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CHINA GEOTHERMAL ENERGY

“清洁供暖”时代赋予的使命与机遇 P08

实现双碳目标中国地热可以大展宏图 ——郑克棪 P16

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中节能咨询有限公司
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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：**
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  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

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- **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.

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CHINA GEOTHERMAL ENERGY

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the Mission and Opportunity
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The State strives to set the goal of reaching the peak of carbon emissions and achieving carbon neutrality, bringing the enterprise unprecedented forms of development and a once-in-a-lifetime opportunity for high-speed development.
The key to rational use of resources, ensuring heating and reducing waste is that the temperature is equivalent to the energy grade; adjustment of measures to local conditions and proper methods are the core. In addition, it is equally important to increase the proportion of "clean heating", reduce the scattered combustion of traditional energy and enhance the affordability of residents.

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“清洁供暖”时代赋予的使命与机遇

"CLEAN HEATING" THE MISSION AND OPPORTUNITY ENTRUSTED BY THE TIMES

作者：吴德绳 徐生恒

中央经济工作会议确定，2021 年要抓好八项重点任务，其中包括做好减碳达峰工作。这是我们恒有源科技发展集团有限公司（以下简称恒有源集团）自成立以来，20 年所期盼的局面终于出现了。

供暖行业发展气势高昂
节能减排、经济惠民两手并重

国家在做好减碳达峰、碳中和工作方面，从根本和源头上作出部署，明确加快调整优化产业结构、能源结构，以及大力发展新能源，继续打好污染防治这场攻坚战。并且明确了我国二氧化碳减排力争 2030 年前达到峰值，力争 2060 年前实现碳中和的目标。

国家力争确定的碳排放达峰和实现碳中和达到目标，让供暖行业面临前所未有的高昂的发展形势和千载难逢的高速发展机遇。

合理使用资源、保证供暖、减少浪费的关键，是温度对口与能源品位相当。因地制宜方式得当是核心。此外，将增加“清洁供暖”的比例，使得“减少分散燃烧传统能源”和“居民可承担”两手并重。

规划产业抓时机
浅层地热“八有利”

从可再生能源供暖来讲，恒有源集团从事的是浅层地热能的清洁供暖。

从清洁供暖来讲，恒有源集团推广的是浅层地热能清洁供暖系统，是电能搬运浅层地热能（低温、低品位）替代北方供暖地区以传统资源燃烧供暖为主的清洁供暖系统。

简单说，浅层地热能清洁供暖系统的工作原理，就是利用一份花钱的电能驱动热泵，因地制宜地搬运不花钱的低品位浅层地热能（低温热能）。通过系统无燃烧的物理变化，得到相当于三份以上的可以取暖的热能，为建筑物提供高效的清洁供暖。同样是这个系统，反之则将低温热能排出，就可以实现为建筑物制冷。

浅层地热能清洁供暖拥有“八个有利于”的优势。一、有利于统筹规划与管理。二、有利于体制、机制与政策的衔接，因地制宜杜绝浪费。三、有利于避免能源供应存在的短板和成本普遍较高的问题，能够同时保证清洁供暖企业盈利且用户可承受。四、有利于技术支撑能力的提升。五、有利于商业模式的创新，从根本上扭转投资运行依靠补贴的局面。六、

有利于缓解建筑节能水平较低与取暖成本较高的矛盾。七、有利于对清洁供暖方式的科普宣传，提高国民的环保认知。八、有利于改善因为对清洁取暖方式不理解，造成的干群关系。

浅层地热能清洁供暖产业的发展，会从根本上建设具有我国特色的供暖产业，以最安全的电能网支撑因地制宜地高效搬运浅层地热能清洁供暖的节能热网。并且，浅层地热能清洁供暖系统热冷一体化发展的成本是居民可以正常承受的。

紧盯北方冬季供暖 早日实现排碳达峰

多年来，恒有源集团发展之所以紧盯浅层地热能作为替代燃烧传统能源的清洁供暖，其原因在于供暖是北方的必需品。今天供暖耗能的碳达峰，有连续的基础数据可供统计和分析，参考和对比。

企业要发展清洁供暖产业，首先需要确定北方供暖面积到底有多少。现在不是没有参考资料，是资料太多并且彼此差异很大。这些文章的数据来源主要是《北方地区冬季清洁供暖规划》(2017-2021)的通知。该文件是 2017 年发布的，并且是“已报国务院同意”的。

依据该文件数据，北方取暖总面积以 206 亿平方米计算，其中已有清洁能源供暖的约 35 亿平方米，大型锅炉热电联产供暖的约 70 亿平方米，这 105 亿平方米可以暂不计入近期可能采用浅层地能取暖的范围。只按总面积的 20% 采用浅层地热能清洁供暖来计算，北方供暖面积就有 41 亿多平方米。这部分面积采用浅层地热能清洁供暖后，并在供暖热量都是 4025（亿 kW · h）的条件下，与之前对比如下：电能直接加热需要配电 2.47 亿 (kW)，需用电量 4025（亿 kW·h)；浅层地热能清洁供暖需要配电 0.82（亿 kW)，需用电量 1342（亿 kW · h)。由此可见，浅层地热能清洁供暖比电直接加热节约用电 2683 (亿 kW · h)。假设所用电都是火力发电，则可节约 0.85 亿吨标煤，并可减排二氧化碳 2.05 亿吨。

2020 年我国碳减排量是 17.9 亿吨，如果实现以上供暖方案，浅层地热能清洁供暖对碳减排的贡献率超过 10%，可以成为早日实现碳达峰的重要支撑。

专家简介：

吴德绳，1939 年出生，籍贯：江苏常州。1957 至 1963 年在清华大学学习，毕业于土建系，共产党员。从事建筑专业设计工作，为教授级工程师职称，在北京市建筑设计研究院历任工程师、主任工程师、总工程师、院长、院长兼党委书记，2003 年退休任顾问总工程师。

曾参与多项工程设计、科研课题。曾领导编制申报 2008 年奥运会场馆规划设计文件。曾任北京第二航站楼、北京东方广场、国家大剧院等大型公共建筑的副总指挥。

曾任高等学校教育指导委员会、评估委员会、认证委员会委员或主任。

曾参与专业学会、协会领导职务和高等学校专业课座教授。

曾荣获全国五一劳动奖章，享受国务院特殊津贴。

现任中国建筑学会暖通空调专业委员会副主任、中国制冷学会副理事长、北京土木建筑学会原理事长。

北方地区清洁取暖率达到 70%

——政府工作报告划定清洁取暖改造时间表

CLEAN HEATING RATE IN NORTH CHINA TO REACH 70%

—— Government Work Report Defines Schedule for Clean Heating Transformation

特约记者：马晓芳

北方地区供暖是关系国计民生的大事，推进北方地区冬季清洁取暖，也是关系中国能源消费革命的重要一环。今年政府工作报告明确提出“北方地区清洁取暖率达到 70%”，为清洁取暖改造划定了一个明确时间表。同时这也是继 2017 年和 2019 年之后，清洁取暖问题五年来第三次写入政府工作报告。而在今年两会期间，多位代表委员也纷纷就北方地区清洁取暖积极建言，献计献策。

中国清洁取暖取得积极进展

政府工作报告中对于能源环保的规划，也促使北方地区不断提高清洁取暖率。在国家不断推动下，中国清洁取暖工作取得积极进展。据生态环境部公布的数据，截至 2020 年底，我国 2+26 城市和汾渭平原累计完成散煤替代 2500 万户左右，相当于减少散烧煤五六千万吨。据公开报道显示，我国北方地区清洁取暖率目前已达到 65%。

“第一代环保人追求首都不烧煤的目标，在我们这代人实现了。”生态环境部大气环境司司长刘炳江在接受媒体访问时表示，当前在北京及通道城市基本上已闻不到烧煤的味道，让人感到很自豪。他指出，不管面临再多困难、再多矛盾，国家都将坚定不移地推进清洁取暖工作，因为这是解决大气污染的重要措施，能够实现经济、社会环境效益多方多赢。

与此同时，伴随经济发展水平和人民生活水平的大幅提升，近年来，南方百姓供暖需求日益增长。有研究显示，到 2030 年，我国 133 个南方城市潜在供暖家庭预计高达 3246-6577 万户。当前，90% 以上的城市家庭拥有分户取暖设备，合肥、武汉、贵阳等城市已在部分城区实行集中供暖。

浅层地热能助力北方清洁取暖改造

今年的政府工作报告指出，推动绿色发展，促进人与自然和谐共生。加快发展方式绿色转型，协同推进经济高质量发展和生态环境高水平保

护，单位国内生产总值能耗和二氧化碳排放分别降低 13.5%、18%。巩固蓝天、碧水、净土保卫战成果，促进生产生活方式绿色转型。优化产业结构和能源结构，大力发展新能源。

地热供暖是利用地热资源，使用换热系统提取地热资源中的热量，向用户供暖的方式。今天的理论和大量规模化的实践证明：首选浅层地热能作为北方供暖的替代能源，区域无燃烧、零排放的为建筑物物理变化过程供暖，成本低于烧煤，是北方供暖能源的转型。目前来看，浅层地热能供暖，形成了新时代北方供暖最合理的能源生产和消费的产业链：靠近能源产地发电，环境治理成本最低；电力运输的输变电技术成熟可靠；建筑物的标准配电就可以满足浅层地热能供暖系统的需要。

经过多年的发展，如今浅层地热能供暖已经在北方多个农村地区使用，为众多当地群众带来了环保舒适的“暖”冬。地热能具有储量大、分布广、清洁环保、稳定可靠等特点。我国北方地区地热资源丰富，可因地制宜作为集中或分散供暖热源，大力开发浅层地热能供暖。按照“因地制宜，集约开发，加强监管，注重环保”的方式，加快各类浅层地热能利用技术的推广应用，经济高效替代散煤供暖。

农工党：编制北方农村清洁取暖中长期规划 制定可持续的清洁能源热源保障方案

北方地区农村清洁取暖是我国打赢蓝天保卫战的重要措施之一，也是今年全国两会农工党的一个重要关注方面。农工党界别小组提案建议，编制 5 至 15 年的北方农村清洁取暖中长期规划，建立长效机制，制定可持续的清洁能源热源保障方案，研究稳定持久的清洁取暖财政和金融政策，制定各类清洁供暖设备、管线安全标准和污染物排放标准，保障北方农村清洁取暖的长期顺利进行。

农村清洁取暖仍存诸多问题

随着我国北方地区“煤改气”“煤改电”工作的推进，清洁取暖后农村人居环境得到极大改善。但随着该工作进入深水区，特别是政府补贴的逐步退出，部分地方财政负担较重的重污染区出现“散煤复烧”的可能性极高，给北方地区冬季大气污染减排带来了不确定性。农工党界别小组提案指出，北方地区农村清洁取暖缺乏中长期的统筹建设。当前此项工作的推进主要依赖行政手段，但个别地方还存在为完成上级硬性任务而“一刀切”的现象。虽然《北方地区冬季清洁取暖规划（2017-2021 年）》强调应坚持“清洁取暖”与“温暖过冬”并重，但是该规划将于近期结束，后续政策和相关的运行保障问题，都需要中长期规划支持。

农村地区相关基础设施落后。该提案指出，农村地区电网和天然气管道建设相对滞后，取暖季用电、用气高峰期可能存在不能稳定供应的情

况。农村地区建筑大多是村民采用砖混结构建造，房屋的保暖性能差，不利于节能，运维保障机制尚未建立。大部分地区尚未建立清洁取暖责任体系和工作机制，“煤改气”“煤改电”的供气、供电设备维护尚未落实到责任人，应对突发情况的抢修力量待储备，存在诸多安全隐患。

农工党界别小组提案强调，清洁取暖费用高于燃煤，政府补贴一旦退出，部分农村居民家庭可能难以承担。据统计，取暖季散煤取暖总成本约为 900—1800 元 / 年，仅为清洁取暖方式的 1/3 至 1/4。清洁取暖项目的推进需要政府的补贴，地方财政难以持续支撑，一旦补贴取消，农村居民家庭将难以承受较高的清洁取暖费用。有调研显示，如果政府补贴退出，34% 的农户表示会完全使用煤炭；43% 的农户会部分使用煤炭；只有 23% 的农户会继续清洁取暖方式。

研究实施大气污染减排以奖代补政策

为此，农工党界别小组提案建议，推动农村建筑节能改造。建立和推进农村村民住宅建筑节能工作激励机制，加大资金投入，稳步推进既有建筑节能改造；优先对既有农村学校、幼儿园、医院、老年公寓、福利院等人员密集的公共建筑实施节能改造。制定新建农房建筑节能标准；鼓励村民对房屋墙体、屋面、门窗、楼板、地面等住宅围护结构进行改造，降低取暖热量损耗。

同时建议加强农村管网基础设施建设、增强运维服务保障能力。联合发改、电力、燃气、质检等相关部门，加强农村地区电网和燃气管道基础设施改造，保障取暖季电力和燃气的稳定供应。明确企业对改造设备的运营维护和质量保障责任，建立区县、乡镇两级维保机制，配置驻镇甚至驻村维保人员，定时排查管线安全隐患，消除潜在风险。研究实施大气污染减排的以奖代补政策。遵循用户可承受、政府可支撑、运行可持续的原则，通过以奖代补等减排政策巩固清洁取暖取得的环境效益。对于电代煤，视为大气污染物零排放；对于气代煤，视为 SO2 和颗粒物零排放。需核算 NOx 和 VOCs 减排效益，建立主要大气污染物以奖代补标准、制定以奖代补政策，设立专项奖励基金奖励给农户。

全国政协委员、中国节能环保集团董事长宋鑫：建多方共赢长效机制 促清洁取暖可持续发展

作为环保能源行业的全国政协委员，中国节能环保集团董事长宋鑫一直关注节能环保领域的发展。在今年的全国两会上，他提交了多个提案，围绕建立清洁供暖可持续发展机制，推进碳达峰、

碳中和战略，强化大宗工业固废综合利用等建言献策。他认为，建立一套多方共赢的长效机制，是解决清洁取暖用户端长期可持续的关键所在。

对于中国北方地区，改善环境的一个有效手段就是采取清洁供暖。在碳达峰等政策带动下，清洁供暖必将迎来用能方式、能源结构的巨大变革。清洁取暖改造资金主要来自 3 个方面：中央财政试点城市奖补资金、地方财政补贴资金、社会资本投入。宋鑫认为，当前北方地区实现可持续清洁供暖缺乏多方共赢的长效资金机制，同时现有建筑物能效水平较低，难以满足建筑节能要求。

宋鑫指出，北方地区清洁供暖比例较低主要体现在广大农村地区。燃气成本高、取暖效果差，尤其是寒冷区域冬季取暖时间较长，农村居民无法承担高昂费用。同时，源供应不足，且天然气后期采暖维护问题责任不明确，导致经常因设备问题而出现停暖现象。部分地区在天然气管道尚未接通或不太稳定的情况下“一刀切”推进煤改气，强制群众散煤清零，也给农村居民带来了较大困扰。

为此，宋鑫建议积极探索多方共赢长效机制。针对清洁供暖市场依赖政府、盈利水平较低、市场积极性不高的问题，根据各地实际情况，选择适用清洁取暖技术，编制相应的技术指南，优化供暖规划。同时，引导当地供热企业、投融资企业、热用户等积极参与清洁供热项目，探索新型多方共赢机制，激活市场潜力。另外，要因地制宜利用太阳能、风能等可再生能源，结合电能、天然气推进北方清洁供暖。

他建议，有序推进供热管网节能改造及采暖末端能效提升。抓紧对各地供热管网进行性能评估，并寻求与清洁取暖技术最相适应的节能改造方案，鼓励探索政府、用户和供热企业三者共同分享成本与收益的新模式——既可以为清洁供暖提供技术保障，又可以为后续智慧供热技术的全面展开提供有力的硬件支撑。指导各省市大力推进建筑节能改造。通过完善政策引导、推广应用节能环保新技术、新工艺和新材料、强化节能监管等措施，鼓励支持建设星级绿色农房、被动式超低能耗农房，结合城市更新行动，对既有房屋墙体、屋面、门窗、地面等住宅围护结构进行规模化节能改造。

代表委员建言

十九届五中全会《关于制定国民经济和社会发展第十四个五年规划和二〇三五年远景目标的建议》提出“广泛形成绿色生产生活方式，碳排放达峰后稳中有降”，包括 2030 年“碳达峰”、2060 年“碳中和”的目标。“碳达峰”、“碳中和”在今年首次被写入政府工作报告，“北方地区清洁取暖率达到 70%”也在政府工作报告中被列入重点工作。2021 年的全国两会上，两会代表委员纷纷热烈讨论，围绕“碳达峰”、“碳中和”、“北方地区清洁取暖”建言献策。

韩峰：
有条件地区可推广地热供暖

全国人大代表、中国石化安全监管部总经理韩峰说，“有条件的地区还可推广地热供暖。”韩峰指出，作为清洁能源的中深层地热供暖产业，出于自身公共服务属性，利润相对较低。他建议加大地热清洁取暖项目财税政策支持，减免地热开发利用行业资源税；针对地热供暖出台退税办法，或通过先征后返、提供清洁能源项目补助等措施，推动产业良性发展。

马化腾：
推动科技企业实现碳中和

全国人大代表、腾讯董事会主席兼首席执行官马化腾建议，“推进碳中和是科技企业履行社会责任的积极体现。他认为，推动我国科技企业实现碳中和，意义不仅在于科技企业自身的节能减排，更重要的是鼓励科技企业加强技术研发创新，以碳中和为契机，倒逼我国低碳技术转型。一方面，集中力量攻克能源互联网、碳捕集利用与封存技术（CCUS）等低碳技术。另一方面，通过和产业互联网结合，促进经济社会向低碳、绿色、循环方向发展。

目前，中国科技企业实现碳中和面临着政策、技术等多重挑战。对此，马化腾提出了多项具体建议，包括优化数据中心布局，完善绿电采购途径，鼓励企业投资可再生能源项目、分布式能源项目等；搭牢碳中和配套基础设施，推动碳中和市场化；加快绿色技术研发，推动绿色数据中心等低碳技术创新应用，建立一批高技术高能效“碳中和数据中心”；出台科技企业碳中和指导意见，鼓励科技企业设立碳中和承诺和目标等。

杨元庆：
科技赋能实体经济、提高企业碳中和能力

全国人大代表、联想集团董事长兼 CEO 杨元庆认为，通过对电子终端产品和信息通讯行业的碳中和路线的推进，可以引导和带动整个产业链，甚至上游原材料供应商的绿色改造和可持续性发展。这对于企业建立绿色、低碳、循环的发展路径，实现中国经济的高质量绿色发展，具有非常现实和重要的意义。杨元庆建议，首先应完善绿色低碳法规标准制定；二是鼓励企业制定长期低碳发展战略和碳中和路线图；三是利用大数据信息平台，推动行业企业绿色数据核查与评价；四是加强源头治理，带动供应链低碳绿色发展。

李东生：

将低碳减排加入上市公司信息披露范围

全国人大代表、TCL 创始人李东生建议将低碳减排加入上市制造企业信息披露范围。李东生认为，在碳排放信息披露方面，国内上市公司还有很多可以改善的地方。比如说目前缺乏明确的法律法规，对此问题重视程度不够。关于低碳减排的信息披露缺乏强制和规范的要求，另外也缺乏足够的社会监督。

李东生建议，在企业信息披露和管理中，增加低碳减排的强制披露要求。目前企业的信息披露，除了经营信息之外，今年增加了对企业社会责任承担的相关情况，低碳减排未来也要成为企业社会责任的一部分。

小资料

我国“碳达峰”的峰值是多少

我国政府在巴黎气候变化大会上提出 2030 年左右碳排放达峰并争取尽早实现达峰。这个峰值是多少？

自巴黎气候变化大会以来，许多学者、专家和机构对此进行了探讨。由于各行业积极行动努力节能减排，新技术和新清洁能源的使用规模也不断扩大。对于这个峰值，第一，可能提前到来；第二，预计的峰值会不断减小。

据 2021 年 3 月 18 日全球互联网发展合作组织在北京举行“中国碳达峰碳中和成果发布暨研讨会”上发布的《中国 2030 年前碳达峰研究报告》披露，中国全社会碳排放 2028 年达峰，峰值是 109 亿吨。2030 年降为 102 亿吨。

实现“双碳”目标 中国地热可以大展宏图

ACHIEVING THE GOALS OF EMISSION PEAK AND CARBON NEUTRALITY CAN CREATE A GRAND PROSPECT FOR GEOTHERM IN CHINA

作者：郑克棪（中国地热产业工作委员会）

我国要实现 2030 年碳达峰和 2060 年碳中和的宏伟目标，今年又是“十四五”规划的开局之年，而且我国已申办成功 2023 年世界地热大会在中国举行，所以摆在全国地热人面前的任务相当紧迫，中国地热可以而且应该大展宏图。

1. 可再生能源的地热优势

碳达峰和碳中和的目标是要把碳降下来，只能靠可再生能源，别无它法。但是，大多数可再生能源的间歇性和波动性限制了其担当主流的能力。虽然地热能现在被重视还不够，但要想实现 30/60 目标没有地热能是不成的。

为了解决太阳能和风能的间歇性和波动性，储能产业近年来大发展，但是路途遥远，问题并非容易解决。今春 4 月 16 日北京南四环（首都核心区边界）发生储能电站施工调试中火灾和爆炸，15 个消防站、47 辆消防车、235 名指战员到场，经 11 小时 23 分钟才将明火扑灭。

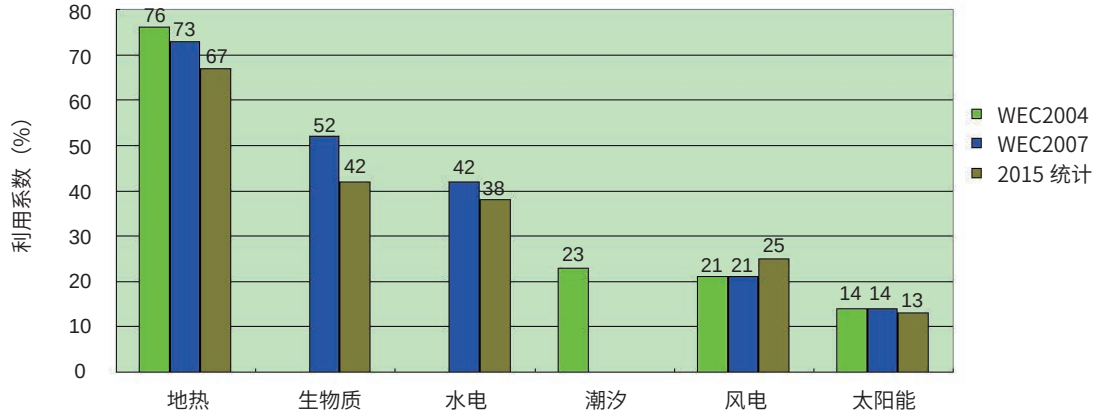


图 1 各种可再生能源的利用系数比较

碳达峰和碳中和最终要依靠地热能发电，才能保障电网的稳定性。丹麦、挪威在世界地热界从来排不上号，但为了碳达峰和碳中和已经制订了开发地热的规划。所以，中国地热到时候终究要被请上来，中国地热的前景肯定可以美好。

