Use Cases and Business Opportunities of Multi- Agent System (MAS) ICT Solutions for LV Flexibility Management

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Mas²tering

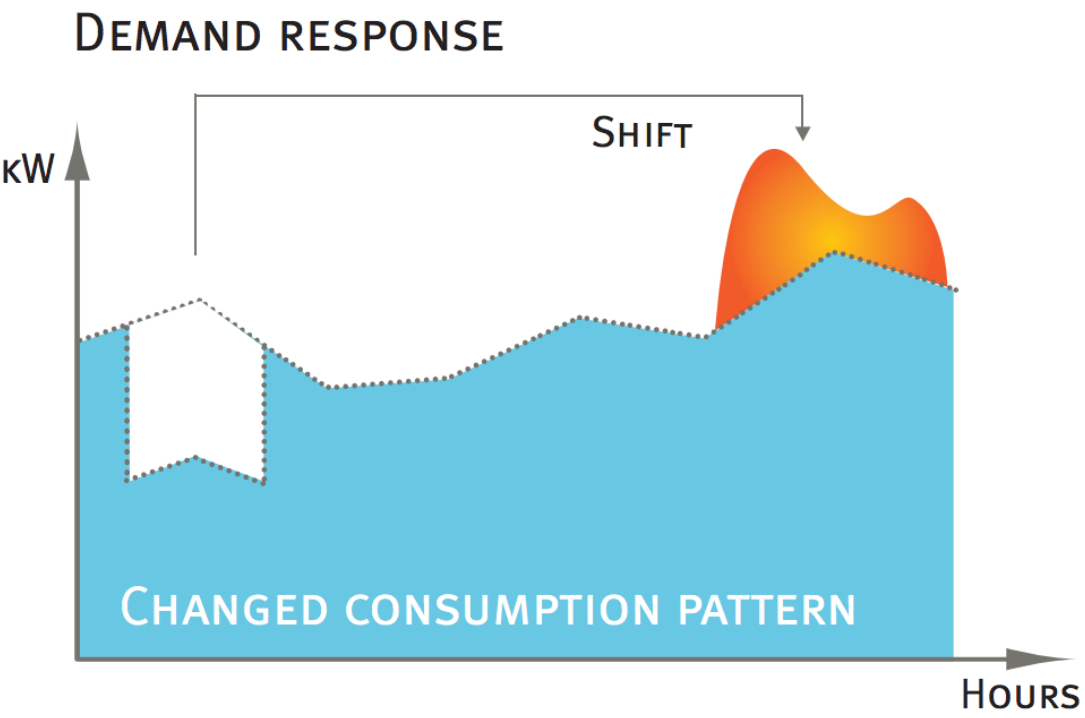
R2M RESEARCH TO MARKET SOLUTION

Outline

- Introduction
- Mas^{2}tering Project
- Use cases of Multi-Agent System ICT Solutions for LV Flexibility Management
- Business Opportunities of Multi-Agent System ICT Solutions for LV Flexibility Management
- Conclusions

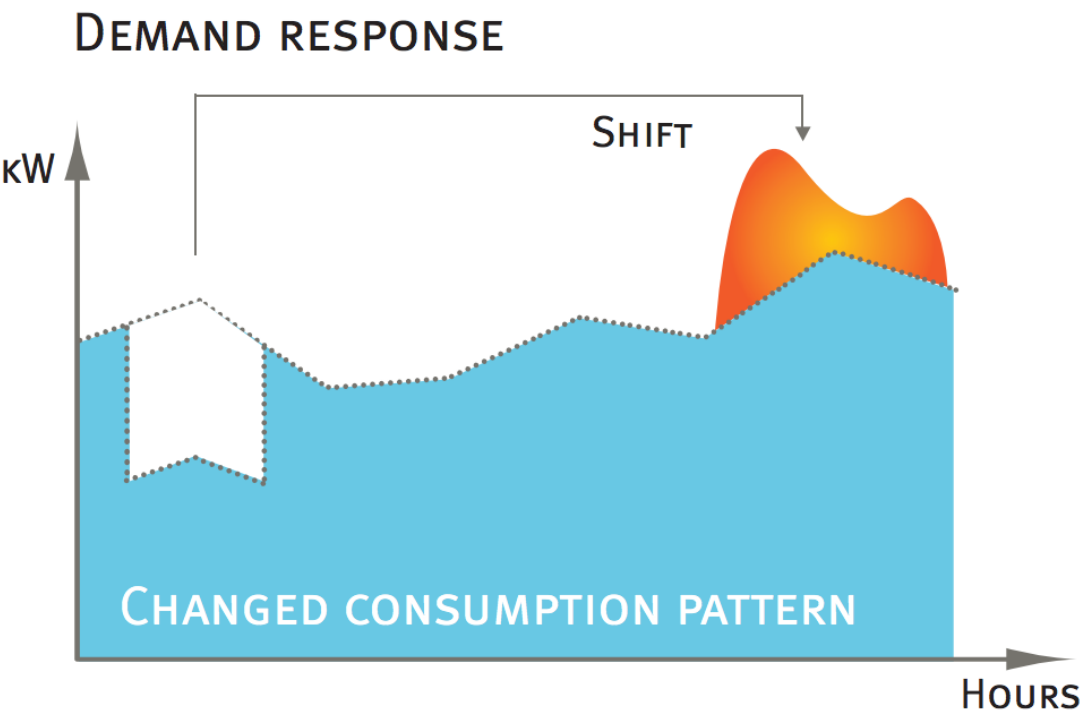
R2M RESEARCH TO MARKET SOLUTION

Flexible Energy – The Value of Demand Response



Demand response, provide flexibility

Flexible Energy – The Value of Demand Response



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Voluntarily changing their usual electricity consumption

