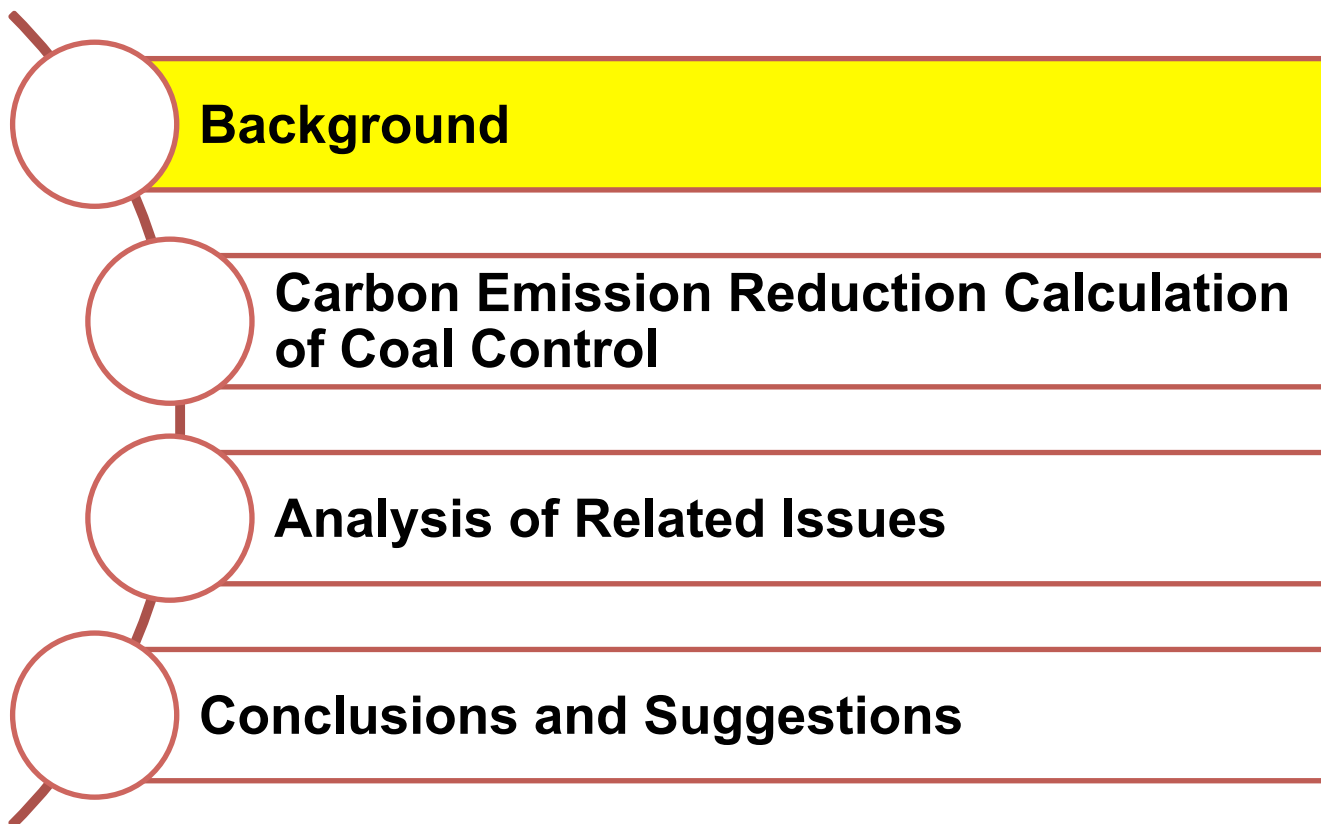


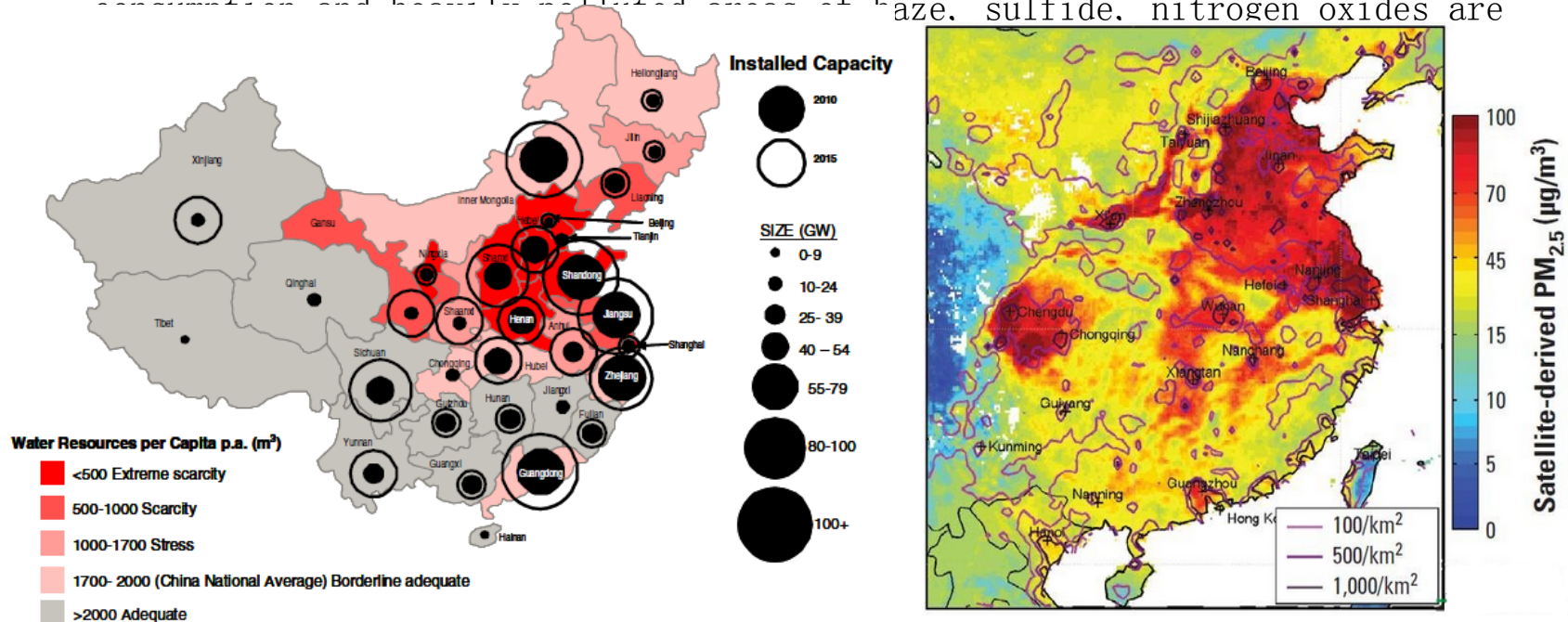
# Outline

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# Aggravated China's Air Pollution Problems

- Since 2012, most areas of China **have been** outbreak of large-scale and long-lasting haze.
- The pollution level and scope of influence are unprecedented, **and the pollution is not end.**
- Coal and fuel **combustion emission is the main reason.** The regions of coal consumption and heavily polluted areas of haze, sulfide, nitrogen oxides are

