TENDERING PROCESS

Technical Report of the IEA DHC TS3 “Hybrid Energy Networks”, subtask A “Technologies and synergy potential”, WP2 “Experiences with hybrid energy networks based on large-scale heat pumps”: *Tendering process*.

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Content

1 The process

The stepwise process of establishing a large scale heat pump for district heating is illustrated in Figure 1, representing the timeline from initial feasibility study through permissions from authorities, purchase of the land, tendering, construction, commissioning and follow-up to check if there are issues to be covered by the guarantee. In this document the focus is on the tendering phase. Though the different steps are general, the approach chosen in practice will vary from what is described in the following.

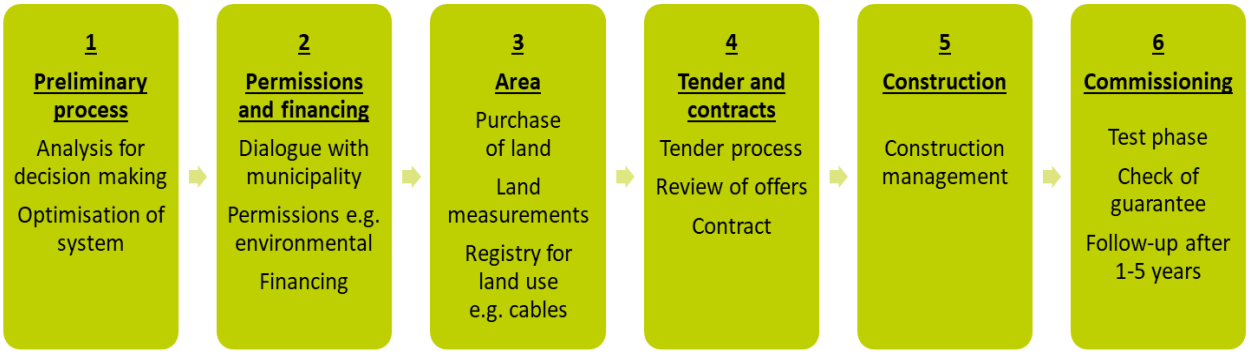

Figure 1. Stages of the process of establishing a heat pump.

2 Tender format

One approach is to have a functional tender to gather several different options to fulfil a given task (e.g. to cover approx. 70% of the annual heat demand of the district heating plant in question). Contractors are continuously working to optimize their proposed solutions by adjusting number and type of compressors, evaporators etc. in bespoke configurations. Hence, a preconfigured design may rule out the alternative, better and more feasible options that contractors otherwise could propose based on their latest experiences and knowledge.

The format reduces the time and efforts spent on preparing the tender documents since the detailed dimensioning etc. is made afterwards. However, the district heating company or its consultant identifies the preconditions such as heat source, location and connection to the district heating plant/network etc. and prepares the initial pre-design. The exact border between what must be included in the offer and what remains the responsibility of the district heating company must be clearly defined. This applies both to physical borders (identifiable on P&I diagram) and non-physical interfaces. One example is who is responsible to fulfil the criteria of the electricity grid DSO. For more information on this topic, see the document “Economics and the electricity grid connection”.

Even without detailed dimensioning already prepared in the tendering documents, the process requires in-depth technical knowledge to be able to evaluate the various proposals and compare the value of each of them.

As described in the document ”Configurations and energy system integration”, it may be relevant to compare different solutions to identify the benefit of either an efficient, yet expensive system against a cheaper but less efficient option.

In the evaluation process it is possible to include an intermediate meeting to discuss the proposed solutions with each of the tenderers. This way questions and/or identified issues conflicting with the predefined terms in the tender can be highlighted to enable an updated version of each offer where all conditions are met.

3 Contractor

A turnkey contractor holds the responsibility of coordinating the different tasks including any delays caused by the interaction between subcontractors. It is also easier this way to place the responsibility in case the system does not perform as it should. However, the single tasks of the project may require know-how which a total contractor cannot cover alone. Hence, skilled subcontractors are required as part of a consortium. A turnkey contractor may include an overhead in their price to cover organizing and risks involved with signing the subcontractor. Besides this, the single point of entry (turnkey contractor) results in less dialogue between the subcontractors handling the construction, and the district heating company, thus potentially hindering efficient communication where optimization of smaller practical issues potentially could be identified and handled on site.

