Report on bioenergy business models and financing conditions for selected countries

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ABBREVIATIONS

EE	Energy Efficiency
RE	Renewable Energy
DH	District Heating
CHP	Combined Heat and Power
FI	Financing Institution
RES	Renewable Energy Sources
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
CRC	Carbon Reduction Compensation
GHG	Green House Gas
NEFCO	Nordic Environment Finance Corporation
ERDF	European Regional Development Fund
EAFRD	European Agricultural Fund for Rural Development
LE	Federal Austrian Rural Development Programme
GGF	Green for Growth Fund
EPEEF	Environmental Protection and EE Fund

1 INTRODUCTION

The Horizon 2020 project **Bioenergy4Business** aims to **increase the usage of bioenergy through an (at least partial) fuel-switch from coal, oil or natural gas, which are used in "in-house" boilers in commercial sectors for heat purposes or in district heating (DH), to solid biomass sources**. The erection of completely new biomass heat applications is considered as an option as well. Bioenergy4Business focuses on solid biomass sources and on medium and large heat-only boilers (> 100 kW heat load) providing low temperature and process heat for commercial usage.

Bioenergy4Business will build bridges between policies and markets to support the creation of an enabling environment, the use of sound business and financing models and the careful assessment and implementation of bioenergy heat in local and district heating and in "in-house" applications. These aspects will be considered for the most promising market segments among industry and commerce, residential buildings, agriculture and commercial and public services.

Bioenergy4Business involves partners from 12 EU Member States and Ukraine. 12 of these project partners (AT, DE, BG, CR, FI, GR, NL, PL, RO, SK, UA and DK, except BE) are target countries, where tailor-made activities for the most promising market segments will take place from January 2015 until August 2017.

This report, **D3.4 "Report on bioenergy business models and financing conditions for selected countries"** is developed under WP3: Analysis of bioenergy business models, regulations, support schemes and policies.

The report presents for the target countries of the project the most common business models and financing options for bioenergy heating installations.

In addition, a cross-country comparative overview indicating the similarities and differences between the business models and the financing options of the target countries is presented.

2 ANALYSIS OF BUSINESS MODELS AND FINANCING OPTIONS IN TARGET COUNTRIES

2.1 Romania

2.1.1 Business models

Description of business models

According to ANRE (Romanian Energy Regulator) there are 8 operational biomass CHP plants in Romania.

The most common business models in Romania are the **Investor's own business initiative** and the **Energy Supply Contracting**.

The **Investor's own business initiative** is used for in-house heat production in industrial facilities that produce wood products. Under this business model, the investor, who owns an industrial facility that produces wood products, installs a biomass heating or a biomass CHP plant financed by his own capital and a bank loan. With this investment, the investor covers the heating needs of its industrial facility, thus reducing its energy costs. The excess electricity (for the case of CHP plant) is sold to the national grid while the heat is used exclusively to cover the heating needs of the industrial facility. Biomass is derived as a by-product of the industrial facility and therefore the investor has abundant raw material at his premises to fuel the biomass heating / CHP plant.

The **Energy supply contracting** business model is used to cover the heating needs in wood-based industrial facilities through the construction and operation of a CHP plant. The excess electricity, if exists, is sold to the national grid.

Main stakeholders / role

Under the **Investor's own business initiative** the main stakeholders / actors involved are the investor and the financing institution that provides the loan. The role of the financing institution (bank) is to provide long term financing for the project for equipment supply, set-up and construction of the biomass heating / CHP plant.

Under the **Energy supply contracting** the main stakeholders / actors involved are the ESCO and the owner of the wood-based industrial facility (who acts as the "customer" for the ESCO).

Ownership of the biomass heating system

Under the **Investor's own business initiative**, the investor owns the whole biomass heating / CHP plant and is responsible for the O&M and other related costs.

Under the **Energy supply contracting** the whole biomass CHP system is in the ownership of the ESCO and is responsible for the O&M and other related costs.

Level of support of the legislative framework to the business models

The current legislative framework **does not promote/support investments in biomass heating or biomass CHP projects**. However, the Romanian Sustainable Energy Financing Facility and the available structural funds provide grants to support investments in biomass heating (presented in the section "*Financing options*").

It is noted that Romania is currently preparing a number of important laws such as the Biomass Law, the Heat Law, the Feed in Tariff system as well as changes to the Law 220/2008 on the promotion of energy from RES in order to provide incentives and further support for biomass heating projects.

Advantages, weaknesses and effectiveness of the business models

The advantages of the **Investor's own business initiative** business model are summarized in the following:

- Reduction of the energy costs (heating) of the main industrial facility
- Security of supply since biomass is derived as a waste from the main industrial activity of the investor
- Supply of biomass at no cost. In this business model, the investor uses its own biomass waste derived from the main activity of his industrial facility
- The production capacity is tailored to function so as to respond to the investors specific energy needs.

The main **weakness** of this business model is that the investor finances an important part of the investment (at least 25 - 30%) by his own capital and to this end, faces **financial difficulties** in investing in such kind of projects. One other issue the investor is facing is the fact that currently, in Romania there are very few **low-interest or dedicated loan packages** to support investments in biomass heating (mainly provided through the Romanian Sustainable Energy Financing Facility).

The **Investor's own business initiative** business model is the most commonly used in Romania for developing biomass heating / CHP plants. Actually, the investors who are involved in the wood processing industry, prefer this model since they use the heat produced by the biomass heating / CHP plant to cover the heating needs of their main industrial facility.

The **Energy supply contracting** business model facilitates the implementation of medium and large scale (capacity of more than 1 MWth) biomass heating projects. Major **advantages** are the following:

- no own initial investments are necessary for the customer
- assignment of duties to the contractor (organization, operation of the plant)
- assignment of risks to the contractor (financial, technical)
- savings in fuel consumption due to efficient operation of the plant

The major **weaknesses** are generated by the lack of complementarity between the legislative provisions regarding concession of lands, concession of services, electricity and heat supply, commercial law, etc.

This model is **considered efficient** for the projects developed in partnership with another private entity. However, the PPP are very difficult to be developed, as there are no specific provisions on the matter; such partnerships do not actually exist, except for a few projects at initiation / study stage.

Key features of a typical raw material supply contract

Under the **Investor's own business initiative**, the investor does not enter into any kind of contractual relationship with external biomass suppliers in order to cover its biomass supply needs, as he uses its own biomass waste produced from his wood-based industrial plant.

Similarly, for the **Energy supply contracting,** biomass is provided by the owner of the wood-based industrial facility.

Key features of a typical heat delivery contract

As in the previous case, for both business models, there is not any kind of contractual relationship with end-customers, since the heat produced from the biomass heating / CHP plant is used exclusively to cover the heating needs of his own.

2.1.2 Financing options

Description of financing options

The available financing options in Romania are:

1. Loans from financing institutions
2. EU grants (RoSEFF[1] program)

The most commonly used financing options, which are analysed below, are the **loans and the EU grants offered by RoSEFF**.

Loans: **Loans** granted by the **banks and non-banking institutions** remain the most important source of funding for investments in biomass projects in Romania. Private banks are providing loans through:

[1] Romanian Sustainable Energy Financing Facility

- **own financing packages** (such as "the loan for renewable energy" from ProCredit Bank)
- **tailor-made financing solutions** (such as the loans granted by the Romanian Commercial Bank, the largest private bank of Romania in terms of market share)
- **financing programs developed with the involvement of financing facilities offered by the EU and EBRD – ROSEFF program** (such as BCR, BRD – Groupe Societe Generale, Banca Transilvania, Unicredit).

Loans are also provided by the **Romanian Fund for Energy Efficiency (FREE)**, a non-banking financing institution authorized by the law to finance EE projects; however, FREE has financed RES projects as well, including **projects in the biomass sector**.

There are typically two types of loans available: traditional financing (available from banks) and project financing (available from both, banks and non-banking financial institutions).

In **traditional financing**, the focus is the company's overall financial capacity to repay the loan from the activity it develops and the medium and long term prospects, plus the capacity of the company to submit value titles or other assets destined to guarantee the loan. In **project financing**, the focus is the project reliability (**most banks require the creation of an SPV in this respect**).

Grants: ROSEFF provides both loans and grants. The Financing Facility is supported by the EU the EBRD and supports SMEs to invest in EE and RES investments, including biomass heating projects. **The program is active until the end of 2015**. ROSEFF is implemented in collaboration with 4 Romanian Banks (Romanian Commercial Bank, Romanian Development Bank – Groupe Societe Generale, Transilvania Bank and UniCredit). At present, **227 investments** are under implementation or have already been implemented. The total funding provided is **EUR 43 million**. For large investments, the loans can be up to EUR 1 million while for the small-scale investments the loans can be up to EUR 250,000.

The financing procedure includes the following steps. The applicant submits the application to ROSEFF for evaluation. Once declared eligible, the applicant may apply for a bank loan from any of the 4 banks involved. ROSEFF verifies the implementation of the project taking into account eligibility criteria and refunds a variable percentage of the investment (loan) to the applicant, under the form of a **non-refundable grant (10 – 15% of the loan)**.

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the loans' schemes in Romania are:

- **Customer-oriented attitude** towards the investor and during the overall assessment of the project

- The **grace period** for refunding the loan can be stretched up to 4 years (typically is between 1 and 2 years)
- The **loan period** can be up to **15 years**
- There is a **mix of warranties** (value titles, real estate, components of the CHP / biomass plant, the company's assets) accepted by the financing institutions.

On the other hand, loans' schemes have the following **weaknesses** in Romania:

- **Strict financing conditions**. The financing institutions apply a large number of financial parameters to assess the creditworthiness of the project.
- **High share of the equity capital** (20 – 35% minimum)
- The evaluation period of the application exceeds 30 days
- The **interest rates are high** and not attractive
- **Large number of documents** is required by the financing institutions (legal, financial, business plan, feasibility study, etc.) for the evaluation of the project.

Loans represent the most used financing instrument by biomass heating project developers. At the current stage, the market of biomass heating is emerging in Romania. The potential is high, and it is expected that the new legislation (under preparation) regarding biomass, heating, Feed in Tariff system and the promotion system of the energy produced from RES, will ensure the grounds for the valorisation of such potential.

Grants

Currently, grants provided by the ROSEFF in Romania are able to finance fast track investments in new equipment. The eligibility certificate can be generated online very quickly (in only 10 minutes). Apart from the equipment, grants are provided also to finance whole plants / facilities. **ROSEFF has financed so far two biomass CHP plants;** both of these projects are in-house biomass fuelled CHP plants that were constructed with the purpose to cover the energy needs of the main industrial plant that produces wood products. The **grants cover up to 15% of the received loan amount**.

On the other hand, the main **weaknesses of the grants** that are offered by ROSEFF are the following:

- The RoSEFF program is active until the end of 2015 when the program is closed
- The grants are provided **after the implementation and verification of the EE / RES investments**
- The main aim of the projects that apply for receiving grants is the energy savings achieved
- **There is a large number of documents** required from the investor (legal, financial, etc.) in order to apply for a grant.

Concerning its **effectiveness**, ROSEFF has financed a large number of small and large scale projects, of which 2 were for biomass CHP plants. **Investors consider ROSEFF as a reliable and preferred financing option** for their projects.

Financing options from structural funds

The structural funds available for Romania in the **renewable energy field are few**. At the moment, **none of them is active, but are expected to open within 2015**. These are:

POS CEE 4.1A – Energy efficiency: The aim of this program, addressed to industrial enterprises (the biomass heating sector is included), is to offer grants for up to 70% of the investment value for implementing EE measures (replacement of high energy-consuming machines with modern low-energy equipment); the EE measures should result in savings of at least 5%. Besides the replacement of equipment, also **investments into cogeneration plants are eligible**, provided however that more than 60% of the energy produced is used internally.

POSCEE 4.2 – RES Investments. New capacities of production for electricity and heat or upgrading of the existing ones: The grant may be awarded to applicants for investments in the energy sector, for both new production capacities and the modernization of the existing ones. The aim of the financing program is the reduction of dependence on fossil fuel imports, and the diversification of the energy production sources. The energy produced can be used for own consumption, but at the same time, can also be supplied to the national / local grid. The conditions that the investment projects must fulfil are:

- Comply with European Union environmental policy
- The energy savings must be measurable and quantifiable
- The implementation period must not exceed 4 years
- The maximum value of the project must not exceed EUR 50 million.

PNDR (National Program for Rural Development): In 2014-2020 financing session, a part of the grants designated to finance investments in farms, will be directed towards the acquisition of equipment for the production of electricity and heat for own consumption from renewable sources. A special amount will be designated for financing the creation of non-agricultural assets – the production of fuels from biomass. The funds can also be accessed by other economic entities apart from farmers, for the processing of biomass in order to produce electricity and heat.

Difficulties in financing biomass heating projects

The main problems for financing a biomass heating project in Romania are the following:

- Lack of equity capital
- Time delays with respect to acquiring the necessary operating licenses
- Availability of long-term contracts for primary biomass supply
- Immaturity of the market in the specific technology
- Unstable and volatile regulatory framework.

Main conclusions from the interviews with the banks

ARBIO interviewed **two Financing Institutions** (FI) that have financed biomass heating / CHP projects in the past. The financing institutions that were interviewed were the Romanian Commercial Bank (BCR) and the Romanian Fund for Energy Efficiency (FREE).

BCR has financed **1 biomass-fired CHP plant** (9 MWe) and FREE has financed **4 biomass heating / CHP projects** so far (2 more projects are in the phases of contracting and under examination).

Both FIs have available **financial experts with experience on RES projects** without however having undergone any specific **training** for RES or biomass projects.

Both FIs **offer guidelines** and information material to their clients for financing RES (including biomass) projects. The guidelines are in the form of a **checklist** or in the form of an **application form** that the client has to fill in, in order to be eligible to receive the loan.

They both offer **loans** to their prospective clients. BCR provides the following types of loans: investment facility, bridge facility, VAT financing and overdraft facility. The **interest rates of the loans vary** and they depend either on ROBOR[2] / EURIBOR or LIBOR[3] rates including a margin. On average, the minimum share of the equity capital is between 20 – 35% and the maximum life of the loan is between 4 – 12 years.

The biomass CHP project is financed by BCR in **2011** while FREE has financed such investments **since 2005**.

Both FIs consider providing financing for **biomass DH projects as well as for projects dedicated to in-house production/usage of biomass heat** and both of them take into account **sustainability and environmental considerations** before financing biomass heating projects.

Table 2-1 provides the **stipulations / requirements** that the FIs check from their clients in order to finance biomass heating projects.

Table 2-1 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Romania)

Stipulation / requirement	BCR	FREE
Security of feedstock supply		
Existence of heat supply contracts and guarantees	✓	✓
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers	✓	
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓ The business shall be integrated (biomass provider part of the SPV shareholding structure)	✓

[2] Romanian Interbank Offered Rate
[3] London Interbank Offered Rate

Stipulation / requirement	BCR	FREE
Indexed heat sale price	✓ As per heat off-take agreement, however regulated price in case of DH systems	✓
Indexed biomass price	✓ Fix prices or index no higher than the heat index	✓
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)	✓ 30%	
Land ownership titles of biomass supplier (no traders)	✓ The biomass supplier shall own at least 200% of the necessary land	
Other (please specify)	The biomass supplier shall own at least 150% of the biomass/input material	
Technical		
Technical due diligence (DD)	✓	✓
Possibility of an Engineering Procurement Construction Contract	✓ The EPC contractor shall provide warranty period for performance reliance and achievement of efficiency ratio	
Review of main contractors and service contracts	✓ Included in the technical DD	✓
Assessment of the technical concept and of process engineering	✓ Included in the technical DD	✓
Assessment of the operation and maintenance (O&M) regime	✓ Included in the technical DD	✓
External construction supervision (verification)	✓ Included in the technical DD	✓
Review of profitability calculation	✓	✓
Other (please specify)	Proven technology	
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓	✓
Legal assessment of production licences, environmental permits, etc.	✓	
Assessment of real-estate property (hypothecs, etc.)	✓	✓
Network connection agreement	✓	✓
Existence of operation and maintenance contracts	✓	✓ Not mandatory
Other (please specify)		
Financial		
Evaluation of business plan	✓	✓
Minimum share of equity capital	✓ 35%	✓ 20-25%
Upper limit for the residual investment value		✓ 80%
Upper limit in percentage of (guaranteed) cash flow		✓ 110%

Stipulation / requirement	BCR	FREE
Upper limit for the Pay Back period	✓ 12 years	✓ 6 years
Minimum Debt Service Cover ratio	✓ 1.3	✓ 4
Minimum Return on Equity		✓ Not mandatory
Maximum lent term (life of the loan)	✓ 12 years	✓ 4-5 years, max 6
Upper limit regarding technical life-time of main equipment	✓ 15-20 years	✓ 10 years
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	✓	✓ Significant advantage
Other (please specify)		
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default	✓	
Supplier's obligation to retain agricultural / forestry production	✓	✓
Account pledge	✓	✓ Included in the warranties package
Risk insurance (liability, damage, business interruption)	✓ Assigned in favour of the bank	✓
Other (please specify)	Mortgage on all project assets, including mortgage on the shares of the SPV	✓

The most important factors that the FIs consider in order to provide financing for biomass heating projects are presented in the **Table 2-2**.

Table 2-2 Important factors that the FIs consider to finance biomass heating projects in Romania

Factor	BCR	FREE
Investor credibility	✓	✓
Project IRR		✓
Payback Period		✓
Maturity of the project / technology	✓	✓
Long term biomass supply contract with predictable raw material prices	✓	
Long term heat delivery supply contract	✓	
Other	Stable regulatory framework	

It is noted that both FIs have **cooperated with other financial institutions** for financing biomass heating / CHP projects (i.e. ROSEFF) and in addition the financing options they

offer are designed to cooperate with financial instruments developed by the **Government**.

According to FIs, the **development potential** of the biomass heating market in Romania is **huge** and biomass heating / CHP projects can play an important role in the development of Romania's energy system. Biomass is abundant and can be used in DH systems, which is the most commonly used heating system in the country. However, biomass has to meet sustainability and environmental requirements.

Both FIs are interested to increase their credit lines for biomass heating projects.

2.1.3 General data on the DH sector in the country

The following Table 2-3 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-3 Data of the DH sector in Romania and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	Not applicable; the heat is used to cover own heating needs.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	Not applicable according to the current legislation.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	There are some **DH projects under development** that intend to solve the heating needs of local communities in cities such as Huedin, Suceava and Buzau.
4. **Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises**	Not applicable.
5. **Payment of costs related to customer's connection to the DH grid**	The customer bears the costs for the connection to the grid and for the metering device and retains ownership of the later.
6. **Measurement of the DH demand at the customer's premises**	Yes; the installation of the general meter at the connecting pipe is borne by the heat supplier, while the individual metering, depending on its case, is borne by the customer.
7. **Payment behaviour of DH customers to the SPVs**	The existing companies delivering heat to the local distribution operators face **financial problems related to the debt collection**. The existing DH system is old and deprecated and the customers are accusing the DH operators for charging high costs. **Since 2005, the customers are free to disconnect from the grid and opt for individual heating solutions**.
8. **Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant**	The financing institutions require contracts of at least 10 years, with a predictable (stable and clear formula) or fixed price, and concession rights over the distribution grid from the city hall.
9. **Strengths and weaknesses of the (fossil and biomass fuelled) DH sector**	**Strengths of the fossil fuelled DH sector**: › The fossil fuelled DH sector in Romania is in operation for many decades; therefore there is plenty of experience and

Parameter	Applicability in the country
	know-how in running DH projects › There is a regulated price; the local authorities set a cap on the price the utility provider can charge the end-customer. **Weaknesses of the fossil fuelled DH sector**: › High production costs resulting in high costs for the customers (although the price is capped, the consumer ends up covering the losses) › Obsolete production and distribution / supply facilities › High O&M costs › Significant energy production and distribution losses › Consumers' tendency to disconnect from the DH grid. There are many complaints regarding the costs which are considered high and non-transparent › Old and inefficient technologies. **The biomass fuelled DH system** is **not yet developed** in Romania, but the situation is expected to change since the country prepares the new Biomass Law and the Heat Law that are expected to promote and support investments on biomass. In addition, Romania has abundant biomass resources which represent an advantage and pave the way towards the swift to biomass based DH plants.
10. Economic health of the existing biomass DH sector	The DH sector in Romania is currently **under-developed**. The existing units are cogeneration units, but they are mainly based on the production and delivery of electricity and not heat. The main purpose of the new Heat Law, which is currently under debate and expected to come into force in the near future, is to regulate the sector and set the parameters of its development.

2.2 Austria

2.2.1 Business models

Description of business models

There are **numerous business models** in place in Austria, which is a consequence of – or a prerequisite for – the successful market diffusion of biomass DH systems and in-house big biomass boilers (Figure 2-1). Currently there are **more than 1,400 biomass DH plants** (small and large scale; Austria has ca. 2,400 villages), ca. **130 solid biomass CHP green electricity installations and more than 10,000 (commercial and private) in-house biomass boilers** with a capacity of more than 100 kW in operation.

Figure 2-1 Austrian map with biomass DH plants and biomass CHP plants (source: Austrian Biomass Association)

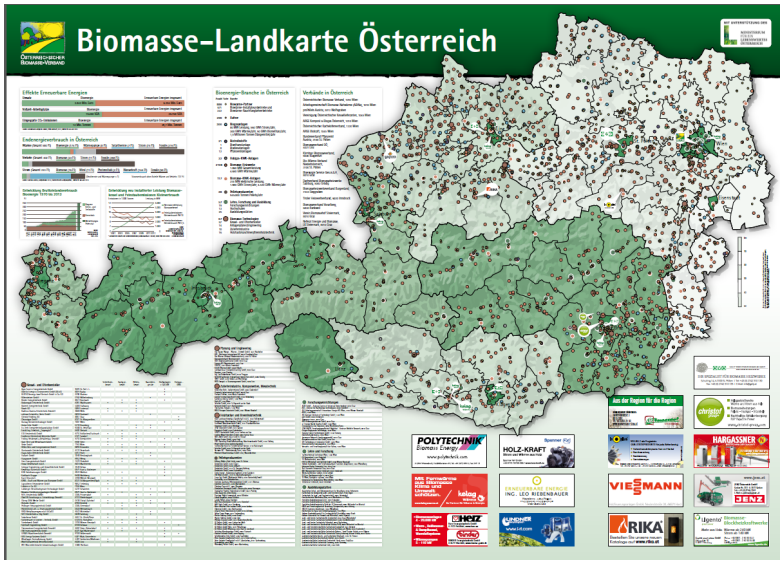
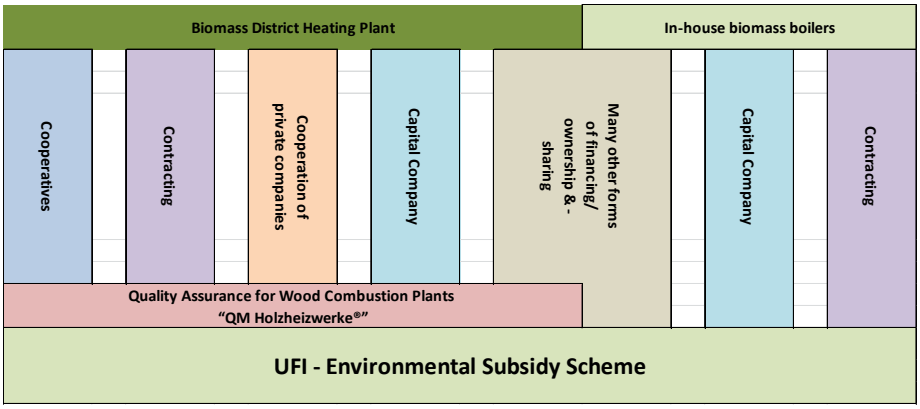


Figure 2-2 gives an overview of implemented business models in the biomass DH and in the in-house boiler sector. All projects fulfilling funding criteria have access to the Federal **UFI – Environmental Subsidy Scheme**. Biomass DH plants with a grid length of more than 1,000 m and a net heat capacity above 400 kW, applying for UFI subsidies, have to take part at the Quality Assurance Program.

Figure 2-2 Principal shape of the Austrian Support Scheme for biomass DH plants and for in-house biomass boilers



The **most common business models** in Austria are:

- **BENÖ (Bioenergy Lower Austria):** The success of Farmers' cooperatives
- **Professional regional cooperation in western Austria:** the case of Bioenergie Tirol (bioenergy tyrol) and
- **Plant-Contracting solutions** for legal persons requiring heat from biomass sources

A further case of plant contracting is the farmer's community based **"rural wood-based energy-contracting" model of Regionalenergie**, a planning office situated in Styria. Regionalenergie together with farmers' communities have **realized nearly 200 biomass micro grid projects with up to 400 kW by now**. A description of this business model, which already spread beyond Styria, is described here:

http://www.biomasstradecentre2.eu/data/intranet/D4.1_Technical%20paper%20energy%20contracting_Lk-Stmk.pdf

The business models of BENÖ and Regionalenergie are suited for smaller biomass heating plants. Larger biomass DH schemes often are owned by (stock or limited liability) companies/energy utilities, the municipality, saw mills with excess heat, farmer's cooperatives or monasteries (which often own forests in Austria). There are also cases where the building with the biomass boilers and storage belongs to a farmers' community and the grid to a classical electricity and gas supplier. The whole biomass DH scheme in such cases is planned by the utility. The utility buys the heat right after the boiler, owns and maintains the grid and arranges the flow of money from customers back to the farmers.

BENÖ (Bioenergy Lower Austria)

BENÖ business model is specific to **small scale DH**, **micro grids**, **in-house heat production and supply** (e.g. **residential buildings, commerce and service buildings, public buildings, agricultural-forestry facilities, industries**), as long as the power output does not exceed the range of several 100 kW.

It is a **"roof-cooperative" for rural cooperatives**. It allows farmers to specialize on the tasks they are easily able to and used to (supply of boilers with biomass/woodchips, operation and simple maintenance of boilers, etc.), while the **peak-cooperative** which has this expertise, performs bookkeeping, detailed planning, etc. **The cooperation of cooperatives allows cost reduction via common procurement of equipment, exchange of experience, etc.**

Bioenergie Tirol

Other than in the agriculturally dominated parts of eastern Austria, the western part of Austria, especially the Federal States of Tyrol and Vorarlberg, are dominated by tourism and a small-structured, high-alpine agriculture. Cooperatives of farmers, although principally known, are not a typical construction for the operation of biomass DH plants in this region. In contrast, capital **companies like limited companies (GmbH) are well known to tourism experts and hotel owners, who are the main customers for DH plants in this area**.

Bioenergie Tirol[4] is one of the regional partners of Energiecontracting GmbH (www.nahwaerme.at). **Energiecontracting GmbH is an energy service provider** which, **in**

[4] http://www.nahwaerme.net/cms/index.php/de/das-unternehmen/team/ansprechpartner-in-den-bundeslaendern/tirol

cooperation with local partners, develops and operates biomass DH plants and other RES plants. In a nationwide network with around 90 partners, nahwaerme.at currently operates 46 locations for energy generation and several locations for raw materials management in Austria.

Bioenergy Tirol has two shareholders, the Nahwärme (www.nahwaerme.at) and the Maschinenring (Federal Organization of Machinery Syndicates, a co-operative of farmers where each of them owns a specific type of machinery and offers the related services www.maschinenring.at). With the shareholder nahwaerme.at, they openly (in the internet) discuss and communicate all relevant experiences of maintenance, financing and operation of the DH plants, so a steady benchmarking of the plants can take place.

This partnership is the basis of a **successful cooperation between the regional partner Bioenergie Tirol, and Energiecontracting GmbH**. Bioenergie Tirol is active in the touristic regions of western Austria. Even in summer, the buildings (hotels, some of them with wellness-areas, municipal buildings etc.) demand up to 25% of the demand of winter-time (usual flats have a summer-demand of only some 10% of winter-demands).

Plant Contracting

The **Plant Contracting** business model is typical for **DH systems** and **heat supply for industrial services**. Principally, however, it may be open for any heat uses.

Aigner is an Austrian company which is active, among others, in **Energy Supply Contracting** (**ESC**) from biomass. The company is placed in Upper Austria; it is active in Austria and its surrounding countries, but also in Canada, North Africa, Japan and Ukraine. It is described as "pars pro toto" for a type of companies offering **biomass plant contracting solutions**.

The contractors in ESC, ESCOs:

- take care for the organization, planning, construction, implementation, financing and operation of energy plants
- intend to improve the efficiency of heat or power generation systems, while providing energy services (supply of heat, cooling, steam, electricity or compressed air) and supply security to the customer.

The **customer**, on the other side, does not buy the energy plant and the technical equipment. Instead, he only **buys the energy in form of heat, electricity, steam compressed air etc. from the contractor (ESCO)**. The energy plant remains the property of the contractor; the period, type and scope of the services can be adjusted individually in an energy supply contract.

Main stakeholders / role

BENÖ (Bioenergy Lower Austria)

BENÖ was founded in 2003 in the Federal State of Lower Austria by six bodies which were active in bioenergy:

- The Lower-Austria federal state government-agency for energy economics
- The chamber of agriculture (timber department)
- The Lower-Austria-heating plant alliance
- The Lower-Austria-timber alliance (70 forest managing communities)
- AGRAR PLUS as the legal entity
- Raiffeisen revisal alliance Lower-Austria – Vienna

Figure 2-3 The Federal State of Lower Austria in the Northeast of Austria

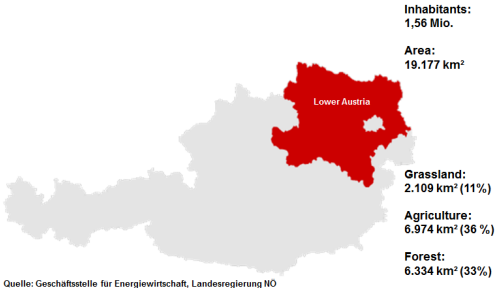
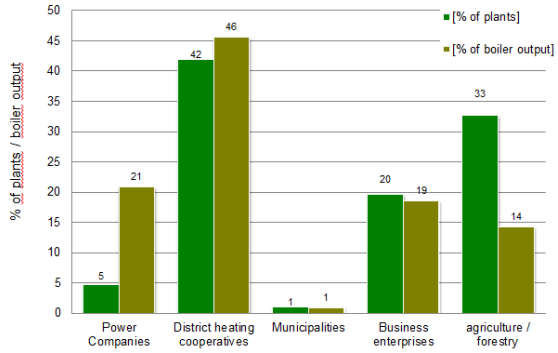


Figure 2-4 Operation of biomass plants in Lower Austria: 42% of the plants, representing 46% of the power, are being operated by DH cooperatives (source: Agrar Plus)



Bioenergie Tirol

As mentioned earlier, the main stakeholders involved are the Nahwärme (www.nahwaerme.at) and the Maschinenring as well as the customers who are capital companies that own hotel buildings, municipal buildings, etc.

