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中國地熱能

CHINA GEOTHERMAL ENERGY



助学启前程 爱心燃希望——恒有源集团爱心助学项目介绍 P16 | 新中国 70 年的能源变迁 P26

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首都科技发展战略研究院
微信公众号：CISTDS
网址：www.cistds.org
地址：北京市朝阳区东三环中路63号
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北京市人民政府新闻办公室
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“首都科技创新发展指数”新闻发布会
“The Capital Science and Technology Innovation Development Index” Press Conference



联合国工业发展组织总干事李勇先生与首都发展战略研究院院长关成华先生亲切会晤
Mr. Li Yong, the Director General of UNIDO, met with Prof. Guan Chenghua, the President of CISTDS.



中欧绿色投资政策对话项目
EU-China Policy Dialogues on Investment



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中国地热能

CHINA GEOTHERMAL ENERGY

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CHINA GEOTHERMAL ENERGY

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合理开发利用地热资源

——记国务院资深参事对地热能的研究历程

PROPER EXPLORATION AND UTILIZATION OF GEOTHERMAL RESOURCES

—— Research Process of Senior Counselor of the State Council on Geothermal Energy

作者：王秉忱 沈梦培

序言

地热能是绿色低碳、可循环利用的可再生能源。地热能储量大、分布广、清洁环保、稳定可靠，是一种现实可行且具有竞争力的清洁能源，是名符其实的“绿色能源”。地热能通常分为浅层地热能、水热型地热能、干热岩型地热能，其成本等于或低于传统能源，具有无污染、无排放、保护生态环境、高效节能等特点，作为可持续发展的新技术和 21 世纪建筑环境供热制冷系统的换代产品，面临着巨大的产业和市场发展机遇。开

发深层地热资源受到地质条件制约（应具备热源、热储、热传导通道、覆盖层四个条件），所形成的地热田（有开发利用深部地热资源价值的区域）分布有限，而浅层地热资源是由太阳辐射的热能广泛储存在地表浅部水体与岩土体中，借助于已成熟运用的地源热泵技术，很容易把这种热能提取出来，耗用能量少，利用价值高。

地源 / 水源热泵技术主要有四种：地下热水、水源热泵、地源（土壤源）热泵和污水源热泵（包

括河水、海水)。

根据国内外的实践经验,利用地源热泵技术,积极大力开发浅层地热能源,用来解决建筑物供暖与制冷问题,有广阔的发展前景,政府应给予足够的重视。

一、众多国务院参事进行地热调研工作

(一)在2004年,王秉忱参事带领国务院参事室城建与水资源组对北京、天津和河北省部分使用深层热水源系统的单位进行了实地考察。

(二)2005年初,王秉忱参事提出要合理开发利用地热资源的参事调研课题,他带领国务院参事室城建与水资源组将调研工作锁定在地热资源的开发利用上,吴学敏参事和沈梦培参事都强烈支持王参事的建议。

(三)2005-2006年,国务院参事室对“开发利用地热资源”课题进行多次调研:

(四)2005年11月15~28日,国务院参事室组织安排王秉忱、吴学敏和沈梦培三位参事专程去埃及、以色列、土耳其三个国家进行考察。在土耳其考察核心内容是地热能源的开发利用技术和政府的引导政策。土耳其政府制定免收增值税,开发地热资源的收入小于投资额的给予免税,用于地热开发新能源的电能只收取一半费用和免收开发地热租赁的土地使用费等政策鼓励利用地热能源,对开发利用地热资源起到显著的推动作用。三位参事将土耳其访问的考察成果及时反映在国务院参事建议中,希望我国吸取土耳其经验,由国务院有关部门(发改委与国家能源局)从国家层面上尽快对地热资源的开发利用制定与出台优惠政策,增大扶持力度,鼓励开发利用可再生能源中的地热能。

(五)2005年3月,王秉忱、吴学敏、沈梦培参事和晏懋洵、石定寰代表被任命为北京市2008办特约监督员,为了实现“绿色奥运”,北

京市决定,2008年奥运会所有体育场馆全部使用绿色能源—地源能量系统。

(六)2006年4月16-29日,国务院参事室组织地热调研组到广东广州市、恩平市,又到云南省腾冲市,瑞丽市和西双版纳做地热调研。

二、北京市2008年奥运项目中地热能的应用:

(一)2006-2008年,北京市10个奥运项目的建设都采用了地源空调系统,这10个项目分别是:水立方、鸟巢、国家体育场、奥运村住宅及森林公园、网球中心、国家体育馆、顺义、北京大学、北京工业大学和残奥游泳馆。所有项目中,北京市只有两个企业获得建设批准,一项是由天银公司承担的奥运村住宅及森林公园项目,项目使用清河污水厂处理的污水,利用热泵提取热能,做成水源热泵空调系统;另一项是由恒有源公司承担的残奥游泳馆项目。项目采用浅层地热能并依托我国原创的单井循环换热地能采集技术结合热泵空调系统为建筑物供暖(制冷)。项目启用后,运行经济、稳定,客户满意度高。

(二)2005-2010年期间,北京市很多企业进入地热行业,完成大量地热工程,在2007年底,沈梦培参事又被选作北京市第十三届人大代表,为了推动地热行业发展,提出代表建议。

(三)北京市《08》重大项目中,地源/水源热泵项目以无燃烧、无废弃物、无污染著称,这成为北京“绿色奥运”的一大亮点。为了帮助北京市《08》重大项目中的地源/水源热泵项目总结经验,2007年6月24日,沈梦培参事编制完成《规范北京市热泵系统做好08工程中热泵项目的全面技术评价工作》报告,交予相关领导,得到有关部门的大力支持。

(四)从项目具体实施的情况看,在技术先进的国家,地源/水源热泵技术系统已经很成熟了,但是在我国,地源/水源热泵技术系统还需

要总结经验教训，找出不足，加以改正。为了做好这方面的工作，专家组提出建议：

① 做好“08”工程项目中地源/水源热泵项目的技术评价工作。

② 聘请知名专家王秉忱大师为专家组长，主持技术评价工作。

③ 在完成08工程中的热泵项目的全面技术评价工作后，以王秉忱大师为专家组长的技术评价组，继续进行其他地源/水源热泵项目技术评价工作。

以上建议得到相关部门领导的高度重视。2011-2012年，北京市发改委下属单位北京市节能环保促进会负责组织“评估北京市地源热泵系统工作”由北京市发改委、北京市农委、北京市水务局和北京市国土资源局共同完成。三位参事（王秉忱、吴学敏和沈梦培）作为评委，共同参与评估工作。

2012年，在完成“评估北京市地源热泵系统工作”之后，几位参事建议将北京市从事地热行业的企业组织起来，成立北京节能环保促进会的二级组织对浅层地温（热）能开发利用专业委

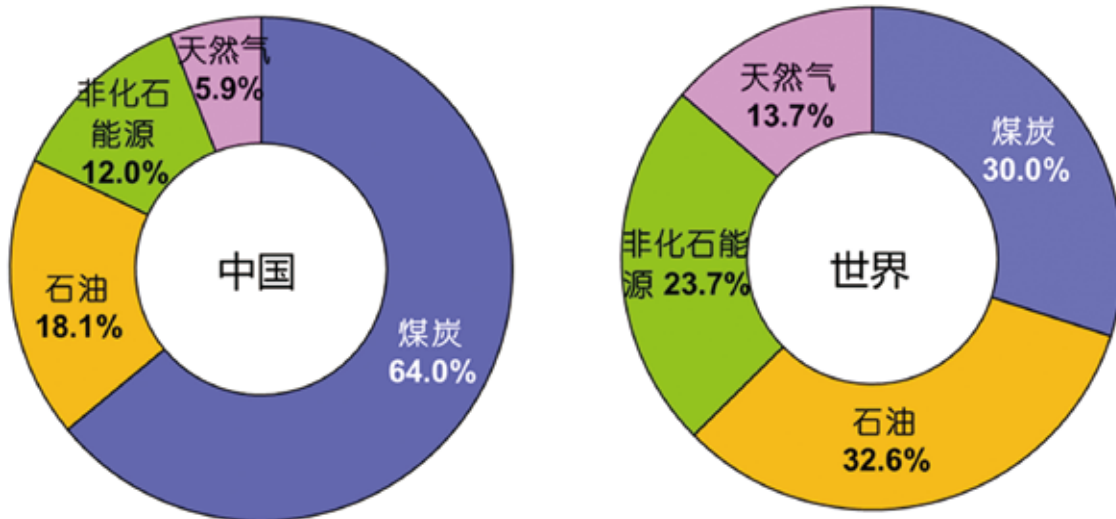
员会，同时北京浅层地温（热）能开发利用专业委员会出版重点报道北京企业在全国建设地热项目的地热科普型刊物《中国地热能》，采用季刊形式，每年四期。

三、地热能的应用解决雾霾问题

2014-2015年北京地热协会开会时，各与会代表讨论雾霾产生问题，随后北京市领导做出北京市“无煤化”的决定，在2016年，北京市城区实现“无煤化”；2017-2018年，北京市实现“无煤化”。

我国地热资源较为丰富，资源潜力巨大，但目前我国地热资源利用量仅占我国能源消费总量的0.6%。我国的能源消费结构与世界能源消费结构相比，煤炭比例过大，而石油、天然气明显低于世界平均水平，非化石能源比例仅约为世界平均水平的一半。

浅层地热能作为分布最广、最易开发的地热资源，近年来发展迅速。浅层地热能主要指地表以下200米以内、温度低于25℃的低品位热能。浅层地热能储量丰富、分布广泛；再生迅速，且



中国与世界能源消费结构对比（2015年）

什么是雾霾：



唐孝炎院士

(中国工程院院士、北京大学环境科学系教授、我国大气环境化学专业创始人)

由于燃烧煤、天然气、庄稼秸秆、石油制品产生大量二氧化硫、氮氧化物和挥发性有机物等污染物，由此形成硫酸和硫酸盐、硝酸和硝酸盐等，当大气的湿度低于百分之八十，污染物逐渐形成霾颗粒，颗粒物的光效应使能见度下降到十公里以下，甚至更低，对光传播造成了视程障碍，呈灰蒙蒙的视程障碍现象叫做霾，但是当湿度高到百分之九十以上，那时候就变成轻雾，湿度更大时，就成为雾了。

霾颗粒和雾不一样，雾较容易散去，霾却很难。因为雾含水量大，受天气变化的影响比较大，太阳一出来，遇到干燥空气，雾就很容易散去，所以雾一般不会全天都有。霾就比较麻烦，因为霾的水蒸汽含量不高，湿度通常在百分之八十以下，再加上霾所处空间一般是3000米以下，如果当上空存在温层，而水平方向没有风或风很小，空气上下对流或者水平流动不畅通时，霾就无法散去。

有较强的恢复能力。

浅层地热能供暖系统在供暖地区用一份最清洁的电能，驱动热泵系统搬运可再生的不花钱的浅层地热能，得到相当于3份以上电能直接转化的热能为建筑物供暖，供暖区域无燃烧、零排放，供暖花费比烧煤还低。

使用取之不尽、用之不竭的浅层地热能需要结合热泵设备，北京市浅层地温（热）能开发利用专业委员会及行业内地热能企业对热泵设备进行深入研究，制造出性能优异的热泵系统，能够在各种周边环境下稳定工作。

结合先进技术，按照“技术先进、环境友好、经济可行”的总体要求，加快地热能开发利用，加强全过程管理，创新开发利用模式，全面促进地热能资源的合理有效利用，是我国地热能发展的新思路。



丁衡高院士

(中国工程院院士)

为了治理雾霾，在实施“无煤化”的地区，推广使用浅层地能，丁衡高院士编写了“关于推荐浅层地能作为供暖替代能源的有关建议”，并呈报给李克强总理。

Proper Exploration and Utilization of Geothermal Resources

— *Research Process of Senior Counselor of the State Council on Geothermal Energy*

Author: Wang Bingchen Shen Mengpei

Preface

Geothermal energy is a green, low-carbon, recyclable and renewable energy. The geothermal energy, characterized by large reserves, wide distribution, cleanliness and environmental protection, reliability and stability, is a practical and competitive clean energy, and can be called a truly "green energy". Geothermal energy is usually divided into shallow geothermal energy, hydrothermal geothermal energy and HDR (hot dry rock) geothermal energy, and its cost is equal to or less than that of traditional energy, with the feature of pollution free, emission free, ecological environment protection, high efficiency and energy saving. As a new sustainable technology and the substitute

of heating and cooling system in building environment in the 21st century, it faces huge opportunities of industrial and market development. The development of deep geothermal resource is restricted by geological conditions (it requires four conditions, namely heat source, geothermal reserves, heat conduction channel and covering layer); the geothermal field formed (area with the value to develop and utilize deep geothermal resource) is distributed limitedly; while the shallow geothermal resource refers to the heat energy radiated by the sun and widely stored in the shallow water body of earth's surface and rock-earth mass, it can be extracted easily with the help of ground source heat pump (GSHP)

technology that has been maturely applied, with less energy consumption and high value in use.

There are mainly four kinds of ground source / water source heat pump (WSHP) technologies: Geothermal water, WSHP, GSHP (soil source) and sewage source heat pump (including river water, seawater).

Based on the practical experience at domestic and abroad, the government shall pay enough attention to the application of GSHP technology to actively exploit shallow geothermal energy, which has a broad prospect of development, and can solve the heating and cooling problems of buildings.

I. Many counselors of the State Council are engaged in geothermal research

(1) In 2004, Counselor Wang Bingchen led the urban construction and water resource panel of Counselor's Office of the State Council and made field visits to some units using deep hot-water system in Beijing, Tianjin and Hebei.

(2) At the beginning of 2005, Counselor Wang Bingchen proposed a counselor research topic about proper development and utilization of geothermal resources, and he led the urban construction and water resource panel of Counselor's Office of the State Council to target the research at the development and utilization of geothermal resources, and Counselor Wu Xuemin and Counselor Shen Mengpei strongly supported his proposal.

(3) From 2005 to 2006, the Counselor's

Office of the State Council conducted many investigations on the topic of "development and utilization of geothermal resources".

(4) From November 15 to November 28, 2005, the Counselor's Office of the State Council dispatched three counselors, Wang Bingchen, Wu Xuemin and Shen Mengpei, to Egypt, Israel and Turkey for investigation. The core of investigation in Turkey was the development and utilization technology of geothermal energy and the guiding policies of the government. The Turkish government has formulated policies to encourage the use of geothermal resources, such as exemption from value-added tax, tax exemption for the income less than the investment in the development of geothermal resources, only half of the electric expenses charged for the electric power used for development of new geothermal energy, and waiver of usage fee for land rented for the development of geothermal energy, all of which played a significant role in promoting the development and utilization of geothermal resources. The three counselors reported the investigation results obtained from their visit to Turkey in counselor's advice to the State Council in a timely manner, and hoped that our country could learn from Turkey, and that relevant departments of the State Council (NDRC and National Energy Administration) could formulate and issue preferential policies on development and utilization of geothermal resources at the national level as soon as possible, increase the efforts in support,

and encourage to develop and utilize the geothermal energy out of the renewable energy resources.

(5) In March 2005, Counselor Wang Bingchen, Wu Xuemin and Shen Mengpei as well as Yan Maoxun and Shi Dinghuan were appointed as special supervisor of 2008 Beijing Office. In order to realize "Green Olympics", Beijing decided that, all the stadiums and gymnasiums of the 2008 Olympic Games should use green energy - ground source energy system.

