Cities, Sustainability & Innovation in China:
Building Ecological Civilization and Realizing Sustainable Urban and Regional Development

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报告提纲 Outline

1 中国可持续发展的进展

Progress to Achieve China's Sustainable Development

2 城市和区域环境问题与未来中国排放峰值

Urban & Regional Environmental Issues with Emissions Peak

3 峰值管理、绿色发展与生态文明制度创新

Cap Management, Green Development, and Institutional Innovation for Ecological Civilization

中国的绿色发展理念与政策路径
New development idea and policy path

- **2002: New industrialization path**
- **2003: Scientific development concept/balanced development**
  pay more attention to sustainable development
- **2004: Resource-Efficient and Environment-Friendly Society (REEFS) and Circular Economy (CE)**
- **2005: Harmonious Society including man and nature relationship; Innovation-oriented country**
- **2006: Energy efficiency and pollutants reduction approach, target-oriented policies (legally binding domestically)**
- **2009: Green and Low-carbon development**
- **2011: Transformation of economic development pattern: green-leading in some extent**
- **2012: Ecological Civilization (EC): green, low-carbon and circular economy development, new governing philosophy**

➢ ***Policy path:*** ***idea → target → plan → pilot/program → model → dissemination***

2000年以来的环保相关立法
Environmental and green legislation since 2000

- **Water Law (issued, 1988; amended, 2002)**
- **Environmental Impact Assessment Law (issued, 2002)**
- **Energy Saving Law (issued, 1997; amended, 2007)**
- **Circular Economy Promotion Law (issued, 2008)**
- **Renewable Energy Law(issued, 2005; amended, 2009)**
- **Cleaner Production Promotion Law (issued,2002; amended, 2012)**
- **Environmental Protection Law (issued, 1989; amended, 2014)**
- **Air/Water Pollution Prevention and Control Law (under revision)**

节能减排目标导向政策与综合性措施（2006-2015）

Target-oriented policy for energy saving and pollution reduction and comprehensive implementation program (2006-2015)

- **National Five-Year Plan (FYP): 11th FYP (2006-10); 12th FYP (2011-15); target-oriented**
  - **Long-term strategy: realize the new development approach**
    - ✓ **Comprehensive instrument (legislative, administrative, economic, tech)**
    - ✓ **Growth pattern transition and structural adjustment**
    - ✓ **Innovation orientation**
  - **Mandatory targets approach: energy efficiency and key pollutants reduction (indicators added continuously)**
  - **Legally binding domestically**
- **Sectoral plan:** such as resource & energy efficiency, renewable, pollution reduction, new energy vehicles, green industry
- **Local FYP**
- **Action plan and comprehensive implementation program**

十二五规划期间的绿色指标
Green targets during 2011-15

- **Green targets: 7 types with 12 targets (11 mandatory targets)**
- **Mandatory targets: allocated to provinces**
  - **Energy intensity, 16% ↓**
  - **Carbon intensity, 17% ↓**
  - **Share of non-fossil energy, reach at 11.4% (8.3% in 2010)**
  - **Pollutant reduction:**
    - ✓**COD: 8%↓**
    - ✓**SO_2: 8% ↓**
    - ✓**NH_3-N: 10% ↓**
    - ✓**NOx: 10% ↓**
    - ✓***$PM_{2.5}$ and PM_{10}: ↓, new target for medium- and long-term, build monitoring system first, not in the FYP but action plan available***

◆**Indicator with orange color: newly added since 2011**

十二五规划期间的绿色指标
Green targets during 2011-15

- **Mandatory targets (cont'd):**
  - **Arable land: keep the area at 1.2 Bn ha.**
  - **Forrest increase:**
    - ✓**forest cover: reached at 21.66% (20.36% in 2010)**
    - ✓**timber stock volume: 600 Mn M^3 ↑**
  - **Water use per unit industrial value-added : 30 % ↓**
- **Predicted targets:**
  - **Agricultural irrigation coefficient: reach 0.53 (0.5 in 2010)**
- **Other targets considered:**
  - **resources productivity: 15% ↑**
  - **total energy consumption (reasonable control)**

十二五规划期间的绿色指标
Green targets during 2011-15

- **Renewables:**
  - Hydro power: 290 GW
  - Wind: 100 GW (grid-connected; 5 GW off shore)
  - Solar: 21 GW
  - Biomass: 50 Mtce
  - Solar heating: accumulated at 400 Mm^2
- **New energy vehicle:**
  - 500,000 accumulated sale in 2015 (battery electric vehicle and plug-in hybrid vehicle, ambitious)
  - Fuel economy: 6.9 l/100km for passenger vehicle

2020年及之后的绿色指标
Green targets in 2020 and beyond

- **Mandatory targets:**
  - **Carbon intensity, 40-45% ↓ (2005-2020)**
  - **Share of non-fossil energy, 15% (target in 2015: 11.4%)**
  - **Forest area: 40 Mn ha. increase (2005-2020)**
  - **Timber stock volume: 1.3 Bn m^3 increase (2005-2020)**
  - **Pollutant reduction: action plans on air and water pollution control available or coming soon**
- **National Plan for Addressing Climate Change (2014-2020), 2013**
- **other targets ?**
  - ✓ **PM2.5 and others (such as: VOC, O_3)**
  - ✓ **Total energy/coal consumption**
  - ✓ **Carbon emissions**

中共十八大和十八届三中全会关于生态文明制度建设

Institution Building of EC by the 3rd plenary session of 18th CPC Central Committee

- **Decision on Major Issues Concerning Comprehensively Deepening Reforms: change of governing philosophy**
- **Ecological Civilization (EC) crucial: integrated into political, economic, social, and cultural process**
- **Path to EC: develop the green, low-carbon and circular economy**
- **Key points:**
  - Make the market a decisive role for resource allocation
    - ✓ improve the property right system of natural resource; price and tax reform; trading for emissions right/energy consumption increment/amount of energy-saving; PPP; the 3rd part participation
  - Play the Gov't role better
    - ✓ administrative system reform; administrative approval procedures reform; gov't procurement (goods and service); etc.
  - Take full advantage of institutions for protecting the environment
    - ✓ eco-redline, accountability system, market-based instruments
  - Build an environmental governance system
    - ✓ responsibility system, top-down with bottom-up, info disclosure and public participation,

