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The 27th INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION

BARCELONA
17th-20th November 2013

Results & Experiences from Demonstration of a fleet of Fuel Cell Electric Vehicles and hydrogen refuelling infrastructure in Scandinavia

H2moves.eu
SCANDINAVIA

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Organized by Fira Barcelona avele

Hosted by AVERE mea Ajuntament de Barcelona

In collaboration with EVAAP EDTA

Supported by European Commission

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Partners & Funding

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Coordination

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SP Your Science Partner

Thomas Berg,
Peter Bremer

Funding

New Energy World JU
fuel cells & hydrogen for sustainability

transnova

The Research Council of Norway

eUDP
Energiteknologisk udvikling og demonstration

Total budget	Funding	
19.5 M€	EU:	7.5 M€
	NO:	1.7 M€
	DK:	0.5 M€

Organized by: Fira Barcelona, avele

Hosted by: AVERE, mea, Ajuntament de Barcelona

In collaboration with: EVAAP, EDTA

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Project Scope

Ambition

Market preparation for Fuel Cell Electric Vehicles (FCEVs)

1. **Demonstrating performance of latest fuel cell technology**
   - Fuel Cell Electric Vehicles in Scandinavia
   - Detailed performance reporting

2. **Gaining Customer Acceptance**
   - Daily operation
   - Public test drives
   - European Hydrogen Road Tour

3. **Establishing partnership amongst stakeholders**
   - Links to existing initiatives
   - FCEV+refuelling station suppliers

4. **Building and improving HRSs (hydrogen refuelling stations)**
   - 1 HRS (Oslo) + 1 moveable HRS,
   - R&D on next generation HRSs

1. Demonstration of FCEVs 1/4

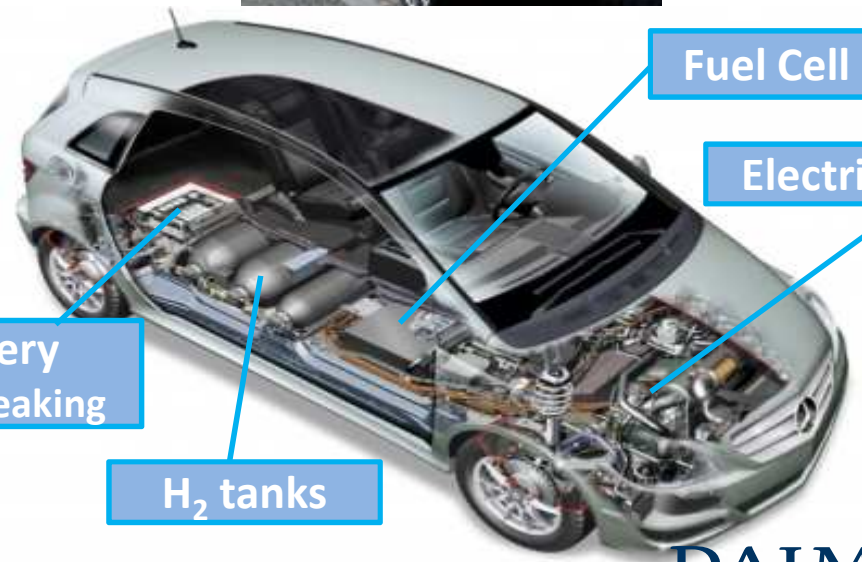
∑ = 19 FCEVs

Mercedes-Benz B-Class F-CELL

Hyundai ix35

Retrofitted TH!NK with FC as range extender

Mercedes-Benz B-Class F-Cell
- ✓ Max speed 170 km/h
- ✓ Refuelling < 3 minutes
- ✓ Fully equipped (climatronic etc.)
- ✓ Range 385 km on 3,7 kg H_2



