ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Laboratory of Renewable Energy Science and Engineering

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Large-scale solar fuel processing plant

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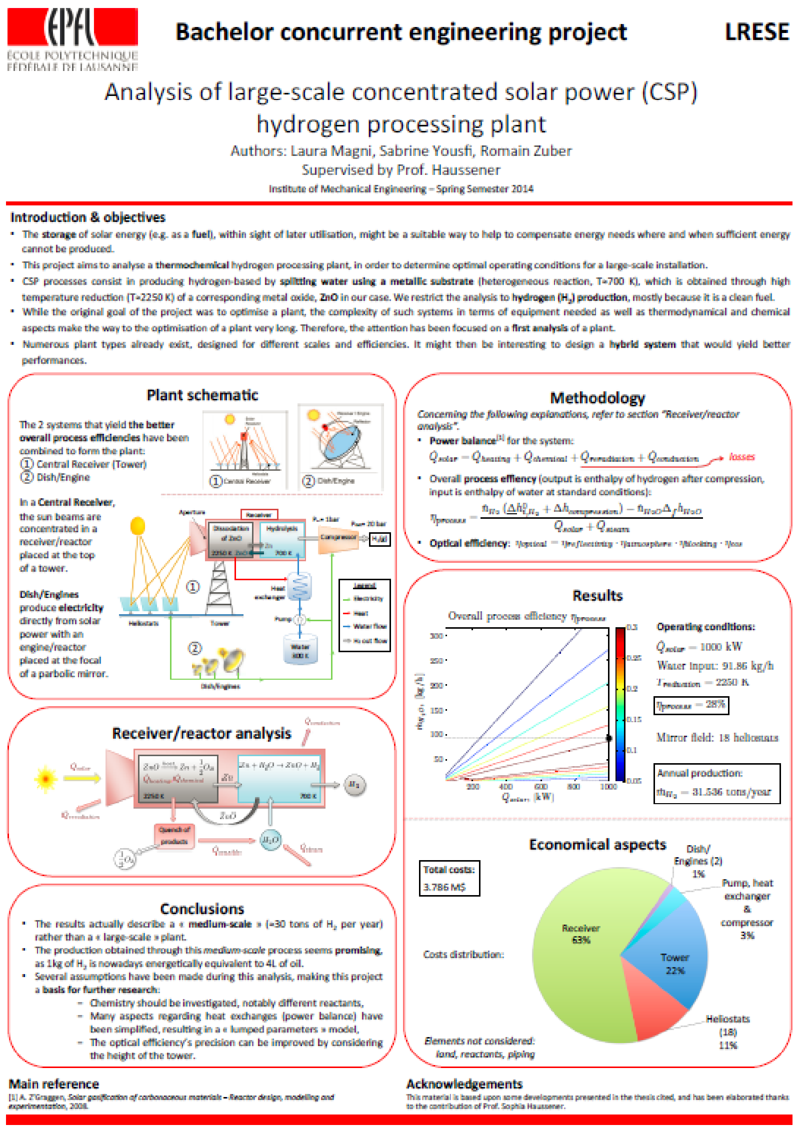
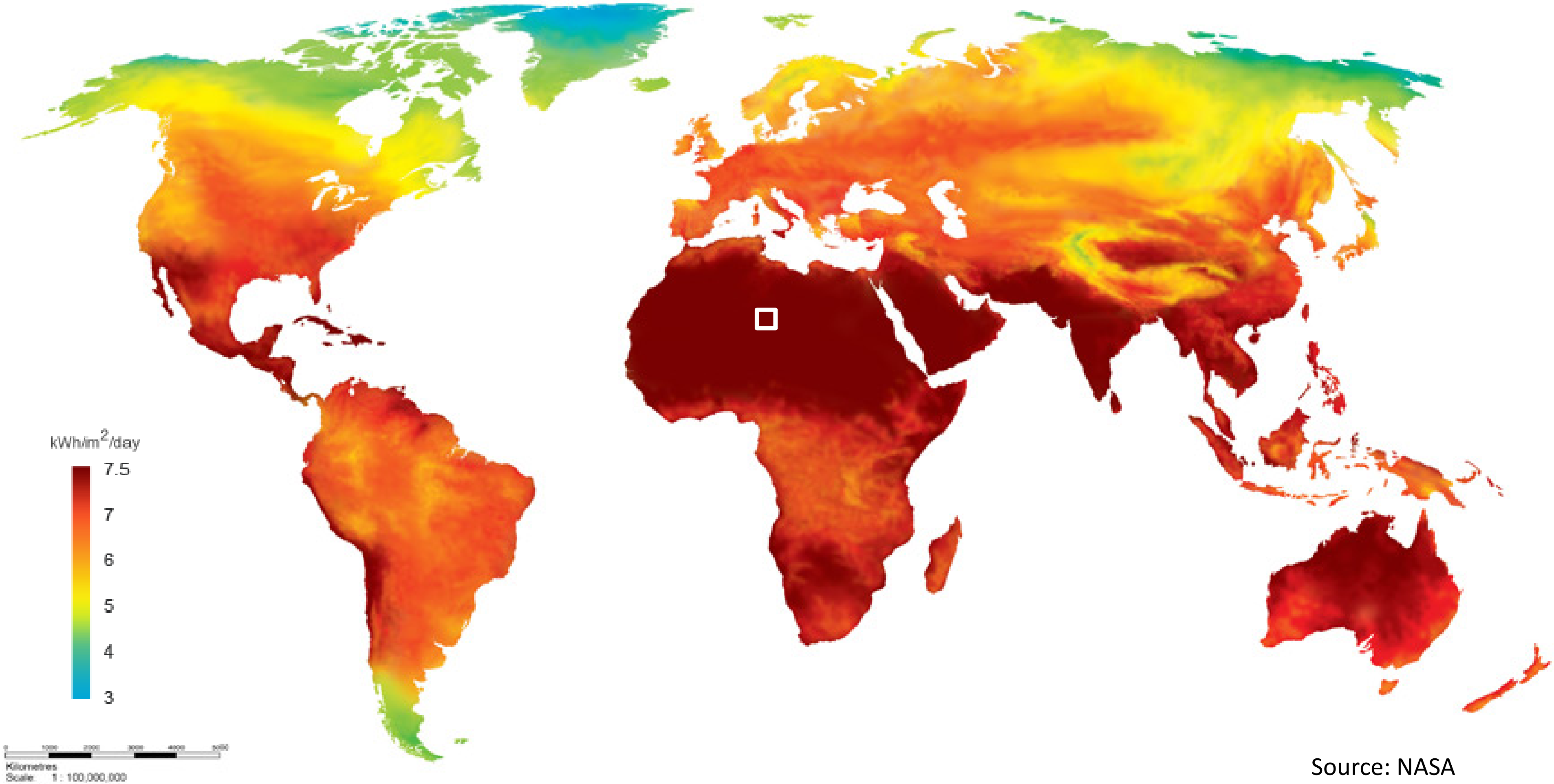
LRESE

