ENGINEERING
TOMORROW

High Efficient Data Center Cooling

Copenhagen Center on Energy Efficiency webinar 12. July 2017 Jörg Saar, Danfoss Cooling

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   - Sizes / capacities
   - Control parameters temperature & humidity
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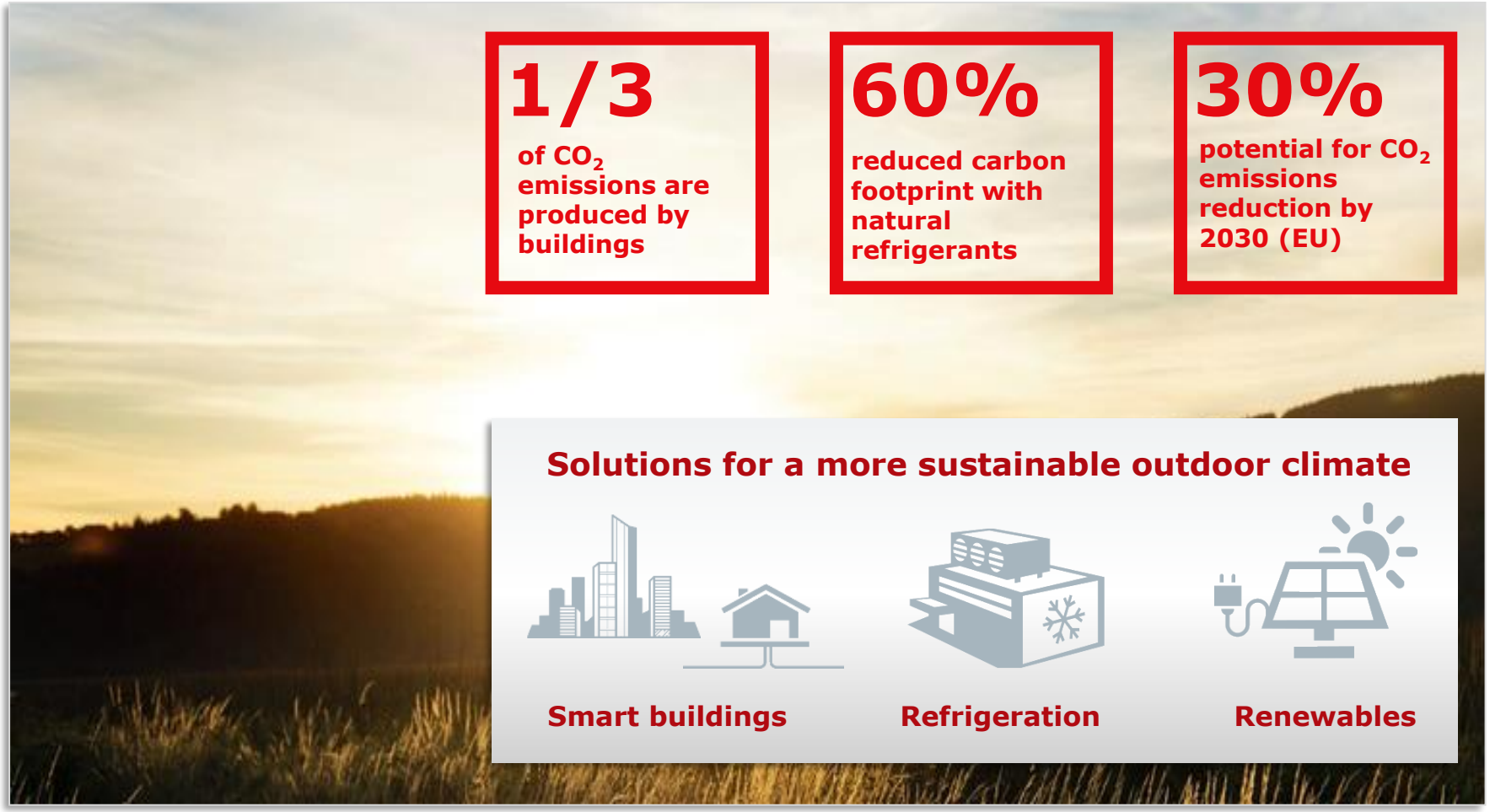
Danfoss Cooling to address global challenges

Sustainable Cooling

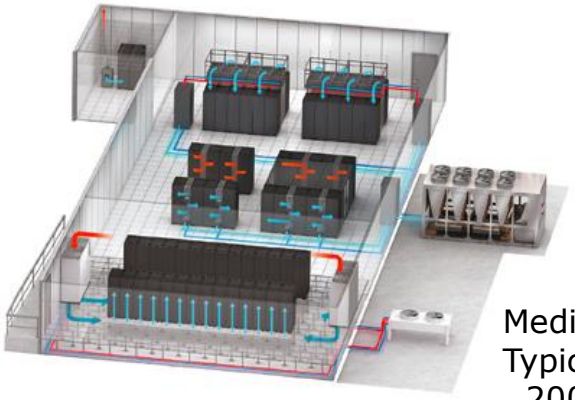
38% of the emissions reduction needed to keep the planet within the 2 degree increase scenario by 2050



Data Center Cooling

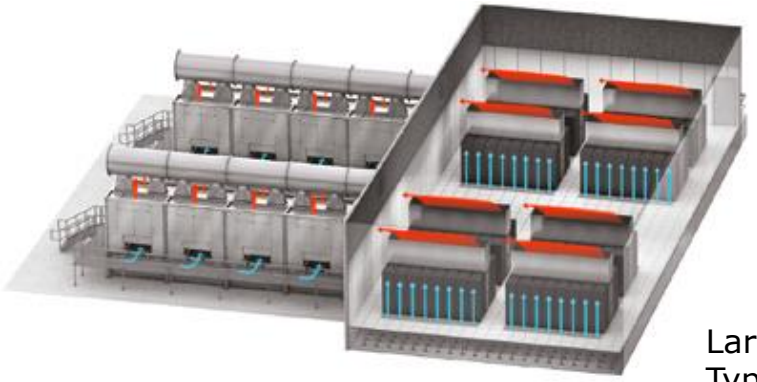
- High cooling loads => High savings potential

Small sized server room
Typical cooling load 3-25 kW



Medium sized data centers
Typical cooling load
200 kW – 1 MW

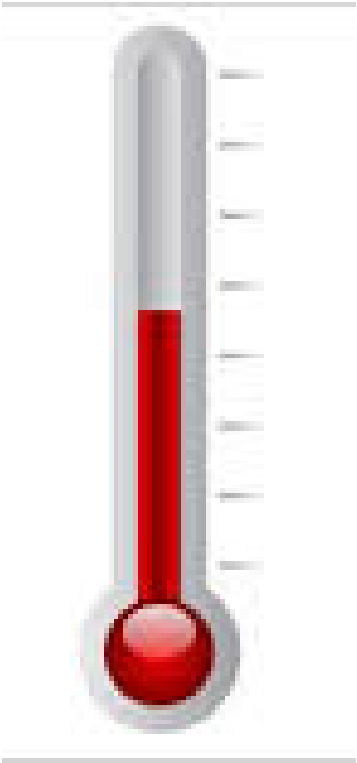
Larger server rooms & small data centers
Typical cooling load 25–200 kW



Large data centers
Typical cooling load
> 1 MW

Data Center Cooling

Temperature



Remove heat from electronic components (server)

Max operating temp of electronic components

Lower temperature = longer lifetime

Temperature too high = server down = no go!

