Energy Smart Appliances Standards for Demand Side Response

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

Department for Energy Security & Net Zero

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ESA standards development

OpenADR User Conference June 2023

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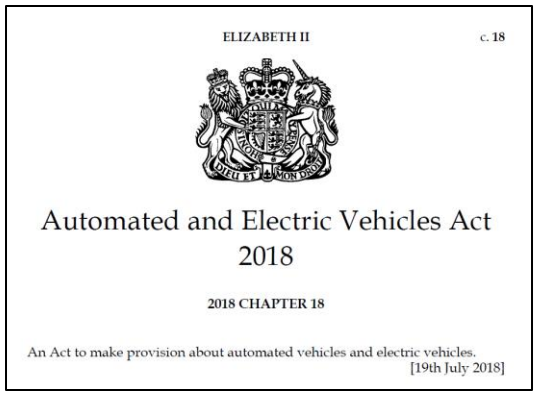
Objectives

- 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**



ELIZABETH II c. 18

Automated and Electric Vehicles Act 2018

2018 CHAPTER 18

An Act to make provision about automated vehicles and electric vehicles.
[19th July 2018]

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Approach: Scope

Principles

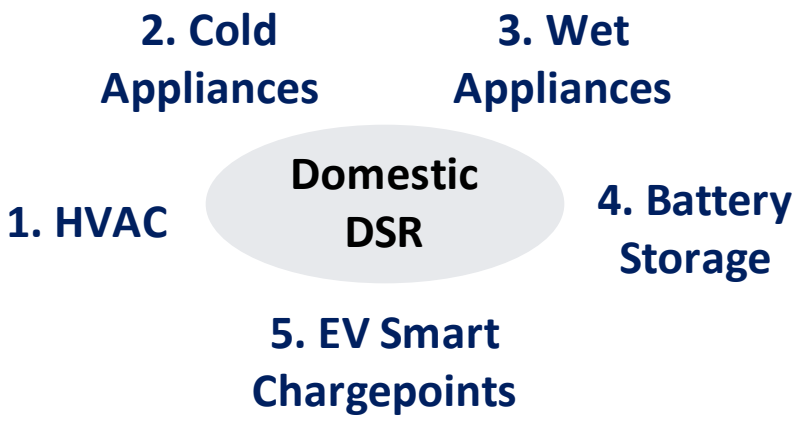
- **4 policy principles** underpin the standards, developed in consultation with industry stakeholders

Compatibility

- **Compatibility** with, but no mandate of, 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



Policy Principles	
1. Interoperability	the ability of an ESA to work seamlessly across any DSR service operated by any system player.
2. Data privacy	the secure storing of data on the device or with any controlling party.
3. Grid-stability	the prevention of outages on the grid caused by erroneous operation of ESAs.
4. Cyber-security	the prevention of unauthorized access to an ESA by third-parties.

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Approach: Process

British Standards Institution (BSI)

- A **standardised technical framework**, covering both **ESAs and DSR** for end-to-end system across **2 PASs**
- Developed in an **industry-led** process, with expert **Steering Groups** and a programme level Strategic Advisory Group
- Producing **PASs** (publicly available specification) in a **fast-track** standards process, which is **updated** every **2 years**

PAS 1878 Appliance-side: "**ESA specification for classification**"

PAS 1879 Grid-side: "**DSR framework for operation**"

BSI ESA Programme		
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		

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PAS 1878 – some technical details

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Definitions – DSRSP, CEM, ESA

DSR Service Provider (DSRSP)

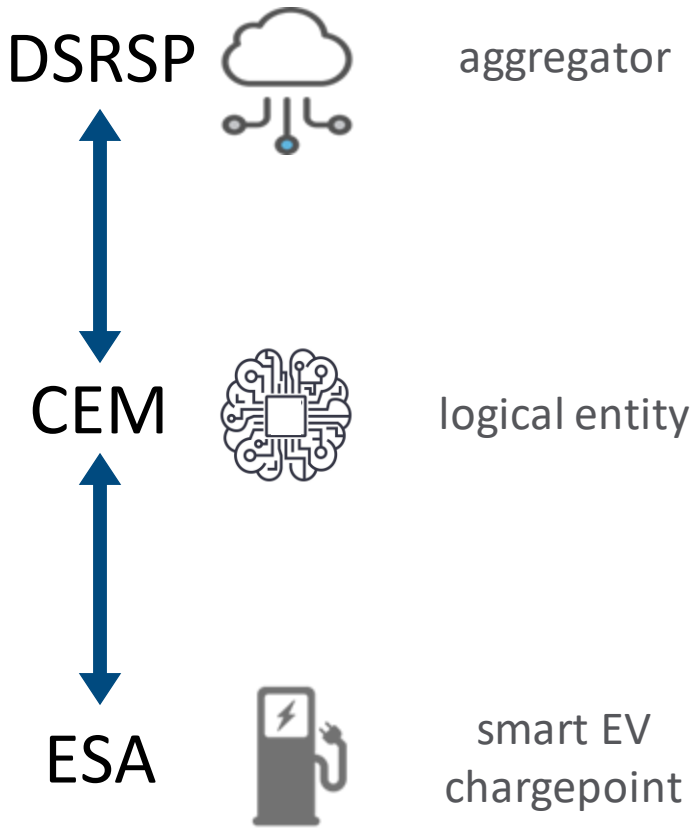
- An organization providing **demand-side** related **energy management services** to electricity system operators, electricity utilities and electricity generators

