

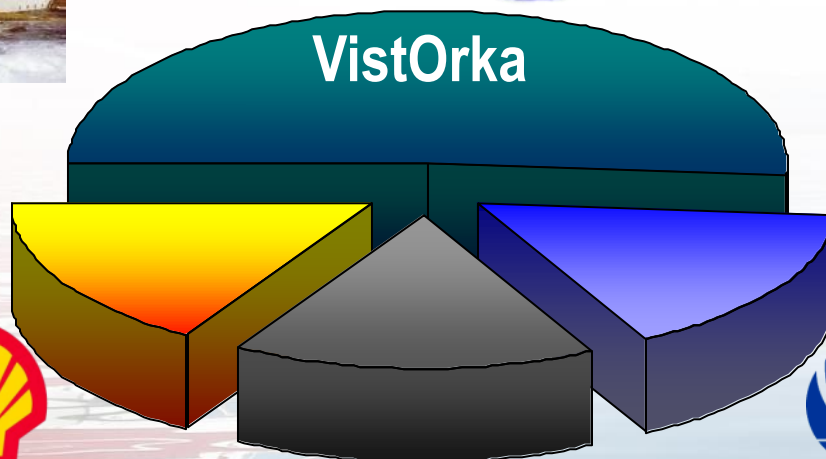


Iceland striving towards the hydrogen society

Jón Björn Skúlason
General Manager
Icelandic New Energy



Unique INE structure / objective



DAIMLERCHRYSLER



HYDRO



Icelandic New Energy Ltd



Status

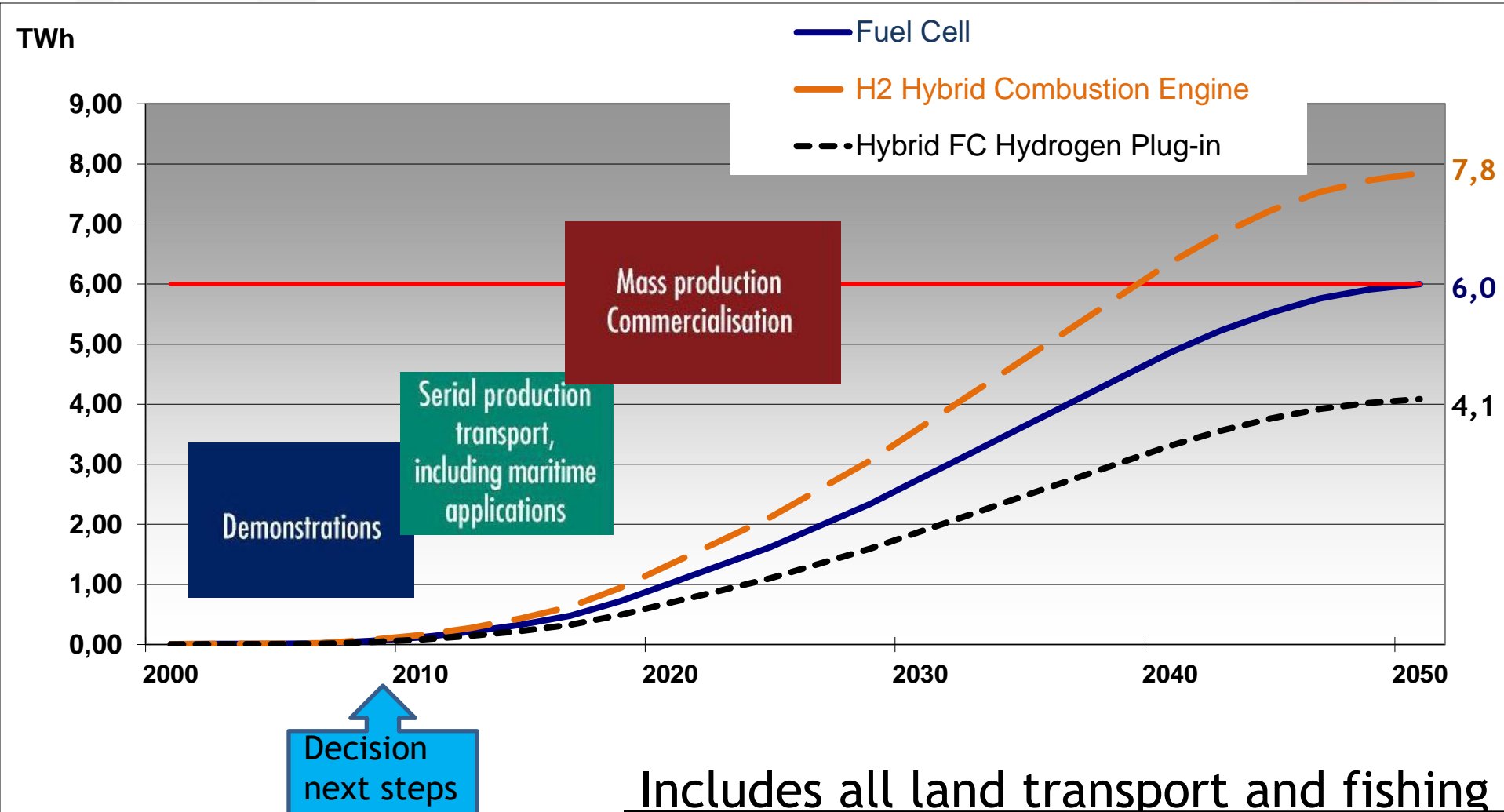


- World's first commercial filling station opened in 2003
- Demonstration of FC-buses 2003-2007
- Demonstration of an electric FC back-up system 2005-2006
- Passenger vehicle demo started 2007
- Marine testing of fuel cells from April 2008





