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IEA Bioenergy Task40

Fabian Schipfer - January 2023
Bettina Muster, Judith Buchmaier (AEE Intec)
Michael Wild (Wild & Partner KG)

Technology Collaboration Programme
by IEA

IEA Bioenergy
Technology Collaboration Programme

Task 40: Deployment of biobased value chains

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IEA Bioenergy Task40 consortium 2022-2024

Germany (lead):

- Fachagentur Nachwachsende Rohstoffe e.V (FNR)
- International Institute for Sustainability Analysis and Strategies (IINAS)
- Deutsches Biomasse Forschungszentrum (DBFZ)

Austria:

- Technische Universität Wien
- AEE Intec
- Wild & Partner KG

Denmark:

- Ea Energy Analysis

Sweden:

- RISE Research Institutes of Sweden

Netherlands:

- Utrecht Universitet
- RWE Generation NL BV

United States:

- Idaho National Laboratory (INL)
- U.S. Department of Energy (DOE)

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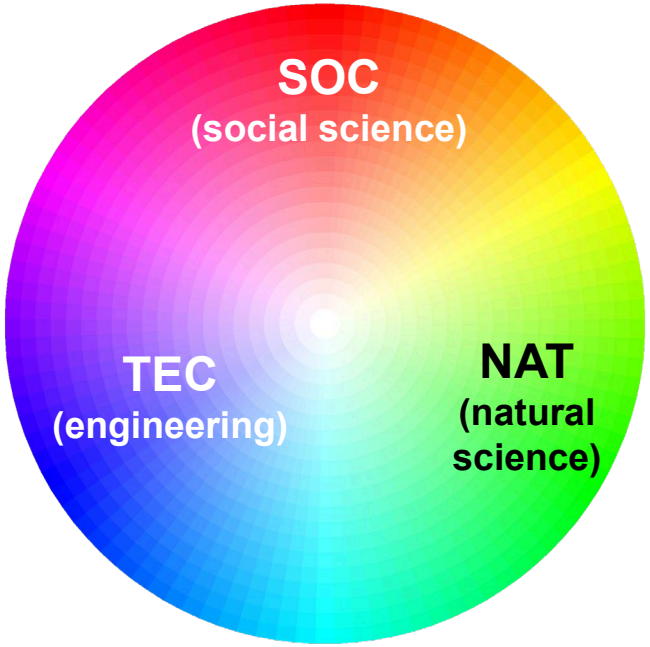
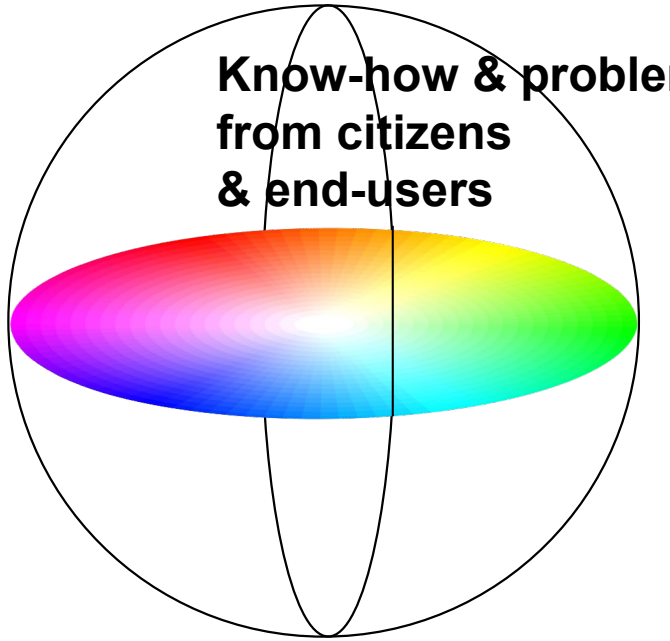
Inter-disciplinarity & Trans-disciplinarity





Schipfer, F. (2022). Inter-and trans-disciplinarity risks in energy system transformation research. Lectures for Future, Universität für Musik und Darstellende Kunst Wien, Austria.
Schinko, T., Borgomeo, E., Dufva, M., Figge, L., Schipfer, F., 2017. Re-shaping Sustainability Science for the 21st Century: Young Scientists' Perspectives (IIASA Working Paper No. WP-17-001).

