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30.08.2019, Sion

Going electric – Ambition to create the first electric region in Norway

Torstein Melhus, Director Market


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Our mission:
We provide clean energy
for a sustainable society
- now and in the future

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Key facts about Agder Energi

Key facts

Offices **five countries**

47 owned hydroelectric power stations in South of Norway

Norway's **fourth largest** producer of hydroelectric power

Operating revenue (2017): **10.221 million NOK**

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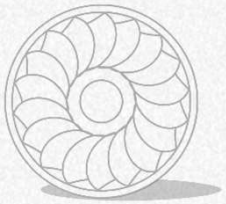
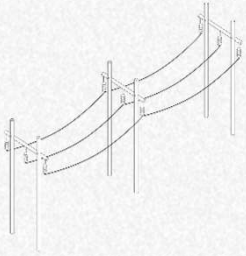
Our business



Hydroelectric power:
Operating and developing hydropower stations



Network:
Operating and developing the power grid

Energy Management:
Energy management and trading, flexibility

Marketing:
Electricity retailing, electrical engineering services, entrepreneur HV services, venture capital investments, district heating and cooling, EV-charging

Bottom-up revolution

- From sentral to decentral production
- From analog to digital
- From fossile to renewable
- From manual to machine learning

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In our area we have a power surplus of flexible and sustainable hydropower of (aprox.) 13 TWh.

That gives credibility to our ambition of beeing the first electric region in Norway.

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Establish a picture of status and potential in Kristiansand

Kristiansand kommune

Songdalen kommune

Søgne kommune

AUST-AGDER FYLKESKOMMUNE

Vest-Agder fylkeskommune

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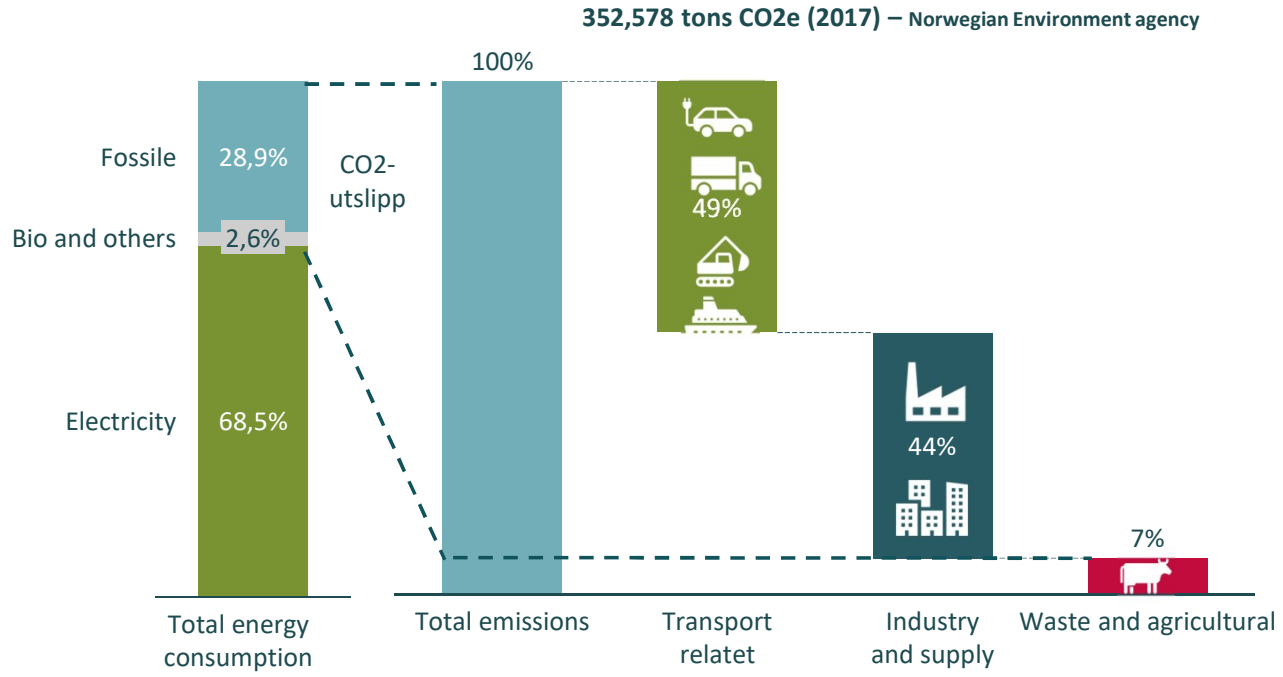
Status electrification - 2019

