SYNERGY

This project has received funding from the **European Union's Horizon 2020 Research** and **Innovation programme** under Grant Agreement No **872734**

Data Week 2023 “Exploiting the Opportunities of Energy Data Platforms”

Lulea, Sweden – June 14th, 2023

SYNERGY

Digitising and transforming European industry and services: digital innovation hubs and platforms

SYNERGY Achievements, Experiences & Lessons Learnt

Dr. Fenareti Lampathaki (Suite5)

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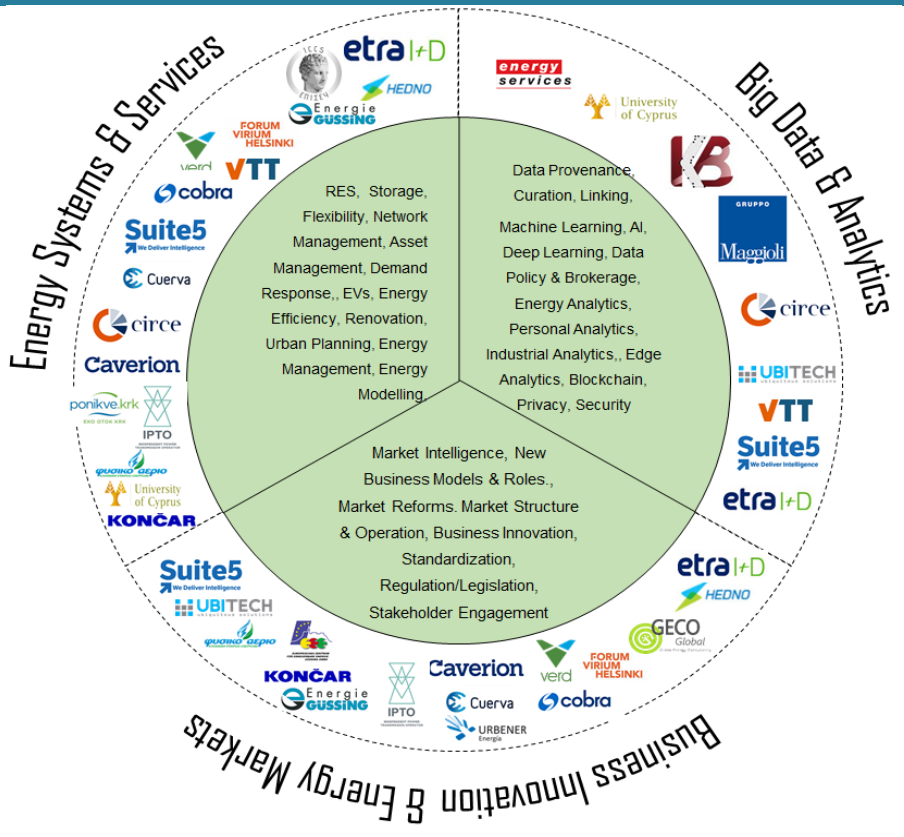
SYNERGY Project Profile

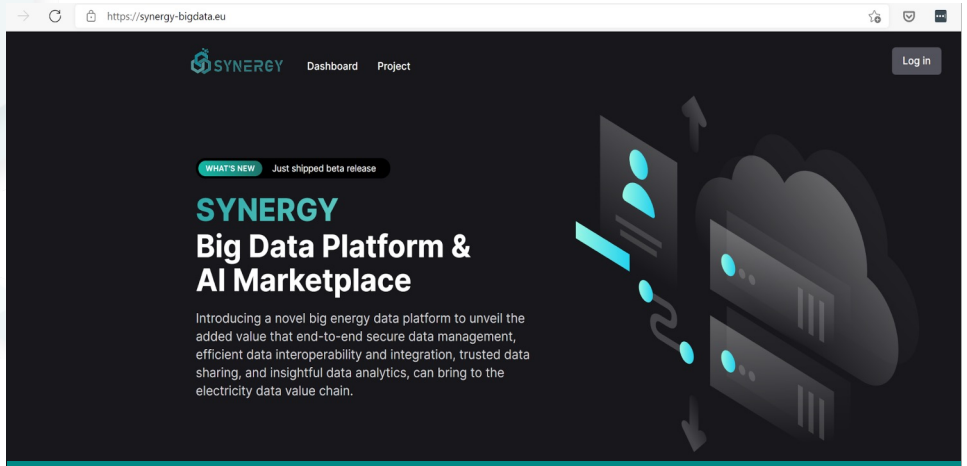
Big Energy Data Value Creation within SYNergetic enERGY-as-a-service Applications through **trusted multi-party data sharing** over an **AI big data analytics marketplace**