Data Center Cooling

Humidity

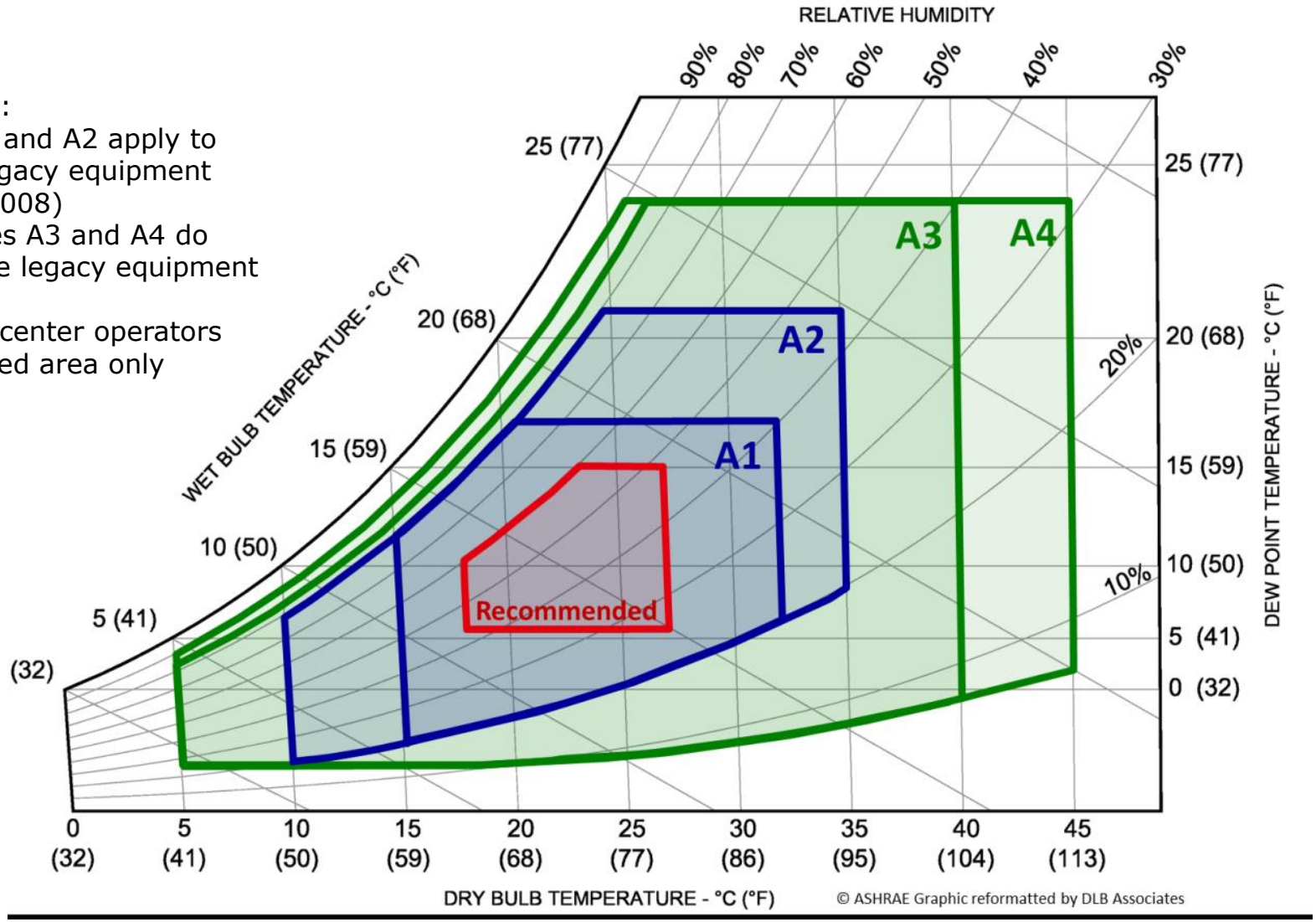
Dry air supports generation of higher electric potential.

Electro-static shock can heavily damage electronic components

Data Center Cooling

Since 2011:
Classes A1 and A2 apply to new and legacy equipment (same as 2008)
New Classes A3 and A4 do NOT include legacy equipment

Many data center operators use small red area only



Supply Air ASHRAE Psychometric Chart – 2011

Data Center Cooling

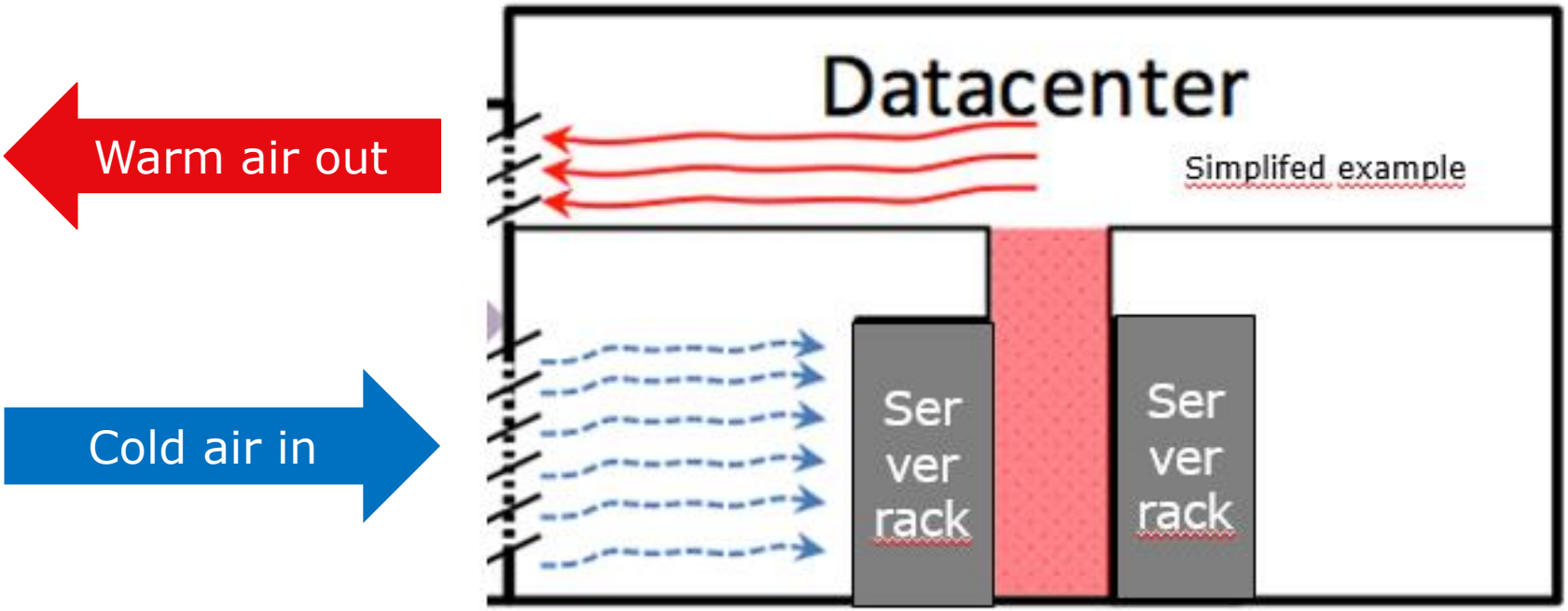
Free cooling

Simplified example

Only ambient air to cool data center

Only energy for air fans needed.
No energy for other cooling systems needed

Challenges :
Only possible when ambient air temperature is low enough
keep contamination (dust, chemicals in the air) out