Possible areas to electrify - C02 red

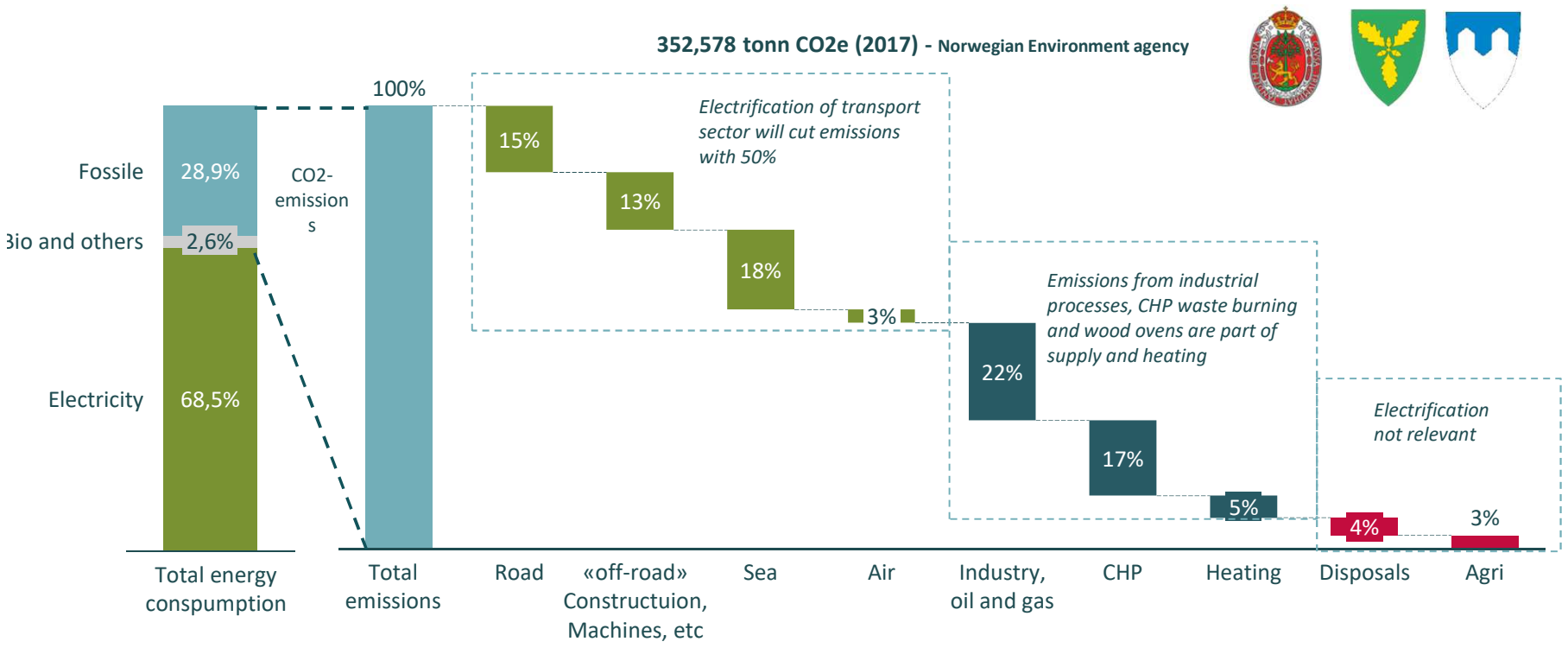
Actions/pilots to perform further electrification

