



BROAD HEAT PUMP PROJECTS

(ABSORPTION LiBr+H₂O)



Function

- Recycle low temperature waste heat
- Reduce heating cost

Application

- District heating,
- Process heating,
- Sanitary heating water
- Make-up water pre-heating

Heating capacity

300~15,500kW

Rated heating COP

1.7

Energy sources

- Natural gas, town gas, biogas
- Waste heat from power generation, industrial waste streams (steam, hot water, exhaust, etc.)



ABOUT BROAD

The mission of BROAD Group is "For Earth & Mankind's Tomorrow", all BROAD technologies are the world's first, and all BROAD products are essentially optimizing earth's environment and human life.

BROAD Air Conditioning Co. Ltd. supplies non-electric central air conditioning powered by natural gas and waste heat with cooling, heating, hot water functions and packaged water distribution system. It is world-renowned for super efficiency.

BROAD Energy Service Co. Ltd. provides equipments, investment, design, construction and operation of district cooling-heating-power (CHP) projects, and pursues the greatest extent of energy conservation through market mechanism.

BROAD Clean Air Technology Co. Ltd. supplies clean fresh air systems that can filter PM2.5 by 99.9%, a complete series of clean air products from commercial to domestic use and wearable air quality monitoring device for personal use.

BROAD Sustainable Building Co. Ltd. provides factory-made stainless steel sustainable buildings (BSB) featuring 90% pre-fabrication, 5 times more energy efficiency and 100 times cleaner air.

BROAD Group, established in 1988, headquartered in Changsha, has over 3000 employees and products in more than 80 countries.

远大集团简介

远大科技集团的使命是“为了地球和人类的明天”，远大所有技术均为全球首创，所有产品都从本质上优化着地球环境和人类生存

远大空调有限公司，提供以燃气和废热为能源，制冷、制热、卫生热水一机三用功能的非电中央空调主机，和一体化输配系统。以超级节能享誉全球

远大能源利用管理有限公司，提供区域冷热电联产系统的设备、投资、设计、施工及运营服务，运用市场机制实现最大限度的节能

远大洁净空气科技有限公司，提供99.9%过滤PM2.5的洁净新风机，以及从商用、家用到穿戴全系列洁净空气产品和空气检测仪器

远大可建科技有限公司，提供90%工厂制造、5倍节省能源、100倍空气净化的不锈钢工厂化可持续建筑（简称可建）

远大集团创立于1988年，员工3000余人，总部设于长沙，产品覆盖80多个国家



BROAD Headquarters, BROAD Town, China 远大总部-远大城

废热利用，为客户创造价值—韩仁川综合能源项目

Recycle waste heat to create value for customer -Incheon Total Energy Project

Project Background

South Korea locates in Korea Peninsula, at the same latitude as Shangdong Province, China. Temperature in Winter is low, and duration is long, heating season lasts from October to April. Usually heating is supplied by power plants, so heating & power combination is widely utilized, main solution is that heating water is heated up by lower pressure steam and then sent to end users. For power plants, electric power can only be sold to KEPCO, this part of profit is limited, main profit comes from heating supply, so power plants try to decrease cost of heating, to get more profit in their specified supply area.

BROAD absorption heat pump is widely used to recycle waste heat in power plants or factories for heat supply, so to decrease cost and increase energy efficiency. Also as a positive response to government's call to save energy and decrease CO2 emission, Heat pump projects create economic profit, meanwhile make huge contribution to the society.

Incheon Total Energy locates in Songdo, Incheon, South Korea, closed to the airport and seaport. As a typical gas-steam combined cycle power plant, its power capacity is 200MW, and supply heat for 32,000 users. The management visited BROAD Town for many times, with deep acknowledge of BROAD products and quality management system, with productive business, meanwhile keep a good relationship in the past years.

项目背景

韩国位于朝鲜半岛南端，与中国山东省处于同一纬度，冬天气温较低，且持续较长，采暖季从10月到4月。供暖的热力公司大多也是发电公司，热电联产非常普及，主要的供热方式是抽取蒸汽轮机的低压蒸汽换成热水输送至用户处。

韩国的热电厂发出的电按照韩国电力公司核定价格上网，因而利润空间不大，而且业务扩展也困难，主要利润来自区域供热的采暖费，热力公司的供热区域一经划定，基本不变，所以区域内的供热总量比较稳定，为了扩大利润，各热力公司均想方设法来降低能源成本。

远大热泵的大力推广，回收了电厂、工业废热用于区域供热采暖，降低一次能源消耗，响应政府号召，实现节能减排，创造经济收益的同时，做出重大的社会贡献。

仁川综合能源位于韩国仁川宋都市，靠近仁川机场和港口，采用燃气-蒸汽联合循环，装机容量200MW，全部电力通过韩国电力输送，同时向周围区域32000家用户供热。客户高层多次访问远大城，对远大产品和质量管理体系非常信任，双方在业务频繁往来的同时，也建立了浓厚的情谊。



Campus of Incheon Total Energy 仁川综合能源都厂区

Value of Project

1. Waste heat recovery 18.6Gcal/h, estimated profit for one year reaches \$5 million.
2. 23,724 ton/year CO₂ emission accomplished, which is also society obligation required by the government.
3. "White smog" eliminated, so reduce complaint from local citizens and effect to airport & seaport.
4. As a local typical energy-saving project, positive effect has expanded by follow-up reports from media.
5. For BROAD, got a big order also accumulated much experience for product improvement.

项目价值

1. 回收废热18.6Gcal/h，预计年净利润500万美元。
2. 完成23724吨的CO₂减排任务，履行韩国政府要求的社会责任。
3. 消除电厂排出的“白烟”，减少周围居民的投诉以及对机场和港口的影响。
4. 该项目成为当地的典型节能案例，媒体持续追踪报道，扩大了社会影响。
5. 远大收获订单的同时，积累了大量的经验，为产品的完善奠定了基础。



Machine room 热泵机房内部

变废为宝，多方共赢—韩安山伴月生态园项目

Turn waste to wealth, all-win cooperation-Ansan Banwol ECO park project

Project Background

From government to the populace, the South Koreans have a strong consciousness of energy-saving because of its narrow land and insufficient energy. South Korea has a long winter with low temperature due to its geographical position. Therefore, the heating season is longer, from November to April. In South Korea, most of the heating-supply companies supply electricity as well, and the district energy is very popular. When government formulates the regional development plan, mostly the heating supply company will be set up in suburb area in order to cover the surrounding areas, thus dispersing the central city function.

The heating fee is the main income of heating company, and litter profit from electricity because the selling price is almost the same with its cost. And the heating demand is stable because the heating-supply area is fixed. So reducing the energy cost is the best way for these companies to expand the profit.

BROAD absorption heat pump is widely used to recycle waste heat in power plants or factories for heat supply, so to decrease cost and increase energy efficiency. Also as a positive response to government's call to save energy and decrease CO2 emission, Heat pump projects create economic profit, meanwhile make huge contribution to the society.

