Eduskunta turvallisuuden tekijänä -keskustelu

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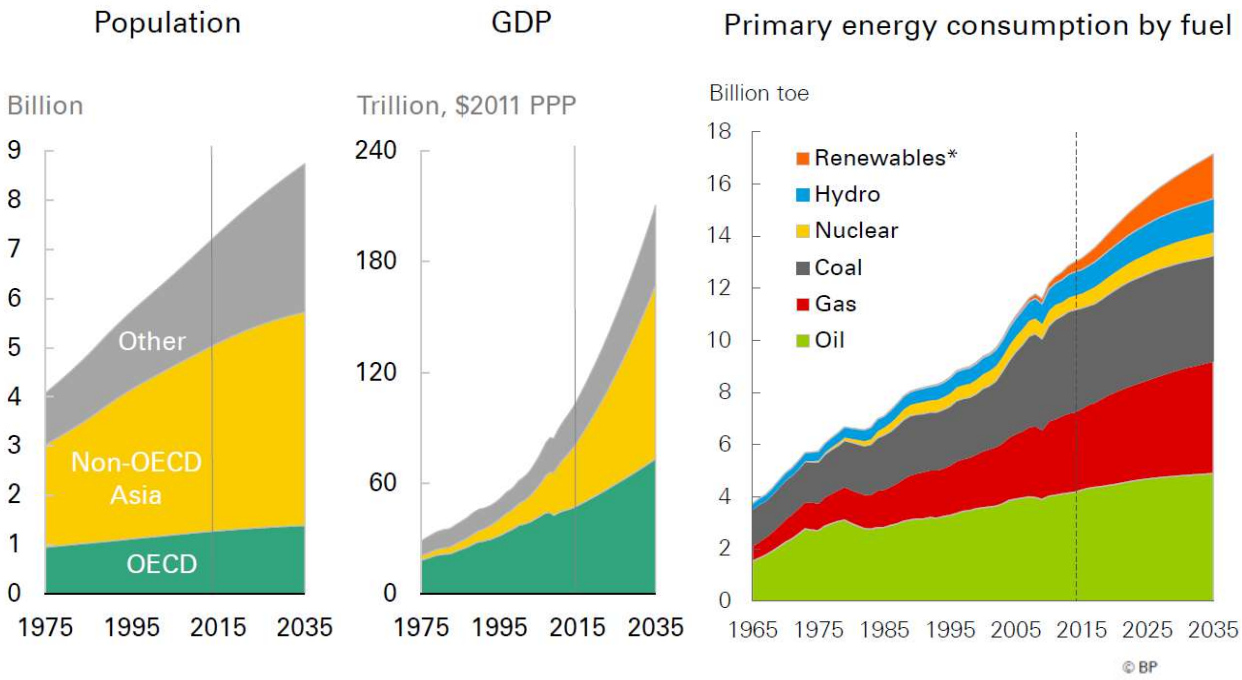
Mika Anttonen

