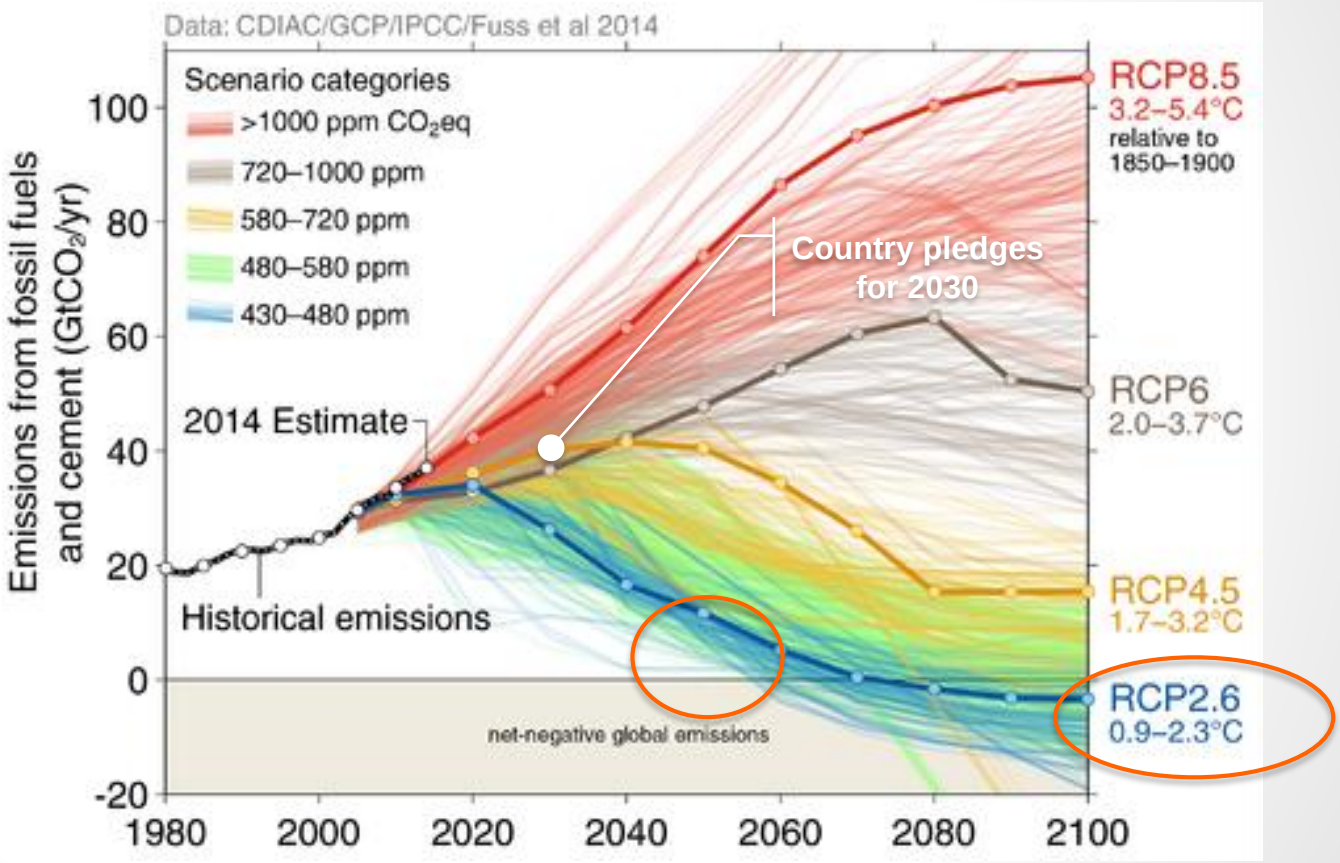


LUT
Lappeenranta
University of Technology

Parisiin sopimus vs. Suomen energia- ja ilmastostrategia 2030

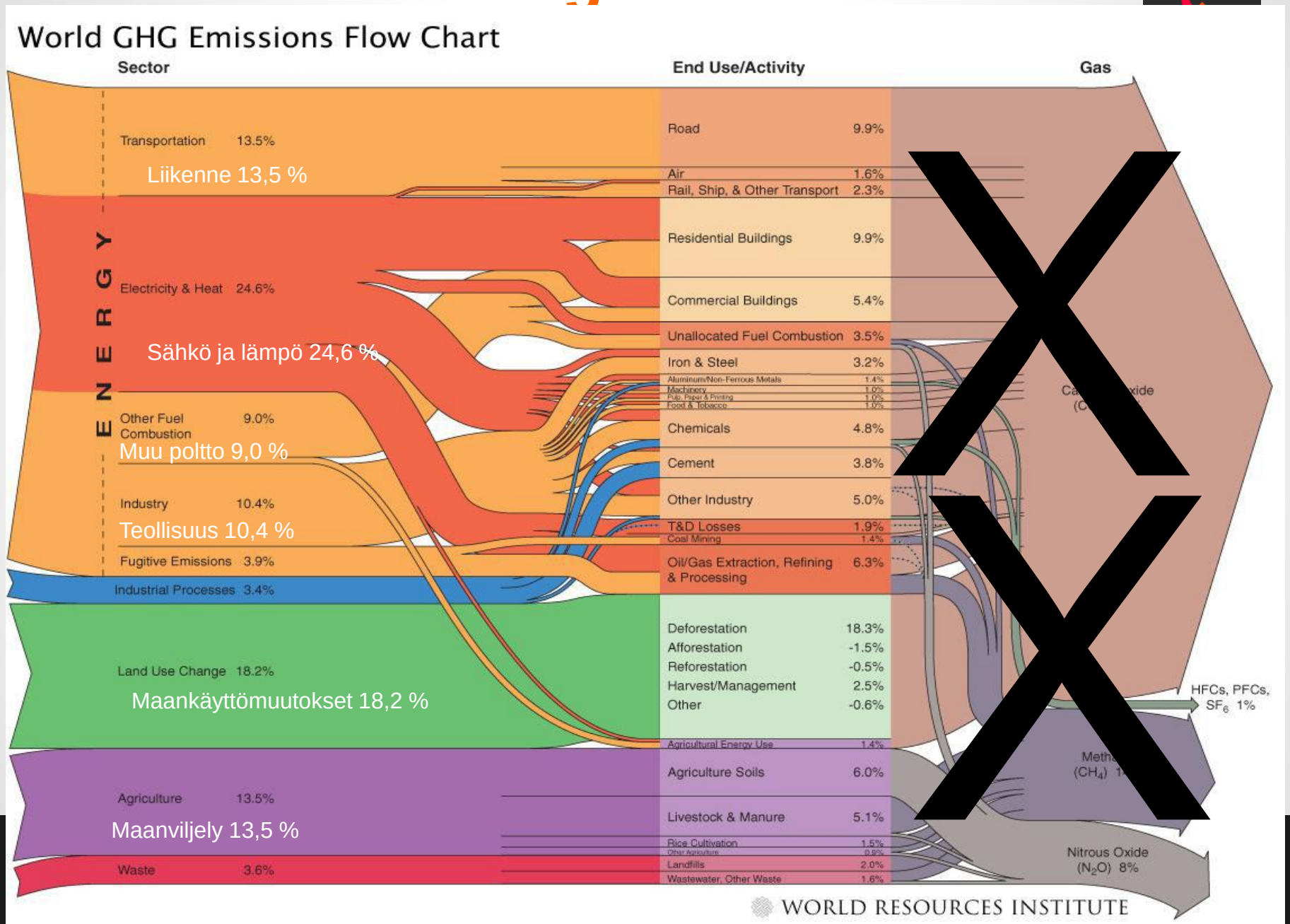
Prof. Jarmo Partanen
Jarmo.partanen@lut.fi
+358 40 5066564
7.10.2016 Eduskunta/Ympäristövaliokunta

What did we agree in Paris 2015?



