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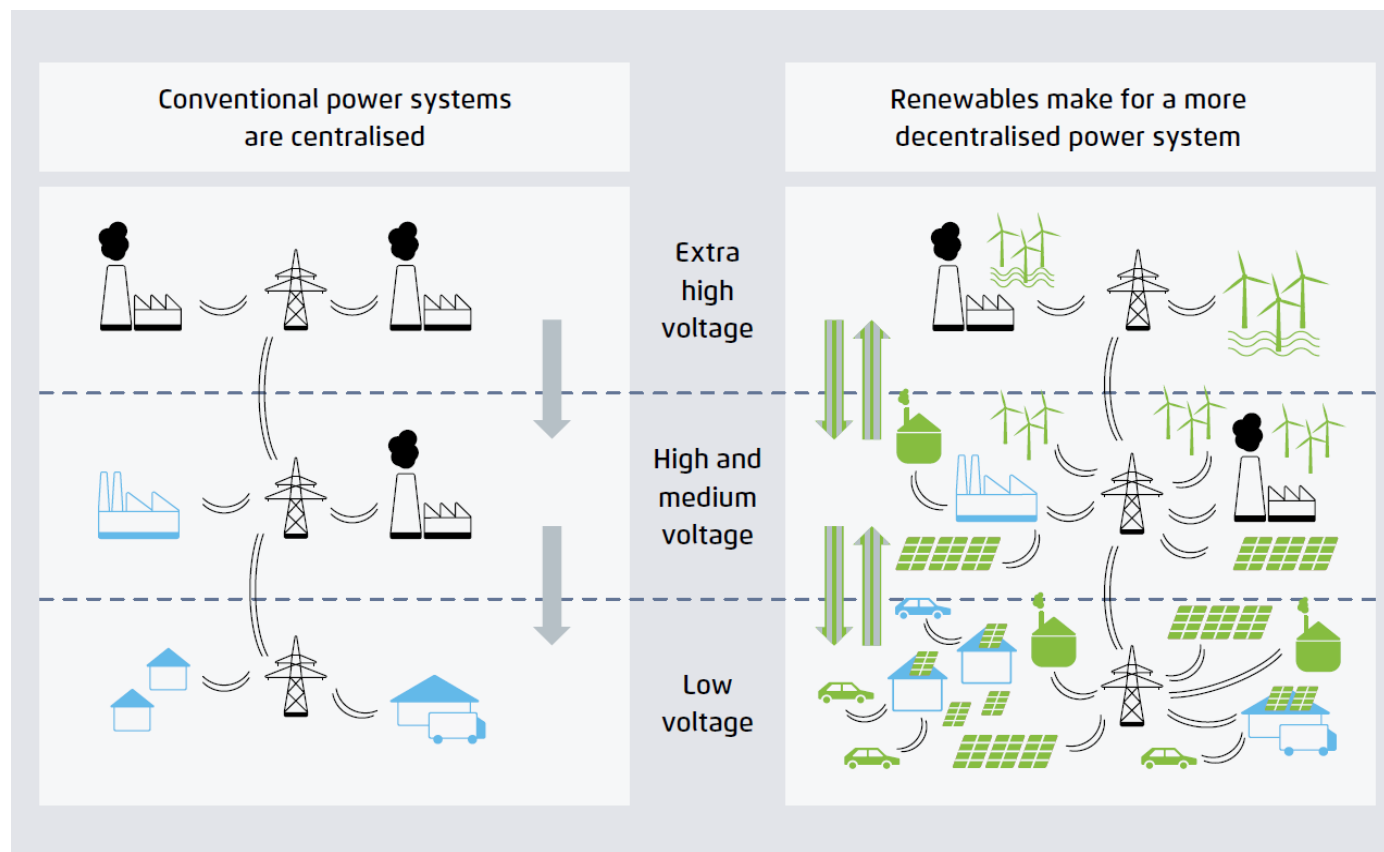
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# **New business models enabling higher flexibility on energy markets**

## What is it all about...

- **Expansion of Demand Response (DR) services to small and medium-sized customers / prosumers**
  - Residential buildings, households
  - Non-residential buildings
  - SMEs
- **Digitisation as a main driver to lower transaction cost**
- **Evolution of business models for the provision of DR services so that they fit to the target group of small and medium-sized customers / prosumers**

