B3 Shared Platform Concept – Market Intel

IESO Transmission – Distribution Working Group (TDWG)

April 22, 2024

Agenda

- B3 Shared Platform Concept Overview
- Key Terminology
- Platform classification by grid services
- Functionalities insights
- Solution overviews
- Observations and next steps

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B3 Shared Platform Concept – Statement of Work

- Objective: Conceptualize a shared platform that enables Transmission-Distribution (T-D) coordination with specific focus on:
  - Defining the platform requirements and functionalities to facilitate optimal system visibility and information sharing across multiple LDCs, IESO and DER owners/aggregators in the context of use cases that involve a T-D coordination component.
  - Gain insights into other jurisdictions to inform the functionalities

- While the main purpose/benefit of the shared platform outlined here is to facilitate T-D coordination, there exists many benefits that go beyond coordination. It is important to document, at a high level, the additional benefits that a shared platform can serve.

- Goal is to build requirements for a conceptual platform that is:
  - Framework agnostic
  - Technology/vendor agnostic
  - Contemplates tri-party coordination
  - Is aligned with other deliverables from the TDWG

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Source: https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/tdwg/tdwg-20231027-sow-b3-shared-platform-oct-27.pdf

B3 Shared Platform Concept - Work packages and Timelines

WP ID	Work package	Timelines
B3_WP1	Finalize SOW	Q4 2023
B3_WP2	**Jurisdiction Research/Market Scan**	**April 2024**
B3_WP3	Workshops: (1): Business, Functional and Technical Requirements (2): Benefits beyond coordination, Integration Requirements	Q2, Q3 2024* May/June 2024 August 2024
B3_WP4	Requirements Documentation and Analysis	Q3 2024
B3_WP5	Key considerations (regulatory, ownership) (3) Workshop to capture key considerations	Q3 – Q4 2024 Workshop month TBD*
B3_WP6	High-level implementation plan	Q3 – Q4 2024
B3_WP7,8	Draft and final report	Q4 2024

Timelines may be adjusted based on actualized work plan.

B3 Shared Platform Concept - Market Intel Overview

The primary objective of this market intel is to:

- **Educate and share knowledge**
  - Provide a comprehensive understanding and key insights into how other jurisdictions are coordinating for flexibility services, and how these jurisdictions are testing/deploying flexibility and/or shared platforms.

- **Lay the foundation for gathering requirements for a shared/market platform**
  - This comprehensive understanding will feed the requirement gathering stage, along with alignment with other deliverable dependencies.

The market intel will NOT:

- Provide any recommendations on how a possible shared platform should be designed in Ontario. This deliverable remains technology/vendor agnostic and is exploratory work that will highlight the different type of solutions that exist across various jurisdictions. This is NOT a technical vendor assessment.

- Provide regulatory insights or recommendations from other jurisdictions.

- Introduce new market roles or recommend changes to existing roles/market design.

- Limit access to current IESO Administered Markets (IAMs)

Note: Information shared is based on what's available in the public domain. Please provide additional feedback on identified functionality details through the feedback form for this meeting.

Emerging flexibility platforms

Snapshot of the emergence of flexibility platforms across Europe
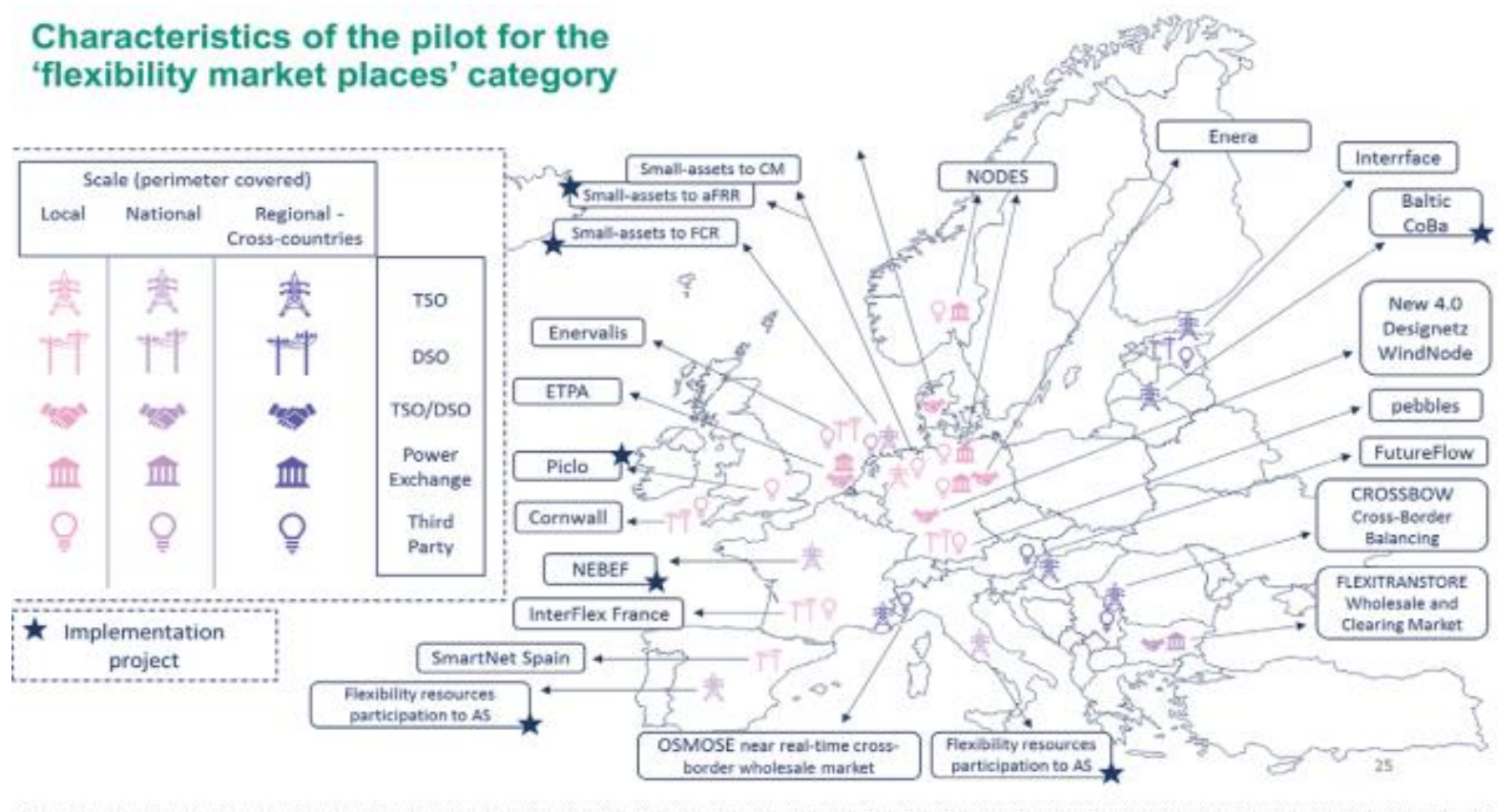

Figure 2: Emergence of flexibility platforms across EU member states

Source: ENTSO-E. Available at: eepublicdownloads.entsoe.eu/clean-documents/events/2019/191205_Flexibility%20Framework_full_public.pdf?Web=1

Platforms explored in Market Intel stage

Solutions as part of projects

- X-flex
- CoordiNet
- GOPACS + Energy Trading Platform Amsterdam (ETPA)
- DA/RE
- EUSysflex
- The Crowd Balancing Platform by the Equigy consortium
- Euniversal
- TSO-DSO Flexhub
- INTERRFACE (IEGSA)
- FLEXITRANSTORE: Wholesale and Clearing Market
- IBM-Ofgem
- CROSSBOW
- Enera
- TDX ASSIST
- Platone

Software providers

- Greensync
- EA Technology
- NODES
- Piclo
- N-Side
- Opus One – GridOS TE
- OATI
- Olivine
- GridBeyond

Out of scope platforms

Market Intel Deliverable Structure

01

Platform classification by grid services

Understand the various services DERs offered in the solutions explored

02

Functionalities Insights

High level functionalities insights gathered based on reviewed platforms

03

Solution Overviews

Deep-dive reviews for a select platforms to understand functionalities

04

Observations and Next Steps

High level observations and next steps for workshop gathering stage

Note: Not all aspects of information are available for every platform. Thus, details on some platforms may be limited.

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Key Terminology

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Terminology

Objective

- To build on the work of Deliverable B4, a few terminologies need to be defined prior to the market intel discussion.
- The goal is to establish a knowledge level set. The terminologies are defined with the intention to educate, NOT to recommend roles or responsibilities based on it.
- Given that majority of the solutions reviewed originate from Europe and the UK, the terminologies and market structure backdrops is from the European perspective. The North American context will be different.

Terminologies to be reviewed:
- Flexibility
- Flexibility platforms
    - Use of "Shared platform" terminology
- Grid services i.e. flexibility services
- Services that DERs can offer in the operational timeframe
- Services that DERs can offer in the planning timeframe
- Other relevant terms found in literature

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Terminology

What is flexibility?*

The ability of potential distribution services to meet dynamic operational needs such as generation, curtailment, voltage support, etc.

- **Flexibility platforms**:** A digital platform that facilitates or coordinates the procurement, trade, dispatch and/or settlement of energy or system services between T/DSOs and DER
- **Shared platforms***: The shared platform is an information technology (IT) solution that simplifies interfaces and coordination between power system actors. The platform also establishes a secure interface between the wholesale market operator, LDCs, the DSOs and DER/As.

The term flexibility platforms and shared platforms can be used interchangeably mostly.

Key distinctions:

- The term flexibility platforms is mainly used in Europe.

- A marketplace platform is a type of flexibility platform. However, for it to be considered a "shared" platform, it would need to **include coordination between power system actors** (ISO,LDCs,DER(A)s). A marketplace can be a component of a shared platform landscape.

- *TDWG Glossary of Working Terms and Definitions rev Dec 8,2023*
- **Source: ENTSO-E Front Economic report: Review of Flexibility platforms*

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Terminology

- **Grid services:** refers broadly to the range of services DERs can potentially provide to distribution system operators (DSO) and/or wholesale market operators (ISO). At a high level, DERs providing grid services are typically required to adjust their power output (active and/or reactive) in response to activation and/or dispatch signals sent by the grid entity to which the services are being rendered (e.g., DSO, ISO). They may require mandatory response or could be voluntary. DERs can provide services as standalone entities, or via DER aggregators (DERA).

- **Flexibility services:** In Europe and the UK, the term "flexibility services" is also used to refer to grid services. The two terms will be used interchangeably.

Source: EPRI report from DER Scenarios and Modelling study - Procuring Grid Services from Distributed Energy Resources (DER)

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Terminology

DERs can offer the following services in the **operational timeframe***:

- **Congestion Management:** The set of actions and procedures used to prevent or alleviate congestion in power transmission networks. Congestion generally occurs when there is too much power being transmitted along a certain pathway in the grid, exceeding its capacity, which can lead to inefficiencies, increased costs, and potential network instability.

- **Frequency Regulation:** Process of maintaining the grid frequency within its nominal value to ensure stable and reliable operation of the power system.

- **Voltage Control:** Maintaining the voltage levels within a power grid at their target values. Voltage levels in a power grid can fluctuate due to changes in power supply and demand, the varying reactive power output of generators, and the physical characteristics of the transmission and distribution lines.

- **Black start:** Restore part of the electric grid to operation to recover from a total or partial shutdown.

- **Controlled Islanding:** Intentionally isolating a portion of the grid when there is a risk of a large-scale blackout. This procedure aims to prevent a disturbance from spreading throughout the entire grid and allows for quicker restoration of power.

- **Inertia response:** The natural ability of a grid to resist changes in frequency due to changes in the balance of supply and demand. This inertia primarily comes from large, rotating generators that have significant kinetic energy.

- **Redispatch:** Changing the dispatch of generation units to redirect power flows away from congested lines and towards those with spare capacity.

- **Load Following:** Adjusting the output of a DER (i.e.: battery storage) to track the daily changes in electricity demand.

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Operational timeframe can be defined as Day-ahead and earlier

Terminology

DERs can offer the following services in the **planning timeframe***:

- **Resource Adequacy:** Ensuring there is sufficient generation and demand-side capacity available to always meet demand.

Other relevant terms found in literature:

- **Market Operator (MO):** A collective term for system operators, product owners, buyers of flexibility services.
- **Flexibility Service Provider (FSP):** An umbrella term to cover entities that provide flexibility such as the asset owners, asset operators and aggregators (like "DER Aggregator"). This term is mostly used in Europe and the UK.