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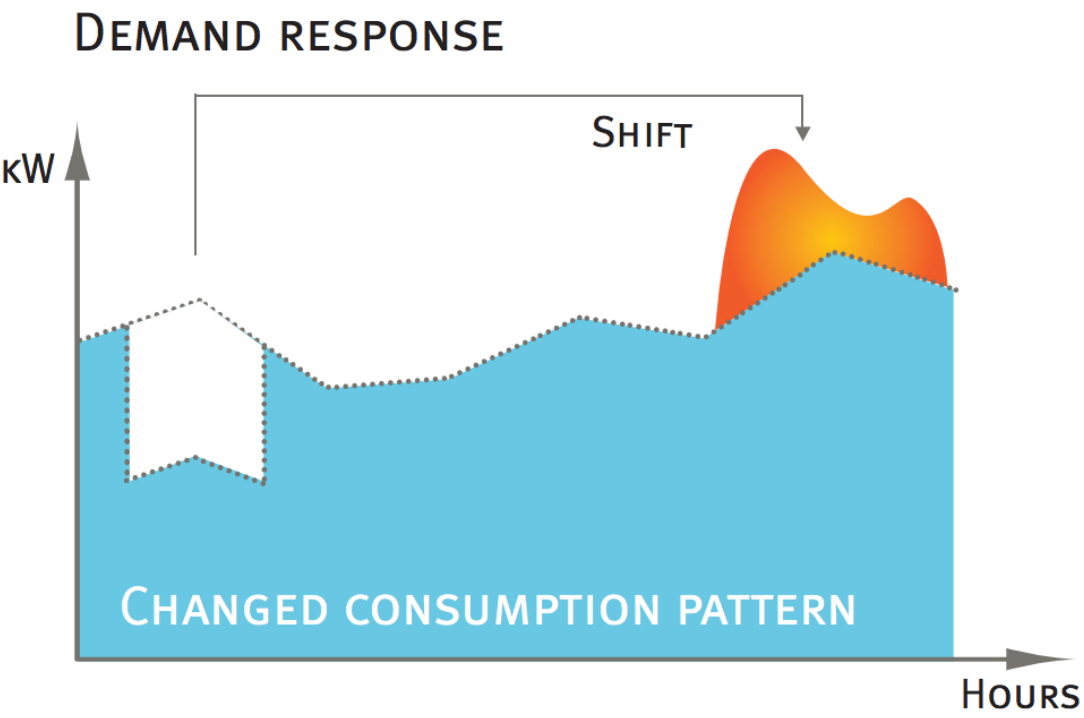
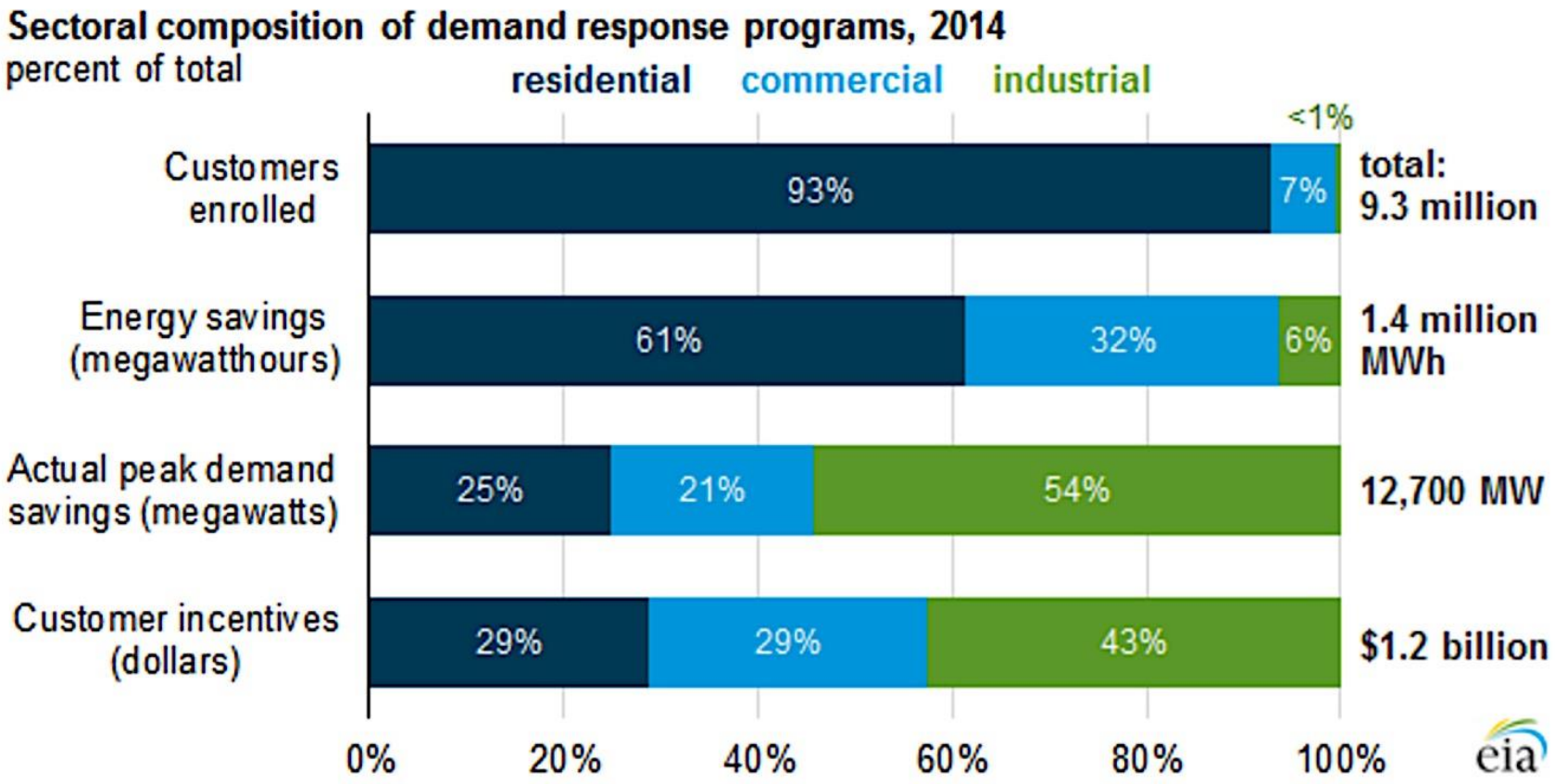