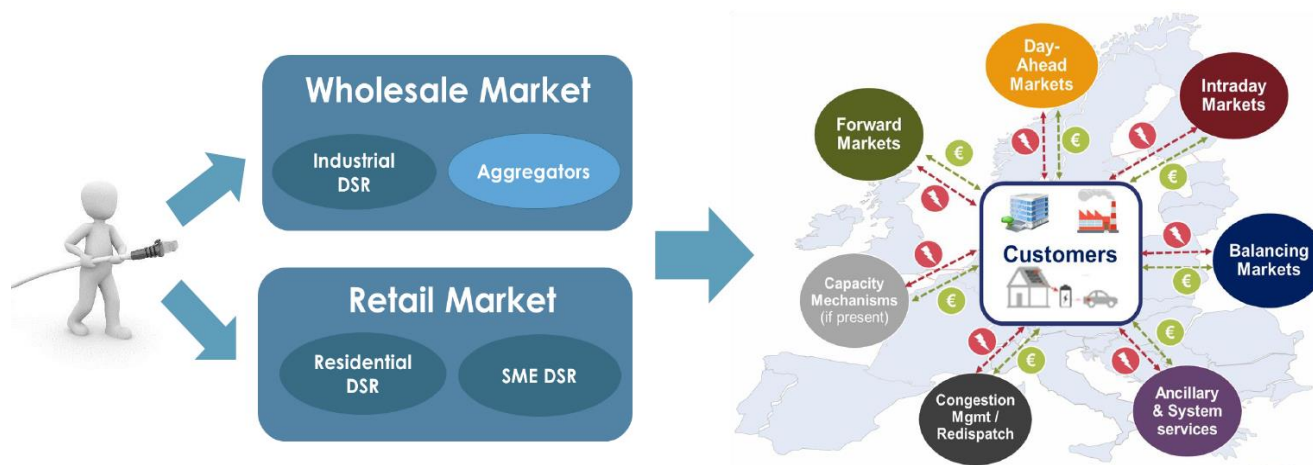
# Setting the scene



Source: Agora Energiewende 2017, taken from Agora Energiewende 2019, A word on grids

# Flexibility markets: Where the value of DR comes from

- **Ancillary services: Reserve capacity market [TSOs]**
- **Balancing market [BRPs] (real-time)**
- **Wholesale market [BRPs]: Spot markets at EEX and OTC**
  - Day-ahead market
  - Intraday market
- **Eventual future market: Congestion management [DSO/TSO]**



## Different forms of DR use

- **Explicit use of DR:** committed, **dispatchable flexibility that can be traded (similar to generation flexibility) on the different flexibility markets.** This is usually facilitated and managed by an aggregator that can be an independent service provider or a supplier. This form of demand-side flexibility is often referred to as “**incentive driven**” demand-side flexibility and its main income stream is **remuneration for flexibility services** from Transmission System Operator (TSO) or Balance Responsible Parties (BRP).
- **Implicit use of DR:** consumers’ **reaction to price signals.** Where consumers have prices that depend on variability on the market and the network, they can adapt their behaviour (through automation or personal choices). This type of demand-side flexibility is often referred to as “**price-based**” demand-side flexibility and its main income stream is the **energy cost savings** that are achieved by shifting loads.

Source: Smart Energy Demand Coalition, 2016

## Transaction cost related to small and medium-sized prosumers

- **Filtering out the facilities with promising DR-potential**
- **Marketing and sales cost**
- **Checking / ensuring connectivity and switchability**
- **User clustering and user management**
- **M&V of DR events**
- **Ensuring contractual arrangements and administration**
- **Invoicing**
- **Clarification of regulatory uncertainties**
- **etc.**

# Digitisation I: Smart devices - electrical appliances houseware

		2010	2015	2020	2030
Dishwashers	Total installed appliances	82,799,000	98,345,000	115,036,000	148,553,000
	Number of smart appliances	0	0	575,18	29,710,600
	Share of smart appliances [%]	0	0	5	20
Washing machines	Total installed appliances	185,828,000	196,821,000	200,805,000	204,744,000
	Number of smart appliances	0	252,335	10,040,250	40,948,800
	Share of smart appliances [%]	0	0.13	5	20
Tumble dryers	Total installed appliances	62,723,000	47818000	71801000	77778000
	Number of smart appliances	0	0	3590050	3111200
	Share of smart appliances [%]	0	0	5	40
Household refrigerators and freezers	Total installed appliances	297,800,000	303,200,000	308,000,000	317,600,000
	Number of smart appliances	0	147,81	15,400,000	63,520,000
	Share of smart appliances [%]	0	0.05	5	20

