

ENGINEERING
TOMORROW



De gode tekniske løsninger **Overskudsvarme..(og kulde)**

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Aktivitetsudvalg for Energieffektivisering ; Spor 2 : Overskudsvarme

Content

WASTE OR EXCESS ENERGY

Past and the future

SUPERMARKETS AS A CASE

SMART GRID AND THERMAL NETWORKS EXPANDS THE OPPORTUNITIES

FLEXIBILITY

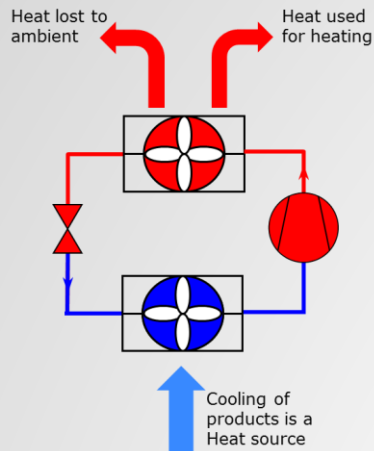
THE HIDDEN CAPACITY

INDEX OF COST AND EMISSION

SUM UP

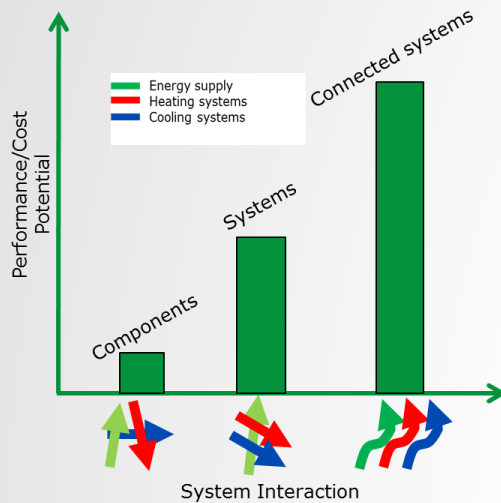


Excess Thermal energy



The past

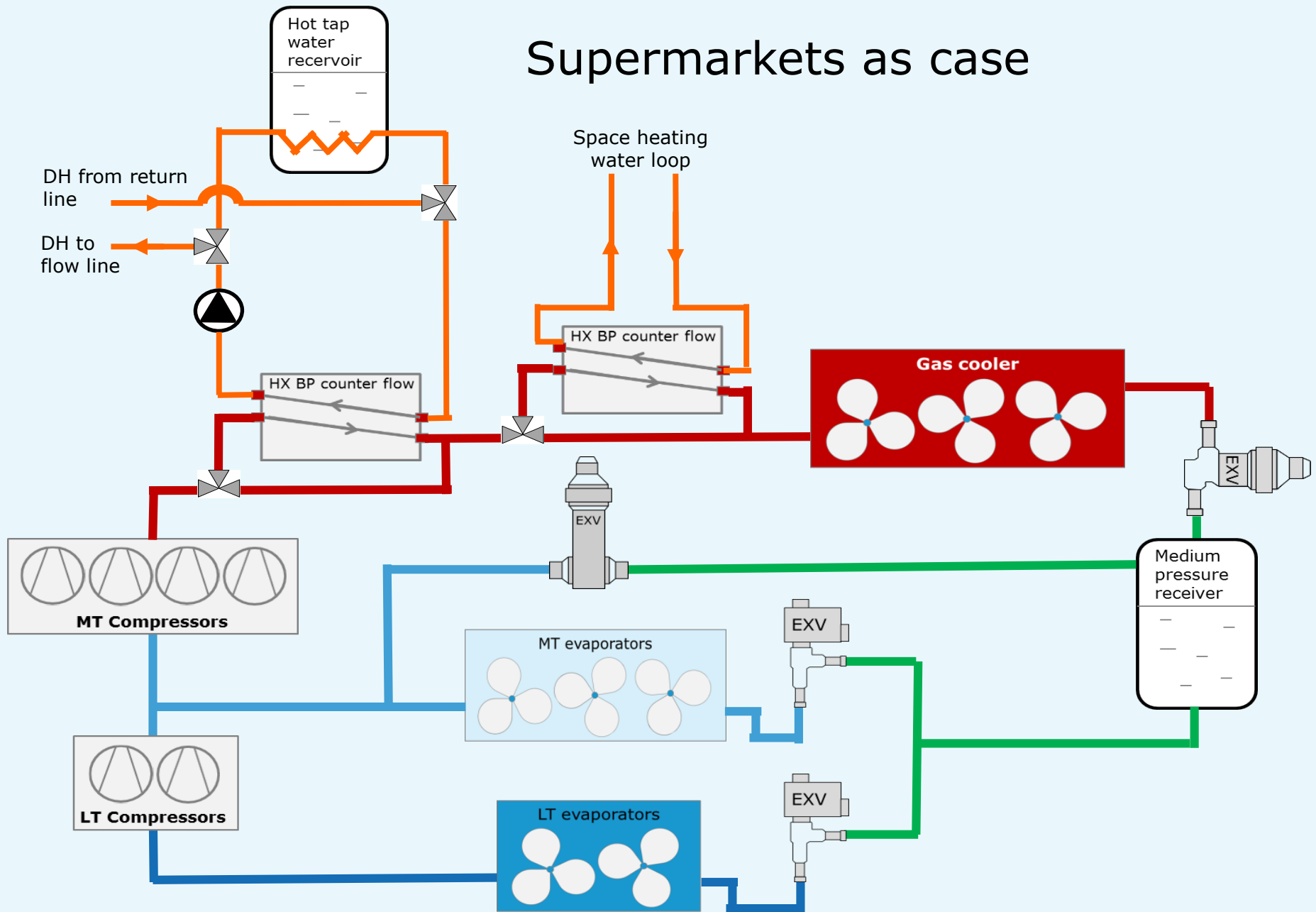
- Thermal energy is a bi-product from a primary process – energy which will be lost unless utilised (waste).
- Taxation by opportunity



