



— 70 years —
1950-2020

PORTS AS ZERO-EMISSION ENERGY HUBS – OPPORTUNITIES AND CHALLENGES

Sigrud Damman, Senior Research Scientist
Technology Management
SINTEF DIGITAL

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- User partners

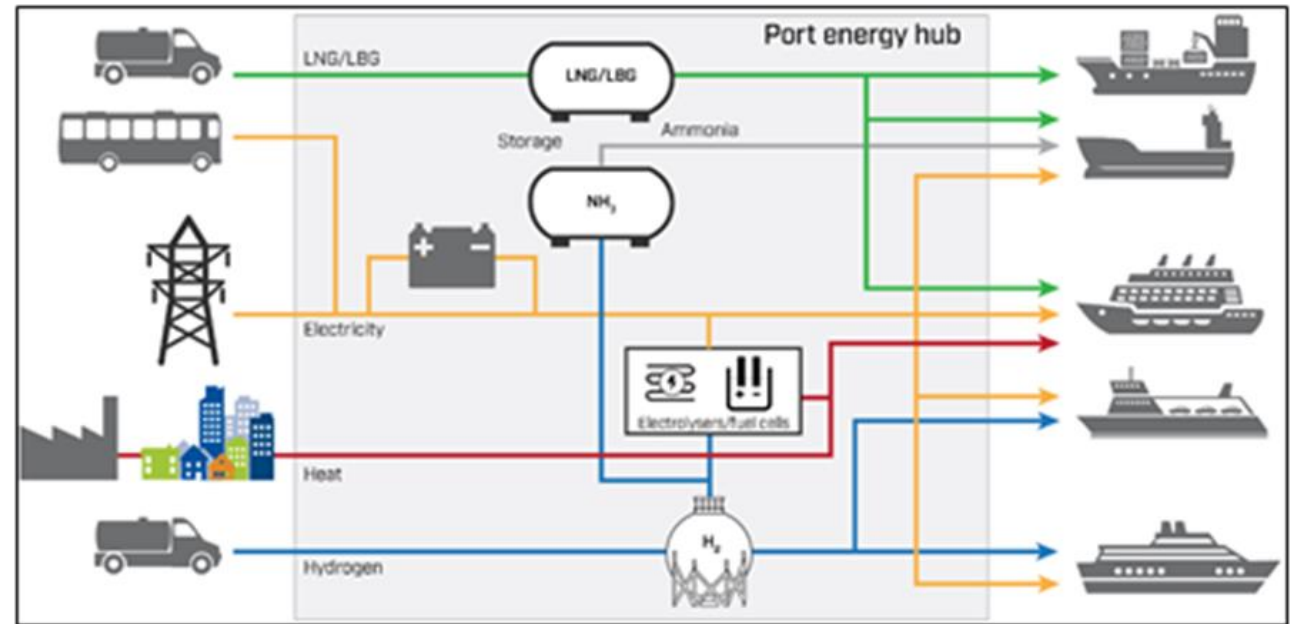


- Research partners



Zero-emission energy hubs – what do we mean?

- Interface
- Complex interactions
- So far focus on technology, OPS
- Infrasytem intermediaries – may facilitate or hinder system change
- Changing roles



Zero emission ports by 2030?