(6) From April 16 to April 29, 2006, the Counselor's Office of the State Council organized geothermal research panel went to Guangzhou and Enping, Guangdong Province and Tengchong, Ruili and Xishuangbanna, Yunan Province for geothermal survey.

II. Application of Geothermal Energy in the Events of Beijing 2008 Olympic Games

(1) From 2006 to 2008, there were 10 Olympic events that adopted ground source air-conditioning system in Beijing during the construction, including: The Water Cube, Bird's Nest, National Stadium, residence of Olympic Village and Forest Park, Tennis Center, National Indoor Stadium, Shunyi, Peking University, Beijing University of Technology and the swimming pool for Paralympic Games. Of all the projects, only two enterprises in Beijing obtained the construction approval, one of which was the residence of Olympic Village and Forest Park undertaken by Tianyin Geothermal, and the project used the

sewage treated by Qinghe Sewage Treatment Plant, and extracted heat energy with heat pump and made into WSHP air-conditioning system; the other project was the swimming pool for Paralympic Games undertaken by Ever Source. The project adopted shallow geothermal energy and relied on China's original geothermal energy collection technology with single-well circulating heat transfer, coupled with heat pump air-conditioning system for supply of heating (cooling) for the buildings. After the project put into operation, it operated economically and stably, with high customer satisfaction.

(2) During the period from 2005 to 2010, many enterprises in Beijing entered the geothermal industry and completed a large number of geothermal projects. By the end of 2007, Counselor Shen Mengpei was elected as a deputy to the 13th National People's Congress of Beijing, and put forward advice for the development of geothermal industry.

(3) Among Beijing 08 major projects, GSHP/WSHP projects were known for combustion free, wastes free and pollution free, which had become a highlight of Beijing's "Green Olympics". In order to help summarize experience for the GSHP/WSHP projects in Beijing 08 Major projects, Deputy Shen Mengpei prepared and completed the report on Standardizing Beijing Heat Pump System in Comprehensive Technological Evaluation of Heat Pump Project in 08 Projects on June 24, 2007, which was submitted to competent leaders and was supported vigorously by

relevant departments.

(4) It can be seen from the specific implementation of projects that, the countries with advanced technologies has mature and proven GSHP/WSHP technical system; however in China, we still need to summarize the experience for GSHP/WSHP technical system, and make correction for those shortfalls accordingly. In this regard, the Expert Panel proposed:

To make technical evaluation for GSHP/WSHP projects of "08" engineering project.

To employ the well-known expert Wang Bingchen as the leader of the Expert Panel and preside over the technical evaluation.

Upon completion of comprehensive technical evaluation of the heat pump project in 08 engineering project, the Expert Panel led by Wang Bingchen would continue other technical evaluation of GSHP/WSHP projects.

The above suggestions were highly valued by the leaders of relevant departments. During the period from 2011 to 2012, Beijing Association to Promote Energy Conservation and Environmental Protection, the subordinate unit of Beijing Municipal Commission of Development and Reform, was responsible for organizing the "Evaluation of Ground Source Heat Pump System in Beijing", which was completed jointly by Beijing Municipal Commission of Development and Reform, Beijing Municipal Commission of Rural Affairs, Beijing Water Authority and Beijing Municipal Bureau of State Land and Resources. Three counselors (Wang Bingchen, Wu Xuemin and

Shen Mengpei) participated in the evaluation as judges.

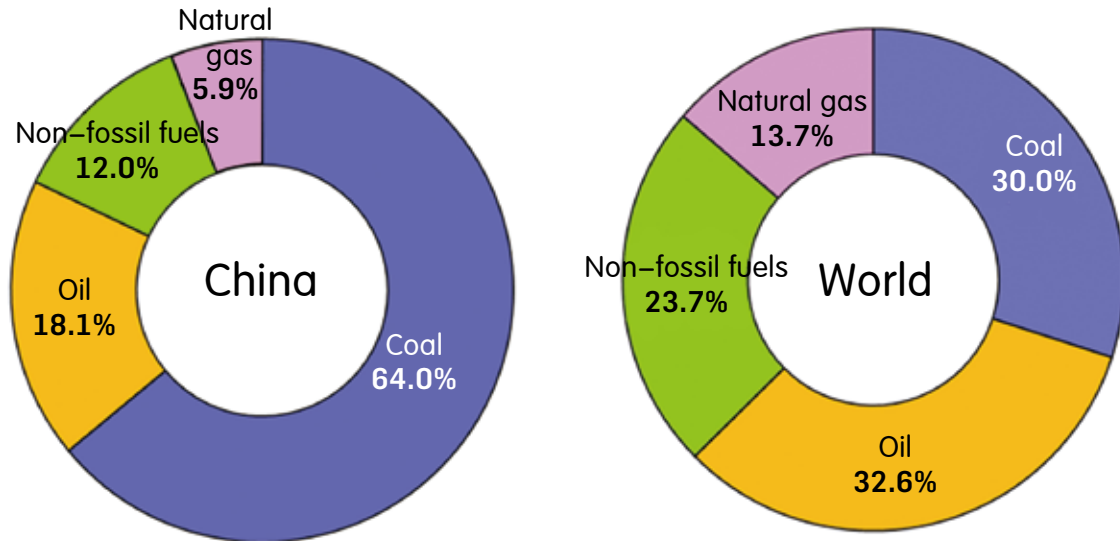
In 2012, after completing the "Evaluation of Ground Source Heat Pump System in Beijing", several counselors suggested to organize the enterprises in Beijing that were engaged in geothermal industry and to establish the Specialized Development and Utilization Committee of Shallow Geo-temperature (Geothermal) Energy, a secondary organization of Beijing Association to Promote Energy Conservation and Environmental Protection, and Beijing Specialized Development and Utilization Committee of Shallow Geo-temperature (Geothermal) Energy would issue the science publication of geothermal named China Geothermal Energy, which is a quarterly publication, with four issues every year and mainly covers the geothermal energy projects constructed nationwide by enterprises in Beijing.

III. Application of Geothermal Energy to Solve Haze Problem

When Beijing Geothermal Energy Association convened meetings in 2014-2015, the participants discussed the problems caused by haze; subsequently, the leaders of Beijing municipal made the decision of "coal-free", which was to realize the target of "coal-free" in the urban area in Beijing in 2016; Beijing was "coal-free" in 2017-2018.

China is abundant in geothermal energy resources with great potential, but at present, the geothermal energy resource used

only accounted for 0.6% of the total energy consumption in China. Compared with the energy consumption structure of the world, the proportion of coal is much too large, while that of the oil and natural gas is significantly lower than the average of the world, and that of non-fossil energy is only about half of the world's average.



Comparison of Energy Consumption Structure between China and World (as of 2015)

The shallow geothermal energy, as the most widely distributed and easily exploited geothermal energy resource, has gained rapid development in recent years. The shallow geothermal energy mainly refers to the low-grade thermal energy, which is located within 200 meters below the earth surface with temperature below 25°C. The shallow geothermal energy is abundant and widely distributed, with rapid regeneration and strong restoration ability.

The heating system using shallow geothermal energy uses one portion of the cleanest energy to drive the heat pump system, and transfer the cost-free stable renewable shallow geothermal energy, but can get more than 3 portions of heat energy equivalently transformed directly from the electricity for heating the buildings, and the heating region is free from combustion, with zero emission, and the heating cost is lower than that of coal burning.

It is required to combine with heat pump equipment when using inexhaustible shallow geothermal energy. Beijing Specialized Development and Utilization Committee of Shallow Geotemperature (Geothermal) Energy and the geothermal energy enterprises within the industry made in-depth research on heat pump equipment, and made well-performed heat pump system, which can operate stably under different surroundings.

It is a new thought for the development of our geothermal energy by accelerating the

What is haze:



Academician

Tang Xiaoyan

(Academician of the Chinese Academy of Engineering, Professor of School of Environmental Science, Peking University, Founder of the Major of Atmospheric Environment Chemistry in China):

It will generate a large amount of pollutants, such as sulfur dioxide, nitrogen oxides and volatile organic compounds, by burning coal, natural gas, straw of crops and petroleum product, thereby forming sulfuric acid and sulfate, nitric acid and nitrate, etc.; when the atmospheric humidity is lower than 80%, pollutants form haze particles gradually, and the luminous effect of particles reduces the visibility to less than

10km or even lower, causing obstruction to vision for optical propagation, which is called as haze; however, when the humidity is higher than 90%, it turns into light fog; when the humidity becomes even greater, it becomes fog.

The haze particles are different from fog as the fog is easy to disperse, while it is hard for haze. As the fog has large water content, and is greatly affected by climate change. It is easy to disperse when the sun comes out or it encounters dry air, therefore, the fog does not last all day in general. Haze is more troublesome because the content of water vapor in haze is not high, with its humidity below 80% generally; in addition, the space where haze is located is generally below 3,000 meters which cause the haze unable to disperse if there is a thermosphere above, without wind or with small wind in the horizontal direction, or unsmooth up-down convection or horizontal mobility of air.

development and utilization of geothermal energy, strengthening the whole process management, innovating the development and utilization mode and promoting the proper and effective utilization of geothermal energy resources comprehensively according to the overall requirements of "technological advance, environmentally friendly and economically feasible" in combination of advanced technologies.



Academician Ding Henggao

(Academician of Chinese Academy of Engineering)

In order to control the haze and promote the use of shallow geothermal energy in the coal-free regions, Academician Ding Henggao prepared "Proposal for Recommendation of Shallow Geothermal Energy as Alternative Heating Energy", and submitted it to Premier Li Keqiang.

助学启前程 爱心燃希望

——恒有源集团爱心助学项目介绍

LIGHTING THE FUTURE BY HELPING STUDENTS IN STUDY, RAISING HOPE WITH A LOVING HEART

——Introduction to Education-Aid Project of Ever Source Science and Technology Development Group Co., Ltd

作者：马晓芳

爱心从来不会断流，只会传递的更远。而在来自河南嵩县的耿海利、耿迎海姐弟俩看来，北京恒有源集团给予他们的不仅是物质上的帮助，更多是心灵上的温暖。去年和今年暑假，姐弟俩两次来到恒有源集团实习，在先后两个月的时间里，姐弟俩近距离接触了这家慷慨解囊帮助自己的企业，同时也切身体会到更多来自这家企业的人文关爱。姐弟俩表示，在未来一定会像供暖把党的温暖传递到千家万户一样，把生命里的这份感动和温暖接力传递下去。

近日，来自河南嵩县耿海利、耿迎海姐弟圆满结束了在恒有源集团为期一个月的暑期勤工俭学。作为恒有源集团的助学对象，姐弟俩已经是第二次来到恒有源集团勤工俭学。早在去年暑假，他们就已在恒有源集团进行了一个月的勤工俭学。

同在师范类院校就读大学的姐弟俩对于恒有源集团充满了感恩。姐弟俩表示集团不仅资助了他们的高等教育学习费用，还提供给他们在集团实习的机会，开拓了二人眼界的同时丰富了他们的视野。

两度勤工俭学拓视野

在姐弟二人到达北京实习后，为使二人更好地融入，同时也保证他们工作生活舒适，集团不仅提前就为姐弟俩安排了宿舍，还指派专人负责姐弟俩的工作指引。姐弟俩表示，在先后两次的勤工俭学期间，学到了很多课堂上没有的知识，也感受到了很多哥哥姐姐的关爱。

去年，姐弟俩在恒有源集团公司总部为期一个月的勤工俭学过程中，先后在市场中心了解了恒有源集团生态供暖产业的发展历程，学习了恒有源单井循环换热采集原创技术的原理，参观了代表性产品和项目工程的展示；在技术中心参与了专项技术问题的讨论和研究；在综合中心参与了合同整理及进度跟踪专项工作。今年实习期间，姐弟俩一起参观了多处北京的风光名胜，恒

有源集团的员工们还利用闲暇时间带姐弟俩观看了电影。

姐姐耿海利说：“没来之前自己的眼界就局限于学校的小圈子，来集团之后了解了很多环保方面的知识以及公司运行的方式，特别是知道了利用浅层地热能供暖制冷的技术，在看过机房和项目之后感觉非常神奇。此外，集团的很多哥哥姐姐都对我们很好，让我们感受到了家一般的温暖。”

“徐伯伯一直支持我们，并且支持我们考研，希望我们好好学习，不要辜负帮助我们的人的希望。”姐弟俩一直亲切称呼恒有源集团董事长徐生恒为“徐伯伯”，在他们眼里这个“徐伯伯”不仅是雪中送炭的人，还是姐弟俩仰慕崇拜的“恩师”。



放飞希望传递温暖

耿海利、耿迎海姐弟是中国节能环保集团2017年“圆梦大学 放飞希望”计划专门落实给恒有源集团负责的助学对象，恒有源集团承诺支持姐弟俩高等教育学习费用直至大本连读研究生阶段。因为成绩优异，姐姐耿海利被“圆梦大学 放飞希望”计划，此后该计划了解到耿海利的家庭情况之后，其弟弟耿迎海也被成为助学对象。

中国节能环保集团公司“圆梦大学、放飞希望”公益助学项目，始于2014年，每年筹款50万元用于资助我县100名最贫困的大学生顺利入学，目前已有300名大学生接受资助。

爱心从来不会断流，只会传递的更远。姐弟俩表示，在未来一定会像供暖把党的温暖传递到千家万户一样，把生命里的这份感动和温暖接力传递下去。

姐姐耿海利的心里话

再次和弟弟一起来到公司实习，有了比去年更深的感触。

在这里，我更深入的了解到一个企业的基本运营流程和部门分工。有时，我和弟弟会情不自禁地惊叹于能够支撑企业可持续发展的核心技术和它的创新思路。同时我们更看到了支撑一个企

业发展的硬件设施，一群卓越见识的领导者 and 一丝不苟的工作者。就实际情况来看，企业发展和我们的学习相比是两个不同的领域。但是换一个角度思考再看，做任何事情其实都是需要软实力和硬设备的完美结合。同样在学习上，我们也必须兼具刻苦努力的态度和思考创新的精神才能更上一层楼。

孟子说“富贵不能淫，贫贱不能移，威武不能屈”，虽然我出身于贫困家庭，但是无论如何我都会牢记着我的梦想，绝不轻言放弃。将来从事什么职业不重要，重要的是要能够对社会产生一些积极的影响，我和弟弟未来的责任将通过教育去改变更多贫困学子的命运。

实习期间，我和弟弟利用周末前往北京师范大学。“学为人师，行为世范”的校训让我深受触动，那一刻起我默默对自己说：这就是你未来要为之不懈奋斗的目标。在北师大，我感受到了和我们学校不一样的学习氛围，很受鼓舞。我和弟弟也慕名前往国家博物馆和时光博物馆，一起参观了象征着国家历史发展的文物，那些富有年代感的一幕幕不由得让人惊叹，同时也让我为祖国的繁荣发展感到骄傲和自豪。

在实习的这段日子里，我们不仅开阔了眼界、增长了见识，更收获了向未来前进的信心。

很幸运有这样宝贵的机遇来到公司学习和完善自己。感恩徐伯伯一直鼓励和支持我们兄弟的学习事业，是徐伯伯提供了这两次宝贵的机会，才让我们兄弟和北京有了一段精彩的相遇。我和弟弟会把徐伯伯对我们的支持化为前行的动力，在未来有能力之时将这份爱传递给社会中更多需要帮助的人。同时也很感谢公司里的哥哥姐姐们对我和弟弟的关心和帮助。

