



Shaping Industrial Demand-Side Flexibility: Stakeholder Requirements and Pilot Insights from LIFE- LEONARDO

RINA-C, EEE, UPAT, FBK

Webinar 1

23, September, 2026



UNIVERSITY OF
PATRAS
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ



LEONARDO





Agenda

Time	Event
14.00	Greetings to all participants and introduction to the webinar (RINA-C, 5')
14:05	Introduction to the LEONARDO project activities (FBK, 7')
14:13	Stakeholder Requirements (EEE, 8')
14:20	Insights from the Italian Pilot (FBK, 10')
14:30	Insights from the Austrian Pilot (EEE, 10')
14:40	Insights from the Greece-Bulgarian Pilot (UPAT 10')
14:50	Q&A (10')





LEONARDO in brief



11 partners from 6 European countries

Project name: fLexibility sERVICES
prOvision eNABled fRom
aggregated inDustrial prOsumers

Project acronym: LIFE24-CET-
LEONARDO

Call: LIFE-2024-CET-BUSINESS

Starting date: 1 September 2025

End date: 31 August 2028

Maximum grant amount: 1.75 M€



Why LEONARDO?

- 1) Rise of Renewable Energy Sources** uncontrollable and weather-dependent
- 2) EU's daily energy flexibility needs will increase** by 133% 2021-2030 and up to 250% 2030-2050.
- 3) industrial Demand Side Flexibility (iDSF) is in the spotlight** as low-cost alternative flexibility resource

BUT: progress on EU-wide iDSF deployment range from low-to non-existent due to several economic, regulatory, technological, organizational, behavioural, informational, and competence barriers.





LEONARDO will...



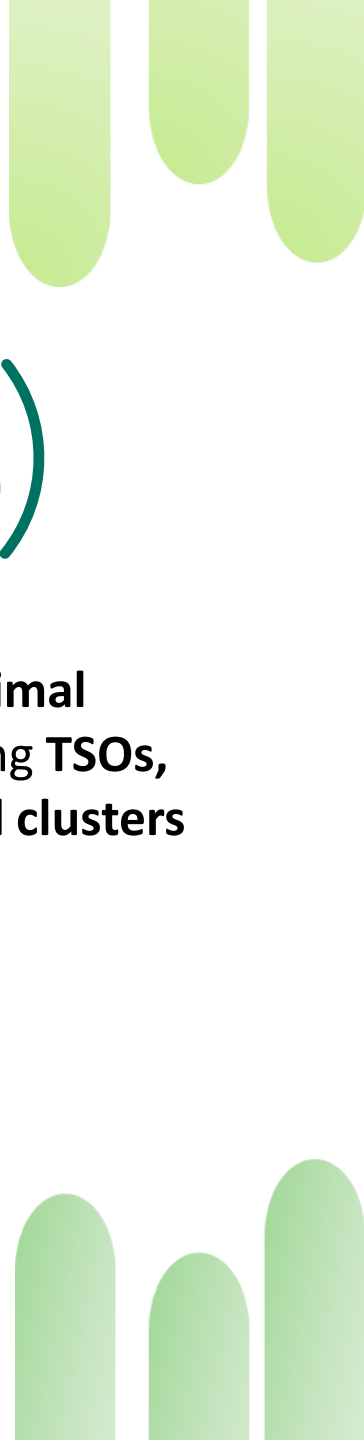
support the **aggregation of diverse Energy Management Systems (EMSs)** from industries in physical proximity