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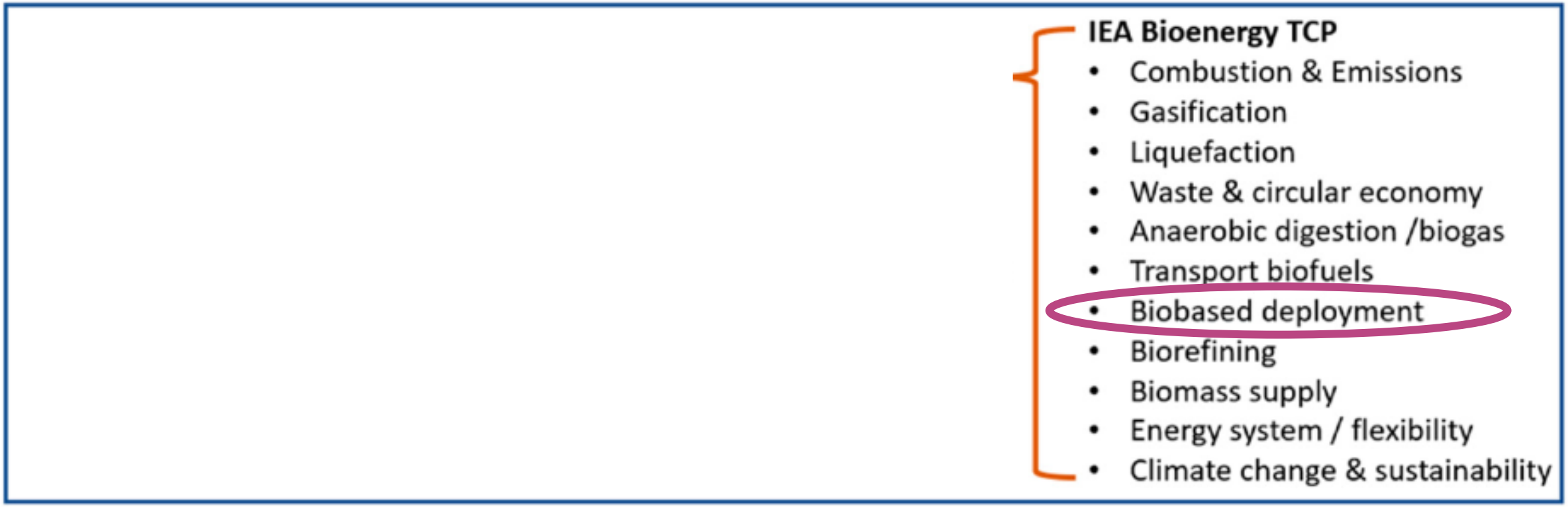
Task40 integration in the IEA TCP platform



Schipfer, F., Pfeiffer, A., Hoefnagels, R., 2022. Strategies for the Mobilization and Deployment of Local Low-Value, Heterogeneous Biomass Resources for a Circular Bioeconomy. Energies 15, 433. https://doi.org/10.3390/en15020433

Task40 integration in the IEA TCP platform

International Energy Agency (IEA) Technology Collaboration Programmes (TCPs)

- Renewable Energies
- Energy End-Use Technologies
- Fusion Power Coordination
- Fossil Fuels
- Cross-cutting activities

IEA TCPs on renewable energy

- Bioenergy
- Geothermal
- Hydrogen
- Hydropower
- Ocean Energy Systems
- Photovoltaic Power Systems
- Solar Heating and Cooling
- Solar Paces
- Wind Energy Systems

