NEGEM

NEGEM carbon neutrality scenarios for Europe and the role of CDR

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Visions and Pathways For Carbon Dioxide Removal in the EU

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- Aim of the NEGEM scenario work
- Constraints adapted from NEGEM studies for the storylines and scenarios
- Storyline descriptions
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- The whole study can be found from: https://www.negemproject.eu/wp-content/uploads/2023/11/NEGEM_D8.2_NEGEM-scenarios.pdf

Aim of the NEGEM scenario work

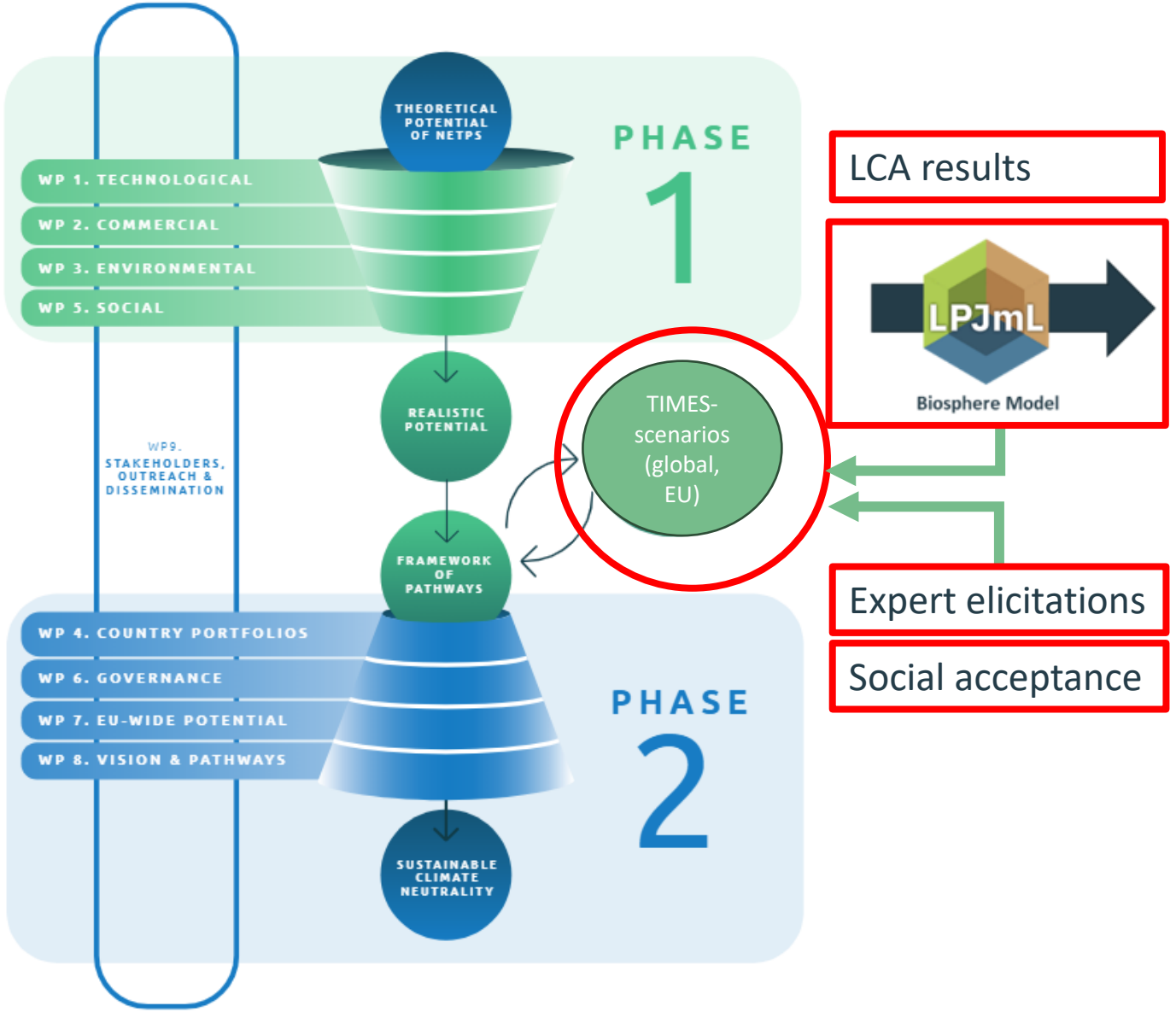
PHASE 1: **What** is the realistic potential for NETPs?