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*Planning timeframe can be defined as 1 Month and earlier

Platform classification by grid services

Platform classification by grid services explored

| SO use cases	Platform	SERVICES							Additional information
		Congestion Management	Voltage Control	Inertia Response	Black start	Controlled islanding	Frequency regulation	Redispatch	
SOLUTIONS AS PART OF PROJECTS									
TSO and DSO use cases	Crossbow	✓	✓				✓		T-D coordination for voltage control and congestion management. Demand side management
	Enera	✓							
	Coordinet	✓	✓	✓	✓	✓			
	INTERFFACE	✓					✓		TSO: mFRR, aFRR, FCR. For DSO: Congestion M.
	FLEXITRANSTRE	✓	✓				✓		
	Xflex						✓		mFRR
	EUSysflex	✓	✓				✓		
	GOPACS+ ETPA	✓							
	DA/RE							✓	
	Platone		✓						Also: Dynamic Phasor simulation, State-Estimation, CIM/CGMES visualization and editing, Probabilistic time-series Forecasting
	TDX Assist	✓	✓						
TSO	Crown Balancing platform by Equigy						✓	✓	FCR,aFRR, mFRR; DSO coordination will be explored
DSO	Euniversal	✓	✓						For DSO only. TSO involvement will be explored
n/A	IBM-Ofgem: System Flexibility Exchange/Utility Flexibility Platform								Did not contemplate services; mapped out use cases
SOFTWARE PLATFORMS									
TSO and DSO uses cases	Open Access Technology International (OATI)	✓	✓				✓		Congestion and outage management, other transmission grid services. Demand side management Dispatch services .
	Olivine								Part of Demand Response programs for Resource Adequacy; capable of wholesale market interactions
	NODES Platform & Market Metering Service (MMS)	✓	✓	*	*	*	✓	✓	Sector Coupling, Reactive Power
	N-Side	✓	✓		✓	✓			Mobile Generation Capacity, Emergency Load Control, Support to Network Planning and Maintenance
	Piclo	✓	✓	*	*	*	*	*	NWAs is a significant use case for many of their DSO clients
Not known	Opus One GE	✓	✓				✓	✓	
Not known	GridBeyond	✓	✓	✓			✓		
Not known	Greensync	✓	✓						
Not known	EA Technology	✓	✓						

Can be implemented in the future.

# Functionalities insights

Insights - Registration and Asset Pre-qualification
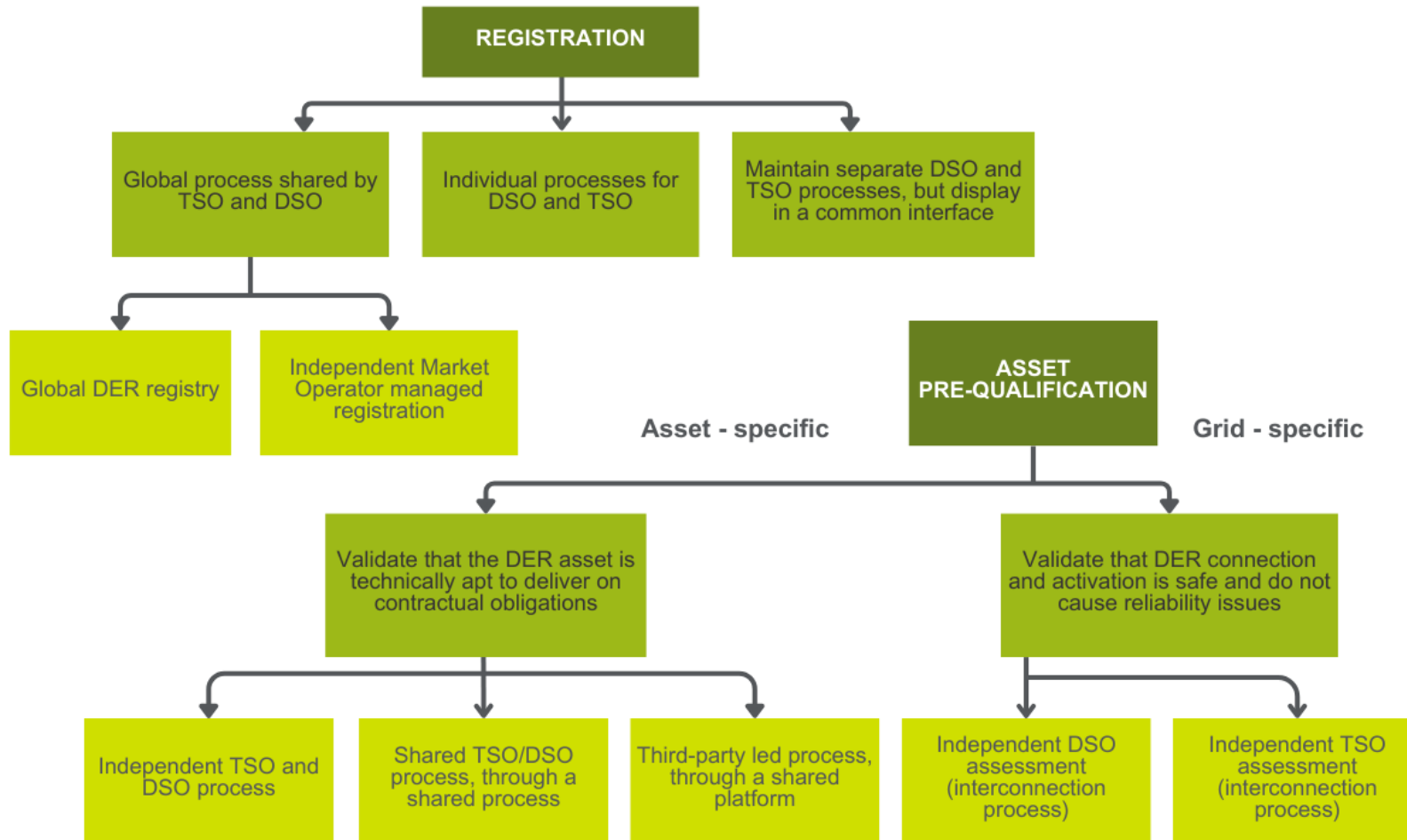
- DER registration
  - Can be managed as a singular process on a shared platform or done individually by TSO/DSOs.
  - Platforms that use a shared/single flexibility register: Piclo, Nodes, Interrface, Xflex

- Pre-qualification of assets is the building block/foundation to access flexibility, both for DSOs and TSOs.
  - Many different approaches possible
    - Test activations
    - On the platform
    - Outside of the platform (existing DSO, TSO processes)
    - Automatic pre-qualification
    - Concept of Market Operator

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Detailed table - registration and pre-qualification

Example of a DER Registry: AEMO DER Registry

- The Australian Energy Markey Operator (AEMO) DER Register is a central database for information on DERs installed across Australia's National Electricity Market (NEM).
- Australia has the world's highest per-capita solar energy penetration, with almost one in three homes hosting PV panels.

Source: https://aemo.com.au/energy-systems/electricity/der-register/data-der/data-dashboard
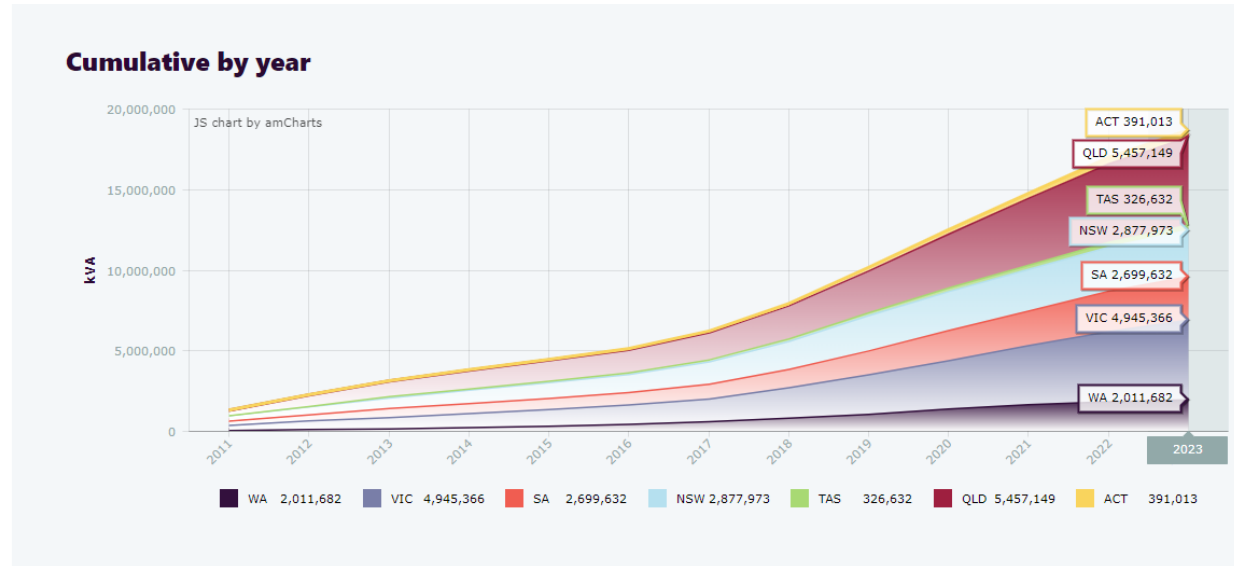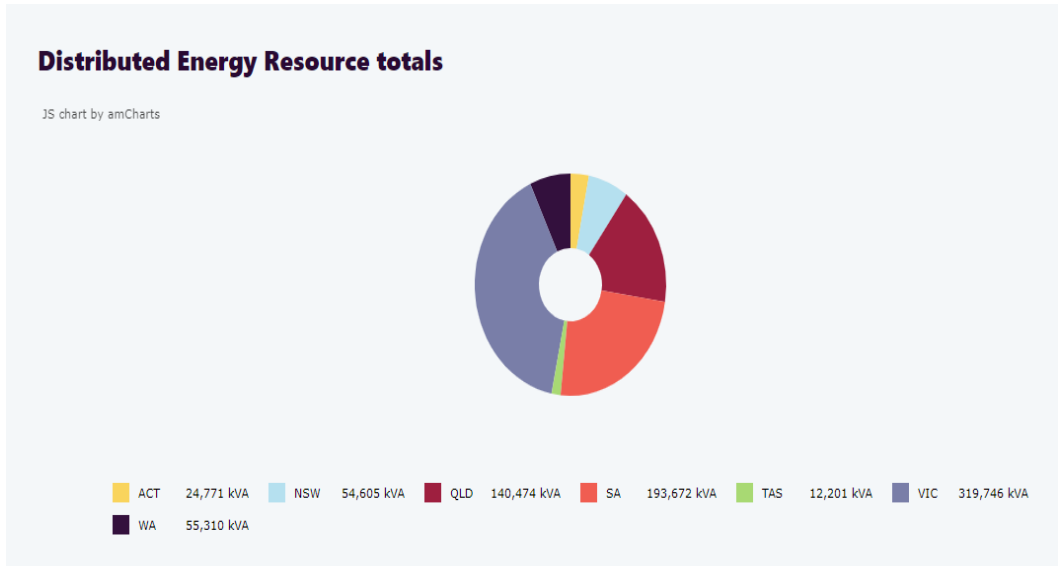
Visibility into flexibility requirements – Insights

- Visibility into flexibility requirements is a key function of any shared/flexibility platform

- Once the visibility into flexibility requirements is available within a shared/flexibility platform, they are either routed to a supplementary platform or housed within the platform to match with supply of DERs.

- Can be done in multiple ways
  - Providing visibility into flexibility requirements using existing utility or commercially available tools (e.g. IESO York Region NWA Pilot platform)
  - Creating a "buy order" at a certain location, or for a given quantity/price
    - Nodes, Piclo, GridExchange
  - Receive a request for flexibility
    - Olivine, Equigy, Flexistrone
  - Collaboration between multiple platforms
    - Coordinet, Xflex

Not in scope:
Tools and procedures that are used by T/DSOs to determine congestion zones/nodes or develop forecasts for upcoming flexibility needs.

Detailed table – Visibility into flexibility requirements

Insights – Market Operations (Bidding, matching and price forma

Bidding	Matching	Price formation
• Received by TSO/DSO in their individual platforms/systems/processes • Third-party market operator platforms manage the bidding process • Received by TSO/DSO, and then forwarded to marketplaces	The matching processes follow suit from the bidding processes. Either done by a third-party system or within DSO platforms.	The price formation processes follow suit from the bidding and matching processes. Either done by a third-party system or within DSO platforms.

