Energy:
How do we move and what will move us in the future?

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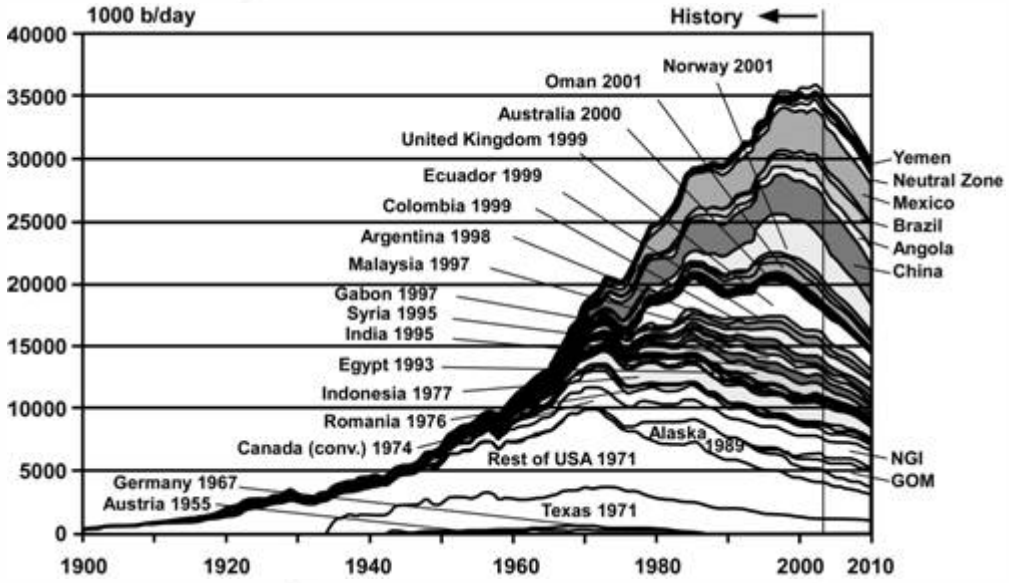
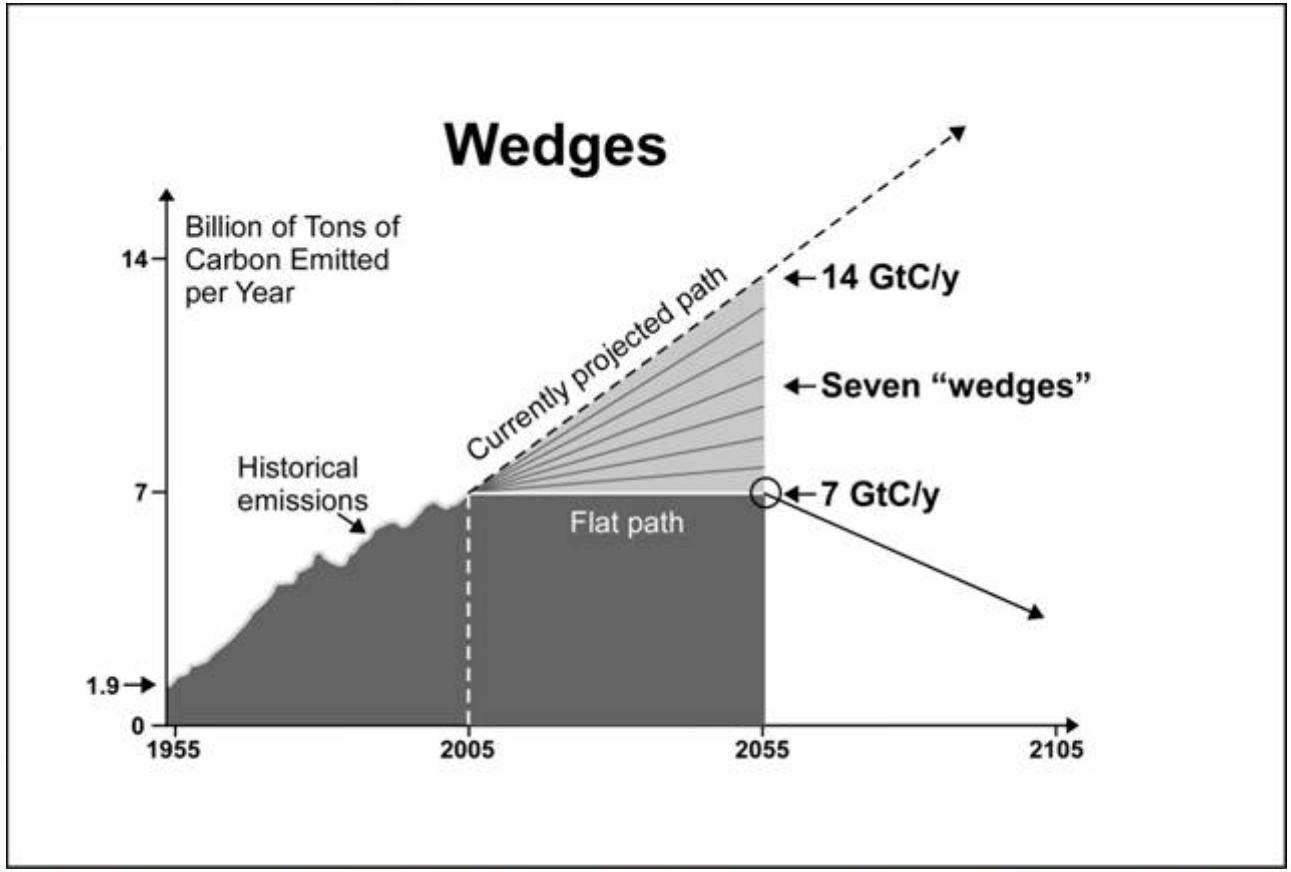
Energy is at crossroads: End of cheap oil

