

- Land for forest carbon sinks: positive for mitigation in the short run, positive for climate resilience, competing for food security if arable land is turned into forest for carbon dioxide removal

Carbon Neutrality versus Food Security

Water-Land-Energy Nexus Issue



国家林业和草原局，2019. 《中国森林资源报告（2014-2018）》，中国林业出版社，北京。451pp.

- Land and water are the necessary and sufficient conditions for agricultural production (food security).
- Land can be solely used for energy generation (wind, solar)
- Water is the constraint for forest sinks and energy crops (arid region no forest can grow, semi-arid, low level of biomass generation)

Where is the forest located in China? Water is the primary constraint!

	(%) Forest coverage rate	(10,000ha) Forestry area	% total	(10,000m3) volume	% total	(m3/ha) Unit stock volume
湿润地区 Humid region	50.82	16648.71	68.95	1344213.30	78.80	80.74
亚湿润区 Sub humid region	23.87	4235.25	17.54	282790.70	16.58	66.77
亚干旱区 Sub-arid region	10.98	2194.30	9.09	62541.06	3.67	28.50
干旱区 Arid region	4.66	648.74	2.69	9060.17	0.53	13.97
极干旱区 Extreme arid region	3.68	418.31	1.73	7214.36	032	17.25
合计 total		24145.31	100.00	1705819.59	100.00	70.65

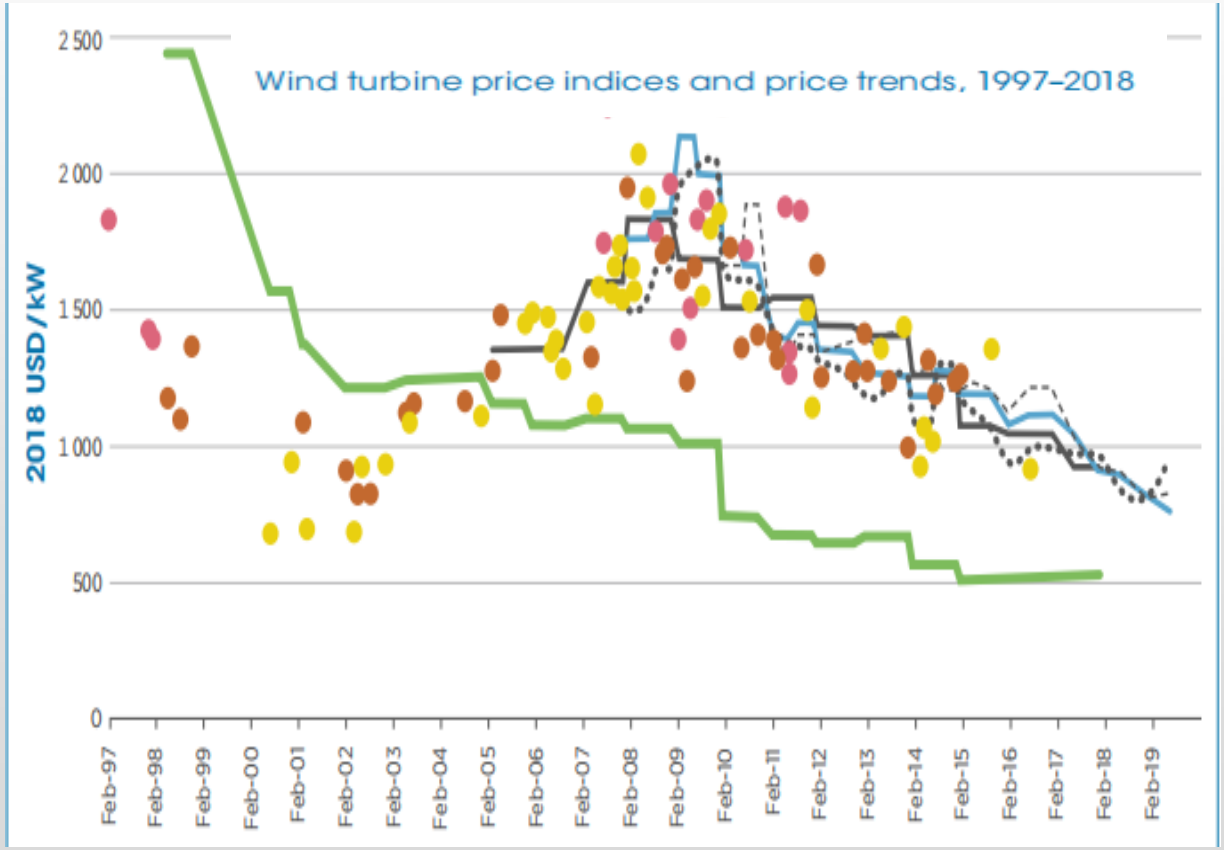
Carbon Neutrality versus Food Security Water-Land-Energy Nexus Issue