中国的城市化发展进程
China's Urbanization Process

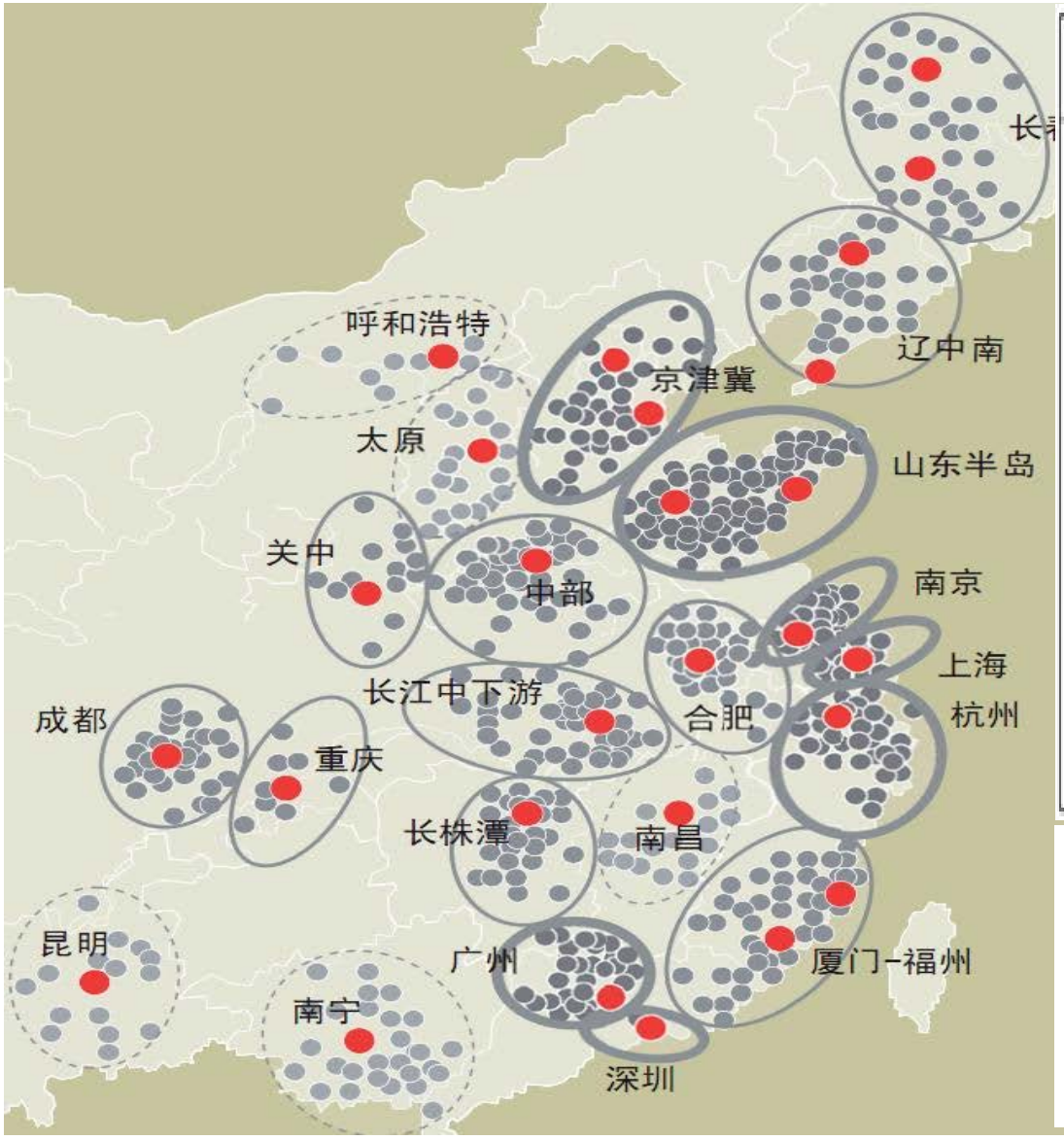


表1 城市（镇）数量和规模变化情况（单位：个）

	1978年	2010年
城市	193	658
1000万以上人口城市	0	6
500万—1000万人口城市	2	10
300万—500万人口城市	2	21
100万—300万人口城市	25	103
50万—100万人口城市	35	138
50万以下人口城市	129	380
建制镇	2173	19410