NEO CARBON ENERGY

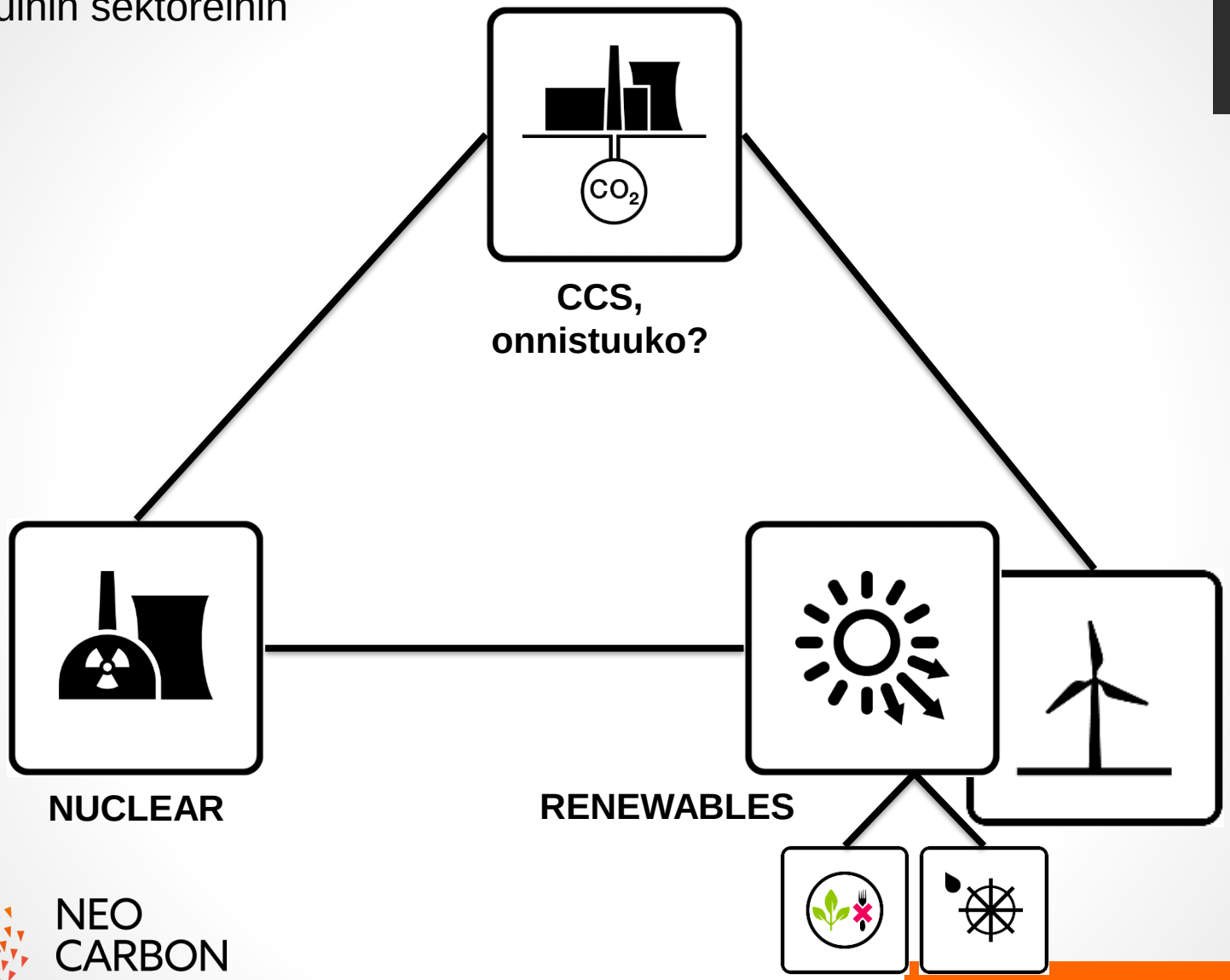
What did we agree in Paris 2015?



Näkökohtia, uhkia ja mahdollisuuksia

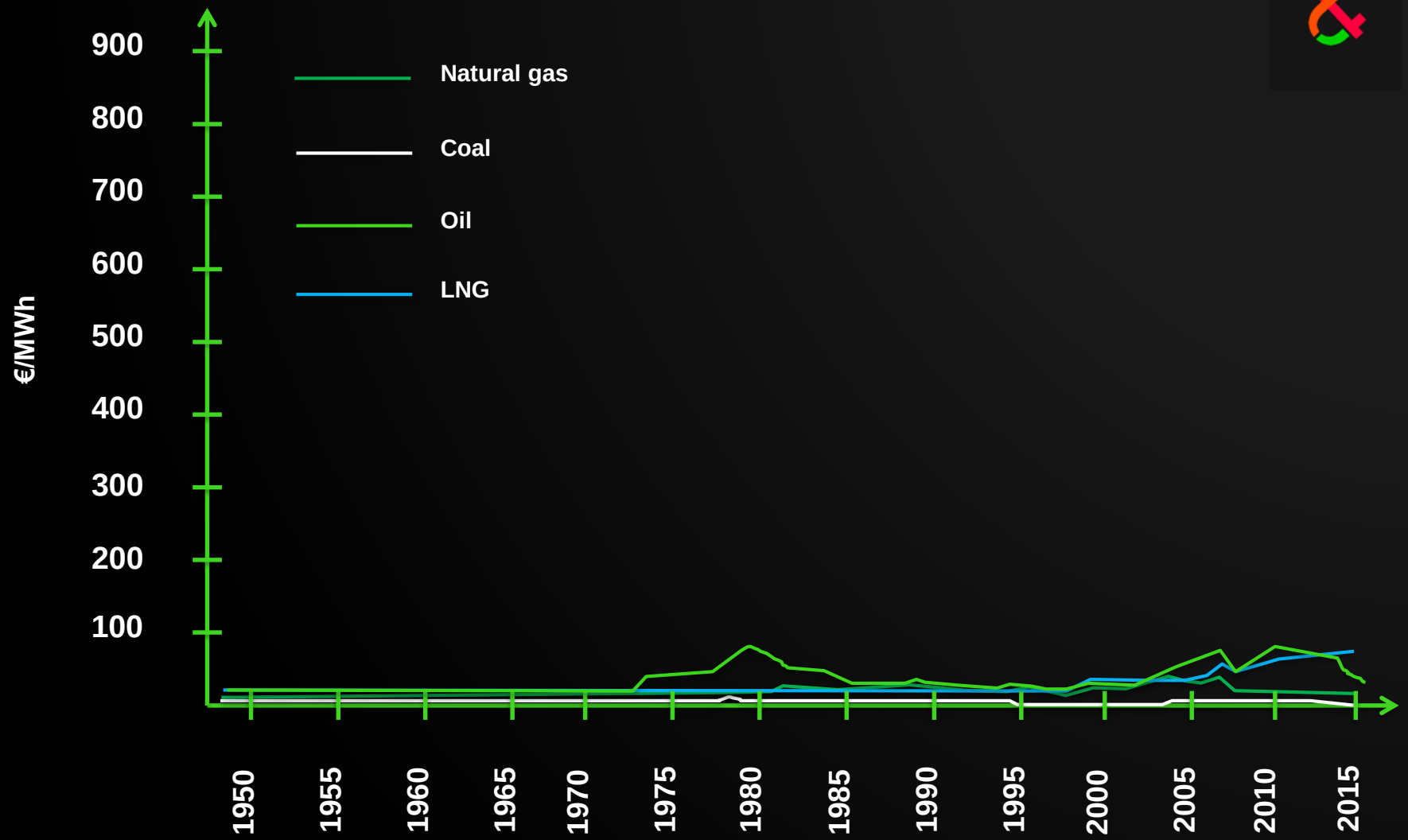
- Pariisin sopimuksen tavoitteiden toteuttaminen tarkoittaa Euroopassa kaikkien kasvihuonekaasupäästöjen nollatasoa noin vuonna 2050
  - Energiasektori
  - Liikenne
  - Teollisuus
  - Maatalous
  - Maankäyttömuutokset
- Suomen energia- ja ilmastostrategiassa on ehdottoman tärkeätä tarkastella asiaa EU:n nykyisten velvoitteiden lisäksi myös 0 % kasvihuonekaasupäästöjen näkökulmasta. EU:n 2030 tavoitteet ovat ’helppoja’ saavuttaa, mutta riski joutua taloudelliseen umpikujaan v. 2050 tavoitteiden suhteen on suuri ilman kokonaiskuvaa päätavoitteista!
- Biomassan eri jakeiden kestävyys on kriittinen Suomen kansantaloudelle. Ratkaiseva tekijä on ilmastomuutoksen hallinnan globaali aikataulu (30 vai 100 vuotta). Riski on todellinen – kuinka voimme pienentää riskiä omilla toimillamme?
- Muutostilanne on myös erinomainen mahdollisuus Suomelle teollisessa mittakaavassa. Sähkön rooli korostuu tulevaisuudessa.