Plant Contracting

The main stakeholders involved are the contractor (ESCO) and the customer (from the building and industrial sector).

Ownership of the biomass heating system

Under the **BENÖ business model the whole biomass heating system is owned by the "roof-cooperative"**. However, sharing of ownership would be possible as well.

The **points of transfer of ownership of the heat supplied** are between the grid and the customer.

Either the local members of the cooperative or the "headquarter" of BENÖ take care for **daily business**, depending on the complexity of the challenge. During the operation of the plant, BENÖ takes care for accounting of heat and biomass, supports the operators of the cooperative in accounting, describes and benchmarks the costs for staff and business management, and it periodically revises the balance sheet through the revision alliance.

Under the **Bioenergie Tirol business model** the whole biomass heating system is owned by Bioenergie Tirol; the operation however is delegated to regional experts.

For fuel supply, regional farmers-cooperations are contracted (Maschinenring, Federal Organization of Machinery Syndicates, a cooperation of farmers where each of them owns a specific type of machinery and offers the related services www.maschinenring.at). There is no point **of transfer of ownership of the heat supplied.**

Operation and maintenance of the plants is organized in cooperation with local plumbers/installers as operations / managers.

Under the **Plant Contracting business model** the whole biomass heating system is owned by the contractor (ESCO). The contractor usually rents the necessary space for the biomass plant (boiler room, property of land) from the building owner.

The **points of transfer of ownership of the heat supplied** are usually between the grid and the customer. **O&M, billing** and the related services are the **responsibility of the contractor**.

Level of support of the legislative framework to the business models

All of the 3 business models are supported by the legislation. It is noted that **cooperative structures are very common in Austria**.

Advantages, weaknesses and effectiveness of the business models

BENÖ (Bioenergy Lower Austria)

The general problems farmers face when they start a bioenergy project (like a DH supply for a village) are manifold:

- Lack of information and know-how
- Need for collection of basic data, key benchmarks
- Missing knowledge about support schemes (investment subsidies)
- Need to produce feasibility study and business plan

- Decision: which legal entity, which formation process offers which legal capacity and legal security?
- Complex technical planning of the plant
- Authorizations needed for the plant
- Accounting during building phase and during operation of the plant
- Accounting of heat and biomass: costs for accountant, staff, and business management.

BENÖ was founded to provide a simple answer to these problems. To avoid a complex formation process, BENÖ **works as a ready-to-use legal entity for farmers**, as a "**cooperative for rural cooperatives**". A cooperative is open at any time for new members: It is no problem when a member contracts out and leaves the cooperative, as well when it enters the cooperative[5]. **Further advantages of cooperatives** are:

- it takes care of the members benefit
- the business purpose is to get a good price for the agricultural/forestry product (biomass/wood chips)
- it is open for new members at any time
- it reduces costs for each member and for each plant
- common actions can be performed, for example marketing
- restricted liability for members
- direct influence of the members on the management.

BENÖ is based on existing infrastructure. To become a member of BENÖ, the one-time entry flat rate amounts to only EUR 600, reducing the costs for the foundation of a legal entity. **As a member of BENÖ, the farmers-cooperatives are supported during pre-feasibility and call for tenders, and during all steps of investment, the financing process, and the construction of the DH plant**. A benchmark system allows comparing plants to each other, as related to construction and operation. During operation, heat meters can be calibrated in common. Risks of operation can be reduced through uniform insurance.

While big plants with an average power of 5.4 MW are usually being operated by power companies, the preferred power range of boilers which are operated by cooperatives is below 750 kW (the average boiler size of new plants operated by cooperatives has decreased to below 400 kW). In this respect, the operating cooperatives are usually small too. **The "weakness" of BENÖ** could be referred to as the fact that cooperatives are not used to operate complex big industrial biomass plants but have their natural power threshold below 1,000 kW.

The **BENÖ business model is considered very effective**. As of 2014, there have been 328 members of the cooperative BENÖ **operating roughly 50 DH plants**, among them mainly farmers and timber owners, and 390 heat consumers (private consumers, residential

[5] In another legal entity or construction (limited, for example), for any leave from and entry into the entity, a notary would be needed, an inscription in the companies-register, etc. This causes additional costs and consumes time

buildings, public buildings, business enterprises, confessional buildings etc.) would be supplied with heat. The total power connected amounted to 11.6 MW, the length of the grids was 11.6 km. Annual heat sales of some 13 GWh compensated for fuel oil sales of 1.6 million liters per year and a calculated reduction of CO_2 emissions of 5,200 t/a. The regional added value generated through the sale of forest wood chips amounted to 380,000 €/a.

Bioenergie Tirol

The **involvement of communities in project development is a success factor**. The argument of bioenergy for eco-tourism is currently being used by some of the hotels and customers of biomass DH. Some hotel owners, however, have even started to carry out field trips to the DH plants as an alternative for tourists when there is bad weather. Besides that, **the main argument for a biomass DH plant, however, remains its economic competitiveness, as compared to fossil fuels (heating oil).**

Bioenergie Tirol is considered **effective** since it offers a **turn-key solution** to its customers.

Plant Contracting

There are **many benefits of this system** for the customer which help to promote biomass heating among industries which would not utilize it without the possibilities of contracting:

- no own initial investments are necessary for the customer, so financial resources can be used for other purposes
- one contact person for the whole project
- use of modern and efficient technology and special know-how by the contractor
- use of renewable and clean energy
- savings in fuel consumption due to efficient operation of the plant
- assignment of duties to the contractor (organization, operation of the plant)
- assignment of risks to the contractor (financial, technical)
- guaranteed reliability: maintenance, repairs, operation, optimization, are done by the contractor
- modern image of the real estate
- quick realization is possible
- security of supply.

On the other hand, financing of biomass heating plants has become more and more **difficult due to bank-restrictions** (Basel III) and reduced risks taken by banks. The contractor has to take the **risks of insolvency of the customer**.

The business model is **preferred by project developers** who want to be guaranteed the above services without being involved in construction and operation of plants. Such

project developers are usually customers who concentrate their forces on their business apart from bioenergy (hotel owners, industrial customers, etc.).

Key features of a typical raw material supply contract

Under the **BENÖ business model**, the members of the cooperative usually supply themselves the raw material to their biomass heating plant. The **subject of the agreement** is the needed quality, the guaranteed quantity of the biomass delivered, the contract duration and the biomass price terms. The **price** is set according to other biomass DH plants and is based on a system of indices comprising costs of heating oil, costs of a typical labour hour etc. **This setting of the price is common among all types of business models.**

Under the **Bioenergie Tirol business model,** there is no purchase of the biomass directly from the producers, but there is a general supplier of biomass for the heating plants: for fuel-supply, regional farmers-cooperations or cooperatives are contracted (Maschinenring). The fuel supply is organized in cooperation with them. The **subject of the agreement** is the needed quality, the guaranteed quantity of the biomass delivered, the contract duration and the biomass price terms.

Under the **Plant Contracting business model**, the **subject of the agreement** for a biomass supply contract is the needed quality (forest-woodchips, bark, from hard- or softwood, etc.), the water content, the guaranteed quantity of the biomass delivered, the contract duration and the biomass price terms.

Key features of a typical heat delivery contract

A **contract between a heat supplier and a heat consumer can be established freely**. Usually, however, the contract would follow the guidelines of a 16 page model contract which is available via a website[6] and which would only little differ from one of the Austrian federal states to the other. According to this reference, a **typical heat delivery contract between a heat supplier and a customer would comprise the following elements**:

- maximum power connected (kW)
- average annual heat delivery (MWh/a)
- the duty of the customer to allow the construction of the heat transfer station in his building – the heat transfer station would remain property of the heat-supplier
- the time of heat-delivery: only in the cold season or the whole year round, both options are possible
- an obligation for the customer not to use any additional heating systems (with the exception of tiled stoves, solar thermal plants and similar devices)
- obligations for the customer to maintain and service his part of the heating system
- composition of the price for the heat, which consists of three parts:

[6] see http://www.noe.gv.at/Umwelt/Energie/Biomasse/Mustervertrag.html

  - a heat-price (€/kWh) which would cover variable costs like fuel costs, ash disposal costs, and others
  - a basic price (€/month or per year), which would cover fixed costs on the side of the plant like investment, plant management, maintenance, all independently form energy consumption
  - a meter rent (€/kW), which covers fixed costs on the side of the customer
- some regulations referring to the time of payment by the customer (4 times a year, monthly, etc.) and rights of the heat supplier in case of non-payment
- a reference to price-adjustment and
- some technical details of the plant, the heat-delivery station etc.

For **BENÖ business model,** the typical duration of a contract is **15 years**, however, contracts can be terminated earlier by the customer of the plant.

For **Bioenergie Tirol business model**, the typical duration of a contract is **15 years**. Furthermore, the contract ends when the customer does not fulfil his duties (payment, maintenance, service, etc.).

For the **Plant Contracting business model**, the typical duration of a contract is **15 years**.

2.2.2 Financing options

Description of financing options

Typical financing options in **Austria** are **bank loans** taken either by privates on their own risk for small-scale projects or by legal persons on the risk of legal person for larger projects. Almost all banks offer loans in Austria. However, **some of them are specialised** in bioenergy projects. Among them are banks of the Raiffeisen-group and the ERSTE group (interview with representatives of both groups are part of this report).

Another very common financing option is the **UFI** (Federal Environmental Assistance in Austria) **subsidy** of the Federal Environmental Aid Act (Umweltförderungsgesetz). The UFI subsidy, which is an **investment subsidy**, depending on the characteristics of the project can cover **30-40% of the total investment costs**. Since 1993, among other measures having a positive impact on the environment and climate, the deployment of installations utilizing biomass for "in-house" and DH production and the (new erection as well as the extension and compaction of existing) heat distribution grid installations is supported for municipal, commercial, agricultural and industrial applicants by direct investment subsidies. **Without the UFI subsidy, there would be no such development of biomass heating projects in Austria**.

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the **loans' schemes** in Austria is that they fill the gap of financial needs between equity capital on the one side, the support scheme UFI, and the financial

demand of a project. They are a flexible instrument for project financing, and banks can profit from a learning process from one project.

As a consequence of the bank crisis and some big insolvency of DH operators, the **credit policy of banks has become more and more restrictive in financing DH systems**. They avoid financing innovative technological solutions and demanding more and more securities from project developers.

Bank loans are **considered effective** and they are preferred by the project developers.

UFI subsidy

UFI subsidy scheme has made all the other developments, business models etc. in biomass heating, possible.

Like any support scheme, UFI was **attributed as being inflexible with respect to quickly changing frame conditions**. In earlier years (in the 1990s), UFI lacked a supporting quality management system which would have assured that biomass DH plants would be built and operated in high quality. In the meantime, the QM Heizwerke was implemented, which works as this quality management scheme.

It is considered **very effective** since between 2011 and 2013:

- **1,622 biomass "in-house" boilers** (utilizing 307 GWh biomass)
- **312 biomass micro grids** (utilizing 99 GWh biomass) and
- **426 biomass DH installations** (utilizing 1,006 GWh biomass)

have been **subsidised with EUR 14, 12 and 44 million cash value respectively**. From 2011 to 2013 the average investment subsidy related to environmentally relevant total investment cost of the projects was 20.9% for biomass in-house boilers, 24.1% for biomass micro grids and 13.5% for biomass DH installations (boiler house, storage and grid installations).

Financing options from structural funds

1. EU structural funds regarding financing of biomass heating in Austria are used for co-financing of UFI supported projects. Funds from the European Regional Development Fund (ERDF) and the European Agricultural Fund for Rural Development (EAFRD) are used by UFI.

A part of "in-house" biomass boilers and micro and DH plants (those up to 4 MW thermal net capacity) were subsidised by the UFI subsidy program co-financed by EU funds of ERDF and EAFRD up to 2013. This will also be possible for the period 2014-2020.

Between 2007 and 2013, **887 UFI projects** with a total environmentally relevant investment volume of EUR 852 million have been co-financed by EU funds of **ERDF and EAFRD**. The total cash value of UFI subsidies granted, amounted to EUR 209 million from 2007-2013, whereof EUR 106 million granted by the two EU funds were triggered by EUR

74 million of the Austrian federal government and by EUR 29 million contributed by federal state governments.

In the period 2000 - 2006 the total EU co-financing amounted to EUR 32 million instead of EUR 106 million from 2007 to 2013. That means that the **contribution of EU funds for UFI projects could be more than tripled in the latter period**. In the latter period **more than half of the subsidies co-financed by EU were dedicated for biomass in-house boilers, biomass micro grids and biomass DH installations**.

2. The new **Federal Austrian Rural Development Programme 2014-2020** (LE 2020) was adopted in **December 2014**. Within the Federal UFI programme, LE 2020 grants EUR 66.8 million of the European Regional Development Fund (ERDF), i.e. +100% compared to the last period, with a co-financing key of 90:10 (ERDF:national) and 85.2 million EUR of the European Agricultural Fund for Rural Development (EAFRD), +23% compared to the last period, with a co-financing key of 49.43:50.57 (EAFRD:national), from 2014 to 2020.

The support for **bioenergy heating installations is provided by investment subsidies** (62%, i.e. EUR 53 million of the EAFRD fund are reserved for such measures). **Investment grants** co-financed by structural funds can be allocated to:

- Biomass central heating systems
- Large heating networks
- Renewal of biomass heating facilities
- Improvement of the energy efficiency of existing district heating plants
- Implementation, expansion and renewal of local heating networks.

The **access to grants for biomass heating projects is regulated within the UFI** (for which the BMLFUW is responsible) the administrative body for UFI grants is the **Kommunalkredit Public Consulting** (Ltd.) - KPC. The website of KPC gives an overview on the funding procedure and subsidy programs available[7].

To receive a grant, plants would have to pass and fulfil the requirements of the quality management system "QM Holzheizwerke®".

Difficulties in financing biomass heating projects

The most crucial factors regarding financing biomass projects currently are:

- **Comprehensive business plan** (good site conditions/long-term availability of biomass resources & heat demand in terms of quantity and quality)
- Resilience of heat and fuel supply contracts
- Quality of the project partners (creditworthiness/experience/trustworthiness).

[7] More information is available at http://umweltfoerderung.at/kpc/de/home/allefoerderungen/#energieversorgung

The first point is increasingly relevant for biomass DH plants as the good sites are exploited already. In this market segment, market potential is still given for smaller plants around 400 kW only. Availability of biomass resources due to high degree of utilization of biomass potential is an issue especially for larger industrial projects also. The other two points are crucial for all kind of biomass heating projects.

Requirements defined for the owner and planners of biomass heating plants under QM Holzheizwerke®.

- The heat demand data have to be plausibly determined according to the relevant valid rules and have to be documented by load characteristics and annual heat lines as well
- the DH network has to have a minimum density
- the combustion system has to be constructed according to a certain utilisation rate
- defined standard solutions have to be used for the hydraulic and pertinent measuring and the control system
- a high utilisation rate requires an optimised waste heat recovery and an optimal layout of the heating network
- the biomass storage has to be designed in accordance to the biomass demand of the plant and the regional biomass supply
- the used biomass has to be in line with the detailed classification of QM heating plants

Sound technical and economic planning (technical and economic due diligence) in general is not a problem anymore, since the Austrian QM Holzheizwerke® program became a prerequisite for UFI subsidies. Regarding access to and availability of financing options, the introduction of the Austrian Quality Assurance Program for Wood Combustion Plants "QM Holzheizwerke®" was a key issue. **QM Holzheizwerke® guarantees that biomass plants granted by UFI are state of the art in terms of technical standards and economic soundness**.

"QM Holzheizwerke®" is currently applied in **Germany and Switzerland on a voluntary basis**. In Austria the quality management system is an integral part of the Austrian climate protection initiative "klimaaktiv" funded by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, managed by AEE INTEC. **Since 2006, QM Holzheizwerke® in Austria is connected to the UFI funding scheme for biomass DH systems with a grid length of more than 1,000 m and a net heat capacity above 400 kW.** This obligation is valid for the expansion of existing plants and for new plants as well. For those plants, the participation at QM Holzheizwerke® is obligatory in order to receive investment subsidies from the UFI subsidy program. For biomass projects below 400 kW a simplified Quick Quality Check is applied.

Since all relevant data of the Austrian projects accompanied by QM Holzheizwerke® are recorded in a central database, a **detailed benchmarking and evaluation of the projects is possible**. Results thereof show that QM Holzheizwerke® leads to a significant improvement of the efficiency and quality of Austrian DH plants based on RES.

Main conclusions from the interviews with the banks

The Austrian Energy Agency interviewed **two FIs that have financed biomass heating projects** in the past. The interviewed FIs were the **Erste Group Bank AG (EGB)** which is also operating on an international level and the **Raiffeisenbank Zillertal (RZ)** – mostly

focussing on regional financing. The EGB finances mainly larger biomass projects that provide heat only. Additionally, the bank has already financed a number of projects in the Czech and Slovak Republic in the size of 1 to 2 M€. Since 2008, the EGB operates with **a specialized department focussed on RES projects**. Before that, however, some individual bioenergy projects have been financed. This department can **provide expertise in financing biomass heating projects**. For more complex projects are available independent advisors, engineering offices or experts.

The **RZ financed 6 biomass projects up to an investment of 7 M€ within the last 10 years**. The experts of the RZ **do not have experience on RES**. Instead of that, **RZ offers a checklist, guidelines and information material**.

They **both offer loans to their clients**. The **EGB supports only the implementation of proven technologies**. CHP biomass plants are financed if they utilize a gasification process, an Organic Rankine Cycle or if they run mainly in condensing mode. **Only loans beyond 0.5 M€ can be granted to the legal body of the company**. Financing of smaller projects is directly connected the owner of the company. The typical life of the loan is between 10 – 15 years.

The **RZ finances mainly biomass DH and larger in-house heat**. Short time financing is provided as loan on current accounts during the project implementation. The financing of long-term projects (15-20 years) are secured by granting of **guarantees, warranties or other assumptions of liability**. The interest rate is generally connected to the EURIBOR.

Table 2-4 provides the **stipulations / requirements** that the FIs check from their clients in order to finance biomass heating projects.

Table 2-4 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Austria)

Stipulation / requirement	EGB	RZ
Security of feedstock supply		
Existence of heat supply contracts and guarantees	✓ Contract duration should at least be the loan period. Economic soundness is checked by Debt Service Cover Ratio (DSCR)	✓
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers		
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓	
Indexed heat sale price	✓	
Indexed biomass price	✓	
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)		
Land ownership titles of biomass supplier		

Stipulation / requirement	EGB	RZ
(no traders)		
Other (please specify)	✓ Relevant contracts (heat supply etc.) have to be signed before	
Technical		
Technical due diligence (DD)	✓	
Possibility of an Engineering Procurement Construction Contract	✓ Dependent on project size	✓ Dependent on project size
Review of main contractors and service contracts	✓	
Assessment of the technical concept and of process engineering	✓ Only the implementation of proven technologies can be financed	
Assessment of the operation and maintenance (O&M) regime		
External construction supervision (verification)	✓ Dependent on project size	✓ Dependent on project size
Review of profitability calculation	✓	✓
Other (please specify)	Proven technology, large projects can need an Environmental and Social Impact Assessment	External experts
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓ Contracts have to be signed before loan-contract will be signed.	✓
Legal assessment of production licences, environmental permits, etc.	✓	✓
Assessment of real-estate property (hypothecs, etc.)	✓	✓
Network connection agreement	✓ Dependent on project configuration	✓
Existence of operation and maintenance contracts		
Other (please specify)		
Financial		
Evaluation of business plan	✓	✓ Large projects are evaluated by external experts
Minimum share of equity capital	✓ 20-30%	✓ 30-40%
Upper limit for the residual investment value	✓ Investors shall share the project risks financially; in eastern Europe debt capital can be up to 70%, in Czech R. up to 80%	
Upper limit in percentage of (guaranteed) cash flow		
Upper limit for the Pay Back period	✓ 10-15 years	✓ 15 years
Minimum Debt Service Cover ratio	✓ 1.3-1.4	

Stipulation / requirement	EGB	RZ
Minimum Return on Equity	✓ At least 12% for private investors	✓ 4-6% interest rate
Maximum lent term (life of the loan)	✓ 10-15 years	✓ 15-20 years
Upper limit regarding technical life-time of main equipment		
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	✓ Significant advantage	✓ Significant advantage
Other (please specify)		
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default	✓	✓
Supplier's obligation to retain agricultural / forestry production		
Account pledge	✓	✓
Risk insurance (liability, damage, business interruption)	✓	
Other (please specify)	Mortgage on real estate, provision of machinery and immovable installations, as security	

The most important factors that the FIs consider in order to provide financing for biomass heating projects are presented in the Table 2-5.

Table 2-5 Important factors that the FIs consider to finance biomass heating projects in Austria

Factor	EGB	RZ
Investor credibility	✓	✓
Project IRR	✓	✓
Payback Period		✓
Maturity of the project / technology	✓	
Long term biomass supply contract with predictable raw material prices	✓	✓
Long term heat delivery supply contract	✓	
Other	Resilience of heat and fuel supply contracts; Only proven technology is accepted; Quality of the project partners.	

It is noted that both FIs have cooperated with other financial institutions for financing biomass heating projects (e.g. EIB) and in addition the financing is in accordance to financial instruments developed by the Government.

According to EGB, **markets for bioenergy are mature in Czech Republic, Slovakia, Hungary, Poland and Austria**; availability of biomass is limited and markets focus on EE. In Eastern Europe, the market development is seen quite positive. To gain sufficient revenues from DH tariffs could be a big hurdle.

Critical issues for financing projects by both banks are creditworthiness of the investor and the operator; sufficient operating experience, secured heat demand and biomass fuel supply. Attractive heat supply prices, diversity of fuel supply, attractive fuel prices and sufficient fuel quality are elements which support the financing of a project. A good project gets its fuel supply in the best case from different sawmills because **fuel supply usually is the most important challenge for a project**.

2.2.3 General data on the DH sector in the country

The following Table 2-6 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-6 Data of the DH sector in Austria and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	A lot of saw mills supply nearby houses or third parties with district heat. A lot of industrial sites (wood based-industry and others) are also increasingly interested to supply district heat to nearby buildings.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	From 2004 to 2006, a 19 km long DH grid between Hallein and the city of Salzburg has been erected. Since then, 120 GWh/y of industrial waste heat and heat from biomass combustion are used for the DH of the city of Salzburg. The waste and biomass heat amount collected from several industrial sites (cement factory Leube, fiber factory Schweighofer, Fiberborad factories MDF and Kaindl, biomass CHP plant Siezenheim) is sufficient to cover the total DH demand of the city in summer, formerly provided by fossil fuel only. Several other similar projects have been realized since then, most of them, however, in a smaller scale.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	**Many examples exist**: biomass CHP Vienna, biomass CHP Linz, biomass CHP Salzburg Siezenheim (see above), biomass CHP Mödling and Wiener Neustadt, etc. Currently in the city of Klagenfurt (roughly 100,000 inhabitants) biomass CHP and biomass heat-only plants are planned, replacing the fossil fuelled DH plants.
4. **Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises**	**Yes** (usual case).
5. **Payment of costs related to customer's connection to the DH grid**	The **customer usually has to pay costs related to his/her connection to the DH grid**. The price for the energy supplied is usually comprised of three parts: a basic price (€/month, which

Parameter	Applicability in the country
	would cover fixed costs on the side of the plant like investment, plant management, maintenance, all independently form energy consumption), an energy-rate (€ per kWh, which would cover variable costs like fuel costs, ash disposal costs, and others), and a meter rent (€ per year, which covers fixed costs on the side of the customer).
6. **Measurement of the DH demand at the customer's premises**	Usually the heat demand is metered at the **customer´s premises at the heat transfer station.**
7. **Payment behaviour of DH customers to the SPVs**	The **willingness to pay of Austrian DH consumers is good**.
8. **Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant**	Each DH plant which would receive an investment subsidy has to undergo and fulfil the requirements and standards of QM Heizwerke (a quality management system for heating plants).
9. **Strengths and weaknesses of the (fossil and biomass fuelled) DH sector**	**Strengths of the DH sector**: › many regional and local initiatives in favour of small biomass DH systems › long tradition in big cities › perfect fulltime service for the customers (heating without handling of dirty fuels, without taking time for boiler-services and maintenance etc.). **Weaknesses of the DH sector**: › high capital costs › principally in competition with thermal insulation of buildings, hardly economically feasible for the supply of new low-energy and passive-house buildings › future EU regulation on emissions from biomass-fired plants that will result in the installation of new filters that are expensive.
10. **Economic health of the existing biomass DH sector**	Generally the sector is rather **well performing**, but it is not the very big business. **Plants which obey the requirements of the quality management are able to reinvest.**

2.3 Bulgaria

2.3.1 Business models

Description of business models

According to BGBIOM, there is only one operational biomass CHP plant, started in 2013 in Surnitsa, Velingrad. Biomass heating projects of smaller scale have realized in the period since 2005.

The most common business models for biomass heating in Bulgaria are the **Agreement for supply of heat energy,** the **Commercial Energy Service (ES)** and the **Contract with guaranteed results**.

1. The **Agreement for supply of heat energy** business model is applicable to **residential buildings, commerce and service buildings, and public buildings**.

Under this business model, the **direct investment is made from the ESCO**, until the completion of the biomass heating plant. The responsibilities of the ESCO are to develop the project, install the biomass heating plant, finance and manage one or more energy systems at the customer premises. The ESCO keeps possession of the technical equipment, provides long-term supply of heat, hot water, cooling, steam, compressed air, etc. and undertakes the technical and economic risks of the investment.

2. The **Commercial Energy Service (ES)** business model is based on **investing on fuel switch – mainly replacement of light fuel oil by wood biomass fuel**. Typical clients of the ES business model are **public buildings, such as schools, kindergartens, hospitals and administrative buildings**. The target buildings include those with old heating systems that are not connected to the gas network.

Under this business model the ES provider/ESCO provides a **complete solution** to the customers, from information and energy audits to financing, replacement of the heating system, fuel (heat) supply, and monitoring of the new biomass heating system. The installation of the heating equipment is the responsibility of the equipment producer (contractor).

3. The **Contract with guaranteed results** business model is used for **in-house heating** when the existing heating system generates high energy expenses.

Under this business model, the contract is based on the **energy savings achieved** from the project and the ESCO is paid on a monthly basis on an "agreed rate", equal to the amount of actual energy savings achieved (EPC contract). The installation of the biomass boiler and the related equipment is the responsibility of the equipment producer (contractor). The ESCO is responsible for the project coordination, know-how and the installation of the heat distribution system. Financing of the investment is made either by the ESCO or by a financing institution (i.e. a bank or the EERSF[8]).

Main stakeholders / role

Under the **Agreement for supply of heat energy** the main stakeholders / actors involved are the **ESCO**, the **financing institution** who provides the financing (for the whole or part of the project), and the **customers (buildings)**.

Under the **ES** business model the main stakeholders / actors involved are the **ES provider/ESCO**, the **contractor** who installs the biomass heating system, the **financing institution** and the **customers**.

[8] EERSF manages the financial resources received by the Republic of Bulgaria from the Global Environment Facility (GEF) through the International Bank for Reconstruction and Development (IBRD) and from other donors. EERSF is an **independent legal entity**, separate from any governmental agency or institution, and **performs its activity in accordance with the EEA, the current legislation framework and the agreements with the major donors**.

Under the **Contract with guaranteed results** the main stakeholders / actors involved are the **ESCO**, the **contractor**, who installs the biomass heating system, the **financing institution** and the **customers**.

Ownership of the biomass heating system

In all of the business models the biomass heating system is owned by the ESCO.

Under the **Agreement for supply of heat energy** the investor is responsible for O&M and other related costs. In relation to the **ES business model**, the ES provider/ESCO offers a complete solution, from information and energy audits to financing, replacement of the heating system, fuel (heat) supply, and monitoring. The ESCO is responsible for O&M and other related costs, for the **Contract with guaranteed results** business model.

Level of support of the legislative framework to the business models

The current legislative framework **does not promote/ support** investments on biomass heating projects. In Bulgaria there is no dedicated legislation promoting heat production from biomass; however there are **available subsidy schemes** as presented in the next section "*Financing options*".

An **indirect policy measure supporting the ES business model** is the obligation of municipalities (set out in the Energy from Renewable Sources Act) to develop RE programmes.

It is also noted that preferential regime existent for biomass CHP units have been shortened, which leaded to bankruptcy of the first biomass CHP plant in Bansko.

Advantages, weaknesses and effectiveness of the business models

Agreement for supply of heat energy

The **advantages** of the **Agreement for supply of heat energy** are the following:

- Reduction of energy costs for the customers
- Fuel supply at low cost (the biomass is often waste /residue from wood logging or wood processing)
- Economically effective in long-term planning
- Guaranteed fuel supply (regional sources of biomass instead of imported fossil fuels)
- Accessible and sustainable energy supply to the customer.

The **Agreement for supply of heat energy** is the most commonly used in Bulgaria for developing biomass heating projects in **municipalities situated close to forest areas and wood processing plants**.