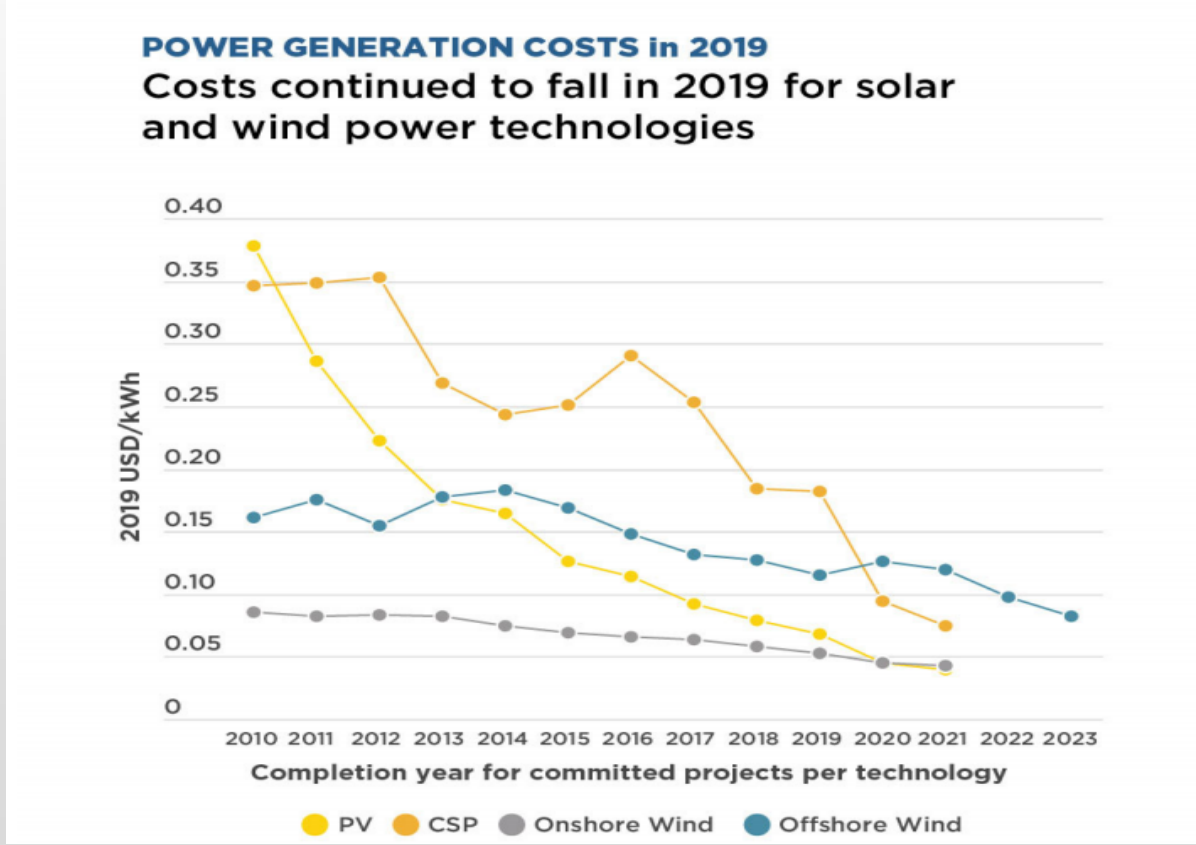
Land, water and energy can be made compatible with agricultural production in many cases.

Rural Prosperity

In the meantime, carbon neutrality will bring opportunitties for rural prosperity while food security has to be prioritised.

