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ReUseHeat website: www.reuseheat.eu

Summary

This report presents the work carried out in Task 2.2 of Reuseheat project regarding bankability of urban waste heat recovery projects.

The input from the techno-economic analysis (T1.4), the stakeholder interviews (T2.1) and the risk evaluation (T2.3) was used for the assessment together with the analysis of a notable set of information regarding approaches adopted by commercial and institutional banks and investors.

The main bankability perspectives and criteria specifically related to project finance of urban waste heat recovery investments were analyzed and a set of Key Performance Indicators relevant to bankability were selected. The main barriers to bankability of this kind of investments were identified and a few policy recommendations are proposed to overcome them, including among others the development of a credit facility for urban waste heat recovery investments.

To conclude the analysis, the relevance of the identified barriers to the demo typologies of the Reuseheat project are assessed to make a preliminary assessment of the bankability of the different demonstrators.

Table of Contents

1. Introduction	5
2. Background: Business Models for Urban Waste Heat Recovery Investments	6
2.1. Actors Involved	6
2.2. Contractual choices and business models	6
2.3. Risk Evaluation	8
3. Background: Financing and Bankability	9
3.1. Equator Principles	9
3.2. EC Technical Expert Group on Sustainable Finance.....	9
3.3. Financial Support Instruments for Sustainable Energy	9
3.4. Commercial Banks.....	11
3.5. Technical Due Diligence Process.....	12
3.6. Corporate vs. Project Finance	12
3.6.1. Corporate Finance.....	12
3.6.2. Project Finance	13
4. Bankability Perspectives, Criteria and Key Performance Indicators	15
4.1. Bankability Perspectives	15
4.2. Bankability Criteria	16
4.3. Bankability Criteria Specific for Urban Waste Heat Recovery Investments.....	18
4.4. Bankability Key Performance Indicators.....	19
5. Barriers and Recommendations	20
5.1. Identification of Main Barriers to Bankability	20
5.2. Recommendations.....	20
6. Proposal for a Credit Facility for Urban Waste Heat Recovery Projects.....	22
7. Guideline of Bankability Evaluation of the Reuseheat Demonstrators.....	23
8. Conclusions.....	24
9. References	25

1. Introduction

A project is bankable if lenders are willing to finance it; a few further definitions related to bankability are hereby presented:

- “bankable is a project or proposal that has sufficient collateral, future cash flow, and high probability of success, to be acceptable to institutional lenders for financing” (BusinessDictionary¹);
- “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” (PWC²);
- “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 Bank³).

The focus of this deliverable is the analysis of the principles that lead lenders in the bankability assessments and specifically of the bankability criteria, with the ultimate objective of identifying barriers to bankability of urban waste heat recovery projects and proposing recommendations on one side to project proponents and on the other to policy makers. A set of bankability Key Performance Indicators (KPSs) will be determined and guidelines for the evaluation of excess heat investment bankability will be developed for the demonstrated waste heat typologies of WP3. An analysis of critical factors related to financial investment structure will be identified and provided (barriers).

To this aim, after Chapter 1 that constitutes the present Introduction, the following topics will be found in this Deliverable:

- Chapter 2 presents the background information related to business models and contracts coming from interactions with Task 2.3 and 2.4;
- Chapter 3 describes the information collected regarding bankability approaches of financial institutions and private banks, with particular attention, among others, to the outcomes of the interviews to banks and investors carried out in Task 2.1;
- Chapter 4 investigates the bankability perspectives and criteria and describes the Key Performance Indicators relevant to these aspects;
- Chapter 5 identifies the main barriers to bankability of urban waste heat recovery investments and provides recommendations to overcome them;
- Chapter 6, following one of the recommendations presented before, proposes the development of a credit facility for urban waste heat recovery investments;
- Chapter 7 provides a guideline for the evaluation of excess heat investment bankability through a preliminary assessment of bankability for Reuseheat demo heat source typologies;
- Chapter 8 draws the conclusions of the present study.

¹ <http://www.businessdictionary.com/definition/bankable.html>

² <https://www.pwc.com.au/legal/assets/investing-in-infrastructure/iif-8-epcm-contracts-feb16-3.pdf>

³ <https://ppp.worldbank.org/public-private-partnership/financing/risk-allocation-mitigation>

2. Background: Business Models for Urban Waste Heat Recovery Investments

This deliverable focuses on the bankability of waste heat recovery investment, i.e. on the interactions between project proponents and banks as potential source of funding for the project. However, banks represent only one of the categories of parts involved in the project development; many other different actors are involved, who interact according to a well-defined business model, each evaluating the existing risks; the interactions among all the involved actors are regulated by specific contracts. In the evaluation of the bankability of a project, banks consider among other aspects also the effectiveness of the interactions among the involved parts.

Business model (D2.4), risk evaluation (D2.5) and contracts (D2.3), i.e. the above mentioned topics, are analysed in-depth in other Tasks of Reuseheat project; for completeness purposes, the key aspects on these subjects are summarized in the present Chapter.

2.1. Actors Involved

From D2.1 it is known that the main stakeholders engaged in urban waste heat recovery projects are owners of excess heat, district heating operators, investors, customers and policy makers. The main targets for each stakeholder group are provided below.

- The owner of excess heat, which sells it either directly to end-users or to the DH company; according to the business model, it may implement the heat recovery project directly or through an ESCO or the DH company; *the main target is creating value from the excess heat available, minimizing the potentially environmentally negative impact of its core activities;*
- The end-users, whose target is to get their heating (and/or eventually cooling) load covered with a high flexibility and security of supply over time and at the lowest possible cost (often without paying attention to the type of fuel or energy input used);
- The DH network operator (whose business is in producing or purchasing heat from third parties and subsequently distributing and selling it to end-users) *that targets to cover the demand of the end-users; in urban waste heat recovery projects, the targets are related to the exploitation of a sustainable heat source, to the diversification and delocalization and heat supply resulting in an increased security of supply and to the reduction of heat production costs;*
- The investor, who targets to make a profitable investment in the production/purchase/distribution/sale of heat and in case needs money from external sources aims at making a bankable investment;
- The policy maker (often the municipality or other local authority), whose role is to assess projects and provide incentives and/or authorizations and licenses to proponents where needed, *targets the avoidance of negative impacts on the existing services and to achieve environmental and social benefits in line with national and European targets.*

Interactions among the actors involved are regulated by contracts that define roles and responsibilities of each actor according to the type of business model adopted.

2.2. Contractual choices and business models

Issues in the definition and stipulation of contracts can lead to increased risk, mainly in case of costs arising due to uncontracted events. Therefore, contracts should provide details about as many high-risk eventualities as possible in order to ensure that each party can agree on its rights and obligations in such cases (this is explicitly addressed in D2.3).

As contracts theory highlights, contracts are always imperfect since inevitably some eventualities are not covered. This may happen for example because some cases are considered to be negligible since their occurrence leads to a very low impact, or because some events are unable to be identified as risk items at the contract stage.

In order to minimize contract-related risks, the key factor is to cover in the contract all the most important eventualities, setting out rights and responsibilities of the parties. Typically, aspects covered in DH-related contracts are Supply, Construction, Operation, Maintenance, Pricing, Insurance, Mitigation, Quality Assurances, Monitoring, Billing, Health and Safety, Changes of Roles, Compensation, Renegotiation, Disputes Solving, Force Majeure (see D2.5).

