Welcome to the 3rd EnTEC Conference

Energy **T**ransition **E**xpertise **C**entre project

7th of February 2024
09:00 – 12:00

Agenda (1)

Time	Topics
08:55 – 09:00	*Dial-in and technical check*
09:00 – 09:05	**Welcome words** Karsten Krause – European Commission DG ENER
09:05 – 09:10	**EnTEC Introduction** Barbara Breitschopf – Fraunhofer ISI
09:10 – 09:45	**Common European energy data space** Intro by DG ENER George Paunescu Volker Berkhout – Fraunhofer IEE
09:45 – 10:10	**Osmotic energy potential** Intro by DG ENER Eric Lecomte Torsten Birth-Reichert – Fraunhofer IFF
10:10 – 10:20	*Break*

Agenda (2)

Time	Topics
10:20 – 10:45	**Regulatory sandboxes in the energy sector** Intro by DG ENER Andrea Hercsuth João Gorenstein Dedecca – Trinomics
10:45 – 11:10	**Supply chain risks in the EU's energy technologies** Intro by DG ENER Karsten Krause Mohammad Ansarin – Trinomics
11:10 – 11:35	**Open public consultation on carbon capture and storage** Intro by DG ENER Szilvia Bozsoki Hans Bolscher – Trinomics
11:35 – 12:00	**Energy efficiency 1st methodology** Intro by DG ENER Veronika Jirickova Jessica Glicker – Trinomics
12:00 – 12:05	**Wrap up and closing** Barbara Breitschopf – Fraunhofer ISI

European Commission

Welcome

by Karsten Krause

Team Leader Unit B5

Digitalisation, Competitiveness, Research and Innovation

DG ENER – European Commission

European Commission

EnTEC Introduction

by Barbara Breitschopf, Fraunhofer ISI

“The electric light did not come from the continuous improvement of candles. ”

[Oren Harari]

European Commission

EnTEC Introduction

What does EnTEC stand for?

- Energy Transition Expertise Centre
- cooperation of six organisations
- studies on selected topics:
  - in-depth studies:
    - Role of green H2 imports
    - Digitalisation for flexibility
    - Energy storage
    - Regulations for carbon capture
  - exploratory studies:
    - Competitiveness and system integration
    - Multi-supplier models
- and ....

EnTEC Introduction

What do we present today?

- in-depth study:
  - Common European Energy data space -> realisation of advanced digital ecosystem to facilitate communications between organisations and devices; Fraunhofer, TNO
  - OPC on CC(U)S -> results of the OPC; Trinomics, Fraunhofer
- exploratory study:
  - Osmotic energy potential -> outlines the energy potential of osmosis; Fraunhofer
  - Regulatory sandboxes -> purpose, regulatory/legal basis, format, implementation barriers and best practices, and impacts in fostering regulatory learning and new business cases; Trinomics, Fraunhofer
  - Supply chain bottlenecks -> looks at the strategic importance of CET based on three criteria; Trinomics
  - Energy efficiency first -> provides methodologies to integrate wider benefits into assessments; Trinomics, Guidehouse, TNO, Fraunhofer

Common European energy data space

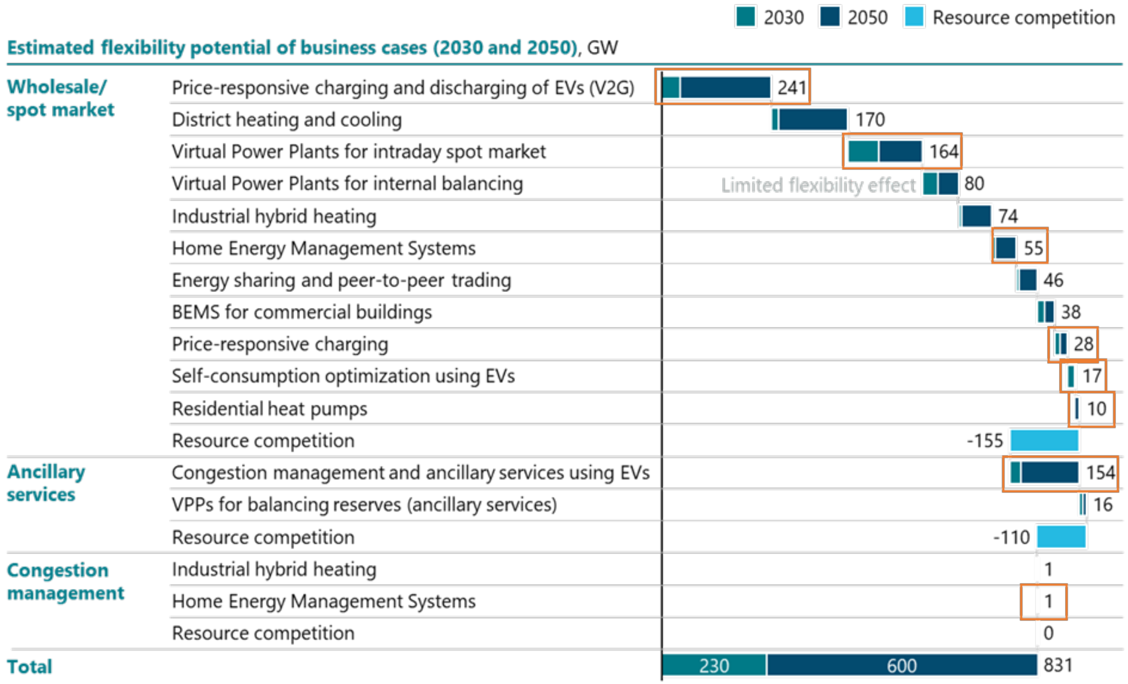
Intro by DG ENER George Paunescu

Presentation by Volker Berkhout, Fraunhofer IEE

20min presentation & 15min questions

Starting point
Digitally enabled flexibility

- Potential for flexibility outlined in previous study
- Digitally enabled flexibility
- Inventory based on three high level use-cases
  - Virtual power plants & aggregation
  - Smart charging &V2G
  - Smart residential flexibilities



Source: (Klobasa et al. 2022)

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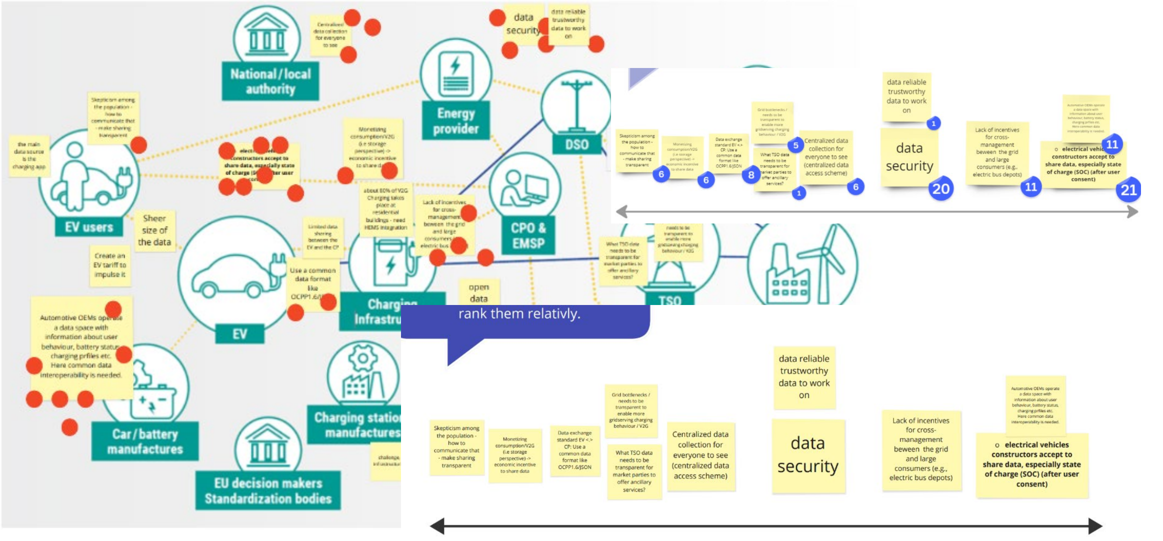
Method description
Workshop I – gap analysis

- Online workshop
- 106 participants
  - Industry | Research | Regulation
- Split between three use-cases
- Major pain points in industry data exchange
  - Seriousness of issue
  - Importance for policy makers to intervene

Clustering and evaluation of raised points



Trivial issue

Serious issue

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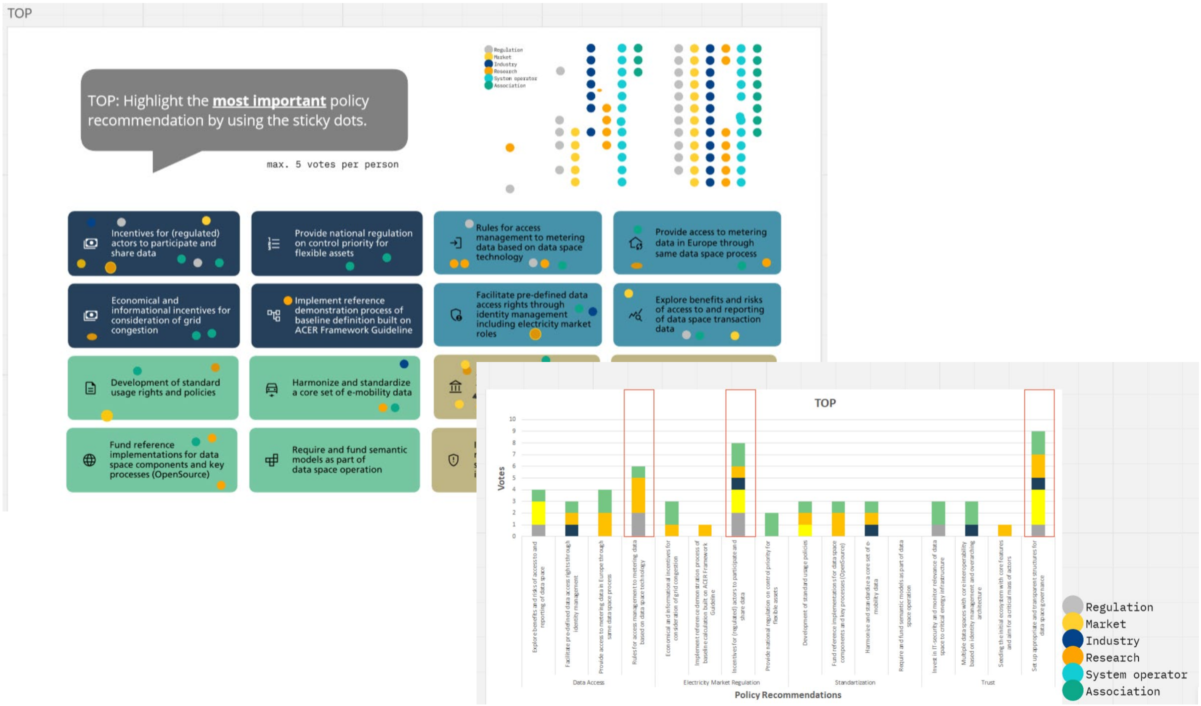
Method description
Workshop II – policy recommendations

- Hybrid workshop
- 26 in-person; 45 online participants
  - **Industry | Research | Regulation**
- Discussion and feedback on draft policy recommendations
  - Top & Flop voting
  - Space for direct feedback

Develop set of recommendations



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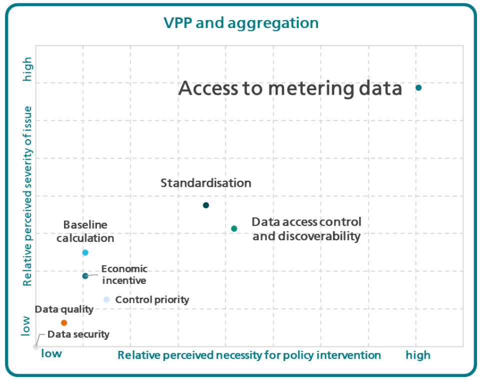
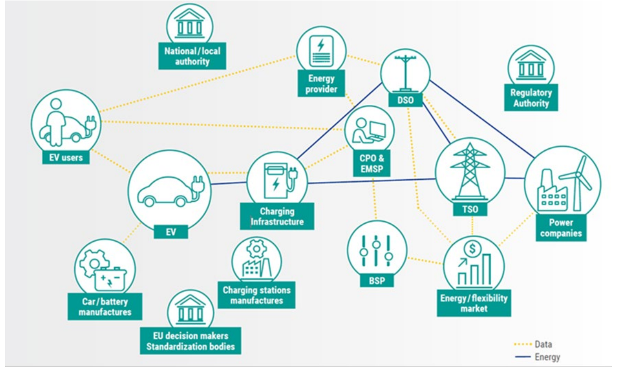
State of Flexibility in Europe
Use case analysis and pain point identification

