



China Coal Consumption Cap Project Main Report Framework

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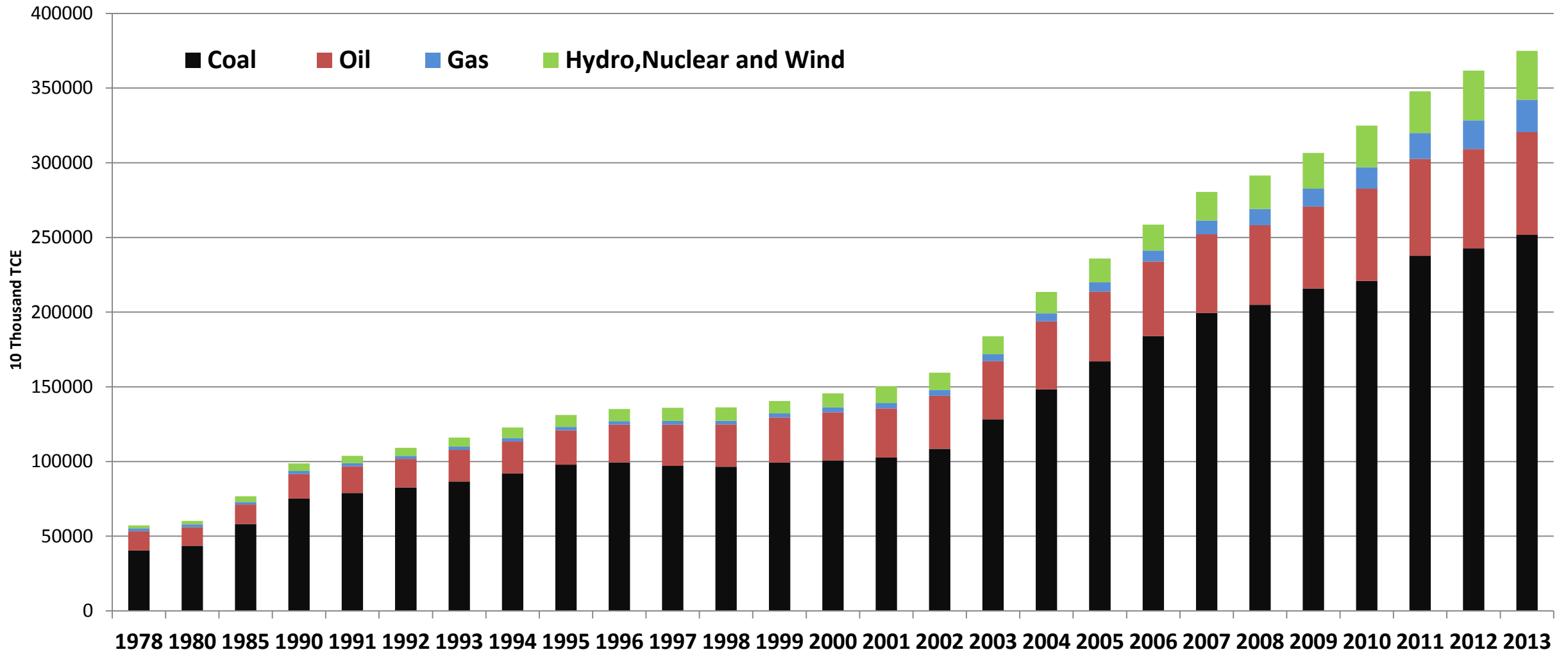
Natural Resources and Defense Council (NRDC)

November 17, 2014

Report Outline

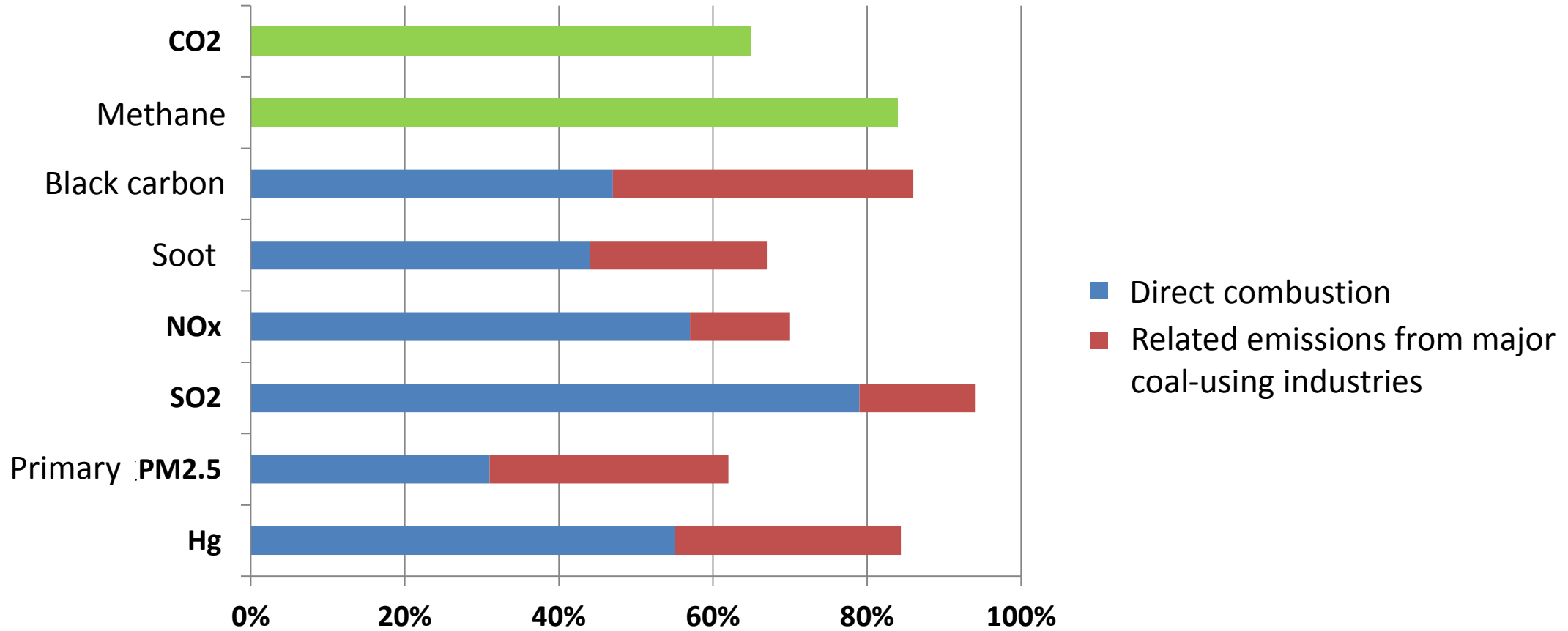
1. Current Situation Of Coal Development And Its Challenges
2. Coal Consumption And Major Red Line Constraints
3. Total Coal Cap Scenario Analysis
4. Establishment Of Total Coal Cap Target And Its Co-benefits
5. Total Coal Cap Targets By Sector
6. Total Coal Cap Targets By Region
7. Analysis Of Major Influencing Factors Of Coal Cap Targets
8. Implementation Roadmap For Total Coal Cap Targets
9. Measures To Ensure Implementation Of Total Coal Cap Targets

Primary Energy Consumption and Composition (1978-2012)



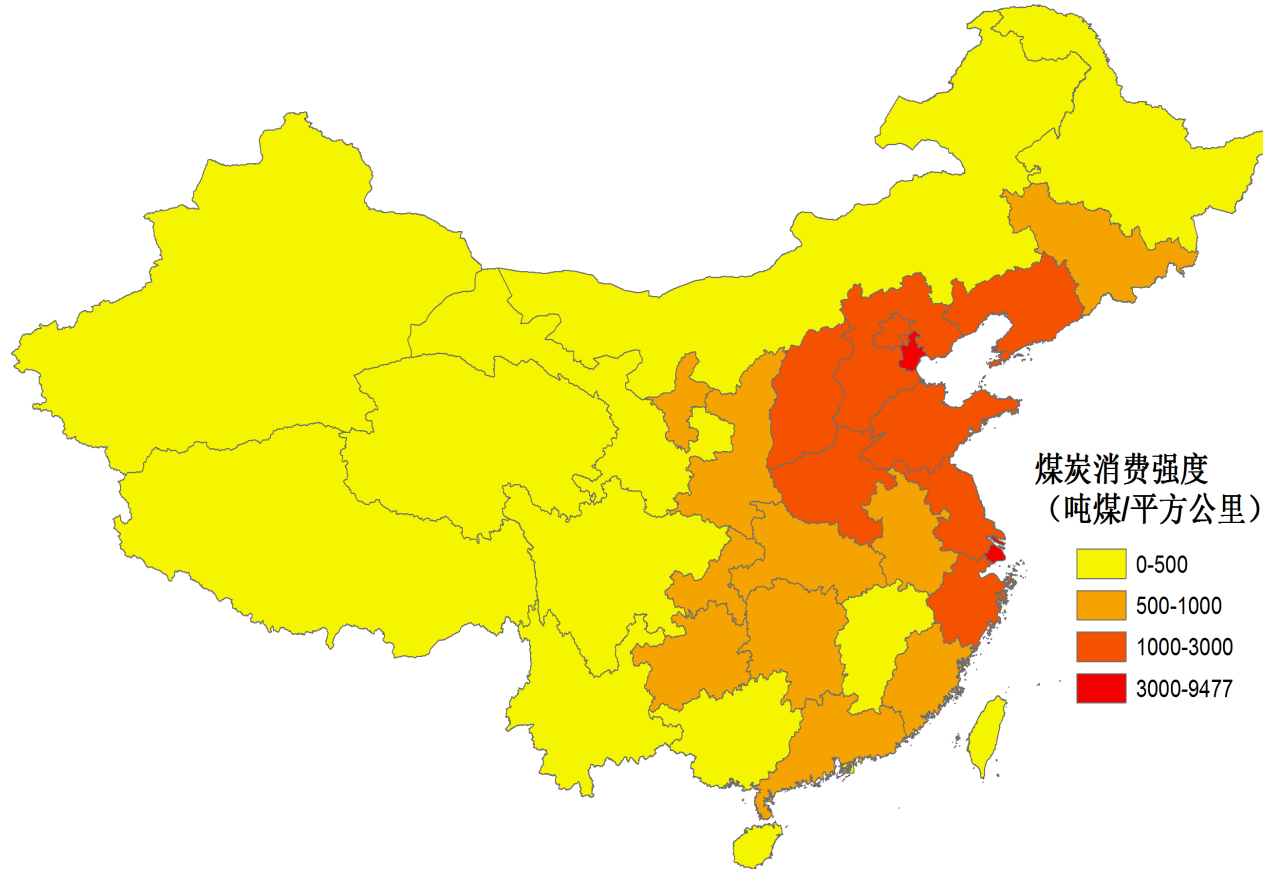
Source: National Statistics Bureau 2013

Coal's contribution to air pollutant emissions

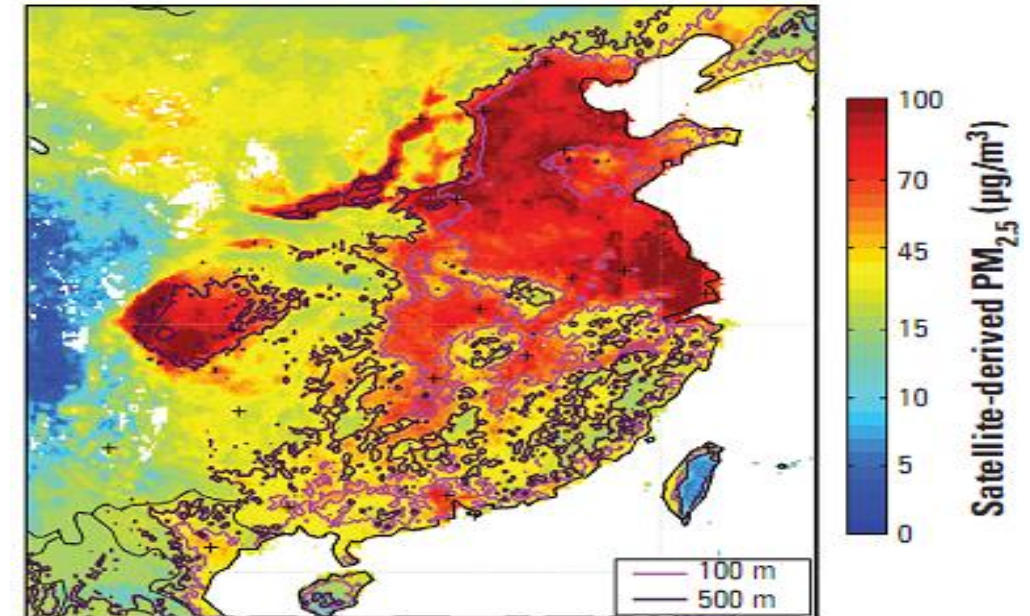


Coal Consumption and Air Pollution Show Spatial Consistency

Distribution of National Coal Consumption

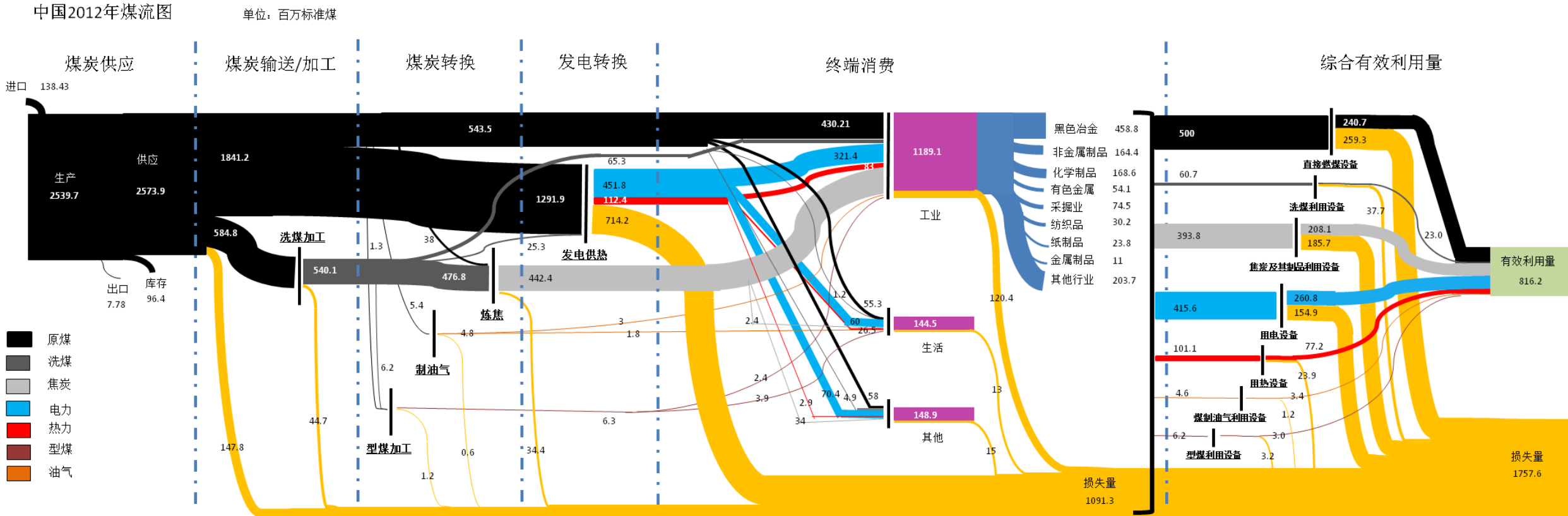


Satellite imagery of national distribution of PM_{2.5} concentrations



- Within the eastern coal-consuming regions, the high intensity coal-consuming areas overlap with areas with extreme smog

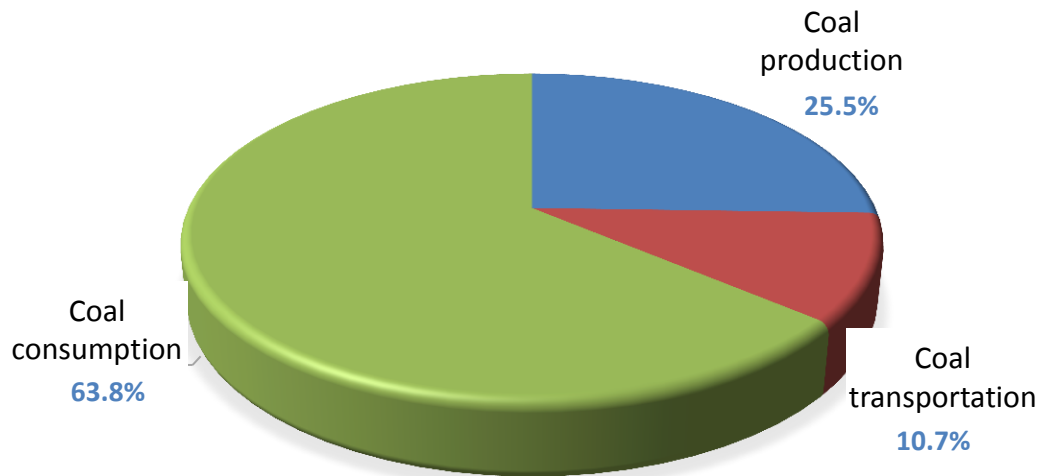
China 2012 Coal Flowchart (Sankey) , Total Energy Efficiency 31.7%



资料来源: 胡秀莲, “中国2012年煤流图,” 2014年.

