Building Low-Carbon, Climate-Resilient Cities as an Essential Element of Global Efforts
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Approaches and Practices of Low Carbon City Planning: Experiences from China

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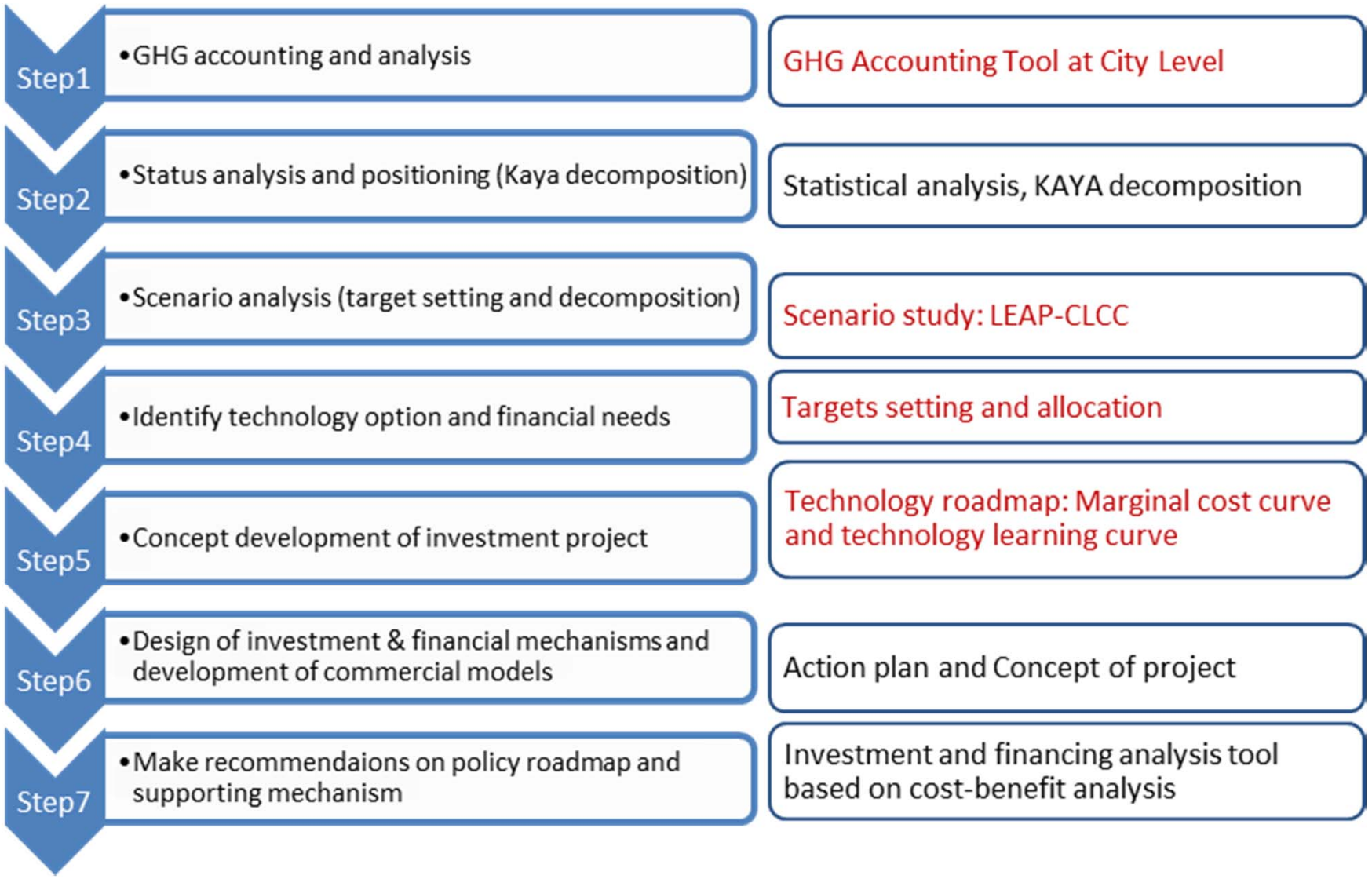
Motivations: Differences Between Cities of Developed Countries and China

- Different development stage: Industrialized vs. under industrialization (GDP per capita);
- Different population growth rate and infrastructure needs: Completed urbanization vs. under urbanization;
- Different economic structure (share of Secondary and Tertiary industry);
- Different major emission sources and energy endowment: emission from transportation and building vs. emission from industry;
- Different government authority: government, community vs. the whole city

Major Problems of Low-Carbon City Development Research in China

- Understanding of Low Carbon City
- Positioning of low carbon city development plan
- Methodology and tool for city level GHG inventory (w or w/o indirect GHG emission from electricity transmitted from outside)
- Methodology and tool for Scenario analysis: including determinants of municipal-level technological options and emission reduction potential, etc.