Energy use in a hydrogen society





Key Projects



1. Hydrogen fuel cell bus demonstration: ECTOS



Demonstration
Programme

Gradual introduction
into bus fleet

2. Hydrogen passenger vehicles



Demonstration
Programme

Gradual introduction
into passenger car fleet

3. Hydrogen fishing vessel demonstration



Demonstration
Programme

Gradual introduction
into fishing fleet

2000

2003

2007

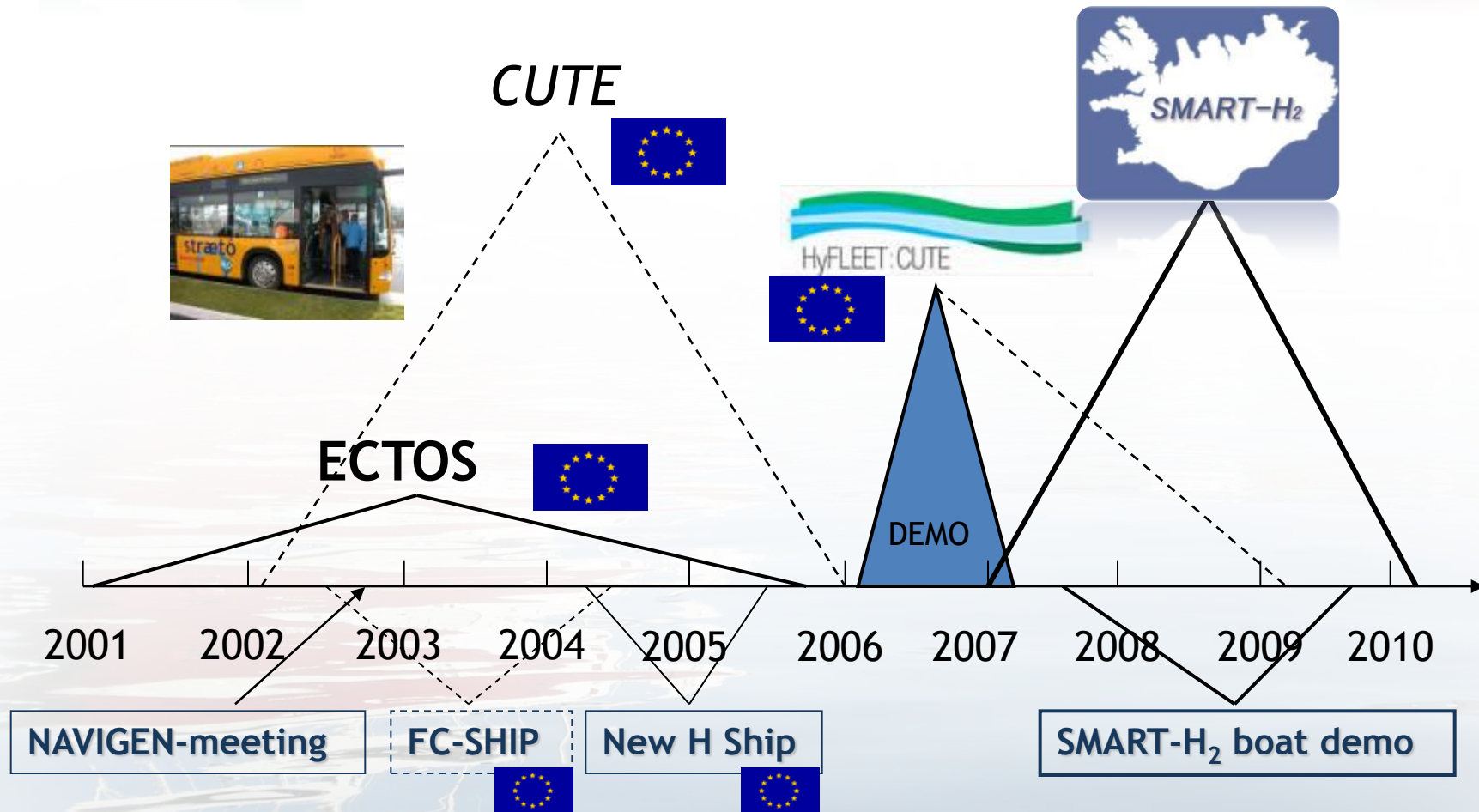
2008

Time





INE's activities





The Icelandic accomplishment with H₂ buses



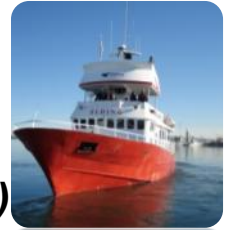
- Results are very promising
- Operation total
 - 144.192 km to date
 - 8.324 operating hours
- Pumped 27.000 kg of hydrogen
- Saved over >70.000 l. of diesel / and close to 200 tons less greenhouse gas emissions
- Indication that there is over 90% of the public positive towards the new fuel