Wind, solar, bio-mass provides low-cost energy services, which generate income and employment, emit zero carbon and conventional pollutants, reduce climate risks and living costs (self energy supply for household and vehicles)

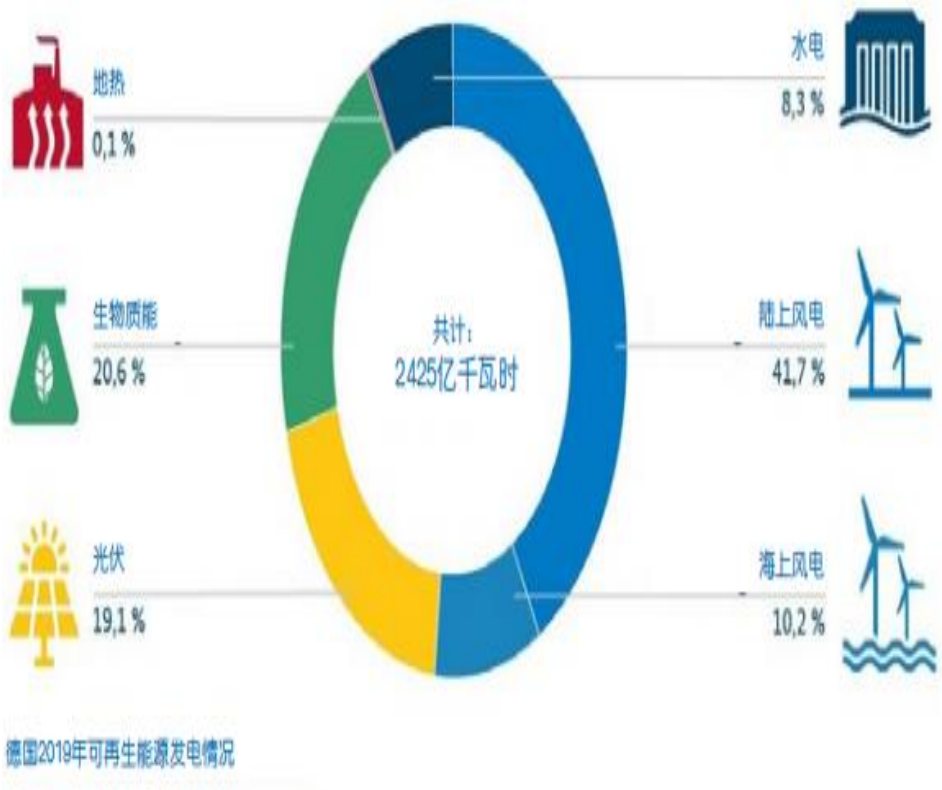




An example illustrating multiple wins in semi-arid region, Qinghai Province

新华每日电讯, 从茫茫戈壁荒滩到葱绿草原牧场 2019-07-23

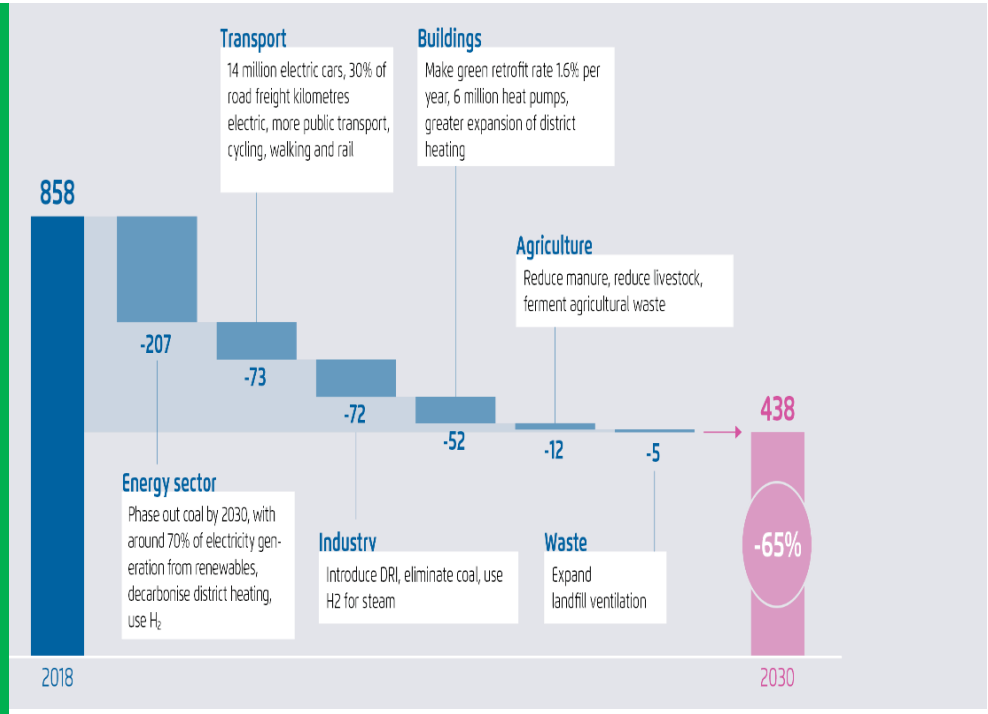
- Tiegai Township (Gonghe County, Qinghai Province), on the side of Tala Beach, is a deeply impoverished township.
- The average altitude of the deserted beach is 2,920 meters. Solar radiation is strong, and average daily sunshine is up to 8 hours: the photovoltaic power generation park is 609 square kilometers, the planned total installed photovoltaic capacity is 19.025GW, and 4.495 GW have been connected to the grid. The accumulated investment has reached 45 billion yuan.
- Ecological recovery: reduced the maximum wind speed in the park by 22%, evaporation rate by 30%, the air humidity increased by nearly 5%, the amount of grassland culverts greatly