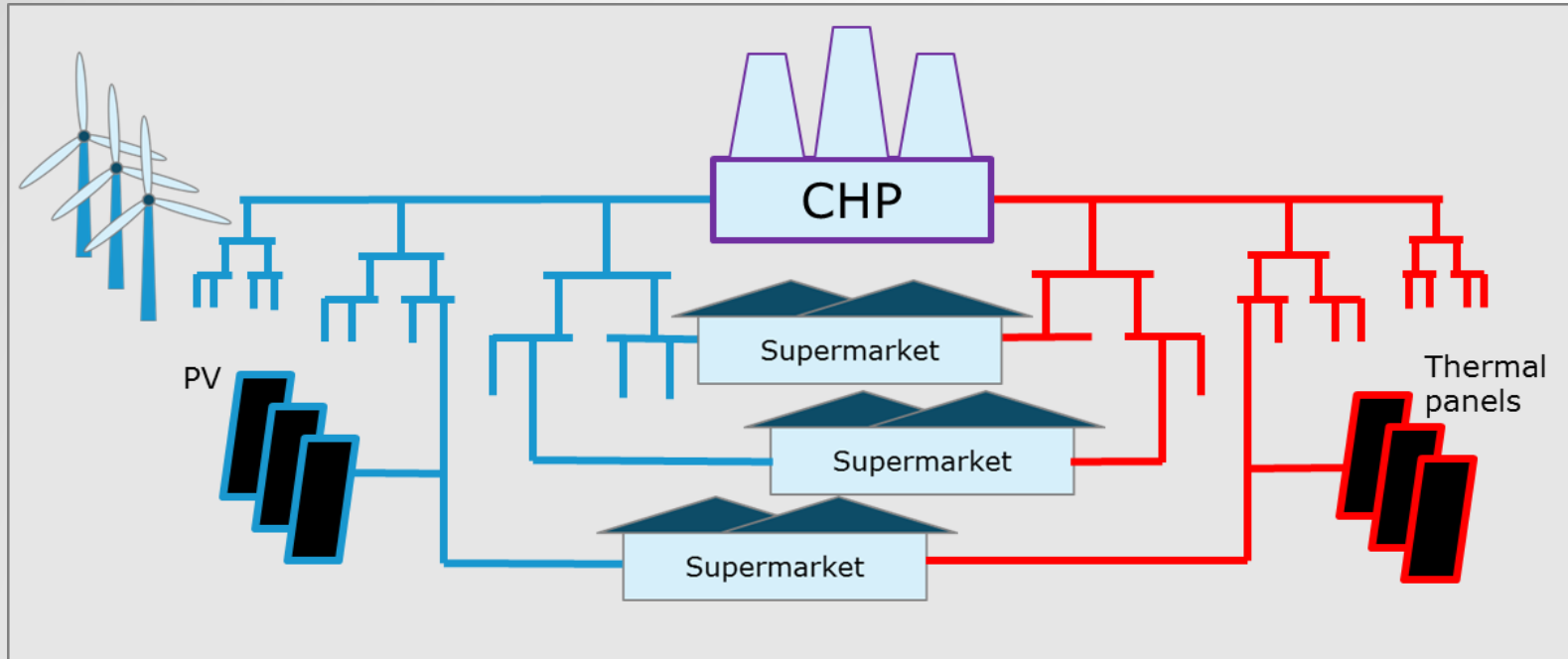
The future

- Thermal energy is a bi-product or an optimised secondary process opportunity
- Maximise utilization of assets
- Optimisation of primary process with a view to the bi-product usage
- Taxation to support innovation

Supermarkets as case



Thermal networks expand the perception of smart systems



District heating and cooling networks are perfect for energy storage

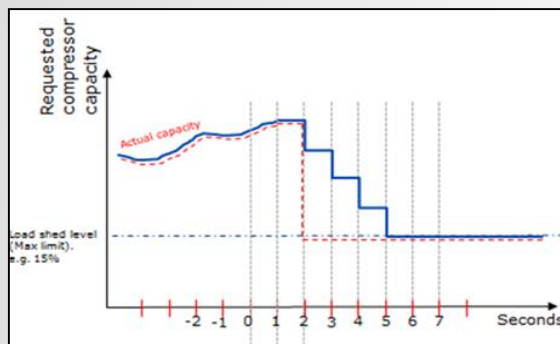
Excess heat from refrigeration can be exported

Supermarkets can add flexibility and become storage enablers for heating and cooling

Flexibility in supermarkets

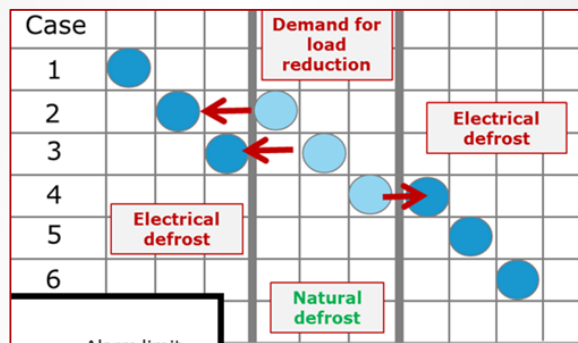
1

LOAD SHEDDING
FFR (COMPRESSORS)



