Öko-Institut e.V.
Institut für angewandte Ökologie
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Synthetic fuels – How can they support climate protection efficiently?

Requirements and needs for regulation supporting a sustainable use of synthetic fuels

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For decarbonisation, many sectors need renewable electricity or e-fuels

Electricity sector

Long term storage

- Storage and conversion back into electricity

Mobility

- Aviation and maritime
- Electrified road and train transport
- Fuel cell and internal combustion engine vehicles

Buildings

- E-Heaters, heat pumps
- Fuel cells
- Boilers for gaseous/liquid fuels

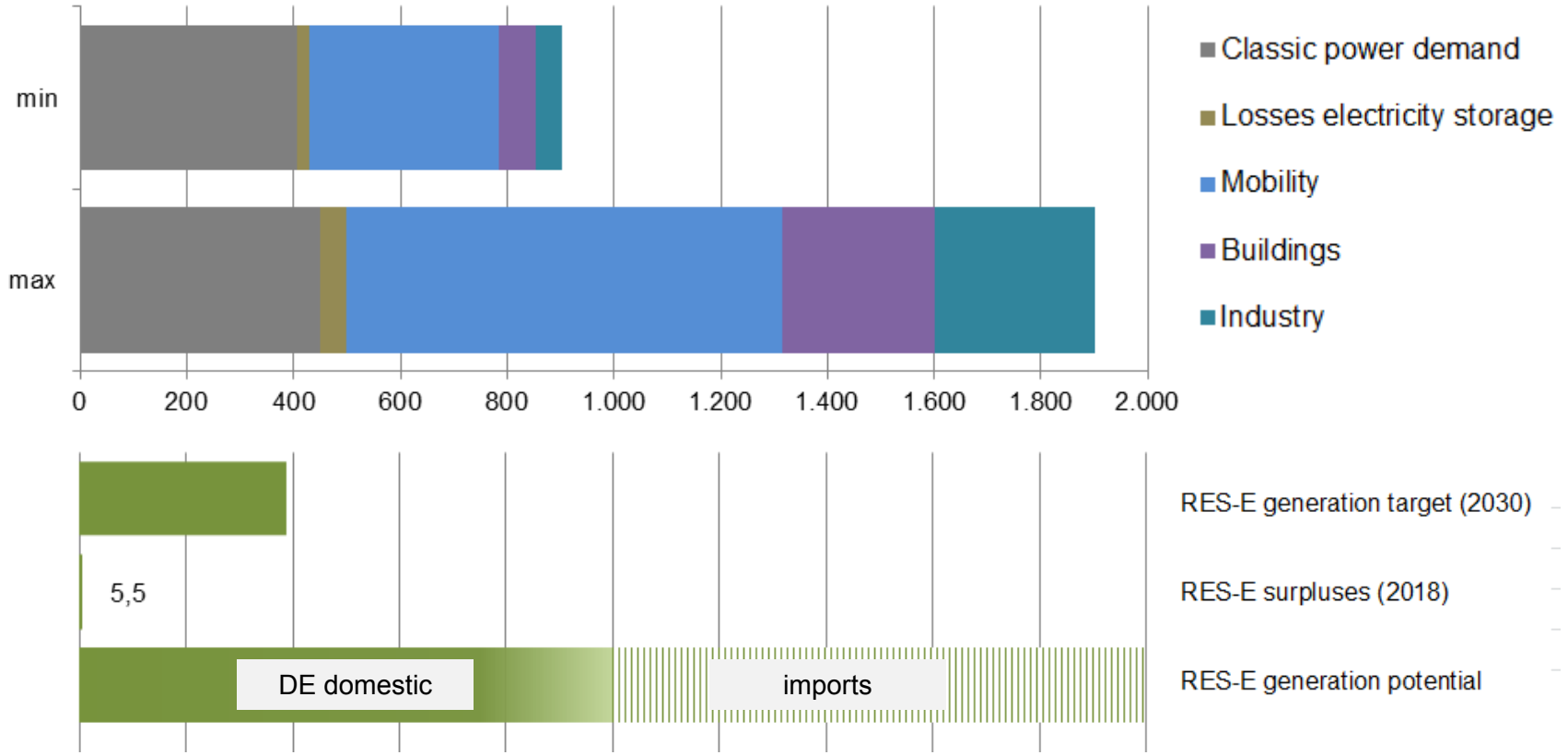
Industry

- High temperature applications
- Base materials (e.g. ammonia)
- Direct reduction (steel)