Source: VITO et al., 2017. Ecodesign Preparatory study on Smart Appliances (Lot 33) – Final report

## Digitisation II: Smart devices – HVAC appliances

		2010	2015	2020	2030
Electric radiators	Total installed appliances	221,000,000	220,920,000	213,000,000	203,275,000
	Number of smart appliances	442	6,627,600	19,170,000	42,687,750
	Share of smart appliances [%]	0.2	3	9	21
Air conditioners	Share of smart appliances [%]	7	16	30	45
Heat pumps	Total installed appliances	7,400,000	9,750,000	10,430,000	10,930,000
	Number of smart appliances	518	1,560,000	3,129,000	4,918,500
	Share of smart appliances [%]	7	16	30	45
Electric boilers	Total installed appliances	1,100,000	1,100,000	1,100,000	1,100,000
	Number of smart appliances	4,4	22	77	198
	Share of smart appliances [%]	0.4	2	7	18
Built- in electric inertia radiators	Total installed appliances	13,800,000	13,775,000	13,700,000	13,550,000
	Number of smart appliances	6,9	137,75	548	1,084,000
	Share of smart appliances [%]	0.05	1	4	8

Source: VITO et al., 2017. Ecodesign Preparatory study on Smart Appliances (Lot 33) – Final report



## Digitisation III: Improved software solutions for DR aggregation

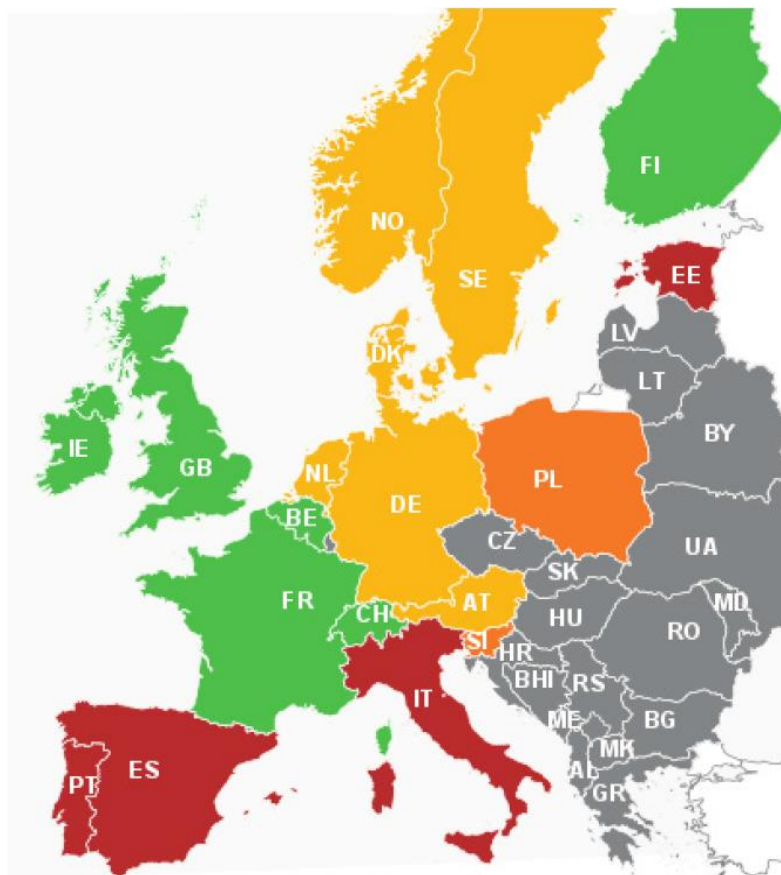
- **Handling small and medium loads**
- **User clustering**, allowing for automatic detection and classification of assets without consuming resources during equipment installation and commissioning.
- **Better managing prosumers** e.g. by introducing an additional layer of optimisation, automation of offerings and dispatch
- **Grid stability assessment**
- **Better accuracy in load forecasting**
- **Individual price forecasting tools for each significant market**, allowing stakeholders to better monetise their assets
- **Interoperability**
- **Tools for self-registration, self-connection and self-assessment** of available DR-potentials