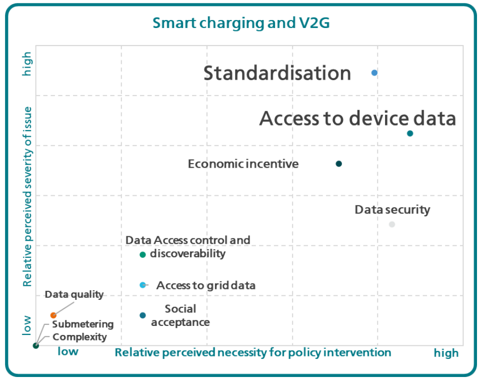
Virtual power plants and aggregation



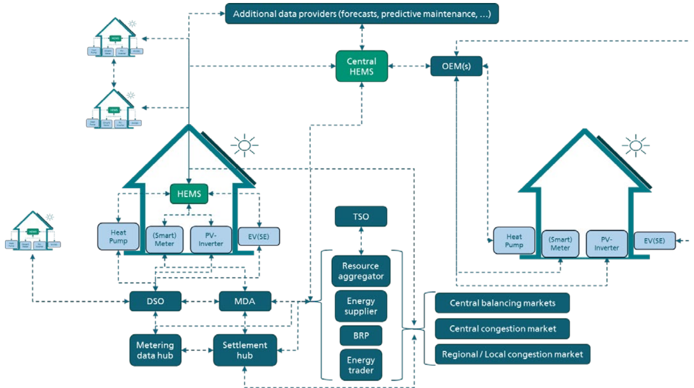
Smart charging and vehicle to grid

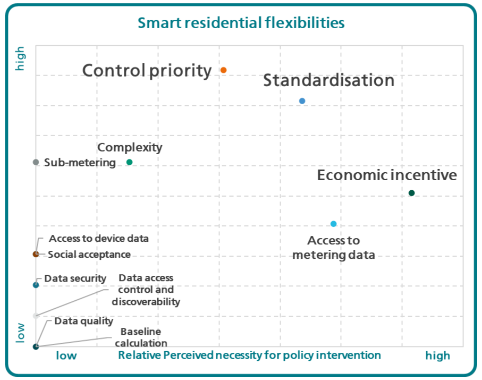


Source: ENTSO-E 2021 - Electric Vehicle Integration into Power Grids



Smart residential flexibilities





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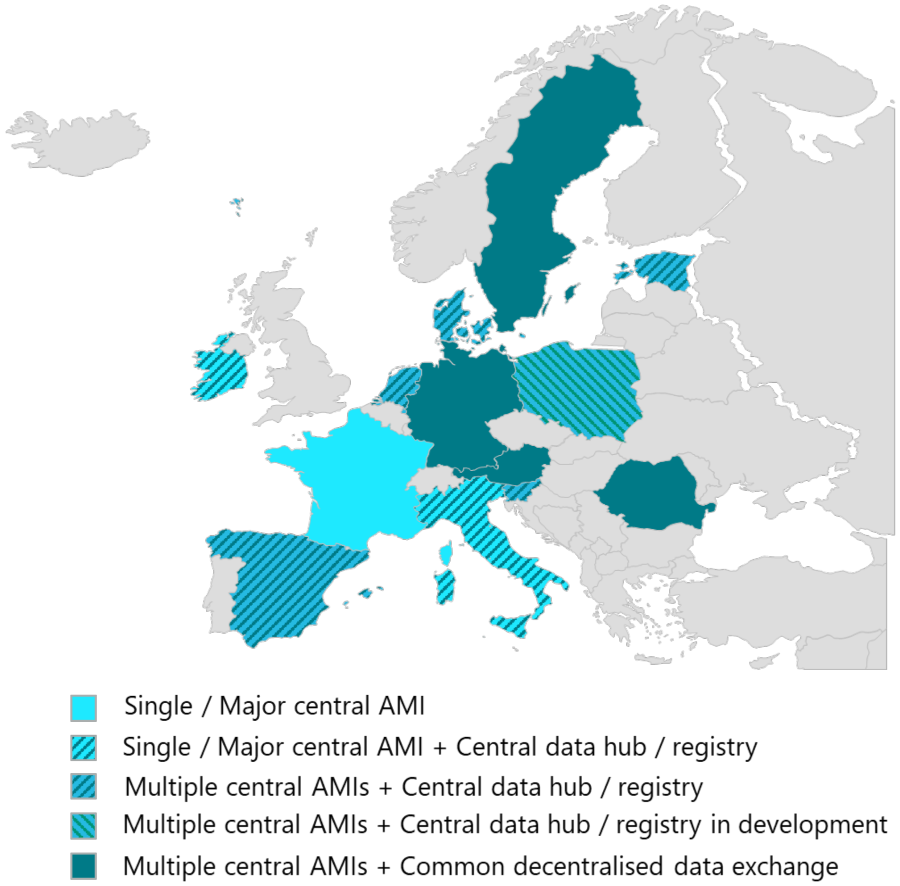
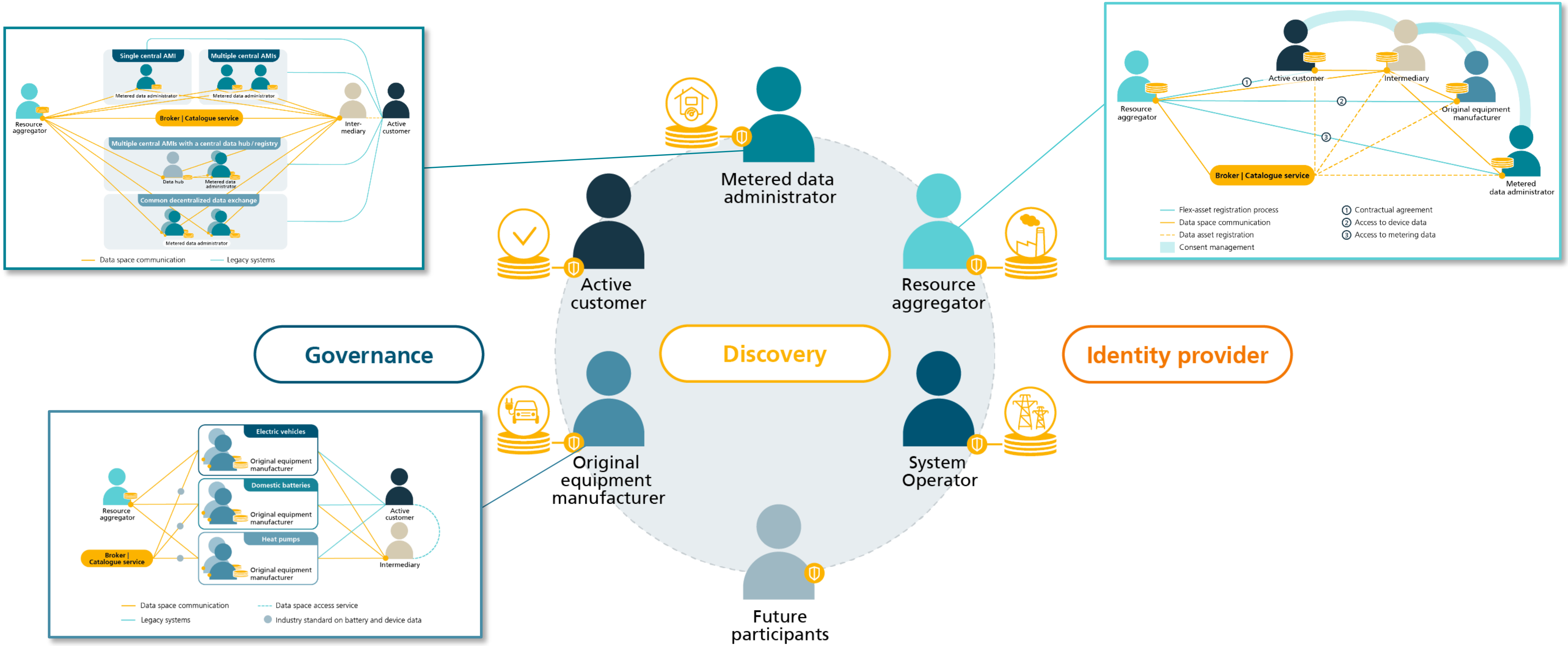
State of Flexibility in Europe
Advanced metering infrastructure

- Advanced metering infrastructure across Europe differs in its organisational setup and follows centralised and/or decentralised approaches.

- Smart meter data necessary for flexibility services
  - Varying concepts for AMI throughout Europe
  - Varying state of rollout across Europe



Common European Energy Data Space

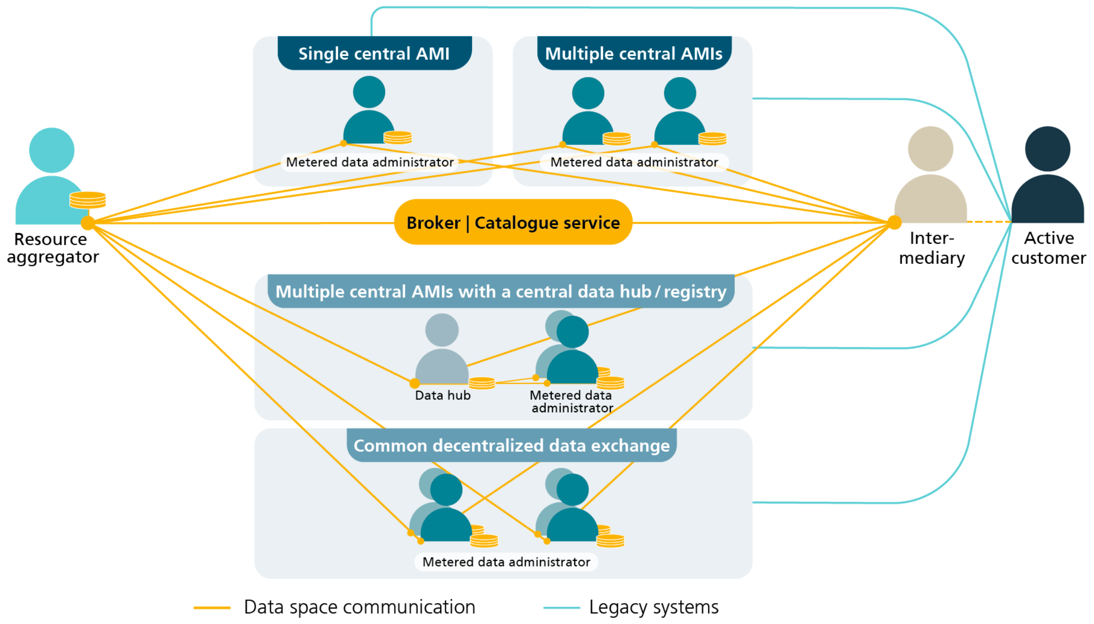


Implementation Plan
Data Space as „one-stop-shop“ for access to AMI infrastructure

- Access to metering data in diverse AMI landscape seen as a major barrier currently

- Proposed solution:
  Unified data space-based process for access to AMI data

- Implications:
  - Connection of responsible actors to data space
  - Strong need for coordination with
  country-specific regulatory requirements



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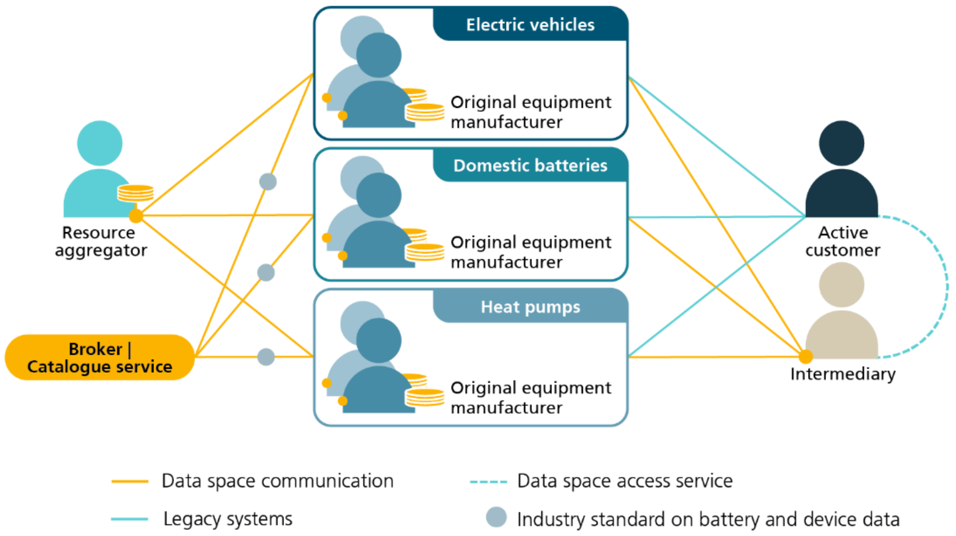
Implementation Plan
Standardised access to device data from OEMs

- **Standardisation**
  - Both access to data and data itself
  - Apply common data standard for Vehicle-to-grid ISO 15118-20
  - Industry-wide data model and standard for EV batteries needed
  - Data flow for RED III flexibility-provision may be facilitated through data space



- **Access to data on OEM cloud through data space**

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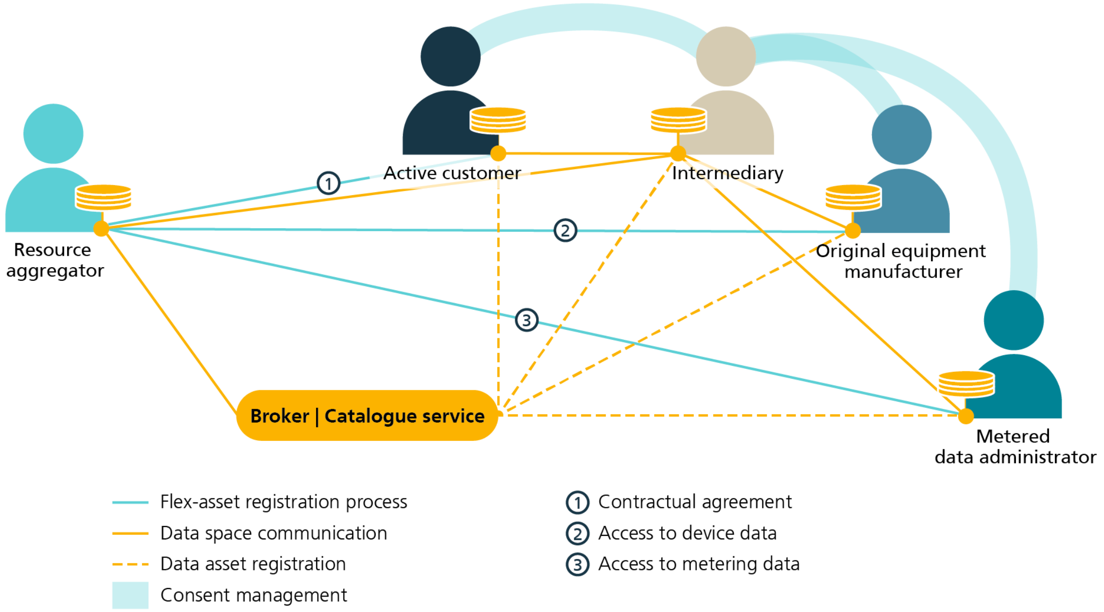
Implementation Plan
Data space enabled VPP asset registration reference process

- Straightforward process to register flexibility assets with resource aggregators
  - Enable market access for smaller asset classes
  - Enable competitive market with low lock-in for asset operators
- Automated asset registration process
  - Minimum and maximum required data to be defined by industry associations
  - Only consent of consumer required before registration to access device and data
  - Defined dataset registered with broker
- Device data may be accessed directly from OEM clouds



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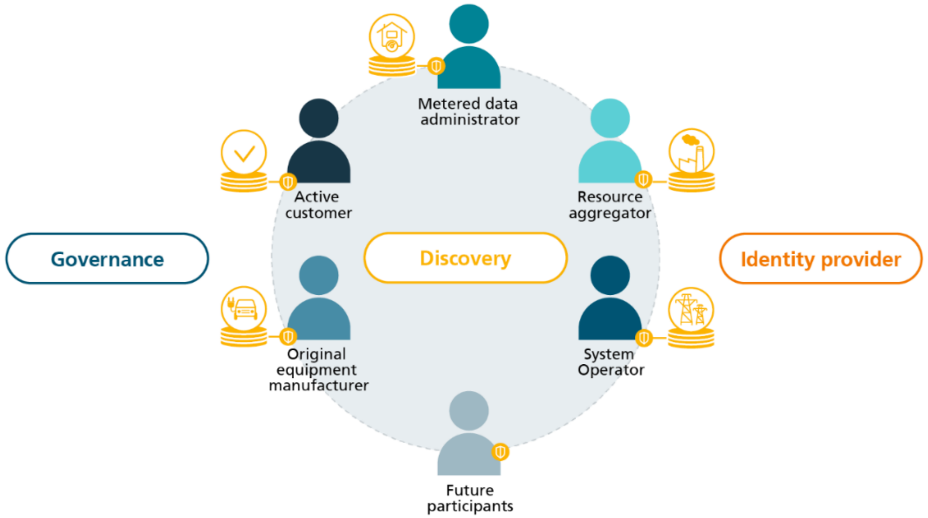
Summary and Outlook

- Adressing the pain points
  - Access to metering data is an enabler for flexibility services as well as a prominent pain point across all use cases.
  - Access to standardised device and battery data from the automotive and heat sector will facilitate and improve flexibility services.
  - A smooth onboarding process to aggregation services will support the uptake of flexibility services and empower owners and operators to switch between aggregators easily, thus enabling competitive market conditions.



