



Department for
Energy Security
& Net Zero

Energy Smart Appliances for Demand Side Response

PAS 1878 and 1879 standards and the Interoperable Demand Side Response (IDSR) programme

Rebecca Shutt
Energy Engineer
Department for Energy Security and Net Zero
Rebecca.shutt@energysecurity.gov.uk

Introduction

- The [Smart Systems and Flexibility Plan 2021](#) (SSFP) set out a suite of policies to enable flexibility from domestic consumers known as demand side response (DSR).
- Following consultation, the Government funded the publication of technical standards (PAS 1878 and PAS 1879) to accelerate the uptake of ESAs and domestic DSR services which are **interoperable, cyber secure**, and which respect consumer **data privacy**, and promote **grid stability**.
- As part of the SSFP, the Government committed to work with industry to support the uptake of PAS 1878 and 1879 for “energy smart” appliances, to encourage development and deployment of DSR-capable devices and to establish a technical framework for small-scale DSR.

1. PAS 1878 & 1879

The UK Government has sponsored the development of PAS 1878 and PAS 1879

These create an end-to-end framework for domestic DSR

Interface A shall support the use of Open-ADR to enable interoperability



2. Interoperable DSR Programme

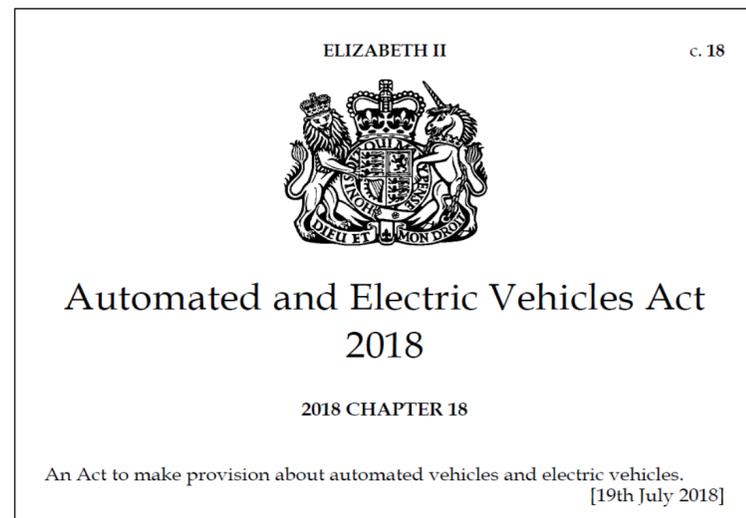
The UK Government has funded the **IDSR Programme** which is developing domestic DSR systems against PAS 1878 and PAS 1879

The findings from this programme will feedback into the next version of PAS 1878



PAS 1878 & 1879 Objectives

- Standardisation helps to **lower costs** and **promote innovation** in technologies, while **accelerating the uptake** of **secure and interoperable** smart products and services
- Develop **technical specifications** which could be referenced and required by **future regulations** and would enable certification
- Demonstrate **UK leadership** on the international stage, by promoting published standards for **international adoption**



Scope of standards PAS 1878 & 1879

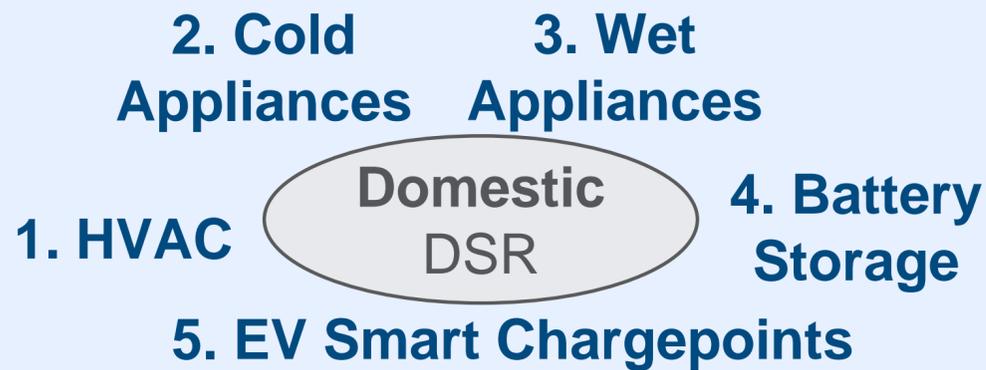
PAS 1878 Appliance-side: “ESA specification for classification”

PAS 1879 Grid-side: “DSR framework for operation”



A standardised technical framework, covering both **ESAs** and **DSR** for end-to-end system across **2 PASs**

Five appliance types:



Commercial

Specify a DSR framework, with details for **called response services**, but also allowing for other **routine services**.

4 **policy principles** underpin the standards, developed in consultation with industry stakeholders