- Project d'ingénierie simultanée
- **Large-scale solar fuel processing plant**
- *The objective of the project is the design of a sustainable (concentrating) solar facility for thermochemical or photo-electrochemical processing of solar fuels (hydrogen and/or synthesis gas) and the prediction of the solar fuel's cost.*



- Solar irradiation:

- Earth's ultimate recoverable oil resource delivered in 1.5 days
- Global annual energy need delivered in 1 hour
- 0.1% of earth surface covered (20% efficient) delivers global annual energy

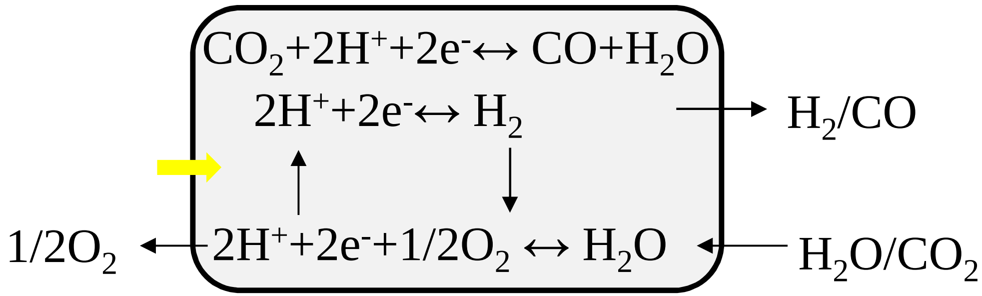


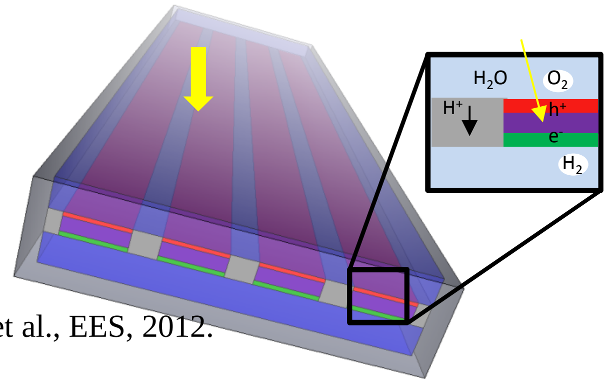
Source: NASA

- But solar energy is:
  - Dilute
  - Unequally distributed
  - Intermittent

- Storage (e.g. as fuel)!

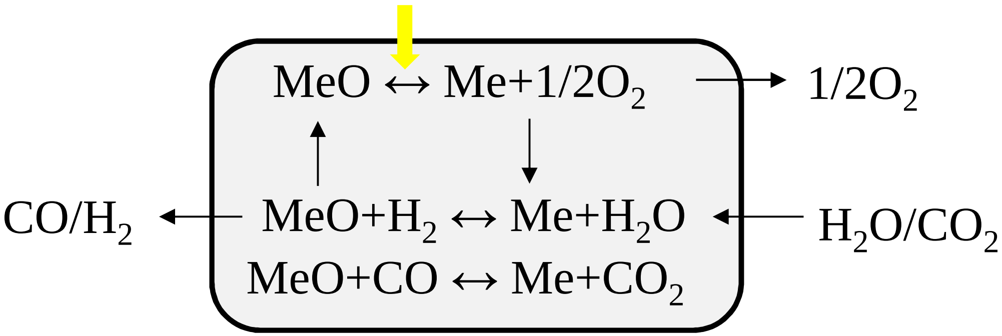
- Photoelectrochemical fuel production

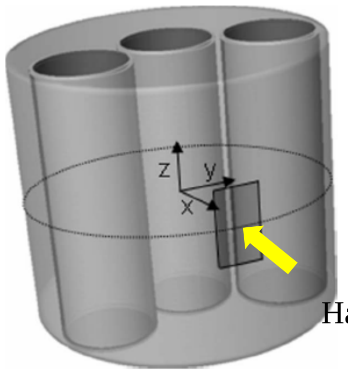




Haussener et al., EES, 2012.

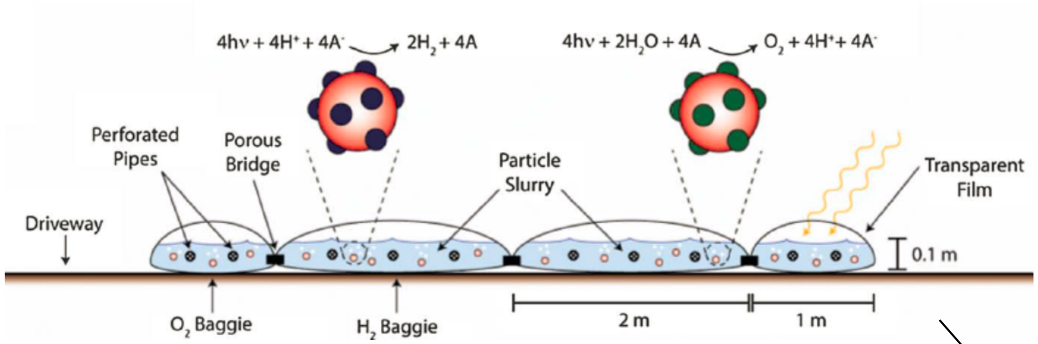
- Solar thermochemical fuel production (temperatures > 1400°C)