## Digitisation IV: Smart contracts

- **Reduction of transaction cost contractual management and invoicing**
- **Blockchain technology as tool**
- **Integration into Software tools for DR aggregation**

# Regulatory framework on the move

- Commercially active
- Partial opening
- Preliminary development
- Closed
- Not assessed



Explicit demand response development in Europe (SEDC 2017)

# Reinforcing framework for integration of small and medium-scale DR potential

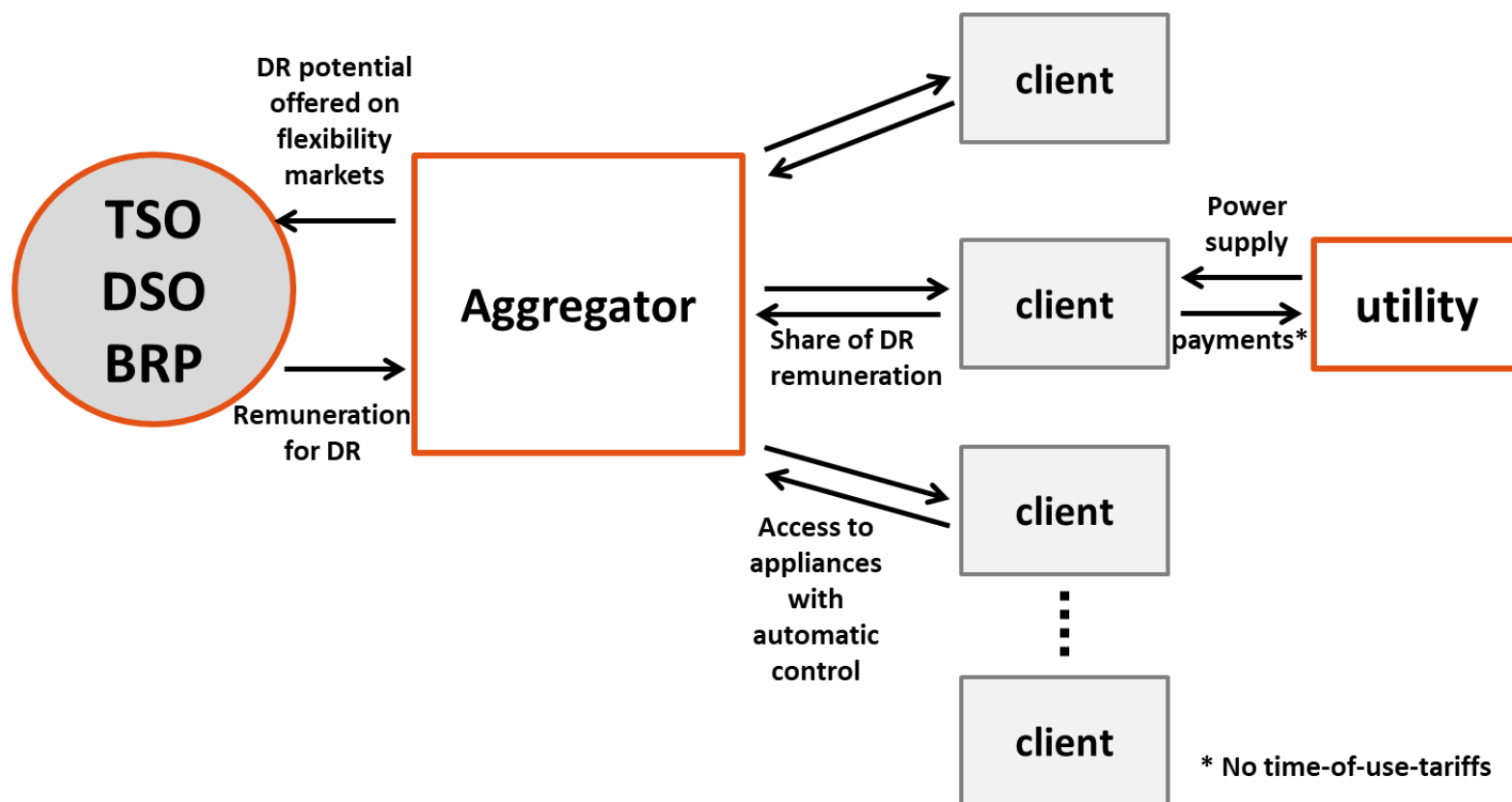
- **Clear definitions of the roles of market participants**
  - e.g. no need for approval of energy supplier, if customer offers DR potentials to an aggregator
- **Adaptation of technical requirements for flexibility products**
  - minimum size of aggregated loads
  - maximum duration of availability
  - procedures for pre-qualification, etc.
- **Roll-out of smart meters**
  - not all smart meters have the functionalities required to support DR
- **Clear requirements for M&V**
  - quantification of effect of DR events (→ price tag)
- **Appropriate tariff structures**