在以后的日子里，我会不负所托，把握好每一次机会，用尽全力走向光明的未来。

弟弟耿迎海的心里话

时隔一年，我和姐姐再一次来到了北京，这个充满温暖与希望的地方。依旧记得去年第一次到这儿时内心的兴奋与激动，那是我第一次远行，第一次见到带给我们希望的徐伯伯。每一次他亲切的话总让我感受到了多年前似曾熟悉却又模糊不清的温暖，也许就像是记忆中残存的一星半点的父爱。今年和去年一样，我们在公司的主要任务是录合同。这项工作看似简单却非常考验人的耐心和细心，合同是非常严谨的，有时多一个字或少一个字就会造成很多问题。我觉得在公司学到的东西最重要在于开拓思维，我们都是学教育的，企业对于我们来说基本上就是一个完全

陌生的新领域。可是在对待一个问题的时候，我们的思维会从各个角度去分析，解决。就像公司的标语，“用三维的角度去看二维，问题自然简单”。也许我们现在在公司学到的东西并不像在学校学到的知识那样直接有用，但我觉得潜移默化的东西往往对人的发展更加重要。

周末的时候我和姐姐一起去了国家博物馆，中国美术馆等一些具有浓厚历史文化气息的地方，感受历史的同时又感受到艺术所带给人的享受与启迪。我们还去了师范大学中的最高学府“北京师范大学”，和我所在的大学相比，不一样的东西有很多。明白了自己前进的方向在哪儿，往后的日子里一步一个脚印才会更加坚定、充实。

在北京的这些日子里，王肖哥、聂丹姐、王彦总的关心和帮助，让我见到了许多不曾见过的事物，懂得了许多不曾明白的道理。感恩每一个帮助过我的人，纵使岁月漫长，我会从不遗忘。

我们是幸运的，有更多的机会到不同的地方增加我们的阅历。可是像我们一样的贫困学生有很多，我们是学教育的，我觉得教育是改变贫穷的根本途径。我会努力提高自己的能力，待将来学业有成之时，给更多的人带去光和热。

Lighting the Future by Helping Students in Study, Raising Hope with a Loving Heart

— *Introduction to Education-Aid Project of Ever Source
Science and Technology Development Group Co., Ltd*

Author: Ma Xiaofang

Love never stops, but goes further. In the opinion of Geng Haili and Geng Yinghai, Ever Source not only provided them with material help, but also provided them with spiritual warmth. During last and this summer vacation, they came to Ever Source twice for an internship, closely contacted this enterprise that helped them generously in two months, and also experienced the humanistic care from this enterprise at the same time. They stated that, they would pass on the touch and warmth in life in the future just like Ever Source transmits the warmth of the Party to thousands of households.

In the past few days, Geng Haili and Geng Yinghai, siblings from Songxian County, Henan Province, finished their one-month summer work-study program in Ever Source Science and Technology Development Group Co., Ltd. (Hereinafter referred to as Ever Source). As an education-aid object of Ever Source, this was the second time for them to come to Ever Source for the work-study

program. As early as last summer vacation, they had been in Ever Source for the one-month work-study program.

The siblings, who are studying in normal universities, are grateful to Ever Source. They stated that, the Group not only funded their higher education, but also provided them with internship opportunities in the Group, which broadened their horizon, and

enriched their vision.

Participated in Work-Study Program Twice to Expand Horizon

After the siblings came to Beijing for an internship, the Group not only arranged dormitories for them in advance, but also arranged specially-assigned personnel to guide their work in order to help them better blend into life and work, and ensured that they could work and live comfortably. They said that, during these two work-study programs they participated in, they had learned a lot of knowledge that did not have in class, but also felt the love and care from

many elder brothers and sisters.

Last year, they learned about the development history of Ever Source in ecological heating business successively in the market center during the one-month work-study program at the headquarters of Ever Source, got to know the principle of the original technology of Ever Source for single well circulating heat transfer and collection, and visited the exhibition of representative products and project engineering; participated in the discussions and research of special technical issues in technical center; participated in contract collation and special work about progress tracking



in comprehensive center. During their internship this year, they visited many scenic spots in Beijing together, and employees of Ever Source took them to see movies in their spare time.

Geng Haili, the elder sister said that, "I limited myself to the small circle of school before I came to the Group, but after that, I learned a lot of knowledge about environmental protection and the operation mode of the Company, especially the technology of heating and cooling with shallow geothermal energy, and felt magical after seeing the computer room and the project. In addition, many elder brothers and sisters from the Group are nice to me, making us feel home-like warmth."

"Uncle Xu has been supporting us all the time, and supported us to take postgraduate entrance exams, and he hoped that we could study hard and live up to the hope of those who help us." The siblings affectionately call Xu Shengheng, Chairman of Ever Source as "Uncle Xu", who is not only the person that provides timely help, but also a "respected teacher" that they admire.

Fly the Hope, Pass the Warmth

Geng Haili and Geng Yinghai are two education-aid objects of Ever Source assigned specially by China Energy Conservation and Environmental Protection Group under the Initiative of "Realizing the Dreams of University, Flying up the Hope" in 2017, and Ever Source promised

to fund their higher education costs till the postgraduate period. Due to outstanding academic performance, the elder sister Geng Haili was selected by the Initiative of "Realizing the Dreams of University, Flying up the Hope", and her younger brother was also selected as the education-aid object after knowing their family background.

The charitable education-aid project named "Realizing the Dreams of University, Flying up the Hope" was started by China Energy Conservation and Environmental Protection Group in 2014, and would raise RMB 500,000 per year to fund 100 underprivileged college students in our county. Currently, 300 college students have received such funding.

Love never stops, but goes further. The siblings stated that, they would pass on the touch and warmth in life in the future just like heating that transmits the warmth of the CPC to thousands of households.

Innermost Thoughts and Feelings of Geng Haili

After coming to the Company for practice with my brother again, I had a deeper feeling than last year.

Here, I had a deeper understanding of the basic operation process and division of labor of an enterprise. Sometimes, my brother and I couldn't help but marvel at the core technologies and innovative ideas that underpin the sustainable development of the enterprise. Meanwhile, we also

saw the hardware facilities supporting the development of an enterprise, a group of brilliant leaders and meticulous workers. As a matter of fact, enterprise development and our study belong to two different fields. But looking at it from another way, doing anything requires a perfect combination of soft power and hardware. Similarly in terms of study, we also have to be hard-working and creative to scale new heights.

Mencius said, "Neither riches nor honors can corrupt him; neither poverty nor humbleness can make him swerve from principle; and neither threats nor forces can subdue him. These characteristics constitute the great man", although I was born to a poor family, I will always remember my dream and never give up. In the future, it is not important what kind of career you are engaged in, what is important is that you can exert some positive influences on society. The responsibility of my brother and I in the future is to change the fate of more poor students through education.

During the course of internship, my brother and I went to Beijing Normal University on weekends. I was deeply touched by the school motto of "Learn, so as to instruct others. Act, to serve as example to all." At that moment, I silently said to myself, "This is what you have to strive for in the future. In Beijing Normal University, I felt a different learning atmosphere from our school, and was encouraged much. My brother and I also went to National Museum

and Museum of Time, and visited the cultural relics representing the historical development of the country jointly and the scenes with rich sense of times amazed and left a deep impression on people; meanwhile, I also took pride in the prosperity and development of the motherland.

During the period of internship, we have not only broadened our horizon, increased our knowledge, but also gained confidence to move forward into future. I am very lucky to have such a precious opportunity to come to the Company to learn and improve myself. Thanks to Uncle Xu for encouraging and supporting my brother and me in study. It was Uncle Xu that provided us with these two opportunities that allowed us to have a wonderful encounter with Beijing. My brother and I will turn Uncle Xu's support to us into a driving force to move forward, and pass the love to more people in need in society when we have the ability in the future. Meanwhile, I also appreciate the care and help from many elder brothers and sisters in the company.

In the days to come, I will live up to the trust, grasp every opportunity, and try my best to walk towards a bright future.

Innermost Thoughts and Feelings of Geng Yinghai

After a year, my sister and I came back to Beijing again, and this is a place full of warmth and hope. I still remembered the excitement when I first came here last year. It was my first trip and the first time I met Uncle

Xu who gave us hope. Each time, his kind words made me feel the seemingly familiar but fuzzy warmth that I felt many years ago, perhaps just like a little bit of paternal love left in my memory. Just like last year, our main task in the Company was to type in contracts. This job seemed simple, but it tested a person's patience and carefulness. Contracts are rigorous and precise, and sometimes, it may cause a lot of problems with one more word or one word missing. I think the most important thing we learned in the Company is to broaden our thinking. We are both students that major in education,

and the enterprise is basically a completely new field for us. But when dealing with a problem, our thinking is to analyze and solve it from all angles. As the Company's slogan reads, "Problems will become simple and easy when you look at the two dimensions from the perspective of three dimensions". Maybe what we learned in the Company is not as direct and useful as what we learned in school, but I think what we learned subtly is more important to our development.

On weekends, my sister and I went to National Museum, National Art Museum of China and other places with a rich



historical and cultural atmosphere, and felt the enjoyment and enlightenment brought by art while experiencing history. We also went to Beijing Normal University, the highest educational institution of all normal universities, and found out that there were so many different things from my university. Also, I knew my direction of advancement, and I will work steadily in the future.

During my stay in Beijing, I have seen many things that I have never seen before and understood many truths that I have never understood before with the care and help of the elder brother Wang Xiao, the

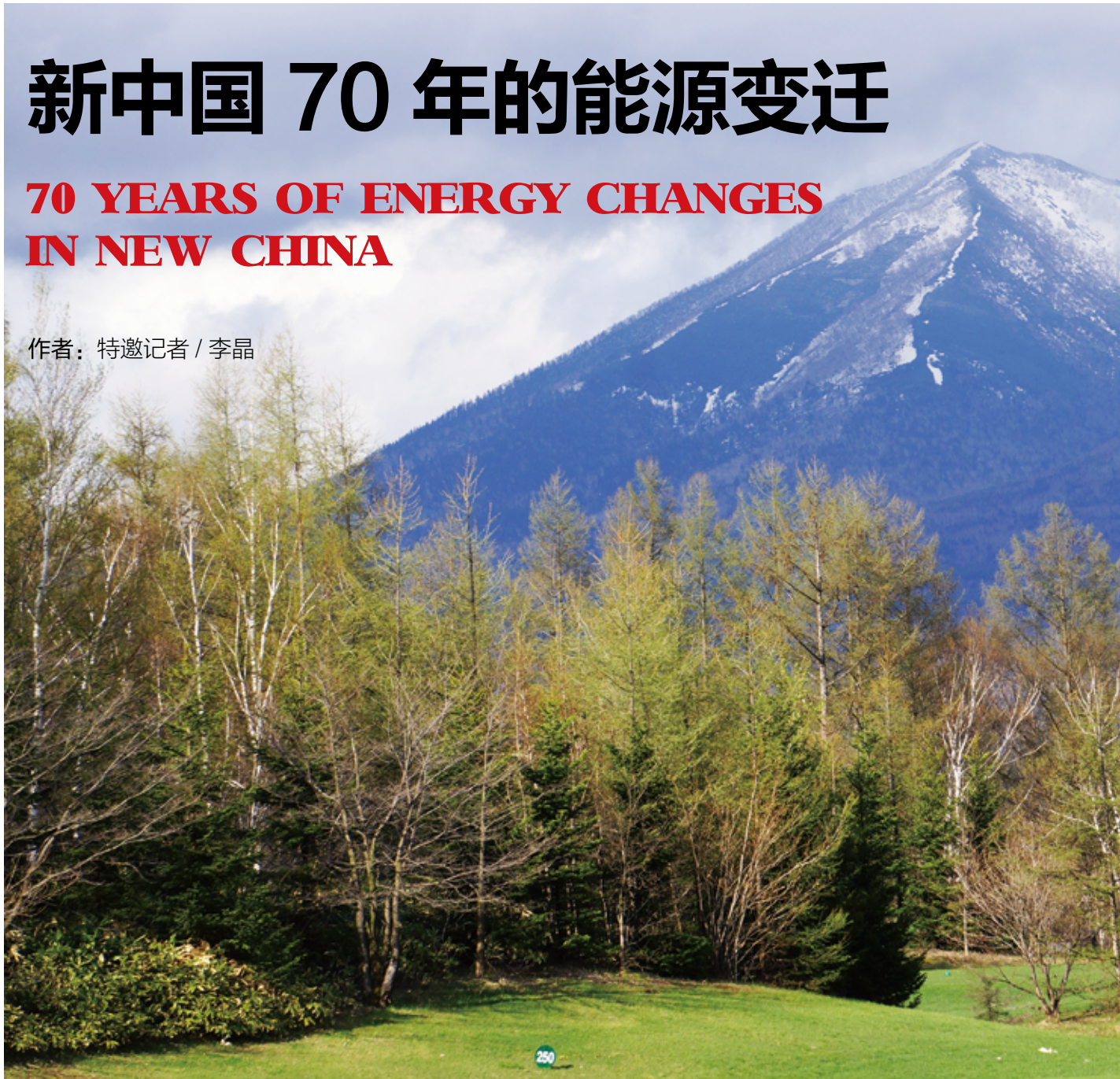
elder sister Nie Dan and GM Wang Yan. I am grateful to everyone who helped me, even if there is a long period of time to come, I will never forget.

We are lucky to have more opportunities to travel to different places and to increase our experience. But there are many underprivileged students like us, and we major in education, and I think education is the fundamental way to eradicate poverty. I will try my best to improve my ability, and bring hope to more people when I achieve academic excellence in my studies in the future.