overcome **interoperability challenges** and enhance **EMS functionalities**

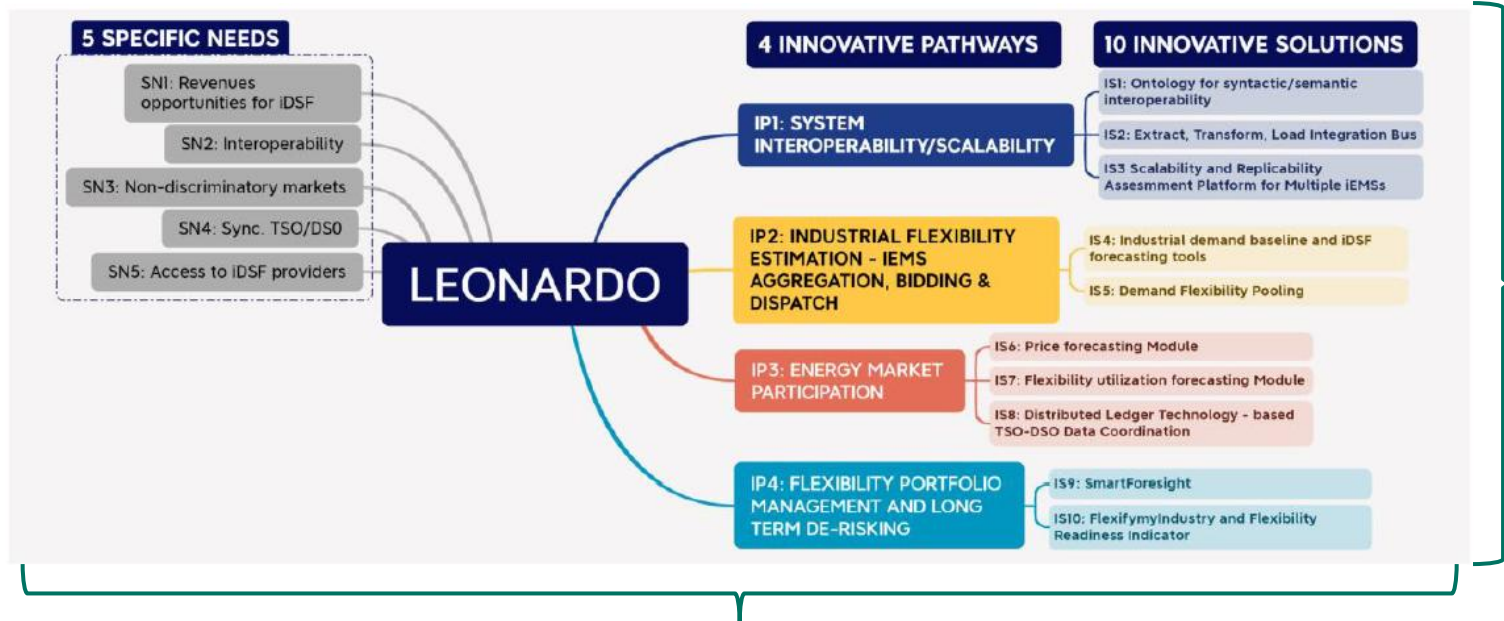


emphasize **optimal coordination** among **TSOs, DSOs** and **industrial clusters**





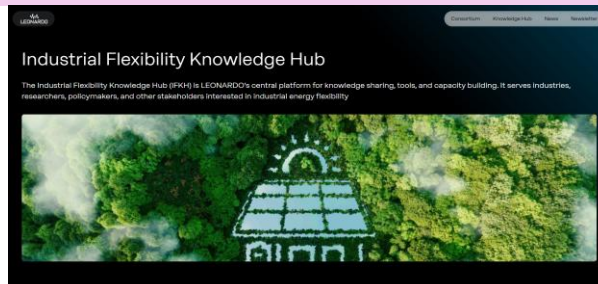
LEONARDO Concept



iFAAP: the industrial Flexibility Activation & Aggregation Platform

- **Composed by a set of digital tools** to assess and forecast demand-side dynamics
- **Capitalizing on EMS historical/real-time data** to enable system-scale flexibility aggregation and market bidding
- **To establish optimal strategies for dispatching flexible assets** within industrial units, coupled with generation and storage technologies

Industrial Flexibility Knowledge Hub: an online forum **in the project webpage** aimed to serve as **a one stop shop for a wide range of information and resources** (case studies, guidelines, technical details, training materials ..) **to help stakeholders' decision making.**





LEONARDO
will support
**flexibility-driven
services covering
both energy and
flexibility markets** at
3 Pilot Sites.