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**.



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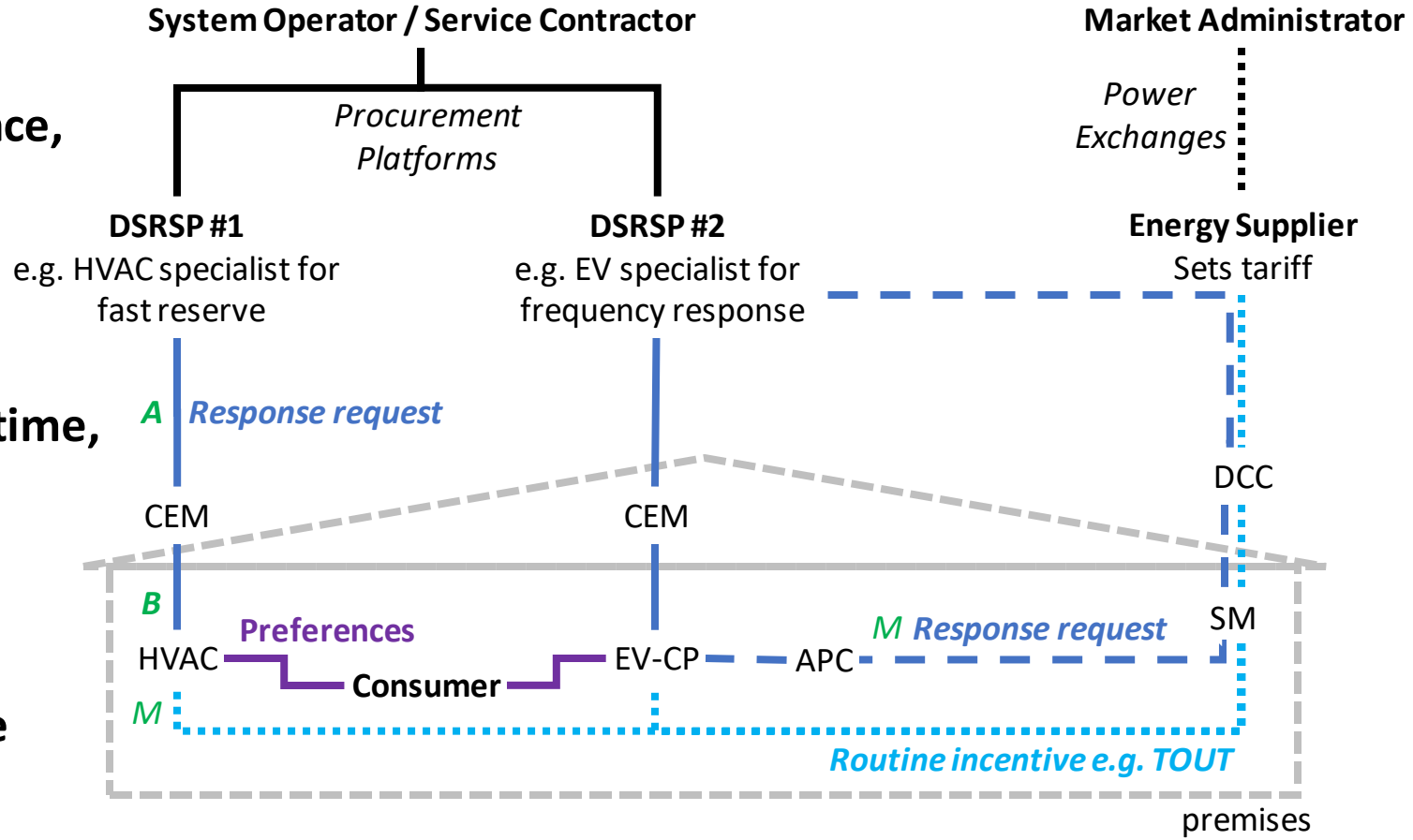
System Architecture – Part 1

