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Impacts of Coal Mining on Water Resources and Mitigation Measures

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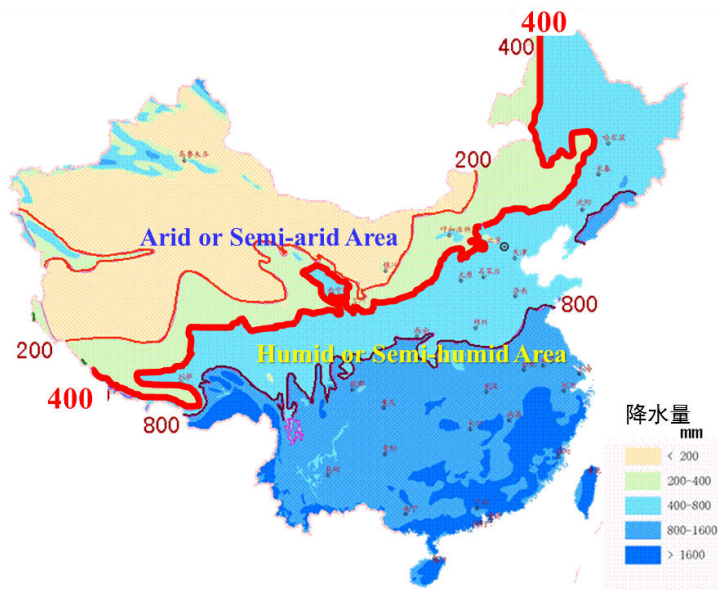
Outline

1. Impacts of coal mining and utilization on water resources
2. Development of coal mining and utilization under the most strict water resources management policy
3. Co-benefits of coal consumption cap policy on water resources
4. Proposals

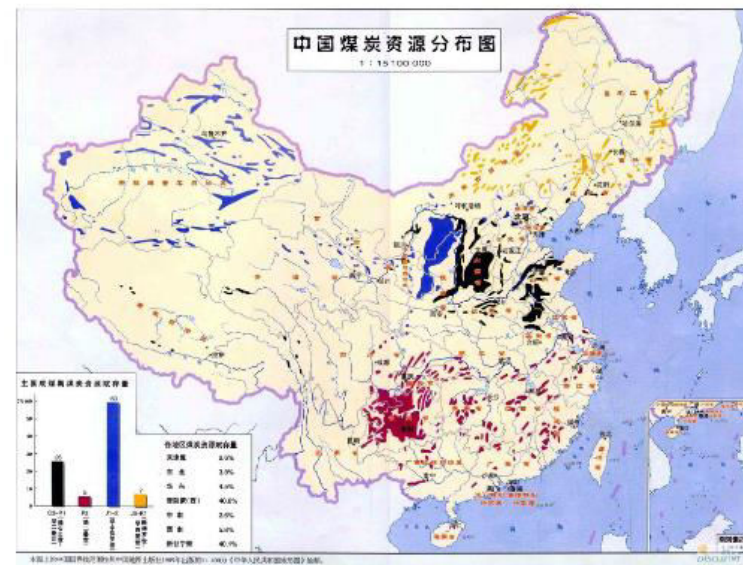
1. Impacts of coal mining and utilization on water resources

Analysis on coal and water resources distribution

- Coal bases are mainly located in **north and west regions of China** where water resources are deficient and socio-economy are relatively undeveloped.
- **Inverse distribution** of coal and water resources in China challenges sustainable development of coal related industries with majority of coal reserve in northern and southwestern parts, while water resources in northern China are extremely limited and highly exploited.