STORO INDUSTRIAL
CLUSTER [ITALY]



CEDIS
ENERGIA PURA

LOCAL DSO

STOMANA
INDUSTRY S.A.
SIDENOR GROUP

INDUSTRY



IN & CROSS-BORDER
INDUSTRIAL CLUSTER
[BULGARIA-GREECE]



HELLENiQ
ENERGY

INDUSTRY

SOUTHEASTERN
STYRIA [AUSTRIA]



evon

EMS
DEVELOPER



WP2 - DEFINING THE BASIS FOR PROVIDING INDUSTRIAL FLEXIBILITY- BASED MARKET SERVICES CAPITALIZING ON EMS INNOVATIONS

Andrea Moser

WP-Leader

European Center for Renewable Energy
Güssing Ltd. (EEE)



LEONARDO



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Stakeholder Requirements for LEONARDO

- ❖ Within the LEONARDO project WP2 has analysed the **conditions** under which **industrial companies** could **participate in demand-side flexibility**
- ❖ The analysis brought together the **requirements of industrial companies** & relevant **stakeholders**, with **market & regulatory conditions** affecting participation
- ❖ **Different industrial settings & national frameworks** were covered
- ❖ It was analysed which **requirements** appear **across the pilot regions** & the different **framework conditions**
- ❖ The **findings** were summarised in ***Deliverable D2.1 – Stakeholder functional & business requirements & regulatory framework conditions***
- ❖ This report provides a **basis for** the subsequent work on pilot **use cases & flexibility** approaches



Objectives & Scope of the Stakeholder Requirement Elicitation

- ❖ The **main objective** was to assess the **stakeholder requirements & framework conditions** relevant to the pilots & the LEONARDO flexibility services
- ❖ The assessment covered **functional, technical & business requirements** for industrial flexibility participation
- ❖ **Functional & operational requirements** concerned the practical conditions for using flexibility in industrial processes
- ❖ **Technical requirements** concerned monitoring, integration with existing energy management systems & the exchange of data between the actors involved
- ❖ **Business & organisational requirements** covered expected benefits & costs, incentives, internal responsibilities & the effort required to participate
- ❖ **Framework conditions** covered the regulatory, contractual & market-related conditions affecting the implementation & operation of flexibility services



Methodological approach of of the Stakeholder Requirement Elicitation

- ❖ In a first step, the **relevant stakeholders** in each pilot region **were identified**, together with their roles related to the flexibility topic
- ❖ A **common questionnaire** was developed to address questions shared by all stakeholders as well as topics specific to individual groups
- ❖ The questionnaire was circulated to the stakeholders & also used to guide **workshops, interviews & bilateral exchanges**
- ❖ The stakeholder consultations were complemented by a review of **market & regulatory conditions** in **each country**
- ❖ The **results were compared across the pilots** to identify common requirements & differences in their framework conditions



Overall findings of D2.1

- ❖ **Different levels of experience:** Stakeholders have different level of experience with industrial flexibility & market participation
- ❖ **Production constraints:** The existence of technical flexibility potential does not automatically make it usable in practice, as its use depends on production processes, operating conditions and organisational constraints
- ❖ **Data and system integration:** Many sites already have monitoring and energy management systems, but different data formats & proprietary interfaces often prevent automated data exchange and require manual configuration
- ❖ **Economic and operational risks:** Expected savings and revenues must justify the investment and effort, while production reliability must remain ensured
- ❖ **Different market conditions:** While some pilot regions already have experience with balancing markets and aggregation, others have no established mechanisms for local flexibility



Main conclusion and transition



- ❖ The analysis for D2.1 showed that **industrial flexibility cannot be assessed from a technical perspective alone**
 - ❖ **Operational feasibility, organisational readiness, market conditions & interoperability** also determine its practical use
 - ❖ The **pilot regions differ in their experience** with flexibility markets, aggregation & practical implementation
 - ❖ **Relevant monitoring & energy management systems** are already **available** in many industrial environments
 - ❖ Further work is needed to **connect these systems & coordinate flexibility activities** across the actors involved
 - ❖ The identified requirements will guide the further development of **iFAAP** & the **application** of its **tools & services** in each pilot context
 - ❖ The upcoming **pilot-specific findings** show how these requirements differ across the industrial & regional contexts
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Pilot 1: ITALY