Moreover, forging strong relationships between partners can also be of help in avoiding contract-related issues: if there is a high degree of trust or of shared business interests between partners, each will likely be reluctant to damage the relationship and willing to negotiate for a mutually beneficial solution.

Contractual choices made will impact the business model design. In Table 2.2, factors to consider in contracts that are important in the urban waste heat recovery context are listed (from D2.3). From it, how different contractual choices will impact the components of the business model are highlighted.

Factor to consider	Impact on the business model
1. Low maturity of the installations (D2.1): e.g. the combination of heat pump and low temperature heat recovery is a system innovation	The low temperature heat recovery installation will necessitate new equipment and skills of employees to use it. It impacts the key resources and key activities of the district heating provider. Depending on contractual choices of ownership, the equipment will belong to the district heating provider.
2. No legal framework in place (D2.1)	The absence of a legal framework necessitates close interaction with the waste heat supplier. A close and frequent customer dialogue will be able to manage the shortage of legal boundary conditions. The closer interaction between the waste heat supplier and the customer generates a new key partnership .
3. The value of heat is subjective (D2.1)	How the price of the heat is fixed will depend on a multitude of factors: the price of electricity, seasonality and perceived value of the waste heat provider. To arrive at a price that is correct and advantageous to both parties a close dialogue is necessary, impacting the key partnership and income structure of the business model. Remembering that the value proposed to the urban waste heat provider is the possibility to offset the waste heat, the value proposition of the canvas is impacted.
4. The payback period is long (D2.1)	Long pay back is risky. This can be troublesome to partners who have differing time horizons. In such cases it can be a solution that one partner is paid off prior to the other partner (a much discussed case in the district heating industry is the collaboration between the Danish district heating company VEKS and the company CP Kelco where the latter got their investment paid off first ⁴). How the payment plan is realized will impact the income structure .
5. Asymmetric information (theory)	Asymmetric information in any part of the business model is detrimental to its success. As much information as possible needs to be known and outlined in the contract. If so, the business model can be built around known information. This impacts all parts of the canvas .
6. Shared incentives (theory) supply operation maintenance pricing insurance quality assurance monitoring billing renegotiation	Depending on where in the contract shared incentives are secured, the different parts of the canvas will be impacted. If it, for example, is on the supply side it is related to the key resource of urban waste heat coming into the district heating providers network. If it is on the operation side , then the key activities undertaken by the district heating company will be impacting the incentives. The same applies for the maintenance aspect . Incentives linked to pricing will impact the value proposition and the income structure . Incentives related to insurance will be linked to key resources . Quality assuring incentives will be linked to the key activities undertaken as will incentives directed towards monitoring activities. Billing incentives are linked to the income structure and renegotiation can be linked to any part of the canvas .
7. Termination of heat recovery (theory)	In the worst case, established sanctions cannot keep the business model afloat if the heat recovery is terminated. One consequence is then the termination of contract and business model.

Table 2.2.: Choices made in regard to important factors for urban waste heat recovery investments impact the business model configuration (from D2.3)

⁴ See more in hot/Cool, International magazine on district heating and cooling, N01, 2019 (pp. 4-6).

In D2.3 it is also noted that ownership configurations are decisive for the business model choices made. It is common with Public-Private Partnership (PPP) in DH but so are also Energy Performance Contracts (EPC) and Energy Service Companies (ESC). Apart from these main categories of ownership there are also others, less spread ownership arrangements, identified in D2.3.

The construction of the most suitable business model (e.g. the customer value offered, how it is delivered and the costs/ incomes from it) has to be carried out case by case considering the specific features of the available waste heat source, of its ownership, of the availability or not of a DH network and of its ownership, and of the number and type of end-users.

2.3. Risk Evaluation

Risks are defined as scenarios in which there is some possibility of losing value; generally, risks are defined in terms of occurrence probability and potential loss.

In the case of an urban waste heat recovery project or more in general of a district heating project, the following risk categories are identified: Engineering Risk, Project Risk, Operations Risk, Demand/Revenue Risk, Supply Risk, Environmental Risk, Financial Risk, Natural Disaster Risk, Performance Risk, Legal Risk, Regulatory Risk, Political Risk, Ramp-up Risk, Competitive Risk.

All of the above listed risks are analysed in detail in D2.5 of Reuseheat project; they also constitute the vast majority of risks considered by banks in their assessment of the bankability of a urban waste heat recovery project or in general of project finance projects.

In order to improve the feasibility of an urban waste heat recovery project, risks should be identified, avoided where possible or otherwise mitigated, and finally either accepted (budgeting for the related cost) or transferred to third parties (through contractual clauses).

Regarding Reuseheat demonstrators, a risk evaluation is carried out before the realization of the demo and monitored monthly through a risk matrix approach; the identified deviations are analysed and mitigation actions are defined where needed. The risks for Reuseheat demonstrators are grouped in the following nine categories: planning and design, permitting, executive design, procurement, area preparation, installation/construction, commissioning, production/operation, monitoring.

3. Background: Financing and Bankability

This chapter describes the data sources considered to carry out the analysis of bankability of urban waste heat recovery investments. The sources are presented, including the Equator Principles adopted to assess environmental and social risks by financial institutions, the financial support instruments from multinational development banks for Sustainable Energy and their typical eligibility criteria as well as the most important aspects considered by commercial banks in taking decisions regarding project financing. A final section is dedicated to the technical due diligence process, a decision support tool for banks in the decision regarding financing medium-large sized projects.

3.1. Equator Principles

The Equator Principles (EPs) is a risk management framework, adopted by financial institutions, for identifying, evaluating and managing environmental and social risk in projects; they constitute a minimum standard content for due diligence and monitoring of projects aimed at supporting decision-making.

The EPs have worldwide application and extension to all industry sectors whereas regarding the type of financial products their application is limited to Project Finance Advisory Services and Project Finance with CAPEX higher than 10 million \$, Project-Related Corporate Loans with CAPEX higher than 100 million USD and Bridge Loans.

Currently the Equator Principles have been adopted by 94 Financial Institutions (EPFIs) in 37 countries, which cover most of international project finance debt in developed and emerging markets.

EPFIs commit to the implementation of the Principles in their internal environmental and social policies, procedures and standards for financing projects and commit not to provide Project Finance or Project-Related Corporate Loans to projects that do not comply with the Principles.

The Equator Principles have promoted convergence around common environmental and social standards, and also multilateral development banks such as the European Bank for Reconstruction and Development and export credit agencies through the OECD Common Approaches are increasingly relying on the same standards as the Principles.

3.2. EC Technical Expert Group on Sustainable Finance

The European Commission has set up a Technical Expert Group (TEG) on sustainable finance with the aim of developing, in line with the EC legislative proposals of May 2018, the following items:

- an EU classification system, i.e. “EU taxonomy”, to determine whether an economic activity is environmentally sustainable;
- an EU Green Bond Standard;
- methodologies for EU climate benchmarks and disclosures for benchmarks;
- guidance to improve corporate disclosure of climate-related information.

At the moment of delivering the present document, the final working documents of the TEG are not yet available, since the conclusion of the TEG activities is foreseen for the end of June 2019; however, the interim working documents constitute an important source of information.