Calculating the True Cost of Coal Production, Transportation, and Consumption

True Cost Of Coal (Yuan / Ton)



Sector	Category	Sub-category	Yuan / Ton
Coal production	Mining coal resources	Resources loss	11.00
		Water resource depletion	27.65
	Water resources	Water pollution	5.81
		Ecosystems	Agriculture ecosystem
	Human health	Soil erosion and ecological degradation	19.30
		Miner deaths	0.23
		Direct loss from occupational disease	0.14
		Indirect loss from occupational disease	0.21
	<i>Sub-Total</i>		66.34
Coal transportation	Highway transport	Accidents, noise, environment, etc.	23.6
		Rail transport	Accidents, noise, environment, etc.
	Waterway transport	Accidents, noise, environment, etc.	1.48
	<i>Sub-Total</i>		27.8
Coal consumption	Human health	Ischemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer excess deaths	166.2
Total Cost			260.3

Impact of Coal Production, Transportation, and Use on Greenhouse Gas Emissions



Based on the results of current mainstream global **comprehensive evaluation model**, cost estimates range between \$12 (5% discount rate) to \$64 (2.5% discount rate), but with large uncertainty.

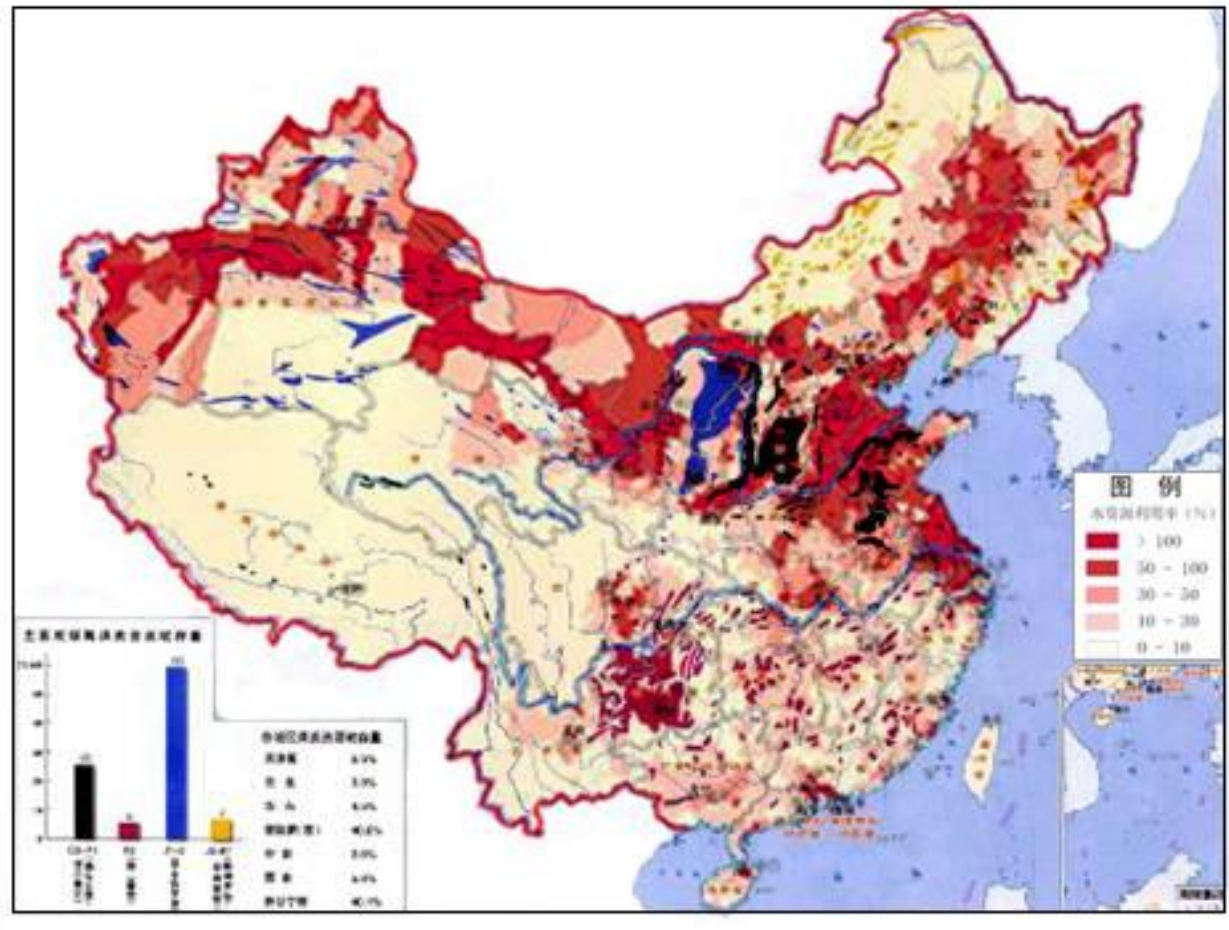
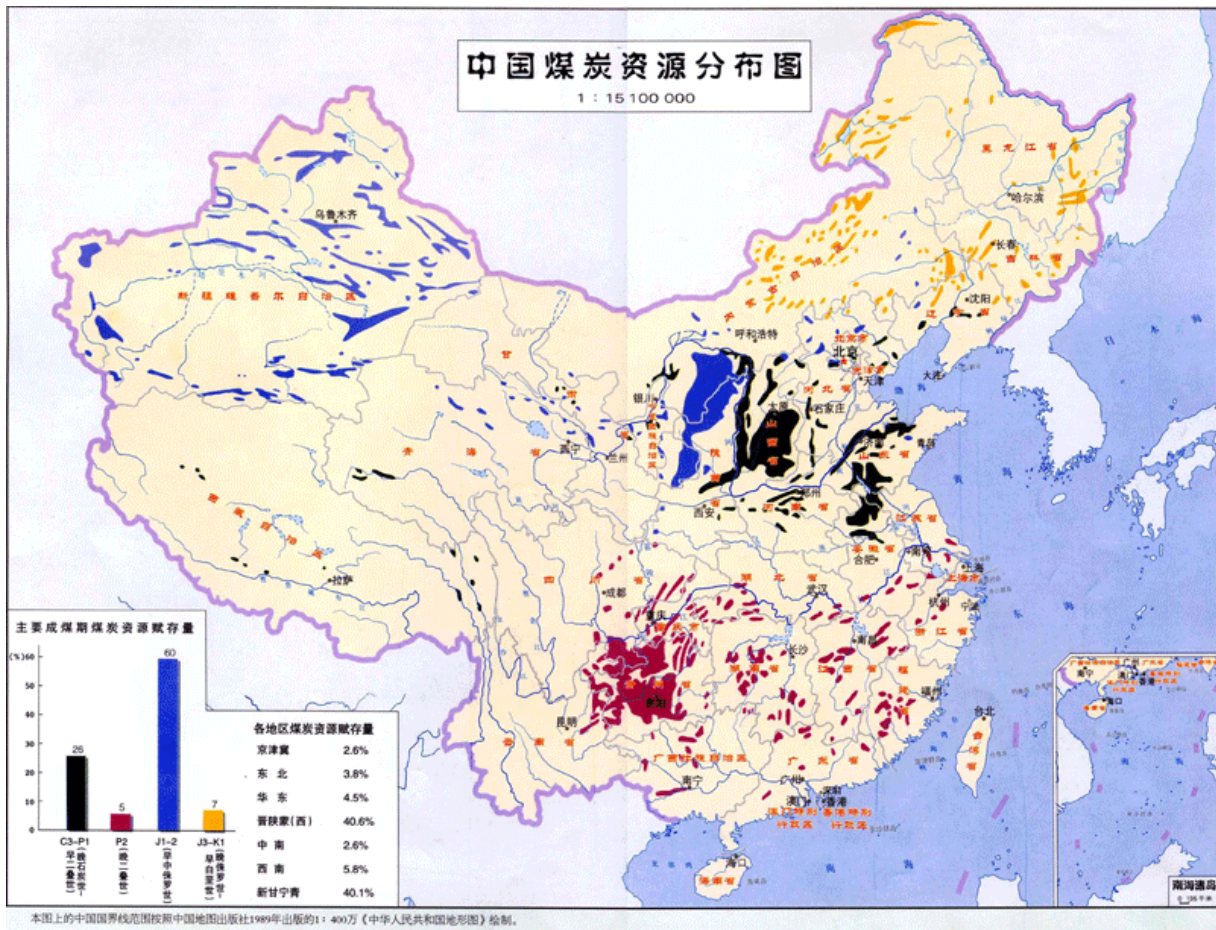
	Greenhouse Gas Emission Control (kg / ton of coal)	Greenhouse Gas Emissions Control (kg CO ₂ e/ ton of coal)	Social Cost (Yuan/ ton of coal)
Coal Production	CH ₄ 4.64	92.4	6.8
Coal Transportation	CO ₂ 16.7	16.7	1.2
Coal Consumption	CO ₂ 1890 Black carbon 0.95	2070	152.8
Total		2179	160.8

*Cited Work: Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis, 2013

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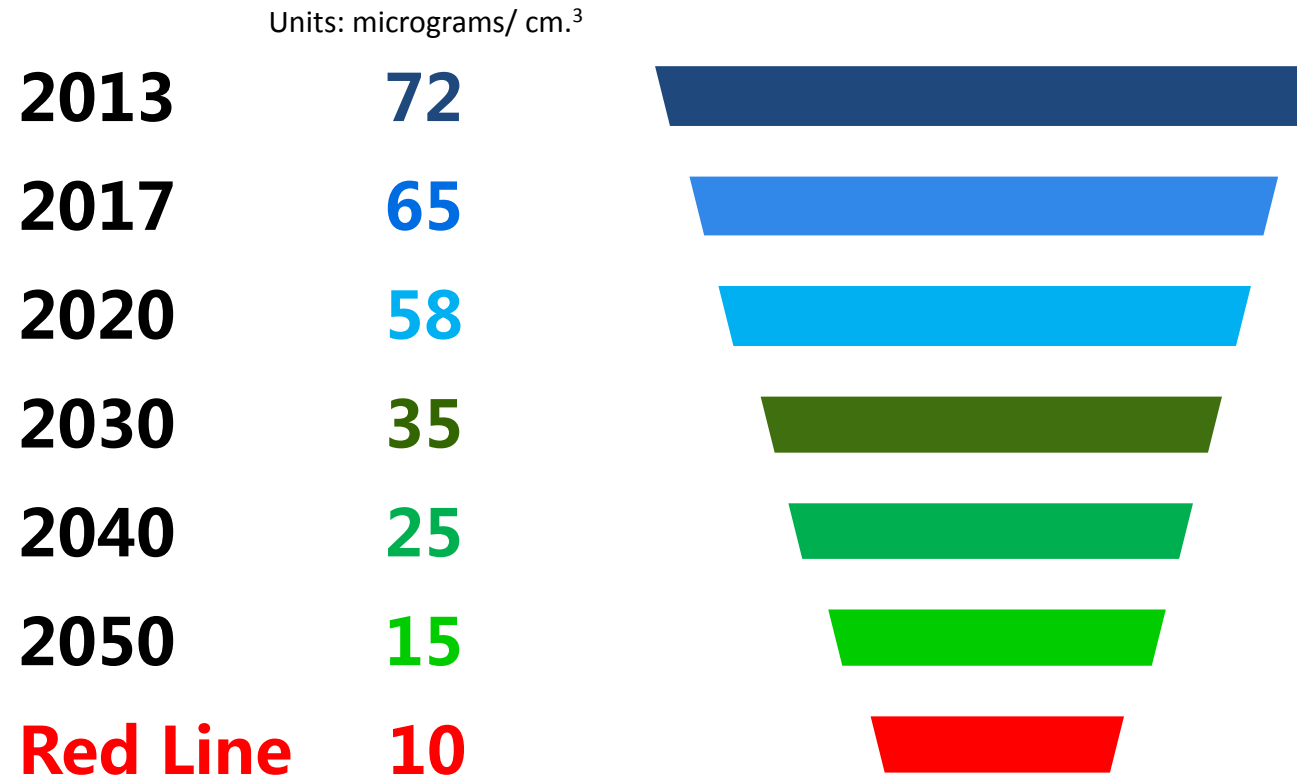
Coal Resources Distribution and Water Constraints



Ecological Resources Red Line Constraints: Coal Consumption and PM2.5 Pollutants (2)