Commercial Energy Service (ES)

The **advantages** of the **ES** are the following:

- Reduction of energy costs for the customers
- Realization of EE measures
- Market development for the biomass technologies.

The business model is the most common for fuel switch – mainly light fuel oil with biomass.

Contract with guaranteed results

The **advantages** of the **Contract with guaranteed results** are the following:

- Reduction of energy costs for the customers
- Realization of EE measures
- Economically effective in long-term planning
- No responsibilities for the customers in relation to the maintenance of the heating equipment.

It is **most commonly used in for developing biomass heating systems in residential buildings using pellets or cherry pits**.

The main **weakness of all of the three business models** is that the ESCOs face financial difficulties in investing in such projects not only due to the need to take grants and/or loans but also due to the price changes and the legislative support, which reduces the revenues.

Key features of a typical raw material supply contract

The key features and the subject of the agreement signed between the investor (ESCO) and the biomass supplier for the 3 business models, are presented in the Table 2-7.

Table 2-7 Subjects of the biomass supply contracts for the 3 most common business models in Bulgaria

Subject of the agreement	Business models		
	Agreement for supply of heat energy	Commercial Energy Service (ES)	Contract with guaranteed results
Needed quality			✓
Guaranteed/intended quantity	✓		✓
Contract duration	✓	✓	✓
Biomass price terms			✓

The **ESCO bears the market risks** for the quantity / quality of the biomass supply. The **price of biomass can be negotiated with the supplier, but there are also regulatory set market prices**.

Key features of a typical heat delivery contract

Agreement for supply of heat energy

As stated earlier, the ESCO (in all of the 3 business models) is responsible for the financing, planning, installation, service, maintenance and supply of fuel (heat) as well as the system performance.

The typical heat delivery contract duration for the **Agreement for supply of heat energy** and the **ES** is between **5-10 years** while for the **Contract with guaranteed results**, the contract duration is approximately **7 years**.

2.3.2 Financing options

Description of financing options

The most commonly used financing options in Bulgaria are:

1. Loans from Financing Institutions
2. Grants (from the BEERECL[9])

Loans: Loans granted by the **banks** and **non-banking institutions** are the most important source of financing for investing in EE and RE projects in Bulgaria. There are typically two types of loans available: traditional financing (available from banks) and project financing (available from both, banks and non-banking financial institutions). In **traditional financing**, the focus is the company's overall financial capacity to repay the loan from the activity it develops and the medium and long term prospects, plus the capacity of the company to submit value titles or other assets destined to guarantee the loan. In **project financing**, the focus is the project reliability.

Private banks are providing loans through:

1. **own financing packages** (such as "the loan for renewable energy" from ProCredit Bank), or tailor-made financing solutions (such as the loans granted by the **UniCredit Bulbank, the largest private bank in the Bulgarian market**).
2. **financing programs developed with the involvement of financing facilities offered by the EU and EBRD – BEERECL** (such as Allianz Bank Bulgaria, DSK Bank, Eurobank Bulgaria, Piraeus Bank Bulgaria, Raiffeisenbank (Bulgaria), UniCredit Bulbank, Unionbank, United Bulgarian Bank).

Loans are also provided by the **Bulgarian Energy Efficiency and Renewable Sources Fund (http://www.bgeef.com/display.aspx) – EERSF**, a non-banking financing institution

[9] Bulgarian Energy Efficiency and Renewable Energy Credit Line

authorized by the law to finance EE projects; however, EERSF has financed RES projects as well, including projects in the biomass heating sector. It has been established by the Energy Efficiency Act and offers **loans** for projects aiming at improving EE and supporting the use of **RES in public, industrial and residential buildings**. The eligible projects must fulfil the following criteria:

- The project must apply a well-proven energy saving technology
- At least 50% of a project's benefits must come from energy savings
- Investment payback period up to 5 years
- Investment range: BGN 30,000 – 3,000,000 (EUR 15,000 – 1,500,000)
- Project developer's equity contribution – at least:
  - 10% in case of co-financing (BGEEF & commercial bank)
  - 25% in case of financing solely from BGEEF
- Credit maturity period up to 5 years (*more information on EERSF is provided in the section "Financing options from structural funds"*).

Another non-banking institution that offers loans is the **BEERECL,** which is a financing program from the EU and the EBRD. **The program was active in the period 2004-2014**. In total 8 Bulgarian banks (Allianz Bank Bulgaria, DSK Bank, Eurobank Bulgaria, Piraeus Bank Bulgaria, Raiffeisenbank (Bulgaria), UniCredit Bulbank, Unionbank and United Bulgarian Bank) worked with the BEERECL. **The financing procedure includes the following steps**. The applicant submits the application to BEERECL for evaluation. Once declared eligible, the applicant may apply for a bank loan from any of the eight Bulgarian banks involved. **BEERECL verifies the implementation of the project taking into account eligibility criteria and refunds a variable percentage of the investment (loan) to the applicant, under the form of a non-refundable grant (10 – 15% of the disbursed loan)** from the **KIDSF**[10]**.**

Grants: An alternative to the loans provided by the financing institutions are the grants. These grants are provided by the **BEERECL program**. The grants are addressed to EE and RES investments, including biomass heating projects. Payment of the grant was made by EBRD only upon verified project completion, ensuring that funds were properly used and providing an incentive for timely implementation. **Loans of EUR 150 million were disbursed with incentive grants paid to project developers of EUR 24 million**.

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the loans' schemes in Bulgaria are:

- **Customer-oriented attitude towards the investor** and during the overall assessment of the project
- The grace period for refunding the loan typically is **between 1 and 2 years**.

[10] Kozloduy International Decommissioning Support Fund

- The loan period can be up to **10 years**
- There is a **mix of warranties** (value titles, real estate, components of the CHP / biomass plant, the company's assets) accepted by the financing institutions.

On the other hand, loans' schemes have the following **weaknesses:**

- **Strict financing conditions**. The financial institutions apply a large number of financial parameters to assess the creditworthiness of the project.
- **High share of the equity capital** (25 – 30% minimum)
- The evaluation period of the application exceeds 30 days
- The **interest rates are high** and not attractive
- **Large number of documents** is required by the financing institutions (legal, financial, business plan, feasibility study, etc.) for the evaluation of the project.

Loans represent the most used financing instrument by the biomass heating project developers. At the current stage, the market of biomass heating is emerging in Bulgaria. The potential is high, and it is expected that the new legislation (under preparation) regarding biomass, heating, feed-in-tariff system and the promotion system of the energy produced from RES, will ensure the grounds for the valorisation of such potential.

Grants

Grants provided by the BEERECL in Bulgaria helped the country reduce its energy intensity and increase its local renewable generation. The facility's EE and RE investments resulted in an energy equivalent savings of 1.08 TWh. This is approximately 3.3% of Bulgaria annual electricity use. Also BEERECL played a key role in helping start and grow Bulgaria's small RE market by supporting 96 MW of RE projects.

BEERECL has financed one biomass CHP plant. The plant converts wood waste into a synthetic gas that fuels the plant. It consumes 12,900 tons wood waste each year. The project's payback period is 3.5 years and it reduces Bulgaria's CO_2 emissions by 7,225 tons per year.

The **main weaknesses of the grants' schemes** that are offered by BEERECL are the following:

- The BEERECL program was **active until the end of 2014**
- The grants are provided after the implementation and verification of the EE / RES investments
- The main aim of the projects that apply for receiving grants is the energy savings achieved
- **Large number of documents** required from the investor (legal, financial, etc.) in order to apply for a grant.

Considering the effectiveness of the grants provided by the BEERECL, approximately **300 EE and RE projects have been financed**, of which **one was a biomass CHP plant**. BEERECL made a significant transformative impact on the local finance market for

sustainable energy. It was also instrumental in creating, shaping, and growing this market to a point where it could become self-sustained.

Financing options from structural funds

The available structural funds in Bulgaria are the following:

Energy Efficiency and Renewable Sources Fund (EERSF) (http://www.bgeef.com/display.aspx): It was established pursuant to the Energy Efficiency Act, with intergovernmental agreements between the Global Environment Facility (through the World Bank), the Government of Austria and the Government of Bulgaria. The fund operates according to the provisions of the Energy Efficiency Act, the Energy from Renewable Sources Act and the agreements with the Donors, and is not part of the consolidated state budget.

The initial capitalization of EERSF is entirely with grant funds. EERSF has the combined capacity of a **lending institution**, a **credit guarantee facility** and a **consulting company**.

The EERSF offers to Bulgarian companies, municipalities and private individuals the following financial products:

- **Loans** below market interest rates (**interest**: 4.5-8% for the municipalities, 5-9% for corporate clients and private individuals, **minimum equity contribution:** 10-25%)
- **Partial credit guarantees**
- **Portfolio guarantees**

National Trust Eco-Fund (https://ecofund-bg.org/): It was developed in cooperation with the Swiss government. The new strategy for 2014-2020 launched in March 2015 and includes financing of RES projects.

OP "Regional development": This OP offers grants up to 75% for implementing EE investments in multifamily buildings. The investments include the replacement of the old heating systems with biomass-fired boilers.

OP "Innovations and competitiveness" (http://www.opcompetitiveness.bg/): For the period 2014 – 2020, this OP includes financing of RES projects.

Difficulties in financing biomass heating projects

The **main difficulty** in Bulgaria is that the Financing Institutions have **no experience in financing biomass heating projects**. Some experience exists only on financing EE projects. The Bulgarian legislation at the moment, **does not promote investments in biomass heating.**

Main conclusions from the interviews with the banks

BGBIOM was not able to make interviews. BGBIOM sent official letters to the governing body of BEERECL and to two participating banks (UniCredit Bulbank and Europbank

Bulgaria). BGBIOM tried to interview personally representatives of both mentioned banks but the results were unsatisfactory. **The information provided below is based on the initial conversation with the bank representatives**.

Both UniCredit Bulbank and Europbank Bulgaria have financed EE and RES projects in the past. The RE projects that have been financed are mainly wind, geothermal, heat pumps, and solar projects. **One biomass CHP plant has been financed by Eurobank and, six biomass (not heating) projects financed by UniCredit Bulbank**.

Both FIs have available financial experts with experience on RES projects without however having undergone any specific training for RES or biomass heating projects.

According to BEERECL brochure, **all participating FIs offer guidelines and information** material to their clients for financing RES (including biomass) projects. The guidelines are in the form of a **checklist** or in the form of an **application form** that the client has to fill in, in order to be eligible to receive the loan.

Table 2-8 provides the **stipulations / requirements** that FIs checks from their clients in order to finance biomass heating projects.

Table 2-8 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Bulgaria)

Stipulation / requirement	UCB	EBB
Security of feedstock supply		
Existence of heat supply contracts and guarantees		
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers		
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).		
Indexed heat sale price		
Indexed biomass price		
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)	✓ 30%	
Land ownership titles of biomass supplier (no traders)		
Other (please specify)		
Technical		
Technical due diligence (DD)		✓
Possibility of an Engineering Procurement Construction Contract		
Review of main contractors and service contracts	✓	✓
Assessment of the technical concept and	✓	✓

Stipulation / requirement	UCB	EBB
of process engineering		
Assessment of the operation and maintenance (O&M) regime	✓	✓
External construction supervision (verification)	✓	✓
Review of profitability calculation	✓	✓
Other (please specify)		
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)		
Legal assessment of production licences, environmental permits, etc.	✓	
Assessment of real-estate property (hypothecs, etc.)	✓	✓
Network connection agreement		
Existence of operation and maintenance contracts	✓	✓
Other (please specify)		
Financial		
Evaluation of business plan	✓	✓
Minimum share of equity capital	✓	✓
Upper limit for the residual investment value		
Upper limit in percentage of (guaranteed) cash flow		
Upper limit for the Pay Back period	✓ 10 years	✓ 10 years
Minimum Debt Service Cover ratio		
Minimum Return on Equity		
Maximum lent term (life of the loan)	✓	✓
Upper limit regarding technical life-time of main equipment	✓	✓
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	✓	✓
Other (please specify)		
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default		
Supplier's obligation to retain agricultural / forestry production		
Account pledge		
Risk insurance (liability, damage, business interruption)	✓	✓
Other (please specify)		

The most important factors that FIs considers in order to provide financing for biomass heating projects are presented in the Table 2-9.

Table 2-9 Important factors that the FIs consider to finance biomass heating projects in Bulgaria

Factor		
Investor credibility	✓	✓
Project IRR		✓
Payback Period		✓
Maturity of the project / technology	✓	✓
Long term biomass supply contract with predictable raw material prices	✓	
Long term heat delivery supply contract	✓	
Other	Stable regulatory framework	

2.3.3 General data on the DH sector in the country

Table 2-10 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-10 Data of the DH sector in Bulgaria and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	It is legally possible but it is not existent in Bulgaria.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	Not applicable.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	No, there are not such cases.
4. **Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises**	Not applicable.
5. **Payment of costs related to customer's connection to the DH grid**	The customer pays the costs in relation to its connection to the DH grid and for the metering device.
6. **Measurement of the DH demand at the customer's premises**	The consumption of heat is **metered at the customer's premises.** According to the national law, the installation of the general meter at the connecting pipe is borne by the heat supplier, while the individual metering, depending on its case, is borne by the customer.

Parameter	Applicability in the country
7. Payment behaviour of DH customers to the SPVs	The existing DH system in Bulgaria is old and causes problems for the customers due to the high cost of heat energy. The DH operators have **problems with debts collection** and some of them (i.e. in Shumen) have **bankrupted**. The existing national law does not allow customers to disconnect from the DH grid and they should pay taxes even if they do not use heating from the DH grid.
8. Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant	**There are not any regulatory provisions**.
9. Strengths and weaknesses of the (fossil and biomass fuelled) DH sector	**Strengths of the fossil fuelled DH sector:** › The fossil fuelled DH sector in Bulgaria is in operation for more than 30 years; therefore there is plenty of experience and know-how in running DH projects › There is a regulated price; the local authorities set a ceiling price the utility provider can charge to the end-customer. **Weaknesses of the fossil fuelled DH sector:** › High production costs resulting in high costs for the customers (although there is ceiling price, the consumer ends up covering the losses) › Obsolete production and distribution / supply facilities › High O&M costs › Significant energy production and distribution losses › Consumers' tendency to disconnect from the DH grid. There are many complaints regarding the costs which are considered high and non-transparent › Old and inefficient technologies. **The biomass fuelled DH system** is not yet developed in Bulgaria, but the situation is expected to change since new regulations are expected to promote and support investments on biomass based DH plants. In addition, Bulgaria has abundant biomass resources which represent an advantage for development of biomass based DH plants.
10. Economic health of the existing biomass DH sector	The DH sector in Bulgaria is currently **under-developed**. The existing units are cogeneration units, but they are mainly based on the production and delivery of electricity and not heat. **Without the reduction of the preferential prices for the electricity derived from CHP, the sector will stay under-developed.** The existing heat installations in the regions close to the forests are limited.

2.4 Greece

2.4.1 Business models

Description of business models

The most common business models in Greece are the **Investor's own business initiative**, the **Co-operative** and the **Partnerships**.

The **Investor's own business initiative** is used for **in-house heat production in agricultural-forestry industrial facilities and other industries as well**. Under this business model, the investor, who owns an industrial facility, installs a biomass heating plant to cover the heating needs of its industrial facility on space heat and heat process. Biomass is derived either as a by-product of the agricultural-forestry industrial facility or is supplied by biomass producers.

The **Co-operative** business model is addressed to **in-house heat production and supply for agricultural-forestry facilities.** In Greece, co-operatives act like private entities. As raw material, they use residues of own waste biomass and the heat produced covers own demand on space heat and heat process. **Potentially**, the supply of raw material may also be undertaken from biomass owners or traders.

Under the **Partnership business model**, the Public Power Corporation – PPC cooperates with municipalities that are connected to DH and the municipalities receive the waste heat from PPC.

Main stakeholders / role

Under the **Investor's own business initiative** the main stakeholders / actors involved are the investor and the financing institution that provides the loan. The role of the financing institution (bank) is to provide long term financing for the project.

Investors may be:

- Wood industries for wood drying and space heating using wood processing residues
- Agro-industries for process heat and space heating using secondary agricultural residues
- Other industries for space heating using mainly refined solid biofuels (wood pellets).

Under the **Co-operative** business model, the main stakeholders / actors involved are agro-industries using secondary agricultural residues as raw material.

Under the **Partnerships business model**, the main stakeholders / actors involved are the municipality, their end-customers and the PPC plants.

Ownership of the biomass heating system

Under the **Investor's own business initiative**, the investor owns the whole biomass heating plant and is responsible for the O&M and other related costs.

Under the **Co-operative** business model, the co-operative owns the whole biomass heating plant and arrange all business issues (management, operation, employment,

etc.). There is always the possibility for third-party assistance, if the technical background is not appropriate.

Under the **Partnerships business model**, the municipality is the owner of the heating system, including the pipelines' network. The waste heat producer (PPC) just injects the heat in the common buffer tank. **Municipalities and their organisations are responsible for the investment, installation, operation and management of the facility**.

Level of support of the legislative framework to the business models

By decree 189533/07.11.2011 of the Ministry of Environment, Energy and Climate Change, "Regulations for issues related to the operation of combustion units for the heating of buildings and water", some restrictions on the use of solid biofuels were lifted. This enables the use of solid biofuels, including refined solid biofuels, for heat production (central heating systems) and process heat.

Aiming to improve the development of Renewable Energy, in order to mitigate climate change, the Ministry of Environment, Energy and Climate Change implemented a rationalization of pricing for electricity produced from CHP units and power plants using RES (L3851/2010). The law is also focused on:

- Protection of the ecosystems from climate change, through promotion and encouragement of renewable energy for power production
- The contribution of RES, in the national energy balance, in the 20% of gross energy consumption equivalent
- The contribution of energy from RES in the 40% of total electricity consumption.
- The contribution of energy from RES in the 20% of total energy consumption equivalent for heating and cooling
- The contribution of energy from RES in the 10% of total energy consumption equivalent for transport.

Law 3809/2011 supports investments and business plans for new bioenergy production (electricity and CHP), as well as enlargement of businesses, providing **subsidies up to the percentage of 60% of total investment and other benefits, like tax deduction, to private investors**. **The update of the legal framework supporting private investments is expected in 2015.**

Measure 123B of the national programme for the rural development during the period 2007 - 2013, calls existing small enterprises of the forest and agricultural sector (wood production and wood process) to submit proposals for funding in order to increase the added value of their products through the **upgrade of their existing infrastructure or creation of new very small enterprises and improvement of wood products trade**. The budget for a business plan can be raised up to EUR 2 million. **The subsidy is ranged from 20% to 65%**. A call for this measure is also expected in the new programme for rural development (2014-2020). Further information is included in the website of the

programme (http://www.agrotikianaptixi.gr/). **Only entities of the agricultural sector could be selected for funding under the current programme.**

Advantages, weaknesses and effectiveness of the business models

The advantages of the **Investor's own business initiative** business model are summarized in the following:

- Provides management flexibility to the owner
- Reduction of the energy costs (heating) to cover own demand in space and/or process heat of the main industrial facility
- Potential support for investments under the legal framework
- More independency regarding energy consumption

The main **weaknesses** of this business model are:

- Periods with low heat demand result in the **reduction of the operational efficiency of the heating system**
- The **short heating period for space heating** increases the risk of the investment.

This business model is effective since most of bioenergy projects are based on this business model.

The advantages of the **Co-operative** business model are summarized in the following:

- Creation of new activities (bioenergy)
- Efficient exploitation of own residues
- Low cost heat to cover own demand in space and/or process heat
- Potential support for investments under the national programme for rural development.

The main **weaknesses** of this business model are:

- The **administrative system is not flexible** (important decisions require the contribution of members of cooperatives)
- Periods with low heat demand result in the reduction of the operational efficiency of the heating system
- The short heating period for space heating, increases the risk of the investment; however there is low risk in case of process heat.

This business model is **effective only in the case of co-operatives that are active in the process of agricultural products (agro-industries) and exploitation of residues**. It is a very interesting sector for project developers due to the low cost of residues and the simple energy conversion technologies (combustion).

The **advantages** of the **Partnerships** business model are summarized in the following:

- Low cost heat to the municipalities
- Public acceptance
- Security of heat supply
- Environmental benefits.

The main **weaknesses** of this business model are:

- The partnership between PPC and a municipality is possible only in locations where waste heat is available (e.g. where there are available PPC plants with biomass boilers)
- The installation cost is high
- Funding to support the investment is necessary.

Municipalities are really interested in the installation of a DH network under the Partnership business model, due to low cost of waste heat provided by the PPC. The end-users are also interested in security of heat supply at prices lower than fossil fuels.

Key features of a typical raw material supply contract

Under the **Investor's own business initiative** (in case the investor is not an industry in the agricultural-forestry sector), the key features of a typical raw material supply contract are:

- The **type** of raw material
- **Minimum quality** requirements (depending on conversion technology)
- Delivered **quantities**
- **Time of delivery** (logistics).

The **subject of the agreement** between the investor and the biomass supplier are the **needed quality**, the **guaranteed quantity** and the **biomass price terms**.

Biomass prices are mainly affected by prices of fossil fuels (competitive fuels), as well as, **availability of raw material and security of supply**. The price for solid biofuels is agreed by both, supplier and user mainly on annual basis.

Under the **Co-operative business model** (in case the co-operative is supplied the raw material by traders or other entities), the key features of a typical raw material supply contract are:

- The **type and quality of raw material**
- **Availability** of raw material
- **Handling** of raw material.

The **subject of the agreement** between the co-operative and the biomass supplier / trader are the **needed quality**, the **guaranteed quantity**, the contract duration and the **biomass price terms**.

The biomass price is affected by market rules (demand and supply, availability of raw material, transportation cost). Fossil fuels prices do not affect biomass prices due to low cost of residues. **The co-operative has to arrange all issues regarding quality and quantities of fuels as well as to make agreements on the prices (in case of biomass supply from external traders).**

Under the **Partnership business model,** the key features of a typical raw material supply contract are the guaranteed **quantity** and the **biomass price terms.** Biomass suppliers provide to PPC the required biomass **at market prices. The biomass price includes fixed and variable costs.** Variable costs are set using energy units (€/kWh$_{th}$), at 30% lower of heating oil price.

Key features of a typical heat delivery contract

Under the **Investor's own business initiative and the Co-operative business model**, there is not any kind of contractual relationship with end-customers, since the heat produced from the biomass heating plant is used exclusively to cover own heating needs.

Under the **Partnership** business model, customers submit their request to the municipality; **the connection to DH is the responsibility of the municipality**.

2.4.2 Financing options

Description of financing options

The most commonly used financing options in Greece are:

1. Capital **grants**
2. Bank **loans**

Capital grants: The **National programme for the Environment and Sustainable Development** gives **capital grants for DH applications**. The Law 3809/2011 supports investments and business plans for new bioenergy production (electricity and CHP), as well as enlargement of businesses, providing **subsidies up to the percentage of 60% of total investment and other benefits, like tax deduction, to private investors.** The update of the legal framework supporting private investments is expected in 2015.

The **National programme for the Environment and Sustainable Development** (http://www.epperaa.gr/el/Pages/Default.aspx) provides opportunities for capital grants for new DH installations and improvement and extension of existing DH applications.

In case of investments in the agricultural sector, the **National Programme for Rural Development** gives opportunities for funding in order to increase the added value of their products through the upgrade of their existing infrastructure (http://www.agrotikianaptixi.gr/). **The subsidy is ranged from 20% to 65%.**

Bank Loans: They are offered as "green banking" solutions, entirely by banks, supporting environmentally-friendly businesses with a range of specially designed products and

services at preferential terms and rates. These bank loans are **long-term** addressed to **small and medium-size enterprises** wishing to invest in green entrepreneurship.

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the loans' schemes in Greece are:

- **Low interest loans** (the rate is variable)
- Flexible procedure
- Green services
- Viable investments (especially, during the first years after the investment).

Financing options from structural funds

The structural funds available for Greece are described in the previous section (**National programme for the Environment and Sustainable Development, National Programme for Rural Development**). The funding procedure is the following: the applicant submits the application together with the technical annex and the business plan. The responsible authority evaluates the proposal for funding and approves or rejects it depending on the eligibility criteria.

Difficulties in financing biomass heating projects

The interviews with the banks were not conducted due to the specific economic regime of the country during July 2015.

Main conclusions from the interviews with the banks

The interviews with the banks were not conducted due to the specific economic regime of the country during July 2015.

2.4.3 General data on the DH sector in the country

The following Table 2-11 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-11 Data of the DH sector in Greece and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	Not applicable; the heat is used to cover own heating needs.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	Not applicable.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	There is only one application (Megalopolis DH) where the main heat provider is a power plant, fuelled with lignite, combined with a biomass unit (2 wood biomass boilers), providing heat to

Parameter	Applicability in the country
	a common buffer tank. The operational plan of the system requires the operation of biomass boilers during periods with high heat demand or during maintenance of lignite boilers.
4. Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises	Yes, as described in the previous parameter (3).
5. Payment of costs related to customer's connection to the DH grid	Fixed costs are included in the bill (or invoice).
6. Measurement of the DH demand at the customer's premises	Only the heat supply is metered. The heat demand is estimated before the connection to the grid, based on dimensions of buildings and heating degree days (HDD).
7. Payment behaviour of DH customers to the SPVs	Not a problem.
8. Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant	-
9. Strengths and weaknesses of the (fossil and biomass fuelled) DH sector	**Strengths of the biomass fuelled DH sector:** › Security of heat supply › Heat supply at reasonable prices › Confidence by customers. **Weaknesses of the biomass fuelled DH sector:** › Short heating period › High cost for the installation of the pipelines' network › Administrative processes › The access to bank loans and the funding is difficult.
10. Economic health of the existing biomass DH sector	There were failures of biomass DH in the past due to problems in planning. There are good possibilities in cases of injection of waste heat from power plants to the grid, due to the low cost.

2.5 Germany

2.5.1 Business models

Description of business models

In Germany the **investor´s own business initiative** is the most common business model. Within this business model one can differentiate between **collaborative initiatives (such as cooperatives)** and **own operation**. Another commonly used business model, which is of interest in the field of heat supply, e.g. of municipal buildings, is the **Energy Supply Contracting**.

Fund Financing and leasing options currently play in contrast a rather **subordinate role**.

Investor´s own business initiative

A **bioenergy village** is a regionally oriented concept for the use of RES in rural areas. Biomass from domestic agriculture and forestry is used in a biomass plant to meet much of the heat demand of the village.

A **single person or few individuals** with great dedication often persuade other locals to invest in a **shared biomass heating system**. The fuel (biomass) supply from local sources is a basic requirement for a high level of acceptance.

There are **various investment models** depending on the specific starting condition. As it is presented below, the **SPV** may be composed of the following members: **municipalities**, **biomass producers**, **citizens**. But there are also exceptions like the stock company solarcomplex. This company plans, builds and operates plants for electricity and heat supply from RES, and primary provides the local inhabitants an equity investment in these installations as an ecological investment.

Potential financers and operators are citizens who are connected to the heating network. Possible characteristics are the **direct and indirect participation**. With the **direct participation**:

- the citizens act as shareholders of the SPV and
- due to their purchased company´s shares they receive voting rights for company related decisions.

With the **indirect participation**:

- an **investor enables citizens to participate in funding**
- the citizens receive bearer bonds or profit by participation rights, but no voting rights.

Because of low equity and a lack of technical expertise as well as diverse challenges in the planning and implementation, **the citizens often form an operator network as project executing organisation**. The cooperation of public and/or private actors can assume different forms.

The **municipality is an important partner**, as it has the planning authority and therefore is entitled to determine locations for privileged projects such as biomass plants. Additionally, the heating network is partly in the public domain, which requires a license agreement with the municipality. **This partnership facilitates the installation of the system on public property**, too.

Through **participation of municipal utilities**, which are often responsible for the local energy supply, their professional expertise can be used within the project implementation and during operation. **The profits of the operating company are of benefit to the whole community, if the municipality is part of the SPV**. Even its

involvement is advantageous for the local authority, because it not only achieves a higher share of added value, but also takes stronger influence on the project design.

By joining as a producer group, **biomass suppliers appear as an attractive business partner and warrant the necessary security of supply**.

The **engineering company as the operator also offers a lot of benefits**. The technical know-how in this case represents the largest gain. An operating company can obtain the product-related services at low cost.

The favoured legal form for the SPV, which operates the woodchip furnace and DH, is a Limited Liability Company. In bioenergy villages, the woodchip furnace and DH are more in common ownership and the legal form is a **registered co-operative**.

For **larger projects** with a high demand for capital, the SPV often found a limited partnership with a limited liability company as general partner. This legal form allows the involvement of various investors as limited partners with no voting rights.

Single Investor

In this business model, the investor, who owns an **industrial facility** that produces wood products, installs a **biomass CHP plant financed by his own capital and a bank loan**. With this investment, the investor covers the electricity and heating needs of its industrial facility and reduces its energy costs. The excess electricity is sold to the national grid. The biomass is derived as a by-product of the industrial facility and therefore the investor has **abundant raw material at his premises to fuel the CHP plant. In some cases the excess heat is also sold to external heat customers**.

In Germany biomass CHP plants are operated mainly by power supply companies (52%) as well as companies of the woodworking and wood processing sector (29%) as was evaluated under the EEG monitoring 2014. On the contrary, the manufacturing industry only has a share of 7%.

The **companies mostly prefer to operate plants independently**, thus in most cases no other project enterprise is involved.

Legal forms of companies in the woodworking and wood processing sector are individual enterprises, business partnerships and joint stock companies. Public utilities can be organized as public enterprises (in-house operating, publicly owned enterprise or public institution) as well as private enterprises (Ltd., plc).

Energy Supply Contracting

Energy Supply Contracting (ESC) solutions are often used for heating systems in **municipal buildings and after the refurbishment of existing buildings**. In this business model, a building is supplied with heat by a third party, the Contractor (ESCO). The Contractor assures besides the investment also the operation, maintenance and repair of power generation plant.

