REWARDHeat

DecarbCities2022

12nd May 2022, MuseumsQuartier, Vienna

Federica Fuligni, RINA Consulting
federica.fuligni@rina.org

The vision

REWARDHeat

- Demonstrate DHC networks, which are able to recover renewable and waste heat available at low temperature, i.e. lower than 40°
    - Reduce supply temperatures
    - Focus is on the exploitation of the energy sources available within the urban context

Brief overview of Project Progress:

- *M30 over 48*
- *6 out of 9 demos have completed the planning process and started their construction*

The overall scope

Demonstrate a new generation of low-temperature district H&C, which are able to recover renewable and waste heat, available at low temperature (i.e. lower than 40°). These solutions aim to promote a cost-efficient and technically viable decarbonisation of the European DHC sector.

How?

1. **Integrate effectively multiple urban renewable and waste energy sources**

2. **Develop innovative technologies for flexible use of heat in DHC networks (e.g. intra-seasonal storages, skids and ad hoc energy centres)**

3. **Demonstrate digitalisation, allowing to optimise the management of the DHC network**

4. **Develop business models and financial schemes to enable large public and private investments to be mobilised**

Development of business models and financial schemes

REWARDHeat aims at facilitating investments in low temperature DHC networks by performing the following:

- **Addressing barriers to low temperature DHC schemes**
  (D3.1- REWARDHeat PESTLE Analysis, online on the website)
- **Understanding the comfort demands and requirements of the consumers**
  (D3.2 - Customers' perspective on REWARDHeat solutions, online on the website)
- **Focusing on the bankability of the investments**
  (D3.3- Bankability for REWARDHeat demonstrators)
- **Designing business models for decentralized solutions that allow multiple heat sources in the fuel mix**
  (D3.4 - Business models at REWARDHeat demonstrators)

Bankability

Definition: "Bankable: project or proposal that has sufficient collateral, **future cash flow, and high probability of success**, to be acceptable to institutional lenders for financing" (BusinessDictionary.com)

Lenders focus: "Where the project is to be financed through limited or non-recourse project financing, **Lenders will demand a great deal of outcome certainty in terms of time and cost because their security** is heavily reliant on sufficient and timely revenue from the operation phase" (PWC)

Successful outcome:"Some of the key technical risks that need to be allocated and managed to ensure the successful financing of the project are: **Construction and Completion Risk (CAPEX, delays, …), Operating Risks (performance, …), Demand Risk (competitors, …)**" (World Bank)

Financial and legal aspects are excluded from the analysis

Sustainable DHC Investments

- **Retrofitting of existing or realization of new low temperature DH systems**
- **Sustainable sources and technologies**, such as:
  - low-temperature district heating
  - district cooling
  - renewable heat sources
  - low-temperature recovered heat
  - thermal energy storage systems
- **Mostly mature technologies**
  - heat pumps
  - heat exchangers
- Main actors involved:
  - WH owners
  - DH utility

Main Bankability Criteria

Technical:

- stable availability of waste heat source
- maturity of technical solution → availability of success cases / importance of pilot projects
- existence of infrastructure → e.g. integration of UWHR in existing DHC systems
- clearly defined investment cost structure → link with business model criteria
- consistency of project implementation time schedule

Importance of Technical Due Diligence

Main Bankability Criteria

Business plan:

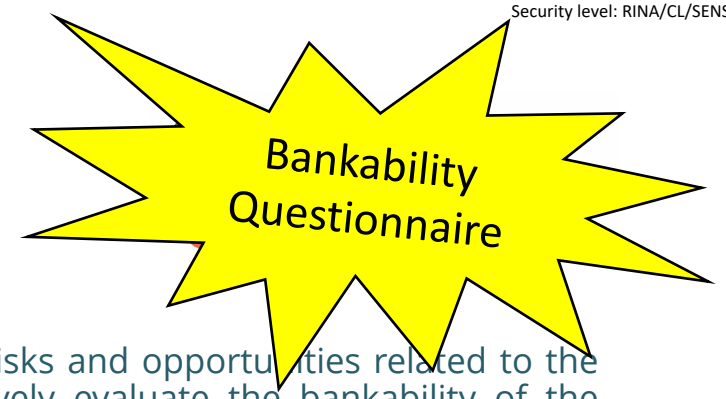
- **profitable ownership model** → interactions among public/private sector
- **low uncertainty on CAPEX** → link with technical criteria
- **low uncertainty on OPEX and revenues** → link with contracts criteria
- **clear legal and permitting framework** → avoid project implementation delays