The Global Energy Challenge

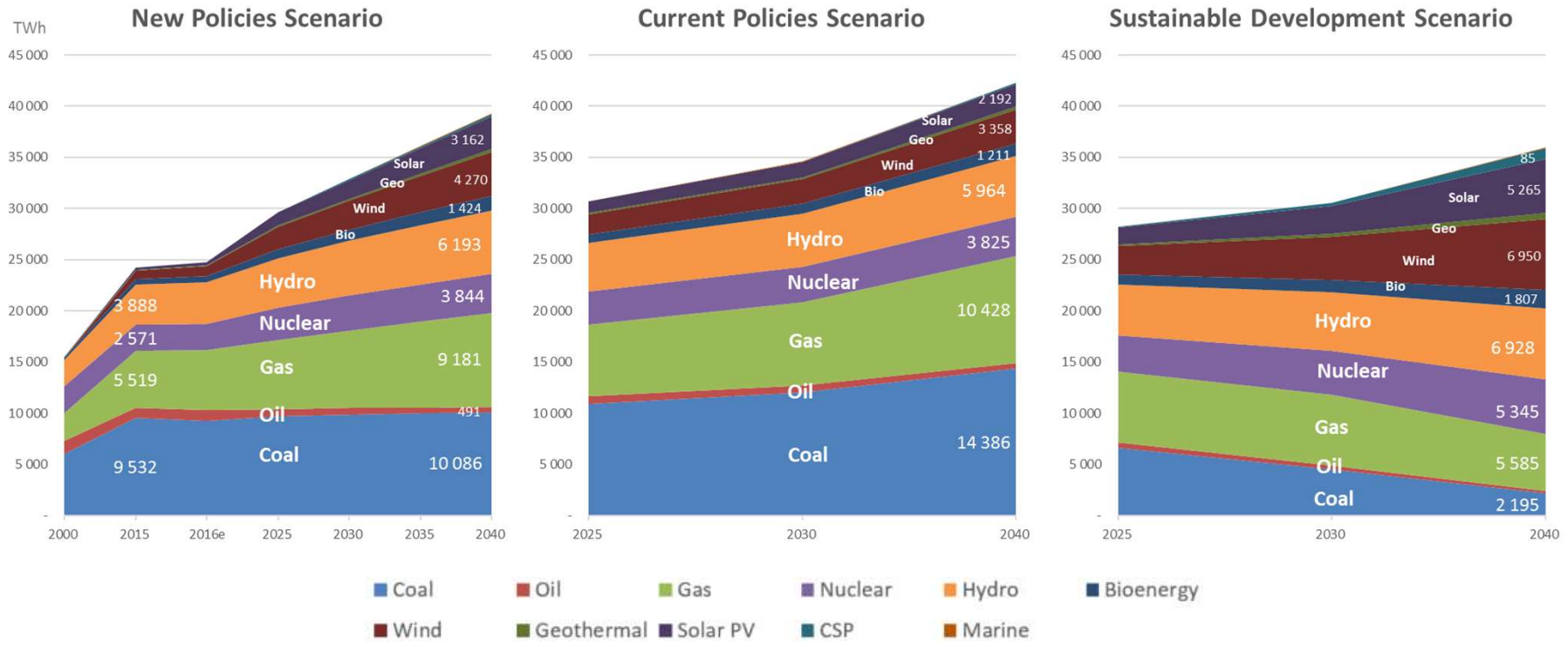


	Energy Demand (Mtoe) Current Policies Scenario		
Fuel	**2020**	**2030**	**2040**
Coal	4 051	4 710	5 327
Oil	4 548	4 960	5 402
Gas	3 194	3 898	4 718
Nuclear	793	936	1 032
Hydro	375	450	515
Bioenergy	1 540	1 695	1 834
Other Renewable	319	535	809
Total	**14 819**	**17 183**	**19 636**

