Aurinkoenergiaa fotosynteettisesti mikro-organismeista

Eva-Mari Aro

Turun yliopisto

Biokemian ja Elintarvikekemian Laitos

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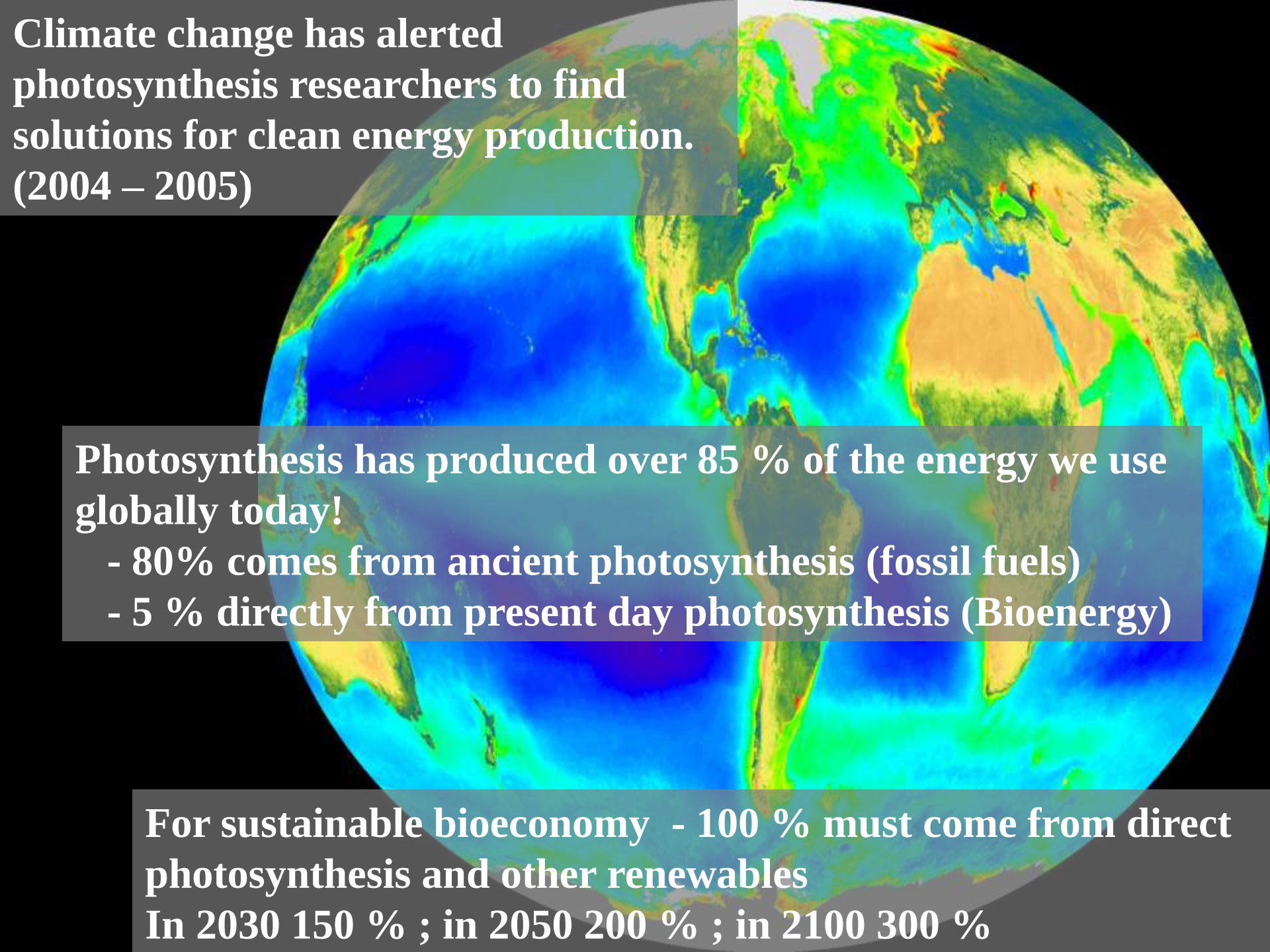
TURUN YLIOPISTO
UNIVERSITY OF TURKU



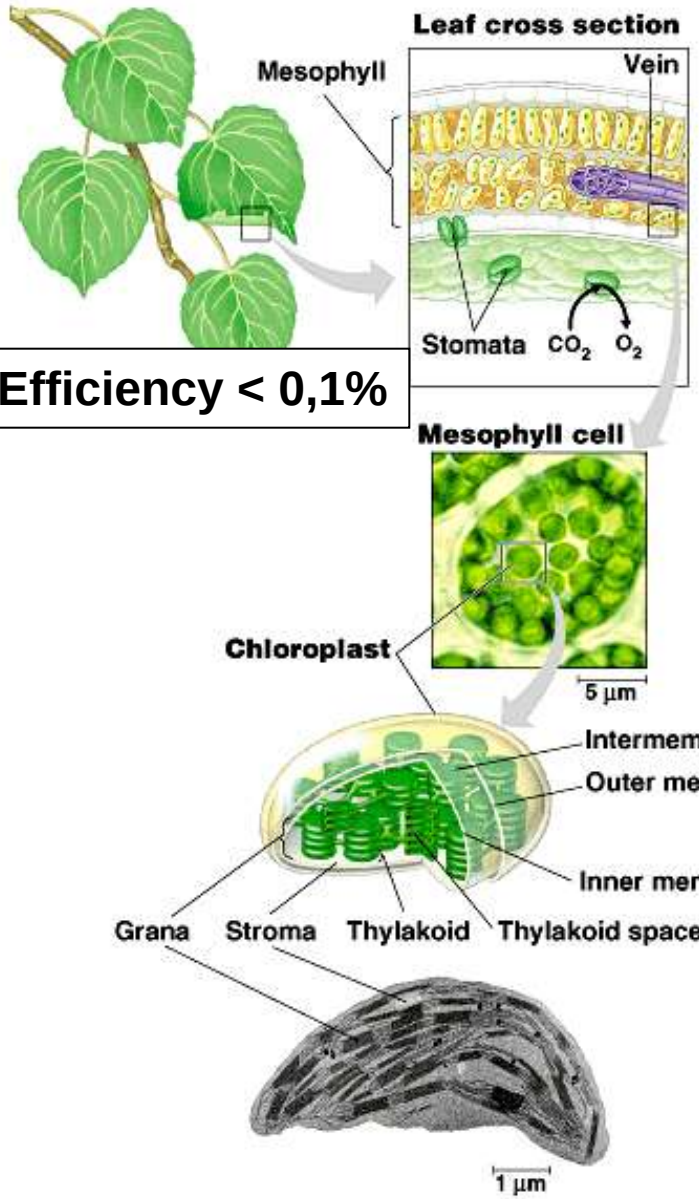
Climate change has alerted photosynthesis researchers to find solutions for clean energy production. (2004 – 2005)

Photosynthesis has produced over 85 % of the energy we use globally today!

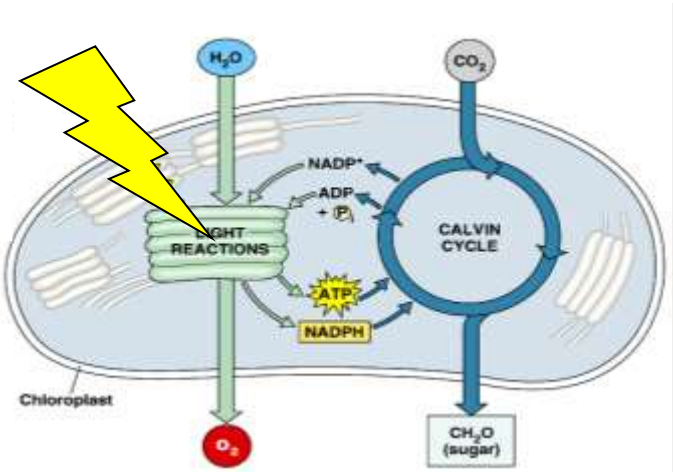
- **80% comes from ancient photosynthesis (fossil fuels)**
- **5 % directly from present day photosynthesis (Bioenergy)**

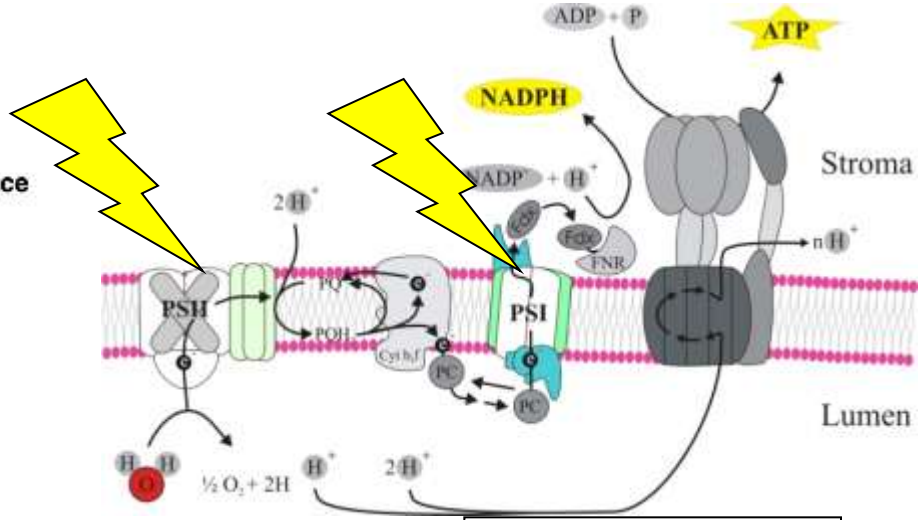
For sustainable bioeconomy - 100 % must come from direct photosynthesis and other renewables
In 2030 150 % ; in 2050 200 % ; in 2100 300 %