Main stakeholders / role

Investor´s own business initiative

In this business model, the **investment community** finance the boiler and DH with their own capital, public grants and low interest bank loans. The investors profits of lower heating costs or receive a share of the net profit. The main stakeholders involved are described in the "*Description of business models*" section.

Single Investor

The main stakeholders / actors involved are the **investor and the financing institution** that provides the loan. The financing institution provides long term financing for the project for equipment supply, set-up and construction of the biomass CHP plant.

Energy Supply Contracting

The main stakeholders / actors involved are the **contractor (ESCO)** as service partner of the heat customer, the **financing institution** that provides the loan and the heat customer, who leaves a part of his plot or of his building to the contractor. The role of the financing institution is to provide long term financing for the project, as for equipment supply, set-up and construction of the biomass CHP plant.

Ownership of the biomass heating system

Investor´s own business initiative

In general the SPV owns the biomass boiler and DH system. In some cases an association of forestry operations or agricultural farms is the initiator of the heat project and also member of the operating company. Thus, biomass supply is ensured during operation. In the predominant part of cases, the connecters have to pay connection fees but are not the owners of the heat transfer station. In some cases the heat transfer station has to be purchased on the connecters´ own expense and thus is in ownership of the customers. Apart from the above-mentioned exceptional cases, **the whole heating system is owned by the operating company (SPV)**.

The **points of transfer of ownership** are between the grid and the customer.

The SPV is responsible for the **O&M and other related costs**. They assign primarily local actors as operating personnel for the regular plant operation. Depending on the technology, an extensive briefing by the plant manufacturer and technical know-how is sufficient for the regular plant operation and small repairs. For guarantee reasons, major repairs and maintenance tasks should be performed by **specialized companies**.

Single Investor

Usually the whole biomass CHP system is in the ownership of the **investor**. In case that excess heat is delivered to external heat customers (public utility companies), the **heat transfer station is the point where transfer of ownership appears**. The investor is responsible for the O&M and other related costs.

Energy Supply Contracting

Usually the whole biomass heating system is in the **ownership of the contractor (ESCO).** In most cases the heat transfer station is the point where transfer of ownership happens. The contractor is responsible for the O&M and other related costs.

Level of support of the legislative framework to the business models

Currently in Germany **not the legislative but rather the economic framework is crucial**.

The **Renewable Energies Heat Act (EEWärmeG)** (came into force on 1st of January 2009, last amended on 1st of August 2014) **promotes the use of renewable energy in the heat market**. Due to this law, builders of new buildings are obliged to generate a percentage of their heating requirements from RES or implement compensatory measures such as installing additional insulation respectively using CHP systems or connecting to a DH network. The **Act on Combined Heat and Power Generation** (Kraft-Wärme-Kopplungsgesetz –KWKG; entered into force in 19 March 2002, last amended in 21 July 2014) promotes the **construction of heating networks**, as long as the heat in these DH systems originates by at least 60% from CHP plants and the commissioning of networks done after 31.12.2011. **Up to 40% of the necessary investment can be funded (DH <100 mm diameter)**.

Contractors also benefit from the support programs. Since July 2013, landlords are allowed to switch the heating supply to energy contracting not only for new tenants but also for existing tenants. But according to the new legal situation, the switch to energy contracting must ensure that the heat is supplied with improved efficiency and the operating costs are not exceeding, compared with the previous supply costs. The landlord and the contracting firms see it as a worsening of their position compared to the old regulation. The burden to prove the cost neutrality was transferred to the landlord. If the tenants refuse to pay the heat supply costs to the contractor, the landlord has to prove that the cost neutrality is met.

Because of depressant oil and gas prices, interest in biomass heating systems is currently restrained. Furthermore the **tight threshold limit values in the Emission Control Act are a huge barrier for potential investors**.

It would be desirable to facilitate the Construction Law. A solution could be to privilege the building applications that are required as part of the implementation of bioenergy systems, e.g. the establishing of woodchip-silos.

Advantages, weaknesses and effectiveness of the business models

Investor´s own business initiative

The **advantages of the Investor's own business initiative** are the following:

- Reduction of energy costs
- Money remains in the region

- Interest income through limited partnerships and cooperative deposits
- **Participation of the citizens in decision making**
- For the public sector increases the community level value creation effects by additional revenues from commercial and income tax
- Community image and public perception.

Depending on the actors involved, there are specific **disadvantages**. If there are operating companies, whose members are mainly energy consumers, they often have **difficulties in raising the necessary equity rate of 20%**. Moreover there is often a **lack of technical know-how**. With the integration of biomass suppliers and equipment manufacturers, the project becomes more profit-oriented and the community loses influence on the operation.

Often, the business case is complicated by the fact that some potential connecters have fears regarding the **security of supply** and prefer to wait until the system is in operation and everything is operational. Businesses often have a lack of know-how of biomass technology. Therefore, they are very cautious when such a long-term major investment is made.

Single Investor

The **advantages of the Single Investor** business model are the following:

- Reduction of own energy costs
- Security of supply since biomass is derived as a waste from the main industrial activity of the investor
- Supply of biomass at no cost. In this business model, the investor uses its own biomass waste derived from the main activity of his industrial facility.
- Low interest for loans and supporting programs
- For **customers of public utility companies**:
  - Space savings
  - no chimney necessary (no costs for chimney sweeps)
  - no maintenance
  - comfortable all-inclusive heat supplement
  - very good CO_2 balance.

On the other hand, one **major weakness** is that businesses (with the exception of public utility companies) mostly think in short payback periods and therefore **prefer to install a fossil fuel plant with lower investment costs**. Another weakness of this business model is that the **investor finances an important part of the investment** (at least 20 - 25%) by his own capital. This can cause **financial difficulties** in investing in such kind of projects.

This model is the **most commonly used in Germany** for developing biomass CHP plants. Actually, the investors who are involved in the wood producing industry prefer this model since they use the heat produced by the biomass CHP plant to cover the energy needs of their main industrial plant.

Energy Supply Contracting

The **benefits for the heating customers** are the following:

- Use of foreign know-how during the construction and operation of the heating plant
- The **contractor is specialized and has specific know-how regarding:**
  - the technology of biomass utilization (e.g. sizing and specifications of the boiler and the design of the fuel storage)
  - the fuel logistics (e.g. existing logistics concept, existing contacts to forestry operations
  - plant operation (e.g. reducing the operating hours of the natural gas reserve boiler, reducing of network losses)
  - The landlords /building owners are relieved of tasks such as maintenance, repair and billing; the contractor takes over the purchase and renovation of the facility and its operation
  - Municipalities, with poor budgetary position do not need equity to finance a biomass heating plant.

On the other hand, the **major drawback** is that companies mostly think in short payback periods and **avoid long-term contracting to retain their operational flexibility**. It is noted that this model is often **preferred by the municipalities**.

Key features of a typical raw material supply contract

Investor´s own business initiative

Under the **Investor's own business initiative,** typical terms of a **biomass supply contract** are delivery **quantity**, delivery **date**, **quality of fuel** adapted to the combustion plant, **remuneration** and other rights and obligations of each party. **Price escalation clauses** bring the general market trend into account and facilitate the conclusion of long-term contracts. The **cost escalation clauses** often involve a price fixing concerning the development of prices for fossil fuels and/or for wood. **Wood chip prices** depend on the **quality and quantity and the respective supplier**. Within the delivery note, the supplier specifies the delivery volume and if procurable the composition of timber species. The customer randomly checks the plausibility of the particulars of the delivery only if it seems to be necessary. **In some cases the billing is based on measurements using heat meters at the output of the boiler**.

There are several billing options:

- **Billing on volume**
  - most suitable for bulk material for homogeneous fuel ranges
  - least effort (quantity determination by the dimensions of the loading space)
- **Billing on mass and water content**
  - suitable for bulk material with inhomogeneous fuel ranges
  - quantity survey by using in-house scales

- additional water content measurements increase the accuracy in determining the energy content

- **Billing on the amount of heat**
  - only makes sense when there is only one biomass supplier
  - reduced technical effort and high accuracy

The raw material (biomass) shall be reasonably free from incombustible foreign particles, such as stones. **If the quality of the delivered wood does not meet the agreed specifications, the purchaser may reject the delivery.** The supplier has to substitute the delivery on his own expense. In some cases the supplier is liable for damages that are proven to be held responsible for pollution in the fuel delivered.

Single Investor

The investor does not get into any kind of contractual relationship with external biomass suppliers in order to cover its biomass supply needs, as he uses its own wood waste produced by his wood-based industrial plant.

Energy Supply Contracting

In case the contractor is not a fuel distributor, **the contracts are designed to specify the delivery quantity, delivery times, quality of fuel,** in consultation with the selected firing system, **liability regulations**, remuneration and other rights and obligations of each party.

The cost escalation clauses and the billing options are the same as in the **Investor's own business initiative** business model.

Key features of a typical heat delivery contract

The key features of typical heat delivery contracts for the 3 business models are presented in the Table 2-12.

Table 2-12 Key features of typical heat delivery contracts of the 3 business models in Germany

Key features of typical heat delivery contracts	Business models		
	Investor´s own business initiative	Single Investor	Energy Supply Contracting
Heat quantity	✓	✓	✓
Heat transfer medium	✓	✓	✓
Connected load	✓	✓	✓
Price regulation	✓	✓	✓
Obligation to accept (heat customer commits to take the heat)	✓	✓	✓
Measurement methods	✓	✓	✓
Price terms (date of	✓	✓	✓

Key features of typical heat delivery contracts	Business models		
	Investor´s own business initiative	Single Investor	Energy Supply Contracting
payment, consequences in case of delayed payment)			
Liability questions	✓	✓	✓
Contract duration	According to current legislative regulations (§ 32 Abs. 1 AVBFernwärmeV) the allowable contract period has a **maximum of 10 years**. An **extension for another 5 years is possible**, assumed that the original contract is not terminated within a period of 9 months before the expiry	It is recommended to agree contract duration of at **least 5 years**. The **maximum term is 10 years after AVBFernwärmeV**, which - if neither side terminates the contract – is **extended for another five years**	It is recommended to agree contract duration of at **least 5 years**. The **maximum term is 10 years after AVBFernwärmeV**, which - if neither side terminates the contract – is **extended for another five years**

When calculating the price of heat, the cost of heat supply and existing risks are taken into account. This includes the technical risk, such as breakdowns and compliances with planned energy efficiencies. Also temperature-dependent fluctuations in consumption and changes of the heat demand of the customer are taken into account. **In order to protect themselves against unforeseeable changes in consumer behavior, the price is usually a division of the heat price as a basic- or capacity charge and a commodity charge**. In addition, the cost of measuring equipment is invoiced.

In general, the adjustment of the base price and the kWh price are adjusted by indices. These indices are influenced by the price development of the goods which are relevant to the composition of the heat price.

The most important indices are:

- Index of C.A.R.M.E.N. e.V. for prices of forest woodchips
- Index von C.A.R.M.E.N. e.V. for prices of Pellets
- Index for wood products to generate energy (Index für Holzprodukte zur Energieerzeugung)
- In case oil and gas is needed for peak load: Price index for light fuel oil or natural gas on basis of producer price index for industrial products
- Price for engineering products, index of producer prices for industrial products
- Price index for manufacturing industry and energy supply based on index of the agreed hourly wages of employees.

2.5.2 Financing options

Description of financing options

In Germany the available financing options are:

- **Loans** from financing institutions
- **Low-interest loans with redemption subsidies** within the framework of Market Incentive Programme (national level)
- **Grants by funding programs** in some federal states
- **Grants by European Regional Development Fund**

Generally, the investors have to contribute 20% equity. Deviations are possible and depend on the solvency of the investor and the project economics.

As funding partner of the KfW-bank, the borrowers´ bank undertakes the check of the customer, evaluates its plans and decides whether the borrower accompanies the project and submits an application to the KfW-bank. After loan approval by the KfW, the financing partner passes through the KfW funds to the customer. By reason of the current low interest of the bank loans, the **borrowers´ sometimes renounce the KfW-loans**.

Some federal states offer additional grants to lower the required equity ratio and thus reduce implementation hurdles.

Loans

There are typically two types of loans available: **traditional financing and project financing.** In **traditional financing**, the focus is on the company's overall financial capacity to repay the loan from the activity it develops, the medium and long term prospects, plus the capacity of the company to submit value titles or other assets destined to guarantee the loan.

Loans granted by the banks are the most important source of funding for investments in biomass projects in Germany.

The FIs cooperate with the KfW-Bank and the guarantee banks of the federals states. KfW is the largest financer of the middle class in Germany. It provides **long-term investment loans** for companies, as well as **loans to finance operating resources**. In particular, the KfW supports companies to invest in order to improve the EE of buildings and EE in production. Loans for the above cases, are partially subsidized by federal funds and thus are considered extra favourable.

The guarantee banks are self-help organizations of the commercial economy. Their task is to ensure the promising projects of small and medium enterprises together with the bank of the borrower. Thus, the remaining need of equity can be further reduced and financing barriers are removed.

A project financing is an investment project by a legally and economically independent special purpose (Special Purpose Company "SPC"); the operating costs and debt services are exclusively generated from the project proceeds. Therefore, project financing is

oriented to the own revenues of the project (cash flow related lending) off the balance sheet of the investor (off balance sheet financing). **Banks like the Environment Bank always evaluates each project carefully in terms of its economic and ecological value. The focus is on the project reliability.**

The complex requirements in the financing of projects are met with individual financing solutions. Depending on the structure and requirements of a project, FIs such as the Environment Bank, support their customers in raising equity. For this, they fall back on mezzanine loan or on emissions of project bonds.

Private banks, **cooperative banks** (VR-Bank, Sparkasse, Commerzbank), and **public law banks** (Investitionsbank SH etc.) offer individual financing packages combined with low-interest loans of the KfW-Bank.

Grants

Grants are provided through the **Support program of the KfW - Renewable Energy in the program section 'Premium', biomass plants or CHP biomass plants (No. 271)**.

For eligible biomass facilities for heat production, a **repayment bonus of 20 EUR/kW** installed nominal heat output (basic funding) is granted, but not exceeding EUR 50,000 per single investment grant. In addition, the following bonuses may be granted:

- **Bonus for low dust emissions**: 20 EUR/kW nominal heat output, provided that the dust emissions (volume content of oxygen in the exhaust gas of 13% under standard conditions (273 K, 1013 hPa) exceed 5 mg/m³.
- **Bonus for the establishment of a heat storage tank**: The basic grant is increased by 10 EUR/kW nominal heat output, in case a buffer with a minimum storage capacity of 30 l/kW is installed.
- **The promotion and the bonuses are cumulative.** The maximum redemption grant is EUR 100,000 per unit.
- For eligible CHP biomass plants, a repayment bonus of 40 EUR/kW of installed nominal heat output is granted, in case the electrical efficiency is higher than 10% and the overall efficiency higher than 70%.

The combination of a loan from the KfW Renewable Energies Program with other aid (loans or grants / subsidies) is possible as long as the sum of loans, allowances or subsidies does not exceed the sum of expenses.

Within the Market Incentive Programme (MAP), KfW also provides financing for the use of renewable energies in the heating market. Among others, the establishment and expansion of a heating network including heat exchangers at the house transfer stations is supported. **Up to 100% of eligible net investment costs can be funded**.

The amount of funding is as follows:

- **Redemption grant** of EUR 60 per newly built meters, but no more than 1 million EUR
- **Redemption grant** of EUR 1,800 for house transfer stations of existing buildings, if the investments are carried out by the investor and operator of the heating network and no connection to the DH is forced.

The program also **funds automatically-fed biomass heating systems with a rated thermal output from 100 kW to 2 MW**. The amount of funding is as follows:

- Redemption grant of 20 EUR/kW rated heat output, max. grant EUR 50,000 per facility.
- The repayment amount will increase by itself:
  - 20 EUR/kW of rated power, when the dust emissions do not exceed 15 mg/Nm³
  - 10 EUR/kW of rated power, when a buffer of at least 30 l/kW is installed
  - The maximum amount of the partial debt remission is EUR 100,000 per unit.

In addition, many federal states offer country-specific support programs. For example, in Hesse grant applications can be submitted to the WI-Bank. Biomass heating plants over 100 kW rated useful heat can obtain a **grant of up to 30% of the eligible expenses**, but **only up to a maximum of EUR 200,000. The own contribution of the beneficiary to the eligible investment costs may normally not be less than 25%.**

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the loans' schemes in Germany are:

- Lenders generally have no co-determination, decision-making and supervisory powers (except when there is a large dependence on the capital) towards the investor and during the overall assessment of the project
- **Elasticity of total assets** (flexibility of the company is increased); the loan period can be up to 15 years
- **Options of combining bank credit and KfW loan**
- **Low interest** loans
- Quick fundraising.

The **weaknesses** on the other hand, are:

- Fixed lent term
- Fixed payment by instalments (usually with little or no flexibility)
- Creditworthiness and high share of equity is assumed (approximately 20%).

The loans represent the most used financing instrument by the biomass heating project developers. Due to the low interest bank loans, **loans are very popular and subsidies that are possibly associated with higher administrative workload are less in demand.**

Grants

In many cases projects are only economical, if the initiator(s) receive grants. The subsidies reduce the capital required and shorten the payback period. In addition, BAFA[11] promotes efficient and low-emission biomass plants with the disbursement of investment grants.

The main **weaknesses** of the grants are the following:

- Grants are often connected with **large bureaucratic burden**, especially for farmers the de-minimis rule is a barrier to invest
- In **heating networks**, a joint promotion by BAFA and KfW is possible. Applications must be submitted to the KFW before the beginning of measures. However, to promote heating networks, the KfW assumes a previous application with the BAFA. The BAFA does not issue advance decisions. Applications must be submitted just before first-time operation. To comply with the conditions for both promotions, it is recommended to submit the request simultaneously before the start of measures. Nevertheless, **these inconsistencies within the application process result in delays**. At the time of loan disbursements, it is not ascertained whether the redemption grant of the KfW is actually granted. From the perspective of the FI, the initially high blank amount presents a risk.

Financing options from structural funds

In Germany, the **federal states have developed operational programs** in order to implement the main objectives of the structural fund "EUROPE 2020 -A strategy for smart, sustainable and inclusive growth".

One of them is the reduction of the GHG emissions by 20% compared to the level of 1990 (or even 30%, provided that the necessary conditions are met). The share of renewables in final energy consumption should rise to 20% and there also an increase in EE by 20% is intended. For example, companies should be able, to switch its heat production to alternative energy sources (biomass, shallow geothermal energy, etc.). Even the heat supply of urban quarters basing on biomass is eligible.

Difficulties in financing biomass heating projects

The main **problems for financing a biomass heating project** in Germany are the following:

- Lack of equity capital
- Too short biomass supply and heat supply contracts
- The investors do not submit to the banks coherent business models
- Lack of profitability
- Long periods for project development (pre-financing is a great challenge especially for small companies).

[11] Federal Office for Economic Affairs and Export Control

Main conclusions from the interviews with the banks

DBFZ interviewed **4 Financing Institutions (FI)** that have financed biomass heating projects in the past. The financing institutions that were interviewed are the Commerzbank (**CB**), the Volks- und Raiffeisenbank (**VR**), the Investionsbank Schleswig-Holstein (**IB**) and the Wirtschafts- und Infrastrukturbank Hessen (**WI**).

All banks have **many years of experience in financing renewable energy concepts and biomass heating concepts (up to 20 years).**

Two Financing Institutions have **specially trained staff** for the business segment Energy and Environment, who improve their skills regularly on internal and external training. Therefore they are able to execute the economic and legal assessment of projects. **The other two FIs are based on specialized companies such as Energy Agencies**. In complex cases all FIs consult lawyers.

Some FIs drafted guidelines in the past, but **none of them offer current guidelines and information material to their clients for financing biomass projects**. Detailed information for project planning and project implementation can be retrieved from **specialized organizations such as C.A.R.M.E.N. e.V. or the Energy Agencies of the federal states**.

In Germany, the **FNR** (Fachagentur Nachwachsende Rohstoffe e.V.) provide assistance with a list of required information and documents, which have to be arranged for the negotiations with banks.

The FIs offer loans to their prospective clients. As funding partner of the KfW-bank, e.g. the bank undertakes the check of the customer, evaluates its plans and decide whether they accompany the project and submit an application to the KfW-bank. After loan approval by the KfW, the financing partner passes through the KfW funds to the customer.

In cases of large credits, the FI favours a syndicated loan. In this case **two banks grant a single loan to a borrower**.

The banks except CB have no special target groups. Anyone can make a loan application (Communities, businesses, schools, etc.) and a wide range of projects will be funded (biomass DH projects as well as projects dedicated to in-house production an in-house usage of biomass heat).

By uncertainties in calculating the development of substrate costs, many companies have fallen into financial difficulties. Consequently, the Commerzbank is now focusing on companies with own substrate volumes who want to use the heat themselves or which want to sell it to third parties.

For prestige reasons, the project appraisal of the CB put particular attention to sustainability and environmental considerations. Other FIs expect the competent licensing authorities to carry out these assessments.

On average, the **minimum share of the equity capital is 20%.** Deviations are possible and depend on the financial background of the borrower and the security of future cash return. The maximum **life of the loan is 15 years** for a combination of biomass plants and district heating and 20 years for district heating only.

Table 2-13 provides the **stipulations / requirements** that FIs checks from their clients in order to finance biomass heating projects.

Table 2-13 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Finland)

Stipulation / requirement	VR	IB	CB	WI
Security of feedstock supply				
Existence of heat supply contracts and guarantees	✓ Contracts or pre-contracts are mandatory; a financial participation of the customer is advantageous	✓	**The bank is focused on self-supply models of companies. The creditworthiness of the company is essential, the criteria- listed in the tables below are of secondary importance.**	**The WI is advised by the hessenENERGIE Ltd., which is an energy agency that is involved in investment projects and consulting services for an efficient and environmentally friendly use of energy.**
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers	In rare cases	✓		
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓ A contractual obligation of 5 years would be optimal, longer periods are currently not realistic	✓ It should be present, but generally the plausibility of this concept is crucial as contracts can be broken. It would be better to embed the producers of solid wood fuels into the SPV. Contract obligations up to 10 years are possible		✓ A procurement concept is necessary
Indexed heat sale price	✓	✓ Usually calculated on the basis of the price development		

Stipulation / requirement	VR	IB	CB	WI
		of woodchips, rarely on the price of heating oil and/or natural gas		
Indexed biomass price	✓	✓		
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)	Not a pre-requisite			
Land ownership titles of biomass supplier (no traders)	Advantageous but **not mandatory**	No general statement possible because there are differences between pellet and wood chips		
Other (please specify)	The heat customer must be bound by contract and should have invested in the DH			
Technical				
Technical due diligence (DD)	✓ If necessary, an engineering office is commissioned to carry out a general examination	✓ It is carried out by the Energy Agency	✓	✓
Possibility of an Engineering Procurement Construction Contract	Not mandatory	✓ Reduces risks		
Review of main contractors and service contracts	✓ In contracts with general contractors that credit plays an important role	✓ In tricky cases by lawyers		
Assessment of the technical concept and of process engineering	✓			
Assessment of the operation and maintenance (O&M) regime	✓ Pilot projects and new process technology are reviewed again by a third party			
External construction supervision (verification)	Only in investments exceeding EUR 500,000	✓ Pilot projects and new process technology	Not necessary, enough own expertise	

Stipulation / requirement	VR	IB	CB	WI
		are reviewed again by a third party		
Review of profitability calculation	✓ The business plan is checked for plausibility in case the investment exceeds EUR 500.000	The business plan is checked for plausibility		
Other (please specify)				
Legal				
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓ **Important,** contracts are reviewed under legal aspects and are amended if necessary	✓ Contracts are reviewed in coordination with the commercial banks		
Legal assessment of production licences, environmental permits, etc.	✓ The licensing authorities are responsible for the legal assessment, the bank checks whether the documents are present	✓ Checked by the bank		
Assessment of real-estate property (hypothecs, etc.)	✓	✓	✓	
Network connection agreement	✓			
Existence of operation and maintenance contracts	✓			
Other (please specify)				
Financial				
Evaluation of business plan	✓ It must be comprehensible and resilient	✓ It must be comprehensible and resilient, it is advantageous if a tax adviser is involved in the development of the project plan	✓	✓
Minimum share of equity capital	✓ 20%, deviations possible		✓ The minimum share depends on the creditworthine	✓ Not less than 25%

Stipulation / requirement	VR	IB	CB	WI
			ss	
Upper limit for the residual investment value				
Upper limit in percentage of (guaranteed) cash flow	✓ 110%			
Upper limit for the Pay Back period		There is **no limit**, debt service capacity is crucial		
Minimum Debt Service Cover ratio	✓ 1.1	✓ 1.2		
Minimum Return on Equity				
Maximum lent term (life of the loan)				
Upper limit regarding technical life-time of main equipment	✓ 15 years (biomass heating plants and DH)	✓ 10-15 years (biomass heating plants; 15-20 years (only DH)		
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	There should be a consistent maintenance concept, however, this need not be a full service contract	There should be a consistent maintenance concept, however, this need not be a full service contract		
Other (please specify)				
Securities for liabilities				
Supplier's financial guarantee in case of supply contract default	**Not mandatory**, but the lack of financial guarantees is criticized	Desirable, but usually not the case		
Supplier's obligation to retain agricultural / forestry production	**Not mandatory**			
Account pledge	✓ Generally, in the first two years the operating company save up an amount for future repairs			
Risk insurance (liability, damage, business interruption)	✓ Insurance for breakdown and interruption, liability insurance			

Stipulation / requirement	VR	IB	CB	WI
Other (please specify)	✓ Mortgage on all project assets			

The most important factors that FIs consider in order to provide financing for biomass heating projects are presented in the Table 2-14.

Table 2-14 Important factors that the FIs consider to finance biomass heating projects in Germany

Factor	VR	IB	CB	WI
Investor credibility	✓	✓	✓	✓
Project IRR	✓	✓	✓	✓
Payback Period	✓	✓	✓	✓
Maturity of the project / technology	✓	✓	✓	✓
Long term biomass supply contract with predictable raw material prices	✓	✓	✓	✓
Long term heat delivery supply contract	✓	The supply concept must be coherent and players must be named	✓	✓
Other	✓ **High debt service coverage ratio**, high **equity base**	The **project development time** is also important, which results in problems in the pre-financing particular in small project companies.	**Stable cash flows**	- **The fuels must be obtained predominantly from raw wood or from straw** (respectively energy crops) - **Heat meters must be installed** - **Defined emission limits** must be adhered to

According to the FIs, **there is still potential of biomass like straw for energy usage**. But currently the biomass price is not competitive due to the cheap fossil fuel energy prices. In this respect, **the interest to invest in biomass heating systems is low compared to previous years**. The improvement of the quality management for solid biomass fuels will play an important role, in order to prevent the number and duration of malfunctions.

2.5.3 General data on the DH sector in the country

Table 2-15 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-15 Data of the DH sector in Germany and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	In Germany, in-house heat producers sometimes deliver the heat produced to third parties; **in this case they have a large accumulation of heat and not enough internal heat sinks**.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	Generally the biomass (excess) heat from industrial / commercial activities is transported over a supplier-owned grid. Connections to a fossil fuelled grid are **exceptional**.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	Connections of woodchip or pellet fuelled boilers to a fossil fuelled grid are **exceptions**. There are some DH projects where CHP plants fired by waste and old timber inject heat into a fossil fueled existing DH grid.
4. **Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises**	Yes.
5. **Payment of costs related to customer's connection to the DH grid**	The customer bears the cost for the connection to the grid and for the metering device. **The heat transfer station is usually in possession of the investing SPV.**
6. **Measurement of the DH demand at the customer's premises**	The costs for reading the heat meter are not separately charged to the customer. Usually these costs are included in the basic price.
7. **Payment behaviour of DH customers to the SPVs**	**Problems only occur if the calculation method of pricing, shown in the contract, is not comprehensible**. In new heat delivery contracts, the cost escalation clauses involve only the price development of wood fuel and no longer that of gas and oil.
8. **Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant**	The financing institutions demand heat supply contracts and guarantees. **In Germany the upper limit for contract duration is 10 years.** A clear expansion strategy must be provided. If there are uncertainties regarding the future connecters, a higher equity ratio is required.
9. **Strengths and weaknesses of the (fossil and biomass fuelled) DH sector**	**Strengths of the fossil fuelled DH sector**: › Considering the current very low prices of oil and natural gas the fossil fuels have a competitive advantage › Lower personnel expenses and labour input of professionals. › The energy utilities have extensive experience in running fossil fuelled heating and cogeneration plants › Because companies think in short payback periods, fossil plants with lower investment costs rather than biomass fuelled plants are of advantage. **Weaknesses of the fossil fuelled DH sector**: › Higher GHG emissions › Dependence on imported raw materials › Low regional value.

Parameter	Applicability in the country
	Strengths of the biomass fuelled DH sector: › Low GHG emissions › Independence on imported raw materials › High regional value since biomass mainly comes from regional sources › Economic benefits in the long term due to lower fuel costs. **Weaknesses of the biomass fuelled DH sector:** › Inadequate quality of fuels often leads to malfunctions (improvement of quality management is necessary) › In many cases, the operator does not have the necessary know-how › High initial investment costs › Higher personnel expenses, the recruitment of well trained staff is only economically feasible in large plants › Promoter, architects, installers and heating engineers still have less experience in biomass plants and need training › Due to negative experiences in biogas plants, individual banks reject financing to a biomass based district heating project.
10. Economic health of the existing biomass DH sector	The majority of existing biomass DH projects show good economic health. But in the light of low gas and oil prices, the ability to make replacements investments is reduced.

2.6 Croatia

2.6.1 Business models

Description of business models

In Croatia, there are **5 operational biomass CHP plants**.

The most common business models in Croatia are the **Investor's own business initiative** and the **Energy Supply Contracting**.

