Ministero degli Affari Esteri
e della Cooperazione Internazionale

Funded by the Ministry of Foreign Affairs and International Cooperation

REGIONAL PEER DIALOGUE

INDUSTRIAL SYMBIOSIS

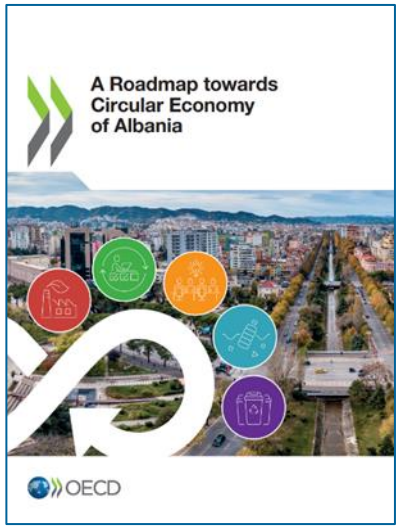
Brussels, 17 April 2024

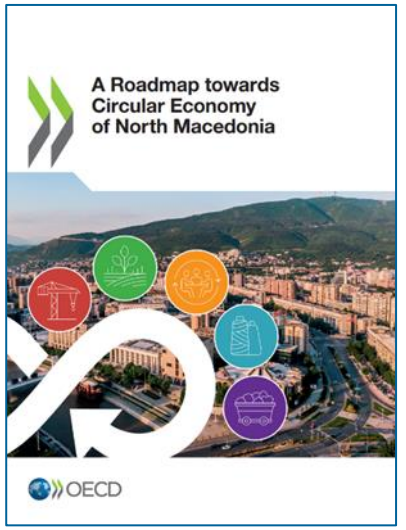
OECD
BETTER POLICIES FOR BETTER LIVES

OECD *GREENING* WORK IN THE WESTERN BALKANS

OECD support to green and circular economy in the Western Balkans

- Competitiveness Outlook: Environmental policy & Greening cluster
- SME Policy Index: SME greening





- Supporting Green Transition through Circular Economy Roadmaps in the Western Balkans

Scaling up OECD support to *greening*: main project features

Support implementation of the Western Balkans' green and circular policy documents, based on OECD greening work

Foster regional dialogue, through capacity building and best practice sharing

Facilitate knowledge exchange among government authorities, the private sector, academia and civil society in the region and OECD countries on how to design, implement and monitor progress

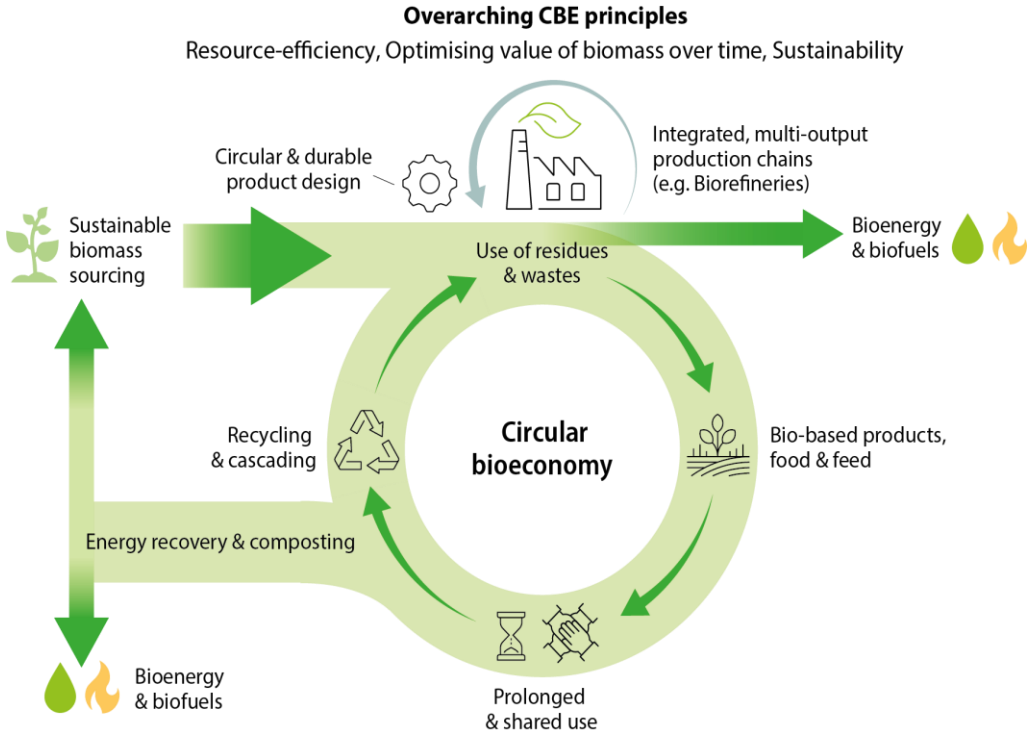
Two Regional peer learning events in 2024

1 – Spring: WCEF 2024, Brussels

Spotlight theme: Industrial symbiosis

2 – Autumn: OECD Public Governance Centre in Caserta, Italy

Spotlight theme: Circular bioeconomy



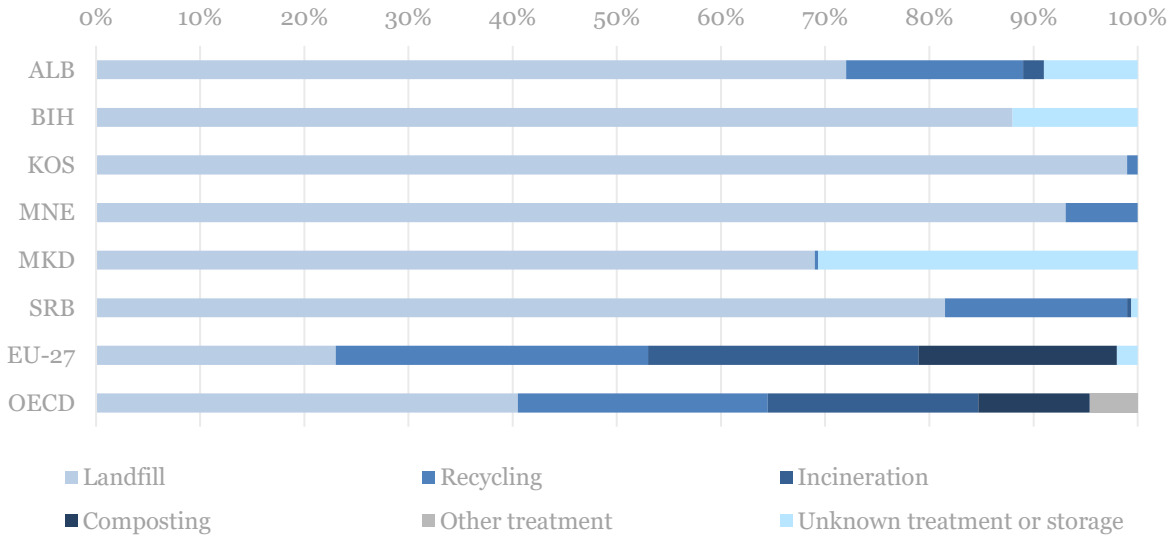
CIRCULAR ECONOMY IN THE WESTERN BALKANS AND INDUSTRIAL SYMBIOSIS

Circular economy in the Western Balkans – key aspects

- Waste generation is increasing and recycling rates remain very low (6.4% compared to 49% in the EU)
- Circular economy policy documents are increasingly gaining momentum
- Relevant legislative frameworks are being revised (waste, public procurement, EPR schemes)

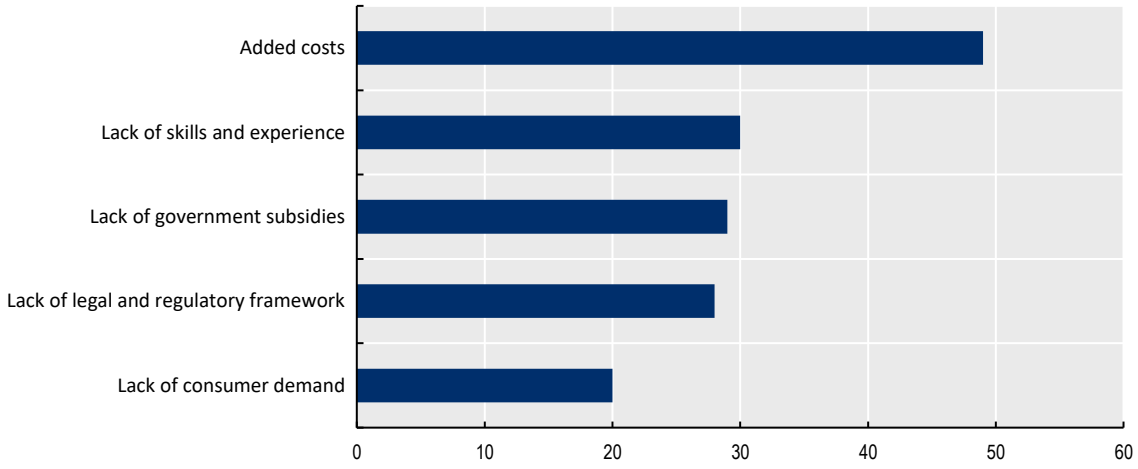
- 42% of business representatives believe that the green transition would have a positive impact on their company
- 20% of businesses believe that their business models allow for a shift towards a circular model
- The business sector faces challenges in adopting circular economy practices

Municipal waste treatment, 2021



Source: Respective Statistical Offices of WB6 economies, EEA, 2022 for BIH and OECD.Stat, 2023 for OECD.

Barriers to adopting circular practices in businesses across the region, in %



Source: Regional Cooperation Council, 2023

Circular economy in the Western Balkans – the policy framework

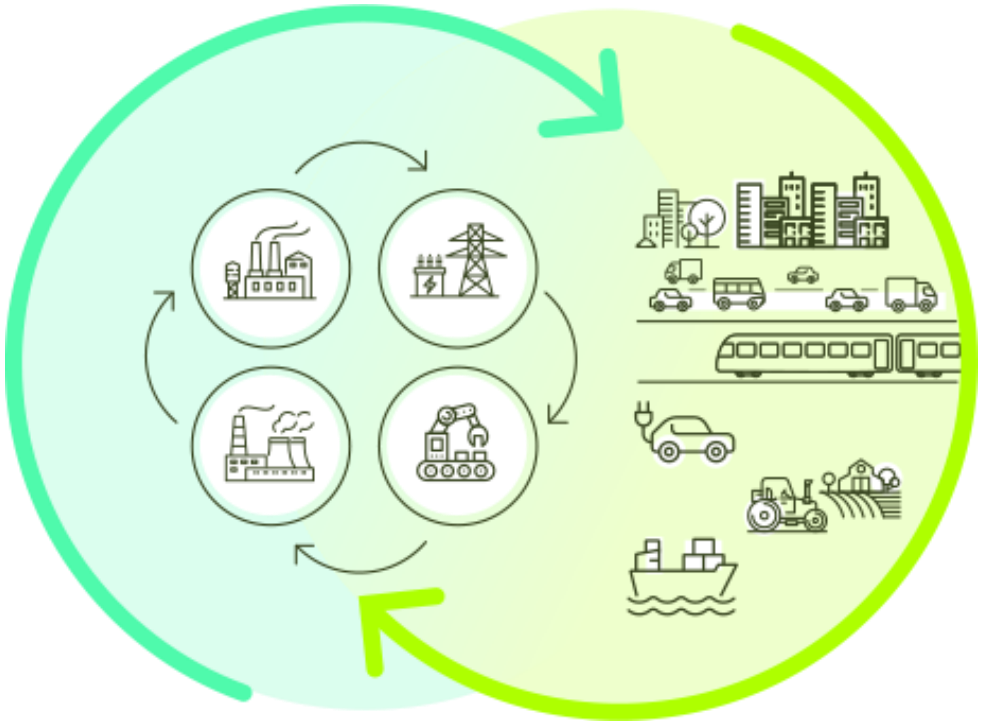
Economy	Document name	Adoption year	Timeline	Key priority areas	Coordinating ministry
Albania	A Roadmap towards Circular Economy of Albania	2024	n/a		Ministry of Tourism and Environment (Directorate of Circular Economy)
Bosnia and Herzegovina	n/a	Under development	2021 - 2027	n/a	Ministry of Foreign Trade and Economic Relations (state level)
Kosovo*	Circular Economy Roadmap of Kosovo	2023	n/a		Ministry of Environment, Spatial Planning and Infrastructure
Montenegro	Roadmap Towards the Circular Economy in Montenegro	2022	n/a		Ministry of Economic Development
	Draft National Circular Transition Strategy until 2030 and a proposal for an action plan for 2023-2024	2022	2023 - 2024		
North Macedonia	A Roadmap towards Circular Economy of North Macedonia	2024	n/a		Ministry of Economy
Serbia	Roadmap for Circular Economy in Serbia	2020	n/a		Ministry of Environmental Protection (Department for Circular Economy and Sustainable Development)
	Circular Economy Development Programme in the Republic of Serbia	2022	2022 - 2024		

- Economic instruments
- Built environment/ construction
- Circular business models for SMEs
- Tourism
- Plastics & packaging
- Manufacturing
- Food/ biomass
- Agriculture
- Forest system
- Textiles
- Creative sector
- Mining & metallurgy
- Retail
- Industry

*This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ opinion on Kosovo Declaration of Independence

The concept of industrial symbiosis

- Industrial symbiosis encourages businesses and industries within a geographic area to engage in a mutually beneficial exchange of materials, energy, water, and by-products
- It is integral to the transition from traditional linear industrial models to a circular economy
- Contributes to environmental sustainability but also offers economic benefits (cost savings, new revenue streams)



Source: Hubs4Circularity

Industrial symbiosis – EU perspective

Industrial symbiosis in EU policies

- Industrial symbiosis is seen as a key tool for achieving the Green Deal's objectives
- The Circular Economy Action Plan promotes industrial symbiosis by encouraging waste reduction and creating markets for recycled materials
- The Industrial Strategy sees industrial symbiosis as a way to boost competitiveness
- Horizon Europe funds research and co-operation and creates standards to make industrial symbiosis easier to implement

horizon europe

TODAY’S AGENDA

Two sessions of today's event

1) **Setting the scene** on industrial symbiosis: what are the main enablers of industrial symbiosis? How to overcome existing barriers?

2) **Policy discussion** on industrial symbiosis and good practice exchange from Italy, Denmark, Slovenia and the EU, highlighting key achievements, challenges and lessons learnt

Thank you for your attention!

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MKseeurope

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REGIONAL PEER DIALOGUE

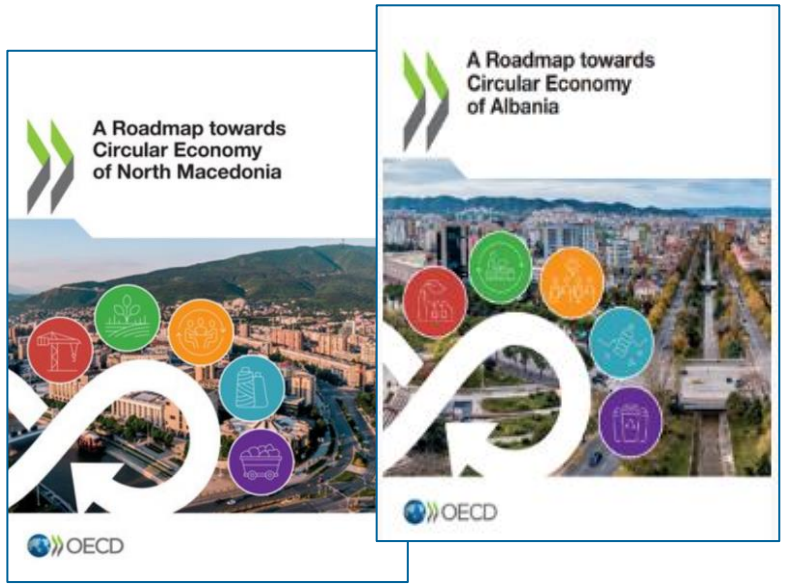
INDUSTRIAL SYMBIOSIS

Katarina Svatikova, OECD Environment Directorate
Brussels, 17 April 2024

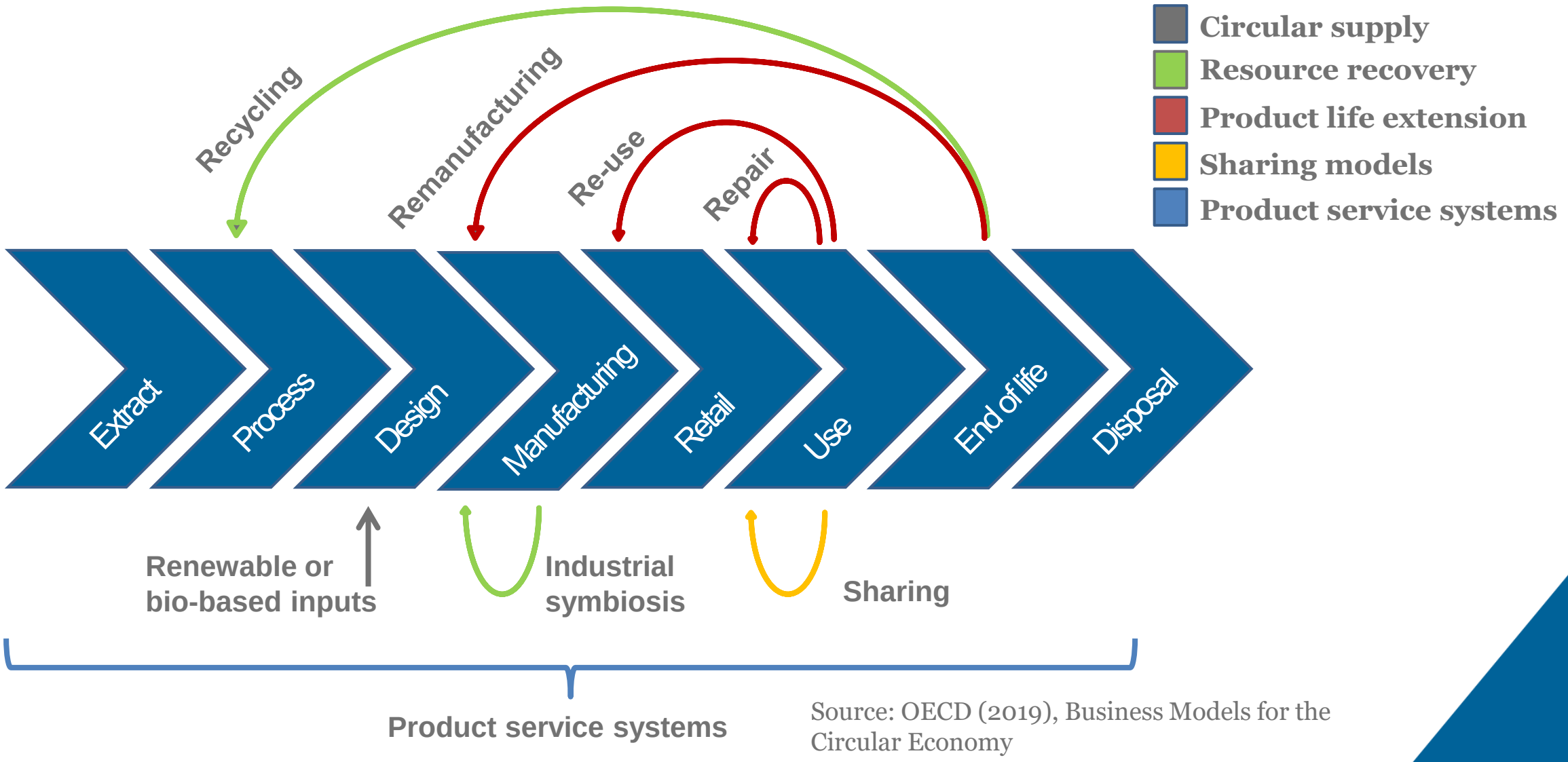
OECD
BETTER POLICIES FOR BETTER LIVES

OECD's work on resource efficiency and circular economy covers multiple areas

1. Extended Producer Responsibility
2. Plastics
3. Economic instruments for the CE
4. In-country studies



Industrial symbiosis is a resource recovery business model



Source: OECD (2019), Business Models for the Circular Economy

Key drivers

Emerging business risks

- increasingly more stringent environmental regulations
- energy and raw material supply risks
- increased consumer awareness of environmental issues.

