



IEA Bioenergy
Technology Collaboration Programme



Bioenergy for Flexibility in Energy Systems *Status, Expectations and Success factors*

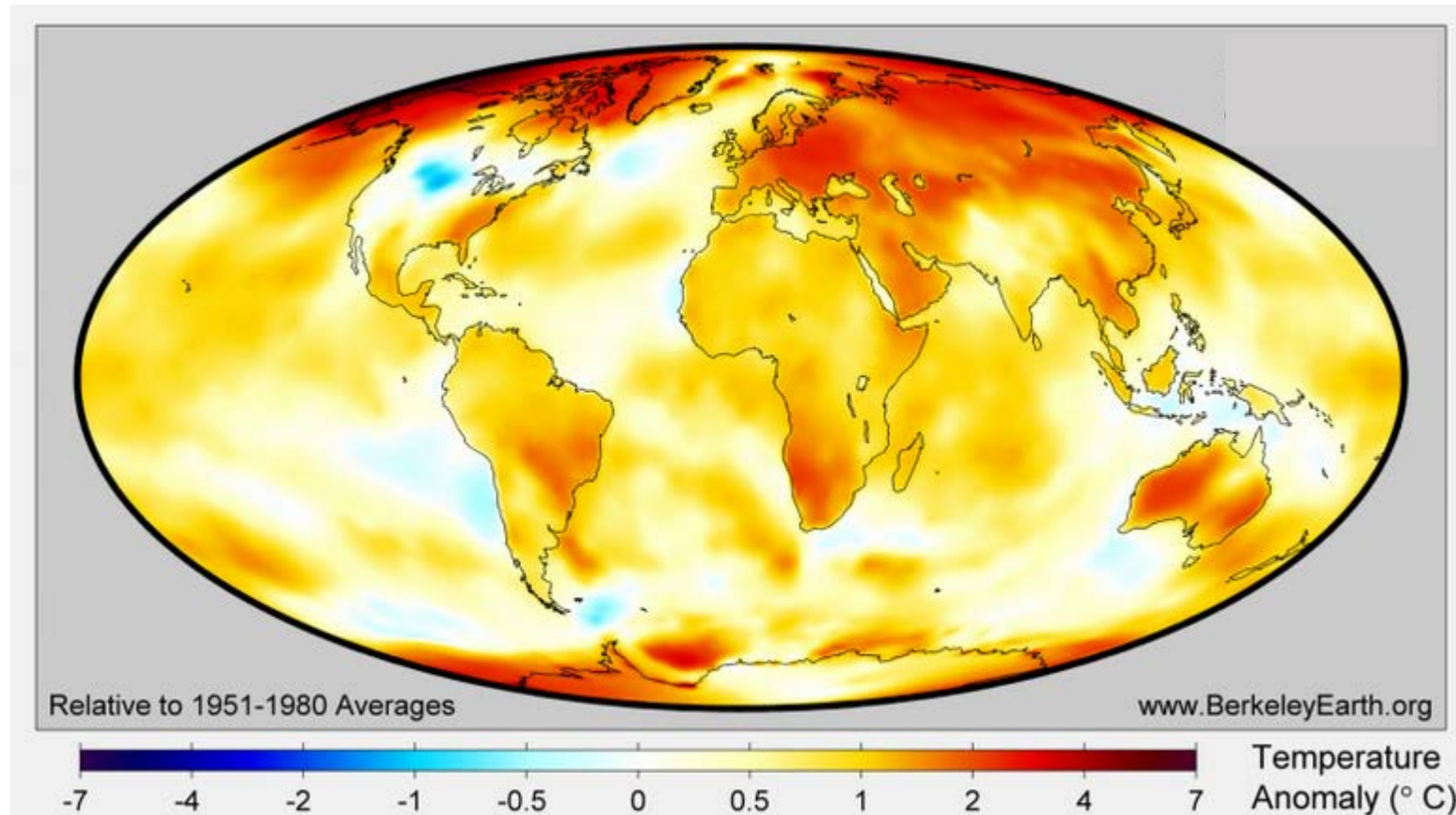
Daniela Thrän

Helmholtz Center for Env. Research (UFZ), Leipzig, Germany
Task leader IEA Bioenergy task 44