3.3. Financial Support Instruments for Sustainable Energy

Regarding the potential credit lines for sustainable energy, two main existing support instruments from multinational development banks were analyzed: the PF4EE promoted by the European Investment Bank with the support of the European Commission and the GEFF promoted by the European Bank for Reconstruction and Development with contributions of many different international donors.

The **Private Finance for Energy Efficiency (PF4EE)** is an instrument developed following a joint agreement between the European Investment Bank (EIB) and the European Commission (EC) which aims at supporting energy efficiency investments through the improvement of access to adequate and affordable sources of commercial financing. The PF4EE mainly supports projects that comply with National Energy Efficiency Action Plans or other energy efficiency programmes of EU Member States.

The PF4EE has two core objectives:

- to make energy efficiency lending a more sustainable activity within European financial institutions, considering the energy efficiency sector as a distinct market segment.
- to increase the availability of debt financing to eligible energy efficiency investments.

In addition to 480 million € of long-term financing funds from the EIB, the EC supports PF4EE through its program for the Environment and Climate Action (LIFE); specifically, the LIFE Programme initially committed 80 million € to fund the credit risk protection and expert support services.

Based on this, the PF4EE instrument provides:

- a portfolio-based credit risk protection by LIFE Programme, provided by means of cash-collateral (Risk Sharing Facility);
- a long-term financing from the EIB (EIB Loan for Energy Efficiency);
- consulting services for the Financial Intermediaries (Expert Support Facility).

A scheme of the PF4EE concept is shown in *Figure 3.1*.

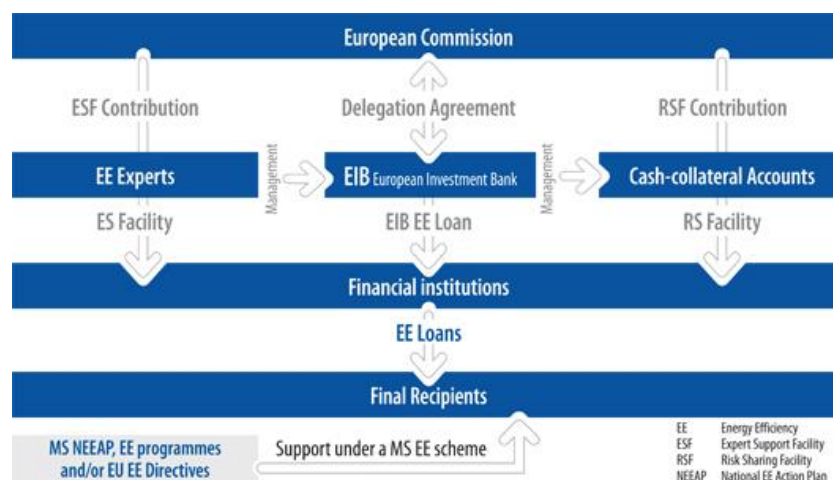


Figure 3.1: PF4EE Concept (Source: EIB)

Currently, PF4EE instrument is available through local commercial banks in ten EU Member States: Czech Republic, Spain, France, Belgium, Italy, Portugal, Croatia, Greece, Cyprus.

The technical eligibility criteria are different according to the specific focus given in the target Member State to the instrument but typically are based on the investment belonging to a list of standard measures for low-CAPEX ones and on meeting specific criteria on percentage energy savings and NPV of the investment for medium- and high-CAPEX ones (up to 10 million € of project cost and 5 million € of covered loan).

Green Economy Financing Facility (GEFF) includes a set of initiatives developed by the European Bank for Reconstruction and Development (EBRD) and many other donors among national bodies and supranational entities and funds, which support businesses and homeowners wishing to invest in green technologies. Eligible projects are related not only to energy efficiency or renewable energy but also to water and resource efficiency, circular economy and climate change mitigation and adaptation.

The GEFF program operates through more than 130 local financial institutions across 24 countries with almost 4 billion € of EBRD finance; over the last years, more than 120,000 clients benefitted of the programme, collectively avoiding almost 7 million tCO₂/y of GHG emissions.

GEFF goes beyond providing simple lines of finance. An experienced EBRD team of bankers and technical programme managers ensures consistent quality and innovation in the GEFF product and service delivery. In addition, advisory services are available to help participating financial institutions and their clients enhance their market practices.

The eligibility criteria for GEFF are slightly different from initiative to initiative, but typical criteria include a maximum investment of few million €, a minimum IRR of 10% for energy efficiency projects and 0% for renewable energy projects, and an energy saving ratio of at least 15-20% compared to the baseline situation.

3.4. Commercial Banks

Regarding the view of commercial banks on financing urban waste heat recovery investments, the most important source of information is constituted by the interviews carried out within Task 2.1 of Reuseheat project with stakeholders of the “investors” category, including several commercial banks.

The interviews were carried out with stakeholders from the following EU Member States:

- Belgium;
- Denmark;
- France;
- Germany;
- Italy;
- Romania;
- Spain;
- Sweden.

Out of the 76 interviewed stakeholders, 10, i.e. 13%, were representatives of banks. The main conclusions on, regarding bankability, from the banker interviews are presented in the following bullet points:

- commercial banks prefer corporate finance compared to project finance since the risks related to the company operation and performance are easier to evaluate and manage compared to those related to a single project especially if not based on a very mature technical solution; on the contrary, banks operating with institutional credit lines need to adopt a project finance approach since eligibility criteria are typically related to the technical and financial performance of single projects;
- in case support of public bodies is provided, like in the case of Risk Sharing Facilities from national/supranational entities or in case of guarantees issued from municipalities for DH infrastructural projects, banks may accept a slightly higher degree of risk for projects; no significant priority is given by banks to projects supported by public incentives on operation, since they prefer that cash flows to repay the loan are sufficiently available from the project and not rely on benefits that may change according to the political context;
- similarly, banks adopting a CSR strategy strongly oriented on environmental topics like institutional banks may devote a specific amount of funds on energy efficiency or GHG reduction or circular economy projects and therefore may accept a slightly lower financial return for these kinds of projects; on the contrary, the majority of banks stated that environmental benefits are only a nice-to-have that do not play a key role in case the project does not guarantee a minimum level of economic profitability;
- different opinions were found among interviewed banks regarding the opportunity of financing public-private partnerships; in some cases the presence of a public body among the project proponents is considered as a guarantee, whereas in other cases banks clearly stated that they prefer to finance private companies since the solvency of municipalities is in some Countries worse and generally more difficult to evaluate;
- banks agreed on the fact that maximum time horizon for projects is around 15-20 years for infrastructural projects (e.g.: the realization ex novo of a DH grid) and around 5-10 years for other projects including urban waste heat recovery ones; the loan duration is typically shorter compared to these technical lifetimes and in some cases even shorter than the expected payback period for the investment, in order to get the loan repaid before the equity of the project proponents;
- regarding the financial eligibility criteria for these investments, only few banks answered with quantitative data, since these values strongly depend on the client creditworthiness; however, a part of the interviewed banks mentioned a maximum payback of 10 years and a minimum internal rate of return (IRR) of 8%; furthermore, they agreed that in order to have sufficient cash flows to repay the loan, an average debt service coverage ratio (ADSCR) higher than 1 is definitely required, with most interesting projects having ADSCR higher than 1.3-1.4;
- technical risks are carefully considered by banks in project finance approach; regarding specifically urban waste heat recovery projects the main risks identified are those related to the security of heat source availability (including the issue of possible termination of waste heat source) and long-term heat demand even in comparison to potential competitor technologies; moreover, the maturity of the adopted technologies is considered, both in terms of single components and of overall technical solution (source+technology+user); the interviewed banks agreed on the fact that it is not worthy paying a third party to carry out a technical due diligence for loans below 10-15 million €, thus it is important that project

proponents provide extensive details on the technical solution, the possible risks and the measures to avoid them or mitigate their effects, the evaluation of their impact on the business plan, etc.;

- an opportunity different from traditional loans between the bank and the project proponent is constituted by green bonds, which can be issued by banks to cover funding of a group of projects of the same category (one of which could be, for example, urban waste heat recovery investments), thus minimizing the risks for third parties to invest in a single project.