# DR Business Models: Assigning roles, responsibilities, incentives to stakeholders

- **Client/User**
  - owner of equipment with DR potential; supply contract with a retailer
- **Retailer**
  - selling electricity to customers for profit
  - eventually including own production
- **DR aggregator**
  - third-party service provider that contracts with the individual demand sites (industrial, commercial or residential consumers) and aggregates them together so that their DR potential can be offered to flexibility markets
- **TSO, DSO, BRP**
  - organisers of flexibility market places

# DR Business Model

## Explicit DR as stand-alone service



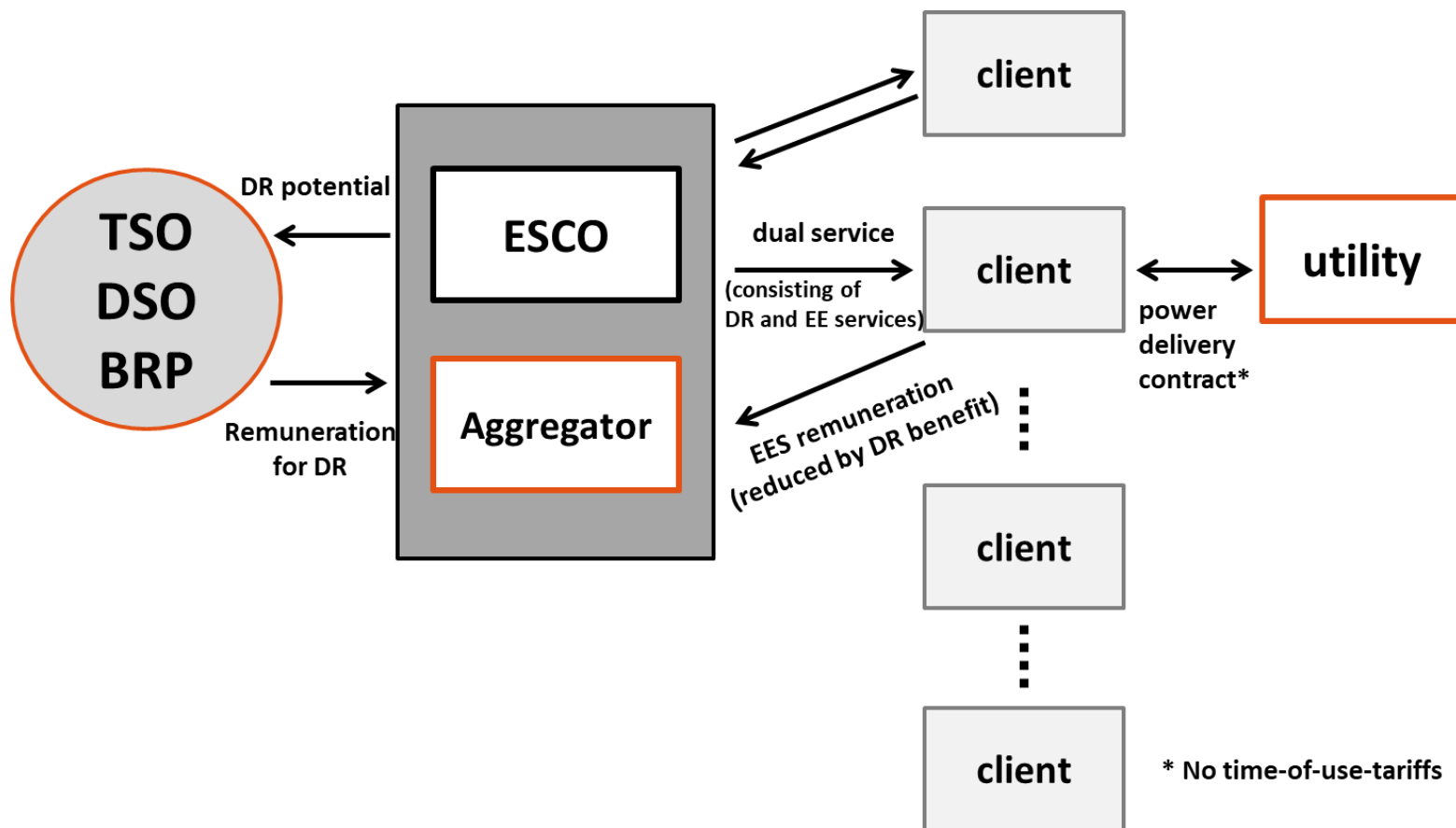
# Explicit DR as stand-alone service

## Transferability to small/medium-sized clients

- **Easy and cost-effective access to large number of switchable devices**
  - access to information about availability of smart devices → SRI?
  - ensuring connection remotely
- **Attractive value proposition to the clients**
  - Additional revenues from selling DR-potential
  - Participation in energy transition (cf. success of green electricity)