- Outlook
  - Define interoperability requirements
  - Timeline of EU Action plan on digitalisation
  - Clear and stable outlook on governance and funding structure

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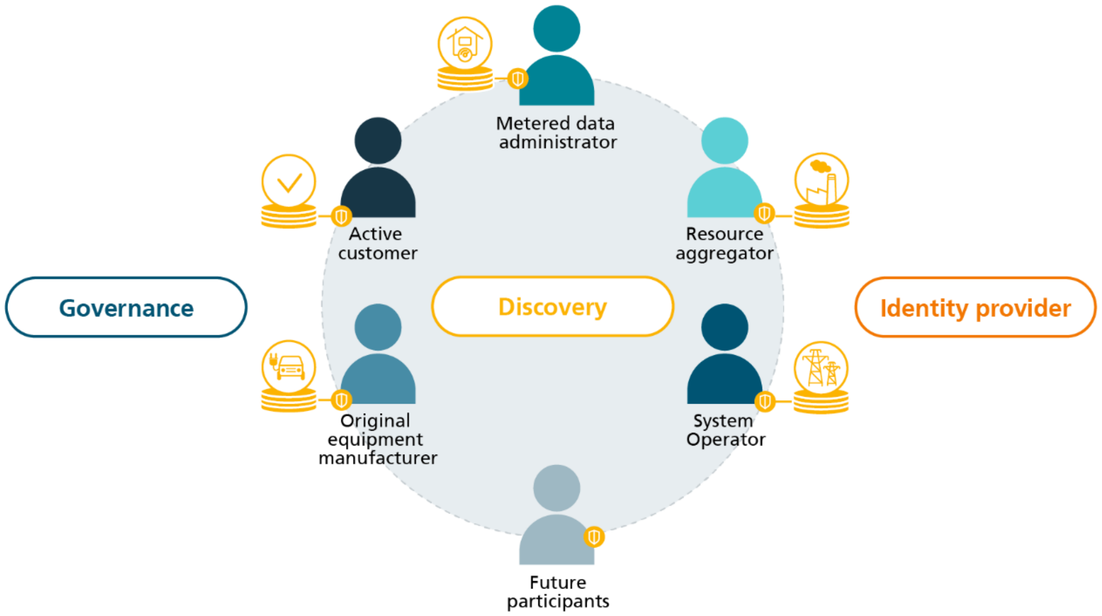
Summary of implementation plan

1. Define initial **user stories** & business cases of **key participants**
2. Define and establish **Data Space framework**
3. Make **data assets discoverable**
4. Develop processes to **solve key pain points**
   1. Standardised access to metering data across Europe
   2. Device data access from OEMs
   3. Asset registration in virtual power plants
5. Extend data space in **iterative process**

Common European Energy Data Space



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Osmotic energy potential

Intro by DG ENER Eric Lecomte

Presentation by Torsten Birth-Reichert, Fraunhofer IFF

20min presentation & 5min questions

The potential of osmotic energy in the EU
Motivation

Renewable energy generation from osmosis technologies offers a promising opportunity to meet the growing demand for clean and green energy

- sustainable energy source
- reduction of greenhouse gas emissions
- contribution to energy transition
- technological progress and economic growth
- technological progress and economic growth
- water resource efficiency

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The potential of osmotic energy in the EU
Approach

Technical and economic review of osmosis technologies

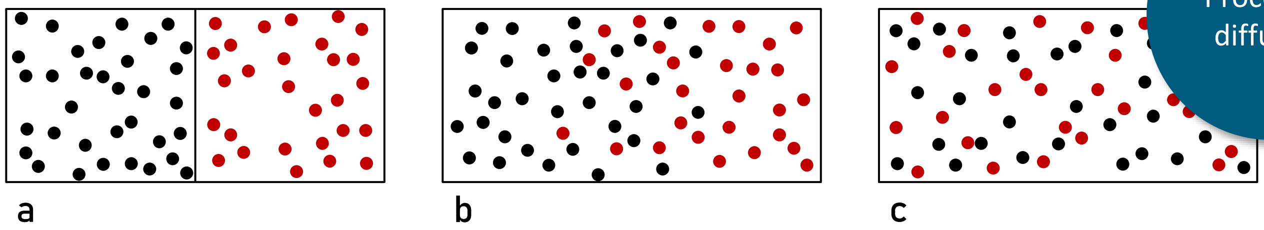
- Basics of osmotic power plants (Driving forces / Power plant design)
- Process control in the power plant system
- Economic overview (CAPEX, OPEX, LCoE)

- Workshop with Industry,
- Survey / Questionnaire

Potential of osmotic energy in the EU

- Data sampling and data preparation
- Tool development for estimating the osmotic energy potential
- Potentials for EU Member States

The potential of osmotic energy in the EU
Leading forces in osmotic power plants

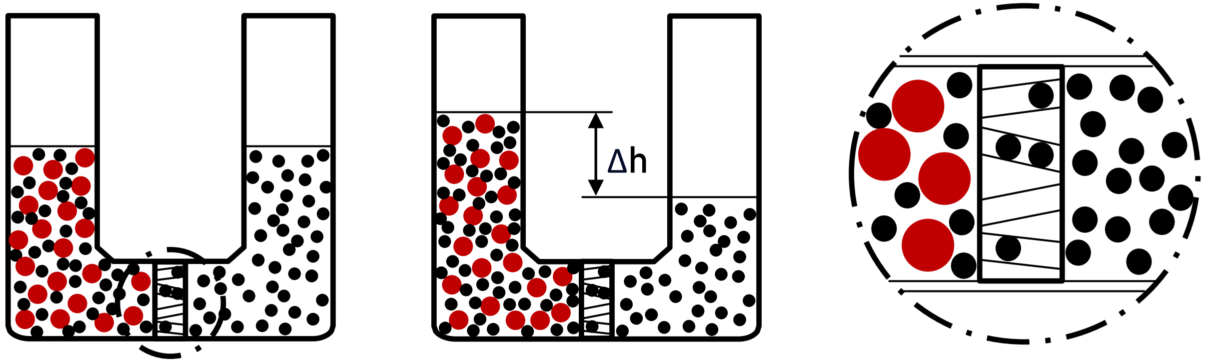


Process of diffusion

- Osmosis is based on the process of **diffusion** - a term that describes the compensation of a concentration gradient between two substances through a transport of molecules

Process of osmosis

- in the case of **osmosis**, the liquids are not separated by a wall, but by a selectively-permeable membrane
- in order to equalize the concentration gradient, the water molecules from the side with lower solute concentration (fresh water side) diffuse to the side with higher solute concentration (salt water side)



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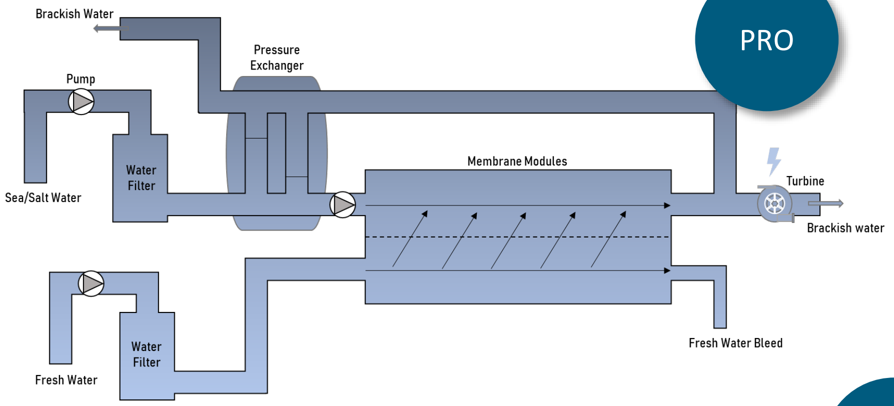
The potential of osmotic energy in the EU
Osmotic power plants

Osmotic power plants

Osmotic energy (synonyms: salinity gradient energy or blue energy) can be captured through different technologies such as:

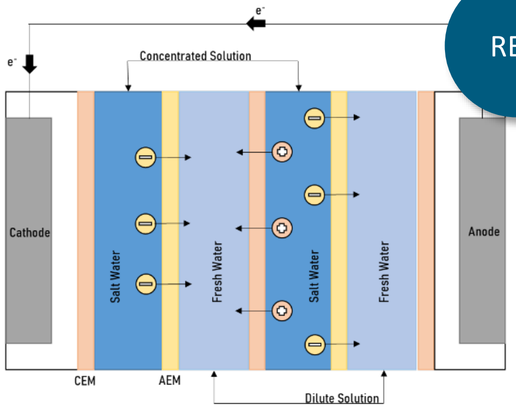
- Pressure Retarded Osmosis (PRO)
- Reverse Electrodialysis (RED)
- Ionic Nano Osmotic Diffusion (INOD)
- Mixing Entropy Battery (MEB)

PRO

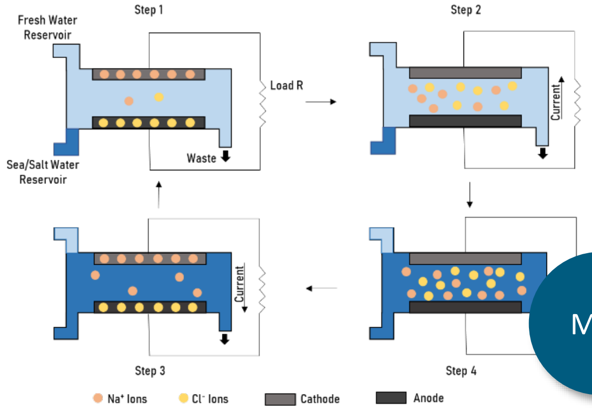


RED

INOD



MEB



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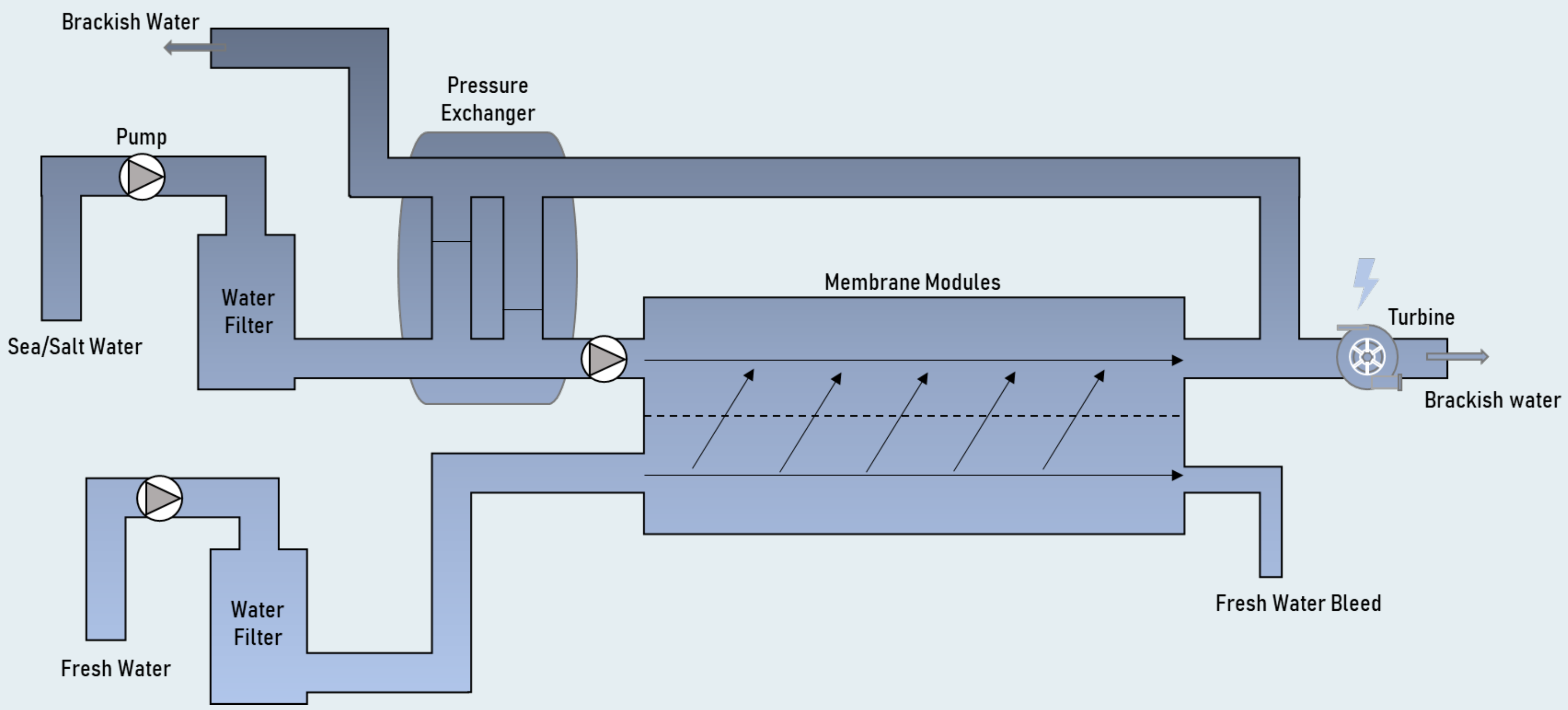
The potential of osmotic energy in the EU
Pressure Retarded Osmosis (PRO)