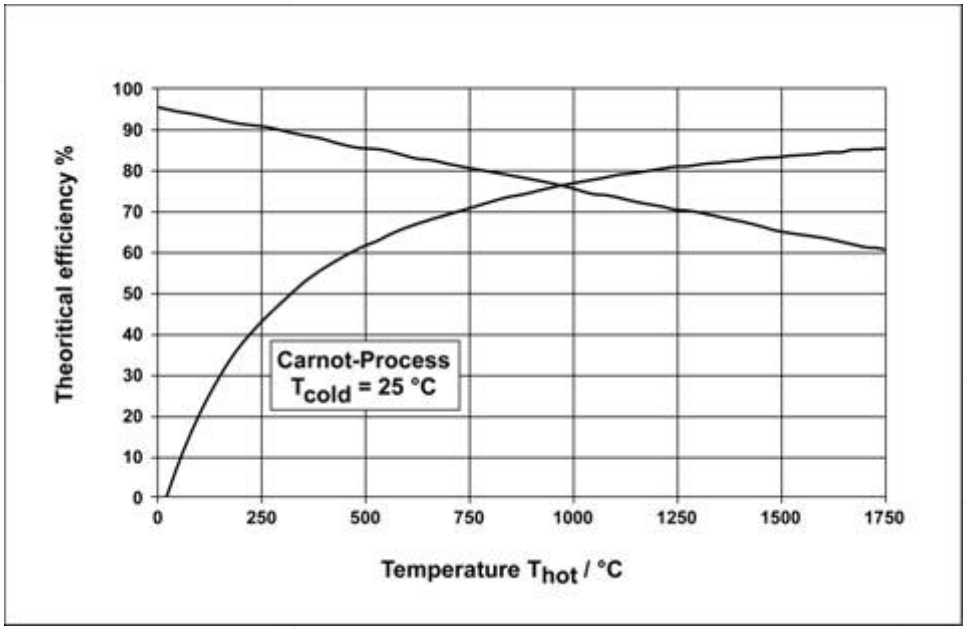


Price of a barrel of oil is increasing alarmingly as the world accepts the finiteness of oil and other hydrocarbons on Earth. If business proceeds as usual, we may expect doubling of CO_2 in atmosphere before 2058

Climate change calls for decarbonization.



The world is also at the crossroads where the Carnot-era of combustion technology is being replaced by the Gibbs Free Energy era of fuel cells



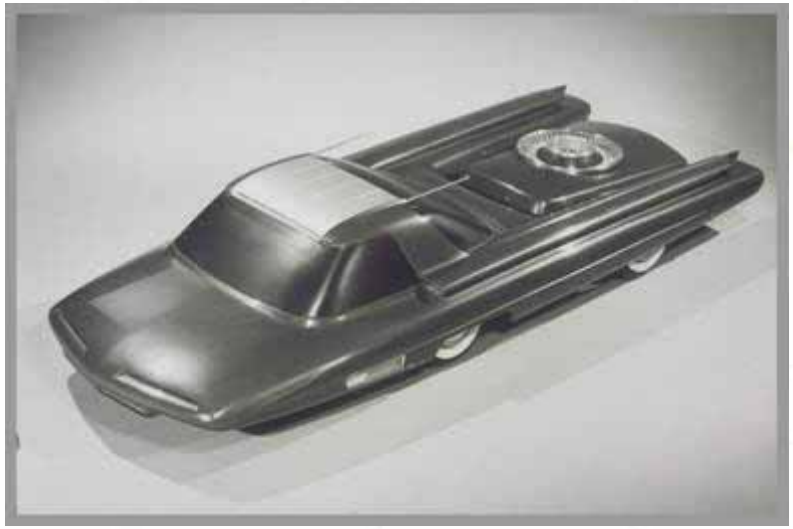
Increased efficiency is a keyword

- Gas replacing coal in power production
- Co-firing in power production
- Hybrid drivetrains in automobiles
- Biofuels replacing hydrocarbons
- Designer fuels from CO_2 and H_2

- New generation of cars:

The car of the future is going to be powered by electricity

- And there are various options of storing the energy needed: Let us take a look at one of them!



Ford Nucleon: powered by a Uranium pin lasting 10.000 kilometres – slightly radioactive! Invented in 1950´s. Never built. The mock-up of the car can be viewed at the Henry Ford Museum in Dearborn, Michigan

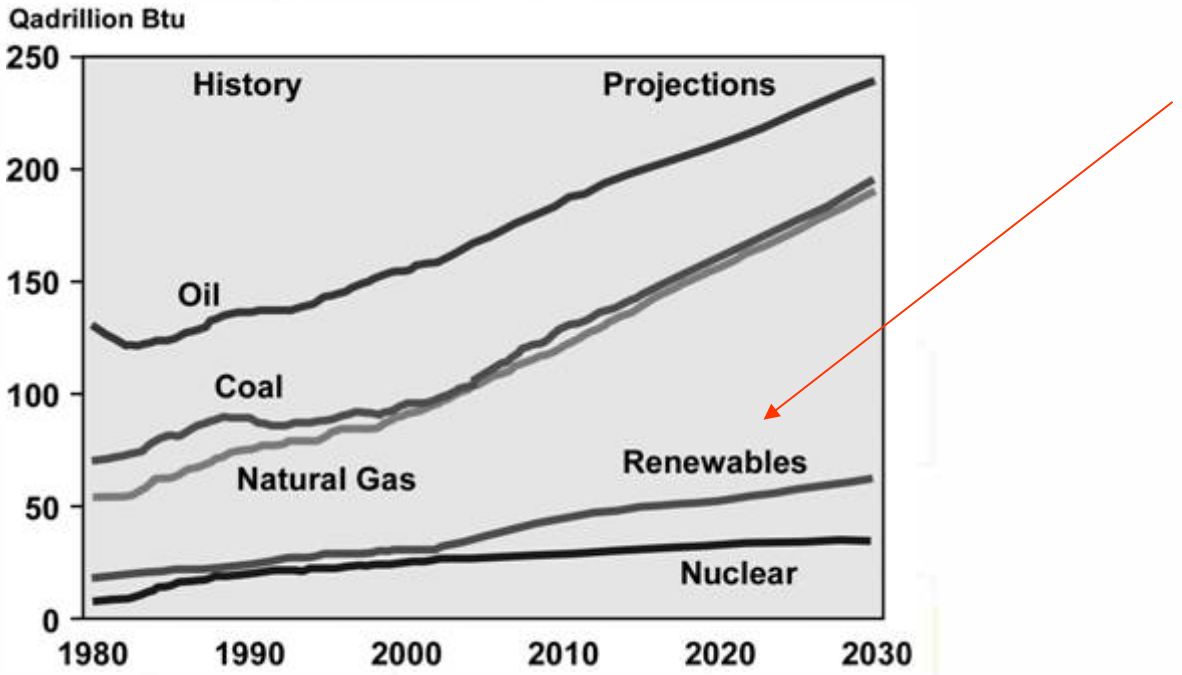
Other possibilities of non-fossil energy carriers:

- Biofuels (from renewable forests)
- Biofuels (competing with food)

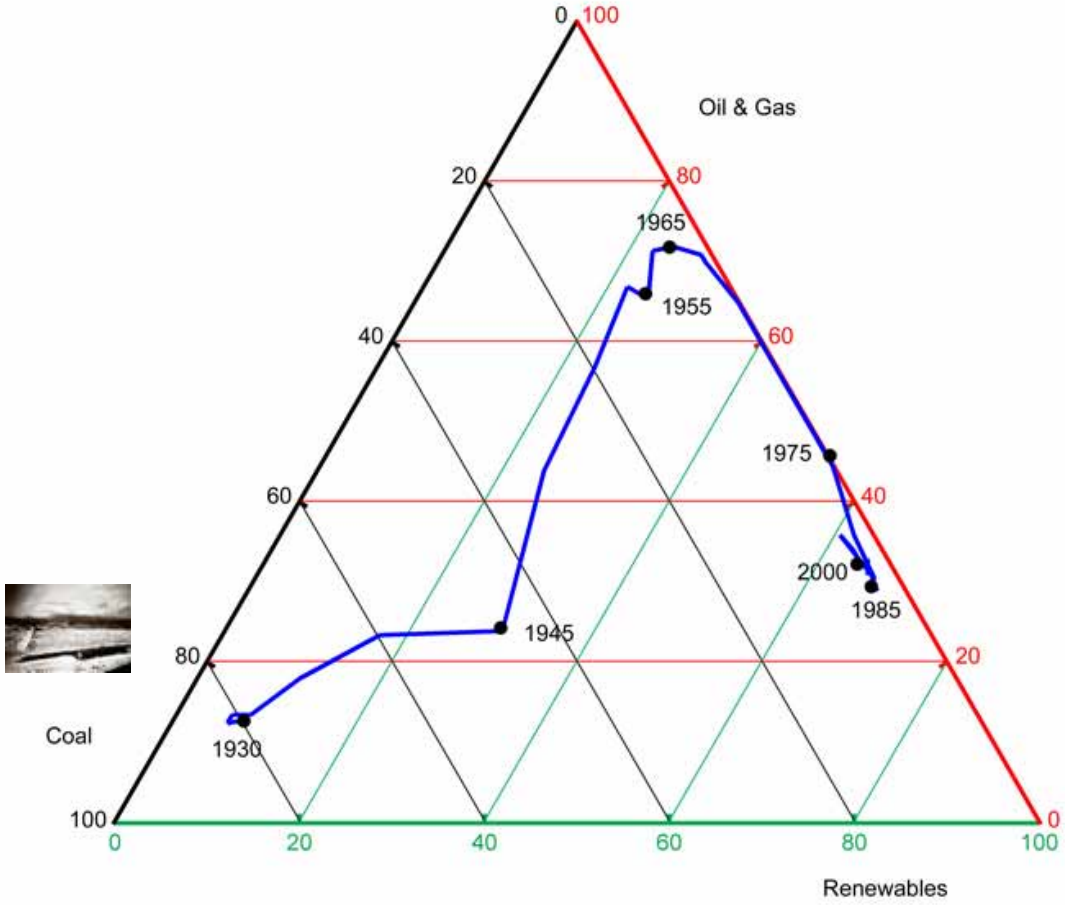
- Methanol (problems with emissions)

- Hydrogen from renewables and water – which is believed to be the ultimate fuel but has proven difficult to tame