Data Center Cooling

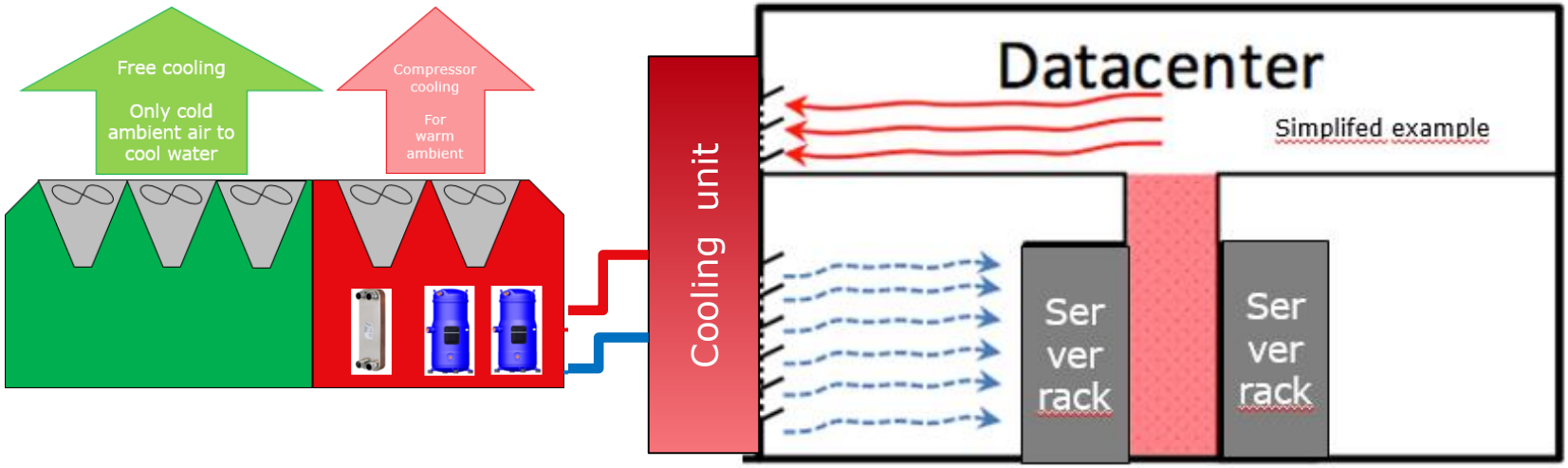
Free cooling

Simplified example

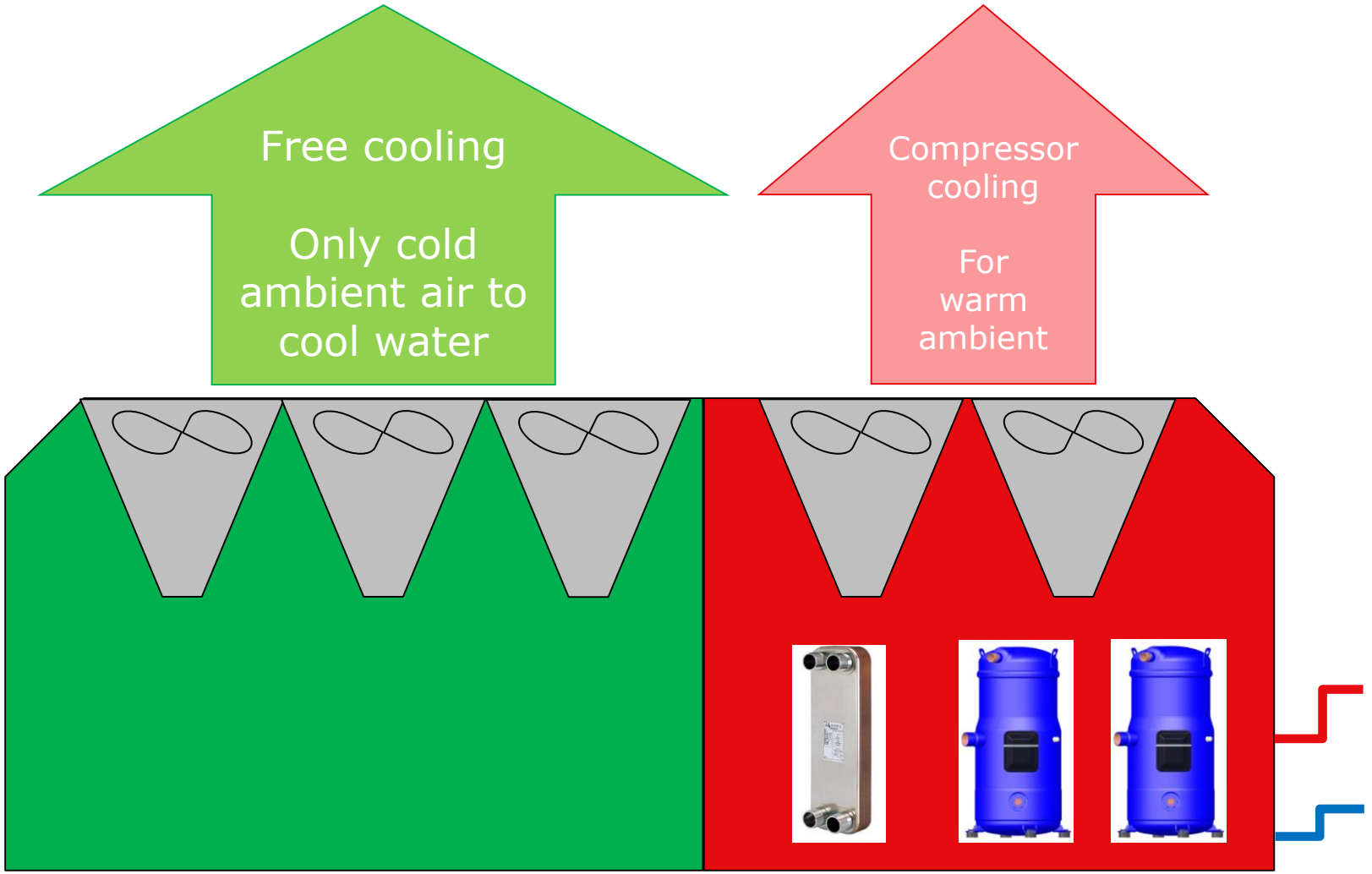
Ambient air to cool data center via cooling units connected to a chiller with free cooling

