

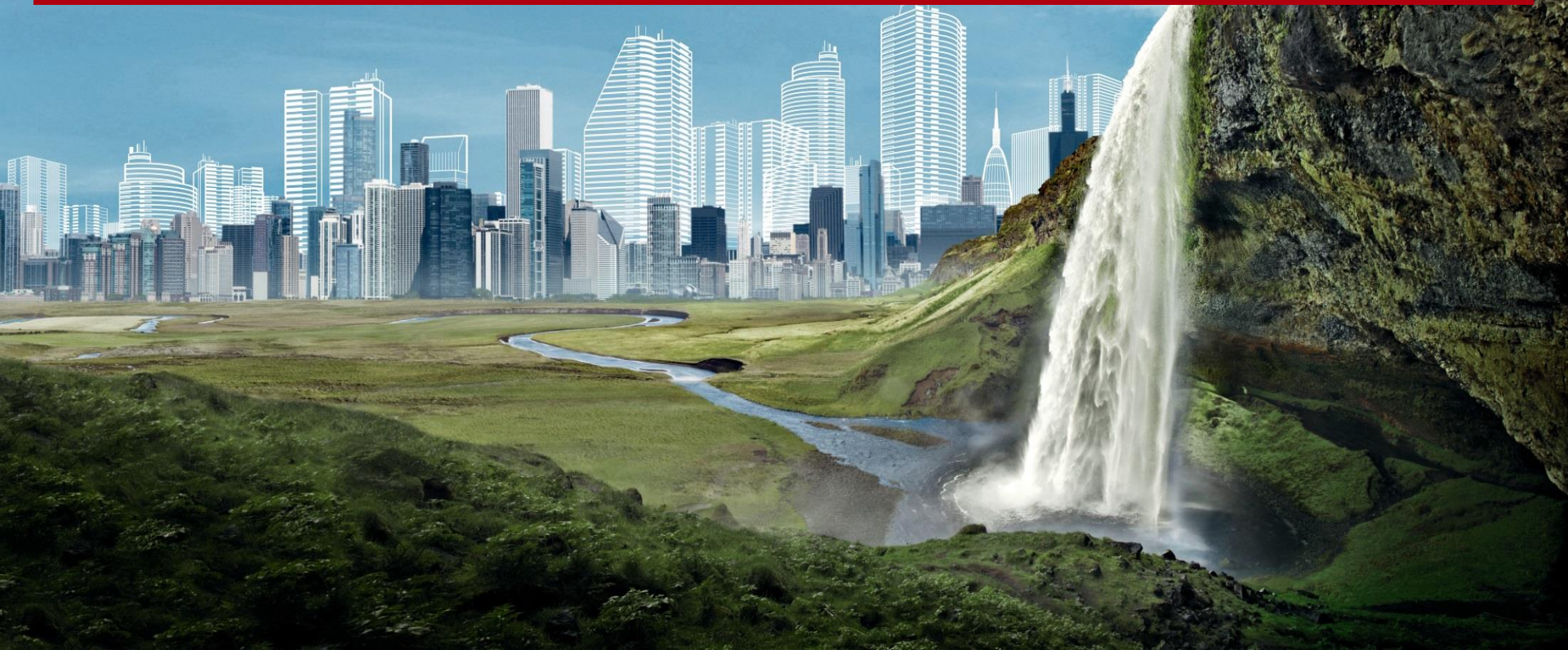
ENGINEERING
TOMORROW

Danfoss

Vapor Compression as Flexibility Enablers

IRENA conference, Bonn , Sept. 5 , 2018

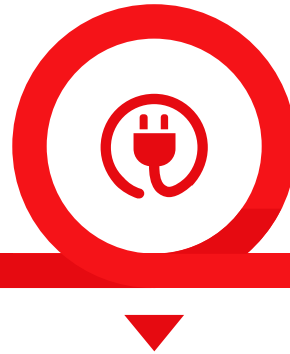
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HVAC-R industry: a major energy consumer with high saving potential