Photosynthetic machinery



Efficiency < 0,1%

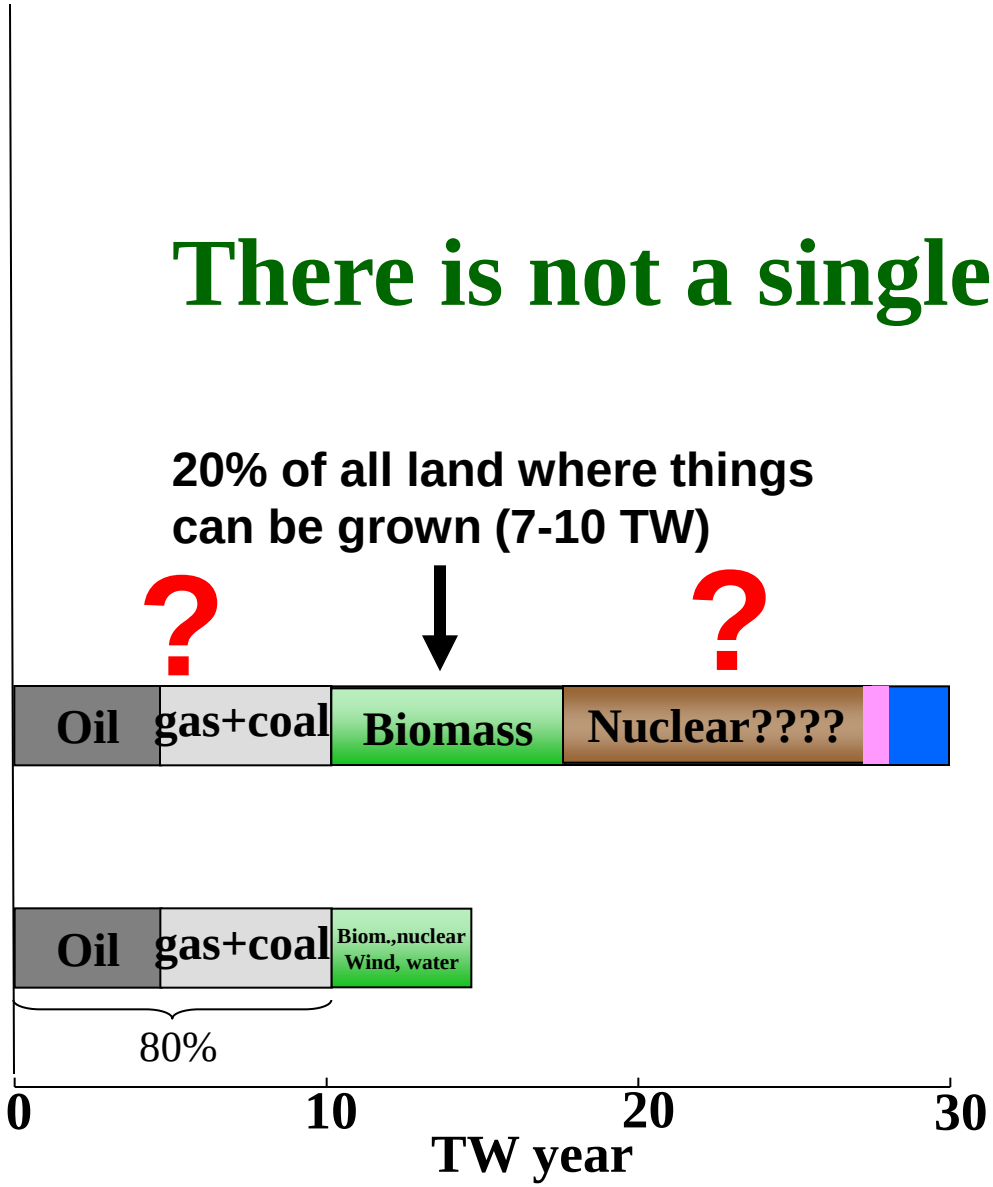




Efficiency 40%

The global concept

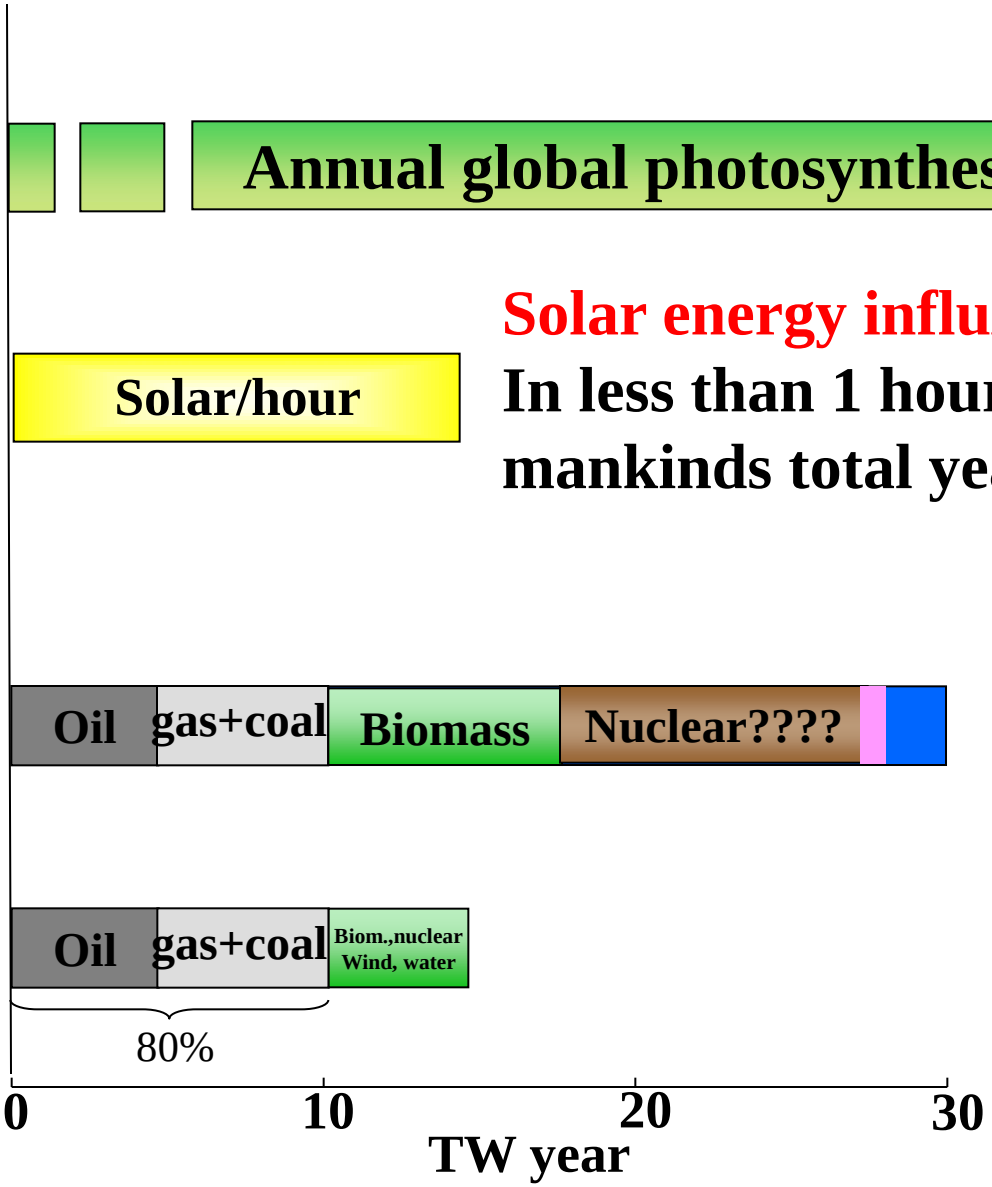
There is not a single solution.....