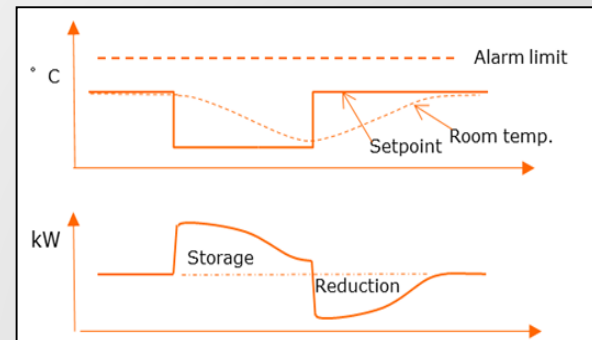
2

DEFROST SHIFTING

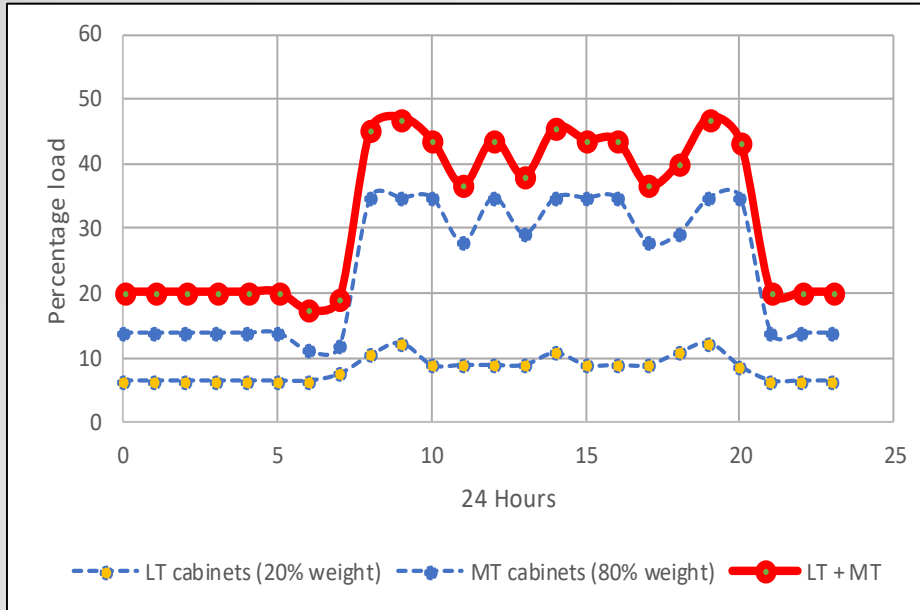


3

THERMAL STORAGE



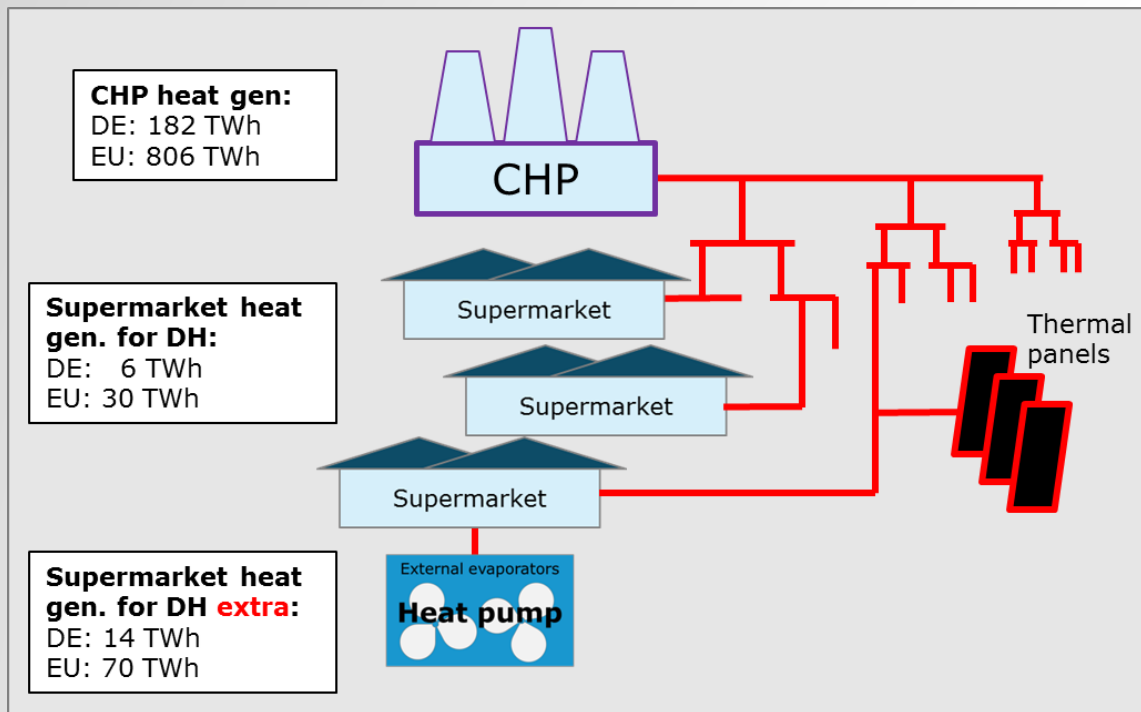
The hidden capacity



- The Cooling capacity has a build-in safety margin due to food safety
- Overall capacity exploitation is low
 - Night load is 20%
 - Day load is 40%
 - Free capacity can be up to 70 % in average
- Results can vary dependent on store set up and geographical location

