

Annex XI | 2014-2017



BRINGING COUNTRIES TOGETHER
TO RESEARCH, INNOVATE AND GROW DISTRICT
HEATING AND COOLING – INCLUDING CHP



RESEARCH, INNOVATE AND GROW

Countries around the world are looking for ways to reduce greenhouse gases and increase energy security. District heating and cooling (DHC) and combined heat and power (CHP) are energy-efficient, environmentally responsible technologies that make achieving these goals possible.

DHC is especially effective in areas of high building density, making it invaluable in this era of growing urbanisation and increased energy and environmental challenges. As a result, many countries are establishing or renewing their commitment to DHC and CHP and the potential they hold.



DHC/CHP systems worldwide already avoid about half the CO₂ reduction presumed in the Kyoto Protocol.

That is why it is more important than ever for the world's nations to share best practices of DHC and CHP and continue to conduct research that will further improve system operations, efficiencies and resulting benefits. A major international research programme operating under the auspices of the International Energy Agency (IEA) does just that.

Established in 1983, the 'IEA Implementing Agreement on District Heating & Cooling including Combined Heat and Power' (IEA-DHC) brings countries together to research, innovate and grow district heating and cooling and CHP.¹

Countries that participate in the IEA-DHC research programme leverage their resources to conduct studies that they may not be able to accomplish on their own. The result is that they gain leading-edge knowledge and insight they can put to work in their communities and cities, supporting their efforts to increase energy efficiency and address climate change.

HOW THE RESEARCH PROJECTS WORK

The IEA-DHC research programme addresses technical as well as policy issues aimed at low environmental impact. We select, manage and publish collaborative co-funded projects, collating and exchanging information on R&D projects between participating countries.

Every three years – a time period we call an Annex – IEA-DHC participant countries can propose research projects, and the programme's Executive Committee decides which of these research projects should be undertaken during the upcoming three-year period.

The selected project teams usually represent at least two countries and are headed by a project manager who coordinates project meetings, conference calls, etc. Each project team also arrange two to three meetings with experts nominated from each country, further sharing knowledge and optimising research results. These experts report progress to their country's Executive Committee representative, and the results of each project are presented at an End-of-Annex seminar. The participant countries also have direct access to all research results. After one year the reports are made available to the public via the IEA-DHC web site.

This brochure provides information about the projects of Annex XI. Just as in past annexes, these projects address issues of current relevance within the DHC/CHP industry. Over the years, we have researched a variety of issues related to distribution systems, operations, customers and benefits of DHC and CHP. [See the "Research" section on www.iea-dhc.org.]

WHO PARTICIPATES IN THE IEA-DHC PROGRAMME

IEA-DHC programme control is vested in its Executive Committee, which comprises one official representative from each participating country. Each country can also assign an alternate committee member. The Executive Committee meets twice a year, normally in May and November. We maintain close links with Euroheat & Power and the International District Energy Association.

Our meetings enable us to continue coordinating our research programme as a whole, dealing with technical, financial and organisational issues. We also compare the status of the DHC industry in our respective countries, discuss project progress,

prepare for new projects and plan upcoming workshops for sharing information.

The Executive Committee closely cooperates with other IEA programmes. In particular the IEA-DHC is a member of the IEA's Building Coordination Group, resulting in more knowledge sharing and planning of joint activities.

Countries may become a part of the IEA-DHC research programme by paying an annual subscription fee based on the country's gross domestic product. Benefits include

- being a part of the international research program for DHC;
- accessing research valued at US\$1 million for each annex, for a fraction of that cost;
- sharing knowledge and networking with countries with diverse DHC/CHP markets and industry maturities;
- related involvement in other international energy groups;
- gaining knowledge from IEA's other building-related programs;
- participation in end-of-annex seminars usually integrated with major DHC conferences; and
- having a global policy voice through the International Energy Agency.

The world may be challenged by climate change, but countries can make district heating and cooling and CHP part of an integrated energy and environmental solution.

