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Methodology and tool for thermal energy audits - best practice case study

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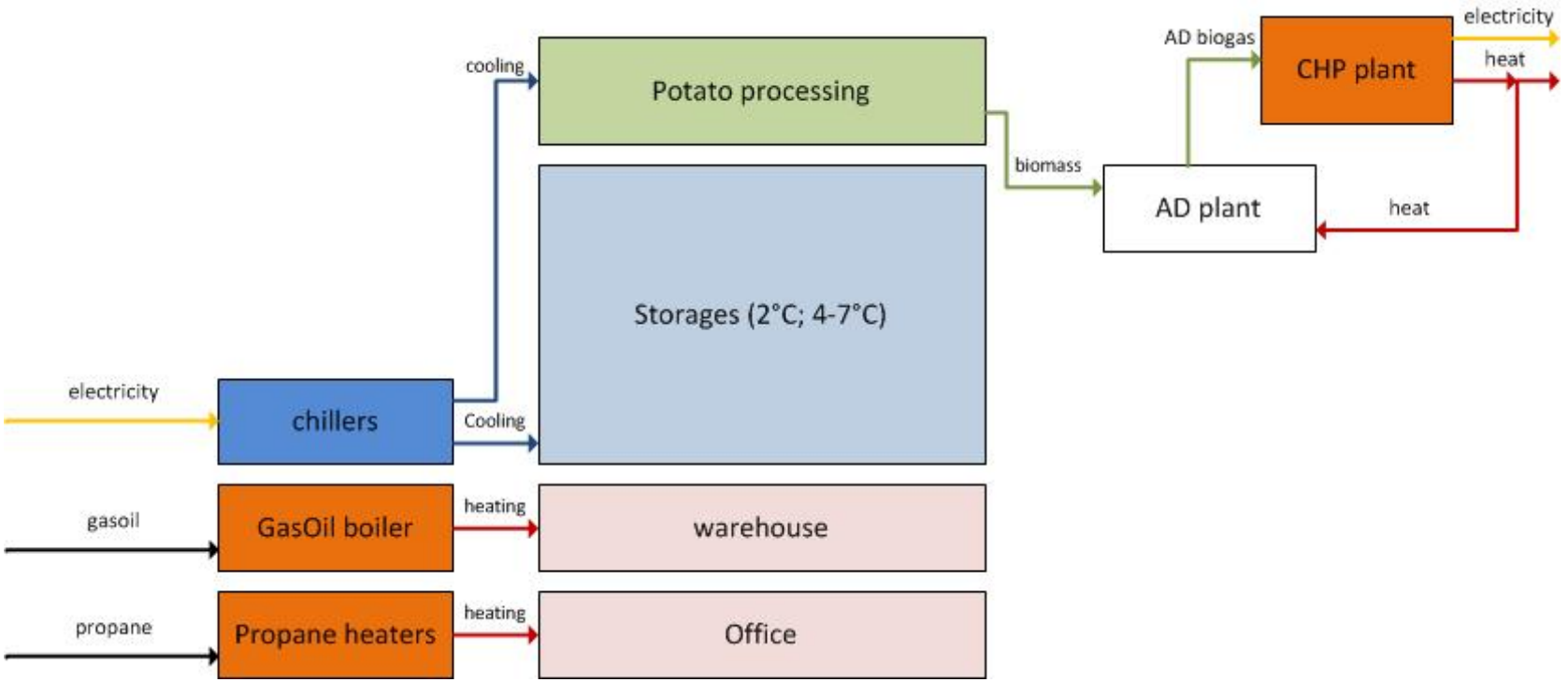
Overview

- **Description of the company and processes**
- **Results after CCheck**
- **Targets and estimations defined**
- **Alternative proposals generated**
- **Comparison**
- **Next steps**

Company description

- **Branston Prepared: The scope of this factory is to process, pack and supply a range of ready to cook vegetable products for retail, foodservice and business customers.**
- **In the production area various sauces, herbs, butters & oils may be added to the vegetables before packing them into retail packs.**
- **Post packing the product is stored in the dispatch building (2 degrees) ready to be picked onto various vehicles for dispatch to customers.**

Flowsheet


cooling
Potato processing
AD biogas
CHP plant
electricity
heat
biomass
AD plant
heat
Storages (2°C; 4-7°C)
electricity
chillers
Cooling
gasoil
GasOil boiler
heating
warehouse
propane
Propane heaters
heating
Office

Objectives of the audit

- **Based on the fact that the company has already installed an anaerobic digestion (AD) plant to exploit the biomass residues of the potato processing to produce biogas, the most efficient use of the biogas was the prior driving point**

- **As the biogas is used in a CHP plant to produce electricity without using the waste heat this proposal focuses on the use of the waste heat**

Assumptions necessary

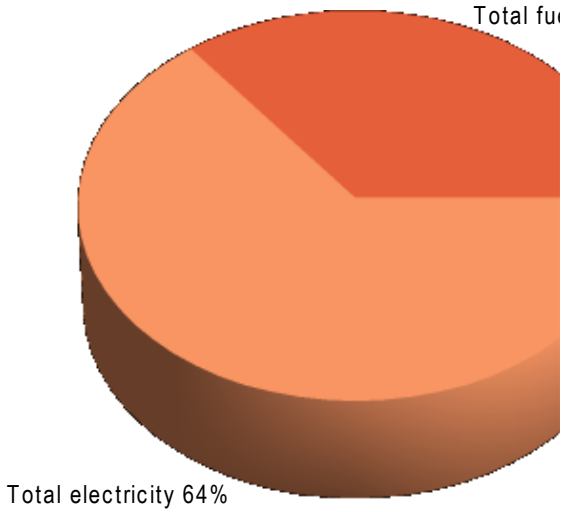
- **The following data had to be estimated due to inconsistent data:**
  - The anaerobic digestion (AD) plant started working in the beginning of 2010. The highest biogas production was reached in March and April of 2011. Due to this fact an average of this two month was taken to represent a maximum biogas production and further on a high electricity and heat production of the CHP during a whole year. This maximum biogas production was taken to represent the present state.
  - As for the chillers only the electricity consumption is known and the technical manuals are not available, assumptions concerning the COP (thermal efficiency of the chillers) were made and have to be revised and checked if a detailed cooling demand is correct.