新中国 70 年的能源变迁

70 YEARS OF ENERGY CHANGES IN NEW CHINA

作者：特邀记者 / 李晶



七十年，从生产水平低、供求关系紧张、结构性问题严重，到跨越式发展和实现历史性的改善，我国的能源事业历经了沧桑巨变。根据国家统计局

能源局发布的《能源发展实现历史巨变 节能降耗唱响时代旋律——新中国成立 70 周年经济社会发展成就系列报告之四》的资料显示，建国以来我国



能源政策不断完善、能源的生产实现了跨越式发展、能源的消费保持着较快增长、能源的结构大幅优化、能效的水平显著地提升，随着节能降耗措施取得巨

大成效，我国的能源发展逐步进入了新的阶段。

纵观十三个“五年计划（规划）”中的能源变迁

建国初期，我国能源基础十分薄弱，能源生产能力不足、水平不高。第一个五年计划（以下简称“一五”计划）是一个重工业优先的全面发展蓝图。它顺利地发动了我国的工业化进程与社会主义改造，改变了 1950 年代初期以农业和轻工业为主的产业结构。截至 1957 年，“一五”计划末（1957 年），我国的工业产值已经超过农业产值，其中重工业占工业总产值的比重由“一五”计划初期（1952 年）的 35.5% 提高到了 45%。在五年计划共实际落实的 150 项工业单位的建设中，仅能源工业方面就实际落实了 52 项。20 世纪 50-70 年代，能源发展得到重视。国家对电力、煤矿、石油等能源工业的发展作出具体部署，同时也提出要节约使用上述能源。

“六五”计划，是改革开放后的第一个五年计划。自此开始，我国经济发展战略目标由工业产量（特别是重工业产量）为中心转向以经济效益为中心，能源发展质量和效率逐步提高，降低能源消耗越发受到注重。在坚持能源的节约与开发并举时，节约已经被放到了首位。到了“九五”计划结束时，我国经济保持平稳快速增长，同一时期的能源消费量增长率仅为 1.1%，二氧化碳、二氧化硫、化学需氧量的排放均出现了负增长。

进入 21 世纪后，面对资源制约日益加剧、生态环境约束凸显的突出问题，我国继续加大节能力度，积极转变经济发展方式；面对国际能源发展新趋势、能源供需格局新变化，我国提出“能源革命”的战略思想，和坚持绿色发展的理念。“十一五”“十二五”“十三五”规划和《能源发展战略行动计划（2014-2020 年）》《能源生产和消费革命战略（2016-2030）》等纲领性文件，以及《能源技术革命创新行动计划（2016-2030

年)》《可再生能源发展“十三五”规划》等专项文件相继出台,在不断加大节能力度的同时,我国能源发展趋势和供需格局有了新的变化。能源结构由原煤为主加速向多元化、清洁化转变,新能源(风电、太阳能及其他能源)呈现出发展动力。能源消费中,天然气、水电、核电、新能源等清洁能源的消费呈现高速增长态势,能源消费总量占比大幅提高,节能降耗取得成效。

能源资源禀赋特点决定能源消费主体

在各项节能降耗政策措施的推进下,我国单位GDP能源消耗呈现整体下降态势。然而,受限于“多煤少油缺气”的能源资源禀赋特点,煤炭占我国能源生产和能源消费总量比重至今保持第一,但总体已经呈现出了下降趋势。

七十年来,在能源生产总量比重方面,原煤和原油的最高生产总量占比分别为96.3%(建国初期)、24.8%(1976年),截至2018年原煤和原油的占比情况已分别下降为69.3%和7.2%。与此同时,天然气、一次电力及其他能源清洁能源的占比有了持续的提高,截至2018年的数据显示,它们的占比已经分别达到5.5%和18%。

在能源消费总量比重方面,煤炭占比由1953年的94.4%下降到了2018年的59%。与之相对,石油、天然气、一次电力及其他能源清洁能源的占比均有提高,分别由最低的3.8%(1953年)、0.1%(1957年)、1.8%(1953年),提高到2018年的18.9%、7.8%和14.3%。值得关注的是,截至2018年,天然气、一次电力及其他能源清洁能源的占比实现了又一次新高。

随着我国能源总量的不断发展壮大,和能源消费革命的不断深化,以及用能方式的不断变革,能源结构由原煤为主,逐步向多元化、清洁化加速转变,能源消费则呈现出向效率高、污染小的清洁能源的倾斜。

当前,我国经济发展已经步入新常态,传统能源产能结构性过剩问题仍显突出,能源质量和效率仍待提升,节能降耗仍需减压。“道阻且长,行则将至”,能源转型变革仍在加快步伐,正在为实现新跨越新突破积蓄新的力量。

中国特色能源发展新格局

随着生态环境和气候变化问题越来越受到国际社会的普遍关注,各国能源开发的环保标准和排放标准不断提高,能源开发的清洁化成为全世界应对气候变化的共同责任。

由于煤炭在世界范围内的广泛分布和丰富储量,美国、欧盟、日本等发达国家和地区将煤炭洁净化开发和应用视为环节能源供应压力,及保护生态环境的重要措施。

我国能源资源品种齐全,总量可观,已探明能源矿产资源(煤炭、石油、天然气)约占世界总储量的11%,居世界第三,水能资源居世界第一。但是,我国人均能源占有量水平较低,能源综合供给能力无法满足能源需求的强劲增长,对我国能源安全及能源战略发展也带来很大影响。由此带来的能源供需科学合理发展的需求,推动我国清洁能源综合发展水平得到了显著的提高,水电、太阳能、风电等资源的综合利用程度及发展能力的提高,成为我国能源供需格局进一步演变的基础保障。

能源供需格局发展的一个重要因素是能源政策的导向。改革开放以来,从强制、引导、激励等方面,我国先后出台一系列能源政策,作为未来能源发展方向以及能源消费趋势的引导,也在一定程度上反映出国内能源发展的方向和能源供需格局的发展。近年来出台的一系列政策法规明确指出了我国的能源发展方向:低碳、节能、环保。

技术的进步也是促进能源供需格局进阶发展的重要因素。由于可再生能源(水电、风电、核电、

太阳能、生物质能、地热能、海洋能等)的开发利用成本、消费价格不断下降,使其替代常规能源(煤炭、石油和天然气等)的可能性逐步增加,亦使得其进一步推动着我国能源产业结构的改变和能源供需格局展开新的局面。

这些年我国地热资源发展与地热能应用

作为重要的可再生能源之一,地热资源包括浅层地热能资源的勘查、开发与研究工作自建国以后得到了系统的发展,也经历了多个发展阶段。

中国历史上,很早就曾有温泉和热水利用的记载。1949年新中国成立后,随着地质普查工作的开展,以及在若干温泉区进行地质勘探,全国温泉分布图首次编制完成。20世纪60年代初期,中国科学院地质研究所和地矿部地质力学研究所测得较准确的传导地温梯度数据,估算得松辽盆地3个热流值。70年代开始,我国在20多个省区开展地热资源普查和考察,累积了一批资料,区域地热资源普查、地热资源开发利用、地热基础理论等方面都取得了显著进展。

在地热能的开发利用方面,我国勘探证实了第一个高温地热田,并于1977年在此地建立了西藏羊八井地热电站。北京、天津、西安等地则相继开展了低温热水温室种植、水产养殖、疗养-洗浴和取暖等地热综合利用实验研究。

进入20世纪90年代,地热资源开发热潮兴起,地热井深度越来越大,地热资源也进入市场化阶段。缺乏科学依据的盲目开采,地热回灌技术、干热岩开发利用技术、地热资源综合开发技术以及深部地热勘探技术的不足等因素,导致地热资源开发利用出现“瓶颈”。

近年来,大气污染问题迫使能源结构需要尽快做出调整。伴随煤改气、煤改电、燃煤锅炉和“散乱污”企业综合整治措施的有效实施,区域空气质量得到持续改善。不仅对环境相对友好,而且

具有持续稳定、高效循环利用、可再生等多种优势的地热能,在改善生态环境、减少温室气体排放方面,尤其是在供暖(制冷)领域的应用方面也逐步受到关注。

相比风能、太阳能等需要介质存储的能源,和开发技术尚不成熟的生物质能及水能等能源,地热能供暖(制冷)领域已经基本解锁了上述条件的限制。《地热能开发利用“十三五”规划》也提出,到2020年,中国地热能年利用量折合7000万吨标准煤,在一次能源消费总量中占比将达1.5%左右,“十三五”时期地热能利用增量将占非化石能源增量的三分之一。

政策的激励、技术的创新,为我国地热能进一步开发利用创造了新的条件。回顾70年能源发展历程,伴随能源结构不断调整,我国地热能在稳中求进的持续发展,而未来则更要在加速推进中继续求稳,一步一个脚印的走进地热能事业收获的季节。

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70 Years of Energy Changes in New China

Author: Collated by Li Jing

Over the past 70 years, China's energy industry has changed tremendously from low production level, strained supply-demand relationship, and serious structural problems to great-leap-forward development and realization of historic improvements. As revealed by Historic Changes Have Taken Place in Energy Development, Energy-saving and Cost-reducing Keeps up the Melody of Era - Series Report IV on Achievements in Economic and Social Development at the 70th Anniversary of the Founding of New China released by Energy Division of the National Bureau of Statistics, China's energy policies have been improved constantly; the energy has achieved the great-leap-forward development in its production; the consumption of energy has maintained a rapid growth; the energy structure has been optimized significantly; the energy efficiency has been significantly improved; with the great achievements in energy conservation and consumption reduction measures, China's energy development has entered into a new stage gradually.

Energy Changes in "13th Five-Year Plans" (Planning)

In the early years after the founding of the People's Republic of China, China's energy



base was very weak, with insufficient and low-level energy production capacity. The first Five-Year Plan (Hereinafter referred to as "1st Five-Year" Plan) is a comprehensive development blueprint with a priority for heavy industry. It launched China's industrialization process and socialist transformation successfully, and changed the industrial structure dominated by agriculture and light industry in the early 1950s. As of 1957, namely the end of the "1st Five-Year" Plan (In 1957), China's industrial output has exceeded that of agriculture, with the proportion of heavy industry in the total industrial output rising from 35.5% at the

beginning of the "1st Five-Year" plan (1952) to 45%. Of 150 industrial units were established as actually implemented under the Five-Year Plan, 52 have been actually implemented in energy sector. Between 1950s and 1970s, great attention was paid to the development of energy. The state has made specific plans for the development of power, coal mines, petroleum and other energy industries, and also proposed to economize the use of the above-mentioned energy sources.

The Sixth Five-Year Plan is the first Five-Year Plan after the reform and opening up. Since then, the strategic goal of China's economic development has shifted from industrial output (Especially the output of heavy industry) to economic efficiency as core, the quality and efficiency of energy development have been gradually improved, and more attention has been paid to reducing energy consumption. While paying equal attention to energy conservation and development at the same time, energy conservation has been put in the first place. At the end of the Ninth Five-Year Plan, China's economy maintained a steady and rapid growth, and during the same period, the growth rate of energy consumption was only 1.1%, and the emissions of carbon dioxide, sulfur dioxide and chemical oxygen demand all showed negative growth.

Since the beginning of 21st century, faced with increasingly severe resource constraints, ecological and environmental constraints, China continued to intensify the efforts in energy conservation and



actively transformed the mode of economic development; confronted with the new trend of international energy development and new changes in energy supply and demand pattern, China puts forward the strategic thought of "energy revolution" and adheres to the concept of green development. The "11th Five-Year", the "12th Five-Year" and the "13th Five-Year" Plan and the framework documents like Strategic Action Plan for Energy Development (2014-2020), Strategy of Revolution in Energy Production and Consumption, etc., the Innovation Action Plan for Energy Technology Revolution (2016-2030), the "13th Five-Year" Plan for the Development of Renewable Energy, etc. were released in succession, which increased the efforts in energy conservation while China's energy development trend and supply-demand pattern have undergone new changes. The energy structure is accelerating the transformation from raw coal to diversified and clean energy, and the new energy resources (Wind power, solar energy and other energy sources) show the momentum of development. In terms of energy consumption, the consumption of natural gas, hydropower, nuclear power, new energy and other clean energies is growing at a high speed, and the total consumption of energy was increased significantly, with achievements made in energy conservation and consumption reduction.

The Endowment Characteristics of Energy Resources Determine the Subject

of Energy Consumption

With the promotion of various energy saving policies and measures, the energy consumption per unit of GDP declined as a whole. However, due to the endowment characteristics of energy resources of "more coal, less petroleum and insufficient gas", coal remains the first in terms of its proportion in China's total energy production and consumption, but it began to decline as a whole.

In the past 70 years, the raw coal and crude oil accounted for 96.3% (at the beginning of the founding of the People's Republic of China) and 24.8% (in 1976) respectively in total energy production; by 2018, the proportion of raw coal and crude oil has decreased to 69.3% and 7.2% respectively. Meanwhile, the proportion of natural gas, primary electricity and other sources of clean energy continue to rise, reaching 5.5% and 18% respectively as revealed by the data in 2018.

The proportion of coal in total energy consumption decreased from 94.4% in 1953 to 59% in 2018. In contrast, the share of oil, natural gas, primary electricity and other clean energies increased, from 3.8% (In 1953), 0.1% (In 1957) and 1.8% (In 1953) to 18.9%, 7.8% and 14.3% respectively in 2018. It is worth noting that as of 2018, the proportion of natural gas, primary electricity and other clean energies reached another record high.

With the continuous development and growth of China's total energy, constant deepening of the revolution in energy consumption as well as the constant reform,

the energy structure, dominated by raw coal, is gradually accelerating the transformation towards diversification and cleanliness, and energy consumption tends to the clean energy with high efficiency and little pollution.

Currently, China's economic development has entered a new normal, and structural overcapacity in traditional energy production is still a serious and predominated problem, with much room for energy quality and efficiency to improve, and pressure for energy conservation and consumption reduction. "The way is arduous and long, you will reach the destination as long as you keep walking ahead". The energy transformation and revolution is speeding up, and is gathering new strength for new leap-forward and new breakthroughs.

New Energy Development Pattern with Chinese Characteristics

As the ecological environment and climate changes have attracted more and more attention from the international communities, all countries begin to improve their environmental protection standards and emission standards for energy development constantly and the clean development of energy become the common responsibilities of the whole world to cope with the climate change.

Due to the extensive distribution and abundant reserves of coal in the world, the United States, the European Union, Japan and other developed countries and regions regard the clean development and application of coal as an important measure to alleviate

the pressure in energy supply and protect the ecological environment.

China has a complete range of energy resources and considerable total reserves, among which the proven energy and mineral resources (Coal, oil and natural gas) account for about 11% of the total reserves of the world, ranking the third in the world and the first in the world in terms of water energy resources. However, the per capita energy occupancy in China is low, and the comprehensive energy supply capacity cannot meet the strong growth of energy demand, which has a significant impact on China's energy security and strategic development of energy. The demands for scientific and proper development of energy supply and demand resulting therefrom have significantly improved the comprehensive development of clean energy in China, and the improvements in comprehensive utilization and development capacity of hydropower, solar energy, wind power and other resources have become the basic guarantee for further evolution of China's energy supply and demand pattern.

An important factor in the development of energy supply and demand pattern is the orientation of energy policy. Since the reform and opening up, China has issued a series of energy policies from the aspect of compulsion, guidance and incentives and others as the guide for the development direction of energy in the future, which also reflects the direction of domestic energy development and development of energy supply-demand

pattern to some extent. In recent years, a series policies and regulations have clearly pointed out the direction of China's energy development: Low carbon, energy conservation and environmental protection.

Technological progress is also an important factor to promote the further development of energy supply and demand pattern. The constant decline in the development and utilization costs of renewable energy (Hydropower, wind power, nuclear power, solar energy, biomass energy, geothermal energy and ocean energy, etc.) as well as in the consumption prices enables it to gradually replace the conventional energy (Coal, oil and natural gas, etc.), and also makes it further promote the change in structure of energy industry in China and to develop a new pattern for the energy supply and demand.

Development and Application of Geothermal Resources in China in Recent Years

As one of the most important renewable energy sources, geothermal resource includes the exploration, development and research of shallow geothermal energy resources, which has been developed systematically since the founding of the new China, and also have gone through many stages of development.

The use of hot springs and hot water has been recorded long ago in Chinese history. Since the founding of the new China in 1949, with the development of

geological survey and geological exploration in some hot spring areas, the distribution map of the hot springs throughout China has been prepared for the first time. In the early 1960s, Institute of Geology, Chinese Academy of Geological Science and Institute of Geomechanics, Department of Geological and Mining Engineering measured relatively accurate conductive geothermal gradient data, and estimated 3 heat flow value of Songliao Basin. Since 1970s, China has conducted geothermal resource surveys and investigations in more than 20 provinces and regions, accumulated a number of data, and have made remarkable progress in regional geothermal resource survey, development and utilization of geothermal resources, basic geothermal theories, etc.

In terms of the development and utilization of geothermal energy, China has confirmed the first high-temperature geothermal field by exploration, and established Yangbajing geothermal power station in Tibet in 1977. The comprehensive utilization and experimental research on low-temperature hot-water greenhouse planting, aqua-culture, recuperation-bathing and heating and others have been conducted in successively in Beijing, Tianjin, Xi'an, etc.