OVERVIEW TOTAL ENERGYCONSUMPTION AND EMISSIONS IN KRISTIANSAND



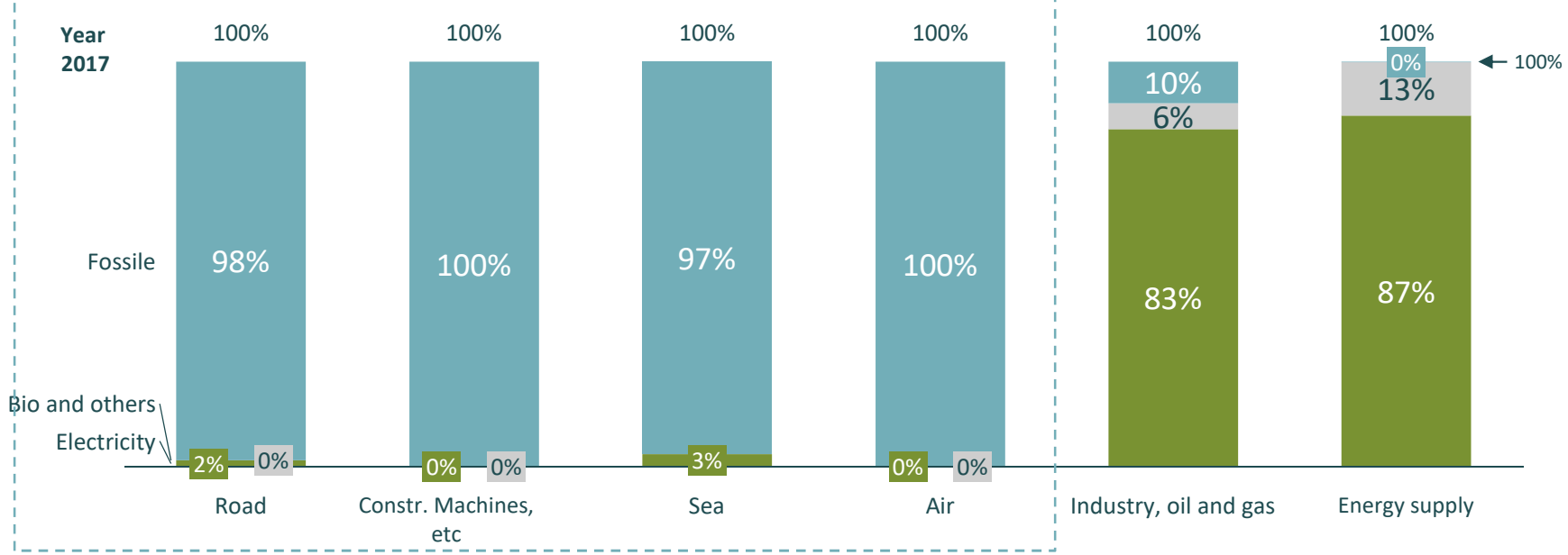
Source: SSB, Norwegian Environment Agency, THEMA Consulting Group

CURRENT ELECTRIFICATIONRATE IS 68.5 % IN KRISTIANSAND AND APPROXIMATELY HALF OF THE REMAINING EMISSIONS HAS POTENTIAL TO BE ELECTRIFIED!



Source: SSB, Norwegian Environment Agency, THEMA Consulting Group

ELECTRIFICATION-RATE PER CATEGORI WITHIN KRISTIANSAND SHOWS THAT TRANSPORT OG CONSTRUCTIONMACHINES ARE THE AREAS WITH HIGHEST POTENTIAL TO BE ELECTRIFIED