For market operations functionalities
- One Market Operator across TSO/DSOs (e.g. Xflex)
- Different market operators (e.g. Coordinet)
- Separate national balancing markets (ETPA/GOPACS)

Applicability of these insights to the Ontario landscape will be discussed in the subsequent deliverables.

Detailed table – Bidding, matching and price formation

Insights - Activation/Deployment processes

Activation and deployment of resources can be done in multiple ways:

- By individual System Operator:
    - For TSO or DSO specific markets, activation and deployment is done by the respective party i.e. in the Equigy solution, TSO activates through their internal platforms.
- By third-party Market Operator platform:
    - The dispatch instructions can be sent by the MO's tool. Important: when MO tools send activation notices, multiple checks by the respective system operators are essential to ensure all grid impact assessments have been conducted and cleared.
- Part of a flexibility/shared platform landscape:
    - Activation and dispatch mechanisms are built within the shared platform landscape i.e. in Xflex, the SERVIFLEX platform activates confirmed schedules based on market results and deactivates the rejected schedules

Detailed table - Activation/deployment processes

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Solution Overviews

Solution overview summary I

Platform/ project name	Description	Type	Linked platforms	Funded by	Relevant timelines	Current stage	Partners
Coordinet	Aimed to demonstrate how DSOs and TSOs can act in a coordinated manner to procure grid services through the implementation of three large scale "TSO-DSO-Consumer" demonstrations, in cooperation with market participants (and end users).	Multiple demonstrations within the project	Demo dependent; internal TSO and DSO platforms, aggregator platforms, marketplaces (N-Side, internal platforms)	Horizon 2020 European programme	Jan 2019 - June 2022	One of the platforms developed during the demonstrations was commercialized as a market solution (Sthmflex market in Scotland)	TSOs, DSOs, research institutes, DSO associations, technology providers, solution providers
OneNet – One Network For Europe	Define a common market design for Europe, define a common IT architecture and common IT interfaces, and run large-scale demonstration to implement and showcase solutions.	Multiple demonstrations within the project (10)	Demo dependent; some include Nord Pool, Piclo, OMIE	Horizon 2020 European programme	Oct 2020 - March 2024	24 key recommendations across four main pillars for interoperability. This work is with the European Commission now and will inform upcoming regulation. EU-widely consultation and stakeholder management over three years; are best practices devised through innovation, that aim to drive regulation.	Over 70 partners - DSOs, TSOs, Energy associations, market operators, research centers, technology providers
IBM Ofgem	Goal: Increased cross-market participation and coordination of assets, simplify market access, increased transparency, build participant trust in the market ecosystem and increase financial viability of flexible DERs	Design study with use cases	Not applicable	Ofgem	Completed in 2022	The work is now with the policy makers and will inform future regulation.	IBM, Ofgem

Solution overview summary II

Platform/ project name	Description	Type	Linked platforms	Funded by	Relevant timelines	Current stage	Partners
TDX-Assist	Aims to study interactions between DSO and other participants, and focused on TSO-DSO interoperability	Demonstration project	ENTSO Communication and Connectivity Service Platform (ECCo SP)	Horizon 2020 European programme	2017 - 2020	Information not available.	TSOs and DSOs
GOPACS	Mitigate capacity shortages in the electricity grid (congestion) and contribute to keep the Dutch grid reliable and affordable. Flexibility offers are not cleared on GOPACS because it is not a market platform; it acts as an intermediary.	Intermediary platform	ETPA	DSO, TSOs	Commercialized in 2019	The GOPACS platform was tested as a project, and then adapted as a commercial solution	Built and operated Energie Data Services Nederland which owned by the TSO and all DSOs
Interrface	Develop an Interoperable pan-European Grid Services Architecture (IEGSA) to act as the interface between the power system (TSO and DSO) and the customers.	Intermediary platform	Nord Pool	Horizon 2020 European programme	Jan 2019 - Dec 2022	Information not available.	42 partners - DSOs, TSOs, consultants, service providers

Solution Overview – CoordiNet

The CoordiNet project is made up of ten demo activities which were carried out in three different countries. In each demo activity, specific products are tested in specific time frames and rely on the provision of flexibility by specific types of Distributed Energy Resources (DERs)

- Spain
- Sweden
- Greece

Focus for grid impact assessment:

- Spanish demonstration
- "Common" Market model which includes DSO and TSO coordination, where both local and central needs are considered, and TSO has access to DSO-connected DERs
- Congestion Management
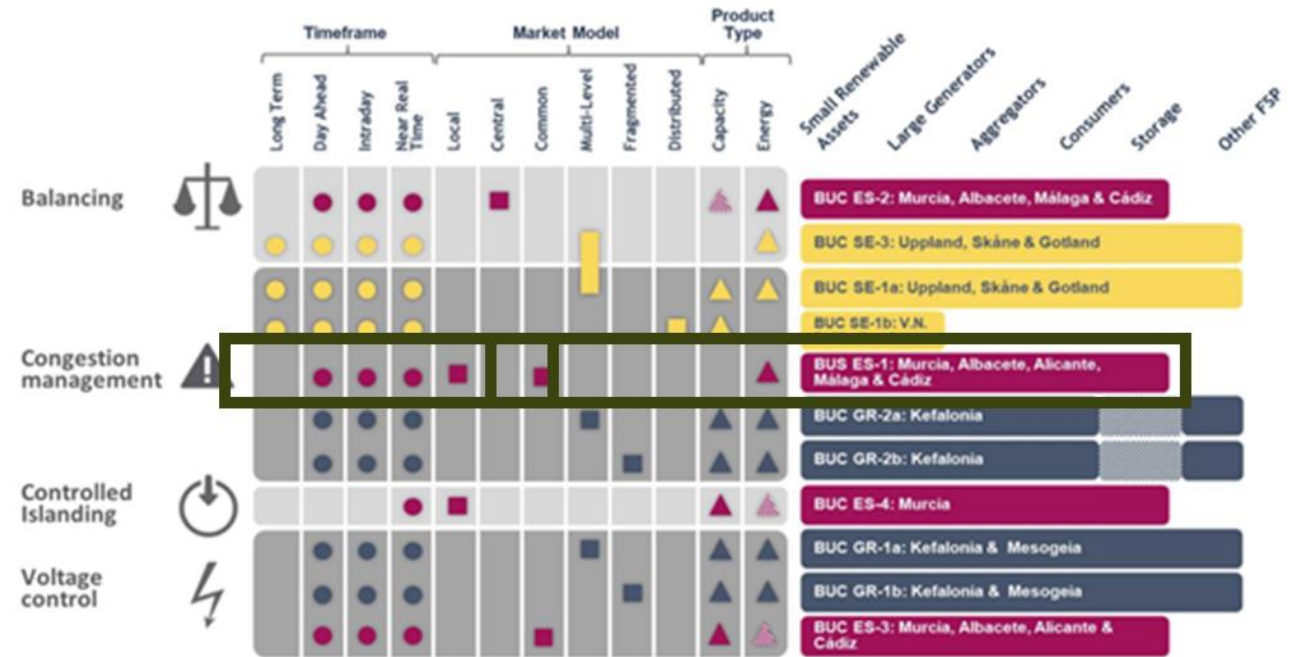
Figure 2: Overall CoordiNet approach: Services, timeframes, coordination schemes and products that will be demonstrated in different countries (Spain in pink, Sweden in yellow, and Greece in grey)

Coordinet Project – Spanish Demonstration Overview

- In the Spanish Demonstration, different platforms existed for the TSO, DSO and Resource aggregators, and the information was shared via TSO platforms, along with Marketplace platform integrations in some cases (e.g. E-distribucion used N-side vs i-DE developed the marketplace as part of the DSO platform)
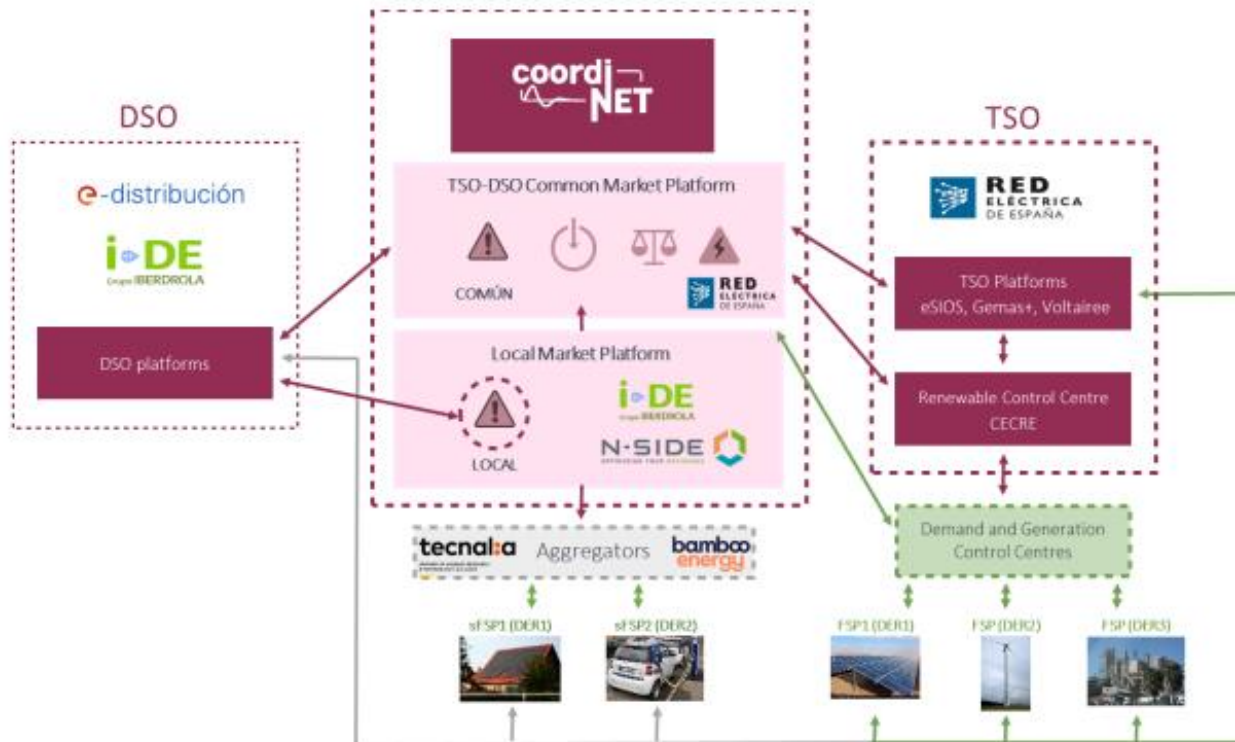
Figure 1 Platforms developed and adapted for the CoordiNet Spanish demonstrator
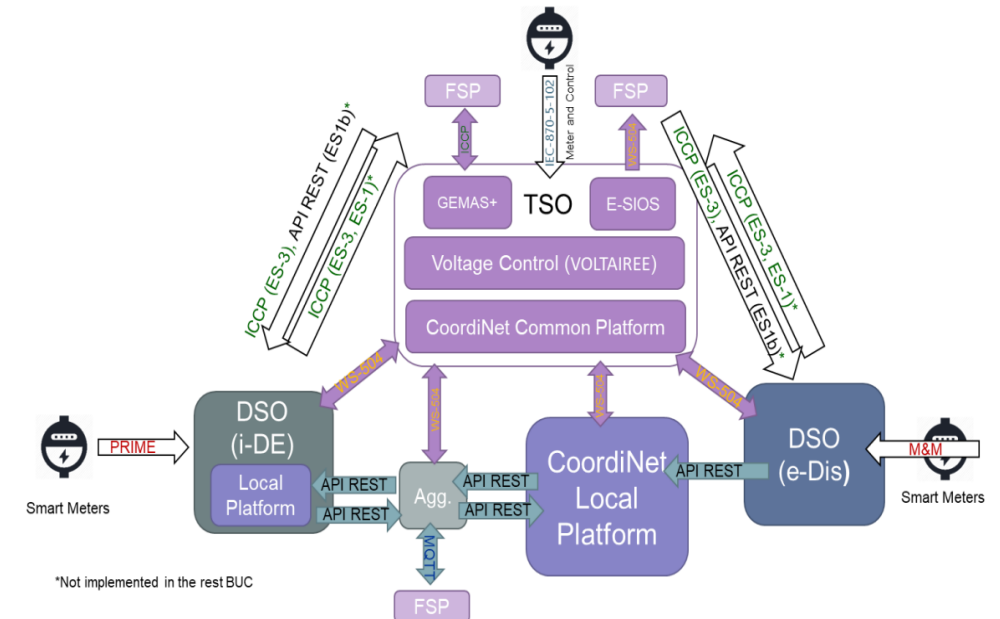
Figure 53.- ICT Architecture implemented in the Spanish Demo. Communication between FSPs and the two DSOs is identical, the figure only shows one for clarity reasons.

