

Legal Statement

The purpose of the information in this presentation is to guide ICA programs and provide members with information to make independent business decisions.

Antitrust Guidelines

Antitrust Guidelines for Copper Industry Trade Association Meetings

The following guidelines with respect to compliance with antitrust laws of the United States, Japan and European Community¹ are intended to govern the conduct of participants in copper industry trade association meetings, both at the meeting itself and in informal discussions before or after the formal meeting.

Price: Competitors should not discuss future prices (including terms of sale) of their products. There is no blanket prohibition against the mention of or reference to current or past prices but limits must be observed. Such references or mentions should occur only when necessary in connection with the development of association programs. For example, reference to a particular price level in comparing the cost of a copper product to a competing product is permitted. Whenever possible, such references should be discussed in advance with legal counsel.

Competitive Information: Competitors should not discuss the market share of a particular copper producer or copper fabricator's products. Furthermore, nothing should be said at a meeting which could be interpreted as suggesting prearranged market shares for such products or producer production levels. The overall market share of copper products may be discussed with regard to competition with non-copper products and general market acceptance.

New Products: Competitors should not encourage or discourage the introduction of a new product by another competitor or reveal a particular copper company's plans to change the production rate of an existing product or to introduce a new product. No company should disclose to another company whether it is in a position to make or market a new product. New products may be discussed in a technical manner or from the standpoints of competition with non-copper products and general market acceptance. In addition, proposed methods for and results of field and laboratory testing can be considered.

The Role of Legal Counsel: Legal counsel attends association meetings to advise association staff and other meeting attendees regarding the antitrust laws and to see that none of the matters discussed or materials distributed raise even the appearance of antitrust improprieties. During the course of a meeting, if counsel believes that the discussion is turning to a sensitive or inappropriate subject, counsel will express that belief and request that the attendees return the discussion to a less sensitive area.

A paper entitled 'Copper Industry Trade Associations and Antitrust Laws' is available upon request.

10/92, 5/93, 10/10

1. Other foreign competition laws apply to International Copper Association, Ltd. (ICA)'s activities worldwide.



NOVEMBER 2017

Coal to Electricity North China Region

Mr. Song Zhongkui
General Secretary
China Energy Conservation Association (CECA)

Coal to Electricity

‘Coal to Electricity’ is an China National government campaign, underpinned by government policies.

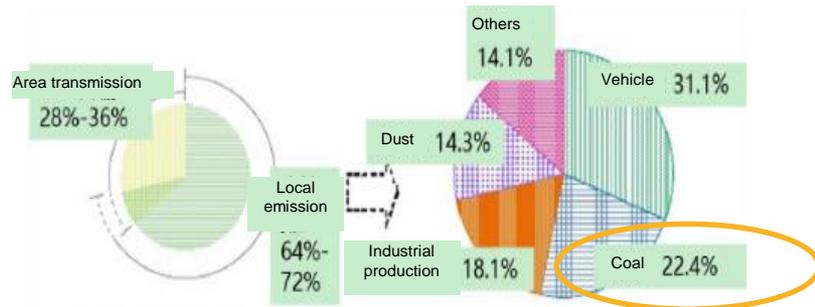
Study work by Brilliance Consulting, China.

Study time-frame: March 2017 to August 2017.

Fog and haze governance is the main driver underpinning 'coal to electricity'

Scattered coal-fired heating is an major source of 'fog and haze'

PM2.5 source apportionment was announced in April 2014 (Beijing Environmental Protection Bureau)



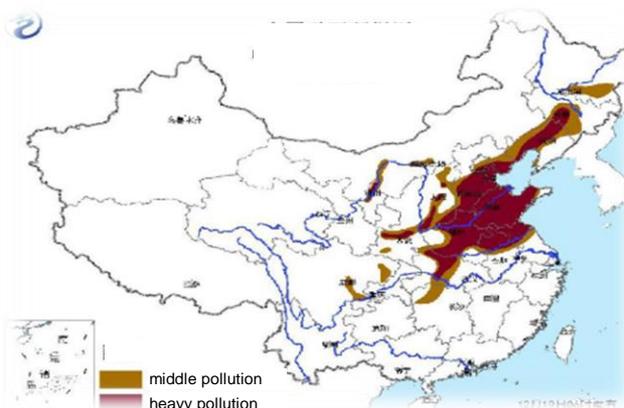
The PM2.5 of fuel emission from bulk coal combustion is 10 times higher than that of large coal-fired boilers



