



**SINGLE BUYER
TENAGA NASIONAL BERHAD**

**Quantitative Analysis on Cross-border Energy
Transaction between Laos and Malaysia**

22 June 2018

A ring-fenced entity pursuant to Electricity Supply Act 1990

www.singlebuyer.com.my

Today's agenda comprises the following:

1

Background

2

Pre-feasibility Study

3

Post Impact Study

1 Background

Laos-Thailand-Malaysia (LTM) Interconnection



A MoU is inked to facilitate the implementation of a multilateral cross-border power trade on the 21st September 2016

PUTRAJAYA: Malaysia, Thailand and Laos have inked a memorandum of understanding (MoU) to facilitate the implementation of a multilateral cross-border power trade up to 100 MW through Thailand.

The Energy, Green Technology and Water Ministry said the MoU would pave the way for Malaysia to purchase up to 100MW of hydro power from Laos and transmitted through Thailand by 2018.

"The multilateral power trade is the initial stage of the Asean Power Grid initiative which is a flagship project under the Asean Vision 2020.

"The project is aimed at enhancing energy security in Asean through the establishment of a network of interconnections between Asean member states," it said in a statement.

The MoU was signed on Wednesday on the sidelines of the 34th Asean Ministers on Energy Meeting (AMEM) in Nay Pyi Taw, Myanmar.

Malaysian Energy, Green Technology and Water Minister Datuk Seri Dr Maximus Johnity Ongkili, Thai Energy Minister General Anantaporn Kanjanarat and Laotian Energy and Mines Vice-Minister Viraphonh Viravong represented their respective governments.

The ministry said the signing of the MoU also marked Malaysia's commitment to increase the share of renewable energy in its fuel mix by 2020 as part of the mitigation action to reduce carbon emission in the power sector.

It said currently the fuel mix of Malaysia was dominated by coal and gas and the Government was committed to rationalise this as per the commitment made in the Paris Agreement at end of 2015.

"The initial capacity of 100 MW could be increased in the future and would positively balance our fuel mix to be more environment friendly," it said.

Meanwhile, Ongkili said the pilot project would pave the way for other multilateral power trading in Asean as a means to enhance energy security in the region which would be of significant advantage to Malaysia. - Bernama