Free cooling when ambient air is cold enough
Energy for compressor cooling only for high ambient temperatures

No contamination (dust, chemicals in the air) in the data center



Data Center Cooling

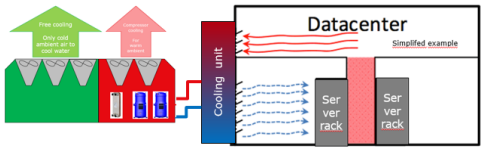


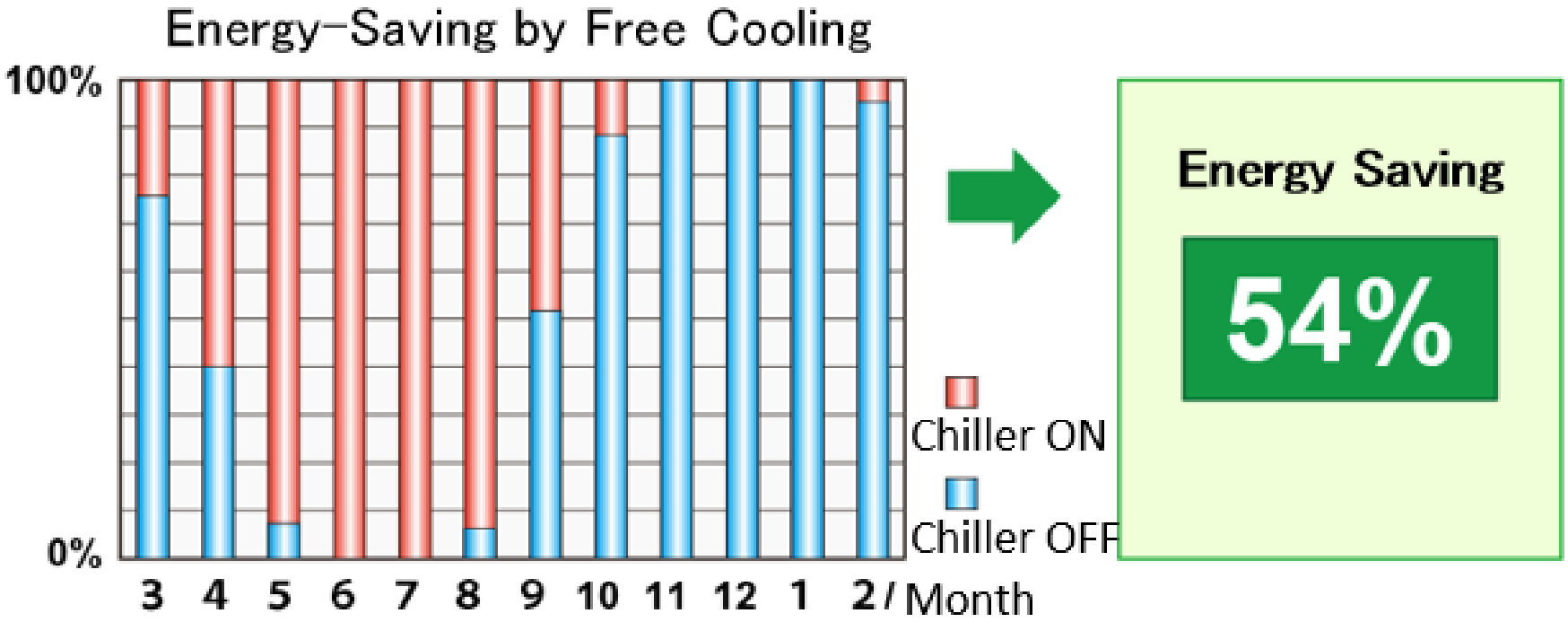
Chiller with free cooling

Data Center cooling

Free cooling

Example for savings potential

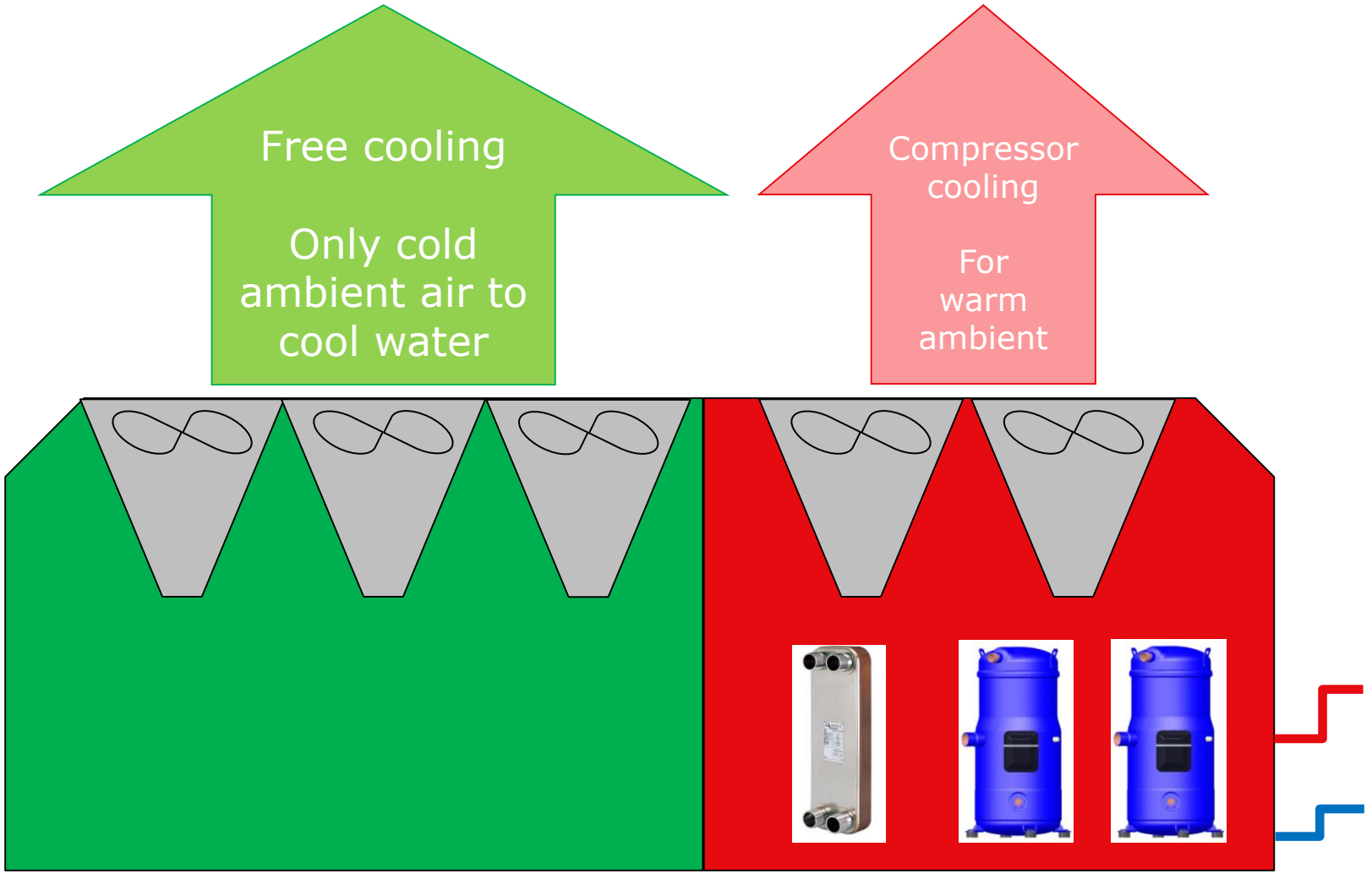




