

ISSN:2309845 7

2020年12月  
第33期

季刊

# 中國地熱能

CHINA GEOTHERMAL ENERGY



**求实创新敢担当 勇立潮头谱新章**  
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周年

ANNIVERSARY

2000-2020

恒有源科技发展  
集团有限公司

EVER SOURCE SCIENCE & TECHNOLOGY  
DEVELOPMENT GROUP CO.,LTD



浅层地热能恒有

无燃烧供暖无扰





**恒有源科技发展集团有限公司**  
EVER SOURCE SCIENCE & TECHNOLOGY DEVELOPMENT GROUP CO.,LTD.

恒有源科技发展集团有限公司（简称恒有源集团），是中国节能环保集团公司旗下的中国地热能产业发展集团有限公司（香港上市号 8128.HK，简称中国地热能）在北京的科技实业发展总部。

Ever Source Science and Technology Development Group Co. Ltd. (HYY Group) is the Beijing Head Office for science and technology development owned by China Geothermal Industry Development Group Ltd. (HKEx: 08128, China Geothermal) which is subordinate to the China Energy Conservation and Environment Protection Group.

在京港两地一体化管理框架下，恒有源集团专注于开发利用浅层地能（热）作为建筑物供暖替代能源的科研与推广；致力于原创技术的产业化发展；实现传统燃烧供热行业全面升级换代成利用浅层地能为建筑物无燃烧供暖（冷）的地能热冷一体化的新兴产业；利用生态文明建设成果，促进传统产业升级换代；走出中国治理雾霾的新路子。

With integrated administrative framework of Beijing and Hong Kong offices, the HYY Group is fully engaged in the R&D and market promotion of using shallow ground source (heat) energy as the substitute energy source of heating for buildings; in industrialized development of its original technology; to the upgrading of traditional heating industry into a new industry of integrated combustion-free heating and cooling with ground source energy; and in pioneering ways to improve ecological construction and curb haze in China.

#### ● 员工行为准则：

Code of Conduct :

安全第一，标准当家

With safety first, standard speaks

扎扎实实打基础，反反复复抓落实

To form a solid foundation, to make all strategies practicable

负责任做每件事，愉快工作每一天

All develop sense of responsibility, and achieve pleasure at work

#### ● 我们的宗旨：求实、创新

Our Mission: Pragmatism and Innovation

#### ● 我们的追求：人与自然的和谐共生

Our Pursue: Harmonious Coexistence of Human and Nature

#### ● 我们的奉献：让百姓享受高品质的生活

Our Dedication: Improve comfort level of the people's livelihood

#### ● 我们的愿景：原创地能采集技术实现产业化发展——让浅层地能作为建筑物供暖的替代能源；进一步完善能源按品位分级科学利用；在新时期，致力推广利用浅层地能无燃烧为建筑物智慧供暖（冷）；大力发展地能热冷一体化的新兴产业。

Our Vision: Work for greater industrialized development of the original technology for ground source energy collection, while promoting the use of shallow ground energy as the substitute energy of heating for buildings; furthering scientific utilization of energies by grades; propelling combustion-free intelligent heating (cooling) for buildings with ground source energy; and forcefully boosting the new industry of integrated heating and cooling with ground source energy.



# 中国地热能

CHINA GEOTHERMAL ENERGY

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<b>出版顾问</b> 王进友 孙伟	<b>Publish Consultant</b> Wang Jinyou, Sun Wei
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**主办**  
**承印**  
中国地热能出版社有限公司  
**地址**  
香港中环干诺道中 62-63 号中兴商业大厦 8 楼

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北矿大(南京)新能源环保技术研究院  
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中国热冷一体化能源研究院

国际标准刊号 :23098457

**发行部**  
黄礼玉 蒋靖璇  
**广告部**  
王赫 彭芳  
**地址、联系电话**  
北京市海淀区杏石口路 102 号 +8610-62592988

**Sponsor**  
**Printed by**  
China Geothermal Energy Press Limited  
**Address**  
8/F., Chung Hing Commercial Building, 62-63 Connaught Road Central, Central, Hong Kong

**Co-Sponsor**  
Nanjing Institute For New Energy & Environmental Science And Technology  
Capital Institute of Science and Technology Development Strategy  
Special Committee on Shallow Ground Source (Thermal) Energy Development and Utilization under Beijing Association to Promote Energy Conservation and Environmental  
Beijing Industrial Association for the Promotion of Foreign Trade & Economic  
China's Geothermal and Hot-Spring Industry Union  
China Integrated Heating and Cooling Energy Research Institute

ISSN:23098457

**Publishing Department**  
Coniah Wong, Jiang Jingxuan  
**Advertising Department**  
Wang He, Peng Fang  
**Address, Telephone**  
Address: No.102,Xingshikou Road, Haidian District, Beijing +8610-62592988

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——Twenty Years of Development of  
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# 求实创新敢担当 勇立潮头谱新章

——恒有源集团二十年发展方兴未艾

**PRAGMATIC, INNOVATIVE AND  
CONSCIENTIOUS, EVER SOURCE  
STRIDES FORWARD TO OPEN UP A  
NEW CHAPTER**

**—— Twenty Years of Development of Ever  
Source in the Ascendant**

作者：陈思

自2000年成立至今的恒有源科技发展集团有限公司（简称恒有源集团），是中国地热能产业发展集团的全资子公司，是注册在北京中关村高科技园区的科技实业总公司。在京港两地一体

化管理模式下，恒有源集团始终专注开发利用浅层地热能作为建筑物供暖替代能源的科研与推广，实施“浅层地热能无燃烧清洁供暖，发展可再生能源热冷一体化新兴产业”的战略。





恒有源集团在二十载的科研与经营试验中，始终秉承“追求人与自然的和谐共生，让百姓享受高品质的生活”的发展理念，围绕“忠诚与责任”的企业核心价值观，坚持“求实、创新”的宗旨，以原始创新的单井循环换热地能采集技术为核心，全力打造集科研开发、设计咨询、装备制造、工程安装、运维保障为一体的全产业链运行体系，形成新兴产业的规划与设计、可再生能源供给（浅层地热能）、智能制造（供暖热泵）、供暖系统工程建设、供暖系统运行与维护五个业务板块，创新探索出了一条利用可再生浅层地热能供暖区域无燃烧、零排放的为建筑物清洁、智慧供暖，治理雾霾的新路子。

恒有源集团二十年如一日，积极推动无燃烧供热地能热冷一体化新兴产业的发展。截至目前，恒有源集团推广浅层地热能清洁供暖/清洁自采暖项目已由北京辐射至除海南及港澳台以外的所有地区，形成行政办公、学校、医院、体育场馆、商业设施、农村农户等各类供热系统，应用 800 余项，建筑面积达到 2000 万平方米，经济环境效益显著。相较直热式电供暖设备，2000 万平方米项目每年每供暖季可节省电量 18 亿度，直接替代电厂电煤 56 万 tce，减少排放二氧化碳 131 万吨、二氧化硫 702 吨、氮氧化物 648 吨、

烟尘 144 吨，相当于减少建设三座 100MW 的电厂，节省火力发电投资约十亿元。同时，恒有源集团开发实施的农村地区 200 万平方米浅层地热能清洁自采暖项目每年每供暖季可直接替代散煤 75600 吨，减少排放二氧化碳 20 万吨、二氧化硫 559 吨、氮氧化物 197 吨、烟尘 783 吨。

浅层地热能智慧供暖项目的应用，合理化完善了供暖能源的产业链，进一步提高区域能源产业结构的合理性和能源利用效率，减少了煤炭等化石能源的消费，从源头控制了污染物的排放，有利于尽早实现碳达峰，努力争取 2060 年前实现碳中和。

多个农村农户浅层地热能清洁自采暖的实践，大量集中清洁供暖项目的落地实施是恒有源集团坚决落实国家清洁供暖指导方针和全力支持全面建成小康社会的一个缩影。恒有源集团将持续的坚决履行社会责任，不断丰富和完善产品产业链，将原创技术的产业化发展与金融资本和工业互联网相结合，建立全新的供热能源体系，在促进经济健康发展的同时，最有效地追去人与自然的和谐共生，让百姓享受高品质的生活，真正践行生态文明建设。智慧供暖促热冷一体化新兴产业蓬勃发展，走出治理雾霾的新道路，迎接供暖能源新时代。



# 我们一起走过的 20 年

## THE TWENTY YEARS WE HAVE GONE THROUGH

作者：孙骥

我在2000年恒有源公司创立的时候，就是恒有源的员工了。20年来我们创建了不少像国家大剧院、国家行政学院和雄安新区的一些冷热源项目等标志性工程。但是，在诸多工程中最令我难忘的是海淀外国语实验学校。那是我们在2001年完成的项目，是恒有源成立以后第一个给几千人服务的供暖、制冷、供生活热水的大项目。

2001年国内对节能减排的认识还刚刚开始，大家深受雾霾之害却不知道它是怎么来的。恒有源提出用浅层地热能作为供暖替代能源实现无燃烧供暖的理念还没有被普遍接受。大街上我们看

到相关企业宣传的牌子上写的都是“创办一个供暖企业带来几十个百万富翁”这样的讲经济利益的口号。恒有源公司这个时候在自己的ISO体系文件里公开宣示我们的宗旨是“提高百姓的生活品质，追求人与自然的和谐共生”。因为超前，我们有点孤独。

海淀外国语实验学校就是在这样的背景下决定采用恒有源公司浅层地热能供暖/冷技术为全校当时近5000名师生冬季供暖、夏季制冷和日常提供生活热水的。校领导三番五次来考察、调研。疑问很多啊：没有燃烧能采暖吗？地下有那





么多的热量吗？人家一口井抽水几口井回灌都不行，你们搞一口井连抽带灌行吗？这些问题都是必然存在的。

我想校领导主要是出于对我们信任才签了合同。全部工程包括办公楼、科技楼、食堂、体育馆、中学楼、小学楼、男生宿舍和女生宿舍等8栋建筑。总供热面积超过50000平方米。总制热功率6400千瓦。总制冷功率超过5700千瓦。每天生活热水供给量约40立方米。

2001年的冬季是海淀外国语实验学校创立后的第一个供暖季。我们在2001年下半年进场，从开工到竣工只用不到三个月的时间，在当年就投入供暖运行。结果各方面都很满意，没有任何污染物排放，不需要储存燃料的空间，没有灰渣运输等问题，运行费用比市政热力还低很多。第一次合作，我们和海淀外国语实验学校获得了双赢。

参观者络绎不绝。最先到来的是市、区的领导。从他们的眼光里我们看到了激励。参观人数最多的群体是学生的家长。他们最想知道是这个新的暖气系统到底安全不安全。在教室和宿舍里他们感受到了扑面而来的热风，采暖的温度达标；在机房里看不到一点火星，也没有燃料的堆积。这就是没有燃烧的采暖。没有火灾、爆炸的危险源，没有污染物排放，毫无疑问它最适合学校使用。

我至今仍然十分感谢校领导们



对我们的信任，钦佩他们对环保问题的高瞻远瞩和对创新技术的深刻的洞察力。海淀外国语实验学校从创立伊始不断前进发展壮大到今天成为北京的名校并非偶然。

初战告捷，海淀外国语实验学校的今后发展自然离不开恒有源公司的无燃烧供暖系统。2008年海淀外国语实验学校第一次扩建包括南校区3栋建筑共12000多平方米。2010年以后又增加充气体育馆和幼儿园等工程，每年都有新的扩展。到2019年原来的地域已经饱和，海淀外国语实验学校决定在原乡设立京北分校。分校分两期进行建设，总建筑面积达140000平方米。一期总建筑面积约60000平方米，二期总建筑面积约80000平方米，涵盖了幼儿园、普通初高中、国际部初高中、海外剧场、综合体育场、冰雪运动中心、滑雪厅及后勤办公楼等十栋建筑。项目一期已于2019年全部竣工，并陆续投入使用。二期建



筑目前已封顶，预计2021年全部竣工。原乡属张家口地域，其供暖期长达6个月，极寒温度在零下20℃以下，对供暖系统要求很高。通过2019-2020供暖季的实际检验，恒有源浅层地热能无燃烧供暖系统完全保证了供暖效果，其运行电耗每平方米只有30度电，大幅度节省了运行费用。

今天的海淀外国语实验学校已经发展成规模宏大的高规格的学校了，有一流的教学设备，完善的体育设施，还有就是我特别要说的，利用浅层地热能的无燃烧供暖/冷系统，可以为广大莘莘学子提供安全的、没有污染物排放的冬暖夏凉的学习和生活环境。

我的居所离海淀外国语实验

学校不远，是散步可以到达的地方。我喜欢站在它的门前仰望主楼正立面上的装饰，心中自然浮起我们一起走过的20年的历程。我们曾经同风雨，一起接受过实践的考验，我们也曾并肩地受到国家领导人的检阅。时光如梭，20年只是历史长河中的一瞬。愿我们比翼双飞，向着更高、更远。



## 北京市海淀外国语实验学校京北校区一期项目介绍

### 秉持三个“一切”舒适孩子们的春夏秋冬

北京市海淀外国语实验学校京北校区一期项目坐落在张家口市怀来县北辛堡镇原乡，建设校区共6栋楼，包括1#小学部、2#中学部、3#海外剧场、4#综合体育中心、5#冰雪中心、滑雪大厅等，供暖冷总建筑面积59292.93m<sup>2</sup>。自2019年9月起投入使用。

“一切为了孩子，为了孩子的一切，为了一切的孩子。”宋庆龄先生这三个“一切”不仅成为一代又一代教书育人者的座右铭，也是每个有担当者义不容辞的责任。作为浅层地热能行业的领军企

业，恒有源集团在建设京北校区时更是秉承了这三个“一切”的理念，公司上下齐心合力，利用浅层地热为孩子们的每个春夏秋冬护航。







### 室内四季恒温 孩子们更舒心

该项目依据学校区域内建筑物功能，采用恒有源集团单井循环换热地能热泵环境系统，系统共设置4个冷热源集中机房、1个集中换热站及22口恒有源单井循环换热地能采集井，采用地能集中供给，各机房独立运行的方式，可满足建筑物的冬季供暖、夏季制冷、全年提供生活热水及泳池加热的需求。

根据室外环境温度，各建筑室内温度可以在 $18^{\circ}\text{C}$ – $26^{\circ}\text{C}$ 之间随意调节，分别满足冬季和夏季对室内环境舒适度的要求。生活热水系统出水温度设置 $40$ – $45^{\circ}\text{C}$ ，不间断提供生活热水并为学校的泳池进行池水加热。



### 每年节约电厂电煤1844吨

在舒适的基础上，项目还更环保低碳。计算项目每年冬季供暖总用电量为226.78万度。与直热式电锅炉相比，每年节电551.8万度，节约电厂电煤1844吨，减少排放二氧化碳4288吨、二氧化

硫2.3吨、氮氧化物2.1吨、烟尘473千克。

项目每年夏季制冷总用电量为50.89万度，比传统中央空调系统节电量约为17.11万度电。因不采用冷却塔，没有水的蒸发损失，每年节水396吨。

经过运行分析计算，该项目冬季供暖和生活热水耗电量平均为 $38.2\text{kW}\cdot\text{h}/\text{m}^2$ （含1400人的生活热水），夏季 $8.6\text{kW}\cdot\text{h}/\text{m}^2$ （夏季余热回收免费制热水和辅助制冷），全年供暖、制冷和提供生活热水共耗电量为 $46.8\text{kW}\cdot\text{h}/\text{m}^2$ ，按照电价 $0.52\text{元}/\text{kW}\cdot\text{h}$ 计算，全年运行费用为 $24.4\text{元}/\text{m}^2$ （146天供热，200天热水，365天泳池加热，90天制冷）。



### 运行费用节约超四成

该项目利用单井循环换热地能采集技术采集地表下百米以内深度的土壤、砂石、地下水中蕴含的低于 $25^{\circ}\text{C}$ 的低温热能，与成熟的热泵技术相结合，为建筑物供暖、制冷、提供生活热水。技术使用过程中没有水的消耗，对地下水无污染，不会产生潜在地质灾害，是土壤源热泵的一种。

系统制冷产生的热量可直接通过热泵机组实施热回收用作制备生活热水或用于泳池池水加热，实现系统能量的循环利用。同时，项目实现了原创技术的完全市场化，参考以往类似项目实际运行情况并结合本项目特点，在没有获得任何项目相关补贴的情况下，可实现项目的低成本运营。年均运行费用 $24.4\text{元}/\text{m}^2$ ，较张家口市2018年发布执行的张家口市非居民（学校）供热价格 $44.1\text{元}/\text{m}^2$ （建筑平米）节约44.7%。



经风雨洗礼 廿载辉煌续前行

# 庆祝恒有源集团

# 成立二十周年系列活动侧记

**Going through Weather-beaten Challenges,  
Making Achievements for Twenty Years and  
Marching forward Courageously**

**SIDELIGHTS FOR SERIES OF ACTIVITIES  
TO CELEBRATE THE 20TH ANNIVERSARY  
OF THE FOUNDING OF EVER SOURCE  
SCIENCE AND TECHNOLOGY  
DEVELOPMENT GROUP CO., LTD**