2050; 30 TW (28-35)

2007; ca 14 TW

The global concept

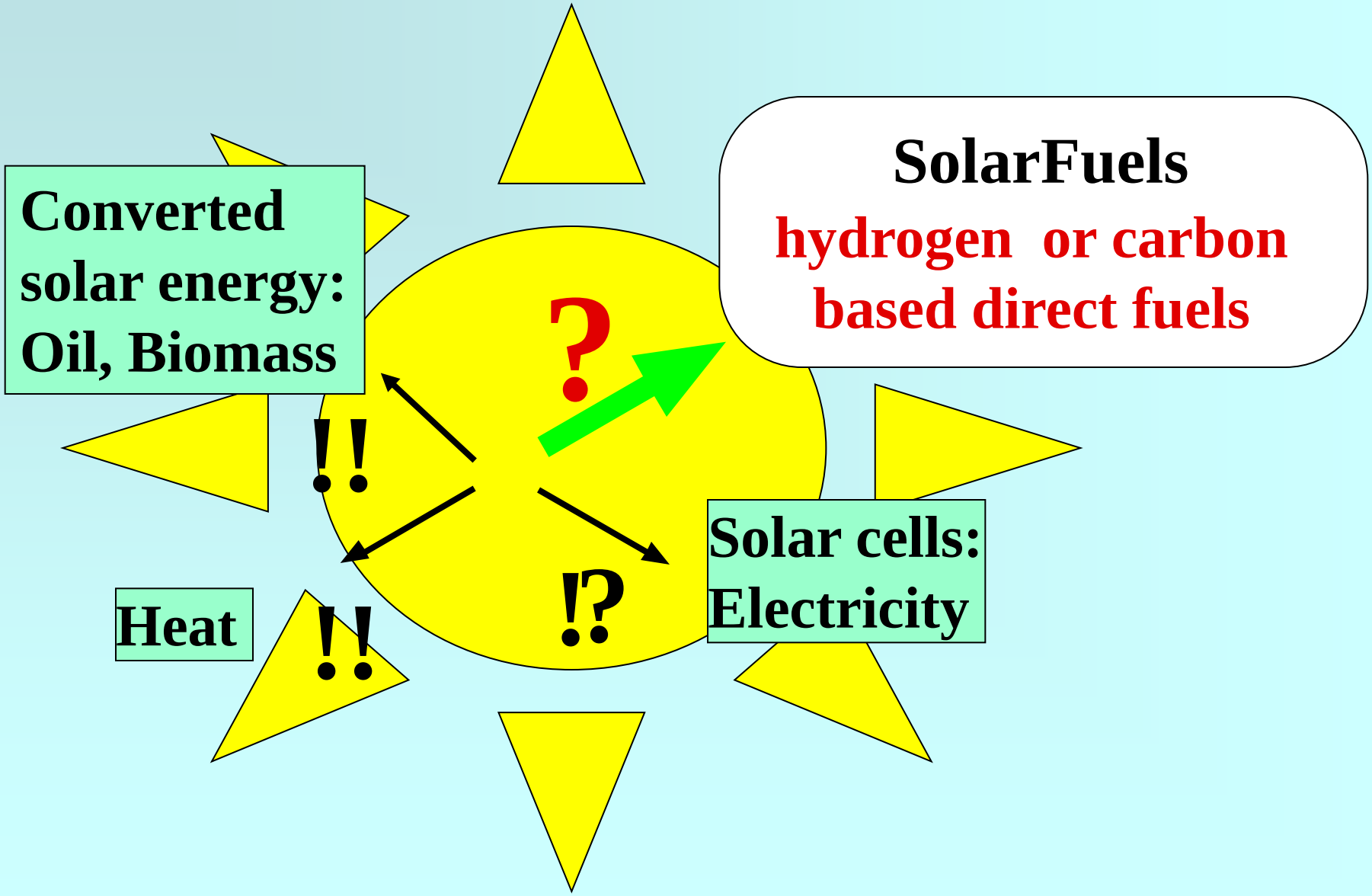


Use of solar energy

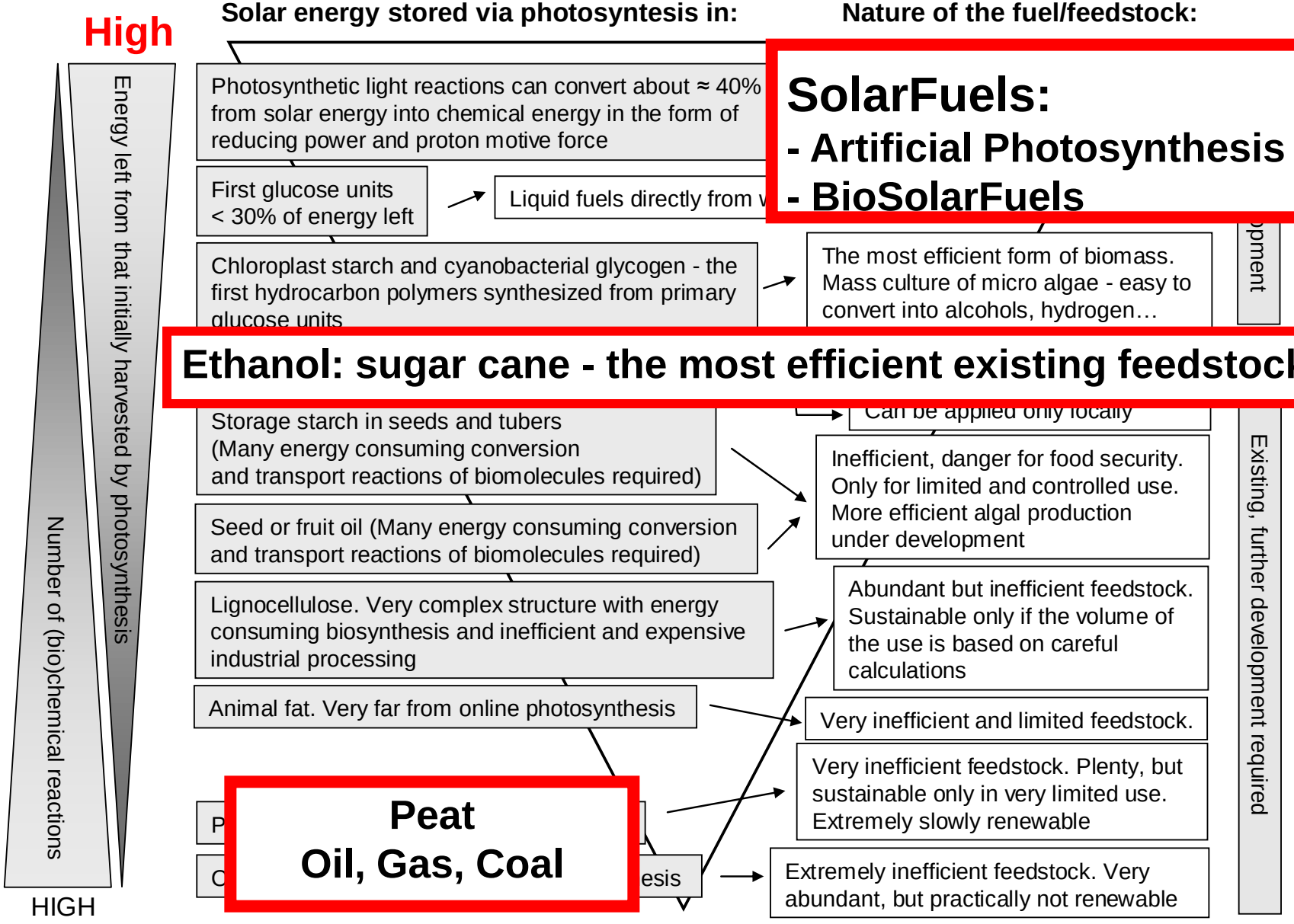
1. **Strong development in solar energy conversion to electricity. Electricity is used to carry a minor part of the energy that is used in the world.**

2. **Production of biomass is limited on a global scale – not enough even in Finland for sustainable Bioeconomy. There is not enough biomass to exchange for fossil fuels.**

SOLAR ENERGY - OPTIONS



Efficiency of Solar Energy Conversion

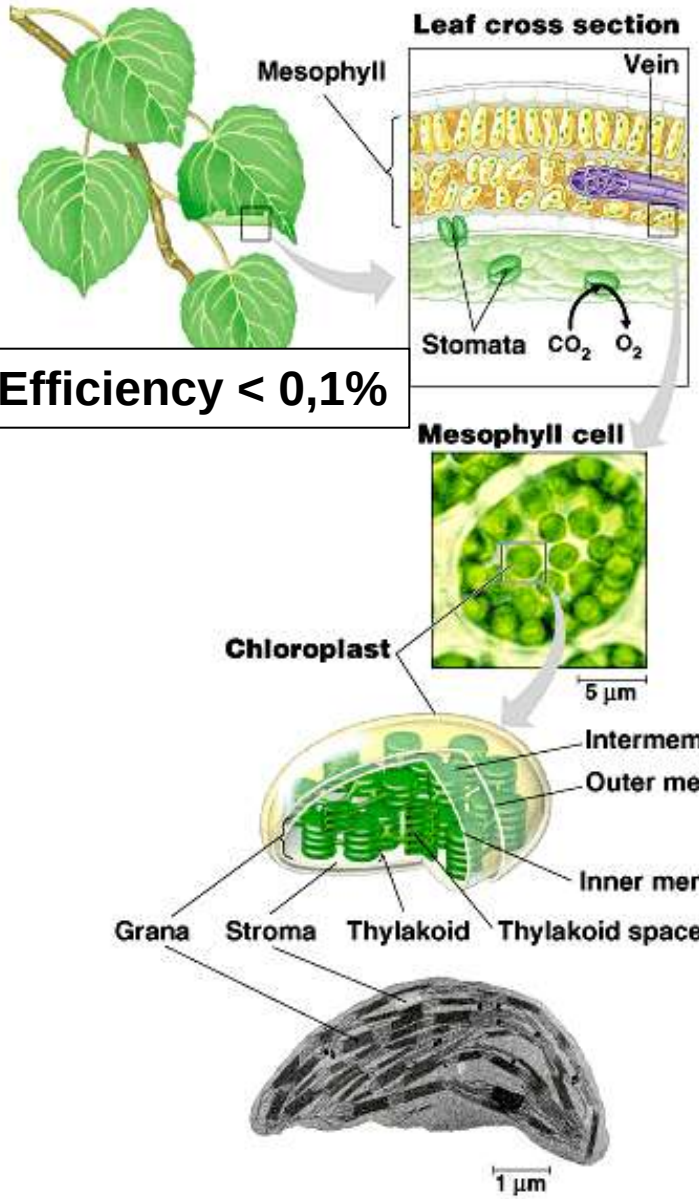


SolarFuels

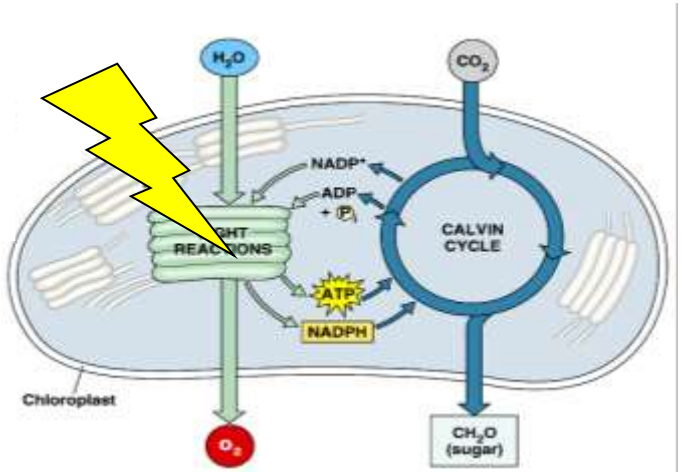
Vision – make a fuel from the endless resources of solar energy – water - CO_2

