清华大学能源环境经济研究所
INSTITUTE of ENERGY, ENVIRONMENT and ECONOMY
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中国“十一五”节能评估及“十二五”节能工作的建议

Assessment of the 11th Five Year Plan Energy Savings Achievements and Prospects for the 12th Five Year Plan

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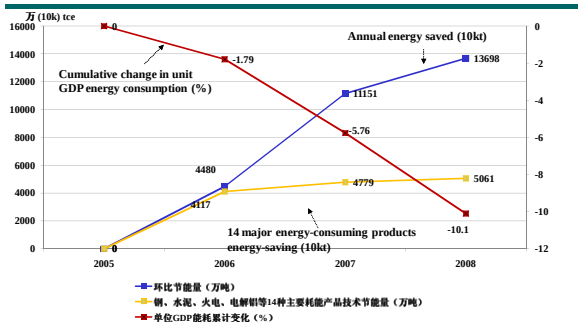
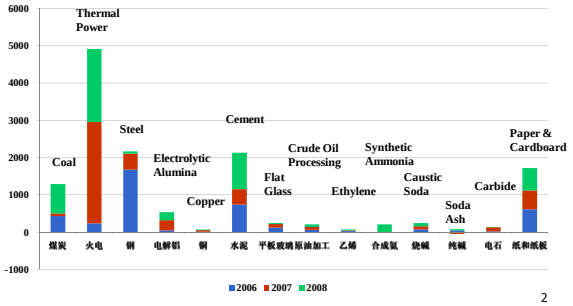
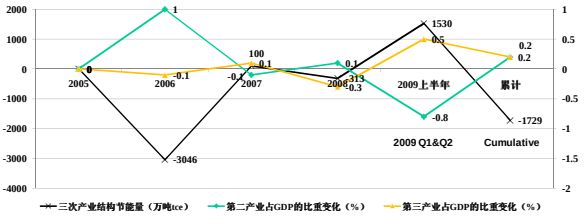
“十一五”期间节能工作的基本态势
Energy Saving in China’s 11th Five Year Plan (FYP)



十四种主要高耗能产品单耗下降节能量
Energy saving from the decrease of energy consumption per unit product for fourteen main high energy-consumption products



第二、三产业增加值占GDP比重变化与三次产业结构调整节能趋势图(1)
Changes in the proportion of secondary (manufacturing) and tertiary (service) sectors within China’s GDP (1)



Black: Structural energy saving of the three sectors (10kt)

Green: Changes in the proportion of the secondary sector within GDP (%)

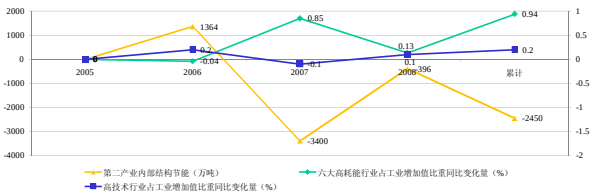
Yellow: Changes in the proportion of the tertiary sector within GDP (%)

第二、三产业增加值占GDP比重变化与三次产业结构调整节能趋势图(2)
Changes in the proportion of secondary and tertiary sectors within China’s GDP(2)

年份Year	2006	2007	2008	2009上半年 2009 Q1&2	累计 Total
第二产业比重变化 Changes in the proportion of secondary sector within GDP	+1%	−0.1%	+0.1%	−0.8%	+0.2%
第三产业比重变化 Changes in the proportion of tertiary sector within GDP	−0.1%	+0.1%	−0.3%	+0.5%	+0.2%
三次产业结构节能（万吨） Structural energy saving of the three sectors（10k ton）	−3046	100	−313	1530	−1729

第二产业占GDP的比重居高不下是导致三次产业结构调整对节能贡献不明显的主因。The main reason for negative energy-savings from structural adjustment among the three sectors is the high proportion of the secondary sector within GDP.