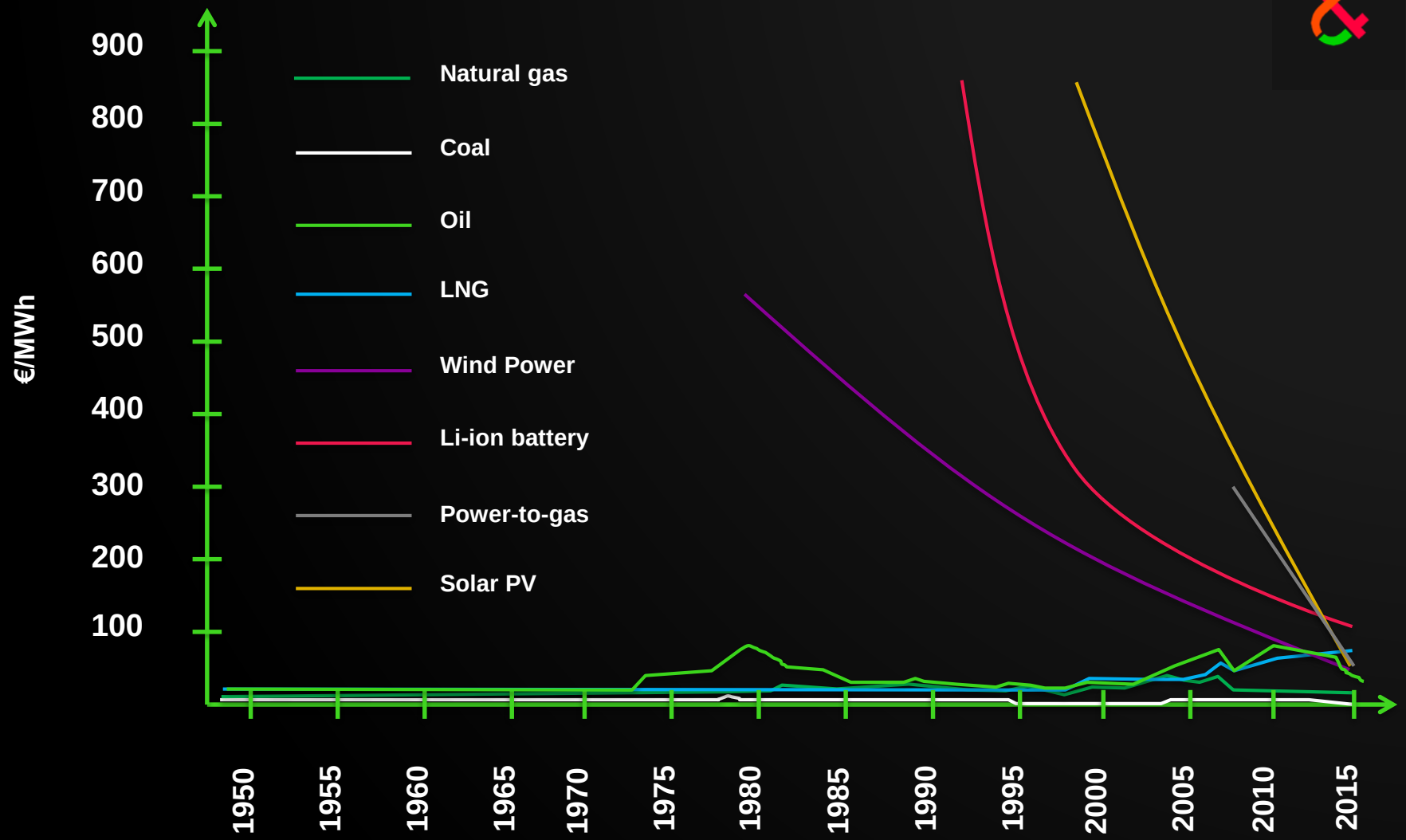
Energiasektorin 100 % uusiutuvaa tavoite on ”helppo” suhteessa muihin sektoreihin



