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TRANSITION
Show and Tell Session 2: Tools and Platforms

24th May 2023

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Host: Brian Wann

Agenda

Topic	Time
Introductions and Welcome	5 mins
Summary of TRANSITION	5 mins
TRANSITION Architecture	5 mins
Power Systems Analysis	10 mins
System Coordination	10 mins
Key Learnings	5 mins
Q & A Session	15 mins

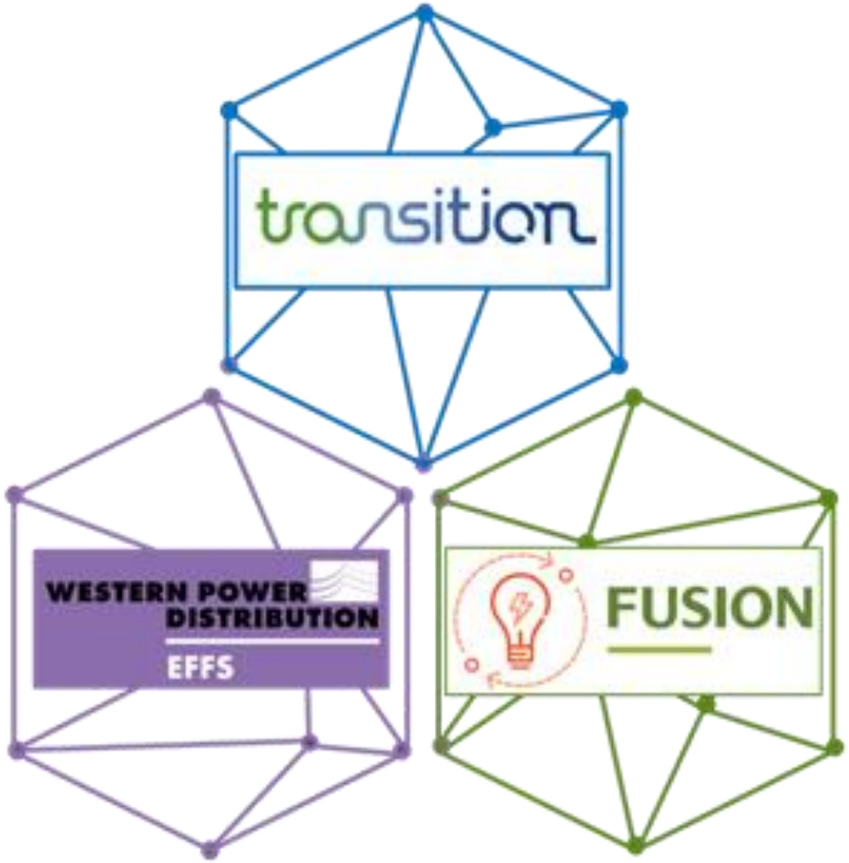
TRANSITION Summary

Working on understanding energy flexibility and its requirements for Smart Local Energy Systems. We're exploring the design requirements of a market for trading flexibility locally, understanding the roles of the marketplace and testing these through practical trials.

TRANSITION is working on…

- Market Development; Contracts, Services, Pricing
- Tools and Platforms; Market Platforms, Select and Dispatch
- Recruitment of Flexibility Providers; Aggregators, Assets

Through delivering energy flexibility trials, building system coordination tools and standardised markets.



TRANSITION Summary

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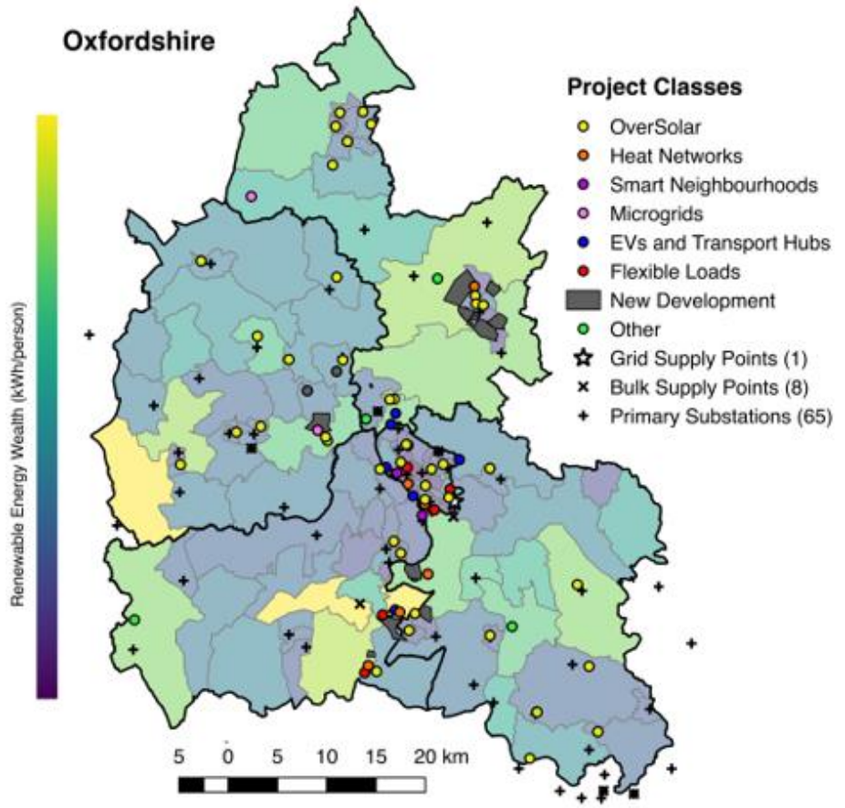
Increasing Complexity

Trial Period 1 (Winter)

Trial Period 2 (Summer)