高耗能、高技术行业增加值比重变化与第二产业结构节能量变化趋势图(1)
Changes in the proportion of high energy-consuming and high-tech sectors within China’s GDP and the secondary sector’s structural energy savings(1)



Yellow: Energy savings from internal structural changes within the secondary sector (10kt)

Green: The share of the six high energy consuming sectors within the total industrial value added (%)

Blue: The change in value added of high-tech industry as a proportion of the total industry value added (%)

高耗能、高技术行业增加值比重变化与第二产业结构节能量变化趋势图(2)

Changes in the proportion of high energy-consuming and high-tech sectors within China's GDP and the secondary sector's structural energy savings(2)

年份 Year	六大高耗能行业占工业增加值比重 Ratio of six high energy consuming industries in industrial value added（%）	同比变化量 Variation	高技术行业占工业增加值比重 Ratio of high tech industry in industrial value added（%）	同比变化量 Variation	第二产业内部结构节能（万吨） Structure energy-saving of the secondary sector (10kt)
2005	31.31	0	10.5	0	0
2006	31.27	−0.04	10.7	0.2	1364
2007	32.12	0.85	10.6	−0.1	−3400
2008	32.25	0.13	10.7	0.1	−396
累计 Total		0.94		0.2	−2450

六大高耗能行业占工业增加值比重不降反升，高技术制造业占工业增加值的比重上升缓慢是第二产业结构节能成效不明显的基本原因。

The internal structural adjustment of the secondary sector is not energy-efficient because the growth in the proportion of high energy consuming sectors within the secondary sector is faster than that of high-tech sectors.

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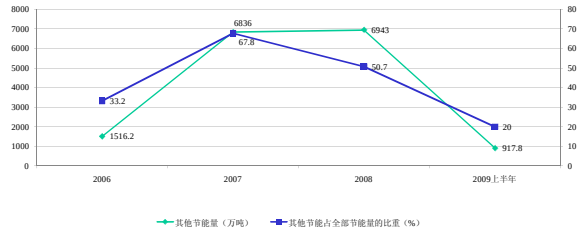
“其他节能”的涵义及构成分析(1)

The definition and the composition of the other energy savings(1)



Green: Other energy savings (10kt)

Blue: Its ratio to the total

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“其他节能”的涵义及构成分析(2)

The definition and composition of other energy savings (2)

- **其他节能主要包括行业内部子行业结构节能、子行业内部产品结构调整节能、特别是产品价值链升级和增加值率提高导致节能以及其他产品（除去已经计算过的14种高耗能产品）技术节能。据估算，“其它节能”中结构节能约占3/4，其他产品技术节能约占1/4。**
- **由于06-08年都有一些因素对总体节能的贡献为负，抵消了别的因素的节能贡献，导致“其他节能”在总节能量中的比重较高。**

- **“Other” includes sub-sectors; products structural energy-saving, especially product value chain upgrading and improved unit product value added; and other tech energy-saving. It is estimated that structural energy-savings is about 3/4 and other product technology energy-savings is about 1/4 of the “other”.**
- **A high ratio of the “other” energy-savings in the total is because industry and sector structural energy-savings are negative, which cancel out other factors' contribution to energy-savings.**

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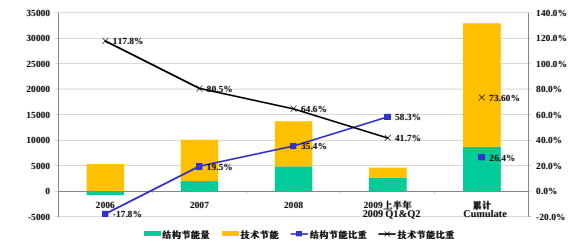
“十一五”以来各年度结构节能和技术节能的总量和比重变化趋势图(1)

Structural energy savings and technology energy savings in the 11th FYP period (1)



Green Bar: Structural energy savings

Blue Line: Ratio (Structural)

Yellow Bar: Technology energy savings

Black Line: Ratio (Technology)

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“十一五”以来各年度结构节能和技术节能的总量和比重变化趋势图(2)