Interoperability

Data Privacy

Grid stability

Cyber-security

Compatibility

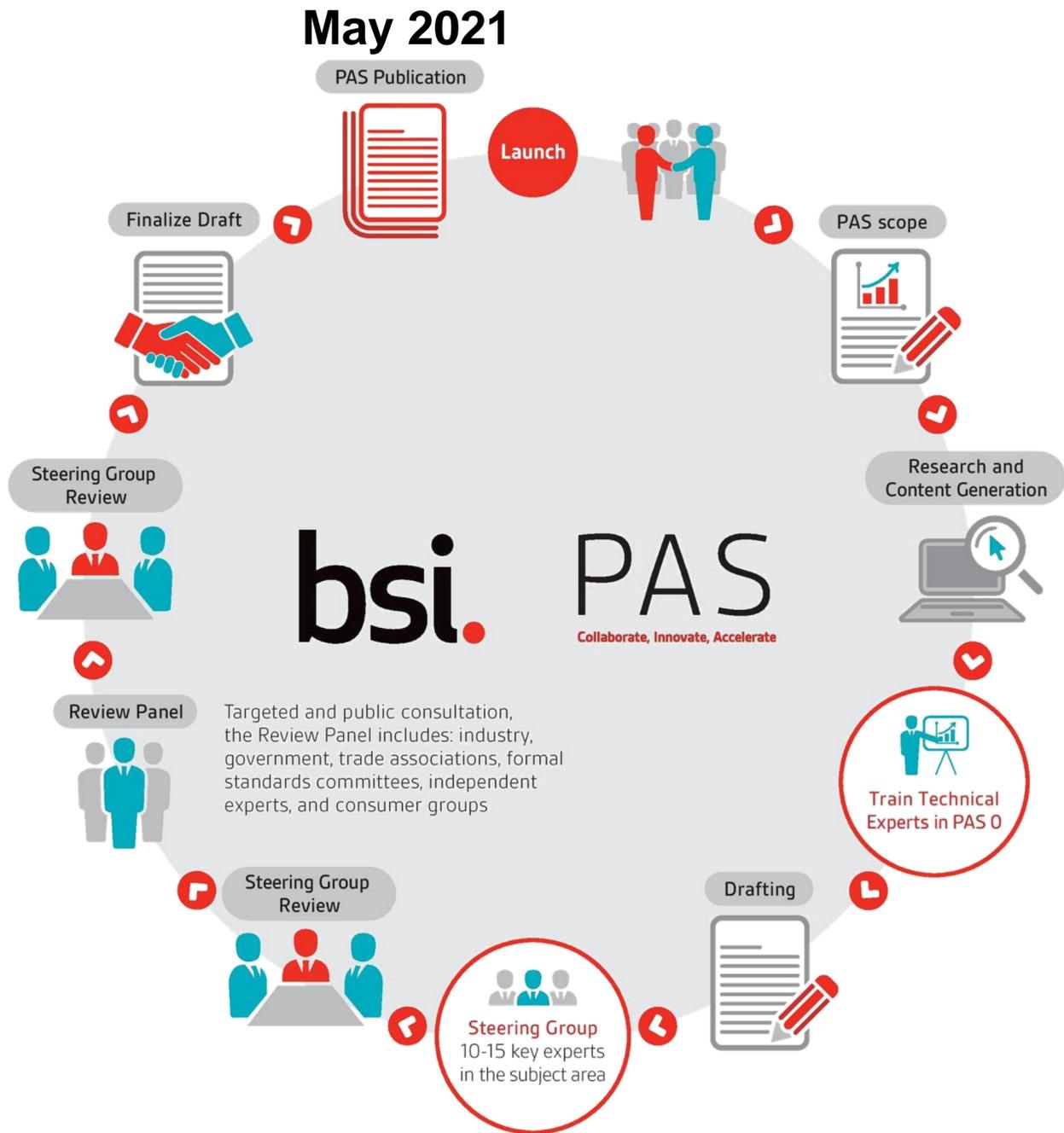
- The standards are **compatible** with, but **don't mandate**, the **GB Smart Metering** system.
- Alignment with **existing international** standards where **possible**.

Innovation

Specify only the **minimum requirements** to deliver DSR in line with 4 Policy Principles, which **allows innovation** on top.



Standards development: Process



- Funded by the then Department for Business Energy and Industrial Strategy
- Led by the **British Standards Institution (BSI)**
- Developed in an **industry-led** process, with expert **Steering Groups** and a programme level Strategic Advisory Group

40+ Organisations (9 Trade Associations)

ABCB	Energy UK	Newcastle Uni (EV)
ADE	ESC	NG ESO
APPLiA	ESSAC	Ofgem
BEAMA	EVET	OVO/Kaluza
BSI Assurance	Flexitricity	Pearlstone Energy
Carbon Co-op	Geo	Samsung
CBI	Hive	Schneider Electric
Citizens Advice	HMG	SMMT
CPIN	Innovate UK (EV)	Sustainability First
CRED	Kiwipower	Tech UK
CSO Confidential	Landis+Gyr	UKAS
EDF Energy	Moixa	UKERC
ENA	NCSC	WPD

Also 120+ individuals on Invited Review Panel



Definitions – DSRSP, CEM, ESA

DSR Service Provider (DSRSP)

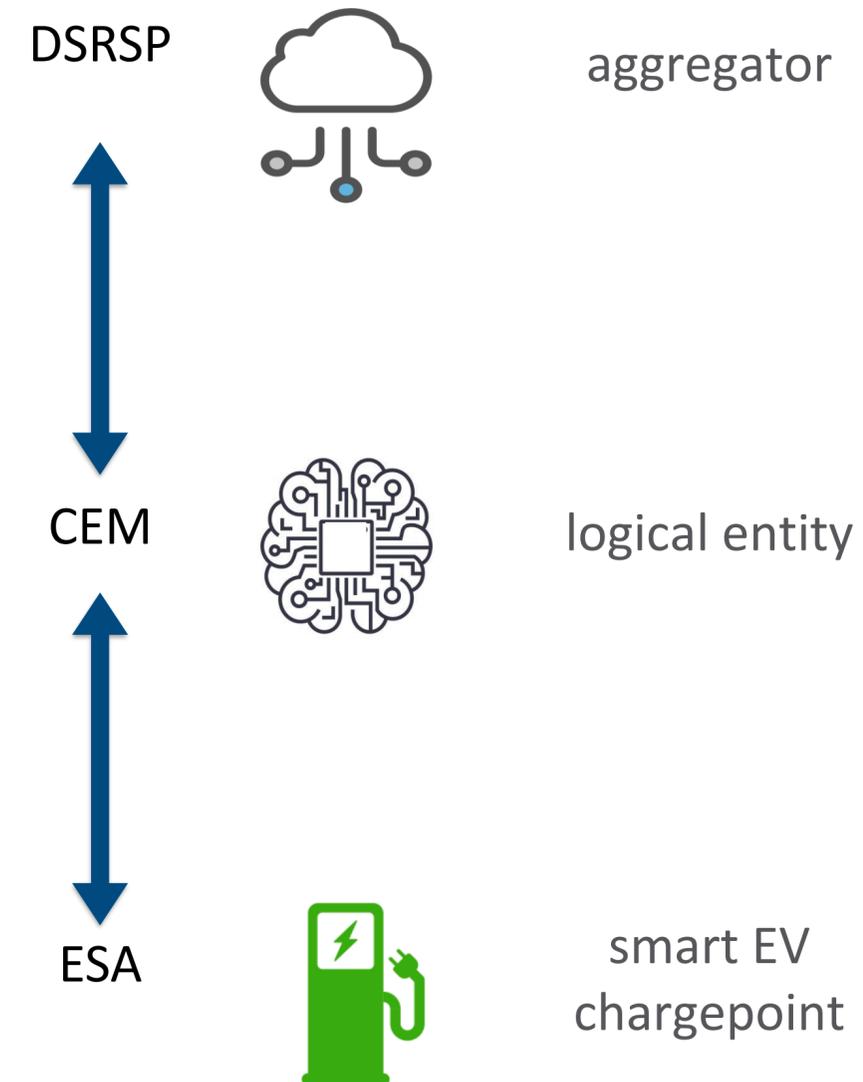
- An organization providing **demand-side related energy management services** to electricity system operators, electricity utilities and electricity generators

