

A Multi-Sided Business Model for Local Flexibility Management in Low Voltage Distribution Networks



Mas²tering



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Mas2tering Vision

Mas2tering develops multi-agent system (MAS) ICT solutions that enable flexibility management within the low-voltage part of the electricity distribution network where decentralized decision making will bring value and competitiveness. The project proposes to put prosumers first, and provides them with access to the energy market in new ways.

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.





Our Proposition

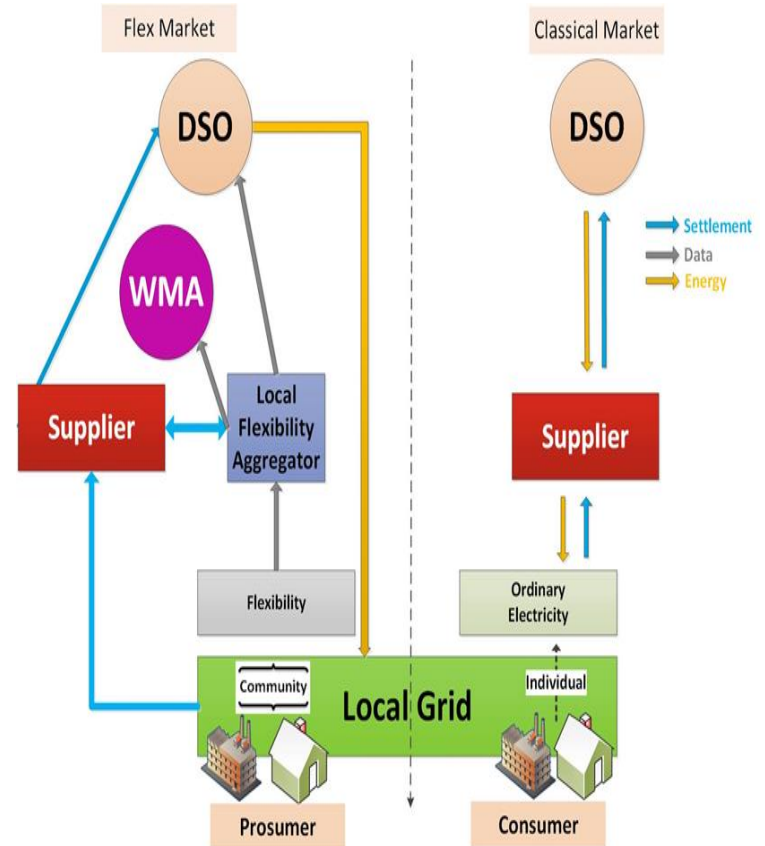
- If homes can individually and collectively level their demand load profile, then the generation, distribution and storage of electricity at the LV level (and indirectly at higher voltages) can be optimized.
- The increasing rate of intelligent domestic devices provides a real impetus for a smarter distribution network by creating a novel market model to maximise the advantages of DERs and flexibility possible by the individual and collective actors at the LV level.
- In such a scenario, smart consumers and prosumers are those that use demand response to shift their flexible loads.
- Local Energy Communities (LEC) are a collective force under a local flexibility aggregator that is positioned to influence, and be influenced by the local energy market. Local flexibility is at the cornerstone of this new emerging energy market design





Local Flexibility Market

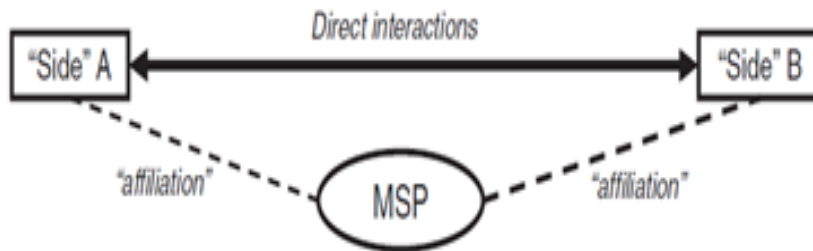
- The formation of local energy communities implies that they should have an intermediary to help manage Distributed Generation and Distributed Storage with regards to the injection of unused capacity to the LV-grid.
- A new role of a flexibility manager or aggregator is foreseen in the energy value chain to act as an intermediary and facilitating agent between prosumers and traditional market players.
- The role being developed is one that combines the main aspects of flexibility management and aggregation labeled the Local Flexibility Aggregator (LFA).