- Technological parameters and their development
- Planetary and regional boundaries
- Costs, opportunities and risks
- Social acceptance, uptake and political feasibility

Sustainable NETP deployment

PHASE 2: **How** do we meet the realistic potential for NETPs?

- Country portfolios, EU-wide potentials
- Enabling governance frameworks

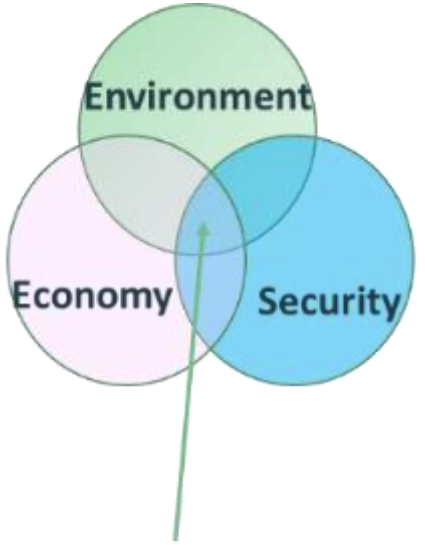


NEGEM storylines to study the realistic potentials

- All storylines aim at **1.5°C global warming**
- With alternative storylines **the realistic potentials of NETPs** are studied to better understand the key uncertainties for the development.

1. **1.5C-Technology:** Storyline focusing on **optimistic technology development** of the NETPs
2. **1.5C-Environment:** Storyline focusing on global **environmental sustainability** and lifestyle changes (e.g. **strictly limited BECCS**)
3. **1.5C-Security:** Storyline focusing on **security and self-sufficiency** due to geopolitical fragmentation and regional markets. (e.g. more **pessimistic development for DACSS** and **CO_2 storage capacity**)

- The **reference pathway** follows the UN NDCs (Nationally Determined Contributions in October 2021)



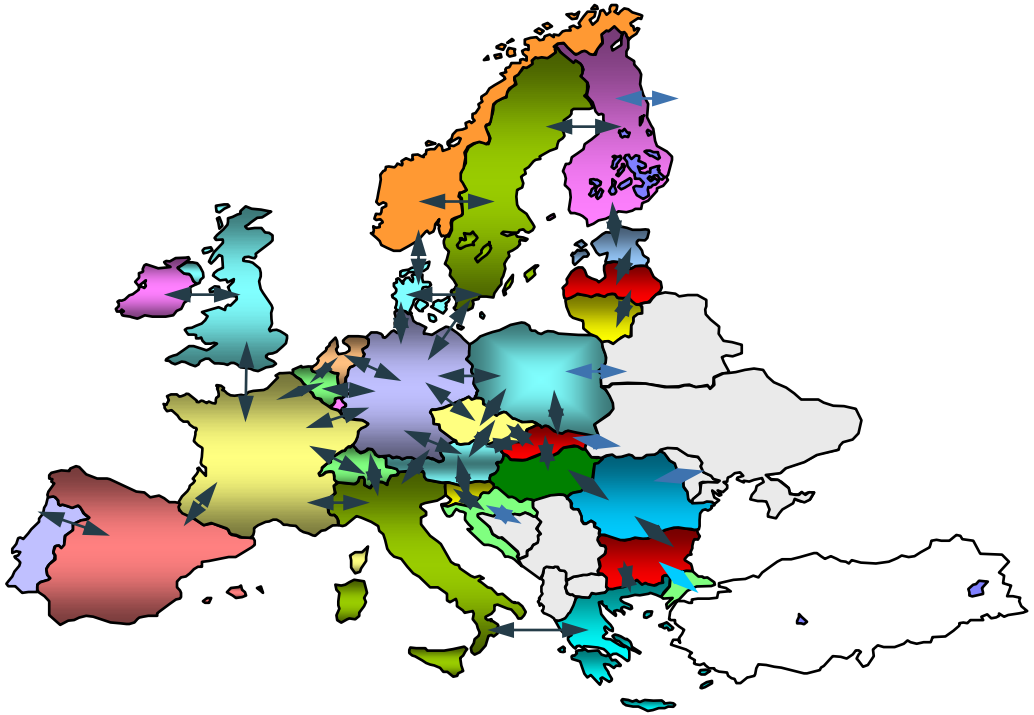
Inputs for realistic NETP potentials and for final NEGEM vision

