IT challenges to activate and monitor flexibilities:

Insights from OSMOSE and EU-SYSFLEX projects

Joint webinar by the
OSMOSE and EU-SysFlex projects
16th June 2021

AGENDA

- Introduction to the OSMOSE and EU-SysFlex projects
- OSMOSE : FlexEnergy Management platform integration
- EU-SysFlex : Flexibility platform demo
- OSMOSE : Performance Assessment of Grid-Forming vs Grid-Following Controls of BESS Providing Primary Frequency Containment to Power Systems: the EPFL Demo
- OSMOSE : Monitoring new services
- EU-SysFlex : Conceptual model for private energy data management
- OSMOSE : IEC61850 communication standard
- Conclusions
- Q&A session

Your questions on the upcoming presentations

- Please use the “Q&A” section and specify the targeted speaker
- There will be a brief Q&A session after each presentations (except project introductions) and a longer one at the end of the webinar
- In case some questions are not answered during the Q&A session due to lack of time, they will be answered per email by the speakers

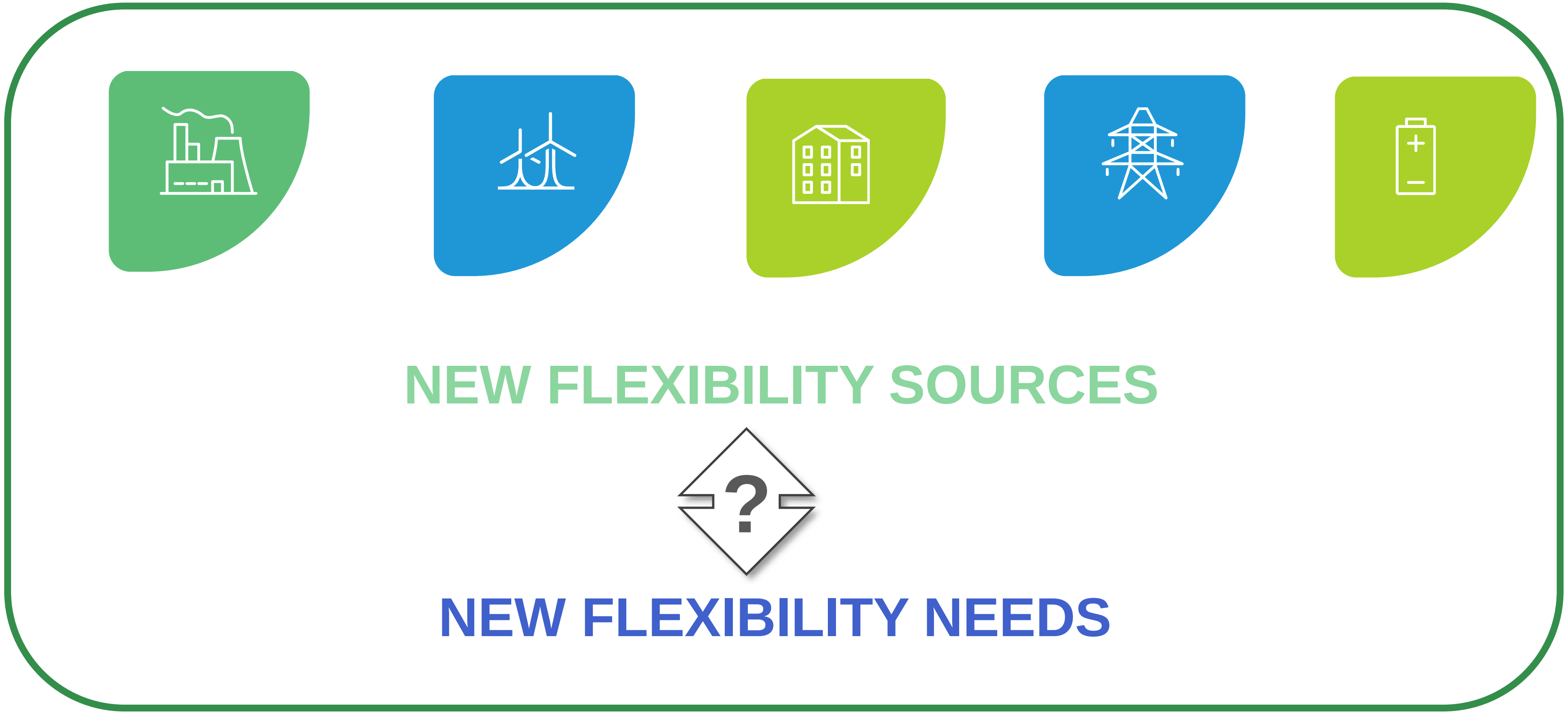
INTRODUCTION TO

THE OSMOSE PROJECT

Nathalie Grisey (RTE), OSMOSE coordinator

OSMOSE : A project about flexibility

Flexibility is understood as a power system's ability to cope with variability and uncertainty in demand, generation and grid, over different timescales.



OSMOSE : Consortium

- ✓ H2020 EU funded
- ✓ 27M€ budget
- ✓ 33 partners
- ✓ WP Leaders: **RTE**, REE, TERNA, ELES, CEA, TUB
- ✓ Jan 2018 – Apr 2022

OSMOSE : Objectives and WPs

Simulations of long-term scenarios

- ✓Identify future needs and sources of flexibility
- ✓Develop new tools and methods for flexibility assessment

WP1 Optimal mix of flexibilities

WP2 Market designs and regulations

WP7 Scaling-up and replication

4 Demonstrators

- ✓Foster the participation of new flexibility providers
- ✓Demonstrate new flexibility services and multi-services capabilities

WP3 Grid forming by multi-services hybrid storage

WP4 Multi-services by different storage and FACTS devices

WP5 Multi-services by coordinated grid devices, large demand-response and RES

WP6 Near real-time cross-border energy market

OSMOSE : Objectives and WPs

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WP7 Scaling-up and replication

Presentations of today !

INTRODUCTION TO THE EU-SysFlex PROJECT

Marie-Ann Evans (EDF), EU-SYSFLEX technical manager

The EU-SysFlex Project

EU-SysFlex in figures

TIMELINE
NOV 2017 - OCT 2021
FEB 2022

TOTAL BUDGET
€26.5 million

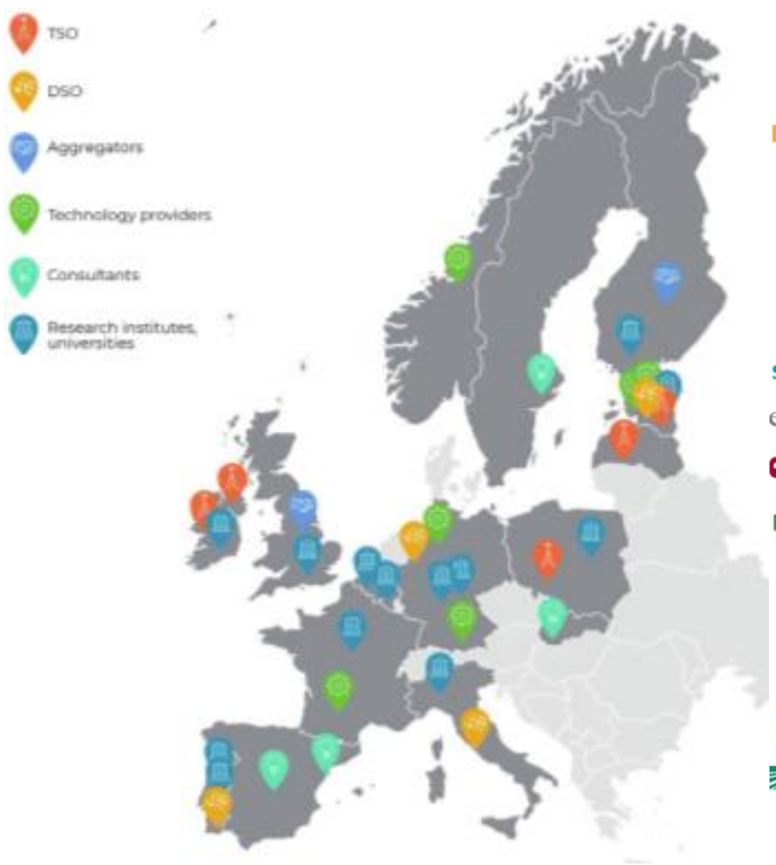
HORIZON 2020 CONTRIBUTION
€20.5 million

CONSORTIUM
34 organisations

WORK PACKAGES
12

DEMONSTRATIONS
7

DELIVERABLES
100



TSO
EIRGRID SONI elering
PSE AST

DSO
edp distribuição innogy
e-distribuzione elektrilevi

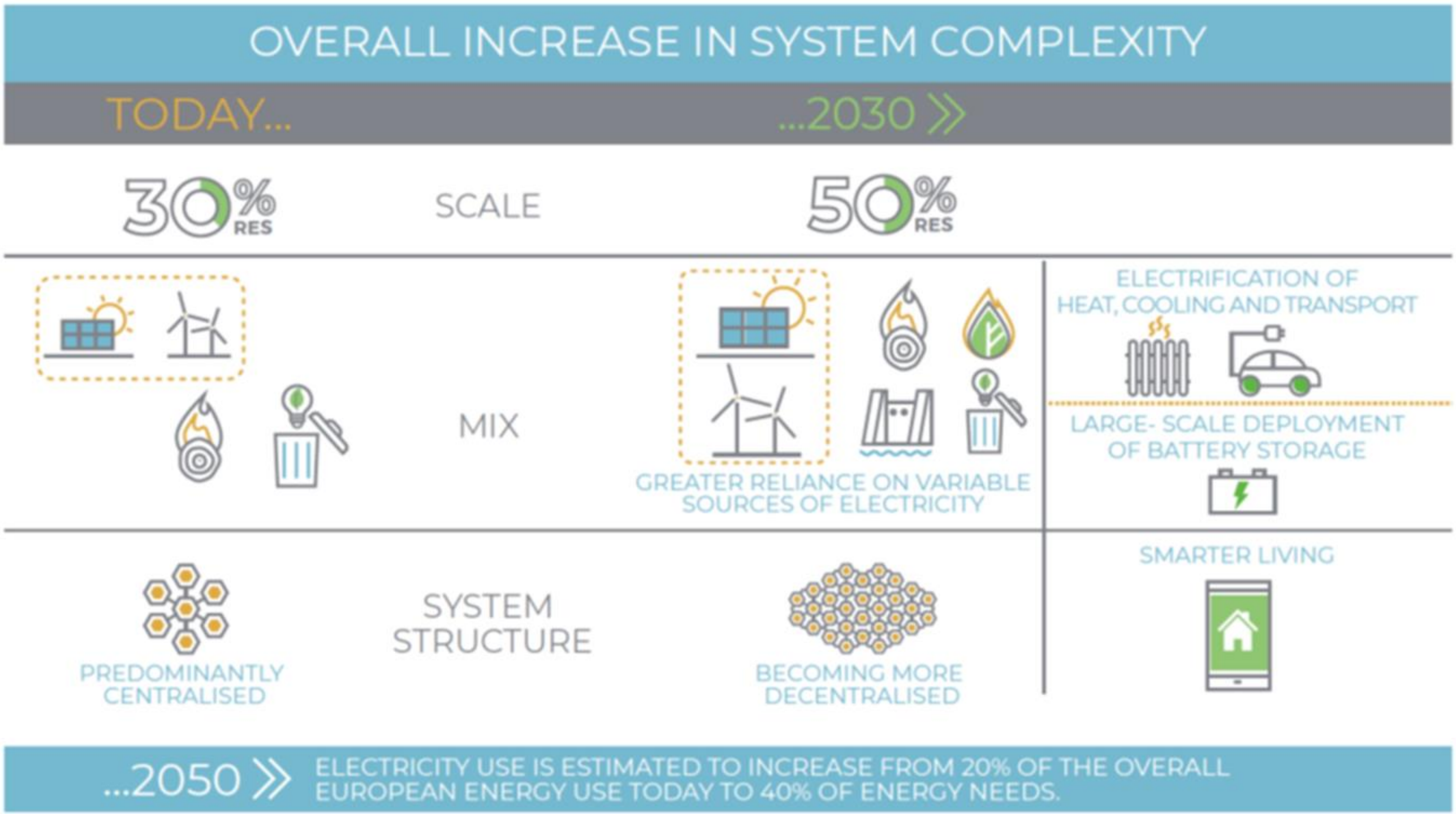
Technology providers, consultants
SIEMENS ENERCON EURACTIV AKKA
enoco PÖYRY CYBERNETICA
zabala ESADE guardtime

Generation, retail and aggregator
upside HELEN

Research institutes, universities
Imperial College London INESCTEC VTT
Fraunhofer KU LEUVEN UCD
RSE UNIVERSITY OF TARTU
vito EnergyVille N-SIDE NATIONAL CENTRE FOR NUCLEAR RESEARCH
EDF

OSMOSE EU-SysFlex

The EU-SysFlex Project demonstrates reliable and efficient flexibility solutions to integrate 50% RES in the European Power System



A future power system increasingly reliant on variable and decentralized sources of electricity and flexibility

Energy Transition

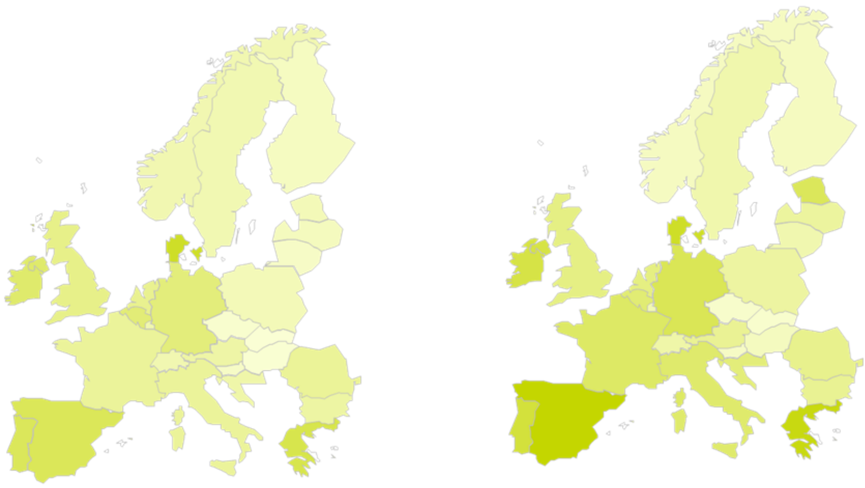
52% RES-E for Europe in 2030

Renewable Ambition

66% RES-E for Europe in 2030

Energy Transition
aligned with EU REF 2030

Renewable Ambition
aligned with EU REF 2050



23 % VRES

34 % VRES

% of non-synchronous renewable generation

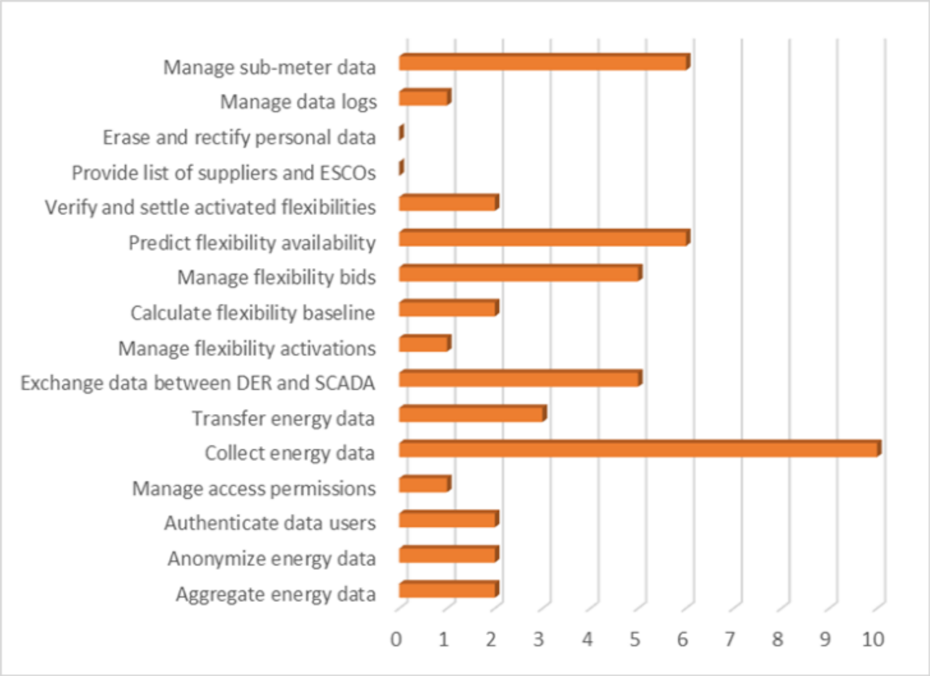
0% 71%

- *Scenarios include electrification of demand (EV, HP, …) and energy efficiency.*
- *Storage includes pumped hydro, batteries, …, but no Power-to-Gas at 2030.*
- *Sensitivities were studied : high solar, distributed RES (80% VRES connected to MV and LV), ...*

The sources of electricity but also of needed **flexibility** are increasingly **decentralized, smaller and numerous**.
They need be accessed, **interfaced and coordinated** between energy systems' players.

OSMOSE EU-SysFlex

Interoperability and exchange of energy and flexibility data in a secure and reliable way is key



Source : T5.3 SUMMARY OF NUMBER OF BIG DATA REQUIREMENTS PER USE CASE

- Flexibility solutions are provided from **smaller and numerous decentralized sources**: VRES, storage, Electric Vehicles, Demand Side Response. Secure and reliable collection, management, authentication, verification, … are key.
- Digitalization challenge relies on **interoperability** : format of data, property, security, standards, ...
- Exchanges between many players can be supported by **data exchange platforms and flexibility platforms**.

