中國地熱能
CHINA GEOTHERMAL ENERGY

本刊独家专访——武强
中国工程院院士、中国矿业大学（北京）教授

Exclusive Interview —— Wu Qiang
Academician of the Chinese Academy of Engineering, Professor at China University of Mining and Technology (Beijing)

北方冬季地能热泵高效清洁取暖
热冷一体化新兴绿色产业

EFFICIENT AND CLEAN WINTER HEATING BY GROUND-SOURCE ENERGY HEAT PUMP IN NORTHERN CHINA
- AN EMERGING GREEN INDUSTRY OF INTEGATED HEATING AND COOLING

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专访中国工程院院士、中国矿业大学（北京）教授——武强

人物简介

武强，男，1959 年 10 月生，内蒙古自治区呼和浩特市人，中共党员。水文地质环境地质学家，中国工程院院士、国际欧亚科学院院士，中国矿业大学（北京）教授、博士生导师，全国政协委员、全国政协人口资源环境委员会委员，国家煤矿水害防治工程技术研究中心主任，国际矿井水协会(IMWA）副主席，国务院学位委员会地质资源与地质工程学科评议组召集人，教育部科技委地学与资源学部副主任，享受国务院政府特殊津贴。

工作简历：1991 年中国地质大学（北京）博士毕业后进入中国矿业大学（北京）从事博士后研究并任教；2015 年当选中国工程院院士；2021 年当选国际欧亚科学院院士。先后荣获首届中国优秀博士后奖、何梁何利基金科学与技术进步奖、李四光地质科学奖、全国创新争先奖及“全国优秀教师”和“北京市人民教师”等称号。长期从事矿山水防治与资源化利用教学和科研工作。曾作为国务院特别重大透水事故调查专家组组长，先后负责了 6 次特别重大透水矿难现场抢险救援或调查研究工作。在我国煤矿顶底板两大主要突水灾害预测预报方法与防控技术、煤——水双资源协调开发理论技术与协调组合模式以及矿井充水条件三维可视虚拟化分析系统研发等方面，取得了多项重要成果。

2025 年 6 月 3 日，中国工程院院士、中国地质大学（北京）武强教授在北京接受本刊访谈组专访。武院士最近工作日程十分繁忙，刚刚才从外地回到北京，风尘仆仆。但是一谈起全球能源形势、我国能源安全和浅层地热能开发利用等重大问题，立刻变得精神百倍，神采奕奕。以下是部分访谈记录。

本刊访谈组：您认为当前全球范围内的能源利用趋势对我国保障能源安全，实现能源结构清洁低碳转型构成了哪些挑战？我们应该如何应对？

武强院士：在百年变局加速演进、地缘政治冲突等复杂背景下，我国能源安全与清洁低碳转型面临挑战。

能源安全方面，我国能源消费结构仍以化石能源为主，且能源需求呈增长态势，在加速能源转型过程中，既要保障能源供应满足需求，又要逐步摆脱对传统化石能源的依赖，实现平稳过渡，压力较大。我国煤炭开发强度大、安全与生态环保约束强；石油、天然气对外依存度高，进口来源集中，易受地缘政治和国际局势影响，威胁能源供应稳定性和可靠性；清洁低碳转型方面，传统能源基础设施占比大，转型需大量资金投入改造与新建；风能、太阳能具有先天间歇性和不稳定性，但目前包括储能、火电机组深度灵活性改造、电网智能化和能源气象学等调节能力滞后，难以满足大规模接入电网需求。

应对策略上，加强国内煤炭、石油、天然气勘探开发，提高自给率，降低进口依存度，保障供应安全。强化能源基础设施建设，提升能源系统智能化、数字化水平，提高其灵活性与适应性。加大能源领域技术创新投入，重点研发可再生能源、储能技术、智能电网等关键技术，提高能源利用效率、降低成本。推动传统能源产业绿色低碳转型，如实现煤炭清洁高效利用、煤电清洁灵活性改造等。制定完善能源转型支持政策，如财政补贴、税收优惠、价格机制改革等；健全碳交易市场等市场机制，充分发挥市场在能源资源配置中的决定性作用，引导社会资本投入能源转型领域。加强国际合作，保障运输通道安全。

本刊访谈组：面对复杂多变的国际能源形势和国内“双碳”目标，您作为我国地热能开发与利用的积极倡导者和推动者结合我国自身资源禀赋，您如何看待包括风能、太阳能以及地热能在内的本土可再生能源在现代能源体系中的战略定位？相较于其他可再生能源，地热能在稳定性、地域普适性以及提供基础供暖冷能源方面有何独特优势？地热能与其他可再生能源的多能互补系统发展前景如何？

武强院士：风能、太阳能凭借清洁、易获取、可再生、分布广等优势，在可再生能源替代传统化石能源战略中潜力巨大。在“双碳”目标及政策推动下，我国风能、太阳能开发规模快速扩张，累计和新增装机规模长期位居世界第一，已成为我国能源结构转型升级的主导力量，未来有望在我国新型能源体系中占据主体地位。地热能作为具有强时变特征的可再生能源家族中最稳定的再生能源，储量大且分布相对广泛，其战略定位独特，在能源供应稳定性、区域能源保障等方面具有不可替代的作用，尤其在供暖制冷生活热水三联供领域优势明显，可发挥基础支撑作用。

地热能作为相对稳定可靠的可再生能源，其稳定性在可再生能源家族中优势显著，不受季节、昼夜、天气变化等自然条件影响，可作为基荷能源持续稳定供应，我国浅层地热能分布极为广泛，开采难度小，利用形式多样，即可供热又可制冷，地域普适性强。地热能供暖制冷高效、环保、节能，可直接供暖或借助热泵技术提升能效实现供暖制冷，运行成本低，减少对传统化石能源依赖，降低碳排放。

地热能与其他可再生能源的多能互补系统发展前景广阔。这种多能互补系统有助于优化我国能源结构，提高可再生能源比重，减少对传统化石能源的依赖，促进能源转型。风能、太阳能发电具有间歇性，而地热能稳定可靠，发展“地热 +”模式可弥补风能、太阳能供应间歇性不足。在资源丰富的地区，地热能可为风能、太阳能发电提供调峰填谷支持。例如，白天太阳能充足时，优先利用太阳能发电；夜间或太阳能不足时，由地热能发电或其他储能装置补充，实现多种可再生能源协同开发利用。

本刊访谈组：近年来浅层地热能作为地热能资源的后起之秀，其开发利用异军突起发展迅猛，您认为其根本原因是什么？未来大规模推广应用于城镇清洁供暖的主要机遇在哪里？同时，面临哪些关键的挑战？

武强院士：浅层地热能开发利用迅猛发展的根本原因主要有以下几点。第一，根据中国地质调查局的调查资料，我国 336 个主要城市的浅层地热能年可采资源量巨大，折合高达 7 亿吨标准煤，可支持实现供暖（制冷）建筑面积达到 320 亿平方米，这种丰富的资源潜力为浅层地热能的开发利用提供了坚实基础；第二，政策大力支持，在国家“双碳”目标驱动下，各地纷纷出台鼓励可再生能源发展的政策，对浅层地热能开发给予补贴、优惠电价等支持，激发了市场主体参与积极性；第三，技术逐渐成熟，地源热泵技术不断进步，提高了浅层地热能利用效率，降低了设备成本与运行能耗，使得浅层地热能开发在经济上更具可行性；第四，环境优势显著，浅层地热能的开发利用过程中几乎不产生温室气体排放和污染物，符合当前环保要求，有助于改善环境质量，减少雾霾等大气污染问题，在“双碳”目标背景下，其环境优势更加凸显，受到越来越多的关注和重视；第五，浅层地热能具有供暖、制冷、生活热水三联供特点，且冬天供暖越多、夏天制冷越多，提供热冷源地质体的热冷恢复能力越强；第六，大量地表水、生活污水、矿山排水和泉水等也是应用热泵技术解决消耗了我国相当比例能源的建筑物供暖制冷的水源。

未来，浅层地热能大规模应用于城镇清洁供暖面临诸多机遇。随着能源转型加速，清洁取暖需求不断攀升，浅层地热能作为相对稳定的可再生能源，凭借其清洁取暖的显著优势，在北方冬季取暖和南方冬季保暖需求的推动下，展现出广阔的应用前景。在城市更新和基础设施建设中，将地热供能管网建设融入其中，不仅可以降低成本、提高能效，还能为浅层地热能城镇清洁供暖的大规模应用创造契机。无论是新建建筑、园区，还是城市区域的基础设施建设，以及老旧城区的改造，都可以将浅层地热能供暖作为重要的改造方向，从而提升供暖制冷的清洁化水平，为浅层地热能供暖制冷系统的大规模建设提供广阔空间。此外，随着区域能源互联网建设的推进，浅层地热能供暖制冷系统能够与其他能源系统实现互联互通，优化能源配置，进一步提升能源利用效率与系统稳定性，从而拓展其应用场景。特别是北方冬季取暖地区，应该大力提倡浅层地热能替代化石能源取暖，发展热冷一体化新型绿色循环产业。

然而，浅层地热能大规模推广也面临诸多关键挑战。技术层面，尽管地源热泵技术不断进步，但在复杂地质条件区域，如在基岩大面积分布地区，系统设计与施工难度较大，打井困难，这严重阻碍了项目的顺利实施。经济方面，浅层地热能项目初期投资成本稍高，包括打井、设备购置及安装等费用，对于资金实力较弱的企业或地区来说，先期投资压力较大。而且，目前浅层地热能供暖制冷成本在部分地区与传统供暖成本相比优势不明显，这在一定程度上削弱了其市场竞争力。在标准规范与监管方面，浅层地热能供暖行业缺乏完善的统一标准，项目设计、施工、验收和运行管理等环节存在标准缺失问题，导致项目质量良莠不齐，严重影响行业健康发展。同时，对于开发利用过程中的环境影响、地下水回灌等关键问题，监管力度不足。此外，公众对浅层地热能的认知度较低，对其开发利用的安全性、可靠性存在诸多疑虑，这也在很大程度上影响了浅层地热能供暖项目的推广和应用。

今年年初北京市发布了《北京市水资源税改革试点实施办法》，进一步明确了科学分类利用和严格地下水的规范管理，进一步保证了浅层地热能替代化石能源健康有序的发展。

本刊访谈组：作为以浅层地热能供暖的企业下一步应重点在哪些方向发力，才能更好地响应国家节能环保号召，推动浅层地热能供暖产业的健康发展？对此您有何建议？

武强院士：为积极响应国家节能环保号召，推动产业健康发展，热泵取暖行业需要像可以在北方冬季最恶劣气候条件下保证供暖的“单井循环换热 100% 回灌系统”的浅层地热能创新采集一类的集成技术，企业应重点发力以下方向：加大研发投入，针对复杂地质条件研发高效钻井技术与优化地源热泵系统，提升能源利用效率，降低能耗，增强项目适应性与经济性。加强与科研院校合作，建立产学研用联合创新机制，加速科技成果转化，保持技术领先优势。同时，健全浅层地热能利用系统运行维护管理，运用互联网、智能监控等现代信息和感知控制技术实时监测分析运行参数，及时解决问题，确保系统安全稳定高效运行，提高供热制冷质量和服务水平。严格遵守法律法规和标准规范，采取措施保护地下水资源、土壤和水环境，实现浅层地热能可持续开发利用。此外，严格把控工程质量，建立完善质量管控体系，确保项目稳定可靠运行。积极参与行业标准制定，推动形成统一、规范的行业标准，提升行业整体工程质量水平，树立企业良好品牌形象。企业还应积极参与能源互联网建设，与其他能源企业开展合作，实现浅层地热能与其他能源的协同互补，提升能源综合利用效率，融入能源发展大格局，为国家节能环保事业贡献更大力量。

推动我国北方地区地能热泵高效清洁取暖、加速热冷一体化新兴绿色产业发展

——以《推动热泵行业高质量发展行动方案》为指引提高我们的认识、规划我们的工作

作者：杨明忠

2025 年 3 月，为深入贯彻党的二十大及二十届二中、三中全会精神，切实执行党中央、国务院的决策部署，致力于推动热泵行业的高质量发展，助力重点领域实现节能降碳，同时培育绿色低碳产业的新增长点，以全面支撑经济社会的绿色转型，国家发展改革委等部门制定和发布了《推动热泵行业高质量发展行动方案》(以下简称《行动方案》) 的通知 (发改环资〔2025〕313 号)。《行动方案》明确了推动热泵行业高质量发展的总体要求，提出了到 2030 年的工作目标；结合技术发展水平和不同行业特征，提出建筑、工业、农业、交通等领域热泵推广应用的主要路径，并强调了热泵设计研发、生产制造、设备更新、报废处置等全生命周期角度的提质升级任务。本次《行动方案》的推出对热泵行业的推广及我国节能降碳具有重大意义，地能热泵供暖作为稳定高效的清洁供暖方式，正迎来加速发展的契机。

一、热泵行业发展的重要意义

热泵是一种高效的能量转换设备，仅需少量电力即可将低品位热能转换为高品位热能，满足生产生活的用热需求，显著提升能源利用效率。效率较高的地能热泵为建筑供暖可以实现用 1 度电搬运获得 4 度电的热效果，在我国北方区域可以实现相当于 50% 燃煤的能耗保证原有 100% 的建筑面积供暖，供暖区域零排放。

二、地能热泵高效清洁供暖支持热泵效率提升

《行动方案》指出“力争到 2030 年，热泵生产制造和技术研发能力不断增强，重点热泵产品能效水平提升 20% 以上”。随着压缩机、换热器和控制系统等硬件产品技术的不断突破，热泵产品能效也将不断提升。而热泵系统的效率除了热泵设备本身性能以外，影响更大的是热泵系统采能端的低温热源品位及稳定性，相对于以我国北方地区冬季室外零度以下的低环境温度作为热源的空气源热泵，浅层地能热泵可以稳定供给温度为 10-15°C的热源，将大幅提升热泵系统能效比，最大地发挥热泵主机性能优势，并且温度稳定不会因严寒天气的出现导致系统供暖不保证的情况。因此地能热泵高效清洁供暖将更好地实现《行动方案》的要求，支持热泵系统效率的提升。

三、鼓励热泵供暖多场景的应用规模化发展

《行动方案》提出了从多个维度因地制宜加大热泵推广应用，支持热泵替代燃煤锅炉和散煤燃烧；积极推进工业领域应用；扩大农业、交通运输等其他领域应用范围；开展存量低效热泵更新改造。

地能热泵供暖行业经过 20 多年的发展，已经形成了多种场景下的成功应用案例，并形成一定体量的客户积累存在着更新改造的需求。比如恒有源科技发展集团有限公司 (以下简称恒有源科技) 的适合城镇集中供暖的分布式地能热泵环境系统、适合农村散户分间取暖的地能热宝系统已经完全可以在不增加用户成本的情况下实现替代燃煤，同时除了在常规的住宅、办公、商业建筑上的应用，也成功应用在工业厂房、农业生态大棚、高速公路沿线收费站服务区等供暖场景，具备在不同供暖领域规模化发展的条件。

