IEA TECHNOLOGY COLLABORATION PROGRAMME ON
DISTRICT HEATING AND COOLING

ANNEX XIV
(1 May 2023 – 30 April 2026)

CALL FOR PROPOSALS

PROGRAMME PERIOD 2023 – 2026 (ANNEX XIV)

List of abbreviations

4GDH	4th generation district heating
CHP	Combined Heat and Power
CV	Curriculum Vitae
DHC TCP	Denomination for IEA DHC within the IEA
DHW	Domestic hot water
ExCo	Executive Committee of IEA DHC
IEA	International Energy Agency
IEA DHC	International Energy Agency Technology Collaboration Programme on District Heating and Cooling
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 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' (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, renewables, 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 through three-year cost-shared 'annexes', and since 2011 also carries out task-shared research. More information about current Annex XIII projects and previous annexes can be found on the IEA DHC website http://www.iea-dhc.org.

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

Call for Proposals for Annex XIV

The IEA DHC Executive Committee (ExCo) through its Programme Manager hereby launches a **Call for Project Proposals.** This fourteenth three-year period (Annex XIV) will run from 1 May 2023 to 30 April 2026.

Proposed projects may range in duration up to a maximum of 30 months, terminating not later than 30 April 2026.

Proposals should be based on one or more of the priority themes, as set out below. (Proposals on innovative issues outside these areas will be considered only after written confirmation from the IEA DHC Programme Manager).

Proposals should have clear relevance to district energy[1] 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 are 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.

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.

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

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

Theme 1: DHC in the post-fossil era with carbon-free energy sources

The challenge: Combine the transition from fossil fuels with resource independence. Both aspects need to take place at pace, so ways to accelerate their implementation are sought. To bring about this acceleration, there also needs to be a focus on cost-reduction.

The IEA DHC programme is concerned with the *integration* of renewable and waste heat sources into DHC networks (research into the heat source technologies is the focus of other research programmes). Integration of multiple different energy sources requires optimization of scheduling and merit-order, as well as temperature levels and flexibility. Technologies that can be integrated with district energy networks include the following:

Solar thermal – large shares of solar heat supply to the DHC system

Solar PV – large scale PV to supply heat pumps for DHC, particularly in off-gas-grid locations.

Deep geothermal – deep geothermal energy could be a vital future energy resource for DHC networks, but technical and commercial barriers need to be addressed.

Biomass – innovative biomass heating & power plants

Hydrogen – what could be the role of DHC if a hydrogen economy is developed? Hydrogen as a fuel for CHP engines to supply DHC networks? Is the storage of hydrogen a better approach than large-scale thermal energy storage? How can the waste heat from electrolysis processes be best utilized?

Local and/or cascaded waste energy sources – efficient deployment of waste heat, including Waste-to-Energy (WtE), from all sectors as part of the circular economy.

Thermal energy storage (TES) – TES + DHC can be the key to maximizing variable renewable electricity generation and can bring advantages to DHC not currently factored into economic appraisals. Cost-effective large-scale storage, including inter-seasonal storage, and temporal load considerations of the DHC system also need to be identified.

CHP – what is its future role, and how is this affected by increased utilization of alternative heat sources? Together, CHP and large-scale heat pumps can deliver effective balancing of the power system.

Heat pumps – play a key role to enable sector coupling and can be a valuable technology for elevating the temperature of waste heat so that it can be used in DH networks; however, the methods for calculating the potential of such sources needs to be improved. When considering replacement of CHP with heat pumps, it has to be borne in mind that marginal use of heat pumps runs the risk of using high carbon electricity.

Theme 2: Flexibility

Flexibility as a service to the rest of the energy system: In a fully decarbonized energy system, receipts from selling flexibility to the rest of the energy system could potentially be a major income stream for DH systems, possibly exceeding revenue from the sale of heat. However, current energy tariffs do not reflect the future value of flexibility. To reap the benefits offered by flexibility, research is needed to quantify the potential and develop the operational tools to deliver it.