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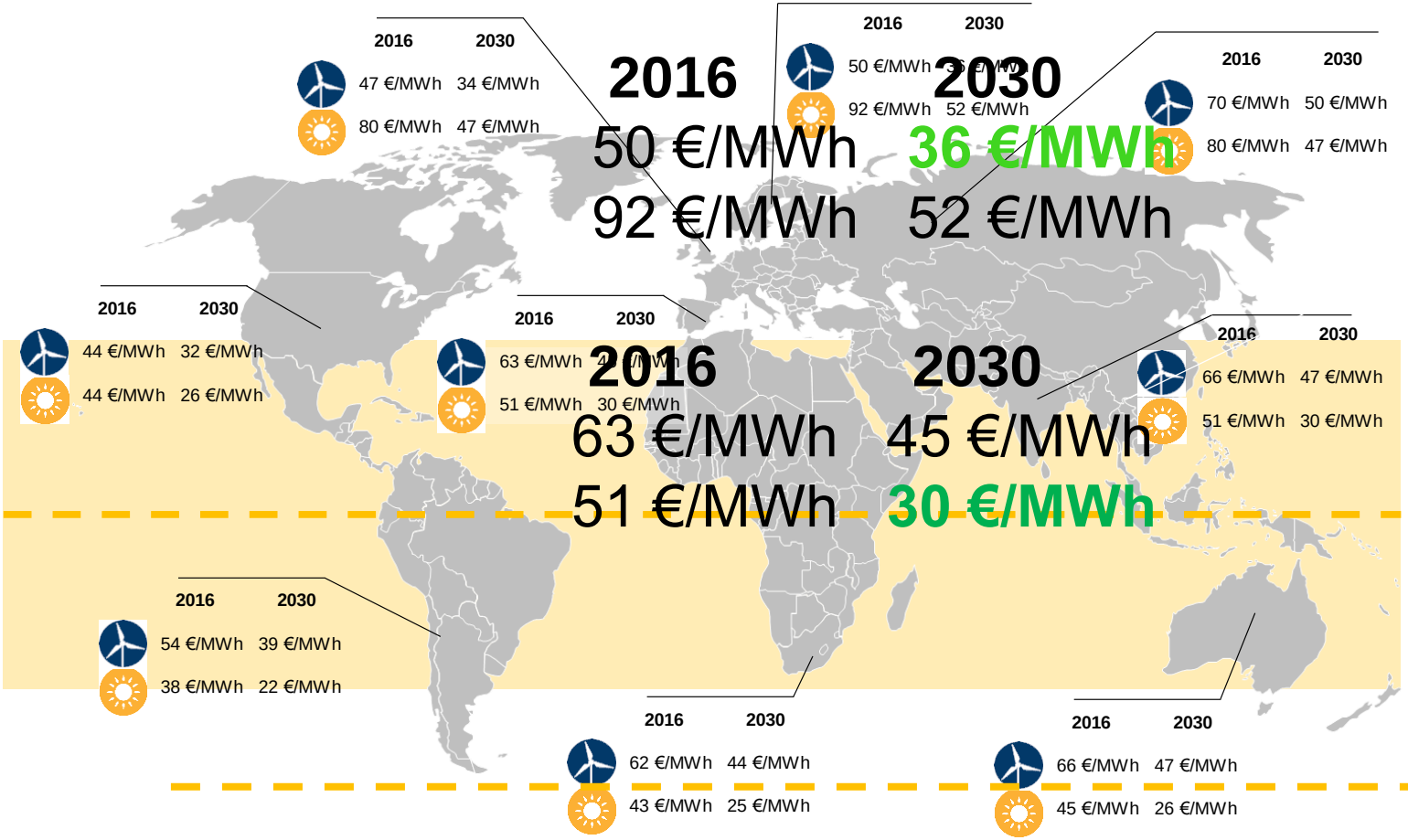