Hydrogen station

First station in the world operating at a conventional gasoline station (has full commercial license)



Permits for this station were granted in 2003





The future hydrogen infrastructure



- Evaluating the future economic- and social implications of a full scale H₂ infrastructure
- Optimisation of H₂ filling stations
 - Production capacity vs. storage
 - Production capacity vs. electric prices (off peak power)
 - Regional planning (size of future infrastructure, footprint)
- National impact (cost-benefit)
 - Foreign currency savings (no imports of fuel)
 - Domestic energy
 - Independence (incentives - taxation - other)
 - Energy security





SMART-H₂ 2007-2010



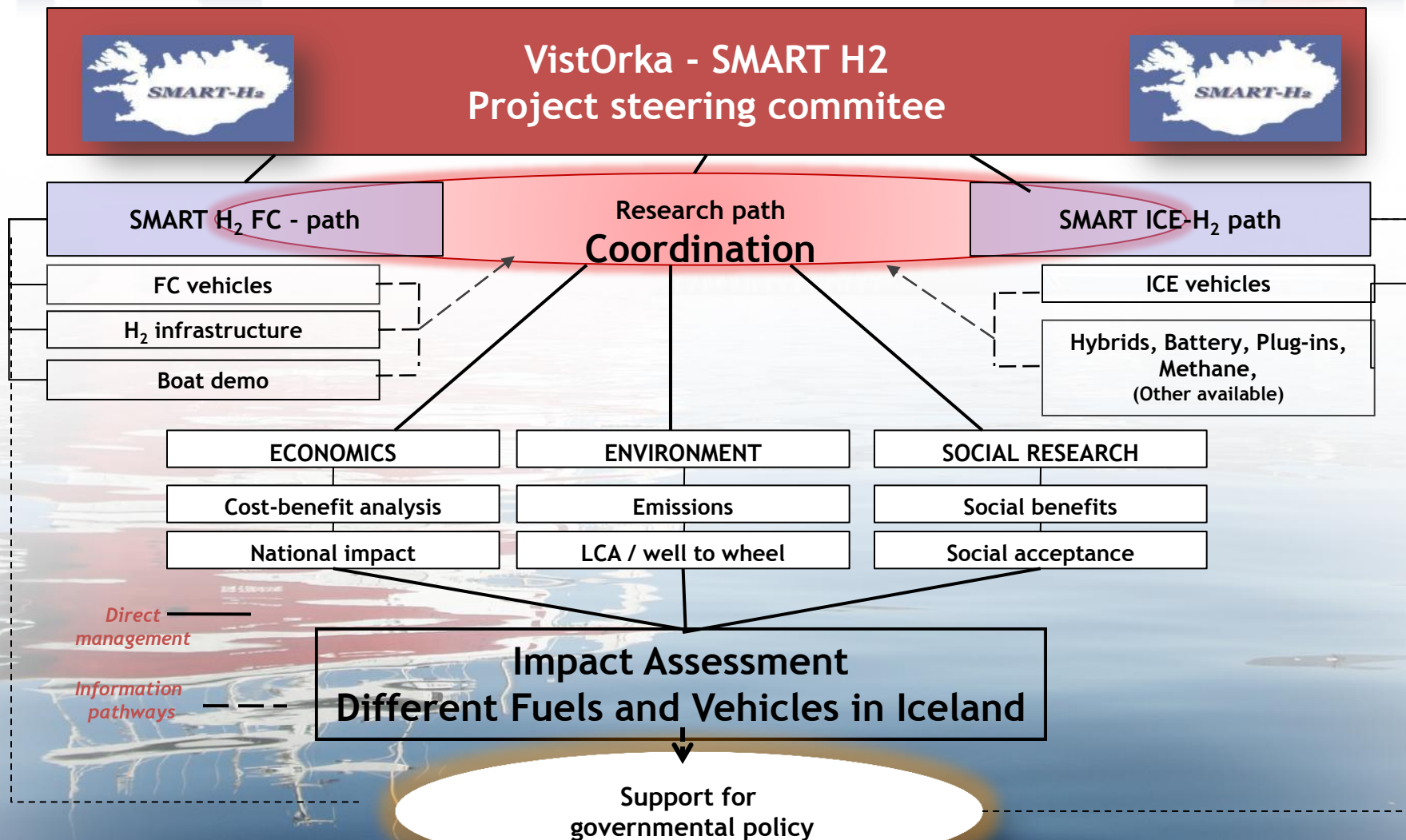
Sustainable Marine & Road Transport - H₂ in Iceland