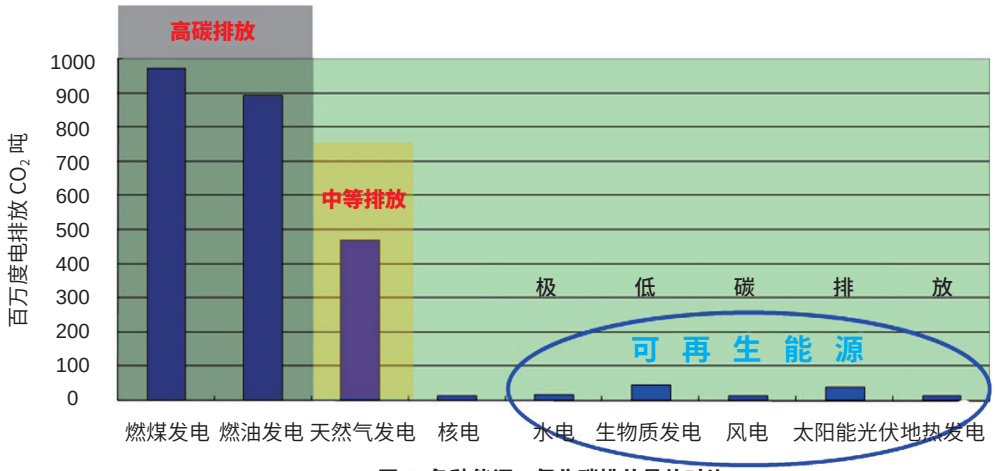


图 2 各种能源二氧化碳排放量的对比

2. 光听好消息是不够的

美好前景绝不会白送上门，光听好消息是不够的，我们需要配合行动。最近有些重大新闻：

2020 年 12 月：自然资源部将从四方面支持地热产业发展（摸清家底，编制规划，矿业权出让，技术支撑）。“十二五”、“十三五”已投入了 10 多亿元，不能永远停留在“摸清家底”，怎么能再跨出实质性有效的一步？

2021 年 3 月全国两会：好几个代表和委员有关地热的提案。届时转相关部门后一纸答复：提案已办。但不可能从相关立法上解决问题。

2021 年 3 月全国人大审议《十四五规划和 2035 年远景目标纲要（草案）》：清洁能源基地是水电 / 风光 / 多能互补。地热能是因地制宜开发利用，力度不够。

2021.4.15. 国家能源局《促进地热能开发利用的若干意见（征求意见稿）》。业内人士提出职能交叉顽疾仍待解。

2021.4.22. 国家能源局《2021 年能源工作指导意见》：研究启动在西藏等地的地热发电示范工程。如果没有政策，无从“示范”，谁会冲上去跟着赔本？

总之，中国地热人盼望有具体的政策实施，光靠说不能解决问题。

3. 要知道自己的不足

“十三五”刚结束，对于成功的经验要推广；对于失败的教训要找出原因解决。不解决则问题永远存在，下一步仍绕不过去。

“十三五”地热规划地热发电新增 500MW 目标，仅完成了 18.08MW，即 3.6%。我在 2020 中国地热大会的地热发电前景研讨会上讲了，记者采访后报导了，我还在《中外能源》期刊上发表了论文，分

析问题的症结在于：没有执行可再生能源上网电价补贴政策；又被征收地热资源税。所以在地热发电企业赔本经营的现状下，再谈发展等于是让傻瓜去做赔本买卖，我当时就说羊易地热发电之后不会有第二家跟上了。事实就是这样，曾有大型国企当初自报完成 200MW，结果 1W 未搞；还有大国企已签约羊八井地热电站改建，做了个方案后现未再往前。明摆着这样的现实，你能期望“十四五”地热发电将是什么目标？什么结果？

土耳其、印度尼西亚颁布地热法，不再将地热开发活动归于矿业开发范畴，地热就得到了解放，土耳其 15 年间从世界地热发电第 16 位猛窜到第 4 位，印度尼西亚从第 3 位升到第 2 位。这是我们可以学习的榜样。

所以，总结过去才能明白当下，才能看清问题所在。如果不解决现有问题，就无法再前进一步，所谓“带动 2000 亿元投资”只能是一句空话。

4. 中国地热美好前景需要共同努力

当前中国提出的“2030 年碳达峰，2060 年碳中和”目标给了中国地热新的鼓舞，但要实现中国地热美好前景需要全体上下共同努力。

（1）现有的好政策需继续发挥作用

今年我们已看到各地许多新规划和新政策支持可再生能源和地热能开发利用，例如：

北京市正按国家有关规定开展碳达峰评估，并制订碳中和行动纲领，节约能耗控制化石能源消费增长，大力发展可再生能源，包括鼓励光伏、热泵技术等应用开发利用本地可再生能源。

江苏省推进可再生能源应用，全面支撑居住建筑节能率提升。湖南省《长株潭一体化发展五年行动计划》推进一批分布式能源项目，推广天然气冷热电三联供、地热能供暖制冷等利用改造。安徽省示范村镇因地制宜发展地热能等绿色清洁可再生能源，改善农村用能，2023 年底至少建 16 个等。

无疑，这些新政，和原有的支持政策和办法，都将继续发挥作用推动地热能的发展。

（2）不适应的办法和管理应有所改进

2015-2018 年东盟地热合作研究项目《东亚常规和新型地热资源可持续利用的必要创新及其收益评价》，中国、日本、韩国、印度尼西亚、菲律宾、泰国、马来西亚、越南各自分析了包括政策、社会、立法、财政和技术诸方面的障碍，收集问卷调查统计百分比。中国最大障碍在政策和立法。日本曾是国家公园保护限制了开发，因福岛核电站事故后有放松，现私人温泉主不同意开发怕妨碍他们温泉洗浴。印尼解决了政策立法，但和其它小国一样是财政和技术问题。

中国的事情有点乱，有开发商没做回灌，如果地热主管部门及早管理，促成回灌，应该不会有河北省一刀切关停 1000 多眼地热井，水务部门也掌握着采水证呢。而如山西省运城市又出了新规，让城管来管理。其实阻碍中国地热发展的症结就是多头管理，各说各有利，没有统一意志，不能形成共识。多头管理，谁都管，谁都不管，你管我掐，不是从整体出发，实际无法达到目的。

自然资源部是矿产资源主管部门，包括地热资源，主管资源勘探，然而又不让搞开发（以前石油部、煤炭部自探自采），只发采矿证让人开发。

国家能源局说地热是能源，归我管，但能源局既不投经费，又对可再生能源补贴也无权决定（要发改委）。水利部说地热是水，归我管，你自然资源部实施探矿证和采矿证，我不给你采水许可证就不准你开采。

生态环保说地热弃水产生污染，我不让你用。本来这靠回灌就能解决问题，但环保不会回灌（今年中央环保督察给国家能源局反馈意见：重污区煤电装机仍在增加，有矿区总规未办环评，有产能大于环评批复，这些排污量远远大于河北省关停千余地热井）。

税务部门说全国人大已通过和发布了资源税法，我得照章收地热税，请问世界上哪个国家征收可再生能源税了？

如果能在这些方面有所改善，则肯定给“十四五”带来新貌。彻底解决问题应如国外经验设立《地热法》。

土耳其曾和中国一样，从 70 年代初到 2004 年地热发电 20MW 踏步不前，但 2005 至 2020 年持续 15 年内平均年累进增长率 33.5%，地热发电 1688MW 跃增 84 倍，登上世界第四。其经验就是两条：一是 2005 年世界地热大会在土耳其召开，议会和政府熟悉了地热，认识到开发土耳其本土地热资源的重要意义；二是紧接着就议会给地热立法，给予开发者政策优惠，上网电价补贴。

世界十强第二名的印度尼西亚近 15 年内增长了 2.68 倍，也是国家立法的功劳。印尼 2014 年发布《地热法》不再将地热开发活动归于矿业开发范畴，对地热电站电价机制做出详细规定，将地热开发项目招投标权收归中央政府，财政部拨款 2.1 亿美元支持地热项目勘探及研究论证。

（3）克服固步自封，坚持技术创新

进入 21 世纪以来，地源热泵在我国飞速发展，迅速形成行业发展壮大，还超过了常规地热利用，使得我国地源热泵和地热直接利用都坐上了世界第一。虽然在我国建筑应用市场还未饱和，但是也面临增速减缓。我们需要用进一步的技术创新取得新的主动，带动行业新发展。

特别在可再生能源中提出的多能互补和储能技术，对于地源热泵和常规地热利用都有巨大的发展前景和市场空间。特别是地下储能，地下地质体的巨大是任何人造设备无法比拟的，其当然蕴含着无与伦比的潜力和潜能。

还有我们进度太慢的干热岩研究开发，是将来零能源社区、碳中和能源的理想前瞻，需加快研究进度。

我愿意特别提一下热传导和热对流，现在有的开发似有走偏，热传导开发可以应急，但无论如何它比不上热对流开发，我希望这里的开发不要迷了方向。

北京 1974 年钻成地热井 1299m 深，出水 56.5 C，水量 1341.6m^3 每昼夜，用到 35 C 热功率 1398kW，供暖 28000m^2，这样抽水利用的是热对流。

唐山 2020 年 3000m 井底 119°C，利用重力热管，地面最高 90°C饱和水蒸汽，热功率近 200kW。这是取的热传导热，井深了 2.3 倍，温度高了 2.1 倍，但取热功率却只有上例对流井的七分之一。

今年许多地热论坛和研讨会，介绍了很多地热

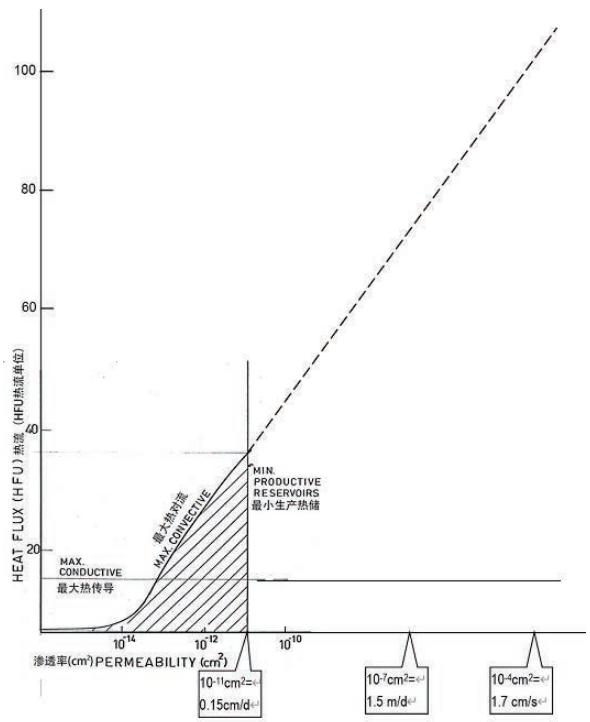


图 3 热传导与热对流的对比

开发的新技术和新研究，不胜枚举。我在此只是提及这个方面，地热界同仁有更多的潜在能力，不妨充分发挥。

让我们作为中国地热的主人，在奔向和实现碳达峰、碳中和目标的征程中，让中国地热大展宏图。

以中国专利申请视角看浅层地热能开发利用现状

CURRENT STATUS OF DEVELOPMENT AND UTILIZATION OF SHALLOW GEOTHERMAL ENERGY FROM THE PERSPECTIVE OF CHINESE PATENT APPLICATION

作者：王森（国家知识产权局专利局三级审查员）

浅层地热能是指蕴藏在地表下 200 米范围内的岩石、土壤、地下水中，在一定技术条件下具有开发利用价值的低温地热能，它主要来源是太阳能和地心热能。其主要特点是绿色清洁、温度恒定、资源丰富、分布范围广等。当前，对浅层地热能开发利用主要借助于地源热泵技术实现，在我国大致分为三种类型：地下水源热泵、土壤源热泵、地表水源热泵。以下从专利申请方面浅析我国浅层地热能开发利用状况。

一、概况

1．地下水源热泵

地下水源热泵是以地下水作为低位热源，并利用热泵技术，通过从地下水中吸收或放出热量，实现冷热量由低位能向高位能的转移，从而达到为使用对象供热或供冷的目的。地下水源热泵多为循环“井水”系统，适合于地下水资源丰富，并且当地资源管理部门允许开采利用地下水的场合。

2. 土壤源热泵

土壤源热泵是利用地下浅层土壤温度相对稳定的特性，通过深埋于建筑物周围的管路系统与建筑物内部完成热交换的装置。冬季从土壤中取热，向建筑物供暖；夏季向土壤排热，为建筑物制冷。它以土壤作为热源、冷源，通过高效热泵机组向建筑物供热或供冷。土壤是一种比环境空气更好的热泵系统的冷热源，并且土壤源热泵系统不会把热量、水蒸气及细菌等排人大气环境。据统计，设计安装良好的土壤源热泵，平均可以节约用户 30% ～ 40% 的供热制冷空调的运行费用。

3. 地表水源热泵

利用江河湖海等地表水资源，为周边建筑物

提供或散发热量。此种方式受到江水、湖水等的面积和深度等制约，需要根据江河湖水量计算可向建筑物提供的制冷或制热量。

4. 海水源热泵是地表水源热泵的另一种形式

海洋水源热泵是将海水中存在的大量的低位能收集起来，借助压缩机系统，通过消耗少量电能，在冬季把存于海水中的低品位能量“取”出来，给建筑物供热；夏季则把建筑物内的能量“取”出来释放到海水中，以达到调节室内温度的目的。它虽然以海水为“源体”，但不消耗海水，也不对海水造成污染；同时，热效率高。

二、相关专利申请状况

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）对浅层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 31 日，该数据库中有关浅层地热能方面的专利申请共计 551 件，其中发明专利申请为 282 件，实用新型专利申请为 269 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

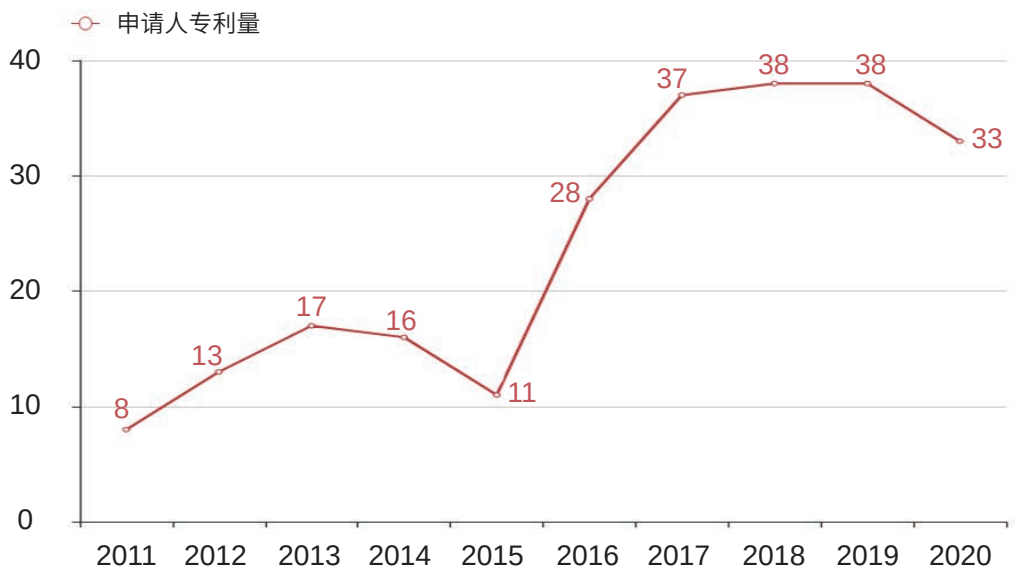


图 1 近十年发明专利申请量

由图 1 可以看出，近十年来，浅层地热能方面的发明专利申请量有两个发展高峰，分别出现在 2013 年的 17 件和 2017 年 -2019 年间的年均 38 件，2015 年至 2017 年间专利申请量增长较快，2020 年申请量与前期相比，大致保持稳定。

1.1.2 近五年发明专利申请授权量排名前十名的省份

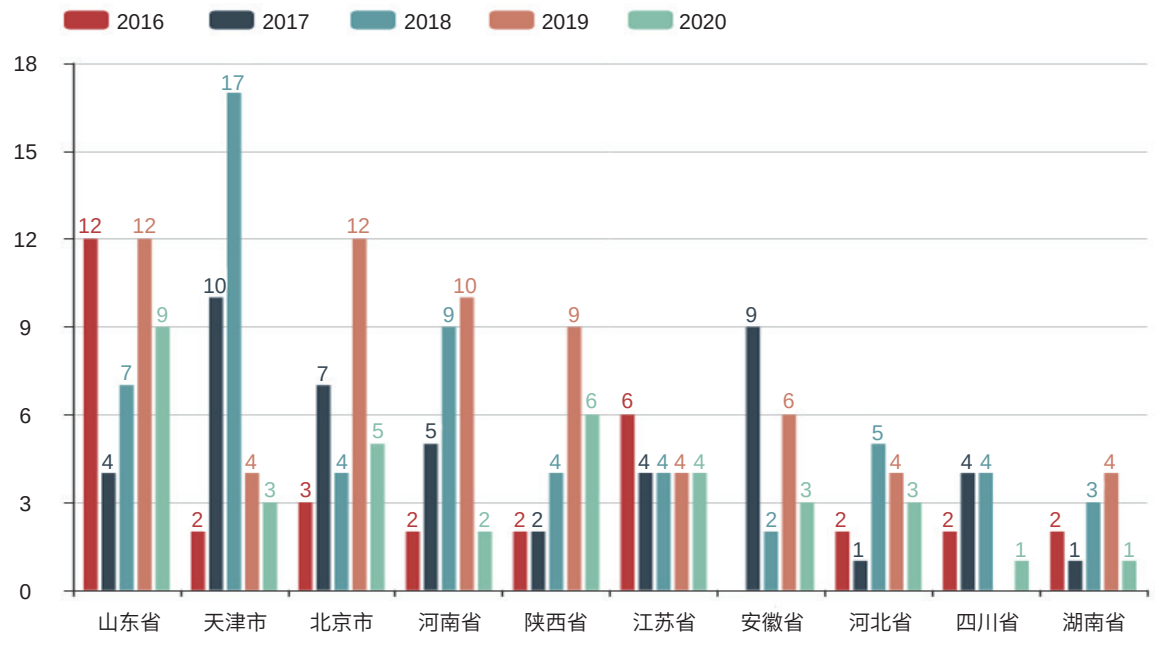


图 2 近五年发明专利申请量排名前十名的省份

近五年发明专利申请量排名前十名的省份分别为：山东省、天津市、北京市、河南省、陕西省、江苏省、安徽省、河北省、四川省、湖南省。

1.1.3 发明专利申请排名前列的申请人

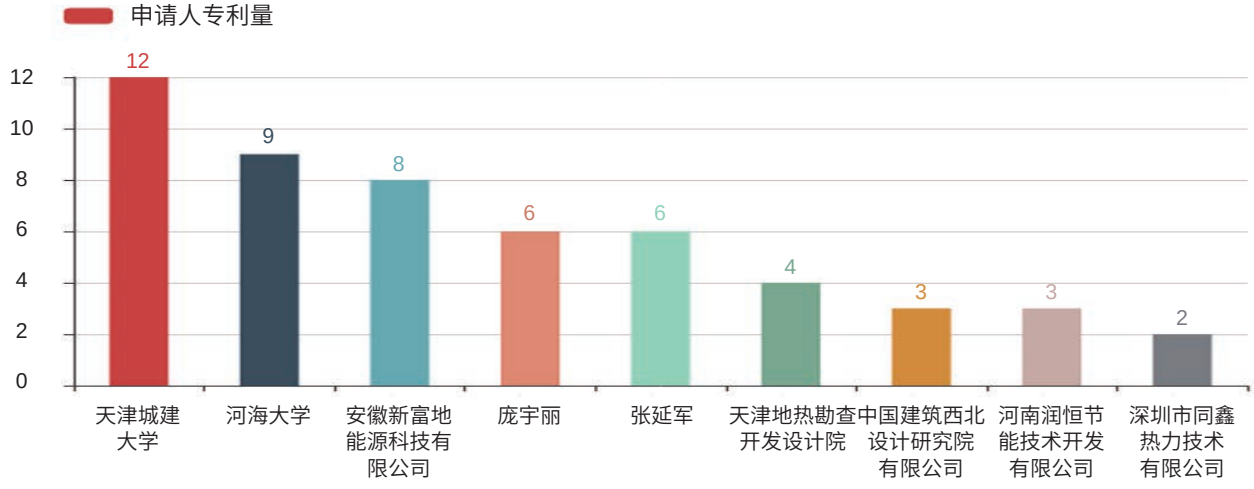


图 3 发明专利申请排名前列的申请人

浅层地热能方面的发明专利申请量排名前列的申请人分别为：天津城建大学、河海大学、安徽新富地能源科技有限公司、庞宇丽、张延军、天津地热勘查开发设计院、中国建筑西北设计研究院有限公司、河南润恒节能技术开发有限公司、深圳市同鑫热力技术有限公司。

1.1.4 采用“单井”技术的发明专利申请排名前列的申请人

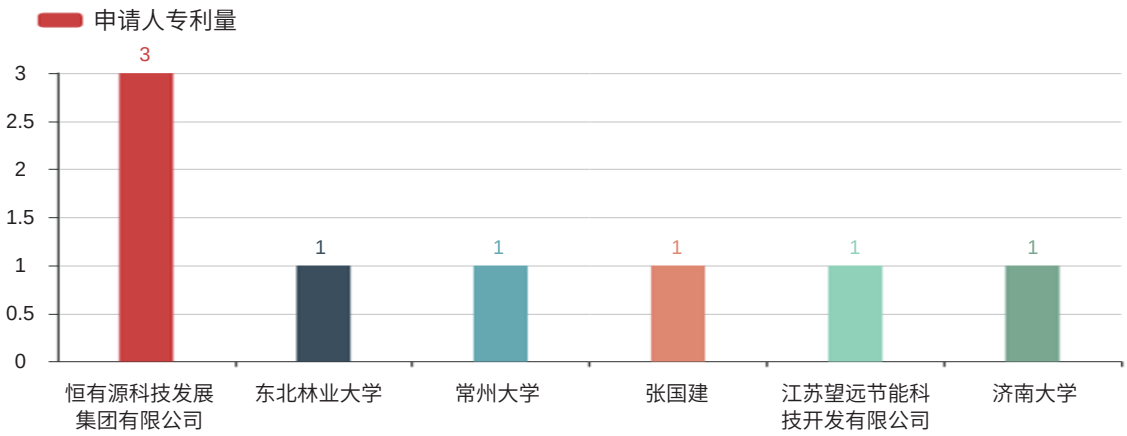


图 4 采用“单井”技术的发明专利申请排名前列的申请人

其中，采用“单井”技术开发利用浅层地热能方面的发明专利申请量排名前列的申请人分别为：恒有源科技发展集团有限公司、东北林业大学、常州大学、张国建、江苏望远节能科技开发有限公司、济南大学。

