The Mathematics of Climate Protection – which EU Strategy should follow for the Transport Sector

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NGVA Europe – Annual Event 2021 – Renewable Gases for Road Transport: Fit for 55!

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Mathematics of climate protection

Climate change is a phenomenon of natural physics.

Francis Bacon: “Nature, to be commanded, must be obeyed".

Those who want to control climate change must consider physical laws.

Physical laws are not politically negotiable!

The mathematics of climate protection, derived from its physics, is presented on the next slide.

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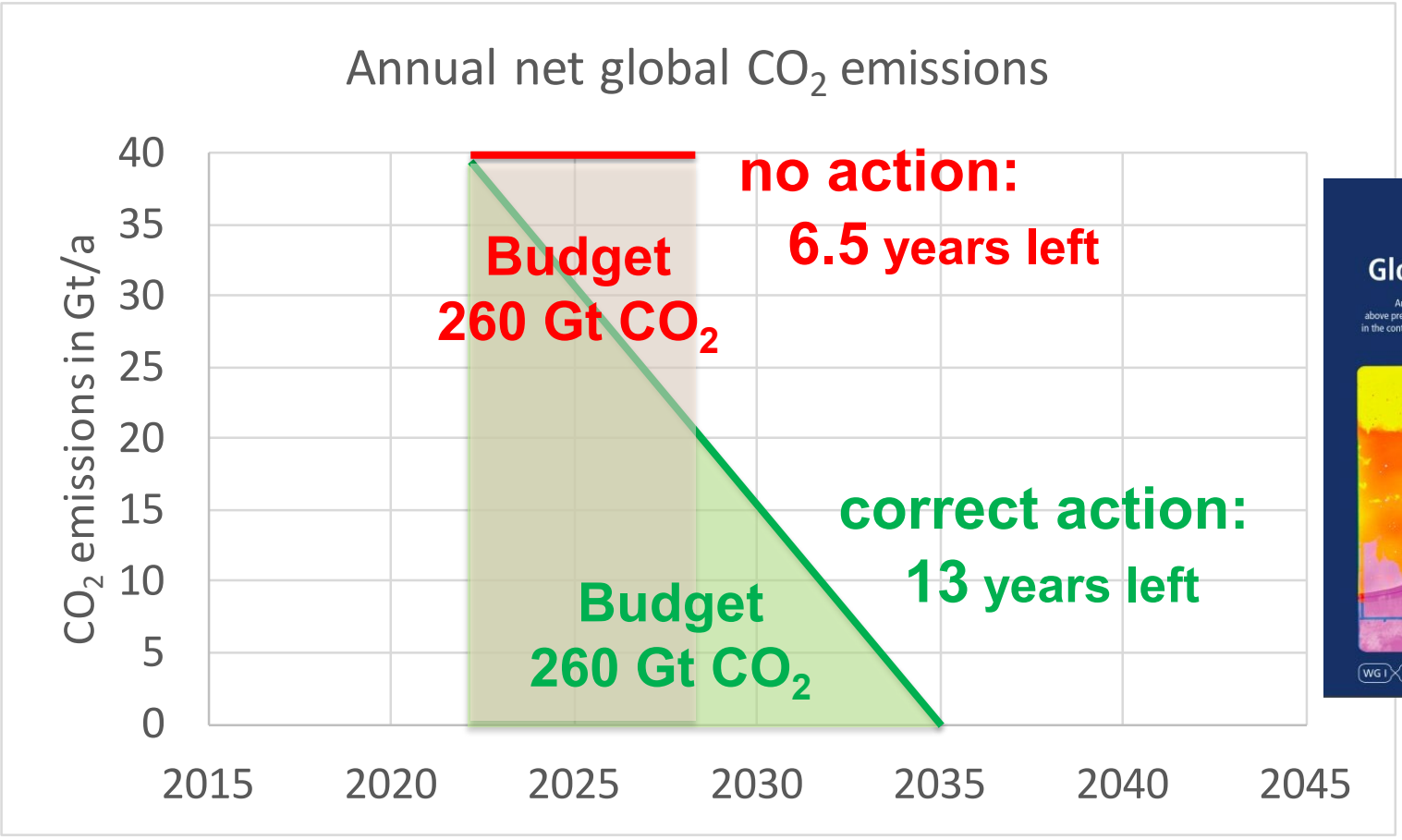
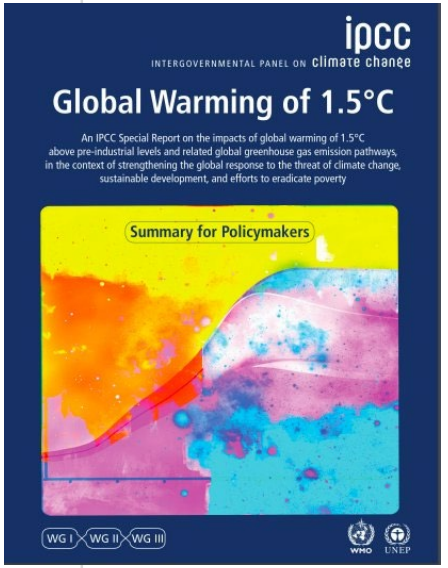
Mathematics of climate protection