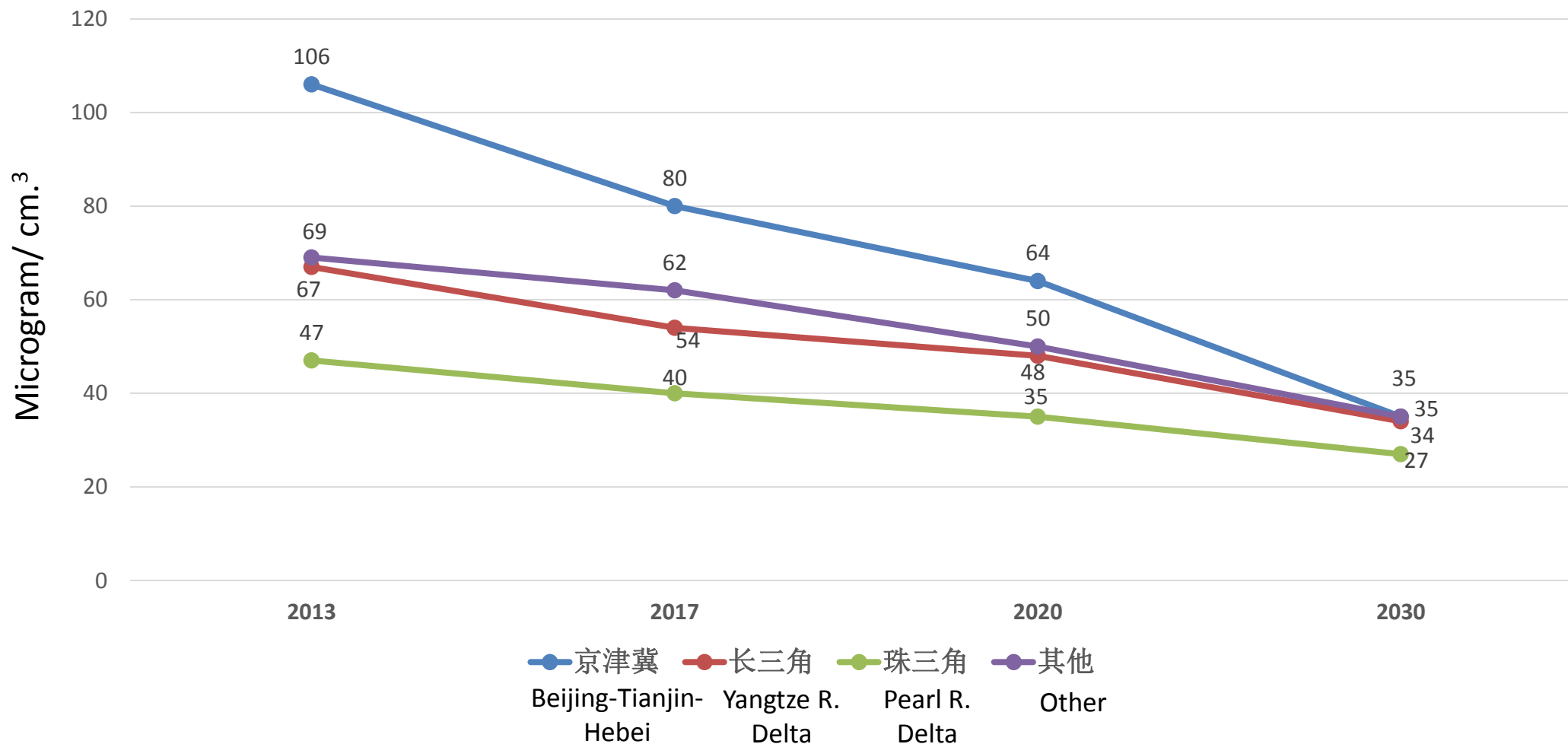
National PM2.5 Pollutant Reduction Targets



Ecological Resources Red Line Constraints: Proposal for Phased PM2.5 Compliance and Air Quality Improvements



Progressive PM2.5 Compliance by Region up to 2030

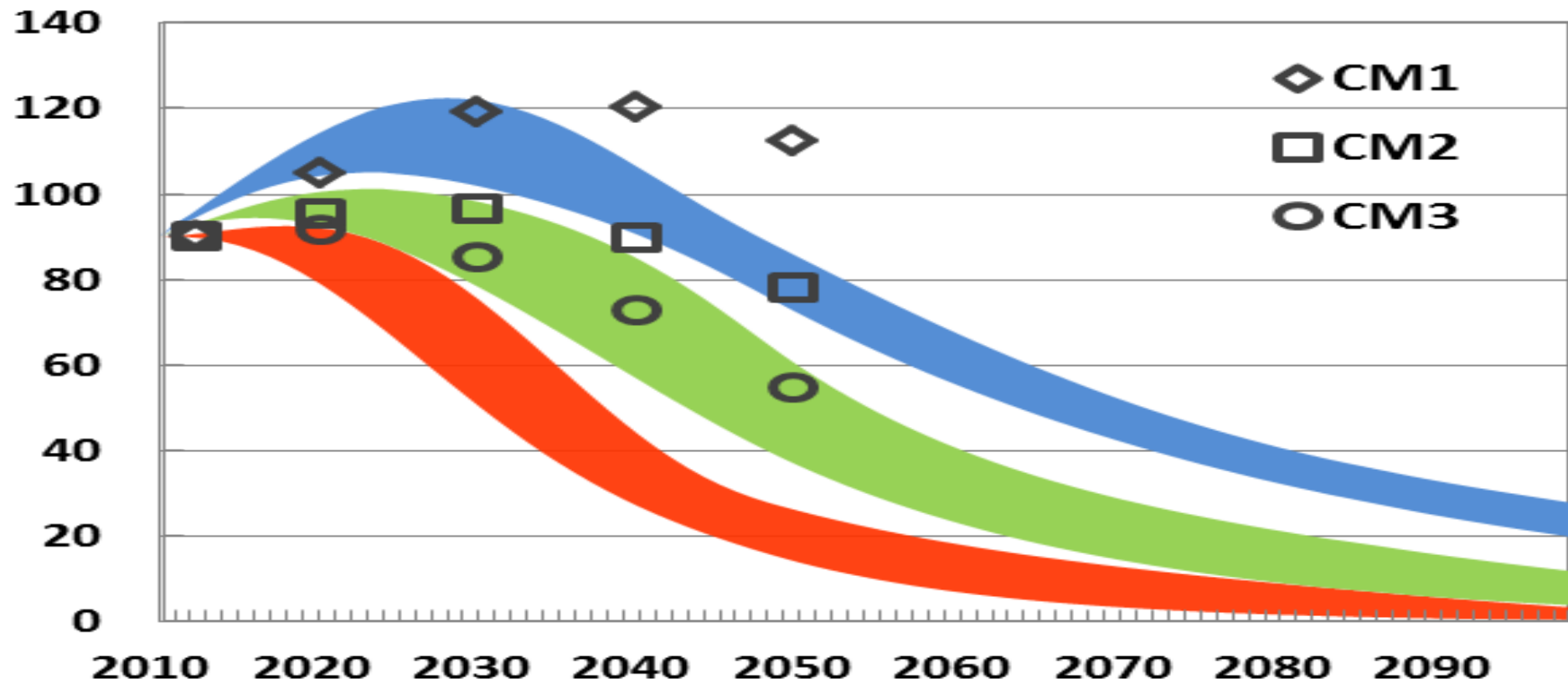


Ecological Resources Red Line Constraints : Climate Change (2)



Units: 100 million tons

China's Carbon Emission Pathway Options and Total Coal Consumption Cap Scenarios



Source: National Climate Change Strategy Center, "China's CO2 Emissions and Total Coal Cap", 2014

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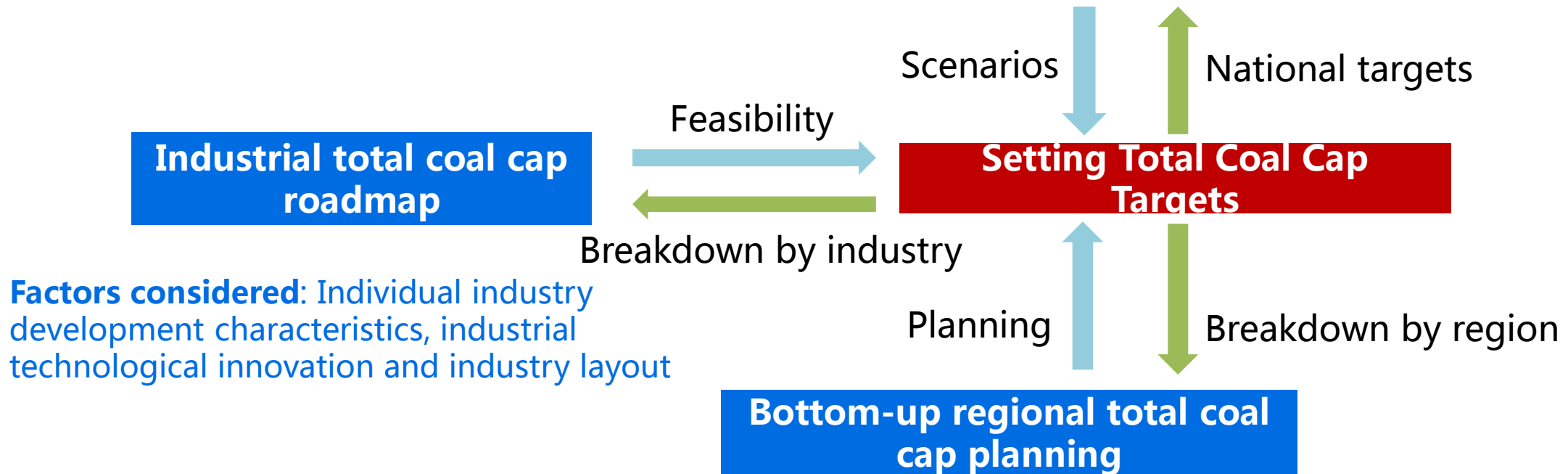
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“China Total Coal Consumption Cap Roadmap and Policy Research” Main Report Framework”



Top-down national total coal cap scenario

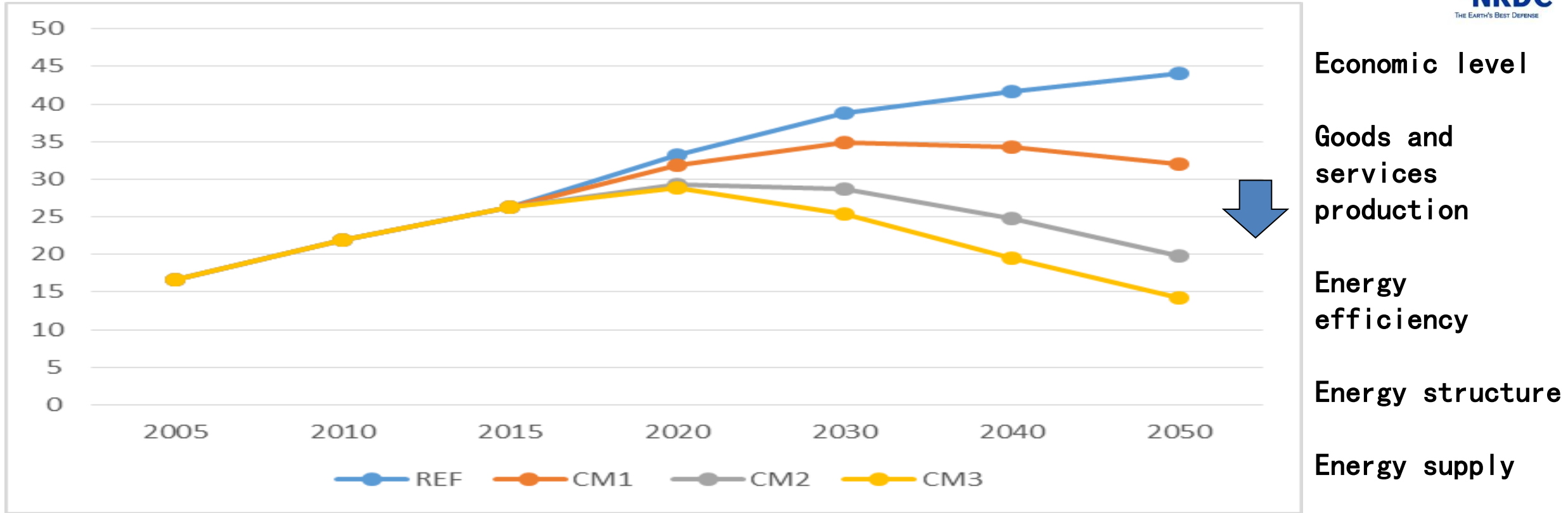
Factors considered : Macroeconomic and social development, policy, price, domestic and international markets and technological innovation, etc.



Factors considered: Individual industry development characteristics, industrial technological innovation and industry layout

Factors considered: Regional environmental red line constraints (air, water, health, CO₂), regional differences and characteristics in economic and social development, areas protected from development

National Scenario (Coal Consumption)



