Welcome in our webinar on the
Clean Energy Transition Partnership

BERA
Belgian Energy Research Alliance

EERA
European Energy Research Alliance

Belgian Energy Research & Innovation Partnership for the Energy Transition
www.energyresearchbelgium.be

We represent +/- 2000 Belgian researchers in energy, active in 11 EERA JP's
Represented in ExCo EERA

sirris
driving industry by technology

Energy Ville
vito
KU LEUVEN
LABORELEC GDF SUEZ
UMONS Université de Mons
bbri.be Researches • Develops • Informs
von KARMAN INSTITUTE FOR FLUID DYNAMICS
LIÈGE université Sciences Appliquées
imec
UHASSELT
Vrije Universiteit Brussel
ULB UNIVERSITÉ LIBRE DE BRUXELLES
UCL Université catholique de Louvain
SCK•CEN STUDIECENTRUM VOOR KERNENERGIE CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE
UNIVERSITEIT GENT
UNIVERSITÉ DE NAMUR

Objective

The Belgian Energy Research Alliance organizes this workshop between the Belgian energy research community and their innovation partners, the funding agencies and the Belgian member states representatives, to set the research and innovation priorities in a European context.

In particular, the discussion will focus on the Clean Energy Transition Partnership, a co-fund instrument where member states and European Commission will jointly fund energy research & innovation projects (similar to the previous ERA-net).

How does the CETP instrument match with the energy R&I activities in Belgium? Which topics are the most relevant for the Belgian energy research community?

Agenda

09: 00 Welcome Leen Govaerts, chair BERA

09:15 Introduction to EU funding instruments, the co-fund CETP and the timelines (Adel El Gammal, Secretary General EERA)

09:45 Content/structure of the Strategic Research & Innovation Agenda of the CETP (Pieter Vingerhoets, BERA/VITO)

10:00 Short pitches key BERA members on their research activities

- Wind energy (Pieter-Jan Jordaens, Sirris)
- CCU (Grégoire Leonard, ULiège & Deepak Pant, VITO)
- Smart Cities (Guy Vekemans)
- PV (Ivan Gordon, Imec & Bart Vermang, UHasselt)
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- Hydrogen (Patrick Hendrick, ULB & Grégoire Leonard, ULiège)
- Consumer interaction (Pieter Valkering, VITO)
- Bio-energy (Julien Blondeau, VUB)

12:00 End workshop

BERA CET Workshop

Adel El Gammal
Secretary General

15 December 2020

Highlights EERA - Personnel Update

Adel El Gammal
Secretary General
11/2016
BE

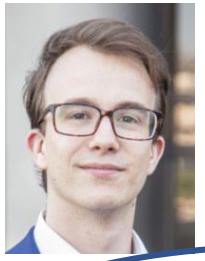
Ivan Matejak
Operations Director
12/2018
HR

Luisa Fernandez
Com's Manager
06/2020
AR

Raffaele Guerini
50% Pol. Communication
50% JP Hydro
06/2020
IT

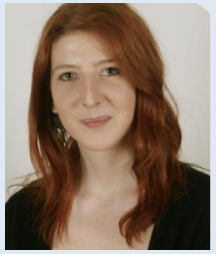
Monica de Juan Gonzalez
Sr. Project Manager
04/2020
ES

Rosita Zilli
Sr. Policy Officer
11/01/2021
IT



Alexandre Metereau
Office Manager
12/2019
FR

Giorgia Bordignon
Project Intern
02/2020
IT



Alma Lamberti
Pol. Communication Intern
09/2020
IT

Interns

Ganna Gladkykh
CET Expert
> 01/2021
(Pending work permit)
UA

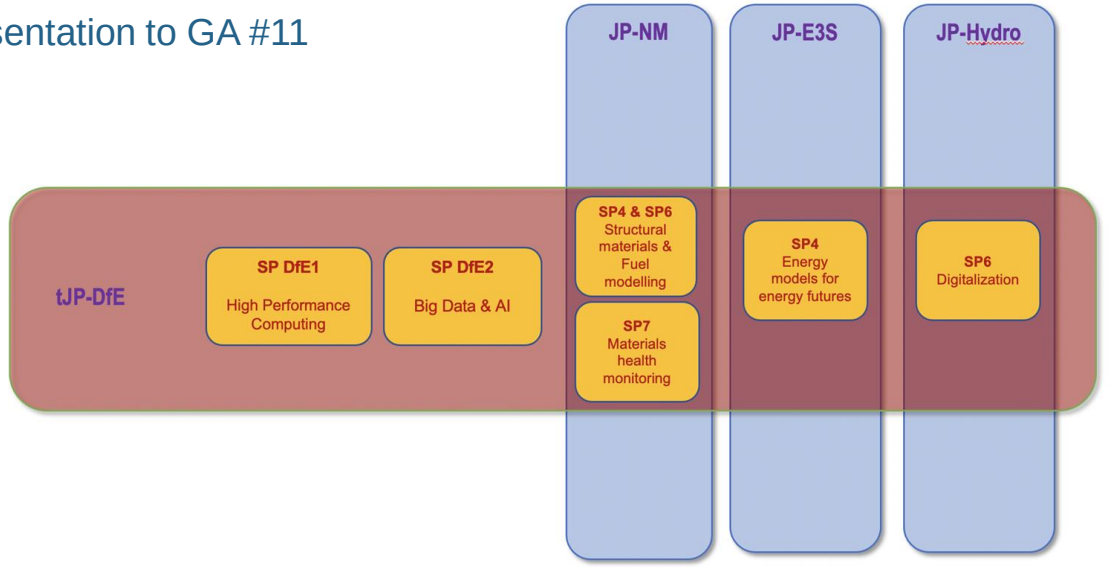
Flaminia Riccioni
JP Wind
01/2019
IT

Benjamin Wyniger
Seconded by CEA
04/2019
FR

Seconded

HIGHLIGHTS EERA - “Transversal JP Digital for Energy” (tJP-DfE)

- **Launched** as per decision of ExCo #39 (14 Oct 2020)
  - Different SPs coming from the same JP are merged in one in this tJP
  - New SPs can be integrated at any time, notably those coming from other JPs with interests in digitalization (procedure described in the SRA)
- **Pilot operations up to Jan 2022**
- Interim governance: JP-SC constituted by EERA President, Vice-President, Secretary General
- JP-MB elected 16 Dec 2020
- Final presentation to GA #11



Link to the tJP-DfE SRIA

Highlights EERA – General Assembly

- **Expanding Executive Committee**
  - From 15 to (up to) 20 members of the Executive Committee
    - Elections of May 2021
    - Open up to smaller but active organisations
    - Expand geographical representation
  - Term = 3 years: continuity
  - 1 President and 2 Vice-Presidents

- **Flexibility regarding UK colleagues**

- **→ revision of ExCoop ToRs**

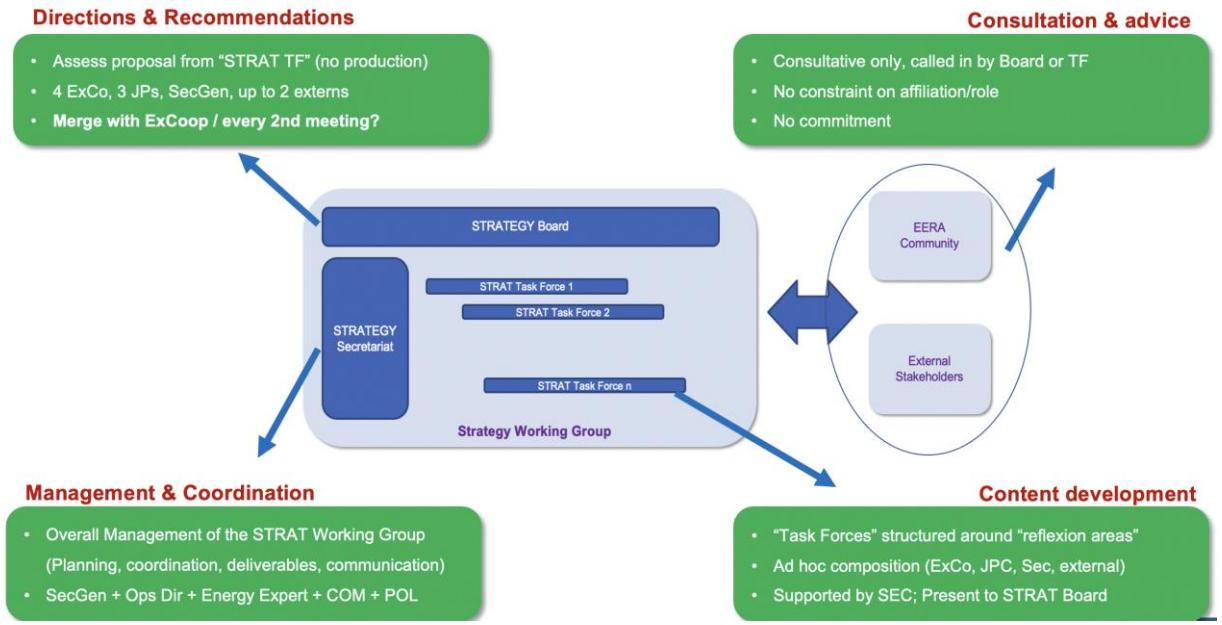
Highlights EERA – Working Groups (1/2)

- **POLICY WG**
  - Significant ramp-up in 2020
  - Videoconferece every 6 weeks
  - Policy monitoring + position papers + advocacy
  - Weekly Policy Briefing
  - Contact: r.guerini@eera-set.eu

- **COMMUNICATION WG**
  - Up to now dedicated to Website and EERA platform
  - Will ramp up in 2021
  - Contact: ml.fernandez@eera-set.eu

Highlights EERA – Working Groups (2/2)

- **STRATEGY WORKING GROUP (kick off Jan 2021)**



- **EERA as EU "Think Tank" on CET**
- **(Industrial) Alliances / initiatives**
  - Batteries
  - Hydrogen
  - Off-Shore Wind ?
- **Shifting Transition Focus**
  - System approach
  - Societal transformation
  - Cross-sectoral
- **International dimension**
  - Int'l Institutions and initiatives (MI-2)
  - Int'l cooperation

The Horizon Europe FP

EERA
European Energy Research Alliance

EU Energy R&I related policies

Sustainable recovery

- **MFF proposal**
- **Next Generation EU**
  - Proposal for the **Recovery and Resilience Facility** tabled
  - MS to present their draft plans
  - Support to key EU programmes (e.g. Horizon EU)

European Green Deal

Published:

- EU Climate Law proposal
- Industrial strategy
- Circular Economy Action Plan
- Energy System Integration Strategy
- Hydrogen Strategy
- NECPs assessment
- EGD H2020 call for proposals

Upcoming:

- Offshore renewable strategy
- Revision 2030 climate targets

Horizon Europe

- **Legislative package** (adoption depending on MFF)
- **Strategic Plan 2021-2024**:
  - Key Strategic Orientations
  - Clusters' expected impact
  - Partnerships
  - Missions
- **Work Programme 2021-2022 drafts available for feedback from MS**

Initial EU Budget proposal from the EC

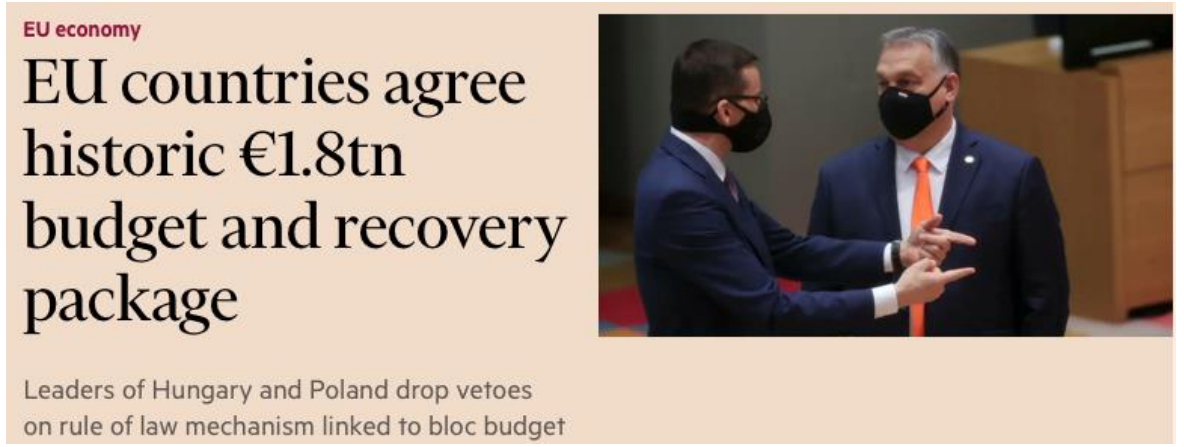
To mobilize investments, the EC tabled in May 2020 a two-fold response:

Multiannual Financial Framework (MFF)	reinforced long-term budget of the European Union for 2021-2027	€1 100 bn	€1 1850 bn
Next Generation EU (NGEU)	One shot, to boost the post-Covid recovery with new financing raised on the financial markets (2021-2024)	€750 bn	
Horizon Europe (from MFF)	Original proposal tabled by the Commission	€80.9 bn	€94.4 bn
Horizon Europe (from NGEU)	Additional one-shot funding proposed under the recovery plan	€13.5 bn	

HEU Budget – Final Agreement

Update 11 Dec 2020

1. 9 Nov 2020: **EERA Advocacy Letter** to MFF & HEU negotiating teams from EP and to all EP Party Leaders (Link)
2. 10 Sep 2020: **EERA Advocacy Letter** to EU institutions to advocate for stronger HEU budget and Cluster 5 budget confirmation (Link)
3. EERA reaction to Council agreement published on 22 July 2020 (Link)
4. Signature letter published by EUREC in collaboration with other EU NGOs



EU economy

EU countries agree historic €1.8tn budget and recovery package

Leaders of Hungary and Poland drop vetoes on rule of law mechanism linked to bloc budget

	Original proposal tabled by the Commission	**€79,9 bn**	**€84.9 bn**
	Additional one-shot funding proposed under the recovery plan	**€5 bn**	

-9.5bn vs. EC proposal

2030 Climate Objectives

Update 11 Dec 2020

GREEN DEAL

EU leaders agree on 55% climate target for 2030

TODAY, 11:37

After hours of negotiations, EU leaders agreed to increase the bloc's emission-reduction target to 55 percent by 2030. But Poland and Hungary made sure that member states give the final green light to future climate legislation by unanimity.

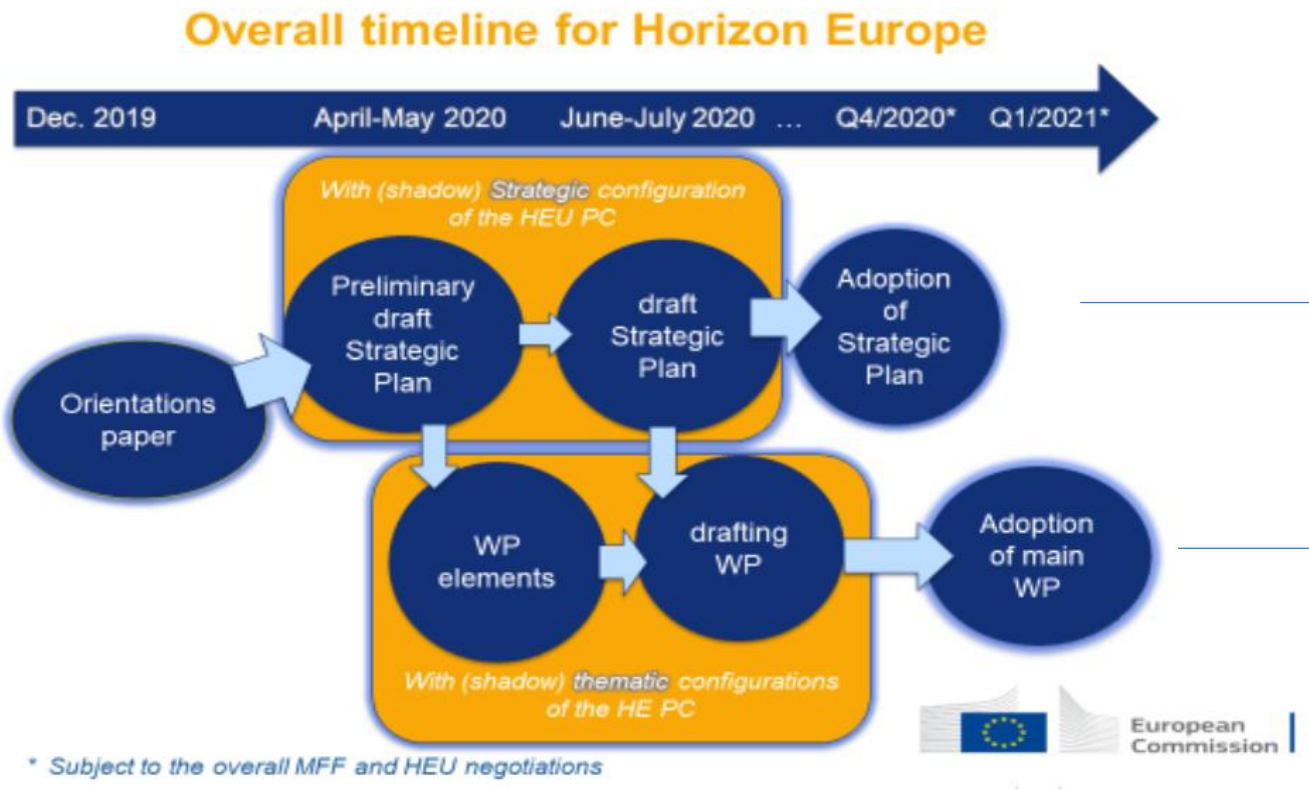
Paradox: the widening gap

- Increasingly challenging climate targets
- Decreasing funding & financial commitments

Anticipated impact:

- Derailing from committed trajectory…
- Chaotic but likely funding revision
- Multiplication of funding sources & instruments?

Horizon Europe preparation process



HEU Strategic Plan

HEU Work Programme

→ Cluster 5: Climate, Energy Mobility

→ ***Final draft leaked 11 Dec 2020***

HEU WP EERA Brokerage event

Thd – February 2021

SET Plan, CET and other Partnerships

EERA
European Energy Research Alliance

SET Plan, Clean Energy Transition & other Partnership

SET Plan

- The “Political instrument” of the EC to boost research in Clean Energy Technologies (and Clean Energy Transition).
  - Created in 2008
  - Established cooperation framework between EC and Members States / Associated Countries (MS/ACs)
  - MS/ACs represented in SET Plan Steering Group.

Clean Energy Transition Partnership (CETP)

- One of the 40+ “Partnerships” defined in the HEU Framework Programme
- A Funding Instrument of HEU dedicated to boost the implementation of SET Plan
- Co-Fund: The “Partners” are programme owners/managers : member States & Associated Countries
- CETP SRIA is heavily inspired by “Implementation Plans” and ERA-Nets pre-existing in the SET Plan.

