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## The Utsira wind –hydrogen project

Presentation on behalf of Hydro - Trygve Riis

# Hydro

- Hydro is an Energy and Aluminium supplier with 36,000 employees in more than 40 countries.
- Hydro is the world's third largest offshore operator.
- Hydro is the third largest integrated aluminium supplier in the world.
- Hydro is positioning in renewable energy and hydrogen

# Utsira – the project

Demonstrating the first hydrogen society in the world

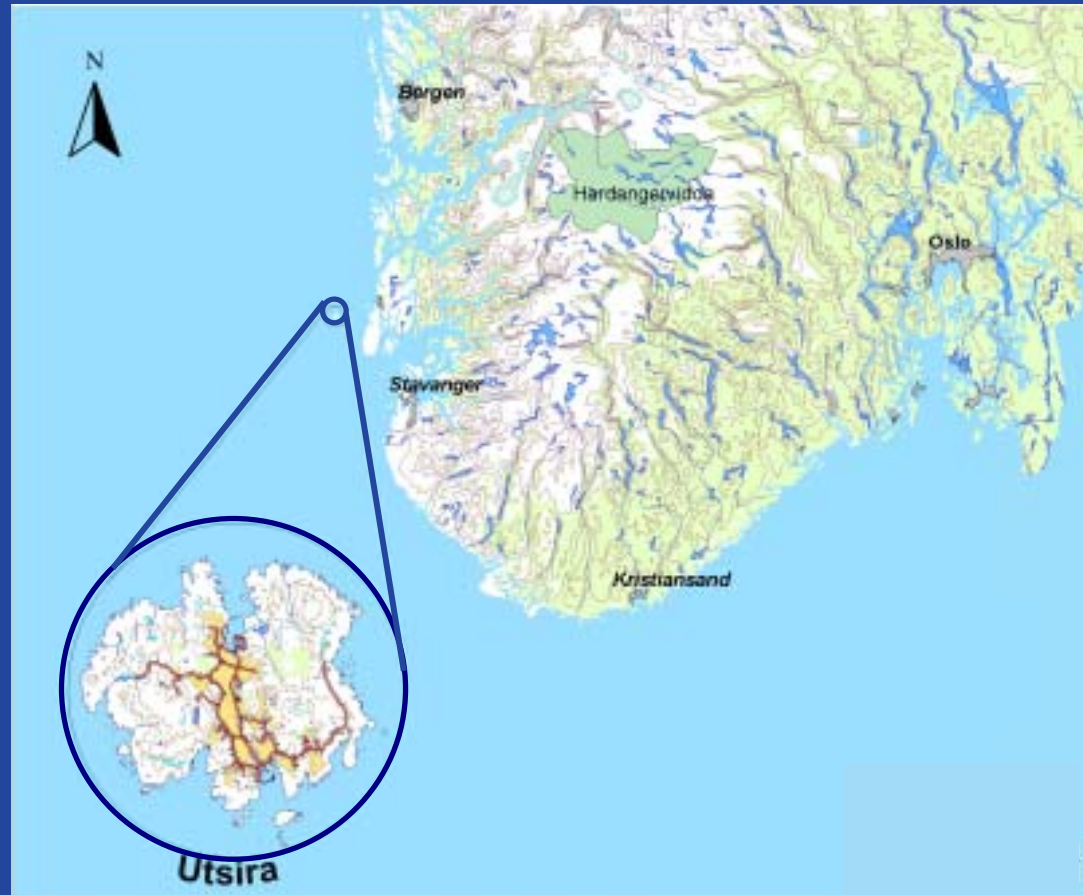
## **Utsira has enough wind power to be self-sufficient:**

- Produce hydrogen in an electrolyser when there is excess wind energy available
- Provide electricity via a fuel cell and hydrogen engine when the wind turbine slows or stops



# Utsira – the island

- 20 km west of Haugesund
- 6.2 km<sup>2</sup>
- 235 inhabitants
- 3.5 GWh/yr
- 900 kW peak load
- 22 kV, 1 MW sea cable
- Ambition to exploit wind resources and become self-sufficient with renewable energy