Data Center cooling

Additional improvement potential

Example compressors

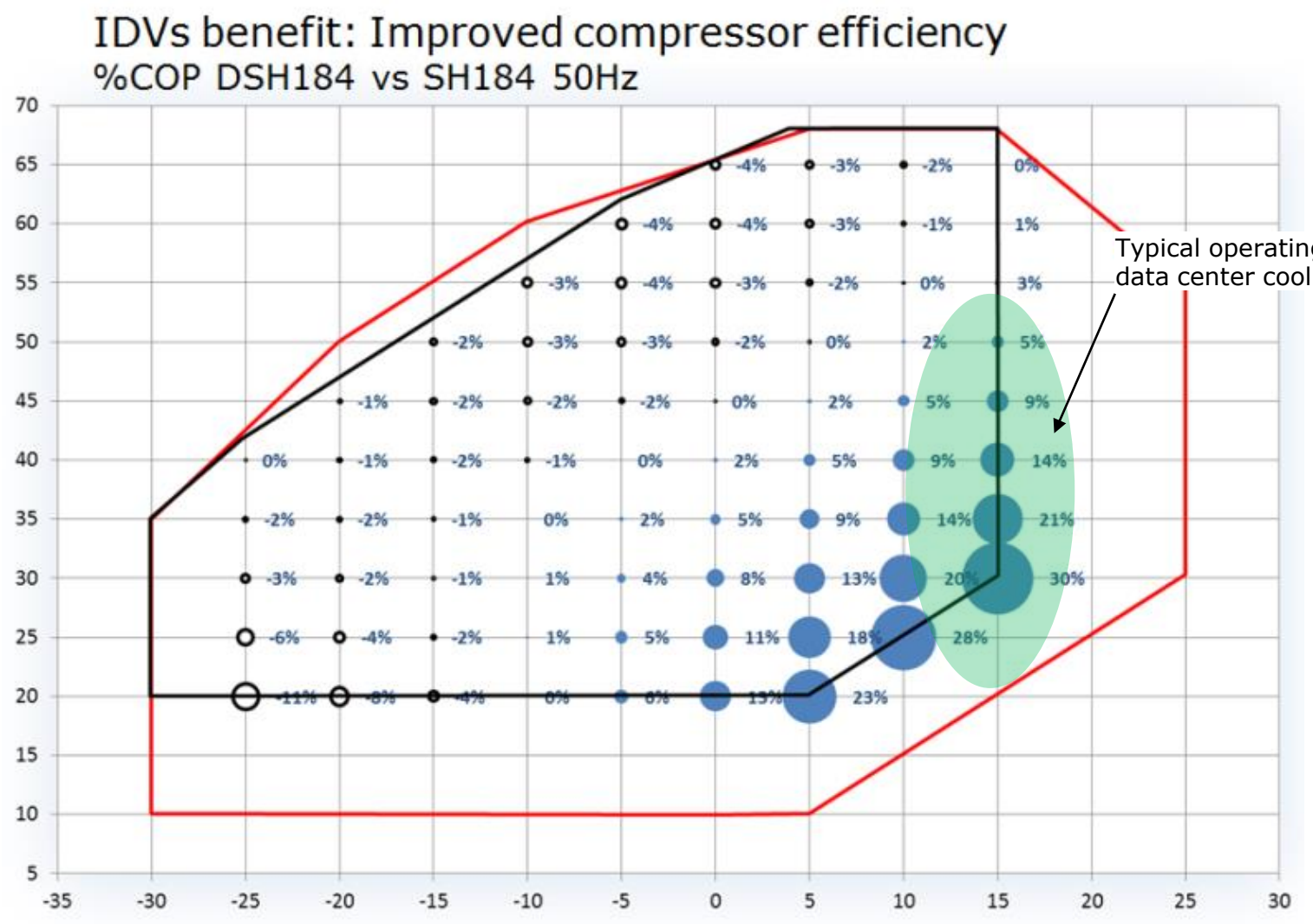


Chiller with free cooling

Data Center cooling

Scroll compressor with IDV

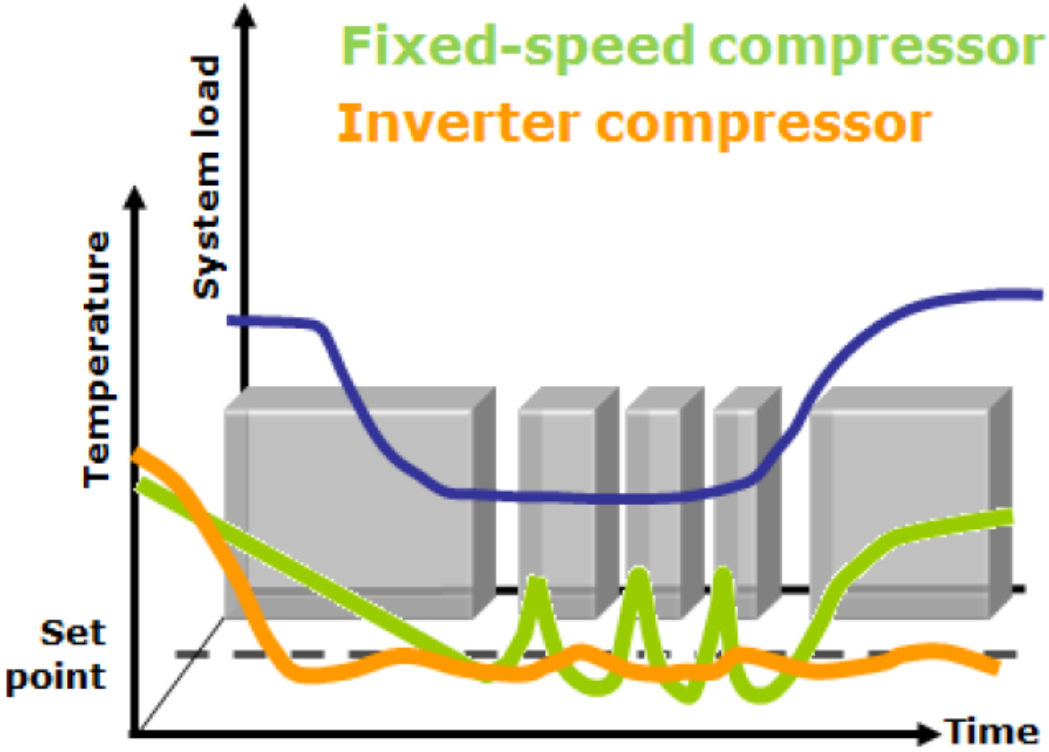
IDV = Intermediate Discharge Valve



Danfoss DSH compressor series

Data Center cooling

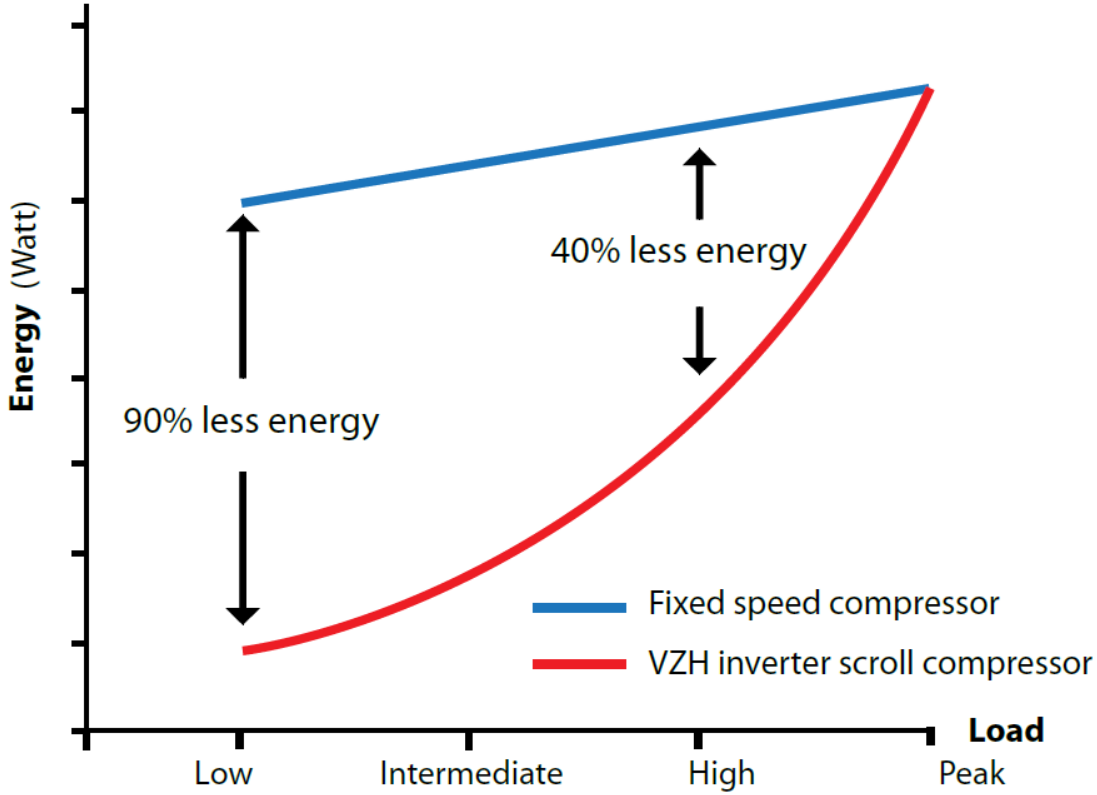
Alternative
