IEA Bioenergy
Technology Collaboration Programme

Management of biogenic CO_2: BECCUS concepts

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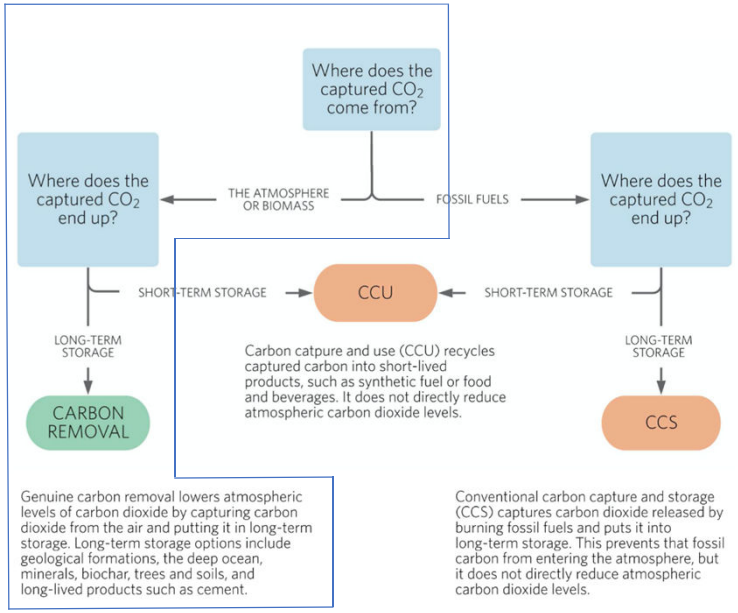
Bioenergy in a Net Zero Future

Lyon, 19 October 2023

Intro

- Net zero emission targets on many governance levels to **counterbalance residual emissions with carbon dioxide removal** (CDR)
- Removals lower atmospheric levels of carbon dioxide by putting it in long-term storage
- CDR shall go hand in hand with cutting GHG emissions
- National models and also the EU long-term climate strategy show that for reaching **net 55% by 2030**, **net zero by 2050**, and **net-negative GHG emissions thereafter** a large scale of CDR is needed
- **Two main groups of CDR methods** „negative emissions technologies“ – natural and technological
- Both groups are feasible under EU Climate Law

Compare: Schenuit, F.; Geden. O. (2023): Carbon dioxide removal: climbing up the EU climate policy agenda.