FBK

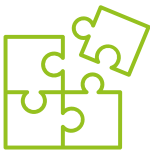


Objectives and Methodological Approach



STAKEHOLDERS CONSULTATIONS

- ❖ **Two-phase** consultation approach:
 - **Workshop** – January 2026: 13 participants, introducing LEONARDO, discussing requirements, barriers and UCs.
 - **Questionnaire + bilateral interviews**: stakeholder-specific questionnaires followed by 8 in-depth interviews.
- ❖ Broad stakeholder coverage: **21 organizations across 5 categories**:
 - 7 Industrial end-users; 3 Technical providers; 4 Regulatory/research actors; 3 Business/financial actors; 4 DSOs.
 - 10 local stakeholders + 11 national actors to provide a broader view of industrial flexibility in Italy.



KEY INSIGHTS AND REGULATION FRAMEWORK

- ❖ **Large energy-intensive industries** most experienced and active in Italian flexibility markets, while discrete/batch industries face stronger **production and scheduling constraints**.
- ❖ Flexibility increasingly relies on **auxiliary assets** (storage, HVAC, pumping, EV) not core industrial processes.
- ❖ **Legacy control systems, limited real-time data, and administrative burdens** remain barriers.
- ❖ Italy has an **advanced and relatively comprehensive** regulatory framework for flexibility markets:
 - **TSO-level participation**: aggregation of distributed resources and industrial loads for balancing.
 - **Distribution-level flexibility**: Local Flexibility Markets, with three pilot projects.

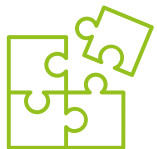


Functional and Technical Requirements



STORO PILOT SITE CONTEXT

- ❖ **Industries:** 2 discrete manufacturers (1 + 0.3 MWe PV) + energy asset owner (1 MWe H₂ electrolyzer, 4.7 MWe PV and 6 MWh BESS) + local DSO (6 MWe hydro + 4.4 MWh hydro storage) acting as BSP
- ❖ Industrial demand flexibility is highly **heterogeneous**:
 - **Electrolyzer:** power modulation and time rescheduling, with ~20 min ramping constraints.
 - **BESS:** fast-response flexibility and support for electrolyzer operation.
 - **Industrial thermal:** rapid modulation, with thermal inertia enabling flexibility from 5–15 min up to ~1 hour.
 - **Heat pumps + storage:** 30–100% modulation, constrained mainly by thermal comfort.
 - **EV charging:** controllable load through power modulation or on/off operation.



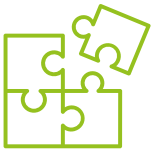
STAKEHOLDERS' FUNCTIONAL AND TECHNICAL REQUIREMENTS

- ❖ **Granular monitoring** with frequent data sharing is essential for designing, activating and remunerating flexibility.
- ❖ **Flexibility potential** depends on the industrial process, with scheduling constraints for industrial production loads.
- ❖ **Response times** vary widely: seconds–minutes for storage, hours–days for industrial processes.
- ❖ **Interoperability** needed, due to multiple protocols, proprietary EMS and the lack of unified data model.
- ❖ **Market integration** is essential, requiring APIs to connect GME and DSO flexibility platforms.





Business and Organizational Requirements



STAKEHOLDERS' BUSINESS AND ORGANIZATIONAL REQUIREMENTS

- ❖ **Organizational barriers** dominates: shift constraints, limited energy-management capacity and production-risk concerns could hinder participation.
- ❖ **Predictable revenues** are essential: availability-based payments are key to justifying flexibility investments.
- ❖ **Different models** are needed: experienced actors may prefer direct/bilateral participation; smaller actors need aggregators and simplified onboarding.
- ❖ **Regulatory complexity** remains a major barrier: simpler procedures and greater regulatory certainty are needed.



