

OMAN ELECTRICITY MARKET RULES

APPROVED METHODOLOGY

DEMAND SHEDDING VOLUME METHODOLOGY

VERSION 1.0

Effective Date:01/01/2022

1. Purpose

Section K.2.1.4 of the Rules for Electricity Market of Oman (the Market Rules) requires the Oman Electricity Transmission Company, OETC (Transmission Company) to prepare, as an Approved Methodology, a methodology for the purpose of determining a value of Demand Shedding for each Trading Period h of a Trading Day d for the purpose of the Ex-Post Market Schedule Runs for Trading Day d .

The Approved Methodology is termed the **Demand Shedding Volume Methodology**.

This document is the Demand Shedding Volume Methodology prepared by Oman Electricity Transmission Company, OETC in accordance with Section K.2.1.4 of the Market Rules and approved by Authority for Electricity Regulation.

2. Market Rules Provision

Interested parties should read this statement in conjunction with the Market Rules and in particular Section K. This Approved Methodology has been produced in accordance with the provisions of the Market Rules. In the event of an inconsistency between the provisions of this Statement and the Market Rules, the provisions of the Market Rules shall prevail.

3. Review Procedure

OETC may review this Approved Methodology from time to time and make changes, subject to APSR approval in accordance with Market Rules Section [C.7.3].

4. Definitions and interpretation

Save as expressly defined, words and expressions defined in the Market Rules shall have the same meanings when used in this Approved Methodology. The rules of interpretation set out in Section B.3 of the Market Rules shall apply in the interpretation of this Approved Methodology. References to particular sections relate internally to this Approved Methodology unless specifically noted. References to Market Rules sections are to the relevant sections of the Market Rules. The terms used to describe

Demand Control procedures and records shall have the same meanings as given in the Grid Code.

Demand

Note that the term “Demand” is defined differently in Grid Code and Market Rules. Grid Code defines Demand as Active Power or Reactive Power in MW, while the Market Rules define Demand as equivalent to Active Energy in MWh. To resolve this inconsistency, this methodology is prepared on the following approach.

- Wherever the term “Demand” is used, it refers to Active Power in MW, consistent with the Grid Code definition.
- Wherever the quantity DS_h is used, it refers to the Demand Shedding volume Active Energy in MWh, consistent with the Market Rules definition.

Demand Control and Demand Shedding

Grid Code defines the term “Demand Control” while the Market Rules define the term “Demand Shedding”. Both terms are used interchangeably in this methodology, and “Load Shedding” also means the same. However, Demand Control and Demand Shedding are used to denote MW values, while DS_h refers to Demand Shedding volume in MWh for a particular Trading Period.

Abbreviation	Expansion	Reference
OETC	Oman Electricity Transmission Company	
LDC	Load Dispatch Centre	
SCADA	Supervisory Control and Data Acquisition System	
DS_h	Demand Shedding in Trading Period h (MWh)	Market Rules
DSM	Demand Side Management	
SOP	System Operation Procedure	

Term	Definition	Reference
Demand Control	Any method of achieving reduction or increase in Demand (to secure a reduction in demand in situations of insufficient generation capacity or where severe operating difficulties pose a threat to the stability of the total system)	Grid Code
Demand	means the demand (for Active Energy) on the Main Interconnected System or any part of it, or (as the context may require) of any installation (including Production Facilities) Connected or premises connected to the Main Interconnected System, at any time or in any period. Unless otherwise provided,	Market Rules

	Demand is stated in MWh for a Trading Period at the Pool Boundary	
Demand Shedding	means the Transmission Company's estimate of lost load in accordance with the Demand Shedding Volume Methodology	Market Rules K 2.1.4
Trading Period	A Trading Period is a period of 30 minutes commencing on the hour or half-hour.	Market Rules I 5.3.1

5. Compliance with Approved Methodology

Compliance with this Approved Methodology is required under the terms as set out in the Market Rules. This Approved Methodology does not create any additional rights or obligations.