Full storylines can be found from Deliverable 8.2: https://www.negemproject.eu/wp-content/uploads/2023/11/NEGEM_D8.2_NEGEM-scenarios.pdf

EU level modelling – specific features and assumptions

- **PAN-European TIMES-VTT model** used (based on open access JRC-EU-TIMES)
  - Bottom-up technology-rich partial equilibrium model
  - The NEGEM scenarios were modelled for “EU-31” region.
  - CO_2 emissions trajectories considered up to 2060, no other GHGs nor LULUCF sector included in modelling

- EU-Specific assumptions:
  - Emission targets in line with the EU’s *Fit for 55* package & effort sharing regulation.
  - Net zero CO_2 target for EU-31 by 2050.
  - Russian trade restricted, and most severely in 1.5C-Sec up to 2060.



Limitations of the EU study

- As only CO_2 emissions are included in the scenario modelling.
  - This can lead to overestimation of CO_2 emissions and the demand for NETS to reach the net zero targets.
  - However, alternative scenarios **can provide rough scale and understanding on the critical barriers or opportunities** for the development**.**

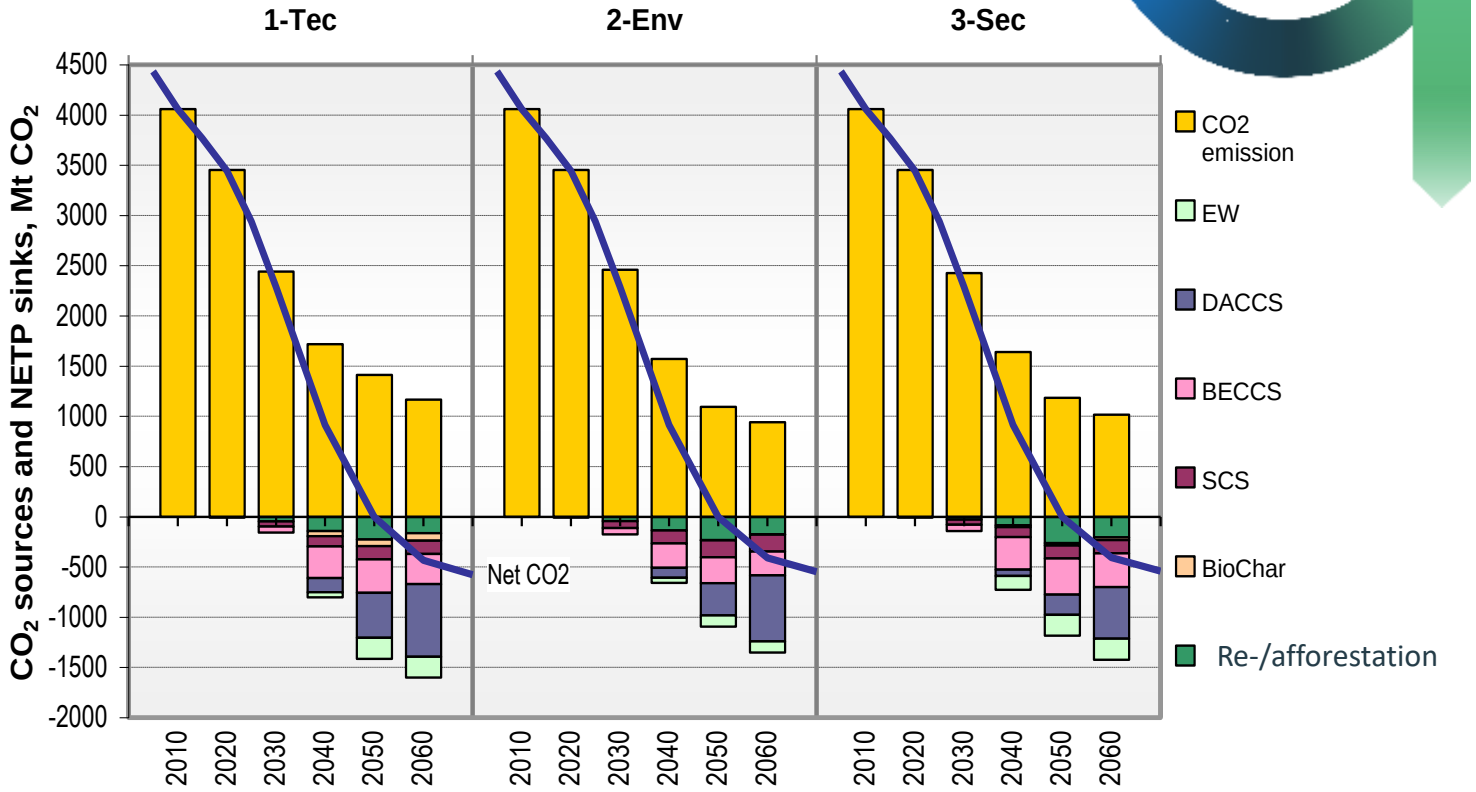
- **Uncertainties** on technical parameters, prices, demographics and macroeconomic drivers.

- **Risk of double counting** for **land use and biomass based NETPs**
  - Use of residues for bioenergy vs. soil carbon sequestration potentials vs. land use for enhanced weathering.
  - To avoid double counting residues used for BECCS not for biochar. In addition, PIK's modelling results were used for land based NETPs (in Env and Sec scenarios).

- Geological storage potentials not limited by distance from CO_2 sources.