increased, and land desertification was effectively curbed. Plant height in the park has increased by 14 cm compared with the non-project area, the frequency and coverage have increased by 20% and 17% respectively, and the vegetation biomass has increased by 20.25 kg per mu.
- Employment and growth: more than 1,000 jobs for Farmers and herdsmen from the surrounding areas came to herd sheep, clean photovoltaic modules, weed and be the security guard. Monthly income per capita of farmers and herdsmen reached 3,000 yuan and earn 1,815 yuan extra subsidy on pasture lease per mu.
- Two seemingly contradictory things have achieved harmony and unity on the bank of the Yellow River. The multiple wins of the government, enterprises, nature, and residents is being presented in Tara Beach.

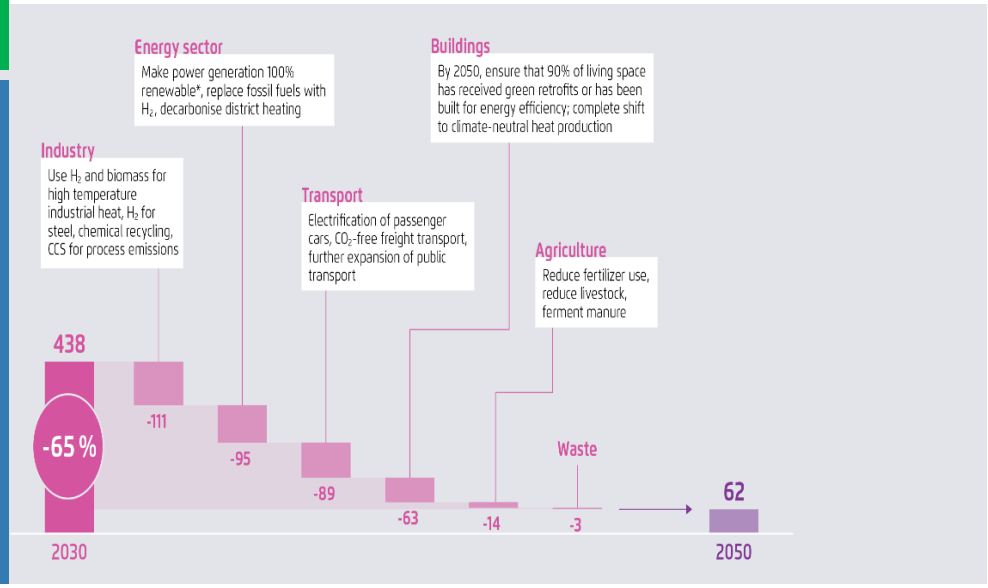


德国2019年可再生能源发电情况

© BMWi; Broschüre „Erneuerbare Energien in Zahlen. Nationale und internationale Entwicklung im Jahr 2019" (teilweise vorläufige Zahlen)

AFOLU Role: carbon neutrality, food security and rural prosperity, or their combination?





