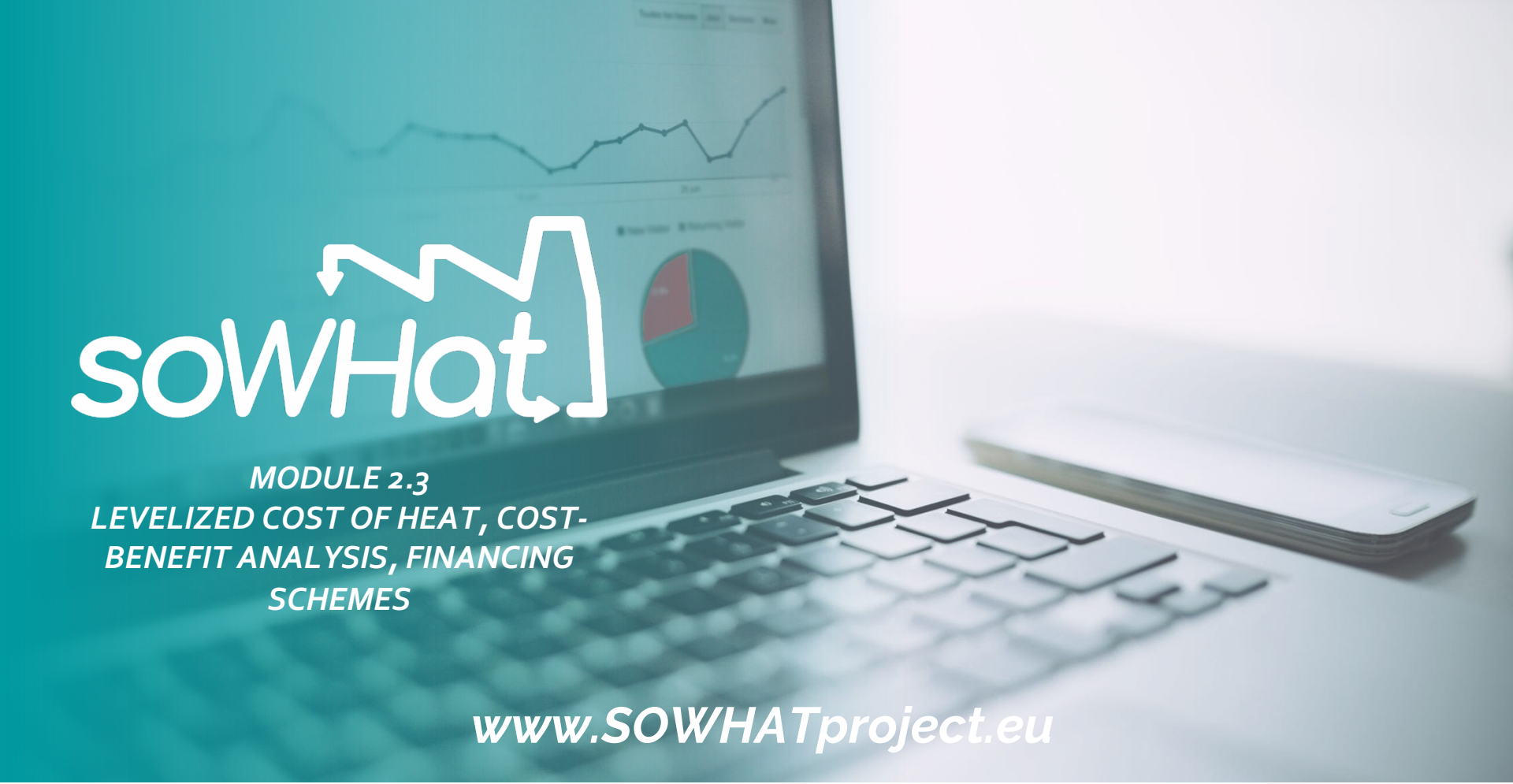

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MODULE 2.3
LEVELIZED COST OF HEAT, COST-BENEFIT ANALYSIS, FINANCING SCHEMES

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Summary

Levelized Cost of Excess Heat (LCoEH)	• Economic assessments of excess heat • Facilitates the pricing of excess heat and the economic comparision of different heating alternatives
Cost-Benefit Analysis (CBA)	• Socio-economic assesments of the costs and benefits from investments in excess heat and cold recovery technologies • Useful for making decisions on large public sector investments and to attract financial support
Financing schemes	• Different types of financing schemes, with special focus on ESCO models • Facilitates the viability of an investment

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LEVELIZED COST OF EXCESS HEAT (LCOEH)

What is the cost of excess heat relative to other heating alternatives?
How could excess heat be priced?