四、推动地能热泵产业提质升级

《行动方案》为热泵设计和制造提出新要求，包括“小型化和易安装化”、“为用户提供一体化定制式供热、制冷方案”等。恒有源科技的地能热宝产品将热泵与循环输送泵和电气控制系统整合到一个模块当中，最小的规格可以实现十几平方米的房间也有对应产品，用户简单安装后通过遥控器就可一键操作，用哪间开哪间，这让农村散户也能用得上高效热泵供暖制冷、在费用低于原来烧煤的情况下省心、省力、省钱、省能源的取暖。恒有源科技的地能热泵系统也形成了定制的成套模块产品，可以实现快速地组合满足用户热冷需求。

《行动方案》也指出要提高运行维护专业化水平，引导热泵生产企业由设备供给商向系统集成商转变，健全安装、运维队伍与服务体系，切实提高热泵稳定高效运行水平。

供暖是关系到千家万户、国计民生的大事，要求就是在极寒天气下要有基本的温度保证，因此热泵系统的稳定运行与有效维护至关重要，这不仅是确保热泵供暖在极寒天气下发挥作用的基石，也是推动热泵供暖区域产业发展的关键因素。构建涵盖热泵 (及其配件) 制造销售、施工安装、运行维护的完整产业体系，为热泵供暖提供了强有力的支撑。恒有源科技自创立之初，便秉持并实践着全过程服务的理念，集团内设有具备专业加工能力的热泵工厂，以及拥有专业资质的设计、施工、钻井团队和运维企业，通过高效统一的运维中心平台，为用户提供覆盖全产业链的优质服务。在新时期，恒有源科技也正在将此模式以区域发展合作的方式复制到其他区域，从制造到服务系统全面提升实现产业的提质升级。

五、地能热泵高效清洁供暖——热冷一体化新兴绿色产业具备加速发展的基础

《行动方案》指出：要强化综合性政策支持，鼓励相关单位选用列入《绿色技术推广目录》、《国家重点推广的低碳技术目录》、《国家工业和信息化领域节能降碳技术装备推荐目录》等的高效热泵技术和产品，研究将热泵相关项目纳入绿色低碳先进技术示范项目支持方向。

恒有源科技的单井循环换热地能采集技术入选国家发展改革委《国家重点节能低碳技术推广目录(2015 年本)》、入选北京市发改委《北京市 2017 年节能低碳技术产品及示范案例推荐目录》、入选国家节能中心第三届《重点节能技术应用典型案例 (2021-2022)》；此外，恒有源科技的地能热宝产品亦成功入选《北京市 2015 年节能低碳技术产品推荐目录》及《北京市节能技术产品推荐目录(2020 年本)》。

《行动方案》指出：要发挥标准引领和支撑作用，推动建筑领域热泵应用标准研究，明确不同建筑气候区热泵性能系数，加快提升热泵性能要求。

除了参与编制国标《地源热泵系统工程技术规范》(GB50366) 等国家和行业规程外，恒有源科技还编写了北京市地方标准《单井循环换热地能采集井工程技术规范》(DB11/T 935)，以及团体标准《供暖热泵机组》(T/BAEE019-2023)。其中，《供暖热泵机组》从不同气候分区供暖保证的角度对热泵产品提出了更高的要求。

《推动热泵行业高质量发展行动方案》的出台，标志着我国热泵产业迈入以创新驱动引领高质量发展的新阶段，将推动我国北方地区地能热泵高效清洁取暖、加速热冷一体化新兴绿色产业发展，将为我国实现“双碳”目标、提升百姓生活品质、实现能源生产和消费革命、农村生活方式革命开启具有里程碑意义的实践篇章。

深入学习、认真领会、努力实践

——公司学习《推动热泵行业高质量发展行动方案》座谈会侧记

作者：周彬

在全球能源转型与我国双碳目标的大背景下，热泵行业迎来了新的发展机遇与挑战。为积极响应国家政策号召，深入贯彻落实《推动热泵行业高质量发展行动方案》（以下简称《行动方案》），恒有源科技发展集团有限公司于 2025 年 5 月 21 日专门组织了座谈会，探讨《行动方案》带来的机遇与应对策略。

在座谈会上，恒有源科技发展集团有限公司总裁杨明忠强调：《行动方案》的出台，为整个热泵行业勾勒出清晰的发展蓝图，对于公司而言，这不仅是一次实现自身更好发展的契机，更是一份沉甸甸的责任。我们必须深刻领会方案精神，将其融入到日常管理与长远发展规划中，以实际行动推动公司在热泵领域持续深耕，为行业的高质量发展贡献力量。

座谈会上，大家踊跃发言，分享了对《行动方案》的理解与感悟，并结合自身工作实际对公司在新形势下的发展提出了意见和建议：

1、由于能量转化的方向性，高品位能在使用过程中最终都会转化为低品位能，唯有热泵技术，能借助少量高品位能的驱动，将低品位能提升为高品位能，因此热泵的作用巨大。公司既是热泵生产者，也是热泵的使用者（在系统集成应用中使用），自 2000 年创立以来，公司始终把热泵的发展和利用作为一项重要内容，未来更需要关注热泵领域的前沿技术，通过持续创新来不断提升企业的竞争力。

2、公司的单井循环换热地能采集技术入选国家发展改革委《国家重点节能低碳技术推广目录（2015 年本）》、入选北京市发改委《北京市 2017 年节能低碳技术产品及示范案例推荐目录》、入选国家节能中心第三届《重点节能技术应用典型案例（2021-2022）》，此外，公司的地能热宝产品亦成功入选《北京市 2015 年节能低碳技术产品推荐目录》及《北京市节能技术产品推荐目录（2020 年本）》，这些荣誉的获得体现了公司地能热泵供暖技术在节能降碳方面的突出优势。后续我们将围绕《行动方案》中“热泵产业提质升级”的任务要求，全方位推进相关工作，进一步强化地能热泵供暖产品的节能降碳效能。

3、公司从 2002 年启动热泵研发与批量生产，现有产品涵盖适用于农村分间取暖的“地能热宝”，以及适用于集中供暖的全系列地能热泵产品。目前公司正在以地能热泵系统产品标准化为工作重点，围绕地能热泵环境系统成套产品、地能热宝系统成套产品、分布式地能冷热源站成套产品三大类产品，开发全系列标准化、模块化产品，以更好地因地制宜实现规模化应用。

4、《行动方案》提出“深化热泵领域国际合作”保障措施。公司已在美国林肯市法院执法培训中心、大卫城养老院、Hershey 学校、Chase County School 等地开发地能热泵项目实现应用。其中，Hershey 学校项目获美国环保署（EPA）“能源之星奖”，以该项目为核心的论文于 2003 年国际地热资源理事会（IGRC）墨西哥蒙瑞利亚年会上荣获“最佳论文奖”；大卫城养老院项目获美国采暖制冷与空调工程师学会（ASHRAE）“卓越技术奖”。此外，公司 3 篇论文入选 2023 世界地热大会（WGC2023）论文集。2025 年，公司在完成国外有关地能热泵供暖市场调研的基础上，正式启动北美市场的开拓工作，目前要加快进度取得更多阶段性成果。

5、《行动方案》明确提出“广泛深入宣传热泵应用实践，提升社会认知度”的工作部署。多年来，公司依托企业官网、《中国地热能》期刊、自媒体等线上媒体，结合展会、卖场等线下场景，全方位推广地能热泵供暖的实际应用案例，显著提升了社会公众对地能热泵的认知水平。后续将重点建立北京热泵暖冷运维大数据服务平台，整合规划、设计、生产加工、施工、运维服务为一体，为客户及从业人员提供全方位服务，进而推动地源热泵行业的发展。

与会人员一致认为：《行动方案》的实施，是公司发展的重要契机，也是一项长期而艰巨的任务，各部门一定要紧密协作，形成合力，将《行动方案》中的各项要求落实到具体工作中，以创新驱动发展，以质量赢得市场，同时，将积极履行社会责任，为推动供暖行业的绿色低碳发展、实现国家双碳目标贡献我们的智慧与力量。

热烈欢迎《北京市水资源税改革试点实施办法》的发布

《中国地热能》编辑部

财政部、国家税务总局、水利部联合发布了《水资源税改革试点实施办法》，明确自 2024 年 12 月 1 日起，全面实施水资源费改税试点。北京市迅速响应，积极推进相关工作，2025 年 1 月 22 日北京市正式发布了《北京市水资源税改革试点实施办法》(以下简称《办法》)，这一举措标志着北京市在水资源管理和利用方面迈出了重要一步。作为国家水资源税改革试点城市之一，北京市的这一政策不仅是对国家政策的积极响应，更是推动水资源可持续利用、促进生态文明建设的重要实践。我们对此表示热烈欢迎，也期待这一政策为北京市乃至全国的浅层地热能开发利用和水资源管理注入新的动力，为热泵清洁供暖行业带来光明的前途。

一、水资源税改革的重要意义

水资源是经济社会发展的基础性资源，也是生态环境的重要组成部分。随着经济的快速发展和城市化进程的加快，北京市面临着一系列多重挑战。如何有效管理和合理利用水资源，已成为北京市可持续发展的关键问题。

水资源税改革的核心目标是通过税收杠杆调节水资源的开发利用，促进水资源的节约和保护。与以往的水资源费相比，水资源税具有更强的法律约束力和调控作用。通过税收手段，推动企业和个人更加珍惜和科学合理地利用水资源，减少浪费和污染。

水不仅是一种重要的资源，还是其他资源 (例如热) 的载体和介质。《办法》在用好管好水资源的同时为其他水载资源的利用提供有利条件。《办法》的实施必将大大降低采用浅层地热能清洁供暖的成本，促进清洁供暖的产业化发展。

二、《办法》的亮点与创新

《办法》在借鉴其他试点地区经验的基础上，结合北京市的实际情况，提出了多项创新举措：

1、差别化税额标准：根据水资源的不同用途和地区差异，在充分调查研究的基础上，对水资源用户进行科学分类，《办法》设定了差别化的税额。对于高耗水行业和超计划用水，税额适当提高，以促使企业加强节水措施；而对于农业用水和民生用水，税额则相对较低，特别是对于 100% 回灌的地能热泵清洁取暖系统确定了每千吨 0.8 元的收费标准，体现了政策的科学性、公平性和合理性。

2、强化水资源监控与管理：《办法》明确要求加强水资源监控体系建设，利用现代信息技术，实现对水资源取用、排放等环节的全程监控。这将有助于提高水资源管理的精细化水平，确保税收政策的有效落实。

3、鼓励节水技术与创新：《办法》提出对采用节水技术和设备的企业给予税收优惠，鼓励企业通过技术创新减少水资源消耗。这不仅有助于降低企业用水成本，也将推动节水技术的研发和推广。

4、加强公众参与与监督：《办法》强调公众参与的重要性，鼓励社会各界对水资源管理和税收政策进行监督。通过信息公开和公众参与，能够增强政策的透明度和公信力，确保政策的公平执行。

三、我们的期待

《办法》的发布，标志着北京市在水资源管理方面迈出了坚实的一步。我们期待这一政策能够在以下几个方面取得显著成效：

1、促进水资源节约与保护：通过税收手段，能够有效抑制水资源的过度开发和浪费，推动全社会形成节约用水的良好风尚。

2、推动产业结构优化：差别化税额将促使高耗水企业加快转型升级，推动北京市产业结构向更加绿色、低碳的方向发展。对于热泵供暖行业，将促进先进的 100% 回灌的技术健康发展。

3、改善水环境质量：通过加强水资源监控和管理，减少水污染排放，改善北京市的水环境质量，为市民提供更加清洁的水资源。

4、为全国提供可复制经验：作为国家水资源税改革的试点城市，北京市的经验将为其他地区提供有益的借鉴，推动全国范围内的水资源税改革进程。

5、面向可持续未来：政府要完善水资源计量体系、强化水质稳定监测、科学定义 100% 回灌标准；多部门联合用力，健全 100% 回灌地能热泵在供暖行业应用的审批流程。

单井循环换热地能采集技术原理及典型应用

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摘要：本文介绍了北京中关村原创的地下水100% 回灌的单井循环换热地能采集技术，阐述其技术原理与特点，并通过“四博连工程师宿舍”示范项目水质监测数据及“承德医学院附属医院”改造项目及“中关村三小”项目案例，验证该技术在100% 回灌和地下水保护、系统稳定性及供热制冷效能方面的可行性与可靠性，为浅层地热能开发提供新路径。

关键词：地能采集；单井循环；100% 回灌；浅层地热能；水质监测

一、技术概述

1.1 技术起源与定位

地下水 100% 回灌单井循环换热地能采集技术为北京中关村原创技术，以地下水为介质，通过系统封闭加压实现 100% 同井回灌，采集地下岩土体浅层低温热能，为建筑物供暖、制冷、提供生活热水，不受天气影响。

1.2 技术原理

采集井内单井密封模块将井体分为加压回水区、密封区和抽水区。井水经电潜泵从抽水区抽出，通过热泵机组放热 / 吸热后，返回加压回水区与岩土体热交换，再经滤水管进入抽水区，完成单井循环换热。

1.3 技术特点

• 高效回灌：100% 同井回灌，不消耗，不污染地下水，同时解决传统井水回灌难题；

• 环境安全：避免塌陷、移砂等地质灾害，保护地下水水质；

• 适应性强：适用于卵砾石、岩石、泥沙等多种地层，单井换热功率最高可达 500kW。

二、示范项目水质监测分析

2.1 监测方案

• 项目概况：监测对象为“四博连工程师宿舍”示范项目单井循环换热地能采集井，监测周期为 2001-2015 年。

• 监测指标：覆盖水温、pH 值、浑浊度等 30 项指标，依据《地下水质量标准》(GB/T 14848-93，现行 GB/T 14848-2017) 评价。

• 监测频率: 2001 年监测 22 次，2002 年 12 次，2004 年后每年 4 次 (供暖季、制冷季各 2 次)。

2.2 监测结果

• 初始状态：2001 年水质基本符合地下水 III 类或 II 类标准，出水与回水温差 3.2℃。

• 长期趋势：2001-2015 年各监测指标 (如 pH 值、浑浊度、总硬度等) 均未发生明显变化，符合地下水III类或 II 类标准，证明该技术未对地下水水质造成影响。

三、工程改造应用案例

3.1 中关村三小万柳校区项目

3.1.1 项目背景

中关村三小万柳校区位于北京市海淀区，属于寒冷地区，地层岩性以粗砂砾石为主，项目总建筑面积 45952 平方米。项目采用 100% 回灌单井循环换热地能采集技术为核心的恒有源地能热泵环境系统，解决了项目采暖、制冷、生活热水的需求。