Agriculture and forestry (AF) should be prioritised for food security, climate resilience, with emissions reduction the last. Other land uses (OLU) in rural region for carbon neutrality as 1st priority

-40%: Reduction of GHG emissions from 1990 – 2018 (mt CO2 eq): 5.1%
-65%: Increase the 2030 target to GHG (GHG emissions in mio. t CO2-eq): 2.9%
-95% reduction 2050: 3.7%

Prognos, Öko-Institut, Wuppertal-Institut (2020): Tow ards a Climate-Neutral Germany. Executive Summary conducted for Agora Energiew ende, Agora Verkehrswende and Stiftung Klimaneutralität.
德国联邦经济和能源部（BMWi）：《可再生能源数据—2019年国家和国际发展概况》

Conclusions and discussion

- **Multiple wins through AFOLU mitigation and adaptation:**
  - rural vitality: income generation through zero and carbon neutral energy production; reduced cost of living in the rural region as a result of localized and low-cost energy supply
  - carbon neutrality: the potential for direct carbon reduction is limited, but contribution of zero carbon and carbon neutral energy to urban consumption
  - climate resilience for better functions of ecological systems, reduced damages and losses of socio-economic systems, and increased agriculture production
- **The Water-Land-Food nexus issue**
  - Zero carbon energy generation requires land, but water consumption can be minimal; carbon sinks and carbon neutral bio-energy production requires both land and water, which competes with food production.
  - water is the critical element: where there is water, land can be used food, energy, and carbon removal; there is serious water constraint, land is less or not suitable for food and carbon removal purposes but good for zero carbon energy.
  - food production takes priority over energy but can contribute to carbon neutrality given the conflict over land and water
- **Rural prosperity, carbon neutrality, food security:** can be mutually reinforcing, and in the meantime, can be in conflict with one another. Policies should be oriented towards promoting mutual reinforcement and reduce potential conflicts

Rural vitality and sustainability

- **Rural: rural region; rural economy, rural lifestyle, rural culture?**
- **IPCC terminology:**
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  - Mitigation: carbon neutrality, not noly for rural region, but also for urban areas
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谢

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The largely power self-sufficient Bosco Verticale (Vertical Forest) towers in Milan, Italy, provide an insight into the future of sustainable living., by Unsplash/Jann An

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2060 Carbon Neutrality and China's Food Systems

Kevin Chen (kzchen@zju.edu.cn)

Qiushi Chair Professor and International Dean of China Academy for Rural Development, Zhejiang University

Senior Research Fellow of IFPRI

Carbon Emissions in China's Food Systems

Carbon emissions from **agricultural activities**

- 710 million tons in 2018, accounting for 5.4% of all carbon emission
- Main emission sources: rice (26%) and beef (17%) in 2017

Carbon emissions from **energy use in food systems**

- 680 million tons in 2018
  - Energy in food processing industry (420 million tons, 62%)
  - Agricultural energy (170 million tons, 25%)
- The total amount is 1.39 billion tons in 2018, accounting for 10.5% of total greenhouse gas emissions.

Forest carbon sequestration is 480 million tons in 2020 and will increase to 1.6 billion tons by 2050 (Energy Foundation China, 2020).

Assessing Options to Achieve 2060 Carbon Neutrality while Ensuring Food Security

- Improving crop technologies (increasing yields, paddy rice field, and increasing fertilizer use efficiency)
- Improving livestock technologies (reduced emissions from livestock production and forage use efficiency)
- Reducing food waste and loss
- Adjusting dietary structure (reducing meat consumption)
- Combined approach (combination of the above)

Forthcoming Report in April, 2021

2021 China Food Policy Report under Global Lens: Rethinking of Food Systems after COVID-19

- Global Academy of Food Economics and Policy (GAFEP), China Agricultural University
- China Academy for Rural Development (CARD), Zhejiang University
- Institute of Agricultural Economics and Development (IAED), the Chinese Academy of Agricultural Science (CAAS)
- College of Economics and Trade (CET), Nanjing Agricultural University
- International Food Policy Research Institute (IFPRI)