IEA: World Energy Outlook 2016

Source BP Energy Outlook – 2016 edition

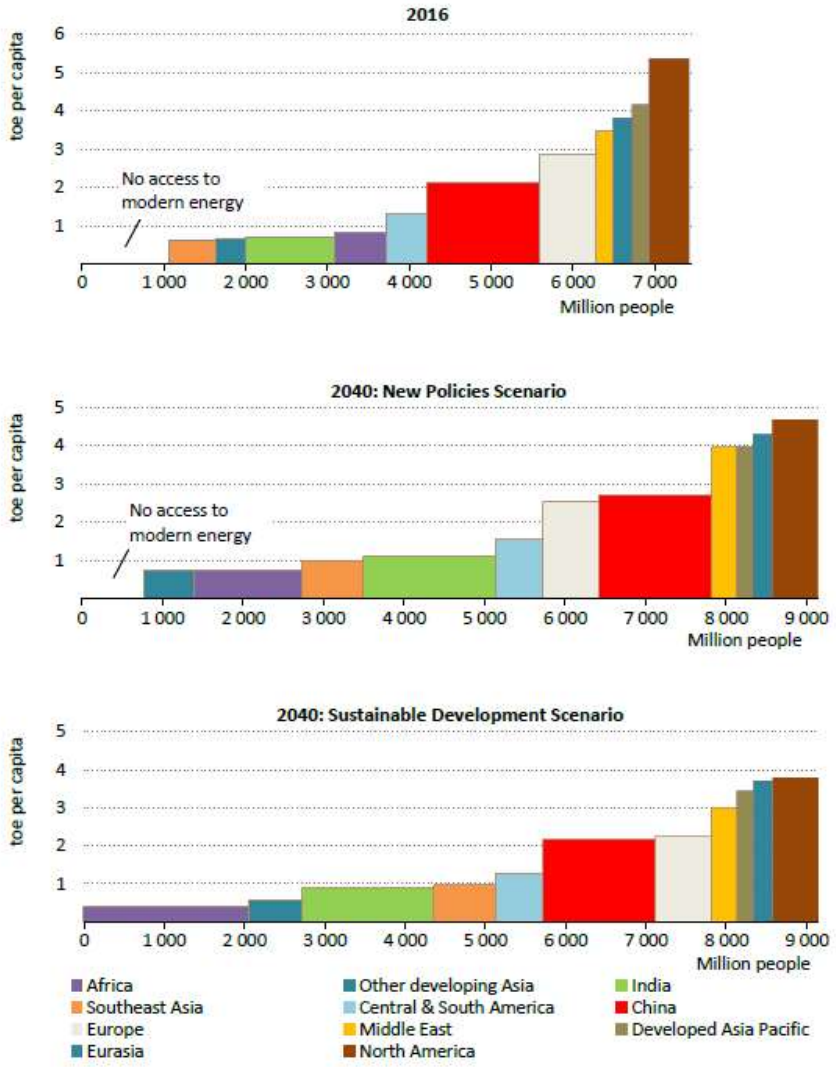
World Electricity Generation Outlook



Source IEA, World Energy Outlook 2017

Modern primary energy demand per capita by scenario*

Strong action needed outside EU



*Source: IEA World Energy Outlook 2017

The Sustainable Development Scenario delivers a higher level of energy services in 2040 than the New Policies Scenario, but with nearly 20% less consumption of modern energy

Notes: toe = tonnes of oil equivalent. Modern primary energy demand excludes traditional biomass. The country/regional blocks show only those with access to modern energy.

