

ECM seminar/webinar

Draghi vs industrial energy clustering – RES2Go tool

7 October 2025

G. Van Eetvelde, N. Dhondt, L. Demolder, L. De Backere, T. Duvillard

ECM WELCOME

TEAM

- ECM: prof.dr.ir. Greet Van Eetvelde, ir. Nienke Dhondt, ir. Lieven Demolder, ir. Louis De Backere, ir. Thijs Duvillard
- EnerGhentIC: dr.ir. Arne De Keyser

MEETING ATTENDANCE

- in person & online ~60p



TIPS FOR A SMOOTH MEETING

- mic & cam only when speaking
- questions & comments via chat or hand
- prioritise questions/comments for debate

mute & dim



open chat



thumb up



ECM SEMINAR AGENDA

MORNING SESSION: SEMINAR & WEBINAR

- 10:00-10:15 Welcome, 25y ECM Greet
- 10:15-10:30 EPOS, AIDRES, PIECE Nienke
- 10:30-11:00 **RES2Go demo** Thijs
- 11:00-11:15 EneMaX Louis
- 11:15-11:30 RISERS Lieven
- 11:30-11:45 TRILATE & PhD Nienke
- 11:45-12:30 Panel debate Greet, Arne; **panellists:**

Manuel von Mettenheim, DG ENER
Bart Adams, INEOS
Pieter Vingerhoets, VITO
Nienke Dhondt, UGent-ECM

WALKING LUNCH

MEET & GREET ECM & ENSY RESEARCHERS till 15:00

25y energy & cluster management at UGent

ECM seminar/webinar

7 October 2025

Prof.dr.ir. Greet Van Eetvelde

INDUSTRIAL SYMBIOSIS [IS]

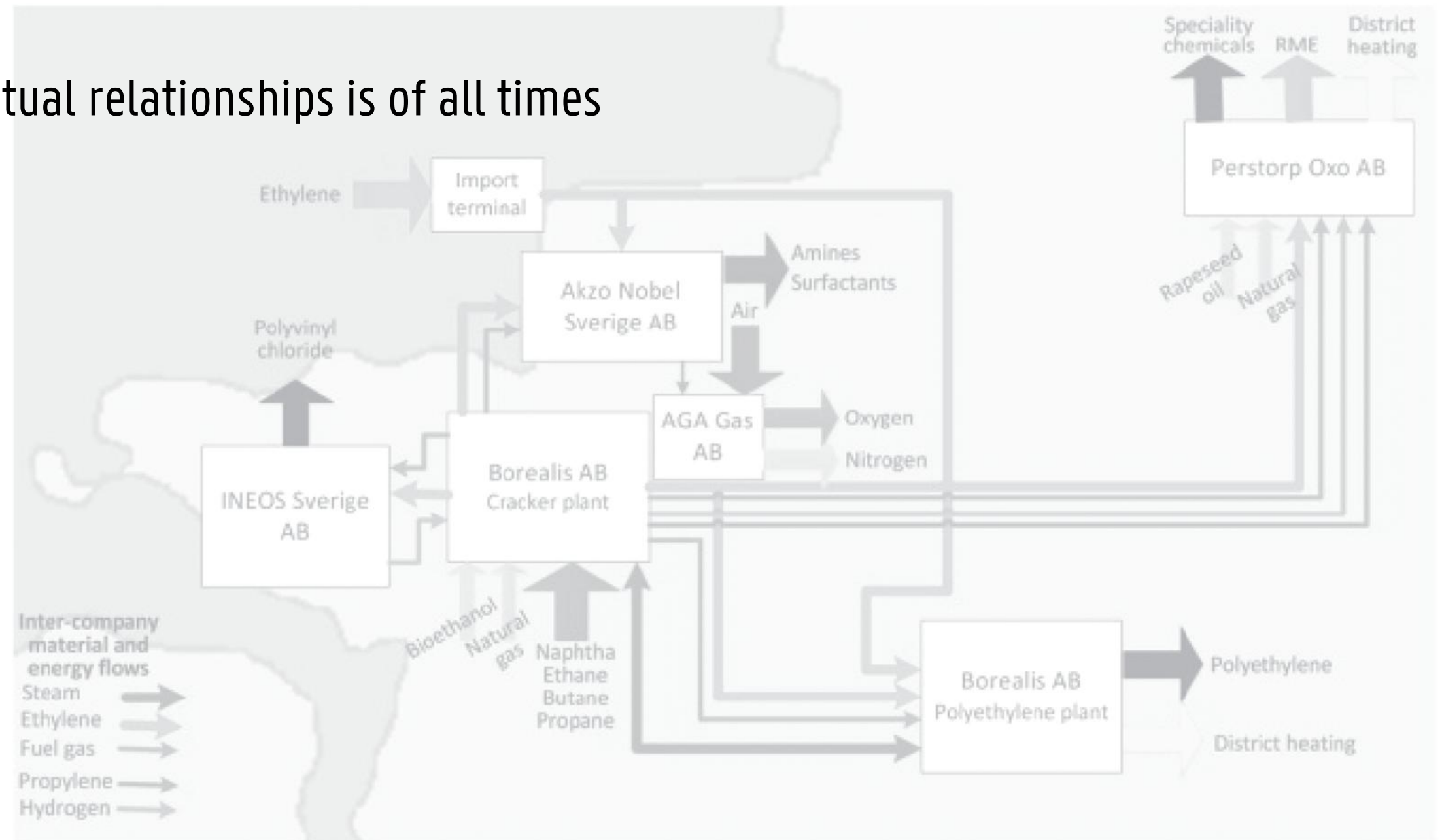
50Y

SYN-BIOS & SYN-ERGON

- living or working together in mutual relationships is of all times
 - economies of scale & scope

INDUSTRIAL ECOLOGY ~CSR, PPP, ESG

- Kalundborg ~1977
- Brundtland ~1987
- Elkington/Lowe ~1997
- J.Ind.Ecol. ~1997
- many authors ~2007
- circular economy ~2017
- Draghi report, EC mission ~2027
- ...



G. Van Eetvelde. Book chapter: Industrial symbiosis. In: Resource efficiency of processing plants. Wiley (2018)

UGENT-ECM: ENERGY & CLUSTER MANAGEMENT

25Y

ENABLING INDUSTRIAL SYMBIOSIS

• facility **clustering** • conference rooms • infrastructure • pipelines • tanks • equipment • machines •
utilities • logistics • purchasing • catering • open days • personnel • job fairs • reception • fire panel
& **services** • gate control • security guards • surveillance • lighting • window cleaners •
building, road & green **maintenance** • water treatment • **waste collection** • storage facilities •
waste streams • waste heat • **wish** • **need** • **duty** • raw materials • renewables • **energy** •
electricity • grid management • VPP • transport service • parkings • carpooling • fitness rooms •
running tracks • **CSR** • site shops • post office • nursery • **catering** • restaurants • ...

UGENT-ECM: ENERGY & CLUSTER MANAGEMENT

INTERDISCIPLINARY RESEARCH

- LESTS – legal, economic, spatial, technical & social aspects of IS
 - drivers & barriers
 - engineering models
- materials, energies, services



SHARING & CARING ECONOMY

- UN ESG principles 2004
- (A)SPIRE IS calls 2014
- Draghi ind. clusters 2024

MATERIALS
resources, waste, emissions, critical materials, by/side-products, ...

ENERGIES
heat/steam, electricity, nuclear, hydrogen, renewable, ...

SERVICES
facilitation, infrastructure, logistics, transport, engineering, platforms, ...

cases

ex BUSINESS/INDUSTRY PARKS FLANDERS



ex UGENT SCIENCE PARK TECH LANE – GREEN ZONE



ARb – Ardoyen bèta (EU EFRO PIAV; 2003-2005)

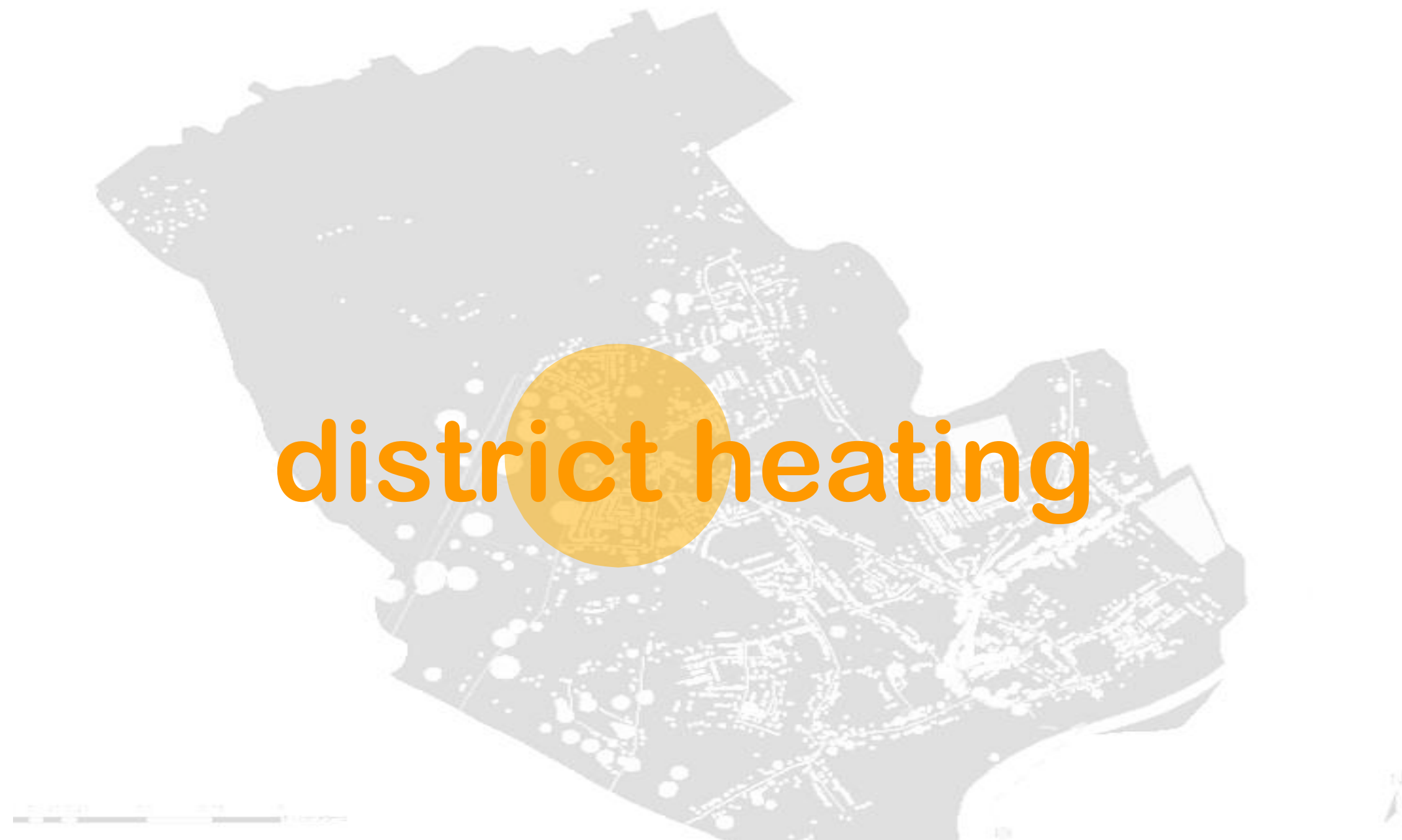
B. Verstraeten. Master thesis: Study of win-win business clusters. UGent (2005)

ex WASE WIND – RENEWABLES





ex WVI KUURNE – WASTE HEAT



J. Vansteenbrugge. Master thesis: Industrial symbiosis in port areas – role of spatial planning? UGent (2012)

ex ANTWERP ECLUSE – STEAM



PORT OF ANTWERP – SMART & SUSTAINABLE

COMPANIES OPERATING IN THE OIL AND CHEMICAL SECTOR

- 1 BASF
- 2 BASF DOW HPPO
- 3 Ineos-Styrolution
- 4 Eurochem
- 5 Air Liquide
- 6 Gunvor Petroleum Antwerp
- 7 Ineos
- 8 Solvay
- 9 Inovyn
- 10 Henkel
- 11 Ferro
- 12 Monsanto
- 13 Eastman
- 14 Evonik Degussa
- 15 FRX Polymers
- 16 Covestro
- 17 Lanxess
- 18 Total (Refinery)
- 19 ExxonMobil
(Refinery + Petrochemicals)
- 20 ATPC
- 21 Total Polymers
- 22 Kuwait Petroleum (Q8)
- 23 BP Lubricants
- 24 DOW
- 25 Momentive
- 26 Praxair

- 27 Kuraray
- 28 3M
- 29 Arlanxco
- 30 BECO2
- 31 Seppic
- 32 Nippon Shokubai
- 33 Borealis
- 34 Lawter
- 35 Lubrizol
- 36 Monument Chemical
- 37 Ashland

green ports

GREENPORTS (BE VLAIO Flux50; 2018-2020)