What is LCOEH calculations?

LCOE (Levelized Cost of Energy) calculation is a standard approach to calculate the average net present cost of the unit of energy (usually KWh) produced by a generation plant over its lifetime. A version of this is LCOEH (Levelized Cost of Excess Heat).

LCOEH facilitates:

- the pricing of excess heat
- the economic comparison with other heating alternatives
- the assessment of the maximum distance from the point of production to generate revenues

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Four approaches to LCOEH calculations

The calculations of LCOEH can be seen from four different perspectives

Industrial facility

Producers of excess heat

District heating and cooling network operator

Distributors of excess heat

End-user

Users of excess heat

Global system

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Calculating LCOEH

Capital cost

Operation and maintenance cost

Excess heat cost
This is zero for the industrial facility and in the global perspective

$$LCOEH[\frac{€}{MWh}] = \frac{I_{EH}\ CFR\ (1 - T\ D_{pv})}{8760\ i\ (1 - T)} + \frac{O_{EH,total}}{8760\ i} + c_{EH}$$

IHE: the investment cost for the equipment [€/MW]

CFR: capital recovery factor which discounts the investment [-]

Dpv: the present value of depreciation [-]

i: the capacity factor, a ratio between the total operative full load hours and the annual hours (8,760 h) [-]

T: tax rate [-]

$OEH,total$: total O&M costs [€/MW]

cEH: the cost of the excess heat [€/MWh], zero for the industrial facility and in the global perspective

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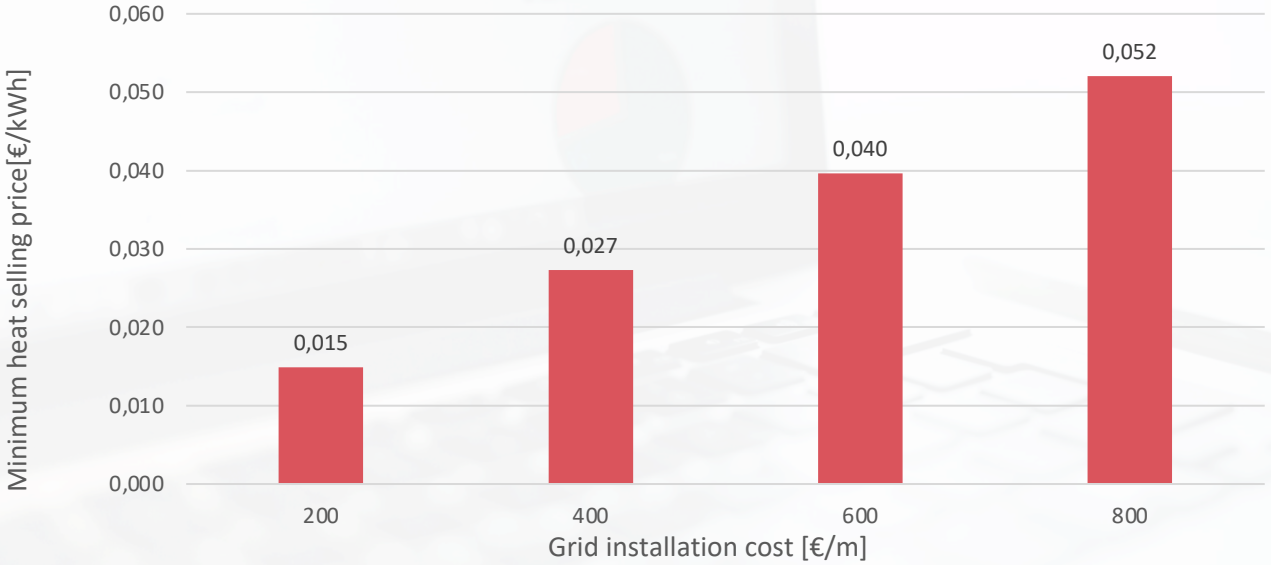
Ex. Heat price with different heat grid costs