Coordinet - Spanish Demonstration Deep Dive

- Example: Congestion Management use case with a "Common" Market Model
- E-Distribucion (DSO)'s internal technical platform (not within the shared platform) used to capture congestion in the Puerto de la Cruz Substation
- Congestion identified with the red line
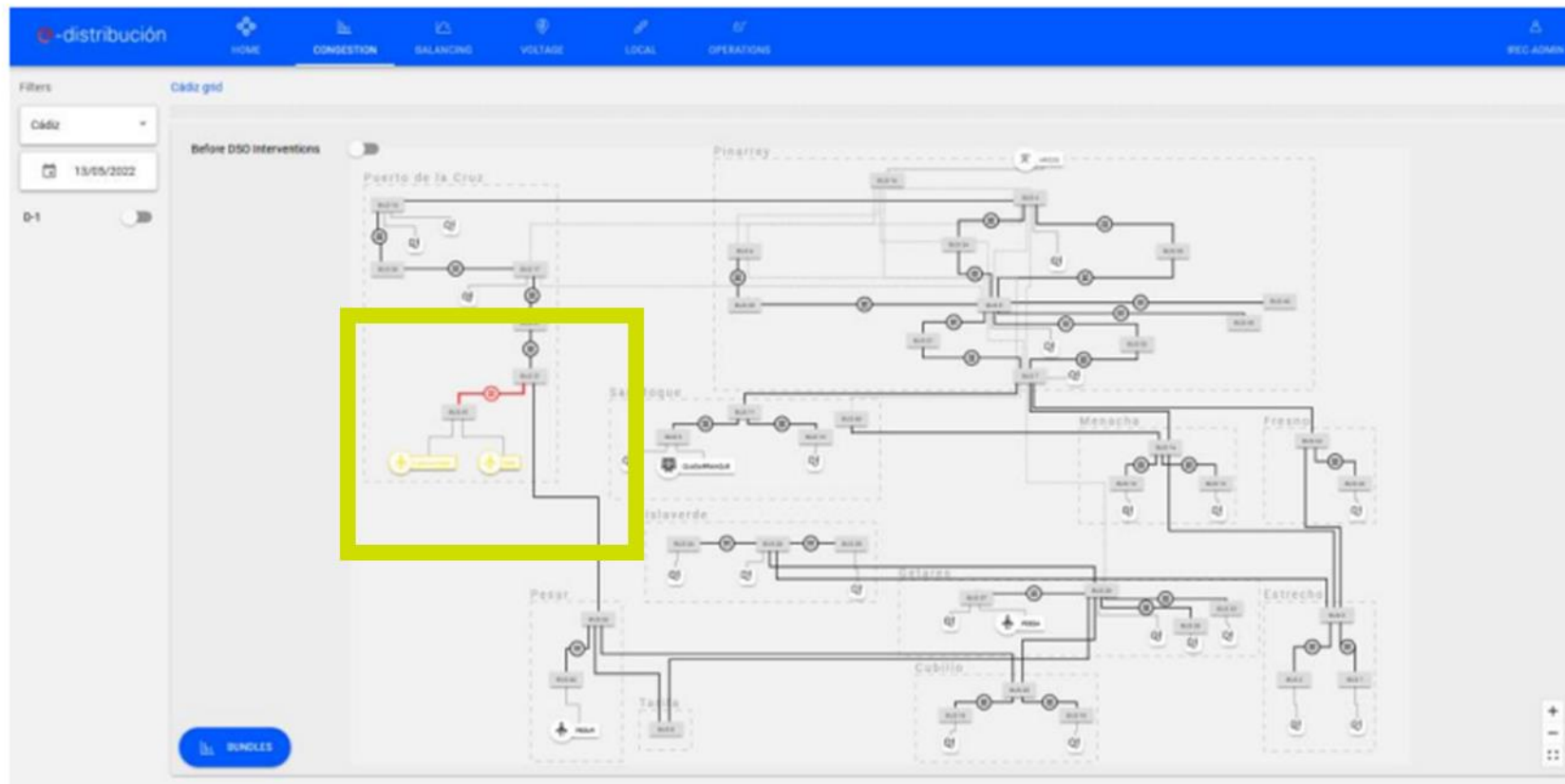
Coordinet - Spanish Demonstration Deep Dive

- Within the internal technical platform (outside of the shared platform),when congestion is detected, E-Distribucion (DSO) issues a power limit based on this congestion

Coordinet - Spanish Demonstration Deep Dive

- Once the power limit is placed, this information is also displayed for TSO visibility.
- Pictured below: Congestion bundles screen in GEMAS (CoordiNet Common Platform)

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Coordinet - Spanish Demonstration Deep Dive

- The power limit is also received by the FSP.
- Picture below depicts the supervision screen of the SCADA in the FSP Control Center.
- The limit sent by the SO is represented by the orange line, and how the FSP applies this limit is represented by the blue line.
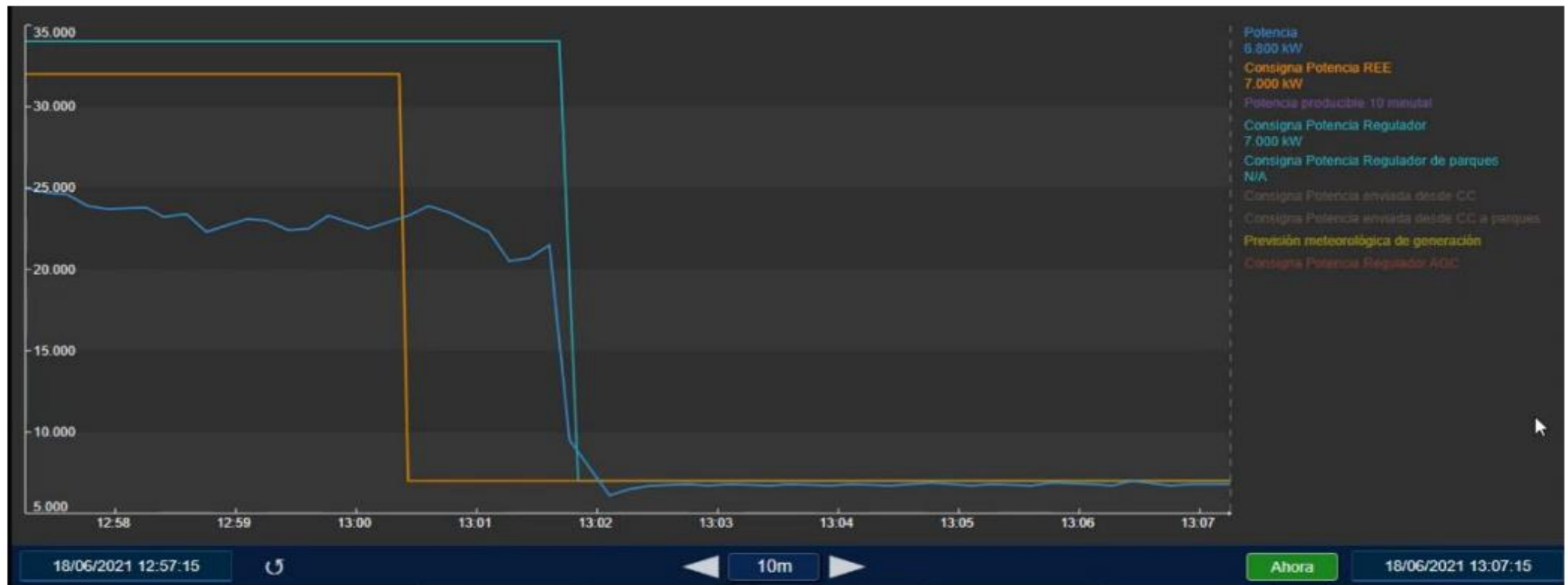
Solution overview – OneNet Project

OneNet - One Network for Europe, will provide a seamless integration of all the actors in the electricity network across EU

Timeline: October 2020 – March 2024

Objectives:

- Define **Common** Market Design, IT Architecture and IT Interfaces.
- Large-scale demonstrations to implement and showcase the scalable solutions.
- Products and services, integrated and coordinated markets, Integrated system operations, Open IT Architecture, Reference IT implementation
- Four clusters of demonstrations spanned various DSO territories across countries.
- Final project stage: from One-Net to EU wide implementation, and external interactions

Detailed Work package descriptions
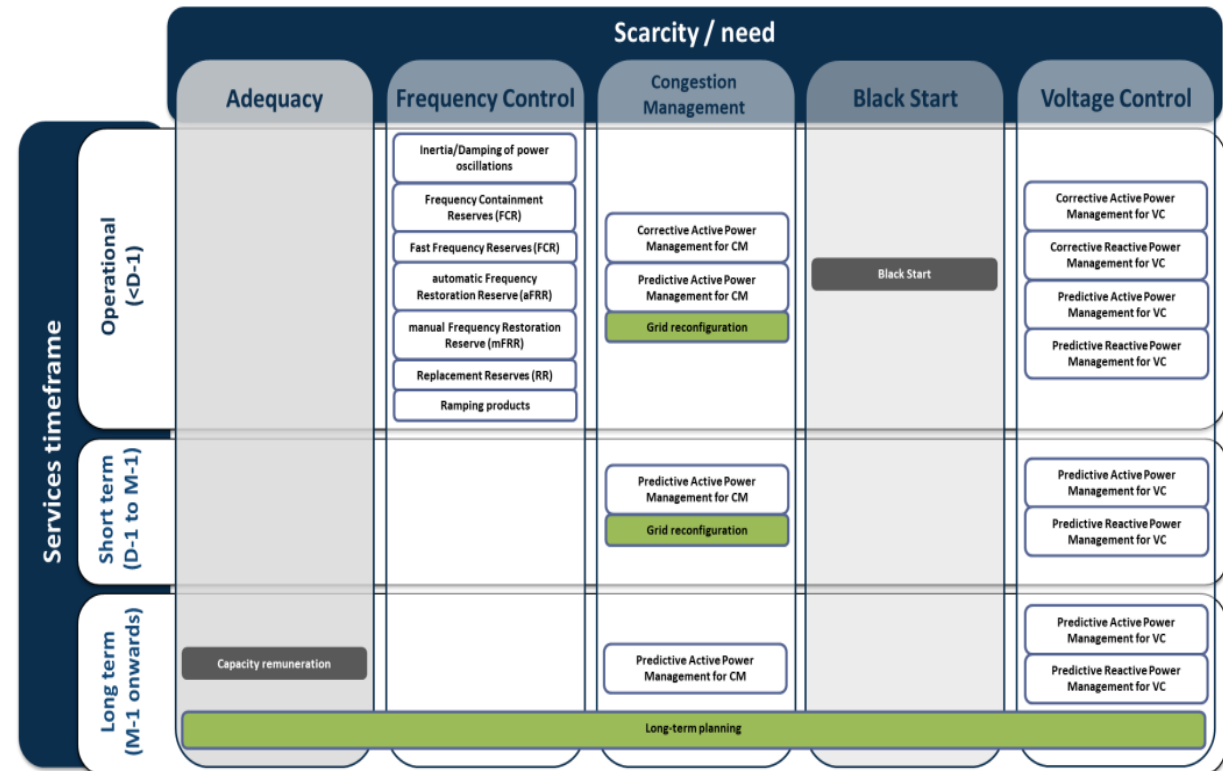
Solution overview – OneNet Project

