# Extra-EU Best Practices for Demand-Side Flexibility

## smartEn Spotlight

Smart Energy Europe
Rue d'Arlon 63-67,
BE-1040 Brussels

info@smarten.eu
www.smarten.eu

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## INTRODUCTION

For over a decade, the EU has assisted to a ramp-up of Demand-Side Flexibility (DSF) through higher available volumes, access to markets and services provided to the grid. Opening of different markets and the development of innovative projects have exposed the ability of DSF and distributed energy resources (DER) to compete with traditional generation in wholesale markets, capacity mechanisms, and ancillary services. Available volumes are expected to reach 164 GW of DSF by 2030[1] from consumers in the industrial, commercial, and residential sectors. However, the current market and product design is not without flaws, and numerous barriers prevent the full development of DSF's potential. The EU will only achieve these 164 GW if the regulatory framework ensures consumers have access to all markets on an equal footing.

To achieve this goal, the EU can learn from some best practices across the world. This smartEn Spotlight is aimed at highlighting best practices for the use of DSF developed outside of the EU. We have focussed on:

- technology-inclusive product designs,
- the possibility to access different revenue streams at the same time (value stacking),
- the implementation of a comprehensive consumer engagement strategy.

### Technology inclusive product design

DSF entails a large spectrum of technologies that could provide services to the power system. A product or market can be on paper technology neutral, but have participation requirements that in practice exclude DERs from participating. For this reason, it is important that prequalification and participation requirements are designed with a system needs perspective and, in a technology inclusive way.

The Independent System Operator (ISO) of the New England[2] region (USA), ISO-NE, created the Price-Responsive Demand Program, a demand response (DR) scheme designed to include a wide spectrum of technologies. Over the past decades, the region started the decommissioning of its most aging powerplants. To counterbalance lost capacities, ISO-NE developed a comprehensive strategy to maximise DSF potential over its control zone through the Price-Responsive Demand Program. It entails two types of products, the Active Demand Resource (ADR) and the Passive Demand Resource (PDR).

ADR is in many regards similar to DR programmes developed in some European countries. It is profiled to contract any type of resource able to follow a dispatch instruction. It requires the installation of measurement and control devices enabling load to be dispatched after receiving an activation order. PDR is tailored for peak-shaving purposes and is designed for processes not able to follow a dispatch order (on/off processes, BTM assets or energy efficiency measures). Contracted clients must be activated during the summer peak (1pm to

[1] Armenteros, A, S. De Heer, H. Fiorini, L. Castillo, M, M. Slot, T. (2022). *Demand-side Flexibility: Quantification of benefits in the EU.* DNV. p.17

[2] The region of New England is composed by the States of Connecticut, Maine, New Hampshire, Massachusetts, Rhode Island and Vermont in the North-East of the United States.

5 pm during weekdays of June, July, and August) and/or during the winter peak (5pm to 7pm during weekdays in December and January)[3]. Both products in combination offer ISO-NE complementary actions for network management, by engaging both dispatchable and non-dispatchable resources. ADR allows a precise load management while PDR provides rough peak-shaving.

This product design allowed ISO-NE to increase contracted flexibility volumes from 63 MW in 2001 to approximately 2.8 GW (765 MW of ADR and 2 GW of PDR) in 2023. This volume must be put in perspective with the 31 GW of generating installed capacity in the region[4]. This strategy has supported the decommissioning of polluting power plants in New England without affecting system security. ISO-NE is an example for SOs adopting a comprehensive strategy for product development based on the system needs and reflecting the technical capacities of grid users rather than extending the volume of its current products.

## Enabling value stacking for DSF

A major obstacle faced by DSF in the EU is its limited access to different markets simultaneously, mostly confined to ancillary services. To create a stable business case, and engage with different types of consumers, DERs need full access to wholesale, ancillary services and local flexibility markets, through a market design that makes products compatible and non-exclusionary. Value stacking not only fosters the economic viability for the flexibility business model, but it also ensures that the available assets are used where they are most needed by the grid, ensuring grid stability without the need for further costly grid reinforcements.

South Korea leads by example by establishing two different but inter-linked programmes. KPX, the South Korean market operator, first developed the Reliability Demand Response (RDR) programme. The RDR is a capacity remuneration mechanism where a dispatch notice is issued one day before delivery once available generation capacity falls under a threshold of 5 500 MW.

In parallel, KPX developed a set of products under the Voluntary Demand Response (VRD) programme. One of these products, the Economic Demand Response, also known as the 'Negawatt' market, is linked directly to the wholesale market, enabling DSF to compete with traditional generators. Aggregators set a price on a part of their portfolio. An activation occurs if the wholesale price surpasses the aggregator's price. This market was designed by KPX to allow DSF to reduce high wholesale prices.