Economic level

Goods and services production

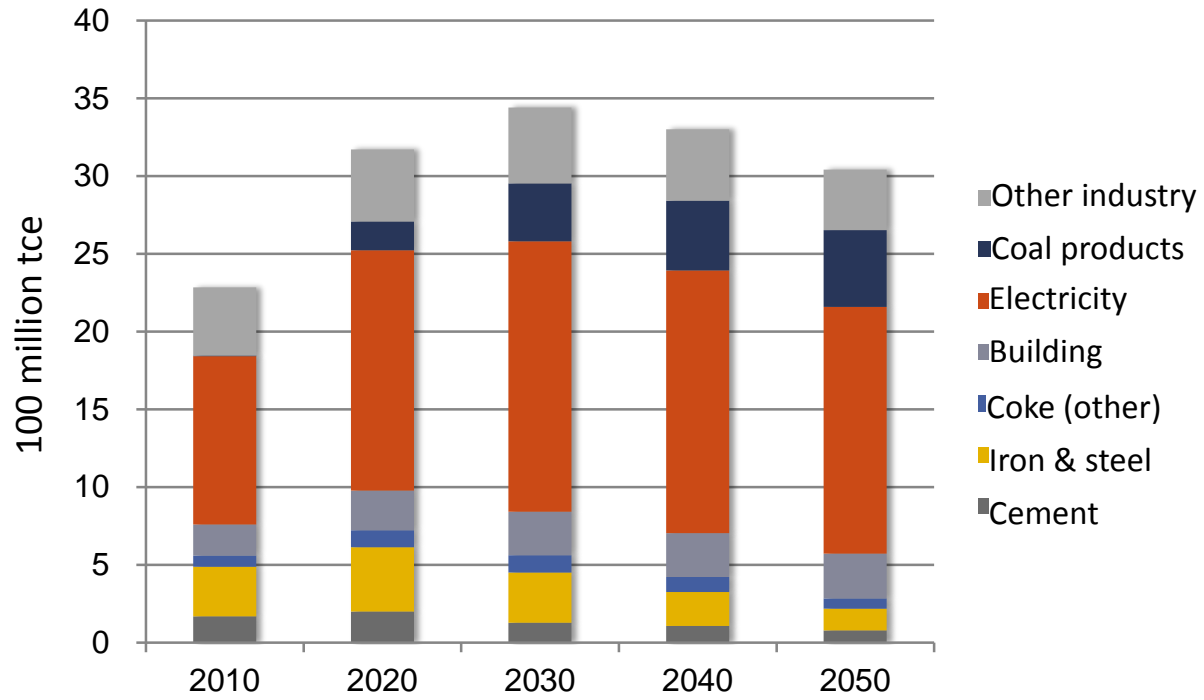
Energy efficiency

Energy structure

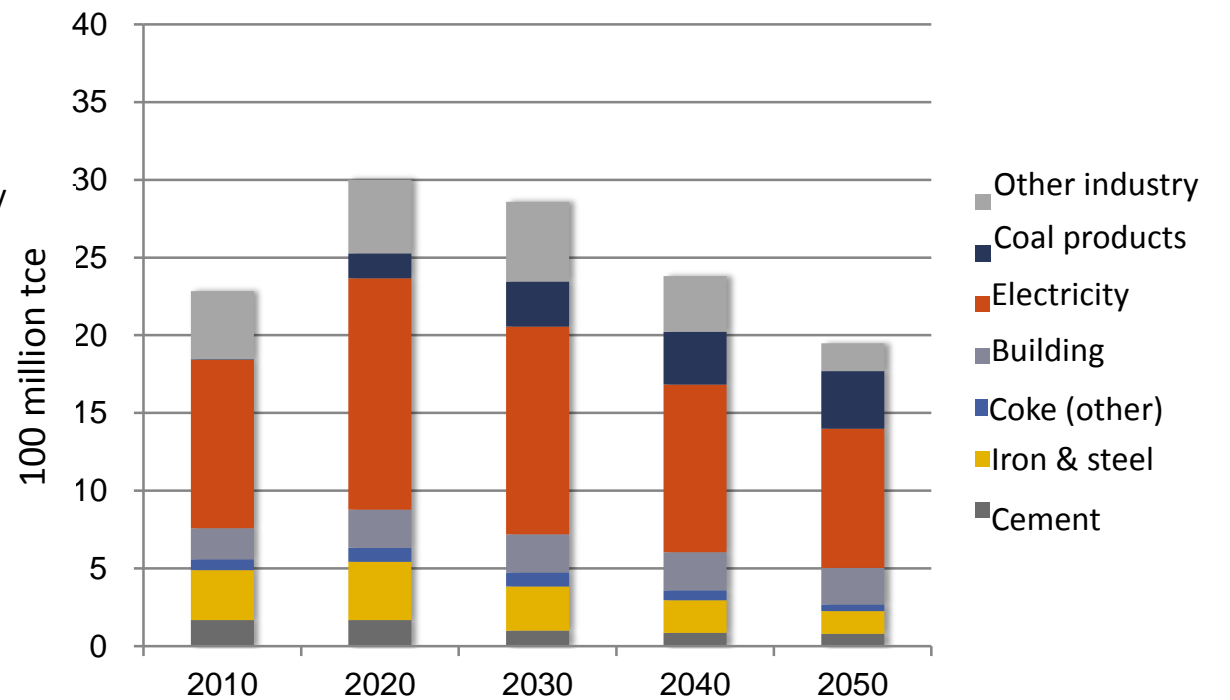
Energy supply

- **Energy-saving CM1:** 2020: 3.2 billion tce, 2030: peak at 3.5 billion tce, 2050: still at 3 billion tce and above, controlling coal consumption is necessary and urgent
- **Coal-control CM2:** 2020: peak at 3 billion tce, 2040: reduce to 2.5 billion tce or less
- **2 degrees CM3:** 2020: peak at 2.89 billion tce, 2030: reduce to 2.5 billion tce or less, 2040: reduce to 2 billion tce or less, 2050: reduce to 1.5 billion tce or less

Sectoral Scenarios (Bottom-up: Coal Consumption)

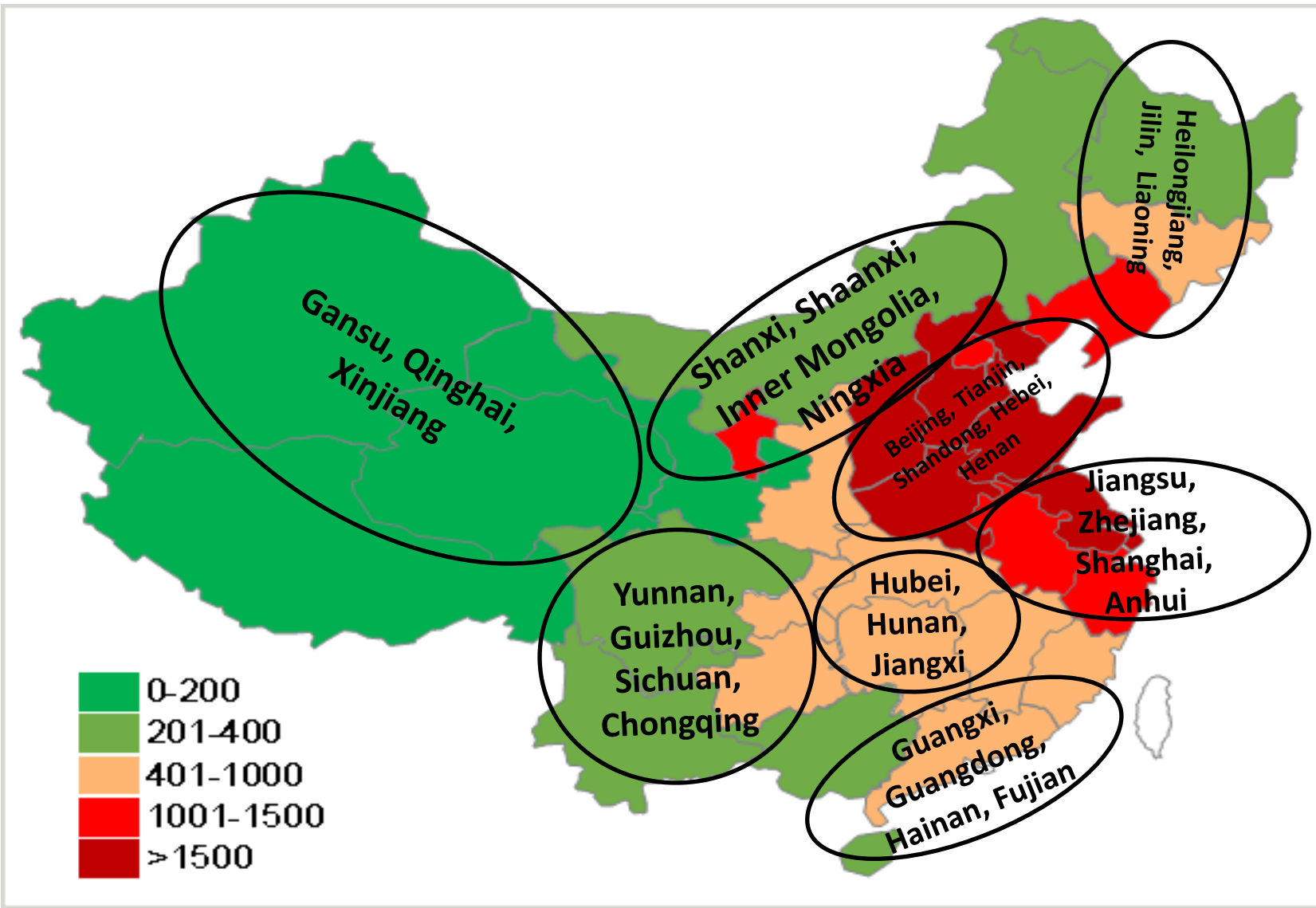


Baseline scenario



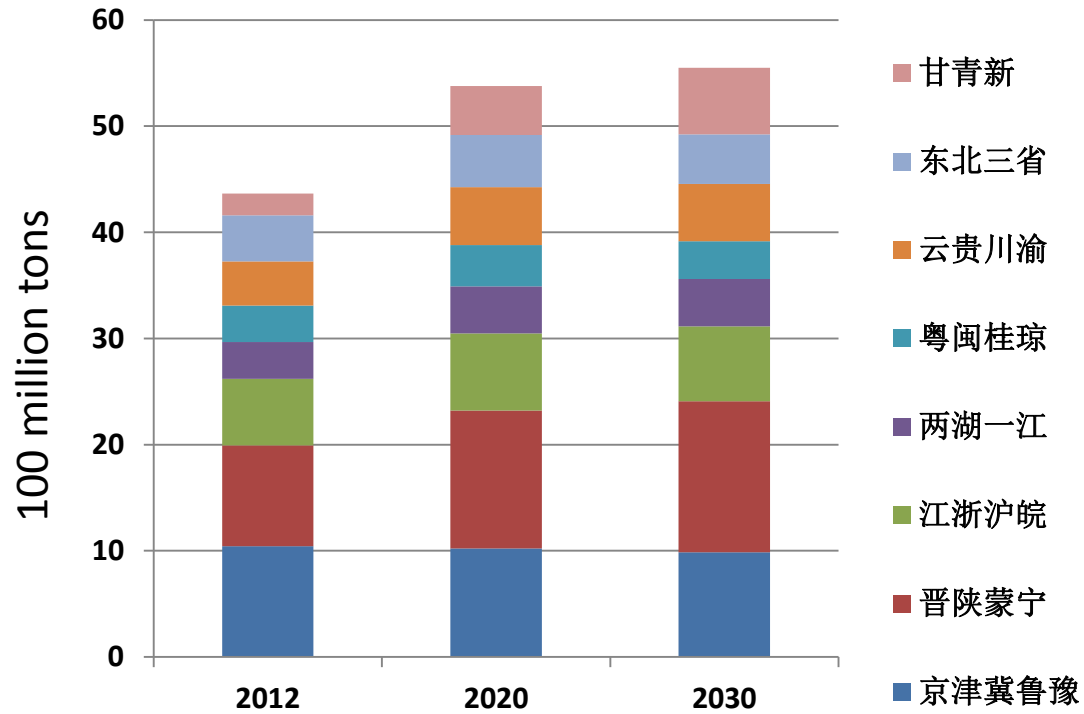
Coal cap scenario

Regional Scenario (Regional Division)

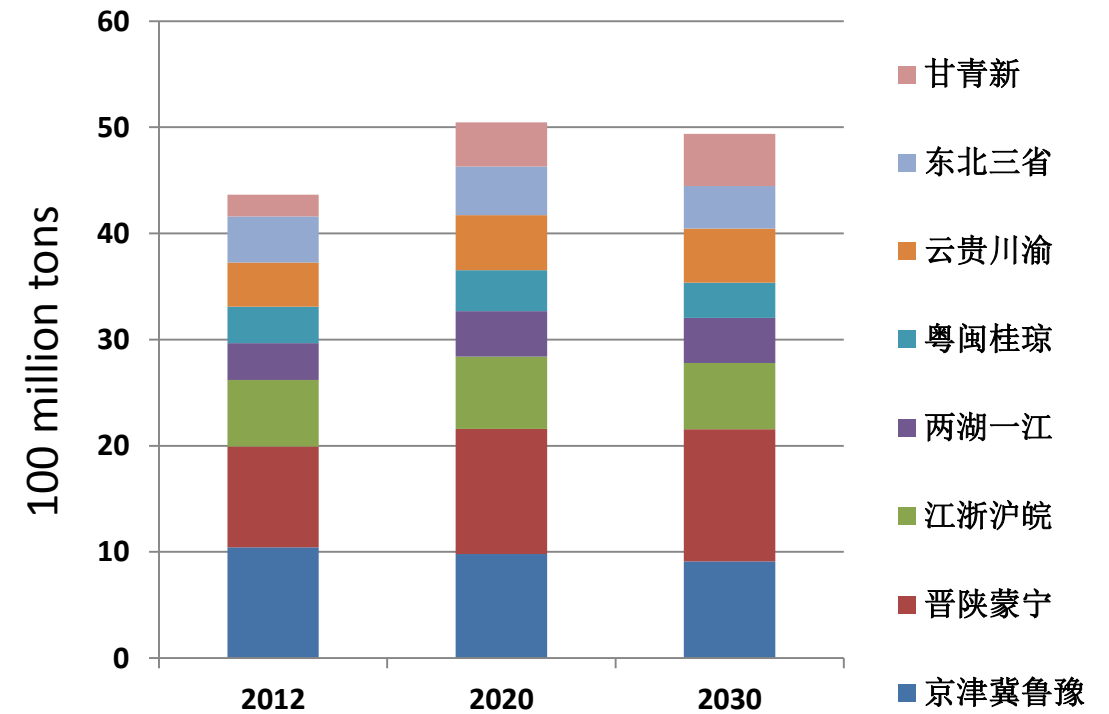


➤ Considering regional natural resources characteristics, including air pollution and water resource requirements, when researching the 30 provincial coal cap targets (excluding Tibet), the country was divided into 8 regions: (1) Beijing, Tianjin, Shandong, Hebei, Henan, (2) Jiangsu, Zhejiang, Shanghai, Anhui, (3) Heilongjiang, Jilin, Liaoning, (4) Hubei, Hunan, Jiangxi, (5) Guangxi, Guangdong, Hainan, Fujian, (6) Yunnan, Guizhou, Sichuan, Chongqing, (7) Shanxi, Shaanxi, Inner Mongolia, Ningxia, (8) Gansu, Qinghai, Xinjiang

Regional Scenario (Regional)



Baseline Scenario



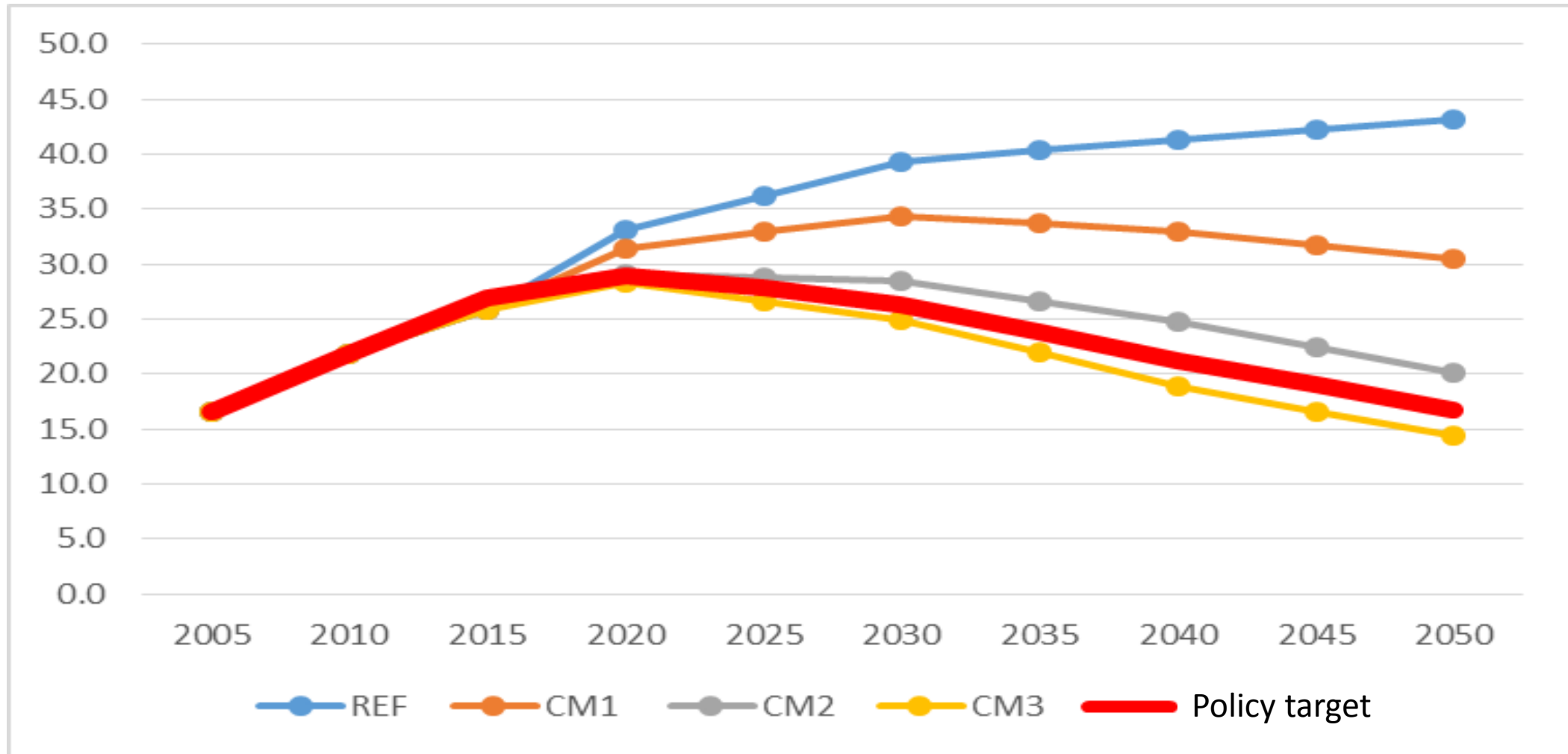
Regional Coal Control Scenario

Legend: 1. Gansu, Qinghai, Xinjiang, 2. Heilongjiang, Jilin, Liaoning, 3. Yunnan, Guizhou, Sichuan, Chongqing, 4. Guangxi, Guangdong, Hainan, Fujian, 5. Hubei, Hunan, Jiangxi, 6. Jiangsu, Zhejiang, Shanghai, Anhui, 7. Shanxi, Shaanxi, Inner Mongolia, Ningxia, 8. Beijing, Tianjin, Shandong, Hebei, Henan