Own illustration.

The demand for RES electricity and e-fuels will grow significantly

Analysis of a range of decarbonisation scenarios (TWh_{el})

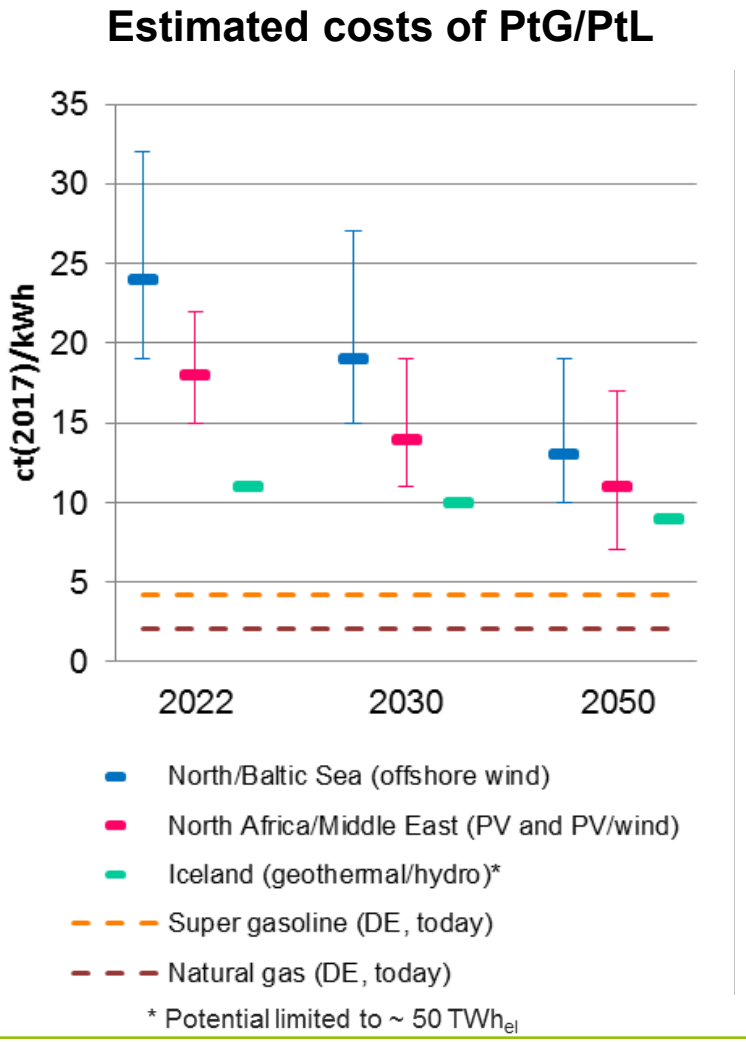


Own illustration, based on a number of decarbonisation scenarios

A large scale provision of e-fuels and e-products is needed after 2030, and most of these will be imported

- The challenge is a sustainable production of e-fuels, „sector integration“ is not an adequate term for this
- Imports will play a major role
  - Expansion of RES-E generation in DE limited by available land and public acceptability
  - Imported e-fuels expected to have lower cost than domestic production

    But prices will differ from cost!
- e-fuels will most likely remain more expensive than fossil fuels