Thermally relevant processes

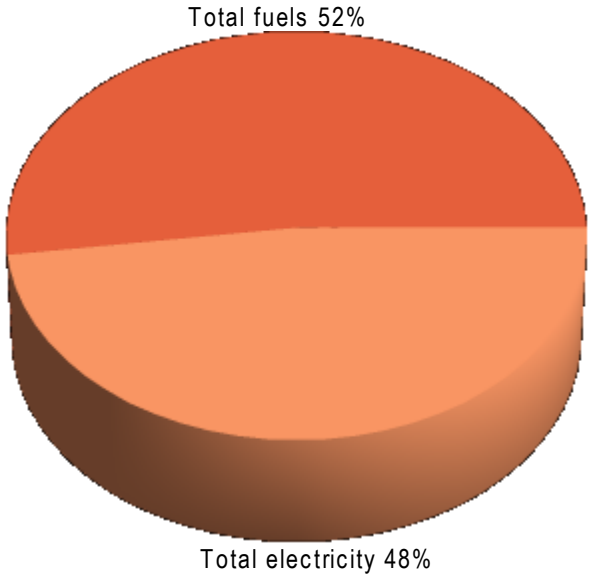
- **Cooling: 9 storages**
  - From 2°C to 7°C
- **Heating: 2 buildings**
  - Office (with propane) and warehouse (with gasoil) heating up to a target temperature of 22°C
  - Waste heat of the CHP was built as heat demand

Present state (1)

- **Total primary energy consumption (PEC – 11,886 MWh) and for thermal use (PET – 6,138 MWh)**



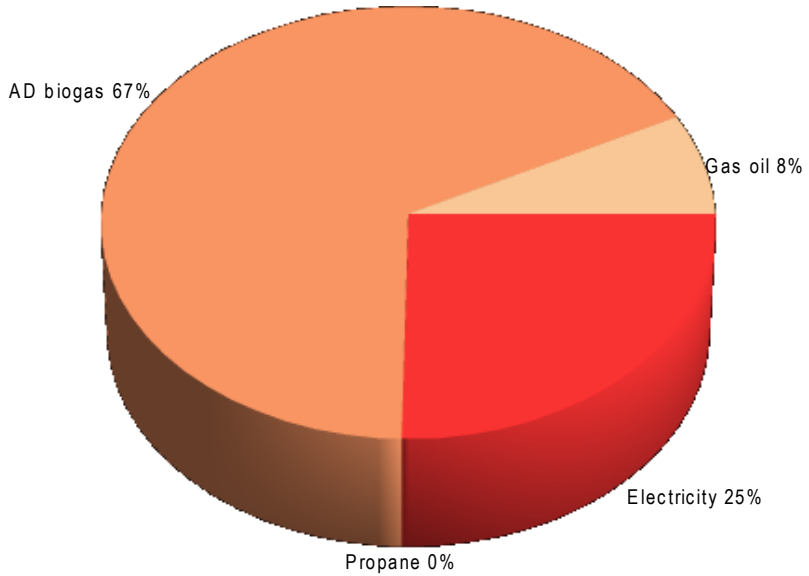
Distribution of PEC by fuel type

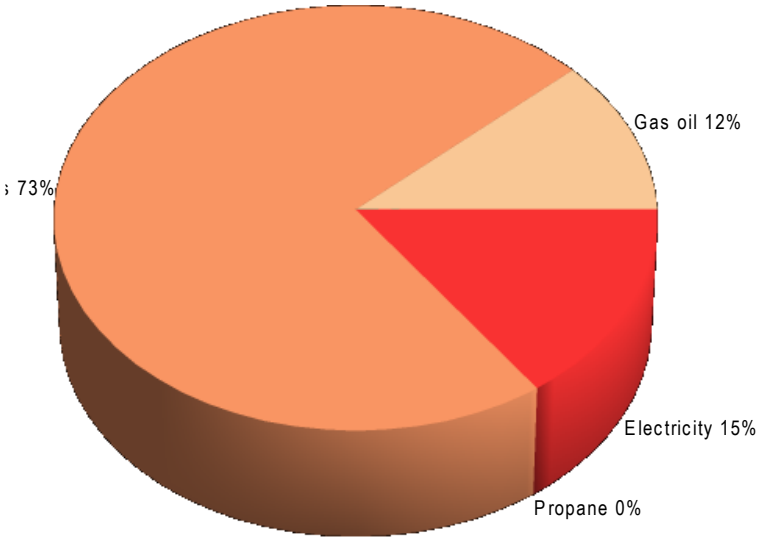


Distribution of PET by fuel type

Present state (2)

- **Total final energy consumption (FEC) and for thermal use (FET)**



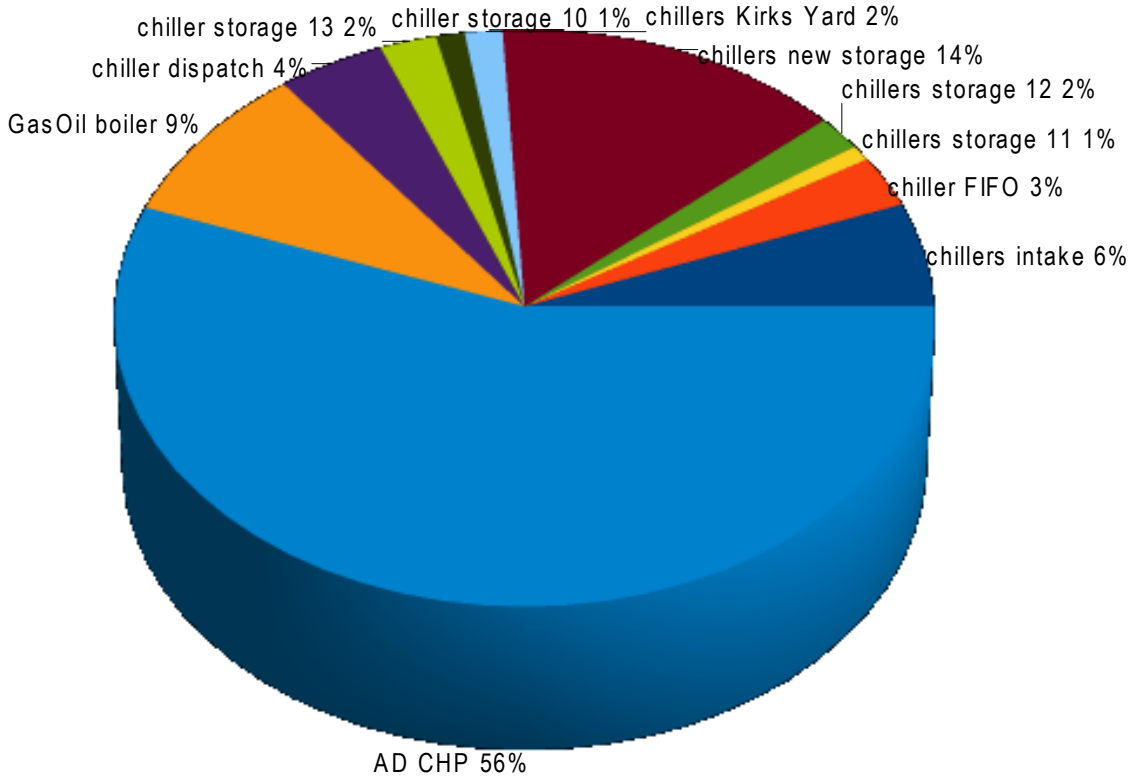


Total final energy consumption (FEC); present state.