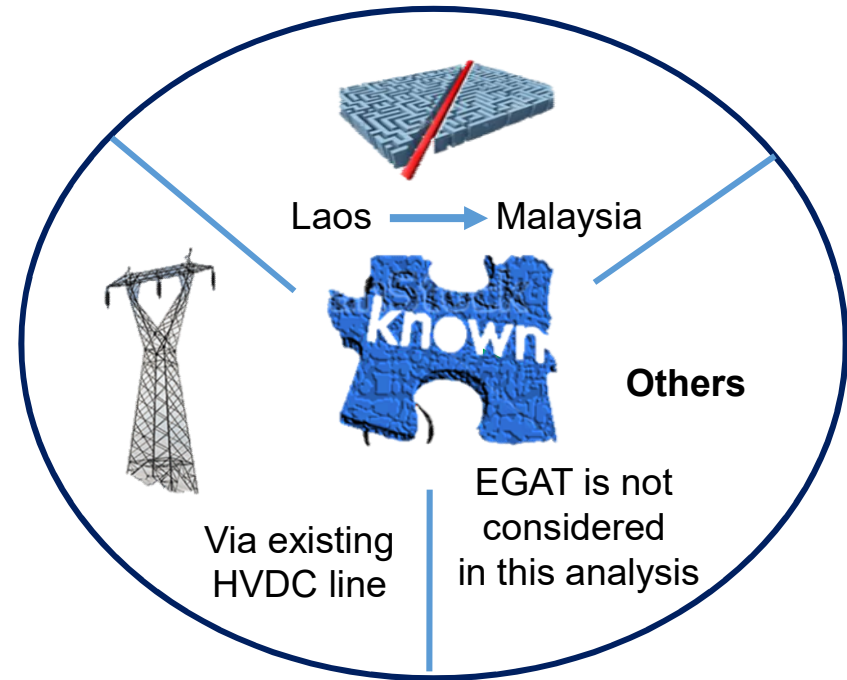
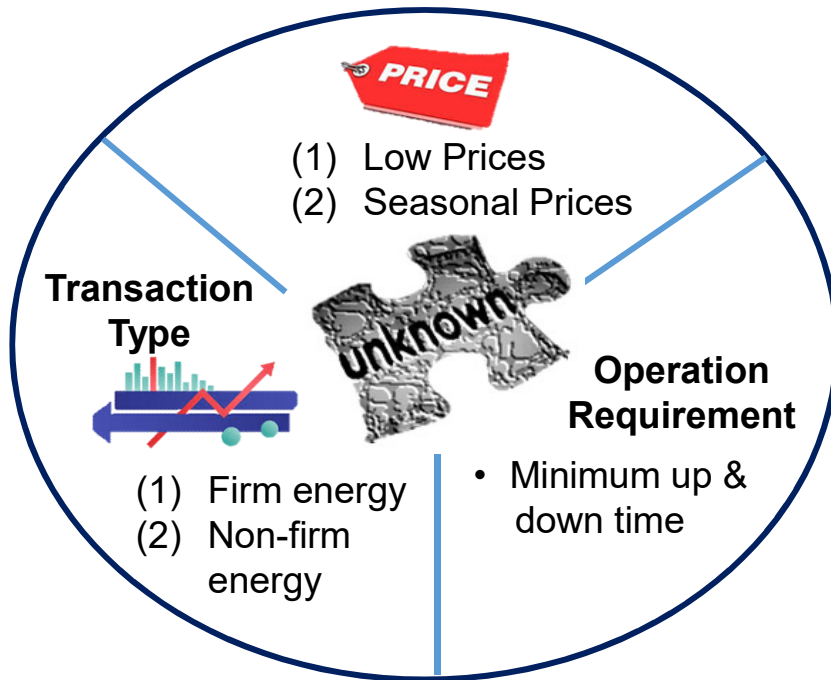
Key Points

- ❖ **A flagship project under the Asean Vision 2020**
- ❖ **100MW of Hydro Power from Laos to Malaysia via Thailand by 2018**
- ❖ **With an objective to enhance energy security in Asean**
- ❖ **Marked Malaysia's commitment to increase the share of RE in its fuel mix by 2020 as part of the mitigation action to reduce carbon emission**