There is still a problem with the needed amounts of renewables

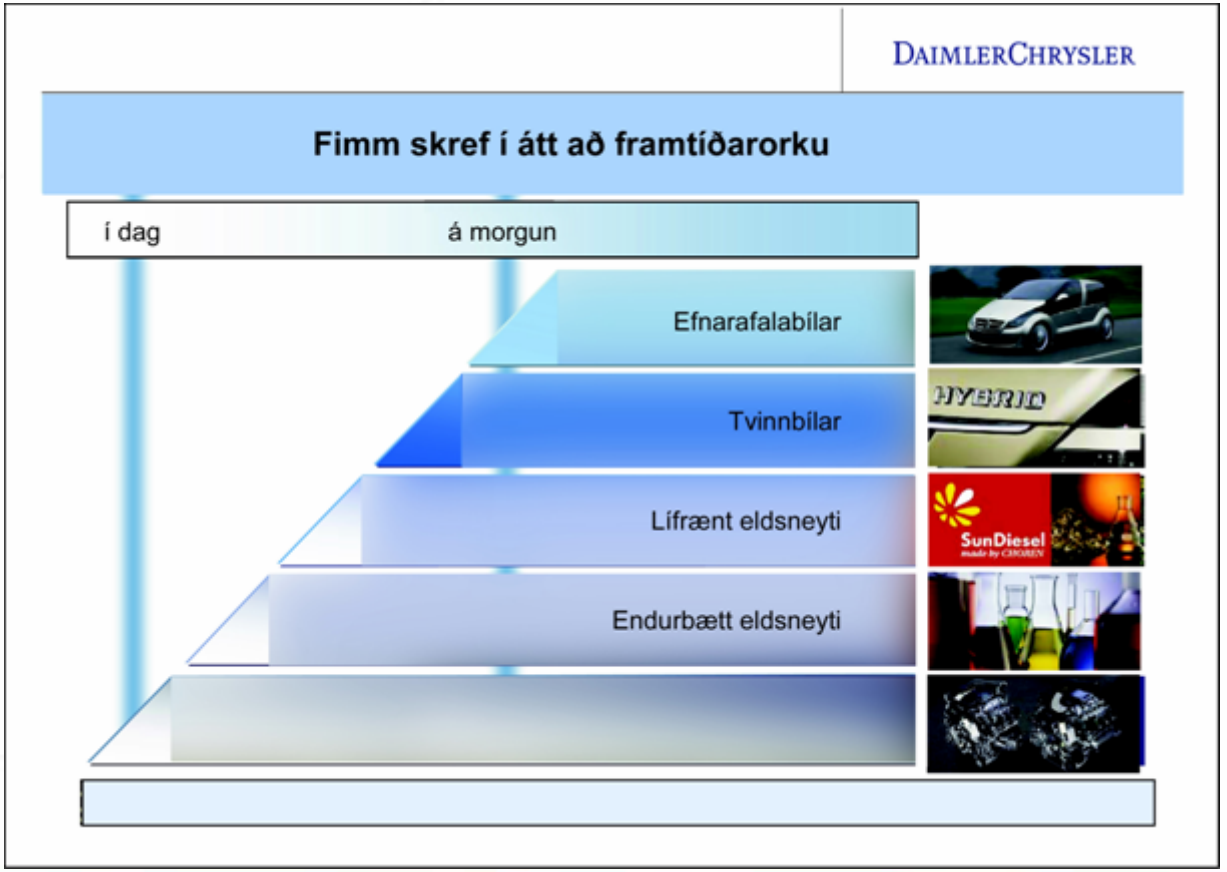


The primary energy sources in Iceland from 1930 - seen as a three component diagram: Coal, oil/gas, renewables

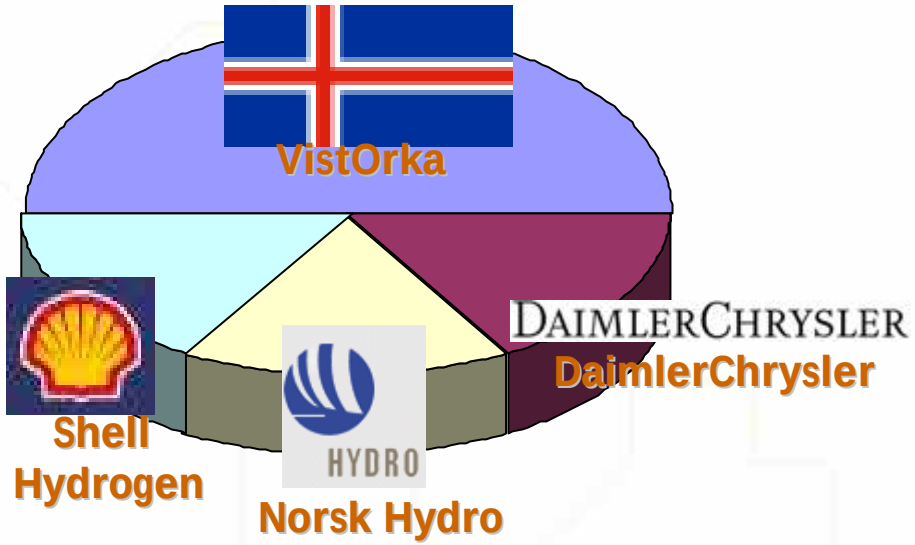


Iceland is currently 72% renewable energy based – the highest ratio in the world!

Iceland has teamed up with Daimler, Shell and Hydro



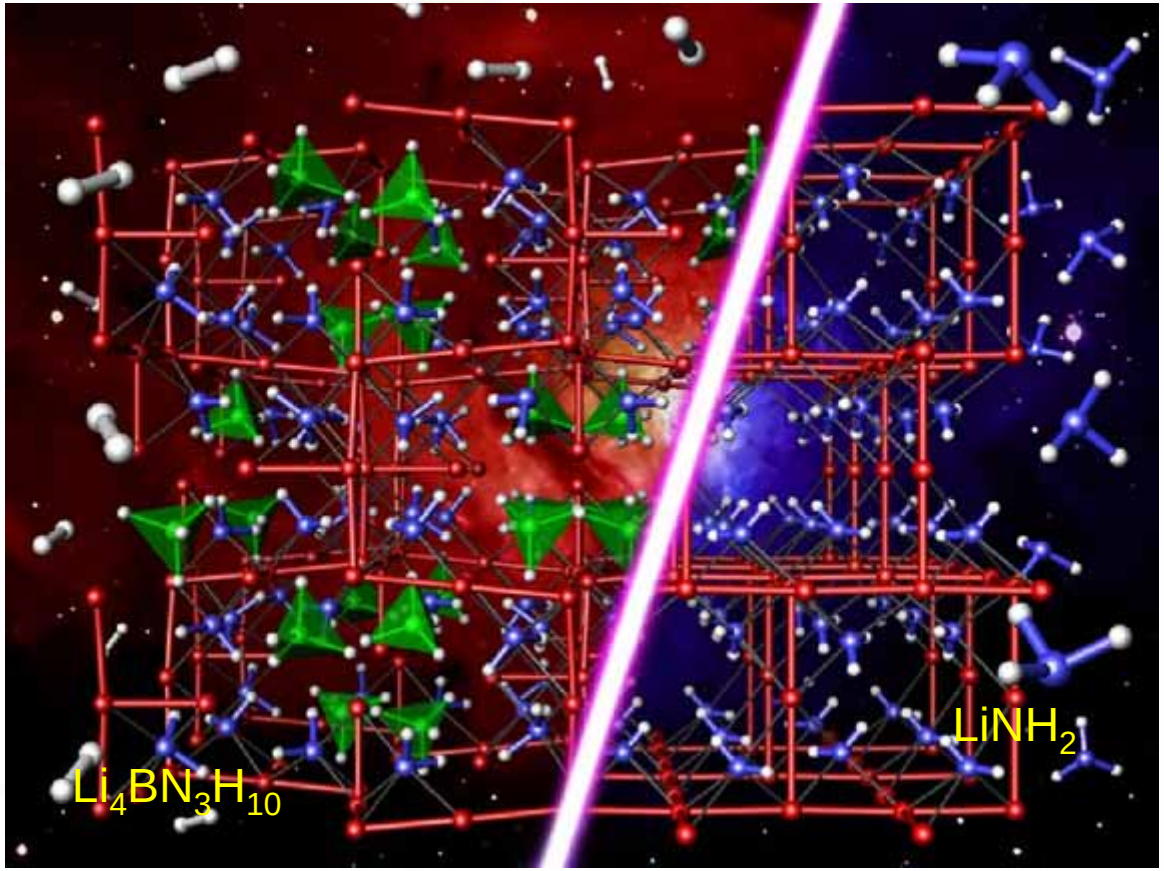
Unique Icelandic New Energy structure / objective



H_2 and fuel cell vehicle development

Taming the proton is a big challenge. Storing Hydrogen can be tough, the fuel cells are still on the expensive side and efficiencies of production must be raised