1.2 实用新型专利申请状况

近十年实用新型专利申请量

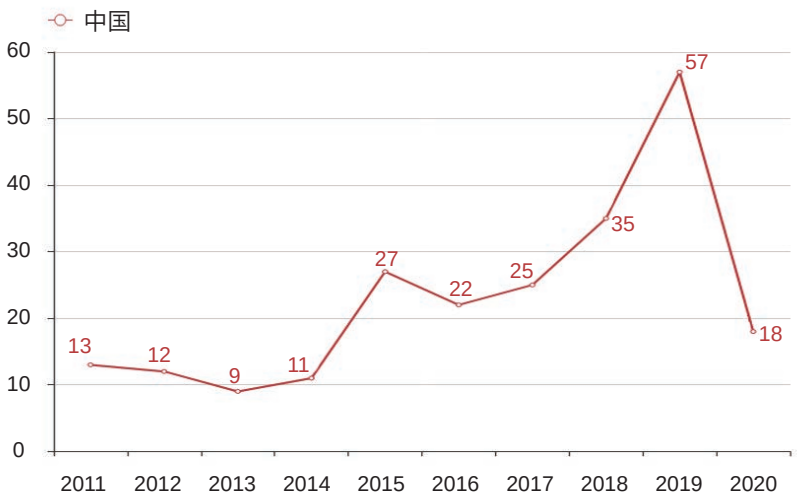


图 5 近十年实用新型专利申请量

由图5可以看出，浅层地热能方面的实用新型专利申请量逐年增长，其中2014年-2015年间增长较快，至2015年申请量已达27件，之后专利申请量继续上升，至2019年到达到峰值57件，但2020年全年专利申请量只有18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。

2.1 发明专利申请技术分类

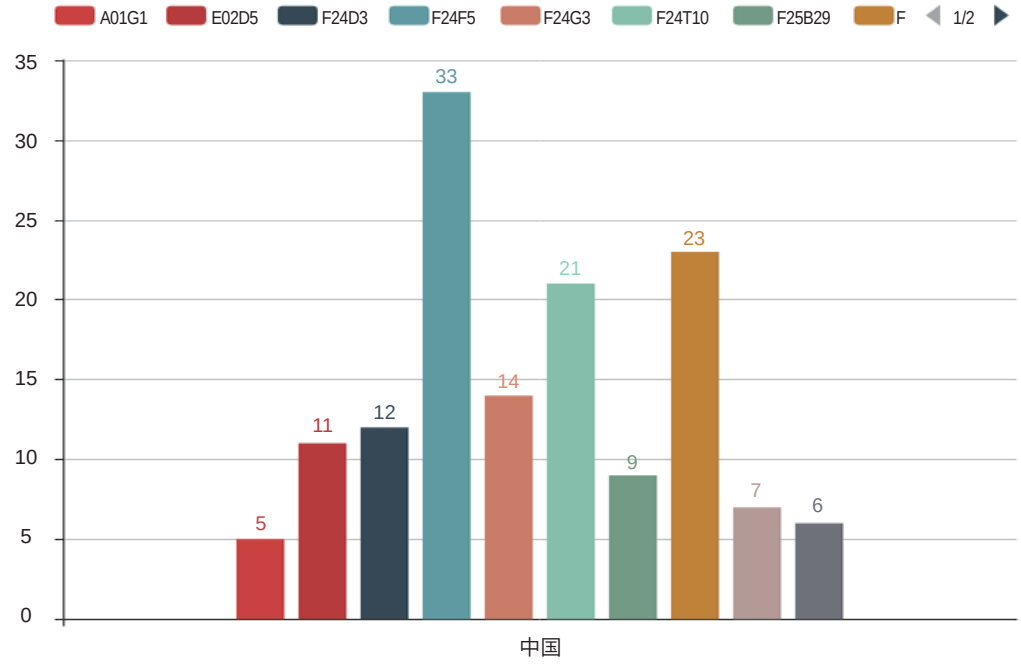


图6 发明专利申请技术分类

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空气调节系统或设备，共计33件。其余依次为热泵、地热集热器、热水集中供暖系统、其他非燃烧热的产生或利用、基础工程专用的板桩墙，桩或其他结构构件等专利技术。

2.2 实用新型专利申请技术分类

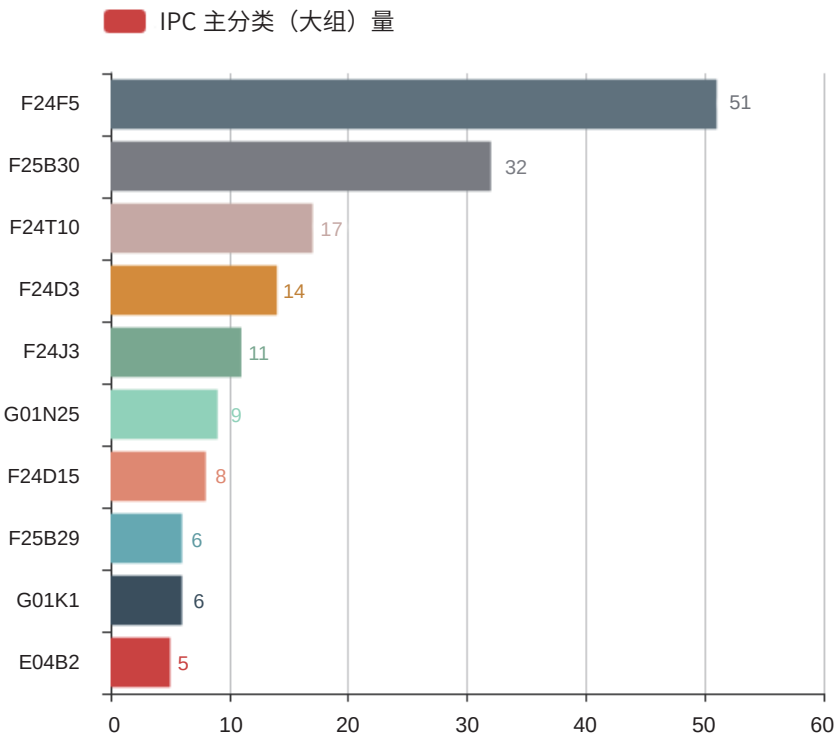


图 7 实用新型专利申请技术分类

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空气调节系统或设备，共计 51 件。其余依次为热泵、地热集热器、热水集中供暖系统、其他非燃烧热的产生或利用、应用热方法测试或分析材料、其他住宅或区域供热系统等专利技术。

三、建议

虽然浅层地热能利用发展潜力巨大，但从我国专利申请量、申请人构成等方面来看，对于浅层地热能的利用及开发等都还有待增强。同时，浅层地热能利用的技术层面涉及到多领域技术相互协作，更涉及许多学科间的相互协调、借鉴、研究等。建议各方在分析研究我国区域气候特征、地下水资源分布、地质环境条件等基础上，提升浅层地热能的开发和利用水平。

国家发文力促地热能产业发展 “十四五”期间将增加50%

THE STATE ISSUED AN OFFICIAL DOCUMENT TO PROMOTE THE DEVELOPMENT OF GEOTHERMAL ENERGY INDUSTRY, WHICH WILL INCREASE BY 50% DURING THE 14TH FIVE-YEAR PLAN PERIOD

特约记者：马晓芳

地热能是一种储量丰富、分布较广、稳定可靠的可再生能源。大力开发利用地热能，对贯彻落实习近平总书记提出的力争于2030年前实现二氧化碳排放达峰、努力争取2060年前实现碳中和的要求具有重要意义，同时也是满足农村供暖需求、助推乡村振兴及农业农村现代化的重要方式。国家能源局近日发布《关于促进地热能开发利用的若干意见(征求意见稿)》（以下简称《意见》），明确指出到2025年，地热能供暖(制冷)面积比2020年增加50%，在资源条件好的地区建设一批地热能发电示范项目；到2035年，地热能供暖(制冷)面积比2025年翻一番。

浅层地热能是高利用率的可再生资源

地热能、太阳能以及风能都属于可再生资源，国家一直很重视地热能等可再生资源的发展。在《地热能开发利用“十三五”规划》中可清晰看到国家对地热能供暖发展的期待：2016-2020年，地热能供暖拉动投资约2200亿元，地热发电可拉动投资约400亿元，合计约为2600亿元；新增地热能供暖(制冷)面积11亿平方米；新增地热发电装机容量500兆瓦。

公开数据显示，地热能的市场规模高达2600亿元人民币。但目前地热能的发展和应用速度仍不及太阳能和风能。如何高效发挥地热能储量大、分布广、清洁环保、稳定可靠的特点，为中国实现碳达峰、碳中和助力，是目前急需讨论和解决的重要问题。

从著名地质学家李四光提出“开发地热能源，向地球要热”的号召开始，中国就开启了对地热能的不断探索。上世纪七十年代，中国取得地热发电实验的成功，成为世界上第8个实现地热发电的国家。然而由于种种原因，地热发电的效益并不稳定，发展路径也出现了一些偏差，使得整个地热

发电行业的前进步伐受阻。

与地热发电相比，中国地源热泵行业近年来却发展快速。地源热泵作为一种高效清洁能源技术，具有节能、环保、经济、可靠的特点，近年来随着大气污染治理、冬季清洁取暖改造工作的推进，地源热泵清洁供暖已被大众所熟知和认可。短短十多年的时间，我国地源热泵产业从无到有、从小到大，发展至今已得到了很多应用。

在可再生能源中，与水电、生物质发电相比，利用系数高是地热能的最大优势，与此同时，地热还可完全替代化石燃料发电，实现“零能耗”。中国能源研究会地热专业委员会专家委员会主任、中国地源热泵产业联盟专家委员会主任郑克棪深耕地热行业几十年，他认为，目前中国地热能行业要发展，面临资源、技术、资金和政策等多方面的制约，首要任务就是借鉴国际上的成功经验，制定实施《地热法》，对地热发电上网电价补贴，废除《资源税法》对地热的收税政策，以更积极的姿态迎接和举办2023年世界地热大会。

鼓励推广“地热能 +”多能互补供暖形式

针对地热能推广发展过程中面临的突出问题，国家能源局在征求意见稿中提出了多项保障措施，鼓励各级政府和发改、财政、自然资源、水利等多部门出台有利于地热能开发利用的价格、财政、金融政策等，对地热能供暖项目给予财政支持。

《意见》明确指出应大力推进地热能资源勘查和项目建设，规范和简化管理流程、完善信息统计和监测体系，保障地热能开发利用快速高质量发展。深化地热资源勘查工作，有关省（区、市）自然资源主管部门要组织开展地热资源调查评价，对地热资源开发利用的可行性、适宜性、开发利用总量和开发强度进行总体评价，科学合理设置矿业权，引入企业开展后续勘查和开发利用工作。在京津冀晋鲁豫以及长江流域地区，结合供暖（制冷）需求因地制宜推进浅层地热能利用，建设浅层地热能集群化利用示范区；在重视传统城市区域浅层地热能利用的同时，以高质量满足不断增长的南方地区供暖需求，大力推进云贵高寒地区地热能利用。

《意见》指出，应根据资源情况和市场需求，在京津冀、山西、山东、陕西、河南、青海等区域大力推进中深层地热能供暖。鼓励各地在进行资源评估、环境影响评价和经济性测算的基础上，根据实际情况选择“取热不耗水、完全同层回灌”或“密封式、井下换热”技术，最大程度减少对地下土壤、岩层和水体的干扰。鼓励开展中深层地热能集中利用示范工作，示范不同地热资源品位的供暖利用模式和应用范围，探索有利于地热能开发利用的新型管理技术和市场运营模式。宜采取地热区块整体开发的方式推进地热能供暖，调动企业保护资源、可持续开发的积极性，鼓励推广“地热能+”多能互补的供暖形式。

《意见》同时鼓励建设地热能高质量发展示范区。开展地热能与旅游业、种养殖业及工业等产业的综合利用。创新管理方式，先行先试开展地热能高质量发展示范区建设，以点带面快速带动地热能开发利用的规模化发展，推动地热能成为清洁取暖的重要力量。稳妥推进地热能发电示范项目建设。适时出台电价或相关支持政策，在西藏、川西、滇西等高温地热资源丰富地区组织建设中高温地热能发电工程，鼓励有条件的地方建设中低温和干热岩地热能发电工程。支持地热能发电与其他可再生能源一体化发展。

在规范地热能开发利用管理方面，《意见》建议规范地热能开发利用项目备案或登记管理，简化地热能开发利用项目前期手续，加强对地热能开发利用项目的监督检查和对地热能开发利用项目的信息化管理，编制地热能开发利用规划并做好衔接，营造有利于地热能开发利用的政策环境。

地热能有望“后卫”转“前锋”

国家日前发布的《国务院关于加快建立健全绿色低碳循环发展经济体系的指导意见》明确指出，要推动能源体系绿色低碳转型，坚持节能优先，完善能源消费总量和强度双控制度，提升可再生能源利用比例，大力推动风电、光伏发电发展，因地制宜发展水能、地热能，加快大容量储能技术研发推广。伴随着国家的重视，地热能作为清洁非碳基可再生能源正迎来空前的发展机遇。

中国科学院地热资源研究中心主任庞忠和近日在接受媒体采访时对中国地热能发展充满信心：“随着国家对深层地热能的重视度越来越高，未来地热能有望从原来的‘后卫’转为‘中锋’或‘前锋’。身为“深层地热能的地球科学问题研究”项目负责人，庞忠和表示，地下“储能”是地热能未来发展的重要方向之一，通过将各种余热回灌至地下空间存储，可有效发挥地热能作为连续稳定基础负荷的作用。

国家政策支持、行业积极发展，在从上到下一致努力下，期待“十四五”期间，地热能开发利用能为经济转型和新型城镇化建设增加新的有生力量，同时推动地质勘查、建筑、水利、环境、公共设施管理等相关行业的发展，在增加就业、惠及民生方面取得显著的社会效益。

列表：专家建言地热能行业发展

1. 中国能源研究会地热专业委员会专家委员会主任郑克棪

政策是制约地热发展的最关键因素。以西藏羊易地热电站为例，该电站2018年并网发电，2019年上网，上网电价仅为0.25元/千瓦时，远低于光伏电价1.05元/千瓦时，严重影响企业投资地热产业的信心与决心。应制定实施《地热法》，对地热发电上网电价补贴，废除《资源税法》对地热的收税政策。

2. 全国政协委员、中核集团核工业北京地质研究院院长李子颖

水资源税影响了很多企业开发地热能的积极性。目前地热能开发利用涉及的原理都是取热不取水，在100%回灌条件下，地热资源税应为零。地热能常被放在太阳能、风能等新能源的“等”字里，不为大多数公众所熟知。从我国风电、光伏发展历程看，适度的鼓励政策对产业快速升级以及行业发展具有重要的引导作用，建议参考风光等可再生能源早期电价政策，加快推动地热上网电价政策尽快出台。对按要求回灌的水热型地热能减免矿产资源税，加大中央财政投入，加大地热资源勘查力度和精细度，特别是基础调查工作，促进地热行业健康稳定发展。

3. 国家能源局新能源和可再生能源司司长李创军

“十四五”是推动能源转型和绿色发展的重要窗口期，“十四五”规划和2035年远景目标纲要中都对加快可再生能源提出了明确要求。国家能源局新能源和可再生能源司司长李创军日前指出，在“十三五”基础上，“十四五”期间可再生能源年均装机规模将有大幅度提升，装机规模将进一步扩大，到“十四五”末可再生能源的发电装机占我国电力总装机的比例将超过50%。同时，可再生能源在能源消费中的占比将持续提升，到“十四五”末，预计可再生能源在全社会用电量增量中的比重将达到三分之二左右，在一次能源消费增量中的比重将超过50%，可再生能源将从原来能源电力消费的增量补充，变为能源电力消费增量的主体。

李创军说，“十四五”期间将进一步发挥市场在可再生能源资源配置中的决定性作用，通过加快构建以新能源为主体的新型电力系统提升新能源消纳和存储能力，既实现可再生能源大规模开发，也实现高水平的消纳利用，更加有力的保障电力可靠稳定供应，实现高质量跃升发展。

4. 全国政协委员，四川省地矿局党委书记、局长王建明

加快推进地热能资源详查，开展大比例尺中深部地热资源和浅层地热能“一县一策”的调查、勘查、评价工作，进一步查明全国地热资源量，划分地热资源开发利用适宜区。在地热资源开发潜力区，制定地热资源开发利用规划并统筹纳入各级国土空间规划，建立地热资源监测网，推动地热资源开发利用。同时，加强地热能产学研用协同攻关，建成以地热能为主的新能源功能系统示范工程，打造地热能浅-中-深梯级综合利用及多种清洁能源互补、分布式新能源智慧供给一体化的新能源技术群攻关高地，形成具有推广价值、示范效应的资源高效开发与循环利用集成技术模式。

5. 全国政协委员、正泰集团董事长南存辉

推进审批制度改革，简化审批程序，并明确地热利用的财政及税费支持政策，如降低地热开发办证费用，取消水资源税，降低企业运营成本；考虑将地热能开发利用纳入到可再生能源基金补贴范围内，制定地热能项目的补贴政策，设立专项补贴基金，鼓励企业投建供暖等公共事业项目；为地热供暖企业争取政策性低息贷款，解决企业融资难问题，推动地热能的科学开发及规模化利用。

地热能源助力长沙融城医院打造“医养结合”节能典范

GEOTHERMAL ENERGY HELPS CHANGSHA RONGCHENG HOSPITAL TO CREATE AN ENERGY-SAVING MODEL OF "COMBINATION OF MEDICAL TREATMENT AND ENDOWMENT"

特约记者：马晓芳

作为长江中游地区重要的中心城市，星城长沙自古就是“楚汉名城”，不仅极具生活气息，也是颐养人群的集聚地。位于长沙南城生态动物园附近的融城医院，就是一家集医疗、养老康复为一体的综合医院，现有医疗床位 400 余张。日前，为响应国家节能减排的号召，降低医院的供暖制冷运行费用，长沙融城医院与恒有源科技发展集团合作，采用恒有源浅层地热能热泵环境系统为医院门诊综合大楼、职工食堂和体检康复中心供暖制冷、提供 24 小时生活热水。数据显示，该系统运行后，长沙融城医院每年将可节约超过百万的费用，更加节能环保，将强有力促进其打造“医养结合”和谐发展的医院。

长沙融城医院项目总建筑面积为 25740.78 ㎡，其中门诊综合大楼面积为 13400.38 ㎡，职工食堂面积为 754.80 ㎡，体检康复中心面积为 11585.60 ㎡，共设置 2 个冷热源集中机房。

采集井与环境和谐统一

“以人为本，以德为医，科学规范，和谐发展”是长沙融城医院坚持多年的办院理念。走在在长沙融城医院项目，你很难发现地热能采集井在哪里。原来，恒有源浅层地热能采集井采用暗井方式，成井后井口与普通市政井盖完全相同，保证了其设置不影响整个建筑物的总体布局，并能与周围环境和谐统一。

同时，该项目方案共设置 2 个机房，机房 1 设置在地下一层原空调机房，选用 2 台浅层地热能热泵和 1 台高温型浅层地热能热泵，满足门诊综合大楼和职工食堂的供暖制冷和生活热水的需求；机房 2 设置 2 个移动机房，设置在建筑外，选用 1 台高温型浅层地热能热泵，满足体检康复中心生活热水的需求，选用地能热宝机组满足体检康复中心供暖制冷的需求。

夏季在制取生活热水同时制冷

长沙融城医院项目机房 1 方案能量提升系统共选用 2 台 YSSR-700A 浅层地热能热泵和 1 台 YSSR-60B/S 高温型浅层地热能热泵。冬季开 1 台 YSSR-700A 浅层地热能热泵满足建筑冬季供暖的需求。夏季开 2 台 YSSR-700A 浅层地热能热泵满足建筑夏季制冷的需求。1 台 YSSR-60B/S 高温型浅层地热能热泵结合热水箱满足全年生活热水需求，夏季可在制取生活热水的同时用于制冷。

机房 2 方案能量提升系统选用 1 台 YSSR-120B 高温型浅层地热能热泵，结合热水箱满足全年生活热水需求。暂定选用 230 套 3P 一拖二卧机 DNW-I-35+35D2 满足检康复中心供暖制冷的需求，具体数量形式可根据现场具体情况调整。

年节约费用超百万

效果好不好，数据是最有力的证据。据推算，仅从运行费用方面，长沙融城医院原系统年运行费用 357.29 万元，项目采用恒有源浅层地热能热泵环境系统进行供暖制冷和供应生活热水后，年运行总费用降为 236.82 万元，节能效益显著。

系统运行维护维修方面，长沙融城医院采用的恒有源浅层地热能热泵环境系统设备使用年限长、维修成本低。系统运行操控及稳定性方面，恒有源浅层地热能热泵环境系统控制操作简单，运行稳定安全可靠。节能环保方面，恒有源浅层地热能热泵环境系统是采用清洁浅层地能资源对建筑物供暖供冷，系统运行没有环境污染物排放避免了因采用其他方式采暖而向大气排放的烟尘、废气。

综合各方面因素，长沙融城医院项目采用恒有源浅层地热能热泵环境系统作为建筑供暖、制冷、制热水系统是可行的最佳选择。

表 1 原系统与新系统运行成本对比表

	单位	原系统	新系统
年供暖、制冷运行电费	万元 / 年	218.49	139.74
年制取热水电费	万元 / 年		15.08
年运行维保费	万元 / 年	40.8	20
年运行人工费	万元 / 年	18	12
设备折旧	万元 / 年	80	50
年运行费合计	万元 / 年	357.29	236.82

浅层地热能优势多

浅层地热能（热）是指在地下 200 米以内、温度在 25°C以下、可再生的低品位热能，利用热泵技术搬运浅层地热能为建筑物供暖，让浅层地热能成为建筑物供暖的替代能源，实现浅层浅层地热能无燃烧为建筑物智慧供暖。浅层地热能与其他可再生能源相比，具有如下特点：

（1）持续供给：浅层地热能的来源和保持主要由于太阳和地芯热的共同作用，温度恒定；

（2）即用即采：按需进行能量采集，为建筑物的供暖需求提供稳定可靠的热源；

（3）天然蓄能：在地下一定深度的岩土体中天然蓄能，就近用能，节约能源运输成本和使用成本；

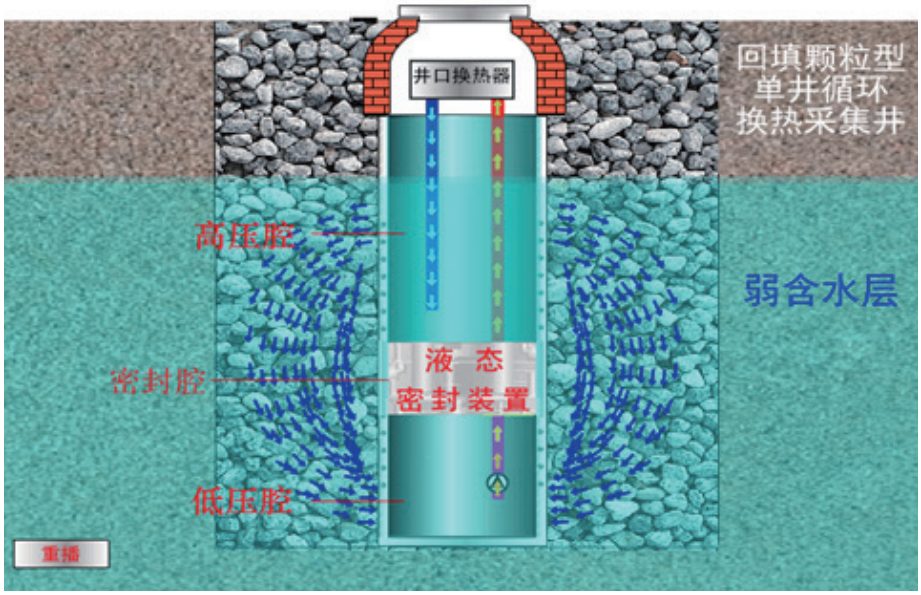
（4）替代能源：在设计合理、施工质量保证的前提下，比用传统化石能源燃烧供暖更安全、可靠。