Technological developments and digitalisation

- reduce the cost of valorising side streams into secondary material inputs
- reduce the transaction costs of inter-firm collaboration.

More widespread and ambitious circular economy policies

- promote or require high levels of waste recovery and use of secondary materials in production.

Key enabling factors

- Inter-firm collaboration
- Market for secondary raw materials from side streams
- Availability of sufficient volume of “waste” material generated

Key sectors

- Chemicals
- Energy
- Pharmaceuticals
- Water treatment plants
- Metals
- Cement
- Manufacturing

Policies to facilitate industrial symbiosis

Inter-firm collaboration

- Industrial parks/ business clusters and hubs
- Digital CE platforms
- Secondary and waste material marketplaces and platforms

Market for secondary raw materials

- Secondary raw material certification
- End of waste criteria legislation
- Recycled content requirements
- Shifting relative prices through taxes, subsidies, GPP and EPR

Availability of sufficient volume of "waste" material generated

- Technological development to improve material recovery
- Tax incentives for attracting new investments
- Transport and energy infrastructure investments

Thank you for your attention!

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Access OECD/ENV in-country reports from:

https://www.oecd.org/environment/waste/circular-economy-country-studies.htm

https://www.oecd.org/ctp/environmental-tax-policy-review-of-andalusia-fe6d8b45-en.htm

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BETTER POLICIES FOR BETTER LIVES

Ministero degli Affari Esteri
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Funded by the Ministry of
Foreign Affairs and International Cooperation

"Supporting Green Transition in the Western Balkans" Project

Regional Peer Dialogue

Speakers

Silvia GRANDI
Director General
for Circular Economy
Ministry of Environment and
Energy Security, Italy

Per MØLLER
Senior Symbiosis Developer
Kalundborg Symbiosis
Denmark

Luigi LO PIPARO
Partner at Technopolis Group,
former Project Manager of the EU
project CircLean and WP Leader for
the H4C ECoP project

Alenka MAUKO PRANJIĆ
Head of the Department for Materials
Slovenian National Building and Civil
Engineering Institute

Moderator

Jovana PAVLOVIC DJUKIC
Team Lead
Green Economy and Sustainability
South East Europe Division
OECD

OECD Global Relations **South East Europe**

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E DELLA SICUREZZA ENERGETICA

Industrial Symbiosis in Italy

Dr. Silvia Grandi

Director General Circular Economy

Italian Ministry of Enviroment and Energy Security

Credits also to ENEA

Summary

- The strategic framework in Italy related to Industrial Symbiosis
- The main legal framework at the EU and Italian level
- The ENEA Methodological approach
- The Case study in Sicily
- The Case study in Umbria

National Strategy for Sustainable Development

- **2023 – Update**
- https://www.mase.gov.it/pagina/pubblicato-il-documento-di-snsvs-2022
- **2017 – first text after UN Agenda 2030 & SDGs**

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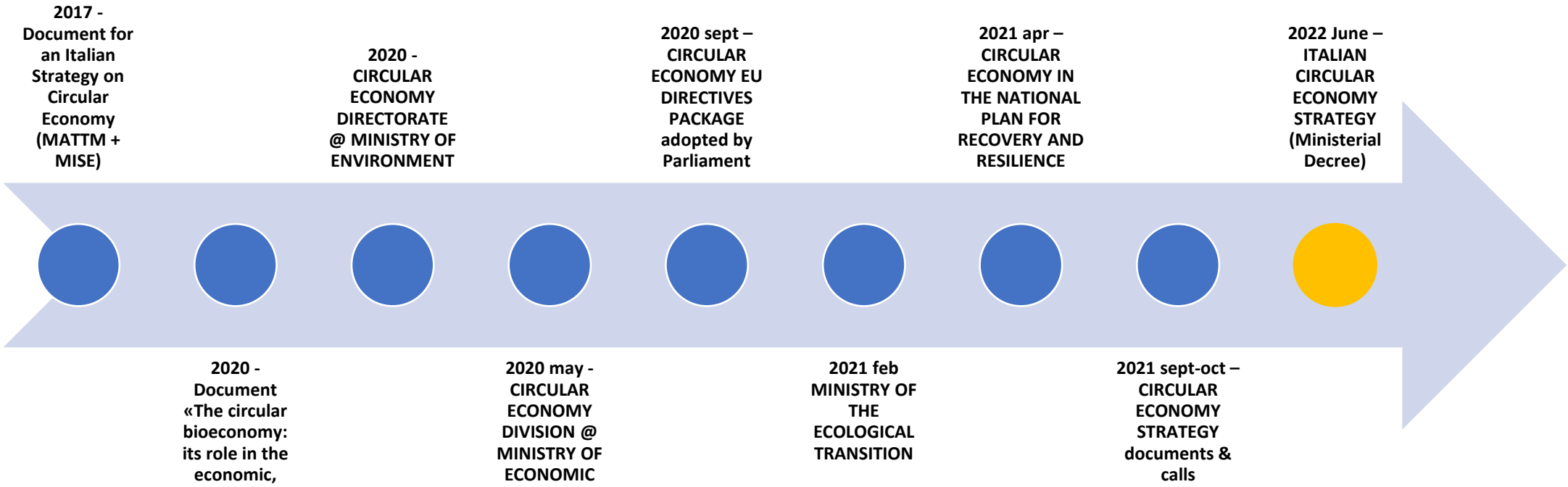
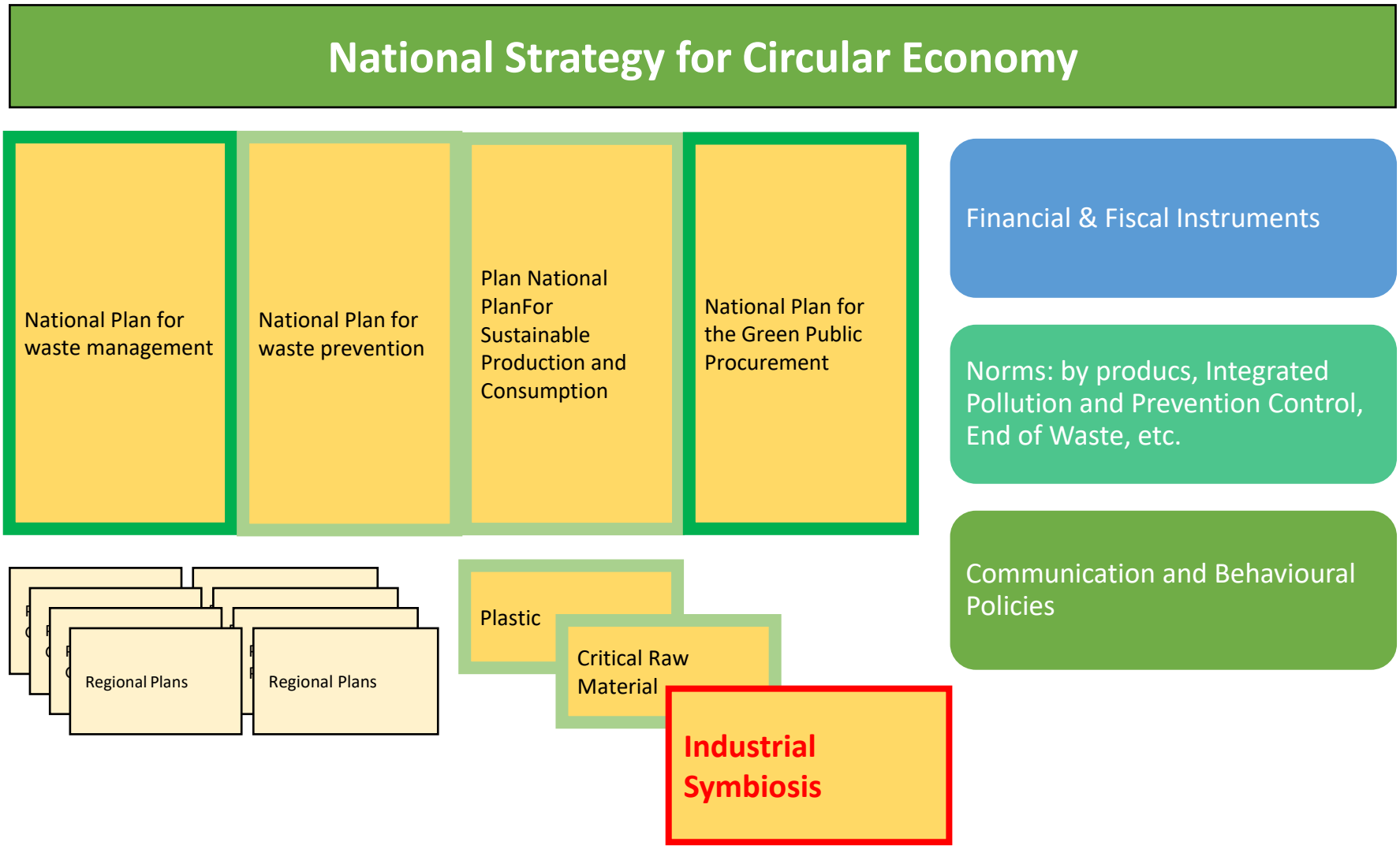
Circular economy as a strategy in Italy



National Strategies and Regional ones



National Strategy for Circular Economy

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Transition to circular economy

Closing cycles:

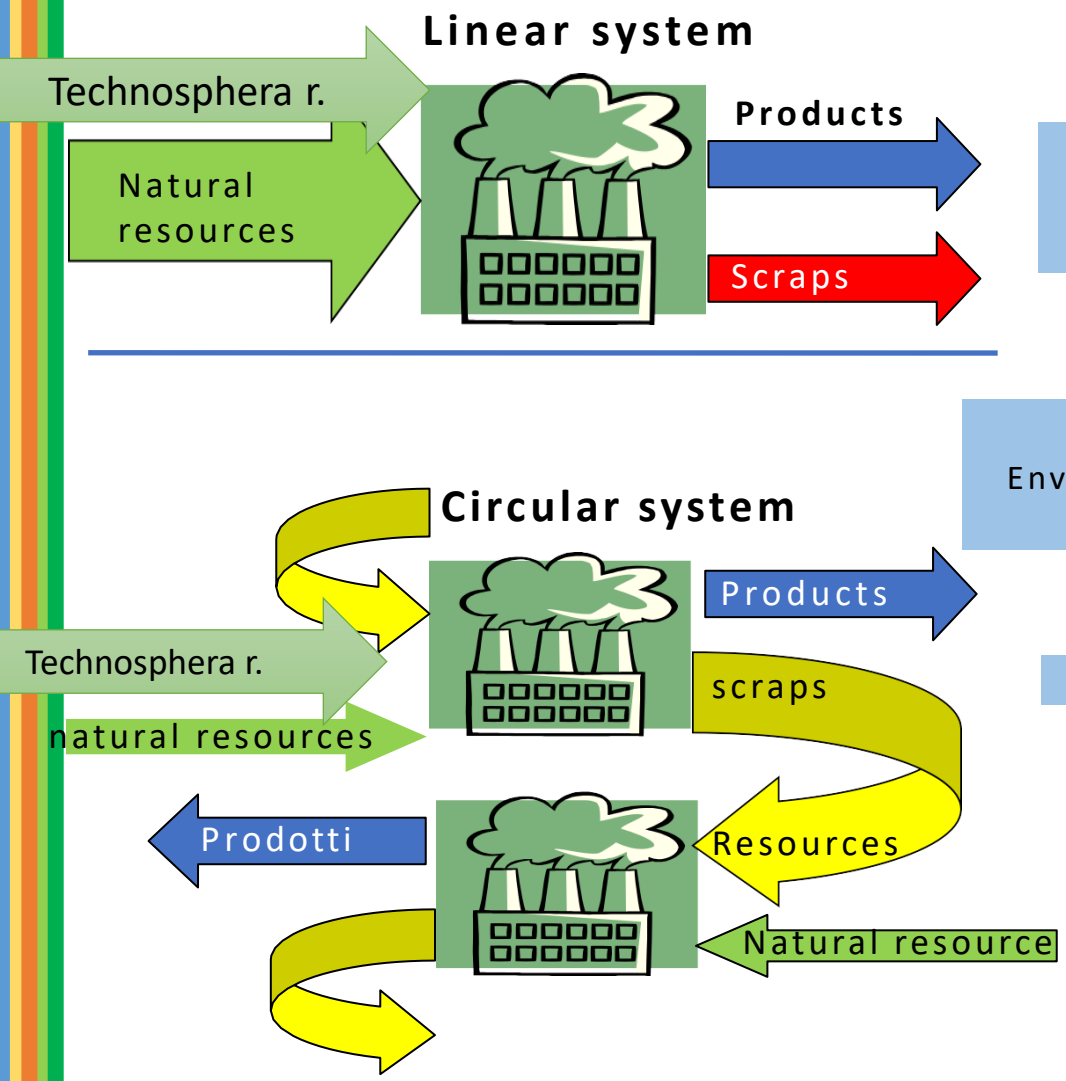
- Within a productive plant, process
- in industrial, urban, touristic and rural areas
- Along the value chain of services, products and materials

We need:

- Service, product, process and system ecoinnovation
- Technologies and plants
- Enabling framework conditions (regulations, standards, market)
- Skills and promotion
- Assessment and monitoring tools
- **Target?**

Holistic approach and involvement:
Institution, companies, research bodies and university – schools, civil society

System eco-innovation: industrial symbiosis



Economy

1. Raw materials cost supply reduction
2. New professional networks
3. New market opportunities
4. Local resource valorization (without outside delegation and transfer)

Environment

1. Better (and longer) use of resources
2. Impacts mitigation
3. Less waste to manage and to be landfilled and/or treated for energy and/or material recovery
4. Less transportation of scraps/waste

society

1. Jobs and new (green) jobs
2. Cultural change (sharing economy)
3. Collaboration between local stakeholders

Major EU policies on industrial symbiosis

"ROADMAP TO A RESOURCE EFFICIENT EUROPE" **(2011) INDICATE INDUSTRIAL SYMBIOSIS AS A STRATEGY USEFUL TO STIMULATE MORE EFFICIENT PRODUCTION THROUGH BETTER USE OF RAW MATERIALS AND THE REUSE OF BY-PRODUCTS**

"EUROPEAN RESOURCE EFFICIENCY PLATFORM – EREP" **(2012) EUROPEAN MANIFESTO AFFIRMING THE INCENTIVIZATION OF INDUSTRIAL SYMBIOSIS IMPLEMENTATION THROUGH PROMOTION OF PAN-EUROPEAN INITIATIVES, SCALING-UP OF EXISTING INDUSTRIAL SYMBIOSIS NETWORKS, AND THE CREATION OF A KNOWLEDGE-SHARING PLATFORM**

"CLOSING THE LOOP" **(2015) THE FIRST EUROPEAN CIRCULAR ECONOMY ACTION PLAN IN WHICH THE COMMISSION PROPOSES TO CLARIFY REGULATIONS REGARDING BY-PRODUCTS TO FACILITATE INDUSTRIAL SYMBIOSIS AND CREATE FAIR COMPETITIVE CONDITIONS WITHIN THE UNION**

CIRCULAR ECONOMY DIRETTIVES **(2018) WHICH ENACT LEGISLATIVE CHANGES ON WASTE AND BY-PRODUCTS TO PROMOTE REUSE AND STIMULATE INDUSTRIAL SYMBIOSIS**

"FOR A CLEANER AND MORE COMPETITIVE EUROPE" **(2020) THE SECOND EUROPEAN CIRCULAR ECONOMY ACTION PLAN, IN WHICH INDUSTRIAL SYMBIOSIS IS EXPLICITLY ENVISAGED AMONG THE STRATEGIES TO BE ADOPTED TO IMPROVE RESOURCE EFFICIENCY AND TRANSITION TOWARDS A CIRCULAR ECONOMY**

Major Italian policies on industrial symbiosis

"TOWARDS A CIRCULAR ECONOMY MODEL FOR ITALY" **(2017) FRAMEWORK AND STRATEGIC POSITIONING DOCUMENT WHERE INDUSTRIAL SYMBIOSIS IS CONSIDERED AS A SYSTEMATIC ECO-INNOVATION TOOL FOR THE EFFICIENT USE OF RESOURCES THROUGH THE CREATION OF RESOURCE-SHARING NETWORKS**

"CIRCULAR ECONOMY AND EFFICIENT USE OF RESOURCES: INDICATORS FOR MEASURING CIRCULAR ECONOMY" **(2018) INDUSTRIAL SYMBIOSIS IS INCLUDED AMONG THE METHODOLOGICAL AND KNOWLEDGE TOOLS FOR THE CIRCULAR ECONOMY AND THE EFFICIENT USE OF RESOURCES**

"ICESP PRIORITIES FOR A POST-COVID-19 RECOVERY" **(2020) PROPOSES A NATIONAL PROGRAM FOR BUSINESSES AIMED AT SUPPORTING THE INDUSTRIAL SYMBIOSIS AND THE ECO-INDUSTRIAL CONVERSION OF PRODUCTION AREAS IN ITALY**

"NATIONAL RECOVERY AND RESILIENCE PLAN" **(2021) FORESEES MEASURES AIMED AT SUPPORTING THE INDUSTRIAL SYMBIOSIS PROJECT THROUGH REGULATORY AND FINANCIAL INSTRUMENTS AND FLAGSHIP PROJECTS**

"PLAN FOR ECOLOGICAL TRANSITION" **(2022) ASSERTING THAT EFFORTS SHOULD BE MADE TO ENCOURAGE THE INDUSTRIAL SECTOR TO TRANSITION TOWARDS MORE ADVANCED FORMS OF INDUSTRIAL SYMBIOSIS**

"NATIONAL STRATEGY FOR THE CIRCULAR ECONOMY" **(2022) RECOGNIZES IS AS A KEY POLICY TO FACILITATE ITALY'S TRANSITION TO A CIRCULAR ECONOMY**

"IMPLEMENTATION SCHEDULE OF MEASURES OF THE NATIONAL STRATEGY FOR THE CIRCULAR ECONOMY" **(2022) FORESEES THREE MEASURES TO SUPPORT INDUSTRIAL SYMBIOSIS PROJECTS THROUGH REGULATORY AND FINANCIAL INSTRUMENTS TO BE IMPLEMENTED BY 2024**

Main leverages

PROJECT, NETWORKS & PRIVATE INITIATIVES (BOTTOM-UP & REASERCH DRIVEN)