注：2010年数据根据第六次全国人口普查数据整理。

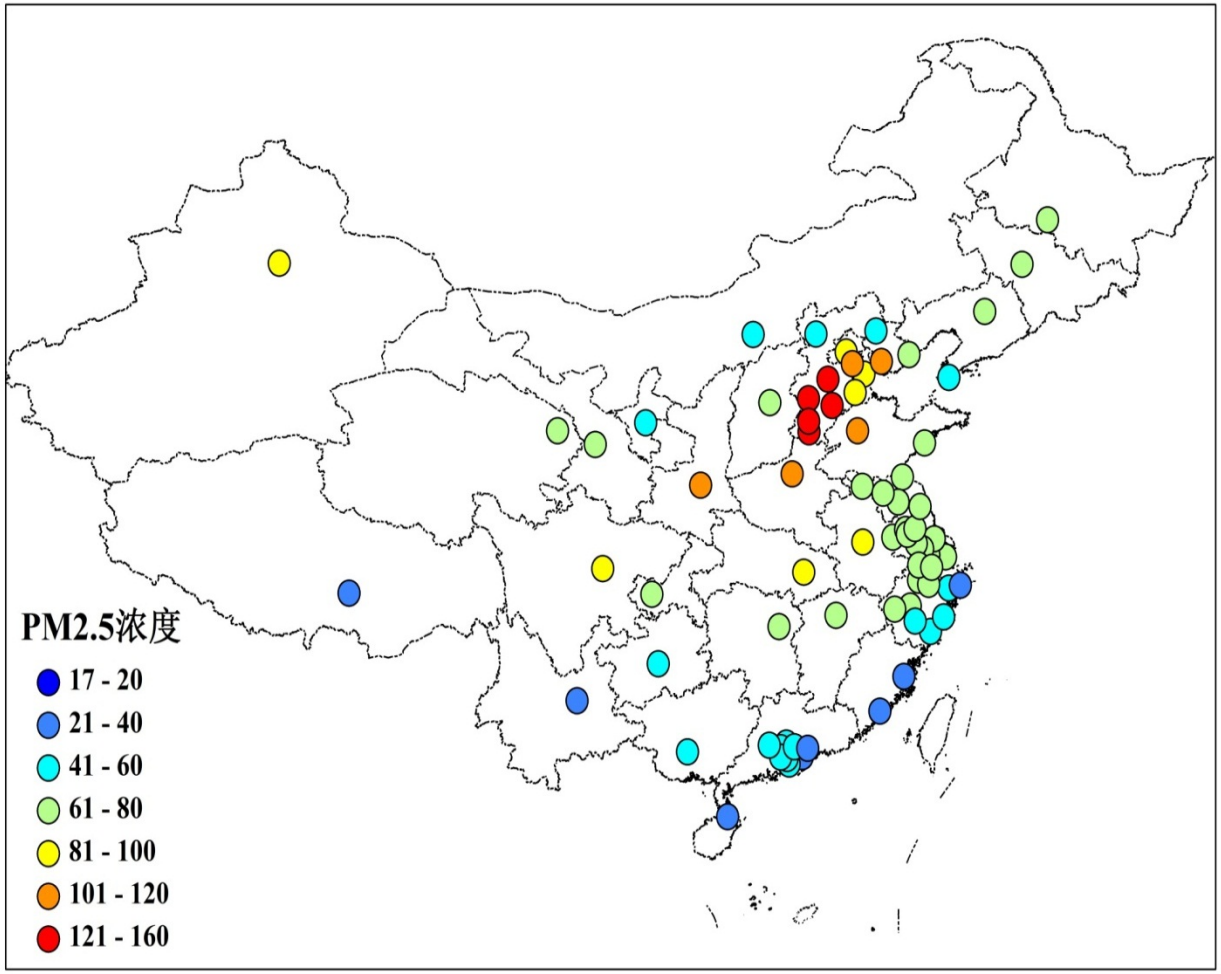
Urbanization: permanent population
Growth rate: 1.02 percentage points per year (1978-2012); 1.36 since 2000
2012: 52.6%
2020: around 60%

中国城镇化进程中存在的问题
Problems of Urbanization in China

- **Too fast growth:** irrational spatial layout, regional disparity, low efficiency of land use
- **Rural migrant workers in cities:** rights and services, citizenization
- **Resource and Environmental issues:** resource/energy supply, regional pollution, land tenure
- **Urban public service:** health care, education, transportation, etc.
- **Management system:** multi-sector coordination, public participation, top-down approach
- **Lack of regional innovation:** comprehensive supporting system

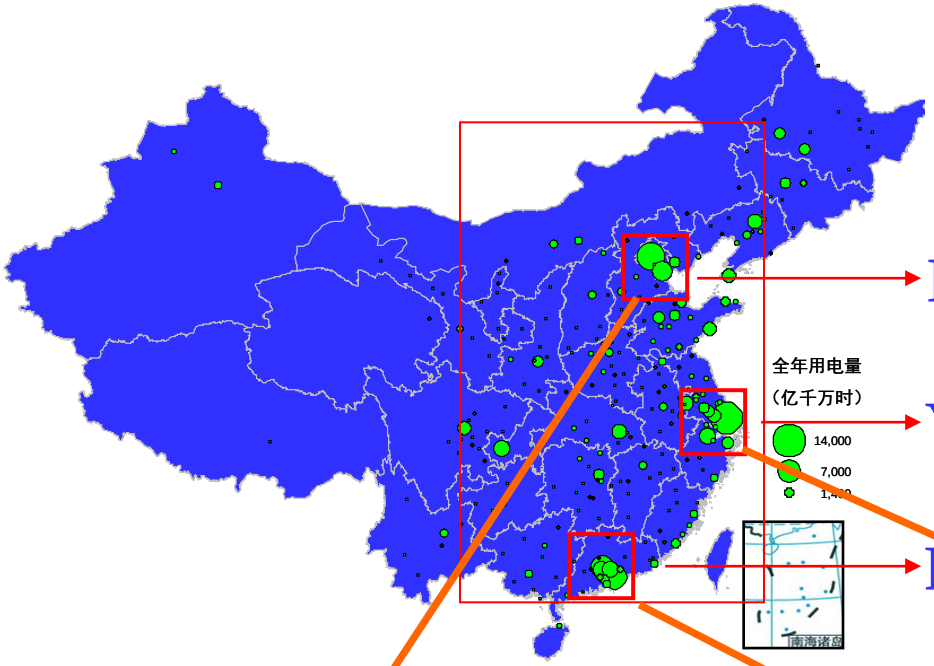
Regional Haze Pollution in China

Annual Average PM2.5 Concentration in China (2013)



Source: Kebin HE, 2014

中国区域大气污染控制的实践案例
Practice of air polluting control in 3 key regions



BTH

YRD

PRD

Share of total:

- Land: 2.8%
- Population: 18%
- GDP: 36%
- Electricity: 38%
- Car ownership: 43%

Beijing 2008

APEC
CHINA 2014

16TH ASIAN GAMES
Guangzhou 2010
XINHUA

EXPO 2010
SHANGHAI CHINA

目前中国城镇化的制度安排
Key Institutional Arrangement for Urbanization

- National New Urbanization Plan (2014-2020)
- National Action Plan for Air Pollution Prevention and Control, 2013
- State Council Guidance on speeding up development of energy-saving and environmental protection industries, 2013
- State Council Guidance on urban infrastructure construction , 2013
- Green Building Action Plan (NDRC and MoC, 2013)