Link with other relevant HEU Partnerships

HEU Partnerships	Relevance	Cluster	Type
Clean Hydrogen	1	5	Co-P
EU industrial battery value chain	1	5	Co-P
Sustainable, Smart & Inclusive Cities and Communities	1	5	Co-P
Circular Bio-based Europe	1	6	Co-P
EIT InnoEnergy	1	N/A	EIT-KIC
EIT Raw Materials	1	N/A	EIT-KIC
EIT Urban Mobility	1	N/A	EIT-KIC
Built Environment and Construction	2	5	Co-P
Smart Networks and Services	2	4	Co-P
Clean Steel	2	4	Co-P
Carbon Neutral & Circular Industry (CNCI)	2	4	Co-P
Transforming Europe’s Rail System	2	5	Co-P
Towards Zero Emission Road Transport (2ZERO)	2	5	Co-P
EIT Climate-KIC	2	N/A	EIT-KIC
Key Digital Technologies	3	4	Co-P
High Performance Computing	3	4	Co-P
AI, data & robotics	3	4	Co-P
Clean Aviation	3	5	Co-P
Zero-emission Waterborne Transport	3	5	Co-P

EERA contribution in the SRIA of the CETP

CETP Proposal
- MS/AC led
- Political
- Funding priorities

Member States start editing SRIA (Sep 2020)

SET Plan Conference (24 Nov 2020)

CETP draft

SRIA Input Papers

CETP SRIA

CETP SRIA proposal

EERA supports the Member States in CETP SRIA development

Q1/2020 | Q2/2020 | Q3/2020 | Q4/2020 | Q1/2021

Operational

SRIA WP (Oct 20, 2020)

Conceptual

CET WP draft

CET White Paper
- EERA
- Scientific
- Unbiased

EERA independently formulates CET priorities

CET WP v.1

GAP REPORTS
- SRIA
- NECPs, etc.

Explaining differences between the EERA white papers

For Reference Only

SRIA WP (Oct 20, 2020)

WHY does EERA write it?

- To "cement" the draft of SRIA and the Input Papers resulted from the stakeholder co-writing process;
- To have a document to reference in the following CETP SRIA discussions.

HOW does EERA write it?

- Involving the core EERA editors for CETP SRIA;
- Sharpening CETP SRIA arguments;
- Limiting EERA's independent opinion.

CET WP v.1 (Nov 20, 2020)

WHY does EERA write it?

- To provide EERA's independent opinion on the key CET challenges;
- To provide EERA's independent opinion on the limits of the existing CET instruments.

HOW does EERA write it?

- Involving the core EERA editors and experts;
- Building on the results of the CET White Paper draft from Q1, 2020;
- Building on the insights from the CETP SRIA development.

CET WP v.2 (from Q1, 2021)

WHY does EERA write it?

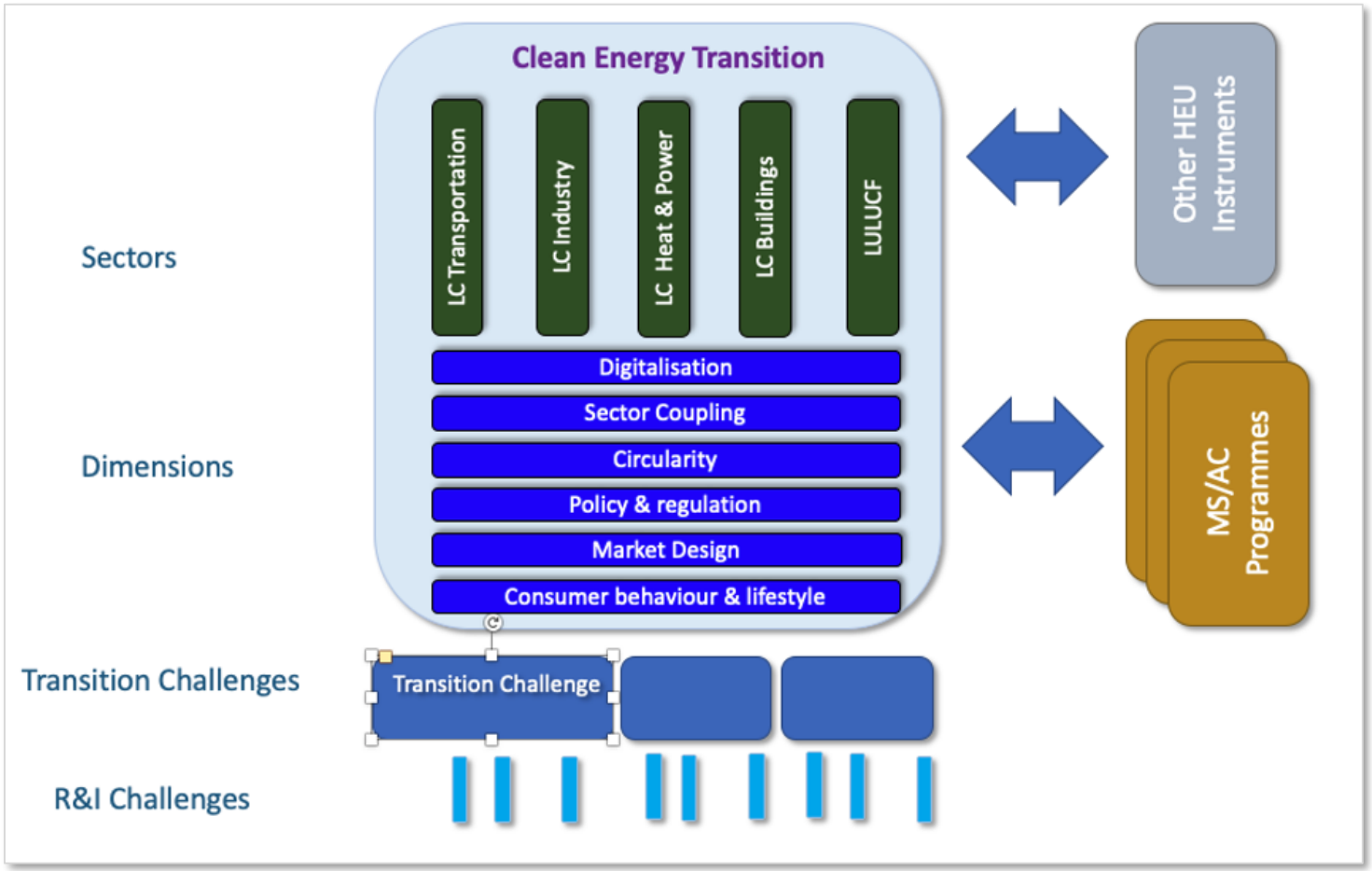
- To set-up a methodological framework for the CET gap analysis;
- To provide analytical capacity for the CETP SRIA revisions process;
- To challenge a Eurocentric approach to CET by addressing beyond-the-EU context.

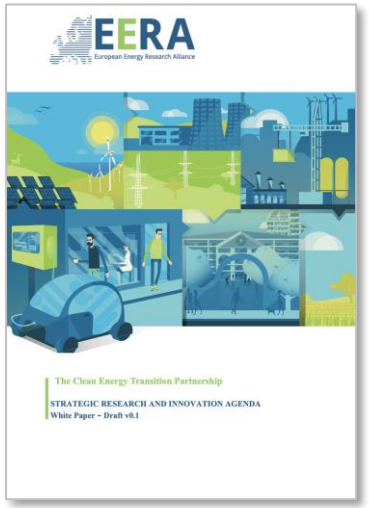
HOW does EERA write it?

- Involving the core EERA editors and experts;
- Building on the capacity of the other EERA projects (e.g. SUPEERA);
- Involving external experts from the key international organizations (e.g. IEA, IRENA, Mission Innovation).

EERA White Paper on the Clean Energy Transition

- A holistic, societal and systemic approach to the CET
- A technology-agnostic platform for integrating other initiatives





EERA CETP
White Paper

Strategic Research and Innovation agenda

https://www.eerajpwind.eu/set-plan-side-event-presenting-the-horizon-europe-partnerships/

File and presentation of SET plan side event are available on **YouTube**, and a slide presentation **download**.

The Strategic Research & Innovation Agenda

- Wind
- Bio-Energy
- PV
- Geothermal

- Electrical storage
- Thermal storage
- Hydro-storage
- Hydrogen
- CCU/CCS

CETP Challenge 1 "Optimised integrated European net-zero emissions Energy System"
Develop the optimised, integrated European net-zero emissions energy system, where electricity distribution and transmission grids are seen as the "backbone" of the future low-carbon energy systems with a high level of integration among all energy carrier networks, by e.g. coupling electricity networks with gas, heating and cooling networks, supported by energy storage and power conversion processes.

CETP Challenge 2 „Enhanced zero emission Power Technologies"
Enhance zero emission power technologies, by increasing the conversion efficiency per unit or surface area by 30 to 40% and lowering technology production costs by 35 to 50 % until 2030, according to the potential and characteristic of the entire technology, as well as by improving their system integration properties and impact.

CETP Challenge 5 „Integrated Regional Energy Systems"
Develop and validate integrated regional and local energy systems, that make it possible to efficiently provide, host and utilize high shares of renewables, up to and beyond 100% in the dynamic local or regional supply by 2030. Such systems shall provide tailor-made solutions that meet the individual regional and local requirements and demand.

CETP Challenge 3 "Enabling Climate Neutrality with Storage Technologies, Renewable Fuels and CCU/CCS"
Develop and deploy energy storage, renewable based fuels, as well as CCU/CCS (Carbon Capture and Use/Carbon Capture and Storage) for a climate-neutral Europe.

CETP Challenge 6 „Integrated Industrial Energy Systems"
Develop and demonstrate integrated industrial power, heating and cooling systems, hybrid solutions and novel technologies that enable efficient carbon-neutral industrial sites and production.

CETP Challenge 4 „Efficient zero emission Heating and Cooling Solutions"
Provide enhanced and improved heating and cooling technologies and systems for all major parts of Europe by 2030, enabling 100% climate-neutral heating and cooling by 2050. Innovation is particularly needed to optimise their efficiency, lowering costs, and providing solutions for the heating demand peak in winter and the cooling demand peak in summer.

CETP Challenge 7 „Integration in the built Environment"
Provide solutions and technologies for existing and new buildings to become an active element in the energy system, with enhanced capability to produce, store and efficiently use energy in the residential and non-residential sector, comprising public and commercial buildings, service and mobility infrastructure buildings, etc.

CETP Challenge 8 „Cross-cutting Dimensions"
Cross-cutting dimensions beyond technology and resources need to be considered in all CETP Challenges, in order to ensure robust transition pathways that should be driven by a multidisciplinary perspective and include transition pathways, regulations, circularity, digitalisation as well as policy and social aspects.

- Energy System Integration
- Smart grids

- Smart cities

- Consumer interaction

CETP1. Optimised integrated net- zero-emission energy system

- System modelling and planning- understanding and analysing the integrated energy system of the future
- System flexibility- robust and clean energy transition pathways
- System operation- operational integration of integrated energy systems
- Economics- market design and regulation for an integrated energy system

CETP2. Enhanced zero-emission power technologies

- CSP
- PV
- Onshore wind
- Offshore wind
- Deep geothermal energy
- BioEnergy
- CCU/S
- Ocean Energy
- Hydropower

✓Higher efficiency

✓Lower costs

✓Sustainable production chain

✓Social acceptance

✓Flexibility

✓Optimize electric power storage and costs

✓Hybrid solutions

✓Negative carbon emission technologies

CETP 3. Storage technologies, renewable fuels and CCU/CCS

- Electrochemical storage
- Thermal storage
- Sustainable bio-energy
- Direct Solar Fuels production and power-to-X
- Hydropower storage
- Cross-sectoral hybrid storage solutions

CETP 4. Efficient heating and cooling solutions

- Renewable heating and cooling technologies
- Collective systems for the built environment
  - Validate unconventional ambient heating sources
  - Retrofit of existing districts and buildings
  - 4th generation heating grids
- Industrial heating and cooling
  - High-temperature heat pumps
  - Solar and geothermal heating
  - Industrial heat storage

CETP 5. Integrated regional energy systems

- Flexibility and infrastructure requirements from a technical perspective
- Cross-sectoral integration (e.g. vehicle-to-grid, excess heat valorization, interface with heating and water supply etc)
- Regional innovation ecosystems (e.g. energy communities, cooperative approaches etc)

CETP 6. Integrated Industrial Energy Systems

- Electrification of processes leading to renewable heating and cooling
- Improvements in heat pumps
- Integrating heat and power-to-heat storage
- Hydrogen and power-to-X
- Bio-energy and CCU based negative emission technologies
- Cross-sectoral cooperation
- Increase in flexibility

CETP 7. Integration in the built environment

- Interaction with renovation scenarios
- Decision support tools for system planning, construction and operation
- Tools for building energy performance assessment
- Societal aspects of positive-energy districts (PEDs)
- Integration with other service and mobility infrastructure
- Digitisation and market design

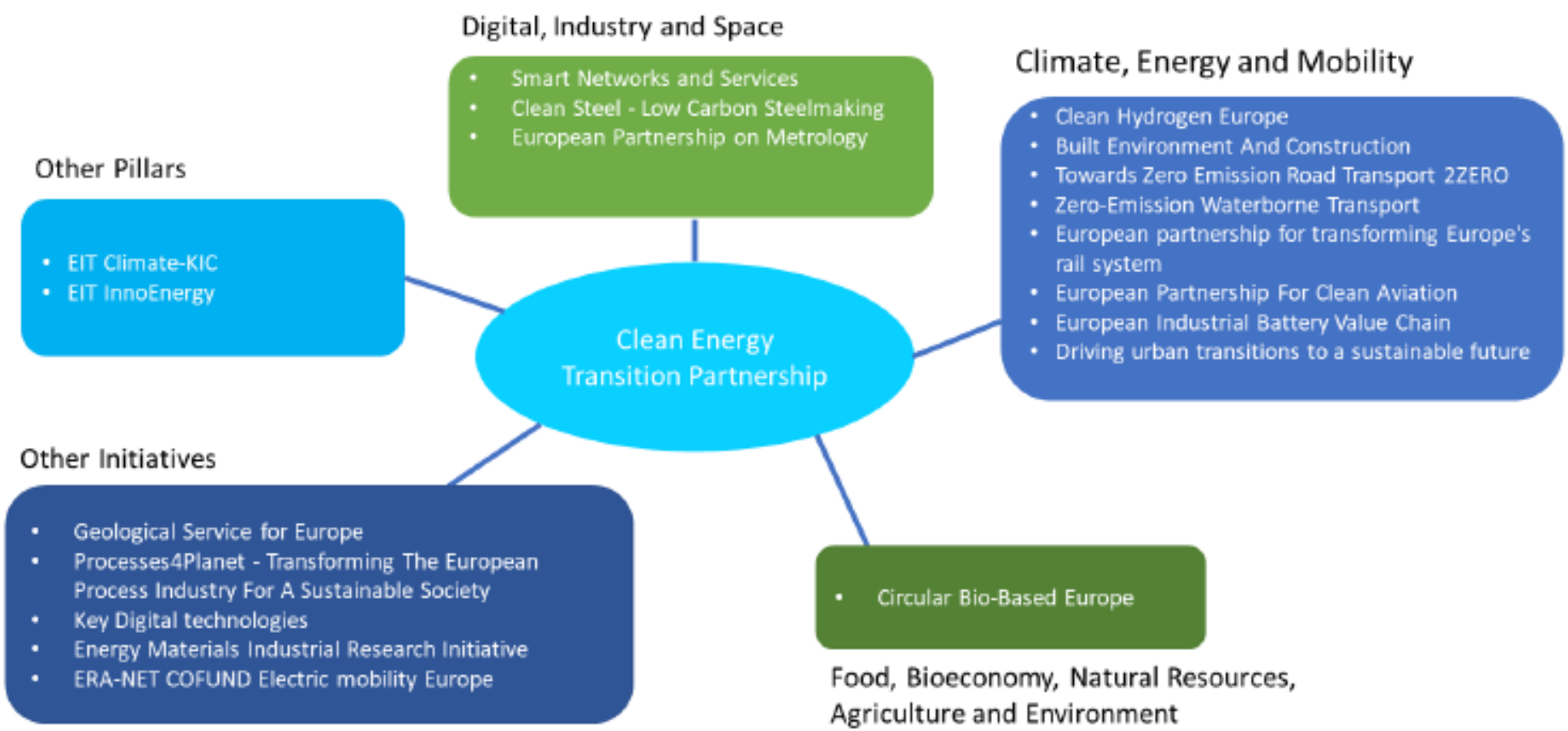
CETP8: Cross-cutting dimensions

- Identifying robust pathways as alternative strategies towards a net zero society
- Accelerate the transition through innovation ecosystems
- Regulation and market design to support optimal resource allocation and value creation both in the short term and long term.
- Policy and actions in support of fair, just and democratic transition
- Encouraging digitalisation of the energy transition processes
- Encouraging transition based on resource efficiency and circularity principles
- Interoperability
- Financing schemes
- Education and cross-sectoral training

Why is a co-fund instrument needed?

- Main reason: foster collaboration between member states
  - E.g. for district heating
- E.g. Industrial/Energy Systems Integration: cross-sectoral and cross-border collaboration can be incentivized
- A co-fund can enhance the possibilities for upscaling/valorization

Links with other EU partnerships and R&I initiatives



CETP next steps

The Strategic Research & Innovation Agenda

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- Consumer interaction (Pieter Valkering, VITO)
- Bio-energy (Julien Blondeau, VUB)

12:00 End workshop

Quick intro

https://www.linkedin.com/in/pieterjanjordaens/

pieterjan.jordaens@sirris.be

2010-2020

Program manager
dept. wind energy
www.sirris.be

sirris
driving industry by technology

Operating officer OWI-Lab
www.owi-lab.be

OWI lab

Quick intro

christof.devriendt@owi-lab.be

2010-2020

AVRG teamlead

R&D coordinator
www.owi-lab.be

BERA Wind Chairman

Quick intro

PhairywinD

Belgian Offshore PhD Expertise

UNIVERSITEIT GENT

ULB UNIVERSITÉ LIBRE DE BRUXELLES

UCLouvain

Universiteit Antwerpen

LIÈGE université

sirris
driving industry by technology

von KARMAN INSTITUTE FOR FLUID DYNAMICS

UMONS
Université de Mons

KU LEUVEN

VUB VRIJE UNIVERSITEIT BRUSSEL

Activities in the EERA JP

- Members

+ Engie Laborelec

- Joint projects: /

- Interest: https://www.eerajpwind.eu/subprogrammes/ → all topics are relevant for the Belgian wind energy R&D community + track record on the topics

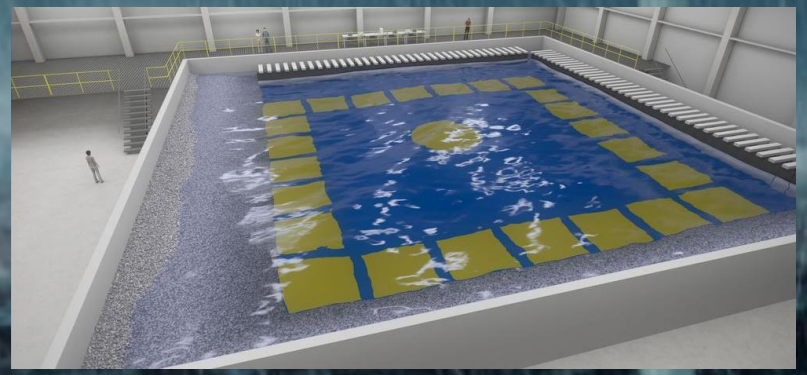
- Which type of information exchange:
  - So far only participation to events / workshops/ networking
  - Events: SP4; SP6; SP7 (VUB/OWI-Lab and ULG)