3.5. Technical Due Diligence Process

Due diligence is the set of investigations and checks that investors are reasonably expected to take before signing an agreement or contract with another party. It is in some cases a legal obligation but generally it is a voluntary instrument adopted to achieve knowledge about the risks for the investing party and to minimize them, usually in the evaluation of a medium-large sized investment like the acquisition or the realization ex novo of an asset.

Indeed, all the actors involved in a project need to understand and mitigate several technical, legal, environmental and social risks before investing, since risks may compromise the profitability of the project during both the inception phase and the operation period.

Risks are evaluated both regarding their probability of occurrence and their potential impact; the overall aim is to ensure that the technical feasibility of the project is guaranteed, all the factors have been considered and risks are well known and do not compromise the profitability of the investment.

These aims are achieved by reviewing all the available information and data in order to highlight all potentially critical issues; for this reason, the review includes design documents, permits, schedules for procurement, construction, installation and subsequent operation and maintenance, contracts and guarantees, financial model with particular reference to the impact of possibly identified technical issues on CAPEX, OPEX and revenues amount and timings.

With reference to urban waste heat recovery investments, the main topics to be investigated during the due diligence phase are related to:

- technology, with particular reference to design review, features of single components and their integration, efficiency, etc., benchmarking with available track record if any;
- waste heat source, with assessment of availability in quantity, quality (temperature) and time, considering also possible variations in the future years up to the limit case of termination of the waste heat source;
- contracts, both for the purchase of components and the realization of the system, for the purchase/sale of heat (long term contracts) and for the purchase of electricity especially if heat pumps are used;
- financial model, with a review of the model provided by the project promoter and a sensitivity analysis based on the possible variations of key parameters following the potential risks identified in the previous reviews.

3.6. Corporate vs. Project Finance

As seen above, two main approaches exist regarding financing projects in general: corporate finance and project finance; also a combination of the two approaches is possible. The following paragraphs are dedicated to the presentation of the main features of these two approaches and the implications for urban waste heat recovery investments.

3.6.1. Corporate Finance

In the Corporate Finance Model, the financing partners (banks through dedicated loans, public bodies through possible grants, project promoters through equity or cash flow) provide funding to the promoter, which can be a company, a group of companies or a public institution, considering the financial strength of the promoter itself. For this reason, generally the promoter is responsible for the repayment of the loan and therefore the financing partners are exposed to the credit risk related to the promoter and not to the project. *Figure 3.2*, taken from EIB, presents the corporate finance concept scheme.

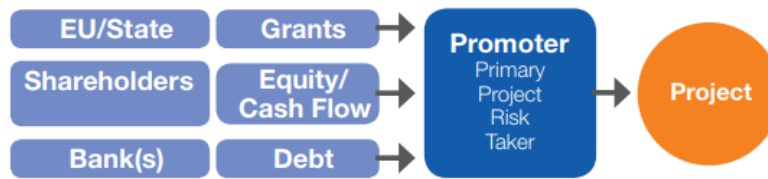


Figure 3.2: Corporate Finance Concept Scheme

In the corporate finance scheme:

- the bankability of transactions depends on the creditworthiness of the promoter, which typically coincides with the borrower;
- the creditworthiness depends on the capacity of the company to repay the debt, including capital and interests;
- the capacity of the company to repay the debt is carried out based on the company's profitability, balance sheet and cash flows;
- provided that the company is evaluated as creditworthy, this approach is applicable to all kinds of projects, without need for detailed investigations on the nature, technical feasibility and economic profitability of the investment, since the debt is dissociated from the project risk.

In the case of urban waste heat recovery investments, this corresponds for example to the case in which the utility managing an existing DH network decides to implement a project to supply heat to the network in a more sustainable way and, being the utility a large and financially strong company, it receives financing from commercial banks independently from the technical nature of the project that they are willing to implement.

Since the evaluation of company creditworthiness goes beyond the scope of the present deliverable and no technical aspect related to the urban waste heat recovery project can influence bankability according to this kind of approach, this approach will not be further discussed in the following sections.

3.6.2. Project Finance

In the Project Finance Model, the project is implemented and financed through a Special Purpose Vehicle (SPV), which is a legally and financially standalone project company of which the project proponents constitute the main shareholders. It is therefore the SPV that receives equity from the project proponents, grants from the possibly involved public bodies and loans from banks, therefore with no recourse to the project promoter; *Figure 3.6.2*, taken from EIB, presents the project finance concept scheme.

This kind of finance model has the main purpose of acquiring equity, quasi equity and a significant share of debt capital, which is accounted on the SPV books and not on the balance sheet of the project proponents; this approach constitutes an off-balance-financing for the project proponents. It is therefore clear that only project cash flows should be considered to cover both debt service and returns on equity; for this reason, banks and other lenders usually carry out deep analysis of the debt services, loan life and project life cover ratios to assess the capacity of the project to repay loans.



Figure 3.6.2: Project Finance Concept Scheme

In the project finance scheme:

- the assessment of bankability focuses specifically on the project, which is typically isolated from a legal and financial perspective in a SPV, with limited recourse to the promoters;
- the project bankability mainly depends on:

- the capacity of the SPV to generate sufficient and stable cash flows and resources to repay the debt, including capital and interests,
- the proportion of equity provided by project promoters in the SPV,
- the sustainable value of project assets and/or of other security,
- other structural aspects and risks related to the project, including legal, environmental and social topics.

In the case of urban waste heat recovery investments, this is the typical approach for projects implemented by owners of excess heat willing to realize a system to recover heat and sell it to a DH network utility or to a different client, or of projects realized in a joint form between the utility and the excess heat owner.

Due to the important role played by technical project features in the evaluation of the bankability of the investment, this is the main approach that will be considered in the following sections of this Deliverable.

4. Bankability Perspectives, Criteria and Key Performance Indicators

This section is dedicated to the assessment of the influence that the interaction among the actors involved in an urban waste heat recovery project have on bankability as well as on the criteria that banks adopt to assess bankability of projects in general and specifically of urban waste heat recovery ones; finally, the main Key Performance Indicators regarding bankability are presented.

4.1. Bankability Perspectives

Bankability evaluation is a multidisciplinary activity involving, among others, economical, technical and legal aspects; moreover, each actor involved in the project sees bankability under a different perspective. *Figure 4.1*, taken from the study by Hampel et al. focusing on photovoltaic, show how different actors, including components suppliers, service providers, project developers and investors, contribute to the different dimensions of bankability.