Control bulk coal



Fog and haze in most parts of the North



Data source: China building energy saving Annual Development Research Report 2016

Electric heating technology included in 'coal to electricity'

- 2001-2012 in the core area of Beijing "coal to electricity" work, limited by housing conditions and technical conditions at the time, the majority of electric heating products are energy storage electric heater products. In 2013 after the start of "reduce and replace coal, clean air action " in rural areas, the Beijing Municipal Agricultural Commission asked districts to carry out work in accordance with guiding principle of "pilot area first, and gradually push forward", 14 districts implementing "reduce and replace coal" conducted pilot experiments on different types of electrical heating locally.
- Electric heating pilot mode: electric boiler, heat storage electric heating, heating cable heating, electric heating film, carbon crystal electric platen heating, ASHP heating, ground source heat pump, carbon fiber geothermal heating, hot carbon rail, etc.
- At present, the coal to electricity technologies adopted in Beijing include: ASHP, regenerative electric heating, ground source heat pump.



Hot carbon rail



Direct heating type electric heater



Electrothermal membrane



Regenerative electric heater



Ground source heat pump



Air Source Heat Pump (ASHP)

Coal fired boiler replacement in Beijing

Replacement of coal fired boilers in the north of China, without district heating facilities. ASHP is an energy saving and copper intensive solution.



ASHP heating >20kg copper per household



No copper

2016 coal to electricity market: equipment application campaign ASHP system - copper density

Outdoor unit evaporator: 6 kg (2-3 row copper tube)



HEX-Evaporator

Valves and Piping: 5 kg



Valves and connection tube

Water pump: 0.5 kg

Fan: 0.5 kg



Pump



Compressor

Compressor: 3 kg, 5P fixed speed



HEX-Condenser

Condenser: 5 kg, bushing type

- ASHP heating system (taking 5P machines as an example, excluding terminal), each set copper usage is about 20 kilograms.

evaporator	compressor	condenser	other	total amount
6kg	3kg	5kg	6kg	20kg

CECA supports Beijing government to choose heat pump as key technical solution, in “Coal to electricity” program

From 2015 to 2016, CECA, supported by ICA, worked closely with Beijing agriculture committee to perform technical comparisons and “coal to electrical” program guidelines:

- Policy proposal preparation.
- Organize OEM for field trials.
- Industry investigation.
- Technical workshops
- Draft guideline and work plan.

Key benefits-Air source heat pump,
-Energy saving
-Low grid update investment
-Comfort



“Coal to electricity” in China Coal fired boiler replacement by electrical heating devices

- As a result, in 2016, Beijing decided to **set the 80% market share requirement** in the “Coal to electricity” program guidelines for heat pump and hybrid system,
- For each household who choose air source heat pump,
- Government subsidy, 24,000 RMB
- Self-paid, 2,000 RMB
- Total **around 26,000 RMB** for one typical air to water heat pump system, not including heat emitter



京新农办函〔2016〕3号

北京市社会主义新农村建设工作领导小组办公室
关于印发《北京市2016年农村地区村庄
“煤改清洁能源和减煤换煤”相关推进工作

- **原则上禁止“直热式”电取暖设备，热泵和多能联动类设备不少于取暖设备的80%**

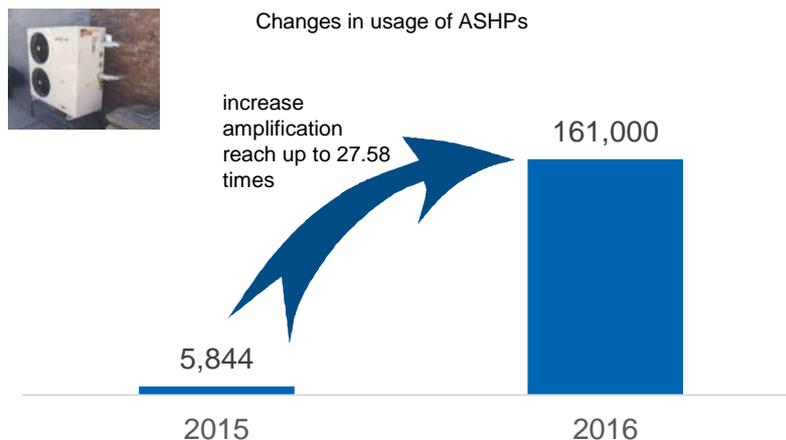
《指导意见》的通知
郊区各区、石景山区人民政府：
“煤改清洁能源和减煤换煤”相关推进工作的具体指导，请结合《北京市“煤改清洁能源和减煤换煤”相关推进工作的具体指导》
《指导意见》印发给你们，请认真组织实施。