Demand response, provide flexibility

Voluntarily changing their usual electricity consumption

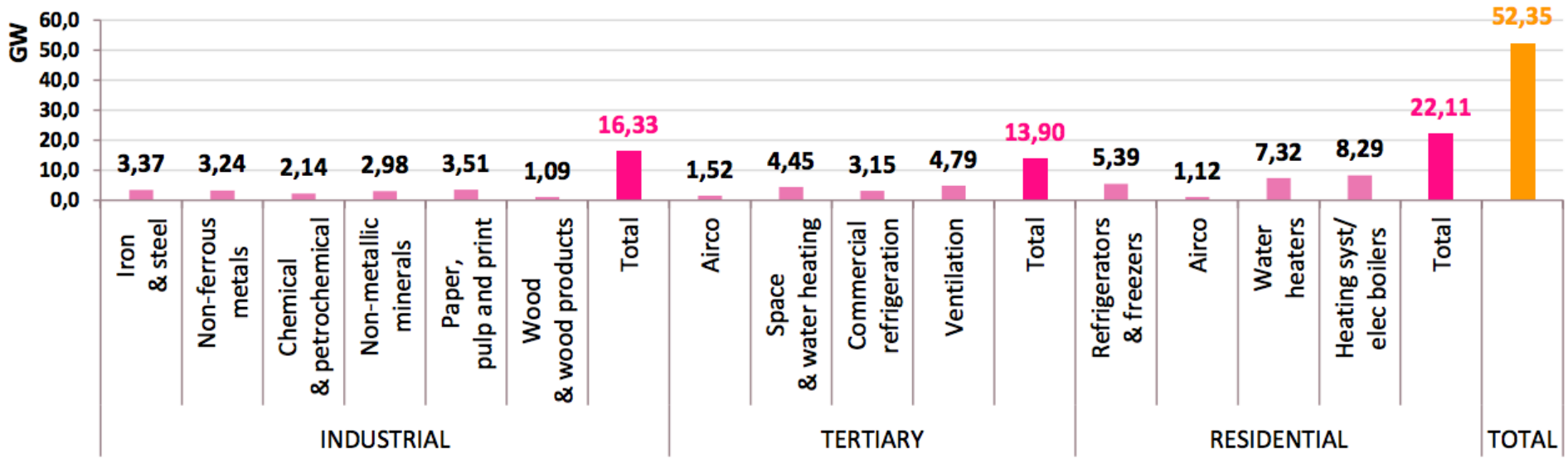
In reaction to:
Price signals→ Implicit
Specific requests→ Explicit

USA Demand Response Market



Source: U.S. Energy Information Administration, Electric power sales, revenue, and energy efficiency Form EIA-861

European DR Potential



Source: Sia Partners

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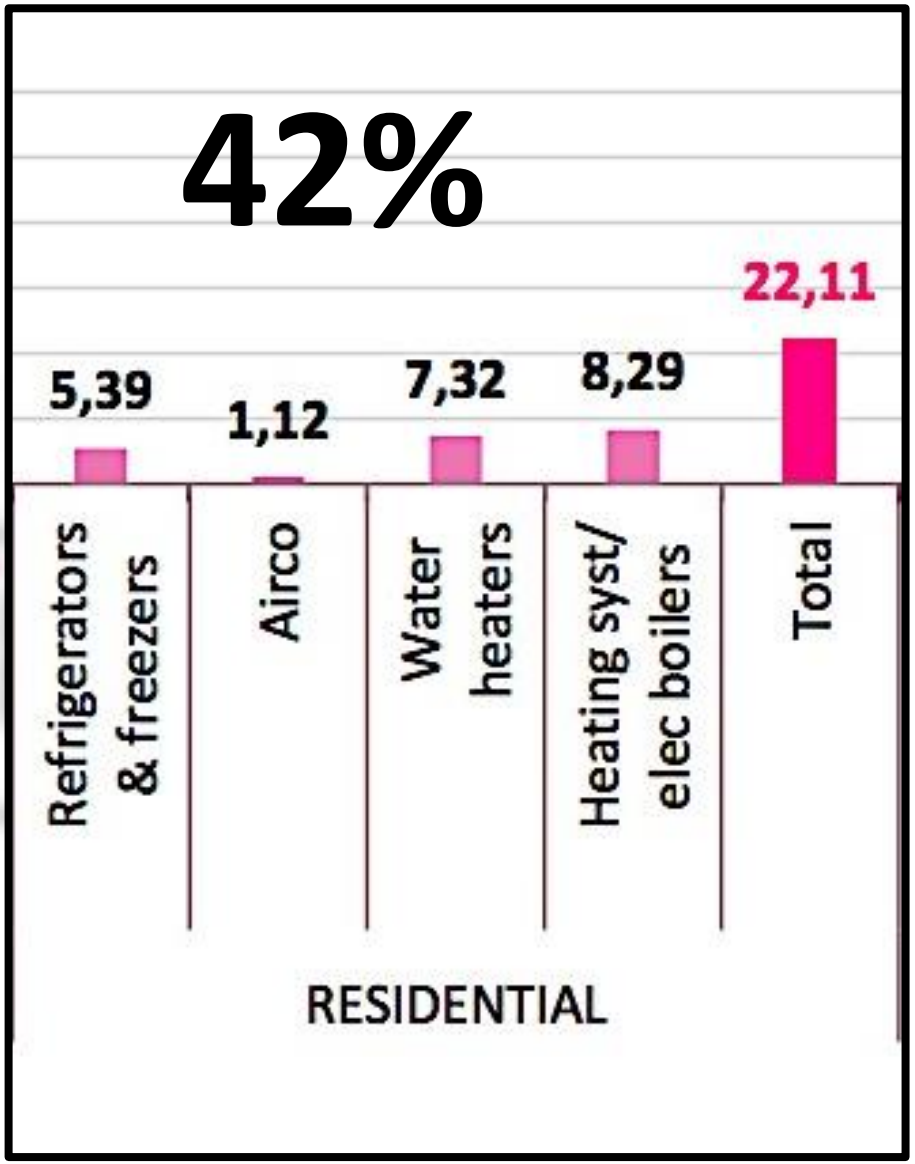
Residential Flexibility