DAIMLER

1. Demonstration of FCEVs 1/4

∑ = 19 FCEVs

Mercedes-Benz B-Class F-CELL

Hyundai ix35

Retrofitted TH!NK with FC as range extender

Hyundai iX35, new version

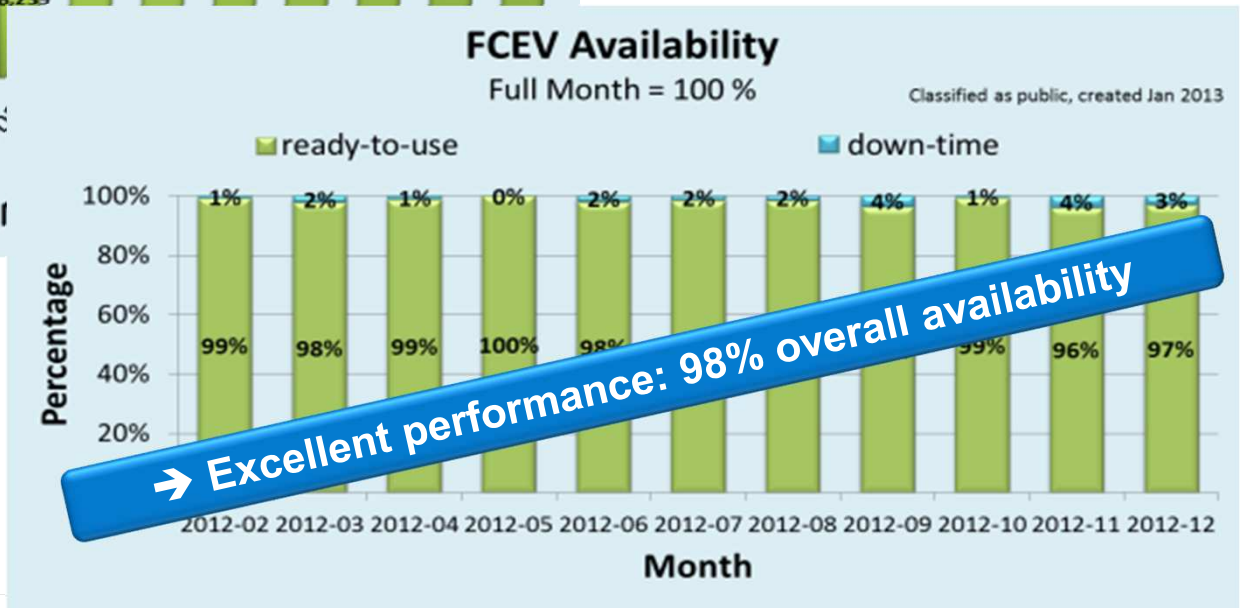
- ✓ Small series production from Jan 2013
- ✓ 100 kW Fuel Cell system
- ✓ 2 hydrogen tanks, totally 5,64 kg H_2
- ✓ Range 590km (0,96 kg H_2 per 100km)
- ✓ Top speed 160 km/h
- ✓ Regenerative breaking 24 kW Li-polymer battery