Distribution of rainfall in China



Distribution of coal reserve in China

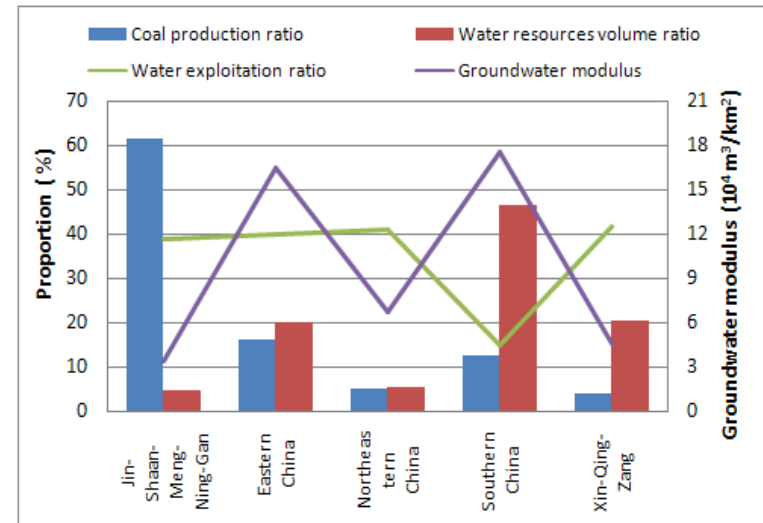
1. Impacts of coal mining and utilization on water resources

Comparison of coal production and water resources

- The whole nation of China is divided into 5 sub-regions based on geographical location and coal mining situation.
- Most of key coal bases are located at administrative districts under severe water stress and groundwater shortage. Water shortage brings grave contradiction between water supply and demand, especially for Jin-Shaan-Meng-Ning-Gan accounting for over 60% of national coal production with only 4.8% of overall water resources.



Division of coal districts



Comparison of coal production and water resources

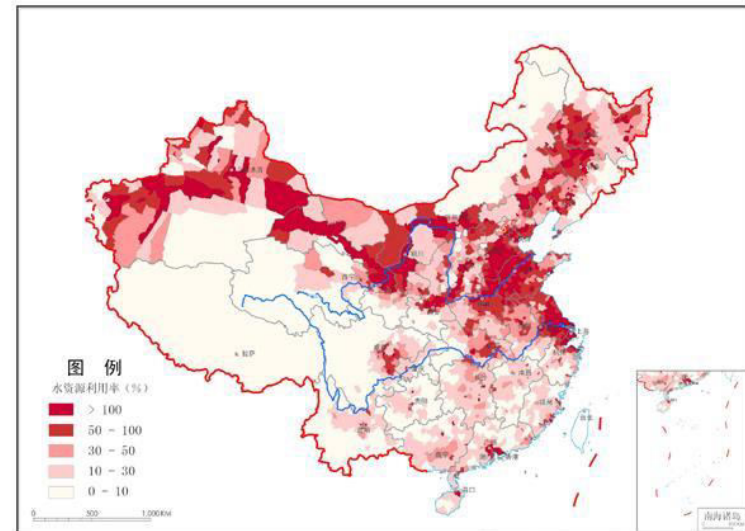
1. Impacts of coal mining and utilization on water resources

Evaluation of water resources in coal bases

- Among 14 coal bases in China, water resources amount in **Yunnan-Guizhou** is highest while lowest in **Eastern Ningxia**.
- In terms of water supply, **surface water** provides 62.0% water use for 14 coal bases in 2012, while **groundwater** 36.8% and **other water** 2.2%. It's worth noting that groundwater makes up over 70% of total water supply in some places of **Shandong, Inner Mongolia and Shanxi**.
- Industrial water use accounts for about 15% total water use of coal bases in 2012.