特约记者：马晓芳

庆祝恒有源集团成立二十周年系列活动日前圆满落下帷幕。体育、文艺、才艺、公益四大类共十几项活动不仅为二十周年庆典系列活动增添了许多亮丽风景，同时也增进各部门的沟通交流，增强员工的荣誉感和使命感，增强集团的自身凝聚力，促使集团企业文化建设走上良性循环的轨道。

2020年11月14日至12月15日期间，恒有源集团组织员工先后在集团公司本部、北京海淀外国语实验学校、香山公园等地，举行了拔河、羽毛球、爬山、包饺子、棋牌、摄影书法展等多种多样的比赛活动。动静结合的活动安排吸引了集团各单位、部门约100余名员工积极参与。集团公司中国地热



能产业发展集团董事局联席主席王彦、恒有源科技发展集团董事长薛江云、总裁王满全等全程参加活动并为优胜者颁奖。

### 拔河赛场显团结 羽毛球 PK 较真功

拔河比赛是考验团队团结协作精神的体育项目之一。随着一声哨响，伴随着啦啦队的加油呐喊，参赛队员齐心协力，抓紧绳子，用力拼搏。激烈角逐后，取得比赛最终胜利的工人们击掌相庆，喜笑颜开。拔河比赛在呐喊声中奋勇“拼搏”，“拼”出了欢笑，“搏”出了情感，充分彰显了各个参赛队伍团结协作、敢打敢拼、勇往直前的精神，增强了集体荣誉感、凝聚力和团队精神。

在北京海淀外国语实验学校气膜馆举行的羽毛球比赛同样精彩纷呈。比赛分团体赛和单项赛，共计十支队伍参赛。比赛现场，参赛选手们状态饱满，精神抖擞，刚刚以巧破千斤，转身又发出大力扣杀，过会儿又展开网前截击，一个个身手敏捷，技巧娴熟。特别是需要高度配合的双打比赛，让比赛高潮迭起，球馆里加油声、欢呼声不断，气氛十分热烈。赛场如战场，各参赛选手勇于拼搏，敢于挑战，表现出了强烈的拼搏竞争意识，更展现了恒有源集团发展热冷一体化新兴产业，做浅层地热能开发利用引领者的饱满激情与昂扬斗志。

### 勇攀高峰 拥抱自然 守护环境

为增强集团员工身体素质，展现良好精神面貌，本次二十周年庆典系列活动特别组织开展香山公园爬山活动。初冬寒冷的北京，无法阻挡员工们的热



情。70余名报名参赛的员工早早的就在比赛起点集合完毕。爬山活动正式开始后，大家两个一组三个一伙，飞速向目标香山香炉峰挺进。在爬山的同时，集团还倡议各参与队伍下山时沿途捡拾景区内垃圾，从自身做起保护自然环境。参赛队员也纷纷相应号召，下山时拾起沿途遇到的垃圾，锻炼身体的同时为环保出一份力。

此外，棋牌比赛、包饺子比赛、摄影绘画展等活动现场也都吸引了众多集团员工参与。

2020年是极不平凡的一年。恒有源集团也迎来二十岁的生日。七千日风雨成劲旅，二十年汗水铸辉煌。进入“弱冠”之年的恒有源集团将同集团员工们一同携手，共克时艰，再创辉煌。



# 专家学者勉恒有源： 继往开来 再创辉煌

——院士专家寄语恒有源集团成立二十周年

## EXPERTS AND SCHOLARS PRAISE EVER SOURCE: CARRY FORWARD OUR CAUSE AND CREATE GLORY AGAIN

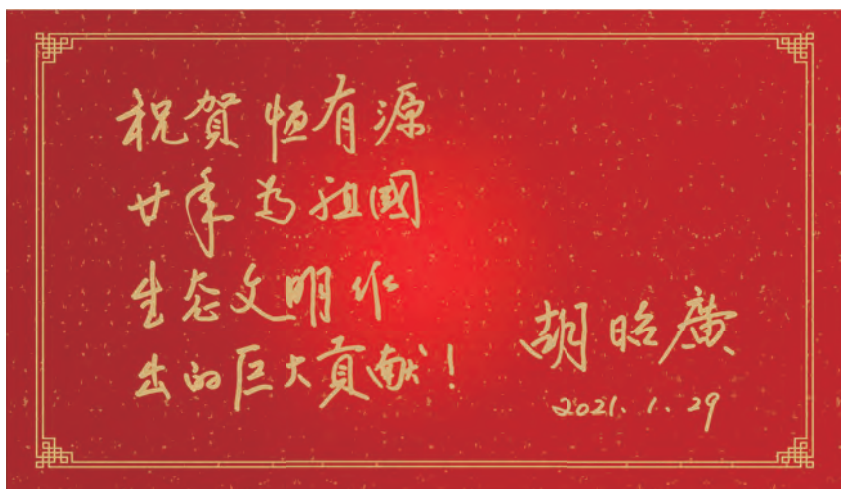
——Academic scholars and experts send words  
to Ever Source Group for its 20th anniversary

“牛背飘春曲，鹊舌报福音”，辛丑牛年如约而至，恒有源集团也迎来创建二十年的重要时刻。在过去的二十年里，恒有源集团上下一心，众志成城，深耕浅层地热能行业，取得了非凡的成就。“不积跬步无以至千里”。二十年来，恒有源集团内外兼修、锐意进取，不仅成为行业的领头尖兵，也为国家和社会做出了诸多贡献。“新竹高于旧竹枝，全凭老干为扶持”，恒有源二十年间所取得的成果和进步，凝聚着众多恒有源人的辛勤付出，也离不开诸多院士专家的指导和关怀。值此恒有源集团成立二十周年之际，这些关心、关注、见证恒有源发展历程的专家们也纷纷发来亲笔题词，勉励恒有源集团“百尺竿头更进一步”，在二十周年的重要时刻重整行囊再出发、继往开来创辉煌，为国家早日实现的低碳中和贡献更多力量。



胡昭广

(北京市原副市长)

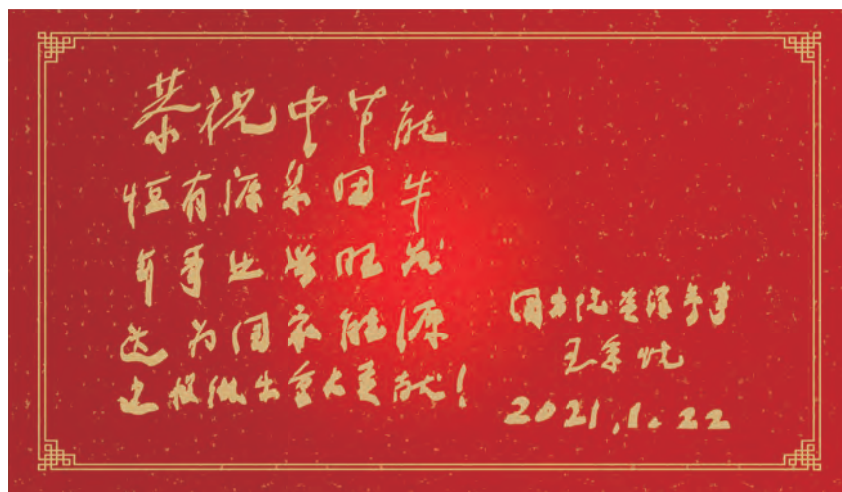






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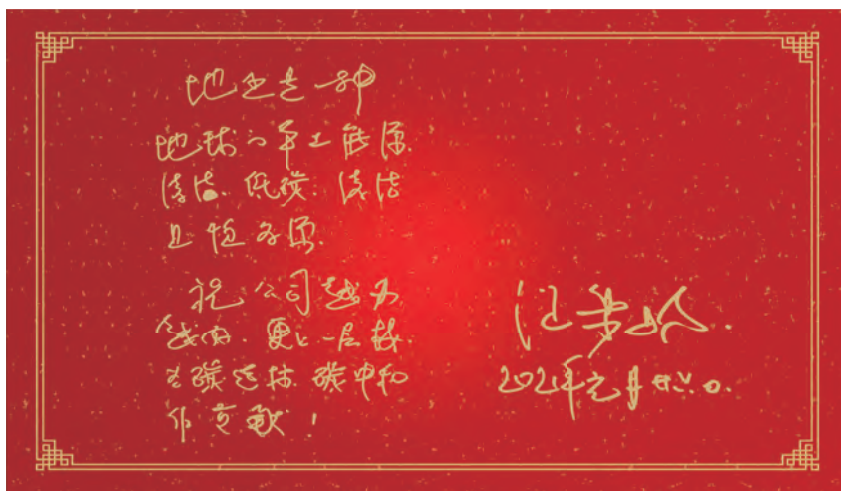




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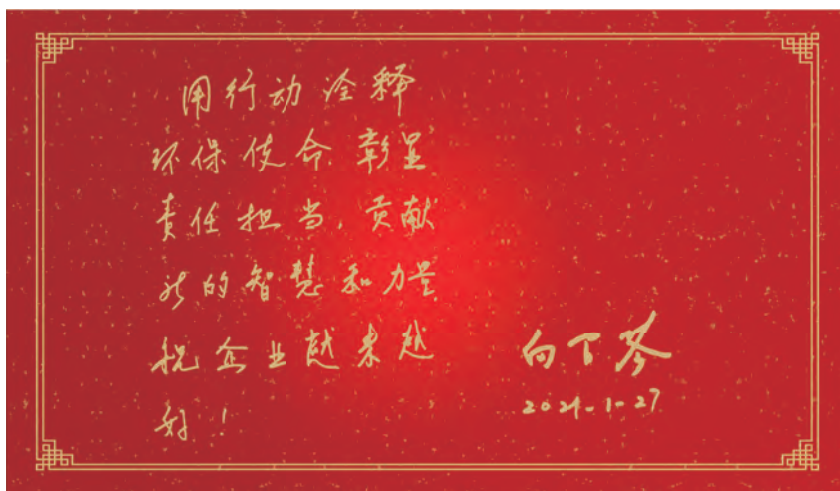
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# 从中国专利申请看我国地热能开发利用现状

## CURRENT SITUATION OF CHINAS EXPLOITATION AND UTILIZATION OF GEOTHERMAL ENERGY FROM THE PERSPECTIVE OF CHINA PATENT APPLICATION

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当前地热能开发利用主要分为地热能发电和地热能直接利用两大方面，地热能直接利用又分为地热能供暖、温泉和工农业应用等。从上个世纪末起浅层地热能建筑供暖方面的开发利用异军突起，发展迅速。

以下所引用的专利文献仅用于举例说明，以便读者更具体地理解各项技术；如读者有进一步的需求，建议向国家知识产权局专利局官方咨询。

### 一、概况

#### 1. 地热能发电

地热能发电，是把地热能先转化为机械能，再将机械能转变为电能的过程。近十年来，全球地热能发电不断发展，全球地热能发电装机容量从2010年的9992MW增长到2019年13931MW，增长了30%以上。而中国地热能发电装机容量从2010年的24MW，到2019年的

27.8MW，基本稳定，由此可知地热能发电并非我国主要的地热能利用开发模式。

#### 2. 地热能供暖

将地热能直接用于供暖和供生活热水是较为重要的地热能利用方式。地热能供暖是利用打井或潜泵将地热水导出，而后将地热水作为加热介质与供热系统或生活热水换热器做热交换，从而将地热水中的热量传导给供热系统循环水或生活热水，满足供热系统和生活热水的需求。

全球直接利用地热能的国家有88个，这个数字在近十年来快速增长。根据统计数据，全球2010年的地热能直接利用装机容量为48493MW，年利用热量为423830TJ（折合 $3360 \times 10^4$ t油当量），到2019年装机容量为107727MW，年利用量为1020887TJ（折合 $8100 \times 10^4$ t油当量），地热能直接利用装机容量和年利用热量分别增长122%和141%。

### 3. 温泉

温泉是地热水的直接利用方式之一，具有利用简单、便利的特点，地热水中具有铁、钾、钠、氢、硫磺等化学元素，通常用于洗浴和医疗，历史悠久。在我国云南、四川、福建等南方地区，温泉资源比较丰富，有很大的旅游开发利用价值。部分地热水可以用作饮用矿泉水，对补充人体微量元素具有较好功效。

### 4. 地热能的工农业利用

地热能在工农业的利用更为广泛，例如温度适宜的地热水可以用来灌溉农田，可使农作物早熟增产，达到较好品质，也可以饲养各种鱼类，加速食用鱼类的生长；利用地热能可以对瓜果、

玉米等进行脱水干燥及用于菌种培养，而建立地热能温室，可以对蔬菜、水果、花卉等进行育种、孵化和种植。

### 5. 浅层地热能的开发利用

浅层地能主要指地球浅表层数百米以内土壤砂石和地下水所蕴藏的低温热能，其中主要来源是太阳能和地心热能。进入21世纪我国浅层地热的开发利用发展很快，专利申请量增加迅速。2012年北京市质监局发布地方标准DB11/T935-2012《单井循环换热地能采集井工程技术规范》，其中引用了专利ZL200610002239.8。专利申请为我国浅层地能的推广利用的健康发展起到了促进的作用。

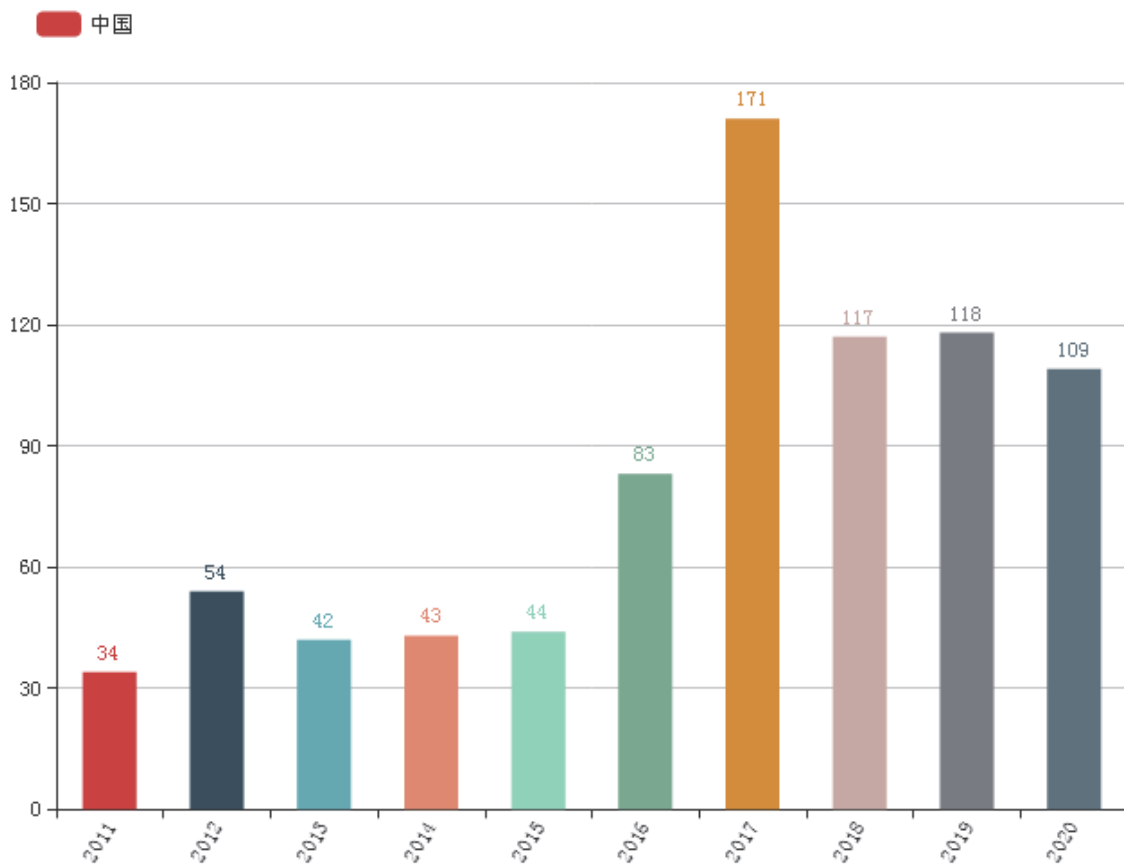


图1 近十年发明专利申请量



## 二、相关专利申请情况

笔者采用国际专利分类号和关键词在中文专利文摘数据库（CNABS）对在住宅供热系统或区域供热系统中利用地热能的相关专利进行检索，具体如下。

### 1. 中国专利申请状况

通过在中文专利文摘数据库（CNABS）进行检索，截至2020年12月，该数据库中有关地热能住宅供热系统或区域供热系统利用方面的专利申请共计2326件，其中发明专利申请为941件，实用新型专利申请为1385件。由于我国在发

