FUTURE MOBILITY

Beate Kvamstad-Lervold

Business Development Director Moblity

THE BIG PICTURE

SINTEF


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
13 CLIMATE ACTION

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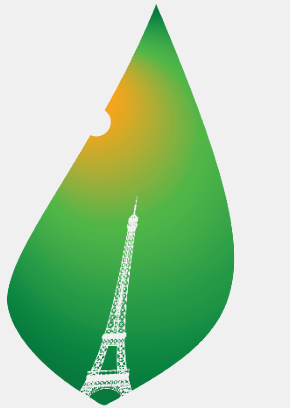
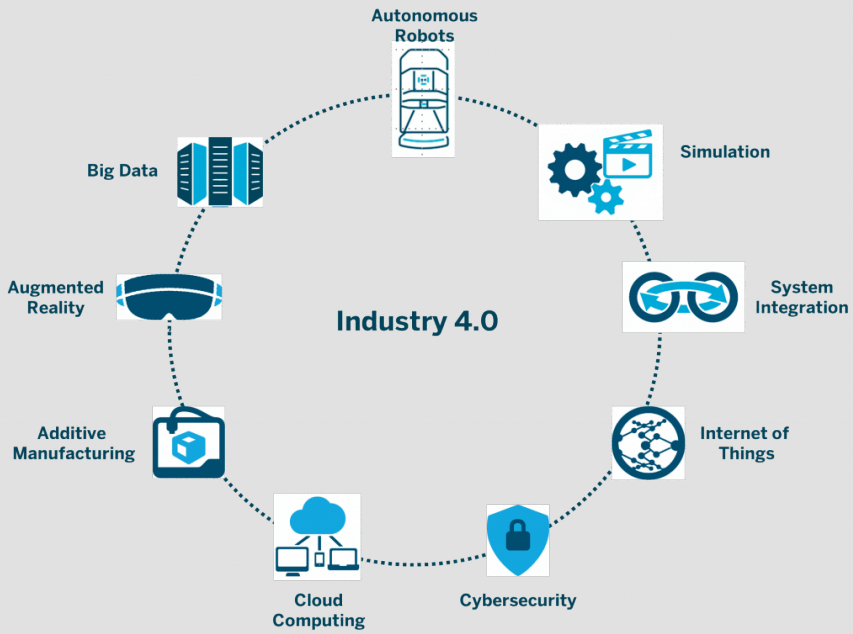


PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

SINTEF


Autonomous Robots
Simulation
System Integration
Internet of Things
Cybersecurity
Cloud Computing
Additive Manufacturing
Augmented Reality
Big Data
Industry 4.0

FNs BÆREKRAFTSMÅL

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

4.0
Industry 4.0

TRANSPORT 21

SINTEF

Drivers for development in Norway

600.000 new jobs

Climate targets and targets for more industrial transport on rail and sea.

Increased urbanisation enhances need for new mobility solutions.

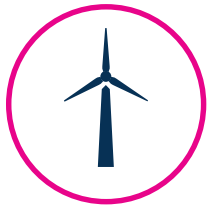
Increased transport due to e-commerce and industrial transport.

MOBILITY @ SINTEF

SINTEF

Applied research, technology and innovation

Expertise from ocean space to outer space:



Renewable energy

Ocean space

Industry

Buildings and infrastructure

Materials

Micro-, nano- and biotechnology

Climate and environment

Oil and gas

Health and welfare

Society

Digitalization

Transport

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AN INDEPENDENT, NOT-FOR-PROFIT RESEARCH INSTITUTE

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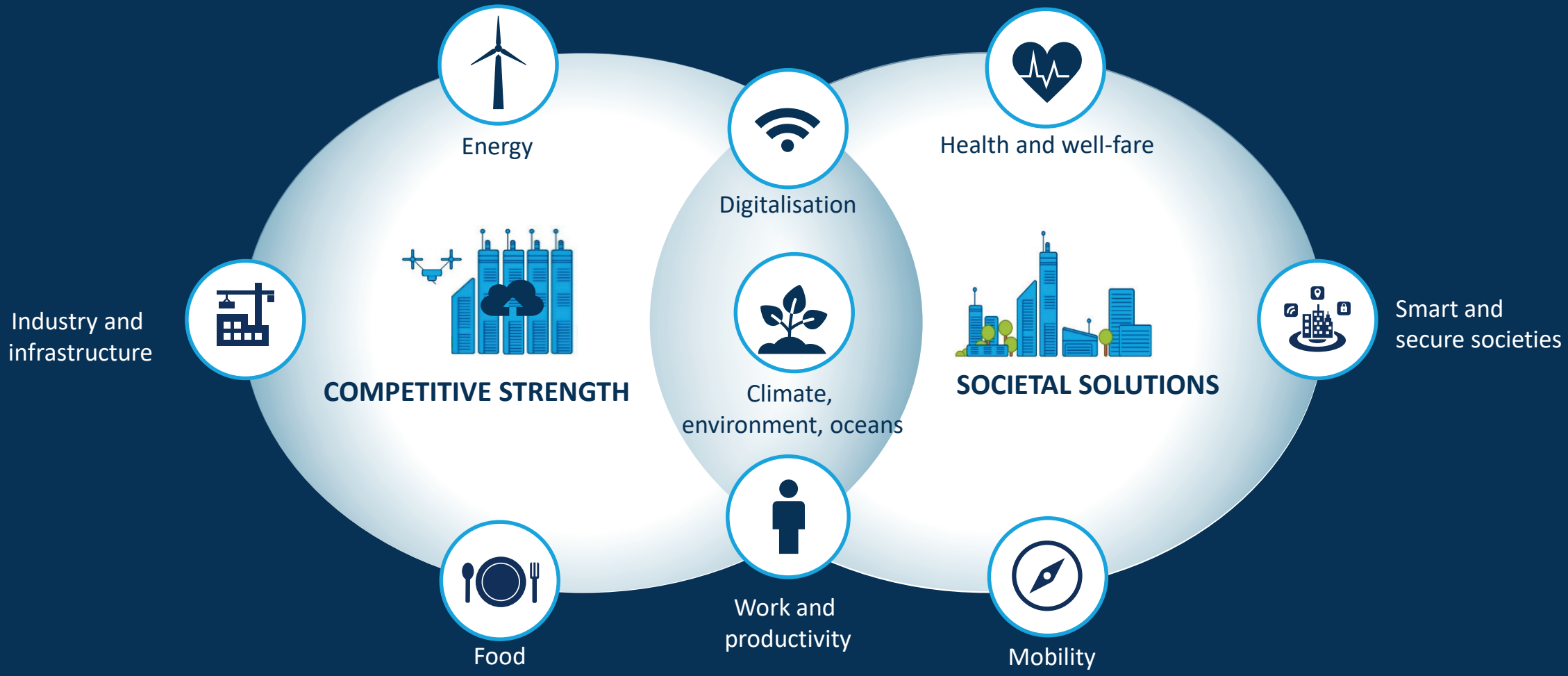
Vision: Technology for a better society