项目背景

韩国面积狭小、能源匮乏，从政府到民众的节能意识非常强。由于其地理位置的原因，冬天气温较低，且持续较长，采暖季为11月到4月。韩国的热力公司大多也是发电公司，热电联产非常普及，政府在制定区域发展规划时，普遍将热电公司设置于城市郊区（韩国称为新都市），以便覆盖周边范围，分散中心城市职能。

热力公司的主要营业收入是区域供热的采暖费，供热区域一经划定，基本不变，所以区域内的供热总量比较稳定，为了扩大利润，各热力公司均想方设法来降低能源成本。韩国政府也大力开展节能减排的推广，提供资金和技术鼓励节能设备和绿色能源的使用，并法令规定各类企业的减排义务，如果企业不能完成，则必须向其他企业购买减排量指标。

安山区域供热是当地一家热力公司，位于安山伴月产业园区内，距离首尔市中心约30公里。主营业务为供热，从附近的GS燃煤电厂购入低压蒸汽，换成热水后向周围约60000家用户供暖。

远大热泵的大力推广，回收了电厂、工业废热用于区域供热采暖，降低一次能源消耗，响应政府号召，实现节能减排，创造经济收益的同时，做出重大的社会贡献。



Ansan District Heating Company 安山都市开发

Project Introduction

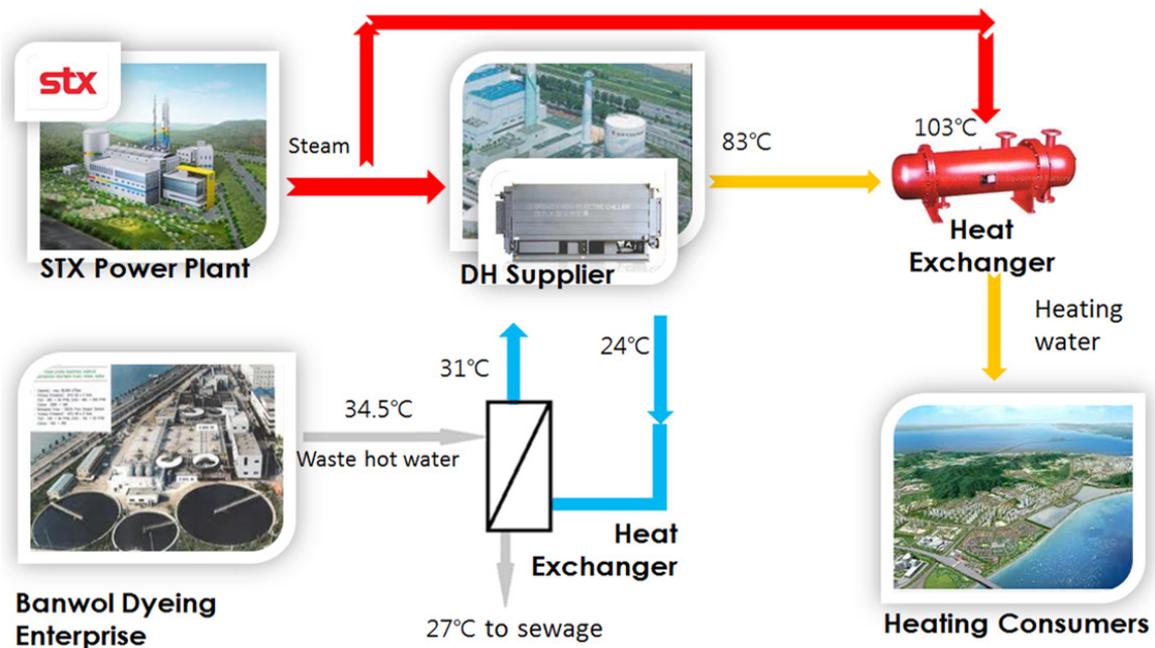
This project was constructed and operational managed by GS Power. By using four BROAD BDS1000 heatpump, pumping 0.8 MPa low pressure steam from STX power plant as the heat source. By exchanging the waste water from dye factory, the heat is got and sent to the residential area and other public places of Ansan city. Decreasing Dyeing wastewater from 34.5°C to 27°C, while increasing heating water from 55°C to 83 °C, then increasing to 103 °C by heat exchanger and then input to hot water pipe network. When the heat pumps work at full load, each unit can reach the capability of 14MW heating output.

Installation and commissioning work were done in 2012, since no record of so huge heat pump operation in South Korea before, the customer required two BROAD engineers to support. The commissioning was completed successfully, all the performance indexes reached or exceeded designed data. After two years operation, the primary investment has been recycled, which provided powerful force for the company's development.

项目简介

该项目由GS Power承担设计，施工，调试及运营管理任务，采用四台远大BDS1000热泵，抽取STX电厂低压蒸汽作为热源，回收印染厂经换热器后得到的废水中的热量，向安阳市居民区及其他公共场所供热。印染厂废水从34.5°C降至27°C，采暖水则从55°C提高到83°C，再经升温热交换器增加至103°C后输入热水管网。设备满负荷运行时，单台热泵供热能力达到14MW。

2012年底安装调试，由于在此之前从未有如此大的热泵设备在韩国运行，应客户要求，远大派两名工程师全程协助，试运行圆满成功，所有的指标都达到或者超过设计参数。经过两个采暖季的运行，项目的投资就已全部收回，为公司的发展提供了强大的动力。



Heat Pump System Diagram 热泵系统简图

Value of Project

- 1.Korea government requires all enterprises finish their duty to decrease emission of CO₂, the decrease of 19.8Gcal equivalent emission was shared by Banwol and STX.
- 2.Banwol Dyeing: Waste water was cooled down to 27 °C, treatment cost was decrease no need to operate cooling tower and no complaint from local citizens any more.
- 3.Anshan Heat Develop (heating supplier) : Cost of heating supply was saved, yearly payback is around \$6.4 million.
- 4.STX: Sells 45% more low pressure steam to heating supplier and share half of the CO₂ emission performance.
- 5.GS Power: EPC contractor of this project, and sells BROAD heat pump.



Campus of Ansan District Heating. 安山区域供热厂区

项目价值

1. 政府部门认定此项目按19.8Gcal/h热量折算CO₂减排量，该部分减排量由印染厂和STX电厂均分。
2. 伴月印染厂：废水降到27度再处理，冷却塔无需再运行，降低了处理成本，同时也减少了周围居民对气味的投诉，得到该项目一半的CO₂减排业绩。
3. 安山区域供热：降低供热成本，年收益达到640万美元。
4. STX电厂：低压蒸汽销量增加45%，得到该项目一半的CO₂减排业绩
5. GS Power：作为远大代理商销售了设备，并承担了项目的总包工程。



Machine room 机房内部

节能降耗新模式—韩电日山/盆唐电厂项目

New Energy Saving Operation for Plants—KEPCO Ilsan/Bundang Power Plant

Project Background

KEPCO is invested by Korean government, a huge company with business of power generation, transmission, distribution and sales, also the only integrated power institution in South Korea. It covers all the power transmission business and almost one-fourth power generation in South Korea, with total annual turnover of \$50 billion, it's in the range of world's fortune top 200.

KEPCO has more than 20 power plants, both Ilsan and Bundang are among them. With total capacity of 900MW, gas-steam combined cycle is used in the plant. Although the income from power generation business is very stable, they never stop to find more energy-saving solution in the past years, to reduce the cost and increase profit.

As communicated with domestic and international partners, KEPCO realized that application of heat pump in power plant can save much energy and reduce water consumption. After strict project feasibility analysis, and visit to a few absorption heat pump suppliers, BROAD was selected to provide the solution and product.