Total final energy consumption for thermal use (FET); present state.

Present state (3)

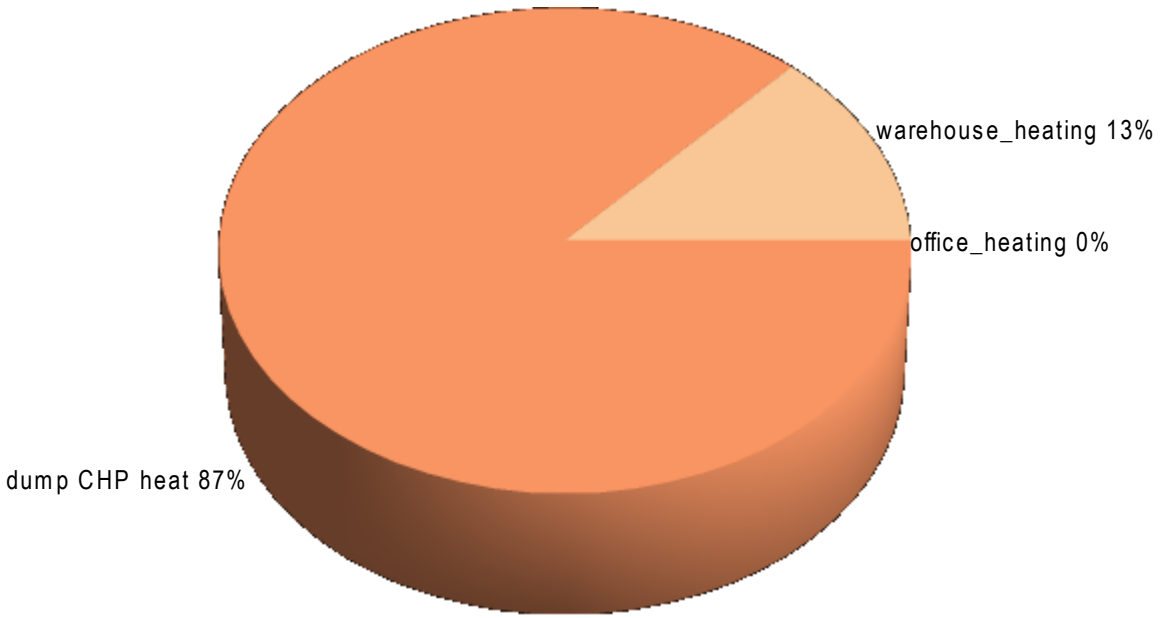
FET by equipment



Present state (4)

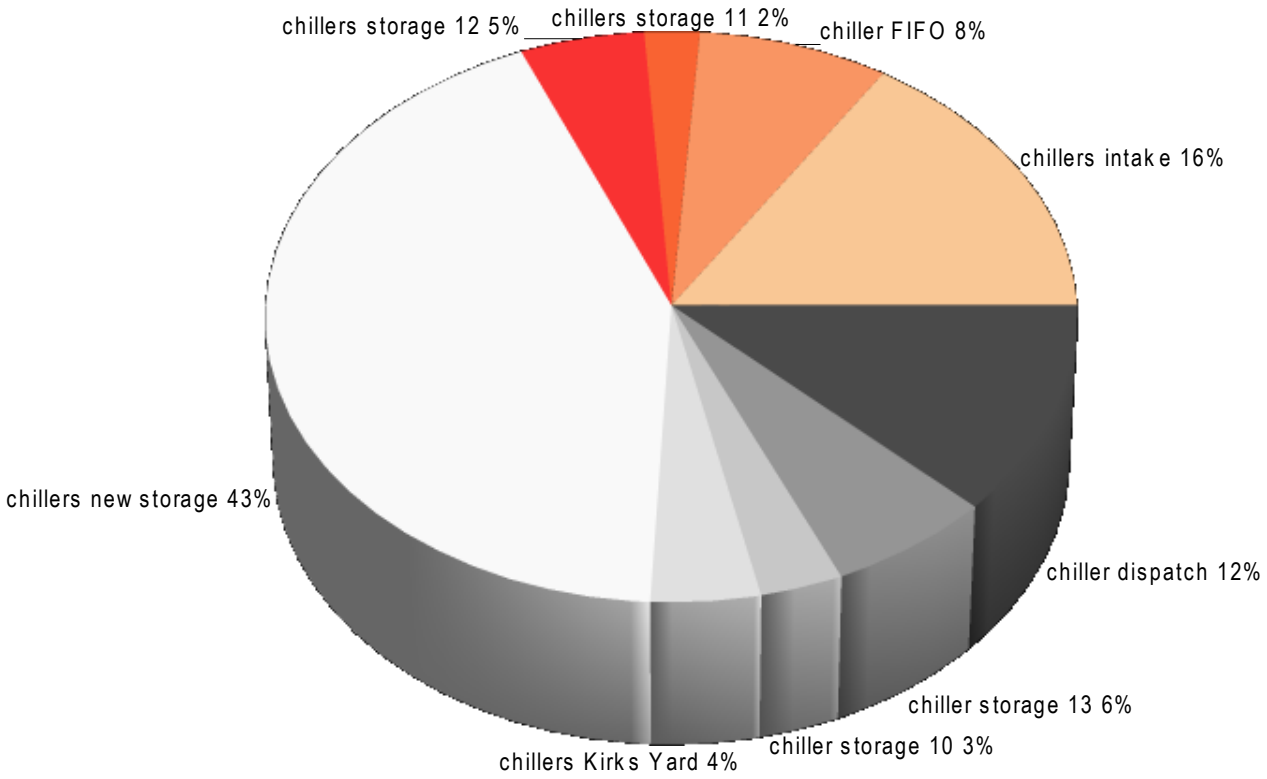
UPH by process

Process	Total [MWh]	Circulation [MWh]	Maintenance [MWh]	Start-up [MWh]
warehouse_heating	609	0	609	0
dump CHP heat	3,999	0	3,999	0
office_heating	0	0	0	0
Total	**4,660**			