In 1990s, the geothermal resources gained rapid development, and the geothermal wells became deeper and deeper, and the geothermal resources were ready for marketization. Blind exploitation without scientific basis, geothermal recharge

technology, HDR development technology, comprehensive development technology of geothermal technology and deficiency in deep geothermal exploration technology and other factors result in the "bottleneck" in the development and utilization of geothermal resources.

In recent years, the problem in air pollution has forced adjustments for the energy structure in a quicker manner. With the effective implementation of turning coal to gas, turning coal to power, coal-fired boiler and comprehensive control measures against "messy and dirty" enterprises, the regional air quality has been improved constantly. Geothermal energy, which is not only relatively friendly to environment, but also is an energy that is sustainable, stable, efficiently recycling and renewable, has attracted attention gradually in improving ecological environment and reducing greenhouse gas emission, in particular in the field of heating (Cooling).

Compared with wind energy and solar energy that require medium for storage, and biomass and water energy for which there is no mature development technology, geothermal energy has basically broken the limitations of the above conditions in the field of heating (Cooling). The "13th Five-Year" Plan for Development and Utilization of Geothermal Energy also proposed that, the annual use of geothermal energy, equivalent to 70 million TCE by 2020, will account for about 1.5% in total primary

energy consumption, and the increment in geothermal energy utilization during the 13th Five-Year Plan period shall account for 1/3 of the increment in non-fossil energy.

Policy incentives and technological innovation have created new conditions for further development and utilization of geothermal energy in China. Look back on the energy development course in the past 70 years, with the constant adjustment of energy structure, China's geothermal energy continues to develop in seeking improvement in stability; in the future, China shall continue to seek stability in acceleration and step into the harvest seasons of geothermal energy.

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单井循环换热地能采集井 施工标准化管理探讨

DISCUSSION ON STANDARDIZED MANAGEMENT FOR THE CONSTRUCTION OF GEOTHERMAL ENERGY COLLECTION WELL WITH SINGLE-WELL CIRCULATING HEAT TRANSFER

作者：李瑛珺

浅层地能资源是一种重要的可再生能源，也是一种绿色低碳、清洁高效的能源，资源丰富，具有较大的发展空间。浅层地热能资源利用系统通常分为三个部分：能量采集、能量提升、能量释放。作为地源热泵系统的能量采集主要方式，单井循环换热地能采集井技术是我国原创的先进的适用于多种地质条件的浅层地能采集技术。它以循环水为介质采集浅层地下的温度低于 25℃ 的热能，可以实现地下水就地同层全部回灌。不消耗也不污染地下水，对地下水是安全的。本文将着重介绍单井循环换热地能采集井施工的标准化管

理。地源热泵系统工程的现场施工管理的好坏直接影响着工程的进度和施工质量，也在很大程度上决定了企业的经济效益、社会效益、企业信誉

乃至企业的存亡。因此必须建立安全、科学、合理、高效的现场施工管理制度，提高施工管理人员的管理水平、安全意识和专业技术水平，并加强对机械设备、施工工具和建筑材料的管理，保障建筑施工现场的安全，全面提高建筑施工的质量和效率，才能促进企业发展，扩大企业的经济效益、社会效益，提高企业信誉。选择一个好的管理方法，则会事半功倍，从根本上保证工程顺利完成。

企业可借助于国际 ISO 标准化体系，贯彻执行 ISO9001 质量管理体系、ISO14001 环境管理体系、OHSAS18001 职业健康安全管理体系，结合企业的实际情况，建立完善的标准化管理体系。通过标准化的管理，使企业在工程现场施工方面，形成一整套完整的标准化的管理体系，使

各工序各岗位都有章可循，有据可查。切实保障工程项目的施工质量及安全。

1 加强工程现场施工质量标准化管

工程质量是施工企业生存的根本所在，如果质量控制不严格会造成工程返工，进度拖延、材料浪费、成本增加，不能令客户满意，也就失去了企业的竞争力，必将被淘汰；工程现场施工质量会直接影响整个工程质量、施工进度及生产安全，所以必须要加强现场施工的质量管理。

1.1 严把原材料质量关

企业通过贯彻 ISO9001 质量管理体系，依据质量管理的八大原则，以顾客为关注焦点，寻求与供方的互惠互利。通过严格筛查选择合格供方并建立长期稳定的合作关系，可保证原材料的质量及供货周期，从而从源头上保证工程的施工质量。

首先，采购人员可根据工程需用量在合格供方范围内订购原材料，既保证有足够的材料满足施工要求，又减少资金占用量，减轻企业的资金压力。其次，由具有专业知识的材料检验人员严把进货质量关，对质量不能满足要求检验不合格的材料坚决不收。最后库房管理人员对原材料进行登记造册，做好入库出库登记，规范材料存储，做好标识，一旦工程中因原材料质量问题引起工程质量不合格，则可以追溯到原材料的供应方。

1.2 严把施工工序质量关

企业依据 ISO9001 质量管理体系要求，制定质量监控作业指导书，对施工过程中项目经理、质检员及质量负责人明确职责、分工，发现问题及时处理，把质量隐患消除在萌芽状态，提升现场施工质量水平。加强施工中的过程检验及最终检验。建立施工中重要关键部位的检验标准及检验规程，重点关注隐蔽工程的检查和验收工作，完善施工全过程中及验收时的质量控制。

1.3 单井循环换热地能采集井作为关键工序，

应严格检验包括：

- 1) 成井：井斜度、井深、井径；
- 2) 井管：丝网、井管安装深度、井管管径；
- 3) 井装置：泵位置、密封位置、水泵电缆的绝缘值、井口管线位置、泵的转向、电流值等；
- 4) 循环出水量、动静水位、含砂量，均须符合设计要求；

2 加强工程现场施工安全标准化管

在工程现场施工管理中，安全管理是尤为重要的环节。安全管理有两个方面的含义，一是工程本身的安全，二是施工人员的安全。企业通过贯彻 OHSAS18001 职业健康安全管理体系，应从以下几方面完善安全的标准化管

2.1 制度层面，建立完善的安全管理制度，明确安全责任制，规定安全巡查频次及事故处理程序；制定安全应急预案做到有的放矢；进场施工前必须与施工队伍签订安全协议书；进场后对现场施工环境进行认真观察，识别出潜在的危险源，对危险性进行评价并制定出相应的应对措施，并且做到制度上墙，人人可见。

2.2 加强对安全生产专项资金的投入和管理，要配备足够的安全器具和设施，指派专人负责登记入账，定期维护和检修，使得安全器具和设施处于良好的工作状态，在硬件设施方面降低施工事故的发生几率；

2.3 选用长期从事安全生产管理工作，实践经验丰富、责任心强、专业技术水平高的同志负责安全生产、环境保护等方面的管理监督工作；在工程现场，配备专职安全员，负责监督检查、处理相关事宜，随时随地纠正和处理违章作业，消除不安全因素，保证工人的人身安全，防止事故发生；对于工程现场的施工人员进行安全交底及技术培训，使每名施工人员都能了解如何进行作业及如何防护，避免发生伤害事故；还可以通过

重大事故案例的解析和教育来提高施工人员的警惕性，提高施工人员的安全意识和自我防范意识，要做到不伤害别人也不要被别人伤害。

3 加强工程现场施工技术标准化管理

3.1 单井循环换热地能采集井施工前进行现场踏勘，根据施工条件编制施工组织设计，应包括：工程任务及施工安全要求；主要设备、人员、材料、费用和施工进度；并按照施工步骤做好每一步的施工技术措施：

3.1.1 施工准备：确定地能采集井位，充分了解井位地下的建筑设施，开钻前要埋设护筒，安排好钻具、材料存放位置、钻井人员临时生活用地，现场留有出入通道。备好凿井工程原始记录表，编制单井施工技术方案。

3.1.2 钻机安装：钻机进入现场，按已定井位进行安装，必须使钻机支稳。

按照设计要求选定钻进参数。

3.1.3 下管：井管分花管（过滤器）、实管（井壁管）、沉砂管三部分组成，具体下管数量、缠绕网标准按设计要求执行。下管前应对井内泥浆进行稀释。

3.1.4 填砾：按设计要求选购颗粒大小、种类。砾料必须有良好的滚圆度。填砾作业宜均匀连续进行，填砾过程中随时测量填砾深度，核实已填数量。

3.1.5 洗井：下管填砾后，及时洗井，以防井壁泥皮加厚、硬化。视井中水力特性及含泥砂情况，采用下述三种方法（拉活塞、空压机和水泵）联合洗井。

3.2 在工程施工中涉及到很多的施工技术，包括钻井、钻孔、试压、焊接等等，而每种施工技术又分为不同的类型。施工所采用的技术标准不得低于国家和行业标准的规定。

3.3 做好技术交底工作。技术交底是施工生产

最详细、最细致的指导，技术交底的详细程度和对错都直接影响着工程施工每一步的进展。详细严密的技术交底直接影响着工程施工的各个方面，对材料的使用、施工的顺序、整体的质量及经济性、安全型都有着至关重要的作用。每一步的技术交底要求详实细致，要能指导施工的每一步环节，对每一步工作的方法、材料设备规格的选用、应注意的事项及相应采取的措施都要尽可能的详



实，让施工人员能够切实了解自己的工作内容及如何达到相关的要求。

4 加强工程现场施工人员的标准化管理

4.1 对每一个工程项目应组建项目部，按照标准要求配备必需的各专业成员，包括：项目管理人员、安全员、质检员、材料员、资料员、施工员、机械员等。



4.2 制定工程现场各岗位责任制，明确各司其职各负其责。

4.3 工程项目施工中，会有众多的施工班组参与其中，不同班组往往会在同一平面共同作业，为避免出现交叉施工、互相影响的情况，要进行统一安排，合理分工，让所有人员有机的结合为一个整体，共同完成任务。

4.4 加强技术人员的业务素质提升，要求各专业技术人员认真学习有关国家标准、行业标准、地方标准、规程、规范及合同文件，熟悉并掌握具体质量要求和技术指标。定期做好人员的培训教育工作，将最新的要求贯彻落实到每个施工人员，了解国家、行业和企业的最新动态，尤其某些淘汰及禁止使用的工艺、材料设备及规范规程，使技术人员的业务水平能够不断提高。

5 工程项目进度的标准化管理

5.1 在工程施工中影响进度的因素有很多，人的因素、技术因素、材料和设备因素、资金因素、气候因素、环境因素等都对工程的进度产生影响。因此，工程开工前，应根据工程特点编制一份完整、切实可行的，既符合合同要求又能指导施工的进度计划，并制定有效的进度管理措施。

5.2 加强工程进度管理的前提是制定完善的工程进度安排，参考整体的工程设计和质量标准制定出工程施工的整体方案。根据施工现场的地理环境和天气条件等安排施工时间，并根据不同的施工顺序进行原材料的进场、施工设备的安排和施工人员的统筹调度，将整体的施工方案进行细分，在确保施工方案可以实施的前提下保障工程进度按时完成。

6 工程现场施工的环境标准化管理

通过贯彻 ISO14001 环境管理体系，建立系统的环境管理机制，不但能够提高环境管理水

平, 实现污染预防, 而且还可以提高企业的整体管理水平。在工程现场, 对全体员工进行环保教育, 增强对环境保护的责任感。对现场的污水排放、垃圾分类能进行有效控制, 对可回收利用的垃圾与收货方签订回收协议, 减少了污染、节约了资源和能源, 使原材料得到了有效利用。同时减少各项环境费用(如赔罚款、排污费), 降低了企业成本, 获得良好的环境效益。

综上所述, 工程现场施工管理是施工企业竞争力重要的直接战场。而国际上成熟的 ISO 管理体系, 可以给企业提供高效便捷的标准化管理体系, 企业通过贯彻 ISO 系列管理体系, 能做到: 质量方面严格把关, 提高了客户满意度; 环境方面环保意识增强, 为社会效益做出巨大贡献; 安全方面严格杜绝安全事故, 为工程及人员的安全保驾护航。大大提升了企业的管理水平及企业形象。

Discussion on Standardized Management for the Construction of Geothermal Energy Collection Well with Single-well Circulating Heat Transfer

Author: Li Yingjun

The shallow geothermal energy resource is a kind of important renewable energy, and also a kind of green, low-carbon, clean and efficient energy, with abundant resources and large development potential. The utilization system of the shallow geothermal energy resource can be divided into three parts in general: Energy collection, energy enhancement and energy release. As the main mode for the energy collection of ground-source heat pump system, the technology of collecting well with single-well circulating heat transfer is an original and advanced shallow geothermal energy collection technology that is suitable for multiple

geological conditions. It uses the circulating water as the medium to collect the shallow underground heat energy with temperature below 25°C, which can recharge the underground water completely at the local same layer. It does not consume or pollute the underground water and is safe for underground water. This article will focus on the standardized management for the construction of geothermal energy collection well with single-well circulating heat transfer.

The field construction management of the ground-source heat pump system project affects the engineering progress and construction quality directly and also determines the economic benefits, social benefits, reputation and survival of enterprise to a large extent. Therefore, it is necessary to establish a safe, scientific, proper and efficient field construction management system, improve the management of construction management personnel, safety consciousness and specialized technical level, and strengthen the management of mechanical equipment, construction tools and construction materials, ensure the safety of the construction site, improve the quality and efficiency of construction, so as to promote the development of enterprise, expand the economic and social benefits of enterprise, and improve the reputation of enterprise. To choose a good management method will yield twice the result with half the effort,

thus ensuring the smooth completion of the project fundamentally.

By virtue of ISO international standardization system, the enterprise can implement ISO 9001 quality management system, ISO14001 environmental management system and OHSAS18001 occupational health and safety management system, and establish a sound standardized management system based on the actual situations of the enterprise. Through standardized management, the enterprise forms a complete set of standardization management system in field construction, so that each working procedure and each post have rules to follow and are well documented. In such case, the construction quality and safety of the engineering project can be guaranteed practically.

1. Strengthen the standardization management of construction quality on the construction field

The engineering quality is the foundation for the survival of construction enterprises, and if it is not controlled strictly, it will lead to rework, delay in progress, waste of materials and increase in cost; if the customer is not satisfied, the enterprise will lose its competitiveness and will be eliminated by markets; the construction quality on construction site will affect the whole engineering quality, construction progress and production safety directly, so it is necessary to

strengthen the quality management of the field construction.

1.1 Control the quality of raw materials strictly

By implementing ISO 9001 quality management system, the enterprise focuses on customers and seeks mutual benefits with suppliers according to the eight major principles of quality management. By screening and selecting eligible suppliers strictly and establishing long-term stable cooperative relationship, it can ensure the quality of raw materials and supply cycle, so as to ensure the construction quality of the project from the source.

First of all, the procurement personnel shall order raw materials from eligible suppliers according to the project demand, which can not only ensure sufficient materials to meet the construction requirements, but also reduce the amount of funds occupied, thus reducing the financial pressure on enterprise. Secondly, the material inspector with specialized knowledge shall control the quality of incoming goods strictly, and shall resolutely reject unqualified materials that cannot meet the requirements of the inspection. Finally, the warehouse management personnel shall register the raw materials, keep records on out-put and input of warehouse, standardize the material storage and mark the materials accordingly; in case of any unqualified engineering works caused by quality of raw materials during the project, it can be traced back to the supplier

of raw materials.