2

Feasibility Study

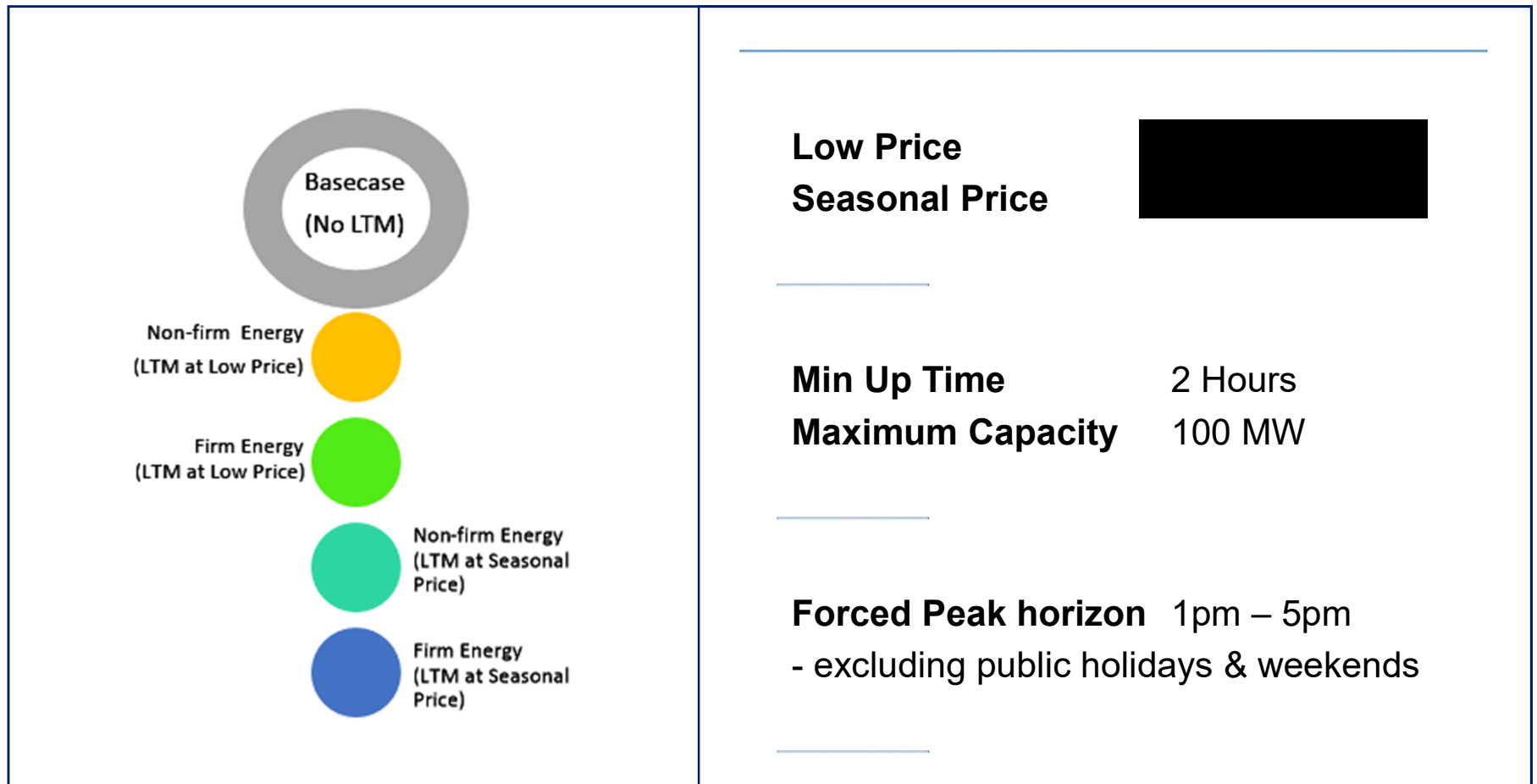
During the feasibility study, some information were yet to be firmed



To evaluate:

- (1) The impact on Peninsular Malaysia system generation cost; and
- (2) the range of energy take-up in terms of capacity factor

