



# **DEVELOPING A FORWARD CAPACITY MARKET TO ENHANCE THE SINGAPORE WHOLESALE ELECTRICITY MARKET**

## **CONSULTATION PAPER**

Closing date for submissions of comments and feedback:  
**08 Jul 2019**

10 JUN 2019 | ENERGY MARKET AUTHORITY  
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# DEVELOPING A FORWARD CAPACITY MARKET TO ENHANCE THE SINGAPORE WHOLESALE ELECTRICITY MARKET

## CONSULTATION PAPER

### Introduction

1 The Energy Market Authority (“**EMA**”) introduced the Singapore Wholesale Electricity Market (“**SWEM**”) in 2003 to facilitate competition among the generation companies (“**gencos**”). The SWEM is designed as an Energy-Only Market (“**EOM**”) with ancillary services. The gencos are remunerated primarily based on the prevailing half-hourly spot price for the energy that they generate, with no separate capacity payments. This was the best practice adopted in the early 2000s by other established competitive electricity markets such as in Australia, New Zealand (“**NZ**”), the United Kingdom (“**UK**”) and the United States (“**US**”).

2 The EOM, by design, seeks to provide short term price signals to guide longer term investments in generation capacity. However, there is no guarantee that the EOM will achieve timely resource adequacy to ensure electricity supply reliability. The experience in many jurisdictions with EOMs is that spot energy prices that result from the prevailing demand and supply conditions may not be high enough, on average over the longer term, to attract adequate new investments in generation capacity to meet the target electricity supply reliability standard (“**Reliability Target**”).

3 EMA is therefore consulting the industry on developing a Forward Capacity Market (“**FCM**”), which together with the real-time wholesale energy market with ancillary services, aims to meet the following objectives:

- a. Maintain resource adequacy by providing adequate incentives to existing resources and new investment; and
- b. Maximise economic efficiency to minimise long-run costs to consumers.

4 EMA has engaged a consultant, viz. The Brattle Group to assist in developing a FCM that is appropriate for Singapore, taking into account characteristics/configuration of our power system and market conditions. The Brattle Group has accordingly prepared a preliminary High-Level Design (“**HLD**”) Straw Proposal, including the transitional arrangement and indicative development and implementation timeline for the FCM. This consultation is to seek written comments from any interested party on the HLD.

## Overview of Preliminary HLD of a FCM for Singapore

5 A FCM is a competitive market-based auction, which procures adequate resources one to four years in advance, to maintain the Reliability Target in the delivery period (“**Delivery Year**”). The longest forward period typically corresponds to the time needed for constructing a new reference generation capacity (e.g. an efficient combined-cycle gas turbine or “**CCGT**” generating unit). This facilitates orderly entry of efficient new generation capacity and exit/retirement of inefficient existing generation capacity for the Delivery Year.

6 Broadly, a FCM has three main components: (a) a demand curve for capacity; (b) the rules defining how supply participates and forms a supply curve; and (c) the format of the auction in which supply and demand come together to determine which resources clear and the prices that they are paid.

7 The demand curve is administratively-constructed, based on the amount of capacity needed to meet the required reserve margin (“**RRM**”) above the projected peak demand in the Delivery Year. It is shaped to reflect the declining marginal value of additional capacity beyond the RRM, and to mitigate market-clearing price volatility.

8 To ensure sufficient capacity is procured to meet resource adequacy requirements, all resources participating in the FCM (both existing and new resources of different technology types) will be subject to a resource qualification process to validate their availability in the Delivery Year, as well as the megawatt (“**MW**”) value they may offer into the FCM auction taking into account their operating characteristics. They will compete in the FCM based on capacity offer prices in dollars per MW-year (“**\$ per MW-year**”) of qualified capacity. Each MW-year of capacity offer requires that MW of qualified capacity to be available, and to offer into the energy market, for a year, subject to penalties for failing to perform (“**Capacity Supply Obligation**” or “**CSO**”). The supply curve is formed by offers stacked in ascending order of capacity offer prices. Market power monitoring and mitigation measures will be implemented to ensure that offers are reasonable and competitive.<sup>1</sup>

9 For each Delivery Year, the FCM auction brings together the relevant ascending supply and the descending demand curve. The resources with offers at or below the market-clearing capacity price (i.e. the marginal capacity price offer where the supply and demand curves intersect) will be cleared. The cleared resources will take on the CSO, and will be paid the market-clearing capacity price in that year. Subsequent to the forward auctions, reconfiguration auctions would be held nearer to the Delivery Year to efficiently address changes in demand or supply availability.