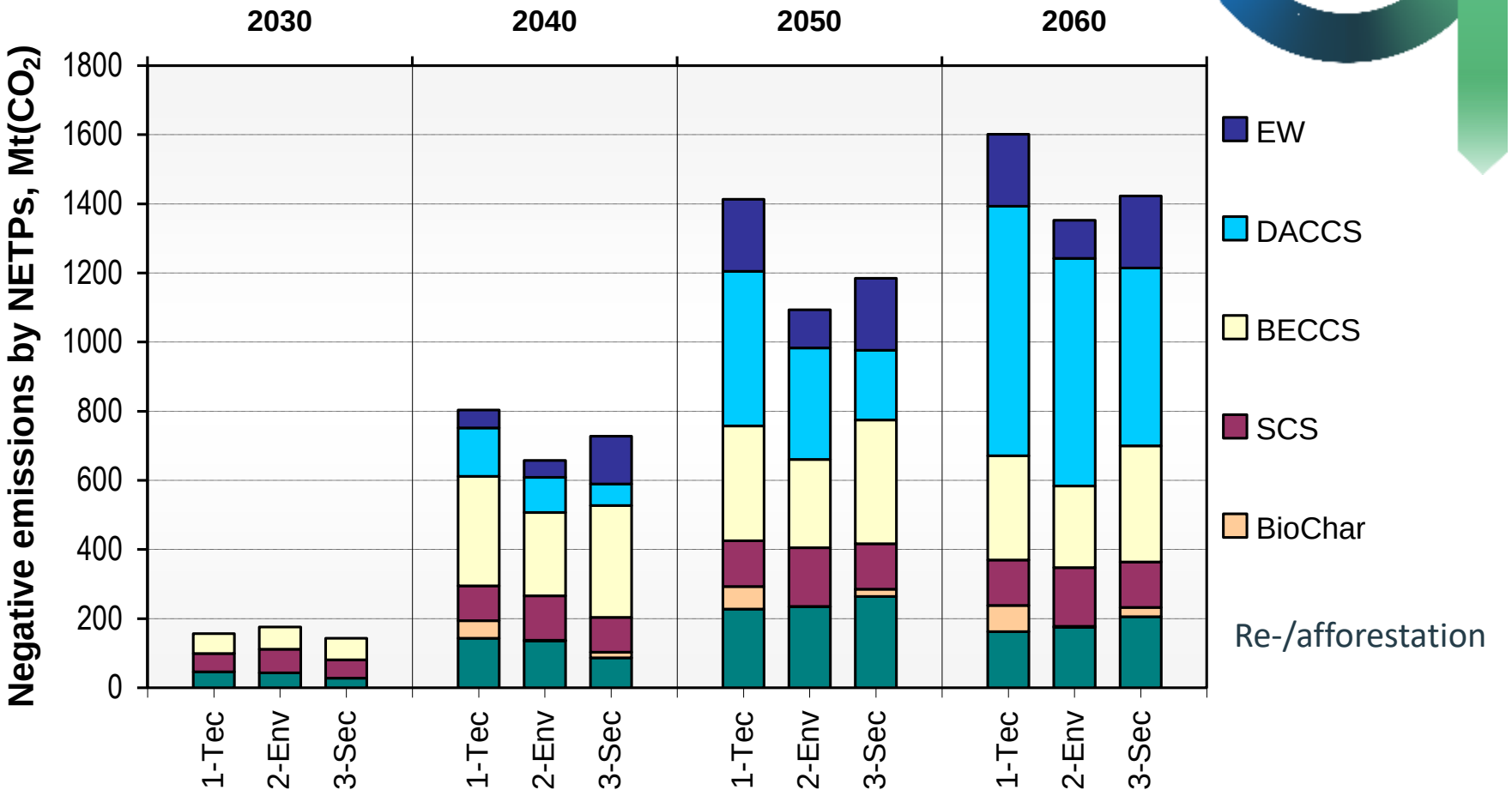
EU-31 scenarios: CO_2 Balances

- A wide variety of NETP options appear to become cost-effective and thus merit consideration.
- Results indicate that deep reductions in emissions would become costly without NETPs.
- In 1.5C-Tec and 1.5-Env BECCS would be left in a smaller role than DACCS by 2050, due to limited resources of sustainable biomass. In 1.5-Sec increased BECCS potential due to dietary changes.