Own illustration. Source of PtG/PtL cost estimates: Agora Verkehrswende, Agora Energiewende and Frontier Economics (2018): The Future Cost of Electricity-Based Synthetic Fuels

e-fuels are not inherently sustainable: Impact on electricity generation

- The CO_2 effect is determined by the electricity used
- Societal perspective: How does the production of e-fuels change electricity generation?
  - Unless the power sector is largely decarbonised, fossil power plants may ramp up generation
  - **Thus, new additional RES capacities are needed for, ensuring that the additional demand is covered by RES**
  - A flexible operation of e-fuel plants should support the management of power grids and the use of RES electricity
- Individual perspective: Which type of electricity has been purchased by the e-fuel plant operator?
  - Electricity disclosure and green power markets allow differentiation in an individual perspective
  - But: The purchase of green power usually has **no relevant impact on electricity generation** due to an oversupply of green power

e-fuels are not inherently sustainable: Sustainability assessment and criteria are needed

- CO_2 supply source must not delay the path to decarbonisation
  - Direct Air Capture is the most sustainable CO_2 source for the future
- Social aspects have to be considered for acceptance of e-fuels
  - Water and energy poverty, local/regional development
- Impact on regional energy system has to be considered

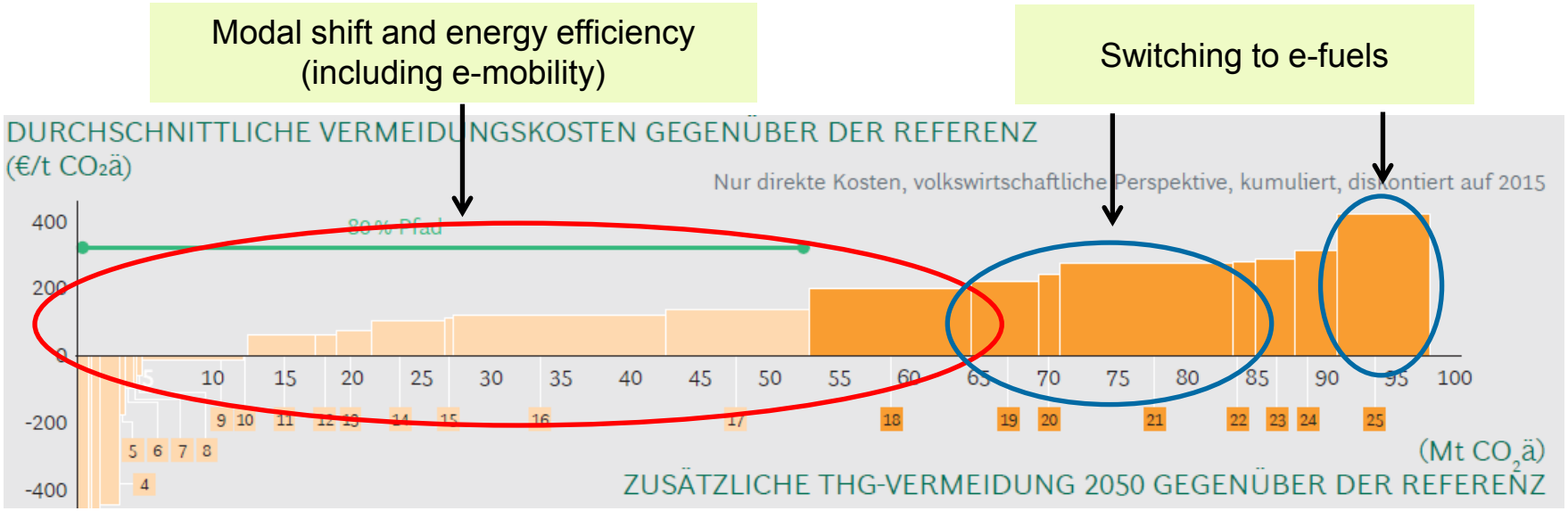
Lessons learned from biofuel uptake:

→ Sustainability assessment at global level needed to estimate global potential of sustainable e-fuels