- Goal:
 - Demonstration of a fleet of hydrogen cars 20-40 cars
 - Various engine types (ICE's/FC's), and from different vehicle producers
 - Demonstration of an auxiliary boat engine
 - Testing of infrastructure for different users and increasing the availability of hydrogen within Reykjavik/Iceland





Organisational Chart





SMART-H₂ 2007-2010



- Project participants: ~20 Icelandic
~10 foreign
 - New partners welcomed
- Project cost:
 - Estimated to be US\$ 8-10 Million
 - The cost might increase if new partner join
- Not funded by any direct official funds
 - Flexible / Scalable
 - No cost statements / project management team involved directly - short communication paths
 - EU application might create new opportunities
 - Project management and partners decide which elements are public and disseminated



Different vehicles



➤ 20.000 km
total in the project





Vehicle customers



- Three key customers
 - Energy companies (electric producers both from hydro and geothermal, already 80% of the total energy usage in Iceland is based on renewable energy)
 - Car rental
- From beginning of Nov. 2007 the normal public and tourists can rent hydrogen vehicles in Iceland and use a self-service H₂ refuelling station.





Increasing H₂ availability



- Passenger cars create new demand - difficult to operate hydrogen vehicles with only one station
- Back-up lacking - security
- Could be containerised
 - Production (4-15 kg/day), storage, dispenser
 - Working pressure needs to be 700 bars - new vehicles from vehicle manufacturers have 700 bar storage
- Vehicle no. still low - but difficult to increase without new stations
 - VistOrka is in discussion with partners for a potential new refuelling station

Example of semi-mobile station
Powertech (Canada)

Icelandic New Energy





Scandinavian cooperation



- Iceland and Norway proudly present the 2nd largest H₂ vehicle fleet in Europe
- HyNor and INE have a MoU - information exchange
- Network projects between all Scandinavian countries
 - NAHA
 - SHHP
- Joint approach
 - Vehicle manufacturers
 - Potential customers



The boat



- Based in Reykjavik, the **Elding**, is a 125-ton, well equipped cruiser with a capacity of 150 passengers.
 - Whale watching
- The Elding is a safe and extremely stable ship, originally built in Iceland as a rescue ship





Elding - Specification

Aux. unit



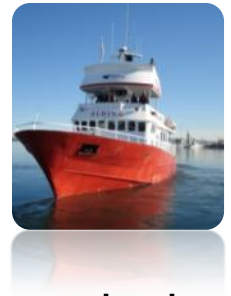
- Today's el-generation in Elding is based on two 50kW generators
- Basic load is though only about 5-10kW
- A 10 kW FC system will be installed and hybridised so peak output can reach 15 kW





Boat intergration

Responsibilities



Shell Hydrogen
refuelling station



→ H₂

Linde Gas

AGA

H₂

Onshore hydrogen
storage/refueller
200 bar storage



 ICELANDIC
HYDROGEN

Refuelling connection

Enclosure unit for hose
and connection (Fixed hose)