Distribution of 14 coal bases

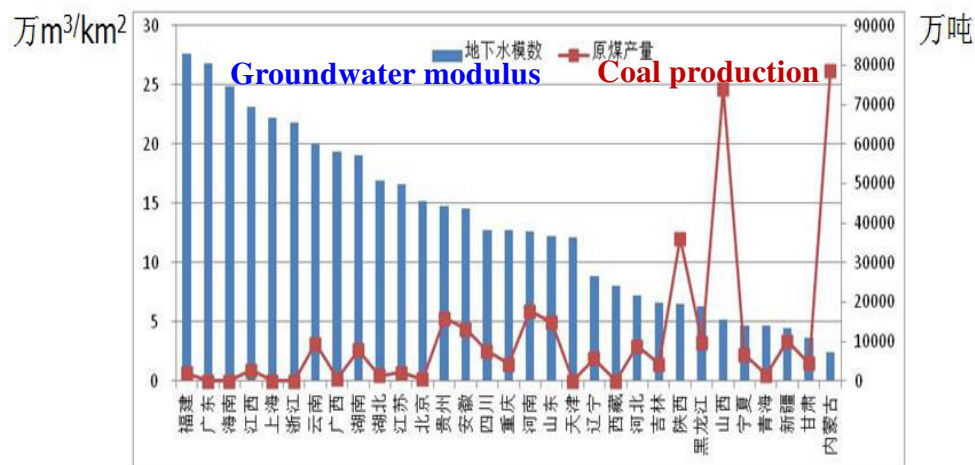


Water utilization assessment

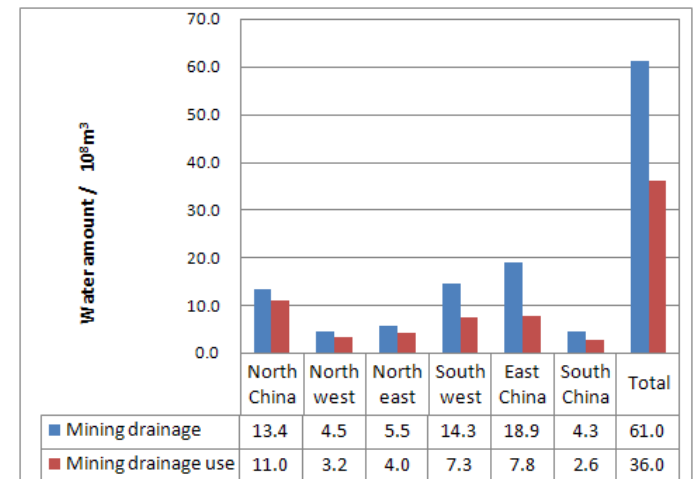
1. Impacts of coal mining and utilization on water resources

Evaluation on impacts of coal mining and utilization on water resources -- Coal mining causes water cycle change and groundwater loss

- The **coal-rich** places are usually **water-deficient**, especially in Inner Mongolia and Shanxi.
- Coal mining processes destroy **aquifer structure** which causes groundwater loss and change of surface water infiltration and runoff, while corresponding waste drainage pollutes regional environment. The mining drainage in China is as high as **6.1 billion m³** in 2010 of which **no more than 60%** are collected and used. The mining drainage accounts for 77.6% of groundwater utilization in some regions.



Comparison of regional groundwater and coal production

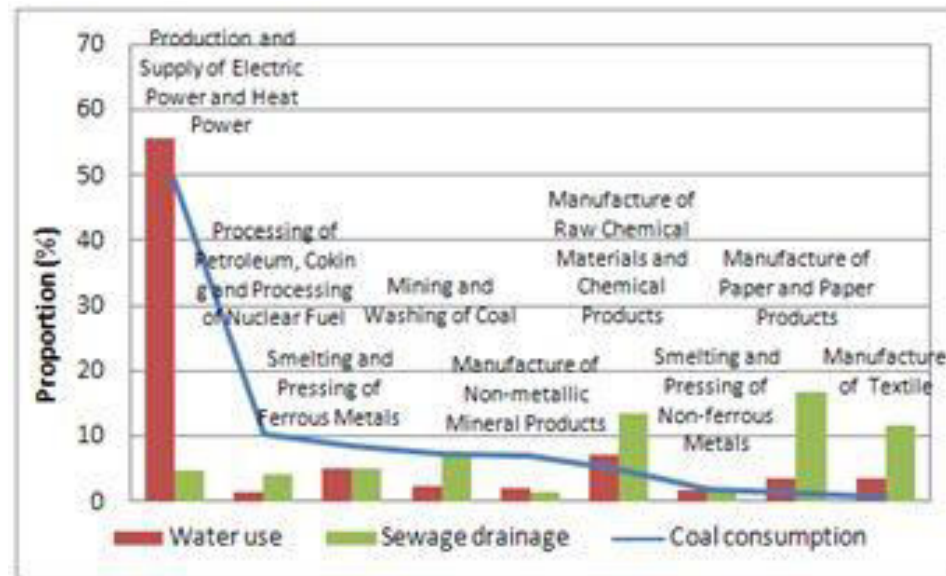


National and regional Mining drainage

1. Impacts of coal mining and utilization on water resources

Evaluation on impacts of coal mining and utilization on water resources -- Coal conversion and utilization aggravates water scarcity and pollution

- In the field of coal conversion and utilization, unreasonable layout of coal downstream industries aggravates water scarcity especially for water deficient areas. Across the country as a whole, main coal-related industries also play important roles in **water use** and **sewage drainage**, indicating significant influence of coal related industries on local water resources and environment.