北京市社会主义新农村建设工作领导小组办公室

2016年4月29日

2016 coal to electricity market situation: equipment application

- According to statistics of villages and total quantities offered by the 14 districts implementing "coal to clean energy" in 2016 in Beijing, 199 thousand households in the total amount of coal to electricity, 151 thousand households choosing ASHP products, total actual installed capacity is about 161 thousand sets, compared with 2015, the total market application amount increase amplification can reach up to 27.58 times.
- If the calculation based on price in Changping District, Tongzhou District, Fangshan District, Huairou District, Fengtai District 2016 5HP equipment average limit price 27800 yuan / heating system cost, 2016 Beijing "coal to clean energy" low temperature ASHP heating system market size can reach up to 4.476 billion yuan.

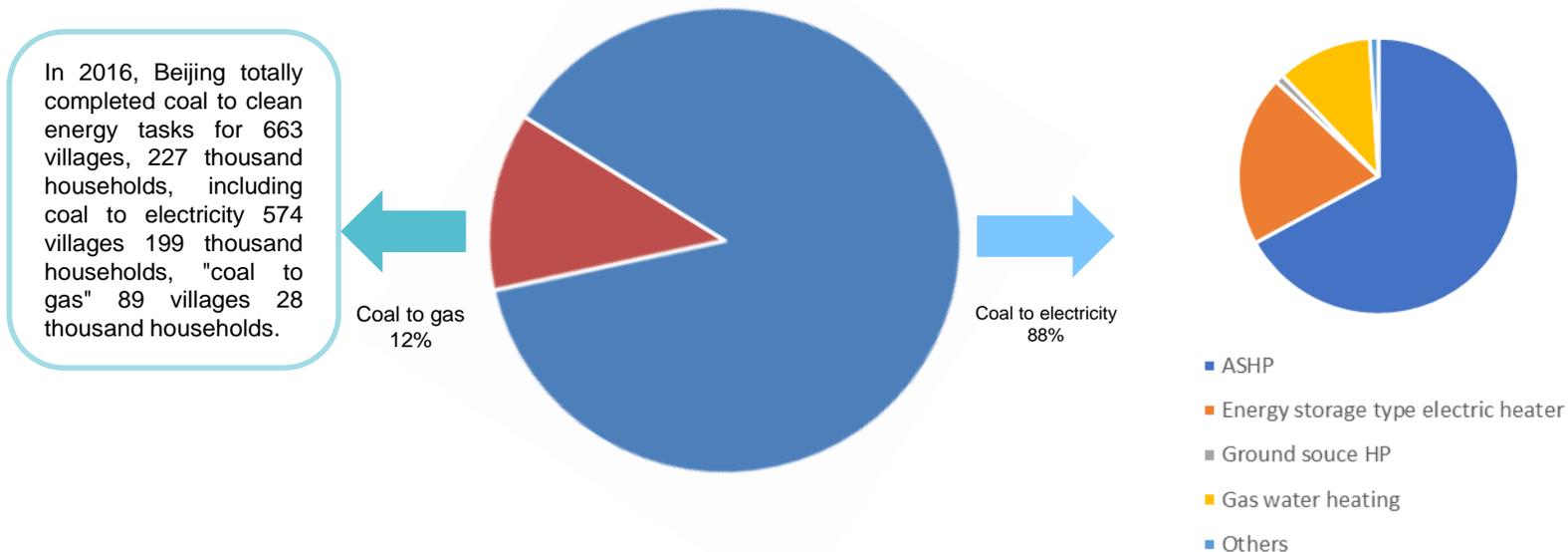


Air to water heat pump, replaced coal-fired boilers, village by village during 2016 winter season



2016 coal to power equipment applications amount

- According to survey comprehensive data, in 2016, Beijing totally completed coal to clean energy tasks for 663 villages, 227 thousand households, including "coal to electricity" 574 villages 199 thousand households, "coal to gas" 89 villages 28 thousand households.
- In the 199 thousand coal to electricity households, **ASHP 151 thousand households**, accounting for 76.28% of the total number of coal to electricity households; ground source heat pump 2139 households, accounting for 1.07% of the total number of coal to electricity households; energy storage type electric heater 44 thousand and 300 households, accounting for 22.3% of the total number of coal to electricity households; other electric heating equipment 688 households, accounting for 0.35% of the total number of coal to electricity households.