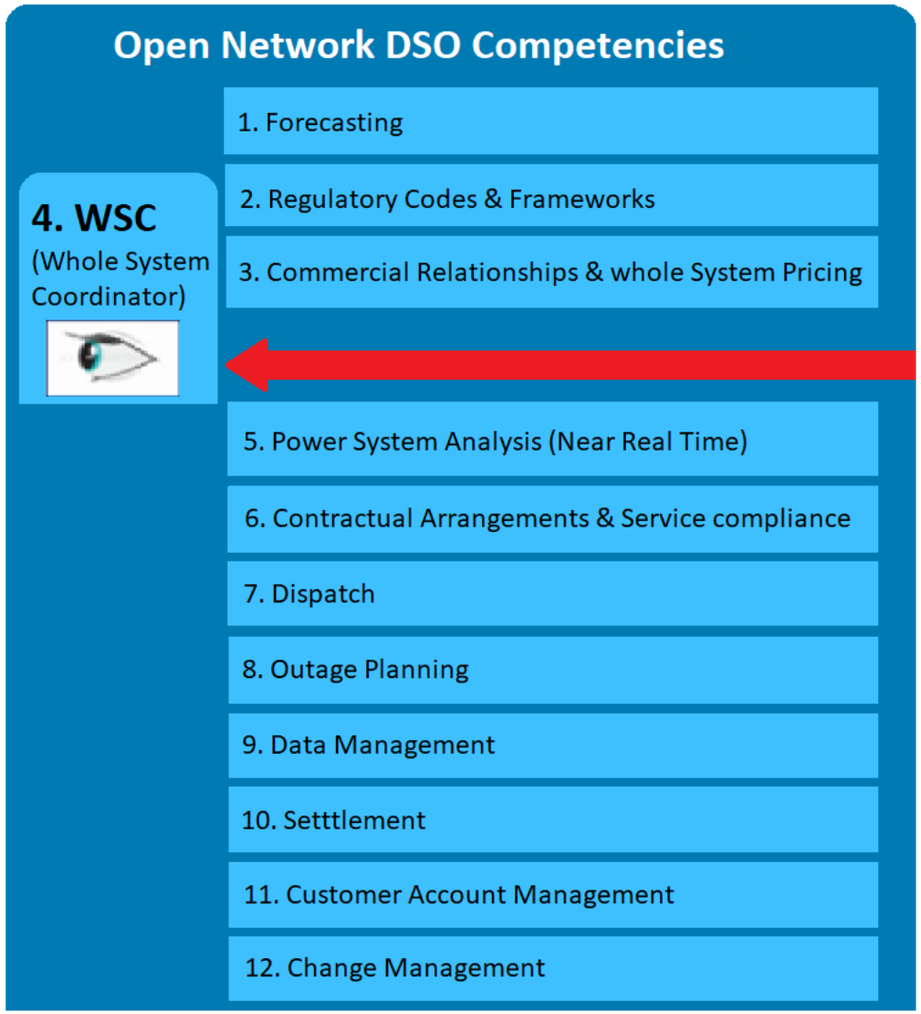
Trial Period 3 (Winter)

Technical Trials

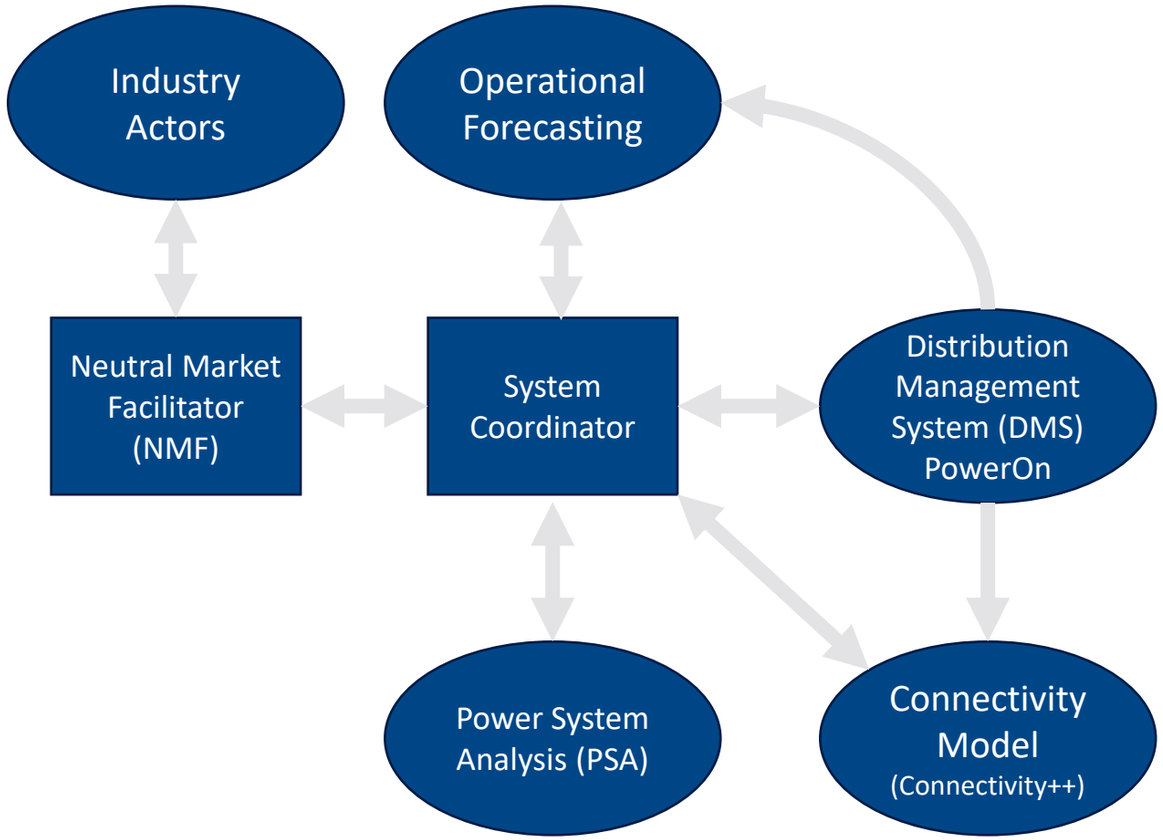


DSO Functions and Industry Needs

- ENA Open Networks has defined a number of competencies that are necessary in support of DSO function development
- “Flexibility First”, and in particular flexibility procurement closer to real time, will require a number of new platforms and tools
- “Neutral market facilitation” as a principle requires delineated roles and alternate routes to market for industry actors
- Flexibility implementation also requires the close alignment of technical processes such as PSA with commercial contracting and industry actor engagement – two sides of same coin
- Automated (as opposed to manual) processes are key to scaling DSO flexibility delivery, with direct integration to data via e.g. APIs
- TRANSITION has designed and delivered a number of new innovative platforms and tools in support of these aims