国家新型城镇化规划

National New Urbanization Plan (2014-2020)

- **Highlights:**
  - **Capacity of rural migrant workers**
  - **Infrastructure program: esp., at county and key towns level**
  - **Zoning plan within city: such as eco-redlines**
  - **Green city**
  - **Smart city**

专栏 1　新型城镇化主要指标

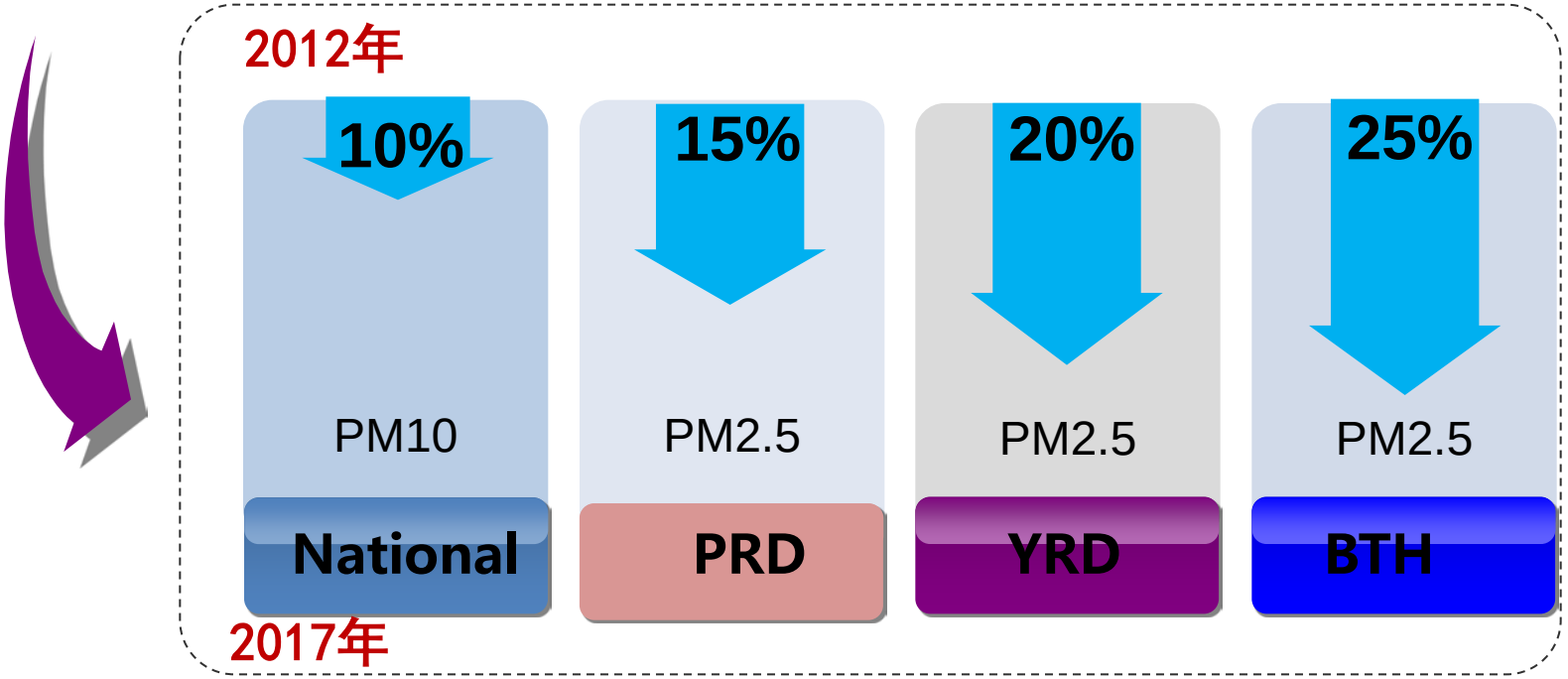
指　　标	2012 年	2020 年
城镇化水平		
常住人口城镇化率（%）	52.6	60 左右
户籍人口城镇化率（%）	35.3	45 左右
基本公共服务		
农民工随迁子女接受义务教育比例（%）		≥99
城镇失业人员、农民工、新成长劳动力免费接受基本职业技能培训覆盖率（%）		≥95
城镇常住人口基本养老保险覆盖率（%）	66.9	≥90
城镇常住人口基本医疗保险覆盖率（%）	95	98
城镇常住人口保障性住房覆盖率（%）	12.5	≥23
基础设施		
百万以上人口城市公共交通占机动化出行比例（%）	45*	60
城镇公共供水普及率（%）	81.7	90
城市污水处理率（%）	87.3	95
城市生活垃圾无害化处理率（%）	84.8	95
城市家庭宽带接入能力（Mbps）	4	≥50
城市社区综合服务设施覆盖率（%）	72.5	100
资源环境		
人均城市建设用地（平方米）		≤100
城镇可再生能源消费比重（%）	8.7	13
城镇绿色建筑占新建建筑比重（%）	2	50
城市建成区绿地率（%）	35.7	38.9
地级以上城市空气质量达到国家标准的比例（%）	40.9	60

注：①带*为 2011 年数据。
②城镇常住人口基本养老保险覆盖率指标中，常住人口不含 16 周岁以下人员和在校学生。
③城镇保障性住房：包括公租房（含廉租房）、政策性商品住房和棚户区改造安置住房等。
④人均城市建设用地：国家《城市用地分类与规划建设用地标准》规定，人均城市建设用地标准为 65.0—115.0 平方米，新建城市为 85.1—105.0 平方米。
⑤城市空气质量国家标准：在 1996 年标准基础上，增设了 $PM_{2.5}$ 浓度限值和臭氧 8 小时平均浓度限值，调整了 PM_{10}、二氧化氮、铅等浓度限值。

国家大气污染防治行动计划（或大气十条）

National Action Plan for Air Pollution Prevention and Control (or National 10 Measures)

- Goals: $PM_{2.5}$ concentration in Beijing-Tianjin-Hebei (BTH) region should be reduced by 25% in 2017 and annual concentration in Beijing can't exceed 60 μg/m^3



国家大气污染防治行动计划（或大气十条）

National Action Plan for Air Pollution Prevention and Control (or National 10 Measures)

- 5 measures with 18 specifications
  - Targeting pollution control
  - Abate emissions, adjust/shift industrial structure, promote clean energy, etc
- 2 measures with 7 specifications
  - Targeting incentives and mechanism
  - Legislation, market-based policy instruments, etc
- 3 measures with 10 specifications
  - Targeting capacity building and public involvement
  - Monitor, forecast and alert, regional cooperation, etc.

