

Inotherm⁺

A next generation highly efficient
thermal energy system for energy
positive buildings

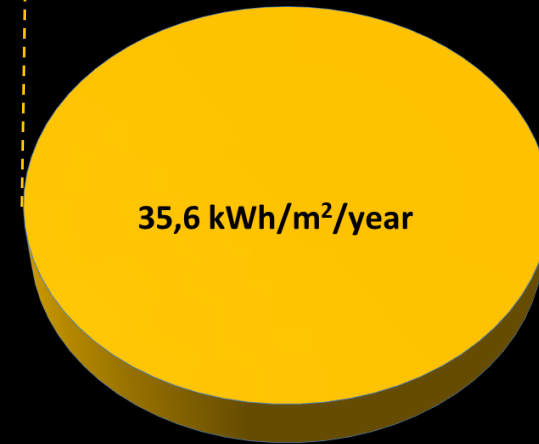
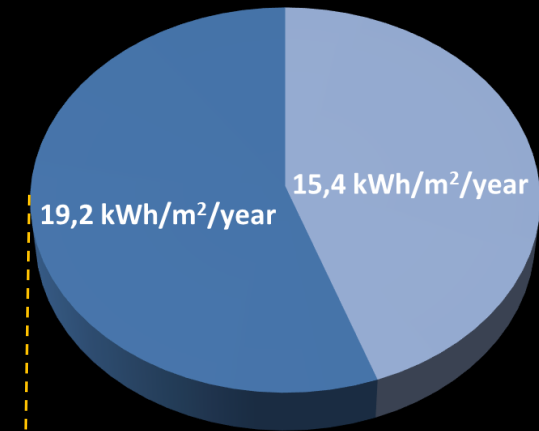
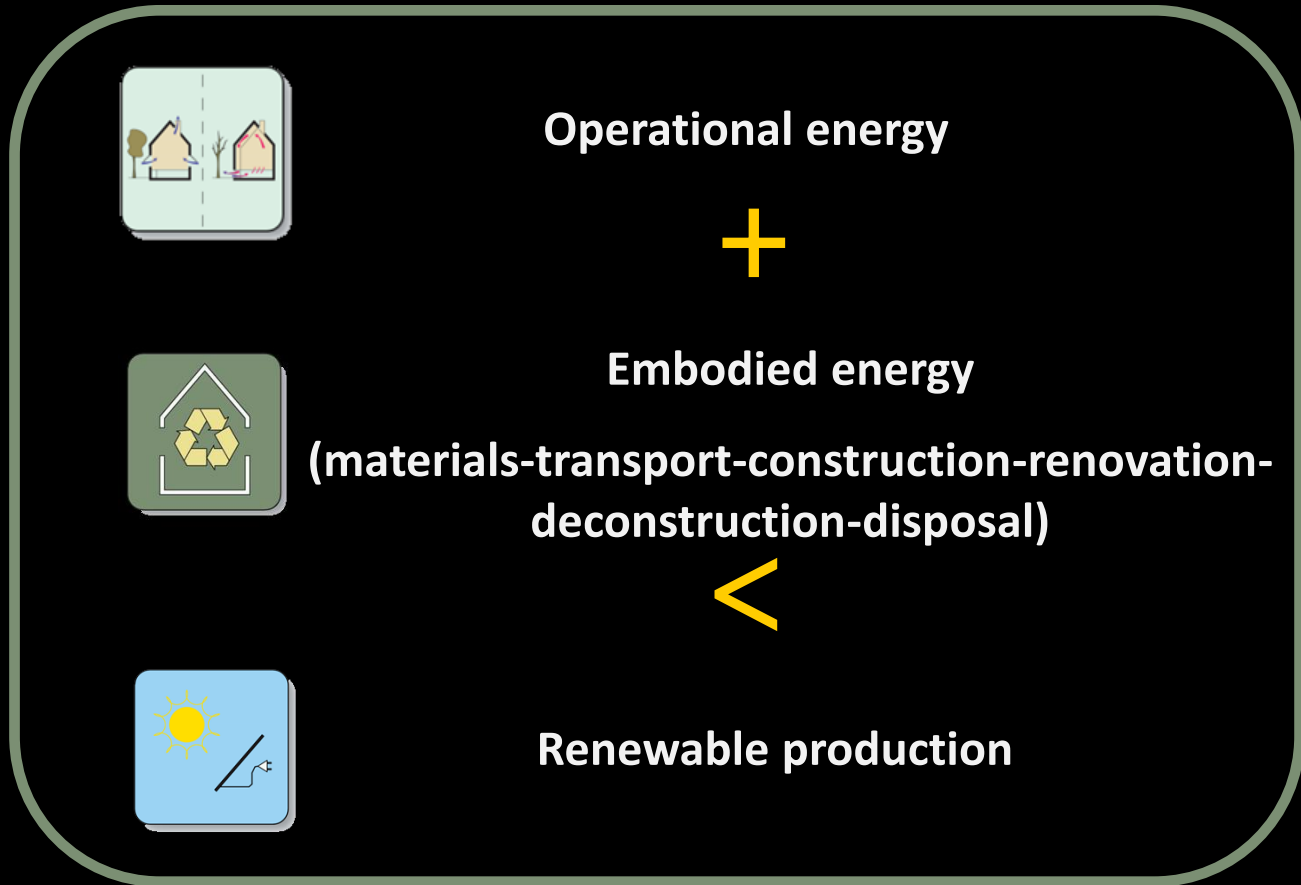
SKANSKA

We build for a better society



Dr. ing. Bjørn Jenssen
Chief advisor, Skanska Teknikk

The original Powerhouse definition




- Operational energy
- Embodied energy
- PV production

Collaboration




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Snøhetta 

«Nobody can design and build
Powerhouses alone,
but with the right partners,
we can make it !»

asplan
viak 

 The Research Centre on
Zero Emission Buildings

ZERO 

 enova

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Less is more

**Integrated
energy
design**

**Form follows
environment**



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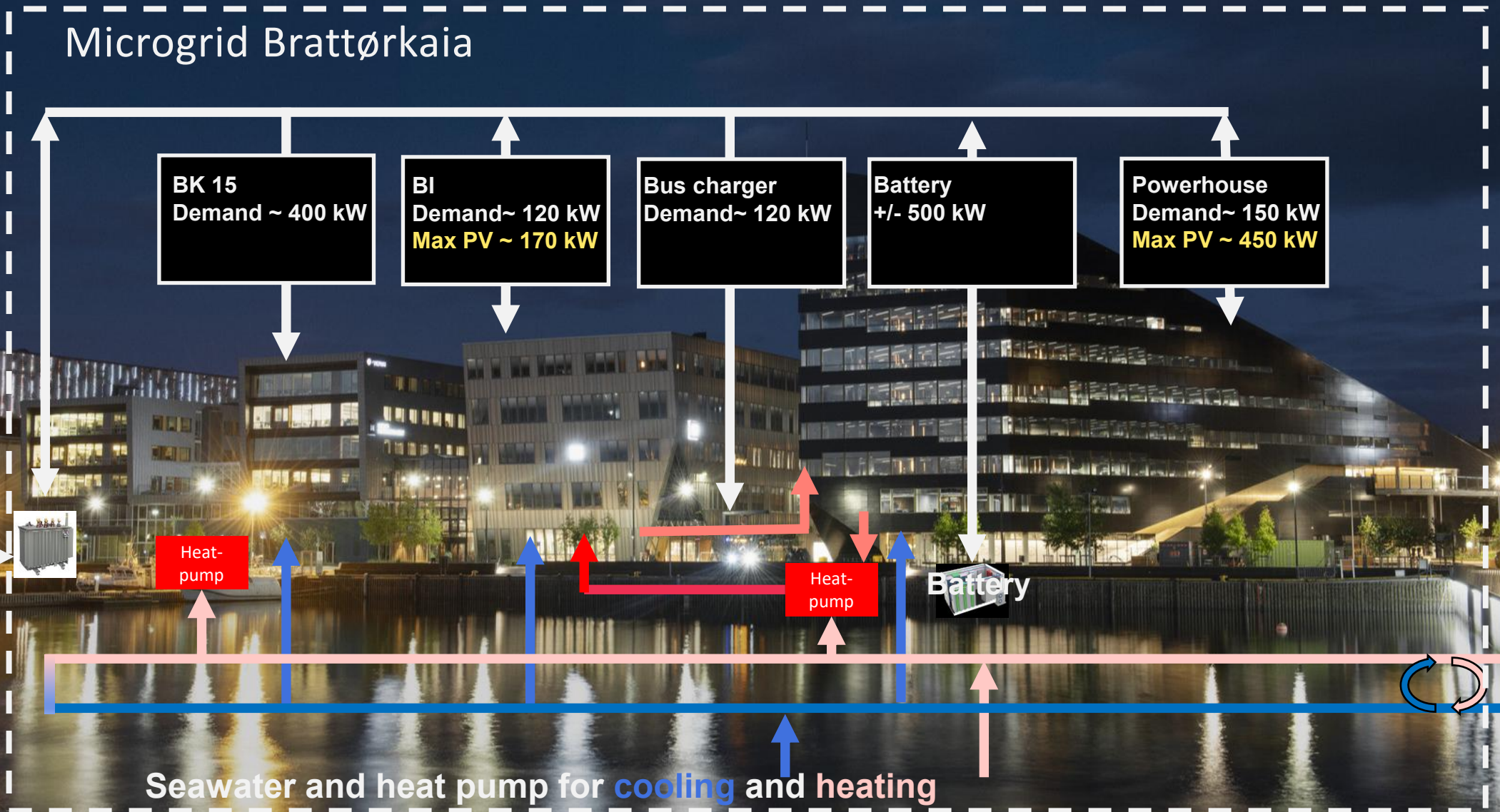


The process of first principle design

1. Identify and Define the Problem Clearly
2. Break Down to Fundamental Truths
3. Reassemble from the Basics
4. Iterate and Validate



Brattørkaia energy sharing community



The thermal energy system in Powerhouse Brattørkaia

Decarboning Award

"Heat pumps as a key enabler in achieving a positive energy building"

Description

Powerhouse Brattørkaia is a positive-energy building, meaning that it produces more energy than it consumes. The surface of the building is covered in solar cells to generate electricity, and this leaves a 5% surplus in the grid for the benefit of the city.

Today, building stock accounts for 40% of the world's total energy consumption. By changing the way we build and focus on construction methods that turn buildings into renewable energy producers, the Powerhouse Brattørkaia is making huge strides towards less energy-consuming buildings.

Powerhouse Brattørkaia is the first building of its kind in Norway and a pioneering project in terms of technology, energy efficiency and production of green energy. The very dense construction of the building, good ventilation and optimal use of the sun and other renewable energy sources ensure greatly reduced energy consumption.

A prerequisite for buildings with low energy consumption is an efficient heating system, in this case a heat pump with an overall COP average of 6, which uses seawater both as a source for free cooling and as a source for the heat pump. This is combined with a low temperature central heating system.