项目背景

韩国电力公社 (KEPCO) 简称韩电, 是韩国政府投资的集生产、输电、配电以及营销于一体的大型电力企业, 也是韩国唯一的电力事业机构, 承担着境内所有的输电业务, 自身发电装机容量约占韩国总量的四分之一, 年营业收入超过500亿美元, 跻身世界200强。

日山和盆唐电厂就是韩电旗下的两家火力发电站, 装机容量均为900MW, 采用燃气-蒸汽联合循环, 由韩电直接运营, 虽然发电业务有非常稳定的收益, 但也一直在探索节能降耗的新技术和模式, 以降低运行成本。

通过与国内外同行的交流, 了解到吸收式热泵的应用可以节水节能, 经过严格的项目分析论证, 反复考察多家吸收式热泵供应商, 最终选定远大的方案。



Ilsan Power Plant 韩电日山电厂



Bundang Power Plant 韩电盆塘电厂

Project Introduction

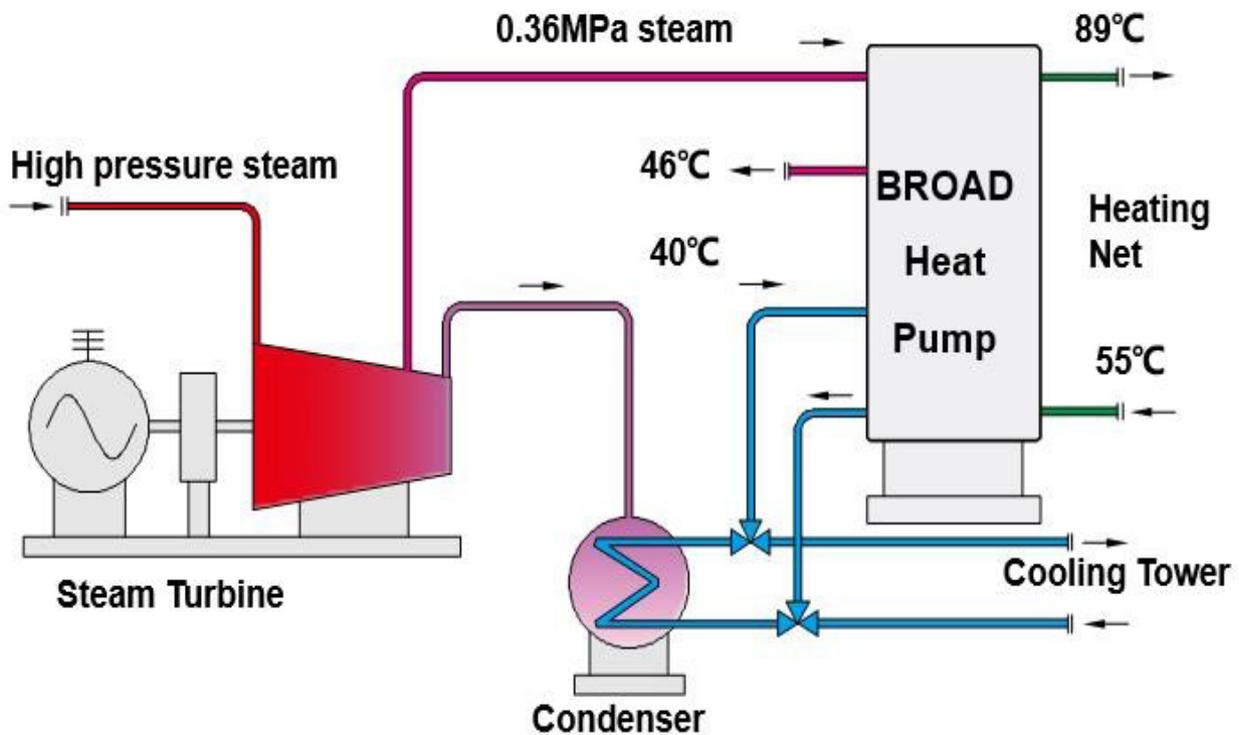
The project was designed, constructed by GS Power-BROAD distributor in South Korea, low pressure steam is used as the driving heat, heat in cooling water from condenser is low temperature heat source, to heat up heating water from 55DegC to 89DegC, in this way waste heat is recycled to provide heating, and the capacity for the largest unit is 15.5MW.

For the sake of operation security, KEPCO asked for unprecedented high standard and strict requirement to BROAD, and one engineer was sent to factory, to supervise the whole fabrication process. The final performance test succeeded, and they were delivered to customer in 2012. The customer was very satisfied, and BROAD obtained trust for high-standard quality management system.

项目简介

该项目由GS Power设计施工，两个电厂均配置两台远大蒸汽热泵，抽取蒸汽轮机中的0.36MPa低压蒸汽作为驱动热源，以蒸汽轮机凝汽器的部分冷却水作为低温热源，将采暖水从55度经提升至89度后用于供暖，单台供热量达到15.5MW。

出于对设备安全的考虑，韩电对远大提出了前所未有的“高标准，严要求”，并派遣一名工程师来工厂全程监督热泵生产过程，经工厂测试，所有设备全部达到设计参数，2012年顺利交付使用，远大以行业内最高标准的质量体系赢得了客户的信任。



System Diagram 系统简图

Value of Project

1. 19.8Gcal/h waste heat is recycled, and the equivalent CO₂ emission reduction is 23,258 ton/year.
2. Cooling water consumption is reduced, and power consumption of cooling tower fan is saved, also, part of the “white smog” from cooling tower is reduced.
3. As the leading power company in South Korea, application of heat pump in KEPCO’s power plant is quite significant, many other power plants begin to analyze this type of new energy-saving technology.
4. For acceptance by KEPCO, trust to BROAD product from other customers in South Korea increased significantly, which is a good foundation of marketing promotion.
5. During the whole fabrication process, BROAD’s production and quality management system was verified, meanwhile, experience was gained for product quality improvement.



Machine room of Ilsan Power Plant heat pump 日山电厂热泵机房

项目价值

1. 回收废热19.8Gcal/h，相当于节油7753吨/年，折算每年CO₂减排量达到23258吨。
2. 减少了冷却水的消耗，以及冷却塔风机的电耗，同时消除部分电厂排出的“白烟”。
3. 作为韩国电力行业的龙头，韩电使用热泵回收废热引起了轰动，国内其他电厂纷纷开始研究这种新型的节能降耗技术。
4. 远大和代理商GS Power收获订单的同时，获得韩电的认可，大大增强了韩国其他客户对远大产品的信任，为市场推广打下良好的基础。
5. 整个生产过程中，远大的生产管理以及质量体系得到了有效的验证，增强了信心，同时大量新技术的应用，为持续改善产品性能和品质积累了经验。



Machine room of Bundang Power Plant heat pump 盆塘电厂热泵机房

小设备，大节能 - 越南维纳纸业

Small Unit, Big Saving - VINA Kraft Paper

Project Background

VINA Kraft Paper Co.,Ltd. is a joint venture by SCG Group and Rengo Group, located in Binh Doung province, Vietnam. VINA Kraft Paper provides high-quality packaging paper products, 220,000 tons per year.

SCG Group

SCG stands for SIAM CEMENT GROUP, A leading business conglomerate in the ASEAN region, has committed itself to conducting business in line with good corporate governance and sustainable development principles throughout 100 years. The Group's longstanding tradition of learning, adjustment and development in all areas has enabled SCG to survive the wave of crises and challenges and earn widespread recognition as a role model for other businesses, both locally and internationally. SCG was established in 1913 following a royal decree of His Majesty King Rama VI to produce cement, the main building material for infrastructure projects that greatly contributed to the progress of the country during that period. Since its founding, SCG has grown continually and diversified into three core businesses, namely SCG Cement-Building Materials, SCG Chemicals and SCG Packaging.

Rengo Group

Since manufacturing the first corrugated board in Japan in 1909, the Rengo Group has striven to respond to the needs of customers for value-added packaging, as well as contribute to society by helping to optimize the flow of products through the distribution process.