OSMOSE WP6

FlexEnergy Management platform integration

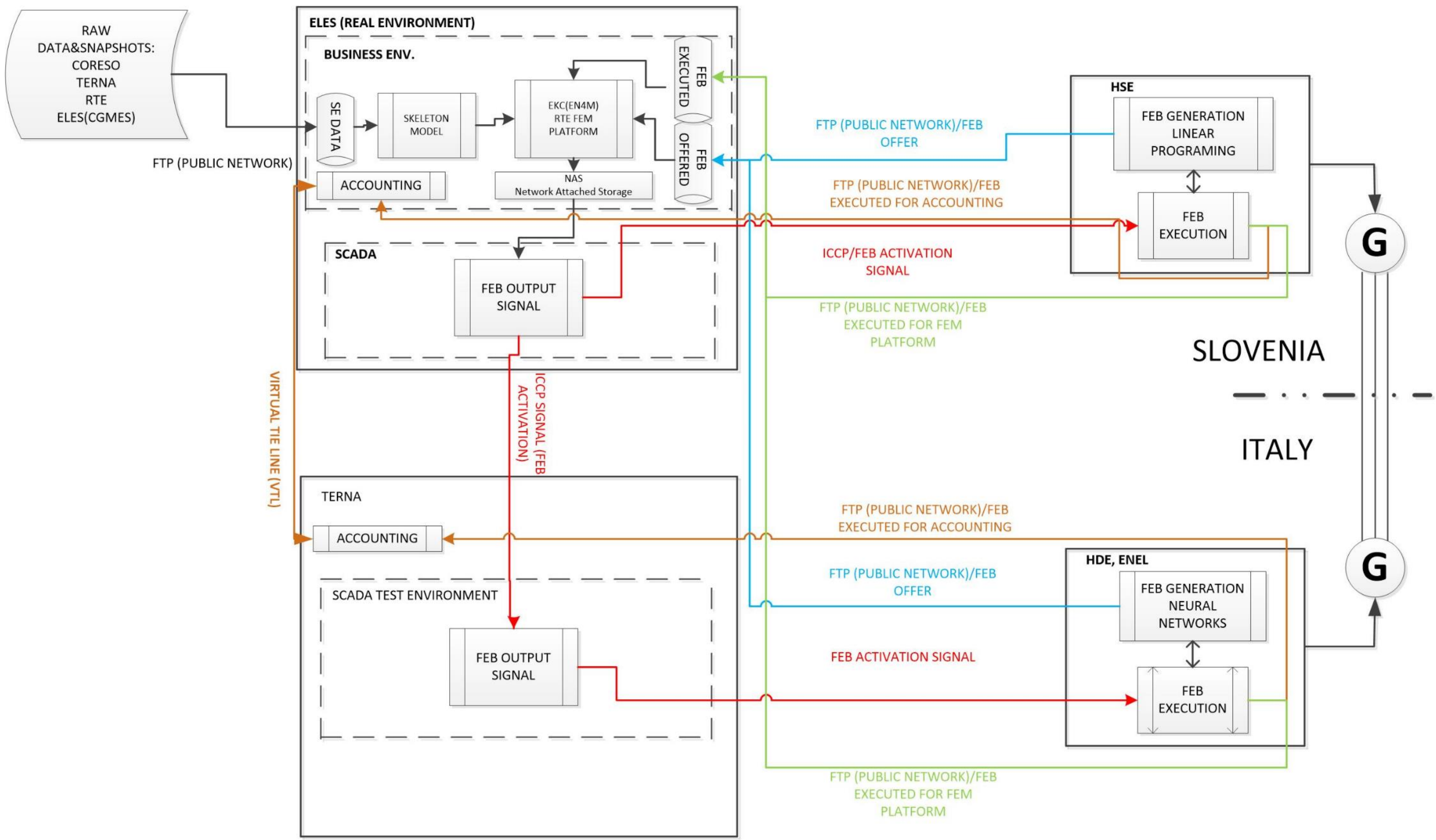
Gregor Goričar, ELES

Objectives of the demo

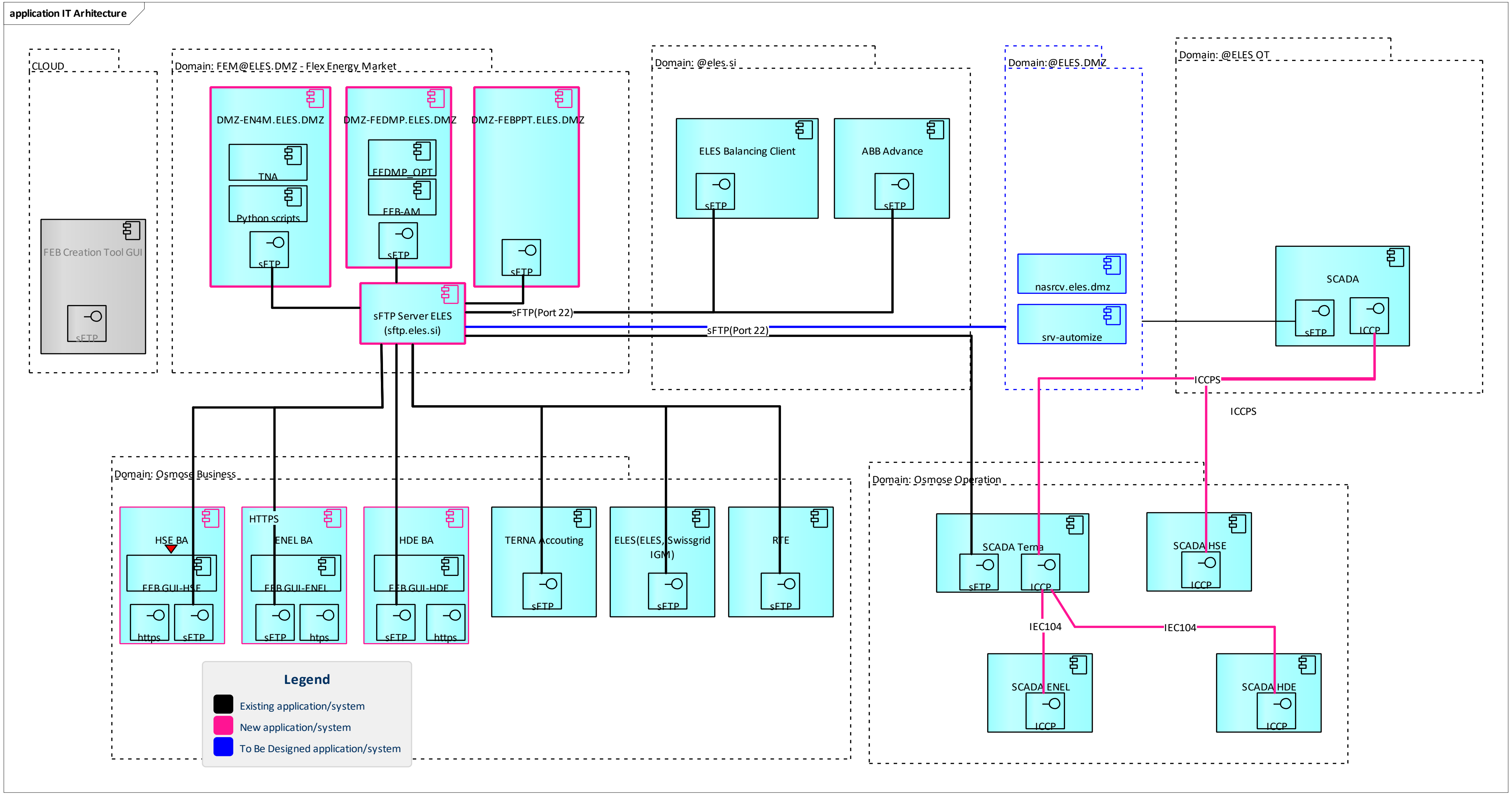
- Close to real time activation of RES between Italy and Slovenia

- Hydro power plants: ENEL(IT), HDE(IT), HSE(SLO)
- 2 TSO's: Terna (IT), ELES (SLO)
- FEM platform integration in real IT environment of TSO
- New products development and market transformation

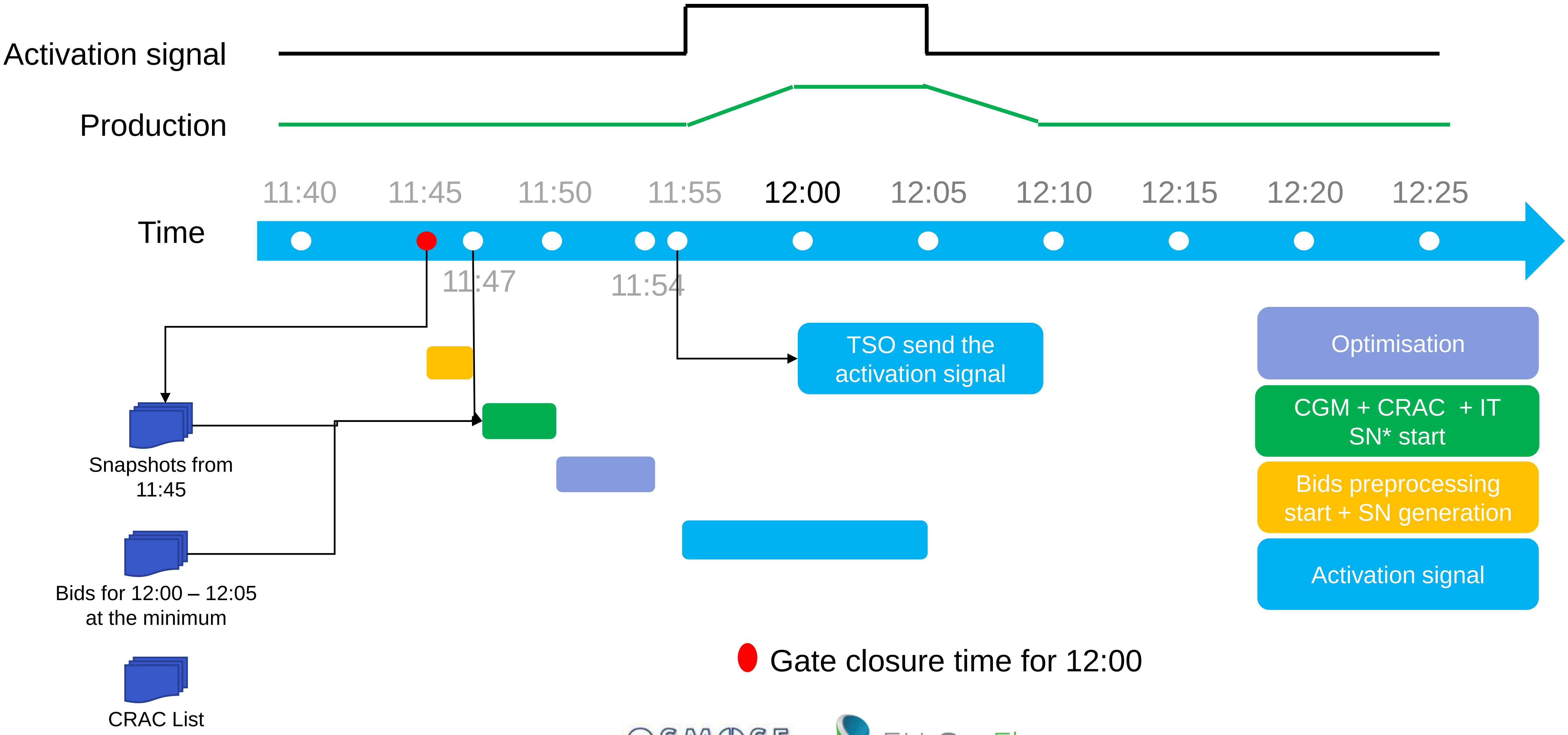
Demonstration tests design



Key innovation & key messages



Goal of the WP6



OSMOSE EU-SysFlex

Key take away

- Cyber security
- sFTP to EcoSp and other platforms
- Observability close to real time-CGM
- Optimisation methods

EU-SYSFLEX - FLEXIBILITY PLATFORM DEMO

Mandimby RANAIVO R. (AKKA)

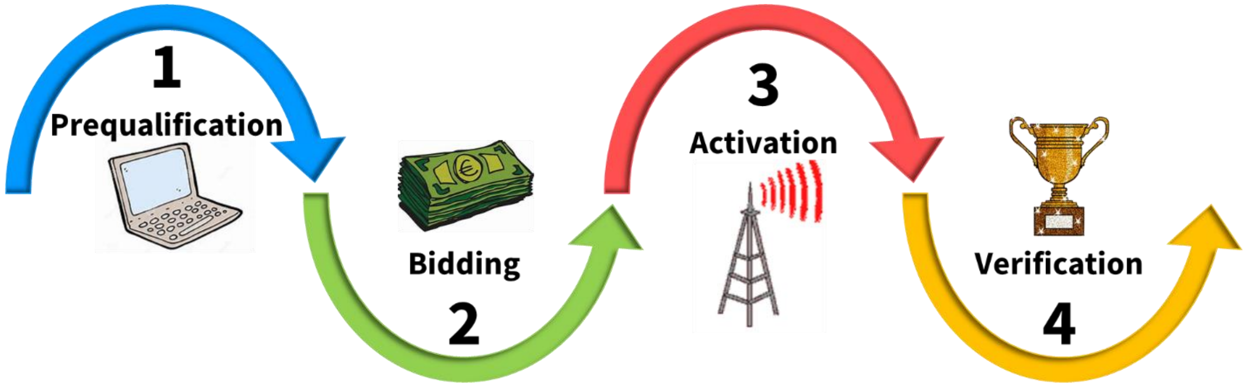
Flexibility platform

- Single marketplace to trade flexibility products
  - Same resource for several flexibility buyers and services at the same time
  - Easy access to the market for the flexibility providers
- Allowing coordination between Transmission System Operator and Distribution System Operator
  - Common flexibility products, coordinated grid impact assessment …

OSMOSE EU-SysFlex

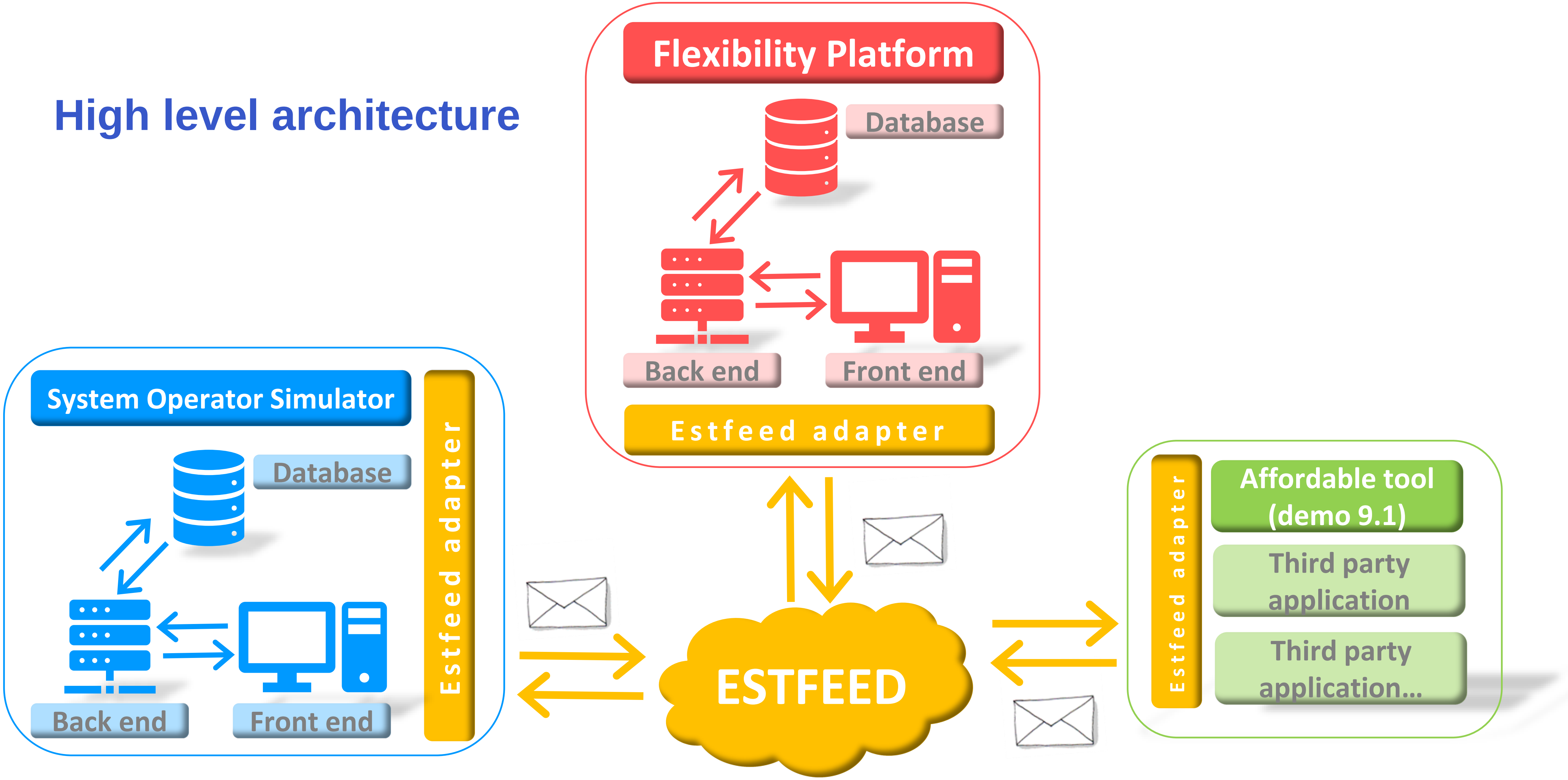
Flexibility platform demo

- Demonstration of flexibility market processes
  - Specified in EU-SysFlex System Use Cases



- Focus on data exchange
  - Data model to support the flexibility market processes
  - Data exchange platform for interoperability and scalability

High level architecture



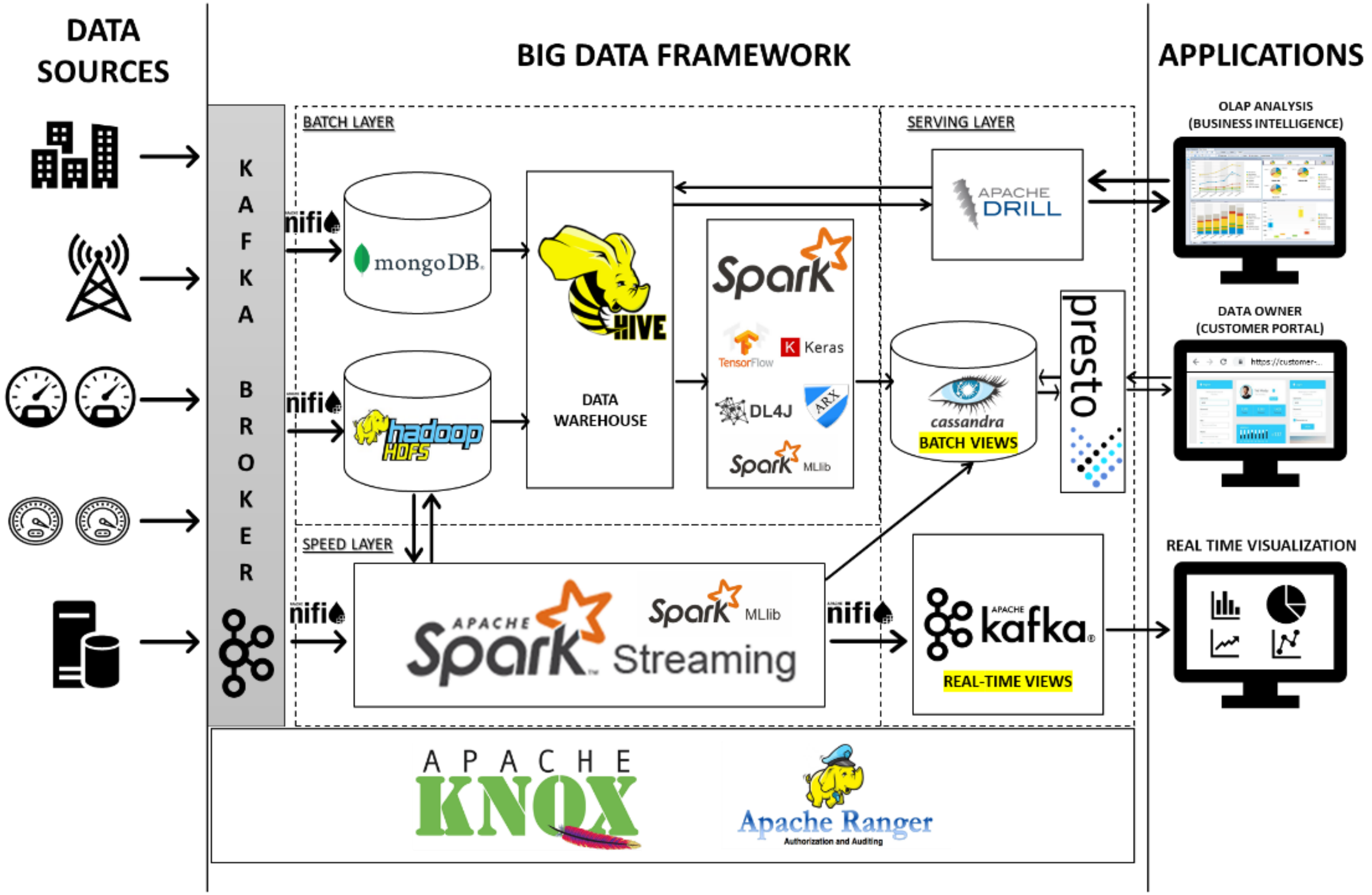
High level architecture

- Flexibility platform & System Operator simulator
  - 3-tier architecture
    - Front end
    - Back end
    - Database
  - Time scheduling
  - Fast and agile development