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**



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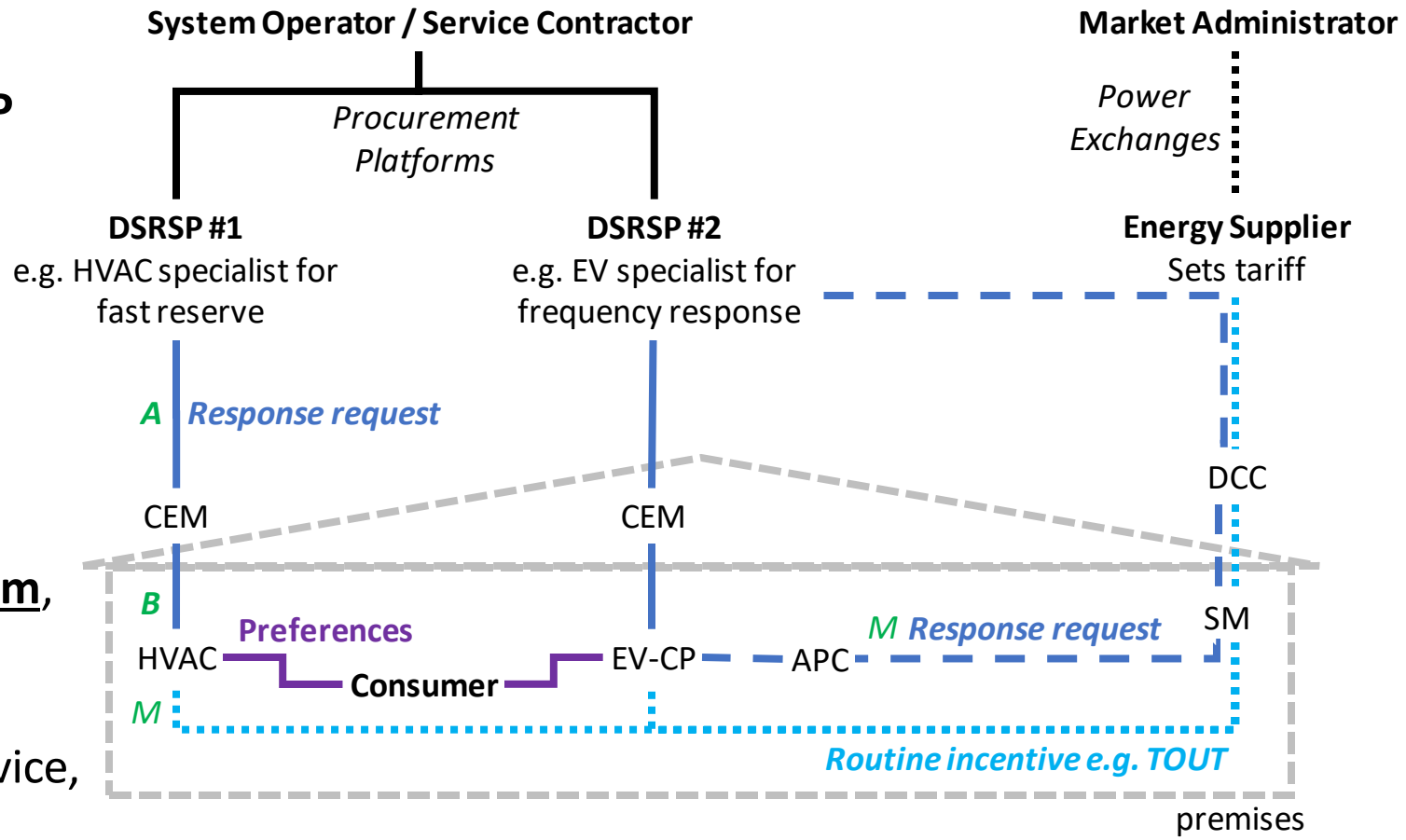
System Architecture – Part 2

3 interfaces:

- A - **Interoperable**, specified for **any DSRSP**
  - **OpenADR**
- B – **Proprietary**, can be ESA specific
  - e.g. can be **OCPP 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