Global CO_2 emission budget (1.5-degree target) at the end of 2021: 260 Gt CO_2

Current global level of CO_2 emissions: 40 Gt CO_2 per year





Source: IPCC (2018) Special Report on Global Warming of 1.5° C, October 2018

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Derived criteria for climate protection measures

3 criteria that climate protection measures must generally fulfil

No delay

- **Immediate effect of GHG reduction measures when implemented. (see "correct-action" scenario)**

No GHG export

- **Entire value chain: No upstream or downstream GHG emissions in other countries or sectors.**

Fast roll-out (of successful technologies)

- **Climate protection is a global task (EU accounts for only 9 % of global GHG emissions) and can only succeed in international cooperation.**

GHG = Greenhouse gas

Source: Willner (2020)

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Significance of the 3 criteria for road transport

No delay

- Alternative fuels: Immediate effect in the large existing vehicle fleet (1.4 billion cars).
- E-mobility: 5 to 15 years delay and no effect in the existing fleet (Exchange takes too long).

No GHG export

- Alternative fuels: Great performance (Germany: 83% GHG reduction[1]).
- E-mobility: Huge GHG export to other countries or sectors.

(e.g. for battery production and recycling, for new infrastructure, for fossil power production[2-6])

Fast roll-out (of successful technologies)

- International cooperation is key for climate protection!
- Export of RE technology to countries with surplus of RE + production of green fuels (e-fuels).
- Import of e-fuels for Germany and Europe (high energy import: Germany 70 %[7], EU28 58 %[8]).

E-mobility = electric mobility; RE = renewable energy, e-fuels = fuels based on electric power

Sources: [1]BLE (2020), [2] Koch, Böhlke (2021), [3] Böhmeke, Koch (2021), [4] FVV (2021), [5] Schmidt (2020), [6] Stahl et al. (2020), [7]BMWi (2020), [8]Euroststat (2021)

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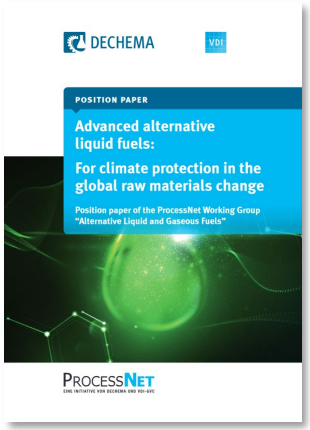
Conclusion

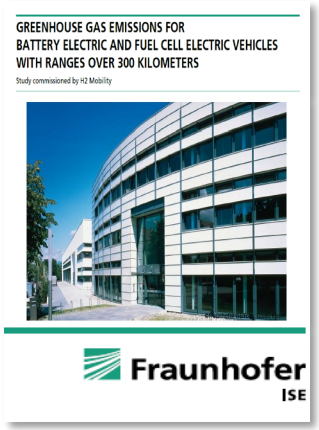
Scientific analysis (see below for relevant literature) clearly shows:

- **Sustainable alternative fuels fulfil all 3 criteria** for effective climate protection. Therefore, they must be promoted as a matter of priority.
- **Electric mobility does not fulfil any of the 3 criteria** for effective climate protection and is therefore ruled out as a medium-term climate protection measure.
- **The excessive one-sided promotion of electric mobility at national and European level must be stopped immediately.**

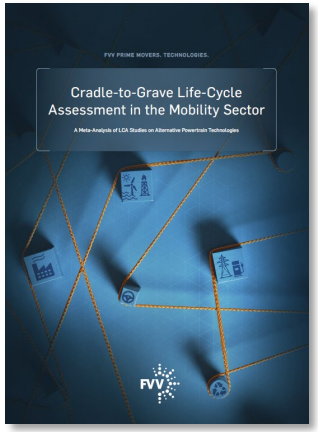


DECHEMA / ProcessNet 2018

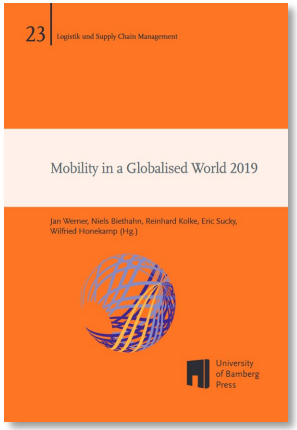
Joanneum Research 2019



Fraunhofer ISE 2019



Frontier Economics 2020



Willner 2020

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Alternative fuels (liquids and gases) are manifold

We need not only biodiversity, but also technology diversity

1. **1G biofuels as a by-product of animal feed production (biodiesel and bioethanol) and bio-methane from agricultural crops**
2. **2G biofuels including hydrogen and bio-methane from waste and residues from agriculture, forestry, wood processing and food industry**
3. **Recycled carbon fuels (RCF) from non-biogenic waste such as plastic waste**
4. **Renewable electricity-based fuels (PtX fuels, e-fuels) including hydrogen, synthetic methane and ammonia from countries with a surplus of RE**
5. **Efficient combinations (hybrids) (e.g. biomass or waste based PtX fuels)**

1G = 1st generation, 2G = 2nd generation, RE = renewable energy, PtX = Power to X

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EU Strategy

The EU should be interested in real climate protection by real global physical CO_2 reduction!

- Transfer of the financial support from e-mobility to alternative fuel technology and production (all kinds of alternative fuels)
- Technology export for alternative fuels production =
  - Start of the urgently needed international cooperation
  - Many new jobs
- Import of green molecules (from countries with a surplus of renewable energy) instead of fossil resources (high energy import: Germany 70 %[1], EU28 58 %[2]).

Sources: [1]BMWi (2020), [2]Euroststat (2021)

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EU Strategy

The EU should be interested in the import of green molecules to meet the huge demand of energy import (58%)!

- **Most efficient use of imported green molecules in non-electricity combustion systems such as ICEs, oil and gas heating systems.**

- **A ban on ICEs would be a major strategic mistake.**

ICE = internal combustion engine

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EU Strategy

The EU should be interested in supporting its automotive industry!

- China, the largest automotive market, is relying on ICEs in the long term because China has recognized that
  - e-mobility does nothing for the climate and
  - the focus on e-mobility would require a huge amount of raw materials.
- Large territorial states and poorer countries (e.g. Africa) stick to the ICE.
- Again, a ban on ICEs in the EU would be a major strategic mistake.