The **Investor's own business initiative** is used for in-house heat and electricity (cogeneration) production in industrial facilities that produce wood products. Under this business model, the investor, who owns an industrial facility that produces wood products, installs a biomass CHP plant financed by his own capital and a bank loan. With this investment, the investor covers the heating and electricity needs of its industrial facility, thus reducing its energy costs. The excess electricity is sold to the national grid while the heat is used exclusively to cover the heating needs of the industrial facility. Biomass is derived as a by-product of the industrial facility and therefore the investor has abundant raw material at his premises to fuel the CHP plant.

Energy Supply Contracting solutions are mainly used in the **industrial sector involving cogeneration, where heat is used as process heat.** One such project involves Hrvatske

šume d.o.o. (Croatian Forests LLC) which is a legal successor of "Hrvatske šume", public enterprise for forest and woodland management in the Republic of Croatia. Hrvatske šume provides heat to public buildings via small DH system and is the main provider of forest biomass is Croatia.

The ESCO model is defined by the Act on EE in direct consumption (OG 127/14). Currently there are approximately **5 ESCO companies in the country**.

Main stakeholders / role

Under the **Investor's own business initiative** the main stakeholders / actors involved are the investor and the financing institution that provides the loan. The role of the financing institution (bank) is to provide long term financing for the project for equipment supply, set-up and construction of the CHP plant.

The main stakeholders / actors involved in the **Energy Supply Contracting** business model are the **contractor (ESCO)** and the heat customer.

Ownership of the biomass heating system

Under the **Investor's own business initiative,** the investor owns the whole CHP plant and is responsible for the O&M and other related costs.

Under the **Energy Supply Contracting** the whole biomass heating system is in the **ownership of the contractor (ESCO).** The owner of the CHP plant is responsible for the O&M and other related costs.

Level of support of the legislative framework to the business models

The current legislative framework does partially promote/support **investments made by investors** to cover their own heating needs. Although there is no dedicated legislation for promoting biomass or heat production, there **are available promotion or subsidy schemes** for RES related projects in terms of structural funds and support for eligible producers (presented in the section "*Financing options*").

Energy Supply Contracting is not promoted by the current legislative framework. Projects that have been implemented so far, are not completely in line with the ESCO model due to legislative limitations.

Advantages, weaknesses and effectiveness of the business models

The advantages of the **Investor's own business initiative** business model are summarized in the following:

- Reduction of the energy costs of the main industrial facility
- Security of supply since biomass is derived as a waste from the main industrial activity of the investor

- Supply of biomass at no cost. In this business model, the investor uses its own biomass waste derived from the main activity of his industrial facility
- The production capacity is tailored to function so as to respond to the investors specific energy needs
- There is a possibility for co-funding through structural funds.

The main **weakness** of this business model is that the investor finances an important part of the investment (at least 25 - 30%) by his own capital and to this end, faces financial difficulties in investing in such kind of projects.

The **Investor's own business initiative** business model is the **most commonly used** for developing biomass CHP plants. Actually, the investors who are involved in the wood processing industry, prefer this model since they use the heat produced by the biomass CHP plant to cover the energy needs of their main industrial plant.

One major **advantage of the Energy Supply Contracting** business model is that there is available an investment subsidy for the development of biomass CHP projects. On the other hand, as mentioned earlier, there are **certain issues that impede** the implementation and mainstreaming of ESCO projects such as:

- Accounting problems related to the transfer of ownership between the ESCO and the client
- VAT rates that impede ESCO projects due to the specific time-line of expenses and revenues.

Energy Supply Contracting is **not considered effective** for biomass CHP projects in Croatia.

Key features of a typical raw material supply contract

Under the **Investor's own business initiative**, the investor does not enter into any kind of contractual relationship with external biomass suppliers in order to cover its biomass supply needs, as he uses its own biomass waste produced from his wood-based industrial plant.

Concerning **Energy Supply Contracting** there is a long-term contract between the plant owner and the feedstock provider (usually Hrvatske šume d.o.o.) or they are the same company (e.g. Hrvatske šume d.o.o. or wood processing industry). The subject of the agreement between the biomass supplier and the plant owner are the **guaranteed/intended quantity** of biomass, the **contract duration** and the **biomass price terms**. The **biomass price is set by a long-term contract**; the **biomass supplier bears the market risks** for the quantity and quality of the feedstock supply.

Key features of a typical heat delivery contract

As in the previous case, the investor does not enter into any kind of contractual relationship with end-customers, since the heat produced from the biomass CHP plant is used exclusively to cover the heating needs of his industrial plant.

However, there are **plans for the development of DH at the local community level**.

Concerning **Energy Supply Contracting** the price of a heat delivery contract is **regulated by the market**. It is lower than the price of the most common energy source used in the project area by a defined percentage.

2.6.2 Financing options

Description of financing options

The most commonly used financing options in Croatia are:

1. Bank **loans**
2. EU **grants** (WeBSEDFF[12], CroPSSF[13], EPEFF[14]) and **investment subsidies**

Favourable loans or RES-oriented credit lines granted by commercial banks are an important source of funding for RES and EE investments and, by extension, for biomass projects in Croatia.

There are typically two types of loans available: traditional financing (available from banks) and project financing (available from both, banks and non-banking financial institutions). In traditional financing, the focus is the company's overall financial capacity to repay the loan from the activity it develops and the medium and long term prospects, plus the capacity of the company to submit value titles or other assets destined to guarantee the loan. In project financing, the focus is the project reliability (most banks require the creation of an SPV in this respect).

Loans are offered by:

- **Commercial banks, through own financing packages** (such as "green credit lines" from ProCredit Bank) or through **cooperation with other financial institutions (GGF[15] and EBRD funds)**
- **Croatian Bank for Development and Reconstruction (HBOR)**; in cooperation with commercial banks, it offers loans for RES projects
- The **Environment Protection and Energy Efficiency Fund (EPEEF)**, a non-banking financing institution authorized by the law to finance EE projects; EPEEF has financed RES projects as well, including biomass.

Grants and investment subsidies are provided by **EPEEF and the Financing Facilities**.

[12] Western Balkans Sustainable Energy Direct Financing Facility
[13] Croatian Private Sector Support Facility
[14] Environmental Protection and EE Fund
[15] Green for Growth Fund

EPEEF was established in 2003 as a non-budgetary institution. Financing is secured through environmental charges and is allocated to legal and natural persons through **loans**, **subsidies**, **financial aid**, and **grants**. In particular:

- **Loans** - **zero interest rate**, repayment period 7 years (grace period 2 years, payback period 5 years), up to EUR 190,000
- **Subsidies** - up to 2% of the stipulated rate and up to EUR 108,000
- **Financial aid** - only for units of regional and local self-government up to EUR 190,000
- **Grants** – for educational, research and development activities, up to EUR 22,000

These resources are allocated following a public announcement inviting applications for allocation. The resources can be allocated to local and regional self-governments and to legal and natural persons. The user of the Fund's financial support is, however, obliged to invest his own financial resources in the proposed project. **The Fund can cover up to 40% of the total investment cost.** For regional and local self-government units in Areas of Special State Concern, this amount can be up to 80% and for undeveloped areas (islands, mountainous and rural areas with an average per capita income of less than 65% of the Croatian average) up to 60%.

The **Western Balkans Sustainable Energy Direct Financing Facility (WEBSEDFF)** is operated by the EBRD. It offers support to small and medium-size enterprises and investors in investing in sustainable energy projects by means of **individual loans in the amount from EUR 2 to 6 million**. In order to qualify for funding and support, the projects must meet certain criteria:

- **Technical criteria**: at least 20% energy savings for industrial EE projects; minimum efficiency (utilization) rate for RE projects
- **Financial criteria**: a sound financial and economic structure with sufficient equity capital contributed to the project by the sponsor
- **Other criteria**: for projects requiring concessions, licenses and permits, those should be obtained in compliance with the relevant EBRD requirements (transparent and competitive process, among others).

The **Sustainable Energy Financing Facility (SEFF)** is dedicated to improving the supply of long term finance for investments in EE and RE for private sector enterprises of all sizes. The objective is to provide financing, incentives and technical assistance for the preparation of eligible investments designed to improve the EE performance and/or implementing RE investments. The Sustainable Energy Financing Facility is a unique opportunity to quickly and effectively realise the energy savings potential. **The facility provides not only the financing and a grant of up to 20%, but also free-of-charge technical assistance by highly qualified experts**. Currently, the SEFF window is under development. **It is expected that the first participating bank will sign the Facility Agreement in November 2015**.

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the loans' schemes in Croatia are:

- **Low interest rate**
- **Availability of funds form EPEEF and HBOR**

On the other hand, loans' schemes have the following **weaknesses**:

- Limited sources for funding by RES credit lines
- Relatively **long payback periods**

Loans represent a useful financing instrument, but **at the current stage EU grants are more appealing for future projects**, even if they are scarce. The potential is high, as new RES regulations are being developed but until they are complete it is difficult to predict their effectiveness.

Grants / Investment subsidies

The main **advantage** of the investment subsidy scheme is that it provides a very good financial incentive for the potential investor, and avoiding jeopardizing the investment.

On the other hand, investment subsidies are provided **after the implementation and verification of the EE / RES investments**.

They are **considered effective**; especially EPEEF has financed a large number of small- and large-scale projects. **It is considered a reliable and preferred financing option, although the budget is limited.**

Financing options from structural funds

There are two structural funds available for Croatia in the renewable energy field. These are:

1. ERDF (European Regional Development Fund): The ERDF is aimed at strengthening the economic and social cohesion in the EU by correcting imbalances between its regions. The ERDF focuses its investments on several key priority areas, known as 'thematic concentration'. Those potentially relevant to biomass heating include support to SMEs and the low-carbon economy. The ERDF resources allocated to these priorities will depend on the category of region. This is 50% in less developed regions, such as Croatia.

Furthermore, some ERDF resources must be channelled specifically towards low-carbon economy projects; for less developed region this is 12%.

2. EU Cohesion Fund: The Cohesion Fund is aimed at Member States whose Gross National Income (GNI) per inhabitant is less than 90% of the EU average. It aims to reduce economic and social disparities and to promote sustainable development. For the 2014-2020 period, the Cohesion Fund will be available to Croatia. The Cohesion Fund allocates a

total of EUR 63.4 billion to activities, among which are also environmental activities related to energy or transport, as long as they clearly benefit the environment in terms of EE, use of RES, developing rail transport, supporting intermodality, strengthening public transport, etc. The financial assistance of the Cohesion Fund can be suspended by a Council decision (taken by qualified majority) if a Member State shows excessive public deficit and if it has not resolved the situation or has not taken the appropriate action to do so.

Difficulties in financing biomass heating projects

The main problems for financing a biomass heating project in Slovakia are the following:

- Lack of equity capital
- Time delays with respect to acquiring the necessary operating licenses
- Too short heat supply contracts
- Availability of primary biomass supply long term contracts

Main conclusions from the interviews with the banks

EIHP interviewed two FIs, **none of which have financed biomass heating projects in the past**, but have financed a number of RES related projects. The FIs that were interviewed were **Privredna banka Zagreb (PBZ)** and **Zagrebačka banka (ZABA)**.

Both FIs have available **financial experts with experience on RES projects** that have undergone **training for RES projects** in general but not specifically for biomass heating projects.

Both FIs **offer guidelines and information** material to their clients for financing RES projects. The guidelines are in the form of a **general information brochure** or in the form of an application form that the client has to fill in, in order to be eligible to receive the loan.

They both offer RES loans to their prospective clients. **ZABA provides loans through the GGF and EBRD funds or specialised RES loans**.

Both FIs take into account sustainability and environmental considerations before financing biomass heating projects.

Table 2-16 provides the **stipulations / requirements** that the FIs check from their clients in order to finance biomass heating projects.

Table 2-16 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Croatia)

Stipulation / requirement	ZABA	PBZ
Security of feedstock supply		
Existence of heat supply contracts and		✓

Stipulation / requirement	ZABA	PBZ
guarantees		
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers		
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓	✓
Indexed heat sale price	✓	
Indexed biomass price	✓	✓
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)	✓ Preferably. If not, dispersion of risks with different biomass supplier; long term contracts	✓
Land ownership titles of biomass supplier (no traders)	✓ Preferably	
Other (please specify)		
Technical		
Technical due diligence (DD)	✓ External and dependent on complexity	✓
Possibility of an Engineering Procurement Construction Contract	✓ External consultant	✓
Review of main contractors and service contracts	✓	✓
Assessment of the technical concept and of process engineering	✓	✓
Assessment of the operation and maintenance (O&M) regime	✓	✓
External construction supervision (verification)	✓	✓
Review of profitability calculation	✓	✓
Other (please specify)		
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓ If the project is complex, it is performed by an external legal audit	✓
Legal assessment of production licences, environmental permits, etc.	✓	✓
Assessment of real-estate property (hypothecs, etc.)	✓	✓
Network connection agreement	✓	✓
Existence of operation and maintenance contracts	✓	✓
Other (please specify)		
Financial		
Evaluation of business plan	✓ Internally	✓
Minimum share of equity capital		✓

Stipulation / requirement	ZABA	PBZ
Upper limit for the residual investment value		
Upper limit in percentage of (guaranteed) cash flow		
Upper limit for the Pay Back period		
Minimum Debt Service Cover ratio		
Minimum Return on Equity		
Maximum lent term (life of the loan)		
Upper limit regarding technical life-time of main equipment		
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring		
Other (please specify)		
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default	✓ Alternatively all risk insurance	✓
Supplier's obligation to retain agricultural / forestry production		✓
Account pledge		
Risk insurance (liability, damage, business interruption)	✓	✓
Other (please specify)		

The most important factors that the FIs consider in order to provide financing for biomass heating projects are presented in the **Table 2-17**.

Table 2-17 Important factors that the FIs consider to finance biomass heating projects in Slovakia

Factor	ZABA	PBZ
Investor credibility	✓	
Project IRR		
Payback Period		
Maturity of the project / technology	✓	
Long term biomass supply contract with predictable raw material prices	✓	✓
Long term heat delivery supply contract	✓	✓
Other		

It is noted that the FIs have cooperated with other financial institutions (GGF and EBRD funds) for financing RES projects and in addition the financing options are designed to cooperate with financial instruments developed by the Government.

According to the FIs, the **development potential** of the biomass heating market in Croatia is **difficult to predict** due to the current development of new RES regulations and feed-in-tariff rules. Therefore it is **difficult to foresee the development in near future**.

2.6.3 General data on the DH sector in the country

Table 2-18 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-18 Data of the DH sector in Croatia and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	A few cases exist in Croatia, but the concept is not widely applicable.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	No information available.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	This concept does not exist at the moment. However, there are some biomass plants which are currently in the planning phase.
4. **Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises**	Not applicable.
5. **Payment of costs related to customer's connection to the DH grid**	Usually yes, but the actual costs differ from utility to utility.
6. **Measurement of the DH demand at the customer's premises**	Yes, at the DH substation by a heat meter.
7. **Payment behaviour of DH customers to the SPVs**	There are no such reported trends.
8. **Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant**	The contents of the contract and all other terms are defined by the Croatian Heat Market Law (OG 80/13, 14/14 and 102/14).
9. **Strengths and weaknesses of the (fossil and biomass fuelled) DH sector**	**The strengths of the DH sector** are that DH can improve EE and the application of new technologies can improve the reliability and security of the sector. It is expected that by 2020, Croatia will set basic preconditions for the development of DH. On the other hand, the **weaknesses** are that the natural gas is favoured as opposed to DH; the DH systems in Croatia require **significant investments** to revitalise and modernise them in order to increase the reliability and security of heat supply; there is a lack of general energy planning.
10. **Economic health of the existing biomass DH sector**	There is no biomass DH sector currently existing in Croatia.

2.7 Poland

2.7.1 Business models

Description of business models

The most common business model in Poland is the **Investor's own business initiative.**

The **Investor's own business initiative** is used for in-house heat production in industrial facilities that produce wood products. Under this business model, the investor, who owns an industrial facility that produces wood products, installs a biomass heating or a biomass CHP plant financed by own capital and a bank loan. With this investment, the investor covers the heating needs of its industrial facility, thus reducing its energy costs. Biomass is derived as a by-product of the industrial facility and therefore the investor has abundant raw material at his premises to fuel the biomass heating / CHP plant.

Main stakeholders / role

The main stakeholders / actors involved are the **investor** and the **financing institution** that provides the loan. The role of the financing institution is to provide long term financing for the project.

Ownership of the biomass heating system

The investor owns the whole biomass heating / CHP plant and is responsible for the O&M and other related costs.

Level of support of the legislative framework to the business models

The current legislative framework does not promote/support investments made by investors to cover their own heating needs.

The RES Law was implemented in February 20, 2015 providing for:

- the achievement of mandatory quotas by the suppliers;
- rules and conditions for energy production from RES and biogas;
- rules for the realisation of domestic plans for RES;
- rules for the certification of RES installations.

However there are available subsidies' schemes providing a combination of subsidy with a loan (presented in the section "*Financing options*")

Advantages, weaknesses and effectiveness of the business models

The **advantages** of the **Investor's own business initiative** business model are the following:

- Reduction of the energy costs of the main industrial facility
- Security of supply since biomass is derived as a waste from the main industrial activity of the investor
- Supply of biomass at no cost. In this business model, the investor uses its own biomass waste derived from the main activity of his industrial facility.

The **Investor's own business initiative** business model is the most popular and it is preferred by biomass heating project developers.

Key features of a typical raw material supply contract

The investor does not enter into any kind of contractual relationship with external biomass suppliers in order to cover its biomass supply needs, as he uses its own biomass waste produced from his wood-based industrial plant.

Key features of a typical heat delivery contract

As in the previous case, the investor does not enter into any kind of contractual relationship with end-customers, since the heat produced from the biomass heating / CHP plant is used exclusively to cover the heating needs of his industrial plant.

2.7.2 Financing options

Description of financing options

The available financing options in Poland are:

1. **Loans** from financing institutions
2. **Combination of loans and subsidies**

The most commonly used financing options, which are analysed below, are the **loans and the combination of loans with subsidies**.

Loans

Loans granted by the banks and non-banking institutions are one of the most important sources of funding for investments in biomass projects in Poland. The major non-banking institution that offers loans is **the National Fund for Environmental Protection and Water Management** which is the pillar of the Polish system for financing projects in the environmental protection field**.** The projects are implemented via priority programmes, aiming to improve the environment and support the sustainable management of natural resources. One of these programmes is the **STORK (BOCIAN) - support for distributed RES**. The aim of the STORK is to reduce or avoid CO_2 emissions by increasing energy production from RES plants. The types of biomass heating installations eligible for a loan are:

- construction and upgrading of RES installations of capacity between 300 kW and 20 MW,

- biomass CHP units between 40 kW - 5 MW capacity.

Combination of loans with subsidies

Loans in combination with subsidies are granted by the **banks** (at the moment only BOŚ Bank is involved) and the **priority programmes through the non-banking institution** "The National Fund for Environmental Protection and Water Management".

One of the priority programmes supporting biomass heating is the **Prosumer** (Prosument) **financing line**, covering the purchase and installation of renewable energy micro-installations. The beneficiaries of the programme are:

- local governments
- individuals
- Regional Funds for Environmental Protection and Water Management
- residential communities and associations.

The aim of the Prosumer programme is to reduce or avoid CO_2 emissions by increasing energy production from RES, through supporting the purchase and installation of small- or micro RES installations in order to produce electricity or heat. Eligible for **financing** are, inter alia, **biomass heating installations with a capacity up to 300 kW**, designed for **residential buildings**, and **installations using more than one source of renewable energy in only heat or CHP units**.

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the loans' schemes in Poland are:

- Customer-oriented attitude towards the investor
- The loan is up to 40,000,000 zł (EUR 9.6 million)
- The loan period can be up to 15 years
- Support is provided to a wide range of RES installations.

On the other hand, loans' schemes have the following **weaknesses** in Poland:

- Necessity to meet a **large number of technical requirements**
- **Large number of documents** is required by the financing institutions for the evaluation of the project
- High share of the equity capital (at least 25%)

Combination of loans with subsidies

The **advantages** of this financing option in Poland are:

- Customer-oriented attitude towards the investor

- Funding in the form of a **combined loan with a subsidy up to 100% of eligible costs**, including:
  - subsidy up to 15% of the total costs (in the period 2014-2016 up to 20%);
  - loan with a subsidy of at least 200,000 zł (~EUR 48,000); fixed interest rate of 1% per annum; the period of funding up to 15 years
- Support is provided to a wide range of RES installations.

On the other hand, the combination of loans with subsidies' scheme has the following **weaknesses** in Poland:

- Necessity to meet a **large number of technical requirements**
- **Large number of documents** is required by the financing institutions for the evaluation of the project
- The project must be implemented within **18 or 24 months from the date of the grant agreement**
- The **maximum amount of eligible costs** is between 100,000 zł (EUR 24,000) – 450,000 zł (EUR 108,000).

Both financing options are considered effective in Poland.

Financing options from structural funds

The available structural fund in Poland is the **Operational Programme Infrastructure and Environment 2014-2020 (OPIE 2014-2020)**. OPIE is a national programme supporting low-carbon economy, protection of the environment, transport, energy security and combating climate change. The main beneficiaries of the OPIE 2014-2020 are **public institutions (including local governments) and private entities (mainly large companies)**. RES investments are implemented mainly through I Priority Axis "Promotion of RES and EE", which consists of six priority programmes, two of which support the construction and modernization of biomass facilities:

- 4.1 Promoting the production and distribution of energy from RES
- 4.7 Promoting the use of high efficiency CHP basing on the heat demand.

For both programmes, only **installations of capacity in excess of 5 MW are eligible.**

Smaller biomass heating projects, which due to their capacity cannot be supported within the abovementioned programmes, **may be financed from the Regional Operational Programmes (RPO) of the region in which the project will be located.**

Difficulties in financing biomass heating projects

The main problems for financing a biomass heating project in Poland are the following:

- **Lack of proper information**, concerning the available methods of financing for potential investors

- **Complicated administrative procedures and large number of documents necessary to submit for grant/loan proposal.**

Main conclusions from the interviews with the banks

According to research carried out by KAPE, two FIs were examined for further analysis, the **National Fund for Environmental Protection and Water Management (NFEP&WM) and Environmental Bank (BOŚ Bank).**

Both FIs offer guidelines and information material to their clients for financing RES (including biomass) projects. The guidelines are in the form of a **checklist** or in the form of an **application form** that the client has to fill in, in order to be eligible to receive the loan.

The National Fund for Environmental Protection and Water Management offers loans or loans with subsidies, while the BOŚ Bank offers loans to their prospective clients. The interest rates of the loans vary and they depend on WIBOR[16] rates plus a margin or have constant value of 1%. **On average, the minimum share of the equity capital is at least 25% and the maximum life of the loan is between 5 – 15 years.**

Both FIs consider providing financing for biomass DH projects as well as for projects dedicated to in-house production/usage of biomass heat and both of them take into account sustainability and environmental considerations before financing biomass heating projects.

Table 2-19 provides the **stipulations / requirements** that the FIs check from their clients in order to finance biomass heating projects.

Table 2-19 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Poland)

Stipulation / requirement	NFEP&WM	BOŚ Bank
Security of feedstock supply		
Existence of heat supply contracts and guarantees	✓	
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers		
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓	
Indexed heat sale price		
Indexed biomass price		
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)		
Land ownership titles of biomass supplier		

[16] Warsaw Interbank Offered Rate

Stipulation / requirement	NFEP&WM	BOŚ Bank
(no traders)		
Other (please specify)		
Technical		
Technical due diligence (DD)	✓	✓
Possibility of an Engineering Procurement Construction Contract	✓	✓
Review of main contractors and service contracts	✓	✓
Assessment of the technical concept and of process engineering	✓	✓
Assessment of the operation and maintenance (O&M) regime	✓	✓
External construction supervision (verification)	✓	✓
Review of profitability calculation	✓	✓
Other (please specify)		
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓	✓
Legal assessment of production licences, environmental permits, etc.	✓	✓
Assessment of real-estate property (hypothecs, etc.)	✓	✓
Network connection agreement		
Existence of operation and maintenance contracts	✓	✓
Other (please specify)		
Financial		
Evaluation of business plan	✓	✓
Minimum share of equity capital	✓ 25%	✓ 25%
Upper limit for the residual investment value		
Upper limit in percentage of (guaranteed) cash flow	✓	
Upper limit for the Pay Back period		
Minimum Debt Service Cover ratio		
Minimum Return on Equity		
Maximum lent term (life of the loan)	✓ 15 years	✓ 15 years
Upper limit regarding technical life-time of main equipment	✓ 15 years	✓ 15 years
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring		
Other (please specify)		

Stipulation / requirement	NFEP&WM	BOŚ Bank
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default	✓	✓
Supplier's obligation to retain agricultural / forestry production		
Account pledge		
Risk insurance (liability, damage, business interruption)	✓ Assigned in favour of the bank	✓ Assigned in favour of the bank
Other (please specify)	Loan collateral 110%	

The most important factors that the FIs consider in order to provide financing for biomass heating projects are presented in the Table 2-20.

Table 2-20 Important factors that the FIs consider to finance biomass heating projects in Poland

Factor	NFEP&WM	BOŚ Bank
Investor credibility	✓	✓
Project IRR	✓	✓
Payback Period		✓
Maturity of the project / technology	✓	✓
Long term biomass supply contract with predictable raw material prices		
Long term heat delivery supply contract		
Other	Effect on the environment, reality check, innovation	Effect on the environment, reality check

2.7.3 General data on the DH sector in the country

Table 2-21 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-21 Data of the DH sector in Poland and its relation to biomass heating

Parameter	Applicability in the country
1. Delivery of heat from in-house biomass boilers to nearby buildings	Not applicable; the heat is used to cover own heating needs.
2. Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid	Not applicable.
3. Injection of heat from a biomass	Only in co-firing; the existing DH grid is dedicated to fossil fuels.

Parameter	Applicability in the country
heating plant into an existing fossil fuel DH grid	
4. Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises	Not applicable.
5. Payment of costs related to customer's connection to the DH grid	The customer bears the costs for the connection to the grid and for the metering device and retains ownership of the later.
6. Measurement of the DH demand at the customer's premises	Yes; the demand is metered at the customer's premises (at the connection with the building).
7. Payment behaviour of DH customers to the SPVs	Not a problem.
8. Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant	The regulation requires contracts and concession from the city hall in relation to the distribution grid.
9. Strengths and weaknesses of the (fossil and biomass fuelled) DH sector	**Strengths of the fossil fuelled DH sector:** › The fossil fuelled DH sector in Poland is in operation for many years; therefore there is plenty of experience and know-how in running DH projects › There is a regulated price. **Weaknesses of the fossil fuelled DH sector:** › High production costs resulting in high costs for the customers › Production of GHG emissions.
10. Economic health of the existing biomass DH sector	The DH sector in Poland is currently **under-developed. Biomass is mainly used in co-firing applications.** According to the new Polish RES Law, there is a provision of heat production from biomass in dedicated heat production plants, but this provision has not been implemented.

2.8 Netherlands

2.8.1 Business models

Description of business models

The most common business models for biomass heating projects in the Netherlands are the:

- **SDE+ support scheme (Feed-in-tariff scheme) –** (500 kW – 5 MW)
- **Investor's own business initiative** to fund investments through own capital and/or bank loans (100 kW – 500 kW).

Almost all biomass projects in the Netherlands are **heat-only projects**. Only some bigger installations are biomass-CHP projects. Approximately 2,000 heat-only projects (varying from 20 kW to 30 MW) are installed and about **20 biomass-CHP projects**. The SDE+ scheme supports all projects (both heat-only and CHP) bigger than 500 kW only. Projects below this power limit have to find other support or finance on the investor's own initiative.

SDE+ support scheme

The SDE+ support scheme can cover DH, micro grids, in-house heat production and supply such as residential buildings, commerce and service buildings, public buildings, agricultural-forestry facilities and industries.

The SDE+ is an operating subsidy (feed-in-tariff). Producers receive a subsidy for the production of renewable energy, and not for the installed equipment, such as with investment subsidies. The SDE+ is aimed at companies and (non-profit) organisations that would like to produce renewable energy. The cost price of renewable energy is higher than that of fossil energy. Likewise, the production of renewable energy is not always profitable. The SDE+ compensates for the difference between the cost price of fossil energy and that of renewable energy, over a period of 12 years. The SDE+ is dependent on the energy price. The subsidy is recalculated each year incorporating the actual energy price.

The SDE+ is open for all kinds of RES, has one total budget for all categories and is opened in phases. The 'less expensive' forms of technology may apply for the subsidy during the first phase. The subsidy amount might increase per phase. Also all kind of energy output (electricity, heat and biomethane) are supported equally. For heat, the support is equal for every phase: € 0.051/kWh minus the energy price of € 0.033/kWh (provisional) = € 0.018/kWh (Note: only boilers >500 kW are supported by the SDE+ scheme).

Investor's own business initiative

As in the SDE+ support scheme, the Investor's own business initiative business model is applicable to DH, micro grids, in-house heat production and supply such as residential buildings, commerce and service buildings, public buildings, agricultural-forestry facilities and industries.

The investors can be private companies or public entities and make the investment to produce heat in order to cover their own heating needs.

Main stakeholders / role

SDE+ support scheme

The main stakeholders involved are the **companies, institutions or non-profit organisations** who make the investment and would like to produce renewable energy

and the **Netherlands Enterprise Agency (RVO) who grants the subsidy**. Another stakeholder is the financing institute (bank) to provide the loan.

Investor's own business initiative

The stakeholders involved can be different actors from the private or public sector. One of the main stakeholders is the financing institute (bank) to provide the loan.

Ownership of the biomass heating system

For both business models, the complete biomass heating system is owned by the investor. There is **no point of transfer of ownership**; the investor produces the heat to cover his own needs. In case of a DH project, the transfer of ownership is the connection between the heating plant and the heating grid.

The **investor** is responsible for the O&M and other related costs.

Level of support of the legislative framework to the business models

The SDE**+ scheme** is a premium feed in tariff which is actually the supportive regulation. The Investor's own business initiative business model is not supported by the legislative framework.

