

The IETS TCP's International Conference

Energy Future in Industry

9–11 May 2023

Gothenburg, Sweden



Industrial
Energy-Related
Technologies
and Systems **iets**
An IEA Technology Collaboration Programme

Task XXI

Decarbonizing industrial systems in a circular economy framework

Energy Future in Industry Conference
10th May 2023 - Gothenburg

*Moderator: Valerie Rodin
(Energieinstitut an der Johannes Kepler Universität Linz)*

Agenda

1. Welcome & Introduction [11:25- 12:10]

- ❖ How Task XXI started and results from first phase (*Valerie Rodin*)
- ❖ Subtask 2 “Circular Carbon” (*Hans Böhm*)
- ❖ Subtask 3 ”Energy- and carbon-oriented Industrial Symbiosis” (*Rickard Fornell*)

2. Lunch Break [12:10 – 13:30]

3. Session Key Notes [13:30 – 14:20]

- ❖ How to handle Circular Carbon in theory and/or policy - Focus: CCU and LCA (*Susan Fancy*)
- ❖ A Business and Financing Model for Industrial Symbiosis (*Thomas Parker*)

4. Elevator Pitches [14:20 – 14:40]

- ❖ Imagining Circular Carbon: A mitigation (deterrence) strategy for the chemical industry (*Ellen Palm*)
- ❖ Circular approaches to net-zero emissions in the heavy industry (*Andrea Lanzini*)

5. Panel Discussion [14:40 – 15:10]

Getting to know the audience (SLIDO)

Where are you from (Country) & which IETS Task are you involved in (if any)?

Wordcloud Poll 26 responses 26 participants



Getting to know the audience (SLIDO)



In which sector do you work?

Multiple Choice Poll  23 votes  23 participants

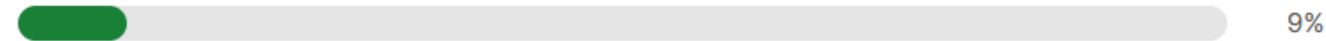
Research - 13 votes



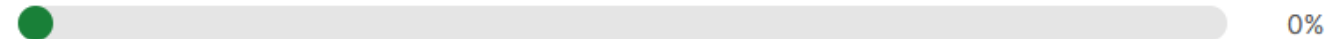
Academia - 6 votes



Industry - 2 votes



Association - 0 votes



Public agency - 2 votes



Getting to know the audience (SLIDO)



Are you working on / interested in...?