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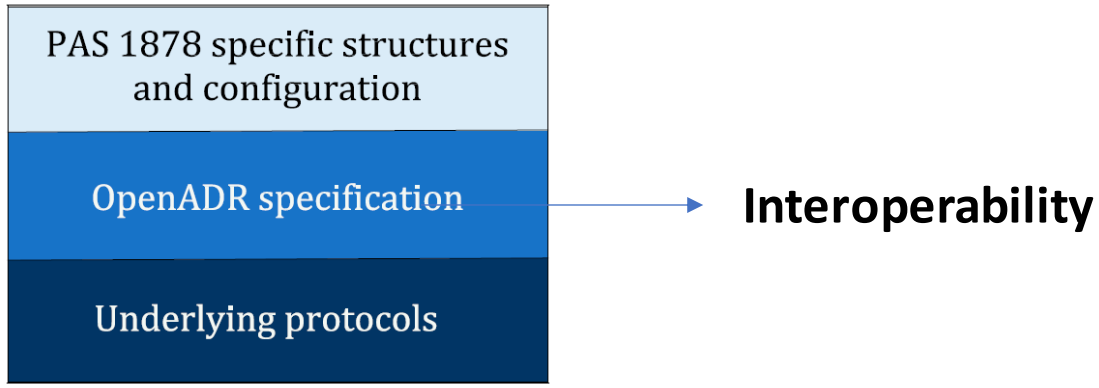
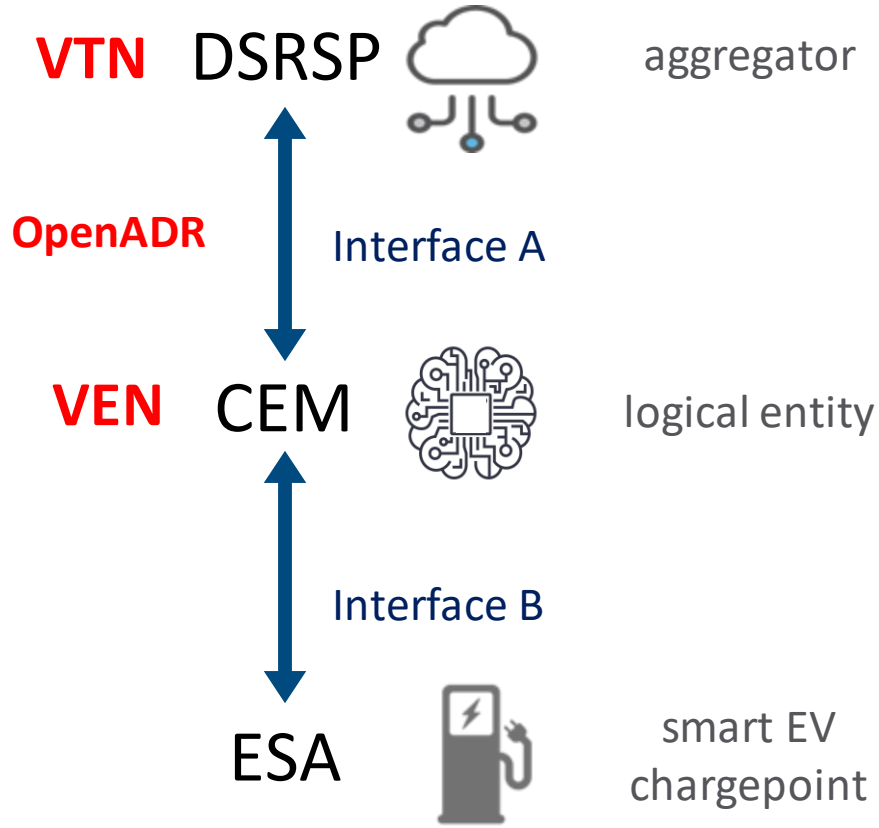
Interface A

- 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





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System Operation – Part 1

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

- **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 Mode
  - Additional **manual override** (*note: their **preferences** are **already** built in)*
- **Failsafe** protections Mode