Expertise from ocean space to outer space



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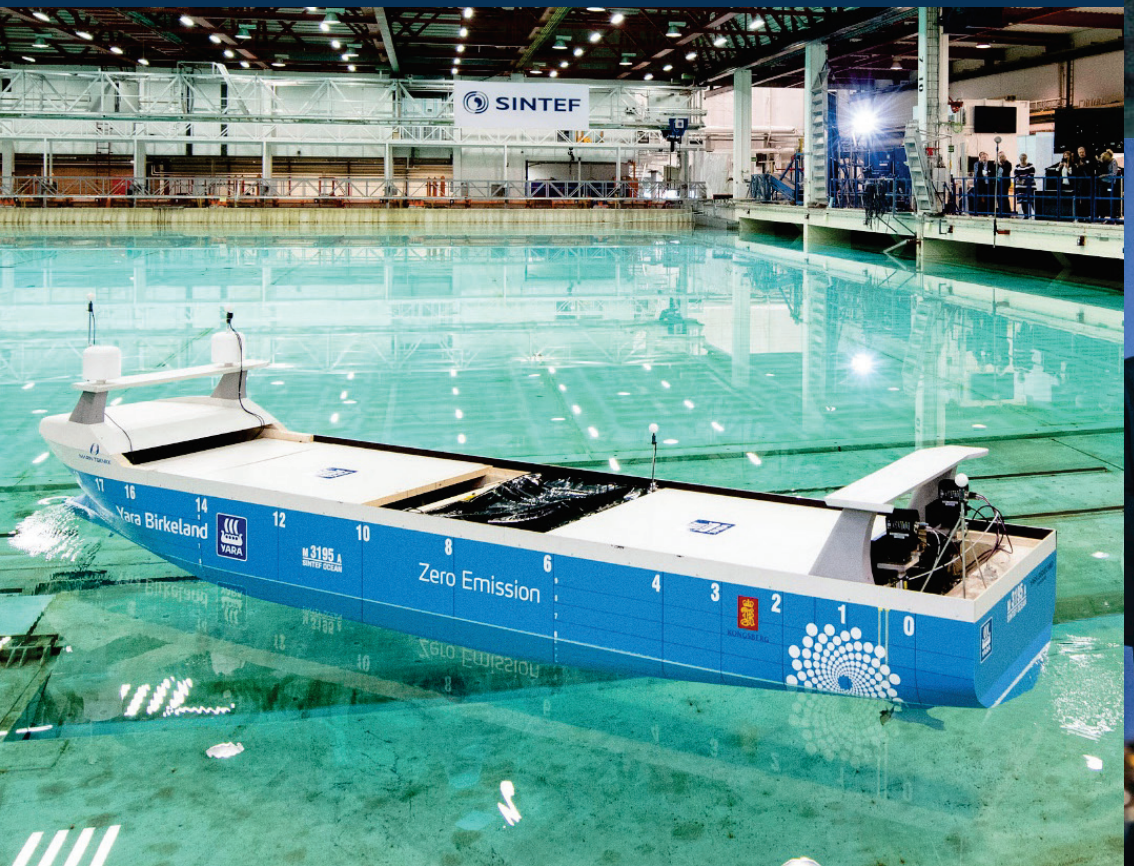
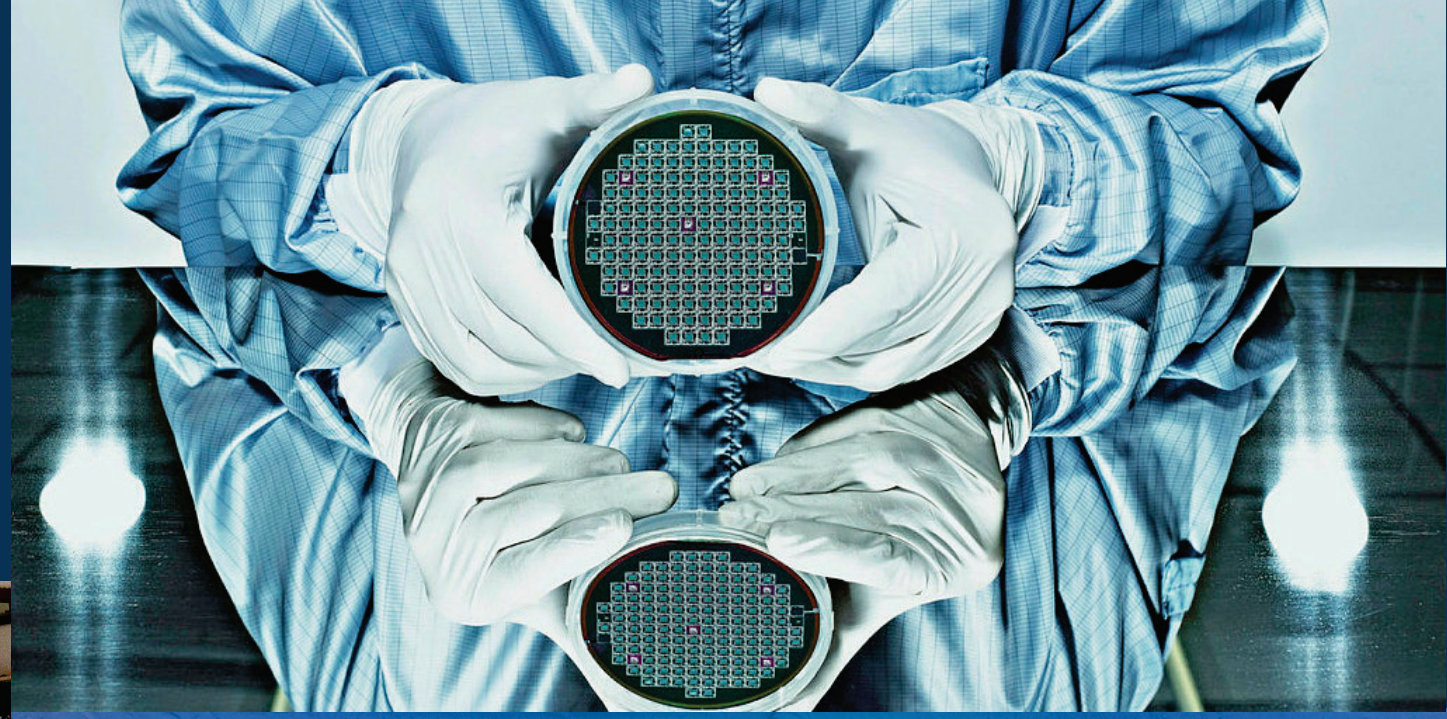
Our ambition: A world-leading research institute





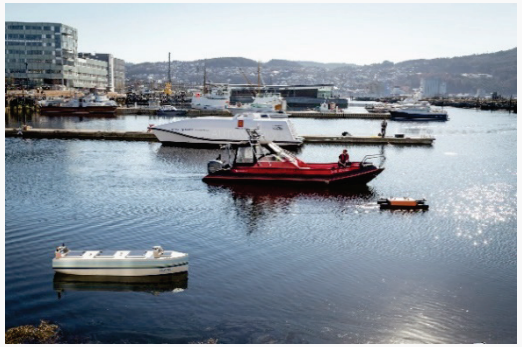
Mobility research key figures (2017)

200
researchers

280
MNOK project portfolio

8
Research labs

Full-scale fieldwork and test sites



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Transport models

Socio-economics
Safety and emergency preparedness
Business models
Change management
LCA

Digitalisation and automation

Mobility-as-a-service
Optimisation
Digital infrastructure
Big data analytics, AI

Zero emission transport

Distribution, storage and flexible energy system integration
Transport electrification
Energy supply systems to & on ships/vessels
Alternative fuels (hydrogen and biofuel)
Transport system energy efficiency

Transport systems of tomorrow

Autonomous ships and vehicles
Drones
Hyperloop
Environmental friendly aircrafts
Platooning

Sustainable infrastructure

Construction process and costs
Emission free construction sector
Environmental friendly materials
Effective ports and logistical hubs/nodes
Fjord-crossings

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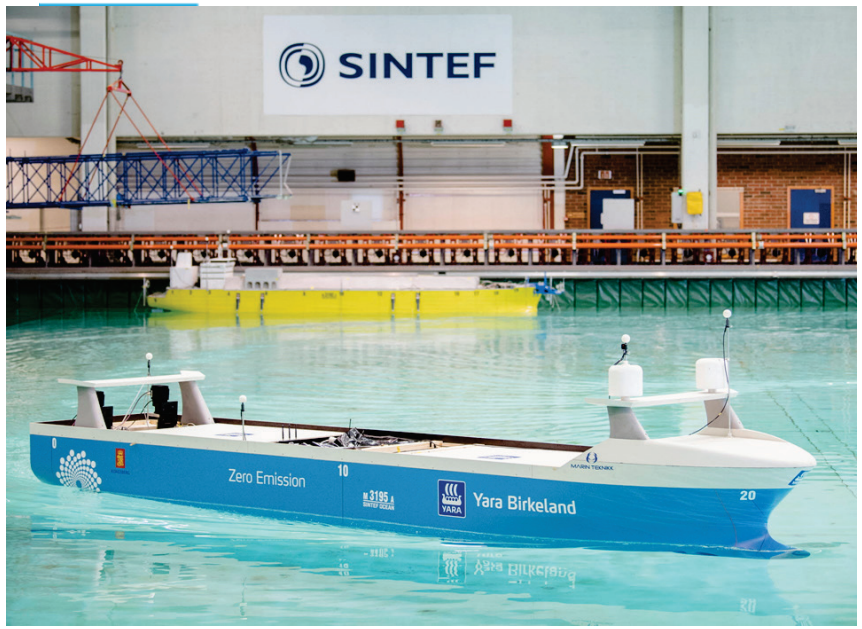
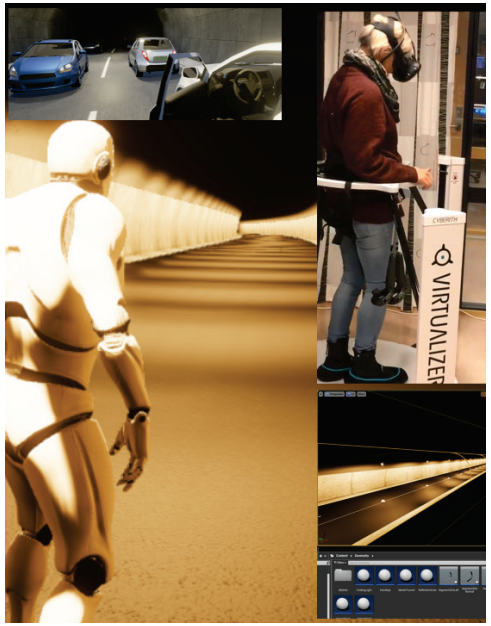
Laboratories



Hydrodynamic sealabs

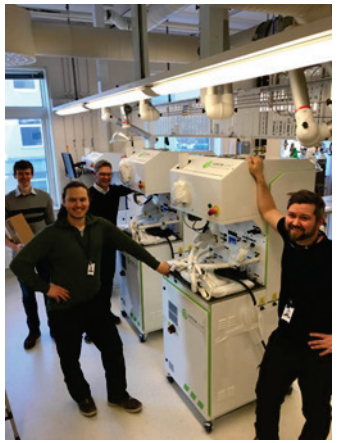
Norwegian Smartgrid lab



VR-lab, walking simulator

Materials labs

Hybrid machinery lab



Low temp. H_2 og fuel cell-lab

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The SINTEF strategic transport platform

Industry relevance

fortum, Hafslund, OSLO KOMMUNE, Statens vegvesen, HAUGALAND KRAFT, equinor, ABB, agder energi, Skagerak Energi, Bergen Havn, SIEMENS, VIKEN SKOG, AVINOR, BKK, REN, ISTAD, WÄRTSILÄ, Color Line, NASTA