Start Date 01/01/2020	24 Partners
48 Months	10 Countries
Innovation Action	5 Demonstrators

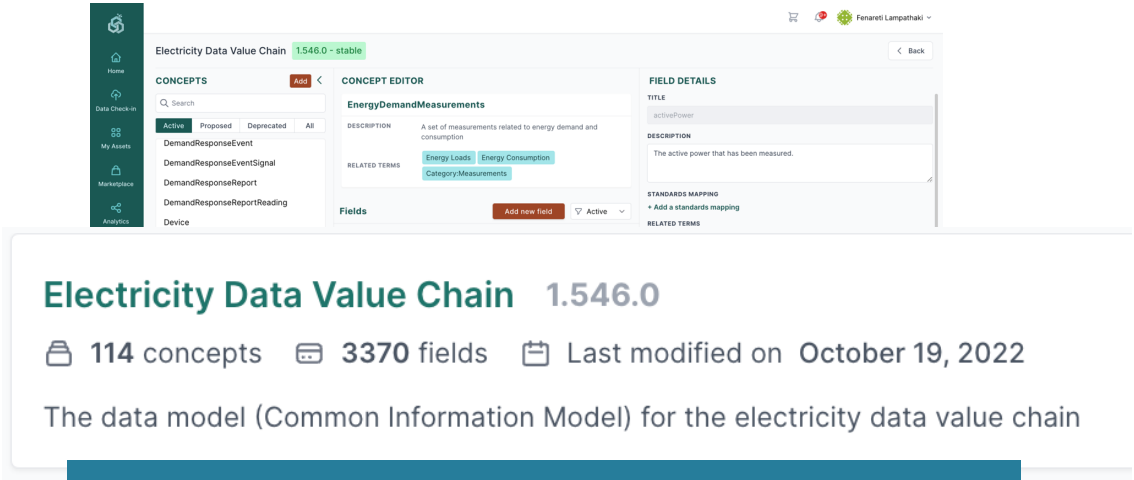


Topic: DT-ICT-11-2019 Big data solutions for energy

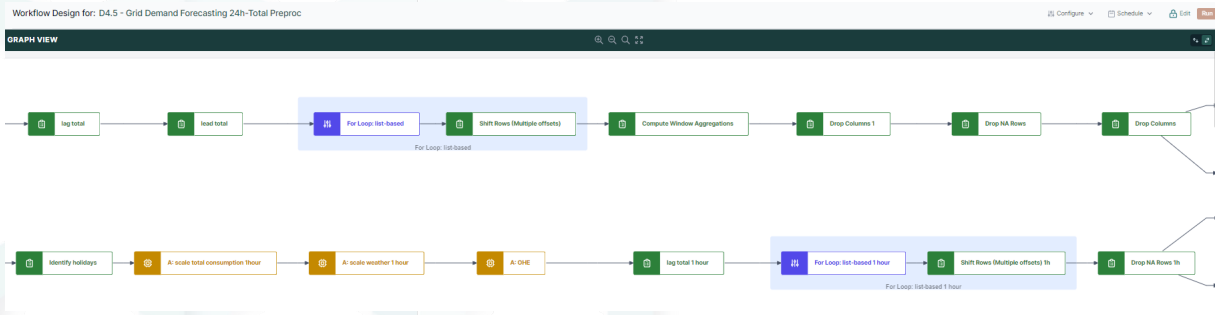
SYNERGY Platforms, Tools and Solutions Overview