~ 1kg$_{H2}$/100 km

HYUNDAI

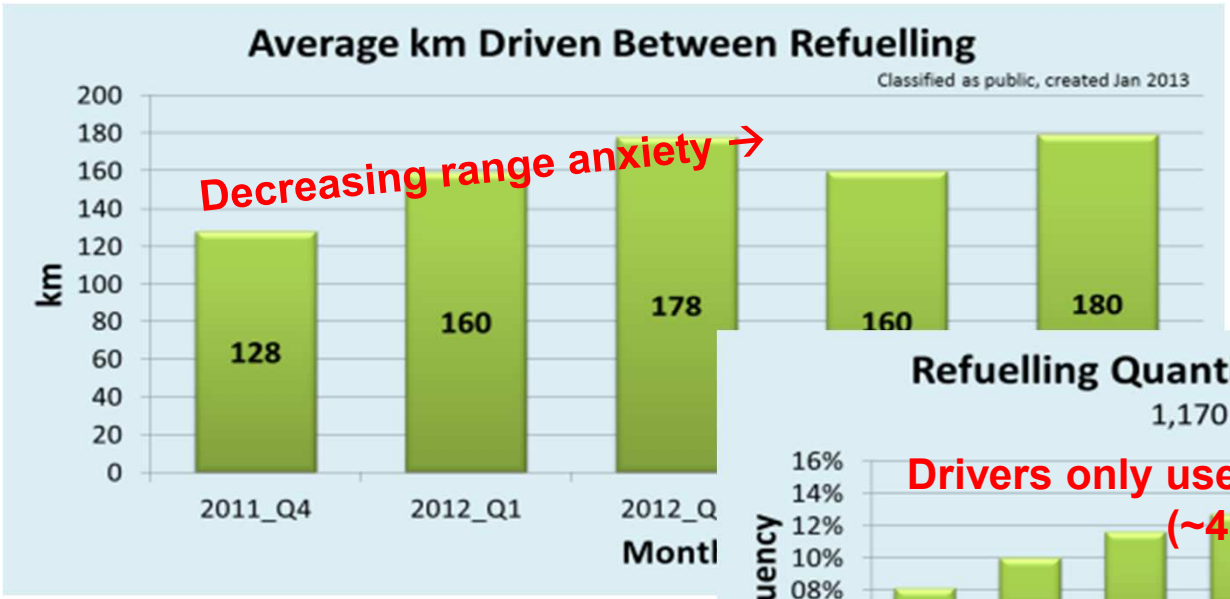
1. Demonstration of FCEVs 2/4

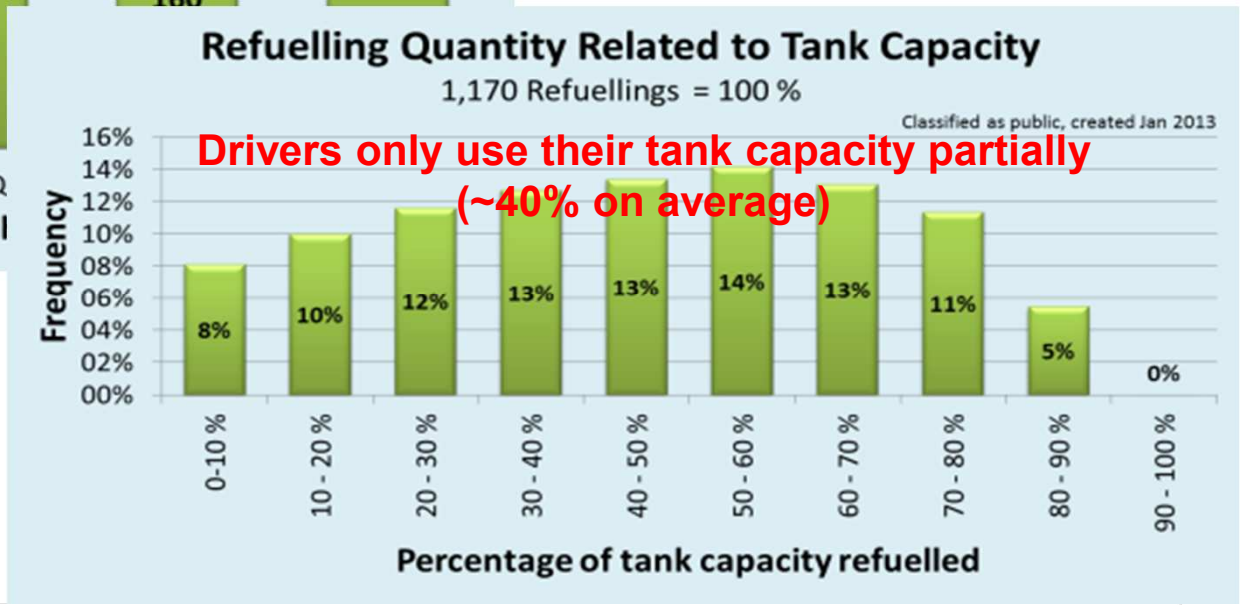
Kilometres driven and FCEV availability



1. Demonstration of FCEVs 3/4

Range anxiety also for FCEVs?





1. Demonstration of FCEVs 4/4

Can Fuel Cell Electric Vehicles operate under harsh climate?

Negligible range decrease at low temperatures

Customer in Norway reported on a trip with temperatures of -27°C.