IEA Bioenergy TCP

- Combustion & Emissions
- Gasification
- Liquefaction
- Waste & circular economy
- Anaerobic digestion /biogas
- Transport biofuels
- Biobased deployment
- Biorefining
- Biomass supply
- Energy system / flexibility
- Climate change & sustainability

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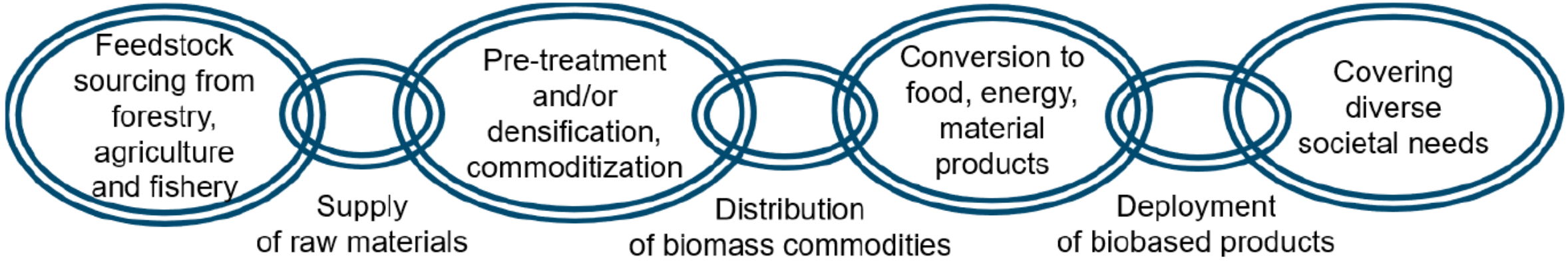
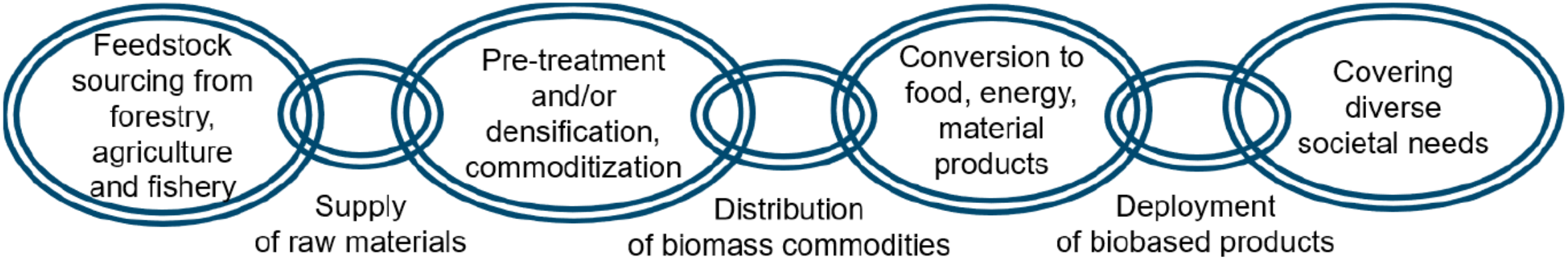
Exploring the value chain perspective



Schipfer, F., Kranzl, L., 2019. Techno-economic evaluation of biomass-to-end-use chains based on densified bioenergy carriers (dBECs). Applied Energy 239, 715–724. https://doi.org/10.1016/j.apenergy.2019.01.219

Exploring the value chain perspective



- Biophysical processes
- Ecosystem services
- Participation, jobs, ownership

- Waste-management
- Technology, Infrastructure
- Economics, econometrics (markets)

- Trends & dynamics
- Macro-economics
- Policy, legal & financing, decision-making under deep uncertainty

Schipfer, F., Kranzl, L., 2019. Techno-economic evaluation of biomass-to-end-use chains based on densified bioenergy carriers (dBECs). Applied Energy 239, 715–724. https://doi.org/10.1016/j.apenergy.2019.01.219