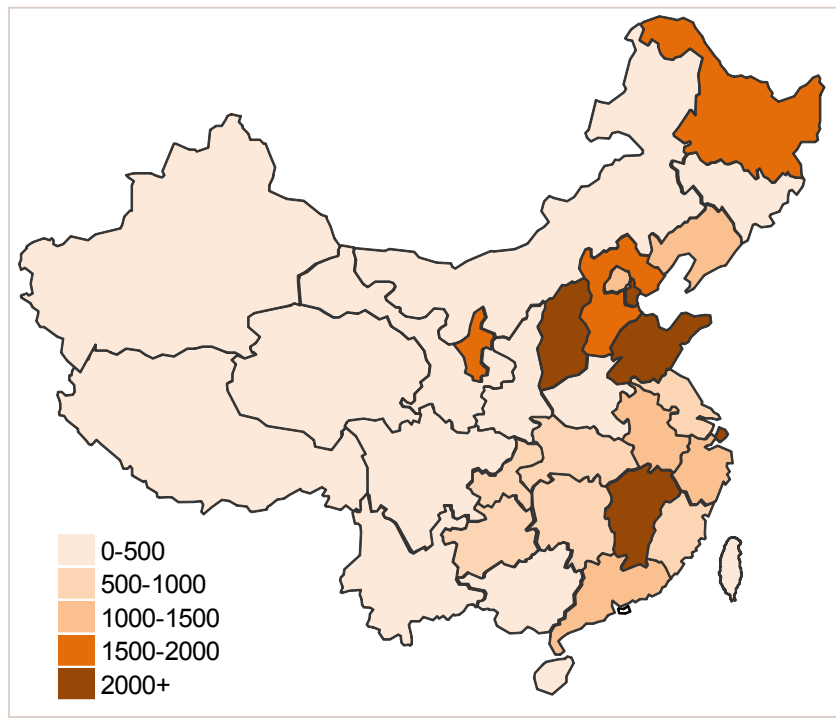


PM<sub>2.5</sub>'s distribution in heavy pollution episode in Jan, 2013

# 3 “High Coal Consumption” Dramatically Increased Regional Air Pollution and GHG Emission

|  | The World<br>Average Except<br>China<br>(2012) | America<br>(2013) | China<br>(2013) |
|--|--|-------------------|-----------------|
| Coal<br>Consumption<br>per Unit Area<br>(ton/km <sup>2</sup> ) | 28.0   | 80                | 456             |
| PM2.5<br>Concentration<br>(μg/m <sup>3</sup> )                 | <10  | <15               | >75<br>(East)   |

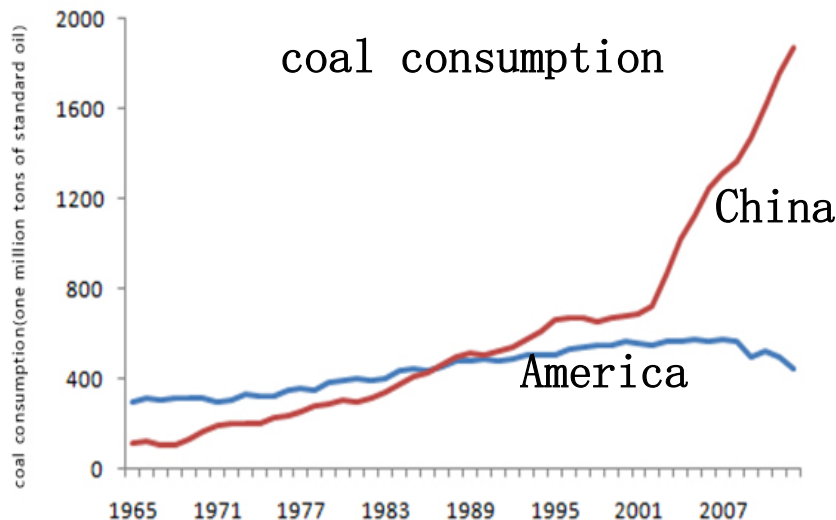
- The average coal use per unit area is 2098 tons/km<sup>2</sup> in Beijing, Tianjin, Hebei, Shanxi and Shandong, North China.
- The average coal use per unit is 1479 tons/km<sup>2</sup> in Shanghai, Jiangsu, Zhejiang, Fujian and Guangdong, along the southeastern coast.



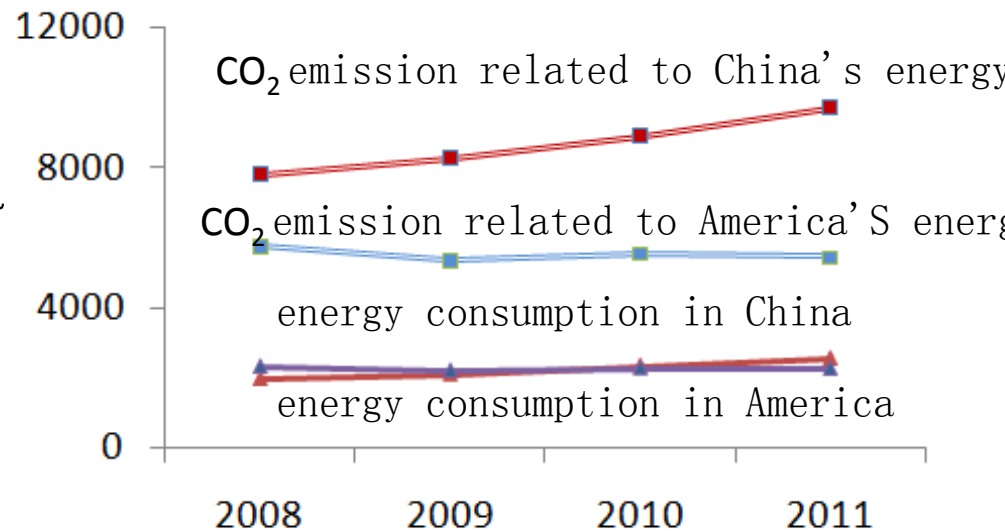
The **Coal Consumption per Unit Area** of Each Province in 2013

## Increased Coal Consumption and CO<sub>2</sub> Emission

- Coal consumption surpassed America in 1988, energy consumption surpassed America in 2007, CO<sub>2</sub> emission surpassed America in 2009.
- China's energy consumption was close to America in 2011. Due to China's coal-dominated energy mix, the greenhouse gas emission is nearly 80% higher than America.



Data from: BP Energy Statistics



Data from: IEA

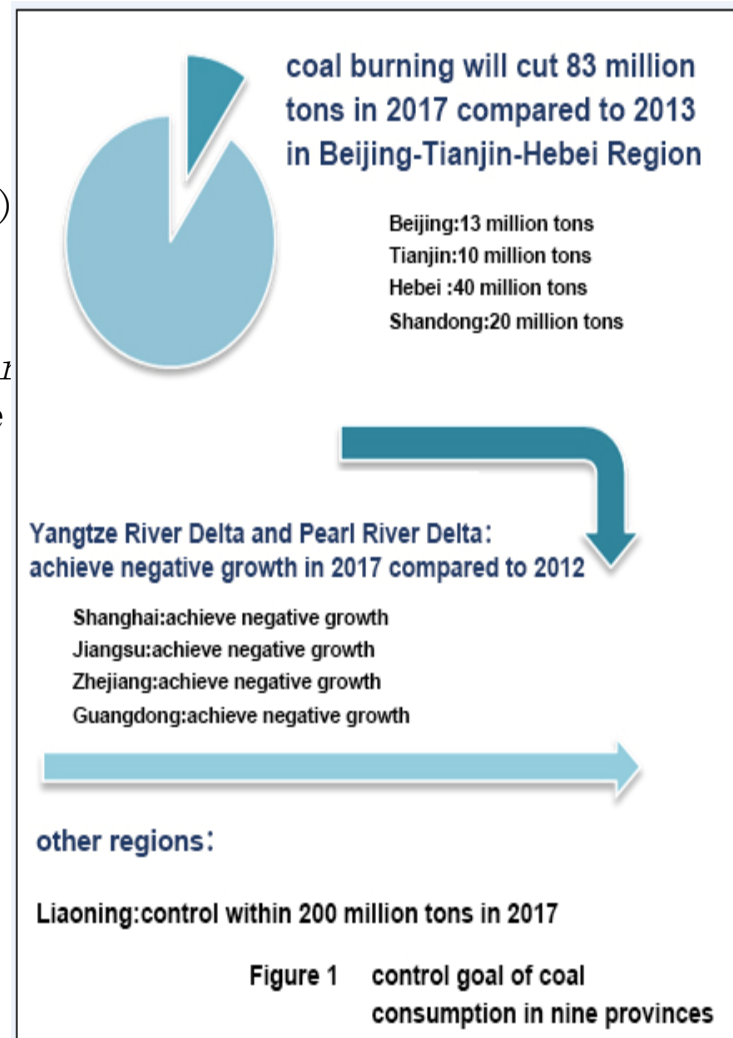
# The Coal Consumption Control Can Bring Remarkable Co-benefits

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- To a large degree, greenhouse gas and traditional air pollutants come from the fossil fuel **combustion**, such as coal burning. They both **share the emission source** and reduction measures.
- Coal consumption control policy **not only** sharply **control** coal use and reduce coal related **air pollution emission**, **but also** makes **potential** remarkable carbon reduction.
- Through the coal consumption **control**, it can **make** more **space** for low carbon energy **development**, and lead enterprises to **have** transformation and technology innovation.