ROADMAP OWI-Lab

Advanced measurements & monitoring strategies + features

Large scale (validation) testing and accelerated test methodologies

Degradation modelling, simulation and analysis



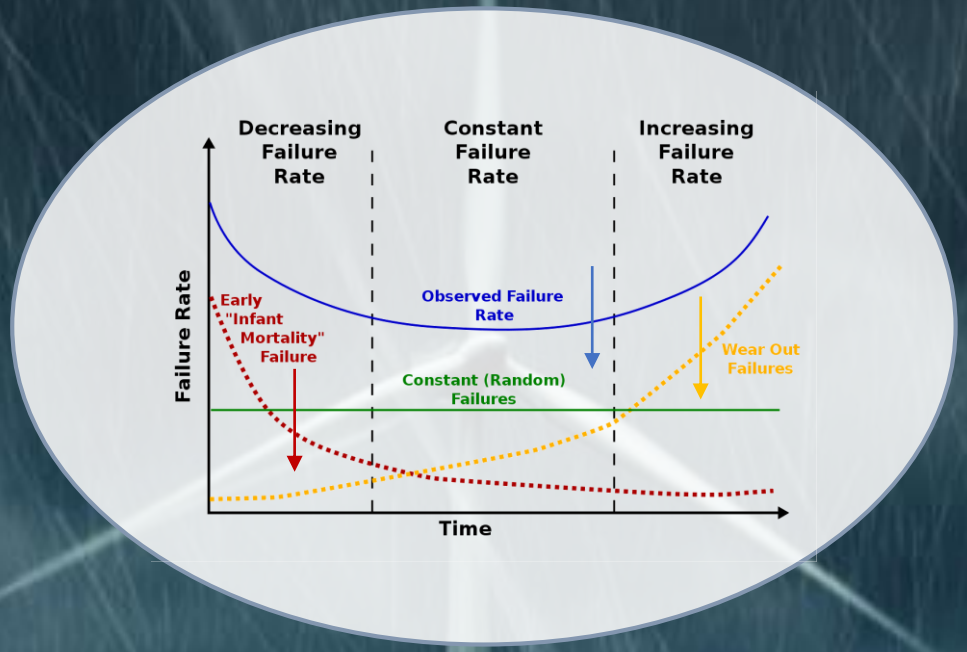
sirris
driving industry by technology

VUB VRIJE UNIVERSITEIT BRUSSEL

GHENT UNIVERSITY

ROADMAP

Advanced measurements & monitoring strategies + features



Reliability ↑

Robustness ↑

LCOE ↓

Large scale (validation) testing and accelerated test methodologies

Degradation modelling, simulation and analysis

Link to Belgian activities

DOCC-OFF: Digitalization Of Critical Components in OFFshore wind turbines
Boptic: Monitoring of offshore power cables and foundations by Distributed Fiber Optic Sensing
COOCK: Fighting Icing - Atmospheric and splash ice conditions on (offshore) wind turbines, aerospace, drones and marine structures
Supersized 4.0: Smart O&M for a fleet of supersized wind turbines in industry 4.0 context
SeaFD: Realistic CFD wind load computations for offshore wind turbines
Newskin: Innovation Eco-system to Accelerate the Industrial Uptake of Advanced Surface Nano-Technologies
Phairywind: Fundamental Phd community for offshore wind
Maxwind: MAintenance, Inspection and EXploitation Optimization of Offshore Wind Farms subjected to Corrosion-Fatigue
Socorro: Seeking Out Corrosion, before it is too late
WindSoil: Design optimization of the foundations for the next Belgian Offshore Wind Concessions using improved soil-structure interaction models
OPIN: Ocean Power Innovation Network
Qualify: Enabling Qualification of Hybrid Structures for Lightweight and Safe Maritime Transport
SoilTwin: Data driven design optimization and smart monitoring of monopile foundations using updated soil-structure interaction models
SaveLife: Lifetime prediction and management of fatigue loaded welded steel structures on structural health monitoring
MasiWec: Material and Signal processing based prediction of WEC probability

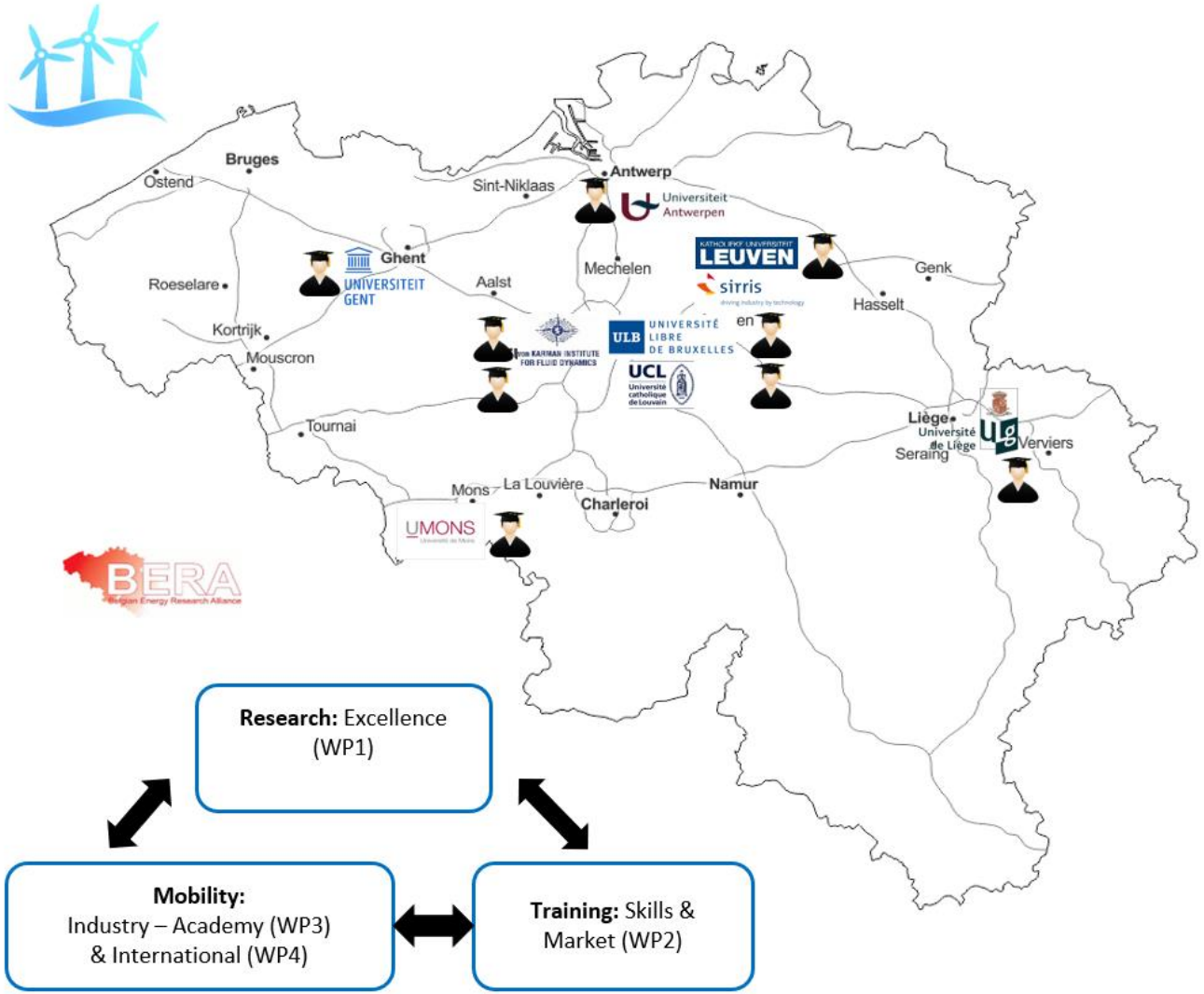
New: (12-2020): ICON Rainbow (offshore wind blade erosion monitoring & degradation)

BERA
Belgian Energy Research Alliance

SuperSized 4.0
COOCK Fighting Icing
MAXWind
DOCC-OFF
NEW SKIN
Interreg 2 Seas Mers Zeeën QUALIFY
Interreg 2 Seas Mers Zeeën SOCORRO
PhairywinD Belgian Offshore PhD Expertise
BOPTIC
Interreg North-West Europe OPIN

www.owi-lab.be

Link to Belgian activities



BERA
Belgian Energy Research Alliance

UNIVERSITEIT GENT

PhairywinD
Belgian Offshore PhD Expertise

https://www.phairywind.be/

UNIVERSITEIT GENT | ULB UNIVERSITÉ LIBRE DE BRUXELLES | UCLouvain | Universiteit Antwerpen | LIÈGE université
sirris | von KARMAN INSTITUTE FOR FLUID DYNAMICS | UMONS Université de Mons | KU LEUVEN | VUB VRIJE UNIVERSITEIT BRUSSEL

Link to Belgian activities

BERA
Belgian Energy Research Alliance

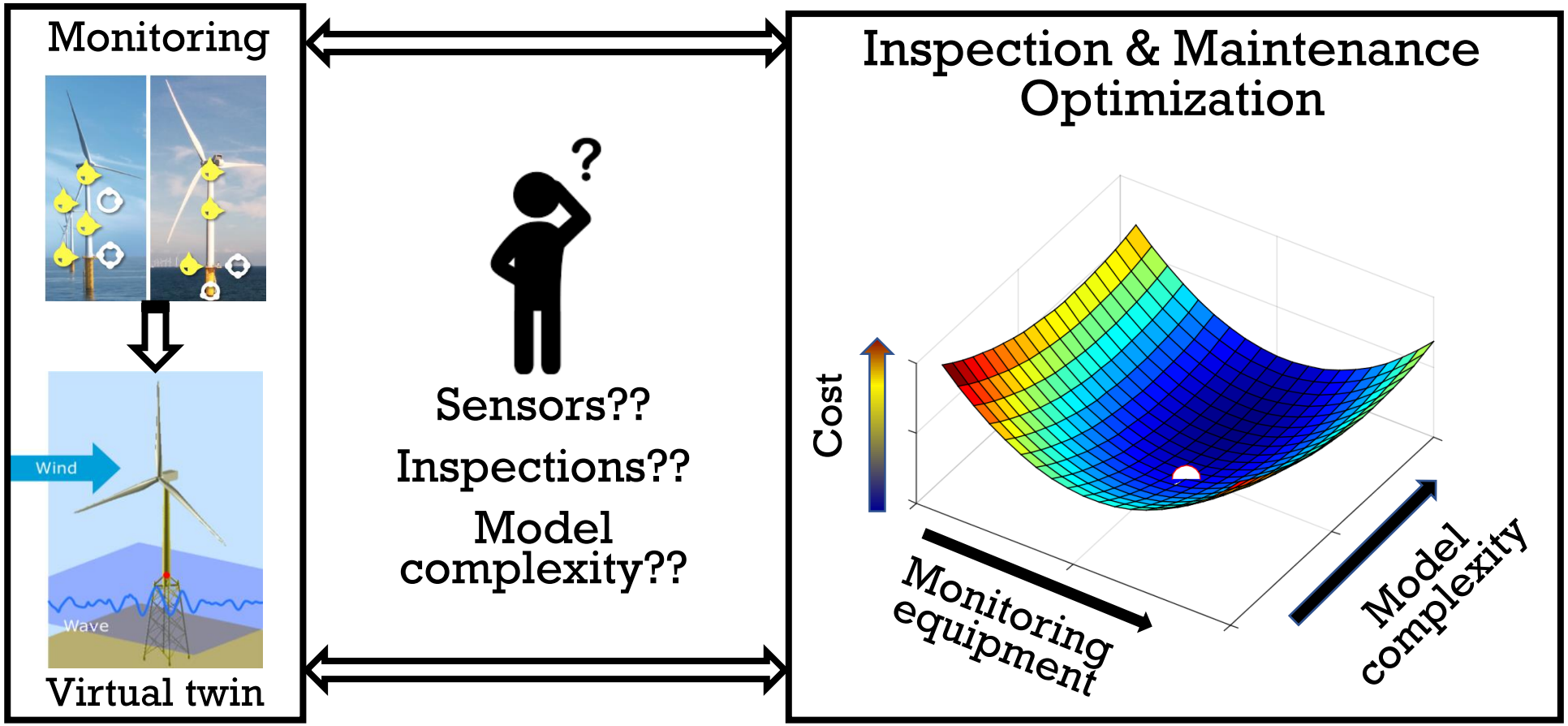
O&M Optimization of OWT Support Structures using Digital Twins