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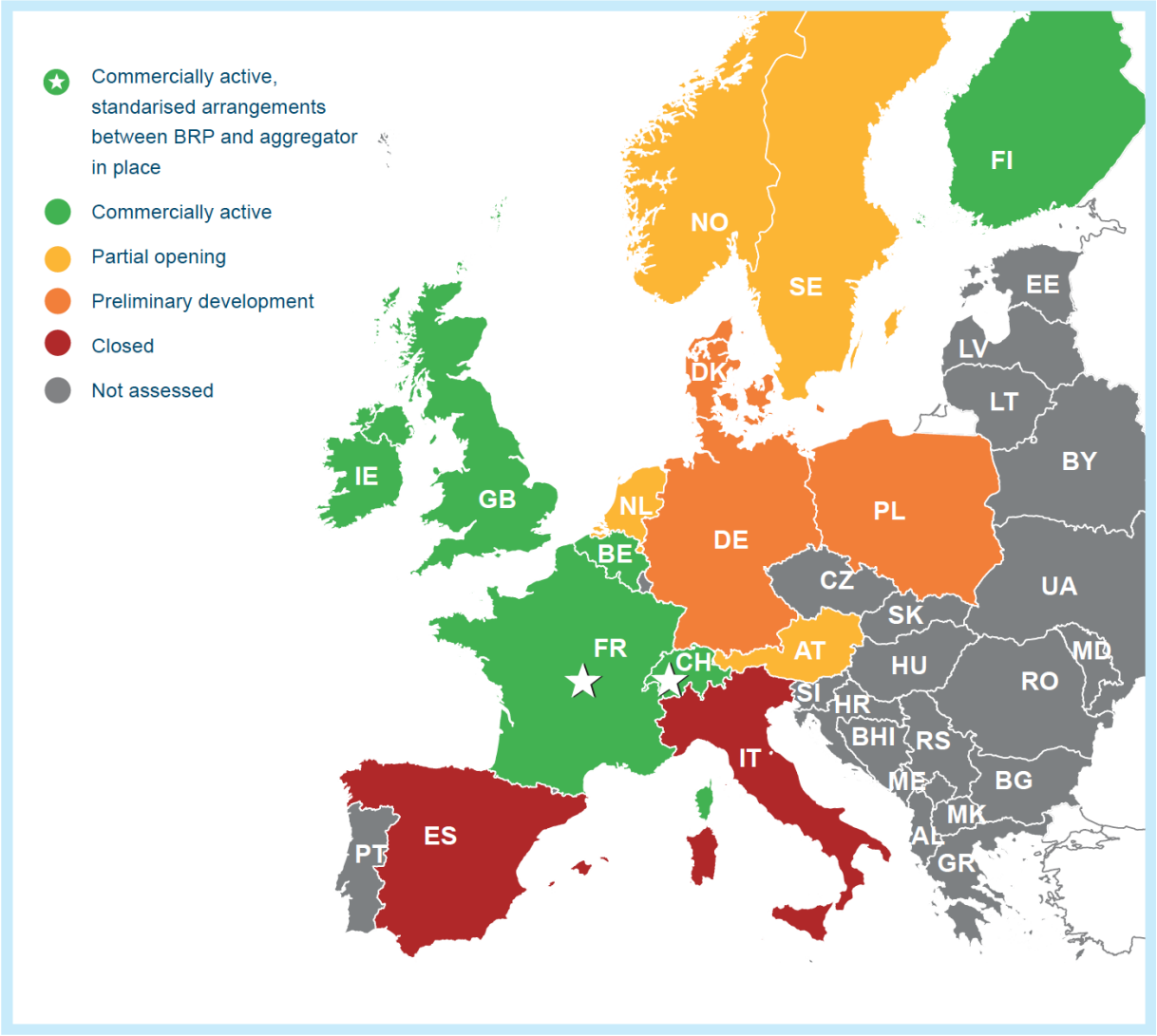
Demand Response in Europe



Programme Requirements

Consumer Access and Aggregation

Measurement and Verification

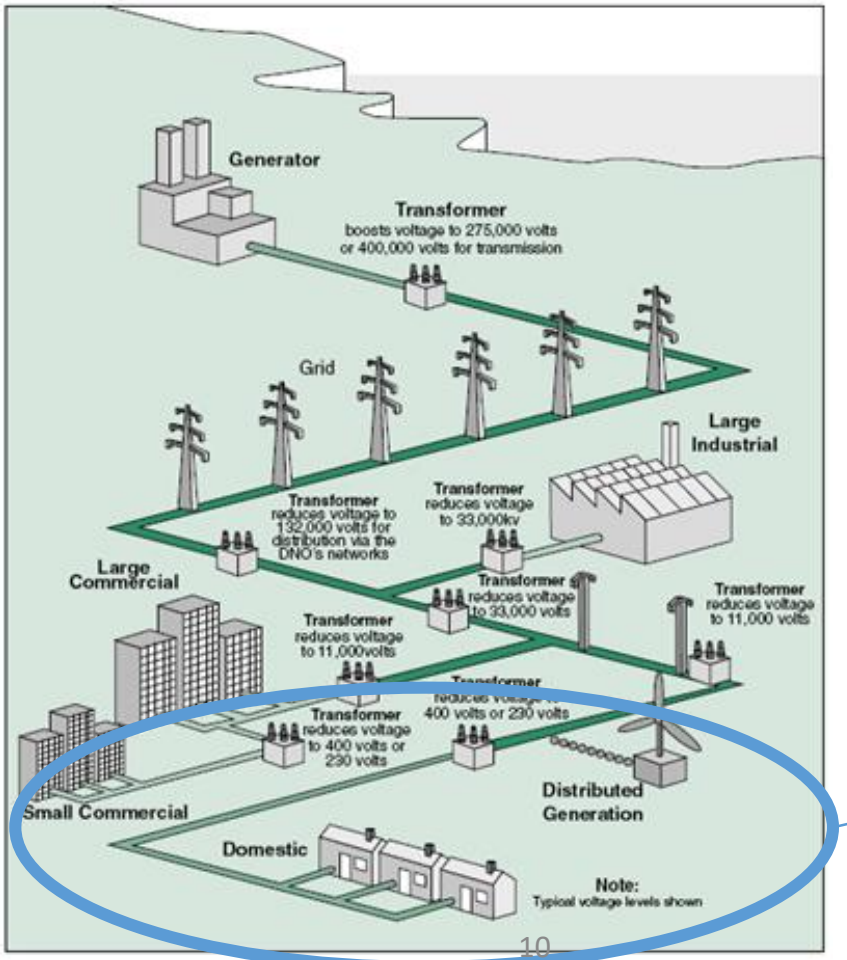
Finance & Penalties

Source: SEDC 2015

Mas²tering

Mas²tering Vision

*The **creation of local communities of prosumers fully empowered to participate in the electricity market** at the low voltage substation level of the smart grid.*