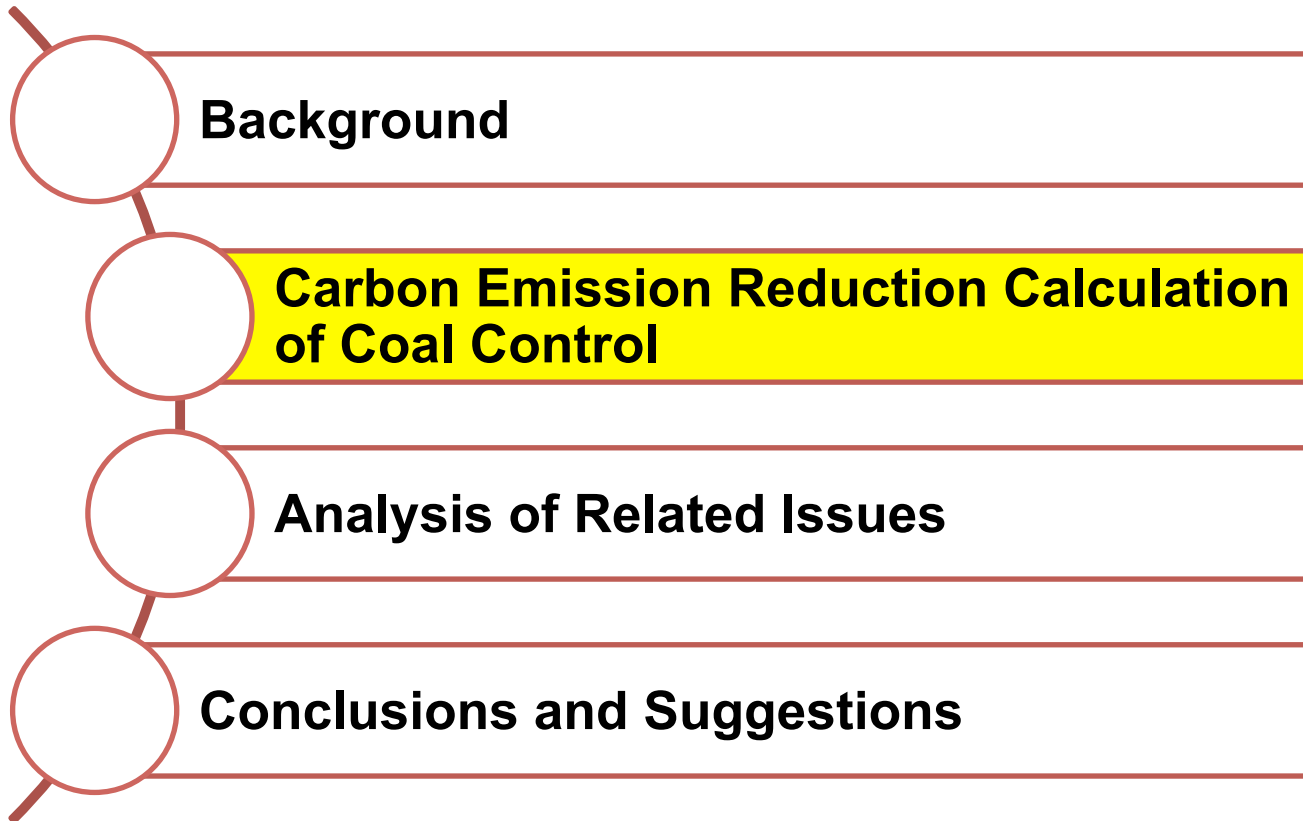
# Air Pollution “Ten Measures”

- In September 2013, in order to improve air quality, the State Council issued “*The Action Plan on Prevention and Control of Air Pollution (2013–2017)*” (**Air Pollution “Ten Measures”** for short). 31 provinces (autonomous regions and municipalities) have introduced local action plans.
- Compared with *The 12th Five-year Plan for National Economic Development* and *The 12th Five-year Plan for Energy*, **Air Pollution “Ten Measures”** puts forward more refined, and strict measures to control air pollution, and it’s the first time to clearly set **mid and long-term target** for controlling national **total coal consumption**.
- Chinese three air pollution joint prevention and control regions: Beijing-Tianjin-Hebei and Shandong city agglomeration set coal consumption **control target**, cutting 83 million tons **coal consumption in 2017 comparing with 2012 level**. The Yangtze River Delta and the Pearl River Delta Region including Shanghai, Zhejiang, Jiangsu, Guangdong Province, promised to achieve coal negative growth by 2017. Liaoning province also proposed to achieve zero growth of total coal consumption **in 2017**. The above 9 provinces and cities **account for 30% of China’s**



# Outline

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# Scenario Setting

8

## Frozen Scenario

- From 2013 to 2017, GDP maintains an average annual growth rate **as** the 12th five-year plan.
- From 2013 to 2017, energy intensity maintains the level of 2010.

## Current Policy Scenario

- From 2013 to 2017, GDP maintains an average annual growth rate **as** the 12th five-year plan.
- From 2013 to 2017, energy intensity **will in accordance with the goal of the 12th Five-Year Plan of Energy Development.**
- From 2013 to 2015, energy structure **will in accordance with the goal of the 12th Five-Year Plan of Energy Development.** From 2016 to 2017, it maintains the growth rate

## Scenario of the Action Plan

- In **2017**, coal consumption will adopt the proposed coal **consumption** from the action plans in each province.
- From 2013 to 2017, **coal consumption decrease constantly.**



# Greater Beijing-Tianjin-Hebei Region-- Beijing

## Energy Consumption in 2010

- Total Energy Consumption: 69.16 million tons coal equivalent.
- Coal Consumption: 26.35 million tons

## Targets in the 12<sup>th</sup> Five-Year Plan

- During the 12<sup>th</sup> five-year period, GDP average annual growth rate is 8%.
- In 2015, energy intensity declined 17% compared to 2010.
- In 2015, coal consumption accounts for 16.8% of the total energy consumption.

## The Scenario of the Action Plan

- In 2017, the coal use will be cut 13 million tons compared to 2012.

## Regional GDP

- In 2015, 1.757 trillion yuan;
- In 2017, 2.0494 trillion yuan

## Energy Intensity

- Frozen Scenario: 0.58tce/ten thousand yuan
- Current Policy Scenario: in 2015, 0.48tce/ten thousand yuan, in 2017, 0.45tce/ten thousand yuan

# Greater Beijing-Tianjin-Hebei Region-- Beijing

“*Beijing 12<sup>th</sup> Five-Year Pplan of Energy Development*” proposed total energy consumption and coal consumption target by 2015.

Table 2 Energy Consumption Target in *Beijing 12<sup>th</sup> Five-year Plan of Energy Development*

|   | 2010              |  |                | 2015              |  |                |
|---|-------------------|--|----------------|-------------------|--|----------------|
|   | Physical quantity | Standard quantity (ten thousand tons of coal equivalent) | proportion (%) | Physical quantity | Standard quantity (ten thousand tons of coal equivalent) | proportion (%) |
| Coal (ten thousand tons)                  | 2750              | 2100   | 30.3           | 2000              | 1500   | 16.8           |
| Electricity transmission(100 million KWH) | 533               | 1600   | 23             | 710               | 2200   | 24.4           |
| Natural gas(100 million cubic meters)     | 75                | 910  | 13.1           | 180               | 2200   | 24.4           |
| Oil (ten thousand tons)                   | 1482              | 2112   | 30.4           | 1680              | 2550   | 28.3           |
| New energy and renewable energy           |                   | 223  | 3.2            |                   | 550  | 6.1            |
| <b>TOTAL</b>                              |                   | <b>6945</b>  | <b>100</b>     |                   | <b>9000</b>  | <b>100</b>     |

# Greater Beijing-Tianjin-Hebei Region--

## Beijing

**Current Policy Scenario:** Reducing coal measures in Beijing during "12th Five-year Plan"

Reducing coal consumption in power generation, industry and civil use.