Solid state storage



Iceland has currently the highest proportion of renewables in its energy portfolio: 80%

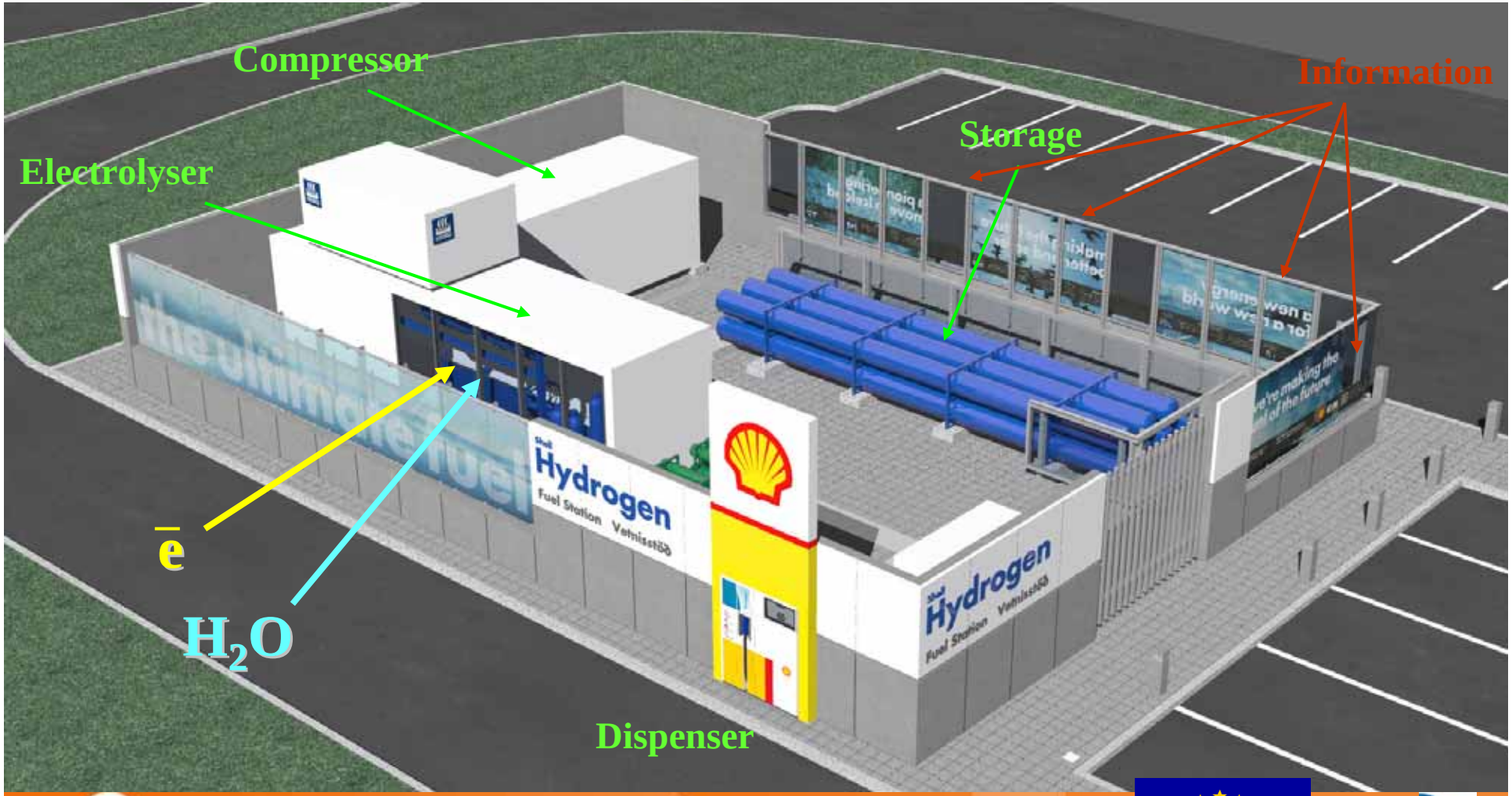
- The aim is to make them account for 100% by tackling transport system and fishing boats

Currently Reykjavik has a fleet of 14 hydrogen cars on the roads and a fueling station

The relatively simple ringroad around Iceland measures appr. 1400 km

Ten stations would create a customer acceptable minimum

The ECTOS-hydrogen station, open from April 24th 2003



Infrastructure

Old

New

- The first dispenser had communication problems with the vehicles
- We had problems of getting up to 350 bars
- The Norsk Hydro team developed a new dispenser, installed in Iceland for testing
- Since then:
  - <10 minute refuelling
  - problem free operation