€/MWh
900
800
700
600
500
400
300
200
100
Natural gas
Coal
Oil
LNG
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015



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Future energy system features:

- **Security of Supply** a limited resource
- **Energy** a non limited resource



2016
50 €/MWh
92 €/MWh

2030
36 €/MWh
52 €/MWh

Clear Seasonality
Wind most competitive
Intermittent power

2016
63 €/MWh
51 €/MWh

2030
45 €/MWh
30 €/MWh

Low seasonality
PV most competitive
Intermittent power

NOTE: Solar and wind resources and CAPEX may largely vary by individual projects, even on same region, thus impacting LCOE. Hence, figures are indicative and do not aim to present our geographical preferences for given technologies but rather illustrate progress of wind and solar globally, long-term.

PV LCOE assumptions based on EU PV Technology Platform report and EU PVSEC 2015 paper (lead author Fortum solar technology manager Dr. Eero Vartiainen)

LCOE assumptions:

- 7% real WACC
- CAPEX, OPEX globally uniform; lifetime solar 30y, wind 25y
- Wind and solar: internal assumptions that solar utilisation to increase by 7,5% and wind by 15% from 2016 to 2030
- Uniform 20% corporate tax assumed

Next generation energy company

Fortum

http://www.bloomberg.com/news/articles/2016-05-01/dubai-s-dewa-gets-5-bids-to-expand-solar-power-complex-in-desert

Dubai's DEWA Gets 5 Bids t...

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BREAKING NEWS 9:30 AM Pound Erases Year-to-Date Loss Versus U.S. Dollar

Dubai's DEWA Gets 5 Bids to Expand Solar-Power Complex in Desert

800 MW

by Anthony Dipaola

May 1, 2016 – 3:27 PM EEST

Dubai Electricity & Water Authority, the Persian Gulf emirate's utility, said it received five bids to build 800 megawatts of solar-power generation capacity.

Developers are bidding to construct the third phase of a DEWA solar park in the sheikhdom's desert, according to an e-mailed statement from the company. The lowest-cost bid would provide power for 2.99 cents a kilowatt-hour, it said.

29,99 $/MWh !!!!

Dubai is boosting solar generating capacity to diversify its energy mix and help meet growing demand for electricity. The emirate aims to get 7 percent of its power from clean energy sources by 2020. Dubai currently has 13 megawatts in operation at the solar park and a further 200 megawatts under construction.

DEWA will now review technical and commercial aspects of the bids, it said. Chief Executive Officer Saeed Mohammed Al Tayer said in March that the company planned to award construction contracts in May.

Before it's here, it's on the Bloomberg Terminal.



90%

FI 9:32 3.5.2016

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WORLD RECORD: 3-CENT WIND, SUB-4-CENT SOLAR (UNSUBSIDISED)

Bloomberg NEW ENERGY FINANCE

ONSHORE WIND



Location:	Morocco
Bidder:	Enel Green Power
Signed:	January 2016
Price:	US$ 3.0 c/kWh