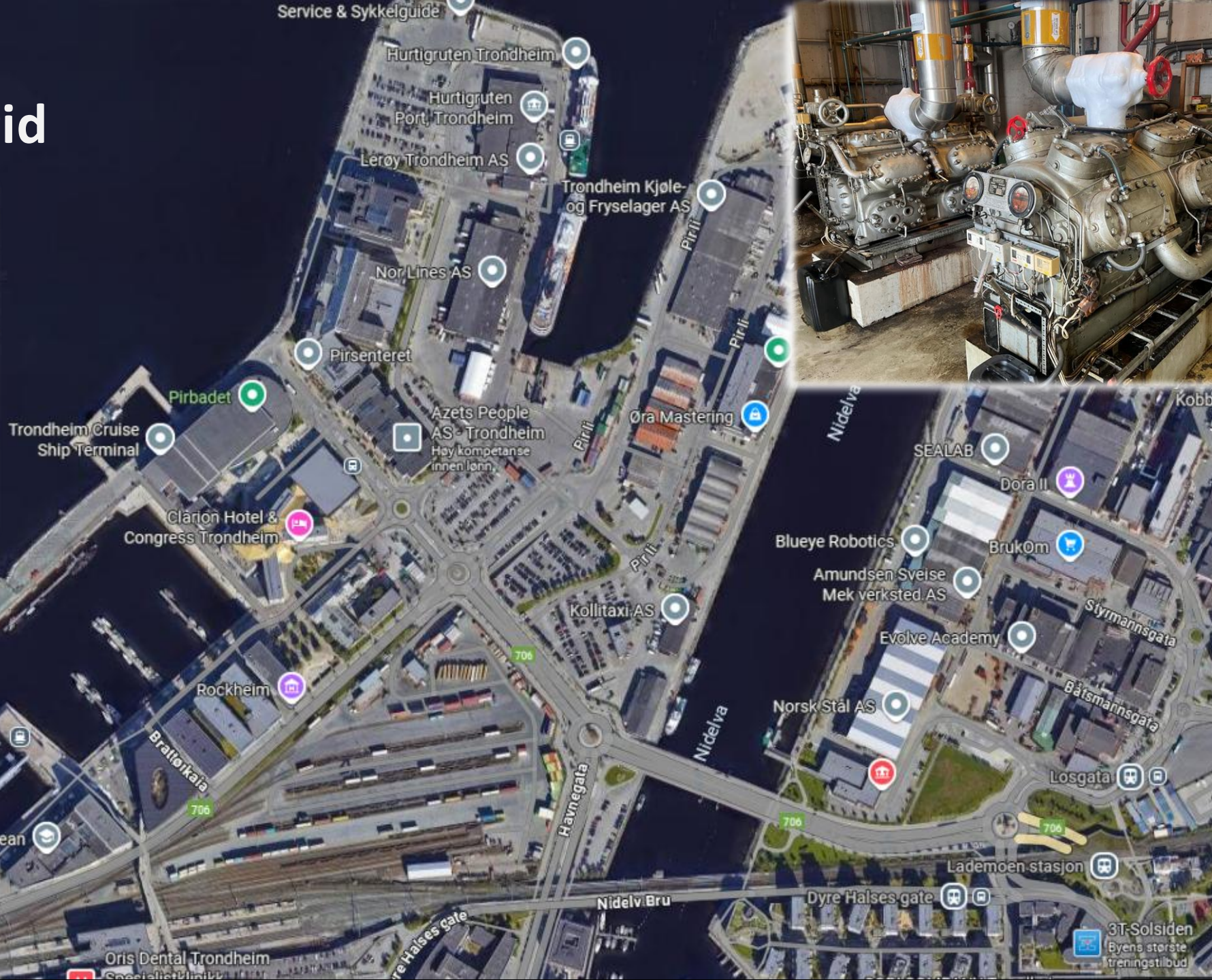
The high COP of the heat pump is the key enabler to the building going "over the top" and becoming a surplus energy building.



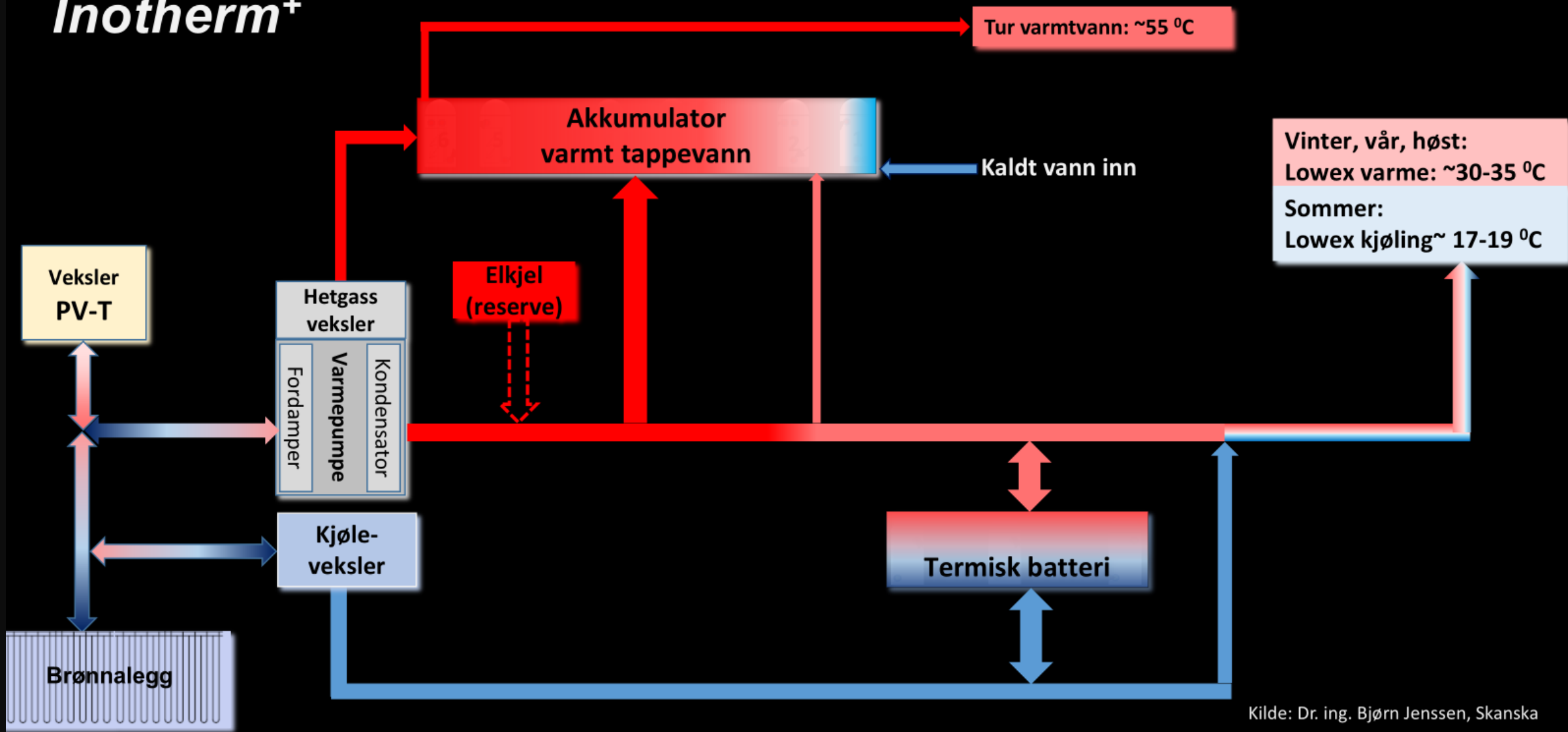
Powerhouse Brattørkaia, heat pumps as a key enabler in achieving a positive energy building, Decarboning Award 2021



Brattørkaia microgrid

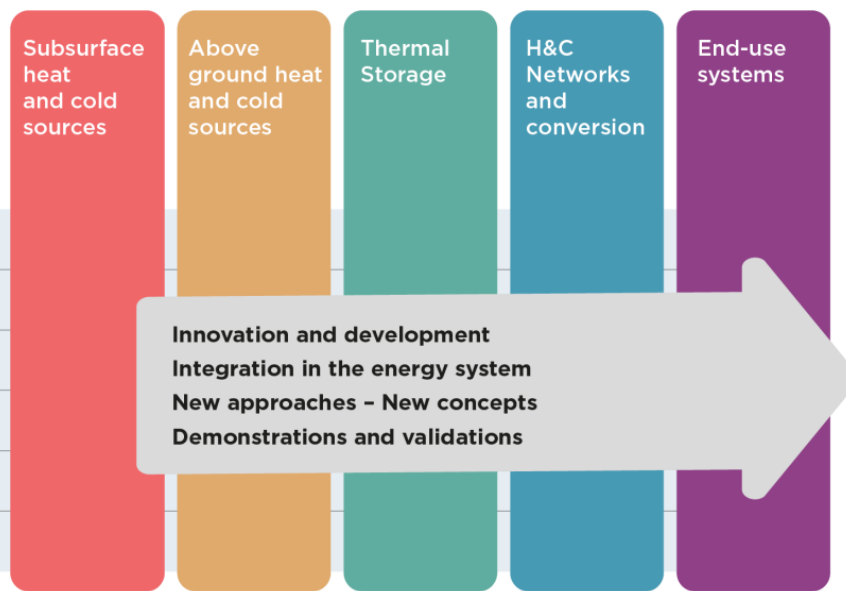


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Kilde: Dr. ing. Bjørn Jenssen, Skanska

Technologies & Concepts
Smart integration and control
Urban and regional planning
Environmental sustainability
Markets and regulations
Stakeholder adoption and engagement



Proposal

THE CHANGE
The Cooling and Heating transition Acceleration
via Network Geothermal Energy

Submitted to the Geothermica & JPP Smart Energy Systems Joint Call 2021

- The CHANGE Consortium*
- Lund University (LU), Sweden
 - Swedish Geoenergy Center (SGC), Sweden
 - VIAUniversity (VIA), Denmark
 - Danish Geological Survey (GEUS), Denmark
 - GeoDrilling (GD), Denmark
 - Skanska (SK), Norway
 - Oak Ridge National Laboratory (ORNL), USA
 - National Renewable Energy Laboratory (NREL), USA
 - Oklahoma State University (OSU), USA

January 31, 2022

First pilot project: Lindesnes Helsehus

- ~23.500 m² BTA
- 72 omsorgsboliger
- 48 kortidsplasser for behandling og rehabilitering
- Tre dagaktivitetssentere
- Base for helsepersonell
- Legevakt
- Blodbank (spesialhelsetjenesten)
- Ambulanse (spesialhelsetjenesten)
- Frisklivssentral, fysioterapi og ergoterapi, hjelpemidler og velferdsteknologi
- Psykisk helsetjeneste (kommune- og spesialisthelsetjenesten)
- Tildeling, utvikling og koordinering av helse- og omsorgstjenester
- Sentralt plassert vestibyle, kjøkken og kafe/kantine, seremonirom, varemottak, møtesenter og møteplasser for frivillige lag og organisasjoner