SaltPower develops and builds PRO

water molecules diffuse through the membrane

uses the salt gradients to build up water pressure that drives a turbine

continuous process

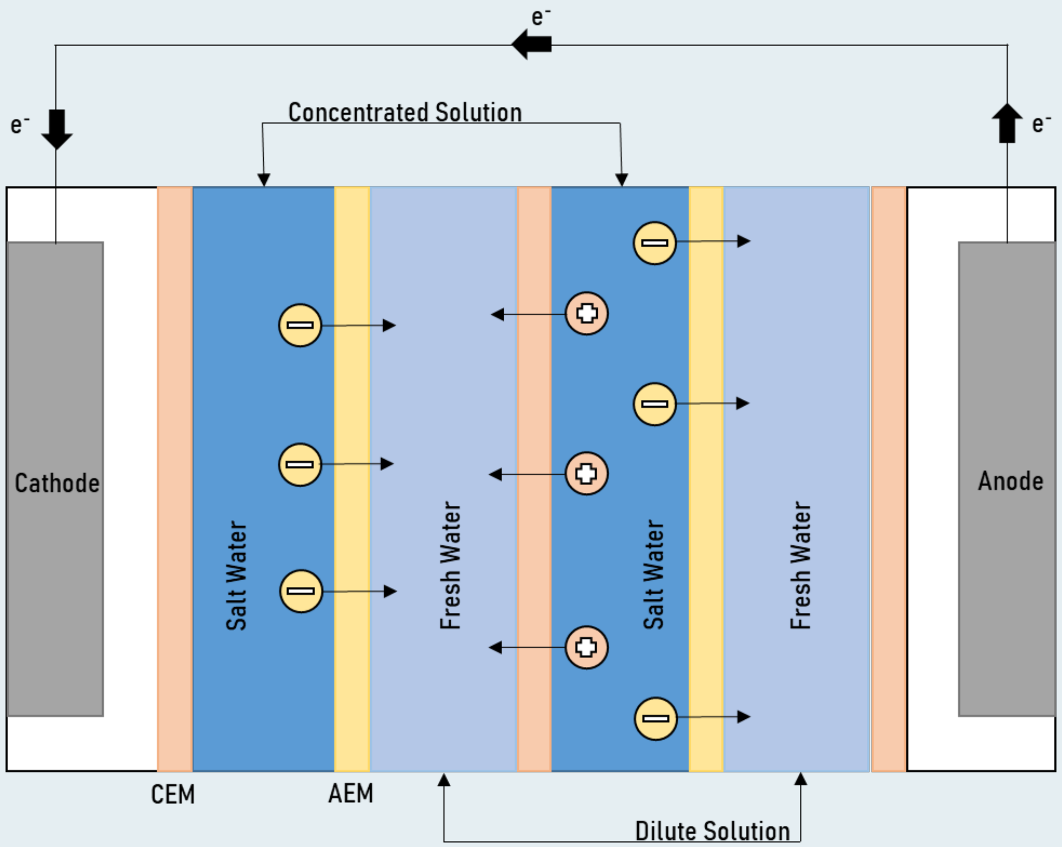
The potential of osmotic energy in the EU
Reverse Electrodialysis (RED) and Ionic Nano Osmotic Diffusion (INOD)

REDStack develops and builds RED

ions diffuse through the membrane

creating a kind of battery that generates electricity

continuous process



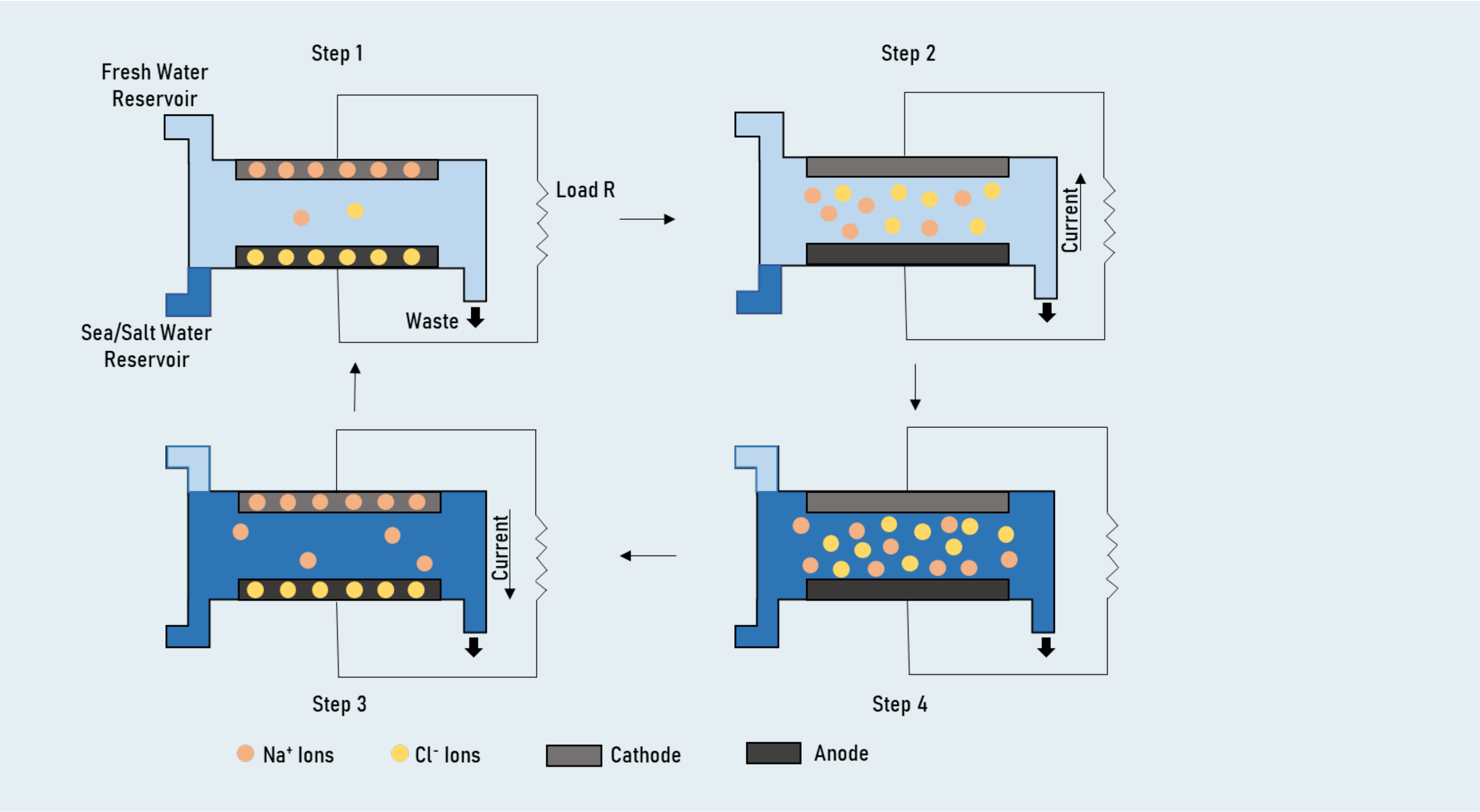
Sweetch develops and builds INOD-technology

similar principle, but uses Ionic Nano Membranes

continuous process

The potential of osmotic energy in the EU
Mixing Entropy Battery (MEB)

- currently only tested on a laboratory scale
- is a membrane- and turbine-free method
- four-step cycle
- discontinuous process



The potential of osmotic energy in the EU
Technical Comparison of osmotic energy technologies

			SaltPower	RedStack	Sweetch
Technological Comparison	Functional principle		PRO	RED	INOD
	TRL 2023	1 - 9	7	7	6 - 7
	TRL 2030	1 - 9	9	9	9
	Mode of operation		continuous	continuous	continuous
	Modularity and scalability		full modular and scalable	full modular and scalable	full modular and scalable
	Water using		mainly hypersaline solutions up to fully saturated brine	mainly fresh- and seawater, also brian	fresh- and seawater
	Membrane performance	W/m²	1.5 - 1.9 (5)	0.7 - 1 (5)	~ 20 (laboratory test)
	Type of membranes		hollow fiber membranes	flat AEM / CEM	nano membranes (bio-sourced)
	Seasonal fluctuations		no fluctuations; availability of feedwater	temperature and salinity gradients; availability of feedwater	temperature and salinity gradients; availability of feedwater
	Land use	m²/kW	~ 1	~ 1	1.2 - 1.5
Economic Comparison	CAPEX	€	-	900 million (first 100 MW)	500 million (assumption:100 MW / first of a kind)
	OPEX	%/a	3 - 5	2 - 5	4 - 5
	LCoE in 2023	€/kWh	0.15 - 0.19	0.11 - 0.12	0.24
	LCoE ~ in 10 years	€/kWh	< 0.09	0.05	0.05 - 0.06

The potential of osmotic energy in the EU
Technical Comparison with other energy systems

		Carbon Neutral	Distributed	Centralized	System modularity	Peaking	Baseload	LCoE ~ in 10 yr (€/kWh)	Land use (m^2/MWh)	Acceptance
Renewable Energy	Osmotic	yes	yes	yes	yes	no	yes	0.05 - 0.09	0,1 - 0,2	good
	Solar PV	yes	yes	yes	yes	no	no	0.02 - 0.04	12,6 (on ground)	good
	Solar Thermal and storage	yes	no	yes	yes	no	no	-	22,0	middle
	Geothermal	yes	no	yes	no	no	yes	0.04 - 0.14	51	good
	Onshore wind	yes	yes	yes	yes	no	no	0.04 - 0.08	0,4*	middle
Conventional Energy	Gas peaking	no	no	yes	no	yes	no	-	1,0	rather bad
	Nuclear	yes	no	yes	no	no	yes	-	0,3	rather bad
	Coal	no	no	yes	no	no	yes	0.08 - 0.12	15,0	rather bad
	Gas Combined Cycle	no	no	yes	no	no	yes	0.06 - 0.08	1,3	rather bad

The potential of osmotic energy in the EU
Potential analysis of osmotic energy

Assumptions for calculating potential

$$E_{max,theo} = i \cdot c_{salz} \cdot k_B \cdot T \quad (1)$$

$$E_{max,theo} = 2 \cdot 510 \cdot 8{,}314 \cdot 10^{-6} \cdot 298\ \mathrm{MJ/m^3} = 2.5\ \mathrm{MJ/m^3}$$

$$E_{max,techn} = E_{max,theo} \cdot eff_{plant} = 2.5 * 45\% = 1.1\ \mathrm{MJ/m^3} \quad (2)$$

$$P_{max,theo,river[MW]} = E_{max,tech} \cdot \dot{V}_{riv} \quad (3)$$

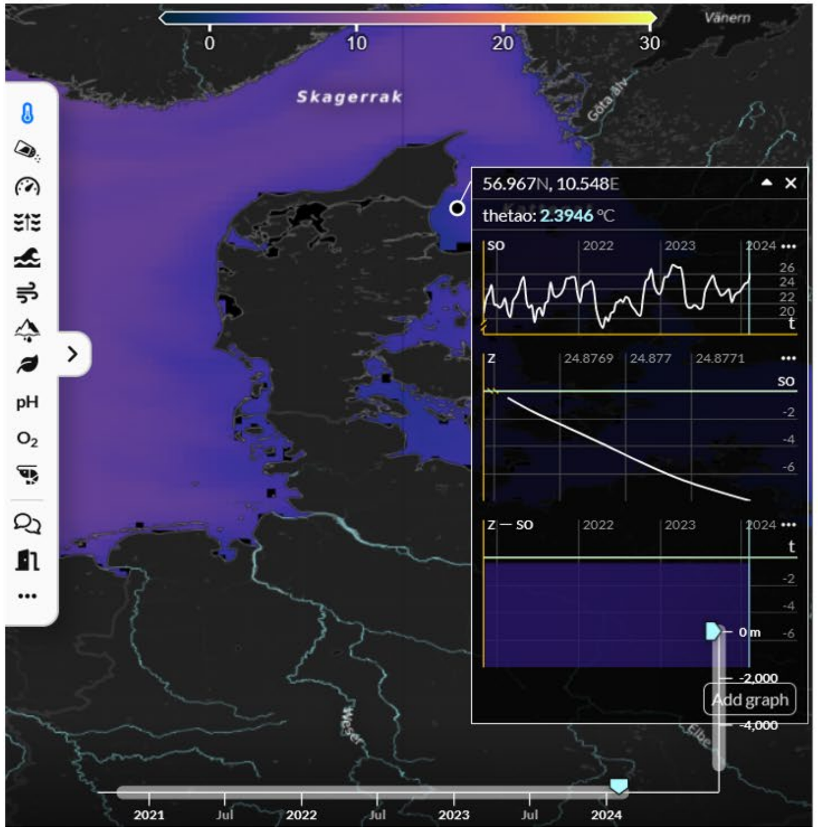
$$P_{withdrawal;0.2\,[GW]} = E_{max} \cdot 0{,}2 \quad (4)$$

$$E_{withdrawal;0.2\,[GWh]} = P_{withdrawal;0.2\,[MW]} \cdot t_{operate} \quad (5)$$

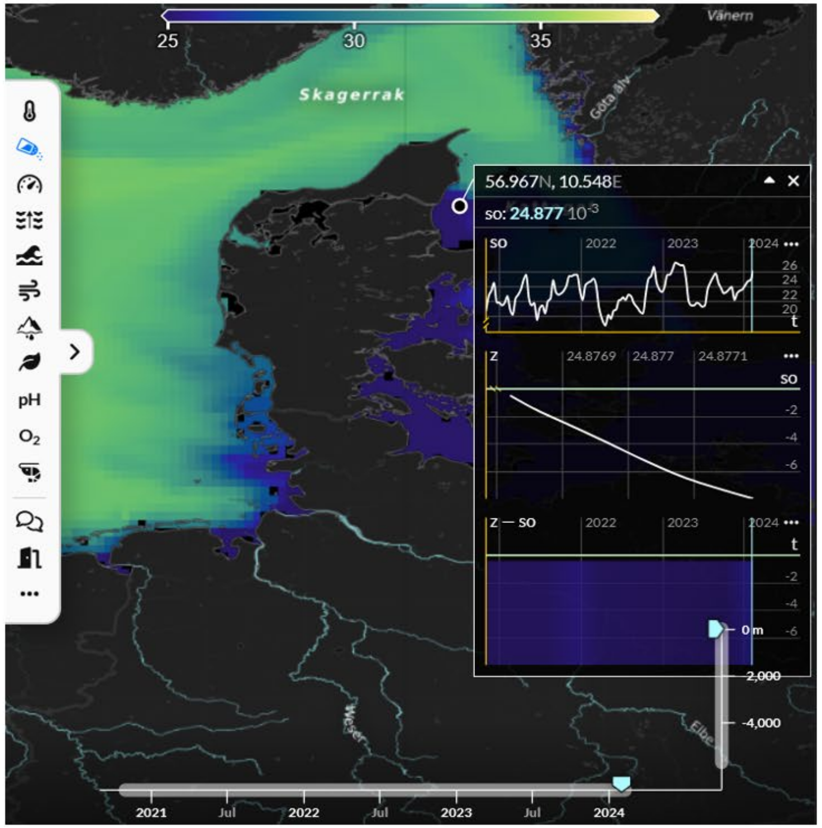
	List of EU Members	Potential determined	Reason
1	Belgium	No	Exclusion by assumptions, Annex A.1
2	Bulgaria	Yes	
3	Denmark	No	Exclusion by assumptions, Annex A.1
4	Germany	Yes	
5	Estonia	Yes	
6	Finland	Yes	
7	France	Yes	
8	Greece	Yes	
9	Ireland	Yes	
10	Italy	Yes	
11	Croatia	Yes	
12	Latvia	Yes	
13	Lithuania	Yes	
14	Luxembourg	No	continental area, no sea connection
15	Malta	No	no permanent flowrates
16	Netherlands	Yes	
17	Austria	No	continental area, no sea connection
18	Poland	Yes	
19	Portugal	Yes	
20	Romania	Yes	
21	Sweden	Yes	
22	Slovakia	No	continental area, no sea connection
23	Slovenia	No	Exclusion by assumptions, Annex A.1
24	Spain	Yes	
25	Czech Republic	No	continental area, no sea connection
26	Hungary	No	continental area, no sea connection
27	Cyprus	No	no permanent flowrates

