Sustainable Energy Systems 2050
NORDIC ENERGY RESEARCH PROGRAMME

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Nordic Energy Research

N-I-S-F-D

Nordic Initiative for Solar Fuel Development

SUSTAINABLE ENERGY SYSTEMS 2050

KICK-OFF EVENT WITH PROJECT PRESENTATIONS

HELSINKI 12 October 2011

DINKO CHAKAROV

N - I - S - F - D

NORDIC INITIATIVE FOR SOLAR FUEL DEVELOPMENT

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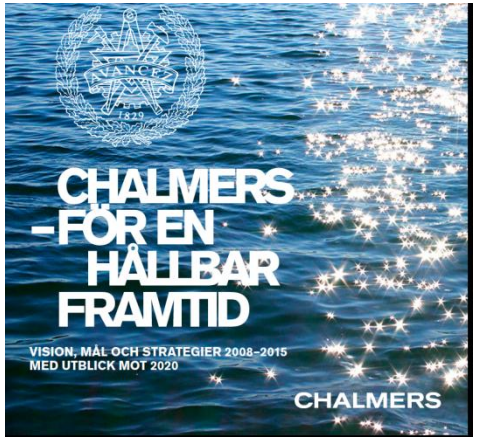
Project owner:

Department of Applied Physics

Chalmers University of Technology



RESEARC

CARBON RECYCLING INTERNATIONAL

NorECs
Norwegian Electro Ceramics AS

→ **RESEARCH PROJECT OVER 4 YEARS**

→ **5 UNIVERSITY, 2 INDUSTRIAL PARTNERS**

→ **ALL NORDIC COUNTRIES**

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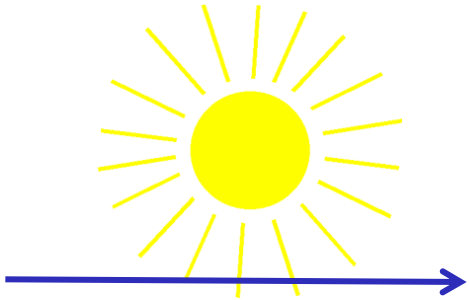
- **What we want to do and why it is a good idea?**



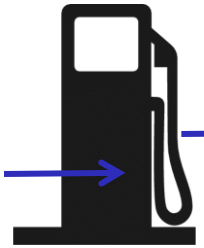
$2H_2O + h\nu = O_2 + 2H_2$

CO_2

CH_3OH

+

$1½\ O_2$



- Direct conversion of solar energy to fuels is superior to photovoltaics (avoids storing electrical energy).
- It could be an order of magnitude more efficient than natural photosynthesis.
- …

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Objectives

- The aim is to develop a system that efficiently and cost effectively produces fuels from water, CO_2 and sunlight.

- Addresses several energy related problems simultaneously:
  - ***efficient conversion of solar energy***
  - ***fuel that can easily be stored, distributed and used within present infrastructure***
  - ***serve the transport sector, where the energy consumption growth/demand is biggest.***

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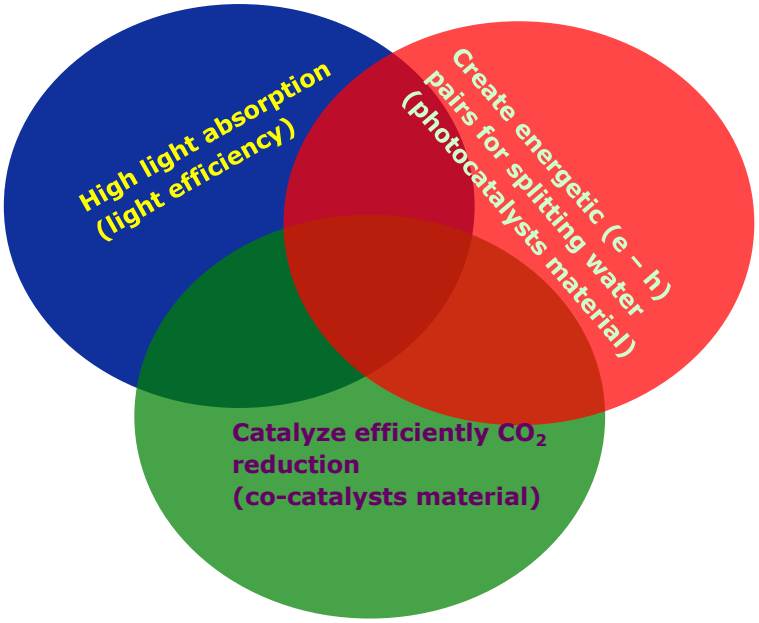
- ***Challenges:***
- Currently used materials and methods are ***expensive and ineffective***.
- The Nordic countries need a ***common platform for advance*** in this field.

- Specific challenge → to meet ***simultaneously*** the demands of:



→ … and simultaneously use stable, nontoxic and cheap materials, suitable at the extremely oxidizing environment created by the holes.

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- ***Leading ideas:***
- The scientific uniqueness lies in the ***Nanoscience*** *and* ***Nanotechnology approach***:

  → the three components of energy transformation: light harvesting, charge carrier separation and catalytic transformation can be optimized using nano-structured materials.
- Significant advantage is the possibility to have all these complex transformations happening at the ***same*** photoelectrode.

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Goals:

- **System** with increased optical absorption and efficiency of photo catalytic synthetic fuel production by new design and materials composition.
- **Synergy** - the advances that will be made on the various individual components of the system can be used in a range of contexts, such as formation of fuel from CO_2 and other energy sources (wind, geothermal, natural gas ...). With focus on producing liquid fuel, the formation of methane gas is also of interest ...
- **Nordic Added Value**
  → Project at the international research frontier in the area of solar energy and photo catalytic conversion of CO_2.
  → Forming a collaborative group with complementary expertise opens up for rapid advances and improved products.

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