Structural and technology energy savings in the 11th FYP period (2)

年份 Year	结构节能 Structural energy savings		技术节能 Technology energy savings	
	数量（万吨） Amount (10k ton)	比重（%） Percentage (%)	数量（万吨） Amount (10k ton)	比重（%） Percentage (%)
2006	−814.2	−17.8%	5285.1	117.8%
2007	1971.1	19.5%	8116.0	80.5%
2008	4847.4	35.4%	8850.7	64.6%
2009上半年 Q1&2 2009	2676.9	58.3%	1912.1	41.7%
累计 Total	8681.2	26.4%	24263.9	73.6%

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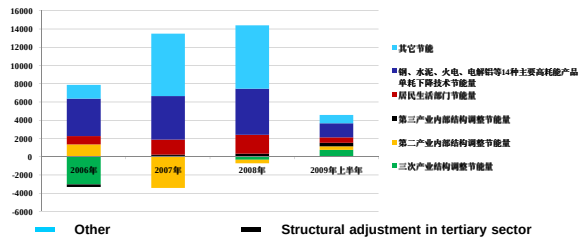
“十一五”期间节能效果评价(1)

Assessment of energy saving work in the 11th FYP period (1)



Other

The 14 main high energy-consuming products

Residential sector

Structural adjustment in tertiary sector

Structural adjustment in secondary sector

Structural adjustment among three sectors

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“十一五”期间节能效果评价(2)
Assessment of energy saving work in the 11th FYP period (2)

- 从总体上看，截止到2009年上半年，结构节能和技术节能对全部节能的贡献率分别为26. 4%和73. 6%；各年度环比技术节能总量稳中有升，对整体节能的贡献率呈逐年下降趋势；各年度环比结构节能总量及其对整体节能的贡献率均呈快速上升势头。

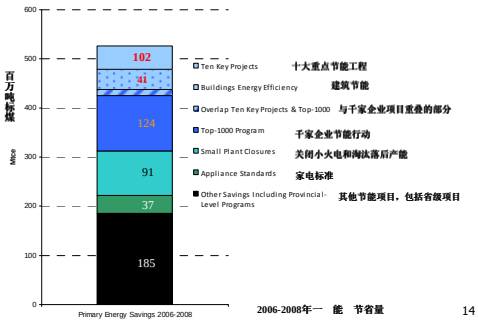
- Overall, the energy saved by structural adjustment and application of technology is 26.4% and 73.6%, respectively, of the total energy saved in the first half of 2009. The year on year relative amount of technology driven energy savings increased slightly and steadily and its contribution to total energy savings decreased annually. The relative amount of structural energy savings each year and the contribution rate of structural energy savings to total energy savings increased quickly year by year.

“十一五”期间节能效果评价(3)
Assessment of energy saving work in the 11th FYP period (3)

- 结构节能的成效主要体现在两个方面：第一，2006-2008年产业结构和行业结构变化对节能的负面影响呈逐年下降趋势，2009年上半年产业结构和行业结构调整对总节能量的贡献率则进一步转变为正1/3左右。第二，子行业结构调整、产品结构调整、特别是产品价值链升级和增加值率提高对结构节能的快速上升起到了决定性的作用。

- The negative effect of structural adjustment among the three industries decreased from 2006 to 2008, and the contribution of structural energy savings turned positive, accounting for about 1/3 of the total energy savings in the first half of 2009. Sub-sector structural adjustment, adjustment of product structure, and especially the upgrading of value chains and the value added rate of products played key roles in the rapid increase in structural energy savings.

