

# Annex XII | 2017-2020



**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 CO<sub>2</sub> 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 Technology Collaboration Programme 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.<sup>1</sup>

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 XII. 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](http://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 more than 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 Technology Collaboration Programme 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](mailto:iea-dhc@agfw.de) for further information on joining.

<sup>1</sup> The IEA DHC is one of 42 international collaborative Implementing Agreements. For further information about the IEA Technology Collaboration Programme, consult [www.iea.org/techagr](http://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:

- Modern DHC systems are one of the most potent ways to reduce carbon emissions.
- The deployment of DHC creates jobs and helps to increase economic prosperity.
- DHC is competitive with individual building systems.
- 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](http://www.iea-dhc.org/the-programme/mission.html).*

# ANNEX XII PROJECTS

## EFFECTS OF LOADS ON ASSET MANAGEMENT OF THE 4TH GENERATION DH NETWORKS

### *Lead Country: Germany*

The transition from Third Generation District Heating (3GDH) to Fourth Generation District Heating (4GDH) means to lower supply and return temperatures in order to facilitate the integration of renewable energy sources and waste heat. This integration is expected to result in higher cyclic mechanical and thermal loads on the DH networks, which can significantly affect the operational lifetime of the DH piping systems.

The objective of this project is to deliver knowledge and methodologies for reliable and cost effective asset management of future 4GDH networks. The consequences of future load characteristics as well as fatigue theories and thermal ageing in combination with cyclic mechanical loads will be identified and investigated. From these results, recommendations to the European standardization organizations and suggestions for an improved asset management strategy will be proposed.

A major outcome of this project will be new knowledge on how to predict the lifetime of 4GDH networks and how to increase it.

### **Project contact:**

Prof. Dr. Ingo Weidlich  
HCU Hafencity University  
Überseeallee 16  
20457 Hamburg, Germany

[ingo.weidlich@hcu-hamburg.de](mailto:ingo.weidlich@hcu-hamburg.de)

## MEMPHIS – METHODOLOGY TO EVALUATE AND MAP THE POTENTIAL OF WASTE HEAT FROM INDUSTRY: SERVICE SECTOR AND SEWAGE WATER BY USING INTERNATIONALLY AVAILABLE OPEN DATA

### *Lead Country: Germany*

The integration of waste heat from industrial processes has been identified as a major research area in the EU strategy on heating and cooling.

While the potential of high-temperature waste heat for example from combined heat and power plants is well understood in the district heating (DH) sector, this project aims to analyze the potential of low-temperature waste heat. The project focuses on waste heat from small and medium industries and the service sector as well as from sewage water systems.

A newly developed and publicly accessible tool based on open data will help local authorities, city planners and developers to identify maximum size and diversity of waste heat potential on a local level. The underlying methodology can help policy makers to promote the usage of low-temperature waste heat at national levels.

### **Project contact:**

Johannes Pelda, MEng  
HAWK HHG  
Rudolf-Diesel-Straße 12  
37077 Göttingen, Germany

[johannes.pelda@hawk-hhg.de](mailto:johannes.pelda@hawk-hhg.de)



## INTEGRATED COST-EFFECTIVE LARGE-SCALE THERMAL ENERGY FOR SMART DISTRICT HEATING AND COOLING

### *Lead Country: Canada*

In modern District Heating and Cooling (DHC) systems integrated thermal energy storage (TES) systems can help to increase flexibility and efficiency of operation. Furthermore large-scale TES enable the coupling of the heat and electricity sector and hence provide a foundation to increase the flexibility and efficiency of the overall energy system.

Within this project data will be collected and analysis tools will be developed to encourage the use of cost-effective large-scale underground thermal energy seasonal storage (UTES) in smart district heating and cooling systems. Large-scale thermal energy storage technologies that can currently offer cost-effective solutions are aquifer and pit thermal energy storage (ATES and PTES).

The overall aim is on one hand to disseminate up-to-date data, information and first-hand-experience on seasonal TES and on the other hand to find reliable and adequate analysis tools which assess the techno-economic potential of large scale ATES or PTES integration in DHC systems.

### **Project contact:**

Reda Djebbar, Ph.D, P. Eng  
Natural Resources Canada (NRCan)- CanmetENERGY  
1 Haanel Drive  
Building 5A  
Nepean  
Ontario K1A 1M1  
  
reda.djebbar@canada.ca

## STEPWISE TRANSITION STRATEGY AND IMPACT ASSESSMENT FOR FUTURE DISTRICT HEATING SYSTEMS

### *Lead Country: Finland*

The potential and relevance of district heating and cooling as a technology for addressing the challenge of climate change has recently received more attention on European level. The optimization of the transition from current district heating systems to 4th generation district heating (4GDH) is a major task for district heating companies.