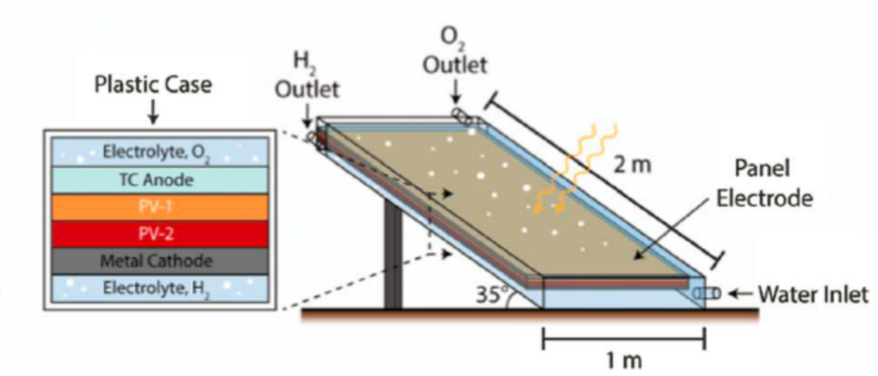




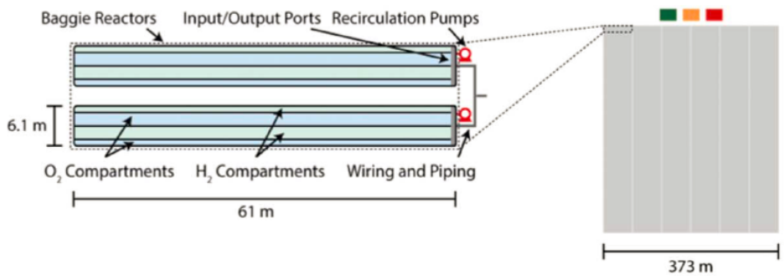
Haussener et al., JSEE, 2009.

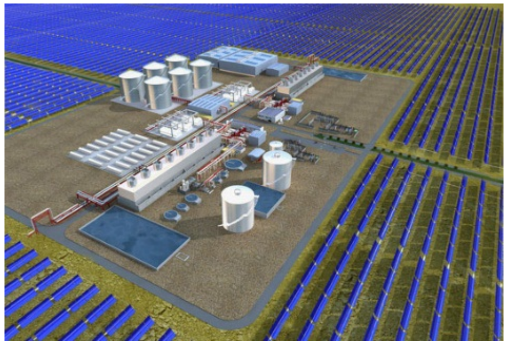
- Possible plant design - photoelectrochemical:





Pinaud et al., EES, 2013.





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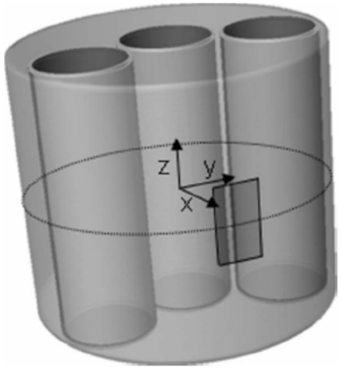
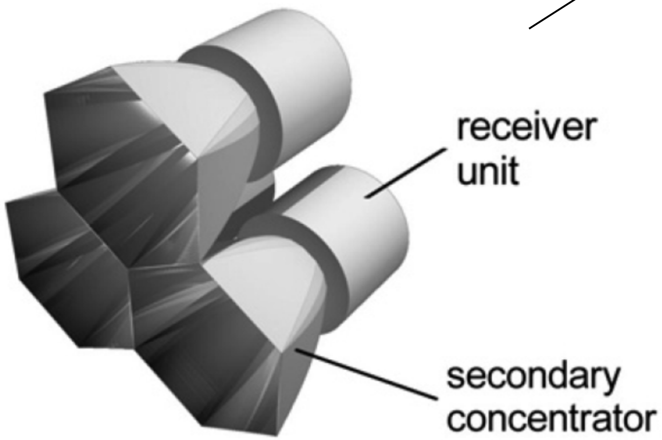
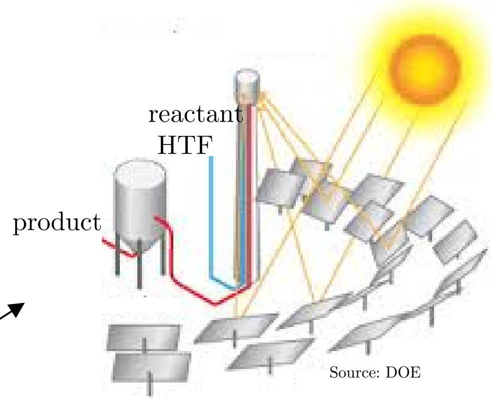
- Possible plant design – solar thermochemical:





Romero et al., JSEE, 2002.



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- Choice of chemistry: thermodynamics, kinetics …
- Reactor design: modeling (heat and mass transport) …
- Plant design: external components, concentration, interfaces …
- Economics: prices of materials, components …
- Life cycle assessment: energy requirements of materials and components …

- 2 teams of 2 students