OMAN ELECTRICITY MARKET RULES

APPROVED METHODOLOGY

CURTAILED QUANTITY METHODOLOGY

VERSION 1.0

Effective Date:01/01/2022

1. Purpose

Section K.2.3.1 of the Rules for Electricity Market of Oman (the Market Rules) requires the Oman Electricity Transmission Company (OETC) to prepare, as an Approved Methodology, a methodology for the purpose of determining a value for the Curtailed Quantity of a Price Taker Production Unit 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 **Curtailed Quantity Methodology.**

This document is the Curtailed Quantity Methodology prepared by the Oman Electricity Transmission Company (OETC) in accordance with Section [K.2.3.1] of the Market Rules and approved by the Authority of Public services Regulation (APSR).

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 the 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.

Table 1 – Defined terms

Abbreviation	Expansion	Reference
OETC	Oman Electricity Transmission Company	
LDC	Load Dispatch Centre	
SCADA	Supervisory Control and Data Acquisition System	
CQ_{uh}	Curtailed Quantity of Pool Scheduling Unit u in Trading Period h	Market Rules B 5.2.1 & K 2.3
SOP	System Operation Procedure	
SDC	Scheduling and Dispatching Code	Grid Code
Curtailed Quantity	means, in relation to a Price Taker Production Unit in a Trading Period h, the quantity of Output which the Transmission Company estimates in accordance with the Curtailed Quantity Methodology could have been Generated if its operation was unconstrained	
Curtailed Quantity Instruction	An instruction issued by LDC to a Price Taker Production Unit to reduce output by a specific quantity, specified in MW output.	
Price Taker	A Production Unit is a Price Taker if any of the GenSets comprised in the Production Unit is not Fully Dispatchable	Market Rules E 2.7.2
Fully Dispatchable	means subject to the procedure of Central Dispatch by the issue of Dispatch Instructions of the kind which may require a change in "the Active Power or Reactive Power Output of a Synchronous Centrally Dispatched Generating Unit including a Desalination Unit" as provided for in SDC2.4.2 of the Grid Code.	Market Rules B 2.1.1
Trading Period	A Trading Period is a period of 30 minutes commencing on the hour or half-hour.	Market Rules I 5.3.1
Optimization Horizon	In respect of a Trading Day d, the Optimization Horizon is the time period from 00:00 on the Trading Day d up to 03:00 on the subsequent Trading Day d+1 over which a Market Schedule Run is performed	Market Rules I 5.2.1

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)

Table 2 – Scope

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	Issuing curtailment instruction as part of dispatch process, in accordance with Grid Code	As per SDC 2 of the Grid Code. Not covered under this methodology.
Oman Electricity Transmission Company	Maintaining Curtailment records	As per internal procedures and tools
Oman Electricity Transmission Company	provide the quantity of Curtailed Quantity (CQ_{uh}) in each Trading Period h in Optimization 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.2.3.2
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 Curtailment Quantity (CQ_{uh}) provided by Transmission Company	Ref. K.2.3.2
Authority for Public Services Regulation-Oman	Approve this methodology, issue directions for any review or modifications	Ref C 7.3

Specifically, Load Dispatch Centre (LDC) of OETC is responsible for operational implementation of this methodology.

7. Implementing Curtailment Instruction

OETC schedule and dispatches generation units in the system in accordance with Scheduling and Dispatch Code (SDC) of the Grid Code.

- SDC 1 deals with Generation and Desalination Scheduling
- SDC 2 deals with Generation and Desalination Dispatching
- SDC 3 deals with Frequency Control.

In particular, SDC 2.4.2 of Grid Code version 3 states that:

"Dispatch Instructions relating to the Schedule Day shall be issued at any time during the period beginning immediately after the issue of the Generation Schedule and Desalination Schedule in respect of that Schedule Day.