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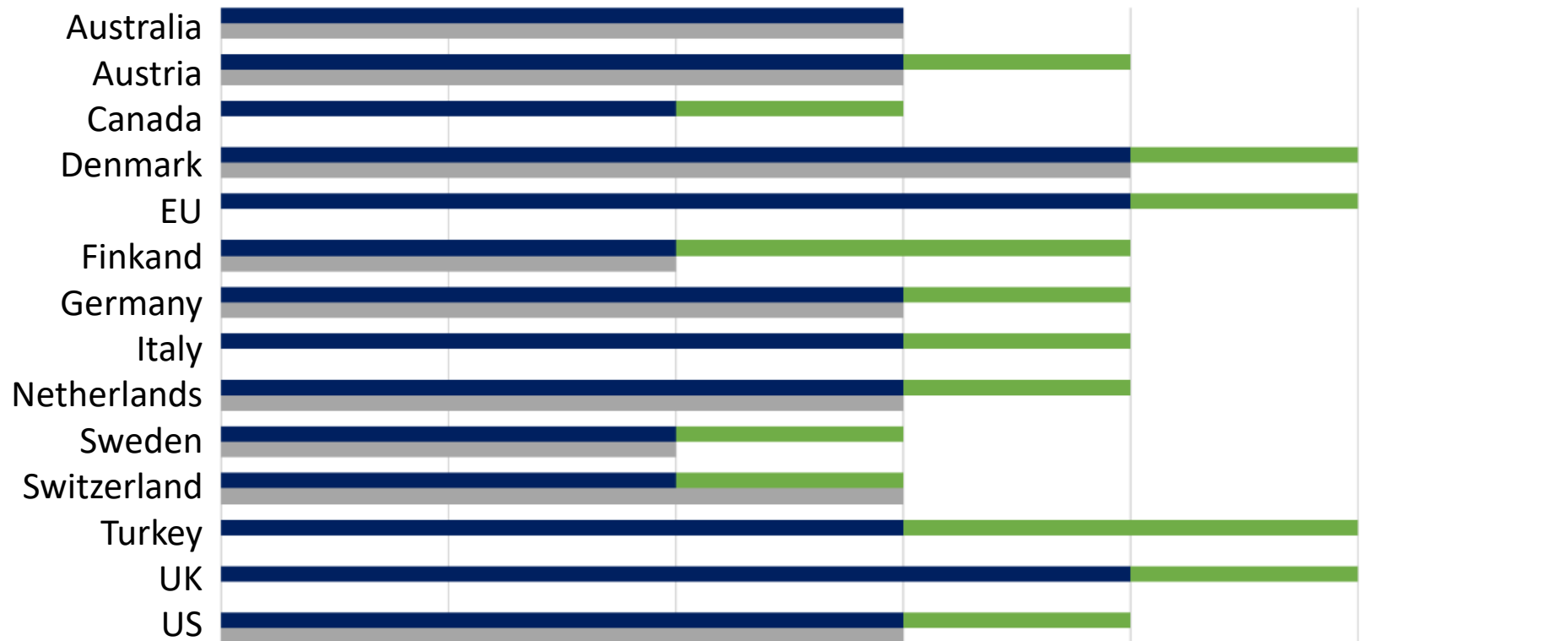
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To maintain a BW2 world we have 10 years to act!



Source: <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>; last attended November 2021

Need for Flexibility in Energy System (Power)



Integration phases of Variable Renewable Energy Sources (VRES) into the power sector in 2020/2021 and 2030