Advantages, weaknesses and effectiveness of the business models

SDE+ support scheme

The **main advantage** of the SDE+ scheme is that investments are actually realized. Without this subsidy, there would be in most cases no renewable energy production. Other advantages are reduction of energy costs, long term security, help attain and maintain a ''green image'' for the investor.

The **major weakness** is that when applying, the first-come-first-serve principle may lead that some other projects might lose their financing possibility. At later stages the total budget might have run out. Competing with other types of renewable energy might cause a disadvantage. The feed-in tariff is coupled to the gas price, so there is still a risk for the investor that the biomass price will increase.

The SDE+ scheme is the most commonly used in the Netherlands and is considered effective.

Investor's own business initiative

The **main advantages** of this business model are the:

- Reduction of energy costs
- long term security
- help attain and maintain a ''green image''

- Investors are not dependant on yearly changing support systems.

If not dependant on the subsidy the investment has probably a very good business case (payback time of about 3 years).

It is considered effective since investors do not like to be dependent on the government/subsidy, due to the administrative burden.

Key features of a typical raw material supply contract

In case of own biomass supply (wood processing industry) there is no contract. In other cases, a **biomass contract is secluded for typically 1 year for wood chips and 3 years for wood pellets**. Biomass suppliers can be the municipality, landscape conservation organisations or private biomass suppliers (specifically for pellets). The subject of the agreement between the investor and the biomass supplier is the needed quality, the guaranteed/intended quantity, the contract duration and the biomass price terms. Usually, the **investor bears the market risks of the biomass supply quantity/quality**.

Depending on the extent of the supply, the delivery requirements or other requirements of the involved parties, the size of a contract can vary from one A4 page to a very elaborated document. In any case, in each and every case the following items are outlined:

- the contracting parties, including the contact details of the authorised persons
- an outline of the supply; here there must be specified the type of wood and its origin, and the undesirable wood type
- The quantity of the wood supply (tonnes), including the estimated time for delivery
- Procedures related to a smaller or bigger demand is depending on the size of the contract (price setting etc.)
- The quality of the wood supply. For the certified pellets, the certification can be mentioned (e.g. EN plus) and for the non-certified pellets, the quality requirements should conform to the EN 14961-2 principles
- In the case of non-certified pellets: there needs to be stated the admissible deviation in quality (homogeneity)
- In the case of non-certified pellets: there should be made an agreement over the quality control of the pellets (samples, sample procedure, laboratory)
- In case of wood chips the size, moisture content, type of wood, dust content, soil content and maximum deviations
- A statement of the responsible person of the supply and acquisition of wood pellets
- The price, and what is included in the price, the time for which the price is valid
- The validity of the agreement
- If possible, a statement of principles related to the moment of supply to the moment the contract expires.

Key features of a typical heat delivery contract

A typical contract duration is 12 years (which is the same as the subsidy timeframe). The heat market is not regulated. For the heat distribution, there is a heating law that sets price limits for delivery of heat to consumers.

2.8.2 Financing options

Description of financing options

The available financing options in the Netherlands for biomass heating investments are usually tailored on the facilities and on the duration of a project. Banks provide loans, leasing options, or give loans coupled with subsidies. **Loans are described below**.

Loans have a share of the **equity capital of 30-40%** and the **payback time of the investments is typically 12 years** along with the subsidy period of 12 years.

Loans are provided by:

- Rabobank
- Energiefonds Overijssel
- ING bank
- ABN Amro bank

Advantages, weaknesses and effectiveness of the financing options

The **advantages** of the loans' scheme in the Netherlands are that loans are easy to understand from the investors' point of view. The conditions for the loans can vary for each bank but the basis is the same. Part of the investment must come from the equity capital (30-40%) and the remainder comes from the loan.

On the other hand, the main **weaknesses** of the loans' schemes are that:

- Only proven technology is trusted
- New developments/innovation in technology or project development are not easily financed
- New players on the market are approached with extra care and scepticism.

Bank loans are considered effective. The terms and conditions are quite clear. Although for more advanced or innovative projects the instrument is not very effective.

Difficulties in financing biomass heating projects

The typical problems that a client faces when developing biomass heating projects are:

- Lack of equity capital
- Too short heat supply contracts

- Conditions of the biomass supply contracts
- Mismatch feedstock prices
- Security/availability of biomass; the volatility of the biomass market is a problem
- Need for constant attention to the technology used. The installations can be quite sensitive and sometimes it can breakdown. It is much harder to maintain in comparison with the other renewable energy technologies, such as solar and wind.
- Sometimes the projects lack professionalism in design/development or operation.

Main conclusions from the interviews with the banks

RVO **interviewed two FIs** that have financed biomass heating / CHP projects: **Rabobank** and **Energiefonds Overijssel**. The interviewed FIs have provided finance for biomass heating projects in the past, for example Rabobank was involved in RES financing for more than 20 years and for **biomass heating projects for more than 10 years**. Both FIs have available financial experts with **experience on RES projects**. They gained most of their knowledge from their project experiences, mainly learning by doing. The finance is done mainly for big installations (1-50 MW), however there are financing possibilities for small installations as well.

Both FIs **offer guidelines and information material to their clients for financing RES (including biomass) projects**. This information comprises branche specific information. No checklists are used as almost all biomass project applications are individual cases with very specific conditions.

The financing for biomass heating is provided both for in-house production/usage of biomass heat (of heat load above ca. 500 kW) and biomass DH. Lower heat loads are not discouraged but the administrative handling costs are too much compared to the investments.

They both **offer loans** to their prospective clients. Rabobank provides more types of loans: investment facility, bridge facility, VAT financing and overdraft facility. Energiefonds Overijssel only provides investment facility. The minimum share of the **equity capital is 30-40%** and the maximum life of the loan for biomass is **12 years**.

When financing a biomass heating project the client's track record is checked. Trust and financial stability are the qualities that banks are looking for when assessing a client or a partner. The technology and the source of biomass is also checked.

Both FIs consider providing financing for biomass DH projects as well as for projects dedicated to in-house production/usage of biomass heat and both of them **take into account sustainability and environmental considerations** before financing biomass heating projects.

Other important factors that a biomass heating project should have are the maturity of the project / technology and the knowledge of the market.

Although the biomass heating market is growing slowly, an increase is expected.

An important issue to be mentioned is that the Netherlands, due to low supply of biomass because of land scarcity, it is not a very suitable country for bioenergy. However the available supply of biomass is currently used for only 50% and 50% is exported.

Table 2-22 provides the **stipulations / requirements** that the FIs check from their clients in order to finance biomass heating projects.

Table 2-22 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Netherlands)

Stipulation / requirement	Rabobank	Energiefonds
Security of feedstock supply		
Existence of heat supply contracts and guarantees	✓	✓
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers		
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓	✓
Indexed heat sale price	✓	✓
Indexed biomass price	✓	✓
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)		It is a preference
Land ownership titles of biomass supplier (no traders)		
Other (please specify)	Investor should incorporate the volatility of biomass prices in the business plan	
Technical		
Technical due diligence (DD)	✓	✓
Possibility of an Engineering Procurement Construction Contract	✓	✓
Review of main contractors and service contracts	✓ Included in the technical DD	✓ Included in the technical DD
Assessment of the technical concept and of process engineering	✓ Included in the technical DD	✓ Included in the technical DD
Assessment of the operation and maintenance (O&M) regime	✓ Included in the technical DD	✓ Included in the technical DD
External construction supervision (verification)	✓ Included in the technical DD	✓ Included in the technical DD
Review of profitability calculation	✓	✓
Other (please specify)	Proven technology and track record of contractor	Proven technology and track record of contractor
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓ Included in legal DD	✓ Included in legal DD

Stipulation / requirement	Rabobank	Energiefonds
Legal assessment of production licences, environmental permits, etc.	✓ Included in legal DD	✓ Included in legal DD
Assessment of real-estate property (hypothecs, etc.)	✓ Included in legal DD	✓ Included in legal DD
Network connection agreement	✓ Included in legal DD	✓ Included in legal DD
Existence of operation and maintenance contracts	✓ Included in legal DD	✓ Included in legal DD
Other (please specify)		
Financial		
Evaluation of business plan	✓	✓
Minimum share of equity capital	✓ 40%	✓ 30%
Upper limit for the residual investment value		
Upper limit in percentage of (guaranteed) cash flow		
Upper limit for the Pay Back period	✓ 12 years	✓ 12 years
Minimum Debt Service Cover ratio	✓ 1.2	✓ 1.2
Minimum Return on Equity		
Maximum lent term (life of the loan)	✓ 12 years	✓ 12 years
Upper limit regarding technical life-time of main equipment	✓ 20 years	✓ 20 years
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	✓ Is a preference	✓ Is a preference
Other (please specify)		
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default	✓	✓
Supplier's obligation to retain agricultural / forestry production		It is a preference
Account pledge	✓	✓
Risk insurance (liability, damage, business interruption)	✓	✓
Other (please specify)		

The most important factors that the FIs consider in order to provide financing for biomass heating projects are presented in the Table 2-23.

Table 2-23 Important factors that the FIs consider to finance biomass heating projects in the Netherlands

Factor	Rabobank	Energiefonds
Investor credibility	✓	✓

Factor	Rabobank	Energiefonds
Project IRR	✓	✓
Payback Period	✓	✓
Maturity of the project / technology	✓	✓
Long term biomass supply contract with predictable raw material prices		✓
Long term heat delivery supply contract		✓
Other	Proven technology and track record of the contractor	Proven technology and track record of the contractor

Other important factors that a biomass heating project should have are the maturity of the project / technology and the knowledge of the market.

Although the biomass heating market is growing slowly, an increase is expected.

An important issue to be mentioned is that the Netherlands, due to low supply of biomass because of land scarcity, it is **not a very suitable country for bioenergy production**. However the available supply of biomass is currently used for only 50% in the country and 50% is exported.

2.8.3 General data on the DH sector in the country

Table 2-24 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-24 Data of the DH sector in the Netherlands and its relation to biomass heating

Parameter	Applicability in the country
1. Delivery of heat from in-house biomass boilers to nearby buildings	Yes, sometimes.
2. Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid	No.
3. Injection of heat from a biomass heating plant into an existing fossil fuel DH grid	Yes, there is a growing interest in using biomass boilers for supplying heat to a heating network. The best know example is the DH network of Purmerend. Other heating networks are also looking into the possibility of using biomass. Several heating grids use heat from waste incineration, which is considered to be 56% from biological source.
4. Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises	Yes, in some cases.
5. Payment of costs related to customer's connection to the DH grid	In case the heat is supplied to a customer with a connection of less than 100 kw, the costs for connection are regulated in the heat law. In that case, the transfer station is owned by the

Parameter	Applicability in the country
	operator of the DH network. If the heat is delivered to a large customer, they can decide how they split the costs.
6. Measurement of the DH demand at the customer's premises	For DH to small customers, the metering is regulated in the heat law. Metering in obliged, but if it is not cost effective other forms of calculation of the heat can be applied. This can be sub-metering or sharing the costs for heat in a building based on floor area
7. Payment behaviour of DH customers to the SPVs	No.
8. Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant	No.
9. Strengths and weaknesses of the (fossil and biomass fuelled) DH sector	There is still little biomass use in DH. Therefore, it is not possible to give an overview of strengths and weaknesses.
10. Economic health of the existing biomass DH sector	No information available.

2.9 Slovakia

2.9.1 Business models

Description of business models

The most common business model in Slovakia is the **Investor's own financing**.

The **Investor's own financing** is used for small scale and local projects or in-house solutions in small farms, agricultural facilities as well as forestry-wood facilities such as saw mills or paper industry. This business model refers to the installation of boiler(s) for biomass heating purposes and/or the installation of a CHP plant for the production of heat and electricity; the electricity is sold to grid.

Main stakeholders / role

The main stakeholders / actors involved are small or medium enterprises (investors), able to invest to the new technologies using biomass waste such as by-products derived from the main industrial activity. These investors either invest in biomass heat-only plants in order to produce heat to cover their own heating needs or invest in a CHP plant to produce both heat and electricity (CHP). In case the investors are not able to cover the whole investment cost, then financing institutions (banks, private financing institutions) provide short-term loans for financing either the technology equipment or the whole facility.

Ownership of the biomass heating system

The investor owns the whole biomass heating / CHP plant and is responsible for the O&M and other related costs.

Level of support of the legislative framework to the business models

The current legislative framework does not promote/support investments made by investors to cover their own heating needs. Support however is provided through the grants' schemes available from the Financing Facilities and through structural funds (presented in section "*Financing options*").

Advantages, weaknesses and effectiveness of the business models

The **advantages** of the **Investor's own financing** business model are summarized in the following:

- Coverage of the investor´s own needs (heat, electricity)
- Security of supply since biomass is derived as a waste from the main industrial activity of the investor
- The income from the electricity sold to the grid covers part of the investment (CHP plants).

The **main weaknesses** of this business model are the following:

- the investor of a CHP plant has to deal himself with the supply of electricity to the grid and undertake to accomplish all the administrative procedures in relation to the reporting obligations to the regulator
- **long payback period** of the investment.

It is noted that the **Investor's own financing** is effective for small scale projects and for projects where the supply of the raw material (biomass) is secured as a by-product of the main industrial activity.

Key features of a typical raw material supply contract

The investor does not enter into any kind of contractual relationship with external biomass suppliers in order to cover its biomass supply needs, as he uses its own biomass waste produced.

Key features of a typical heat delivery contract

As in the previous case, the investor does not enter into any kind of contractual relationship with end-customers. Only the electricity is sold to the grid in the case of CHP plants.

2.9.2 Financing options

Description of financing options

The most commonly used financing options in Slovakia are:

3. **Loans** from financing institutions
4. EU **grants** (SLOVSEFF[17], MUNSEFF[18])
5. **Structural funds**

Loans

Loans granted by the financing institutions are the most important source of funding for future investments in biomass heating projects. Loans are provided by:

- Private banks through:
  - own financing packages
  - financing programs developed with the involvement of financing facilities (SLOVSEFF and MUNSEFF)
- Private Financial Institutions

Grants

Grants are also very helpful tools for financing RES and biomass projects since they are considered a good motivation from investors to reach the savings and switch from fossil fuels to RES or biomass. **SLOVSEFF I, II and III** as well **MUNSEFF** are the facilities that provide grants to investments in residential and industrial EE and RE, with the collaboration of 2 Slovakian Banks (Slovenská sporiteľňa, a.s., VÚB, a.s.). **SLOVSEFF I and II** are closed; during their operation, they have financed 15 RE projects out of 700 EE and RE projects. **SLOVSEFF III is co-financed by the proceeds from the sale of carbon credits from the Slovak Republic to Spain. It is the first time that donor funding for a sustainable energy financing facility is sourced from a market-based mechanism**. The transaction was structured under the Green Carbon Fund of the Multilateral Carbon Credit Fund (MCCF), established and managed jointly by the EBRD and the EIB. The grant or the Carbon Reduction Compensation (CRC), may vary in **between 5 – 20% of the disbursed loan amount**. The calculation of the CRC depends on the amount of GHG emissions avoided as a result of the investment. **MUNSEFF** finances EE and RE projects. In relation to RE, the eligible measures are fuel switch from coal, gas or oil to biomass and Fuel switching or greenfield RE investment for the use of (a) solar thermal energy, (b) geothermal energy (with or without heat pump) and (c) biogas production for heating/cooling and/or power generation. The grant amount for each project varies between **5% and 15% of the principal amount of the relevant loan**.

Structural funds

Structural funds support the enforcement of RES and biomass sources on the market. They are mainly targeted at small RES or small CHP facilities using biomethane, biomass, biogas or other RES. In 2015, the new Operational Programme "Quality of Environment"

[17] Slovakian Sustainable Energy Financing Facility
[18] Municipal Sustainable Energy Financing Facility

has started, giving **subsidies to investments in DH and to modernisation / reconstruction of existing facilities with maximum capacity of 20 MW**. However, the rules have not been published yet. During the previous OP, there were investment subsidies for the production of electricity and heat from RES, fuel switch to RES and in-house applications based on RE. The **structural funds** are available from the Ministry of Environment, the Ministry of Economy and the Ministry of Agriculture and Rural Development.

Advantages, weaknesses and effectiveness of the financing options

Loans

The **advantages** of the loans' schemes in Slovakia are:

- Good availability of the funds
- The loan period can be **up to 10 years**

On the other hand, loans' schemes have the following **weaknesses** in Slovakia:

- **Large number of administrative documents** is required by the financing institutions for the evaluation of the project
- High share of the equity capital
- **Long payback time of the investment**

Loans provided by the banks and not from non-banking institutions **are considered effective** by the project developers.

Grants

The main **advantage** of the grants' scheme is that they are **offered by a number of Financing Facilities in Slovakia** with free technical assistance and guidance, giving the opportunity to investors to apply, following a standardized procedure to receive the grant.

On the other hand, the **only weakness** is that grants are provided **after the implementation and verification of the EE / RES investments**.

They are **considered effective** since a number of projects, mostly undertaken from the municipal and industrial sector, have been financed from the grants offered by the Financing Facilities.

Structural funds

The main **advantages** of the structural funds are the following:

- The rules for funding are clear
- The target groups are specified
- The amount of support is predefined and the **investors are aware of the exact amount of money that they will receive**

On the other hand, the main **weaknesses** of the structural funds in Slovakia are:

- Investors have to **co-finance their investments by a share of 5-10%**
- **Large number of administrative documents** is required and the administrative control is **strict**

Structural funds are considered highly effective by project developers in the RES and in particular in the biomass sector.

Difficulties in financing biomass heating projects

The main problems for financing a biomass heating project in Slovakia are the following:

- Too short heat supply contracts
- Payback time of the investment
- Maturity of the market

Main conclusions from the interviews with the banks

The Slovak Innovation and Energy Agency has interviewed two **FIs**, the **Ekofin Bratislava** Ltd and **VÚB bank**. They have financed together **more than 25 projects** in biomass DH, modernisation of biomass and biogas CHP plants under renewable energy support schemes.

The **financial experts of both FIs are experienced** on financing of RES projects; they are regularly attending specialized conferences, discussions panels and workshops dedicated to RES and EE. In addition, the **experts of the VÚB bank have external know-how learned by practice**. Ekofin Bratislava and VÚB bank are **involved for approximately 10 and 12 years respectively in financing biomass heating projects**; however they became more active after 2009-2010 with the adoption of the RES supporting act for CHP and renewable electricity by the Government.

Ekofin Bratislava provides financing to investments through **middle-term loans**, with max. 7 year maturity. The interest rate of the loan depends on the EURIBOR (3 months) and includes a margin up to 1,5-3% according to risk analysis, overdraft to cover operating costs – fuel, VAT, etc. **VÚB bank** provides financing under SLOVSEFF and also under own financing products.

It is noted that both FIs take into account **sustainability and environmental considerations** before financing biomass heating projects.

Table 2-25 provides the **stipulations / requirements** that the FIs check from their clients in order to finance biomass heating projects.

Table 2-25 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Slovakia)

Stipulation / requirement	Ekofin Bratislava	VÚB bank

Stipulation / requirement	Ekofin Bratislava	VÚB bank
Security of feedstock supply		
Existence of heat supply contracts and guarantees	✓ The heat market potential and the structure of segments (households, public sector, industry) is an important part of the project analysis	✓ Contracts for the production of heat need to be made with creditworthy customers based on the conditions acceptable for VÚB
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers	✓ This tool is mentioned in national legislation, but barriers still exist. The heat price level is important for both the investor and the huge DH system	
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓ Any legal structure and nature of the contract must be backed by real market potential (possible replacement of supplier, quality of fuel)	✓ It must be a long term and sustainable relationship, beneficial to both parties with creditworthy partners
Indexed heat sale price	No indexation, but a regulatory mechanism is crucial for the economy of the project	The heat price need to be correctable in case of increased production costs
Indexed biomass price	Supplementary information, availability of fuel from reasonable distance is a prerequisite	The biomass price is set up by the market by the time of contracting
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)	✓ Usual structure, consortium of heat plant operator and biomass supplier. Otherwise, strong company has to act as supplier.	Not necessary
Land ownership titles of biomass supplier (no traders)	Supplementary info	Not necessary (specifics of Slovak market – big farms produce biomass production on rented areas)
Other (please specify)	Biomass Market study, with an option of a backup fuel	Major requirements are directed on the quality and stability of supply in view of the sensitivity of the technology
Technical		
Technical due diligence (DD)	✓ The technical report is one of the key documents under the loan approval process (verification of technical concept, quantification of technical risks, review of permits etc.)	✓ Ideally, operational risk is allocated by concluding contracts with a company that has acceptable operating experience and financial standing
Possibility of an Engineering Procurement Construction Contract	✓ EPC structure is strongly preferred, however combination of technology supplier and building part supplier occurred often	
Review of main contractors and service contracts	✓ Only experienced contractor is accepted, who is willing and able to provide an	✓ Requirement to supply turnkey certified and experienced contractors.

Stipulation / requirement	Ekofin Bratislava	VÚB bank
	acceptable mix of guarantees (completion, time schedule, quality)	Suppliers must point out the positive references.
Assessment of the technical concept and of process engineering	✓ Only standard concept is accepted, no applied research is accepted for commercial financing	✓ VÚB contracts an external expert company (energy auditors) for these purposes
Assessment of the operation and maintenance (O&M) regime	✓ Assessment of in-house maintenance (if experienced staff) or external company	✓
External construction supervision (verification)	✓ Verified progress of works is one of the conditions precedent to loan utilization	✓ Yes, banks require bank supervision in process of using sources in order to comply with expediency.
Review of profitability calculation	✓	
Other (please specify)		
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓	✓ Internal lawyers consider the enforceability of contracts
Legal assessment of production licences, environmental permits, etc.	✓	✓
Assessment of real-estate property (hypothecs, etc.)	✓	✓ Verification of the relationship and possibility to access to property
Network connection agreement	✓	✓
Existence of operation and maintenance contracts	✓	✓ Check of the main parameters of the contract and its enforcement
Other (please specify)		
Financial		
Evaluation of business plan	In-house elaboration of the specific financial model	✓ Always by bank evaluation in terms of future policy arguability cash flow (CF) to repay.
Minimum share of equity capital	✓ This depends on the nature of the counterparty (municipal, corporate sector) and the heat market, typically ranges between 10-30%	✓ Depends on concrete parameters of transaction, but in principle min. 30%
Upper limit for the residual investment value		
Upper limit in percentage of (guaranteed) cash flow	This parameter is not applied. The loan is either guaranteed or at project finance risk	✓ Lower bound: Cash flow for repayment need to cover the debt service each year repayment on min. 1,2 times
Upper limit for the Pay Back period	✓ PBP is restricted by heat market scope, licence duration and estimated technology lifespan	✓ Depends on time of regulated price, or other form of support, loan maturity is always ends with a sufficient reserve before the end of the project life

Stipulation / requirement	Ekofin Bratislava	VÚB bank
Minimum Debt Service Cover ratio	Most often covenant used in loan documentation	✓ Lower bound: Cash flow for repayment need to cover the debt service each year repayment on min. 1,2 times
Minimum Return on Equity	No, but bank requires that the project generates an acceptable return for the investor; for projects in the municipal sector, the bank checks also social criteria (heat price stability)	
Maximum lent term (life of the loan)	✓	✓ Depends on time of regulated price, or other form of support, loan maturity is always ends with a sufficient reserve before the end of the project life
Upper limit regarding technical life-time of main equipment	✓ The standard life-time is used for technology	✓ Viability of the project should reach min. 1.5 times the maturity of funding
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	✓	✓ Yes, obviously we require allocation of construction risk and operation risk to those who know best to manage it, by a trained and verified third party
Other (please specify)		
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default	Bank´s guaranties are required	For securing the debt against the VÚB usually serve all financing assets, the payment of credits is based only on future results of production by this assets.
Supplier's obligation to retain agricultural / forestry production		
Account pledge	✓ Debt service reserve account	
Risk insurance (liability, damage, business interruption)	✓ Risk insurance for EPC contract only	
Other (please specify)		All biomass supplies are based on contracts with acceptable qualitative and quantitative standards and penalties for non-delivery. Partners need to be creditworthy

The most important factors that the FIs consider in order to provide financing for biomass heating projects are presented in the Table 2-26.

Table 2-26 Important factors that the FIs consider to finance biomass heating projects in Slovakia

Factor	Ekofin Bratislava	VÚB bank
Investor credibility	✓	✓

Factor	Ekofin Bratislava	VÚB bank
Project IRR		
Payback Period		✓
Maturity of the project / technology		✓
Long term biomass supply contract with predictable raw material prices	✓	✓
Long term heat delivery supply contract	✓	✓
Other		

It is noted that the FIs have cooperated with other financial institutions for financing biomass heating projects and in addition the financing options are designed to cooperate with financial instruments developed by the Government.

According to the FIs, on our market with heat, will be more hard competition for high quality biomass and for reliable suppliers. The FIs in general will carefully select from experienced investors and strong sponsors.

2.9.3 General data on the DH sector in the country

The following Table 2-27 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-27 Data of the DH sector in Slovakia and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	Not applicable in Slovakia.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	No information available; according to the Slovakian legislation, it is possible on a commercial basis.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	Nowadays there are not any such cases, however it is possible since Slovakia is in the process to change the fuel base for the operation of the DH plants and use biomass or other RES.
4. **Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises**	Usually not.
5. **Payment of costs related to customer's connection to the DH grid**	The DH operators are responsible for the customer's connection to the DH grid and all related costs are included to the end price for the customers.
6. **Measurement of the DH demand at the customer's premises**	Yes; the DH demand is meter at the entrance of the customers' facilities. The exact location can be the subject of the agreement.
7. **Payment behaviour of DH customers to the SPVs**	Not a problem for the SPVs.

Parameter	Applicability in the country
8. **Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant**	Decree 152/2005 on the specified time and the determination of the quality of heat supply to the final customer.
9. **Strengths and weaknesses of the (fossil and biomass fuelled) DH sector**	**Strengths of the fossil and biomass fuelled DH sector:** › Good coverage of the heat market › Good localisation of the DH network around cities **Weaknesses of the fossil and biomass fuelled DH sector:** › Old and inefficient distribution network and pipes › Significant energy production and distribution losses › Old and inefficient technologies
10. **Economic health of the existing biomass DH sector**	DH plants in Slovakia are able to cover O&M costs as well as they are able to make some small investments on their own. However, **state subsidies or loans are prerequisite for large-scale investments**.

2.10 Ukraine

2.10.1 Business models

Description of business models

According to UABio (Bioenergy Association of Ukraine), there are 4 operational CHP plants on solid biomass in the country.

The most common business models for biomass heating projects in Ukraine are the:

- **Feed-in-tariff scheme**
- **Investor's own business initiative** to fund investments through own capital and/or bank loans.

Both options are equally common business models and are described below.

Feed-in-tariff scheme

The feed-in-tariff scheme is specific to **public buildings** (i.e. organisations financed from the state budget like schools, hospitals, research institutes) and for **residential buildings** (for the general population). There are some **peculiarities in the scheme for public and for residential buildings**. The peculiarities are connected with the procedure of determining the feed-in tariff that is calculated individually for each heat producer. For public buildings, the basic point of the calculation is *100%* of the tariff for heat produced from natural gas and supplied to *public consumers* (*tariff A*). For residential buildings the basic point of the calculation is *90%* of tariff A. Besides, a company/producer of heat for

residential buildings is not allowed to have profitability >21% while there is no such restriction for a company/producer of heat for public buildings. As a result the value of the feed-in-tariff for public buildings is *higher* than that for residential buildings.

The feed-in-tariff scheme is applied to heat **produced by a biomass boiler plant** (and not by a CHP plant) and is valid for biomass heat supplied to public buildings (budget-financed organisations) and residential buildings.

In relation to **public buildings**, the biomass heat production tariff (feed-in-tariff) is set on the level of the existing average tariff for heat produced from natural gas. Nowadays, the tariff for heat produced from natural gas is rather high, thus making the biomass heat business feasible. In relation to **residential buildings**, the biomass heat production tariff (feed-in-tariff) is set on the level of the existing average tariff for heat produced from natural gas minus 10%. In addition, the profitability of the biomass heat producer should not exceed 21%.

Investor's own business initiative

Under this business model, the investor uses his **own capital or a mixture of bank loan and his own capital** to finance the investment. The investor has to perform all the project steps (getting permissions, construction, putting into operation and others) in accordance with the existing rules and regulations in Ukraine. Under this business model an **investor can also apply for the feed-in-tariff (described above) if he supplies biomass heat to budget-financed organisations or to population**.

Main stakeholders / role

Feed-in tariff scheme

The main stakeholders involved in the feed-in-tariff scheme are the following:

- **Producer of biomass heat** (the boiler plant) is responsible for generating heat from biomass
- **Supplier of biomass** is responsible for providing biomass feedstock to the plant
- **Transporter of heat** is the company-owner of the heating network; the transporter of heat accepts the biomass heat into the network and transport it to a consumer
- **Heat supplier** is responsible for supplying heat to customers
- **Customer**.

It should be noted that in most cases **Producer, Transporter and Supplier of heat is the same company** (but in some cases they may be different companies).

Investor's own business initiative

The main stakeholders / actors involved are the **investor** and the **financing institution** that provides the loan. The role of the financing institution is to provide long term

financing for equipment supply, set-up and construction of a biomass boiler/CHP plant. The other stakeholders are described above under the feed-in-tariff scheme.

Ownership of the biomass heating system

Usually for **both business models**, the biomass heat producer owns the **biomass heating plant and the grid**. Rarely, the biomass heating plant and the grid belong to different companies. Heat equipment/devices inside a building belong to a local house-servicing company (in case of residential buildings) or to a relevant higher state body (in case of budget-financed organisations). In some cases, the local house-servicing companies may act as suppliers of heat.

The biomass heat **producer** is responsible for the O&M of the biomass plant while the **transporter** of biomass heat (owner of heat network) is responsible for the O&M of the grid. The **biomass heat supplier** is responsible for the billing and the customer acquisition.