项目位于北京市水源保护地，为促进北京市采用安全的采集技术开发利用浅层地热能，配合北京市水务局研究，为单井循环换热地能采集井审批及监管方法提供参考、规范工程实施和验收，恒有源科技发展集团有限公司与 2014 年 4 月向北京市水务局申请在此项目进行单井循环换热技术实验应用，并与同月获准批复。多年监测表明，系统对地下水质没有影响，有效的保护了水源保护地的地下水安全。

2016 年 7 月 20 日，北京节能环保促进会组织有关专家对 100% 单井循环换热地能采集技术在中关村三小万柳校区项目的应用情况进行了评审。经过与会专家的认真讨论和质询，形成了如下评审意见：

1、单井循环换热地能采集技术是我国拥有其全部核心技术与知识产权。其核心原理是以水为介质，利用地能换热采集系统的压差，实现循环水同层回灌，源汇同一的循环换热采集浅层地能。在动态平衡下，实现自然能源的循环利用。地能采集利用全过程，没有水量损失、污染和地质灾害。成果促进了新时期绿色能源供暖的实现。单井循环地能采集系统面对各种地质条件，可设计性强，适用范围广，其作为我国原创的可再生能源应用技术已经输出海外，并获得美国“能源之星奖”。

2、采用单井循环换热地能采集技术的中关村第三小学万柳北校区按照《北京市水务局关于单井循环换热地能采集井工程技术开展应用实验的批复》内容要求，2014 年 9 月 26 日，实验项目实施方案、监测方案通过专家评审。2014 年 11 月 28 日，实验项目开始进场实施。在北京市节能环保促进会第三方机构及专家的全程监督、指导下，2015 年 11 月 11 日，按照审定的实施方案、监测方案，实验项目完成并投入冬季供暖试运行，相关监测数据向社会公开，并定期向北京市水务局报告实验项目运行情况结果表明不影响水源安全。

3、恒有源科技发展集团有限公司已委托“北京市水环境监测中心”专业机构对项目实施前后水质变化情况进行定期检测，结果表明单井循环换热地能采集井的水体质量各项指标在供暖运行时期内未发生明显变化，水质监测评价结果与初始水体质量一致，未对地下水质造成影响，与历次水务专家评审鉴定结果一致，单井循环换热地能采集井全过程没有水量损失、污染和地质灾害。

4、中关村三小万柳校区的单井循环地能热泵环境系统 (单井循环地源热泵环境系统) 项目的实施，符合《国务院关于实行最严格水资源管理制度的意见》(国发〔2012〕3 号)、《中共北京市委北京市人民政府关于进一步加强水务改革发展的意见》(京发〔2011〕9 号) 及《北京市人民政府关于实行最严格水资源管理制度的意见》(京政发〔2012〕25 号) 等有关文件规定。中关村三小万柳校区的单井循环地能热泵环境系统项目的运行信息公开、公正，是北京市水务局严格水资源管理和保护有效作为的一个典范。该实验项目的实施，可为建立地能热泵供暖项目的后评估制度、确保浅层地能的科学利用、实现在传统能源供暖产业基础上升级换代为地热能冷一体化新兴的绿色产业提供科学依据。为政府加强运行监管，落实创新应用技术，助力北京市加快压减燃煤和清洁能源建设提供有意义的参考。

5、专家建议

与会专家一致同意形成专家建议上报有关部门，以推动单井循环换热地能采集技术的利用和发展。市水务局继续深入落实《北京市人民政府关于实行最严格水资源管理制度的意见》，涉及浅层地能利用的项目，优先采用单井循环换热地能采集技术，市水务局审批备案后向社会公开，并转移第三方全过程跟踪、检查、验收。市水务局，随时抽查，发现问题及时处理。市发改委、市环保局等政府部门，应将推广单井循环地能热泵环境系统纳入治理雾霾、农村电高效替代工程。市政府借率先规模化示范：建议北京副中心优先采用单井循环地能热泵环境系统，成为新时期可再生能源供暖的绿色示范工程。单井循环换热地能采集系统是一种科学创新的换热技术，与传统的取水井有本质的区别，建议市水务局在管理中应从创新的角度给予大力支持。

3.2 承德医学院附属医院项目

3.2.1 项目背景

承德医学院附属医院位于河北省承德市，属于寒冷地区，地层岩性以岩石为主，供暖面积 19000 平方米，制冷面积 79000 平方米。医院原浅层地热能采集系统由 18 口一抽多灌式采集井组成。至 2018 年初，18 口井已经有 8 口井因不能够回灌等原因报废，所以直接将换热后的地下水排入市政污水管道。

承德医学院附属医院针对上述问题对多种解决方案进行对比分析。最终决定采用恒有源 100% 回灌单井循环换热地能采集技术替代原有抽水井一抽多灌方式，来解决采集系统存在的问题。由于恒有源科技发展集团有限公司是单井循环技术的专利发明者、持有者。经过相关部门批准，项目采用单一来源的招标采购方式。

3.2.2 改造方案

• 技术选型：采用恒有源 100% 回灌单井循环换热地能采集技术，改造原有 11 口井，新打 7 口井，设计井深 60 米，单井冬季换热功率 200kW，夏季换热功率 300kW。

• 实施效果：2018 年改造完成后，系统运行稳定，总循环流量 540m^3/h，供水温度 15.3℃，回水温度 13.1℃，室内温度 18-22℃，实现 100% 回灌，无地表塌陷等地质安全问题。解决了困扰浅层地热能行业发展的回灌难及渗透性差地层浅层地能采集的难题。

四、结论与展望

100% 回灌单井循环换热地能采集技术实现了浅层地热能的环保高效开发利用，经工程实践与长期监测验证，其在水质保护、地质安全及能效保障方面表现优异，是开发利用浅层地热能保持地下水质的更新换代新技术。未来可进一步推广至不同地质条件区域，为清洁供暖与可再生能源利用提供技术支撑。

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恒有源科技发展集团有限公司推进全面标准化地能热泵高效清洁取暖的转型变轨

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引言：二十五载深耕地能热泵，开启标准化发展新篇章

恒有源科技发展集团有限公司（以下简称恒有源科技）自 2000 年成立以来，始终专注于浅层地热能开发利用，致力于为中国北方供暖提供高效清洁的替代能源解决方案。二十五年来，恒有源科技从技术研发到工程实践，积累了丰富的行业经验，成功将地能热泵技术应用于北方多个地区的清洁供暖项目。随着国家“双碳”目标的深入推进和清洁能源产业的高质量发展要求，恒有源科技审时度势，决定在 2025 年这一关键节点实施重大战略转型——从传统的工程模式全面转向标准化、规模化发展路径，通过区域代理和项目独家代理模式，发展北方冬季地能热泵高效清洁取暖，推动热冷一体化新兴绿色产业。这一“转型变轨”不仅是企业经营策略的调整，更是对行业发展模式的创新探索，标志着恒有源科技进入标准化、规模化发展的新阶段。

一、战略转型背景：从工程驱动到标准引领的必然选择

恒有源科技二十五年的发展历程，见证了中国浅层地热能开发利用从技术探索到规模应用的完整过程。在早期发展阶段，恒有源科技主要通过承接具体工程项目来推广地能热泵技术，这种模式虽然能够确保每个项目的技术质量和实施效果，但也存在明显的局限性，难以快速响应国家清洁能源替代的迫切需求。随着恒有源科技技术体系的成熟和品牌影响力的提升，传统的工程模式已无法满足市场的需要。

与此同时，国家能源结构调整和环境保护政策对清洁供暖提出了更高要求。《北方地区冬季清洁取暖规划 (2017-2021 年)》明确提出要大力发展可再生能源供暖，到 2025 年，清洁取暖比例要达到 80% 以上。这一政策导向为地能热泵技术提供了广阔的市场空间，但也对技术的标准化、规范化应用提出了严格要求。行业亟需建立统一的技术标准和服务体系，避免因无序发展导致的技术风险和市场混乱。

基于这一背景，恒有源科技决定实施战略转型，将企业发展重点从工程项目转向标准制定和模式创新。通过建立完善的区域代理和项目独家代理体系，推广标准化的技术解决方案和商业模式，实现地能热泵高效清洁取暖技术的快速普及。这一转型不仅是企业自身发展的需要，更是推动行业健康有序发展的重要举措。

二、标准化体系建设：打造可复制、可推广的市场发展模式

恒有源科技推进全面标准化的核心在于建立一套完整的、可复制的技术标准和商业体系。为此，已制定出《专属定项服务区域发展合作总经理标准协议》、《区域发展合作商协议书》、《项目独家代理标准协议》，这些文件不仅规范了合作双方的权利义务，更重要的是将恒有源科技二十五年积累的技术经验、管理方法和服务体系固化为标准化操作流程，确保不同地区、不同规模的代理机构都能按照统一标准提供高质量的地能热泵供暖服务。

从市场发展模式上，提供以下合作模式：

1、项目独家代理商：传统业务模式，项目标准系统价格体系：代理商成本价、代理商签约价、恒有源市场指导价。

2、区域发展合作商：支付技术服务费，为取暖区域覆盖 5.7 亿人口，提供持续服务。发展取暖地区的绿色产业。

3、恒有源科技地能热泵高效清洁取暖的三类标准系统成套产品：

(1) 适用于城镇集中供暖的分布式地能热泵环境系统；

(2) 适用于农村散户独立计量分间取暖的地能热宝系统；

(3) 适用於一次规划分期实施的分布式地能冷热源站系统。

系统成套产品供热量涵盖 5.6kW-2500MW，取暖面积涵盖 40 平方米 -5000 万平方米。三类系统成套产品共包含 25 个系统成套产品、38 个循环成套产品、202 个加工组装模块产品。其中，157 个是专有技术产品。

集团同时还制定了《恒有源科技地能热泵高效清洁取暖发展热冷一体化新兴绿色产业系统成套产品标准》手册及相关的标准价格。

恒有源科技建立的标准化体系不是一成不变的教条，而是具有持续优化机制的动态标准。集团成立了标准化委员会，定期收集相关信息，对标准进行修订完善，确保标准化体系始终与行业前沿保持同步。

三、代理模式创新：构建合作共赢的产业发展生态

恒有源科技战略转型的关键举措是大力发展区域代理和项目独家代理模式，这一转变将彻底改变企业传统的市场拓展方式，从“单打独斗”转向“合作共赢”。区域代理模式和项目独家代理模式都建立在标准化体系基础上，确保无论由哪个代理机构实施的项目，都能达到恒有源科技统一的技术和服务标准。

为确保代理模式顺利实施，恒有源科技建立了完善的代理支持体系。设立了“区域发展合作总经理管理办公室”和“项目独家代理商管理办公室”。区域发展总经理部全面支持各区域代理商开展工作，项目独家代理商管理办公室则以项目备案的形式，对代理商跟踪项目进行信息的更新以随时跟进市场、提供支持，同时也对代理商本身工作进行推进和监督，对不能满足公司要求的代理商进行筛选直至淘汰。

四、转型保障措施：全方位推进标准化战略落地

为确保从工程模式向标准化代理模式的顺利转型，集团制定了一系列保障措施，从组织架构、人才队伍、信息化建设等多个方面推进标准化战略落地。

在组织架构调整方面，集团成立了标准化委员会，由企业高层直接领导，负责标准化战略的制定和实施。同时，对原有工程项目部门进行重组，重新组建了安装一、二、三分公司，使组织架构更加适应标准化、规模化发展的需要。

人才队伍转型是战略实施的关键。恒有源科技持续对现有员工进行培训，促进从工程思维向标准思维的转变；另一方面大力引进专业人才，充实关键岗位。

信息化建设为标准化战略提供了技术支撑。恒有源科技投入大量资源建设“恒有源大数据运维中心”。在以前“恒有源地能云平台”的基础上，持续开发。利用信息化手段实现高效的管理。

五、未来展望：标准化引领行业高质量发展

恒有源科技推进全面标准化的战略转型，通过建立统一的技术标准和服务体系，为行业树立标杆，推动地能热泵应用从无序竞争走向规范发展，从工程项目驱动走向标准引领驱动。

从行业发展角度看，恒有源科技主动承担起标准制定的责任，2023 年，由恒有源科技发起，北京节能环保促进会主持起草的《供暖热泵机组》团体标准正式发布。为行业高质量发展提供了重要参考。

从国家战略层面看，有助于加速北方地区清洁能源替代进程，发展热冷一体化新兴绿色产业。使更多地区能够享受到高效清洁的供暖服务。这将有力支持国家“双碳”目标的实现，为生态文明建设做出积极贡献。

展望未来，恒有源科技将以 2025 年标准执行年为起点，持续推进标准化战略的深化和完善。一方面，将不断优化现有标准体系，提升技术的先进性和适应性；另一方面，将积极探索标准国际化路径，推动中国地能热泵标准走向世界。通过坚持不懈的标准创新和实践，为中国乃至世界的清洁能源发展贡献更多力量。

六、结语：以标准化驱动清洁能源革命

恒有源科技从工程模式向标准化代理模式的转型变轨，是一次深刻的战略变革，体现了企业把握行业发展规律、引领技术创新方向的前瞻思维。通过建立完善的标准化体系和代理网络，恒有源科技将实现从技术提供商向标准制定者和模式创新者的角色转变，开创地能热泵高效清洁取暖的新局面。

在国家大力推进能源革命和生态文明建设的大背景下，恒有源科技的标准化战略具有重要的示范意义。它证明了企业完全有能力通过自主创新和标准引领，推动清洁能源技术的规模化应用，为全球环境治理提供中国方案。随着标准化战略的深入推进，恒有源科技必将在清洁能源领域书写更加辉煌的篇章。

新工程、新动向

西山林场改造工程

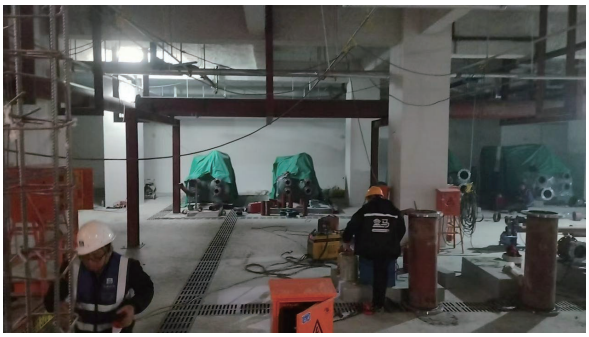
西山林场管理处安全隐患治理项目空调系统改造工程，位于北京市海淀区西山森林公园内，总建筑面积 3600 平方米，集办公、餐饮、会议于一身的多功能办公楼。