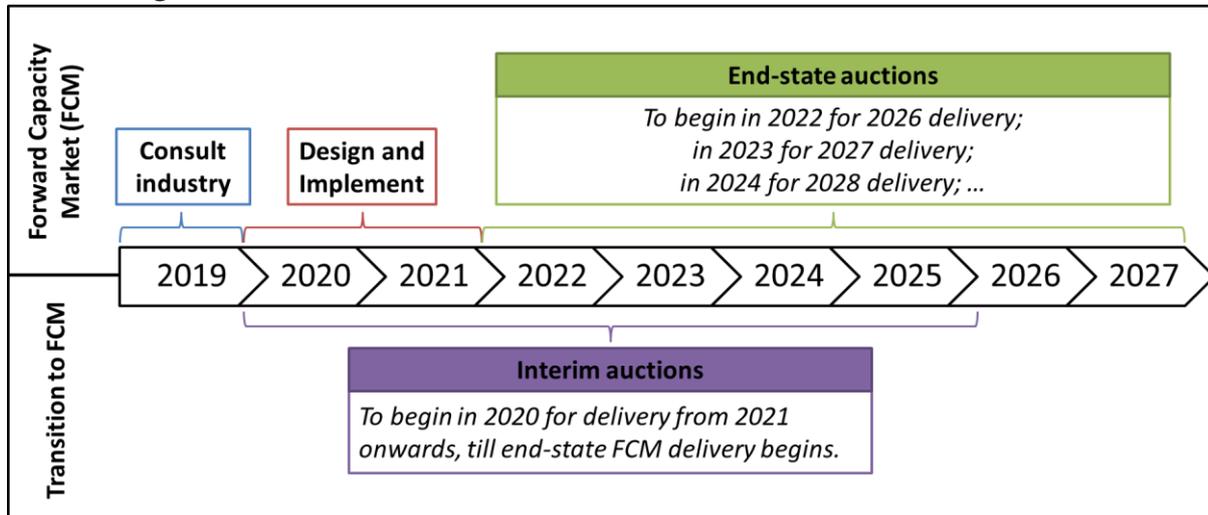
10 As shown in *Figure 1*, the plan is for the detailed design and rules to be ready for the first ‘**end-state**’ FCM auction to be called in **2022**, for delivery in **2026**. EMA

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<sup>1</sup> Competitive offers would reflect the resources’ net avoidable going-forward fixed costs after considering net revenues from the energy and ancillary services markets.

also plans to conduct transitional ‘**interim**’ auctions from **2020**, for delivery in **2021 till 2025**, based on simplified design parameters. This will ensure a smooth transition from the current EOM to an energy-plus-capacity market, by ensuring generation capacity adequacy over the transitional period ending 2025, as well as providing useful insights and data points to inform the progressive development and implementation of the end-state FCM.

**Figure 1: Indicative Timeline for Interim and End-state FCM Auctions<sup>2</sup>**



## Request for Comments/Views

11 A summary of the key FCM design elements in The Brattle Group’s preliminary HLD Straw Proposal is set out in Appendix 1. A detailed discussion on each design parameter is set out in The Brattle Group’s HLD Straw Proposal at Annex A.

12 EMA would like to invite written comments and views on each key FCM design element, as well as the transitional arrangement and indicative development and implementation timeline for the FCM. EMA will take the comments/views into consideration as we develop the detailed FCM design and rules in consultation with the industry.

13 Please submit all written feedback via email to: [ema\\_mdspd@ema.gov.sg](mailto:ema_mdspd@ema.gov.sg).

14 All feedback should reach EMA by 5pm on 08 Jul 2019 in the format shown at Appendix 2. You are requested to include a soft-copy of your comments in both **PDF and Microsoft Word** format.

15 EMA will acknowledge receipt of all submissions via email. Please contact Mr Nathaniel Tang (6376 7661) or Ms Chloe Wang (6376 7522) if you do not receive an acknowledgement of your submission within two business days.