Integrative and Systematic Framework



GHG Accounting at Municipal Level

- Developed a simplified city level GHG accounting framework and methodology to calculate Qingdao's energy-related and process related CO2 emissions which is adapted to the existing data availability and statistical condition in Qingdao and according to general principle and standards put forwarded by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, GHG protocol (WRI), ICLEI methodologies, etc.

GHG Accounting Tool at Municipal Level in the Context of China

Step1
- Adjust statistical definition of sectors based on energy balance sheets

Step2
- Calculate the total and sector-wide energy related emissions and emissions from industrial process

Step3
- Calculate more detailed technology-wide (or service-wide) emissions based on bottom-up approach

Step4
- Calculate the emission corresponding to electricity transmitted from the outside

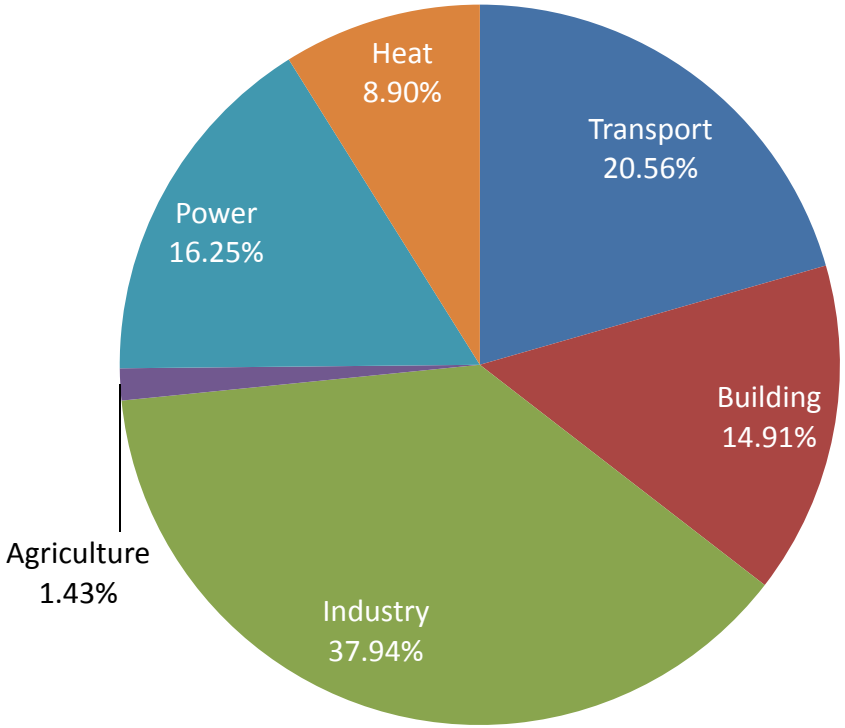
Step5
- Develop GHG inventory for a city covering Scope 1 and 2

Information Needs

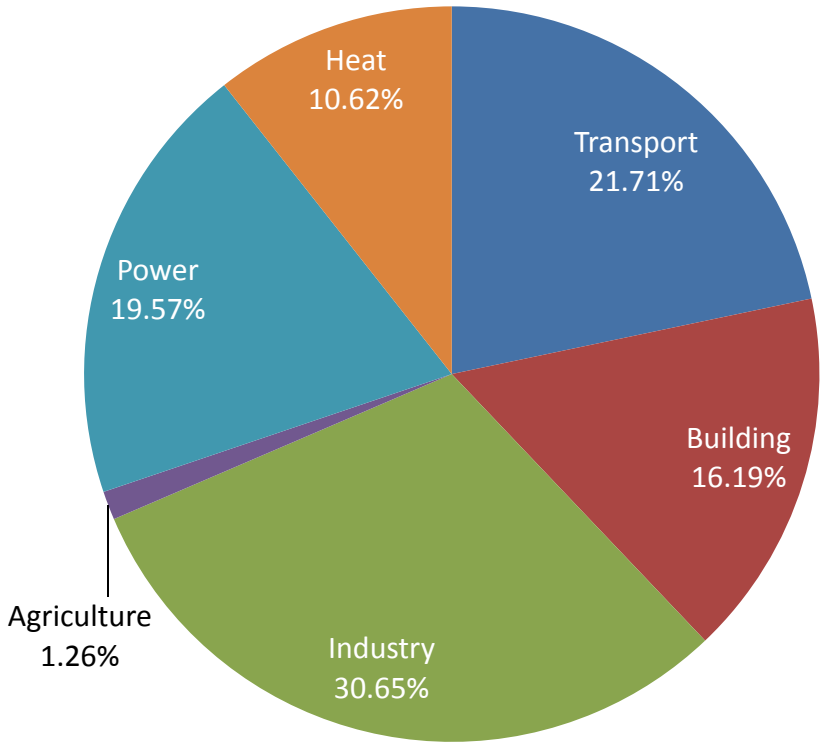
Government Authorities	Information Needs	Collection Methods
• Local DRC • Bureau of Statistics • Bureau of Environmental Protection • Commission of Industry and Information Technology • Bureau of Planning • Bureau of Transport • Bureau of Housing and Urban-rural development ……	• Socioeconomic development scenarios • Current status and future development plans • Energy statistics, including energy balance sheets, energy consumption of different industries • Energy service demand: demand for energy intensive products, buildings and transportation • Current status, gap, barriers, future trends and diffusion potential of technologies of different sectors • Basic technology information (performance, cost, application potential, etc.) • Relative policies and regulations	• Literature review • Statistical yearbooks, reports and relative case studies • Field investigation and interviews