Inverter driven compressors



VZH Inverter driven compressors
for optimal free cooling adaption

Data Center cooling

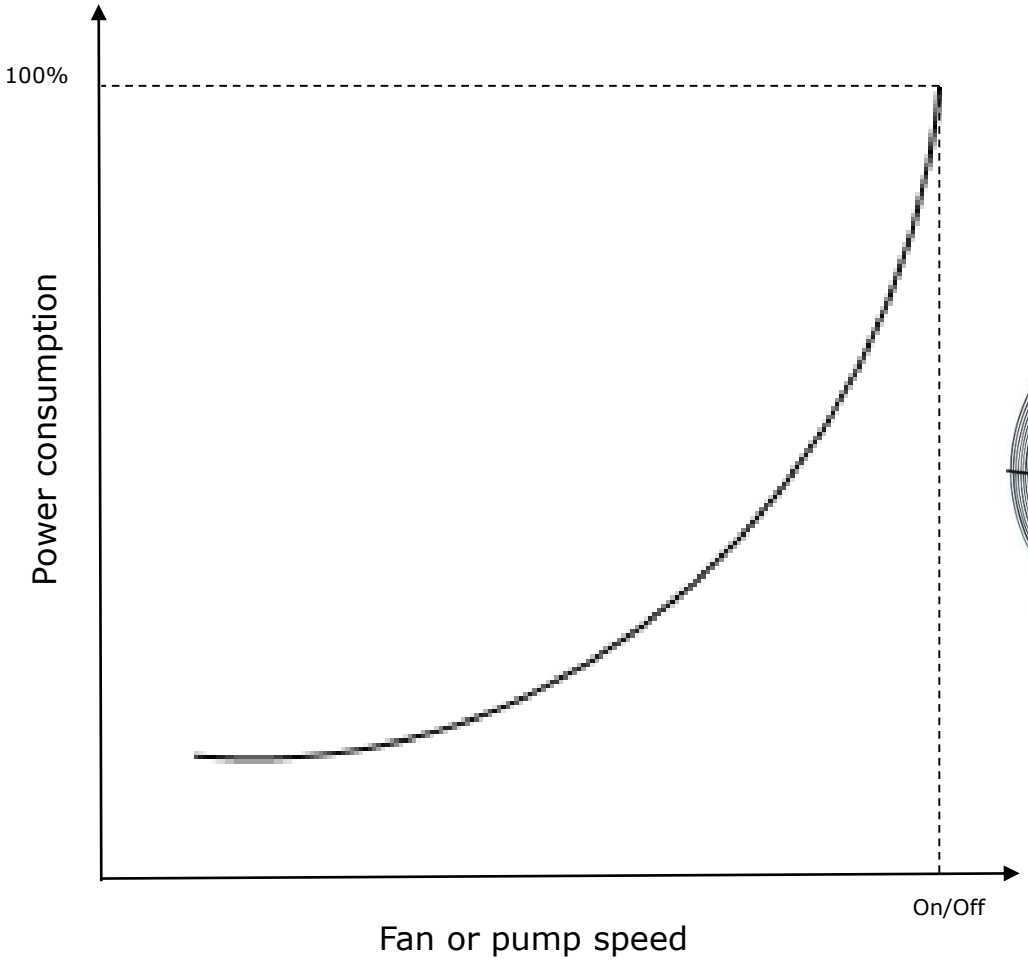
Inverter driven compressors



VZH Inverter driven compressors for optimal free cooling adaption

Data Center cooling

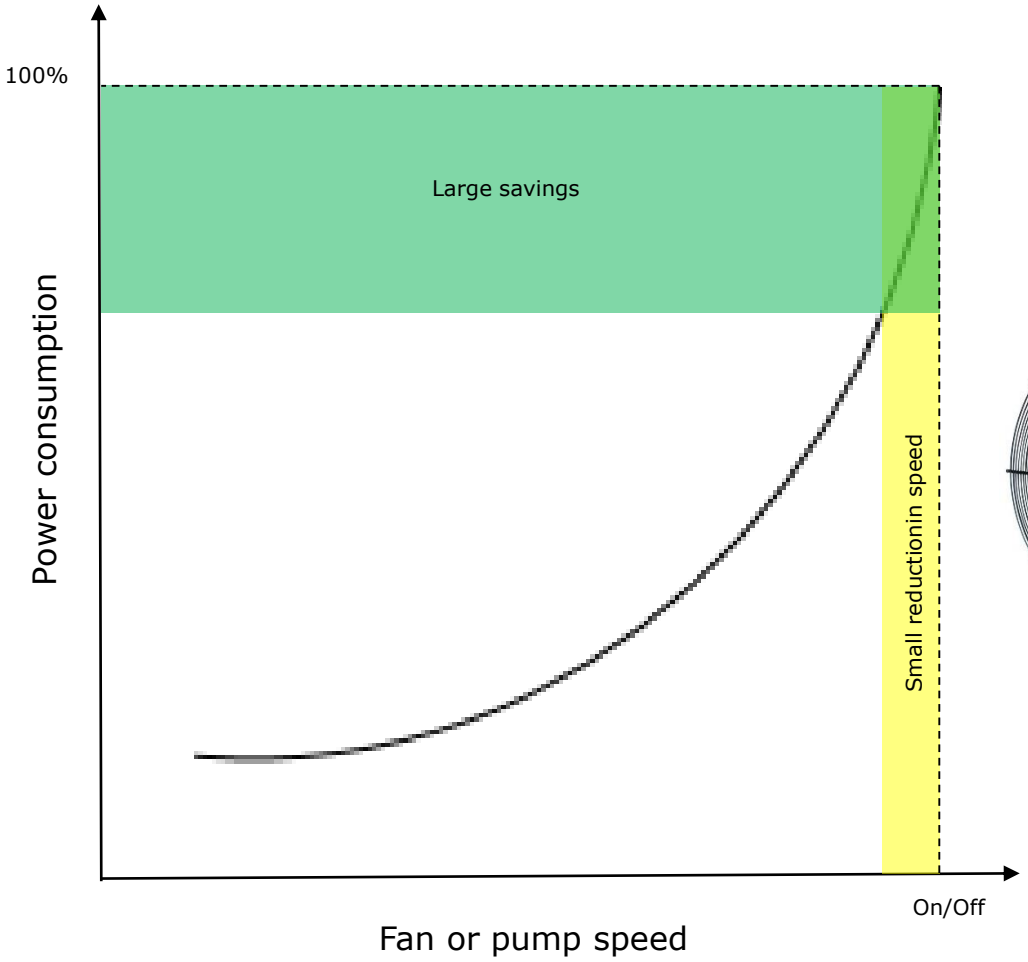
Inverter for fans & pumps



Danfoss VLT Drive

Data Center cooling