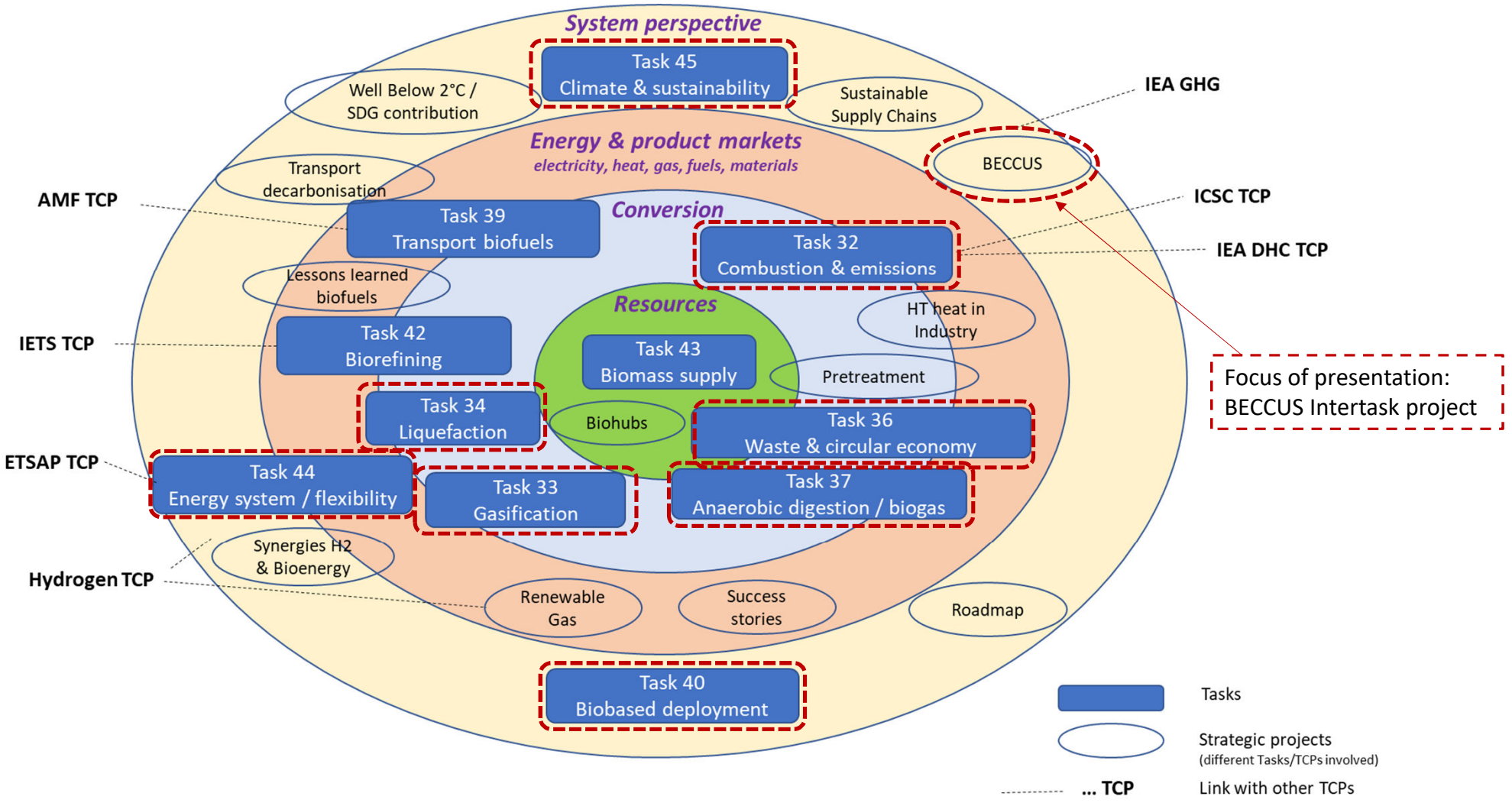
Compare: Institute for Carbon Removal Law and Policy (2020): Explainer: Carbon Removal.

BECCS as carbon removal

- The Commission supports technological solutions and storage infrastructure via co-funding
- CCS and CCU at industrial facilities through DACCS and BECCS have been identified as important aspect by the Commission (Comm. ‚Sustainable Carbon Cycles‘)
- Motivation at IEA Bioenergy is to provide guidance how to realize BECCS (and also BECCU) deployment by
  - Presenting examples (case studies) and describing their successes and challenges
  - Analyzing crucial aspects for accelerating deployment (system studies)
  - Support for good governance to adopt and upscale BECCUS

Compare: Schenuit, F.; Geden. O. (2023): Carbon dioxide removal: climbing up the EU climate policy agenda and Institute for Carbon Removal Law and Policy (2020): Explainer: Carbon Removal.