- Estfeed
  - Data exchange platform
  - Security mechanisms
  - Uniform interface through REST APIs

Big data architecture framework

- Suitable for
  - High performance with large amount of data
  - Batch and real-time processing
  - AI algorithms
- Compatible with Estfeed



OSMOSE EU-SysFlex

Results and conclusion

- Demonstration of data exchange between different stakeholders participating in a flexibility market
  - Flexibility platform
  - System Operator with the System Operator simulator
  - Aggregator with the affordable tool

- Key aspects for the data exchange:
  - Data model
    - CIM mapping in perspective
  - Data exchange platform
    - Interoperability
    - Scalability
    - Security mechanisms

- Partners: AKKA, Cybernetica, Elering, Enoco, PSE

Performance Assessment of Grid-Forming vs Grid-Following Controls of BESS Providing Primary Frequency Containment to Power Systems: the EPFL Demo

Prof. Mario Paolone
Distributed Electrical Systems laboratory
École Polytechnique Fédérale de Lausanne, Switzerland

Validation of grid-forming control on a large-scale test setup

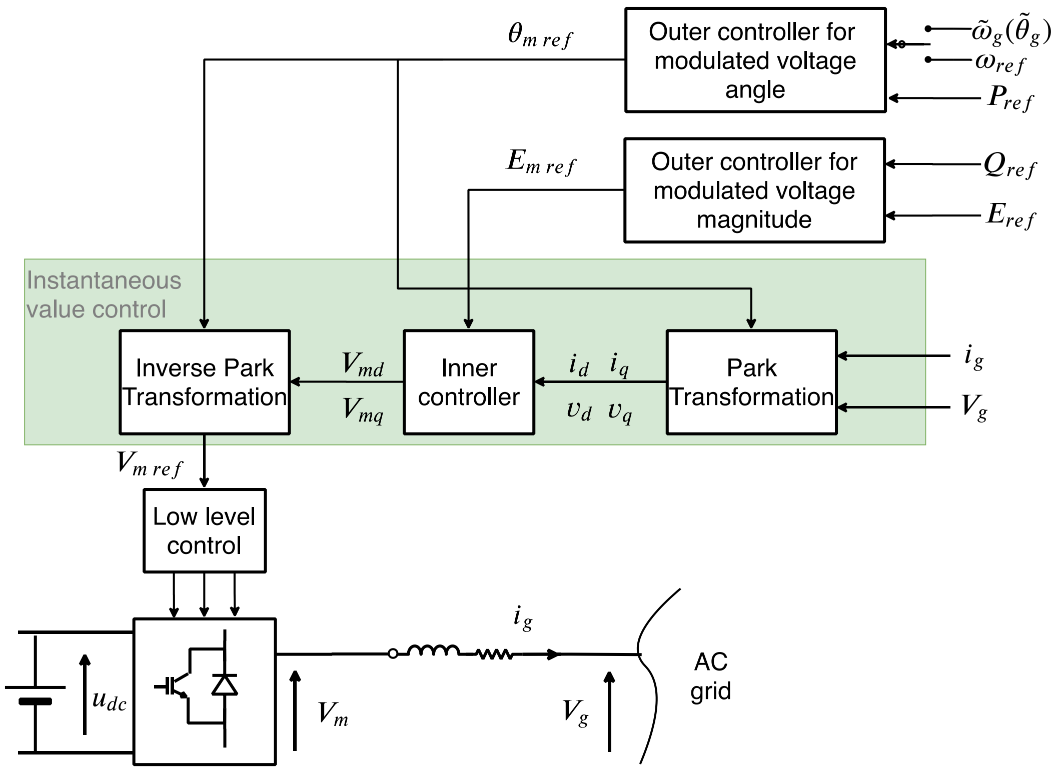
Objective:

- Assess the performance and impact of a grid-forming unit on the local grid frequency

Activities:

- Experimental investigations carried out on the utility-scale BESS at EPFL
- Simulation investigations carried out on a modified version of the IEEE 39-bus benchmark
- Analysis of the obtained results of the experimental and simulation investigations via specific KPIs

Grid-forming unit[1]

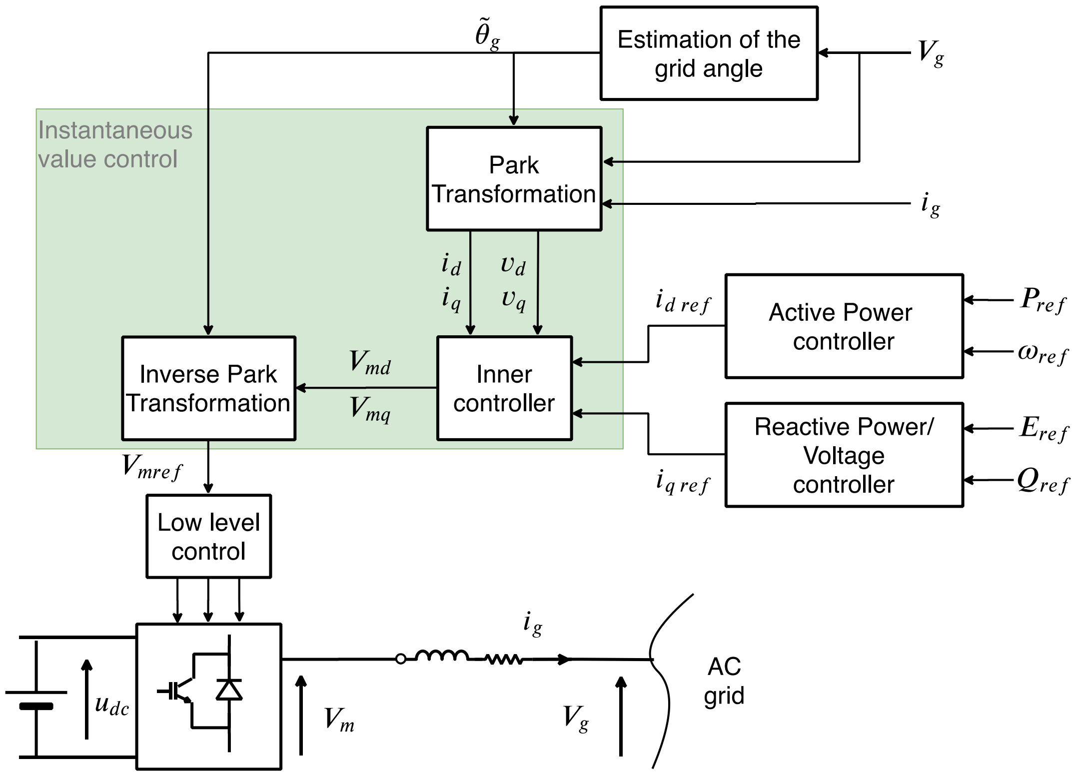


Features

- It controls **magnitude and angle of the voltage** at the Point of Common Coupling (PCC).
- It does not strictly require the knowledge of the fundamental frequency phasor of the grid voltage at the PCC as it can use the estimated grid frequency $\tilde{\omega}_g$ (grid voltage angle $\tilde{\theta}_g$) or, instead, use constant frequency reference ω_{ref} to create a PLL-free controller.
- The outer loops allow it to adapt the injected active and reactive power to provide other services (active/reactive power dispatch) superposed to primary frequency/voltage controls.

[1] M. Paolone, A. Monti, T. Gaunt, T. Van Cutsem, X. Guillaud, V. Vittal, M. Liserre, C. Vournas, and S. Meliopoulos, "Fundamentals of power systems modelling in the presence of converter-interfaced generation," Electric Power Systems Research, Volume 189, 2020.

Grid-following unit[1]



Features

- **Injected currents** are controlled with a specific phase displacement with respect to the grid voltage at the PCC.
- The knowledge of the fundamental frequency phasor of the grid voltage $\tilde{\theta}_g$ (estimated by a PLL) at the PCC is needed at any time for correctly calculating the converter reference currents.
- Outer active and reactive power controllers enable the converter operating in frequency and voltage supporting mode (i.e., $\boldsymbol{f-p}$ **and** $\boldsymbol{v-q}$ **droop controller**).

[1] M. Paolone, A. Monti, T. Gaunt, T. Van Cutsem, X. Guillaud, V. Vittal, M. Liserre, C. Vournas, and S. Meliopoulos, “Fundamentals of power systems modelling in the presence of converter-interfaced generation,” Electric Power Systems Research, Volume 189, 2020.

Inclusion of DC-link dynamics and converter capability curves[2]

The optimal active power and reactive power set-points are obtained by solving the following optimization problem:

$$\underset{\Omega}{\text{Minimize}}\ f = (P_t^{AC} - P_{0,t}^{AC})^2 + (Q_t^{AC} - Q_{0,t}^{AC})^2 \quad \text{(1p)}$$

subject to (1e) – (1g), (1m) – (1o)

To efficiently find an optimal solution, we then convexify constraint (1m) to [22], [23]:

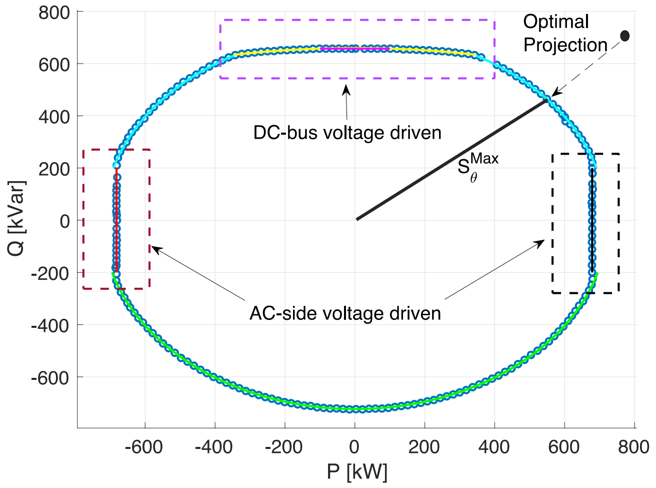
$$(v_t^{DC})^2 + (\mathbf{1}^T \mathbf{v_c} - E)v_t^{DC} + P_t^{DC} R_s \leq 0 \quad \text{(2b)}$$

However, the convex relaxation in constraint (2b) can make the final solution infeasible for the original constraint (1m). In order to deal with this situation and drive the optimal solution to be feasible for the original constraint, we propose to modify the original objective function to:

$$f^M = (P_t^{AC} - P_{0,t}^{AC})^2 + (Q_t^{AC} - Q_{0,t}^{AC})^2 - \xi v_t^{DC} \quad \text{(2c)}$$

We denote the modified optimization problem as PQ-opt-m:

$$\underset{\Omega}{\text{argmin}} f^M := \{\Omega \in [(1e) - (1f), (1n) - (1o), (2a) - (2b)]\} \quad \text{(2d)}$$



Theorem 1
If the original optimization problem PQ-opt-o is feasible and $\xi > 0$, the modified optimization problem PQ-opt-m is feasible.

Theorem 2
If the original optimization problem PQ-opt-o is feasible and $\xi > 0$, the optimal solution of the modified optimization problem PQ-opt-m is equal to the global optimal solution of the original optimization problem PQ-opt-o.

[2] Z. Yuan, A. Zecchino, R. Cherkaoui and M. Paolone, "Real-time Control of Battery Energy Storage Systems to Provide Ancillary Services Considering Voltage-Dependent Capability of DC-AC Converters," in IEEE Transactions on Smart Grid, 2021.

Metrics to assess performance of grid-forming vs grid-following units

- **Relative RoCoF [Hz/s/kW]**

$$rRoCoF = \left| \frac{\Delta f \ / \ \Delta t}{\Delta P} \right|$$

This indicator is independent from the actual frequency variation, since the RoCoF is normalized by the variation of delivered active power within the time interval Δt used to compute the RoCoF.

- **Relative Integrated Phase Angle Difference Deviation (Relative IPADD)**

$$rIPADD = \sum_{k=1}^{n} \left| \frac{\Delta\theta_k - \Delta\theta_0}{P_k} \right|, \qquad \begin{cases} \Delta\theta_k = \theta_{k,PMU1} - \theta_{k,PMU2} \\ \Delta\theta_0 = \theta_{0,PMU1} - \theta_{0,PMU2} \end{cases}$$

This indicator quantifies the change of the phase-to-neutral voltage angle difference $\Delta\theta_k$ measured by two PMUs installed in different nodes of the grid, versus the case with null delivered active power $\Delta\theta_0$. Such a angle difference is normalized by the delivered active power.

Experimental setup – EPFL battery energy storage system

Parameter	Value
Nominal Capacity	720 kVA/560 kWh
GCP Voltage	20 kV
DC Bus Voltage Range	600/800 V
Cell Technology (Anode/Cathode)	Lithium Titanate Oxide (LTO) Nichel Cobalt Alumnium Oxide (NCA)
Number of racks	9 in parallel
Number of modules per rack	15 in series
Cells configuration per module	20s3p
Total number of cells	8100
Cell nominal voltage	2.3 V (limits 1.7 to 2.7 V)
Cell nominal capacity	30 Ah (69 Wh)
Round-trip efficiency (AC side)	94-96%
Round-trip efficiency (DC side)	97-99%

Experimental setup - phase measurement units

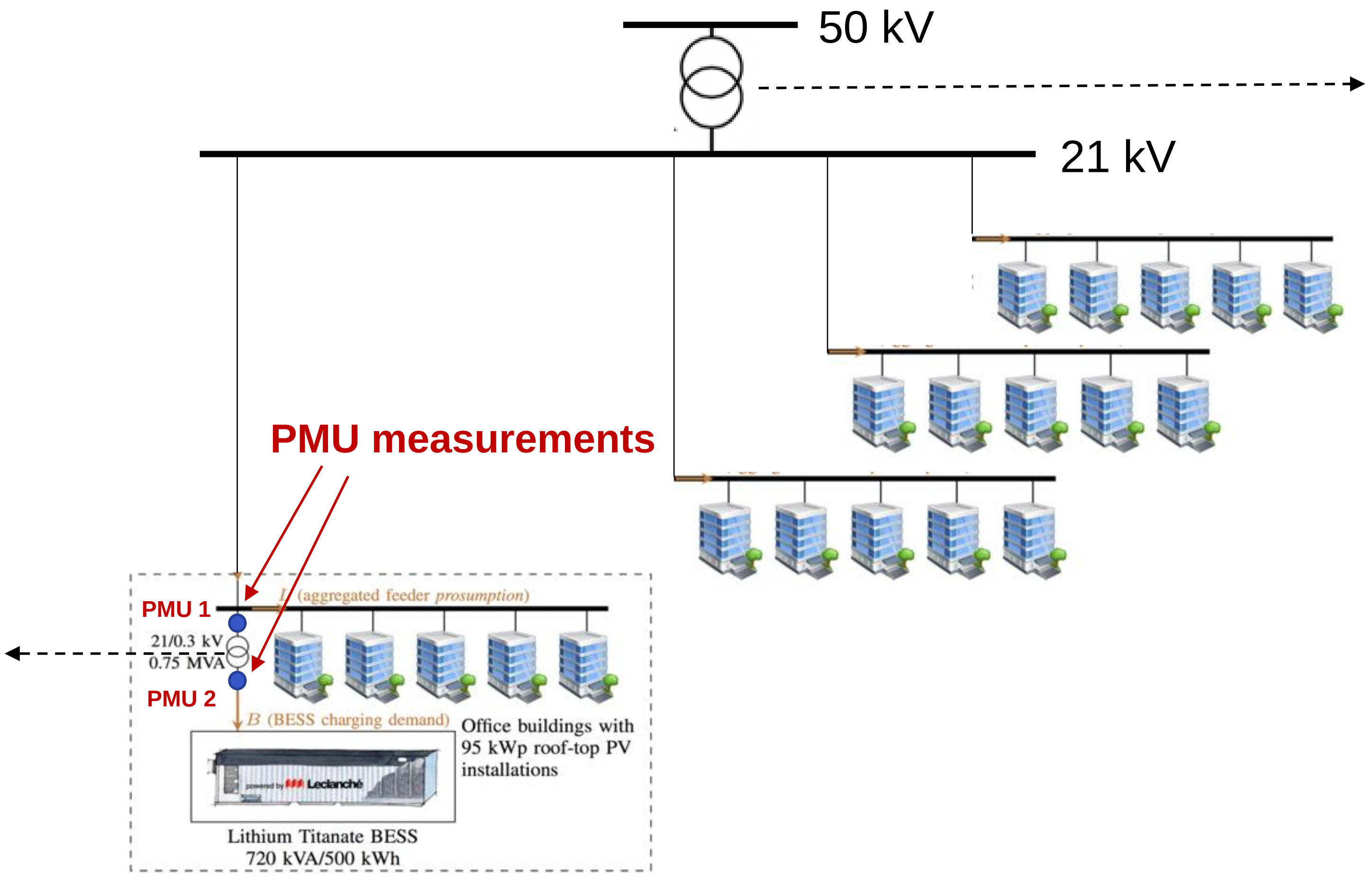
The adopted PMU hardware and software

- Synchrophasor Estimation ➔ Enhanced Interpolated-DFT [3]
- Total Vector Error (TVE) ~ 0.0X %
- Accuracy in terms of 1 std deviation σ: 0.001 deg – 18 µrad
- Frequency Error < 0.4 mHz
- Reporting Rate 50 frames per second (fps) ➔ Reporting time 20 ms
- GPS Time synchronization ➔ 100 ns accuracy
- Hardware based on the national instrument cRio platform (the e-IpDFT is implemented entirely into the FPGA of the cRio hardware).
- Instrument Transformers: Altea Solutions ➔ (current 0.2 class, voltage 0.5 class).