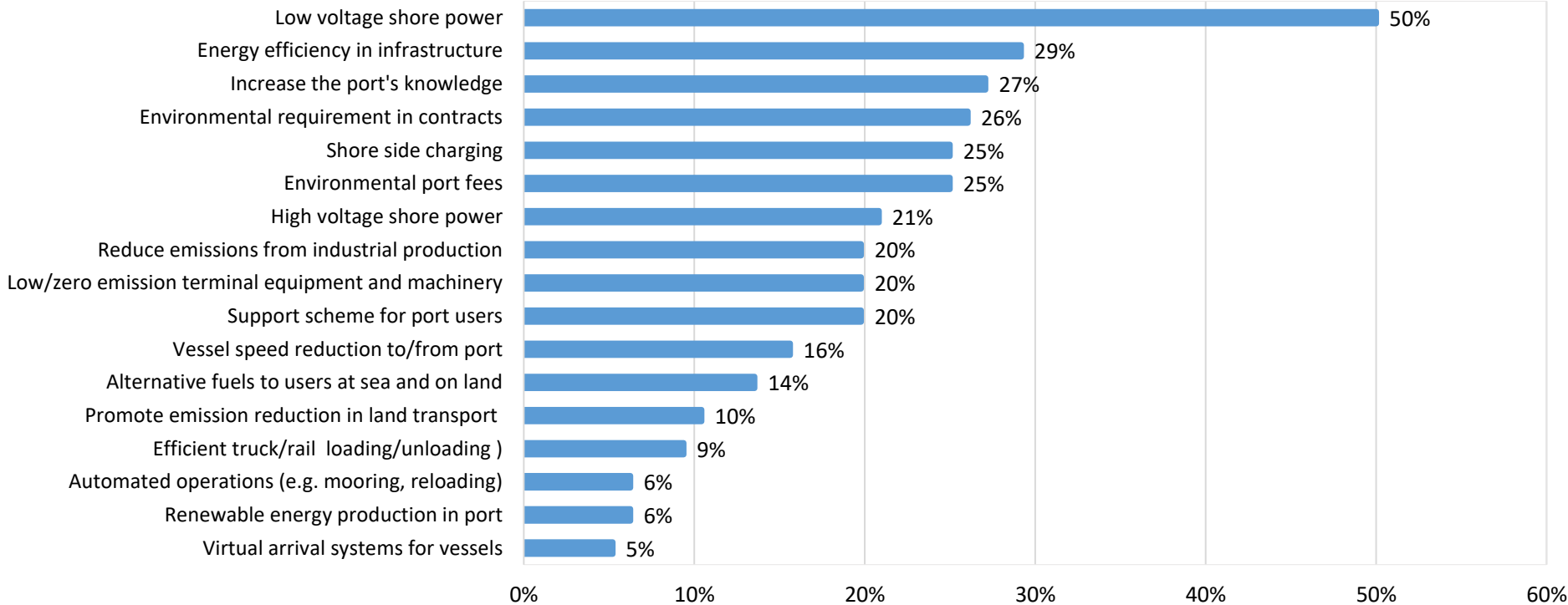
Drivers

- Future energy scenarios
- Int. climate policies
 - EU: CEF, AFID Directive, GREEN DEAL
- IMO 2050 target: 50% reduction
- National climate strategy
- National action plan for green shipping
- National plan for infrastructure for alternative fuels in transport
- Ambitions of the maritime industry
- Transition potential linked to hydrogen

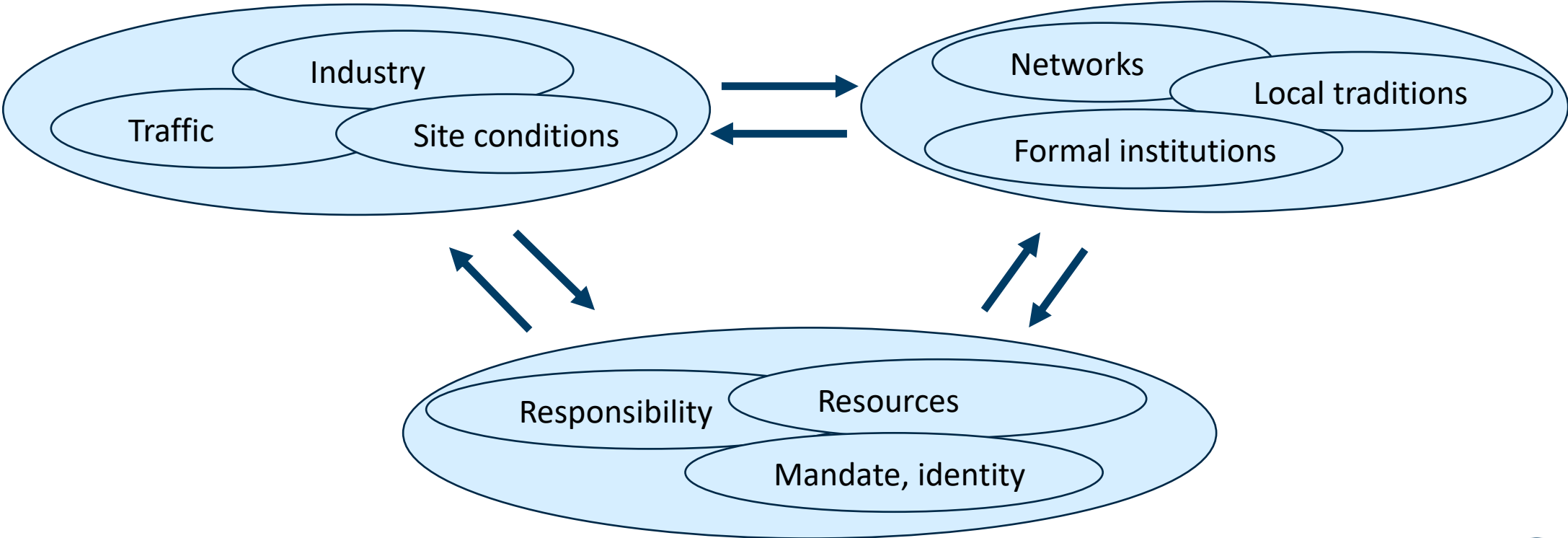
Barriers, uncertainties

- Voluntary vs. required use of OPS
- Development of standards
- Licencing and tariffs for establishment and operation of high voltage el facilities?
- Technological uncertainties; storage/batteries, production, storage & distribution of hydrogen and/or ammonia, fuel cells
- Fear of lock-in to costly infrastructure
- Degree of system thinking, framework conditions for sea vs. road transport