据自然资源部中国地质调查局 2015 年调查评价结果，全国 336 个地级以上城市浅层地热能年可开采资源量折合 7 亿吨标准煤；全国水热型地热资源量折合 1.25 万亿吨标准煤，年可开采资源量折合 19 亿吨标准煤；埋深在 3000-10000 米的干热岩资源量折合 856 万亿吨标准煤，资源潜力巨大。

浅层地热能无燃烧供暖是将热泵系统与大地中浅层浅层地热能相结合起来的，是一种集供暖制冷提供生活热水于一体的绿色、高效、节能的调温系统。同时也是一种以地球浅表层蕴藏的浅层浅层地热能为低品位热能，通过输入少量的高品位能源（如电能），实现低品位热能向高品位热能的转移，改变温度，进而实现冬季供暖、夏季制冷及常年提供生活热水的目的。

浅层浅层地热能作为热泵供暖的热源，即把浅层地热能中的热量“取”出来，提高温度后，传递给室内房间，同时热泵主机消耗电能产生的热量也同样传递给室内房间，也就是说，浅层地热能热泵消耗 1kW 的能量，可以得到 4kW 以上的热量。

今年两会，有人大代表提交《关于加快发展我国南方百城供暖市场的建议》。南方百城是指我国淮河以南到长江沿线的“夏热冬冷”地区，包括上海、武汉、重庆等 101 个城市。“发展南方供暖市场”已经由一般性的呼吁发展成为具有可操作性的方案。中国节能环保集团党委书记、董事长宋鑫说，随着生活质量的提高，人们对幸福生活的追求也不断提升。现在南方也有了冬季供暖的需求。但我们大家都知道，如果采用传统的烧煤供暖，会出现雾霾；如果都用天然气，会出现气荒；直接用电费用太高。因此，清洁能源的推广势在必行。



毫无疑问，恒有源科技发展集团有限公司打造的长沙融城医院项目也必将成为南方城市浅层地热能供暖应用的典型案例。

浅层地热能热泵环境系统学校工程案例

SCHOOL PROJECT CASES OF SHALLOW GEOTHERMAL ENERGY HEAT PUMP ENVIRONMENTAL SYSTEM

作者：孙骥

学校是人员相对集中的场所，其内部建筑物的功能也比较多样。通常包括：教室、办公室、实验室、食堂、宿舍、浴室、图书馆、礼堂、体操馆、游泳馆、冰球馆等。对室内空气的温度、湿度、流速、新风的换气率等都有很严格的要求。供应的热水的流量和温度也必须满足规范。可以说，学校的供暖冷系统涉及了空调领域的大多数门类。对系统运行的安全性、可靠性和环保性能也有较高的要求。

恒有源科技发展集团有限公司从 2000 年起承接学校的供暖冷工程，至今已有 20 多年的历史。虽然在公司的总工程量 2000 多万平方米的大数字下，学校类的工程量并不占有很大的比重，但公司从内部管理上特别强调学校工程的特殊性。对于学校工程，从设计理念到施工组织，直到调试验收无一不体现以人为本的宗旨。学校的工程一定是最安全的工程，也必须是节能环保的典范。我们要让莘莘学子们进入校园的第一天，在参观学校的时候就能体会到自己的学校因为采用了恒有源公司的技术和产品，正在为碳达峰和碳中和努力奉献着。

公司以浅层地能作为供暖的替代能源，供暖期间可节约常规能源 1/2~3/4。制冷期间以地下岩土体为介质实现季节储能减少制冷能耗 1/4~1/2。在设计理念上，公司坚持因“地”制宜的原则，大力推广单井循环换热地能采集技术，执行 DB11/T 935« 单井循环换热地能采集井工程技术规范 »；在地下岩土体热物性适合的条件下，采用地埋管换热技术，执行本公司和国家的相应标准。

恒有源科技发展集团有限公司从创建伊始就致力于地下温度场的研究和岩土体热物性测试。地能采集和换热技术已达到国际领先水平。可以确保要冷有冷，要热有热，不消耗地下水，不污染地下水，节能环保。

以下介绍公司的几个学校工程的案例。

1、北京市海淀外国语实验学校

北京市海淀外国语实验学校位于北京市海淀区，总占地面积350 亩，总建筑面积超过 10 万平米，有在校学生和教职员工 6000多人。

该项目是应用恒有源地能热泵环境系统的第一个学校项目，于2000 年开始建设，采用 16 个分布式冷热源系统，包括教学楼、实验楼、体育馆、游泳馆、图书馆、宿舍、食堂等各类建筑 16 栋，已经稳定运行了 20 多年。

20 年以前像这样大规模的采用浅层地能无燃烧供暖冷的成功案例还十分罕见。海淀外国语实验学校运行以后引来的参观者络绎不绝。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可靠不可靠，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。

经过多年实际运行，该项目冬季供热和热水耗电量为 37.92kW•h/㎡，折合 18.53 元 / ㎡，较北京市执行的居民供热价格 30 元 / ㎡节约 38.23%；考虑夏季制冷与热水能耗 14.74 kW•h/ ㎡，全年供热、制冷和提供生活热水总耗电量为 52.66kW•h/ ㎡，全年运行费用仅为 25.72 元 / ㎡（151 天供热，100 天制冷，200 天热水，365 天泳池加热），经济效益显著。

2、北京市海淀外国语实验学校原乡校区

北京市海淀外国语实验学校原乡校区冷热源机房

北京市海淀外国语实验学校原乡校区坐落于北京延庆古崖居西侧的奥伦达部落原乡，是一所设施完善、崇尚绿色生态、崇尚体育运动的田园式国际学校。原乡校区占地 660 亩，可容纳 5000 余名学生和教职工同时生活、学习。原乡校区分三期规划实施：一期 6 万平米已经建成投入使用，二期 8 万平米于 2021 年正式投入使用。校内包含教学楼、办公楼、科研中心、艺术学院、剧场、教职工食堂、学生公寓、教师公寓、室内运动场馆（综合体育中心、乒羽中心、冰雪运动中心、游泳馆、网球馆等）。采用恒有源分布式冷热源系统，一期共设置 4 个冷热源机房，二期设置 3 个冷热源机房，满足了全部供暖、制冷及全年生活热水的需求，实现了使用区域清洁能源无燃烧全覆盖，降低系统运行成本的同时，保护了生态环境。

3、中关村三小北校区

中关村三小北校区冷热源机房

中关村三小北校区项目位于北京市海淀区万柳中路，总建筑面积 45952 ㎡。

采用以单井循环换热地能采集井为核心技术的恒有源地能热泵环境系统有效解决了采暖、制冷、生活热水的需求。系统共配置 4 台地能热泵机组和 12 口恒有源地能采集井。

该项目位于北京市地下水水源保护区内，对地下水保护有严格的规定。北京市水务局对项目的审批十分慎重，召集院士、学科专家、国务院参事等对此项目进行论证。专家们仔细研究了恒有源公司的技术和产品，确认了它对于地下水和地质结构的安全性。水务局最终批复同意并要求投入运行后相关运行监测数据向社会公开。

项目于2014年10月开工建设，于2015年9月竣工验收，使用效果良好。2015 开始运行至今，相关运行监测数据由互联网向社会公开。接受社会各界监督。根据项目对地下水监测数据显示，系统循环水除进出水温度随运行工况周期变化以外，对地下水水质没有影响。完全达到了评审专家的各项要求。

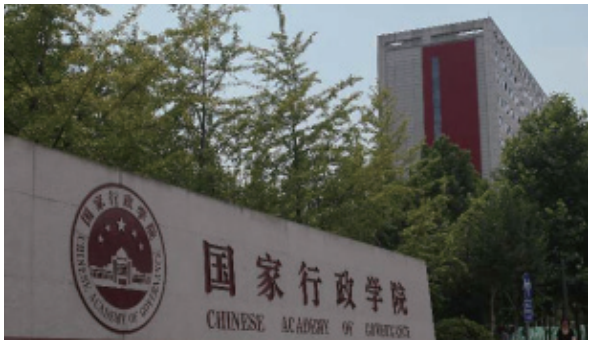
运行数据显示，平均冬季供暖成本为 13.03 元 / 平方米，较北京市执行的居民供热价格 30 元 / ㎡节约 56.56%。

4、北京市信息管理学校（清河校区）

北京市信息管理学校（清河校区）位于海淀区清河龙岗路，占地面积 58 亩，总建筑面积 42573 平方米，包含教学办公楼、培训楼、宿舍、食堂及体育馆等。

项目建设区位于永定河冲积扇中部平原西北边缘，第四系以粘土、细砂为主。岩土体热物性测试表明该建设区场地地层密实度好，沉积物整体含水量高，地层导热性好，但渗透系数很低，地下水流动换热过程受限。经过反复对比分析和使用计算机软件模拟，决定采用垂直地埋管换热地源热泵系统作为空调冷热源。共设 674 个深度为 80 米的垂直地埋管换热器，机房内安装 3 台地能热泵机组，满足项目冬季供暖、夏季制冷及全年生活热水需求，运行效果良好。项目建设为海淀区可再生能源示范项目，是海淀区应用垂直地埋管换热地源热泵系统的典型案例。

5、国家行政学院港澳公务员培训中心



国家行政学院港澳公务员培训中心冷热源机房

国家行政学院港澳公务员培训中心项目位于北京市海淀区，总建筑面积为 43000 ㎡，包含涉外培训楼、综合体育馆（游泳馆、网球馆、羽毛球馆及乒乓球馆等）等建筑。要求满足冬季供暖、夏季制冷、常年热水和泳池加热需求。项目原采用传统的燃气锅炉和电制冷系统作为冷热源，运行能耗高、污染大。

2012 年恒有源公司应邀对上述系统进行改造，采用公司的地能热泵环境系统完全替代了原有的燃气锅炉和电制冷系统。共设置 14 口无蓄能颗粒单井循环换热地能采集井和 6 台 HD660B 地能热泵机组。采用热回收技术，在夏季利用空调制冷排出的热量回收加热游泳池水和生活热水。节省了运行费用。项目于 2012 年 10 月改造完成并正式投入运行。

项目改造前，每年的费用为 545 万元，利用恒有源地能热泵环境系统改造后，每年的费用为 228 万元，节约比例达 58%。

6、獐子岛长海四中

长海四中位于大连市獐子岛镇，于 1993 年投入使用。学校占地面积 15000 平方米，建筑面积 4949 平方米。

项目原采用燃煤锅炉冬季供暖。由于地处海岛上，燃煤需要由外地运输至岛上，成本较高。另一方面，燃烧后的炉渣无处堆放，造成占地和区域污染影响居民的渔业生计。恒有源公司应邀对项目进行无燃烧无排放的清洁可再生能源供暖技术改造。根据当地资源情况决定采用海水源热泵系统替代了原有的燃煤锅炉系统。由于项目处于寒冷地区，冬季海水温度最低只有 3-5°C，项目设计时采用了高效换热器，保证在海水较低温度时的换热效率和换热量。针对海水腐蚀性较高的特点，系统设计时采用多重防腐措施，包括防腐换热器、防腐材料管道及配件等，保证系统使用寿命。系统改造完成后，既避免了燃煤运输和炉渣处理，实现了区域内无污染、无排放，又降低了供暖系统的运行费用，带来了很好的环境效益和经济效益。

7、北京大学环境科学与工程学院教学科研大楼

北京大学环境科学与工程学院教学科研大楼
冷热源机房

北京大学环境科学与工程学院的教学科研大楼坐落于北京大学主校区的东北部成府园内，占地面积 6521 平方米，为地上五层、地下三层，总建筑面积 20500 平方米。地源热泵系统包括 6 套（4 用 2 备）恒有源 350kW 单井循环换热地能采集井、2 台 YSSR-600B/2 地源热泵螺杆机组、13 台 DNV-I-280A/W 地能热宝多联机机组。其中地源热泵螺杆机组为楼内办公区域房间供冷 / 暖；地能热宝多联机机组常年为楼内实验室房间供冷 / 暖保持恒温。

恒有源地源热泵系统冬季供暖的主要能源是免费的浅层地能，夏季可以低成本地获得冷量，为学院节约了大量的传统能源消耗。根据 2018-2020 三年运行数据统计，夏季制冷每年可节约电能 13.5 万度，折合发电用煤约 45 吨，冬季替代传统燃煤锅炉供暖每年可节约燃煤近 180 吨。环境效益方面，从污染物减排效益和货币化环境效益两个方面考虑，每年可减排二氧化碳 410 吨、二氧化硫 3 吨、氮氧化物 6 吨及粉尘 113 吨，由于节能减排带来的总货币化环境效益达 431 万元。

8、山西省农业科学院科研创新基地


机房内热泵主机

山西省农业科学院科研创新基地总建筑面积超过 14 万㎡，包含研究生院、生物工程技术中心、试验研究中心及学术交流中心等。项目建筑规模大，冷热源系统容量和负荷率高。由于农业科研的特殊性，对冷热源系统的可靠性，污染物排放指标等都有很严格的要求。山西省农科院经过反复对比和专家论证，决定利用浅层地热能作为供暖冷的主要能源，采用恒有源地能热泵环境系统满足全部的冬季供暖、夏季制冷和全年生活热水需求。

热泵主机冬季供暖最大供热功率为 10736kW, 夏季制冷最大供冷功率为 10874kW。通过合理规划、优化设计使多井群的地能采集井系统科学有效配置。全系统高效稳定运行，能效比很高。因为是无燃烧供暖制冷，没有任何污染物排放。

运行数据显示，项目冬季供暖能耗为每供暖季 28 度电 / 平米，夏季制冷能耗为每制冷季 8 度电 / 平米。全年的运行能耗费用仅为 25.2 元。全年供暖冷费用较太原市市政单独供暖收费标准 37.5 元 / 平米还低 30%。

9、北方交通大学附属中学

北方交通大学附属中学综合楼总建筑面积 20370 平方米，建筑物包括培训中心、餐厅、办公及游泳馆和篮球馆等，建筑用能需求比较多样，既需要常规的冬季供暖和夏季制冷，又需要全年提供生活热水和泳池加热维温等。冷热源系统设计采用恒有源地能热泵环境系统，充分发挥该系统一机多用的优势。经过简单的切换操作，同一机组既可以用来供暖又可以用来制冷。

热泵主机冬季最大供热功率为 1669kW, 夏季最大制冷功率为 1478kW。根据项目运行能耗统计，冬季供暖能耗为每供暖季 22 度电 / 平米，夏季制冷能耗为每制冷季 12 度电 / 平米，节能效果显著。

除上述典型学校类工程之外，恒有源科技发展集团有限公司还承建了专业的培训中心类工程。如运动员培训中心、飞行员培训中心、和登月工程的生态系统实验装置等。这些项目的专业性更强，技术难度更大。恒有源公司依靠业内专家的支持和自身在地能采集换热应用领域方面的领先优势，都取得了良好的效果。

"CLEAN HEATING" THE MISSION AND OPPORTUNITY ENTRUSTED BY THE TIMES

Written by: Wu Desheng, Xu Shengheng

Among the eight national priority tasks in 2021 endorsed by the Central Economic Work Conference, carbon reduction and carbon peak is highlighted. This is what the Company has been looking forward to for 20 years since its establishment. In terms of carbon peak and carbon neutrality, the Central Government has made arrangements from the root and source, Via accelerating the adjustment and optimization of industrial structure and energy structure, vigorously developing new energy sources, and continuing to fight a tough battle against pollution. Moreover, the conference has made it clear that China's carbon dioxide emission reduction will peak by 2030 and efforts will be made to achieve carbon neutrality by 2060.

The national strive to achieve carbon peak and carbon neutrality brings in unprecedented development opportunity of high-speed growth for the Company.

The key to rational utilization of resources, sufficient supply of heating, and reduction in unnecessary energy consumption is to align energy types with temperature needed and local availability. In addition, it is equally important to increase the proportion of "clean heating", reduce the scattered combustion of traditional energy and enhance the affordability of residents.

I. Plan the Industry and Seize the Opportunity

(i) From the perspective of renewable energy heating, HYY Group is engaged in clean heating with shallow geothermal energy.

(ii) In terms of clean heating, HYY Group promotes a shallow geothermal energy clean heating system, which is a clean heating system in which electric energy transport shallow geothermal energy (low temperature, low grade) and upgrade it to replace traditional combustion-based heating.

(iii) The working principle of the clean heating system of shallow geothermal energy is: the electrically driven heat pump is used to transport free low-grade shallow geothermal energy (low-temperature heat energy) and generate heating equivalent to 3 times of electric power consumed Through the physical change of the system without combustion, more than 3 portions of electric energy are obtained for direct heating, thus providing efficient and clean heating for buildings. The

same system, working reversely can provide cooling to buildings in summer.

(iv) Clean heating by shallow geothermal energy has eight advantages: 1. It is conducive to overall planning and management. 2. It is conducive to the convergence of systems, mechanisms, and policies, and easy adaption to local conditions to eliminate waste. 3. It is conducive to overcome the shortcomings of energy supply and high cost. It can ensure the profitability of clean heating enterprises and the affordability of users at the same time. 4. It is conducive to the improvement of technical supportability. 5. It is conducive to the innovation of business models and fundamental reversing the situation that returns of investment and operation depend on subsidies. 6. It is conducive to alleviating the contradiction between low building energy conservation levels and heating costs. 7. It is conducive to the popularization of clean heating methods and improvement of the national scientific and technological literacy. 8. It is conducive to improving the relationship between cadres and masses with a very positive understanding of clean heating methods.

The development of shallow geothermal energy clean heating industry will fundamentally build an energy-saving heating network with Chinese characteristics and supported by the safest electric energy network to efficiently transport shallow geothermal energy for clean heating according to local conditions. The cost of integrated development of heating and cooling via shallow geothermal energy clean heating system is definitely within the easy affordability of residents.

II. Harmonious coexistence between man and nature and improvement of people's quality of life are our goals

For many years, the development of HYY Group has focused on shallow geothermal energy as clean heating instead of burning traditional energy, because heating is a necessity in North China. Today, for carbon peak in the consumption of heating energy, there are consistent basic data for statistics, analysis, reference, and comparison.

To develop the clean heating industry, the enterprise first needs to determine the heating area in North China. At present, it is not that there are no reference materials, but that there are too many materials and they differ greatly from each other. At present, the data of the article are mainly from "the Paper on Clean Heating Plan for Winter in North China" (2017-2021). The paper has been "reported to the State Council for approval" and it was released in 2017.

According to the paper, the total heating area in North China is calculated at 20.6 billion square meters, of which about 3.5 billion square meters have been heated with clean energy and about 7 billion square meters have been heated by cogeneration of large boilers. The 10.5 billion square meters seem to be temporarily excluded from the range are where shallow geothermal energy may be used for heating in the near future. As only 20% of shallow geothermal energy is used for clean heating, the heating area in North China is more than 4.1 billion square meters. The results of achieving clean heating with shallow geothermal energy are

basically as follows: 1. Under the condition that the same heating amount is 402.5 billion kW•h, 2. Direct heating with electric energy requires power distribution of 247 million kW and 402.5 billion kW•h of electricity; 3. Shallow geothermal energy clean heating needs a power distribution of 82 million kW, which is 165 million kW less than electric heating, and requires electricity of 134.2 billion kW•h; 4. Clean heating with shallow geothermal energy saves 268.3 billion kW•h of electricity compared with direct electric heating. 5. Assuming that all the electricity used is thermal power, 1) 85 million tons of standard coal can be saved; 2) 205 million tons of carbon dioxide can be reduced.

In 2020, China's carbon emission reduction is targeted at 1.79 billion tons. If the above clean heating scheme is realized, the contribution rate of shallow geothermal clean heating to carbon emission reduction will exceed 10%, and it can become an important support for the early realization of carbon peak.

Expert Introduction

Wu Desheng, Born in 1939 in Changzhou, Jiangsu. Member of the Chinese Communist Party. Was attending Tsinghua University from 1957 to 1963 and graduated with a degree in civil engineering. He is engaged in architectural design work, with the title of professor-level engineer. He worked at Beijing Institute of Architectural Design Co., Ltd, serving consecutively as an engineer, engineer in charge, chief engineer, dean, dean and the secretary of the communist party at BIAD, and retired and appointed as the consultant chief engineer in 2003.

Mr. Wu has participated in many engineering designs and scientific research projects led the formulation and application of 2008 Olympic Games venue planning and design documents. He was also in the position of the deputy commander in chief of large public buildings such as the Terminal 2 of Beijing Capital International Airport, Beijing Oriental Plaza, and the National Centre for the Performing Arts.

He also served as a member or director of the Education Steering Committee, Evaluation Committee, and Accreditation Committee of Higher Schools,

Mr. Wu was also in the leadership positions in professional societies, associations and guest professors in colleges and universities.

He has honored with the National May 1st Labor Prize and receives the special allowance of the Chinese State Council.

Mr. Wu Desheng is currently the deputy director of the HVAC Professional Committee of the Architectural Society of China, the deputy director of the Chinese Association of Refrigeration, and former director of the Civil Engineering & Architectural Society of Beijing.

CLEAN HEATING RATE IN NORTH CHINA TO REACH 70%

—— Government Work Report Defines Schedule for Clean Heating Transformation

Written by: Ma Xiaofang

Heating in northern China is a cause related to the national economy and people's livelihood. Promoting clean heating in winter in northern China is also an important part of China's energy consumption revolution. This year's government work report clearly stated that "the clean heating rate in northern China should reach 70%", which set a clear timetable for the renovation of clean heating. At the same time, that was the third time that the clean heating issue had been written into the government work report in five years after 2017 and 2019. During the Two Sessions this year, many NPC deputies and CPPCC National Committee members also actively made suggestions on clean heating in northern China.

China makes positive progress in clean heating

The government work report's planning for energy and environmental protection has also prompted the northern regions to continuously increase the rate of clean heating. With the country's continuous promotion, China's clean heating efforts have made positive progress. According to data released by the Ministry of Ecology and Environment, by the end of 2020, China's 2+26 cities and the Fenwei Plain will have completed the replacement of scattered coal in about 25 million households, equivalent to a reduction of 50 to 60 million tons of scattered coal. The clean heating rate in China's northern regions has now reached 65%, according to public reports.

"The goal of the first generation of environmentalists to pursue the goal of no coal burning in the Capital has been achieved in our generation." Liu Bingjiang, Director of the Department of Atmospheric Environment at the Ministry of Ecology and Environment, said in a media interview that the odor of burning coal is now basically not smelt in Beijing and its corridor cities, giving a sense of pride. He pointed out that no matter how many difficulties and contradictions we face, the country will unswervingly promote clean heating because it is a significant measure to solve air pollution and can achieve multiple wins in terms of economic and social environmental benefits.

At the same time, thanks to the substantial improvement of economic development level and people's living standards, in recent years, the heating demand of people in South China is increasing day by day. Studies have

shown that by 2030, the potential heating households in 133 cities in South China are expected to reach 32.46-65.77 million. At present, more than 90% of urban households have household heating equipment, and Hefei, Wuhan, Guiyang and other cities have practiced central heating in some urban areas.

Shallow geothermal energy helps clean heating transformation in North China

According to this year's government work report, it is essential to enhance green development and harmonious coexistence between man and nature, accelerate the green transformation of development mode, jointly promote high-quality economic development and high-level protection of ecological environment, reduce energy consumption per unit of GDP and carbon dioxide emissions by 13.5% and 18% respectively, consolidate the achievements of defending blue sky, clear water and pure land, promote the green transformation of production and lifestyle, optimize the industrial structure and energy structure and vigorously develop new energy sources.