1.2 Control the quality of construction procedures strictly

According to the requirements of ISO9001 quality management system, the



enterprise formulates the operating instructions for quality supervision and control, defines the responsibilities and division of labor of the project manager, quality inspector and head of quality control, so as to identify and deal with the problems in a timely manner, eliminate



the hidden trouble in the bud and improve the quality of field construction; strengthen the process inspection during the construction and final inspection; establish the inspection standards and procedures for key links in construction, focus on the inspection and acceptance of concealed works, and improve the quality control during the whole construction process and acceptance.

1.3 As a key important procedure, it is required to inspect the geothermal energy collection well with single-well circulating heat transfer strictly, including:

- 1) Finished well: Inclination, depth and diameter of well;
- 2) Well casing: Silk screen, installation depth of well casing, diameter of well casing;
- 3) Well devices: Pump location, sealing position, insulation value of water pump cables, position of wellhead pipeline, steering, electric current value of pump, etc.;
- 4) The circulating water yield, dynamic and static water level and sand-carrying capacity shall meet the design requirements;

2. Strengthen the standardization management of construction safety on the construction field

Safety management is of particular significance in the field construction management. The safety management has two aspects, namely the safety of the project itself and the safety of construction personnel. By implementing the occupational health and safety management system of OHSAS18001, the enterprise shall improve the safety standardization management in the following aspects:

2.1 In terms of system, the enterprise shall establish a sound safety management system, define the safety responsibility system, stipulate the frequency of safety inspection and accident handling procedures; develop a targeted safety contingency plan; sign the safety agreement with the construction team before entering the site for construction; observe the construction environment carefully, identify the potential hazard sources after entering the construction site, evaluate the risk and formulate corresponding countermeasures, and post the system information onto the wall so that it is visible to everyone.

2.2 Strengthen the investment and management of the special funds for production safety, equip with sufficient safety appliances and facilities, assign

specially-assigned personnel to take the responsibility for the registration and bookkeeping, maintain and repair the safety appliances and facilities regularly, so as to keep them under good working conditions, and reduce the probability of construction accidents caused by hardware facilities;

2.3 Select the personnel who have long been engaged in the management of safety production and who have abundant practical experience, a strong sense of responsibility and high-level professional technology for management and supervision of production safety and environmental protection; appoint full-time safety officers on the construction site to supervise, inspect and handle relevant matters, correct and handle operations against regulations at anytime and anywhere to eliminate unsafe factors and ensure the personal safety of workers and prevent accidents; carry out safety disclosure and technical training for the construction personnel on the construction site, so that each construction personnel can understand how to operate and how to protect against injury accidents; also, it is possible to improve the vigilance of the construction personnel by analyzing major accidents and by education, thus improving the safety awareness and self-prevention awareness of the construction personnel, thus not hurting others or being hurt by others.

3. Strengthen the standardization management of construction technology on the construction field

3.1 Before the construction of the geothermal energy collection well with single-well circulating heat transfer, it is required to make a site survey and prepare overall construction design according to the construction conditions, which shall include engineering tasks and construction safety requirements; main equipment, personnel, materials, expenses and construction schedule; well implement every construction technical measure according to the construction steps;

3.1.1 Construction preparation: Make clear of the position of geothermal energy collection well, get to know the underground construction facilities at the well position, bury the pile casing before spud-in, arrange the storage position of drilling rig and materials, the temporary living quarters of drilling personnel, and reserve access roads on the construction site. Prepare the original records on shaft sinking project and prepare the single-well construction technical programs.

3.1.2 Rig arrangement: After the arrival of rig at the construction site, install the rig according to the pre-determined well location, and the rig must be erected steadily.

Select spud-in parameters according to the design requirements.

3.1.3 Run down the pipe: The well

casing consists of three parts, namely bored pipe(filter), solid pipe(casing pipe) and sand sediment pipe, and the specific number of pipes to be run down and standard of entangling nets shall be implemented according to design requirements. It is required to dilute the mud in the well before running down the pipe.

3.1.4 Gravel filling: Purchase the size and type of particles according to the design requirements. The gravel must have good roundness and shall be filled evenly and continuously. It is required to measure the depth of gravel filled at any time during the gravel filling and check the amount of gravel filled.

3.1.5 Well flushing: Flush the well in a timely manner after running down the pipe and filling the gravel to prevent the mud cake of well walls from thickening and hardening. The following three methods (pulling of piston, air compressor and water pump) are combined to flush the well according to the hydraulic characteristics and muddy sand contents in the well.

3.2 There are many construction technologies involved in the engineering construction, including drilling, borehole, pressure test, welding, etc., and each construction technology can be divided into different types. The technical standards adopted by the construction shall not be lower than the provisions stipulated in national and industrial standards.

3.3 Do a good job in technical disclosure.

The technical disclosure is the most detailed and meticulous guidance for construction and production, and the details and correctness of technical disclosure affect the progress of every step of the engineering construction directly. The detailed and rigorous technical disclosure affects all aspects of engineering construction, and plays a crucial role in the use of materials, construction sequence, overall quality as well as economy and safety. Each step of the technical disclosure is required to be detailed and meticulous, and shall guide the each step of the construction, and shall be as detailed as possible in terms of working method for each step, selection of materials and equipment specification, matters needing attention as well as corresponding measures to be taken, so that the construction personnel can understand their working tasks as well as how to meet relevant requirements.

4. Strengthen the standardization management of construction personnel on the construction field

4.1 Each engineering project shall be established with a project department, and equipped with necessary professional members, including project management personnel, safety officer, quality inspector, material-man, data processor, constructor and machinist, etc.

4.2 Formulate the responsibility system for each post on the project site, and make

it clear that each performs its own functions and takes its own responsibility.

4.3 There will be many construction teams involved, and they will often work together on the same plane during the construction of engineering projects. To avoid cross-construction and affecting each other, it is required to make unified arrangement and proper division of labor, so that all personnel can coordinate organically as a whole to complete the task together.

4.4 Enhance the professional competence of technicians, and the professional technicians are required to study relevant national standards, industrial standards, local standards, procedures, norms and contract documents, and get familiar with and master specific quality requirements and technical indicators. Train the staff regularly, implement the latest requirements to each construction personnel, understand the latest national, industrial and enterprise trends, in particular some obsolete and prohibited technologies, material and equipment as well as specifications, so as to improve the professional competence of the technicians constantly.

5. Standardized management of project schedule

5.1 There are many factors affecting the progress of the engineering construction, including human-related factors, technical factors, material and equipment factors, financial factors,

climate factors and environmental factors. Therefore, a complete and practical schedule that can not only meet the contractual requirements, but also guide the construction schedule shall be developed based on the engineering characteristics prior to the commencement of project, and effective schedule management measures shall be formulated.

5.2 The premise to strengthen the project schedule management is to formulate a perfect engineering schedule, and formulate the overall plan for engineering construction with reference to the overall engineering design and quality standard. Arrange the construction time according to geographical environment and weather conditions of the construction site, arrange to deliver the raw materials to the construction site, make arrangement for the construction equipment and overall planning and scheduling of the construction personnel according to different construction sequences, well divide the overall construction scheme and ensure to complete the project under the premise that the construction scheme can be implemented.

6. Standardization management of construction environment on the construction field

By implementing ISO14001 environmental management system and establishing a systematic environmental

management mechanism, the enterprise can not only improve the environmental management to prevent pollution, but also improve the overall management of enterprise. Educate all the staff on environmental protection on the project site so as to enhance their sense of responsibility for environmental protection. Control the sewage discharge and garbage classification effectively on the construction site, sign a recycling agreement with the receiver for recyclable waste so as to reduce pollution, save resources and energy, and make effective use of raw materials. Meanwhile, reduce various environmental costs (such as compensation and fines, sewage charge), and reduce the costs of enterprise and obtain better environmental benefits.

To sum up, the construction management on project site is an important and direct battlefield of the construction enterprise's competitiveness. The proven international ISO management system can provide the enterprise with efficient and convenient standardized management, and by implementing ISO series of management system, the enterprise can control the quality strictly, and improve customer's satisfaction; enhance the awareness of environmental protection, and make greater contributions to social benefits; eliminate safety accidents strictly and protect the safety of project and personnel, thus improving the management and corporate image significantly.

国家发改委、工信部等七部门联合印发 《绿色高效制冷行动方案》

NATIONAL DEVELOPMENT AND REFORM COMMISSION AND MINISTRY OF INDUSTRY AND INFORMATION TECHNOLOGY AND OTHER SEVEN DEPARTMENTS JOINTLY ISSUED THE GREEN AND EFFICIENT REFRIGERATION ACTION PLAN

国家发展改革委、工业和信息化部、财政部、生态环境部、住房城乡建设部、市场监管总局、国管局于6月13日联合印发《绿色高效制冷行动方案》，具体内容如下：

为贯彻落实2019年《政府工作报告》和国务院《“十三五”节能减排综合工作方案》等文件要求，加快生态文明建设，促进绿色消费，推动高质量发展，积极参与全球环境治理，制定本方案。

一、重大意义

制冷产业是制造业的重要组成部分，制冷产品是满足人民美好生活需要和消费升级的重要终端消费品，制冷能耗总量高、增速快、节能减排

潜力大。我国是全球最大的制冷产品生产、消费和出口国，制冷产业年产值达8000亿元，吸纳就业超过300万人，家用空调产量全球占比超过80%，电冰箱占比超过60%。我国制冷用电量占全社会用电量15%以上，年均增速近20%，大中城市空调用电负荷约占夏季高峰负荷的60%，主要制冷产品节能空间达30-50%。中国已向国际承诺积极履行《联合国气候变化框架公约》及其《巴黎协定》，提高制冷行业能效标准。实施绿色高效制冷行动，是促进节能减排，应对气候变化，加快生态文明建设的重要措施，对推动行业高质量发展，形成强大国内市场，培育绿色发展新动能，落实国际减排承诺，推动《蒙特利尔议定书》基

加利修正案的批准和落实，深度参与全球环境治理具有重要意义。

二、总体要求

(一) 指导思想

以习近平新时代中国特色社会主义思想为指导，全面贯彻党的十九大和十九届二中、三中全会精神，以新发展理念为引领，着力推进供给侧结构性改革，以市场主导、政府引导，标准先行、统筹推进，提升增量、优化存量为原则，大幅提高制冷能效和绿色水平，扩大绿色产品供给，壮大绿色消费市场，实现制冷行业高质量发展、绿色发展，满足人民日益增长的美好生活需要。

(二) 主要目标

到 2022 年，家用空调、多联机等制冷产品的市场能效水平提升 30% 以上，绿色高效制冷产品市场占有率提高 20%，实现年节约 1000 亿千瓦时。到 2030 年，大型公共建筑制冷能效提升 30%，制冷总体能效水平提升 25% 以上，绿色高效制冷产品市场占有率提高 40% 以上，实现年节电 4000 亿千瓦时左右。

三、主要任务

(一) 强化标准引领

大幅度提高制冷产品能效标准水平，强制淘汰低效制冷产品，主要制冷产品能效限值达到或超过发达国家能效准入要求，一级能效指标达到国际领先。加快合并家用定频空调和变频空调能效标准，修订多联式空调、商用冷柜、冷藏陈列柜、热泵机组、冷水机组、热泵热水器等产品的强制性能效标准。到 2022 年，家用空调能效准入水平提升 30%、多联式空调提升 40%、冷藏陈列柜提升 20%、热泵热水器提升 20%。到 2030 年，主要制冷产品能效准入水平再提高 15% 以上。加快新制定数据中心、汽车用空调、冷库、冷藏

车、制冰机、除湿机等制冷产品能效标准，淘汰 20%—30% 低效制冷产品。鼓励龙头企业制定严于国家标准的企业标准，争当企业标准“领跑者”。

制修订公共建筑、工业厂房、数据中心、冷链物流、冷热电联供等制冷产品和系统的绿色设计、制造质量、系统优化、经济运行、测试监测、绩效评估等方面配套的国家标准或行业标准。加快制修订制冷行业用环保制冷剂产品标准和安全标准，促进低温室效应潜能值 (GWP) 制冷剂的推广应用。鼓励协会、学会、联盟等社会团体制定制冷领域绿色技术、创新产品、售后服务、回收拆解和再利用等方面的团体标准。

加强能效标准采信，将其作为节能审查、政府采购、工程招标、节能技改、检测认证、产品推广、市场监管等政策措施的重要技术依据，切实推动能效标准落地。扩大能效标识产品覆盖面，在主要制冷产品能效标识上试行增加能效“领跑者”、制冷剂 GWP 等信息。开展标准标识宣贯培训，加强生产企业、监管部门人员能力建设。

(二) 提升绿色高效制冷产品供给

落实《绿色产业指导目录》，推动政策、资金向绿色产业倾斜。将先进适用的绿色高效制冷技术及时纳入《国家绿色技术推广目录》和《产业结构调整指导目录》鼓励类项目，推动绿色技术与资本、产业的对接。加大对变频控制、高效压缩机、紧凑轻量化高效传热、高性能润滑油、新型蓄冷材料、高精度测试评价、量值传递方法等关键共性技术研发，推动革命性技术的探索与储备。完善强化能效“领跑者”制度，树立行业标杆，引导企业生产更加高效的制冷产品。鼓励企业大幅提高变频、温（湿）度精准控制等绿色高端产品供给比例。鼓励生产企业为工商用户提供按需定制、精准适配的绿色高效制冷系统，推动从“制造”向“产品/工程+服务”转变。

加大环保制冷剂的研发，积极推动制冷剂再

利用和无害化处理。严格落实《消耗臭氧层物质管理条例》和《蒙特利尔议定书》，引导企业加快转换为采用低 GWP 制冷剂的空调生产线，加速淘汰氢氟碳化物 (HCFCs) 制冷剂，限控氢氟碳化物 (HFCs) 的使用。鼓励制冷产品生产企业创建绿色工厂，严格控制生产过程中制冷剂的泄漏和排放。



(三) 促进绿色高效制冷消费

完善节能环保产品政府采购制度，扩大政府绿色采购范围，加大绿色高效制冷创新产品政府采购支持力度。在工程项目招投标中，鼓励招标人把绿色、能效指标作为重要的条件纳入产品综合评标标准，提升绿色、能效等指标权重。推广《企业绿色采购指南（试行）》，鼓励大宗采购企业通过节能自愿承诺、参与推广倡议等方式提高绿色高效制冷产品采购比例。

严格实施高效节能家电产品销售统计调查制度，激励各地区完善推广政策。鼓励有条件的地方，通过实施“节能补贴”“以旧换绿”等措施，采用补贴、奖励等方式，支持居民购买绿色高效制冷产品、更新更换老旧低效制冷产品。鼓励零售企业、电商平台开辟绿色产品销售专区，集中展示销售绿色高效产品。加强职业技能培训，要求操作运行和售后服务人员严格落实操作规程，保障制冷设备的高效经济运行，有效防止安装、使用、维修、移机过程中制冷剂泄漏。

(四) 推进节能改造

加强制冷领域节能改造，重点支持中央空调节能改造、数据中心制冷系统能效提升、园区制冷改造和冷链物流绿色改造等重点示范工程，更新升级制冷技术、设备，优化负荷供需匹配，实现系统经济运行，大幅提升既有系统能效和绿色化水平。

