Status: Draft

HyNor and Scandinavian Hydrogen Highway Partnership

NWV 6th National Hydrogen Congress
11 December 2008 Arnhem

Hilde Strøm

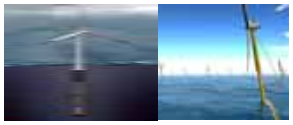
Business Development Manager Hydrogen, New Enery Dpt.

StatoilHydro

Agenda

- About StatoilHydro Hydrogen
- HyNor – The Hydrogen Road of Norway
- Scandinavian Hydrogen Highway Partnership

New energy portfolio



Wind

Biofuel

Tidal

Wave

CCS

Hydrogen

Energy systems

Kyoto CDM/JI

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Developing Hydrogen as an energy carrier

- Participating in market preparation activities
- Developing Hydrogen as a vehicle fuel
- Developing Renewable Hydrogen Systems
- Developing technology for Hydrogen production and supply

StatoilHydro delivers hydrogen solutions for Europe

- **ECTOS/HyFLEET:CUTE**–
  Hydrogen station Reykjavik
- **CUTE/HyFLEET:CUTE** –
  Hydrogen station Hamburg
- **CEP Berlin**
  Hydrogen production Messedam
- **Utsira Wind-Hydrogen plant**
- **HyNor** –
  Grenland Hydrogen station
  Oslo, Drammen, Stavanger II

HyNor

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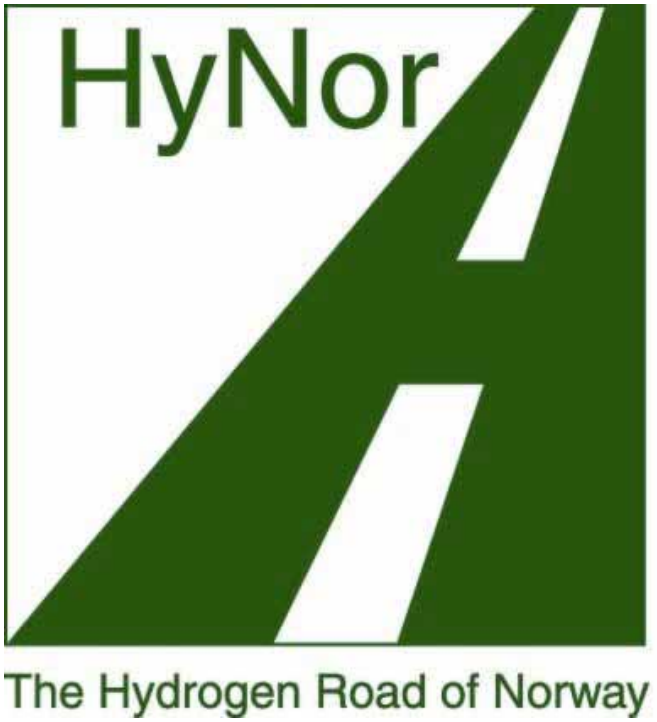
HyNor Objective

- The HyNor project was established in 2003 with the objective of a broad market demonstration of hydrogen for transportation in Norway, described by the following vision:

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

- This is to be achieved by establishing local nodes along the 580 km long road – ”The hydrogen road of Norway”



EVS Viking Rally 11-13 May 2009

- **The Event** A 570 km rally starting in Oslo the 11th of May 2009 and arriving two days later in Stavanger at the opening day of the 24 th Electric, Fuel Cell and Hybrid Vehicle Symposium

- **www. Evs24.org**

- The rally is also the official opening of the Hynor – The hydrogen road of Norway.

- **www.hynor.no**

HyNor: Public Private Partnership at work

- Introducing a new fuel requires a major co-operation effort
  - HyNor has more than 50 partners organised in the various nodes
- PPPs are needed in the early development phase
  - HyNor is a good example of successful implementation of PPPs
- Example Grenland:
  - *Partners in HyNor Grenland are:*
    University of Telemark, Zero Emission Resource Organisation, TelTek Institute, Miljøbil Grenland, Ineos (Hydro Polymers), Telemark County Municipality and StatoilHydro
    with vehicle partners: Quantum Technologies, Porsgrunn Municipality, Vekst i Grenland, Skagerak Energy, University of Telemark, Choice Hotels, Hydro and StatoilHydro
    and funding from Department of Transport via Norwegian Research Council together with industrial funding

The HyNor nodes

Bergen

Plans for station in phase II (2010)