恒有源科技负责对现有空调系统进行改造施工，包含室外一次网能量采集系统、机房二次网换热系统、机房三次网能量提升系统、原有设备拆除、机房消音降噪的全部材料设备提供及安装。有效解决了原系统供暖制冷效果欠佳且噪音大的问题。

华北电力大学新建体育中心项目

华北电力大学新建体育中心项目由地上二层和地下二层构成，总建筑面积 44372.55 平方米。屋面 (地面) 部分为标准 400 米田径场，作为室外田径场和足球场使用。首层：武术、舞蹈、普拉提、跆拳道训练馆、器械健身房、更衣室、公共联系廊等；地下一层：游泳馆、篮球馆、综合馆、器械健身房、健美操、瑜伽、跆拳道训练馆、运动员休息室、公共通廊等；地下二层：社团多功能社团活动中心、人防停车库以及各设备机房。

项目采用以浅层地热能清洁能源为主的地能热泵系统满足体育中心建筑内的供暖、制冷需求，并保留燃气锅炉 + 电制冷系统作为备用系统，以提高项目运行的安全可靠性。项目采用设备租赁 + 工程的合作方式，与常规的冷热源系统工程方式在经济方面、施工管理方面、后期运行及风险方面等有明显的优势。



机房施工中现场照片

中国农村财经研究会未来科技驱动发展工作委员会来访

2025 年 3 月 13 日，中国农村财经研究会未来科技驱动发展工作委员会领导和专家一行到恒有源集团考察。

委员会领导、专家一行首先考察了公司项目，包括：恒有源分布式地能热泵环境系统清洁高效集中供暖项目全国工商联大楼和海淀外国语实验学校。地能热宝高效清洁分户供暖八年的首都精神文明村、北京市农村工作先进集体罗家坟项目。然后领导、专家在恒有源集团信息中心听取了专项汇报，并进行了座谈。领导、专家对恒有源原创的“单井循环换热地能采集技术”的技术原理和应用实践效果非常关心，双方对此进行了充分的交流、沟通。

武强院士作为公司特邀嘉宾也一同参加了座谈会。

参观照片

聚焦“供暖保证”核心，推动绿色供暖高质量发展
——解读《供暖热泵机组》团体标准

作者：刘宝红

在全球积极推进绿色发展、我国清洁供暖需求持续攀升的大背景下，热泵技术凭借高效利用低温热源、节能环保等突出优势，已成为供暖领域的热门选择。据统计，仅恒有源科技发展集团有限公司实施的热泵供暖面积就已超过 2100 万平方米，热泵技术在我国绿色供暖市场具有广阔的应用前景。

长期以来传统的热泵机组多用于制冷。一般地说，用于制冷系统的热泵用于供暖也可以运行，但是其成本、效率和寿命等都难以达到最佳值。与此同时，专门针对供暖特性的技术标准存在缺失，这一现状严重制约了热泵供暖行业的健康、有序发展。在此背景下，由恒有源科技发展集团有限公司提出并参与制定的《供暖热泵机组》T/BAEE019-2023 团体标准，于 2023 年 12 月 1 日经北京节能环保促进会正式发布，并于 12 月 25 日正式实施。该标准明确了水源供暖热泵机组、低环境温度空气源供暖热泵热水机组、低环境温度空气源供暖热泵热风机组三类机组的性能指标，覆盖设计、制造、测试全流程，为严寒、寒冷等不同气候区划提供差异化解决方案。该标准填补了供暖热泵机组在低温适应性、能效评价、舒适性保障等方面的空白，为设计、生产和使用者提供了科学依据，助力行业规范化发展，推动绿色供暖系统高质量发展。

一、供暖保证的核心创新内容

1.1 强化低温工况适应性设计

供暖热泵机组的核心挑战在于极端低温环境下的稳定运行。本标准针对不同气候区域，提出以下关键要求：

(1) 拓宽水源供暖热泵机组进水温度范围

新增 6 °C 进水工况，覆盖标准 GB/T19409-2013 未涉及的低温区域。同时，根据实际工程案例，将机组增加了两类低温型机组，即 II 型 (最低 0°C) 和III型 (最低 -5°C)，并明确防冻剂使用规范，确保机组在严寒条件下的可靠性。

(2) 规范水流量计算

明确制热工况下热源侧流量为 0.134m^3/(h·kW)，弥补现行标准仅针对制冷工况的不足。

1.2 以制热能效为核心的评价体系

现行能效标准 (如 ACOP 指标) 偏重制冷权重，与供暖需求不匹配。本标准创新提出：

(1) 优化能效评价指标

采用 COP_h(制热性能系数) 和 COP_{dh}(低温制热性能系数) 作为核心评价参数，突出制热场景的能效要求。

(2) 严控热风舒适性

规定热风型机组在入口空气 14°C时，出风温度不得低于 38°C，避免送风温度过低影响体感舒适性，并通过风量控制、变流量调节等技术实现温度保障。

1.3 差异化气候区划选型指南

中国地域气候差异显著，本标准结合不同地区的极端低温、常温层岩土体原始温度为等数据，提供选型指导，通过科学匹配机组类型与当地气候条件，确保供暖系统高效稳定运行。

(1) 严寒地区 (如哈尔滨)

常温层岩土体原始温度为 8°C，推荐III型水源供暖热泵机组，适应 -5°C低温环境。

(2) 夏热冬冷地区 (如合肥)

常温层岩土体原始温度为 17.4°C，推荐 I 型水源供暖热泵机组，兼顾经济性与效率。

二、高质量生产要求保障可靠性

2.1 严控机组密封与振动性能

(1) 双重密封检测

对制冷剂侧增加了“除工厂在线检测外，在产品生产入库 24h 后再进行一次检测，机组换热系统各部分不应有压缩机工质泄漏”和“对分体式热风型机组，在出厂前应对未加注压缩机工质的室内机进行充氮密封，充干燥氮气压力为 0.2MPa ～ 0.3MPa(表压)”要求。

(2) 振动测试标准化

新增机组振动测试要求，避免因压缩机、电机等部件异常振动引发故障。

2.2 低温启动与维保规范

(1) 低温启动试验

明确压缩机油、制冷剂等在低温环境下的性能测试要求，确保极端气候下机组正常启动。

(2) 说明书规范化

机组使用说明书也按照供暖保证、高效节能等原则进行规范，涵盖产品说明、参数、安装、使用、维修保养等内容，为用户和安装维护人员提供全面指导，保障机组正确安装和使用，从售后环节巩固供暖保证。

三、标准实施，推动绿色供暖高质量发展

该标准的实施发布，从设计、生产到选用，全方位筑牢供暖保证根基，为热泵供暖行业的高质量发展提供了有力保障，将推动绿色供暖行业朝着更加规范、高效、环保的方向迈进。

从市场层面来看，该标准为产品提供了统一、明确的技术规范，有效规范了市场秩序，大幅减少了不合格产品的流通，提升了产品的整体质量，为实现稳定可靠的供暖奠定了坚实基础。同时，标准的实施增强了消费者对产品的信任度，有力促进了产品的推广应用。

从行业发展角度而言，标准的推行有力推动了节能减排工作的开展。通过提高热泵的能效比，显著降低了能源消耗和温室气体排放，助力我国实现“双碳”目标。此外，高标准的要求促使企业技术和产品升级，提升经济效益和服务水平，全方位保障供暖热泵机组在实际应用中实现稳定、高效、舒适的供暖。

该标准文档已在《全国团体标准信息平台》(www.ttbz.org.cn) 正式公布。热泵供暖相关企业可通过网站下载，或联系协会咨询标准细节及获取支持。我们期待行业同仁认真研究、落地应用本标准，共同提升热泵供暖行业的技术规范性与整体竞争力，推动行业高质量发展。

Interview with Mr. Wu Qiang, Academician of the Chinese Academy of Engineering and Professor at China University of Mining and Technology (Beijing)

Profile

Wu Qiang, male, born in October 1959 in Hohhot, Inner Mongolia Autonomous Region, is a member of the Communist Party of China. He is a hydrogeologist and environmental geologist, an academician of the Chinese Academy of Engineering and the International Eurasian Academy of Sciences, a professor and doctoral supervisor at China University of Mining and Technology (Beijing), a member of the National Committee of the Chinese People's Political Consultative Conference (CPPCC), and a member of the CPPCC National Committee's Population, Resources, and Environment Committee. He serves as the Director of the National Coal Mine Water Hazard Prevention and Control Engineering Technology Research Center, Vice Chairman of the International Mine Water Association (IMWA), Convener of the Geological Resources and Geological Engineering Discipline Evaluation Group of the Academic Degrees Committee of the State Council, Deputy Director of the Earth and Resources Science Division of the Science and Technology Commission of the Ministry of Education, and enjoys special government allowances from the State Council.

Professional Experience: After completing his Ph.D. in 1991, he joined China University of Mining and Technology (Beijing) for postdoctoral research and teaching. He was elected as an academician of the Chinese Academy of Engineering in 2015 and as an academician of the International Eurasian Academy of Sciences in 2021. He has received numerous accolades, including the inaugural China Outstanding Postdoctoral Award, the Ho Leung Ho Lee Foundation Prize for Scientific and Technological Progress, the Li Siguang Geological Science Award, the National Innovation Award, and titles such as "National Outstanding Teacher" and "People's Teacher of Beijing." Wu Qiang has long been engaged in teaching and research on mine water prevention and resource utilization. As the leader of the State Council's expert investigation team for major water inrush accidents, he has overseen six major mine water inrush disaster rescue operations or investigations. His significant contributions include the development of prediction and control technologies for coal mine roof and floor water inrush disasters, theories and technologies for coordinated coal-water dual-resource development, and the creation of a 3D visualization and virtual analysis system for mine water filling conditions.

On June 3, 2025, Academician Wu Qiang, Professor at China University of Geosciences (Beijing) and Academician of the Chinese Academy of Engineering, was interviewed by our magazine's interview team in Beijing. Academician Wu's recent schedule has been extremely busy; he had just returned to Beijing from out of town, still bearing the dust of travel. However, as soon as the conversation turned to major issues such as the global energy landscape, China's energy security, and the development and utilization of shallow geothermal energy, he immediately became highly energetic and spirited. Below are excerpts from the interview.

Interviewer: What challenges do you believe the current global trends in energy utilization pose for China in ensuring energy security and achieving a clean, low-carbon transformation of its energy structure? How should we respond?

Wu Qiang: Against the backdrop of an accelerating century-long transformation and complex geopolitical conflicts, China's energy security and clean, low-carbon transition face challenges.

In terms of energy security, China's energy consumption structure is still dominated by fossil fuels, and energy demand continues to grow. During the accelerated energy transition, we must both ensure supply meets demand and gradually reduce dependence on traditional fossil fuels to achieve a smooth transition, creating significant pressure. China's coal development intensity is high, with strong constraints on safety and ecological protection. The dependence on imported oil and natural gas is high, with concentrated import sources, making it vulnerable to geopolitical and international situations, threatening the stability and reliability of supply. Regarding the clean, low-carbon transition, traditional energy infrastructure accounts for a large proportion, and transitioning requires substantial capital investment for retrofitting and new construction. Wind and solar energy have inherent intermittency and instability. However, current regulating capabilities, including energy storage, deep flexibility retrofitting of thermal power units, grid intelligence, and energy meteorology, lag behind, making it difficult to meet the demands of large-scale grid integration.

Facing up to the challenges, we shall strengthen domestic exploration and development of coal, oil, and natural gas to increase self-sufficiency, reduce import dependence, and ensure supply security. Enhance energy infrastructure construction, upgrade the intelligence and digitalization level of the energy system to improve its flexibility and adaptability. Increase investment in technological innovation in the energy sector, focusing on key technologies such as renewable energy, energy storage, and smart grids, to improve energy utilization efficiency and reduce costs. We shall promote the green, low-carbon transformation of traditional energy industries, such as achieving clean and efficient coal utilization, and clean, flexible retrofitting of coal power, and formulate and improve supportive policies for energy transition, such as fiscal subsidies, tax incentives, and price mechanism reforms; improve market mechanisms like the carbon trading market, fully leverage the decisive role of the market in energy resource allocation, and guide social capital into energy transition fields. In addition, international cooperation is needed to ensure the security of transportation channels.

Interviewer: Facing the complex and volatile international energy situation and the domestic "dual carbon" goals, as a strong advocate and promoter of geothermal energy development and utilization in China, and considering China's own resource endowment, what is your view on the strategic positioning of local renewable energy sources, including wind, solar, and geothermal energy, in the modern energy system? Compared to other renewables, what unique advantages does geothermal energy have in terms of stability, geographical applicability, and providing base heating/cooling energy? What are the development prospects for multi-energy complementary systems integrating geothermal with other renewables?

Wu Qiang: Wind and solar energy, with their advantages of being clean, easily accessible, renewable, and widely distributed, hold immense potential in the strategy of replacing traditional fossil fuels with renewables. Driven by the "dual carbon" goals and supportive policies, China's wind and solar development has expanded rapidly, with cumulative and newly installed capacity long ranking first in the world. They have become the dominant force in China's energy structure transformation and upgrading and are expected to occupy a primary position in China's future new energy system. Geothermal energy, as the most stable renewable within the family characterized by strong temporal variability, has large reserves and relatively widespread distribution. Its strategic positioning is unique, playing an irreplaceable role in energy supply stability and regional energy security, especially demonstrating significant advantages in the combined supply of heating, cooling, and domestic hot water, where it can provide fundamental support.

As a relatively stable and reliable renewable energy source, geothermal energy's stability is significantly advantageous within the renewable family. It is unaffected by natural conditions like seasons, day/night cycles, or weather changes, allowing it to serve as a baseload energy source for continuous and stable supply. Shallow geothermal energy in China is extremely widely distributed, with low extraction difficulty and diverse utilization forms–capable of both heating and cooling–giving it strong geographical applicability. Geothermal heating and cooling is efficient, environmentally friendly, and energy-saving. It can provide direct heating or utilize heat pump technology to enhance efficiency for heating/cooling, with low operating costs, reducing dependence on traditional fossil fuels and lowering carbon emissions.

The development prospects for multi-energy complementary systems integrating geothermal with other renewables are vast. Such systems help optimize China's energy structure, increase the proportion of renewables, reduce dependence on traditional fossil fuels, and promote the energy transition. Wind and solar power generation are intermittent, while geothermal energy is stable and reliable. Developing a "geothermal plus" model can compensate for the intermittent supply shortcomings of wind and solar. In resource-rich areas, geothermal energy can provide peak-shaving and valley-filling support for wind and solar power generation. For example, prioritize solar power generation during the day when sunlight is abundant; supplement with geothermal power generation or other energy storage devices at night or when solar is insufficient, enabling the coordinated development and utilization of multiple renewable energy sources.