N. Dhondt e.a. Trilateral research for optimal investments in adequate cross-border energy infrastructure. FEARS UGent (2022)

ex DE CHEMCOLOGNE – EFFICIENCY



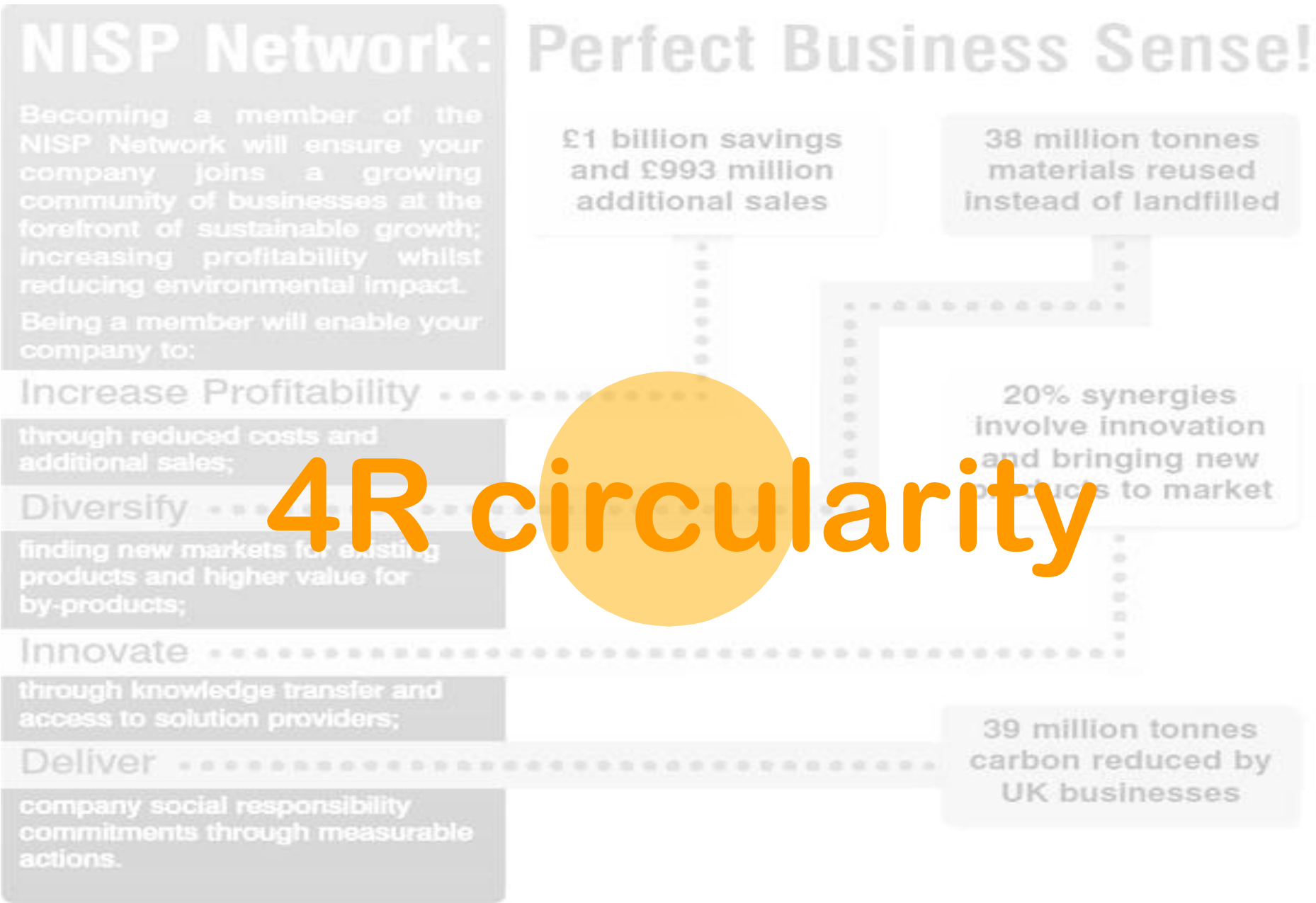
ex NL ROTTERDAM OCAP – EMISSIONS



carbon networks

S. Gabay. Master thesis: Energy synergy in horticulture. UGent (2013)

ex UK NISP – WASTE INTO RESOURCE



ex SE STENUNGSUND – RESOURCES



R. Hackl. PhD thesis: A methodology for identifying transformation pathways for industrial process clusters: toward increased energy efficiency and renewable feedstock. UChalmers (2014)

ex DK KALUNDBORG – FULL INTEGRATION



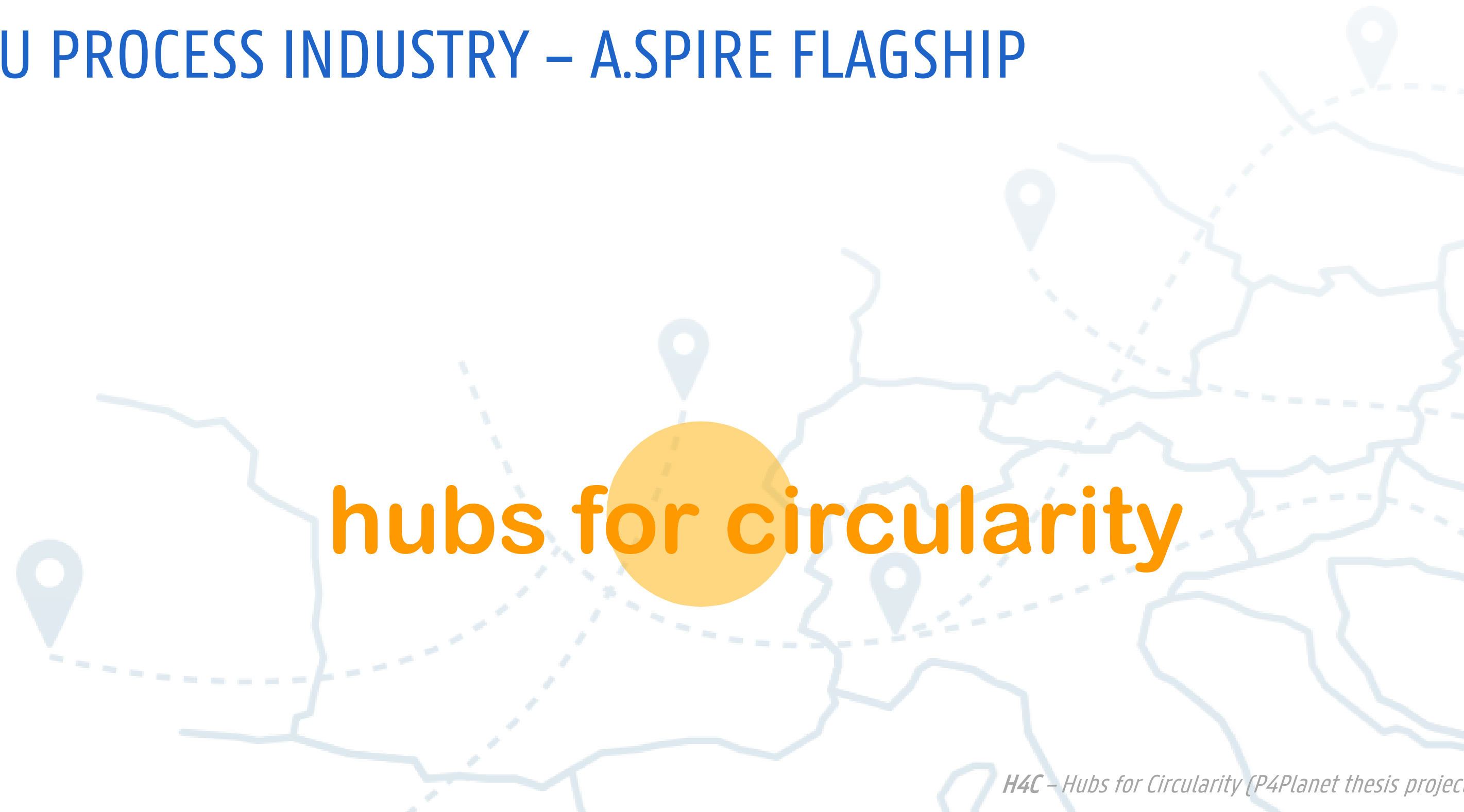
ex EU CHEMICAL INDUSTRY – 3P INTEGRATION



chemical cluster



ex EU PROCESS INDUSTRY – A.SPIRE FLAGSHIP



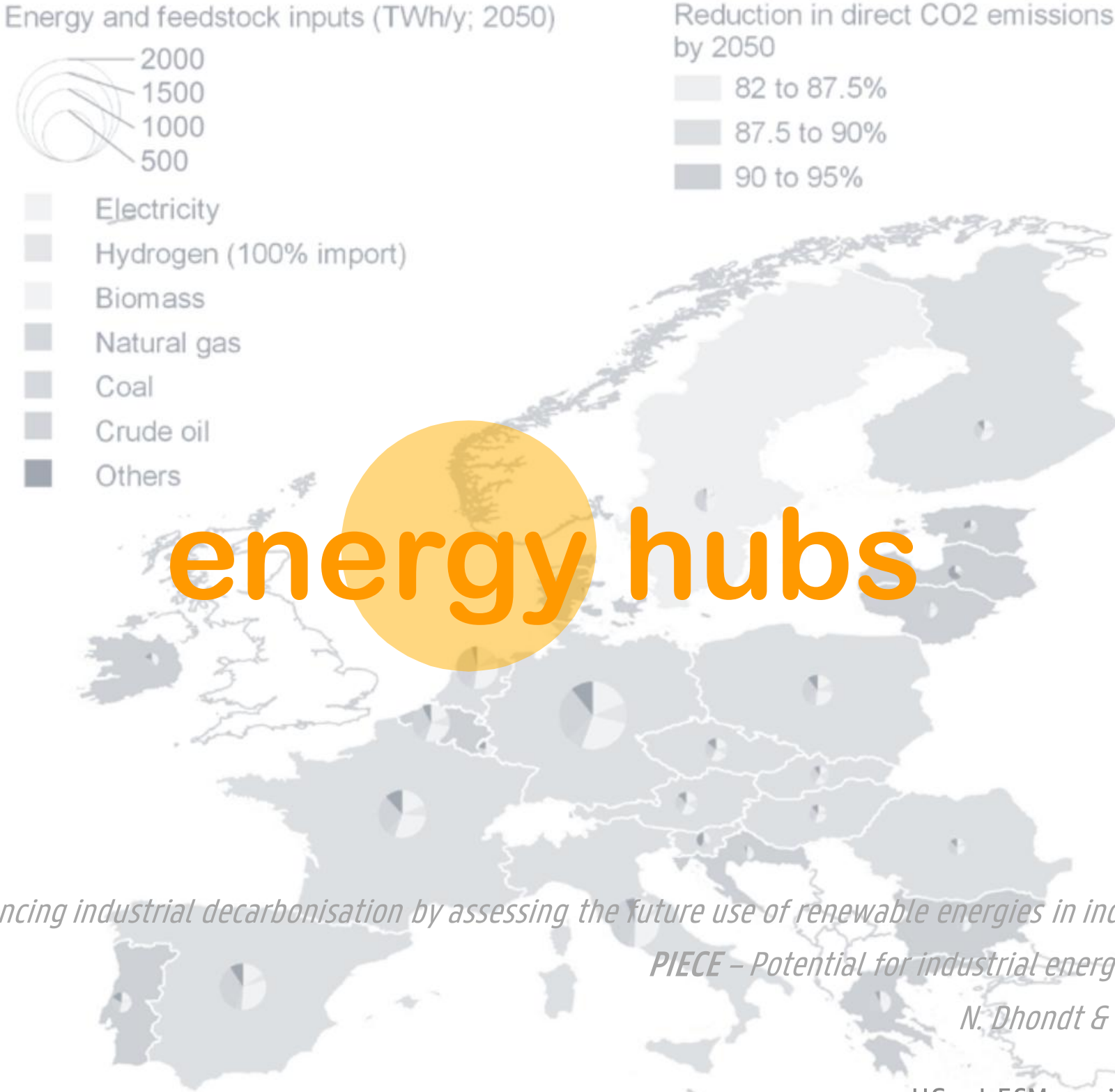
hubs for circularity

H4C – Hubs for Circularity (P4Planet thesis project; 2020-2021)

AIDRES – Advancing industrial decarbonisation by assessing the future use of renewable energies in industrial processes (EU DG ENER; 2020-2022)

F. Mendez Alva. PhD thesis: Cross-sectorial strategies for industrial symbiosis towards a circular economy in the process industry. UGent (2022)

ex EU CROSS-SECTOR IS – RES2Go



AIDRES – Advancing industrial decarbonisation by assessing the future use of renewable energies in industrial processes (EU DG ENER; 2020-2022)

PIECE – Potential for industrial energy clustering in Europe (EU – DG ENER; 2025)

N. Dhondt & T. Duvillard. PhD theses. UGent (2026, 2029)

EPOS, AIDRES & PIECE projects

ECM seminar/webinar

7 October 2025

Ir. Nienke Dhondt

Industrial context

ANTWERP DECLARATION, FEBRUARY 2024

- high energy prices
- slow grid developments
- long permitting procedures
- complex regulatory framework
- unlevel playing field
- ...



CALL TO ACTION FOR CLIMATE POLICY THAT DOESN'T UNDERMINE EU INDUSTRY'S COMPETITIVENESS

- competitiveness compass, omnibus, clean industrial deal, action plans for automotive, steel, chemicals, ...