Consumer Energy Manager (CEM)

- A **logical entity**, that can be **physical or virtual**, which deals with **flexibility information** and requests
- **Translates** between the **DSRSP** and the **ESA**

Energy Smart Appliance (ESA)

- An internet **connected** device that can **modulate or shift** its **electricity** consumption in **response** to **signals**.



System Architecture – Part 1

2 DSR service types:

- **Routine** DSR

Operate based on **incentives** set in **advance**, often **multi-party market signals**

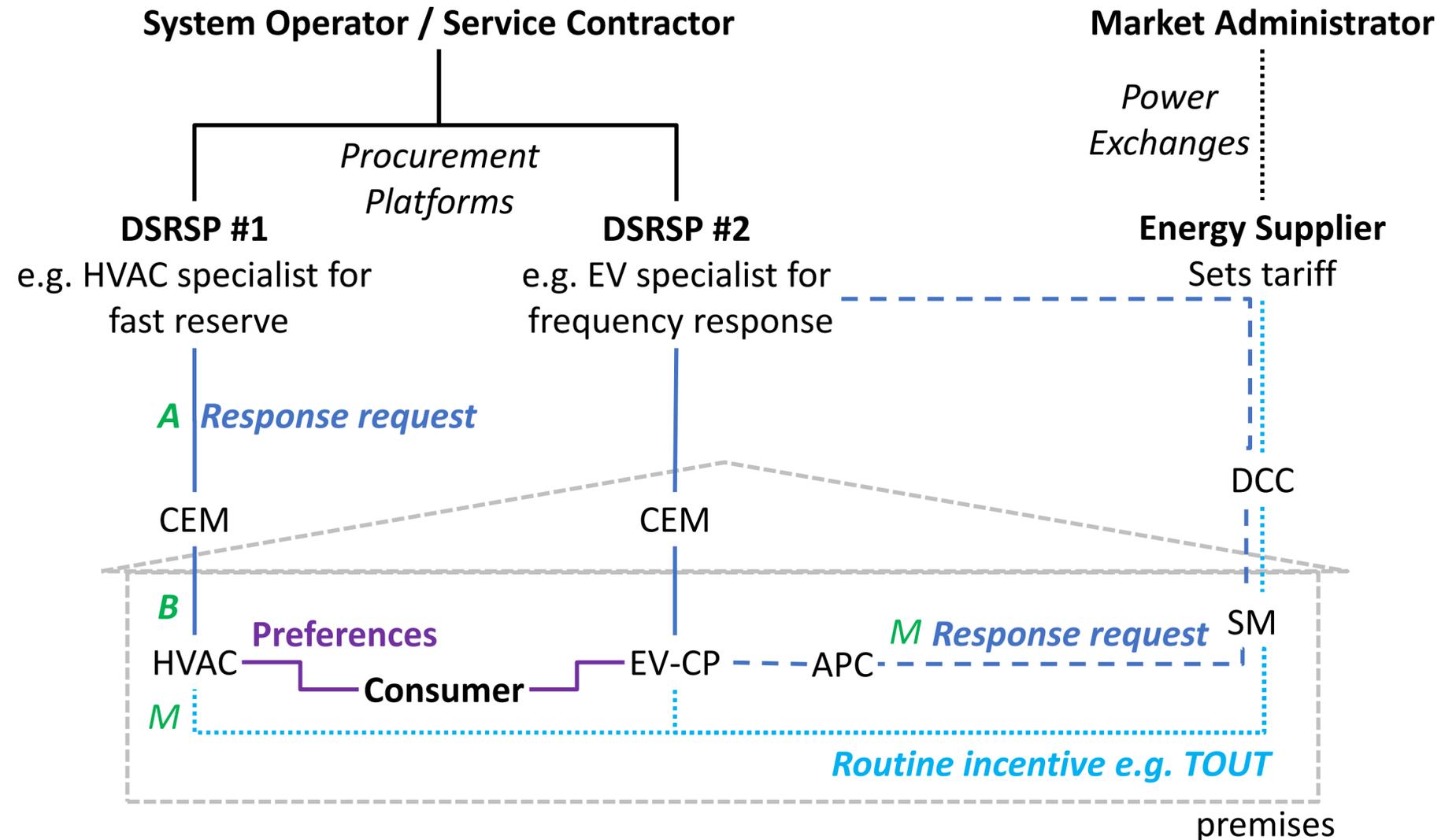
e.g. TOUT incentive via **Supplier**

- **Response** DSR

Operate based on **requests** made in **real time**, often due to firm **bi-lateral contracts**

e.g. grid FR request via **DSRSP**

PAS **specifies** how **response** requests are sent/received, but how **routine** incentives are **optimised** against is left to **innovation**