Mas²tering

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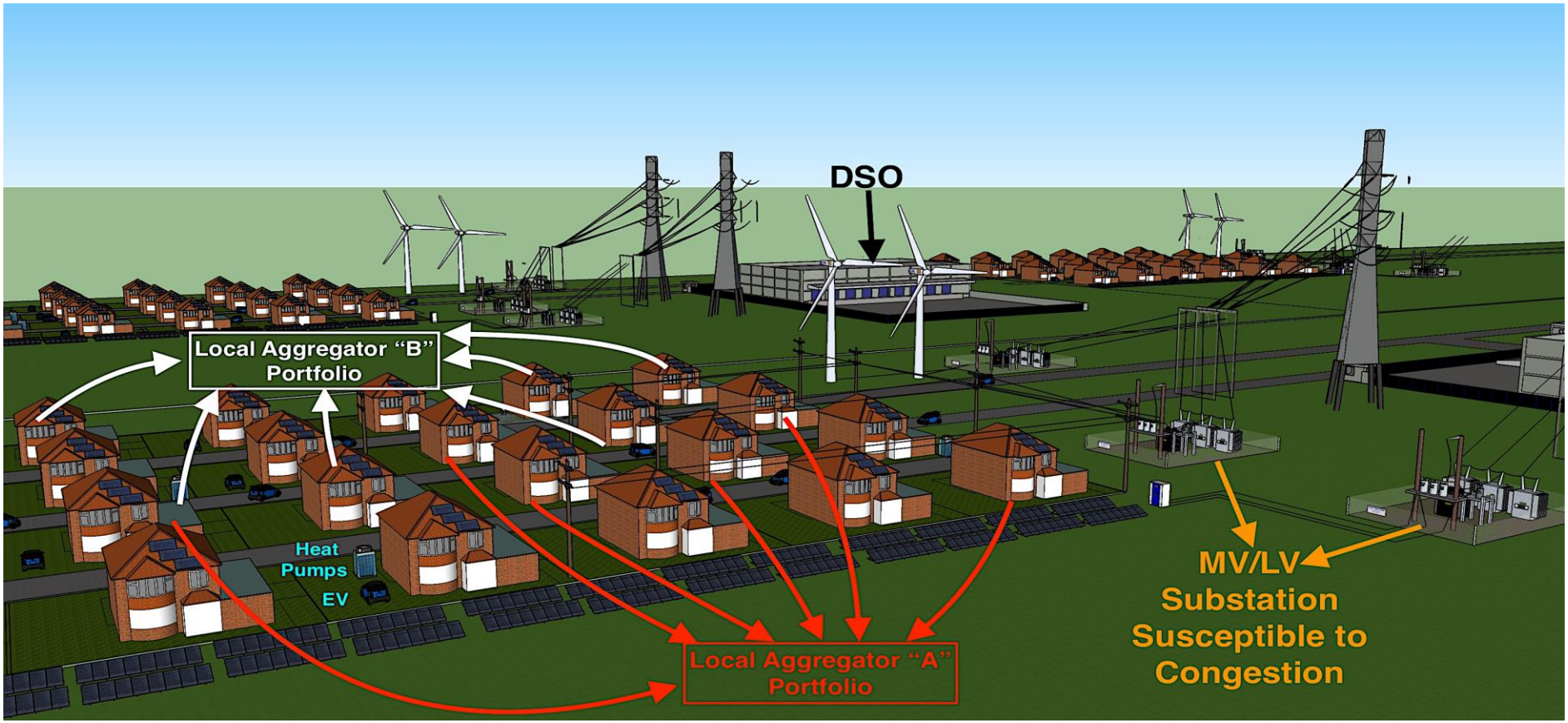


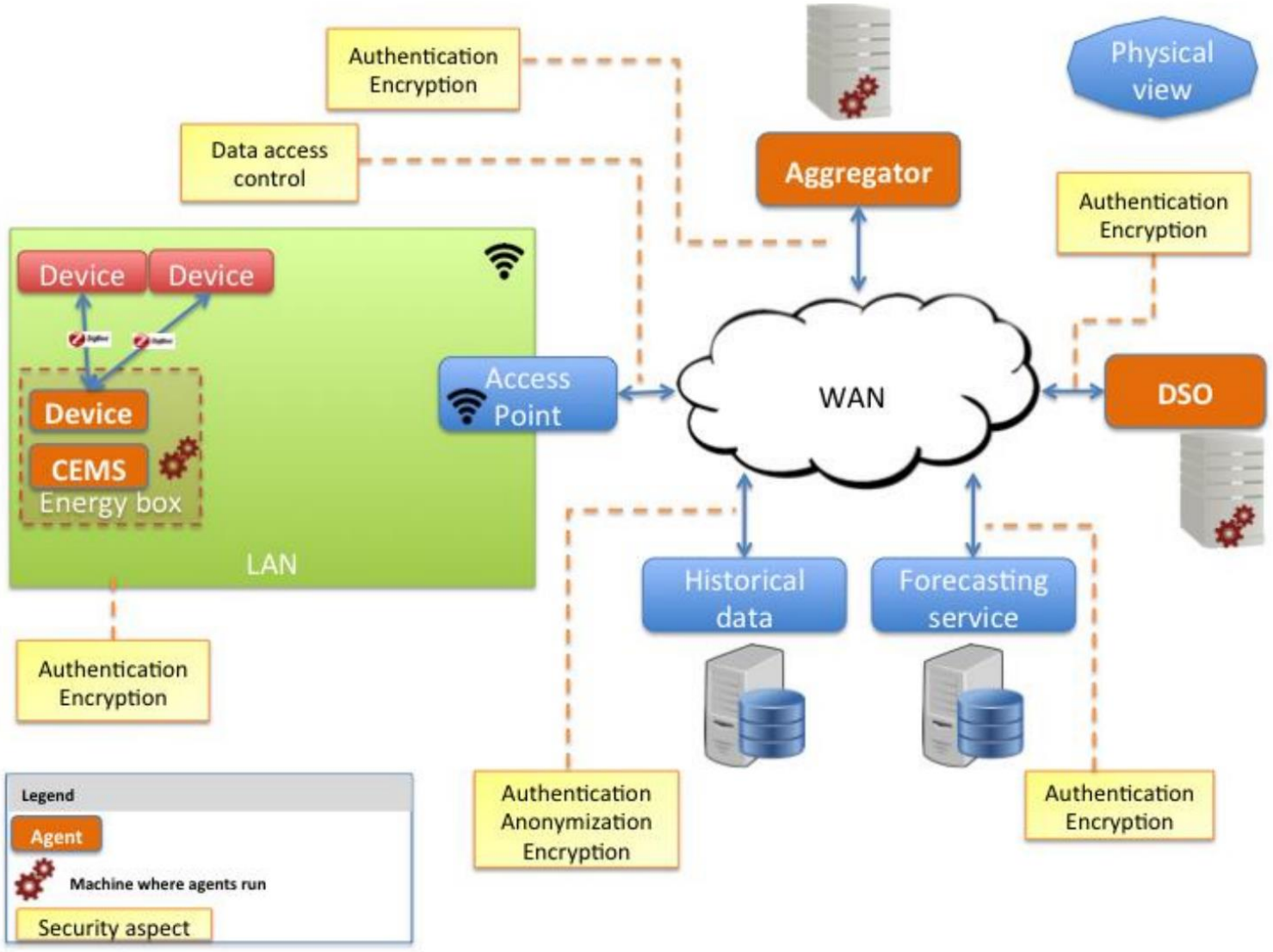
- Local Flexibility Aggregator (LFA)
- Local (physical) Energy Communities