H_2 from refinery by-product

Stavanger

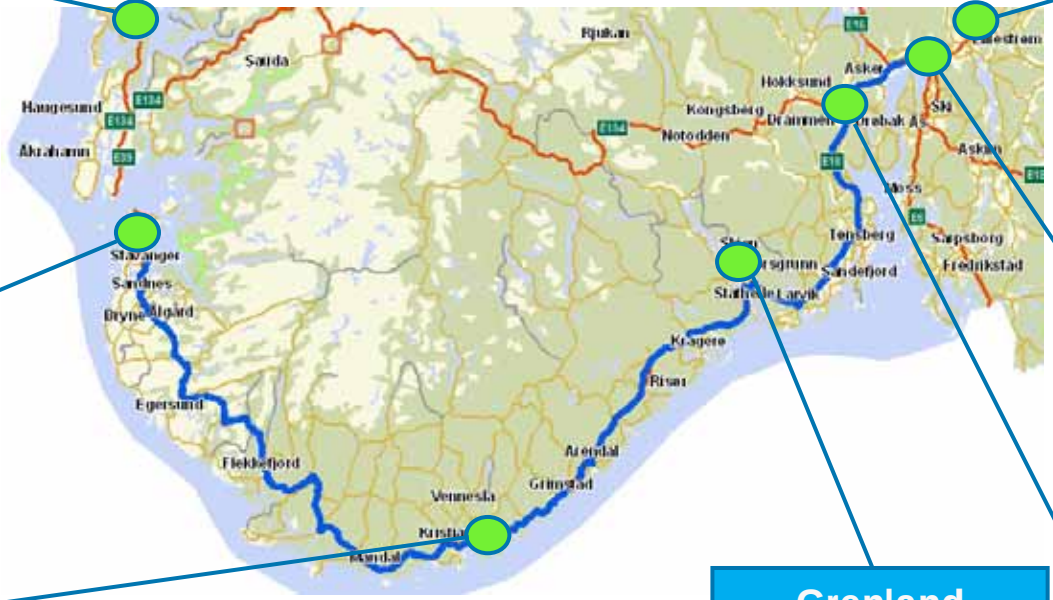
2006: trucked-in 2. station (3Q09)

H_2 from biogas reforming (3Q09)

Kristiansand

Trucked in hydrogen

By-product or electrolysis



Romerike

Plans for station in phase II (2010)

H_2 from electrolysis

Oslo

Car station (2Q09)
Bus station (4Q09)

H_2 from electrolysis

Grenland

2007: Pipeline supply

H_2 from by-product

Drammen

Trucked-in hydrogen (2Q09)

H_2 reformed from local landfill

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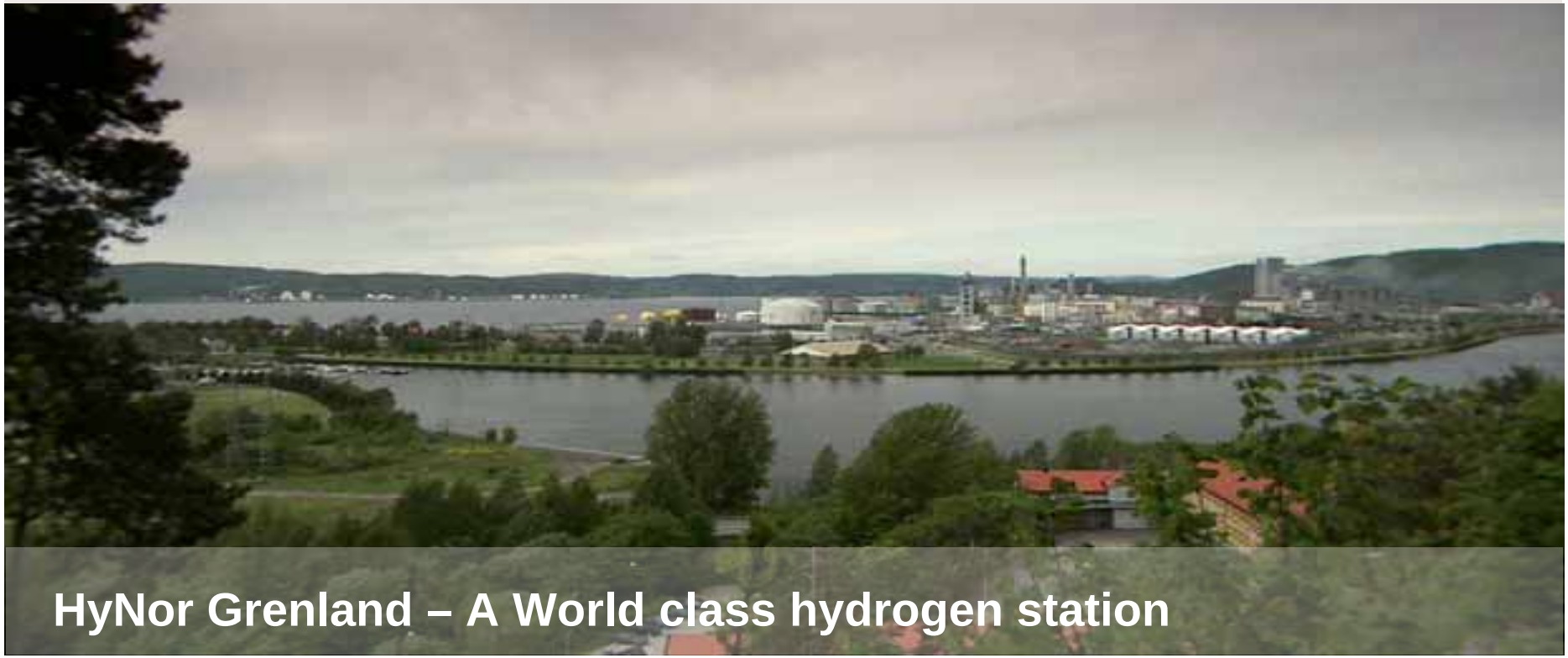
HyNor Stavanger – Norway's 1st Hydrogen Station