明专利申请与实用新型专利申请的审查过程有一定的区别，在此对两种专利申请分别进行统计说明，以期能为读者提供更多的参考。

#### 1.1 发明专利申请状况

##### 1.1.1 近十年发明专利申请量

由图1可以看出，地热能住宅供热系统或区域供热系统中的应用发明专利申请量在2016年之前达到30至50余件之间，在进入2016年后申请量明显增大。在2017年的申请量为最高值171件，2018-2020年间，每年申请量均突破100件，基本稳定在120件左右。

1.1.2 近五年发明专利申请量排名前十名的省份

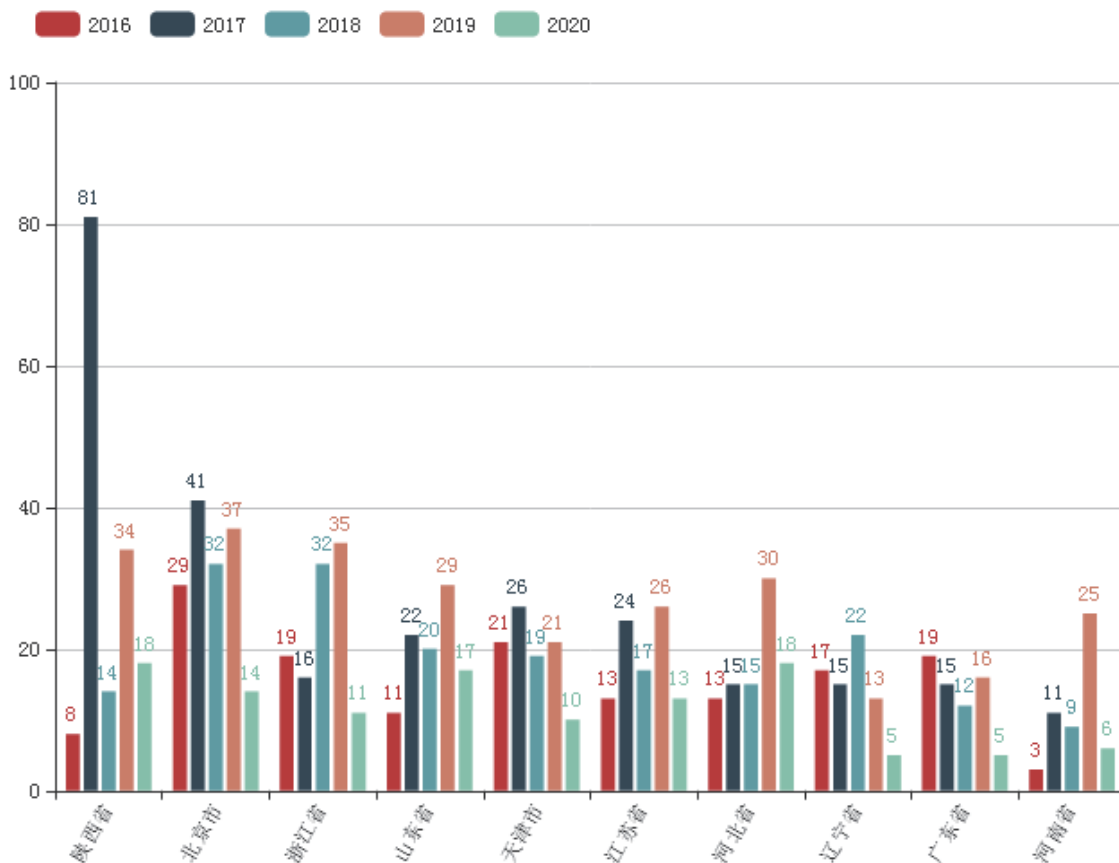


图2 近五年发明专利申请量排名前十名的省份

近五年发明专利申请量排名前十名的省份分别为：陕西省、北京市、浙江省、山东省、天津市、江苏省、河北省、辽宁省、广东省、河南省。

## 1.2 实用新型专利申请状况

### 1.2.1 近十年实用新型专利申请量

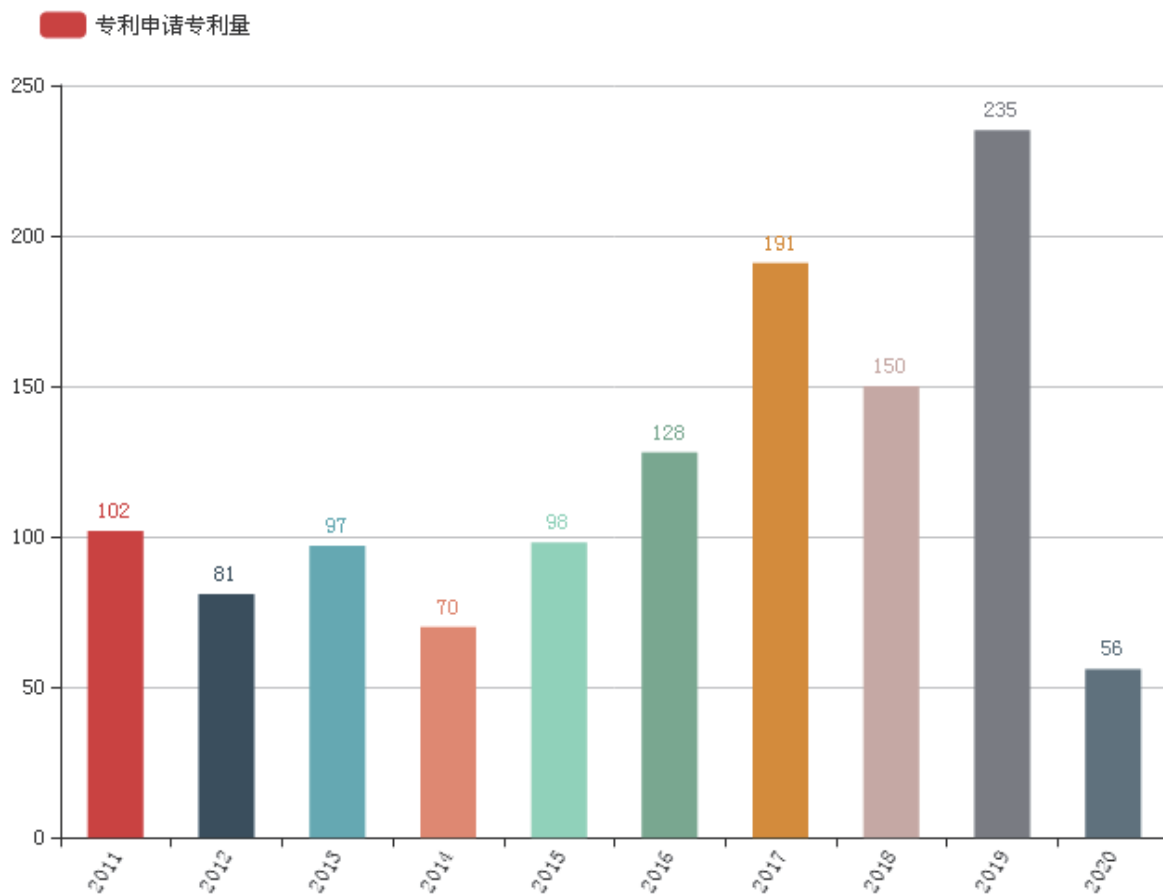


图3 近十年实用新型专利申请量

由图3可以看出，地热能在住宅供热系统或区域供热系统中应用的实用新型专利申请量在2016年之前达到70至100余件，进入2016年以后申请量略有增长，2017年和2019年申请量较高，分别为191件和235件。

## 2. 技术分类

《关于国际专利分类斯特拉斯堡协定（1971）》已于1975年10月7日生效，它为包括公开的专利申请书、发明人证书、实用新型和实用新型证书在内的发明专利文献（以下简称“专利文献”）提供了一种共同的分类。依据该协定第1条，建立了特殊（IPC）联盟。

国际专利分类法是国际统一化、标准化的管理、使用专利文献的分类方法。它是国际间长期合作的结果，也是当今专利制度趋向国际化和统一化的必然产物。国际专利分类法是当今世界上最重要的、起主导作用的专利分类法。由于其具有完整性、科学性、实用性，目前，世界上绝大多数国家都采用了国际专利分类法。我国自1985年4月1日实施专利法以来，就采用了国际专利分类法管理和使用我国的各种专利文献。

国际分类号F24D为住宅供热系统或区域供热系统，包括诸如集中供热系统；住宅热水供应系统；其所用部件或构件。“集中供热系统”是指在一个中心热源处产生或贮存热并通过流体传输装置将热量分配到要供热的地点或区域的系统等。

### 2.1 发明专利申请技术分类

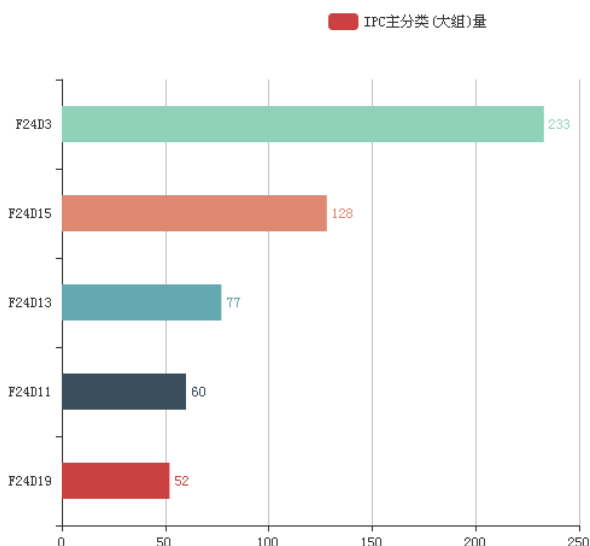


图4 发明专利申请技术分类

由图5可以看出，中文专利文摘数据库中实用新型专利申请也主要集中于热水集中供热系统，共计400件。其余依次为其他住宅或区域供热系统、零部件、电热系统、利用在储热物质中积累热量的集中供暖系统等。

由图4可以看出，中文专利文摘数据库中发明专利申请主要集中于热水集中供热系统，共计233件。其余依次为其他住宅或区域供热系统、电热系统、利用在储热物质中积累热量的集中供暖系统、零部件等。

### 2.2 实用新型专利申请技术分类

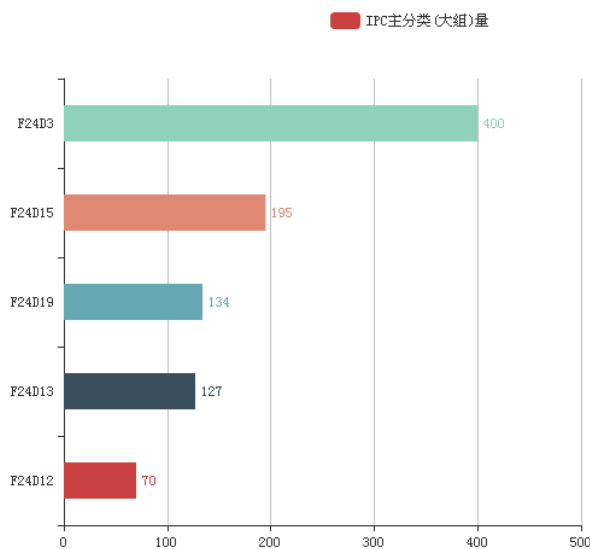


图5 实用新型专利申请技术分类

## 三、建议

地热能作为一种可再生能源，发展潜力巨大，但从专利申请量、申请人构成等方面来看，地热能住宅供热系统或区域供热系统中的应用还不够充分，一方面说明涉足地热能领域的大型企业不多，一方面也说明设计地热能利用的先进技术储备和研究不足。建议相关科研企事业单位对地热能直接利用等技术积极开展研究，不断攻克制约地热能发展的技术难题，提升地热能直接利用水平。



特别报道

SPECIAL REPORT

《中国地热能》杂志  
专访中信建筑设计研究总院副总工程师

陈焰华先生



# EXCLUSIVE INTERVIEW OF CHINA GEOTHERMAL ENERGY WITH MR CHEN YANHUA

## Deputy Chief Engineer of CITIC General Institute of Architectural Design and Research Co., Ltd

### 编者按

2020年的供暖季顺利开启。疫情之下的供暖与往常有怎样的变化？我国南方清洁供暖的重要程度？地源热泵在我国南方清洁供暖中有怎样的地位？带着这些问题，《中国地热能》杂志独家专访了中信建筑设计研究总院副总工程师、中国地源热泵产业联盟理事长陈焰华先生。下文是编辑部经过整理后的专访实录：

### 1、《中国地热能》：疫情对供暖制冷空调行业带来怎样的影响？

陈焰华：2020年新年伊始，一场突如其来的新冠肺炎疫情席卷全国，并蔓延扩展到全世界，对全球社会经济的各个方面都带来了前所未有的重大影响，对供暖制冷空调行业的影响也不可避免。

据相关统计数据显示，2020年1月—9月，我国中央空调市场销量下滑10.34%。分季度看，一季度市场表现惨淡，二季度市场增长加速趋势明显，而三季度增长趋于缓和。从近3年的行业走势来看，中央空调行业的发展依然呈现下行趋势，但相比上半年降幅持续收窄，这意味着在国内疫情得到有效控制后，国内中央空调市场形势逐渐好转。特别是第三季度，我国统筹疫情防控和经济社会发展成效显著，国内基础设施建设取得明显发展，居民消费能力进一步提升，这些对中央

空调行业的刺激作用都十分明显。

尽管疫情对供暖制冷空调行业带来了重大影响和未来发展的众多不确定因素，但也同时对建筑领域发展方向和供暖制冷空调行业提供了新的巨大机遇和挑战，在疫情防控常态化的形势和要求下，人们更加关注绿色、健康的生活方式和与自然和谐相处、可持续发展的发展理念，更加重视建筑室内空气品质和生物安全性，我们的建筑设计应该更绿色生态、更节能环保，应尽可能减少大面积的密闭空间，人员密集的密闭场所和空间（如地铁车站、商场和医院门急、诊等）尤其应重视通风空调系统的设计及其运行管控，应尽量加大通风换气次数和新风量的供应，在建筑节能和卫生安全之间找到有效的平衡点，当然还有舒适健康的新的空调系统形式和高效的空调系统送风方式的开发和研究。

新基建和碳排放达峰、碳中和目标的提出，更是为供暖制冷空调行业的未来发展指明了方向，我们应该积极响应和紧跟国家的战略发展方向，一方面在绿色低碳和可再生能源利用领域深化研究，拓展能源高效利用的新的技术领域和新的研究方向；另一方面专注工程业态的细分和深化，用专业化、系统化、智能化的解决方案拓展更多的工程领域，如平疫结合医院、医疗净化、数据中心、家居健康等领域；又如行业普遍关注的装配式或集成式能源站、高效制冷机房等，新的技术研究方向、新的技术领域的拓展，新的设备、系统的开发和应用领域的拓展永远是供暖制冷空调行业的未来高质量发展的必由之路。

## 2、《中国地热能》：请您介绍一下目前我国南方供暖的现状，如何看待南方清洁供暖的重要性？

陈焰华：我国南方目前供暖主要包括局部集中供暖和分散供暖两种方式，包括：土炉取暖、取暖电器（电暖器、电热扇、电油汀等）、家用空调、燃气壁挂炉等。有条件的小区采用局部集中供暖（地源热泵、风冷热泵、燃气锅炉等），有工业余热和热电厂周边建筑采用小范围集中供热。各种供热方式的供热效果、经济性、能耗、对环境的影响及供热安全性等差别很大。

直接用电取暖是高品位能的低位利用，一次能源利用效率很低，能耗大，存在安全隐患；家用空调利用热泵原理，吸收空气中低位热能，是一种有效的可再生能源利用方式，是南方分散供暖的主力军，但受气候的影响大，能效和供暖效果都有待提高；壁挂炉燃烧天然气，供暖费用较高，初投资较大，集中使用对环境会造成一定的影响；风冷热泵大多为办公楼、写字楼等公共建筑采用；燃气（油）锅炉、直燃溴化锂机组宾馆、医院、商业建筑应用较多；燃煤锅炉主要为满足工业用户生产需

求，辅助供暖，燃煤锅炉效率低，污染严重。而且南方城市煤炭、石油、天然气资源紧缺，几乎全部需要从外地购买。煤炭通过铁路从北方运送，致使煤炭价格较北方高，并且煤炭大量消耗势必加重国家铁路运输的压力。燃油价格受国际原油价格的影响，波动大、价格高，利用燃油供暖很不经济。天然气资源主要靠西气东输、川气东送等国家大型输气气源供应，一到冬季供暖高峰期由于上游天然气气源的紧缺，往往导致下游供气不足，燃气供暖不能保证正常运行。

随着经济的快速发展和人们对美好生活的向往，建筑供冷供热和生活热水供应的需求越来越大，但究竟采用何种技术路径和能源供应方式来满足这种快速增长的需求，无论是政府管理部门和暖通空调行业的研究和准备都是远远不够的，更别说从城市可持续发展和城市能源高效综合利用的高度和视野来进行高屋建瓴的整体规划和顶层设计了。这就导致了南方建筑供冷供热领域发展方向不清、技术路径不明、各种供冷供热技术形式和设备任由市场盲目发展的混乱现状，节能减排、可再生能源建筑应用的国家战略和清洁低碳能源综合利用的技术路线很难在建筑工程设计和建设过程中得到落实与执行。如何在对建筑能源特性及南方地区气候特点深入研究的基础上，梳理和提出适合当地资源能源禀赋和供应现状的建筑能源科学合理利用的技术路径就尤显迫切和重要。