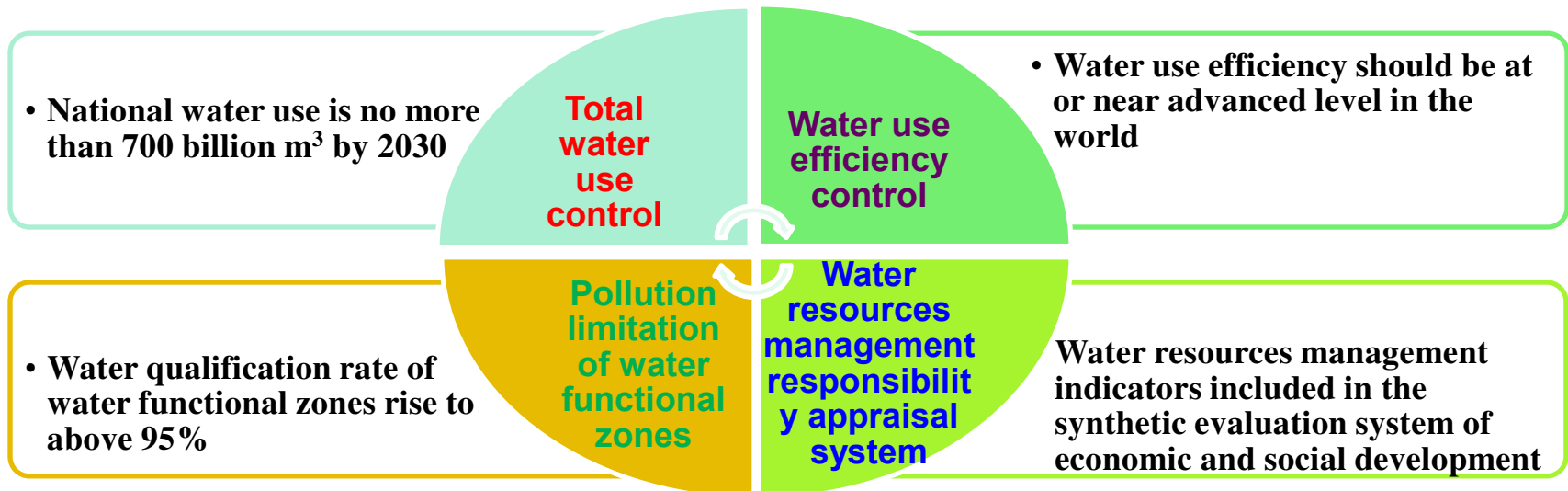


Coal consumption, water use and sewage drainage of coal-related industries

2. Development of coal mining and utilization under the most strict water resources management policy

The most strict water resources management policy

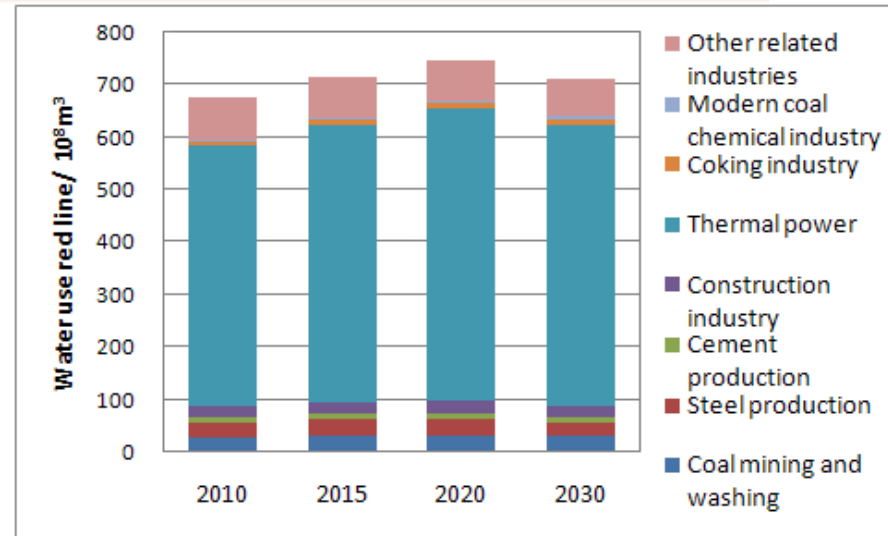
- In January 2012, the State Council released ‘Official instruction on the most strict water resources management policy’ carrying out comprehensive deployment and detailed arrangement.
- In January 2013, the General Office of the State Council released ‘Assessment method for implement of the most strict water resources management’ bringing forward three red lines including total water use, water use efficiency and pollution drainage limitation of water functional zones.