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Involvement in recent key-results

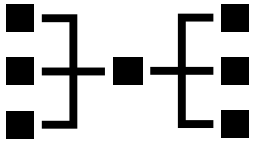
Schipfer, F., Kulišić, B., 2022. Regional development opportunities based on flexible biomass value networks. Collaboration workshop between IEA Bioenergy TCP Task 40,42,43,44,45 and the Horizon 2020 BRANCHES project. 2022 November 2nd. ISBN: 979-12-80907-20-2

Schipfer, F., Pfeiffer, A., Hoefnagels, R., 2022. Strategies for the Mobilization and Deployment of Local Low-Value, Heterogeneous Biomass Resources for a Circular Bioeconomy. Energies 15, 433. https://doi.org/10.3390/en15020433

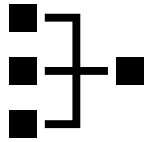
Schipfer, F., Mäki, E., Schmieder, U., Lange, N., Schildhauer, T., Hennig, C., Thrän, D., 2022. Status of and expectations for flexible bioenergy to support resource efficiency and to accelerate the energy transition. Renewable and Sustainable Energy Reviews 158, 112094. https://doi.org/10.1016/j.rser.2022.112094

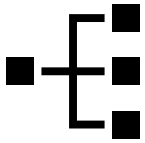
Olsson, O., Schipfer, F., 2021. Decarbonizing industrial process heat: the role of biomass.
A report for the IEA Bioenergy Inter-task project on industrial process heat.
https://www.ieabioenergy.com/wp-content/uploads/2022/02/Role-of-biomass-in-industrial-heat.pdf

Exploring the ~~value chain perspective~~ value network perspective

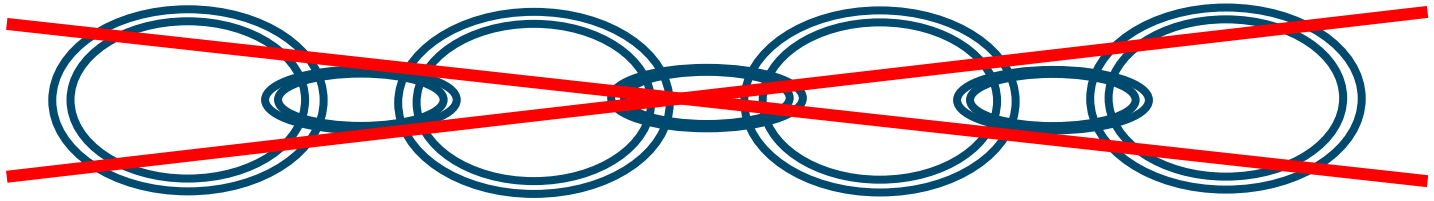


Biogenic wastes & residues
→ Heterogeneity, variable supply, highly scattered, waste-stream of a primary product ...

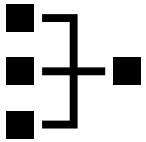


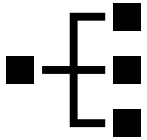


Nexus with other resources
→ P.V. and wind power
→ CO2 utilization & storage
→ Water, nutrients, ...



Pre-treatment and conversion
Products, markets, storage,
→ feedstock/final-use agnostic?
→ Diverse bio-tech portfolio, which tech to deploy when?





Multi-purpose value network
→ Food
→ Materials (traditional)
→ Materials (advanced)
→ Heat, power, methane, ...