95% of all systems only
utilise **50%** of the
compressor work



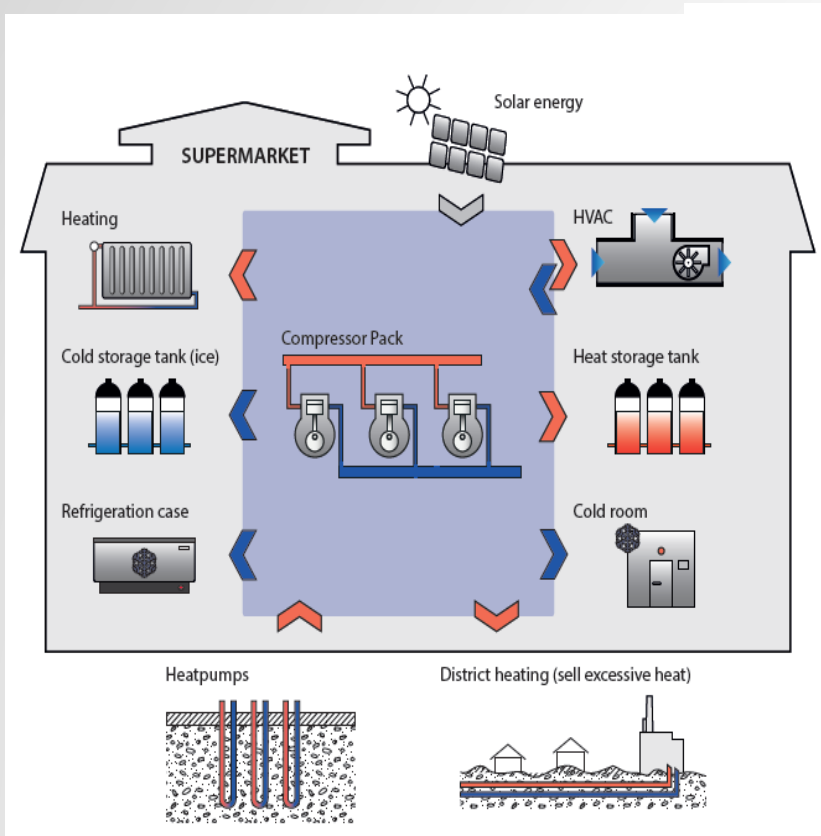
Compressors use
17 % of all
electricity



Cooling capacity
increase year
over year

Total Energy Store

From Energy **Consumer** to Energy **Prosumer**

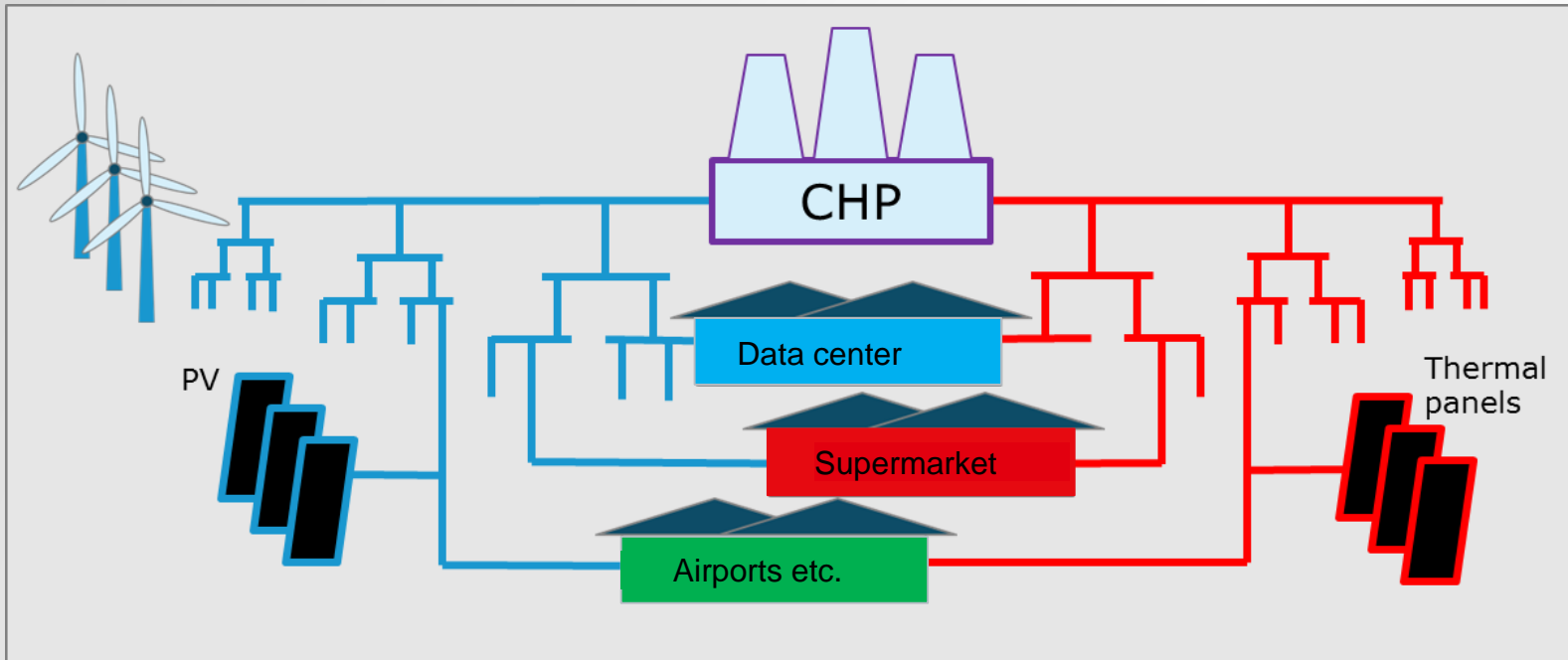


Supermarket as an Energy Prosumer

Total energy store:

- Heat recovery with CO₂ as refrigerant
- Use refrigeration compressors for heat pump purposes where cooling load is low and heating load is high (winter).
- Install heat/cooling storage units (to store energy where electricity price is low and/or COP is high).
- Sell excessive heat from refrigeration system into the district heating system.
