



**IEA Technology Collaboration Programme on
District Heating and Cooling
including Combined Heat and Power**

**ANNEX XIII
(1 May 2020 – 30 April 2023)**

**CALL FOR PROPOSALS
PROGRAMME PERIOD 2020 – 2023 (ANNEX XIII)**

List of abbreviations

CHP	Combined Heat and Power
CV	Curriculum Vitae
DHC TCP	Denomination for IEA DHC within the IEA
ExCo	Executive Committee of IEA DHC
IEA	International Energy Agency
IEA DHC	International Energy Agency Technology Collaboration Programme on District Heating and Cooling including Combined Heat and Power
TCP	Technology Collaboration Programme
USD	United States of America Dollars

2-STAGE PROJECT SELECTION PROCEDURE FOR IEA DHC ANNEX XIII

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Background

The International Energy Agency

The International Energy Agency (IEA) was established in 1974 in order to strengthen international co-operation on energy technologies. It works to ensure reliable, affordable and clean energy for its member countries and beyond. As an element of its international energy technology co-operation, the participating countries undertake co-operative actions in energy research, development and demonstration. These are known as Technology Collaboration Programmes (TCPs).

The Technology Collaboration Programme for District Heating and Cooling

The 'IEA Technology Collaboration Programme for District Heating and Cooling including Combined Heat and Power' (IEA DHC) was established in 1983. It is the only international research and development programme for this technology that has global reach.

Specifically, IEA DHC deals with the design, performance and operation of non-individual heating and cooling generation, distribution systems and consumer installations. It is dedicated to helping district heating and cooling, combined heat and power and the recycling of excess heat become powerful tools for energy conservation and the reduction of environmental impacts of supplying heating and cooling.

IEA DHC has proceeded since 1983 by means of three-year cost-shared 'annexes', and since 2011 also carries out task-shared research. More information about current Annex XII projects and previous annexes can be found on the IEA DHC web site <http://www.iea-dhc.org>

For the purpose of this document, the term "Operating Agent" shall refer to the management of the IEA Technology Collaboration Programme on District Heating & Cooling (IEA DHC) as represented by its Operating Agent.

Call for Proposals for Annex XIII

The IEA DHC Executive Committee (ExCo) through its Operating Agent hereby launches a **Call for Project Proposals**. This thirteenth three-year period (Annex XIII) will be run from 1 May 2020 to 30 April 2023.

Proposed projects may range in duration up to a maximum of 30 months, terminating not later than 30 April 2023.

Proposals should be based on one or more of the priority themes as set out below. (Proposals on innovative new issues outside these areas will be considered only at the discretion of the Operating Agent).

Proposals should have clear relevance to district energy¹ practice, provide a clear contribution to a more sustainable energy system and they should be relevant to all the participant countries of the IEA DHC programme.

The project selection is based on a 2-stage proposal process. The first stage is the submission of an outline while the second stage is the submission of a full proposal. For details see respective chapters of this document.

Proponents who were successful in the first stage of the selection procedure should explain in their full proposal how and to what extent they contribute to a more sustainable energy system. I. e. they should describe how the proposed research helps to decrease carbon emissions and resource consumption. This explanation is expected to be qualitative. However, proponents are invited to quantify their contributions to a sustainable energy system. A guideline on the estimation of overall resource consumption can be found at the end of this document in Appendix A.

Proponents sending in full proposals should clearly state and explain how and why their research tackles a well-defined need, who will use the results of their research, and to what benefit. Target groups should be clearly specified and there should be a clear communication plan towards these groups.

¹ District energy has the same meaning as district heating and cooling and may include combined heat and power generation.

² IEA-EBC Working Group on Cities and Communities, <https://www.iea-ebc.org/new-page>

³ See the Appendix A for a description of a methodology to assess overall efficiency / low resource consumption.

Proponents should illustrate links to other international activities where and if applicable, like related IEA TCPs, Mission Innovation, WGCC² etc. and should avoid duplication of existing research.

Proposals can cover project types from theoretical studies, applied research, to experimental investigations and demonstration projects.