“十一五”计划节能目标和当前实现的节能量
2006-2008年，基于维持2005年能源强度不变的基线情景
11th FYP energy saving targets and savings to date, 2006-2008
(based on 2005 efficiency baseline)



研究结果：节能项目
Findings: Energy Saving Programs

目 看 有 能在 现其目标的上， 其节能目标的的节能项目包括：

十大重点节能工程
千家企业节能行
关闭小火电和淘汰落后产
在 建建筑上 节能标准
家电标准和标 项目

有一 项目 有在 现其 定目标的 上：

有建筑
结构调整

Energy efficiency programs that are on track to meet or exceed their energy-saving targets:

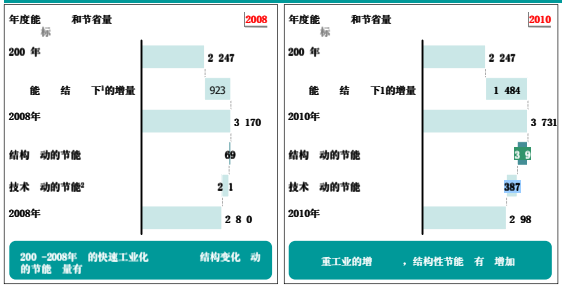
- Ten Key Projects
- Top-1000 Program
- Small Plant Closure Program
- Enforcement of new building energy standards
- Appliance standards and labeling program

Programs not on track to meet targets:

- Building retrofits
- Structural adjustment

据McKinsey分析:2006到2008年，技术性节能占总节能量的~80%，到2010年，这一比例将下降到~50%

关 术 ，
结构性节能， 结构 第一、第二和第 产业及其子产业 和产品结构 子产业中的产品 调整 的节能
技术 动节能， 用 技术 的节能，包括 1 小上大 和 2 程



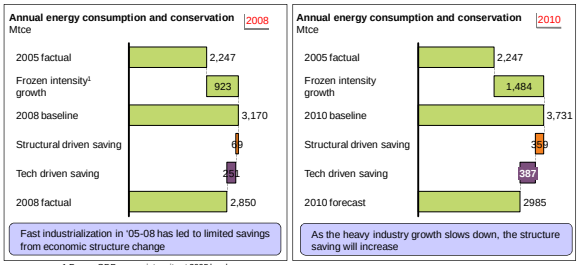
1 能 结在200 年
家 ，
分

Overview

In 2008, savings from technology represents ~80% of the total savings and will account for 50% in 2010

Key terminology:

- **Structural saving**: energy saving from changes in both economic structure (the split of primary, second and tertiary sectors and of the sub-sectors) and product structure (mix of products within the subsector)
- **Technology driven saving**: energy saving from adoption of clean technologies, including 1)"replacing small with large scale" and 2) management process improvement

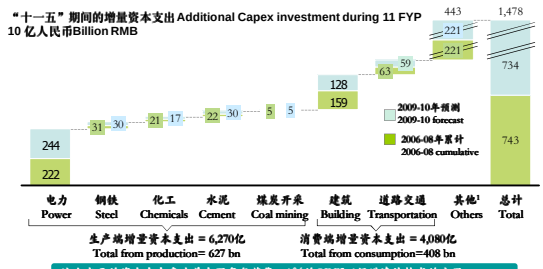


1 Frozen GDP energy intensity at 2005 level

SOURCE: NBS; McKinsey analysis

06-08年中国在节能技术上增量资本支出 达RMB7430亿元, 预期09-10年将再支出7340亿元人民币

China has invested an additional Capex of USD 100 billion in the clean tech sector from 2006-2008, with another USD 100 billion expected in 2009-2010

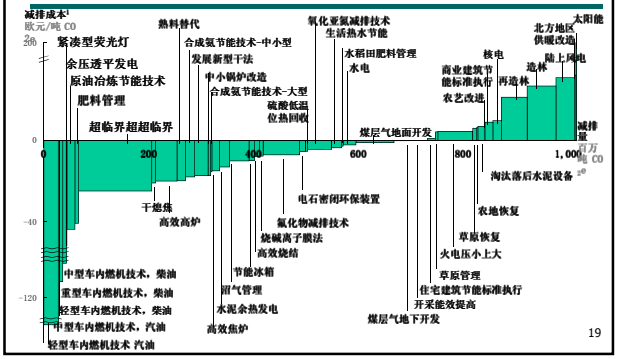


这个水平的资本支出意味着中国每年花费一1%的GDP2以促进清洁技术的应用
Additional Capex investment at this level means China has spent ~1% of its GDP2 every year to induce clean tech adoption

