BioVill
Increasing the Market Uptake of Sustainable Bioenergy

Training on bioenergy projects for the financial sector

Financing models, risks and opportunities for bioenergy villages

Rüdiger Lohse
Ljubljana, 12.05.2017

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Content

- Life Cycle Calculation
- Tools supplied by BioVill
- Financing instruments
- Risks and mitigation

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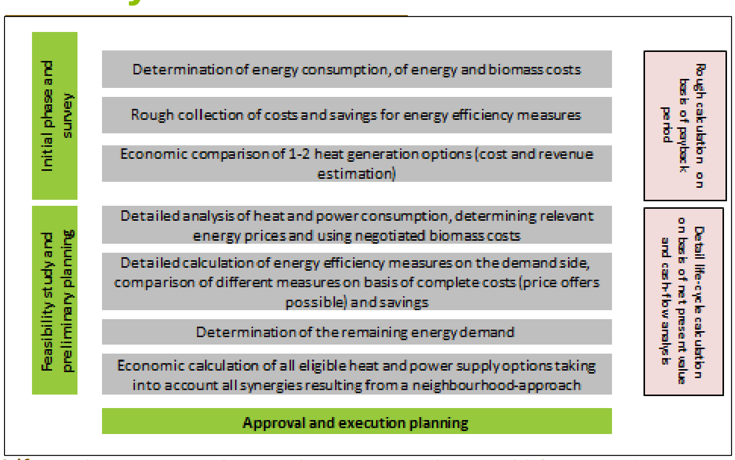
General
Investments in the energy supply

- Investments in energy generation/supply are high
- Local start-ups that operate the plants have few equity
- Numerous options to obtain funding by instituional, private or local investors (e.g. cooperative)
- Depending heavily on national legislation and framework

Life Cycle Cost Calculation



Life cycle costs are the total costs over the total life time, discounted according to the year when they occur → ISO 14040-44

Life Cycle Cost Calculation Key performance indicators

Simple methods for the beginning

- Static Amortisation
- Net- and Gross Return on Investment (ROI)

complexe methods, for detailed analysis

- Annuity method
- Net present value (NPV) combined with a cash flow calculation
- Internal rate of return (IRR)

Life Cycle Cost Calculation Cost Categories

Capital-bound costs	• **Capital costs for installation systems and their respective building components (incl. renovation)**	
Demand-related costs	• fuel • miscellaneous energy • operating materials	• cash disposal • concession fees etc.
Operation-related costs	• costs of servicing (personnel) • maintenance • repair, inspection • trouble-shouting	• rent • cleaning • chimney sweeping • flue gas analyses
Other costs	• insurance • general levies and charges • administration	

Life Cycle Cost Calculation

Estimate calculation of heating price in German case study (passive house district heating)

- Energy demand: 9.215 MWh
- Investment & planning: € 5.55m (€ 4.43m debt capital)
- Interest rate: 3.6%
- Calculation period: 20 a

- Annuity (annual capital costs) € 315,000
- Energy costs: € 245,000
- Other variable costs: (repair, maintenance, insurance, staff..) € 400,000
- Sum: € 960,000

➢ Heat price (excl. VAT): 104,17 €/MWh

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Life Cycle Cost Calculation

Example b) Calculation with B4B BioHeat Profitability.Assessment tool

- Step 1: Calculation of the energy demand
- Step 2: Design of the biomass boiler and the district heating system
- Step 3: Cost calculation
  - Investments in the district heating system
  - Investments in ECM
  - Investments in biomass boiler and fossil fuelled boiler
  - Construction and development investments (heating centre and others)
  - Other investments
  - Planning costs, approval costs
  - Replacement costs

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Life Cycle Cost Calculation

Example b) Calculation with B4B BioHeat Profitability.Assessment tool

- Step 4: Calculation of revenues
  - Calculated heat price (sale)
  - Subsidies
  - CO_2-certificates
  - Other revenues