## 3、《中国地热能》：南方供暖的发展方向和思路。

陈焰华：建筑能源无论是从供冷还是供热的需求来看，其所要求的能源品味都是不高的。在建筑物普遍执行节能标准的情况下，供暖时维持室内舒适温度所需求的供热量和热水温度都不会太高，采用散热器供暖时其供回水温度按规范要求要在75/50℃，采用空调末端其供回水温度为60/45℃，采用辐射供暖时供回水温度在45/35℃



即可。因此，在南方地区各类热泵就能够很好的满足建筑物的供暖需求，且夏季还能能为建筑物供冷。

从建筑能源特性和南方地区气候条件、资源禀赋、能源供应及利用现状来看，可以清晰地梳理出南方供暖或建筑能源科学合理利用的技术路径。一是，应该依据城市总体规划和城乡建设发展规划，充分利用资源禀赋，坚持集中与分散相结合的多元化的城市建筑能源发展路线；二是，采用先进、可靠的技术，以节约能源和提高能源综合利用效率为前提，与可再生能源利用和绿色建筑规划衔接和协调，实现城市建筑能源利用的清洁、低碳化和可持续发展。

1) 基于南方地区的气候条件和建筑能源需求特性，建筑供热应与建筑供冷一起考虑，在满足需求的前提下提高建筑能源的利用效率和使用经济性。

2) 依据工业生产的需要合理进行新建热电联产电厂的布局，并与现有热电厂和工业余热的利用统筹考虑、统一规划、分期实施，利用热电联产电厂和工业余热实现周边地区建筑的集中供热、供冷。

3) 集中供热管网覆盖的商务区、城市综合体、工业园区、大学城等建筑冷热负荷密度大、建筑冷热负荷需求稳定的区域，优先利用热网的蒸汽（高温热水）或可再生能源冷热源点建设多能互补区域能源站，为周边建筑供热供冷，提高城市综合服务功能，提高集中供热供冷系统的综合利用效益。

4) 集中供热管网未覆盖的商务区、城市综合体、工业园区、大学城等建筑冷热负荷密度大、建筑冷热负荷需求稳定的区域，应积极发展可再生能源与常规能源复合利用或天然气冷热电三联供等分布式区域能源系统，实现能源的合理和梯级利用，提高能源综合利用效率。

5) 其他区域，应依据资源条件使用利用浅层

和中深层地热能、空气能、太阳能等可再生能源的各类热泵（水地源热泵、中深层地热能、热源塔热泵、空气源热泵、燃气热泵、太阳能等）技术进行供热供冷。因资源条件受限或确需通过锅炉供热才能满足使用要求时，否则不应采用锅炉供热。

6) 除建筑供冷供热需求外，生活热水需求量也越来越大，居住建筑和宾馆、医院等有稳定热水需求的公共建筑，可再生能源热水系统使用比例应达到100%。居住建筑应采用太阳能热水或空气源热泵热水系统供应生活热水，不应采用电热水器制取生活热水。

#### 4、《中国地热能》：地源热泵在南方清洁供暖中的地位 and 作用？

陈焰华：除能够利用热电厂和工业余热建设的区域能源综合利用项目及集中供热设施外，应依据资源条件使用利用浅层和中深层地热能、空气能、太阳能等可再生能源的各类热泵（水地源热泵、中深层地热能、热源塔热泵、空气源热泵、燃气热泵、太阳能等）技术进行南方地区供热供冷，实现建筑能源利用的清洁、低碳化和可持续发展。

地热能是一种绿色低碳、可循环利用的可再生能源，具有储量大、分布广、清洁环保、稳定可靠等特点，一次能源利用率远高于空气源热泵，对建筑供冷供热来说是一种安全可靠且具有竞争力的清洁能源。随着可再生能源建筑应用的推进和绿色建筑的发展，以地源热泵为代表的地热能利用已从单个建筑项目扩展到建筑物的规模化应用和集中连片应用，为南方地区清洁低碳能源的应用起到了极好的示范和表率作用。加快开发利用地热能也是贯彻党的十九大精神，全面推进能源生产和消费革命战略的必然选择。促进地热能高效利用，不仅对调整能源结构、节能减排、改善环境、应对全球气候变化具有重要意义，同时也是中国生态文明建设和绿色低碳发展的重要举措。

《新时代的中国能源发展》白皮书发布：  
截至 2019 年底，北方地区清洁取暖面积达  
116 亿平方米，比 2016 年增加 51 亿平方米

**THE WHITE PAPER, TITLED ENERGY IN CHINA'S NEW ERA, WAS RELEASED BY THE END OF 2019, THE AREA OF CLEAN HEATING HAD REACHED 11.6 BILLION SQUARE METERS IN NORTHERN CHINA, WITH AN INCREASE OF 5.1 BILLION SQUARE METERS OVER 2016.**

近日，《新时代的中国能源发展》白皮书在京发布。白皮书提到，能源发展取得历史性成就：能源供应保障能力不断增强，截至 2019 年底，浅层和中深层地热能供暖建筑面积超过 11 亿平方米；能源惠民利民成果丰硕，截至 2019 年底，北方地区清洁取暖面积达 116 亿平方米，比 2016 年增加 51 亿平方米。其中北方农村地区清洁取暖率约 31%，比 2016 年提高 21.6 个百分点；北方农村地区累计完成散煤替代约 2300 万户，其中京津冀及周边地区、汾渭平原累计完成散煤清洁化替代约 1800 万户。

白皮书指出，北方地区冬季清洁取暖关系广大人民群众生活，是重大民生工程、民心工程。以保障北方地区广大群众温暖过冬、减少大气污

染为立足点，在北方农村地区因地制宜开展清洁取暖。按照企业为主、政府推动、居民可承受的方针，稳妥推进“煤改气”“煤改电”，支持利用清洁生物质燃料、地热能、太阳能供暖以及热泵技术应用。

白皮书建议，制定财政、价格等支持政策，积极推进北方地区冬季清洁取暖，促进大气环境质量改善。大力推进天然气热电冷联供的供能方式，推进分布式可再生能源发展，推行终端用能领域多能协同和能源综合梯级利用。因地制宜发展生物质能、地热能 and 海洋能。创新地热能开发利用模式，开展地热能城镇集中供暖，建设地热能高效开发利用示范区，有序开展地热能发电。

（编辑部整理）

# 恒有源集团部分项目工程实例

## SHOWCASE OF HYY PROJECTS(PARTIAL)

恒有源集团浅层地热能供暖（冷）项目经过多年发展，在我国的推广已由北京为中心辐射至除海南及港澳台以外的所有地区，应用于雄安市民服务中心、国家大剧院、国家行政学院、全国工商联、北京海淀外国语实验学校、APEC 国际会议中心、北京奥运会网球馆等建筑，实现地能无燃烧为 2000 万平方米（其中由集团值守管理的供暖面积 500 多万平方米）建筑物智慧供暖。此外该技术还出口到美国应用于 Hershey 学校等项目并在当地获奖。

### 集中供暖典型案例

**项目名称：**雄安市民服务中心

**项目面积：**100000 平方米



**项目名称：**国家大剧院（景观水池）

**项目面积：**35000 平方米（池水面积）



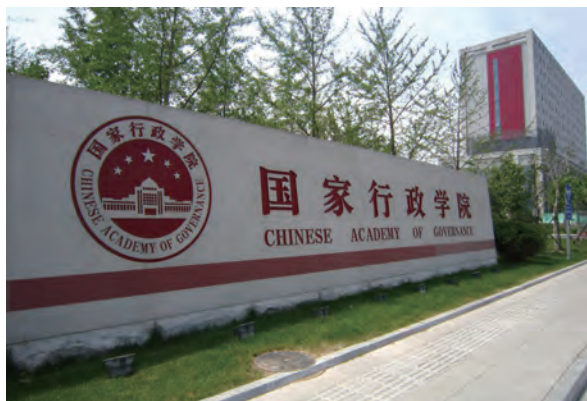


## 实用案例

### PROJECT SHOWCASE

**项目名称：**国家行政学院港澳公务员培训中心

**项目面积：**43365 平方米



**项目名称：**全国工商联办公楼

**项目面积：**50000 平方米



**项目名称：**北京大兴国际机场

**项目面积：**参建的地源热泵 2 号站本期供能面积 46.15 万平方米，远期供能面积约为 115 万平方米



**项目名称：**北京海淀区外国语实验学校

**项目面积：**100000 平方米



**项目名称：**北京中关村三小万柳校区

**项目面积：**45952 平方米



**项目名称：**四季香山多层建筑居民住宅小区

**项目面积：**90000 平方米



# 行政办公项目（集中供暖）

**项目名称：**雁栖湖国际会展中心

**项目面积：**79000 平方米



**项目名称：**益园办公区

**项目面积：**110000 平方米



**项目名称：**海淀区政府第二办公区

**项目面积：**63000 平方米



**项目名称：**和利时系统工程有限公司控制与自动化生产基地

**项目面积：**83017 平方米





## 科研院所及学校项目（集中供暖）

**项目名称：**山西农科院  
**项目面积** 143105 平方米



**项目名称：**北京交通大学附属中学  
**项目面积**：20370 平方米



**项目名称：**师达学校  
**项目面积**：38000 平方米



**项目名称：**北京海淀外语电子职业高中  
**项目面积**：13000 平方米





## 商业项目（集中供暖）

**项目名称：**稻香湖景国际酒店  
**项目面积：**59455 平方米



**项目名称：**嘉乐比温泉度假酒店  
**项目面积：**9600 平方米



**项目名称：**金四季购物中心  
**项目面积：**140000 平方米



**项目名称：**北京市蟹岛生态度假村  
**项目面积：**21531 平方米



## 住宅项目（集中供暖）

**项目名称：**香山清琴别墅

**项目面积：**98000 平方米



**项目名称：**天津老城厢

**项目面积：**170000 平方米



**项目名称：**富园东里 VILLA 别墅小区

**项目面积：**64702 平方米



**项目名称：**工程师宿舍

**项目面积：**8000 平方米

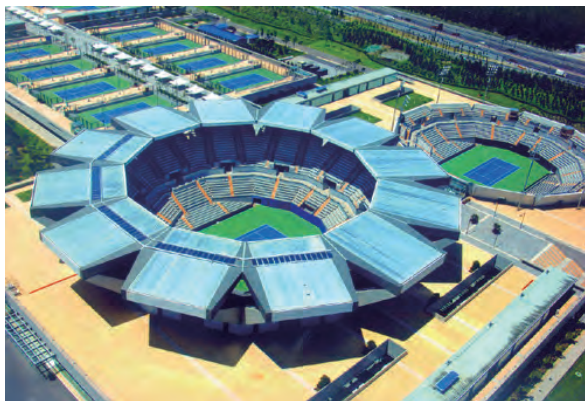




## 体育场项目（集中供暖）

**项目名称：**奥林匹克公园网球中心

**项目面积：**26514 平方米



**项目名称：**中国残疾人体育综合训练基地

**项目面积：**64382 平方米



**项目名称：**芦城体校自行车训练场

**项目面积：**6449 平方米





## 国外项目（集中供暖）

**项目名称：**美国 Hershey School

（Hershey 学校因采用恒有源地能热泵环境系统，获得由美国能源部和美国环境总署共同颁发的能源之星奖）

**项目面积：**6000 平方米



**项目名称：**美国林肯市法院和执法培训中心

**项目面积：**3000 平方米



**项目名称：**美国大卫城养老院

**项目面积：**3600 平方米



# 地能热宝（自采暖）

**项目名称：**河北省张家口市怀来县义和堡村  
**项目面积：**25560 平方米



**项目名称：**北京市门头沟龙泉雾村  
**项目面积：**156949 平方米



**项目名称：**北京市海淀区西闸村  
**项目面积：**47079 平方米



**项目名称：**大连市旺海兴城别墅  
**项目面积：**13400 平方米



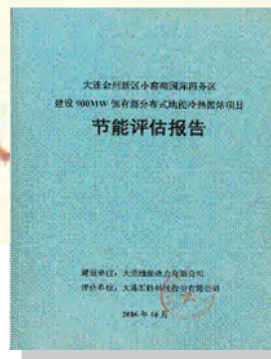


# 分布式地能冷热源站

**项目名称：**大连市金州新区小窑湾国际商务区 900MW 分布式地能冷热源站（正在建设中）

**项目介绍：**大连市金州新区小窑湾国际商务区 900MW 分布式地能冷热源站设计 5227 个“源”、216 个“站”，通过 3 种形式的“地能做联网”（环形、支状和局部）通过“互联网+”智慧“控制”和服务 1500 万平方米的终“端”用户。

**国际上第一个规划和启动的单井循环换热采集浅层地热能在全域 1500 万平方米建筑物供暖项目**



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# Pragmatic, Innovative and Conscientious, Ever Source Strides Forward to Open up a New Chapter ——*Twenty Years of Development of Ever Source in the Ascendant*

**Author:** Chen Si

Ever Source Science & Technology Development Group Co., Ltd. (Briefed as Ever Source Group), a wholly-owned subsidiary of China Geothermal Energy Industry Development Group Limited incorporated in 2000, is a science and technology industrial corporation registered in Zhongguancun High-Tech Park in Beijing. Under the integrated management mode of its entities in Beijing and Hong Kong, Ever Source Group has always focused on scientific research and promotion of the development and utilization of shallow geothermal energy as an alternative energy source for building heating, and implemented the strategy of "shallow geothermal energy for clean heating without combustion and the development of renewable energy based heating and refrigeration integrated new industries"

In the twenty years of scientific research and business experiments, Ever Source Group has always adhered to the development concept of

"pursuing the harmonious coexistence of man and nature, and letting people enjoy high quality life", insisted on the corporate core values of "loyalty and responsibility", adhered to the philosophy of "practice and innovation", stuck to the core of original innovative single-well recirculation heat exchange geothermal energy collection technology, and made every effort to build a whole industry chain operation system integrating scientific research and development, design and consultation, equipment manufacturing, engineering installation and operation and maintenance, formed five business sectors of planning and design for emerging industries, renewable energy supply (Shallow geothermal energy), intelligent manufacturing (Heating pumps), heating system engineering construction, heating system operation and maintenance, made innovations and developed a new path for building cleaning, intelligent heating, and haze management



without combustion or emissions in renewable shallow geothermal energy heating areas.

Ever Source Group has been actively promoting the development of the new industry of combustion-free heating and geothermal energy based heating and refrigeration integration for twenty years. Up to now, Ever Source Group has expanded promoted shallow geothermal energy clean heating / clean self-heating projects from Beijing to all regions except Hainan, Hong Kong, Macao and Taiwan, forming various types of heating systems for administrative offices, schools, hospitals, stadiums, commercial facilities, rural farmers, etc., with more than 800 applications, 20 million square meters of building area, and remarkable economic and environmental benefits. Compared with direct heating electric heating equipment, the 20 million square meters project can save 1.8 billion kw/h of electricity per heating season per year, which directly replaces 560,000 tce of coal for power generation by power plants, reduces emissions of 1.31 million tons of carbon dioxide, 702 tons of sulfur dioxide, 648 tons of nitrogen oxides, 144 tons of soot, which is equivalent to reducing the construction of three 100MW power plants and saving thermal power generation investment of about 1 billion yuan. Meanwhile, the 2 million square meters of shallow geothermal energy clean self-heating projects in rural areas developed and implemented by Ever Source Group can directly replace 75,600 tons of bulk coal, and reduce emissions of 200,000 tons of carbon dioxide, 559 tons of sulfur dioxide, 197 tons of nitrogen oxides and 783 tons of soot per

heating season each year.

The application of shallow geothermal energy intelligent heating project rationalizes and improves the industrial chain of heating energy, further improves the rationality of regional energy industry structure and energy utilization efficiency, reduces the consumption of fossil energy such as coal, controls the emission of pollutants from the source, and is conducive to the early realization of carbon peaking and strives to achieve carbon neutrality by 2060.

The practice of clean self-heating with shallow geothermal energy in several rural farmers and the implementation of a large number of centralized clean heating projects is a microcosm of Ever Source Group's resolute implementation of the national clean heating guidelines and full support for the overall building of a well-off society. Ever Source Group will continue to resolutely fulfill its social responsibility, continuously enrich and improve the product industry chain, combine the industrial development of original technology with financial capital and industrial Internet, establish a new heating energy system, and pursue the harmonious coexistence of man and nature in the most effective way while promoting healthy economic development, allowing people to enjoy a high quality of life and truly practicing the construction of ecological civilization. Intelligent heating promotes the flourishing of the new industry of heat and refrigeration integration, takes a new path to combat haze, and ushers in a new era of heating energy.