Grand challenges in society

Climate change, Paris agreement, EU SET plan, Nordic ministry council, IMO strategy, Directive 2014/94/EU, NTP, ENERGIX

Strategic project portfolio

Industry projects
IPN NESS, IPN ELinGO, Pilot-E UWS, Pilot-E ZED, Bergen Landstrøm, IPN Energytics, IPN Dynamisk kapasitet i framtidens kabelnett, BioFuel Development, Equinor

KPN-projects
Optistore, ModFlex, FuChar, GAFT

EU-projects
MoMeWEC, NextGenRoadFuels

Research centra (FME/SFI) / Infrastructure
FME CINELDI, FME Bio4Fuels / NorBioLab, SmartGridLab, SINTEF EnergyLab

SIP, Blue Sky and researcher projects
IPT ElTra, GasPro, Flash

Research agenda in Norway, EU and beyond

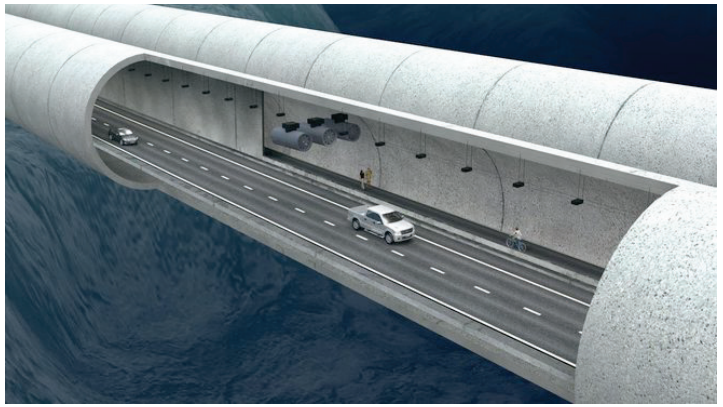
NVE, DET KONGELEGE OLJE- OG ENERGIDEPARTEMENT, Forskningsrådet, energi21, iea International Energy Agency, CLIMIT, Nordic Energy Research, EERA, FME Forskningssenter for miljøvennlig energi, Norges forskningsråd, Innovation Norway, HORIZON 2020, U.S. DEPARTMENT OF ENERGY

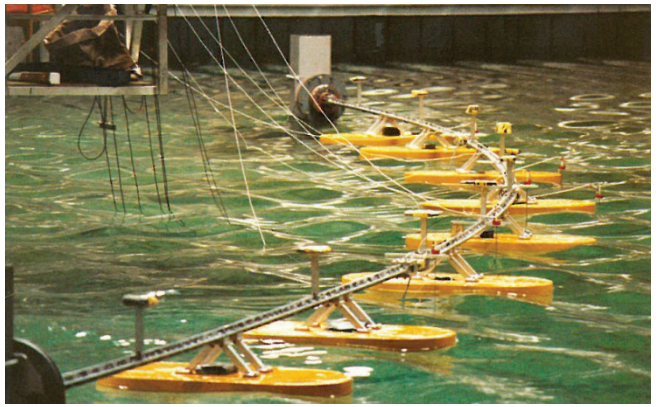
Frontier research and world-leading research infrastructure

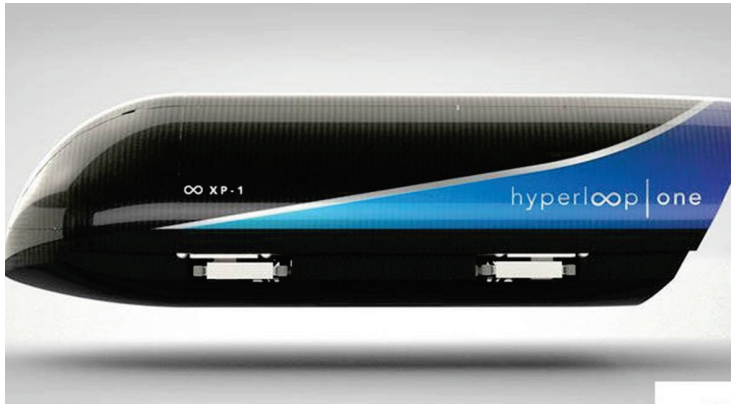
TNO innovation for life, NTNU, UNIVERSITY OF LEEDS, Cornell University, RWTH AACHEN UNIVERSITY, NREL NATIONAL RENEWABLE ENERGY LABORATORY, Stanford University, 長岡技術科学大学 Nagaoka University of Technology, 東京大学 THE UNIVERSITY OF TOKYO, AIST NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST), CHALMERS UNIVERSITY OF TECHNOLOGY, UPC UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH, DTU

SINTEF

Alternative transport consepts







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Teknologi for et bedre samfunn

EXAMPLES FROM ONGOING RESEARCH

#ENERGI

SINTEF og Revolve NTNU bygger egen vekselretter til Norges hurtigste elbil: NOVA

BY HÅKON SKEIE
AUGUST 6, 2019

COMMENTS
0

Revolve NTNU er en studentorganisasjon som hvert år designer, produserer, og deltar med to helelektriske racerbiler, en med sjåfør og en autonom, i verdens største ingeniørkonkurranse for studenter; Formula Student.

Prestisjetunge pallplasser

Konkurransen priser bilens dynamiske evner, men også studentenes evne til å finne forbedringspotensiale, utrede for løsninger, og designe et produkt som skal være pålitelig og presist.

Fjorårets resultater ble den gang organisasjons beste, med en andreplass på den prestisjefylte Formula Student Germany. Her slo studentene fra NTNU ut titalls veletablerte lag fra Europas største universiteter, mange av dem med støtte fra giganter som Audi, BMW og Porsche. 1 august tok laget igjen en 2.plass, denne gangen i Formula Student Austria. Den egendesignede vekselretteren, utviklet sammen med SINTEF, var et viktig bidrag til den sterke prestasjonen.