Phase 1: No relevant impact on system integration	Phase 2: Drawing on existing system flexibility	Phase 3: Investing in flexibility	Phase 4: Requiring advanced technologies to ensure reliability	Phase 5: VRE surplus from days to week	Phase 6: Seasonal or inter- annual surpluses of VRE
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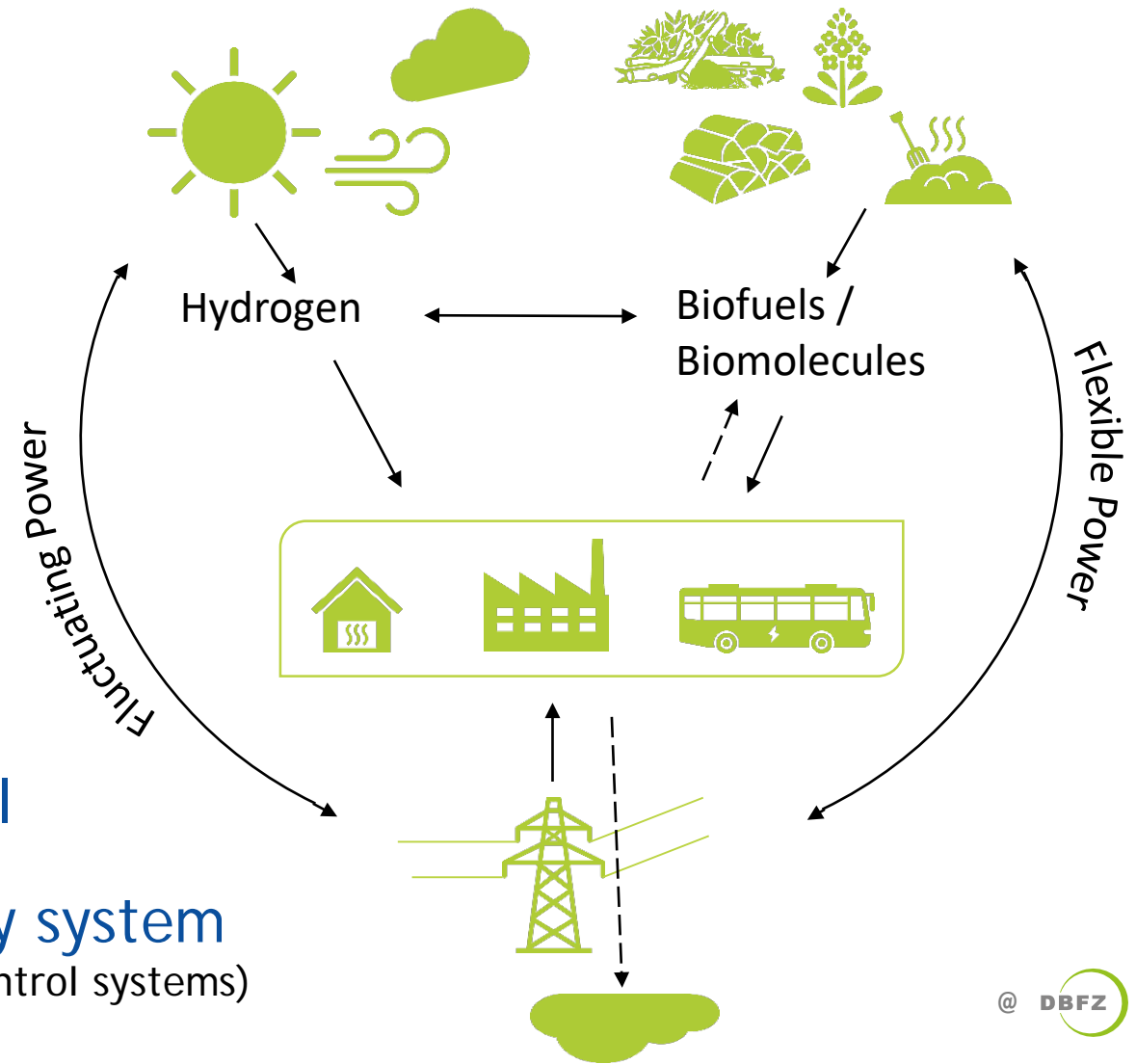
Blue: 2021

Green 2030

Grey: expectation for 2030 in former report

Flexibility beyond Power - Expectations on Bioenergy

- Sustainable resources and modern bioenergy
 - Flexible RE in systems with increasing variable RE
 - Storable fuels for application difficult to electrify
 - Support implementation of hydrogen
 - Facilitate Carbon Dioxide Removal
- "Smart" embedding in the energy system
(e.g. networked information exchange and smart control systems)



Definition of Flexible Bioenergy (IEA Bioenergy Task 44)

“Flexible bioenergy is defined as deployment of sustainable biomass to provide multiple services and benefits to the energy system under varying operating conditions and/or loads contributing to energy security”

But: common understanding of energy expert groups is still missing

- ☹️ Energy strategies, energy system modelling energy planning do not consider the flexible bioenergy options appropriate
- 😊 IEA has started a joint action to define Flexibility between expert groups

Synergies with other renewables

A variety of options

<https://task44.ieabioenergy.com/best-practices/>



Germany, E-gas plant in Werlte (@ e-gas GmbH, 2021)