项目背景

维纳纸业有限公司(越南)由SCG集团和Rengo集团成立的合资公司，位于越南平宁省。生产各种高品质包装用纸产品，年产能可达220,000吨每年。

SCG集团

SCG是SIAM CEMENT GROUP的缩写，正式称谓泰国暹罗水泥集团。作为东盟的领军商业集团，在过去的100年当中，一直致力于用健全的公司管理和可持续发展理念来经营。集团长期的学习、改变、和发展的文化传统，让SCG能够屹立于各种危机与挑战之下，被当地和国际的各种行业视为模仿的榜样。SCG成立与1913年，由拉玛六世国王陛下主持创建，开始是生产水泥这一主要建材，为当时的泰国各种基础设施建设，提供了强有力的支持。自创建以来，SCG一直稳步发展，主要有3项核心业务：水泥-建材、化工材料、和包装材料。

Rengo集团

自1909年在日本，开始生产第一块瓦楞纸板，Rengo集团一直努力满足客户各种需求，并提供超出客户预期的各种增值的包材方案，帮助客户优化其物流分发过程中的产品包装需求。



VINA Kraft Paper 越南维纳纸业



Machine room 热泵机房

Project Introduction

The co-generation plants have the capability to supply low pressure steam for paper drying process, and electricity to serve the demand within Plant.

During the process, unavoidably, the cooling water is used, and the heat of the cooling water normally was wasted, because the temperature of cooling water is lower than make-up water of the system. An absorption heat pump is used to transfer the waste heat to make-up water.

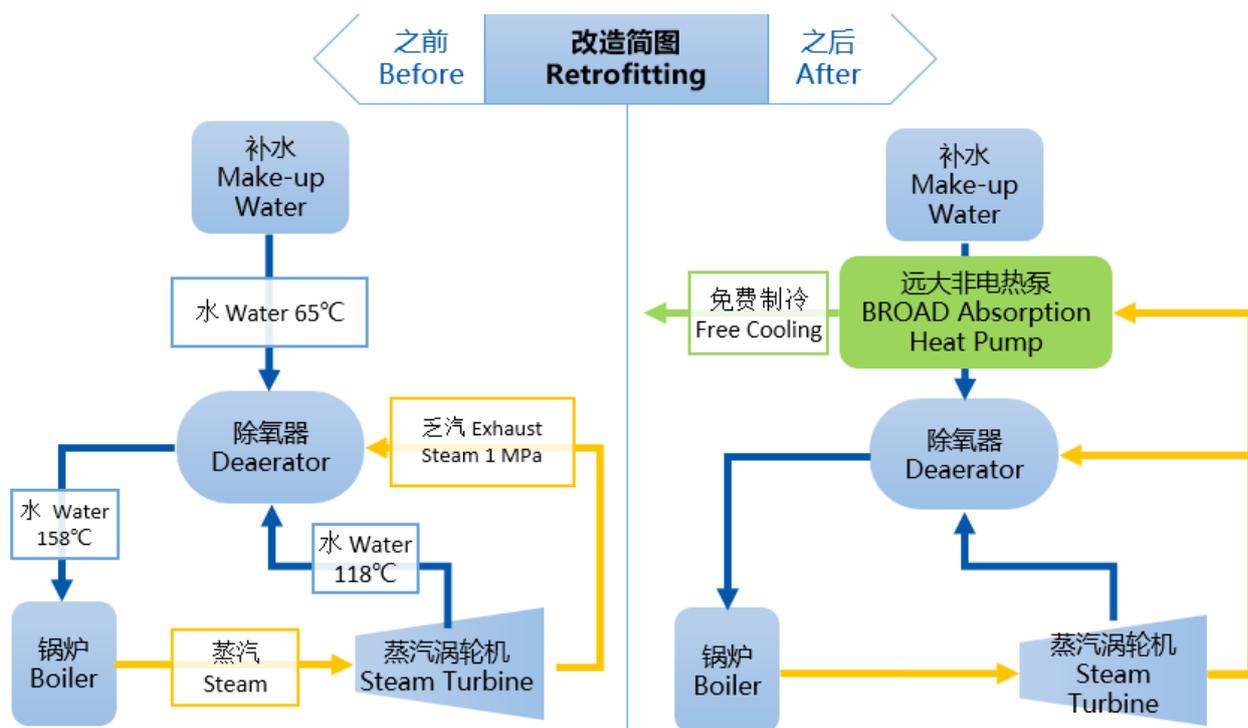
At the same time, by using the existing exhaust steam as the driving source, no extra energy demand is added to the system, on the contrary, we lower the system demand on steam.

项目简介

该项目中的联合发电厂被设计为满足工厂的电力供应，并将发电后的蒸汽乏汽用于纸张干燥工艺。

过程中的，不可避免会产生冷却水，通常这部分的热量，因为低于补水需求温度而白白浪费，非电热泵就吸收这部分的热量，来加热系统补水。

同时，利用本身的低压乏汽作为驱动热源，不增加原系统负荷，反而降低系统的蒸汽需求量，实现节能。



System Diagram 系统简图

Value of Project

1. Steam consumption: -1 Ton/h

Before, heating the make-up water was fully by steam. After using the absorption chiller, the waste heat from cooling water is utilized, therefore the steam demand is reduced. Steam consumption reduced by 1 ton/h.

2. Free Cooling: 593 kW

Before, the heat was reject to the air by cooling tower. After, the heat pump transfers the heat for make-up water, therefore, the system cooling demand can reduce 593 kW.

3. Water: -1 Ton/h

Before, 593 kW heat would consume 1 ton/h water to evaporate by cooling tower. After cutting this heat rejection, the 1 ton/h water can be saved.

项目价值

1. 蒸汽消耗: -1吨/小时

原来补水加热的热量，完全来自蒸汽。引用热泵后，部分热量来自冷却水的废热，这样就降低了用蒸汽的需求，系统每小时可以少用1吨蒸汽。

2. 免费制冷: 593千瓦

原系统是通过冷却水将这些热量排放在大气中，非电热泵将这些热量收集用于补水加热，原系统的制冷需求即可减少593千瓦。

3. 用水: -1吨/小时

原来，593千瓦热量使用冷却塔冷却时，会有1吨每小时的水量蒸发排放到大气中，当不需要用冷却塔时冷却时，这部分的水就节省出来。

两级提升，全球首创—丹麦约灵区域供暖

Double Lift Heat Pump, Global Initiative-Hjorring District Heating

Project Background

Denmark is a small country which short of natural resources, the Government always encourages high energy efficiency which lead the energy companies try the best to improve their system energy efficiency.

For the Hjorring biomass heating plant, in order to improve their system energy efficiency, they request to fully recover the 40° C flue gas waste heat from their boiler for heating purpose. BROAD developed the world's first double lift absorption heat pump to provide 10° C cold water for recovering 40° C flue gas waste heat from boiler and supplies 85° C hot water for district heating, which fully recover the waste heat and maximize the energy efficiency of this plant.

What is double lift?

When the temp. difference between chilled water outlet temp. and cooling water outlet temp. is very big, such as more than 70°C, if use a standard absorption heat pump with single lift, it is impossible to achieve this target. BROAD developed a new heat pump which has two evaporators and two absorbers inside. And the 1st absorber combines with the 2nd evaporator which composes a inner closed circle inside the heat pump. So the chilled water heat energy will be transferred and lifted by two times with this special design(inner circle and outer circle) which we called double lift heat pump. So that we can make the big temp. difference between chilled water outlet temp. and cooling water outlet temp. with one unit. In Hjorring project, the temp. difference is 75°C.