$$Q_c = K * \sum_{k=1}^n Q_{c,k}$$

Unused compressor capacity is an opportunity

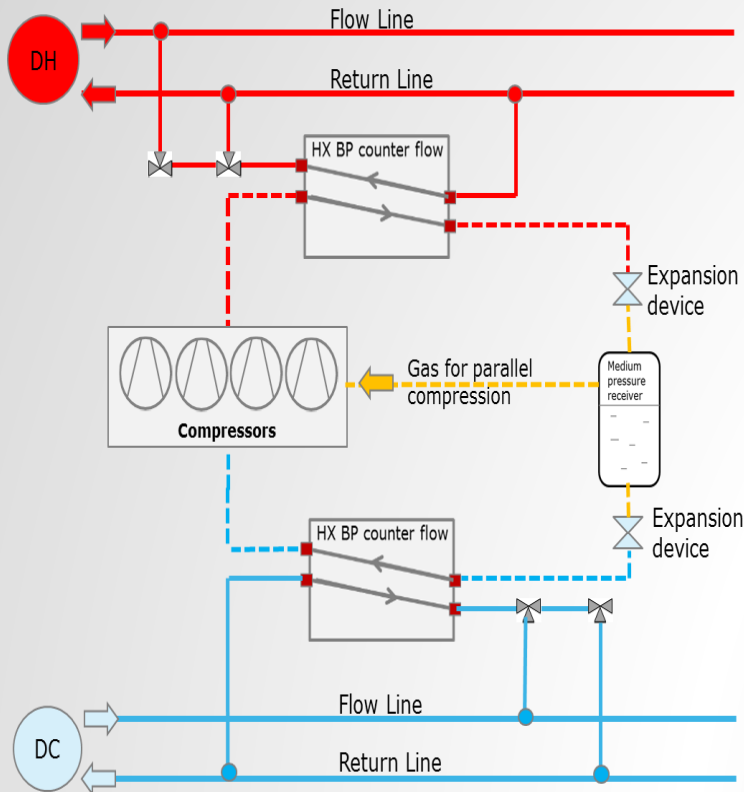


DISTRICT HEATING NETWORKS
can absorb limitless energy

TYPICALLY ONLY 30%
of the total compressor capacity is used

ASSUMING A FACTOR 2
more energy can be produced with
external heat sources

Free capacity can be used to serve external needs for thermal services



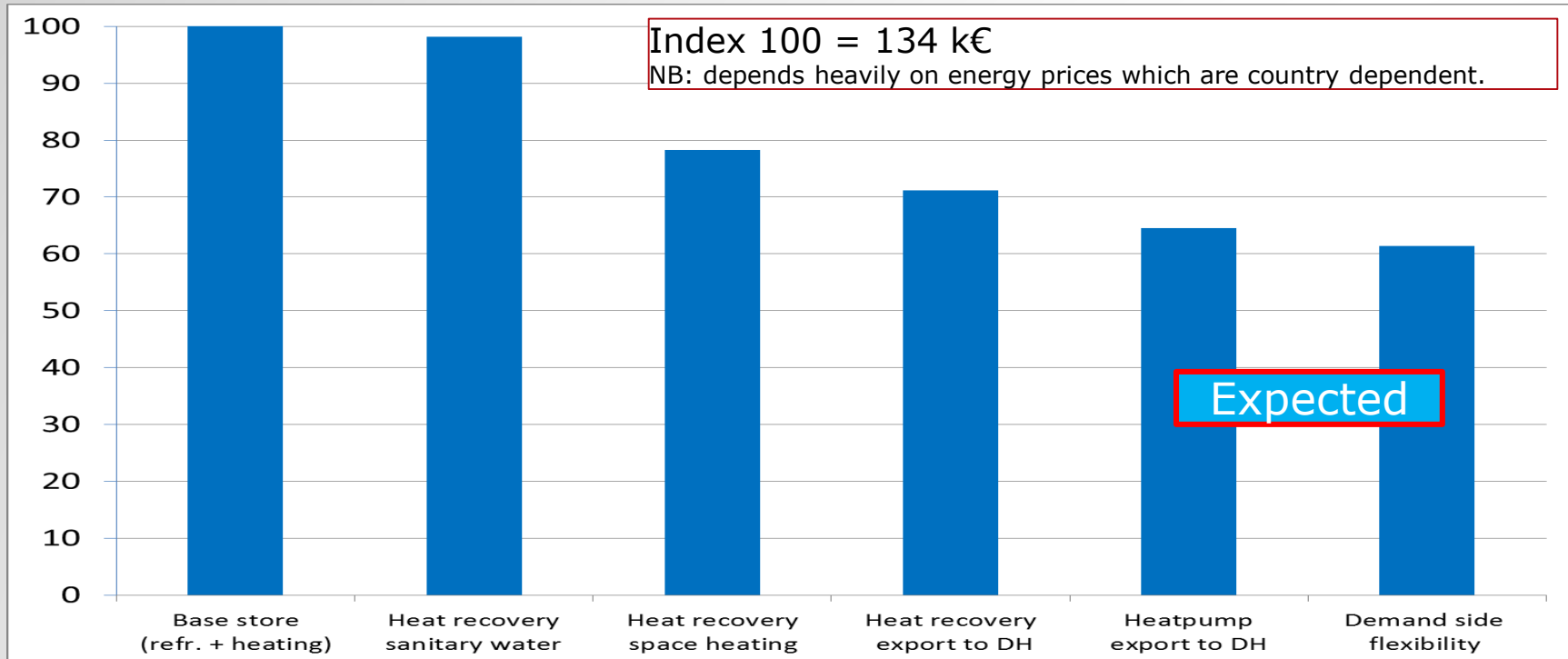
Understand the integration of energy systems