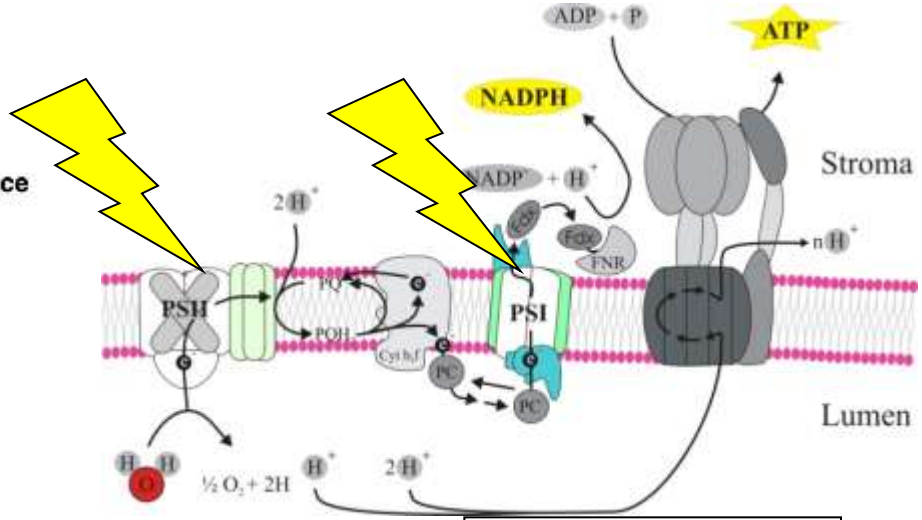
Photosynthesis

Photosynthetic machinery



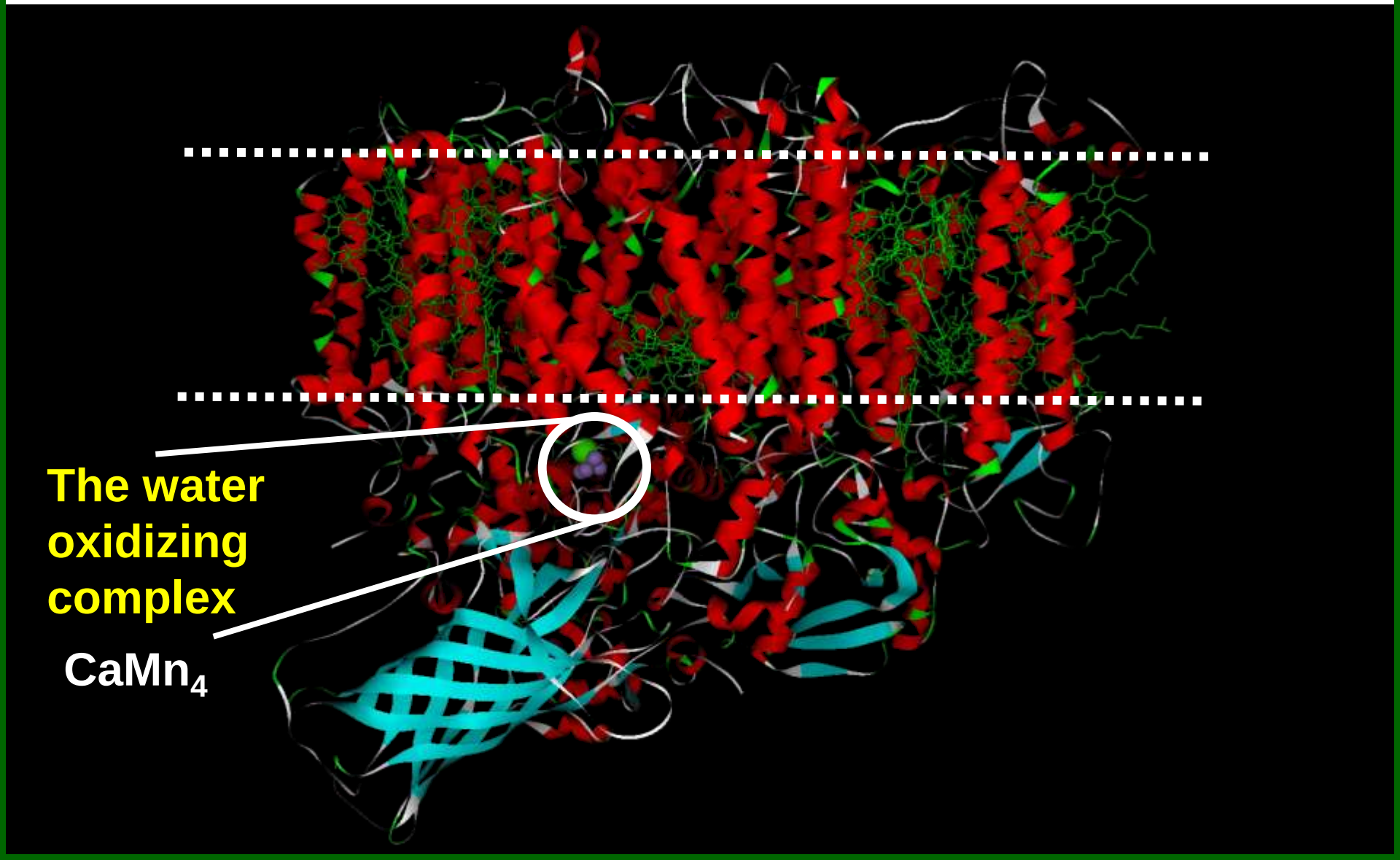
Efficiency < 0,1%



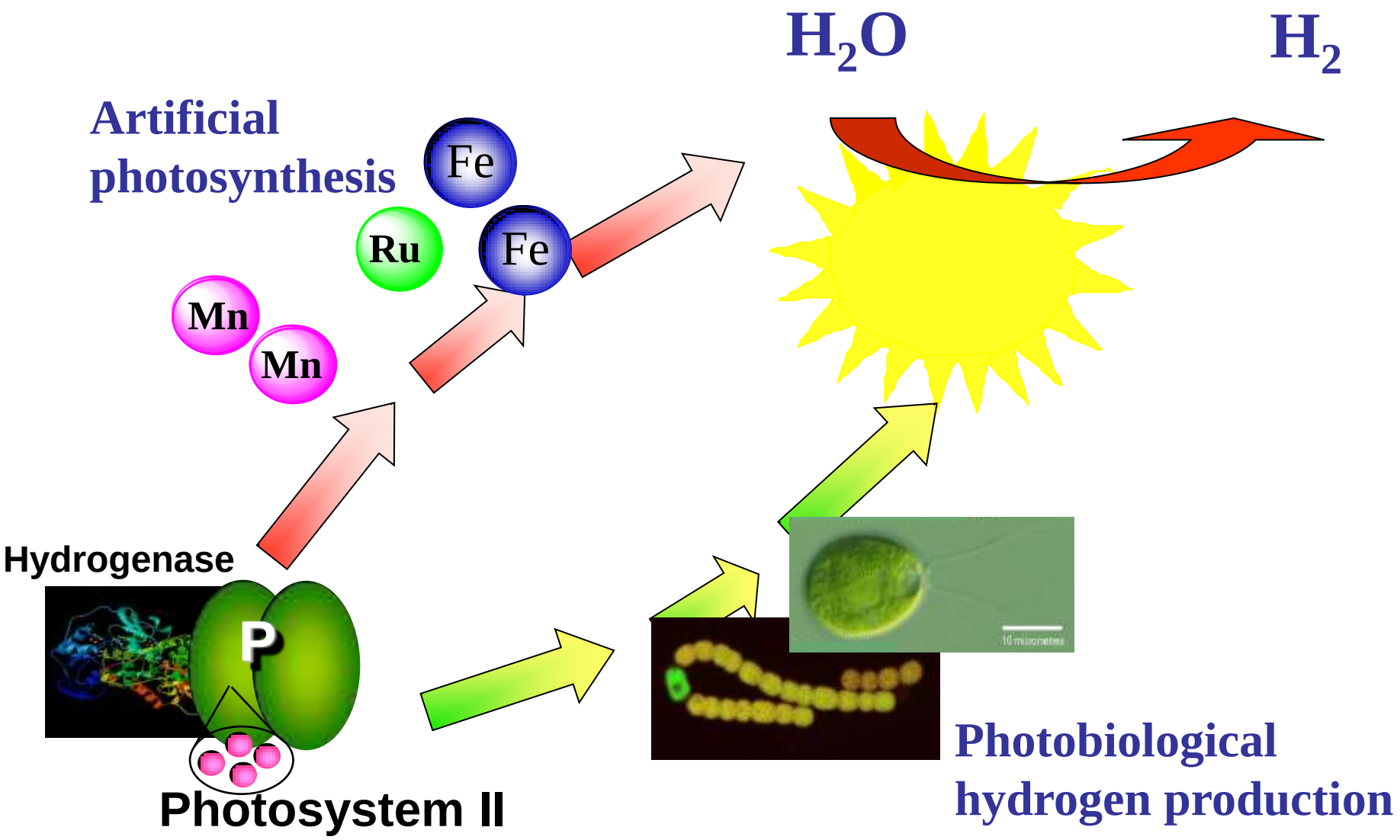


Efficiency 40%

Photosystem II, the water oxidizing enzyme

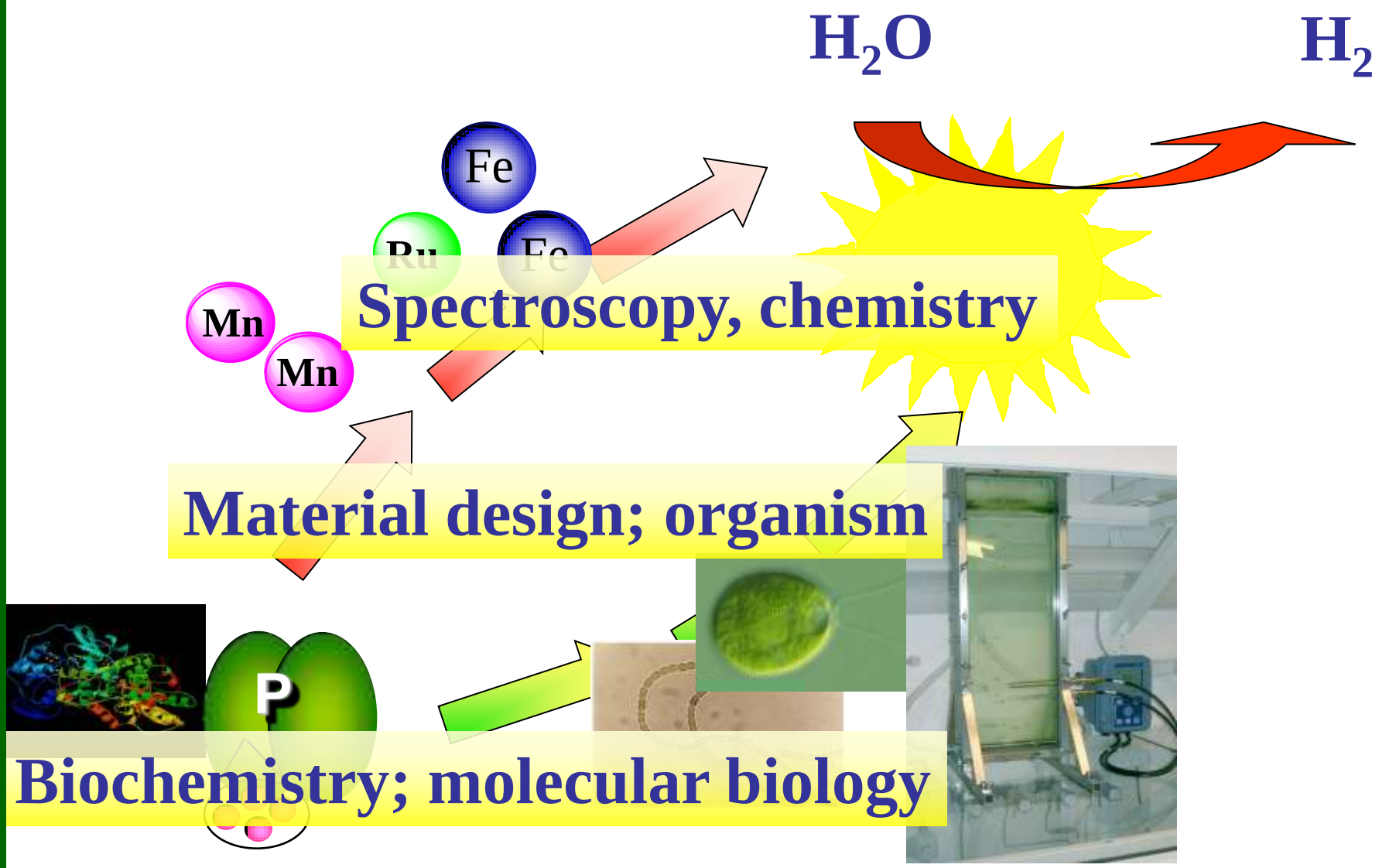


EU FP7 Solar-H2 network develops two novel processes; both unproven and conceptually new



Coordinator Stenbjörn Styring, Uppsala University

Interdisciplinary science
Building closely integrated networks



Coordinator Stenbjörn Styring, Uppsala University

Biodiversity of Cyanobacteria

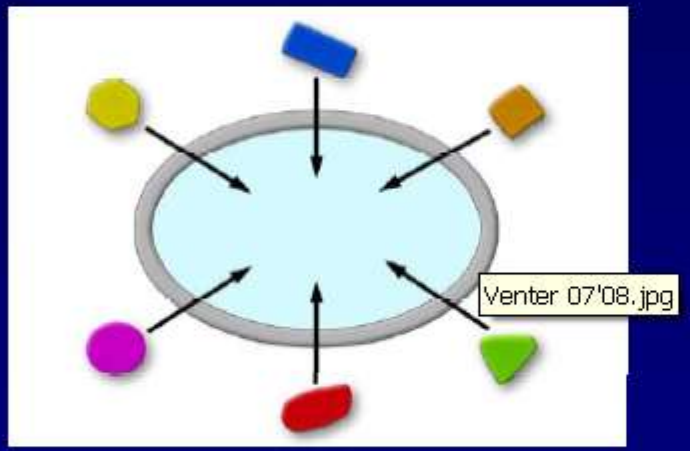