实施中央空调节能改造工程，支持在公共机构、大型公建、地铁、机场等重点领域，更新淘汰低效设备，运用智能管控、管路优化、能量回收、蓄能蓄冷、自然冷源、多能互补、自然通风等技术实施改造升级，在有条件的地方推广部分时间、部分空间的空调使用方式。

实施数据中心制冷系统能效提升工程，落实《关于加强绿色数据中心建设的指导意见》，支持老旧数据中心（包括公共机构数据中心）等开展节

能和绿色化改造工程，加强在设备布局、制冷架构、外围护结构等方面的优化升级，鼓励使用液冷服务器、热管背板、间接式蒸发冷却、行级空调、自动喷淋等高效制冷系统，因地制宜采用自然冷源等制冷方式，推动与机械制冷高效协同，大幅提升数据中心能效水平。

实施园区制冷改造工程，支持有条件的地方选择商业聚集区、高校园区、集中行政中心、休闲度假区等制冷需求大、负荷集中的园区，整体设计供冷改造方案，探索采用供冷服务托管、按冷量计量收费、制冷需求和能效性能保障合同等商业模式，建设高效绿色供冷系统。

实施冷链物流绿色改造工程，在农产品、食品、医药等领域支持冷链物流龙头企业集中更换绿色高效冰箱、冷藏陈列柜、商用冷柜、冷藏车、冷库等制冷设备和设施，建立能耗管控中心，运用物联网、温（湿）度精准控制等技术，实现成本和腐损率双降。

（五）深化国际合作

积极参与和引领全球环境治理体系改革和建设，推动落实《联合国气候变化框架公约》及其《巴黎协定》和《蒙特利尔议定书》，提高能效、减少温室气体排放，削减 HFCs，展示我国负责任大国形象。促进双边和多边务实合作，共享绿色高效制冷政策、项目和技术的国际最佳实践，积极推进《“一带一路”绿色高效制冷行动倡议》。积极开展制冷能效标准及测试方法的国际比对分析，探索推进区域、国际协调互认。倡导“人人享有绿色制冷”，支持绿色产品贸易便利化，鼓励绿色高效制冷产品“引进来、走出去”，培育和扩大全球绿色高效制冷市场，促进优质制冷产品惠及全球。

四、保障措施

（一）完善政策措施

落实好现有的促进绿色产业发展的财税金融等支持政策，鼓励地方进一步创新对绿色高效制冷产品的支持方式，拓宽支持渠道。加大峰谷电价、气价实施力度，鼓励推行天然气市场化季节性差价政策。企业购置并实际使用的绿色高效制冷产品和设备、清洁能源空调等，符合《节能节水专用设备企业所得税优惠目录》规定的，依法享受企业所得税抵免政策。引导银行业金融机构支持绿色高效制冷生产企业和改造项目融资，落实《绿色信贷指引》，通过绿色贷款、绿色债券等促进绿色高效制冷产业发展。利用国际金融机构的技术援助、低息贷款以及赠款资金，实施制冷能效提升和环保制冷剂替代。

（二）强化监督管理

严厉打击产品能效虚标、认证检测作假、虚假宣传等行为，增大制冷产品抽查力度。完善监督检查结果公布制度，将抽查检查结果和行政处罚信息纳入国家企业信用信息公示系统和全国信用信息共享平台，实行联合惩戒。强化质量责任追究机制，严格问责追责，不符合强制性能效标准的产品由生产企业限期召回，责令情节严重的企业停产整顿。加大对制冷产品回收处理的监管，规范废旧制冷产品和制冷剂的回收、拆解和再利用。鼓励消费者监督、第三方监督、企业互查等社会监督，规范市场行为，加大消费者合法权益的保护力度。

（三）积极宣传引导

倡导健康理性的消费理念，引导节俭、文明、适度、合理的消费模式，营造绿色消费的良好社会氛围。运用多种媒体特别是用好新媒体，普及绿色消费知识，推介绿色产品，推广绿色节能的空调使用方式，宣扬先进典型，曝光不合格产品。在全国节能宣传周、全国低碳日、环境日，举办形式多样的主题宣传活动，开展集中宣传。

（选自智通财经网）

雄安新区首份地热资源勘查评价报告出炉

THE FIRST SURVEY AND EVALUATION REPORT ON GEOTHERMAL RESOURCES IN XIONGAN NEW AREA HAS BEEN RELEASED

近日出炉的雄安新区首份地热资源勘查评价报告显示，容东片区深部水热型地热资源赋存条件较好，年可采量折合标准煤 3.71 万吨，供暖总能力约 300 万平方米，建议采用大区块集中采灌模式，合理布设井间距，科学开发深部地热资源。

雄安新区是我国中东部地热资源开发利用条件最好的地区。为支撑服务雄安新区绿色低碳发展，依靠自然资源部中国地质调查局、河北雄安新区管理委员会、河北省自然资源厅、河北省地质矿产勘查开发局四方协调联动机制，中国地质调查局组织实施了雄安新区地热清洁能源调查评价。该工作近日率先完成了容东片区地热资源勘查，评价精度总体达到控制级别，可以作为该区域能源规划和地热矿权设置的基础科学依据。

勘查评价结果还显示，容东片区普遍适宜浅层地热能的开发利用，公共建筑、大型商业

建筑和小型单体建筑供暖（制冷）可积极推广应用地源热泵供暖制冷。评价结果认为，科学开发利用地热资源，采用“取热不取水、全封闭回灌”先进技术工艺，不会引起环境问题。此外，可发挥地热资源易储存、可调节的优势，构建以地热能为基础的多能互补弹性供应系统，提高综合供能保证程度，建议加强地热资源监管能力建设，建立完善的地热资源开发利用动态监测网，支撑地热资源可持续开发。

据了解，下一步，自然资源部中国地质调查局将瞄准打造地热资源利用全球样板的目标，以探测深部地热资源开发的第二空间为重点，继续拓展雄安新区三大地热田整装勘查和重点规划建设区地热资源评价，并进一步提出因地制宜的地热资源开发利用建议，支撑雄安新区能源规划和地热资源可持续高效开发。

（摘自中国科技网）

青海共和干热岩科技攻坚项目正式启动

QINGHAI GONGHE BASIN HOT AND DRY ROCK SCIENCE AND TECHNOLOGY PROJECT OFFICIALLY LAUNCHED

中国地源热泵产业联盟名誉理事长、中国工程院院士曹耀峰 5 月 29 日在天津出席“2019 年第二届全国油田地热资源开发与利用研讨会”上作了题为《关于推进我国干热岩地热开发的思考》的报告，他指出当前青海省正积极打造能源示范省，在共和盆地开展干热岩开发，提供绿色清洁的基础电源，恰逢其时。在此次会议上他表示青海共和盆地干热岩科技攻坚战启动在即。

干热岩有望成战略性接替能源

根据中国石化新闻网报道显示：6 月 4 日，中国石化集团公司承担的青海共和 GR1 井作业开工，标志着由中国地质调查局、青海省政府、中国石化共同合作的青海共和干热岩科技攻坚项目正式启动。曹耀峰院士认为，青海共和盆地干热岩科技攻坚战的启动标志着我国干热岩资源科技攻关从室内试验正式进入了场地开发阶段。

2017 年，政府相关部门出台的《地热能开发利用“十三五”规划》明确提出，“十三五”时期，开展干热岩开发试验工作，建设干热岩示范项目，通过示范项目的建设，突破干热岩资源潜力评价与钻探靶区优选、干热岩开发钻井工程关键技术及干热岩储层高效取热等关键技术。

何为干热岩？根据国家能源局发布于 2019 年 3 月 1 日起实施的中华人民共和国能源行业标

准《NB/T 10097-2018 地热能术语》显示：干热岩 (hot dry rock)，不含或仅含少量流体，温度高于 180℃，其热能在当前技术经济条件下可以利用的岩体。增强地热系统 (EGS, Enhanced Geothermal System)，也称工程地热系统，为利用工程技术手段开采干热岩地热能或强化开采低孔渗性热储地热能而建造的人工地热系统。

据了解，干热岩的利用主要通过增强型地热系统 (EGS) 来实现，基本原理是：通过深井将高压水注入地下 2 ~ 6 千米的人工储层内，使其通过渗透循环而吸收热能；再通过开采并将高温水、汽通过生产井抽出地表用于发电；冷却后的水再次通过高压泵注入地下热交换系统循环使用，整个过程都是在一个封闭的系统内进行。

曹耀峰院士在报告中指出，干热岩资源潜力巨大，且不受季节、气候制约，可有效取代煤炭、石化能源消耗，有效保护生态环境。数据显示，全球陆区干热岩资源量相当于 4950 万吨标准煤，是全球所有石油、天然气和煤炭所蕴藏能量的近 30 倍。中国大陆 3.0-10.0 千米深处干热岩资源量约合 856 万吨标准煤，占世界资源量的六分之一左右。资源类型较多，广泛分布于青藏高原、松辽盆地、渤海湾盆地、东南沿海等地。资源潜力巨大，有望成为战略性接替能源。

自上世纪 70 年代美国在芬顿山开始第一次干

热岩开发现场试验开始，世界范围内已建立试验性质的 EGS 工程 31 项，累积发电能力约 12.2MW。尽管美、法、德、日、英等国在干热岩开发方面取得了一定进展，但总体上世界干热岩开发仍然处于试验和示范阶段，还没有实现商业化开发。

曹耀峰院士表示，与国外相比，我国干热岩资源技术研发起步较晚，尚属起步阶段，国内部分高校和科研院所在基础理论和试验方面做了一些探索性研究工作。国内干热岩的钻探仅限于获取干热岩的温度、岩性、埋深、分布范围等基础资料，压裂改造工作未取得实质性进展。

青海打造干热岩开发示范工程

曹耀峰院士透露，2018 年 3 月、8 月，中国地调局、青海国土厅与中石化召开两轮工作协调对接会。明确三方联合建设青海共和盆地干热岩勘查开发试验项目，着力打造干热岩勘查开发示范工程。三方表示共同筹建攻关团队、制定科技攻坚战实施方案。

早期，我国开展干热岩勘探开发关键技术攻关研究已做了大量工作。2010 年，国土资源部公益性项目“我国干热岩勘查关键技术研究”；2012 年，国家科技部 863 项目“干热岩热能开发与综合利用关键技术研究”。

为推动我国干热岩勘查开发，2013 年以来，中国地质调查局先后在东南沿海地区、松辽平原地区、华北地区和青藏高原等重点地区实施了干热岩勘查。2014 年，中国地质调查局与青海省国土资源厅共同组织实施的青海共和盆地干热岩勘查钻获干热岩，填补了我国一直没有勘查发现干热岩资源的空白。2017 年 5 月在共和县恰卜恰镇完井的 GR1 干热岩勘探孔再获温度新高，3705 米的孔底测得温度高达 236℃，取得了一批重要成果，为我国进一步开展干热岩勘查开发研究打下了重要基础。

在此次会议上，曹耀峰院士透露了青海共和



盆地干热岩热能开发试验最新进展情况：圈定出共和、达连海和贵德等 14 处隐伏干热岩体；在共和盆地外围圈定出同仁县兰采、海东市三合镇同德和倒淌河 4 处干热岩远景区，总面积达 3092.89km²。共和干热岩体远景资源量数据显示：面积达到 246.9km²。3-10km 埋深干热岩地热资源基数为 1638.16 EJ，折合标准煤 559.09 亿吨。

青海共和具有优越的地理及基础设施优势。曹耀峰介绍，共和盆地位于青藏高原北东缘，秦祁昆造山带的接合部；地势平坦，海拔适中；共和县恰卜恰镇距西宁 142km，贵德县热水泉距西宁 130km；共和县光伏规划装机容量 18675 兆瓦；已并网装机 3405 兆瓦；总装机容量 1280 兆瓦龙羊峡水电站就在附近；目前共和县电网通过青海主网连接国家电网；井底温度与当前超高温钻测井技术的作业区间基本匹配。

“中国石化共计启动十余项、总投资 5000 多万元干热岩相关项目研究，并已建成中国石化地



热资源开发利用重点实验室。”曹耀峰表示，纵观多年来世界范围的干热岩勘查开发实践，EGS 工程所涉及的核心技术，多数是石油工程相关技术的借鉴、移植或改造。中国石化拥有丰富的石油勘探开发实践经验，为干热岩勘查开发技术攻关提供了坚实基础。

曹耀峰透露，中国石化干热岩产业规划分三个阶段包括：技术研发突破期；示范项目建设期；技术革新、商业化应用期。具体而言，2018-2020 年，通过技术攻关，形成具有国际先进水平的干热岩勘探开发利用技术系列，并在资源评价的基础上优选 1-2 个国家级 EGS 现场试验基地，初步形成核心技术系列。2021-2023 年示范项目建设期，完成试验基地实施方案设计优化，建立我国首个可复制可推广的干热岩开发示范项目，实现干热岩的成功利用。到 2024-2035 年，通过干热岩产业技术、工艺升级，大幅降低干热岩勘探开发利用成本，尝试商业化应用。

干热岩开发面临诸多问题挑战

近两年干热岩已成业界关注的焦点。然而，世界干热岩开发总体上仍处于试验和示范阶段，还未实现商业化开发。我国干热岩开发更是处于起步阶段，面临资源勘查难、开发工程难度大、技术薄弱等挑战。

曹耀峰院士介绍，除藏南-滇西地区高温地热资源较为丰富外，其他高品质资源并不富集。由于地壳结构复杂，成因机理尚不清楚，干热岩资源分布极为不均匀，我国目前尚未形成成熟可靠的资源评价技术和方法。

“干热岩埋藏深，探测精度难以满足勘探要求，获取地下热储物理参数的技术和能力有限，难以有效地优选场址；现有的井下原地岩石地层描述方法难以适应 EGS 高温热储的特殊条件。”曹耀峰说。

干热岩开发工程难度大。由于仪器、工具和材料的耐温能力不足；岩体可钻性差，工程设计优化难度大，钻速慢、周期长、成本高等问题，面临高效成井难题。另外还存在高温测井技术、以及热储改造难题。

干热岩开发还存在利用工程难题。由于缺乏高温潜水泵、抗高温示踪剂、适合于干热岩循环测试的解释技术等，面临干热岩循环测试及热能提取难题。另外，规模化发电需要的高温大流量流体产量还未达到，EGS 系统产能稳定性还有待加强。

干热岩研发属于前瞻性技术，曹耀峰院士建言应持续增大科研项目、人员、经费支持力度，加强与国内政府部门、研究机构合作，加强干热岩资源靶区评价和开发利用工程技术攻关。同时他还表示，要实现干热岩资源开发利用的实质性进展，需针对制约规模化经济开发的关键问题，在资源富集与勘查评价、热储改造与高效换热等方面，开展攻关研究。

（选自地源热泵杂志 文 / 代海雷）

安徽省池州大力支持 地热能开发利用

CHIZHOU, ANHUI PROVINCE STRONGLY SUPPORTS THE DEVELOPMENT AND UTILIZATION OF GEOTHERMAL ENERGY



近日，安徽省池州市发布了《池州市可再生能源发展规划(2018-2022年)》(以下简称《规划》)。池州市地热资源(地热能)总量为 1.00×10^{13} 千卡，可利用地热能资源量为 2.05×10^{12} 千卡，热储层中水储存总量为 3.61×10^8 立方米。池州市浅层地热能资源十分丰富，值得统筹规划充分利用。