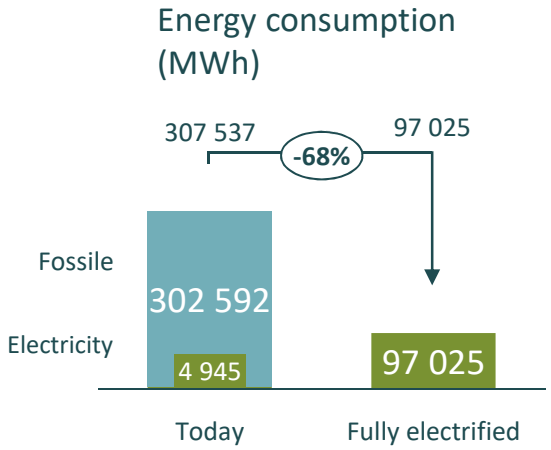
Source: SSB, Norwegian Environment Agency, THEMA Consulting Group, fjernkontrollen.no

** Statistics underestimates actual energyconsumption from ships in harbour, so elektrifiseringsrate might be lower*

Electric vs fossile fuel

ENERGYEFFICIENCY INCREASES DRAMATICALLY AND
VALUECHAINS WITHIN ENERGYDISTRIBUTION WILL CHANGE

Example category
Road



Source: SSB, Norwegian Environment Agency, THEMA Consulting Group

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Fædrelandsvennen Nyheter Sport Kultur Magasin Jon Anders Meny

Presenterer «grønt» Høyre-program: Vil at Kristiansand skal bli helelektrisk

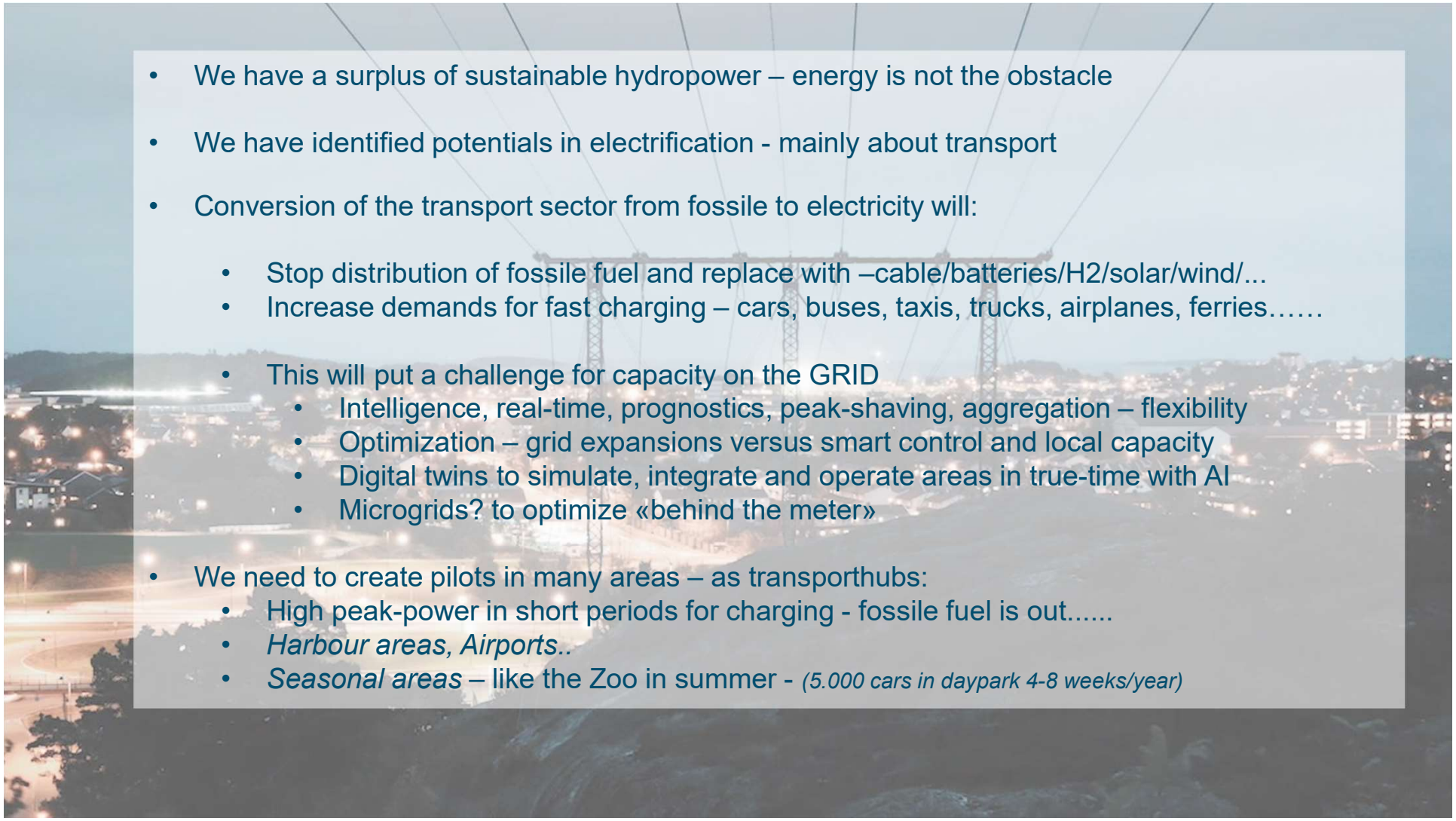
Når Høyre nå går til valgkamp fokuserer de på fem saker: skole, klima, omsorg, idrett, og redusert eiendomsskatt.