1 来自于其他34个行业部门的增量资本支出，外推数字1 Incremental CAPEX from other 34 sectors, extrapolated number
2 中国2008年GDP，30万亿人民币2 China GDP in 2008: RMB 30,067 bn

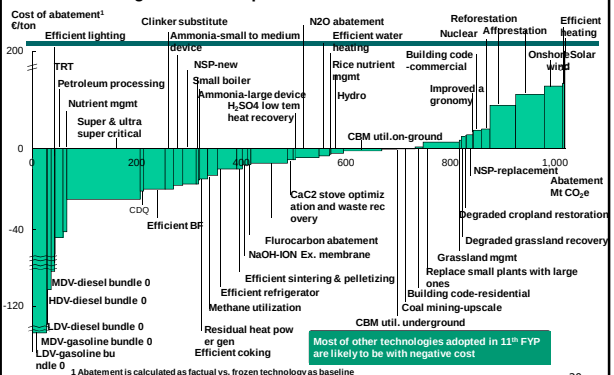
资料来源：麦肯锡分析SOURCE: McKinsey

这些技术加上农林业的减排措施 合计能够在2010年贡献~1GT的温室气体减排



Technology saving

Combined with the efforts in agriculture and forestry these technologies would help abate ~1 Gt GHG in 2010



1 Abatement is calculated as factual vs. frozen technology as baseline
Source: McKinsey analysis

"十二五"应设明确节能目标(参考值18%)(1)

Explicit energy savings target should be made for the 12th FYP (reference value 18%) (1)

◈ 《节约能源法》明确规定："国务院和县级以上地方各级人民政府应当将节能工作纳入国民经济和社会发展规划、年度计划"。

◈ 《节能中长期专项规划》提出："到2010年每万元GDP（1990年不变价）能耗由2002年的 2.68tce下降到2.25tce…2020年每万元GDP能耗下降到1.54 tce"这意味着2020年单位GDP能耗要比2010年下降约1/3 （31.6%）。

- The *Energy Conservation Law* stipulates that "the State Council and local governments above the county level should incorporate energy saving work into the national economic and social development plan and annual plan."
- The *Medium and Long-term Energy Saving Plan* stipulates that energy consumption per 10,000 yuan GDP (1990 constant price) in 2020 should be decreased to 1.54tce, which means that energy consumption per 10,000 yuan GDP (1990 constant price) in 2020 should be lowered by about 1/3 based on 2010 level.

"十二五"应设明确节能目标(参考值18%)(2)

Explicit energy savings target should be made for the 12th FYP (reference value 18%) (2)

能效状况（黑）和目标（红） Current situation（Black）and Target（Red）	2002年 Year	2005年 Year	2010年 Year	2015年 Year	2020年 Year
《节能中长期专项规划》目标（tce/万元，1990年不变价） Target in Medium-term and Long-term energy-saving special plan（tce/10k yuan, 1990 constant price）	2.68		2.25		1.54
《节能中长期专项规划》目标（tce/万元，2005年不变价） Target in Medium-term and Long-term energy-saving special plan（tce/10k yuan，2005 constant price）	1.157		0.9709		0.6646 (31.6%)
《十一五规划》降低目标（tce/万元，2005年不变价） Target in 11th FYP（tce/10k yuan，2005 constant price）		1.226	0.9808（20%）		(32.2%)
《十二五规划》降低目标（tce/万元，2005年不变价） Target in 12th FYP（tce/10k yuan，2005 constant price）				?	