² IEA-EBC Working Group on Cities and Communities, <https://www.iea-ebc.org/new-page>

Theme 1: Decarbonisation and temperature reduction in District Heating Networks

Background: Established district heating and cooling systems need to evolve in order to maximise their contribution to a global decarbonised energy system. The overall efficiency³ of new solutions needs to be high in order to minimise their impact on valuable resources. This theme calls for initiatives that help to decarbonise existing district heating systems, reduce the temperature levels in district heating systems, increase flexibility and provide concepts for demand-side solutions (including substations) that are optimized for low-carbon and low-temperature district heating networks. The investigated approaches should be applicable to a variety of district heating situations and should address the concerns of the industry and/or policy makers. Research should focus on innovative methods, materials and practices and could be presented as case studies, guidelines/handbooks and/or demonstration projects:

- 1.1. Cost-effective system transformation – pathways towards low-carbon energy solutions; for district heating networks, innovative low-carbon and low-temperature technology combinations promising cost reductions
- 1.2. Flexibility and thermal storage⁴ – balance between different heating and cooling sources and demand profiles; simulation models; integration of alternative materials and technologies; considering different time-scales (from hours to seasonal variations)
- 1.3. Demand side – solutions that allow the demand side to contribute to more sustainable district heating systems; improved substations e.g. that enable the return temperature to be minimised while remaining cost-effective.

³ See the Appendix A for a description of a methodology to assess overall efficiency / low resource consumption.

⁴ Proposers should be aware of the IEA Technology Collaboration Programme on Energy Storage (ECES TCP). For more information on this programme please visit <http://www.energy-storage.org>.

Theme 2: Improving the business case of DHC including the integration of prosumers

Background: A major challenge for the deployment of district heating and cooling networks can be the local political and market frameworks. Laws and regulations as well as market prices influence the economic viability of the technology as a whole and can lead to a preference for less integrated technologies. The following three challenges have been identified that currently need special attention of researchers:

- 2.1. Improve economic viability of DHC, for both new and existing systems - cost-reduction strategies for network piping and building connection; design and construction and installation; trenchless technologies; optimised design for systems integrating multiple heat sources, technical aspects of maintenance improvement
- 2.2. Bringing together the investment world and the DHC world – making low-carbon DHC fundable at a large scale; identification of barriers that deter investment in DHC and how to overcome them, including risk management as well as decision support strategies for infrastructure investment
- 2.3. Market development to allow the integration of prosumers – synergies with electricity markets; development of realistic market regulations that allow DHC to thrive.

Theme 3: Digitalisation – systematic optimisation of DHC in the era of big data

Background: Digitalisation is a major influence on modern society. How can DHC networks benefit from this trend? How can the tools and methods of digitalisation help to make DHC a backbone of a sustainable energy future? Proposals in the following three subthemes are expected to help answer these questions:

- 3.1. Improving planning, operation and maintenance of production, network, storage and demand – digital twins; monitoring schemes; overall system and city level solutions (i.e. energy use and potential mapping) to help design and control DHC systems; tools for decision support
- 3.2. Collection, management and application of data for overall DHC optimisation and maintenance – market surveys; actions needed to achieve 3.1; smart tariffs: adapting price based on network data; data security and privacy
- 3.3. Smart controls and Internet of Things for DHC networks – data gathering systems for DHC; integration of sensors into DHC elements; automated, self-regulating subsystems

Procedure

The call will follow a two stage procedure:

1. As a first step a short project outline (limited to 2 pages) should be submitted by February 28th 2020 to the Operating Agent. The outline will be screened and evaluated jointly and results will be notified to the participants by March 30th 2020.
2. Partners with approved outline proposals will be invited to submit a full project proposal (limited to 12 pages) by May 15th 2020. Submission guidelines can be found in the section on full proposals. Submitting proponents will be notified by July 15th 2020.

Outline proposal format – stage 1

Proposals should contain the following information and should not exceed **2 pages**

(Arial 11pt, line spacing 1.3, 2 cm borders.)

1.	Title of project
2.	Priority theme and further themes addressed
3.	<p>Proposal summary (300 words maximum)</p> <ul style="list-style-type: none"> • Include a clear statement of the research area stating the target audience(s) and the specific issue(s) that will be addressed. Define the end product(s) / deliverable(s) of the research.
4.	Lead organisation; country, description (one sentence), contact, email
5.	Partner organisations; country, description (one sentence), contact, email
6.	<p>Objectives / goals</p> <ul style="list-style-type: none"> • What is the principal objective of the project? • How will the research assist the development of the District Heating & Cooling Sector? • In what timeframe will these results occur: short term (< 5 years), medium term (5 to 15 years), long term (>15 years).
7.	<p>Project plan</p> <ul style="list-style-type: none"> • State the deliverables and products of the project. • What about these outcomes is new? • How relevant are these outcomes to the international DHC community?
8.	<p>Budget</p> <ul style="list-style-type: none"> • State the upper limit of your required budget in USD.