项目背景

丹麦自然资源匮乏，政府一直鼓励能源的高效利用，所以丹麦各能源公司都以资源节约，能源高效利用为发展目标。

丹麦约灵区域供暖公司采用木屑生物质锅炉供暖，为了提高整个供暖系统的能源效率，客户要求将40度左右的锅炉尾气余热充分回收用于供暖。远大开创性地开发出全球首台两级提升热泵，在提供10度冷水回收40度锅炉尾气余热同时提供85度的高温热水用于区域供暖，为客户真正做到废热的充分回收和供暖系统能效最大化。

什么是两级提升？

当冷水出口温度和冷却水出口温度温差要求非常大时，如70°C温差，用普通的一级提升热泵是无法实现的。远大开发了一种新型热泵来实现这种大温差的目标，这种热泵内部有2个蒸发器和2个吸收器，其中1号吸收器和2号蒸发器组成了一个内部闭式循环。通过此特殊设计，冷水侧的热量通过了两次能量传递和提升并传递至冷却水侧（因通过了内部循环和外部循环）。我们将这种技术称为两级提升，通过此技术，冷水出口温度和冷却水出口温度温差可以超过70°C，约灵热泵项目实现了75°C的温差。



Project Introduction

Hjorring District Heating A.m.b.a. supplies electricity, heating and cooling to commercial industries and private homes in northern Jutland, Denmark. It aims for top reliability and low heating prices. In April 2014, the world's biggest hot water absorption heat pump from BROAD Air Conditioning has been started up in Hjorring District Heating plant in Denmark. And this plant already becomes one of the lowest cost district heating plants in Denmark.

BROAD heat pump recycles the waste heat from flue gas of biomass boiler and provide 13 MW heating water(85° C) to the DH network. The advantage of this absorption heat pump system is using 10° C cold water to directly cool down and recycle the waste heat from the flue gas, decrease its temperature to 9-12° C, which can deeply recover the latent heat in flue gas and also clean it to keep the emissions at the lowest level. This is the first absorption heat pump which can achieve the highest temperature difference (75° C) between chilled and cooling water cycle.

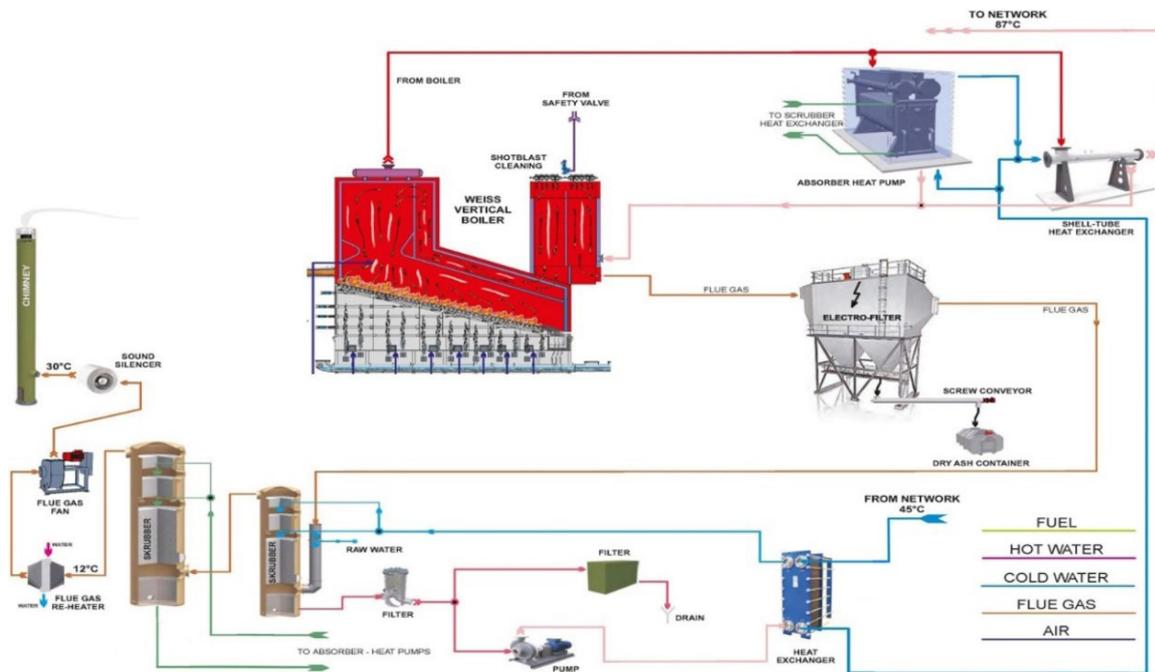
This is one of the typical cases to utilize the absorption heat pump to recover the flue gas condensate heat and improve the final efficiency of the whole heating plant.

项目简介

约灵区域供暖中心为约灵镇周边提供冷热电。此项目实现了高可靠低成本的区域供暖服务，是丹麦运行成本最低的供暖中心之一。2014年4月，远大热泵机组成功调试运行。

远大热泵回收生物质锅炉尾气的废热作为热泵的低位热源(10° C /20° C),并将此低品位废热提升至85° C供给区域管网，总供热量13MW。此项目的特点是用热泵的10° C冷水直接去回收锅炉尾气废热，将尾气降温至9-12° C，将尾气中的潜热全部回收，同时清洗了尾气，确保排放在最低水平。此热泵是全球第一台两级提升热泵，实现了低温冷水与高温供暖水的大温差(75° C)。

这是利用吸收式热泵回收锅炉尾气冷凝废热并提高整个供暖中心能源效率的典型案例。



System Diagram of Hjorring District Heating 约灵热泵系统图

Benefits

The heat pump cool the flue gas and recover 3,000kw waste heat from it. With the heat pump, the energy efficiency of the whole plant rises to 120%, which is the world-class fuel utilization performance. The facilities can dramatically lower their carbon footprint by 1,800 Tons/year, while reducing the cost of demand charge by USD 446,300/year, the payback time is around 3 years. The flue gas emission levels are extraordinarily low. Gas and dust emission are on the lowest level of current permissible limits, and some already meet the planned compliance levels for the year 2022 in Denmark.

效益分析

热泵将40度的锅炉尾气降低至9-12度，可以从回收3,000kW废热。同时将整个供暖中心的能源效率提升至120%，这是世界级的能源利用效率。此套设备每年可以显著降低碳排放至1,800吨，同时每年减少费用446,300美元，并预计在3年内收回成本。

锅炉尾气的排放水平极低。气体和颗粒物排放已经处于目前所容许范围的最低水平，同时部分参数已经达到了2022年丹麦地区容许的排放水平。

绿色能源，循环经济—丹麦格雷诺区域供暖 Green Energy, Circular Economy Grenaa Biomass Heating Plant Project

Project Background

Denmark is one of the Nordic countries, at the same latitude as Scandinavia. Temperature in Winter is low, and duration is long, heating season lasts from September to April. Usually heating is supplied by district heating, so there are many local district heating companies. In order to protect the environment, the renewable energy-biomass energy, Geothermal and solar energy are widely utilized for district heating.

For biomass heating plants, it mainly use biomass as energy source, such as woodchip, straw etc. the biomass be burned in the biomass boiler and then provide high temp. hot water, steam for district heating. Meanwhile, the flue gas of boiler will be cleaned and recycled the waste heat, then release to environment.

BROAD absorption heat pump is widely used to recycle waste heat in biomass heating plants for heat supply, so to decrease cost and increase energy efficiency. Also as a positive response to government's call to save energy and decrease CO2 emission, Heat pump projects create economic profit, meanwhile make huge contribution to the society.

Grenaa biomass heating plant locates in east coast of Jutland Peninsula, Denmark, closed to the sea port Aarhus. As a typical biomass heating plant, its heating capacity is 30MW, and supply heat to the whole Grenaa city. The management visited BROAD Town in 2017, and has a deep approbation of BROAD products and culture.