4 Comparing offers

While the bespoke configurations can result in optimized efficiency, they make it more complex to predict final performance figures. The feasibility comparison should take into account costs for operation and maintenance, investment costs, displaced fuel costs, etc. and evaluate based on net present value to identify the best solution for the district heating company. This requires an evaluation, which calculates the operation of the system with the proposed solution. One option is to include a template how the calculation will be made as an annex to the tender documents so that the contractors tenderers may investigate the effect of different solutions they could offer.

The tender may be made flexible in terms of the exact heating capacity, since a proposed configuration could enable significant financial benefits by deviating slightly from the initially expected capacity due to the combination and number of compressor units,

evaporators etc. In other words, the tenderer may for example have identified the option of installing extra capacity with little extra investment to match a suitable combination of compressor units and evaporator units for the given case. With this approach the variety of potential components and units increases. In turn, the period for running-in and commissioning is more time consuming than a tender with a predefined detailed design.

Also non-economical factors are part of the evaluation criteria (though the feasibility are weighted highest). General quality of the components and the configuration, the contractors' experience, references and team, and the offered service option can be part of the evaluation.

5 Performance check

After the commissioning but before the official hand over of the heat pump, a test phase must be carried out to prove the reliability of the system as well as a check of the performance and efficiency.

In the tender documents it is possible to include the option of both penalty and bonus if the final system turns out to perform worse or better than initially promised. However, an uncertainty range without penalty or bonus may be relevant to take measurement uncertainties into account. The calculation method should be clearly described already in the tender documents to reduce the risk of disagreements on a financial penalty (subtraction from the final payment share).
In this respect it is important to define the preconditions for the evaluation data i.e. which period(s) and who decides this, length of the measuring periods, how much data (handpicked periods or all applicable data included) and which sensors are used.

What has been seen from several realised projects is that some systems are performing worse than expected while others perform better. Hence, experiences show that both penalties and bonuses can come into play. A penalty for lack of performance (power and efficiency) may not represent the actual cost for the district heating company with no upper limit, since the tenderers may not be willing to accept a potential fine corresponding to the actual value that may be substantial. Hence, the district heating company may have to accept a certain risk to obtain the desired (amount of) offer(s). Similarly, a bonus should have an upper limit since the district heating company will not benefit proportionally from an unlimited amount of extra capacity.

6 Waste heat agreement between industry and DH

When waste heat is to be utilized, a formal agreement is to be made between the industry providing the heat and the district heating company. This should include the following points[1]:

- General terms
  - Involved partners etc.
  - Purpose of the agreement
  - Who will handle legally required reporting
- Establishing and ownership
  - Who owns, establishes and operates which parts of the setup (heat exchanger, pipes, pumps, compressors etc.)
  - Ownership and obligation borders
- Supply and off-take obligations
  - Amounts by supplier and periods
  - Off-take amounts and periods
  - Properties of the supplied heat
  - In case of downtime
- Operation and maintenance
  - Operation and maintenance obligations by each part
  - Mutual duty to notify each other
  - Allowed out-time due to maintenance
- Measurements
  - Measuring units to be used for the cost calculation
  - Ownership and responsibility of measuring units
- Prices
  - Prices
  - Terms of payment
- Agreement breaches
  - Definition of breach of the agreement
  - Liability
  - Force majeure
- Timeline

[1] Based on list from Danish District Heating Association "Aftalepunkter ved indgåelse af aftale om køb af overskudsvarme" (Agreement on the purchase on waste heat). www.danskfjernvarme.dk/-/media/danskfjernvarme/gronenergi/projekter/drejebog-om-store-varmepumper/drejebog_2017_ny/aftalepunkter-ved-indg%C3%A5else-af-aftale-om-k%C3%B8b-af-overskudsvarme_januar_2015.pdf.

    - Date of the agreement entering into force
    - Start date of the heating supply
    - Duration of the agreement
    - Termination of the agreement
- Renegotiation
- How to handle disputes