13th Five-year Plan and Medium-and-Long term Energy Development Strategy of China

Prof. Yande Dai
Energy Research Institute of National Development and Reform Commission
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Present Situation of Social-economic and Energy Development in China
Economic Development entered “New Normal Status”
-- High-speed economic growth sustained for more than 30 years

For more than thirty years after the reform and opening-up, China's economy continues to grow at high speed. The GDP growth has rapidly increased from RMB 454.6 billion in 1980 to RMB 67.7 trillion in 2015, with annual GDP growth rate about 10%

Since 2010, the economic growth rate began to enter a slow down channel. Year 2015 was defined as starting year of the “New Normal Status”
Economic Development entered “New Normal Status”

The breakneck growth of energy-intensive products (except non-ferrous metals) has stalled, turning negative in 2015. These industries exist a huge over-capacity problem due to lack of demand at present. Decapacity, which also brought a series of social problems, has become difficulties of the economic operation.

Main energy-intensive products’ annual average growth from 2001 to 2015:

- Sulfuric acid: 9.1%
- Caustic soda: 10.6%
- Ethylene: 9.0%
- Cement: 10.7%
- Plate glass: 9.7%
- Crude steel: 13%
- Non-ferrous: 13.6%

Non-ferrous: 50.9 million tons
Crude steel: 800 million tons
Caustic soda: 30.3 million tons
Plate glass: 740 million weight case
Cement: 23.5 billion tons
Ethylene: 17.2 million tons
Sulfuric acid: 89.8 million tons
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The economy of Liaoning province presented negative growth in the first quarter of 2016.

Traditional industries existed widespread losses

- nearly half of cement plant cannot sell profitably in 2015

Iron and steel enterprises once appear the phenomenon of industry-wide losses. The total liabilities of the whole steel industry is more than 3 trillion yuan, the average asset-liability ratio is about 70%

The provincial fiscal revenue growth fell

- Negative growth: Shanxi, Heilongjiang, Liaoning province

Average annual energy consumption growth is 3.6% during 12th five year, lower than half of the growth during 11th five year, the growth is even lower than one percent in 2015.

Annual energy consumption reduced quickly, the amount is just 40 million tons, lower than one-sixth of that in 2011.

Elasticity coefficient of energy consumption has a great change:
- 2002-2005: 1.0
- 2006-2010: 0.59
- 2015: 0.13

With “New Normal Status” of Economic Development, “New Phenomenon” of energy development appeared in China---weak energy consumption growth, and economic development is reducing reliance on energy demand.
With “New Normal Status” of Economic Development, “New Phenomenon” of energy development appeared in China

--- a turn on the coal consumption, including production, import, and consumption

- The production of coal begin to decline (3.97 billion tons in 2012 → 3.75 billion tons in 2015)
- The import of coal begin to decline (320 million tons in 2013 → 200 million tons in 2015)
- The coal consumption decreased for two consecutive years, which is 3.7% lower than the year earlier

Coal consumption from 1980 to 2015

The Chinese proportion of the world coal consumption

Coal production from 1990 to 2015

Cola net import since 2009

Average annual coal production growth is 6.9% from 2001 to 2015
China itself accounted for 46.9% of world coal production in 2014
With “New Normal Status” of Economic Development, “New Phenomenon” of energy development appeared in China

Coal demand will continue to decline according to coal consumption structure. This trend will hopefully improve the regional environment and reduce GHG emissions.

- Coal consumption rate of thermal power is 315 gce/kWh in 2015, the target of 2020 is 300 gce/kWh, the utilization hour of generation of thermal power may fall further.
- Over-capacity: steel, building material (30%)
- Regional environmental improvement: from coal to natural gas.

Coal consumption structure in 2014

- Coal consumption rate of thermal power is 315 gce/kWh in 2015, the target of 2020 is 300 gce/kWh, the utilization hour of generation of thermal power may fall further.
- Over-capacity: steel, building material (30%)
- Regional environmental improvement: from coal to natural gas.

Note: coal consumption of thermal power contain heat supply
Data sources: Wang Qingyi

The utilization hour of generation of thermal power from 2001 to 2015

4329h in 2015
With “New Normal Status” of Economic Development, “New Phenomenon” of energy development appeared in China

---Natural gas consumption maintain rapid growth and keep a steady rise in proportion of primary energy consumption

Average annual growth of natural gas consumption is 14.7% from 2000 to 2015, the amount of natural gas consumption is 191 billion cubic metres in 2015.