- SUN - Industrial Symbiosis Network
- ICESP (Italian Circular Economy Stakeholder Platform) https://www.icesp.it/sites/default/files/2020-08/Brochure_ICESP_2020_ENG.pdf
- Circular Economy Network https://circulareconomynetwork.it/
- CICERONE H2020 Coordinated Action on CE SRIA Strategic Resaerch & Innovation Agenda https://cicerone-h2020.eu/
- …

NORMS & REGULATION (TOP DOWN)

- 1998 – «Ronchi Decree» and start-up of EPR Systems and start of CONAI System
- End of Waste Decrees
- Case by Case authorisation
- By Products
- IPPC authorisation
- …

ENEA for IS

Methodology and projects

SYMBIOSIS

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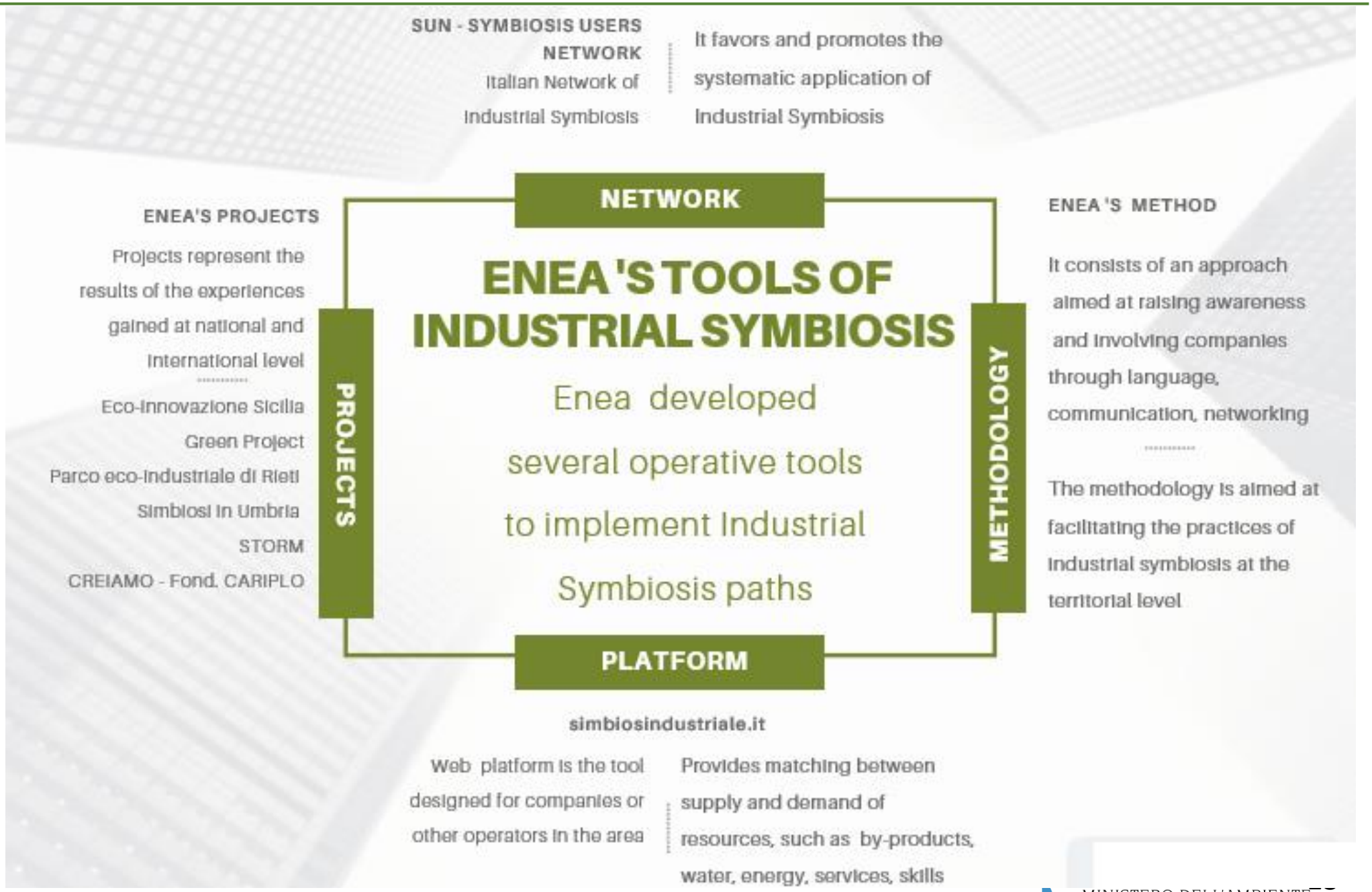
E DELLA SICUREZZA ENERGETICA

Industrial Symbiosis - tools



ENEA approach

Organizative Phase

1. Analysis of the territory of the productive sectors, identification of areas
2. Mapping of key sectors, creation of company databases (about 2000 companies)
3. Networking & promotion to involve companies
4. Sending and receiving input / output data collection sheets
5. Organization workshop invite companies
6. Involvement of institutional stakeholders

Executive Phase

7. Workshops;
8. A first stage of "data processing", analysis of all data and identification of synergies;
9. Data download on industrial symbiosis platform;
10. A second moment of "data processing" and identification of any new synergies;
11. Selection of industrial symbiosis paths to propose to companies;
12. First drafting of Operative Handbooks;

Conclusive Phase

13. Consultation tables;
14. Revision of Operative Handbooks;
15. Handbooks Final draft;

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Methodology

input/output data sheets pre-event

input/output data sheets for the event

ENEA AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE

Scheda raccolta dati di INPUT-OUTPUT

SYMBIOSIS Piattaforma di simbiosi industriale

INPUT OUTPUT	Risorsa (descrizione)	Risorsa (nome commerciale)	Risorsa (tipologia 1)	Risorsa (se tipologia 1 – a)	Risorsa (se rifiuto) [CER – prime 6 cifre]	Risorsa (se rifiuto) [CER – complete]	Risorsa (se prodotto o sottoprodotto) [ProdCom]	Risorsa [NACE – se servizio]	Tipo di quantitativo risorsa	quantità	unità di misura	note

Methodology

Network implementation

Pre-event

- ✓ Collaboration with local authorities and stakeholder association
- ✓ Companies DB
- ✓ Getting in touch with companies directly
- ✓ First request of data to companies

Post-event

- ✓ First results to companies and as a whole
- ✓ Selection of most suitable matches
- ✓ Collaboration with involved companies
- ✓ Handbooks for IS
- ✓ Interested stakeholders involvement (if needed)

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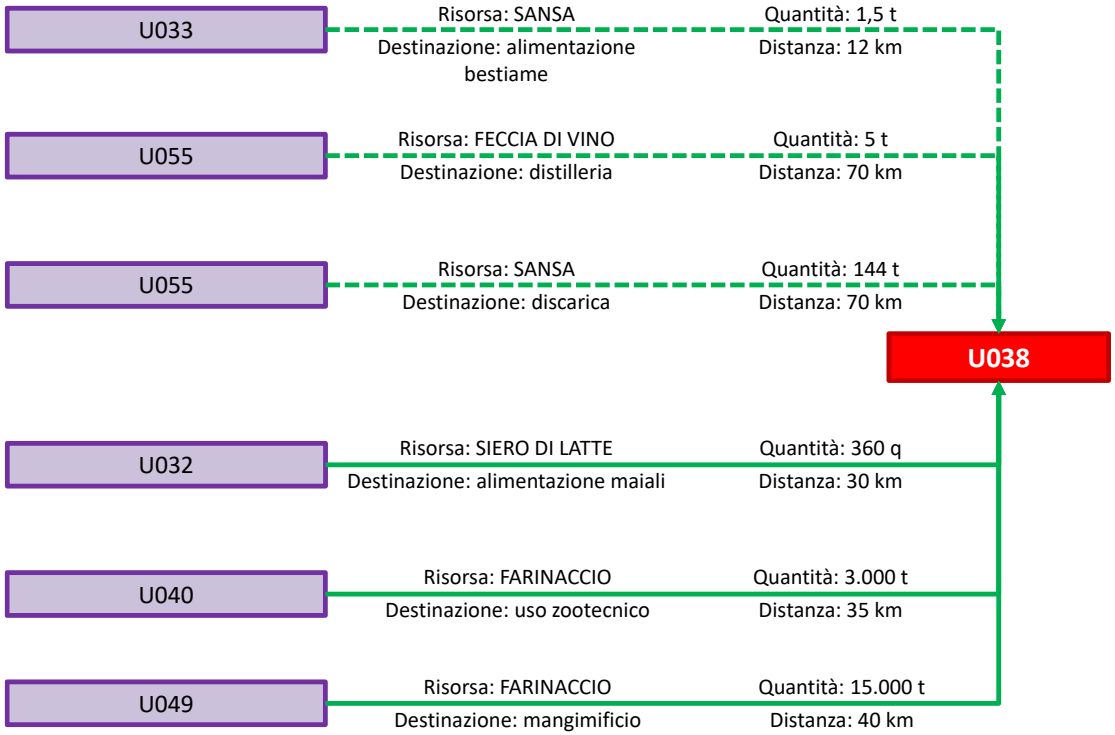
Methodology - **Handbooks**

1. Chapter I: LAYOUT of match
2. Chapter II: technical addendum

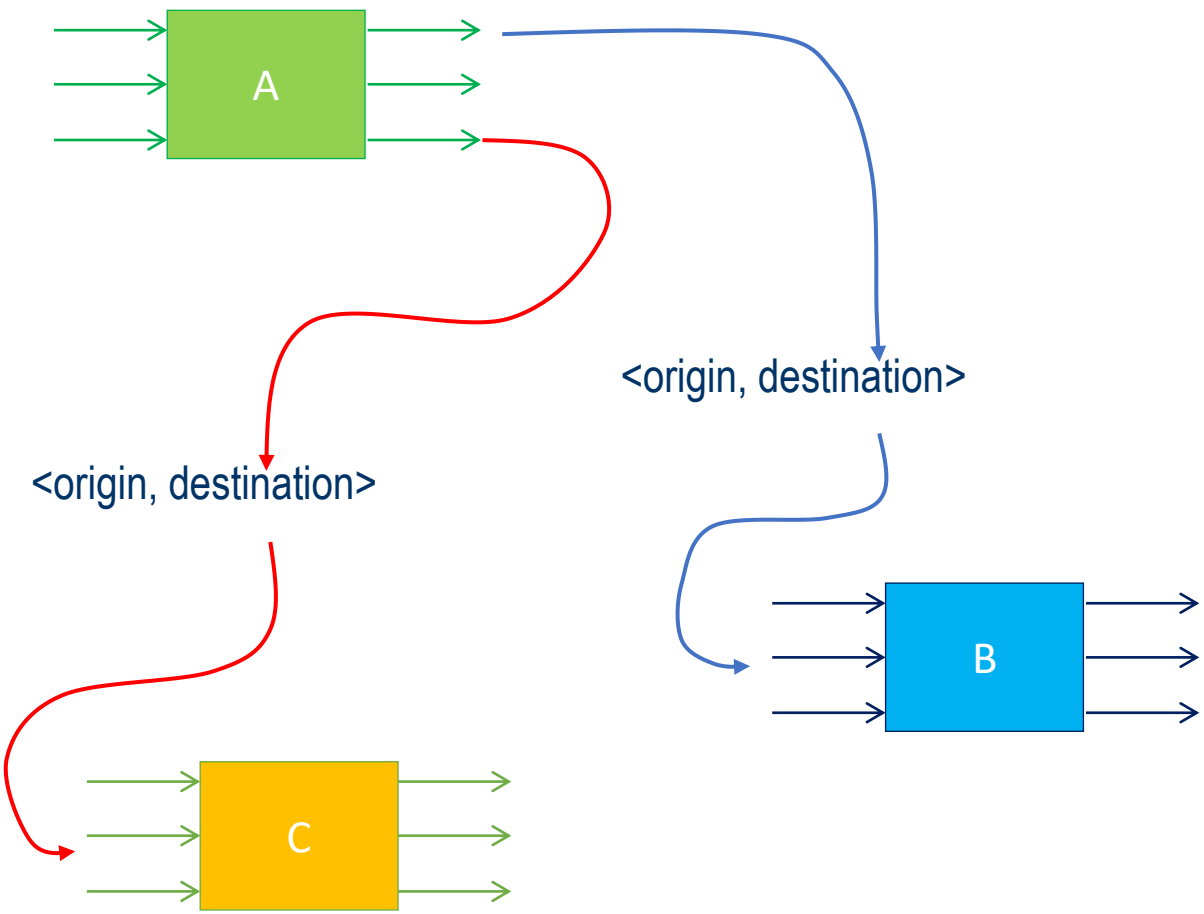


Legenda:

- Sinergie individuate durante il tavolo di lavoro – Flusso continuo nel corso dell'anno
- Sinergie individuate durante il tavolo di lavoro – Flusso discontinuo (Batch)
- Sinergie individuate da ENEA

Es. 127 km: distanza tra l'azienda che dà e l'azienda che riceve la risorsa
Es 5 t: quantità annua dichiarata durante i tavoli di lavoro o nella schede input/output

Methodology - <origin, destination> strings



PRODUCT DESCRIPTION (OUTPUT)	
EWC code (if the resource is waste), or other appropriate code (if the resource is not a waste)	
Origin	
Fiscal properties	
Composition properties	
POSSIBLE PRODUCTIVE DESTINATIONS	
Activity code (ATECO/NACE)	Input type
RELEVANT REGULATIONS AND TECHNICAL STANDARDS	
OTHER USEFUL INFORMATION (e.g. actual destination, collection systems, etc.)	
ABSTRACT OF THE <ORIGIN-DESTINATION> STRING	
KEYWORDS	

Methodology – IS platform

SYMBIOSIS
Piattaforma di simbiosi industriale

http://www.industrialsymbiosis.it

Is part of the methodology. Support companies and facilitators to manage data and finding opportunities for industrial symbiosis

- Web-based
- Companies and resources are gereferred
- <origin, destination> strings are implemented and added
- Cooperative mechanism (different users' levels)
- Searching for potential matches
- Implementaton of networks
- Recently updated with Resource Audit tool

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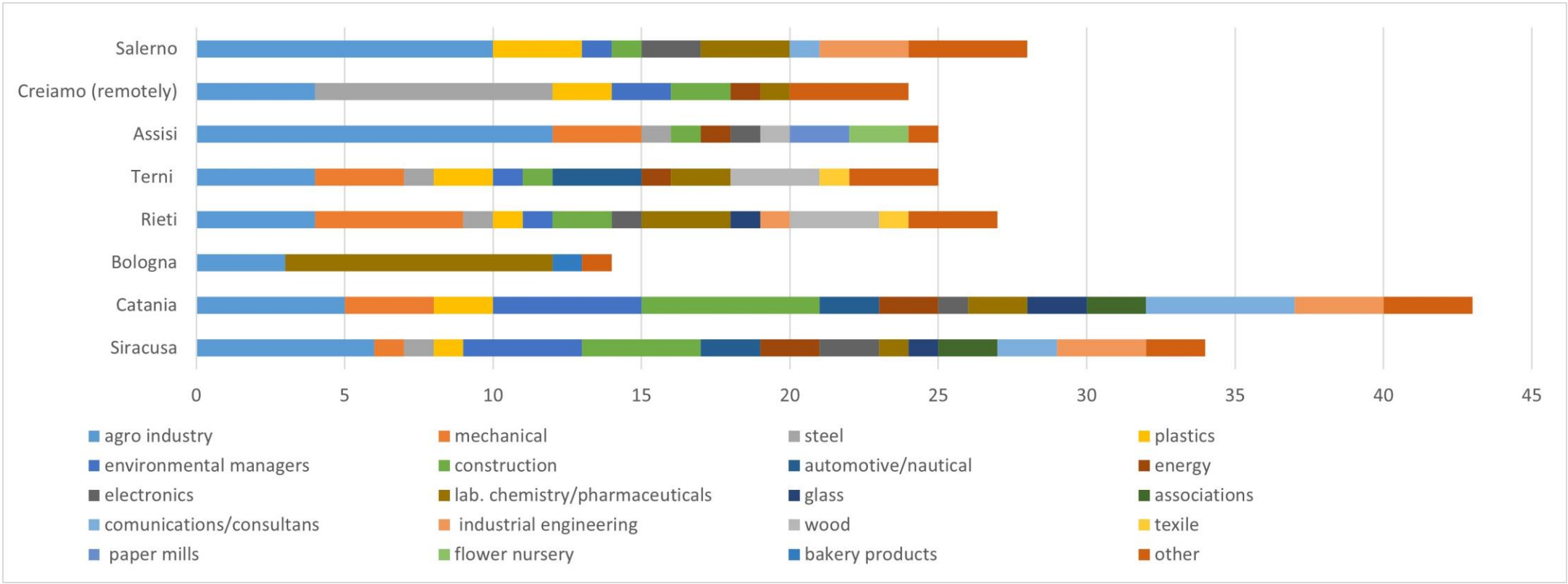
Production sectors In the IS Workshops



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Main results of ENEA's IS projects

IS projects	Participating Companies	Workshops	Shared resources	Potential synergies	Operative handbooks
Ecoinnovation Sicily	100	3	585	690	4
Green Industrial Symbiosis	13	1	104	96	3
Industrial Park of Rieti	27	2	146	110	1
Industrial Symbiosis in Umbria	50	2	200	259	2
CREIAMO	22	1	96	102	2
STORM	63	2	96	102	2
MARLIC*	30	1	317	86	1
BRIDGeconomies**	28	1	300	225	1

*MARLIC project didn't involve the development of an actual operative handbook but rather a final report.