  - supplementary services related to facility O&M
- **Distribution channels and customer relationships**
- **Improvement of software solutions for aggregation**

# DR Business Model

## Explicit DR combined with EES



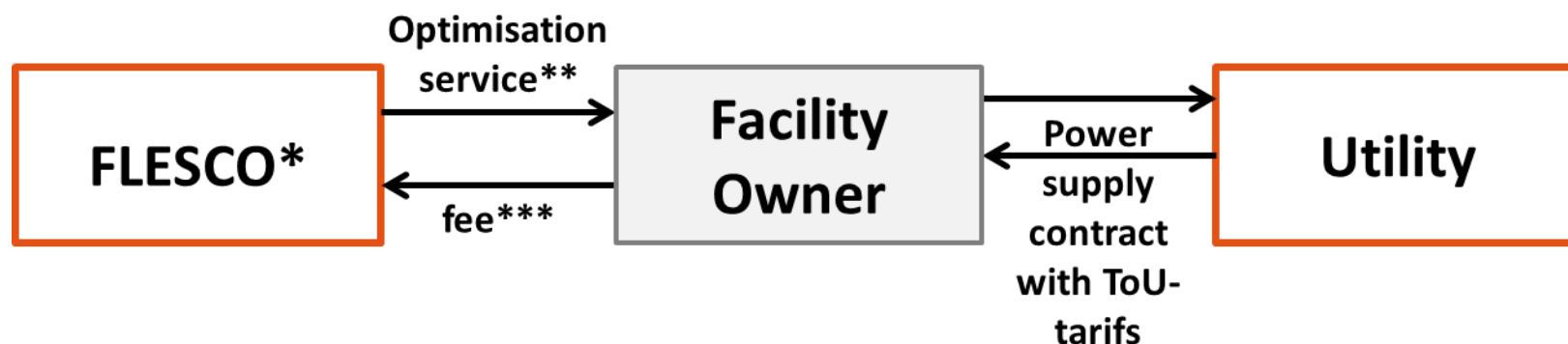


# Explicit DR combined with EES

## Transferability to small/medium-sized clients

- **main target group the same as for EES business**
  - annual energy cost at least 20,000 to 30,000 €
  - mainly non-residential buildings
- **DR as add-on to the standard EES**
- **No big trade-off between EE and DR expected**
  - ambiguous relationship between DR and EE
  - in theory, load shifts lead to higher consumption if connected to “storage function”
  - in practice, DR can also lead to immediate reduction of energy consumption – rather switching off than shifting

# DR Business Model: Implicit DR service for optimal use of TOU-contracts



\* Flexibility service company

\*\* optimisation service: control of appliances with the aim to utilise the flexibility of the ToU-tariffs

\*\*\* e.g. shared-savings model (verification of savings?)