- Reducing coal consumption in power generation, industry and civil use. Speed up the project of replacing large coal-fired thermal power **plants** and 63 large coal-fired boiler with natural gas in urban center **areas**.
- Continue to push clean energy **retrofit** of small coal stoves in bungalows and simple houses **outside** cultural protection areas.

Strictly control coal-burning facilities in new **urban district**.

- Towns and vilages follow the principles of "operating large generators and shutting small ones" to develop coal-fired centralized boiler **facilities** properly.
- The existing industrial coal-fired boiler **facilities** gradually implement clean energy renewal

Gradually establish the whole process management and clean coal utilization system

- Strengthen clean management in each part including coal transportation, storage, processing, combustion and emission, the emission **from** all coal-fired facilities **should** reach the local emission standard.

# Greater Beijing-Tianjin-Hebei Region--

**The Scenario of the Action Plan:** By 2017, Beijing's total coal **consumption shall** be cut 1.3 million tons compared to 2012, aiming to control **the total consumption** within 10 million tons.

## Fully shut down coal-fired power generating units

- Fully shut down coal-fired power generating unit such as Keliyuan, Gaojin, Shijingshan, Guohua and Huaneng coal-fired plants. Establish 4 large gas thermal power center. Cut down 9.2 million tons in total.

## Centralized heating boiler retrofits

- Centralized update heating boiler, including that six areas of the city change 137 boilers, about 4900 T/h, "from coal to gas", cutting down 1.2 million tons coal consumption;
- Carrying out clean energy transformation of bellow 20 T/h coal-fired heating boilers in suburban metro and key towns as well as metro regional unexpected business services units. the areas which have connected natural heating pipelines focus on promoting the "coal to gas", other regions transform electricity and heat pump, reducing 1 million tons of coal

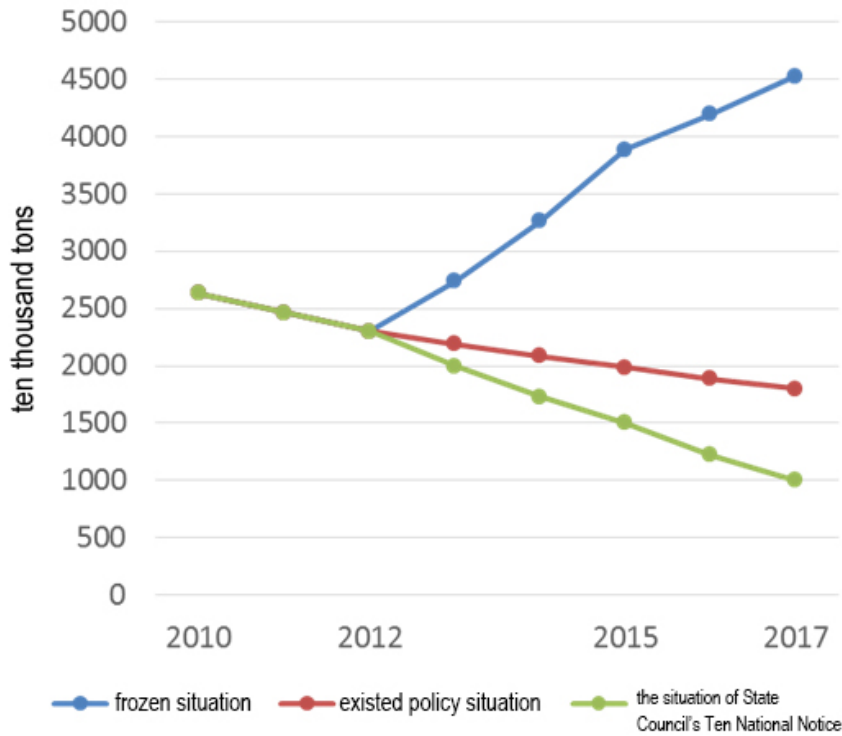
## Significantly reduce industrial coal consumption

- Significantly reduce industrial coal, including 19 industrial parks above municipal level, about 2100 T/h boilers, change "coal to gas", cutting down 500 thousand tons of coal consumption;
- Basically complete "coal to gas" among industrial enterprises above municipal level, promoting grounding coal-fired facilities clean energy transformation among industrial development zone, park and industry bellow municipal level, reduce coal of 550000 tons, cutting 55 thousand tons of coal consumption;

## Multiple measures to control the bulk coal

- Dongcheng and Xicheng Districts realize non-coal.
- Reduce civil scattered coal in Chaoyang, Haidian, Fengtai and Shijingshan Districts;
- Rural areas substitute coal liquefied petroleum gas, electricity, gas and renewable clean energy transformation.

# Greater Beijing-Tianjin-Hebei Region-- Beijing



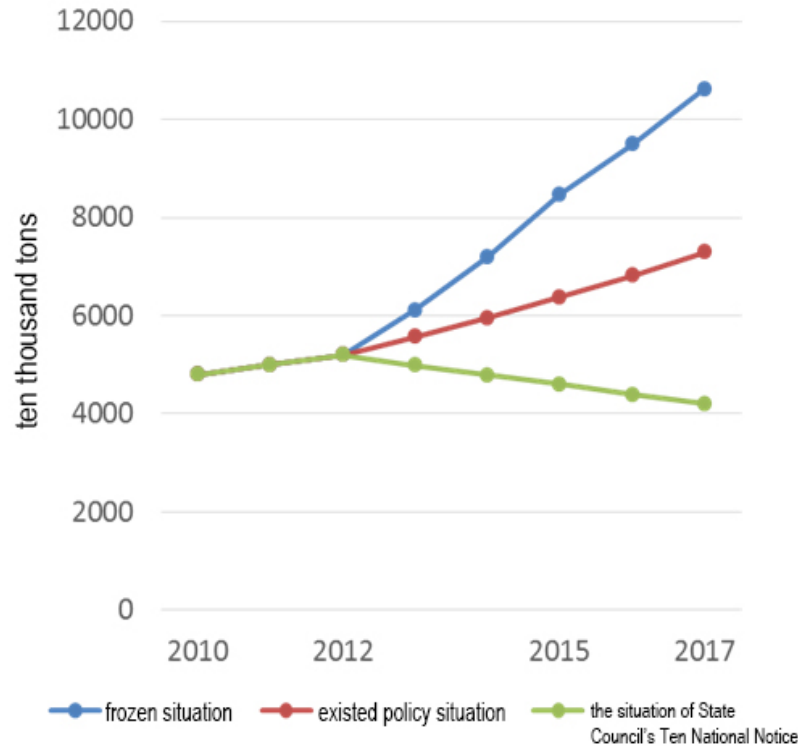
Beijing coal onsumption predict under the three Scenarios

Compared with the **current** policy, the implementation of **“Ten Measures”** will bring further coal reduction of **7.99** million tons, and CO<sub>2</sub> reduction of **8.34** million tons.