Screening of Cyanobacteria culture collection (*University of Helsinki, Department of Applied Chemistry and Microbiology*) for excellent H_2 producers

- **Cyanobacteria isolated from Finnish lakes and the Baltic Sea (water, sediment and mats)**
- **Over 1000 strains**
- **N2-fixing filamentous strains, non-N2-fixing filamentous and single cell strains**

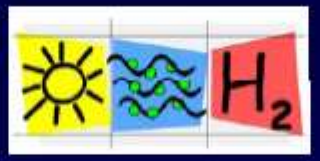
Further improvement of naturally efficient H_2 producers

"Design cell strategy"

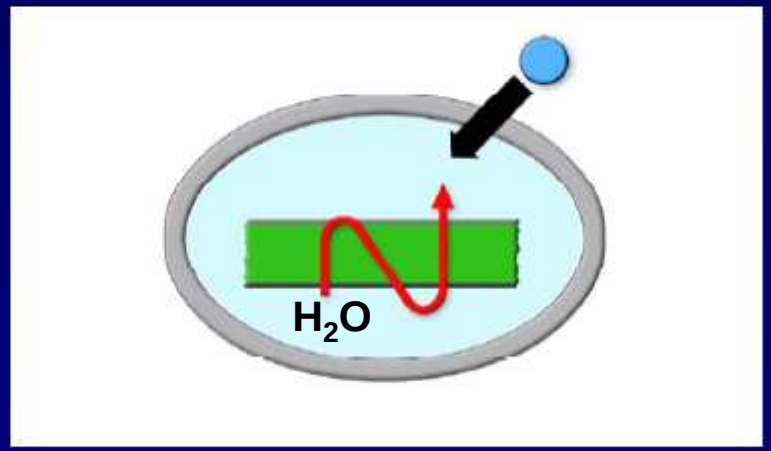
Craig Venter Approach



"Bottom up"



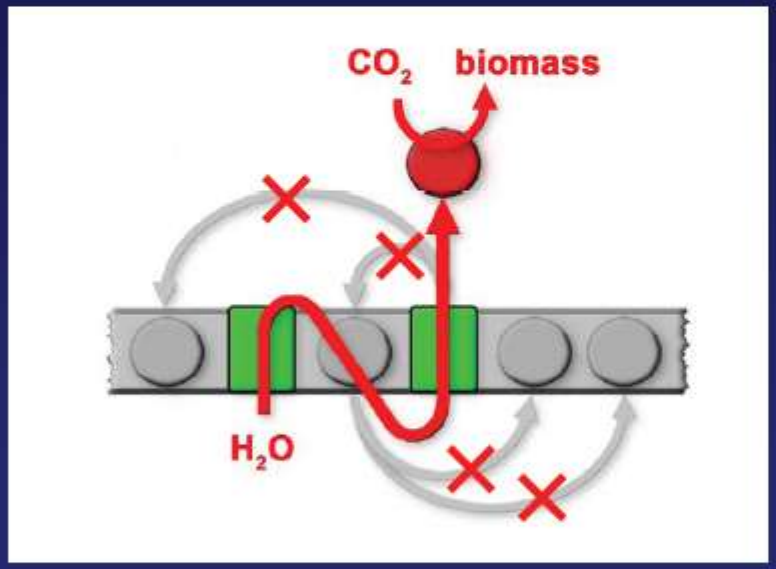
CyanoBioEnergy Approach



"Top down"