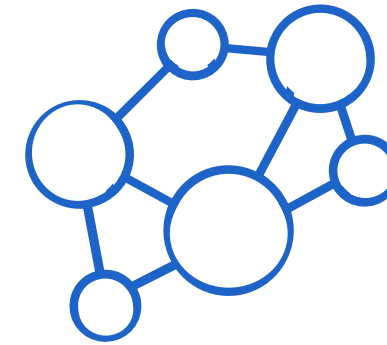
ECM = energy clustering

FOCUS EFFORTS ON INDUSTRIAL CLUSTERS

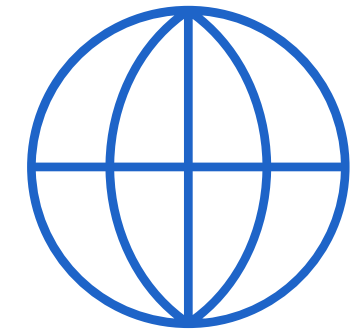
- tendency of energy-intensive industry sectors to co-locate
- complex web of material & energy flows
- economies of scale & scope

► OPPORTUNITIES FOR INDUSTRIAL SYMBIOSIS

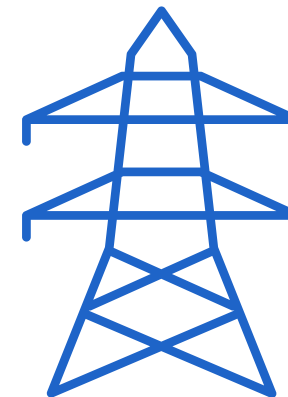
- improve energy & resource efficiency
- lower costs
- reduce emissions
- spread risk
- optimise system value



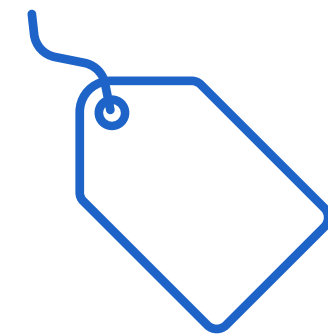
**INDUSTRY
COMPOSITION**



GEOGRAPHY



**EXISTING
INFRASTRUCTURE**



**ENERGY COST
& POLICY**

industrial cluster characteristics by Accenture & WEF

Draghi report on industrial competitiveness

"Coordinate the establishment of
green regional industrial clusters
around EU energy-intensive industries"

September 2024

POTENTIAL FOR

- energy clusters
- infrastructure sharing
- resource-efficient hubs

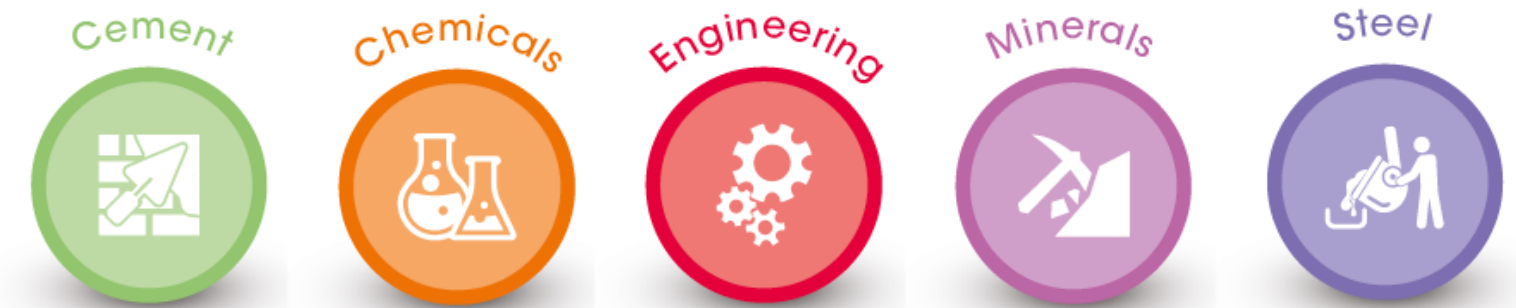
= CORE RESEARCH OF ECM



EPOS – EU H2020 project (2015-2019)



*Enhanced energy and resource efficiency and performance
in process industry operations via onsite and cross-sectoral symbiosis*



OBJECTIVE

- enable cross-sectoral industrial symbiosis

METHODOLOGY

- develop industry blueprints

BARRIERS TO OVERCOME

- missing information
- data sharing issues
- unknown IS potential

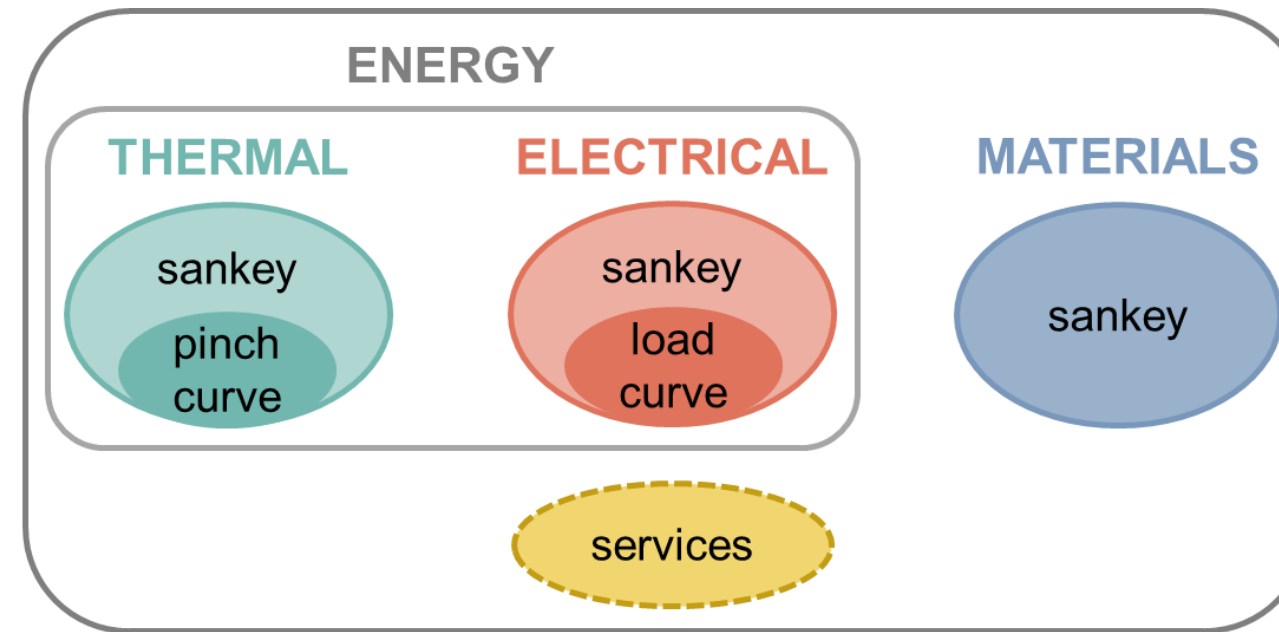


EPOS blueprints – EPFL IPESE

- virtual profile
- typical process industries
- simple & clear message
- validated by sector associations

METHODOLOGY

- real-life data logging
- representation level
- modelling & optimisation
- aggregation & anonymisation



select units, major energy & mass flows
(Pareto approach), key parameters

identify utility consumptions/process requirements

close mass & energy balances

merge process units, vary quality,
parametric equations, response surfaces

AIDRES – EU DG ENER tender (2020-2022)



Advancing industrial decarbonisation by assessing future use of renewable energies in industrial processes

OBJECTIVE

- explore routes towards carbon neutrality
- find effective & (cost-)efficient innovation pathways

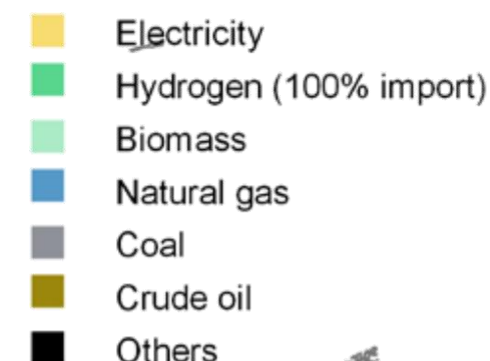
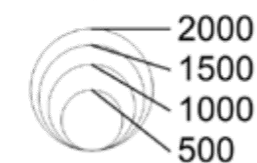
METHODOLOGY

using blueprint models

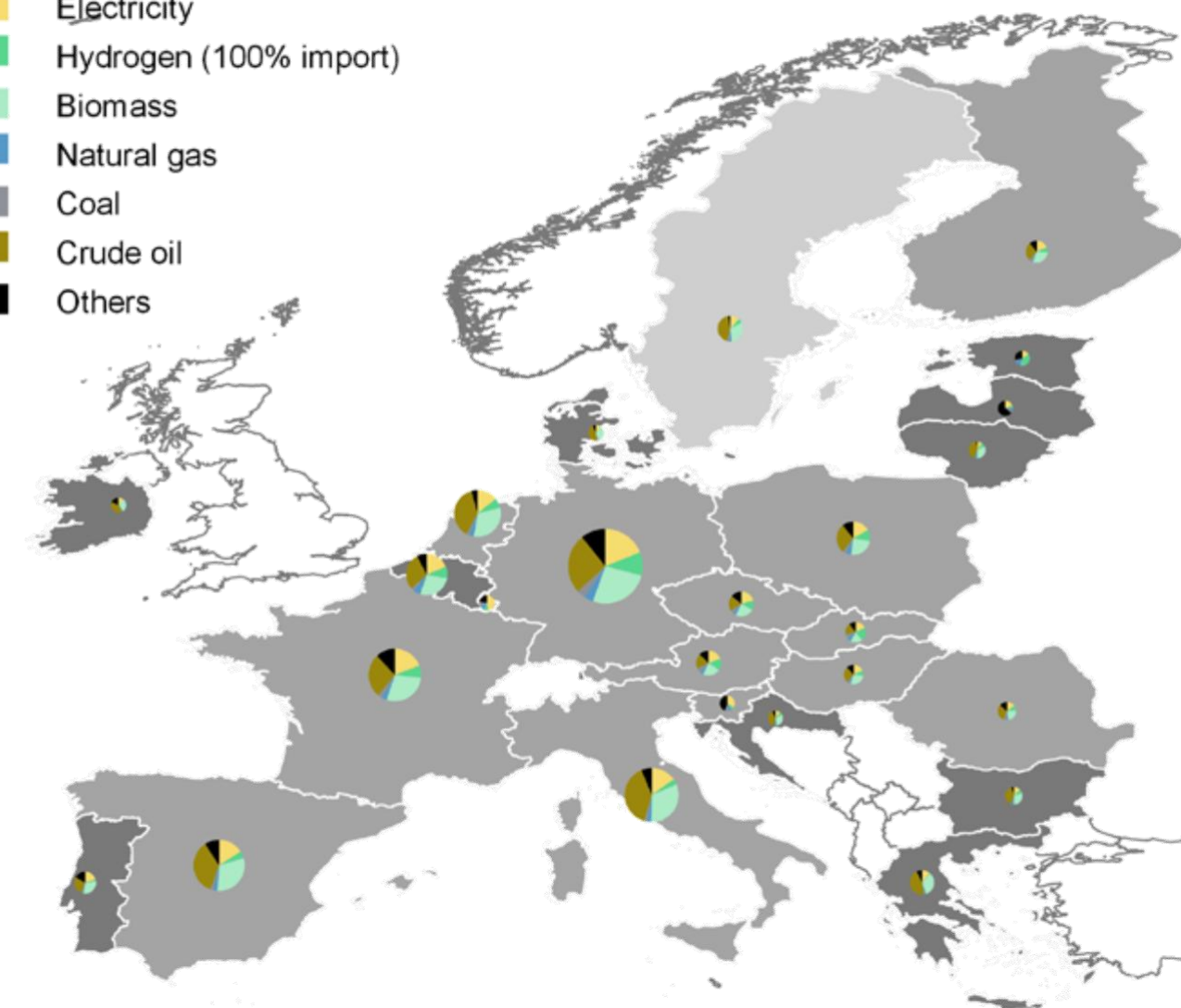
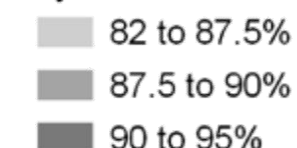
- reference pathway and future production routes
- steel, chemicals, cement, glass, fertilisers & refineries

► IDENTIFY SYMBIOSIS OPPORTUNITIES

Energy and feedstock inputs (TWh/y; 2050)



Reduction in direct CO₂ emissions by 2050



H4C – EU A.SPIRE project (2020-2021)

H4Cs

Hubs for circularity

Processes4Planet initiative

OBJECTIVE

- interconnect process industries and urban areas
- increase circularity in hubs in Europe

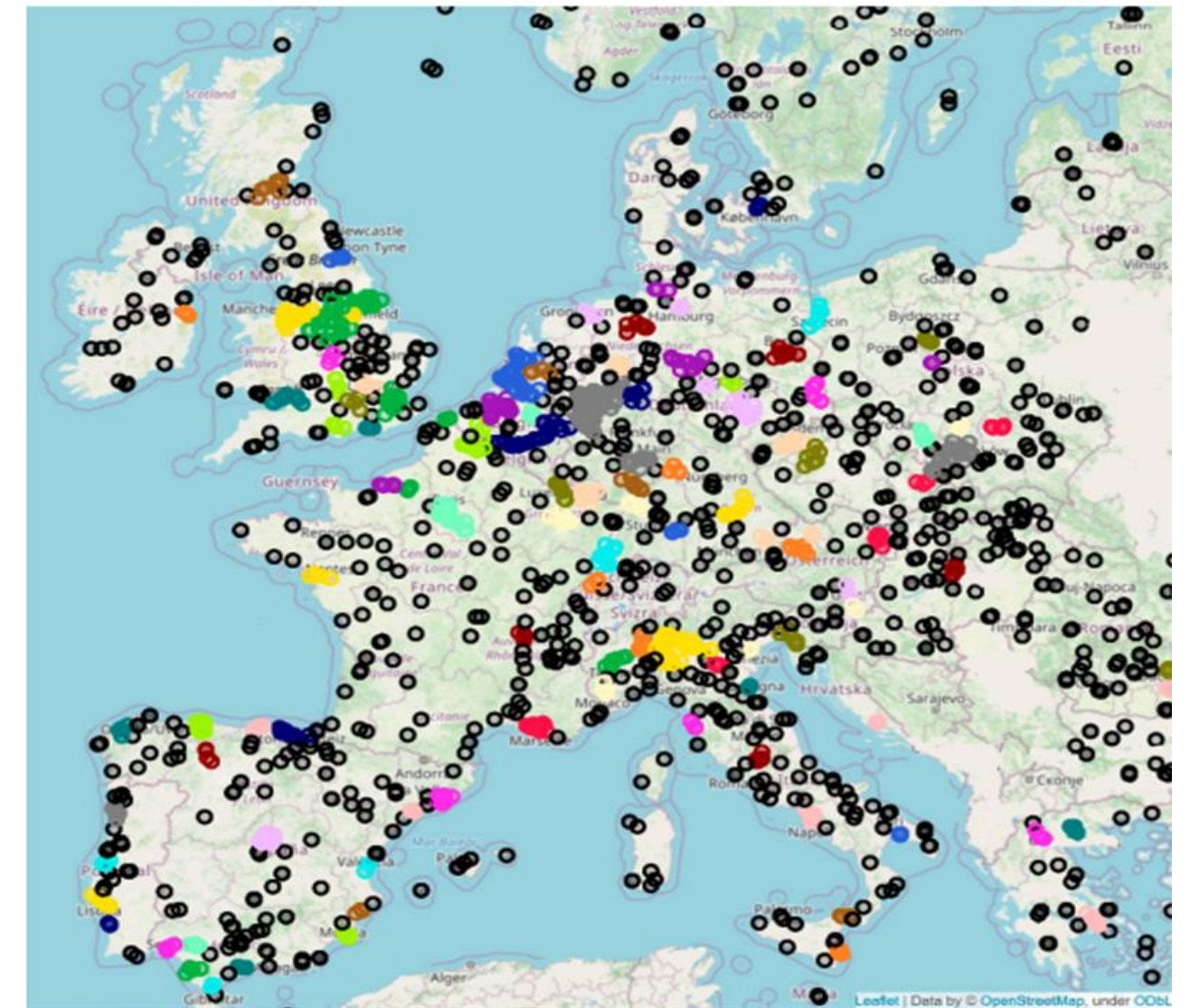
METHODOLOGY

applying cluster algorithms to public industry data

- K-means, HAC, **DBSCAN**

► IDENTIFY SYMBIOSIS OPPORTUNITIES

DBSCAN (radius 25 km, 5 min-points): hubs in color, non-clustered installations in black