These products allow the participation of DSF to help solving the following issues:

- Fine-dust pollution: South Korea regularly experiences events of high concentration of fine-dust in the atmosphere (partly due to thermal power plants). Under the VRD

[3] New England region is experiencing summer peak due to AC use as well as winter peak electrical consumption due to an increasing electrification of heating systems.

[4] New England Power Grid 2022-2023 Profile

program, customers receive a payment for reducing their demand to help reduce the fine-dust concentration in the atmosphere.
- High peak-hour price: During the summer and winter peaks, when power prices surpass a certain ceiling, DSF will be activated to help flatten the curve.

KPX facilitates value stacking by allowing DSF already engaged in the RDR programme to also bid on the Negawatt market. This mechanism allows for a steady revenue stream for DSF through availability payments in the RDR programme while providing an additional revenue if wholesale prices are high enough. It also provides value for the overall system as it ensures security of supply while reducing wholesale prices.

### Implementation of a comprehensive recruitment strategy

Residential and small commercial profiles will represent the main share of DERs in the future and will encompass large amounts of flexible capacity. The benefits they can provide to the grid are significant as around half of the European winter peak consumption comes from residential profiles[5]. Moreover, the rise of residential flexible assets (EVs, heat-pumps, smart home appliances, residential batteries) will increase the flexible potential of households. However, engaging consumers can be challenging, and recruitment strategies with appealing and easy to understand propositions will play a key role in enabling them to participate with their flexibility.

To fully use the potential of residential and commercial loads pooled and improve its recruitment strategy, the California Independent System Operator (CAISO) launched the Emergency Load Reduction Program (ELRP). In 2020, California faced a series of cascading blackouts caused by historical electrical consumption peaks during extreme heat waves. The situation was mitigated by voluntary and uncompensated curtailment. To prevent a recurring situation, CAISO launched the ELRP in 2021. ELRP is designed to incentivise consumers to reduce their electricity demand through periods of system stress during heat waves. Targeting industrial and commercial loads in its first year of existence, the programme was open to residential loads during the summer 2022.

CAISO gave the three largest investor-owned utilities (IOU), acting as producers and de-facto retailers in most of the California territory, the responsibility to increase consumer enrolment and compensation, and event communication in the ELRP. The programme is open to all households and targeted profiles are automatically enrolled (e.g. households with a load higher than 2.5 kW). Enrolment in ELPR does not force households to curtail its consumption when CAISO calls for an ELRP event. The recruitment strategy facilitated the enrolment of approximately four million residential and commercial customers. The service can be called from May to October, between 4pm and 9pm. After receiving an ELRP alert one day before delivery, service providers will notify consumers to reduce their demand for a given period. Consumers willing to reduce their consumption are ensured to receive a compensation of 2$/kWh. The remuneration is solely based on energy and no penalties are imposed in case of

[5] European Smart Grids Task Force Expert Group 3. (2022). *Paper on electricity demand reduction: Measures to mobilise consumers' flexibility this winter and beyond.* P.5

non-activation. On the 7th of September 2022, California faced power shortage leading to an ELRP event. Historical protocols would have forced rotating power outages to avoid cascading blackouts. This event managed to reduced electricity demand by 2 GW[6] and highlighted the benefits of residential and commercial loads integration in DR schemes.

South Korea also opted for a strategy targeting households and small businesses. Residential and commercial loads have the possibility to engage either in the RDR (see above) or Energy Pause Programme (ERP). RDR customers receive an availability payment in exchange for an obligation of activation. However, potential penalties can limit households' willingness to participate in RDR. ERP is similar to the California programme. Consumers can engage voluntarily thought an aggregator or a supplier. EPR is called if a risk of outage is foreseen by KPX. Participants will receive from their contracted aggregator an activation notice. If consumers participating in the programme own smart appliances, the process can be fully automated. Consumers then receive a compensation based on their curtailed energy. The program is voluntary and does not include penalties in case of non-activation.

Both Californian and South Korean examples highlight that the development of a product without high constraints and penalties can lead to engagement of households and small businesses in the DR scheme. A specific product is a crucial first step toward further participation in other programmes. Once they developed a better understanding of their electrical consumptions, improved their ability to precisely manage their loads (for example with an energy management system) or invested in DERs, residential and commercial loads will be able to join more complex programmes providing higher quality services to the grid while increasing their remuneration.

[6] ELRP was not the only DR program activated during this event.

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