6. Scope

This methodology applies to the following parties (as per the Market Rules)

Party	Scope	Remarks / Market Rule ref.
Oman Electricity Transmission Company (OETC) (Transmission Company)	Preparation of this methodology for approval Review and revise as per approved procedures	Ref. C 7.3
Oman Electricity Transmission Company	Implementing Demand Control	As per OC 4 of the Grid Code. Not covered under this methodology.
Oman Electricity Transmission Company	Maintaining Demand shedding data	As per internal procedures and tools
Oman Electricity Transmission Company	provide the quantity of Demand Shedding (DS_h) in each Trading Period h in Optimisation Horizon o , associated with Trading Day d , by 12:00 one day after Trading Day d to the Market Operator	Calculation based on this methodology. Ref. K.2.1
Market Operator (Oman Power and Water Procurement Company)	Consultation with OETC on the methodology	Ref. C.7.3.4
Market Operator (Oman Power and Water Procurement Company)	Receive data on the quantity of Demand Shedding (DS_h) provided by Transmission Company	Ref. K.2.1

Authority for Electricity Regulation-Oman	Approve this methodology, issue directions for any review or modifications	Ref C 7.3
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Specifically, Load Dispatch Centre (LDC) of OETC is responsible for operational implementation of this methodology.

7. Implementing Demand Control

OETC implements demand control as per provisions of Grid Code, as given in OC 4. Demand Control. These procedures are further detailed in OETC procedure **OETC-LDC-C-SOP-M-303** which is approved by the Grid Code Review Panel. The important provisions of implementing Demand Control are summarized below.

Sl. No.	Demand Control Type	Remarks
1	Consumer Demand Side (DSM) Management agreements	At present, OETC does not have any DSM agreements
2	Planned Rota Demand Shedding	In the event of a sustained period of shortfall in the Generation Capacity and Demand balance, either for the Transmission System as a whole or for significant parts of the System, manual de-energization of Demand will be implemented on a rota basis.
3	De-energization by Automatic Under Frequency Relays	Demand shedding is normally used to address short-term imbalances in the Generation Capacity and Demand situation, and generally following the tripping of an amount of Generation Capacity beyond the planned contingency value. It is a method of safeguarding the stability of the Transmission System when other actions, such as the use of the Operating Margin, have failed to stabilize or hold the Frequency within required Operating Limits.

4	Emergency Manual Demand Shedding	<p>Demand Control measures will be applied only in circumstances when it is required to ensure system reliability and security and alternate measures are not adequate. Typical conditions requiring Demand Control are</p> <ul style="list-style-type: none"> - Generation not adequate to meet system load, and import sources are not sufficient. - Temporary shortages caused by generation outages, in which case Demand Control will be applied till new generation is brought on line. - Transmission constraints (such as overloading of transmission equipment), which will necessitate Demand Control only in specific areas. - Conditions of low voltage / voltage instability in certain areas. - Fuel shortage conditions, which will need measures to conserve fuel. <p>OETC may implement Emergency Manual Demand Shedding by issuing an instruction to manually de-energize to Licensed Distributors, Users, and Directly Connected Consumers. OETC shall issue such instructions in accordance with plans prepared in paragraph OC4.5 that establish the principles of the amounts and locations of Demand to be manually de-energized at a particular point in time or at specified Frequency levels.</p>
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8. Maintaining Demand Control Records

OETC shall maintain Demand Control records, noting the amount of Demand Control implemented in each period in MW in the daily operational records, usually referred to as daily report of control room. The Demand Control records to be maintained for half-hourly period to comply with Spot Market requirement.

The record shall maintain separate columns for each type of Demand Control as given below. The amount of MW entered in the records is the MW Demand Control implemented at the start of that period. The format is given below.