# The Utsira demonstration project

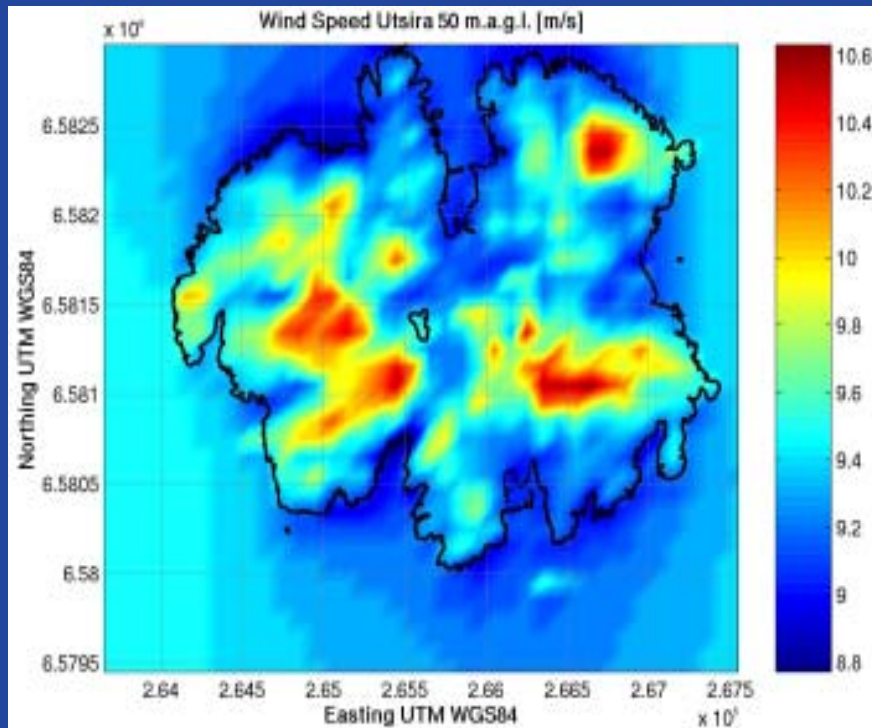
- **Project purpose**
  - Demonstrate how renewable energy can provide safe and efficient energy supply to isolated areas
- **Project goals**
  - Full scale demonstration and testing of a wind - H<sub>2</sub> energy system
- **Project partners**
  - Hydro, Enercon, Enova, NFR, and SFT
- **Project status**
  - Demonstration running (until 2006)

Why Utsira?

**U**Tility  
**S**ystems  
**I**n  
**R**emote  
**A**reas

# Why Utsira?

Very good wind conditions, small but variable load, power supply from main land by sub sea cable



**...and a very supporting community**

# Utsira is unique because it is the first full-scale stand-alone wind-hydrogen project in the world

- Hydrogen is used to store wind energy
- A fuel cell and a hydrogen combustion engine is producing power from stored hydrogen when no wind energy available
- Ten private households are part of the demo
- Remote-operated autonomous energy system