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The integrated circular bioeconomy **value network**

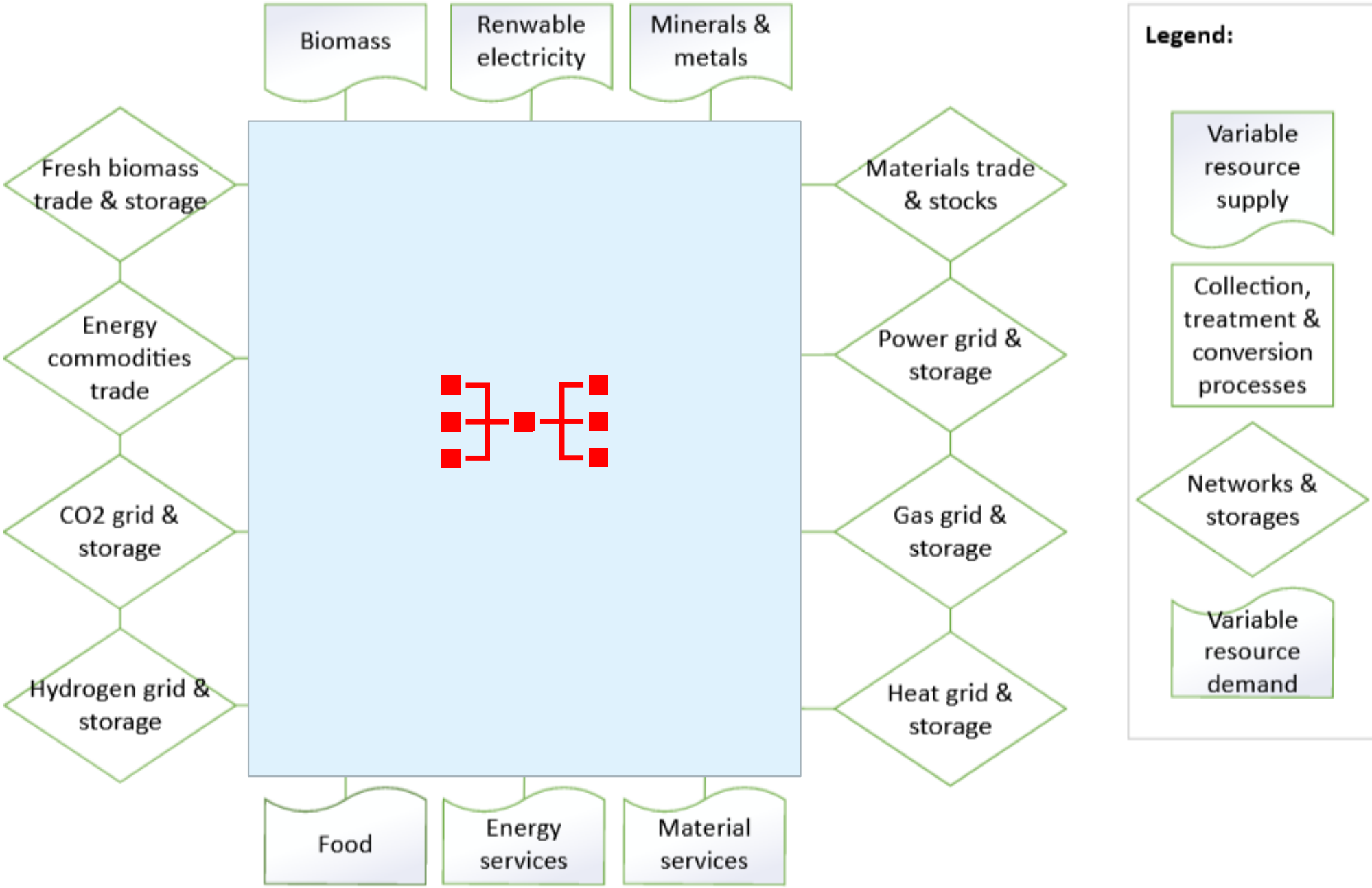

Figure: Network of network modeling for the development of resource shifting strategies. Source: Schipfer, F., Proskurina, S., Stricker, F., Wirth, M., Burli, P., Fritsche, U., Hennig, C., unpublished. Framing Circular Bioeconomy Systems Engineering.