Natural gas keep a steady rise in proportion of primary energy consumption
With “New Normal Status” of Economic Development, “New Phenomenon” of energy development appeared in China

--- renewable energy gained rapid development

- In 2015, the generation capacity of wind and solar power have added 31.4 million kW, 16.7 million kW, respectively, growth 32.5%, 67.3%
- Renewable energy proportion of primary energy consumption is 11.8% (12% including nuclear power), exceeded the target of 12th plan (11.4%)

Utilization amount of renewable energy

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Generation capacity of hydropower

Average annual growth is 10.5% from 2005 to 2015

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Generation capacity of wind power

- Added 31.4 million kW in 2015
- Average annual growth is 53.3% from 2007 to 2015

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Generation capacity of solar power

- Added 16.7 million kW in 2015
- Average annual growth is 112.5% from 2007 to 2015

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<td>28</td>
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<td>341</td>
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<td>2486</td>
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With “New Normal Status” of Economic Development, “New Phenomenon” of energy development appeared in China —— nuclear power gained rapid growth

- Nuclear unit under operation: 30 (up to Apr 2016), total capacity: 28.6 million kW (1.9%)
- Nuclear generation in 2015: 169.5 billion kWh (3%), year-on-year growth 27.2%
- Nuclear unit under construction: 25 (up to Apr 2016), total capacity: 28.09 million kW

Generation capacity of nuclear power

Nuclear power generation

Source: China Nuclear Energy Industry Association

Source: China Electricity Council (CEC) & China Energy Statistical yearbook 2015

Generation capacity of nuclear power under construction

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Problems and Challenges faced

Although New Phenomenon had appeared, but the accumulated environmental problems was not solved
Problems and Challenges faced

--- Although the economy develops at fast speed and with great gross, the economic development is low in level and imbalanced.

Per capita GDP of Main Countries and Regions in the World in 2014

- Per capita GDP is less than the world average level of 80% and one-fourths of high-income countries;
- Domestically, it is still very different among the eastern, central and western regions and between rural and urban areas. The per capita income in rural areas is less than 40% of urban residents. The population of 82.49 million nationwide is still living below the standard line for rural poverty alleviation (per capita annual income is RMB 2300 (at the fixed price in 2010);
- The gross energy consumption reaches 4.3 billion tons of standard coal in 2015 but some rural areas are still using traditional biomass energy. The consumption exceeds 250 million tons of standard coal.
Problems and Challenges faced
--Overwhelmed environmental pollution

The overall ecological environment deterioration are not fundamental change: Solid waste, automobile exhaust, persistent organic, heavy metal

Air pollution
- Haze is sweeping the most areas in the central and eastern regions.
- Among 161 cities at the level of prefecture and above monitored in 2014, more than 90% of the cities are out of limits in air quality.
- Among 470 cities covering precipitation monitoring in 2014, more than 44.3% of the cities are impacted by acid rain

Land pollution
- The national soil pollutant over standard rate is up to 16.1%.
- The nationwide water and soil loss area accounts for nearly 1/3 of the national territorial area
- The desertification soil area accounts for nearly 1/5 of the total national territorial area

Water pollution
- Among the ten water basins in China, the water quality worsen than Grade V in three water basins exceeds; in which, the Haihe River is nearly 40%.
- Groundwater pollution has worsened continuously, 61.5% of the groundwater quality is poor or very poor, only 10.8% of that is good

Ocean pollution
- The results of China oceanographic survey in 2012 suggest that, 48 estuaries nationwide have been polluted by heavy metal, DDT, and petroleum hydrocarbon.
Problems and Challenges faced
-- Ever complicated deterioration of ecological environment

The environmental situation in China is characterized by compression type, superimposed type, compound type, and disaster type.
- Environmental pollution is shifting from urban areas to rural areas;
- Shifting from densely populated and economically developed regions to sparsely populated and economically underdeveloped regions;
- Shifting from conventional pollution to unconventional pollution and toxic and harmful pollution;
- Spreading from local to area;
- Extending from urban section of rivers to basins;
- Evolving from shallow level to deep-level environmental problems
Problems and Challenges Faced
-----Marine ecological environment is especially worrying

Chinese marine ecological environment is especially worrying, according to a eight-year survey by the State Oceanic Administration (SOA) from 2004 to 2012

- The Marine pollutant emissions continue to rise over the past ten years, and more than three quarters of the emissions didn’t meet the standards. The eutrophication of coastal waters in China increase due to heavy metals, DDT, petroleum hydrocarbons and chemical fertilizer.
- Red tides occur 83 times per year on average in the past two decades, and caused a loss of 1.3 billion yuan in 2008.
- Compared with the 1950s, the mangrove forests of China dropped a 73 percent, corals dropped a 80 percent, coastal wetlands dropped a 57 percent.
- The coastal fishery resources will be drastically reduced, such as krill, little yellow croaker, etc.
The first China national soil pollution condition survey was carried out from 2005 to 2013. The results show that the national soil environmental situation is not optimistic.