Opportunities

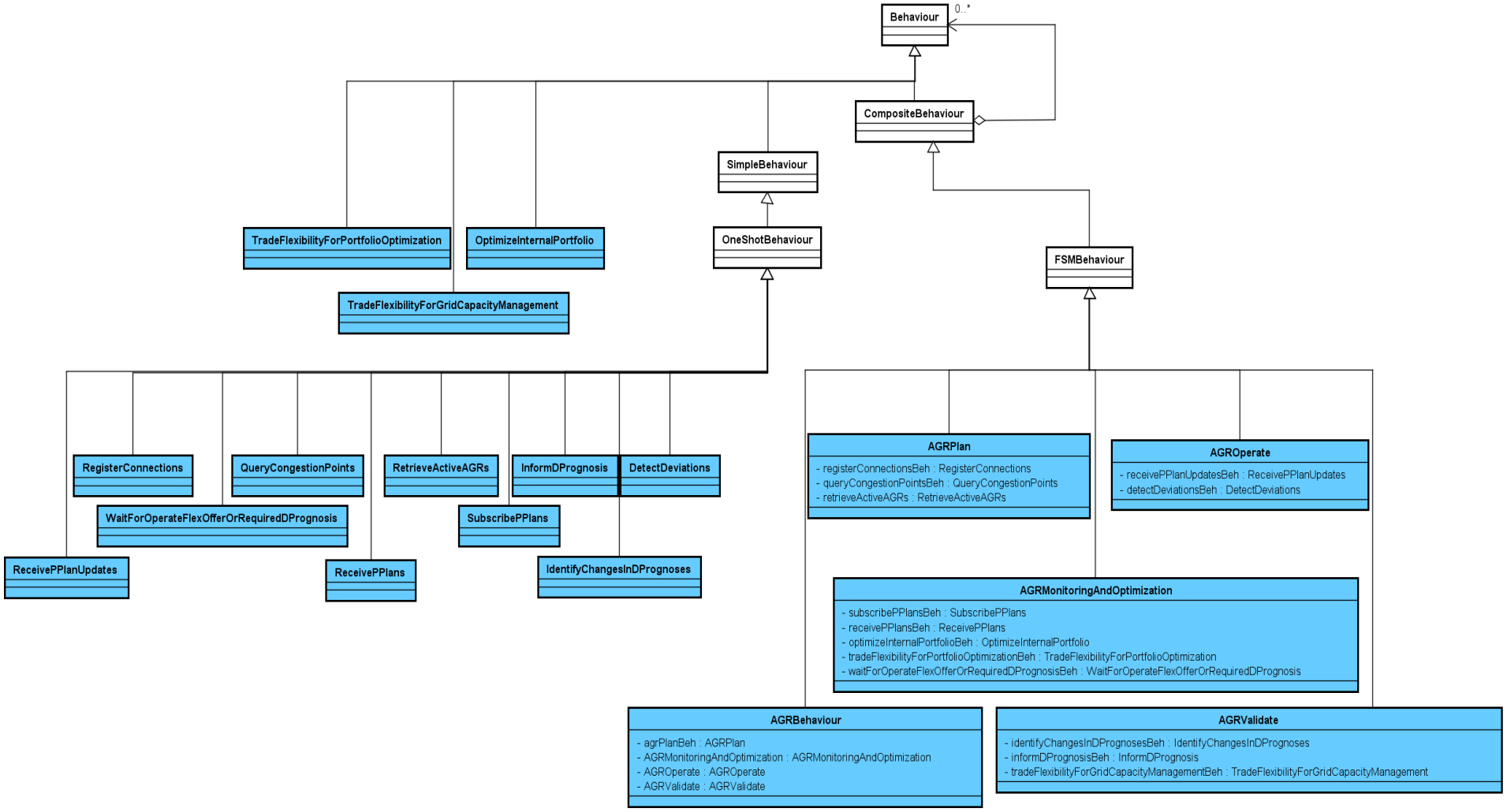
Prosumer Empowerment + Energy Bills

DSO Capacity Management

Multi-Agent System



Multi-Agent System



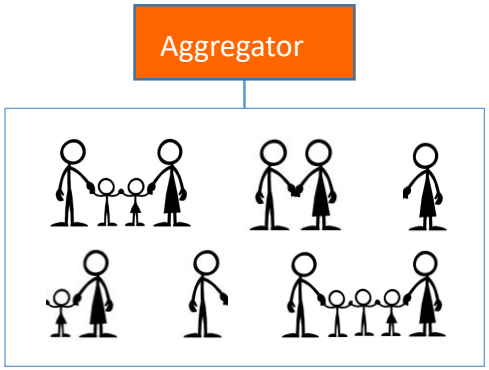
Use Cases

Home
Optimizing the
energy bill

UC1

RESEARCH TO MARKET SOLUTION

Use Cases



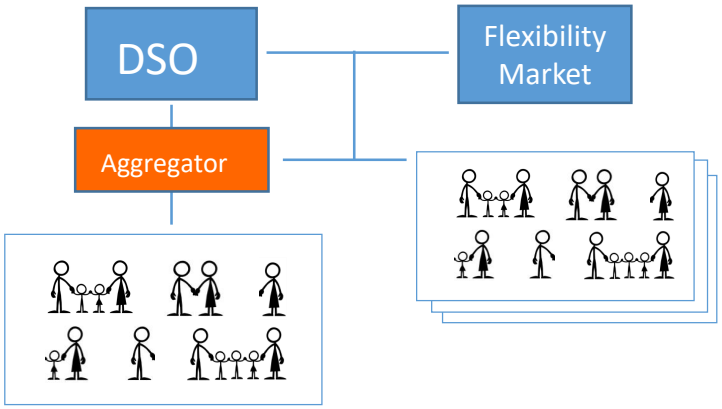
Energy Community
Optimizing the
community energy bills
(copper plate)
+ resultant grid benefit

UC2

Home
Optimizing the
energy bill

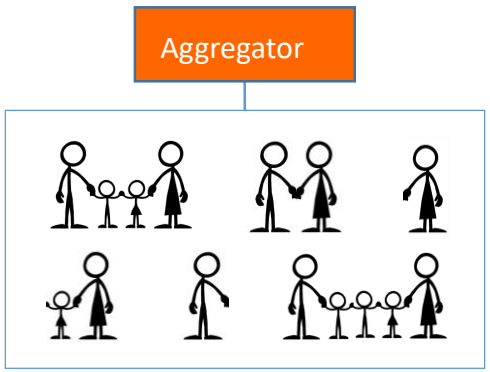
UC1

Use Cases



Energy District
Optimizing community energy bills and DSO capacity management
(grid constraints considered)

UC3



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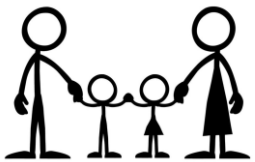