Action Plan on Air Pollution Prevention and Control

Highlights:

Reduce/cap coal use & encourage alternative energy

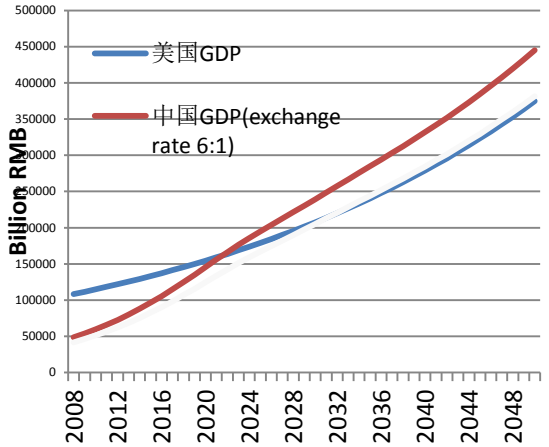
- **Coal consumption cap in 3 key regions**
- **No coal power plants in 3 key regions (except CHP), small coal boilers in urban areas phased out**
- **By 2017, coal share in energy use <65%, increase natural gas & non-fossil fuel energy to 13%**
- **Coal washing rate increase to 70% by 2017**

Vehicles and fuel quality

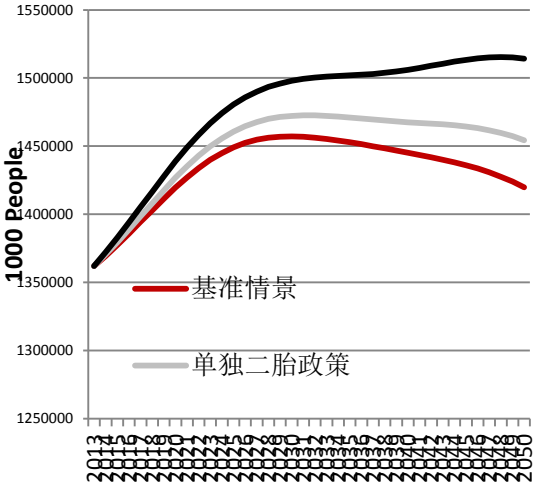
- **By 2015, supply Euro-V gasoline and diesel in the three key regions**
- **By 2017, supply Euro-V gasoline and diesel nation wide**
- **By 2017, eliminate all high polluting vehicles**

基准情景：快速增长及转型
Baseline : China's fast development

- China's economic growth will gradually slow down in the future;
- Energy emissions growth is dependent on the overall economic growth；
- In the baseline, we do not think too much about the energy efficiency and its improvement.



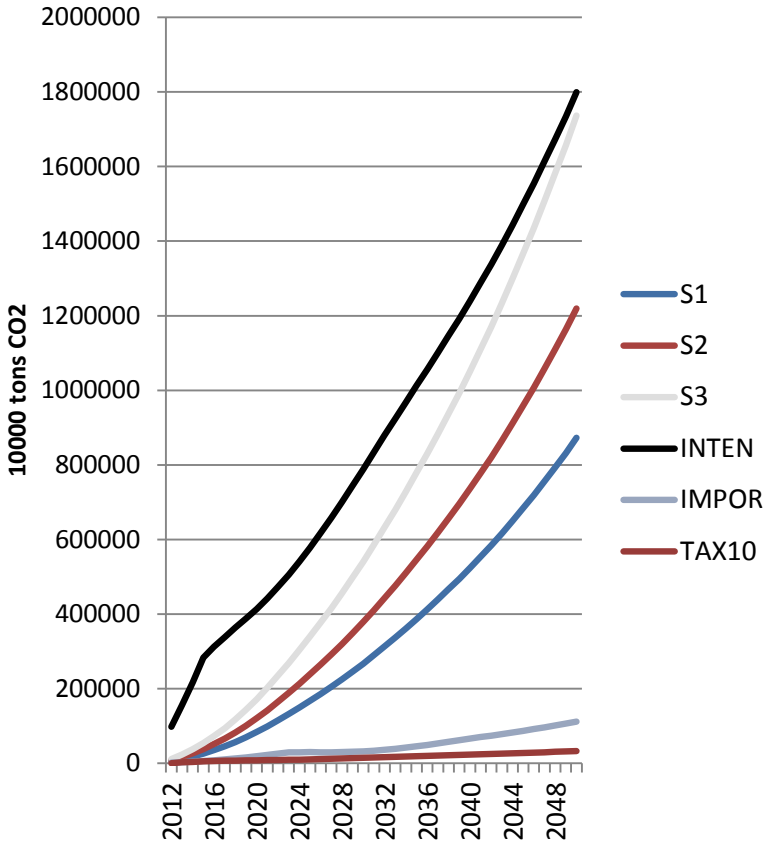
	2015	2020	2025	2030	2035	2040	2045	2050
population	1.377	1.410	1.449	1.457	1.453	1.445	1.436	1.420
Economic growth rate	7.5	7	6	5	4.5	4.0	3.7	3.5
Urbanization	56.4	60.0	63.0	66.0	68.3	70.5	72.8	75.0
Portfolio of Service Industry	44.46	44.50	47.35	50.20	53.20	56.20	58.70	61.20
Energy intensity Tons of standard coal per USD GDP)	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06