Eva Myklebust

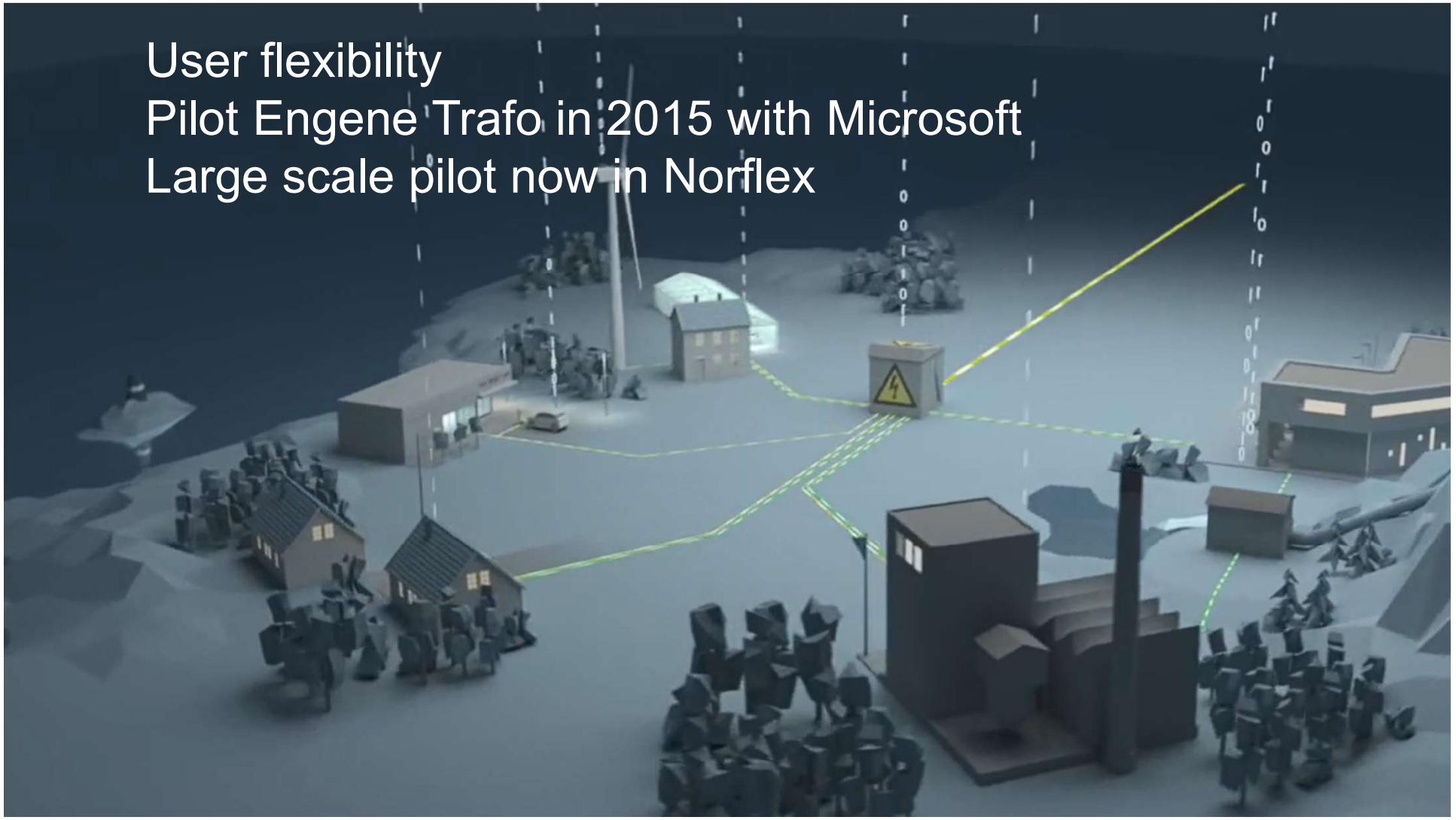
«Todays available technology is *not* the obstacle to solve the climate crisis. For the majority of us it's about changing our own habits. This might be a painful transformation. But I think we *are* willing to change our behaviour to make neccessary changes.»