Sector-Wise CO2 Emissions in Qingdao at 2005 and 2009

CO_2 Emission in 2005
5745.6 (10 thousand tons CO2）



CO_2 Emission in 2009
8106 (10 thousand tons CO2)



A significant increase in transportation and building sector

Decomposition of CO2 Emissions in Transport Sector in Qingdao

	2005		2008		2009	
	CO2 emission (10000 tons）	Percent	CO2 emission (10000 tons）	Percent	CO2 emission (10000 tons）	Percent
Non-operating Vehicle	401.81	34.0%	520.95	33.3%	683.05	38.8%
Resident	78.01	6.6%	80.78	5.2%	105.17	6.0%
Operating Vehicle	779.34	66.0%	1043.69	66.7%	1076.45	61.2%
Road Transportation	217.71	18.4%	263.53	16.8%	285.72	16.2%
Public Transportation	114.00	9.7%	161.47	10.3%	173.70	9.9%
Water Transportation	329.75	27.9%	464.97	29.7%	450.47	25.6%
Others (Including loading/unloading, storage, post, etc.)	117.88	10.0%	153.71	9.8%	166.54	9.5%

Decomposition of Emission in Building Sector in Qingdao

	2005		2008		2009	
	CO2 emission (10000 tons）	Percent	CO2 emission (10000 tons）	Percent	CO2 emission (10000 tons）	Percent
Residential Buildings	441.75	51.55%	390.57	35.06%	464.65	35.39%
Urban	337.85	39.43%	297.33	26.69%	346.82	26.42%
Rural	103.90	12.12%	93.24	8.37%	117.83	8.98%
Public Buildings	415.16	48.45%	723.31	64.94%	848.10	64.61%
Total	856.91		1113.88		1312.75	

Key Procedure for Scenario Analysis

Step1
- Determine current energy use and technology status of each sector in the base year

Step2
- Estimate future economic development and energy service scenarios of city

Step3
- Predict future technology status and stocks of each sector in the target year base on several constrain conditions such as device share ratio constrains, stock exchange constrains as well as energy endowment constrains, etc. Sectors considered here should cover both energy supply sector and endues sectors

Step4
- Calculate future energy use and GHG emissions in city based on the technology profile and characteristics under different policy scenarios

Step5
- Calculate emission reduction potentials for each area, sector or technology , identify key area, sector and technologies

Main Procedure for Target Setting and Allocation

Step1

- Based on the different scenario result, determine low carbon development target in target year;

Step2

- Based on the determined carbon intensity target and GDP assumption, calculate the absolute emission reduction target in target year;

Step3

- Calculate emssion reduction potential based on structure readjustment such as change of industrial structure and increase on value added, etc.: assuming the technology level among differnt sectors is contant;