Home
Optimizing the energy bill

UC1

Primary Stakeholders

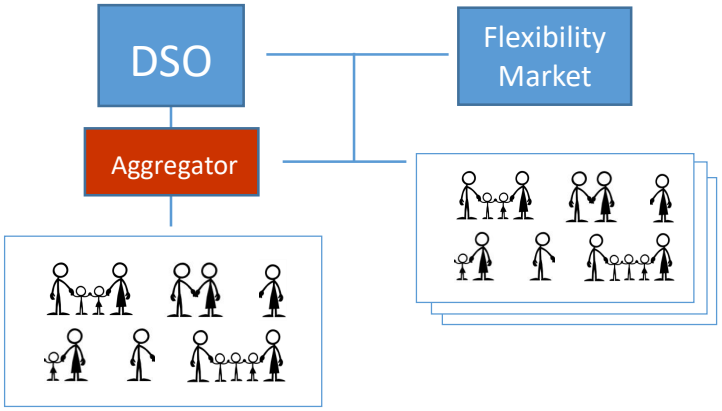
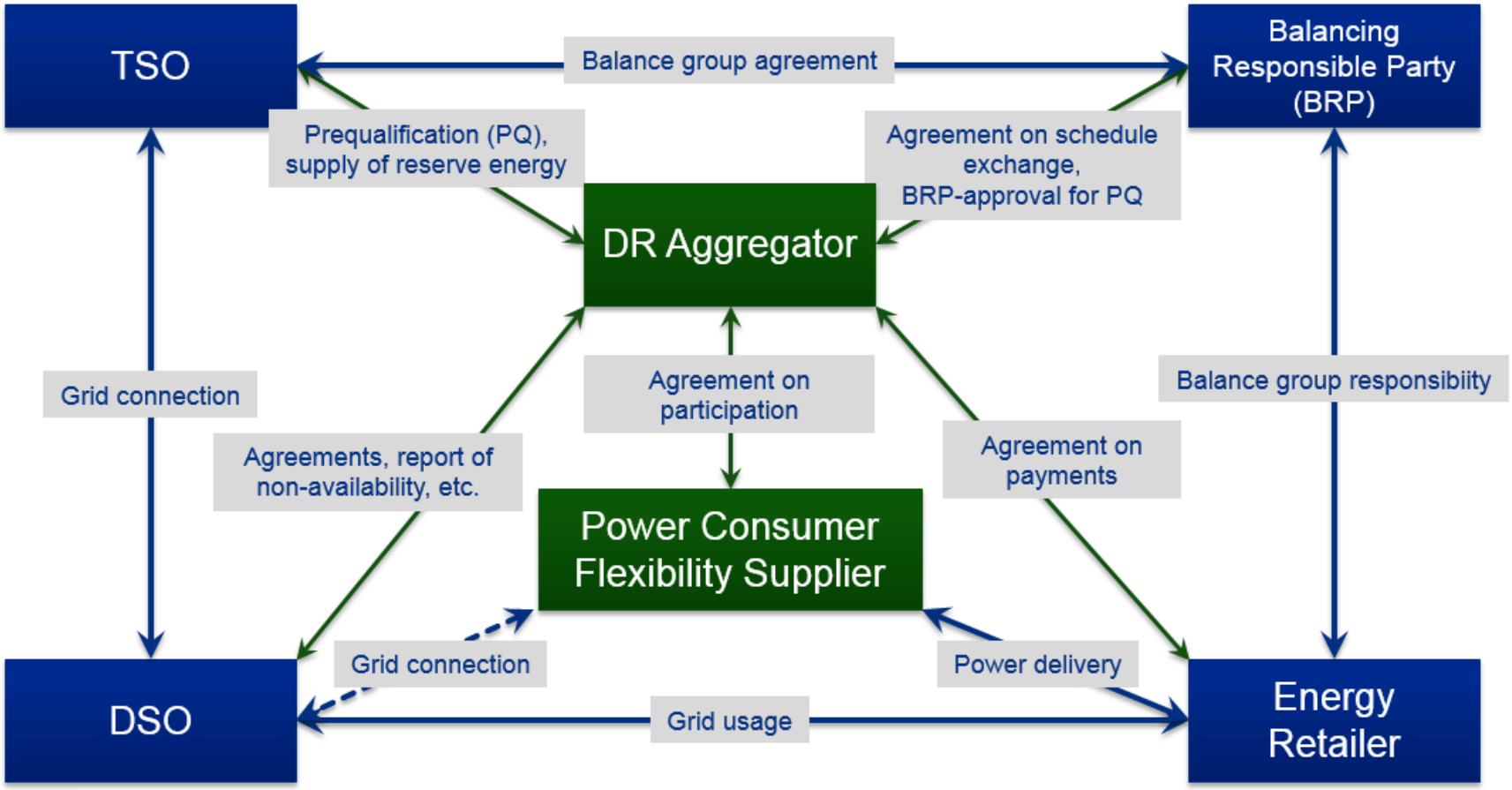


Table 3. Objectives of the main socio-economic actors present in the envisioned community of prosumers.

Actor	Objectives
Prosumer*	Save money and lower their electricity bills.
	Respect of comfort preferences and desired electricity use.
Energy Service Company	Maximize its margin when offering auxiliary energy-related services to prosumers.
Aggregator	Maximize the value of flexibility for its portfolio, taking into account customer needs, economic optimization and grid capacity.
Supplier	Maximize its benefit when sourcing, suppling and invoicing energy to its customers. (i.e. Portfolio optimization)
DSO	Reduce grid congestion.
	Guarantee security of supply.
	Efficient network capacity planning

** Although not all consumers are expected to be prosumers, traditional consumers can be modelled as a prosumer who consume but do not produce energy*

Business Model Opportunities



Business model opportunity buckets:

- Primary business models are those that directly relate to the grid efficiencies possible by unlocking consumer/prosumer flexibility.
- Supporting business models are those associated with entering or facilitating the ecosystem.

Business Model Opportunities

Primary

Flexibility as a Product

B1. Sale of Flexibility by a consumer/prosumer to a Local Aggregator is appropriate for consumers/prosumers that do not require services related to in-home optimization and desire to gain value from offering flexibility to the market through an aggregator.

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B2. Sale of Flexibility by a Local Aggregator to the Flexibility Market deals with flexibility that a local aggregator may sell for purposes other than DSO Services. This flexibility is made available to the flexibility market where the buyer may be a DSO who does not require services, an aggregator of aggregators, a BRP or other market participant.

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B3. Sale of Flexibility by a Local Aggregator Service Contract to a predetermined buyer (DSO, Aggregator of Aggregators or BRP) deals with the predetermined sale of flexibility to a contracted buyer.

Business Model Opportunities

Primary

Consumer: In home optimization services

B4. Time-of-use (ToU) optimization is based on load shifting from high-price intervals to low-price intervals or even complete load shedding during periods of high prices. This results in the lowering of the energy bill proportional to the price differential and quantities of energy consumed.

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B6. Control of the maximum load is based on reducing the maximum load (peak shaving) that the Prosumer consumes within a predefined duration (e.g., month, year), either through load shifting or shedding. By lowering this maximum load the consumer can benefit from lower tariffs.

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B7. Bundled Flexibility Management Service the combination of optimization services coupled with flexibility (as a product) sales to a Local Aggregator.