# The Twenty Years We Have Gone Through

**Author:** Sun Ji

I was an employee of Ever Source Science and Technology Development Group Co., Ltd (hereinafter referred to as HYY) when it was established in 2000. For 20 years, we have built many iconic projects, such as the National Center for the Performing Arts, the National Academy of Governance and some cooling and heating projects in the Xiongan New Area. However, of all the projects, Beijing Haidian Foreign Language Experiment School left me a deep impression. It was a project completed by us in 2001, and also the first big project to provide heating, cooling and domestic hot water for thousands of people after the establishment of HYY.

In 2001, we just began to be aware of the energy conservation and emission reduction, and were deeply affected by the haze but

unknew how it came. HYY proposed to idea of using shallow geothermal energy as an alternative source of heating to realize the non-combustion heating, which has not been widely accepted. On the street, we could the slogan of "Creating a heating enterprise will bring dozens of millionaires" on the propaganda sign of relevant enterprises, which focused on the economic interests. HYY declared its mission publicly in ISO system file at this time, which read as "improving the quality of people' life, and pursuing the harmonious coexistence between man and nature". We were a little bit lonely because we were ahead of time.

Under such context, Beijing Haidian Foreign Language Experiment School decided to use the heating/cooling technology of HYY's shallow geothermal







energy to provide heating in winter and cooling in summer as well as daily domestic hot water for nearly 5,000 teachers and students. The school leaders came to visit and made research repeatedly. They have many questions; for example, can you heat without combustion? Is there much heat under the ground? It did not work well when one well is used for pumping water and several wells are used for recharging, will it really work with one well used for pumping and recharging at the same time? These questions were inevitable.

I think the school leaders signed the contract with us because of their trust in us. The whole project included 8 buildings, such as office building, science and technology building, canteen, gymnasium, middle school building, primary school building, boy's dormitory and girl's dormitory. The total heating area was more than 50,000 square meters. The total heating power

was 6,400kW. The total cooling power was 5,700kW. The daily supply of domestic hot water was about 40 cubic meters.

The winter in 2001 was the first heating season after the establishment of Beijing Haidian Foreign Language Experiment School. We entered the construction site in the second half of 2001, and put the heating system into operation in the same year as we completed the project in less than three months from commencement to completion. All parties concerned were satisfied with the results as the system did not have emissions, with no storage space required for fuel or no problems with ash transport, so its operating costs were much lower than that of municipal heating. We got a win-win result with Beijing Haidian Foreign Language Experiment School for the first cooperation.

Visitors came in an endless stream. The municipal and district leaders were the first



to come. We saw encouragement from their eyes. The largest groups of visitors were the parents of the students. They wanted to know whether the new heating system was safe or not. They felt the hot air blowing on their face in the classrooms and dormitories, and the heating temperature reached the standard; there was no spark at all in the engine room, with no stacks of fuel. It is the heating without combustion. No fire, explosion hazards or pollutant emissions, it is undoubtedly the most appropriate for the use in schools.

Till now, I am still grateful for the trust that the school leaders have in us, and admire their foresight on environmental issues and deep insight into the innovative technologies. It is no accident that Beijing Haidian Foreign Language Experiment School has developed and grown from its founding to become a well-known school in Beijing today.



We won the first victory and the future development of Beijing Haidian Foreign Language Experiment School is naturally inseparable from HYY's non-combustion heating system. Beijing Haidian Foreign Language Experiment School expanded its school in 2008 for the first time, including 3 buildings, with a total of more than 12,000 square meters. Since 2010, it would make new expansions every year, like inflatable gymnasium and kindergarten, etc. By 2019, its original region could not meet the requirements, so Beijing Haidian Foreign Language Experiment School decided to set up a branch in Yuanxiang in the north of Beijing. The branch school will be constructed in two stages, with the overall floorage of up to 140,000 square meters. The overall floorage in the first stage is about 60,000 square meters and about 80,000 square meters in the second stage, covering 10 buildings such as the kindergarten, common middle and high schools, international middle and high schools, overseas theater, stadium complex, ice and snow sports center, ski hall and logistics office building, etc. The projects in the first stage were completed completely in 2019, and were put into use in succession. Currently, the projects in the second stage were capped, and it is expected to complete completely in 2021. Yuanxiang is located in Zhangjiakou, whose heating season lasts 6 months, and its extreme cold temperature is below minus 20°C, which imposes a high demand for heating system. By the actual



test of the heating season from 2019 to 2020, HYY's shallow geothermal heating system without combustion could guarantee the heating effect completely, and its operating power consumption is only 30kWh per square meter, which greatly saved the operating costs.

Today, Beijing Haidian Foreign Language Experiment School has developed into a large-scale high-standard school, with first-class teaching facilities and perfect sports facilities. What I want to mention is that utilizing the non-combustion heating/cooling system of the geothermal energy can provide a safe and pollution-free learning and living environment that is

warm in winter and cool in summer for the vast number of students.

My residence is not far from Beijing Haidian Foreign Language Experiment School, where you can get by walking. I like to stand in front of its door and look up at the decorations on the front facade, which naturally reminds me of the twenty years that we have gone through together. We have experienced wind and rain together, and accepted the test of practice; we have also been paraded side by side by national leaders Time flies so fast, and 20 years is just a twinkle in the river of history. I wish we could reach for the sky together, toward higher and farther.





## Introduction to Stage 1 Projects of Jingbei Branch School of Beijing Haidian Foreign Language Experiment School

**Uphold three "Alls", make the four seasons comfortable for children**



Stage 1 projects of Jingbei Branch School of Beijing Haidian Foreign Language Experiment School is located in Yuanxiang, Xinbao Town, Huailai County, Zhangjiakou, Hebei Province, with a total of 6 buildings to be built, including No. 1 Primary School, No. 2 Middle School, No. 3 Overseas Theater, No. 4 Sports Complex, No. 5 Ice and Snow Center and Ski Hall, etc., and the total heating floorage reached 59,292.93 m<sup>2</sup>. All of them were put into operation in September 2019.

"All for the children, for all of children and for all children." The three "Alls" proposed by Soong Ching-ling has not only become the motto of those who impart knowledge and educate people generation after generation, but also the obligatory duty of each

responsible person. As a leading enterprise in shallow geothermal energy industry, Ever Source Science and Technology Development Group Co., Ltd ("HYY") upheld the concept of three "Alls" when constructing the Jingbei Branch School, and the Company made concerted efforts to utilize the shallow geothermal heat to make every spring, summer, autumn and winter comfortable for children.

**Keep the indoor temperature constant in four seasons, make children more comfortable**



Based on the functions of buildings in the school area, this project used the geothermal energy heat pump environment system of HYY's single-well circulating heat exchange, which set up 4 centralized engine

rooms with cold and hot sources, 1 centralized heat exchange station and 22 geothermal energy collection wells with single-well circulating heat exchange. It adopted the mode of centralized supply of geothermal energy and independent operation of each engine room, which can meet the needs of buildings for heating in winter, cooling in summer, and providing domestic hot water and heating the swimming pool throughout the year.

The indoor temperature of each building can be adjusted freely from 18°C to 26°C according to the outdoor ambient temperature, so as to meet the requirements for indoor and outdoor comfort in winter and summer respectively. The outlet temperature of the domestic hot water system is set to 40-45°C, and the system can provide domestic hot water continuously and heat the swimming pool in school as well.

**Save 1,884 tons of electricity coal  
for the power plant every year**



On the basis of comfort, the project can also be more environmentally friendly and low-carbon. It is calculated that the annual total electricity consumption for heating in winter of the project would be 2.2678 million kWh. Compared with directly-heated electric boiler, this project would save 5.518 million kilowatt-hours of electricity every year, save 1,884 tons of electricity coal for the power plant every year, and reduce the emission of carbon dioxide by 4,288 tons, sulfur dioxide by 2.3 tons, nitrogen oxide by 2.1 tons, and soot by 473 kilograms.

The total electricity consumed by this project for heating in summer is 508,900kWh per year, saving about 171,100kWh as compared with the conventional central air-conditioning system. No cooling tower is used, so there is no evaporation loss of water, saving 396 tons of water every year.

By operation analysis and calculation, this project will consume 38.2kW·h/m<sup>2</sup> on average for heating and domestic hot water in winter (including the domestic hot water for 1,400 persons), and 8.6 kW·h/m<sup>2</sup> in summer (heating water and auxiliary refrigeration for free in summer by waste heat recovery), so the total

power consumption for heating, cooling and providing domestic hot water throughout the year is  $46.8\text{kW}\cdot\text{h}/\text{m}^2$ . Assuming that the electricity price is RMB  $0.52/\text{kW}\cdot\text{h}$ , the

total operating costs would be  $24.4/\text{m}^2$  in a year (146 days for heating, 200 days for hot water, 365 days for heating the swimming pool and 90 days for cooling).

### Save the operating costs by 40%



This project used the geothermal energy collection technology with single-well circulating heat exchange to collect the low-temperature energy below  $25^{\circ}\text{C}$  contained in the soil, gravel and underground water within a hundred meter of the earth's surface, which can heat and cool the buildings and provide domestic hot water in combination with mature heat pump technology. There is no water consumption during the process when using the technology, with no pollution to the underground water or potential geological disasters, and it is a kind of soil source heat pump.

The heat generated by system refrigeration

can be directly recycled by heat pump unit for preparation of domestic hot water or heating the pool water, so as to realize the recycling of the system energy. Meanwhile, the project marketized the original technology completely, and can be operated at a low cost without any project-related subsidies with reference to the actual operation of similar projects in the past and the characteristics of the project. The annual average operating cost is RMB  $24.4/\text{m}^2$ , saving by 44.7% compared with the heating price of RMB  $44.1/\text{m}^2$  (floor area per square meter) for non-resident (schools) in Zhangjiakou issued and implemented in 2018.



*Going through Weather-beaten Challenges, Making Achievements for Twenty Years and Marching forward Courageously*

Sidelights for Series of Activities to Celebrate the 20th Anniversary of the Founding of Ever Source Science and Technology Development Group Co., Ltd

**Stringer:** Ma Xiaofang

A series of activities to celebrate the 20th anniversary of the founding of Ever Source Science and Technology Development Group Co., Ltd ("HYY") came to a successful conclusion recently. A total of 4 major categories like sports, literature and arts, talent shows and public benefits, with more than 10 activities, not only add more beautiful scenery for the series of activities to celebrate the 20th anniversary of the founding of the Company, but also promote the communications among departments, enhance the employee's sense of honor and

mission, improve the cohesion of the Group itself and promote the construction of the Group Enterprise's culture onto the track of virtuous circle.

From November 14 to December 15, 2020, HYY organized the employees to take part in the competitions like tug-of-war, badminton, mountain climbing, dumpling making, chess and card, photography and calligraphy exhibition in the headquarters of the Group Company, Beijing Haidian Foreign Language Experiment School, Xiangshan Park and other places. The activity



arrangements combining the dynamic and the static attracted about 100 employees from all units and departments of the Group to actively participate in. Wang Yan, Co-chairman of China Geothermal Industry Development Group Limited, Xue Jiangyun, Chairman of Ever Source Science and Technology Development Group Co., Ltd and President Wang Manquan participated in the whole event and gave prizes to the winners.

### **Tug-of-War Exhibited the Spirit of Solidarity, Badminton PK Competed the Strength**

The tug-of-war is one of the sports to test the spirit of teamwork. With the sound of whistle, accompanied by the cheers of the cheering squad, the players worked together to hold the rope tightly and fight hard. After the fierce competition, the winning employees high-fived each other and smiled happily. Employees "fought" bravely in the shouts for the tug of war, and they "fought" for happiness and "struggled" for emotion, which fully demonstrated the



spirit of solidarity and cooperation, daring to fight and marching forward bravely, and enhanced the sense of group honor, cohesion and team spirit.

The badminton game held in the gas-filmed hall of Beijing Haidian Foreign Language Experiment School was also unusually brilliant. The game was divided into team competition and individual competition, with a total of 10 teams participating in the game. On the game field, the players were in high spirits, just skillfully fought back, turned and gave a strong smash, and later volleyed in front of the net, and all of them were agile and skillful. In particular, the doubles requiring a high degree of cooperation made it one climax after another, and the stadium was filled with cheers, with an impassioned atmosphere. The field was more like a battlefield, and all the players were brave to fight and dare to challenge, showing a strong sense of competition, and exhibiting the passion and high spirit of HYY as the leader in developing the emerging industry integrating heating and cooling and in the development and utilization of shallow geothermal energy.

**Challenge new heights bravely, embrace the nature and protect the environment**

In order to enhance the physical quality of the Group's employees, show a better mental outlook, a mountain climbing event was held in Xiangshan Park specially in order to celebrate the 20th anniversary of the founding of the Company. The cold weather in Beijing at the beginning of winter could not stop the enthusiasm of the employees. More than 70 employees who signed up for the event gathered together at the starting point early. After the official start of the mountain climbing, they organized themselves freely with two persons or three persons as a group, and marched toward the target of Mount Xianglu quickly. While climbing the mountain, the Group also advocated that the participating teams pick up rubbish along the way to go downhill in the scenic area to protect the natural environment from

themselves. The participants responded to the call one after another, and picked up the rubbish in the way to go downhill, which built up their body while making contributions to environmental protection.

In addition, the card and chess games, dumpling-making event, photographic and painting exhibition and other events also attracted many employees to take part in.

The year of 2020 was an extraordinary year. Ever Source Science and Technology Development Group Co., Ltd ("HYY") also ushered in its 20th birthday. We have stood together regardless of situations in the past 7,000 days, and striven to make a success with our hard-work in the past twenty years. Ever Source Science and Technology Development Group Co., Ltd, which is entering the age of 20, will work together with the employees, make joint response to challenges and strive to create glory again.





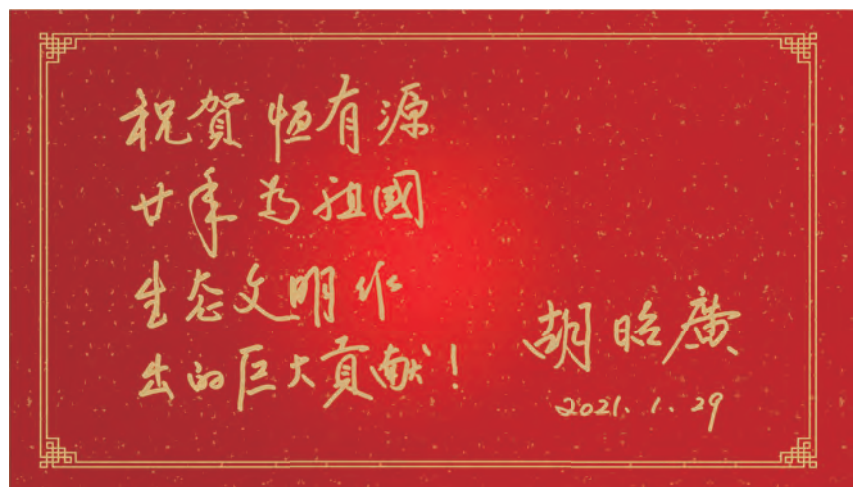
## Experts and Scholars Praise Ever Source: Carry Forward Our Cause and Create Glory Again ——*Academic scholars and experts send words to Ever Source Group for its 20th anniversary*

"Spring songs are heard across the ox back and the magpie spreads good news". The Year of the Ox has arrived as promised, and Ever Source Group has also ushered in the important moment of the 20th anniversary of its establishment. In the past twenty years, Ever Source Group has been working with one heart and one mind, and has made extraordinary achievements in the shallow geothermal energy industry. "Accumulation of steps will lead to a thousand miles". Over the past twenty years, Ever Source Group has not only become the leading pacesetter in the industry, but also made many contributions to the country and the society by cultivating internally and externally and forging ahead. "Supported by the old trunk, new bamboo is higher than old bamboo branches." The achievements and progress made by Ever Source in the past twenty years are the result of the hard work of many Ever Source people and the guidance and care of many academicians and experts. On the occasion of the twentieth anniversary of the establishment of Ever Source Group, these experts who care, concern and witness the development of Ever Source have also sent their own inscriptions, encouraging the Group to "go extra miles", to pack up at the important moment of the twentieth anniversary, carry forward the cause, create brilliance, and contribute more to the early realization of a low-carbon neutral country.