"十二五"应设明确节能目标(参考值18%)(3)

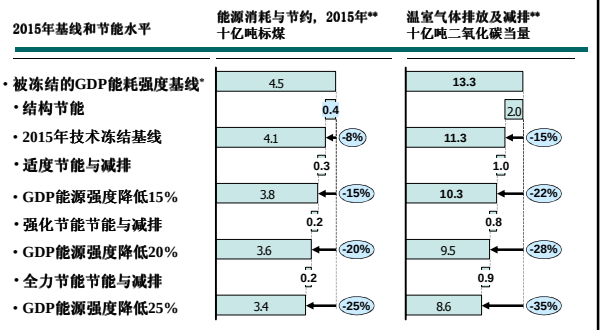
Explicit energy savings target should be made for the 12th FYP (reference value 18%) (3)

◈ 如果"十一五"能源强度按计划降低20%，则基本完成《节能中长期专项规划》的预期目标。即便如此，2020年的能源强度也要在2010年下降20%的基础上，再下降32.2%。为此，"十二五"、"十三五"期间能源强度需要各自下降约18%。

◈ 因此，"十二五"期间节能目标的参考值应该是18%左右。

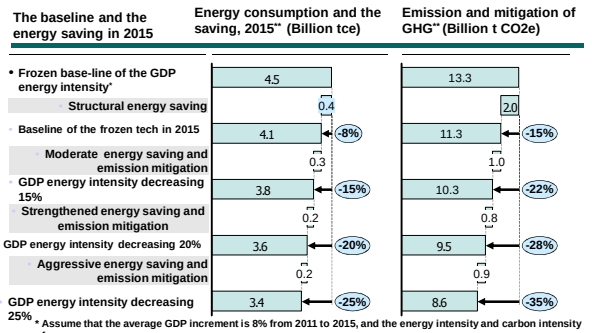
- **In order to achieve the goals of China's mid- and long-term energy conservation plan, even if the 20% target in 11th FYP could be achieved, it would still require an energy intensity reduction of 32.2% by 2020 based on 2010 baseline. GDP energy intensity in the 12th and 13th FYPs need to drop off about 18% each.**
- **Therefore, the reference target we recommend for the 12th FYP is 18%.**

中国十二五期间不同节能目标的分析



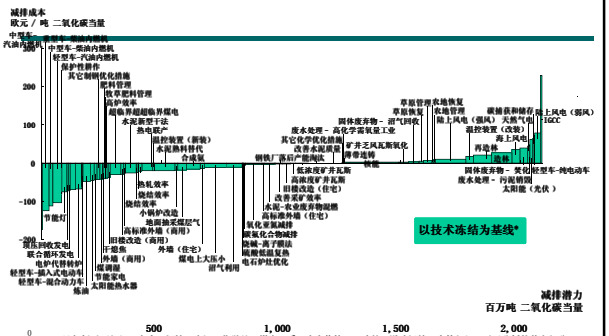
* 假设从2011年到2015年GDP平均增长约8%而能源/碳强度被冻结
** 节能和碳减排的差距主要来自于在可再生能源和非能源减排技术的因素
资料来源：“十二五”成本曲线模型；专家访谈；小组分析

Analysis of three different energy conservation targets of China's 12th FYP



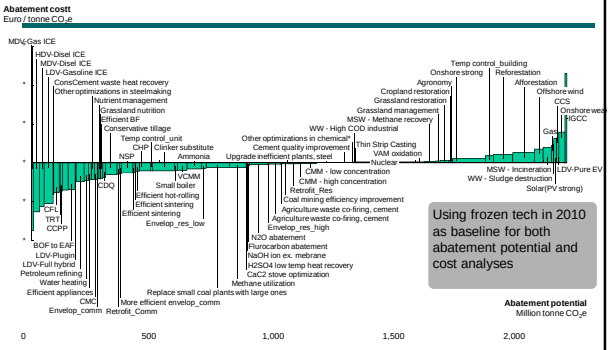
* Assume that the average GDP increment is 8% from 2011 to 2015, and the energy intensity and carbon intensity frozen
** The main difference between the energy saving and the carbon emission mitigation comes from the renewable energy and the non-energy carbon emission mitigation technologies.
Resources: the cost-curve model of the 12th FYP, interviews with the professionals