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COST-BENEFIT ANALYSIS (CBA)

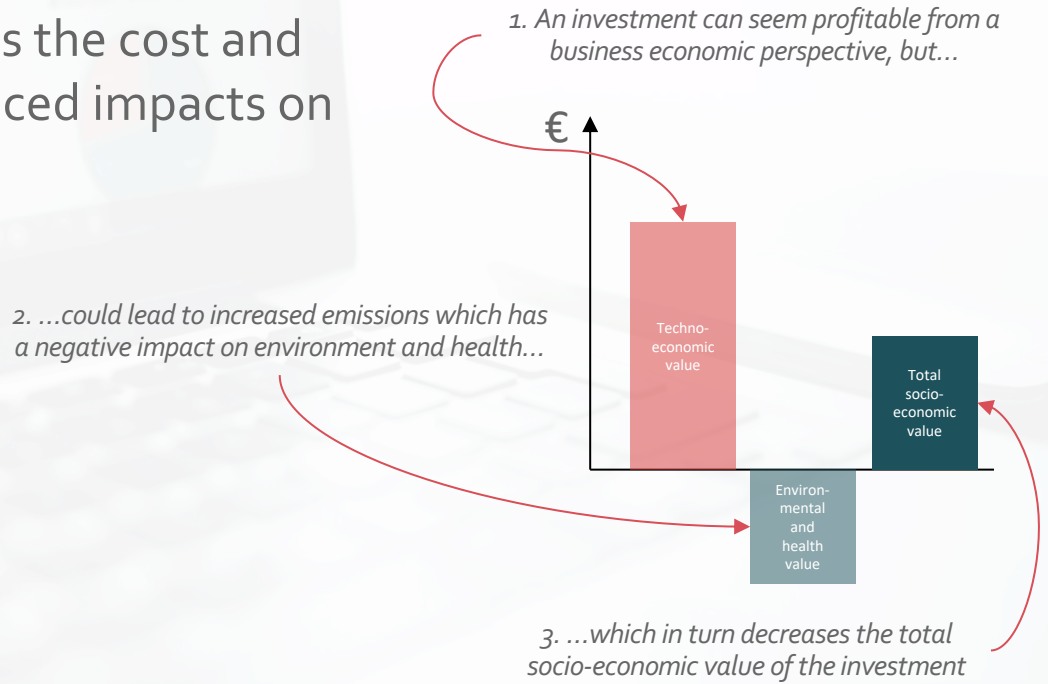
Is the investment profitable from a socio-economic perspective?

CBA captures socio-economic values

The CBA captures more values than a business economic perspective, such as the cost and benefits for increased or reduced impacts on environment and health.

Why do a CBA?

- Make a socio-economic assessment of the costs and benefits from investments in excess heat and cold recovery technologies
- Useful for making decisions on large public sector investments and to attract financial support



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CBA inputs

Technology investment option

- Type of technology
- Technical life time
- Installation size
- Annual energy production
- Investment and maintenance costs*
- Input demand (water, material, work hours etc.)*
- Fuel and electricity demand*
- Emissions*

***For these four input categories there is also a need for additional national input data**

- Emissions from the electricity production
- External costs of the emissions
- Costs of the variable inputs, fuel and electricity

Investment scenario

1. a combination of **technology investment options**
2. the investment and reinvestment years of these options and
3. the years during which these options are in operation

Example:

Scenario 1: Excess heat to nearby industry
- Technology investment option 1: Heat exchanger
- Technology investment option 2: Absorption chiller

A collection of the investment scenarios to be compared, incl. a reference scenario as baseline

Example:

- Reference Scenario: No excess heat recovery
- Scenario 1: Excess heat to nearby industry
- Scenario 2: Excess heat to district heating grid
- etc.