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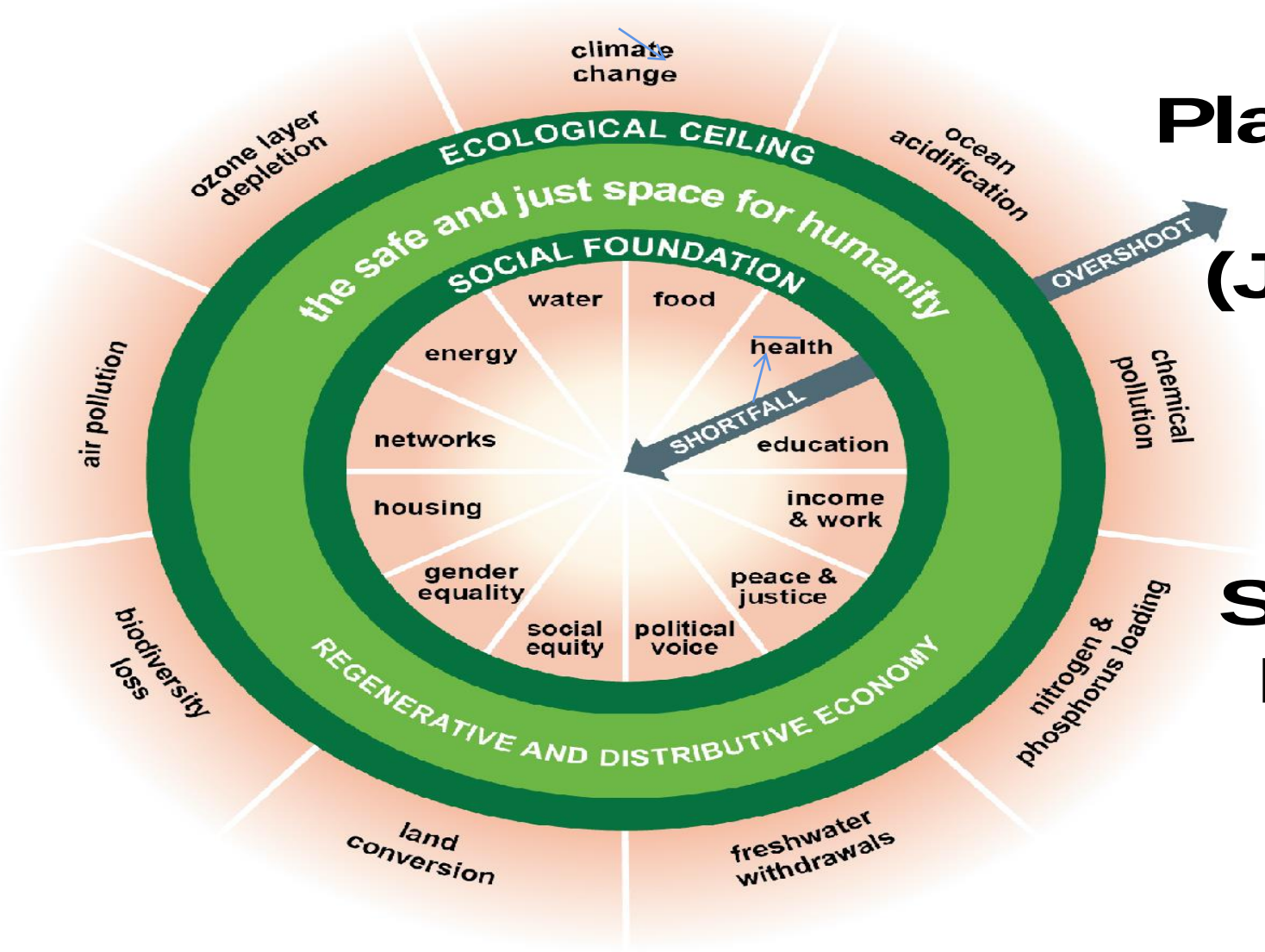
Food-Ecological-Climate-Security

“Natural Capital”
Investing in Nature
Investing in People

Yangtze River

https://en.wikipedia.org/wiki/Doughnut_(economic_model)



Risk-based Planetary Boundaries Model (Johan Rockström)

+

Social / Ecological Doughnut Model (Kate Raworth)

NEW ECONOMY & GLOBALIZATION APPROACH


“MUTUALLY REINFORCING”
Co-Benefits / Synergies
Every Project ‘Nature Positive’
Every Project ‘Carbon Neutral’
Bundle Benefits: Short + Long-term
Whole System Models for Scaling Up
SOCIO-ECOLOGICAL INTEGRATED RURAL DEVELOPMENT

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24 March 2021

Thank you so much!

Please click the post-event survey link in the chat box or enter the URL below in your browser

https://bit.ly/31c4kSL