Australia, @ The Ethtec Lignocellulosic Bioethanol Pilot Plant in Muswellbrook

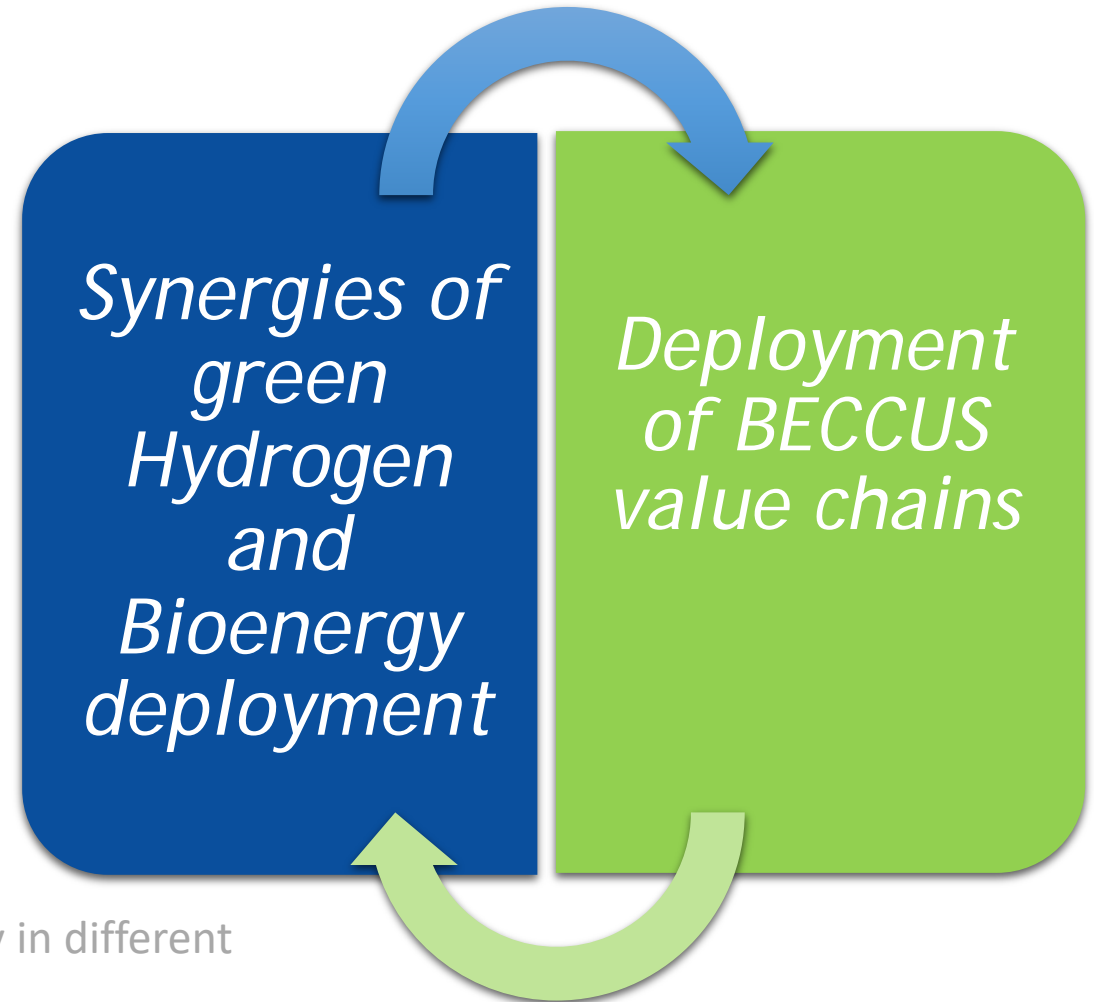


Sweden, Liquid Wind's production facility (@ Övik Energi)

Policy and markets

Support schemes

- More and more countries establish direct and indirect support (i.e. Denmark, Italy, Austria, Switzerland, Germany, Netherlands)
- Level of support is different
- Synergies with Hydrogen and Carbon Dioxid Removal (BECCUS, Biochar) as potential accelerators



Thrän et al. (2024): Implementation of flexible bioenergy in different countries (available at IEA bioenergy website)

Policy and markets:

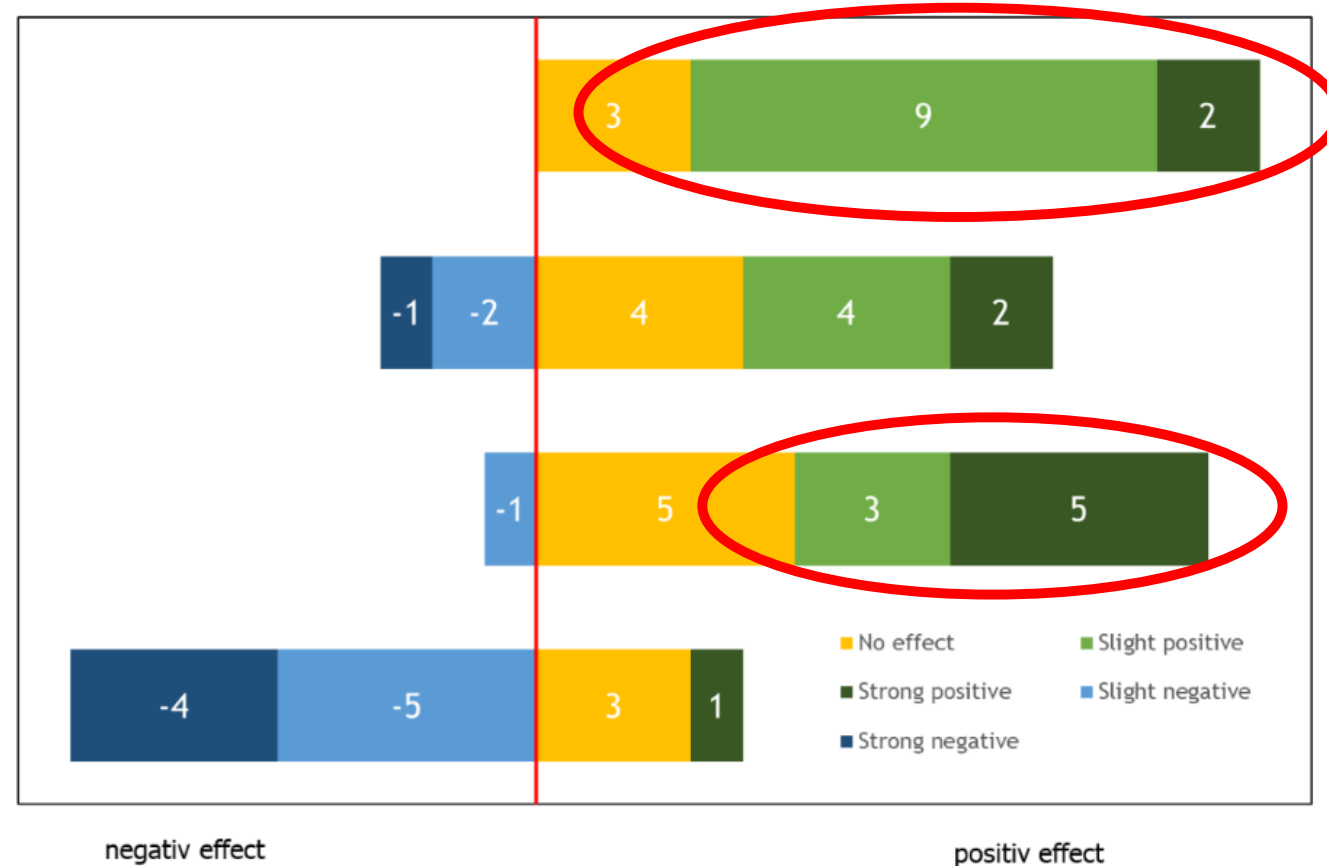
Which issues affect the implementation of flexible bioenergy?

Energy Security Requirement

Sustainability Requirement

High Energy Prices

High Ressource Prices



Thrän et al. (2024): Implementation of flexible bioenergy in different countries (available at IEA bioenergy website)

Bioenergy for Flexibility in Energy Systems

The way forward

- (1) Agreement on definition → Ongoing joint activity at IEA ongoing
- (2) Multiplication of Best Cases and Lessons Learned
- (3) Development of Technologies and Automation
- (4) Policy and markets addressing energy security
- (5) Appropriate consideration in long energy system planning

Based on

<https://task44.ieabioenergy.com/publications/five-cornerstones-to-unlock-the-potential-of-flexible-bioenergy-2021/>

Thank you

Prof. Dr. Daniela Thrän

Task Lead IEA Bioenergy Task 44

Head of Department Bioenergy (BEN)

Helmholtz-Zentrum für Umweltforschung GmbH - UFZ

in cooperation with Deutsches Biomasseforschungszentrum
gGmbH - DBFZ

Leipzig, Germany

daniela.thraen@ufz.de



www.ieabioenergy.com