政策选择及其减排效果

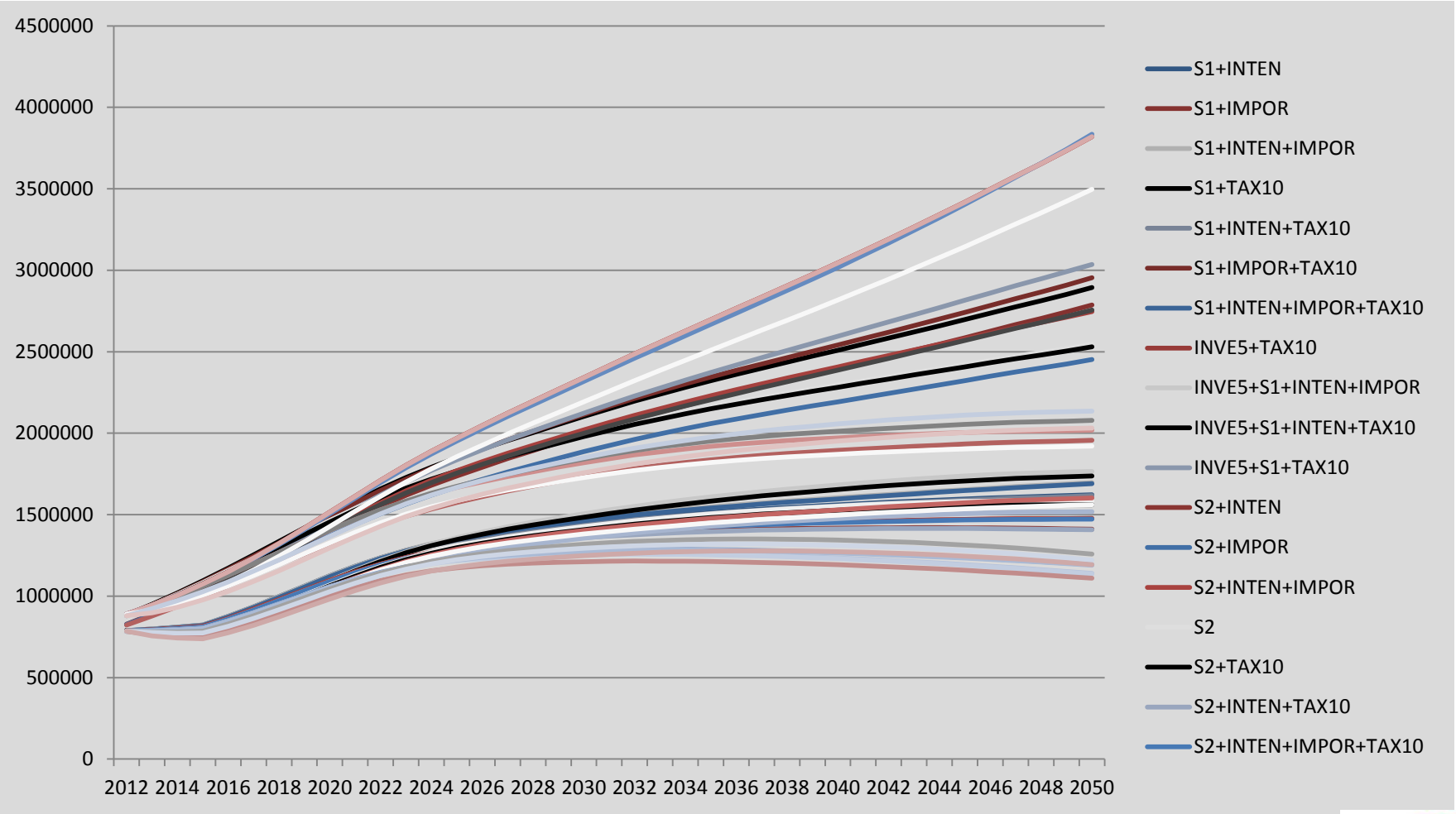
Policies option and their emission reductions

能源结构 / Energy Mix (S)	高油情景 / high oil
	高煤情景 / high coal
	高非化石能源情景 /high non-fossil
能源强度 / Energy intensity	2015年降低16%，至2050年降低50% / decreases 16% by 2015; 50% by 2050
进口依存度 / Import dependency	进口能源占比小于65% / ≤65%
投资消费比重 / Investment-consumption ratio	
碳税/Carbon Tax	10 元/吨CO_2排放 / ¥10/tCO_2
	100元/吨CO_2排放 / ¥100/tCO_2
碳税的再利用/ Use of carbon tax	返还企业 / Return to enterprises
	补贴居民 / Return to households