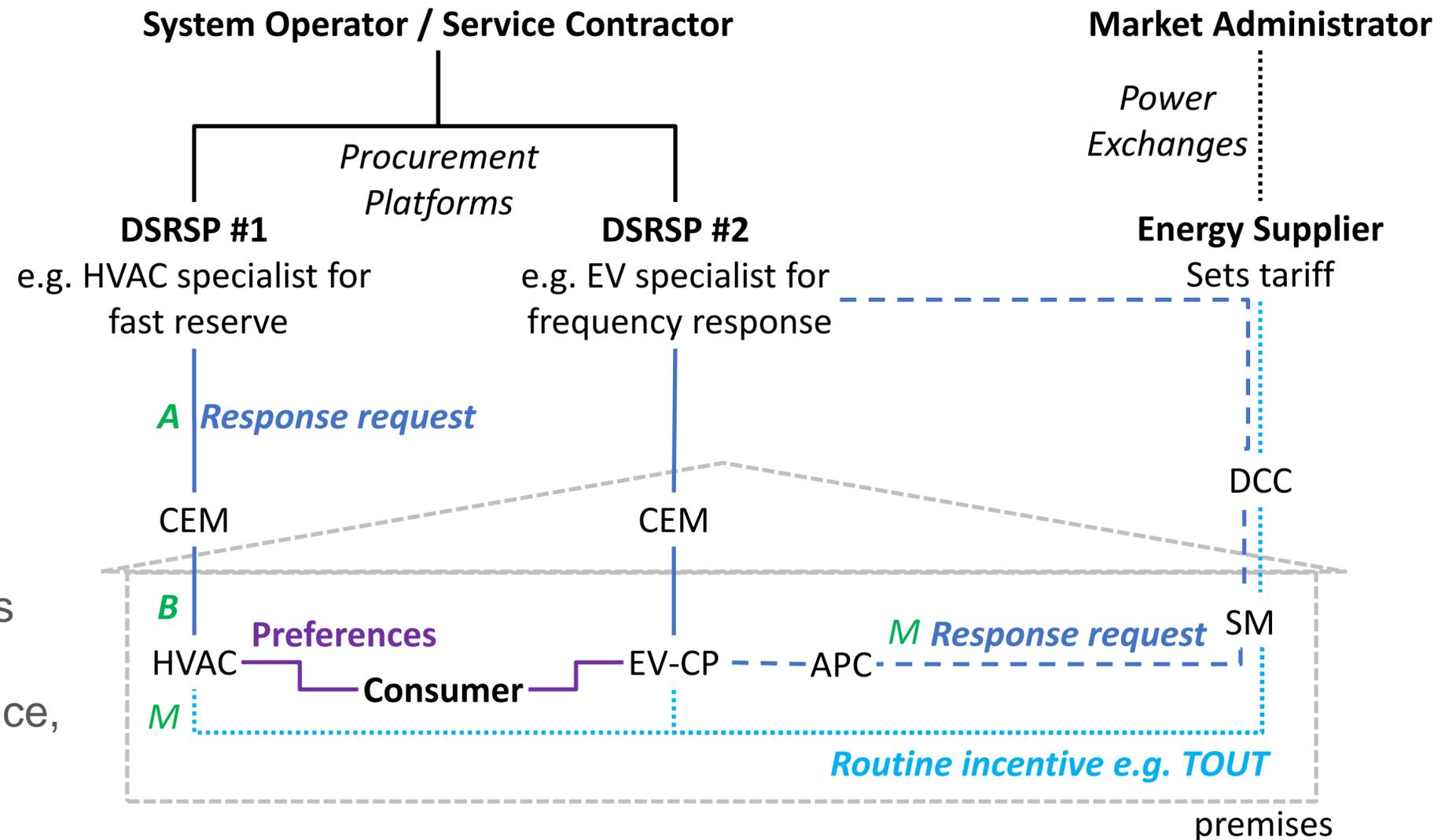
System Architecture – Part 2

3 interfaces:

- **A** - Interoperable, specified for any DSRSP
 - OpenADR
- **B** – Proprietary, can be ESA specific
 - e.g. can be **OCP** for **EV-CP**
- **M** - (optional) for GB Smart Metering