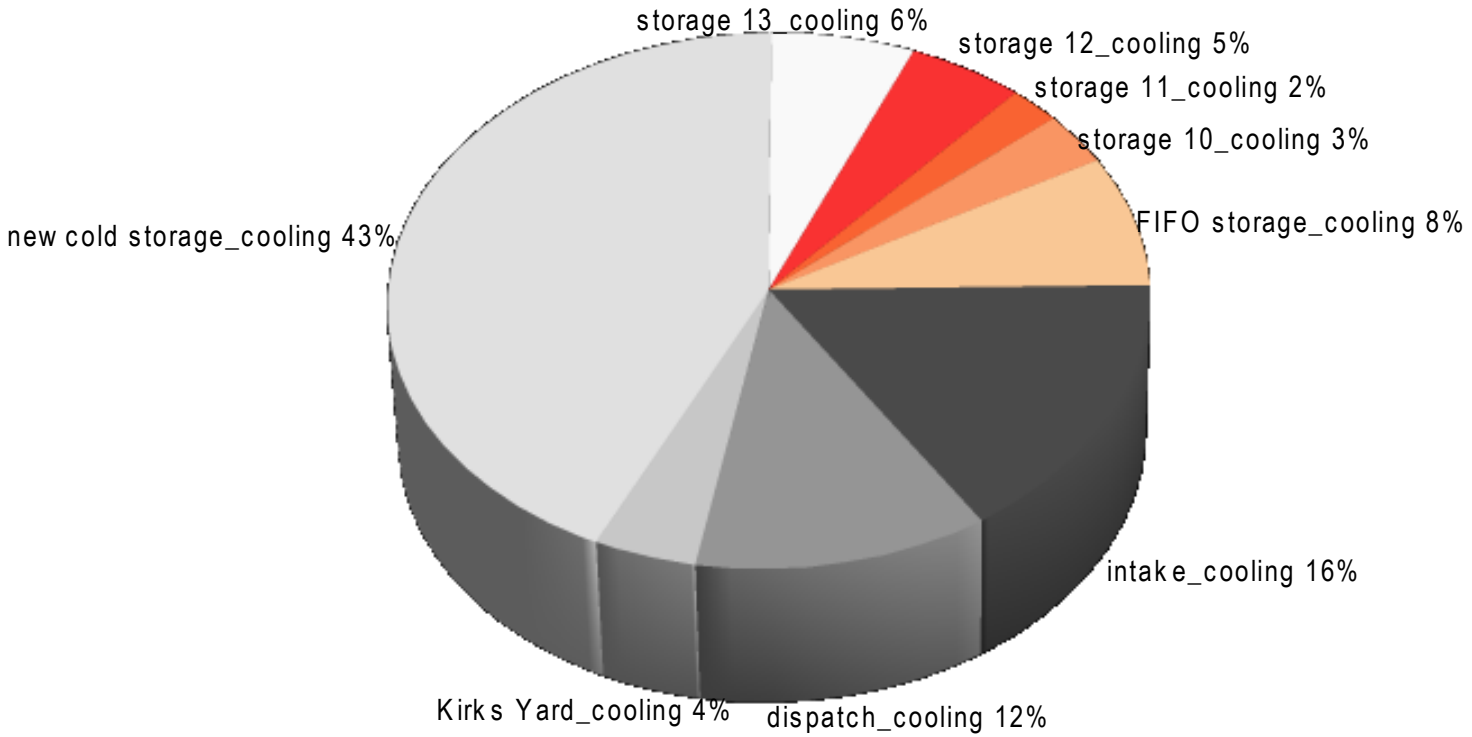
Present state (5)

USC by equipment



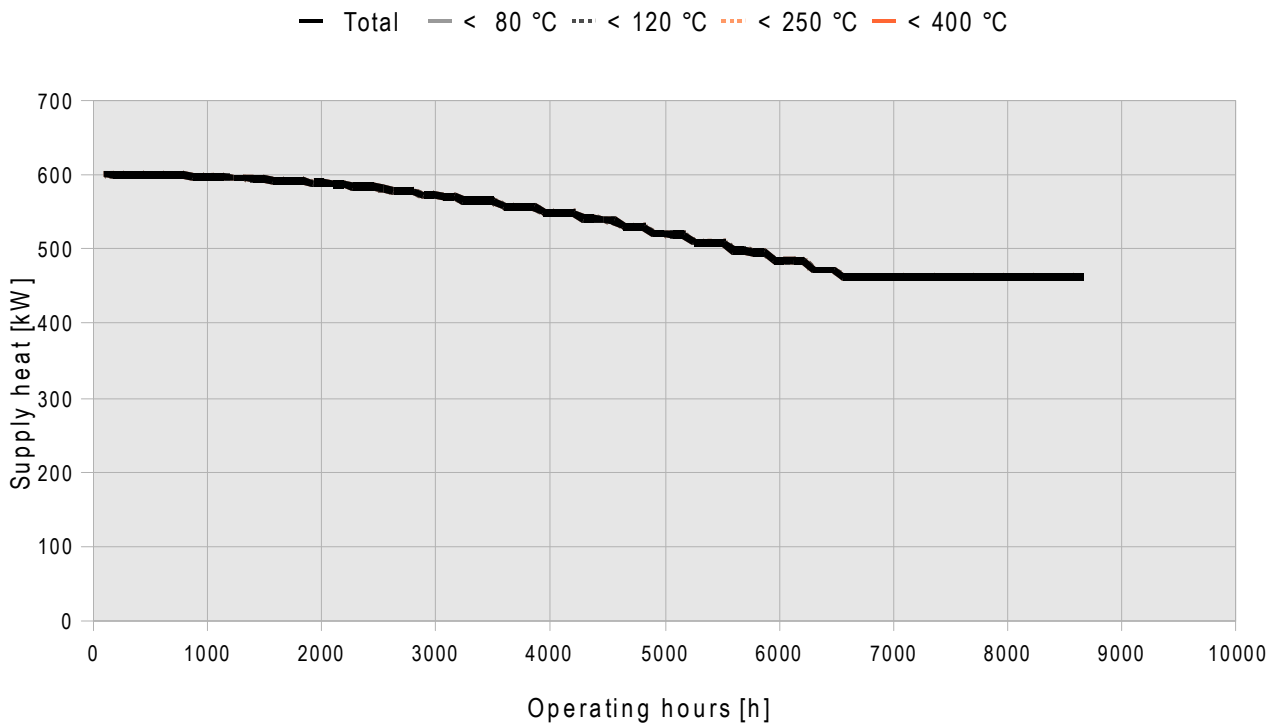
Present state (6)

UPC by process



Present state (7)