- Smart energy systems
- Flexibility in supermarkets

Identify a customer to the thermal service

- Establish the business case

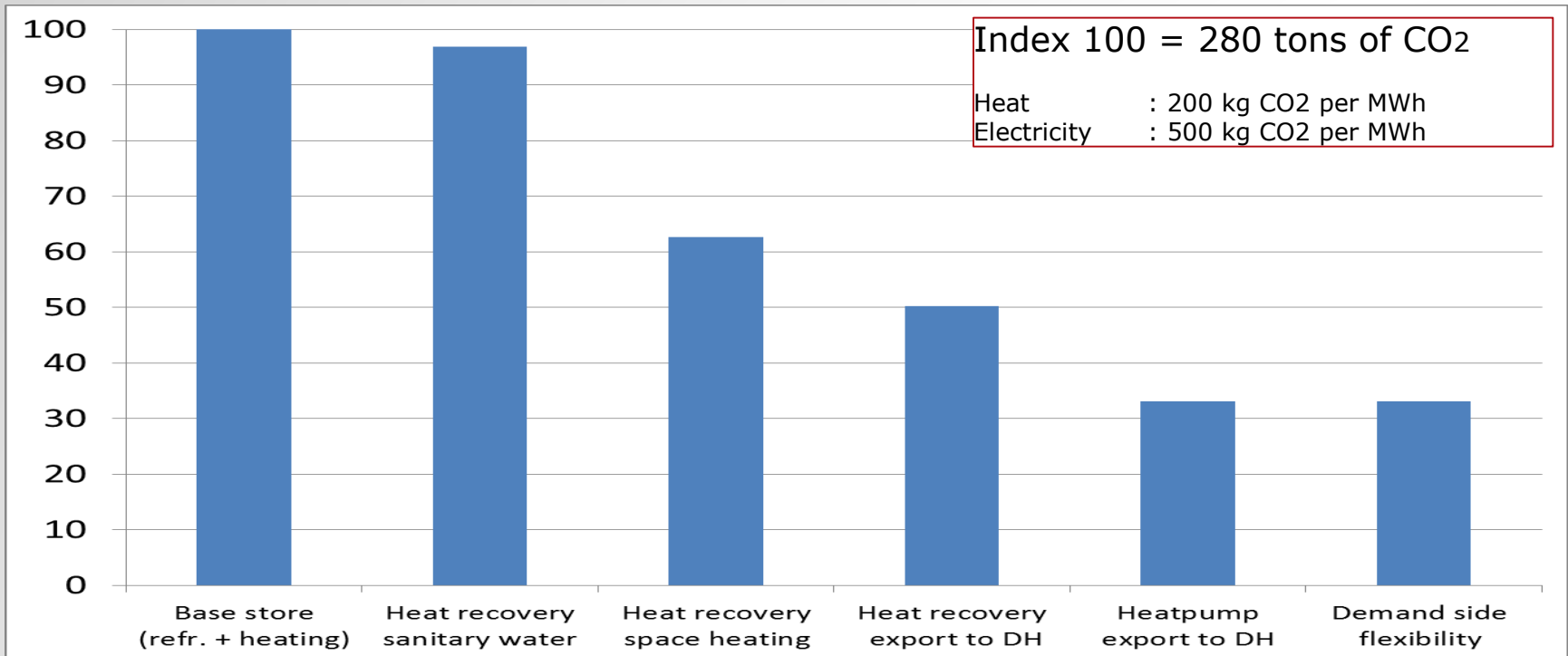
Index of cost



Electricity (base)	0,14 € / kWh
Electricity (HP mode)	0,04 € / kWh