Scalability and effectiveness of modern modes of transport - EV

1. By 2040, 55% of all new car sales and 33% of the global fleet will be electric

2. China is and will continue to be the largest EV market in the world through 2040

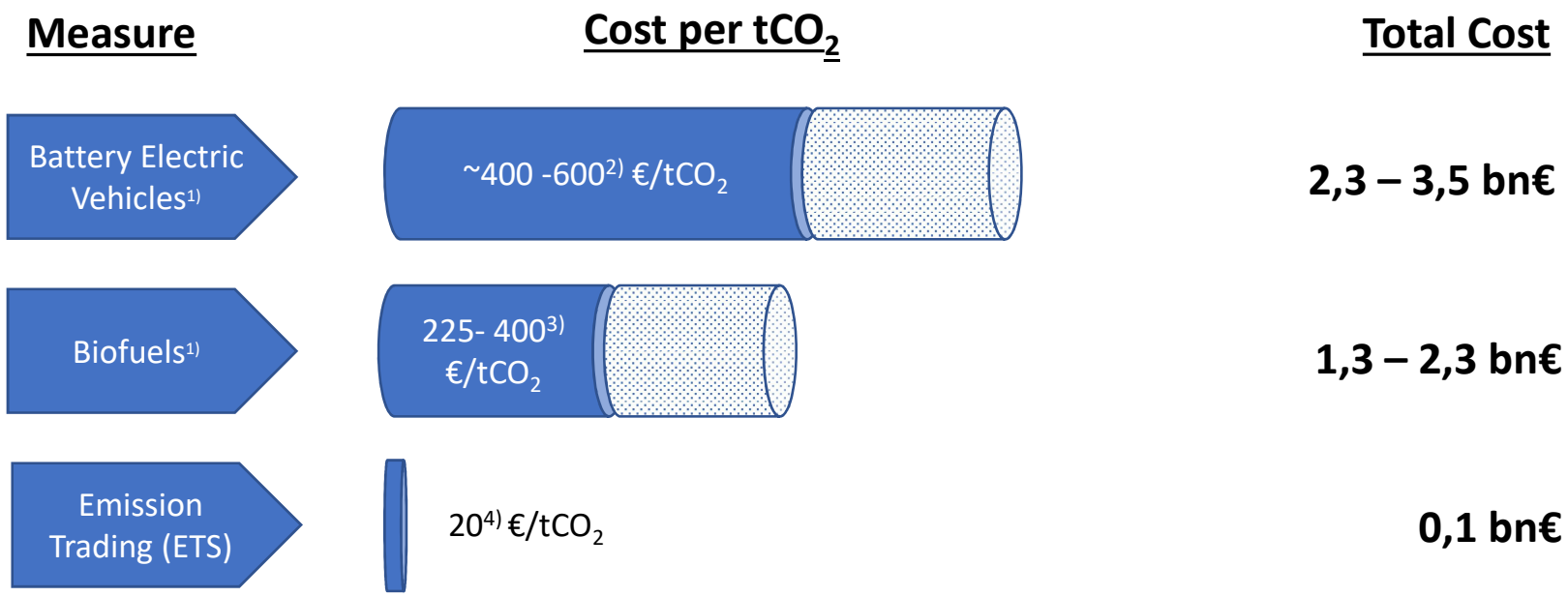
3. EV costs
   - The upfront cost of EVs will become competitive on an unsubsidized basis starting in 2024
   - By 2029, almost all segments reach parity as battery prices continue to fall