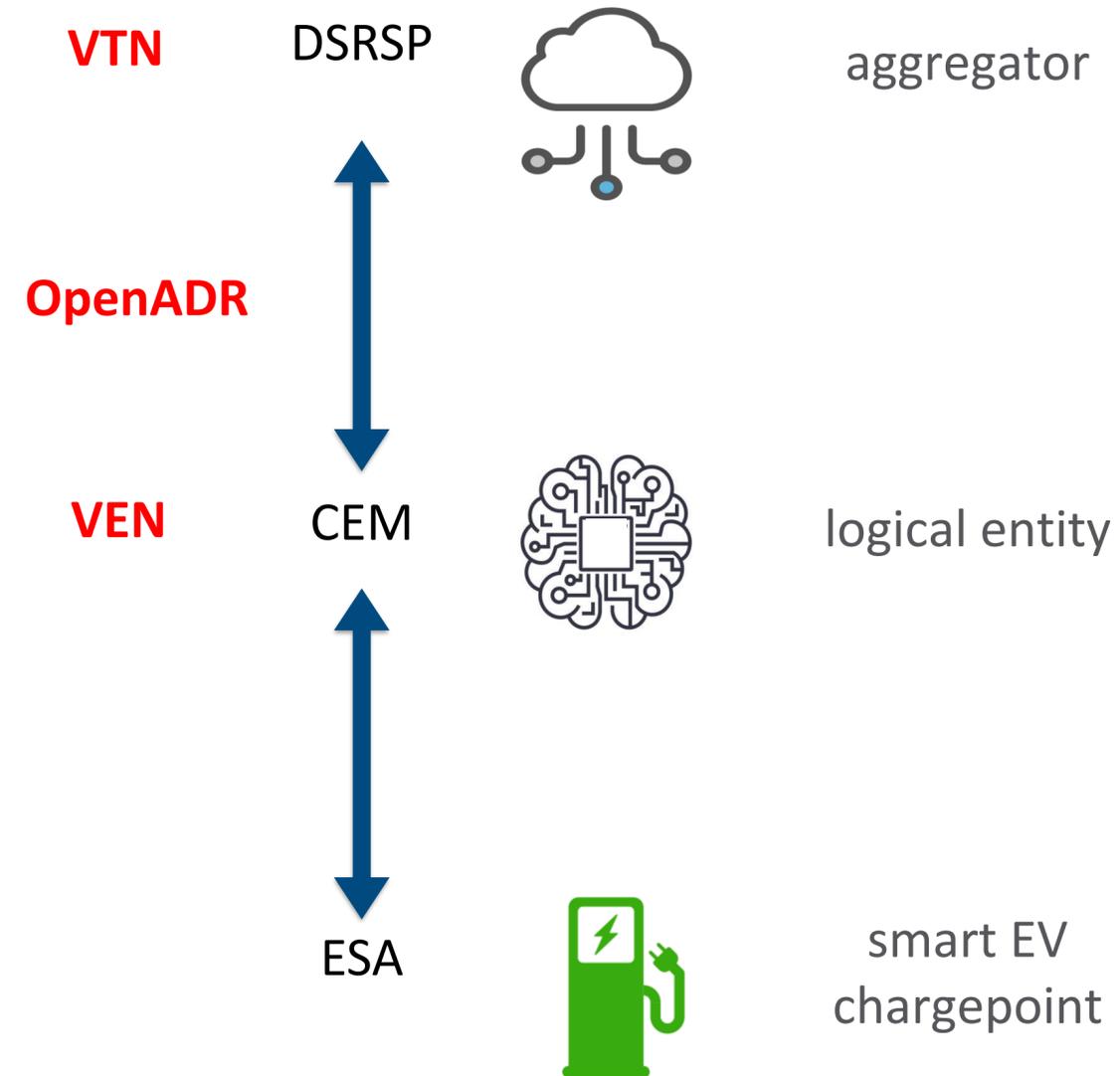
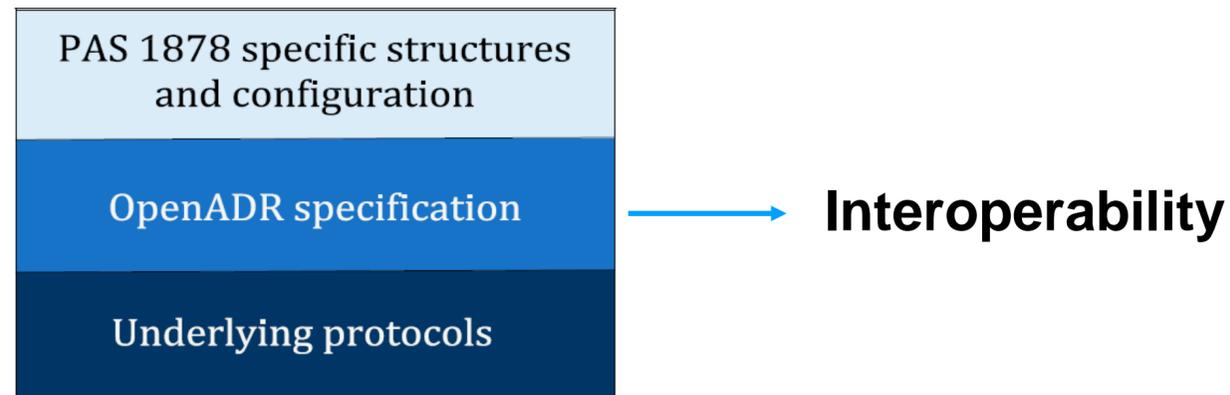
ESA must be **supplied with CEM** as a minimum, but this does **not restrict 3rd party** provided CEMs

User **subscribes individual ESAs** to a DSR service, allows **specialist DSRSPs** for specific ESAs



Interface A

- PAS 1878 mandates that any implementation of Interface A shall support the use of **OpenADR**
- The use of OpenADR guarantees interoperability and therefore **enables consumer choice**
- PAS 1878 provides a structure that is mapped on to the OpenADR protocol



System Operation – Part 1

A hierarchy of DSR operation is defined, with consumer preferences always respected:

Higher Priority



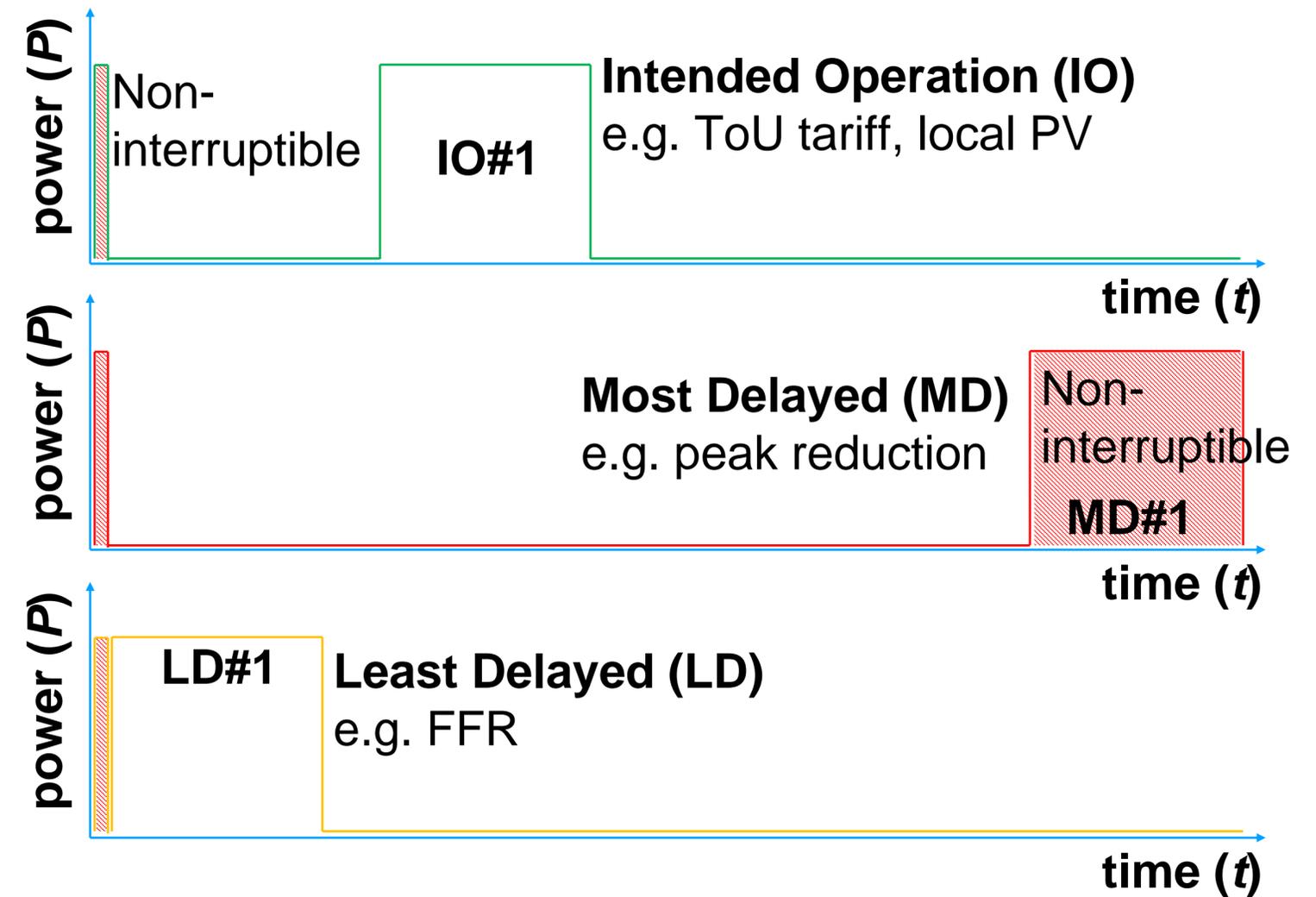
- **Routine** Mode
This is **baseline** DSR operation
The ESA controls electricity consumption according to the **consumers wishes** and any **external incentives** e.g. TOUT or grid CO2 intensity
- **Response** Mode
This **overrides** the baseline during a **response request**
The ESA controls electricity consumption according to the **consumers wishes** and **DSRSP's chosen flexibility option**, e.g. for frequency response
- **Consumer** override
Additional **manual override** (*note: their preferences are already built in*)

- **Cyber security requirements** are also specified. Grid stability risks mean they **go beyond IoT security**, but employ **well established industry best practice**. e.g. authentication, encryption, updates, ETSI EN 303 645
- During a Response request, the DSRSP will **statistically request flexibility** from **~100,000 devices** which makes the system **more resilient** as some **non-response is expected**.



System Operation – Part 2

- A **ESA** creates flexibility offers as **power profiles (P vs T)**, based on **consumer preferences**, appliance operation and any external incentives.
- At a **minimum** 3 power profiles:
 - (1) **Intended Operation (IO)**
Consumers preferences baseline
Runs in **Routine** mode
 - (2) **Most Delayed (MD)**
Consumers preferences with maximum delay
Option for **Response** mode
 - (3) **Least Delayed (LD)**
Consumers preferences with minimum delay
Option for **Response** mode
- The 3 profiles are **updated whenever their status changes** and sent to the DSRSP, so the **DSRSP keeps a live merit order** for response requests.