Time	DSM Demand Control MW	Transmission Constraints Demand Control MW	Generation Shortage Demand Control MW	UFLS Demand Control MW	Total Demand Control MW
00:00					
00:30					
01:00					
01:30					
02:00					
.....					
24:00					

The data inputs for the above records are obtained from operational communications and operational observations of OETC LDC. Typical sources of data are

- Loads recorded on the feeders / transformers before the start of Demand control, typically obtained from SCADA readings.
- Loads recorded on feeders / transformers on similar day (typically previous day)
- Information provided by the Users (Distribution companies or Directly Connected Customers).
- Instructions issued by OETC LDC for Demand Control.

LDC will use a combination of the above inputs to calculate the amount of load shed in MW at the start of each record period. In case the data is not complete, LDC will use their reasonable judgment to arrive at an appropriate estimate of Demand Control in MW.

In addition to the above data, LDC will record further information on Demand Control in control room log book. The typical information to be logged is

- Start time of demand control (load shed time)
- Amount of demand control (MW shed)
- Instruction issued.
- End time of demand control (restoration time)
- Reason for demand control.

9. Calculation of DSh for each trading period

The Market Rules require that DS_h should be calculated for each trading period in MWh.

DS_h = Demand Shedding for the trading period h in MWh.

The following procedure applies for calculating DS_h .

- The resolution for calculation of DS_h is one minute.
- The Demand Control in MWh is calculated for the number of minutes the Demand Control is implemented in the Trading Period.
- If start time and end time of Demand Control is available for a Trading Period, then DSh is calculated only for the amount of time Demand Control is applied.
- If such details are not available, then the Demand Control is assumed to be constant in the Trading Period.

Example of Demand Control implemented in a sample time between 00:01 hrs and 03:00 hrs. This is typically based on log book records. This consists of six Trading Periods.

00:01 hrs. – Load shed = NIL

00:11 hrs. – Implemented Load shed of 10 MW

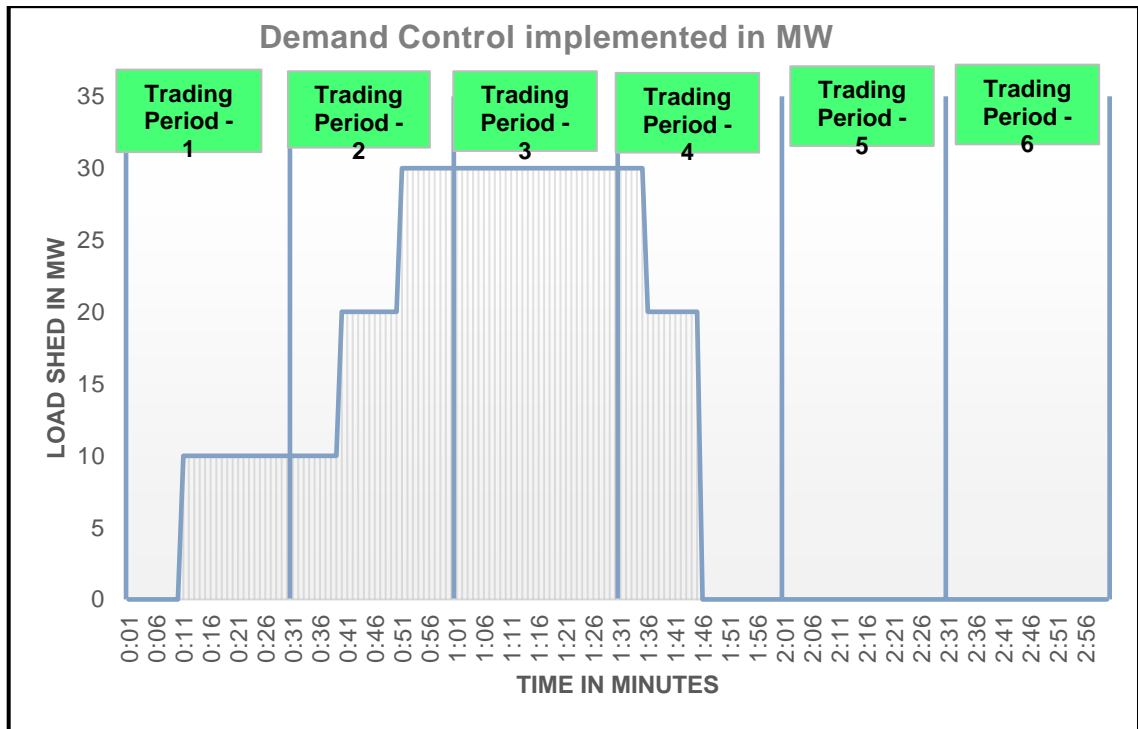
00:40 hrs. – Load shed increased to 20 MW