The potential of osmotic energy in the EU
Potential analysis of osmotic energy

Temperature



Salinity



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relevant data such as salt concentrations and temperatures of the seas in the estuaries of the rivers were retrieved via the Copernicus Marine Data Store

https://data.marine.copernicus.eu/viewer

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The potential of osmotic energy in the EU
Potential analysis of osmotic energy

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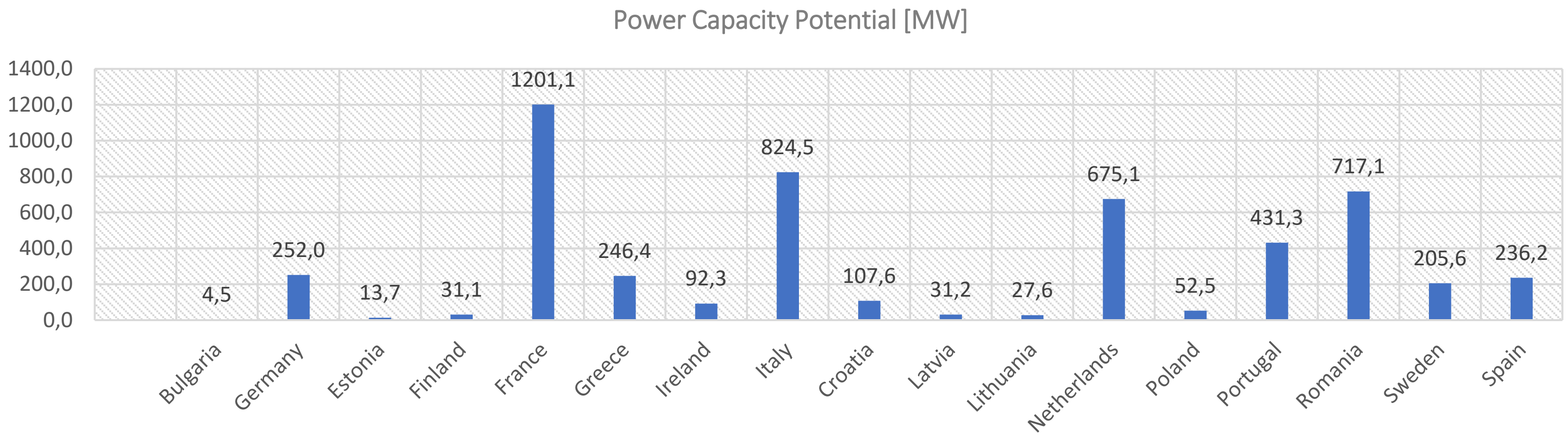
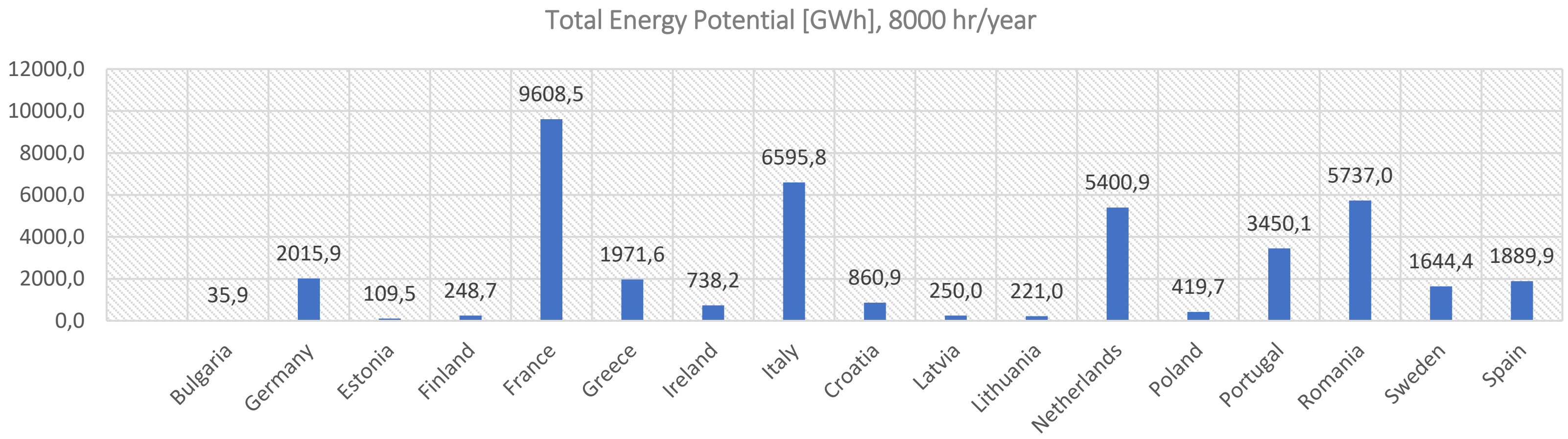
Assumptions: withdrawl of 0.2, efficiency coefficient of 0.45 and operating time of 8000 hr/year

Power Capacity Potential of 5,1 GW

with 8000 hr/year, this results in approx. 41 TWh





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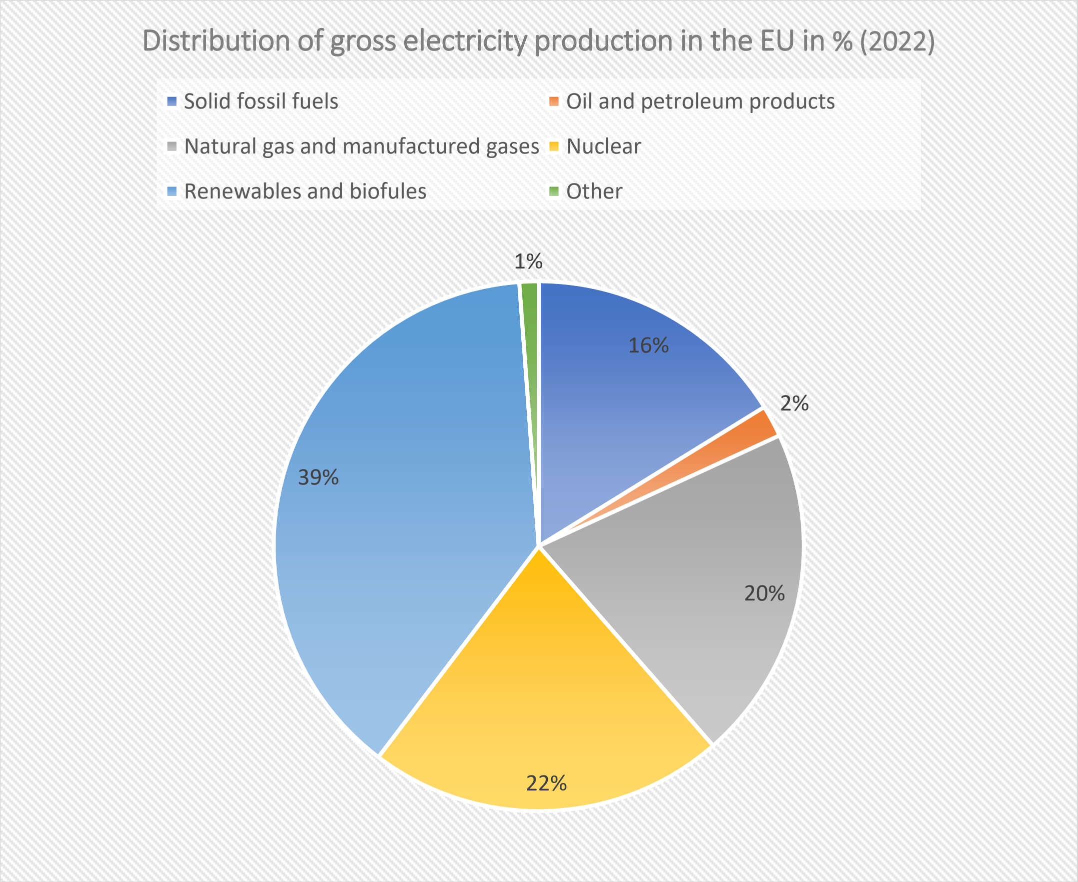
The potential of osmotic energy in the EU
Potential analysis of osmotic energy



gross electricity production in the EU (2022)

Type of energy	GWh	-
Solid fossil fuels	453.180	0,16
Oil and petroleum products	54.277	0,02
Natural gas and manufactured gases	571.687	0,20
Nuclear	609.169	0,22
Renewables and biofules	1.076.710	0,38
Other	32.822	0,01
Total	**2.797.845**	**1,00**

Osmotic energy: Power Capacity Potential of 5,1 GW with 41.148 GWh

an increase of 1.5 % in relation to total gross electricity production

an increase of 3,8 % in relation to renewables and biofules gross electricity production

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The potential of osmotic energy in the EU
Hypersaline sources – an Overview

Desalination brines

Natural resources

Hyper-saline lakes

Salt domes

Hyper-saline geothermal water

Industrial brines

Brine waste water

Oil field brines (fracking wastewater)

Evaporation ponds – solar salterns

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The potential of osmotic energy in the EU
Conclusion

Osmotic power plants offer a way to provide renewable energy in the future

Energy potential for EU27 amounts to approx. 41 TWh

Additional potential lies in the use of hypersaline waters

Various technologies are close to market maturity to 2030

PRO, RED, INOD

future LCoEs lie in the area of other renewable technologies

legal framework conditions still need to be considered

European Commission

Regulatory sandboxes in the energy sector

Intro by DG ENER Andrea Hercsuth

Presentation by João Gorenstein Dedecca, Trinomics

15min presentation & 10min questions

EU energy-related experimentation initiatives

- 2020 European Council conclusions on regulatory sandboxes
- REDII amendments to promote testing of new RES technologies
- 2023 SWD on Regulatory Learning in the EU
- Testing of emergent techniques under the amended IED
- Revised Better Regulation Toolbox and Tool #69
- Commission recommendation on permitting procedures and PPAs
- Net-zero regulatory sandboxes in NZIA

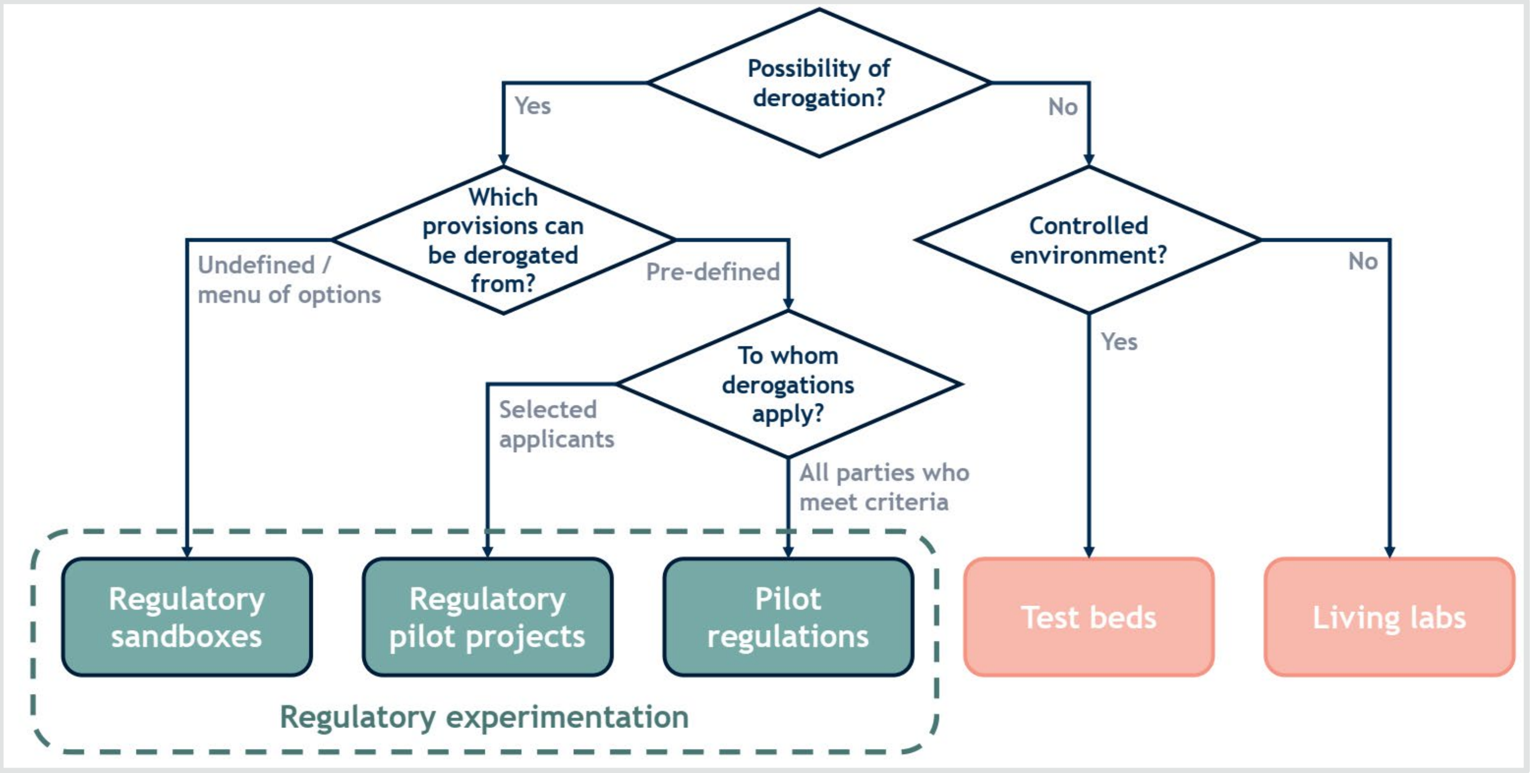
Project objectives

1. Analyse existing regulatory sandbox schemes for the energy sector…
2. With a focus on the EU Member States…
3. Regarding their:
    1. Purpose
    2. Regulatory/legal basis
    3. Format
    4. Implementation barriers and best practices, and impacts in fostering regulatory learning and new business cases

! Project implemented between February and May 2023 !