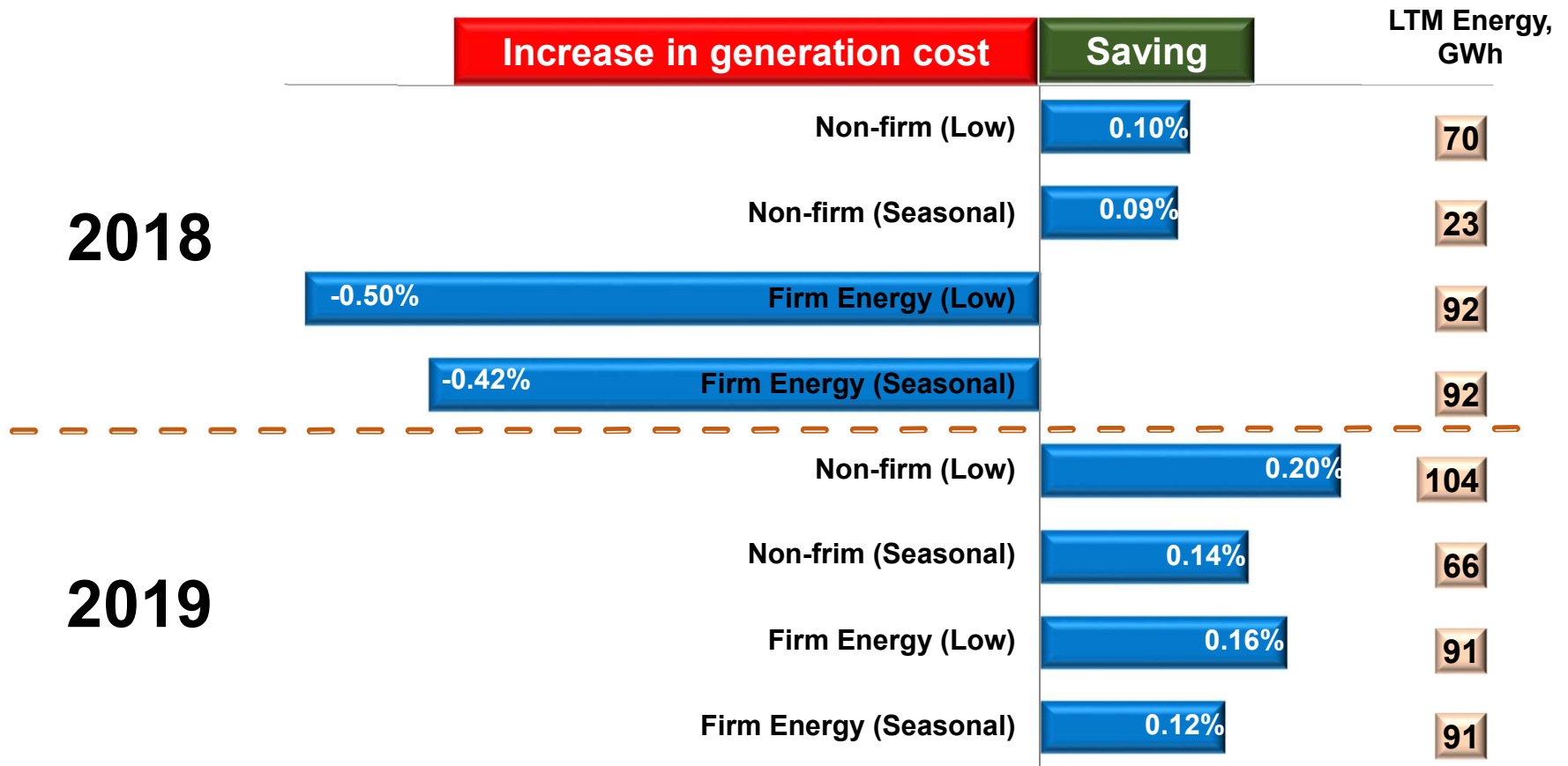
A Basecase without the interconnection was created, followed by four scenarios for the analysis (2018 and 2019)



During the feasibility study, some information were yet to be firmed and was based on Single Buyer's best assumptions

Note: Price consists of Energy Cost from Laos PDR, Thailand Transmission Tariff, Cost of HVDC interconnection, and Thailand System Losses

The result shows that the non-firm energy transaction is a more flexible arrangement towards the system



In 2018, the impact on the annual generation cost saving ranges from 0.09% - 0.10% for non-firm energy scenarios, but caused additional generation cost for firm energy scenarios ranges from 0.42% - 0.50%. In 2019, all scenarios yield positive savings