The exceeding rate of the soil pollutant is 16.1%, the ratio of high level pollution area is 1.1%

The soil environment is warrying, the over-standard rate is 20% based on soil tests (heavy pollution proportion is 1.1%)

Industrial and mining land soil environmental problems highlight. More than a third of soil pollutants exceeds standards in Heavy polluting enterprises and their surrounding, industrial wasteland, mining area, 36.3%, 34.9%, and 33.4% respectively (29.4% in industrial park; 26.4% in sewage irrigation areas; 23.6% in oil producing region; 21.3% in Solid waste centralized processing field 21.3%; 20.3% On both sides of highways)

Inorganic pollutants are the main sources of soil pollution, accounting for 82.8%.

The soil pollution in South China is more serious than that in North China. Heavily polluted area: Yangtze River delta, Pearl River delta, Northeast China old industrial base, etc. Heavy metal polluted areas: the Southwest, Central South Regions
Problems and Challenges Faced
---Fog & haze weather became more and more serious

Since 2013, Fog & haze weather was being of much wider coverage, more frequency, longer duration, and higher PM2.5 density.

PM2.5 average density on Jan 3, 2016

Fog & haze in part of months in Beijing Since 2013

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Days from Nov to Dec</th>
<th>Longest Duration</th>
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</thead>
<tbody>
<tr>
<td>2013</td>
<td>11-12</td>
<td>10</td>
<td>3 days</td>
</tr>
<tr>
<td>2014</td>
<td>11-12</td>
<td>13</td>
<td>3 days</td>
</tr>
<tr>
<td>2015</td>
<td>11-12</td>
<td>28</td>
<td>8 days</td>
</tr>
</tbody>
</table>

PM2.5 daily average density from Jan 28, 2013 to May 26, 2016 in Beijing

Sky in May, 2016
Sky in Nov and Dec, 2015

Beijing: CCTV tower launched
Shanghai: East Pearl Tower launched
Fog & haze became even worse

--- Much wider coverage

PM2.5 average density on Jan 3, 2016
Fog & haze became even worse  
--- more frequency, and longer duration

Fog & haze happened more and more frequently, and became normalized
- Since November, heavy fog & haze happened often in Beijing. And there were 28 days fog & haze from Nov to Dec in 2015.
- It was fog & haze at the first 3 days of 2016.

Duration of each fog & haze was longer and longer. The longest duration was **8 days** in December in Beijing, and it was almost **2 weeks** in north-east China.

### Fog & haze in part of months in Beijing Since 2013
(Yellow column means fog & haze weather)

<table>
<thead>
<tr>
<th>Year</th>
<th>November-December Days</th>
<th>Longest Duration</th>
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<tbody>
<tr>
<td>2013</td>
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<tr>
<td>2014</td>
<td>13 days</td>
<td>3 days</td>
</tr>
<tr>
<td>2015</td>
<td>28 days</td>
<td>8 days</td>
</tr>
</tbody>
</table>

Source: Collection according to the happened weather data
Fog & haze became even worse
---PM2.5 density was often over measurement of the device

There were more and more days the PM2.5 daily average density of which was more than the standard (70 μg/m³)

The top level in Beijing was nearly 500 μg/m³. Sometimes somewhere the instantaneous PM2.5 density was over 500 μg/m³ and it was also reported over 1000 μg/m³

PM2.5 daily average density from Jan 28 2013 to May 26, 2016 in Beijing

Source: Collection according to the happened weather data
Present Situation and Trend of Energy Consumption

With high gross, low per capita consumption, coal dominated, the proportion of low-carbon clean energy remains low while the external dependence of oil and natural gas is very high.

Gross primary energy consumption (100 million tons of standard coal)

The energy consumption structure remains dominated by coal, but the proportion continues to decline. Coal accounts for approximately 64% of the gross primary energy consumption in 2015. Relatively low-carbon clean energy such as oil, natural gas and non-fossil energy only accounts for 36%.

Gross primary energy consumption is 4.3 billion tons tce in 2015. In which,
- Coal consumption is approx. 3.97 billion tons, decreased in last two years;
- Crude oil consumption is approx. 540 million tons; the external dependence approaches 60%;
- Natural gas consumption is approx.191.0 billion m³;
- Total electricity consumption is approximately 5.55 trillion kWh, with 0.5% increase

Source of data: State Statistics Bureau, BP, World Bank
Long term energy demand and emission sustainable energy scenarios
Present Situation of Social and Economic Development
--- Although the economy develops at fast speed and with great gross, the economic development is low in level and imbalanced.

- The economy has grown at continued high speed for more than 30 years and the annual growth rate approaches 10%;
- The economic aggregate reaches RMB 67.7 trillion in 2015, ranking the second in the world.