Introduction

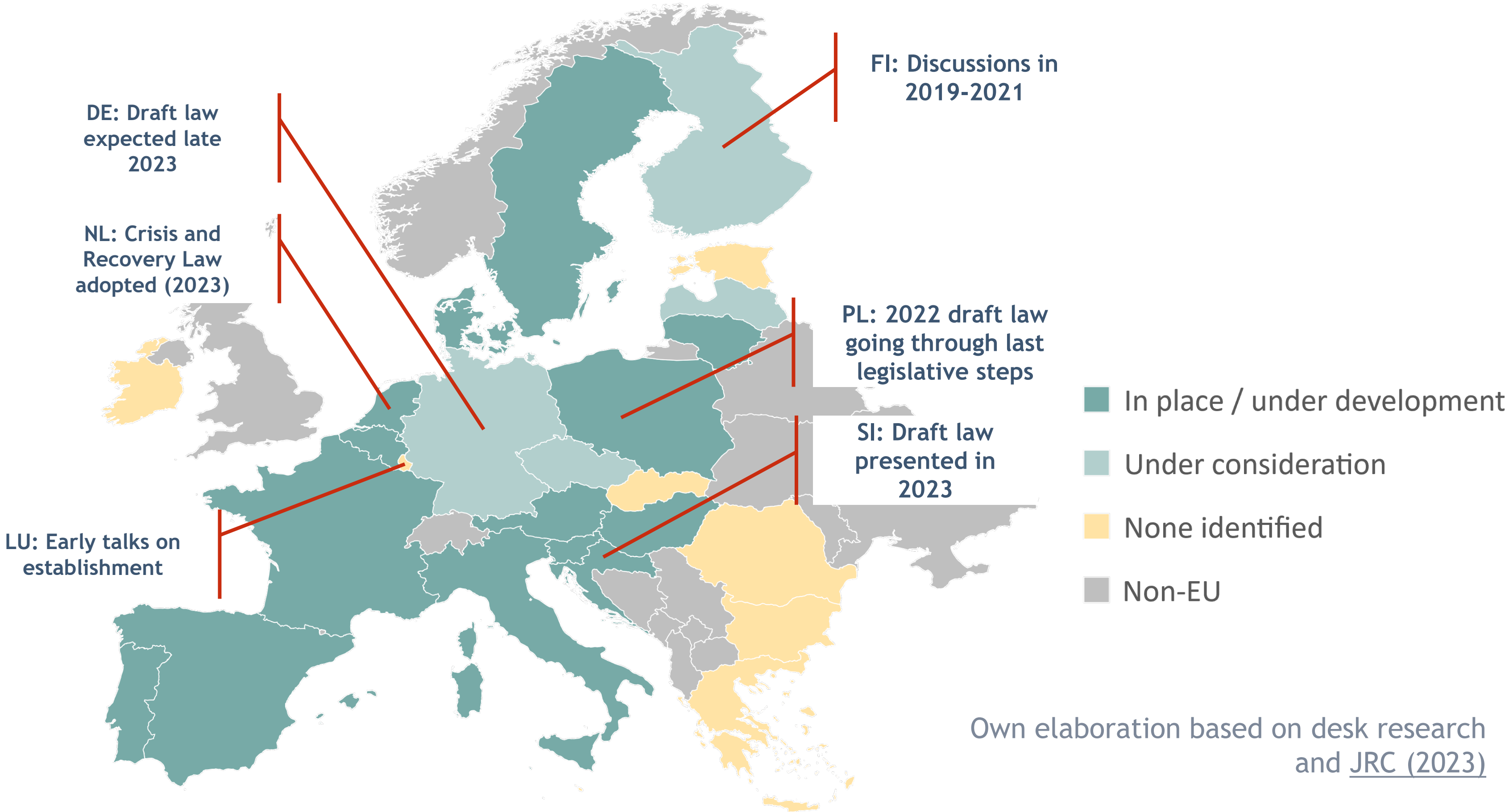
Regulatory sandboxes **support innovative solutions** and **promote regulatory learning**, often by granting **derogations** from regulatory provisions for a **limited period**



Regulatory experimentation frameworks in the EU

- Additional information identified for DE, FI, LU, NL, PL, SI
- Further confirmation of no frameworks in place for CY, IE, EL, RO
- Reg sandboxes for competition regulation does exist in EL

Member States with regulatory experimentation frameworks (May 2023)



Own elaboration based on desk research and JRC (2023)

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Implementation barriers

- Absence of a legal basis
- (Lack of) mandate by implementing entities
- Participation constraints
- Lack of resources/expertise
- (Perception of) conflicts with other binding (especially EU-level) regulations

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Best practices

- Determine if sandboxes are the best tool
- Provide regulators with mandate for promoting experimentation
- Choose suitable authorities for granting derogation and administering sandbox
- Develop transparent, clear, and detailed planning
  - Choose suitable timelines
  - Develop eligibility criteria
  - Set up a good scheme for (during sandbox) monitoring and (results of sandbox) evaluation
  - Set up robust and precise procedure for actions following the sandbox
- Integrate regulatory sandboxes into a larger (sectoral) strategy

Environmental considerations in regulatory experimentation

- No identified specific example of concrete environmental considerations in energy regulatory sandboxes
- Some examples exist in broader mechanisms promoting experimentation in the Netherlands and France
- Environmental aspects may be included in stated objectives of overall energy policy, but not affect sandbox implementation concretely
  - For example French regulatory sandbox for the energy sector (“dispositif d'expérimentation réglementaire”)
- Greater attention is being paid to the interactions between energy and environmental sector regulation, both to promote and avoid negative impacts of experimentation

The role of the EU

1. Inform on how to best provide guidance to innovators, including through mechanisms other than regulatory sandboxes

2. Providing implementation guidelines for EU-level provisions (e.g. NZIA) to ensure regulatory learning while minimizing the risk of market distortion

3. Provide guidance on regulatory experimentation in the energy sector as part of a broader guidance on regulatory experimentation

4. Facilitate the development of regulatory sandboxes by governments and regulators with limited resources

Main takeaways

A well-designed regulatory framework for experimentation can significantly promote innovation

Are warranted only in case where a regulatory exemption is strictly necessary for the innovation to take place

In other cases, different instruments may be more adequate while avoiding the risk of distorting the level-playing field

19 Member States had implemented or were considering frameworks for regulatory sandboxes as of May 2023

Several new initiatives have been adopted recently at the EU level

The EU can continue to play a role through the provision of guidance for implementation and sharing of knowledge

Supply chain risks in the EU’s energy technologies

Intro by DG ENER Karsten Krause

Presentation by Mohammad Ansarin, Trinomics

15min presentation & 10min questions

Background

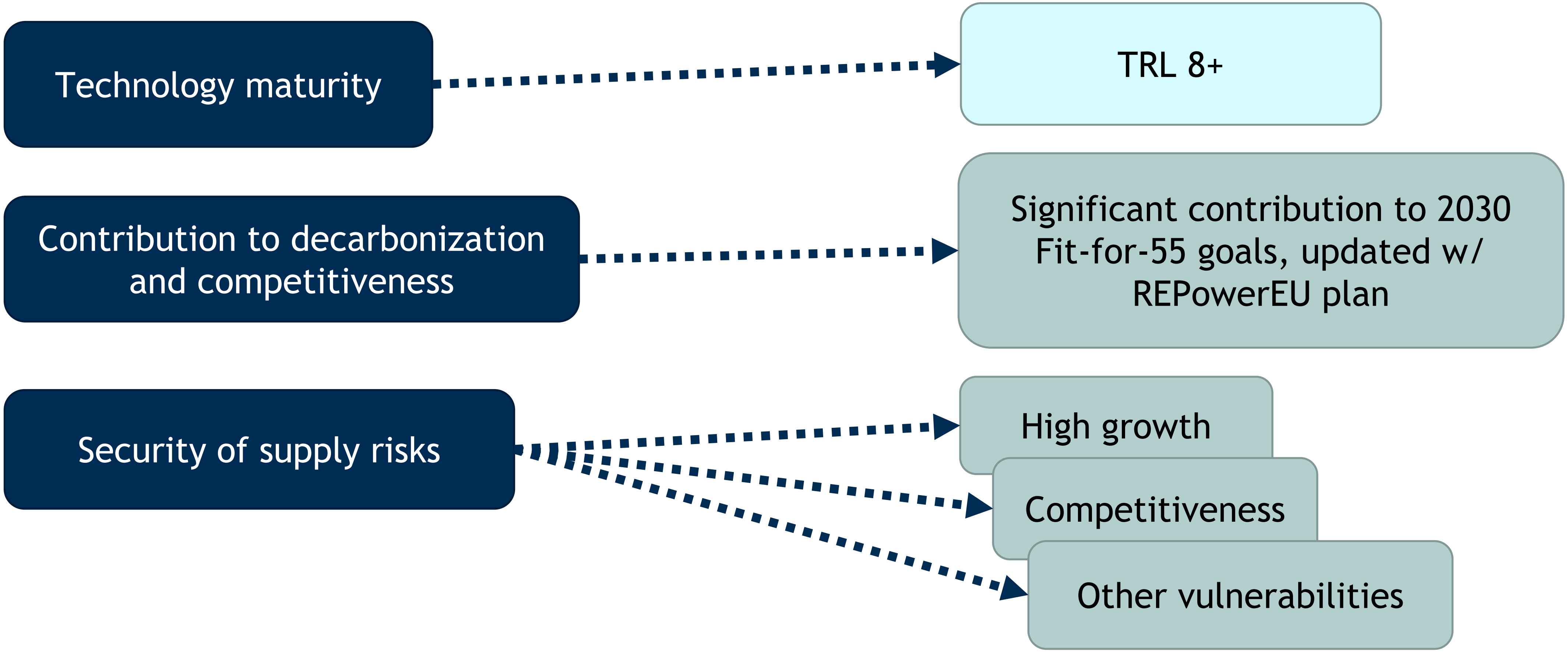
- (proposed) Net Zero Industry Act, focuses on manufacturing of components and devices of strategic energy technologies, up to 2030
- NZIA sets some technologies as strategic:
  - High maturity
  - Contribution to EU decarbonisation and competitiveness
  - Security of supply risks

Strategic net-zero techs:

1. Solar photovoltaic and solar thermal
2. Onshore wind and offshore renewables
3. Batteries/storage
4. Heat pumps and geothermal
5. Electrolysers and fuel cells
6. Sustainable biogas/biomethane
7. Carbon capture and storage
8. Grid tech

Strategic technologies

NZIA:



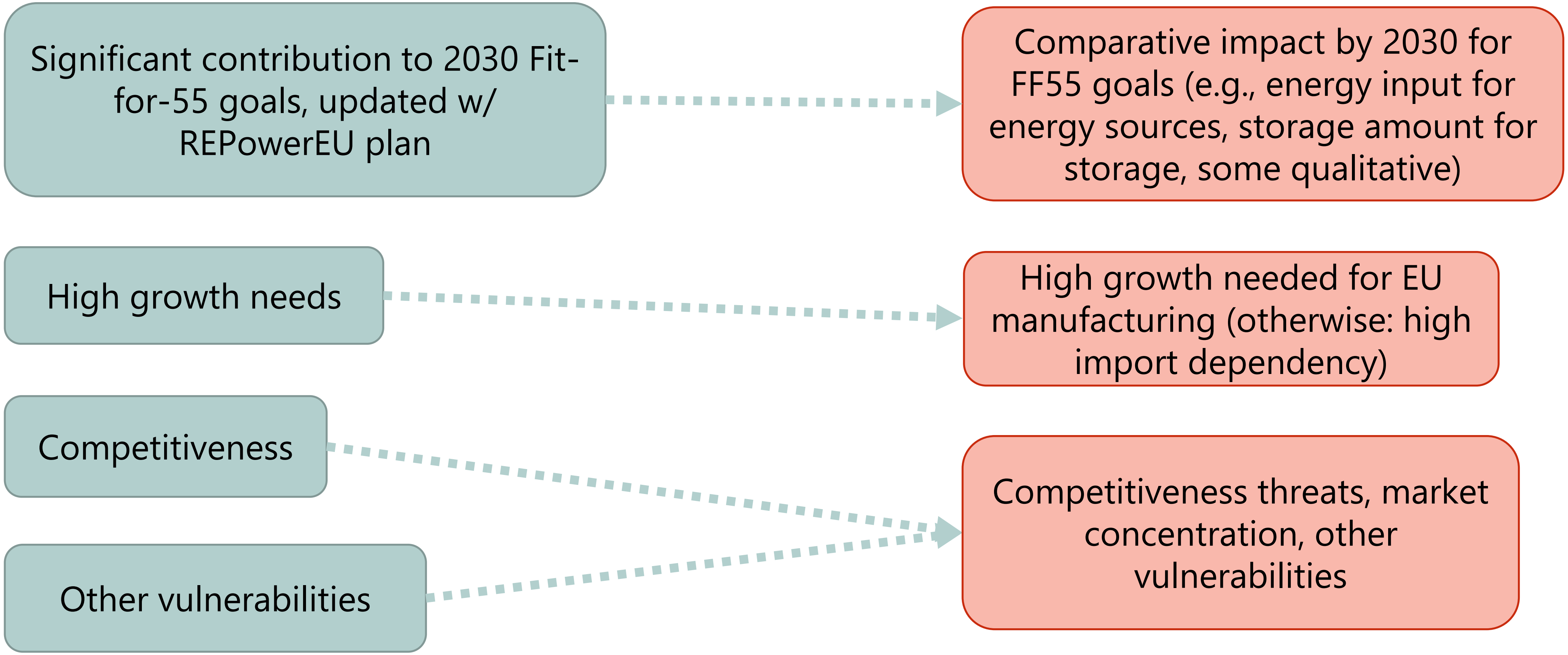
Plan

1. Set indicators for table

2. Assess indicators for each tech
   - Based on expert sources and desk research
   - Assessments for secondary tech to be done later for final report

3. Collect assessments into final analysis

Approach



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Technology categories

1. Solar photovoltaic and solar thermal
2. Onshore wind and offshore renewables
3. Batteries/storage
4. Heat pumps and geothermal
5. Electrolysers and fuel cells
6. Sustainable biogas/biomethane
7. Carbon capture and storage
8. Grid tech

→

1. Solar photovoltaics
2. Solar thermal
3. Onshore and offshore wind
4. Ocean energy tech
5. Batteries
6. Other storage
7. Heat pumps
8. Geothermal energy
9. H2 Electrolysers and fuel cells
10. Sustainable biogas/biomethane
11. CCUS
12. Grid tech

+ secondary techs

Sources

- Desk research of recent sources
  - Staff working documents, EC COMs
  - CETO reports (Nov 2022)
  - Other JRC reports (2021-2023)
  - IEA reporting (2022, 2023)
  - Industry associations (2022, 2023)
  - Eurobserv'ER (2022, 2023)
  - Eurostat data
  - …
- Contact with experts

Table 1

Tech	High Contribution to EU FF55 goals in 2030	High Growth Rate for manufacturing, import dependency	Competitiveness threats, market concentration, and other vulnerabilities	Aggregate Score
Solar photovoltaic systems	5	5	5	15
Wind (onshore & offshore)	5	4	4	13
Batteries (storage and E-mobility)	5	5	3	13
Heat pumps	5	3	4	12
Carbon capture storage and utilisation	4	5	3	12
H2 Electrolysers and Fuel cells	3	4	4	11
Grid technologies	4	2	4	10
Offshore renewable techs (wave and tidal)	1	5	3	9
Other storage tech (incl. thermal storage)	3	3	2	8
Solar thermal systems	2	2	3	7
Sustainable biogas/biomethane techs	3	3	1	7
Geothermal energy systems	1	2	3	6

Table 2

Tech	High Contribution to EU FF55 goals in 2030	High Growth Rate for manufacturing, import dependency	Competitiveness threats, market concentration	Aggregate Score
Ener. System-related Ener. Eff. Measures	4	2	2	8
Nuclear fission	2	2	2	6
RFNBOs (excl. H2)	2	2	3	7
Bio-liquids (incl. Adv. Biofuels)	2	2	2	6
Solid Bioenergy	3	1	2	6
Hydropower (& pumped hydro storage)	2	1	2	5

Conclusions

- Solar PV, Wind, Batteries remain the main critical techs
- Other strategic techs due to recent policies (e.g., heat pumps, hydrogen tech, CCS)
- Some tech of medium strategic importance for various reasons
- Secondary tech is less strategic (except building insulation material)
- Changes might appear when looking at a longer time window
- More info: full report on EU publications website

★★★★★ Rate this publication

Supply chain risks in the EU's clean energy technologies

This study focuses on the clean energy technologies (CET) defined as strategic in the proposed Net Zero Industry Act (NZIA) and considers their strategic importance. The study looks at each technology chosen in the NZIA (and other less strategic but relevant technologies) and uses desk research and expert input to

View more

European Commission

Support to the Open Public Consultation on Carbon Capture and Storage

Intro by DG ENER Szilvia Bozsoki

Presentation by Hans Bolscher, Trinomics

15min presentation & 10min questions

Agenda

- Introduction
- Overview of the OPC process
- Summary of key feedback points from the OPC
- Q&A

Objectives of the project

The project's objectives were:

1. Supporting the European Commission in preparing the questions for both the general public and the expert parts.

2. Conducting the analysis of the results from both the general public and the expert parts of the OPC, as well as the papers sent in under the call for evidence.