Multiple Choice Poll  25 votes  25 participants

Industrial Symbiosis - 2 votes



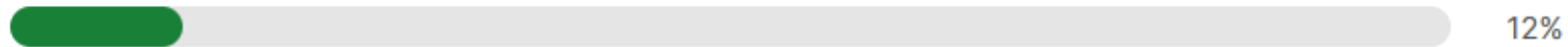
Circular Carbon - 6 votes



both - 14 votes



other - 3 votes



Task XXI Introduction

Core team of Task XXI



- Simon Moser, EI-JKU/AT – overall Task lead

- Hans Böhm, EI-JKU/AT – Subtask 2 Lead



- Rickard Fornell, RISE/SE – Subtask 3 Lead

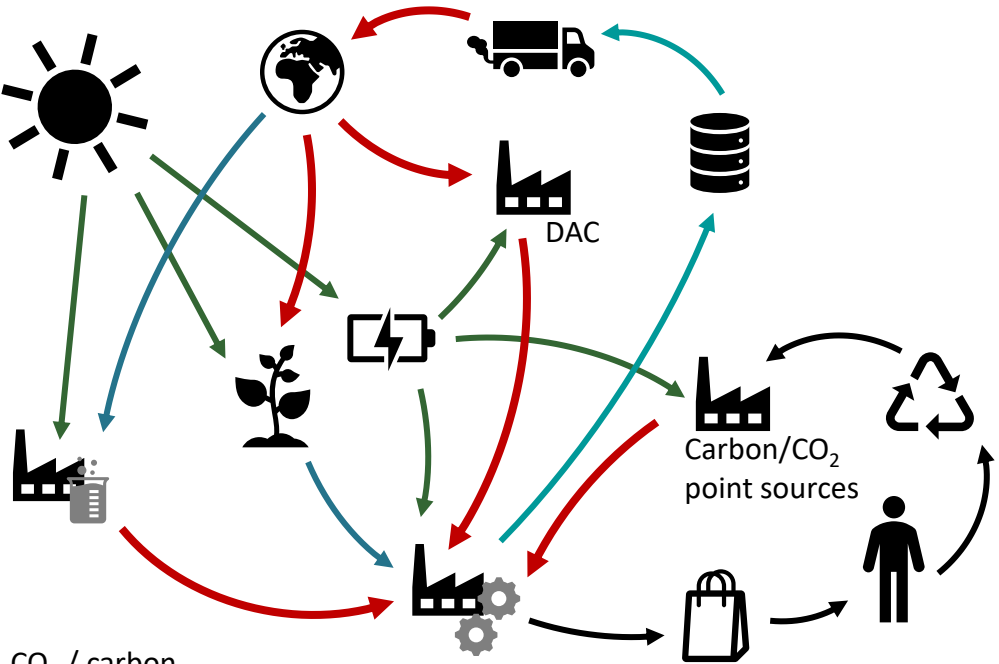


- Valerie Rodin, EI-JKU/AT – Co-worker Subtasks



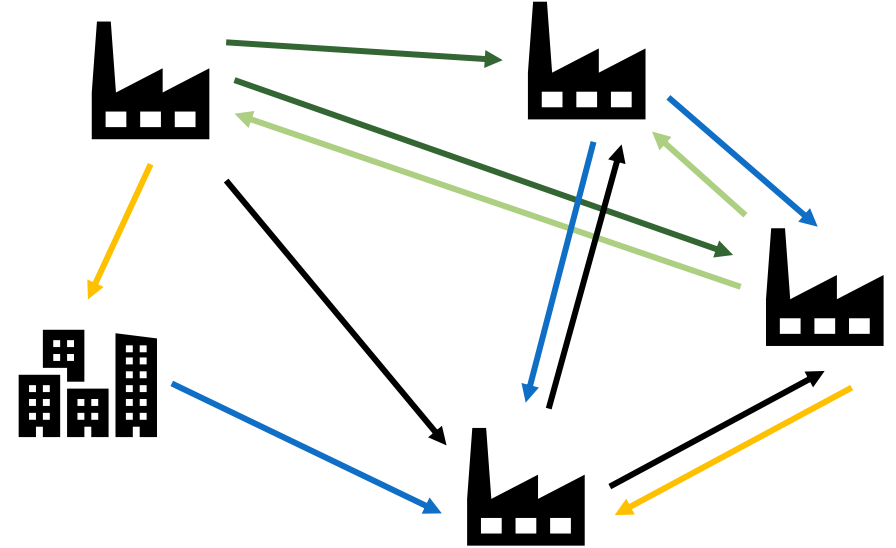
Two concepts – one pathway?

Circular carbon



- CO₂ / carbon
- e-fuels
- renewable energy
- carbon-based products
- biomass & natural resources

