Delft Energy Initiative

Prof. dr. ir. Paulien Herder
TU Delft
Delft Energy Initiative

Four main themes:
- Urban Energy
- Powerweb
- e-Refinery
- Duwind

- Education
- Entrepreneurship
- Outreach, lectures
- Games, competitions
- about 1000 FTE
The challenge: power to chemical bonds
e-Refinery

This is a TeraWatt challenge
Exponential Growth of Global Solar PV (in GW)

- 2016: estimate 306 GW
- 2017: projection 401 GW

Swanson's Law

Module Cost ($/Watt) vs. Cumulative Module Shipments (MWp)
Circular economy

- Water
- Air (CO₂/N₂)
- Biomass
- Electricity
- Bulk chemicals
- Process industry
- Electrosynthesis
- Use
- Fuels
- Chemicals
- Waste & emissions
Interacting system scales

Lab scale
- Feedstock (CO₂)
- Catalyst
- Electricity

Process scale
- Resource consumption
- Pretreatment
- Photo/electro-chemical conversion
- Downstream processing/upgrading
- Product
- Coproduction
- Waste and emissions

Supply chain
- Feedstock
  - CO₂ sources
  - RES electricity
- Conversion & upgrading
- Distribution & end use

Socio-economic system
- Ecosystems
  - Lithosphere
  - Hydrosphere
  - Atmosphere
  - Biosphere
- Economy interconnections
Required Expertise

- Materials science
- Catalysis
- Electrochemistry
- Process technology
  - Transport Phenomena
  - Membrane Technology
  - Reactor Engineering
  - Process Intensification
- Energy technology and system engineering
- System integration and Value Chain Impact + institutional embedding
Required Education

- **BSc and MSc level**
  - Minors in BSc programmes (ChemE, Geo, MechE, SysE)
  - MSc programmes, incl 4TU
  - MSc level track, new MSc programmes?

- **PhD level**
  - Investment needed the Netherlands: ECCM, NWO, NWA
  - 4TU.Energy

- **Life long learning**
  - PDEng programmes
  - Industrial PhD programme
Towards sustainable production of chemicals and fuels

- Water
- Air (CO₂/N₂)
- Biomass
- Electricity
- Bulk chemicals
- Electrosynthesis
- Process industry
- Fuels
- Use
- Chemicals
- Waste & emissions
Thank you

Prof.dr.ir. Paulien Herder
TU Delft