



Smart Energy, Sustainable Future

**ELECTRICITY IMPORTS BACKUP PRODUCTS DESIGN
CONSULTATION PAPER AND CALL FOR EXPRESSION OF INTEREST**

**Closing date for submission of comments, feedback and expression of
interest:**

27 June 2022

27 May 2022

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1. Background

- 1.1. Importing electricity is a key initiative that will allow Singapore to further diversify our energy mix. This will help reduce carbon emissions from the power generation sector, as it allows Singapore to overcome land constraints and tap on clean energy resources outside Singapore's borders. EMA intends to allow up to 4GW of imports by 2035, which is expected to make up around 30% of Singapore's total electricity supply by 2035.
- 1.2. EMA will need to ensure sufficient local backup capacity to maintain energy security and reliability as we scale up Singapore's electricity imports. EMA had earlier launched an Industry Co-creation Exercise in August 2021 to seek initial views on how such backup capacity might be designed and provided. The industry generally supported the backup planning methodology and indicated interest to provide backup capacity for the Singapore system.
- 1.3. EMA has since further developed the framework for backup capacity. This consultation paper seeks further views from the public and industry players on the design and future procurement of the backup capacity.
- 1.4. EMA is also conducting a call for Expression of Interest (EOI) to invite interested industry players to indicate their interest in providing such backup capacity. This will enable EMA to better design our future backup procurement process.

2. Overview of Backup Capacity

- 2.1. Electricity imports is expected to make up around 30% of Singapore's total electricity supply by 2035. To ensure system reliability, the outage risk of electricity imports will have to be addressed in a timely and cost-efficient manner.
- 2.2. EMA notes that electricity imports typically have a higher failure risk and restoration time compared to combined-cycle gas turbines (CCGTs), which is the dominant generation technology today. Individual CCGT outages are typically rectified within days or weeks. In comparison, for electricity imports transmitted via subsea cables, a sufficiently severe outage (e.g. subsea cable damage) may take up to several months to repair.
- 2.3. To ensure reliability of electricity supply, EMA envisages that electricity imports will have to be supported by backup capacity in Singapore that can respond quickly, as well as sustain output for months. Such backup should be designed as a centralised and pooled service, like reserves today, and serve to mitigate the impact of outages from any electricity imports source or local generation. A centralised and pooled service would, reduce the overall cost of backup to the system.
- 2.4. For the specific backup capacity that is meant to respond quickly (in order to arrest the frequency drop arising from a sufficiently large outage), such capacity cannot be dependent on CCGTs which are online and providing energy. This is because EMA envisages that in future, a combination of electricity imports and local renewables penetration would result in times where only a small number of CCGTs would be dispatched to meet demand. This would differ from the situation in Singapore today, where most of Singapore's energy and reserves are provided by online CCGTs.
- 2.5. EMA intends to procure this centralised pool of backup from 2023 onwards, after there is more clarity on the size and commencement date of Singapore's initial tranche of electricity imports. EMA may procure backup capacity over multiple tranches, to align with the different commencement dates for each tranche of electricity imports. EMA intends for backup capacity to be procured ahead of time via an Ancillary Service Contract ("**ASC**") from service providers ("**Providers**"), such that the backup is fully operational prior to the commencement of its relevant electricity imports tranche. To help EMA understand industry interest and ability to provide backup capacity, an exercise calling for Expression of Interest (EOI) is launched in conjunction with this Consultation Paper. Please refer to Section 9.