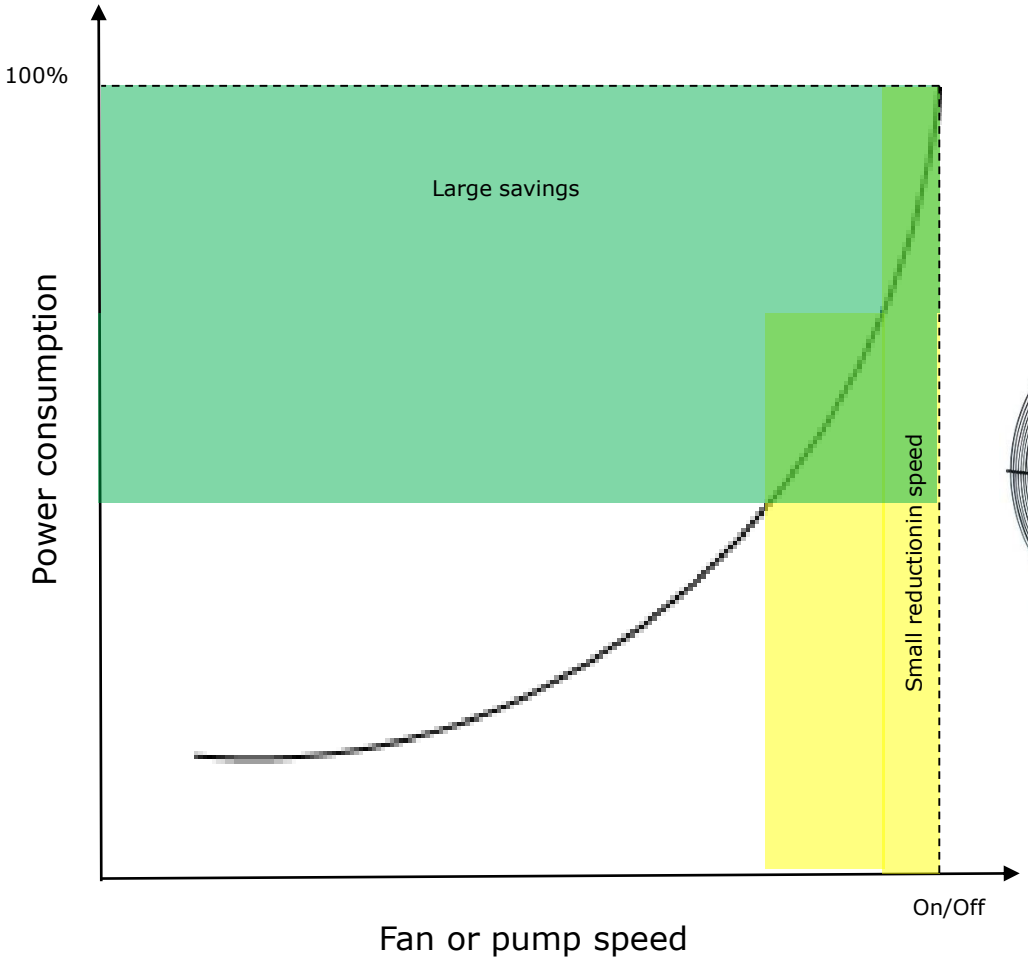
Inverter for fans & pumps



Danfoss VLT Drive

Data Center cooling

Inverter for fans & pumps



Danfoss VLT Drive

Data Center cooling

Inverter driven compressors
fans & pumps

Example:

35 kW cooling unit for data center
Fix spped compressor replaced by inverter driven varibale speed compressor VZH088.
Saving : approx. 10.000 kWh/year.
= 32% compared to fix speed