Gas	0,55 € / m ³
District Heating	0,05 € / kWh

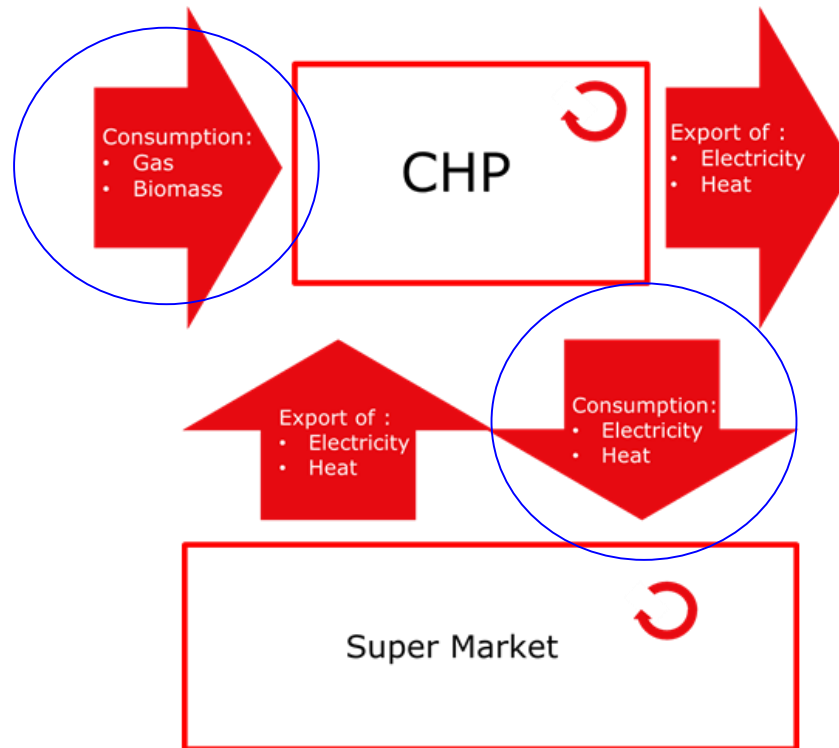
DSF	KW reductn	Min. per event	Events per day	Value per KWh	SUM year €
Defrost	13	90	3	0,03	570
Capacity reduction	20	30	4	0,03	390
Imbalance Service	53	15	n.a.	60	3200