R. De Boever. Master thesis: Hubs 4 Circularity: Facts and figures. UGent (2021)

TRILATE – BE ETF project (2021-2026)

TRILATE

*TRILateral research for optimal investments
in adequate cross-border infrastructure*

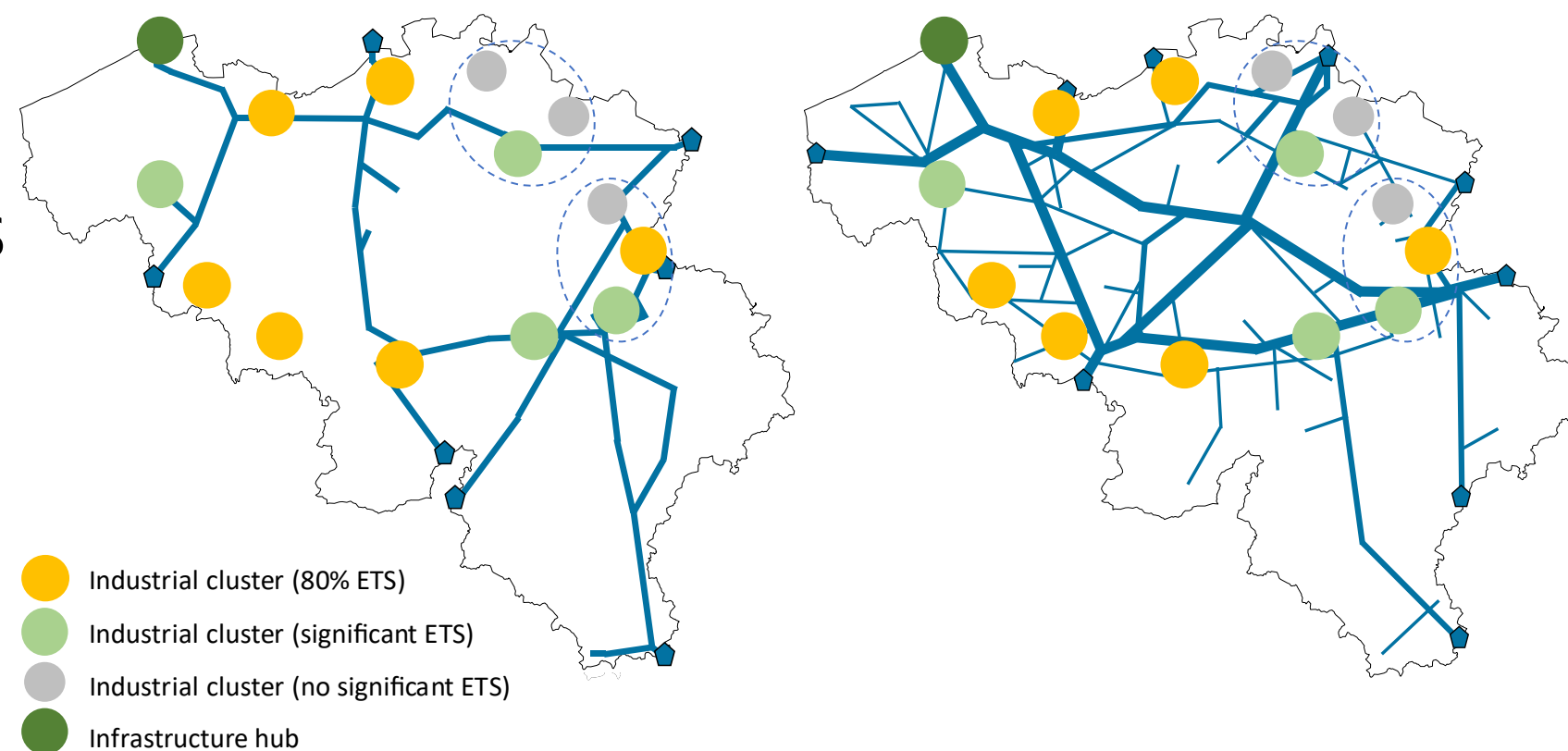
OBJECTIVE

- secure adequate energy supply to industrial clusters
- assess energy transport infrastructure needs

METHODOLOGY

- model at various levels (process, cluster, country)
- link with energy system models
- connect with TSOs: Elia & Fluxys

► IDENTIFY SYMBIOSIS OPPORTUNITIES



TRILATE industrial clusters positioned in backbone grids:
left electrical grid, right molecule grid

PIECE – EU DG ENER Erasmus project (2025)



Potential for industrial energy clustering in Europe

OBJECTIVE

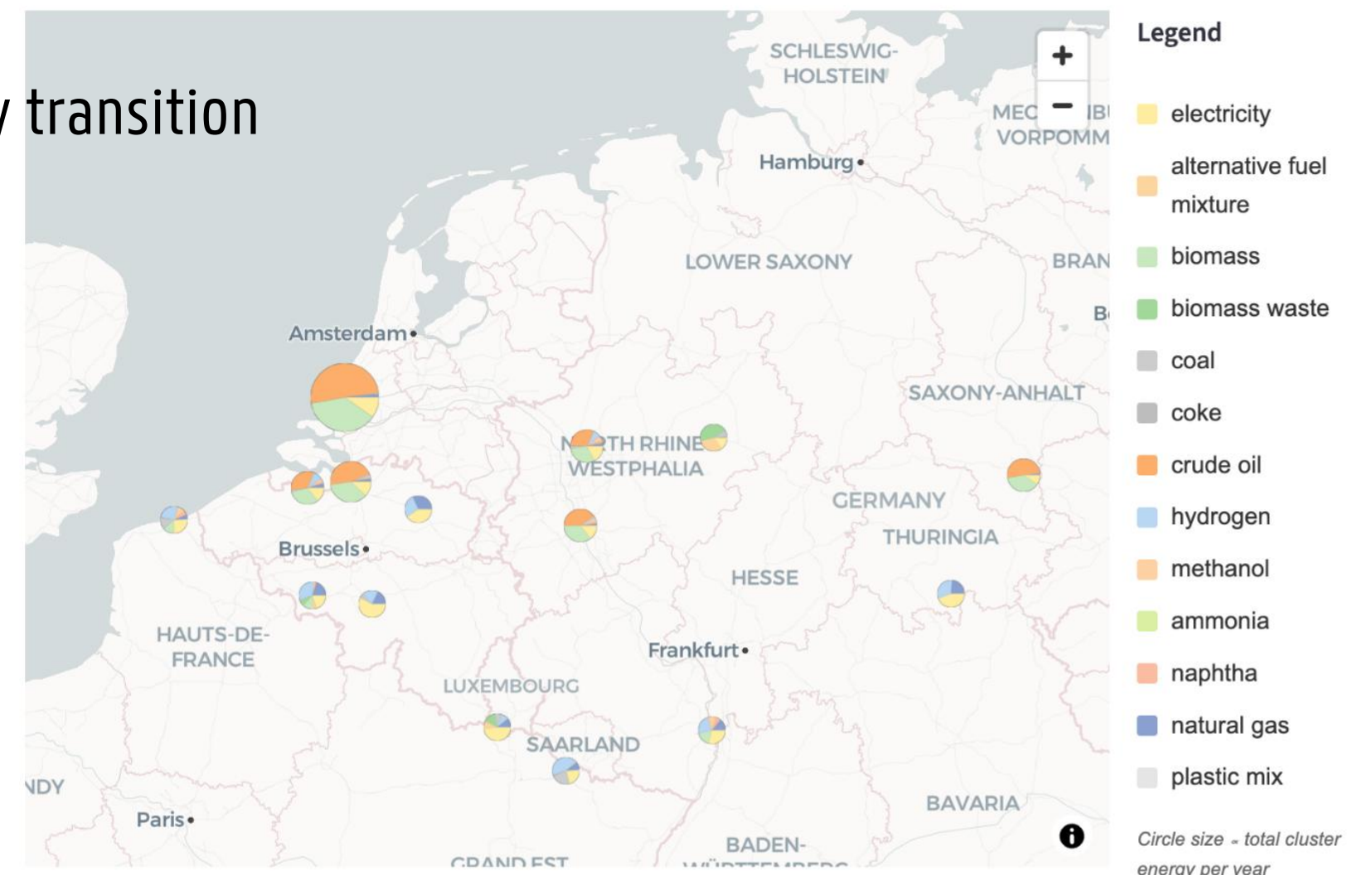
- model energy system integration to support industry transition
 - by assessing & addressing EII cluster potential

METHODOLOGY

- match local energy demand & supply
 - by modelling at various levels (process, cluster, country)
- link with energy system models
- connect with TSOs: ENTSO-E/G

► IDENTIFY SYMBIOSIS OPPORTUNITIES

Energy clusters from EU-MIX-2050 using DBSCAN



RES2Go tool

KEY ISSUE IN EU

- high energy prices

KEY FEATURES

- transition pathways
- industrial clusters
- energy demand/supply
- energy infrastructure

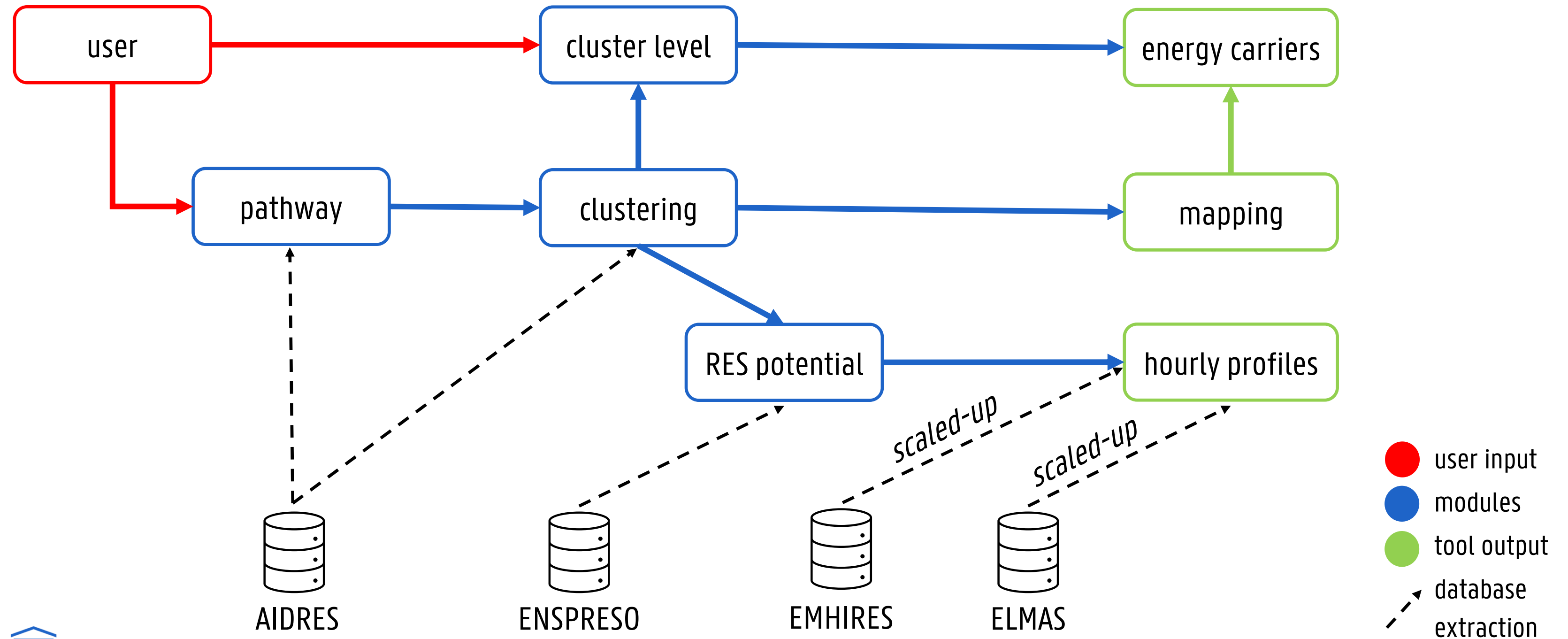
RES2Go SOLUTION

- map industrial clusters in RES landscape

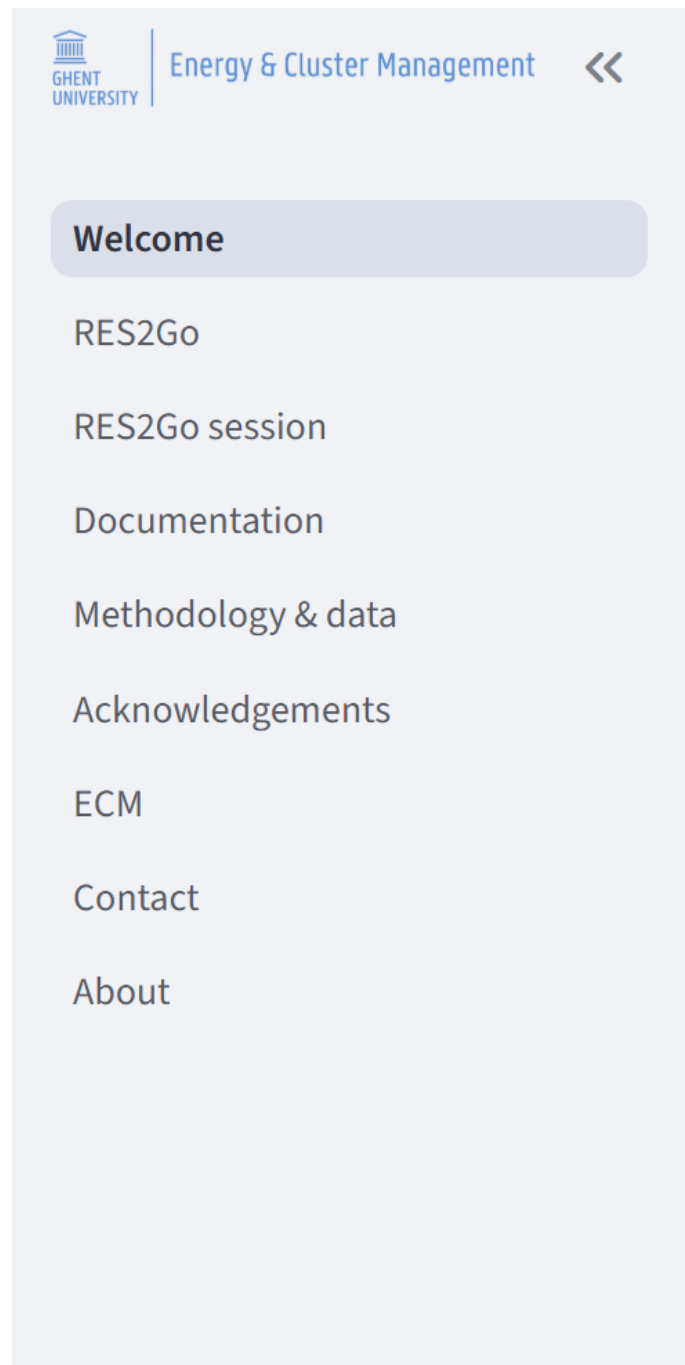
TOOL ANSWERS

- allow to customise, to import, to develop, ...
 - KPIs, production routes, blueprints, ...
- draw hubs at local up to regional level
 - tailored algorithms
- match demand with local (RES) supply
 - eg onshore wind & solar potential, ...
- assess needs vs availability & accessibility
 - infrastructure grids and databases

RES2Go methodology



RES2Go tool



UGent ECM RES2Go

Assessing and addressing the future of renewable energy in industrial processes and clusters

The RES2Go tool starts from the [AIDRES project](#), creating a variety of energy demand projections for industrial sites and clusters with a high level of product, process and location-based flexibilities and functionalities. Users can forecast energy pathways by modifying products and processes, creating clusters at micro to macro level, and assess future demand of various energy sources.