PhairywinD
Belgian Offshore PhD Expertise

LIÈGE université

ANAST

VUB VRIJE UNIVERSITEIT BRUSSEL



Link to Belgian activities

BERA
Belgian Energy Research Alliance

Offshore wind structures deterioration: corrosion-fatigue

MAXWind

LIÈGE université

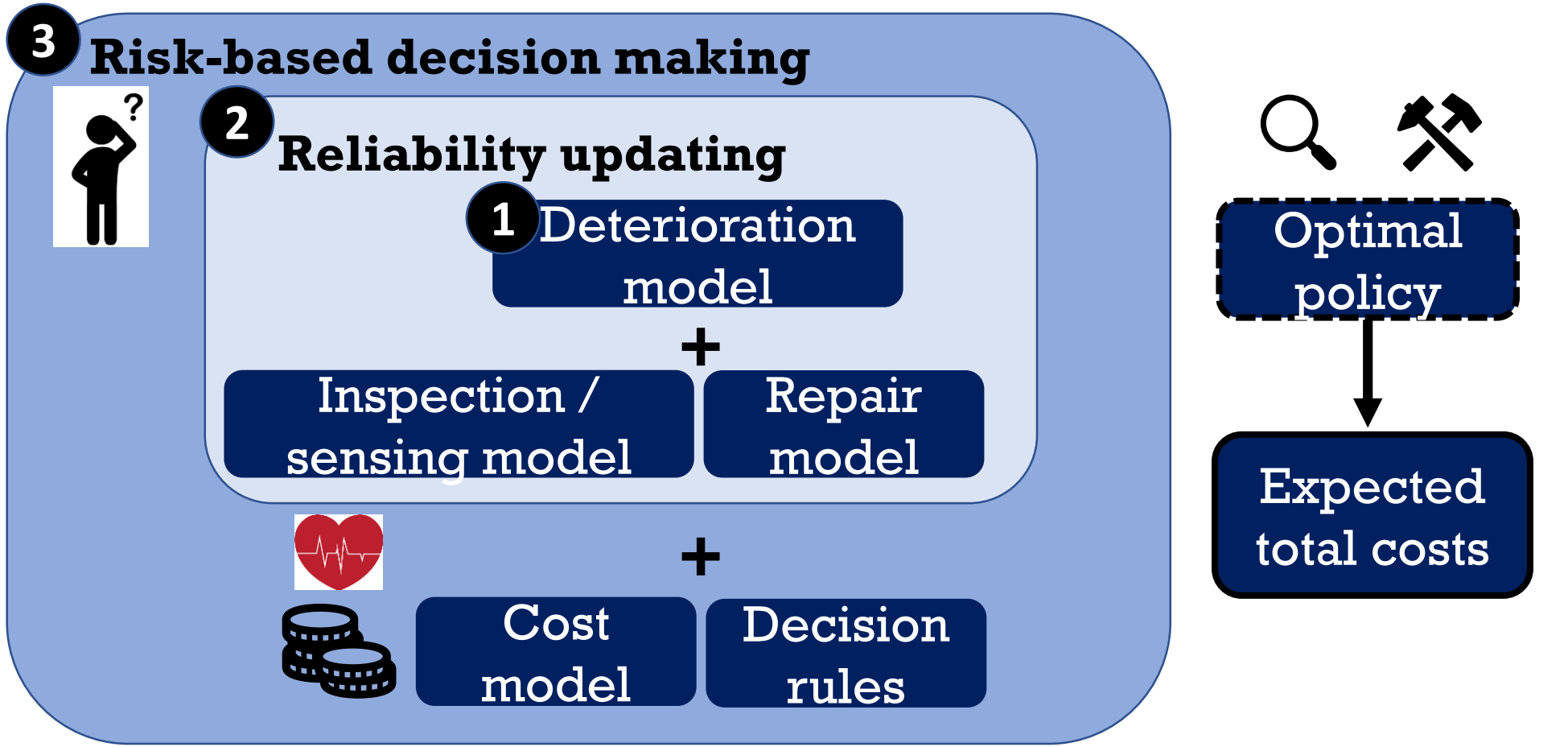
ANAST

GHENT UNIVERSITY

VUB VRIJE UNIVERSITEIT BRUSSEL

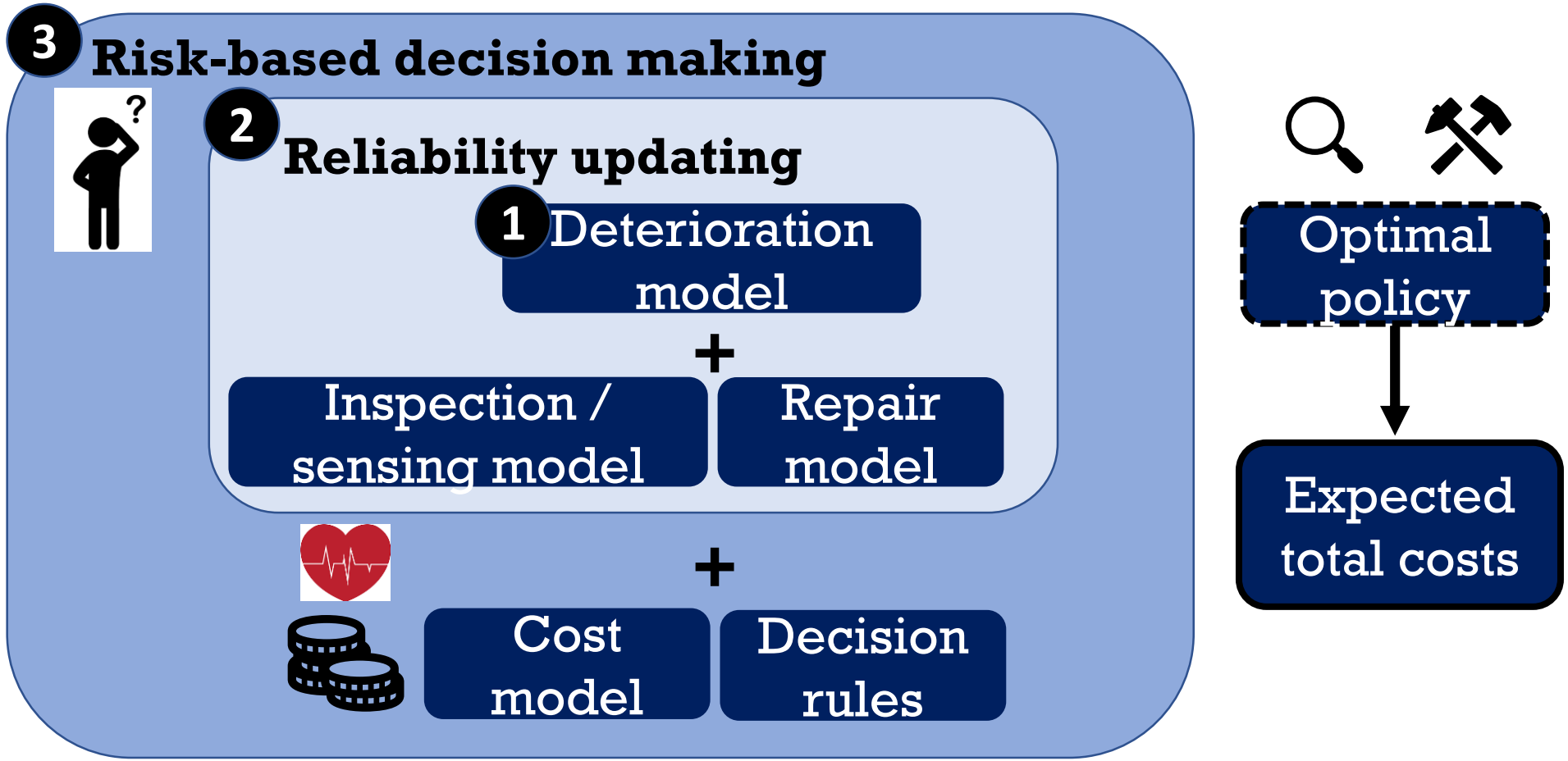
sirris

OWI lab



Link to Belgian activities

Offshore wind structures deterioration: corrosion-fatigue



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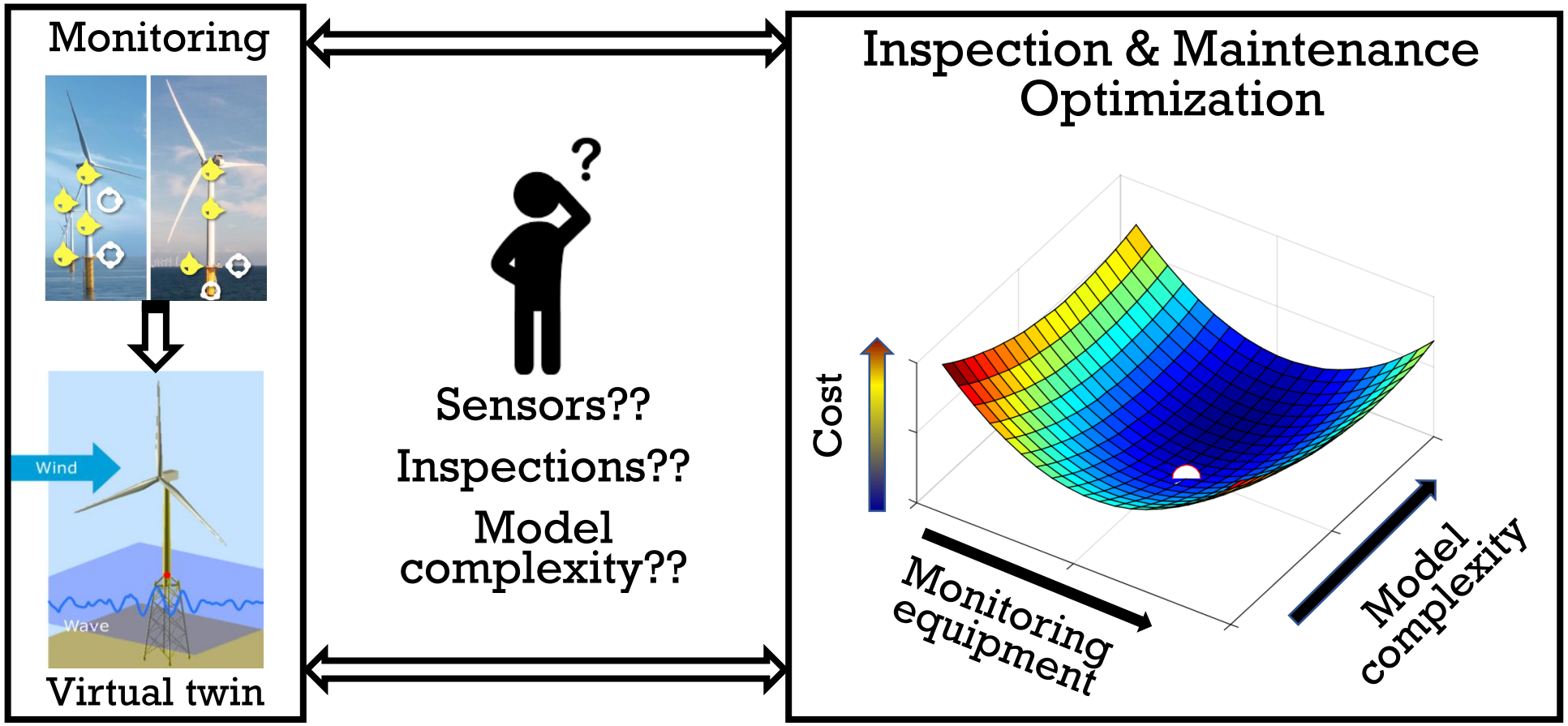

How does the research link to the CETP

- What are for you the topics of interest in the Strategic Research and Innovation Agenda (SRIA) of the Clean Energy Transition Partnership?
  - Lowering the cost of (offshore) wind energy – and make sure the projected LCOE's are also met after 20 years lifetime → low cost renewable essential for example for green hydrogen trend
  - Increasing reliability and robustness (for specific harsh environment markets)
  - Lifetime extension (and related research to give these insights)
  - Efficiency increase (planning, wakes,…)
- Are there some energy related topics that you don't see represented enough in the current version of the SRIA?
- Could the CETP be an important funding source for your topic? Why yes/no?

Agenda

09: 00 Welcome Leen Govaerts, chair BERA

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12:00 End workshop

Electrification of the chemical industry

- Electrochemistry is a competing alternative for reactions that :
  - Are highly exothermal (cogeneration; from steam to current)
  - Are highly endothermal (store energy from electrons; e-fuels)
  - Have temperature sensitive reactants or products (as reaction speed can be increased via potential U)
  - Highly selective (catalyst freedom)

- Electrification of the (biobased) chemical industry can create opportunities
  - Combination of biomass and renewable energy can decrease production costs, and has a positive impact on **use of local resources**
  - **Lower volatility** in production cost (e.g. fixed electricity prices over set periods) and flexibility to work with intermittent power sources (Solar/Wind)
  - Potential to create **truly renewable chemicals** with net consumption of CO_2

CCU AT VITO

CCU pilot

20 tons

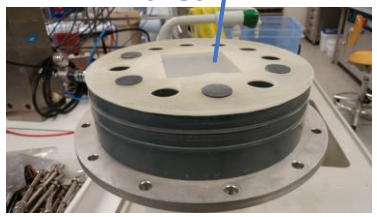
CO_2 based chemical per year

Electrochemical CO_2 conversion

- gas diffusion electrodes
- Electrocatalyst development
- Process engineering

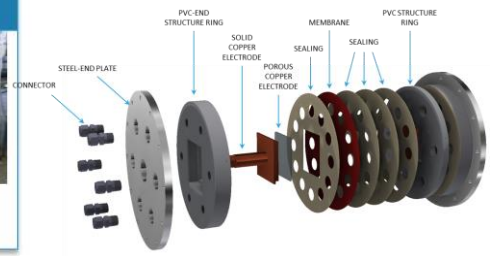
≈ 100-400 cm^2 electrode area

Proprietary (Gas Diffusion) Electrode



Production facility

Samples and larger electrodes



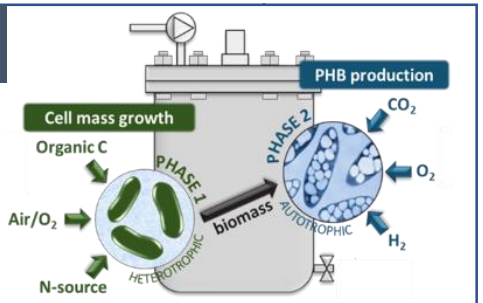
Ambition

demo

economically feasible technology value chain

Gas Fermentation

- Infrastructure[TRL 5]
- first products:
  PHA/PHB polymers



Algae harvesting & biorefinery

Carbonation
+ steel slags – Carbstone[TRL 7]

Techno-Economic and Life Cycle Assessment

VITO – a founding member of CO2ValueEurope (CVE)

CAPTURE

vito

pre-2016	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025

CO_2

E-catalyst

demonstration – TRL7

Moonshot

Integration

PERFORM PowER platFORM

Integration

Demonstration- TRL5

E-catalyst - key technology

Sugars
$-C_n(H_2O)_n-$

E-catalyst - key technology

$N_2 + H_2O$ -> NH_3

Moonshot

vito
H_2
technologies

HORIZON 2020

H_2 process components

Integration / Demonstration

Revived interest in core development

Synergies with NH_3 and CO_2 co-electrolysis

How does the research link to the CETP

- What are for you the topics of interest in the Strategic Research and Innovation Agenda (SRIA) of the Clean Energy Transition Partnership?
    - CETP Challenge 3: **Enabling Climate Neutrality with Storage Technologies, Renewable Fuels and CCU/CCS**
    - CETP Challenge 2**: Enhanced zero emission Power Technologies**
- Are there some energy related topics that you don't see represented enough in the current version of the SRIA?

No

- Could the CETP be an important funding source for your topic? Why yes/no?

YES……

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12:00 End workshop

Activities in the EERA JP

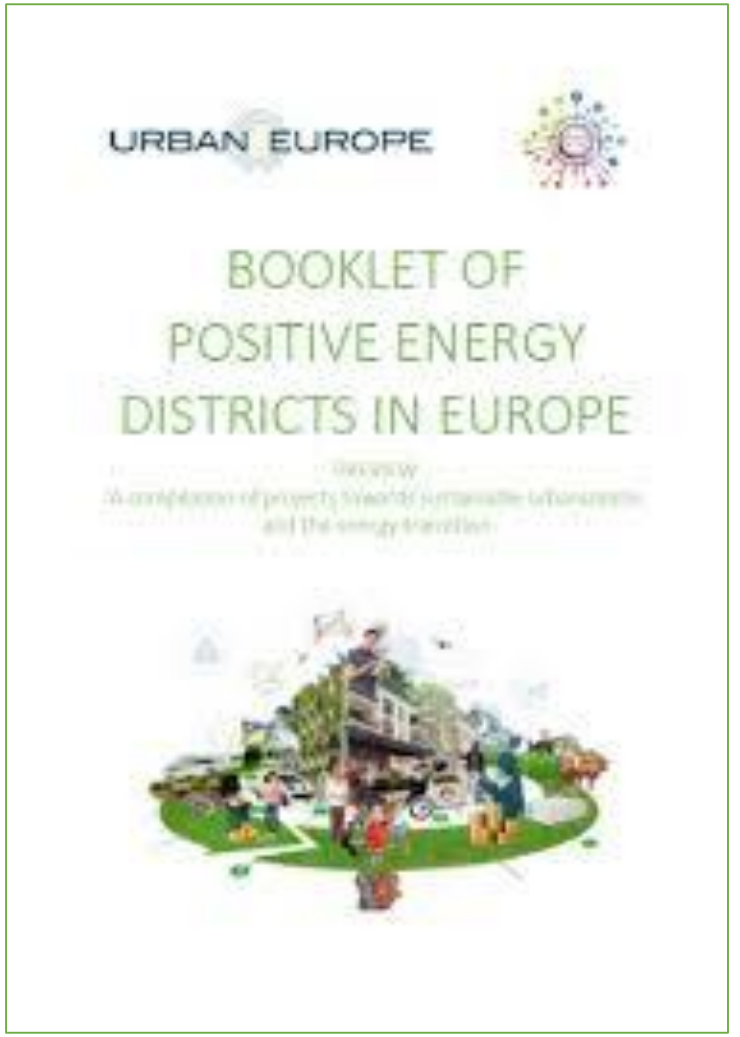
- H2020 Smart City Lighthouse projects: integration of buildings, regional energy,mobility ICT system
- R&I roadmap for SET-implementation plan Action 3.2
- Closely linked to JPI Urban Europe: active role of city stakeholders
- About 40 members (research & universities building, architecture, energy systems, planning, etc)

100 Positive Energy Neighbourhoods by 2025 – 5 modules:

- **Module 1** Towards European Positive Energy Cities (Lead: VTT & TNO)
- **Module 2** PED Labs (Lead: LNEG)
- **Module 3** PED Guides & Tools (Lead: Fraunhofer ISE)
- **Module 4** PED Replication & Mainstreaming (Lead: CVUT & ENEA)
- **Module 5** Monitoring and Evaluation (Lead: AIT)

Decision tools – Urban Pathfinder

Innovative design and management of neighbourhoods - Smart city living labs



How does the research link to the CETP

- What are for you the topics of interest in the Strategic Research and Innovation Agenda (SRIA) of the Clean Energy Transition Partnership?

  - Challenge 5 'regional energy system'
  - Challenge 7 'system integration in the built environment'
  - Challenge 8 'cross-cutting dimension'

  RRF (recovery & resilience facility): Improvement of efficiency in buildings (renovation)

- Are there some energy related topics that you don't see represented enough in the current version of the SRIA?

Generally there is few ambition level to be found (but probably more on detailed plans)

- Could the CETP be an important funding source for your topic? Why yes/no?

Yes but key requirements is the funding of the quadruple/quintuple helix = extremely important for smart cities (scientific partners – industry – local governments/communities – natural environment)

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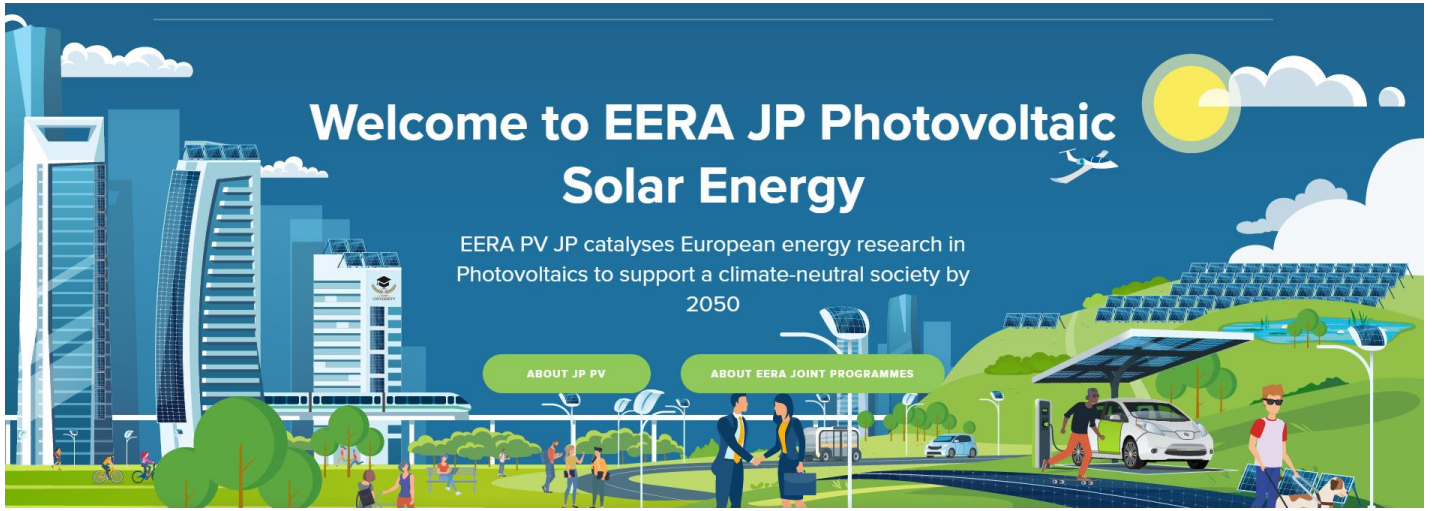
EERA JP on Photovoltaic Solar Energy

- 35 members including BERA (imec)



- JP Coordination
  - Ivan Gordon (imec)
  - Simon Philipps (F-ISE)
- Strong network of partners
  - Close collaborations between partners
  - Lobbying at EC level and member state level
- Close collaboration with European Technology and Innovation Platform (ETIP-PV)

EERA JP on Photovoltaic Solar Energy

- New infrastructure project “Viperlab” accepted for funding
  - H2020 INFRAIA-02-2020 call
  - Consortium consists of 12 JP-PV partners + 3 external
  - Transnational access to key perovskite-PV infrastructure in Europe
  - Reinforcing the EC perovskite-PV community to accelerate developments

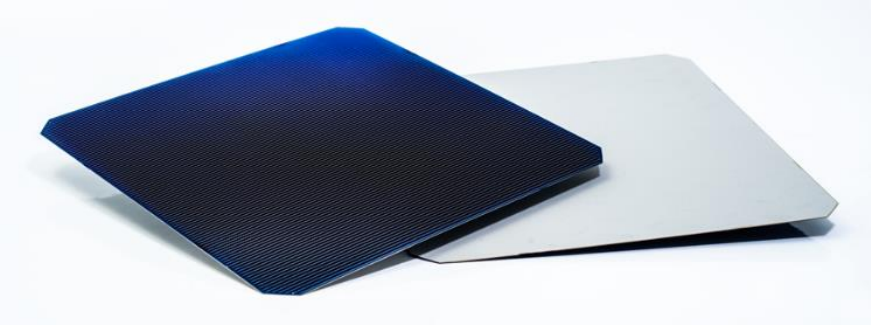
- Drafting of a European Strategic Research and Innovation Agenda PV
  - EERA-PV + ETIP-PV
  - Starting from the CETP-SRIA
  - Detailed listing of research and development that is needed for PV in Europe in the coming decade to reach the SET-plan goals
  - Instrument to be used towards national and European funding bodies

Link to activities at imec

imec PV technology highlights

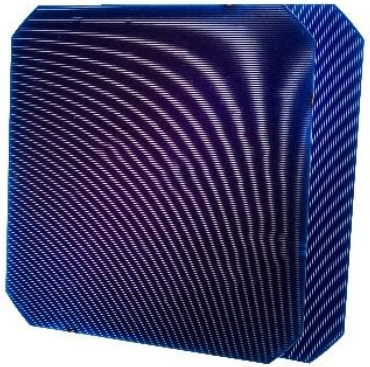
Better monofacial Si solar cells

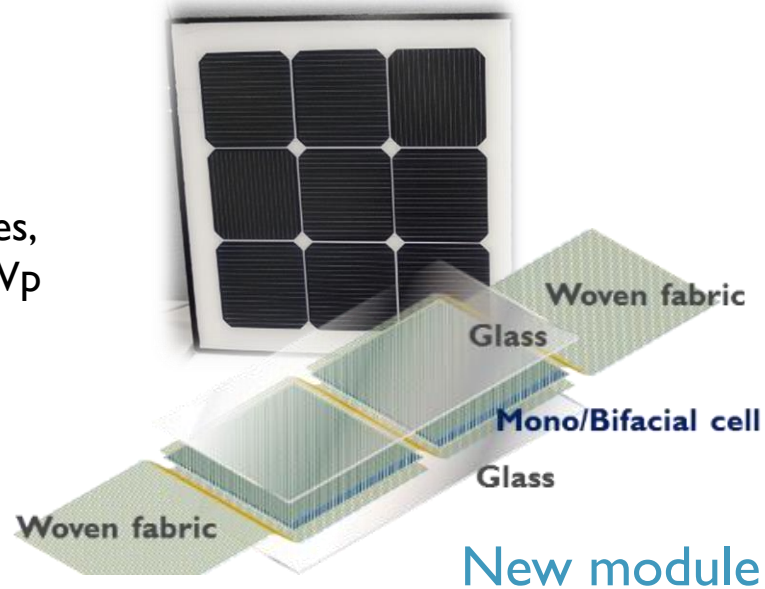
~23%, certified, industrial size, industrial processes



Better bifacial Si solar cells

~23%, industrial size, industrial processes, >95% bifacial, more kWh/kWp





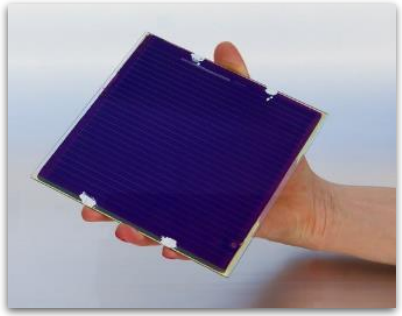
New module interconnection techniques

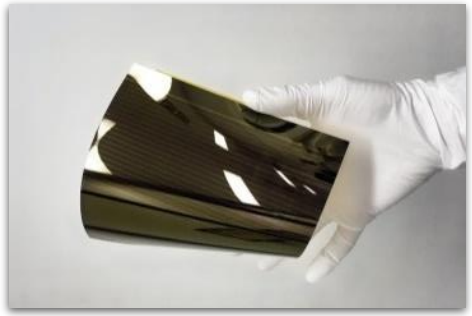
Simplified manufacturing, higher reliability, allowing mass customization