- Opened August 2006 as an integrated part of a petrol station
- Hydrogen, NaturalHy (8% H_2 in Natural Gas) and Natural Gas
- Start-up with trucked in hydrogen, dispensers for 350 and 700 bar hydrogen
- Phase II with production of H_2 from Natural gas with CO_2 handling or from biogas + second filling station



HyNor Grenland – A World class hydrogen station

- Several technology innovations
- Directly linked to large scale hydrogen production, scalable solution
- Possibility for supply and back-up for other HyNor stations
- 10 hydrogen cars in operation at the station
- Upgrading to 700 bar technology

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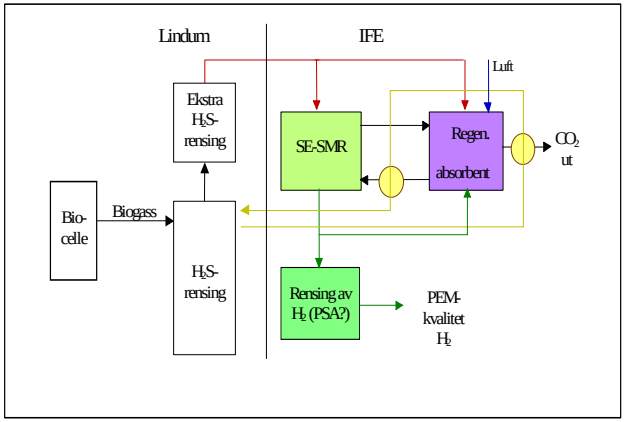

H_2

HyNor Drammen – Hydrogen from local waste

- Hydrogen production from local landfill
- Transport of hydrogen to Statoil station in Drammen
- Plans for a few cars, and one bus
- The hydrogen station will be in operation by early 2009, offers 350 and 700 bar

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HyNor Oslo – Hydrogen in Public Transport

- Plan for 4 buses, 5 taxis and 15 cars
- Production of hydrogen from water electrolysis
  - demonstrating new world-class electrolyser technology
- Car station will be in operation in 2009 (350/700 bar), bus station in 2009/2010

Vehicle fleet in HyNor

Hydrogen Prius:
converted to hydrogen operation by Quantum US, 15 cars in Norway

Think Hydrogen:

A hydrogen / electric hybrid, 5 cars to HyNor in 2008 / 2009

Mazda RX8:

Hydrogen / petrol, dual fuel, 30-40 cars to HyNor / SHHP in 2008 / 2009

Buses:
Plans for 8 buses in HyNor 2009-2010

More cars:
Dialogue ongoing with several car manufacturers for larger series of cars to HyNor and SHHP