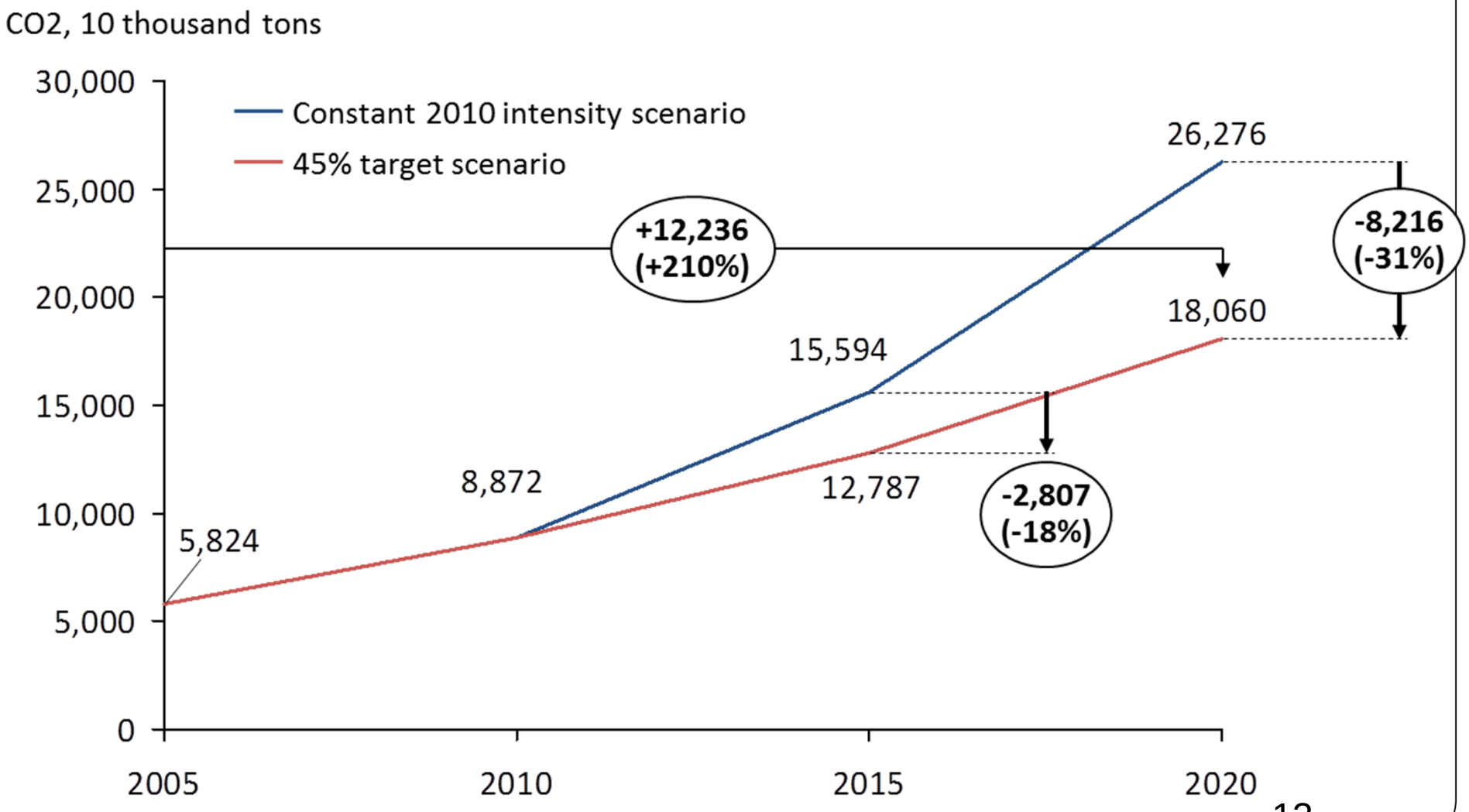
Step4

- Based on scenario analysis, calculate sector-wise technology emission reduction potential because of technology upgrading and the adoption of low carbon energies;