Geothermal heating is a way to utilize geothermal resources and use heat exchange system to extract heat from geothermal resources and supply heat to users. Today's theory and a large number of large-scale practices have proved that shallow geothermal energy is the first choice as an alternative energy source for heating in North China. With no combustion and zero-emission, it heats the physical change process of buildings, and the cost is lower than that of burning coal, making it an alternative to heating energy in North China. At present, shallow geothermal energy heating has formed the most reasonable industrial chain of energy production and consumption for heating in North China in the new era: Power generation close to the energy-producing producing area for the lowest cost of environmental governance; the power transmission and transformation technology for power transportation is mature and reliable; the standard power distribution of buildings can meet the needs of shallow geothermal heating systems.

After years of development, shallow geothermal energy heating has been used in many rural areas in North China, bringing an eco-friendly and comfortable "warm" winter to many local people. Geothermal energy, characteristic of large reserves, wide distribution, cleanness, eco-friendliness, stability and reliability. Geothermal resources are abundant in North China, and can be used as centralized or decentralized heating sources according to local conditions, and shallow geothermal energy heating can be vigorously developed. According to the method of "adjustment of measures to local conditions, intensive development, strengthened supervision and attention to environmental protection", the popularization and application of various shallow geothermal energy utilization technologies shall be accelerated and replace scattered coal heating economically and efficiently.

Chinese Peasants and Workers Democratic Party: Prepare the Medium-and Long-Term Plan for Clean Heating in Rural Areas in North China and Formulate a Sustainable Support Scheme for Clean Energy and Heat Source

Clean heating in rural areas in North China is one of the significant measures to win the blue sky defense war in China, and it is also an important concern of the Chinese Peasants and Workers Democratic Party at the Two Sessions this year. According to the proposal of the sector group of Chinese Peasants and Workers Democratic Party, it is essential to prepare a medium-and long-term plan for clean heating in northern rural areas for 5 to 15 years, establish a long-term mechanism, formulate a sustainable support scheme for clean energy and heat source, study stable and lasting financial policies for clean heating, formulate safety standards for various clean heating equipment, pipelines and pollutant emission standards to ensure the long-term smooth progress of clean heating in rural areas in North China.

There are still many problems in rural clean heating

With the promotion of "coal to gas" and "coal to electricity" in North China, the rural living environment has been noticeably improved after clean heating. However, as the work carries on, especially with the gradual withdrawal of government subsidies, the possibility of "re-burning of scattered coal" in some heavily polluted areas with heavy financial burden is extremely high, which brings uncertainty to the reduction of air pollution in northern areas in winter. The proposal of the sector group of Chinese Peasants and Workers Democratic Party pointed out that there is a lack of medium and long-term coordinated construction of clean heating in rural areas in North China. At present, the promotion of this work mainly depends on administrative means, and there is still a "one-size-fits-all" phenomenon in some places to complete the hard tasks of superiors. Although the Winter Clean Heating Plan for North China (2017-2021) emphasizes that both "clean heating" and "warm winter" should be emphasized, the plan will expire in the near future, and the follow-up policies and related operational guarantee issues need medium and long-term planning support.

Relevant infrastructure in rural areas is backward. The proposal points out that the construction of power grids and natural gas pipelines in rural areas is relatively lagging behind, and there may be unstable supply

during the peak period of electricity and gas consumption in the heating season. Most buildings in rural areas are built by villagers with a brick-concrete structure, which has a poor thermal insulation performance and is not conducive to energy conservation, and the operation and maintenance guarantee mechanism has not yet been established. Most areas have not established a clean heating responsibility system and working mechanism, and the maintenance of gas supply and power supply equipment for "coal to gas" and "coal to electricity" has not been implemented to the responsible person. The emergency repair force to deal with emergencies needs to be reserved, and there are many potential safety hazards.

The proposal of the sector group of Chinese Peasants and Workers Democratic Party highlights that the cost of clean heating is higher than that of coal-fired heating, and once government subsidies are withdrawn, some rural households may find it difficult to afford. According to statistics, the total cost of heating with scattered coal during the heating season is about 900-1800 yuan/year, which is only 1/3 to 1/4 of the cost of clean heating. The promotion of clean heating projects requires government subsidies, which are difficult to sustain with local finances, and once the subsidies are withdrawn, rural households will find it difficult to afford the higher cost of clean heating. Some research shows that if government subsidies were withdrawn, 34% of farmers said they would use coal completely; 43% would use coal partially; and only 23% would continue with the clean heating practice.

Study the policy of rewards in lieu of subsidies in implementation of emission reduction of atmospheric pollution

To this end, the proposal of the sector group of Chinese Peasants and Workers Democratic Party suggests promoting the energy-saving renovation of rural buildings. Establish and promote an incentive mechanism for the energy-saving work of rural villagers' residential buildings, increase financial investment and steadily promote the energy-saving renovation of existing buildings; give priority to the energy-saving renovation of existing rural schools, kindergartens, hospitals, apartments for the elderly, welfare homes and other densely populated public buildings. Develop energy-saving standards for new rural buildings; encourage villagers to renovate the walls, roofs, doors and windows, floor slabs, floors and other residential enclosing structures of their houses to reduce heat loss in heating.

It is also recommended to strengthen the construction of rural pipe network infrastructure and enhance the ability to guarantee operation and maintenance services, work with relevant departments for development and reform, electricity, gas and quality inspection, strengthen the renovation of power grids and gas pipeline infrastructure in rural areas to ensure a stable supply of electricity and gas during the heating season. Clarify the responsibility

of enterprises for the operation and maintenance of renovated equipment and quality assurance, establish a maintenance mechanism at the district/county and township levels, deploy maintenance staff based in towns and even villages, regularly identify pipeline safety hazards and eliminate potential risks. Study the implementation of a policy of rewards in lieu of subsidies in air pollution reduction. Following the principles of user affordability, government support and operational sustainability, the environmental benefits achieved by clean heating will be consolidated through incentive-based subsidies and other emission reduction policies. For substitution of coal with electricity, it is regarded as zero-emission of air pollutants; for substitution of coal with gas, it is regarded as zero emission of SO2 and particulate matters. It is necessary to account for the benefits of NOx and VOCs emission reduction, establish standards for rewards in lieu of subsidies in the control of major air pollutants, formulate corresponding policies, and set up special incentive funds to reward farmers.

Song Xin, Member of the National Committee of the CPPCC and Chairman of China Energy Conservation and Environmental Protection Group:

Building a Multi-win and Long-term Mechanism to Promote the Sustainable Development of Clean Heating

As a member of the National Committee of the CPPCC in the environmental protection energy industry, Song Xin, Chairman of China Energy Conservation and Environmental Protection Group, has been paying close attention to the development of energy conservation and environmental protection. At this year's Two Sessions, he submitted a number of proposals, focusing on establishing a sustainable development mechanism for clean heating, promoting carbon peak and carbon neutrality strategies, and strengthening the comprehensive utilization of bulk industrial solid wastes. He believes that the establishment of a long-term win-

win mechanism is the key to the long-term sustainability of clean heating at the user side.

For North China, an effective means to improve the environment is to adopt clean heating. Driven by policies such as carbon peak, clean heating is bound to usher in great changes in energy consumption mode and energy structure. Clean heating renovation funds mainly come from three aspects: Central financial rewards and subsidies for pilot cities, local financial subsidy funds and social capital investment. Song Xin believes that there is a lack of a win-win long-term financial mechanism to achieve sustainable clean heating in North China, and the energy efficiency level of existing buildings is low, which makes it difficult to meet the requirements of building energy conservation.

Song Xin points out that the low proportion of clean heating in North China is mainly reflected in the vast rural areas where the cost of gas is high and the heating effect is poor, especially in cold areas where the heating time is long in winter, and rural residents cannot afford the high cost. At the same time, the source supply is insufficient, and the responsibility for the heating maintenance of natural gas in the later period is not clear, which often leads to stoppage of heating due to equipment problems. In some areas, when the natural gas pipeline has not been connected or is unstable, the "one-size-fits-all" promotion of coal to gas has forced the masses to give up scattered coal, which has also brought great troubles to rural residents.

To this end, Song Xin suggests actively exploring a long-term win-win mechanism. In view of the problems that the clean heating market depends on the government, the profit level is low, and the market enthusiasm is not high, according to the actual situation in various places, the applicable clean heating technology is selected, the corresponding technical guidelines are compiled, and the heating planning is optimized. At the same time, local heating enterprises, investment and financing enterprises, heat users, etc. are guided to actively participate in clean heating projects, explore new multi-win mechanisms, and activate market potentials. In addition, renewable energy sources such as solar energy and wind energy should be utilized according to local conditions, and clean heating in North China should be promoted in combination with electric energy and natural gas.

He recommends the orderly promotion of energy-saving renovation of heat supply networks and energy efficiency improvement at heating ends. The performance assessment of heat supply networks in all places should be carried out urgently, and energy-saving renovation solutions that are most compatible with clean heating technology should be sought. Exploration of a new model in which the government, users and heat supply enterprises share costs and benefits should be encouraged - this will provide not only a technical guarantee for clean heating, but also a strong hardware support for the subsequent

full-scale launch of smart heating technology. Provinces and municipalities should be guided to vigorously promote energy-saving building renovation. Through measures such as improving policy guidance, promoting the application of new technologies, techniques and materials for energy conservation and environmental protection, and strengthening energy conservation supervision, we encourage and support the construction of star-rated green farmhouses and passive ultra-low energy farmhouses, and combine urban renewal initiatives to carry out large-scale energy-saving renovations to the walls, roofs, windows, doors, floors and other residential enclosing structures of existing houses.

Suggestions from Deputies and Members

The Proposal on Formulating the 14th Five-Year Plan for National Economic and Social Development and the Long-Term Goal for 2035 of the Fifth Plenary Session of the 19th CPC Central Committee put forward that "a green production mode and lifestyle should be widely formed, and carbon emissions should decline steadily after reaching the peak", including the goals of "carbon peak" in 2030 and "carbon neutrality" in 2060. "Carbon peak" and "carbon neutrality" have been written into the government work report for the first time this year, and "the clean heating rate in North China reaching 70%" has been also listed as a key task in the government work report. At the Two Sessions in 2021, the deputies and members discussed enthusiastically and made suggestions on "carbon peak", "carbon neutrality" and "clean heating in North China".

Han Feng:
Geothermal heating can be promoted in eligible areas

Han Feng, Deputy to the National People's Congress and General Manager of Sinopec's Safety Supervision Department, says that geothermal heating can also be promoted in areas where conditions permit. Han Feng points out that the industry supplying heat from middle and deep geothermal energy as a clean energy source, has relatively low profits due to its own public service attributes. He suggests intensifying fiscal and taxation policy support for geothermal clean heating projects and reducing and exempting resource taxes in geothermal development

and utilization industries; tax rebates will be introduced for geothermal heating, or measures such as levying taxes before returning and providing subsidies for clean energy projects will be taken to promote the sound development of the industry.

Pony Ma:
Promoting Technological Enterprises to Achieve Carbon Neutrality

Pony Ma, Deputy to the National People's Congress, Chairman and CEO of Tencent, suggests that promoting carbon neutrality is a positive manifestation of technology enterprises fulfilling their social responsibilities. He believes that the significance of promoting carbon neutrality in China's scientific and technological enterprises lies not only in their own energy conservation and emission reduction, but also in encouraging scientific and technological enterprises to strengthen technological research and development innovation. Taking carbon neutrality as an opportunity, China's low-carbon technology transformation is forced. On the one hand, efforts are concentrated on conquering low-carbon technologies such as the energy Internet and carbon capture, utilization and storage (CCUS) technology. On the other hand, through the combination with the industrial Internet, the economy and society will be promoted to develop in a low-carbon, green and circular direction.

At present, Chinese science and technology enterprises are facing multiple challenges such as policies and technologies to achieve carbon neutrality. In this regard, Pony Ma put forward a number of specific suggestions, including optimizing the layout of data centers, improving green electricity procurement channels, and encouraging enterprises to invest in renewable energy projects and distributed energy projects; building up carbon neutrality supporting infrastructure and promoting carbon neutrality marketization; accelerating the research and development of green technologies, promoting the innovative application of low-carbon technologies such as green data centers, and establishing a number of high-tech and energy-efficient "carbon neutrality data centers"; issuing guidance on carbon neutrality of science and technology enterprises, and encourage those enterprises to set up carbon neutrality commitments and targets.

Yang Yuanqing:
Science and Technology Empowers the Real Economy and Improves the Carbon Neutrality Capability of Enterprises

Yang Yuanqing, Deputy to the National People's Congress, Chairman and CEO of Lenovo Group, believes that by promoting the carbon neutrality route for electronic end products and the information and communication industry, it is possible to guide and drive the green transformation and sustainable development of the entire industrial chain, even upstream raw material suppliers. This is very realistic and important for enterprises to establish a green, low-carbon and circular development path and achieve high-quality green development of China's economy. Yang Yuanqing suggests that firstly, green and low-carbon regulations and standards should be improved; secondly, enterprises should be encouraged to formulate long-term low-carbon development strategies and carbon-neutral roadmaps; thirdly, big data information platforms should be used to promote green data verification and evaluation of industry enterprises; fourthly, source governance should be strengthened to drive low-carbon and green development of the supply chain.

Li Dongsheng:
Introducing Low Carbon Emission Reduction to the Information Disclosure Scope of Listed Companies

Li Dongsheng, Deputy to the National People's Congress and Founder of TCL, suggests introducing low-carbon emission reduction to the information disclosure scope of listed manufacturing enterprises. Li Dongsheng believes that domestic listed companies still have a lot to improve in terms of disclosure of carbon emission information. For example, there is a lack of clear laws and regulations, sufficient attention paid to this issue, and mandatory and normative requirements for information disclosure on low carbon emission reduction. In addition, there is a lack of sufficient social supervision.

Li Dongsheng suggests mandatory disclosure requirements for low-carbon emission reduction in enterprise information disclosure and management. At present, the information disclosure of enterprises, in addition to business information, has introduced the relevant information on corporate social responsibility this year, and low-carbon emission reduction will also become a part of corporate social responsibility in the future.

Additional Information

What is the Peak Value for the Country's "Carbon Emissions"?

During the Paris Climate Change Conference, the Chinese government announced that China has set a goal, which the nation would reach the peak of carbon emissions around the year 2030 and would try to reach this goal as soon as possible.

Ever since the conference, discussions were held between scholars, experts, and institutions. Due to the active efforts to conserve energy and emissions reductions in various industries, the scale of implementations of new technologies and types of new clean energies has become larger and larger. Therefore, the peak of carbon emissions may come earlier, and the estimated peak may also be decreasing constantly.

According to the Research Report on China's Carbon Peak Before 2030 released by the Global Internet Development Cooperation Organization in Beijing on March 18, 2021, at the “China Carbon Peak Carbon Neutrality Achievement Release and Seminar”, the entire society's carbon emissions in China will reach its peak in 2028, with a value of 10.9 billion tons. The value will drop to 10.2 billion tons in 2030.

ACHIEVING THE GOALS OF EMISSION PEAK AND CARBON NEUTRALITY CAN CREATE A GRAND PROSPECT FOR GEOTHERM IN CHINA

Written by: Zheng Keyan
（Geothermal Industry Working Committee）

China hopes to achieve the ambitious goals of emission peak by 2030 and carbon neutrality by 2060, and this year is the opening year of the "14th Five-Year" Plan; moreover, China has successfully bid for the World Geothermal Congress (WGC) to be held in China in 2023. Therefore, the task before the personnel nation-wide involving in geotherm is quite urgent, and the geotherm in China can and should make great strides.

1. Geothermal Advantages of Renewable Energy

The goal of emission peak and carbon neutrality, which is to bring down carbon, can only be achieved by renewable energy, with no other way. However, the intermittence and volatility of most renewable energy sources limits their ability to take on mainstream roles. Although the geothermal energy is not valued enough now, it is not possible to achieve the goals of emission peak by 2030 and carbon neutrality by 2060 (30/60 Goal) without geothermal energy.

To address the intermittency and volatility of solar and wind energy, the energy storage industry has gained significantly growth in recent years, but the

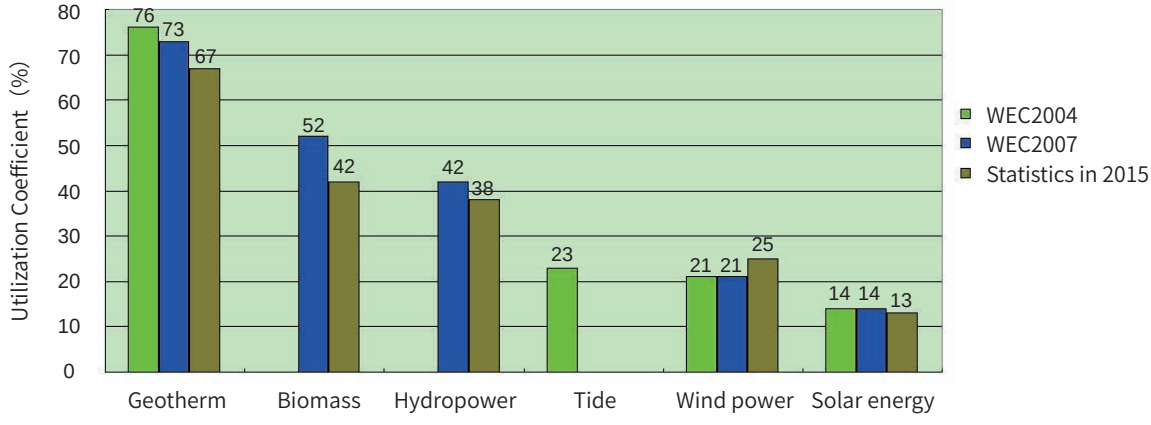


Figure 1: Comparison on the Utilization Coefficient of Various Renewable Energy Sources

road is rather long and it is not easy to solve the problems. The fire and explosion in the construction and commissioning of an energy storage power plant in Beijing's South Fourth Ring Road (the boundary of the capital's core area) on April 16 this spring, 15 fire stations, 47 fire-fighting trucks and 235 officers and men arrived to extinguish the open fire after 11 hours and 23 minutes.

To realize the goals of emission peak and carbon neutrality, China needs to rely on geothermal energy generation ultimately to guarantee grid stability. Denmark and Norway, which have never been ranked in the geothermal community in the world, have developed plans to develop geothermal energy for emission peak and carbon neutrality. So, China's geotherm will eventually come up in time, and the future of Chinese geothermal can certainly be wonderful and promising.

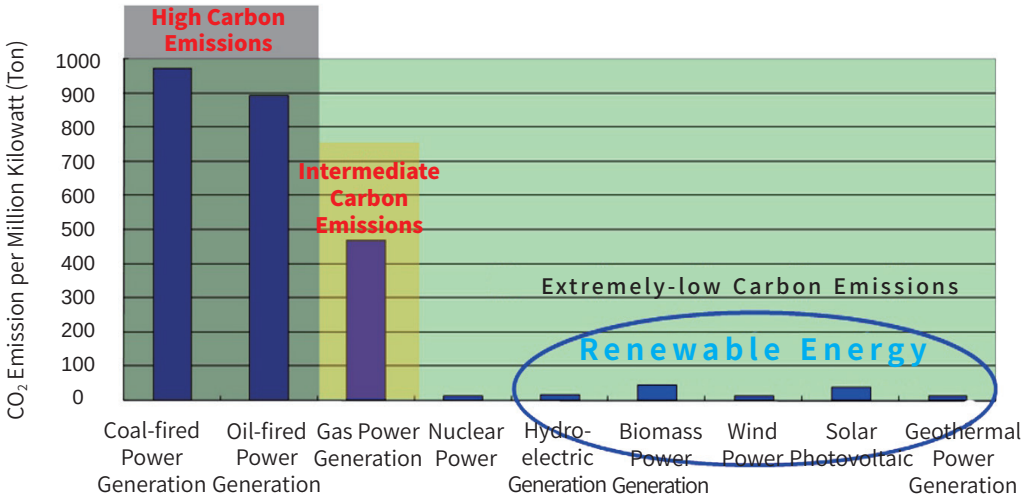


Figure 2: Comparison on Carbon Dioxide Emissions from Various Energy Sources

2. Good News is Not Enough

A bright future is never a free gift. Good news is not enough, and we need to act on it. Recently, there was some major news:

December 2020: The Ministry of Natural Resources will support the development of geothermal industry in four aspects (making clear of the resources, preparation of planning, transfer of mining rights and technical support). The "12th Five-Year Plan" and the "13th Five-Year Plan" have invested more than 1 billion yuan, China cannot stay forever in the stage of "making clear of the resources", how to take another substantial and effective step?

Two Sessions (the National People's Congress and the Chinese Political Consultative Conference (NPC and CPPCC)) in March 2021: several proposals from delegates and members regarding geothermal energy. Then, relevant departments might reply on a paper, which reads: the action has been taken. However, it is not possible to solve the problem with relevant legislation.

In March 2021, the NPC deliberated the 14th Five-Year Plan and the Outline of the 2035 Vision (Draft): The clean energy base refers to hydropower/wind and solar PV/multi-energy complement. The geothermal energy is developed and utilized on a site-specific basis with insufficient intensity and efforts.

On April 15, 2021: Several Opinions on Promoting Development and Utilization of Geothermal Energy (Draft for Comments) by the National Energy Administration. The industrial insiders proposed that the cross-functional stubborn problems remain to be solved.

On April 22, 2021: Energy Work Guideline 2021 released by the National Energy Administration: It studied and launched demonstration projects of geothermal power generation in Tibet and other places. No policy, no "demonstration", who will rush to follow up at the risk of losing money?

In short, people engaging in geothermal energy in China look forward to the implementation of concrete policies, and talking alone cannot solve the problem.

3. Be Aware of Your Deficiencies

The "13th Five-Year Plan" has just ended, from which the successful experience we obtained shall be promoted; the causes for lessons learned from failure shall be located and solved. If not solved, the problem will always be there, you cannot bypass it in the next step.

The target of increasing geothermal power generation by 500MW in the period of the "13th Five-Year Plan" has only been accomplished by 18.08MW, that is, 3.6%. I spoke at a seminar on the prospects of geothermal power generation at the 2020 China Geothermal Congress, which was reported by journalists after interviews, and I also published a paper in the journal Sino-Global Energy analyzing the crucial reasons of the problem: the failure to implement a renewable energy feed-in tariff subsidy policy; and being levied a geothermal resource tax. So under the reality of operating the geothermal power generation enterprises at a loss, talking about development again is like asking a fool to do a bad bargain, and I said at that time that there would not be a second one to follow after Yangyi Geothermal Power Station. That's the way it is. Some large state-owned enterprises self-reported to complete 200MW at the beginning, but failed to complete even 1W actually; some large state-owned enterprises have signed a contract for the reconstruction of Yangbajing Geothermal Power Station, but did not go there after making a proposal. With such an obvious reality, what do you expect the "14th Five-Year Plan" to be for geothermal power generation? What results?

Turkey and Indonesia enacted geothermal laws, which no longer classified the geothermal development activities as mining development, and then the geotherm was liberated, with Turkey surging from 16th to 4th in the world in geothermal power generation over the 15 years and Indonesia rising from the 3rd to the 2nd. Their practices can be an example we can learn from.

So, we can understand the present and see the problem clearly by summarizing the past. You cannot make progress if you do not solve the existing problems, and the so-called "Boosting the Investment of RMB 200 Billion" can only be nothing but an empty phrase of all meaning.