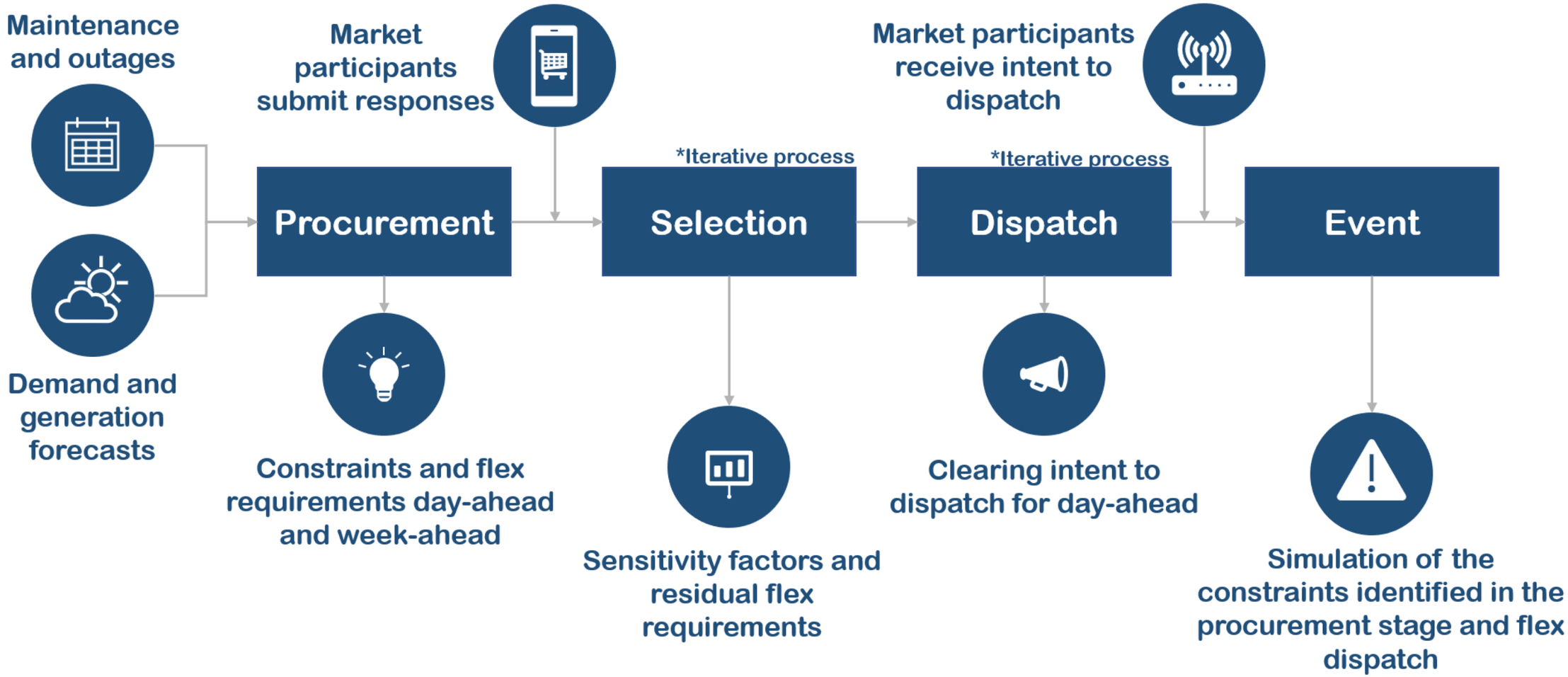


TRANSITION HLD of Tools



- **Operational Forecasting:** provides a view of **demand/generation** profiles at granular nodal level for 0-10 days ahead of real-time
- **Distribution Management System (PowerOn):** Provides control room view of **live/real-time network connectivity** and power flows
- **Power System Analysis (PSA):** Computes anticipated **power flows** under different near-term topology change and forecast scenarios
- **System Coordinator (WSC):** Provides the core intelligence for **flex market decision making**, allows an input interface for control room, and manages automated data flows between sub-component DSO systems
- **Neutral Market Facilitator (NMF):** Provides a user interface **portal for DSO interaction with the Industry Actors** to enter/accept their available flex service volumes/costs, and for them to request approval for peer-to-peer (P2P) capacity trades
- **Connectivity model (Connectivity++):** The **master model that holds the network** and how customers relate to it and master repository for key **network parameters** (e.g., impedance, ratings and normal running arrangement).

Process Flow



What is PSA and what does it do?

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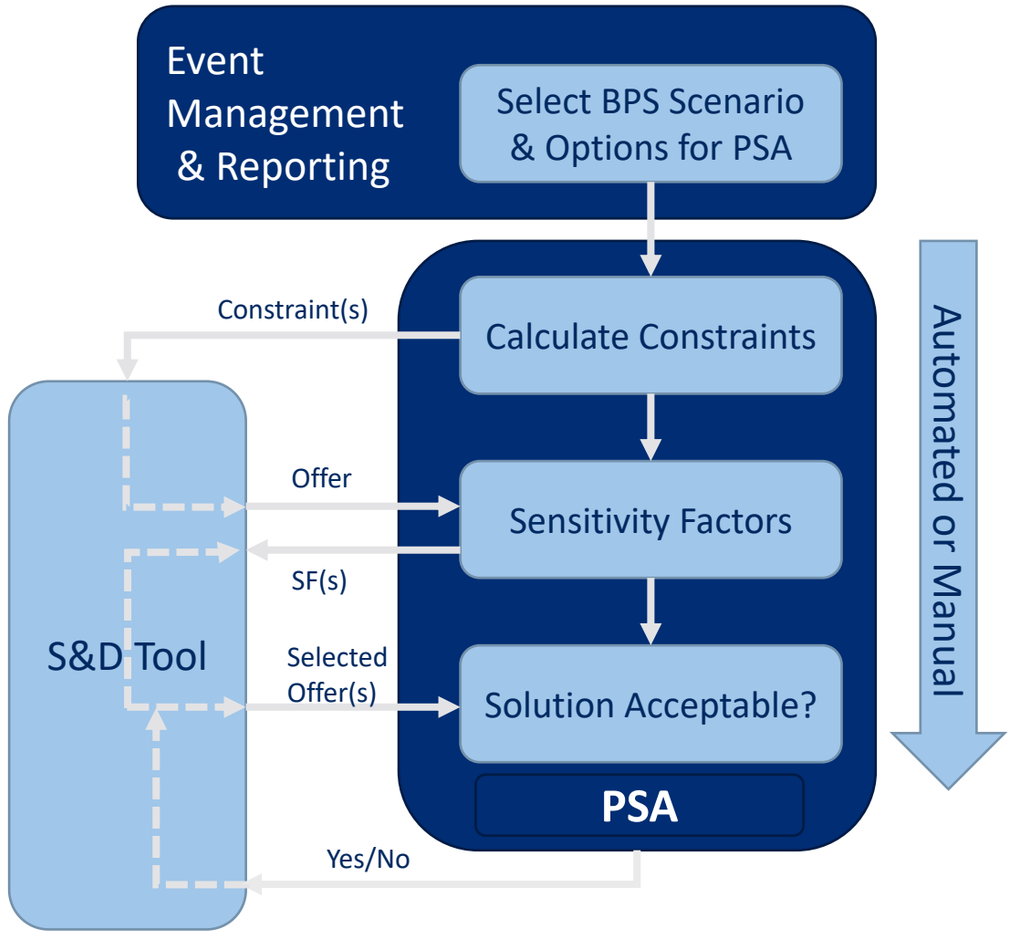
Power Systems Analysis (PSA) Model: integrates the collection of various data sets required to provide an accurate representation of the physical network. It can be used to study the resulting network flows under different scenarios.