ZEB-O ÷ EQ + 20 % M

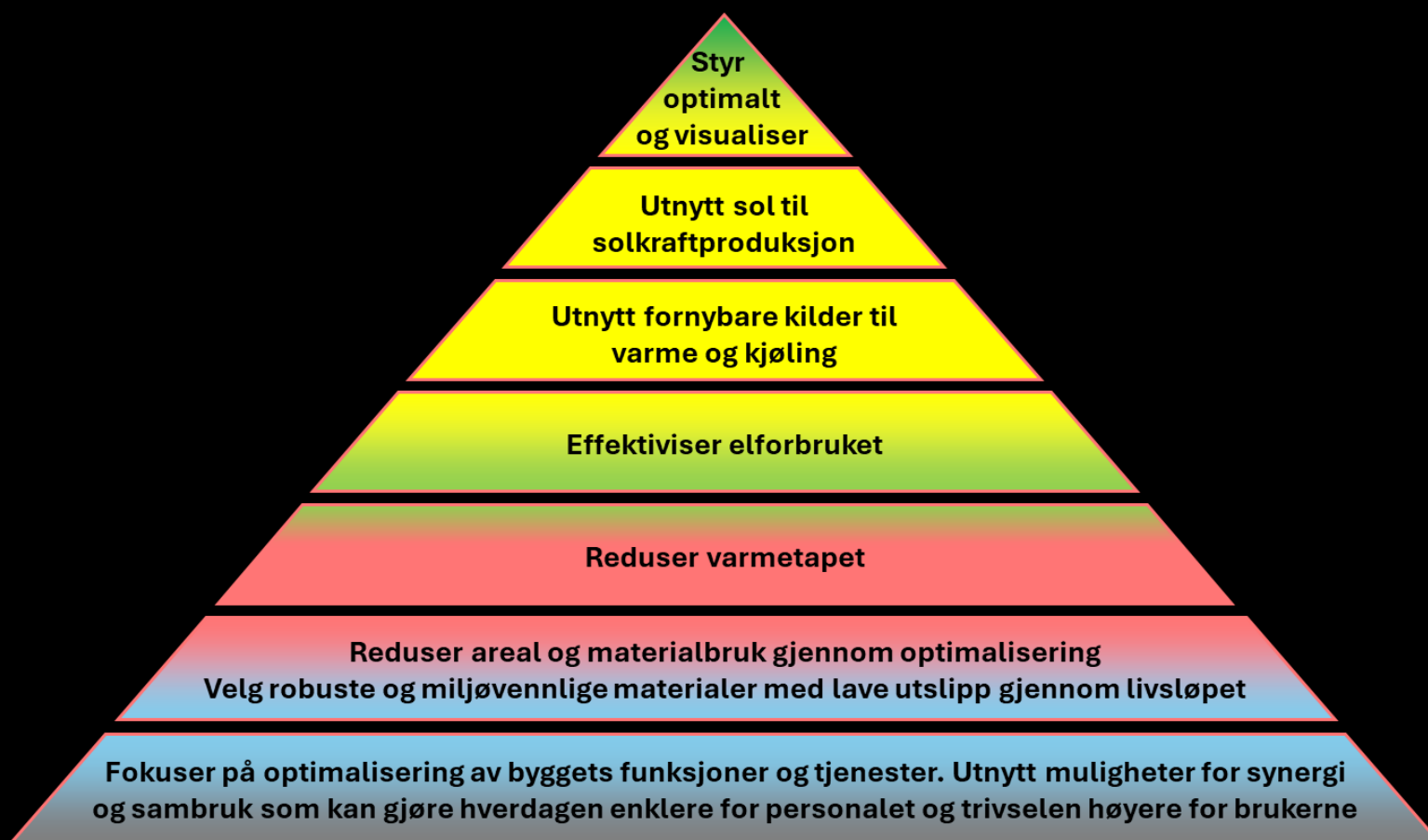


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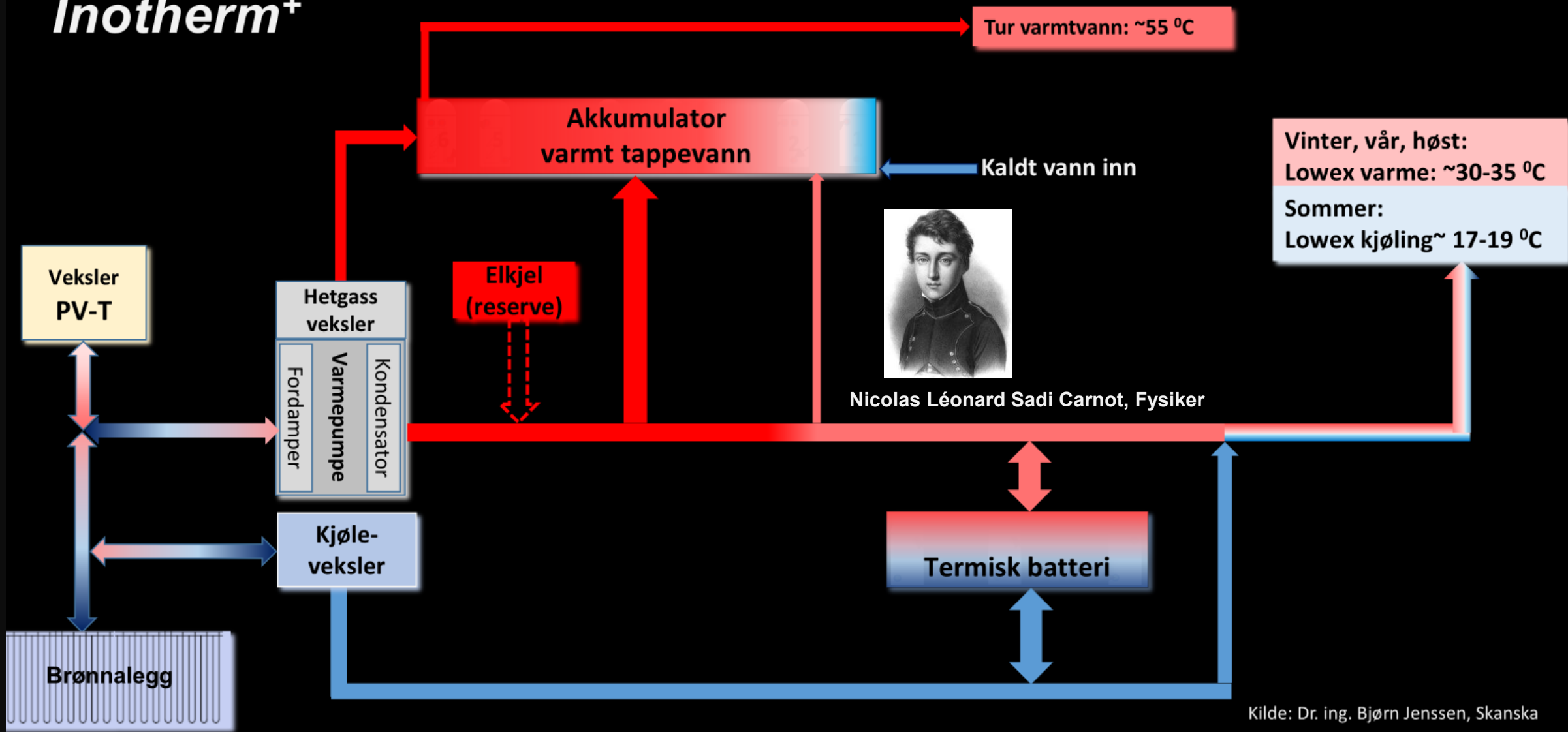