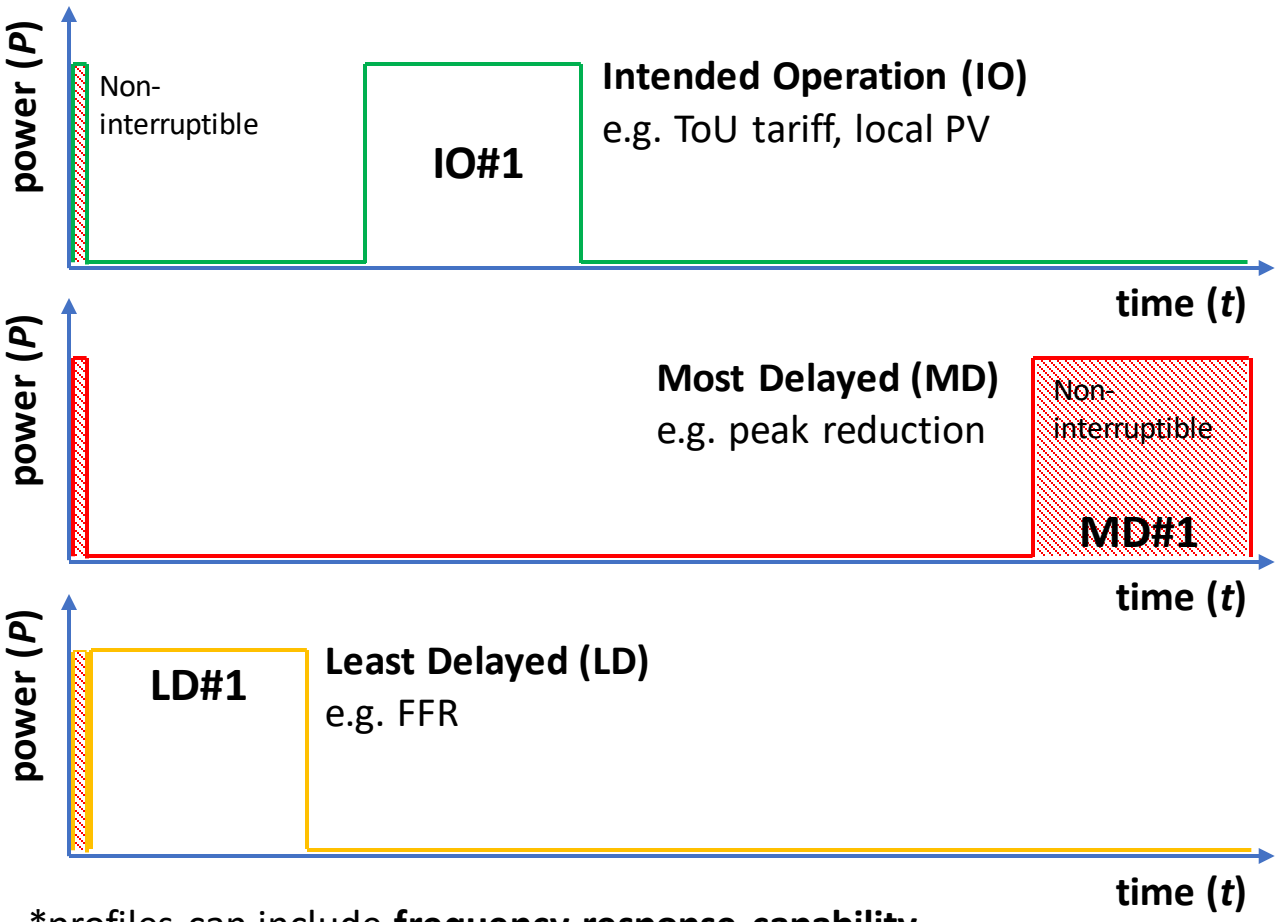
- During a Response request, the DSRSP will **statistically request flexibility** from **~100,000 devices** which makes the system **more resilient** as some **non-response is expected**.

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**

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Worked Example (illustrative)

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

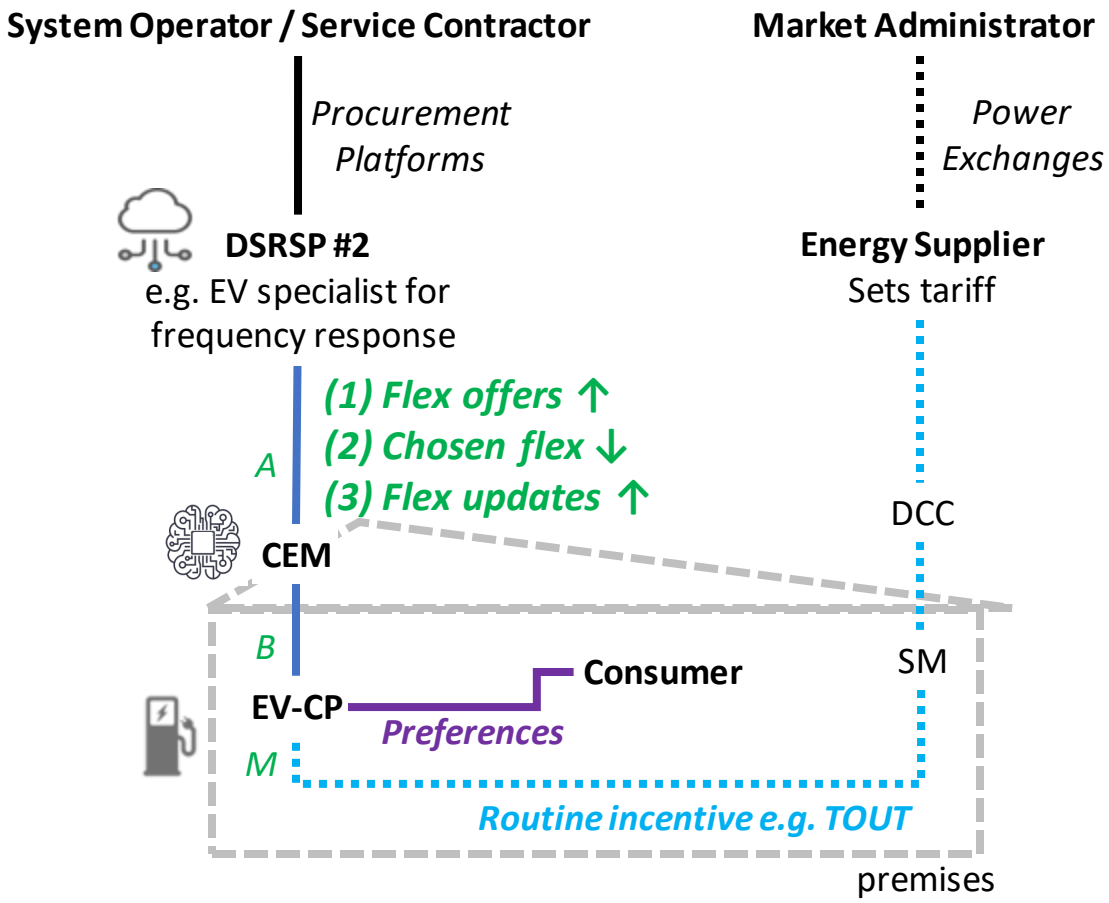
  (1) ESA>CEM>DSRSP
- The ESA sends **updates** whenever the flexibility **status changes.**