**Data is not definitive. This project is ongoing. Another IS workshop and OH are planned for Apulia

Case study: Ecoinnovation Sicily

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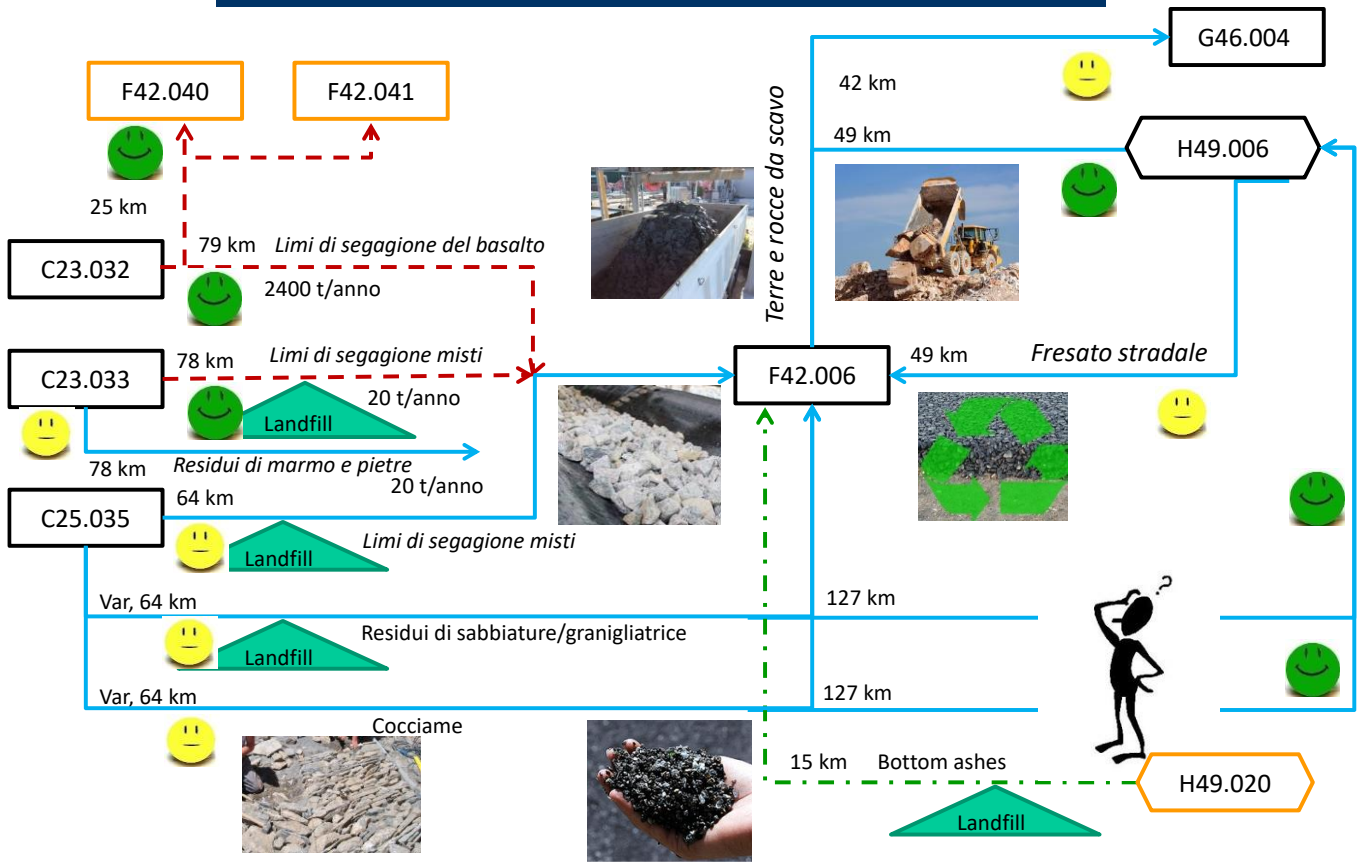
Ecoinnovation Sicily: an IS handbook - Layout of matches

Operational verification of synergies in the construction sector, stone materials, and aggregates

- Synergies emerged following the IS workshops
- Synergies emerged during the meetings/site visits with the companies
- Synergies emerged subsequently based on specific requests from companies initially not involved in the project

Sawdust as a filler for bituminous conglomerates production



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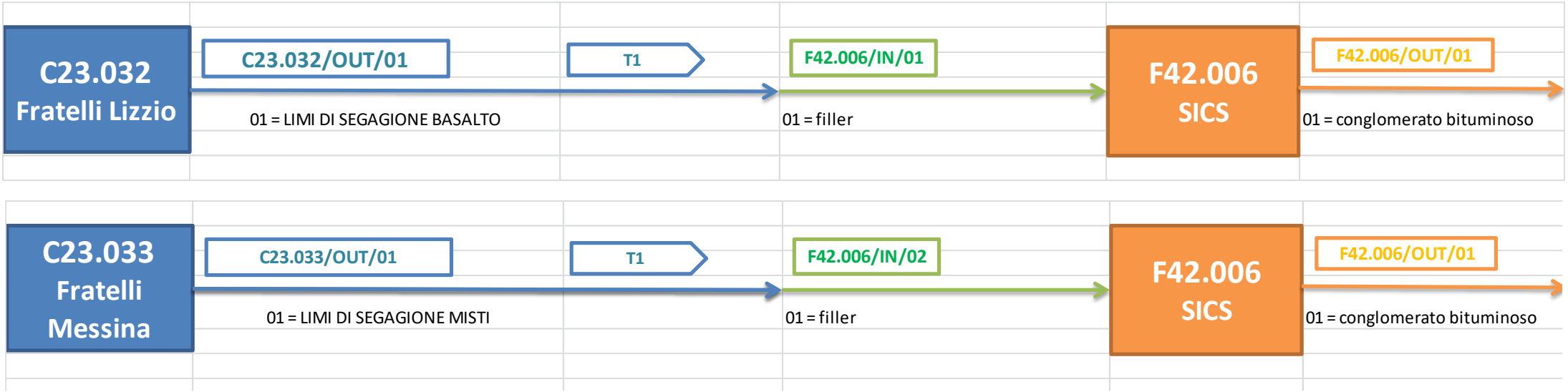
Ecoinnovation Sicily: an IS handbook - Technical addendum



NORMATIVA					
	Regolamentazione degli scarti provenienti dalla lavorazione dei materiali lapidei		Normativa e norme tecniche per il riutilizzo nel campo delle costruzioni		

STANDARD TECNICI					
	Caratteristiche dei limi di segagione in funzione di un possibile riutilizzo		Norme tecniche relative ai prodotti da costruzione		

ALTRI ASPETTI					
					Aspetti logistici
			Aspetti economici		

Ecoinnovation Sicily: an IS handbook - Technical addendum

Economic and logistical considerations

Companies of the Etna lava stone production district

1. Economic advantage based on production quantities, current disposal costs (15 Euros per ton), and transportation
2. The widespread presence of small enterprises with quantities of residues that individually do not allow for a substantial economic advantage in reuse. Therefore, it is necessary to evaluate the possibility of a 'consortium' transportation management system for companies in the District to achieve economies of scale

Considerations regarding the 'user' companies

1. Low-cost availability of materials with high-quality characteristics.
2. Increase in the environmental sustainability of the company

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Case study: Industrial symbiosis in Umbria

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E DELLA SICUREZZA ENERGETICA

Industrial Symbiosis – case study

2 IMPORTANT REGIONAL PROJECT:

- INDUSTRIAL SYMBIOSIS IN UMBRIA (2017)
- PROPER PROJECT(2018)

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SVILUPPUMBRIA

SYMBIOSIS Piattaforma di simbiosi industriale

Industrial Symbiosis – case study

CASE STUDY FOR INDUSTRIAL SYMBIOSIS IN UMBRIA

Innetwork program financed by ERDF ROP 2014-2020 of the Umbria Region Support for the development of productive activities: pilot interventions for the sustainability and competitiveness of tourism and industrial areas - 2017

REGIONAL AGENCY FOR UMBRIA'S COMPETITIVENESS AND ECONOMIC GROWTH

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Industrial Symbiosis – case study

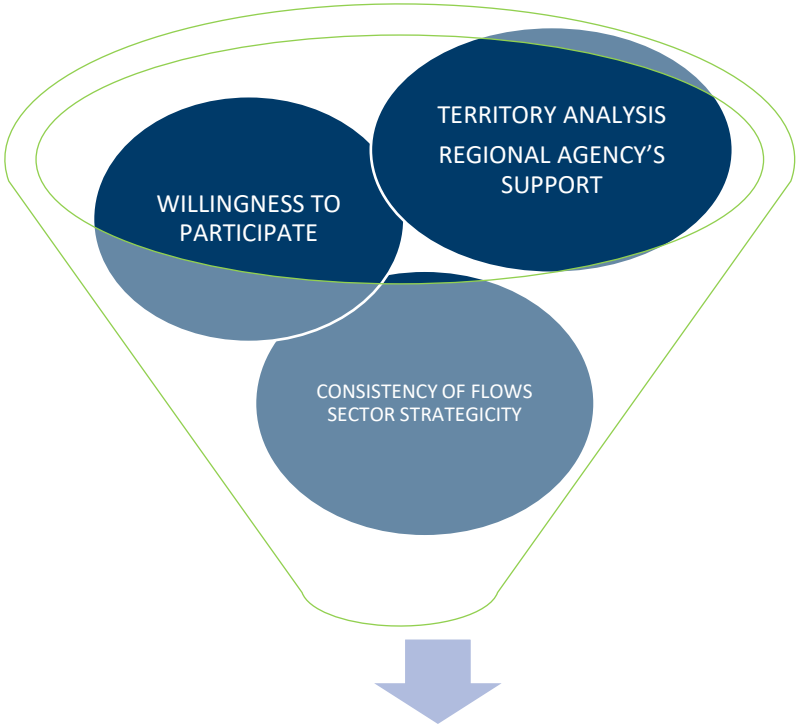
Terni
7th April 2017

- 34 Companies
- 127 shared resources
- 100 potential synergies

Assisi
9th June 2017

- 26 Companies
- 125 shared resources
- 99 potential synergies

Industrial Symbiosis – case study



CHOICE OF WASTE FLOWS

HANDBOOK FOR VALORIZATION OF WASTE FROM OLIVE OIL PRODUCTION

HANDBOOK FOR VALORIZATION OF WASTE FROM AGRO-INDUSTRIAL

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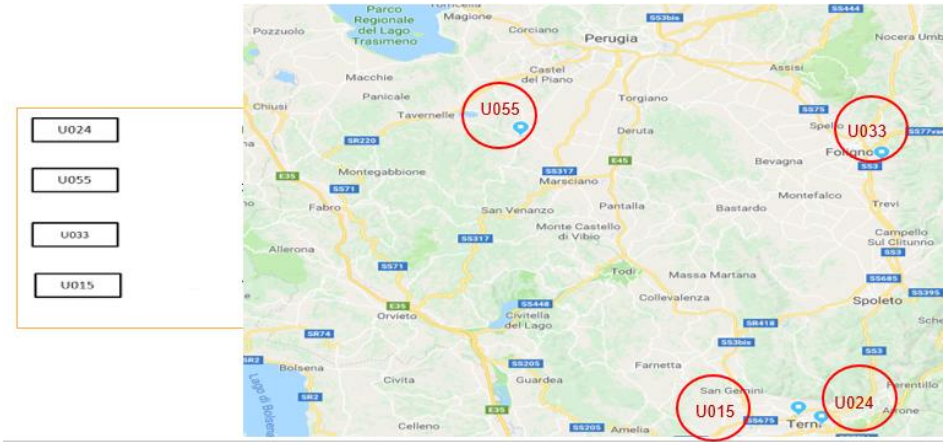
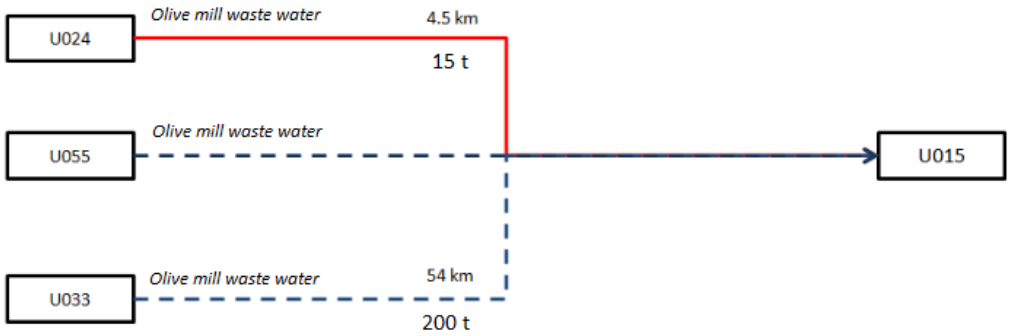
Industrial Symbiosis – case study

HANDBOOK FOR VALORIZATION OF WASTE FROM OLIVE PRODUCTION

Geo-localization → Coding → Synergy scheme





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Industrial Symbiosis – case study

BAU Scenario						
Company	***Resource***	***Quantity (t/y)***	***Disposal unit cost (€/y)***			***Total costs (€/y)***
Output	Description					
U024	*Olive mill waste water*	*15*	*3*			45
U033	*Olive mill waste water*	*200*	*3*			*600*
Company	***Resource***	***Quantity (t/y)***	***Unit purchase cost (€/t)***	***Unit shipping cost (€/t)***	***Unit management cost (€/t)***	***Total costs (€/Y)***
Input	Description					

Industrial Symbiosis Scenario						
Company	***Resource***	***Quantity (t/y)***	***Disposal unit cost (€/y)***			***Total costs (€/y)***
Output	Description					
U024	*Olive mill waste water*	*15*	*0*			*0*
U033	*Olive mill waste water*	*60*	*0*			*0*
Company	***Resource***	***Quantity (t/y)***	***Unit purchase cost (€/t)***	***Unit shipping cost (€/t)***	***Unit management cost (€/t)***	***Total costs (€/a)***
Input	Description					
U015	*Olive mill waste water*	*75*	*0*	*12,2*	*3*	*1140*

COMMERCIAL PROFITS WITH HIGH REVENUES GOOD PRODUCT SALES

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Industrial Symbiosis – case study

Waste

Olive mill waters

extraction of polyphenols through a chemical process

✓ Production of nutraceutical substances for pharmaceutical and food uses

- COSMETIC INDUSTRY
- PHARMACEUTICAL INDUSTRY
- FOOD (FOOD SUPPLEMENTS)

Classificazione ATECO 2007

DENOMINAZIONE ATECO: » G COMMERCIO ALL'INGROSSO E AL DETTAGLIO; CODICE ATECO:

COMMERCIO AL DETTAGLIO DI PRODOTTI MACROBIOTICI E DIETETICI 47.29.30

DENOMINAZIONE ATECO: » C ATTIVITÀ MANIFATTURIERE CODICE ATECO:

FABBRICAZIONE DI MEDICINALI ED ALTRI PREPARATI FARMACEUTICI 21.20.09

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Industrial Symbiosis – case study

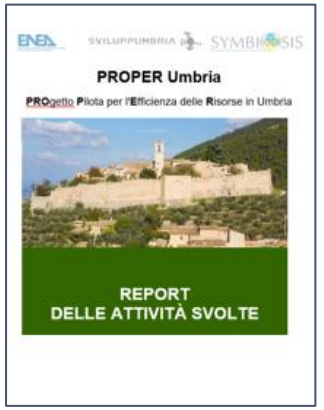
Pilot for the Efficiency of Resources in Umbria "PROPER Umbria" Project -2018
developed by Enea and Sviluppumbria Regional Agency for Umbria's competitiveness and economic growth

Two tools developed by Enea to make more efficient productive processes:

- Resource Audit as an internal evaluation to make more efficient the production process
- industrial symbiosis as an external choice for valorize waste, by-product, residues;

PROPER Umbria Project provides to exploit interesting synergies among climate change and resource management policies

"PROPER Umbria" Project offers an opportunity to carry out a preliminary evaluation of Resource management in terms of Emission reduction



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SUN

industrial symbiosis users network

Network italiano di simbiosi industriale

SUN
SYMBIOSIS USERS NETWORK

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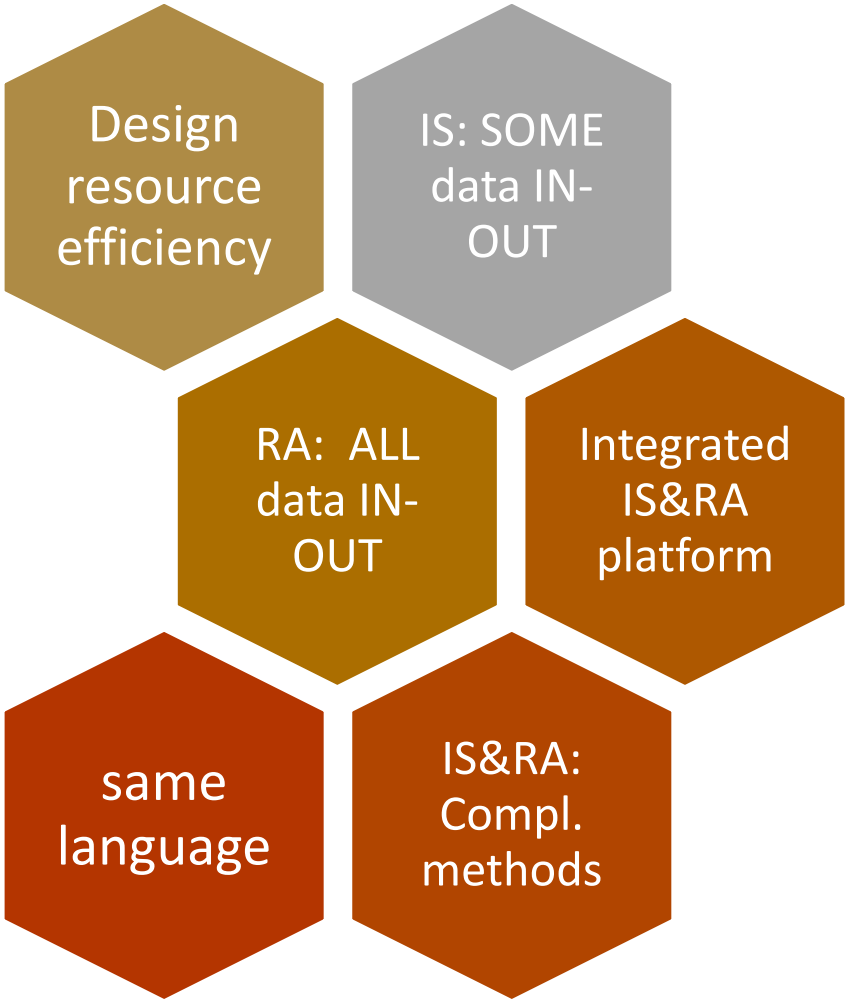
SUN – The network

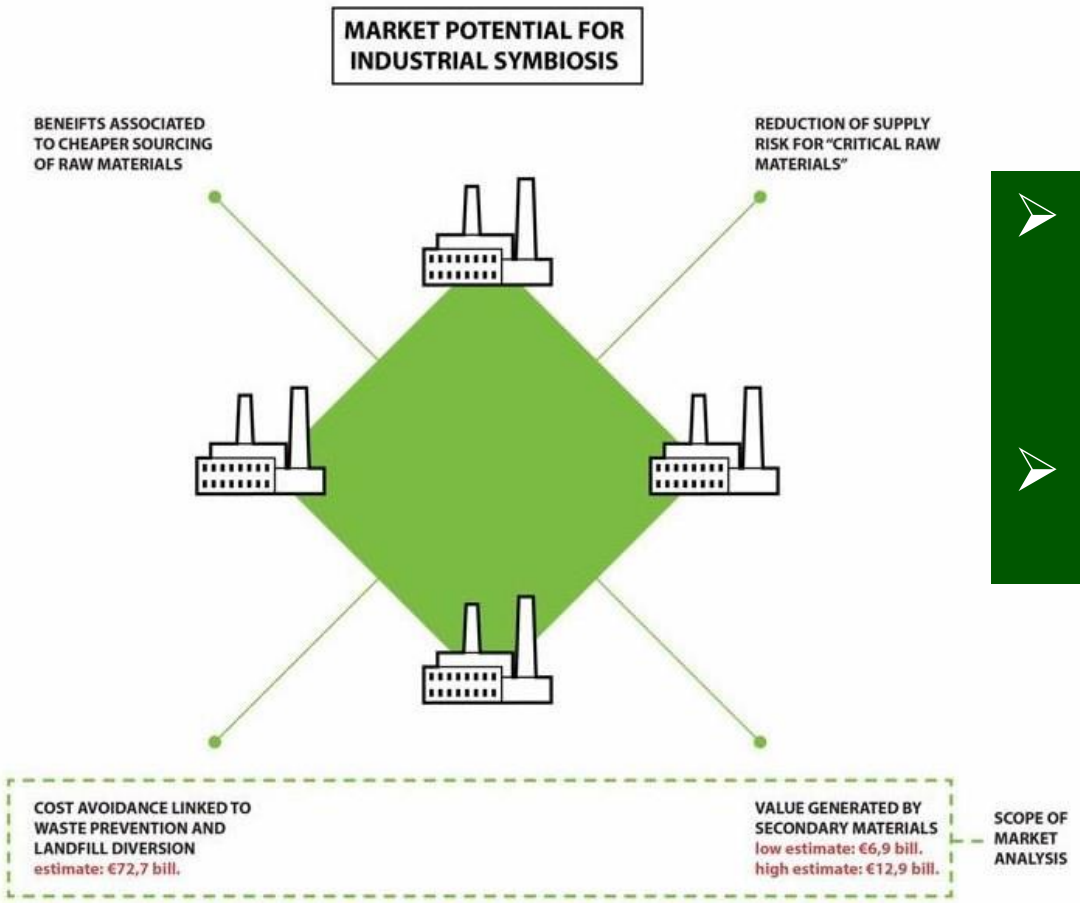
Industrial Symbiosis and Resource Audit



RA – Pilot application 2018 in Umbria Regione "PROPER Umbria" (PROgetto Pilota per l'Efficienza delle Risorse) with Sviluppumbria and Meccanotecnica Umbra – MTU.