4. Buses go electric faster than light duty vehicles

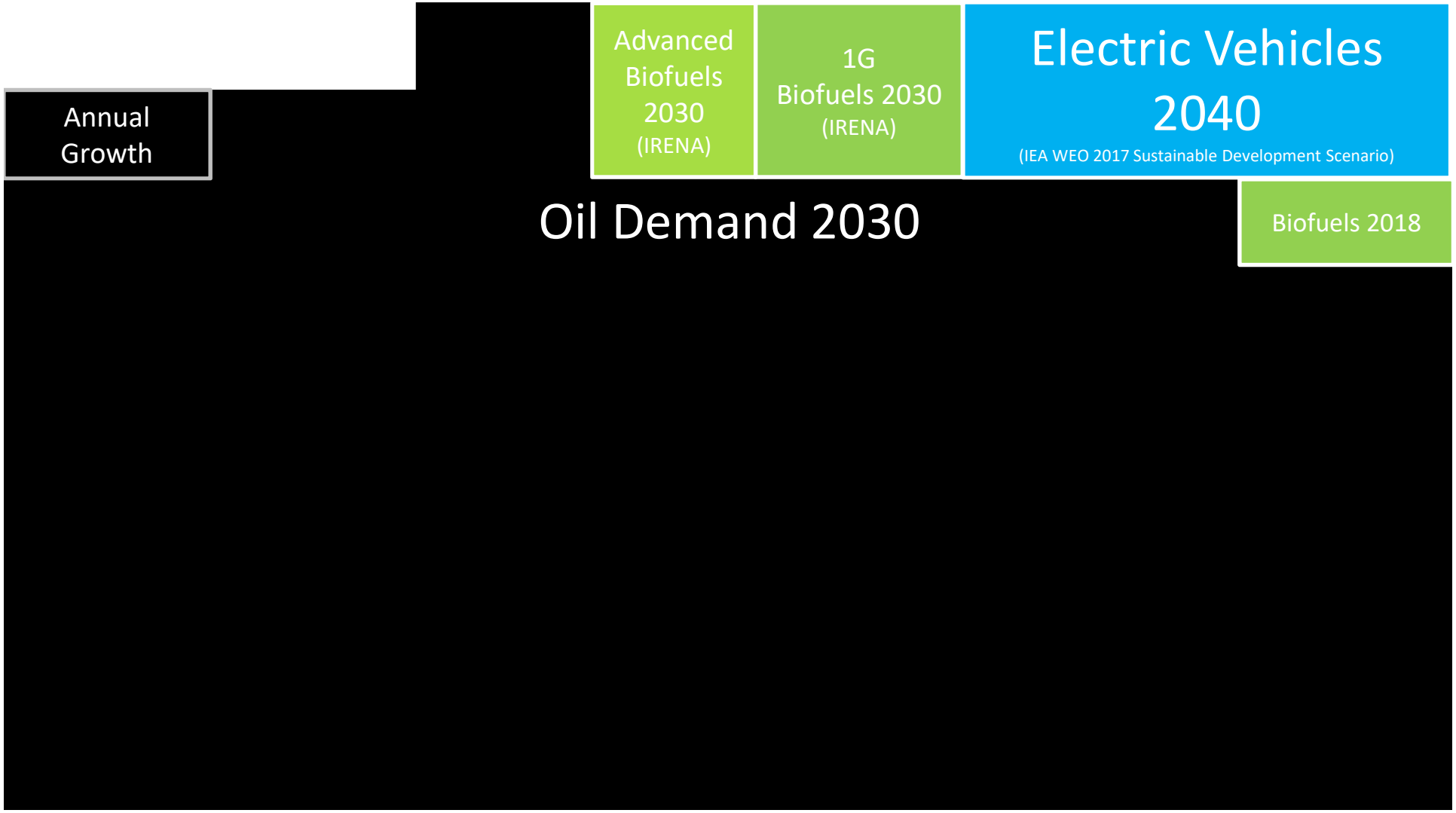
5. Electrified buses and cars will displace a combined **7.3 million barrels per day of transportation fuel in 2040**

*Source: Bloomberg Electric Vehicle Outlook 2018

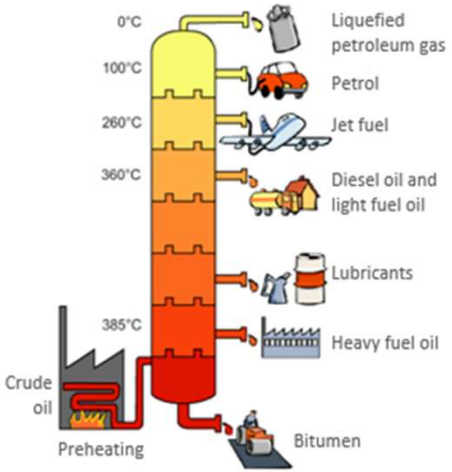
Extreme cost scenarios to abate 5,8 mt[1)] CO_2 in the Finnish road transport by 2030