Hyundai winter test in northern Sweden (Feb. 2012):

- outside temperature reached -41.5 °C
- no damage of parked fuel cell electric vehicle

2. Gaining Customer Acceptance 1/2

Public Events

Oslo Launch Event (21 NOV 2011)


Photo: Jóran Fagerlund, H2S

Photo: Jóran Fagerlund, H2S

- Live broadcasting on 2 largest Norwegian TV channels (NRK & TV2)
- 85 press quotations worldwide

Public Test Drives: Oslo+Trondheim


Photo S. Møller-Holst, SINTEF

Photo: Svein Tønseth, SINTEF

- ~ 300 drivers / passengers
- Reach out to ~ 15,000 people on the streets

Distance record on one refuelling in Norway (508 km on one tank)

Oslo – Monte Carlo Drive 2 cars, 2,260 km (18-25 APR 2012)

Denmark leg of Giro d'Italia (4 MAY 2012)

"The FCEV exceeded my expectations – especially the silence and instantly available torque."

Photo: Jóran Fagerlund, H2S

2. Gaining Customer Acceptance 2/2

European Hydrogen Road Tour

- 4 weeks
- 9 cities
- 9 seminars
- 8 public test drives

Road Tour in cooperation with HONDA TOYOTA

ynni glan

UK H_2 Mobility

Forward swindon

TUHH Hydrogen Colloquium

SOLVAY

2012 PARIS MONDIAL DE L'AUTOMOBILE 29 SEPT - 14 OCT

Paris Motor Show

AIR LIQUIDE

Klimamobility

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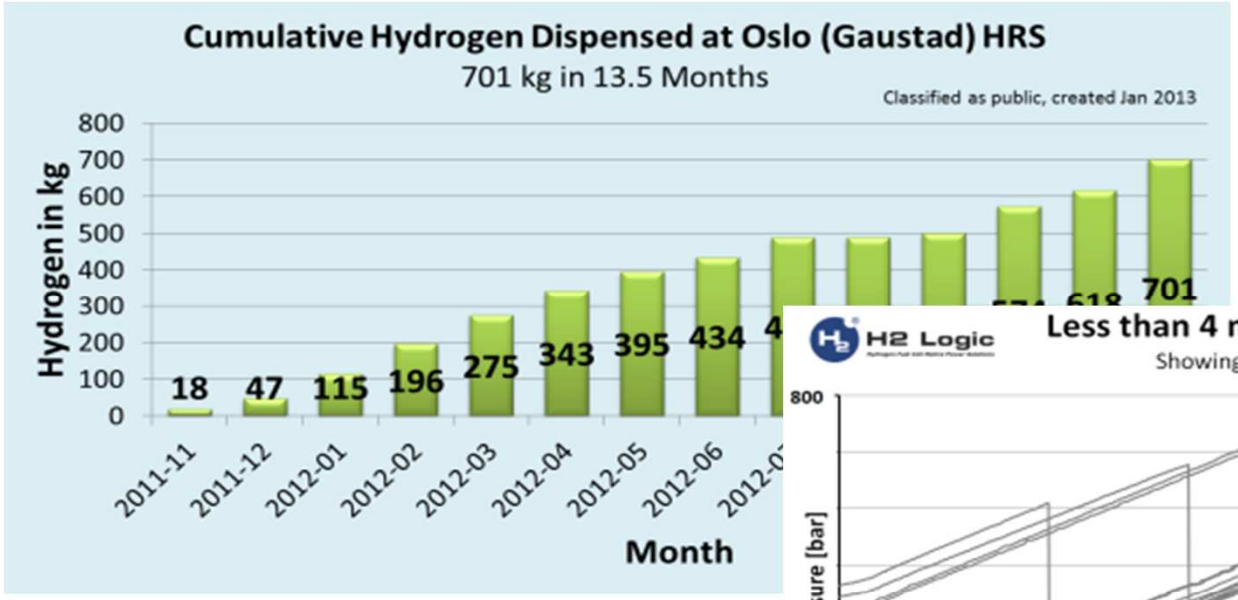
4. Build up infrastructure 1/4