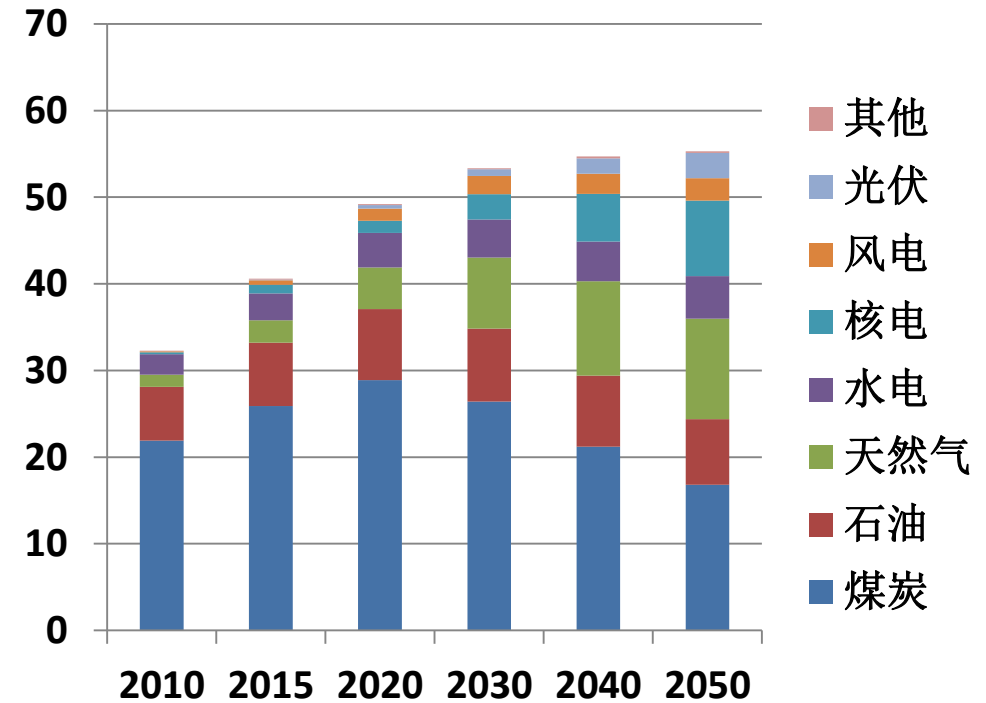
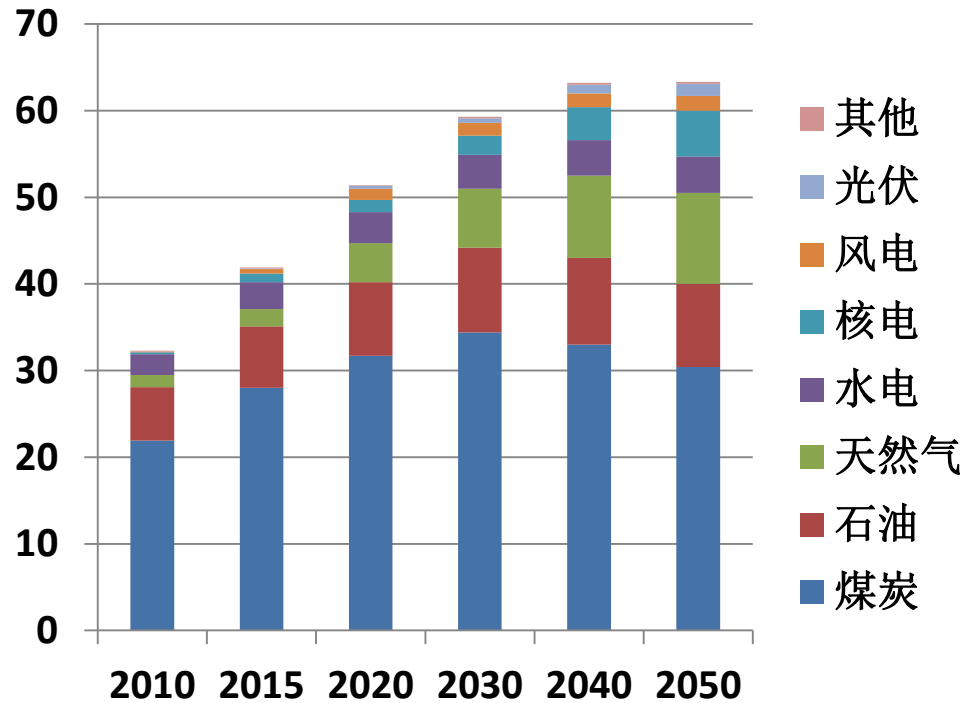
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National Coal Cap Targets (Top-down)



Total Primary Energy Use

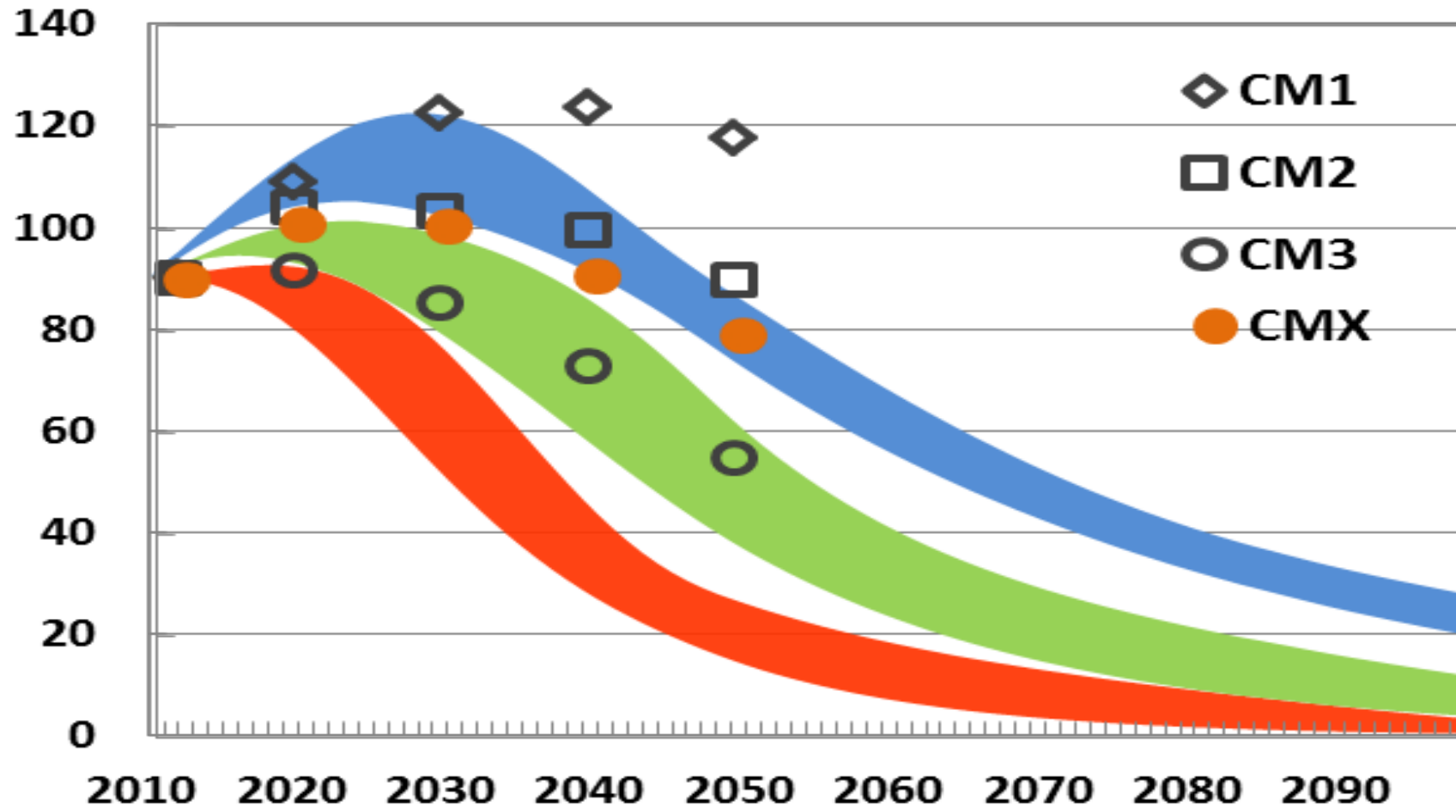


Baseline Scenario

Coal Cap Targets

Legend: 1. Other, 2. Solar PV, 3. Wind, 4. Nuclear, 5. Hydro, 6. Natural Gas, 7. Oil, 8. Coal

CO2 Emissions Pathways and Coal Cap Target Restrictions

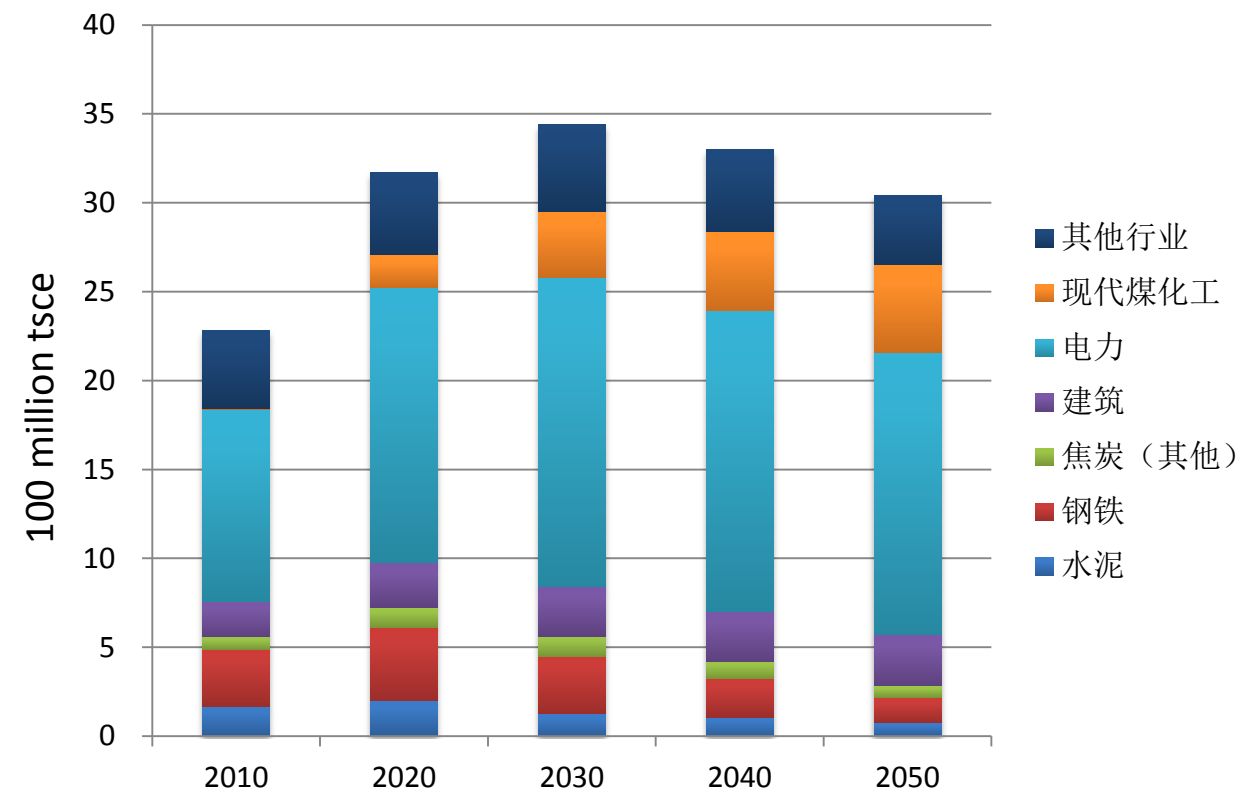


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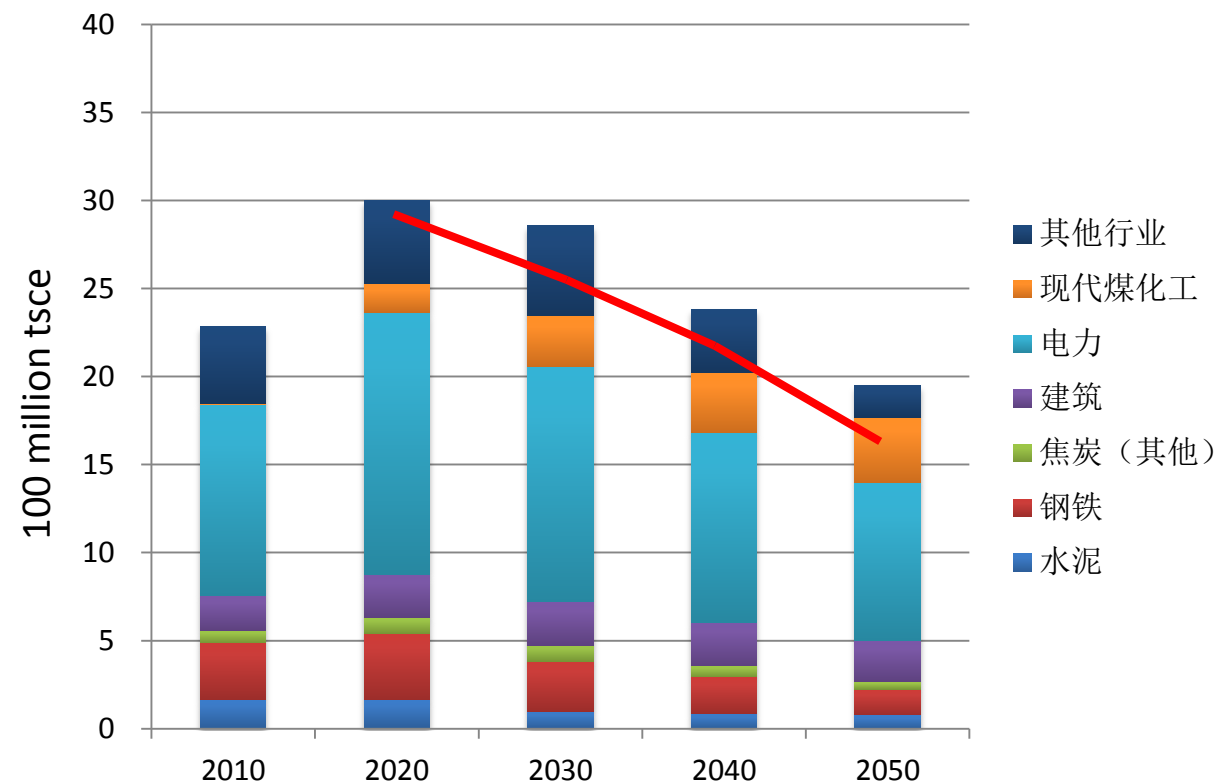