**Hu Zhaoguang**

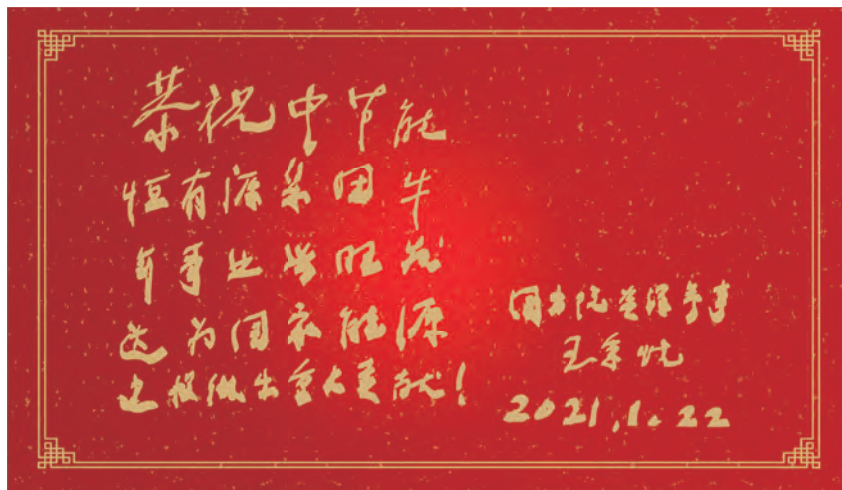
Former Vice Mayor of Beijing





**Wang Bingchen**

Senior Counselor of the  
State Council



**Wu Desheng**

Consultant Chief Engineer  
of Beijing Institute of  
Architectural Design



**Ding Henggao**

Academician of the Chinese  
Academy of Engineering





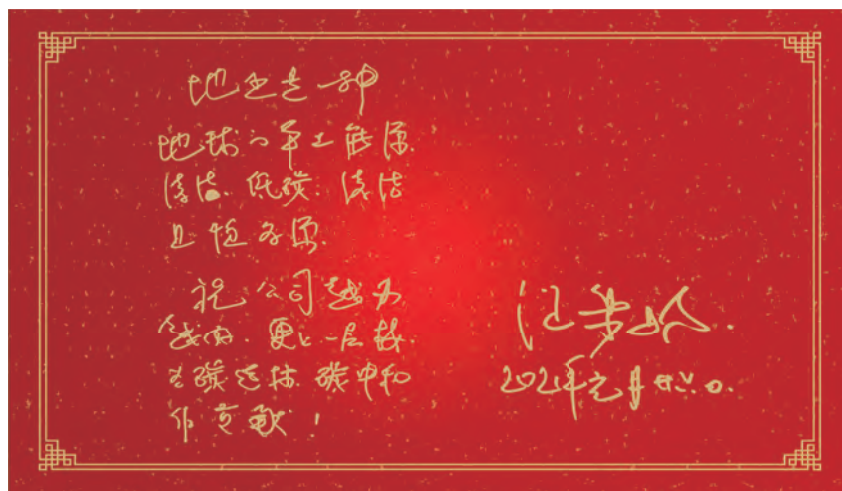
**Shen Mengpei**

Senior Counselor of the  
State Council



**Wang Jiyang**

Academician of the Chinese  
Academy of Sciences



**Wu Qiang**

Academician of the Chinese  
Academy of Engineering







**Ni Jinren**

Academician of the Chinese  
Academy of Sciences



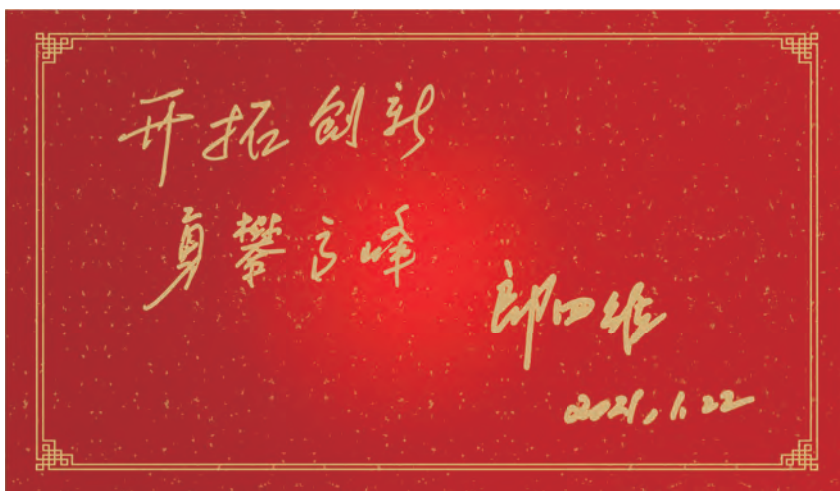
**Chai Xiaozhong**

Former Counselor of Beijing  
Municipal Government



**Lang Siwei**

Consultant Deputy Chief  
Engineer of China Academy of  
Building Research





**Xu Huadong**

Consultant Chief Engineer of  
IPPR Engineering Design &  
Research Institute Co.,Ltd



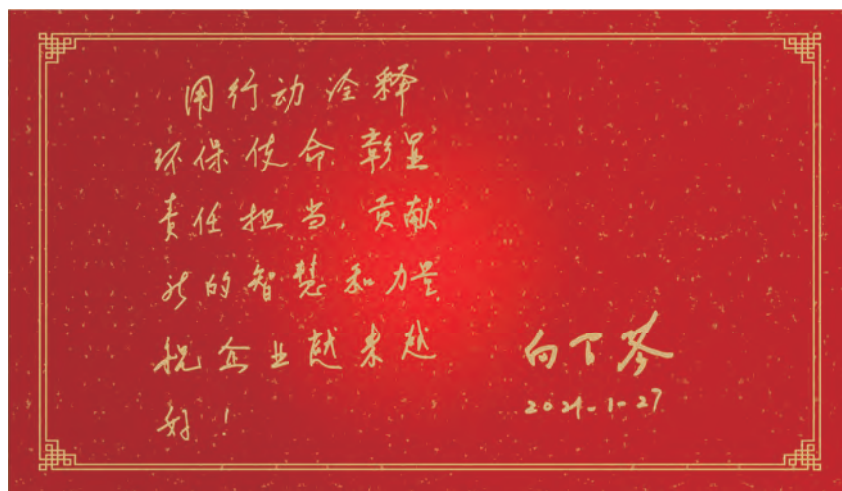
**Xu Wenfa**

Former President of Urban  
Construction Research Institute  
of Ministry of Construction



**Xiang Baiqin**

Former Deputy Chief Engineer of  
Beijing Municipal Environmental  
Protection Bureau



# CURRENT SITUATION OF CHINA'S EXPLOITATION AND UTILIZATION OF GEOTHERMAL ENERGY FROM THE PERSPECTIVE OF CHINA PATENT APPLICATION

**Written by:** Wang Ying

(A three-level examiner of Materials and Engineering Invention Examination Department of the Patent Office, China National Intellectual Property Administration.)

Currently, the development and utilization of geothermal energy can be divided into two aspects: geothermal power generation and direct utilization of geothermal energy, while the latter can then be divided into geothermal heating, hot spring and industrial and agricultural applications, etc. Since the end of last century, the development and utilization of the shallow geothermal energy in building heating rose suddenly and gained a rapid growth.

The reference below to the patent literature is for illustrative purposes only, so that the readers can understand each technology more specifically; for further information, please consult the Patent Office of China National Intellectual Property Administration.

## I. Profile

### 1. Geothermal Power Generation

The geothermal power generation

refers to the process that transforms the geothermal energy into mechanical energy, and then turns the mechanical energy into electric energy. In recent 10 years, the geothermal power generation in the world has gained continuous development, with the global installed capacity increasing from 9,992MW in 2010 to 13,931MW in 2019, and an increase of more than 30%. However, the installed capacity of geothermal energy in China increased from 24MW in 2010 to 27.8MW in 2019, which was basically stable, so it can be known that the geothermal power generation is not the main development and utilization mode of geothermal energy in China.

### 2. Geothermal Heating

The direct use of geothermal energy for heating and domestic hot water is an important way to utilize the geothermal energy. Geothermal heating is to use



wells or submersible pumps to export the geothermal water, which then serves as the heating medium to exchange heat with heating system or domestic hot water heat exchanger, thus transferring the heat of the geothermal water to the circulating water or domestic hot water of the heating system, so as to meet the needs of heating system and domestic hot water.

There are 88 countries in the world that can use the geothermal energy directly, which has grown rapidly in the last decade. According to the statistical data, the installed capacity for the direct use of geothermal energy in 2010 in the world was 48,493MW, with the annual heat utilization of 423,830TJ (equivalent to 3,360×10<sup>4</sup>t oil equivalent), while that in 2029 was 107,727MW, with the annual heat utilization of 1,020,887TJ (equivalent to 8,100×10<sup>4</sup>t oil equivalent). The installed capacity of direct utilization of geothermal energy and annual utilization of heat increased by 122% and 141% respectively.

### 3. Hot Spring

The hot spring is one way to use the geothermal water directly, which is characterized by simpleness and convenience, and the geothermal water is rich in chemical elements, such as ferrum, potassium, sodium, hydrogen, sulfur, etc., and is often used for bathing and medical treatment, with a long history. In Yunnan, Sichuan, Fujian and other southern areas in China, there

are abundant hot spring resources, with a great value of tourism development and utilization. Part of the geothermal water can be used as drinking water, which has a good effect on supplementing trace elements in human body.

### 4. Industrial and Agricultural Utilization of Geothermal Energy

The geothermal energy is widely applied in industry and agriculture, for example, the geothermal water with appropriate temperature can be used to irrigate the fields, which can make the crops mature early and increase its production as well as achieve better quality; it can also be used to feed various kinds of fish and accelerate the growth of edible fish; the geothermal energy can also be used to dewater and dry the fruits and corn as well as cultivate strains, and the geothermal energy greenhouse established can be used to breed, hatch and plant vegetables, fruits and flowers.

### 5. Development and Utilization of Shallow Geothermal Energy

The shallow geothermal energy mainly refers to the low-temperature heat energy contained in the soil, gravel and underground water within hundreds of meters of the shallow surface of the earth, among which its main sources are solar energy and geocentric heat energy. In the 21st century, the exploitation and utilization of shallow geothermal energy in

China has gained a rapid growth, and the number of patent application has increased rapidly. The Technical Code for Single Well of Geothermal Energy Collection with Circulation Heat Exchange issued by Beijing Municipal Administration of Quality and Technology Supervision in 2012 referred to Patent ZL200610002239.8. The patent application plays an important role in promoting the healthy development of shallow geothermal energy popularization and utilization in China.

## II. Relevant Information Concerning Patent Application

The author used the international patent classification and keywords to retrieve the patents related to the utilization of geothermal energy in residential heating

system or regional heating system in CNABS, with the details shown as follows:

### 1. Status of patent application in China

Through retrieval in CNABS, there were 2,326 applications for patents concerning the utilization of geothermal energy in residential heating system or regional heating system by December 2020, among which there were 941 applications for patents for invention and 1,385 for patents for utility models. As the audit process of the application for patents for invention differs to a certain extent from that for patents for utility models. Here in this paper, the two applications for patents were statistically explained respectively to provide references for readers.

#### 1.1 Status about applications for patents for invention

##### 1.1.1 Number of applications for patents

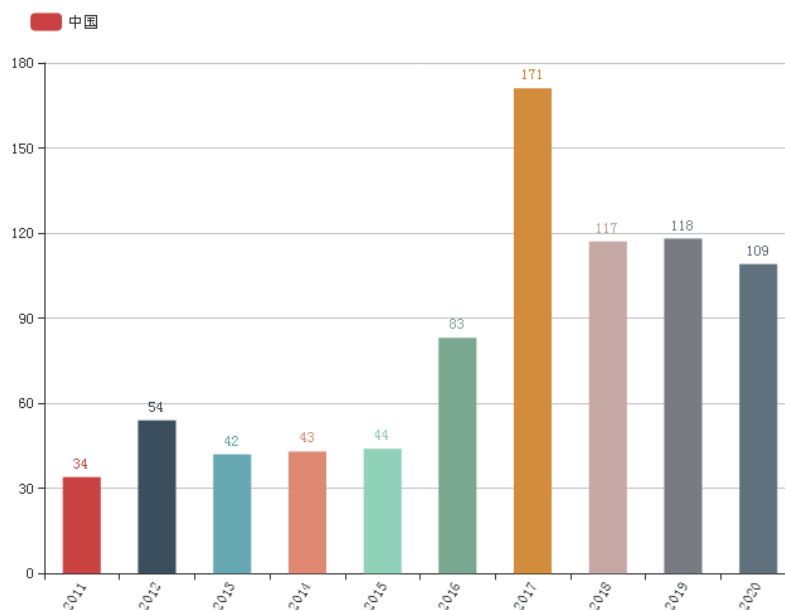


Figure 1 Number of Applications for Patents for Invention in Recent Ten Years

for invention in recent 10 years

As can be seen from Figure 1, the number of the applications for patents for invention concerning the application of geothermal energy in residential heating system or regional heating system ranged from more than 30 to more than 50 before 2016, after which the number increased significantly. The number of applications reached a peak of 171 in 2017, and the number exceeded 100 every year from 2018 to 2020, and basically stabilized at about 120.

1.12 Top 10 provinces in terms of the number of applications for patents for

invention in the past five years

The top 10 provinces in terms of the number of applications for patents for invention in the past five years include respectively: Shaanxi Province, Beijing, Zhejiang Province, Shandong Province, Tianjin Province, Jiangsu Province, Hebei Province, Liaoning Province, Guangdong Province and Henan Province.

**1.2 Status about applications for patents for utility models**

1.2.1 Number of applications for patents for utility models in recent 10 years

As can be seen from Figure 3, the

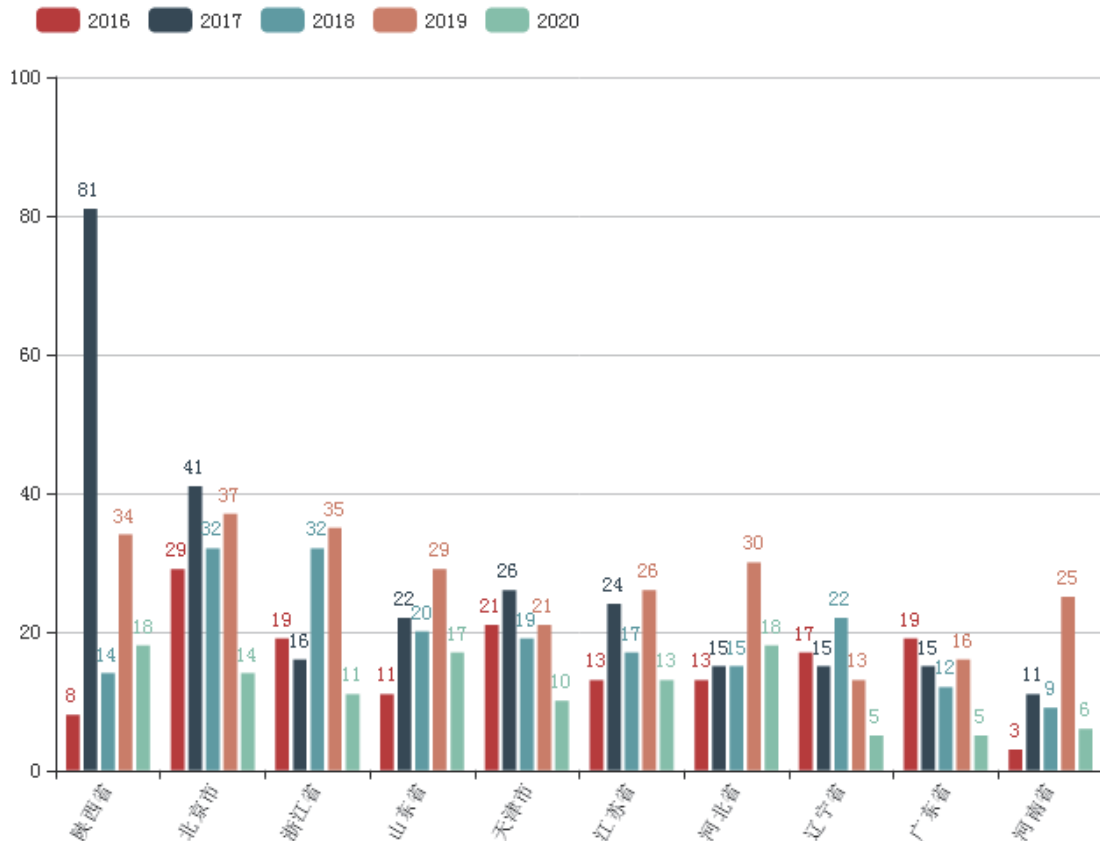


Figure 2 Top 10 Provinces in Terms of the Number of Applications for Patents for Invention in the Past Five Years



number of the applications for patents for utility models concerning the application of geothermal energy in residential heating system or regional heating system ranged from more than 70 to more than 100 before 2016, after which the number increased slightly, and the number of applications was relatively high in 2017 and 2019, with 191 and 235 applications respectively.

**2. Technical Classification**

The International Patent classification Agreement (1971) (IPCA) has come into effect on October 7, 1975, which provided

a common classification for the literature of patents for inventions, including the open patent applications, inventor's certificate, utility model and utility model certificate (hereinafter referred to as "Patent Literature"). According to Article 1 of the Agreement, a Special Union for the International Patent Classification (IPC Union) was established.