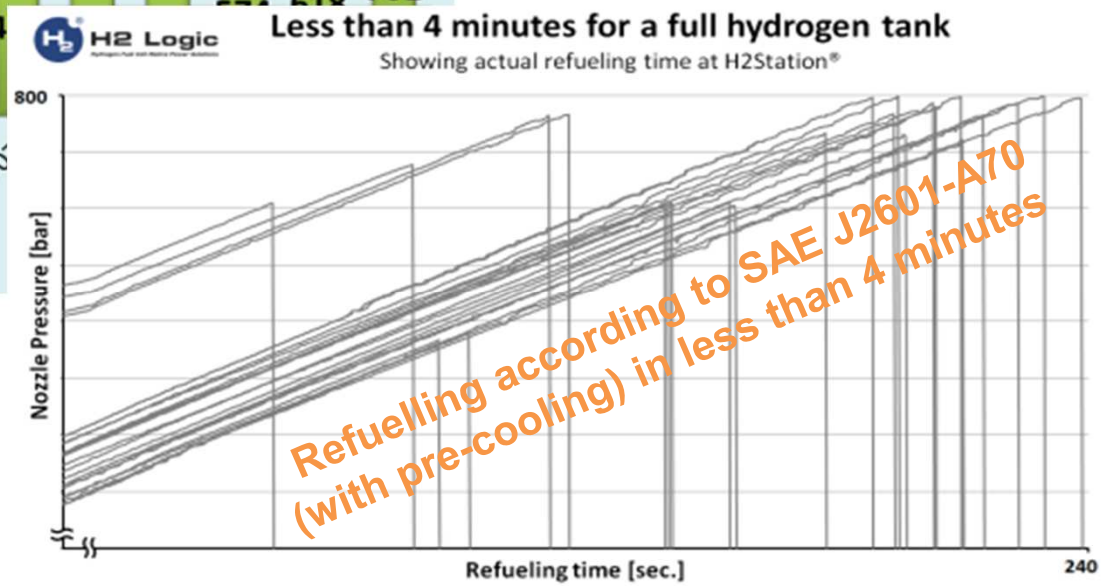
- Sites in city centre confined, difficult to identify suitable, conventional site
- Sites at main entry roads to city centre larger / can be reached by more cars
- New HRS @ Gaustad to complement existing stations in HyNor-network
- Permit for hydrogen refuelling station obtained from Oslo building authorities