Energy metabolism design :

Removing energetic barriers for PS-powered H_2-production



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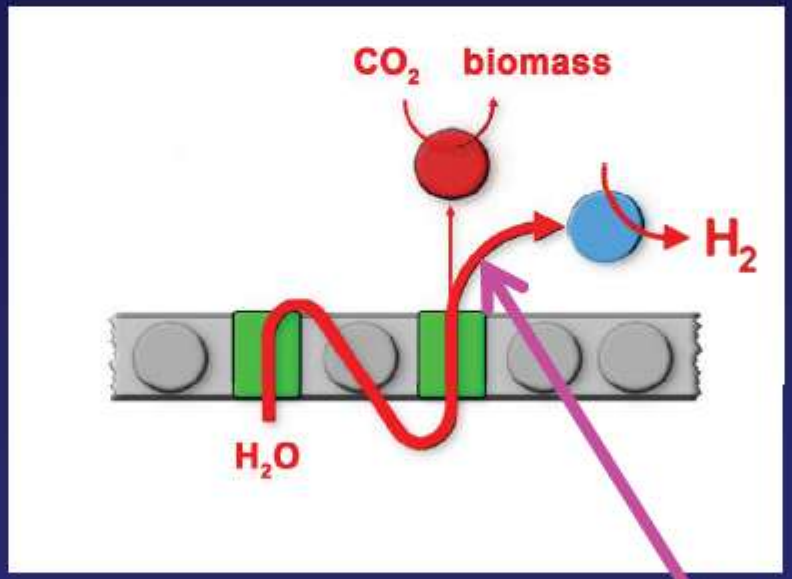

"Design organism"

design!

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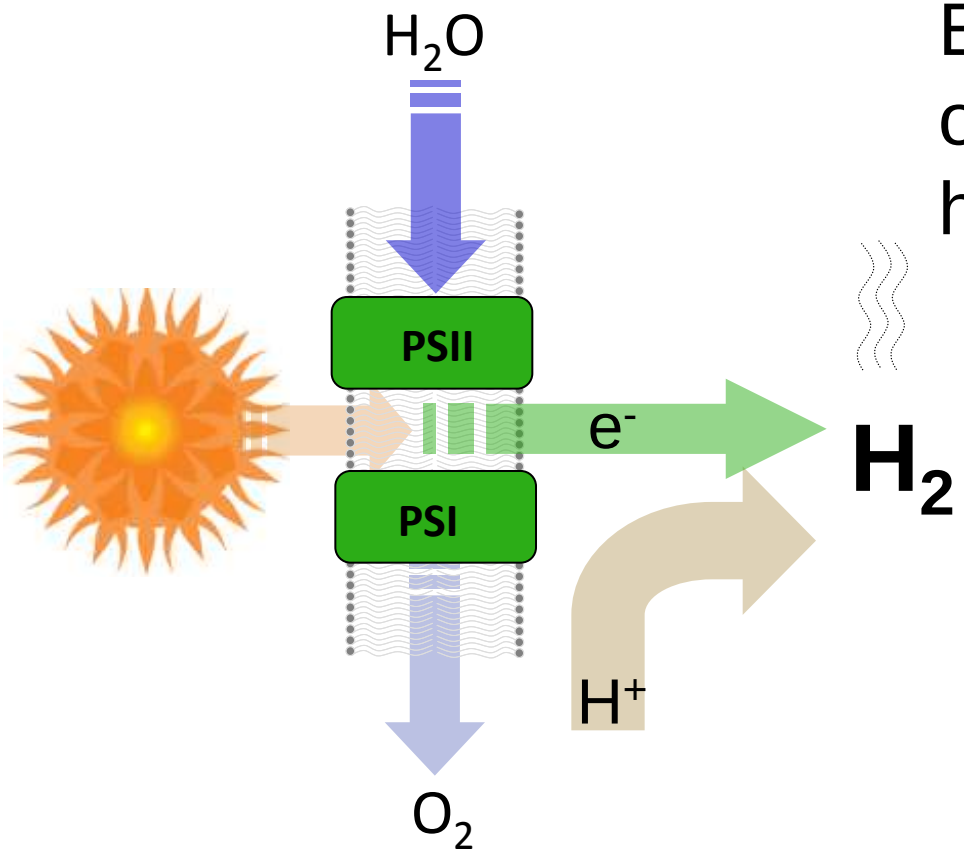
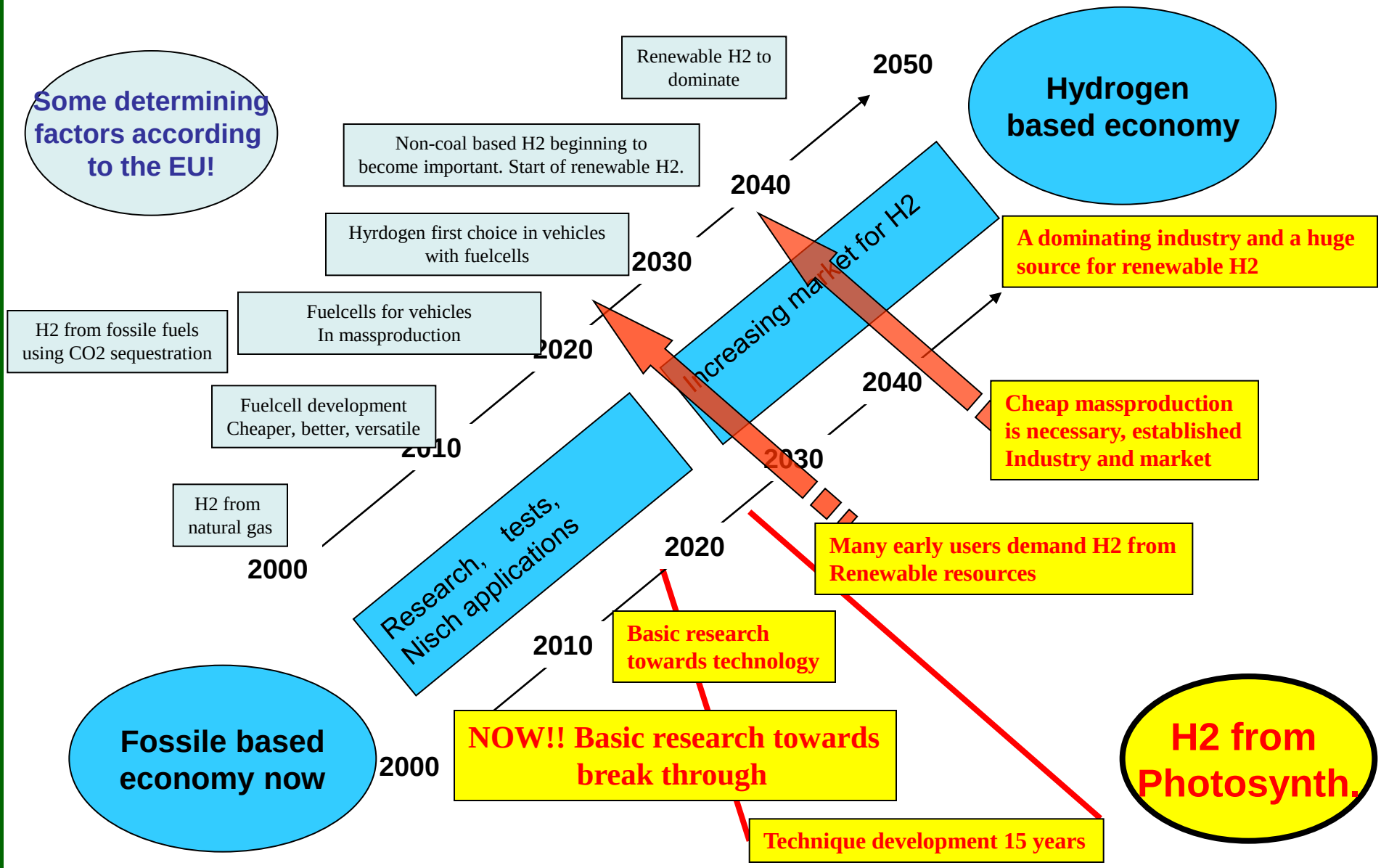