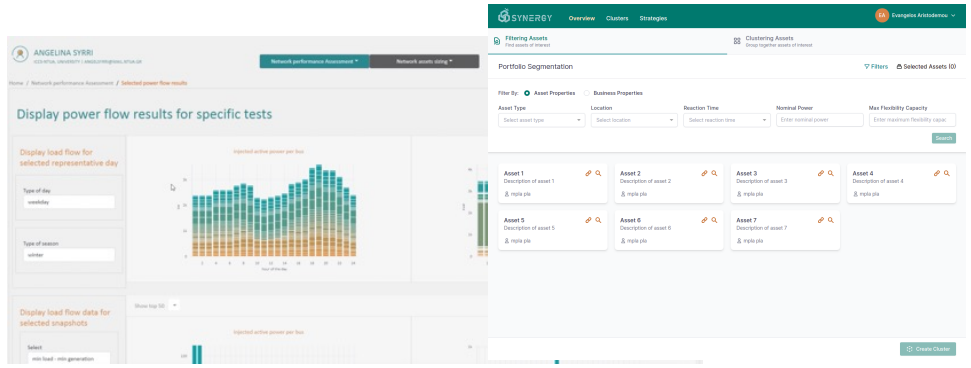
SYNERGY Integrated Platform - Final



SYNERGY CIM



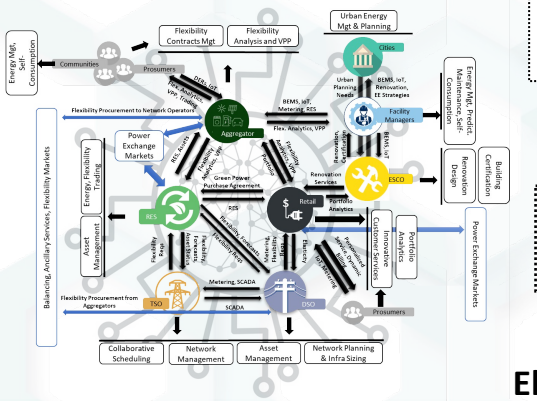
>30 SYNERGY Personal & Industrial Analytics Solutions



12 Native Energy Apps + 5 Open Call Energy Apps

SYNERGY “Compass”

- ❑ Increase own data quality
- ❑ Control access over own data
- ❑ Acquire access to other data “assets” through smart contracts
- ❑ Run analytics pipelines over own and acquired data



SYNERGY Energy Apps

Data Retrieval Queries: Retrieve data depending on “active” data asset contracts

Data Check-in Jobs: Upload app data

Data Analytics Pipelines: Run on demand / according to schedule / event-based
- Retrieve results via customizable APIs

SYNERGY Big Data Platform & AI Marketplace

Multiple Data Ingestion Modalities (e.g. Files, APIs, PubSub, …)

Data Check-in Jobs

Data Gathering

Data Generation / Discovery

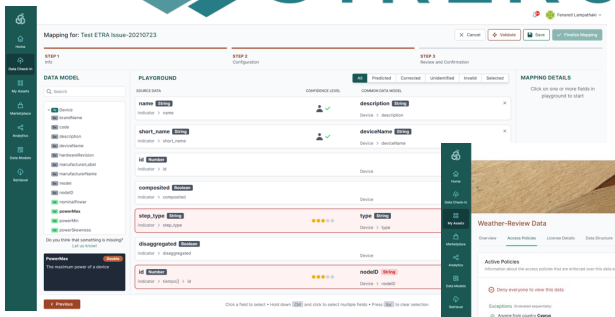
Business-Generated Data

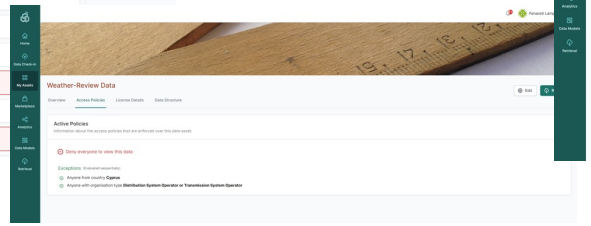
Human-Generated Data

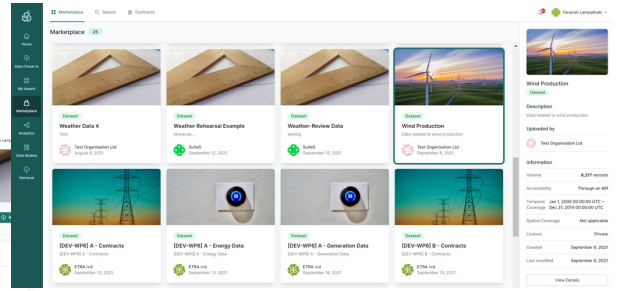
Machine-Generated Data

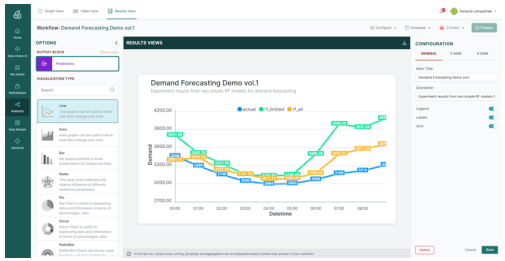
Electricity Data Value Chain Stakeholders