The graph shows the GDP growth over the years from 1980 to 2015. The annual growth rates are as follows:

- 1980-1985: 10.7%
- 1985-1990: 7.9%
- 1990-1995: 9.3%
- 1995-2000: 12.3%
- 2000-2005: 8.6%
- 2005-2010: 9.8%
- 2010-2015: 11.2%

- Per capita GDP is about US$ 7700 in 2015, less than the world average level of 80% and one-third of high-income countries;
- Urbanization rate is 56.1% in 2015; rural population is 600 million;
- Car ownership is approximately 118/1000 persons, about 60% of the world average level, less than 25% of the developed countries;
- Per capita housing area is 70% of the developed countries;
- Per capita power generation is less than a half of the average level in OECD countries.
Objective of Middle and Long-term Social and Economic Development

- Realize the objective of an overall well-off society by 2020: Economic development (per capita GDP doubled, income doubled), democracy strengthened, science and education advance, culture prosperity, social harmony, and ecological civilization.

- Basically complete industrialization by 2030
  - Achieve considerable degree of urbanization;
  - Basically complete infrastructure construction;
  - The output of the products in high-energy consumption industries will be greatly reduced.

- The economic and social development by 2050 will reach the level of medium-developed countries at that time.
  - Live in comfort
  - Convenient transportation
  - Green water and blue sky

Chinese Dream
Energy demand for modernization would more than double or treble, following current developed countries’ path.

- **Energy demand scenario according to per capita energy consumption level in OECD countries**

- **Energy demand scenario according to the per capita energy consumption level in Japan**

If reaching the per capita energy consumption level in OECD countries, the gross energy consumption by 2050 will be nearly 11.6 billion tce by 2050, 3.2 times of the gross energy consumption in 2010.

Even if reaches the level in Japan, which is the highest energy efficiency level of the world today, the gross energy consumption will be 8.5 billion tce by 2050, 2.4 times of that in 2010.

- **Using Chinese power plant coal consumption method**

Note: The data are those in 2014 for China.
Energy Demand Scenario for 2050: Achieving Pollutants Reduction Targets

- Energy demand scenario according to per capita energy consumption level in OECD countries
  - Energy demand scenario if achieving environmental target

11.6 billion tce

6.6 billion tce

To realize the scene of clear water and sky, the gross energy consumption shall be controlled within 5 billion tce.

In this scenario, the gross energy consumption is only increased by approximately 0.7 billion tons on the basis of current energy consumption.

- The per capita energy consumption is 54% lower than OECD countries, and 38% lower than Japan.
- The energy-saving capability of 6.6 billion tons shall be formed.
- This can fundamentally reverse the current environmental situation.
- The challenges are very serious. The energy utilization efficiency should be greatly improved.

Note: The data are those in 2014 for China.

Annual per capita primary energy consumption in 2013 (tce/person)

- USA
- France
- South Korea
- Russia
- Germany
- Japan
- China
- OECD
- World

Using Chinese power plant coal consumption method

3.61 billion tce in 2010

0.6 billion tce in 1980
RIGOROUS AND INNOVATIVE SOLUTIONS TO IDENTIFY A LOW CARBON PATHWAY

6 × GDP
Chinese economy increases 6 times by 2050

+36% Primary Energy
Using about the same amount of energy as today

57% non-emitting*
Over half from non-fossil energy

¥22 Trillion net benefit
Requires ¥46 Trillion investment for ¥68 Trillion benefit, excluding environmental gains

100%
Technically feasible, cost-effective and socially acceptable
REINVENTING FIRE RESULTS (result of Sino-US joint research)

Primary energy demand increase 36% only. Compared to REF Scenario, energy demand could reduce 45%, which equals to 4.73 billion tce.

Decoupling due to improving energy efficiency

High penetration of low carbon energy

Primary Energy Demand
Mtce

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-45%

Primary Energy Demand Mtce

- Coal: 20% in 2050Ref, 23% in 2050RF
- Nuclear: 10% in 2050Ref, 13% in 2050RF
- Wind: 9% in 2050Ref, 13% in 2050RF
- Solar: 7% in 2050Ref, 10% in 2050RF
- Oil & Gas: 41% in 2050Ref, 28% in 2050RF
- Hydro: 6% in 2050Ref, 13% in 2050RF

IEEJ June 2016 © IEEJ2016
Reinventing Fire: Sector Contributions and Roadmaps

Primary energy demand (Mtce)

- Industrial structure transformation
- Improve product quality and service life
- Greatly improve technical efficiency
- Material recycling use
- Develop new business types such as Internet of Things, 3D printing, intelligent production, etc.