- Step 5: Calculation of consumption-related costs and operation related costs
  - Costs of biomass, fossil fuels and power
  - Staff costs
  - Repair- and maintenance costs
  - Land costs
  - Other annual costs

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Life Cycle Cost Calculation

Example b) Calculation with B4B BioHeat Profitability.Assessment tool

- Step 6: Compiling economic parameters
  - Subsidies / grants
  - Share of equity / loans
  - Interest rate for both equity and loans
  - Period under consideration
  - Annuity
  - Weighted average costs of capital (loans and equity)
-
- Step 7: Deriving results
  - Outputs of the dynamic cash-flow-calculation are
  - Dynamic time of amortisation
  - Net present value,
  - IRR
  - Calculated heat generation costs (€/MWh)

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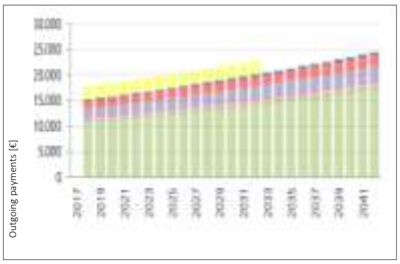
Life Cycle Cost Calculation

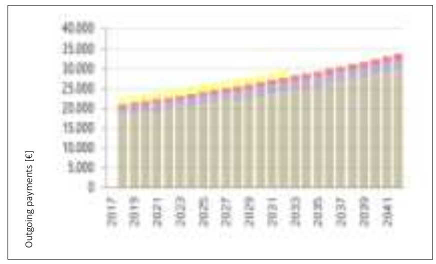
Example b) Calculation with B4B BioHeat Profitability.Assessment tool

Annual payments

Option 1: wood-pelletss with fossel fuel peak boiler



Option 2: fossel fuelled reference system



- Biomass Fuel Costs
- Electricity Costs
- Staff Costs (excl. R&M)
- Other annual costs

- Fossil Fuel Costs
- Property Costs
- Repair- and Maintenance Costs (R&M) according to VDI Guideline 2067
- Capital expenditures (interest & redemption payments)

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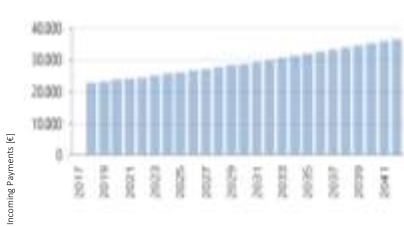
Life Cycle Cost Calculation

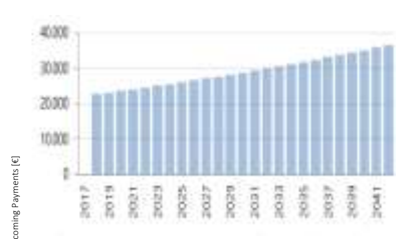
Example b) Calculation with B4B BioHeat Profitability.Assessment tool

Annual revenues

Option 1: wood-pelletss with fossel fuel peak boiler



Option 2: fossel fuelled reference system



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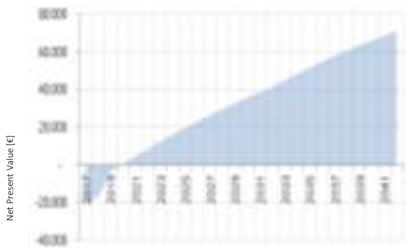
Life Cycle Cost Calculation

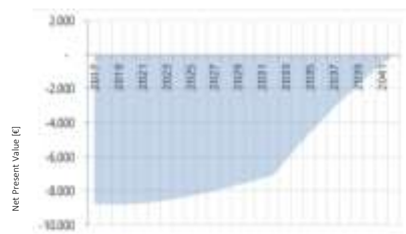
Example b) Calculation with B4B BioHeat Profitability.Assessment tool