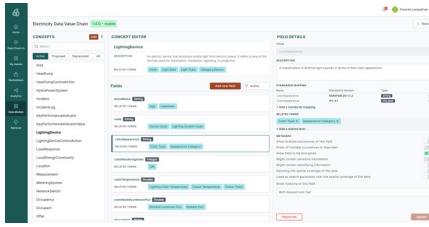
SYNERGY Data* Building Blocks

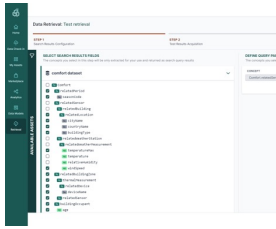












Data Ingestion (Cloud, OnPrem, Edge)

DATA COLLECTION SERVICES BUNDLE

Data Transformation & QA (Mapping to CIM, Cleaning)

DATA SECURITY SERVICES BUNDLE

ABAC-based Data Access Control

Data Anonymisation

End-to-End Data Encryption

DATA SHARING SERVICES BUNDLE

Data & AI Marketplace (Datasets, Models, Results)

License & IPR Management

Assets Contract Lifecycle Manager

DATA MATCHMAKING SERVICES BUNDLE

Remuneration Policies for Multi-party Contracts

DATA ANALYTICS SERVICES BUNDLE

Analytics Pipelines Management & Execution (Cloud, OnPrem, Edge)

- **Trained Energy Data Analytics Models** (in or outside the Platform)