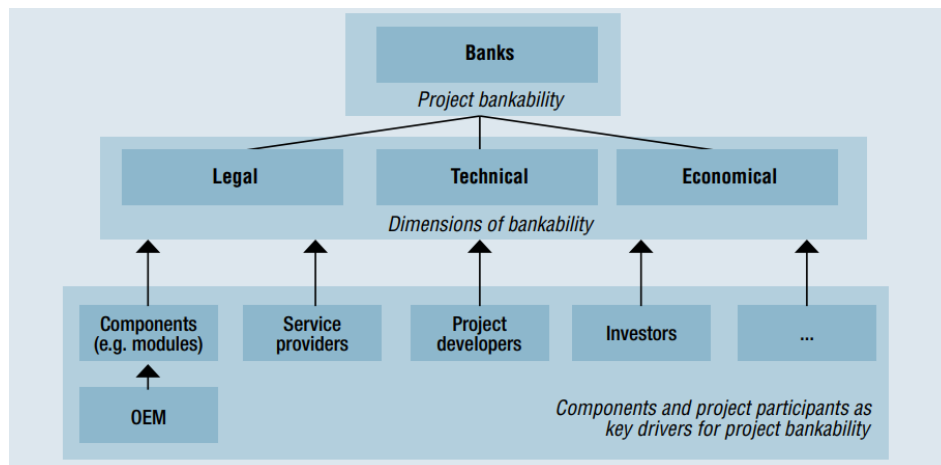


Figure 4.1: Actors and Components of Project Bankability

Figure 4.2, taken from the same study by Hampel et al., focuses on different bankability concepts from the perspective of technology producers, project developers, service providers, investors and banks.

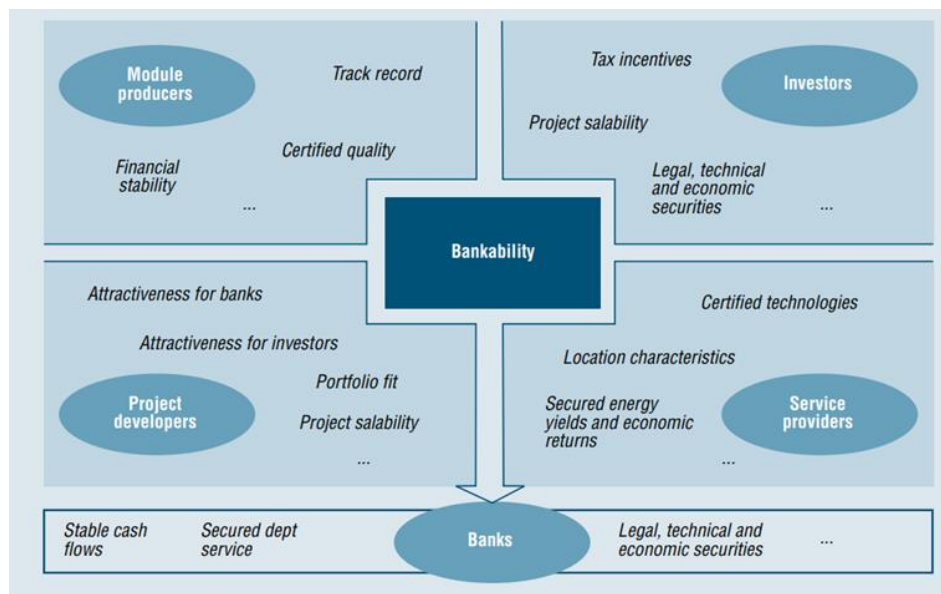


Figure 4.2: Bankability Definition from Multiple Perspectives

From the **technology producers** perspective, it is clear that new equipment and components or new innovative application of consolidated technologies encounter problems in achieving bankability. For this reason, their main aim is to achieve and keep a track record and get a performance/reliability certification for their technology, which

means that in the initial phases of development of a product or of application of an existing product they need to accept a certain degree of risk, for example by participating to one or more pilot projects.

On the other hand, **project developers** need to make their projects attractive for investors and banks and to find reliable support in technology producers and service providers; they can operate according to a variety of different business models and adopting different kinds of contracts with suppliers including EPC and O&M ones, thus shifting – at a certain cost – a part of the risks related to the project implementation and operation to a third party.

Service providers, as seen above, play a key role in reducing project risks; indeed, this group of actors offers services related to design, engineering and consulting including the provision and analysis of data regarding the source availability, as well as in the certification of the technology performance. Banks give high consideration to documents and data provided by third parties, which contribute to the reduction of the uncertainty of energy and economic yields of the project over its lifetime.

To conclude, **investors** mainly look for legal, technical and economic securities, which means that they are attracted by mature projects with low risks, e.g. turnkey projects and projects in operation whose shares are sold “from the secondary market”; some of them also invest in early project stages, provided that the project type and risk is in line with the investor’s business model and that the availability of debt from banks at an acceptable cost leads to a suitable rate of return. Aspects such as track record, experience and financial strength of project partners like project developers and engineering, procurement and construction (EPC) contractors, as well as confidence in the performance and maturity of the technology are fundamental aspects for investors, together with the predictability and stability of cash flows and with the stability and reliability of the local legislation and political framework.

4.2. Bankability Criteria

Generally speaking, banks assess projects under a risk evaluation perspective; their aim is to minimize the overall risk related to the project in order to achieve security of loan repayment through the identification, assessment and management of different types of risks including technical and technological, legal, regulatory and market aspects.

Banks take decisions regarding project financing by following a practically standardized project assessment process based on qualitative and quantitative aspects. Figure 4., taken from Hampel et al., provides an overview of typical steps followed to carry out a bankability assessment.

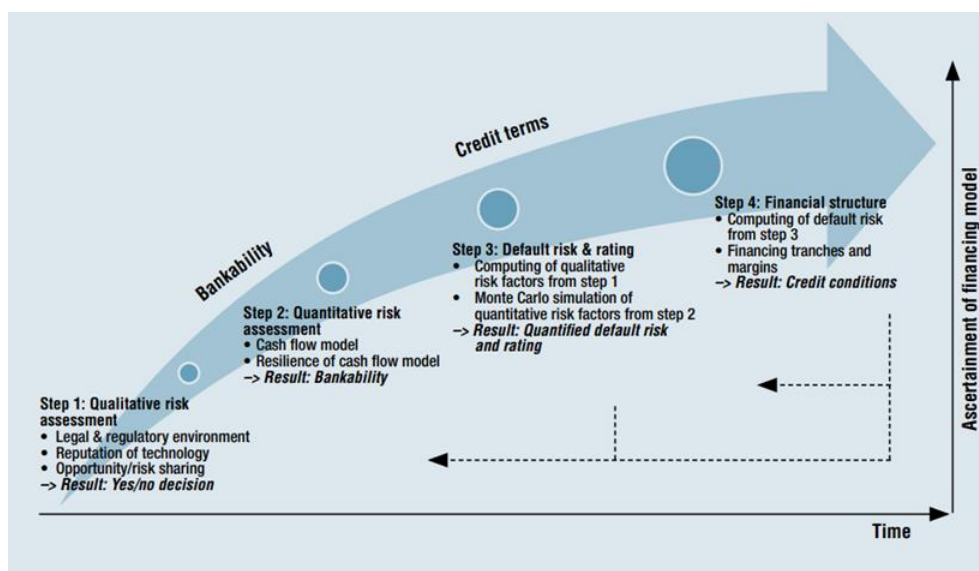


Figure 4.2: Bankability Assessment for Project Financing

This process is articulated in four main steps:

- **qualitative risk assessment**, in which the available information is screened and the project partners (proponents, investors, technology providers, EPC contractors, clients, etc.) are evaluated and the availability of equity is verified; in this phase the technology maturity and the legal and regulatory environment are also evaluated together with the bank’s experience with the specific type of projects; the output of this step is the yes/no decision of the bank about proceeding with the opportunity or not;

- **quantitative risk assessment**, in which a more detailed analysis is carried out, based on the evaluation of technical design documents, contracts, licenses, etc.; this phase is carried out by qualified experts among the bank personnel or consultants and aims at identifying the potential specific risks and at quantifying their impact on the cash flow model; the outcome of this phase is the actual decision on the bankability of the project;
- **default risk assessment and rating**, in which a sensitivity analysis, also based on a Monte Carlo approach, is carried out on the financial model to determine the impact on the project profitability of the identified risks and of possible other factors and the default risk is assessed; the outcome of this step is the risk rating of the project that, if too high, may lead to a change in the bankability decision;
- **finance structuring**, in which the tranches and conditions of the loan are defined based on project risk rating and on the outcomes of the previous phases.