Interviewer: In recent years, shallow geothermal energy, as a rising star among geothermal resources, has seen rapid and remarkable development in its utilization. What do you believe are the fundamental reasons for this? Where are the main opportunities for its large-scale application in clean urban heating in the future? Simultaneously, what key challenges does it face?

Wu Qiang: The fundamental reasons for the rapid development of shallow geothermal energy utilization mainly include the following points. First, according to survey data from the China Geological Survey, the annual exploitable resource potential of shallow geothermal energy in 336 major Chinese cities is enormous, equivalent to 700 million tons of standard coal, capable of supporting heating (cooling) for a building area of 32 billion square meters. This abundant resource in reserve provides a solid foundation for its development and utilization. Second, strong policy support is the backbone. Driven by the national "dual carbon" goals, various regions have introduced policies encouraging renewable energy development, offering subsidies, preferential electricity tariffs, etc., for shallow geothermal projects, stimulating market participation. Third, technology has gradually matured: Ground source heat pump technology has continuously advanced, improving the utilization efficiency of shallow geothermal energy and reducing equipment costs and operational energy consumption, making its development more economically feasible. Fourth, significant environmental advantages are the incentives. The development and utilization process of shallow geothermal energy produces almost no greenhouse gas emissions or pollutants, meeting current environmental protection requirements, helping improve environmental quality, and reducing atmospheric pollution issues like smog. Under the "dual carbon" goals, its environmental advantages are even more prominent, garnering increasing attention and importance. Fifth, shallow geothermal energy generates triple supplies, i.e., heating, cooling, and domestic hot water. Moreover, the more heating provided in winter and cooling in summer, the stronger the thermal/cold recovery capacity of the geological body providing the heat/cold source. Sixth, large amounts of surface water, domestic sewage, mine drainage, and springs can all be utilized as water sources for applying heat pump technology to solve the heating and cooling of buildings, contributing to conservation of a significant proportion of energies in China.

In the future, the large-scale application of shallow geothermal energy for clean urban heating faces numerous opportunities. As the energy transition accelerates, demand for clean heating continues to rise. Shallow geothermal energy, as a relatively stable renewable, with its significant advantages for clean heating, shows broad application prospects driven by winter heating needs in the north and winter warmth needs in the south. Integrating geothermal energy supply pipelines into urban renewal and infrastructure construction can not only reduce costs and improve energy efficiency but also create opportunities for large-scale application in urban clean heating. Whether for new buildings, parks, urban area infrastructure, or the renovation of old urban districts, shallow geothermal heating can be a key renovation direction, thereby enhancing the cleanliness of heating and cooling and providing vast space for large-scale construction of such systems. Furthermore, with the advancement of regional energy matrix construction, shallow geothermal heating and cooling systems can interconnect with other energy systems, optimize energy allocation, further enhance energy utilization efficiency and system stability, thus expanding their application scenarios. Especially in northern winter heating regions, vigorously promoting the replacement of fossil fuel heating with shallow geothermal energy and developing the emerging green industry of

integrated heat pump heating and cooling should be prioritized. Especially in northern winter heating regions, vigorous promotion should be given to replacing fossil fuel heating with shallow geothermal energy, developing an emerging green industry of integrated heating and cooling.

However, large-scale promotion of shallow geothermal energy also faces several key challenges. Technically, although ground source heat pump technology continues to advance, in areas with complex geological conditions, such as regions with extensive bedrock distribution, system design and construction are difficult, and drilling is challenging, which severely hinders the smooth implementation of projects. Economically, the initial investment cost for shallow geothermal projects is relatively high, including drilling, equipment purchase, and installation expenses. For enterprises or regions with weaker financial strength, the upfront investment pressure is significant. Moreover, the cost of shallow geothermal heating and cooling in some areas is not yet clearly advantageous compared to traditional heating costs, which somewhat weakens its market competitiveness. Regarding standards, regulations, and supervision: The shallow geothermal heating industry lacks comprehensive, unified standards. Issues of missing standards exist in project design, construction, acceptance, and operation management, leading to inconsistent project quality and seriously affecting the industry's healthy development. Simultaneously, supervision over key issues like environmental impact and groundwater reinjection during development and utilization is insufficient. Additionally, public awareness of shallow geothermal energy is low, and there are many doubts about the safety and reliability of its development and utilization, which also significantly affects the promotion and application of shallow geothermal heating projects.

At the beginning of this year, Beijing Municipality released the Implementation Measures for the Pilot Reform of Water Resource Tax in Beijing, which further clarifies the scientific categorization and utilization along with the strict standardized management of groundwater. This ensures the robust and orderly development of shallow geothermal energy as a replacement for fossil fuels.

Interviewer: As enterprises focused on shallow geothermal energy heating, in which directions should they focus their efforts next to better respond to the national call for energy conservation and environmental protection and promote the healthy development of the shallow geothermal heating industry? What suggestions do you have?

Wu Qiang: To actively respond to the national call for energy conservation and environmental protection and promote the healthy development of the industry, the heat pump heating sector requires integrated technologies such as innovative shallow geothermal energy collection exemplified by the "single well circulation heat exchange geothermal energy collection 100% reinjection system" that ensures reliable operation even under the harshest winter conditions in northern China. Enterprises should focus efforts in the following directions: Increase R&D investment to develop efficient drilling technologies for complex geological conditions and optimize ground source heat pump systems, enhancing energy utilization efficiency, reducing energy consumption, and improving project adaptability and economic viability. Strengthen collaboration with research institutions and universities to establish an industry-academia-research-application integrated innovation mechanism, accelerate the transformation of scientific and technological achievements, and maintain technological leadership. Simultaneously, improve the operation and maintenance management of

shallow geothermal energy utilization systems. Employ modern information and sensing control technologies such as the Internet and intelligent monitoring to conduct real-time monitoring and analysis of operational parameters, promptly resolve issues, ensure safe, stable, and efficient system operation, and enhance heating/cooling quality and service levels. Strictly comply with laws, regulations, and standards, implementing measures to protect groundwater resources, soil, and the aquatic environment to achieve sustainable development and utilization of shallow geothermal energy. Furthermore, rigorously control project quality by establishing comprehensive quality management systems to ensure stable and reliable project operation. Actively participate in the formulation of industry standards, promoting unified and standardized industry norms to elevate the overall engineering quality level of the sector and build a positive corporate brand image. Enterprises should also actively engage in energy internet construction, collaborating with other energy companies to achieve synergistic complementarity between shallow geothermal energy and other energy sources, improve comprehensive energy utilization efficiency, integrate into the broader energy development landscape, and contribute greater strength to the national cause of energy conservation and environmental protection.

Promoting Efficient and Clean Heating with Geothermal Energy Heat Pumps in Northern China and Accelerating the Development of Integrated Heating-Cooling Emerging Green Industries

——Guided by the "Action Plan for Promoting High-Quality Development of the Heat Pump Industry" to Enhance Understanding and Plan Work

Author: Yang Mingzhong

In March 2025, to thoroughly implement the spirit of the 20th National Congress of the Communist Party of China and its Second and Third Plenary Sessions, and to earnestly execute the decisions and deployments of the Party Central Committee and the State Council, the National Development and Reform Commission and other departments formulated and issued the "Action Plan for Promoting High-Quality Development of the Heat Pump Industry" (hereinafter referred to as the "Action Plan") (NDRC Resource and Environment [2025] No. 313). The "Action Plan" clarifies the overall requirements for promoting the high-quality development of the heat pump industry and sets work goals for 2030. It outlines the main pathways for the application of heat pumps in sectors such as construction, industry, agriculture, and transportation, based on technological development levels and industry characteristics. Additionally, it emphasizes tasks for quality improvement and upgrading across the entire lifecycle of heat pumps, including design, R&D, manufacturing, equipment updates, and disposal. The introduction of this "Action Plan" is of great significance for the promotion of the heat pump industry and China's energy conservation and carbon reduction efforts. Geothermal energy heat pump heating, as a stable and efficient clean heating method, is now poised for accelerated development.

I. The Significant Importance of the Heat Pump Industry

A heat pump is a highly efficient energy conversion device that can transform low-grade thermal energy into high-grade thermal energy with minimal electricity input, meeting the heating demands of production and daily life while significantly improving energy utilization efficiency. Highly efficient geothermal energy heat pumps can achieve the effect of using 1 kWh of electricity to obtain the equivalent of 4 kWh of heat for building heating. In northern China, this can ensure 100% heating coverage for buildings with only 50% of the energy consumption of coal-fired systems, achieving zero emissions at the regional level.

II. Efficient and Clean Heating with Geothermal Energy Heat Pumps Supports Heat Pump Efficiency Improvement

The "Action Plan" states, "Strive to achieve a 20% or higher improvement in the energy efficiency of key heat pump products by 2030, while continuously enhancing heat pump manufacturing and technological R&D capabilities." With continuous breakthroughs in hardware technologies such as compressors, heat exchangers, and control systems, the energy efficiency of heat pump products will also improve. However, the efficiency of a heat pump system depends not only on the performance of the heat pump itself but also on the temperature grade and stability of the low-temperature heat source at the energy collection end. Compared to air-source heat pumps that rely on the low ambient temperatures (often below zero degrees Celsius) of northern China in winter, shallow geothermal energy heat pumps can stably provide a heat source of 10-15° C, significantly improving the system's energy efficiency ratio and maximizing the performance advantages of the heat pump host. Moreover, the stable temperature ensures that the system remains reliable even in extreme cold weather. Therefore, efficient and clean heating with geothermal energy heat pumps will better meet the requirements of the "Action Plan" and support the improvement of heat pump system efficiency.

III. Encouraging Large-Scale Application of Heat Pump Heating in Multiple Scenarios

The "Action Plan" proposes increasing the promotion and application of heat pumps from multiple dimensions, tailored to local conditions. It supports replacing coal-fired boilers and scattered coal burning with heat pumps, actively promotes industrial applications, expands the scope of use in agriculture and transportation, and initiates updates and retrofits of inefficient existing heat pumps.

After more than 20 years of development, the geothermal energy heat pump heating industry has established successful application cases in various scenarios and accumulated a substantial customer base with retrofit needs. For example, HYY has developed geothermal energy heat pump environmental systems suitable for urban centralized heating and ground source energy treasure systems for rural household heating. These systems can fully replace coal without increasing user costs. Beyond conventional applications in residential, office, and commercial buildings, they have also been successfully deployed in industrial plants, agricultural greenhouses, and highway toll stations and service areas, demonstrating the conditions for large-scale development across different heating sectors.

IV. Promoting Quality Improvement and Upgrading of the Geothermal Energy Heat Pump Industry

The "Action Plan" sets new requirements for heat pump design and manufacturing, including "miniaturization and ease of installation" and "providing users with integrated, customized heating and cooling solutions." HYY's ground source energy treasure product integrates the heat pump, circulation pump, and electrical control system into a single module. The smallest specification can serve rooms as small as a dozen square meters. Users can simply install it and operate it with a remote control, turning it on or off as needed. This makes efficient heat pump heating and cooling accessible to rural households, offering a worry-free, labor-saving, cost-effective, and energy-saving solution at a lower cost than coal burning. HYY's geothermal energy heat pump systems also feature

customized modular products that can be quickly assembled to meet users' heating and cooling needs.

The "Action Plan" also emphasizes improving the professional level of operation and maintenance, guiding heat pump manufacturers to transition from equipment suppliers to system integrators, and establishing installation, operation, and maintenance teams and service systems to ensure stable and efficient heat pump operation.

Heating is a major issue affecting millions of households and the national economy, requiring basic temperature guarantees even in extreme cold weather. Therefore, the stable operation and effective maintenance of heat pump systems are crucial. This is not only the foundation for ensuring heat pump heating functions in extreme cold but also a key factor in promoting regional industrial development of heat pump heating. Building a complete industrial system covering heat pump (and accessory) manufacturing, sales, installation, and operation provides strong support for heat pump heating. Since its inception, HYY has adhered to and practiced the concept of full-process service. The group includes a professional heat pump factory with processing capabilities, as well as design, construction, drilling, and operation teams with professional qualifications. Through an efficient and unified operation and maintenance center platform, HYY provides users with high-quality services covering the entire industrial chain. In the new era, HYY is replicating this model in other regions through regional development cooperation, achieving comprehensive industrial quality improvement and upgrading from manufacturing to service systems.

V. The Foundation for Accelerating the Development of Integrated Heating-Cooling Emerging Green Industries with Geothermal Energy Heat Pumps

The "Action Plan" states: Strengthen comprehensive policy support, encourage relevant units to adopt efficient heat pump technologies and products listed in the "Green Technology Promotion Catalog", "National Key Low-Carbon Technology Promotion Catalog", and "National Industrial and Informatization Energy Conservation and Carbon Reduction Technology Equipment Recommendation Catalog", and explore incorporating heat pump-related projects into the support direction of green and low-carbon advanced technology demonstration projects.

HYY's "The technique of single well circulation heat exchange geothermal energy collection" was included in the National Development and Reform Commission's "National Key Energy Conservation and Low-Carbon Technology Promotion Catalog (2015 Edition)", the Beijing Municipal Development and Reform Commission's "Beijing 2017 Energy Conservation and Low-Carbon Technology Products and Demonstration Case Recommendation Catalog", and the National Energy Conservation Center's third "Key Energy Conservation Technology Application Case Studies (2021-2022)". Additionally, HYY's ground source energy treasure product was successfully included in the "Beijing 2015 Energy Conservation and Low-Carbon Technology Product Recommendation Catalog" and the "Beijing Energy Conservation Technology Product Recommendation Catalog (2020 Edition)".

The "Action Plan" states: Leverage the leading and supporting role of standards, promote research on heat pump application standards in the construction sector, clarify heat pump performance coefficients for different building climate zones, and accelerate the improvement of heat pump performance requirements.

In addition to participating in the compilation of national standards such as the "Technical Code for Ground-Source Heat Pump Systems" (GB50366) and other industry regulations, HYY also led the drafting of the Beijing local standard "Technical code for single well of geothermal energy collection with circulation heat exchange" (DB11/T 935) and the group standard "Heating heat pumps" (T/BAEE019-2023). Among these, "Heating heat pumps" sets higher requirements for heat pump products from the perspective of heating guarantees in different climate zones.

The introduction of the "Action Plan for Promoting High-Quality Development of the Heat Pump Industry" marks a new stage of innovation-driven, high-quality development for China's heat pump industry. It will promote efficient and clean heating with geothermal energy heat pumps in northern China and accelerate the development of integrated heating-cooling emerging green industries. This will open a milestone chapter in China's efforts to achieve the "dual carbon" goals, improve the quality of life for its people, realize energy production and consumption revolution, and revolutionize rural lifestyles.