For example, in hybrid networks the intrinsic flexibility of the DHC network could provide support to the power grid, by switching CHPs/heat pumps when there is a need/excess of power. In this way, thermal flexibility delivers more resilient energy systems. Furthermore, balancing of the power system could lead to a possible expansion of the business when the heating load is downsized.

To offer the best flexibility service, sector coupling tools could be developed to optimize operation in different electricity markets. Sector coupling may finance the transformation towards climate-neutral heat, with energy system integration as a driver for renewable, circular, flexible and efficient districts.

How can DHC best contribute to flexibility? — Development of control strategies, variable supply temperature, peak shaving, demand side management, load shifting and electric: heat boilers. With increased flexibility of demand in buildings, there is an increased opportunity to act on the electricity market at shorter notice.

Theme 3: Digitalization

As well as leading to improvements in all aspects of district energy systems (from planning to operation) to which it is applied, effective deployment of digitalization (hardware, software, and controls) has the potential to be a fundamental game-changer leading to the emergence of new business models. Digital platforms can also promote user engagement.

The availability of remotely readable data from energy meters and sub-meters has opened up new opportunities for improved operations and building services that were overlooked in the

past because these data were simply not available. Using these data can help building-service personnel and DH operators perform fault diagnosis and continuous commissioning of the heating systems to secure low-temperature operation in existing buildings. This is crucial for DH operators to safely plan the investment for the transition towards renewables-based DHC networks, implement demand side management and secure a fair heat price for the end-users.

Digital techniques can monitor and optimize operation from overall heat distribution and optimal integration of new technologies, down to the individual component level, enabling fault detection of problems that otherwise would not be found. In this way thermal grids can become smart grids, integrating multiple heat sources and enabling the circular economy, with utilization of data for intelligent solutions. This area can involve the Internet of Things (IoT), management of large data sets (Big Data), AI and Cloud Services.

A further important element is cybersecurity.

Theme 4: Business models

Changing conditions, in particular the development of a circular economy culture, the interface with the electricity market, the integration of prosumers and recognition of the service value of flexibility, mean that we need to review overall business models. Business models could also include flexibility services for professional end-users.

Through cooperation with aggregators and building users, we can move towards data-driven buildings with smart DH systems. Business models to assess and increase the economic feasibility of DC systems, (alone or together with DH) should also be investigated.

These conditions also include the deployment of low-temperature systems, modernization measures especially digitalization, integration of multiple energy sources, the reduction of network temperatures, and the response to increased energy efficiency.

Different ownership structures can also be reviewed, emerging from the increased visibility of energy issues and the sudden rises of fossil fuel prices, and can include heating grids owned by communities. Attention is also required to develop district energy in existing communities.

Enabling the integration of sources of heat that would otherwise be wasted requires consideration of the gap between the short amortization periods of industry and the long

contract periods required by DH companies, together with the associated insurance and legal issues.

Theme 5: Tariff structures

To make the best of the flexibility offered by district energy networks, this flexibility can also be the springboard to a review of tariff structures. Where these are successfully devised, by taking advantage of effective short-term reaction to the electricity market, they can enable the accommodation of prosumers into the network, and the connection of new consumers without the need for expensive expansion of energy supply.

Prosumers could benefit from heat purchase obligations for decentralized renewable heat suppliers at defined tariffs.

With innovative ESCO services and/or blockchain technology, consumers could be rewarded (e.g. discount on their energy bill) for establishing consumption patterns (temperature levels, demand response actions, capacity-based etc) beneficial to the system operation.

Predictive management tools for optimal demand side management, innovative ESCO structures and a review of fixed versus variable costs can all contribute to this review. Pricing models are needed to suit the emergence of 4th generation district heating (4GDH) and to reflect how the benefits of flexibility could be passed on to customers.

Theme 6: Sub-stations

The operation of existing substations may face some technical challenges when the available supply temperature in the DH networks will be low or very low. There is a need for a new generation of substations for space heating and domestic hot water (DHW) systems for future low temperature district heating. Effective new sub-station designs could reduce the heat demand in existing DH networks, leading to free capacity to make expansion cheaper. New generation bidirectional sub-stations can also help the transition towards accommodating both consumers and prosumers.