It is highlighted that banks prefer to finance projects that are related to technologies or technical solutions already financed or in any case with proven technical performance and financial profitability; it hardly occurs that a first-of-a-kind investment is bankable according to a project finance approach, if no external guarantee is provided to cover the loan amount. Moreover, banks are highly sensitive to risks related to policy uncertainties, which means that generally incentives are not considered as source of revenues in cash flow models since they may be subject to changes without explicit prior notices and even with retroactive effects, and atypical projects for which a clear legal, permitting and authorization process is not defined are generally not bankable.

Regarding **risk management**, the main steps are presented in *Figure 4.3* (taken from Solar Bankability project): the risk assessment phase identifies most of the risks related to the project; then, mitigation actions should be foreseen to prevent and reduce a significant part of risks; the remaining ones should be transferred to third parties where possible and finally the residual risks should be borne provided that their impact is acceptable. A transversal component to these risk components is constituted by unidentified risks, which should be as much limited as possible thanks to a detailed and careful risk assessment phase.

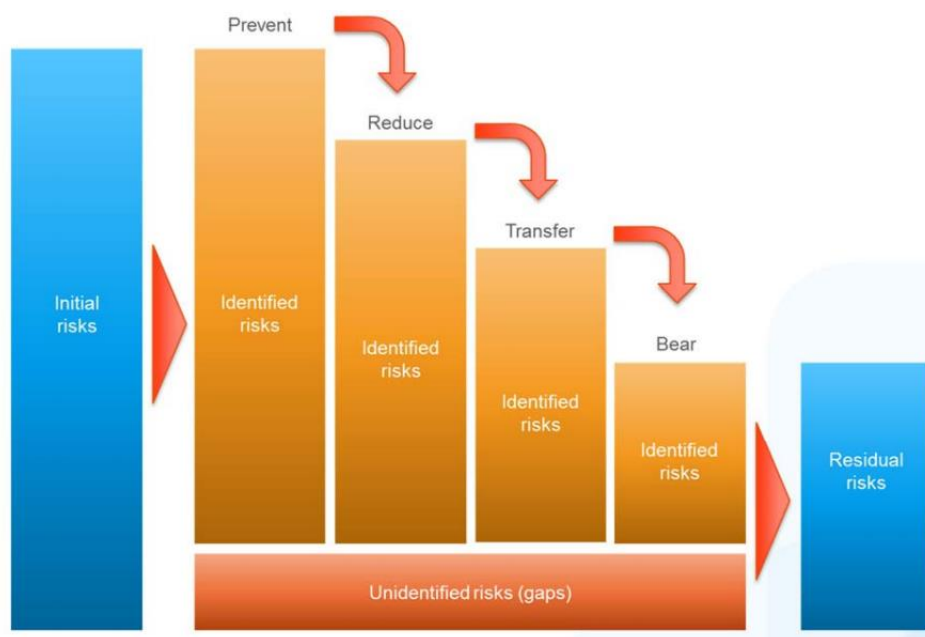


Figure 4.3: Risk Management Concepts

4.3. Bankability Criteria Specific for Urban Waste Heat Recovery Investments

The above described criteria for bankability and risk assessment from the bank's perspective are transposed into requisites for specific project finance of urban waste heat recovery in the following bullet points:

- the proposed technical solution should be proven to be mature under several perspectives, such as the proven track record of the single devices (heat pumps, heat exchangers, pumps, etc.), of their integration and of their use for the exploitation of the same or of similar sources of urban waste heat; particularly if the solution is innovative or first-of-a-kind, the typical technical problems affecting the specific technology and/or the exploitation of the specific heat source should be identified, their potential occurrence in the project evaluated and the potential impact on the financial model quantified;
- the suitability of the selected urban waste heat source in quantity, quality and time availability should be evaluated and forecasts should be done regarding the possible expected variations in upcoming years that could hinder the correct operation of the waste heat recovery system and consequently reduce its profitability; in this regard, also the eventuality of the termination of the waste heat source availability should be carefully analyzed;
- the project implementation time schedule should be assessed and found to be consistent with experience in similar projects, considering technical procurement, construction and installation periods but also time possibly needed for the authorization of the project by relevant local authorities (that in some cases may require more time due to the lack of clear permitting procedures for “innovative” solutions);
- the financial model should be validated also under a technical perspective, by evaluating the assumptions made and verifying that risks are minimized regarding possible contingencies and delays in the construction/installation phase, ordinary and extraordinary operation and maintenance costs, possible changes in revenues due to lower source availability, lower equipment efficiency or equipment downtimes due to technical failures;
- the expected investment cost should be checked regarding the single components of the overall cost structure, including engineering design and legal costs and fees, and the uncertainty on all components due to different reasons should be quantified and the effects on the financial model evaluated;
- the interactions of the project with existing infrastructures should be verified; e.g. for projects that need integration with an existing DH network, aspects to be evaluated are the need for additional piping, the capacity of the DH system to integrate the new heat source, the impacts on the other heating sources, phase-out of fossil fuel-based systems, etc.;
- the ownership model and the business model of the project components should be defined with the aim to maximize the bankability of the project, with particular reference to the interactions among public and private sector; as seen in the previous sections, depending on the specific location a project may attract banks in different ways if a public body is involved; therefore, cooperation with municipalities and other local or national authorities should be favored or disfavored taking into consideration also the preferences of the partner banks;
- the contracts with suppliers of excess heat and buyers of produced heat, those for electricity supply (especially if heat pumps are used), as well as those with operation and maintenance contractors and with the EPC contractor regarding the guarantee part should be evaluated carefully in order to achieve a low uncertainty on cash flows for years after the initial investment, i.e. on OPEX and revenues;
- the legal and permitting framework for the specific technology should be clear and well defined enough in order to avoid project implementation delays due to long time periods needed for the authorization process by local authorities; in case this condition is not verified, the project proponents should provide evidence of the timely provision of documents to the relevant authorities and of having considered in the project implementation schedule the possible delays related to this aspect;
- the availability of public incentives should be verified although it is rarely considered in decisions on bankability; the cash flows from the possibly available incentives should be highlighted separately from those related to the project operation in the cash flow model;
- the environmental and social benefits related to the project implementation should be quantified in order to favor bankability by specific banks and credit facilities giving priority to projects characterized by external benefits.