Perovskite thin film PV

Focus on large area, high efficiency, stability, industrialization

Achieving 15% for 12x12cm²

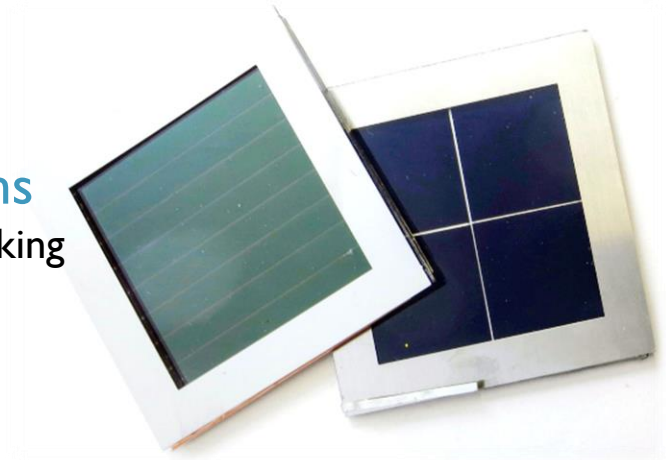




SOLLIANCE
SOLAR RESEARCH

Silicon-thin film tandem solutions

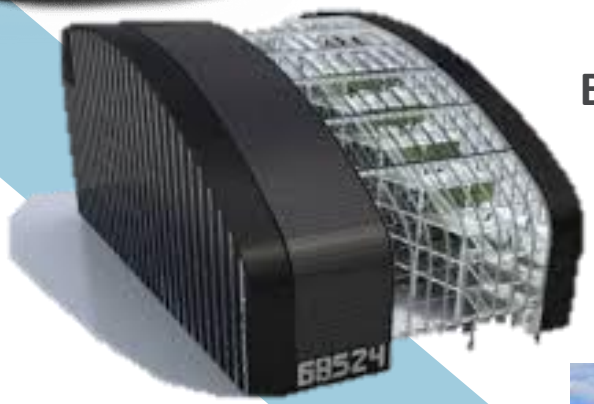
achieving 27.1%, working towards +30%



We focus on technology development for integrated PV systems

- Focus on Integrated Applications
  - Demand high W_p/m^2
  - Require a customized and local production
- Working on scalable customized automation, enabling lower cost
- Going from small-scale devices up to full system demonstrators

VIPV – Vehicle Integrated PV

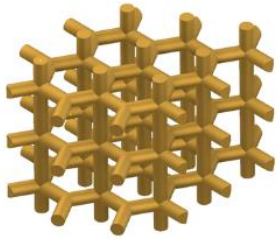


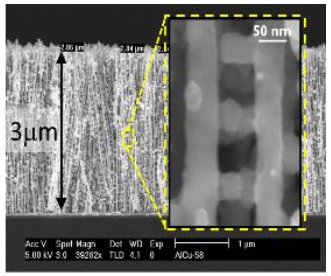
BIPV – Building Integrated PV

Agri-PV

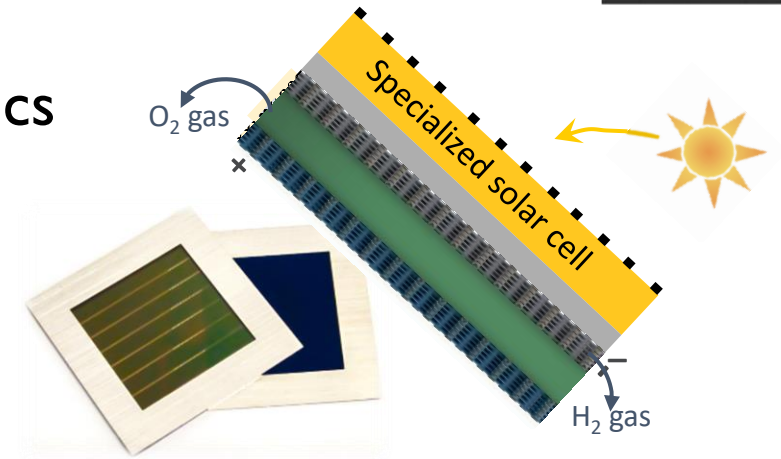
Imec's 'power-to-molecules' activities

- Water electrolysis





- Photovoltaics



- 'Solar fuels'
- Materials for chemical industry
- Seasonal energy storage

Link to activities at UHasselt

IMO: Materials for PV

- Single-junction
  - Chalcogenides (/kesterites)
  - Perovskites (Pb-free)
  - Organics
- Tandem
- Triple-junction

- Other projects: Sunovate (interreg), PROCEED (FWO) ...

IMO: Materials for Power-to-X

- Photocatalytic (PC)
- Photoelectrochemical (PEC)
- Photovoltaic-electrolysis (PV-EC)

  …

- X = molecules
  - Methanol (MeOH)
  - Dimethoxy ethane (DME)
  - Hydrogen (H_2)

  …

- Projects: Lumen, CleanH2, SYN-CAT, nanoCCU …

IMO: Quick overview

- **Dirk Vanderzande / Laurence Lutsen** – 2D layered hybrid perovskites
- **An Hardy / Marlies Van Bael** – Inorganic chemistry, catalysis
- **Wouter Maes** – Organic PV
- **Louis Pitet** – Polymers and hybrid materials
- **Bart Vermang** – Chalcogenides, tandem, thin film solar cell analysis
- **Michael Daenen** – PV reliability, electro-thermal modeling
- **Wim Deferme** – Printing technologies
- **Hans-Gerd Boyen** – HAXPES + lead-free perovskites
- **Koen Vandewal** – FT spectroscopy + defect analysis
- **Frank Renner** – Atom probe tomography
- **Sebastien Lizin** – Techno-economic assessment

How does our research link to CETP

Link to the CETP SRIA

- Topics of interest
  - CETP challenge 2 – Enhanced zero emission power technologies
  - CETP challenge 3 – Enabling climate neutrality with storage tech., renew. fuels & CCU/CCS
  - CETP challenges 5-7 – Integration into: regional/industrial energy syst., built environment

- Underrepresented topics
  - The topics are all described very general. More detailed plans are needed for the different topics and technologies.
    - SRIA PV is being drafted by EERA/ETIP to address this for PV technology

- Could the CETP be an important funding source for your topic
  - Yes, we hope it will be.

How does the research link to the CETP

Group of **R**esearch in **E**nergy and **E**nvironment from **Mat**erials **(www.greenmat.uliege.be)**
Professor Rudi CLOOTS (rcloots@uliege.be)

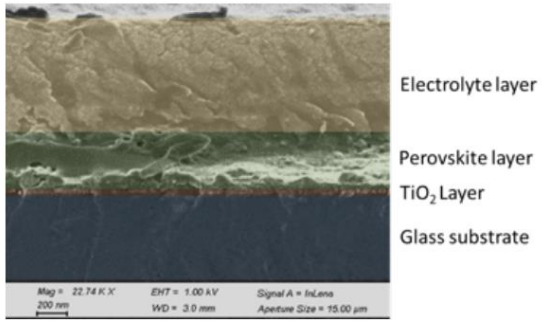
➢ Core business

Study and development of (new) **materials with controlled microstructure** and **physical/chemical properties** to enhance or facilitate their use in different applications related to **energy** (storage (batteries), production (PV), management (electrochromism)), **environment** (recycling of Si-based panels, recycling of materials from batteries,…) & **health** (ceramic additive manufacturing),…

➢ Some topics of expertise

- **<u>Generation technologies : PV</u>**

- **3D perovskite device fabrication and basic characterization** of photovoltaic parameters (I-V curves, electrochemical impedance spectroscopy);
- **Thin film processing :** full spray-processing (+ spin-coating) and shaping control (thickness, roughness, cystallization, 3D ordered porosity, pore size);
- **Ageing test and degradation study** of the devices over time (thermal stress, humidity stress, light degradation...);
- **Characterization facilities**: XRD (T°-controlled in-situ measurement), SEM, TEM, UV-vis spectrophotometer, cyclic voltametry, electrochemical impedance spectroscopy (on individual layers and fully assembled cells),…



Thanks!

Ivan.Gordon@imec.be

Bart.Vermang@imec.be

Gregoire.leonard@uliege.be

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EERA
European Energy Research Alliance

EERA Joint Programme on Energy Systems Integration (EERA JP ESI)

Expanding system boundaries

Erik Delarue
Management Board Member, EERA JP ESI
Professor, KU Leuven & EnergyVille

Members

- Aalborg University (Denmark)
- AIT (Austria)
- BERA (Belgium): KU Leuven, VITO
- Copenhagen School of Energy Infrastructure
- German Aerospace Center (DLR, Stuttgart)
- Delft University of Technology (Netherlands)
- DTU (Denmark)
- ECN part of TNO (Netherlands)
- EFZN (Germany)
- ENEA (Italy)
- IREC (Barcelona)
- IRIS; Norway
- Fraunhofer (Germany)
- Groningen University (Netherlands)
- LEI; Lithuania
- LNEG (Portugal)
- LUT (Finland)
- NTNU (Norway)
- Politecnico di Torino (Italy)
- Ruhruniversität Bochum (Germany)
- SINTEF (Norway)
- Rijksuniversiteit Groningen (Netherlands)
- TNO (Netherlands)
- University of Stavanger (Norway)
- University College Dublin (Ireland)
- UKERC: Strathclyde; Newcastle, Manchester, Imperial College, Durham, Edinburgh (UK)
- VTT (Finland)

Types of activities

- Research:
  - Development of ESI community: common language, concepts, goals, tools
  - H2020 / Horizon Europe proposals (SPINE, TradeRES projects)
- Energy sector:
  - Public workshops with policy makers, network operators and energy companies
- EU
  - Input in the research agenda of the Clean Energy Transition Partnership (together with EERA secretariat in Brussels)
  - Interaction with EC: policy advice, feedback on research
- EERA
  - Active participation in EERA aisbl activities
  - Active coordination with key JPs

Past activities

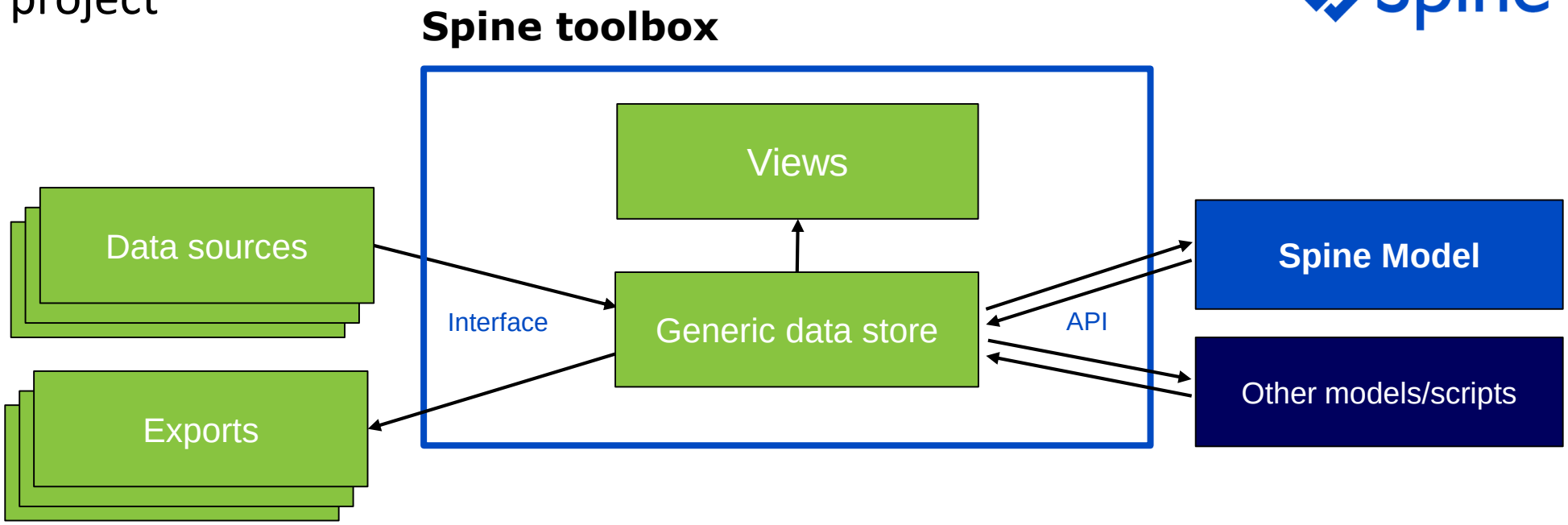
- Delft, Dec. ‘17: first Steering Committee Meeting since the kick-off meeting in Dublin in May ’16.
- May 2018: Copenhagen policy workshop
  - May 24: public workshop ‘policy makers meet scientists’ on the challenges of energy system integration.
  - May 25: research workshop on energy systems modeling.
- Fall 2018, Imperial College: SC meeting plus workshop
- April 2019, Imperial College: joint policy conference with ESIG (Mark O’Malley)
- May 2019, Delft: workshop on multi-model approaches to energy systems integration
- Fall 2019, Stavanger:
  - Workshop on a Nordic ESI theme, e.g. EV integration
  - Heating/cooling system integration workshop (Newcastle)
  - Joint workshop with EERA project SmILES Project (data sharing)
  - Steering Committee meeting

Current activities

- Steering committee meeting on 29 October 2020 (online)
- Thematic groups that we recently initiated:
  - Digitalization for Energy (Led by Peter Breuhaus)
    - Participation in the new cross-cutting EERA Joint Programme on Digitalization
  - Heating and cooling (Led by Tony Roskilly)
  - Hydrogen (Led by Goran Strbac)
  - Modelling (Led by Erik Delarue and Henrik Madsen)
  - Consumer (Led by Lisa Ryan & Kristiane Lindland)
- Online workshop series on ESI aspects of hydrogen, heating and cooling
  - in view of expected Horizon Europe calls in these areas
- Expert Workshop: “Towards a common understanding of energy system costs”
  - KU Leuven, Spring or Fall, 2021

Link to Belgian activities

- H2020 Spine project



Main output:

1. Open-source energy modeling toolbox
2. Open-source energy-system model generator
3. Deployment on case studies

https://github.com/Spine-project

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 774629.

Link to Belgian activities

- Other projects (examples):
  - Energy Modeling Toolbox for Policy Decision Support
    - SBO project; 2018-2022
  - EPOC 2030-2050
    - Energy technology modelling framework for Policy support towards a Cost-effective and Sustainable society in 2030 and 2050 – ETF; 2018-2022
  - Procura
    - System-level, technology oriented analysis of carbon capture and utilization potential in Belgium, leveraging power-to-X-technologies, with specific attention for markets for CO2 – ETF; 2020-2025

How does the research link to the CETP

- Topics of interest in the Strategic Research and Innovation Agenda (SRIA) of the Clean Energy Transition Partnership
  - Challenge 1: “Optimised integrated European net-zero emissions Energy System”
    - *“System modelling and planning- understanding and analysing the integrated energy system of the future: modelling, design and planning of the Integrated Energy System overcoming the silos among energy vectors.”*
    - *“System flexibility- robust and clean energy transition pathways”*
    - *“System operation- operational integration of integrated energy systems”*
    - *“Economics- market design and regulation for an integrated energy system”*
  - Challenge 5 “Integrated Regional Energy Systems”

Contact information

- JP coordinator: Laurens De Vries, Delft university of Technology, l.j.devries@tudelft.nl

- Erik Delarue, KU Leuven, erik.delarue@kuleuven.be

Agenda

09: 00 Welcome Leen Govaerts, chair BERA

09:15 Introduction to EU funding instruments, the co-fund CETP and the timelines (Adel El Gammal, Secretary General EERA)

09:45 Content/structure of the Strategic Research & Innovation Agenda of the CETP (Pieter Vingerhoets, BERA/VITO)

10:00 Short pitches key BERA members on their research activities

- Wind energy (Pieter-Jan Jordaens, Sirris)
- CCU (Grégoire Leonard, ULiège & Deepak Pant, VITO)
- Smart Cities (Guy Vekemans)
- PV (Ivan Gordon, Imec & Bart Vermang, UHasselt)
- System integration (Erik Delarue, KUL)
- **Electric/thermal Storage (Pieter Vingerhoets, VITO & Grégoire Leonard, ULiège)**
- Hydrogen (Patrick Hendrick, ULB & Grégoire Leonard, ULiège)
- Bio-energy (Julien Blondeau, VUB)
- Consumer interaction (Pieter Valkering, VITO)

12:00 End workshop

EERA
European Energy Research Alliance
Energy Storage

11 October 2017
Launch of the European Battery Alliance

Aim: Create competitive manufacturing value chain in Europe with sustainable battery cells at its core.

March 2020
Publication Battery 2030+ Roadmap

Long-term R&D roadmap
- Accelerated discovery of battery interfaces and materials
- Integration of smart functionalities
- Cross-cutting actions

10 December 2020
Proposal for a Regulation on batteries

General objectives:
- Strengthening battery sustainability throughout their entire life, by ensuring minimal requirements for batteries placed in the EU internal market
- Increasing the resilience of the EU battery supply chain by closing the materials loop
- Reducing the environmental and social impacts throughout all the stages of the life cycle of batteries

17 May 2018
Strategic Action Plan for Batteries

(part of Clean Mobility Package)
Combines targeted measures at EU level in raw materials, R&I, financing/investment, standardization/regulatory, trade and skills development
Aim: Make Europe a global leader in sustainable battery production and use, in the context of the circular economy.