- Improve building energy efficiency
- Integrated design: Passive house
- Ultra-high-efficient electrical appliance
- Intelligent electrical appliance
- Distributed renewable
- Strengthen urban and rural planning
- Rational lifestyle

- Optimize development, reduce demand for transportation
- Construct railway and public transport as basic transportation system
- Truck up-sizing
- Automobile automation
- Logistics optimization
- Demand-side response

- Improve coal-fired power generation efficiency
- Develop renewable energy
- Steadily develop nuclear power
- Construct intelligent and flexible power grid
- Construct railway and public transport as basic transportation system

2050 Reference  Industry  Buildings  Transportation Transformation  2050 RF

Primary energy demand (Mtce):

- 10,500
- 2020
- 1164
- 966
- 550
- 5,800

-45%
Overall roadmap

- 2010
  -一次能源消费量: 33.7亿tce
  -氢能强度下降率: 19.1%
  -能源结构绿色低碳化: 81%
  -SO₂排放: 2165万t

- 2020
  -一次能源消费量: 48.7亿tce
  -氢能强度下降率: 34%
  -能源结构绿色低碳化: 90%
  -SO₂排放: 1554万t
  -工业能源消费比重: 11.5%
  -CO₂排放: 86亿t

- 2030
  -一次能源消费量: 52.5亿tce
  -氢能强度下降率: 58%
  -能源结构绿色低碳化: 95%
  -SO₂排放: 919万t
  -CO₂排放: 106亿t

- 2040
  -一次能源消费量: 50.0亿tce
  -氢能强度下降率: 70%
  -能源结构绿色低碳化: 100%
  -SO₂排放: 518万t
  -CO₂排放: 110亿t

- 2050
  -一次能源消费量: 38.2亿tce
  -氢能强度下降率: 70%
  -能源结构绿色低碳化: 100%
  -SO₂排放: 308万t

- 2010
  -工业能源消费比重: 80%
  -能源消费结构: 70%

- 2020
  -工业能源消费比重: 90%
  -能源消费结构: 80%

- 2030
  -工业能源消费比重: 100%
  -能源消费结构: 90%

- 2040
  -工业能源消费比重: 100%
  -能源消费结构: 100%

- 2050
  -工业能源消费比重: 100%
  -能源消费结构: 100%
Industry roadmap

2010-2020: Reach an early peak through stock upgrade and incremental capacity control
2020-2030: Scale up ecological industrial parks and integrative factories
2030-2050: Fundamental reform with intelligent technologies
### Building roadmap

**2010-2020:** Transform urbanization pattern, improve standards system

**2020-2030:** Promote ultra-low energy building

**2030-2050:** Reach high-efficient, clean and intelligent energy use

#### 2010-2050

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<td>12%</td>
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<td>50%</td>
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<tr>
<td>一体化和被动式设计</td>
<td>新建城镇住宅中被动房占比</td>
<td>0%</td>
<td>10%</td>
<td>27%</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>农村住宅中近零能耗建筑占比</td>
<td>0%</td>
<td>1%</td>
<td>12%</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>新建公共建筑中超低能耗建筑占比</td>
<td>0%</td>
<td>10%</td>
<td>25%</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>城镇住宅/公建总改造率 - 北方</td>
<td>2%/0%</td>
<td>35%</td>
<td>55%</td>
<td>67%</td>
</tr>
<tr>
<td></td>
<td>城镇住宅/公建总改造率 - 过渡区和南方</td>
<td>2%/0%</td>
<td>10%</td>
<td>25%</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>城镇住宅/公建深度改造率</td>
<td>0%</td>
<td>29%</td>
<td>45%</td>
<td>67%</td>
</tr>
<tr>
<td>提高系统和设备效率</td>
<td>超高效用能系统和设备普及率</td>
<td>0%</td>
<td>25%</td>
<td>50%</td>
<td>75%</td>
</tr>
<tr>
<td>终端用能清洁化</td>
<td>城镇住宅太阳能热水器普及率</td>
<td>17%</td>
<td>25%</td>
<td>34%</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td>公共建筑太阳能热水器普及率</td>
<td>0%</td>
<td>9%</td>
<td>18%</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>城镇住宅电炊具普及率</td>
<td>4%</td>
<td>18%</td>
<td>32%</td>
<td>46%</td>
</tr>
<tr>
<td></td>
<td>农村住宅电炊具普及率</td>
<td>6%</td>
<td>18%</td>
<td>31%</td>
<td>43%</td>
</tr>
</tbody>
</table>
Transportation roadmap

2010-2020: Accelerate development of public transit system, and upgrade fuel economy standards remarkably.

2020-2030: Infrastructure system centering on railway and public transit, with electric vehicles widely adopted.