Industrial Symbiosis

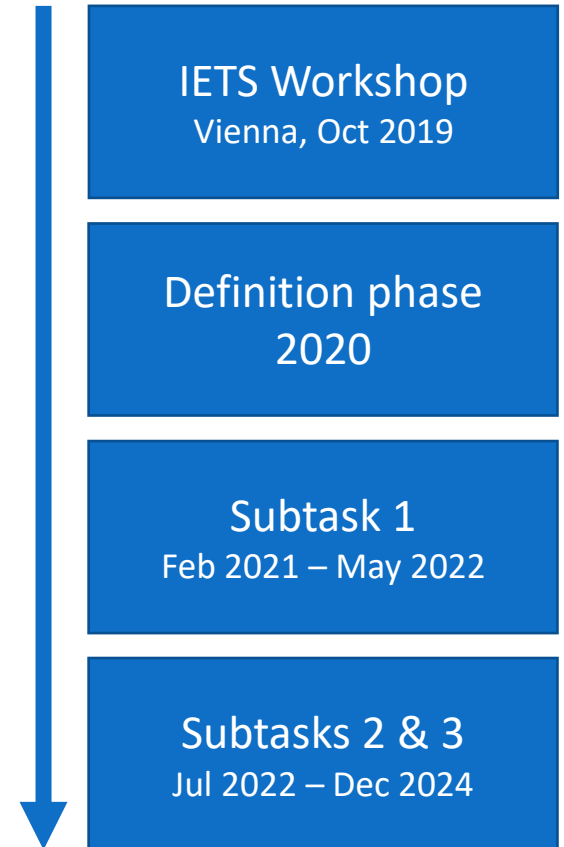


- heat/cold
 - renewable energy
 - various materials/wastes
 - various intermediates
 - knowledge
- } **These could be CO₂ and/or carbon-resources!**

Recap

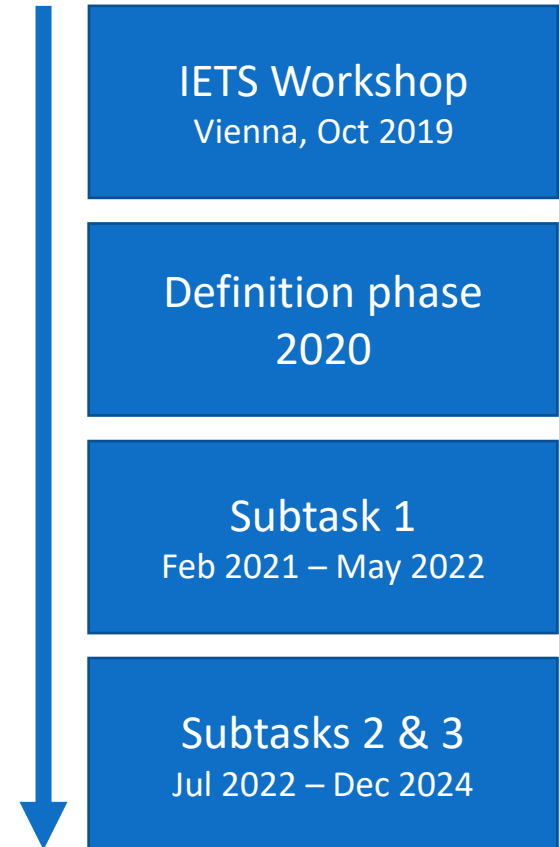
- Task delimitation (excerpt)

- Focus industrial processes
- Focus energy and carbon
- Do not look into other resources
- Do not look into biorefineries
- Do not look into waste heat except when needed for carbon capture
- Do not look into permanent carbon storage
- Network with related IEA TCPs and IETS Tasks



Recap

- IETS Workshop 2019
 - „Circular + Carbon + Symbiosis“
- Definition Phase 2020
 - Definition of title
 - Definition of framework
 - Establishing a broad topic
 - Won many interested groups / participants
- Subtask 1 Framework
 - Clear delimitation to other IEA TCPs and IETS Tasks
 - Approval by ExCo
 - Five activities
 - First elaboration of a broad topic: “clarify joint work, find white spots”