2. Development of coal mining and utilization under the most strict water resources management policy

Red line of water use

➤ National water use red line of coal related industries is calculated on basis of national total water use red line and water use efficiency released by the State Council combined with the water-saving potential and development needs of coal related industries.



Year	2010	2015	2020	2030
National water use red line (10 ⁸ m ³)	6022.00	6350.00	6700.00	7000.00
Coal related industries water use red line (10 ⁸ m ³)	677.32	715.84	746.98	713.27
including:				
Coal mining and washing	29.13	32.43	32.71	31.41
Steel production	27.90	29.71	30.31	25.07
Cement production	11.22	11.95	11.55	9.07
Construction industry	20.28	21.60	22.77	21.87
Thermal power	497.20	529.52	558.22	536.09
Coking industry	9.69	10.32	10.88	9.58
Modern coal chemical industry	1.05	2.03	4.91	7.55
Other related industries	80.85	78.28	75.64	72.64

2. Development of coal mining and utilization under the most strict water resources management policy

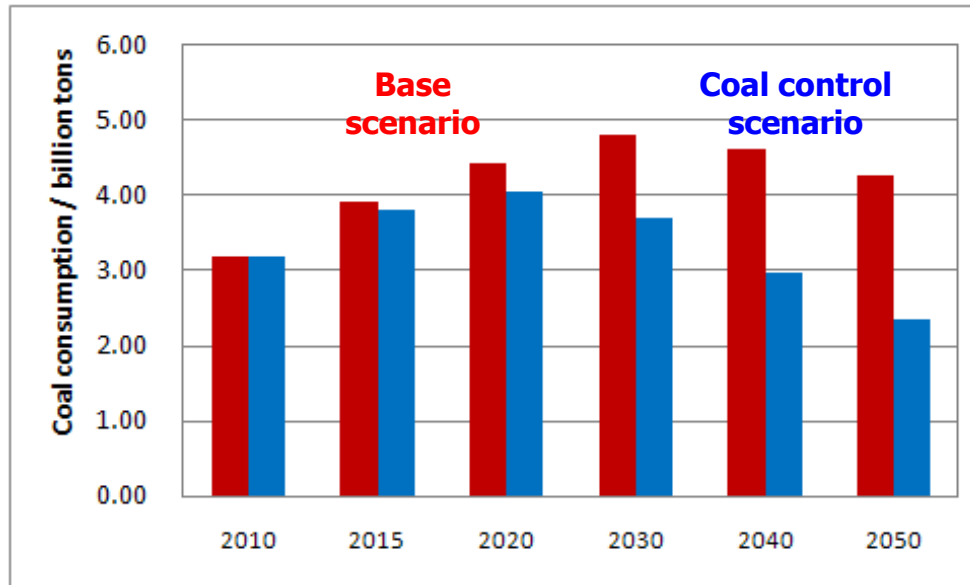
Discussion on water use red line

- In terms of the **national total water use red line**, water demands in 2015, 2020 and 2030 show a trend of steady growth indicating increasing need of social and economic development on water resources.
- In terms of **national water use red line of coal related industries**, the peak of water use will be 74.7 billion m³ in 2020, rising by **10.3%** than that of 2010, slightly lower than corresponding growth rate of national total water use **11.3%**.
- The water use of **thermal power** makes up more than **70%** of total water use of coal related industries.