EU-31 scenarios: NETPs contribution in alternative scenarios

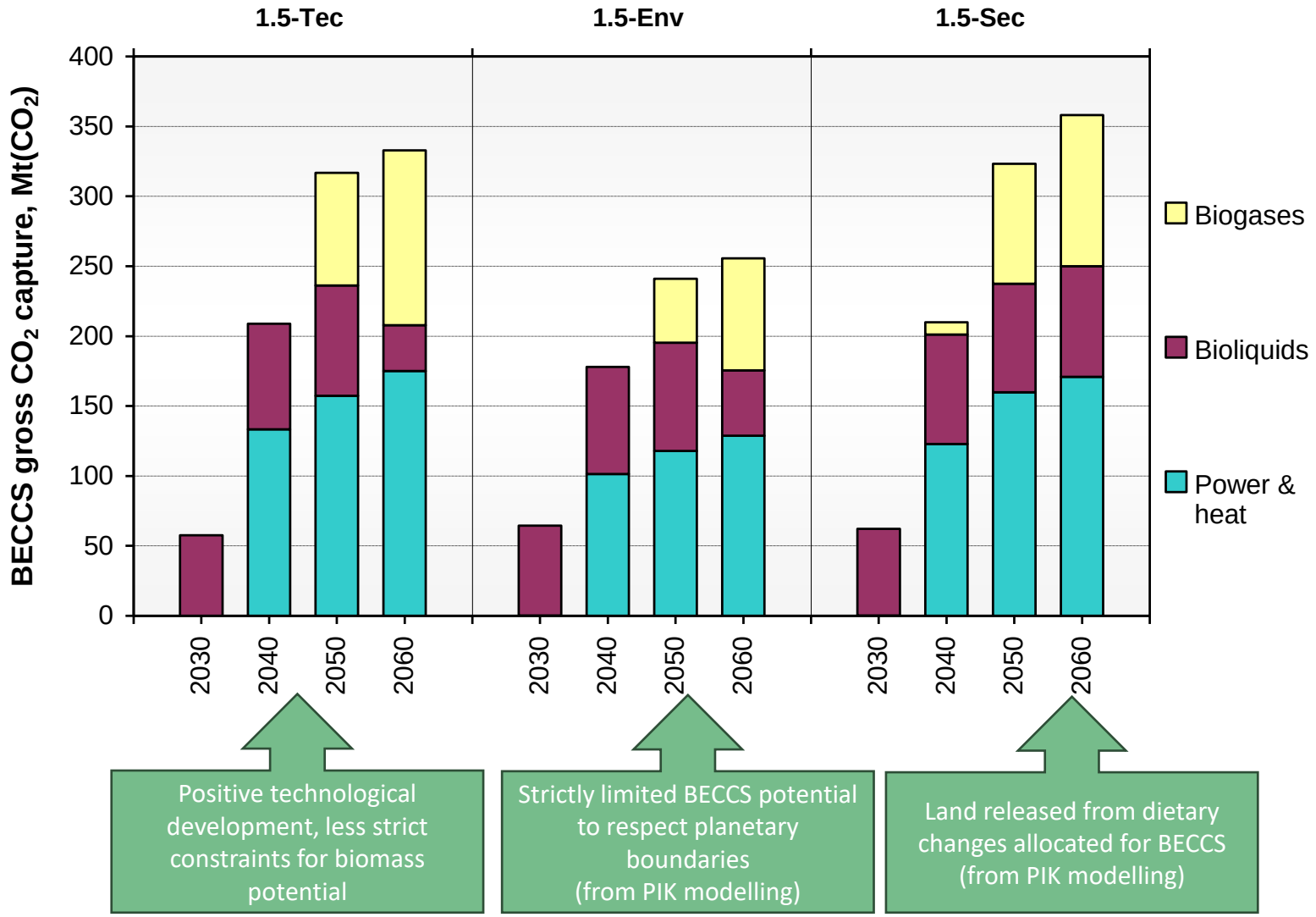
- Total demand for NETPs above 1 Gt/a by 2050.
- Need for geological CO_2 storage 0.6–0.7 Gt/a by 2050.
- DACCS becomes cost-effective even when all other NETP options are available. Beyond 2050 DACCS would appear to become dominant NETP.



EU-31 NEGEM scenarios: Deployment of BECCS by application

BECCS integrated with electricity production is not the only option

- Point-source emissions of biogenic CO_2, CHP-plants, and biorefineries could provide interesting solutions combined with sustainable use of residual biomass feedstock.
- Potentials vary a lot between countries.



Key conclusions

- The existing climate policy measures are not sufficient for deep emission reductions.
  - ⇒ More measures are needed, including incentives for CDR.
- Investments for all the NETP options appear in alternative scenarios.
  - ⇒ The whole portfolio of NETPs should be considered and further analysed.
  - ⇒ BECCS would dominate in the short term but the demand for DACCS increases beyond 2040-2050.
- Use of sustainable biomass resources is a key for successful BECCS.
  - ⇒ BECCS can be integrated in biorefineries, power and CHP-plants, and industrial plants.

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Thank you!

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