MHHS PROGRAMME
Industry-led, Elexon facilitated

# Load Shaping Service: Methodology Statement

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# Section A Background

1.1 This document sets out the Load Shaping Service (LSS) requirements for creating Load Shapes and associated Load Shape Totals. The Load Shapes are used by the Data Services and MDS for calculation of UTC Period level data where UTC Period Level Data is unavailable, invalid or missing.

1.2 A Load Shape is a set of daily average consumption or export data for each UTC Period for a Categorisation of Metering Systems in the population.

1.3 The following processes are covered in this document:

- Identifying Load Shape Categories (LSC) using Industry Standing Data (ISD);
- Counting the MPAN data associated with each LSC;
- Calculating the Load Shape associated with each LSC;
- Calculating the Load Shape Total for each LSC;
- Calculating the Off-peak total associated with each LSC;
- Calculating the Peak total associated with each LSC;
- Calculating the 7 day Rolling Total for each LSC;
- Calculating the 7 Day Rolling Off-peak Total For each LSC;
- Calculating the 7 Day Rolling Peak Total For each LSC;
- Calculating the default Load Shapes where the available data for an LSC is less than the configured de-Minimis value defined in ISD;
- Calculating back-stop Load shapes where no data is available for LSCs in any GSP Group; and
- LSS post calculation validation requirements.

1.4 This document also sets out the how to identify Load Shape Categories required for the LSS Process.

1.5 The term UTC Period Level Consumption Data refers to consumption or export data that is of UTC Period Granularity. LSS must have flexibility as to the duration of a UTC Period. The LSS must be able to process varying durations of one UTC Period. The UTC Period will not change in a UTC date and there will not be different UTC durations per Load Shape Category. All participant systems will be future proofed to handle changes to the definition of a Settlement Period. This does not mandate the complete re-design of participants existing systems, however, any changes to existing functionality or new functionality introduced to support MHHS should be configurable so as to allow for different settlement period lengths

# Section B General Requirements

The Load Shaping Service shall:

- Identify the UTC date for each Load Shaping Run using the Load Shaping Calendar set out in ISD;
- Only access the most recent UTC Period Level Data for each MPAN and UTC date, where more than one set of data exists;
- Access the ‘A’ flagged UTC Period Level Data for the UTC date to be processed;
- Access the associated Registration data for each MPAN that has ‘A’ flagged data; and
- All Load Shape value will be in kWh and rounded to 3 decimal places when output

1.6 When processing the data the LSS shall address each UTC Period for a given UTC Date independently and be cognisant of any in day changes to the Registration data identified by the date-time of the ‘Effective from Dates’ (EFDs), e.g. a change in Domestic Premise Indicator.

## 2. Identifying Load Shape Categories (LSC) using Industry Standing Data (ISD)

2.1 The LSS shall use the Registration data provided for each MPAN and the LSC set out in the source of the published ISD applicable for the UTC Date being processed. The required Data Items need to be configurable. Initially the following Data Items will be required to identify the appropriate Load Shape Category:

| Data Item Id | Data Item Name | Definition |
|---|---|---|
| DI-050 | Market Segment Indicator | An enumeration of Smart/Advanced/Unmetered. |
| DI-037 | GSP Group ID | Identifies the distinct grid supply point group (physical region of the country) where the metering point is located. |
| DI-030 | Domestic Premise Indicator | A flag that indicates if the MPAN of the registration appointment is used to identify a domestic premise. |
| DI-052 | Measurement Quantity ID | Identifies UTC Period if the data is Active Import (AI) or Active Export (AE). The Measurement Quantity Table in ISD maps Measurement Quantity ID to the Direction of Flow Indicator which matches the Registration data item. |
| DI-015 | Connection Type Indicator | Whole Current (W), Low Voltage Current Transformer (L), High Voltage Current Transformer (H) or Extra High Voltage Current Transformer (E) |

2.2 The Non-smart Switched Load Profile Class is not used for the production of Load Shapes other than identifying the periods that are totalised in the Load Shape totals. These identifiers are used by Smart Data Services to identify the Off-Peak/Peak periods for use in the SDS estimation processes The ISD also defines the Off-peak period (and hence the Peak period) for use in the calculation of the Peak and Off-Peak Load Shape Totals for LSCs that require these totals to be calculated.