4.4. Bankability Key Performance Indicators

The following list summarizes the main Key Performance Indicators used to evaluate bankability according to a project finance approach:

- **Annual Debt Service Coverage Ratio (ADSCR)** – it is a measurement of the cash flow available to pay debt obligations and is calculated as the ratio between the annual net operating income of the SPV (EBIT, i.e. revenues minus operating expenses, not including taxes and interest payments) and the debt obligations due per year; it is important that this indicator is higher than 1 and from the bank's perspective also much higher, i.e. 1.3-1.4 or more; thresholds are fixed by banks both on annual and on average basis over the project lifetime;
- **Net Present Value (NPV)** – it is one of the most important indicators, calculated as the difference between the present value of positive and negative cash flows over a period of time depending on the type of project (around 20 years for urban waste heat recovery investments); a positive NPV indicates that the project is profitable since revenues exceed the anticipated costs, both expressed in present currency; it is important that this indicator is higher than zero and possibly much higher, to an extent that depends on the investment done;
- **NPV to Investment (NPV/I)** – is one of the indicators based on the previous one; since a certain amount of NPV can be acceptable for investors depending on the investment done, this is calculated as the ratio between the NPV and the total investment; typically, profitable investments have NPV/I higher than 1 with even much higher values, around 3-4, for short return investments;
- **Internal Rate of Return (IRR)** – it is a metric used to estimate the profitability of an investment, also based on the NPV; indeed, it is the value of the discount rate that makes NPV of a project equal to zero; the benefit of this indicator is that it is uniform to any type of investment, thus allowing comparisons; the requirement of this indicator is to be as highest as possible, and in any case higher than the loan interest rate;
- **Project Life Coverage Ratio (PLCR)** – it is a financial ratio used to estimate the ability of a project to repay outstanding loans; it is calculated by dividing NPV of the money available for debt repayment by the amount of outstanding debt; this indicator has a similar meaning to ADSCR but is more commonly used in project finance because of its long-term nature; indeed, ADSCR refers to a single year, whereas the PLCR addresses the entire duration of the loan; a ratio of 1.0 means that PLCR is at the breakeven; higher ratios indicate lower potential risks for banks;
- **Return on Equity (ROE)** – it is a measure of financial performance calculated by dividing net income by shareholders' equity (i.e.: assets minus debt); it is not directly connected with the capacity of the project to produce cash flows to repay the loan. It is an indicator of how effectively management is using assets to create profits; this indicator should be as high as possible;
- **Payback Time (PBT)** – it is the length of time required to recover the cost of an investment; it is calculated as the ratio between the initial investment and the average annual cash flow, which can be either discounted or non-discounted; in the former case, similarly to NPV and IRR, the time-value of money is considered; the shortest is the payback, the most profitable is the investment, although the threshold of payback to define the investment profitability depends on the investors business model; from the bank perspective, the duration of the loan should be shorter than the expected payback time, in order to get the debt repaid earlier than the investors' equity;
- **Energy Saving Ratio (ESR)** – it is a non-financial indicator that is typically not of interest of commercial banks but is considered under specific credit lines for energy-related investments; it is calculated as the ratio between the reduction of primary energy consumption allowed by the project implementation and the baseline primary energy consumption; some credit lines require that ESR is higher than a certain threshold, typically 15-20%;
- **Avoided GHG Emissions** – this non-financial indicator may be considered in some credit lines, either in absolute (tCO₂e/y) or relative (%) value, to define eligibility for financing; it is calculated as the difference between the GHG emissions before (baseline situation) and after the implementation of the project;
- **CAPEX/OPEX per avoided GHG emission** – in order to compare the environmental profitability of the project, this indicator can be calculated to evaluate the investment cost and the operational cost required to avoid the emission of 1 tCO₂e.

5. Barriers and Recommendations

This chapter is dedicated to the analysis of the barriers that obstacle the bankability of urban waste heat recovery projects and to the definition of recommendations to policy makers to overcome such barriers.

5.1. Identification of Main Barriers to Bankability

Urban waste heat recovery ones are generally considered as high-risk projects by banks, for the reasons listed below that therefore constitute barriers to bankability. Several of them coincide with the factors to address when drafting contracts and business models (table 3.1).

- absence of similar projects in their portfolios demonstrating that such projects are technically feasible and able to generate cash flows (e.g. what is pointed out to be low maturity of solutions in D2.3)
- lack of experience of the project developers in similar projects, especially if the project is proposed by the excess heat owner (e.g. what is pointed out to be low maturity of solutions in D2.3);
- long payback periods - (also identified in D2.3);
- operational risks regarding supply, operation, maintenance, pricing, insurance, quality assurance, monitoring, billing and renegotiation (from D2.3)
- risk of underperformance due to lower availability of urban waste heat source than expected (addressed as one of the items under shared incentives in D2.3);
- risk of underperformance of devices used for project implementation (addressed as one of the items under shared incentives in D2.3);
- no clear legal framework and authorization procedures and possible impact on project implementation timeline (the absence of a legal framework for urban waste heat recovery investments is also identified in D2.3);
- lack of technical knowledge on these topics both among bank officers and most of their technical consultants (information from D2.1);
- absence of 'solid & experienced' EPC contractors ready to realize these systems and provide suitable guarantees to transfer risks (information from D2.1);
- preference to finance different technologies like cogeneration or renewables to meet sustainability targets (information from D2.1);
- banks prefer large investments, above 5 million € which makes the urban waste heat recovery investments less important (information from the shared HRE4/Reuseheat event in Brussels, February 2019).

To summarize, the main barriers to bankability of urban waste heat recovery projects are related to the lack of proven experience on this topic of most of the actors involved. The investments are too small to motivate a bank to engage in a due diligence process which necessitates some kind of bundling activity of urban waste heat recovery investments to make them bankable. Also, existing incentives for renewables create a competition that constitutes a barrier to urban waste heat recovery projects.

5.2. Recommendations

To overcome the aforementioned barriers policy changes are essential (both at EU and national level) to increase the bankability of urban waste heat recovery investments. These are:

- **Support to the implementation of pilot projects;**

The implementation of pilot projects, as in the case of Reuseheat demonstrators, has the main aim to demonstrate the technical feasibility of technological solutions to recover heat available at urban level from a number of different sources, and proving the economic profitability by evaluating the capacity of the projects to operate as expected thus guaranteeing the cash flows to repay the possible debt with a bank. Moreover, these demonstrators allow collecting real monitored data on all project phases, from the design and permitting early stages to the procurement, construction and installation ones and to the real systems operation period, thus generating technical and non-technical knowledge for all stakeholders involved in the project and making easier the replication of this kind of projects even under a bankability perspective.

The implementation of pilot projects does not necessarily imply the financial support of public entities; many urban waste heat recovery investments are profitable also without incentives and first-of-a-kind projects may be realized by utilities with own funds or recurring to corporate finance instead of project finance. This would allow building a track record related to the kind of projects that could be used to request project finance in the following

similar investments, and is especially useful for utilities managing a DH network willing to exploit urban waste heat in more than one location. Generally speaking, it is also worth highlighting that the involvement of utilities is a plus in the bankability assessment; indeed, these companies are considered as reliable as experienced in the energy sector and the same urban waste heat recovery project has a higher probability to get funding if promoted by an utility rather than, for example, by the waste heat owner.