Data & Results Visualisation

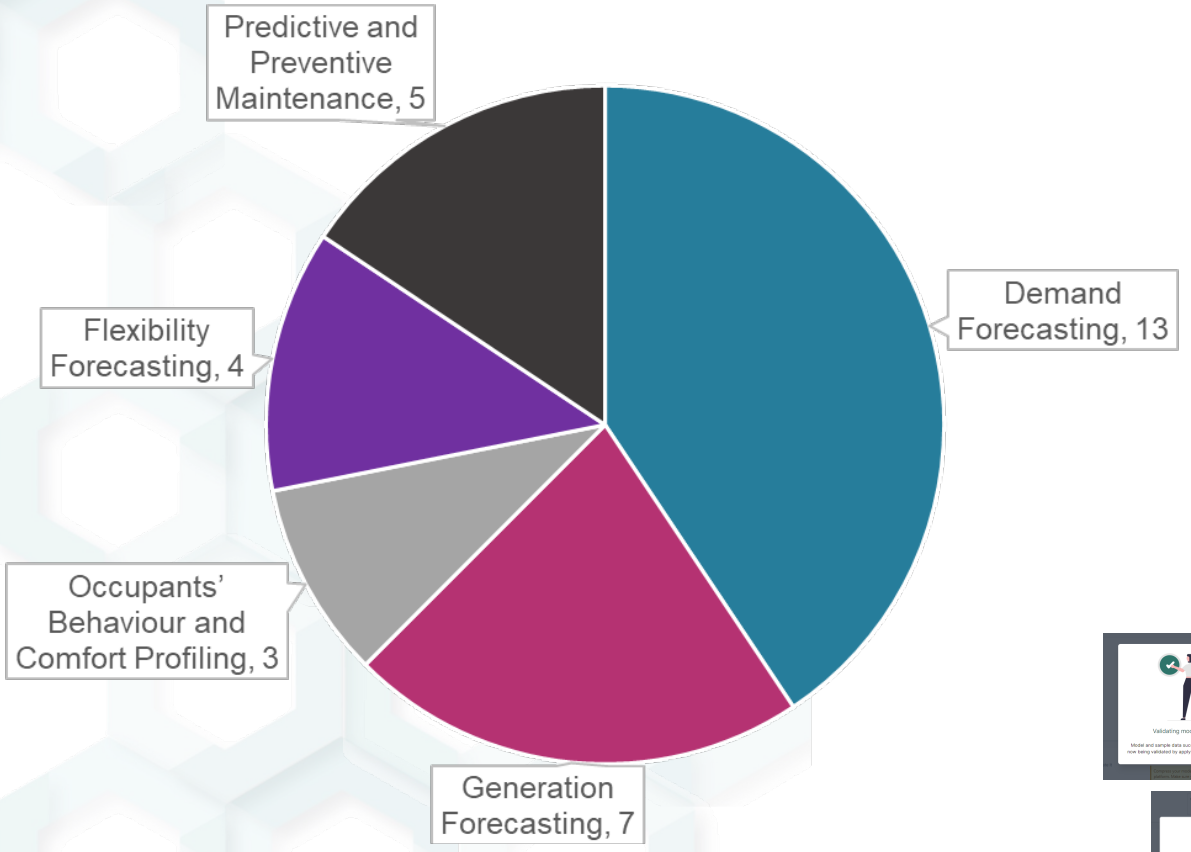
DATA GOVERNANCE SERVICES BUNDLE

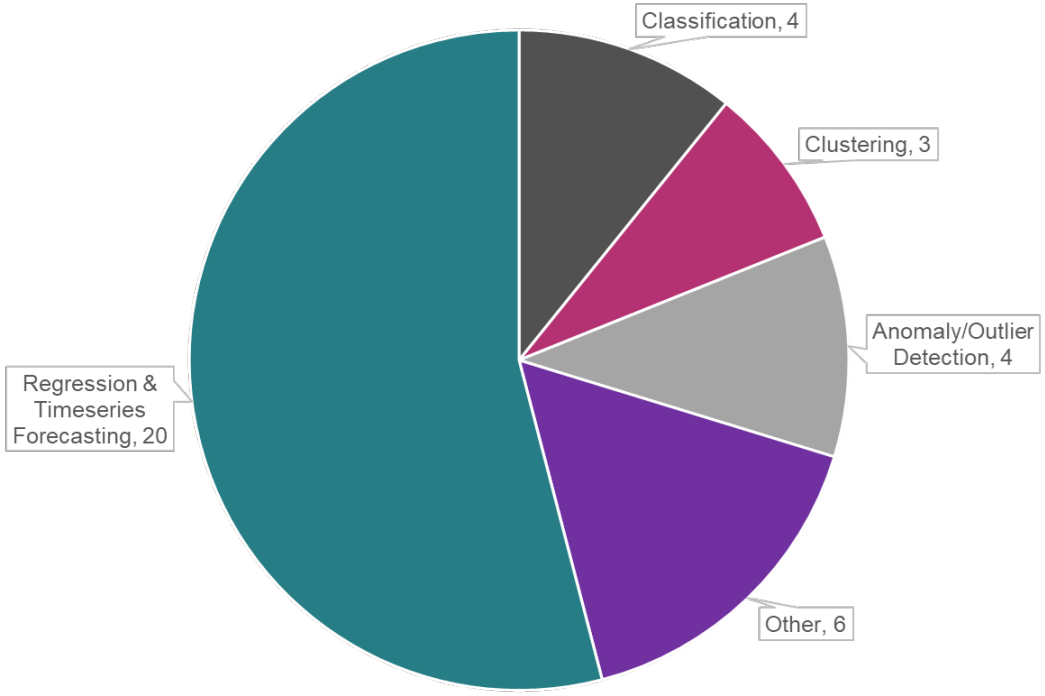
- Data Lineage*
- CIM lifecycle management

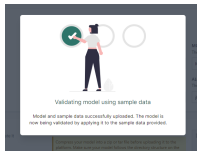
PLATFORM MGMT SERVICES BUNDLE

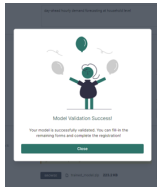
- API Gateway
- Identity Provider
- Orchestrator