2.3 An illustration of the data in this ISD table is shown in Appendix 1 (the actual data items in the table are set out in the ISD specification).

## 2A. Load Shape Totals definition using Industry Standing Data (ISD)

The LSS shall use the Registration data provided for each MPAN and the LSC set out in ISD. The following Load Shape totals will need to be calculated for each LSC. Calculation methods are covered in Section C.

| Load Shape Total | Description |
|---|---|
| Load shape total | The sum of all LS Period Values for the UTC Date. |
| Load shape peak total | The sum of LS Period Values for UTC times (07:00 to 00:00) or (00:00 to 00:30 and 07:30 to 00:00) as defined in ISD |
| Load shape off-peak total | For Smart Segment Metering Systems the sum of LS Period Values for UTC times (00:00 to 07:00) or (00:30 to 07:30) as defined in ISD |
| Load shape 7 day rolling total | The sum of the Load Shape Total defined above and the Load Shape Total for the past 6 UTC Dates. |
| Load shape 7 day rolling peak total | For Smart Segment Metering Systems the sum of the Load Shape Peak Total defined above and the Load Shape Peak Total for the past 6 UTC Dates. |
| Load shape 7 day rolling off-peak total | For Smart Segment Metering Systems the sum of the Load Shape Off-Peak Total defined above and the Load Shape Off-Peak Total for the past 6 UTC Dates. |

### Identifiers used in this Method Statement

The following Identifiers are used in this document:

| Identifier | Data item |
|---|---|
| *C* | Load Shape Category |
| *D* | UTC Date |
| E | Previous UTC date with the same day type as UTC date D |
| H | GSP Group |
| *j* | UTC Period |
| K | MPAN |
| U | A UTC Date |

Where identifiers are in italics these are new MHHS Identifiers and do not have the same meaning as those set out in: https://www.elexon.co.uk/documents/bsc-codes/bsc-sections/bsc-section-x-2-technical-glossary/

# Section C Load Shaping Methods

### Selecting data for a UTC date and calculating totals

When selecting data for a UTC date the LSS shall ensure the 'Effective to' datetime logic is used to identify the correct data for UTC Date "*D*". For example under MHHS the first period would have a UTC datetime 'effective to' 00:30. The last period would have a UTC datetime 'effective to' 00:00 even though the 'date' part of the datetime will be for the following day. The same logic must be used when calculating Load Shape Totals.

### The Load Shaping Methods are set out below for each Load Shaping Run for each LSC defined in ISD

### 3. Counting the MPAN data associated with each LSC

3.1 The LSS must use Registration Data, together with the Load Shape Categories from ISD, to allocate each MPAN 'K' to a Load Shape Category so the number of MPANs with UTC Period Level Data in each Load Shape Category for each UTC Period can be derived.

**Method:** For the UTC Date (*D*) and each UTC Period (*j*) and LSC (C) the LSS must count the number of UTC Period Level Data ($UTCP_{Dj}$) with actual (A Flagged) meter data as follows:

$LSCCOUNT_{DjC}$ = Count ($UTCP_{KDjC}$) across MPANs 'K'

### 4. LSS Identifies LSC UTC Periods for a default calculation

4.1 Where the count is less than the de-Minimis value set out in the ISD the Load Shape Period Value ($LSPV_{DjC}$) shall be identified for a default calculation, and the Load Shape $LSPV_{DjC}$ will be set to the Default Load Shape $DLSPV_{DjC}$.

4.2 Therefore:

$$LSPV_{DjC} = DLSPV_{DjC}$$

## 5. Calculating the default Load Shapes for the smart Segment where available data for a LSC is less than the configured de-Minimis value defined in ISD

5.1 Where the MPAN 'K' count for a Load Shape Category for a UTC Period is less than the De-Minimis Value the LSS shall calculate a default Load Shape for that UTC Period averaging UTC Period Level Data over all GSP Groups that have the same remaining Load Shape Category characteristics.