Harald Furre, Mayor of Kristiansand

The Mayor:
Electric Kristiansand
A political aim



- We have a surplus of sustainable hydropower – energy is not the obstacle
- We have identified potentials in electrification - mainly about transport
- Conversion of the transport sector from fossile to electricity will:
  - Stop distribution of fossile fuel and replace with –cable/batteries/H2/solar/wind/...
  - Increase demands for fast charging – cars, buses, taxis, trucks, airplanes, ferries……
  - This will put a challenge for capacity on the GRID
    - Intelligence, real-time, prognostics, peak-shaving, aggregation – flexibility
    - Optimization – grid expansions versus smart control and local capacity
    - Digital twins to simulate, integrate and operate areas in true-time with AI
    - Microgrids? to optimize «behind the meter»
- We need to create pilots in many areas – as transporthubs:
  - High peak-power in short periods for charging - fossile fuel is out.....
  - *Harbour areas, Airports..*
  - *Seasonal areas* – like the Zoo in summer - *(5.000 cars in daypark 4-8 weeks/year)*


User flexibility
Pilot Engene Trafo in 2015 with Microsoft
Large scale pilot now in Norflex

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Kristiansand Harbour:
Established Europes largest shore-power 2018

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DHC from reuse – helps the power grid

Heating from:
CHP & Glencore
99% re-use wasteheat

Cooling from:
Cold, salt seawater
(intake 150m depth)

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Possible pilot - Kristiansand Harbour

Shore-power to Cruiseships

(8 MW/ship – 5 hrs)

Transport

Car, bus, taxi, truck …

Urbanizing

Electric ferries

Colorline, Fjordcat..

Microgrid?, Digital Twin, Flexibility market, H2, batteries, GRID:
Ideal area to start a pilot, *high peak-load/few hours usage*
Explore the challenges in capacity need, capacity build in grid, hydrogen as carrier, batteries vs grid, V2G....
Possible load in city to turn off periodically (aggregation/flexibility market)
Digital twin virtual model of Harbour (and city) for tru time simulation and control

Goal:
Make electrification smart
Reduce high investments in GRID with few hours use.
Optimize through digital infrastructure, processing of data in real-time and load-shifting to reduce peak-power

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Norway: Focus on electric airplanes for short distance routes

SATSER: Widerøe ønsker å utfordre Avinors om elektrifisert innenriksluftfart innen 2040. Foto: Gorm Kallestad / NTB scanpix

Widerøe fremskynder el-satsingen

- Hele flåten kan være elfly før 2030, sier konsernsjef Stein Nilsen.