Net present value

Option 1: wood-pelletss with fossel fuel peak boiler



Option 2: fossel fuelled reference system



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Life Cycle Cost Calculation Available tools

- B4B BioHeat Profitability.Assessment tool
- Heat cost comparison of biomass vs. fossil fuels for
  - small in-house ovens and boilers
  - Micro grids and medium scale district heating plants
- (biofuel) CHP plant assessment tools

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Financing Instruments
Key criteria for the creditor

- Equity/ Debt Ratio
- Cash- Flow of Life Cycle costs
- NPV or IRR (net present value or internal rate of invest)
- Available securities during construction and performance phase
- If third party involved: creditworthiness check as usual

Source: Energy Agency Northrine-Westphalia, 2014

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Financing Instruments
Key criteria for the creditor TDD

- **Technical Due Diligence (TDD) in brief**:
- Motivation of the project (cost effectiveness, local value generation
- Organizing team: experience, expertise (1-3)
- Redundance: Heating station Back- up philosophy; back up or super- storage: (80% of peak load/ 2-6 h)
- Quality assurance Biomass logistic concept (wood harvest- boiler)
- Grid: line densitiy of 380- 500 kWh/m grid as one first indicator for technical and economic feasibility of the concept
- Grid costs: cost driver- costs of 150- 350 €/m grid depending on sealed or not sealed ground
- Grid cost reduction measures: small ditches, combined with new water,power, fibreglass
- Grid: selection of materials decides on costs/temperature level

Source: Energy Agency Northrine-Westphalia, 2014

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Financing Instruments
Key criteria for the creditor TDD

- **Technical Due Diligence (TDD) in brief**: II
- Operational concept: responsibilities for the whole value chain: chip, ashes, hotline servicve, technical repair, maintenance, daily control, controlling, invoicing
- Heating station concept: a) mono: 100% of load provided by biomass b) 40- 60% load (kW) by biomass + peak boiler (biomass or fossile)
- Specific cost factors for power station, building, storage (80- 130 €/m³), grid (130- 350 €/m)

➔ National key performance indicator values required

Source: Energy Agency Northrine-Westphalia, 2014

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Financing Instruments
Overview

Instrument	Investment volume	Flexibility	Risks obligor	Risks creditor	Requirements	Cost effectivenes s
(soft) loans	small – large	medium	medium	Medium	Creditworthiness-check	High
Subsidies/ grants	Small – large	Medium	Low	Medium	Sticking to technical standards	High
Leasing	Small – medium	Medium	High	Medium	Creditworthiness-check	Low
Project finance	Small – large	Medium	Medium	Medium	Creditworthiness-check	Low

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Financing Instruments Overview (cont.)

Instrument	Investment volume	Flexibility	Risks obligor	Risks creditor	Requirements	Cost effectiveness
Energy Efficiency Funds	Large	Low	Low	Medium	Creditworthiness-check + project assessment	High
Green bonds	Small – large	Low	Low	Medium	Creditworthiness-check + sustainability criteria	Low
Crowdfunding	Small	High	High	High	Check by credit reference agency of crowdfuning platform	High

Potential Risks for Financial Institutions

Potential risks	Risk mitigation options
Insolvency or bankruptcy of the lender	• Limit the duration of the loan/ contract duration). • Include a risk premium in the interest rate • Request a high share of ESCO's own equity • Request for guarantees or collaterals/indemnity bonds.
Delay or cease of payment of annuities	• Request for guarantees and collaterals
* if claims were sold from the ESCO to the bank: Building owners disagreeing to pay for services	• Request an objection waiver from the building owner → put the risk of disputes on the building owner

BioVill
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Part 2

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BioVill
Increasing the Market Uptake of Sustainable Bioenergy

Training on financing, contracts and business models: Business models and contractual agreements

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Dole pri Litiji, 11.05.2017

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Content

- What are business models?
- Three possible buisness models
  - Citizen model
  - ESCO model
  - Resource-based model
- Contractual agreements