Lindesnes pyramiden



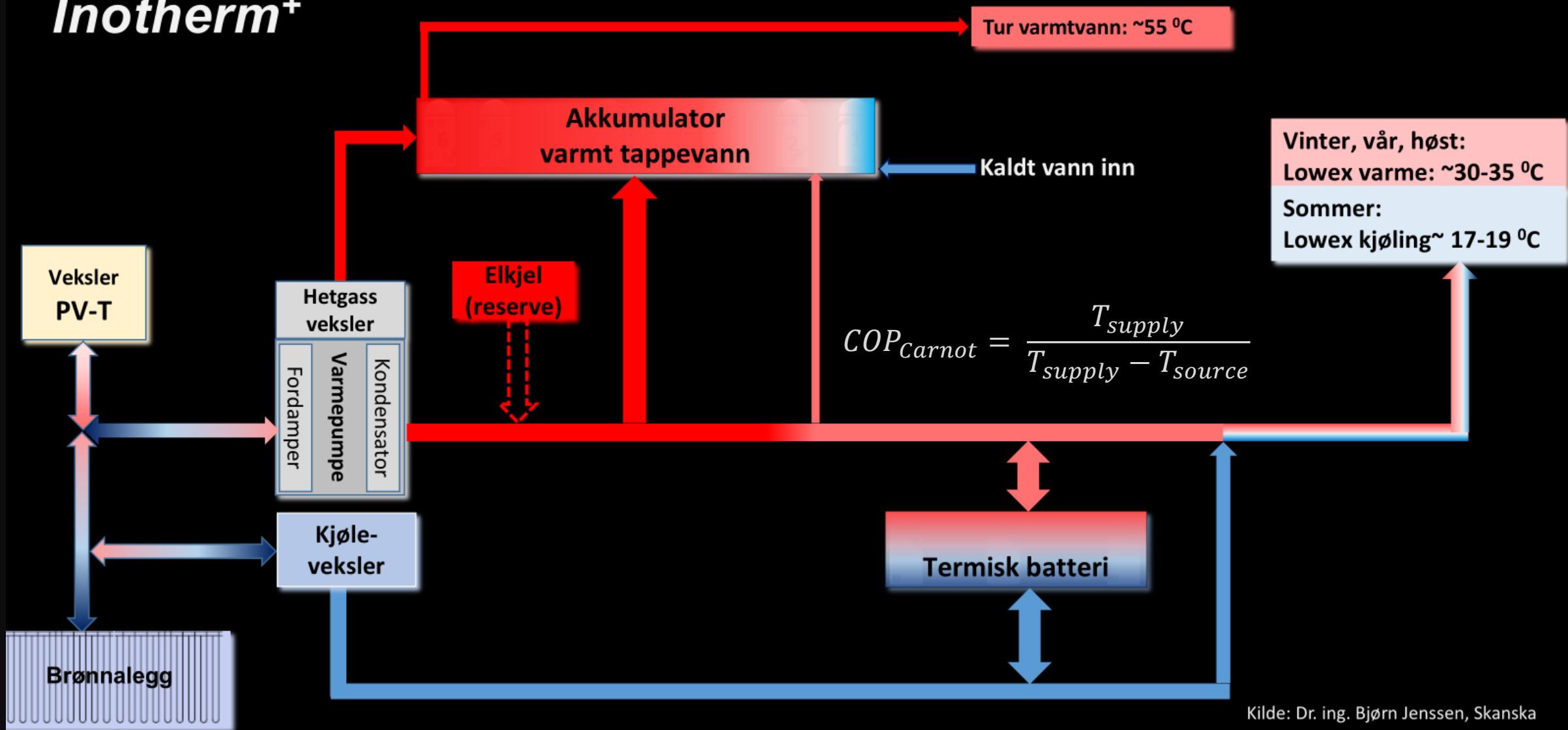


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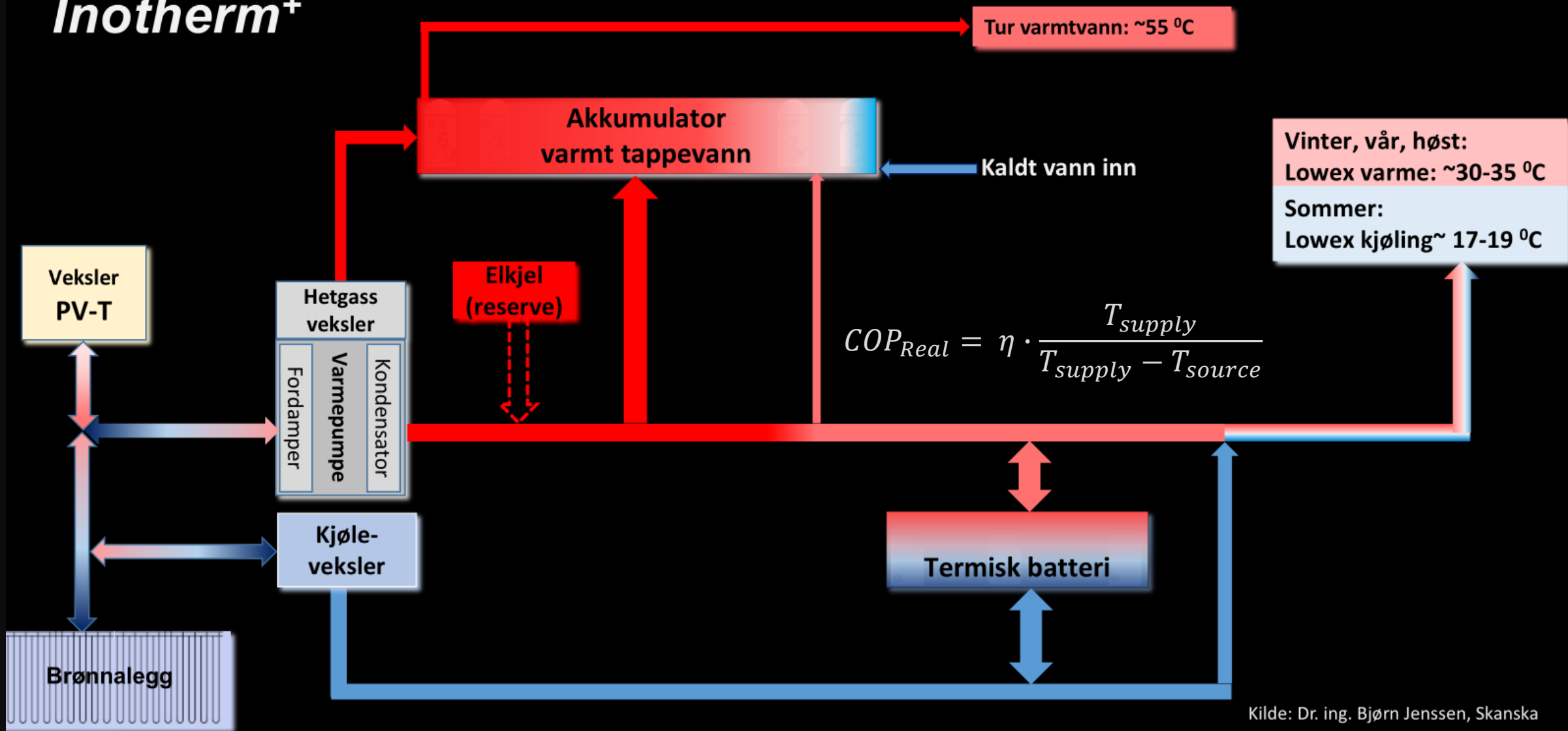
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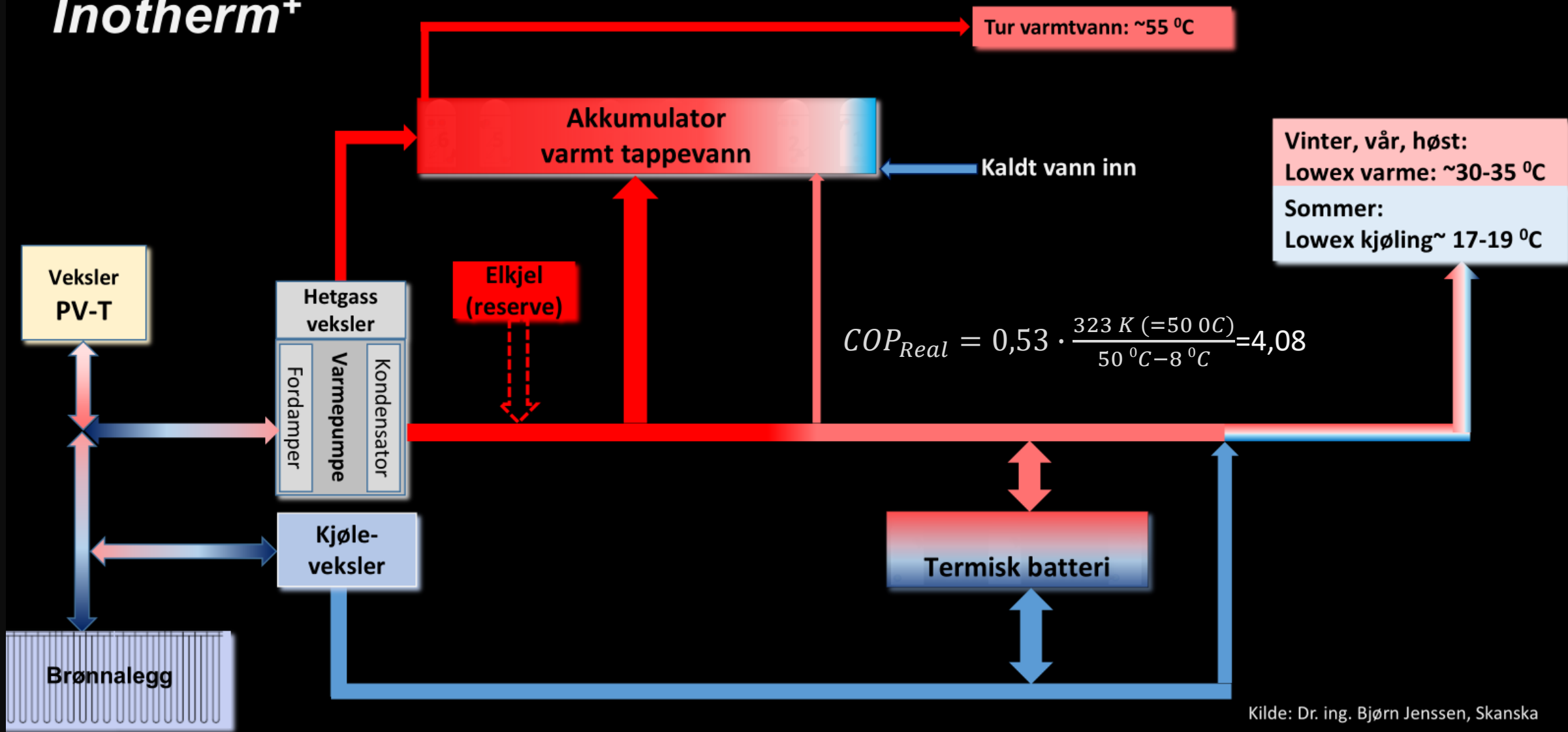
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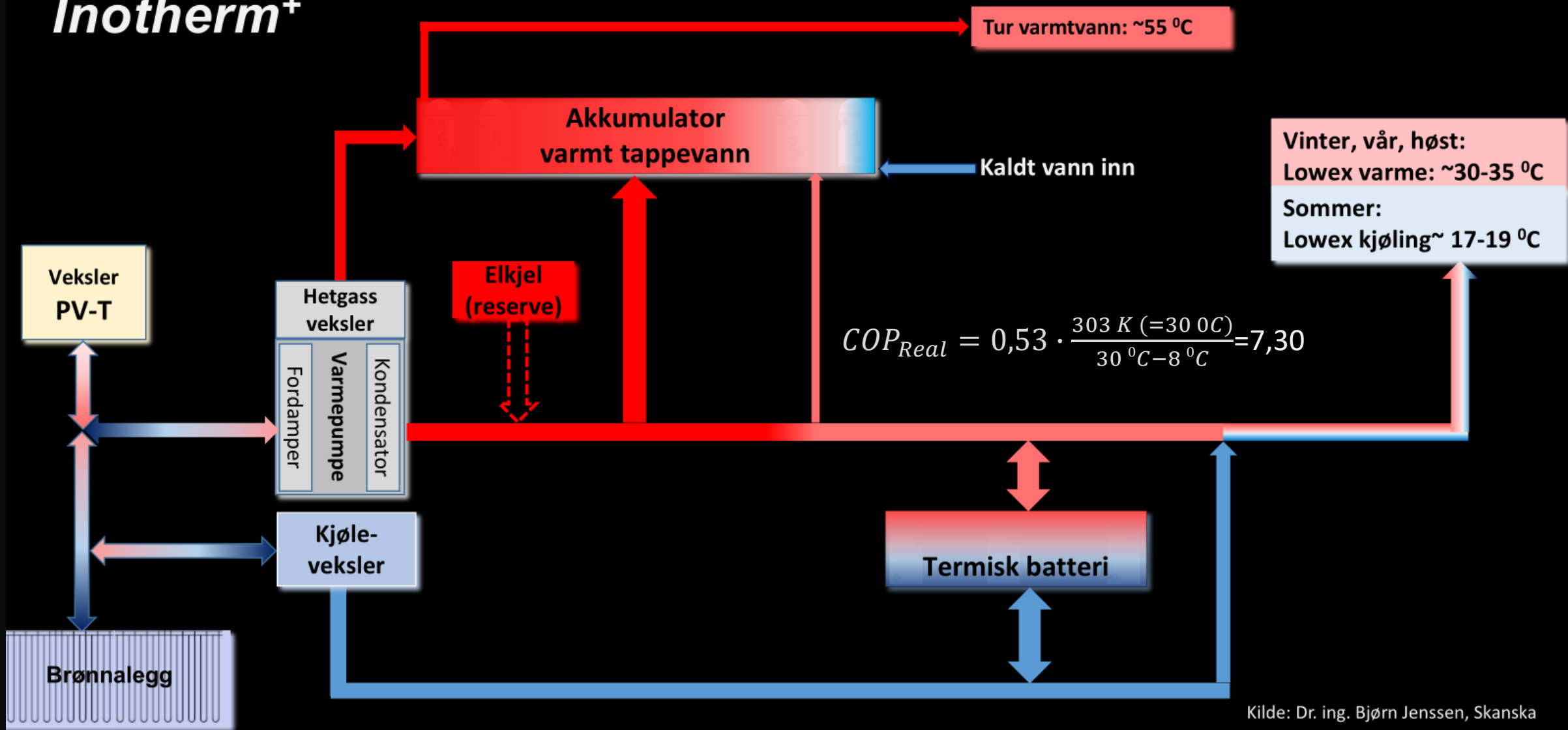


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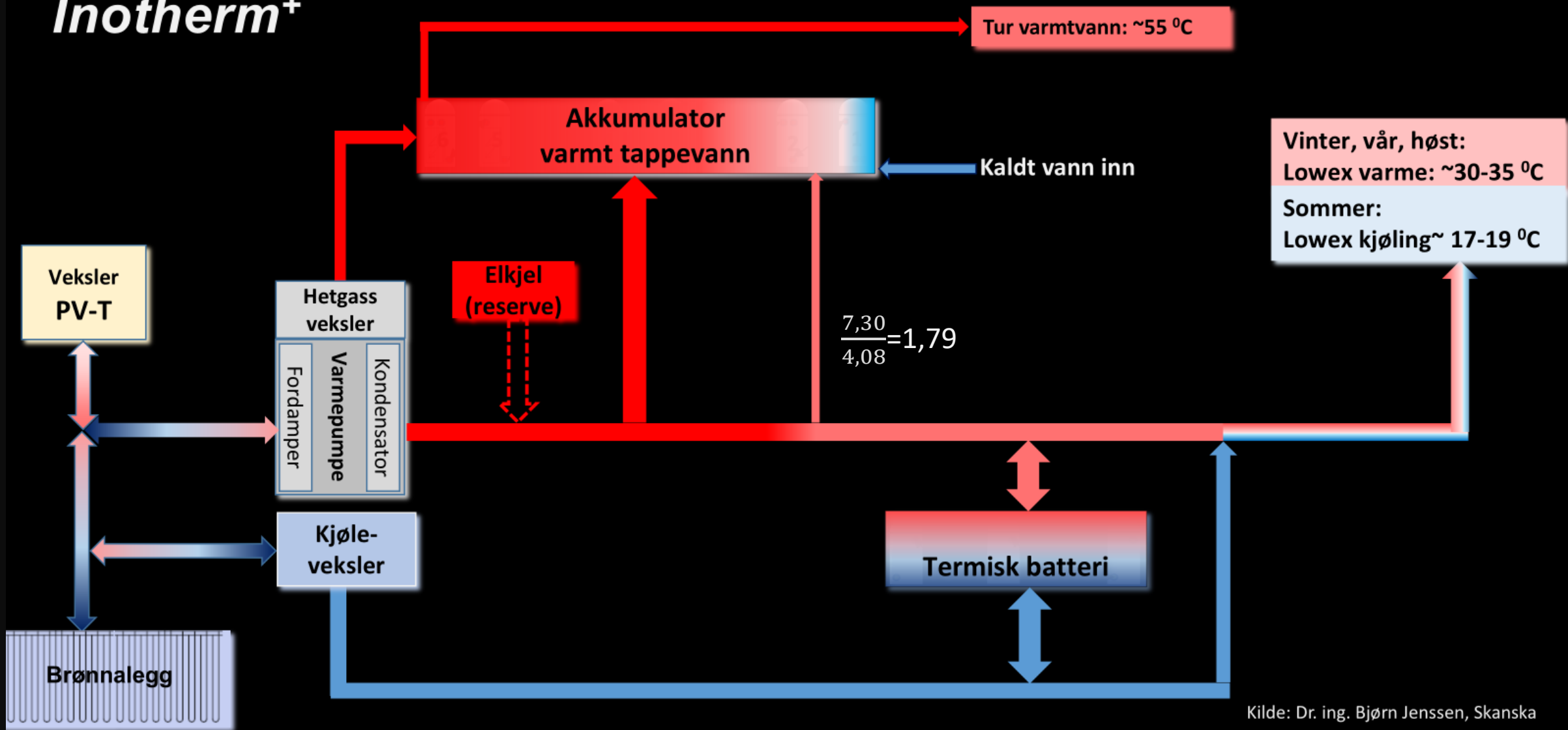