Diligent Study and Practice in Heat Pump Heating

——A Side Note on Eversource Science & Technology Development Group held a symposium on Studying the Action Plan for Promoting High-Quality Development of the Heat Pump Industry

by: Zhou Bin

Against the backdrop of global energy transition and China's dual-carbon goals, the heat pump industry is facing new opportunities and challenges. To actively respond to national policy calls and thoroughly implement the Action Plan for Promoting High-Quality Development of the Heat Pump Industry (hereinafter referred to as the Action Plan), HYY organized a symposium on May 21, 2025, to explore the opportunities and strategies brought by the Action Plan.

At the symposium, Yang Mingzhong, President of HYY, emphasized: "The introduction of the Action Plan outlines a clear development blueprint for the entire heat pump industry. For our company, this is not only an opportunity to achieve better development but also a significant responsibility. We must deeply comprehend the spirit of the plan and integrate it into daily management and long-term development planning. Through practical actions, we will continue to deepen our expertise in the heat pump field and contribute to the high-quality development of the industry."

During the symposium, participants actively shared their understanding and insights on the Pllan, offering suggestions and recommendations for the company's development under the new circumstances:

1. Due to the directional nature of energy conversion, high-grade energy will eventually transform into low-grade energy during use. Only heat pump technology can utilize a small amount of high-grade energy to elevate low-grade energy to high-grade energy, highlighting its immense significance. As both a producer and user of heat pumps (applied in system integration), HYY has consistently prioritized the development and utilization of heat pump technology since its establishment in 2000. Moving forward, greater attention will be put into cutting-edge technologies in the heat pump field, and continuous innovation is essential to enhance the company's competitiveness.

2. HYY's the technique of single well circulation heat exchange geothermal energy collection was included in the National Key Energy-Saving and Low-Carbon Technology Promotion Catalog (2015 Edition) by the National Development and Reform Commission, the Beijing Municipal 2017 Energy-Saving and Low-Carbon Technology Products and Demonstration Case Recommendation Catalog by the Beijing Municipal Development and Reform Commission, and the Third Edition of Key Energy-Saving Technology Application Case Studies (2021-2022) by the National Energy Conservation Center. Additionally, the company's Ground source heating device was successfully listed in the Beijing

Municipal 2015 Energy-Saving and Low-Carbon Technology Product Recommendation Catalog and the Beijing Municipal Energy-Saving Technology Product Recommendation Catalog (2020 Edition). These honors reflect the outstanding advantages of HYY's geothermal heat pump heating technology in energy conservation and carbon reduction. In the future, the company will focus on the Action Plan's task of "improving and upgrading the heat pump industry" to comprehensively advance related work and further enhance the energy-saving and carbon-reducing performance of geothermal heat pump heating products.

3. Since launching heat pump R&D and mass production in 2002, HYY's product portfolio now includes the Ground source energy treasure for rural household heating and a full range of geothermal heat pump products for centralized heating. Currently, the company is prioritizing the standardization of geothermal heat pump system products, developing a complete series of standardized and modular products across three categories: geothermal energy heat pump environmental system, ground-source energy heating device system, and distributed geothermal energy cooling and heating source station. This will better facilitate large-scale applications tailored to local conditions.

4. The Action Plan proposes "deepening international cooperation in the heat pump field" as a safeguard measure. HYY has already implemented geothermal heat pump projects in locations such as the Lincoln City Court Law Enforcement Training Center in the U.S., the David City Nursing Home, Hershey School, and Chase County School. Among these, the Hershey School project won the U.S. Environmental Protection Agency's (EPA) Energy Star Award, and a paper centered on this project received the Best Paper Award at the 2003 International Geothermal Resources Council (IGRC) Annual Meeting in Monterrey, Mexico. The David City Nursing Home project was awarded the Technology Excellence Award by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Additionally, three of the company's papers were included in the proceedings of the 2023 World Geothermal Congress (WGC2023). In 2025, based on market research on geothermal heat pump heating abroad, HYY officially began exploring the North American market and is now accelerating progress to achieve more phased results.

5. The Action Plan explicitly calls for "extensive and in-depth promotion of heat pump application practices to raise social awareness." Over the years, HYY has relied on its corporate website, the China Geothermal Energy journal, self-media platforms, and other online channels, combined with offline scenarios such as exhibitions and retail stores, to comprehensively promote practical application cases of geothermal heat pump heating. This has significantly improved public awareness of geothermal heat pumps. Moving forward, the company will focus on establishing the Beijing Heat Pump Heating and Cooling Operation and Maintenance Big Data Service Platform, integrating planning, design, production, construction, and operation services to provide comprehensive support for customers and professionals, thereby driving the development of the ground-source heat pump industry.

Participants unanimously agreed that the implementation of the Action Plan presents a significant opportunity for the company's development, as well as a long-term and challenging task. All departments must work closely together, pooling their strengths to translate the requirements of the Action Plan into concrete actions. By driving development through innovation and winning the market with quality, HYY will actively fulfill its social responsibilities, contributing its wisdom and strength to the green and low-carbon development of the heating industry and the realization of the nation's dual-carbon goals.

Celebrating the Promulgation of "Implementation Measures for the Pilot Reform of Water Resource Tax in Beijing"

China Geothermal Energy Editorial Department

The Ministry of Finance, the State Taxation Administration, and the Ministry of Water Resources jointly issued the Implementation Measures for the Pilot Reform of Water Resource Tax, specifying that the nationwide pilot program replacing water resource fees with taxes will be fully implemented starting December 1, 2024. Beijing responded swiftly and actively advanced related work, officially releasing the Implementation Measures for the Pilot Reform of Water Resource Tax in Beijing (hereinafter referred to as the Measures) on January 22, 2025. This move marks a significant step forward in Beijing's water resource management and utilization.

As one of the national pilot cities for water resource tax reform, Beijing’ s policy not only demonstrates a proactive response to national directives but also serves as a crucial practice in promoting sustainable water resource utilization and advancing ecological civilization. We warmly welcome this initiative and anticipate that it will bring new momentum to the development and utilization of shallow geothermal energy and water resource management in Beijing and across the country, while also fostering promising prospects for the clean heating industry powered by heat pumps.

I. Significant Implications of Water Resource Tax Reform

Water resources are fundamental to socioeconomic development and a critical component of the ecological environment. With rapid economic growth and urbanization, Beijing faces multiple challenges. Effectively managing and rationally utilizing water resources has become a key issue for the city's sustainable development.

The core objective of water resource tax reform is to regulate the exploitation and use of water resources through fiscal leverage, promoting conservation and protection. Compared to the previous water resource fee system, the tax approach carries stronger legal binding force and regulatory power. By leveraging taxation, the reform encourages enterprises and individuals to value and utilize water resources more scientifically and efficiently, reducing waste and pollution.

Water is not only a vital resource but also a carrier and medium for other resources, such as heat. While ensuring proper water resource management, the Measures create favorable conditions for the

utilization of other water-carried resources. The implementation of the Measures will significantly reduce the costs of adopting shallow geothermal energy for clean heating, accelerating the industrialization of sustainable heating solutions.

II. Highlights and Innovations of the Measures

Building on the experiences of other pilot regions and tailored to Beijing's specific conditions, the Measures introduce several innovative initiatives:

1. Differentiated Tax Rates: Based on thorough research and classification of water resource users, the Measures establish differentiated tax rates according to water usage purposes and regional variations. Industries with high water consumption and those exceeding allocated quotas face proportionally higher tax rates to incentivize water-saving measures. In contrast, agricultural and residential water use are subject to relatively lower rates. Notably, a fee of 0.8 yuan per thousand tons is set for clean heating systems using geothermal heat pumps with 100% reinjection, reflecting the policy's scientific, fair, and reasonable design.

2. Enhanced Water Resource Monitoring and Management: The Measures mandate the strengthening of water resource monitoring systems, leveraging modern information technology to achieve full-process oversight of water extraction and discharge. This will improve the precision of water resource management and ensure the effective implementation of tax policies.

3. Encouragement of Water-Saving Technologies and Innovation: The Measures propose tax incentives for enterprises adopting water-saving technologies and equipment, encouraging innovation to reduce water consumption. This not only helps lower operational costs but also drives the development and adoption of water-saving technologies.

4. Increased Public Participation and Oversight: The Measures emphasize the importance of public engagement, encouraging societal oversight of water resource management and tax policies. Transparency and public involvement will enhance the credibility and fairness of policy execution.

III. Our Expectations

The release of the Measures marks a solid step forward in Beijing's water resource management. We anticipate this policy will achieve notable outcomes in the following areas:

1. Promoting Water Conservation and Protection: Taxation will effectively curb over-exploitation and waste of water resources, fostering a societal culture of water conservation.

2. Driving Industrial Structure Optimization: Differentiated tax rates will incentivize water-intensive industries to accelerate transformation and upgrading, steering Beijing's industrial structure toward greener and low-carbon development. For the heat pump heating industry, it will promote the healthy advancement of 100% reinjection technologies.

3. Improving Water Environment Quality: Enhanced monitoring and management will reduce water pollution discharges, improving Beijing's water environment and providing cleaner water resources for residents.

4. Providing Replicable National Experience: As a pilot city for national water resource tax reform, Beijing's practices will offer valuable lessons for other regions, advancing the nationwide rollout of water resource tax reform.

5. Toward a Sustainable Future: The government must improve water resource measurement systems, strengthen stable water quality monitoring, and scientifically define 100% reinjection standards. Multi-department collaboration is essential to streamline approval processes for geothermal heat pump systems with 100% reinjection in the heating industry.

Research on Single Well Circulation Heat Exchange Geothermal Energy Collection Technology and Its Applications

Authors: Zhang Wei, Li Daqiu

Abstract: This paper introduces the 100% reinjection single well circulation heat exchange geothermal energy collection technology, an original innovation from Beijing's Zhongguancun. It elaborates on the technical principles and features, and validates the feasibility and reliability of this technology in groundwater protection, system stability, and heating/cooling efficiency through demonstration projects such as the "Sibolian Engineers' Dormitory" (water quality monitoring data), the "Affiliated Hospital of Chengde Medical University" renovation project, and the "Zhongguancun No. 3 Primary School" project. The study provides a new pathway for shallow geothermal energy development.

Keywords: Geothermal energy collection; Single well circulation; 100% reinjection; Shallow geothermal energy; Water quality monitoring

I. Technology Overview

1.1 Origin and Positioning

The 100% reinjection single well circulation heat exchange geothermal energy collection technology is an original innovation from Zhongguancun, Beijing. Using groundwater as the medium, it achieves 100% same-well reinjection through a closed pressurization system, collecting low-temperature thermal energy from shallow underground rock and soil layers to provide heating, cooling, and domestic hot water for buildings, unaffected by weather conditions.

1.2 Technical Principle

The sealed module inside the collection well divides the well into three zones: pressurized reinjection, sealed, and extraction. Well water is pumped from the extraction zone by a submersible pump, releases/absorbs heat via the heat pump unit, and then returns to the pressurized reinjection zone for heat exchange with the rock and soil. It then re-enters the extraction zone through the filter pipe, completing the single well circulation heat exchange process.

1.3 Technical Features

• Efficient Reinjection: 100% same-well reinjection with no groundwater consumption or pollution, solving traditional reinjection challenges.

• Environmental Safety: Prevents geological hazards such as collapse and sand migration while protecting groundwater quality.

• Strong Adaptability: Suitable for various strata, including gravel, rock, and silt, with single well heat exchange capacity up to 500 kW.

II. Water Quality Monitoring Analysis of Demonstration Projects

2.1 Monitoring Plan

• Project Overview: The monitoring target was the single well circulation heat exchange geothermal energy collection well at the "Sibolian Engineers' Dormitory" demonstration project, with a monitoring period from 2001 to 2015.

• Monitoring Indicators: Covered 30 parameters, including water temperature, pH, and turbidity, evaluated according to the Groundwater Quality Standards (GB/T 14848-93, updated to GB/T 14848-2017).

• Monitoring Frequency: 22 tests in 2001, 12 in 2002, and 4 annually from 2004 onward (2 during heating season, 2 during cooling season).

2.2 Monitoring Results

• Initial State (2001): Water quality met Class II or III groundwater standards, with a temperature difference of 3.2° C between extracted and reinjected water.

• Long-Term Trends (2001–2015): No significant changes in monitored parameters (e.g., pH, turbidity, total hardness), consistently meeting Class II/III standards, proving no adverse impact on groundwater quality.

III. Engineering Application Cases

3.1 Zhongguancun No. 3 Primary School Wanliu Campus Project

3.1.1 Project Background

Located in Beijing's Haidian District (cold climate zone, coarse gravel stratum), the project (total area: 45,952 m^2) adopted HYY geothermal heat pump environmental system with 100% reinjection single well technology for heating, cooling, and domestic hot water.

Approved by Beijing Water Authority in 2014 for experimental application, long-term monitoring confirmed no groundwater impact, aligning with strict water resource policies (e.g., State Council Document [2012] No. 3).

On July 20, 2016, the Beijing Energy Conservation and Environmental Protection Association organized experts to evaluate the application of the technique of single well circulation heat exchange geothermal energy collection at Zhongguancun Third Primary School's Wanliu Campus project. After thorough discussion and questioning, the experts formed the following evaluation opinions:

1. The technology of single well circulation heat exchange geothermal energy collection is wholly owned by China in core technology and intellectual property rights. This technology relies on water as the medium, leveraging the pressure difference in the geothermal heat exchange collection system to achieve same-layer reinjection and source-sink unity for circulating water exchange, thereby collecting shallow geothermal energy. Under dynamic equilibrium, it enables the cyclic utilization of natural energy. The entire process of geothermal energy collection and utilization involves no water loss, pollution, or geological hazards. This achievement promotes the realization of green energy heating

in the new era. The Single well of geothermal energy collection with circulation heat exchange system demonstrates strong design adaptability for various geological conditions and broad applicability. As an original Chinese renewable energy application technology, it has been exported overseas and received the U.S. "Energy Star Award".

2. The Zhongguancun Third Primary School Wanliu North Campus project utilizing this technology strictly followed the requirements of the "Approval from the Beijing Water Authority on Conducting Application Experiments for the Technical Code for single well of geothermal energy collection with circulation heat exchange". On September 26, 2014, the project's implementation plan and monitoring plan passed expert review. Construction commenced on November 28, 2014. Under the full supervision and guidance of the Beijing Energy Conservation and Environmental Protection Association as the third-party institution and its experts, the experimental project was completed and began trial operation for winter heating on November 11, 2015, according to the approved plans. Relevant monitoring data was publicly disclosed, and operational status was regularly reported to the Beijing Water Authority. Results confirmed no impact on water source safety.

3. HYY commissioned the professional institution "Beijing Water Environment Monitoring Center" to conduct regular water quality testing before and after the project. Results showed that the water quality parameters of the Single well of geothermal energy collection with circulation heat exchange did not undergo significant changes during the heating operation period. The water quality evaluation results remained consistent with the initial water quality, confirming no adverse impact on groundwater quality. This aligns with all previous assessments by water experts. The entire process of the Single well of geothermal energy collection with circulation heat exchange involved no water loss, pollution, or geological hazards.