2030-2050: Modernize transportation system to world-class.
Electricity roadmap

2010-2020: Upgrade coal-fire plants, reaching an early pollutants emission peak
2020-2030: Reach early peak of carbon through rapid deployment of non-fossil power plants
2030-2050: Construct a modernized, low-carbon, smart electricity system
Investment and Savings to Produce Reinventing Fire result

**Economic results**

- Accounts for “hard” costs and benefits: upfront capital, ongoing operations, and maintenance costs
- Excludes external costs such as the costs of pollution or public health; also excludes transaction or program costs
- Shows that China can realize the Reinventing Fire Scenario at a profit; an upfront cost of 46 Trillion RMB secures 68 Trillion RMB in savings, with 22 Trillion RMB NPV
- Highlights opportunity for markets to support investment in helping drive the transformation, supplementing traditional government policies

**Net Present Value to Chinese Economy**

<table>
<thead>
<tr>
<th>Trillion RMB</th>
<th>Transportation</th>
<th>Industry</th>
<th>Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>-60</td>
<td>-40</td>
<td>-20</td>
</tr>
<tr>
<td>Fuel Savings</td>
<td>20</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Net</td>
<td>20</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

Note: Transformation costs and benefits are embedded in demand sectors through fuel prices.
Reinventing FIRE $\text{SO}_2$ and $\text{NO}_x$, reductions by 85% and 90% in 2050

Energy-Related Sulfur Dioxide and Nitrogen Oxides Air Emissions
10,000 Metric Tons
Energy Transformation and Green Development Strategy
Energy Transformation and Green Development Strategy

Energy transformation and green development is a long process and cannot be accomplished in a single day. It must be advanced continuously, comprehensively, and systematically.

- **In development mode** (direct/indirect exportation consumed 20% of energy in China, short building life wasted 15% of energy in lifetime)
  - Adjust economic structure and transform the economic growth pattern
  - Improve the quality of economic growth and reduce cyclic waste

- **In supply mode** (share of clean energy 15% ➔ 20% ➔ 50%)
  - Strive for shaking off the high dependence on traditional high-carbon energy -- energetically develop low-carbon/no-carbon continuously regenerating, sustainably utilized non-fossil energy.

- **In consumption mode** (from 116/85 ➔ 50)
  - Greatly improve efficiency -- reduce demand

- **In living pattern** (simple life)
  - Try to simplify -- reduce demand
Top-level design of medium and long term energy development strategy
---four revolutions and one strenthen.

- Promoting energy consumption revolution, reining in irrational energy use.
- Promoting energy production revolution, establishing a diversified energy system.
- Promoting energy technology revolution, facilitating industrial upgrading.
- Promoting energy institutional revolution.
- Strengthening all-around international cooperation.

While presiding over a meeting of the Central Leading Group on Financial and Economic Affairs in June 13th, 2014, President Xi said, to ensure national energy security, China must promote a revolution of energy production and consumption.
Energy Transformation and Green Development Strategy

-- The central government has promulgated a series of fundamental policies.

The eighteenth National Congress of CPC has been incorporated ecological civilization construction into the “five in one” overall layout including economic construction, political construction, cultural construction, and social construction, and clearly called for making efforts to boost “green development” in the future.

- Stick to the basic state policy of saving resources and protecting environment
- Adhere to the guidelines of saving first, protection first, and giving priority to natural restoration
- Make efforts to advance green development, cyclic development, and low-carbon development

Progressively form the spatial pattern, industrial structure, production mode, and lifestyle of saving resources and protecting environment, reverse the trend of ecological environment deterioration from source, create good production and living environment for the people, and make contribution to global ecological safety.
Energy Transformation and Green Development Strategy
-- The central government has put forward a series of objectives and action plans.

Set the total amount control objective of energy consumption and coal consumption.

Propose the objective of the renewable energy proportion and published the medium and long-term development objective of renewable energy.

Incorporated the objective of energy conservation and emission reduction into the National Five-year Plan as obligatory target, and clearly put forward the energy conservation objective of the Five-year Plan.

Developed the medium and long-term greenhouse gas emission reduction objective and implement the pilot trading of carbon emission permit.
China has announced the emission reduction objective by 2020 to the international community early in 2009; In June 2015, China officially announced the national independent contribution plan for greenhouse gas emission reduction and defines the action objective for dealing with climate change by 2030.

### Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>Objective in 2020</th>
<th>Objective in 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ emission reduction peak value</td>
<td></td>
<td></td>
<td>CO₂ emission will reach peak value by approximately 2030, and strive for reaching peak value.</td>
</tr>
<tr>
<td>Comparing with 2005, reduction of CO₂ emission intensity per unit GDP</td>
<td>33.8%</td>
<td>40%-45%</td>
<td>60%—65%</td>
</tr>
<tr>
<td>Proportion of non-fossil energy in primary energy consumption</td>
<td>11.2%</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>Forest area increased from 2005</td>
<td>21.6 million ha.</td>
<td>40 million ha.</td>
<td></td>
</tr>
<tr>
<td>Forest growing stock increased from 2005</td>
<td>2.188 billion m³</td>
<td>13亿m³</td>
<td>4.5 billion m³</td>
</tr>
</tbody>
</table>
Energy Transformation and Green Development Strategy
--- vigorously Improving energy efficiency and promote energy conservation & pollution reduction

China attaches great importance to energy conservation
China’s energy efficiency is constantly improving

Energy intensity in 2015 decreased by 73% of that in 1980, and decreased by 26% of that in 2000.