Business Model Shift

Historically the consumer was a passive recipient of the value chain product (power), they will become an active, empowered value chain participant requiring integration into the network. Both information and power will flow in multiple directions. and, exponentially increase and business models will emerge to capture that value.



The value chain will extend further, grow more complex and involve a wide variety of new participants

Multisided business models are technologies, products or services that create value primarily by enabling direct interactions between two or more customer or participant groups.

Their complexity arises out of the need to create value for more than one participant group in order for it to be viable, and in the chicken-and-egg situation that arises when the model is first created and a critical mass of one group is required in order to convince another group to participate.



The Business Challenge

Design a multi-sided business model that **creates, delivers and captures** value for the Local Flexibility Aggregator including description of the network stakeholders and their roles and relationships.





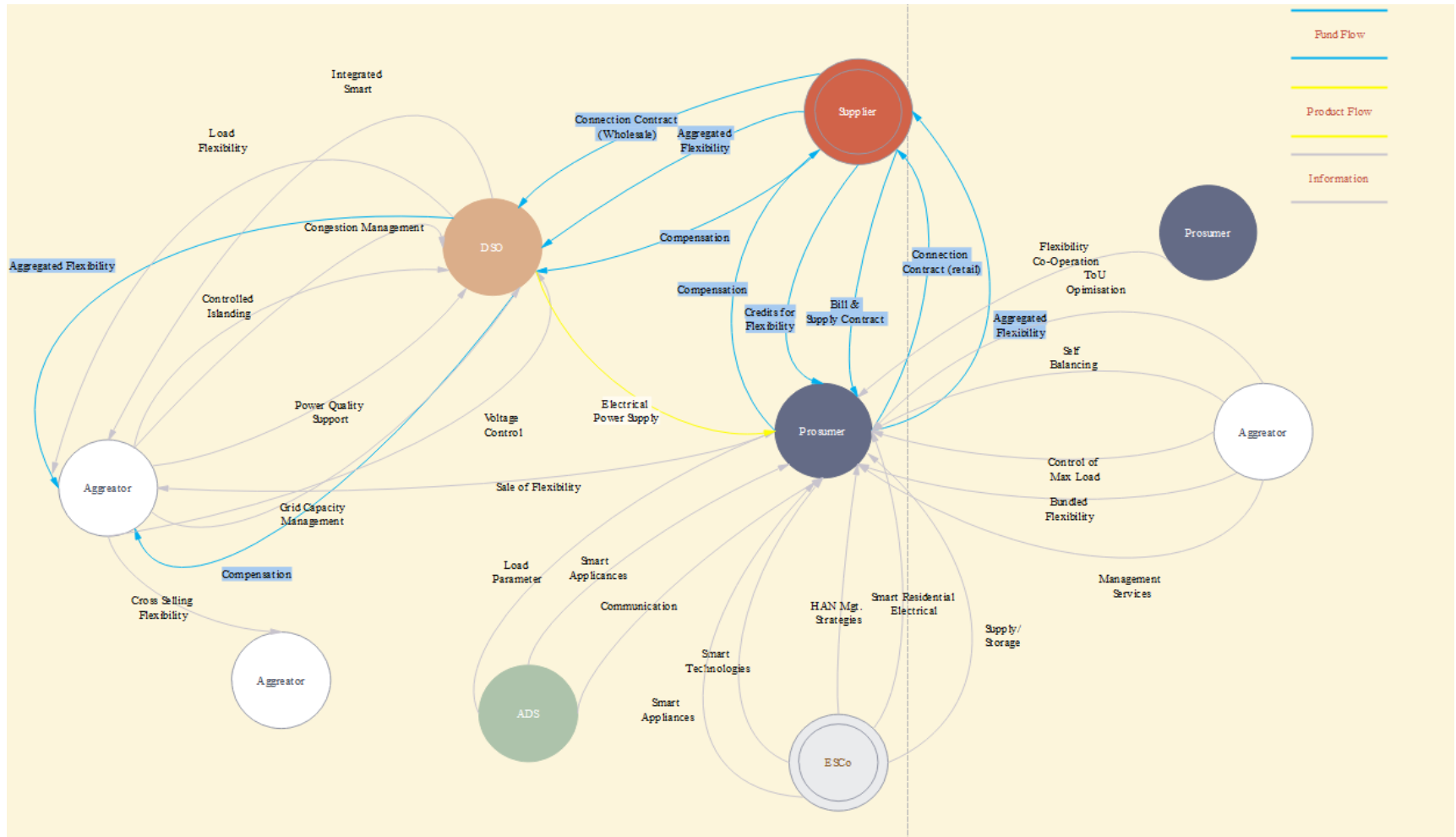
Business Modelling Methodology

- As a business modelling methodology, Value Network Analysis (VNA) facilitated the visualization, analysis and insight into the business exchange flows and network relationships
- The central tenet of VNA is to understand
 - *How value is created in a network of interdependent relationship?*
 - *Where value is located in the network? and*
 - *What network interactions are required for value delivery?*
- VNA focuses on the value-creating system itself, within which different economic actors perform roles
 - DSO, Supplier, Aggregator, Prosumer– who in essence work together to co-create value of local flexibility
 - Mapping of various value flows
 - Fund flow which refers to settlement,
 - Information flow refers to the data commodity and
 - Power flow which refers to transmitted electrical product
- Multiple Interviews and Workshops to gather data