2.6. EMA is considering designing 3 new backup products:

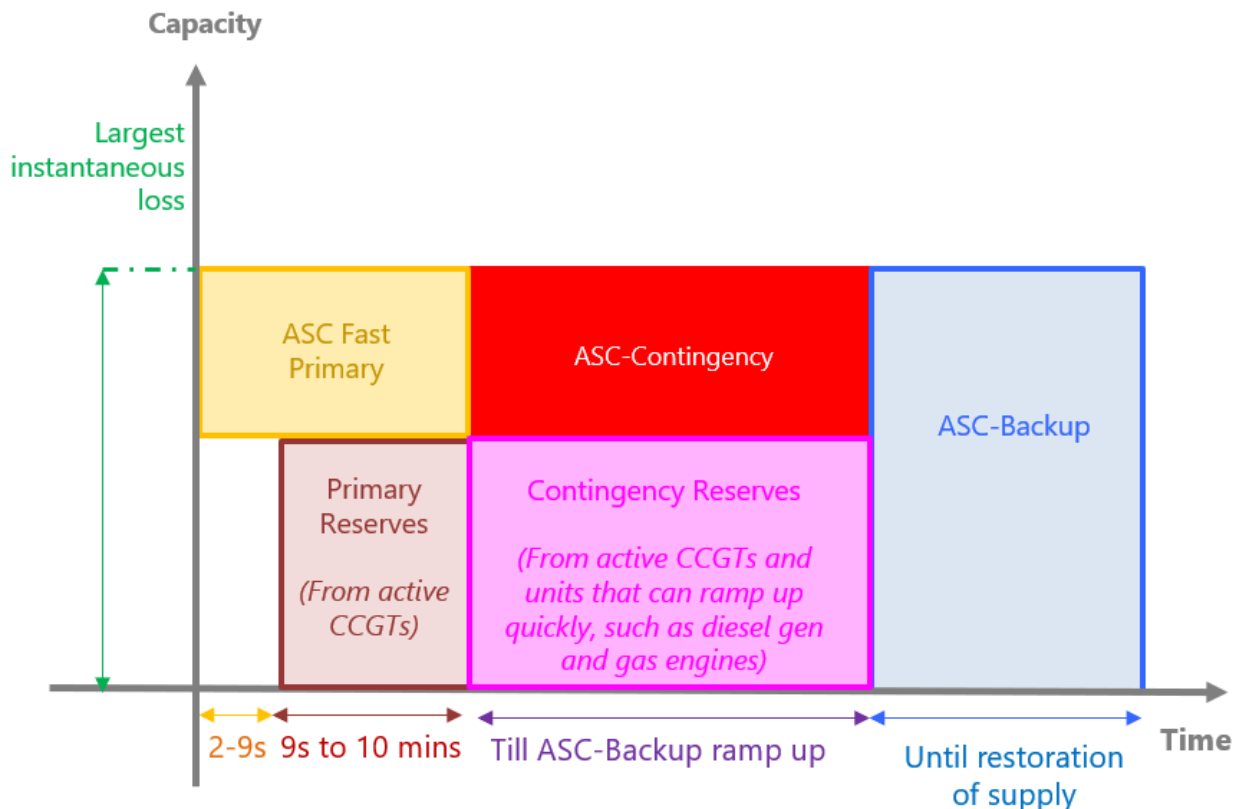
- a. **“ASC Fast Primary”**: Upon activation, Providers providing ASC Fast Primary must achieve the product's maximum output capacity within 2 seconds, and sustain output for 10 minutes. This service, together with Primary Reserves procured from the Singapore Wholesale Electricity Market (SWEM), aims to arrest a drop in frequency arising from a sufficiently large outage. Market participants who own CCGTs and are looking to provide this service must be capable of doing so without relying on their online CCGTs. EMA envisages that this service will be provided by a combination of Battery Energy Storage System (BESS) and fast response generators (such as diesel generators and gas engines).
- b. **“ASC Contingency”**: Upon activation, Providers providing ASC Contingency must achieve the product's maximum output capacity within 10 minutes, and sustain output until otherwise instructed by the Power System Operator (PSO). The required duration of output is expected to be typically between 4 to 14 hours. This service, together with Contingency Reserves procured from the SWEM, aims to provide energy until the outage event has been rectified or stabilised. Market participants with CCGTs and are looking to provide this service must be capable of doing so without relying on their online CCGTs. EMA envisages that this service will be provided by fast response generators (such as diesel generators and gas engines).
- c. **“ASC Backup”**: Upon activation, Providers providing ASC Backup must achieve the product's maximum output capacity within 4 to 14 hours from cold start, and sustain output until otherwise instructed by the PSO. This service aims to provide energy continuously for months, which may be necessary if the original outage event requires months to rectify (e.g. repair of a damaged subsea electricity imports interconnector). EMA envisages that this service will be provided by end-of-life CCGTs, which could be refurbished and kept at cold start conditions. Market participants with CCGTs and are looking to provide this service must be capable of doing so without relying on their online CCGTs.