↓ Start to check tutorial in documentation section and use the tool ↓

 Documentation

 RES2Go

 About

Contact:

 Contact

REFERENCES & CONTACT

— UGent biblio	ECM name search	biblio.ugent.be
— ECM projects	landing page	ecm.ugent.be →
— EPOS project	summary	→ EPOS
— AIDRES project	summary	→ AIDRES
— H4C project	summary	→ H4C
— TRILATE project	summary	→ TRILATE
— PIECE project	summary	→ PIECE

contact: ecm@ugent.be, Nienke.Dhondt@ugent.be

RES2Go demo

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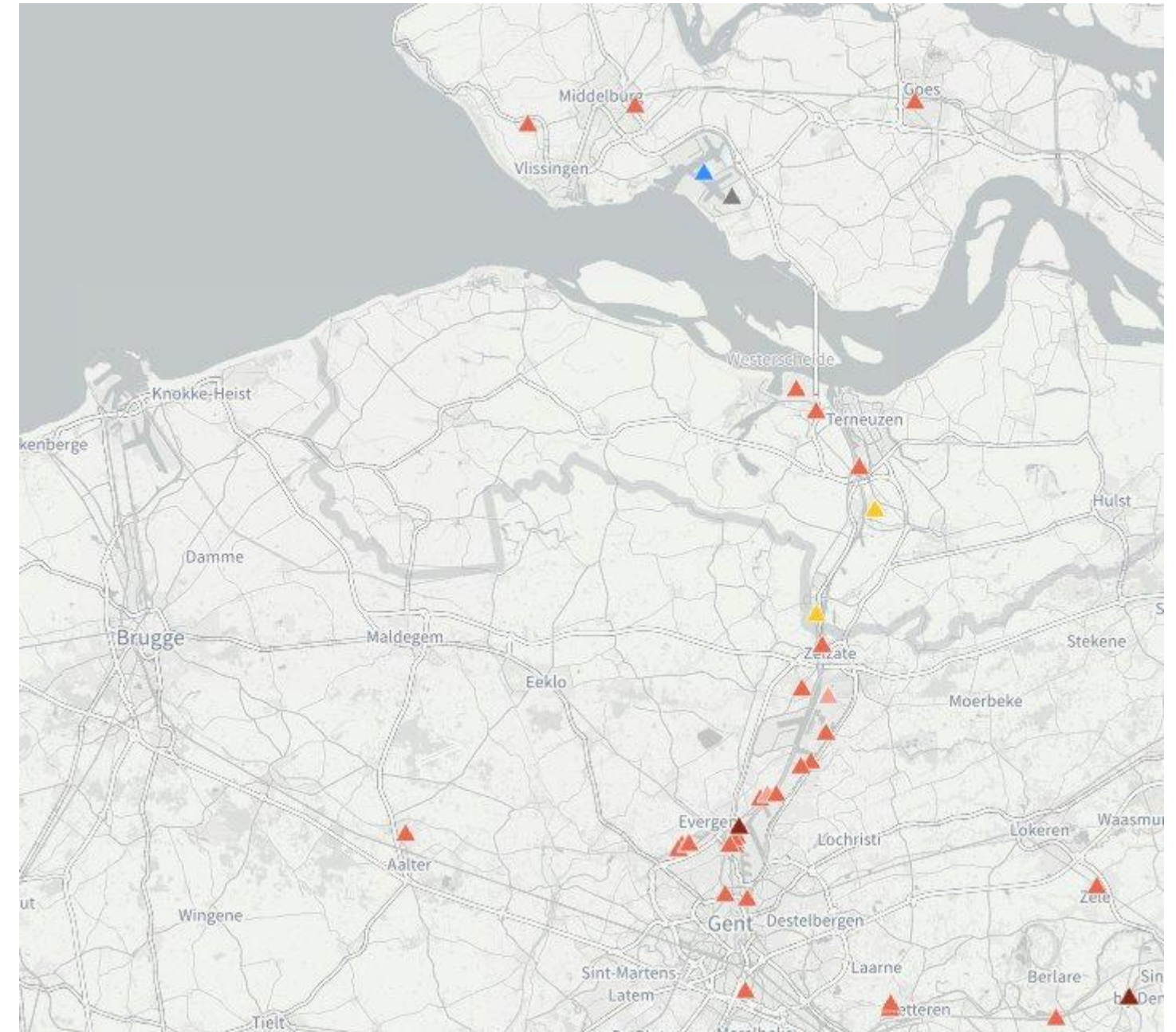
Ir. Thijs Duvillard

RES2Go tool – let's use it!



► IDENTIFY SYMBIOSIS OPPORTUNITIES

- tool run
- case: North Sea Port (BE Ghent – NL Terneuzen)
 - impact of electrification in 2050?
 - role of all energy carriers in local system?
 - RES to supply local demand?
- steps
 - define scope & settings
 - select cluster algorithm
 - match local RES supply/demand



REFERENCES & CONTACT

— UGent biblio	ECM name search	biblio.ugent.be
— ECM projects	landing page	ecm.ugent.be →
— PIECE project	summary	→ PIECE
— RES2Go host	ECM tool access	→ RES2Go
— RES2Go link	JRC reference	data.jrc.ec.europa.eu/dataset/d8835f35-6d14-40d5-a55e-eaaf973aef58
— RES2Go app	direct tool access	ugent-ecm-res2go.streamlit.app

contact: ecm@ugent.be, Thijs.Duvillard@ugent.be

EneMaX project

ECM seminar/webinar

7 October 2025

Ir. Louis De Backere

ENEMAX – BE cSBO project (2025-2027)

Enabling energy transition in manufacturing through flexibility

OBJECTIVE

- accommodate more renewable energy sources
- enhance competitiveness of end consumers

METHODOLOGY

- standardise quantification and characterisation

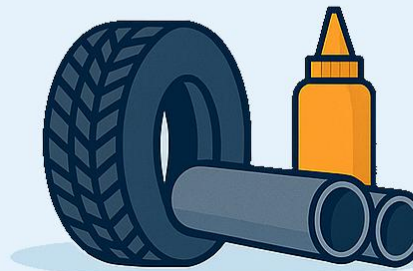
BARRIERS TO OVERCOME

- institutional, technological, economical and behavioural

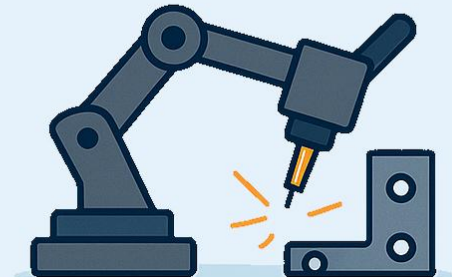
► IDENTIFY FLEX CLUSTER OPPORTUNITIES



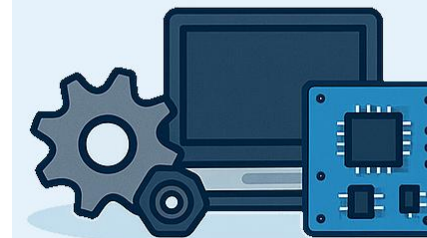
NACE 22



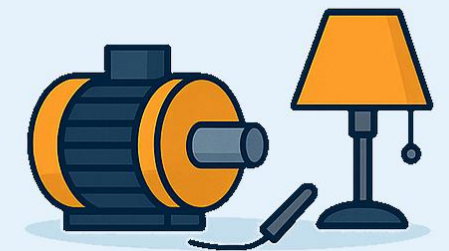
NACE 25



NACE 26



NACE 27

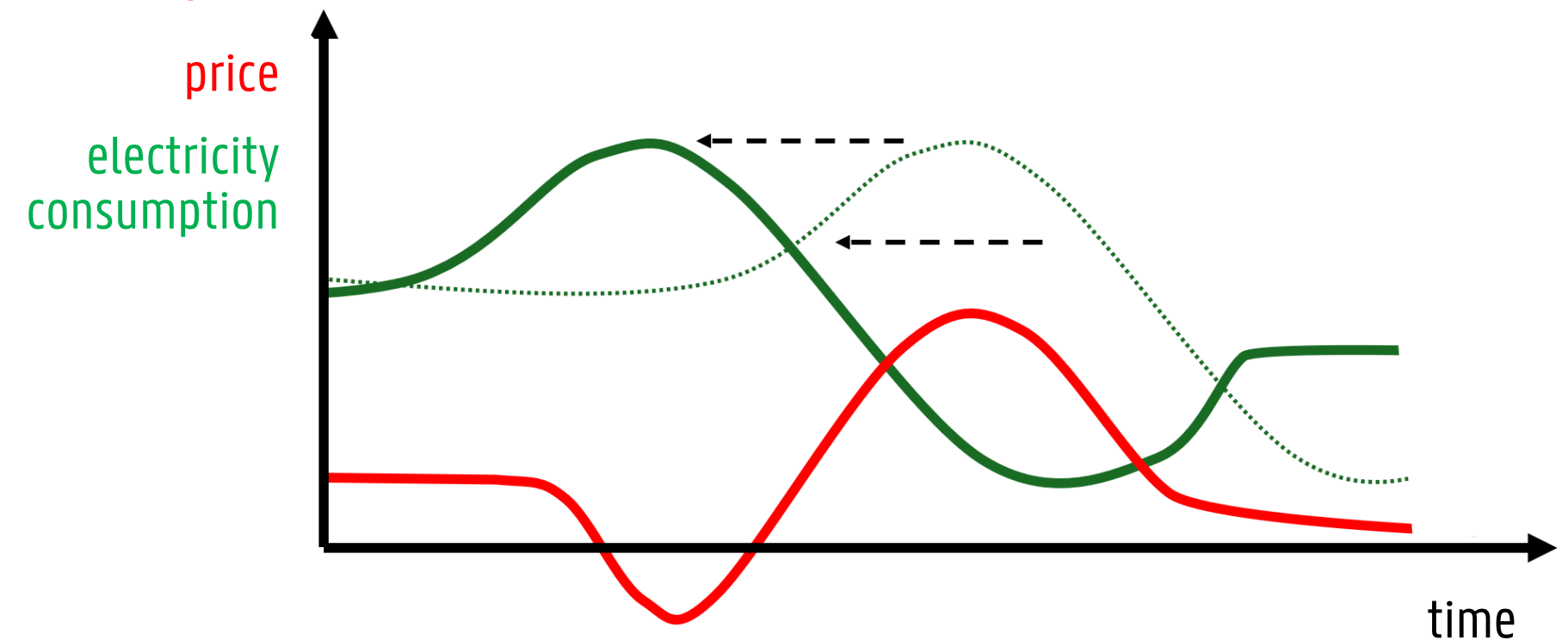


ENEMAX rational

ELECTRICAL FLEXIBILITY

- because energy transition leads to
 - more renewable power generation
 - intermittency, due to weather dependency
 - low levelised cost of electricity (LCOE)
 - more electrical demand
 - residential: electrification of heat & mobility
 - industrial: electrification of heat
- to optimise energy consumption
- to provide stabilisation services to grid

► COULD LEAD TO SIGNIFICANT REVENUE



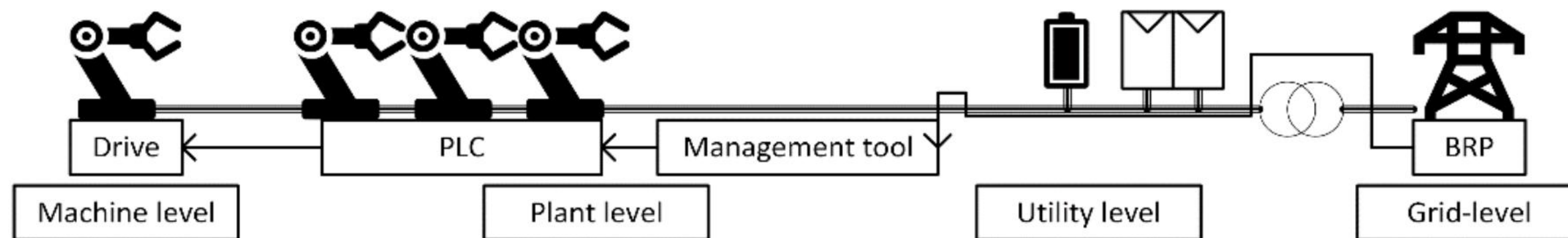
ENEMAX objectives

QUANTIFICATION AND CHARACTERISATION OF FLEXIBILITY IN MANUFACTURING INDUSTRY ...