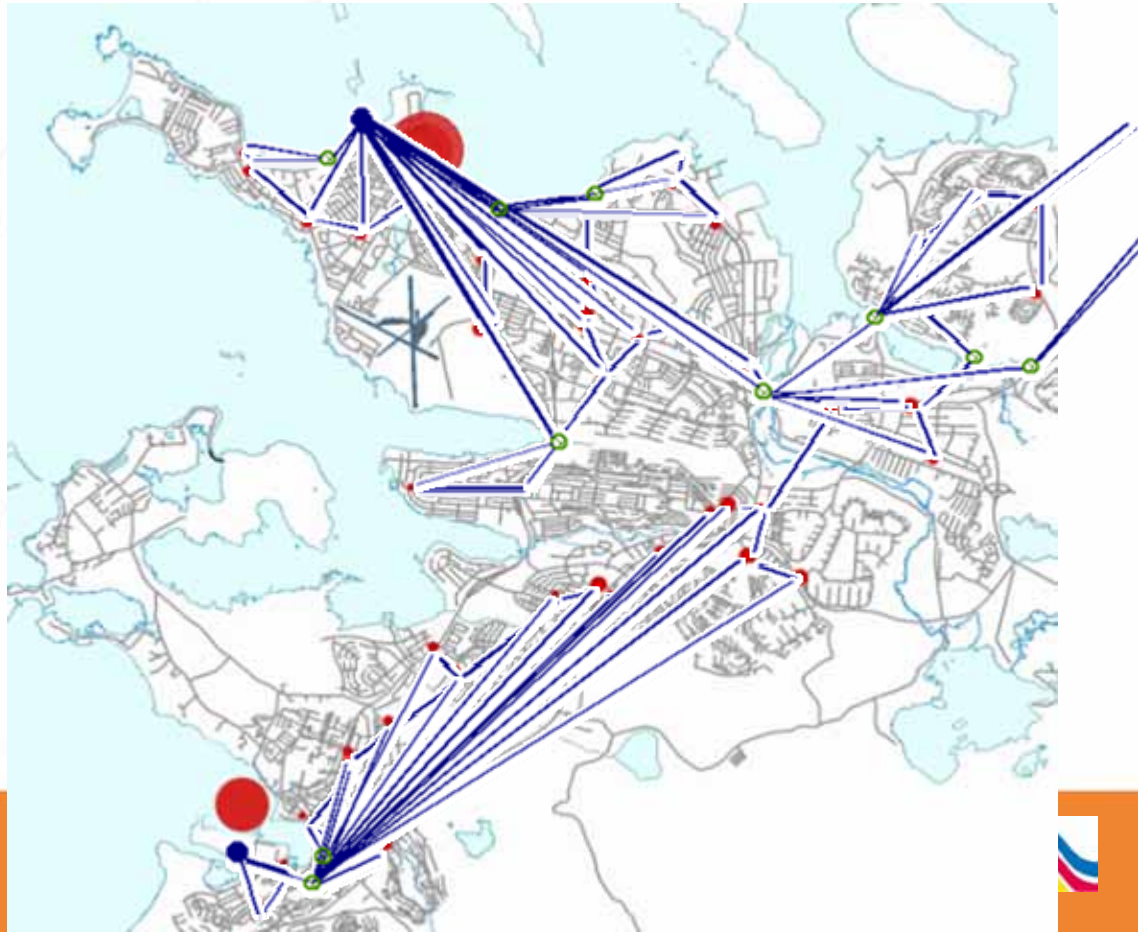
Infrastructure Scenarios – Overview

The Capital area

On-site

Truck distribution

Pipeline distribution

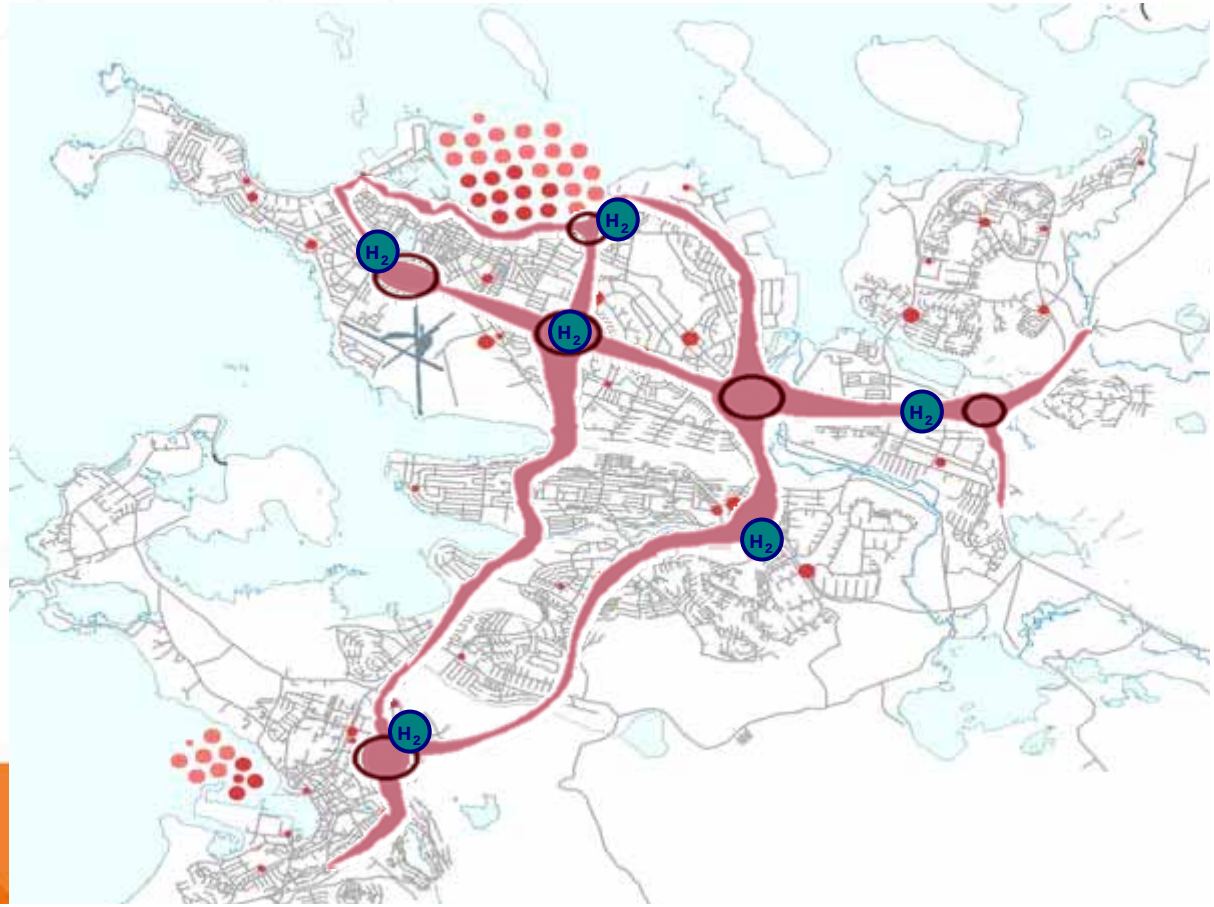


EURO-HYPORT

Initial Infrastructure Suggestion

The Capital area