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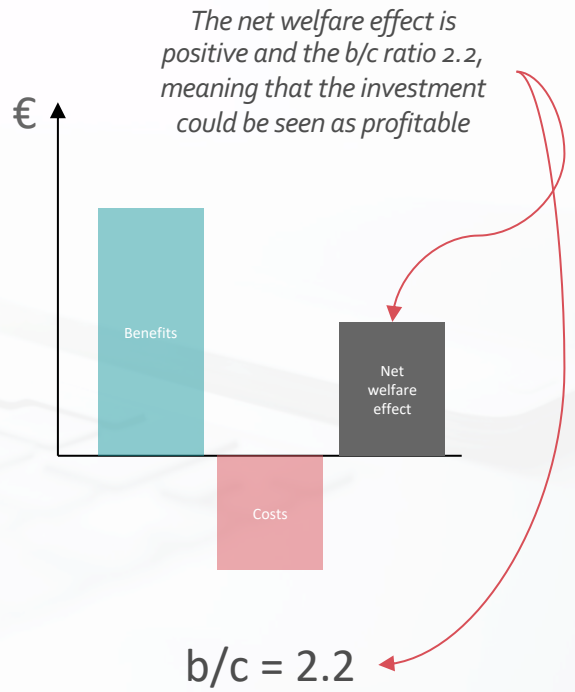
CBA outputs

The investment scenarios are compared to a reference scenario and the following could be calculated:

- **Changes in emissions**
- **Net welfare effect = benefits - costs**
  - The difference between the change in external costs, e.g. decreases in impact on environment and health, and the change in techno-economic costs, e.g. changes in CAPEX and OPEX.
  - Investments where the net welfare is positive could be considered a profitable investment.
- **Benefit/cost (b/c) ratio:**
  - The ratio between the calculated benefits and costs.
  - Investments where the b/c ratio exceeds 1 could be considered a profitable investment.

Example



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FINANCING SCHEMES

What financing schemes could support the viability of an investment?
What type of ESCO contracts could be useful?

Chosing a financing scheme

Excess heat and cold recover as well as district heating and cooling projects have high upfront costs, but choosing the right financing scheme can support the viability of an investment.

The answers to these questions can provide some guidance:

- What kind of organisations will be involved in the ownership and the operation?
- Will the ownership be divided?
- Will an ESCO (energy service company) be involved?
- What will be the target of the ESCO?

- Financing schemes
- ESCO model (if applicable)

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Financing schemes

The ownership and operation of district heating and cooling networks can be public, private and mixed public private. This affects the possible financing schemes.

Public	Private	Mixed public-private
Investments by a public entity could be finances through: 1. Financial aid from European Union and from different national administration 2. Collaboration with another public organisation 3. Acquisition and/or exploitation of networks of other municipalities	Investments from a 100 % private company can get financial support from a local entity: 1. Repayable loans 2. Non-refundable grants 3. Tax advantages 4. Other benefits	Different financing schemes for public-private collaborations: • **ESCO contracts** • Concession • Leasing • Property Differentiated by Elements • Mixed Society with Selected Minority Private Capital • Mixed Society with Minority Private Capital from Investment Funds • Mixed Society with Majority Private Capital

ESCO is the most common model

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ESCO (Energy Servive Company) contracts

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		Services	Values
Energy Supply Contracting (ESC)	Efficient supply of the energy demand	• Purchasing of fuel • Energy delivery and invoicing • Management of energy distribution • Energy production plants: financing, engineering design, planning, construction, O&M etc.	• Efficiency increase • Clear and optimized operational costs • Supply assurance increase • Application of the most recent safety standards
Energy Performance Contracting (EPC)	Reduction of the energy demand through energy conservation measures	• Design • Installation • (Co)-Financing • Operation & Maintenance • Optimization • Customer specifications	• Guarantee of results • All-inclusive costs of the services • ESCO assumes commercial, technical and operational risks
Integrated Energy Contracting (IEC)	Both efficient supply and reduction of the energy demand	A combination of ESC and EPC models	

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THANK YOU FOR YOUR PARTICIPATION

SOWHAT TEAM

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