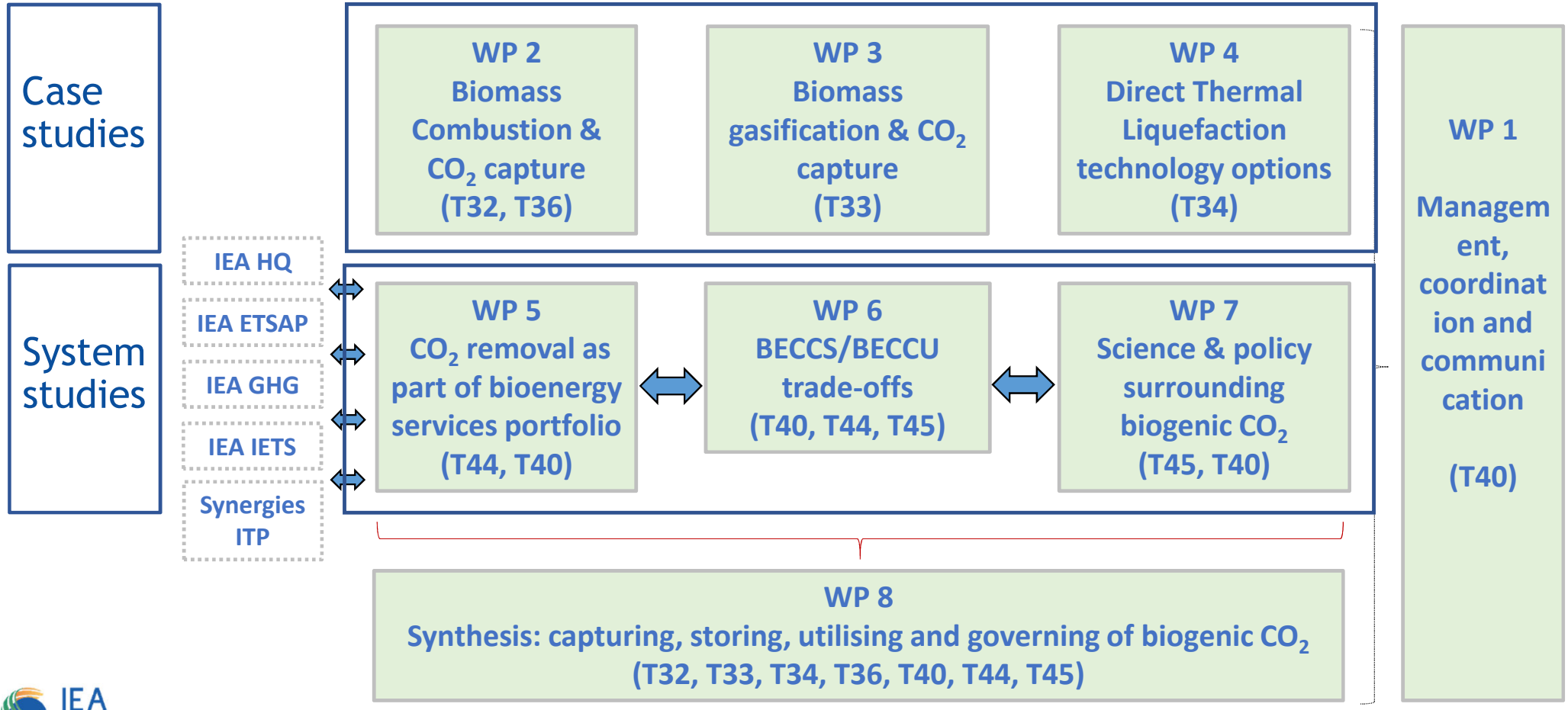
BECCS activities within IEA Bioenergy



Project essentials

- 2 project phases
- Timeframe
  - Previous Project “Phase 1” 2019 to 2021
  - Phase 2 started in 2022 until end of 2024
- 8 out of 11 IEA Bioenergy Tasks participating
- Overarching goal:
  - Analysing technological, political and economic aspects related to near- to medium term deployment of systems used for capture and utilization or storage of biogenic CO_2
  - Systemic analysis of how to facilitate deployment of BECCUS applications
- Key questions addressed:
  - Which technologies/concepts are (potentially) available? >> case studies
  - What are the requirements/implications for the deployment of BECCUS? >> system studies

Main activities | project work packages phase 2



BECCUS Project Phase 1.0 & BECCUS Project Phase 2.0

completed

BECCUS 1.0

5 case studies

- Biomass-based CHP
- Biomass-based electricity generation
- Bioethanol
- Waste-to-energy
- Cement, steel

3 system reports

- Scoping report
- Carbon accounting across BECCUS supply chains
- Bioenergy flexibility and carbon removal – finding the balance

ongoing

BECCUS 2.0

4 case studies

- Biomass combustion and CO_2 capture
- Biomass gasification and CO_2 capture
- Direct Thermal Liquefaction technology options
- Biomethane and CO_2 capture