Selection process for outline proposals

Outline proposals will be assessed according to the following ranking process:

Issue	
	Maximum per issue
Contribution to DHC ⁵	15
Novelty	10
Scientific competence of involved organisation	5
Relevance of expected results	10
Benefit to important target groups	10
Cost-benefit-ratio	10

The following guidelines should apply when clustering proposal outlines. IEA DHC reserves the right to modify the percentages needed for each category based on the number and quality of proposal outlines sent in.

- Top 20% - A
- Top 35 – 20% - B
- Below top 35% - C – not recommended

⁵ Contribution to DHC is considered something that will likely help DHC to be more successful in a future energy system. This means that the research enables the DHC community to perform better in the transition towards a carbon-neutral, sustainable energy system.

At least two proposals will be requested per theme, if at least two B outlines have been submitted for that theme.

A feedback of average scores for outline evaluation will be sent to research teams selected for sending in full proposals in order to allow for an improvement of the full proposal documents. All proponents who submitted proposal outlines that are not selected will be notified by the IEA DHC Operating Agent.

Full Proposals – Stage 2

Full Proposals should contain the following information and should not exceed **12 pages** (Arial 11pt, line spacing 1.3, 2 cm borders) excluding CVs.

1.	Title of project
2.	Priority theme and sub-theme
3.	<p>Proposal summary (1000 words maximum)</p> <p>Include a clear statement of the research area stating the target audience(s) and the specific issue(s) that will be addressed. Define the end product(s) / deliverable(s) of the research.</p>
4.	Lead organisation; project manager, address, country, telephone number, email
5.	Partner organisations; project participants, addresses, countries, telephone numbers, emails
6.	<p>Objectives / goals</p> <ul style="list-style-type: none"> • What is the principal objective of the project? • How will this research address the needs of the priority theme? • How will the research assist the development of the District Heating & Cooling Sector? To demonstrate the value to a specific target group (e.g. industry, communities and policy makers) a letter of support would be an asset. • How will the research and its benefits advance sustainable energy systems and be transferable to other countries, particularly those countries who are members of IEA DHC? • In what timeframe will these results occur: short term (< 5 years), medium term (5 to 15 years), long term (>15 years).
7.	<p>Project plan</p> <ul style="list-style-type: none"> • Describe fully the content of your proposal and the methodology for your research. • Provide a Gant Chart showing the overall project schedule together with major milestones for project review and interim deliverables. • Identify the use of any confidential or proprietary material, equipment, etc. • State the deliverables and products of the project.

8.	<p>Previous research in this area</p> <ul style="list-style-type: none"> • What is the current global level of knowledge in this area? • Is this research unique or does it call upon previous work either by the proponent or by others? • If it does call upon previous research, please specify in detail how the intended work follows on from what has already been done. • What linkages or communication exists between this research and other areas of research (other IEA TCPs, universities etc.)?
9.	<p>Budget</p> <ul style="list-style-type: none"> • Provide a detailed budgetary breakdown according to the proposed project plan (section 7 of this table) in terms of hours worked, sub-contracts, promotion, travel & accommodation. • Identify and quantify any in-kind contributions from participants (see Appendix A). • Additional cash funding will be regarded favourably. (A letter of intent or similar is required.)
10.	<p>Communication plan</p> <ul style="list-style-type: none"> • Describe how you intend to communicate and disseminate your research results. • Outline how your budget supports this plan. • Include details of any related promotional opportunities for the project e.g. webinars, websites, conferences, social media etc.
11.	<p>Project team</p> <ul style="list-style-type: none"> • Identify the organisational structure, experience, roles and responsibilities within the project team. • Include CVs of personnel who will be working on this project. These individuals will be specified within the project contract and any changes will require approval of the Operating Agent.
12.	<p>Conflict of interest</p> <ul style="list-style-type: none"> • Please declare any conflict of interest.

Selection process for full proposals

Full proposals will be assessed according to the following ranking process. The highest ranking proposals that fit within the IEA DHC Annex XIII budget are considered for funding first. The final selection of projects to be funded will be made by the IEA DHC Executive Committee.