4. Build up infrastructure 2/4

Hydrogen refuelling station

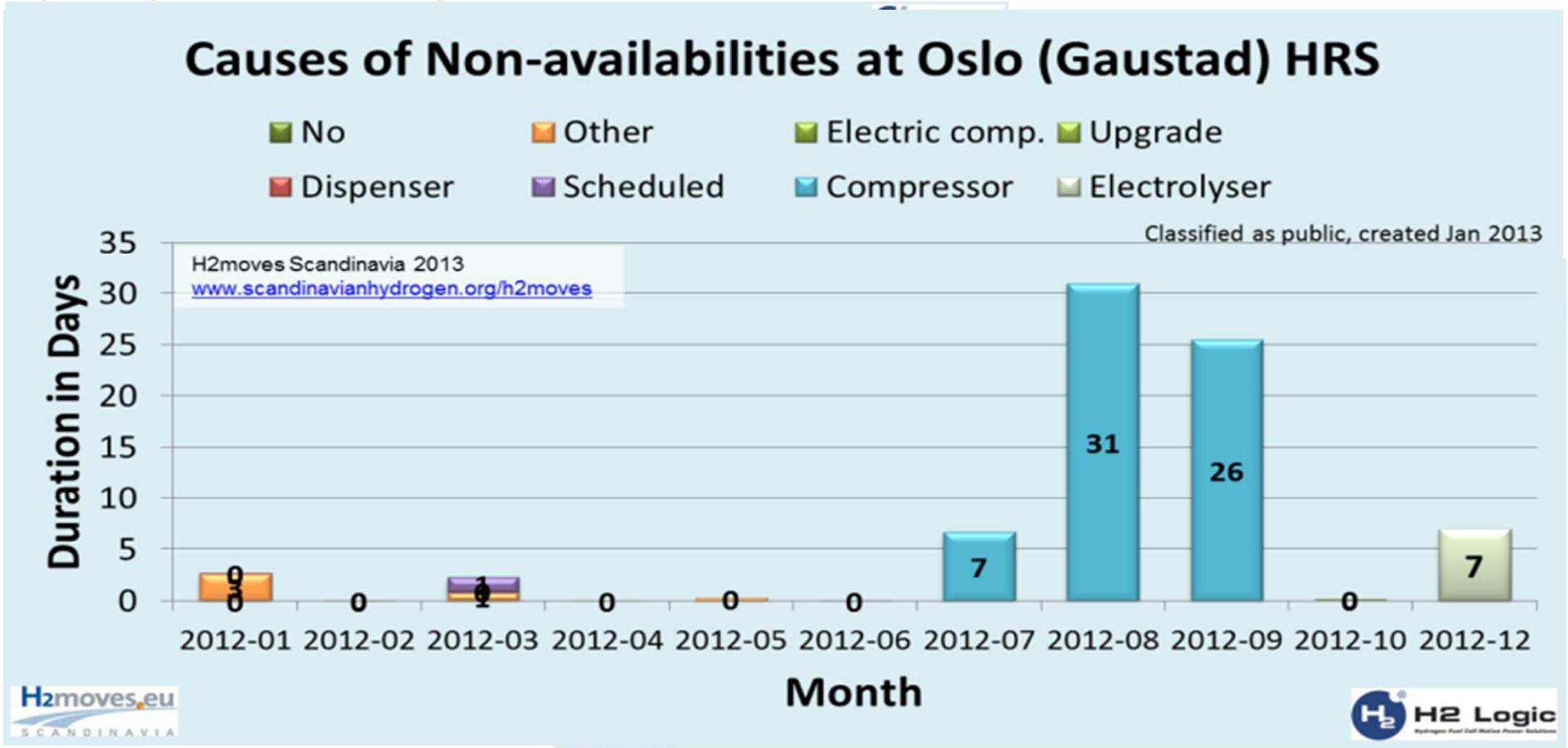


701 kg out of a total of 2,334 kg of hydrogen refuelled at project HRS



4. Build up infrastructure 3/4

Hydrogen refuelling station



4. Build up infrastructure 4/4

Hydrogen refuelling station, R&D activities

SINTEF

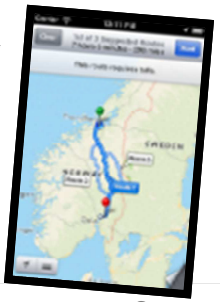
Next-Generation Hydrogen Stations

- Producing high quality hydrogen at lower costs:

1. Hydrogen gas quality assurance
   - *Developing new, more efficient methods to predict gas quality and develop strategies to mitigate impurities vulnerable for automotive fuel cells.*

2. Lowering the cost of hydrogen at nozzle by 'clever' production
   - *Dynamic, on-line operation optimization of production to reduce the cost of hydrogen generated from electricity by water electrolysers, utilizing price variations in Norway, Nordic countries and Germany.*

3. Where is the nearest open hydrogen station?
   - *Developing applications for smartphones, the Web, and SMS, so customers can conveniently find the nearest HRS.*



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Conclusions

Contribution to accelerate market introduction of FCEVs

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Market preparation for Fuel Cell Electric Vehicles (FCEVs)

1. Successful FCEVs demonstration as part of the preparation for commercialization, incl. FCEVs validation in harsh winter climate ☑
2. Without exception, our customers and passengers are enthusiastic about fuel cell electric vehicles ☑
3. Informal and trustful linkage between partners from industry has developed Scandinavian Hydrogen Highway Partnership DAIMLER HYUNDAI HONDA TOYOTA ☑
4. Hydrogen refuelling station (HRS) has been operative ~ 80 % of the time **Experience shows that some key components need to be improved** ☑

➢ ***Demonstration activities play a key role in the technology development,***

➢ ***Feedback to R&D has shown to be valuable for technological progress!***

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Acknowledgement

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CO-Funded by transnova

eUDP Energiteknologisk udvikling og demonstration

The Research Council of Norway

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Scandinavian Hydrogen Highway Partnership

New Energy World JU
fuel cells & hydrogen for sustainability

Contact

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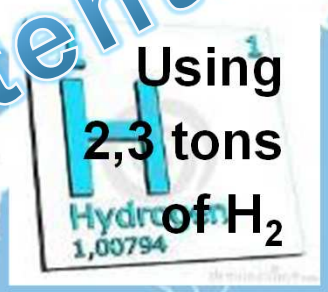
Thank you for your attention!

Reduction

CO_2

~ 25 tons



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