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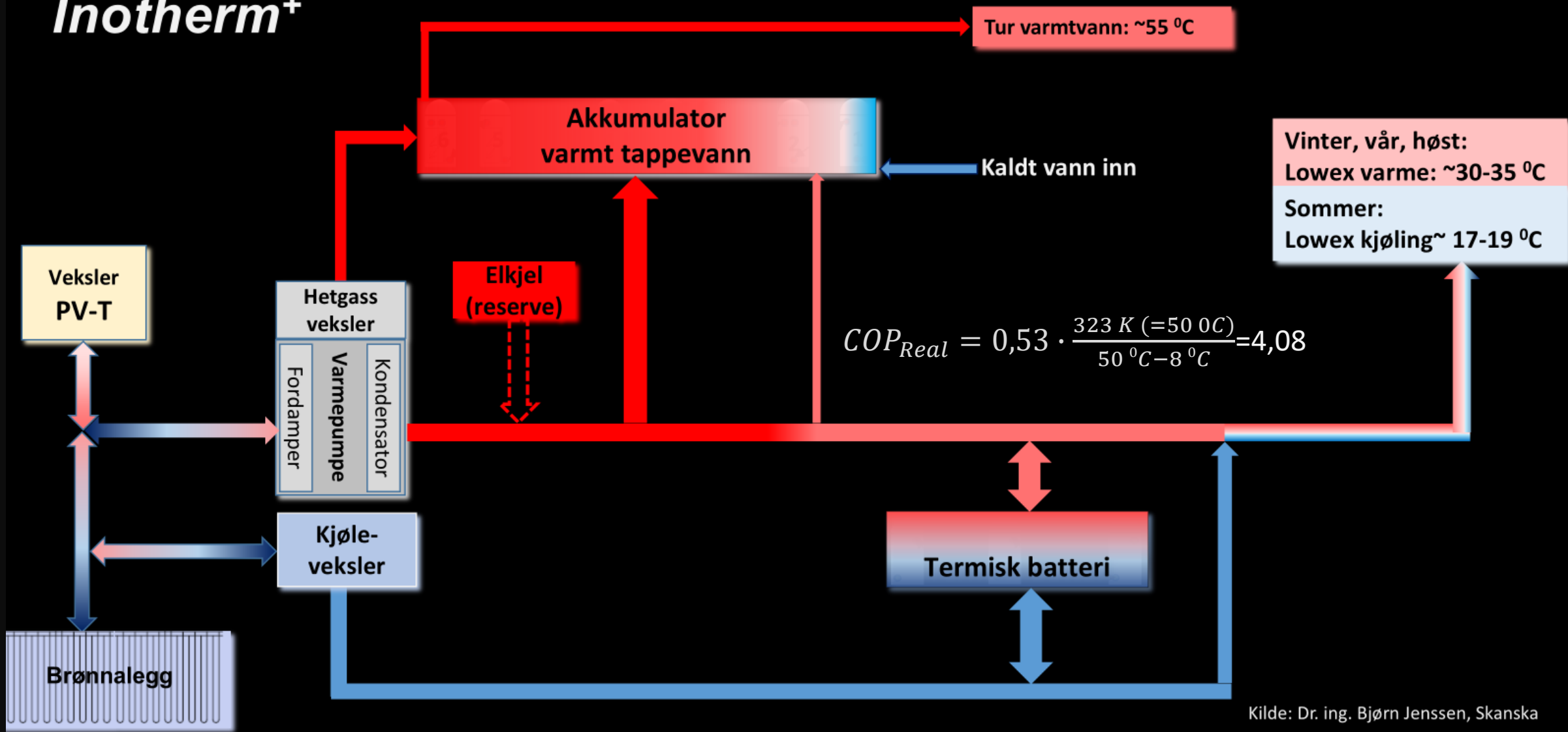
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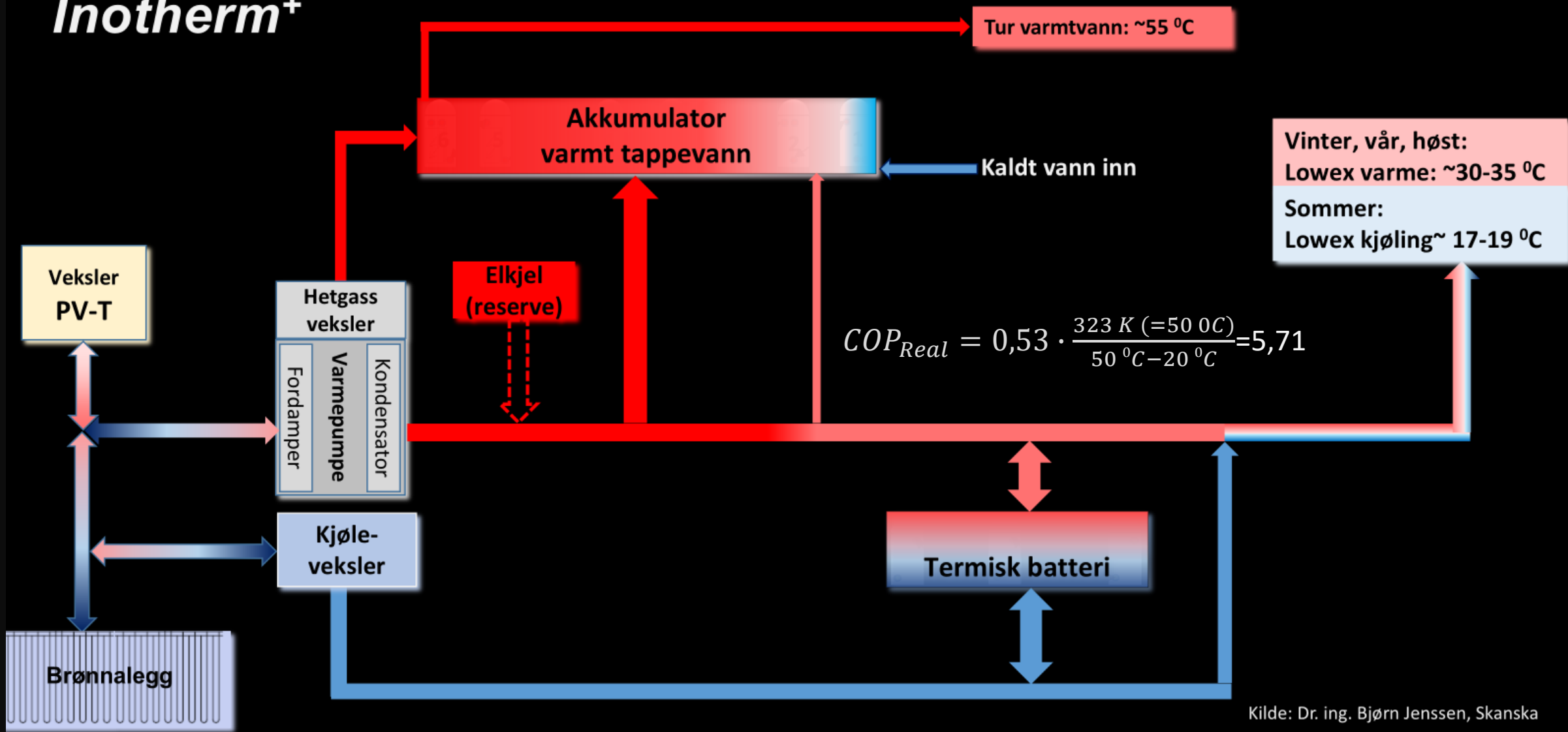
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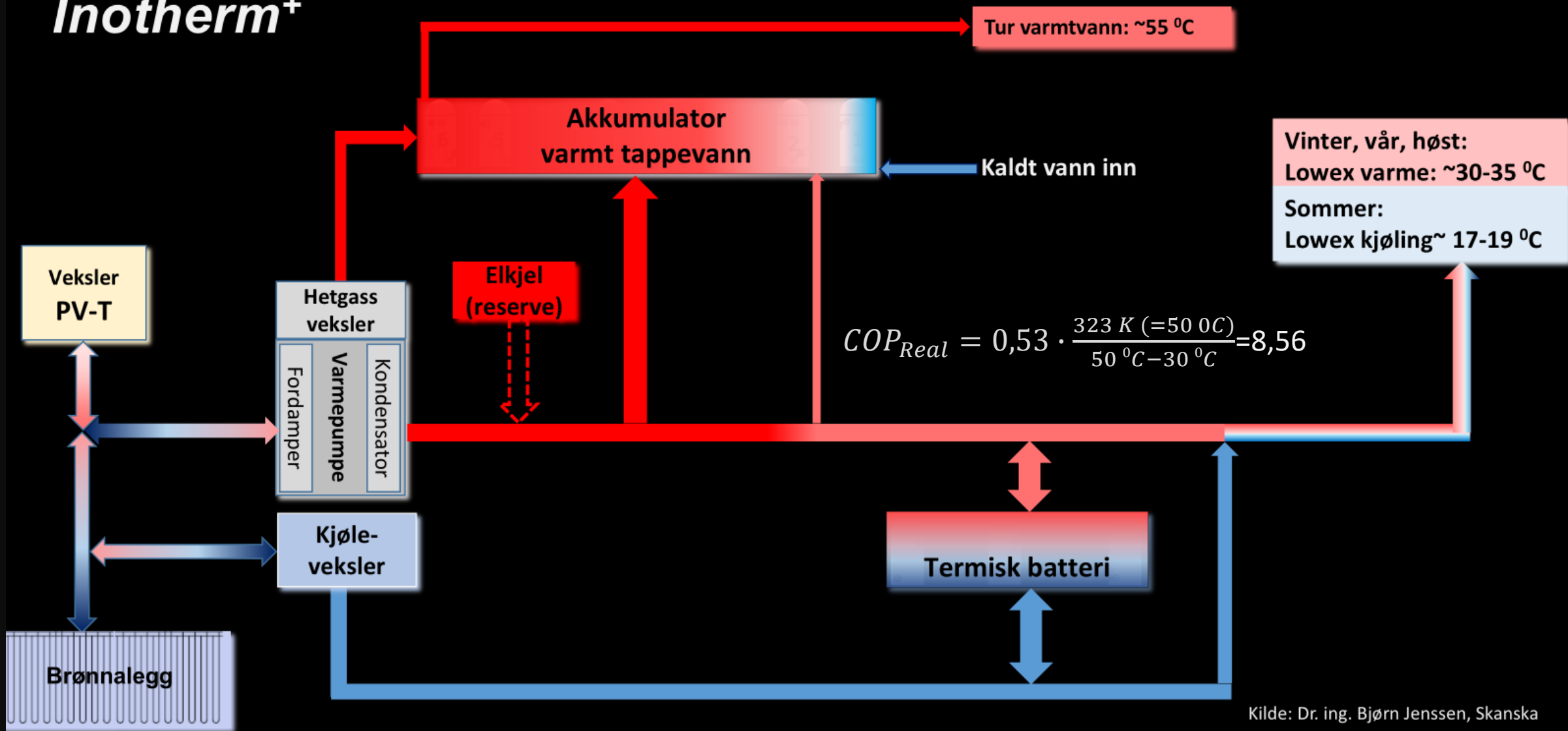
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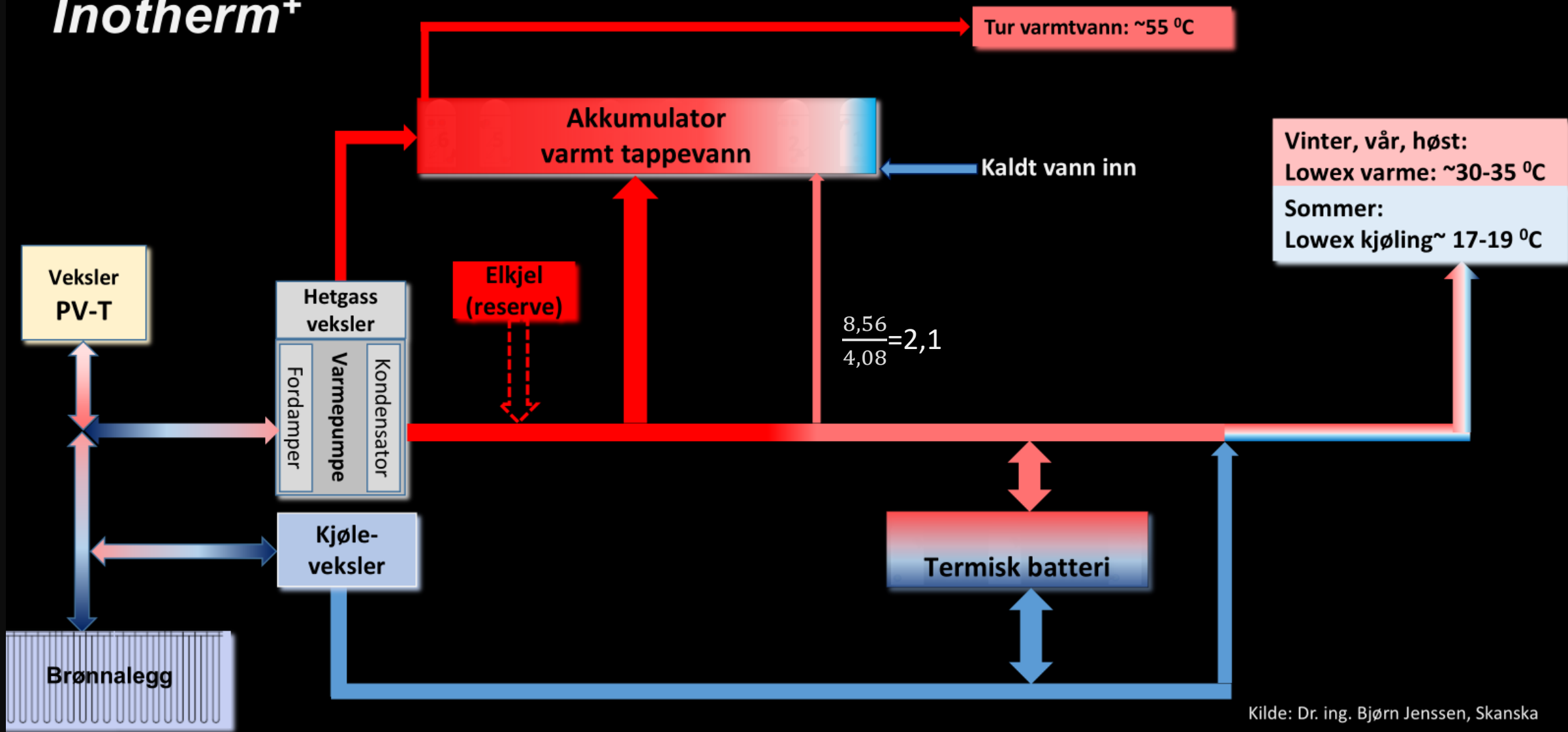