**Method:** For the UTC Date (*D*) and each UTC Period (*j*) and LSC (*C*) identified for a default the LSS must average the UTC Period Level Data with actual ('A' Flagged) for the set of all GSP Groups (H). The LS data ($DLSPV_{DjC}$) shall be calculated as follows:

$LSCCOUNTN_{DjC}$ = Count($UTCP_{KHCDj}$) across K = MPAN and H = GSP Group

If the de-minimis value for the defaulted LSC is still not met then the Back-stop calculation set out below (in 6) shall be applied.

$$\mathrm{DLS}_{DjC} = \frac{\sum_{HK} \mathrm{UTCP}_{KHDjC}}{\mathrm{LSCCOUNTN}_{DjC}}$$

Where the GSP Group Set H is all the GSP Groups (from A to P) and Load Shape Category *C* has the same identifiers other than the GSP Group Identifier.

The $DLSPV_{DjC}$ shall be 'D' Flagged for that UTC Period (j).

For other Market Segments see Back-stop defaulting see below.

## 6. Calculating Back-stop Load shapes where no data is available for LSCs in any GSP Group

6.1 For each UTC Period where data count is less than the De-minimis values for the Load Shape Category across all GSP group, the LSS must default to the most recent Load Shape for the Day Type and UTC Period that is the same as the UTC Date being processed.

**Method**: For the UTC Date (*D*) and each UTC Period (*j*) and LSC (*C*) where $LSCCOUNTN_{DjC}$ is below the De-mimimis or zero the LSS shall set the LS data ($DLS_{DjC}$) as follows:

$DLSPV_{DjC} = LSPV_{EjC}$

where E is the previous UTC date with the same day type as UTC date *D*

6.2 The day type for each UTC date is defined in the Load Shaping Calendar.

6.3 The defaulted UTC Periods shall be 'E' Flagged for each UTC Period (*j*).

## 7. Calculating the Load Shape where no previous data is available when defaulting

7.1 If no data exists for at least one UTC Period for previous UTC date with the same Day Type as the UTC Date being processed the LSS must use value of 1 for all UTC Periods associated to the UTC Date.

7.2 If there is no $LSPV_{EjC}$ for all UTC Periods *j*:

$DLSPV_{DjC} = 1$

The defaulted UTC Periods shall be 'B' Flagged for each UTC Period (*j*).

## 8. Calculating the Load Shape associated with each LSC

8.1 The LSS must average Actual UTC Period Consumption and process data by UTC Period and Load Shape category so that Load Shapes can be created for the whole UTC date.

**Method**: For the each MPAN 'K' and UTC Date (*D*) and each UTC Period (*j*) and LSC (*C*) not identified for a default calculation the LSS must average the UTC Period Level data (UTCP) with actual (A Flagged) data, the LS data ($LSPV_{DjC)}$ shall be calculated as follows:

$$\mathrm{LSPV}_{DjC} = \frac{\sum_K UTCP_{KDjC}}{\mathrm{LSCCOUNT}_{DjC}}$$

The $LS_{DjC}$ shall be 'A' Flagged for the UTC Period (*j*).

The Load shape for the UTC date will be the set of $LSPV_{DjC}$ and any $DLSPV_{DjC}$ values calculated.

## 9. Calculating the Load Shape Total for each LSC

9.1 The LSS must sum all of the individual UTC Period averages, for the UTC date, so as to calculate a daily total for each load shape category. This daily total should be stored/published alongside the Load Shape Data.

**Method:** For the UTC Date (*D*) and LSC (*C*) the LSS must sum the Load Shape data ($LSPV_{DjC)}$ including any default LS data ($DLSPV_{DjC}$) to calculate the ($LS_TOT_{DC)}$ as follows:

$$\mathrm{LS_TOT}_{DC} = \sum_j \mathrm{LSPV}_{DjC}$$

## 10. Calculating the Off-peak total associated with each LSC

10.1 Where defined for a Load Shape Category the LSS must sum all of the off-peak UTC Period averages, for the UTC Date, so as to calculate an off-peak daily total for each Load Shape Category. These off-peak totals should be stored/published alongside the Load Shape Data.

**Method:** For the UTC Date (*D*) and LSC (*C*) the LSS must sum the Load Shape data ($LSPV_{DjC}$) including any default LS data ($DLS_{DjC}$) to calculate the Load Shape Off-peak total ($LS_OFF_{DC}$) as follows:

$$\mathrm{LS_OFF}_{DC} = \sum_j \mathrm{LSPV}_{DjC}$$

Where *j* = UTC Periods covering (00:00-07:00) or (00:30-07:30) as defined for the LSC in the Load Shape Category Table in ISD.