Production of carbon and silica rings (for mechanical applications)

Industrial symbiosis potential in EU



- Landfilling diversion savings: 72,7 billion €
- Potential market: 6,9 - 12,9 billion €

Domenech et al. (2018) Cooperation fostering industrial symbiosis market potential, good practice and policy actions Final report, EUROPEAN COMMISSION Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

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Industrial symbiosis potential in EU

waste	Potential market (billion €/ y)
Plastic	2,4
WEEE	2,1 - 3,7
Exhausted oil	1,6
C&D	0,8 - 1,4
Wood	0,6 - 2,7
Textiles	0,27
Food waste	0,1 - 0,43

Potential still under exploited.
In the future potential are estimated also for some specific sectors such as CRM in WEEE, batteries, solar panels

Domenech et al. (2018) Cooperation fostering industrial symbiosis market potential, good practice and policy actions Final report, EUROPEAN COMMISSION Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

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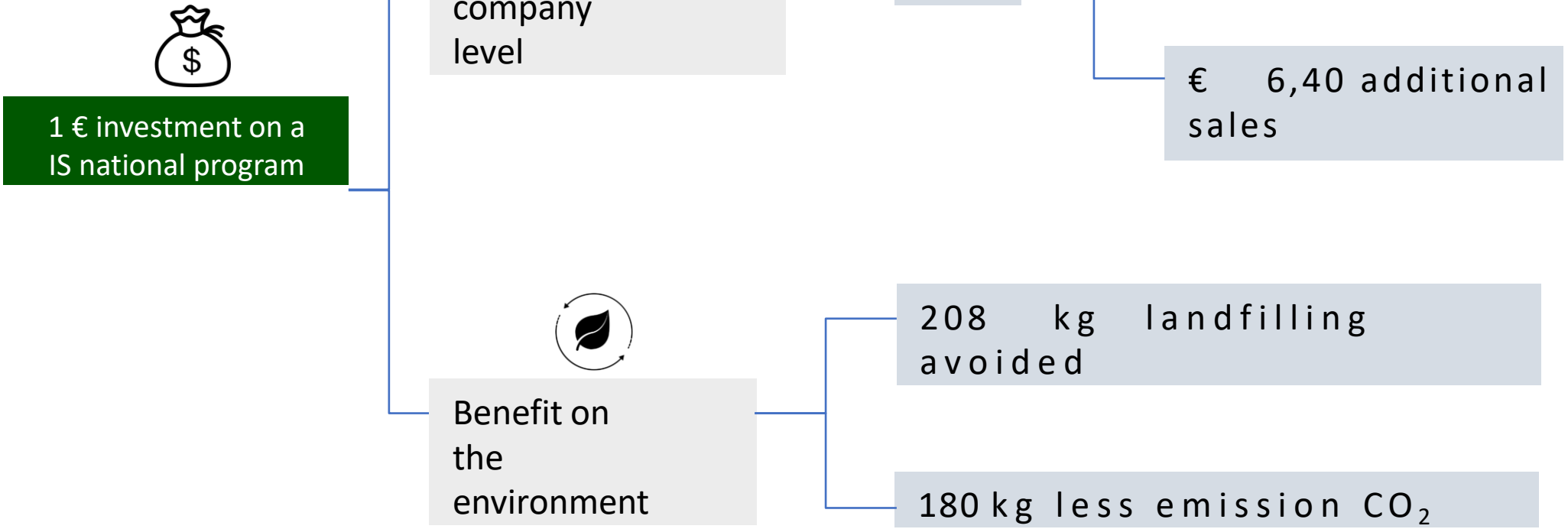
Why national programs on IS?



Domenech et al. (2018) Cooperation fostering industrial symbiosis market potential, good practice and policy actions Final report, EUROPEAN COMMISSION Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

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barriers and d r i v e r s

Regulation and policies

- Uncertainty between by-product and waste
- Not homogenous implementation of regulations in Europe (in Italy too)

Technical and economics

- Environmental and economic costs for transport
- Quality of resources
- Eco-innovation costs
- Availability (and quality) of data for IS

Social

- Confidence between companies-facilitators
- Need of specific professional skills

Regulation and policies

- Clarify regulation and its implementation
- Harmonize regulation and implementation among member state
- Develop specific policies for IS

Technical and economics

- Geo-economic proximity (as enabling factor)
- Design for IS (at company and system level)
- Economy scale at system level (from single to community)
- I-O Data harmonization and cooperative DBs
- New networks and business opportunities
- Fiscal/economic actions to support/boost IS

Social

- Data protection and confidentiality
- Resource value remains local
- New jobs and qualifications
- Collaboration between IS hubs, regional/local agencies and UNI&Research
- New professional skills and qualifications (resource manager)

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Industrial symbiosis

Industrial symbiosis engages industries, and organizations in general , to obtain mutual advantages with sharing of un-exploited or partially exploited resources (materials, energy, water, skills, capacities).

"…There are relationships between industries, sometimes simple, but often quite complex, which enter into and complicate the analysis. Chief among these is the phenomenon of industrial symbiosis. By this is meant the consorting together of two or more of dissimilar industries. …".
Renner, Renner, G.T.. Geography of Industrial Localization. Economic Geography 23, no. 3: 167–189., 1947

"Industrial symbiosis engages traditionally separate industries and other organisations in a network to foster innovative strategies for more sustainable resource use (including materials, energy, water, assets, expertise, logistics etc.)……."
Lombardi & Laybourn, NISP

Italian Ministry for the Environment and Energy Security

Department for Sustainable Development
DG Circular Economy

THANK YOU FOR YOUR ATTENTION!

Director General

Dr. Silvia Grandi, PhD

Email: grandi.silvia@mase.gov.it

https://www.mase.gov.it/pagina/national-sustainable-development-strategy

https://www.mase.gov.it/pagina/economia-circolare

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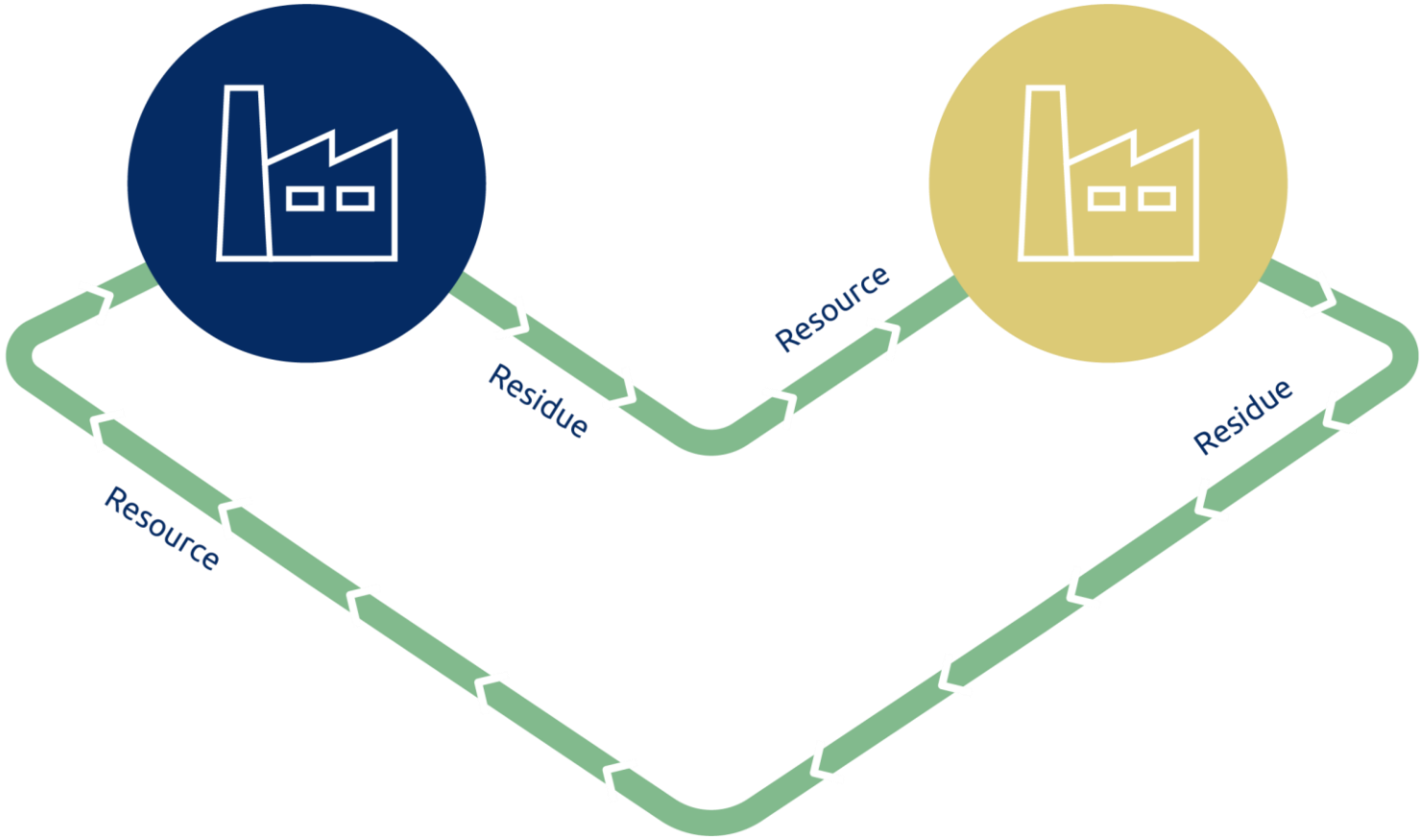
Kalundborg Symbiosis

Surplus from circular production

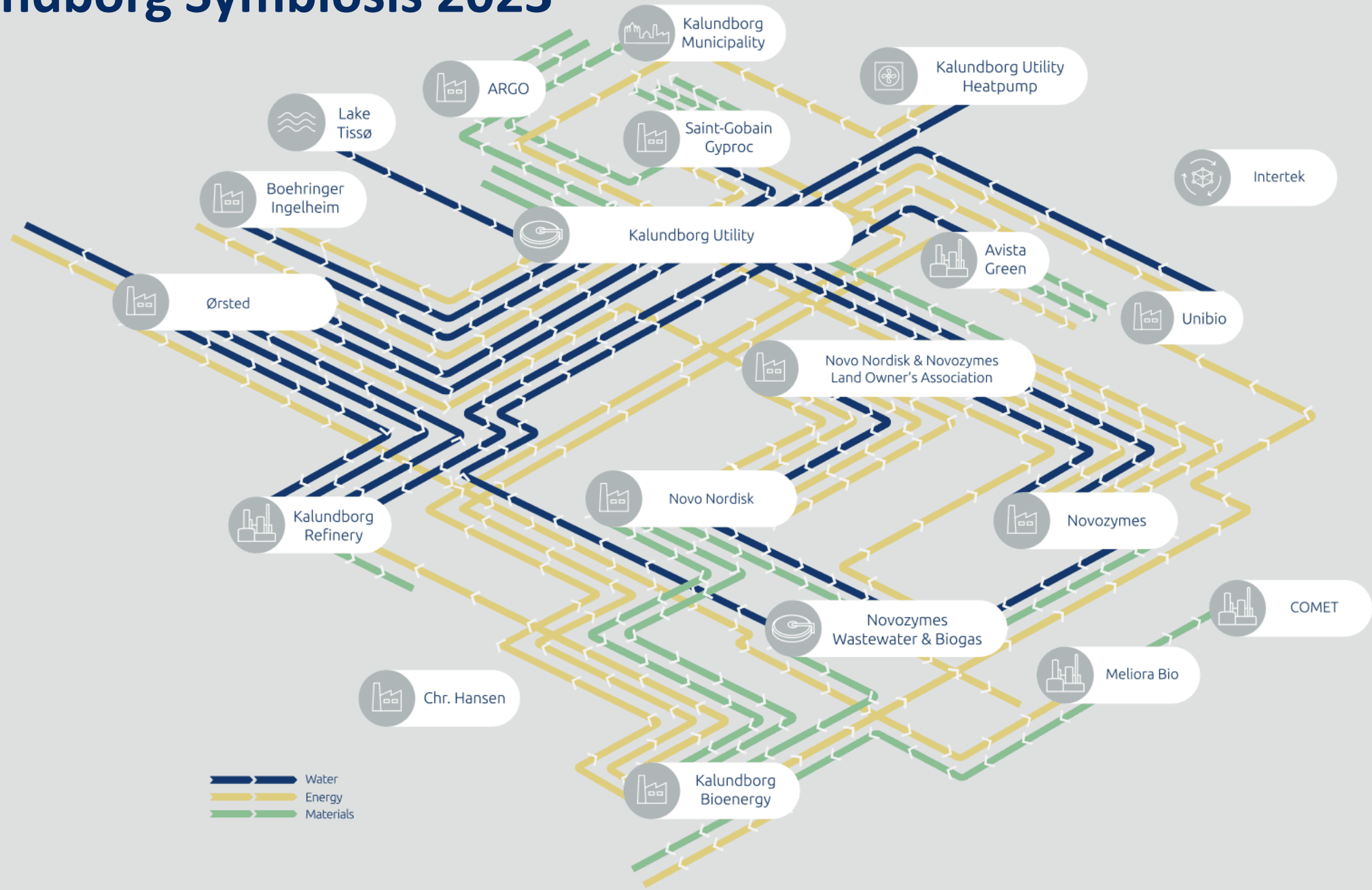
Kalundborg
SYMBIOSIS

The Kalundborg Symbiosis Administration

Industriel Symbiosis



Kalundborg Symbiosis 2023




Kalundborg Municipality
Kalundborg Symbiosis
Novonesis
Avista Green
Novo Nordisk
Novonesis
Boehringer Ingelheim
Kalundborg Utility
Unibio
Intertek
Saint-Gobain Gyproc
COMET
ARGO
Meliora Bio
APM Terminals
Ørsted
Kalundborg Bioenergy
Schultz Shipping Group
Kalundborg Refinery

Kalundborg Symbiosis 2023

AVISTA Green

Mission & Vision

Renew

Strengthening the partnership

Connect

Full resource utilization

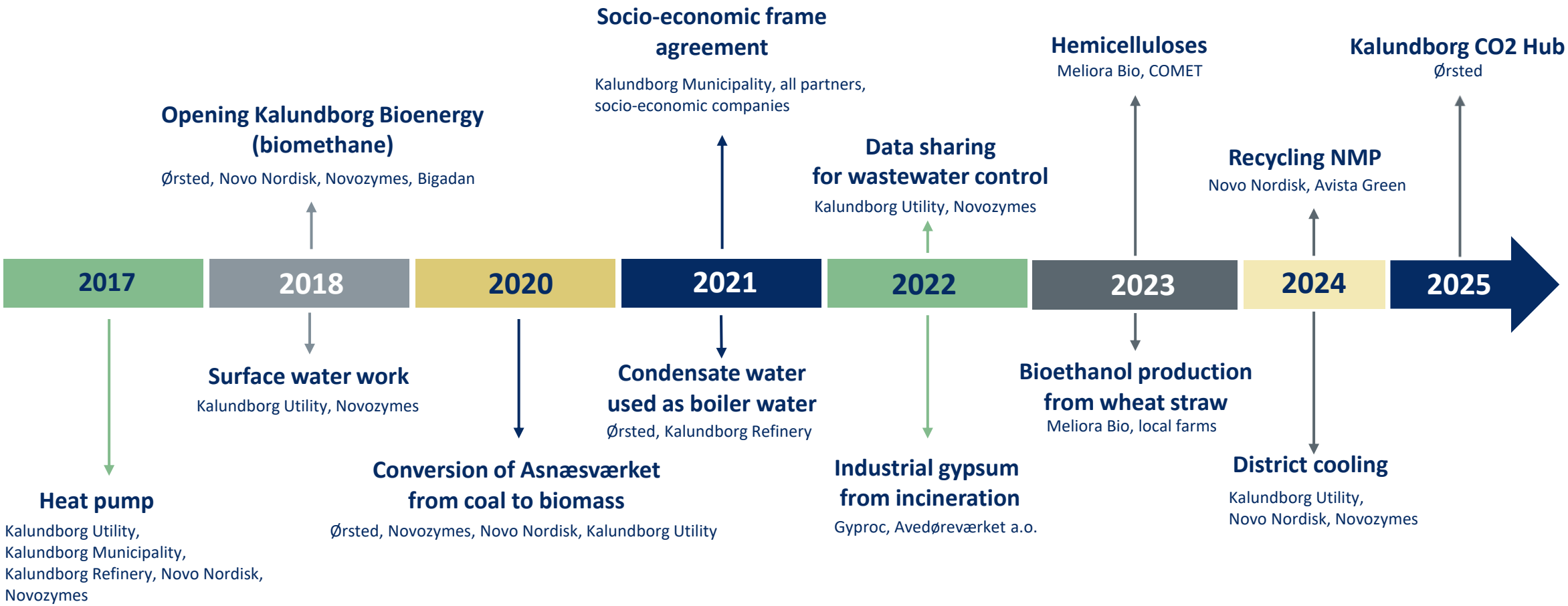
Promote

Sharing the symbiotic mindset

The worlds leading industrial symbiosis with a circular approach to production

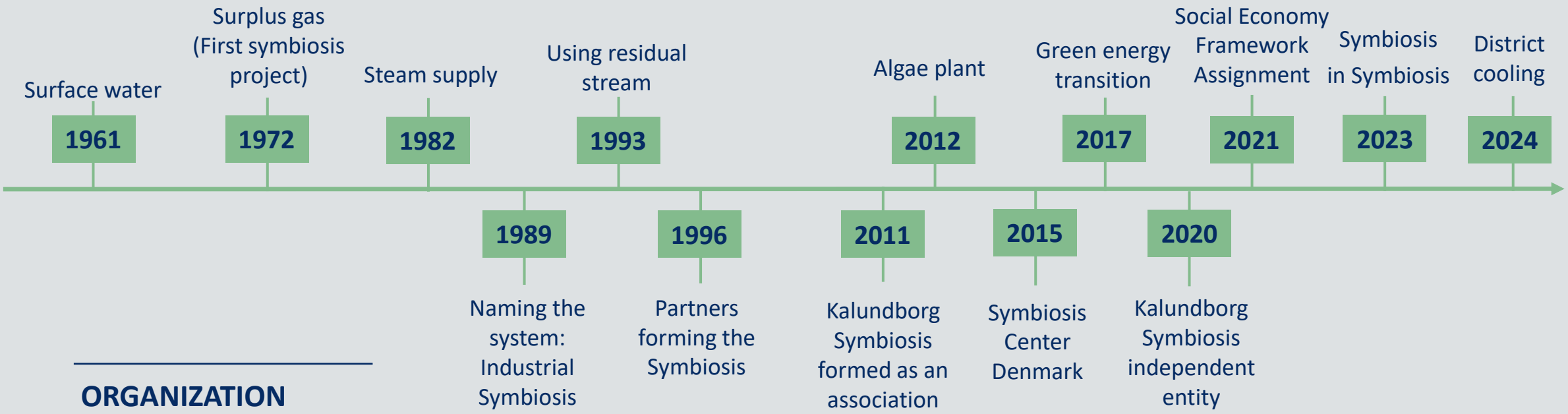
Kalundborg Symbiosis creates sustainable development in our companies through joint projects

10 new streams before 2025



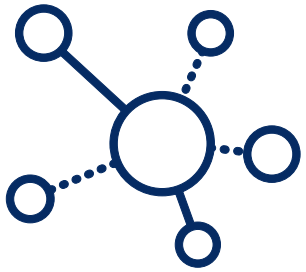
More than 50 years of cooperation

PROJECTS

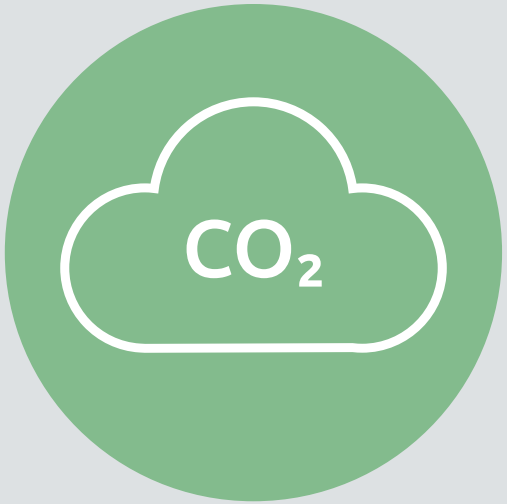


ORGANIZATION

Governance structure



Annual savings (by LCA)



586,000 tons CO_2
The local energy production is now CO_2 neutral

4 million m3
of groundwater

62,000 tons
of residual materials recycled

Examples of local growth

9,3 mia €
investment

The investments create
1,300+ new, permanent jobs

12 new educational programs
in Kalundborg

Value proposition

Resource Efficiency: By sharing resources, such as energy, water, materials, and expertise, industrial symbiosis optimizes resource use, reducing waste and improving overall efficiency.