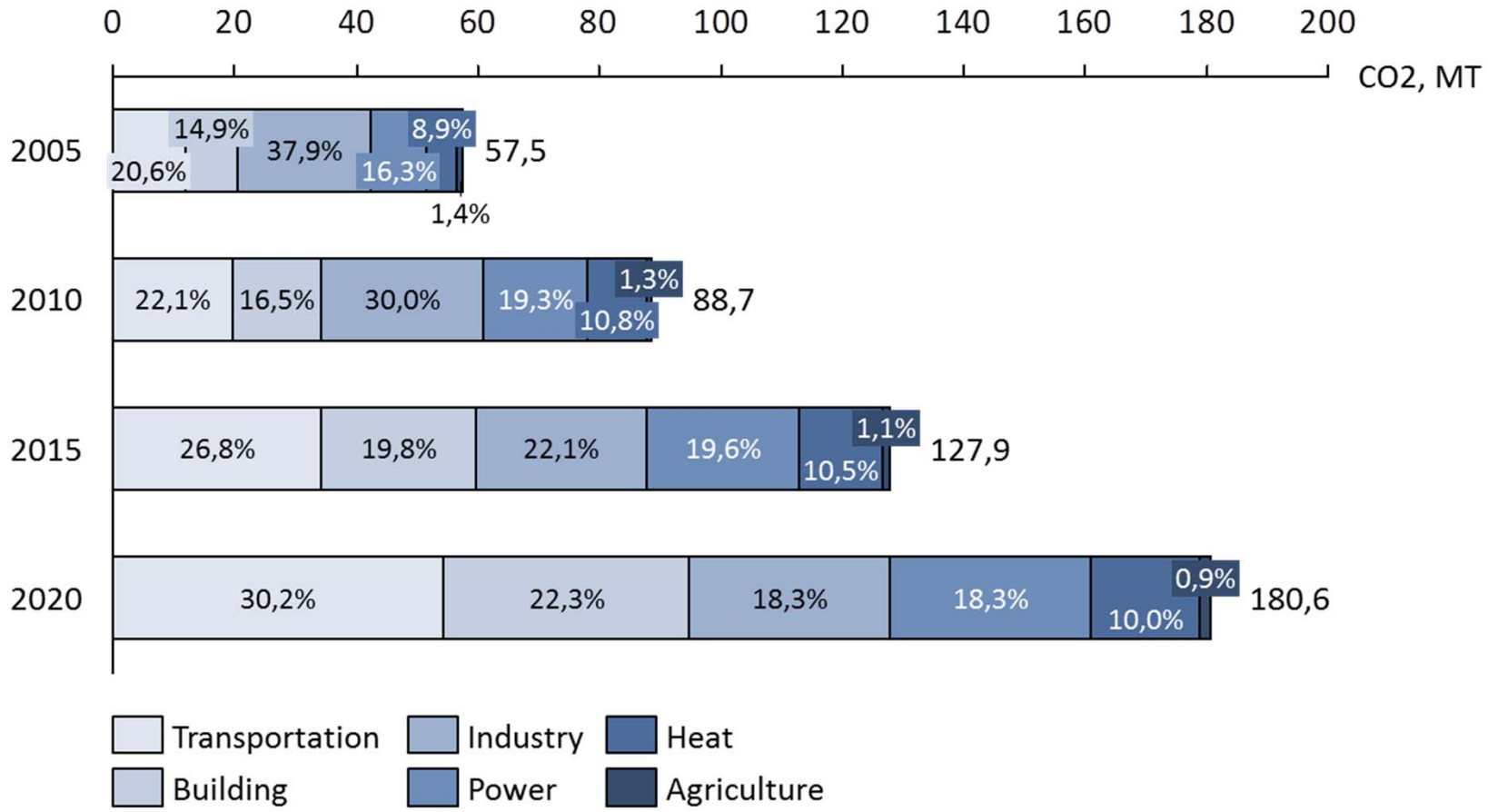
Step5

- Put forward sector wise emission reduction target and more detailed quantitative indicators, such as energy consumption per unit of product, penetration rate of technology, etc.