A Dispatch Instruction given by OETC may require:

- *a change in:*
    - *the Active Power or Reactive Power Output of a Synchronous Centrally*
    - *Dispatched Generating Unit including a Desalination Unit.*
    - *the Reactive Power Output of a Wind Farm Power Production Facility or*
    - *Solar Power Production Facility.*
    - *the mode of Operation or an instruction to provide an Ancillary Service by a specific Centrally Dispatched Generating Unit or a Wind Farm Power Production Facility or Solar Power Production Facility; or*
    - *an instructed reduction in, or cessation of, Output from a Wind Turbine Generating Unit or Solar Generating Unit.*

The Grid Code (version 3) makes no mention of "Price Taker Units" or any units not being "Fully Dispatchable". These are terms introduced in the Market Rules. Hence, as per Grid Code, all units are Fully Dispatchable.

The Grid Code version 3 was proposed with additional provisions regarding Wind Turbine Generating Units and Solar Generating Units by introducing to the above clause SDC 2.4.2 that a dispatch instruction may require “an instructed reduction in, or cessation of, Output from a Wind Turbine Generating Unit or Solar Generating Unit”. This clause closely applies to the concept of Price Taker production units mentioned in Market Rules.

Hence, using Grid Code current version (3), it can be summarized that:

- All generating units are fully dispatchable.
- The dispatch instructions will be issued as per SDC 2.4.2.
- Certain units, which are registered as Price Taker Units in Market Rules refer to either Solar power plants or Wind power plants or MSF desalination plants which tend to be high on merit order due to economic considerations or water requirements.
- OETC LDC generally dispatches such plants / units at full capacity (which is treated as Not Fully Dispatchable under Market Rules).
- LDC issues instructions to Price Taker Production Units reduce or cease outputs of such Production Units only in case of unavoidable system limitations such as high frequency or transmission constraints. Such instruction is interpreted as “Curtailed Quantity Instruction” for the purpose of this methodology.

A Curtailed Quantity Instruction is issued to a Price Taker Unit in the following format.

Curtailed Quantity Instruction no. **Date:** **Time:**	
From:	OETC LDC
To:	Production Facility (Name)
Applicable for the period	From: To:
Applicable for the Unit	
Quantity curtailed in MW	
Reason	

Time of instruction issued	
Time of instruction cancelled	
Instruction issued by LDC Control engineer	Name: Signature:
Compliance confirmation from Price Taker Unit	Complied from ---- to --- Name: Signature:

The instructions (both start and end of curtailment periods) are issued by phone and recorded in log book of both LDC and the Price Taker Unit. Confirmation is required as soon as possible, usually expected within an hour after cancellation of the instructions.

8. Maintaining Curtailed Quantity Records

OETC shall maintain Curtailed Quantity records, noting the amount of Curtailment implemented in each period in MW for each Price Taker Production Unit (Renewables & MSF desalination units) in the daily operational records, usually referred to as daily report of control room. The period is hourly at present, proposed to be converted to half-hourly period from the start of Spot Market operation.

The record shall maintain separate columns for each Price Taker Unit as given below. The amount of MW entered in the records is the MW Curtailed at the start of that period. The typical format is given below.

Time	**Production Unit 1 Curtailment** **MW**	**Production Unit 2 Curtailment** **MW**	**Production Unit 3 Curtailment** **MW**	**Production Unit 4 Curtailment** **MW**	**Total Curtailment** **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 between OETC LDC and Price Taker Production Units.

9. Calculation of CQ_{uh} for each trading period

The Market Rules require that CQ_{uh} should be calculated for each trading period in MWh.

CQ_{uh} = Curtailed Quantity of Pool Scheduling Unit (u) in Trading Period (h) in Optimization Horizon (o) associated with Trading Day (d).

The following procedure applies for calculating CQ_{uh}.

- The resolution for calculation of CQ_{uh} is one minute.
- At this stage, each Price Taker Unit is considered as one unit, but the methodology can be modified to add further units.
- The Curtailed Quantity in MWh is calculated for the number of minutes the Curtailment is implemented in the Trading Period.
- The Curtailed Quantity period and quantity are obtained from the Curtailed Quantity instruction issued by LDC.
- Any reductions of production due to outages or disturbances are not considered as Curtailed Quantities.