3. Co-benefits of coal consumption cap policy on water resources

3.1 Coal consumption control schemes

- The **base scenario** and **coal control scenario** are brought forward by NRDC according to collection and coordination of each subtopic's result with consideration of both **resources and environment constraints** and **development demand of coal related industries**.
- Generally, the coal consumption of coal control scenario are lower than those of base scenario. The **peak of coal consumption** of base scenario is 4.8 billion tons in 2030, while that of coal control scenario is 4.0 billion tons in 2020, indicating obvious influence of coal control policy on coal consumption.



Year	Base scenario (billion tons)	Coal control scenario (billion tons)
2010	3.20	3.20
2015	3.92	3.80
2020	4.44	4.06
2030	4.82	3.70
2040	4.62	2.97
2050	4.26	2.35

3.2 Effects of coal consumption cap schemes on total water use

□ The overall water use during coal consumption is consist of coal mining and washing water use and coal utilization water use.

- Water use of coal mining and washing relate closely with coal production and spatial distribution..

- Water use of coal utilization are mainly influenced by total amount of coal consumption and corresponding departmental structure.

3.2 Effects of coal consumption cap schemes on total water use

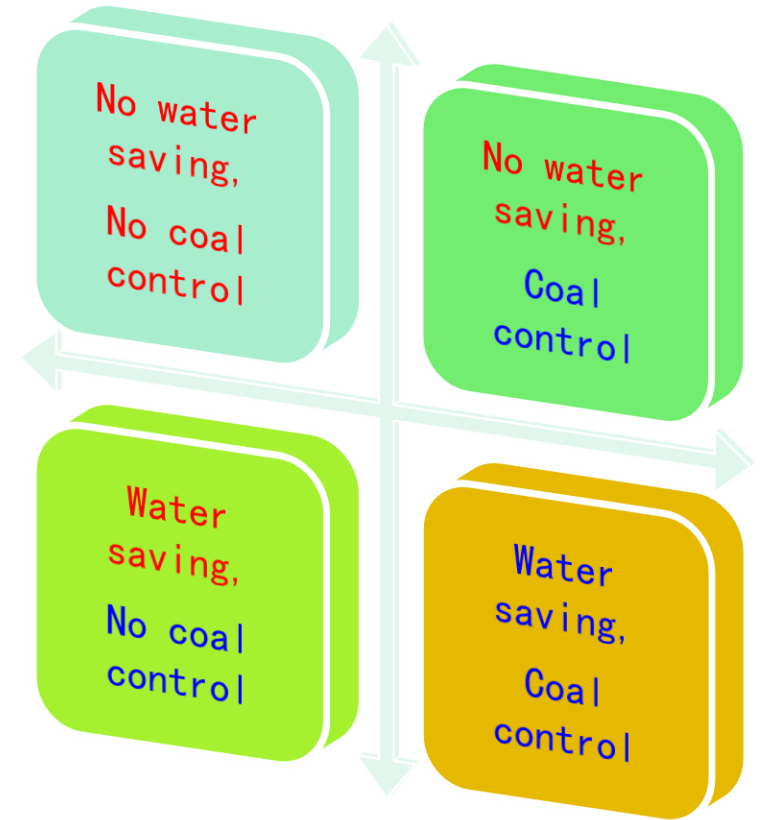
□ The effects of coal consumption control on water resources

- On one hand, coal consumption control reduces coal production and utilization so that water use during coal mining and utilization as well as mining water flow will decrease immediately.

- On the other hand, coal consumption control indirectly promotes readjustment of energy structure and water consumption structure, therefore water use will decrease due to water-efficient alternative energy consumption and water-saving technology application.