[3] P. Romano and M. Paolone, "Enhanced Interpolated-DFT for Synchrophasor Estimation in FPGAs: Theory, Implementation, and Validation of a PMU Prototype," IEEE Trans. Instrum. Meas., vol. 63, no. 12, pp. 2824–2836, Dec. 2014

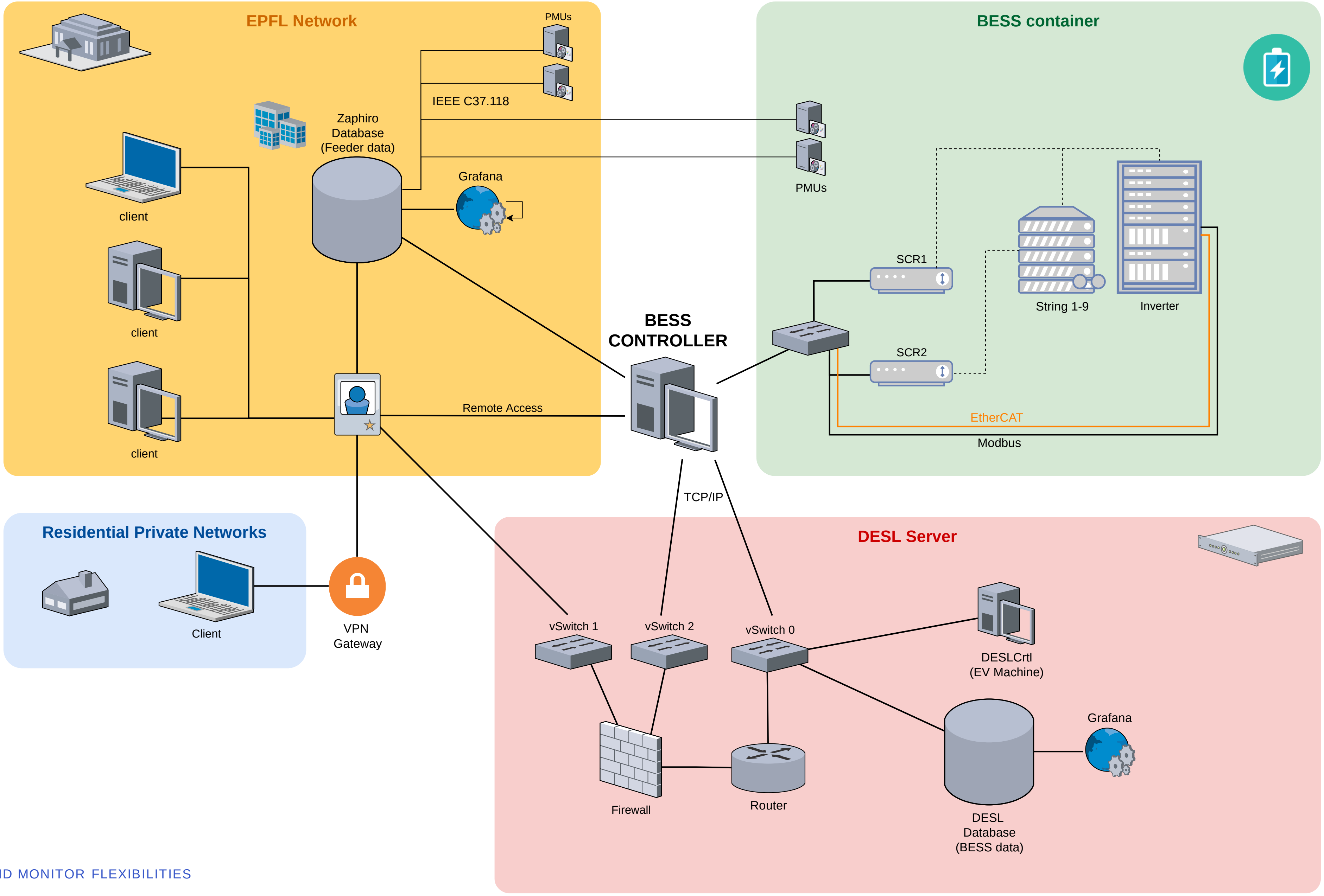
Experimental setup – topology

BESS step-up Transformer parameters	
Rated power	630 kVA
High voltage	3 x 21 kV
Low voltage	3 x 300 kV
Short circuit voltage	6.28%
Group	Dd0

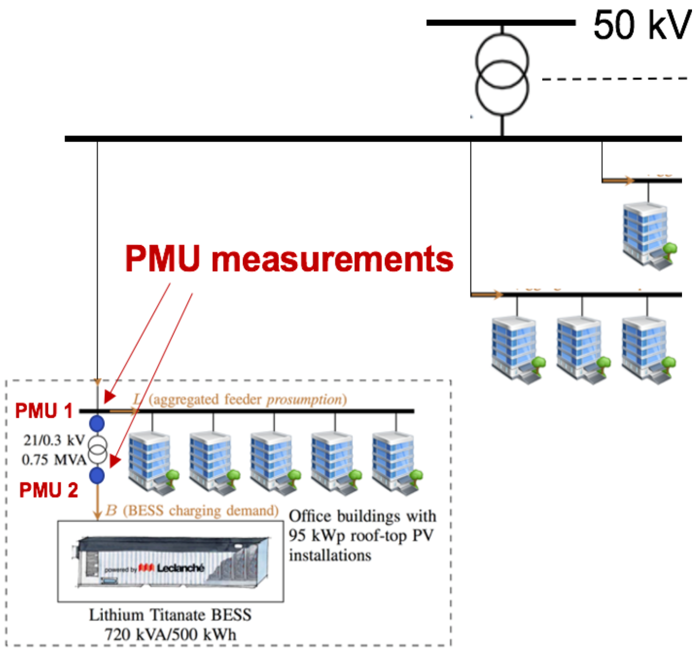


EPFL MV grid Transformer parameters	
Rated power	40 MVA
High voltage	3 x 50 kV
Low voltage	3 x 21 kV
Short circuit voltage	8.06%
Group	YNd5

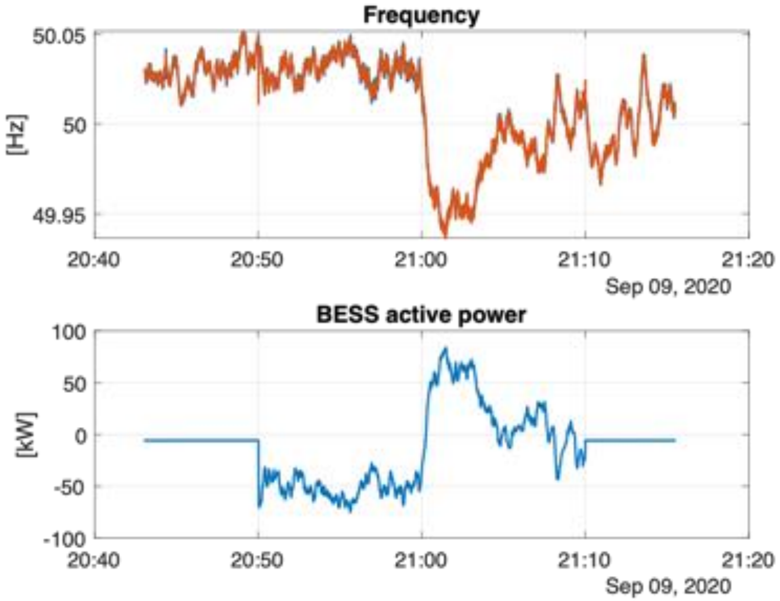
Experimental setup – IT architecture

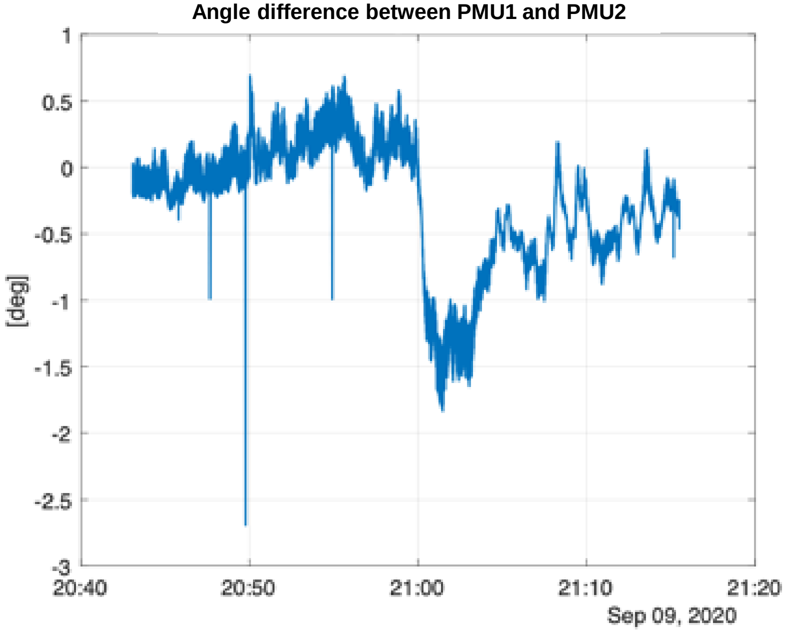


Grid-forming experimental test



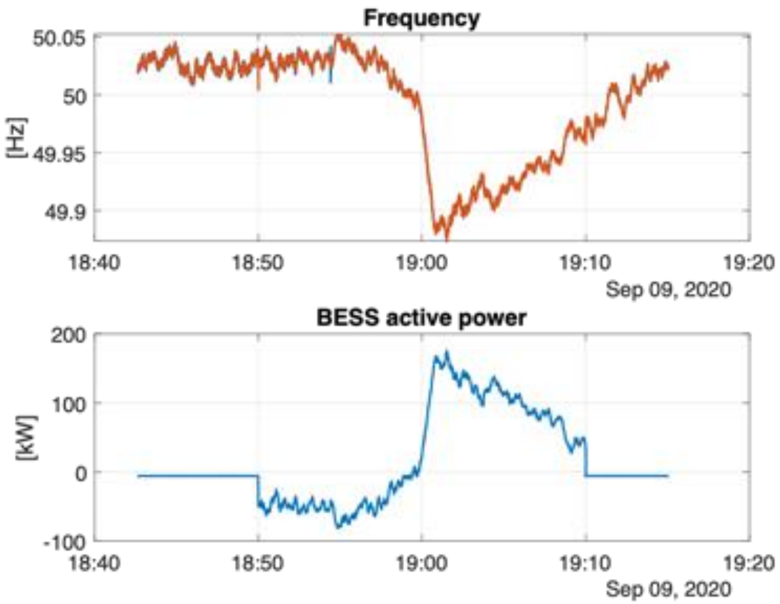
20 min test with max grid-forming droop (1.44 MW/Hz) – PMU reporting rate: 20 ms

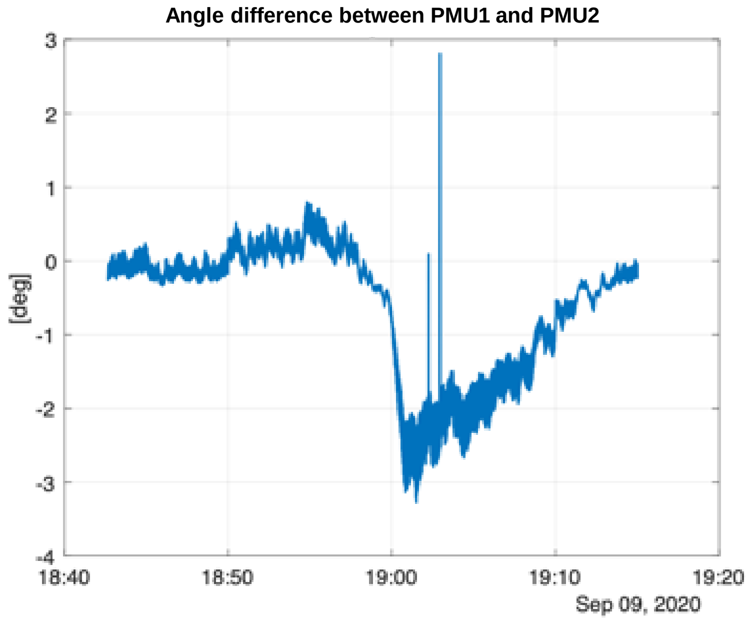


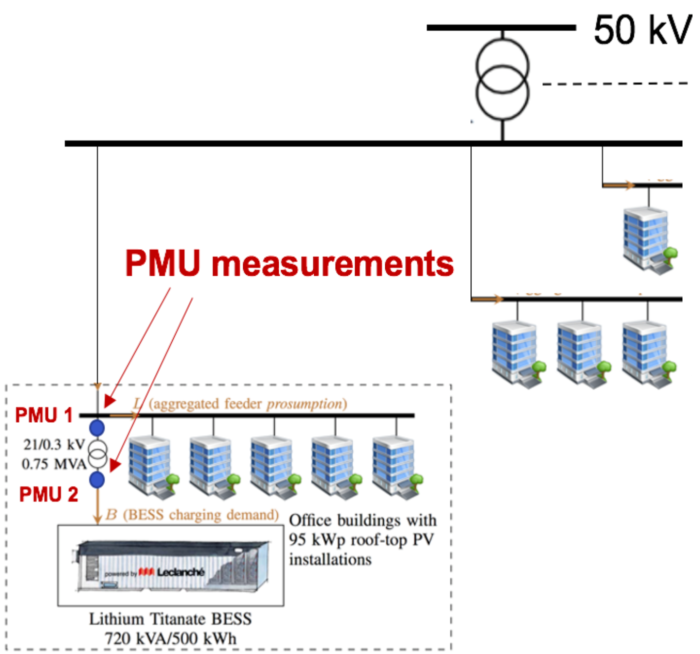


Grid-following experimental test

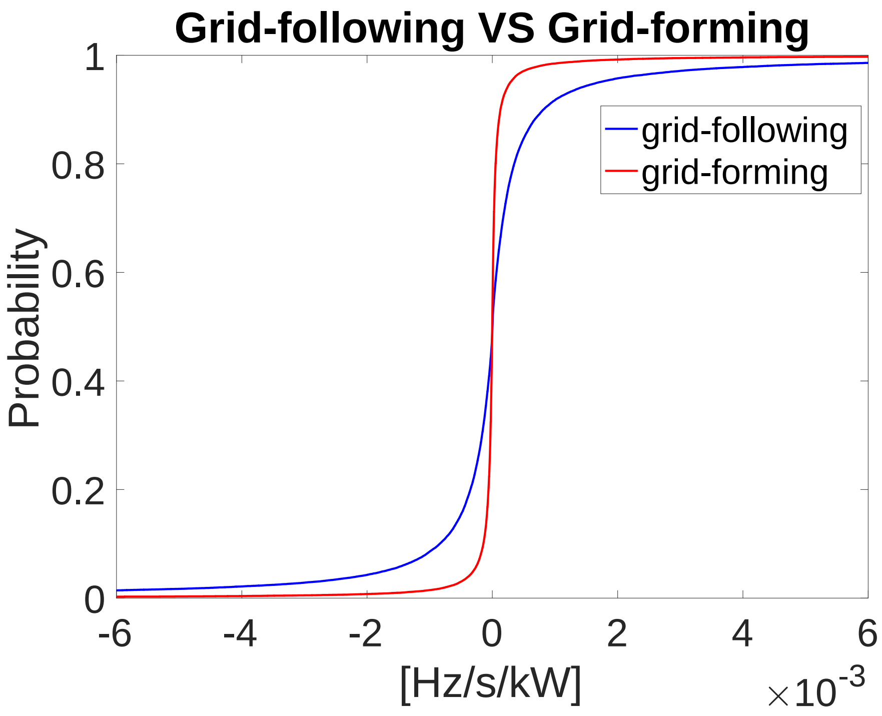
20 min test with 1.44 MW/Hz grid-following droop – PMU reporting rate: 20 ms





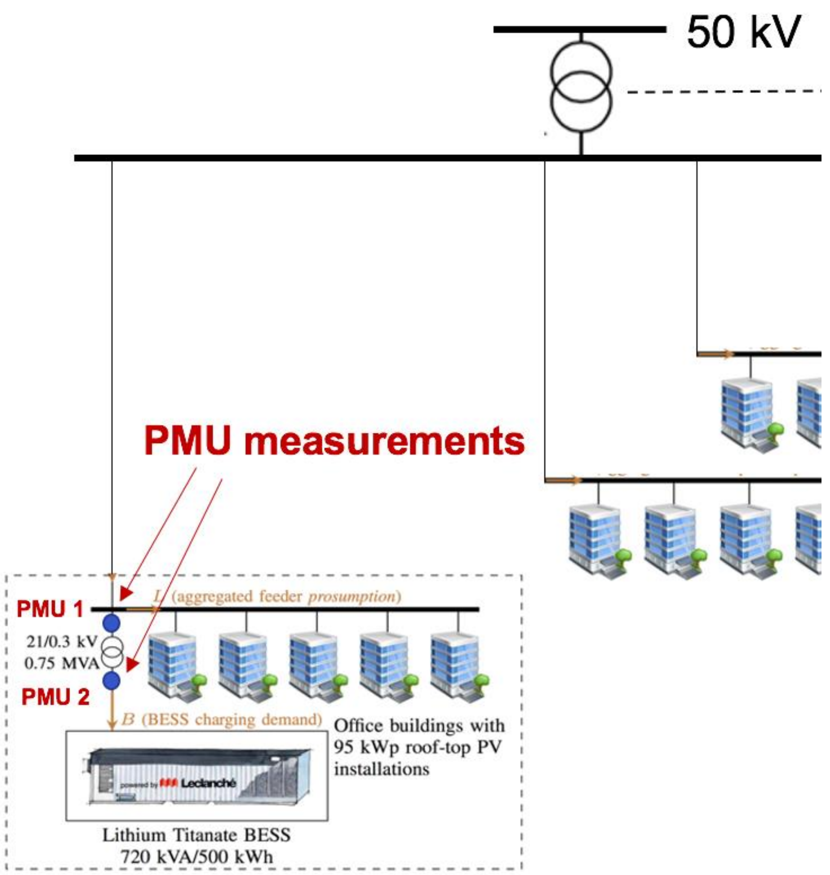


Experimental results – relative RoCoF



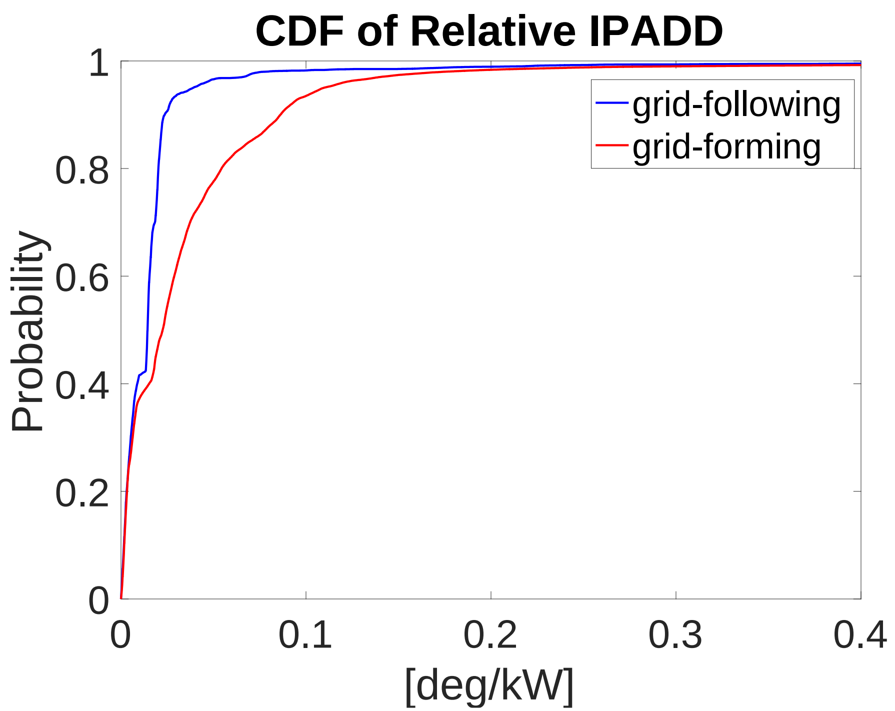
$$rRoCoF = \left| \frac{\Delta f \ / \ \Delta t}{\Delta P} \right|$$