PSA Tool: the software suite used to perform the analysis on a given PSA model, which can comprise a load flow engine (e.g., DIgSILENT PowerFactory), as well as additional automation and data processing functions (e.g. through scripting)

PSA tool:

- **Ingests** network models and uses demand/generation forecasts and real-time topological data (NeRDA) to identify ***future*** constraints on a continuous basis (i.e. every half-hour)
- **Calculates** the amount of flexibility required to resolve the constraints identified on the network model*
- **Validates** the effect of dispatching flexibility assets on the network flows, via **Sensitivity Factors**, to ensure constraints can be resolved based on actual network connectivity



*The flexibility required is calculated at the point of the constraint, thus there might be a mismatch between this amount and what is actually offered by the flexibility assets

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PSA + Forecast Model & Topological Data

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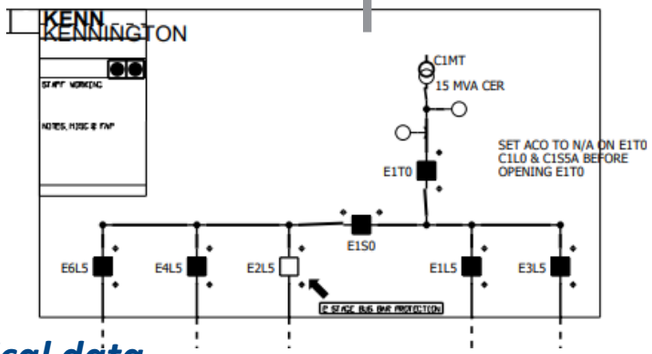
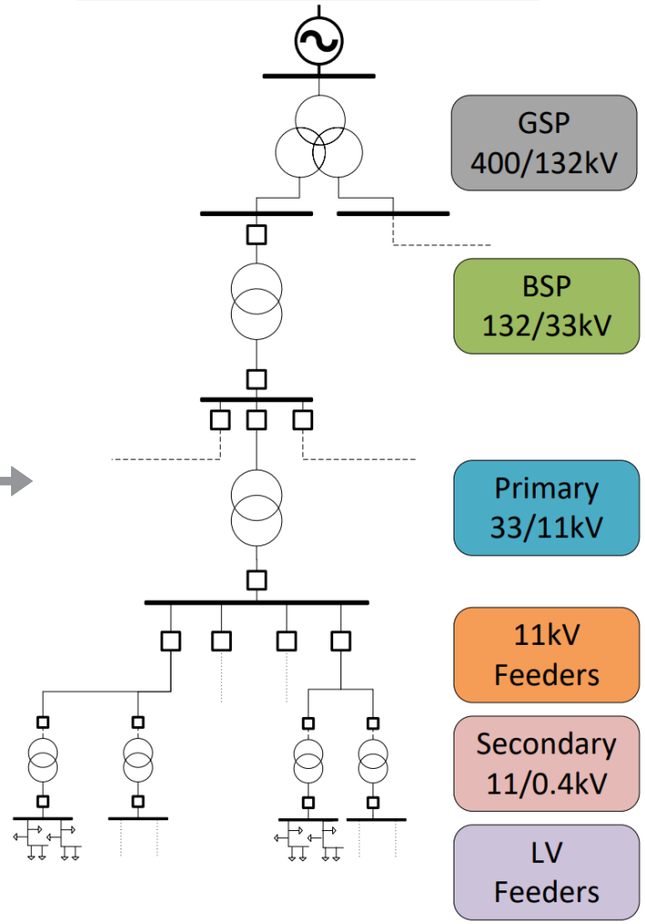
Operational Forecast & Topological data

Demand and generation forecasts



Topological data

PSA network model & load flow engine



Flexibility market

Network capacity and constraints:

- ***DSO flexibility requirements and contracting***
- ***DSO flexibility utilisation and dispatch***
- ***Flex delivery and settlement***