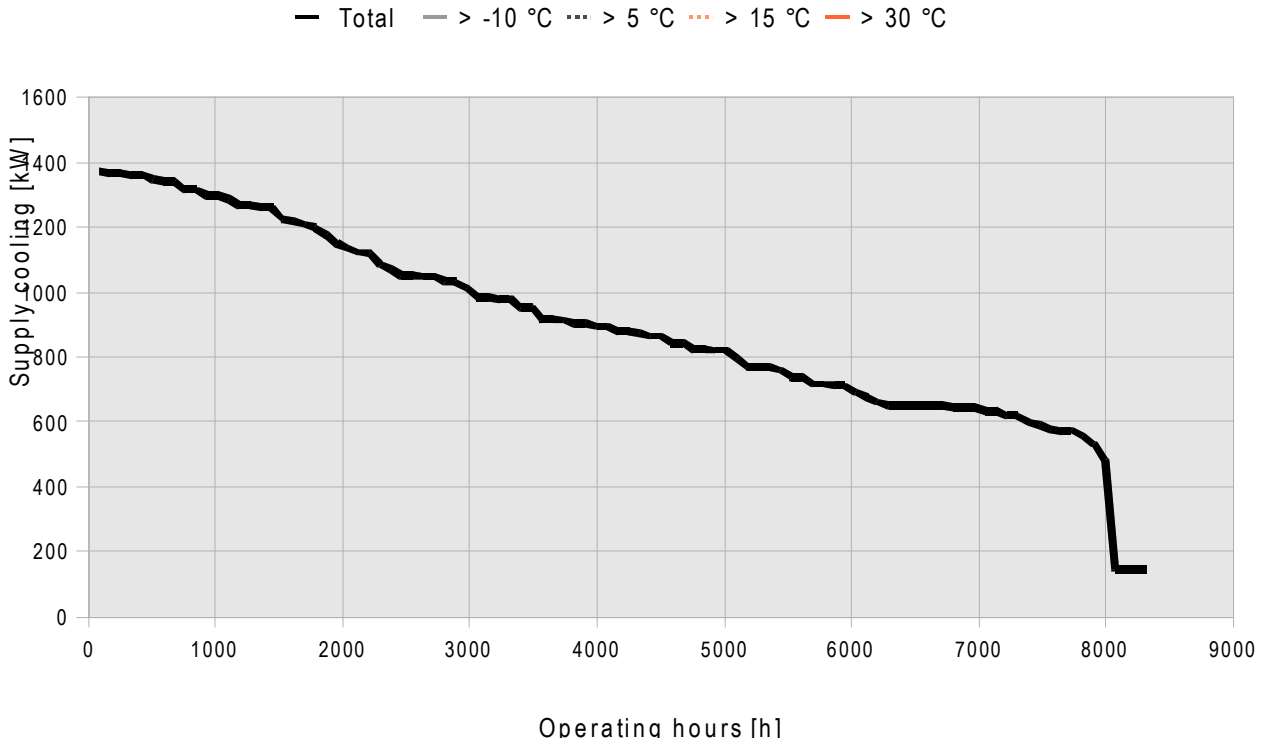
Heat supply (USH) by temperature



Distribution of supply heat by temperature levels and annual operating hours. Present state.

Present state (8)

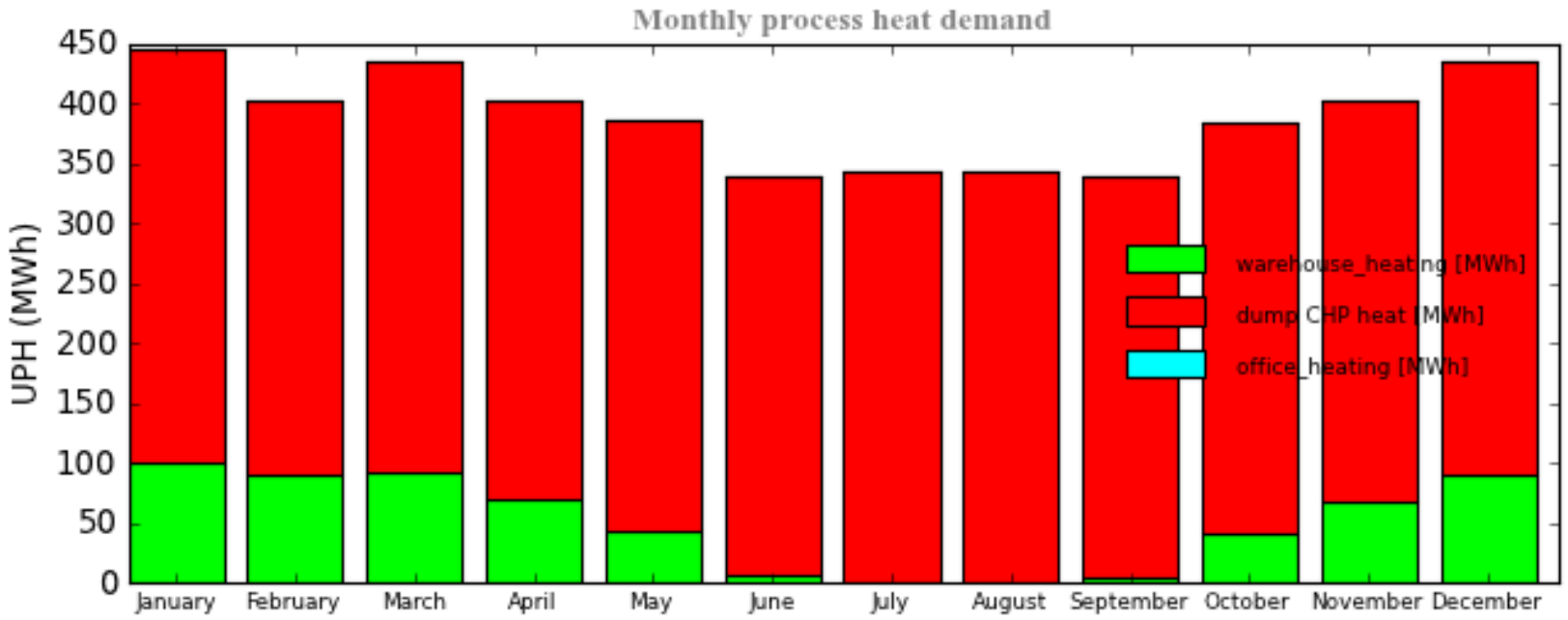
Cold supply (USC) by temperature



Distribution of supply cooling by temperature levels and annual operating hours. Present state.