Status: Draft

The Scandinavian Hydrogen Highway Partnership

StatoilHydro

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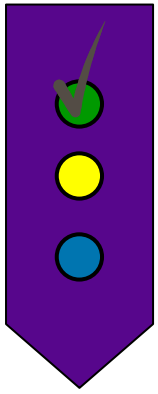
WWW.SCANDINAVIANHYDROGEN.ORG

Vision

“Making Scandinavia one of the first regions in Europe where hydrogen is available and used in a network of refueling stations”



Time line

2008 - 4 stations already open

2009 - 7 new stations planned

2010 and beyond

Ambition for 2015

15 stations + 30 satellite stations

100 buses + 500 cars + 500 specialty vehicles

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Creating an early market

Key points in our strategy

- **Involve actors throughout the value chain**
- **Identify and motivate the early adopters**
- **Collaborate to create a market to compete in**
- **Share risks and costs through partnerships**
- **Explore synergies with other alternative fuels and technologies**
- **Create practical experience**
- **Gradually move from R&D & demonstration projects towards early market activities and commercialisation**

Joining forces

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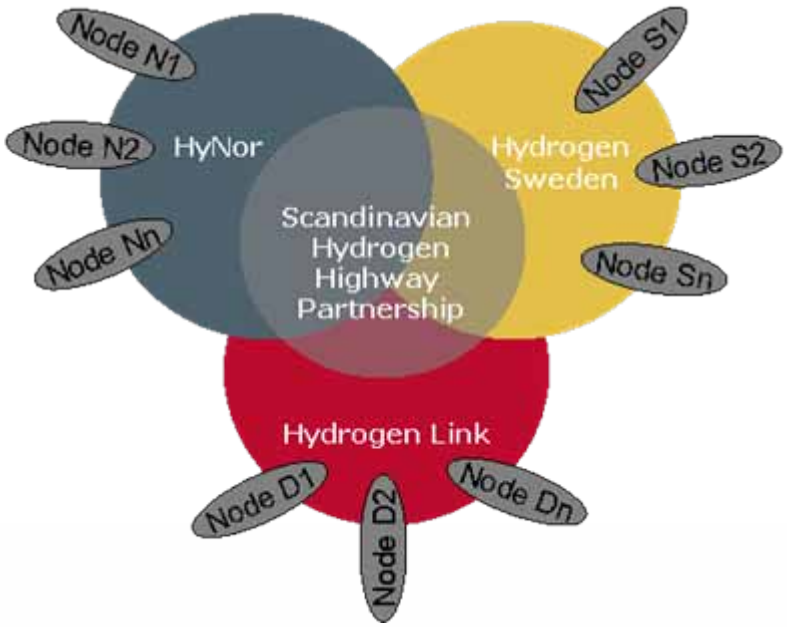
Working groups

- Project planning and coordination
- Joint vehicle procurement
- Standards and certification
- EU and national lobbying
- Marketing and communication



Benefits & Challenges

- On or way to bringing hydrogen demonstrations up to the next level
- Showing a multitude of pathways for hydrogen supply with focus on sustainable hydrogen from local production
- Reinforcing each others industries and infrastructures

- More vehicles
- Matching demand from customers with available vehicles and aligned infrastructure
- Connect the Scandinavian Hydrogen Network to the rest of Europe
- Continue to form the right consortium with all the right partners

Preparing to become a Lighthouse Project in EU-JTI-FCH

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- **Application for Demonstration of next state-of-the-art fuel cell vehicle and hydrogen refuelling technology in Scandinavia**
  - **Minimum 5 vehicles (+ min 2 on EU-tour)**
  - **1 region/city with adjusted hydrogen refuelling infrastructure**
- **Potential and existing partners**
  - **Vehicle manufacturers**
  - **Certification & approval bodies**
  - **Committed regions in Scandinavia/Europe**
  - **Institutes**

Scandinavian Hydrogen Highway Partnership

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Sponsored by:

norden

Nordic Energy Research

HyNor
www.hynor.no

HyFuture
www.hyfuture.eu

Hydrogen Link
www.hydrogenlink.net

StatoilHydro

Key data – Hydrogen station

- Daily average refuelling capacity : 130 kg/day
- Storage capacity : 200 kg hydrogen
- Hydrogen purity: In line with Fuel Cell specifications
- Dispenser technology: Fast filling
- Environment: Hydrogen produced by hydro power. No emissions
- Safety: Highest priority. Underground storage. Training of drivers

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