Measures implemented in Norwegian ports (2020)



Case study: Influence of contextual factors



Different 'energy hub' approaches

Nordkraft

Arctic Energy Ports

Port of Narvik
 Modal shift, int. corridors
 Multifuel station
 "Smart Narvik"
 Preproject OPS, bulk ships

Port of Oslo
 Broad, plan-based
 strategy (85% cut by
 2030)
 OPS and charging,
 biofuels etc.
 Sydhavna concept

Port of Kristiansand
 Technol. orientation
 electrification
 OPS (incl. Cruise),
 solar power
 Batteries, H2, LNG

Hafslund Eco

Agder Energi

Port of
 Tromsø, OPS,
 Arctic Energy
 Ports

Bergen
 OPS
 Plug

Eigersund
 Næring og Havn
 Energy
 Innovation
 export/import
 of green energy

Ålesund
 OPS, Plug

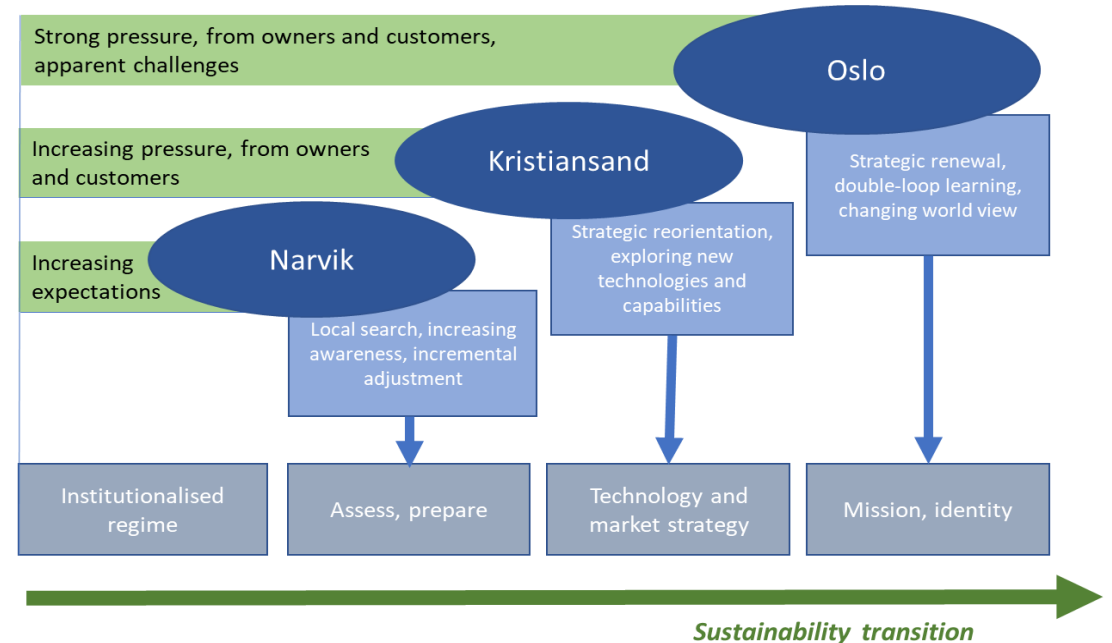
Borg Havn
 Industry
 cluster, CF

Karmsund Havn
 "Intelliport",
 Havnekraft,
 largest OPS for
 cruise in Europe
 2022

Stavanger-
 regionen
 Elnett21
 Grid, airport,
 industry, smart
 integration
 Smartly

Different roles and impacts

- Ports utilizing full spectre of roles or functions
 - as regulators, operators, landlords, "community managers"
 - according to the opportunities and limitations in the given context
- Direct and indirect impacts
 - emission reductions
 - sector coupling and flexibility
 - sustainable enterprise development
 - facilitating transition, reorientation in the sector



Opportunities and challenges

- Take the inherent complexity and contextuality of ports as a starting point
- Reducing port emissions vs. reducing transport emissions
 - Afry 2020*: Estimated climate gas emissions at port around 370.000 tons, or 6% of total estimated emissions within Norwegian waters
- Much focus on technology implementation – ports' role as intermediaries, community managers also very important
- Optimise ports' interaction with other system actors
- How to strengthen coordination, foster system thinking?