Area	Issue	Score	
		Maximum per issue	Maximum per Area
Technical	Are the expected research results new and significant?	15	40
	Is a high level of competence evident in the proposal? Is the methodology appropriate?	10	
	How well does the research contribute to a more sustainable energy system?	10	
	How well does the research plan address the sub-theme specified in section 2 of the proposal?	5	
Management	Is the research team qualified?	10	20
	Is there a sound management structure and is the project plan and budget realistic?	10	
Target group	How well does the proposal demonstrate value to the target group(s)?	10	20
	How relevant will the research results be to IEA DHC member countries?	10	
Information dissemination	How effective is the communication plan? Does it include interim dissemination so that the target audience remains aware of the project?	10	15
	To what degree information sharing between the researchers and the final users has been considered?	5	
Additional Funding	To what extent has additional funding (including in-kind contributions) been secured and proved by a letter of intent or similar and submitted with the project proposal?	5	5

Format requirements

- All reports should be sent in in “Microsoft Word” **and** “pdf” format.
- All presentations should be sent in in “Microsoft PowerPoint” **and** “pdf” format.
- Reports and presentations (including e.g. requirements for graphics) should be prepared as specified by the Operating Agent; templates will be provided.

Deliverables

Project managers are required to prepare at least the following deliverables:

During the project

- Status reports (including budget expenditure and a one page status report overview) - twice a year, one month before the DHC TCP ExCo meetings, usually in April and October. The status reports should summarise the progress of the research in relation to the proposal and include an explanation of any deviations from the original proposal.
- A six slide ‘status presentation’ - updated twice a year and submitted along with each status report. This should comprise a quick overview of project progress and any interim results. It should be aimed at the intended target audience(s) and decision makers.
- Two progress meetings of the project teams per year at least one over the duration of the project involving the assigned group of technical experts designated by the Operating Agent. Over the duration of the project at least one of these project meetings should be face-to-face. These meetings should be minuted and the minutes should be sent to the Operating Agent no later than two weeks after the meeting took place.
- In order to make management more effective and keep deadlines IEA DHC will reserve the right to charge the contractor for delivering information after mutually agreed deadlines. The project manager is advised to include a similar agreement in his contracts with the sub-contractors.

A contract template is part of the information package that project teams selected for full proposals receive from the Operating Agent with the request for a full proposal. Please consult the sample IEA DHC project contract – section 3 for details.

- Communication is a vital aspect of the IEA DHC programme: provision for at least one public webinar is required.

At the end of the project

- A final public technical report including supporting drawings, models, pictures etc. describing the work completed in the project.
- A summary report of up to 2 pages for decision makers which presents the results in an easily understandable way.
- A technical article (1,500-1,800 words) for publication in international DHC magazines.
- A final power point slide deck (up to 6 content slides) aimed at decision makers.
- An oral presentation of the results at an IEA DHC End of Annex seminar or a major conference or meeting relevant to the project target audience **and** as agreed with the Operating Agent. This presentation should be recorded on video and a copy provided to the Operating Agent for publication.

Publication and property rights

The Operating Agent and the project team will each have a non-exclusive copyright of all project results. Preliminary project results can be published under a creative commons license after the written agreement of the Operating Agent. All mandatory and explicitly agreed deliverables of IEA DHC projects will be public after final delivery and approval. The project team has the right to conduct further projects based on preliminary and final results from projects. This requires proper scientific reference to the research funded by IEA DHC (e.g. "IEA DHC final report: title...").

All project reports will be available to the public on the IEA DHC website (www.iea-dhc.org) and eventually in selected scientific libraries.

Submission conditions (outlines and full proposals)

- Communication between the project team and IEA DHC shall be through the Operating Agent (iea-dhc@agfw.de) mainly via email.
- The language of all proposals, reports and any communication with the Operating Agent shall be English.
- Project teams should comprise at least two countries. More than four countries are not recommended.
- The Lead Organisation has to be from a member country of IEA DHC.
- Organisations from non-member countries are only permitted to participate as subcontractors.
- Proposals will be judged based on their merit and are expected to be within the range of \$100,000 to \$220,000 (USD). The total budget for this Call is approximately \$1.200.000 (USD). Full proposals can include an adapted budget and project team compared to the outline. Significant deviations from the outline should be explained in a dedicated section of the full proposal document.
- IEA DHC funding is considered international research funding and therefore the proponents are asked to invoice without VAT. Please investigate before applying whether you have to invoice with VAT or can invoice without VAT using the VAT number of the Operating Agent (DE 185180282).
- The budget should be in USD and will be paid in USD. **The proponent is asked to consider the exchange rate risks in his budget calculation if using different currencies internally.** Changes to the budget or the proposal due to exchange risks will not be accommodated after the full proposal submission deadline.
- Proposals should be submitted in “pdf” format.
- Project managers will be informed of the assessors’ decision by the Operating Agent in writing. The assessors’ decision will be final and any further correspondence is at the discretion of the Operating Agent