The International Patent Classification (IPC) is an internationally unified, standardized classification method for managing and using the patent literature. It is an outcome of the long-term international

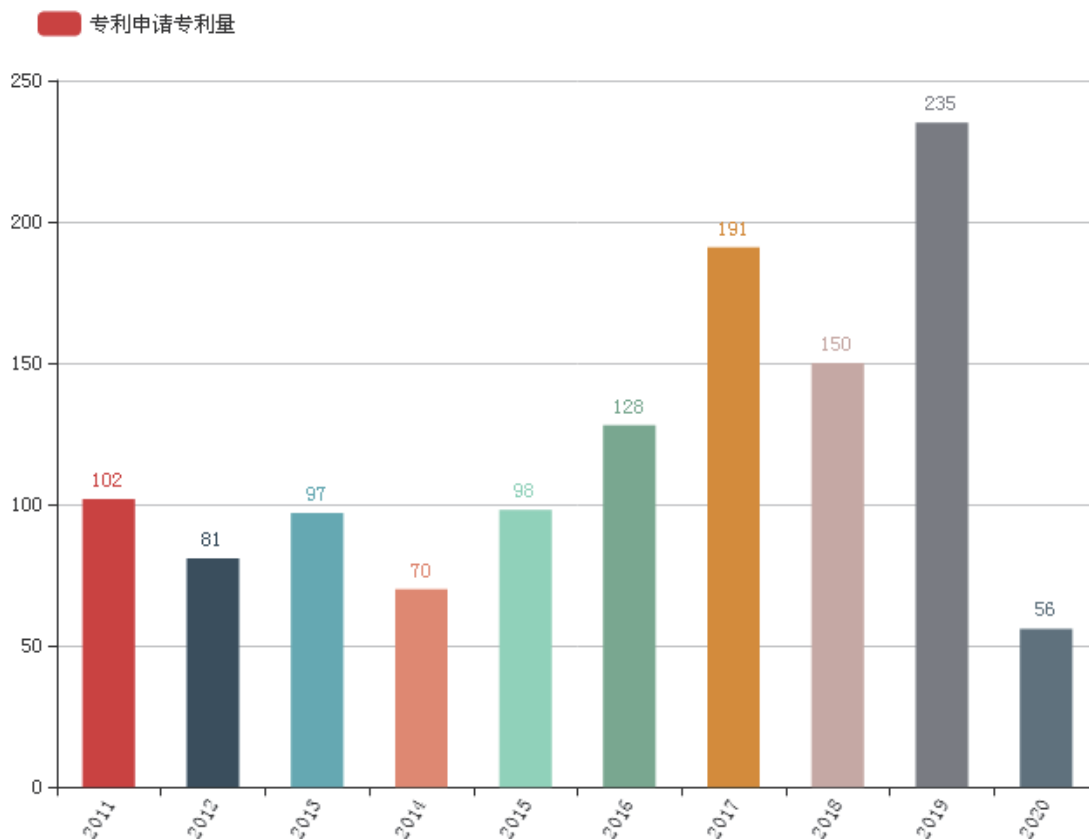


Figure 3 Number of Applications for Patents for Utility Models in Recent Ten Years

cooperation and an inevitable product of the internationalization and unification of the current patent system. IPC is the most important and dominant patent classification in the world today. Due to its integrity, scientificity and practicality, most countries in the world have adopted the IPC. Since the implementation of the Patent Law on April 1, 1985 in China, we used IPC to manage and use various kinds of patent literature in China.

The international classification number F24D indicates the residential heating system or regional heating system, including centralized heating system; residential hot water supply system; parts or components used. The "centralized heating system"

refers to the systems which generates or stores the heat at a central heat source, and distributes the heat to the location or areas to be heated via a fluid transfer device.

#### 2.1 Technical classification for the applications for patents for inventions

It can be seen from Figure 4 that the applications for patents for invention mainly focused on the centralized heating system of hot water, a total of 233. Followed by other residential or regional heating system, electric heating system and the centralized heating system, parts and components using the heat accumulated in the heat storage materials, etc.

#### 2.2 Technical classification for the applications for patents for utility models

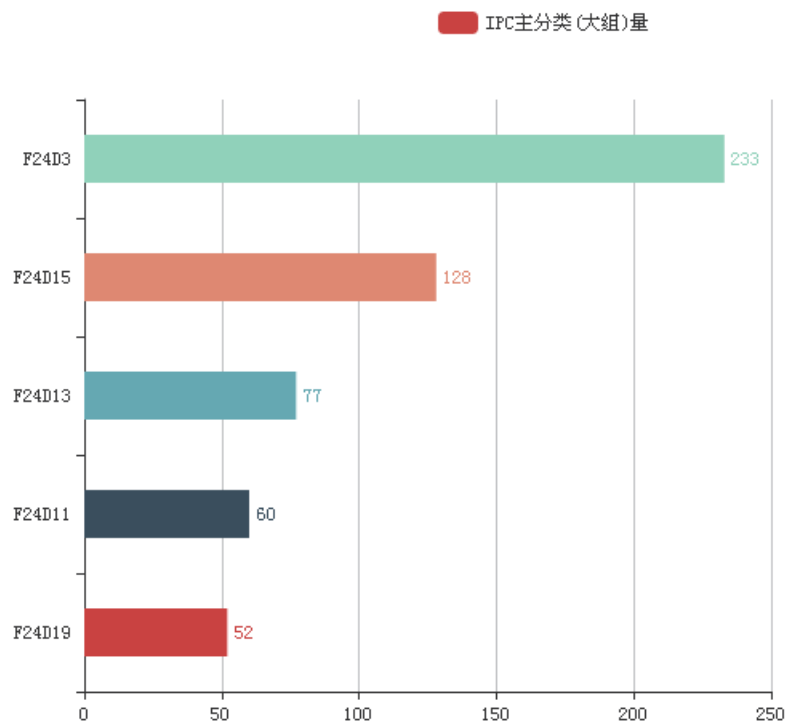


Figure 4 Technical Classification for the Applications for Patents for Inventions

It can be seen from Figure 5 that the applications for patents for utility models also mainly focused on the centralized heating system of hot water, a total of 400. Followed by other residential or regional heating system, parts and components, electric heating system and the centralized heating system using the heat accumulated in the heat storage materials, etc.

### III. Recommendations

Geothermal energy, as a renewable energy, has a huge potential for development; however, it is not sufficient for the application of the geothermal energy in the residential heating system or regional

heating system from the perspective of the number of patent applications and composition of applicants, which indicates that there are few large-scale enterprises engaging in the field of geothermal energy on the one hand; on the other hand, it also indicates the lack of advanced technological reserves and research on designing the utilization of geothermal energy. It is suggested that relevant research enterprises and public institutions actively conduct research on the direct utilization of geothermal energy and other technologies, overcome the technical problems that restrict the development of the geothermal energy constantly and improve the level of direct utilization of geothermal energy.

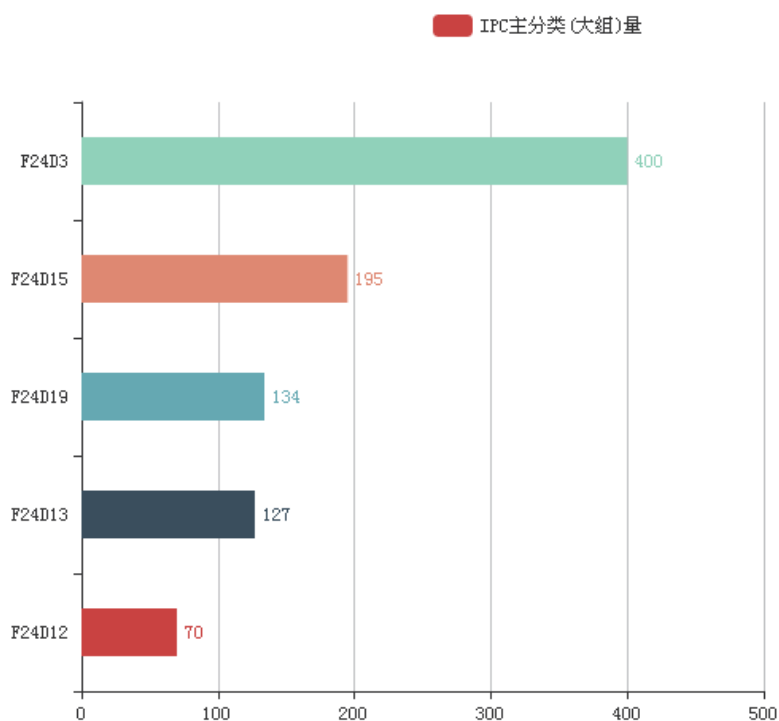


Figure 5 Technical Classification for the Applications for Patents for Utility Models





# Exclusive Interview of China Geothermal Energy with Mr Chen Yanhua, *Deputy Chief Engineer of CITIC General Institute of Architectural Design and Research Co., Ltd*

## Editor's Note



The heating season in 2020 was started successfully. How has the heating changed during the epidemic? What about the importance of clean heating in South China? What is the status of GSHP (Ground Source Heat Pump) in clean heating in South China? Within these questions in mind, the magazine China Geothermal Energy made an exclusive interview with Mr Chen Yanhua, Deputy Chief Engineer of CITIC General Institute of Architectural Design and Research Co., Ltd. The following is the transcript of the interview edited by the Editorial Office:

### **1. China Geothermal Energy: What is the influence of the epidemic on the heating, refrigeration and air-conditioning industry?**

Chen Yanhua: At the beginning of the New Year of 2020, the sudden epidemic of COVID-19 swept across our nation and spread to the whole world, which has brought unprecedented and significant impact on all aspects of the global social economy, and it also inevitably affected the heating and cooling air conditioner industry as well.

Relevant statistical data revealed that the sales volume of China's central air-conditioning market declined by 10.34% from January to September 2020. It could be seen by quarter that, the market remained bleak in Q1, gained a more obvious growth in Q2 and tended to moderately increase in Q3. From the industrial trend in the past three years, the development of central air-conditioning industry showed a downward trend; however, the decrease continued to

decline as compared with the first half of the year, which means that the market of central air-conditioning improved gradually after the domestic epidemic has been controlled effectively. Especially in Q3, we have achieved remarkable results in overall coordination of epidemic prevention and control as well as economic and social development, and have made significant progress in the construction of domestic infrastructure, and the resident's power of consumption has been further improved, all of which have a significant incentive role in the central air-conditioning industry.

Although the epidemic has brought a significant impact on the heating and cooling air conditioning industry and many uncertain factors for its future development, it also provides new great opportunities and challenges for the development orientation of the construction field and the heating, refrigeration and air-conditioning industry; under the situation and requirements of normalized epidemic prevention and control, people focus more on the green and healthy lifestyle and the development concept of living in harmony with nature and sustainable development, and pay more attention to indoor air quality and biological safety of buildings; we shall highlight more green, ecological measures and more energy saving and environmental protection in architectural design, reduce large areas of confined space as far as possible, stress the design of ventilation and air-

conditioning systems and their operation control in densely populated confined places and spaces (such as subway station, shopping mall and outpatient emergency treatment, etc.);

The proposal of new infrastructure, carbon emission peak, carbon neutrality and target pointed out the development orientation for the heating, refrigeration and air-conditioning industry. We shall respond to and keep pace with the strategic development orientation of the state, and deepen the research in the field of green, low-carbon and renewable energy utilization on the one hand, and expand the new technology fields and new research directions of efficient energy utilization; on the other hand, we shall focus on the subdivision and deepening of the engineering type of operation, expand more engineering fields with professional, systematic and intelligent solutions, such as hospitals combining normal time with emergency, medical purification, data center, home health and other fields; like the assembled or integrated energy stations, highly efficient refrigeration rooms, etc. concerned commonly by the industry. The new technological research direction, expansion of the new technological fields, new equipment and the expansion of the system development and application fields has always been the only way for the high-quality development of heating, refrigeration and air-conditioning industry in the future.



## 2. China Geothermal Energy: Could you please introduce the status quo of the heating in southern China, and how do you think about the importance of cleaning heating in southern China?

Chen Yanhua: Currently, there are two heating modes in South China: local centralized heating and decentralized heating, including: heating by soil furnace, electric heating appliance (electric heater, electric fan, electrical oil heater, etc.), household air conditioner, gas-fired wall-hanging stove, etc. The communities with conditions adopt the mode of local centralized heating (GSHP, air-cooled heat pump, gas-fired boiler, etc.), while the buildings with industrial waste heat and around the thermal power plant will adopt the mode of small-scale centralized heating. The heating effect, economical efficiency, energy consumption, impact on environment and heating safety of different heating modes differ greatly with each other.

Direct heating with electricity is the low-grade utilization of high-grade energy, with very low primary energy utilization efficiency and large energy consumption, which has safety risks; the household air conditioner utilizes the principles of heat pump to absorb the low-grade heat energy, which is an effective way of renewable energy utilization. It is the main force for decentralized heating in South China, but it is affected largely by the climate, so it has much room for energy efficiency and heating

effect; the wall-hanging stove, which takes the natural gas as fuel, has higher heating costs and large initial investment, so its centralized use will cause a certain impact on environment; the air-cooled heat pump is used mostly by administration buildings, office buildings and other public buildings; the gas(oil)-fired boiler and direct-fired lithium bromide unit are applied most by hotels, hospitals and commercial buildings; the coal-fired boiler is mainly used to satisfy the production needs of industrial users and to assist the heating, but it is featured with low efficiency and serious pollution. In addition, the southern cities are short of coal, oil and natural gas, almost all of which need purchasing from other places. The coal is transported from the north by railway, resulting in the price of coal higher than that of the north, and the large consumption of coal will increase the pressure on the national railway transportation for sure. The price of fuel gas is affected by that of international crude oil, with great fluctuation and high price, so it is not economical to use fuel oil for heating. The natural gas resources are mainly supplied by such large natural gas sources like West-East Natural Gas Transmission, the Sichuan to East Gas Transmission, etc.; however, when it comes to the heating peak in winter, the shortage of upstream natural gas source often leads to insufficient gas supply downstream, so it is unable to guarantee the normal operation for gas heating.

With the rapid development of economy and people's longing for better life, there is a growing demand for building heating and cooling and domestic hot water supply, but it is far from enough for the research and preparations made by the administrative departments of the government and HVAC industry as to what kinds of technical path and mode of energy supply to adopt to meet such rapid growth of demand, let alone the overall plan and top-level design from the height and vision of sustainable urban development and efficient comprehensive utilization of urban energy. Therefore, it leads to such problems as unclear development orientation and ambiguous technical path for the building heating and cooling fields in the south, blind development of various forms of heating and cooling technology and equipment on the markets. It is also difficult to implement and execute the national strategies and technical path of integrated utilization of clean and low-carbon energy applied in the buildings with energy conservation and emission reduction as well as renewable energy in the engineering design of buildings and the process of construction. On the basis of in-depth research on energy characteristics of buildings and climate characteristics in South China, it is of particular urgency and importance to sort out and put forward the technical path to scientific and rational utilization of building energy which is suitable for the local resource and energy

endowment and supply status.

### **3. China Geothermal Energy: The development orientation and thoughts for heating in the south.**

Chen Yanhua: The building energy, no matter in terms of the demands for refrigeration or heating, requires a low energy grade. As buildings have to follow the energy conservation standards in general, the heating load to maintain a comfortable indoor temperature and hot water temperature will not be that high during the heating. For example, the temperature of the supply and return water as required by specification is 75/50°C when the radiator is used for heating, 60/45°C for air-conditioning terminal and 45/35°C for radiant heating. Therefore, all kinds of heat pumps can well meet the heating demands of buildings in southern areas, and can also refrigerate the buildings in summer.

The technical path for scientific and rational utilization of heating or building energy in the south can be clearly sorted out from the perspective of energy characteristics of buildings and climate conditions in southern areas, resource endowment, energy supply and utilization status. First, we should, based on the overall urban planning and urban and rural construction development, make full use of resource endowment, and adhere to the diversified urban building energy development path combining centralization

and decentralization; second, we shall adopt advanced and reliable technologies, with energy conservation and improvement of comprehensive energy utilization efficiency as premise, to integrate and coordinate with renewable energy utilization and green building planning, so as to realize the clean, low-carbon and sustainable development of urban building energy utilization.

1) Based on the climate conditions and characteristics of building energy demand in southern China, the building heating shall be considered together with building refrigeration to improve the energy utilization efficiency and economical efficiency of use of buildings under the premise of meeting demands.

2) As the industrial production needs to make proper layout for the new CHP plants, we shall make overall consideration, unified planning and phased implementation with the existing thermal power plant and utilization of industrial waste heat, and use the CHP plants and the industrial waste heat to realize the centralized heating and cooling of the buildings at the surrounding areas.

3) For the areas with high density of building cooling and heating load and with stable demands for building heating and cooling load such as the business districts, urban complex, industrial parks, university towns, etc. covered by heat supply network, priority shall be given to the steam (high-temperature hot water) or the cold and hot source points of the renewable energy

to construct multi-energy complementary regional energy stations, so as to heat and cool the surrounding buildings, improve the comprehensive urban service functions and improve the comprehensive utilization efficiency of the centralized heating and cooling systems.