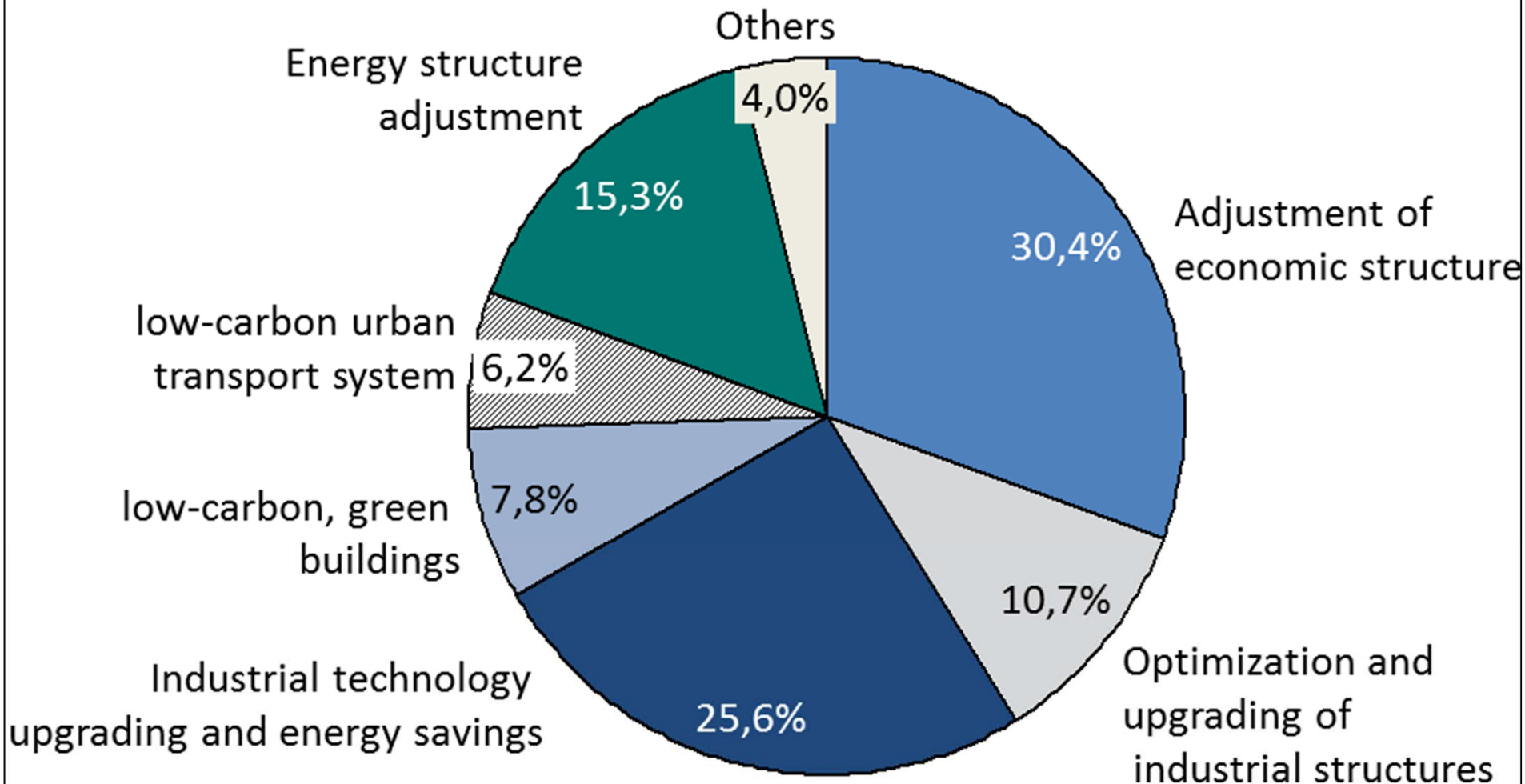
Trends of CO2 Emissions under Different Scenarios in Qingdao



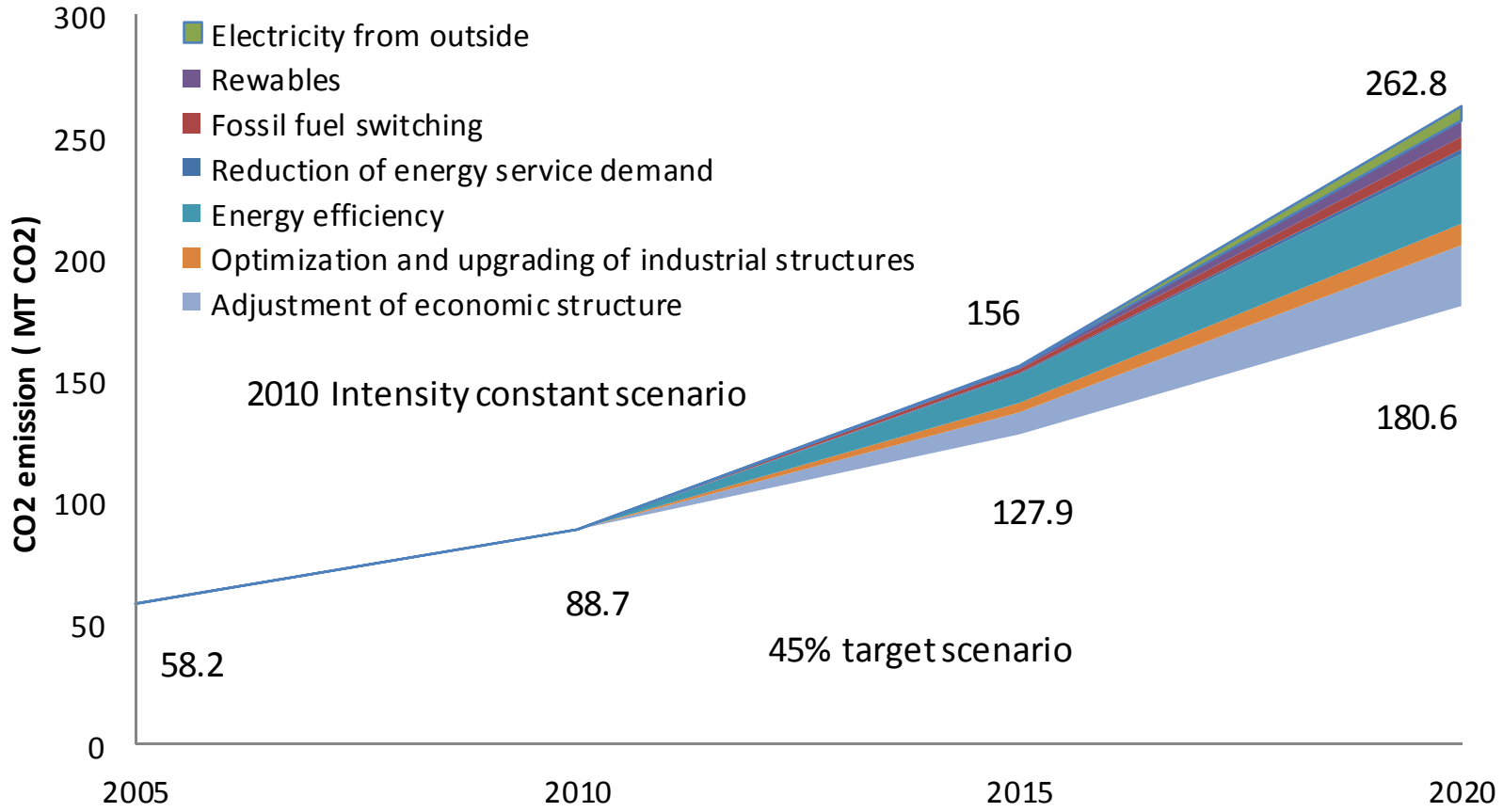
Sector-wise CO2 Emission under 45% Target Scenario from 2005 to 2020 in Qingdao