Cost Savings: Collaborative resource sharing and waste exchange can lead to significant cost savings for participating companies through reduced procurement costs and waste disposal expenses.

Environmental Sustainability: By promoting the reuse of materials and the reduction of waste generation, industrial symbiosis helps to minimize environmental impact, contributing to sustainability goals and regulatory compliance.

Innovation Stimulus: Collaboration within industrial symbiosis networks fosters innovation by encouraging the development of new technologies, processes, and business models to optimize resource use and waste management.

Value proposition - continued

Competitive Advantage: Participation in industrial symbiosis initiatives can enhance a company's reputation and attractiveness to customers, investors, and regulators by demonstrating a commitment to sustainability and responsible resource management.

Resilience and Risk Mitigation: Diversifying resource supply chains and reducing dependency on single sources through industrial symbiosis can enhance resilience to disruptions such as supply chain failures or resource shortages.

Community and Stakeholder Engagement: Industrial symbiosis facilitates collaboration among businesses, government agencies, and communities, fostering positive relationships and creating shared value for all stakeholders involved.

Long-Term Viability: By promoting circular economy principles and sustainable business practices, industrial symbiosis contributes to the long-term viability and prosperity of participating industries and the broader economy.

Value proposition – last but not least!

ESG compliance:

When implementing IS solutions it will help companies adhere to Environmental, Social, and Governance (ESG) principles, guidelines, regulations, and standards in its business operations and practices.

Communication, awareness and capacity building !

Kalundborg Symbiosis

Surplus from circular production

For more information please contact:

symbiosecenter@kalundborg.dk

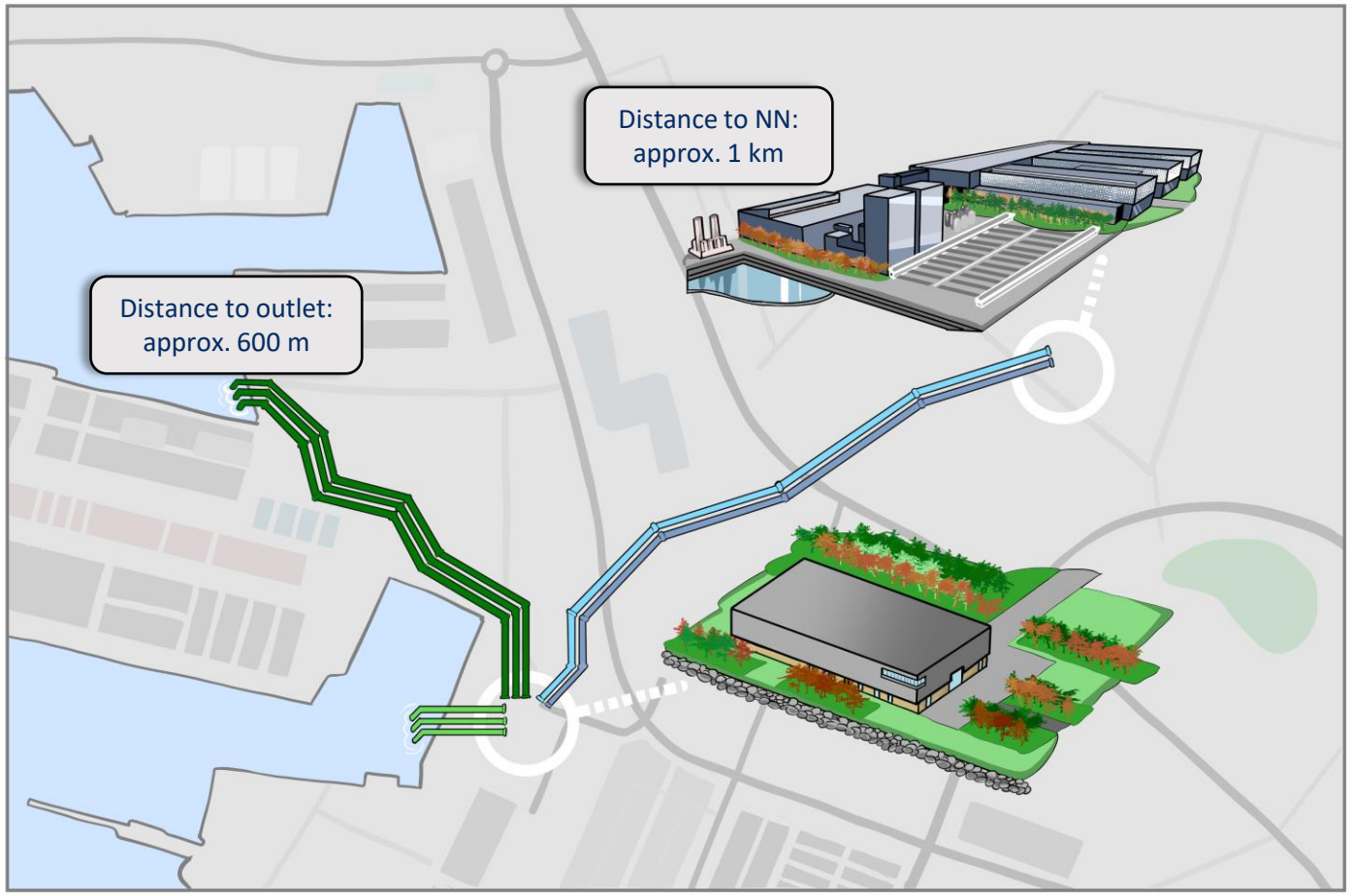
District cooling/excess heat

The biggest industrial combined cooling and heating central in Northern Europa

Saving water and chemicals, utilizing the potentials of excess heat

Key numbers behind the closed loop facility:

- Investments: 188 mil €
- Approx. 2 X 1 km underground pipes, Ø2 m
- Operating in 2025
- Capacity: 166 MW cooling
- Sea water intake: 18.000 m^3/h (max)
- Temperatures on the water flows:
  - Cooling for Novo Nordisk / Novozymes: 22,5^0 C
  - Heating from Novo Nordisk / Novozymes: 31,5^{0}C
- Back-up chillers: 10 MW

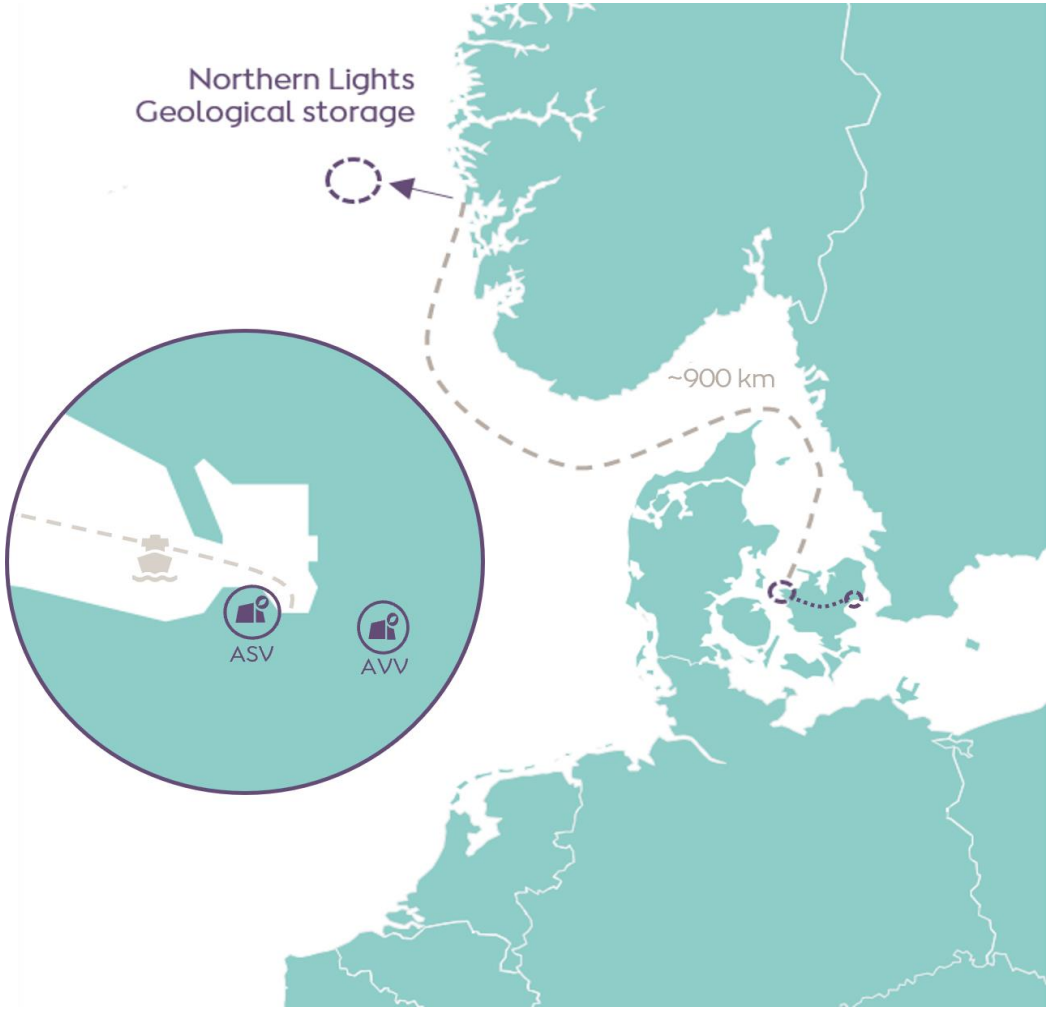


More info here: Nordeuropas største industrielle fjernkøl- og varmecentral | Kalundborg Forsyning (kalfor.dk)

The Ørsted Kalundborg CO2 Hub establishes a key starting point for CO2 infrastructure centrally in Denmark, capturing & storing 430,000 tonnes CO2 annually

Key numbers behind the CO2 infrastructure:

- Project is based on a portfolio of two-point sources to deliver the contracted CO_2 quantity of 430,000 tonnes annually:
  - Asnæs Power Station (ASV) with ~280,000 tonnes/annually
  - Avedøre Power Station (AVV) with ~150,000 tonnes/annually
- Commencement of operations end of 2025
- Total funding pool of ~8 bn DKK



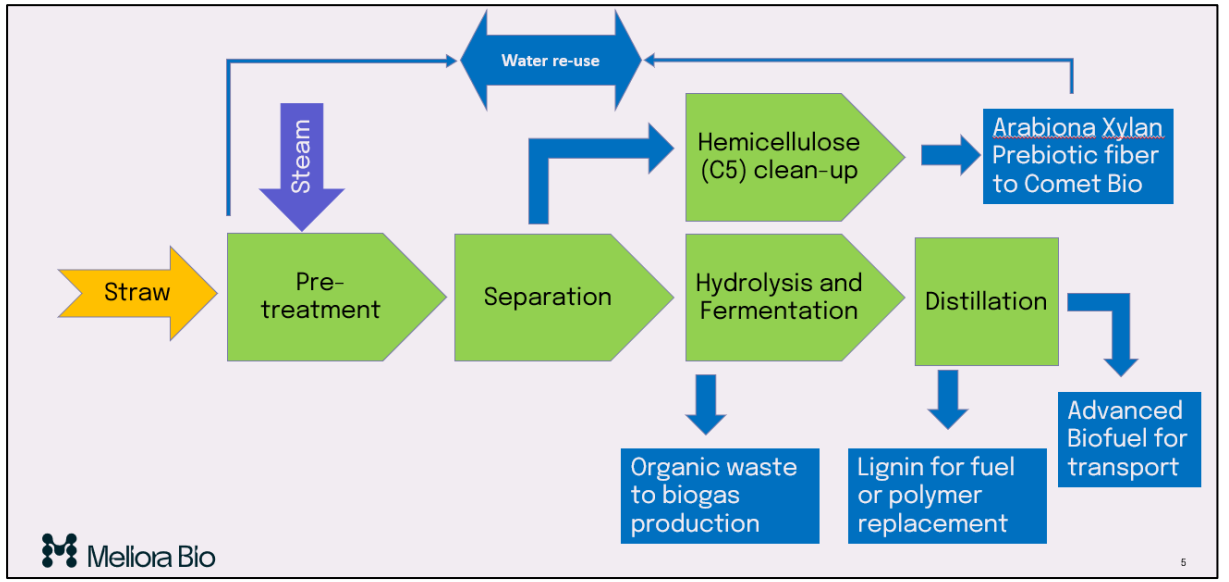
More info here: Carbon Capture & Storage (CCS) | Ørsted (orsted.com)

Ørsted Kalundborg CO2 Hub

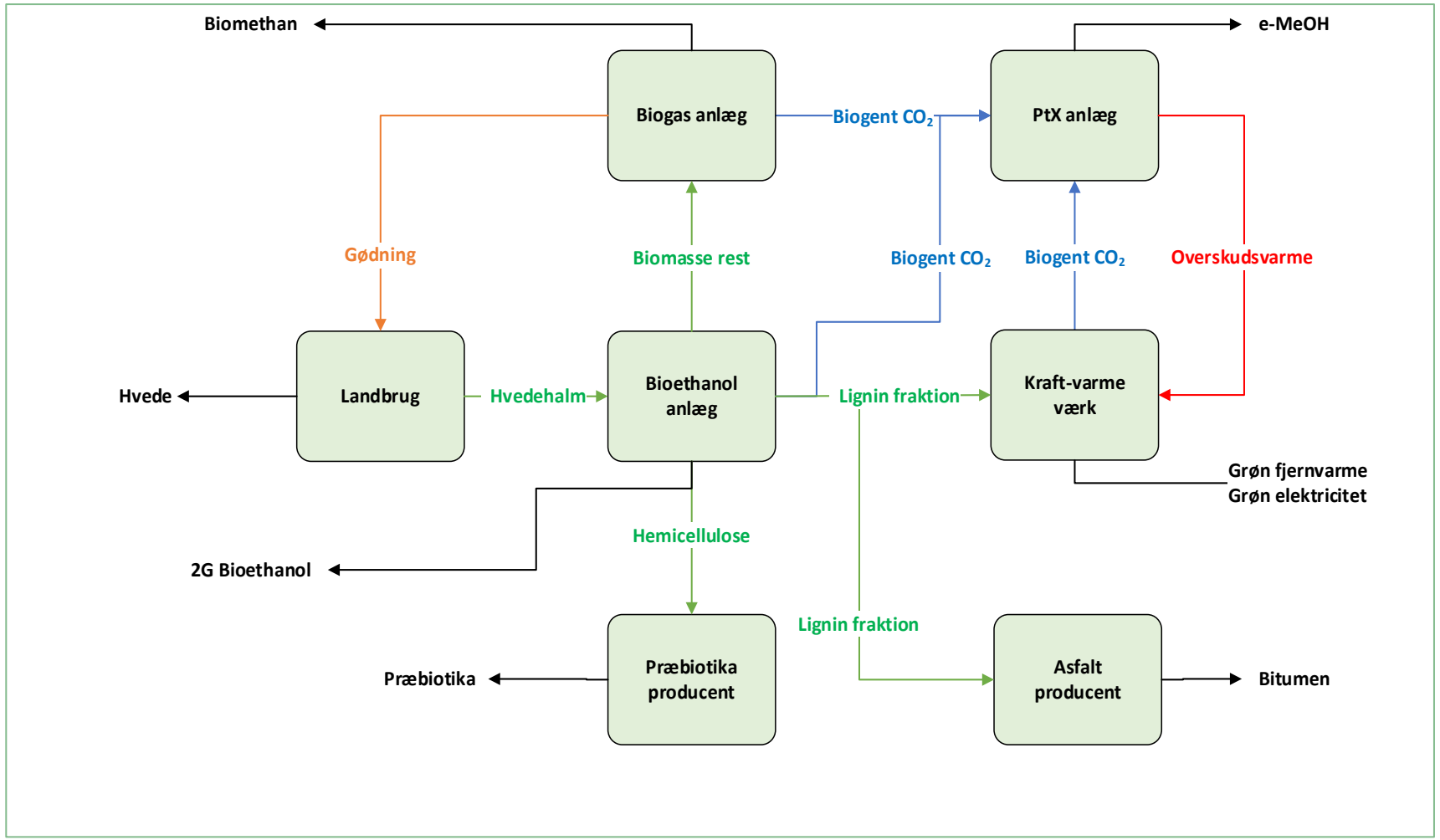
Case: Agro-Urban-Industrial symbiosis

2G Bioethanol production in full scale and related synergies

Biosolution – a biorefinery business model



Agri-Urban-Industrial Ecosystem



Value proposition – key performing indicators (KPI's)

- Local production of 2G bioethanol - approximately 5 million liters/year - saves 88% CO2 compared to gasoline (~10,000 tons of CO2)
- Local recycling of wheat straw residue from agriculture - approximately 35,000 tons/year
- Local utilization of hemicellulose fraction from straw - 28,000 tons/year - for the production of prebiotics - 4,000 tons/year
- Local recycling of wet residual biomass from fermentation - approximately 110,000 tons/year - for biogas/biomethane production
- Local recycling of wet lignin fraction, for example, as fuel or in bitumen production Local point-capture of biogenic CO2 - 140 tons/year - for example, for dry ice or future PtX plants.
- Synergies and value creation for existing local businesses and agriculture Attraction of new companies and investments - estimated 2 new companies
- Job creation - estimated 60 new permanent jobs
- Utilization of locally produced renewable energy