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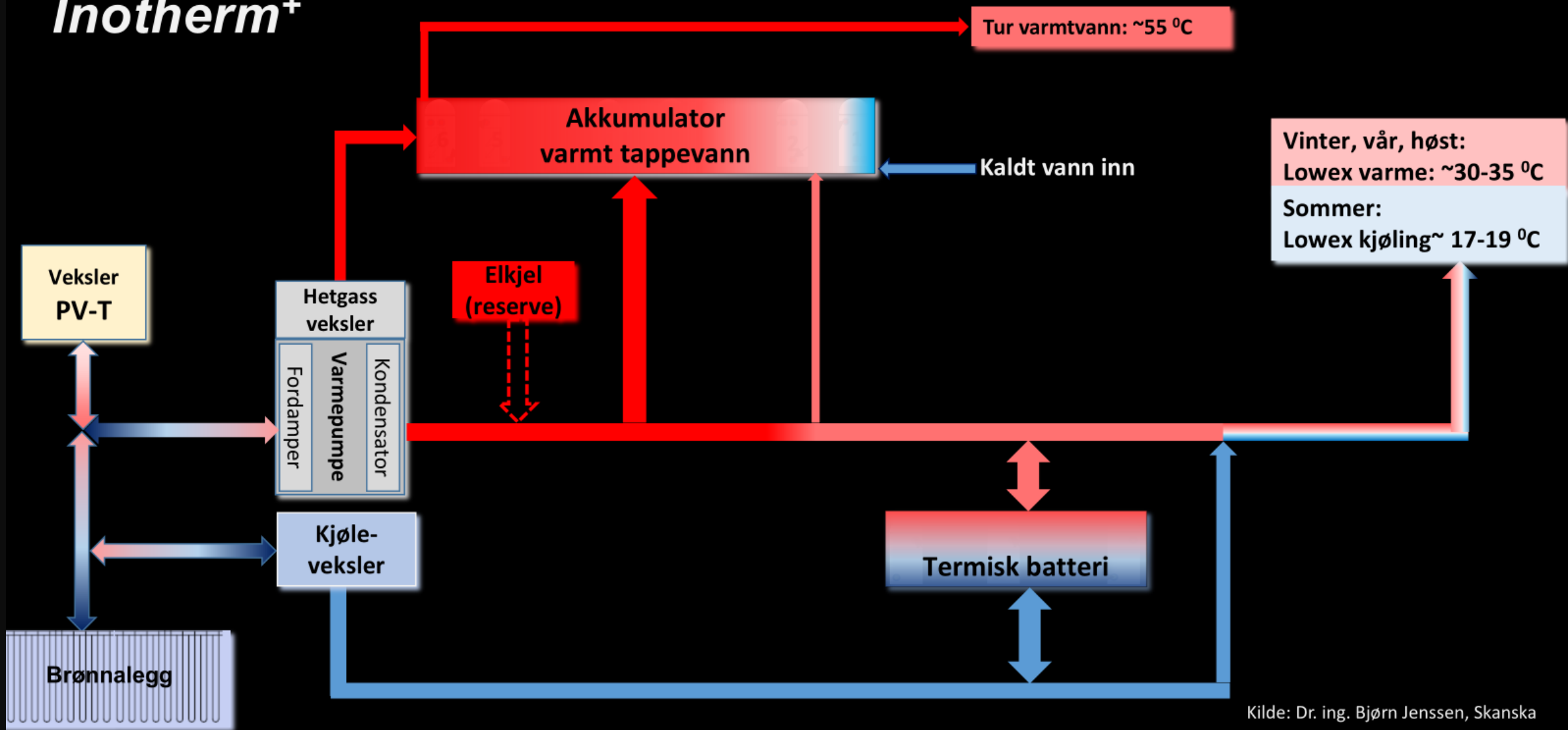
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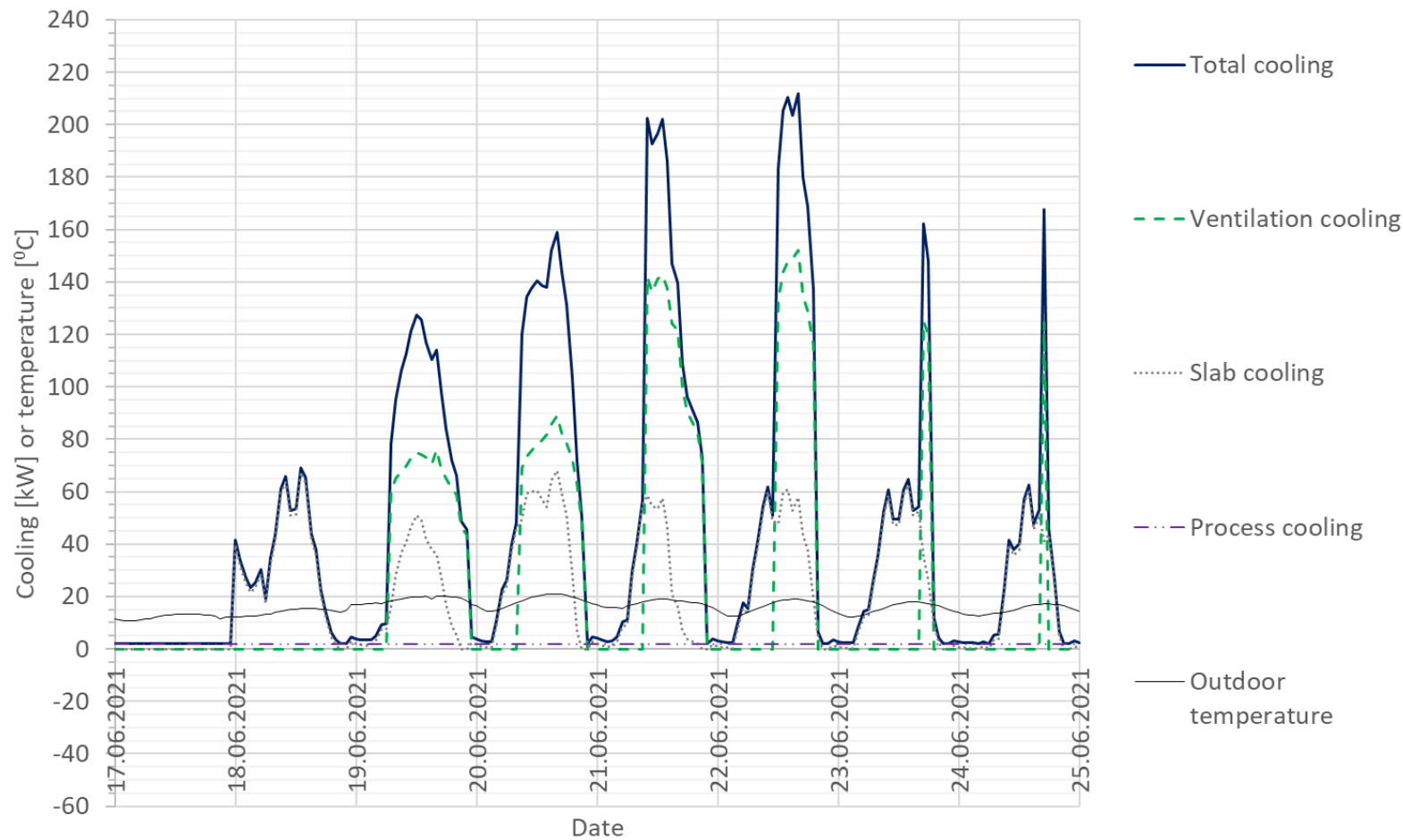
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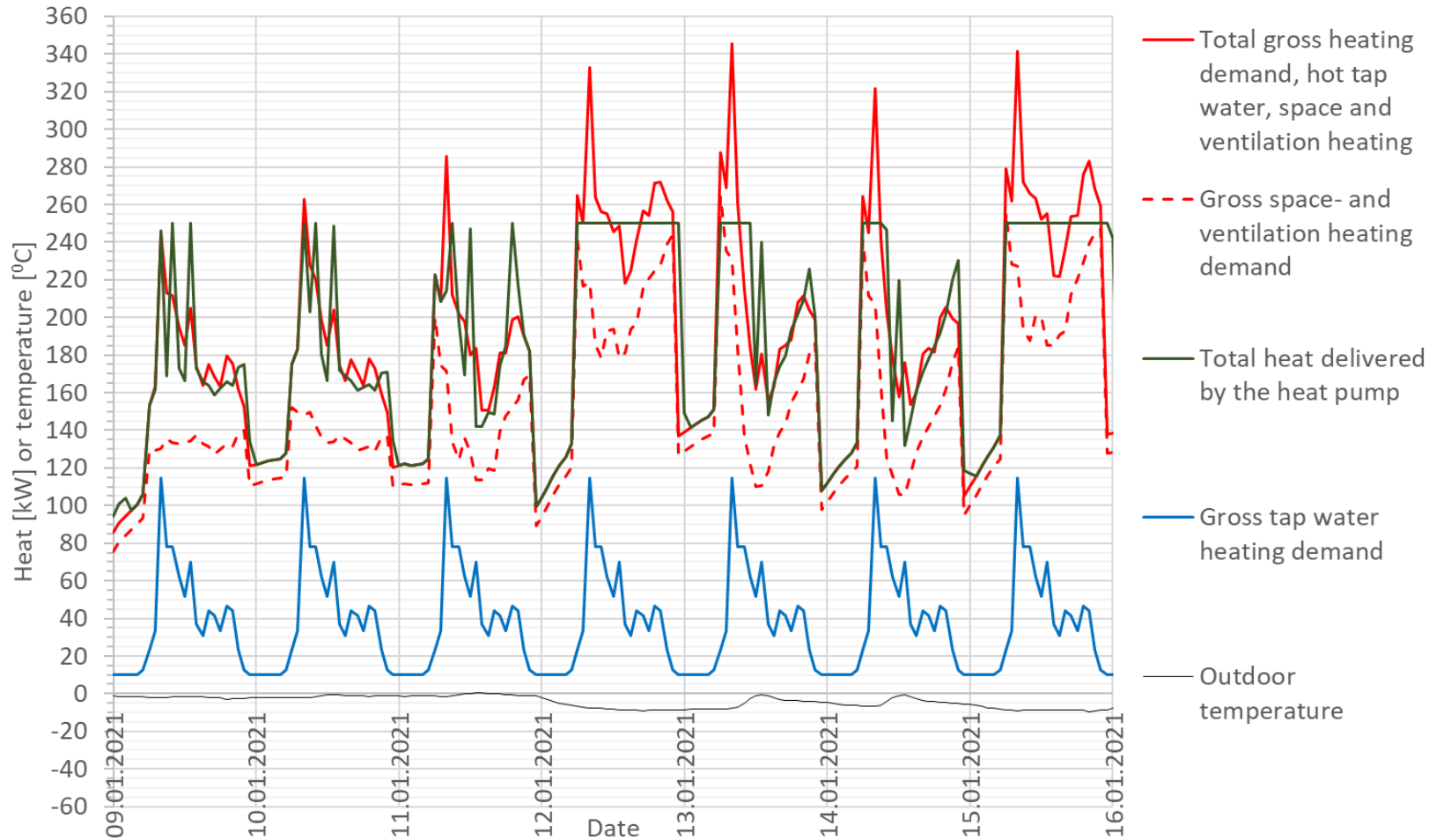


