

HyNor

- the hydrogen road of Norway

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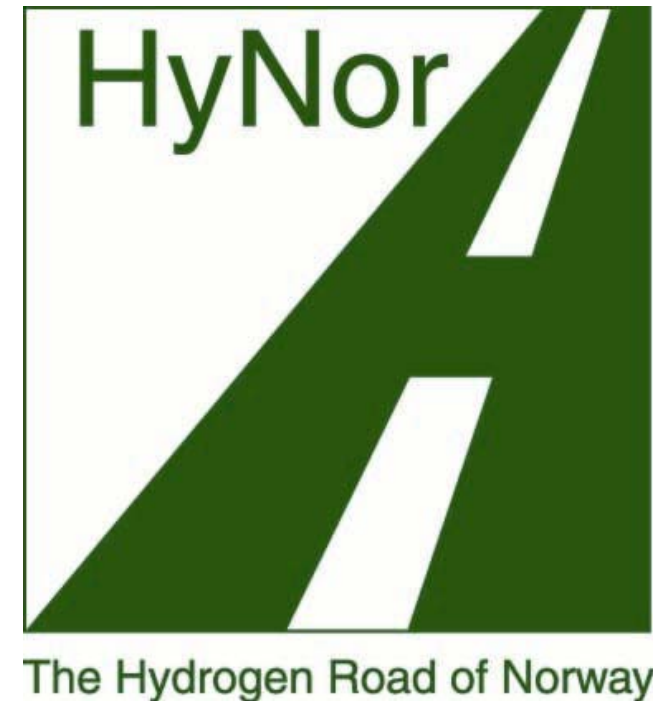


HyNor – short history

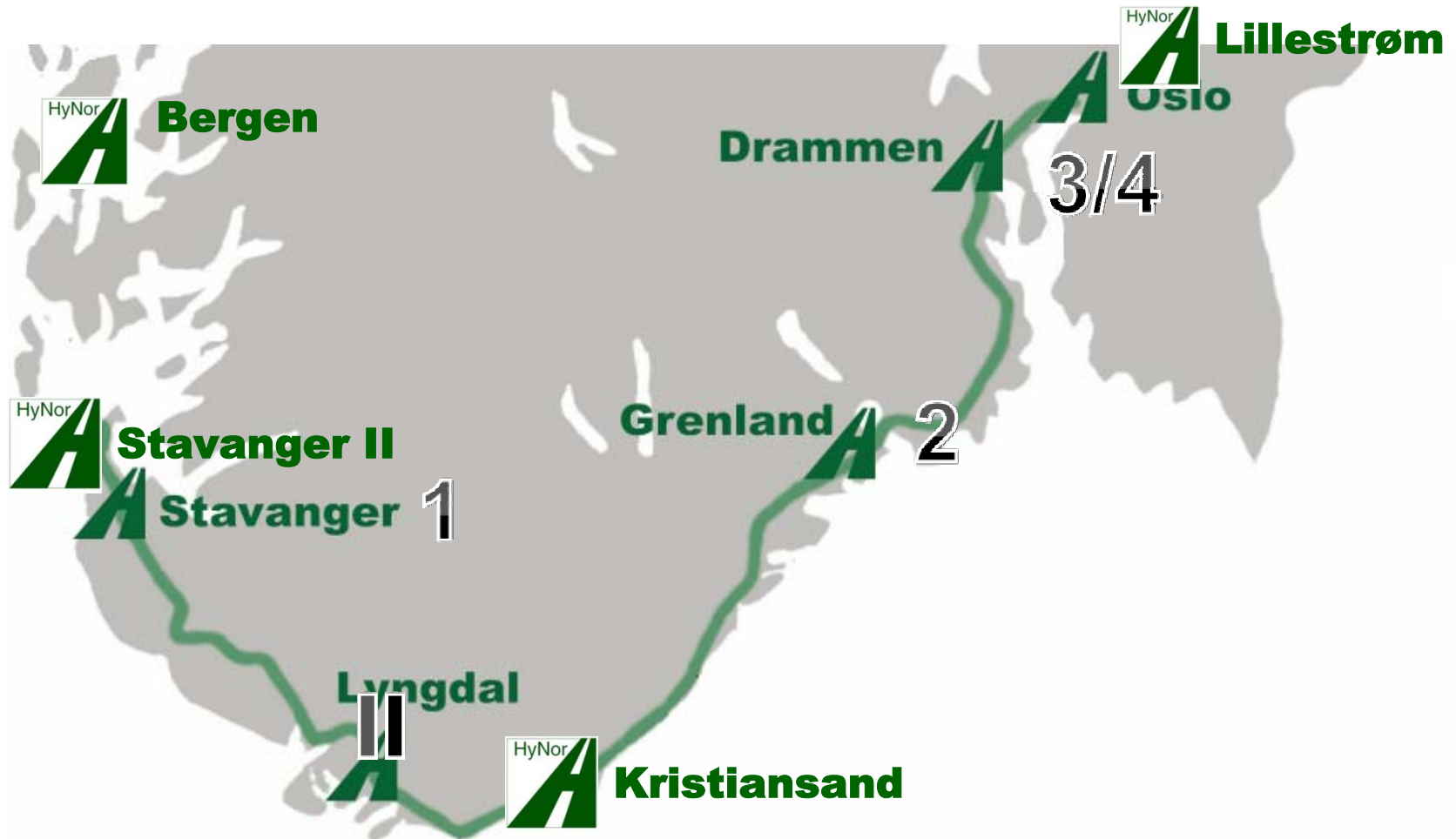
- Initiative started in 2003
- Objective: broad market demonstration of hydrogen for transportation in Norway
- Vision:

“In 2009 it shall be possible to drive hydrogen fuelled vehicles between Stavanger and Oslo ”

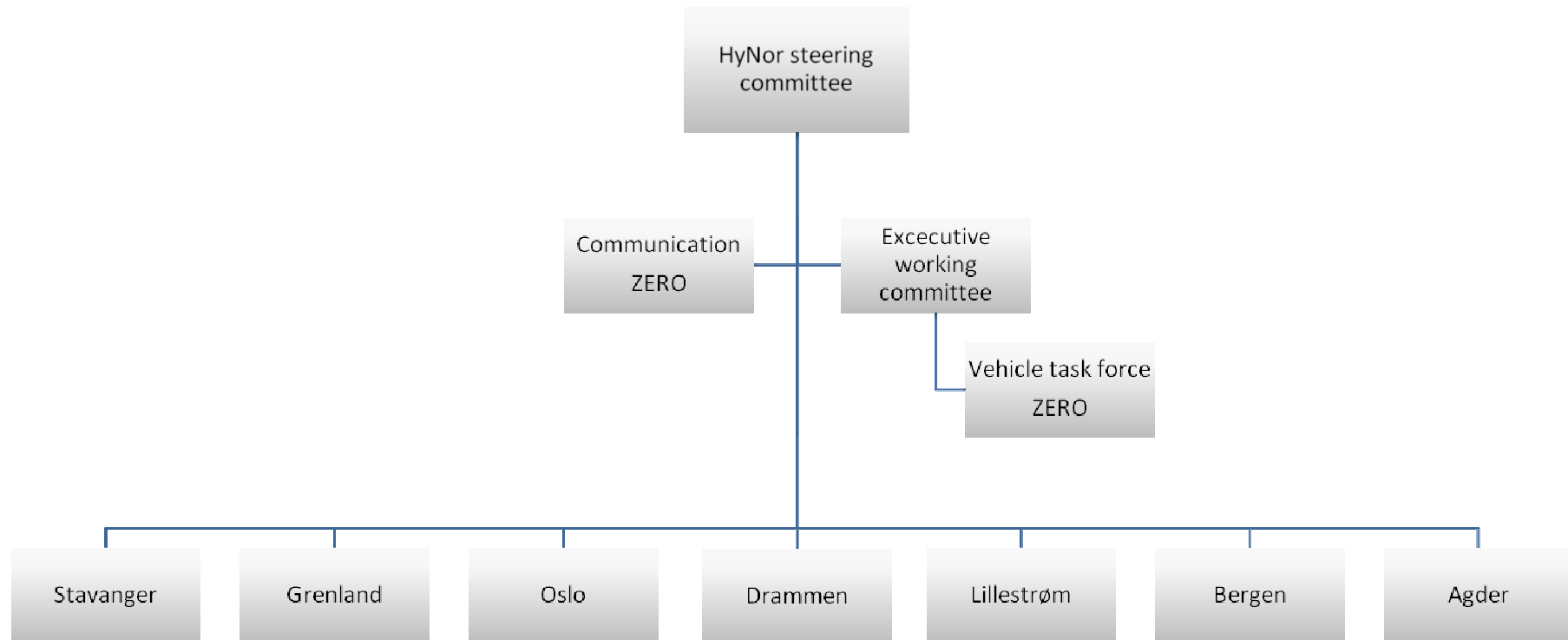
- A number of nodes along the road identified as locations for filling stations
- Public-private partnerships
- StatoilHydro strong driver for hydrogen implementation



The HyNor nodes



Organizing things



Approach – integration into retail

- All hydrogen stations are open to the public and/or integrated into a public filling station
- High visibility – people get used to having it around
- High focus on safety
 - At and around dispenser
 - While filling
 - Emergency response plans
- Payment – based on card payment at dispenser
- Learning, training and systematic HSE and quality work needed
 - Operators of station
 - Local fire and police department



HyNor Stavanger – Norway's 1st hydrogen station



- Opened August 2006 as an integrated part of a petrol station
- Hydrogen, Hythane (8% H₂ in Natural Gas) and Natural Gas
- Start-up with trucked in hydrogen
- Upgraded to 700 bar technology in 2009

HyNor Grenland



- Opened in 2007
- Next to StatoilHydro research centre at Herøya, Grenland
- Directly linked to large scale hydrogen production, scalable solution
- Possibility for supply and back-up for other HyNor stations
- Underground storage, 150kg @ 400 bar, high pressure tanks submerged in liquid
- Hydrogen delivered at 350 and 700 bar