Case: Water sharing

Surface water

Case: Co-production of steam

Energy

Case: Biogas from fermentation sludge

Materials

Case: Social Economy

The triple bottom-line

Case: Purified condensate water

Saving resources in scarcity

Case: Residue from service provider

Collecting residue from laboratories and use it as commodity

Case: From waste to raw material

Additional material to biogas production

Kalundborg Symbiosis

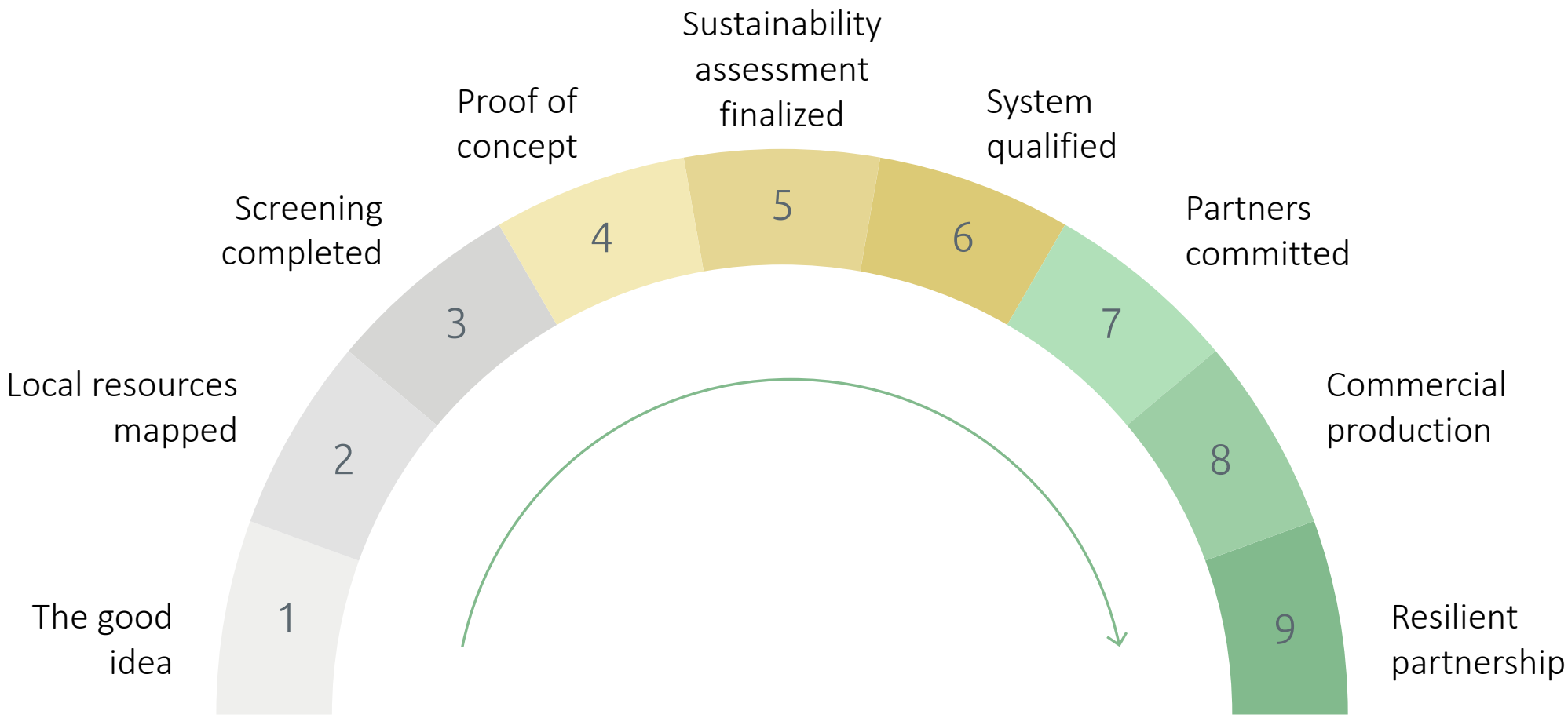
Surplus from circular production

For more information please contact:

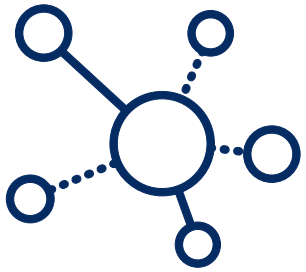
symbiosecenter@kalundborg.dk

Symbiosis guided tour

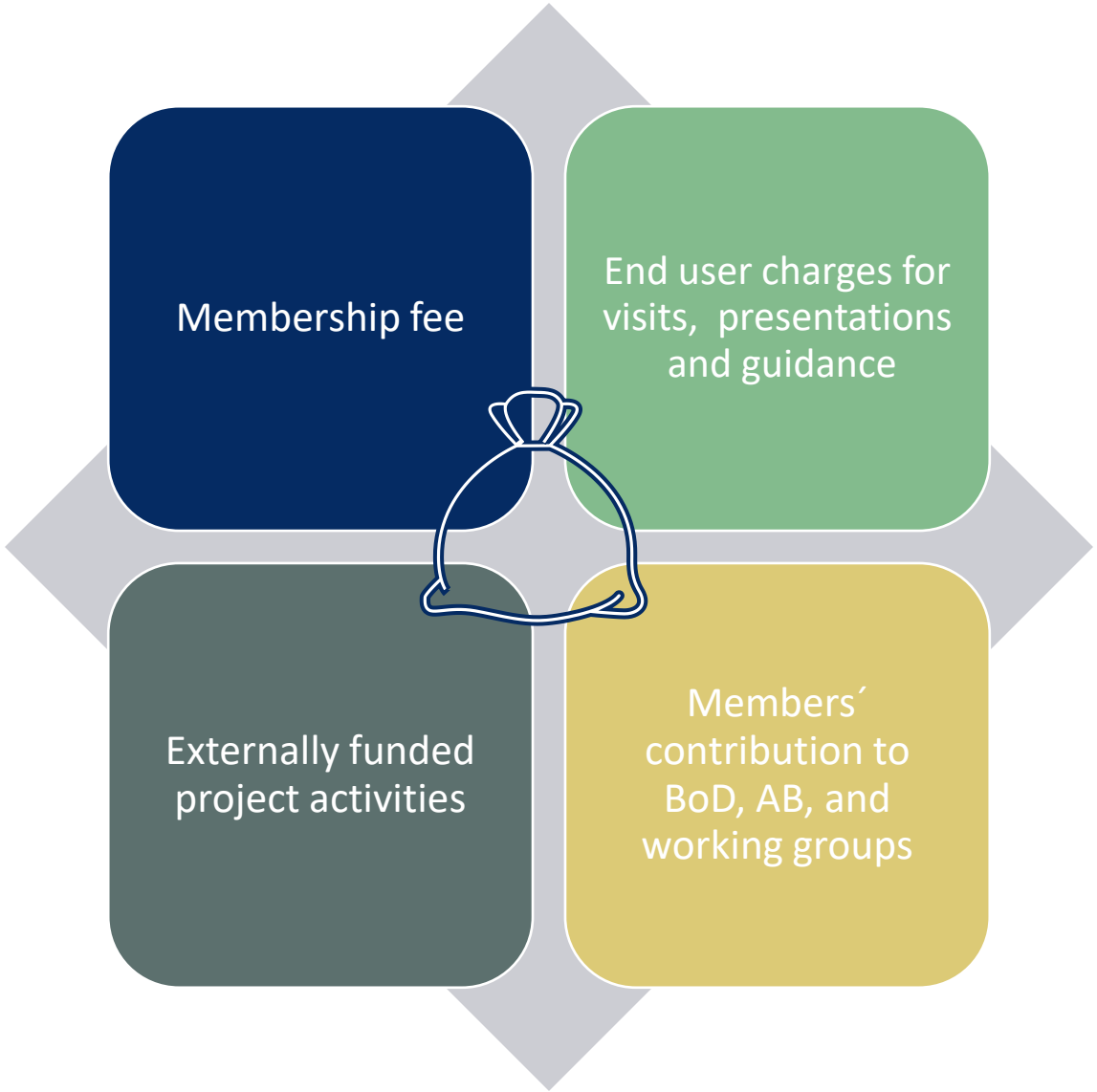
Symbiosis Readiness Level



Governance structure



Funding


Membership fee
End user charges for visits, presentations and guidance
Externally funded project activities
Members´ contribution to BoD, AB, and working groups

Annual membership fee 2023

More than 300 employees	115.500 DKK
Less than 300 employees	69.500 DKK
Associated membership	29.500 DKK

Gains from your membership

- Network with industrial partners, local authorities and utilities in Kalundborg
- Access to new streams – better resource utilization
- Innovation, for instance through participation in international projects
- Employee development
- International branding

Innovation tracks

Fast track – INNOVATION BOARD

No wrong door

Due diligence

Meeting with Innovation Board

Decision, reach out, mapping

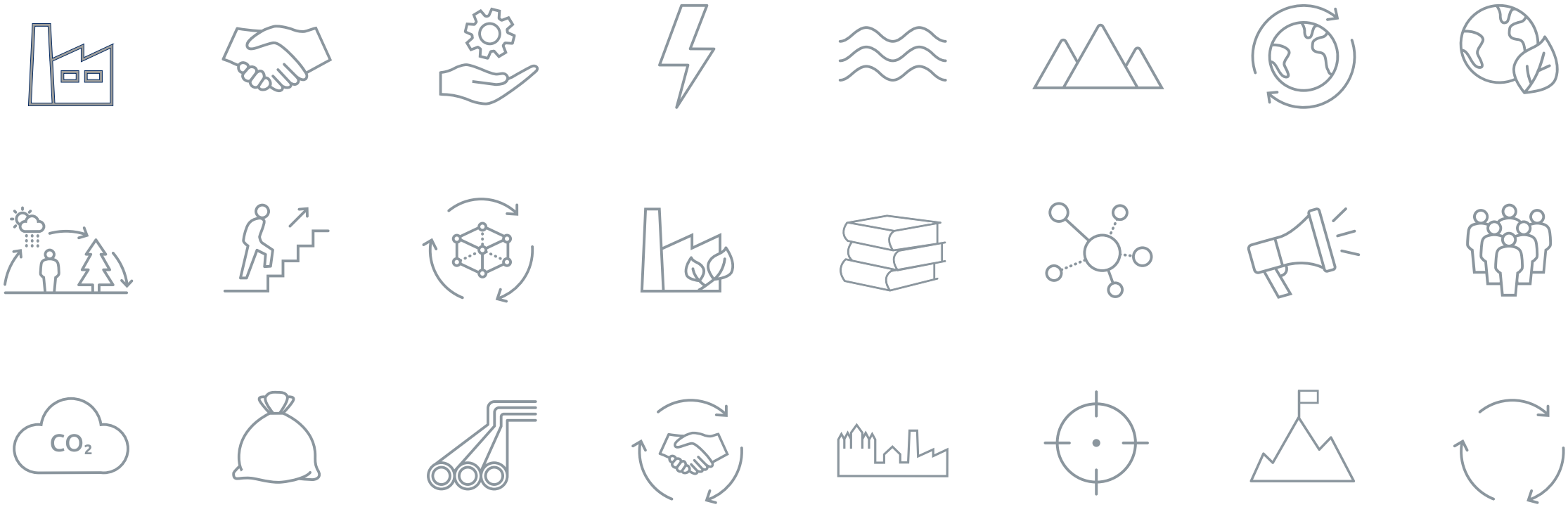
Final feed back

Slow track – ADVISORY BOARD

The symbiosis concept

Helix Lab

Ikoner



technopolis group

POLICY DISCUSSION ON INDUSTRIAL SYMBIOSIS AND GOOD PRACTICE EXCHANGE

Connecting IS stakeholders across borders: insights from CircLean and H4C ECoP

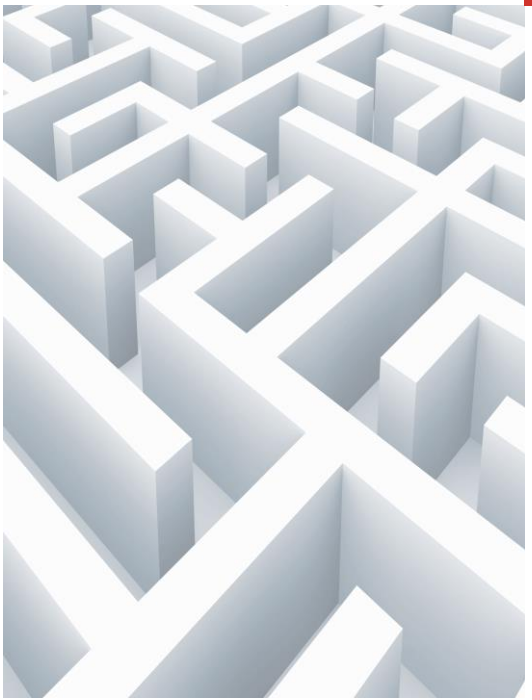
Luigi Lo Piparo

Hubs4Circularity COMMUNITY OF PRACTICE

2018 EC study 'Cooperation fostering industrial symbiosis: market potential, good practice and policy actions'

- **Led by Technopolis Group**
  - with University College London, International Synergies, Trinomics, and TNO.
- **European businesses could save up to €72.7b** by diverting waste from landfills
- **Between €7b and €13b could be generated through transactions of secondary raw materials**.
- Many new **'green' jobs** could be created.

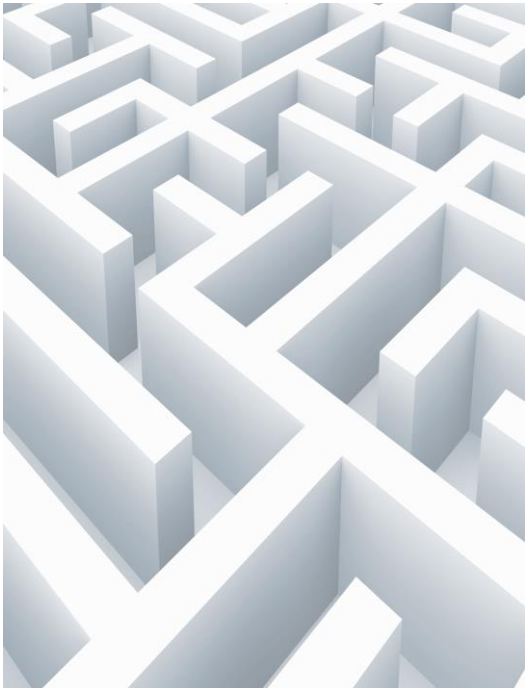
The market potential of IS remain underutilised...



WHY?

- **Cultural barriers**
  - many are still **comfortable with business-as-usual** practices in dealing with the waste and not open to invest in changes
  - perceived **complexity**
  - **trust**
- **Technological barriers**
  - **unavailability of technologies** that allow the transformation or clean-up of the waste stream so that it can be used as a resource
  - **price of available technology** does not guarantee the commercial viability of the synergy
- **Financial barriers**
  - **High dependence of public funding**
  - Lack **of funding schemes**, and **incentives** for the use of secondary raw materials
  - Perceived **risks** (e.g. initiation upfront costs, negotiation costs) and **unclear benefits** (low profit margins, low prices for virgin materials)

- **Geographical / physical barriers**
  - dispersed production / storage sites
- **System and market failures**
  - **different level of landfilling costs** in different countries
  - **unharmonised regulatory frameworks** (e.g. concepts of 'by-products' and 'End-of-Waste' criteria)
  - **lack of standards**
- **Informational barriers**
  - **lack of knowledge** on resources and waste streams generated by others
  - **Information asymmetries** demand vs supply
  - lack of **recognition**, and **awareness** on impact/benefits



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CircLean

European Network of Businesses and SMEs for Industrial Symbiosis

European Commission

KEY FACTS:

- **Contracting Authority**: EC, DG GROW
- **Project value**: € 1,195,750
- **Duration**: 3 years (2019–2022)
- **Website**: **circlean-symbiosis.eu**
- **Contractor:**

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International Synergies
industrial ecology solutions

Trinomics

Arctik

eit RawMaterials Connecting matters

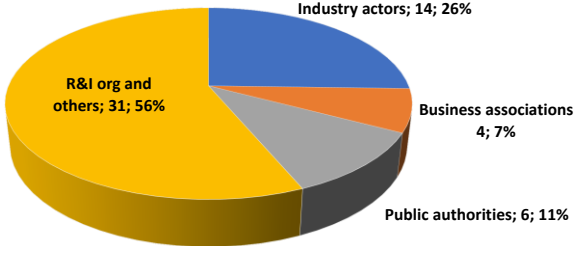
ACR+

SPIRE Sustainable Process Industry through Resource and Energy Efficiency

The CircLean Network

58 Members from:

- Industry Actors
- Business Associations
- Public Authorities
- Research & Innovation stakeholders



21 countries represented

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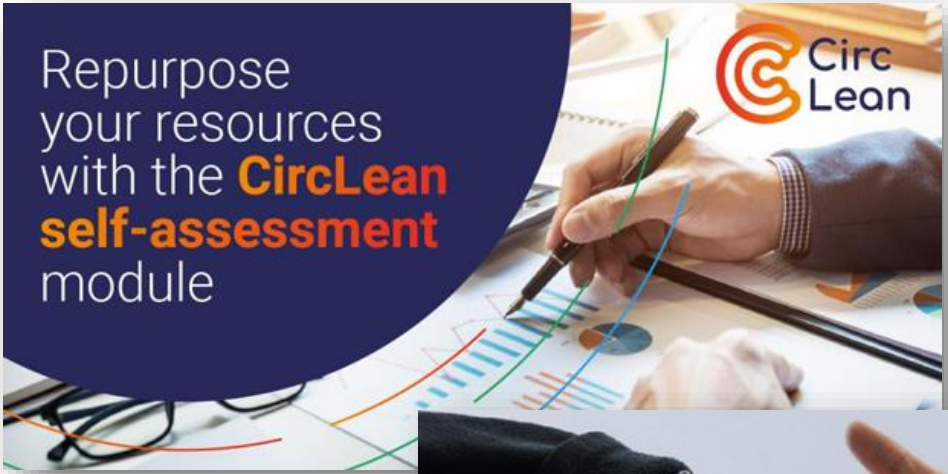


The Self-Assessment web module & Matching tool

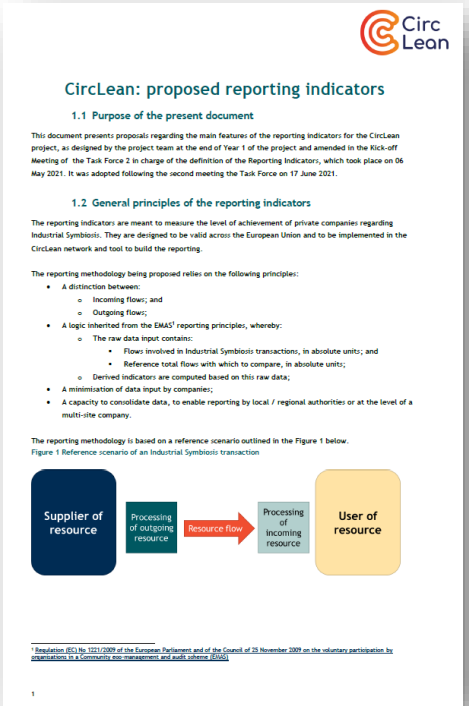
Guided learning for companies
Three-stage assessment process of site resources
Marketplace for industrial symbiosis synergies


Circ
Lean
Be a pioneer of the
CircLean reporting methodology


Recognise
industrial symbiosis
efforts with the
CircLean label
Circ
Lean

CircLean Reporting methodology

- Methodology differentiating **incoming/ outgoing flows**
- Logic including **raw input data** (with minimal input by companies) and derived indicators
- Capacity to **consolidate data**, to enable reporting by local / regional authorities or at the level of a multi-site company
- Also **economic and social indicators**



Circ Lean

CircLean: proposed reporting indicators

1.1 Purpose of the present document

This document presents proposals regarding the main features of the reporting indicators for the CircLean project, as designed by the project team at the end of Year 1 of the project and amended in the Kick-off Meeting of the Task Force 2 in charge of the definition of the Reporting Indicators, which took place on 06 May 2021. It was adopted following the second meeting the Task Force on 17 June 2021.