Beijing coal cutting measures and CO<sub>2</sub> reduction

| Measures                               |   | Coal reduction (ten thousand tons) | CO <sub>2</sub> reduction (ten thousand tons) |
|--|---|------------------------------------|---|
| Thermal power shut down transformation | Coal gas alternative                                | 349                                | 359   |
|  | Thermal power renewable energy alternative          | 0                                  | 0   |
| Heating boiler transformation          | Heating boiler gas alternative                      | 100                                | 75  |
|  | Heating boiler renewable energy alternative         | 0                                  | 0   |
| Reducing industrial coal               | Industrial coal boiler gas alternative              | 55                                 | 48  |
|  | Industrial coal boiler renewable energy alternative | 0                                  | 0   |
| Governing scattered coal               | Raw coal bulk burning gas alternative               | 100                                | 97  |
|  | Raw coal bulk burning clean energy alternative      | 50                                 | 79  |
|  | Raw coal burning power alternative                  | 50                                 | 4   |
| outdating backward production capacity |   | 95                                 | 172   |
| <b>Total</b>                           |   | <b>799</b>                         | <b>834</b>                                    |

# Greater Beijing-Tianjin-Hebei Region-- Tianjin



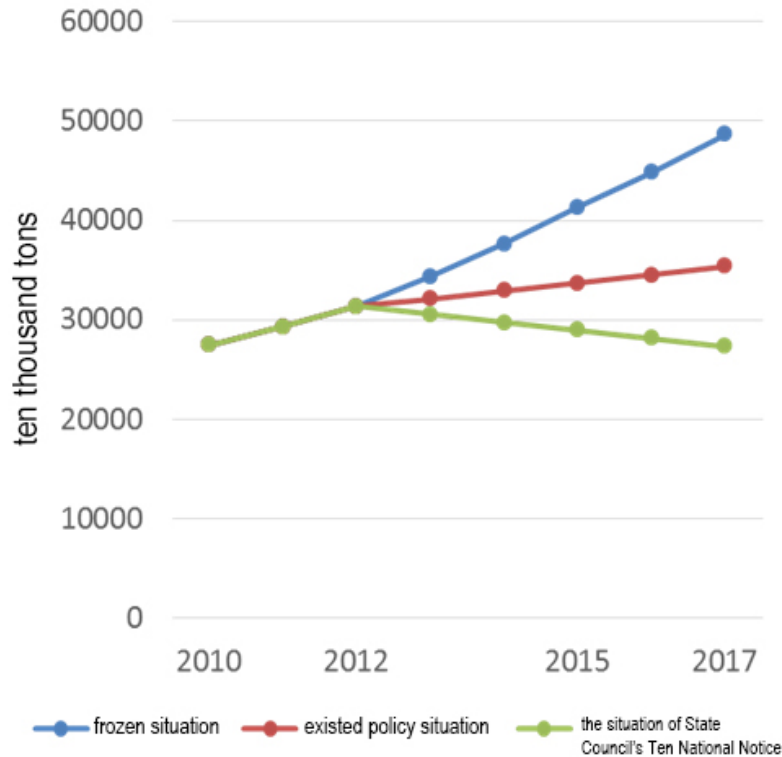
Tianjin coal consumption predict under the three Scenarios

Compared with the **current** policy, the implementation of “**Ten Measures**” will bring further coal reduction of **30.98** million tons, and CO<sub>2</sub> reduction of **38.82** million tons.

Tianjin coal cutting measures and CO<sub>2</sub> reduction

| Measures                               |   | Coal reduction (ten thousand tons) | CO <sub>2</sub> reduction (ten thousand tons) |
|--|---|------------------------------------|---|
| Thermal power shut down transformation | Coal gas alternative                                | 775                                | 797   |
|  | Thermal power renewable energy alternative          | 0                                  | 0   |
| Heating boiler transformation          | Heating boiler gas alternative                      | 465                                | 351   |
|  | Heating boiler renewable energy alternative         | 0                                  | 0   |
| Reducing industrial coal               | Industrial coal boiler gas alternative              | 465                                | 405   |
|  | Industrial coal boiler renewable energy alternative | 0                                  | 0   |
| Governing scattered coal               | Raw coal bulk burning gas alternative               | 310                                | 302   |
|  | Raw coal bulk burning clean energy alternative      | 186                                | 294   |
|  | Raw coal burning power alternative                  | 0                                  | 0   |
| outdating backward production capacity |   | 898                                | 1734  |
| <b>Total</b>                           |   | <b>3098</b>                        | <b>3882</b>                                   |

# Greater Beijing-Tianjin-Hebei Region-- Hebei



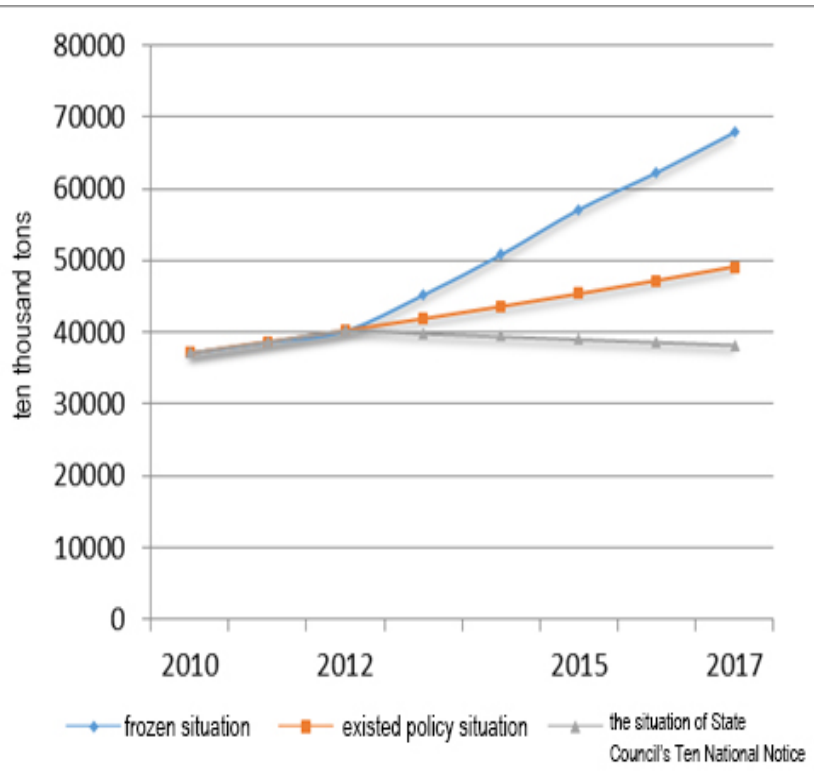
Hebei coal onsumption predict under the three Scenarios

Compared with the existing policy, the implementation of “**Ten Measures**” will bring further coal reduction of **80.16** million tons, and CO<sub>2</sub> reduction of **136.04** million tons.

Hebei coal cutting measures and CO<sub>2</sub> reduction

| Measures                               |   | Coal reduction (ten thousand tons) | CO <sub>2</sub> reduction (ten thousand tons) |
|--|---|------------------------------------|---|
| Thermal power shut down transformation | Coal gas alternative                                | 0                                  | 0   |
|  | Thermal power renewable energy alternative          | 0                                  | 0   |
| Heating boiler transformation          | Heating boiler gas alternative                      | 1603                               | 1201  |
|  | Heating boiler renewable energy alternative         | 0                                  | 0   |
| Reducing industrial coal               | Industrial coal boiler gas alternative              | 0                                  | 0   |
|  | Industrial coal boiler renewable energy alternative | 0                                  | 0   |
| Governing scattered coal               | Raw coal bulk burning gas alternative               | 401                                | 391   |
|  | Raw coal bulk burning clean energy alternative      | 401                                | 633   |
|  | Raw coal burning power alternative                  | 0                                  | 0   |
| outdating backward production capacity |   | 5611                               | 11279   |
| <b>Total</b>                           |   | <b>8016</b>                        | <b>13604</b>                                  |

# Greater Beijing-Tianjin-Hebei Region-- Shandong



Shandong coal onsumption predict under the three Scenar:

Compared with the existing policy, the implementation of **“Ten Measures”** will bring further coal reduction of **108.66** million tons, and CO<sub>2</sub> reduction of **171.11** million tons.

