

Helsinki Energy Challenge

Answers to the questions in webinar on 16 June 2020

Helsinki

Is the challenge mainly addressed to students or professionals?

Helsinki Energy Challenge is open for everybody, so students and professionals are both welcome to join. The only requirement is that you should join the challenge as a team with minimum two (2) team members - however, we encourage large and more diverse teams.

"Is this person joining Helsinki Energy Challenge as a representative of a certain organisation?" (question in the application portal) - what does it mean?

We ask you to indicate on the application form for each team member if she/ he is representing a certain organisation in this competition (and if so, to name the organisation and describe it shortly) - or, if joining the Challenge as an individual expert, so not representing any organisation.

Cost impact: does it mean that the total cost of our solution (e.g. development work, implementation/investment costs, usage/operating costs) must be lower than a grant amount?

We ask you to indicate the estimation of the total costs that are related to the solution you propose, estimation is enough in the application phase (eg. development work, implementation/ investment costs, usage/ operating costs). The cost impact evaluation criteria has nothing to do with any "grant amount" and is not in any way connected to the main prize of this challenge competition.

A question field in the application form: "Describe what assumptions have been made?" I don't understand about what assumption this means. Please clarify.

On the application form there is a field where you can indicate the assumptions that you might have made in your application. You can leave it empty in case you haven't made any such assumptions that you want to indicate to us, that we should be aware of. But for example, if you have used certain figure in your cost calculation, or something else that you should indicate to us so that we interpret your solution correctly, that kind of information is important to showcase for us.

Publishing of the proposed solution: Do I have to allow publishing of the proposed solution and our team? Can disagree with publishing hurt the chances of winning a grant?

Due to the public nature of this competition, all submitted applications will be public after the competition prize has been paid, except the business secrets disclosed. By default, we advice you not to reveal any business secrets in the application phase. If it is necessary to reveal business secrets to review the solutions, it has to be clearly marked in the application form (*in the application form, in each question field you can mark if that specific answer includes business secrets; if marked as business secret, the information will not be public at any point*). We do want to use some of the information for marketing purpose as we want your solutions to get visibility outside Finland as well - but we do ask your permission for that in advance. If you disagree and do not want us to publish information, it will not harm your chances to win the competition. All the permissions are asked in the application form.

What exactly are you not satisfied with when firing biomass?

When you burn something, there are CO₂ emissions, also when burning biomass. In Finland, we have lot of forests. But the amount of heat we need in Helsinki is substantial; from all the district heat used in Finland, 20% is used in Helsinki. If we would replace the coal with biomass, it would mean that the volume of biomass needed would grow a lot. It would affect the carbon sinks which the forests at the moment are. There are of course some sustainable biomass fractions, but it is very unlikely it is enough for everybody. These are some of the reasons why we do not want to replace the use of coal with biomass.

What emissions' rate as a final result would you like to see?

Climate impact is one of the evaluation criteria that is used in this challenge competition. We are searching for solutions that will help us to decarbonise the heating of Helsinki - solutions that will help us to get rid of coal used in heat production by 2029 and speed up our journey to become carbon neutral by 2035. But we

haven't set any exact figure or limitations on the emission rate. But of course, as low as possible: the bigger the impact on the emissions reduction, the higher the score.

You have a certain cost price for one kilowatt currently. What cost price do you expect?

We haven't set any preconditions for the price in this challenge competition. In the background report describing the current heating system (available for download on the challenge website), in chapter 4, the current cost components of district heat production (etc) is presented.

How much zeros are you ready to add to the final prize?

We haven't published that information. However, cost impact is one of the evaluation criteria. The goal is to find solutions that can be implemented and used at a feasible cost to the city and end-users.

What type of solutions the municipality is seeking? Is it more centralized solution or more distributed such as neighbourhood-level solutions?

In this challenge competition, is important that the implementation of the proposed solutions can be influenced or managed by the City of Helsinki, to ensure necessary large-scale impact. So we are searching for solutions that the city or its energy utility can either implement centrally or have control over the implementation otherwise. Solutions whose implementation are in the hands of individual house owners, and whose implementation the City of Helsinki cannot influence, those are excluded. Other than that limitation, all kind of solutions can compete, also non-technological solutions. We are open for solutions that fit our current district heating system, but also for those that require more system level change. All proposed solutions will be evaluated against the same evaluation criteria.