IFAAP PRIORITIES

- ❖ Enable **granular monitoring & forecasting** to quantify flexibility and support reliable activation and remuneration.
- ❖ **Adapt to industrial processes** by managing different flexibility potentials, response times and scheduling constraints.
- ❖ **Ensure interoperability** through standardized APIs and data models across EMS, devices and protocols.
- ❖ **Simplify market participation** with direct integration to GME/DSO platforms and streamlined onboarding.
- ❖ **Support predictable & low-risk participation** through availability-based revenues, flexible participation models and production override mechanisms.



Pilot 2: AUSTRIA

EEE





Austrian pilot context

Geographical focus: Styria (AT)

Pilot lead: EEE

Data & EMS integrator: EVON GmbH

Pilot context & characteristics:

- Pilot covers two medium-sized companies in food and feed production in Southeastern Styria
- Medium-scale industrial loads
- Process-driven electricity consumption (linked to production processes, including milling, refrigeration, etc.)
- On-site electricity generation (pv) & battery storage systems with potential for self-consumption optimisation



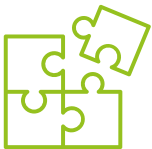


Objectives & Methodological Approach



STAKEHOLDERS CONSULTATIONS

- ❖ In Austria, **stakeholder input** was collected through a **series of small-group workshops & bilateral meetings**
- ❖ The developed LEONARDO **questionnaire guided discussions** on **flexibility** opportunities, available **data**, operational **constraints & participation conditions**
- ❖ The consultation included **grid & energy-service actors, technology & software providers, applied research organisations** and **regional energy-transition actors**
- ❖ Industrial perspectives were included through established **exchanges** with the involved **industries**
- ❖ Together, these perspectives provided a **broad view of the conditions** affecting **industrial flexibility in Austria**



AUSTRIAN MARKET AND REGULATORY CONTEXT

- ❖ **Desk research** examined the **regulatory conditions for industrial flexibility** in Austria
- ❖ **Industrial flexibility** is currently used mainly in **response to wholesale prices or in balancing markets**
- ❖ Austria **does not yet have** an established **DSO flexibility market**
- ❖ The new **Electricity Act provides the legal basis**, while market procedures & the common platform are still under development
- ❖ The Austrian pilot will examine how industrial flexibility could support future DSO needs



Functional and Technical Requirements

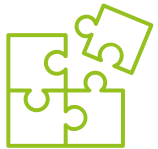


STAKEHOLDERS' FUNCTIONAL AND TECHNICAL REQUIREMENTS

- ❖ The **functional & technical requirements** identified for the Austrian industries were closely linked to their production processes & operating conditions
- ❖ At the feed-production site, flexibility is linked to the timing of milling, mixing & other production steps
- ❖ At the meat-processing site, refrigeration offer flexibility within defined temperature & hygiene limits
- ❖ Production **schedules & product requirements** determine when & for how long electricity consumption can be adjusted
- ❖ Plant operators require **clear operating limits, defined activation procedures & the possibility to override flexibility actions**
- ❖ **Existing monitoring & energy management systems** provided relevant data, but automated data exchange require additional configuration
- ❖ For future use by DSOs, the consulted grid stakeholder require **reliable forecasts & better visibility of the available flexibility**



Business & Organizational Requirements



STAKEHOLDERS' BUSINESS AND ORGANIZATIONAL REQUIREMENTS

- ❖ Industry expect to **reduce costs, increase on-site PV & storage use & limit peak demand**
- ❖ These **benefits must justify the required investment & operational effort**, while **production reliability & product quality** remain ensured
- ❖ Participation require **clear internal responsibilities & small additional effort** for operational staff
- ❖ **Flexibility services have to fit** existing customer, billing & settlement processes
- ❖ Future use by DSOs require **clear contractual conditions & verifiable service delivery**