Shandong coal cutting measures and CO<sub>2</sub> reduction

| Measures                               |   | Coal reduction (ten thousand tons) | CO <sub>2</sub> reduction (ten thousand tons) |
|--|---|------------------------------------|---|
| Thermal power shut down transformation | Coal gas alternative                                | 1630                               | 1677  |
|  | Thermal power renewable energy alternative          | 435                                | 868   |
| Heating boiler transformation          | Heating boiler gas alternative                      | 1087                               | 820   |
|  | Heating boiler renewable energy alternative         | 435                                | 785   |
| Reducing industrial coal               | Industrial coal boiler gas alternative              | 1087                               | 947   |
|  | Industrial coal boiler renewable energy alternative | 435                                | 785   |
| Governing scattered coal               | Raw coal bulk burning gas alternative               | 0                                  | 0   |
|  | Raw coal bulk burning clean energy alternative      | 0                                  | 0   |
|  | Raw coal burning power alternative                  | 0                                  | 0   |
| outdating backward production capacity |   | 5759                               | 11230   |
| <b>Total</b>                           |   | <b>10866</b>                       | <b>17111</b>                                  |



# Analysis Result - Coal Consumption

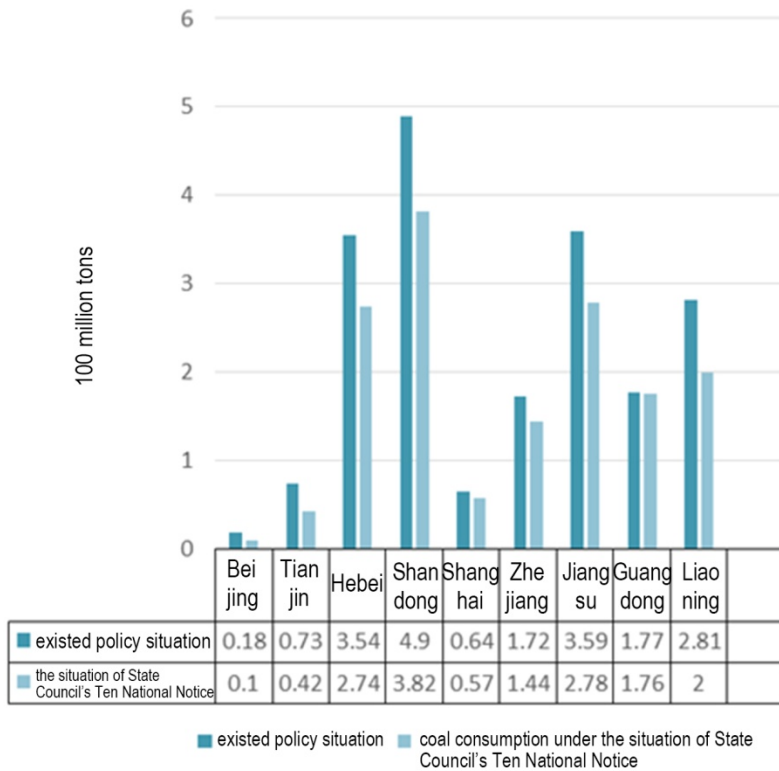


Figure 1 Coal consumption of different provinces in 2017

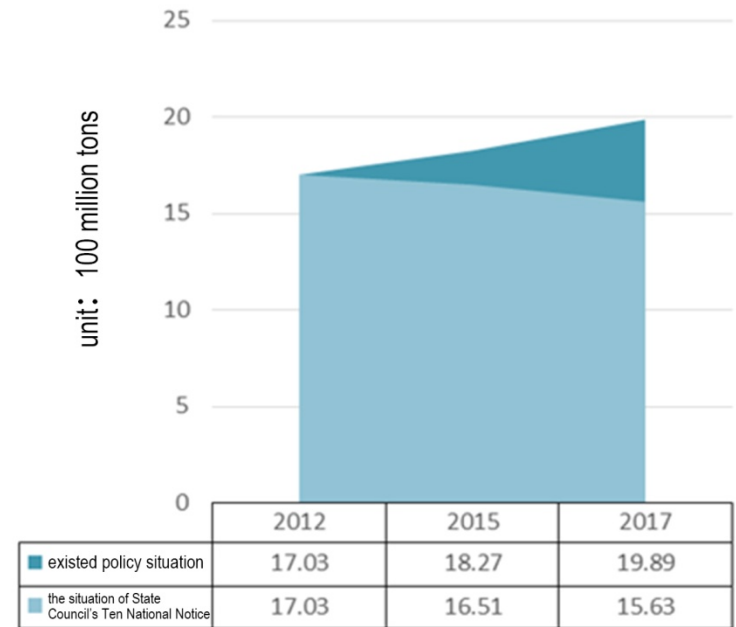
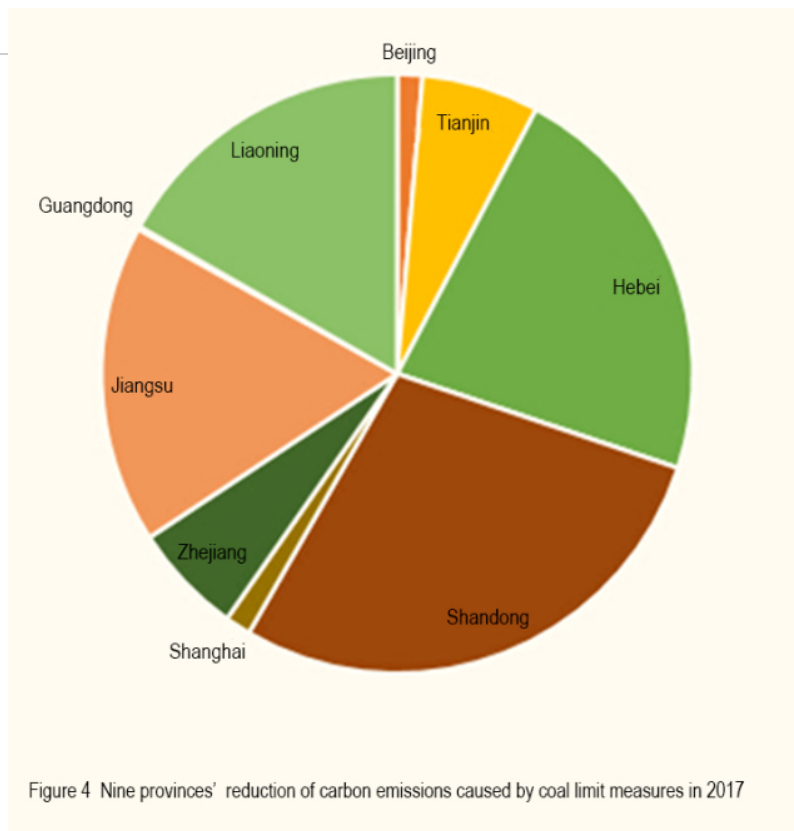


Figure 2 Total coal consumption trend during 2012 - 2017

Compared with the **current** policy, *Air Pollution "Ten Measures"* will bring further coal reduction of **426** million tons.