- 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.



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IDSR innovation programme

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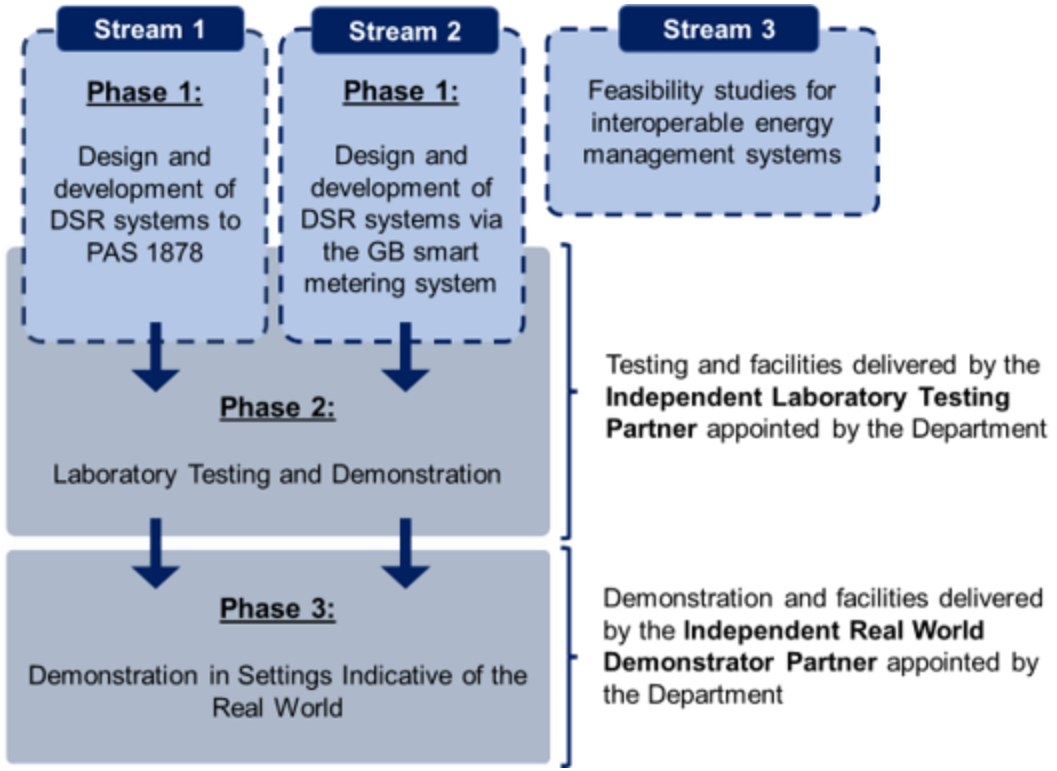
Interoperable Demand Side Response Programme

- 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:
  - PAS 1878/1879
  - 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

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Interoperable Demand Side Response Programme

