OMAN ELECTRICITY MARKET RULES

APPROVED METHODOLOGY

RESERVE HOLDING ADJUSTMENT METHODOLOGY

VERSION 4.0

EFFECTIVE DATE: 30/12/2021

1. INTRODUCTION

1.1 Scope, Purpose and Effectiveness of the Approved Methodology

Section K.2.8.1 of the Oman Electricity Market Rules (the Market Rules) requires the Market Operator to prepare, as an Approved Methodology, a methodology for determining the adjustment of the Commercial Offer Data of relevant Pool Scheduling Units in respect of Spinning Reserve holding for Pool Scheduling Units included within a Non-Pool-Based Contracted Production Facility or that are the subject of a relevant Ancillary Services Agreement.

The Approved Methodology is termed the Reserve Holding Adjustment Methodology.

This document is the Reserve Holding Adjustment Methodology prepared by the Market Operator in accordance with Section K.2.8.1 of the Market Rules and approved by the Authority on 5/7/2021.

This Approved Methodology is effective on and from **30/12/2021.**

1.2 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.

1.3 Review Procedure

The Market Operator may review this Approved Methodology from time to time and make changes, subject to the Authority's approval in accordance with Market Rules Section C.7.3.

1.4 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 – Variable names	
Variable	**Description**
OFA_{uh}	Offered Availability of Pool Scheduling Unit u in Trading Period h

CONFIGS_b	Set of all Configurations for Production Block b
RHT_{bh}	Reserve Holding Tolerance of Production Block b in Trading Period h
ACA_{uh}	Actual Availability of Pool Scheduling Unit u in Trading Period h
MINOUPUT_u	Minimum Output of Pool Scheduling Unit u

Table 2 – Subscripts

Variable	Description
h	Trading Period
u	Pool Scheduling Unit
b	Production Block

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.

2. RESERVE HOLDING ADJUSTMENT METHODOLOGY

2.1 Introduction

In accordance with Section K.4.2 of the Market Rules, part of or entire Price-Quantity Pairs of the Offer Curve of each Pool Scheduling Unit are to be removed and not to be included as inputs for the purposes of determining the Market Schedule. Such adjustment should reflect the Spinning Reserve Requirement on the Main Interconnected System.

The Reserve-Adjusted Quantities and Reserve-Adjusted Offer Prices are used solely as inputs to the Market Scheduling Software. Such adjustment to the Offer Curve is not intended to be applied for the purposes of determining the Constrained On Credits, as per Section L.4 of the Market Rules, and the Uninstructed Imbalance Credits and Debits, as per Section L.5 of the Market Rules.

This methodology sets out the conceptual steps required to calculate the:

- Ex-Ante Reserve Holding Limit for Pool Scheduling Unit u in Trading Period h;

- Ex-Post Reserve Holding Limit for Pool Scheduling Unit u in Trading Period h;

- Ex-Ante Reserve Holding Quantity for Pool Scheduling Unit u in Trading Period h; and

- Ex-Post Reserve Holding Quantity for Pool Scheduling Unit u in Trading Period h,

each of which is used to calculate the Reserve Adjusted Quantities and Reserve Adjusted Offer Prices in Section K.4.2.6 of the Market Rules.

The Reserve Holding Methodology used by the Market Operator should be capable of:

- estimating the Reserve Holding Limit for each Pool Scheduling Unit aimed at excluding part of the capacity of a Pool Scheduling Unit for the purposes of contributing to meeting the Spinning Reserve Requirement on the Main Interconnected System;

- determining the allocation of the Spinning Reserve Requirement on the Main Interconnected System across Production Blocks of the Main Interconnected System; and

- allocating the Reserve Holding Quantity as determined from (a) for each Production Block between the different Pool Scheduling Units that belong to such Production Block.

2.2 Process to Determine the Reserve Holding Limit for a Pool Scheduling Unit

The Reserve Holding Limit is the level of Output (in MWh) above which no adjustment for Spinning Reserve holding is made.

The methodology for determining the Reserve Holding Limit for each Pool Scheduling Unit is detailed below.

Formulation for estimating the Reserve Holding Limits for Pool Scheduling Units

Ex-Ante Configuration With Greatest Availability

The Ex-Ante Configuration With Greatest Availability ($EACWGA_{uh}$) in respect of Pool Scheduling Unit u in Trading Period h is the Configuration in which u has an Activity State of Active and satisfies the following condition with regards to each other Configuration, in which u has an Activity State of Active:

$$\sum_{u \text{ in } EACWGA_{uh}} OFA_{uh} = \max_{c \text{ in } CONFIGS_b} \left(\sum_{u \text{ in } c} OFA_{uh} \right)$$

Ex-Ante Reserve Holding Limit

The Ex-Ante Reserve Holding Limit ($EARHL_{uh}$) for Pool Scheduling Unit u in Trading Period h is calculated as follows:

If $\sum_{u \text{ in } EACWGA_{uh}} OFA_{uh} \leq RHT_{bh}$ then

$$EARHL_{uh} = OFA_{uh}$$

Else if $\sum_{u \text{ in } EACWGA_{uh}} OFA_{uh} > RHT_{bh}$ then

$$EARHL_{uh} = OFA_{uh} - \left\{ \frac{OFA_{uh}}{\sum_{u \text{ in } EACWGA_{uh}} OFA_{uh}} \times \max \left(0, \sum_{u \text{ in } EACWGA_{uh}} OFA_{uh} - RHT_{bh} \right) \right\}$$

Ex-Post Configuration With Greatest Availability

The Ex-Post Configuration With Greatest Availability ($EPCWGA_{uh}$) in respect of Pool Scheduling Unit u in Trading Period h is the Configuration in which u has an Activity State of Active and satisfies the following condition with regards to each other Configuration, in which u has an Activity State of Active:

$$\sum_{u \text{ in } EACWGA_{uh}} ACA_{uh} = \max_{c \text{ in } CONFIGS_b} \left(\sum_{u \text{ in } c} ACA_{uh} \right)$$

Ex-Post Reserve Holding Limit

The Ex-Post Reserve Holding Limit ($EPRHL_{uh}$) for Pool Scheduling Unit u in Trading Period h is calculated as follows:

If $\sum_{u \text{ in } EPCWGA_{uh}} ACA_{uh} \leq RHT_{bh}$ then

$$EPRHL_{uh} = ACA_{uh}$$

Else if $\sum_{u \text{ in } EPCWGA_{uh}} ACA_{uh} > RHT_{bh}$ then

$$EPRHL_{uh} = ACA_{uh} - \left\{ \frac{ACA_{uh}}{\sum_{u \text{ in } EPCWGA_{uh}} ACA_{uh}} \times \max \left(0, \sum_{u \text{ in } EPCWGA_{uh}} ACA_{uh} - RHT_{bh} \right) \right\}$$

2.3 Process to Determine the Reserve Holding Quantity for a Production Block

The Reserve Holding Quantity is the quantity of Output (in MWh) which represents the Spinning Reserve holding of the Pool Scheduling Unit . The following steps illustrates how the Reserve Holding Quantity is determined in each Trading Period:

Step 1: Allocate Reserve Holding Quantities to Production Blocks that have Ancillary Service Agreements.

Step 2: Sum the Reserve Holding Quantities from Production Blocks that have Ancillary Service Agreements and subtract the value from the Ex-Ante Spinning Reserve Requirements.

Step 3: Sum the Ex-Ante Configuration With Greatest Availability (EACWGA_{uh}) of each most efficient Production Block, that have no Ancillary Service Agreements.

Step 4: allocate the remaining value of the Ex-Ante Spinning Reserve Requirements in step 2 above among the Ex-Ante Configuration With Greatest Availability (EACWGA_{uh}) in ratio wise as per the below formula.

$$\text{EAPBRHQ}_{bh} = \text{EASRR}_h / \text{EACWGA}_{uh}$$

Step 5: The allocated Reserve Holding Quantities in step 4, is then allocated among Pool Scheduling Units of respective Production Blocks as per Section 2.4 below.

The above allocation steps are also applied for the determination of the EX-Post Reserve Holding Quantity.

2.4 Reserve Holding Quantity for a Pool Scheduling Unit

The next step in the process is to determine the Reserve Holding Quantity for each Production Unit within each Production Block by allocating the Production Block Reserve Holding Quantity of each Production Block across the different Pool Scheduling Units within the Production Block.

Formulation for estimating the Reserve Holding Quantities for Pool Scheduling Units

Ex-Ante Reserve Holding Quantity

The Ex-Ante Reserve Holding Quantity (EARHQ_{uh}) for each Pool Scheduling Unit u in Trading Period h is calculated as follows:

$$\text{EARHQ}_{uh} = \max\left\{\min\left(\frac{\text{EARHL}_{uh}}{\min\left(\sum_{u\ \text{in} \text{EACWGA}_{uh}} \text{OFA}_{uh}, \text{RHT}_{bh}\right)} \times \text{EAPBRHQ}_{bh}, \text{EARHL}_{uh}\right.\right.$$
$$\left.\left. - \text{MINOUTPUT}_u\right), 0\right\}$$

Ex-Post Reserve Holding Quantity

The Ex-Post Reserve Holding Quantity (EPRHQ_{uh}) for each Pool Scheduling Unit u in Trading Period h is calculated as follows:

$$\text{EPRHQ}_{uh} = \max\left\{\min\left(\frac{\text{EPRHL}_{uh}}{\min\left(\sum_{u \text{ in EPCWGA}_{uh}} \text{ACA}_{uh}, \text{RHT}_{bh}\right)} \times \text{EPPBRHQ}_{bh}, \text{EPRHL}_{uh} \right. \right.$$
$$\left. \left. - \text{MINOUTPUT}_u \right), 0\right\}$$