## 11. Calculating the Peak total associated with each LSC

11.1 Where defined for a Load Shape Category the LSS shall calculate the sum all of the peak UTC Period averages, for the UTC Date, so as to calculate a peak daily total for each Load Shape Category. These peak totals should be stored/published alongside the Load Shape Data.

**Method:** For the UTC Date (*D*) and LSC (*C*) the LSS use the Load Shape Total data to calculate the Load Shape Peak total ($LS_PEAK_{DC}$) as follows:

$LS_PEAK_{DC} = LS_TOT_{DC} - LS_OFF_{DC}$

## 12. Calculating the 7 day Rolling Total for each LSC

12.1 For each LSS Category, the LSS must calculate a 7 day rolling total using the total for the UTC date plus the previous 6 UTC dates. This total should be stored and publish as part of the Load Shape Data.

**Method:** For the UTC Date (*D*) and LSC (*C*) the LSS use the Load Shape Total data to calculate the Load Shape Rolling 7 Day total ($LS_ROLL_TOT_{DC}$) as follows:

$$\mathrm{LS_ROLL_TOT}_{DC} = \sum_{V=D-6}^{D} \mathrm{LS_TOT}_{VC}$$

Where V is a UTC date.

## 13. Calculating the 7 day Rolling Off-Peak Total for each applicable LSC

13.1 For each LS Category, where it is defined, the LSS must calculate a 7 day rolling Off-Peak total using the Off-Peak total for the UTC date plus the last 6 UTC dates. This total should be stored and publish as part of the Load Shape Data

**Method:** For the UTC Date (*D*) and LSC (*C*) the LSS use the Load Shape Total data to calculate the Load Shape Rolling 7 Day Rolling Off-peak total ($\text{LS_ROLL_OFF}_{DC}$) as follows:

$$\text{LS_ROLL_OFF}_{DC} = \sum_{E=D-6}^{D} \text{LS_OFF}_{XC}$$

Where X is a UTC date

Where *D* = UTC date to *D* = UTC date-6

## 14. Calculating the 7 Day Rolling Peak Total for each LSC

14.1 For each LS Category, where it is defined, the LSS must calculate a 7 day rolling Peak total using the Peak total for the UTC date plus the last 6 UTC dates. This total should be stored and publish as part of the Load Shape Data

**Method**: For the UTC Date (*D*) and LSC (*C*) the LSS use the Load Shape Total data to calculate the Load Shape Rolling 7 Day Peak total ($\text{LS_ROLL_PEAK}_{DC}$) as follows:

$$\text{LS_ROLL_PEAK}_{DC} = \sum_{X=D-6}^{D} \text{LS_PEAK}_{XC}$$

Where V is a UTC date

## 15. LSS Validates for processing errors

15.1 The LSS must validate that processing has completed correctly without error prior to the publishing of the LSS data and notifying to MDS. If validation fails an investigation into the cause of failure must be undertaken to correct the validation failure and the LSS calculations must be re-run. If no error is identified the data is assumed to be correct. For each UTC Period the LSS shall check that the output was reasonable before publishing.

**The interfaces produced by LSS are covered in MHHSP_InterfacesDoc_BPRWG_2020_02_21.xlsx**

# Appendix 1: ISD Table: Load Shape Categories

The Load Shape Categories are set out in the published source of Industry Standing Data (ISD) in the ISD Table: Load Shape Categories. An illustration of the data in this ISD table is shown in Appendix 1 (the actual data items in the table are set out in the ISD specification). All term meanings are set out in ISD glossary.