- Combine Photovoltaic (PV) and refrigeration/heating into a local “micro-grid power system”

Thermal networks: expand the perception of smart systems and the scope for Vapor Compression Systems



District heating and cooling networks are perfect for thermal energy storage – but limited in temperature range.

Vapor Compression can upgrade temperature levels to grid demands.

In some application areas thermal storage can provide flexibility in electricity consumption.

Overview of selected opportunities

Opportunity



Heat Recovery (HR)



Use of idle compressor capacity (HP)



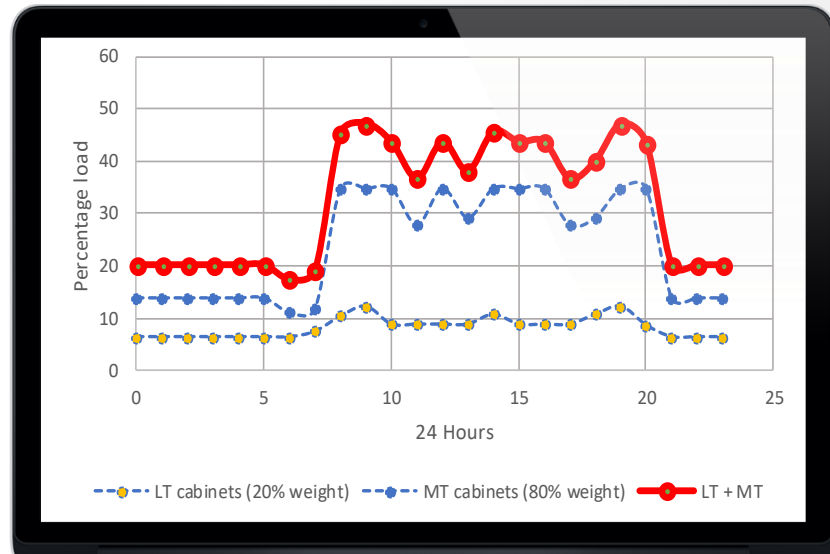
Ice storage (ICE)