据估算，全国287个地市级以上城市浅层地热能可利用资源能量相当于每年3.56亿吨标准煤，如有效开发利用，每年可以节约标准煤2.48亿吨，

减少排放二氧化碳6.52亿吨。目前，我国地源热泵技术的建筑物应用面积已超过1.4亿平方米。

根据2010年池州市地热资源调查评价报告，池州市浅层地热能资源非常丰富。2010年池州市委托安徽省地质矿产勘查局324地质队，对市区东部 55km^2 范围进行了浅层地热资源调查，具体位置包括主城区清溪河以东、北至长江、东至平天湖、南至站前区。设计勘查面积约 50m^2 ，实际调查面积约 50.26m^2 。

根据调查结果，该区域内全新统(alQ4)下



部细~中粗粒沙砾层、三迭系南陵湖组(T1n)灰岩、二迭系下统栖霞组(P1q)灰岩是本区浅部埋藏浅,可采资源量大,含水层渗透条件好,回灌易,水质无侵蚀性,水温17~25℃,温度适宜,具开发利用浅层地能地质、水文地质条件。因此上述地层(alQ4、T1n、P1q)分布区可作为地源热泵利用浅层地能的首选区域。池州市主城区各水体水系水质达到Ⅱ~Ⅲ类标准,水温15~25℃之间,满足地表水水源热泵使用要求。

《依据浅层地热能勘查评价规范》(DZ/

T0225-2009)、《地热能资源勘查规范》(GB11615-89)和《地热能资源评价方法》(D240-85)估算,池州市浅层地热资源丰富:地热资源(地热能)总量为 1.00×10^{13} 千卡,可利用地热能资源量为 2.05×10^{12} 千卡,热储层中水储存总量为 3.61×10^8 立方米,其中:容积储量为 3.60×10^8 立方米,弹性存储量为 4.90×10^4 立方米。

《池州市可再生能源发展规划(2018-2022年)》指出,目前池州市浅层地热能只有少量应用,该勘探范围内可利用地热能资源量为 2.05×10^{12} 千卡,即使开采其中的10%,就能够满足4000万平方米建筑冬季同时采暖需求。

《规划》提出三点建议:一是本区浅层地热能开发利用规划应充分考虑地质、水文地质条件,保护地下水水质;二是保护地下水资源,优先采用单井抽灌技术。依据动态数据规划控制分区,实行总量与强度双控;三是开采地表水资源必须按照《池州市地表水开发利用保护管理规定》办理相关手续。

根据《地热能开发利用“十三五”规划》,我国浅层和水热型地热能供暖(制冷)技术已基本成熟,浅层地热能南北均有开发,但80%集中在华北和东北南部,包括辽宁、北京、山东、河南、河北等地区;而水热型地热能的开发利用基本都在北方,包括河北、天津、陕西等地,南方几乎尚未开发。

安徽省在“十三五”时期要加强地热能资源勘查评估,并要在资源条件优越和建筑用能需求旺盛的地区推广浅层地热能供暖制冷,探索开展中深层地热能高效梯级利用。到2020年,浅层地热能供暖制冷面积达到4800万平方米。《池州市可再生能源发展规划(2018-2022年)》的发布将积极促进安徽省地热能资源开发应用。

(摘自地源热泵网)

地热能是印度尼西亚的一种重要的环保能源

GEOTHERMAL ENERGY IS AN IMPORTANT ENVIRONMENTALLY FRIENDLY ENERGY SOURCE IN INDONESIA

据报道，印度尼西亚地热协会秘书长哈利表示，一些人拒绝使用地热或地热能发电，原因是由于他们缺乏对地热能的了解。而其中之一的一种观点即地热利用会破坏地下水水位，而地下水一直是社区生计的来源，无论是农业还是其他需要。哈利指出，这个观点显然是错误的。印度尼西亚的地热资源位于山区，主要是利用 1.5 到 2 公里深度的地热资源，不会影响到 100 米以上地下水的状况。

同时，如果有人将斯洛文尼亚和印度尼西亚的地热能开发利用进行比较，其得到的结果并不合理。因为斯洛文尼亚穆拉扎拉盆地的地热与印尼的地热不同。该地区使用的地热深度不足 1 公里，仅用于家庭取暖，不用于山区，也不用于发电。

另一方面，世界地热利用已经持续了很长时间。地热能可用于干燥洋葱、干燥小麦或西红柿。由于其可再生、环保的特点，被广泛应用于发电。由于对环境的友好，世界自然基金会 (WWF) 和绿色和平组织 (Greenpeace) 等国际非政府组织支持开发地热能，以取代化石能源。

从 1974 年起，印度尼西亚就开始使用地热

能发电。到目前为止，印尼的地热发电量为 2000 兆瓦，仅次于美国，居世界第二。除了用于发电，印度尼西亚的地热还为开发地区周围的社区提供了更多便利条件。直接参观地热项目可以直观地感受到地热对周围环境立竿见影的效果。

主要由于燃烧包括煤、石油、天然气和天然气的化石燃料产生二氧化碳和主要的温室气体，气候变化正成为世界关注的焦点。过量的温室气体和全球气温的上升使气候不稳定，使我们的健康和全球生态系统的健康处于危险之中。地热发电厂的排放物包括氫、砷和汞。如果在没有地热发电厂的前提下，这种排放物仍然存在，因为它是一种自然元素，从火山地区产生。但由于数量非常少，我们这些生活在火山地区的人没有感受到任何影响。印度尼西亚所有的地热系统都是封闭的，这意味着没有任何废物会通过河流或水体排放到地表。因此，地热发电厂的排放与西苏门答腊大量开采金矿造成的排放污染有很大的不同。地热发电厂的排放量非常小并可以并在闭合系统内循环。这就是地热能可作为印度尼西亚一种重要的环保能源的原因。

北京市 2016 年农村地区 煤改清洁能源工程案例介绍

CASE PRESENTATION OF COAL TO CLEAN ENERGY TRANSFORMATION PROJECT IN RURAL BEIJING 2016



一、项目介绍

恒有源科技发展集团根据《北京市 2016 年农村地区村庄“煤改清洁能源和减煤换煤”相关推进工作指导意见》的相关要求，于 2016 年供暖季开始前完成西冉村、西山村、清河四街社区等集中“煤改电”清洁自采暖改造项目。

二、项目概况

西冉村集中“煤改电”项目包括西冉、佟家坟共 434 户，总供暖面积 161791 平方米，改造前冬季供暖散煤燃烧约 4774 吨；西山村“煤改电”项目包括东平庄、西平庄、南平庄共 724 户，总供暖面积 316039 平方米，改造前冬季供暖散煤燃烧约 9412 吨。清河四街社区集中“煤改电”项目包含清河四街 935 户，总供暖面积 142609 平方米，改造前冬季供暖散煤燃烧约 4300 吨。

三、项目特点

项目采用恒有源地能热泵环境系统进行集中供暖改造，系统由单井循环换热地

实用案例

PROJECT SHOWCASE

能采集技术支撑，地能采集井 + 集中热泵机房 + 暖气片组成。针对三个村的不同地质，项目分别采用了有蓄能颗粒和无蓄能颗粒的单井循环换热地能采集井。

集中热泵机房系统全部采用模块式设计安装，所有模块预制完成后整体运往安装现场。现场只需利用管道将所有模块进行连接即可，大幅度的缩短了施工工期，同时提高了系统的安装精度，保证了系统的施工质量。

为提高集中供热系统的可靠性，项目在每个集中热泵站房中设置了集中监控系统，管理人员可以随时掌控运行参数。

同时，根据改造村庄和社区建筑分布情况，末端外线管网采用分区域的支状管网布置方式，安装采用无补偿直埋和架空敷设方式相结合。考虑到改造区域内居民多、各户面积、各户房屋建筑保温条件不一的特点，设计时采取按热计量表收费方案。各户安装远传热计量表、电动开闭阀门，设置集中热计量监控平台。运行时利用热计量监控平台可以直接读取每户的用热量，根据其缴费情况控制其供暖阀门开闭。



四、运行情况

（一）运维保障

该项目由恒有源集团下属物业公司对村民进行专业运维培训，并建立专业队伍对项目进行运维保障，保证供暖时间和温度。

（二）项目运行环境效益

项目改造后，西冉村相较燃煤供暖，直接替散煤 4774 吨，区域内直接减排二氧化碳 12508 吨，二氧化硫 35 吨，氮氧化物 12 吨，烟尘 49 吨；

西山村相较燃煤供暖，直接替散煤 9412 吨，区域内直接减排二氧化碳 24659 吨，二氧化硫 70 吨，氮氧化物 24 吨，烟尘 98 吨；

清河四街社区相较燃煤供暖，直接替散煤 4300 吨，区域内直接减排二氧化碳 11266 吨，二氧化硫 32 吨，氮氧化物 11 吨，烟尘 45 吨。



五、项目优势

浅层地热能集中“煤改电”清洁自采暖改造，让居民告别了传统的燃煤取暖方式，还免除了添煤、倒煤渣以及一氧化碳中毒的安全隐患。在保证冬季供暖温度的前提下，与直热式电采暖相比，浅层地热能清洁自采暖的配电和运行成本都是直热式电采暖设备的四分之一。浅层地热能清洁自采暖使农村农户的生活质量得到很大提升，实现了企业、政府、农村居民的共赢发展。

Case Presentation of Coal to Clean Energy Transformation Project in Rural Beijing 2016

I. Project Introduction

In accordance with the relevant requirements of Guiding Opinions on Promoting “Transformation from Coal to Clean Energy and Coal Reduction and Replacement” in Villages in Rural Beijing



in 2016, Ever Source Science & Technology Development Group Co., Ltd. completed the centralized “coal to electricity” clean self-heating renovation project in Xiran Village, Xishan Village and the communities at the 4th Qinghe Street before the heating season in 2016.

II. Project Overview

The centralized “coal to electricity” project in Xiran Village covers 434 households in Xiran and Tongjiafen, with a total heating area of 161,791m², 4,774 tons of scattered coal were burned for heating in winter before the renovation; the “coal to electricity” project in Xishan Village covers 724 households in Dongping Village, Xiping Village and Nanping Village, with a total heating area of 316,039m², about 9,412 tons of scattered coal were burned for heating in winter before the renovation. The “coal to electricity” project in the communities at the 4th Qinghe

Street covers 935 households at the 4th Qinghe Street, with a total heating area of 142,609m², and about 4,300 tons of scattered coal was burned for heating in winter before the renovation.

III. Project Features

The project adopts HYY Ground Energy Heat Pump Environment System to carry out central heating renovation, and the system is supported by single-well heat exchange circulation for ground source energy collection, composed of ground source energy collection wells, central heat pump rooms, and heating radiators. According to the different geology of the three villages, the project adopts single well of geothermal energy collection with circulation heat exchange with and without energy storage grains respectively.

The centralized heat pump room system is designed and installed in a modular manner, and all modules are transported to the installation site after prefabrication. All the modules can be connected by pipelines on site, thus greatly shortening the construction period, improving the installation accuracy and ensuring the construction quality of system.



In order to improve the reliability of the central heating system, the project has set up a centralized monitoring system in each central heat pump station building, and the management personnel can control the operation parameters at any time.

In the meantime, according to the distribution of renovated villages and community buildings, the end of outside pipe network is laid divisionally using branch network of pipes, and installed with the combination of direct burial without compensation and overhead laying. Considering the characteristics of large number of residents, household areas and different heat preservation conditions of each house building in the renovation area, it is designed to charge according to the heat meter. All households are equipped with remote heat meters, electric on-off valves and centralized heat metering monitoring platforms. During operation, the heat metering monitoring platform can be used to directly read the heat consumption of each household and control the on-off of the

heating valve according to payment status.

IV. Operation Conditions

(I) Operation & maintenance guarantee

In this project, the property company affiliated to Ever Source Group conducts professional operation and maintenance training for villagers, and establishes a professional team to guarantee the operation and maintenance of the project and ensure the heating time and temperature.

(II) Environmental benefit of project operation

After the renovation, compared with coal-fired heating, Xiran Village directly replaces 4,774 tons of scattered coal, directly reduces the carbon dioxide emissions of 12,508 tons, sulfur dioxide of 35 tons, nitrogen oxide of 12 tons and smoke dust of 49 tons;

Compared with coal-fired heating, Xishan village directly replaces 9,412 tons of scattered coal, directly reduces the carbon dioxide emissions of 24,659 tons, sulfur dioxide of 70 tons, nitrogen

oxide of 24 tons and smoke dust of 98 tons;

Compared with coal-fired heating, the communities at the 4th Qinghe Street directly replaces 4,300 tons of scattered coal, directly reduces the carbon dioxide emissions of 11,266 tons, sulfur dioxide of 32 tons, nitrogen oxide of 11 tons and smoke dust of 45 tons.

V. Project Advantages

The centralized “coal to electricity” clean self-heating renovation of shallow ground source energy has enabled residents no longer use traditional coal-fired heating and also eliminated the potential safety hazards of stoking, cinder dumping and carbon monoxide poisoning. On the premise of ensuring the heating temperature in winter, compared with directly-heated type electric heating, the distribution and operation costs of shallow ground source energy clean self-heating are one quarter of that of directly-heated type electric heating equipment. The clean self-heating of shallow ground source energy has greatly improved the quality of life of rural households and realized the win-win development of the enterprise, government and rural residents.



敬告读者

TO INFORM THE READER

《中国地热能》是由中国地热能出版社主办，北京节能环保促进会浅层地（热）能开发利用专业委员会协办的科技期刊，于香港公开发刊，双语季刊。我们的办刊宗旨是为政府制定能源政策提供参考建议；为地能开发企业提供宣传平台；为设计者、大众提供交流空间；推广浅层地热能利用经验，展示应用实例。

我们始终不忘读者的期待，用心用力办好期刊。毫无疑问，优化空气、节能减排、治理雾霾是当前摆在全体中国人民面前一个重大课题，我们期望《中国地热能》这本小小的期刊能够为攻克这一难题贡献微薄之力。

立足长远，着眼当前，在继承中创新，在变革中发展。自创刊以来，期刊一直得到了业内专家学者和广大读者的热情支持，在此致以我们的衷心感谢。大家的关注是我们的追求，大家的支持是我们的动力。让我们携手共进，共同打造《中国地热能》的美好明天。

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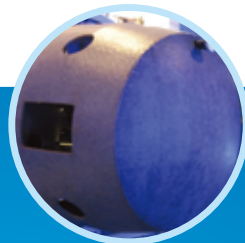
投稿及广告联系人：陈思

电话：010-62599774

邮箱：journal@cgsenergy.com.hk

中國地熱能
CHINA GEOTHERMAL ENERGY

为推广地能热冷一体化新兴产业的发展，恒有源科技发展集团有限公司与四川长虹空调有限公司合资成立了宏源地能热宝技术有限公司。公司以智慧供热市场为导向，专注于地能热冷机各类产品的开发和各种形式的地能热宝系统的产品集成，推广地能无燃烧方式为建筑物智慧供热，满足人们舒适稳定的生活环境需求。



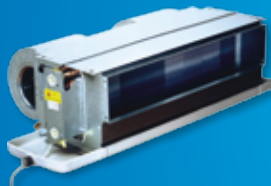
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1



2



4



3



5



6



7



9



8

- 1. 地能热（冷）吸顶机
- 2. 地能热（冷）风管机
- 3. 地能热（冷）柜机 A
- 4. 地能热（冷）柜机 B
- 5. 地能热（冷）卧机
- 6. 地能热（冷）壁挂机
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地址：四川省绵阳市涪城区金家林下街 29 号
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