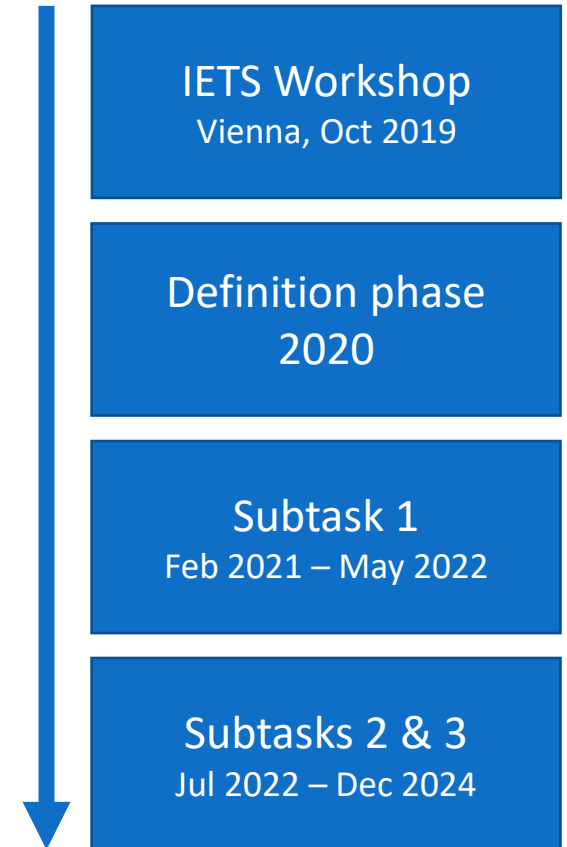
Recap

• Subtask 1 content

- Definitions and metrics (Energieinstitut)
- Circularity in modelling (FFE)
- Circular Carbon Technologies and Systems (ENEA)
- Industrial Symbiosis (Energieinstitut)
- Networking (WIVA P&G)

Find the final report here:

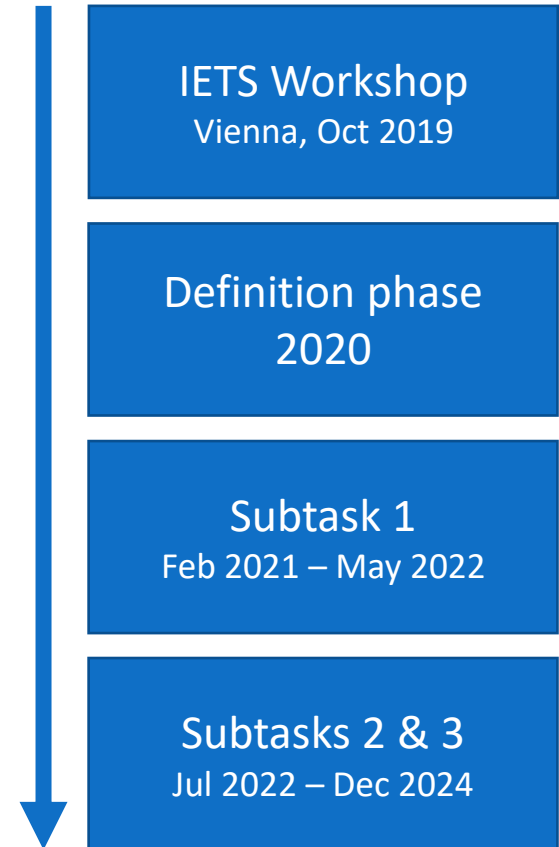
https://iea-industry.org/app/uploads/IETS-21_final-report_2022-09-09.pdf



Recap

• Lessons learnt for 1st phase

- Broad topic with many participants, but
 - Little interaction
 - Little contribution
- Need to focus the work
 - Two subtasks
 - More detailed topics
 - Make topics workable
 - On the risk of losing groups
 - But focused work may attract new groups
- Get out of the vicious circle
 - Define groups → define projects → define topics → redefine → ... → work?



Task structure – current term

Current time frame: July 2022 – December 2024

Task Manager: Simon Moser, Energieinstitut an der JKU Linz, AT

Sub-task no	Sub-task title	Sub-task Manager [Name, Org., Country]
2	Circular Carbon	Simon Moser / Hans Böhm, Energieinstitut an der JKU Linz, AT
3	Industrial Symbiosis	Rickard Fornell, RISE, SE

Current subtasks

- *Subtask 2: Circular Carbon*
 - Activity A: How to handle circular carbon in LCA modelling
 - Activity B: Integration of carbon capture in industry
 - Activity C: Networking
- *Subtask 3: Energy- and carbon-oriented Industrial Symbiosis*
 - Activity A: Definition and delimitation
 - Activity B: Good practice examples and new development in knowledge
 - Activity C: Business Models
 - Activity D: Networking

Participants

Austria

- Energieinstitut an der JKU Linz
 - Task Lead; Subtask 3 Lead
- AEE INTEC
- AIT Austrian Institute of Technology
- University of Leoben
- University of Natural Sciences (BOKU) Vienna

Sweden: RISE

- Subtask 3 Lead

Denmark: University of Southern Denmark (SDU)

Italy: ENEA & POLITO

Netherlands: TU Delft & TNO

Portugal: Universidade de Lisboa

Canada: Université du Québec à Trois-Rivières (UQTR)

*Austria, Sweden and Denmark collaborated
in drafting the Subtask proposal*



Collected projects (ongoing work)