$$\Delta t = 60\ ms$$



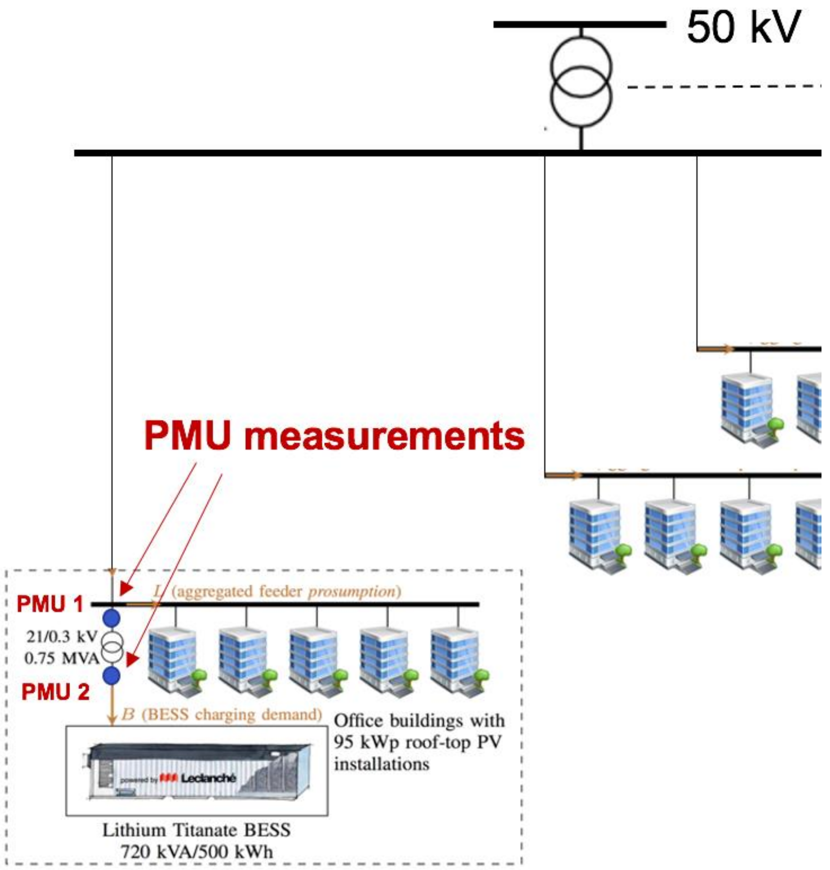
	rRoCoF
Grid-following vs grid-forming	↓ for grid-forming

Experimental results – relative IPADD



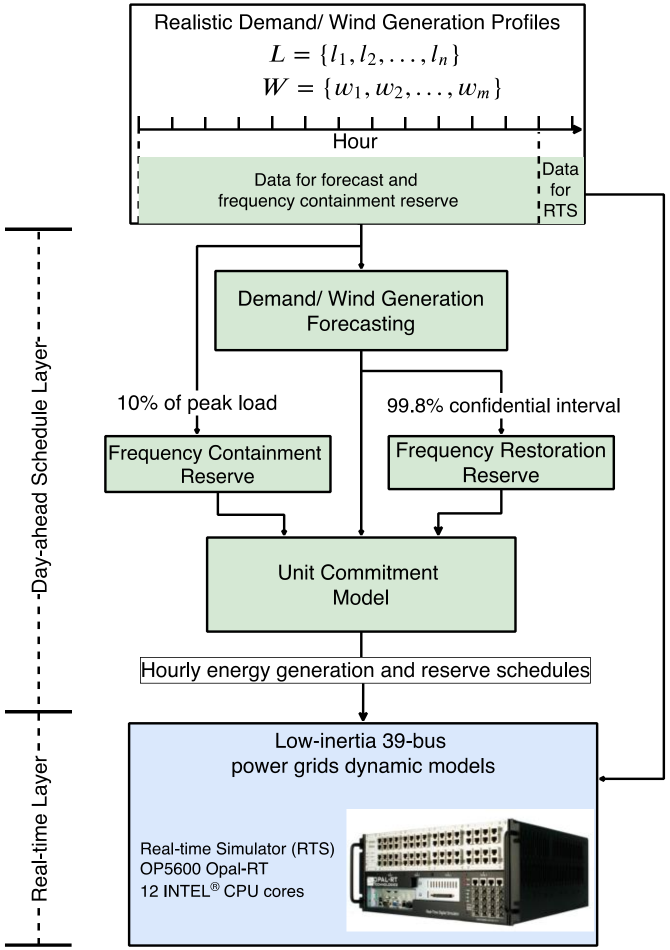
$$rIPADD = \sum_{k=1}^{n} \left| \frac{\Delta\theta_k - \Delta\theta_0}{P_k} \right|,$$

$$\begin{cases} \Delta\theta_k = \theta_{k,PMU1} - \theta_{k,PMU2} \\ \Delta\theta_0 = \theta_{0,PMU1} - \theta_{0,PMU2} \end{cases}$$



	Relative IPADD
Grid-following vs grid-forming	⬇ for grid-forming

Simulation setup – framework[4]



Coupling of two layers:

I. Day-ahead Schedule

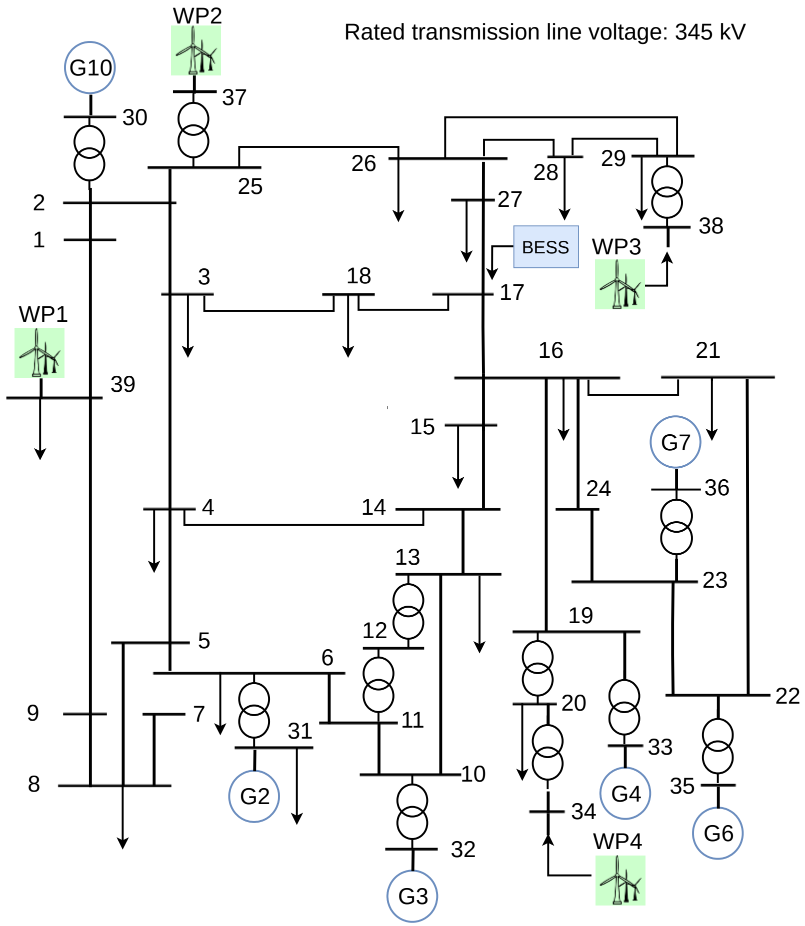
- Demand and wind generation forecasting.
- Frequency containment and restoration reserves allocation.
- Unit commitment model provides energy generation and reserve schedules for the next 24-hour operation.

II. Real-time Simulation

- Execute 24-hour long simulations of low-inertia IEEE 39-bus benchmark network in an OPAL-RT eMEGAsim real-time simulator.

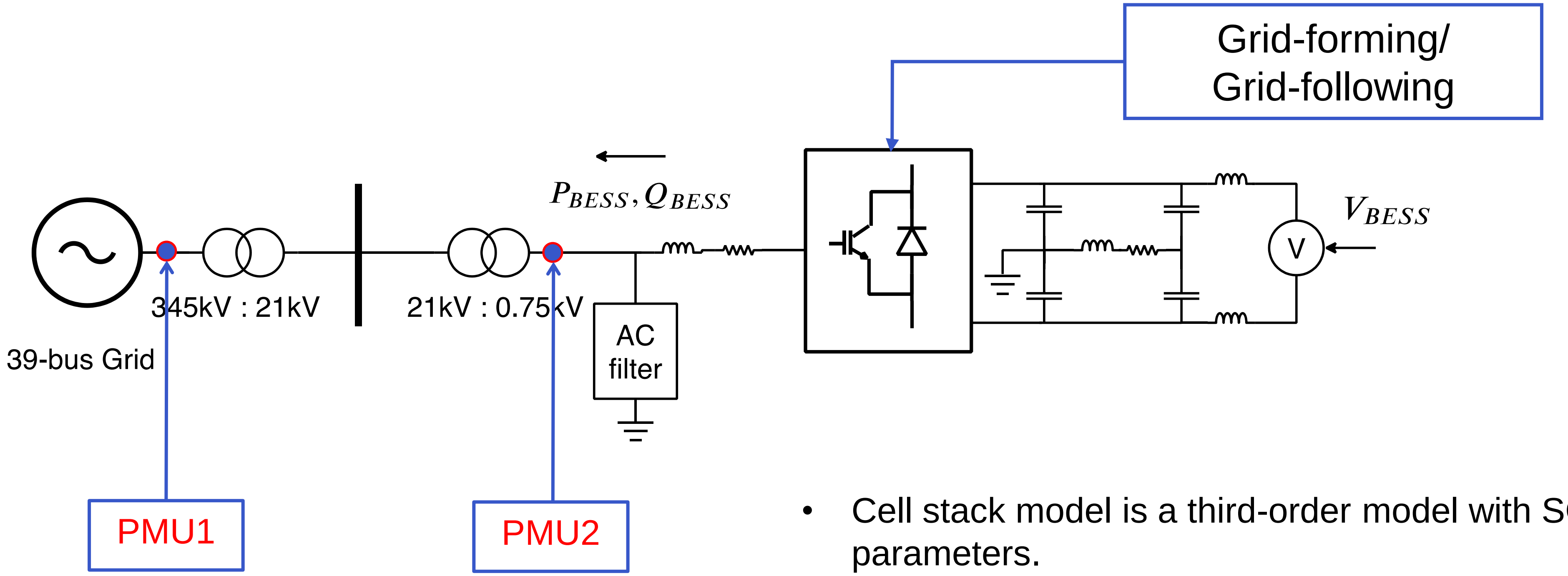
[4] Y. Zuo, Z. Yuan, F. Sossan, A. Zecchino, R. Cherkaoui, and M. Paolone. Performance assessment of grid- forming and grid-following converter-interfaced battery energy storage systems on frequency regulation in low-inertia power grids. Sustainable Energy, Grids and Networks, p.100496, 2021.

Simulation setup—low-inertia IEEE 39-bus benchmark grid



- 6 synchronous machines: 6000 MWA.
- 4 type-III wind farms: 4000 MWA.
- BESS: 225 MVA/175MWh.
- 19 PMUs (implemented with e-IpDFT) installed on 19 load buses, with a reporting rate of 20 ms.
- The time-domain dynamic models are available at: https://github.com/DESL-EPFL/

BESS in low-inertia IEEE 39-bus benchmark grid



- Cell stack model is a third-order model with SOC-depend parameters.
- Identified from measurements of the 720 kVA/560 kWh BESS at EPFL.
- The target power (225 MW) is achieved by composing 2 cell stacks in series and 156 in parallel.

✓ PMU1 and PMU2 are added to compute the proposed metrics: rRoCoF and relative IPADD.

Simulation results – integrated frequency deviation

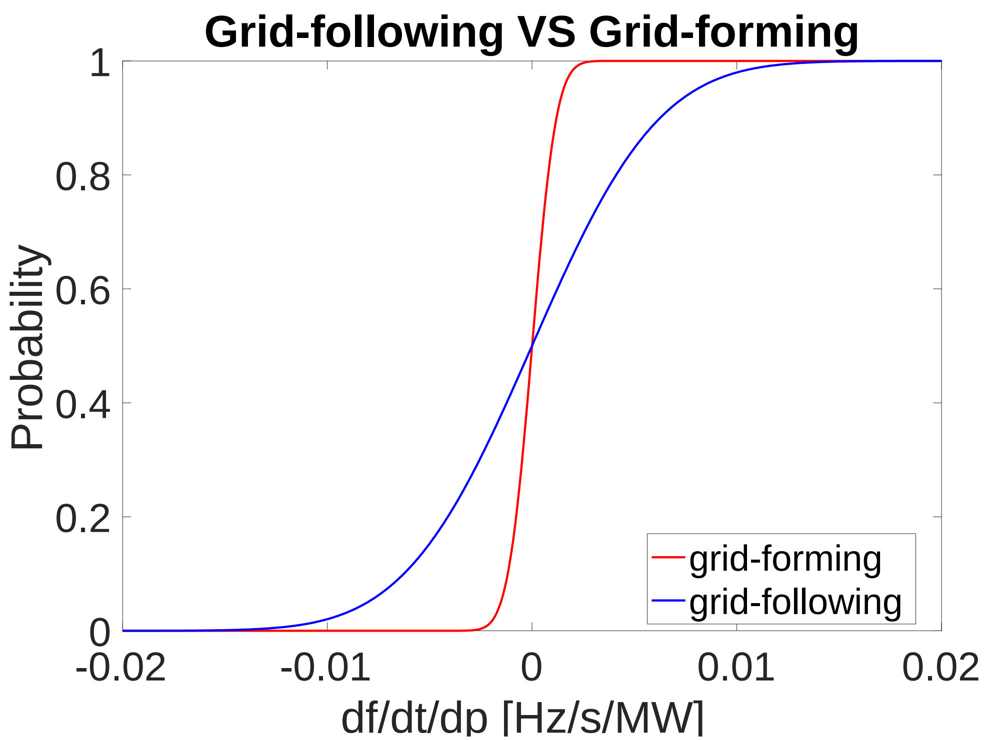
Integrated Frequency Deviation (IFD) computed using frequency measurements of 19 PMUs

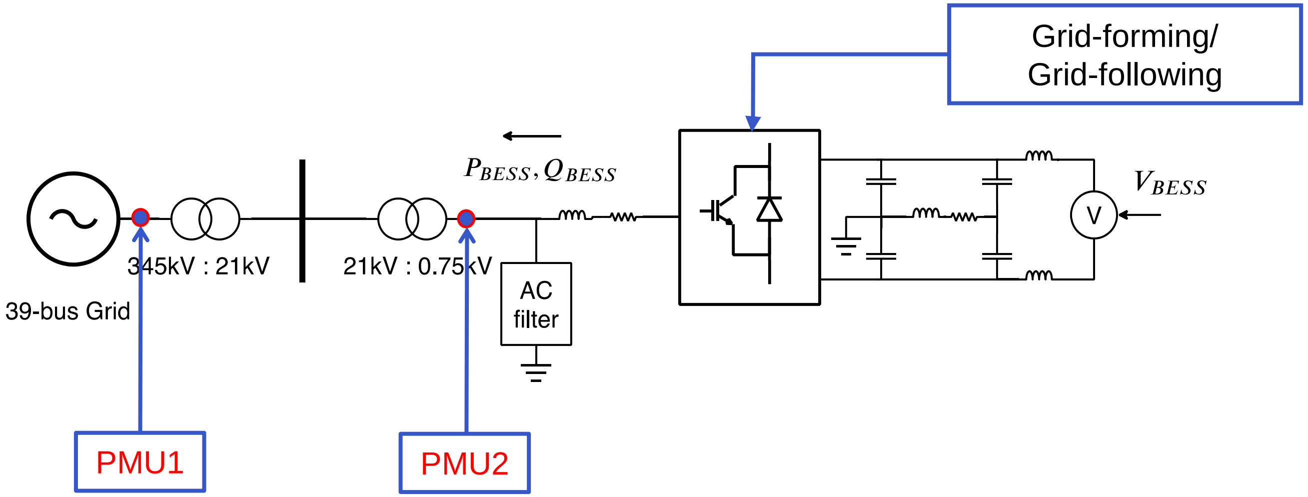
$$IFD = \sum_{i}^{L} \sum_{k=1}^{N} |f_{k,i}| - f_0$$

where L is the number of loads and N is the total sampling number of frequency measurements for each load

Case	BESS converter control	$f - p$ gain	IFD [Hz]	Decrease w.r.t *Case 1*
Case 1	No BESS	-	7.547×10^5	-
Case 2	Grid-forming	225 MW/Hz	6.718×10^5	11.0 %
Case 3	Grid-forming	450 MW/Hz	6.015×10^5	20.3 %
Case 4	Grid-following	225 MW/Hz	6.798×10^5	10.0 %
Case 5	Grid-following	450 MW/Hz	6.138×10^5	18.7 %