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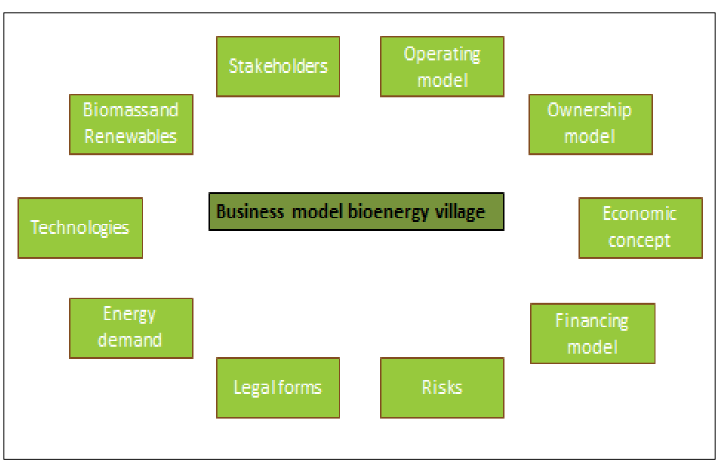
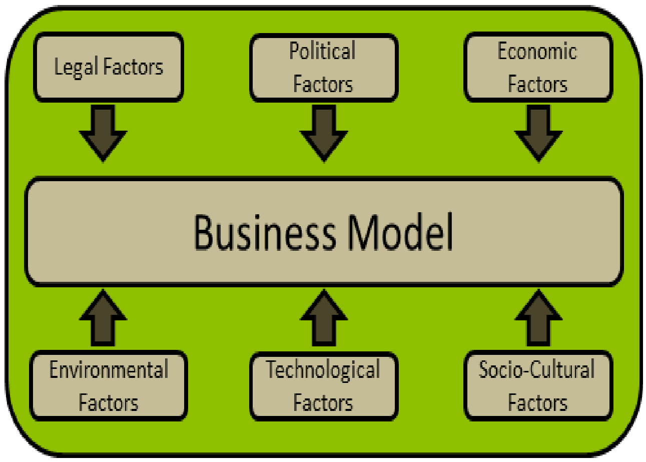
Business modell





Source. Schallmö, 2013a

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Buisness Model 1 - Citizen Cooperative Stakeholders

Stakeholder	Motivation	Input	Role
Cooperative member	Sustainability, financial investment	Financing, initiating and managing the project	Initiator & driver
Municipality	Regional added value & image	amplification of ideas Connecting its buildings	Supporter
Famers	Diversification of income	Supply of biomass	Supplier
Citizens	Cheaper energy	Purchasing power or heat	Customer
SMEs & planners	Diversification of income	Technical expertise on planning, implementation and maintenance	Consultant & executor

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Buisness Model 1
Citizen cooperative

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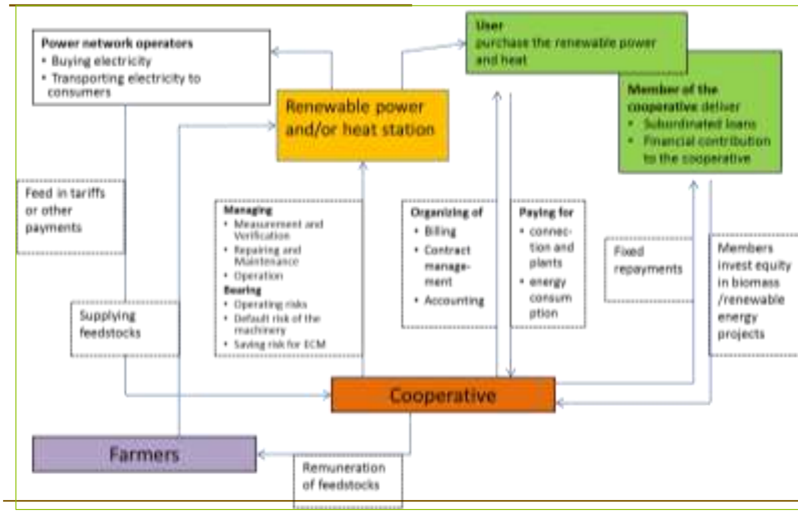