- Concept of Integral Market Platform (IMP)
- The role of the integral market platform is to provide a framework that will enable TSOs, DSOs, and other grid flexibility users (e.g., balancing responsible party) to procure and use flexibility services through harmonized flexibility products and to orchestrate data exchange in a standard way among all market participants.
- Validated through four national demos in the Cluster East (Czech, Slovenian, Polish and Hungarian)
- Different layers
  - **User layer**: System Operator group (TSO and DSO), Market Operator, Flexibility Services Provider
  - **Market layer**: business and functional sub-layers
  - **Service layer**: catalog of services
  - **Data governance**
  - **Data interoperability**: Common Information Model
  - **Data sources**
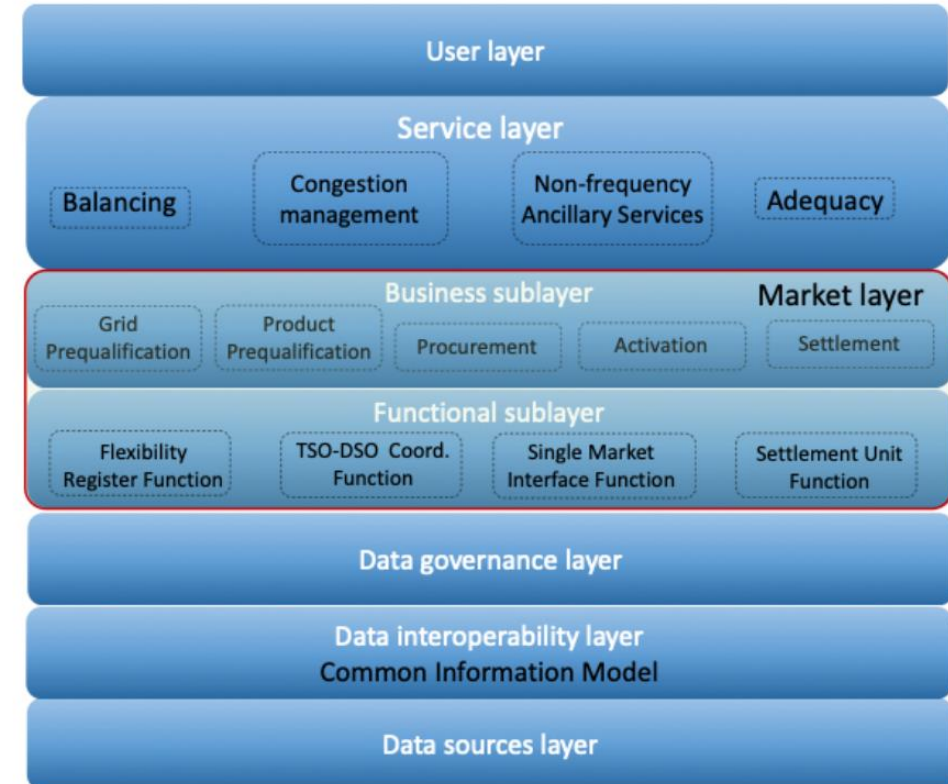
Detailed information on integration of national market platforms with OneNet systems is lacking.

Solution overview – IBM/Ofgem

- Ofgem (regulator in the UK) brought on IBM to investigate the potential role for a System-wide Flexibility Exchange (SFE). A SFE platform could facilitate the interaction between flexibility service providers (FSPs) and market operators (MOs) through data exchange.
- Ofgem published a paper on enabling smarter, more flexible grids in 2017 (updated in 2018) with the UK Department of Business, Energy & Industrial Strategy.
- IBM responded to Ofgem's call for consultation on Delivering Faster and More Reliable Switching, which included themes of flexibility and providing market services (Dec 2017).
- IBM recently covered potential use cases for a Flexibility Services Platform in December 2022.

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Solution overview – IBM/Ofgem

Explored three market archetypes:
- Thick SFE platform: end-to-end delivery
- Thin SFE platform: bilateral interactions between parties
- Medium SGE platform: enabling coordination across markets

Green denotes use case will be handled **on platform.**
Red denotes use case will be handled **off platform.**
Use cases highlighted in orange were determined to be out of scope.

Archetype	UCs delivered 'on' the SFE platform	Feasibility of Technical Implementation
Thick	●	◔
Thin	◔	◑
Medium	◕	◕

Table 8. Depicts proportion of UCs the SFE platform delivers for each archetype, and technical feasibility
*Estimate is approximate, highly dependent on the UCs Ofgem decide to implement

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| Use Case ID	Title	Archetype		
		Thick	Thin	Medium
1	Maintain Taxonomy	1	0	1
2	User Registration	1	1	1
3	Asset Registration	1	0	1
4	Product Registration	1	0	1
5	Rule Enablement	1	0	1
6	Reporting on prices and volumes for market trends	1	0	1
7	External information provision (market rules)	1	0	1
8	Asset value based on historic data	1	0	1
9	Understand Eligibility for Prequalification	1	0	1
10	Reporting on trade, dispatch and settlement for asset performance	1	0	1
11	Market Conflict Identification	1	0	1
12	Visualisation of Assets - De-prioritised			
13	Market testing of Products	1	0	1
14	Streamlining Contracts across markets and products	1	0	1
15	Centralised PreQualification	1	0	1
16	Visibility of Current & Future Flexibility Needs for all Networks	1	0	1
17	Fully Informing Consumers - Deprioritised			
18	Transparency of DER Positions & Actions	1	0	1
19	Grid Supply Point Visibility for DER Assets - De-prioritised			
20	Probabilistic Products enabling Small Assets	1	0	1
21	Facilitate Small Asset Participation	1	0	1
22	SO Disclosure of rational behind asset dispatch	1	0	1
23	Ability for SO to veto another SO planned dispatch - De prioritised			
24	Transparency of Proposed and Planned Assets - Deprioritised			
25	Secondary Market	1	0	1
26	Transparency of assets below 3.5kW			
27	Bid strategy support - 3rd party	1	0	0
28	Asset value prediction - 3rd party	1	0	0
29	Change Management	1	0	1
30	Streamlining user rating	1	0	1
31	Risk Calculation	1	0	1
32	Settlement	1	0	0
33	Dispatch	1	0	0
34	Optimisation across all markets and voltage levels	1	0	
35	Auctions	1	0	0
36	Simple market participant search	1	1	1
37	Market monitoring	1	0	1
38	Impartial route to recourse in case of dispute	1	0	1
F1	Feature - collect data on prices, volumes, dispatch, trades, settlement	1	0	1

Solution overview – TDXAssist

- Project focuses on TSO-DSO interoperability, as TSO-TSO is already established in Europe by ENTSO-E.
- Project (which ran from Oct 2017 – Sept 2020) aims to study interactions between DSO and other market participants (i.e.: DSOs, Aggregators, Microgrids, etc.).
- Goals of the project included:
  - Defined interface specifications for TSO-DSO info exchange based on Use Case analysis and International Electrotechnical Commission (IEC) standards.
  - Interface specifications for automated info exchange between DSOs.
  - Proof of Concept using field tests and demonstrations with industry specifications at TSO and DSO levels.

Solution overview – TDXAssist

BUC: Business Use Case
SUC: System Use Case
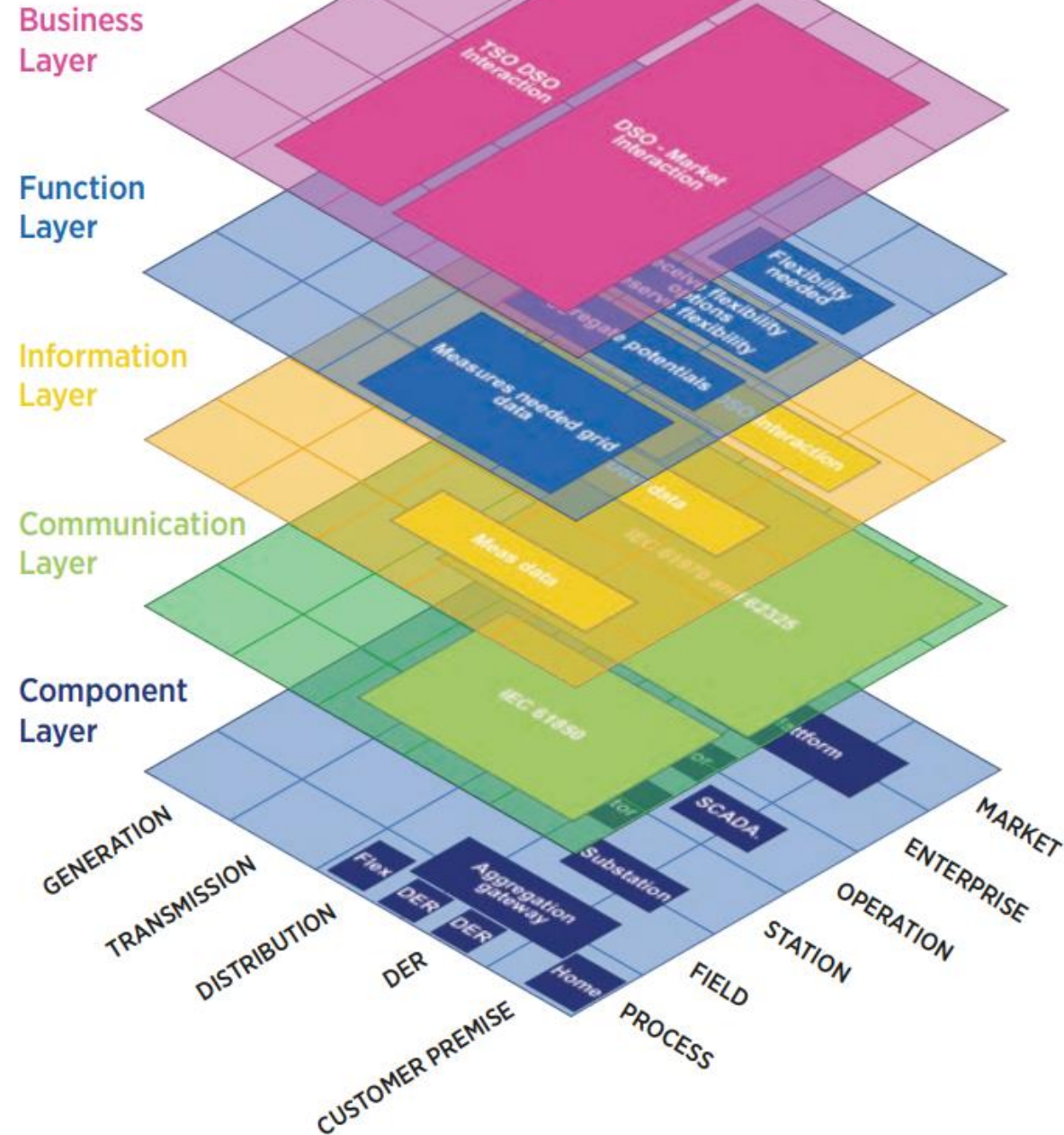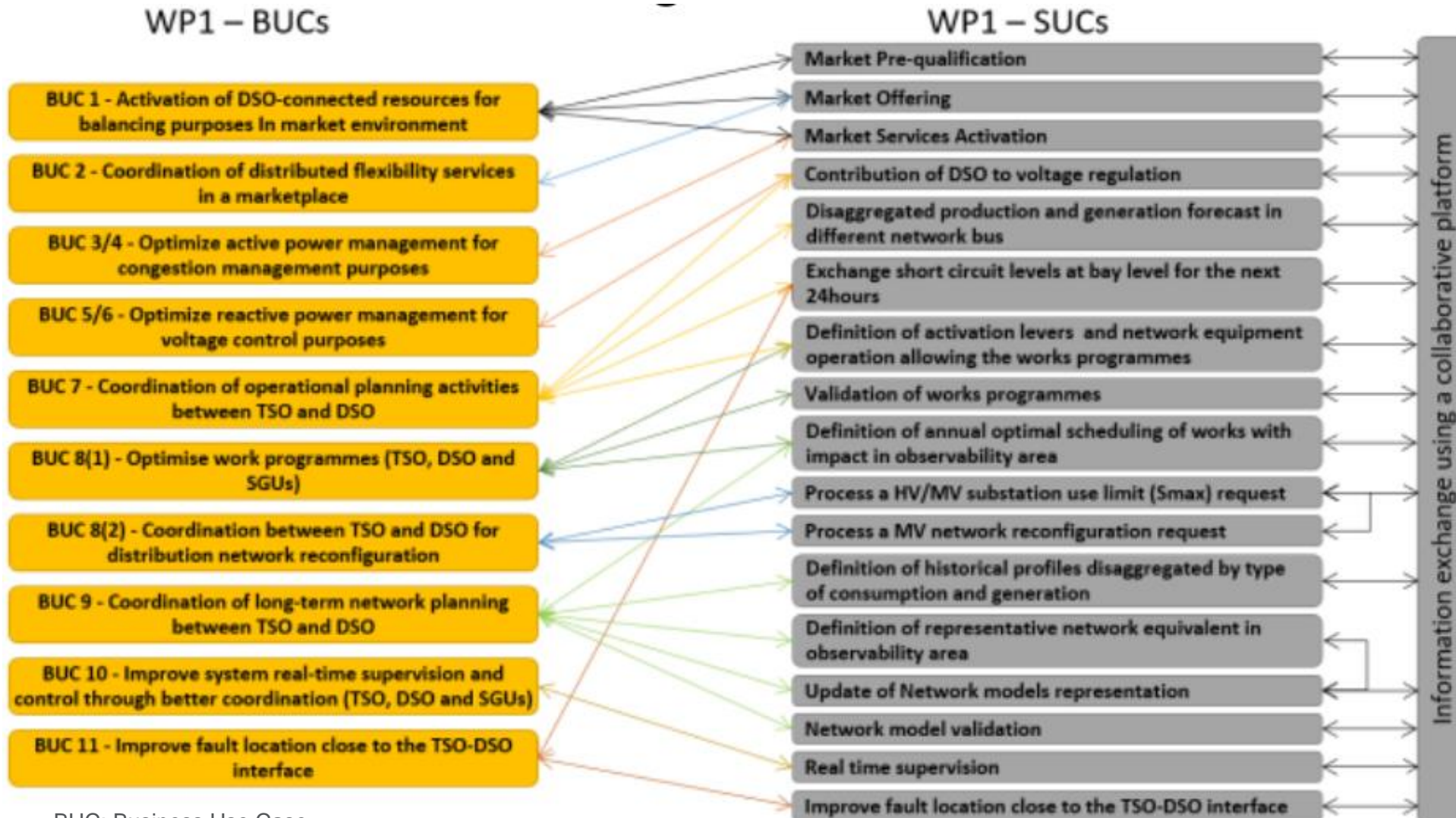
Solution overview – TDXAssist

- TSO-DSO coordination happens in 'Business Layer' of platform
- Substation load and generation forecasting required at day-ahead level
    - DSO does the forecast; TSO receives info from DSO and proceeds to secure bulk generation
- Real-time data to better understand counterparty signals
- ENTSO-E Communication & Connectivity Service Platform (ECCo SP) is a standardized communication platform, consisting of an Energy Communication Platform as well as the ENTSO-E Data Exchange deployed as a software solution for TSO communication.
    - Examined for use case in which flexibility service providers placed a bid in the market
- TSO responsible for balancing system even though DERs are on Distribution network.
- Smart meter rollout unifies the access to relevant data.