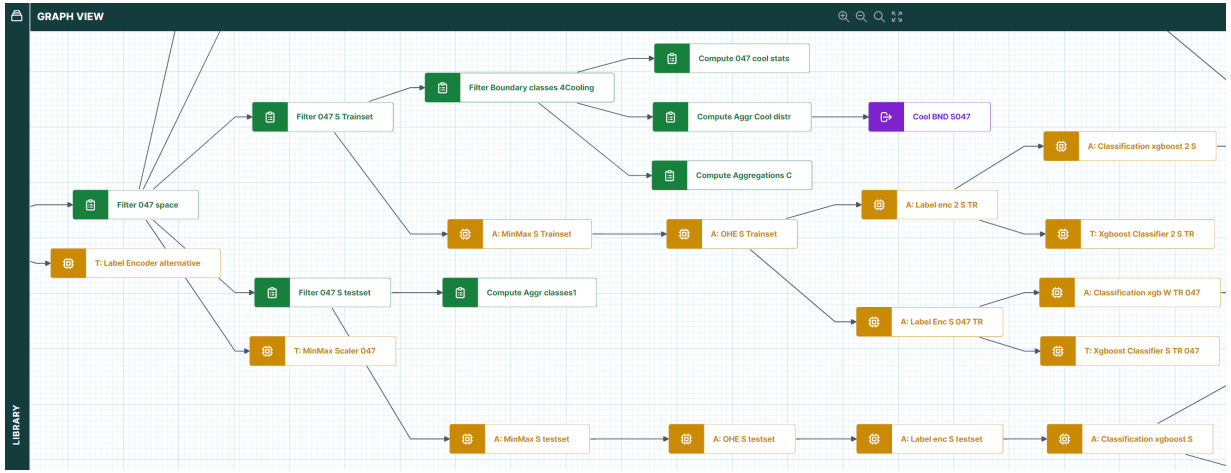
Energy Analytics Solutions







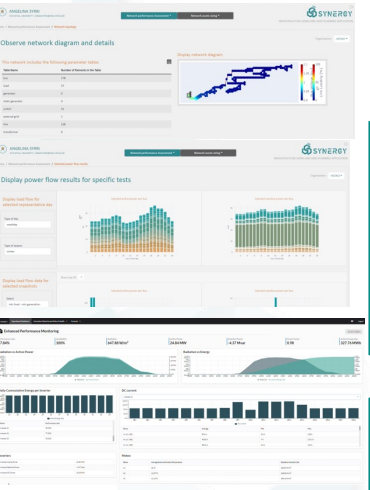




Energy Analytics Solutions in Detail

1. Short-term occupants' thermal comfort prediction (15min-1hour)
2. Occupants' thermal comfort duration prediction
3. Identification of occupants' thermal comfort boundaries
4. HVAC usage short-term prediction
5. Clustering of occupants to identify behavioural common features
6. Prediction of energy demand at grid level
7. Day-ahead prediction of energy demand at district and portfolio level
8. Short-term energy demand prediction at grid and building level
9. Prediction of energy demand at portfolio level in short-term
10. Prediction of energy demand at building level in short-term
11. Prediction for the hours in the day we expect peak demand at grid level
12. Short-term energy generation prediction at DER level
13. Prediction of energy generation at portfolio level (1-168 hours ahead)
14. Long-term energy generation prediction at PV Power Plant
15. Clustering of PV Power Plants to identify common features
16. Short term and very short-term prediction of energy generation at grid level
17. Anomaly detection in PV energy generation
18. Prediction of day-ahead demand flexibility at building level
19. Prediction of generation flexibility at DER level at very short term
20. Prediction of generation flexibility at DER level - short-term
21. Short-term malfunctioning prediction at PV plants
22. Anomaly/outlier detection in the energy performance of HVAC system components
23. AC consumption for different comfort levels
24. AC consumption flexibility forecasting
25. Anomaly Detection in household energy consumption
26. Building Energy Demand Forecasting
27. Prediction of day-ahead demand flexibility at building level
28. Anomaly detection in energy demand at building level
29. Outlier detection in energy demand
30. Prediction of peak & average energy generation at portfolio level in TSO/DSO areas
31. Prediction of storage flexibility
32. Malfunction Duration Prediction in PV energy generation
33. Clustering of PV malfunctions/inefficiencies

SYNERGY Energy Apps

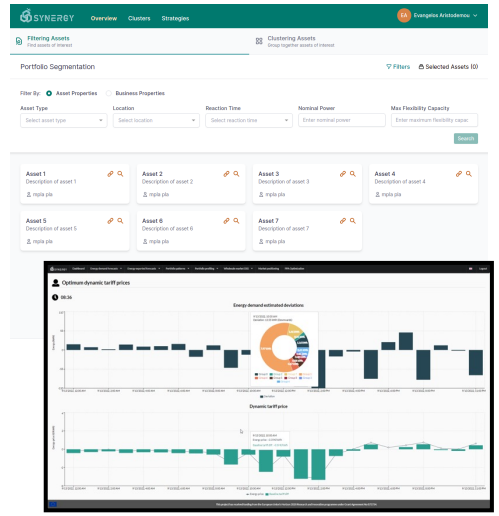


Applications for Network Operators & RES Plant Operators

- Infrastructure sizing and grid planning App
- Flexibility based Network Management and DSO-TSO common operational scheduling App
- Advanced Performance Monitoring/ Forecasting and Predictive Maintenance App
- Asset management optimization for power grids App

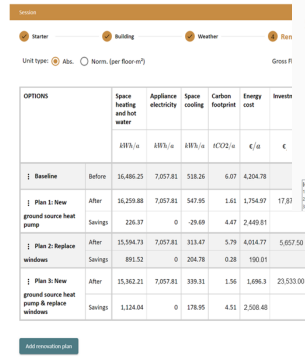
Applications for Energy Retailers & Aggregators