Network Value Flow Map



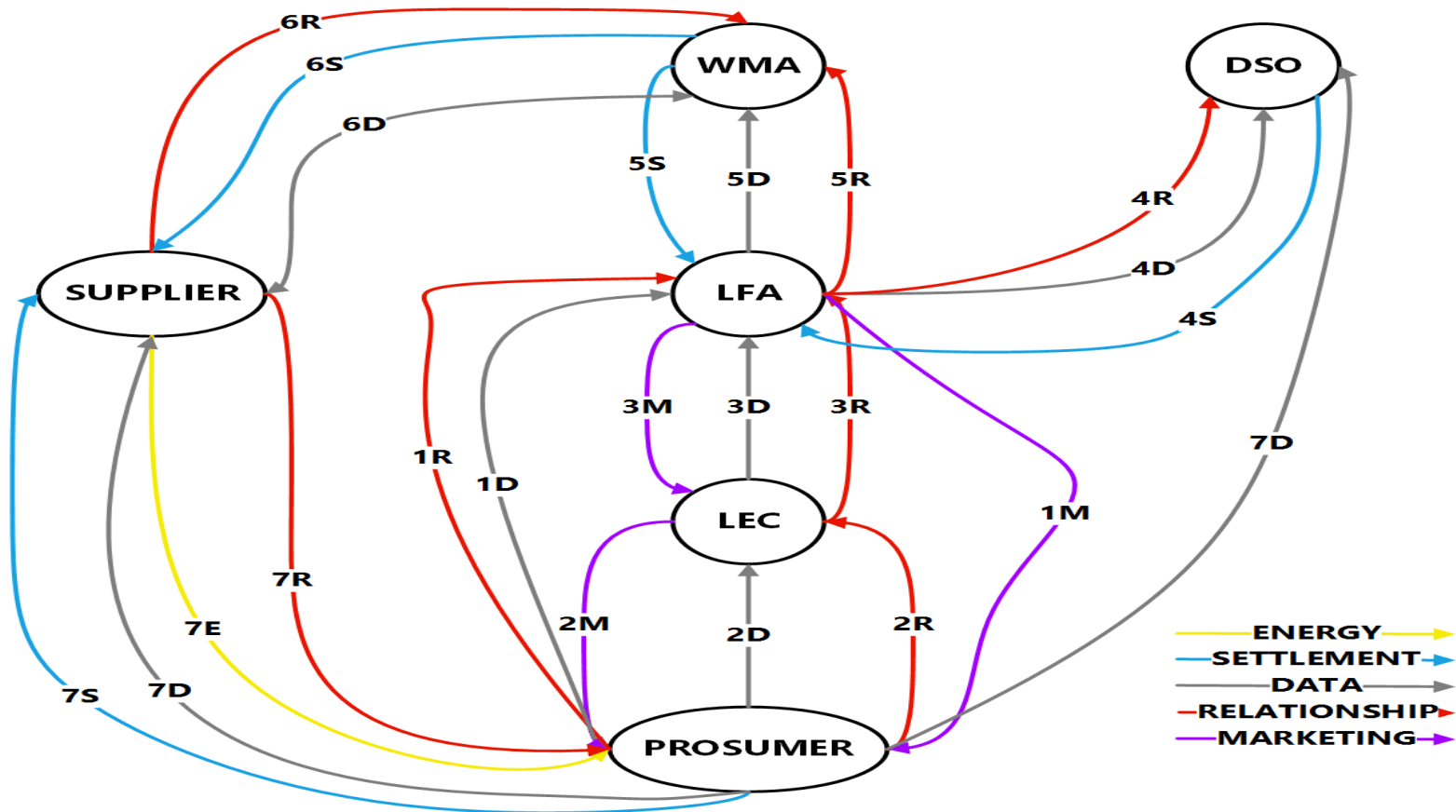


Interaction Flow Matrix

| Flow To (i.e. Who) | Value Flow | Flow From (i.e. Seller) | Product/Opportunities | Market Opportunity | Customer Needs/Pain | Value Proposition to Customer (i.e. The Value) | Value Chain Partners | Revenue Model | Constraints |
|--------------------|------------------|--|---|---|---|---|--|--|---|
| | Value Flow | | | Customer Value Proposition | | | Value Delivery | Value Capture | Constraints |
| Prosumer | Product Flow | DSO | Electrical Power Supply | Supply households participatin in the flexibility market | Reduce total energy usage Reduce peak energy usage for reener energy generation | Cheaper energy bills More environmentally friendly | Aggregator; Cybersecurity;Telco;Prosumer;Supplier;ESCO | Flexibility capture. LFA pays ervice charge rebate to DSO | Model Maturity; Amount of energy; Bill reduction; Critical mass of Prosumer take-up Network Effect |
| | Information Flow | Prosumer | Flexibility Co-operation | LEC to sell flexibility to LEC | Competition with neighbours; Co-operation to reduce energy costs; Profit in flexibility | Reduce energy bills; Novelty environmentally friendly; | Aggregator;Cybersecurity;Telco;Prosumer;Supplier;ESCO | LEC save money by trading flexibility at a local level | Amount of savings preclude participation; Critical mass at LV; Neighbours need the same level of technology enabled devices installed |
| | | Aggregator | ToU Optimisation; Self balancing; Control of Max | Energy Optimisation Services;Minimise LEC energy cost Minimise Community overall | Reduce energy costs; Reduce overall electrical usage; Revenue selling flexibility;Reduce environmental footprint;access | Cheaper energy bills;More environmentally friendly;Trigger flexibility supply in peak demand;Trigger flexibility | Aggregator;Cybersecurity;Telco;Prosumer;Supplier;ESCO;Third party application providers | Service tariff trade of flexibility;Margin on Wholesale vs Retail flexibility rates | Cost of Prosumer installations; Critical mass of Prosumer uptake |
| | | ADS | Smart Appliances Load parameter communication | Smart appliances enablement for participation in the SmartGrid market Device homogenisation | No ability at the domestic level to take advantage of flexibility savings unless consumption devices can be controlled | Enablement participation in SmartGrid;Resulting money savings;More Eco friendly devices-secondary benefits-remote/higher levels of control of devices | Devicemanufacturers;Distributors;retailers;Finance/credit partners | Retail sale of devices; Subscription based model | Replacement cost of appliances & devices prohibitive;Range availability of devices;Privacy issues; Interoperability;Unproven-technology;Initial outlay vs recoup of money |