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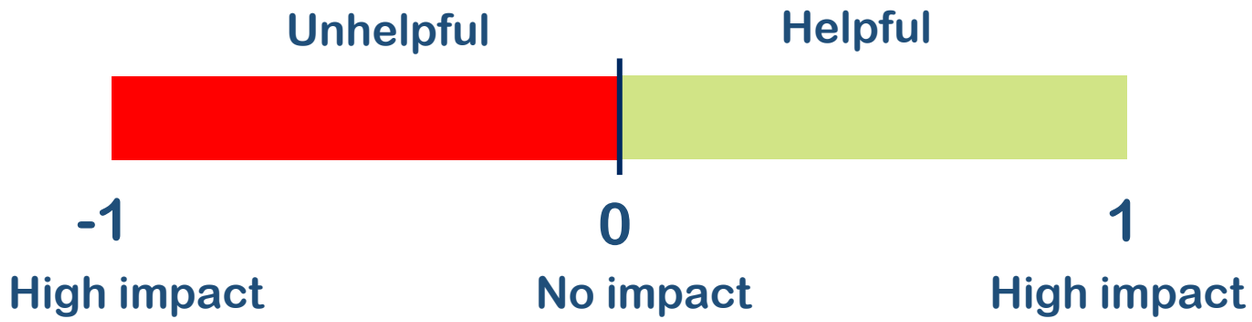
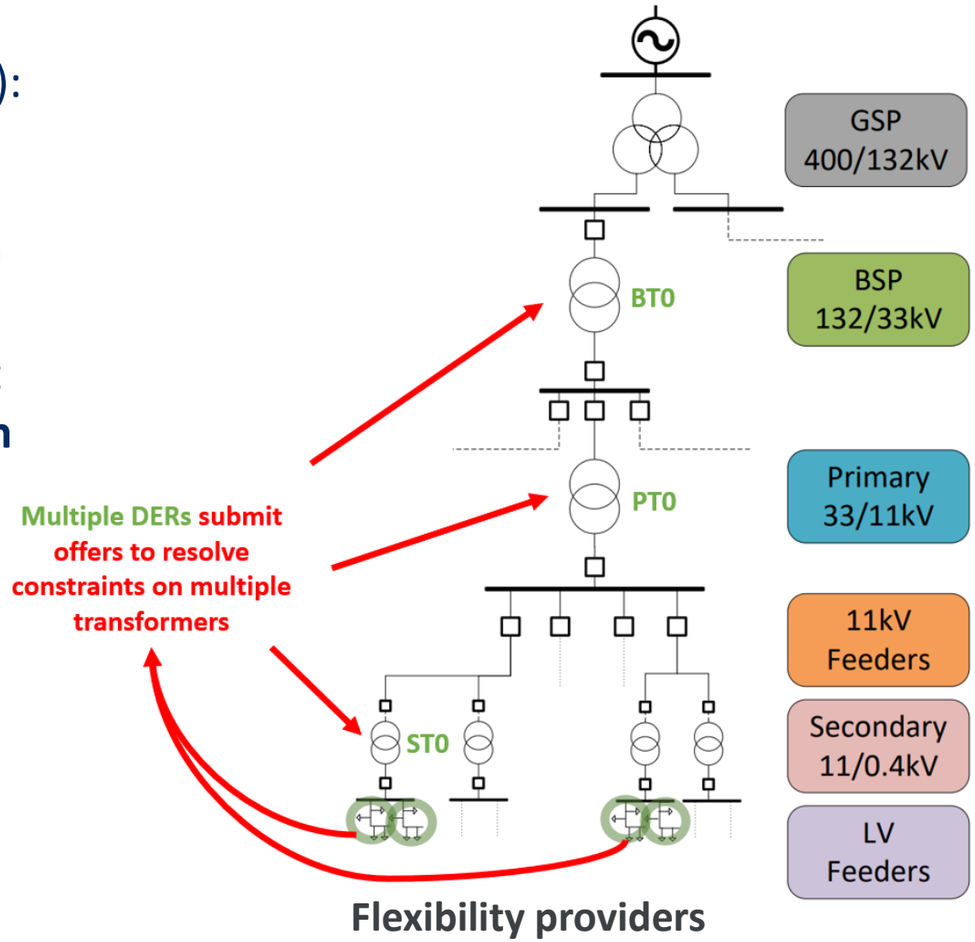
PSA - Sensitivity Factors

Motivation for using sensitivity factors (SFs):

- Assess the impact, both **magnitude** and **direction**, a flex asset (generation or demand) has on a network element (transformer or line):
  - The **scale/magnitude** of the SF is whether the flex asset has a **low/high impact** on a network element based on $\frac{\Delta Flow\ [MVA]}{\Delta Flex_k [MW]}$
  - The **sign/direction** of the SF tells us whether the (low/high) impact is **helpful/harmful** (in terms of loading) depending on the **direction of the network flows** (import/export) and the type of flex asset (demand/generator)





PSA - Key learnings/outcomes

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High level of automation and ability to interface with other systems and data sources (e.g. via APIs) are both essential to support a flexibility market

Balancing accuracy, robustness and computational overhead when calculating network flows and flexibility impact (i.e. SFs)

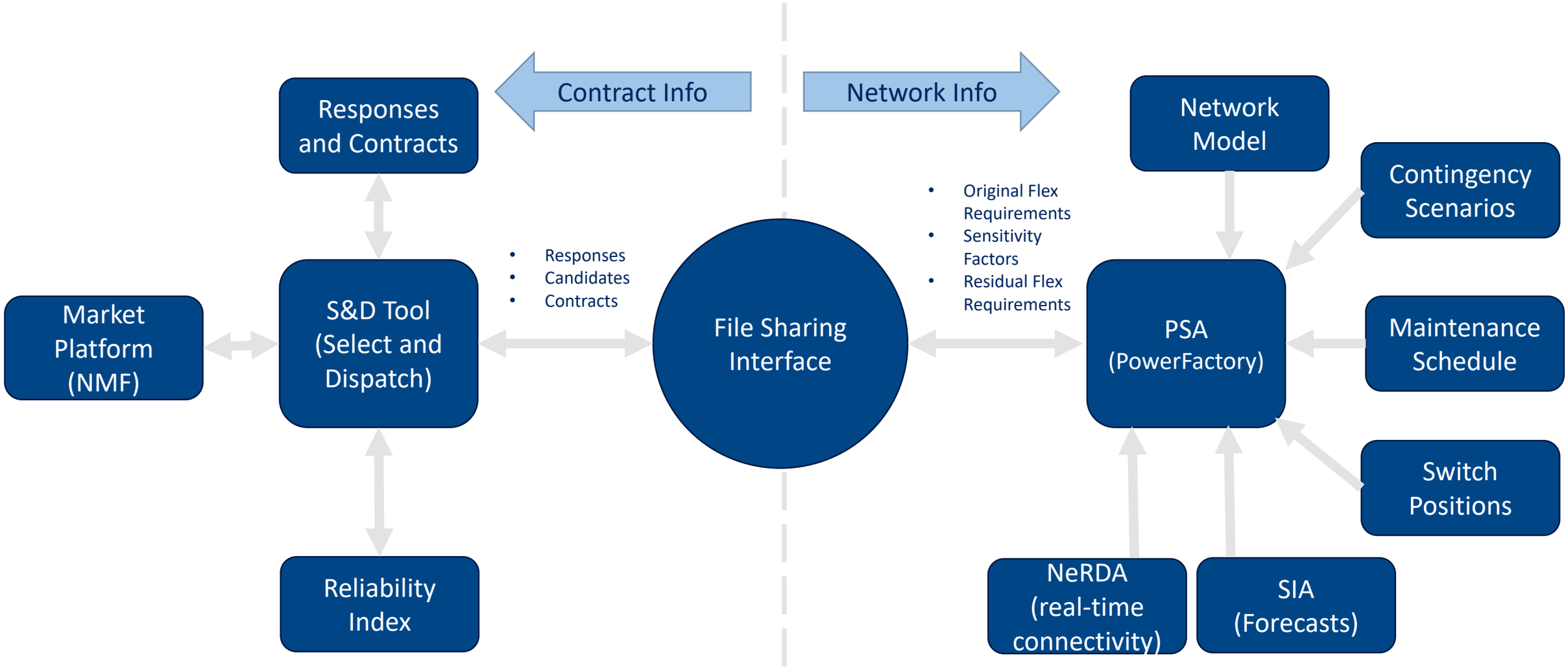
PSA

Industry-standard software (PowerFactory)