Estimated >10MW charge/plain
From 2025 towards 2030

A challenge for Avinor
A challenge for the grid

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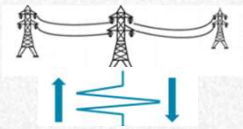
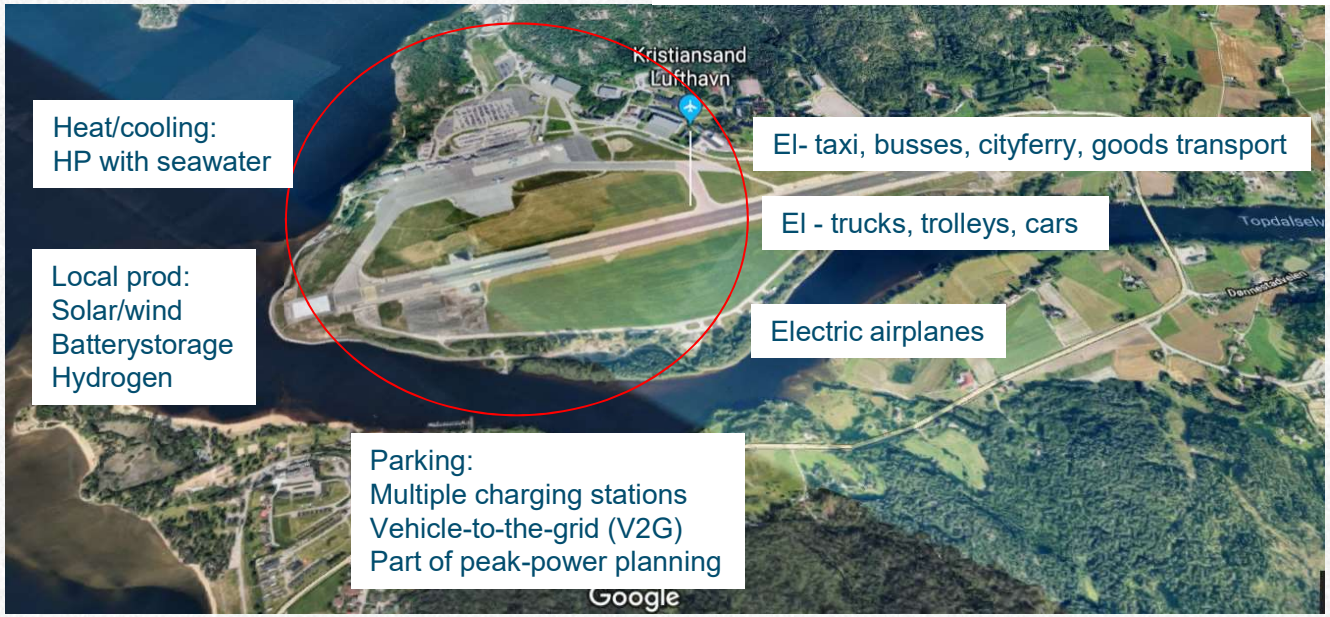
Kjevik Airport – possible pilotarea – not concluded