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Solution Overview – INTERRFACE's IEGSA Platform

- The INTERRFACE Interoperable pan-European Grid Services Architecture **(IEGSA)** aims to facilitate competition between energy markets by linking wholesale, retail, balancing and new congestion management markets
- Included external **Market Operator – NordPool**
- Architecture is comprised of four main modules: Flexibility Register (FR), **TSO-DSO Coordination Platform (TDCP)** Single Interface to Market and Settlement Unit
- The demonstration project in Latvia, Estonia and Finland **owned and operated by a pan-European consortium of T/DSOs:** Fingrid (TSO), Elering (TSO), AST (TSO), Elenia (DSO), Elektrilevi (DSO)
- European Dynamics and Cybernetica were the **IT partners**
- The solutions have been tested in Estonia, Finland, Latvia
- The IEGSA platform is focused on both TSO and DSO use cases: Frequency response for TSO (mFRR,aFRR,FCR), and congestion management for DSO (operational and short-term)

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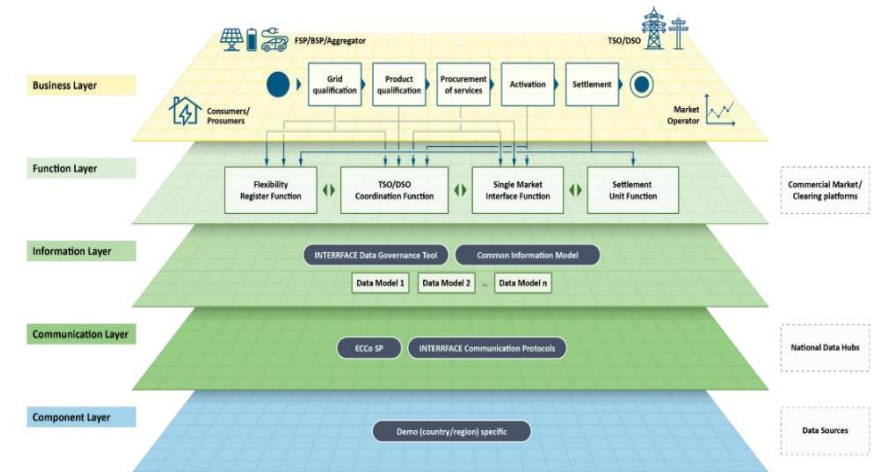
Solution overview – GOPACS and ETPA

- GOPACS: Goal is to mitigate capacity shortages in the electricity grid (congestion) and contribute to keep the Dutch grid reliable and affordable
- Acts as an intermediary between the needs of network operators and markets. It is not a market platform. Bids are passed along to the ETPA platform.
- ETPA is a spot power exchange for continuous intraday trading and market-based congestion management whereby ETPA provides the trading venue and acts as a Central Counter Party (CCP).
- The GOPACS system is built and operated by EDSN (Energie Data Services Nederland) which owned by the TSO and all DSOs.
- Launched as a pilot, then become a commercial solution in 2019.
- Magnitude of the available flexibility on the platform is between 10-100 MWh per trade.
- Minimum bid size depends on each market-platform linked to GOPACS (500 kW for ETPA)
- Forecasting is an independent process for TSO and DSO.
  - On the balancing side of the grid, the TSO is only concerned about consumption and production balance. Every party shows they have balanced their portfolio. Supplier can be active on multiple distribution companies. But the TSO only worries that the portfolio is balanced as a whole.
  - Transport forecast is on a regional level. For instance, on Stedin (DSO)'s grid, there is a focus on examining feasibility of facilitating the transport of the grid. This produces a different number from the total portfolio of supplier. This is why it has been developed as 2 separate systems

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Solution overview – GOPACS and ETPA

GOPACS: Grid Operator Platform in the Netherlands for market based congestion solutions
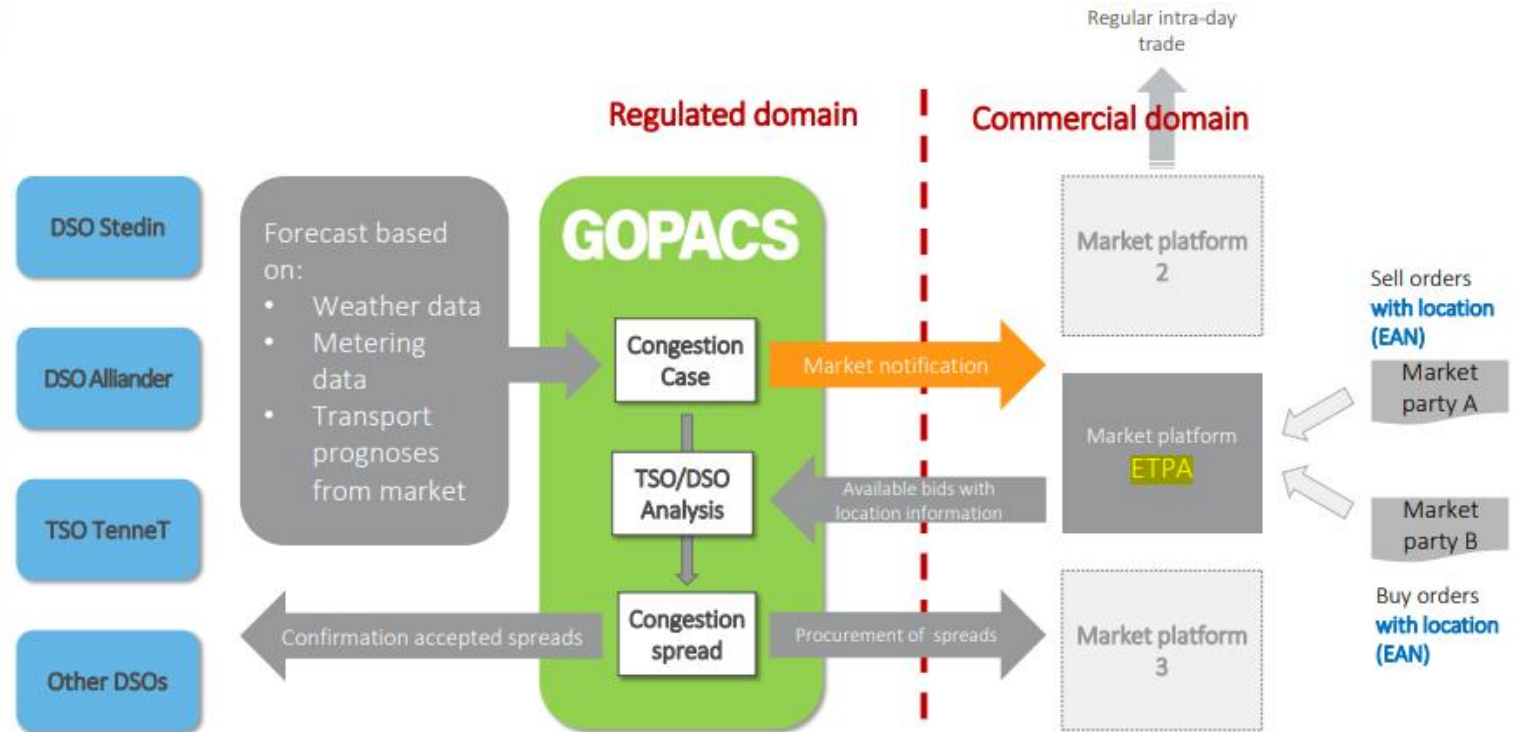
Observations and next steps

Observations

- **There is no one solution to effectively accomplish T/D coordination, it will need a whole eco-system**
  - Complexity of T-D coordination was highlighted by some of the deep-dive examples
  - Jurisdictions have taken many different approaches: some have built new platforms, some have enhanced platforms already in place, some have only dealt with one component of the DER lifecycle through a platform or have used a combination.
  - There is no one-size-fits-all platform out there. Each solution tackles a different component of the DER lifecycle. A combination of existing and new tools will provide the required landscape for coordination of DERs and accomplish T/D coordination of these DERs to unlock maximum potential.

- **Role of existing markets**
  - The shared platforms have common starting points, adapting TSO-DSO coordination based on market structure.
  - Some projects have attempted to "fit" the assessment of flex services in the existing market structure; attempt to adapt the TSO-DSO structure based on the market process.
  - For example, CoordiNet

- **Shared processes can be built for TSO and DSOs, thus sharing requirements**
  - Processes between TSO and DSOs can be shared. For example: registration can all happen in the same place
  - This would minimize the burden of information exchange, especially in cases where new information is required.

Observations

- **The importance of inputs and outputs**
  - Identify what key inputs and output will be, and where they will come from – whole system approach
  - Understand inherent requirements. For example, for a standard Flexibility Register to function, it would need to store asset information, trading results and receive metering data.
  - Defining inputs and output also provide clarity for data exchange nuances. For example, if network limits need to be communicated, will it be done at a "zonal" level or "nodal" level? Are zones and/or nodes defined differently between system actors?

- **Interaction between platforms**
  - To enable information exchange needed within the shared platform, important to understand how all the system actors existing platforms will interact with each other. Look at it as a whole landscape, just not one solution.
  - This process will also help highlight if enhancements to existing roles and processes are required to enable the shared platform functionalities.

- **Further specifications will dictate requirements**
  - Specify users: Defining users in the shared platform landscape is going to be important. To establish who does what, plan what roles exist. These will dictate requirements.
  - Specify grid services: It is crucial to specify the grid services or products that will be encompassed within the shared platform.

Next Steps – B3 Workshops

Workshops will aim to define business, functional and technical requirements for a shared market platform in Ontario. We will also identify benefits beyond coordination. In a subsequent workshop, we will identify integration requirements. Note: The coordination protocols developed for Ontario will be aligned with the requirements for this deliverable.

Structure

- Grid Services - It is crucial to specify the grid services or products that will be encompassed within the shared platform.

- Pre-market operations
  - Registration and Pre-qualification
  - Visibility into flexibility Requirements

- Market Operations

- Bidding, Matching and Price formation
  - Activation/Deployment processes
  - Coordination with existing system actors
  - Outage management and coordination

- Post- Market Operations
  - Measurement and Verification and Settlement

Next Steps – Stakeholder feedback questions

Engagement Questions:

1. Are there any key highlights/insights you would like to add to the functionalities that were identified in this market intel?

2. Would you like to add additional context/details for the shared platforms reviewed in this market intel?

3. Are there any other functionalities that you consider important for the shared platform?

4. Are there any additional observations you would like to highlight from this market intel for consideration in the requirements gathering stage?