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Citizen cooperative

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- Cooperative conducts technical and financial management, either with own staff or in cooperation with planners and SMEs
  - Procurement
  - Accounting
- Cooperative acts as a heat provider (district heating systems)
- Tasks: procurement, planning, implementation, financing, operation of the heating systems, accounting

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Citizen cooperative
Cash flow and financing

- Equity financing from cooperative members
  - its a subordinated loan
- Debt financing from banks or other financing institutions
  - Needed for large investments
  - Better financing conditions (especially in Germany)
- Obtaining subsidies
- Income through basic payments and heat price
- Use of surpluses
  - Dividends distributed to the member's according to their share
  - Building financial reserves
  - Supporting social projects
  - Lowering heat prices

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Citizen cooperative
Legal forms

- Energy cooperative as most common form
  - Grassroot democracy
  - Owns all technical appliances
  - Sometimes open for municipalities and SMEs
  - Owns the technical plants

- Other structures are possible depending on the national regulations

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Citizen cooperative
Strengths and weaknesses

- Strengths
  - Open to all citizens
  - Shared benefits
  - Likely to win public trust and sympathy
- Risks
  - Volunteers might loose motivation if there is no quick success
  - Lack of professionality which might cause higher costs, delay and failure

Necessity of consulting experts for work that cannot be done by the cooperative (efficiently)!

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Citizen cooperative
Summary

- Cooperatives need
  - back-up from the municipality
  - Persistence
  - A good communication strategy
  - Clear responsibilties
  - Professional external partners
  - Motivated citizens
- Cooperatives generate high support by the local population

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Energy Contractor Model Stakeholders

Stakeholder	Motivation	Input	Role
Energy Service Company (ESCO)	Generation of income	Planning, implementing, operation, maintenance, energy controlling, optimisation, fuel purchase, (co-) financing, taking the risk	Executor
Farmers	Diversification of income	Supply of biomass	Supplier
Citizens	Cheaper energy	Purchasing power	Customer
SMEs* planners*	Diversification of income	Technical expertise	Consultant & exectuor

* Applicable if not carried out through the ESCO

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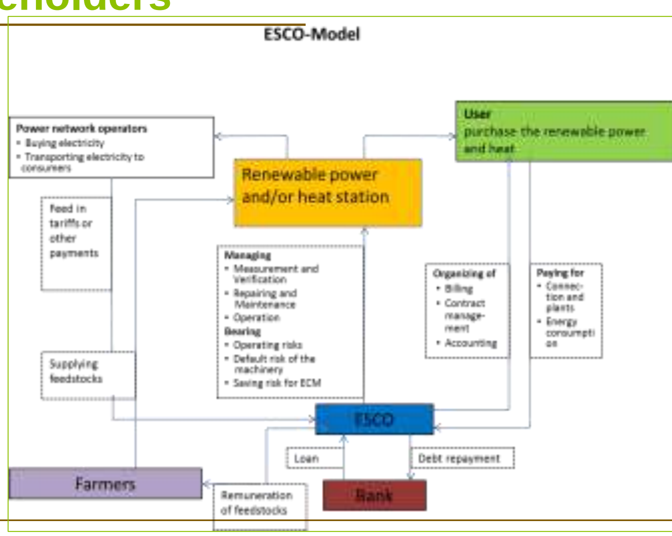
Energy Contractor Model Stakeholders



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Energy Contractor Model Operation model

- ESCO conducts technical and financial management
  - Planning
  - Implementation
  - Maintenance
  - Operation
  - Financing
  - Procurement
  - Accounting

The **integrated approach** of the model comprises both a) the operation of the ECMs and b) the operation of the heating generation systems or other renewable energy systems. The building owner often bears the responsibility for the operation of the energy conservation measures.