Integrated network models (i.e. EHV + HV + LV) are essential to estimate flexibility requirements and to evaluate benefit of flexibility provided

The model development process and maintenance needs to be efficient and use automation where possible

Integration of Systems and Data



Market Gates

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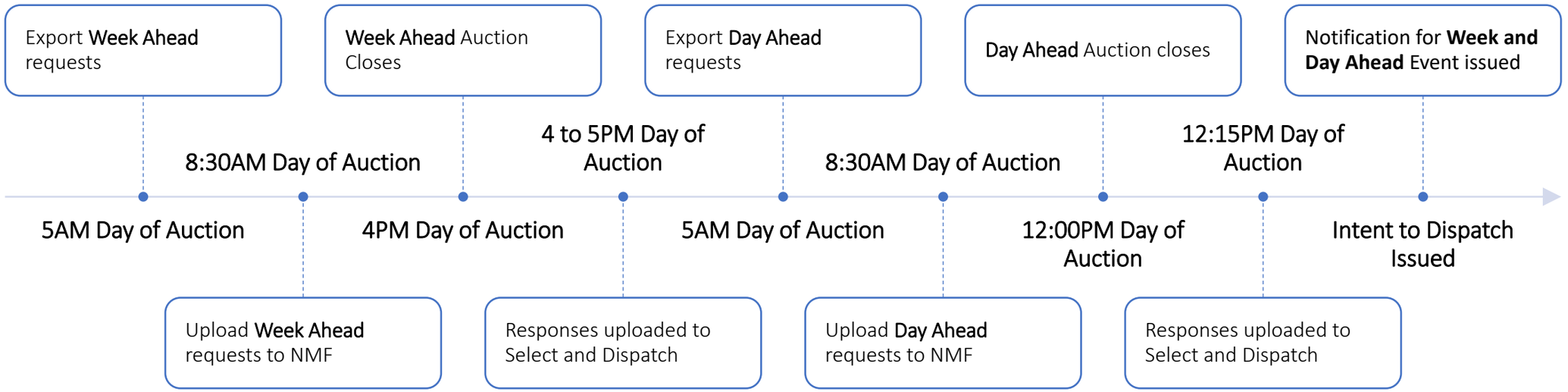
Week ahead - 80%

Day ahead - 20%

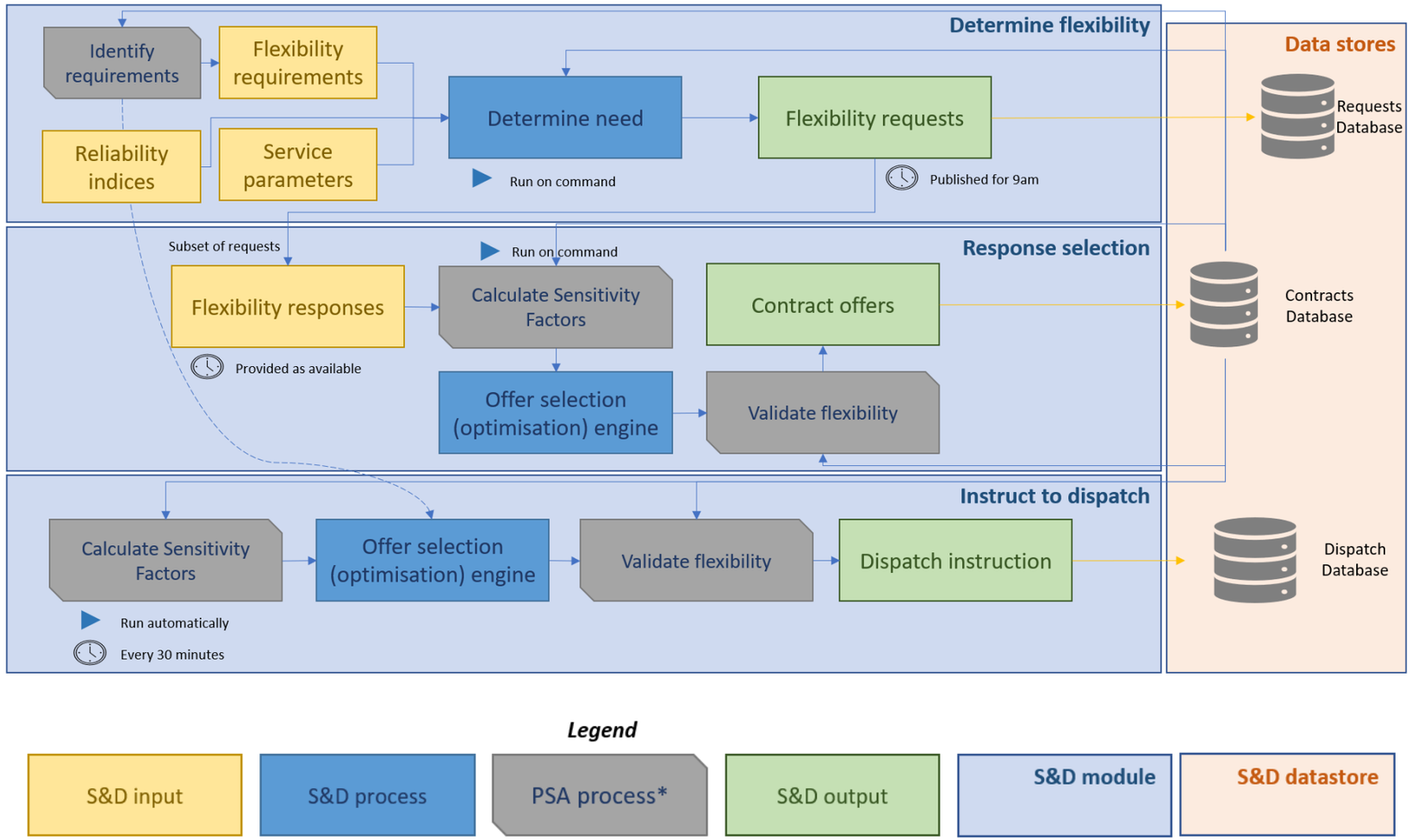


Notification of Intent to Dispatch Per Service:

- Sustain Peak Management/ Sustain Export Peak Management – 12 hrs notice
- Secure – 4 hrs notice
- Dynamic – 30 mins notice

Select and Dispatch Tool Overview

- Prepares flexibility requirements for Procurement
- Accepts and validates contract responses based on Sensitivity Factors and Total Contract Value
- Selects the most economic and viable contract against the requirements
- Provides Intent to Dispatch timings and requirements.