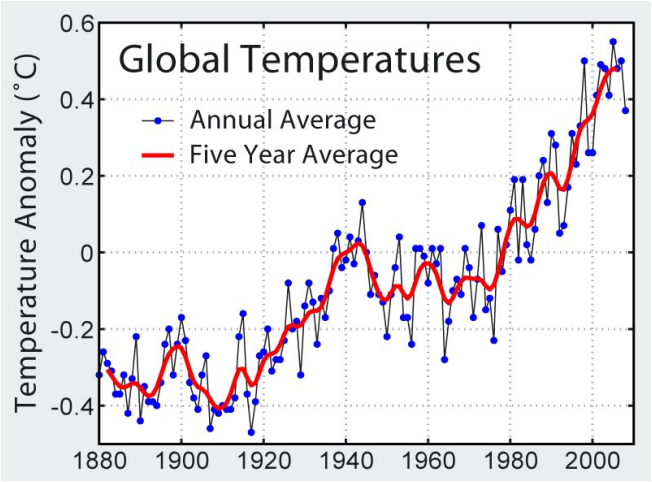


1) Target set in the Government Report on Medium-term Climate Change Plan for 2030 – Towards Climate-Smart Day-to-Day Living (KAISU), Ministry of Environment 9/2017
2) Integrated Fuels and Vehicles Roadmap 2030+ (Roland Berger, April 27, 2016): For long-range BEVs across different personnel vehicle segments
3) Current market price for HVO in the Nordic market, Actual offer for 225 €/tCO2 and by market intelligence estimated price span for 2030
4) Approximate price 2018 / 8


Annual Growth
Advanced Biofuels 2030 (IRENA)
1G Biofuels 2030 (IRENA)
Electric Vehicles 2040
(IEA WEO 2017 Sustainable Development Scenario)
Oil Demand 2030
Biofuels 2018

Resulting Global Consequences





Bottlenecks of the decarbonization through renewable energy

- Limited biomass amount
- Energy storage
- Distillation curve

Global warming

- Problems of the CCS have not been solved
- Carbon sequestration into biomass

Increasing and uncontrolled migration

- Population growth
- Worsening living conditions (desertification, erosion, aridity etc.)

Image Pickit Images

What Should Be Done?

1. Strong increase of biological carbon sinks

2. Restrictions for the production of fossil fuels

3. R&D to create environmentally friendly solutions, which are affordable to people in developing countries

4. Social responsibility for developing countries focusing on education of women and girls and preventing climate refugee crisis

5. Critical self review and scaling down of current Western consumer behaviour

Balancing Global Carbon Cycle

Carbon capture from atmosphere = payment of "carbon debt"

100 billion tons of carbon → forest size equals of Sahara *

Yearly carbon increase offset

4 billion tons of carbon → compensation forest of 40 million ha planted annually *