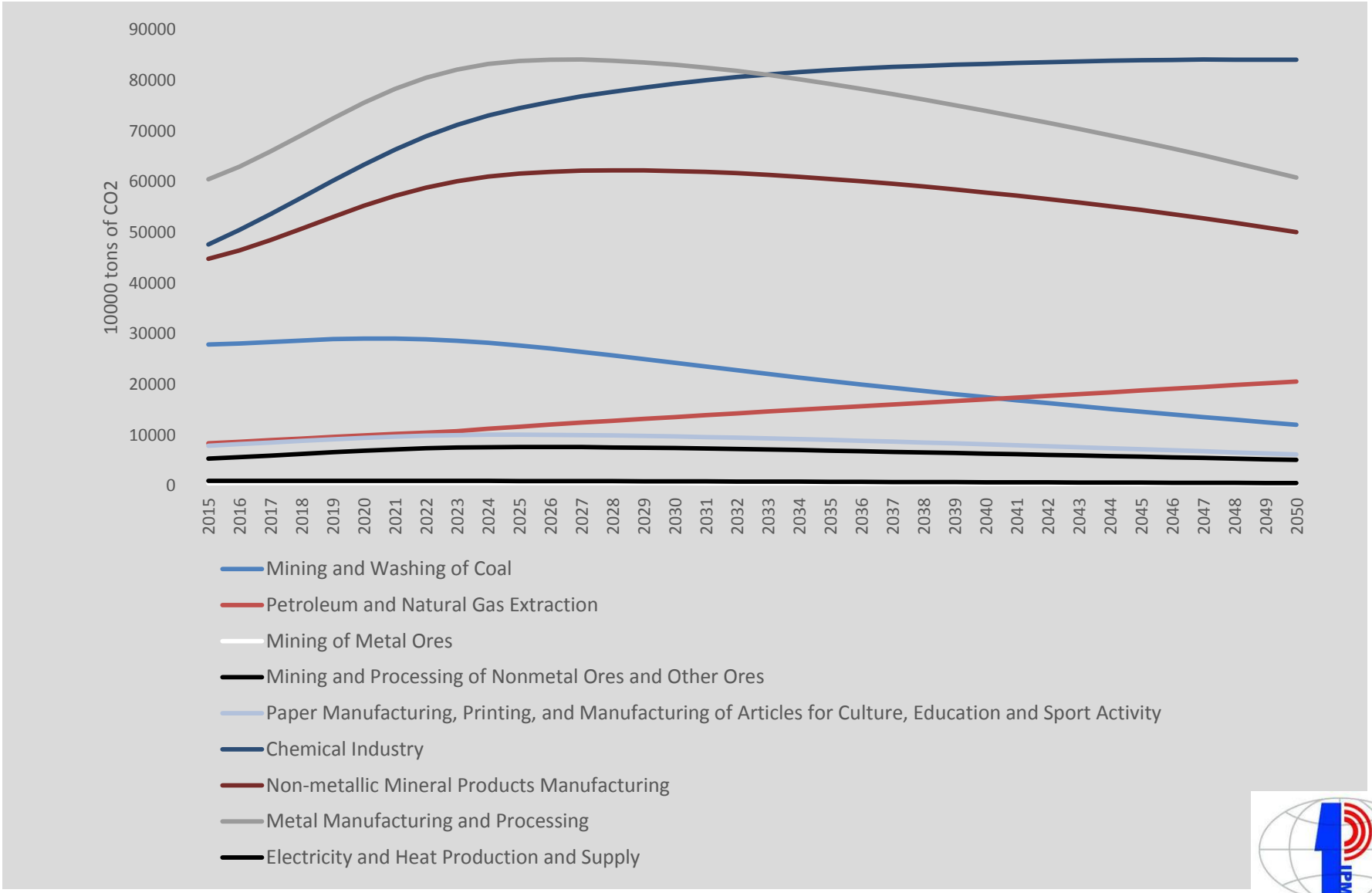
No a single policy can realize the carbon peak → **Policy mix**

不同政策组合情景下的碳排放
Carbon emissions by policy mix



不同政策组合下的能源密集型产业排放峰值

Emissions Peak of energy-intensive industries by policy mix scenarios



政策组合– 趋势及相应峰值区间

Peak value and timeframe by policy mix scenarios

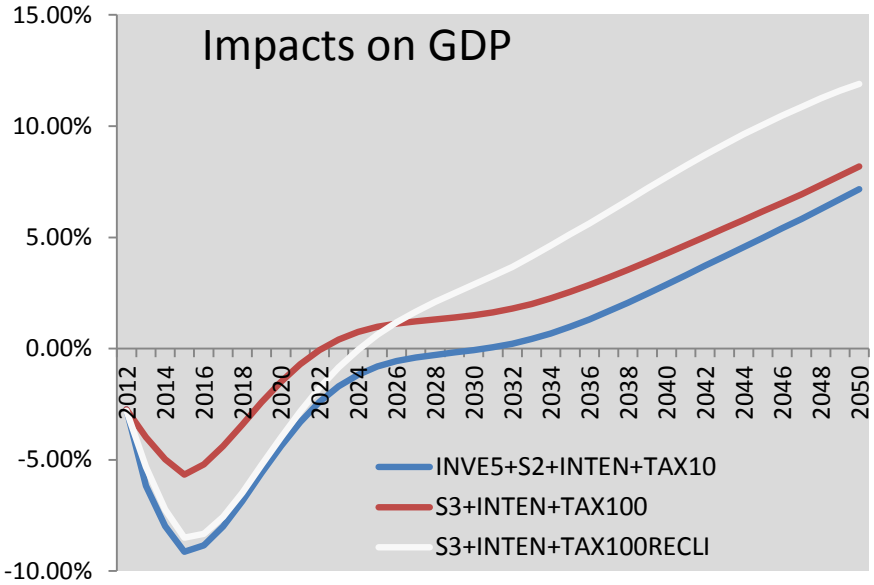
	单位	峰值/peak value	达峰时间/Peak timeframe	政策组合/Policy Mix
人口/population	Bn.	1.47~1.51	2031~2046	单独二孩政策; 全面二孩政策
煤炭消费总量/Coal consumption	Bn. tce	3.33~4.63	2027~2048	高非化石能源+降低能源强度+ 100元碳税; 高油+ 降低能源强度+ 10元碳税
能源消费总量/Energy consumption	Bn. tce	4.77~6.12	2032~2049	高煤 +降低能源强度+ 10元碳税 高非化石能源+降低能源强度+ 100元碳税
$PM_{2.5}$	Mn. t	9.62~15.49	2027	高非化石能源+降低能源强度+ 100元碳税; 高非化石能源+ 降低能源强度+ 10元碳税
重工业部门排放/High energy intensive sectors' emissions	Bn. tCO_2	4.96~5.04	2032~2034	高煤 +降低能源强度+ 10元碳税 高非化石能源+降低能源强度+ 100元碳税
CO_2 emissions	Bn. tCO_2	12.15~15.61	2032~2049	高非化石能源+ 降低能源强度+ 100元碳税; 高油+ 降低能源强度+ 10元碳税