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Coal Cap Targets by Sector



Baseline Scenario



Coal Cap Targets

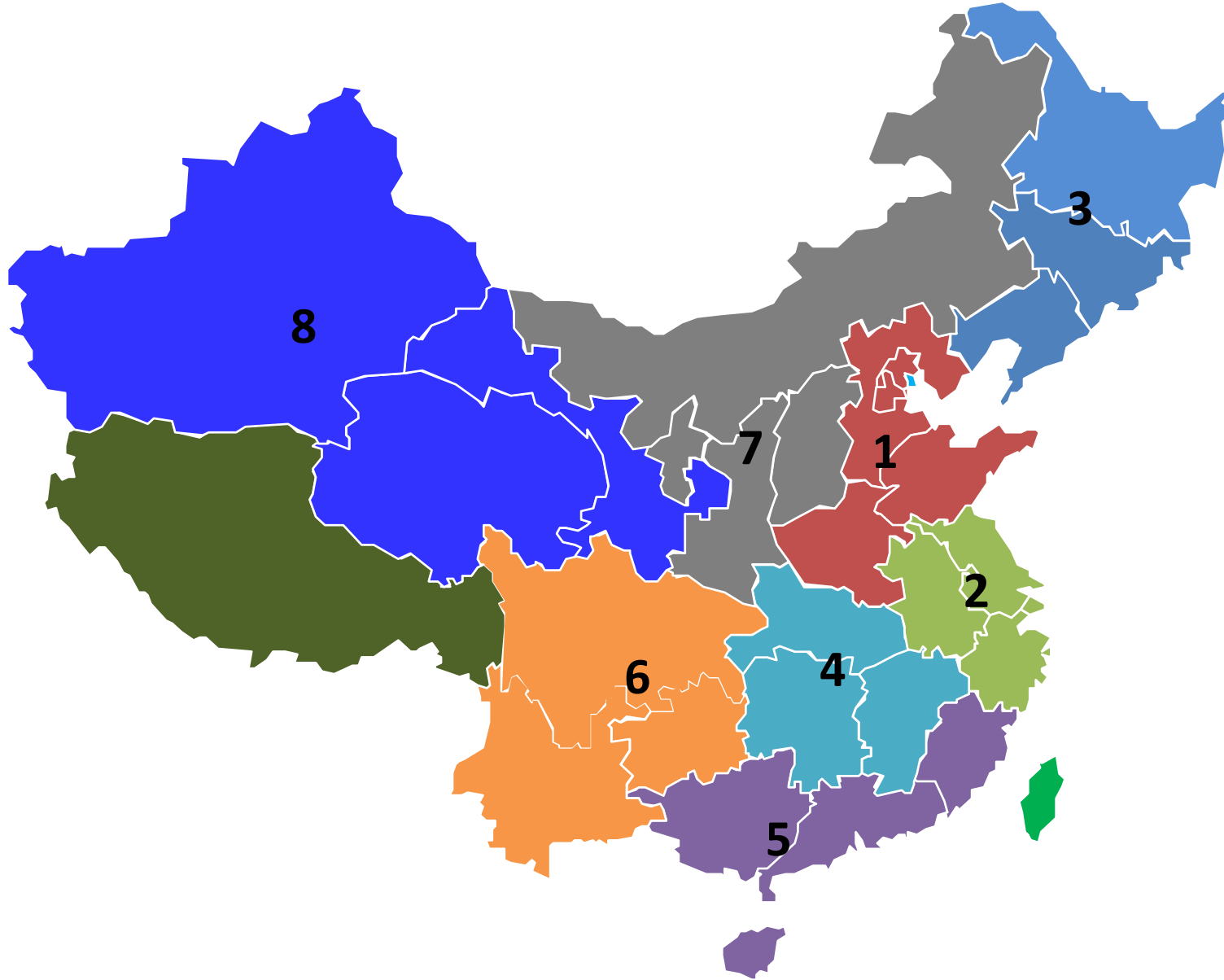
Legend: 1. Other sectors, 2. Coal Chemicals, 3. Power, 4. Buildings, 5. Coke (other), 6. Iron and Steel, 7. Cement

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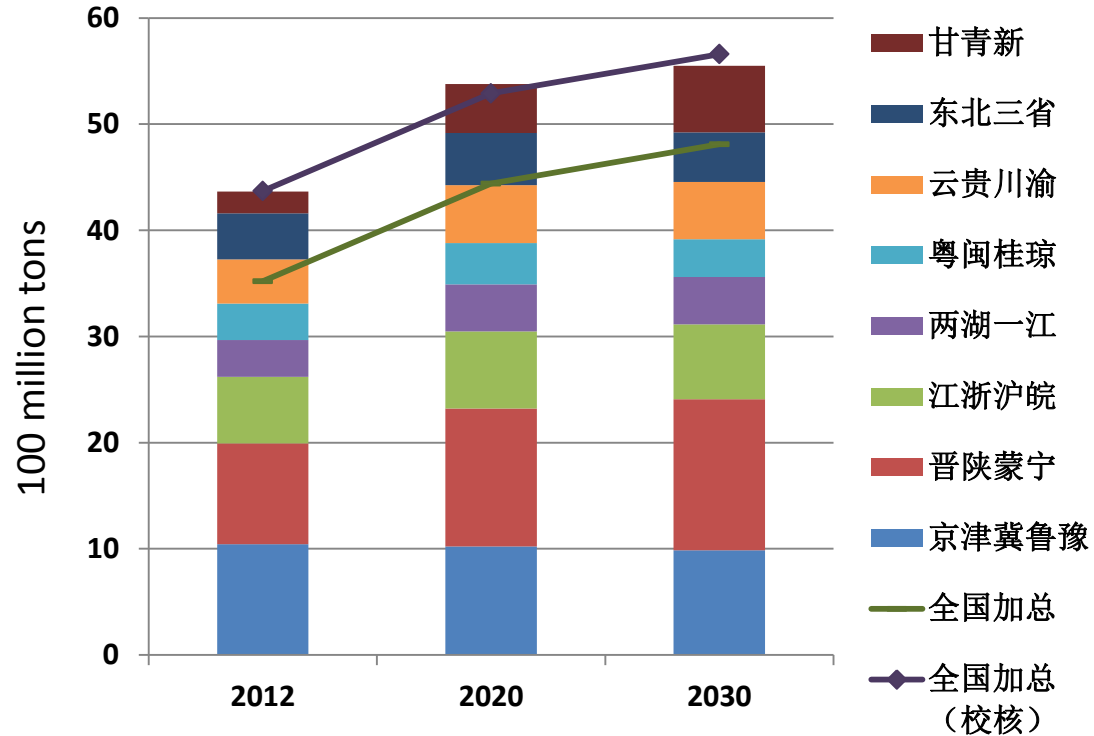
Local Coal Cap Targets (Regional)



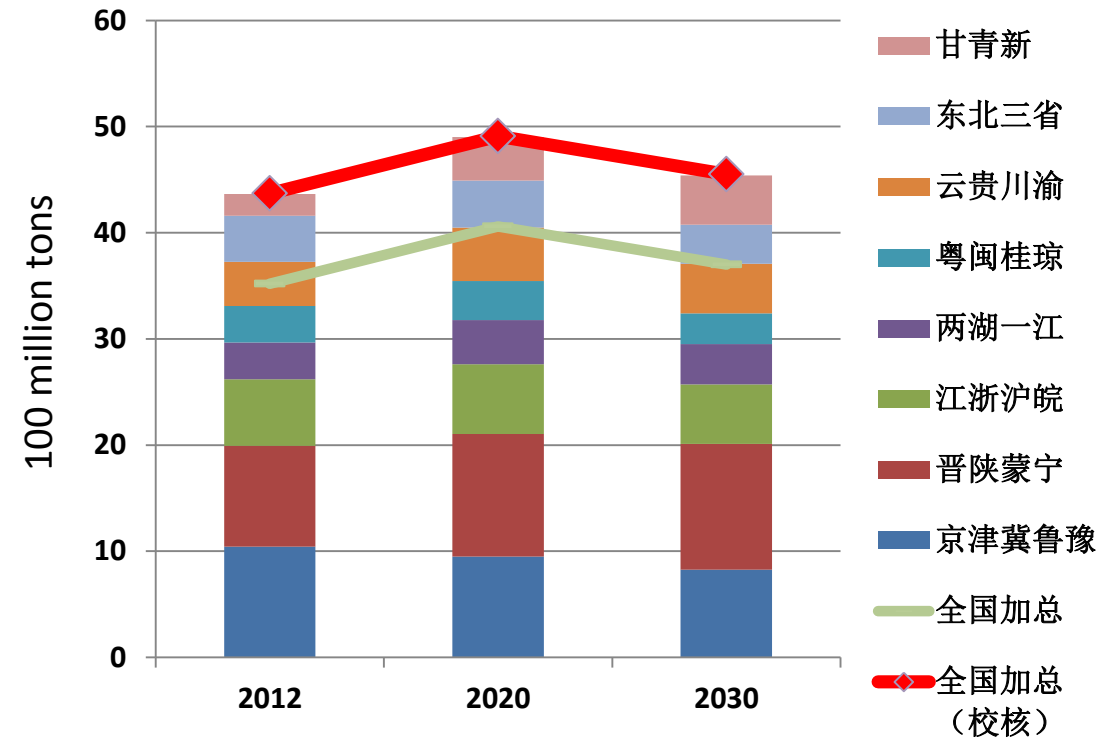
Taking into account local environmental and resource characteristics, including air pollution and water resources, the project studied the coal cap targets of 30 provinces (excluding Tibet), and investigated the perspectives from 8 regions:

1. Beijing-Tianjin-Hebei
2. Jiangsu-Zhejiang-Shanghai-Anhui
3. Heilongjiang-Jilin-Liaoning
4. Hubei-Hunan-Jiangxi
5. Guangdong-Guansi-Fujian-Hainan
6. Yunnan-Guizhou-Sichuan-Chongqing
7. Shanxi-Shaanxi-Ningxia-Inner Mongolia
8. Gansu-Qinghai-Xinjiang

Local Coal Cap Targets (Regional)



Baseline Scenario



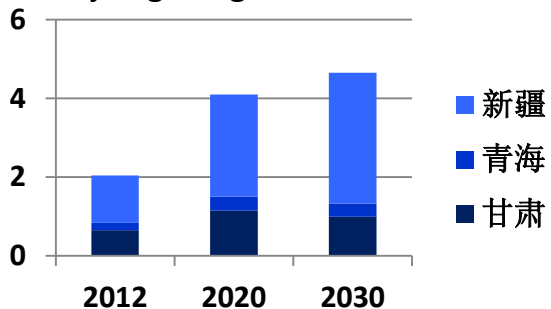
Coal Cap Targets

Legend: 1. Gansu, Qinghai, Xinjiang, 2. Heilongjiang, Jilin, Liaoning, 3. Yunnan, Guizhou, Sichuan, Chongqing, 4. Guangxi, Guangdong, Hainan, Fujian, 5. Hubei, Hunan, Jiangxi, 6. Jiangsu, Zhejiang, Shanghai, Anhui, 7. Shanxi, Shaanxi, Inner Mongolia, Ningxia, 8. Beijing, Tianjin, Shandong, Hebei, Henan, 9. National Total (adding up provinces), 10. National Total (relative to reported national total)

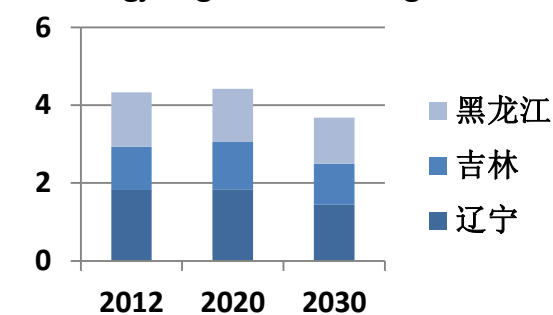
Local Coal Cap Objectives (Provincial Targets)



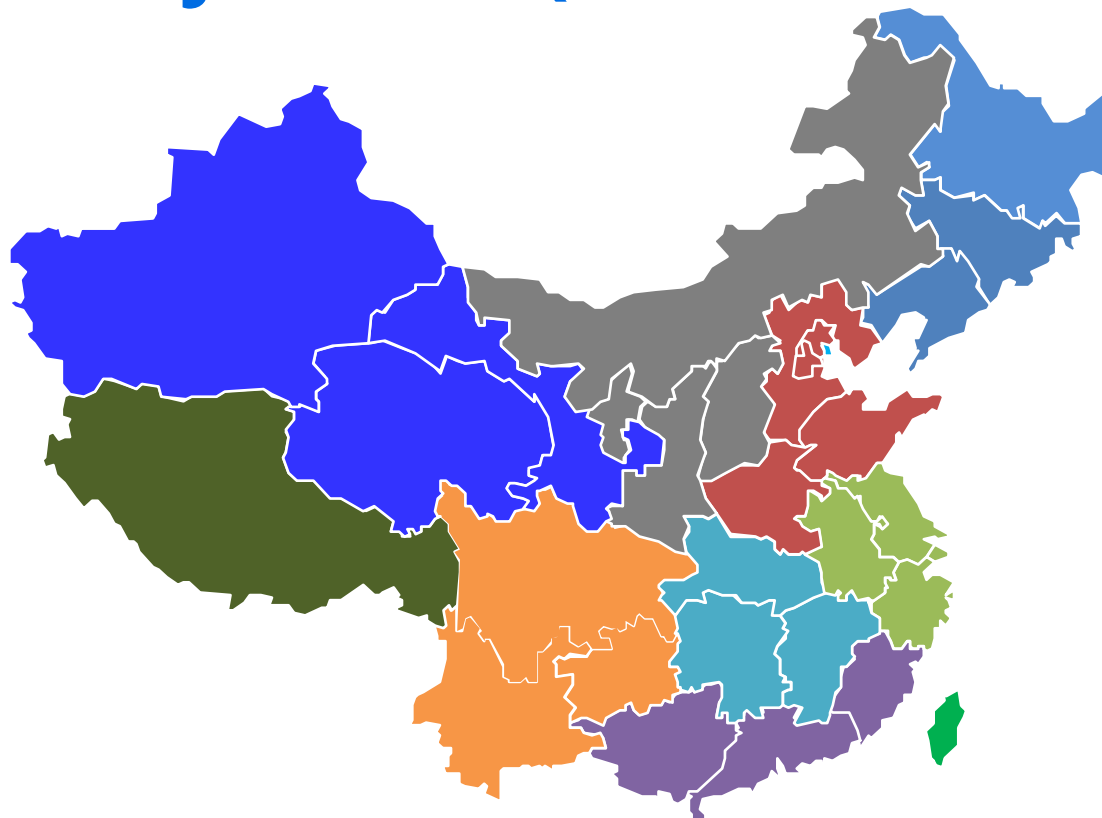
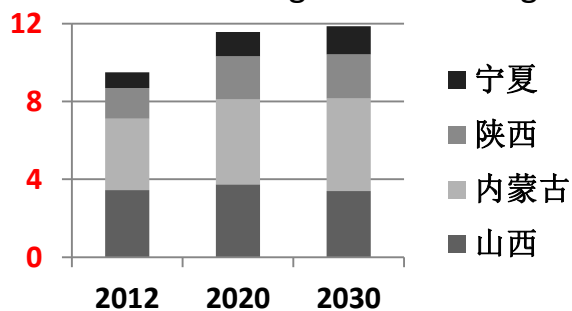
Xinjiang-Qinghai-Gansu