项目背景

丹麦属于北欧三国之一，与斯堪的纳维亚半岛处于同一纬度，冬天气温较低，且持续较长，采暖季从9月到4月。因自然资源匮乏，所以供暖能源尽量采用可再生能源如生物质能，太阳能等。同时为了节省能耗，区域供暖非常普遍，所以丹麦各地都有相应的区域供暖公司为本区域内的居民供暖。其中，生物质区域供暖中心在丹麦的应用非常成熟和普遍。

生物质区域供暖主要是利用木屑，秸秆等各种生物质作为燃料，在生物质锅炉中燃烧进而提供高温热水或蒸汽来供暖。同时排出的高温烟气被多层净化并回收余热再排放到大气中。

远大热泵的大力推广，回收了生物质锅炉尾气废热用于区域供热采暖，降低一次能源消耗，响应政府号召，实现节能减排，创造经济收益的同时，做出重大的社会贡献。

丹麦格雷诺区域供暖中心位于丹麦日德兰半岛东岸，靠近奥胡斯港口，采用2台木屑生物质锅炉为当地居民供暖，总供热量为30MW，向整个格雷诺市用户供热。17年2月，客户高层访问远大城，对远大产品和文化体系非常认可，并盛情邀请远大拜访他们公司，进一步增强双方合作关系。



Grenaa District Heating 格雷诺区域供暖

Project Introduction

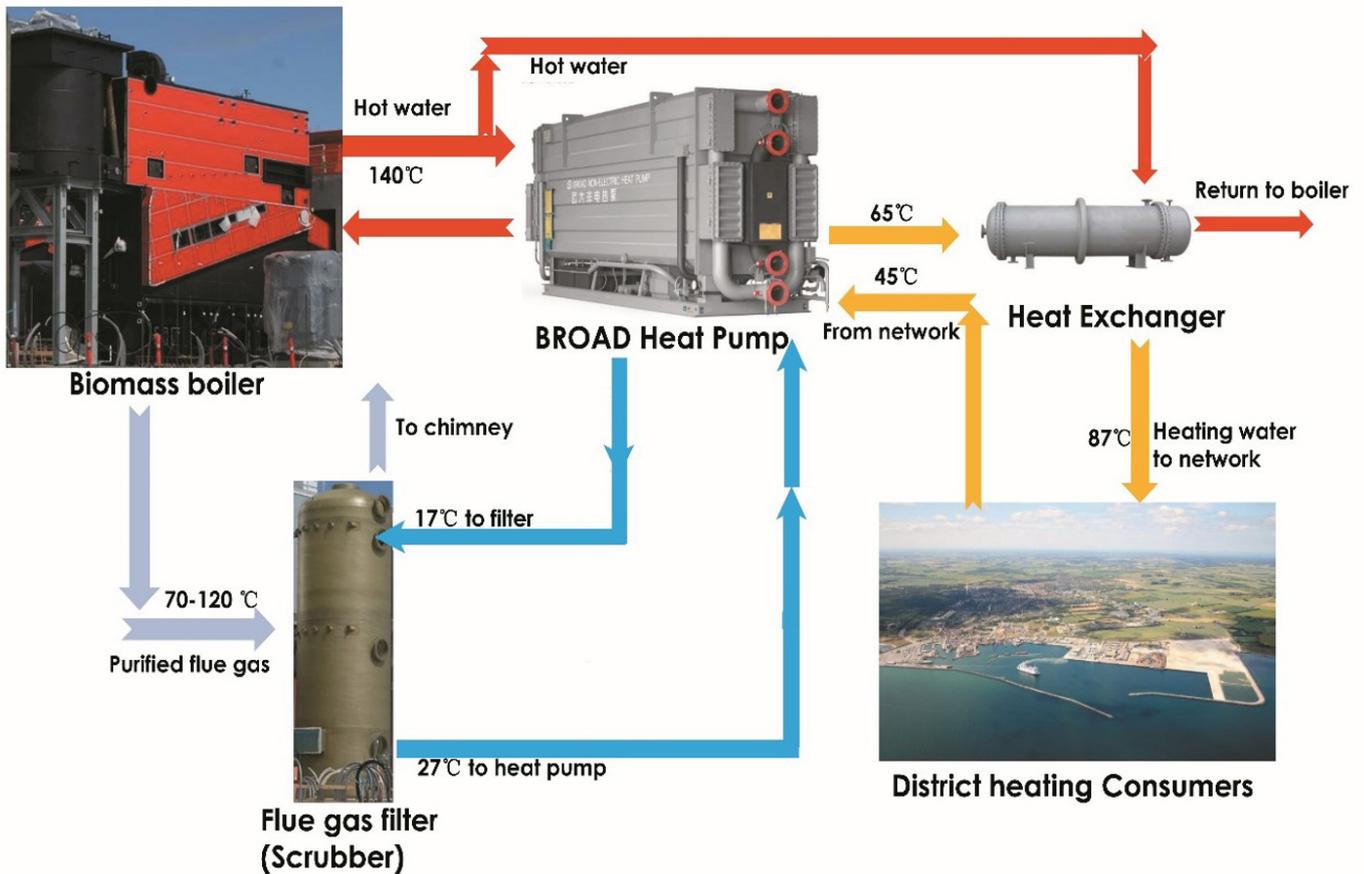
The project is designed by famous design company-COWI. It installs a combined cycle of wood chip biomass boiler and heat pump. Heat pump recover the low temp. flue gas waste heat from boilers, and provide heating to DH network. This project is an innovation for heat pump application, it has following technical highlights:

1. Use biomass as energy source, biomass is renewable energy, it is environment friendly energy source.
2. The CO₂ emission volume is exactly same as the biomass absorb volume, no damage to the CO₂ balance.
3. Use heat pump to recycle the flue gas waste heat for DH, improve the energy efficiency and reduce emission.
4. With flame gas scrubber, the chilled water and biomass boiler flue gas is a direct heat exchange, further purification to flue gas, and the final emissions close to 0.

项目简介

该项目由丹麦当地生物质锅炉公司Weiss A/S负责总包，著名设计公司COWI负责设计。该项目采用木屑生物质锅炉与热泵联合循环，作为生物质供暖典型项目，技术亮点如下：

- 1.以生物质作为燃料，生物质属于可再生能源，对环境无任何破坏。
- 2.生物质所吸收的CO₂又还回大自然，未增加新的碳排放，不破坏生态平衡。
- 3.利用热泵回收生物质锅炉排放的废烟气，用于区域供暖，提高能源利用效率的同时，减少对环境的破坏。
- 4.热泵冷水与生物质锅炉排放的废烟气是直接换热，进一步净化烟气，最终烟气接近0排放。



System Diagram of Grenaa District Heating Project 格雷诺区域供暖系统图

Value of Project

1. Denmark Grenaa district heating system installed the combined cycle of wood chip biomass boiler and heat pump. BROAD heat pump recovers 4MW of flue gas waste heat, achieving nearly zero emission
2. It saves 3,000 t/year oil equivalent, equivalent planting 490,000 trees; becoming a new benchmark in northern Europe in energy-saving and emission reduction filed.
3. Biomass is a renewable energy. As a response to the appeal of energy diversification and clean energy from government, this project assists Denmark to achieve its goal of reducing dependence on fossil energy.
4. Biomass cost is lower than fossil fuel, and it is resourceful. Biomass heating not only ensures the residents' heating safety, but also reduces heating cost.

项目价值

1. 丹麦格雷诺区域供暖系统采用木屑生物质锅炉与热泵联合循环，利用远大非电热泵回收锅炉尾气余热4兆瓦，实现锅炉尾气近零排放。
2. 为20万m²住宅供暖，每年节省3000吨油当量，相当于种了49万棵树，成为北欧节能减排事业新标杆。
3. 生物质为可再生资源，可以减少对化石能源的依赖。此项目响应丹麦政府能源多元化，发展清洁能源的号召，助力丹麦早日实现去化石能源的目标。
4. 生物质供暖成本低，资源丰富，不但保证了居民供暖安全，也降低了供暖成本。



Grenaa District Heating heat pump machine room 格雷诺区域供暖机房外景

资源节约，能效最大化—丹麦霍森斯区域供暖 Energy Resource Saving, Energy Efficiency Maximization- Fjernvarme Horsens A/S

Project Background

Denmark is one of the happiest countries in the world, but their development did not accompany with environmental degradation. As one of the Nordic countries, winter sunshine time is very short, and cold season is very long, the heating demands are huge in winter. Denmark has been able to achieve energy saving and emission reduction target in just a few decades, one of the most important reasons is widespread use of DH. The most important feature of DH is flexible which can flexibly choose the cheapest fuel in the heating network, such as industrial waste heat, incineration or biomass energy.