The IEA's DHC Implementing Agreement has played a significant role in the DHC/CHP industry's history and will play a vital role in its even brighter future. We encourage you to join us as we bring countries together to research, innovate and grow district heating and cooling – including CHP.

JOIN US!

Please contact the Operating Agent at iea-dhc@agfw.de for further information on joining.

¹ The IEA-DHC is one of 42 international collaborative Implementing Agreements. For further information about the IEA Implementing Agreements, consult www.iea.org/techagr.

DHC/CHP

The fundamentals of district heating and cooling are simple but powerful: connect multiple buildings through a hot water, steam and/or chilled-water piping network to environmentally optimal – and often local – energy sources. These can include CHP, municipal or industrial waste heat and renewable energy sources such as biomass, geothermal and solar. Customer buildings use the energy for space heating, domestic hot water and/or air conditioning.

As highlighted in our policy paper, the IEA-DHC programme asserts the following:

- DHC is competitive with individual building systems.
- Modern DHC systems are one of the most potent ways to reduce carbon emissions.
- DHC networks create opportunities to increase CHP.
- CHP enables power demands to be met efficiently.
- Linking buildings with DHC opens up technology options.
- DHC provides a flexible infrastructure for transition to renewable fuels.
- DHC confers energy security benefits.

These findings and more are included in our policy paper on DHC and CHP that is available as a pdf download at www.iea-dhc.org/the-programme/mission.html.

ANNEX XI PROJECTS

TRANSFORMATION ROADMAP FROM HIGH TO LOW TEMPERATURE DISTRICT HEATING SYSTEMS

SUMMARY

Lead Country: Sweden

The project focuses on developing a transformation roadmap for the technology shift from one generation of district heating to another. The focus is the transformation from second generation (2GDH) and third generation (3GDH) systems using high and medium supply and return temperatures for heat distribution to fourth generation (4GDH) systems using lower supply and return temperatures. Additionally some experiences for transforming first generation (1GDH) systems which operate with steam will be presented.

The transformation roadmap will be elaborated building on seven research issues. It will be based on results from earlier research projects and experiences gained from operation of existing district heating systems. The transformation roadmap overview will provide unique insights and information.

The main benefit of this project will be a clearer overview of the steps required to transform district heating nets for the future. It is intended as a tool to support the future competitiveness of district heating.

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PLAN4DE: REDUCING GREENHOUSE GAS EMISSIONS AND ENERGY CONSUMPTION BY OPTIMIZING URBAN FORM FOR DISTRICT ENERGY

SUMMARY

Lead Country: Canada

The way in which cities and towns develop has a major influence on energy consumption. District energy, a key strategy for reducing GHG emissions and creating energy security, is much more cost effective in a compact city than in a sprawling city. Furthermore, it is very challenging and costly to transform a sprawling city into a compact city because of the investments in buildings, roads and other infrastructure, an idea known as path dependence.

Current land-use decisions by urban planners are thus influencing whether or not district energy will be possible in the future. Urban planners, however, seldom consider district energy in city planning due to a lack of knowledge and because they have few tools to do so.

This project aims to create a tool that will enable planners to consider the impacts of land-use plans on the feasibility of district energy and to develop standard land-use patterns that will enable district energy. In other words, the project hopes to help planners rule-in the option of district energy rather than ruling it out.

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SMART USE AS THE MISSING LINK IN DISTRICT ENERGY DEVELOPMENT: A USER-CENTRED APPROACH TO SYSTEM OPERATION AND MANAGEMENT

SUMMARY

Lead Country: Sweden

This project aims to develop an intuitive, smart and predictive home energy management interface. By being visually attractive, intuitive and interactive it increases the residents' understanding of smart energy systems and how they can use energy more efficiently. The target audience for this research are primarily district energy end users, producers of home energy management systems and district energy suppliers.

It has already been shown that the way people interact with district heating systems can have a great influence on energy consumption. Even though there are only a few studies on how people actually interact with district heating systems it is quite clear that most of the controls are difficult to both understand and use.

The newly developed interface is aimed to help end users of district energy to become more aware of the benefits of district energy, i.e. its environmental benefits, its resource and cost efficiency and its convenience.