SOLAR PV



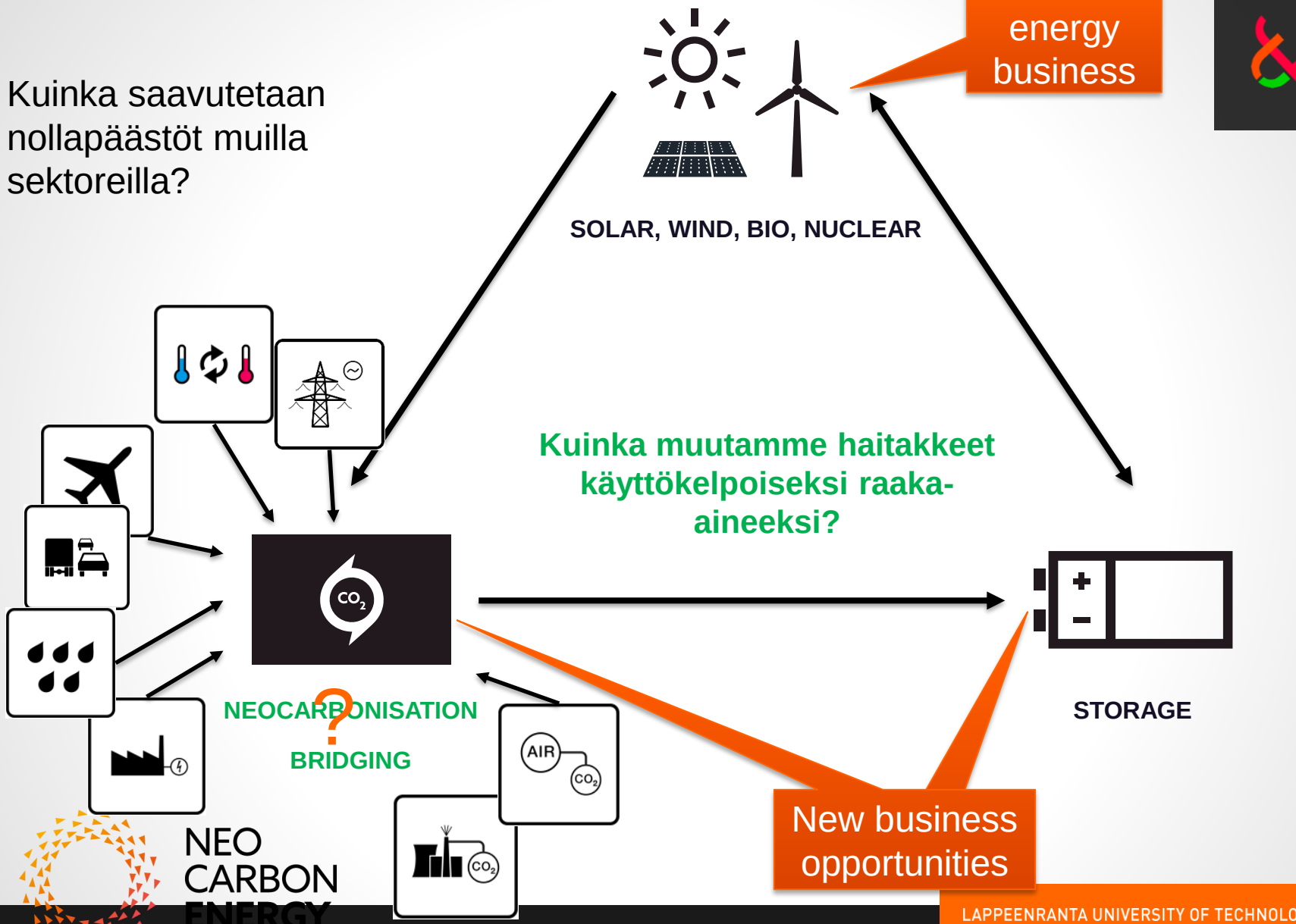
Location:	Coahuila, Mexico
Bidder:	Enel Green Power
Signed:	March 2016
Price:	**US$ 3.6 c/kWh**

Source: Bloomberg New Energy Finance; ImagesSiemens; Wikimedia Commons

ENERGY

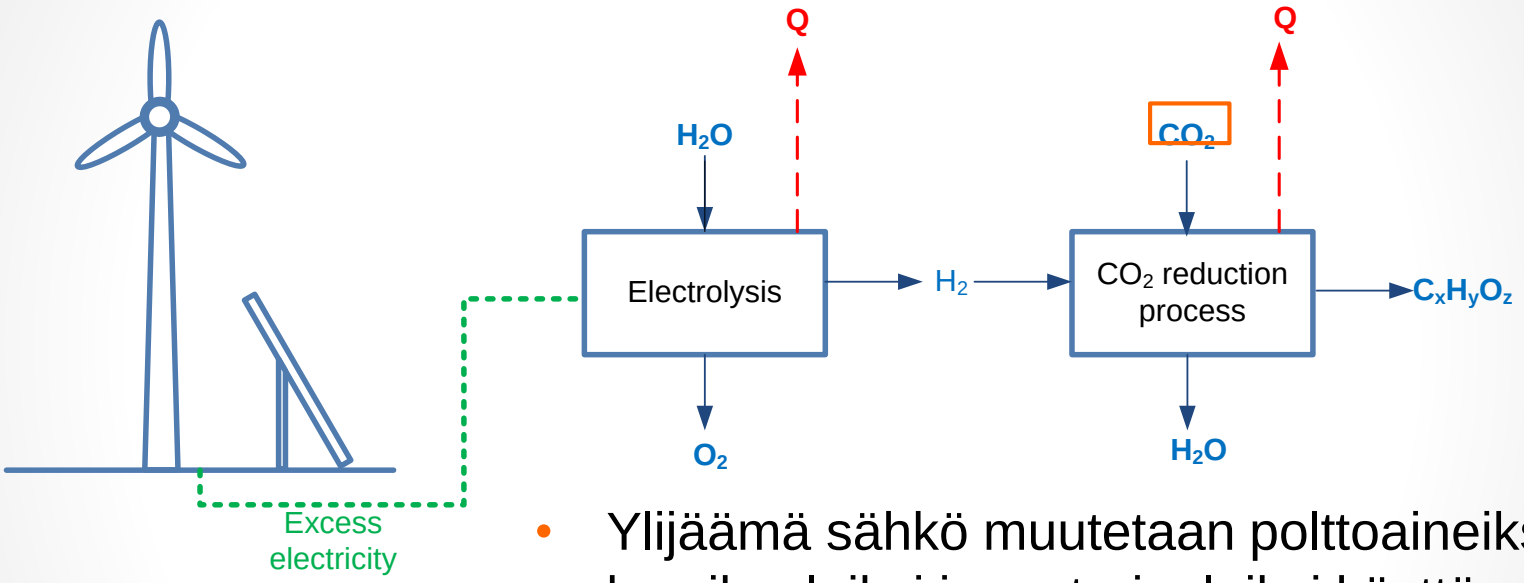
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Kuinka saavutetaan nollapäästöt muilla sektoreilla?