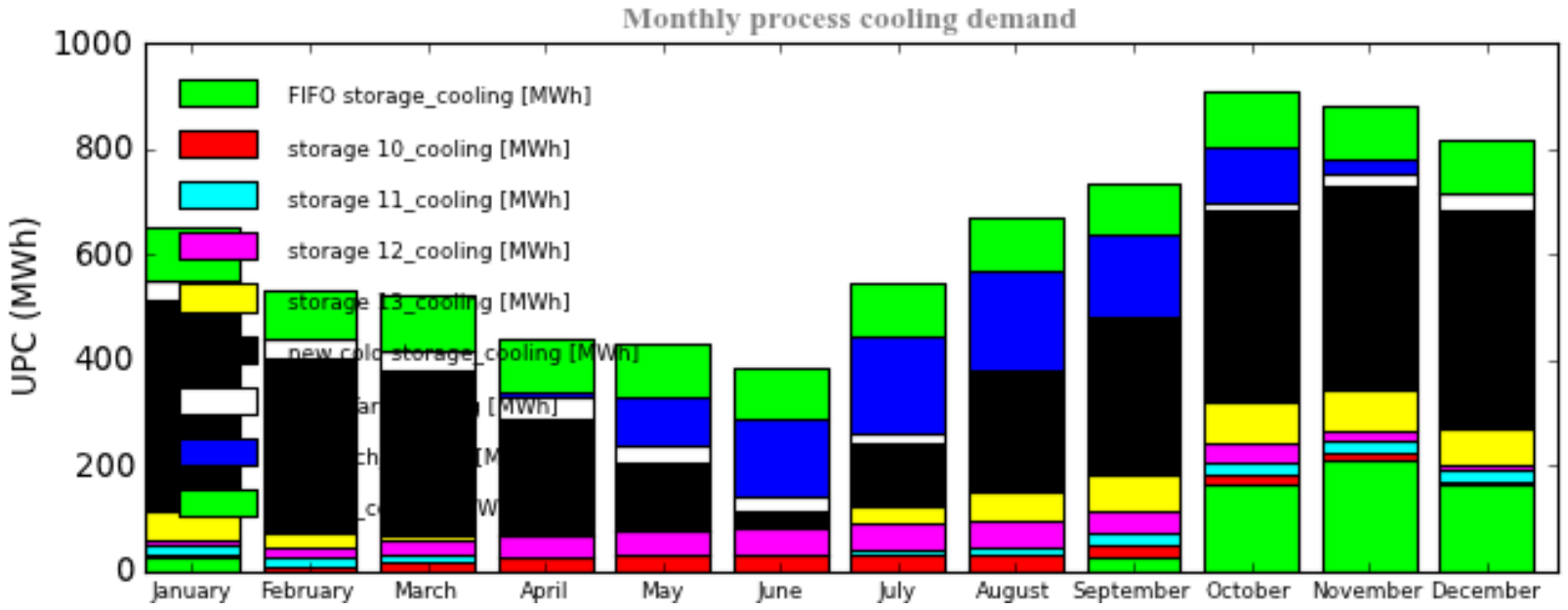
Present state (9): Monthly demand

Distribution of useful process heat per months



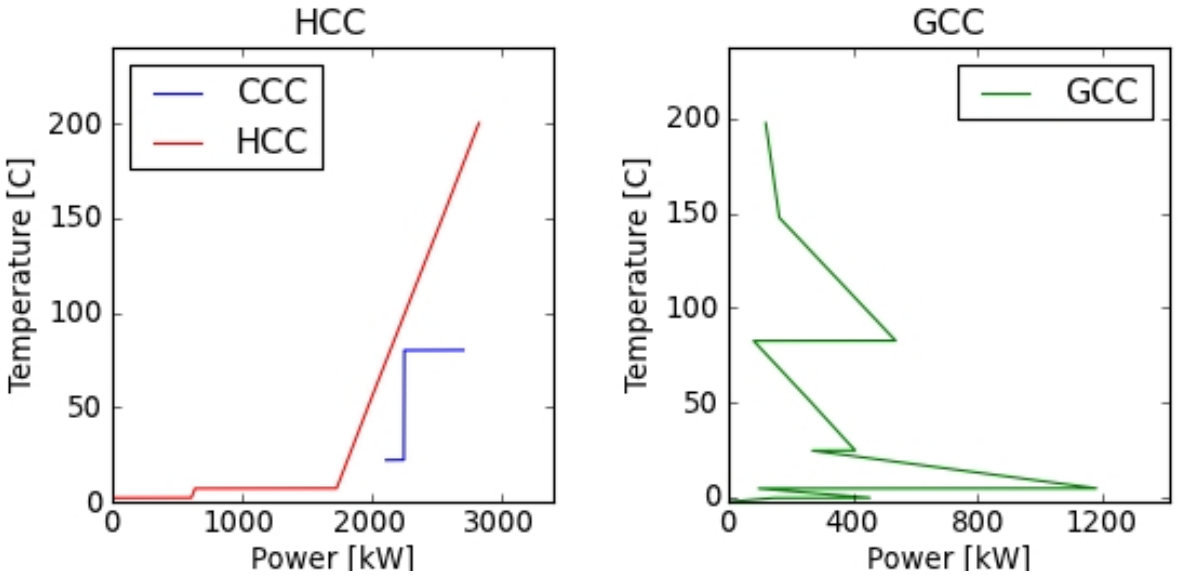
Present state (10): Monthly demand

- **Distribution of useful process cooling per months**



Alternative proposals generated (1)

- **Process optimisation**
  - Based on the available data no process optimisation was proposed.
- **Heat exchanger network**
  - No additional heat recovery and installation of heat exchangers is suggested.



Alternative proposals generated (2)

Heat and cold supply

CHP -> heating

- **No new equipment has been installed.**
  The CHP waste heat is used to cover the heat demand of the warehouse and the offices.