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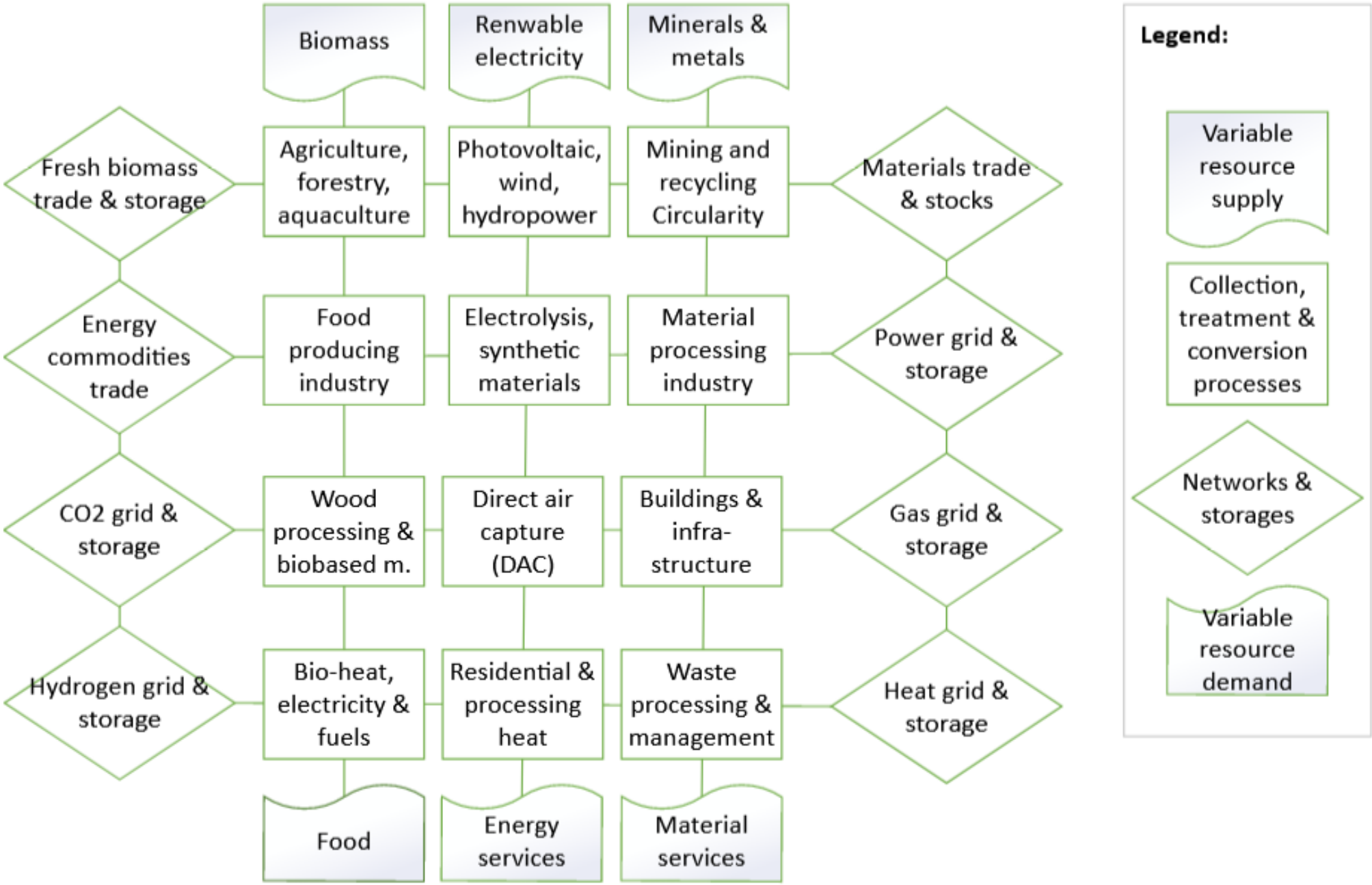
The integrated circular bioeconomy **value network**