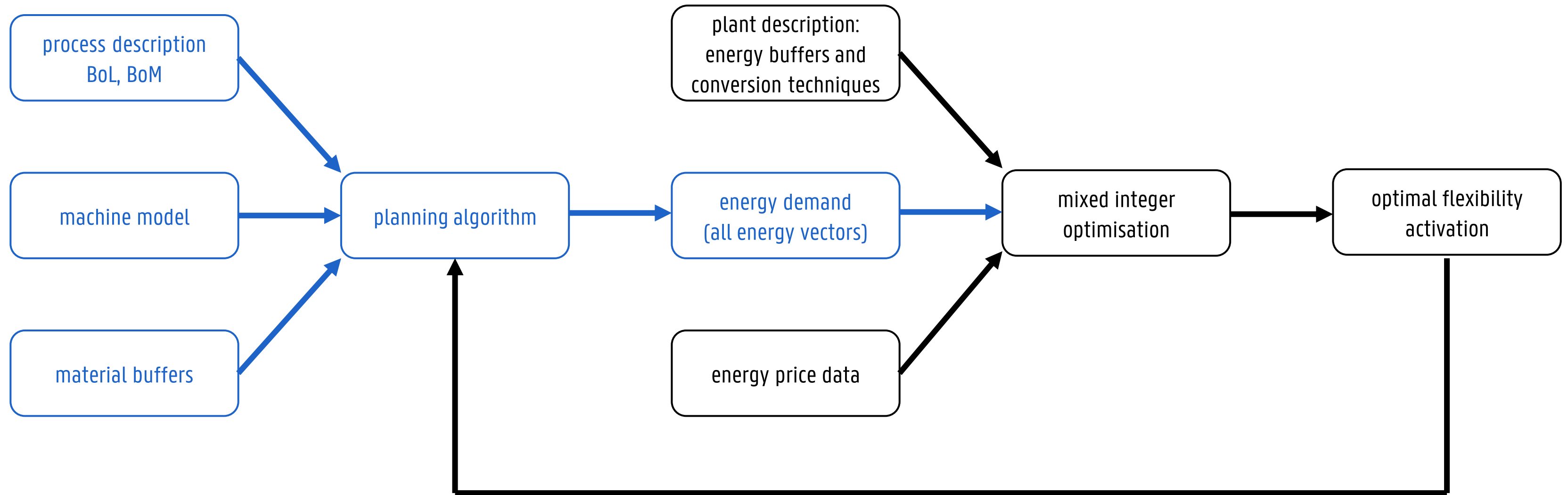
- at machine, utility, plant level
- ... using simulation-based approach

VALORISATION STRATEGY OF FLEXIBILITY ...

- peak shaving, ancillary services, imbalance settlement
- ... resulting in techno-economic analysis



ENEMAX methodology



ENEMAX case

CLUSTER FLEXIBILITY POTENTIAL

- manufacturing industry flexibility analysis

RES2Go TOOL

- model mismatch ELMAS profile vs renewable generation
- investigate impact of flexibility on projected temporal mismatch

► IDENTIFY SYMBIOSIS OPPORTUNITIES

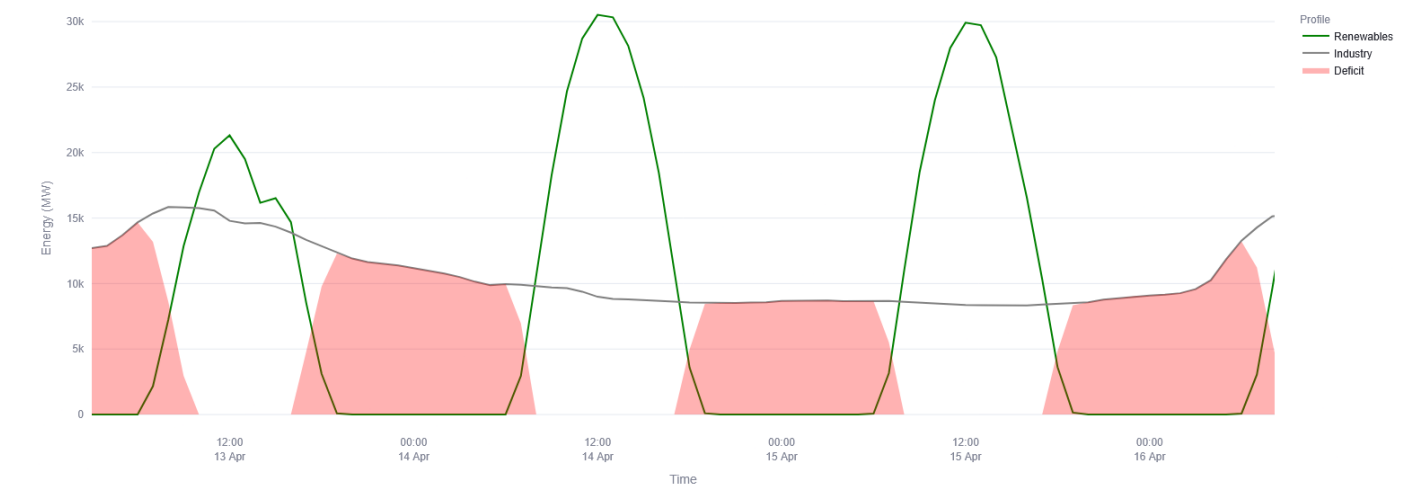
- flexibility potential per NUTS2 region in Belgium
 - using Kruispuntbank Ondernemingen (FSP Economy)

PORT OF ANTWERP, EU-MIX 2050

Profile load with ELMAS Dataset



Profile load with ELMAS Dataset



REFERENCES & CONTACT

— UGent biblio	ECM name search	biblio.ugent.be
— ECM projects	landing page	ecm.ugent.be →
— EneMax project	summary	→ ENEMAX
	EPES website	epes.ugent.be/research/EneMaX

contact: ecm@ugent.be, Louis.DeBackere@ugent.be

RISERS project

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Ir. Lieven Demolder

RISERS – HEU CSA project (2024-2026)



*Roadmap for industrial symbiosis standardisation
for efficient resource sharing*

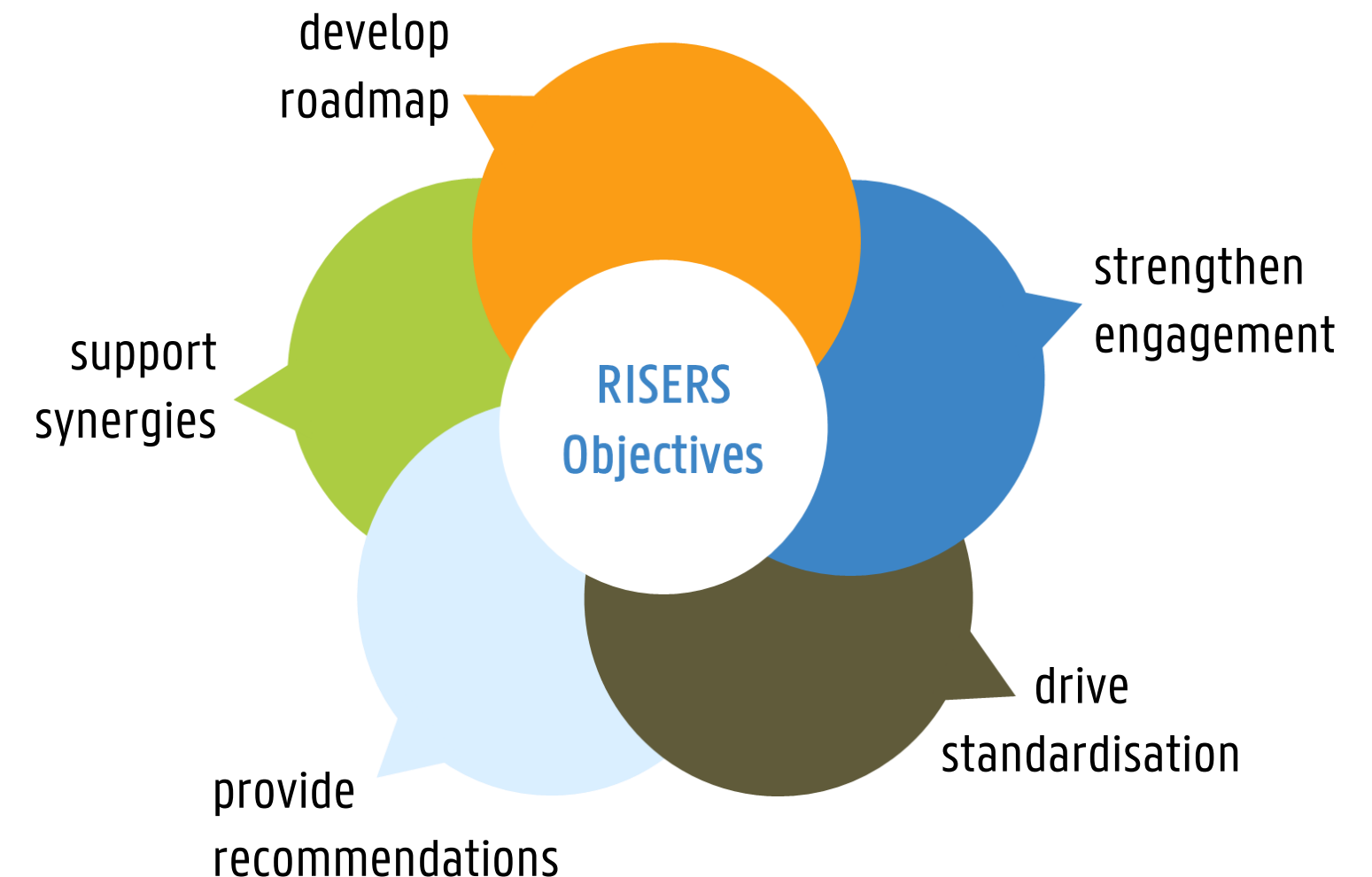
OBJECTIVE

- accelerate IS through standardisation

METHODOLOGY

- map IS practice and related standards
- provide recommendations to close IS gaps
- develop roadmap for IS standardisation