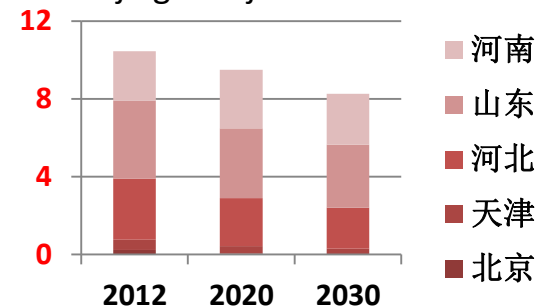
Heilongjiang-Jilin-Liaoning



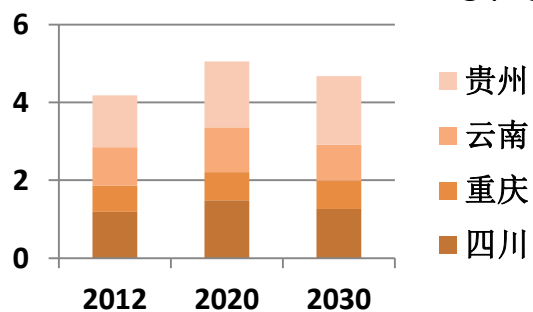
Shanxi-Shaanxi-Ningxia-Inner Mongolia



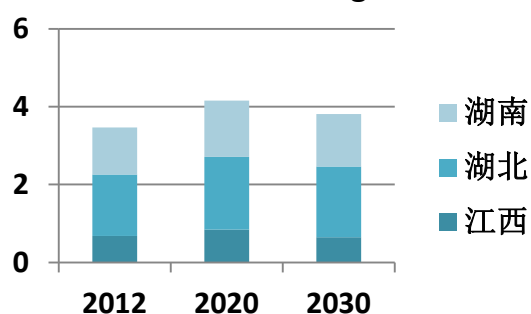
Beijing-Tianjin-Hebei



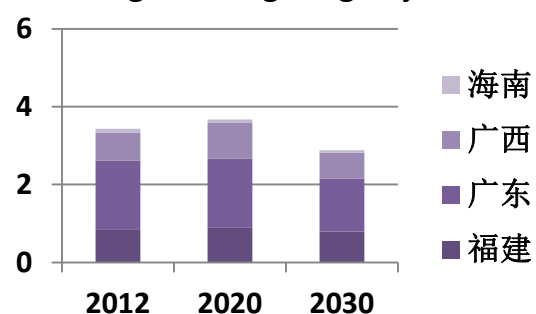
Yunnan-Guizhou-Sichuan-Chongqing



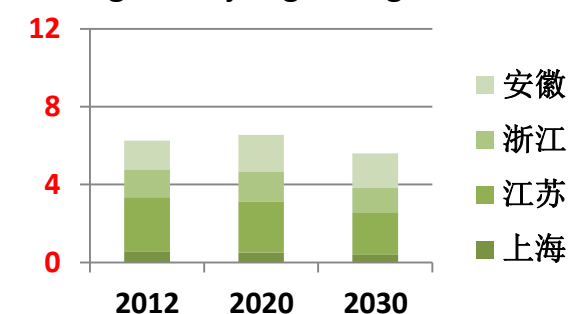
Hubei-Hunan-Jiangxi



Guangxi-Guangdong-Fujian-Hainan



Jiangsu-Zhejiang-Shanghai-Anhui



Cities are Key Focus Points

MEP Air Pollution Control Regions

(3 Regions, 10 City Clusters)

2011-2015:

3 Regions:

- Beijing-Tianjin-Hebei
- Yangtze River Delta
- Pearl River Delta

2016-2020:

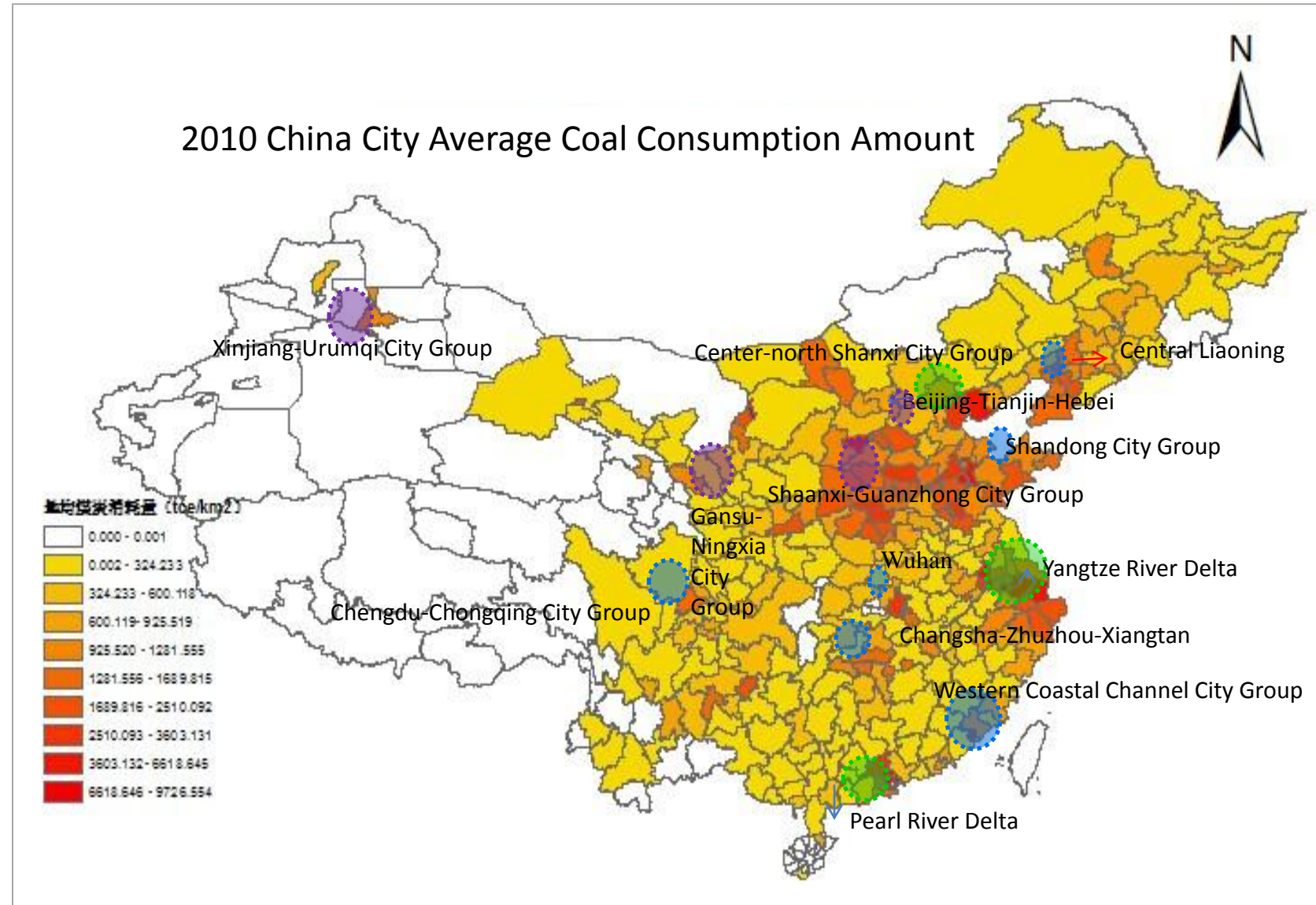
6 City Clusters

- Central Liaoning
- Wuhan
- Shandong
- Western Coastal Channel
- Changsha-Zhuzhou-Xiangtan
- Chengdu and Chongqing

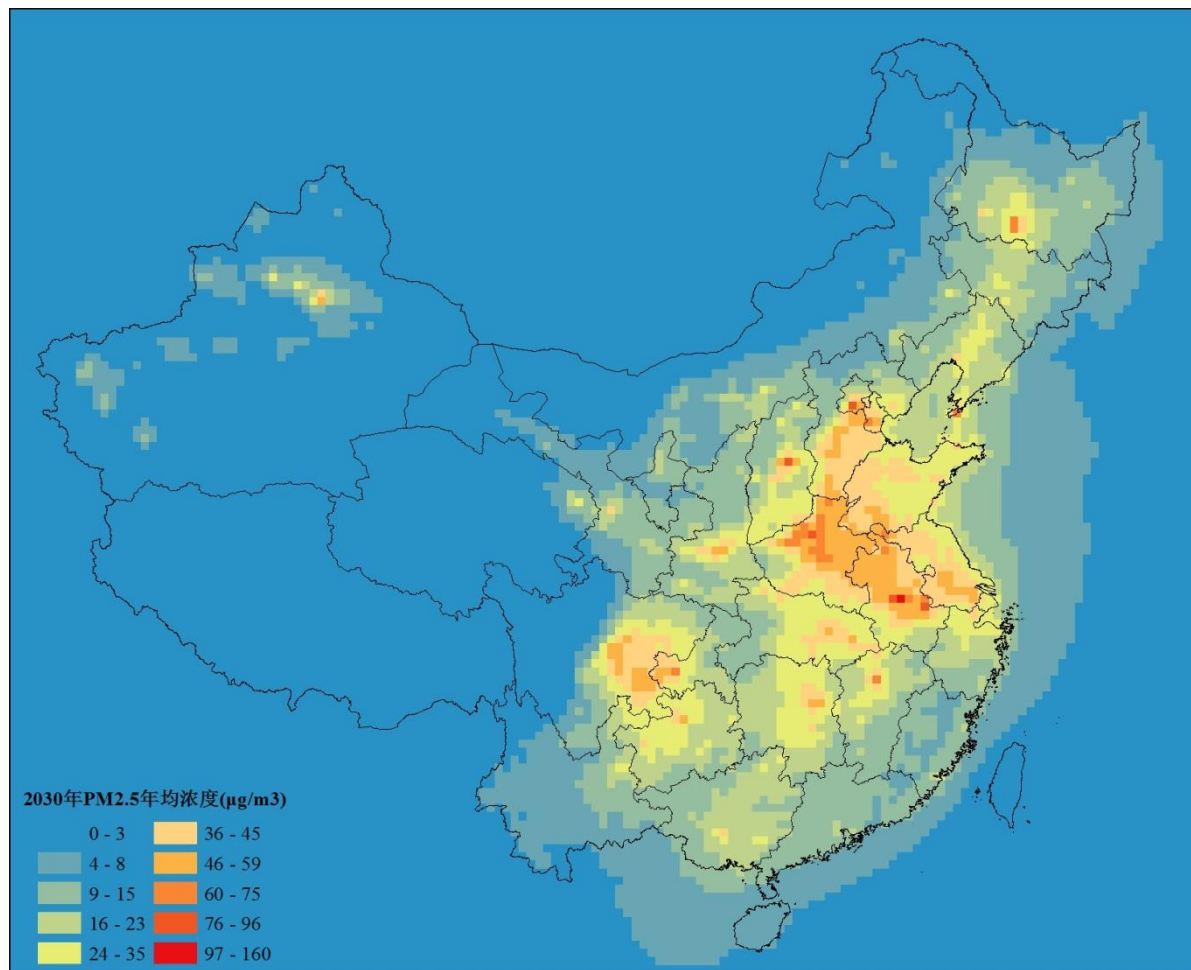
2016-2020:

Additional 4 City Groups:

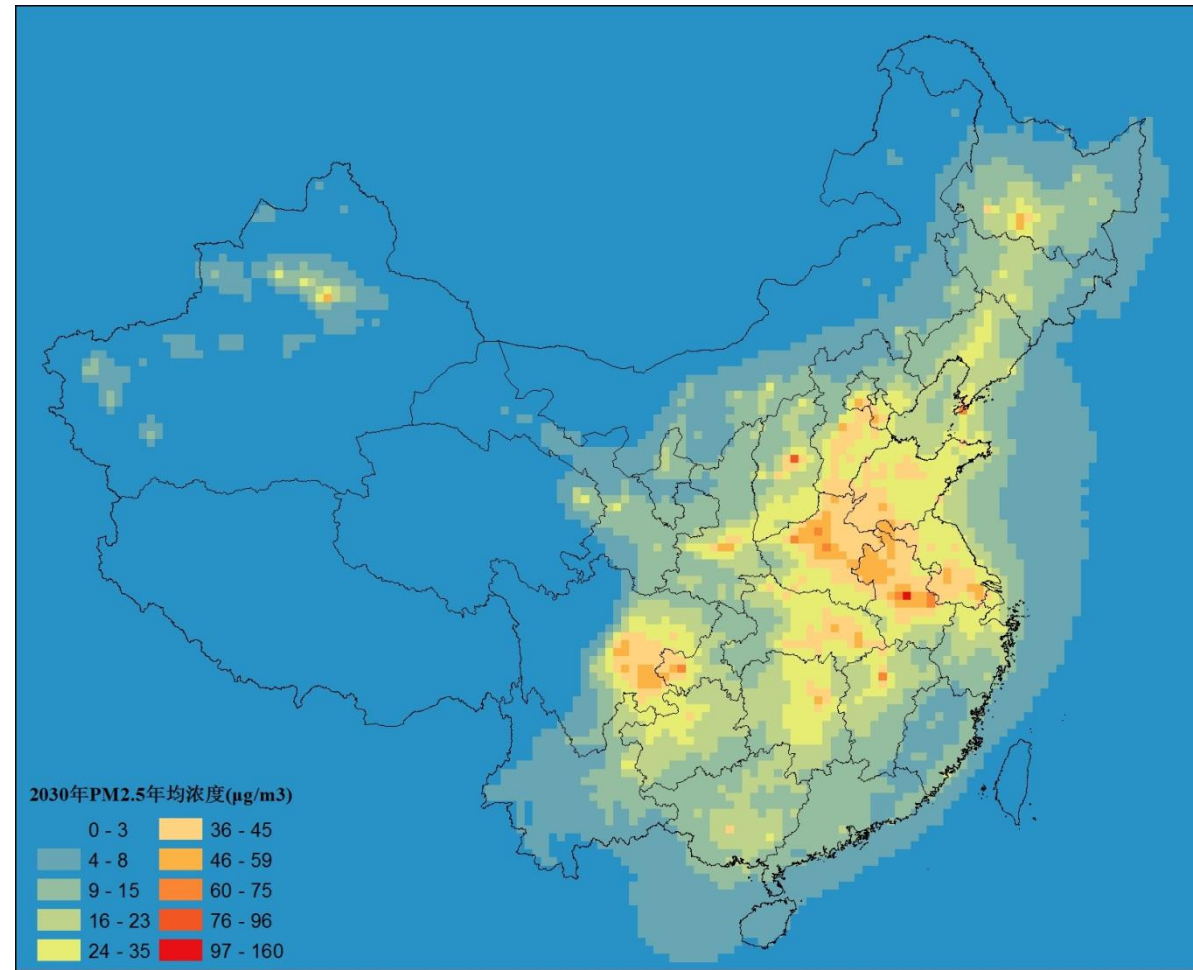
- Northern Shanxi City Group
- Shaanxi-Guanzhong
- Gansu-Ningxia
- Xinjiang-Urumqi