3. Supporting the EC in organising a stakeholder event to present and discuss the outcomes.

Task organization

The project consisted of 3 tasks:

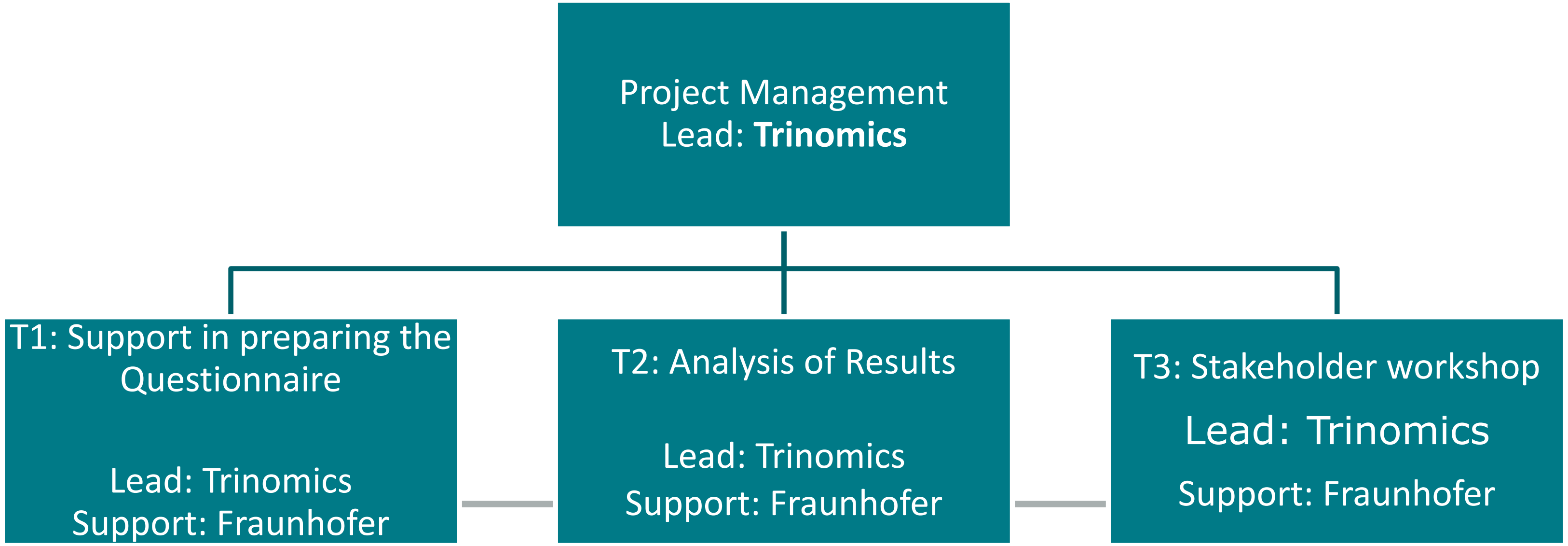
Task 1: Support in formulating the questions for the online survey. The final survey consisted of 29 questions with:

i. five general, multiple-choice questions; and

ii. a section for experts that included multiple-choice and open questions.

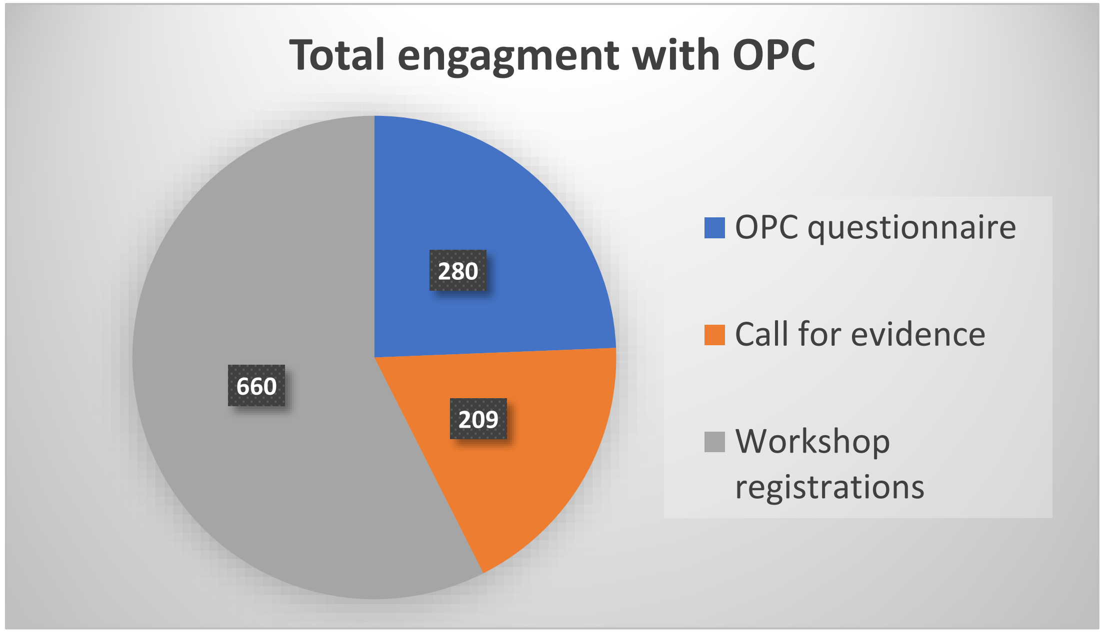
Task 2: Analysis of results of the survey + additional documents submitted under 'call for evidence'

Task 3: Support in organization of a stakeholder workshop and presentation of OPC results at event.



Overview of Respondents Profile

- Total OPC questionnaire submissions: **280**
- Total submissions under 'call for evidence': **209** responses out of which 152 contained attachments
- Number of workshop registrations: **660** in total out of which 171 were in-person and 489 were online registrations (numbers from the EC as of 02/10, workshop on 06/10)



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Summary of key feedback points from the OPC

RELEVANCE FOR EU CLIMATE GOALS

- **General acknowledgment that CCS is necessary to achieve net-zero emissions by 2050.**
  - Focus: hard-to-abate sectors.
  - Industrial Carbon Removals also generally acknowledged for addressing residual emissions.
- Some **concerns that CCS and CDR might divert resources** from investments in other (more deployment-ready) mitigation options.
  - Industrial carbon management should be done in a way that does not inadvertently incentivize more fossil power and bioenergy production.
- **Role of CCU in achieving climate targets is more contested** partially due to differing pathways and CO_2 retention/storage timelines.
  - Use of CO_2 as feedstock and circular economy was emphasised.
- **Most find that a balanced approach between technologies is needed.**
  - A number of stakeholders advocating for technology neutrality.
  - A few submissions particularly cautious of BECCS.

MAIN CHALLENGES AND POLICY OPTIONS TO ADDRESS THEM

- **Strong need for coherent policy and regulatory framework.**
- **A need for clear definitions for CCS, CCU and (I)CDR**
- Clarity on how the carbon capture market will function
  - Market for permanet carbon removals was mentioned. Suggestion for a market for negative emissions (mostly linking with EU ETS)
- **Consistent and timely permitting** across the entire value chain **is important**
- Milestone targets were viewed favourably. Storage targets for 2040 and 2050 mentioned beyond those in the NZIA. Development of an **EU CO_2 storage atlas** would be helpful.
- Need for **viable business models** along the whole value chain in the future.
- Regulatory framework should include support mechanisms to **reduce risks for developers**.
- **In absence of a business case, a majority of the papers stressed the need for financial support.**
  - Carbon Contracts for Difference and Innovation Fund were mostly mentioned. Some suggestions on State Aid, public procurement and CO_2 removals bank
- **All transport modes should be recognized.** Important to **ensure interoperability.**
- Need to address **public perception and societal acceptance**. Importance of **skills and education**

ROLE OF THE EUROPEAN COMMISSION

- A few responses stressed that while **European coordination is needed, flexibility should be given** to Member States.
- **Two main areas** in which a role for the EU is necessary:
  I. **The development of a coherent EU regulatory framework.**
  II. **Coordination for the development of a pan-European infrastructure** for CO_2 transport and storage.
- Clarity around **regulation at both EU and Member State level** is needed.
  - Need for clearly defining CCU and (Industrial) CDR. There should be clarity around what is considered permanent carbon storage under CCU.
  - European Commission could provide guidelines to MS to ensure a coherent approach.
  - Legal and **policy frameworks should be developed in a timely manner.**
  - Policies should reflect that the nature and climate impact of carbon removals and emission reductions are not equal.
- Suggestion of a **European alliance for industrial carbon management**.

FULL SUMMARY OF OPC PROCESS AND CONCLUSIONS HAS BEEN PUBLISHED

Download report HERE

European Commission

Energy efficiency 1st methodology

Assistance for guidelines to assess impacts of Energy Efficiency first

Intro by DG ENER Veronika Jirickova

Presentation by Jessica Glicker, Trinomics

20min presentation & 5min questions

BACKGROUND

Energy efficiency first in decision making

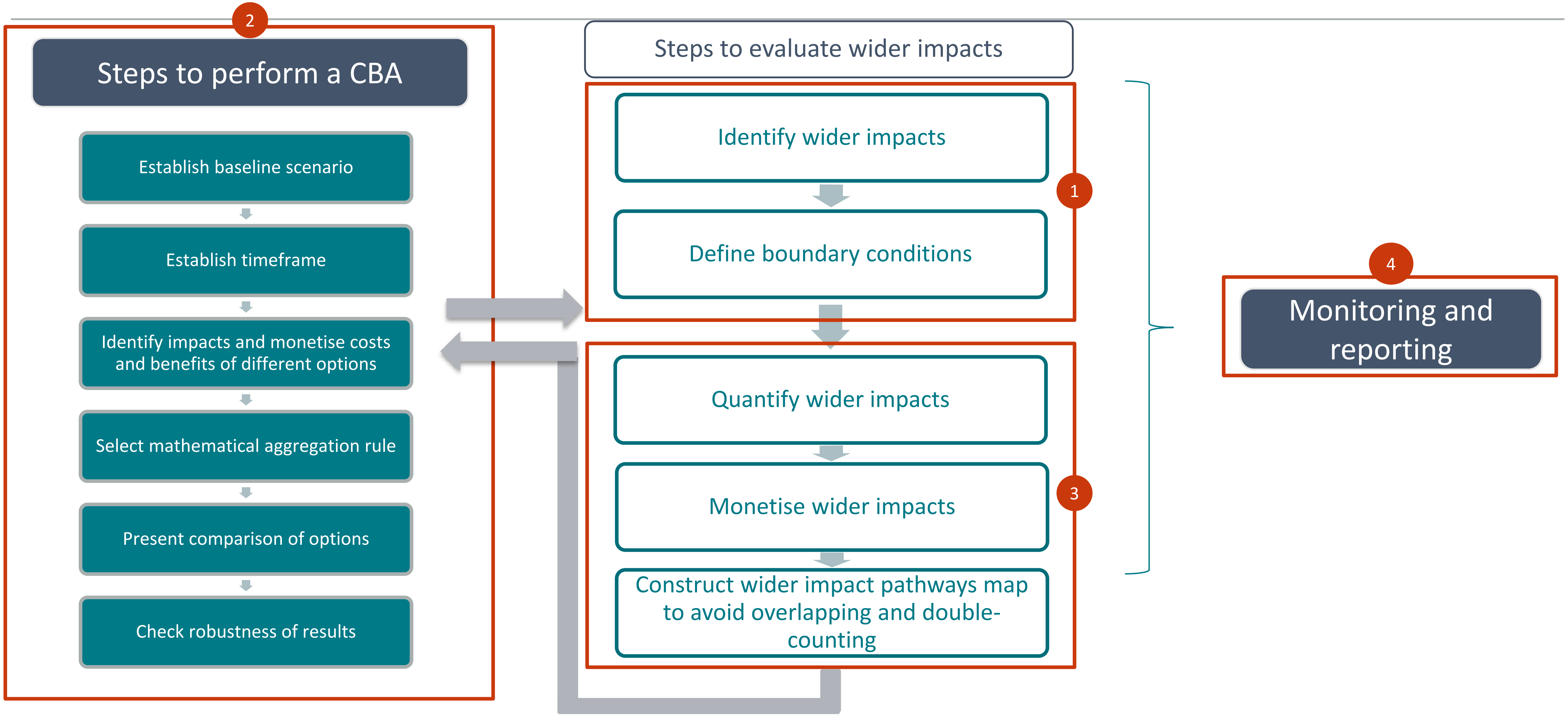
- The Energy Efficiency First (EE1st) principle **prioritizes energy efficiency solutions over supply-side** alternatives when they are **more cost-effective**, emphasizing demand-side resources.
- **Article 3 of the Energy Efficiency Directive** (EU) 2023/1791 requires Member States to implement the energy efficiency first (EE1st) principle.
- **Article 3(5) of the EED** encourages the use of cost-benefit methodologies that **assess the "wider benefits" of energy efficiency**, considering socio-economic dimensions.
- The Commission will adopt **guidelines by April 2024** to establish a common framework for **assessing wider impacts, implementing cost-benefit analysis methodologies**, and overseeing supervision, monitoring, and reporting procedures.