Data source: latest data from Beijing Rural Work Committee

Environment contribution by AWHP

Coal and pollution emission reduction

Beijing in 2016

Per household installed with AWHP could reduce coal fired by 3.331 tons in Beijing, averagely. In 2016, 151,000 household were installed with AWHP to replace the coal fired boiler, so the we achieve big emission reduction.

Beijing AWHP 2016 Contribution	
Coal reduction (0,000 tons)	50.3
SO ₂ reduction (tons)	3722
Nox reduction (tons)	805
CO reduction (tons)	70466
VOCs reduction (tons)	2012
PM10 reduction (tons)	6790
PM2.5 reduction (tons)	5432



* Calculation made based on MEP emission data

Coal to electricity: Grid upgrade

In 2016, State Grid Beijing, Tianjin and Hebei 398 thousand households residents carry out the implementation of coal to electricity:

- In 2016 and 2017, plans to invest about 30 billion yuan to upgrade the power grid.
- **Each household power distribution upgrade from 2kW to 9kW**, driving a large number of transformer to upgrade.

Average grid upgrade copper usage for each household directly caused by coal to electricity, more than 15kg/household



Policy and market development forecast from 2017 to 2021: policy trends National air pollution prevention mission

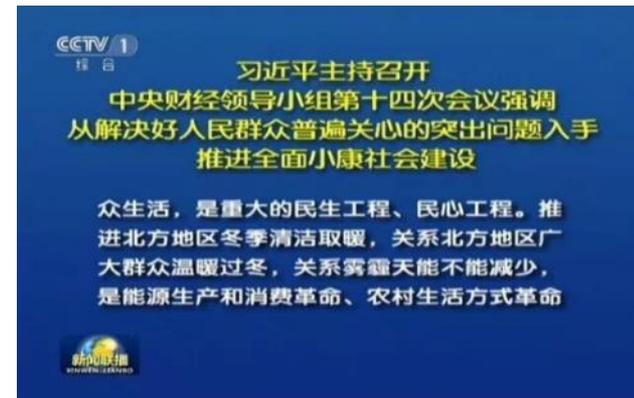


- According to the Ministry of environmental protection, according to the “Beijing, Tianjin, Hebei and surrounding areas air pollution prevention and control plan in 2017”, Beijing, Tianjin, Hebei Shijiazhuang, Tangshan, Langfang, Baoding, Cangzhou, Hengshui, Xingtai, Handan, Shanxi Taiyuan, Yangquan, Changzhi, Jincheng, Shandong Ji’nan, Zibo, Jining, Dezhou, Liaocheng, Binzhou, Heze, Henan Zhengzhou, Anyang, Hebi, Xinxiang, Jiaozuo, Puyang(hereinafter referred to as the "2+26" city) was identified as the Beijing Tianjin Hebei transmission channel city of air pollution.

2017 to 2021 policy and market development forecast: policy trends

Winter clean heating - from "coal to electricity" to "winter clean heating"

- On December 21, 2016, General Secretary of the Communist Party of China Xi Jinping presided over the fourteenth meeting of the central financial work leading group and stressed that promoting winter clean heating in northern China is related directly to broad masses' getting through an warm winter, to fog and haze days decrease, is an important part of a revolution in energy production and consumption, rural lifestyle revolution.
- Prime minister, Li Keqiang, announced this March, in 2017, China will complete **3 million** household "coal to clear energy", including gas and electricity.



Fast market growth for low temperature Air Water heat Pump (AWHP) heating



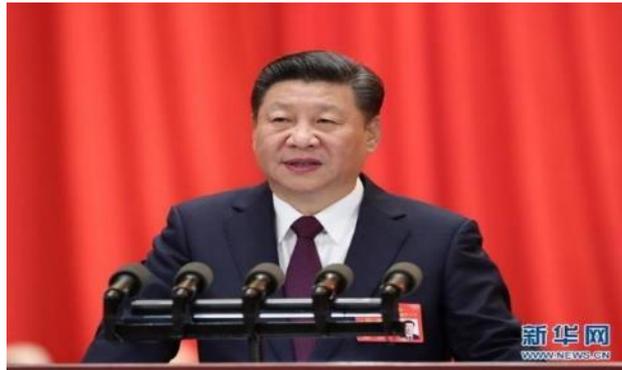
2015	Units (0,000)	Growth rate	Turnover RMB (0,000)	Growth rate
Commercial	0.74		3.7	
Household	2.23		3.345	