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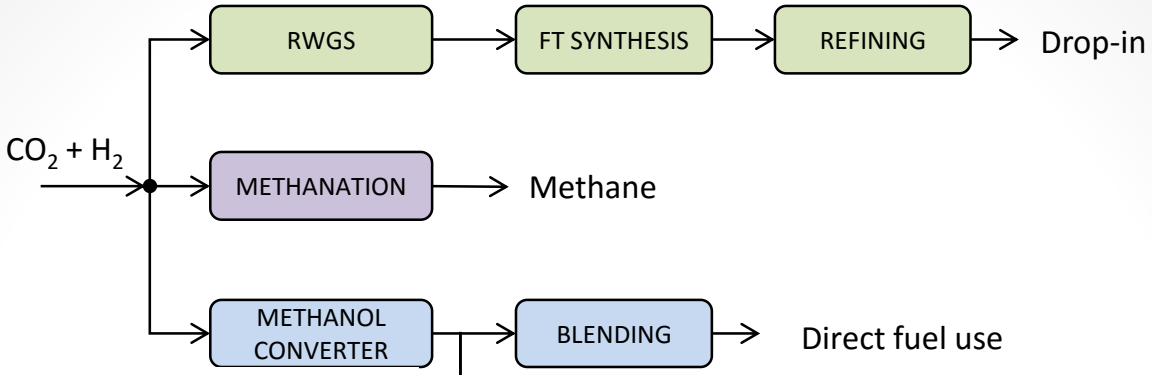
Power-to-x

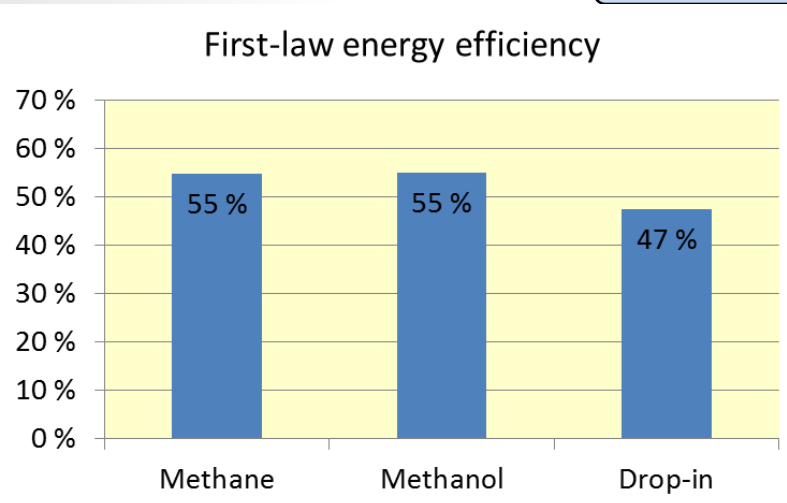


- Ylijäämä sähkö muutetaan polttoaineiksi, kemikaaleiksi ja materiaaleiksi käyttämällä CO_2 raaka-aineena (korvataan fossiiliset raaka-aineet)
- Power to fuels - ”sähköpolttoaineet”

NEO CARBON ENERGY

Power-to-x





Kuinka saavutetaan teollinen kilpailukyky?

Massatuotantoon perustuva teknologia ☺

NEO CARBON ENERGY

Power-to-X at LUT & VTT, 2017

LUT PV PLANT (EXISTING)



VTT: CO_2 CAPTURE FROM AIR





BUFFER STORAGES



VTT: SYNTHESIS OF CH_4 (SOLAR SNG) AND MeOH





LUT: H_2 PRODUCTION THROUGH ELECTROLYSIS

- SOLAR SNG AND H2 REFILL
- ELECTRICITY CHARGING FOR EV'S
- MeOH FOR PLASTICS SYNTHESIS

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Electricity has an enormous history but the future is … unbelievable

Cost efficient, clean and unlimited energy source

Heat, cooling, working power

Electricity based fuels, food