Opening of HyNor Oslo + Drammen, May 11th 2009



HyNor Oslo and HyNor Drammen concept



- Filling station concept developed by StatoilHydro – working on commercialization
- Moveable solution
- 350 and 700 bar fillings, 2-nozzle dispenser
- Storage: 46 kg @ 900 bar, 34 kg @ 200 bar
- Room for electrolyser at station

Vehicle fleet in the HyNor project



15 Toyota Prius
 Converted to ICE Hydrogen
 by Quantum (US)
 Range: 170 km



5 Think Hydrogen
 10kW FC (range extender)
 Total range: 250 km



10 Mazda RX-8
 Delivery in 2009/2010
 Flexifuel wankel engine
 Range: 100 km H₂,
 50 km gasoline



More cars + buses
 Other car manufacturers
 have expressed interest in
 testing their H₂-cars in HyNor

 Ongoing work with acquiring a
 number of buses to 2011

Objective achieved?

HyNor phase II, 2010 - 2015

- Focus on market, diversity and adapting infrastructure
- Strengthen cooperation with neighbour countries and other projects
- Making the hydrogen road longer, but also “thicker”
 - New filling stations
 - More vehicles
 - Hydrogen buses
- Maintaining HyNor’s attractiveness for large scale testing of hydrogen vehicles
 - Clusters of stations
- Repeating this year’s success of the Viking Rally



HyNor phase II – new stations

• HyNor Lillestrøm (2010)

- Located 20km north of Oslo, close to IFE
- Grid-connected PV & PEM-electrolyzer
- Bio-hydrogen via Sorption Enhanced Steam Methane – Reforming (SE-SMR)
- Thermal Sorption Metal Hydride Compression

• HyNor Bergen (2011)

- ZEGPower concept
 - Solid oxide fuel cell coupled with SE-SMR

• HyNor Stavanger II (2011)

- New filling station at Risavika pier, Norway's biggest harbour
 - On-site natural gas reforming
 - Hydrogen utility vehicles

• Lyngdal and Kristiansand (hopefully 2011)

- Need of a hydrogen station to cover HyNor road stretch between Grenland and Stavanger





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SHHP: the road to Europe



Building a network of hydrogen stations



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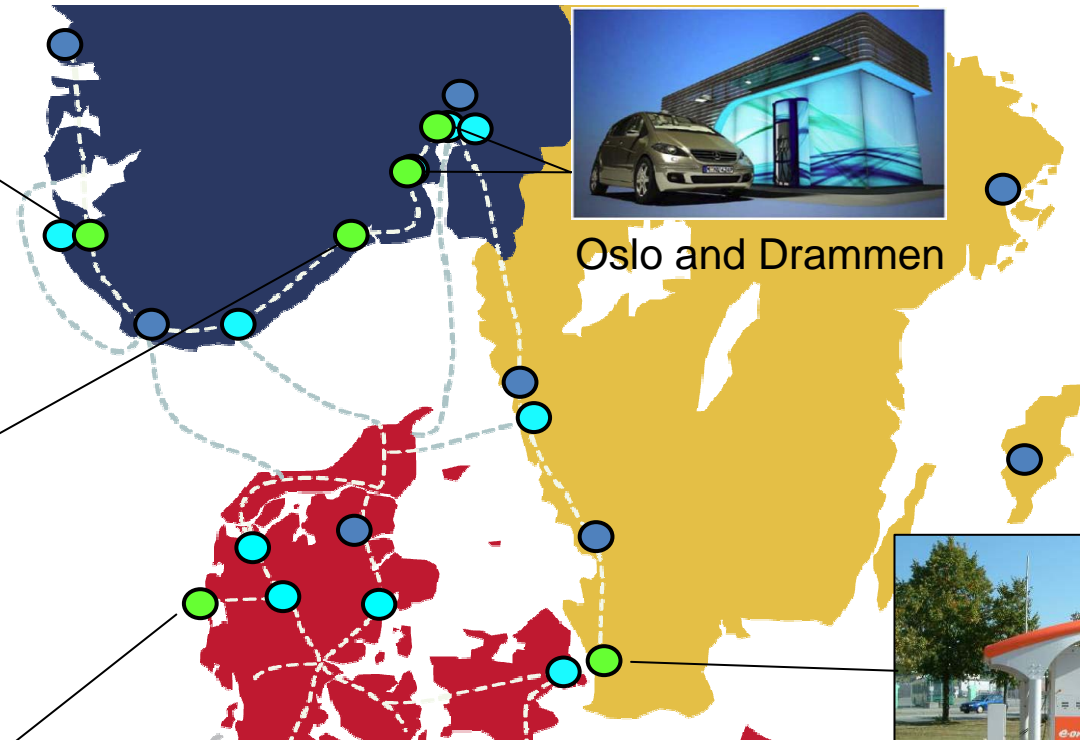
Stavanger



Porsgrunn (Grenland)



Ringkøbing



Oslo and Drammen



Malmö

- 6 stations are opened
- 8 planned for 2010/2011
- 8 sites under evaluation

Questions?

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