ICE = internal combustion engine

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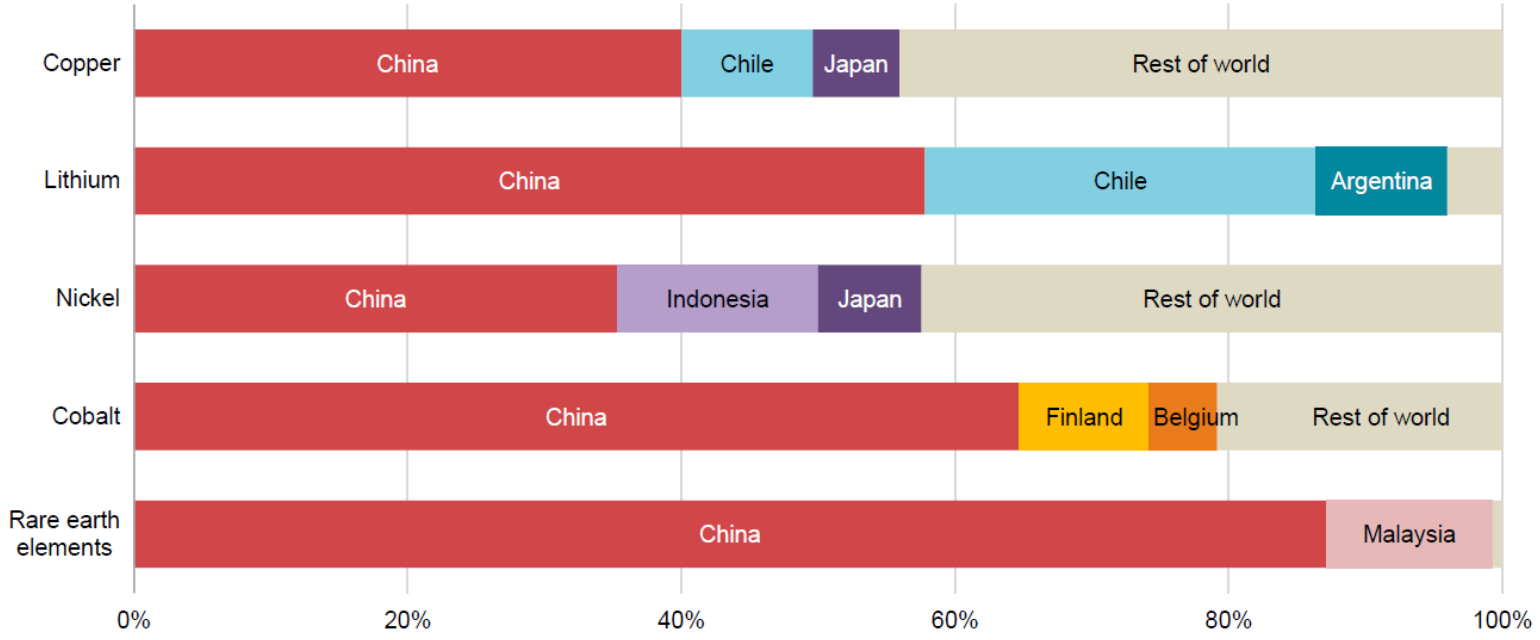
EU Strategy

The EU should be interested in minimizing its dependency on China for raw materials!

- **Thus, the focus on all-electric concepts would be a major strategic mistake as it would maximize this dependency**



Processing of critical raw materials for all-electric scenarios, status 2019 Source: IEA (2021)

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EU Strategy

The EU should be interested in minimizing the risk of blackouts!

- **Again, the focus on all-electric concepts would be a major strategic mistake due to the risk of extremely high peaks in power consumption**

One example:

The U.K. will ban private charging of e-cars during the hours of 8 a.m. - 11 a.m. and 4 p.m. - 10 p.m. starting in March 2022 due to increasing risk of blackout.

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Messages for the EU

- **The focus on e-mobility and a ban of ICEs would be a major strategic mistake.**
- **Alternative fuels must be promoted as a matter of priority.**
- **We need all kinds of sustainable alternative fuels including 1G biofuels.**
- **Legal hurdles that deter investors must be abolished:**

  The fleet CO_2 regulation system is the biggest obstacle for investments in alternative fuels and for climate protection in the transport sector:

  - **It contradicts physical laws, as battery electric vehicles count with zero emission, but renewable fuels do not count at all.**
  - **This regulation and the tailpipe emission approach needs urgent correction considering at least well-to-wheel (WtW) emissions.**

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Call to action

- All 5 process groups of alternative fuels are equally important!
- We need all effective options for the energy transition and transport transition! E-Mobility is definitely no effective option for climate protection.
- All stakeholders for alternative fuels should work together and fight at EU level
  - for the immediate stop of the excessive one-sided promotion of electric mobility and
  - for the overdue correction of the fleet CO_2 regulation and the tail-pipe emission approach.