*profiles can include **frequency response capability**



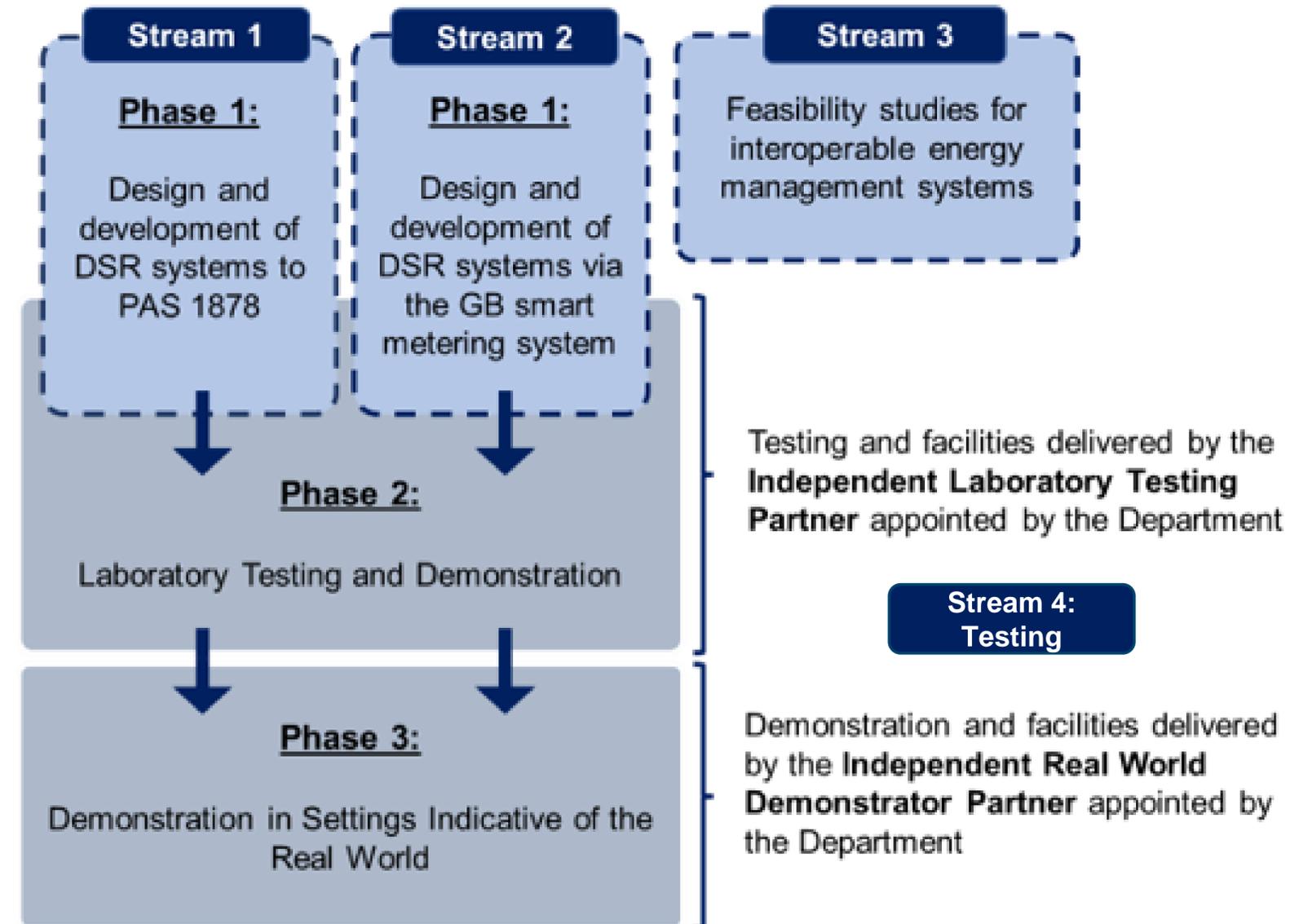
Interoperable Demand Side Response Programme

- Over **£12.8M funding**; 13 projects including independent testing/demonstration partners
- Development and demonstration of energy smart appliances and systems for the delivery of interoperable demand side response:

Stream 1 & 3: PAS 1878/1879

Stream 2 & 3: GB Smart Metering System

- Providing feedback on PAS 1878
- Part of the up to £65m [Flexibility Innovation Programme](#) within the £1bn [Net Zero Innovation Portfolio](#)



<https://www.gov.uk/government/collections/interoperable-demand-side-response-programme>



Interoperable Demand Side Response Programme: Stream 1 Projects

Stream	Project name	Lead applicant	Partner Organisations
1	Energy Smart Heat Pump	Samsung Electronics UK	Passiv UK
1	Project DSRR	Green Energy Options	Vailant, EDF, GreenSync Pty Ltd, Smarter Grid Solutions Limited
1	PAS-DSRFlex	Landis + Gyr Ltd	
1	Zen Smart IDSR Interoperability	Systems Mechanics Limited	Ev.energy Limited, carbonTRACK UK Limited
1	IREF: Interoperable Residential Energy Flexibility	Centrica Business Solutions Ltd	Mixergy Ltd, Daikin Airconditioning Limited Glen Dimplex UK Limited
1	Tomorrow's Homes Today	Voltalis UK	The Electric Heating Company Ltd, Enea Consulting

6 projects in total, including HVAC and EV Chargepoint appliances, as well as other ESAs.



Interoperable Demand Side Response Programme: Stream 2-4 Projects

Stream	Project name	Lead applicant	Partner Organisations
2	Smart-DSRFlex	Landis + Gyr Ltd	
2	ChameleonFIP	Chameleon Technology (UK) Limited	
4	Laboratory testing	Engage Consulting Ltd	NMI, SMS
4	Demonstrations in Real World	Resillion	Quality Logic, ScottishPower, Power Networks, Demonstration Centre
3	OpenDSR for All	The Society for the Reduction of Carbon Limited	
3	Project Open IC	Green Energy Options Ltd	
3	Feasibility of using Toshiba's DUCM to create a network of ESAs	Accenture UK	Toshiba Europe

Two Stream 2 projects, two Stream 4 projects, and three Stream 3 projects total.

The UK and DSR: Forward Look

- In response to the **July 2022 Consultation** “[Delivering a Smart and Secure Policy System](#)”, the Government is **minded-to** use a Standard based on PAS 1878 to develop a regulatory framework for ESAs.
- The Government expects to establish an **industry-led and BSI-co-ordinated** approach to the **next phase** of standards development, with BSI ensuring all stakeholder groups are appropriately represented.
- The findings of **the Interoperable Demand Side Response programme**, which is developing the first PAS-compliant ESAs, will feed into the next iteration of standards development.



Summary

The UK Government has sponsored the development of PAS 1878 and PAS 1879

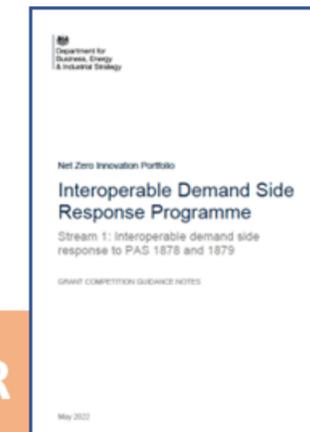


These create an end-to-end framework for domestic DSR

Interface A shall support the use of Open-ADR to enable interoperability

The UK Government has funded the **IDSR Programme** which is developing domestic DSR systems against PAS 1878 and PAS 1879

The findings from this programme will feedback into the next version of PAS 1878



...and thank you!