OBJECTIVE

Guidelines for EE1st in practice

- **Guide the inclusion of wider impacts in the cost-benefit analysis (CBA)** of energy efficiency solutions and explore the implications of implementing CBA.
- Establish a common set of cost-benefit methodologies that **enable the consideration of wider impacts** in the CBA of energy efficiency solutions.
- Assist the Commission in **developing guidelines,** as required by **Article 3(6)** of the Energy Efficiency Directive, to support Member States.

PROCESS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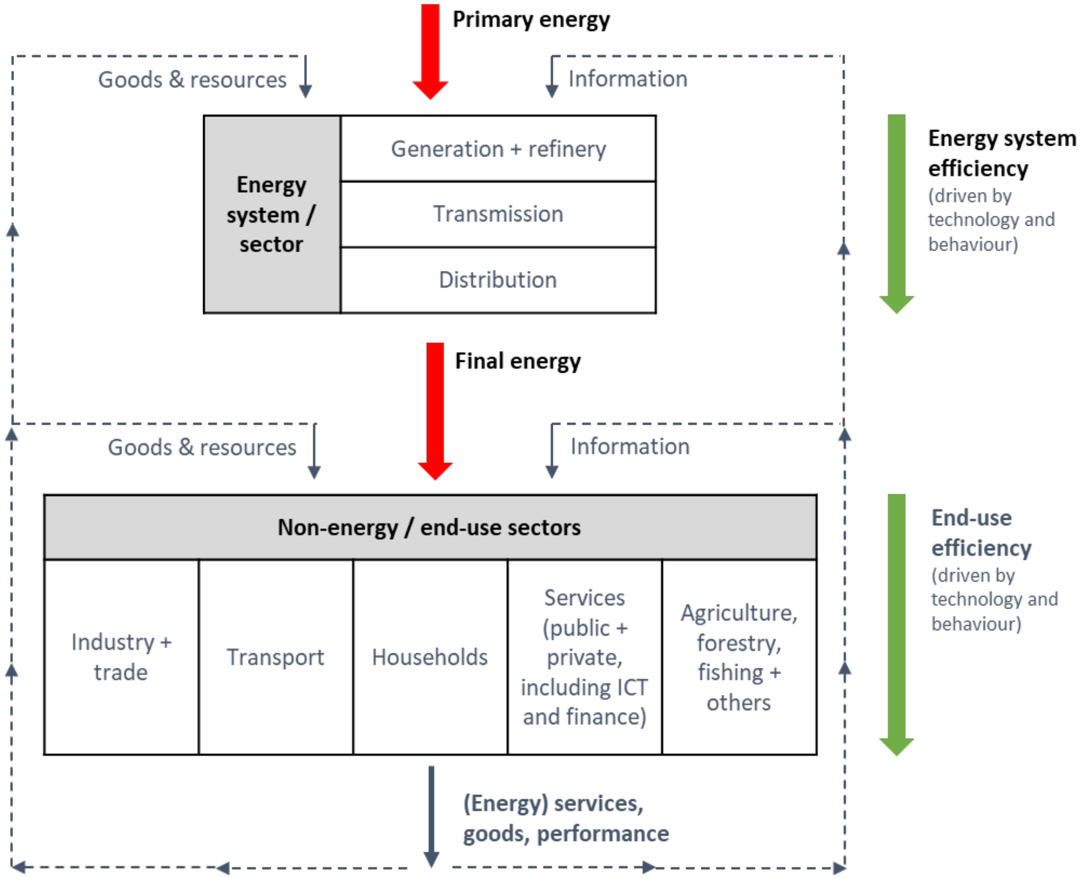
Steps to perform a CBA
Establish baseline scenario
Establish timeframe
Identify impacts and monetise costs and benefits of different options
Select mathematical aggregation rule
Present comparison of options
Check robustness of results
Steps to evaluate wider impacts
Identify wider impacts
Define boundary conditions
1
Quantify wider impacts
Monetise wider impacts
3
Construct wider impact pathways map to avoid overlapping and double-counting
4
Monitoring and reporting

Define boundary conditions

Define boundary conditions

1

- The aim is to achieve a **balanced approach between energy efficiency and energy use** across the entire value chain.
- The EE1st principle takes a **holistic approach**, seeking integrated solutions for both the energy system and end-use sectors, rather than optimizing them separately.
- Increased demand for certain services or goods often triggers decisions that **require consideration of the EE1st** principle.
- Focus on EE1st on **technological, behavioral, or economic** changes can reduce energy use compared to a business-as-usual scenario.



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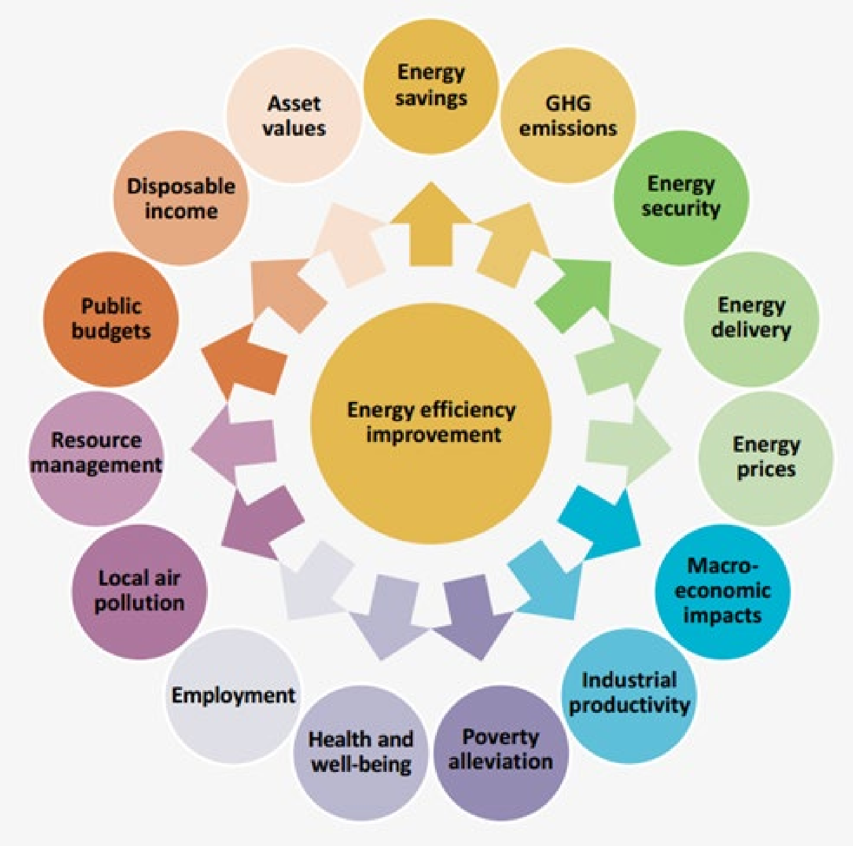
Definitions and scope

Identify wider impacts

1

- Categorized into **social, environmental, and economic pillars.**
  - Social impacts of energy efficiency implementation include **improved health and comfort, reduced energy poverty, and decreased noise pollution**.
  - Environmental impacts encompass **reduced greenhouse gas emissions, improved air quality, and better management of energy** and resources (such as water, waste, and land).
  - Economic impacts include non-energy benefits such as **GDP impacts, employment effects, increased productivity, public budget improvements, enhanced energy security, and innovation and competitiveness.**



- Time-dimensions, **including short-, medium-, and long-term,** are crucial to consider when assessing wider impacts.
  - Different impacts may manifest at varying speeds depending on the **beneficiaries and hierarchical** levels involved.
  - For instance, health impacts from energy retrofits can be immediately observed at an individual level, but may take longer to be evident at a national or public health level. Defining time-dimensions is **essential for accurately evaluating and aggregating wider impacts** in policy and investment decision-making.

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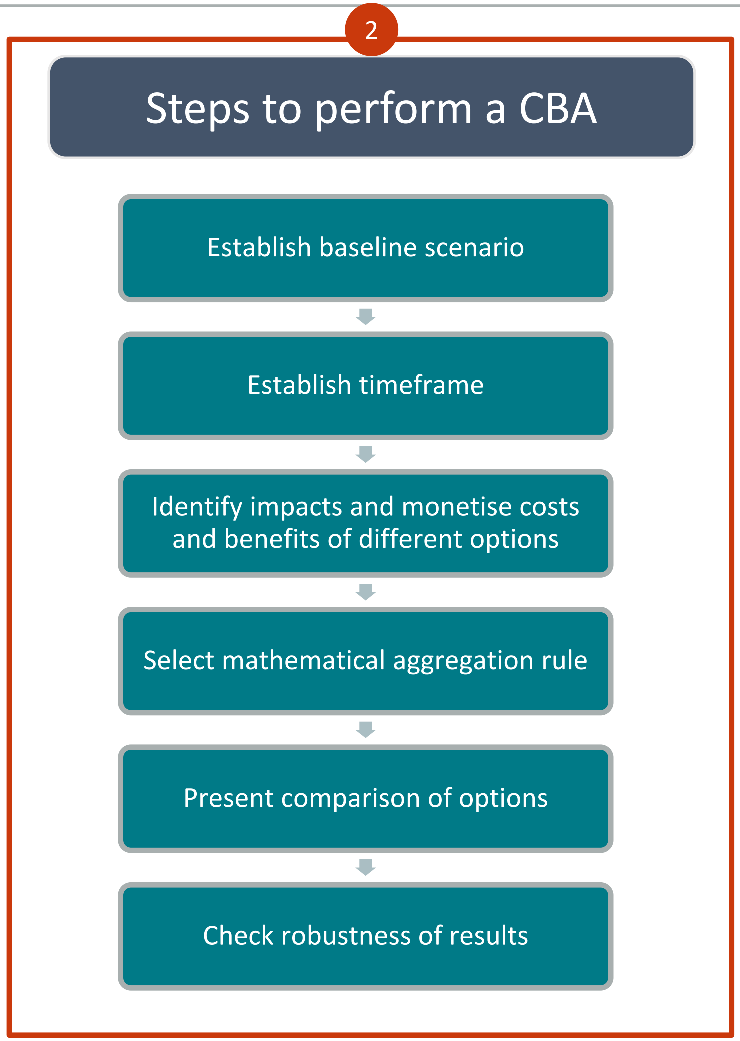
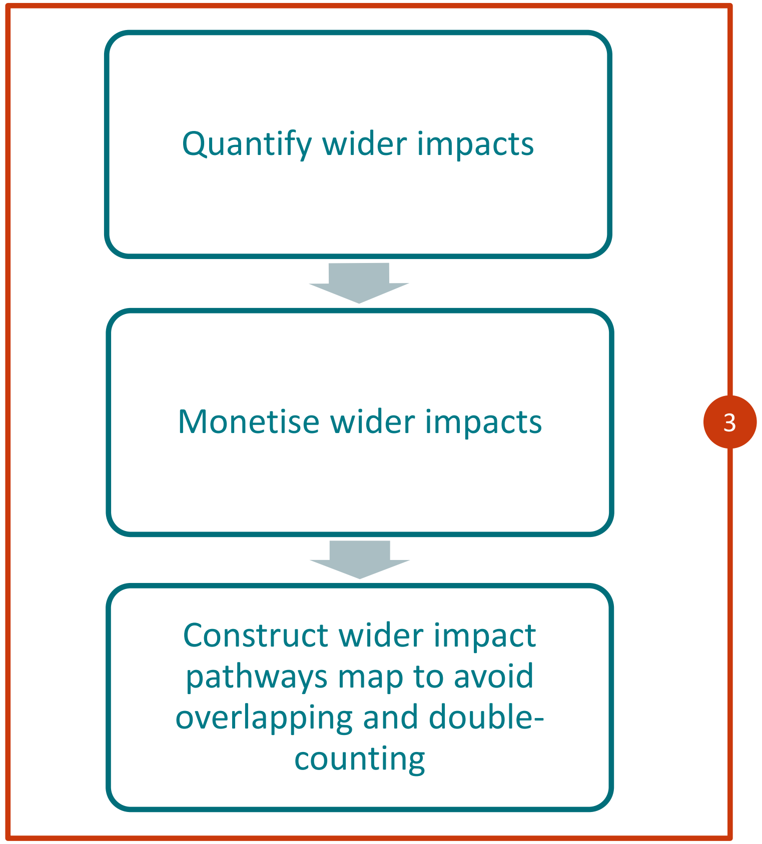
Common principle and methodology of cost-benefit analysis

- Focus on Cost-Benefit Analysis (CBA) of energy efficiency solutions, considering **impact levels and areas** (policy, planning, and investment).
- Include **predicted impacts, stakeholders involved, and legal requirements**.
- Relevant impacts should be assessed and presented **qualitatively and quantitatively whenever possible**. Efforts should be made to **quantify or monetize impacts**, even if challenging, and conservative estimates are preferable to assuming no impact.



Quantification and monetization of wider impacts

1. For a **balanced assessment** and to avoid biases, sufficient coverage in regard to various sectors and actors should be considered.
2. **Define the boundary conditions** of the object system. Additionally, describe the **identified wider benefits qualitatively,** including the casual links between them and significant end-points.
3. **Quantify the wider impacts in physical units.** The physical units may vary depending on the impact being evaluated. This initial evaluation provides a basis for comparison between different investment actions.
4. Monetise the individual impacts (where possible) by assigning a monetary value, in Euros, to impacts with no inherent market price to aggregate the wider impacts. **This process is complex and even controversial.**



Monitoring and reporting

4

Monitoring and reporting

Categories of impacts:

1. Economic, Social, and Environmental Impacts:
   1. Holistic approach to capture diverse consequences of EE1st policies.
   2. Includes job creation, social equity, reduced emissions, and environmental preservation.
2. Sector/System Integration and Cross-Sectoral Impacts:
   1. Reporting on how EE1st principles enhance system integration.
   2. Examining benefits such as grid stability, reduced reliance on energy imports, and circular economy contributions.

Timing for measuring Key Performance Indicators:

- Initial Baseline Measurement
- Short-Term Measurements
- Medium to Long-Term Measurements
- Strategic Review and Adjustment Periods
- Comprehensive measurement during strategic review periods.

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Reporting and monitoring

Sector	Name of the decision (Local language)	Name and reference of the decision(s) (English)	Strategy/ policy/ investment	Year(s) active	Context/ description	Was the EE1st solution chosen? (YES/NO/not explicity considered)	Total net benefits (EUR)		Total energy use (GWh)		Other system benefits	Comments
							EE1st	Other solution	EE1st	Other solution		
Buildings												
Transport												
Agriculture												
Financial												
Information and Communications Technology (ICT)												
Energy demand in industry and services												
Energy supply and distribution												
Electricity markets												
Water												

EnTEC – Wrap up and closing

Today’s stakeholder event:

https://energy.ec.europa.eu/events/online-event-energy-transition-expertise-centres-studies-2024-02-07_en

Slides and reports are available at EnTEC’s website:

https://energy.ec.europa.eu/studies/preparatory-studies/energy-transition-expertise-centre_en

Any comments or questions?

contact: **EnTEC@isi.fraunhofer.de**

Thank you for your participation

European Commission

Thank you for your participation!

Find this presentation here.