<sup>2</sup> Length of the forward period for auctions is subject to further review.

16 Please note that EMA will not consider anonymous submissions. EMA reserves the right to make public all or part of any written submissions made in response to this Consultation Paper and to disclose the identity of the source. Any part of the submission, which is considered by respondents to be confidential, should be clearly marked and placed as an appendix (with justification on the need to maintain confidentiality). EMA will take this into account in the disclosure of the information submitted.

\* \* \*

**Summary of Key FCM Design Elements in The Brattle Group’s HLD Straw Proposal**

| Market Design Element   | Preliminary Design Straw Proposal   | Remarks   |
|---|---|---|
| <b>Product Definition</b>   | <ul style="list-style-type: none"> <li>• 1 MW-year of unforced Capacity Supply Obligation (“<b>CSO</b>”); “unforced” is derated for availability, as addressed below.</li> <li>• A CSO entails a must-offer requirement in the energy market whenever available (i.e. not on outage), subject to penalties for being unavailable or otherwise not performing during peak or shortage periods.</li> </ul>  | <ul style="list-style-type: none"> <li>• Product definition must correspond to the MW “demand” for resource adequacy.</li> <li>• Product must have clear obligations.</li> </ul>  |
| <b>Administrative Demand Curve</b>  | <ul style="list-style-type: none"> <li>• <b>Downward-sloping demand curve</b> with minimum acceptable reliability at the price cap, then sloping downward to the right; shape tuned to reflect relative marginal reliability value or to achieve acceptable reliability/price outcomes under an assumed Net Cost of New Entry (“<b>CONE</b>”).<sup>3</sup></li> <li>• <b>Price cap</b> at or above estimated Net CONE to account for estimation error.</li> <li>• <b>Update CONE</b> on a X-year review cycle. Implement annual updates based on a formulaic approach. <b>Update annually the (expected) net revenues received from the energy and ancillary services markets.</b></li> </ul> | <ul style="list-style-type: none"> <li>• The objective is to meet the resource adequacy requirement.</li> <li>• A downward sloping demand curve reduces price volatility, and recognises some incremental value of capacity.</li> <li>• Cap must be high enough to express higher marginal value at low reserve margins, to mitigate the possibility of underestimating true Net CONE, and to shift the distribution of reserve margin outcomes rightward without paying high prices for excess capacity.</li> <li>• Net CONE parameters need to be adjusted to market conditions.</li> </ul> |
| <b>Supply Curve (including Resource Qualification and Offer Mitigation)</b> | <ul style="list-style-type: none"> <li>• <b>Technology-neutral</b> design to qualify all resources that can contribute to resource adequacy, including demand response, imports, efficiency, storage; both existing and planned.</li> </ul>   | <ul style="list-style-type: none"> <li>• Technology-neutral approaches will maximise efficiency, competition, and innovation.</li> <li>• “UCAP” is a uniform product, with all MW competing to</li> </ul>   |

<sup>3</sup> Net CONE is an administrative estimate of the long-run marginal cost of capacity (\$/MW-year) from the generation technology most likely to enter the market. It includes capital recovery plus the fixed and variable operating costs of a new resource, minus (expected) net revenues received from the energy and ancillary services markets.