Would you prefer that the proposals seek to focus on the complete problem, or rather - as you have indicated you may select multiple winners - focus on specific bottle-necks/challenges?

Capacity of the proposed solution is one of the evaluation criteria. We are looking for solutions that can have a significant impact on the cessation of the current coal-fired heat production. But we have not restricted out of competition those solutions that only partially solve our problem. The jury will decide on the winner. The goal is to find one winner but the jury has the right to divide the prize money also differently, between more than one winner.

What do you mean by "masterplan"?

This is a design contest. The goal is to find a master plan that helps us make decisions on the next steps (*the implementation of the plan and the solutions included in it is a possible continuation of the competition, but yet a separate process from this challenge competition*). So the competition entries are plans - *master plans* - on how to decarbonise the heating of Helsinki using as little biomass as possible. These "masterplans" proposed by the Challenge participants can include one or more technological or other types of solutions.

What are the plans for geothermal heating in Helsinki? How would you evaluate a solution that assumes part of the heating is produced by geothermal heat in the future?

Each proposed solution will be evaluated using the same evaluation criteria (presented in the Competition program, section 3.5). The City of Helsinki's target is to increase the share of the geothermal heat to be 15% within the next 15 years. 15% of the heating is 1 GWh a year. At the moment the share of ground source heat is about 1% (mainly single family houses) but more and more apartment buildings are changing to ground source heat pumps; ground source heat is competitive here in Finland and actually we have a quite good potential for the geothermal here in Helsinki. Geothermal heat can be used both on building level solutions or centralised solutions (e.g to produce district heating). More information about the potential can be found in recent studies (available in Finnish only): <https://dev.hel.fi/paatokset/media/att/ad/ada15fdd55e906cea901947438e9e55ee4aff5f2.pdf>, https://www.hel.fi/hel2/ksv/liitteen/2020_kaava/5066_9_Maalamposelvitys_Sweco_2019.pdf

The Challenge encourages non-technological solutions... will these be eligible even if they able to decarbonise only 20%, ie, not able to shut down any PP, but able to complement technological solutions?

Yes they would be eligible. The capacity is one important evaluation criteria and we are looking for solutions that can have a significant impact on the cessation of coal-fired heat production. But we have set no limitation on how big part of the problem the proposed solution has to solve.

Are you willing to join Horizon2020 consortium as a pilot site?

We cannot answer this question at this stage of the Helsinki Energy Challenge.

The Challenge will encourage finalists to team up, in order to present the best possible solution?

We encourage the innovators and solutions providers to team up before they send their proposals/ applications in the first phase, Application phase. So if you have a great idea, it is good to consider if it is "good enough" to submit it as a single solution with the team you might have already, or, whether you would have a bigger chance to get to the next phase of Helsinki Energy Challenge, and even win, if you would still team up with somebody to create even more impactful competition entry.

Is there a height limitation for structures in the municipality if so what is the limit?

The height limitation for the structures depends on the city plan that is in place in the specific area. A map of Helsinki including information of the existing city plans can be found from: <https://kartta.hel.fi/?setlanguage=en>

What is the historically highest wind speeds experienced by the city and general frequency?

In the background report describing the current heating system in Helsinki (available for download on the Challenge website, energychallenge.hel.fi) you will find information as well as links for further sources - for example, a link to Finnish Wind Atlas (an online tool for estimation of the regional and local wind energy potential in Finland), available at: <http://www.tuuliatlas.fi/en/index.html>

Do you have any infrared data of direct downwelling and upwelling as well as atmospheric IR radiation in the range of 1800-4000nm (or higher)?

Unfortunately, we are not able to provide data on this granularity. However, there are public sources on solar radiation available, such as Global Solar Atlas (includes only the most Southern parts of Finland) <https://globalsolaratlas.info/map>

(1) What is the total energy output you are looking to have (in GWh) replaced and what is the projected future growth of energy demand growth?

(2) Are you looking for both heat and electrical energy generation as part of the solution?

(1) We are looking for solutions that will significantly affect the cessation of coal use by 2029 and speed up the City of Helsinki's journey to becoming carbon neutral by 2035 (see all evaluation criteria in section 3.5. of the Competition program). The annual district heat production in Helsinki is approximately 7 Twh and currently more than half of this is generated using coal. See more exact information and figures in the background report describing the current district heating system in Helsinki (available for download on energychallenge.hel.fi). The heat consumption drivers and their impact on demand is described in the background report section 2.3.