- **Improved legal framework;**

As concerns the improvement of the legal framework, a top-down insertion of the exploitation of urban excess heat sources in the EU and national strategies, and subsequently in plans made by regions and municipalities would result in an increased knowledge about these opportunities and in easier, faster and more standardized permitting processes. This will reduce the risk associated to these projects in terms of possible delays.

- **Promote financial support and guarantees for the investments**

Regarding the need of dedicated incentives or public funding schemes for urban waste heat recovery projects, a proposal for a credit facility including a public guarantee is presented in the following section. In addition to this, the involvement of the public sector, especially at local scale – e.g. municipalities – in the realization of urban waste heat recovery projects financing is a plus that increases the bankability of the projects not in terms of reducing intrinsic project risks but at least in terms of increasing the equity provided by project proponents thus reducing the fraction of investment covered by debt.

6. Proposal for a Credit Facility for Urban Waste Heat Recovery Projects

The previous sections have shown that financing an urban waste heat recovery project is typically considered as risky by most commercial banks, unless a number of conditions are verified. The presence of a guarantee from the public sector is considered by banks as a positive aspect in the decision making process about financing and such experiences already exist in the field of energy efficiency projects.

For these reasons, the present section is dedicated to the proposal of a pilot credit facility for financing urban waste heat recovery projects, foreseeing that part of the risk related to funding is borne by a public body due to the importance of these projects in the EU strategies for heating and cooling and more in general for energy and environment.

The proposed credit facility foresees a long-term financing made available by an Institutional Bank, acting as sponsor, to one or more Commercial Banks in the EU and the issue of a credit guarantee fund by national or supranational entities aimed at covering risks related to the performance/availability/delay related to the technology or the urban waste heat source. The risks related to the default of the project proponent or to other financial causes are not covered by the public guarantee and are borne by the commercial bank as per the usual credit evaluation and management procedures. Within this scheme, the key incentive would be constituted by the risk sharing facility rather than by the funding line, since as highlighted during the discussion with stakeholders the lack of liquidity for banks in the EU is nowadays not a key issue.

In addition to the sponsor, the partner banks and the institutional entities, a key role in the support to the credit line is played by a consulting company, which is awarded by the sponsor with the provision of support to all the involved parties. The Project Consultant supports the sponsor and the partner banks in the definition of the procedures and forms of the credit facility and in the monitoring of the progress of the facility as a whole and of single projects, evaluates the requests for funding and provides technical support to applicants.

The proposed facility, having a duration of at least 3-4 years and a total capacity of 20-30 million Euro with maximum 1-2 million Euro per project, works according to the following cycle:

- the entity requesting the loan submits an application form to the selected commercial bank with attached technical documents regarding the urban waste heat recovery project;
- the commercial bank evaluates the creditworthiness of the applicant and, if positive, forwards the technical documents to the project consultant;
- the project consultant carries out a preliminary technical assessment, based on the design documents made available and on the discussion with the project proponent taking place during a dedicated site visit; the output of the assessment is a report validating the technological concept and the cash flow model under a technical perspective and providing recommendations for improvement, if any, to the project proponents;
- based on the creditworthiness verification and on the technical validation, a loan agreement is signed between the commercial bank and the project proponents;
- the project proponent implements the project according to the schedule attached to the application form; the project consultant monitors the progress of the project implementation and provides the commercial bank with periodic updates, especially in case of deviations; at the completion of the project, the project consultant evaluates the consistency of the implemented project with the initial statement and with the objectives of the credit facility;
- the project proponents carry out periodic evaluation of benefits related to the implemented project after the start of operation and submit data to the project consultant that provides periodic updates to the sponsor and the institutional bank on the results of the credit facility;
- in parallel to the above described activities, the project consultant supports the sponsor and the partner banks and provides periodical reports to the sponsor regarding the number of applications and requested loan amounts, the signed loans, the progresses in projects implementation, the achieved energy and environmental benefits, etc.

7. Guideline of Bankability Evaluation of the Reuseheat Demonstrators

At the time of delivery of this deliverable, a detailed business plan and cash flow model is not available for the Reuseheat demonstrators, thus it is not possible to calculate the bankability KPIs to carry out a tailored assessment of the business case (waste heat owner – technology providers – end-users). Moreover, the public nature of the present deliverable would not allow disclosing business-related financial parameters that may be confidential.

Taking the above into consideration, as well as the aim to realize a more general assessment of the waste heat sources and technologies for the demonstrators, a different approach is applied to evaluate the bankability of Reuseheat demonstrators.

More in detail, this paragraph qualitatively assesses the relevance of the main identified barriers to the four demo types, i.e. heat recovery from sewage network, datacenters, underground stations and hospitals. The higher is the relevance of barriers for a demo type, the lower is the potential for bankability.

In table 7.1, guidelines for bankability evaluation are obtained by reviewing the severity of barriers. The table indicates the severity of different barriers to the demo heat source typologies. If the relevance is higher, lower or more or less equivalent compared to other demos. Based on this qualitative assessment, it can be stated that heat recovery from hospitals and datacenters are the demo types that appear to be characterized by a slightly higher potential for bankability, due to two main reasons:

- the more steady operation of the system from which heat is recovered during the year (i.e. lower seasonal variations), with more stable availability of heat and potentially more stable efficiency of used devices;
- the potential for reuse of the recovered heat within the same site/building/organization, which leads to a more limited impact of issues related to contracts with third parties and also to permits needed.

Barrier	Sewage	Datacenters	Underground	Hospital
absence of similar projects	Low	Medium	Medium	Low
lack of technical knowledge and experience of stakeholders	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)
long payback period	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)
operational risks in regards to supply, operation, maintenance, pricing, insurance, quality assurance, monitoring, billing and renegotiation	Medium (depending on contracts signed)	Low (if heat is reused within the building) Medium (in other cases)	Medium (depending on contracts signed)	Low (if heat is reused within the building) Medium (in other cases)
risk of underperformance	High (not negligible seasonal variations)	Low (steady operation in different seasons)	High (not negligible seasonal variations)	Medium (quite steady operation in different seasons)
no clear legal framework and authorization procedures and possible impact on project implementation timeline	High (significant need of civil works needing permits)	Low (if heat is reused within the building) Medium (in other cases)	High (significant need of civil works needing permits)	Low (if heat is reused within the building) Medium (in other cases)
preference to finance different technologies or larger projects	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)	Medium (no significant difference with other demos)

Table 7.1: Relevance of identified barriers to different demo types

8. Conclusions

A project is bankable if lenders are willing to finance it, which means that it has sufficiently low risk, high success probability and future cash flows to repay the loan.

The findings indicate urban waste heat recovery investments are generally considered as high-risk projects by banks. One main reason is the low maturity of the technical solutions but equally important is the fact that there is no legal framework in place on urban waste heat recovery. For increased penetration of urban waste heat recovery investments policy changes are important (putting the legal framework in place, incentivize pilot projects and promote financial support and guarantees).

Urban waste heat recovery investments are interesting to investors but the investments are too small to motivate the conventional due diligence process of banks which constitutes another hurdle calling for new solutions to unlock finance for urban waste heat recovery investments. One way to do so would be the installation of a dedicated Credit Facility to urban waste heat investments incentivizing investments across the EU.

In order to address the identified issues, policy recommendations have been provided as well as a proposal for a Credit Facility of urban waste heat recovery investments.

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