ST2 CC	CC Modelling	CC Process Integration	ST3 IS	IS Def.	IS Good Practice	IS BM	Country	Main contact institution	Project acronym	Project full title	Project Status	End year	Funding source
x	x						Austria	Energieinstitut an der JKU	CaCTUS	Austria's climate neutrality: An in-depth evaluation of the potential contribution of CCU and CCS for the Austrian long-term climate goals	ongoing	2025	National
x	x						Austria	Energieinstitut an der JKU	HydroMetha	Development of a stationary electricity storage system via high-temperature co-electrolysis and catalytic methanation	finished	2023	National
x	x	x					Austria	Energieinstitut an der JKU	CircPlast	Mechanisches Recycling von Kunststoffen: Von Abfall-Kunststoffen zu hochwertigen, spezifikationsgerechten Rezyklaten	ongoing	2026	National
x		x			x	x	Austria	Energieinstitut an der JKU	C-CED	Carbon Cycle Economy Demonstration	ongoing	2025	National
			x	x		x	Austria	Energieinstitut an der JKU	CORALIS	Creation Of new value chain Relations through novel	ongoing	2024	Horizon
x	x		x		x		Austria	Energieinstitut an der JKU	Vision Upper Austrian Central Area	Vision Upper Austrian Central Area	finished	2023	State of Upper Austria
x				x			Austria	MU Leoben VTIU	Hy2Market		ongoing		
x							Austria	MU Leoben VTIU	HiPoLiq		ongoing		
x							Austria	MU Leoben VTIU	Bio-Heat		ongoing		
x							Austria	MU Leoben VTIU	Renewable Gasfield		ongoing	2023	National
x							Austria	AIT Austrian Institute of Technology	NEFI_Greensteel		ongoing		National
x							Austria	AIT Austrian Institute of Technology	Co-Electrolysis		ongoing		
x			x				Norway	SINTEF	PyroCO2	Demonstrating sustainable value creation from industrial CO2 by its thermophilic microbial conversion into acetone	ongoing		
			x				Portugal	Uni Lisboa	GrAPHy	Green Ammonia Production from Intermittent Sources of Hydrogen			
			x		x	x	Sweden	RISE	I.U.S. Centre	National Resource Centre for Industrial and Urban Symbiosis	ongoing		
			x			x	Sweden	RISE	CORALIS	Industrial Symbiosis in Energy-intensive industries	ongoing		Horizon
			x				Sweden	RISE	Climate-leading Process Industry	??	ongoing		

Session Discussion & Conclusions

Audience Questions (selection)

- What level of interconnectedness is reasonable to achieve in the future?
- Don't you think that Track 1 and Track 2 categories are set too wide to reflect the importance and urgency of reducing CO₂ emissions in a timely manner?
- Are you looking for industry clustering in view of centralized carbon storage?
- Do you include plastics and other carbon-based chemicals CO...)?
- The high decrease in costs of PV was achieved by having heavenly subsidized PV for many years, is this what we need to also do for CCU?
- What are your views on rebound effects from industrial symbiosis?
- To your knowledge, how is CCU is perceived by the general public? How relevant is it in the roll out of CCU ?
- ...

Session Conclusions

- Circular Carbon technologies have a huge potential but...
 - We need to understand the real effects – there is no „silver bullet“ and not every CCU pathway creates sustainability
 - Thus, we need to rethink today's and future Carbon demands – when the way we live changes, also Carbon demand will change
 - Industrial Symbiosis is well known, however business models need to be developed and adapted for the industries that are not used to sector interlinkages
 - North America and Europe are not the only ones who need to adapt – the question is, how will the rest of the world implement Circular Carbon & Industrial Symbiosis
- **There is a lot of work ahead of us!**

Task XXI Outlook

Timeline Phase 2



...we are open for more participants 😊

Rules for participation

- Official registration at the IETS secretariat, done by IETS ExCo member
- Inform ExCo member and in CC the Task manager about your participation
- ExCo member will register at the IETS secretariat and in CC at the Task manager

Groups become Task participant but must not contribute in both subtasks.

...we are open for more participants 😊

→ *Reach out to us during the conference!*

...or get in touch with **Simon Moser (Task Manager)**

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