«**Nice to have**»:

- **availability of public incentives** → rarely considered in decision on bankability
- **environmental and social benefits** → only for specific banks and credit facilities

Importance of BP Sensitivity Analysis

Due Diligence Package for REWARDHeat Demonstrators



For each demo site, a list of questions that potential investors might ask in order to evaluate risks and opportunities related to the project to be supported was elaborated. These questions constitute a checklist to qualitatively evaluate the bankability of the proposed projects, a sort of due diligence package specific to the district heating aspects, to be applied in parallel to the conventional technical and financial checks.

The elaborated checklist is, for each demo site, articulated into six categories:

- **Source** – covering where applicable the aspects related to the renewable or excess heat source used as thermal energy input for the project;
- **Offtaker** – covering the aspects related to the identification, the evaluation of the demand and the actions needed from the customers side;
- **Technology** – focusing on the specific technical solution implemented within the project, its efficiency and ability to reduce primary energy demand and GHG emissions;
- **Network** – focusing on the presence and characteristics of the existing or new district heating network;
- **Legislation/permit** – analyzing the aspects related to the permits and authorizations needed, with particular focus on environmental ones, to realize the project;
- **Business model** – evaluating the interactions between project promoter and customers, the heat price, the project cash flows, etc.

Bankability Key Performance Indicators

REWARDHeat

- Return on Equity (ROE)
- Annual Debt Service Coverage Ratio (ADSCR)
- Project Life Coverage Ratio
- Payback period
- Financial Internal Rate of Return (FIRR)
- Net Present Value (NPV)
- NPV to Investment Ratio

- CAPEX/OPEX per unit of avoided GHG emission
- reduction of GHG emissions
- GHG emissions per unit of energy produced/provided

The three most frequent DHC networks RES/WH integration and retrofitting investment

Based on a discussion within the REWARDHeat consortium, which involved EURAC, RINA-C, IVL and HFT, the three most common investment types have been identified as:

The preconditions for bankability of LTDHC investments are screened for the EU Member States hosting a REWARDHeat demonstrator and the three most common DHC investment types are identified, which are:

- *Greenfield LTDH projects*, which foresee the creation of new LTDH network based on the **exploitation of a renewable or excess heat source**, like in the case of the REWARDHeat demonstrators in **Milano (Balilla and Gadio), Helsingborg and Mölndal**;

- *Retrofitting existing DH to LTDH*, which foresees the **adoption of actions for the energy transition of existing networks,** like in REWARDHeat demonstrators in **Albertslund and Topusko** or the **optimization of the existing DHN through innovative devices** like in REWARDHeat demonstrators in **Mijnwater and Toulon**;

- *District Cooling investments*, which although not fully represented among REWARDHeat demonstrators would constitute a relevant solution for the study of bankability, replicability and scalability.

Opportunities:

RINA has evaluated the scalability and replicability of the three most common types of investment in LTDHC projects based on the outcomes of the analysis done on bankability and on the preconditions and available financial support at national level.

Opportunities for the 2 types of LTDHN will be discussed:

- *Greenfield LTDH projects*
- *Retrofitting existing DH to LTDH*

Greenfield LTDH projects

Based on the analysis carried out, the main factors influencing the replicability and scalability of greenfield LTDH projects in EU Member States are listed below:

- **A significant heating demand of buildings**, which is maximum in Central-Norther Europe countries but also in continental areas of Southern Europe countries;
- **Concentration of heating demand in urban contexts**, which is a common characteristics of most EU Member States;
- **Absence of district heating networks**, which is a feature mainly of Southern Europe countries and only to a much lesser extent of isolated neighbourhoods and towns in Central-Northern Europe countries;
- **Availability of renewable or sustainable heat sources** (including industrial and urban excess heat) in the area where the district heating network is planned; these features are difficult to reconduct to a given geographical area but are more site-specific;
- **Presence of political support** for the decarbonization of the heating sector, which typically is a result of the policies promoted by the European Union, thus being a common feature of most EU Member States;
- **Familiarity of stakeholders**, including public institutions and authorities, private companies, final customers, investors, etc. **with district energy concepts**, which is a main feature of Northern and Central-Eastern Europe countries;
- **High values of electricity prices and of GHG emission factors** of grid electricity, which make conventional individual cooling solutions less economically convenient and environmental-friendly.

Greenfield LTDH projects

REWARDHeat

- Based on the list of factors presented above, it can be concluded that the potential for scalability/replicability for greenfield low-temperature district heating solutions **is medium or medium-high in the Countries not having fully exploited their DH potential, i.e. Member States like Italy, France, Croatia, Poland.**
- Member States having already a historically higher presence of district heating are characterized by a **low or medium-low potential** for greenfield projects, whereas on the other hand their potential for the **retrofitting projects will be higher.**
- Nevertheless, the implementation in these Member States of the few greenfield projects that are still feasible **benefits of the mature context** for district heating, in terms of clear legal and permitting framework at national level, as well as in terms of familiarity of stakeholders, including investors, with the technology and its environmental and financial benefits.

Retrofitting of Existing DH to LTDH

The potential for scalability/replicability of projects related to the retrofitting of existing DH systems to LTDH is influenced by the following main factors, which are partly overlapping with those listed for greenfields projects, except for the one related to the presence of existing DH systems:

- **the presence of a medium-high temperature district heating network**, which is a feature mainly of Northern and Central-Eastern Europe countries and to a lesser extent of continental areas in Southern Europe countries;
- **a significant heating demand of buildings**, which is maximum in Central-Norther Europe countries but also in continental areas of Southern Europe countries, and its concentration in urban contexts, which is a common characteristics of most EU Member States; these conditions are already sufficiently met if a district heating system is already present at the specific location;
- similarly to the previous bullet, **the familiarity of stakeholders**, including public institutions and authorities, private companies, final customers, investors, etc. **with district energy concepts**, which is a pre-requisite already met with the presence of a DH network;
- **the availability of renewable or sustainable heat sources** (including industrial and urban excess heat) in the area where the district heating network retrofitting is planned; these features are difficult to reconduct to a given geographical area but are more site-specific;
- **the interest of end consumers, local businesses and public authorities** in the reduction of energy consumptions and GHG emissions, as well as in the reduction of related energy supply costs;

continue

Retrofitting of Existing DH to LTDH

REWARDHeat

- **the adoption of significant incentives and support programmes** for the refurbishment of the building energy systems, which can enable the transition to LTDH and is a common feature of EU Member States, especially based on National Recovery and Resilience Plans elaborated after the Covid-19 outbreak;
- **the presence of political support** for the decarbonization of the heating sector, which typically is a result of the policies promoted by the European Union, thus being a common feature of most EU Member States;
- **the high levelized cost of heat** in the baseline district heating situation, which makes transition to LTDH more economically profitable.

Based on the list of factors presented above, it can be concluded that the potential for scalability/replicability for projects related to the retrofitting of existing district heating systems to low-temperature is **high** in countries in **Central-Eastern Europe** historically adopting high-temperature district heating systems (e.g.: Poland, Croatia), and **medium-high** in **Northern Europe** countries where the transition to lower temperature heat supply has already started (e.g.: Denmark, Sweden). For other EU Member States not having fully exploited yet their district heating potential, the retrofitting option shows a lower potential, being greenfield LTDH the favorite option.

REWARDHeat

THANK YOU

Federica Fuligni, RINA Consulting
federica.fuligni@rina.org

Elena Ricci, EHPA
elena.ricci@ehpa.org

Giorgio Bonvicini, RINA Consulting
giorgio.bonvicini@rina.org

www.rewardheat.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857811.
The document reflects the author's view. The European Commission has no liability for any use that may be made of the information it contains.