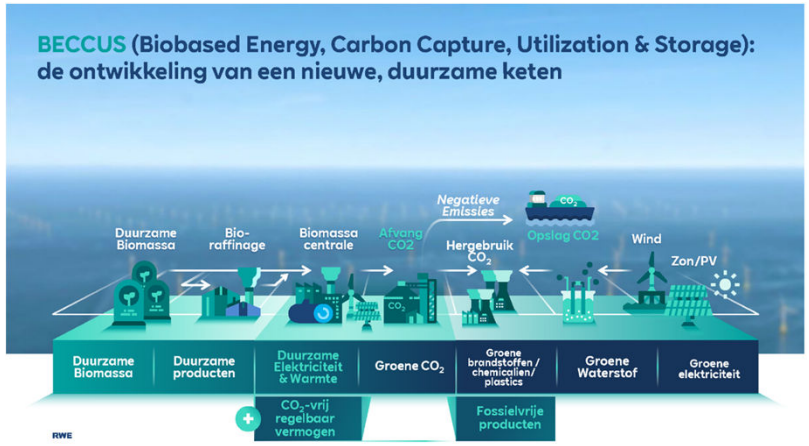
3 system reports

- CO_2 removal as part of the overall bioenergy services portfolio
- BECCS/BECCU trade-offs
- Science & policy surrounding biogenic CO_2

BECCUS 1.0 & BECCUS 2.0 combined will allow for a complete picture of technology options in the bioenergy field and hard-to-abate industrial sectors, and a broader **systemic view**.

BECCUS deployment

- Within IEA Bioenergy we have the expertise and link to various „first-of-its-kind“ projects
- Modelling of possible BECCUS applications to understand the concept and potential
- Project examples:
  - DRAX in the UK
  - Hafslund (pka Fortum Oslo Varme) in Norway
  - Hofor and Ørsted in Denmark
  - RWE in the Netherlands
  - Archer Daniels Midland in the US



RWE‘s BECCUS project: Amer and Eemshaven power plant, start of construction 2025 and operation 2029/2030

Compare: https://benelux.rwe.com/en/press/2022-12-12-rwe-launches-project-beccus-for-large-scale-capture-and-storage-of-co/

Key messages

- Policy level
  - Countries are moving at different speeds and approach >> some are low-key others are proactive, first clusters emerge
  - As example Denmark, Sweden and Norway are progressing in their national legislation and support schemes for BECCS and also drive the discussion on CDR methods at EU level
  - Governance so far: financial support for investment, planning reverse auctions
- Technology/energy system level
  - Finding models for on-the-ground deployment that make most sense from a techno-economic perspective (e.g. scale)
  - Reflecting on the role of CCU and CCS with bioenergy >> store and/or utilize the carbon?
  - Infrastructure and developing storage sides are a main challenge
  - Understanding complexity of energy system integration

Available publications

All planned reports/deliverables have been achieved.

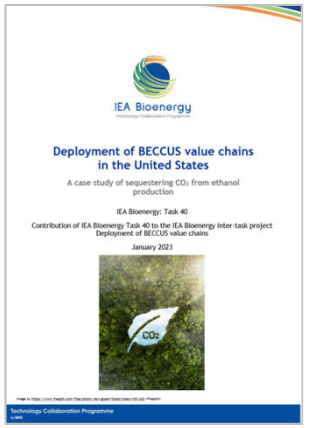
Case studies/sectoral deep-dives:

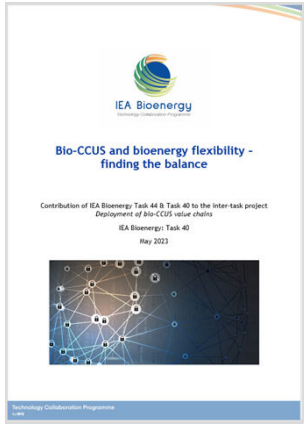
- Waste-to-energy (Task 36)
- Biomass-based CHP (Task 40)
- Biomass-based electricity generation (Task 45)
- Cement (Task 45/40)
- Bioethanol (Task 40)

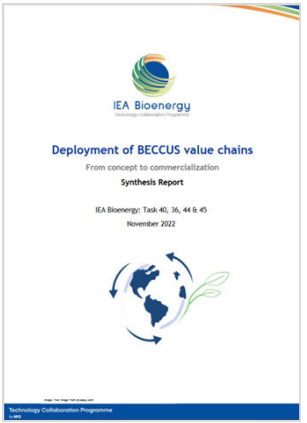
Cross-cutting/system studies:

- Scoping report (Task 40)
- BECCUS and flexible Bioenergy (Task 44/40)
- Carbon accounting across BECCUS supply chains (Task 45/40)

- Synthesis Report (Task 40 + all Tasks)







All reports are available via:

https://www.ieabioenergy.com/blog/task/deployment-of-beccus-value-chains/

Thanks for your attention

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