Suggestion to a building sequence of the initial H_2 infrastructure



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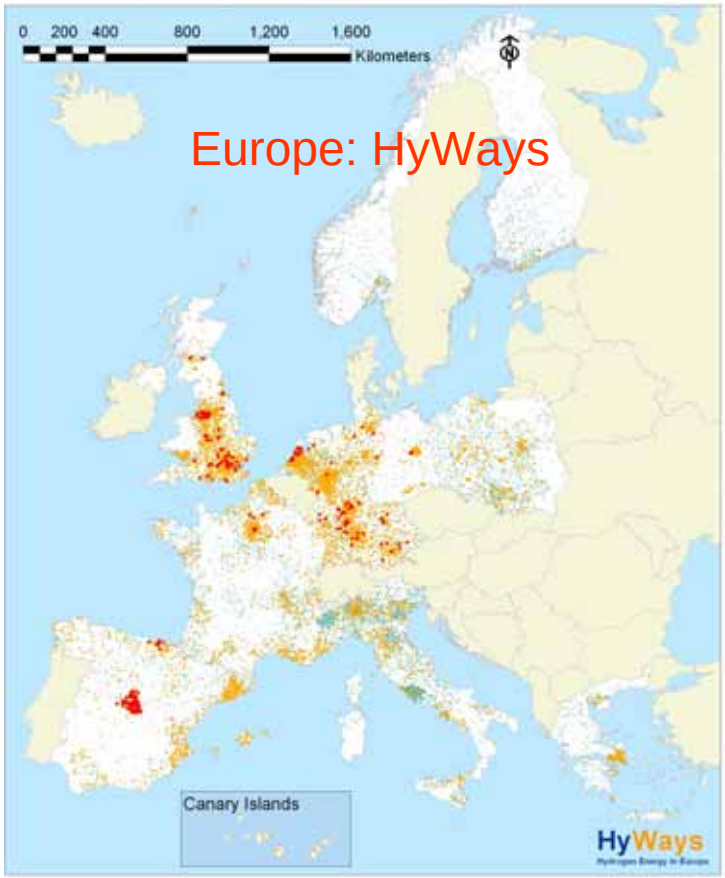
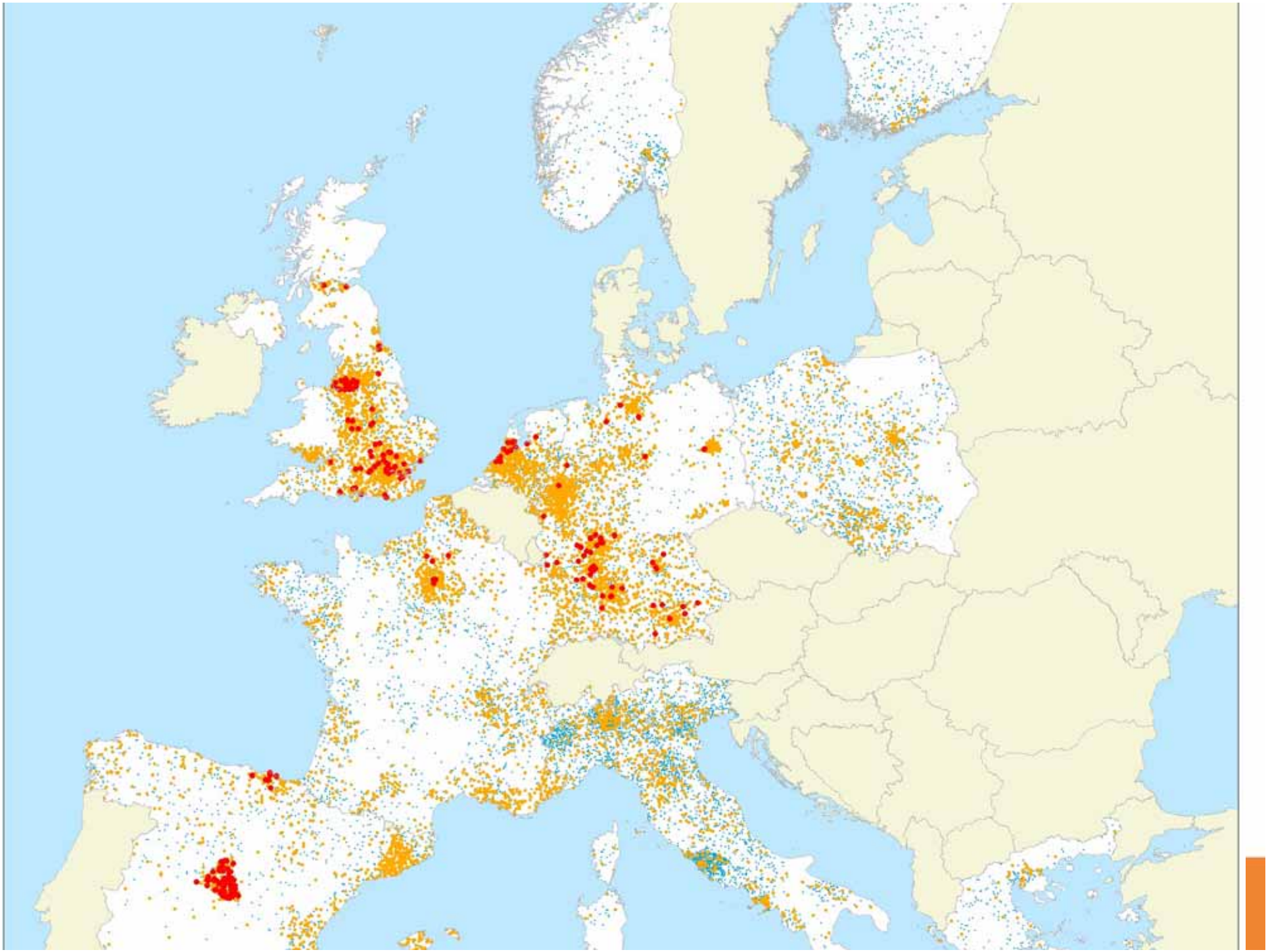
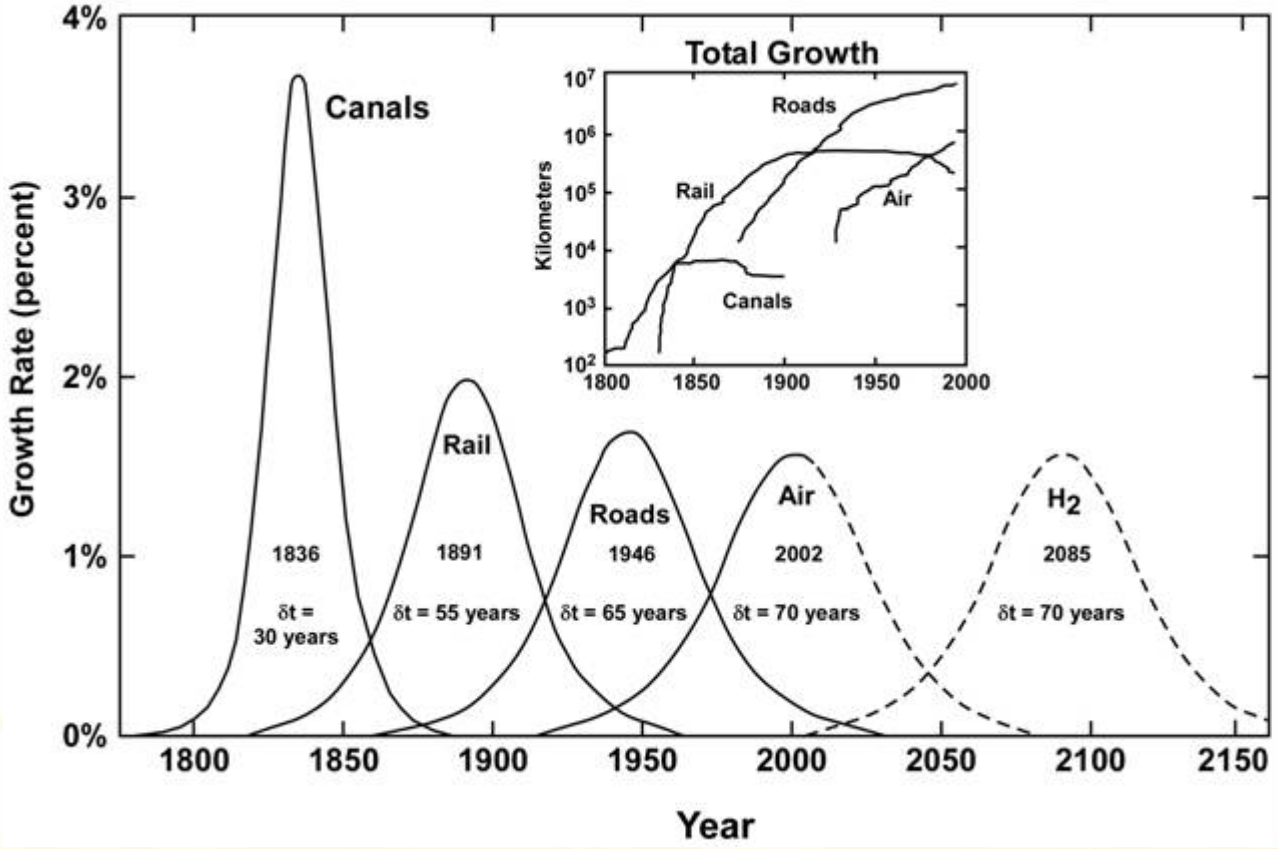
The world is a platform for tests of new energy carriers:



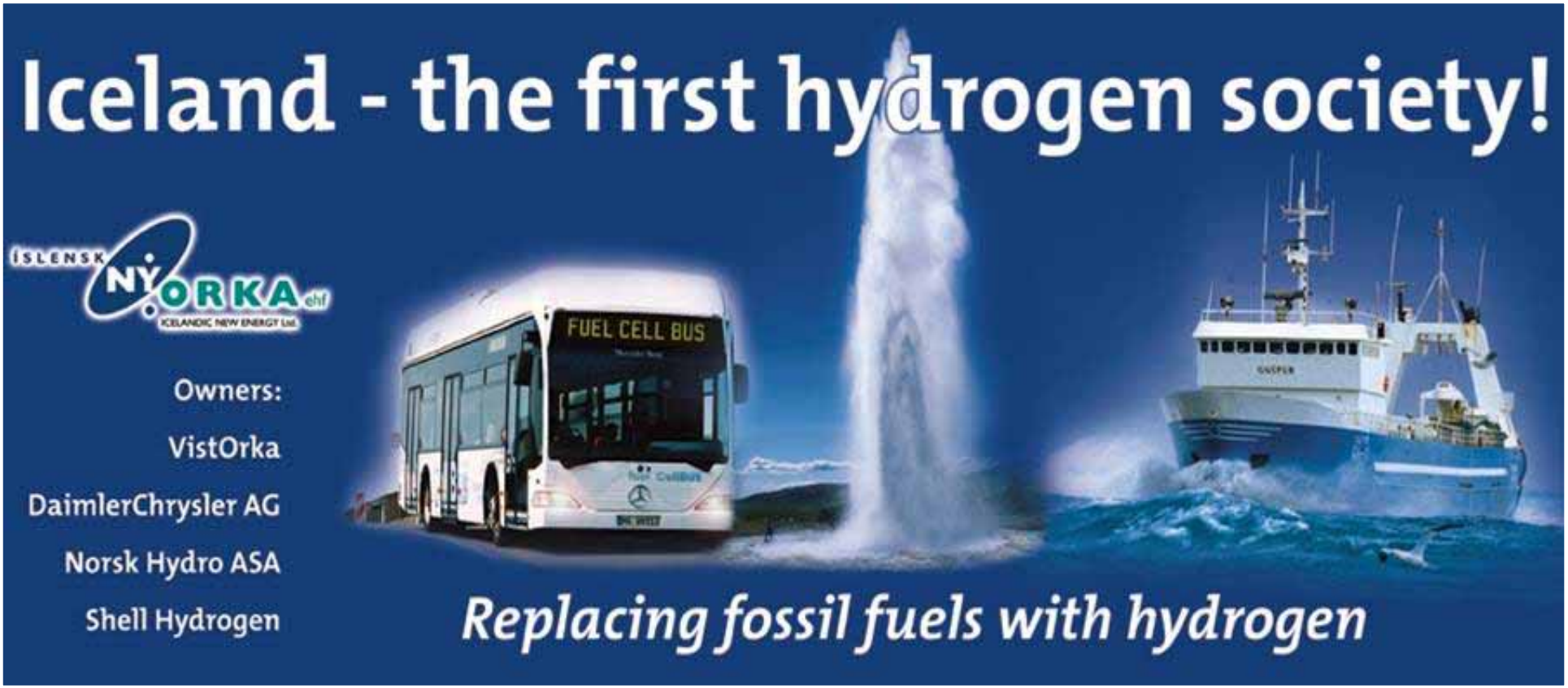


Our partners in Norway have created a HyNor hydrogen highway that is about to be extended into Sweden and Denmark

Hydrogen would create a paradigm shift in the development of the infrastructure of our society
(see: Sigfusson, Taming of the Proton)



On the way to a carbon free energy economy



See you in Iceland in 2012!

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