NOHL - Total cooling, typical warm and sunny summer week



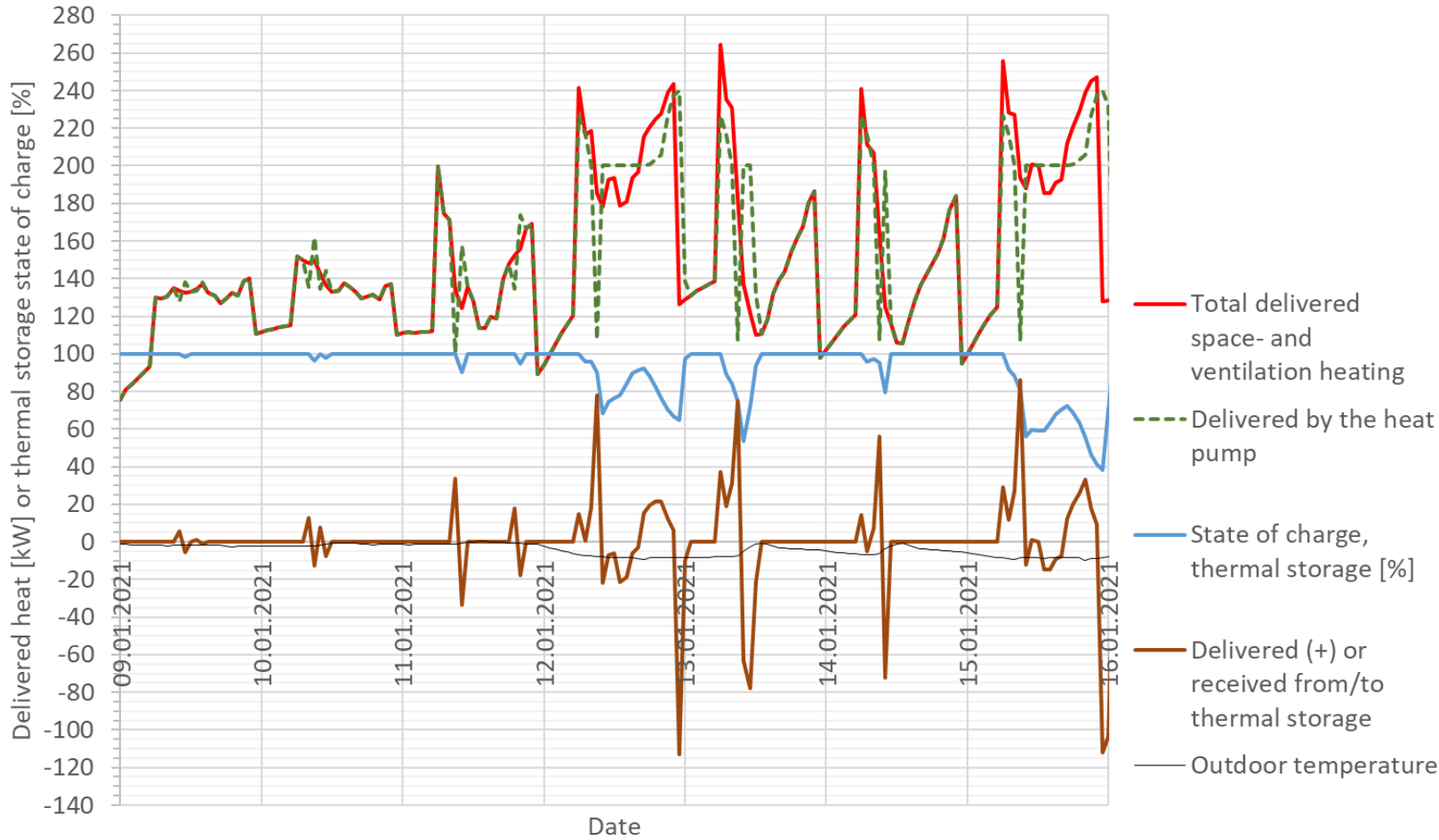


NOHL - Heating demand and heat pump production, building operation with load balancing control of building systems and EV-charging, typical cold winter week



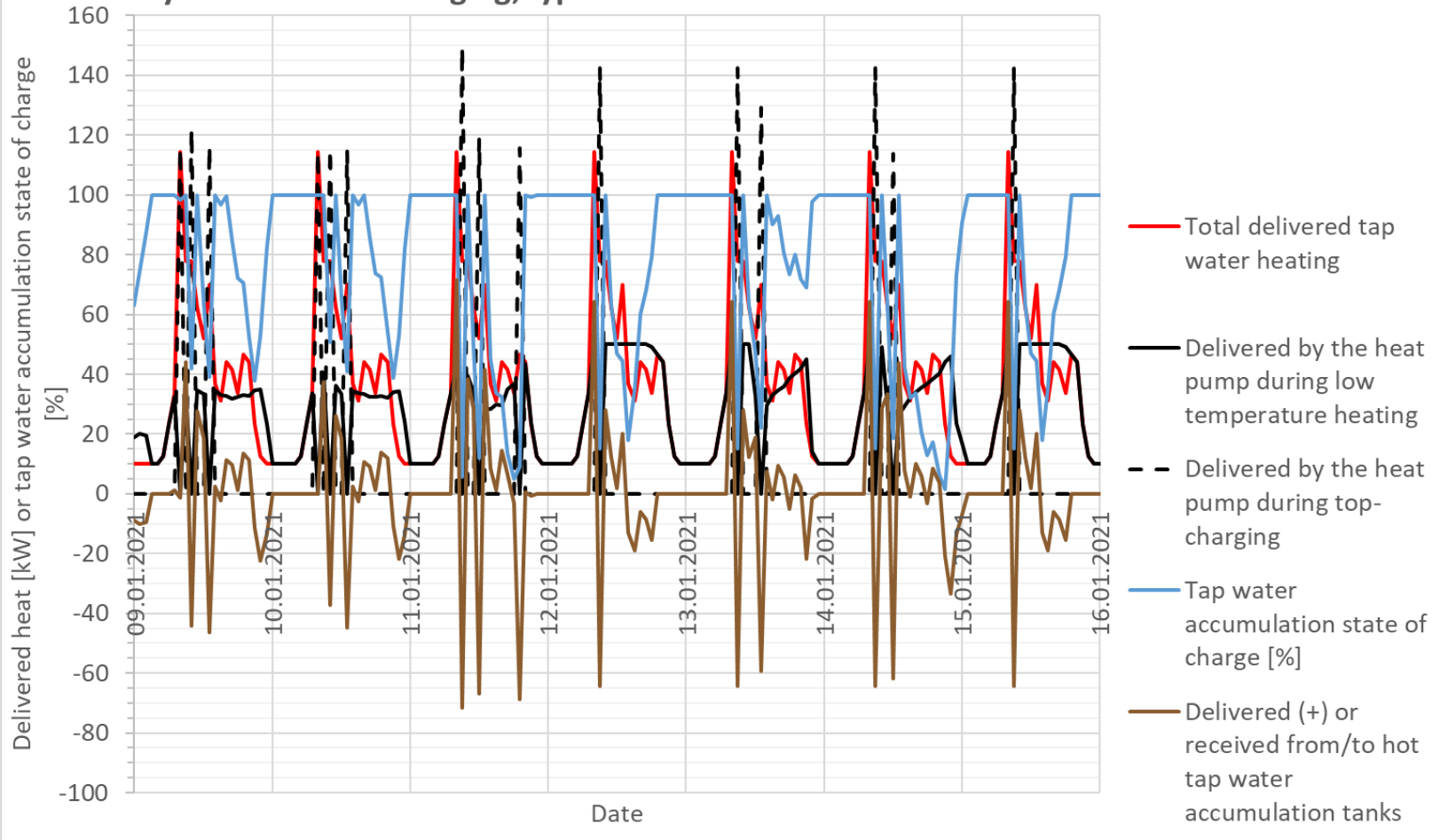


NOHL - Delivered space and ventilation heating with load balancing control of building systems and EV-charging, typical cold winter week

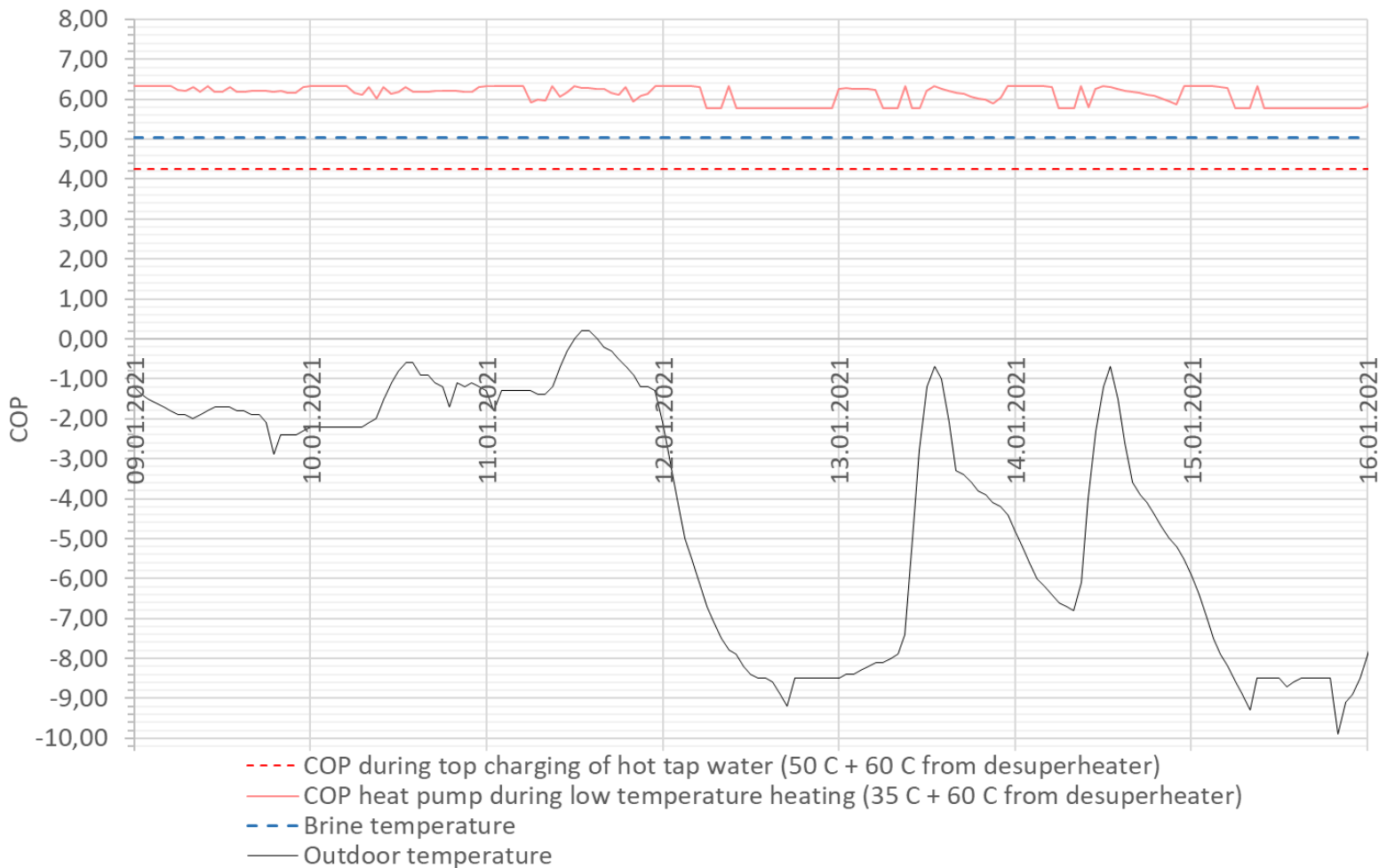




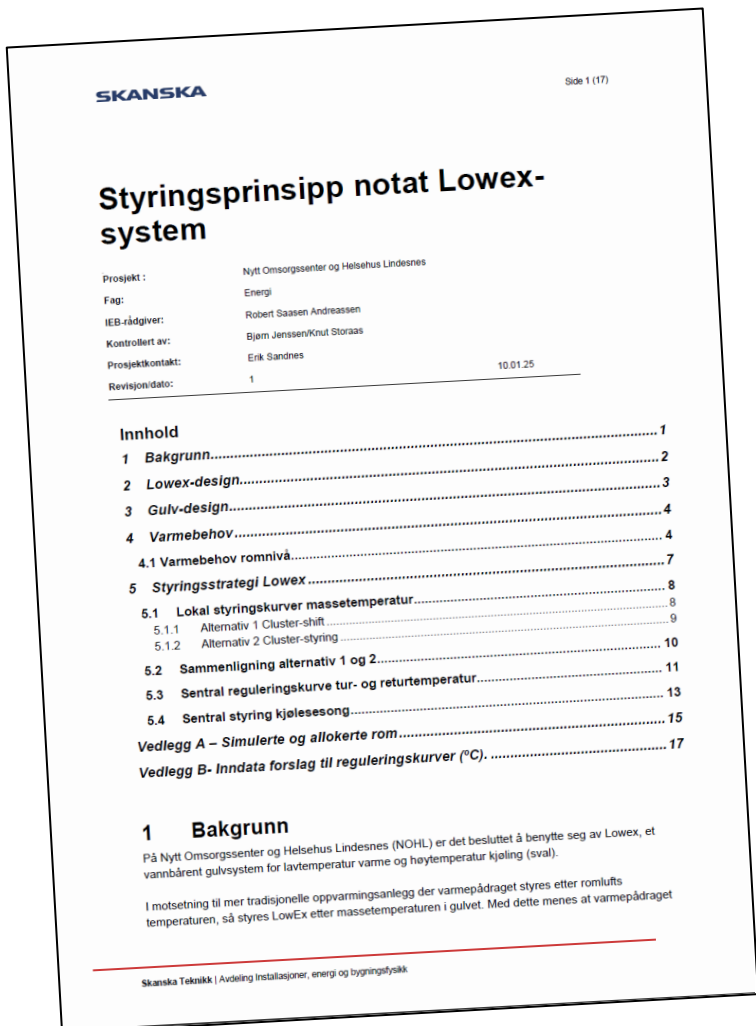
NOHL - Delivered tap water heating with load balancing control of building systems and EV-charging, typical cold winter week



