Solar Fuelled Electric Maritime Mobility in Tunisia and MENA Region

Moez Jomâa

Scandinavia's largest independent research organization

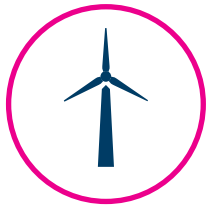
NOK 3,2 billion
Revenues

NOK 500 MILL
International sales

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

ICT

Transport

SINTEF

Societal mission and vision

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**

SINTEF

We are among Europe's largest contract research organizations

Fraunhofer

VTT

SINTEF

SP

TNO

DANISH TECHNOLOGICAL INSTITUTE

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

cea

tecnalia Corporación Tecnológica

AN INDEPENDENT, NOT-FOR-PROFIT RESEARCH INSTITUTE

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SINTEF's achievements in working to improve sustainable transport

A leader on sustainability

We develop solutions to some of sustainable mobility grand challenges.

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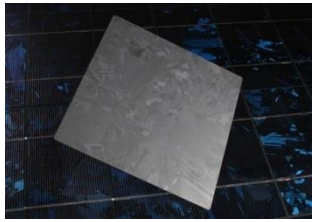
Renewable Energies at SINTEF

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


Polysilicon **Wafer** **Solar Cell** **Solar Module** **Systems**

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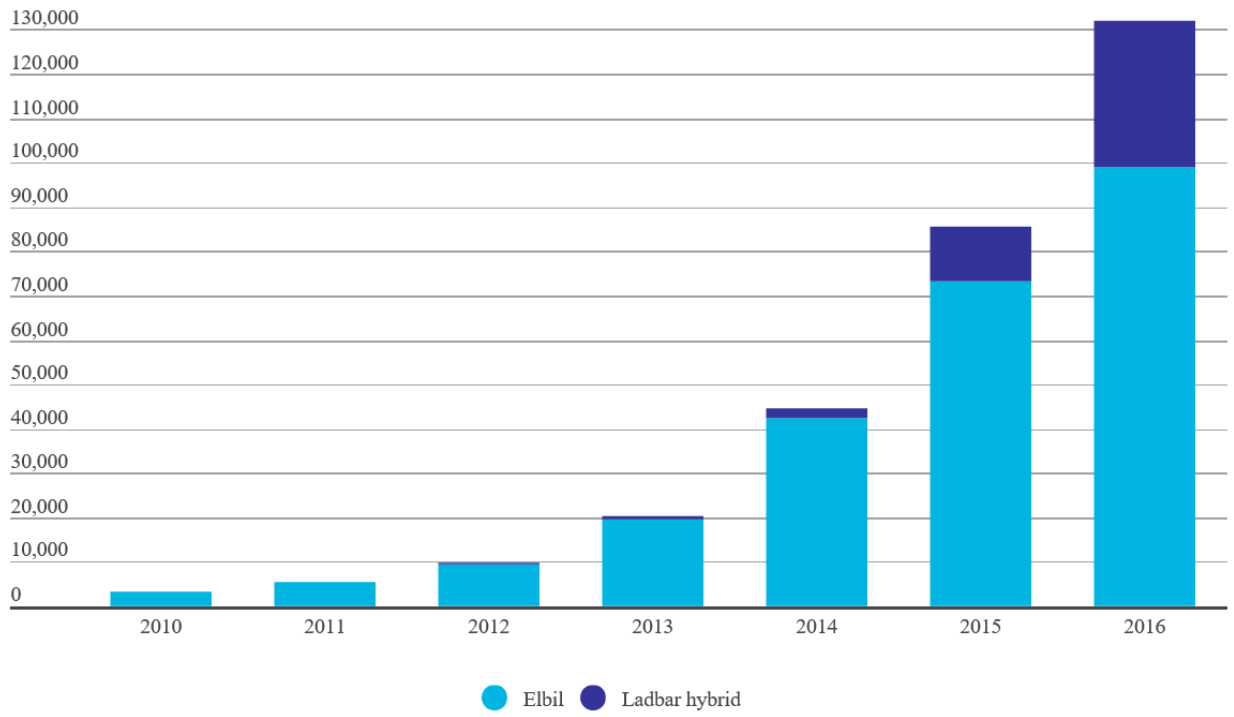
SINTEF main activities in sustainable transport

- 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

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

- 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)

EV and PHEV cars in Norway



Total car stock:
2.6 million

Source: Elbilforeningen

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!