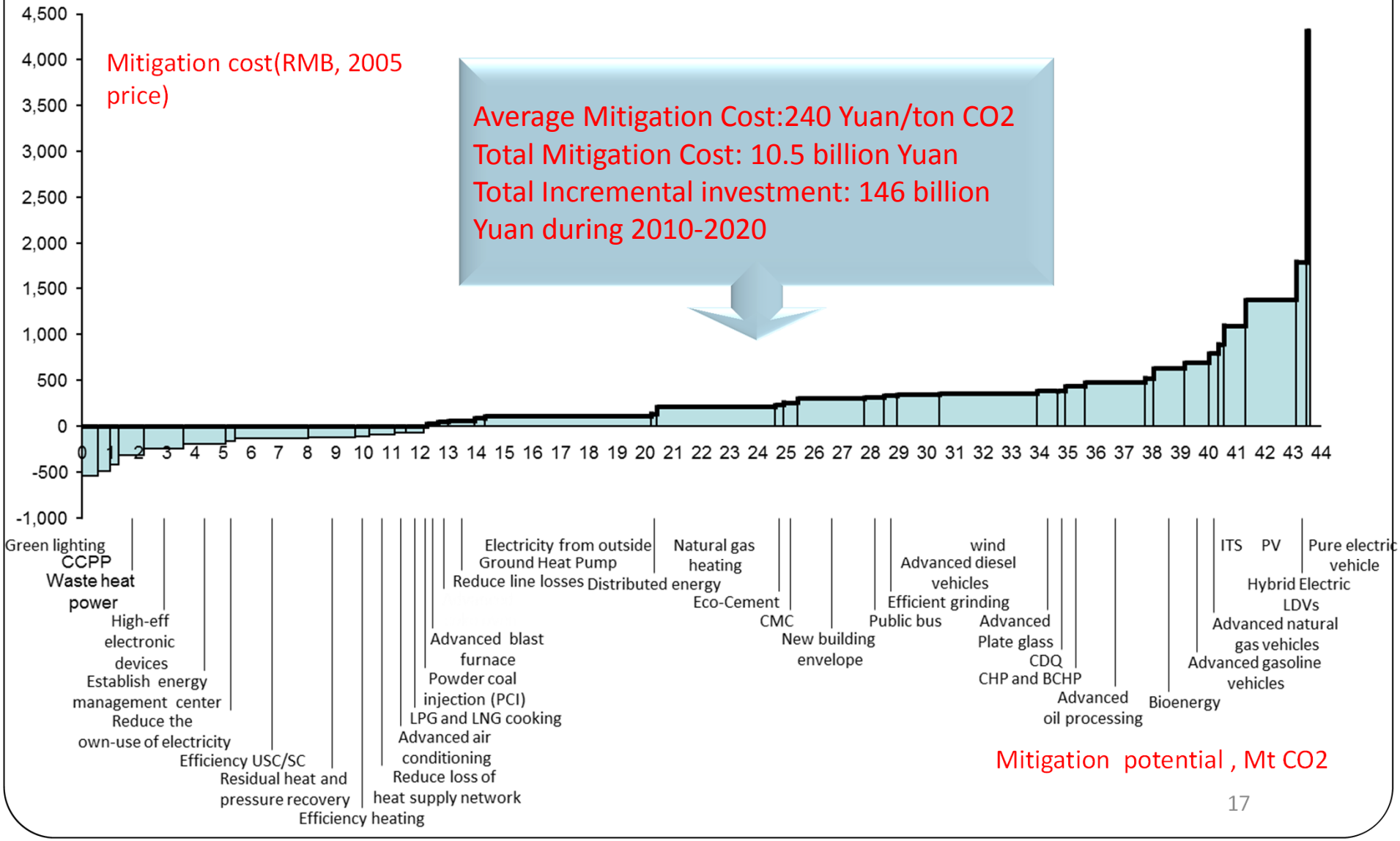
The Contribution of Key Areas to Meeting 45% Intensity Target by 2020 in Qingdao



