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

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
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<tr>
<td><strong>Dishwashers</strong></td>
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<tr>
<td>Total installed</td>
<td>82,799,000</td>
<td>98,345,000</td>
<td>115,036,000</td>
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<td>Number of smart</td>
<td>0</td>
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<td>575,18</td>
<td>29,710,600</td>
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<tr>
<td><strong>Washing machines</strong></td>
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<tr>
<td>Total installed</td>
<td>185,828,000</td>
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<td>0.13</td>
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<td>20</td>
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<tr>
<td><strong>Tumble dryers</strong></td>
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<tr>
<td>Total installed</td>
<td>62,723,000</td>
<td>478,18000</td>
<td>71801000</td>
<td>77778000</td>
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<tr>
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</tr>
<tr>
<td>Number of smart</td>
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<td>0</td>
<td>3590050</td>
<td>3111200</td>
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<td>appliances [%]</td>
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<td>0</td>
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<td><strong>Household</strong></td>
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<tr>
<td>refrigerators and</td>
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<tr>
<td>freezers</td>
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<tr>
<td>Total installed</td>
<td>297,800,000</td>
<td>303,200,000</td>
<td>308,000,000</td>
<td>317,600,000</td>
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<tr>
<td>appliances</td>
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<tr>
<td>Number of smart</td>
<td>0</td>
<td>147,81</td>
<td>15,400,000</td>
<td>63,520,000</td>
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<td>appliances [%]</td>
<td>0</td>
<td>0.05</td>
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<td>20</td>
</tr>
</tbody>
</table>

Source: VITO et al., 2017. Ecodesign Preparatory study on Smart Appliances (Lot 33) – Final report
### Digitisation II:
Smart devices – HVAC appliances

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2030</th>
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</thead>
<tbody>
<tr>
<td><strong>Electric radiators</strong></td>
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<tr>
<td>Total installed appliances</td>
<td>221,000,000</td>
<td>220,920,000</td>
<td>213,000,000</td>
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<td>19,170,000</td>
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<tr>
<td>Share of smart appliances [%]</td>
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<td>3</td>
<td>9</td>
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<tr>
<td><strong>Air conditioners</strong></td>
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<td></td>
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</tr>
<tr>
<td>Share of smart appliances [%]</td>
<td>7</td>
<td>16</td>
<td>30</td>
<td>45</td>
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<tr>
<td><strong>Heat pumps</strong></td>
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<tr>
<td>Total installed appliances</td>
<td>7,400,000</td>
<td>9,750,000</td>
<td>10,430,000</td>
<td>10,930,000</td>
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<tr>
<td>Number of smart appliances</td>
<td>518</td>
<td>1,560,000</td>
<td>3,129,000</td>
<td>4,918,500</td>
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<tr>
<td>Share of smart appliances [%]</td>
<td>7</td>
<td>16</td>
<td>30</td>
<td>45</td>
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<tr>
<td><strong>Electric boilers</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total installed appliances</td>
<td>1,100,000</td>
<td>1,100,000</td>
<td>1,100,000</td>
<td>1,100,000</td>
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<tr>
<td>Number of smart appliances</td>
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<td>22</td>
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<tr>
<td>Share of smart appliances [%]</td>
<td>0.4</td>
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<td>7</td>
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<tr>
<td><strong>Built- in electric inertia radiators</strong></td>
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<tr>
<td>Total installed appliances</td>
<td>13,800,000</td>
<td>13,775,000</td>
<td>13,700,000</td>
<td>13,550,000</td>
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<tr>
<td>Number of smart appliances</td>
<td>6.9</td>
<td>137,75</td>
<td>548</td>
<td>1,084,000</td>
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<tr>
<td>Share of smart appliances [%]</td>
<td>0.05</td>
<td>1</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

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
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

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

DR potential offered on flexibility markets

Remuneration for DR

Aggregator

TSO
DSO
BRP

Power supply payments*

* No time-of-use-tariffs

client

Share of DR remuneration

Access to appliances with automatic control

utility
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

TSO
ESCO
Aggregator

DSO

BRP

client

utility

* No time-of-use-tariffs

power delivery contract*

dual service
(consisting of DR and EE services)

EES remuneration
(reduced by DR benefit)

Remuneration for DR

DR potential
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

- TSO
- DSO
- BRP

- Retailer

- Microgrid manager

- Various loads
- Distributed energy production
- Storage devices

Offer of DR potential
Remuneration for DR
Access to DR potential

* 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

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