Solar Fuelled Electric Maritime Mobility in Tunisia and MENA Region

Moez Jomâa
Scandinavia's largest independent research organization

- 2000 Employees
- 70 Nationalities
- 3800 Customers
- NOK 3.2 billion Revenues
- NOK 500 MILL International sales
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
- ICT
- Transport
SINTEF develops society through research and innovation

• We create value and develop solutions to challenges faced by society
• We actively and boldly communicate our knowledge, solutions and recommendations

Our vision: Technology for a better society
We are among Europe’s largest contract research organizations
AN INDEPENDENT, NOT-FOR-PROFIT RESEARCH INSTITUTE
SINTEF's achievements in working to improve sustainable transport
A leader on sustainability

We develop solutions to some of sustainable mobility grand challenges.
Renewable Energies at SINTEF

- SINTEF is world leader in R&D within the renewable energies holding an extensive portfolio of projects with public authorities and private companies.
SINTEF main activities in sustainable transport

• Electromobility
  • Cars and Trucks – charging systems and system integration issues – dynamic energy storage
    • Inductive charging (charge on the fly), sliding connectors
    • Battery technologies – new systems, increased lifetime, charging cycles, charge time optimisation
  • Ferries and short range ship transport
    • Fishing vessels
    • Inductive charging systems

• Biofuels- sustainable 2nd generation technologies
  • From wood waste, industrial biomass waste, seaweeds,..
  • Thermochemical, biological,..
  • Leading the new Bio4Fuel Centre of Excellence in Norway together with the host institution NMBU (Norwegian University for Life Sciences)

Facts: Norway has the highest electric vehicle concentration in the world- 5% of all cars are electric, plug-in hybrids and 28% of all new car sales are electric or plug-in hybrids
The Norway Parliament has pledged the government to change the emission legislation with the aim of all new cars to be sold from 2025 at the latest to be zero emission!

Total car stock: 2.6 million

Source: Elbilforeningen
SINTEF main activities in sustainable transport

• Hydrogen and Fuel Cells
  • Hydrogen production from electrolysers and from natural gas reforming with CCS
  • Development and testing of fuel cells and stacks
  • Supporting hydrogen roll-out for trucks, trains and ship transport
    • ASKO pilot plant- PV driven electrolyser to fuel 4 trucks for goods delivery in mid Norway (next slide)
  • Major operator in the EU framework programmes for research
  • Strategic partner in a new Centre of Excellence for mobility- MOZEES (Mobility Zero Emission Energy Systems) led by Institute for Energy Technology (IFE)

Facts: Norway has a long tradition for producing hydrogen- starting with the Norsk Hydro electrolysers at Rjukan in 1929 – worlds largest electrolyser plant for many years added by Glomfjord later
Intelligent Transport Systems

- Seamless transport-digitalization – transport as a service
- Big data management and decision support tools
- Advanced programming and sensing systems- sensor development
SINTEF main activities in sustainable transport

• Powerroads
  • A new concept where the infrastructure itself produces energy
  • Integrated with wind power, PV, tidal or other power producing technologies
  • Could be suited for coastal highways and roads with many bridges, tunnels etc.
  • Emission optimised use of infrastructure materials- short travelled materials, reuse and fossil-free building practices

• Sustainable air and sea transport
  • Biofuels for aero engines
  • Smart flight routes and traffic planning (SEASAR)
  • Low emission targeted ship management systems
  • Autonomous ship transport- fuelled by PV/Hydrogen/batteries

Facts: Norway is the most electrified country in the world, 97% of all electricity is produced from hydropower and is used extensively in the society.
Challenges
Challenges

- Challenges facing the sustainable mobility are of five types:
  - **Technical**: Autonomy and ease of recharge (availability of infrastructure), extending lifetime and capability of cycling, lighter construction materials, ..
  - **Legal**: legislation should consider the carbon footprint in order to make a fair competitiveness of the sustainable mobility with the traditional, regulation needs to evolve to adapt to new era of autonomous cars, ships, trains - legal constraints,
  - **Financial**: man kind has developed an amazing infrastructure for supply of fossil fuels – it's unparalleled. How to finance new infrastructure of sustainable mobility?
  - **Perception**: Safety (people are for some reason very afraid of hydrogen for instance), reliability, breaking habits.
  - **Public awareness**: unfortunately not everyone is aware about the urgency to act in order to save the planet from the global warming!
An accelerating imperative

- Kyoto – 8 years from signing to effect
- Paris – 1 year!
Source: Fawcett et all, 2015
Project proposal
Project Proposal: Solar Fuelled Maritime Mobility in Tunisia and MENA

• Objectives:
  • Demonstrate the feasibility of the Solar Fuelled Electric Maritime Mobility
  • Evaluate the socio-economic impact of such mobility
  • Promote and disseminate results of the project

• Project partners
  • SINTEF (Norway)
  • Tunisian Agency for Energy Conservation (Tunisia)
  • Regional Environmental Center (Hungary)
  • Ecole Nationale D'Ingénieur de Tunis (Tunisia)
  • European Centre for Women and Technology
Possible demonstration case: Jerba Ferry, Tunisia

- The ferry is connecting Jerba island to Tunisia main land.
- Tunisia has high potential of Solar Energy
- The ferry used daily by local and tourists
- Jerba is threaten by rising seawater level due to climate change
Demonstration case: upgrade of existing ferry

Grid connected solar array

Net-metering

Full charge by night

Partial charging between two trips

Onboard battery

Battery charger

Rooftop solar PV

Retrofit

ON-SHORE

OFF-SHORE
Socio-economic impact of the solar mobility

- Monitoring of the ferry operation
- Evaluation of the economic viability
- Evaluate the potential of the replication value
- Promotion
- Dissemination
Future plans
Future plans

• SINTEF intends to continue to promote this type of mobility locally, regionally and globally.

• SINTEF will continue to engage, when possible, in a north-south cooperation in order to promote the sustainability.

• SINTEF will continue to work in developing solution for the major technical and societal challenges hindering the development of a carbon neutral society.
Technology for a better society