(2) In Helsinki Energy Challenge, we are in search for sustainable heating solutions. The proposed solutions do not need to replace the electricity that is currently produced in the coal-fired CHP plants locally. However,

the Challenge team can (but not mandatory) in its competition entry also describe the proposed solution's impact on electricity production or demand, in case the solution has an impact on them.

Do you have any mine workings in the area?

We do not have any mine workings in Helsinki.

Are there other known large caverns or ground cavities in the area of Helsinki that could be used for water storage (on top of Mustikkamaa and Kruunuvuorenrata)?

At this stage of the competition, we don't have information available whether there would still be other unconsidered large caverns or ground cavities that would be suitable for water/heat storage.

If a StartUp company does not have a finished product/technology at the start of the challenge, should we participate anyway?

We are not requesting that the proposed solution has to be ready at the start of the Helsinki Energy Challenge. We are looking for solutions that will help us to get rid of coal by 2029 and speed up our journey to becoming carbon neutral by 2035. All evaluation criteria are presented in chapter 3.5. of the Competition program (available for download on the Challenge website). Implementation schedule is one of the evaluation criteria and we are looking for solutions that can be implemented before 2029. The challenge participants are requested to describe the estimated implementation schedule of their proposed solution, including risk factors that may have an impact on the implementation schedule.

Does the district heating temperature level have to be the same by 2035 as now (65 °C - 115 °C) or it can be decreased?

Some decrease in the temperatures may be possible, the Helsinki Energy Challenge participants are welcome to propose in their competition entry how to do it, if relevant as part of their competition entry. However, it is good to notice that the problem currently is that in the old buildings, the measuring temperature is 115°C. Basically it means that if the temperature on the district heating system is lower, the radiators in the houses wouldn't be big enough to cover the heat demand during the winter time. If the solution requires changes to the buildings or renovation of the apartments, this should be described in the competition entry, as well as the related cost impact. *Note also - in this competition, it is important that the implementation of the proposed solutions can be influenced or managed by the City of Helsinki; solutions whose implementation are in the hands of individual house or apartment owners, and whose implementation the City of Helsinki cannot influence, are excluded from the Helsinki Energy Challenge.*

If provided an alternative energy source to provide thermal energy needed to operate the coal-fired plants that are scheduled to be closed is the equipment in these plants suitable for continued use of either plant (the heat source would, of course, totally without any carbon footprint)?

There are already plans by the city to use the Hanasaari site for other purposes. In the current plans, the Salmisaari area will remain as an energy production area also when there is no coal-fired production anymore. The participants are requested to present the resources needed for their solution and it is possible to present a competition entry which utilises the current plant equipment. This should be described on a high level in the competition entry.

To what extent will the production of electricity be part of the challenge, as it is today and might in the future be closely linked to the heating supply? Is Nuclear allowed?

In Helsinki Energy Challenge, we are in search for sustainable heating solutions. The proposed solutions do not need to replace the electricity that is currently produced in the coal-fired CHP plants locally. However, the Challenge team can (but not mandatory) in its competition entry also describe the proposed solution's impact on electricity production or demand, in case the solution has an impact on them. We welcome different types of solutions and all solutions will be evaluated against the same evaluation criteria.

Can we get information about: how many private, separate house and how many bigger, multistore houses are in Helsinki, which should be upgraded by our proposal? How many buildings are thermally isolated?

Information about the current heating system, including some information about the buildings in Helsinki, is available on the background report prepared for this challenge competition (available for download: energychallenge.hel.fi). In this challenge competition, we are looking for solutions on how to decarbonise the heating of Helsinki, using as little biomass as possible. We are not requesting "upgrade of certain buildings". As a general note: almost all the buildings in Finland and Helsinki are insulated so the insulation level in general is very high – this means that to increase the energy efficiency by adding even more insulation is not the best solution.

Another note: if the Challenge participant is proposing energy efficiency solution as part of the competition entry, it should be such that the City of Helsinki or its energy utility can either implement centrally or have control over implementation otherwise. This is to ensure large scale impact. Improving the energy efficiency of individual buildings is often based on the decisions of the owners and is therefore associated with an uncertainty independent of the city; therefore, this kind of solutions are excluded from the Helsinki Energy Challenge, unless the competition entry also includes an element for "central implementation" as described.

Is there any agenda at the background which may prevent or hold back a carbon neutral yet proven technology to be selected or seriously considered?