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Special issue on the Energy Contractor Model

- ESCO realises energy efficiency measures on the demand side
  - control systems
  - heat distributions systems
  - hot water generation
  - air condition
  - lighting
  - user behavoir
  - and others
- ESCO calculates the savings on the demand side and the efficient supply of the remaining useful energy demand

→depending on the economic outcome on the availability of subsidies and additional payments from the building owners

→quality assurance instruments are used in short-term, medium-term and long-term performances

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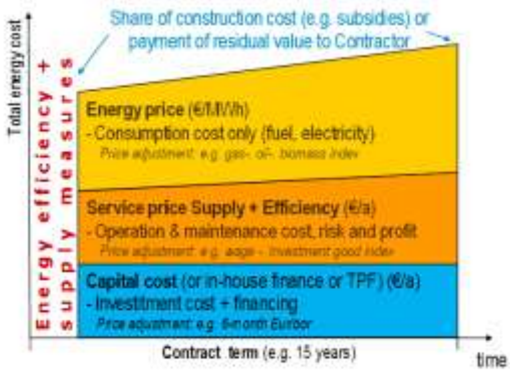
Energy Contractor Model Cash flow and financing



Source: Bleyl-Androschin J.W., 2009

- Equity from ESCO and loans from banks
- Obtaining subsidies
- Income through
  - basic payments (capital costs and service price)
  - heat price

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Energy Contractor Model Legal forms and owership

- ESCO acts often as limited liable company or stock company
- Ownership of devices
  - stay with the ESCO for the duration of the contract or
  - directly go over to the customers

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Energy Contractor Model
Strenghts and weaknesses

- Strengths
  - High proficiency (professional and cost efficient projects)
  - May involve investments in energy demand reduction at the customers (HVAC, lighting)
  - Risks do not stay with the citizens (risk transfer tp the ESCO)
  - Quality assurance instruments for ECMs
- Weaknesses
  - Availability of ESCO ?
  - Few influence by the citizens

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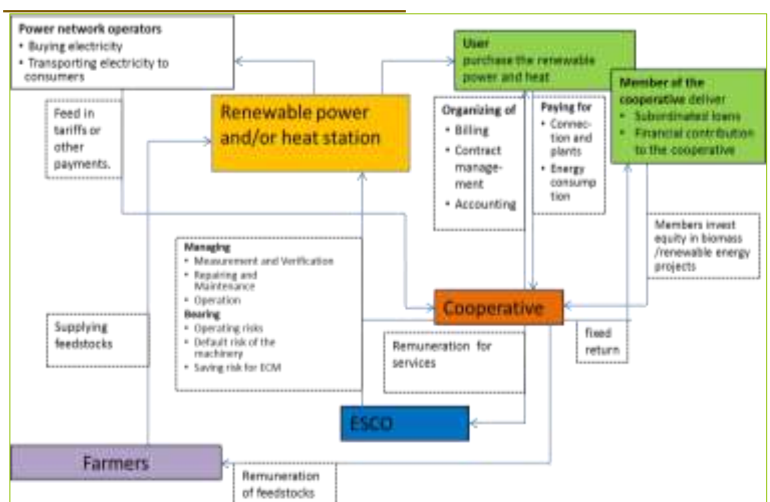
Alternative Operation Model
Cooperation between cooperative and ESCO



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Ressource-based business model Stakeholders

Stakeholder	Motivation	Input	Role
Biomass producers (farmers, saw mills, food industry)	Increasing added value, diversify the income	Supply of heat	Supplier
Industries (saw miles, paper industrie…)	Diversification of income	Sale residues that are used for energy production	Supplier
Citizens and municipality	Cheaper energy	Purchasing power and heat	Customer
Heat plant operators*	Diversification of income	Converting biomass to heat (and electricity)	Executor