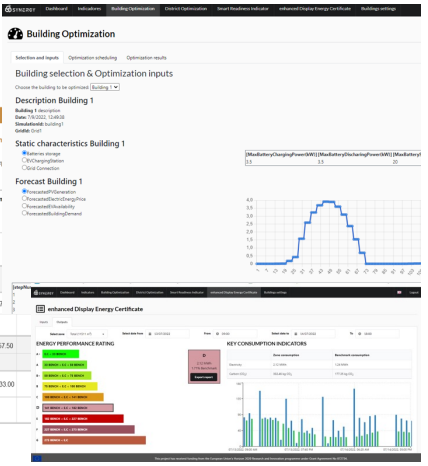
- Portfolio Analytics and Management for Electricity Retailers
- Flexibility Analytics and Consumer-Centric DR Optimization App
- Personalized Energy Analytics App
- DR Smart Contract Monitoring, Handling, Settlement and Remuneration Platform



Applications for Facility Managers, City Authorities & ESCOs

- Advanced Renovation Support App
- Urban Energy Monitoring and Planning Support App
- Energy Analytics, Self-Consumption Optimization & Predictive Maintenance App
- Real-time Building Energy Performance and Smart Readiness Certification App





SYNERGY Real-life Demonstration & Usage Metrics

1.289 Data Check-in Jobs (**54** recurring)

1.283 Datasets (Available in Marketplace: **617** – **5.676.254.365** records - **~5,04 TB** volume uncompressed)

1.754 Analytics Pipelines (executions: **89.377**, recurring: **145**)

1.497 Analytics Results (Available in Marketplace: **46**)

267 Trained, Available Models (Available in Marketplace: 60)

404 Single Contracts (Active: 256) – **17** Derivation Contracts

59 Bundle Contracts (Active: 37), containing as part of the bundle **469** contracts

1.198 Retrieval Queries

Active Users: **169**

Organisations: **30** (44 registered)

A typical hour in the SYNERGY Platform: 85053 Requests

** As of 18/05/2023*

Real-life Demonstration & Usage Metrics

21 Demo Cases in 5 Demo Sites (Greece, Spain, Austria, Finland, Croatia)

48 Demo Validation Scenarios

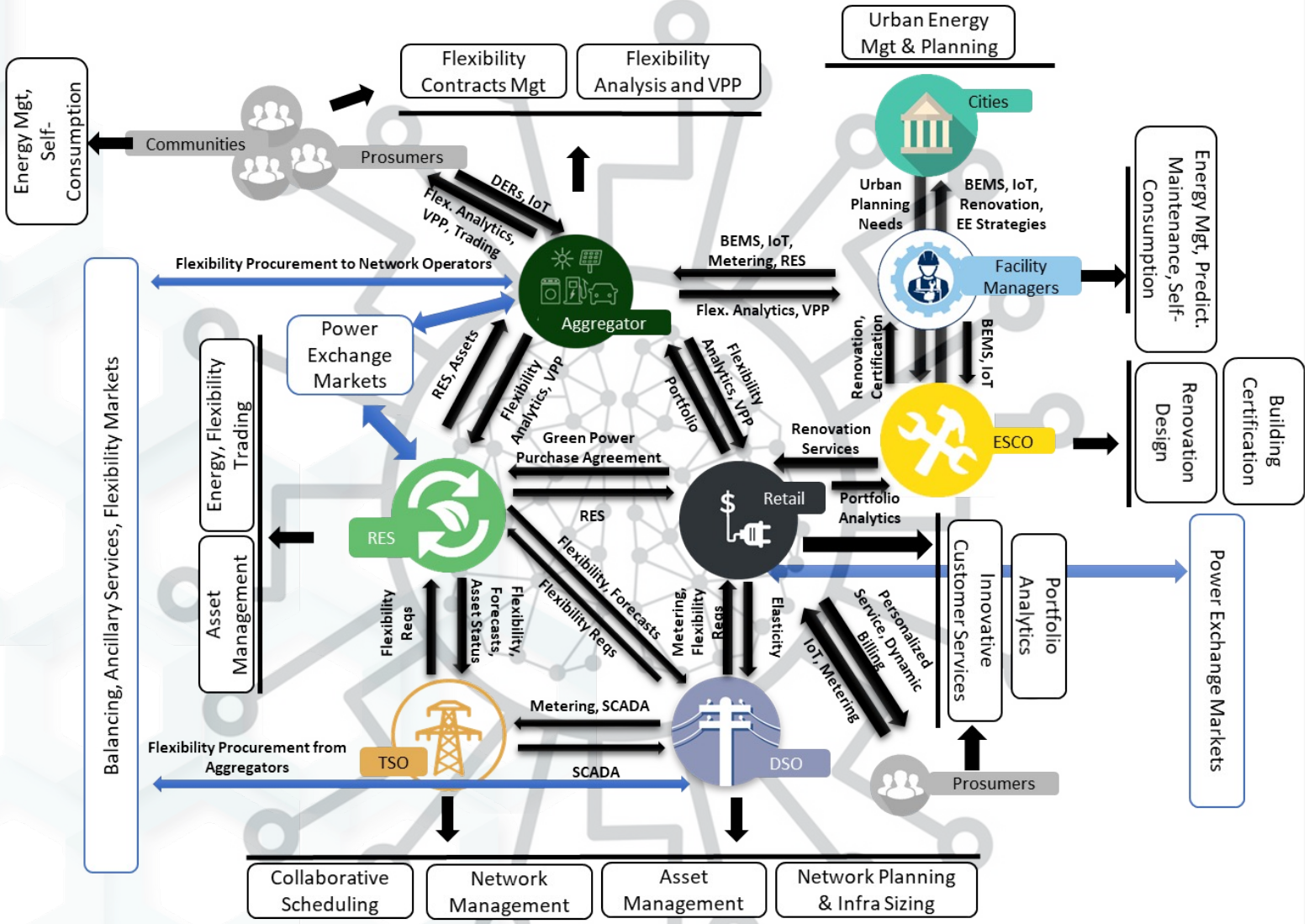
54 Business Validation KPIS and 74 Technical Validation KPIs