In Helsinki Energy Challenge, all solutions will be evaluated against the evaluation criteria that are presented in chapter 3.5 in the Competition program. When evaluating the proposed solutions, there are no hidden agenda.

Who is the target "recipient"/"end user" of the solution, the City of Helsinki itself, or possibly the energy utility?

The proposed solutions should be such that their implementation can be influenced or managed by the City of Helsinki; solutions that the City of Helsinki or its energy utility can either implement centrally or have control over the implementation otherwise. We haven't set in this challenge competition other limitations on who the "end user" of the solution is. The solutions can be either implemented as part of Helsinki's current district heating system, or solutions requiring system-level change.

What is the forecast of future electricity production (renewable, gas?) Are there any gas plants that are planned? What is the age of the District heating system? What is the maintenance procedure? Costs?

The future electricity production in Finland can be assumed to be based largely on renewables and nuclear. There are several scenarios available for the future electricity generation in Finland, one recently published study can be found here: https://energia.fi/julkaisut/materiaalipankki/raportti_finnish_energy_low_carbon_roadmap.html#material-view. There are no plans to invest in gas plants in Helsinki, and also in other locations in Finland, investments are directed more to other energy production alternatives. The Helen district heating system has been operating since 1957 and thus some parts of the network can be relatively old. However, the network has been renewed and maintained by Helen during the years. Unfortunately, we are not able to provide any cost data on maintenance at this point in the competition.

Do you have any biogas plants? Are you connected to the sewerage treatment plant as an input to districts heating?

The city energy company Helen has since 2016 burned biogas in its existing gas plants followed by a cooperation agreement with Gasum who produces biogas (<https://www.helen.fi/en/news/2016/biogas>). The waste heat from the Viikmäki sewage water plant has been utilised in Katri Vala heat pump station since 2006. Viikmäki sewage treatment plant has also been utilised in biogas production since 1994. Biogas has also been produced in Vuosaari landfill gas pumping station since 1990. Information of biogas production can be found from the Finnish National Biogas Statistics (https://epublications.uef.fi/pub/urn_isbn_978-952-61-2856-6/urn_isbn_978-952-61-2856-6.pdf).

For the purpose of reducing the carbon dioxide emission, why not just move to Natural Gas? It is already being used in lot of European countries (like Germany, Netherlands etc). Using gas is also a good way to reduce the CO2 emission quickly without increasing the cost of fuel too much.

35% of the heat in Helsinki is currently produced with natural gas. To reach the carbon neutrality targets, fossil natural gas is not a long term solution. We welcome all types of solution, but the participants should present the proposed solutions' impacts on emissions, and the cost impact, among other competition criteria.

Does the implementation schedule has to be bonded to the 2035 or it can be further extended like 2050?

In Helsinki Energy Challenge, we are looking for solutions that will help us to get rid of coal by 2029 and that will help us to speed up our journey to become carbon-neutral by 2035. If there are any risk factors that may have an impact on the implementation schedule, those should be described in the application.

Is the city looking for innovative business models for some of the heat production units ? Or will Helen be the investor and operator in all production units anyway (like it is today)?

We welcome all types of solutions to the Helsinki Energy Challenge. Technological but also non-technological solutions - such as business or operating model innovators for city-governed organisations, or innovative policies (note, these are just examples!). The proposed solutions can either be implemented as part of Helsinki's current district heating system or, solutions requiring system level change.

How detailed should be the solutions for the first round of the competition?

It is important to provide enough information that we are convinced that your team and proposal should be selected to the next phase. In chapter 3.5 of the competition program it is described what is expected in the application phase. Also, instructions are provided in the application portal.

The City of Helsinki has very wisely and generously opened the Challenge to parties from around the world to engage in fair competition for the prize. Based on the Mayor's comments and the comments that disruptive solutions are welcome, if a novel energy source is presented, say for example based on water, which would be expected to be significantly less expensive per KW or MW than current energy sources, including wind and fossil fuels, its impact on existing energy and industrial suppliers in Finland and the Nordic countries would be accommodated so as to allow selection of the novel energy source in accordance with fair competition for the prize and to meet the 2035 CO2 reduction emission goals of Finland. Is this correct?

All competition entries will be evaluated with the same evaluation criteria, including cost and climate impacts, please see the Competition program, section 3.5 for full evaluation criteria.

Helsinki