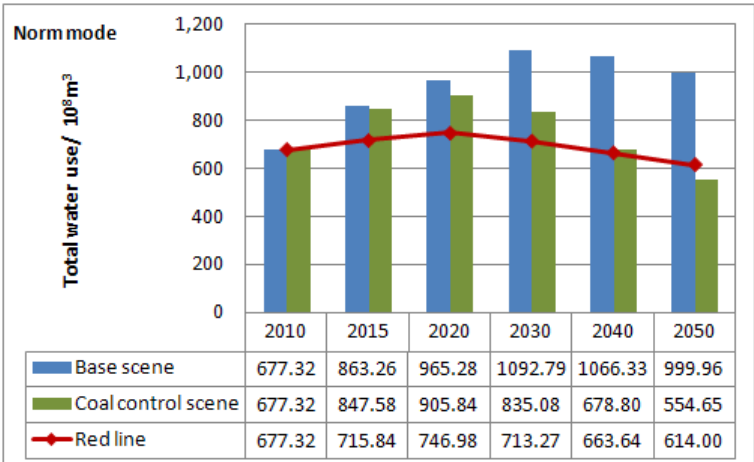
3.2 Effects of coal consumption cap schemes on total water use

- Two modes of water use are considered including **normal mode** and **water-saving mode**. In normal mode, total water use of each department are calculated on basis of current water use quota, while in water-saving mode, low water quota is adopted in newly increased capacity of coal related industries with backward technique gradually eliminated.
- Combing **coal consumption control scenarios** and **water-saving modes**, **four schemes** are considered.

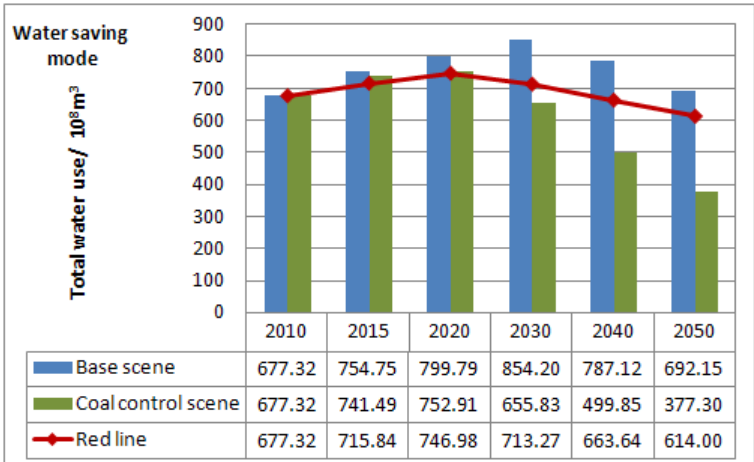


3.2 Effects of coal consumption cap schemes on total water use

- Comparing results under **norm mode** and **water saving mode**, the total water use of coal consumption under norm mode is much bigger than that of water saving mode, indicating that applications of water saving technology could greatly restrain total water use growth with increasing coal consumption .
- Comparing results under **base scenario** and **coal control scenario**, the total water use of coal consumption under coal control scenario is less than that of base scenario, and coal consumption control makes positive contribution to water use control.
- Both of **coal consumption control** and **water saving technology** are indispensable for coordination and sustainable development of coal industries and water resources under the most strict water resources management policy.



Water use of coal consumption under norm mode



Water use of coal consumption under water saving mode

3.3 Effects of coal consumption cap schemes on water conservation

- The impacts of coal mining and utilization on **water quantity and quality** of surface water and groundwater, as well as geological environment, are much lower under coal consumption control scenario than that under base scenario.
- The **total water use** of coal mining and utilization under coal consumption control scenario is much less than that of base scenario, which would be helpful for the regional water use control to meet the requirement of corresponding water use red line.
- The impacts of coal mining and utilization on regional **water cycle and eco-environment** are much lower under coal consumption control scenario than base scenario, which would play a positive role in water resources conservation and environment improvement.

4. Proposals

- (1) The **planning and construction of coal related industry** should be properly demonstrated following the principle of coordination between coal consumption and water resources.
- (2) **The policy of the most strict water resources management** should be comprehensively implemented.
- (3) The innovation researches and application of **water saving technology** in coal related industry should be promoted.
- (4) The **water pricing mechanism** should be improved to regulate the development of coal industry by economic instruments.
- (5) The **water right transfer policy** should be promoted to meet the water demand of coal industry development.
- (6) The **water monitoring system and informatation level** should be improved to provide decision support for coordination of coal industry development and water resources utilization especially in coal bases.

**Thanks for
your attention**