Følg oss

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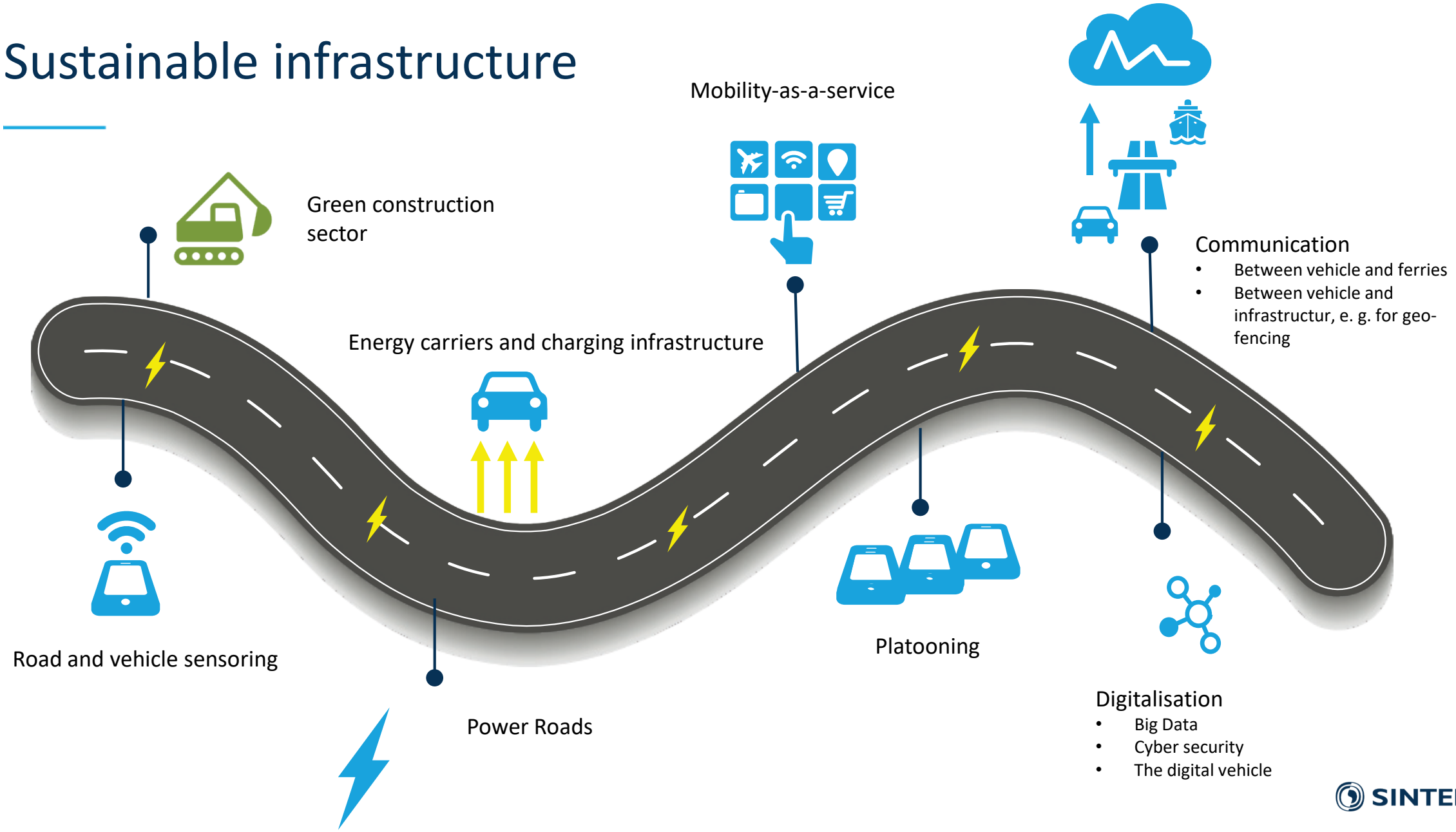
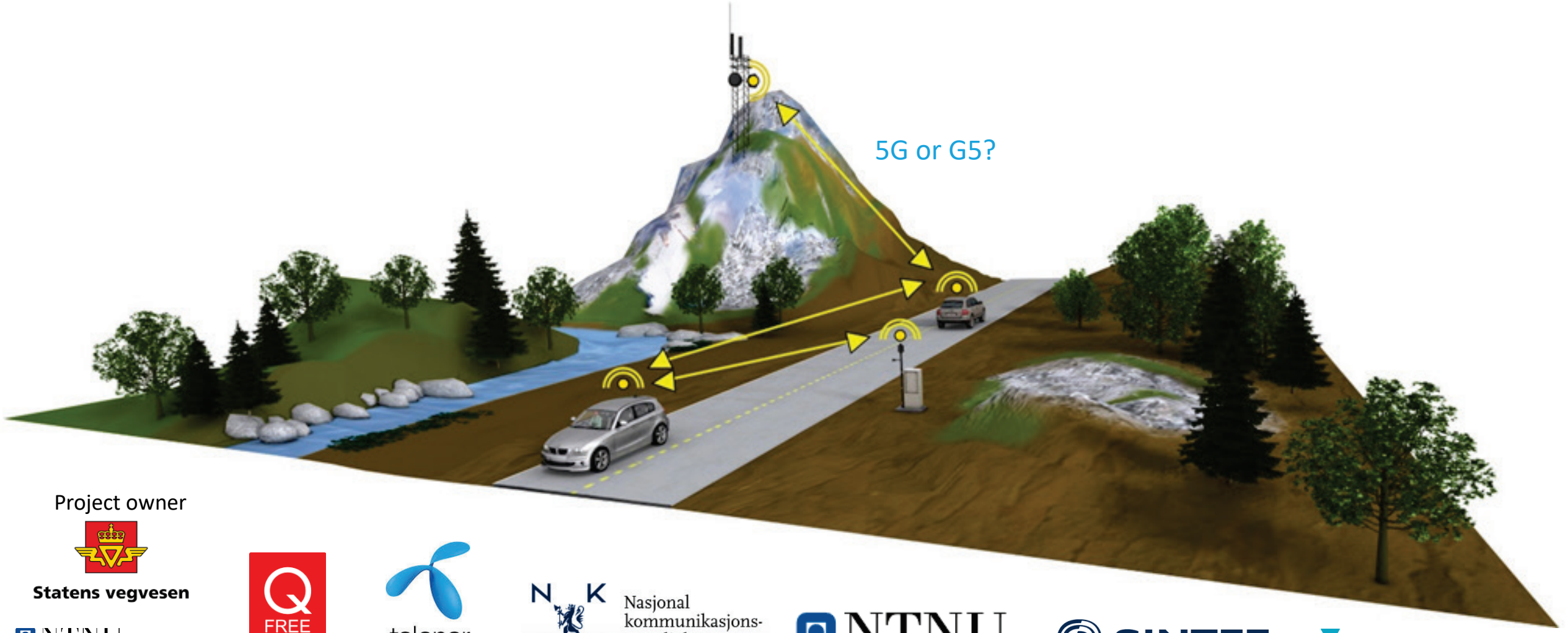
Sustainable infrastructure



SINTEF

λRoad – Future digital communication for road transport



Project owner

Statens vegvesen

NTNU
Kunnskap for en bedre verden

FREE

telenor

Nasjonal kommunikasjons-myndighet

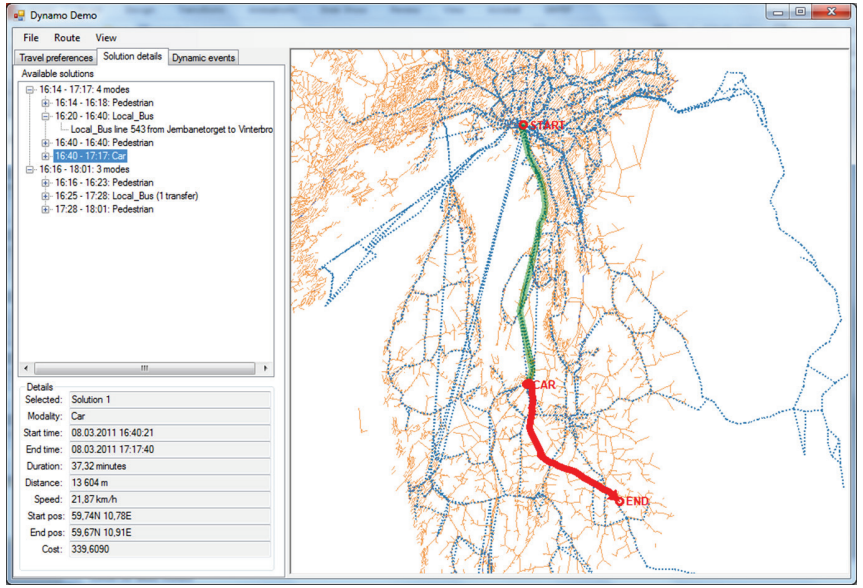
NTNU

SINTEF

Forskningsrådet

Optimisation for Mobility-as-a-Service (Ruter)

- Optimisation methods & software for dynamic travel planning
- All relevant transport modes (collective, privat car, privat bike, city bikes…)
- Flexible (autonomous) minibuses for first/last mile legs, mode-shifts, mobility-on-demand
- Optimal fleet control of Flexible autonomous minibuses



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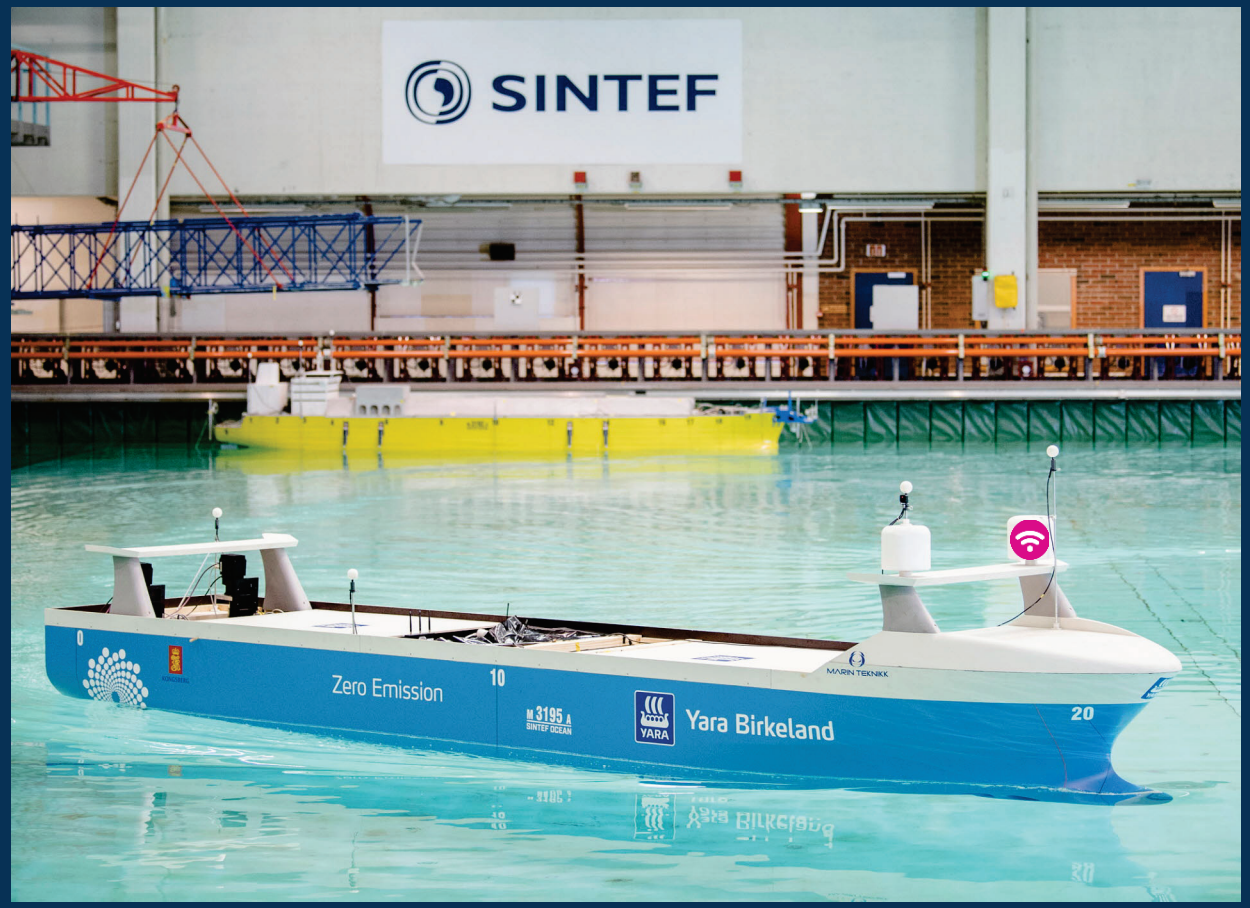
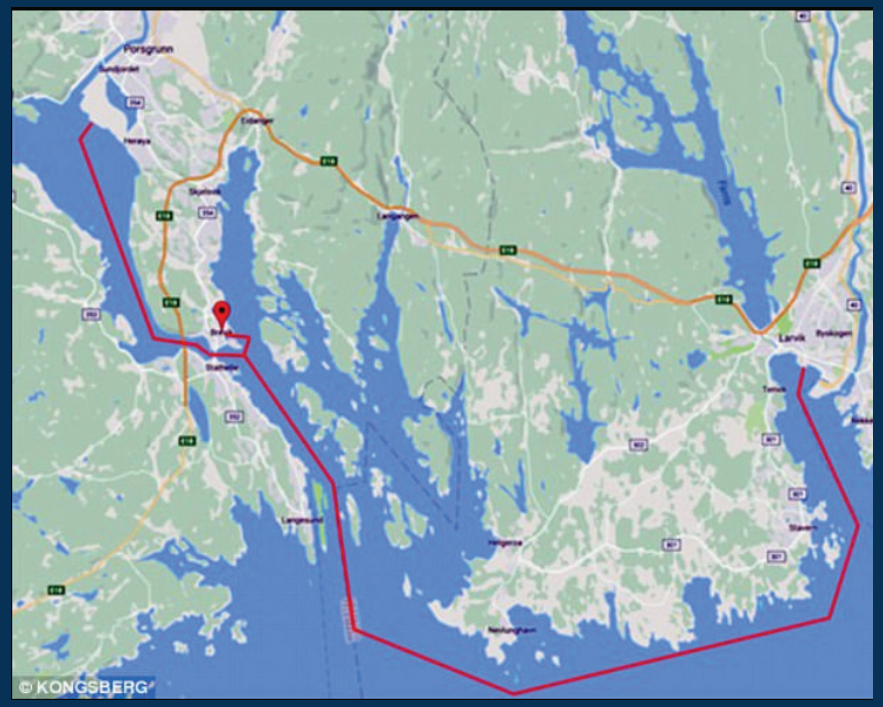
Autonomous zero emission transport