→ Sustainability criteria needed for positive impact and market certainty

→ No rollout without established long-term sustainability criteria

e-fuels are the most expensive GHG mitigation measure in transport: Less is more



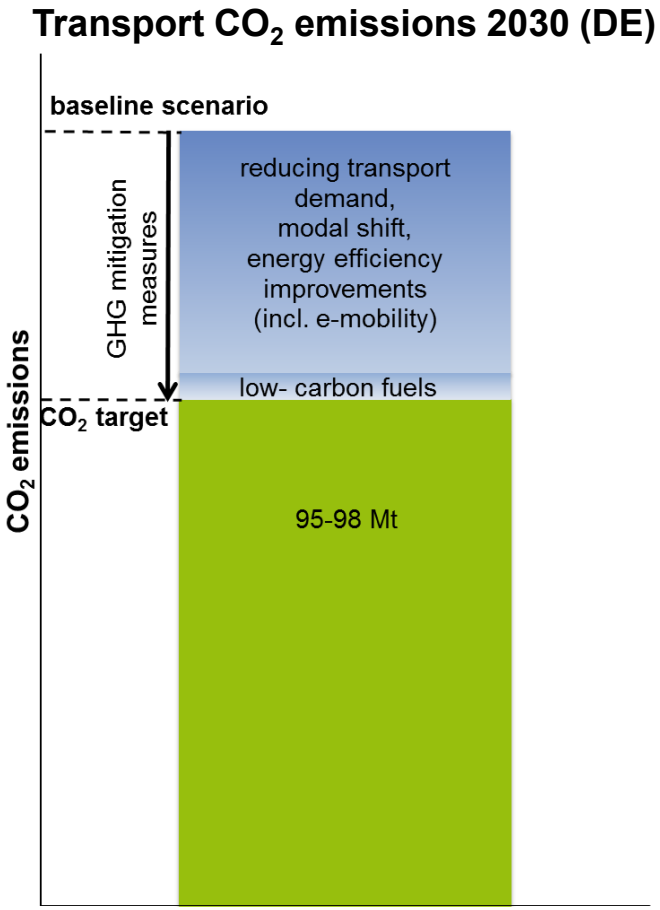
- Challenge for e-fuel strategies:
  - e-fuels require support to become a real climate protection option
  - Support strategies for e-fuels must not offset measures w.r.t. modal shift and energy efficiency gains (including e-mobility)

→ The less e-fuels are used, the smaller the GHG mitigation cost for the society!

Source: BCG, Prognos (2018). Klimapfade für Deutschland. On behalf of: BDI

Until 2030: Reduction of energy demand in transport + cost reduction and technology development for e-fuels

- Focus on reducing transport demand as well as supporting modal shift and energy efficiency improvements (incl. e-mobility)
  - Inclusion of externalities in transport cost → carbon pricing
  - Increasing transport cost
  - Supporting transformation into livable cities
- e-fuels: focus on cost reduction and technology development
  - Technology and market roadmap
  - Cost reduction and upscaling of technology requires appropriate support
  - Support measures should “make polluters pay”



Source: Own illustration

Summary: Principles of a sustainable e-fuels strategy

e-fuels are needed for reaching the long-term climate protection goals in transport (and other sectors), but …

- e-fuels are not inherently sustainable
  - Additional RES generation required → Purchase of green power not sufficient!
  - Comprehensive sustainability criteria must be the basis for support strategies
  - No estimate of global potential for sustainable e-fuels available
- e-fuels are the most expensive GHG mitigation measure in transport
  - e-fuels will mostly be imported due to lower cost and less constraints
  - Support schemes must not offset other climate protection measures (e.g. modal shift, efficiency gains) → less e-fuels is more!
- Priorities until 2030:
  - Reducing energy demand in transport (e.g. e-mobility, modal shift)
  - Cost reduction and upscaling of e-fuel technologies requires appropriate support → “make polluters pay”!

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