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ESA Programme website:

www.bsigroup.com/smart-appliances-flexible-energy

PAS 1878 & 1879 – free to download



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Worked Example #1 (illustrative)

During **Routine Mode**, the **ESA** regularly creates and sends **power profiles** to the DSRSP, the route is:

(1) ESA>CEM>DSRSP

The ESA sends **updates** whenever the flexibility **status changes**.

During a **DSR Response request**, the DSRSP selects an appropriate **power profile** and **duration time** and sends the **chosen flexibility** to the **CEM** for the **ESA** to implement, the route is:

(2) DSRSP>CEM>ESA

The DSRSP keeps a live merit order of **pre-registered power profiles**, so a **single request** delivers a DSR response, enabling fast response **high-value DSR services**.

During **Response Mode**, the **ESA** regularly sends **active power and power profile updates** to the DSRSP, the route is:

(3) ESA>CEM>DSRSP

The ESA sends **updates** whenever the flexibility **status changes** and in accordance with the **technical requirements** of the **DSR service**.

The DSRSP can then call **more/less DSR response** from its **live merit order** as necessary to meet system requirements.

When the DSR **request period ends**, after duration time, **Routine Mode** operation can **resume**, e.g. optimised for **TOUT** from **Smart Meter**.

**System Operator /
Service Contractor**

Procurement
Platforms



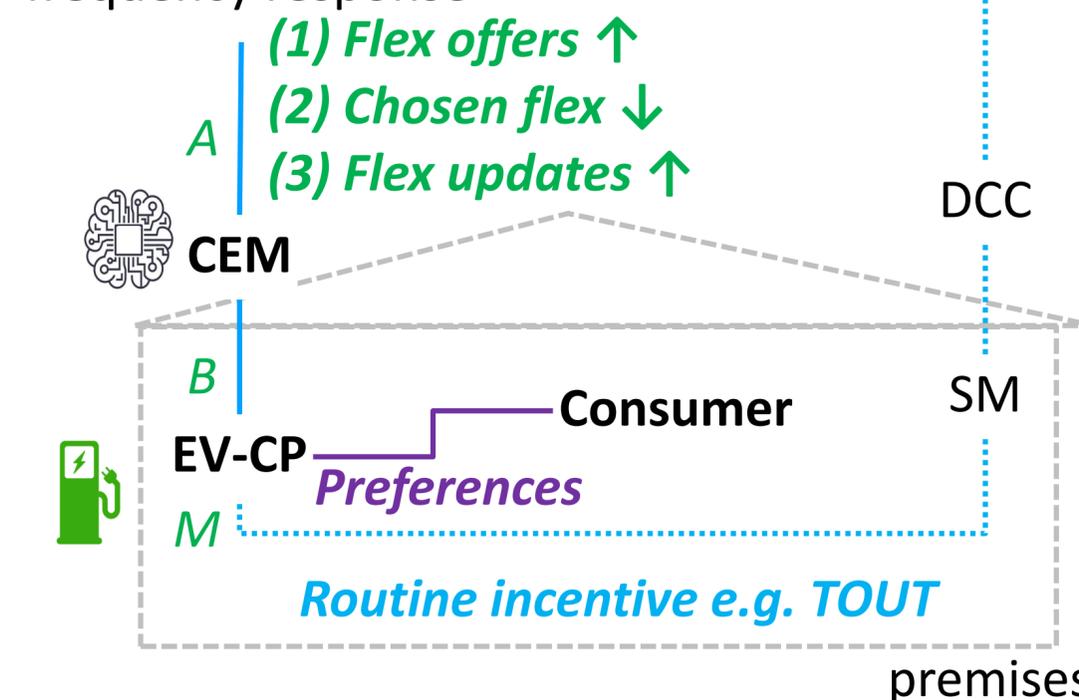
DSRSP #2

e.g. EV specialist for
frequency response

Market Administrator

Power
Exchanges

Energy Supplier
Sets tariff



Worked Example #2 (Annex D, clause D.4.2)

During **Routine Mode**, the **ESA** regularly creates and sends **power profiles with unique numbers** to the DSRSP as an **APC event-based alert**, **after CEM translation**, the route is:

(1) ESA>CEM>ESA>APC>CH>DCC>DSRSP

The ESA sends **updates** whenever the flexibility **status changes**.

During a **DSR Response request**, the DSRSP selects an appropriate **power profile number (n)** and **duration time** and sends the **chosen flexibility** to the **APC** for the **ESA** to implement, the route is:

(2) DSRSP>DCC>CH>APC>ESA

The DSRSP keeps a live merit order of **pre-registered power profiles**, so a **single request** delivers a DSR response, enabling fast response **high-value DSR services**.

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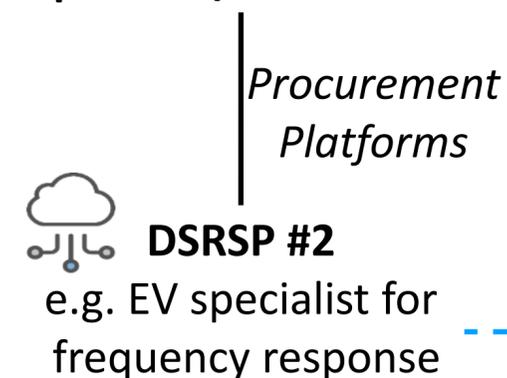
(3) ESA>CEM>ESA>APC>CH>DCC>DSRSP

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System Operator / Service Contractor



Market Administrator