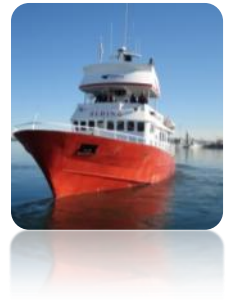
Enclosure unit for
hose connection nozzle

H₂



Boat intergration

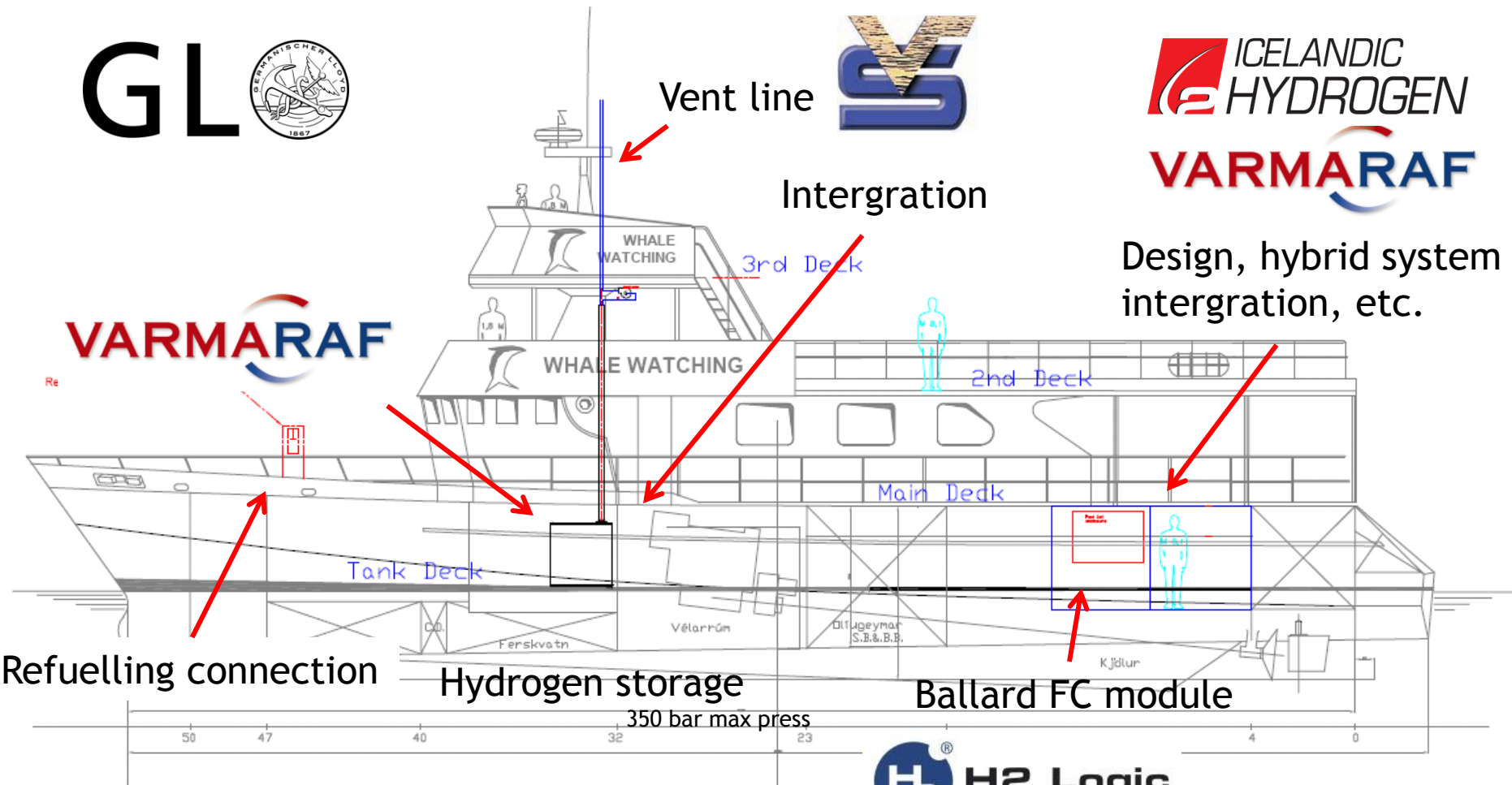
Responsibilities



Certification



Design, hybrid system
intergration, etc.