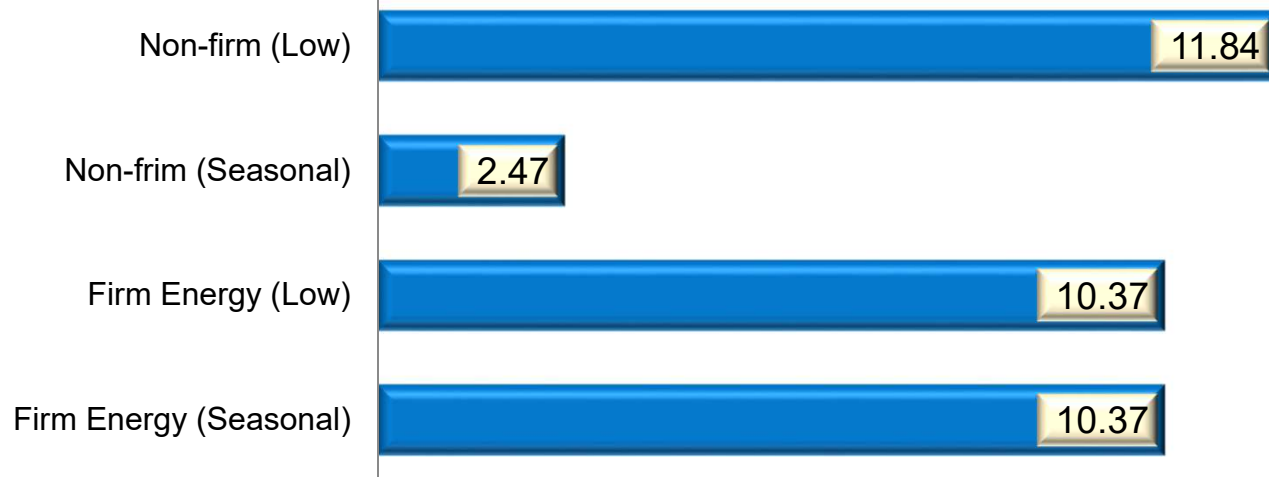
* The generation cost difference is compared with the base case
 * Base case is without the interconnection

The annual capacity factor of LTM is low for both 2018 and 2019

2018



2019



Conclusion: Pre-feasibility Study

1

System is expecting a marginal generation cost reduction in 2018 for non-firm scenarios (0.09% – 0.10%).

2

Firm scenarios may cause the system to incur additional generation cost due to displacement of cheaper generations.

3

The capacity factor for LTM is expected to be low in both years due to LTM being the marginal.

4

Based on the assumptions, operating energy (capacity factor) for LTM as follows:

2% - 11%

2018

2% - 12%

2019

5

Based on the pre-feasibility study, Single Buyer is in view for a negotiation for a non-firm energy arrangement.