NOHL - Calculated COP, typical cold winter week



Control system



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Peak shaving



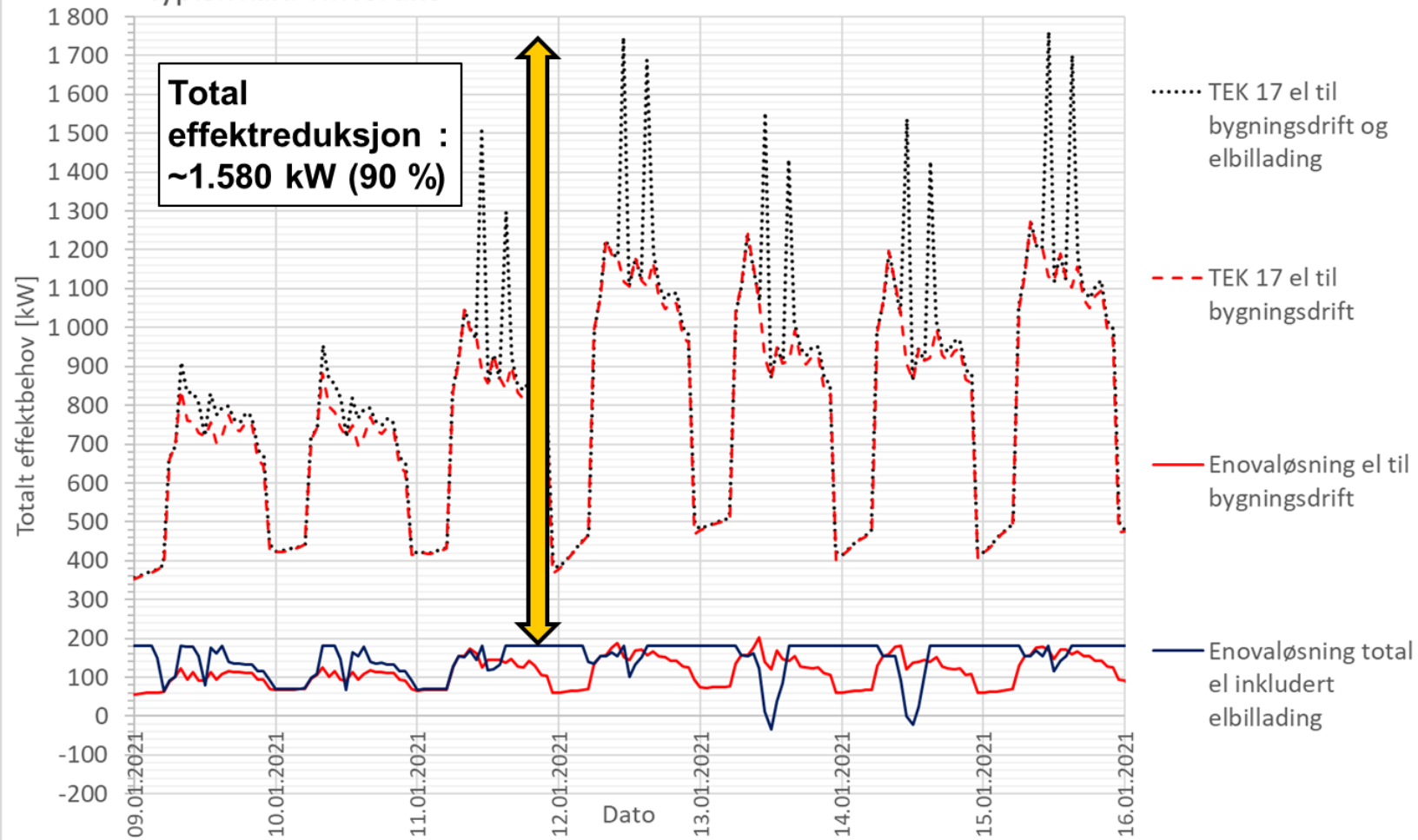
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KOMMUNE



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Peak shaving

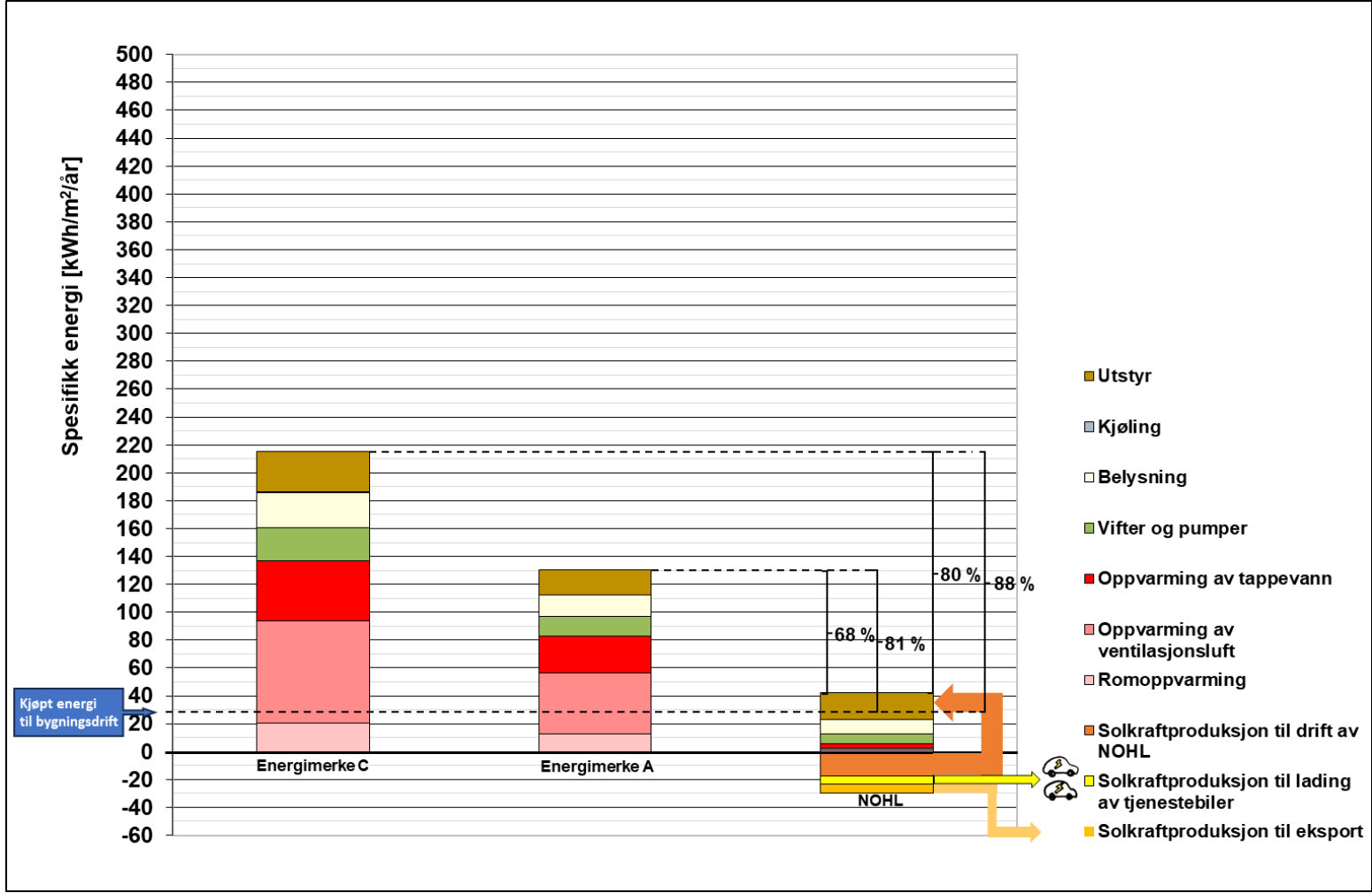
Nytt Omsorgsenter og Helsehus Lindesnes, TEK 17 referanse vs Enovaløsning, typisk kald vinteruke



Specific energy performance



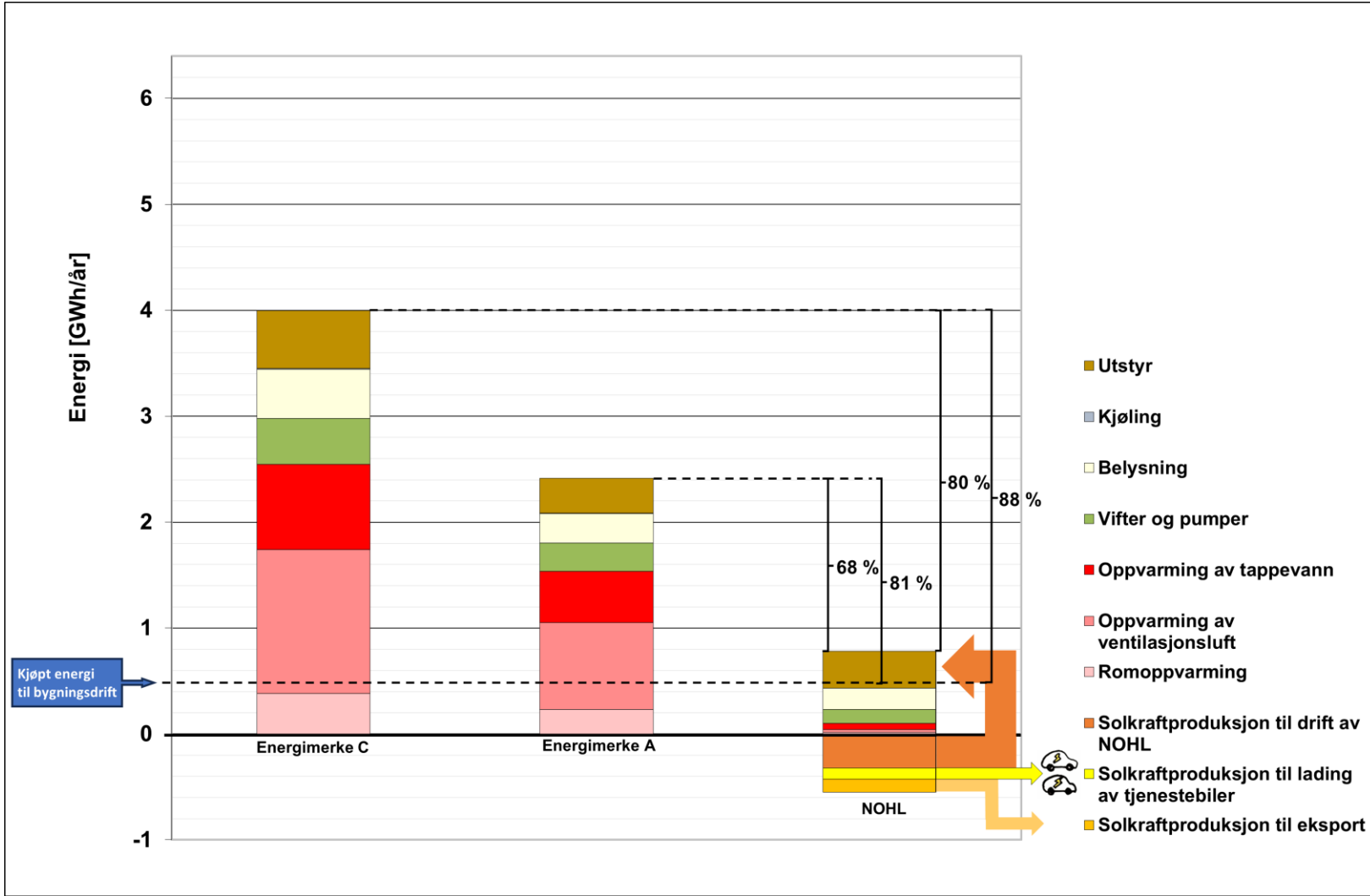
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Total energy performance



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El. use and emissions vs. district heating