9 December 2019
Approval of first IPCEI on batteries
(Important Project of Common European Interest)

Aim: Accelerate upscaling of pre-commercial projects

4 December 2020
Publication of Strategic Research Agenda
European Technology and Innovation Platform Batteries Europe

Aim: Create competitive manufacturing value chain in Europe with sustainable battery cells at its core.
- Transversal Aspects
- Battery Applications
- Battery Manufacturing and Advanced Mate
- Raw Materials for Circular Economy
- European Competitive Edge

December 2020
Launch of European Partnership On Batteries

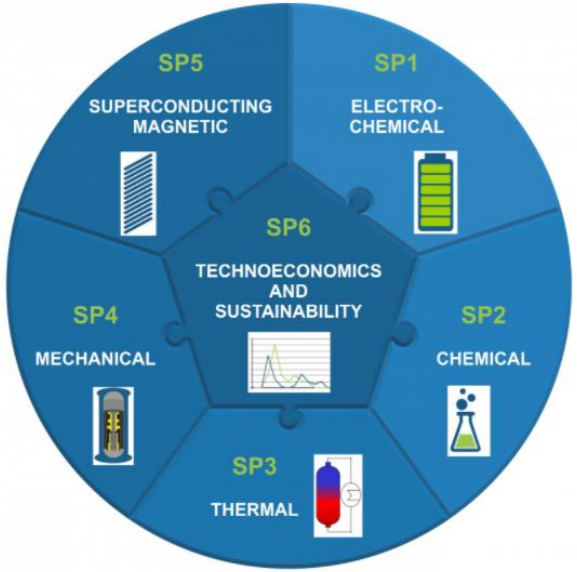
Objective: Propose concrete R&I actions for Horizon Europe

Energy Ville

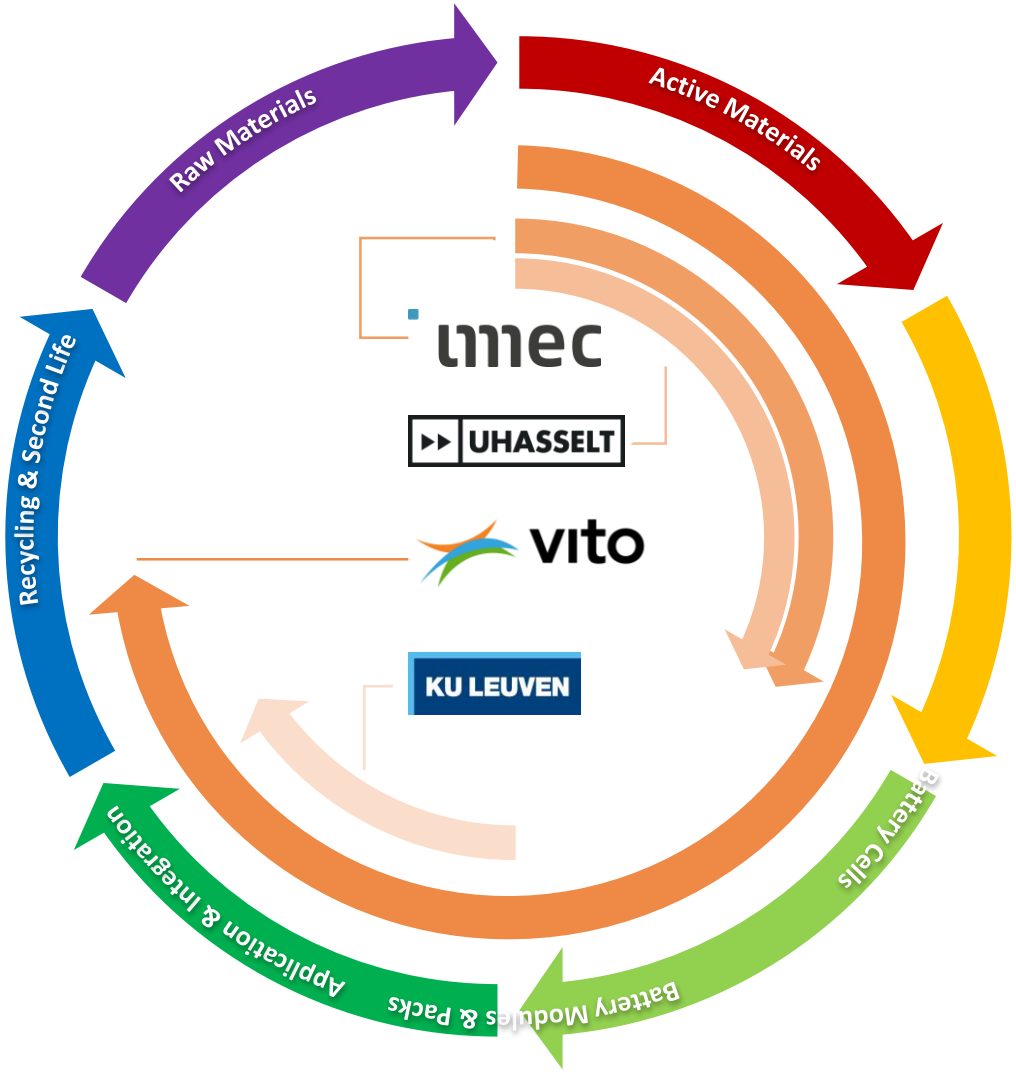
EERA
European Energy Research Alliance
Energy Storage

EERA Joint Programme on Energy Storage (JP ES)

- First pan-European programme bringing together major fields of energy storage research – officially launched in 2011
- Fostering the efficient development of new energy storage technologies and supporting the SET Plan objectives and priorities
- Coordinated by Karlsruhe Institute of Technology (KIT, GE)
- 39 research organisations and universities from 15 European countries
- 6 sub-programmes



EnergyVille – Batteries R&D



EnergyVille – Batteries R&D

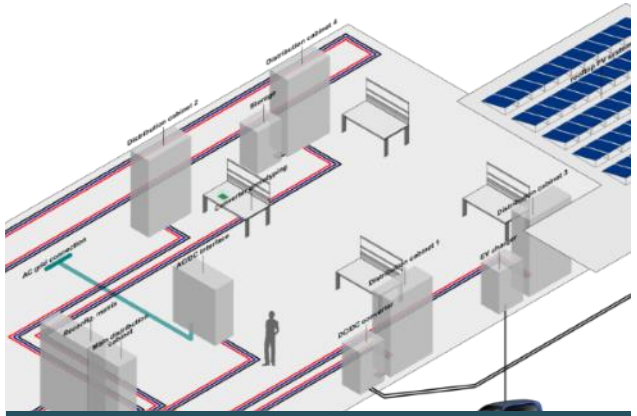
New materials for batteries

Modelling, characterization and testing of batteries and battery materials

New battery cell architectures

Exploratory cell concepts & battery concepts

Advanced battery sensing & management systems

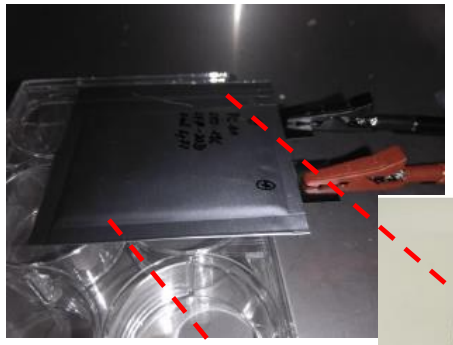


Battery integration support

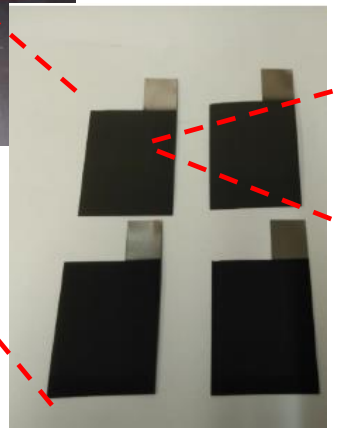
Activities in batteries

Prof. Nathalie JOB, Chemical Engineering

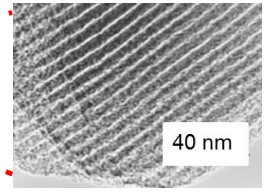
- Assembly and characterization of batteries from components
  - Microbatteries, coin cells, pouch cells
  - Electrode preparation at larger scale
  - Relationship between electrode structure and performance



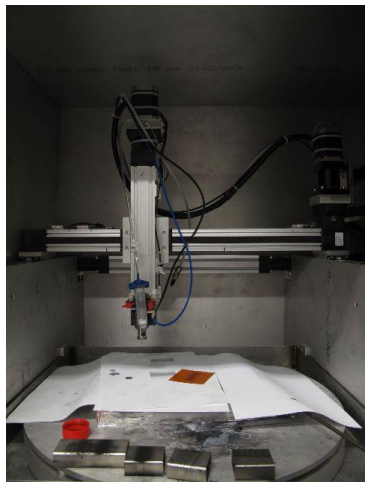
Device



Component



Nanostructured material



Spray-coating
→ Versatile
→ Upscalable
→ Reproducible

Microbattery electrode

Activities in batteries

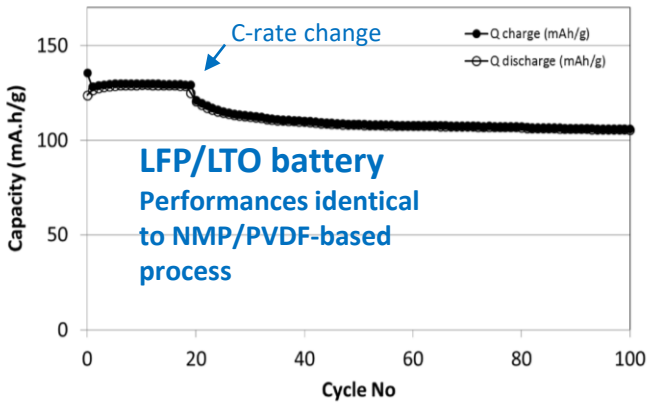
Prof. Nathalie JOB, Chemical Engineering

- Assembly processes based on green technology
  - Spray-coating of each element (current collectors and electrodes)
  - Elimination of toxic solvents and binders

Wallonie

BATWAL project
« all paintable batteries »

WO/2017/211555A1



Electrode processing (from carbon, oxides, etc.)
- Solvent = water
- Water-compatible binder
- Processing on various surfaces(Cu, Al, steel, carbon, etc.)
- Easy recycling

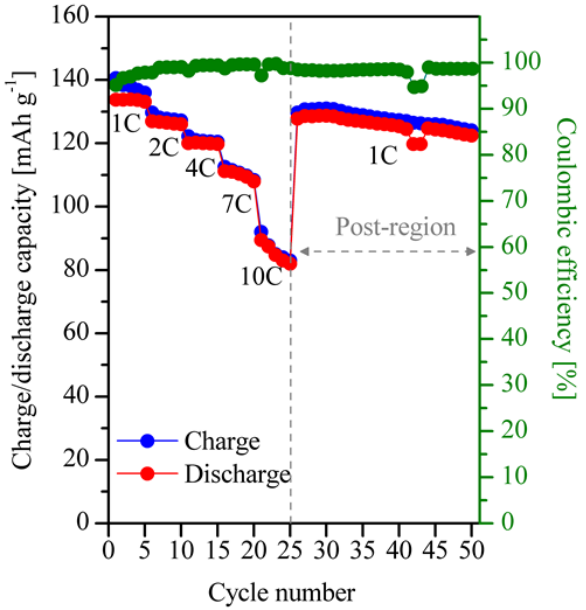
Possibility to process carbon current collectors

EnSO project
« LCO electrode without binder »

WO/2016/097396

ECSEL Joint Undertaking

Pouch cell (6.25 cm^{-2})	$LiCoO_2$ load: 8.5 mg cm^{-2}
Electrolyte/separator/Anode	$LiPF_6$/Celgard/Li°
Nominal voltage	3.6 V
Nominal capacity (C/2 rate)	7.2 mAh
Nominal energy	26 mWh
Life cycle (4C rate, 0-100 % Q_0[4]) 80 % (End-of-Life):	300 cycles
Charge method	CV-mode at 4.2 V (for fast charging: 15 min)[5]
Typical operating range	3.0–4.2 V
Maximum continuous discharge current	30 mA



- High performances at high C-rate
- NO binder
- NO conductive additive
- Deposition process based on water/ethanol slurry
- Easy recycling

How does the research link to the CETP

Group of **R**esearch in **E**nergy and **E**nvironment from **Mat**erials **(www.greenmat.uliege.be)**
Professor Rudi CLOOTS (rcloots@uliege.be)

➢ **Some topics of expertise**

- **Electric/Energy storage**

1. Li-,Na-,K-,Zn-…ion batteries

- **Optimized synthesis (including recycling) of nano-/microsized powders** (oxides, hybrid, ...) as **cathode or anode materials**
  → several **pilot units** for the green synthesis of powders :
  hydrothermal reactors (5.5 & 100 liters) and two spray-dryers (5 liters/h - aqueous or non-aqueous (ATEX) feed)
- **Development of formulations** (suspensions and/or slurries) for the **processing of layers** (by spray or tape-casting)
- Complete **physico-chemical characterization** of the designed **materials** (XRD, Mössbauer and Raman spectroscopies, TG/TDA, SEM, TEM, BET, particle size, liquid and powder rheology,…)
- **Cell assembly** and **electrochemical characterization of the materials** in half-cell and full-cell configurations (**coin and pouch cells**) + *in situ* characterization techniques (XRD, Impedance and Raman analysis)

2. Energy efficiency: electrochromic smart windows

- **Dynamic filtration of light passing** through windows in glass buildings; towards costs and energy savings for air conditioning, heating, lighting…
- Design of **fully-solid electrochromic devices** from inorganic metal oxides: 50+% transmittance contrast between colored and bleached states within 1-10 min commutation times
- Use of **plasmonic nanomaterials for "new-generation" smart windows**, allowing for selective **modulation of VIS (light) and NIR (heat) contributions**
- Tools for materials thin film processing (by spray or tape-casting) and characterization (XRD, SEM, TEM, (opto)electronic properties,…)

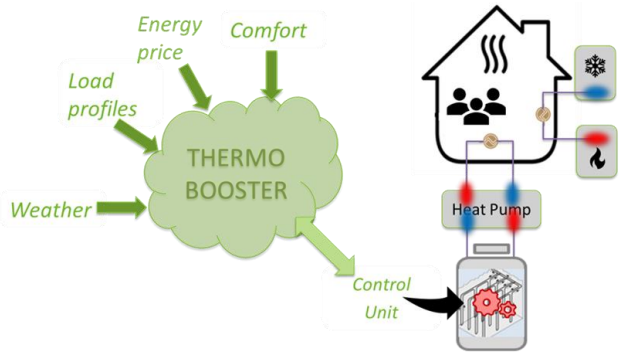
Thermal Storage

Intelligent control systems – Building level

Product development

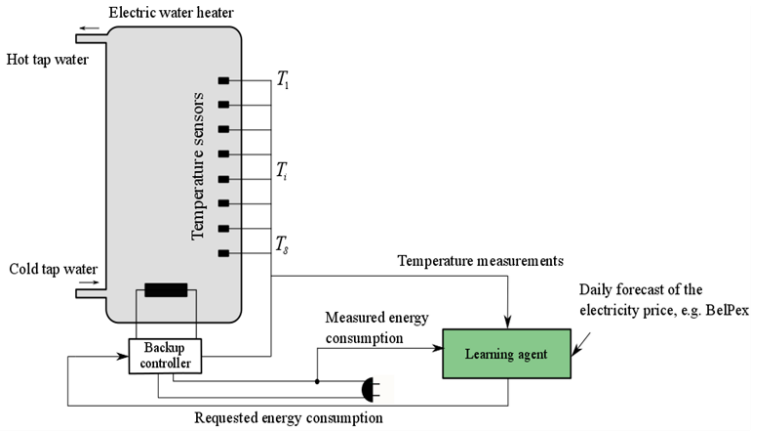
ThermoBooster

- Patent: US2011166718
- Advise system for ground source heat pumps
- Guarantees heating and cooling power of BTES field
- Avoids depletion of the geothermal field during remaining heating (cooling) season
- Reduces back-up power capacity (Capex) and energy consumption for heating and cooling (OPEX)



Smart hot water heater

- Patent: EP 12729056.7
- Minimisation of electricity cost of hot water heaters
- Black-box self-learning application – learning of storage dynamics and water consumption profile



Intelligent control systems – Building level

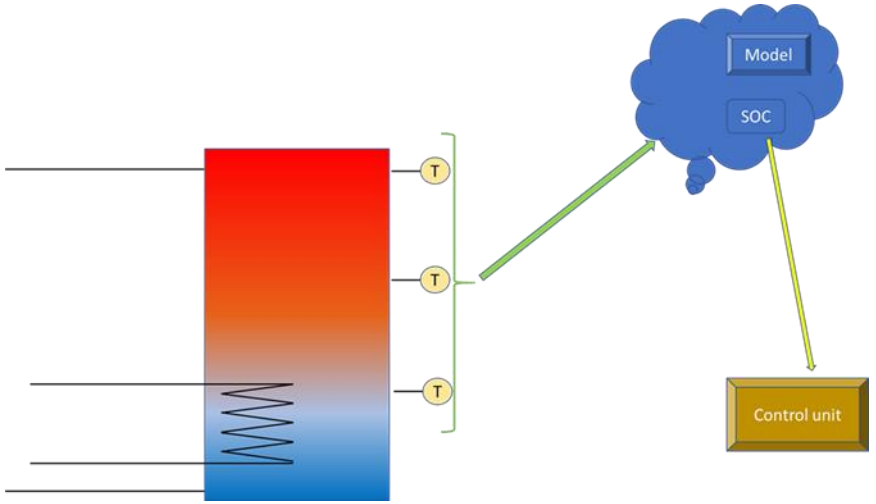
Product development

Coldstore controller

- Market: cold stores
- Active use of thermal mass of the stored goods in cold stores to control the cooling compressors
- Reduced electricity costs and/or increased self-consumption of renewable energy
- To be demonstrated

State of charge (SoC) of water storage tanks

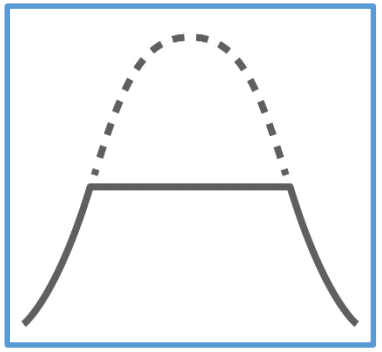
- Patent: EP 16 207 504.8
- Limited number of strategically placed temperature sensors
- Combination of parametrised grey-box model and temperature sensors



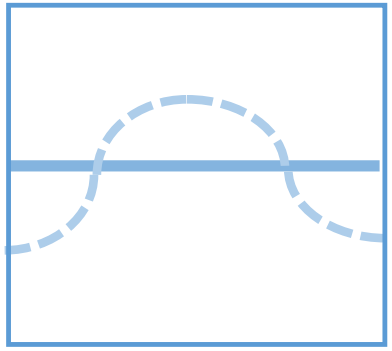
Intelligent control systems – District level

STORM District Energy Controller

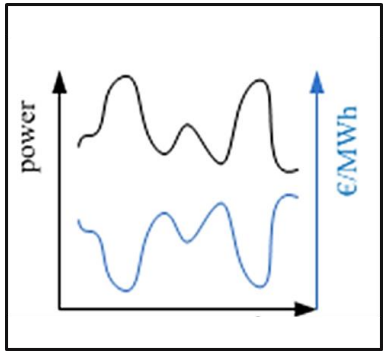
An artificial intelligence based smart controller for district heating network operators to optimize operations through active demand side management.