3

Post Impact Study

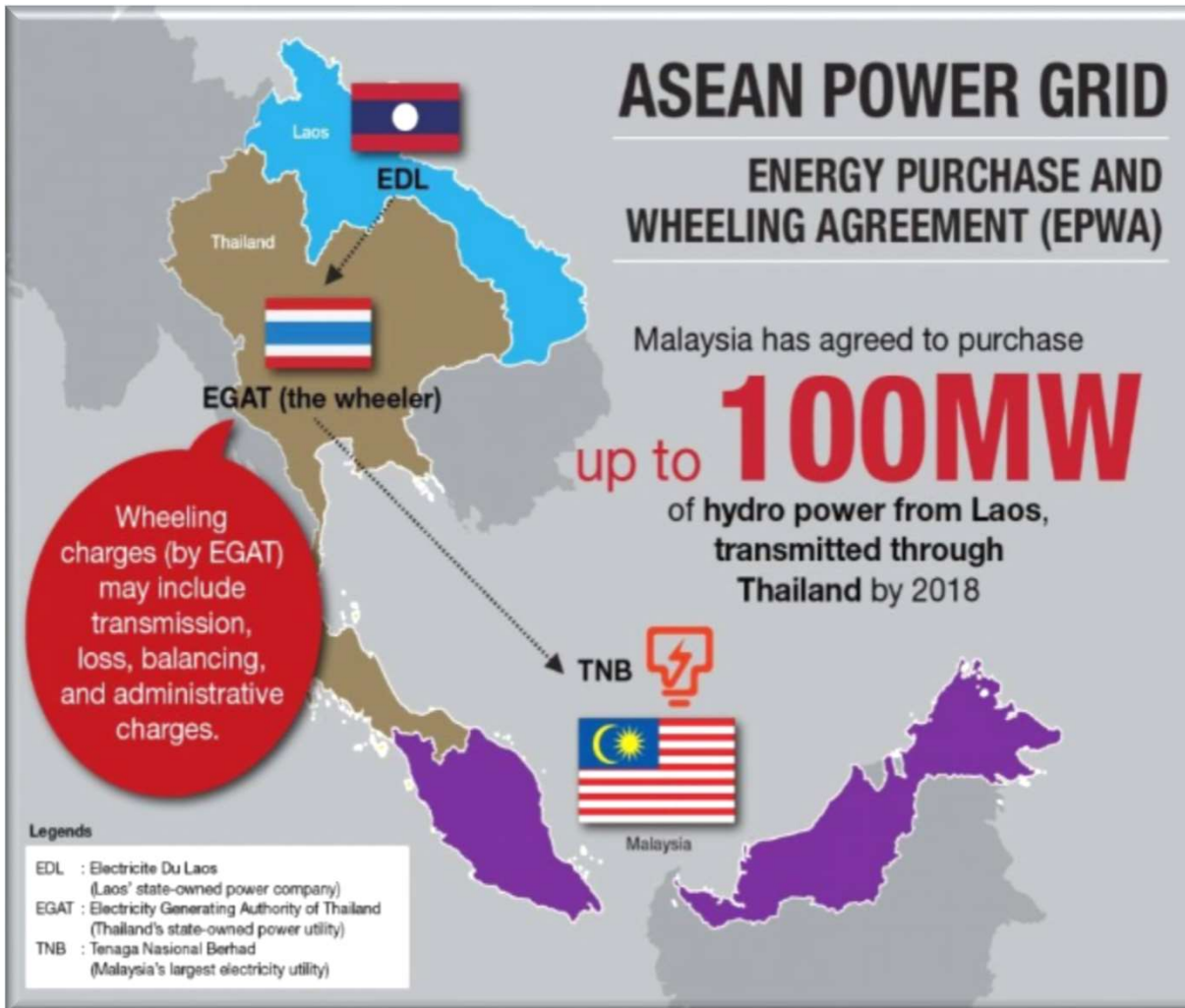
Background:

The energy purchase and wheeling agreement is signed on the 27th September 2017.

Objective:

To evaluate the impact of LTM on the daily generation operation in 2018.

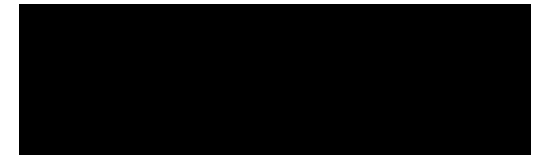
Malaysia has agreed to purchase up to 100MW of hydro power from Laos, transmitted via Thailand by 1 Jan 2018 for 2 years



Purchasing Agreement

- Minimum 3 consecutive hours energy purchase
- Maximum & Minimum Stable Level: 100 MW