Contract Selection Criteria

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S&D Translates

PSA Flex requirements based on constraints

- Sustain Peak Management
- Secure Constraint Management
- Dynamic
- Sustain Export Peak Management

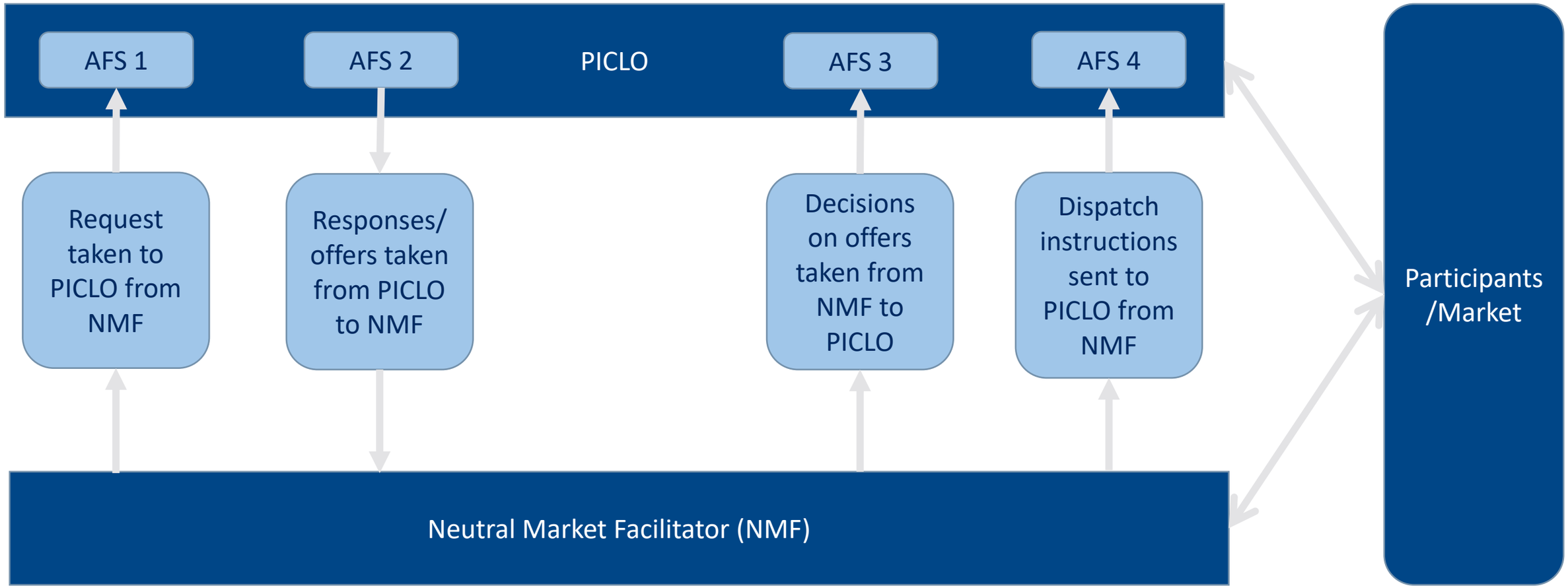
Factors to consider for selection

- Availability £/kW
- Utilisation £/kWh
- Sensitivity factor

Output

- Contracts
- Total Contract Value (TCV)
- Intent to dispatch

NMF/PICLO Interface



Key learnings/outcomes

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NMF

- Unavailability of assets is not visible via the platform
- Market platform needs to align with S&D tool, the NMF allows for only full acceptance of contracts whereas the S&D allows for partial acceptance.

Select and Dispatch Tool

- Market readiness and Sensitivity Factors
- Max Asset availability for utilisation needs to be considered within the S&D when selecting contracts.
- TCV can be exceeded depending on the duration dispatch is requested for

System Coordination

PICLO/NMF

- More development needed to add in functionality for edge cases such as cancelling requests.
- BAU should consider which platform is best for the procurement of flexibility. In the future, one market place across all DNOs/ESO for flex procurement may increase simplicity and thus liquidity

Market Gates

- Office hour restrictions regarding intent to dispatch
- Market readiness on event time sharing

TRANSITION Trials Timeline / Outcomes

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Trial Period 1

- All IAs and assets registered on time for start of TP1
- Processing requests via the NMF was clear and simple to use.
- 1st/2nd API's NMF <> Piclo achieved
- Sustain
- Week ahead service
- 3 Bulk Supply Points

Trial Period 2

- Can automatically publish week-ahead requests based on needs analysis, reducing manual workload
- Email notifications from NMF when there are changes on the platform
- 3rd API NMF <> Piclo achieved
- Sustain, Sustain Export, Secure, Dynamic + Import/Export capacity trading
- Season, week and day ahead
- 6 Bulk Supply Points

Trial Period 3

- Automated settlement completed
- Platform had the ability to stacking contracts across different services.
- 4th API NMF <> Piclo achieved
- Primary substations

Technical Trials

- Proved forecasted events
- Procured for contracts based off of real-time data
- Developed further market learnings via technical capabilities
- Understood the impact of Sensitivity Factors on the Market
- Proved the notification periods for different contracts are compatible with the market.

Summary Take Away

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- Project TRANSITION has delivered a suite of new tools, and generated a range of innovation learnings, to enable DSO functions for flexibility market implementation, e.g.
  - Real-Time PSA network constraint analysis using advanced industry grade tool PowerFactory
  - Close to real-time flexibility market procurement and dispatch
  - Alternate routes to enable industry actors to participate via neutral market facilitation
  - An overall largely automated end-end process
  - Coupled technical and commercial processes that are integrated with e.g. APIs
- These learnings and capabilities are further informing the SSEN requirements for ED2 design and implementation of these functions
- Similar to the TRANSITION Baseline tool developed in cooperation with ENA, under NIC terms these tools are available to peer DNOs for evaluation, and use as part of similar DSO objectives across GB

Q&A Session

For more information or to access our extensive learning reports; please visit www.ssen-transition.com

Annex

References / Report Links

- TRANSITION website / other reports : Library | SSEN Transition (ssen-transition.com)
- Project LEO website : Home - Project LEO (project-leo.co.uk)
- Original Transition Tools HLD : High-Level-Solution-Design-Summary-v1.pdf (ssen-transition.com)
- WSC functions : Requirement Specification (ssen-transition.com)
- NMF functions : Requirement Specification (ssen-transition.com)
- Select and Dispatch (S+D) Tool functions : *Due for publication on TRANSITION website in ~ June 2023*
- Power System Analysis (PSA) functions : *Due for publication on TRANSITION website in ~ June 2023*
- LEO Smart and Fair Neighbourhood LV Modelling report on Osney : *Due for publication on Project LEO website in ~ June 2023*

What are we trying to achieve?