Efficient and oxygen tolerant hydrogenase

Direct photobiological conversion of solar energy to volatile biofuels

May 2010, Patrik Jones

EU´s roadmap to the hydrogen economy



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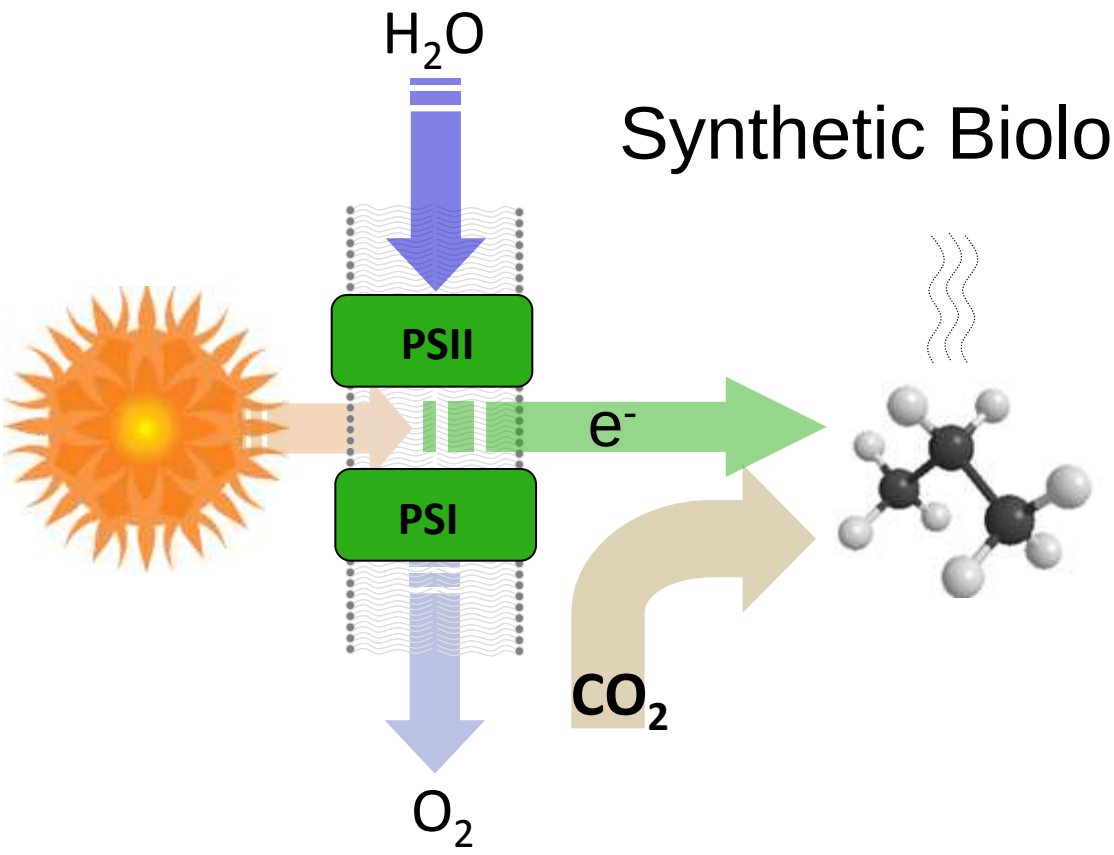
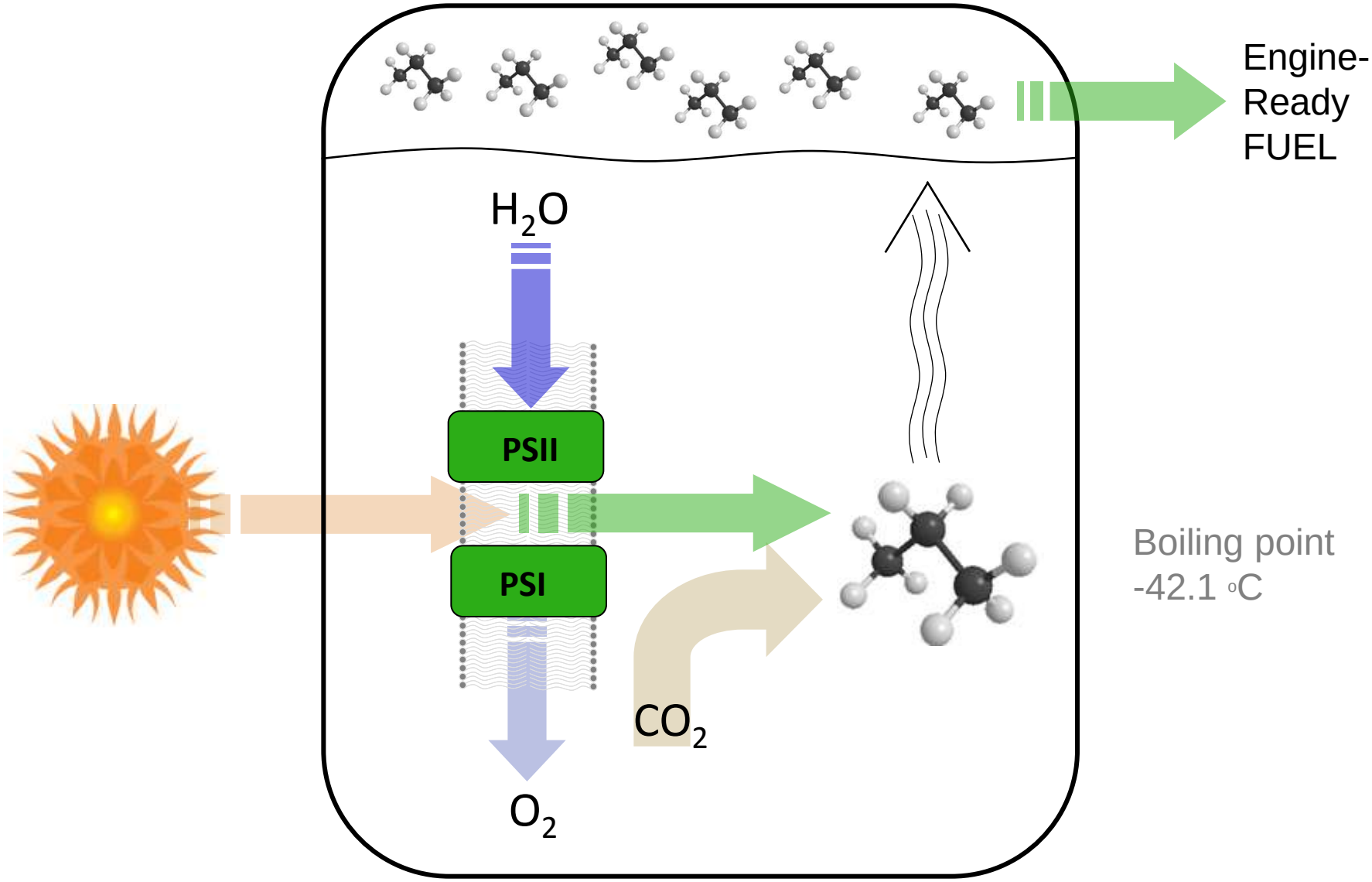
EU FP7 DirectFuel Network