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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)

ASKO

Hydrogen refuelling station at SINTEF

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

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Intelligent Transport Systems

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

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SINTEF main activities in sustainable transport

- Powerroads
  - A new concept where the infrastucture itself produces energy
  - Integrated with wind power, PV, tidal or other power producting 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 accellerating imperative

- Kyoto – 8 years from signing to effect
- Paris – 1 year!

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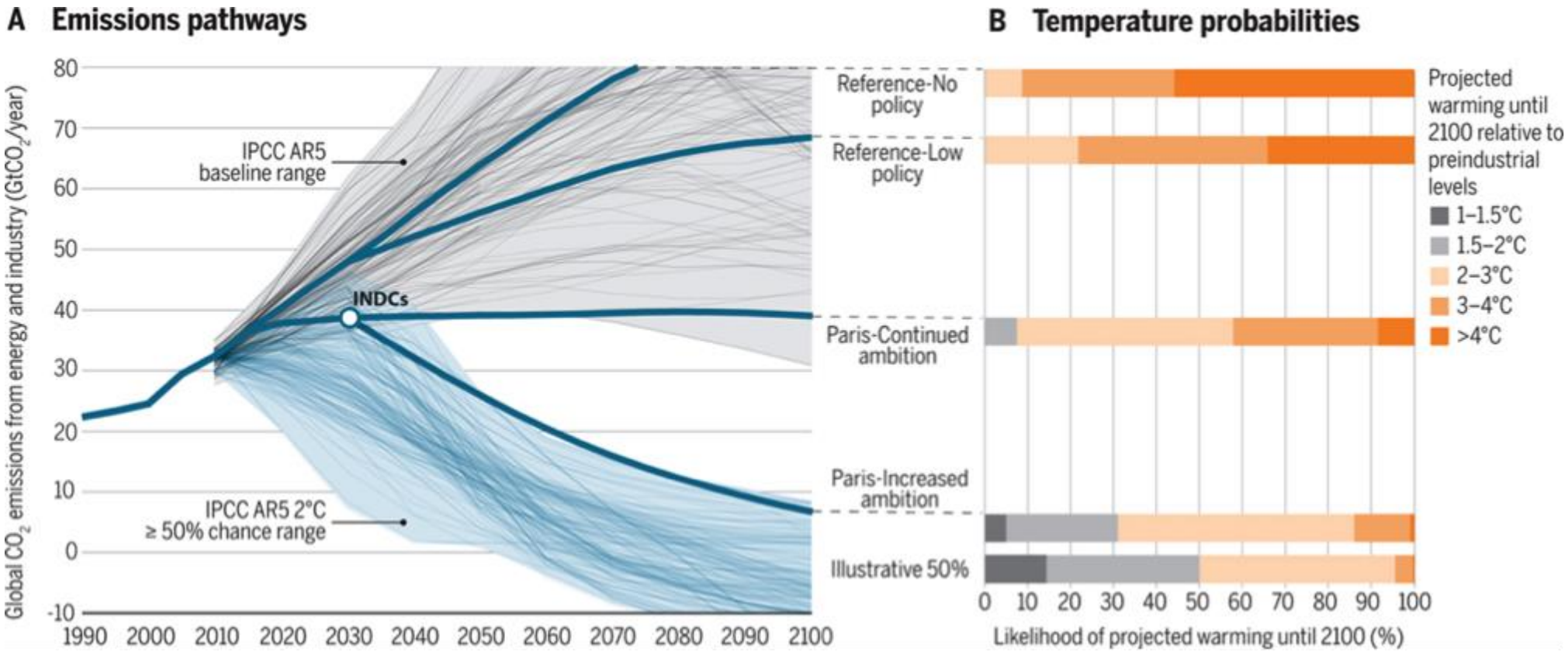