Demand Response (DR)



PV panels and Battery



Energy cost overview based on auxiliary type

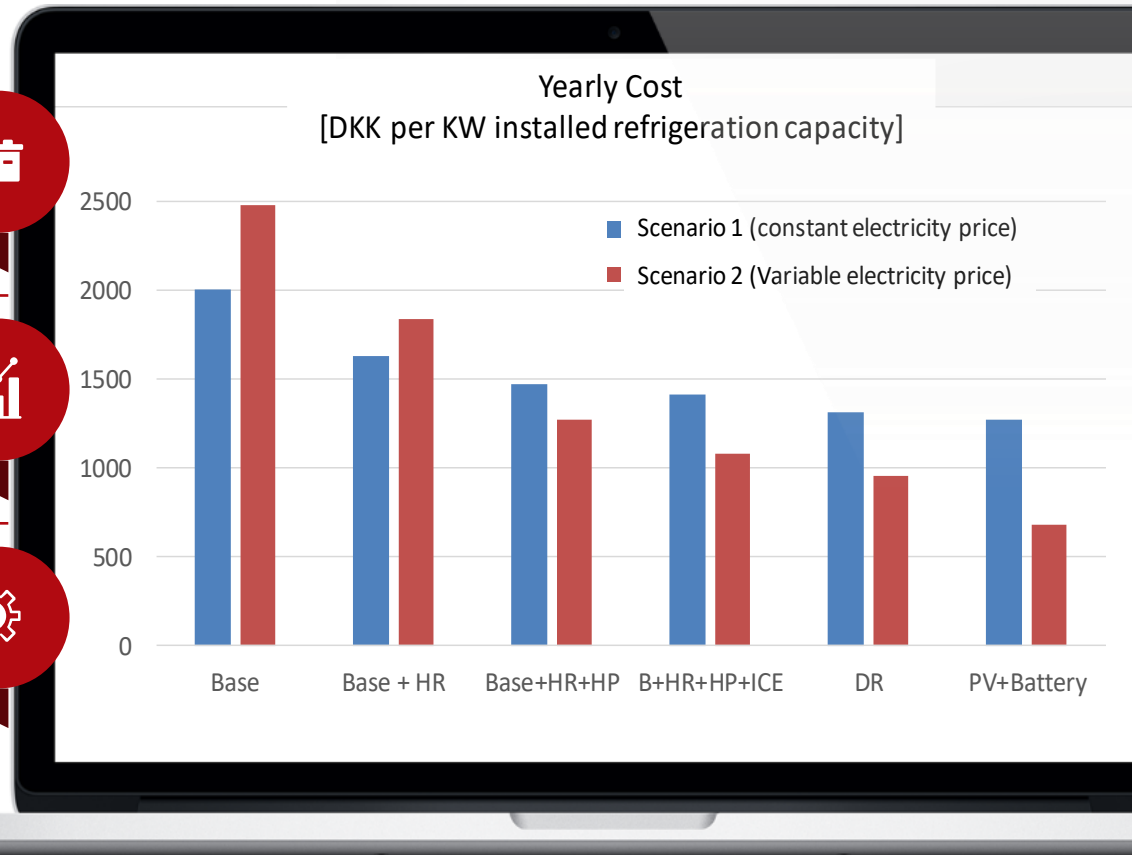
A higher degree of variable electricity pricing can be foreseen



Basic case stores will likely experience an **increase in energy costs**



There is an **overall advantage (win-win)** to invest in advanced technology solutions



Sum up



Key messages

Vapor compression systems are huge energy consumers and that will increase with growing urbanization.

- Most systems only utilise 50 % of the compressor work
 - Most systems do not use their full capacity
 - Systems are suited to connect to grids
 - Systems can store energy – Hot / Cold
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- **Marginal investments to become ‘smart’ are small**
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Volatile electricity price structures can lead to:

- Increase in electricity cost if no flexibility and storage opportunities are disregarded
 - significant energy cost reductions if the electricity consumption is flexible and planned.
 - investments in advanced technology solutions
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