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

00:01 hrs. – Curtailed Quantity = NIL

00:11 hrs. – Price Taker Unit 1 issued with Curtailed Quantity instruction for 20 MW.

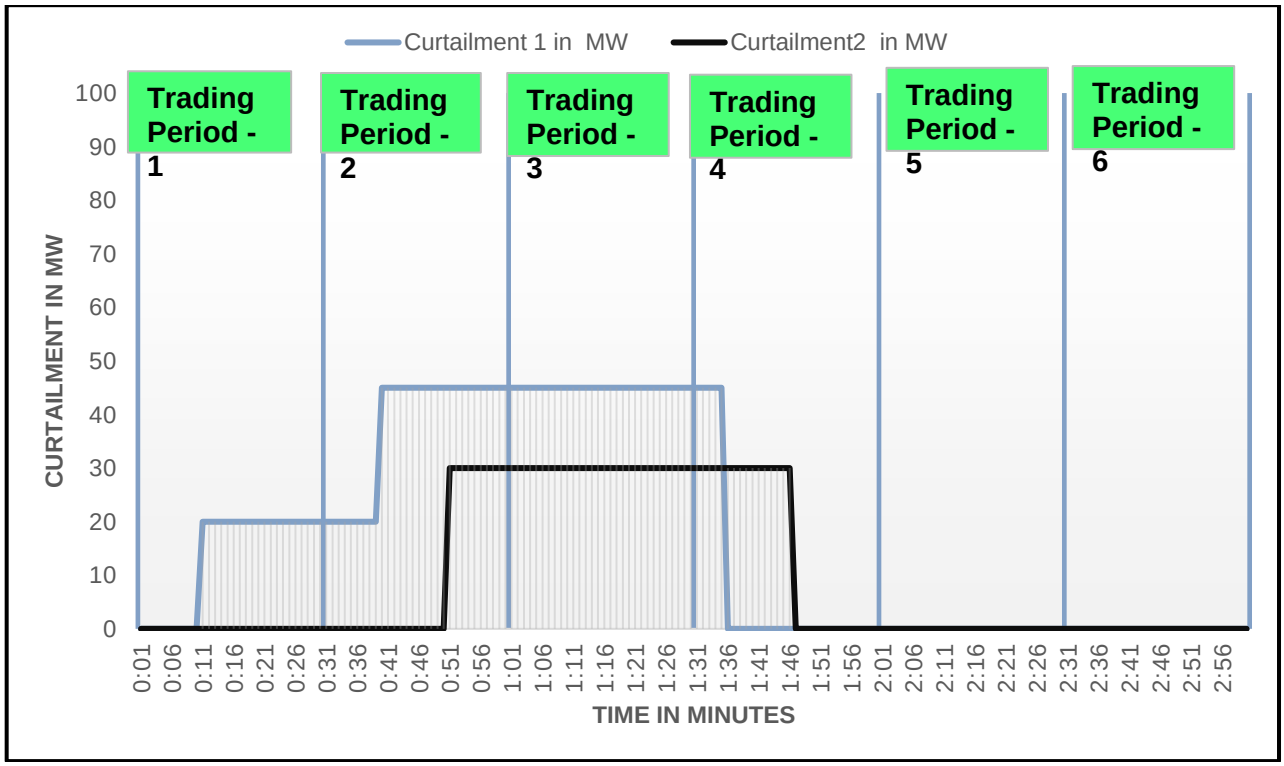
00:40 hrs. – Price Taker Unit 1 issued with Further Curtailed Quantity instruction for 25 MW, thus total curtailment is 45 MW.

00:51 hrs. – Price Taker Unit 2 issued with Curtailed Quantity instruction for 30 MW.