| Market Design Element           | Preliminary Design Straw Proposal  | Remarks   |
|---------------------------------|--|---|
|                                 | <ul style="list-style-type: none"> <li>• <b>Qualified “unforced” MW ratings (or UCAP)</b> adjust for outage rates, intermittency, and energy-limits.</li> <li>• <b>Market Power Mitigation</b> <ul style="list-style-type: none"> <li>– All existing resources must offer.</li> <li>– Screen suppliers to detect supply-side market power, and mitigate offers of those that fail (to net going-forward costs).</li> <li>– Do not apply minimum offer price.</li> </ul> </li> <li>• <b>Supply curve</b> aggregates all supply offers (subject to mitigation) in ascending order.</li> </ul>  | <p>provide the same marginal reliability value.</p> <ul style="list-style-type: none"> <li>• Market is structurally uncompetitive with pivotal suppliers. <ul style="list-style-type: none"> <li>– Must-offer requirement and mitigated offers prevent supply-side market power abuse.</li> </ul> </li> </ul>         |
| <b>Forward Capacity Auction</b> | <ul style="list-style-type: none"> <li>• <b>Uniform price auction</b>, all cleared suppliers earn the same price.</li> <li>• <b>Single round, sealed bid</b> auction.</li> <li>• <b>Four-year forward period.</b></li> <li>• Single-year commitment.</li> </ul>  | <ul style="list-style-type: none"> <li>• Uniform price, single-round, sealed-bid auctions maximise competition; has a proven record of delivering efficient market outcomes.</li> <li>• Multi-year lock-in for new resources discriminates against and distorts incentives to maintain existing resources.</li> </ul> |
| <b>Reconfiguration Auctions</b> | <ul style="list-style-type: none"> <li>• <b>Reconfiguration auction(s)</b> conducted between the forward period and delivery, e.g., at T-1.</li> <li>• <b>Supply offers</b> would include: <ul style="list-style-type: none"> <li>– Any capacity without existing supply obligation from base auction.</li> <li>– Any excess capacity procured by central buyer in base auction that is not needed with updated (lower) load forecast.</li> </ul> </li> <li>• <b>Demand bids</b> would include: <ul style="list-style-type: none"> <li>– Any incremental needs by the central buyer to meet updated (higher) load forecast.</li> <li>– Any capacity with a CSO that wishes to buy out of that obligation.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Provides an opportunity to adjust capacity commitments with demand changes and changes in availability.</li> </ul>   |
| <b>Bilateral Transactions</b>   | <ul style="list-style-type: none"> <li>• Enable buyers and sellers to engage in voluntary bilateral contracts.</li> </ul>  | <ul style="list-style-type: none"> <li>• Support market participants in managing their own risks and uncertainties.</li> </ul>  |

| Market Design Element                                   | Preliminary Design Straw Proposal  | Remarks   |
|---|--|---|
|   | <ul style="list-style-type: none"> <li>• Enable post-auction exchange of CSOs.</li> </ul>  |   |
| <b>Supply Obligations and Performance Incentives</b>    | <ul style="list-style-type: none"> <li>• Suppliers are obligated to demonstrate availability consistent with their obligations, and face penalties consistent with under-performance.</li> <li>• Penalty rates will be high enough to incentivise performance (but not so high as to impose undue costs that discourage participation).</li> </ul> | <ul style="list-style-type: none"> <li>• An appropriate penalty system will ensure capacity obligations are appropriately fulfilled and supply is available during shortage conditions.</li> </ul>  |
| <b>Settlements and Cost Allocation</b>                  | <ul style="list-style-type: none"> <li>• Costs allocated to customers based on their contribution to system peak(s).</li> <li>• Costs of serving each demand bid in the base and reconfiguration auctions would be allocated to the relevant demand.</li> </ul>  | <ul style="list-style-type: none"> <li>• System peak(s) drive the need for capacity, so cost allocation should reflect contribution to that peak(s).</li> </ul>   |
| <b>Reforms to Energy and Ancillary Services Markets</b> | <ul style="list-style-type: none"> <li>• <b>Mitigate energy offers to Short Run Marginal Cost (“SRMC”).</b></li> <li>• Consider <b>alternative or additional ancillary services (“AS”).</b></li> </ul>   | <ul style="list-style-type: none"> <li>• Emulates a perfectly competitive market; no need to allow exercise of market power (and associated inefficiencies) since FCM supports recovery of fixed costs.</li> <li>• Expressing marginal value of energy and AS incentivises efficient operations and investment.</li> <li>• Additional ancillary products, if necessary, provide revenues to resources that supply AS needed for reliable operations.</li> </ul> |

**FORMAT FOR SUBMISSION OF COMMENTS/VIEWS**

**DEVELOPING A FORWARD CAPACITY MARKET TO ENHANCE THE SINGAPORE WHOLESALE ELECTRICITY MARKET**

| S/No.                    | Please indicate in each cell in this column, the section/paragraph in <b>The Brattle Group’s HLD Straw Proposal</b> to which your comments/views refers | Comments |
|--------------------------|---|----------|
| 1                        |   |          |
| 2                        |   |          |
| 3                        |   |          |
| .                        |   |          |
| Any other comments/views |   |          |

**Comments/views submitted by:**

Name :  
 Designation :  
 Company :  
 Email :  
 Contact No. :