4. The implementation of the Geothermal energy heat pump environmental system (Single well circulation ground source heat pump environmental system) project at Zhongguancun Third Primary School Wanliu Campus complies with relevant regulations including the State Council Opinions on Implementing the Strictest Water Resources Management System (Guo Fa [2012] No. 3), the Beijing Municipal Committee of the CPC and Beijing Municipal People's Government Opinions on Further Reform and Development of Water Management (Jing Fa [2011] No. 9), and the Beijing Municipal People's Government Opinions on Implementing the Strictest Water Resources Management System (Jing Zheng Fa [2012] No. 25). The project's operational information disclosure is transparent and fair, making it a model example of the Beijing Water Authority's effective implementation of strict water resources management and protection. This experimental project provides a scientific basis for establishing a post-evaluation system for geothermal heat pump heating projects, ensuring the scientific utilization of shallow geothermal energy, and facilitating the transition from traditional energy heating to an integrated geothermal cooling/heating green industry. It offers valuable reference for the government to strengthen operational supervision, implement innovative applied technologies, and support Beijing's efforts to reduce coal consumption and accelerate clean energy construction.

5. Expert Recommendations: The participating experts unanimously agreed to submit recommendations to relevant departments to promote the utilization and development of the technique of single well circulation heat exchange geothermal energy collection. The Beijing Water Authority should continue to thoroughly implement the Beijing Municipal People's Government Opinions on Implementing the Strictest Water Resources Management System (Jing Zheng Fa [2012] No. 25). Projects involving shallow geothermal energy utilization should prioritize the use of technology of single well circulation heat exchange geothermal energy collection. Projects approved and recorded by the Water Authority should be publicly disclosed, with third-party institutions assigned for full-process tracking, inspection, and acceptance. The Water Authority should conduct random checks and address issues promptly. Government departments such as the Municipal Development and Reform Commission and the Municipal Environmental Protection Bureau should incorporate the promotion of the Geothermal energy heat pump environmental system into haze control initiatives and efficient rural coal-to-electricity replacement projects. The Municipal Government should lead by example in large-scale demonstration: It is recommended that the Beijing Subcenter prioritize adopting the Geothermal energy heat pump environmental system, establishing it as a green demonstration project for renewable energy heating in the new era. The Single well of geothermal energy collection with circulation heat exchange system represents a scientifically innovative heat exchange technology, fundamentally distinct from traditional water extraction wells. It is recommended that the Beijing Water Authority provide strong support from an innovation perspective in its management.

3.2 Chengde Medical University Affiliated Hospital Project

3.2.1 Project Background

The Chengde Medical University Affiliated Hospital is located in Chengde City, Hebei Province, within a cold climate region. The stratum lithology is predominantly rock. The project covers a heating area of 19,000 square meters and a cooling area of 79,000 square meters. The hospital's original shallow geothermal energy collection system consisted of 18 wells operating on a "one extraction well with multiple reinjection wells" principle. By early 2018, 8 of these 18 wells had been decommissioned due to issues like failed reinjection, leading to the direct discharge of heat-exchanged groundwater into the municipal sewage pipeline.

Faced with these problems, the hospital conducted a comparative analysis of various solutions. It ultimately decided to adopt EVER SOURCE SCIENCE & TECHNOLOGY DEVELOPMENT GROUP CO., LTD. (HYY)'s 100% reinjection Single well circulation heat exchange geothermal energy collection technology to replace the original pumping well system with multiple reinjection wells, thereby resolving the issues plaguing the collection system. As HYY is the patent inventor and holder of the Single well circulation heat exchange technology, and after obtaining relevant approvals, the project utilized a single-source procurement method for bidding.

3.2.2 Retrofitting Solution

Technology Selection: Employed HYY's 100% reinjection Single well circulation heat exchange geothermal energy collection technology. Retrofitted 11 existing wells and drilled 7 new wells. The designed well depth was 60 meters, with a single well heat exchange capacity of 200 kW in winter and 300 kW in summer.

Implementation Outcome: Since the retrofit's completion in 2018, the system has operated stably. Key parameters include a total circulation flow rate of 540 m^3/h, supply water temperature of 15.3°C, return water temperature of 13.1°C, and indoor temperatures maintained between 18-22°C. The system achieves 100% reinjection with no geological safety concerns, such as surface subsidence. This solution successfully addressed the persistent challenges in the shallow geothermal energy industry–difficult reinjection and efficient energy collection in strata with poor permeability.

4. Conclusions and Prospects

The 100% reinjection single well technology enables eco-friendly, efficient shallow geothermal energy utilization. Validated by long-term projects, it excels in water/geological protection and energy efficiency. Future applications across diverse geological conditions can further support clean heating and renewable energy goals.

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Ever Source Science & Technology Development Group Promotes Transformation and Transition to Comprehensively Standardized Application of Geothermal Energy Heat Pump for Efficient and Clean Heating

Author: He Tianyue

Introduction: Twenty-Five Years of Deep-rooted Growth in Geothermal Energy Heat Pumps Heating Industry, Lead a New Chapter in Standardized Development

Since its establishment in 2000, HYY has consistently focused on the development and utilization of shallow geothermal energy, committed to providing efficient and clean alternative energy solutions for heating in northern China. Over the past twenty-five years, HYY has accumulated extensive industry experience from technological R&D to engineering practices, successfully applying geothermal heat pump technology to clean heating projects in multiple regions of northern China. With the deepening of China's "dual carbon" goals and the high-quality development requirements of the clean energy industry, HYY decided to implement a major strategic transformation at this critical juncture in 2025 – shifting from the traditional engineering model to a comprehensive standardized and scaled development path. Through regional agencies and exclusive project agency models, HYY aims to develop efficient and clean geothermal heat pump heating for northern winters, promoting the emerging green industry of integrated heating and cooling. This "transformation and transition" is not only an adjustment in corporate strategy but also an innovative exploration of industry development models, marking HYY's entry into a new phase of standardized and scaled development.

I. Background of Strategic Transformation: The Inevitable Shift from Project-Driven to Standards-Led Development

HYY's twenty-five-year development journey has witnessed the complete process of China's shallow geothermal energy development and utilization, from technological exploration to large-scale application. In the early stages, the group primarily promoted geothermal heat pump technology by undertaking specific engineering projects. While this model ensured technical quality and implementation effectiveness for each project, it also had obvious limitations, making it difficult to quickly respond to the urgent national demand for clean energy alternatives. As HYY's technological system matured and its brand influence grew, the traditional engineering model could no longer meet market needs.

At the same time, national energy restructuring and environmental protection policies have imposed higher requirements for clean heating.

The Clean Winter Heating Plan for Northern Regions (2017–2021) explicitly called for vigorous development of renewable energy heating, aiming for clean heating to account for over 80% by 2025. This policy direction provides vast market opportunities for geothermal heat pump technology but also imposes strict requirements for its standardized and regulated application. The industry urgently needs unified technical standards and service systems to avoid technical risks and market chaos caused by disorderly development.

Against this backdrop, HYY decided to implement a strategic transformation, shifting its focus from engineering projects to standard formulation and model innovation. By establishing a comprehensive regional agency and exclusive project agency system, HYY aims to promote standardized technical solutions and business models, enabling the rapid adoption of efficient and clean geothermal heat pump heating technology. This transformation is not only necessary for the company's own development but also a critical measure to promote healthy and orderly industry growth.

II. Standardization System Construction: Creating a Replicable and Scalable Market Development Model

The core of HYY's comprehensive standardization lies in establishing a complete and replicable set of technical standards and business systems. To this end, the company has formulated the Exclusive Customized Service Regional Development Cooperation General Manager Standard Agreement, Regional Development Cooperation Agreement, and Exclusive Project Agency Standard Agreement. These documents not only standardize the rights and obligations of both parties but also solidify HYY's twenty-five years of accumulated technical expertise, management methods, and service systems into standardized operational procedures. This ensures that agencies of different scales and regions can provide high-quality geothermal heat pump heating services according to uniform standards.

In terms of market development models, the following cooperation models are offered:

1. Exclusive Project Agency: A traditional business model with a standard project pricing system, including agency cost price, agency contract price, and HYY market guidance price.

2. Regional Development Partner: Payment of technical service fees to provide continuous services for heating regions covering 570 million people, fostering green industries in heating areas.

3. Three Types of Standardized System Products for HYY's Efficient and Clean Geothermal Heat Pump Heating:

(1) Distributed geothermal heat pump environmental systems for urban centralized heating.

(2) Ground energy heat treasure systems for rural decentralized independent metering and room-by-room heating.

(3) Distributed geothermal cooling and heating source station systems for phased implementation under a unified plan.

The maximum heating capacity of these system products ranges from 5.6 kW to 2,500 MW, covering heating areas from 40 square meters to 50 million square meters. The three categories include 25 system products, 38 circulation products, and 202 processing and assembly module products, of which 157 are proprietary technology products.

The group has also compiled the HYY Geothermal Heat Pump Efficient and Clean Heating Development Integrated Heating-Cooling Emerging Green Industry System Product Standards manual and related standard pricing.

HYY's standardization system is not rigid dogma but a dynamic standard with continuous optimization mechanisms. The group has established a Standardization Committee to regularly collect relevant information, revise standards, and ensure the system remains aligned with industry advancements.

III. Agency Model Innovation: Building a Win-Win Industrial Development Ecosystem

A key measure in HYY's strategic transformation is the vigorous development of regional agency and exclusive project agency models. This shift fundamentally changes the company's traditional market expansion approach, moving from "going it alone" to "collaborative success". Both regional and exclusive project agency models are based on standardized systems, ensuring that all projects meet HYY's uniform technical and service standards, regardless of the implementing agency.

To ensure smooth implementation, HYY has established a comprehensive agency support system, including the "Regional Development Cooperation General Manager Management Office" and the "Exclusive Project Agency Management Office". The former provides full support to regional agencies, while the latter updates project information through a filing system, tracks market developments, offers support, supervises agency performance, and filters out underperforming agencies.

IV. Transformation Safeguards: Comprehensive Measures to Implement Standardization Strategy

To ensure a smooth transition from the engineering model to standardized agency operations, the group has implemented safeguards in organizational structure, talent development, and IT infrastructure.

In organizational restructuring, the group established a Standardization Committee led by senior executives to oversee strategy formulation and implementation. Meanwhile, the original engineering departments were reorganized into three installation subsidiaries to better align with standardized and scaled development needs.

Talent transformation is critical to strategy execution. HYY provides continuous training to shift employees' mindset from project-based to standards-based thinking while recruiting professionals for key positions.

IT infrastructure supports the standardization strategy. HYY has invested heavily in the "HYY Big Data Operation and Maintenance Center", further developing the existing "HYY Geothermal Energy Cloud Platform" to enable efficient management through digital means.

V. Future Outlook: Standardization Leading High-Quality Industry Development

HYY's strategic transformation toward comprehensive standardization sets industry benchmarks through unified technical standards and service systems, shifting geothermal heat pump applications from chaotic competition to regulated development and from project-driven to standards-led growth.

From an industry perspective, HYY has taken the initiative in standard formulation. In 2023, the group initiated the Heating Heat Pump Unit group standard, drafted by the Beijing Energy Conservation and Environmental Protection Association, providing an important reference for high-quality industry development.

At the national strategic level, this transformation accelerates clean energy adoption in northern regions, fostering the emerging green industry of integrated heating and cooling. It enables more areas to benefit from efficient and clean heating, supporting China's "dual carbon" goals and contributing to ecological civilization.

Looking ahead, HYY will use 2025 as the starting point for standardization enforcement, continuously refining and optimizing standards while exploring international pathways to promote Chinese geothermal heat pump standards globally. Through persistent innovation and practice, HYY will contribute to clean energy development in China and beyond.

VI. Conclusion: Driving the Clean Energy Revolution Through Standardization

HYY's transformation from a project-based model to a standardized agency model represents a profound strategic shift, reflecting the company's forward-thinking approach to industry trends and technological innovation. By establishing a robust standardization system and agency network, HYY transitions from a technology provider to a standard-setter and model innovator, pioneering efficient and clean geothermal heat pump heating.

Against the backdrop of China's energy revolution and ecological civilization construction, HYY's standardization strategy serves as an exemplary model. It demonstrates how enterprises can drive large-scale clean energy adoption through independent innovation and standards leadership, offering Chinese solutions to global environmental governance. As the standardization strategy advances, HYY is poised to achieve even greater milestones in the clean energy sector.

New Projects Update

Xishan Forest Farm Renovation Project

Xishan Forest Farm Renovation Project – HVAC System Upgrade for Safety Hazard Remediation at Xishan Forest Farm Management Office. Located within Xishan Forest Park in Haidian District, Beijing, this multifunctional office building covers a total floor area of 3,600 square meters, integrating office spaces, dining facilities and conference rooms. HYY was responsible for the comprehensive renovation of the existing HVAC system, which included: the outdoor primary network energy collection system, equipment room secondary network heat exchange system, equipment room tertiary network energy enhancement system, complete removal of original equipment, as well as supply and installation of all materials and devices for equipment room noise reduction. The upgraded system has successfully addressed the previous issues of suboptimal heating/cooling performance and excessive noise levels in the original system. The project demonstrates HYY's expertise in implementing advanced single well circulation heat exchange geothermal energy collection technology through its ground energy heat treasure heating system solution.

The Newly-built Sports Center of the North China Electric Power University

The newly constructed Sports Center at North China Electric Power University comprises two above-ground levels and two basement levels, with a total construction area of 44,372.55 square meters. The rooftop area features a standard 400-meter athletic track that serves as both an outdoor running track and soccer field.

The ground floor accommodates facilities including martial arts studios, dance halls, Pilates rooms, taekwondo training centers, fitness gyms, locker rooms, and public corridors. The first basement level contains a swimming pool, basketball courts, a multi-purpose gym, additional fitness facilities, aerobics and yoga studios, taekwondo training areas, athlete lounges, and connecting passageways. The second basement level houses a multifunctional club activity center, civil air defense parking, and various equipment rooms.

For its heating and cooling requirements, the project primarily utilizes a shallow geothermal energy-based heat pump system, complemented by a backup system combining gas boilers and electric chillers to ensure operational reliability. The project adopts an innovative equipment leasing plus engineering cooperation model, which demonstrates significant advantages over conventional cold/heat source systems in terms of economic efficiency, construction management, long-term operation, and risk mitigation.

This integrated approach showcases the successful application of HYY's geothermal energy heat pump environmental system, combining the single well circulation heat exchange geothermal energy collection technology with traditional backup systems to create a sustainable and reliable energy solution for large-scale sports facilities. The project serves as an exemplary model for implementing clean winter heating in the northern region through advanced geothermal technologies.