Index of emission savings

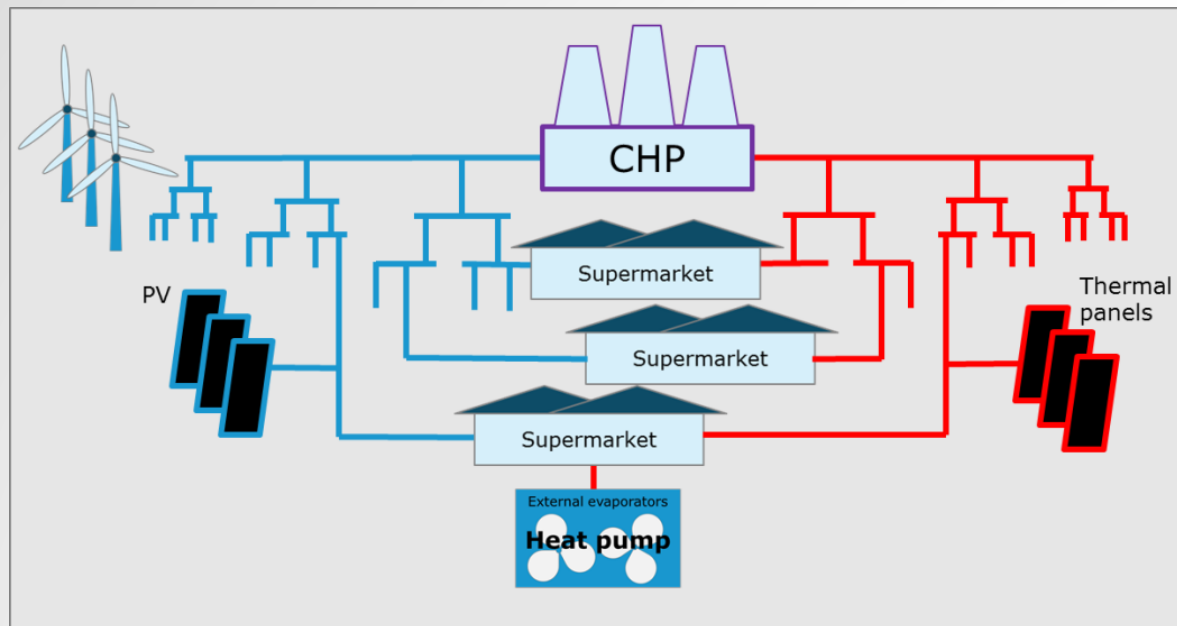


- The extra electricity used for HP mode is subtracted the emission saving
- DSF enables renewables and represents indirect emission savings
- Heat recovery can be categorised as energy savings and become subject to incentives in some countries

Flow of energy and TAX GATES



Conclusion



SYSTEMS CHANGE

WASTE ENERGY TRANSFORMS
INTO EXTENDED USAGE IN AN
OPTIMIZED CONTEXT

SUPERMARKETS START THE TRANSFORMATION

COMBINING DEMAND RESPONSE
– STORAGE AND EXPORT OF
HEAT

COST REDUCTION IS THE DRIVER

BUT EMISSIONS ARE EVEN MORE
REDUCED

TAXATION METHODOLOGY NEEDS A
CHANGE – DEFINE THE TAX GATES TO
PROTECT AND SPUR INNOVATION