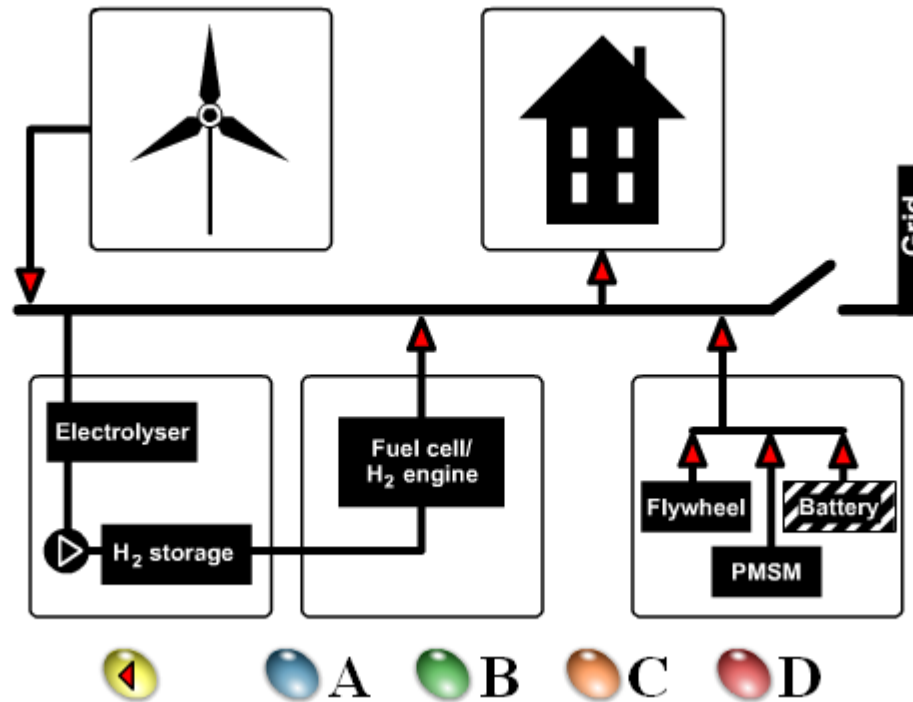


# Main components

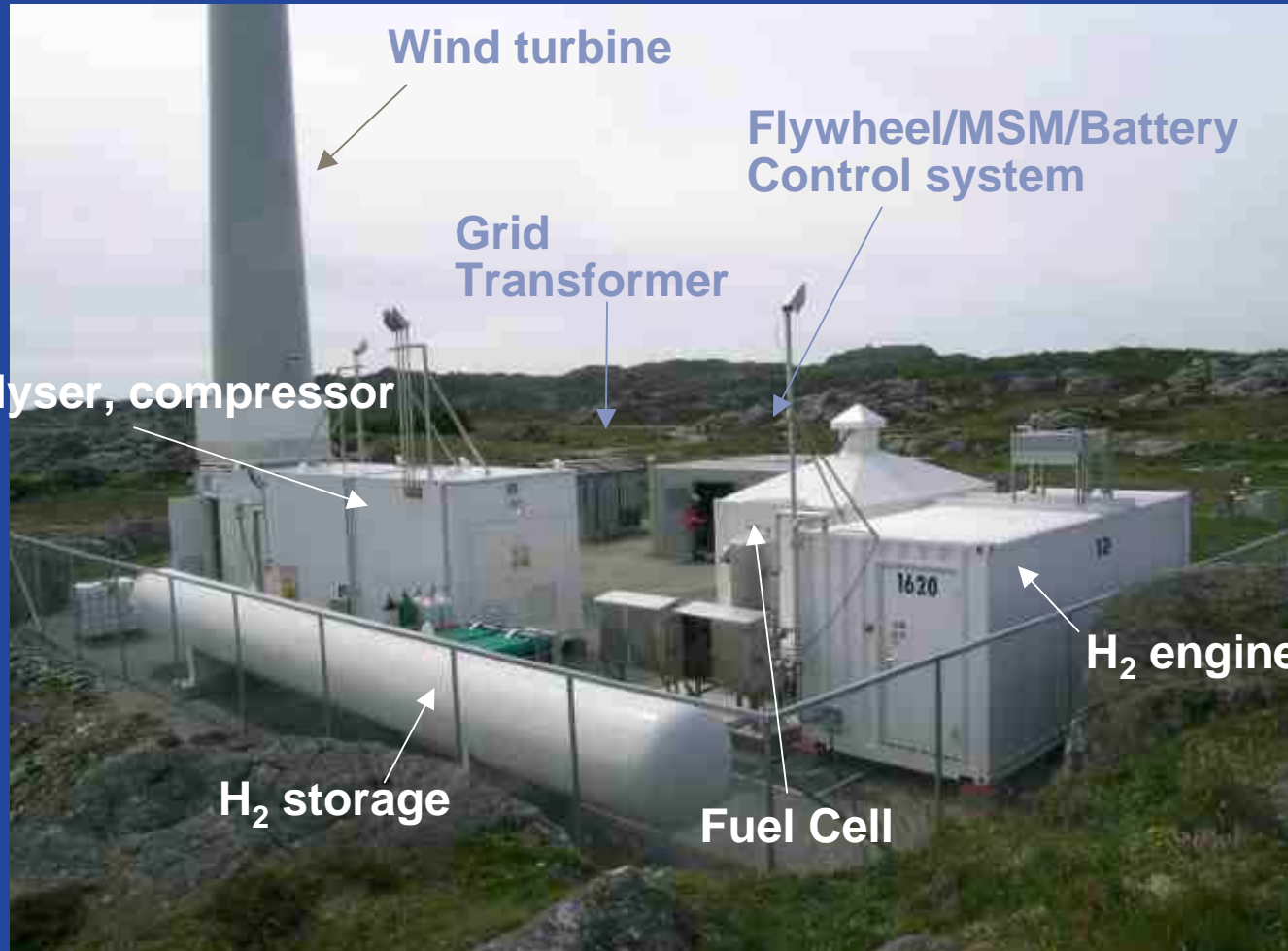
<b>Wind turbines</b>	<b>2 * 600 kW</b>
<b>Hydrogen engine</b>	<b>55 kW</b>
<b>Fuel cell</b>	<b>10 kW</b>
<b>Electrolyser</b>	<b>10 Nm<sup>3</sup>/h, 48 kW</b>
<b>Compressor</b>	<b>5,5 kW</b>
<b>Hydrogen storage capacity</b>	<b>2400 Nm<sup>3</sup>, 200 bar</b>
<b>Flywheel</b>	<b>5 kWh</b>
<b>Master Synchronous Machine</b>	<b>100 kVA</b>