Human emissions carbon offset 9 billion tons of carbon

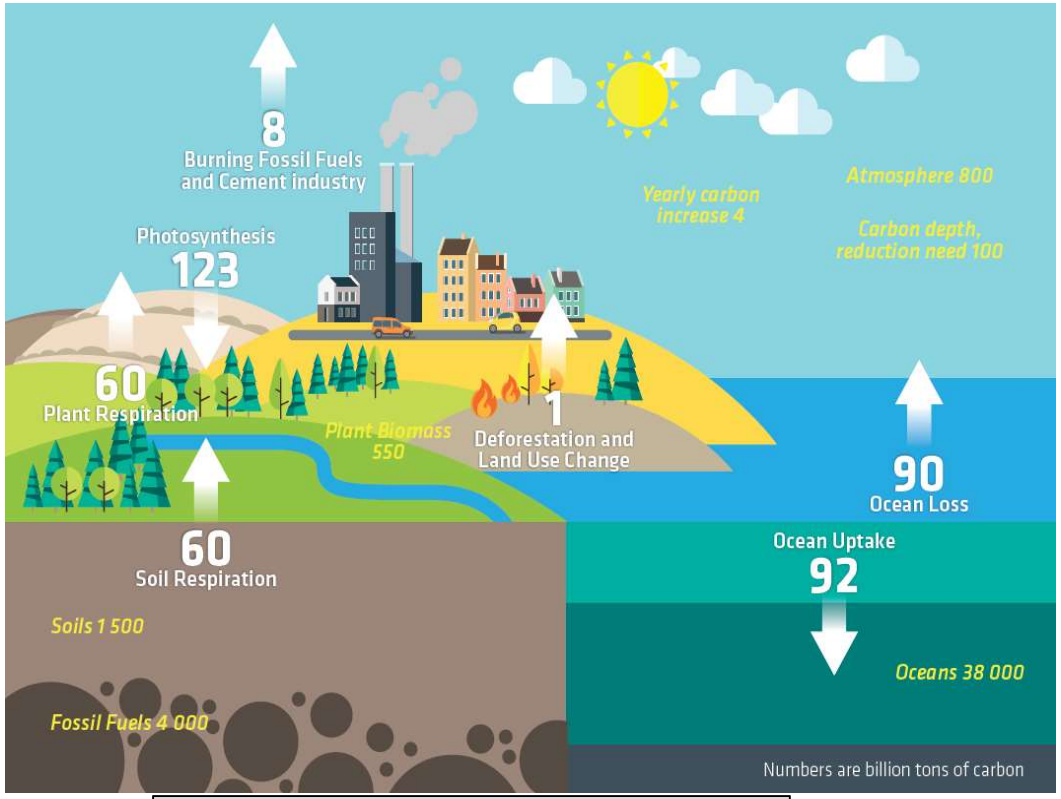
- **Fossil fuel carbon offset**

  6 billion tons of carbon → compensation forest of 60 million ha planted annually *
- **Other industrial carbon offset**

  2 billion tons of carbon → compensation forest of 20 million ha planted annually *
- **Balance deforestation and land use change**

  1 billion tons of carbon → replacement forest of 10 million ha planted annually *

** capturing CO_2 during ~ 20 years of lifecycle*



Note!

- *Probably the biggest source of confusion and errors in climate discussions concerns "carbon" versus "carbon dioxide.*
- *One ton of carbon equals 3.67 tons of CO_2*
- *The central climate number is the atmospheric concentration of carbon dioxide*

Source http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=t2020_35&plugin=1

Sustainable Carbon Cycle

There are over 100 billion tons of excess carbon in atmosphere

- Growing fossil fuel demand increases carbon amount in atmosphere

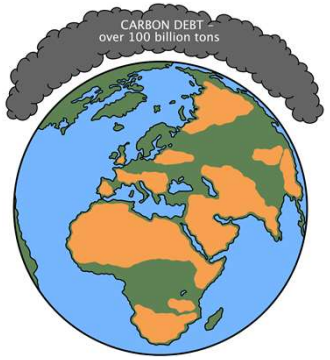
Carbon cycle must turn over sustainably!

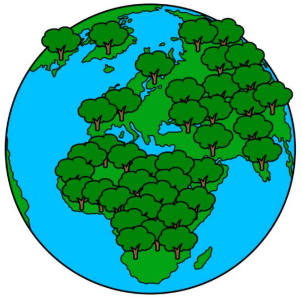
- Instead of burning fossil fuels, the carbon in atmosphere is circulated via photosynthesis to energy

How to make sustainable carbon cycle?

1. Reforesting an area equal to Sahara to achieve remarkable carbon capture from atmosphere
2. One day new massive biomass could be used for fulfilling energy and bioproduct need of society
3. As new biomass is utilized, it is necessary to replace utilized forests with new plants to maintain or increase forest areas

In the sustainable carbon cycle the growing forests enable sufficient and continuous biomass amount for energy demand