PM2.5 Assessment (2030)



Baseline Scenario

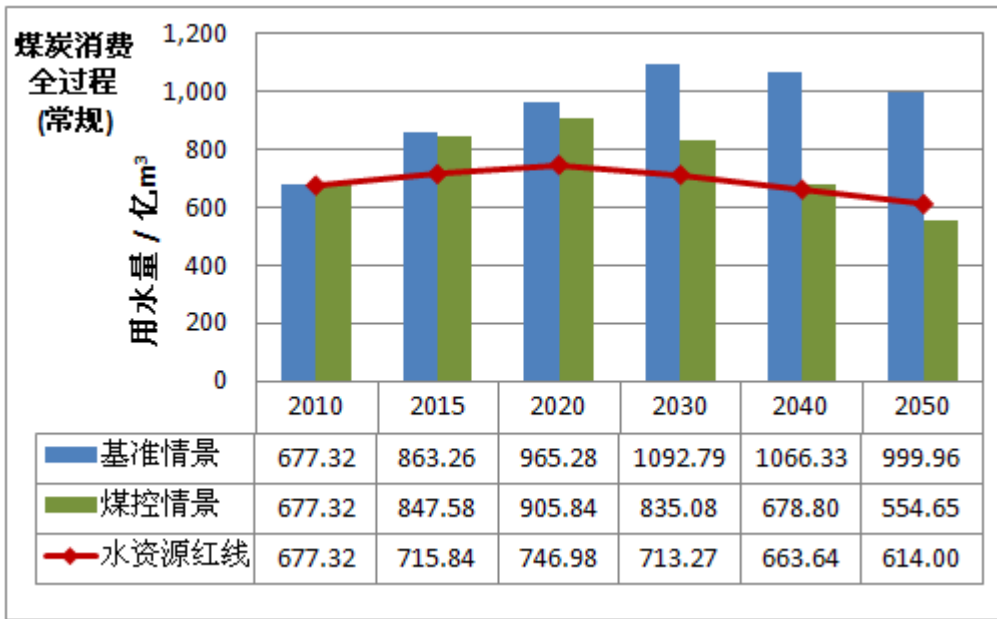


Coal Cap Targets

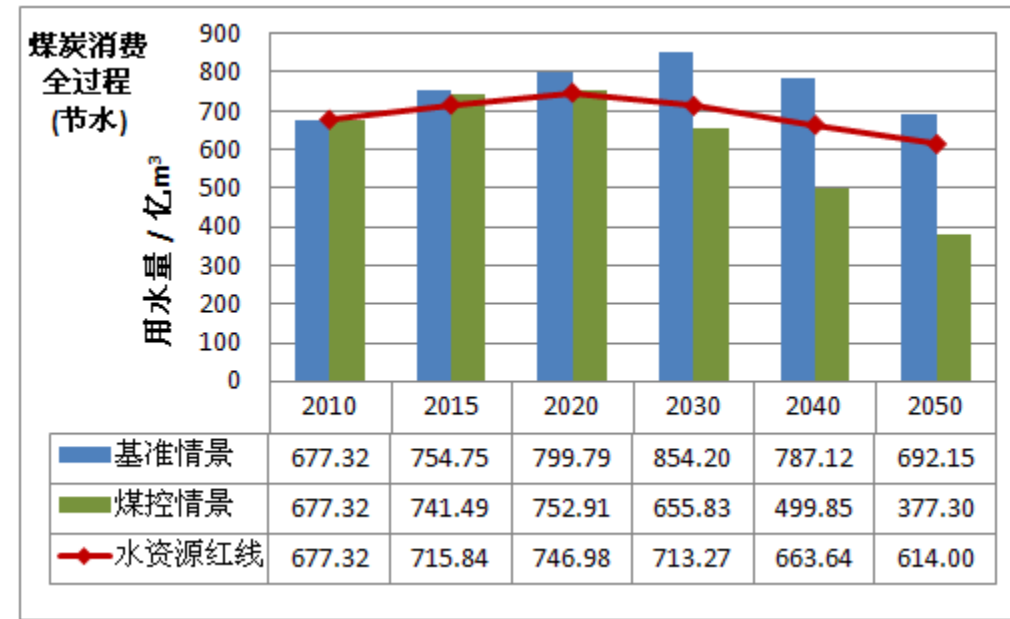
Water Usage Scenario (National)



- Coal consumption water use levels and Levels of water consumption and coal production are structurally related
- Two Scenarios: Conventional Model (Coal Cap) and Water Saving Model (Coal Cap, Water Saving)
 - The conventional model follows existing water use patterns, while the water saving model considers the expanded use of water saving technology, the phasing out of outdated technologies, and the impact that increased water savings will have on water usage.



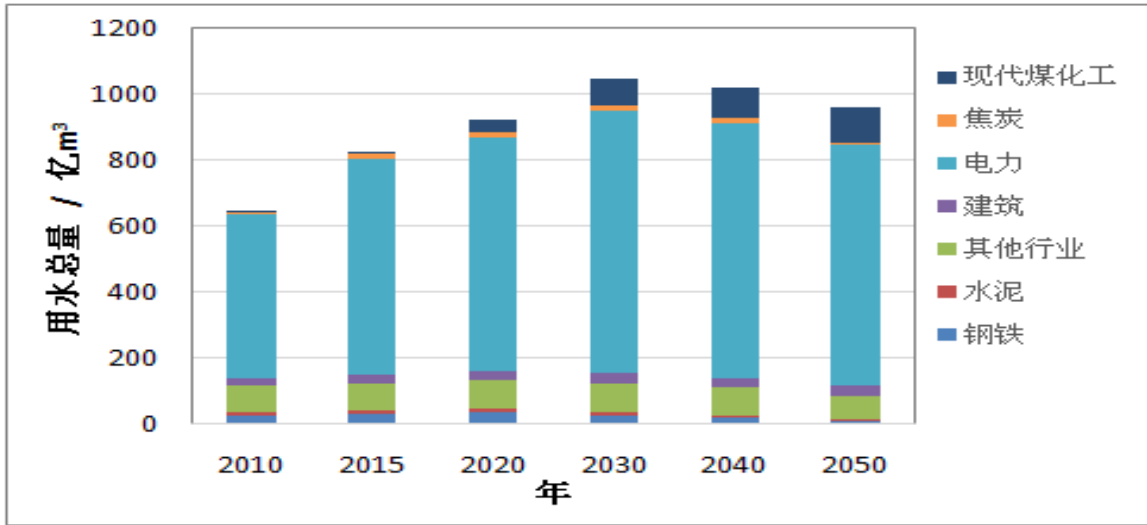
Conventional Water Use Model*



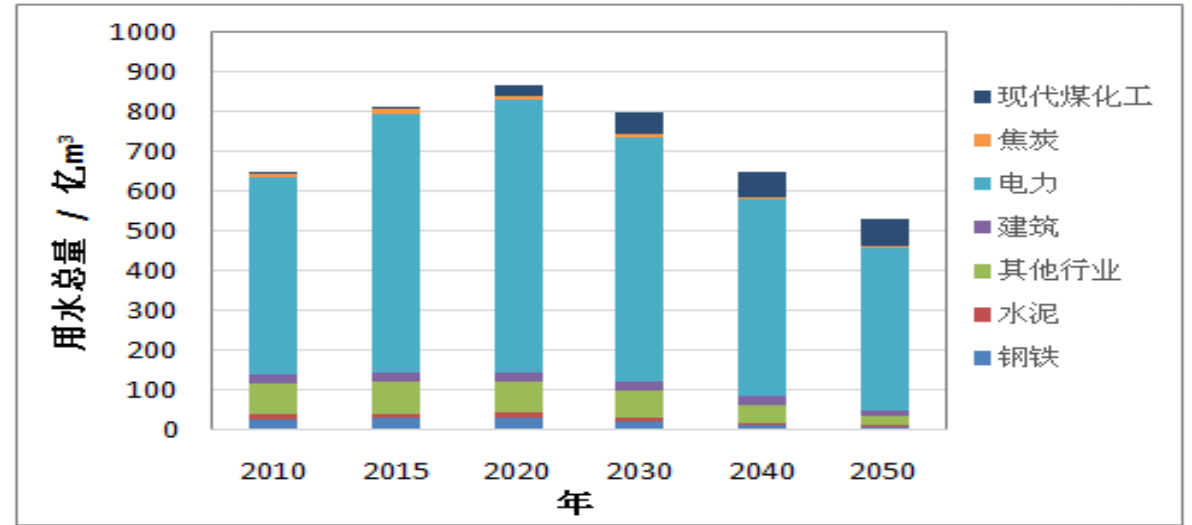
Water Saving Model*

* Total Water Usage in Coal Consumption Process

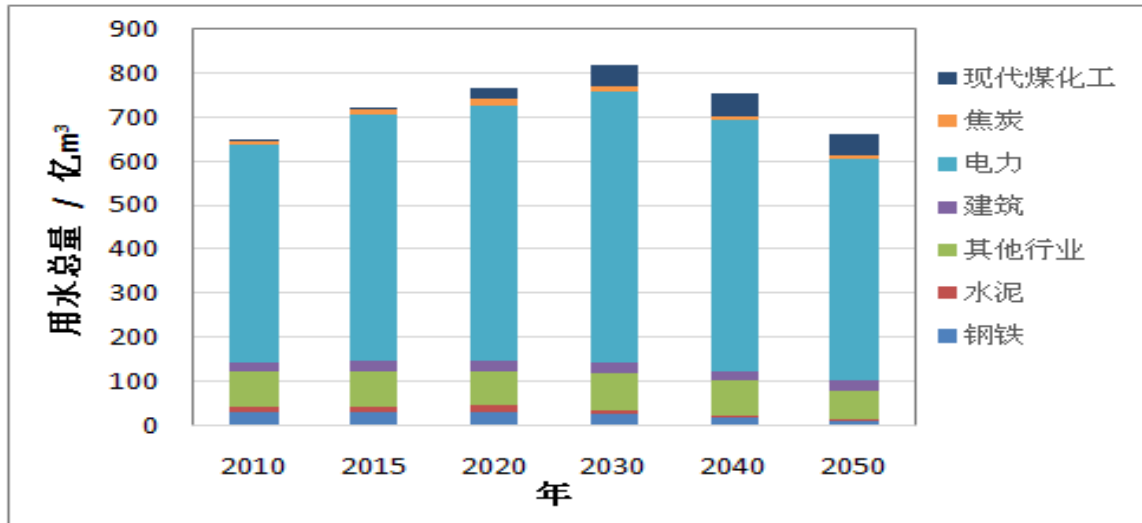
Scenarios for Water Usage by Sector



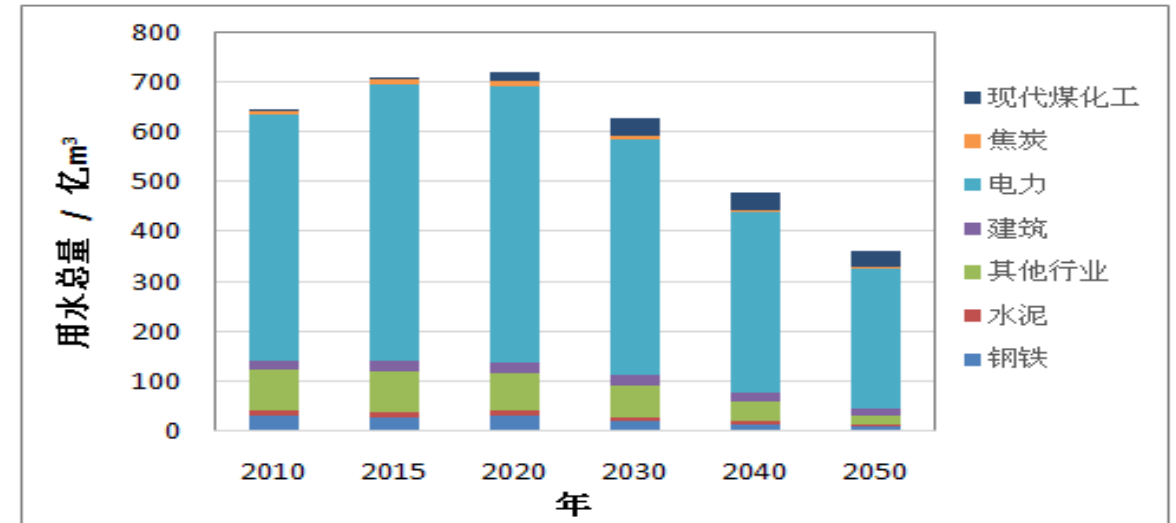
Conventional Model: Baseline Water Usage by Sector



Conventional Model: Water Usage by Sector w/ Coal Cap



Water Savings Model: Baseline Water Usage by Sector



Water Savings Model: Water Usage by Sector w/ Coal Cap

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Factors Influencing Coal Cap

1. Unemployment and Employment
2. Levels of competitiveness
3. Energy supply security
4. Coal production base ecological loss

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Three Critical Steps

1. Reform energy system and upgrade technology
2. Strengthen investment in energy reduction and alternative energy
3. Establish a new energy security concept

1) 13th FYP Energy System Reform



	2014	2015-2017	2017-2020
Relevant Legislation	Environmental Protection Law Energy Conservation Law Renewable Energy Law	Air Law Revisions Coal Law Revisions Electricity Law Revisions	Natural Gas Legislation Energy Law Legislation Oil Law Revisions Climate Change Law
Industry Reform		Electricity Natural Gas	Coal Oil
Basic Infrastructure		Gas and Oil Pipelines Smart Grid	Natural Gas Smart Grid
Regulation	National Air Pollution Action Plan	Energy and Coal Consumption Caps Climate Change Response Plan	

2) Strengthen Investments to Achieve Energy Conservation and Alternative Energy Development Goals

- Mandatory Energy Conservation and Energy Efficiency Targets and Restrictions
- Mandatory Renewable Energy Targets and Restrictions
- High Penetration Renewables Development, Renewable Energy Quotas and Market Trading
- Safe and Efficient Nuclear Energy
- Reform Conventional Natural Gas Pricing and Regulation
- Competitive Development of Unconventional Natural Gas
- Encourage Diversified Investment of Energy Infrastructure

3) Establish a New Energy Security Perspective



- Utilize the current international energy market system
- Open a transparent, new international energy market system:
the Asian Energy Security Agency
- Ensure international energy supply and guard against price manipulation and other dangers

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Eight Key Measures to Achieve the Coal Cap



1. Make full use of market mechanisms and measures to effectively reduce coal consumption
2. Set ecological and public health “red line” constraints
3. Establish mechanisms to retire coal and guarantees
4. Establish a coal cap target responsibility system, alert system and action plan
5. Coordinately closely with environmental regulations and standards, using penalization and incentives
6. Strengthen climate change restraints
7. Emphasize focus areas, assessments and practical results
8. Increase public participation, information transparency and disclosure