Denmark government has strict control on the heating price, and the main owner of the DH plants are local community, so the heating can only be sold with a low price, the profit is limited, the payback time will be longer. So heating plants also try to decrease cost of heating and short the payback time. Increasing the energy efficiency is one of the effective solutions to decrease the heating cost.

BROAD double-lift absorption heat pump is more and more popular in Denmark, which can recycle the waste heat from boiler flue gas, provide DH and decrease the flue gas temperature, achieving nearly zero emission. It has a great contribution on energy saving and emission reduction filed.

项目背景

丹麦以“清洁发展”立国，是世界最幸福的国家之一，却没有付出环境恶化的代价。作为气候严寒，冬日日照时间极短的北欧国家，丹麦在冬日对供热的需求都极大。丹麦之所以能在短短几十年间实现了节能减排，其中最重要的原因之一是区域能源的广泛使用。区域能源最大特点是灵活，它是一个集合的力量，可灵活选择在供热网内最低廉的燃料，丹麦很多供热来自工业余热、垃圾焚烧或生物质能源。

丹麦政府对当地区域供暖公司的供暖价格有严格限制，同时各区域供暖公司基本是集体所有制，所以不以营利为目的，利润空间不大，主要利润来自区域供热采暖费，供暖公司的供热区域一经划定，基本不变，所以区域内的供热总量比较稳定，为了减少开支，各供暖公司均想方设法来降低能源成本。所以为了节省开支，缩短投资回收期，另一种有效方案是提高能源效率。

远大两级提升热泵的大力推广，回收生物质锅炉烟气废热用于区域供热采暖，降低一次能源消耗，提高了供热系统总能源效率，降低了锅炉尾气排放，再次助力丹麦实现0能耗供热，为北欧及全球节能减排事业做出了卓越的贡献。



Grenaa District Heating heat pump machine room 格雷诺区域供暖机房外景

Project Introduction

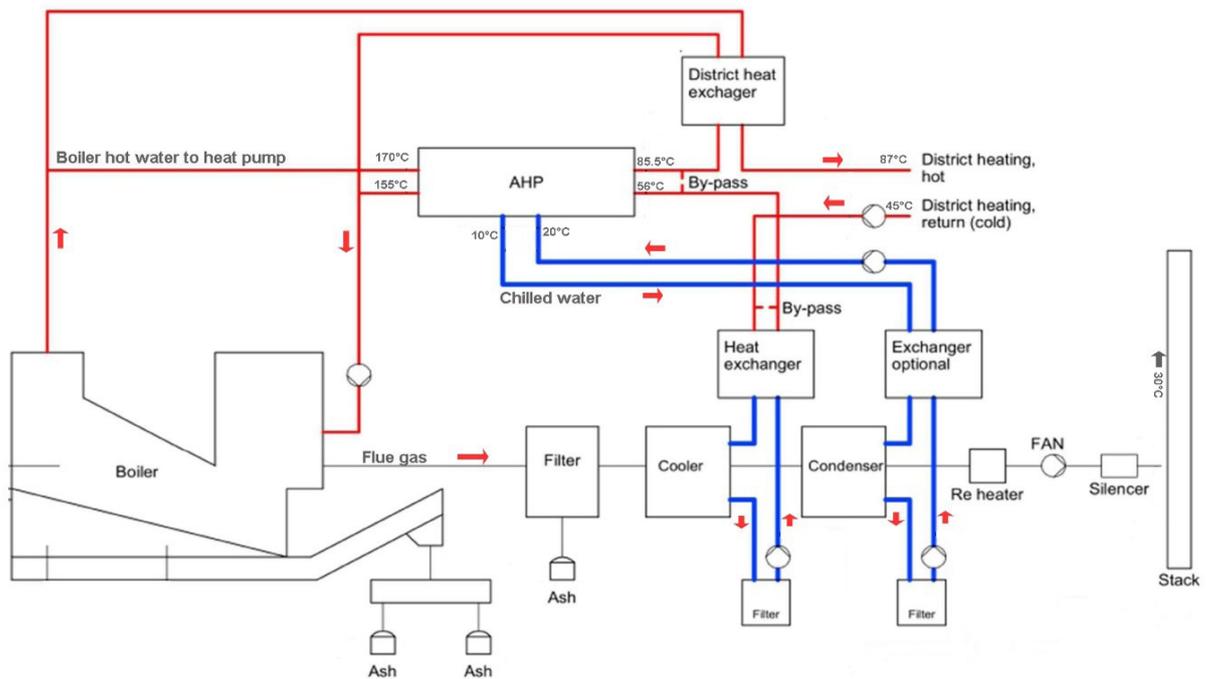
Horsens DH system will install 60MW combined cycle of wood chip biomass boiler and heat pump system. In this system, BROAD heat pump recovers 4MW of boiler's flue gas waste heat, achieving nearly zero emission for the biomass fuel boiler, while providing heating for the Horsens residence. It is becoming a new benchmark in northern Europe in the energy-saving and emission reduction filed. With the following technical highlights, this project is a new innovation for heat pump application.

1. Equipped with vacuum meter on heat pump, it can freely monitor the vacuum condition in the heat pump, which can effectively monitor the heat pump situation.
2. One unit BDH1200 heat pump with left&right structure, not only meet client's demand with only one unit, while highly reduce the machine height and avoid the lifting & transport problems
3. This heat pump can provide cooling and heating simultaneously, and achieve the high temperature difference (75 ° C) between chilled water and cooling water cycle.
4. The flue gas is cooled down to around 10C, nearly all waste heat is recovered, achieving the highest energy efficiency.

项目简介

项目用户Fjernvarme Horsens A/S投资建设总供热60MW的生物质锅炉供暖中心，联合既有CHP供暖系统，共同为霍森斯和附近地区居民提供区域供暖。此项目由著名设计公司Ramboll负责设计。丹麦霍森斯区域供暖系统采用木屑生物质锅炉与热泵联合循环，热泵回收4MW锅炉尾气废热用于区域供暖。作为全球最大的两级提升热泵机组,项目技术亮点如下:

1. 机组配备真空计，随时可以监控机组内部真空，准确监控机组状况。
2. BDH1200万机组分为左右结构，不但实现一台机组满足客户需求，同时减少了机组高度和吊装运输问题。
3. 机组回收超低温废热至10度并同时提供85.5度高温采暖水，实现超75度温差提升。
4. 废热温度降到最低，废热回收做到极致，能源效率全球最高。



System Diagram of Horsens A/S 霍森斯区域供暖系统图

Value of Project

1. BROAD heat pump fully recovers the flue gas waste heat, the flue gas is cooled down to around 10C, all latent heat is recovered, achieving the highest energy efficiency.
2. BROAD heat pump recovers 4MW of flue gas waste heat, it saves 3000 t/year oil equivalent, equivalent to planting 490,000 trees; becoming a new benchmark in northern Europe in energy-saving and emission reduction filed..
3. World biggest hot water driven single effect double lift absorption heat pump, it is a great technology innovation in the absorption heat pump industry.
4. This heat pump can provide cooling and heating simultaneously, and achieve the highest temperature difference (75.5 ° C) between chilled water and cooling water cycle.