The objective of this project is to develop a stepwise transition strategy including practical and highly replicable actions. The three aspects of building level actions, integration of new heat sources and energy system level benefits will be investigated.

An overall guideline combining all results will complete this project and support district heating companies in taking the next steps on the path to 4GDH.

### **Project contact:**

Mr. Miika Rämä  
VTT Technical Research Centre of Finland  
Vuorimiehentie 3  
Espoo  
P.O. Box 1000  
FI-020044 VTT, Finland

miika.rama@vtt.fi



# CURRENT PARTICIPATING COUNTRIES AND THEIR REPRESENTATIVES

## AUSTRIA

Mr. Michael Hübner  
Federal Ministry of Transport,  
Innovation and Technology  
Energy and Environmental  
Technologies  
Tel: +43 171 162 296 522  
michael.huebner@bmvit.gv.at

## CANADA

Mr. J. Raymond Boulter  
Canmetenergy  
Natural Resources Canada  
Tel.: +1 613 943 095 1  
raymond.boulter@canada.ca

## CHINA

Dr. Jianjun Xia,  
Tsinghua University  
Tel +86 106 277 555 3  
xiajianjun@tsinghua.edu.cn

## DENMARK

Mr. Lars Gullev (Vice Chairman)  
West Copenhagen Heating Transmission Company - VEKS  
Tel +45 436 603 66  
lg@veks.dk

## FINLAND

Mr. Martti Korhikoski  
Tekes, Finnish Funding Agency  
for Technology and Innovation  
Tel +358 295 055 875  
martti.korhikoski@tekes.fi

## FRANCE

Ms. Sihem Tasca-Guernouti  
CEREMA  
Tel.: +33 240 128 454  
sihem.tasca-guernouti@cerema.fr

## GERMANY

Dr. Carsten Magass  
Projekträger Juelich  
Energietechnologien (ERG1)  
Tel +49 246 161 930 8  
c.magass@fz-juelich.de

## KOREA

Mr. Bongkyung Seo  
Korea District Heating Corp.  
District Heating Technology Research Institute  
Tel +82 220 401 200  
Mobile +82 108 865 229 7  
seobk@kdhc.co.kr

## NORWAY

Dr. Rune Volla  
Research Council of Norway  
Tel +47 220 373 52  
rv@rcn.no

## SWEDEN

Mrs. Sofia Andersson  
Swedish Energy Agency  
Tel +46 165 442 445  
sofia.andersson@energimyndigheten.se

## UNITED KINGDOM

Dr. Robin Wiltshire (Chairman)  
BRE/Building Research Establishment  
Tel +44 1 923 664 324  
wiltshirer@bre.co.uk

## USA

Mr. Robert P. Thornton  
IDEA  
Tel +1 508 366 933 9  
Mobile +1 508 254 736 9  
rob.idea@districtenergy.org

## OBSERVER

Mr. Alessandro Provaggi  
Euroheat & Power  
Tel +32 274 021 13  
ap@euroheat.org

## OPERATING AGENT

Dr. Andrej Jentsch  
AGFW Projekt GmbH  
GERMANY  
Tel +49 696 304 344  
Tel +49 251 149 126 0 (direct call)  
iea-dhc@agfw.de

*Please contact the Operating Agent  
for more information.*



## HIGHLIGHTS OF IEA DHC RESEARCH (1983 – 2017)

### 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 2017)

- Transformation roadmap from high to low temperature district heating systems
- Plan4DE: optimizing urban form for district heating
- Smart use as the missing link in district energy
- Governance models and strategic decision making processes for thermal grids

All research results are available for free after registration on: [www.iea-dhc.org/the-research.html](http://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 30 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 30 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](mailto:iea-dhc@agfw.de)) if you want your country to benefit from an IEA DHC membership!



**IEA DHC|CHP**

### IEA DHC

c/o AGFW Projekt GmbH  
Stresemannallee 30  
50596 Frankfurt am Main  
GERMANY  
[www.iea-dhc.org](http://www.iea-dhc.org)

*The IEA DHC, also known as the Technology Collaboration Programme 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.*

*IEA DHC thanks and acknowledges the following individuals and organisations for the use of these photographs:*

*Amsterdam's Zuidas building construction: Massimo Catarinella — Distribution piping: DBDH — Helsinki skyline: ©Andrei Nekrassov — Man, woman inside mechanical room: District Energy St. Paul Inc — Oujé Bougoumou, Quebec, plant: FVB Energy — Plant control room: Växjö Energi AB — Seoul aerial: ©2012 Ken Brown. All rights reserved — Solar panels: Dreamstime — Wood chips, plant stack, chiller, plant piping: Bob Smith, RMF Engineering — Miscanthus: © Udo Feinweber.*