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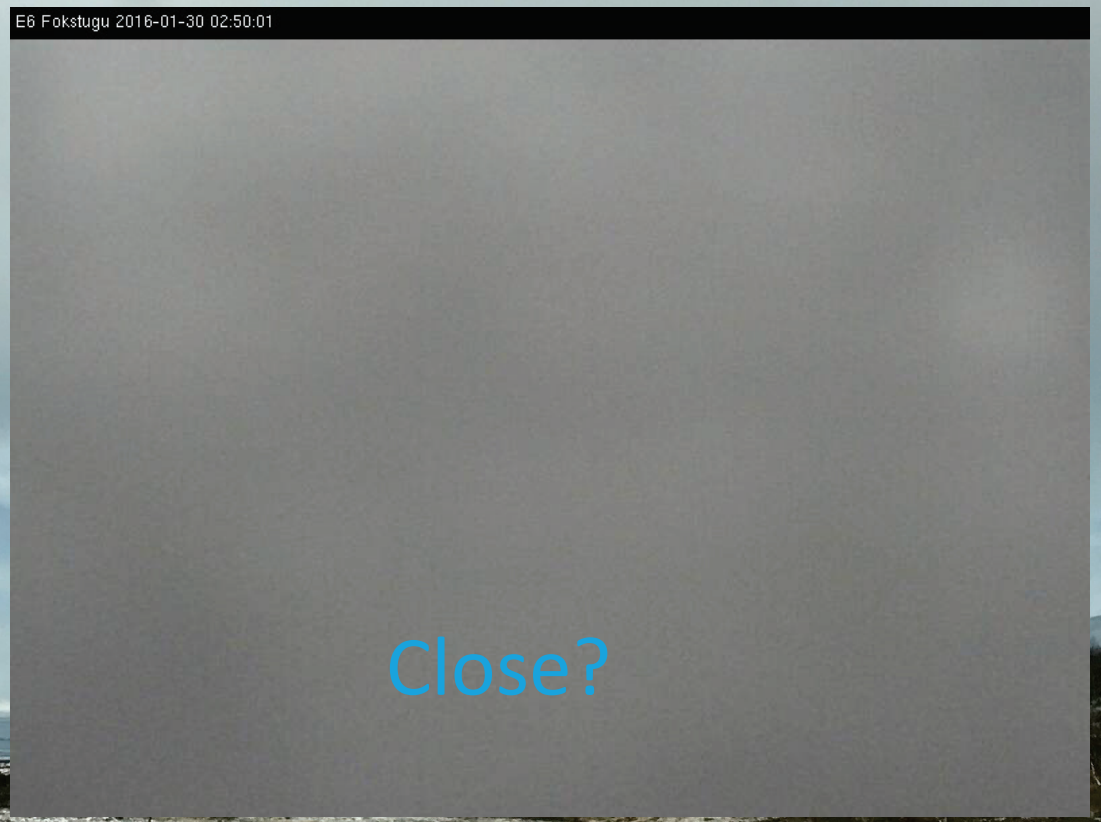
CBR EV6 Dovre



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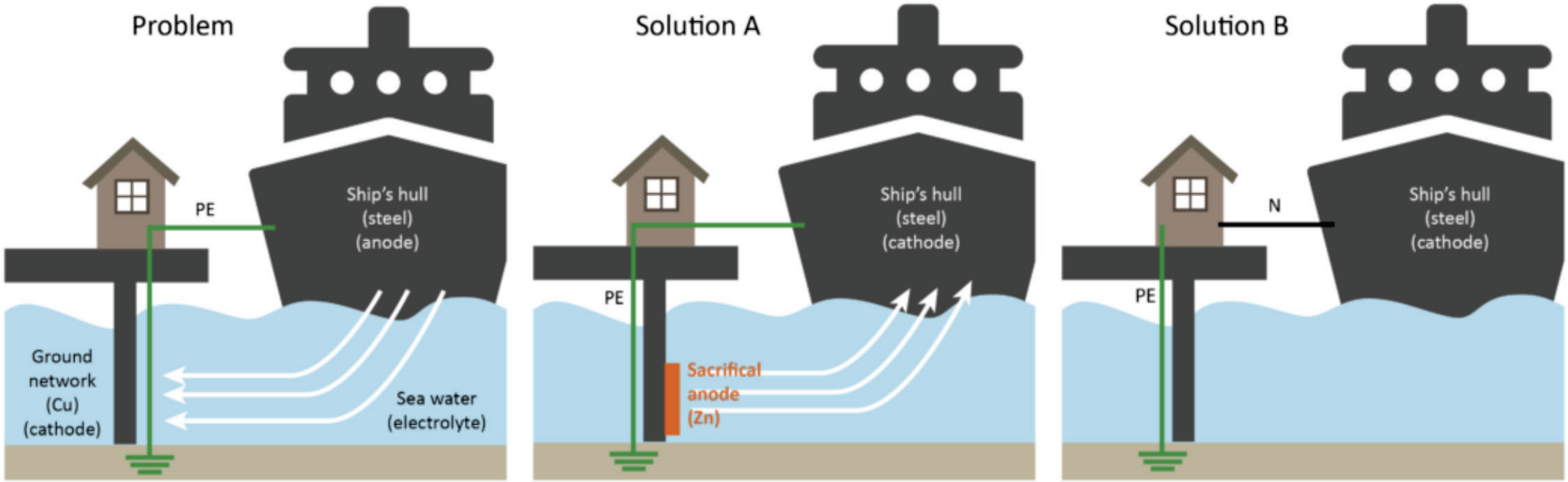
#ENERGY #INDUSTRY #OCEAN

Avoiding corrosion and hazardous touch voltages caused by onshore power supply to marine vessels