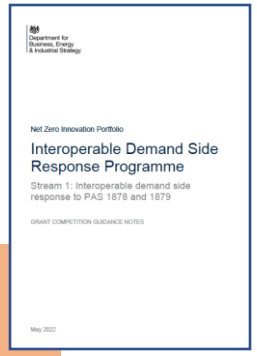
Stream	Project name	Lead applicant	Partner Organisations
1	Energy Smart Heat Pump	Samsung Electronics UK	Passiv UK
1	Project DSRR	Green Energy Options	Vailant, EDF, GreenSync Pty Ltd, Smarter Grid Solutions Limited
1	PAS-DSRFlex	Landis + Gyr Ltd	
1	Zen Smart IDSR Interoperability	Systems Mechanics Limited	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, Dcbel

Interoperable Demand Side Response Programme

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 assessment to understand the different functional and technical options available to create interoperable domestic energy management system	Accenture UK	

Summary

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



The UK Government has funded the **IDSR Programme** which is developing domestic DSR systems against 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 findings from this programme will feedback into the next version of PAS 1878

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Annexes

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System Architecture – HEMS integration

DSR service type:

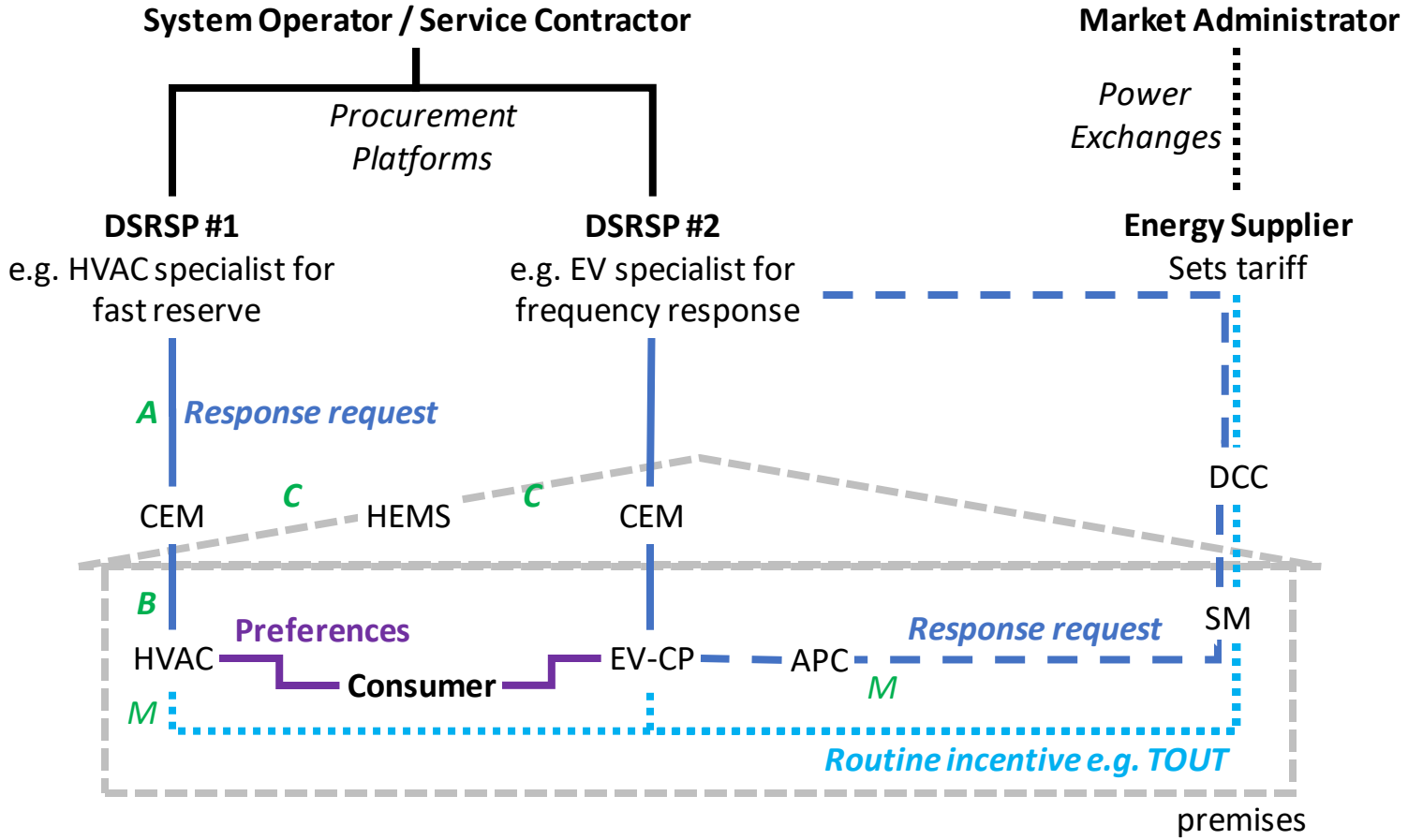
- **Routine** DSR
  Operate based on **incentives** set in **advance,** often **multi-party market signals**

  e.g. household optimisation via **HEMS** (Home Energy Management System)