<table>
<thead>
<tr>
<th>Year</th>
<th>Energy Intensity Decrease Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990 compares to 1980</td>
<td>32.8%</td>
</tr>
<tr>
<td>2000 compares to 1990</td>
<td>44.8%</td>
</tr>
<tr>
<td>2010 compares to 2000</td>
<td>9.6%</td>
</tr>
<tr>
<td>2015 compares to 2010</td>
<td>18.2%</td>
</tr>
<tr>
<td>2015 compares to 1980</td>
<td>72.6%</td>
</tr>
<tr>
<td>2015 compares to 2000</td>
<td>26.0%</td>
</tr>
</tbody>
</table>

Calculated by energy intensity in 1980, the total energy consumption in 2015 would be 15.7 billion tce, which was 3.6 times of the actual value.

Calculated by energy intensity in 2000, the total energy consumption in 2015 would be 5.8 billion tce, which was 1.4 times of the actual value.
Energy Transformation and Green Development Strategy
-- Vigorously improve energy utilization efficiency and boost energy conservation and emission reduction.

Since “the Eleventh Five-year Plan” period, energy conservation and emission reduction has been incorporated into the National Five-year Plan as obligatory target.

11th FYP: 20%, 12th FYP: 16% 13th FYP: 15%

Summary of Energy Conservation and Emission Reduction Objectives during “the 13th FYP” Period

- The proportion of non-fossil energy in primary energy consumption has been increased to 15%.
- Reduce the per unit GDP energy consumption intensity by 15%;
- Reduce the carbon dioxide emission intensity per unit of GDP by 18%.
- Reduce the gross emission of main pollutants by 10% to 15%;
  - Reduce the emissions of chemical oxygen demand and ammonia nitrogen by 10% respectively;
  - Reduce the emission of sulfur dioxide and nitric oxide by 15% respectively;
- Increase forest growing stock by 16.5 billion m³ and make the forest coverage rate reach 23.04%;
- share of days with good air quality >80%, PM 2.5 decrease 18%;
- share of higher water quality (above grade 3) in land survive > 70%
Energy Transformation and Green Development Strategy
-- Implement the total amount control of energy consumption and coal consumption

The Comprehensive Work Program for Energy Conservation and Emission Reduction during “the Twelfth Five-year Plan” Period printed and distributed by the State Council in August 2011 clearly pointed out “rational control of gross energy consumption”.

The Atmospheric Pollution Prevention and Control Plan released by the State Council in 2013 pointed out that, the regions including Beijing, Tianjin and Hebei, the Yangtze River Delta, and the Pearl River Delta shall strive for realizing the negative growth in gross coal consumption.

The Interim Measures for the Management of Coal Consumption Decrement and Substitution in Key Regions jointly promulgated by six departments including the National Development and Reform Commission, the Ministry of Industry and Information Technology, etc. in January 2015 clearly pointed out the coal decrement objective in Beijing, Tianjin, Hebei, and Shandong in 2017.

By 2017, the coal consumption in Beijing, Tianjin, Hebei, and Shandong shall be reduced by 13 million tons, 10 million tons, 40 million tons, and 20 million tons respectively from 2012. The accumulative reduction is 83.00 million tons.
13th Five-year Plan (FYP) and Green Development
13th FYP and Green Development

-- Strengthening green and low-carbon development & Speeding up the Improvement of ecological environment

‘Improvement in the quality of China’s overall ecological environment’ is firstly taken as an development target.

The main tasks in the treatment of ecological environment are laid out with 1 volume and 7 chapters in 13th five-year period.

Actively responding to global climate change and promoting the conservation and intensive use of resource are 2 of the explicit tasks.

Vol 10 Speeding up the improvement of ecological environment

- Ch42 Accelerating the construction of the main functional areas
- Ch43 Promoting the conservation and intensive use of resource
- Ch44 Increasing the efforts of comprehensive environment treatment
- Ch45 Strengthening ecological protection and restoration
- Ch46 Actively responding to global climate change
- Ch47 Completing the mechanism to safeguard ecological security
- Ch48 Developing the green industry and environmental protection industry
13th FYP and Green Development

Clearly putting forward the 5 new concepts of development, and emphasizing the status and role of green development

Innovation, Coordination, Green, Opening, Sharing

Green, is a necessary condition for ensuring lasting development as well as an important way in which people pursue a better life

- Adhering to the basic state policy of ‘resources conservation and environment protection’, and adhering to sustainable development
- Firmly taking the civilized road with production developing, life rich and ecology friendly
- Accelerating the construction of a resource-saving and environment-friendly society, formatting of a new pattern of modernization where human and nature is harmonious, promoting the construction of beautiful China, and making a new contribute to the global ecological security