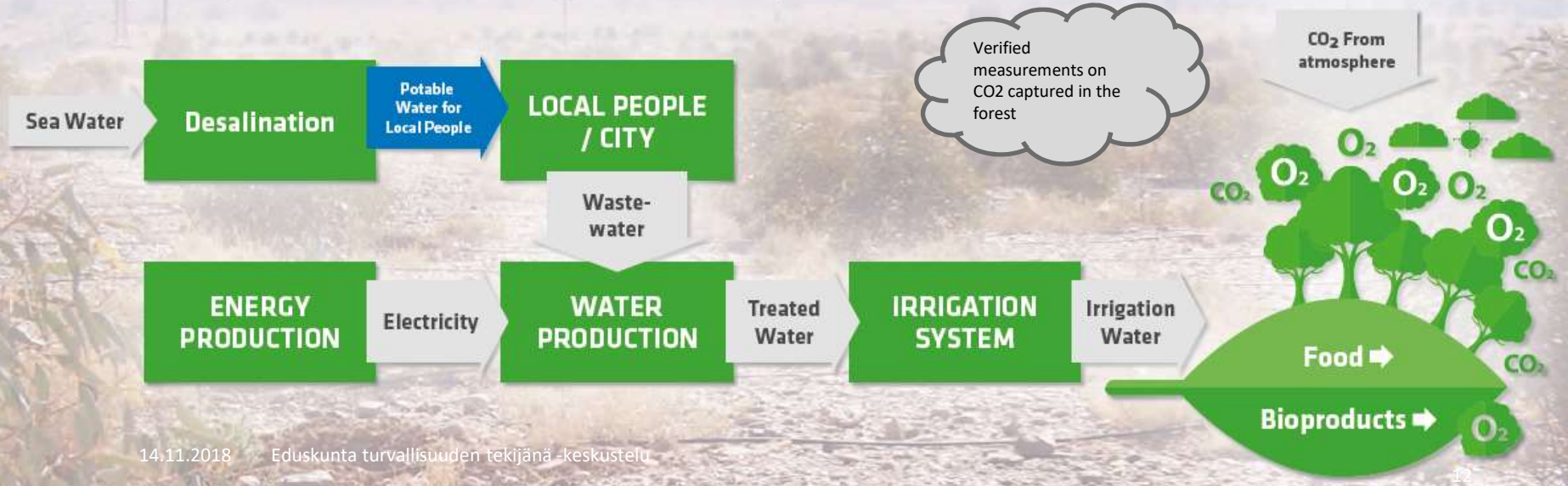


St1 Carbon Farming Concept

TARGET OF THE DEMO PROJECT

Annual carbon sink 10 000 - 100 000 t CO_2 captured

- 500-5 000 ha agroforest
  (size depends on selected case and growth conditions)



Carbon Farming

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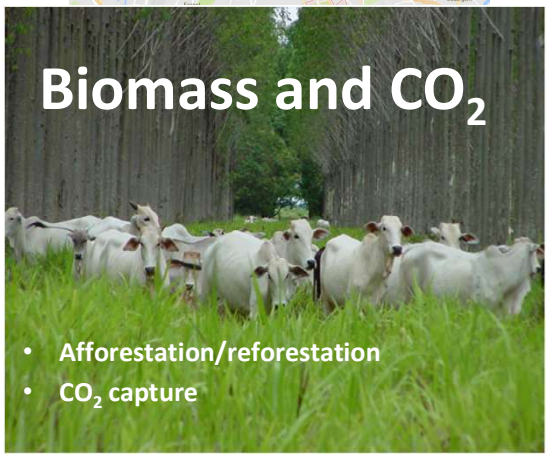

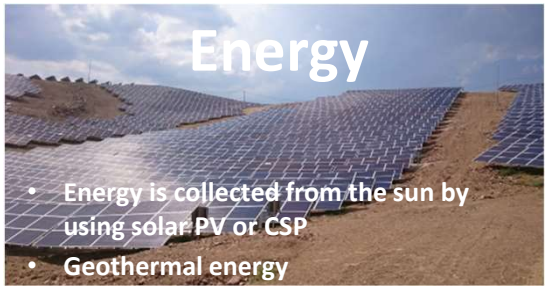

Images http://wca2014.org/soybean-wheat-cropping-sequence/#.WcTRGsgjGUk, https://www.researchgate.net/publication/224830968_Economic_Feasibility_of_an_Eucalyptus_Agroforestry_System_in_Brazil, http://www.astronergy-solarmodule.de/en/presse-leser/astronergy-receives-licence-to-import-100-mw-of-solar-modules-to-turkey.html, https://blogs-images.forbes.com/uhenergy/files/2016/09/clean-drinking-water-1200x795.jpeg, google.com,

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