- Project managers will be solely responsible for the outcome in respect to IEA DHC. Project partners will be contracted as subcontractors of the project manager and do not have direct communication with IEA DHC. The project manager is advised to use similar conditions for the subcontracts as are laid out in the project contract with IEA DHC.
- Please consider some administration time for a group of experts appointed by IEA DHC, who will advise your project during expert (web) meetings usually one per year. The first expert meeting could be attached to the first project meeting, so all participants get to know each other. Expert meetings can be integrated with the project meetings that take place at least twice per year.
- Please consider some time for your final technical report being reviewed by the assigned Expert group (We recommend to reserve one month for the feedback loop after your first draft of the final report). Furthermore please take into account that you will be expected to provide a line numbered draft report for professional review by a reviewer assigned by IEA DHC. It is recommended that you take **plan three months** for the review and improvement phase from your final draft report delivery to the delivery of the final version of your technical report.

Schedule

The outline and the full proposal must be sent in PDF format by **e-mail exclusively** to the IEA DHC Operating Agent at:

IEA-DHC@agfw.de

The proposal outline must be received by **February 28th 2020 6pm Central European Time**.

The full proposals of project teams with approved outline proposals must be received by **May 15th 6pm Central European Time**.

The results of the outline evaluation will be communicated to the participants by March 30th 2020.

Successful project teams selected for funding will be notified by the Operating Agent by July 15th 2020.

Appendix A

Calculation methodology for overall resource consumption

Low overall resource consumption for a given task is a measure of high overall efficiency. It is measured by a low consumption of exergy associated with the consumed resources. In order to estimate the total resource (exergy) consumption of operation all storable primary exergy (fuels, water) and storable secondary energy used, need to be calculated and summed up. The lower the total exergy consumption for a given task, e.g. heat supply to provide thermal comfort, the more overall efficient the technology combination is.

The following description explains how the exergy of energy sources can be estimated.

For fuels exergy can be approximated with the higher heating value. Higher Heating Value (HHV). E.g. for natural gas the Cumulated Energy Consumption (CEnC) could be 1.14. Therefore the exergy of 100 kWh (HHV) natural gas would be 114 kWh.

All electricity consumption needs to be multiplied by a Cumulated Exergy Consumption Factor (CExC) for the electricity to provide insight into resource consumption. CExC can be approximated with the (CEnC) in case it is not available in a Life Cycle Inventory or similar database. E.g. for an average power mix based on production from condensation power plants the CEnC could be 2.5. 100 kWh power consumption would thus equal 250 kWh in resource (exergy consumption)

Energy from thermal primary sources (Geothermal, Excess heat) needs to be multiplied by the Carnot Factor. (CF). It is calculated based on the average temperature between return and forward flow (T_a) and the average outside temperature during the heating period (T_0) – both in Kelvin. The equation is $CF=1-T_0/T_a$. E.g. Geothermal heat with a forward flow temperature of 90°C and a return flow temperature of 50°C has an average temperature of 70°C (approximately 343 K). If the outside temperature is 10°C during heating season (approximately 283 K) the CF calculates to: $1-283/343=17.5\%$. Thus 100 kWh of this geothermal heat would amount to 17.5 kWh of resource exergy.

Fluctuating renewable energies such as wind and sun are non-storable primary energies and therefore not resources to be used on demand. For an assessment of the exergy associated with resource consumption the first storable energy form is considered a resource, e.g. for wind – electricity, for sun – electricity or heat (multiplied with the CF). E.g. 100 kWh electricity from wind result in a resource consumption for operation of 100 kWh. 100 kWh heat from solar panels with a CF of 17.5% (see example above) result in a resource consumption of 17.5 kWh.

As a consequence of the presented aspects energy assessment is insufficient to estimate overall efficiency, as it does not take into account that the value of thermal energy is lower than that of electrical energy and depending on temperature levels.

Overall efficiency or resource consumption provides an insight into how efficient a system performs its task. However, in order to assess the contribution of an energy system to climate change total greenhouse gas emissions should be calculated. For CHP units the calculation of carbon emissions associated with the heat requires an allocation method. In order to be consistent with the overall efficiency definition explained above the Carnot-method (Exergy method) of allocation should be used.

A more detailed description of the methodology mentioned above can be found in:

Jentsch, Andrej, 2016: Redesign of the dairy industry for sustainable milk processing, part 2, page 13 ff. (The report can be downloaded at:
https://www.susmilk.com/images/download/SUSMILK_Deliverable_D07.3.pdf)