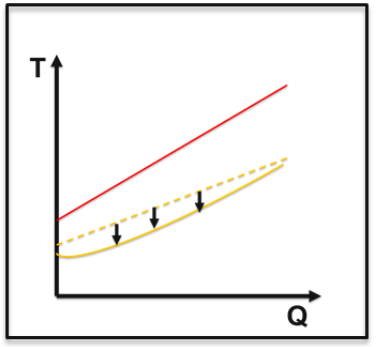
Peak reduction



Flattening the curve



Market interaction



Return temperature reduction

Commercially available

Projects

RES4BUILD

STORY

GEOSMART

MATChING

MERITS
A RECHARGEABLE HEAT BATTERY

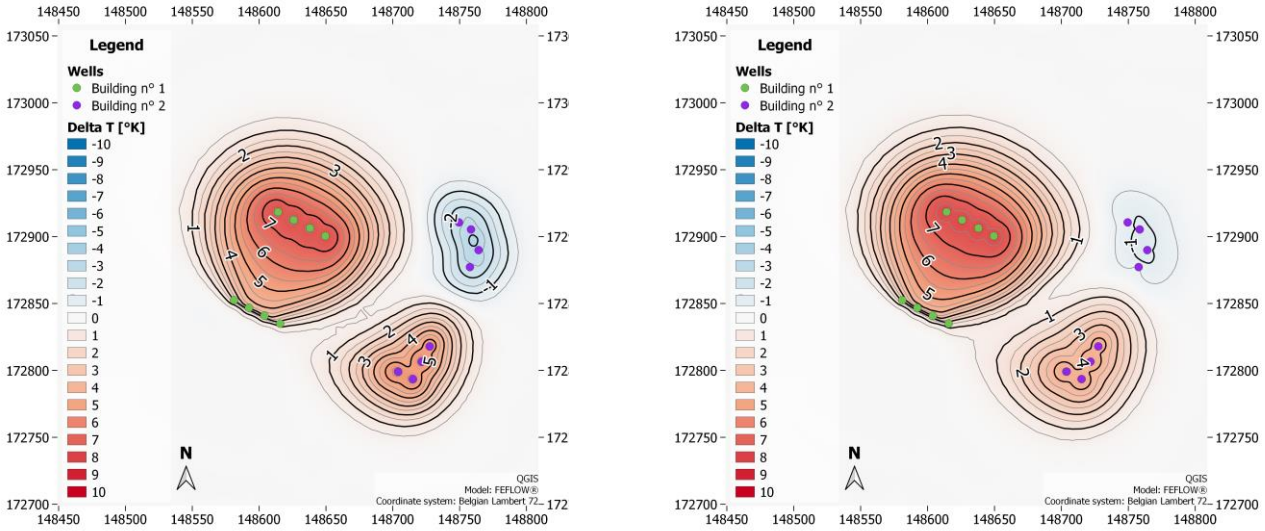
EXCESS

Energy Ville

Thermal storage

- open geothermal systems in shallow aquifers (ATES = Aquifer Thermal Energy Storage): feasibility, impact and heat balance in the underground
- seasonally or intraday storages, mutual influences of multiple systems and unbalance effects in urban areas, optimizations … investigated and simulated according to the underground hydraulic and thermal parameters, and local conditions

Hydrogeology and Env. Geology (HGE) team (Prof. A. Dassargues) of the Urban and Environmental Engineering (UEE) research unit team, ULiège



results from Bulté, 2020 (MSc thesis, ULiege)

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- PV (Ivan Gordon, Imec & Bart Vermang, UHasselt)
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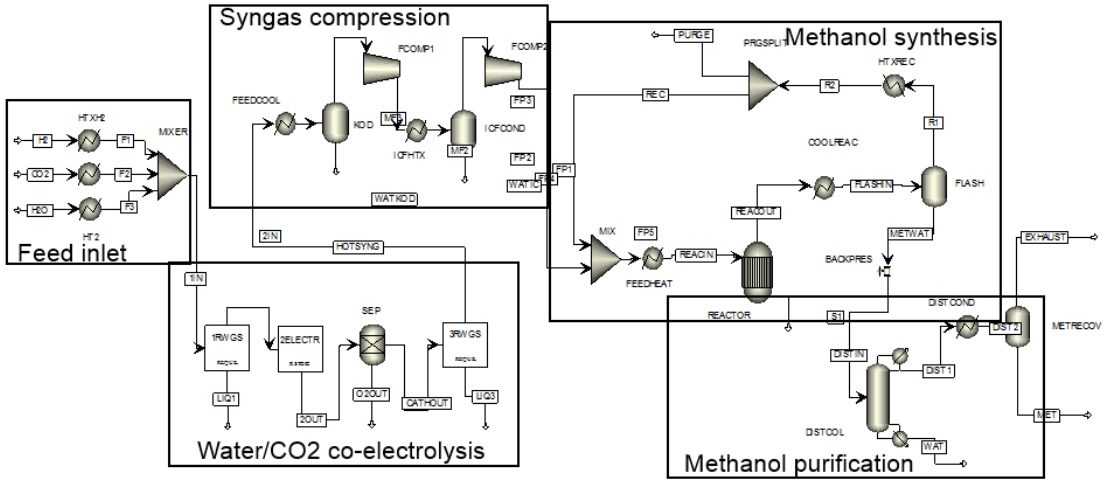
- **Hydro and hydrogen (Patrick Hendrick, ULB & Grégoire Leonard, ULiège)**
- Consumer interaction (Pieter Valkering, VITO)
- Bio-energy (Julien Blondeau, VUB)

12:00 End workshop

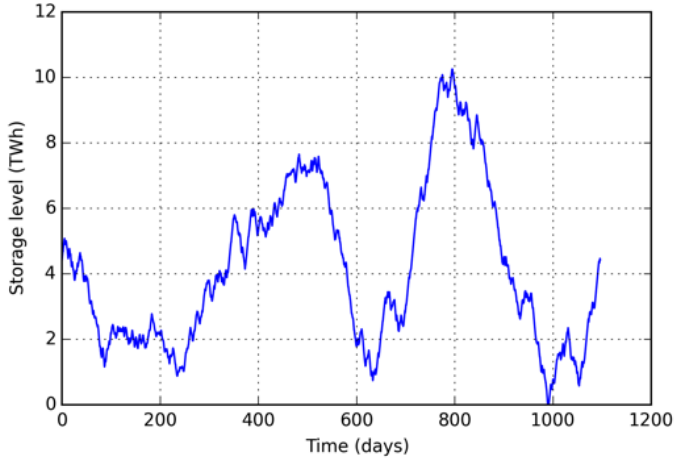
Power-to-fuel energy storage

Prof. Grégoire Léonard, Chemical Engineering

- Core activity: Process modeling & integration
  - First-principles numerical model of chemical/energy processes
- Power-to-fuel: CO_2 capture; Electrolysis; fuel synthesis (see next)
- Energy system planning and modeling
  - Optimization of power grid with power-to-fuel for long-term electricity storage



Léonard et al., 2016. Computer aided chemical engineering *38*, 1797.
DOI: 10.1016/B978-0-444-63428-3.50304-0

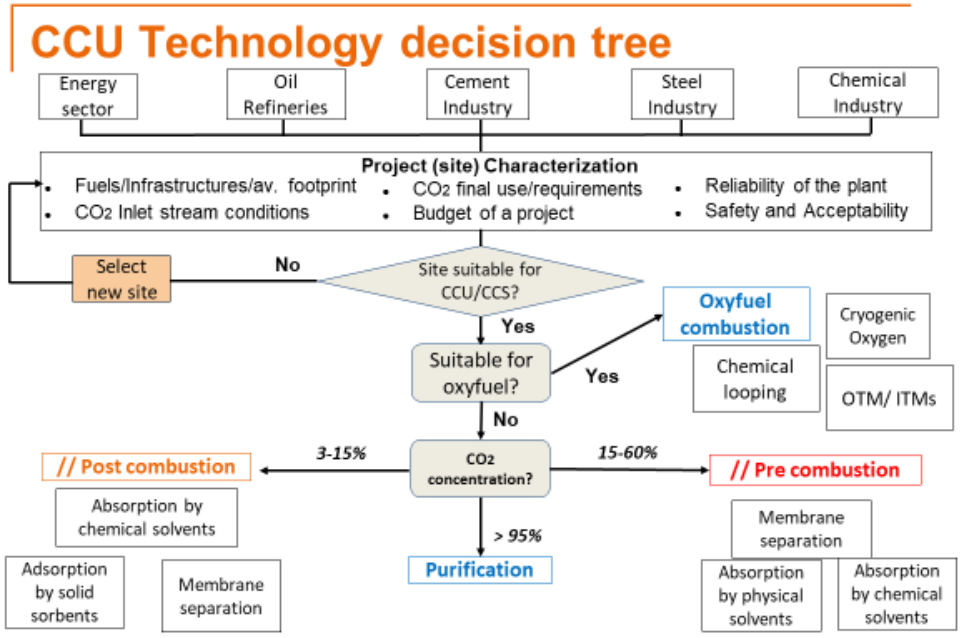


Léonard et al., 2015. Electricity storage with liquid fuels in a zone powered by 100% variable renewables, IEEE 978-1-4673-6692-2.

Link to Belgian activities

Prof. Grégoire Léonard, Chemical Engineering

- PROCURA (ETF)
  - Power to X and Carbon Capture & Utilization Roadmap for Belgium
  - ULiège main task: Focus on CO_2 capture applied to belgian case studies



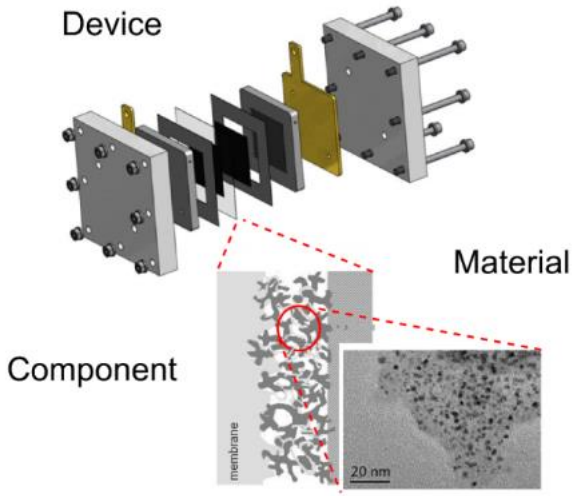
Fuel cell activities – Nathalie JOB

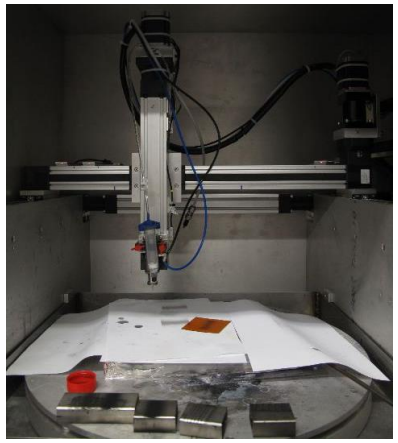
- Catalyst synthesis (Pt, PtM, PdM) for PEMFC electrodes

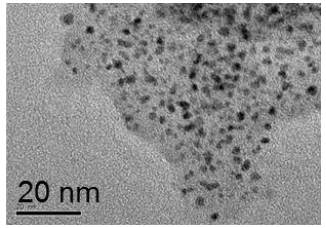
- Characterization of PEMFC elements (catalysts, membranes, MEAs, bipolar plates
  - *Ex situ* characterization with various techniques
  - *In situ* characterization in (home-made) automated FC test bench

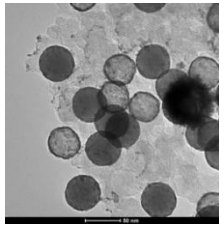
- Testing of FC stacks
  - Test bench assembled – stacks up to 10 kW – water cooled
  - First measurements starting in January
  - For now: stationary applications but extendable

Fuel cell activities – Nathalie JOB

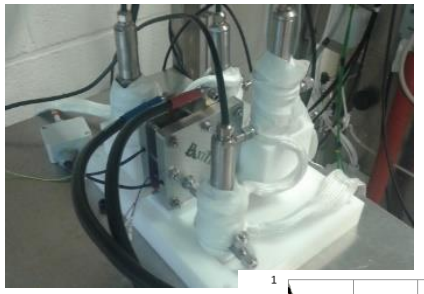


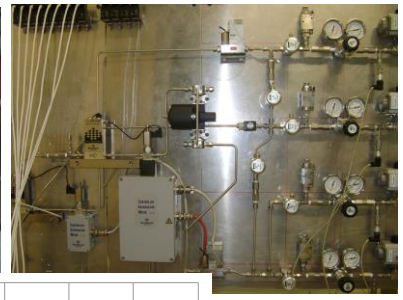


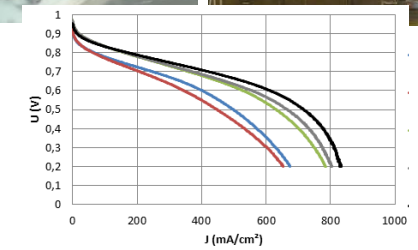




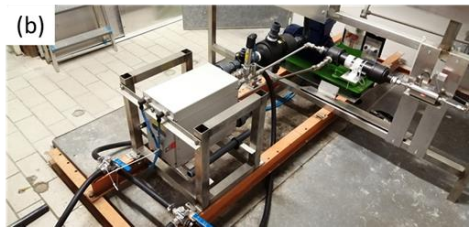
Elements







Stacks



LIÈGE université
Sciences Appliquées

NCE
NANOMATERIALS CATALYSIS
ELECTROCHEMISTRY

Power-to-fuel – Grégoire LEONARD

- CO_2 capture: Point-source and Direct air capture as carbon source for carbonated fuels
  - Process modeling, design and optimisation (Aspen but not only)
  - Experimental study of sorbents/solvents stability

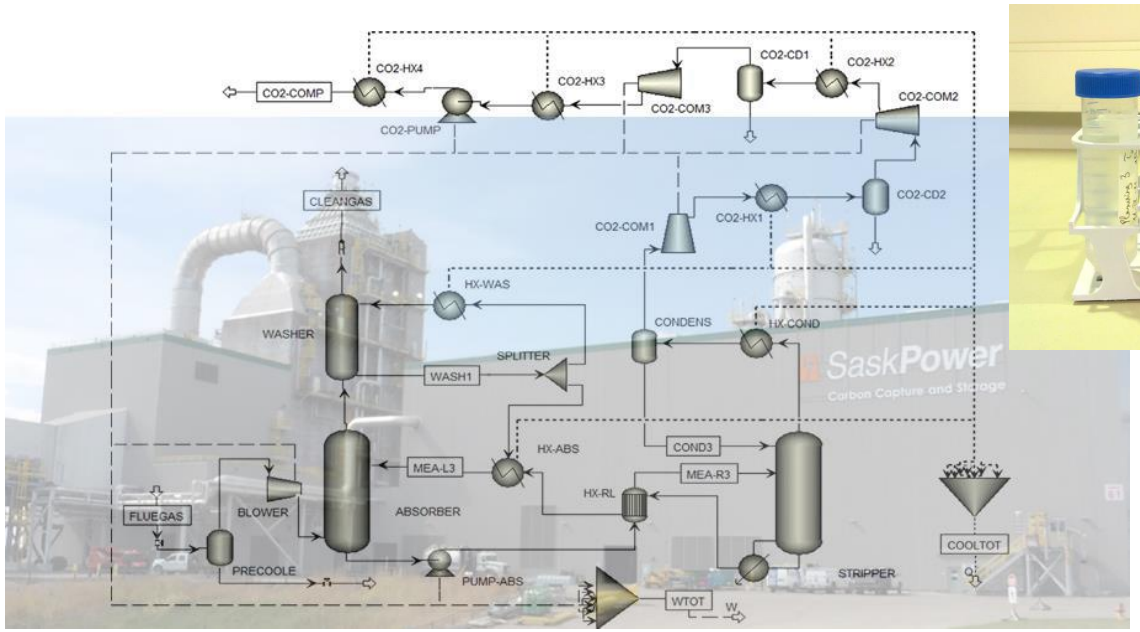
- e-Fuel synthesis
  - Process modeling with techno-economical analysis
    - Power-to-methanol, power-to-gas…
  - Experimental study of fuel synthesis based on 6.6 kW capacity of low-T electrolysis

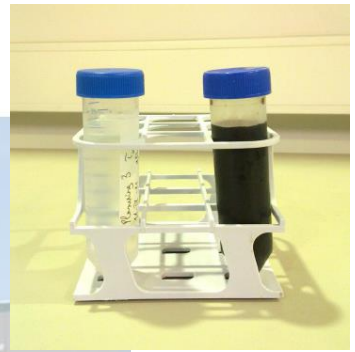
- Energy system planning and modeling
  - Optimization of power grid with power-to-fuel for long-term electricity storage

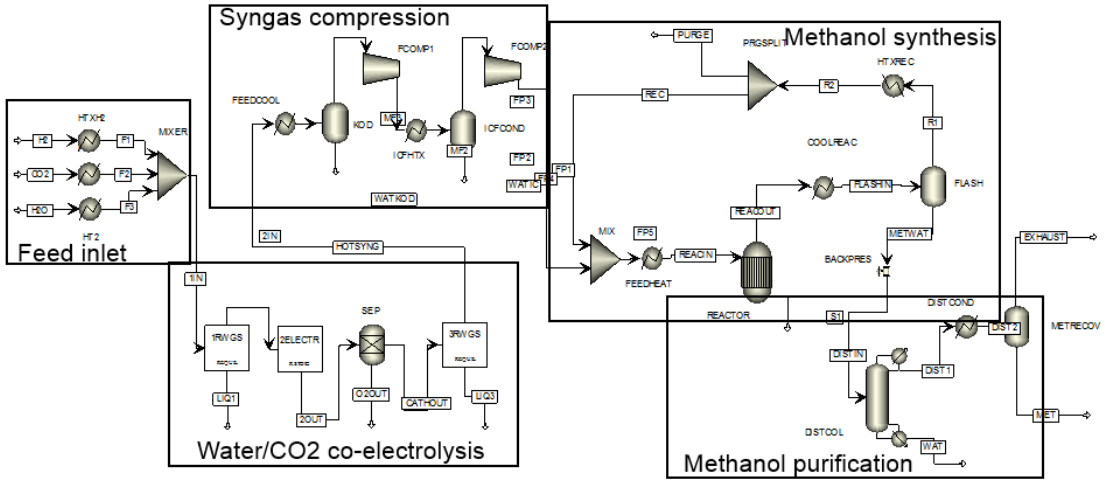
PEPs CHEMICAL ENGINEERING

LIÈGE université Sciences Appliquées

Power-to-fuel – Grégoire LEONARD



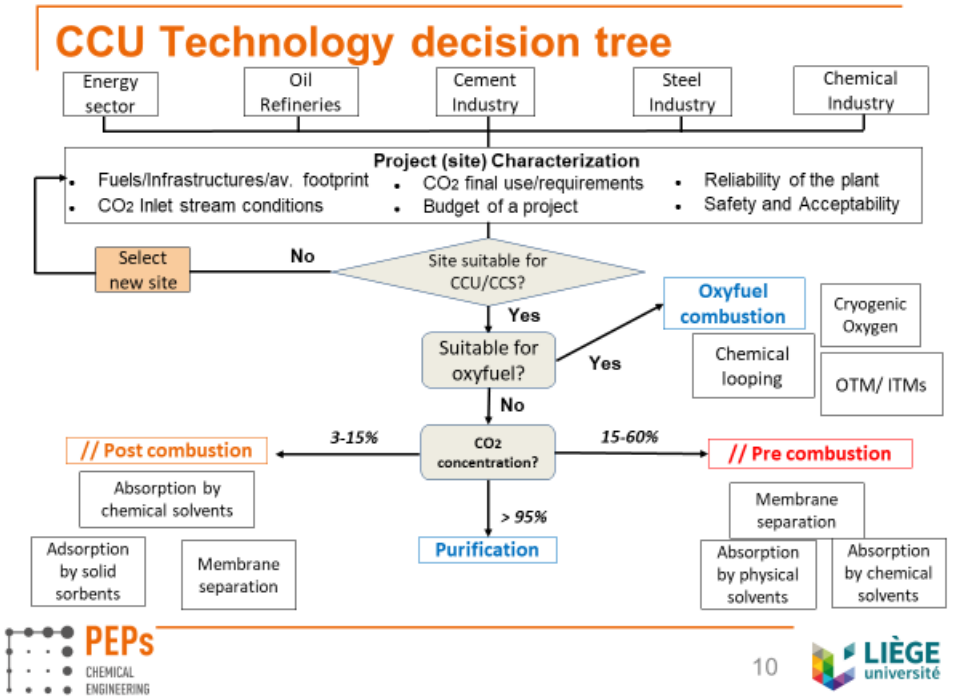




Léonard et al., 2016. Computer aided chemical engineering *38*, 1797.
DOI: 10.1016/B978-0-444-63428-3.50304-0

Link to Belgian activities

- PROCURA (ETF)
  - Power to X and Carbon Capture & Utilization Roadmap for Belgium
  - ULiège main task: Focus on CO_2 capture applied to belgian case studies



PEPs CHEMICAL ENGINEERING

LIÈGE université Sciences Appliquées

Thanks!