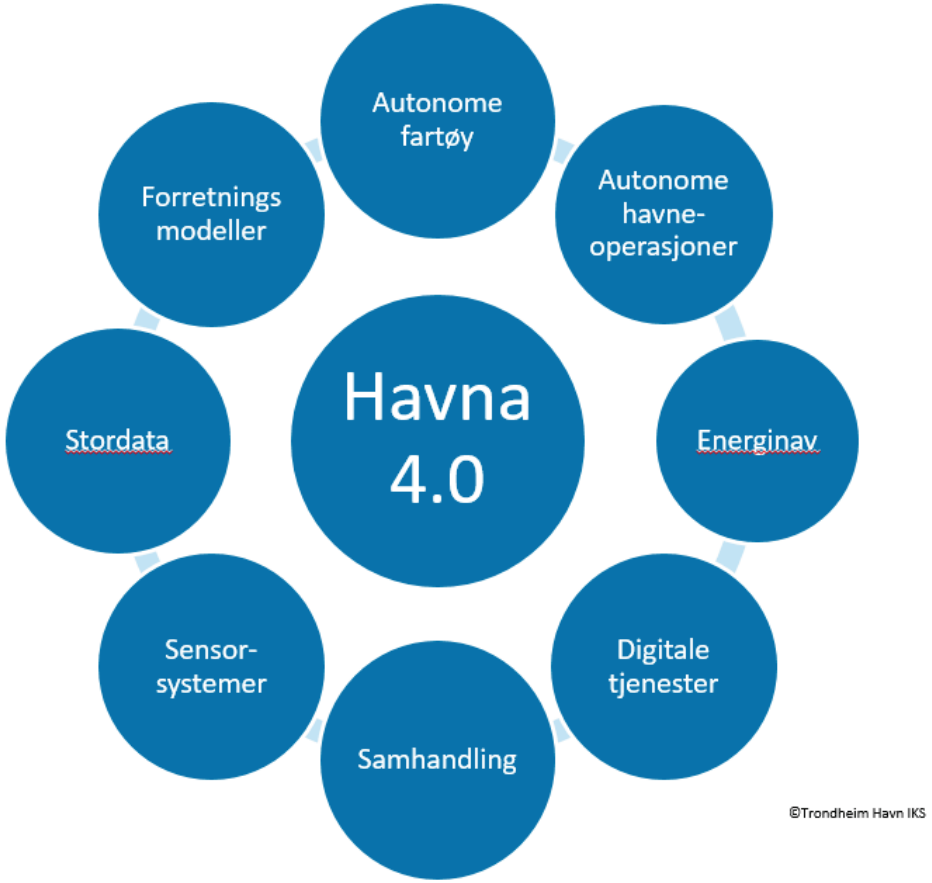
BY EIRILL BACHMANN MEHAMMER

MARCH 13, 2018

COMMENTS 2



Transport of goods – Port 4.0



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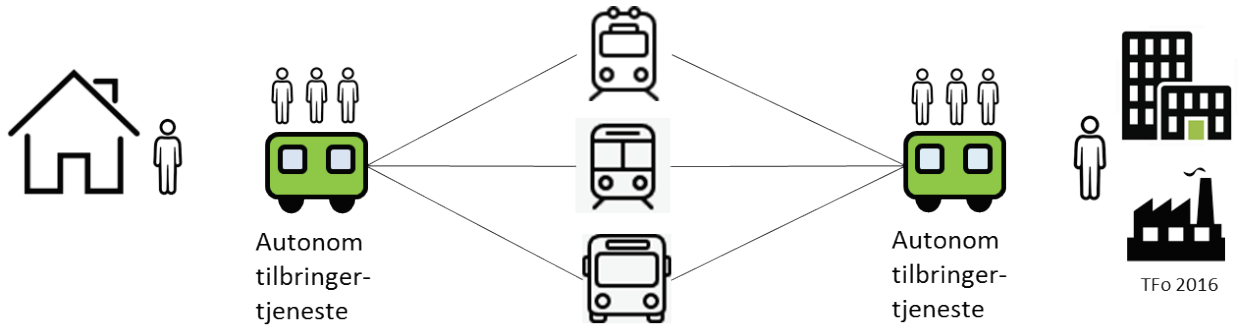
Smart Feeder

How can autonomous vehicles contribute to improve public transport?

3 pilots



Jernbaneverket

(Project owner)

ACANDO

ITS NORWAY

SINTEF

(R&D partner)

Statens vegvesen

SINTEF

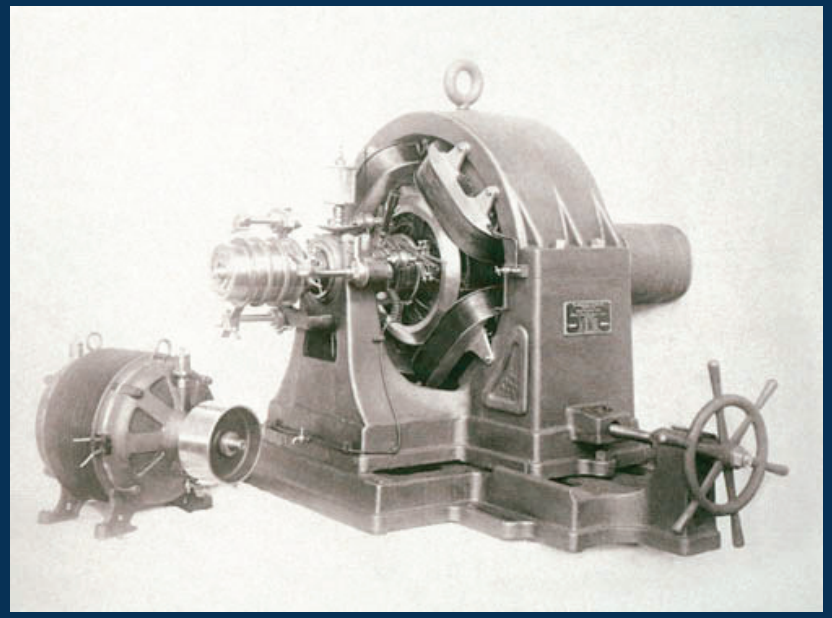
Inductive power transfer technology for ship applications

Jon Are Suul, Giuseppe Guidi

SINTEF Energy Research

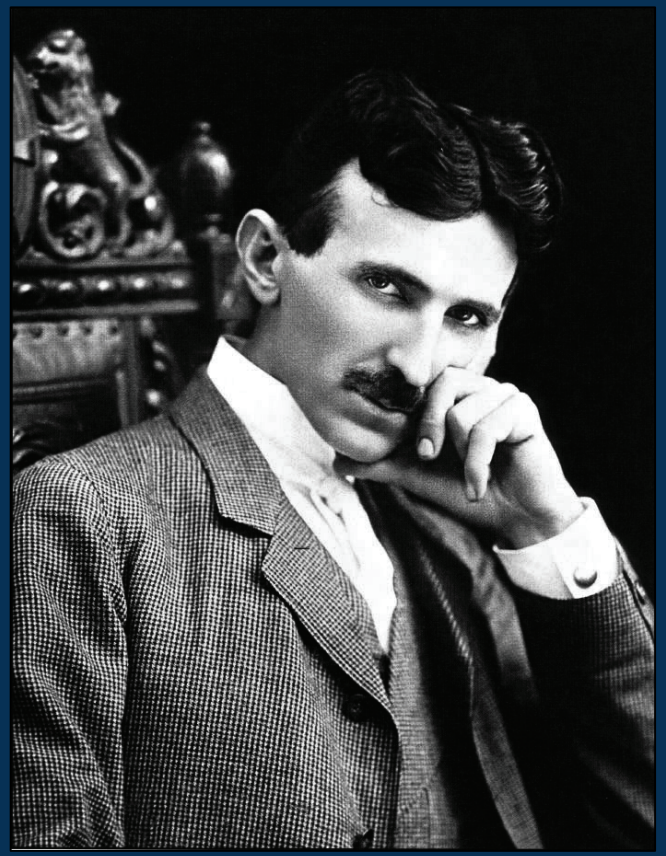
Wireless inductive power transfer

The basic principles of inductive power transfer have been known for more than a century



Tesla motor from Westinghouse

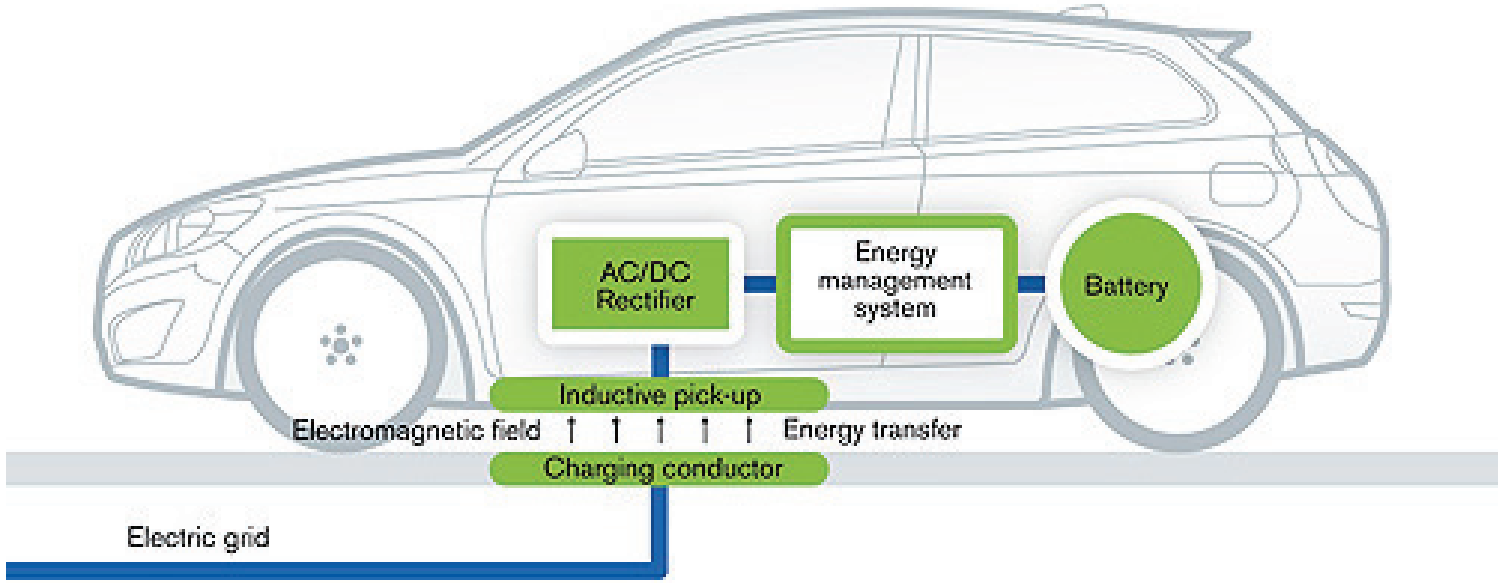
"World wireless system"