# Utsira – How it works



# The Utsira wind-hydrogen system



# Fuel Cell and Hydrogen Genset



# The Electrolyser and Storage





# Demonstration period – main focus

- Making the installed components in the autonomous system function together
- Deliver power with the expected quality and reliability to the customers
- Cost reductions, technical/operational simplifications and optimisations
- Commercialisation and marketing

# Market development creating demand

- Growth in renewable power
- Lack of electricity and security of supply
- Replacement of diesel or LPG



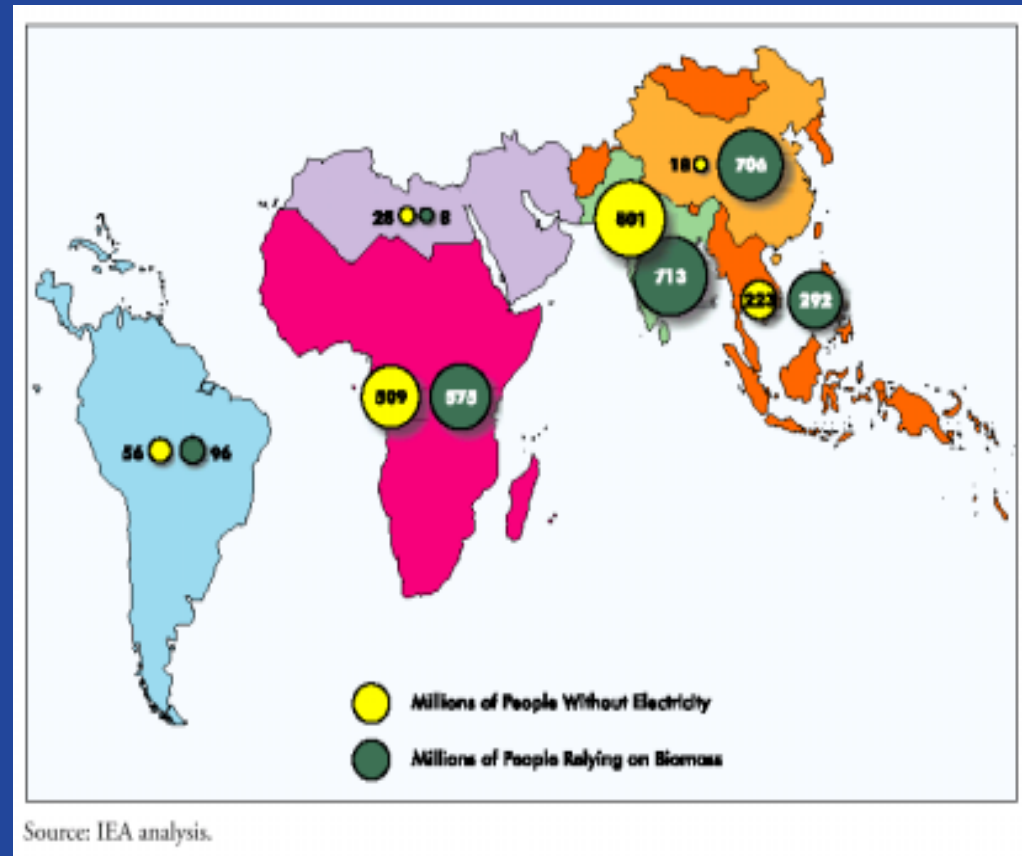
# Early markets

- The current markets are remote and isolated areas belonging to industrialised countries
- These markets are highly dependent on import of oil products for their power generation
- These markets are dependent on power and energy in order to secure economic life and development
- These markets have started developing alternative and renewable power and energy



# Long term, there is a global demand for more renewable, safe, clean and low cost electricity

- More than 1,6 bill or 25% of the global population are without access to electricity. This is expected to decrease to 1,4 bill in 2030. (IEA World Energy Outlook 2004)



# Future

Market is there – technology must be proved

Large-scale demonstration projects can prepare the way for a future hydrogen marketplace.

Hydro will continue to initiate and participate in demonstrations of sustainable energy solutions using hydrogen as an energy carrier.

Demonstrations will help improve public awareness and acceptance, improve cost competitiveness, and reduce market barriers.



*There is gold at the end of the rainbow*



# At Utsira the future meets the past

## Preserving cultural heritage

- Archaeologists found a unique 10000 years old stone age settlement
- The site was moved and the findings preserved



# The Hydro mission

*Create a more viable society by developing natural resources and products in innovative and efficient ways*



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