| | | ESCO | Smart Technologie;Appliance s;HAN Mgt. Strategies Smart Residential | Smart Device Management; Electrical Supply Optimisation | Lack of cost-maximisation of flexibility savings;Insights and support required to capitalise; environmentally active, lack of tools | Reduction of energy expenditure by optimising use of smart appliances and technologies in the house. Tech awarness; Environmental friendly; Participation support | Prosumer;Aggregator;Suppliers;ADS manufacturers / Retailers | Variety of revenue models: % of flexibility sold;Flat fee;Dynamic pricing regime | Model Maturity;Ignition of model; Third-party model V ADS. Amount of bill reduction |
| Fund Flow | Supplier | Balanced Supply Contract Charges for Product Credits for Flexibility | Supplier role: invoicing & collection of funds; Services to LEC;Share in flexibility trade margin Provision of an 'All In' billing & credit service to LEC | High energy costs; Participation in MAS; Needs familiar relationship with established named entity in the MAS; Needs an 'All In' service for participation in Flexible Energy market | Reduce energy bills; environmentally friendly; Removes complexity arising from several Prosumer relationships - single bill | Aggregator;Cybersecurity;Telco;Prosumer;Metering Supplier; ESCo | Service contract charge; margin | Model Maturity;Reduce bill Critical mass of LEC take-up required for Network Effect Increase in market competition due to new actors in the Value Chain | |
| Aggregator | Information Flow | Prosumer | Sale of flexibility | Sale of flexibility | Access to prosumer data; Control of prosumer's loads | ToU Optimisation;KWMax Control;Self Balancing; Controlled Islanding | Cybersecurity;Telco;LEC;Supplier;ESCO;Third party application providers | Bill credit arising from sale of flexibility | Scheme being available to LEC; Amount of bill credit available Cost of system participation |
| | | Aggregator | Flexibility Cross-selling | Local balance of peak power outputs | Threshold management - local shortages; Balance ability for peak deviation | Spread risk of exceeding declared max/peak usage | DSO; Cybersecurity; Telco | Reduced penalties;Increased revenue s from risk management | |