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STRUCTURED FOR SUCCESS: GOVERNANCE MODELS AND STRATEGIC DECISION MAKING PROCESSES FOR DEPLOYING THERMAL GRIDS

Lead Country: USA

With an emphasis on increasing efficiency and clean energy production, it's no surprise many communities around the world are focusing on district energy and combined heat and power (CHP) systems as a means to achieve targets related to emissions, sustainability, and increasing resilience. With strategic planning and foresight, these systems can be leveraged to provide significant gains in energy efficiency, effectively capturing both thermal and electricity production from a single fuel source.

While district energy system development may face a number of challenges related to financing, and perhaps less frequently technology, the primary barrier related to system deployment and implementation remains complexity around identifying appropriate governance models to align with project objectives.

This project aims at reviewing a range of innovative governance models and strategic decision making processes proven to develop successful, financially viable district energy systems. It will provide comprehensive analysis of existing policies, studies, regulations, technical and market barriers with the potential to impact the governance model and development of district energy in selected case study jurisdictions. The study will include urban and rural district energy case studies from the United Kingdom, United States, Canada, Denmark and So. Korea. Findings will be synthesized to produce a Governance Guidance Report with global application for strategic decision makers in local communities and municipalities. It will assist them in charting a pathway to the most appropriate model for deploying thermal grids in their community.

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HIGHLIGHTS OF IEA DHC RESEARCH (1983 – 2014)

DISTRIBUTION

- District heating distribution in areas with low heat demand density
- Handbook on plastic pipe systems for district heating
- Cost-effective and low-cost district heating networks

OPERATIONS

- Appraisal of benefits of low-temperature district heating
- Design and operation of ice slurry-based district cooling systems
- Supervision of district heating networks

COMBINED HEAT AND POWER

- Balancing production and demand of combined heat and power
- Design guide for integrating district cooling and combined heat and power
- Comparing distributed CHP/DH and large-scale CHP/DH

OTHER TOPICS

- Environmental benefits of district heating and cooling
- District heating and cooling building connection handbooks
- Promotional manual for district energy systems

MOST RECENT (FINISHED 2014)

- Improved maintenance of district heating pipes
- Integrating renewables and waste heat into district heating
- 4th generation district heating
- Universal calculation model for primary energy factors

All research results are available for free after registration on: www.iea-dhc.org/the-research.html.

ABOUT THE INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) is an intergovernmental organisation that serves as energy policy advisor to 28 member countries in their effort to ensure reliable, affordable and clean energy for their citizens. Founded during the oil crisis of 1973-1974, the IEA was initially established to coordinate measures in times of oil supply emergencies.

As energy markets have changed, so has the IEA. Its mandate has broadened to incorporate the “Three E’s” of balanced energy policy making: energy security, economic development and environmental protection. Current work focuses on climate change policies, market reform, energy technology collaboration and outreach to the rest of the world, especially major consumers and producers of energy like China, India, Russia and the OPEC countries.

With a staff of nearly 200 who are mainly energy experts and statisticians from its 28 member countries, the IEA conducts a broad program of energy research, data compilation, publications and public dissemination of the latest energy policy analysis and recommendations on good practices.



BENEFITS OF MEMBERSHIP IN IEA DHC

- Enabling researchers from member countries to apply for direct funding from IEA DHC.
- Influence on future research topics through voting rights in the Executive Committee.
- Up-to-date expert information on international DHC research and developments.
- Participation in the only major international research programme devoted to district heating and cooling including combined heat and power.
- Networking of researchers of member countries through research projects
- High level of influence by being part of the IEA technology network.

Contact the IEA DHC Operating Agent (iea-dhc@agfw.de) if you want your country to benefit from an IEA DHC membership!



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The IEA-DHC, also known as the Implementing Agreement on District Heating and Cooling, Including the Integration of Combined Heat and Power, functions within a framework created by the International Energy Agency (IEA). Views, findings and publications of the IEA-DHC do not necessarily represent the views or policies of the IEA Secretariat or of all its individual member countries.

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