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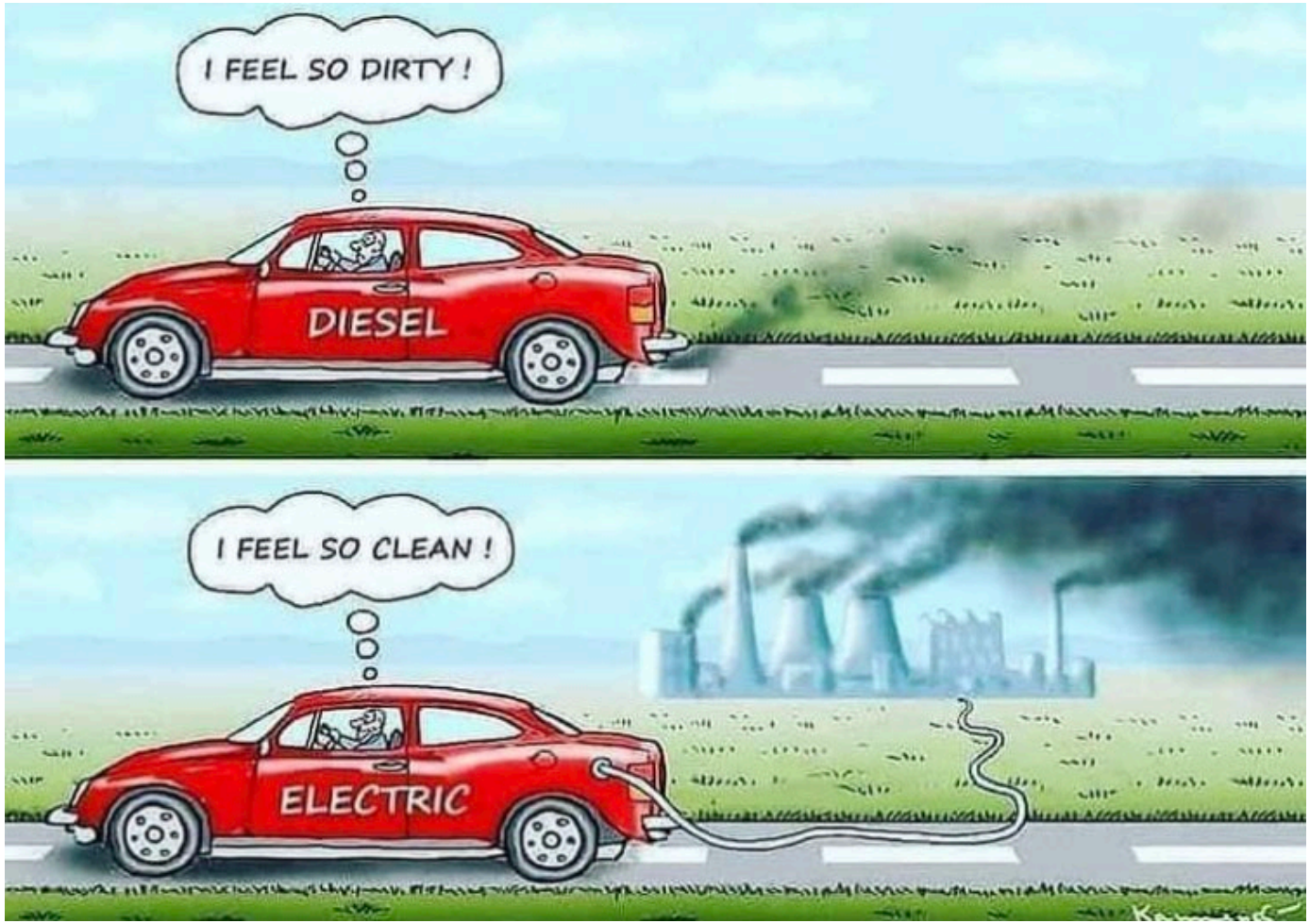
Thank you



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