Direct photobiological conversion of solar energy to volatile transport fuel

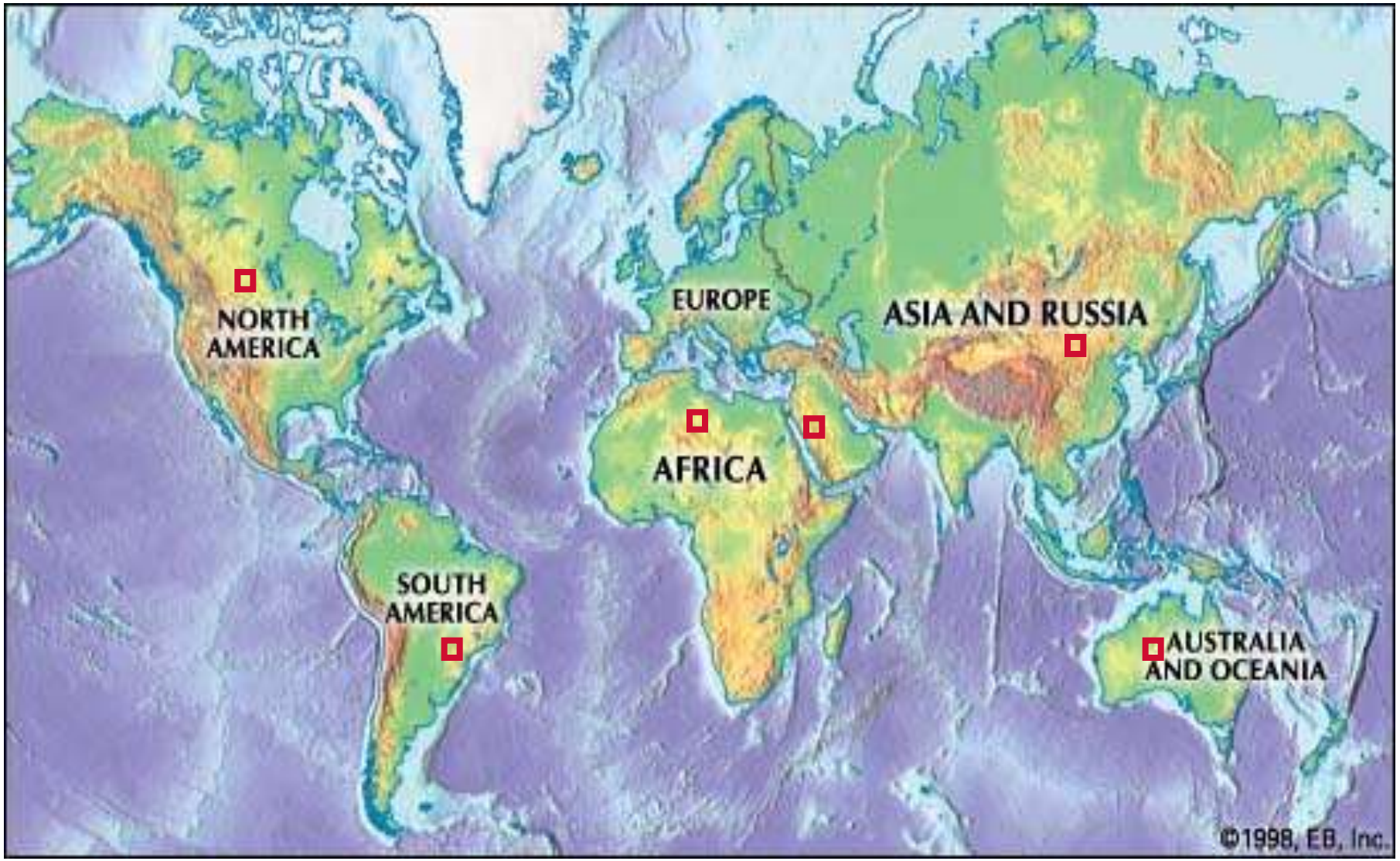
May 2010, Patrik Jones

Direct photobiological synthesis of engine-ready fuel



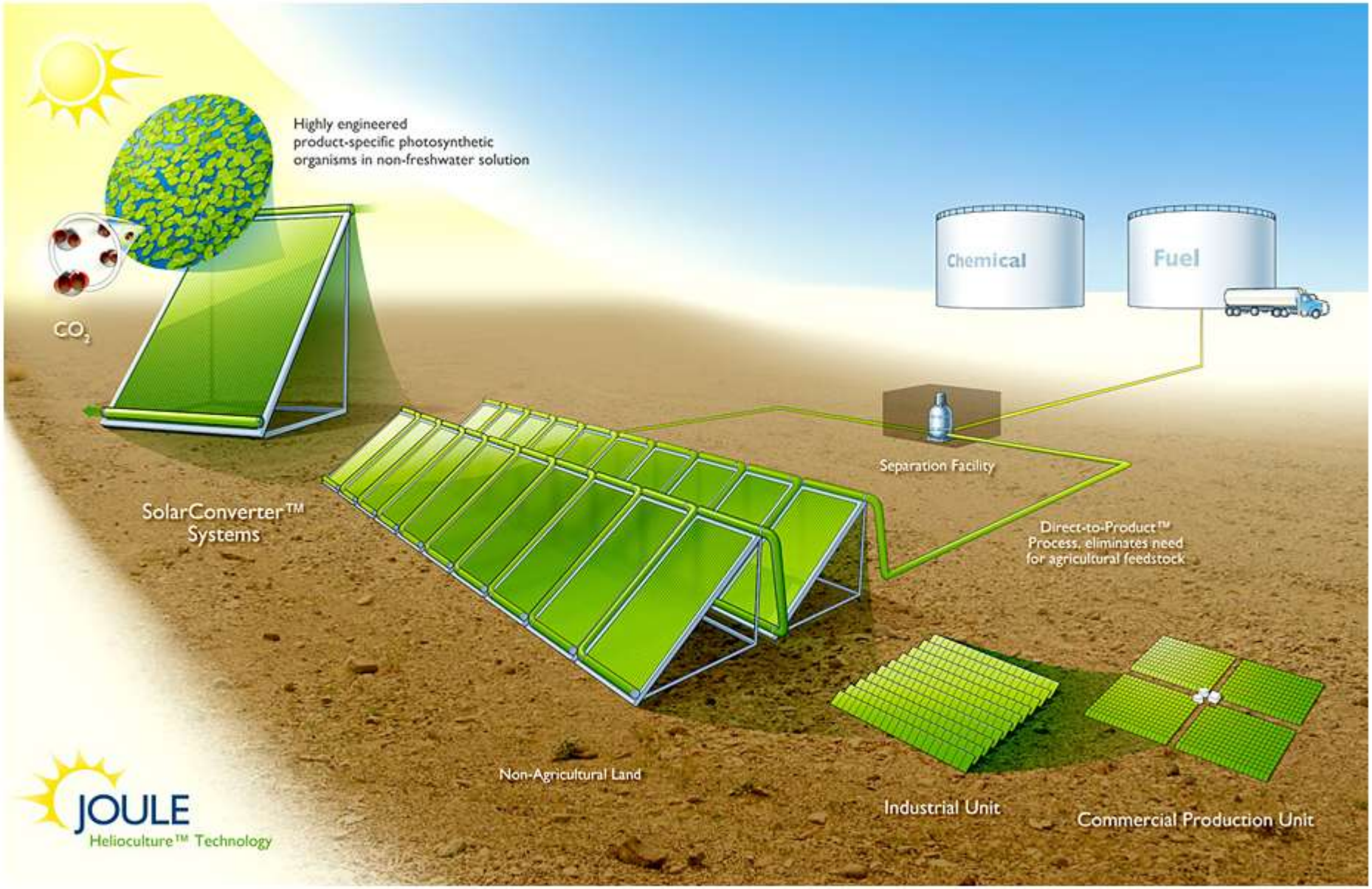

Thank You !
Bio Tie
THERAPIES
Sonera GSM

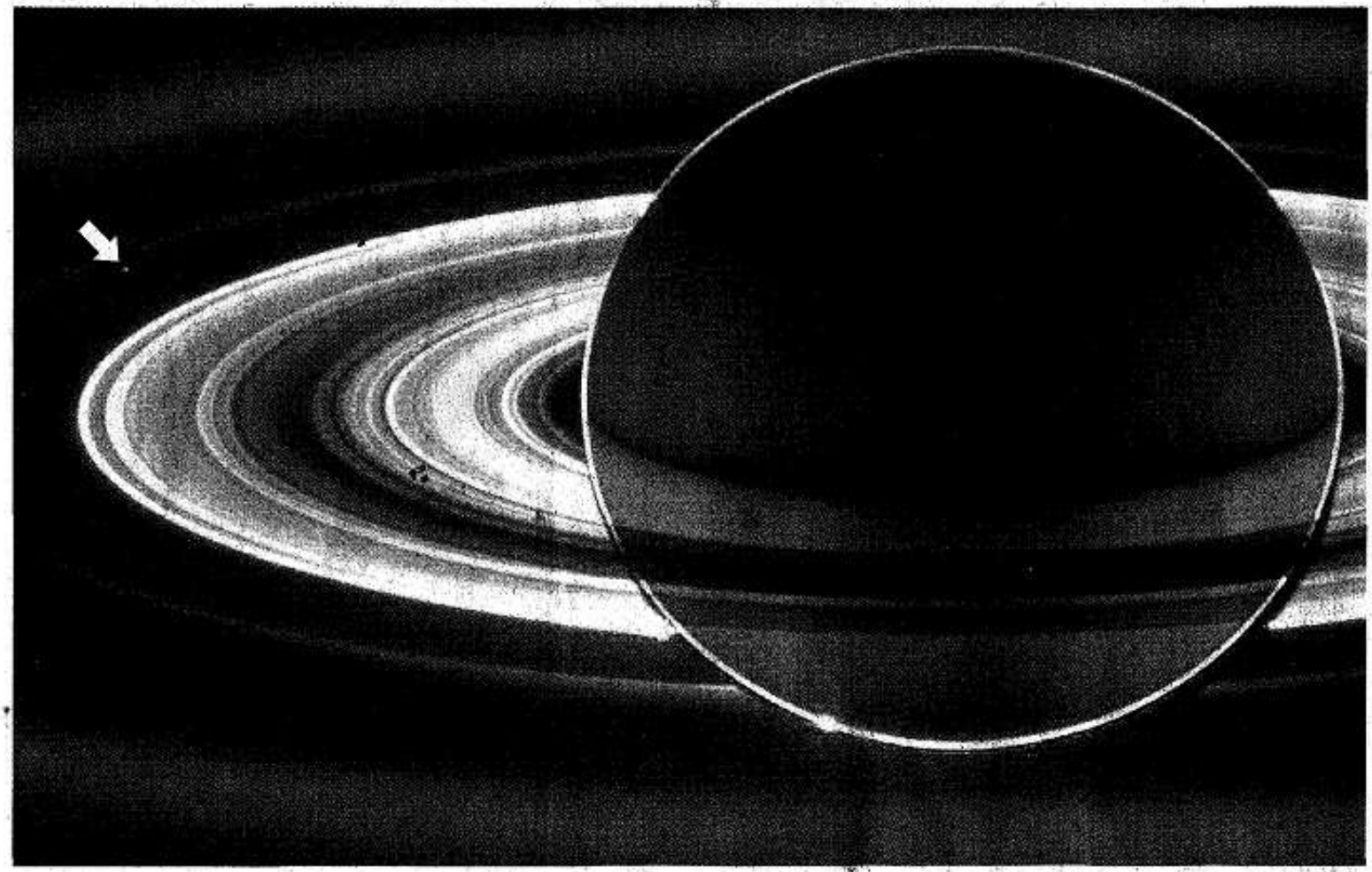
Solar Land Area Requirements



6 Boxes at 3.3 TW Each

How it Works


Highly engineered
product-specific photosynthetic
organisms in non-freshwater solution
CO_2
Chemical
Fuel
Separation Facility
SolarConverter™
Systems
Direct-to-Product™
Process, eliminates need
for agricultural feedstock
Non-Agricultural Land
Industrial Unit
Commercial Production Unit
JOULE
Helioculture™ Technology



Ein Pünktchen Erde im All

Zum zweiten Mal in der Geschichte der Raumfahrt ist der Planet Erde aus der Tiefe des Weltalls fotografiert worden. Diese Aufnahme stammt von der europäisch-amerikanischen Raumsonde *Cassini*. Sie zeigt die Heimat der Menschheit als Lichtpunkt über dem linken Rand der Ringe des Saturn (Pfeil). Das Bild wurde aus 165 Weitwinkel-Fotos zusammengesetzt, die *Cassini* schoss, während die Sonde den Schatten des Saturn durchquerte. Die Sonne steht hinter dem Planeten und erzeugt einen gleißenden Kranz um den Saturn, während ein Teil des Sonnenlichts auf die Erde fällt und sie als Fleckchen sichtbar macht. *Foto: AP/Nasa*