01:36 hrs. – Price Taker Unit 1 Curtailed Quantity instruction ended.

01:46 hrs. – Price Taker Unit 2 Curtailed Quantity instruction ended.

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



Based on the above data, the Curtailment Quantity for each Trading Period (CQ_{uh} in MWh) is calculated as below. Note that the Trading Period is 30 minutes.

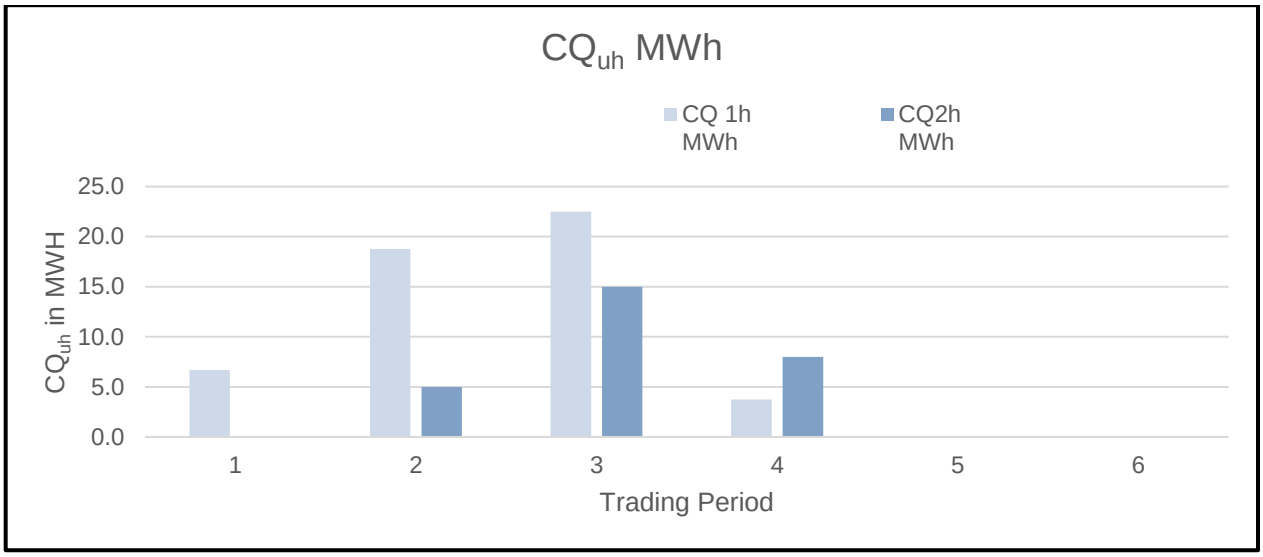
CQ_{uh} = Sum of MW for each minute in the Trading Period / 60.

This value is calculated separately for each Production Unit.

Using this formula, the CQ_{uh} for each trading period works out to the values given below.

Trading period	CQ 1h MWh	CQ2h MWh
1	6.7	0.0
2	18.8	5.0
3	22.5	15.0
4	3.8	8.0
5	0.0	0.0
6	0.0	0.0

The same values are depicted in the chart shown below.



10. Practical Implementation

OETC will maintain Curtailed Quantity calculations to obtain final outputs by any of the following methods.

(a) Manual entry of data and calculation in excel sheets.

(b) Implementing the feature in GE SCADA system. The entry of Curtailed Quantity in MW will be manual process by the control room operator, but the integration over Trading Period is done by the system automatically and included in the reporting formats.

(c) Developing a software tool to implement this feature, in addition to some more requirements of the Spot Market.

The first method is explained below. The other two methods will be based on the same process, but partially automated in the system.

This final report is given to the Market Operator on d+1 by 12:00 as per Market Rules K.2.3.

11. Transmission of data to the Market Operator

The final data will be transmitted to the Market Operator.

The format of Data Transfer has to be worked mutually between OETC and the Market Operator.

12. REFERENCES

- Grid Code
- Market Rules