4. A Bright Future for Geothermal Energy in China Requires Joint Efforts

The goals of "emission peak by 2030 and carbon neutral by 2060" proposed by China has given new encouragement to China's geothermal industry, but all of us need to work together so as to achieve a bright future for China's geothermal industry.

(1) Existing good policies shall continue to play their due roles

This year, we have seen many new plans and policies across the country to support the development and utilization of the renewable energy and geothermal energy, for example:

Beijing is carrying out emission peak assessment in accordance with the relevant national regulations and formulating a carbon neutrality action plan to save energy and control the growth of fossil energy consumption and vigorously develop renewable energy, including encouraging the application of photovoltaic and heat pump technologies to develop and utilize the local renewable energy.

Jiangsu Province is promoting the application of renewable energy to fully support and improve the energy efficiency rate of residential buildings.

The Five-Year Action Plan for the Integrated Development of Changsha-Zhuzhou-Xiangtan released by Hunan Province promoted a number of distributed energy projects, and promoted the utilization and reconstruction of combined cooling, heating and power (CCHP) of natural gas, heating and refrigerating by geothermal energy, etc.

The model villages and towns in Anhui Province develop the geothermal energy and other green and clean renewable energies in accordance with local conditions to improve rural energy use, with at least 16 built by the end of 2023.

Undoubtedly, these new policies and the original supporting policies and approaches will continue to play a role in promoting the development of geothermal energy.

(2) Non-adaptive approaches and management should be improved

For the ASEAN Geothermal Cooperation Research Project 2015-2018, Necessary Innovations for Sustainable Utilization of Conventional and Novel Geothermal Resources in East Asia and Evaluation of Their Benefits, China, Japan, Korea, Indonesia, the Philippines, Thailand, Malaysia and Vietnam each analyzed barriers including policy, social, legislative, financial and technical aspects to collect questionnaire surveys to count percentages. China's biggest obstacles lie in the policy and legislation; Japan's development was restricted by national park protection, which was loosened due to the accident of

Fukushima Nuclear Power Station, and now the private owners of hot springs do not agree to develop for fear of hindering their hot spring bathing; Indonesia solved the problem in policy legislation, but had the same financial and technical issues like other small countries.

Things in China are a bit chaotic as some developers did not recharge. If the geothermal authorities could manage issues early and facilitate the recharging, there should not have been a blanket shutdown of more than 1,000 geothermal wells in Hebei Province; the waterworks department also holds the water-drilling certificate, while a new rule was rolled out by Yuncheng City, Shanxi Province, which stipulated that the city management shall be responsible for management.

In fact, the crucial problem that hinders the development of geothermal energy in China is that there is multiple management, each saying of its own advantages, with no unified will, and no consensus can be reached. Multiple management implies that all parties involved are responsible, but no one really takes the responsibility; if some authority wants to manage the affairs, the others do not cooperate with the same, so actually the purpose cannot be achieved.

The Ministry of Natural Resources is the competent department of mineral resources, including geothermal resources, and is in charge of resource exploration, yet it does not explore the resources (previously, the Ministry of Petroleum and the Ministry of Coal explored and mined their own resources), and only issues mining licenses for others to develop.

The National Energy Administration states that geotherm is an energy source and shall be under their control, but the National Energy Administration neither invests funds nor has the authority to decide on renewable energy subsidies (the National Development and Reform Commission has such authority).

The Ministry of Water Resources states that geotherm is a kind of water and shall be under their control, and if the Ministry of Water Resources refuses to grant a water-drilling certificate for exploitation, you cannot make exploitation even if the Ministry of Natural Resources implements the system of the prospecting and mining license.

The Ministry of Ecology and Environment states that the geothermal wastewater generated pollution, so it is not allowed for use. Originally, such problem can be solved by recharging, which will not be conducted for environmental protection (this year, the Central Inspectors of Environmental Protection feedback opinions to the National Energy Administration: the installed capacity of coal-fired power in heavy pollution areas is still increasing; EIA is not conducted for the general plan of the mine lot; or the capacity is greater than that approved by EIA; the discharge capacity of which are far greater than that of more than a thousand geothermal wells shut down by Hebei Province)

The tax department states that the National People's Congress has passed and issued the Resource Tax Law, so it has to

collect geothermal tax according to the rules, and then the question is that which country in the world has levied a renewable energy tax?

If we can make improvements in these areas, we will definitely bring a new look to the "14th Five-Year" Plan. To address the problem thoroughly, we should establish a Geothermal Law as experienced abroad.

Turkey, once like China, had 20MW of geothermal power generation from the early 70s to 2004, but the average annual progressive growth rate was 33.5% for 15 consecutive years from 2005 to 2020, with the geothermal power generation of 1688MW, jumping by 84 times to the fourth place in the world. We can learn from its two pieces of experience: First, the World Geothermal Congress was held in Turkey in 2005, on which the parliament and government became familiar with geotherm and recognized the importance of developing Turkey's indigenous geothermal resources; second, immediately afterwards, the parliament legislated for geotherm, giving developers policy preferences and feed-in tariff subsidies.

Indonesia, the second of the world's top 10, has grown by 2.68 times in the last 15 years, which can also be attributed to national legislation. Indonesia issued the Geothermal Law in 2014, which no longer classified geothermal development activities as mining development, made detailed provisions on the tariff mechanism for geothermal power plants, reverted the bidding authority for geothermal development projects to the central government, and the Ministry of Finance allocated USD 210 million to support the exploration, research and demonstration of geothermal projects.

(3) Overcome the difficulties in refusing to make progress, and insist on technological innovation

Since entering the 21st century, GSHP has developed rapidly in China, rapidly forming a growing industry that also surpasses conventional geothermal utilization, which makes both GSHP and direct geothermal utilization in China No. one in the world. Although the market for construction applications in China is not yet saturated, it is also facing a slowdown in growth. We need to use further technological innovation to achieve new initiatives and drive new developments in the industry.

Especially the multi-energy complement and energy storage technology proposed in renewable energy, both GSHP and conventional geothermal utilization have huge development prospects and market space, especially for the underground energy storage, the underground geological body is huge and incomparable to any man-made equipment, so it certainly contains unparalleled capacity and potential.

The research and development of hot dry rock, whose development progress is too slow, are an ideal prospect for future zero-energy communities and carbon-neutral energy, and needs to be accelerated.

I would like to mention in particular the

heat conduction and heat convection. Now, some development seems to have gone off course, the heat conduction development can be used to meet emergencies, but in any case it is not as good as heat convection development. So, I hope not to lose direction to the development here.

The heat conduction and heat convection are basic conceptual understandings actually, so what about heat convection and recharging? Or heat conduction, but not recharging? A comparison on technical and economic feasibility can be made, and in fact, the heat convection is ten times more powerful than heat conduction in terms of thermal power! The heat conduction is constant as seen in Figure 3, while the heat convection increases geometrically with increasing permeability.

Beijing in 1974 drilled the geothermal wells of 1,299m deep, with the outflow temperature of 56.5℃, the water yield of 1,341.6m^3 per day and night, using the thermal power of 1,398kW at the temperature of 35℃ to heat an area of 28,000m^2, so pumping water like this is to use the heat convection.

The temperature at the bottom of 3,000m well was 119℃ in Tangshan in 2020, using gravity-assisted heat pipe, and the temperature of saturated steam at the surface was up to 90℃, with the thermal power of nearly 200kW. It uses heat to conduct heat, with the well depth increased by 2.3 times and temperature improved by 2.1 times, but the thermal power accounts for only 1/7 of convection well mentioned in the example above.

This year, many geothermal forums and seminars have presented many new technologies and research in geothermal development, which are too numerous to mention one by one. Here, I am only mentioning this aspect, and my colleagues in the geothermal community have more potential capabilities that they may wish to give full play to.

Let us, as masters of China's geotherm, make China's geotherm great as we run towards and achieve the goals of emission peak and carbon neutrality.

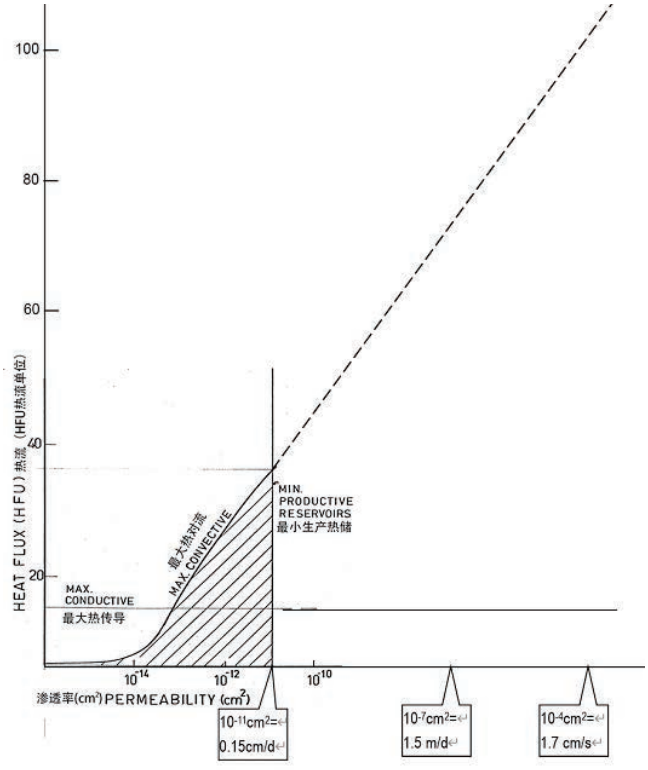


Figure 3: Comparison on Heat Conduction and Heat Convection

CURRENT STATUS OF DEVELOPMENT AND UTILIZATION OF SHALLOW GEOTHERMAL ENERGY FROM THE PERSPECTIVE OF CHINESE PATENT APPLICATION

Written by: Wang Sen

（Wang Sen, Third-level Examiner of the Patent Office of the State Intellectual Property Administration）

Shallow geothermal energy refers to low-temperature geothermal energy which is stored in rocks, soil and An underground within 200 meters below the surface and has development and utilization value under certain technical conditions. Its main sources are solar energy and geocentric thermal energy and it is mainly characteristic of greenness and cleanness, constant temperature, abundant resources and wide distribution. At present, the development and utilization of shallow geothermal energy is mainly realized by means of the ground source heat pump technology, which can be roughly divided into three types in China: Underground source heat pump, soil source heat pump and surface water source heat pump. The following is a brief analysis of the development and utilization of shallow geothermal energy in China from the aspect of the patent application.

I. Overview

1. Underground water source heat pump

An underground water source heat pump uses underground water as a low-level heat source, utilizes heat pump technology, absorbs or releases heat from groundwater, realizes the transfer of cold and heat from low-level energy to high-level energy, thus achieving the purpose of heating or cooling for users. Underground water source heat pumps are mostly circulating "well water" systems, which are suitable for occasions where underground water resources are abundant and local resource authorities allow exploitation and utilization of underground water.

2. Soil source heat pump

A soil source heat pump is a device that uses the relatively stable temperature of underground normal temperature soil to

complete heat exchange with the interior of the building through the pipeline system buried deep around the building. In winter, heat is taken from the soil to heat buildings; in summer, heat is discharged to the soil to cool buildings. It uses soil as the heat and cold source, and supplies heat or cold to buildings through highly efficient heat pump units. Soil is a better cold and heat source of the heat pump system than ambient air, and the soil source heat pump system will not discharge heat, water vapor and bacteria into the atmospheric environment. According to U.S. statistics, well-designed and installed soil source heat pumps can save users 30% ~ 40% of the operating costs of heating, cooling air conditioners on average.

3. Surface water source heat pump

Surface water resources such as rivers, lakes and seas are used to provide or dissipate heat for surrounding buildings. This method is restricted by the area and depth of rivers, lakes, etc. It is necessary to calculate the cooling or heating amount that can be provided to buildings according to the number of rivers and lakes.

4. Seawater source heat pump is another form of surface water source heat pump

Seawater source heat pump collects a large amount of low-grade energy in seawater, and "takes out" the low-grade energy stored in seawater in winter by consuming a small amount of electric energy with the help of the compressor system to supply heat to buildings; in summer, the energy in the building is "taken out" and released into seawater to adjust the indoor temperature. Although it uses seawater as its "source body", it does not consume seawater or pollute seawater; at the same time, the thermal efficiency is high.

II. Relevant Patent Application

The author uses international patent classification numbers and keywords to search the related patents of shallow geothermal energy in CNABS and the results are as follows:

1. Patent applications in China

By searching in CNABS, there were 551 patent applications related to shallow geothermal energy in the database as of December 31, 2020, including 282 invention patent applications and 269 utility model patent applications. Because there are some differences in the examination process between invention patent applications and utility model patent applications in China, statistical descriptions are made on the two types of patent applications in order to provide more references for readers.

1.1 Invention patent applications

1.1.1 Number of invention patent applications in previous ten years

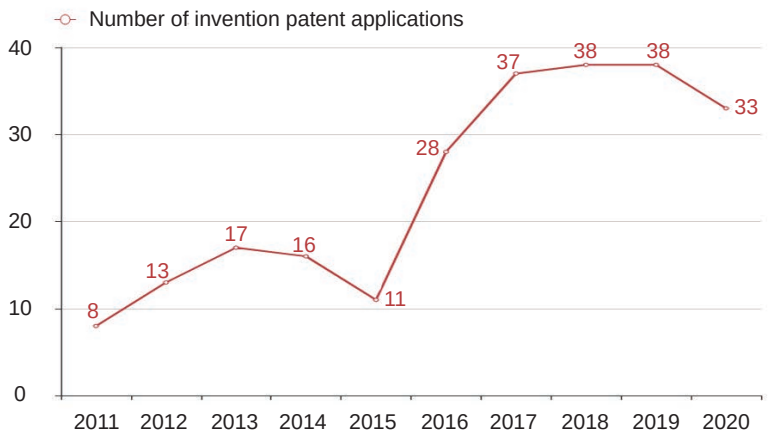


Figure 1: Number of invention patent applications in previous ten years

As can be seen from Figure 1, in the previous ten years, there have been two development peaks in the number of invention patent applications for shallow geothermal energy, with 17 applications in 2013 and 38 applications each year from 2017 to 2019. The number of patent applications increased rapidly from 2015 to 2017, and the number of applications in 2020 remained roughly stable compared with the previous period.

1.1.2 Top ten provinces in the number of invention patent applications granted in recent five years

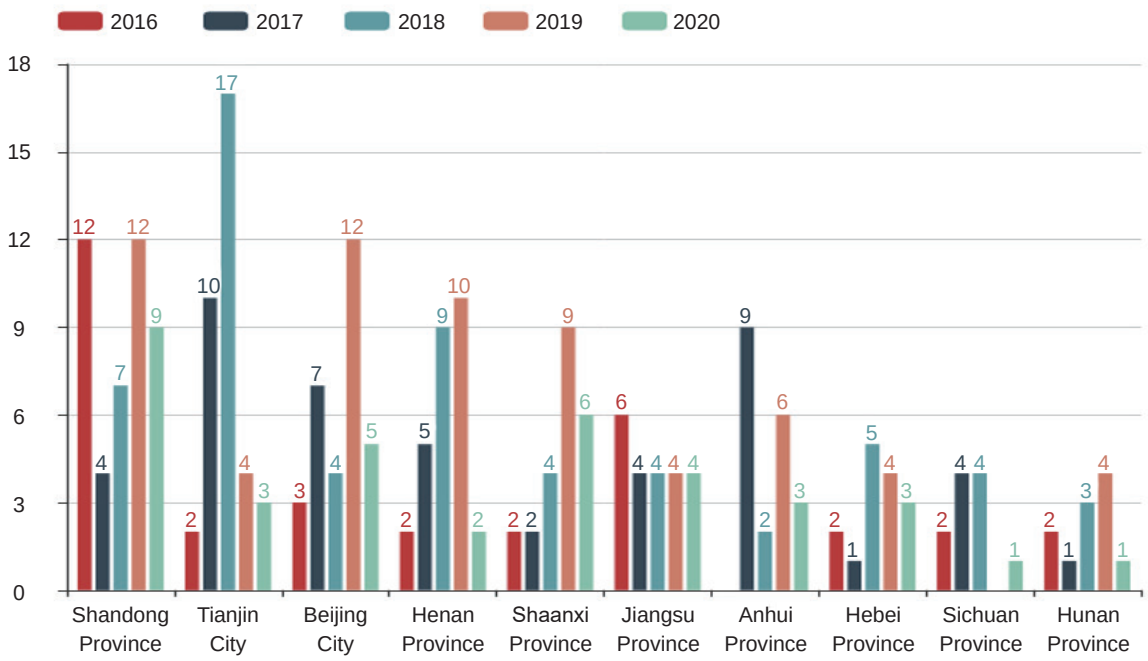


Figure 2: Top ten provinces in the number of invention patent applications in the past five years

The top ten provinces in the number of invention patent applications in the past five years are: Shandong Province, Tianjin City, Beijing City, Henan Province, Shaanxi Province, Jiangsu Province, Anhui Province, Hebei Province, Sichuan Province and Hunan Province.

1.1.3 Top-ranked Applicants for Invention Patents

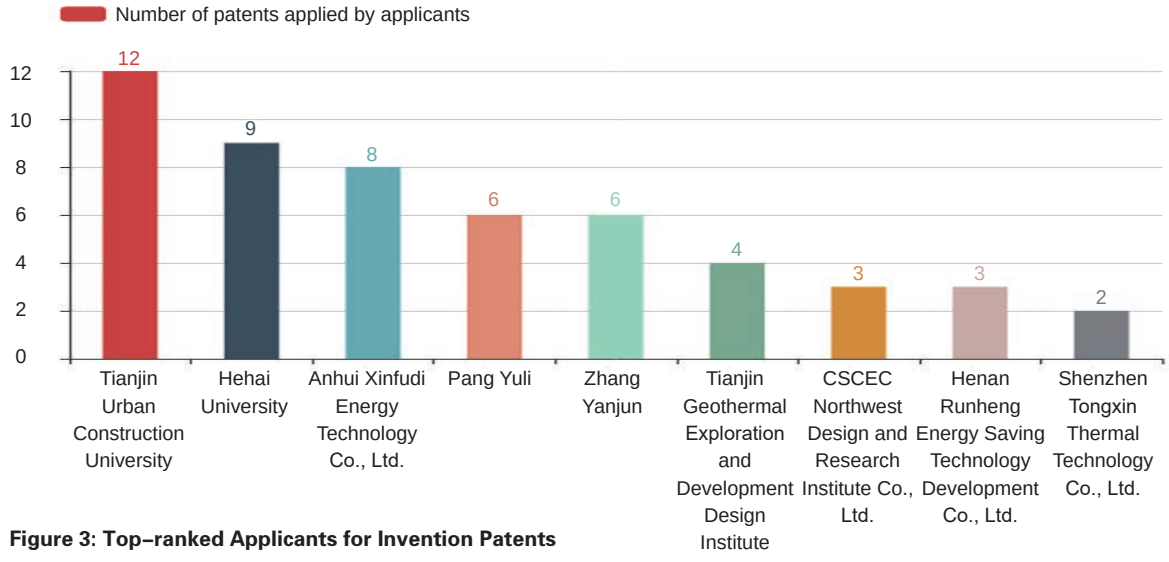


Figure 3: Top–ranked Applicants for Invention Patents

The top applicants in the number of invention patent applications for shallow geothermal energy are: Tianjin Urban Construction University, Hehai University, Anhui Xinfudi Energy Technology Co., Ltd., Pang Yuli, Zhang Yanjun, Tianjin Geothermal Exploration and Development Design Institute, CSCEC Northwest Design and Research Institute Co., Ltd., Henan Runheng Energy Saving Technology Development Co., Ltd., and Shenzhen Tongxin Thermal Technology Co., Ltd.

1.1. 4 Top applicants for invention patent applications using "single well" technology

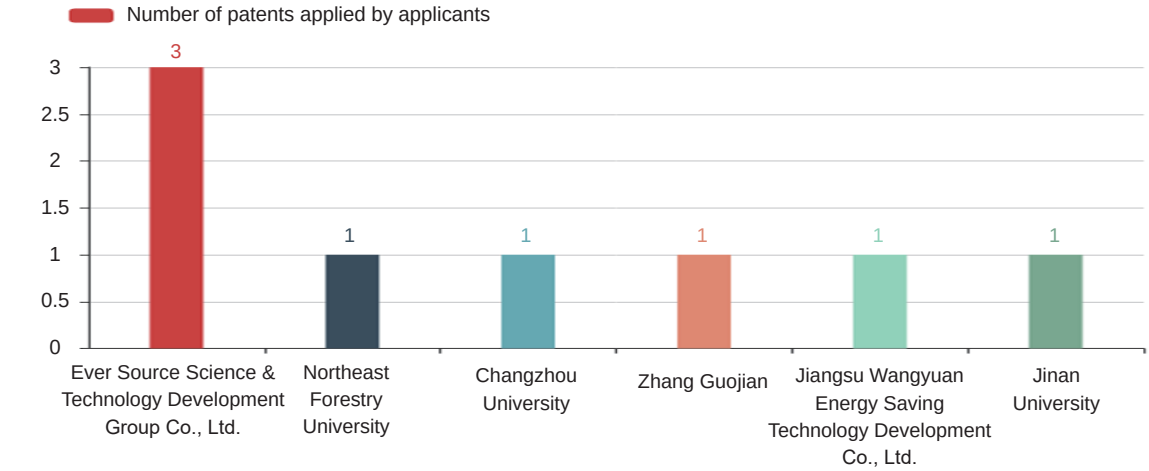


Figure 4: Top applicants for invention patent applications using "single well" technology

1.2 Utility model patent applications

1.2.1 Number of utility model patent applications in the past ten years

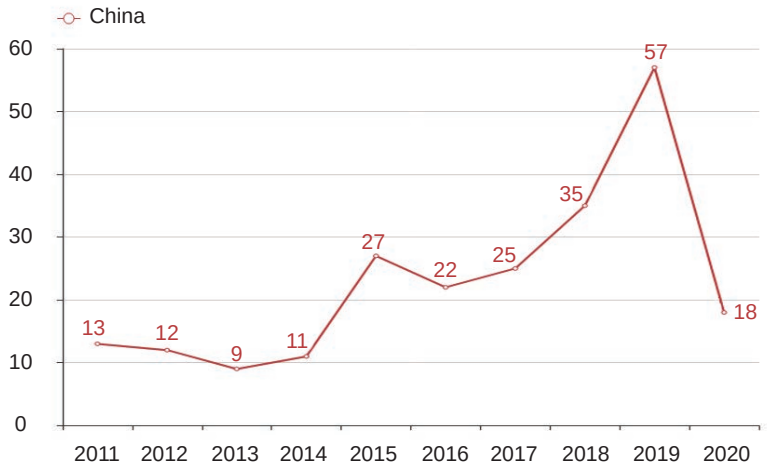


Figure 5: Number of utility model patent applications in the past ten years

As can be seen from Figure 5, the number of utility model patent applications for shallow geothermal energy has increased year by year, with rapid growth from 2014 to 2015, reaching 27 applications by 2015. After that, the number of patent applications continued to rise, reaching a peak of 57 by 2019, but the number of patent applications in 2020 was only 18.

2. Classification of technologies

The Strasbourg Agreement on International Patent Classification (1971) came into effect on October 7, 1975. It provides a common classification for invention patent documentation including published patent applications, inventor certificates, utility models and utility model certificates (hereinafter referred to as "patent documents"). According to Article 1 of the Agreement, a special (IPC) alliance was established.