Simulation results – relative RoCoF



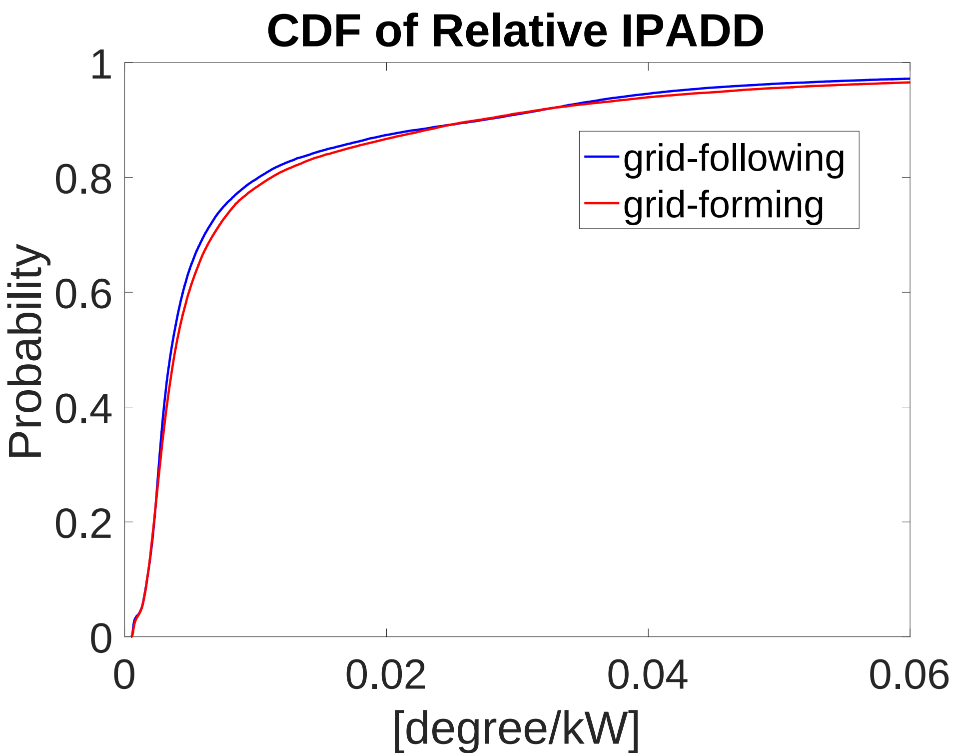


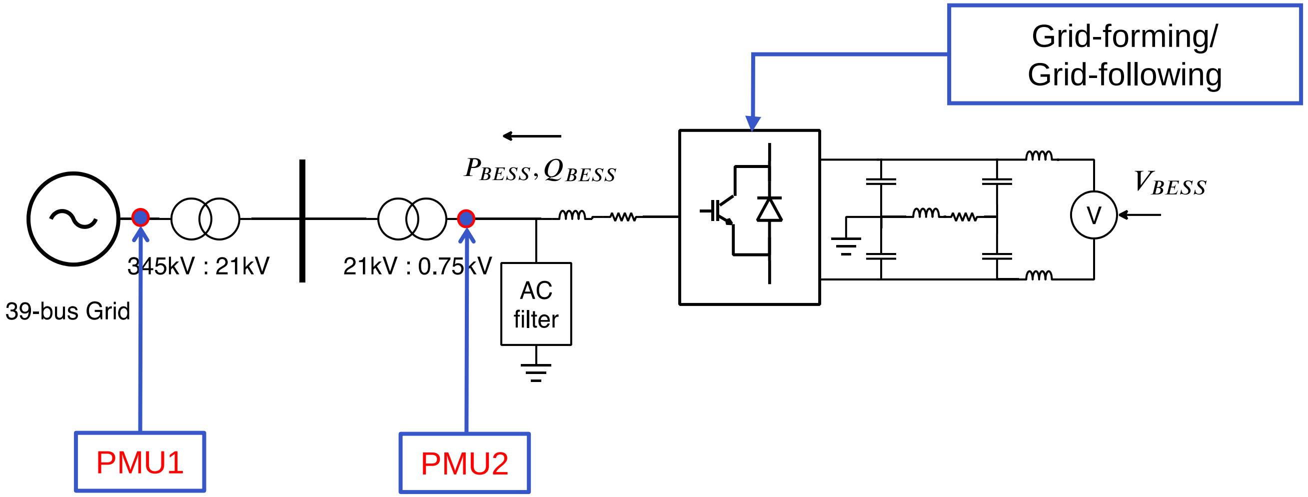
	rRoCoF
Grid-following vs grid-forming	⬇ for grid-forming

$$rRoCoF = \left|\frac{\Delta f \,/\, \Delta t}{\Delta P}\right|$$

$$\Delta t = 60\ ms$$

Simulation results – relative IPADD





$$rIPADD = \sum_{k=1}^{n} \left| \frac{\Delta\theta_k - \Delta\theta_0}{P_k} \right|,$$

$$\begin{cases} \Delta\theta_k = \theta_{k,PMU1} - \theta_{k,PMU2} \\ \Delta\theta_0 = \theta_{0,PMU1} - \theta_{0,PMU2} \end{cases}$$

	Relative IPADD
Grid-following vs grid-forming	↓ for grid-forming

Conclusions

- The OSMOSE demonstrator at EPFL has been specifically designed with an architecture capable to assess the performance of grid-forming vs grid-following controls as well as the impact on the local power grid frequency. The experiments carried out on the EPFL demonstrator has quantified the superiority of the grid-forming vs the grid-following control strategy by means of suitably defined metrics.
- The extension of the study to simulated bulk power grids (i.e. the IEEE 39-bus benchmark system) quantitatively verified, by means of the same frequency metrics used in the EPFL demonstrator, that the grid-forming control strategy outperforms the grid-following one achieving better frequency containment and lower relative RoCoF. Simulations also quantitatively demonstrate that large-scale BESSs are capable of significantly improving the system frequency containment, and the level of improvement is proportionally related to the level of the f-p gain.

OSMOSE : Monitoring new services

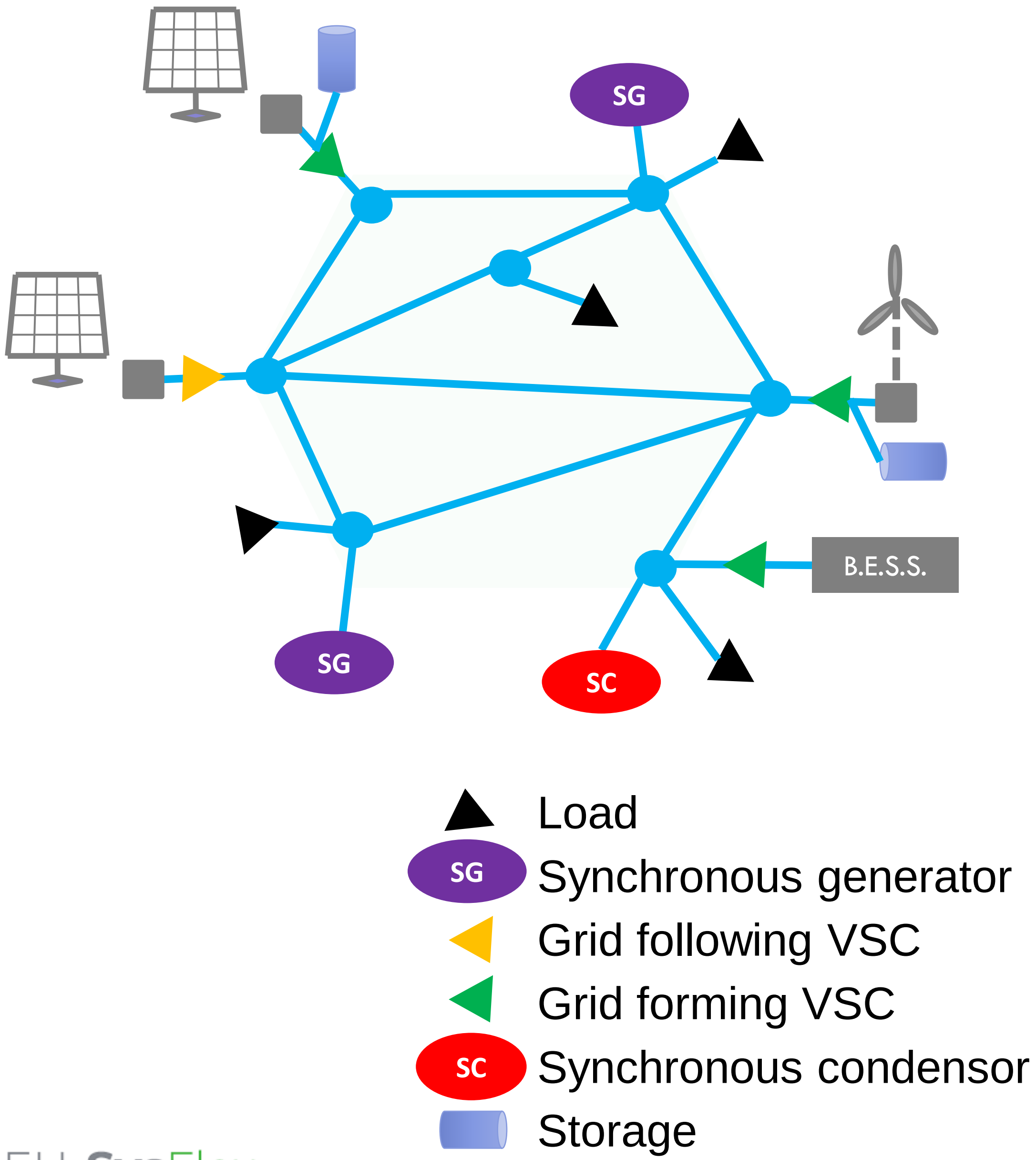
Emeline Guiu – RTE R&D for OSMOSE WP3

Example of Grid Forming function

Grid forming function could be performed in multiple ways.

Specification must be technologically agnostic, as well as the monitoring methods. These methods should be able to easily discriminate grid forming from grid following behavior in order to check that system needs are fulfilled at all time.

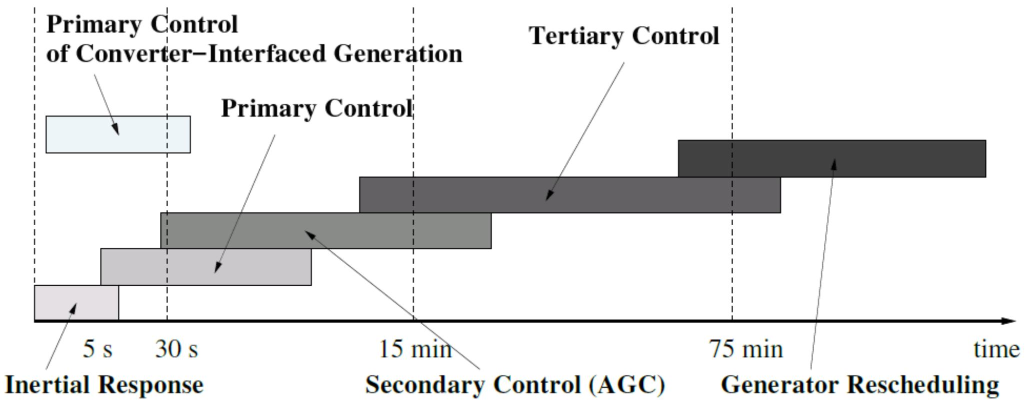
This function is part of a set of levers used to maintain the equilibrium of the system.



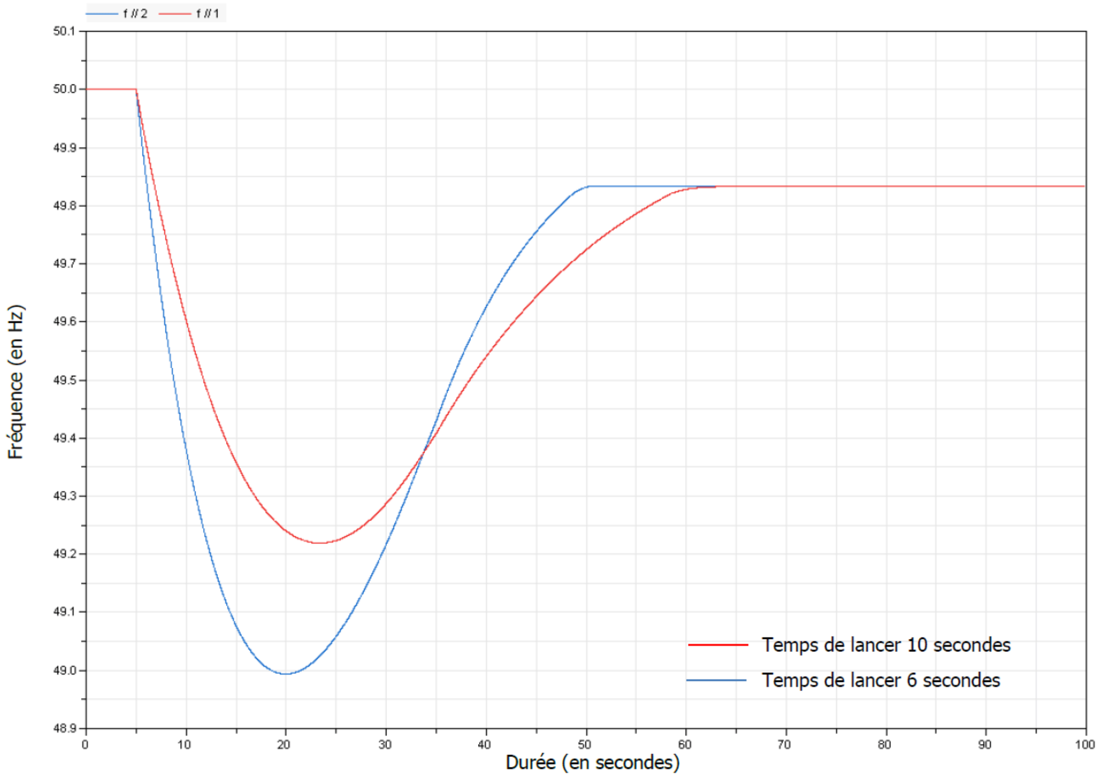
Increasingly rapid phenomena

The increase in renewable energies connected via power electronics leads to new phenomena. One of them is the decrease in inertia and consequently to faster and greater frequency variations.

Some services will need to be adapted created to the stabilize new system dynamics.



MIGRATE Deliverable 3.3: New options for existing system services and needs for new system services



Monitoring new services

For each new service, it will at least be necessary to:

- identify the different technologies which can provide it,
- identify the signals to monitor,
- adapt the signals to be processed if necessary (for example data with a shorter time-scale, resolution of measurements…),
- implement specific monitoring methods, potentially local, in order to asses the efficiency of the regulation.

Regarding IT aspects, the evolution of the services will impact:

- the amount of data to deal with (there will be much more installations to monitor),
- the quality of data to measure, and so on the equipment to be installed (for example PMU),
- the location of controls (for example continuous local monitoring with specific event reporting).

Next steps

- Determine the minimal global, and potentially regional, needs that will ensure the system stability through system-wide studies.
- Establish service provider requirements: expected performances and settable parameters.
- Demonstrate effectiveness of proposed monitoring methods in large scale applications;
- Adapt these specifications in Network Codes.

Conceptual model for private energy data management

Kalle Kukk

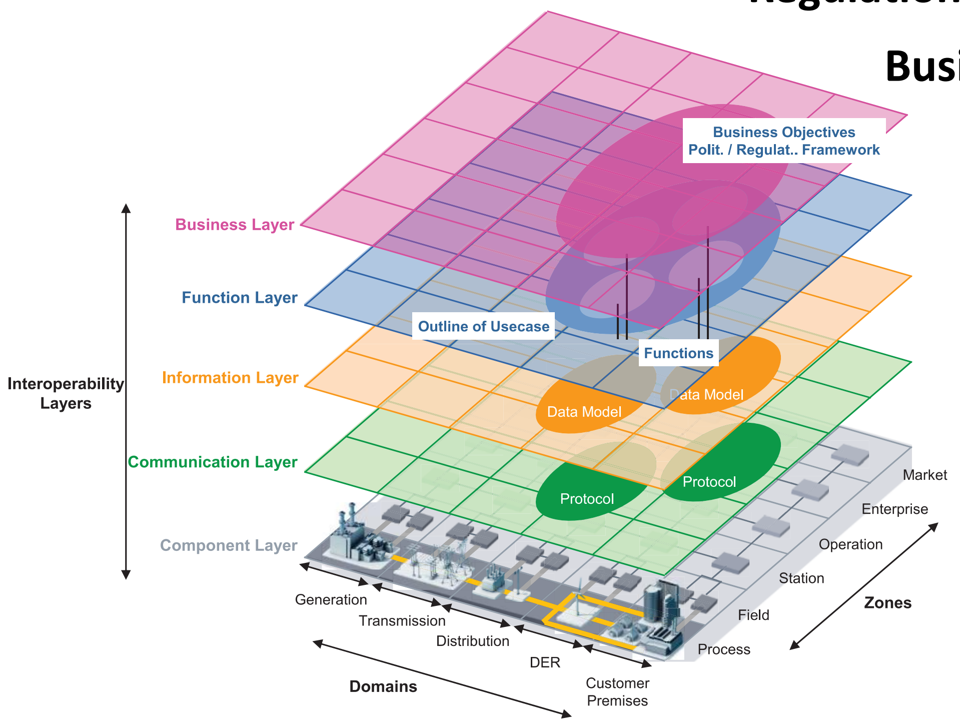
Topics of the presentation

- Objectives of data management in EU-SysFlex
- Elaboration and elements of the model
- Evidence from demonstrators
- Key messages

Objectives: customer focus and interoperability

Customer-centric cross-border data exchange model for flexible market design serving all stakeholders (TSOs, DSOs, suppliers, flexibility providers, ESCOs, etc.).

The aim is NOT a single data exchange platform but ensure the **interoperability** of different solutions.