2015年温室气体减排技术的成本曲线



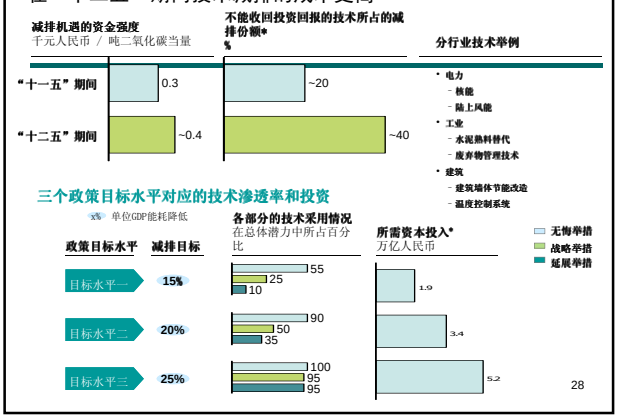
* 只包括以下部门：电力、钢铁、水泥、化学品、煤炭开采、废弃物管理、建筑、道路运输、农林部门，对于分析的其它部分潜力可能推算至其它部门，大多数都是工业部门
资料来源：“十二五”成本曲线模型；专家访谈；小组分析

GHG abatement Cost Curve in in 12th FYP

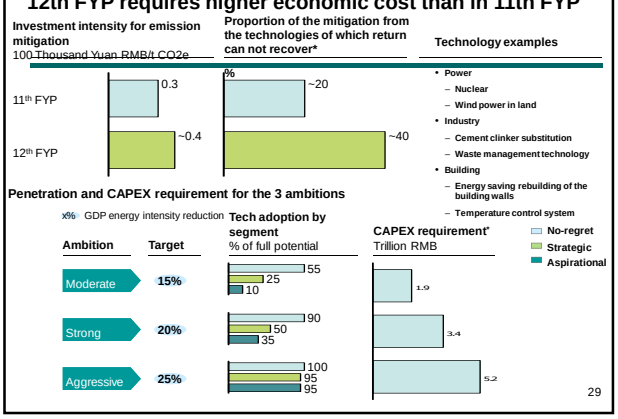


Source: 12th FYP cost curve model; expert interview; team analysis

在“十二五”期间技术减排的成本更高



Capturing technology potential during 12th FYP requires higher economic cost than in 11th FYP



对“十二五”期间节能政策的建议(1)
Energy Saving Policy Proposals for the 12th FYP (1)

1. **继续设定量化的约束性节能目标18%～20%。**
2. **更加倚重结构节能，积极转变发展方式，将产业价值链升级和增加值率提高作为结构调整的基本方向，出台更为有力的促进服务业和高技术制造业快速发展的政策措施。**

1. **Continue to make explicit mandatory energy savings goals of 18%~20% decrease in unit GDP energy consumption.**
2. **Put additional effort into structural energy savings, change the development path, and make upgrading of value chains and value added rates of products the major emphasis of structural adjustment. Implement more powerful policies and measures to promote the development of the service industry and the high-tech industry.**

对“十二五”期间节能政策的建议(2)
Energy Saving Policy Proposals for the 12th FYP (2)

3. **完善并严格执行高耗能产业总量限制政策，对新增产能要提高能耗标准，对现有产能要深化能效对标和技术改造，对落后产能要坚决淘汰。**
4. **对行之有效的鼓励节能技术应用和推广的政策法规继续保持，加强节能技术和节能管理体系信息的交流推广。**
5. **对新增产能应当严格采取等量淘汰落后产能的方式。**

3. **Improve and strictly execute high energy- consumption industry capacity restriction policies. Raise energy consumption standards for the new capacity, strengthen energy efficiency benchmarking and technology innovation for the current capacity, and be vigilant in closing inefficient capacity.**
4. **Keep effective energy efficiency policies that promote energy efficient technologies and enhance the capacity for dissemination of the technologies and energy management information.**
5. **Take out an equal amount of inefficient capacity when new capacity is built.**

谢谢！
Thank you!