2.7. Refer to Figure 1 below for a visualisation of all backup measures. In the future, assuming EMA continues to procure 600MW of primary reserves and contingency reserves from the market, ASC Fast Primary and ASC Contingency capacity will need to be procured should our largest generation or imports source be larger than 600MW. In the event of the largest instantaneous loss,

defined as 100% loss of single largest generating unit or imports in the system, the following will take place:

- a. ASC Fast Primary are instantaneously activated by system frequency and must achieve the product's maximum output capacity within 2 seconds;
- b. Within 9 seconds, primary reserves must provide sufficient power to complement ASC Fast Primary in arresting the system frequency drop;
- c. Within 10 minutes, contingency reserves and ASC Contingency must provide sufficient power to match the size of the largest instantaneous loss; and
- d. ASC Backup is expected to be able to deliver electricity within 4 to 14 hours, if necessary to ensure replacement of the largest instantaneous loss.

Figure 1: Concept of Backup Design for import supply



3. General Product Specifications for ASC Fast Primary, ASC Contingency and ASC Backup

- 3.1. The following specifications will apply for the three products of ASC Fast Primary, ASC Contingency and ASC Backup.
- 3.2. **Minimum size:** 0.1MW. This is aligned with the minimum bid size that is accepted by the Energy Market Company (EMC).
- 3.3. **Product duration:** As the Authority prefers a longer committed product duration to develop a reliable portfolio of backup supply, Providers of the ASC product should offer this product for a duration of five years. Providers can propose a shorter duration for EMA's consideration, to cater flexibility for units with shorter remaining lifespans.
- 3.4. **Availability requirement:** The Provider shall declare the availability of its resource during EMA's procurement of the service. Providers are allowed to state specific days/hours of unavailability to plan for maintenance etc. Provider's resource must be available for activation, on days other than those days/hours of unavailability that were earlier stated. Testing shall be conducted on a monthly basis, unless there was an activation within the same month.
- 3.5. **Fixed payment to Service Providers on standby:** Providers are paid to be on standby. Hence, Providers will earn a fixed (\$/MW) for each period when it is on standby to cover its fixed costs, including necessary incremental capital expenditure needed to maintain reliability under the ASC.
- 3.6. **Payments for generated electricity:** When Providers are supplying electricity to the market, the prevailing USEP may be sufficiently high such that collected revenues exceed its variable cost over a month. As the ASC product is designed to be a low- risk product that already earns a fixed upfront payment, EMA will set the allowable returns on variable costs at the Return of Equity as set out in the prevailing vesting parameters¹. EMA intends to adopt a clawback mechanism to recover excess revenues from Providers.
- 3.7. **Treatment for unrecovered variable costs:** When Providers are supplying electricity to the market, the prevailing nodal price may be too low to cover the variable costs of the Provider over a month. Upon application by the Provider, EMA will allow the Provider to seek a revenue top-up, to allow it to recover its costs and achieve its allowable returns on variable costs.

¹ Vesting contract parameters are updated every two years. [For the year 2021 and 2022](#), the Return on Equity is stated as 9.56%.

3.8. Payment and settlement frequency:

- a. Fixed payments, and adjustments for over and under-recovery of variable costs, will be provided on a monthly basis to Providers.
- b. Should ASC Providers be activated, payments for supplying electricity to the market will align with EMC’s existing settlement mechanisms and frequency.

3.9. Penalties for non-performance: For all the ASC products, a penalty scheme will be imposed to incentivise reliability. It will take reference from the existing Fuel Changeover (FCO) penalty mechanism, which incentivises reliability by ensuring that the gas fired generating plants are able to successfully hot-switch from gas to diesel and continue to generate electricity in event of a gas supply disruption. Random monthly spot checks will be conducted on the ASC units, and any unit which has failed in a spot check, by under-performing or not performing, will need to have its cause of failure rectified. Failing units may also be placed on a watch list, which will only be removed after it has successfully cleared 3 spot checks in the following 3 months, with the first within a month. It will also be penalised according to the Financial Penalty Framework (see [Table 1](#)) below. The Provider is also required to engage an OEM at its own cost to determine the causes of the unit’s failure to perform and submit a report to the EMA. If EMA finds the report unsatisfactory, the EMA may require the Provider to separately engage an independent technical auditor for further technical audit.