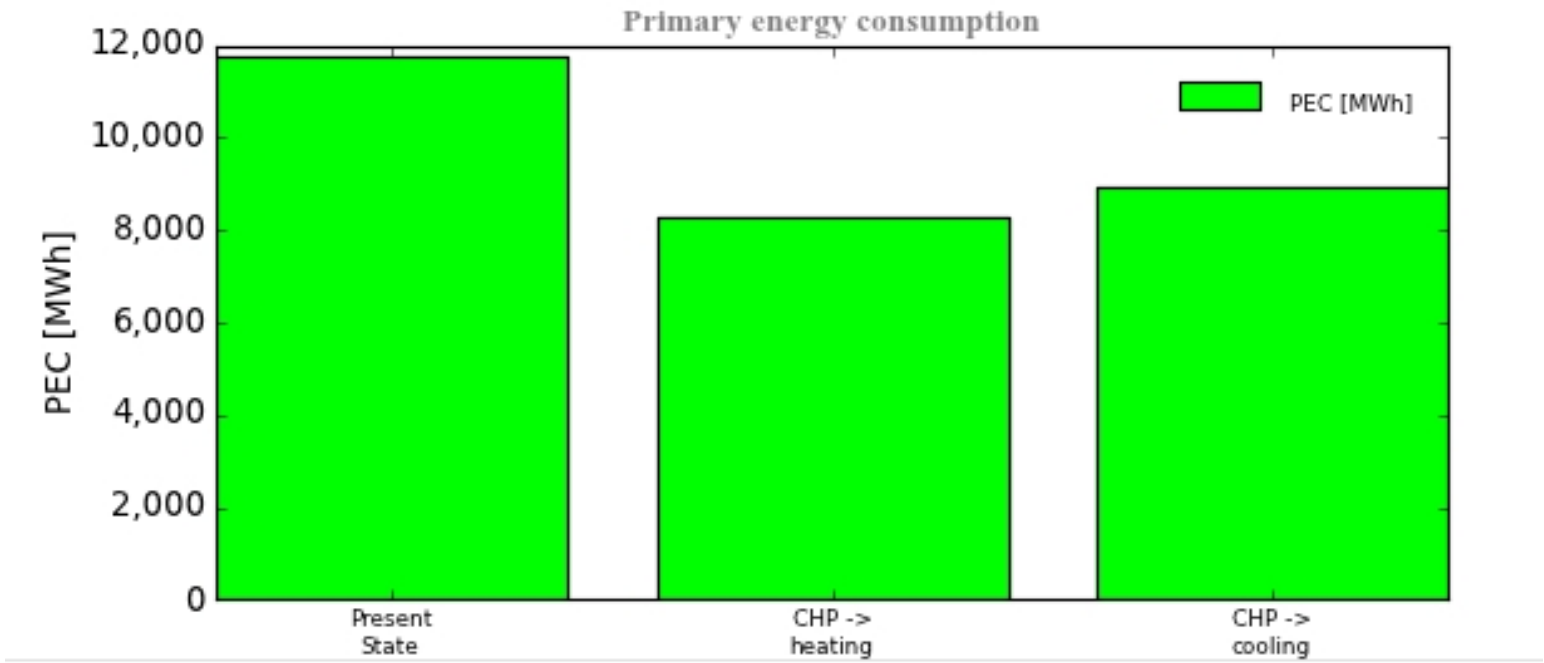
CHP -> cooling

- **Equipment:** **absorption chiller**
- **Nominal cooling power:** **480 kW**
- **COP (coefficient of performance):** **0.67**

The new installed chiller is connected to the storages and substitutes the existing electrical compression chiller.

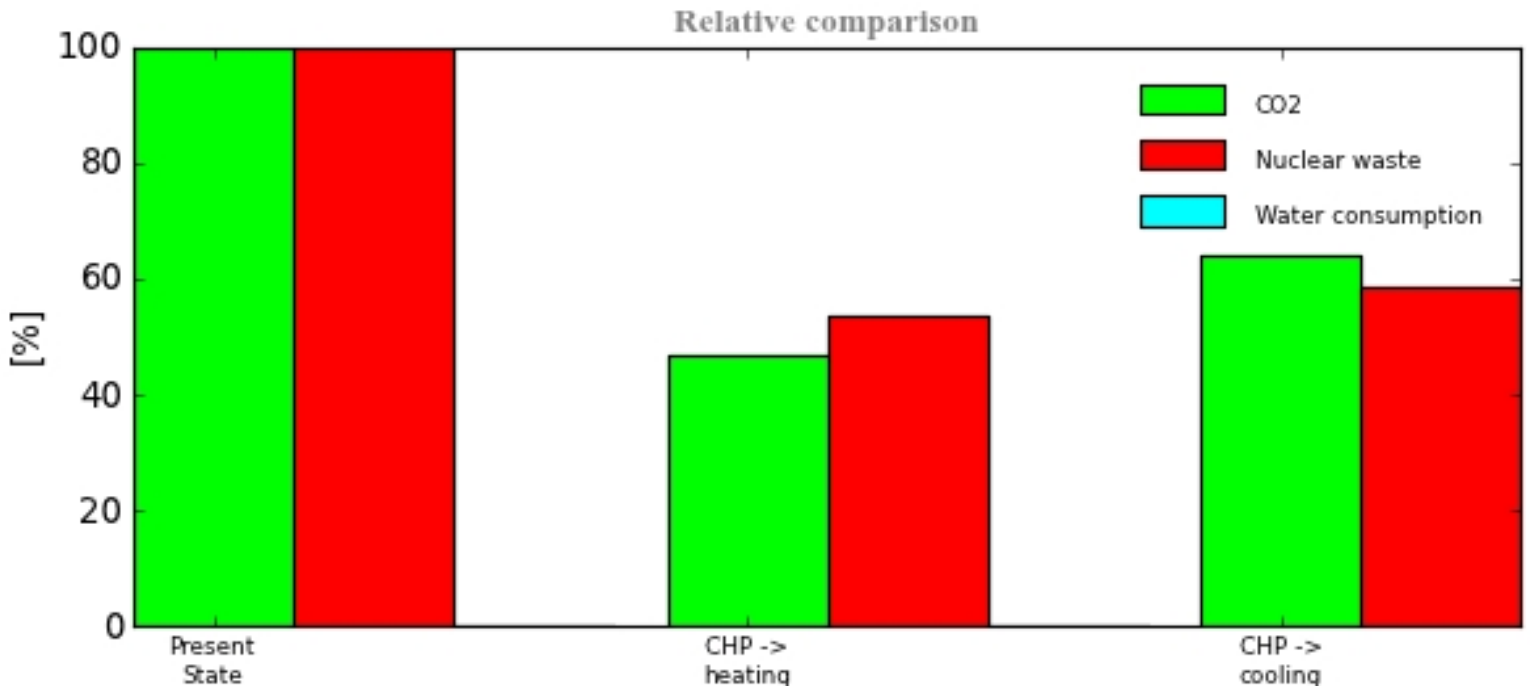
Evaluation of the proposals (1)