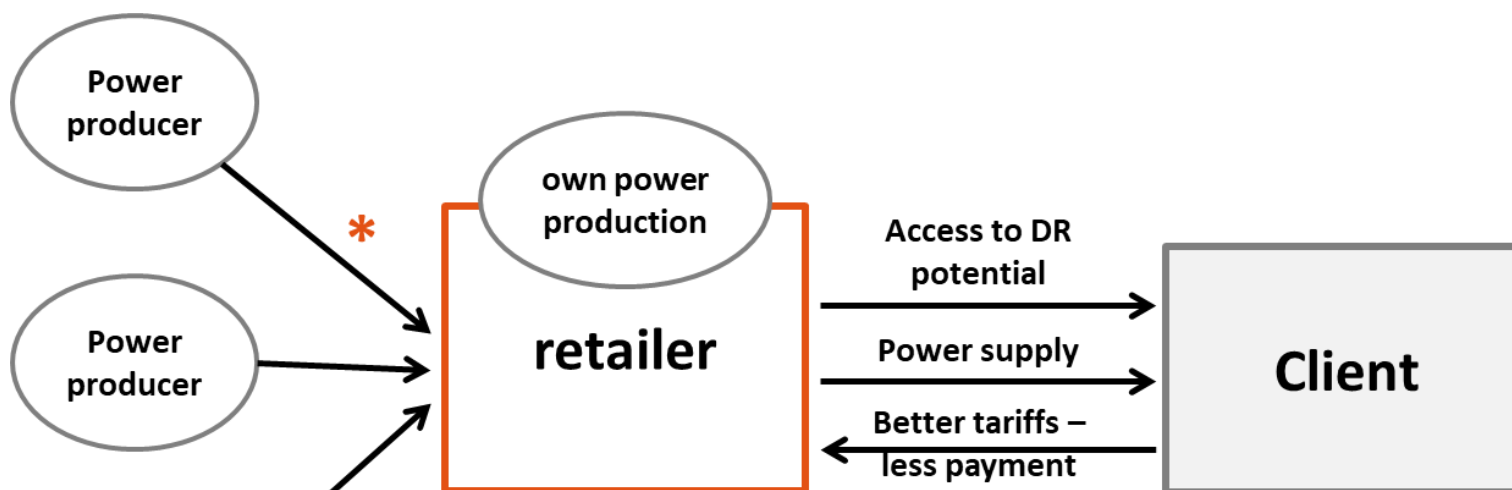
# Implicit DR for optimal use of TOU-contracts

## Transferability to small/medium-sized clients

- **sufficient spread between high and low price in tariff structure**
  - preferably dynamic tariffs (real time pricing, critical peak pricing)
- **continuous up-date about price signals at a large number of customers**
  - supported by suitable software solution
- **embedded in a broader range of services**
  - consultancy on most suitable energy tariffs
  - technical facility management
- **most promising target groups**
  - medium-sized client that has already outsourced FM services
  - cross-selling potential