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Bioenergy value chain → Circular bioeconomy value network

	Strengths	Weaknesses
Internal factors	• Flexibility concerning harvest output • Flexibility concerning product demand • Resource efficiency	• Coupled supply risks • Coupled demand risks • Higher complexity
	Opportunities	**Threats**
External factors	• Improved system reliability & resilience • Bio-sphere <> Techno-sphere integration • Regional case: Similar policy push for Biorefinery/Bioeconomy communities as for energy communities	• Limited knowledge capture capacity of operators, lack of digital infrastructure • Too narrow standards / legal barriers • Regional case: Weak regional structures, lack of bioeconomy ecosystem at place

Schipfer, F., Kulišić, B., 2022. Regional development opportunities based on flexible biomass value networks. Collaboration workshop between IEA Bioenergy TCP Task 40,42,43,44,45 and the Horizon 2020 BRANCHES project. 2022 November 2nd. ISBN: 979-12-80907-20-2

Thank you for your attention

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Automation and Control
BEST - Bioenergy and Sustainable Technologies GmbH
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Major publications of Fabian Schipfer:

1. Schipfer F, Mäki E, Schmieder U, Lange N, Schildhauer T, Hennig C, et al. Status of and expectations for flexible bioenergy to support resource efficiency and to accelerate the energy transition. Renewable and Sustainable Energy Reviews 2022;158:112094. https://doi.org/10.1016/j.rser.2022.112094.
2. Schipfer F, Pfeiffer A, Hoefnagels R. Strategies for the Mobilization and Deployment of Local Low-Value, Heterogeneous Biomass Resources for a Circular Bioeconomy. Energies 2022;15:433. https://doi.org/10.3390/en15020433.
3. Schipfer F, Kranzl L, Olsson O, Lamers P. The European wood pellets for heating market - Price developments, trade and market efficiency. Energy 2020;212:118636. https://doi.org/10.1016/j.energy.2020.118636.
4. Schipfer F, Kranzl L. Techno-economic evaluation of biomass-to-end-use chains based on densified bioenergy carriers (dBECs). Applied Energy 2019;239:715–24. https://doi.org/10.1016/j.apenergy.2019.01.219.
5. Junginger HM, Mai-Moulin T, Daioglou V, Fritsche U, Guisson R, Hennig C, et al. The future of biomass and bioenergy deployment and trade: a synthesis of 15 years IEA Bioenergy Task 40 on sustainable bioenergy trade. Biofuels, Bioproducts and Biorefining 2019;13:247–66. https://doi.org/10.1002/bbb.1993.
6. Schipfer, F., Yilan, G., Govoni, F., Morone, P., 2022. Strategies for Brand Owners and Retailers in the Circular Bioeconomy Transition, in: The Role of Business in Global Sustainability Transformations. Routledge.

First-author publication gap between 2017 - 2019 due to a Head of Research position at a Bioeconomy start-up (Ponix Systems GmbH – first B2C vertical farm), acquiring and managing seven national (AWS, FFG, WKO) and European (EASME) research and development projects.

7. Proskurina S, Heinimö J, Schipfer F, Vakkilainen E. Biomass for industrial applications: The role of torrefaction. Renewable Energy 2017;111:265–74. https://doi.org/10.1016/j.renene.2017.04.015.
8. Schipfer F, Kranzl L, Leclère D, Sylvain L, Forsell N, Valin H. Advanced biomaterials scenarios for the EU28 up to 2050 and their respective biomass demand. Biomass and Bioenergy 2017;96:19–27. https://doi.org/10.1016/j.biombioe.2016.11.002.
9. Kalt G, Baumann M, Lauk C, Kastner T, Kranzl L, Schipfer F, et al. Transformation scenarios towards a low-carbon bioeconomy in Austria. Energy Strategy Reviews 2016;13–14:125–33. https://doi.org/10.1016/j.esr.2016.09.004.