There is also a need to explore and optimize the interactions between complex new technology applications, such as new substations and large-scale heat pumps or booster heat pumps.

The main challenge is to develop new control systems that can regulate the operation of heat transfer from the DH system to the heating systems inside the buildings with very small temperature differences from the primary side to the secondary side.

Supplementary solutions may consider the use of electricity (i.e. booster heat pumps, electric heaters etc) to raise the temperature or cover the circulation heat losses in DHW systems.

Cascade coupling of the DH flow used to supply the DHW circulation heat loss to the space heating systems can be established to minimize the return.

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 2023 to the Programme Manager. The outline will be screened and evaluated jointly and results will be notified to the participants by March 30th 2023.

2. Partners with approved outline proposals will be invited to submit a full project proposal (limited to 12 pages) by May 15th 2023. Submission guidelines can be found in the section on full proposals. Submitting proponents will be notified by July 15th 2023.

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.	Proposal summary (300 words maximum) • 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 organization; country, description (one sentence), contact, email
5.	Partner organizations; country, description (one sentence), contact, email
6.	Objectives / goals • 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.	Project plan • 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.	Budget • 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[2]	15
Novelty	10
Scientific competence of involved organization	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

Feedback of average scores for outline evaluation will be sent to research teams selected for sending in full proposals to allow for an improvement of the full proposal documents.

[2] 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.

All proponents who submitted proposal outlines that are not selected will be notified by the IEA DHC Programme Manager.

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.	Proposal summary (1000 words maximum) 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 organization; project manager, address, country, telephone number, email
5.	Partner organizations; project participants, addresses, countries, telephone numbers, emails
6.	Objectives / goals • 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 policymakers) 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.	Project plan • 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.	Previous research in this area • 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.	Budget • Provide a detailed budgetary breakdown according to the proposed project plan (section 7 of this table) in terms of hours worked, subcontracts, 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.	Communication plan • 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.	Project team • Identify the organizational 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 Programme Manager.
12.	Conflict of interest • 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 XIV 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 are 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 “Microsoft Word” **and** “PDF” format.
- All presentations should be sent in “Microsoft PowerPoint” **and** “PDF” format.
- Reports and presentations (including e.g. requirements for graphics) should be prepared as specified by the Programme Manager; 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 summarize 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.
- At least two meetings of the project teams per year, and at least one over the duration of the project involving the assigned group of technical Experts designated by the Programme Manager. Over the duration of the project, at least one of the project meetings should be face-to-face. These meetings should be minuted, and the minutes should be sent to the Programme Manager no later than two weeks after the meeting took place.
- 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 subcontractors.

  A contract template is part of the information package that project teams selected for full proposals receive from the Programme Manager 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 PowerPoint 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 Programme Manager. This presentation should be recorded on video and a copy provided to the Programme Manager for publication.

Publication and property rights

The Programme Manager 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 Programme Manager. 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 Programme Manager (iea-dhc@agfw.de) mainly via email.
- The language of all proposals, reports and any communication with the Programme Manager shall be English.
- Project teams should comprise at least two countries. More than four countries are not recommended.
- The Lead Organization has to be from a member country of IEA DHC.
- Organizations 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 $235,000 (USD). The total budget for this Call is approximately $1,270,000 (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 Programme Manager (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 Programme Manager in writing. The assessors’ decision will be final, and any further correspondence is at the discretion of the Programme Manager.

- 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, ideally 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 consider 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 **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 Programme Manager at:

IEA-DHC@agfw.de

The proposal outline must be received by **February 28th, 2023, 6pm** Central European Time.

The full proposals of project teams with approved outline proposals must be received by **May 15th, 2023, 6pm** Central European Time.

The results of the outline evaluation will be communicated to the participants by March 30th, 2023.

Successful project teams selected for funding will be notified by the Programme Manager by July 15th, 2023.