# DR Business Model

## Implicit DR including power supply

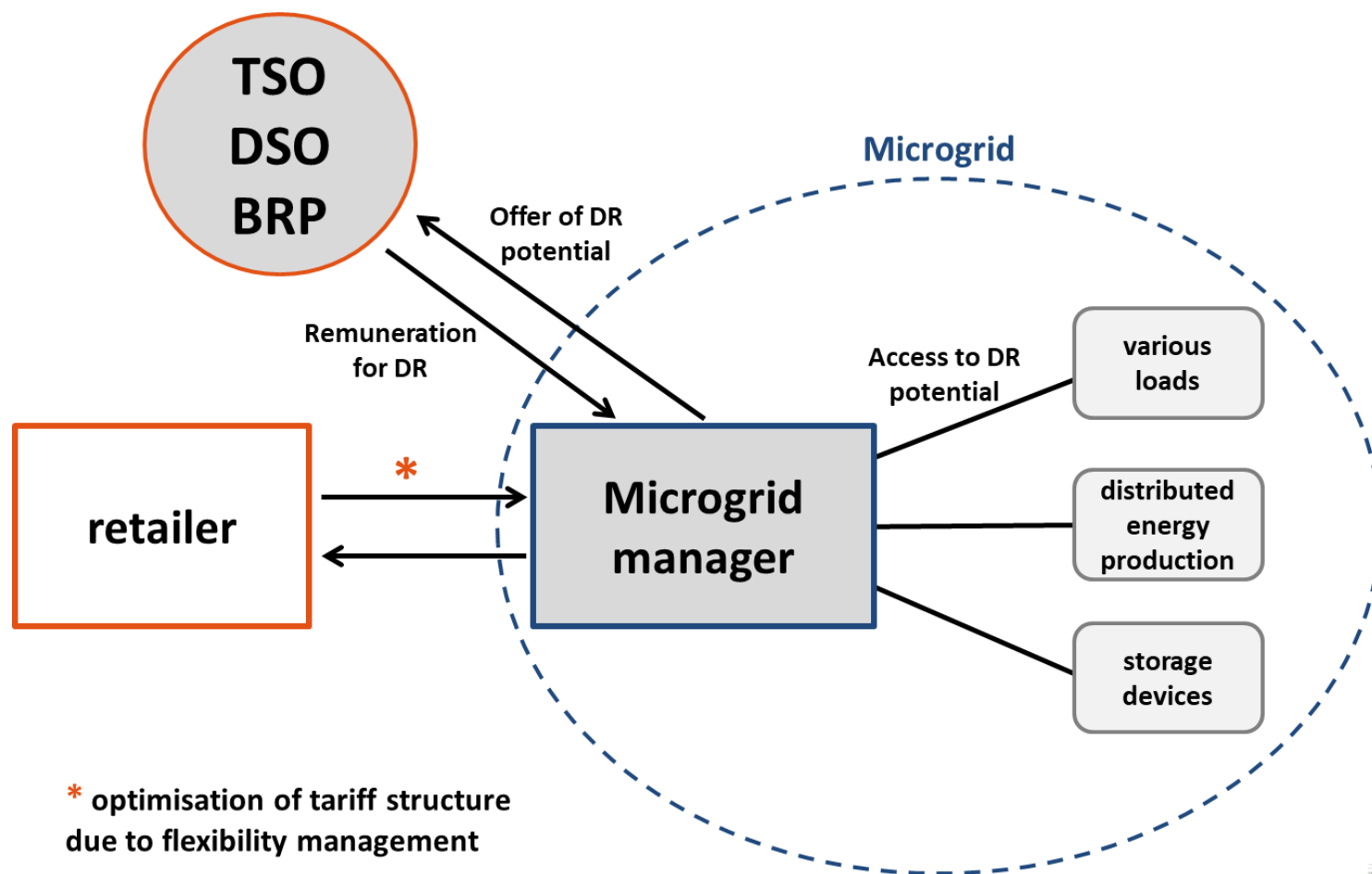


- \* - optimisation of conditions of purchase and/or
- balancing profiles of customers with own production profile (both options related to balance group management)

# Implicit DR including power supply Transferability to small/medium-sized clients

- **Good starting position of retailer**
  - existing customer relationships
  - DR as add-on to existing services
- **Convincing value proposition for the client**
  - attractive tariff
  - environmental arguments
  - supplementary services (monitoring, ensuring operability,...)
  - combination with (subsidised) sale of smart devices
- **Generally, applicable also to households**

# DR Business Model Microgrid Management



\* optimisation of tariff structure due to flexibility management

# Microgrid Management

## Transferability to small/medium-sized clients

- **Microgrid-manager is similar to FLESCO**
  - larger size facility
  - complex demand patterns in combination with multitude of switchable devices and various sources of decentralised on-site production
  - island-mode versus grid-connected mode
- **Business case is limited by regulatory framework**
  - very restrictive in EU-countries
  - EU regulation on local energy communities expected

## Main take-aways

- **Expansion of DR to small and medium-sized prosumers:  
Still a long way to go... from a business perspective...  
...but it can be gone...**
- **It's all about reduction of transaction cost**
  - easy access and connection to smart devices
  - additional functionalities of DR aggregation platforms
  - reduction of regulatory barriers
- **Promising starting point/s**
  - building automation systems, heat pumps, AC, electric hot water boiler, EV charging stations
  - explicit DR business model for medium-size prosumer (non-residential buildings, SMEs, business parks etc.
  - For households implicit DR business models with retailer



# Contact

## DELTA-project

<https://www.delta-h2020.eu/>

## NOVICE-project

<http://novice-project.eu/>

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