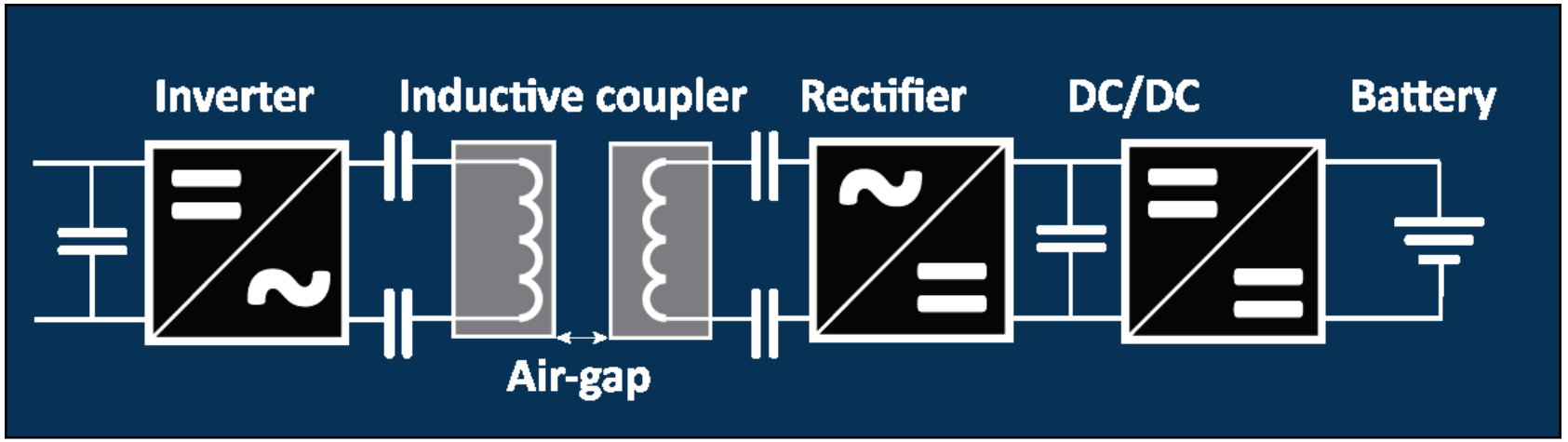


Nikola Tesla - 1896

Basic Concept

- Power transfer by magnetic field between two coils
- Controlled by power electronic converters





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Stationary wireless charging for electric transport

- Electric cars
  - Avoid need for manual plug operation
    - User convenience
    - Reliable solution
  - Suitable combination with self-parking functions
  - Retro-fit systems are commercially available in USA
    - 3 kW, 11 kW
    - Expected 22 kW and higher

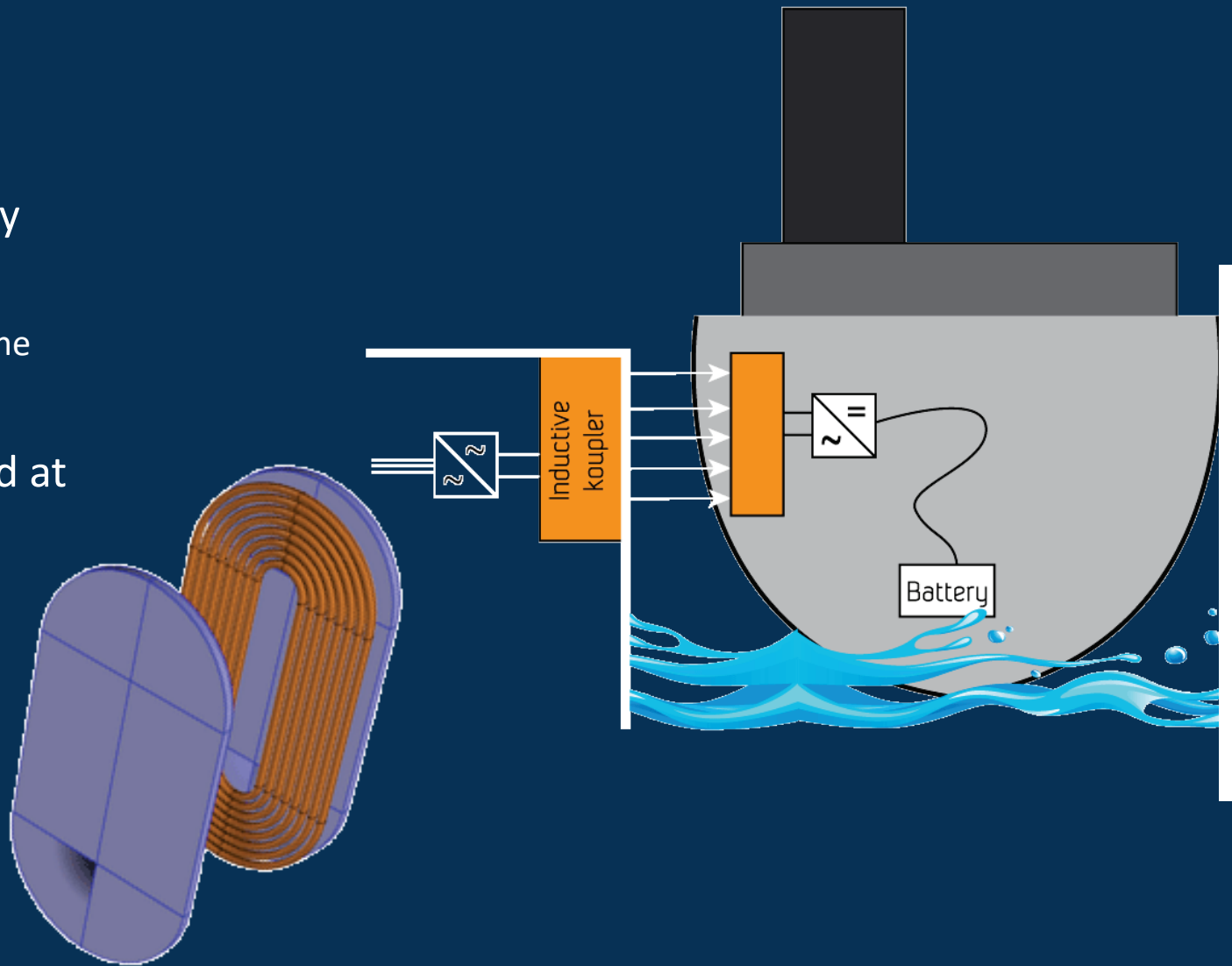
- Public transport – busses/trams/ferries
  - Automated operation
  - Maximized utilization of charging time
  - Fully enclosed solutions
    - No wear and tear of contacts
    - Reliability in harsh environments
  - Demonstration systems have been in regular operation since 2006
  - Power levels up to 200 kW

➢ **Enabling technology for autonomous vehicles**

Development for ship applications

Wireless high-power battery charging for ships

- Concept developed in Norway from 2013 to 2015
  - Innovation project supported by the Research Council of Norway
- Design concept demonstrated at SINTEF Energy
- Full-scale system rated for 1 MW power transfer demonstrated by Wärtsilä in laboratory environment