A section for general comments

Thank you

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APPENDIX

Registration and Asset Pre-qualification – By platform

Platform	Market Operator	DSO	TSO	Platform
CrossBow	Responsible for resource and participant registration			
Enera	Marketer registers	Connecting grid operator reviews and allocates them to correct market region		
NODES				Platform verifies assets to qualify on platform. Flexibility register visible to the TSO/DSO. As part of the prequalification process for NODES-IntraFlex and NODES-NorFlex, NODES requires the T/DSO to approve flexible assets by verifying in which grid area (at the lowest voltage level) the asset is located. To aid in the pre-qualification process, rulebook is developed with a core set of requirements (submit registration form, complete technical build, end to end system testing and asset approval.
N-side				Supported
Piclo				Register on Piclo, upload assets using Excel with detail or API. Update at any time. A subset of that becomes visible to the LDC/ISO. Voltage, power type, location of assets, and more are verfied against constraints. Company must pass qualification (legal, control capability, other SO defined parameters, insurance, etc.). Full set of aggregator information is passed to SO for eligible assets. Automatic qualification, up to the SO to define qualification parameters. They can disqualify if necessary. Piclo operates a Dynamic Purchasing System (DPS) register that enables DSOs to set the duration that a FSP remains qualified to bid for flexibility services. When DPS exists, Piclo performs an automatic qualification assessment for every competition for each DSO
Coordinet				For Spanish Demo: Test activations and pre-qualification done by DSOs.
Crowd Balancing Platform Equigy			Approved by the TSO. Exploring an automatic pre-qualification of specific device types via APIs to the OEMs	
INTERFACE		T/DSOs and marketplaces may require parallel prequalification.		Flexibility Register: Is a country-specific module that enables Flexibility Service Providers (FSPs) to bring their flexibility resource/product to markets. Assets must qualify with platform
FLEXITRANSTRE				The FEG platforms includes a central component that acts as the glocal registry of FEG installations
Xflex				Each flexible unit will be registered in MARKETFLEX before participating in the market. Saved as metadata during registration, includes: Device ID, Owner, Name, Geocentric Coordinate System, Node (Connection point ID defined by the DSO), Meter ID, contracted power, minimum and maximum operating power, operator, contact of the operator (tel number, email).
Euniversal	Different flexible resources (RA/RP) can qualify for the flexibility market. RA/RPs can request qualification when their assets meet market access requirements as defined by the DSO and the FMO. If the prequalification is successful, the RA/RP becomes an approved FSP for the respective assets on the flexibility market. The FSP can now create offers on the flexibility market. If the prequalification is not successful, the RA/RP cannot register the assets nor create offers on the flexibility market. In this phase, it is also assumed that the DSO registers on the market platform as a buyer and defines grid areas to determine the locations of flexibility potential in all BUCs.			

Flexibility Requirements – By Platform

Platform	Forecasting
IBM-Ofgem: System Flexibility Exchange/Utility Flexibility Platform	In-platform with the goal of showing DER/A what their potential asset value is (most likely on both TSO and DSO level, especially if DER/A is participating in more than one market)
Open Access Technology International (OATI)	
Olivine	Allows ISO and DSOs to directly communicate their flexibility requirements to DER services providers for forward market solutions (e.g., capacity, ancillary services, distribution capacity deferral, etc.)
NODES Platform & Market Metering Service (MMS)	T/SO requirements submitted to, and publicised within, platform.
N-Side	
Piclo	No forecasting capabilities exist on the platform.
Coordinet	The flex tool component of the market platform integrates with the TSO tool called SUSIE that is used by Swedish TSO to request temporary subscriptions. The market tool has a link with mFRR market platform to forward unused bids of resources that are prequalified for TSO mFRR market.
Crown Balancing platform by Equigy	TSO may input requirements offers on platform.
GOPACS	Separate forecasts created for TSOs and DSOs, and need is pushed through to the spot market.
INTERFFACE	Inputted on the platform, and then routed to afficilate marketplace.
FLEXITRANSTRE	System services are defined as a need from the system operator that can be supplied by the market participants by bidding their flexibility capacity in the flexibility marke
Xflex	GRIDFLEX makes the forecast of network conditions (to predict the available capacities) based on a power-flow calculation using the forecasts of production from the renewable energy sources (RES) and non-flexible loads consumption. GRIDFLEX makes forecasts for non-controllable consumption and generation from variable RES. The DSO, with the help of GRIDFLEX, runs the power-flow simulations and the state estimation module to calculate the available capacities at each node/feeder. The available capacities are then sent to MARKETFLEX, and the DSO signals the feeder statuses to MARKETFLEX with a 'Traffic Light Signal'. Once the market is run, MARKETFLEX sends the results to GRIDFLEX which calculates the new grid power-flow by adding the confirmed activations of capacities
Euniversal	DSO determines the geographic scope according to its needs by defining grid areas defined by a grid node or a set of grid nodes

Market Operations – Bidding, matching and price formation

Platform	Bidding	Matching	Price Formation
Crossbow	The market operator receives bids/offers from market participants. The prosumer decides whether to bid or not based on the wholesale forecasted price when a market operator sends a demand reduction request.	Balance Response Party (BRP) actively balances supply and demand for its portfolio of producers and prosumers in the most economical way. It is financially responsible for the imbalances to be settled with the connecting TSO.	
Enera	Flexible power owners commission a third party (marketer or aggregator) to aggregate and control and market them on the trading platform within the same market region.	Wherever potential congestion could occur, grid operators define local market regions and allocate them to an order book. The demand of the grid operators is matched with flexible active power offers there with price and quantity of flexibility.	
IBM-Ofgem	Rules engine to be applied to bidding process, factoring in participation in multiple markets	In-platform	Historic prices (and corresponding volume) made available, broken down by asset type to more clearly show market trends
Nodes	Allows DER services providers to submit offers for specific ISO and/or DSO services from pre-registered DER assets/aggregations for forward transactions	Within platform	Within platform
Equigy	Bids are submitted on the platform, but then routed to balancing markets.	Matching is done within national balancing markets	Prices are formed within national balancing markets.
GOPACS	Currently manual, future automation planned. Takes place in ETPA platform.	Takes place in ETPA platform	Takes place in ETPA platform.
INTERRFACE	External Market Operator – NordPool (3rd party market operator/facilitator). Aggregators submit bids on the NordPool platform. TSO-DSO coordination module performs a grid security assessment before activating resources.	NordPool	NordPool
DA/RE	Currently manual process, future automation planned.		
Xflex	Aggregator participates through Marketflex, with the following information: offered quantity, time period, price, type of product (divisible or non-divisible), timestamp)	MARKETFLEX checks the schedules from SERVIFLEX with the available network capacities from GRIDFLEX and confirms or rejects them.	
N-side	Within platform	Supported	Supported
Piclo	Defined by the user (ISO/LDC), implemented by the platform	Implementable	Implementable
Coordinet	Different for the different pilots within the project.	Managed by the same solution that manages bidding	Managed by the same solution that managed bidding and matching
Flexitranstre			
EUniversal	nly FSPs that are prequalified can submit bids. Use Nodes and N-side as market platforms.	Nodes and N-side	Pay-as-bid, actvation fee is the renumeration Nodes and N-side

Market Operations – Activation/Deployment processes

Platform	Activation
Crossbow	Aggregators are entities which accumulate flexibility from prosumers and sell it to the supplier, the DSO or the TSO, When demand side management is considered, aggregators have a contractual relation with prosumers at the TSO side (DSO prosumers not considered in this case). Aggregators offer to the TSO a way to balance their network, by first estimating their available flexibility and then measuring the performance. The most economically efficient option is then selected. Aggregators coordinate with the prosumers for demand response. Prosumers have to offer the energy in the market and may receive requests from TSO for load shedding / limiting their consumption.
IBM-Ofgem	In-platform
Nodes	Dispatch notifications are sent to Flexibility Providers/Aggregators/DER Owners
Equigy	TSOs send the activation signals via the platform to FSPs. FSP responsible for the activatiom of the devices via it's own systems
GOPACS	
INTERRFACE	Interrface is an intermediary platform, activation takes place in adjoining markets.
DA/RE	DA/RE issues activation instructions to FSPs via Secure File Transfer Protocol (SFTP) or Email Adapter (EA).
Xflex	The markets results consist of confirmed/rejected schedules and the clearing price associated with the confirmed activation. SERVIFLEX activates confirmed schedules based on market results and deactivates the rejected schedules. After market clearing has been done, the accepted bids will be openly shared through the X-FLEX platform. The USEF/UFTP protocol offers Responses messages ('FlexOffer' in USEF terminology) with the result of the bid (accepted or rejected) which can be sent directly to SERVIFLEX.
N-side	Supported
Piclo	Implementable
Coordinet	FSP activations- are out of the scope of this platform and are performed by the relevant grid operator.

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OneNet Work Package details

Work package	Title	Explanation
1	Ethics requirements	
2	Products and services definition in support of OneNet	Market solutions and digital platforms presented so far in the EU pilot projects, revisit European policy frameworks, summarize their contributions and benefits and build on this information to sketch the new products and business use cases proposed in the OneNet approach.
3	Integrated and coordinated markets for OneNet	Define a theoretical market framework for innovative market designs options based on previous and ongoing projects and initiatives; Study market integration aspects and interrelations of new market mechanisms with existing energy and flexibility markets and the overall economic framework; Design integrated market(s) to procure the standardized products for system services as defined in WP2;
4	Integrated System Operation for OneNet	link the market activities with grid operation with the target to maximize the integration of FSP e.g. RES. The goal is achieved both at TSO and DSO level while also the customer perspective is considered.
5	Open IT Architecture for OneNet	o design an open conceptual architecture for effective yet seamless operation of a smarter pan-European electricity system where market and network technical operations are coordinated closer to real-time among them and across countries. To provide requirements, functional and technical specifications, together with interoperable and standardizable interfaces for an open scalable decentralized interconnection of the platform, technology-agnostic adaptable and flexible IT reference architecture which fully supports the OneNet concept and provides the necessary backbone for the WP6subsequent implementation of the OneNet data sovereignty-preserving working space.
6	Reference IT Implementation for OneNet	develop a decentralized middleware that will enable the interconnection of energy actors and the seamless data management and exchange
7	Northern Cluster Demonstrator	The Northern Demonstrator includes TSO-DSO pairs from four countries and also shows multiple DSO interaction in one of these to demonstrate capabilities to provide network value in multiple DSO countries, of which there are many in Europe. Enabled by implementing the framework developed in the INTERRFACE and EU-SysFlex projects and scaling up both the number of networks and the capability of the flexibility enabling solution mechanisms
8	Southern Cluster Demonstrator	Describe, develop, implement and evaluate two pilot projects in Greece and Cyprus dealing with balancing and congestion management challenges facing system operators in the clean energy era, in compliance with the OneNet overall architecture. The TSOs and DSOs in both countries will share flexibility resources and coordinate their efforts to meet their augmenting regional challenges through grid services stemming from prosumers, aggregators, suppliers, producers, while at the same time they are optimizing the use of network assets and big data processing tools for network predictability and observability
9	Western Cluster Demonstrator	Run in three different countries – Portugal, Spain and France - and will allow for the implementation of a wide range of flexibility mechanisms to address both DSO and TSO needs, including coordination between market mechanisms and the planning and real-time operation of the grids
10	Eastern Cluster Demonstrator	Strongly relying on field test that will be performed on various locations and will be supported by various groups of Demo ClusterEast. Partners of the Demo Cluster East will develop and extend capabilities of existing flexibility market platforms for TSO and DSO grid services, which will be standardized to an appropriate European format
11	From OneNet demonstrators to EU wide implementation of coordinated market schemesand interoperable platforms for standardized system products	Analyze the results of the different cluster demonstrations to extract conclusions for EU implementation, including the corresponding supportive policies to enable TSOs-DSOs-customers to procure standardized system products in a coordinated manner through interoperable platforms
12	External Interactions for Large Impact of OneNet	key dissemination and exploitation activities at large impact
13	Dissemination and Exploitation WP13 will develop the ne	develop the necessary communication interfaces with the public (stakeholders, interest groups, media etc.) in order to raise awareness of the concepts, technologies and OneNet enabled application. t will highlight the innovation activities within the project but also actively engage with the relevant stakeholders in policy, regulation, technology, businesses and academia to ensure constant feedback to the project and to prepare the ground for large-scale uptake of our results.