Interface:

- **C** - **Interoperable**, specified for **any HEMS**
  - **(currently undefined)**
- **B** – **Proprietary**, can be ESA specific
  - e.g. can be **OCPP for EV-CP**

- **A** - **Interoperable**, specified for **any DSRSP**
  - **OpenADR** (+optional EEBUS/DLMS/etc)
- M - (optional) for GB Smart Metering



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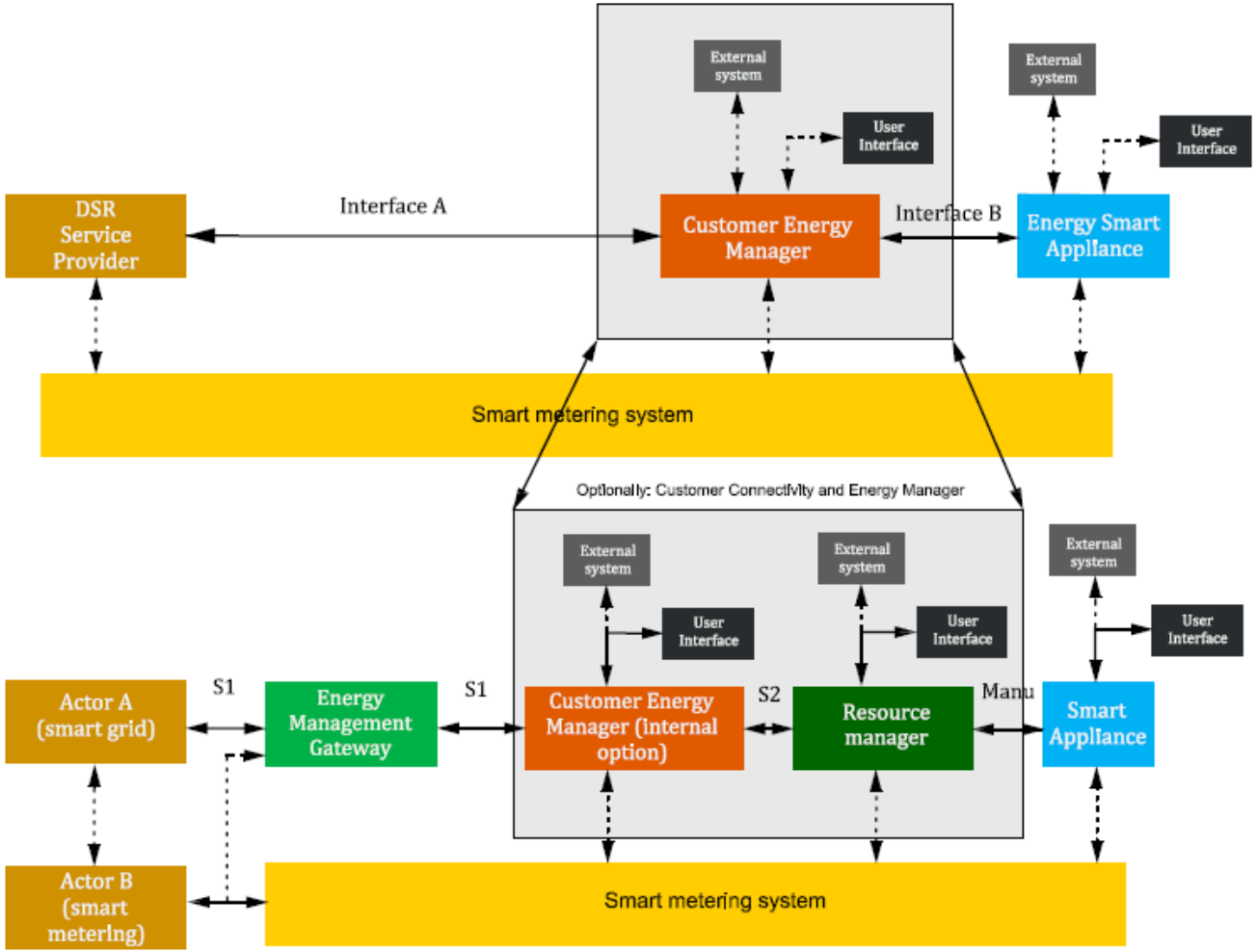
Mapping of PAS 1878 and CENELEC/IEC functional architectures



PAS 1878 architecture

CENELEC and IEC architecture

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