“Petta reddast”



Bottle rack prepared
Boat in the shipyard, 3 weeks ago



Bottles installed
“is smoking safe?”





SMART-H₂ - Research



- Technical assessment of different vehicles and technologies
- Follow up on all the research done in the bus demo - focusing on the three pillars of sustainability
 - Social
 - Environment
 - Economics
- Continue the validation of the hydrogen infrastructure - station only 5 years in operation
 - There is a need to validate lifetime and reliability of the infrastructure



SMART-H₂ - Dissemination



- Total 13 H₂ cars are currently in Iceland
- Tomorrow INE again starts a “worlds first” when H₂ will be used as part of the power source for a commercial boat
- The goal is to increase the no. of H₂ vehicles from 2008 onwards
- Companies attention is very high >450 int. media visits since 2003

High level US guests at INE



Opening of the hydrogen refuelling station





Iceland today



**& also for
future
generations**



We make it happen



Iceland - the first hydrogen society!



Owners:

VistOrka

DaimlerChrysler AG

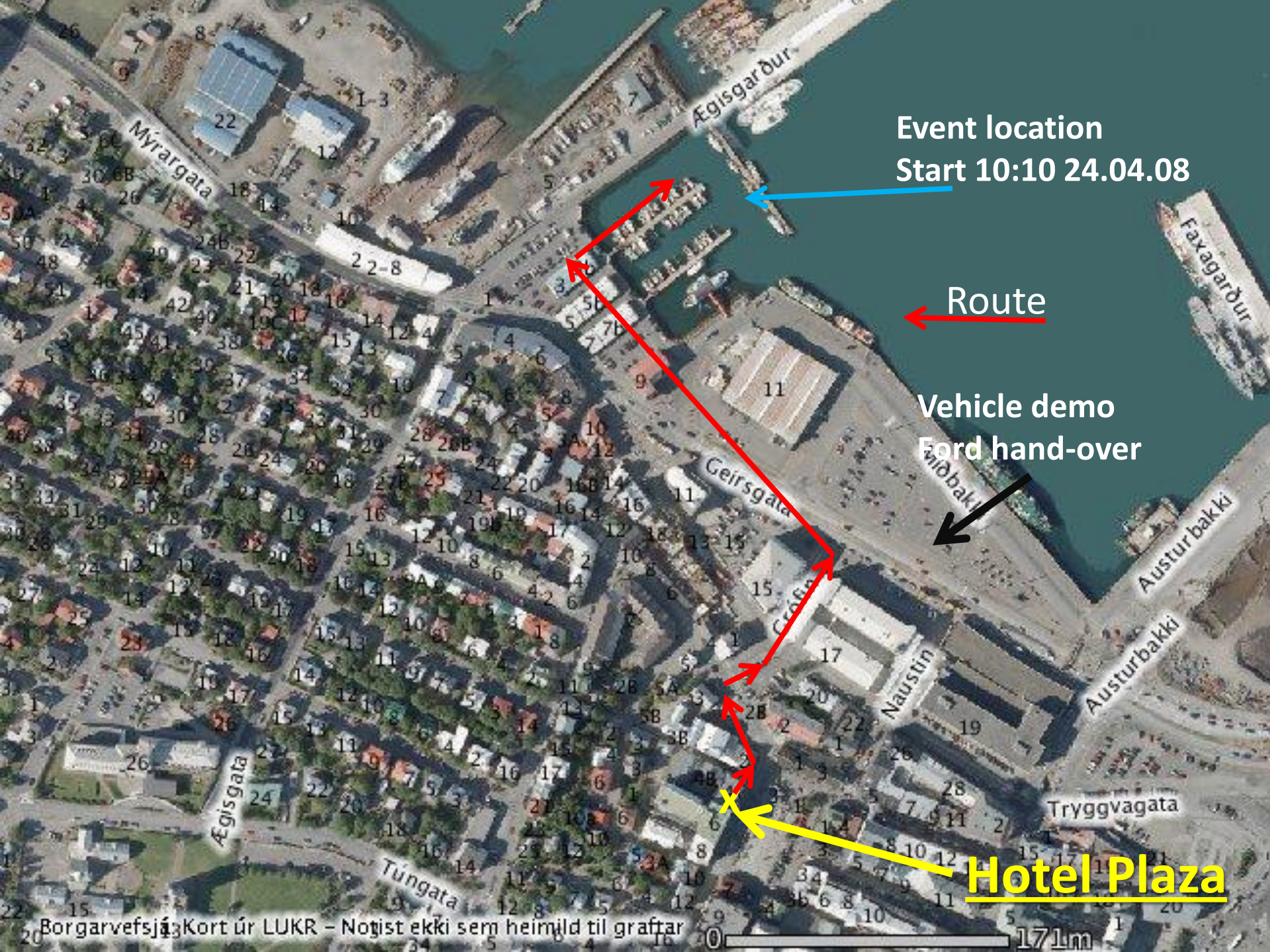
Norsk Hydro ASA

Shell Hydrogen



Replacing fossil fuels with hydrogen

Icelandic New Energy Ltd

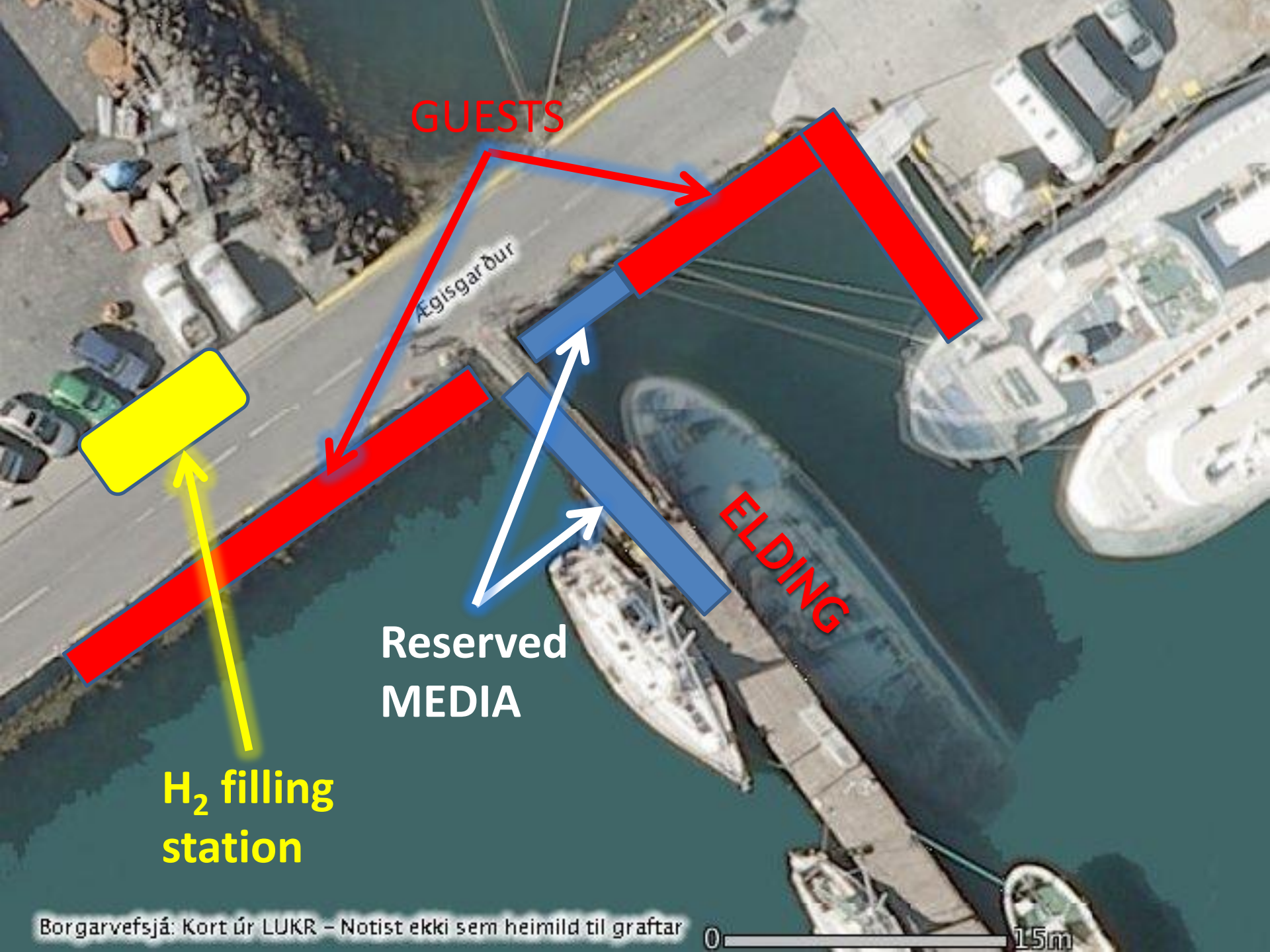


Event location
Start 10:10 24.04.08

Route

Vehicle demo
Ford hand-over

Hotel Plaza



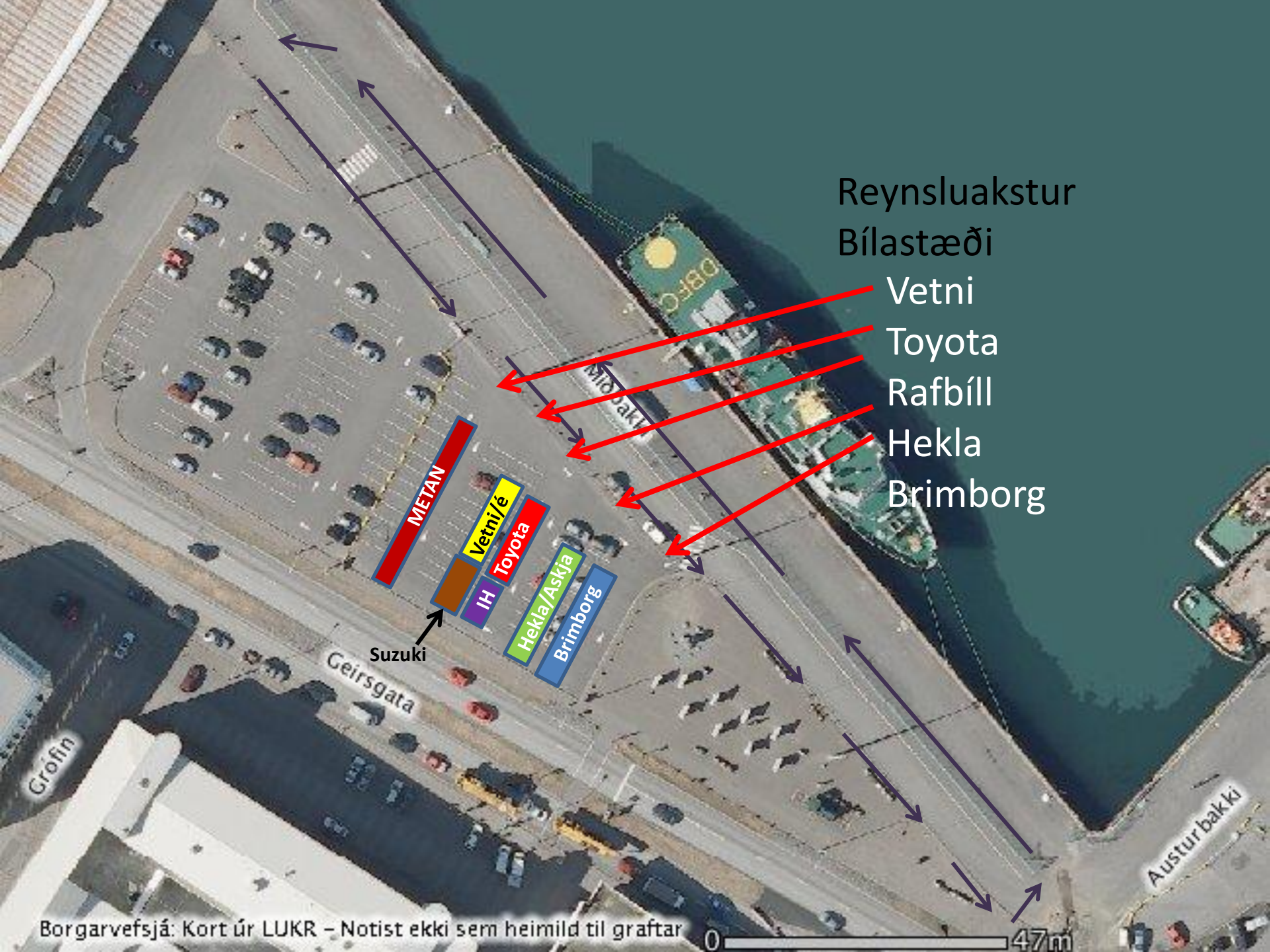
GUESTS

Ægisgarður

ELDING

Reserved
MEDIA

H₂ filling
station



Reynsluakstur
Bílastæði

Vetni

Toyota

Rafbíll

Hekla

Brimborg

METAN

Vetni/e

Toyota

IH

Hekla/Askja

Brimborg

Suzuki

Geirsgata

Grofin

Austur bakki