Source: Fawcett et all, 2015

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Project proposal

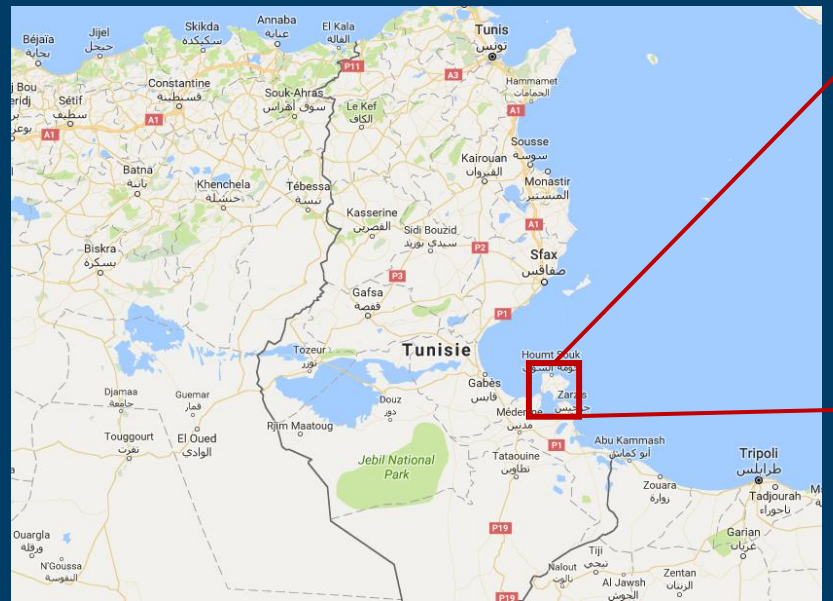
Project Proposal: Solar Fuelled Maritime Mobility in Tunisia and MENA

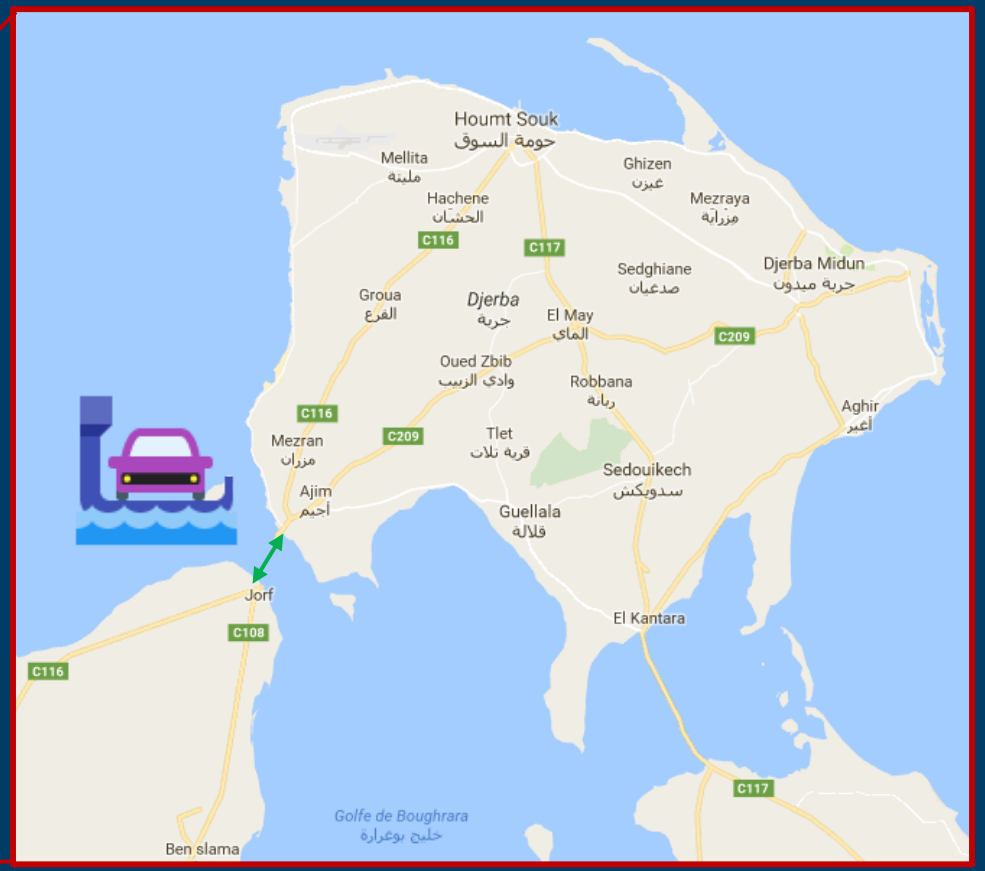
- Objectives:
  - Demonstrate the feasibility of the Solar Fuelled Electric Maritime Mobility
  - Evaluate the socio-economic impact of such mobility
  - Promote and disseminate results of the project