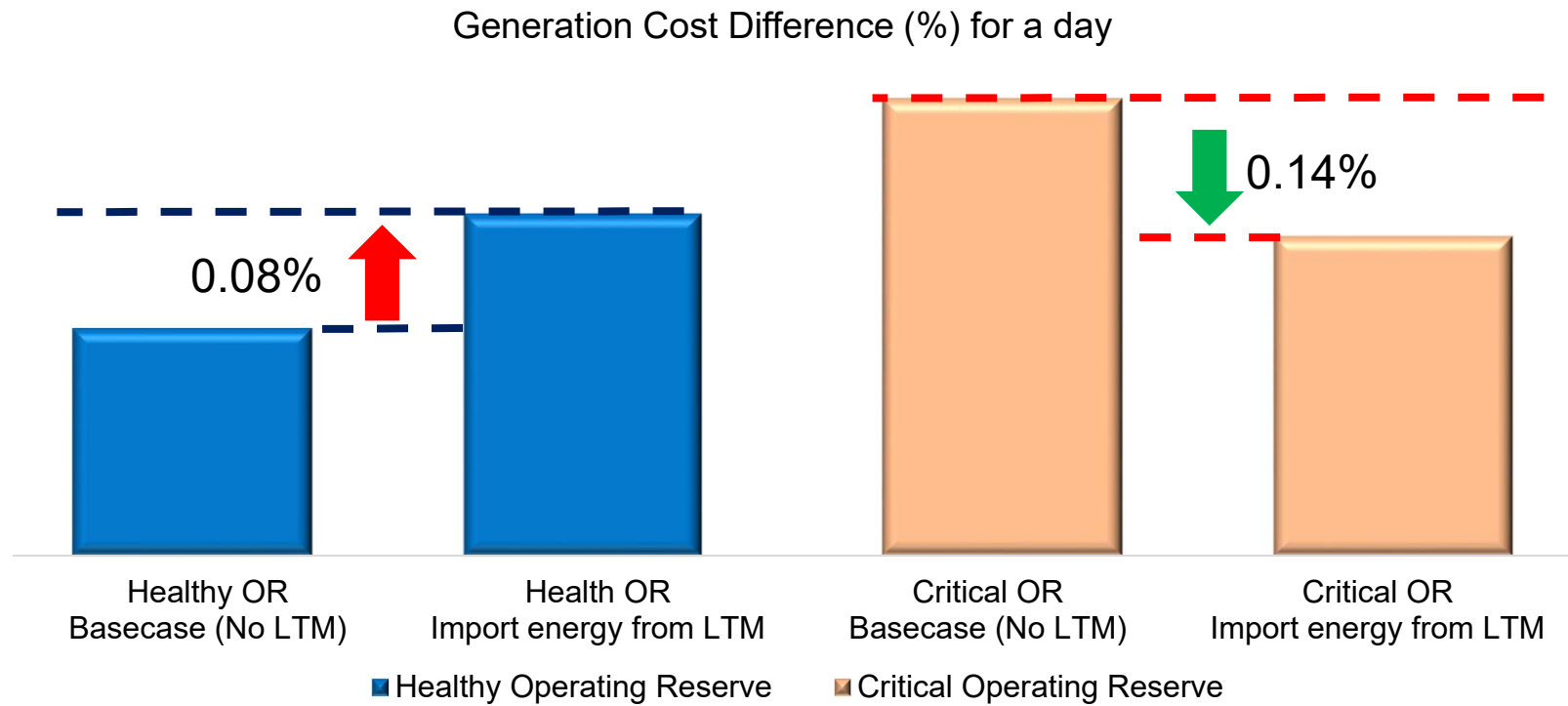
LTM Energy Prices in USD cents/kWh



The post impact study evaluates the system mainly on the generation cost for a day snap shot in 2018 for two (2) criteria: *healthy and critical operating reserve; and fuel limitation condition*