Innovation is the primary engine of development

Coordination is an integral aspect of sustained and healthy development

Opening up is the path China must take to achieve prosperity & development

Sharing is the essence of socialism with Chinese characteristics
13th FYP and Green Development
--Strengthening the effect of constraint indicators

Target of annual GDP growth rate is 6.5%

- Cultivated land quantity stays at 1.865 billion Mu
- Land for new construction is less than 32.56 million Mu
- Water intensity decreases by 23%
- Energy intensity decreases by 15%
- CO₂ intensity decreases by 18%
- Share of non-fossil attains 15%
- Emissions of 4 main pollutants decrease by 10%~15%
- Forest coverage attains 23.04%
- Forest stock volume attains 16.5 billion m³
- Good air quality days are over 80%
- PM2.5 density decreases by 18%
- Surface water in good quality is over 70%
- Share of five bad of that is less than 5%
13th FYP and Green Development
--making clear the targets of economy and social development

GDP annual growth rate is 6.5%. Total amount of GDP is over 92.7 trillion ¥ by 2020.

Annual growth rate of total labor productivity is 6.6%. Total labor productivity per capita is over 120 thousand ¥ by 2020.

Value-added Share of service sector attains 56%.

Urbanization rate (for resident population) attains 60%. That for household population attains 45%.

Annual growth rate of disposable income per capita of residents is 6.5%.

New employment in urban area attains more than 50 million.

Poverty population out of poverty in rural area attains more than 55.75 million.
Water intensity decreases by 23%;
Energy intensity decreases by 15%;
CO₂ intensity decreases by 18%;
Share of non-fossil attains 15%;
Emissions of main pollutant decrease by 10%~15%;
    COD and NH₃-N decrease by 10%;
    SO₂ and NOₓ decrease by 15%.
Forest coverage attains 23.04% and its stock volume attains 16.5 billion m³
Good air quality days are over 80% and PM2.5 density decreases by 18%;
Share of surface water in 3-level quality and higher quality is over 70% and share of five bad of that is less than 5%
13th FYP and Green Development

Energy saving amount of 13th FYP is higher than 16% decrease in 12th FYP

- Energy intensity decrease 15% in 13th FYP, CO2 Emission intensity decrease 18%
- If GDP growth rate is 6.5% in 13th FYP, energy saving amount target would be 780 million tce, which is 116% of energy saving amount in the 12th FYP
### 13th FYP and Green Development

---Accelerate the development of energy supply mode to clean low-carbon direction and increase the proportion of clean energy consumption

#### Medium and Long term Development Objective of Renewable Energy

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>2010</th>
<th>2015</th>
<th>2020 Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropower</td>
<td>216 GW</td>
<td>320 GW</td>
<td>420 GW</td>
</tr>
<tr>
<td>In which, conventional hydropower</td>
<td>199GW</td>
<td></td>
<td>350GW</td>
</tr>
<tr>
<td>Pumped storage power station</td>
<td>16.9GW</td>
<td></td>
<td>70GW</td>
</tr>
<tr>
<td>Grid-connected wind power generation</td>
<td>29.6GW</td>
<td>130GW</td>
<td>200GW</td>
</tr>
<tr>
<td>Solar energy utilization</td>
<td>Solar power generation</td>
<td>864 MW</td>
<td>41.58 GW</td>
</tr>
<tr>
<td></td>
<td>Solar water heater</td>
<td>220 Mil m²</td>
<td>440 Mil m²</td>
</tr>
<tr>
<td>Biomass power generation</td>
<td>5.50GW</td>
<td>10.31 GW</td>
<td>30GW</td>
</tr>
</tbody>
</table>
13th FYP and Green Development

Coal consumption peak before 2020. CO$_2$ emission peak before 2030.

Fossil energy consumption and total energy consumption peak by 2040.

By 2050, total energy consumption is slightly higher than the current level.

- Vigorously promoting energy conservation
  - Implementing "one-link and double-control " mechanism
  - Assessment on energy total consumption and intensity simultaneously
  - relative permit allocation and trading

- Strengthening the capacity of domestic oil& gas supply
  - Production of shale gas and coal-bed methane attains respectively 30 billion m$^3$

- Making use of coal in a more clean and efficient manner
  - Coal use standard of new-built coal power is less than 300 gce/kwh and the pollutant emission standard of it is almost the same with that of gas power

- Increasing the share of renewable energy to 15%
  - Hydro power: 420GW, Wind power: 200GW, Solar power: 100GW

- Developing nuclear power safely
  - Nuclear power generation capacity attains 58GW by 2020

Energy efficiency is the key
Thank you for your attention!

daiyande@eri.org.cn

谢谢！

Energy Research Institute