2016	Units (0,000)	Growth rate	Turnover RMB (0,000)	Growth rate
Commercial	1.5	203%	6.9	186%
Household	18.5	830%	25.9	774%

2017E	Units (0,000)	Growth rate	Turnover RMB (0,000)	Growth rate
Commercial	5.5	367%	25.3	367%
Household	40	216%	56	216%

Source: China heat pump alliance

Xi speech for clean heating and blue skies In the 19th CCP conference



**President Xi request, we must win
the blue skies protection war.**

**“We will continue our campaign
to prevent and control air pollution
to make our skies blue again.”**

打好→打赢

达成什么目标才算“打赢蓝天保卫战”？十九大记者招待会给出答案

2017-10-23 央视新闻 热泵在线



今天下午，十九大新闻中心举办第六场记者招待会，邀请环境保护部党组书记、部长李干杰，中央财经领导小组办公室副主任杨伟民，介绍践行绿色发展理念，建设美丽中国的有关情况，并回答记者提问。



From MEP, 338 cities, good air quality must be more than 80% days of the whole year.

Big investment in following 3 years for clean heating

From China national television station, 12 key cities in northern China will make 20 billion RMB investment for clean heating in following 3 years.

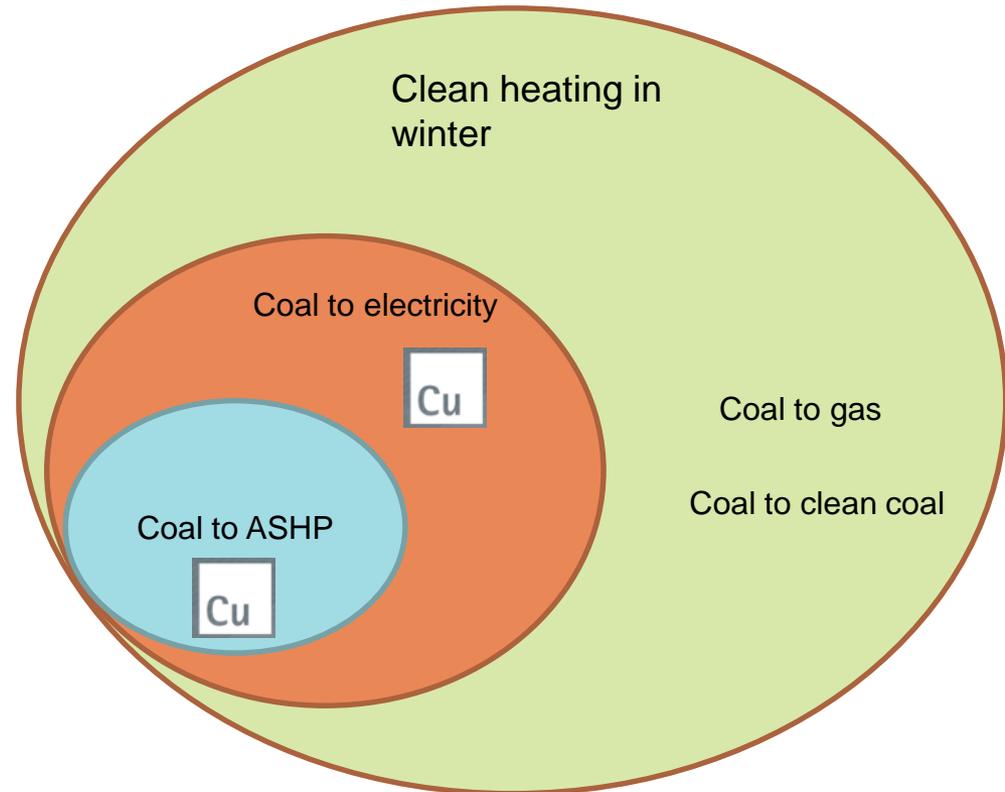
12试点城市中央奖补219亿元

根据试点方案，12个试点城市未来3年将共计获得中央奖补219亿元，而地方财政将投入约697亿元保障清洁取暖改造顺利实施，计划吸引金融机构、企业投入等社会资本超过2000亿元。



Key questions for ASHP and Copper industry policy trends and technical direction

- In winter, clean heating includes the technical direction of coal to gas, coal to electricity and coal to clean coal
- Coal to electricity has broad category, and coal to ASHP is one of the important directions
- Coal to ASHP technology path has the largest copper intensity.



Thanks !

Mr. Song Zhongkui
General secretary
China energy conservation association