Optimization towards grid

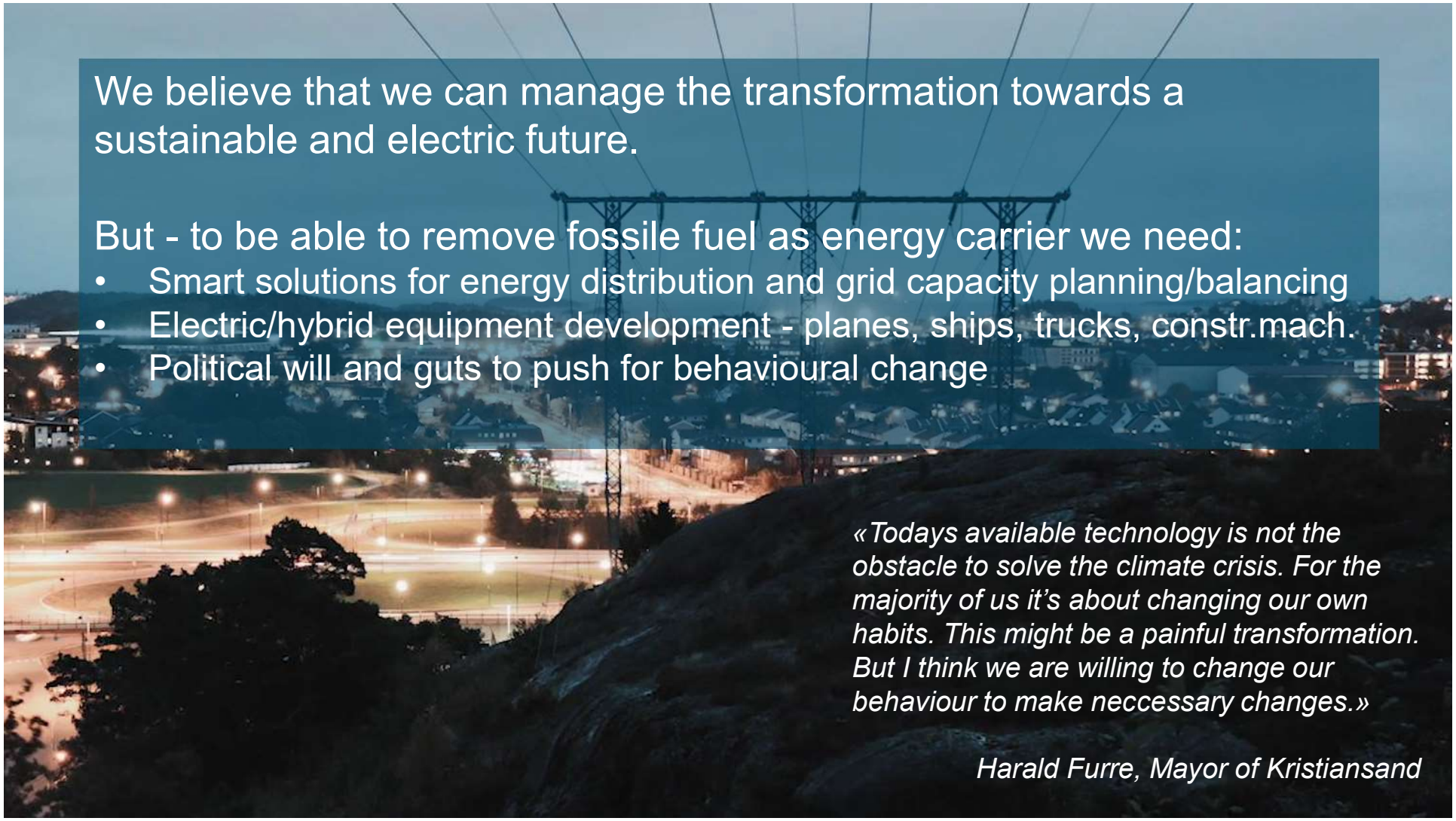


Planning of future peak-power demands
Aggregation, loadshift, balancing
In true-time connect production hydroturbine and usage Kjevik



Goal:
Reduce cost and investment in GRID/capacity through optimizing all users, producers and storage in, and around, the area.

Develop tomorrows regional, electric airport


We believe that we can manage the transformation towards a sustainable and electric future.
But - to be able to remove fossile fuel as energy carrier we need:
• Smart solutions for energy distribution and grid capacity planning/balancing
• Electric/hybrid equipment development - planes, ships, trucks, constr.mach.
• Political will and guts to push for behavioural change
«Todays available technology is not the obstacle to solve the climate crisis. For the majority of us it's about changing our own habits. This might be a painful transformation. But I think we are willing to change our behaviour to make neccessary changes.»
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