Level of support of the legislative framework to the business models

The current legislative framework **supports** the **feed-in-tariff scheme**. The feed-in-tariff scheme for public buildings was introduced by governmental Resolution N 453 of 10.09.2014 for the period until 01.10.2019. The feed-in-tariff scheme for residential buildings was introduced by governmental Resolution N 293 of 09.07.2014 (the period of validity is not specified).

Advantages, weaknesses and effectiveness of the business models

Feed-in tariff scheme

The **main advantage of the feed-in tariff scheme** is that it gives an opportunity to profitably introduce biomass heat technologies and replace natural gas in the public buildings and the DH sector (before, profitable biomass heating projects were practically impossible in these sectors).

Concerning the **weaknesses**, the **feed-in tariff scheme is applied only to biomass boiler plants (not to CHP plants)**. The feed-in-tariff is set for biomass heat production, though it would be much more **reasonable to set it just for biomass heat including production, transport and supply**. Most of the companies related to heat production/supply in Ukraine have an "entire" heat tariff not evidently structured into production, transport and supply. To this end, they cannot use the feed-in-tariff for the production of heat. To solve this problem, the companies have to apply to the National Commission for State Regulation of Energy and Public Utilities so that to get a new structured tariff. It should be noted that an improved version of the feed-in-tariff scheme (that takes into account the above weaknesses) was developed and submitted to the Government for approval (the version is currently under consideration).

The **feed-in-tariff scheme** is considered **very effective for cases where it is eligible.** It is preferred by biomass heating project developers for heat supply to public and residential buildings.

Investor's own business initiative

The **advantage** of this business model is that the investor can rather quickly cover the investment cost, with the prerequisite that the biomass heat project has good financial indexes (in Ukraine, biomass is cheaper compared to fossil fuels).

The main weaknesses can be summarized in the following:

- **Long and bureaucratic procedure** for the project implementation, a **big number of permissions and licences** is required
- General risks associated with the project realization: **unstable economic and political situation in the country**.

The business model is considered **effective for well-designed projects with good financial indexes**. The model is **good only if the investor is a big stable company with large assets**. Under these conditions it may be preferred by biomass heating project developers. A "well-designed" project means a project with availability of reliable biomass suppliers or the use of own biomass feedstock, availability of preliminary agreements with local authorities regarding quick allocation of a land plot, etc.

Key features of a typical raw material supply contract

In Ukraine, **the market of biomass as fuel is in the process of development**. Key features of a typical biomass supply contract include the determination of the period of supply (**contract duration**), the needed **biomass quality** and also the **amount, type and price of the raw material**.

Usually, the **biomass supplier sets the price**. In case of wood biomass, the price may be fixed in the process of auctioning. Usually, the **consumer bears the market risks of the biomass supply quantity/quality**.

Key features of a typical heat delivery contract

Key features of a typical heat delivery contract include the **duration of heat supply**, the **price of heat** (in UAH/Gcal) and (in some cases) the **amount of heat to be supplied** (in Gcal/yr). The typical contract duration is **1 year**.

The National Commission for State Regulation of Energy and Public Utilities sets **heat prices by the type of customer:** residential or public buildings, religious organisations and other consumers. The price is set individually for each company that produce/supply heat to these customers. The general process is the following: based on the approved methodology, a heat producer calculates the primary cost of heat. The calculation takes into account fixed and running costs of the biomass plant and also a certain profitability. Afterwards, the company submits the documents to the Commission. The Commission

checks the calculations and approves or adjusts the heat tariff. **For a consumer, the heat tariff consists of tariffs for production, transport and supply of heat.**

2.10.2 Financing options

Description of financing options

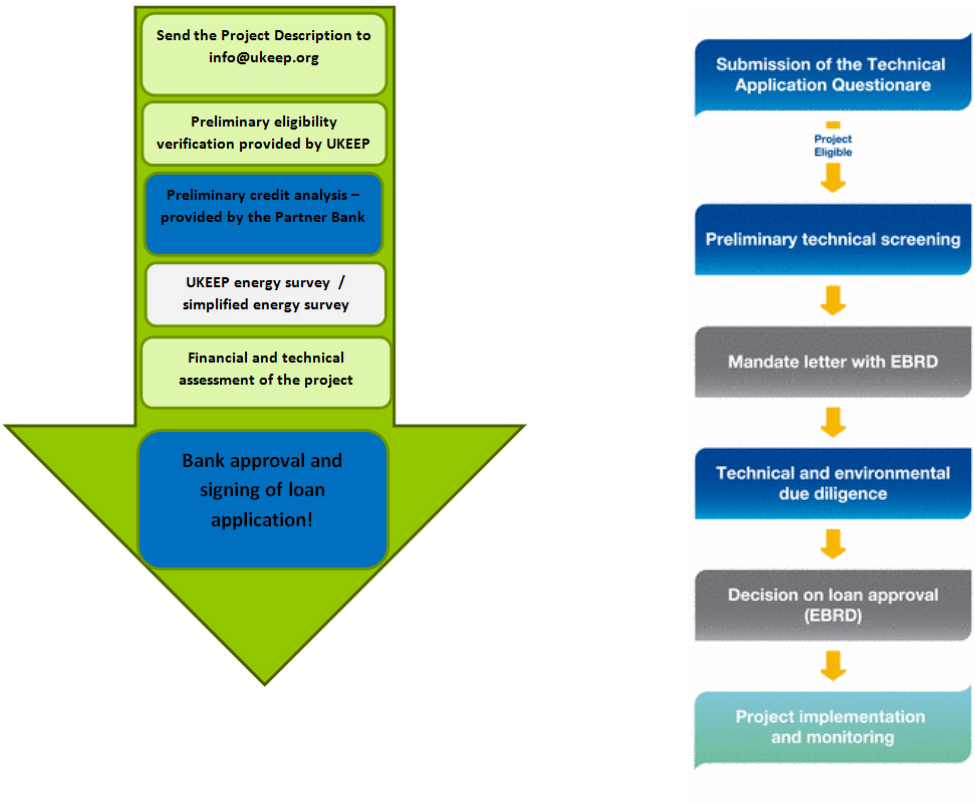
The available financing options in Ukraine are:

1. (Comparatively) **soft loans** by Financing Facilities (programs/funds) like UKEEP, USELF[19] etc.
2. **Bank loans**

Both options are equally common financing options for biomass heating projects.

Soft loans are provided by Financing Facilities for financing RES and EE projects which covers part of the investment. Financing Facilities cooperate with partner banks (which allocate their financial resources), and partner companies (which provide technical consultations to project developers). A typical flowchart of the process of a project assessment and approval is presented in the Figure 2-5 (example of UKEEP and USELF).

Figure 2-5 Typical flowcharts of the process for a project assessment and approval under the UKEEP and USELF Facilities



[19] UKEEP, USELF and other target financial facilities are described in the next section.

Bank loans are the second financing option in Ukraine. In order the bank to provide a loan, **assesses thoroughly the potential borrowers** in terms of technical and financial capacity; loans are given only to very **reliable companies and very well-developed projects**. **Bank loans** are provided by the EBRD, IFC, Ukreximbank and 1-2 other private banks (the total number of relevant banks is very limited).

Advantages, weaknesses and effectiveness of the financing options

The **advantages** of the soft loans' scheme in Ukraine are:

- Intelligible procedure for a project assessment and decision making regarding the loan
- Soft loan conditions (peculiarities strongly depend on a concrete financial program and a concrete bioenergy project)

On the other hand, one of the main **weaknesses** of the soft loans' schemes is that there are **strict requirements (restrictions) to the types, sizes and financial indexes of the projects to be financed**, thus reducing the number of potential projects. USELF for example, finances only power production from biomass, meaning that heat production can be of support only in the form of biomass CHP plants. **USELF and UKEEP give loans only to private companies**. The Nordic Environment Finance Corporation (NEFCO) does not support construction of new energy installations, while DemoUkrainaDH covers not more than 50% of the capital costs of the investment.

Soft loans are considered effective provided that the projects meet the respective requirements set by the FIs.

Bank loans have no particular advantage, apart from the opportunity to obtain financing for implementing a biomass project.

On the other hand, the main **weaknesses** of the **bank loans** are the following:

- The potential borrower has to submit **due diligence assessment** and the potential project needs to present **high indexes** in relation to technical and financial aspects
- **Large number of documents** is required by the FIs (legal, financial, business plan, feasibility study, etc.) for the evaluation of the project
- High requirements to risk insurance
- **Very limited number of banks** which are really ready to give a loan for implementing a biomass heating project.

Bank loans are considered effective provided that the projects meet the respective requirements set by the Financing Institutions.

Difficulties in financing biomass heating projects

Most commercial banks in Ukraine are rather **skeptical** in financing biomass heating projects because **this sector is not familiar to them**. As a result, these banks are not

willing to give loans. As for the Financing Facilities (UKEEP, USELF etc.), which can give a (comparatively) soft loan, they **require well-designed biomass projects with good financial indexes and low risks**. Besides, each FI has its own **strict requirements for the types, sizes and other aspects of RES projects to be financed**.

Additional difficulties for financing biomass heating projects in Ukraine are connected with:

- **Time delays** with respect to acquiring the necessary operating licenses
- **Too short biomass supply contracts**
- **Under-developed market** of biomass as fuel
- **Unstable** economic and political **situation**

Main conclusions from the interviews with the banks

SEC Biomass interviewed **two FIs** that financed biomass heating and/or other biomass projects in the past. These are the International Financial Corporation **(IFC)** and the Ukraine Sustainable Energy Lending Facility **(USELF)**.

IFC has been involved in financing RES (including biomass heating) projects in Ukraine **since 2000**. It has experience in financing projects of big agro-holdings in Ukraine, for which biomass heating is just part of a big project connected with general reconstruction/ modernization. **USELF** has been involved in financing RES (including biomass heating) projects in Ukraine **since 2010**. By now, **USELF has financed the construction of the first (and the only) biomass power plant in Ukraine of 18 MWe** and also considers the possibility to finance biomass CHP plants.

Both FIs have available financial experts with experience on RES projects, and the experts have undergone **specific training for biomass heating projects**.

IFC does not offer guidelines or other information materials to prospective investors. Such information can be obtained via phone or during a personal meeting with representatives of IFC's Investment Division. **USELF offers guidelines** and other information in the form of a **printed book and also on-line** (http://www.uself.com.ua/index.php?id=14&L=0). Among others, the information includes an Application Questionnaire that gives USELF the opportunity to quickly estimate whether the project is eligible for the program.

Both FIs consider providing financing for biomass DH projects as well as for projects dedicated to in-house production/usage of biomass heat and both of them take into account sustainability and environmental considerations before financing biomass heating projects.

Table 2-28 provides the **stipulations / requirements** that the FIs check from their clients in order to finance biomass heating projects.

Table 2-28 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Ukraine)

Stipulation / requirement	IFC	USELF
Security of feedstock supply		
Existence of heat supply contracts and guarantees	✓ One of the main requirements	Not mandatory
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers	✓	
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓ One of the main requirements	✓
Indexed heat sale price	✓	✓
Indexed biomass price	✓	✓
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)		
Land ownership titles of biomass supplier (no traders)	✓ It is important who is the final owner of land	
Other (please specify)		
Technical		
Technical due diligence (DD)	✓	✓
Possibility of an Engineering Procurement Construction Contract		
Review of main contractors and service contracts	✓	✓
Assessment of the technical concept and of process engineering	✓	✓
Assessment of the operation and maintenance (O&M) regime	✓	✓
External construction supervision (verification)		✓
Review of profitability calculation	✓	✓
Other (please specify)	Proven technology	Proven technology
Legal		
Legal assessment of contracts (biomass supply, heat supply, etc.)	✓	✓
Legal assessment of production licences, environmental permits, etc.	✓	✓
Assessment of real-estate property (hypothecs, etc.)	✓	✓
Network connection agreement	✓	✓
Existence of operation and maintenance contracts	✓	✓
Other (please specify)		
Financial*		

Stipulation / requirement	IFC	USELF
Evaluation of business plan	✓	The business plan developed by a company-borrower is not mandatory. USELF requires a big number of financial data related to the project and calculates all the financial indexes itself.
Minimum share of equity capital	✓ 50%	✓ 40%
Upper limit for the residual investment value		✓
Upper limit in percentage of (guaranteed) cash flow		✓
Upper limit for the Pay Back period	✓ Individual approach to each project, in general **10 years**	✓ Individual approach to each project
Minimum Debt Service Cover ratio	✓	✓ It Is considered one of the most important indexes
Minimum Return on Equity	✓	✓ It Is considered one of the most important indexes
Maximum lent term (life of the loan)	✓ 7-12 years	✓ max 12 years
Upper limit regarding technical life-time of main equipment	✓ 15-20 years	✓ 15-20 years
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	Not mandatory as Ukraine does not have much experience in such contracts	Not mandatory as Ukraine does not have much experience in such contracts
Other (please specify)		
Securities for liabilities		
Supplier's financial guarantee in case of supply contract default	✓ It Is considered one of the most requirements	✓
Supplier's obligation to retain agricultural / forestry production	✓	✓ It is mandatory for the period of the loan
Account pledge	✓	✓
Risk insurance (liability, damage, business interruption)	✓	✓
Other (please specify)		

***** *It is noted that the representatives of FIs were not willing to discover any actual values of the financial indexes applied saying that they depend upon a concrete project. That is why a lot of values were not specified during the interviews.*

The most important factors that the FIs consider in order to provide financing for biomass heating projects are presented in the **Table 2-29**.

Table 2-29 Important factors that the FIs consider to finance biomass heating projects in Ukraine

Factor	IFC	USELF
Investor credibility	✓	✓
Project IRR	✓	✓ Very important

Factor	IFC	USELF
Payback Period	✓	
Maturity of the project / technology	✓ Very important	✓
Long term biomass supply contract with predictable raw material prices	✓	
Long term heat delivery supply contract	✓	
Other		Stable regulatory framework

IFC has already established cooperation with NEFCO in the form of co-financing biomass heating projects. USELF is also considering the possibility for establishing such cooperation with NEFCO.

Both FIs believe in the successful development of the biomass heating market in Ukraine within the next 5 years. Both FIs are interested to increase their credit lines for biomass heating projects, though they admit that such projects sometimes may have **rather high risks.** Biomass has to strictly meet sustainability and environmental requirements.

2.10.3 General data on the DH sector in the country

Table 2-30 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-30 Data of the DH sector in Ukraine and its relation to biomass heating

Parameter	Applicability in the country
11. Delivery of heat from in-house biomass boilers to nearby buildings	Yes, sometimes.
12. Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid	It is possible, but depends on the local conditions.
13. Injection of heat from a biomass heating plant into an existing fossil fuel DH grid	It is possible.
14. Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises	Not applicable.
15. Payment of costs related to customer's connection to the DH grid	The customer has to pay some costs related to the customer's connection. Ownership of the heat transfer station may be different depending on who installed it. The heat transfer station may be owned either by the customer or by the heat supplier.
16. Measurement of the DH demand at the customer's premises	Yes; there may be a single heat meter for the whole building or individual heat meters for individual apartments.

Parameter	Applicability in the country
17. Payment behaviour of DH customers to the SPVs	Yes, sometimes.
18. Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant	The content of a typical heat delivery contract is determined by governmental resolution N 630 of 21.07.2005 (with amendments). A funding authority does not set any provisions but checks the contracts before granting a biomass DH plant.
19. Strengths and weaknesses of the (fossil and biomass fuelled) DH sector	**Strengths of the fossil fuelled DH sector:** › Historically well-developed centralized DH system with numerous customers connected to it › Significant experience and know-how in running DH projects since the DH system has been in operation in Ukraine for many decades. **Weaknesses of the fossil fuelled DH sector:** › Depreciated equipment and grids › Lack of financing to perform reconstruction/modernization › Lack of installed metering devices for accurate metering of the heat demand/supply › High O&M costs › Significant energy production and distribution losses › In some regions (cities) consumers' tendency to disconnect from the DH grid. There are many complaints regarding the costs which are considered high and non-transparent. **The biomass fuelled DH system** is **rather limited** in Ukraine. One of the main **weaknesses** are the undeveloped market of biomass as fuel and therefore difficulties in providing reliable supply of biomass as well as the lack of support / promotion / replication mechanisms.
20. Economic health of the existing biomass DH sector	The economic health of the existing biomass DH sector in Ukraine can be estimated as **average**. The sector has quite good prospects for the future; the expectations are based on the approved NREAP (October 2014) and some recent legislative incentives (like the feed-in-tariff for biomass heat introduced in 2014).

2.11 Denmark

2.11.1 Business models

Description of business models

In Denmark, the most commonly used business models are the **cooperative** (DH conversion from gas to biomass) and the **VE til Proces (Renewable energy to processes)**.

Cooperative a.m.b.a.

Denmark had since 1860 a strong tradition, particularly widespread in rural and provincial areas, of organizing of local common functions like dairies, consumer associations, slaughter houses, and most recently also **DH plants in the cooperative form** (In Danish; 'Andelsselskab').
The legal entity a.m.b.a. (Andelsselskab med begrænset hæftelse) is the most common used among 3 possible cooperative models. The two other are s.m.b.a. (selskab med begrænset ansvar) and f.m.b.a (forening med begrænset ansvar)[20].

The a.m.b.a. limits the liability of its members to their deposit, and further more distinguish itself from the traditional 'limited company' by the way influence is exercised. All the members have equal influence regardless of their size. As a special provision imposed on the DH a.m.b.a.'s, they are not allowed to pay out any dividend to the members. The a.m.b.a's should remain non-profit organizations, in order to project the a.m.b.a and its members against unscrupulous speculators. There are **no shares and no return of profits to the members**. The general assembly is the highest authority and it works the way that one man has one vote, regardless being a major or a minor consumer.

In Denmark, there are in total **130 small and medium size DH plants** scattered throughout the country. They serve as a communal source of heating, outside the major cities and outside the piped natural gas network. The consumers are predominantly private households, schools and institutions, small scale industry and craftsmen.

The plants were mainly built in the mid 1990'ties and from the beginning contractually obliged to use only natural gas, of which Denmark had plentiful supplies from oil & gas fields in the North Sea. Many of these plants suffered from poor economy, because the price of gas was linked to the oil price and because of network loss, leading to very high heating costs for the consumers.

In 2010, 35 plants were allowed to replace gas with biomass, up to a maximum of 1 MW of their total capacity. Now in mid-2015, another 50 plants were allowed to similarly partially replace gas with biomass, leaving the remaining 45 plants totally depending on natural gas, for the time being.

Denmark is fully covered with DH plants; no new plants are being commissioned. On the contrary, there seems to be a tendency towards merging minor works, or displacement of the heat production to bigger remote works. Therefore, whatever biomass introduction is taking place, is in the form of replacement of existing fossil fuel.

In Denmark there has been no tradition for developers or venture capitalist to become involved in erection or running of DH plants, neither there are ways of financing like the other target countries.

VE til Proces

[20] For further details, see https://erhvervsstyrelsen.dk/amba-smba-fmba or http://www.danskfjernvarme.dk/vi-mener/debatindlaeg/arkiv/2013/fællesejeermesteffektivt

The Danish Government launched in 2013 a new **subsidy scheme to promote conversion from fossil fuel to biomass fuel in industry and agriculture**, the so-called **VE til Proces.** The grant scheme is **administrated by the Danish Energy Agency** (Energistyrelsen). The fund holds in total DKK 3.650 mill to be applied over 8 years from 2013 to 2021.

So far (mid 2015), a total of **475 projects** have applied for funding and the total pay-out in 2014 amounted DKK 500 mill. **Biomass conversion ranks highest among the technologies eligible and in terms of figures, agriculture is the most frequent type of applicant**.

The average **grant share amounts approximately 45%**.

Main stakeholders / role

The main stakeholders involved in the **cooperative a.m.b.a.** are:

- The consumers organized in the a.m.b.a.
- The municipal authorities
- The biomass supplier(s)

The main stakeholders involved in the ***VE til Proces*** are:

- The industrial or agricultural operator (as applicant) in order to cover his own heating needs
- Danish Energy Agency (as sponsor)

Ownership of the biomass heating system

Cooperative a.m.b.a.

All the consumers own in common, the entire production facility and the distribution network. As for the installation in the site of consumption, the ownership varies and depends whether the site is in the property of the occupant or communal property of the plant.

The **points of transfer of ownership of the heat supplied** are between the grid and the customer. The responsibility for the **O&M and other related costs lies on a.m.b.a.** who typically allocates a staff of 1-3 persons.

VE til Proces

The whole heating system is owned by the industrial or agricultural operator, since it is an in-house solution. There is **no point of transfer** of the heat supplied.

Level of support of the legislative framework to the business models

The legislative framework **supports the a.m.b.a. business model only to some extent**. The DH plants were forbidden to use biomass until 2010 when the first 35 plants were allowed to partially substitute gas with biomass and now in 2015 where another 50 plants

were allowed to do likewise. **But still, a limit of maximum 1 MW per plant is maintained, preventing full switch over to biomass**.

On the other hand, **VE til Proces being** a dedicated grant scheme, is **very well supported**.

Advantages, weaknesses and effectiveness of the business models

Cooperative a.m.b.a.

The major **advantage of the cooperative a.m.b.a.** is that it supports the biomass from local sources.

On the other hand, there is a **legal binding obligation to continue the use of natural gas** which hampers biomass introduction to the DH network.

VE til Proces

By offering close to **50% grants of the total investment**, barriers are lowered, so quite many industries and farms are very interested to enter the scheme. The return on investment is high and the **payback time is low because of the substantial grant share**.

Key features of a typical raw material supply contract

For the **cooperative a.m.b.a.** typically the biomass supply contract is set up on a **framework agreement** with one, or more likely, several local suppliers, following a kind of tendering procedure. The **subject of the agreement** between the biomass suppliers and the a.m.b.a. is primarily the **biomass price**; however other parameters such as the needed biomass **quality**, the guaranteed **quantity** and the **contract duration** are also important.

The price is agreed for a **definite period**, in which the **price is fixed**. The duration of the fixed period can be **1 year or more**.

For the **VE til Proces,** the agricultural operator does not enter into any kind of contractual relationship with external biomass suppliers since the agricultural operator uses his own biomass to fuel the biomass boiler.

Key features of a typical heat delivery contract

In relation to the **cooperative a.m.b.a.** normally it is not an option for the consumers to choose their heat supplier. If the consumer is located in a definite geographical area, which is covered by the DH plant, then he is **obliged to take heat from this DH plant**. Municipal authorities can strengthen this obligation by declaring mandatory connection and a-stay-on-board clause. Only new build zero-energy houses may be exempted from mandatory connection and use of DH.

The heat price for the customer is variable and depends on the **running costs and the fuel used**; no regulation or price limit applies.

The price is normally composed of **several elements**. All prices are quoted excluding VAT, **which does not apply for heating purposes**.

There is 1:1 network establishing costs in a new development area. The costs can be quite substantial. There is an interim payment of minimum DKK 25,000. The typical fees are:

- Connection fee: DKK 18,500
- Connecting plumbing, valve and meter: DKK 1,000
- Annual administration fee: DKK 1,100
- Annual metering fee per m2 heated area: DKK 40 (for the first 100 m2 living area)
- Price per kW heat delivered: DKK 0,75

Furthermore, most works operates an extra % charge of the annual variable cost, if the consumer does not extract sufficient heat from the hot water circuit. The surplus charge amounts 1% per degree the consumer fails to extract (it can easily amount to an extra 5-10%). For industry or other professional purpose, the metering fee is cancelled for 50% of the heated area. For the remaining 50%, a reduced metering fee of DKK 16 per m2 is applied. **The fees quoted above are a typical example**, but all DH plants operate an individual economy, so variations in either direction do occur.

Regarding the **VE til Proces,** the agricultural operator does not enter into any kind of contractual relationship with end-customers, since the heat produced from the biomass heating plant is used exclusively to cover his own heating needs.

2.11.2 Financing options

Description of financing options

Because of this very special Danish heating structure, which is totally controlled by 'Varmeforsyningsloven' (the Heating Act) **not one single DH plant can be built or converted without prior permission from the local municipal authority**. In return, the municipality issues a **loan guarantee**, with which the **cooperative can obtain a loan from KOMMUNEKREDIT (http://www.kommunekredit.dk/)[21] on beneficial terms** (see below).

The steps to obtain a loan for KOMMUNEKREDIT are the following:

- Present the project (being new plant or fuel conversion) to the local municipal authority
- Obtain the municipal loan guarantee
- Take the loan guarantee to KOMMUNEKREDIT and get the loan

It is pointed out that there is no market for other private finance institutions specifically aimed at DH of introduction of biomass.

[21] KOMMUNEKREDIT was established in 1899 by a special Act and is legally organised as an association under Danish Law.

Advantages, weaknesses and effectiveness of the financing options

The **advantages** of the loans' schemes offered by **KOMMUNEKREDIT** in Denmark are:

- **Attractive interest rate** because of the no risk arrangement with the municipal loan guarantee
- **Payback period of up to 30 years,** of which the first 5 years may be free of repayments The interest is very low for the benefit of the consumer
- **Good regulation** for the heat supply

Actually, there is **no weakness** to be reported.

The **KOMMUNEKREDIT loan is considered very effective. It is noted that there is no cheaper or better alternative for the development of biomass DH projects.**

Financing options from structural funds

There are not available any available financing options from structural funds. In theory EU's regional fund for Denmark 2014-2020 has as the 4th priority (and last) the focus area "Green City Development" calling for introduction of low emission technologies and holding a specific measure of 20% emissions reduction by 2020 (relative to 2005 base line).

Difficulties in financing biomass heating projects

Actually **there are not any difficulties** in financing biomass heating projects.

Main conclusions from the interviews with the banks

In Denmark, banks are not involved in the process of giving loans to finance RE investments. This role is undertaken by KOMMUNEKREDIT.

2.11.3 General data on the DH sector in the country

The following Table 2-31 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-31 Data of the DH sector in Denmark and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	It might occur, but it is not common in Denmark.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	**Usually not**. In Denmark there are quite substantial potential for utilization of excess heat from industry, retail shops, refrigeration and A/C in general, but delivering the heat to someone external is very complicated, due to taxation. A case study from the medium size province town of Brande, shows the local industries were capable of delivering as much as 140% of the entire heat demand in Brande (7.100 inhabitants). Industries are exempted from energy tax when purchasing energy like i.e. gas or oil. In return, any sold excess energy must

Parameter	Applicability in the country
	be burdened with a tax of 35%, on top of which comes investments in distribution and metering.
3. Injection of heat from a biomass heating plant into an existing fossil fuel DH grid	**No**.
4. Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises	**Yes**, always. Preferable by means of a heat exchanger, or in the older installations, via a hot water tank with a separation circuit.
5. Payment of costs related to customer's connection to the DH grid	**Yes**, there is a **fixed annual fee**, and a **variable fee** depending on the heat consumption and the size of the house. Please see 2.11.1 for further details.
6. Measurement of the DH demand at the customer's premises	**Yes**. Denmark has, since 1997, compulsory settlement of the heat bill based on individual metering. Also, Denmark is in good course of implementing the EED Directive (2012/27/EU) on smart metering. Approximately, 50% of the consumer installations have radio frequency remote metering, and most of the remaining part operates semi-automatic metering with weekly or monthly reporting on a closed radio network.
7. Payment behaviour of DH customers to the SPVs	Not a problem.
8. Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant	There are not any regulatory provisions in relation to the content of the heat delivery contract. This is because there is the **municipal loan guarantee**, so to speak in-between the plant and the finance institute. Therefore, the finance institution carries no risk related to building or operating the DH plant.
9. Strengths and weaknesses of the (fossil and biomass fuelled) DH sector	**Strengths of the fossil and biomass fuelled DH sector**: › Extremely **widespread geographical network**. As many as 60% of the Danish households receives their domestic heat from a DH plant › Well-defined boundaries to the gas network › **Mandatory obligation for consumers to connect to and buy heat from the DH plants** › **Very competitive prices on those plants which are utilizing waste incineration and those which use biomass** as fuel › Quite high heating costs for consumers on those (small & medium size) plants which are contractual tied to use only natural gas as fuel › Very useful 'tool' to control CO_2 quotas and to monitor CO_2 savings in Denmark. **Weaknesses of the fossil and biomass fuelled DH sector**: › **Obligation to cogenerate heat and electricity**[22], rules out pure biomass heating plants and does lead to sub optimization as heat is being produced non-intentional, when the price of electricity is high. It also makes 'injection' quite complicated. › Rapid conversion of the bigger coal power plants to wood pellets leads to massive import of wood pellets, where sustainability is arguable.
10. Economic health of the existing	In general, the biomass DH sector is considered **very healthy**.

[22] There is an increasing political awareness on the restraints of compulsory cogeneration, and it is not unlikely that Denmark is going to see this provision being eased up over the next 5 years.

Parameter	Applicability in the country
biomass DH sector	Many plants, all of them cooperatively owned, have accumulated quite substantial profits. However, they are not allowed to pay out dividend to the owners, so any profit must be used for new investments or used to cut down the heat bill. Many plants are looking into solar heat and heat accumulation these years.

2.12 Finland

2.12.1 Business models

Description of business models

There are about **8,000 biomass boilers in the range of 100 kW – 1 MW in Finland**. Most of the **major cities have their own CHP plants which use also biomass**.

In Finland, the most common business models are the **Investor's own business initiative** and the **Energy Supply Contracting**. There are also some cases of Energy Performance Contracting (EPC), but they are so rare that are not described here in detail.

The **Investor's own business initiative** is used for **in-house heat production in public buildings, commercial buildings, agricultural-forestry facilities and other industrial facilities**. Under this business model, the investor installs a biomass heating plant financed by his own capital and a bank loan. With this investment, the investor covers the heating needs of its facility and reduces its energy costs. CHP technology is more common in large scale plants usually in the industrial sector.