Business Model Opportunities

Primary

DSO: Flexibility services for DSO

B8. Congestion management deals with the use of flexibility to attain the benefits of peak reduction, local balancing, the reduction of losses and voltage management in a discrete timeframe of high demand to avoid the thermal overload of system components.

Business Model Opportunities

Primary

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B9. Grid capacity management deals with the use of flexibility to conduct congestion management but also in a longer term horizon to defer grid investments to ensure future capacity needs and to extend the operational lifetime of system components.

Business Model Opportunities

Primary

Joint Services Business Models

B10. Bundled Contracts (Phone-Internet-Energy) for the providing of In-Home Optimization and Flexibility Management Services deals with strategic alliances between utilities and telecoms to offer bundled services or with 3rd party organizations that self-organize to offer holistic bundled solutions.

Business Model Opportunities

Secondary

Knowledge & Data Services

B11. The sale of congestion point forecasting to local aggregators as a service deals with the ability to create and deliver a competitive advantage and work avoidance via forecasting services.

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B12. The sale of consumer / prosumer consumption data to Local Aggregators or Common Reference Point Operators as a service deals with the data flow concerning consumer/prosumer load profiles and/or flexibility potential.

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B13. The sale of MAS IP to Local Aggregators to maximize price differentials between flexibility purchases and flexibility sales deals with the business model for the exploitation of the Mas^{2}tering foreground as it relates to the ICT platform / MAS IP.

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B14. The* sale *of MAS IP to In-Home Agent Manufacturers (white goods and renewable energy technologies) to increase product competitiveness and differentiation deals with the exploitation of the Mas^{2}tering foreground as it relates to the MAS IP.

Highlights D1.6: Business Model Opportunities

Secondary

Telecom Services

B15. Broadband Content, VAS and OTT sales deals with the sale of content licensing, Value Added Services(VAS) or Over the Top Content (OTT) subscription-based services by Telecom Operators to combined energy suppliers / LFA for enhanced device abstraction interoperability within major smart appliance categories connected to ZigBee, Energy@Home, 5G, cloud access channels, etc.

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B16. HAN Sales deals with the provision of Smart Gateway and related products / services in the HAN. According to the specific country and type of market the Telco company may also be the owner of the device and ask the final user to pay a fixed rate.

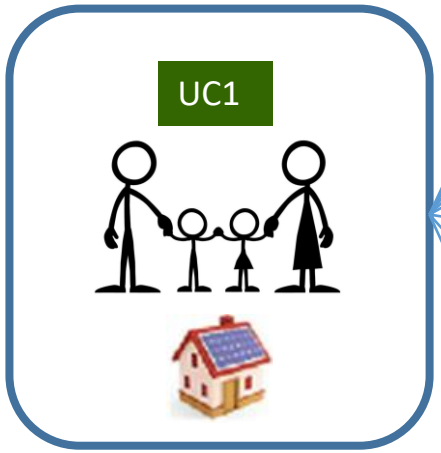
Highlights D1.6: Business Model Opportunities

Secondary

Security Services

B17. The sale of security software to ensure the secure transport of consumer/prosumer data deals with how software and data security providers add and take value from the system.

Mapping Business Opportunities to Use Cases



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B4. Time-of-use (ToU) optimization

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B6. Control of the maximum load

B7. Bundled Flexibility Management Service

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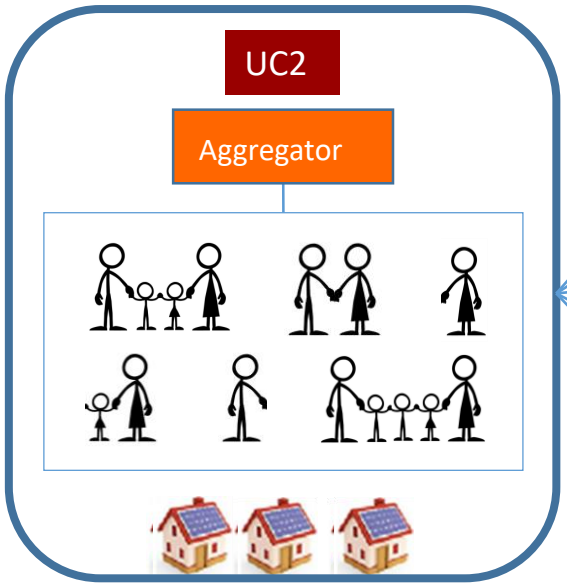
Mapping Business Opportunities to Use Cases



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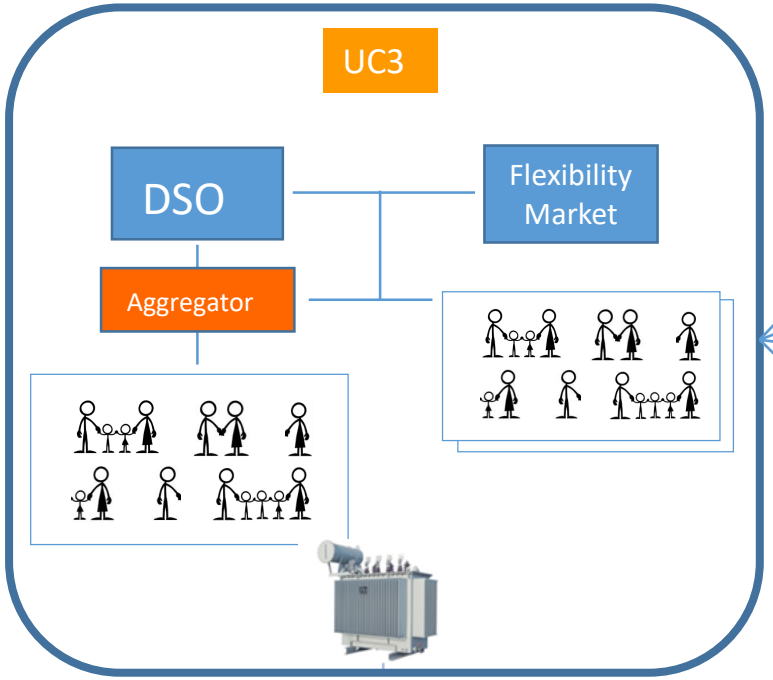

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B8. Congestion management

B9. Grid capacity management

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Conclusions

Multi-sided platform-based business model framework where flows (data, electricity, euros) are bi-directional, between multiple actors, and with network effects

A **converged business orientation** that represents the conceptual requirements of industrial stakeholder segments: Energy Supplier, Telecom Operator, Cyber-Security Service Provider, DSO, Metering Company/ESCo, and IP provider .

A mapping between the business model opportunities facilitates the alignment of business models and technical architectures and therefore the **gap between the research and the market is reduced.**