152 tests on SYNERGY platform and applications prior to launch

Austrian Demo Site

- *Demo case 13*: Innovative Flexibility-based Distribution Network Management
- *Demo case 14*: Local Energy System Optimization and Enhancement of Security of Supply through Islanding
- *Demo case 15*: Flexibility segmentation, classification and clustering towards VPP configuration for flexibility activation and explicit demand response
- *Demo case 16*: Local Flexibility Market for network services and self-consumption through blockchain-enabled smart contract establishment and handling

SYNERGY Data Sharing-driven Business Value



- ✓Raw data and derivative data (models, results) sharing among **all stakeholders in the electricity data value chain** and with IT actors (energy app developers)
- ✓**Very high trust** in sharing the data through the SYNERGY Platform
- ✓**Easy process** of negotiating and reaching an agreement over the sharing terms

Experiences and Lessons Learnt from a Technical Perspective

- ✓The **needs of data asset providers vs the needs of data asset consumers** (e.g. in terms of temporal granularity) cannot be always reconciled. Designing generic solutions (baseline analytics, energy apps) required flexibility and adaptations on the data asset consumer side.
- ✓**Data interoperability** is ever present and cannot be addressed in an one-off solution – “design to anticipate change” as there is no data model/standard/ontology that addresses all needs of the energy domain.
- ✓When **monitoring multiple data check-in jobs and managing a number of datasets**, data observability is a key towards troubleshooting problems and ensuring reliable, high quality data.
- ✓**Experimentation with analytics pipelines** requires inspiration, time and, of course, significant resources.
- ✓Even **contracts in the blockchain** should not be considered as “written in a stone” – it needs to be possible to re-negotiate a contract.
- ✓With a view to exploitation/commercial activities, **admin interfaces** are not to be neglected. Direct **support channels** (slack, github) were very useful for immediate communication.

Experiences and Lessons Learnt from a Business Perspective

- **Data** may be available by a stakeholder but **in a disperse manner** – significant time is required to collect the data from the different departments “offline” and prepare them for data check-in.
- **Multiple methods for ingesting data**, without requiring changes in the stakeholders’ side, proved to be key to anticipate and address the diverse needs of different data providers.
- **Data (sharing) needs between the same stakeholders evolve** over time. The mechanism for sharing data assets in a trusted manner has been universally appreciated.
- The **value extracted** from the data owned or shared with a stakeholder (and the benefits from all data “derivatives” that can be shared/traded) **became tangible even from the 1st demo run**.
- Data check-in and management is continuous - **improved execution (error) handling** has been appreciated.
- **Change in the mentality/culture and training** of all users is necessary - user manuals do help.

✓A **unique one-stop-shop** for the discovery and acquisition of data assets relevant to the electricity data value chain.
✓A **holistic data platform** enabling end-to-end secure data management spanning a variety of functionalities and services for data asset ingestion, harmonization, quality enhancement, interoperability, exploration, manipulation, and analytics.
✓An **ecosystem building environment** enabling the development of new energy services and applications in a highly fragmented data value chain that leverage the SYNERGY Platform’s offerings.

Any questions or comments

Thank you!

www.synergyh2020.eu

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