The **Energy supply contracting initiative** (heat entrepreneurship) is used for heat supply in all **types of buildings and in DH**. Traditionally (since 1992), publicly-owned buildings (e.g. **schools, hospitals**) have been the most common customers, but recently the share of companies has been rising. Certain industry branches are seen as the most potential segments. Potential segments are **business parks or industrial zones in locations which are not connected to the DH network**. The following three segments were selected for further promotion in the project: metal industry, food processing industry and other small and medium size manufacturing industry[23].

Main stakeholders / role

Under the **Investor's own business initiative** the main stakeholders / actors involved are the investor and the financing institution that provides the loan. The role of the financing institution (bank) is to provide long term financing for the project for equipment supply, set-up and construction of the biomass CHP plant.

[23] The targeted segments are described in the report prepared in WP2 of the Bioenergy4Business project

Under the **Energy supply contracting** business model the main stakeholders involved are:

- **ESCOs**
- **Farmers:** Supply of biomass for heating
- **Ministry and banks:** Provide funding opportunities to the potential investors
- **Customers**

Ownership of the biomass heating system

Under the **Investor's own business initiative,** the investor owns the whole biomass heating / CHP plant and is **responsible for the O&M and other related costs**.

In relation to **Energy supply contracting,** there is a **large variation concerning the division of ownership** of the biomass heating system. Usually the whole biomass heating system is owned by the **ESCO**.

In Finland, the heat energy business often started with the customer making the investment and the entrepreneur running the practical operations, such as maintenance and services. In other words, customers (municipalities) made investments because they could handle better the risks. In this century, the business has become more familiar and profits are increased, so **entrepreneurs are also investing in the heating plants and taking the risk of the whole business**.

The **points of transfer of ownership of the heat supplied** are between the grid and the customer. **ESCOs** take care of all the daily routines and services (O&M, billing, etc.).

Level of support of the legislative framework to the business models

The current legislative framework **promotes investments** in both business models. Finland has regional and national ambitious targets to increase the use of bioenergy. They are based on EU directives and national strategies. There are subsidies available to make bioenergy competitive compared to fossil fuel-based investments.

Advantages, weaknesses and effectiveness of the business models

The **advantages** of the **Investor's own business initiative** business model are that the investor can get an **investment subsidy of 10-15%** of the total investment cost. This is important for developing a project.

The main **weakness** however is that the investor finances an important part of the investment (at least 25 - 30%) by his own capital and to this end, faces financial difficulties in investing in such kind of projects.

The **Investor's own business initiative is considered the most common way in Finland for developing biomass heating projects.**

On the other hand, **Energy supply contracting** has the following **advantages**:

- **easy to switch to biomass heating**
- **long term supply** of heat
- **cost-effective** compared to fossil fuels

Wood energy schemes give public municipal authorities a welcomed opportunity to exploit locally available renewable bioenergy resources, and support local businesses instead of buying imported fossil fuels supplied by large multinational corporations. Such schemes help to build up local economies by providing employment and promoting energy self-sufficiency.

The main **weakness** of the **Energy supply contracting** business model is that it can be **complicated for small companies and new entrepreneurs**. There is a risk for unprofitable business deals or contracts.

The business model is **effective since there are over 300 ESCOs / local heating businesses established in Finland**, operating over **500 local heating plants** (one company can own several plants in the area).

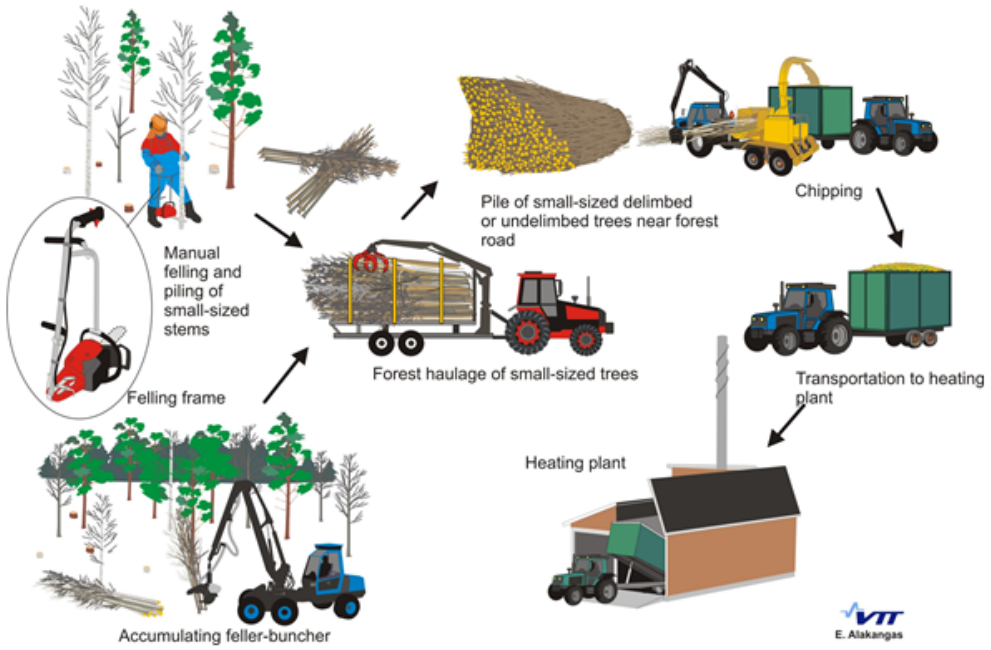
Key features of a typical raw material supply contract

Under the **Investor's own business initiative**, the investor buys wood chips from the farmers or forestry associations under long term supply contracts. The **subject of the agreement** between the two parties is the guaranteed **quantity** of the biomass delivered, the **contract duration** and the **biomass price terms**. The price of the biomass is negotiated between the parties. There is a **wood chip price index in Finland**. There is **usually no risk of non-delivery**.

Under the **Energy supply contracting** business model, the ESCO gets large share of the biomass from **own forests**. In bigger plants, commonly the ESCO purchases biomass from outside wood chip suppliers. The **subject of the agreement** between the ESCO and the biomass suppliers is the needed **quality** and the guaranteed **quantity** of the biomass. There is a **well-established market for wood chips** in Finland because there are **many specialised chipping companies**. Usually they make **long term delivery contracts, but also spot trading** is possible. **The ESCO bears all the risks for the quality and quantity of the biomass delivered**. It is better to have only one organisation responsible for heat delivery by biomass, since the organisation gets paid only by the produced heat so the interest to get/use good quality fuel is high.

As a rule, the more the entrepreneur refines the raw material, the better the profits are for the company. As an example, if an entrepreneur produces raw material from his own forest, takes care of transportation, storage, chipping and heat production in his own heat plant, the profit from the produced energy is the highest. A typical raw material chain is presented in **Figure 2-6**.

Figure 2-6 Typical raw material chain in Finland



Key features of a typical heat delivery contract

Under the **Investor's own business initiative**, the investor does not enter into any kind of contractual relationship with end-customers, since the heat resulted produced from the biomass heating / CHP plant is used exclusively to cover his own heating needs.

In relation to **Energy supply contracting** business model, there are **template contracts** available and the regional wood energy advisers are able to assist the heat providers in the negotiation process.

The **price of the heat is evaluated in general every 1-6 months**. Only agreed major price moves affect the price and invoicing. The **basic fee, energy fee and possible O&M costs are usually invoiced every month**.

If the customer is a public body (80% of the cases), then there are certain strict rules in the bidding process and the content of the service contract.

The duration of a typical heat delivery **contract duration** is between **6-10 years**.

In small scale heating, there is **market price** and there is huge variation between the areas. In DH, the price is the same for each (private) customer in the area. For companies the price can vary.

2.12.2 Financing options

Description of financing options

The most commonly used financing options in Finland are:

3. **Capital grants** (investment subsidies)

4. Bank **loans**

Capital grants

The Ministry of Employment and Economy, based on its assessment of the project in question, can **grant energy support to companies, communities and other organisations**, for climate and environment investments and surveys that promote the production or use of renewable energy. This energy support is particularly intended to promote the introduction and market launch of new energy technologies. Support decisions are mainly processed by local Centres for Economic Development, Transport and the Environment (ELY-center, regional). Those projects whose costs exceed EUR 5 million, and those including new technology, are processed by the energy department of the Ministry of Employment and the Economy.

Usually the grant is **10-15% of the total investment value**. In certain cases, **even the pipe network gets subsidy**. The subsidy percentage has decreased in recent years for biomass heating plants because it is considered as already fairly common and conventional technology.

Loans

Loans granted by the banks are the **most important source of funding** for investments in biomass projects in Finland. They are provided by **private banks** of which the major ones are:

- **OP Financial Group** (www.op.fi)
- **Nordea Bank** (www.nordea.fi)
- **Sampo Bank** (www.sampopankki.fi)
- **Finnvera**: specialized financing company owned by the State of Finland. Loans from FInnvera are handled through private banks.

Advantages, weaknesses and effectiveness of the financing options

Capital grants

The primary aim of such support is to enhance the profitability of early-stage investments and minimise the risks associated with the introduction of new technologies.

On the other hand, the subsidy share is declining, especially for conventional technology. It is noted that there are **no major weaknesses**. Most market actors know the way the system works and there are consultants readily available to assist in the application process.

Capital grants are effective since almost all biomass projects are partly funded by this financing option.

Loans

The **advantages** of the loans' schemes in Finland are:

- **Customer-oriented attitude towards the investor** and during the overall assessment of the project
- **Low interest rates**
- **The loan period can be fairly long**

One weakness of the loans' schemes is the **high share of the equity capital (25 – 30%).** However, there are **no other major weaknesses**. Most market actors know the way the system works and there are consultants readily available to assist in the application process. The companies have usually in the bank their own contact person who knows the earlier credit and financial history of the company.

Loans are considered effective since almost all biomass projects are funded by bank loans.

Financing options from structural funds

Structural funds are not available for commercial bioenergy plants. Farms may get structural funds in some parts of Finland.

Difficulties in financing biomass heating projects

There are **no major difficulties** in financing biomass heating projects in Finland. The **financing market is liquid and interest rates are low**. For economically sound investments it is fairly easy to get funding. **The main challenge for the ESCOs is to get the own funding (30%) for the investment.**

Main conclusions from the interviews with the banks

MOTIVA interviewed Finnvera. Finnvera is a **specialised financing company owned by the State of Finland** and plays a **major role in funding new biomass heating projects**. It is important because the risks included in financing are shared between Finnvera and other providers of financing.

Finnvera charges interest on its lending (reference rate + margin) and a guarantee fee for its guarantees. In addition, Finnvera **charges a service fee for each loan**. Its guarantee fee is determined on the same basis as the interest margin on its loans. **Finnvera does not compete with banks as a provider of financing.**

Before making its financing decision, Finnvera examines whether the company is able to engage in profitable business and put its plan into effect. Finnvera assesses the company's aims, development plans, outlook and competitive position. The adequacy of the overall funding and self-financing is also examined. The entrepreneur must also have good financial standing.

Table 2-32 provides the **stipulations / requirements** that Finnvera checks from their clients in order to finance biomass heating projects.

Table 2-32 Stipulations / requirements that the FIs check from their clients in order to finance biomass heating projects (Finland)

Stipulation / requirement	Finnvera
Security of feedstock supply	
Existence of heat supply contracts and guarantees	
Priority feed in provisions in case of supplying to a huge district heating system with several heat providers	
Existence of biomass supply contracts and guarantees (in case of a biomass supplier's withdrawal from the supply contract).	✓
Indexed heat sale price	✓
Indexed biomass price	✓
Minimum participation rate of biomass supplier in project enterprise (e.g. 25%)	✓
Land ownership titles of biomass supplier (no traders)	
Other (please specify)	
Technical	
Technical due diligence (DD)	✓
Possibility of an Engineering Procurement Construction Contract	
Review of main contractors and service contracts	
Assessment of the technical concept and of process engineering	✓
Assessment of the operation and maintenance (O&M) regime	
External construction supervision (verification)	
Review of profitability calculation	✓
Other (please specify)	
Legal	
Legal assessment of contracts (biomass supply, heat supply, etc.)	
Legal assessment of production licences, environmental permits, etc.	
Assessment of real-estate property (hypothecs, etc.)	
Network connection agreement	
Existence of operation and maintenance contracts	
Other (please specify)	
Financial	

Stipulation / requirement	Finnvera
Evaluation of business plan	✓
Minimum share of equity capital	✓
Upper limit for the residual investment value	
Upper limit in percentage of (guaranteed) cash flow	
Upper limit for the Pay Back period	
Minimum Debt Service Cover ratio	
Minimum Return on Equity	
Maximum lent term (life of the loan)	
Upper limit regarding technical life-time of main equipment	
Main contractor's contract for turnkey-ready plants in combination with a full O&M contract with online monitoring	
Other (please specify)	
Securities for liabilities	
Supplier's financial guarantee in case of supply contract default	
Supplier's obligation to retain agricultural / forestry production	
Account pledge	
Risk insurance (liability, damage, business interruption)	
Other (please specify)	

The most important factors that FInnvera considers in order to provide financing for biomass heating projects are presented in the Table 2-33.

Table 2-33 Important factors that the FIs consider to finance biomass heating projects in Finland

Factor	Finnvera
Investor credibility	✓
Project IRR	✓
Payback Period	✓
Maturity of the project / technology	✓
Long term biomass supply contract with predictable raw material prices	✓
Long term heat delivery supply contract	✓
Other	

2.12.3 General data on the DH sector in the country

The following Table 2-34 presents general data of the DH sector in the country and its relation to biomass heating.

Table 2-34 Data of the DH sector in Finland and its relation to biomass heating

Parameter	Applicability in the country
1. **Delivery of heat from in-house biomass boilers to nearby buildings**	It is possible but usually in-house heat production is for own consumption.
2. **Supply of biomass (excess) heat from industry / commerce to a fossil fuel grid**	Yes, some forest companies provide their excess heat to the grid owned by someone else.
3. **Injection of heat from a biomass heating plant into an existing fossil fuel DH grid**	There are some biomass heating plants built to provide the heat into an existing fossil fuel DH grid. One example is in the city of Tampere when a pellet boiler was established in 2013 with an annual production of 28,500 MWh. Also, Helsinki is considering building a big pellet boiler (the approximate date is 2018).
4. **Hydraulic disconnection between the DH grid and the customer's heat installations at the customer's premises**	Yes.
5. **Payment of costs related to customer's connection to the DH grid**	The equipment in the heat distribution substations includes the heat exchangers for heating and service water. The substations are industrially manufactured units. Customers acquire their DH equipment and the related installation work from heating contractors or as comprehensive deliveries from energy or DH suppliers. **The heat exchanger is the property of the customer.**
6. **Measurement of the DH demand at the customer's premises**	The parts of the heat meters are the flow sensor, temperature sensors and the heat consumption meter. The flow sensor measures the volume of circulating DH water. The temperature sensors constantly measure the temperature of water going into and coming out of the building. The heat consumption meter calculates the thermal energy consumed. **The heat supplier owns the metering equipment.** **The customer sends meter readings to the heat supplier** according to instructions, or the **heating company reads the meter remotely**. The DH supplier provides their customers with a follow-up report on heat consumption at least once a year. In many locations, customers can monitor their consumption directly on the heat supplier's website.
7. **Payment behaviour of DH customers to the SPVs**	There is no problem with the payment behaviour of the DH customers.
8. **Regulatory provisions (e.g. set by the funding authority) in the content of the heat delivery contract before granting / erection of a biomass DH plant**	**There are not any regulatory provisions**. Regulatory supervision of DH activities in Finland is based mainly on competition legislation and partly on the Electricity Market Act. Customers are also protected by the Consumer Protection Act. According to the Finnish Competition Authority, a DH supplier holds a dominant market position with respect to the customers connected to the DH network. Pricing is also regulated by energy taxation. The impacts of emissions trading

Parameter	Applicability in the country
	must also be taken into account.
9. Strengths and weaknesses of the (fossil and biomass fuelled) DH sector	**DH is the most common form of heating in Finland.** It is a natural and reliable heating method in densely built areas. DH has been produced in Finland since the early 1950s. It is available in almost all towns and population centres. About 2.6 million people live in houses heated by district heat. DH accounts for almost 50% of the total heating market. Almost **95% of apartment buildings and most public and commercial buildings are connected to the DH network**. **Strengths of the fossil fuelled DH sector**: › The fossil fuelled DH sector in Finland is in operation for many decades; therefore there is plenty of experience and know-how in running DH projects › The plants are fairly modern and the large scale CHP plants can partly use co-firing of biomass › Profitable business for their owners. **Weaknesses of the fossil fuelled DH sector** › In large scale CHP, there is no storage for biomass **Strengths of the biomass fuelled DH sector:** › cost effective, cheaper than fossil fuels › positive economic effects in employment and tax revenues › silviculture, i.e. harvesting of forests is performed in time › usually profitable. **Weaknesses of the biomass fuelled DH sector**: › future EU regulation on emissions from biomass fired plants that will result in the installation of new filters that are expensive.
10. Economic health of the existing biomass DH sector	The large-scale DH sector in Finland is **well-developed.** Also, small-scale biomass heating plants are fairly profitable and have a steady business.

3 CROSS-COUNTRY COMPARATIVE OVERVIEW OF THE BUSINESS MODELS AND FINANCING OPTIONS IN THE TARGET COUNTRIES

This chapter presents a cross-country comparative overview of the most common bioenergy business models and financing options for biomass heating installations in the target countries. General data on the biomass DH sector of the target countries are also presented.

The number of the biomass heating and/or biomass CHP plants installed differs significantly from country to country. There are some countries like Austria, Denmark, Germany and Finland with significant number of biomass heating installations (more than a few hundreds), while in other countries the sector is under-developed or is at the early stages of development (Romania, Bulgaria, Greece, Croatia, Poland, Slovakia, Ukraine). It is worth mentioning that in **Austria** there are **more than 1,400 biomass DH plants,** approximately **130 solid biomass CHP green electricity installations and more than 10,000 (commercial and private) in-house biomass boilers** with a capacity of more than 100 kW in operation. **Denmark** is a unique case with **country's heating needs** being fully covered by DH plants running on natural gas; however since 2010 many DH plants started replacing natural gas with biomass and presently **85 out of 130 DH plants are running on biomass**. In **Finland**, there are about **8,000 biomass boilers in the range of 100 kW – 1 MW.**

On the other hand, **8** biomass CHP plants are operated in **Romania**, only **one biomass CHP plant is operated in Bulgaria** (in 2013), **5 are operated in Croatia** and **4 in Ukraine**.

The above situation reflects to an extent the effectiveness of the business models implemented and the financing options available in each target country, which will be described in the next chapters.

3.1 Business models

Table 3-1 presents the most commonly used business models in the target countries.

Table 3-1 Most common business models in the target countries

Country / Business model	Investor's own business initiative	Energy Supply Contracting	Energy Performance Contracting	Cooperative	Partnership	Feed-in-Tariff scheme
Romania	√	√				
Austria		√		√		
Bulgaria		√	√			
Greece	√			√	√	
Germany	√	√		√		
Croatia	√		√			
Poland	√					
Netherlands	√					√
Slovakia	√					
Ukraine	√					√
Denmark				√		
Finland	√	√				

The **Investor's own business initiative** business model refers to the funding of the investment through own capital of the investor or through the combination of own capital, grant and bank loans, based on investor's planning.

Under the **Energy Supply Contracting** business model, an ESCO (contractor) supplies useful energy, such as electricity, hot water or steam to a client and is remunerated on contract basis. Usually the ESCO supervises the entire process from the purchasing of fuel (e.g. biomass) to the delivery and invoicing of energy to the client. Financing, engineering design, planning, constructing, operation and maintenance of biomass production plants as well as management of energy distribution are often included in the complete service package.

Under the **Energy Performance Contracting** business model, an ESCO (contractor) implements an energy saving project/intervention for a client guaranteeing energy cost

savings in comparison to a historical (or calculated) energy cost baseline. For its energy costs savings services, the ESCO receives a performance-based remuneration from the client.

Co-operatives are legal/financial entities owned, controlled and operated by a group of people for their own benefit usually on a community/municipal level. Each member contributes equity capital and receives shares of the firm.

Feed-in tariff schemes are policy mechanisms offering long-term contracts reimbursing RES producers based on the cost of generation of each technology.

The existing business models in the target countries are various and diverse. However, the **most common business model is the Investor's own business initiative**. This business model refers to in-house heat production in industrial facilities that either utilize their own biomass residues (in case the industry is a wood based) or are supplied the biomass from traders or other companies. This business model is most common in **9 countries** and in most of the cases, the potential investor realizes the investment by own capital combined with a bank loan.

Energy Supply Contracting is common in **5 target countries** while the **Co-operative** business model is also popular in **4 target countries**. The **Partnership** business model is specific only to Greece and the **Feed-in-Tariff business model** is applied to Ukraine and the Netherlands.

The **Co-operative** business model is considered very successful in the target countries where it is applied. One example is **BENÖ (Bioenergy Lower Austria)** business model, applied in Austria, which refers to a **farmers' cooperative** which is specific to **small scale DH**, **micro grids**, **in-house heat production and supply** (e.g. residential buildings, commerce and service buildings, public buildings, agricultural-forestry facilities, industries). It is a "**roof-cooperative**" for rural cooperatives. It allows farmers to focus on the tasks they are familiar and capable of realizing (supply of boilers with biomass/woodchips, operation and simple maintenance of boilers, etc.), while the **peak-cooperative which has this expertise, performs bookkeeping, detailed planning, etc.** The cooperation of these entities allows cost reduction via common procurement of equipment, exchange of experience, etc. **Bioenergie Tirol** is another co-operative in Austria, which is regional partner of Energiecontracting GmbH. **Energiecontracting GmbH is an energy service provider** which, **in cooperation with local partners, erects and operates biomass DH plants** and other RES plants.

Another successful Co-operative model is applied in Germany. It is the so-called **bioenergy village** which is a regionally oriented concept for the use of RES in rural areas. The rationale is that a **single person or few individuals** with great dedication often persuade other locals to invest in a **shared biomass heating system.** Various **investment models** are available depending on the specific starting condition. The SPV that is formed may be composed of **municipalities**, **biomass producers**, **citizens**.

In **Denmark**, having a long tradition in operating DH plants, the **Co-operative a.m.b.a.** is the most common business model. All the members have equal influence regardless of their size. There are **no shares and no return of profits to the members**; the general assembly is the highest authority and it works the way that one man has one vote, regardless being a major or a minor consumer. All the consumers own in common, the entire production facility and the distribution network.

Ukraine applies a feed-in-tariff scheme addressed to **public and residential buildings.** This scheme is actually a **heat tariff** for the heat produced by a biomass boiler plant (not by a CHP plant) and is applicable for biomass heat supplied to public buildings (budget-financed organisations) and residential buildings. The same concept also exists in the **Netherlands**. This scheme is addressed to DH, micro grids, in-house heat production and supply such as residential buildings, commerce and service buildings, public buildings, agricultural-forestry facilities and industries. The SDE+ compensates for the difference between the cost price of fossil energy and that of renewable energy, over a period of 12 years.

Table 3-2 **presents the level of support of the legislative framework** in terms of adequacy, relevant provisions, etc. in relation to the business models available in each target country.

Table 3-2 Level of support of the legislative framework to the business models in the target countries

Country	Level of support of the legislative framework to the business models	Country	Level of support of the legislative framework to the business models
Romania		Poland	
Austria		Netherlands	
Bulgaria		Slovakia	
Greece		Ukraine	
Germany		Denmark	
Croatia		Finland	

	Low		Average		High

It is noted that the legislative framework of **Romania, Poland and Slovakia** does not support/promote the business models in biomass heating. In **Bulgaria**, an **indirect policy measure supporting the business models** is the obligation of municipalities (set out in the Energy from Renewable Sources Act) to develop RE programmes.

On the other hand, the business models of the target countries of **Austria, Germany, the Netherlands, Ukraine, Denmark and Finland are supported by the legislative framework**. In **Ukraine**, for example, the Feed-in-Tariff scheme for public and residential buildings was introduced by governmental Resolution N 453 and N 293 respectively (during 2014). **Germany** has a number of legislative Acts supporting biomass heating; these are the **Renewable Energies Heat Act** which promotes the use of renewable energy in the heat market and the **Act on Combined Heat and Power Generation** promoting the construction of heating networks.

Table 3-3 **presents the key features of a typical biomass supply contract** in the target countries. Biomass supply contracts are available in Austria, Bulgaria, Greece, Germany, Croatia, the Netherlands, Ukraine, Denmark and Finland. They exist in cases where a biomass supplier is involved to provide the raw material to the investor / ESCO / SPV. In the case that the investor is an industry activated in the forestry / agricultural sector, biomass is derived as a by-product of the main industrial activity and thus biomass is available as a fuel for the boiler / CHP unit.

Table 3-3 Key features of a biomass supply contract in the target countries

Country / Key features	Biomass quality	Biomass quantity	Contract duration	Biomass price terms	Other
Romania	Not applicable				
Austria	√	√	√	√	Water content of biomass (for ESC)
Bulgaria	√	√	√	√	
Greece	√	√		√	Time of delivery
Germany	√	√			Time of delivery
Croatia		√	√	√	
Poland	Not applicable				
Netherlands	√	√	√	√	
Slovakia	Not applicable				
Ukraine	√	√	√	√	

Country / Key features	Biomass quality	Biomass quantity	Contract duration	Biomass price terms	Other
Denmark	√	√	√	√	
Finland	√	√	√	√	

As it is obvious from the above Table, the key features of biomass supply contracts in almost all target countries are the biomass **quality** and **quantity** delivered, the **duration** of the contract and biomass **price** terms.

It is worth noting that the **biomass prices are set in different ways in the target countries.** In **Austria** the price is set taking into account other biomass DH plants and is based on a system of indices comprising costs of heating oil, costs of a typical labour hour, etc. in **Bulgaria**, biomass price is negotiated with the supplier, but there are also available regulatory set prices on the market. In **Greece**, for the Investor's own initiative business model, biomass prices are mainly affected by prices of fossil fuels (competitive fuels), as well as, availability of raw material and security of supply. Under the Co-operative business model, biomass price is not affected by fossil fuels due to the low cost of residues. In **Germany**, the biomass price often involves a price fixing concerning the development of prices for fossil fuels and/or for wood. In **Ukraine**, the biomass price can be fixed in the process of auctioning. In **Denmark**, the price is fixed between the two parties for a specific period of time (commonly 1 year or more). In **Finland** on the other hand, there is a **well-established market for wood chips** and there is a **wood chip price index which sets the price.**

The duration of a typical heat delivery contract is presented in the Table 3-4. Heat delivery contracts exist in cases where the heat produced is directed to third parties and not for own use.

Table 3-4 Duration of a typical heat delivery contract

Typical Heat Delivery Contract Duration	Austria	Bulgaria	Germany	Ukraine	the Netherlands	Finland
	15	5-10	10	1	12	6-10

A number of observations in the advanced target countries in relation to heat delivery contracts are presented below:

- There are template contracts available in **Austria and Finland.**
- In **Finland**, the heat price is composed of a basic fee, an energy fee and possible O&M costs. The price is evaluated in general every 1-6 months.
- In **Austria** the heat price consists of three parts: a heat price (€/kWh) – covering variable costs like fuel costs, a basic price (€/month or per year) – covering fixed

costs on the side of the plant like investments and a meter rent (€/kW) – covering fixed costs on the side of the customer.

- In **Germany**, the heat delivery price usually comprises the basic price and a commodity charge; these prices are **adjusted by indices which are influenced by the price development of the goods which are relevant to the composition of the heat price.**
- In **Denmark**, the heat price is variable and depends on the running costs and the fuel used; it is normally composed of **several elements** such as connection fee, annual administration fee and metering fee as well as price per kW heat delivered.

3.2 Financing options

Table 3-5 presents the available financing options in the target countries.

Table 3-5 Available financing options in the target countries

Country / Financing option	Loan	Capital Grant	Investment Subsidy	Loan with redemption subsidy
Romania	√	√		
Austria	√		√	
Bulgaria	√	√		
Greece	√	√		
Germany	√	√		√
Croatia	√	√	√	
Poland	√		√	
Netherlands	√			
Slovakia	√	√		
Ukraine	√			
Denmark	√		√	
Finland	√	√		

It is obvious from the above table that **loans and capital grants are the most common financing options in the target countries**.

In some countries, **Financing Facilities** are operating and, through credit lines**, provide loans and grants for RE investments**. Financing Facilities are operating in 5 target countries (**Romania, Bulgaria, Croatia, Slovakia and Ukraine)**. However, **both loans and grants** are provided by the Financing Facilities in Romania, Bulgaria, Croatia and Slovakia apart from Ukraine where UKEEP and USELF provide only loans. The amount of the grant varies for each project and is between **5% and 20% of the principal amount of the disbursed loan that the investor receives.**

Table 3-6 **presents the major advantages and weaknesses of the loans' schemes, from the investor point of view, in the target countries**. As it is observed, one of the major advantages reported for the target countries is the **long loan period** for the investment. In general it is between **10 – 15 years** in most of the countries. There are however some countries like Denmark and Austria where the loan period is 30 years and up to 20 years respectively. Another advantage in 5 target countries (Greece, Germany, Croatia, Denmark, Finland) is the **low interest rates**, giving the opportunity to biomass heating projects in these countries for shorter payback times. In addition, the customer-oriented attitude towards the investor and during the overall assessment of the project by the FIs is considered an advantage in Romania, Bulgaria, Poland and Finland.

On the other hand, the **major weakness of the loans' schemes** in almost all target countries is the **high share of the equity capital** in order to minimize financial risk by banks, which is however not easily available by investors. In most countries, this is between 20-30%; there are some countries like Ukraine and the Netherlands where this share can be up to 40-50% or 40% respectively. Another weakness reported in 5 target countries (Romania, Bulgaria, Poland, Slovakia, Ukraine) is the **requirement of large number of documents and permits** for granting a loan by the FIs. The **strict financing conditions** that the FIs apply for the assessment of the creditworthiness of a project is also considered a weakness in 4 target countries (Romania, Bulgaria, Poland, Ukraine). As it is observed these types of weaknesses are observed in the less advanced countries where the biomass heating sector is not well-developed.