* Applicable if not carried out by the biomass producers

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Ressource-based Model Operation model, owership, cash flow

- Look at citizens model (biomass suppliers instead citizens, but also organised as a cooperative)
  - biomass suppliers (farmers and foresters) and energy producers, which could also biomass suppliers, organizes the sufficient energy supply
  - local biomass processing company (SME), the energy production is mostly owned by that company

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Ressource-based Model Strenghts and weaknesses

- Strengths
  - Performance and price guarantees for consumers
  - Risks do not stay with the citizens
  - Local value creation
- Weaknesses
  - Requirement of a driving subject to bring supply and demand together

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Contractual agreements

- Contracts with heat consumers
- Contracts with banks/investors
- Contracts with biomass supplier

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Contractual Issues
Contracts with heat consumers

- Sign preliminary contract/ memorandum of understanding
  - Security for supplier: demand exists
  - Security for consumer: heat will be delivered
- Use dedicated heat supply contracts
- The contract mainly contains
  - Start and end time
  - Prices of the heat supply service
  - Responsibilities for ownership and operation
  - Grid and capacity issues
- Agree on basic or guaranteed heat supply

Contractual Issues
Contracts with heat consumers

	Basic heat supply	Guaranteed heat supply
Heat plants	Already existing	Newly installed
Back-up boilers (peak-demand, grid maintenance)	At the consumers	At the operator
Consumer price for district heat	Low	High
Risk for operator	Low	High

In basic heat supply schemes, the capacity of (existing) waste heat plants is not sufficient to cover the heat demand at any time.

Contractual Issues
Contracts with heat consumers

The pricing of the heat supply consists of

- **(unique) connection price** €/kW or €/connection point
- **Basic price**: in €/kW/a
- **Energy price**: in €/MWh
- **Measurement price**: €/a
- **Equipment rental price**: €/device/a

The heat price can either be fixed or coupled with an index.

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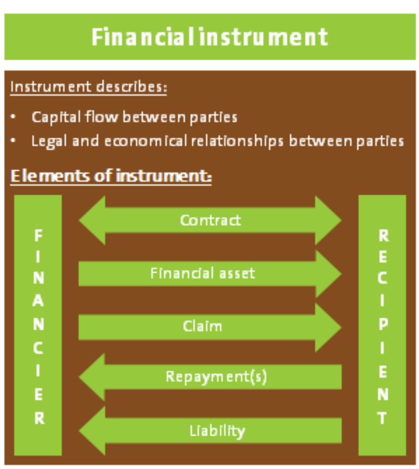
Contractual Issues
Contracts with banks/investors



Description of the financing instruments:

- Investment volume
- Flexibility
- Risks for the obligor and for the creditor
- Requirements and necessary securities
- Cost effectiveness

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Contractual Issues
Contracts with banks/investors

customer's point of view:

- **Conditions:** (fixed) interest rates, fees, provisions, extent of the financing / which measures are financed, compatibility to subsidies, contract duration, flexibility, requirements of the financing institutions (properties of the investments..)
- **Securities:** cash-flow assessment (financing on the basis of the project), equity of the investors (contractor, citizen initiative..), insurances, bank guarantees, land registry, ..),
- **Financing related supports:** tax exemption, tax limits, ..

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Contractual Issues
Contracts with banks/investors

financing institutions,
criteria for the project assessment (rating)

- Can the project cover the obligations based on the cash flow?
- Are the securities quickly available and for low costs?
- How is the credit rating / the creditworthiness of the project / the company?
- Are additional securities necessary? Which ones?
- Is the customer able to pay back the loan on basis of the agreed conditions?

Source: Energy Agency Northrine-Westphalia, 2014

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Contractual Issues
Contracts with biomass supplier

- Long term contracts for stable prices and security for the supplier
- The quality of the biomass has to be defined
(defined Standards: EN 17225 or the biofuel handbook of the Biomass Trade Centers)

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