Platforms out of scope for Market Intel stage

Platform	Reasoning for out of scope
Baltic Coca	TSO-TSO only coordination platform
NEBEF (Block Exchange Notification of Demand Response)	Demand Response only solution. Does not fit the objective of shared platform work.
Parity	Does not fit the objective of shared platform work.
Electron: Blockchain trading platform	Limited info available to the public
ARGE FNB – 50Hertz	Most info found online was in German
bne Flexmarkt	Most info found online was in German
MARI	Limited info found online
Big 5 (in-house)	Limited info found online
TERRE	Sounds like a DER only software; CyberPower Terra is an online platform for remote monitoring and management of an energy system. It provides 24/7 device monitoring and automatic status alarm to ensure a smooth system operation.
Dynamo Flexmarkt in Nijmegen-Noord	Limited info found in English
IGCC: imbalance netting project	Not related to the shared platform concept
Rigas Tehniska Universitate	University; no relevant platforms
SII (Italy)	Not much info found; one webpage in Italian only
TSO-DSO communication platform (IO.E)	Limited info found in English
ReFlex (Enedis)	Only one webpage found, with error :"The Amazon CloudFront distribution is configured to block access from your country"
AMT-SYBEX (Affinity Networkflow)	Only tackle one functionality, building a network flow to feed into forecast
Picasso	TSO-TSO only tool

Platone

- Platone aimed at defining new approaches to increase the observability of renewable energy resources and of the less predictable loads while exploiting their flexibility.
- The consortium of 12 partners from Belgium, Germany, Greece and Italy developed advanced management platforms to unlock grid flexibility and to realize an open and non-discriminatory market, linking users, aggregators and operators.
- The solutions developed in the project were tested in three European demonstration examples.
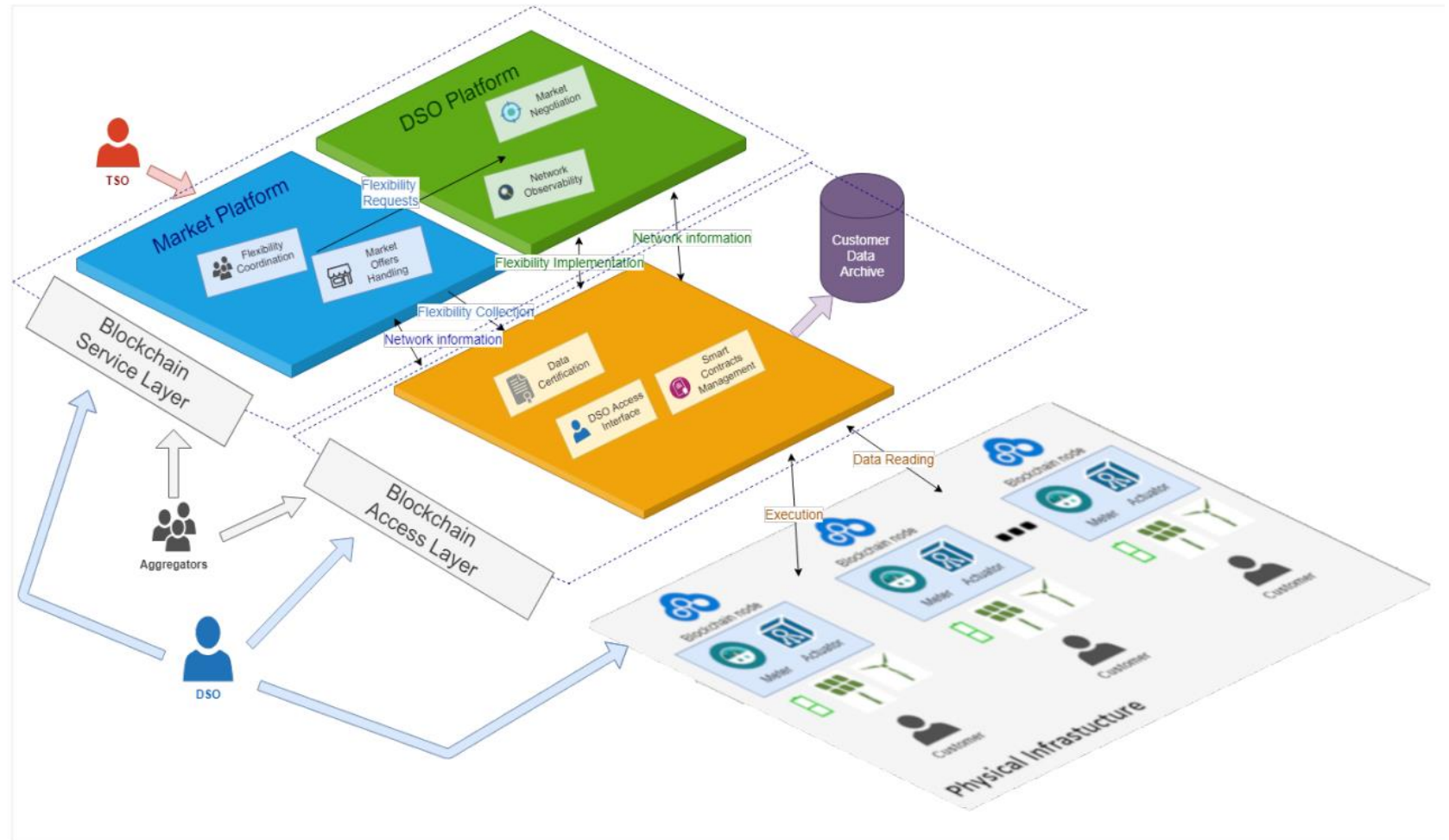

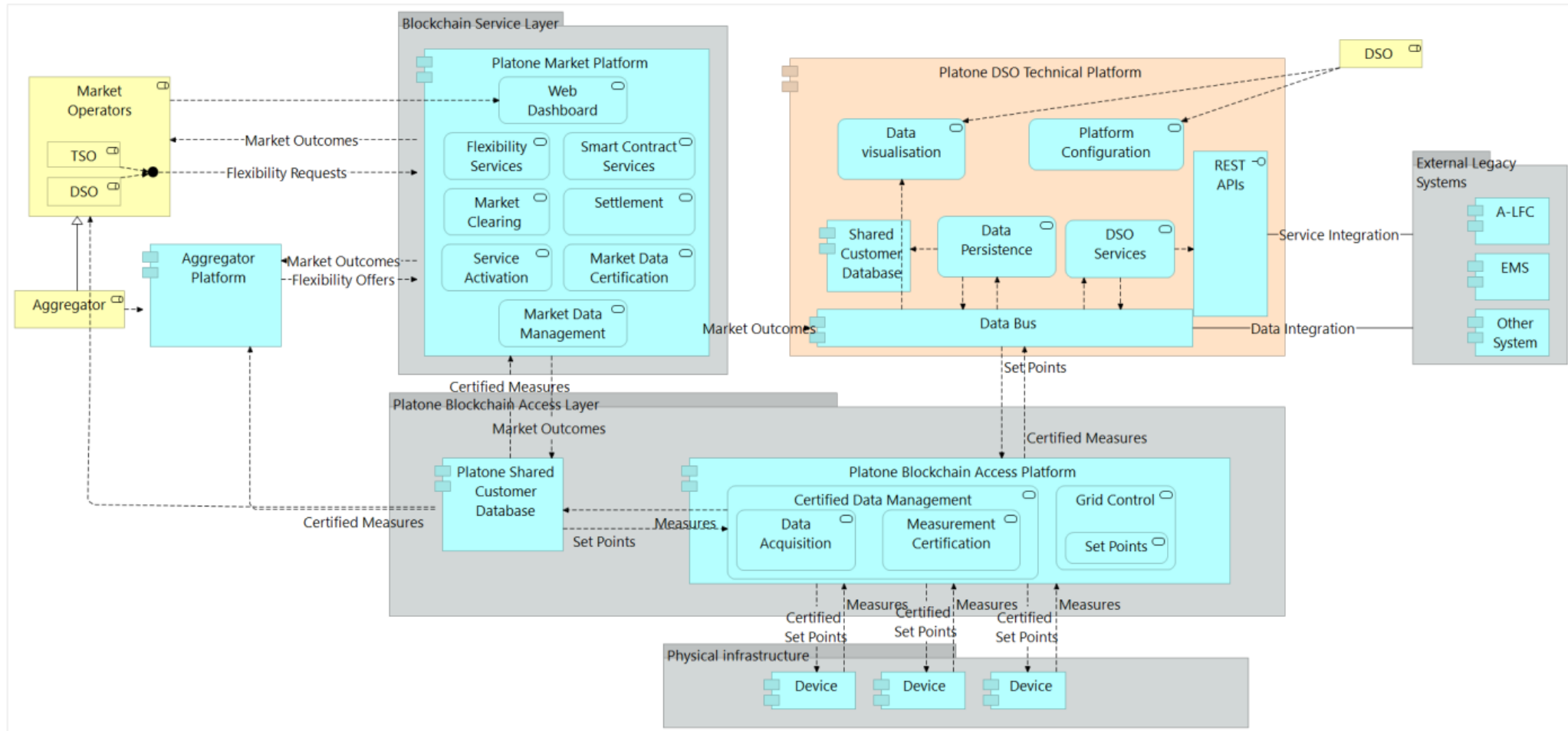Figure 2: Initial Platone Framework Architecture
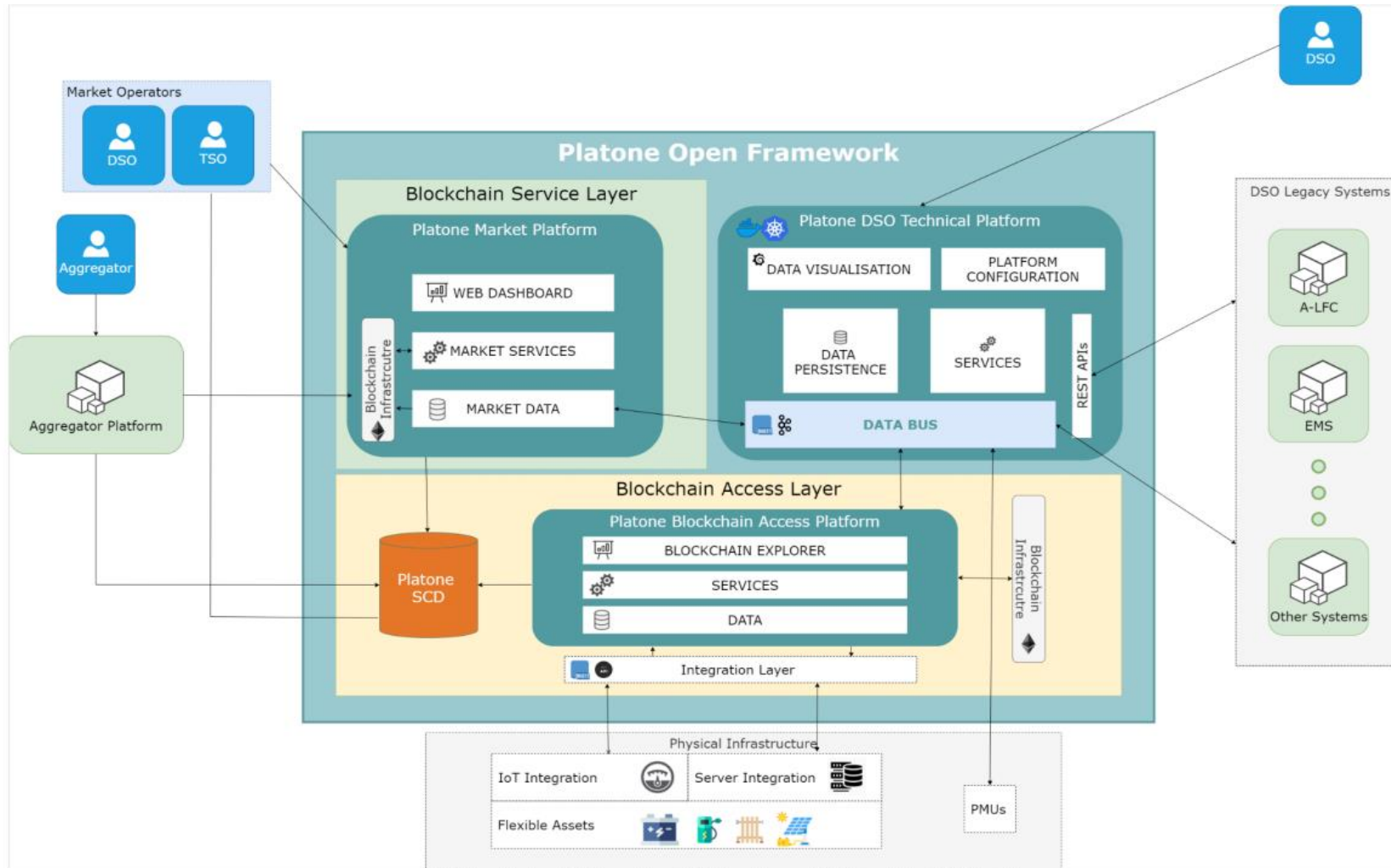
Platone

Figure 10: Logical View and functional components

Platone

Figure 5: Platone Open Framework