00:51 hrs. – Load shed further increased to 30 MW

01:36 hrs. – Load shed reduced to 20 MW

01:46 hrs. – All load normalized. No load shed from this point.

Based on the above information, the MW shed on a minute wise basis looks like this.



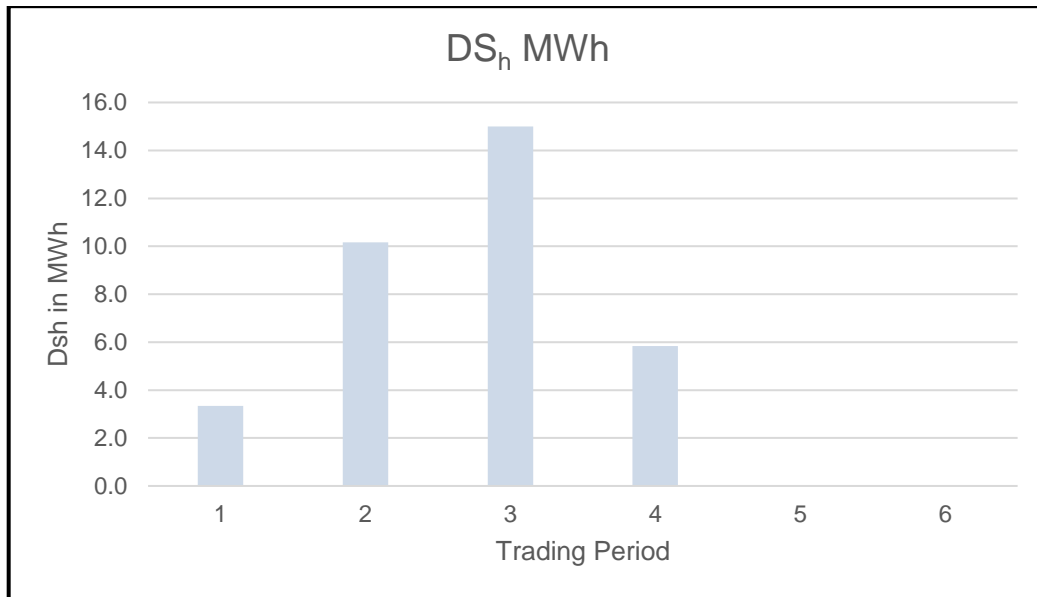
Based on the above data, the quantity of Demand Shedding for each Trading Period (DS_h in MWh) is calculated as below. Note that the Trading Period is 30 minutes.

$DS_h = \text{Sum of MW for each minute in the Trading Period} / 60.$

Using this formula, the DS_h for each trading period works out to the values given below.

Trading period	DS_h MWh
1	3.3
2	10.2
3	15.0
4	5.8
5	0.0
6	0.0

The same values are depicted in the chart shown below.



10. Practical Implementation

OETC may use any of the methods given below for compiling the records of Demand Shedding volume.

- Manual entry of data and calculation in excel sheets.
- Implementing the feature in Market Interface Application.

This final report is given to the Market Operator on d+1 to comply with the following requirement of the Market Rules K 2.1.5.

11. Transmission of data to the Market Operator

The final data will be transmitted to the Market Operator as per the agreed format between OETC and Market Operator

12. REFERENCES

- Grid Code
- Market Rules