International patent classification is an international unified and standardized classification for managing and using patent documentation. It is the result of long-term international cooperation, and it is also the inevitable outcome of internationalization and unification of the patent system. International patent classification is the most important and leading patent classification in the world today. Because of its integrity, scientificity and practicality, at present, most countries in the world have adopted international patent classification. Since the implementation of the Patent Law on April 1, 1985, China has adopted the international patent classification to manage and use various patent documentation in China.

2.1 Classification of technologies for invention patent applications

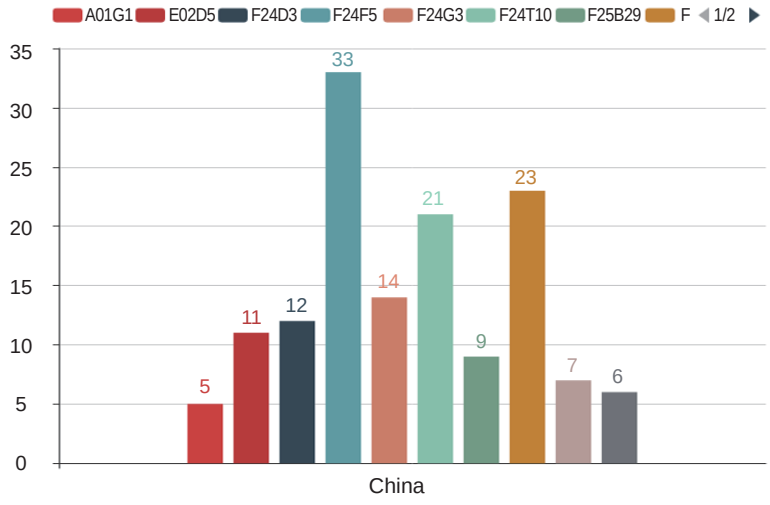


Figure 6: Classification of technologies for invention patent applications

It can be seen that the invention patent applications in CNABS are mainly concentrated in air conditioning systems or equipment, totaling 33. The rest are, in turn, patented technologies for heat pumps, geothermal collectors, hot water central heating systems, generation or utilization of other non-combustion heat, sheet piled walls, piles or other structural components special for foundation works, etc.

2.2 Technical Classification of Patent Application for Utility Model

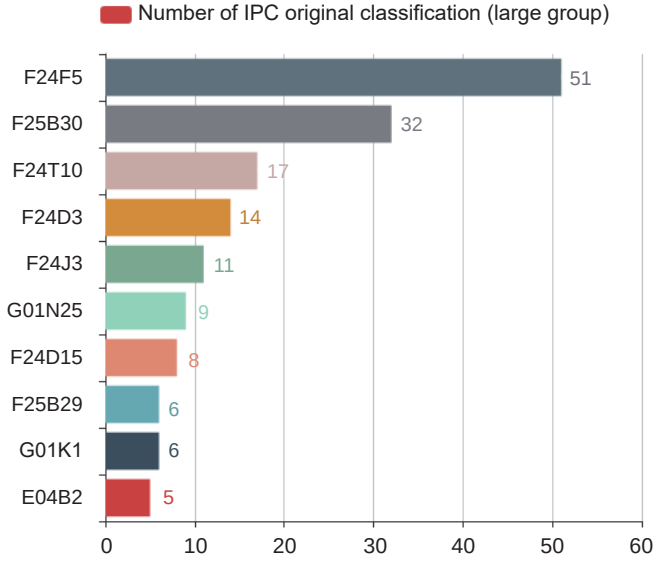


Figure 7: Classification of technologies for utility model patent applications

It can be seen that the utility model patent applications in CNABS are mainly concentrated in air conditioning systems or equipment, totaling 51. The rest are, in turn, patented technologies such as heat pumps, geothermal collectors, hot water central heating systems, generation or utilization of other non-combustion heat, application of thermal methods to test or analyze materials, and other residential or district heating systems.

III. Suggestions

Although there is great potential for the utilization and development of shallow geothermal energy, the utilization and development still need to be strengthened in terms of the number of patent applications and the composition of applicants in China. At the same time, the technical level of shallow geothermal energy utilization involves the cooperation of multi-domain technologies, as well as the coordination, reference and research among many disciplines. It is suggested that all parties should improve the development and utilization level of shallow geothermal energy on the basis of analyzing and studying the regional climate characteristics, underground water resources distribution and geological environment conditions in China.

THE STATE ISSUED AN OFFICIAL DOCUMENT TO PROMOTE THE DEVELOPMENT OF GEOTHERMAL ENERGY INDUSTRY, WHICH WILL INCREASE BY 50% DURING THE 14TH FIVE-YEAR PLAN PERIOD

Written by: Ma Xiaofang

Geothermal energy is a kind of renewable energy with abundant reserves, wide distribution, stability and reliability. Vigorously developing and utilizing geothermal energy is of great significance for implementing the requirements put forward by General Secretary Jin Ping to achieve the peak of carbon dioxide emissions by 2030 and to strive to achieve carbon neutrality by 2060. It is also an important way to meet rural heating needs and promote rural revitalization and agricultural and rural modernization. The State Energy Administration has recently issued "Several Opinions on Promoting the Development and Utilization of Geothermal Energy (Draft for Comments)" (Hereinafter referred to as the "Opinions"), which clearly points out that by 2025, the geothermal heating (cooling) area will increase by 50% compared with 2020, and a number of geothermal power generation demonstration projects will be built in areas with favorable resource conditions; by 2035, the heating (cooling) area of geothermal energy will double that of 2025.

Shallow geothermal energy is an efficient renewable energy resource with high utilization rate

Geothermal energy, solar energy and wind energy are all renewable resources, and the State has always attached great importance to the development of renewable resources including geothermal energy. In the 13th Five-Year Plan for the Development and Utilization of Geothermal Energy, we can clearly see the State's expectation for the development of geothermal energy heating: from 2016 to 2020, geothermal energy heating will drive an investment of about 220 billion yuan, and geothermal power generation will drive an investment of about 40 billion yuan, totaling

about 260 billion yuan; The newly introduced geothermal energy heating (cooling) area is 1.1 billion square meters; the newly installed capacity of geothermal power generation will be increased by 500 MW.

Public data show that the market size of geothermal energy is up to 260 billion yuan. However, the speed of development and application of geothermal energy is still not as fast as that of solar energy and wind energy. How to give full play to the geothermal energy characteristic of large reserves, wide distribution, cleanness, environmental friendliness, stability and reliability to help China achieve carbon peak and carbon neutrality is an important issue that needs to be discussed and solved urgently.

Since the famous geologist Li Siguang put forward the call of "developing geothermal energy and use heat from the earth", China has started the continuous exploration of geothermal energy. the 1970s, China successfully carried out geothermal power generation experiment and became the eighth country in the world to realize geothermal power generation. However, due to various reasons, the benefits of geothermal power generation are not stable, and there are some deviations in the development path, which hinders the progress of the geothermal power generation industry as a whole.

Compared with geothermal power generation, China's ground source heat pump industry has developed dramatically in recent years. As an efficient clean energy technology, the ground source heat pump has the characteristics of energy conservation, environmental friendliness, high cost-effectiveness and reliability. In recent years, with the advancement of air pollution governance and winter clean heating renovation, clean heating via ground source heat pumps has been well known and recognized by the general public. In just over ten years, China's ground source heat pump industry has grown from scratch, from small to large, and has been widely used until now.

Geothermal energy has the greatest advantage of high utilization coefficient among renewable energy sources compared with hydropower and biomass power generation. At the same time, geothermal energy can completely replace fossil fuels for power generation, realizing "zero energy consumption". Zheng Keyan, Director of the Expert Committee of Geothermal Professional Committee of China Energy Research Society and Director of the Expert Committee of China Ground Source Heat Pump Industry Alliance, has been dedicated the geothermal industry for decades, and he is convinced that for the development of China's geothermal energy industry which is now faced with the constraints of resources, technology, capital and policies, the first task is to learn from the successful international experience, formulate and implement the Geothermal Law, subsidize the on-grid electricity price of geothermal power generation, abolish the tax collection policy of the Resource Tax Law on geothermal energy, and usher in and hold the World Geothermal Energy Conference 2023 with a more active attitude.

Encourage the promotion multi-energy complementary heating form of "geothermal energy +"

In view of the highlighted problems in the promotion and development of geothermal energy, the National Energy Administration put forward a number of safeguard measures in the Draft for Comments, encouraging governments at all levels and development and departments of reform, finance, natural resources, water conservancy etc. to introduce price, fiscal and financial policies conducive to the development and utilization of geothermal energy, and give financial support to geothermal energy heating projects.

The Opinions clearly point out that geothermal energy resources exploration and project construction should be vigorously promoted, management processes should be standardized and simplified, information statistics and monitoring systems should be improved, and rapid and high-quality development of geothermal energy development and utilization should be ensured. To deepen the exploration of geothermal resources, the competent authorities of natural resources of relevant provinces (autonomous regions and municipalities) should organize the investigation and evaluation of geothermal resources, make an overall evaluation of the feasibility, suitability, total amount and intensity of development and utilization of geothermal resources, scientifically and rationally set up mining rights, and introduce enterprises to carry out follow-up exploration, development and utilization. In Beijing, Tianjin, Hebei, Shanxi, Shandong, Henan and the Yangtze River Basin, the utilization of shallow geothermal energy will be promoted according to local conditions in combination with heating (cooling) needs, and a demonstration area for the cluster utilization of shallow geothermal energy will be built; while paying attention to the utilization of shallow geothermal energy in traditional urban areas, we should meet the growing heating demand in South China with high quality and vigorously promote the utilization of geothermal energy in Yunnan-Guizhou alpine region.

The Opinions point out that heating with geothermal energy in the middle and deep layers should be vigorously promoted in Beijing, Tianjin, Hebei, Shanxi, Shandong, Shaanxi, Henan, Qinghai and other regions according to the resource situation and market demand. On the basis of resource assessment, environmental impact assessment and economic calculation, all regions are encouraged to choose the technology of "taking heat without consuming water, recharging completely in the same layer" or "sealed underground heat exchange" according to the actual situation, so as to minimize the interference to underground soil, rock strata and water bodies. Encourage the development of demonstration work of centralized utilization of geothermal energy in the middle and deep layers, demonstrate heating utilization modes and application scope of different geothermal resource grades, and explore new management technologies and market operation modes conducive to the development and utilization of geothermal

energy. It is advisable to promote geothermal energy heating by means of overall development of geothermal blocks, mobilize the enthusiasm of enterprises for resource protection and sustainable development, and encourage the promotion of the multi-energy complementary heating form of "geothermal energy +".

The Opinions also encourage the construction of high-quality development demonstration zones of geothermal energy. Carry out the comprehensive utilization of geothermal energy, tourism, crop farming, breeding and other industries. Make innovations in management methods, take the initiative to build demonstration zones for high-quality development of geothermal energy, quickly drive the large-scale development of geothermal energy utilization by promoting work in all areas by drawing upon the experience gained on key points, and promote geothermal energy to become an important force for clean heating. Steadily push forward the construction of demonstration projects for geothermal power generation. Timely introduce favorable electricity prices or related support policies, organize and build medium and high-temperature geothermal power generation projects in Tibet, western Sichuan, western Yunnan and other areas rich in high temperature geothermal resources, encourage the construction of medium and low temperature and dry hot rock geothermal power generation projects in places where conditions permit. Support the integrated development of geothermal power generation and other renewable energy sources.

In standardizing the management of geothermal energy development and utilization, the Opinions suggest standardizing the filing or registration management of geothermal energy development and utilization projects, Simplify the preliminary procedures for the projects, strengthen supervision and inspection of the projects and information management of the projects, prepare development and utilization plans for geothermal energy and make good coordination, and create a policy environment conducive to geothermal energy development and utilization.

Geothermal energy is expected to turn from a "guard" to a "forward"

The Guiding Opinions of the State Council on Accelerating the Establishment and Improvement of a Green and Low-carbon Circular Development Economic System issued by the State recently clearly pointed out that it is necessary to promote the green and low-carbon transformation of the energy system, give priority to energy conservation, improve the dual control of total energy consumption and intensity, increase the proportion of renewable energy utilization, vigorously promote the development of wind power and photovoltaic power generation, develop hydropower and geothermal energy according to local conditions, and accelerate the research, development and promotion of large-capacity energy storage technologies. With the attention from the State, geothermal energy, as a clean non-

carbon-based renewable energy, is ushering in unprecedented development opportunities.

Pang Zhonghe, Director of Geothermal Resources Research Center of Chinese Academy of Sciences, was full of confidence in the development of geothermal energy in China in an interview with the media recently: "As the country pays more and more attention to deep layer geothermal energy, geothermal energy is expected to turn from a 'guard ' to a 'center forward' or a 'forward' in the future. As the project leader of "Research on Geoscience Issues of Deep Layer Geothermal Energy", Pang Zhonghe said that underground "energy storage" is one of the important directions of geothermal energy development in the future. By recharging various waste heat into underground space for storage, geothermal energy can effectively play its role as a continuous and stable foundation load.

With the support of national policies and the active development of the industry, concerted efforts from top to bottom, it is expected that during the 14th Five-Year Plan period, the development and utilization of geothermal energy will add new effective forces to economic transformation and new urbanization construction, and at the same time promote the development of geological exploration, construction, water conservancy, environment, public facilities management and other related industries, and achieve remarkable social benefits in increasing employment and benefiting people's livelihood.

List: Experts offer suggestions for the development of geothermal energy industry

1. Zheng Keyan, Director of the Expert Committee of Geothermal Professional Committee of China Energy Research Society

Policy is the most critical factor restricting geothermal development. Taking Yangyi Thermal Power Station in Tibet as an example, the power station was connected to the grid in 2018 and incorporated into the grid in 2019. The on-grid electricity price was only 0.25 yuan/kW·h, far lower than the photovoltaic electricity price of 1.05 yuan/kW·h, which seriously affects the confidence and determination of enterprises to invest in geothermal industry. We should formulate and implement the Geothermal Energy Law, subsidize the price of on-grid electricity from geothermal power generation, and abolish the tax collection policy of the Resource Tax Law on geothermal energy.

2. Li Ziying, Member of CPPCC and President of CNNC Beijing Research Institute of Uranium Geology

Water resource tax has affected the enthusiasm of many enterprises to develop geothermal energy. At present, the principle involved in the development and utilization of geothermal energy is to take the heat instead of water. Under the condition of 100% recharge, the geothermal resource tax should be zero. Geothermal energy is often put behind new energy sources such as solar energy and wind energy, it is not well known to the public.. Judging from the development process of wind power and photovoltaic power generation in China, appropriate incentive policies play an important guiding role in the rapid upgrading and the development of the industry. It is suggested to refer to the early electricity price policies for renewable energy sources such as wind and solar energy, and accelerate the introduction of geothermal on-grid electricity price policies as soon as possible. For hydrothermal geothermal energy recharged as required, the mineral resource tax should be reduced or exempted, the central financial input should be increased, and the exploration of geothermal resources should be intensified and refined, especially the basic investigations, so as to promote the healthy and stable development of the geothermal energy industry.

3. Li Chuangjun, Director of the Department of New Energy and Renewable Energy of the National Energy Administration

The "14th Five-Year Plan" period is an important window period to promote energy transformation and green development. Both the "14th Five-Year Plan" and the Outline of the Long-Range Objectives Through the year 2035 put forward clear requirements for accelerating renewable energy. Li Chuangjun, Director of the Department of New Energy and Renewable Energy of the National Energy Administration, recently pointed out that on the basis of the 13th Five-Year Plan, the average

annual installed capacity of renewable energy will be greatly increased and further expanded during the 14th Five-Year Plan period. By the end of the 14th Five-Year Plan, the installed capacity of renewable energy will account for more than 50% of China's total installed power. At the same time, the proportion of renewable energy in energy consumption will continue to increase, By the end of the "14th Five-Year Plan", it is estimated that the proportion of renewable energy in the whole society's electricity consumption increment will reach about two-thirds, and the proportion in the primary energy consumption increment will exceed 50%. Renewable energy will change from incremental supplement of original energy and electricity consumption to the main body of energy and electricity consumption increment.

Li Chuangjun said, During the 14th Five-Year Plan period, the decisive role of the market in the allocation of renewable energy resources will be further exerted. By accelerating the construction of a new power system with new energy as the main body, the consumption and storage capacity of new energy can be improved, which can not only realize the large-scale development of renewable energy, but also realize the high-level consumption and utilization, more effectively guarantee the reliable and stable supply of power, and realize high-quality leapfrog development.

4. Wang Jianming, Member of CPPCC, Party Secretary and Director of Sichuan Bureau of Geology & Mineral Resources

We will accelerate the detailed investigation of geothermal energy resources, carry out large-scale investigation, exploration and evaluation of "one county, one policy" for medium and deep layer geothermal resources and shallow geothermal energy, further ascertain the amount of geothermal resources in the country, and identify suitable areas for the development and utilization of geothermal resources. In the potential areas for geothermal resources

development, plans for the development and utilization of geothermal resources shall be formulated and incorporated into all levels of land and space planning, and a geothermal resources monitoring network shall be established to promote the development and utilization of geothermal resources. At the same time, it is necessary to strengthen the collaborative research on geothermal energy with the industry, colleges, institutes and users, build demonstration projects of new energy functional system with geothermal energy as the main factor, construct an integrated highland for tackling key problems of new energy technology clusters with shallow-medium-deep cascade comprehensive utilization of geothermal energy, complementary various clean energy sources and intelligent supply of distributed new energy, and form an integrated technology model of efficient development and recycling of resources with a popularization value and a demonstration effect.

5. Nan Cunhui, Member of CPPCC, Chairman of Chint Group

Promote the reform of the examination and approval system, simplify the examination and approval procedures, and clarify the financial and tax support policies for geothermal utilization, such as reducing the licensing cost of geothermal development, abolishing the water resource tax, and reducing the operating costs of enterprises; consider bringing the development and utilization of geothermal energy into the scope of subsidies from renewable energy funds, formulate subsidy policies for geothermal energy projects, set up special subsidy funds, and encourage enterprises to invest in public utilities such as heating; Strive for policy-based low-interest loans for geothermal heating enterprises, solve the financing difficulties of enterprises, and promote the scientific development and large-scale utilization of geothermal energy.

GEOTHERMAL ENERGY HELPS CHANGSHA RONGCHENG HOSPITAL TO CREATE AN ENERGYSAVING MODEL OF "COMBINATION OF MEDICAL TREATMENT AND ENDOWMENT"

Written by: Ma Xiaofang

As an important central city in the middle reaches of the Yangtze River, Changsha has been a famous city since Han Dynasty. It is not only full of life atmosphere, but also the destination for endowment. Rongcheng Hospital, located near Changsha Nancheng Ecological Zoo, is a general hospital integrating medical treatment and endowment, with more than 400 medical beds. Recently, in response to the call of the State for energy conservation and emission reduction and to reduce the heating and cooling operating costs of the hospital, Changsha Rongcheng Hospital cooperated with Eversource Science and Technology Development Group to use Eversource shallow geothermal energy heat pump environment system to heat and cool the outpatient complex, staff canteen and physical examination and rehabilitation center of the hospital, providing domestic hot water for 24 hours a day. Data show that after the system is put into operation, Changsha Rongcheng Hospital will save more than one million yuan every year to be more energy-saving and environmentally friendly, and this will strongly promote the hospital to build into a harmonious hospital of "combination of medical treatment and endowment".

Changsha Rongcheng Hospital has a total construction area of 25,740.78m^2, including an outpatient complex of 13,400.38m^2, a staff canteen of 754.80m^2 and a physical examination and rehabilitation center of 11,585.60m^2, with two centralized computer rooms for cold and heat sources.

Harmony and Unity between Collection Well and Environment

"People-orientation morality-orientation, scientificity and standardization, and harmonious development" has been the concept of Changsha Rongcheng Hospital for many years. Walking in Changsha Rongcheng Hospital Project, it is difficult for you to find

out where the geothermal energy acquisition well is. The Eversource shallow geothermal energy acquisition well is a concealed well, and the wellhead after completion is exactly the same as an ordinary municipal manhole cover, which ensures that its setting does not affect the overall layout of the whole building and it can be harmonious and unified with the surrounding environment.

At the same time, the project plan is to set up a total of 2 machine rooms; machine room 1 is set up in the original air-conditioner room on the ground floor; 2 shallow geothermal energy heat pumps and one high-temperature shallow geothermal energy heat pump are selected to meet the needs of heating, cooling and domestic hot water in the outpatient complex and staff canteen; machine room 2 is equipped with 2 mobile machine rooms, which are located outside the building. 1 high-temperature shallow geothermal energy heat pump is selected to meet the demand for domestic hot water in the physical examination and rehabilitation center, and the geothermal energy heater unit is selected to meet the demand for heating and cooling in the physical examination and rehabilitation center.

Cooling while preparing domestic hot water in summer

Two YSSR-700A shallow geothermal energy heat pumps and one YSSR-60B/S high-temperature shallow geothermal energy heat pump are selected for the energy upgrade system of Machine Room 1 of Changsha Rongcheng Hospital Project. In winter, one YSSR-700A shallow geothermal energy heat pump will be activated to meet the demand of building heating in winter. Two YSSR-700A shallow geothermal energy heat pumps will be activated in summer to meet the demand for building cooling in summer. One YSSR-60B/S high-temperature shallow geothermal energy heat pump combined with hot water tank can meet the demand for domestic a hot water all year round, and can be used for cooling while preparing domestic hot water in summer.

One YSSR-120B high-temperature shallow geothermal energy heat pump is selected for the energy upgrade system of machine room 2, and the hot water tank is combined to meet the annual demand for domestic hot water. 230 sets of 3P DNW-I-35 + 35D2 horizontal machines (one outdoor unit and two indoor units) are tentatively selected to meet the heating and cooling requirements of the examination and rehabilitation center. The specific quantity and form can be adjusted according to the specific conditions on-site.

Annual cost savings of more than one million yuan

To confirm if the effect is good or not, the data is the most powerful evidence. It is estimated that from the aspect of operating cost, the annual operating cost of the original system of Changsha Rongcheng Hospital is 3,572,900 yuan. After the Eversource shallow geothermal energy heat pump environment

system is adopted for heating, cooling and supplying domestic hot water, the total annual operating cost is reduced to 2,368,200 yuan, with remarkable energy-saving benefits.

In terms of system operation and maintenance, the Eversource shallow geothermal energy heat pump environment system adopted by Changsha Rongcheng Hospital has a long service life and low maintenance cost. In terms of system operation control and stability, the Eversource shallow geothermal energy heat pump environment system is easy to operate, stable, safe and reliable. In terms of energy conservation and environmental protection, the Eversource shallow geothermal energy heat pump environmental system uses clean shallow geothermal energy resources to heat and cool buildings, and the system operates without environmental pollutant emission, thus avoiding soot and waste gas discharged into the atmosphere due to heating by other methods.

Considering various factors, Changsha Rongcheng Hospital Project adopts Eversource shallow the geothermal energy heat pump environment system as the building heating, cooling and hot water system, which is the best feasible option.