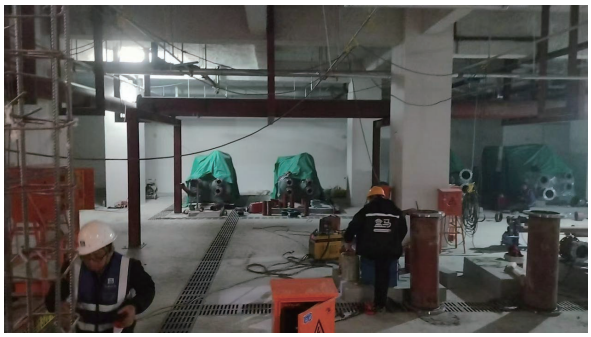

Photo from the construction site of the computer room

Visit by the Future Technology-Driven Development Committee of China Rural Finance Research Association

On March 13, 2025, a delegation of leaders and experts from the Future Technology-Driven Development Committee of the China Rural Finance Research Association visited HYY for an inspection and exchange.

The delegation first toured HYY's demonstration projects, including:

The HYY distributed geothermal energy heat pump environmental system for clean and efficient centralized heating at the All-China Federation of Industry & Commerce Building and Haidian Foreign Language Experimental School.

The ground energy heat treasure system for efficient and clean decentralized household heating at Luojiafen Village, a model project recognized as both a Capital Civilized Village and an Advanced Rural Development Collective in Beijing, with eight years of successful operation.

Following the site visits, the delegation attended a special briefing and discussion session at HYY's Information Center. The leaders and experts showed keen interest in HYY's proprietary "single well circulation heat exchange geothermal energy collection technology", engaging in in-depth exchanges on its technical principles and real-world application performance.

Academician Wu Qiang, invited by HYY as a special guest, also participated in the discussion, contributing valuable insights on geothermal energy innovation and sustainable rural development.

This visit reinforced HYY's leadership in shallow geothermal energy utilization and highlighted the potential of its technologies to support clean winter heating in northern regions through both large-scale centralized systems and decentralized household solutions. The dialogue also explored opportunities for future collaboration in advancing low-carbon rural energy transitions.

Photo of the visit

Focusing on "Heating Assurance" to Drive High-Quality Development of Green Heating

——Interpreting the Group Standards of "Heat Pumps Heating System"

Author: Liu Baohong

Amid global efforts to promote green development and China's rising demand for clean heating, heat pump technology has emerged as a preferred solution due to its high efficiency in utilizing low-temperature heat sources and its energy-saving, eco-friendly advantages. For instance, HYY alone has implemented heat pump heating systems covering over 21 million square meters, highlighting the technology's vast potential in China's green heating market.

Traditionally, heat pump units were primarily designed for cooling. While cooling-oriented heat pumps can function for heating, their cost, efficiency, and lifespan often fall short of optimal performance. The lack of specialized technical standards for heating applications has hindered the industry's healthy and orderly growth. Addressing this gap, the group standard Heating Heat Pumps (T/BAEE019-2023), proposed and co-developed by HYY, was officially released by the Beijing Energy Conservation and Environmental Protection Association on December 1, 2023, and took effect on December 25. This standard defines performance metrics for three types of units – water-source heat pump heating units, low ambient temperature air-source heat pump hot water units, and low ambient temperature air-source heat pump air heaters – covering design, manufacturing, and testing processes. It provides tailored solutions for diverse climate zones (e.g., severe cold, cold regions) and fills gaps in low-temperature adaptability, energy efficiency evaluation, and comfort assurance, offering scientific guidance for designers, manufacturers, and users.

1. Core Innovations in Heating Assurance

1.1 Enhanced Low-Temperature Adaptability

The standard addresses the critical challenge of stable operation in extreme cold:

(1) Expanded Inlet Water Temperature Range: Adds a 6°C inlet condition for water-source units, complementing GB/T19409-2013, and introduces two low-temperature models (Type II: 0°C ; Type III: –5°C) with antifreeze specifications.

(2) Standardized Water Flow Calculation: Sets a heating-side flow rate of 0.134 $m^3/(h \cdot kW)$, rectifying the previous focus on cooling-only scenarios.

1.2 Heating-Centric Energy Efficiency Metrics

Replacing cooling-biased metrics like ACOP, the standard prioritizes heating performance:

(1) COP_h (Heating Coefficient of Performance) and COP_{dh} (Low-Temperature Heating COP) as key indicators.

(2) Comfort Requirements: Mandates ⩾ 38°C outlet air temperature for air heaters at 14°C inlet to ensure user comfort, supported by airflow and variable-speed controls.

1.3 Climate-Zone-Specific Selection Guidelines

Tailored recommendations based on regional climate data:

(1) Severe Cold Zones (e.g., Harbin): Recommends Type III water-source units (-5°C capability) for 8°C bedrock temperatures.

(2) Hot Summer/Cold Winter Zones (e.g., Hefei): Suggests Type I units for 17.4 °C bedrock, balancing cost and efficiency.

2. High-Quality Production for Reliability

2.1 Rigorous Sealing and Vibration Testing

(1) Dual Sealing Checks: Post-production leak tests and nitrogen pressurization (0.2–0.3 MPa) for split air heaters.

(2) Vibration Standards: New requirements to prevent faults from compressor or motor vibrations.

2.2 Low-Temperature Startup and Maintenance

(1) Cold-Start Testing: Validates compressor oil and refrigerant performance in extreme cold.

(2) Standardized Manuals: Detailed guidelines for installation, use, and maintenance to ensure proper operation.

3. Standard Implementation: Boosting Green Heating

The standard strengthens heating assurance across design, production, and selection, fostering a more regulated, efficient, and sustainable industry.

Market Impact: Unified technical specifications curb substandard products, enhance consumer trust, and accelerate adoption.

Industry Advancement: Higher efficiency reduces energy use and emissions, supporting China's "dual-carbon" goals while driving technological upgrades.

The standard is available on the National Group Standards Platform (www.ttbz.org.cn). Industry stakeholders are encouraged to adopt it, elevating technical rigor and competitiveness for high-quality growth.

小知识

“恒有源标准化系统成套产品简介”

作者：刘宝红

恒有源科技地能热泵高效清洁取暖共分为三类系统成套产品：

1. 适用于城镇集中供暖的分布式地能热泵环境系统，是替代小区锅炉房、供热站的首选清洁能源产品，为城镇集中供暖绿色升级。典型应用场景有城市居民区、学校、医院、商业综合体等。

2. 适用于农村散户独立计量分间取暖的地能热宝系统，是专为北方城镇郊区和农村建筑开发的浅层地能分户取暖系统，是地能无燃烧为建筑物智慧取暖的电高效替煤自采暖系统。典型应用场景有北方农村自建房、别墅、小型商户等。

3. 适用于一次规划分期实施的分布式地能冷热源站系统，可替代区域热电厂的燃烧供暖，服务于区域能源站低碳转型。典型应用场景有产业园区、新城开发区、大型公共设施等。

“单井循环换热地能采集井简介”

作者：李大秋

单井循环换热地能采集技术是一项北京中关村原创的先进的适用于多种地质条件的浅层地热能采集技术，它以循环水为介质采集浅层地下低于 25°C的热能，可以实现地下水 100% 全部回灌。不消耗也不污染地下水，对地下水是安全的。

地能采集井按结构分为三种：

1. **有换热颗粒采集井：**
循环水由置于隔热管底部抽水区的潜水泵抽出，进入热泵机组放热或吸热后，由热泵机组返回进入换热颗粒的上部加压回水区内。水流在有换热颗粒的环形空间内向下流动至抽水区，透过隔热管下部的花管部分进入隔热管，再由潜水泵抽出。

2. **单一水层无换热颗粒地能采集井：**
井水由置于隔热管底部抽水区的潜水泵抽出，进入热泵机组放热或吸热后，由热泵机组返回进入隔热管上部的加压回水区，部分井水通过花管流出地能采集井外与周围岩土体进行热交换后，通过隔热管下部的花管进入隔热管内再由潜水泵抽出。上述抽水区和加压回水区应在同一水层内，实现同层回灌。

3. **多水层无换热颗粒地能采集井：**
在多水层地质结构的地区可采用两个或多个井上下叠加的结构。上下井之间的分隔层应符合当地相关主管部门的要求。

单井循环换热地能采集技术，能够实现地下水的 100% 回灌，水只作为介质输送地下热量；没有“取水易、回灌难”，地下水位下降和交叉污染等问题；没有水的流失、不会产生潜在的地质灾害，是一种安全、高效、可靠的浅层地热能采集技术。

HYY Standardized System Complete Products

Author: Liu Baohong

HYY offers three types of geothermal heat pump systems for efficient and clean heating:

1. The Geothermal energy heat pump environmental system for centralized urban heating serves as the preferred clean energy alternative to boiler plants and heating stations, enabling green upgrades for municipal heating. Typical applications include residential areas, schools, hospitals, and commercial complexes.

2. The Ground energy heat treasure heating system for independent metering and zonal heating in rural households is specifically designed for northern suburbs and rural buildings. This shallow geothermal energy self-heating system replaces coal with high-efficiency electricity for combustion-free intelligent building heating. Applications include rural self-built houses, villas, and small businesses.

3. The Distributed geothermal energy cooling and heating source station system for phased implementation planning replaces regional thermal power plants' combustion-based heating, supporting low-carbon transformation of regional energy stations. It serves industrial parks, new urban developments, and large public facilities.

Single Well of Geothermal Energy Collection with Circulation Heat Exchange

Author: Li Daqiu

The technology of single well circulation heat exchange geothermal energy collection is an advanced, Beijing Zhongguancun-originated technology adaptable to diverse geological conditions. It utilizes circulating water to extract shallow geothermal energy below 25° C while achieving 100% groundwater recharge. This method consumes no groundwater, prevents contamination, and ensures aquifer safety.

Geothermal energy collection wells are structurally categorized into three types:

1. **Heat exchange particles well:**
Circulating water is extracted by a submersible pump in the bottom intake zone of an insulated pipe. After heat release/absorption in heat pump units, water returns to the upper pressurized recharge zone above the heat exchange particles. It flows downward through the particle-filled annular space to the intake zone, enters the insulated pipe via its screen section, and is recirculated by the pump.

2. **Single-aquifer well without heat exchange particles:**
Well water is pumped from the intake zone, processed by heat pump units, and returned to the upper pressurized recharge zone. Partial water exchanges heat with surrounding rock/soil through the screen before re-entering the insulated pipe for recirculation. The intake and recharge zones reside in the same aquifer for confined recharge.

3. **Multi-aquifer well without heat exchange particles:**
In multi-aquifer geology, vertically stacked wells are employed, with separation layers complying with local regulatory requirements.

This technology guarantees 100% groundwater recharge, using water solely as a thermal transport medium. It eliminates challenges like "easy extraction but difficult recharge," groundwater depletion, cross-contamination, water loss, and geological hazards, establishing itself as a secure, efficient, and reliable shallow geothermal energy harvesting solution.

敬告读者

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

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

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Editor's Note

"China Geothermal Energy" is a scientific journal sponsored by China Geothermal Energy Publishing House, and co-organized by the Nanjing New Energy and Environmental Technology Research Institute of Beijing University of Science and Technology, the Capital Science and Technology Development Strategy Research Institute, the Beijing Industrial Foreign Trade Promotion Association, the Shallow Geothermal Energy Development and Utilization Professional Committee of the Beijing Energy Conservation and Environmental Protection Promotion Association, the China Geothermal and Hot Spring Industry Technology Innovation Strategic Alliance, and the China Thermal and Cold Integrated Clean Energy Research Institute. It is a bilingual semi-annual publication. Our mission is to provide meaningful proposals to policymakers in energy sector, to offer a promotional platform for geothermal energy development enterprises; to create a communication channel for providers and consumers; and to showcase the good practices and applications of shallow geothermal energy for efficient heating.

We always strive to constantly improve the journal, so as to live up to the expectations of our readers. Undoubtedly, optimizing air quality, energy conservation and emission reduction, and smog control are significant challenges facing all Chinese people today. This journal "China Geothermal Energy" is designed with a hope to make its contribution to overcoming these challenges.

Looking towards the future while staying focused on the present, we strive to innovate and evolve in our practices. Since its establishment, our journal has received tremendous support from industry experts, scholars, and readers, for which we are sincerely grateful. Your attention is our treasure, and your support serves as our motivation. Let us join hands and work together to shape a brighter future for "China Geothermal Energy".

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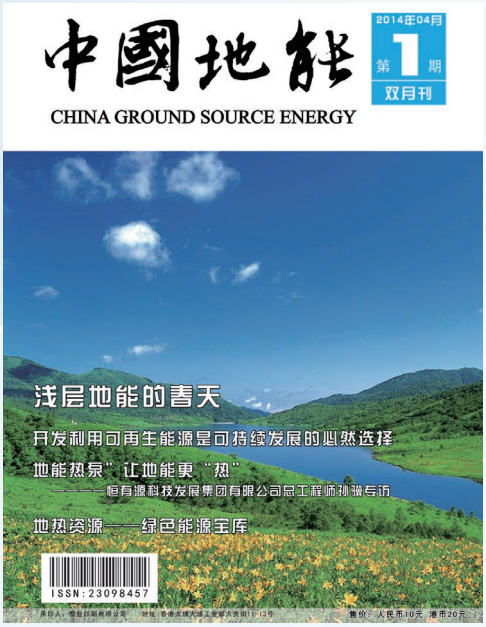


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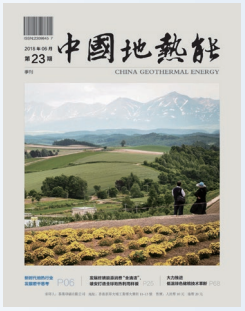
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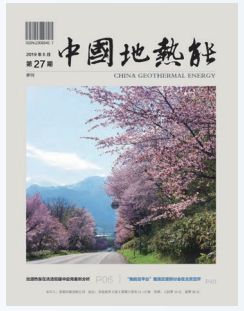
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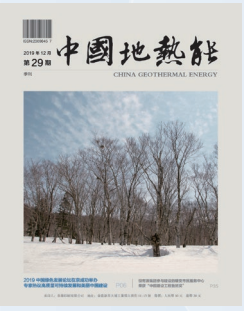
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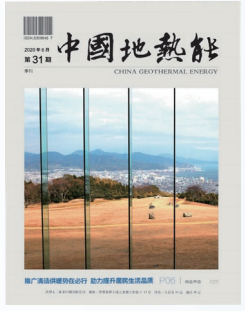
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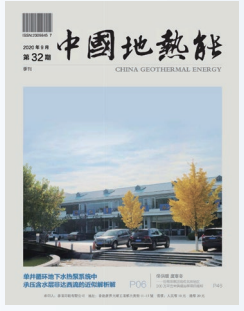
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