# Analysis Results – Carbon Reduction



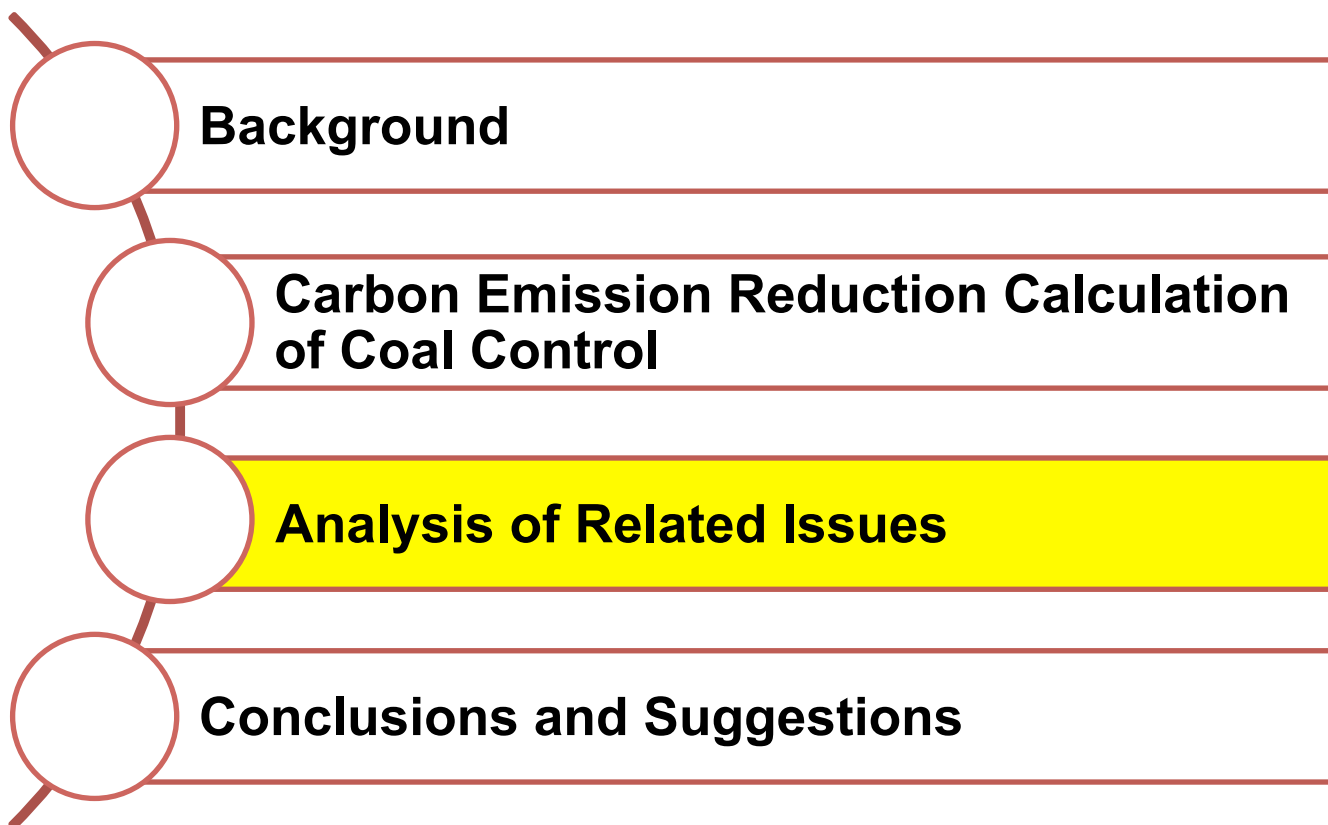
The implementation of *Air Pollution "Ten Measures"* will bring further CO<sub>2</sub> reduction of 605 million tons for nine provinces

| Area                          | Beijing | Tianjin | Hebei | Shandong | Shanghai | Zhejiang | Jiangsu | Guangdong | Liaoning | TOTAL |
|-------------------------------|---------|---------|-------|----------|----------|----------|---------|-----------|----------|-------|
| Carbon Reduction (10000 tons) | 834     | 3882    | 13504 | 17111    | 845      | 3647     | 10423   | 88        | 10175    | 60509 |

Figure 3 CO<sub>2</sub> emission reduction of different provinces under the scenario of action plan

# Outline

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# Emission Reduction Effect of Different Coal-controlling measures

Table 7 Reducing coal measures and its reduction coefficient

| coal-controlling measures  | reduction coefficient <sup>(1)</sup><br>(ton CO <sub>2</sub> /ton standard coal) |
|--|--|
| Energy saving and renewable energy instead of raw coal bulk burning        | 2.99   |
| Energy saving and renewable energy displacing coal                         | 2.8  |
| Alternative heating coal boiler energy saving and renewable energy         | 2.53   |
| Energy saving and renewable energy displacing industrial coal-fired boiler | 2.53   |
| Backward production capacity shut down                                     | 2.49-2.53 <sup>(2)</sup>   |
| Natural gas displacing coal burning  | 1.84   |
| Natural gas displacing coal  | 1.44   |
| Natural gas displacing industrial coal-fired boiler                        | 1.22   |
| Natural gas displacing heating coal boiler gas                             | 1.05   |
| Electric power displacing raw coal bulk burning                            | 0.61   |
| Coal gas displacing coal burning   | 0.58   |
| Purchased electricity displacing coal                                      | 0.42   |
| Coal power transfers to non-limited coal region                            | 0  |
| Backward production capacity transfers to non-limited coal region          | 0  |
| Coal gas replacing coal power  | -0.26  |
| Coal gas displacing heating coal boiler coal gas                           | -0.97  |
| Coal gas displacing industrial coal-fired boiler                           | -1.06  |

## The overall comparison:

- ✓ Governing scattered coal has good effect no matter from the aspect of carbon reducing emissions or environmental quality improvement.
- ✓ synergy effect is more significant in Reducing industrial coal, transformation of heating boiler, pollutants emission and carbon emission reduction
- ✓ The carbon reduction effect of coal power shut , transformation and the backward production capacity depends on whether

there is offshoring production capacity.

## Effect of specific measures:

- ✓ Backward production capacity and renewable energy (without regard to the transfer of coal pollution) have the most remarkable reduction effect. Gas replacement is in the middle.
- ✓ The way of Purchasing electricity couldn't remarkably bring coal and carbon reduction effect.
- ✓ Using coal gas to displace coal, except displacing coal burning, can't reduce carbon emission but increase it. It is

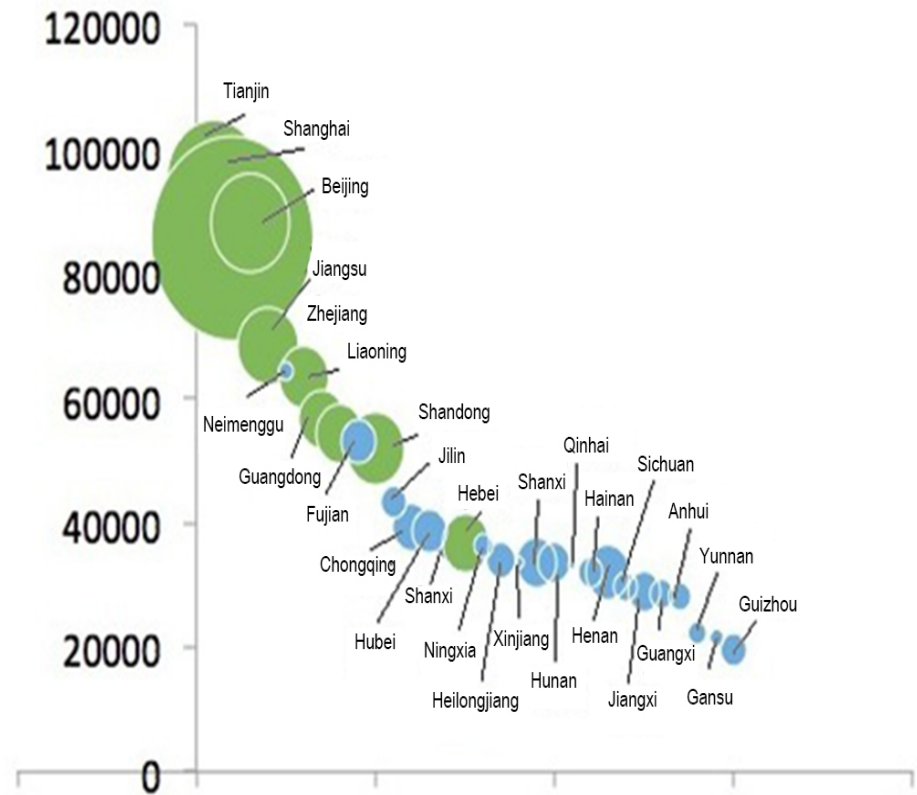
negative effect for carbon reduce emission.

Note: (1) The reduction coefficient refers to adopting the measures of cutting CO<sub>2</sub> emissions every tons of standard coal.

(2) The reduction coefficient of backward capacity closures depends on the type of capacity, hence the reduction coefficient would be different accordingly.

# The Possible Carbon Leakage

- The districts that have an higher GDP per capita consume more coal per unit area, these two have a certain correlation, which reflects currently that our country,s economic development has a dependence on the coal.
- Nine coal areas are the coal mine province having a rapid economic development of, The control of coal taking place in these provinces has the higher urgency and the higher possibility
- But some coal mine province and bad environment areas are not controlled at present, these are mainly located in the Midwest, whose per capita GDP is relatively low. Based on the needs of economic development. These areas is likely to take in the coal' s supply of the coal controlled areas and the transfer of polluted industry, which will result in the so-called "carbon leakage" that forms a new heavy pollution area.
- In order to avoid that the coal industry transfer from the coal controlled areas to those areas without coal control and it finally causes further pollution of those areas, The exact objectives of controlling total amount of coal in the areas without coal control should be sett up as soon as possible.