Contact Fuel Cells: Nathalie.Job@uliege.be

Contact Power-to-X: G.leonard@uliege.be

Agenda

09: 00 Welcome Leen Govaerts, chair BERA

09:15 Introduction to EU funding instruments, the co-fund CETP and the timelines (Adel El Gammal, Secretary General EERA)

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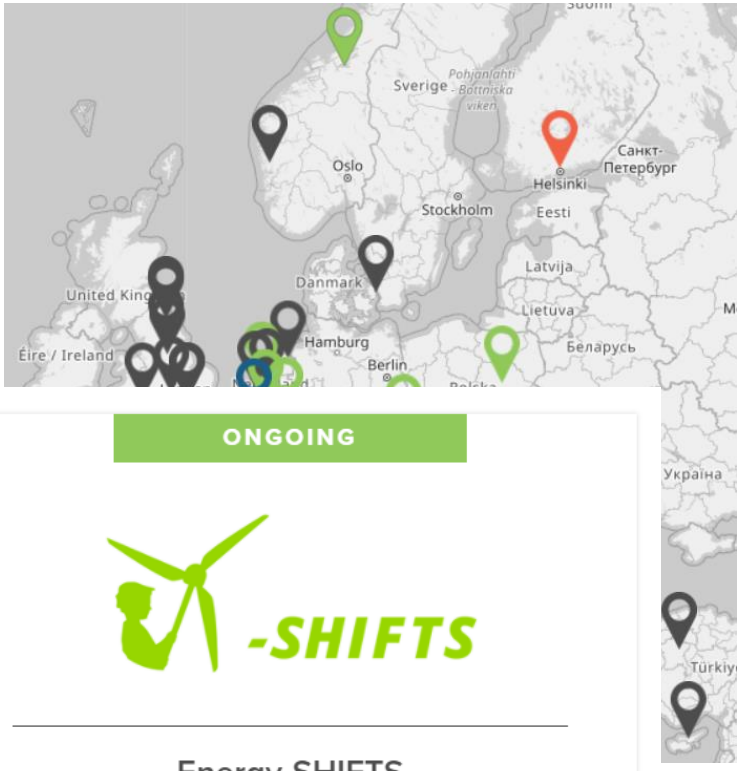
- **Consumer interaction (Pieter Valkering, VITO)**

12:00 End workshop

EERA JP e3s

- Complex interactions in socio-technical-economic systems:
  - consumer behavior and engagement,
  - market dynamics,
  - collective action,
  - innovation, and technological change

University Association Research organisation Company



ONGOING

EERAdata

Funding period: 03/2020 - 02/2022

ONGOING

COMETS

COllective action Models for Energy Transition and Social Innovation

Funding period: 05/2019 - 04/2022

ONGOING

-SHIFTS

Energy-SHIFTS

Funding period: 04/2019 - 03/2021

Activities

- Acquire new funds
  - Horizon Europe
- Policy events
  - Better integrating SSH research in policy
- Coordinate existing research

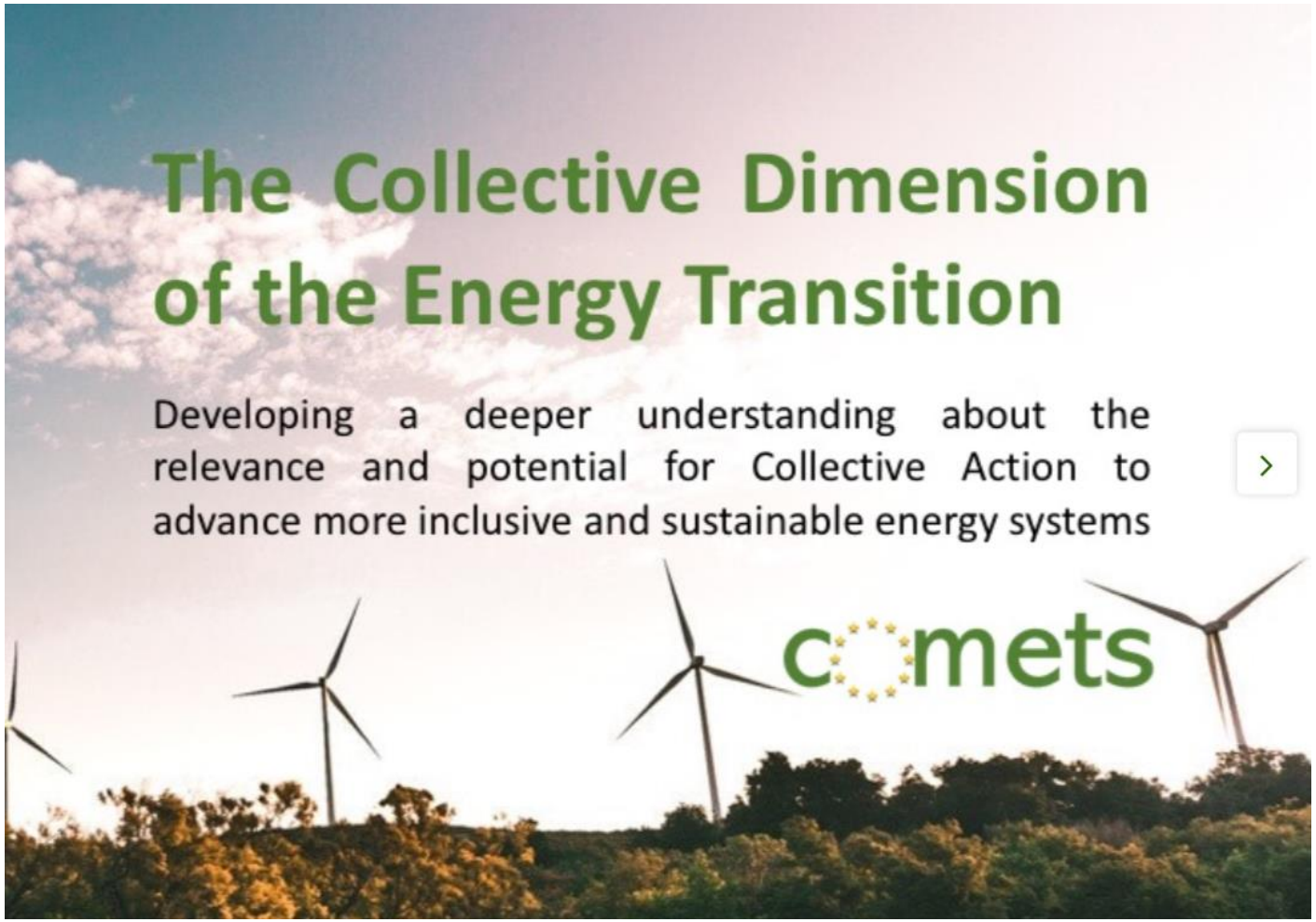
Working groups:

1	Climate and Energy Policy
2	Social innovation in the energy sector
3	Integrated assessment modeling of the energy system
4	FAIR and open low carbon energy data

COMETS

Collective Action Initiatives (CAIs):

- Overview of CAIs (EU database)
- Analysis of barriers and enablers (survey)
- In-depth analysis and engagement:
- Evolution and scaling up (qualitative approach)
- Supporting platform



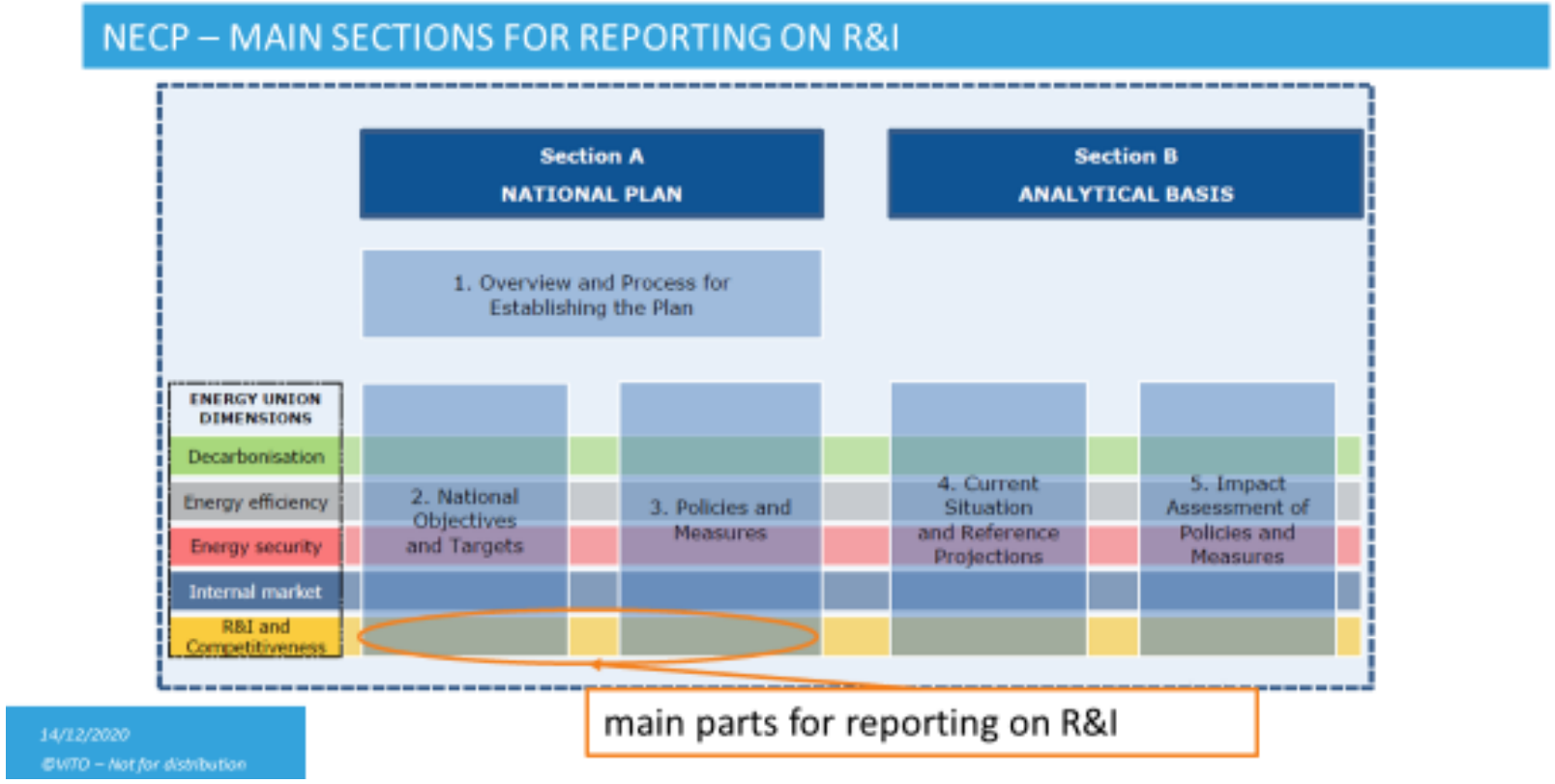
COME-RES

- Facilitating the rollout and supporting the implementation of the facilities for renewable energy communities (RECs)
- Country desks: engage directly with market actors and other stakeholders to co-create solutions to overcome existing barriers for the growth of community energy
- Transfers of best practice solutions

Activities - NECP

Presentation at *EERA SET Plan Conference Side Event - 25 November 2020*

- NECPs: Linking climate and R&I strategies



How does the research link to the CETP

<u>CETP Challenge 8: Cross-cutting dimensions:</u>

- Identifying robust pathways as alternative strategies towards a net zero society
- Accelerate the transition through innovation ecosystems
- Regulation and market design to support optimal resource allocation and value creation both in the short term and long term.
- Policy and actions in support of fair, just and democratic transition
- Encouraging digitalisation of the energy transition processes
- Encouraging transition based on resource efficiency and circularity principles

- <u>Challenge 5: Regional energy systems</u>
- <u>Challenge 7: Built environment</u>

How does the research link to the CETP

- Are there some energy related topics that you don’t see represented enough in the current version of the SRIA?
  - No ‘gaps’, but maybe:
  - More focus on spatial aspects, including social an policy parameters (besides technical) in regional contexts
  - More focus on integration of policy, behavioral aspects and modelling
- Could the CETP be an important funding source for your topic? Why yes/no?
  - In principle yes!

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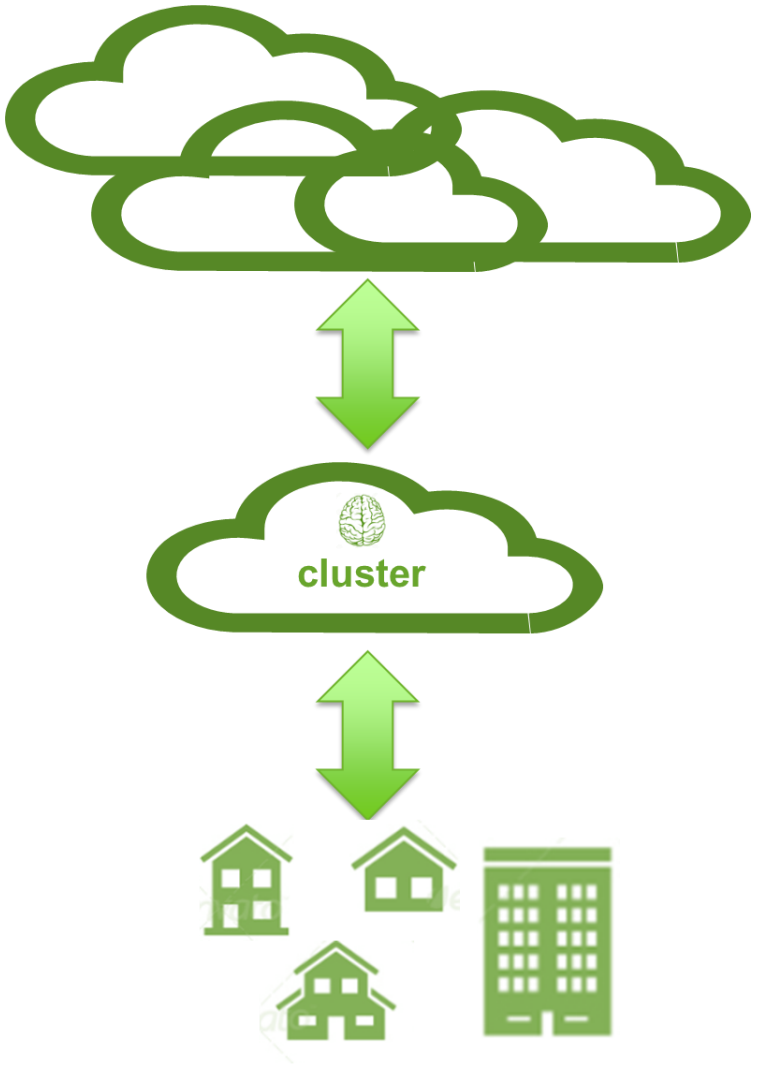
- **Smart Grids (Chris Caerts, VITO)**

12:00 End workshop

Flex Trading

- Standardized Interaction Scheme for information exchanges on consumption plans and flexibility between buildings, cluster of buildings and other stakeholders
- To make better informed decisions for more effective and grid-secure flex activations



Demand Response (Re-active buildings)

Flex Trading (Interactive Buildings)

Context and Relevance

- Increasing need for flex: paradigm shift to load follows generation
- Active Distribution System Management & Decentralization: grid-secure flex activations, use local energy locally
- Active consumers and energy communities ➔ use building and community (= cluster of buildings) level flexibility

- **Need for grid-aware flex activations**
  - Avoid that building-centric optimizations (incl. aggregation) cause grid problems
  - Only offer flex services if the corresponding flex activation can be done in a grid-secure manner (cfr USEF)

Responding to DR Requests by Re-active Buildings

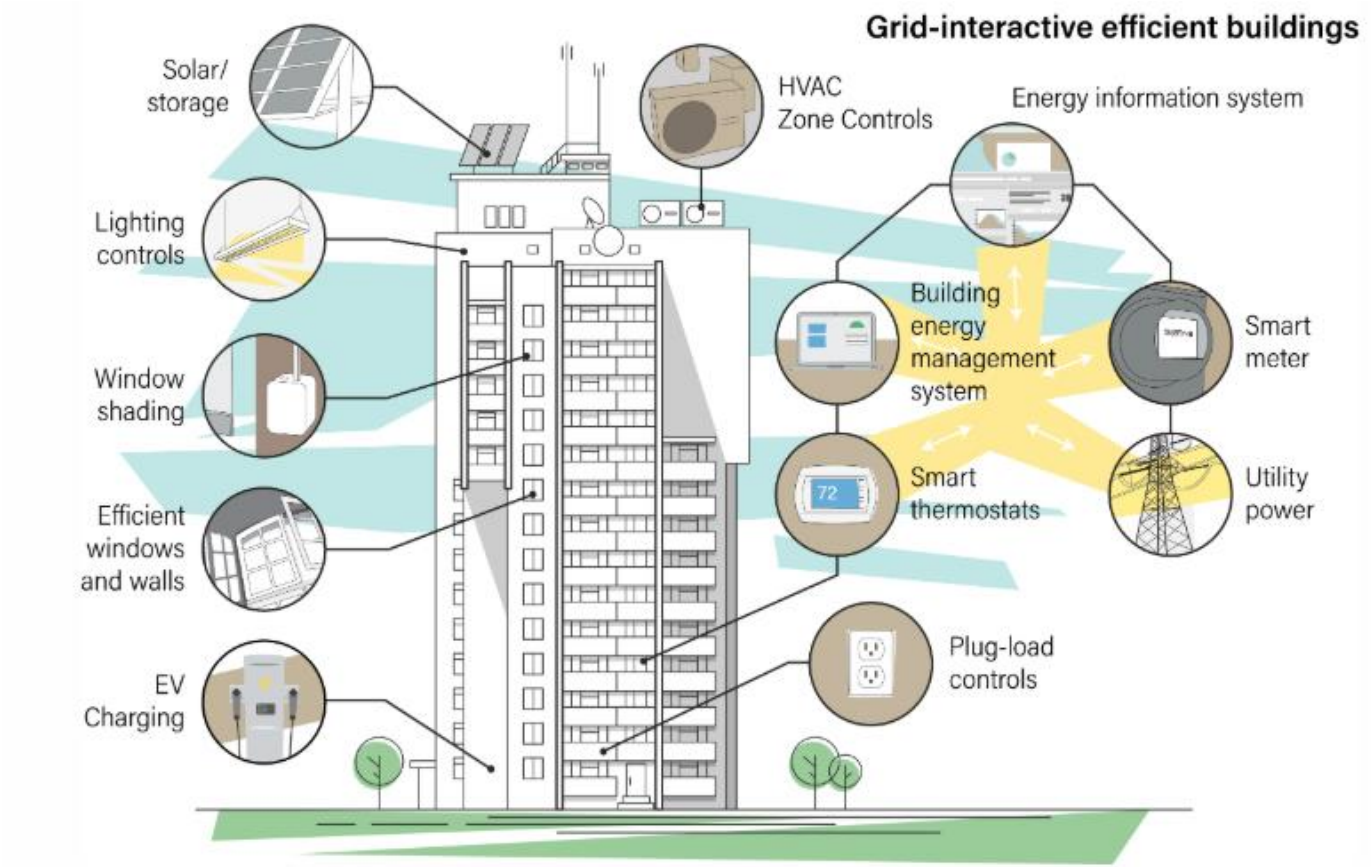
- Use flexibility to react on a DSO DR Request

- DR Request creation challenge
  - **It becomes harder to predict if, when and where a congestion would occur,** as buildings become smarter and perform building-centric optimizations (for self-consumption, dynamic prices, …).
  - What will be the response on a request ? Impact on user comfort ? Opting-out option ?

- DR Request dispatching challenge
  - Will all (flex offering) buildings be affected in the same manner, e.g. dynamic capacity reduction ? Impact on comfort ?

- Flex Trading by Grid Interactive Buildings

Grid-Interactive buildings … from one-way response to two-way interaction



Source: American Council for an Energy-Efficient Economy

Grid-Interactive buildings … from one-way response to two-way interaction

Grid-interactive efficient buildings

September 24, 2019 By Elisa Wood 4 Comments

During the solar eclipse PJM had assumed demand would rise because homes and businesses with solar panels would turn to grid power as the eclipse blocked the sun.

"Then something very weird happened," Monken said. Rather than rising, demand for power fell by 4,000 to 5,000 MW.

Why? As is often the case, weather played a role. It was cooler than expected. But the unknown unknown emerged from a distributed asset. Without notifying PJM, the maker of the NEST thermostat had asked customers to conserve during the eclipse, which reduced demand by 900 MW.

Analytics supported by sensors and controls co-optimize efficiency, flexibility, and occupant preferences

Flexible loads and distributed generation/storage can be used to reduce, shift, or modulate energy use

Source: American Council for an Energy-Efficient Economy

Flex Trading by Grid Interactive Buildings

- Pro-actively provide information on consumption/injection plan (resulting from building-centric optimisation) and available flexibility

- Better informed decisions can be taken by DSO
- Better and customised flex activation requests can be dispatched to buildings, taking into account their state and flexibility.

Thanks

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Activity Leader IFTS
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Thomas Polfiet
Business Developer IFEM
thomas.polfiet@energyville.be

Key takeaways

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