EXPECTATIONS FOR iFAAP

- ❖ Identify **when, how & to what extent flexibility can be used & show** the expected **economic benefit**
- ❖ **Support** clear & simple operational **decisions**
- ❖ **Reduce the effort** required for coordination between the involved actors
- ❖ **Connect with existing industrial systems & processes**
- ❖ **Avoid** significant **additional workload** for industrial staff





Pilot 3: GREECE

UPAT



Objectives and Methodological Approach

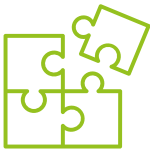


STAKEHOLDERS CONSULTATIONS



- **Online workshop:** 26 participants from 15 organisations.
- **Participants:** industrial end-users, a TSO (IPTO), a market operator (HEnEx), energy suppliers, technology providers and research actors.
- **Programme:** project and pilot introductions, industrial use cases, technical/market data needs, stakeholder questionnaire and interactive discussion.

KEY INSIGHTS AND REGULATION FRAMEWORK



- Flexibility is limited mainly by **production** continuity, safety and scheduling, not by monitoring or EMS maturity.
- **EMS integration lags:** manual data exchange, legacy interfaces and strict access policies block automated activation.
- **Economic viability** remains essential: flexibility revenues must outweigh production losses, investment costs and exposure to volatile balancing prices.
- **Cross-border participation needs** aligned market rules, interconnection capacity and clear roles for activation, telemetry and settlement.
- Greece has a relatively mature flexibility framework, with industrial access to balancing services and independent aggregation.
- Bulgaria has strong direct industrial market participation through BRP/BSP structures, but still lacks mature explicit demand-response and DSO-level flexibility mechanisms.





Functional and Technical Requirements

BG-GR PILOT SITE CONTEXT



Industries: 2 manufacturers (4MW PV + 1MWh BESS) + generation asset owner (1.5 GW PV + wind, 160 DC fast chargers + 544 AC EV charging points)

- **Flexibility is diversified across assets:** storage, thermal demand and EV charging.
- **BESS:** fast response for **peak shaving, short-term balancing and PV integration.**
- **Thermal loads:** load shifting through thermal inertia, subject to process constraints.
- **EV charging:** controllable and schedulable demand for load modulation and charging optimisation.
- **Large PV/wind portfolio:** increases the need for forecasting, curtailment management and demand coordination.
- Industrial flexibility requires **coordinated orchestration, interoperable data, forecasting and optimisation across assets.**



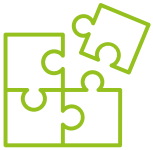
STAKEHOLDERS' FUNCTIONAL AND TECHNICAL REQUIREMENTS

- **Granular verification:** use 15-minute data to verify delivered flexibility at process level.
- **Process compatibility:** respect production schedules and safety when selecting feasible flexibility services.
- **Interoperability:** bridge legacy APIs due to the lack of unified data models
- **Secure data exchange:** automate spreadsheet-based reporting while preserving ownership, access rights and confidentiality.
- **Flexibility potential:** it highly depends on the industrial process schedule and the existing restrictions



Business and Organizational Requirements

STAKEHOLDERS' BUSINESS AND ORGANIZATIONAL REQUIREMENTS



- **Financial incentives and predictable revenues are essential:** shared-savings, capacity payments and balancing/ancillary-service revenues are the preferred models on the Greek side.
- **Organisational readiness:** internal approvals and day-ahead planning constrain participation. Staff need demand-response and market training.
- **Organisational barriers:** operational constraints, limited load shifting capability and production line constraints is an obstacle to participation.
- **Aggregators are seen as the key market interface,** handling market access, portfolio settlement and bilateral payment of industrial customers.



IFAAP PRIORITIES

- **Prioritise monitoring & forecasting:** support operational decisions with consumption visibility, alerts and reporting.
- **Adapt to industrial processes:** respect continuity, safety and nomination schedules when assessing flexibility.
- **Ensure interoperability:** integrate existing EMS through standard interfaces and CIM-based data models.
- **Enable secure data sharing:** automate exchanges with authorised actors while retaining industrial control over data.
- **Support grid and market coordination:** combine asset forecasts with congestion indicators and grid constraints.



Q&A





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Thank you!