Table 1 Comparison of Operating Cost between Original System and New System

	Unit	Original system	New system
Annual electricity charge for heating and cooling operation	10000 yuan / year	218.49	139.74
Annual electricity charge for production of hot water	10000 yuan / year		15.08
Annual operation and maintenance cost	10000 yuan / year	40.8	20
Annual labor cost for operation	10000 yuan / year	18	12
Depreciation of equipment	10000 yuan / year	80	50
Total annual operating costs	10000 yuan / year	357.29	236.82

Shallow geothermal energy has many advantages

Shallow geothermal energy (heat) refers to renewable low-grade heat energy within 200 meters underground and below 25℃ . Heat pump technology is used to transport shallow geothermal energy to heat buildings, so that shallow geothermal energy can become an alternative energy source for building heating, and shallow geothermal energy can be used for intelligent heating of buildings without combustion. Compared with other renewable energy sources, shallow geothermal energy has the following features:

(1) Continuous supply: shallow geothermal energy is sourced and maintained at a constant temperature mainly due to the combined effect of the Sun and ground core heat;

(2) Ready-to-use: on-demand energy acquisition to provide a stable and reliable heat source for the heating needs of buildings;

(3) Natural energy storage: natural energy storage in the geotechnical body at a certain depth underground to use energy in the vicinity and save energy transportation costs and usage costs.

(4) Alternative energy: it is safer and more reliable than heating with the combustion of traditional fossil energy under the premise of reasonable design and assured construction quality。

According to the survey and evaluation results in 2015 by the China Geological Survey of the Ministry of Natural Resources, the annual exploitable resources of shallow geothermal energy in 336 cities above the prefecture-leve nationwide are equivalent to 700 million tons of standard coal; the national hydrothermal geothermal resources are equivalent to 1.25 trillion tons of standard coal, and the annual exploitable resources are equivalent to 1.9 billion tons of standard coal; the resources of dry heat rock buried at a depth of 3,000-10,000 meters are equivalent to 856 trillion tons of standard coal, so the resource potential is huge.

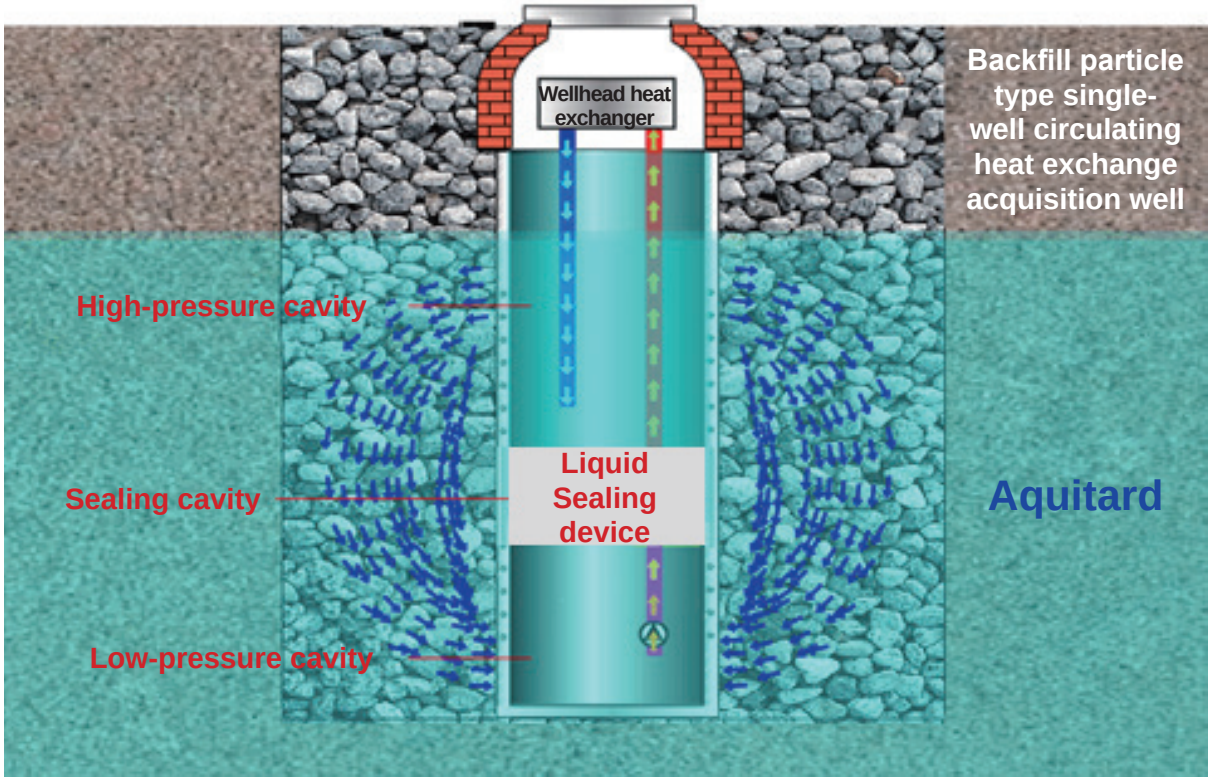
Shallow geothermal energy combustion-free heating combines the heat pump system with shallow geothermal energy in the earth as a green, efficient and energy-saving temperature adjustment system integrating heating, cooling, provision of domestic hot water. At the same time, it is also a kind of shallow geothermal energy stored in the shallow layer of the earth as low-grade heat energy. By inputting a small amount of high-grade energy (such as electric energy), the transfer of low-grade heat energy to high-grade heat energy is realized, and the temperature is changed, thus realizing the purposes of heating in winter, cooling in summer and providing domestic hot water all the year-round.

Shallow geothermal energy is used as the heat source for heat pump heating, i.e. the heat in shallow geothermal energy is "taken out" and transferred to indoor rooms after the temperature is increased. At the same time, the heat generated by the electric energy consumed by the heat pump

host is also transferred to indoor rooms, i.e. the shallow geothermal energy heat pump may consume 1kW of energy and obtain more than 4kW of heat.

At the Two Sessions this year, some deputies submitted "Suggestions on Accelerating the Development of Heating Market in 100 Cities in South China". The 100 cities in South China refer to the "hot summer and cold winter" areas from the south of Huaihe River to the Yangtze River in China, including 101 cities such as Shanghai, Wuhan and Chongqing. "Developing the South China Heating Market" has developed from a general appeal to an operable plan. Song Xin, Party Secretary and Chairman of China Energy Conservation and Environmental Protection Group, said that with the improvement of quality of life, people's pursuit of a happy life is constantly improving. Now there is also a demand for heating in winter in South China. However, we all know that if traditional coal-fired heating is used, smog will occur; if natural gas is used, there will be a gas shortage; Direct electricity costs too much. Therefore, the promotion of clean energy is imperative.

There is no doubt that the Changsha Rongcheng Hospital Project built by Eversource Science & Technology Development Group Co., Ltd. will also become a typical case of heating applications of shallow geothermal energy in cities in South China.



SCHOOL PROJECT CASES OF SHALLOW GEOTHERMAL ENERGY HEAT PUMP ENVIRONMENTAL SYSTEM

Written by: Sun Ji

A school is a relatively crowded place with diverse functions of its internal buildings. A school usually includes classroom, office, laboratory, canteen, dormitory, bathroom, library, auditorium, gymnasium, natatorium, ice hockey hall, etc. Therefore, the requirements for temperature, humidity and flow rate of indoor air, and exchange rate of fresh air are very strict. The flow rate and temperature of hot water supplied shall meet the specification. Thus, heating and cooling systems involve most categories in the field of the air conditioner. There are also higher requirements for the safety, reliability, and environmental performance of the system.

Since 2000, Ever Source Science & Technology Development Group Co., Ltd. has undertaken heating and cooling projects of schools for more than 20 years. Although the quantity of school projects does not occupy a large proportion to the total engineering quantity (20 million m^2) of the company, the company emphasizes the particularity of school projects in internal management. Concerning the school projects, from the design concept, the construction organization to the commissioning and acceptance, all reflect the people-oriented tenet. The school project must be the safest and also be a model of energy conservation and environmental protection. We want to impress the students who visit the school on the first day that the school which uses Ever Source technologies and products is dedicating to peak carbon dioxide emissions and carbon neutrality.

The company uses shallow geothermal energy as the alternative energy for heating and can save 1/2~3/4 of conventional energy during heating. During cooling, the underground rock and soil are used as the medium to reduce the energy consumption by 1/4~1/2 through seasonal energy saving. In design concept, the company adheres to the principle of "adaptation

to local condition" and vigorously promotes the single well of geothermal energy collection with circulation heat exchange. It implements DB11/T 935 Technical Code for Single Well of Geothermal Energy Collection with Circulation Heat Exchange. Under the conditions of suitable thermophysical properties of underground rock and soil, the company adopts the heat exchange technology of buried pipe and implements the corresponding standards of the company and the country.

Since its establishment, the company has been committed to the research of underground temperature fields and the test of the thermophysical property of rock and soil. The geothermal energy collection and heat exchange technology has reached the international leading level to ensure on-demand cooling and heating, no consumption of underground water, no pollution to underground water, and energy conservation and environmental protection.

The following is the introduction to several cases of school projects of the company.

1. Beijing Haidian Foreign Language Experimental School

Beijing Haidian Foreign Language Experimental School, located in Haidian District, Beijing City, has a total floor area of 350 mu, a total building area of over 100,000m^2, and 6,000 students and staff members.

Commenced in 2000, this project is the first project which uses the Ever Source geothermal energy heat pump environment system. It has 16 distributed cold and heat source systems, including 16 buildings, such as teaching building, experimental building, gymnasium, natatorium, library, dormitory, and canteen. These systems have stably operated for 20 years.

20 years ago, the successful cases of large-scale using of shallow geothermal energy for heating and cooling without combustion were very rare. After the Haidian Foreign Language Experimental School used the system, there has been an endless stream of visitors. Most of the visitors are parents of the students. What they want to know most is whether the new heating system is reliable or safe. In the classroom and dormitory, they feel the warm wind, and the heating temperature reaches the standard; there is no spark and no

accumulation of fuel in the machine room. This is called heating without combustion. There is no hazardous source of fire and explosion and no pollutant emissions. Undoubtedly, it is most suitable for schools.

After years of practical operation, the power consumption of heating and hot water of the project in winter is 37.92kW·h/m^2, equivalent to 18.53 yuan/m^2, 38.23% less than the residential heating price of 30 yuan/m^2 in Beijing; considering that the energy consumption of cooling and hot water in summer is 14.74 kW·h/m^2, the total power consumption of heating, cooling and providing domestic hot water in the whole year is 52.66kW·hm^2, and the annual operation cost is only 25.72 yuan/m^2 (heating for 151 days, cooling for 100 days, providing hot water for 200 days, and heating the swimming pool for 365 days). The economic benefits are significant.

2. Yuanxiang Campus of Beijing Haidian Foreign Language Experimental School

Cold and Heat Source Machine Room of Yuanxiang Campus of Beijing Haidian Foreign Language Experimental School

Yuanxiang Campus of Beijing Haidian Foreign Language Experimental School, located in Orenda Yuanxiang, west of Guyaju, Yanqing, Beijing, is an idyllic international school with perfect facilities, green ecology, and sports spirit. Yuanxiang Campus covers an area of 660 mu, which can accommodate more than 5,000 students and staff members for living and studying. Yuanxiang Campus is planned to be constructed in three phases: 60,000 m^2 in phase I has been completed and used, and 80,000 m^2 in phase II is officially used in 2021. The campus includes teaching building, office building, scientific research center, art college, theater, staff canteen, student apartment, teacher apartment, indoor sports venues (comprehensive sports center, table tennis and badminton center, ice and snow sports center, natatorium, tennis hall, etc.). The campus adopts Ever Source distributed cold and heat source system. 4 and 3 cold and heat source machine rooms are constructed in phases I and II respectively. They meet all requirements of heating, cooling, and annual domestic hot water. They realize the full coverage of clean energy without combustion in the use area, reduce the operation cost of the system, and protect the ecological environment.

3. North Campus of Zhongguancun No.3 Primary School

Cold and Heat Source Machine Room of North Campus of Zhongguancun No.3 Primary School

The project is located in Wanliu Middle Road, Haidian District, Beijing City, and has a total building area of 45,952m^2.

Ever Source geothermal energy heat pump environment system with the single well of geothermal energy collection with circulation heat exchange as core technology effectively meets the demand of heating, cooling, and domestic hot water supply. The system has 4 geothermal energy heat pump units and 12 Ever Source geothermal energy collection wells.

The project is located in the Beijing groundwater source protection zone for which there is strict regulation on groundwater protection. Beijing Water Authority was very cautious in examining and approving the project and called academicians, subject experts, and counselors of the State Council to demonstrate the project. Experts carefully researched Ever Source technologies and products and confirmed the safety for groundwater and geological structure. Beijing Water Authority finally approved and required the relevant operation monitoring data to be disclosed to the public after it was put into operation.

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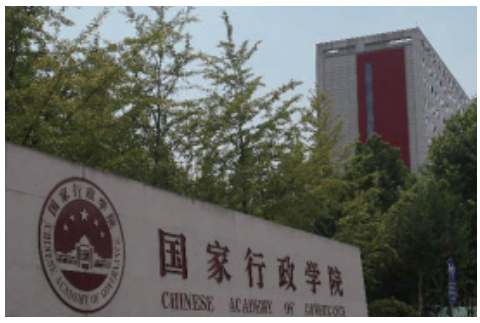
The operation data shows that the average heating cost in winter is 13.03 yuan/m^2, 56.56% less than the residential heating price of 30 yuan/m^{2}in Beijing.

4. Beijing Information Management School (Qinghe Campus)

Located at Longgang Road, Qinghe, Haidian District, Beijing Information Management School (Qinghe Campus) covers an area of 58mu (total building area of 42573m^2), including teaching building, training building, dormitory, dining hall, stadium, etc.

The project construction area is located at the northwest edge of the alluvial fan plain of Yongding River, which is dominated by quaternary and fine sand. The thermal property test of the rock-soil body shows that the construction area has good formation compactness, high water content in sediment and good thermal conductivity but less permeability coefficient and restricted underground water flow and heat transfer. Through repeated comparison and computer software simulation, the vertical ground heat exchanger and ground-source heat pump system was decided to be used as the air conditioning cold and heat source, namely, install 674 80m-deep vertical ground heat exchangers and three ground-source heat pump units in the machine room to meet the demand of the project for heating in winter, cooling in summer and domestic hot water throughout the year. The operation effect is good. This project is a renewable energy demonstration project in Haidian District and a typical case of Haidian District to apply the vertical ground heat exchanger and ground-source heat pump system.

5. Chinese Academy of Engineering Sciences Hongkong and Macao Civil Servant Training Center



Located in Haidian District, Beijing, Chinese Academy of Engineering Sciences Hongkong and Macao Civil Servant Training Center Project covers a total building area of 43000m^2, including foreign training building, multi-purpose sports stadium (indoor swimming pool, indoor tennis stadium, badminton stadium and table tennis stadium) and other buildings. The project has the demand for heating in winter, cooling in summer, hot water, and swimming pool heating throughout the year. It ever adopted

the traditional gas-fired boiler and electrical cooling system as cold and heat sources, but the operation energy consumption was high and the pollution was serious.

In 2012, HYY Ever Source Company was invited to modify the above system by replacing the former gas-fired boiler and electrical cooling system with the ground-source heat pump system composed of 14 standing column well-ground heat exchange systems and 6 HD660B ground source heat pump units. With the heat recovery technology, the project can recover the heat from the air conditioning refrigeration in summer to heat the swimming pool and domestic hot water so as to save operating costs. The project was completed and put into operation in October 2012.

Before modification, the annual cost was 5.45 million Yuan. After modification by using the HYY Ever Source geothermal energy heat pump environment system, the annual cost is 2.28 million, decreasing by 58%.

6. Zhangzidao Changhai Fourth Middle School

Located in Zhangzidao Town, Dalian, Changhai Fourth Middle School was put into use in 1993. The school covers an area of 15000m^2 and has a building area of 4949m^2.

The project ever adopted the coal-fired boiler for heating in winter. Because the school is suited to an island, the coal has to be transported to the island from other places to largely increase the cost. On the other hand, the furnace slag has nowhere to store, causing land occupation and area pollution and affecting the livelihood of residents. HYY Ever Source Company was invited to modify the project by using clean and renewable energy heating technology without combustion and emission. Based on the local resources, we decided to replace the former coal-fired boiler system with the seawater-source heat pump system. Because the project is located in a cold region, the seawater temperature is as low as 3-5℃ in winter, the project was designed to adopt the high-efficiency heat exchanger to ensure heat exchange efficiency and capacity in the case of low seawater temperature. In consideration of seawater corrosion, multiple anti-corrosion measures (anti-corrosive heat exchanger, anti-corrosive pipe, and fitting) were taken to ensure the system service life. After modification, no pollution and no emission are realized because the coal transportation and the furnace slag treatment are avoided, and the reduction of heating system operation cost brings better environmental benefits and economic benefits.

7. Teaching Building of Beijing University Environmental Sciences and Engineering College

Located in the Chengfu Park in the northeast of Beijing University, the teaching building of Beijing University Environmental Sciences and Engineering College covers an area of 6521m^2, composed of aboveground five floors and underground three floors. Its building area is 20500m^2. The ground-source heat pump system includes six (four for operation, two for standby) HYY 350 standing column wells, two YSSR-600B/2 ground-source heat pump screw units, and 13 DNV-I-280A/W multiplex ground-source heat pumps, of which the ground-source heat pump is used to cool/heat the office area and room of the building, and the multiplex ground-source heat pumps are used to cool/heat the laboratories of the building and maintain them at a constant temperature.

HYY Ever Source geothermal energy heat pump environment system is to utilize the free shallow geothermal energy for heating in winter and obtain cooling capacity in summer at a low cost. According to the statistical operation data of 2018~2020, the cooling in summer saved 135,000 degrees of electric energy, equivalently saving 45 tons of coal for power generation. In winter, the replacement of traditional coal-fired boilers saved about 180 tons of coal. Environmentally, from a perspective of pollutant emission reduction and monetized environmental benefit, the emissions of 410 tons of CO_2, 3 tons of sulfur dioxide, 6 tons of nitrogen oxide, and 113 tons of dust were reduced annually, and the total monetized environmental benefit brought by such emission reduction was 4.31 million Yuan.

8. Research and Innovation Base of Shanxi Academy of Agricultural Sciences

The Research and Innovation Base of Shanxi Academy of Agricultural Sciences is located in Taiyuan, Shanxi and covers an area of 140,000m^2 above, including graduate school, biological engineering technical center, laboratory center, and academic exchange center.

The project has a large area of construction and high cold and heat source system capacity and load rate. The agricultural scientific research has strict requirements on the reliability of cold and heat source systems and the pollutant emission index. Through repeated comparison and expert evaluation, the academy decides to adopt the shallow geothermal energy as heating/cooling energy, namely, adopt the HYY Ever Source geothermal energy heat pump environment system to meet the demand for heating in winter, cooling in summer, and domestic hot water throughout the year.

The shallow geothermal energy collection is designed to be composed of 81 standing column wells, three centrifugal ground-source heat pumps, and two screw-type ground-source heat pumps in the cold and heat source machine room. The maximum heating power in winter is 10736kW, and the maximum cooling power in summer is 10874kW. Through reasonable planning and optimization design, the multiple geothermal energy collection wells are configured scientifically and effectively to ensure efficient and stable operation and high energy efficiency ratio of the system. In addition, the heating and cooling are free of combustion to result in no pollutant emission.

According to the operating data, the heating energy consumption of the project in winter is 28 kW·h/m^2, the cooling energy in summer is 8 kW·h/m^2, the annual operating energy cost is 25.2 Yuan, and the annual heating/cooling cost is 30% lower than 37.5 Yuan/m^2—the individual heating rate of Taiyuan City.

9. Middle School Affiliated to Northern Jiaotong University

The multiple-use building of Middle School Affiliated to Northern Jiaotong University has a total building area of 20370m^2, including training center, dining room, office, swinging pool, and basketball gym. The energy demand of the building is diversified, such as conventional heating in winter and cooling in summer, domestic hot water, and swimming pool heating throughout the year. The cold and heat source system is designed to adopt the HYY Ever Source geothermal energy heat pump environment system to give full play the multi-purpose advantages. Through simple switching operation, the same unit can be used for heating and cooling. One cold and heat source machine room is designed with three ground-source heat pumps to meet the demand for heating in winter and cooling in summer. In summer, it is allowed to recover the heat produced from cooling to supplement the domestic hot water and maintain the swimming pool temperature so as to further reduce the system operating cost.

The maximum heating power of the heat pump in winter is 1669kW and the maximum cooling power in summer is 1478kW. According to the operating energy consumption of the project, the energy consumption is 22 kW·h/m^2 for heating in winter and 12 kW·h/m^2 for cooling in summer. The energy-saving effect is significant.

In addition to the above school projects, Ever Source Science & Technology Development Group Co., Ltd. also undertakes the projects of professional training centers such as athlete training center, pilot training center, and lunar exploration project ecosystem experimental facility. These projects are more professional and difficult technologically, but HYY Company relies on the supports of industry experts and its leading advantages in the geothermal energy collection and heat exchange field to obtain good effects. They are not repeated here due to limited space.

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，北矿大（南京）新能源环保技术研究院、首都科技发展战略研究院、北京工业对外经贸促进会、北京节能环保促进会浅层地（热）能开发利用专业委员会、中国地热与温泉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，双语半年刊。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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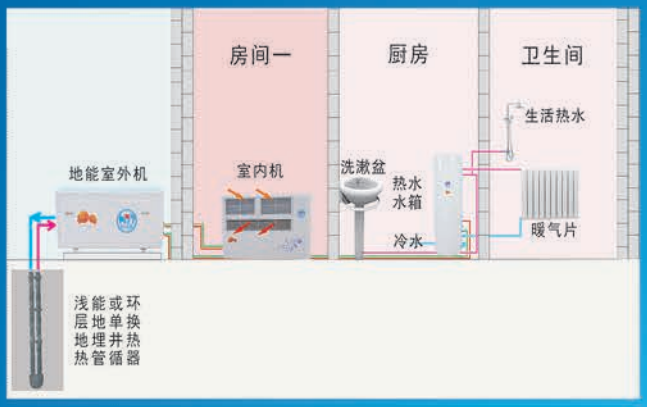
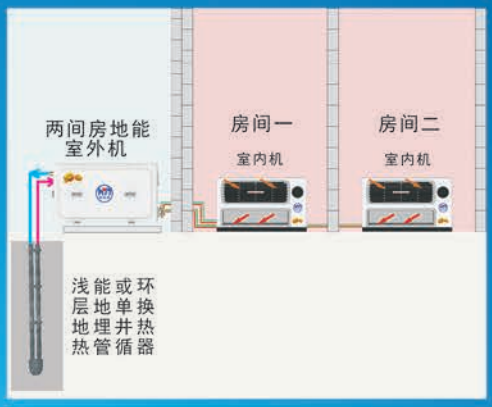


一间房暖冷及生活热水一体化地能热宝系统



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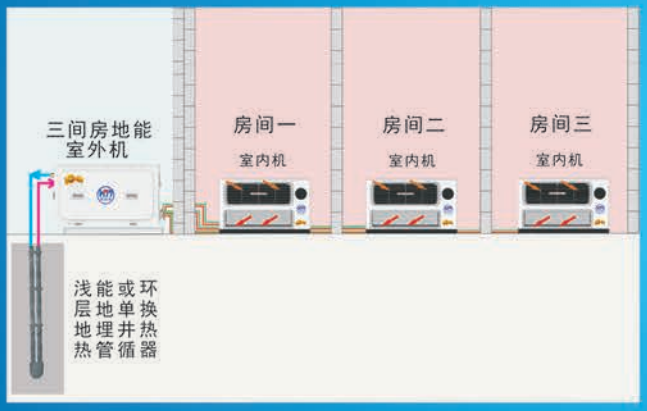

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