1.2 General principles of the reporting indicators

The reporting indicators are meant to measure the level of achievement of private companies regarding Industrial Symbiosis. They are designed to be valid across the European Union and to be implemented in the CircLean network and tool to build the reporting.

The reporting methodology being proposed relies on the following principles:

- A distinction between:
  - Incoming flows; and
  - Outgoing flows;
- A logic inherited from the EMAS[1] reporting principles, whereby:
  - The raw data input contains:
    - Flows involved in Industrial Symbiosis transactions, in absolute units; and
    - Reference total flows with which to compare, in absolute units;
  - Derived indicators are computed based on this raw data;
- A minimisation of data input by companies;
- A capacity to consolidate data, to enable reporting by local / regional authorities or at the level of a multi-site company.

The reporting methodology is based on a reference scenario outlined in the Figure 1 below.

Figure 1 Reference scenario of an Industrial Symbiosis transaction

[1] Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS)

1

European IS Label

Certificated voluntary compliance with the project's IS reporting standards

H4C European Community of Practice (ECoP)

KEY FACTS:

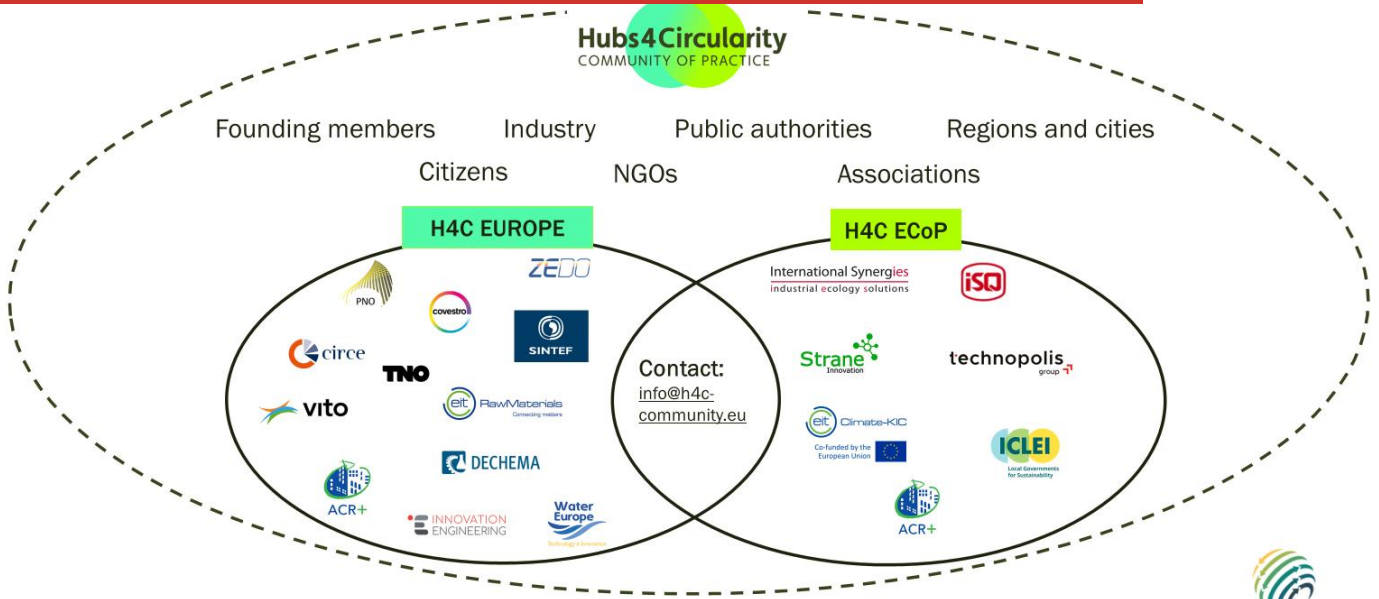
- **Grant agreement ID:** 101058656
- **Project value**: € 1 658 186,25
- **Duration**: 4 years (2022–2026)
- **Website**: https://www.h4c-community.eu/the-h4c-ecop-project/
- **Contractor:**

Co-funded by the European Union

H4C ECoP project structure & objectives

- **To build a dynamic and productive European Community of Practice around industrial-urban symbiosis and circular use of resources**, building on existing Hubs and their local communities
- To **provide collective learning materials and resources via the knowledge platform**.
- **Developing and activating the community** through workshops and training at the local and pan-EU level
- **Identifying the regions and areas best suited for implementing advanced industrial-urban symbiosis** in Europe
- **Measuring results and impact** through key performance indicators
- **Ensuring long-term continuity of community and work** through appropriate investment and governance strategies

Two projects with a joint vision for the community



Contact: info@h4c-community.eu

PROCESSES4PLANET

Services to accelerate

Training and support on **business modelling and governance models** for H4C Organisations/Facilitators
Training and support on **funding and finance** for H4Cs
Training on **Industrial Symbiosis and Circular Economy**
Support to build **business-to-territory stakeholder networks**
Support data-collection and analysis for **IS opportunity identification**
Support **assessment of Industrial Symbiosis KPIs**
Technology **scale-up support**

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Access to knowledge

Case studies, examples and learnings SCALER overview of 100 sound IS opportunities
An overview of relevant **skills profiles and training blueprint** (+ access to training materials and platform)
Guides and Manuals for cities, regions, industries, communities and Hubs on I-US
(Self) assessment tools for Hubs and organisations to evaluate (KPIs) or support the IS exploitation opportunities
Searchable database of funded IS, I-US, CE projects, patents and papers
Relevant results (knowledge, tools, roadmaps etc) from publicly-funded IS, I-US and CE projects
Funding Guide to advance H4C activity

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Thank you for your attention!

Luigi Lo Piparo
luigi.lopiparo@technopolis-group.com

ZAG

ZAVOD ZA GRADBENIŠTVO SLOVENIJE

SLOVENIAN NATIONAL BUILDING AND CIVIL ENGINEERING INSTITUTE

Ministero degli Affari Esteri e della Cooperazione Internazionale

Funded by the Ministry of Foreign Affairs and International Cooperation

Industrial symbiosis with construction sector and examples from Slovenia

OECD – Supporting Green Transition in the Western Balkans – Regional Policy Peer Dialogue

OECD

BETTER POLICIES FOR BETTER LIVES

Dr. Alenka Mauko Pranjić, Univ. Dipl. Inž. Geol.
Head of Department of Materials

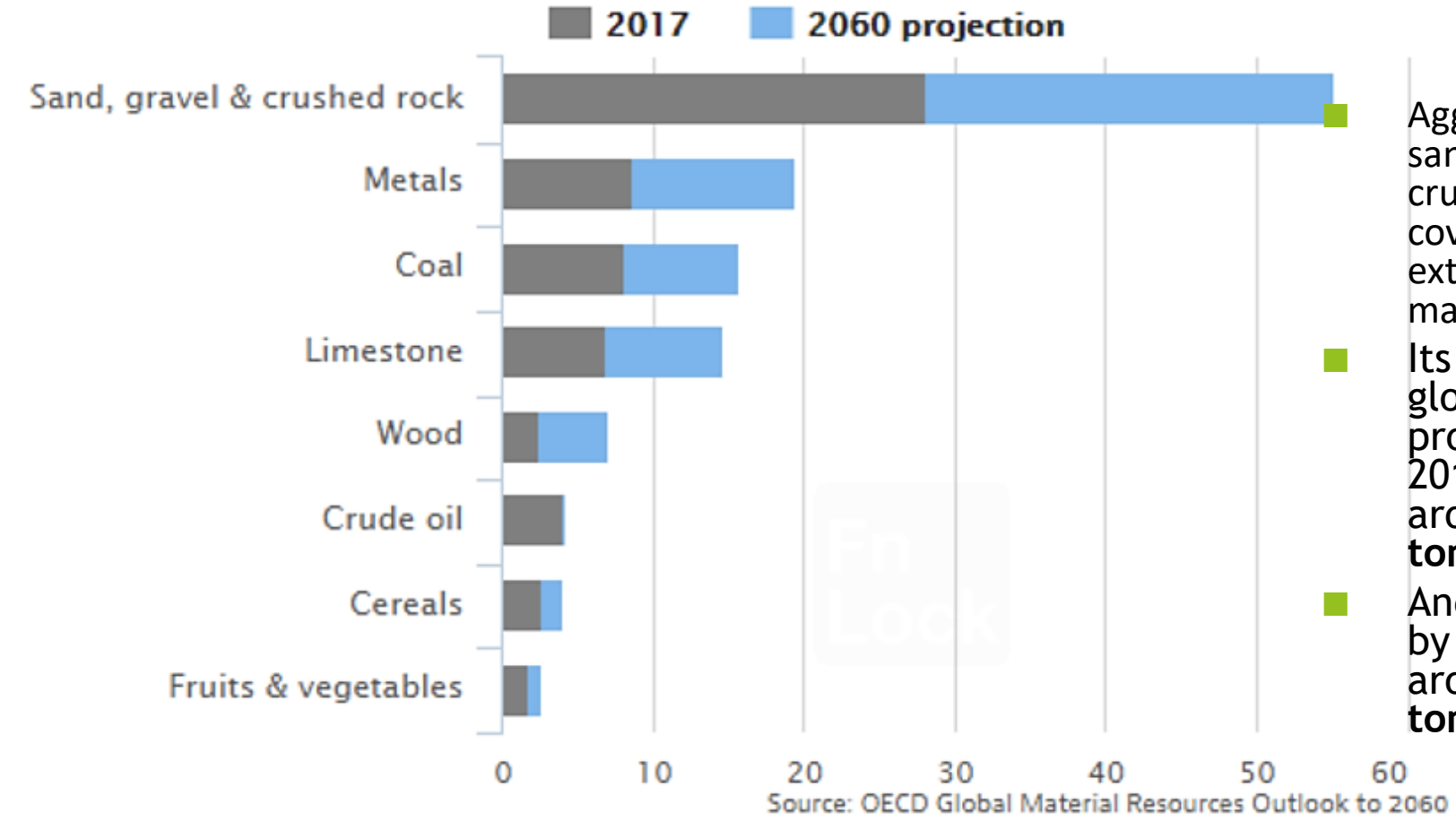
Brussels, 17. 4. 2024

Slovenian National Building and Civil Engineering Institute

- Public Research Institute
- R&D and market activities
  - ca. 260 employees
    - 1949 establ.

Construction materials dominate resource consumption

Consumption in gigatonnes



- Aggregate (e.g. sand, gravel and crushed rocks), covers 32% of all extracted materials.
- Its annual global production in 2017 was around **28 Giga tonnes.**
- And will double by 2060 to around **55 Giga tonnes.**

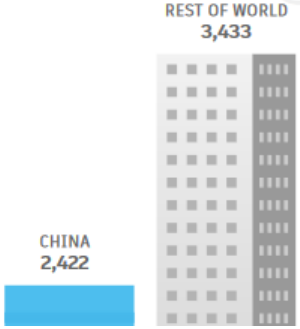
A Roof Over Every Head

More people, more houses

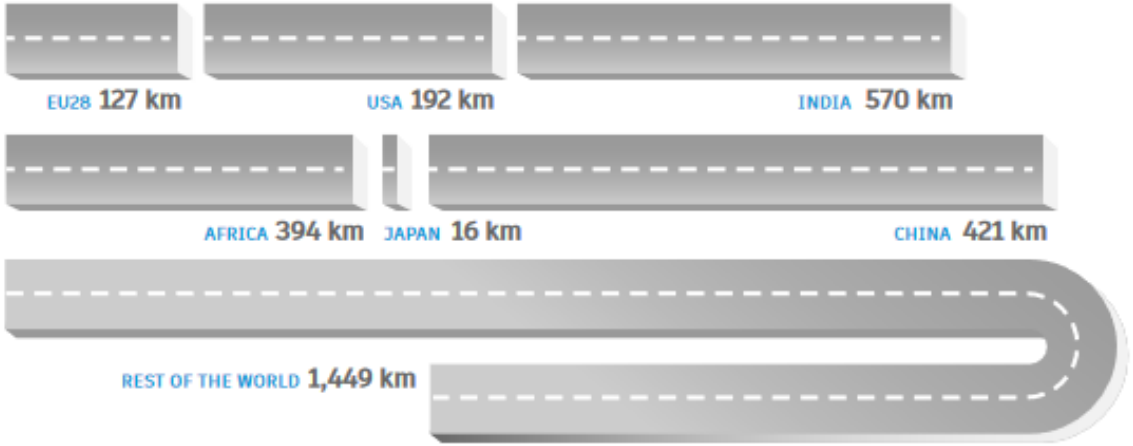
The move to urban areas over the next few decades will impact how people live as well as the number of homes needed. Population growth, combined with an increase in two-person households, means we'll need more than two billion new homes by the end of the century.[3]

urban areas, population density is still a major factor that affects one's personal space. When it comes to housing, urban areas have long been and will long continue to be, defined by multifamily housing.

Between 2018 and 2050, multifamily housing will comprise more than half



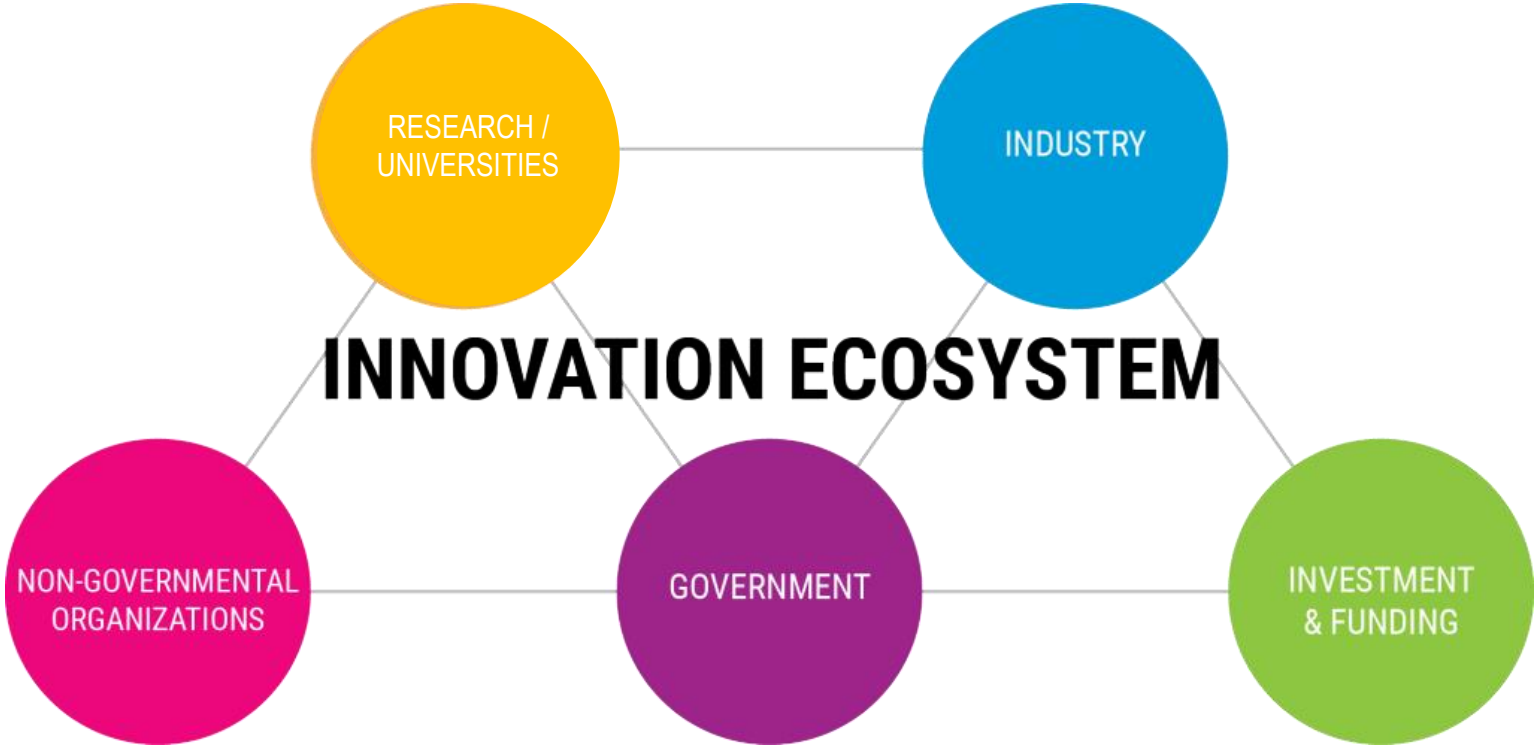
GLOBAL AVERAGE DAILY NEW ROAD & HIGHWAYS CONSTRUCTION



Intensive urbanisation - 68% of people living in cities by 2050*, 784 new homes and 127 km of roads constructed each day until 2050**

United Nations, ** World bank, Statista

Innovation ecosystem for industrial symbiosis



- Construction and Demolition Waste
- Waste from thermal processes (slags, fly ashes)
- Mining waste
- MSW

- Use of gasses (e.g. CO2 capturing).

- **Cascade recycling**

- Hidden hazards

- **LEGISLATION**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 776751

CARE
4CLIMATE

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA OKOLJE,
PODNEBJE IN ENERGIJO

UTILISATION OF SECONDARY RAW MATERIALS - Boosting transition to Circular Economy with Industrial Symbiosis

10th and 11th April 2017, CCIS (Hall A), Dimičeva 13, Ljubljana, Slovenia

Monday, 10. 4. 2017

13.00 – 14.00	*Welcoming lunch and registration*
PART 1: Presentation of KIC EIT RawMaterials	
14.00 – 14.10	Welcoming, introduction - *Janja Leban, CCIS and Alenka Mauko Pranjić, ZAG*
14.10 – 14.30	Introducing KIC EIT RawMaterials *- Karen Hanghøj, CEO EIT RawMaterials*
14.30 – 14.50	How to work with KIC EIT RawMaterials? *- Krzysztof Kubacki, CEO of CLC-East*
14.50 – 15.10	EITs and KICs strategy for and in RIS countries *- Markus Klein, Business Developer of CLC-East*
15.10 – 15.30	Successful practice of circular economy at EIT RawMaterials *- Ignacio Calleja, EIT RawMaterials Thematic officer for Circular Economy*

The one-stop shop is the platform that serves you in order to make the transition towards circular activities in the construction sector aiming at zero waste in 2050.

Sign up | Sign in

Business finder

33

Companies in **12** countries

Business model

29

Success cases in **3** countries

Marketplace

1

Secondary-raw materials and products available

- Thank you for your attention!
- alenka.mauko@zag.si