4) For the areas with high density of building cooling and heating load and with stable demands for building heating and cooling load such as the business districts, urban complex, industrial parks, university towns, etc. that are not covered by heat supply network, we shall develop the distributed regional energy systems actively, such as combined utilization of renewable energy and conventional energy or the natural gas CCHP, etc., so as to realize the rational and cascade utilization of energy, and improve the comprehensive utilization efficiency of energy.

5) In other areas, we shall, based on the resource conditions, use and utilize all kinds of heat pumps (water/ground source heat pump, intermediate and deep geothermal energy, heat-source tower heat pump, air source heat pump, gas heat pump, solar energy, etc.) of the renewable energies, such as shallow and intermediate and deep geothermal energy, air energy and solar energy, etc. for heating and cooling. Heating by boiler shall not be used unless the resource conditions are restricted or heating by boiler is readily needed to meet the requirements of use.




6) In addition to the demands for building heating and cooling, the demands for domestic hot water is also increasingly large, the proportion to use the hot water system of renewable energy shall reach 100% for the residential buildings and hotels, hospitals and other public buildings that have stable hot water demands. The residential buildings should use solar hot water or air source heat pump hot water system to supply domestic hot water, rather than the electric water heater for the supply of domestic hot water.

#### **4. China Geothermal Energy: What's position and role of GSHP in clean heating in South China?**

Chen Yanhua: In addition to the regional comprehensive energy utilization projects and centralized heating facilities that can be constructed by using the thermal power plant and industrial waste heat, we shall, based on the resource conditions, use and utilize all kinds of heat pumps (water/ground source heat pump, intermediate and deep geothermal energy, heat-source tower heat pump, air source heat pump, gas heat pump, solar energy, etc.) of the renewable energies, such as shallow and intermediate and deep geothermal energy, air energy and solar energy, etc. for heating and cooling in southern China, so as to realize the clean, low-carbon and sustainable development of the building energy utilization.

Geothermal energy is a green, low-carbon, recyclable and renewable energy, which is characterized by large reserves, wide distribution, cleanliness and environmental protection, stability and reliability, etc., and its primary energy utilization rate is much higher than that of air source heat pump, so it is a safe, reliable and competitive clean energy for building cooling and heating. With the advancement of the application of renewable energy buildings and development of green buildings, the utilization of geothermal energy represented by GSHP has been expanded from a single building project to large-scale application of buildings and centralized and grouped application, which has played an outstanding demonstration and exemplary role for the application of clean and low-carbon energy in southern China. Accelerating the development and utilization of geothermal energy is also an inevitable choice to carry out the spirit of the 19th National Congress of the Communist Party of China and promote the revolution strategy of energy production and consumption comprehensively. Promoting the efficient utilization of geothermal energy is not only of great importance to adjusting the energy structure, saving energy and reducing emission, improving environment and coping with the global climate changes, but also an important measure for the ecological and civilized construction as well as green and low-carbon development in China.



The white paper, titled "Energy in China's New Era," was released: by the end of 2019, the area of clean heating had reached 11.6 billion square meters in northern China, with an increase of 5.1 billion square meters over 2016.

In recent days, the white paper, titled "Energy in China's New Era," was released in Beijing. As indicated in the white paper, the historic achievements have been made in energy development: the capacity to guarantee the energy supply has been strengthened, and by the end of 2019, the floor area heated by shallow and medium-deep geothermal energy had exceeded 1.1 billion square meters; energy has yielded fruitful achievements in benefiting the people, and by the end of 2019, the area of clean heating had reached 11.6 billion square meters in northern China, with an increase of 5.1 billion square meters over 2016. The rate

of clean heating was about 31% in northern rural areas, with an increase of 21.6% over 2016; about 23 million households in northern rural areas have replaced the scattered coal with clean coal, including 18 million households in the Beijing-Tianjin-Hebei region and its surrounding areas, as well as in the Fenwei Plain.

The white paper pointed out that, the clean heating in winter in northern China is a major livelihood and heart-winning project that is closely related to the life of broad masses of the people. By guaranteeing to enable the broad masses of the people in northern China to pass the winter warmly

and reduce the atmospheric pollution as the standpoint, it is advisable to use clean heating in the northern rural areas according to local conditions. We will steadily advance the reform of "Coal to Gas" and "Coal to Electricity", and support the use of clean biomass fuels, geothermal energy, solar heating and the application of heat pump technologies in accordance with the principle of giving priority to enterprises, being promoted by the government and being affordable to the people.

The white paper suggested we formulate financial, price and other supporting policies and advance the clean heating in northern rural areas in winter to promote the improvement of atmospheric environmental quality. We shall vigorously promote the

energy supply mode combining cooling, heat and power system for buildings using natural gas, promote the development of distributed renewable energy, and promote multi-energy coordination and comprehensive cascade utilization of energy in the field of terminal energy use. We shall also develop biomass energy, geothermal energy and marine energy in line with local conditions. We shall innovate the new modes for the development and utilization of geothermal energy, carry out centralized heating for urban areas using geothermal energy, build demonstration zones for the efficient development and utilization of geothermal energy, and carry out geothermal power generation in an orderly manner.

(Written by: Collated by Editorial Department)





## Showcase of HYY Projects (Partial)

Through many years of development and promotion, the shallow geothermal heating (cooling) projects undertaken by Ever Source Science and Technology Development Group Co., Ltd ("HYY") have been radiated from the center Beijing to all regions except Hainan as well as Hong Kong, Macao and Taiwan, and have been applied in Xiong'an Citizen Service Center, National Center for the Performing Arts, the National Academy of Governance, All-China Federation of Industry and Commerce, Beijing Haidian Foreign Language Experiment School, APEC International Conference Center and Indoor Tennis Stadium for Beijing Olympics and other buildings, realizing the smart building heating without combustion for 20 million square meters (among which more than 5 million square meters of heating areas are managed by the Group). In addition, the technology has also been exported to USA, and was applied in Hershey School and other projects, which also won local prizes.

### Typical cases of central heating

**Project name:** Xiongan Citizen Service Center

**Project area:** 100,000 m<sup>2</sup>



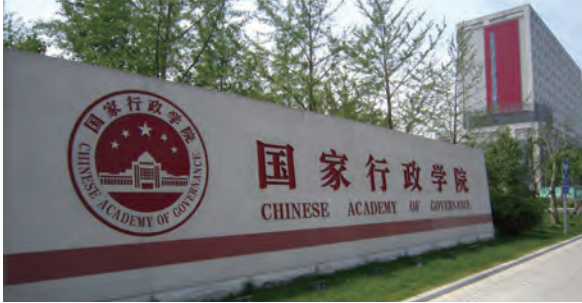
**Project name:** National Theatre(Landscape pool)

**Project area:** 35,000 m<sup>2</sup>(Pool Size)



**Project name:** Public Servant Training Center for Hongkong and Macau of National Academy of Governance

**Project area:** 43,365 m<sup>2</sup>



**Project name:** Beijing Daxing International Airport

**Project area:** Participated in the construction of the ground source heat pump No. 2 station, the energy supply area is 461,50 m<sup>2</sup>, the long-term energy supply area is 1.15 million m<sup>2</sup>



**Project name:** Wanliu Campus of Zhongguancun No. 3 Elementary School

**Project area:** 45,952 m<sup>2</sup>



**Project name:** Office Building of ACFCI

**Project area:** 50,000 m<sup>2</sup>



**Project name:** Beijing Haidian Foreign Language Experiment School

**Project area:** 100,000 m<sup>2</sup>



**Project name:** Siji Xiangshan Community

**Project area:** 90,000 m<sup>2</sup>





## Administration projects (Central heating)

**Project name:** Yanqi Lake International Exhibition Center

**Project area:** 79,000 m<sup>2</sup>



**Project name:** Beijing Yiyuan  
Office area

**Project area:** 107,937 m<sup>2</sup>



**Project name:** The second office area of  
Haidian District Government

**Project area:** 63,000 m<sup>2</sup>



**Project name:** Control and Automation  
Production Base of Hollysys Systems  
Engineering Co. Ltd

**Project area:** 83,017 m<sup>2</sup>





## Research Institute & School projects(Central heating)

**Project name:** Shanxi Academy of Agricultural Sciences

**Project area:** 143,105 m<sup>2</sup>



**Project name:** The High School Attached to Beijing Jiaotong University

**Project area:** 20,370 m<sup>2</sup>



**Project name:** Beijing Shi Da High School

**Project area:** 37,380 m<sup>2</sup>



**Project name:** Beijing haidian foreign language electronic vocational high school

**Project area:** 13,000 m<sup>2</sup>



## Commercial projects (Central heating)

**Project name:** Beijing Nirvana Resort Hotel

**Project area:** 59,455 m<sup>2</sup>



**Project name:** Jialebi Hot Spring Resort Hotel

**Project area:** 9,600 m<sup>2</sup>



**Project name:** Jinsiji Shopping Mall

**Project area:** 140,000 m<sup>2</sup>



**Project name:** Xiedao Ecological Resort Village

**Project area:** 21,531 m<sup>2</sup>





## Residential projects(Central Heating)

**Project name:** Xiangshan Qingqin Villa

**Project area:** 98,380 m<sup>2</sup>



**Project name:** Fuyuan Dongli Villa Community

**Project area:** 64,702 m<sup>2</sup>



**Project name:** Tianjin Longting Home Community

**Project area:** 170,000 m<sup>2</sup>



**Project name:** Engineer's houses

**Project area:** 8,000 m<sup>2</sup>

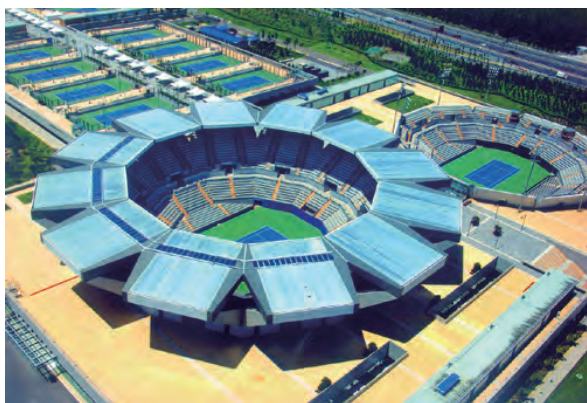




## Sports Venue projects(Central heating)

**Project name:** Tennis Center of the Olympic park

**Project area:** 26,514 m<sup>2</sup>



**Project name:** China Comprehensive Athletic Training Base for the Disabled

**Project area:** 64,382 m<sup>2</sup>



**Project name:** velodrome Training Center of Lucheng Sport School

**Project area:** 6,499m<sup>2</sup>



## Residential projects(Central Heating)

**Project name:** Hershey School(Hershey School won a prize of Energy Star appraised by US Department of Energy and Environment Program because of its adoption of HYY ground source heat pump environment system)

**Project area:** 6,000 m<sup>2</sup>



**Project name:** City Court and Law Enforcement Training Center

**Project area:** 3,000 m<sup>2</sup>



**Project name:** Geracomium of David City

**Project area:** 3,600 m<sup>2</sup>





## Ground Source Heating Devices(Self-heating)

**Project name:** Yihepu Village, Huailai County, Zhangjiakou City, Hebei Province

**Project area:** 25,560 m<sup>2</sup>



**Project name:** Xizha Village, Haidian District, Beijing

**Project area:** 47,079 m<sup>2</sup>



**Project name:** Longquanwu Village, Mentougou District, Beijing

**Project area:** 156,949 m<sup>2</sup>



**Project name:** Dalian Wanghai Xingcheng villa

**Project area:** 13,400 m<sup>2</sup>



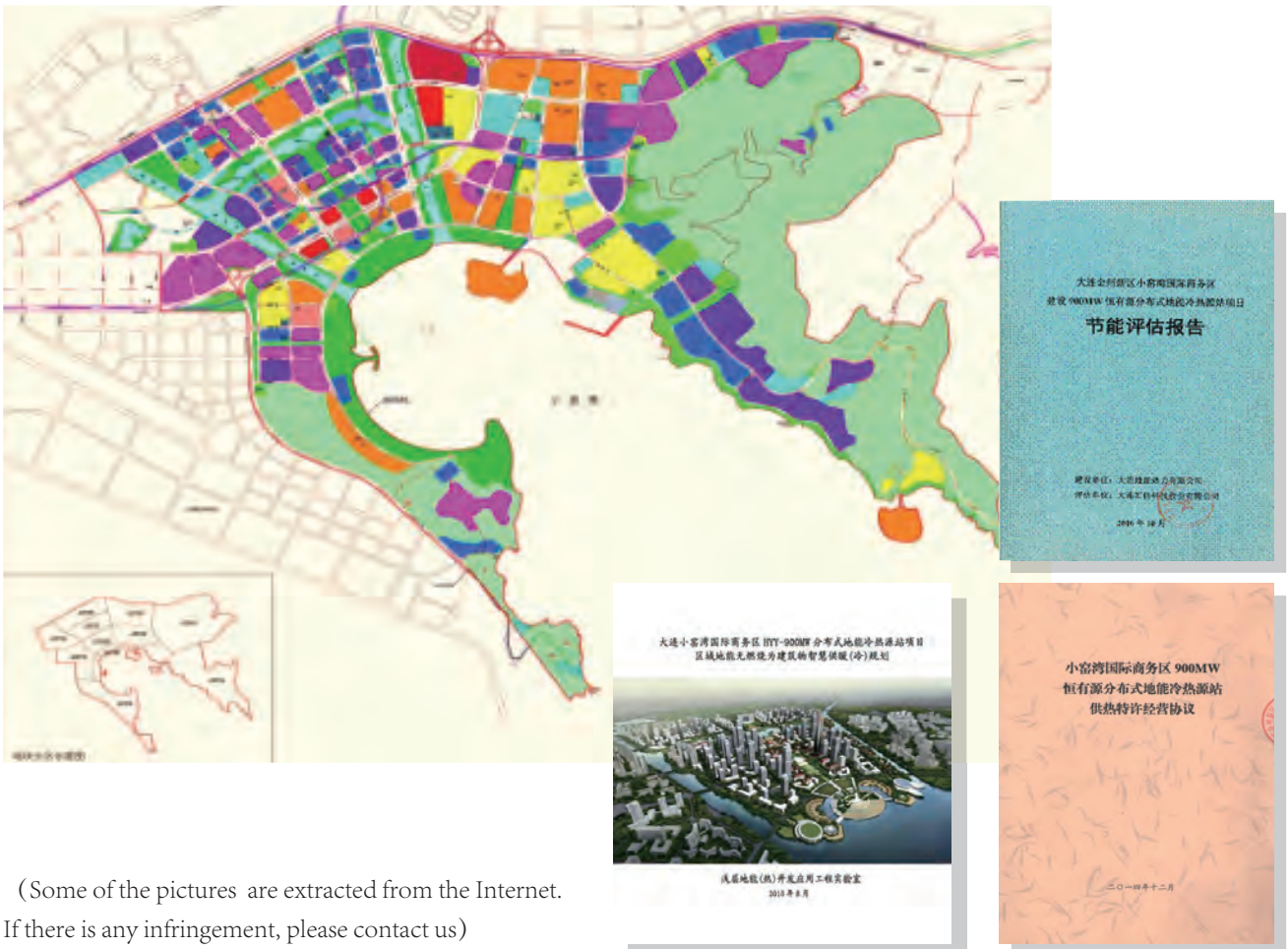


## Distributed Geothermal Cooling and Heating Source Station

**Project name:** 900MW Distributed Geothermal Heating and Cooling Source Station for Xiaoyaowan International Business District in Jinzhou New District, Dalian (under construction)

**Project Profile:** The 900MW Distributed Geothermal Heating and Cooling Source Station for Xiaoyaowan International Business District in Jinzhou New District, Dalian designed 5,227 "sources", 216 "stations", and will provide services for the "end" users of 15 million square meters through 3 forms of "Internet of Geothermal Energies" (annular, branch and local form) and by means of "Internet + "Wisdom" control".

This is the world's first planned and launched heating project using shallow geothermal energy with single-well circulating heat exchange to heat the buildings of 15 million square meters.



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产业技术创新战略联盟、中国热冷一体化能源研究院协办的科技期刊，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。

《中国地热能》编辑部

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中國地熱能  
CHINA GEOTHERMAL ENERGY



# 中國地熱能

## CHINA GEOTHERMAL

六年风雨兼程 六载始终如一  
勇于开拓奋进 促地热能腾飞





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。



**可靠性技术：航空领域先进的数字控制系统，拥有能与战机媲美的可靠性**



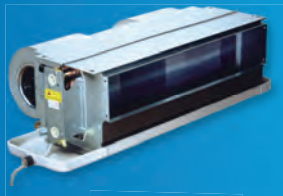
**防腐技术：新工艺军工防腐技术抗氧化腐蚀，经久耐用**



**军用雷达防电磁干扰技术**



1



2



4



3



6



5

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
- 7. 地能热泵热水器（生活热水）
- 8. 地能热泵锅炉
- 9. 地能热泵多联机

**航天飞机燃料箱真空氦检技术**

**航天飞机防腐防锈处理技术**



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