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Testing the end to end process for flexibility by:

- Incorporating short term operational forecast & topological datasets
- Calculating constraints on the network
- Advertising for offers to resolve constraints
- Receiving and assessing offers
- Validating offers and sensitivity factors
- Requesting dispatch(s)

Using these services:

- Sustain Peak Management SPM (including Export)
- Secure Constraint Management SCM
- Dynamic

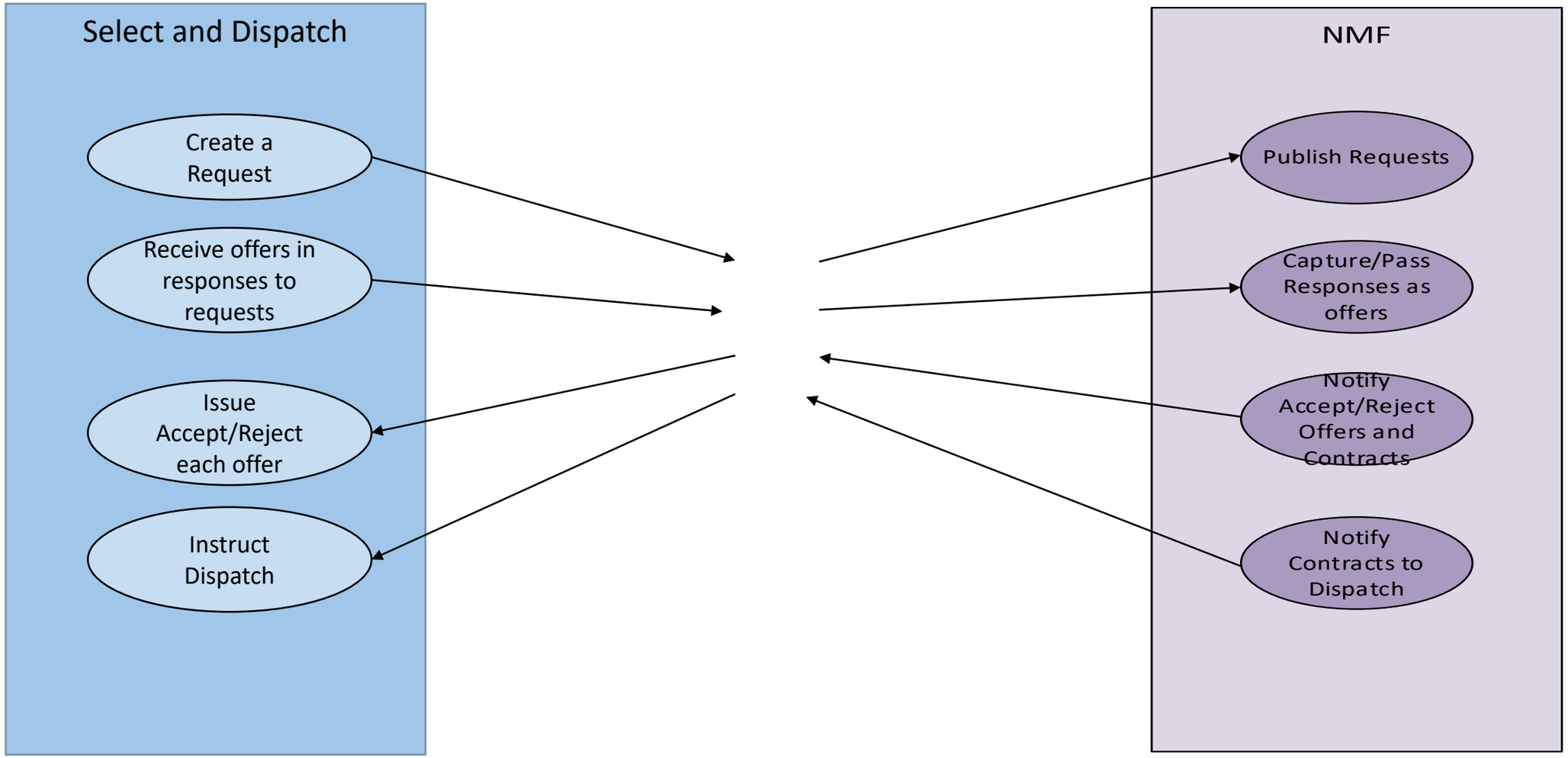
Across these time horizons:

- **Week, Day**

Not testing:

- Within day time horizon for procurement process
- MIC/MEC services
- Financial settlement process for Participants
- Baselining of measured utilisation data
- Edge cases (events that fall outside of the normal expected behaviour)

Procurement and Swivel Chair



PSA - Key learnings/outcomes

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- The PSA function should be designed with a high level of automation (both for internal calculations and for data processing) to support decision making regarding how much flexibility to procure and to assess the impact of the flexibility dispatch ahead of an event taking place.

- The PSA function needs to be able to interface with different tools and systems via APIs (e.g. a forecast provider) to deliver a richer picture of the possible array of network conditions, the constraints and the resulting flexibility requirements ahead of time.

- The PSA function needs to strike a balance between accuracy, robustness and computational overhead when estimating the benefit/impact of flexibility dispatch on the network to ensure results are provided when required by other systems (e.g. commercial platform). This can be achieved through the use of linearisation (e.g. sensitivity factors).

- Developing integrated network models that span multiple voltage levels (e.g., EHV and HV combined) is critical when considering the impact of flexibility providers connected at the lowest voltage levels on constraints upstream in the network. In particular, when flexibility from multiple providers is aggregated at a certain network level.

- The network is constantly changing, both from a planning and an operational perspective. The model development process, and ongoing maintenance, needs to be made more efficient, using automation where possible, to ensure models stay up to date (e.g. connectivity/availability of flexible assets) while making sure the process is scalable to large network areas.