项目价值

- 1.远大非电热泵充分回收锅炉尾气废热，使锅炉尾气温度降到最低，废热回收做到极致，能源效率全球最高。
2. 远大非电热泵回收锅炉尾气余热4兆瓦，每年节省3000吨油当量，相当于种了49万棵树，成为北欧节能减排事业新标杆。
3. 此项目机组是全球最大的两级提升非电热泵，是非电热泵技术的巨大创新。
4. 提供10度冷水同时供应85.5度高温采暖水，实现超75度温差提升，也是同时供冷供热的典型案例。



Grenaa District Heating heat pump machine room 格雷诺区域供暖机房

小项目，大示范—白俄戈梅利化纤厂项目

Small Project, Great Influence Belarus JSC "Svetlogorsk Khimvolokno" Project

Project Background

JSC "SvetlogorskKhimvolokno" is one of the largest multidisciplinary enterprises of the petrochemical complex of the Republic of Belarus. The products produced enjoy a stable demand in the domestic and foreign markets. The geography of export of products covers more than 40 countries of near and far abroad.

The introduction of heat pump at SvetlogorskKhimvolokno made a significant contribution to improving the energy efficiency of the enterprise. The project implementation confirms the economic, environmental and technical advantages of using absorption technologies, namely heat pumps.

Project Introduction

The heat pump is used to heat the hot water to a temperature of 82°C and to utilize the low-potential heat of cooling water of turbochargers. As a heating source, steam is used with a pressure of 0,6MPa and a temperature of 180°C, supplied from Svetlogorskaya CHP, which is located near the enterprise. Turbochargers are designed to produce compressed air for the technology. The application of the heat pump allows to utilize the heat of cooling of turbines the previously released through a cooling tower and to obtain network hot water for heating of the plant of polyester textile yarn. The heat pump fully covers the heat load from October to December and from February to April. At more peak temperatures in late December and January, the existing boiler plant is included in the heat supply system.

The heat pump is located in the premises of the existing air-refrigeration compressor station. For transportation of the heat pump and its subsequent installation, a special frame-foundation was designed, which, along with the heat pump, was moved along the roller guides to the installation site. All work from design to installation was performed by the plant's specialists. Commissioning were conducted by the specialists of CJSC "Servisteploihladoooborudovanija" - the official representative and service partner of BROAD in the territory of the Republic of Belarus, with the participation of the BROAD service engineer.

项目背景

JSC "SvetlogorskKhimvolokno" 是白俄罗斯共和国石油化工综合体最大的企业之一。生产的产品在国内外市场有着稳定的需求，产品出口到海外近40个国家。

SvetlogorskKhimvolokno推出的热泵为提高企业的能源效率做出了重要贡献。项目运行也证明了使用吸收技术（即热泵）的经济，环境和技术优势。



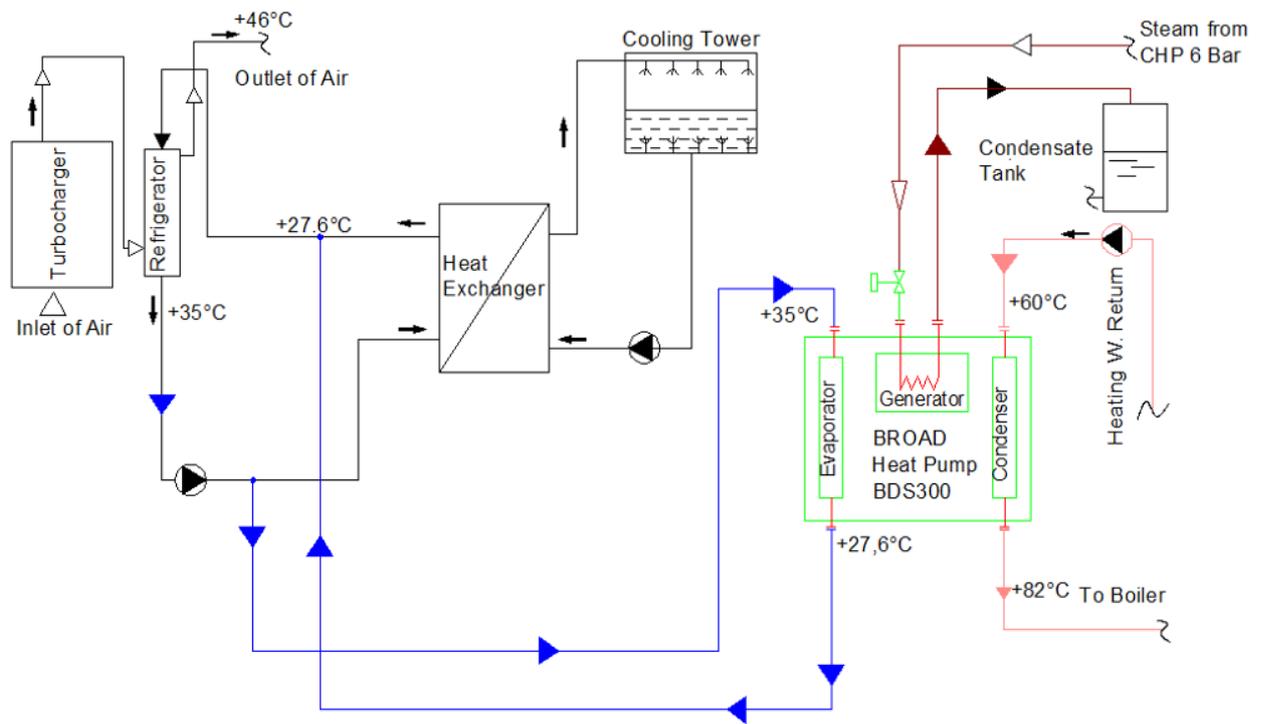
Overall perspective of Belarus JSC 项目全景图

项目简介

该项目是把涡轮增压器的冷却水做为低位热源，利用热泵将热水加热到

82°C。热源是位于项目附近的Svetlogorskaya CHP提供的压力为0.6MPa，温度为180°C的蒸汽。涡轮增压器为工艺流程生产压缩空气，热泵用来利用之前通过给涡轮增压器进行冷却的冷却塔释放到空气中的低品味热，来生产工艺流程中加热聚酯纺织纱线的热水。热泵可以完全覆盖10月至12月和2月至4月的热负荷。在12月下旬到1月底的高峰期，现有的锅炉厂为供热系统提供补充。

在该项目中，热泵位于现在的空气制冷压缩机的机房内，并且为其运输和之后的安装，专门设计了一个特殊的框架基础，可以与热泵一起沿着导轨移动到安装位置。该公司的专家对此项目给予了很大的重视，全程参与了基础设计，机组现在就位的所有工作。远大工程现与当地合作伙伴CTX的工程师一起对机组进行了调试。



System Diagram of Belarus JSC 热泵系统图

Value of Project

The project for the introduction of an absorption heat pump was fully financed from the own funds of "SvetlogorskKhimvolokno". Expected payback period is 2 years. The introduction of the heat pump gives real economic benefits in the form of reducing the consumption of heat energy for heating by 1.48 Gcal/h.

According to the terms of reference at the outlet of the hot water and the steam installed the heat meters. So during the first 2 months of operation, the economic effect amounted to about 2 000 Gcal (about 90 thousand USD).

项目价值

该吸收式热泵的项目由“SvetlogorskKhimvolokno”自有资金全额供资。预期回收期为2年。热泵的推出给企业带来了真正的经济效益，具体到热能消耗可以减少1.48Gcal / h。根据热水出口和蒸汽入口安装的热量表统计。在前两个月的运营中，经济效应换算节能量约为2000Gcal（约合九万美元）。



Heat pump machine room of Belarus JSC 项目机房内部



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Note: Please take BROAD MODEL SELECTION & DESIGN MANUAL as standard for detail parameters