| | | DSO | Demand for load flexibility | Trigger flexibility supply at peak demand; low overall demand | LEC flexibility participation;Aggregator signalling of energy production costs / wholesale pricing status | Enables Agg to participate in SmartGrid | Cybersecurity; Telco;LEC | | Critical mass at a LEC level required; Trust in system capabilities;Barrier to entry new competitors |
| Fund Flow | DSO | Aggregated Flexibility Compensation | Reduce cost of energy/ peak production | Reduce Peak demand;costly to generate & distribution system max capacity (avoid grid investment);Optimisation of asset usage | Enables DSO to participate in SmartGrid | Cybersecurity;Telco;LEC;Supplier;ESCO;Third party application providers | Financial incentives for efficient grid & energy production management Savings with respect to grid reinforcement | Critical mass at a LEC level required; Trust in system capabilities;Barrier to entry new competitors | |
| DSO | Information Flow | Aggregator | Congestion Management Voltage Control Grid Capacity Management Controlled | Sale of flexibility provided by client portfolio on the flexibility markets | Congestion management and grid capacity management | Delay/Avoid grid reinforcement;Optimise asset use;Reduce grid losses;Reduce frequency & duration outage; Avoid grid investments | Cybersecurity;Telco;Prosumer;Supplier;ESCO;Third party application providers | Cutting generation costs;Reduced penalties;Share of margin service tariff for the trade of flexibility | Regulated market;Contractual relationship;Grid capability to offset demand spikes |
| | Fund Flow | Supplier | Aggregated Flexibility Compensation Connection Contract | Compensation for Energy Supply in SmartGrid | Compensation mechanism for services supplied | Compensation for Energy Supply in SmartGrid | Aggregator;Cybersecurity;Telco;Prosumer;ESCO;Third party providers | Compensation for Energy Supply in SmartGrid | Compensation for Energy Supply; no constants once Supplier is already a Retail Electrical Supplier |
| Supplier | Fund Flow | Prosumer | Aggregated Flexibility Compensation Connection Contract (Retail) | LFA flexibility to DSO settled from the Funds coming to the Supplier on prosumer invoice | Compensation mechanism for services supplied | New services;New business models.Closer involvement with clients.Improves synergy in the energy value chain | Aggregator;Cybersecurity;Telco;ESCO;Third party application providers | Compensation for Energy Supply in SmartGrid | Competition from new/novel service providers in the value chain |