The Data Items are set out in the headers of the following ISD table:

| Market Segment Indicator | GSP Group ID | Domestic Premise Indicator | Measurement Quantity | Non-Smart Switched Load Profile Class | Off-Peak Period (UTC) | Connection Type Indicator | De-minimis Data Count |
|---|---|---|---|---|---|---|---|
| S | _A | T | AI | 02 | 00:00-07:00 | W | [50] |
| S | _A | F | AI | 04 | 00:00-07:00 | W | [50] |
| S | _A | T | AE | NULL | NULL | W | [50] |
| S | _A | F | AE | NULL | NULL | W | [50] |
| S | _B | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _B | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _B | T | AE | NULL | NULL | W | [50] |
| S | _B | F | AE | NULL | NULL | W | [50] |
| S | _C | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _C | F | AI | 04 | 00:00-07:00 | W | [50] |
| S | _C | T | AE | NULL | NULL | W | [50] |
| S | _C | F | AE | NULL | NULL | W | [50] |
| S | _D | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _D | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _D | T | AE | NULL | NULL | W | [50] |
| S | _D | F | AE | NULL | NULL | W | [50] |
| S | _E | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _E | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _E | T | AE | NULL | NULL | W | [50] |
| S | _E | F | AE | NULL | NULL | W | [50] |
| S | _F | T | AI | 02 | 00:00-07:00 | W | [50] |
| S | _F | F | AI | 04 | 00:00-07:00 | W | [50] |
| S | _F | T | AE | NULL | NULL | W | [50] |
| S | _F | F | AE | NULL | NULL | W | [50] |
| S | _G | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _G | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _G | T | AE | NULL | NULL | W | [50] |

| Market Segment Indicator | GSP Group ID | Domestic Premise Indicator | Measurement Quantity | Non-Smart Switched Load Profile Class | Off-Peak Period (UTC) | Connection Type Indicator | De-minimis Data Count |
|---|---|---|---|---|---|---|---|
| S | _G | F | AE | NULL | NULL | W | [50] |
| S | _H | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _H | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _H | T | AE | NULL | NULL | W | [50] |
| S | _H | F | AE | NULL | NULL | W | [50] |
| S | _J | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _J | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _J | T | AE | NULL | NULL | W | [50] |
| S | _J | F | AE | NULL | NULL | W | [50] |
| S | _K | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _K | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _K | T | AE | NULL | NULL | W | [50] |
| S | _K | F | AE | NULL | NULL | W | [50] |
| S | _L | T | AI | 02 | 00:00-07:00 | W | [50] |
| S | _L | F | AI | 04 | 00:00-07:00 | W | [50] |
| S | _L | T | AE | NULL | NULL | W | [50] |
| S | _L | F | AE | NULL | NULL | W | [50] |
| S | _M | T | AI | 02 | 00:30-07:30 | W | [50] |
| S | _M | F | AI | 04 | 00:30-07:30 | W | [50] |
| S | _M | T | AE | NULL | NULL | W | [50] |
| S | _M | F | AE | NULL | NULL | W | [50] |
| S | _N | T | AI | 02 | 00:00-07:00 | W | [50] |
| S | _N | F | AI | 04 | 00:00-07:00 | W | [50] |
| S | _N | T | AE | NULL | NULL | W | [50] |
| S | _N | F | AE | NULL | NULL | W | [50] |
| S | _P | T | AI | 02 | 00:00-07:00 | W | [50] |
| S | _P | F | AI | 04 | 00:00-07:00 | W | [50] |
| S | _P | T | AE | NULL | NULL | W | [50] |
| S | _P | F | AE | NULL | NULL | W | [50] |
| A | NULL | T or F | AI | NULL | NULL | W | [50] |
| A | NULL | T or F | AE | NULL | NULL | W | [50] |
| A | NULL | T or F | AI | NULL | NULL | L | [50] |
| A | NULL | T or F | AE | NULL | NULL | L | [50] |

| Market Segment Indicator | GSP Group ID | Domestic Premise Indicator | Measurement Quantity | Non-Smart Switched Load Profile Class | Off-Peak Period (UTC) | Connection Type Indicator | De-minimis Data Count |
|---|---|---|---|---|---|---|---|
| A | NULL | T or F | AI | NULL | NULL | H | [50] |
| A | NULL | T or F | AE | NULL | NULL | H | [50] |
| A | NULL | T or F | AI | NULL | NULL | E | [50] |
| A | NULL | T or F | AE | NULL | NULL | E | [50] |
| U | NULL | F | AI | NULL | NULL | W | [50] |
| U | NULL | F | AE | NULL | NULL | W | [50] |

Where the indicator is set to NULL for GSP Group this indicates the LSC includes all GSP Groups.