Technological Roadmap: Contribution to Emission Reduction by Different Type of Technologies in Qingdao



MACs in 2020 (45% Target Scenario in Qingdao)



The Concept of Key Projects

Key Projects	Industry	Building	Transport	Renewable Energy
The Concept of Key Projects (example)	•Technical revamp project of Qingdao Iron and Steel Group Co. ltd •The 2nd supporting energy efficiency projects(such as 100 tons / year of methanol and petroleum coke gasification projects) Qingdao Refining & Chemical Company, SINOPEC •High-tech, high value-added industrial projects such as design and manufacturing high-tech low-carbon ship and over10-ton ship projects •Power Plant and Qin Coal-fired boilers (industrial furnaces), the electrical system renovation project •Huangdao Power Plant expansion project and supporting energy-saving projects •Cogeneration project in Jiaozhou, Jiaonan, Jimo, etc. •BIPV LNG project	•Urban green lighting demonstration project; •Governmental green lighting Demonstration Project; •BIPV solar power project; •Ground and sewage source heat pump project; •Seawater source heat pump project; •Geothermal heating supply project in the east of Jimo; •The rebuilding of gas pipe net; •The rebuilding of pipe net of cogeneration power plant and supporting; •Heat metering rebuilding of old residential heating systems •Standard research and design of energy-saving appliances.	•The 1st and 2nd subway project •Bus lanes construction project of Shandong Road, Anshan Road, Liao yang Road •Bus station constructio n project •Bus transfer hub project •The rebuilding of bus energy saving project •Intelligent transport system construction project •Electric city bus demonstration project •Taxi energy-saving demonstration project •Automobile Gas Statio n construction project	•Wind Power: Huaneng wind power project; wind power in Datang Huangdao, Jimo, Pingdu; •Solar Power: Huangming solar power research center; •Biomass Energy：waste power generation project; Straw power project of Huangdao power plant; household biogas construction project; •Ocean Energy： wave power project of Qingdao YEE TER energy Co.ltd and Hehe Energy Co.ltd

Possible Financing Sources and Models for Identified Qingdao's Key Low Carbon Projects

Sources of funding			Focus areas
Public	International	•International organization：ADB, WB, UNIDO; •Grant：ODA, GEF	Power, Transport, Infrastructure; R&D or pre-commercial technologies
	National	•Financial budget：subsidy/ incentives •Governmental financing platform：e.g. the city investment company, etc.	
Private	International	•FDI •Venture capital	Manufacture, End-users, Building; Pre-commercial or commercialized technologies
	National	•Direct investment •Venture capital	
PPP		•BOT, TOT, PPT, etc.	Infrastructure
Capital Market		•Commercial loans / policy loans •Fund (Investment funds、Expansion Funds) •Stock market (IPO， Equity Financing) •Bonds（corporate bond，municipal bond） •Carbon market	ALL

Lessons learnt

- Low carbon development strategy and planning need to exceed the traditional category of energy conservation and emissions reduction planning
- The most important thing is to integrate low carbon development planning into the overall urban development strategy in accordance with local conditions and to boost the leapfrogging socioeconomic development especially for western provinces/cities

Lessons Learnt (cont')

- It's essential to provide simplified and practical decision-making supporting tools matching the current accounting and management system and the availability of data information with the following features:
  - Integrative: considering population, economy scale and structure, energy and technology
  - Dealing with the problem of carbon accounting at city level
  - Action oriented: from theory to action
  - User-friendly

Thank you for your attention
Comments are welcomed

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