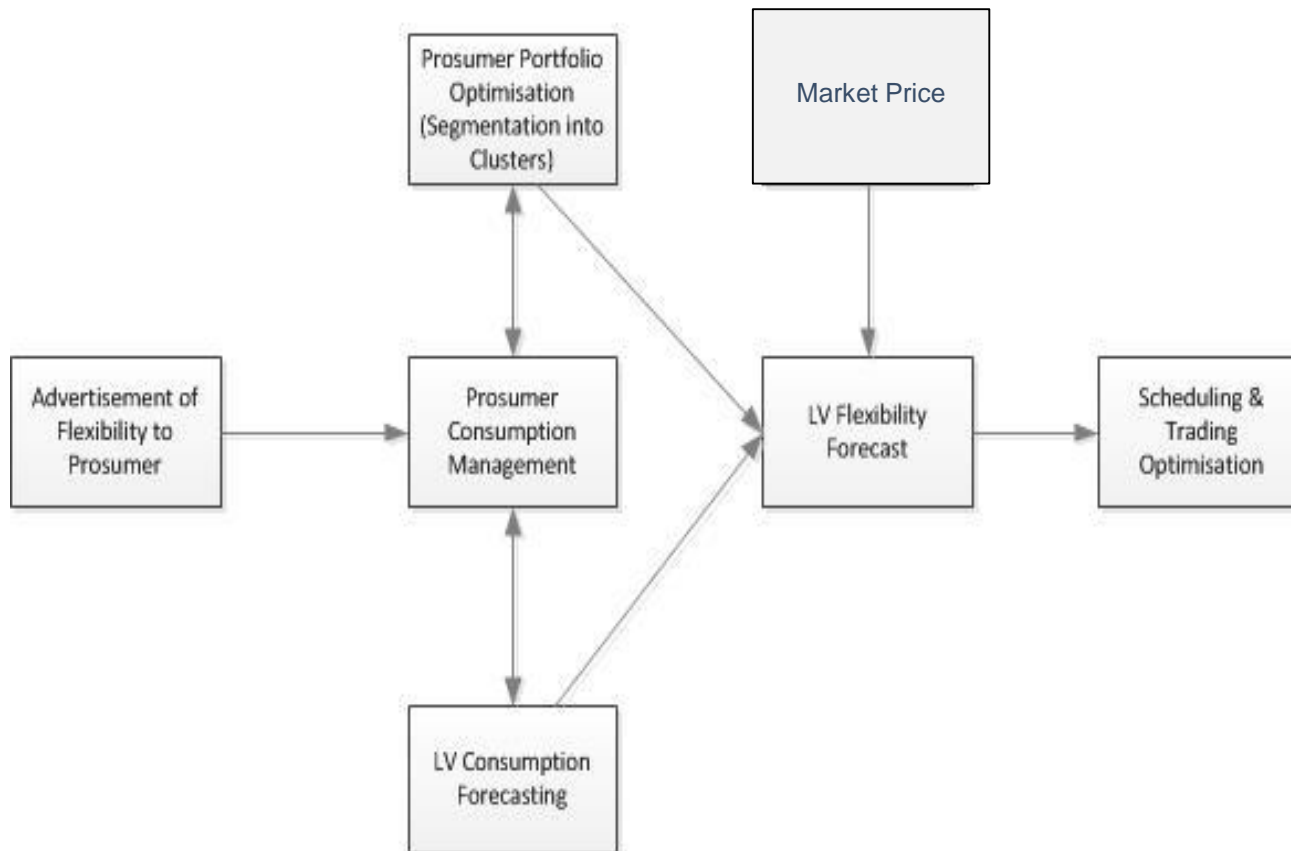


Multi-Sided Market Platform





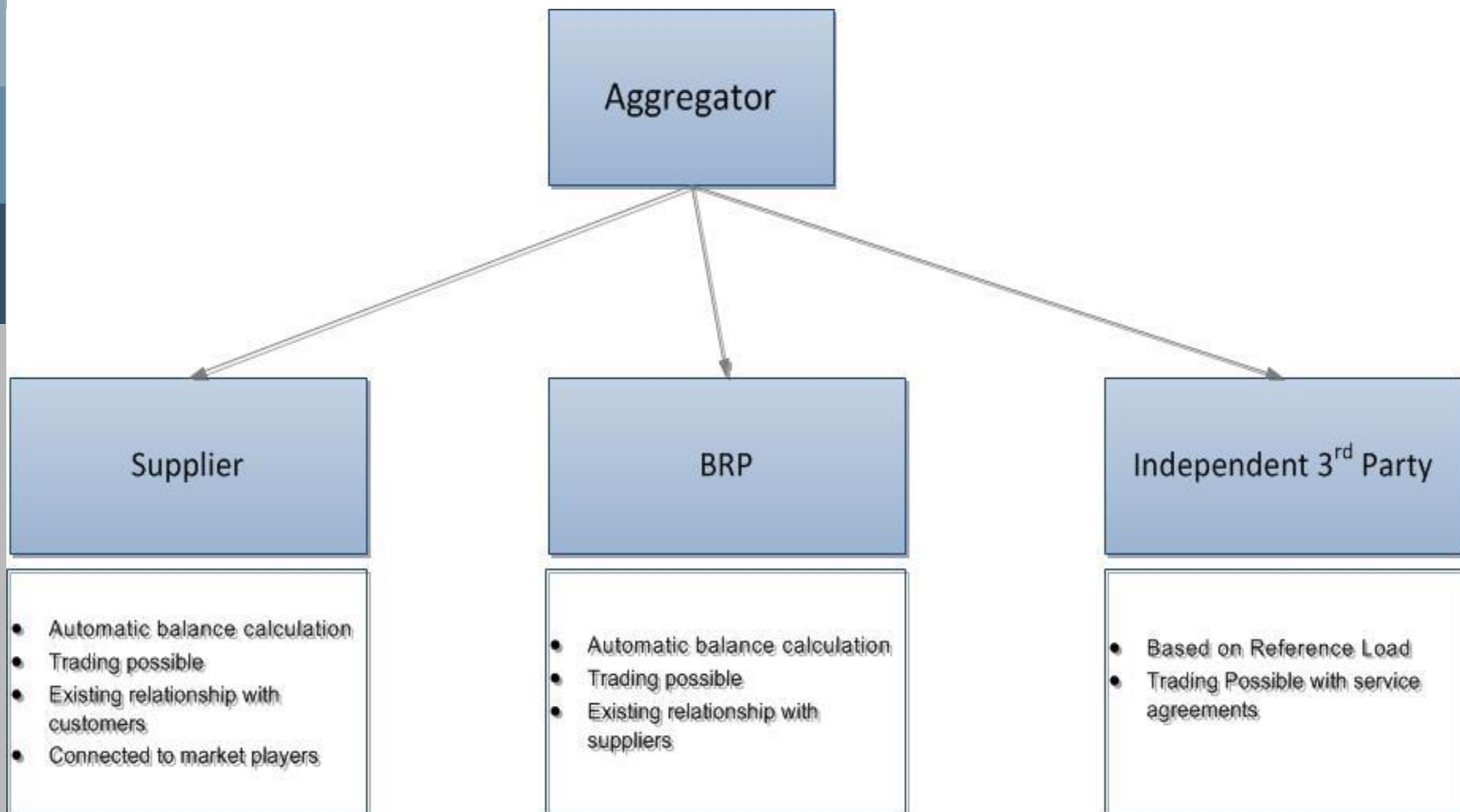
LFA Role



- Advertisement of flexibility services to potential customers
- The aggregator performs an initial study of whether customer's demand response provision can be profitable by evaluating the appliances/equipment that can participate in demand response.
- The aggregator's business model must focus on accepting only profitable customers segments and must be capable of clustering customers in to segments based upon similar characteristics.
- The aggregator must be capable of performing a consumption forecast to determine the consumption needs of consumers.
- The aggregator must be capable of flexibility forecasting for the cluster.
- Calculates financial benefit to prosumer and pays premium to the customers for provision of demand response.
- The aggregator must interface with the consumer in terms of consumption data so that the prosumer is knowledgeable.



Who can be the LFA?



State of the Art – Aggregator Businesses

| Company | Customer Type | Main Activity in Aggregation | Country |
|-------------------------------------|--------------------------------------|---|------------------------|
| EnerNOC | Industrial & Commercial | Demand Response | USA |
| Evonik | Power plants | Generation aggregation for balancing market | Germany |