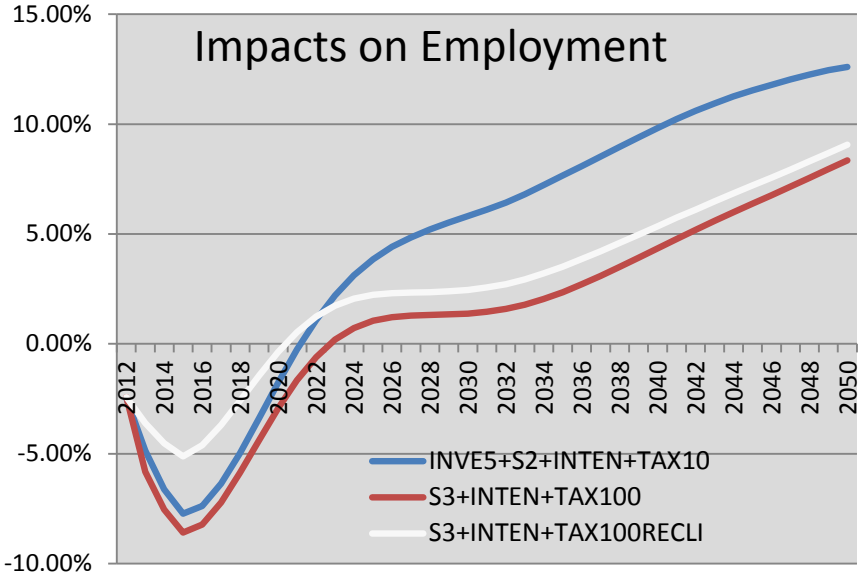
- Energy structure + Carbon tax: in 2030, CO_2 emission reduced by 11.3%-33.3%
- + energy intensity: In 2050 the CO_2 emissions will be at the same level of 2015

以可接受的成本实现减排目标

Reducing emissions with affordable costs

GDP or Employment ?





- Before 2030, GDP lose will be around 3% by scenario
- Adjust peak by Intensity: GDP lose additionally 2.13% for each one year earlier than 2032
- By energy structure: GDP lose additionally 2.31% per year

中国资源环境峰值组合的结论
Conclusions for peak package simulation

- **Peaks of population, energy consumption, and carbon emissions are linked to each other**

- **Peak timeframe: will reach at peaks of main resource use and emissions in 10-20 years; energy mix restructuring crucial for carbon peak**
  - Population: 2031-2046 (plateau period)
  - Coal consumption: 2026-2030； target year for peak to strive for: 2025
  - PM2.5: 2026-2030； partial region could reach at peak earlier
  - CO_2 emissions: 2031-2035; target year to strive for: 2030

中国资源环境排放峰值组合的挑战
Challenges for peak package simulation

- **Integrated policy solutions are needed for realizing the peaks package: target + roadmap/b-model + tech+ +policy mix + fine management + etc.**
- **Promote transformation of development pattern with system innovation**
- **Adjust energy structure and reduce energy intensity are the fundamental way for achieving peaks**
- **Carbon tax, carbon market, and other market-based instruments could work as supplemental ways to reduce CO_2 emissions**
- **If China reach at the carbon peak earlier than 2030, it would cause the reduction of global welfare (based on MRICES-CINCIA simulation)**
- **Manage the uncertainty/risk**

新常态下的生态文明建设

Building Ecological Civilization and in the New Normal

- **The "new normal" economy**
  - **GDP: 6-7%, energy elasticity: 0.5 ?**
  - **Economic transition**
  - **Energy mix transition**
  - **Change of consumption pattern**
  - **Resource and environmental impact**

- **Building ecological civilization:** limit vs. driver
  - **Impact by resource/coal/emissions cap**
  - **Support by new green, circular, and low-carbon economy**
  - **Cap Management in a context of EC institution: legislation, price/fee/taxation reform, emission trading, etc.**

资源环境总量管理的制度安排 (1)

Institutional Arrangements for the Management of Carbon Emissions Cap (1)

- **Legislation**
  - Amendment of Environmental Protection Law
    - ✓ implementation of basic principle and institutional arrangements
    - ✓ detailed implementation
  - Amending of air/water pollution prevention and control law, drafting soil pollution law
  - Environmental taxation act (inclu. carbon tax?)
  - Climate change law, related regulations such as carbon market management
  - Nuclear safety law
  - Sectoral standard, IPR protection and enforcement; low-carbon product standard, labeling and certification system

资源环境总量管理的制度安排 (2)

Institutional Arrangements for the Management of Carbon Emissions Cap (2)

- **Reform of administration system**
  - Multi-sector involvement
  - Super Environment Ministry? Ministry of Energy and Climate Change ?
  - Fine, adaptive, transition, and risk management
- **National co-control action plan**
  - multi-sector coordination
  - multi-region coordination
  - multi-pollutant, co-benefit, co-control
- **Capacity building: statistical system, accounting, etc.**

资源环境总量管理的制度安排 (3)

Institutional Arrangements for the Management of Carbon Emissions Cap (3)

- **Innovative financing institution /with PPP**
  - Energy price reform and resource tax for fossil energy; carbon tax ?
  - Invest green and low-carbon economy: renewables, e-mobility, etc.
  - Cap & Trade / ETS
  - PPP and the 3rd part participation
  - Comparative study on market-based instruments and schemes
  - Externality and public goods
- **International cooperation**
  - Energy transformation
  - Advanced energy efficiency tech, etc.
  - Best practice: policy, mgmt., standard, etc.

谢谢关注！

Thanks for your attention!

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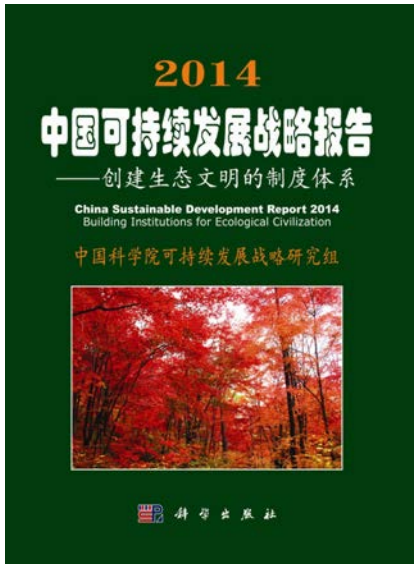

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