Danfoss VLT Drive

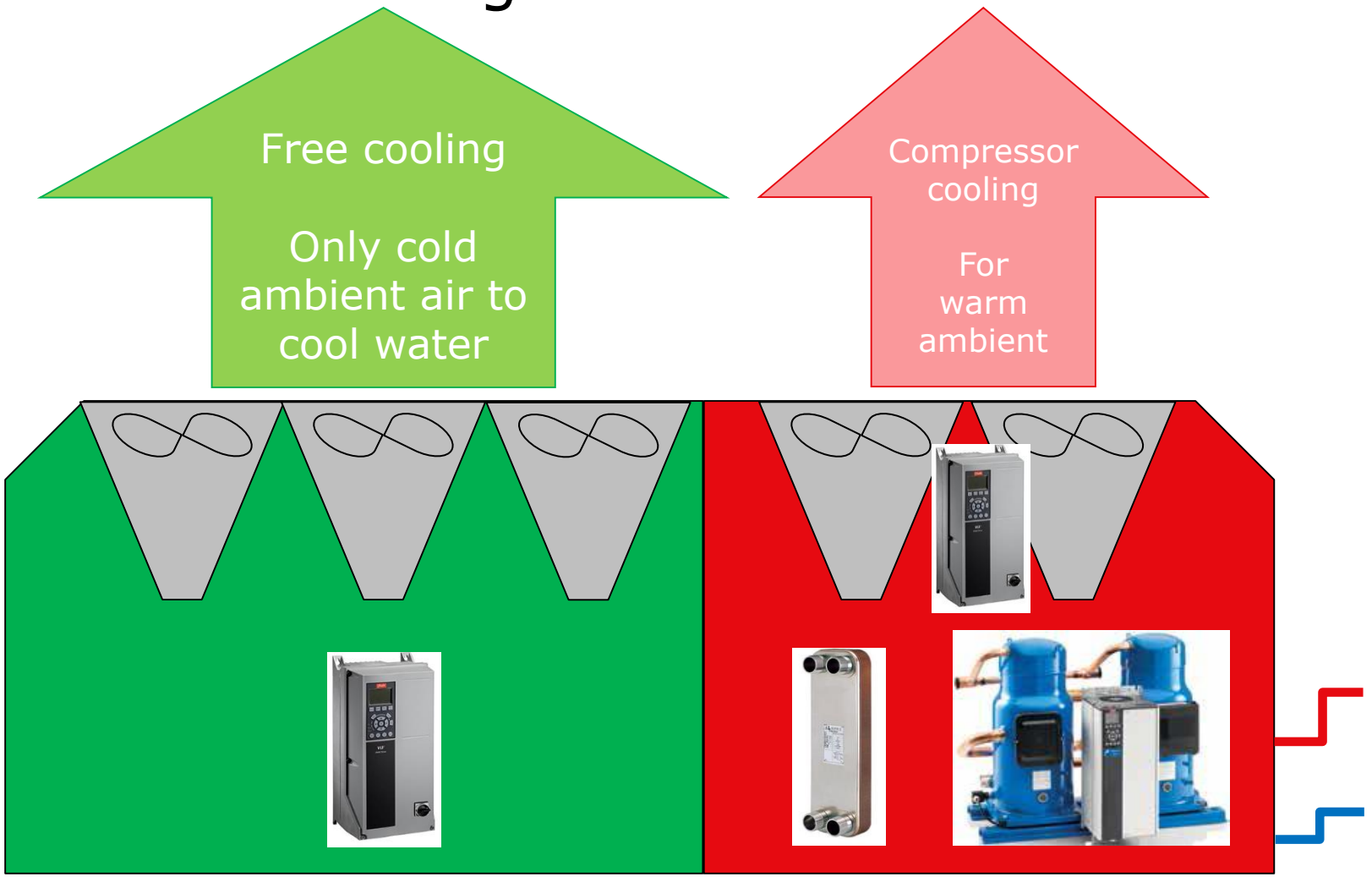
Return on investment often< 3 years.

Additional benefits :
70% lower starting current
⇒ Lower load on electric grid
⇒ Smaller back up generators

VZH Inverter driven compressors
for optimal free cooling adaption

High efficient Data Center Cooling

Inverter driven compressor
Inverters for fans & pumps
High efficient heat exchangers



Chiller with free cooling

Sustainable Cooling

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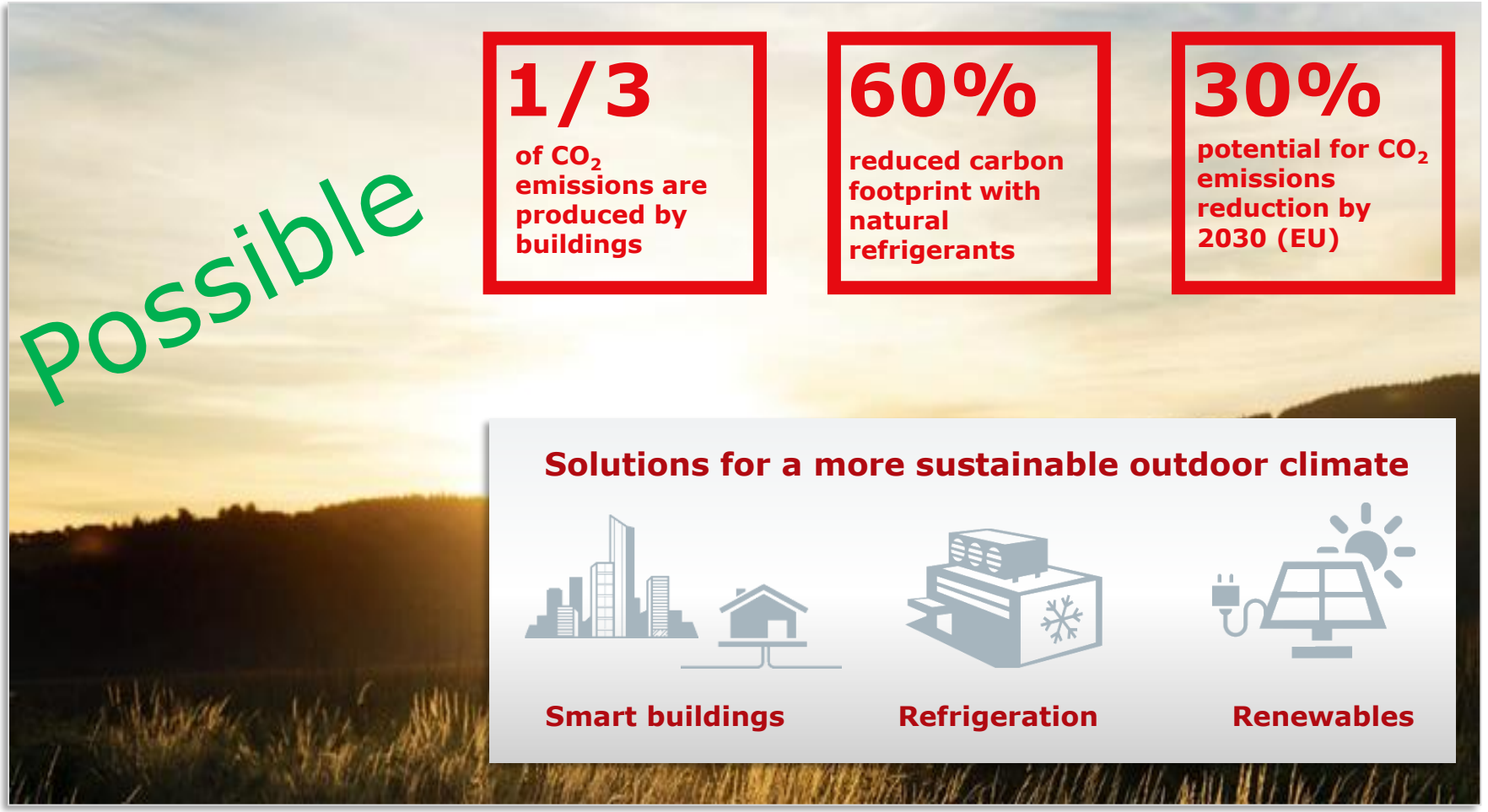

Many thanks for your attention

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