- Project partners
  - SINTEF (Norway)
  - Tunisian Agency for Energy Conservation (Tunisia)
  - Regional Enviromental 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





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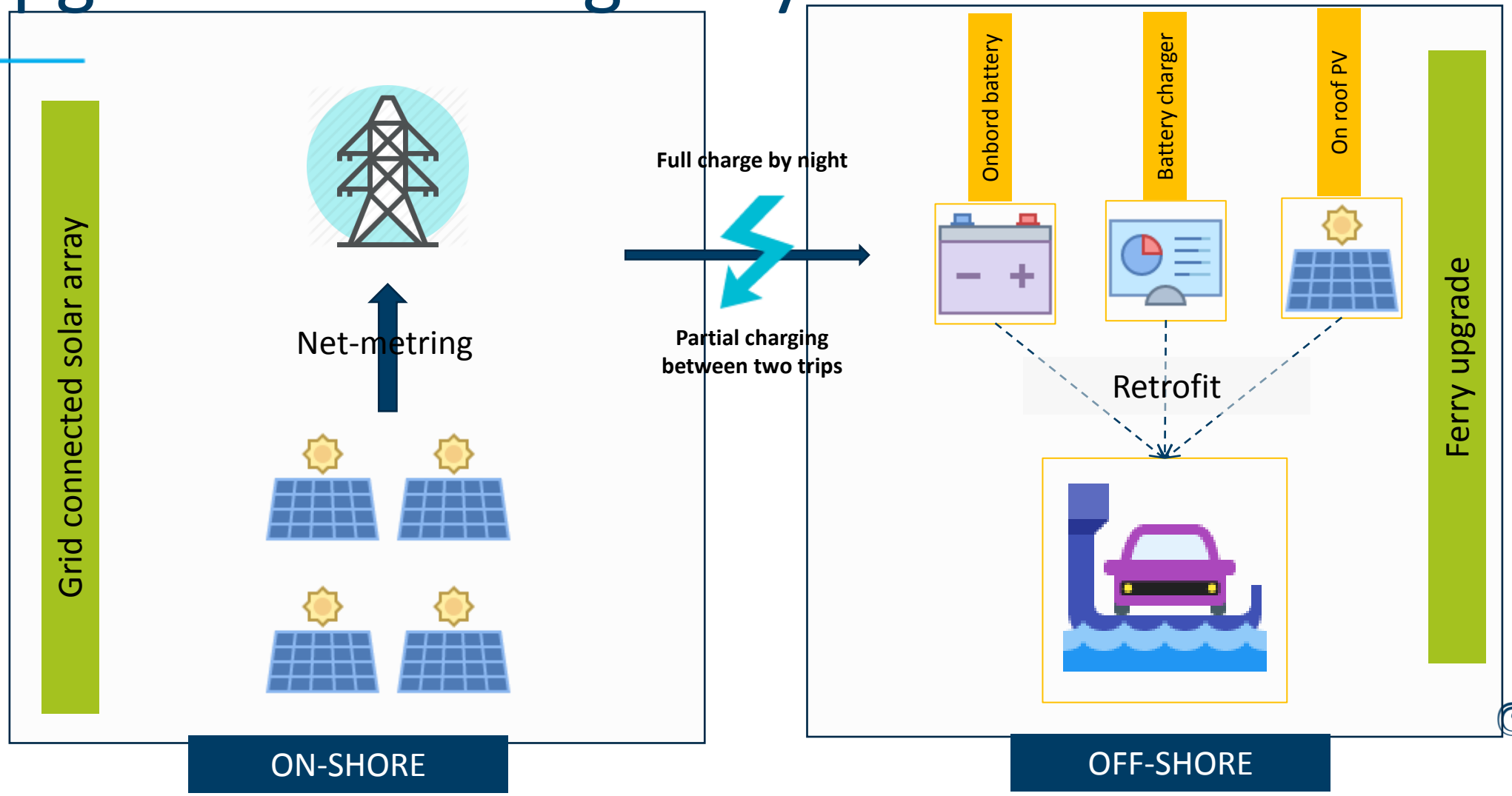
Demonstration case: upgrade of existing ferry



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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.

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Technology for a better society