| NRG Curtailment Specialists | Industrial, Commercial & Public | Demand Response | USA |
| Energy Pool | Industrial, Commercial & Public | Demand Response | France |
| NAPP (North America Power Partners) | Industrial & Commercial | Demand Response | USA |
| Innoventive Power | Industrial & Commercial | Demand Response | USA |
| Energy Spectrum | Industrial, Commercial & Public | Demand Response | USA |
| Fletricity | Industrial & Commercial | Demand and generation aggregation | UK |
| KiWiPower | Industrial & Commercial | Demand Response | UK |
| Powerhouse Generation | Industrial & Commercial | Demand Response | Belgium & UK |
| CPower | Industrial, Commercial & Residential | Demand Response | USA |
| Converge | Industrial, Commercial & Residential | Demand Response | USA |
| Enedis-Linky | Commercial & Residential | Demand Response | France |
| Energy Pool | Commercial & Residential | Demand Response | France, UK and Belgium |
| Tempus Energy | Commercial & Residential | Demand Response | UK |
| Upside Energy | Commercial & Residential | Demand Response | UK |
| Direct Energy | Residential | Demand Response | France |
| Voltalis | Residential | Sale of power reductions to BRP or TSO | France |
| TIKO | Residential | Demand Response | Switzerland |

- USA market is more advanced than Europe
- Most aggregators are focused on large scale commercial, industrial, and utility customers
- Where domestic household is a customer type the focus is on controlling electric heating using thermostats





Conclusions

- ❖ Flexibility is at the core of the emerging energy market model landscape.
 - Although embryonic, complex and challenging, this new market landscape holds new business and collaboration opportunities for all stakeholders
- ❖ The emergence of prosumer communities:
 - Changes the roles of the consumers [individual passive relationship to an active participant in the value chain].
 - Requirement to design new value propositions to maintain and attract their business
 - Utilize the collaboration potential of the value chain network to provide a more responsive and interactive service model
- ❖ MSP for local energy communities
 - Where a local flexibility aggregator facilitates flexibility management between retailers, distribution system operators, and consumers/prosumers



Discussion Points

1. How can the prosumer community be ignited given that they may not see a huge saving?
2. How can the technology involved be aligned so the basic functions can be carried out?
3. Who is best placed to carry out the role of aggregator?





www.mas2tering.eu



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