► IMPLEMENT SYMBIOSIS OPPORTUNITIES

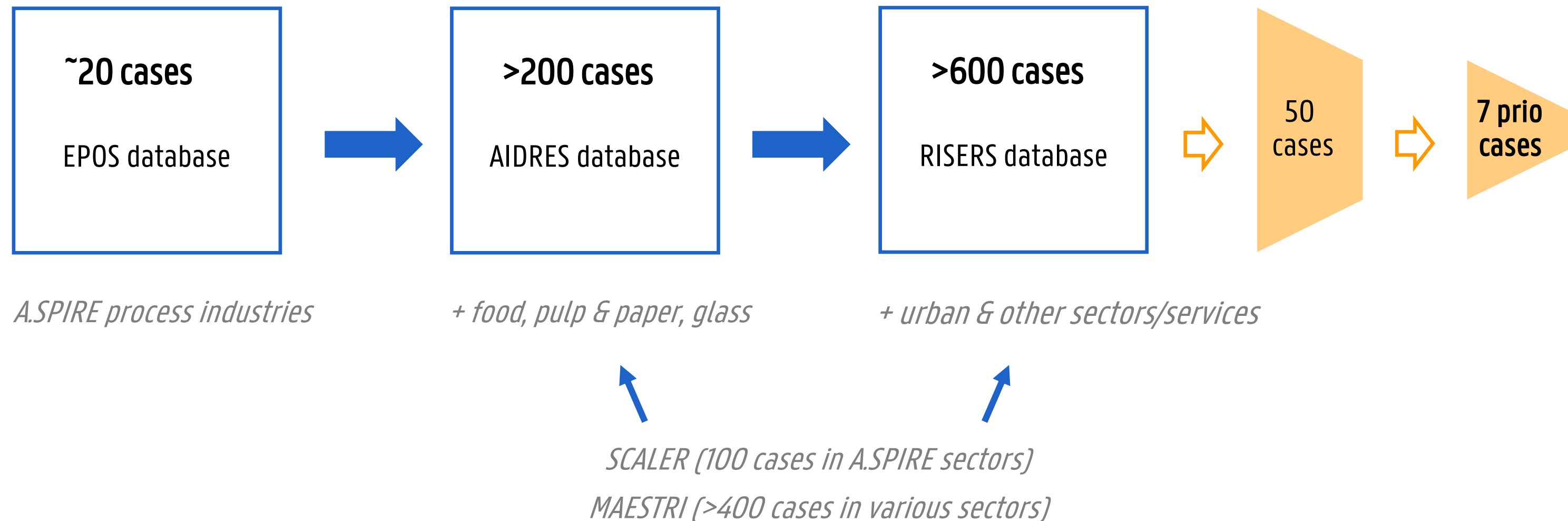


RISERS methodology

SYNERGIES DATABASE

- exchange of materials/energies/services between sink/source sectors

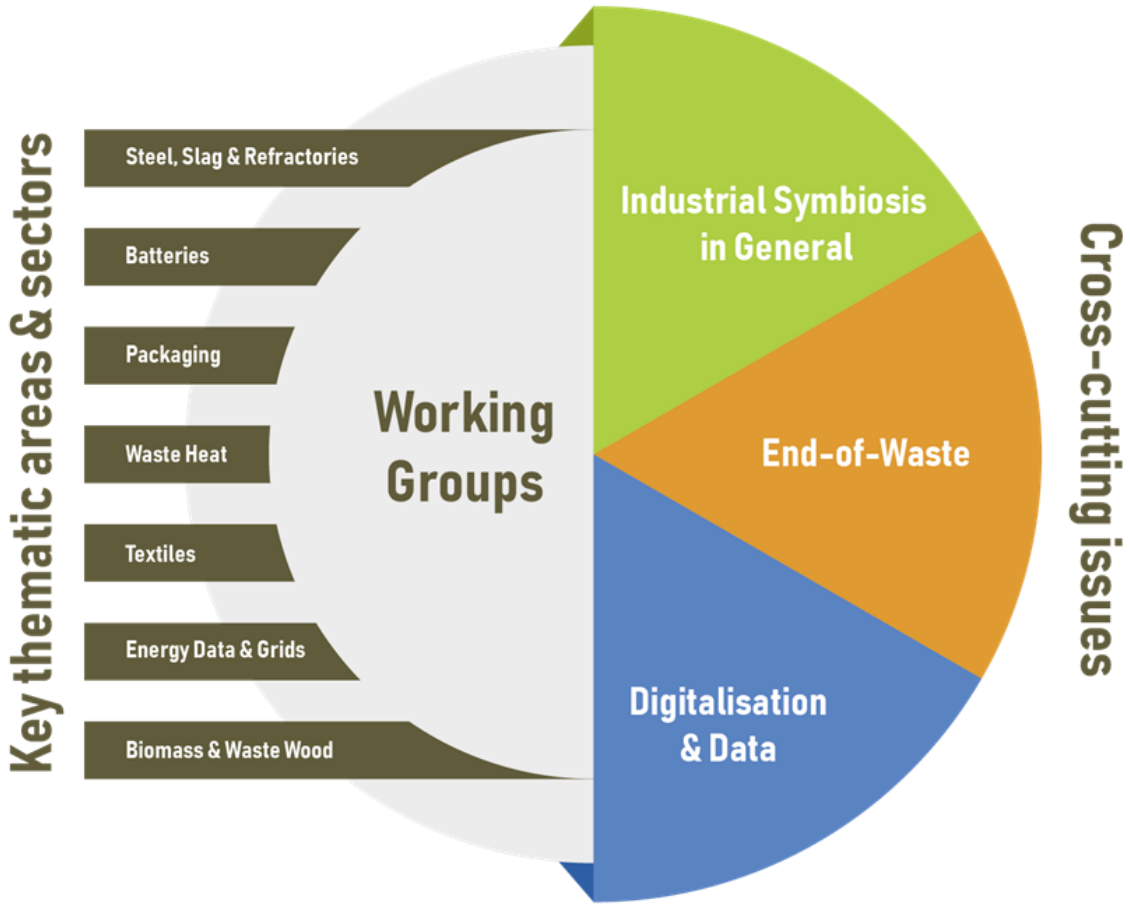
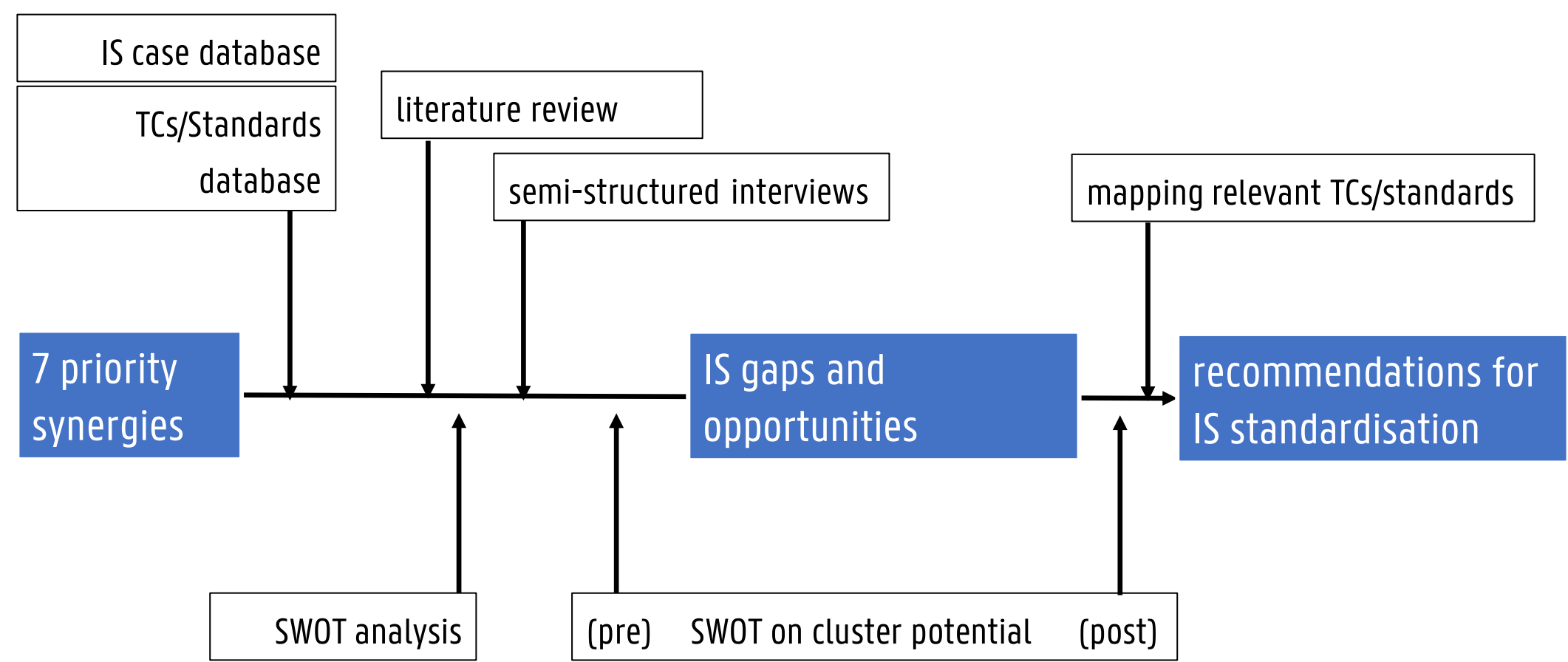
> SELECTION PRIORITY CASES



RISERS methodology

PRIORITY CASES

> STANDARDISATION



RISERS case

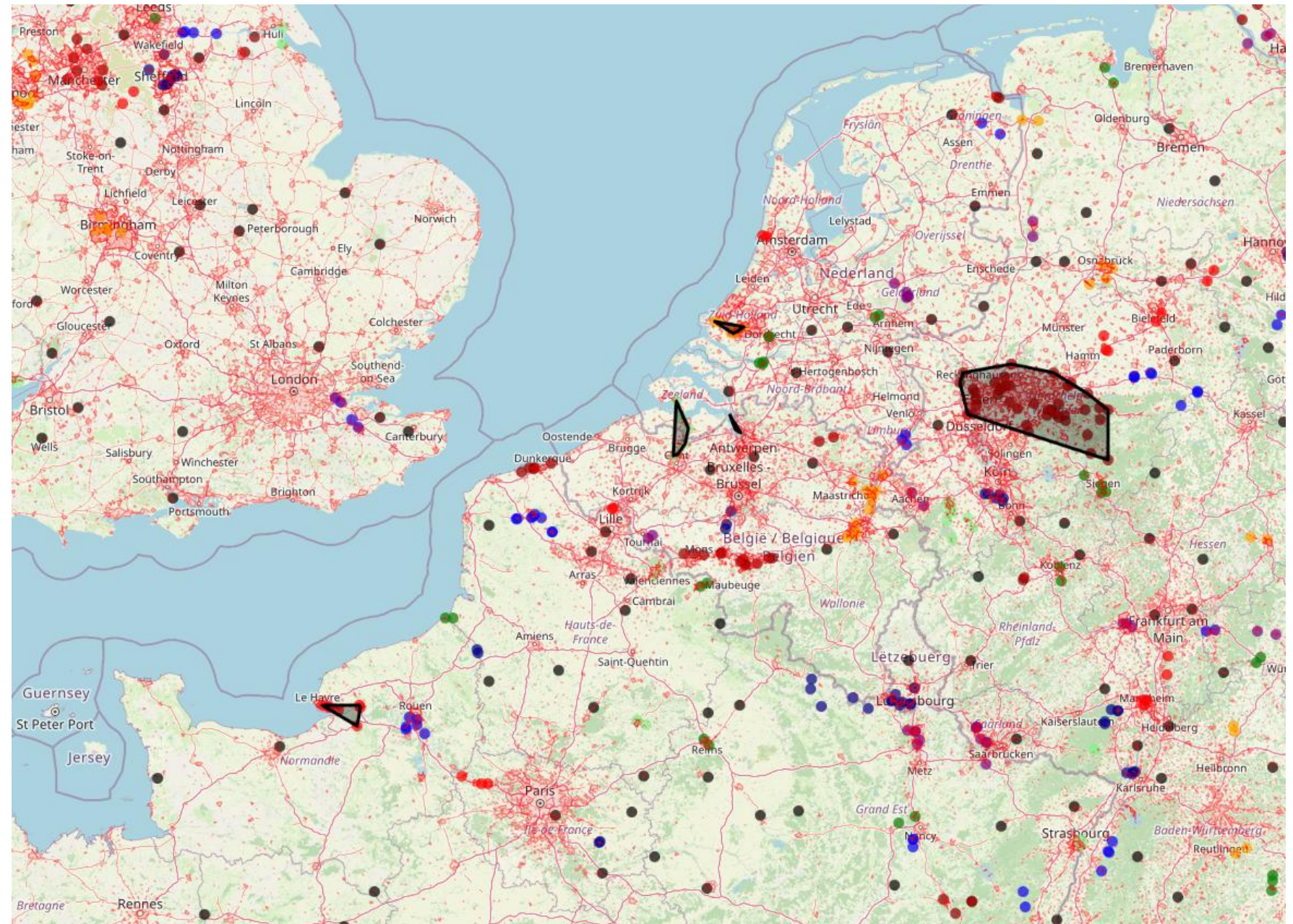
WASTE HEAT

- cross-sector synergies in EU

RES2Go TOOL

- screen heat demand/supply
- identify cross-sectoral clusters
- visualise cluster potential
- standardise waste heat synergies

► RECOMMEND POLICY/INDUSTRY ACTION



REFERENCES & CONTACT

— UGent biblio	ECM name search	biblio.ugent.be
— ECM projects	landing page	ecm.ugent.be →
— RISERS project	summary	→ RISERS
	EU website	risers-project.eu

contact: ecm@ugent.be, Lieven.Demolder@ugent.be

TRILATE & PhD projects

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TRILATE – BE ETF project (2021-2026)

TRILATE

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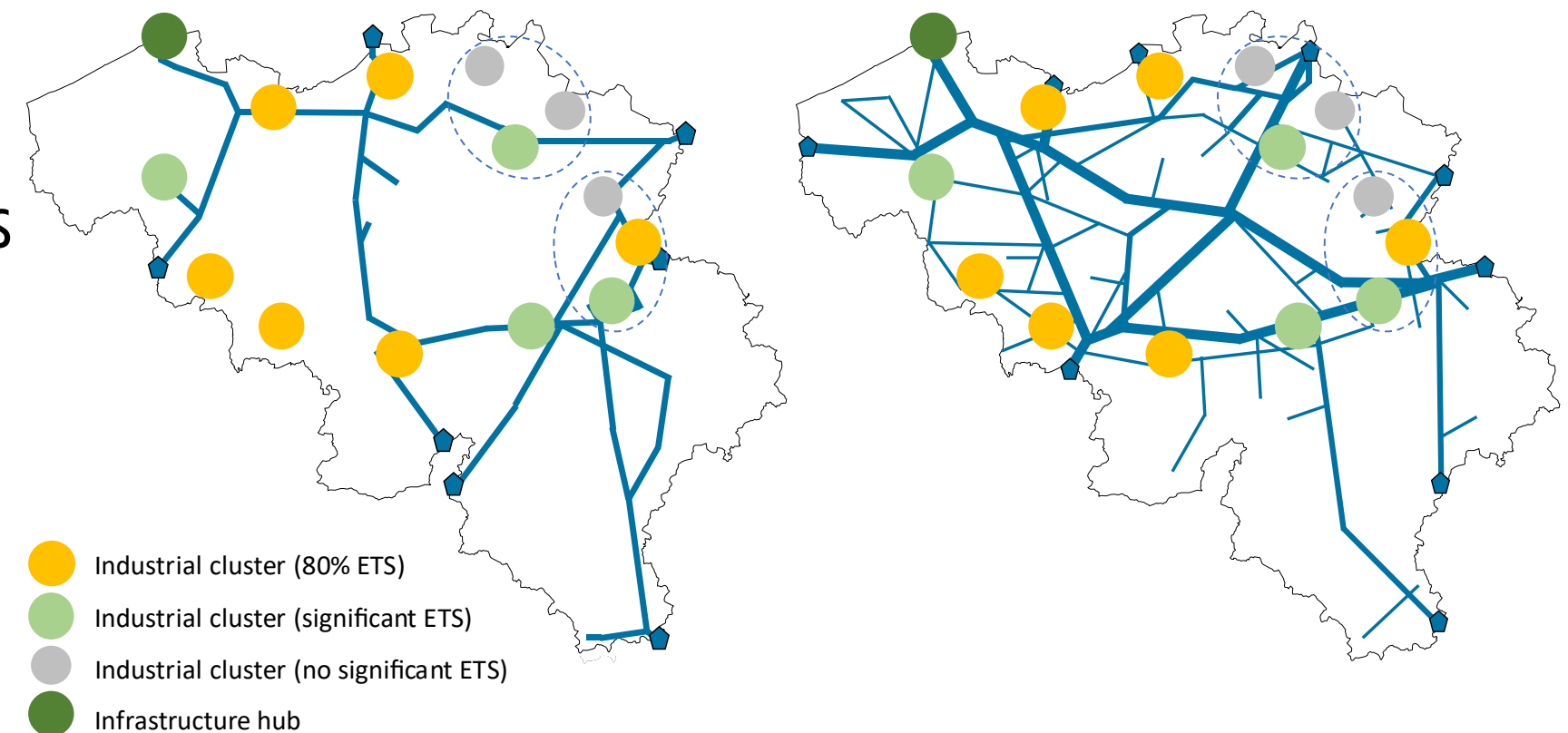
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TRILATE industrial clusters positioned in backbone grids:
left electrical grid, right molecule grid