Regulation -> e.g. CEP, GDPR

Business -> governance model, business use cases for data exchange demos

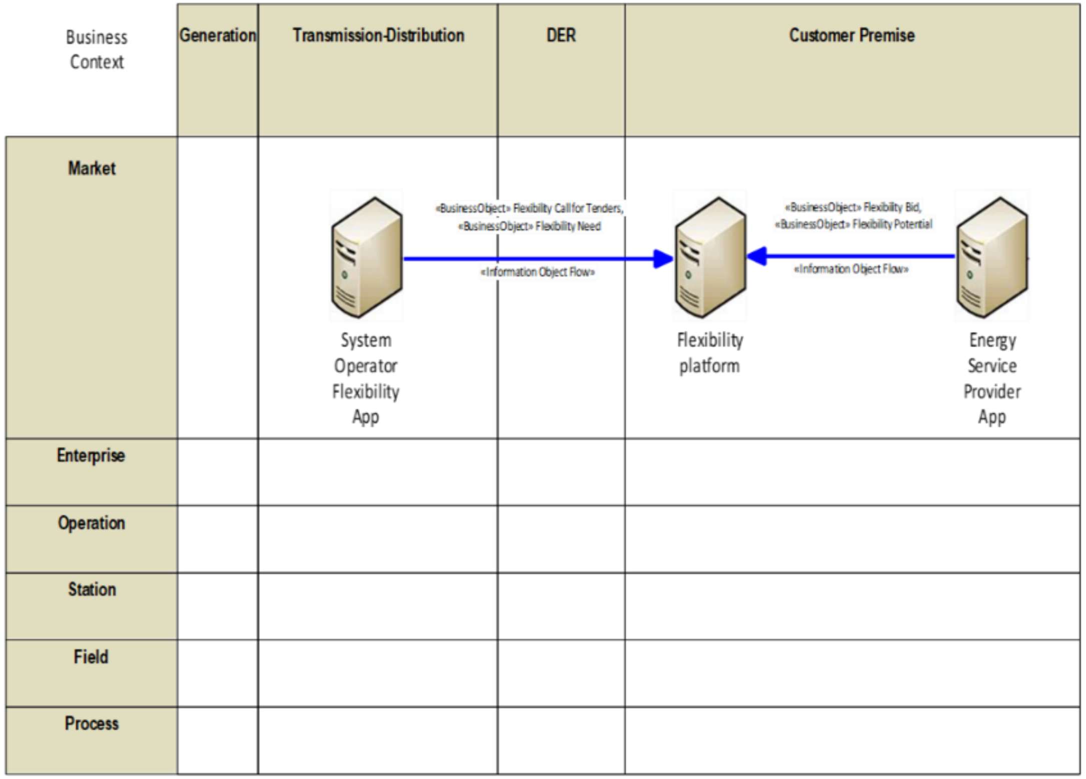
Functions -> data exchange system use cases, focus on private data

Information -> data semantics, standards' assessment, focus on CIM

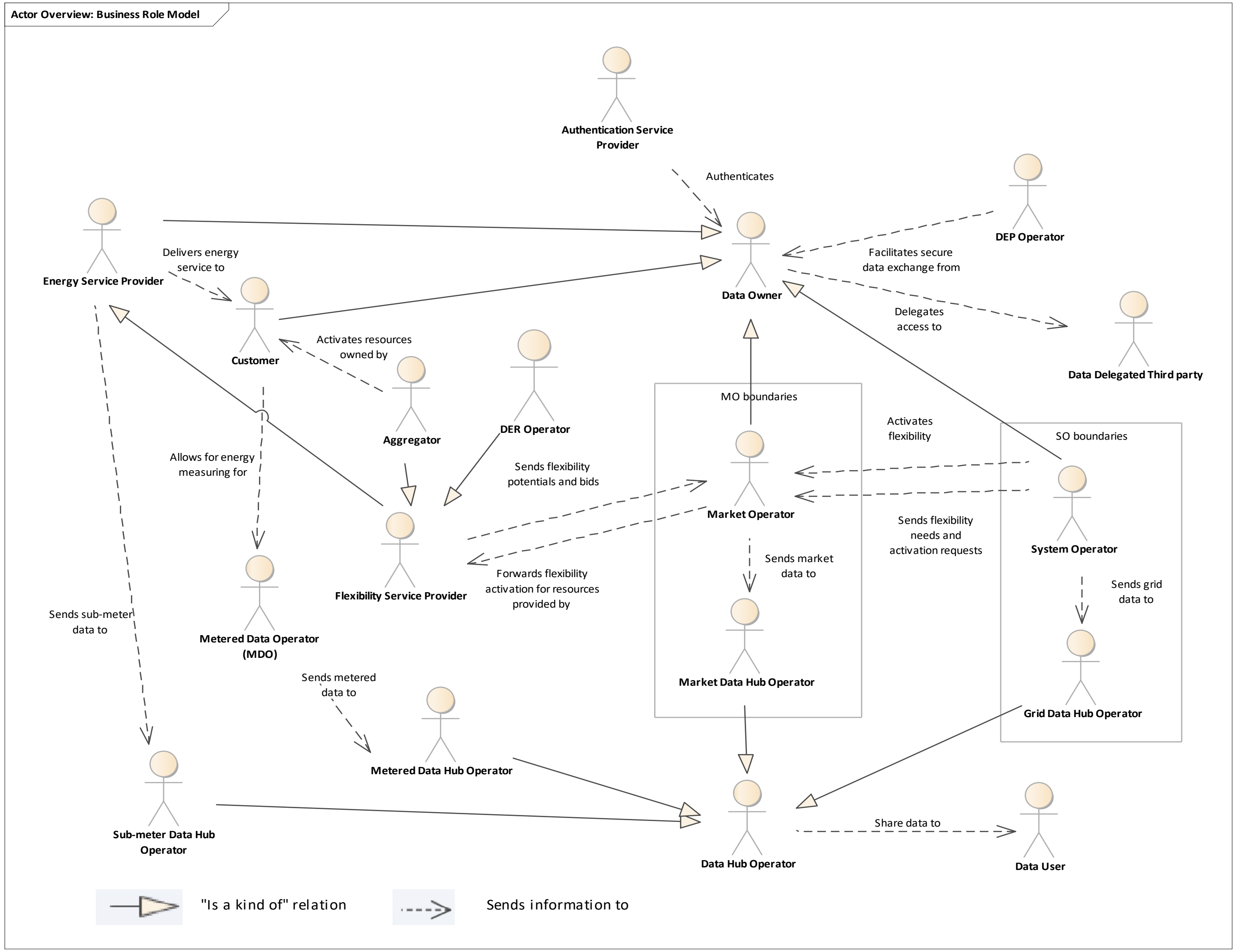
Communication -> standards' assessment

Components -> data platforms

SGAM model



Data role model



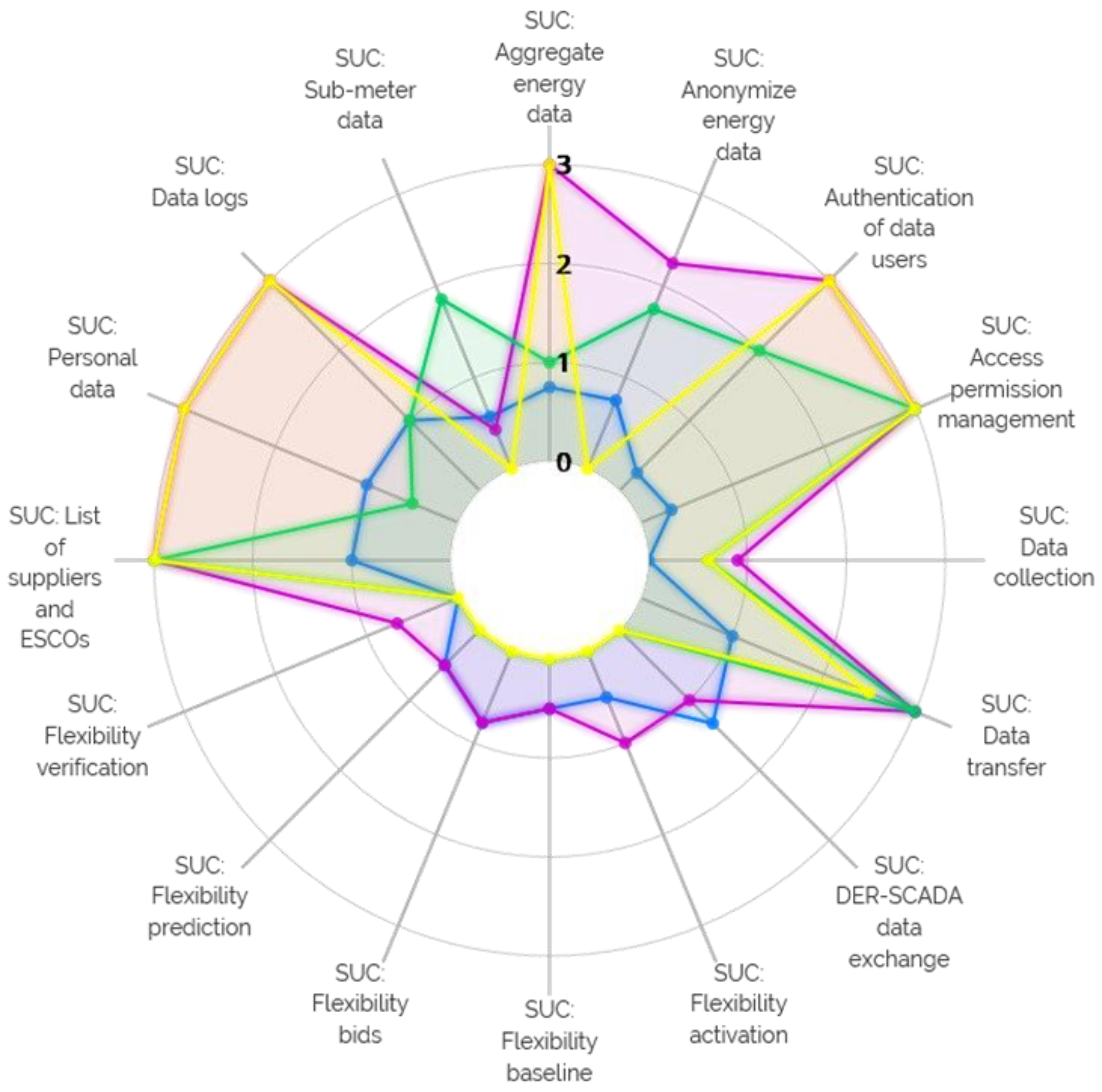
Data exchange system use cases

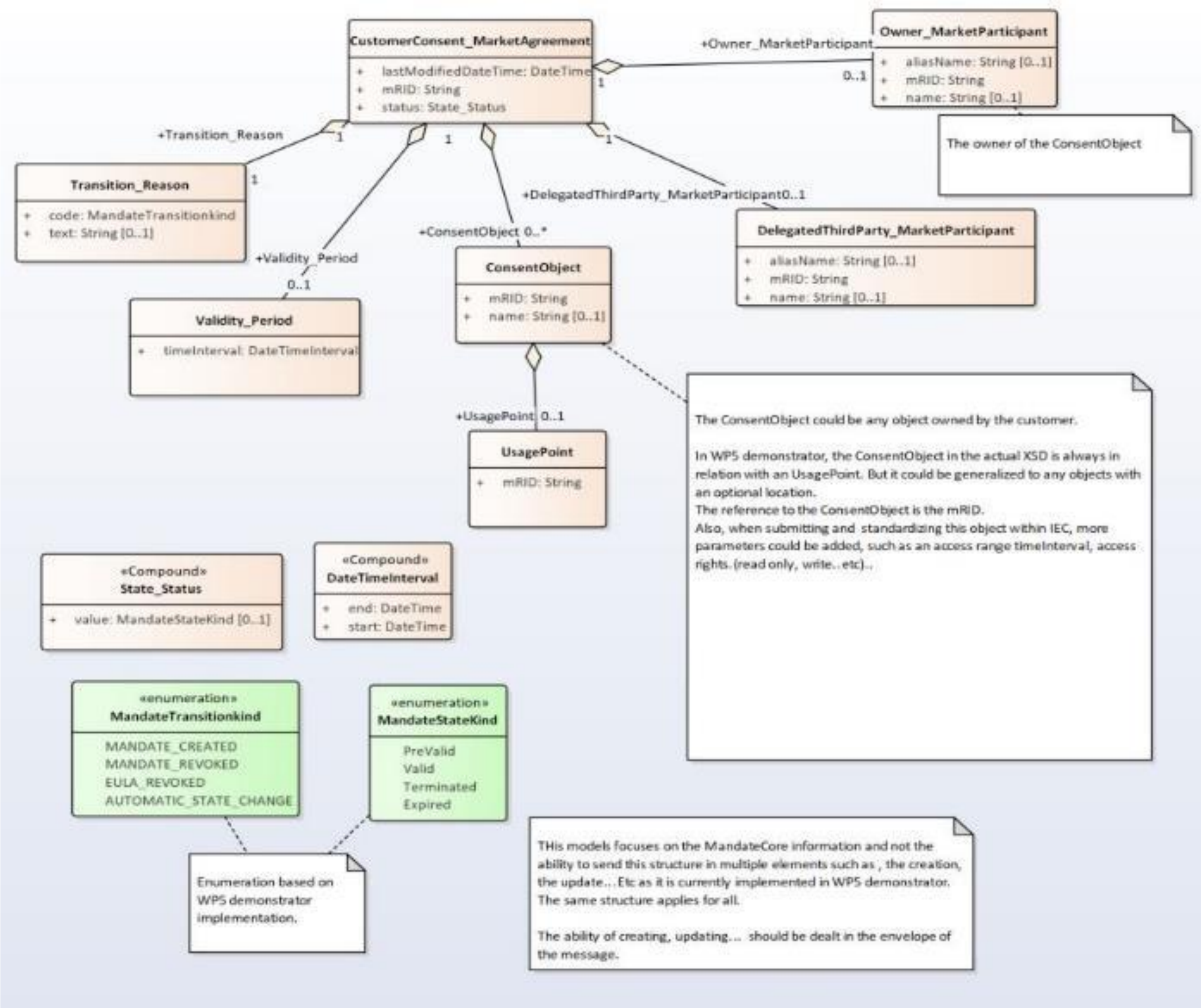
	System Use Case
1	Aggregate energy data
2	Anonymize energy data
3	Authenticate data users
4	Calculate flexibility baseline
5	Collect energy data
6	Erase and rectify personal data
7	Exchange data between DERs and System Operators
8	Manage access permissions
9	Manage flexibility activations
10a	Manage flexibility bids / Prequalification process
10b	Manage flexibility bids / Bidding process
11	Manage data logs
12	Manage sub-meter data
13	Predict flexibility availability
14	Provide list of suppliers and ESCOs
15	Transfer energy data
16	Verify and settle activated flexibilities

Data privacy: Rights according to GDPR

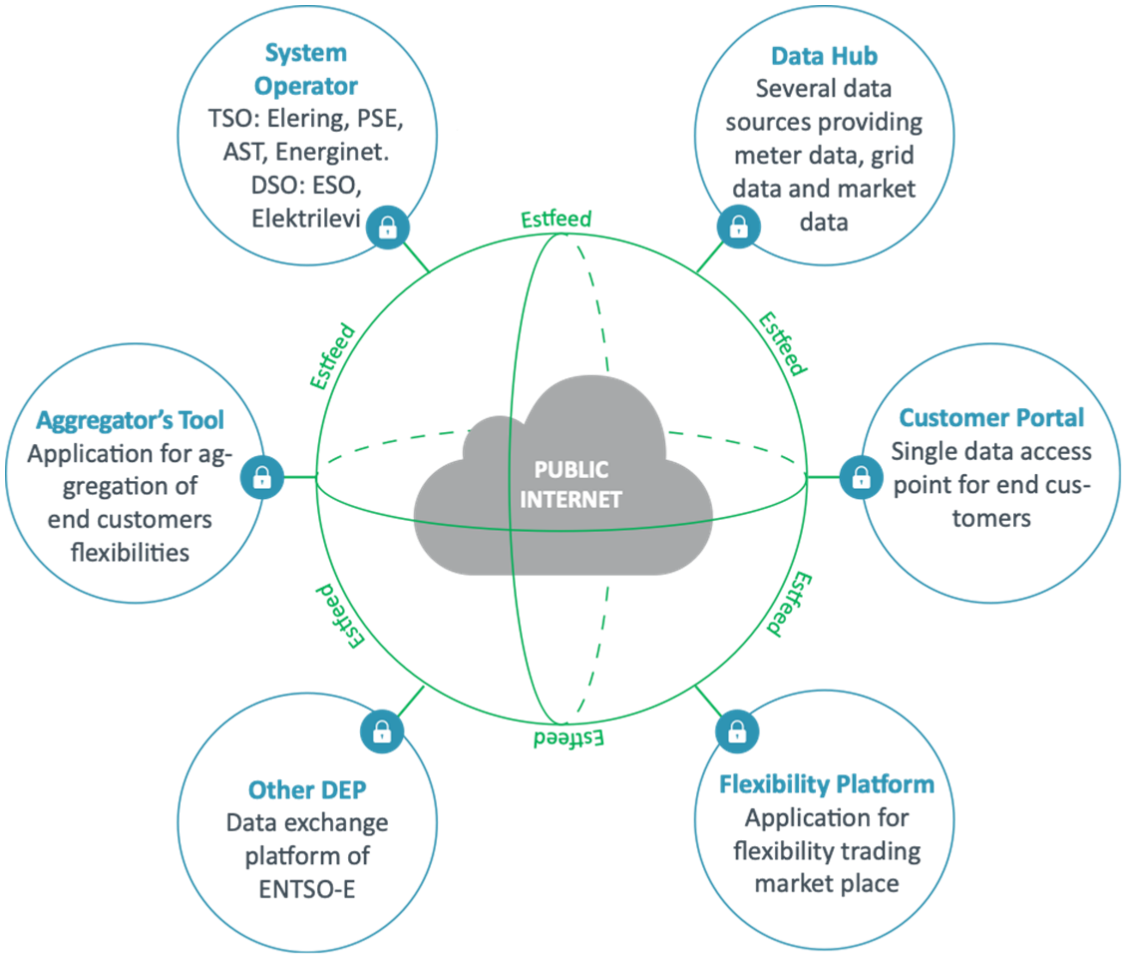
RIGHTS	EU-SYSFLEX USE CASES
To be informed	'Manage data logs'
To have data access	'Authenticate data users', 'Manage data logs', 'Transfer energy data'
To correct data	'Erase, restrict and rectify personal data'
To erase data	'Erase, restrict and rectify personal data'
To restrict data processing	'Manage access permissions'
To move data	Transfer energy data
To object to data processing	'Manage access permissions'
To avoid automated decision-making	'Manage data logs', 'Manage access permissions'

Solutions vs standards?