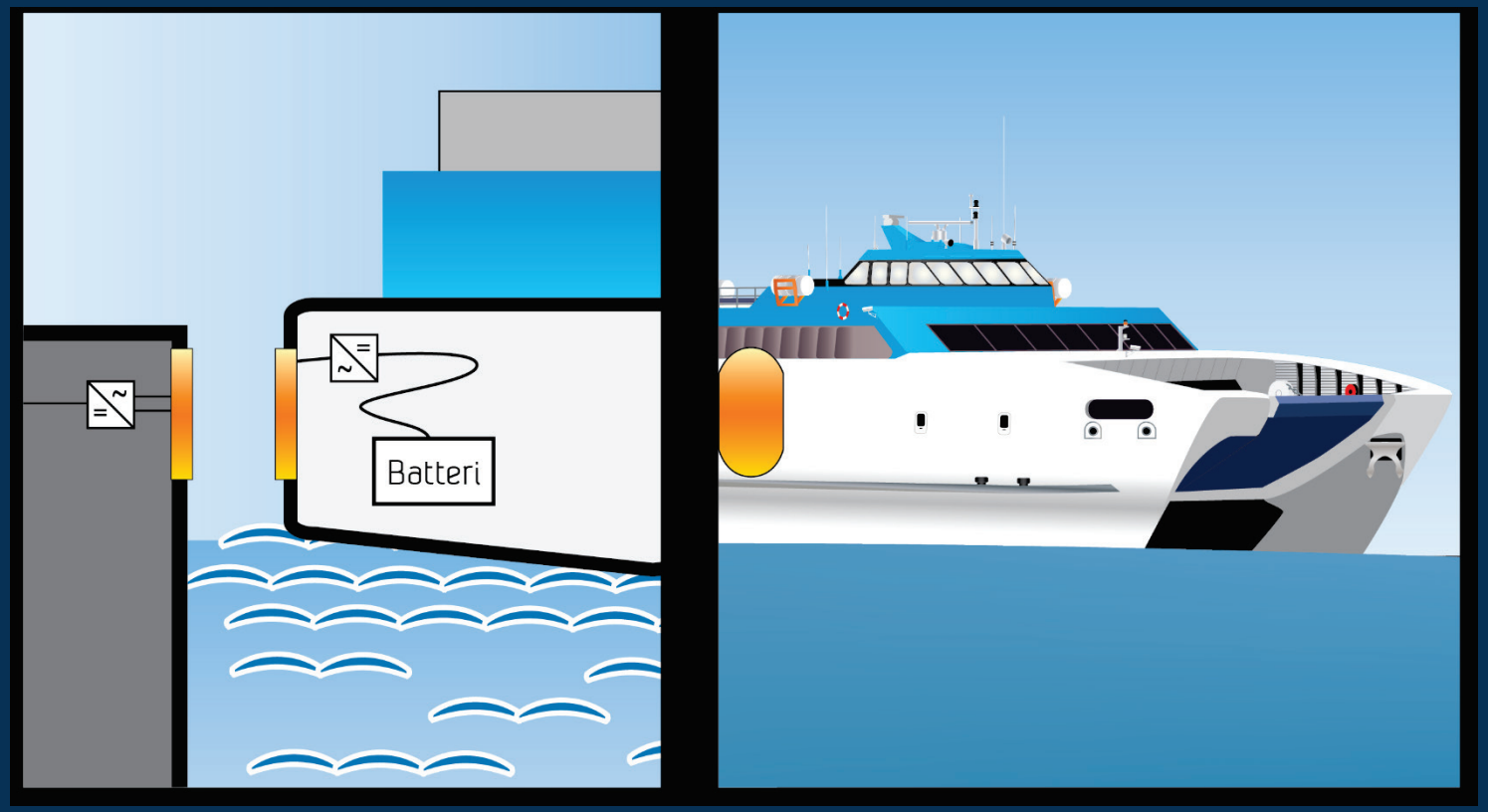


WÄRTSILÄ
FJELLSTRAND
SKL
Energi til utvikling
NORLED

SINTEF

Technical challenges

- New application area
- High power levels – 1 MW
  - 5 X similar systems for busses/trams
- Long airgap distance
  - Up to 50 cm
- Continuous movement during operation
  - Operation area: 15-50 cm distance
  - 6 degrees of freedom for position
  - Implies challenges for design and continuous control



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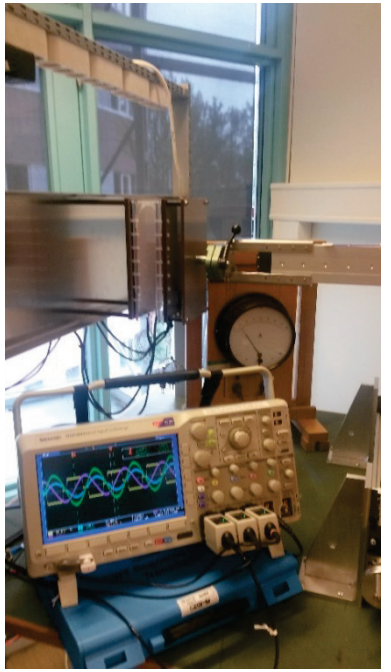
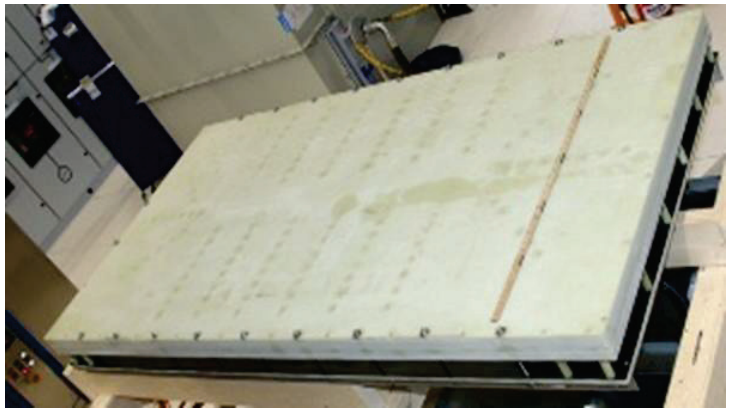
Results from Innovation Project

- Complete concept for inductive power transfer for ships
- Small-scale 1 kW model demonstrated in laboratories
- Demonstration of full scale prototype in Wärtsiläs high power laboratory
  - ➢ **1 MW power transfer with air gap distance 15-50 cm**
- Integrated design approach for electrical components and control system
  - Ensuring full utilization of components
    - 1 MW power can be transferred with components rated for about 1 MW
    - Conventional designs require about 3X total component rating to tolerate the same variation in airgap distance
  - Design approach and control method patented for Wärtsilä Norway





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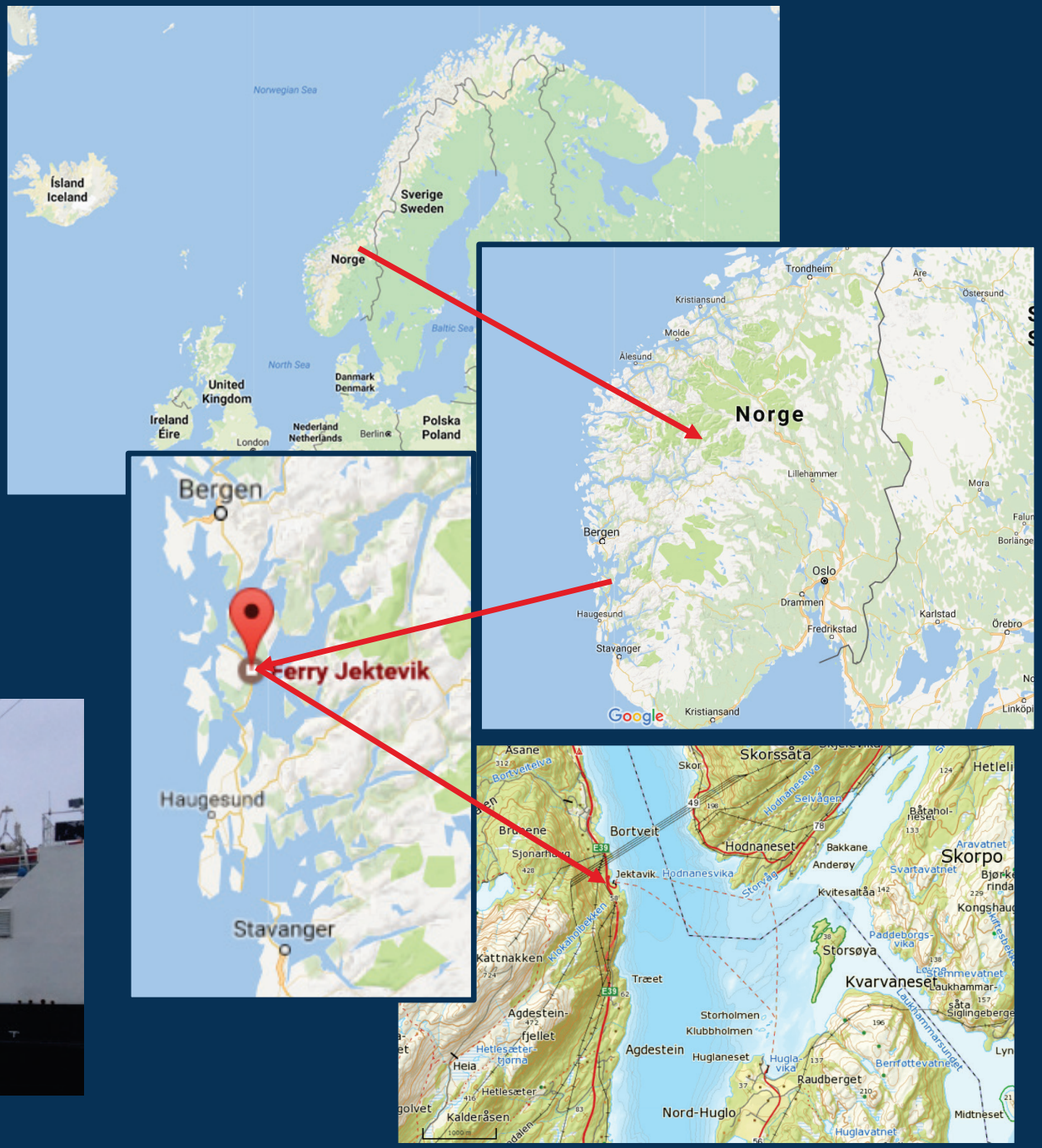
Commercialization

- Wärtsilä are developing a commercial product in cooperation with Cavotec
  - Cavotec produces equipment for vacuum mooring which allows for saving energy by stopping the ship propellers during docking
  - Integrated in zero emission ferry concept by Wärtsilä
- Wärtsilä wants to increase the maximum power transfer capacity
  - Applications in future ferries might require up to 2 MW power transfer

Pilot installation

- The first system was installed on the ferry MS Folgefonn for operation in August 2017
- Test site at one terminal of a regular ferry route at Stord, close to Bergen, Norway



Demonstration

- Regular operation of the pilot installation as a demonstration case until October 2018
- Operates with 1.2 MW power transfer

- Fully autonomous docking
  - Demonstration from spring 2018
- First electric ferry with combined autonomous docking and charging

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