GDPPC (vertical axis) & total coal consumption of unit area (radius) of 31 provinces and the municipalities of 2012

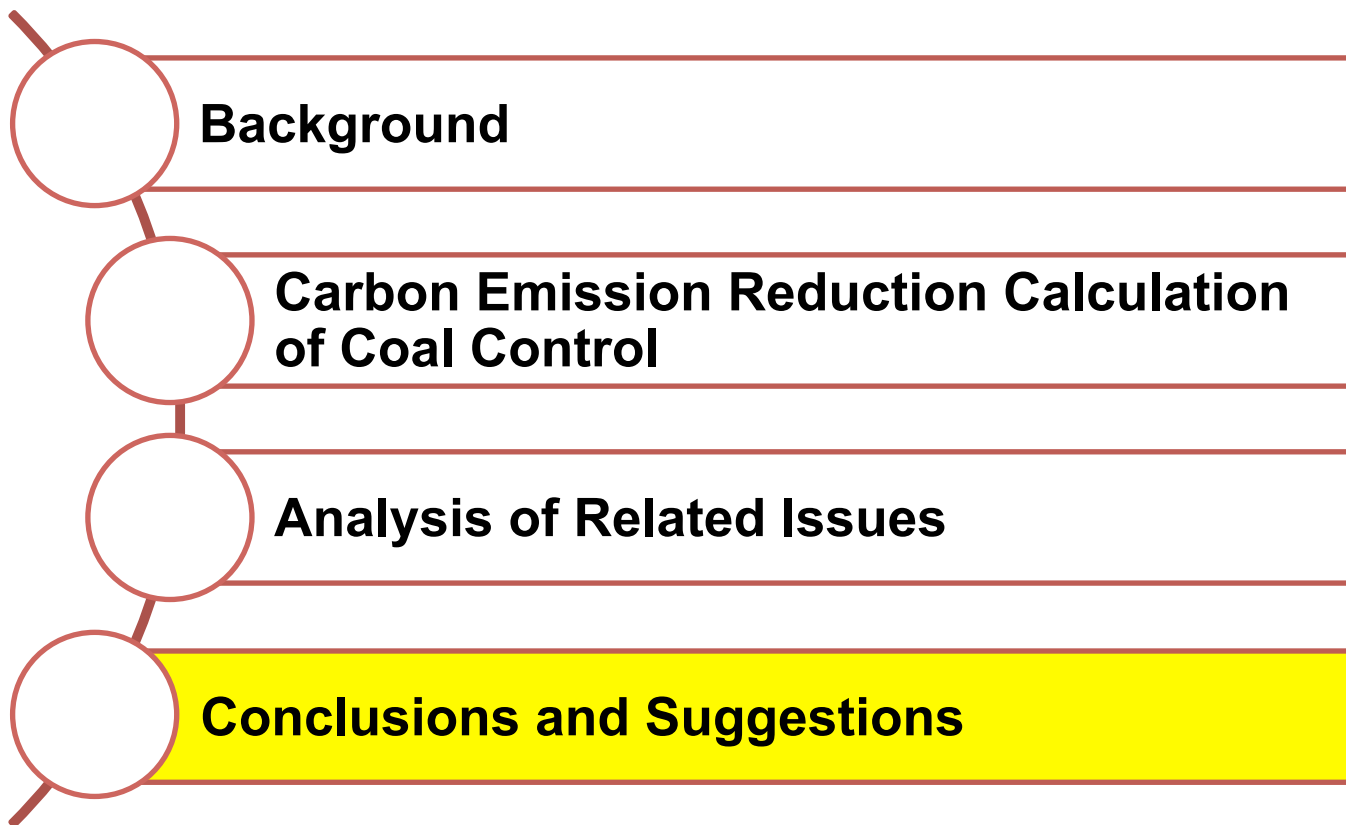
# The Possible Carbon Leakage

In the above alternative measures of coal reduction, it most likely to produce carbon leakage problem to eliminate backward capacity and use purchased electricity instead of coal.

- **Eliminate backward capacity:** there are two possible situations, backward product capacity shut directly and backward product capacity transfers to non-limited coal district. To a certain extent, the latter is equal to transferring these capacity to non-limited coal area. though the energy efficiency will improve, it will lead to the possible transfer of coal pollution.
- **Purchased electricity replacing local coal consumption:** it is an effective measure to reduce regional atmospheric CO<sub>2</sub> emission. However, if it lead to outside power supply area of coal proportion rising, The possible transfer of coal pollution is not allowed to ignore. Of course, if it can make full use of the resource advantages of the external power supply, and promote the development of non-fossil energy to generate electricity, the negative effect might be largely reduced. at the same time, it will have a positive impact to improve the overall structure of China's energy.

# Outline

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# Conclusions and recommendations

- Coal consumption control policy is of great significance
  - The coal consumption control policy of the air pollution prevention and control action plan is a mid and long-term control target that clearly put forward for the first time to control total coal consumption.
  - If the other 22 provinces and cities could reduce the total coal consumption in 2017 back to the levels in 2012, the national coal consumption can cut one billion tons, which can reduce 1.4 billion tons CO<sub>2</sub> emissions.
  - It can bring significant co-benefits to promote coal consumption control, and it's the key to control greenhouse gas emissions and reduce air pollution emissions. It can influence the change of economic growth mode and the optimization of energy structure, and it's one of the core content of energy production and consumption revolution in China.



# Conclusions and Recommendations

- Implement the coal **consumption** control policy nationwide, and make different coal control plan in different regions.
  - Obligatory targets for national coal consumption control and the implementation of the programme should be issued as soon as possible.
  - At present, nine provinces that clearly put forward coal **consumption** control target can not be on half of the other regions' situation in the whole country, specific goals of coal **consumption** control should be issued as soon as possible in a larger **scale**.
  - Explore the measures and means of coal **consumption control** that fit each region's **situation**, and effectively avoid the pollution **source transmission** from coal **control** region to **non coal control** region.

# Conclusions and Recommendations

- **Coal control measures** that have greater **co-benefits** should be adopted preferentially
  - General speaking, coal use reduction has CO<sub>2</sub> emission reduction co-effect, but different coal substitution approach brings varied CO<sub>2</sub> effect, and the cost and economic effects are also different.
  - In the pilots that have been controlling coal use, consideration should be given to local characteristics and comprehensive effects that may bring when implement the control measures, try to select the measures with better CO<sub>2</sub> emission reduction co-effect to achieve the co-benefit.
  - In the regions that have not carried out coal use control, regional characteristics should be fully intergrated in the plans, and the measures that have remarkable redution effect and effective cost should be included.
  - Be careful to use coal gas replacement policy .

# Conclusions and recommendations

## ■ **Potential carbon leakage should be tried** to avoid


- When eliminating the production capacity and reduction of coal **consumption** related **production**, regional coordination should be strengthened to avoid a **production transferring to other regions without coal use limit**.
- It 's an effective measure to **reduce local CO2 emissions via purchasing electricity from other regions** instead of **using local coal**. It may cause **carbon leakage and pollution transfer**. If we can make full use of the resource advantages in **the** power supply area to promote the development of non-fossil energy to generate electricity, it can largely reduce the negative effect from the carbon leakage, besides, it has a positive impact on China's overall energy structure.

# Conclusions and recommendations

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- Combined with regional development trend and requirements of environmental protection, coordinated interaction and dynamic adjustment of plan would be strengthened
  - The interaction of the current regional economy, producing, transportation, resource and other aspects gradually strengthened. **With the increasing requirements for the structural transformation of the economy and the requirements of the environmental protection and low carbon development in various regions in the future, the strategy on air pollutant and carbon emissions control should be constantly innovated in each province and city, strengthen the policy measures of economic effectiveness, operability and implementation effect.**
  - Under the new situation of development, provinces and cities should be **comprehensively consider their local existing plannings and other documents, adjust the goals and measures when necessary.**

Thank you!  
All comments and advice are welcomed!



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