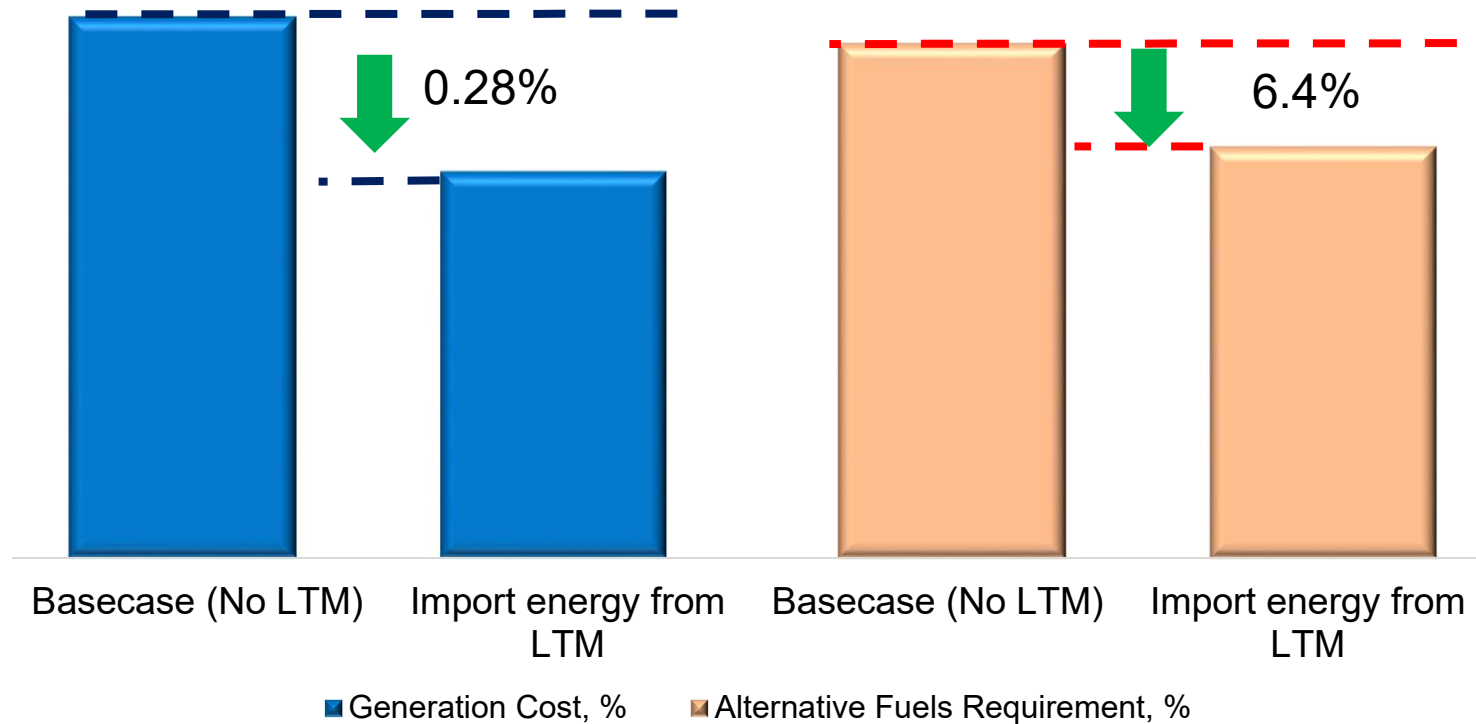
**Impact to the
System Generation Cost**

Under critical Operating Reserve (OR) system condition, the import of LTM shows generation cost saving due to displacement of expensive generations



The minimum requirement for Operating Reserve for Peninsular Malaysia is set at 2,900MW. This includes the capacity of the largest unit in the system.

Under gas fuel supply limitation condition, the import of LTM shows generation cost saving due to displacement of alternative fuels requirement



Conclusion: Post Impact Study

1

If system operating reserve is critical (<2,900 MW) and gas requirement is more than 1000 mmscfd, energy import from LTM is expected to reduce daily generation cost (i.e. 0.14% in a day snap shot in 2018).

2

During gas supply limitation period which involve operation of alternate fuels, energy import from LTM is expected to reduce the daily generation cost (i.e. 0.28 % in a day snap shot in 2018).

3

In 2019, in consideration of higher gas prices, the option for energy import from LTM is expected to be a cheaper option compared to existing gas generation in the system.

4

The energy import from LTM act as peak shaving (replace marginal unit operation especially OCGT) due to its operation flexibility and capacity.

5

The final agreement is negotiated with a non-firm energy transaction type and a minimum of 3 consecutive hours for each LTM energy transaction up to 100MW.

www.singlebuyer.com.my



DISCLAIMER CLAUSE FOR SINGLE BUYER

All information contained herein are for general information only. Single Buyer makes no representation or warranty, whether expressly or by implication. Neither is Single Buyer responsible nor liable for any loss or damage of whatsoever kind which may be suffered, directly or indirectly, arising from the use or reliance on the information contained herein. All copyright and other proprietary rights over the information contained herein are unless otherwise stated the copyright works of Single Buyer. No part or parts may be copied, distributed, retransmitted, broadcasted, displayed, reproduced or published, without the express prior written consent of the Single Buyer.