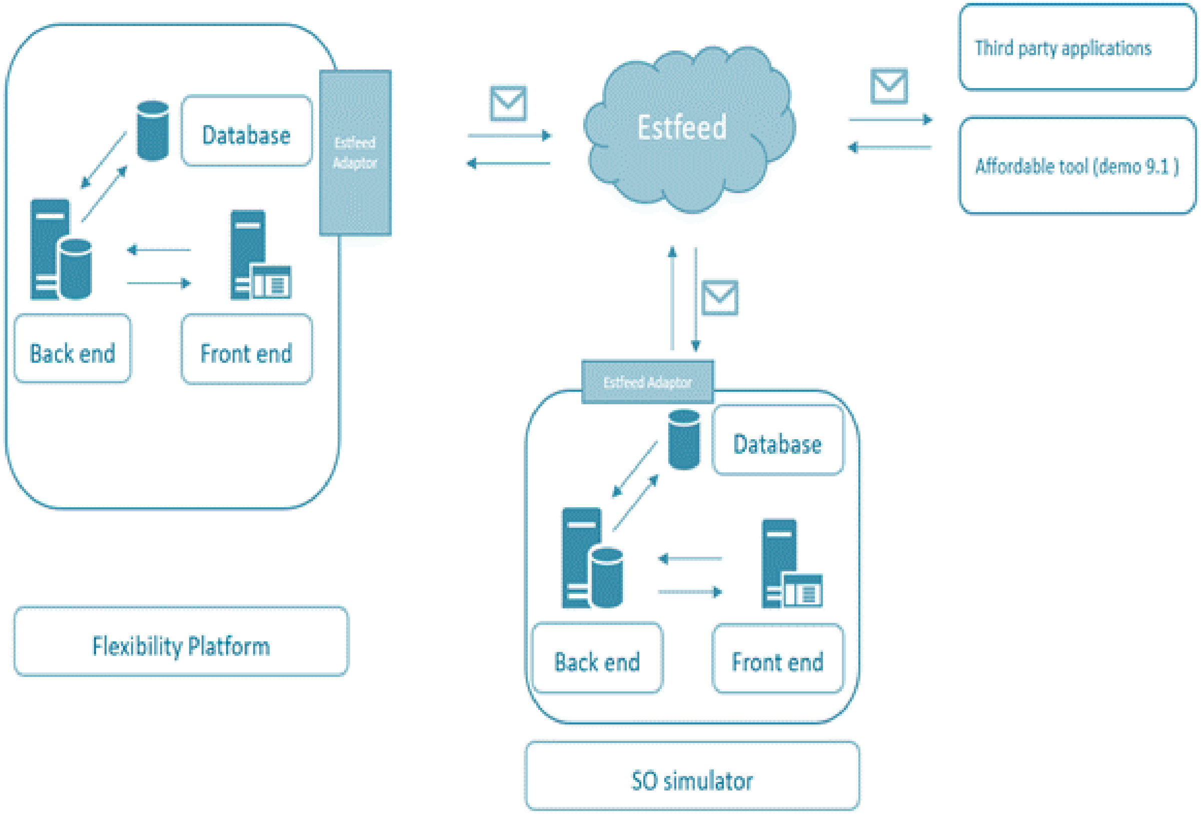




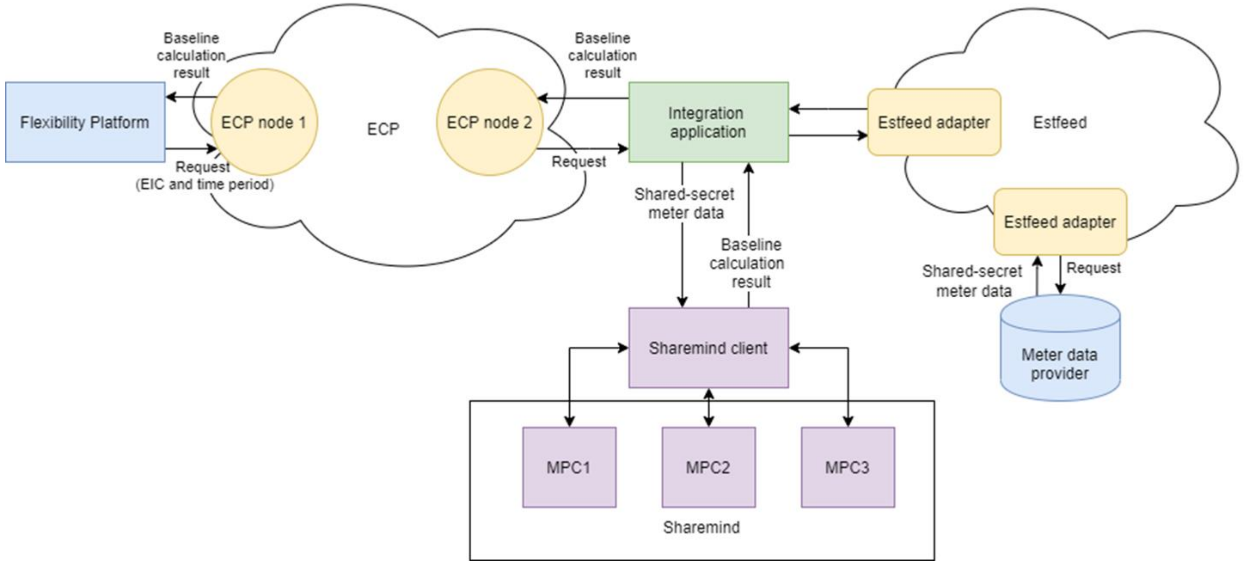
Data exchange platform concept



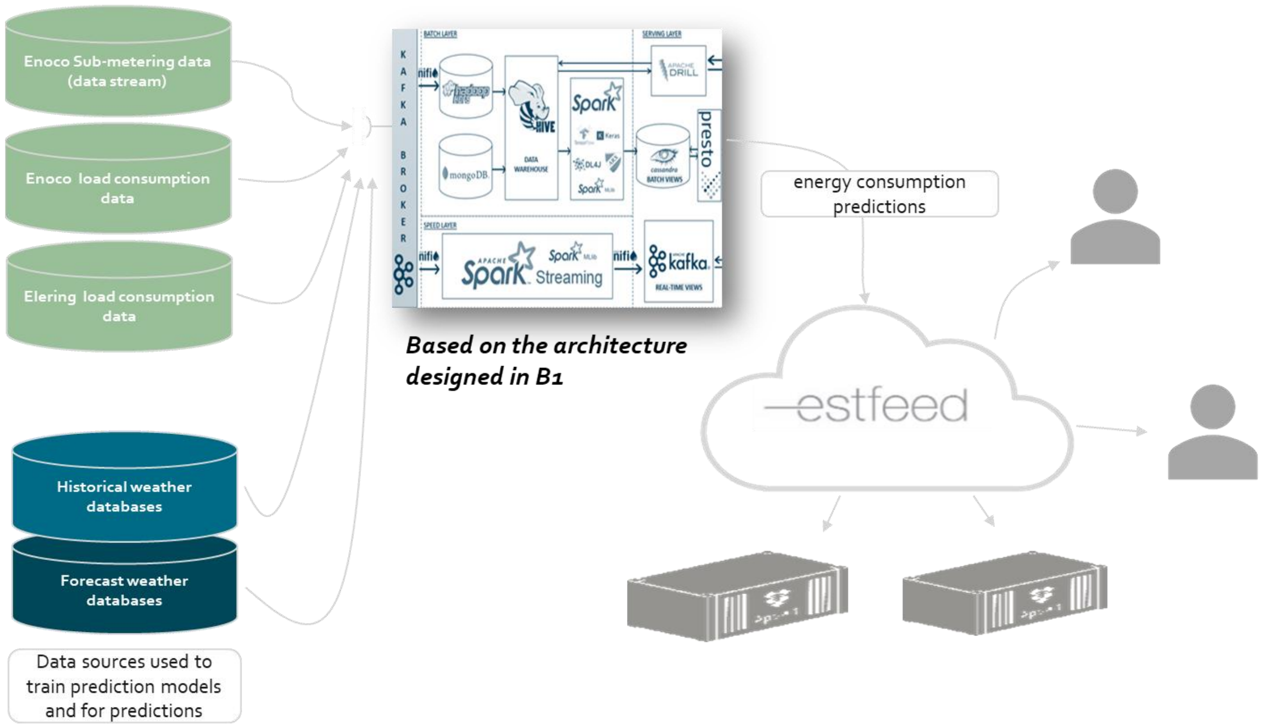
'Flexibility Platform' demo



Cross-sector and privacy demos



‘Big Data’ demo



Based on the architecture designed in B1

Key innovation & key messages

- **Data role model** with new roles illustrating the increasing importance of data exchange in energy sector.
- Interoperability at any SGAM layer through **open-standards** and **open-source** approach.
- Focus on data platforms but the model should enable a mix of different **data management models** (central, decentral, distributed) and **data governance models** (standards-based, open-source).
- **Data Exchange System Use Cases** identified and described, agnostic to specific business processes.
- **„CIMification"** proposed by EU-SysFlex. CIM profiles are recommended for flexibility data exchange and private data exchange.
- Data **privacy** – current legislation and standards generally sufficient, however interpretations could differ per country; personal data protection has to be considered at all the steps when building a DEP.
- Several **demonstrators proved the usability of approach based on Data Exchange Platform** to exchange any data (e.g. meter data, flexibility data) between any stakeholders (e.g. system operators, flexibility providers, data hubs, other data platforms), including across country borders and across sectors. With this distributed data exchange approach a single API is provided and multiple connections different by nature can be avoided while ensuring secure and privacy-respecting data exchange.

IEC 61850 communication standard

Camille Bloch – Schneider Electric – Osmose WP7.1

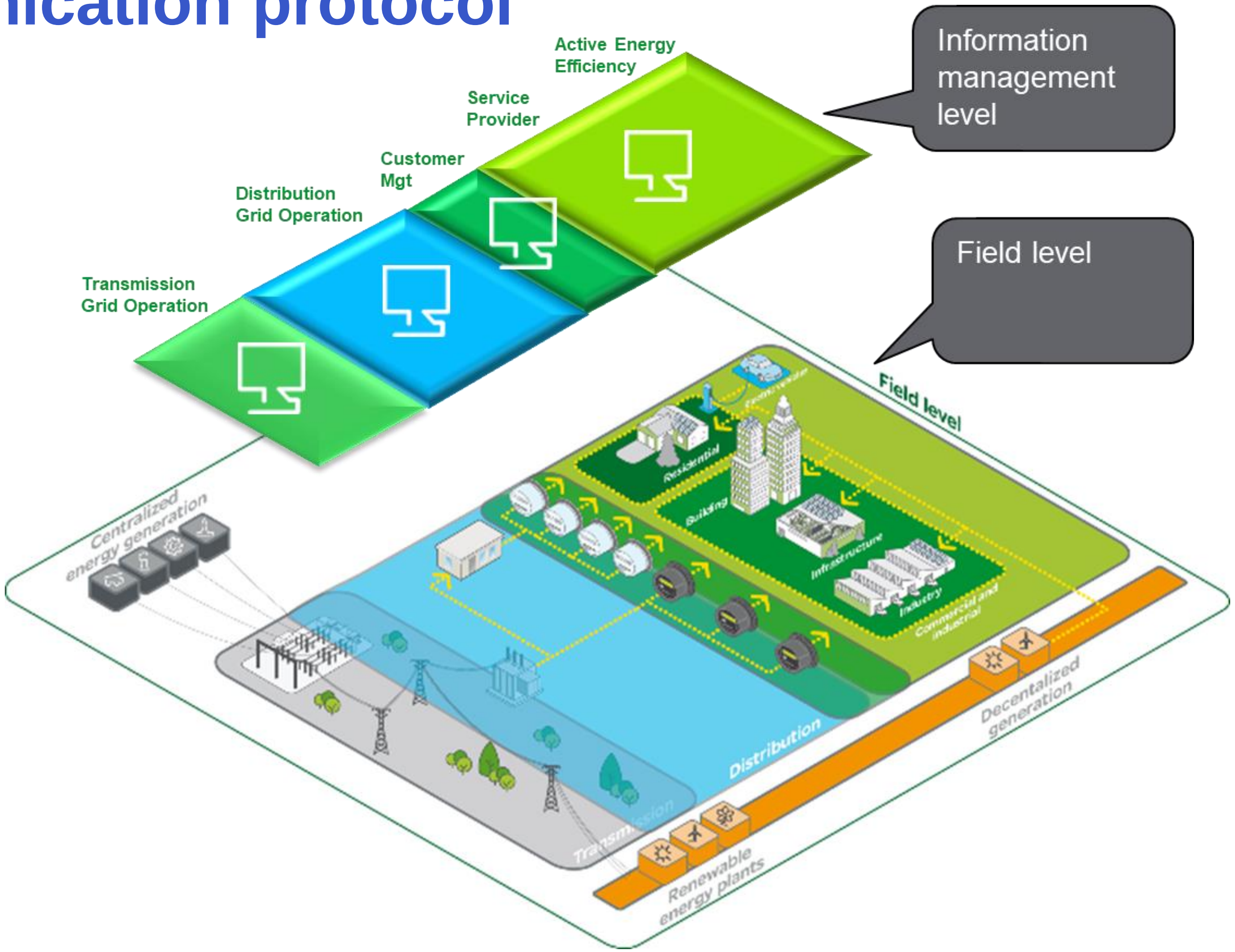
IEC 61850 is more than a communication protocol

Three main aspects part of IEC 61850

- **Modelling**: give standardized semantic to information exchanged
- **Engineering**: standardized workflow between engineering tools from different parties of a system
- **Communication**: standardized way to exchange information, covering event-based point to point communication and fast broadcast communication to ensure properly protection functions

It offer **interoperability** between all vendors participating to a project

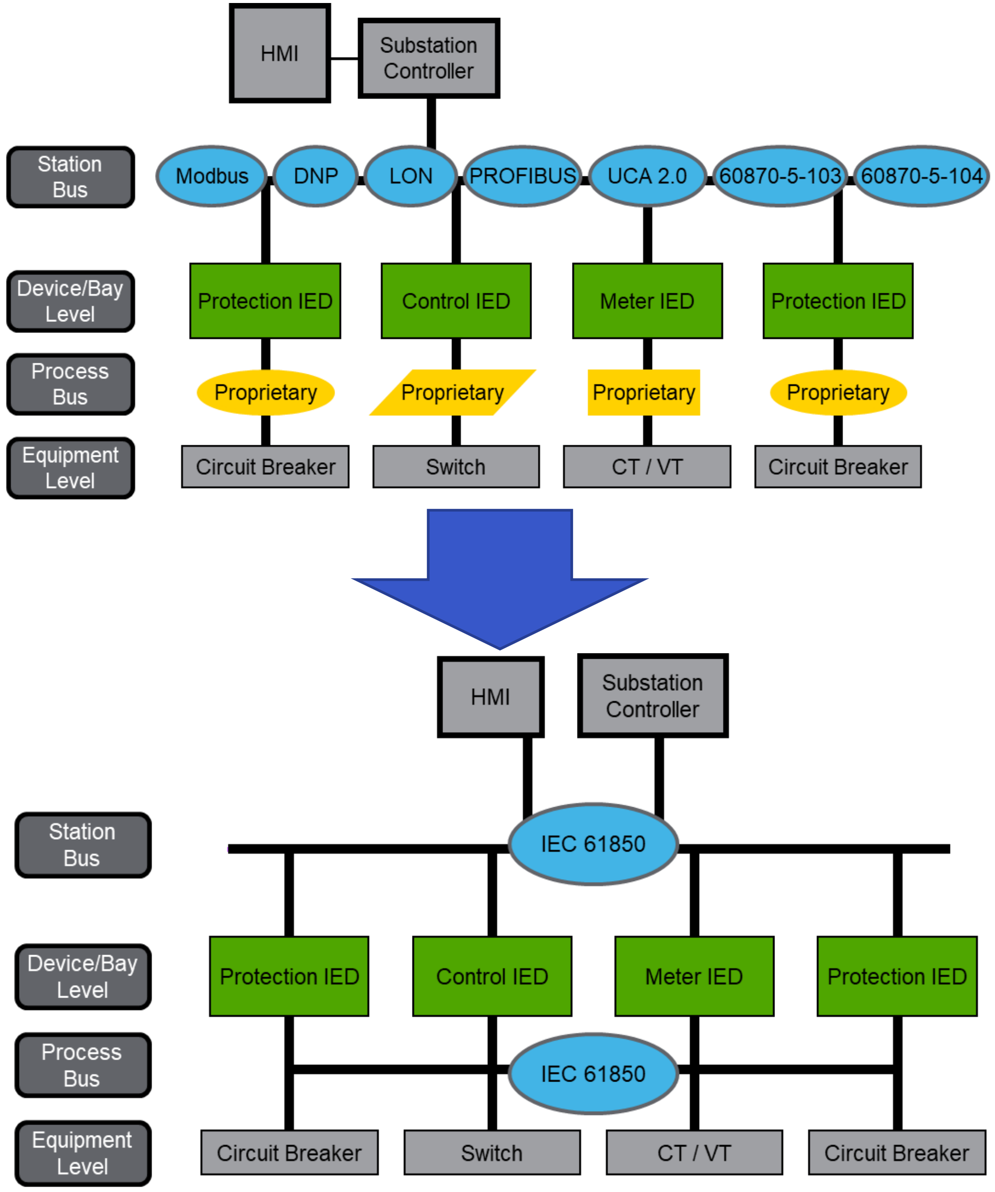
These principles are defined independently of the domain, and are already used for substation, DER, Wind and hydro domains



How IEC 61850 may benefit

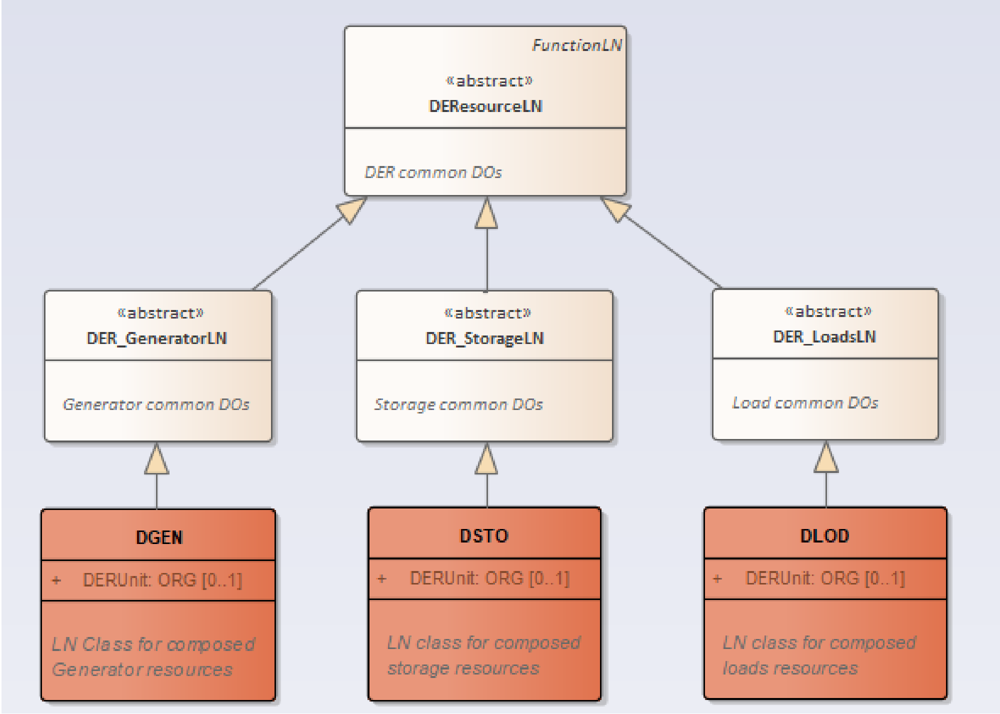
IEC 61850 propose to replace old technologies:

- Legacy protocols can be replaced by IEC 61850 protocol stack to harmonize communication between manufacturers with semantic
- Process communication is standardized, allowing to use new intelligent sensors and controllers, based on efficient and reliable protocols (GOOSE, SMV)
- Protection functions are supported by IEC 61850 protocols with interoperability between vendors and with performances required to protect the system
- IEC 61850 is a live standard, continuously evolving to integrate new domains, functions and protocols (EV, system management, travelling wave faults, Webservices…)



IEC 61850 usage

- DER domain already part of IEC 61850 with dedicated modelling for generators, storages an loads
- Engineering and Communication with DSO is supported by IEC 61850
- IEC 61850 offer mapping with legacy protocols (T104, Modbus…) allowing interconnection between systems
- New standard IEC 62361-102 is describing integration of IEC 61850 and CIM to exchange information between the two levels



- DGEN: Generator
- DLOD: Load
- DSTO: Storage

References

- Osmose WP7.1 Webinar about IEC 61850: https://www.osmose-h2020.eu/webinar-recording-about-iec61850-standard-now-available/
- Osmose WP7.1 Enhanced engineering process: https://www.osmose-h2020.eu/osmose-releases-an-enhanced-engineering-process-for-iec61850-standard/
- Video: IEC 61850 Origins and evolution by Christoph Brunner https://www.youtube.com/watch?v=JH1hBnxUVcs

CONCLUSIONS

Q&A SESSION

Thanks for your attention

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