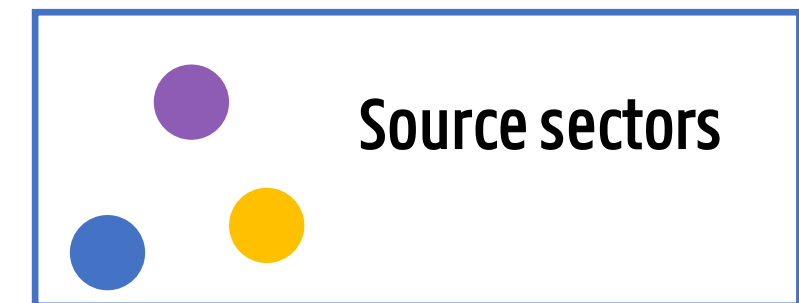
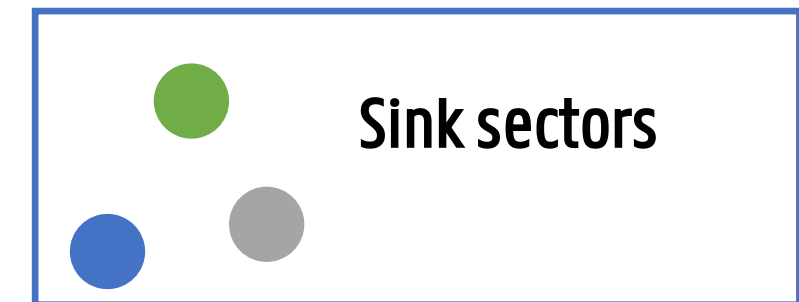
TRILATE

RES2Go HELPS TO CUSTOMISE CLUSTERS AND TRANSITION PATHWAYS

- flexible demand scenarios
- ▶ **IDENTIFY SYMBIOSIS OPPORTUNITIES**
 - tailored high-potential synergies
 - no-regret vs pathway-dependent
- ▶ **DEFINE ENERGY INFRASTRUCTURE NEEDS**
 - energy system modelling
 - industrial demand assumptions

RES2Go DELIVERS INPUT DATA FOR PyPSA-EUR

Map sectors & companies



Suggest IS opportunities

PyPSA-Eur

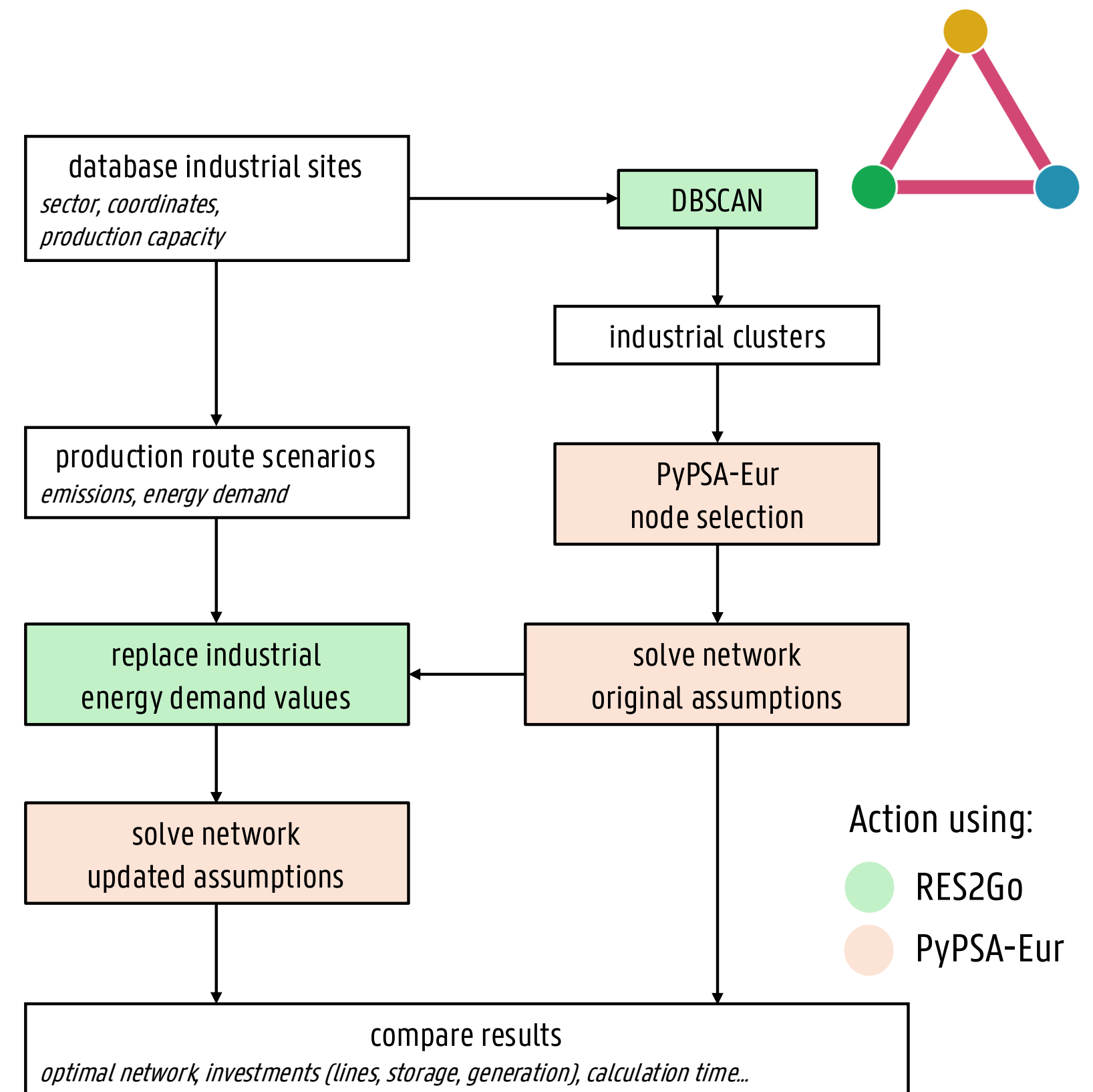
*Sector-coupled open optimisation model
of European energy system*

IMPROVE INDUSTRY REPRESENTATION USING RES2Go

- align nodes with industrial clusters
- update energy demand projections

STRATEGIC ENERGY PLANNING

- optimal energy system
- dependency on cluster transitions



RES2Go leverage ~Draghi

ACADEMIA

- support IS, energy system modelling, cluster flexibility research
- engage BE/EU researchers by sharing expertise and jointly growing databases

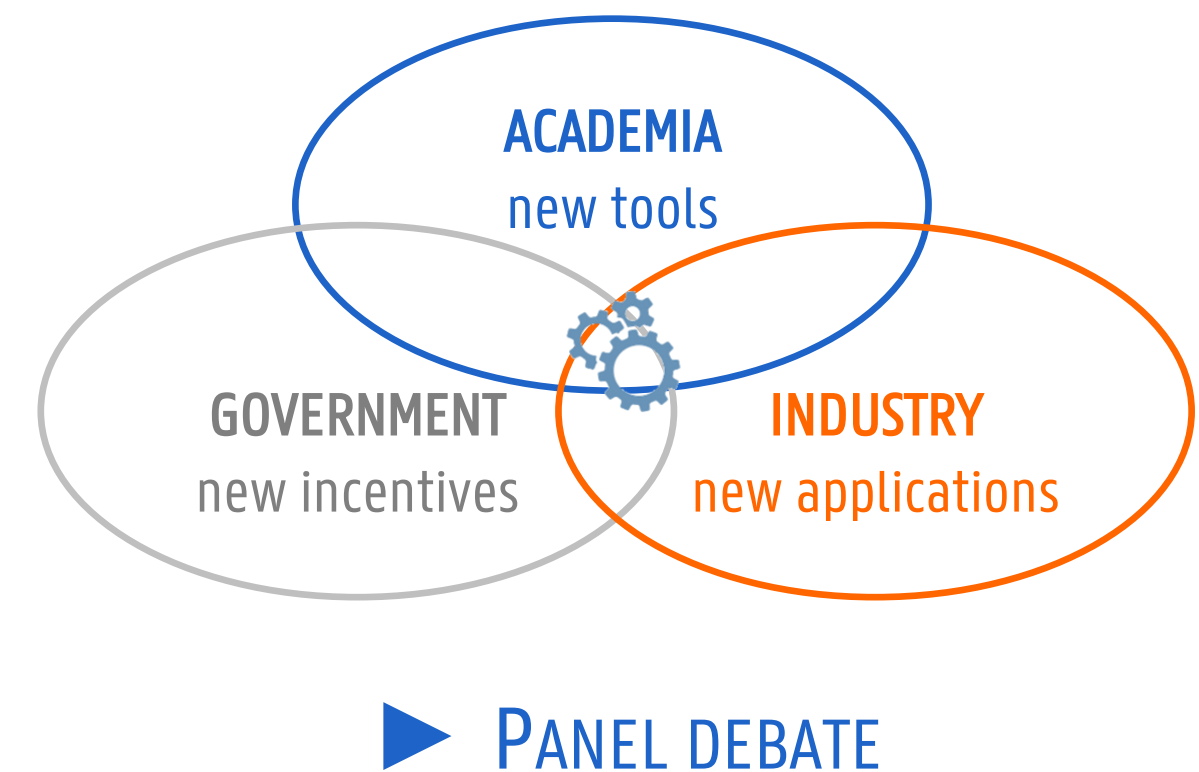
POLICY

- implement Draghi recommendations (only 11% after 1y)
- join forces, complement studies (eg JRC, ENTSOs, ...)
- add dynamic scenarios to energy & industry geolab (EIGL)

INDUSTRY

- use RES2Go in continuation of EPOS toolbox
- screen for IS potential and join forces

ECM & EnSy expertise



PANEL DEBATE

ECM seminar/webinar

7 October 2025

Prof.dr.ir. Greet Van Eetvelde, dr.ir. Arne De Keyser

Panel debate

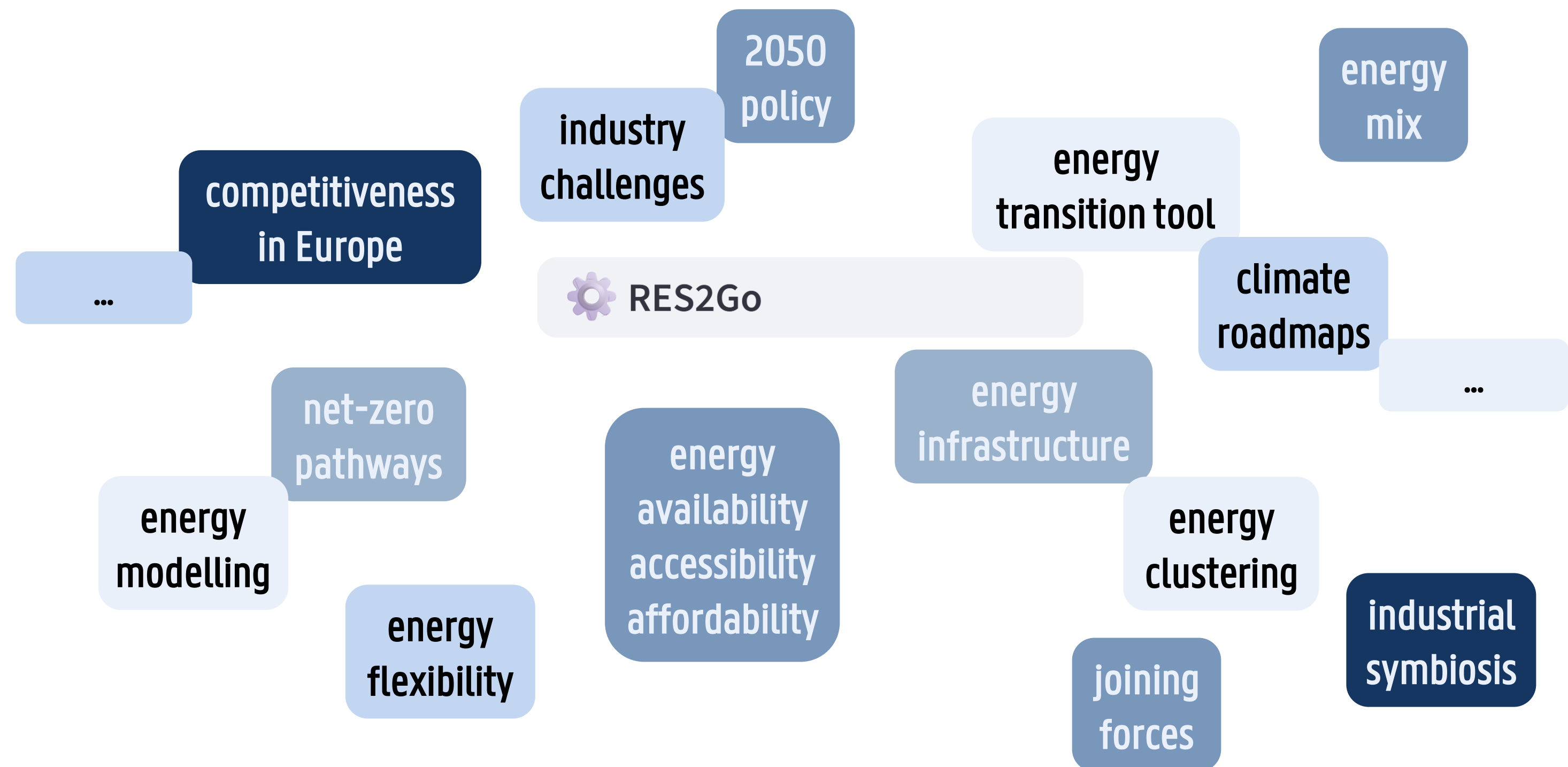
PANELLISTS

- mr. **Manuel von Mettenheim**, policy officer, DG Energy, European Commission
- dr. **Bart Adams**, EMEA energy manager, Styrene business, INEOS group
- dr. **Pieter Vingerhoets**, senior researcher, VITO-EnergyVille
- ir. **Nienke Dhondt**, PhD researcher, ECM group, Ghent University

MODERATORS

- dr. Arne De Keyser, head EnerGhentIC, business development center sustainable energy, Ghent University
- prof. Greet Van Eetvelde, head ECM group, Ghent University

Panel debate



Special thanks

ECM seminar/webinar

panellists & moderator
audience in room & online
support teams ECM, EnSy, EnerGhentIC

7 October 2025

G. Van Eetvelde, N. Dhondt, L. Demolder, L. De Backere, T. Duvillard

LUNCH – MEET & GREET ECM & ENSY

ECM seminar

7 October 2025

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Prof.dr.ir. Greet Van Eetvelde

Ir. Nienke Dhondt, Ir. Lieven Demolder, Ir. Louis De Backere, Ir. Thijs Duvillard

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