PEC – primary energy consumption



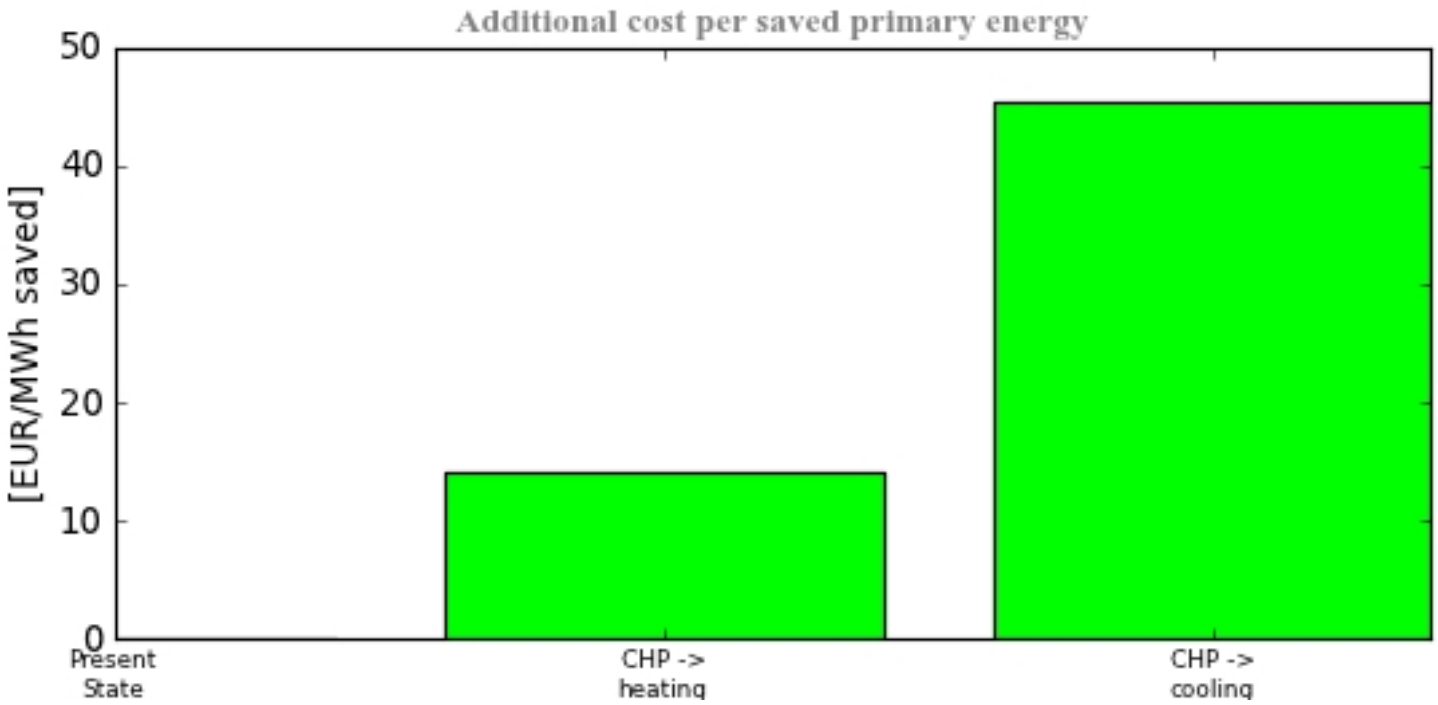
Evaluation of the proposals (2)

Environmental impact



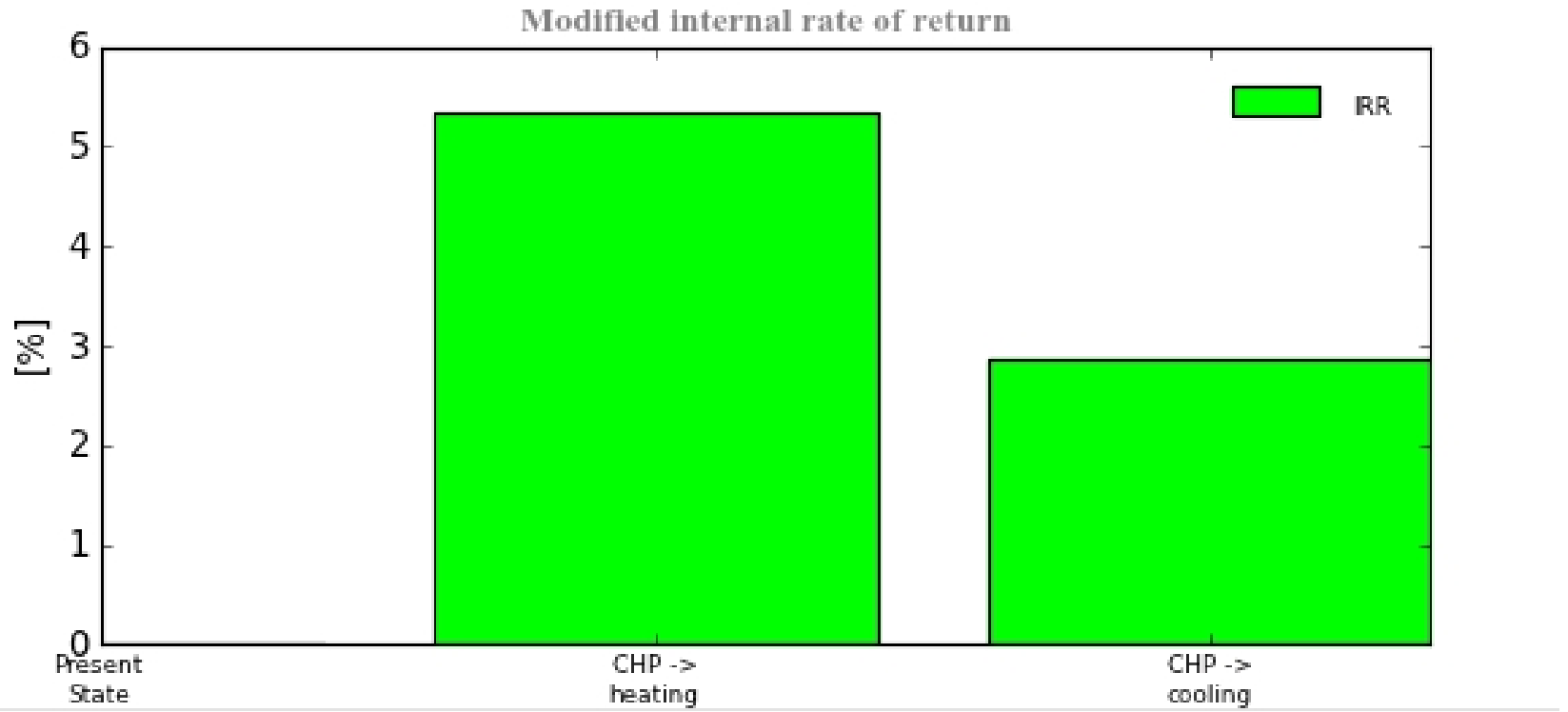
Evaluation of the proposals (3)

Economical impact - 1



Evaluation of the proposals (4)

Economical impact - 2



Conclusions (1)

Overview

- By using the waste heat of the CHP plant and a minimum of imported electricity from the grid, the CO_2 production on the company site decreases significantly by 102 t of CO2 per year compared to the present state.
- By using the CHP waste heat for heating the warehouse and the offices the energy costs can be lowered by € 50,743 per year. The adaptation of the heat distribution system total costs of € 100,000 were assumed, that has to be revised and updated regarding the pipe length and necessary adaptations in the buildings.
- For both alternatives rather short payback periods can be achieved.

Conclusions (2)

- As the biogas is used in a CHP plant to produce electricity without using the waste heat this proposal focuses on the implementation of the waste heat. This leads to a complete substitution of the fossil fuels used for heating the warehouse and offices.
- Based on the available data and measurements performed the energy consumption split to the processes and equipment calculated by EINSTEN is well comparable to the present state of the company. For the economic aspects some further calculations will be necessary as final investment costs are based on first estimations.
- **Follow up will be performed**.

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