Table 1: Financial Penalty Framework for Activation Failure

Activation Failure	Financial Penalty	
	If Activation Failure Caused Power Failure	If Activation Failure Did not cause Power Failure
First activation failure in the last 12 months	5% of annual revenue	1% of annual revenue
Second activation failure in the last 12 months	7.5% of annual revenue	1.5% of annual revenue
Third and any subsequent activation failure in the last 12 months	10% of annual revenue	2% of annual revenue

4. Unique Product Specifications for ASC Fast Primary

- 4.1. The following specifications are additional specifications that are unique to the ASC Fast Primary product.
- 4.2. **Response time of product:** Required to achieve maximum output within 2 seconds upon activation and required to last for 10 minutes. This is meant to rapidly supply electricity to arrest a drop in system frequency due to sudden large instantaneous loss, with supply lasting until contingency reserves provides replacement electricity.
- 4.3. **SWEM bidding requirement:** There is no requirement to bid into the SWEM.
- 4.4. **Operations:** Droop settings will be calibrated such that the ASC Fast Primary is only activated by system frequency after a large outage event. These droop settings are designed such that only Primary Reserves are expected to be activated, in the event of smaller outages.
- 4.5. **Anticipated generation technology:** ASC Fast Primary is anticipated to be provided by BESS, or a combination of BESS and fast response generators. Fast response generators may need to be kept at a warm or pre-heated state to ensure that they can run at maximum loading in time for a handover from the BESS. Interruptible Load could also be used to provide ASC Fast Primary if such loads can meet the ASC Fast Primary product specifications. It is important that Providers providing ASC Fast Primary are not dependent on online CCGTs.
- 4.6. **Procurement method:** Given that many companies may tender to provide BESS or a BESS-fast response generator combination, ASC Fast Primary will be procured via an open Request-for-Proposal (RFP) process that is conducted annually (for 5-year product durations).

5. Unique Product Specifications for ASC Contingency

- 5.1. The following specifications are additional specifications that are unique to the ASC Contingency product.
- 5.2. **Response time of product:** ASC Contingency will have the same response time requirement as Contingency Reserves. Required to achieve maximum output within 10 minutes upon activation and required to last until otherwise instructed by PSO. The intent is for ASC Contingency to continue generating until ASC Backup are online (typically in 4 to 14 hours).
- 5.3. **SWEM bidding requirement:** There is no requirement to bid into the SWEM.
- 5.4. **Operations:** After an outage event, ASC Contingency Providers will be instructed by PSO to run up. Such instructions will be conveyed via SMS and check advisories notices, similar to the activation of contingency reserves today. PSO may also instruct ASC Contingency Providers to run up additional units or continue generating from operating units, if it is anticipated that supply from ASC Backup will be insufficient. Testing shall be conducted on a monthly basis, unless there was an activation within the same month.
- 5.5. **Anticipated generation technology:** ASC Contingency is anticipated to be provided by fast response generators. Interruptible Load could also be used to provide ASC Contingency if such loads can meet the ASC Contingency product specifications. Under current Market Rule provisions, Interruptible Load participants are allowed to seek compensation at prevailing USEP prices, if a load restoration notice is not issued within 120 minutes after the Load Registered Facility is activated to provide primary and/or contingency reserves. It is important that Providers providing ASC Contingency should not depend on online CCGTs. EMA welcomes comments on load restoration duration for Interruptible Loads.
- 5.6. **Procurement method:** Given that many companies may tender to provide fast response generators, ASC Contingency will be procured via an open RFP process that is conducted annually.

6. Unique Product Specifications for ASC Backup

- 6.1. The primary intent of ASC Backup is to provide continuous electricity supply to replace shortfall in electricity supply that may arise from a long-term disruption of generation or imports supply. As such long-term disruptions are expected to be rare, ASC Backup Providers are generally expected to have their units on “cold start”, so as to keep their daily costs low, hence units will not be generating electricity and competing in the market.
- 6.2. Nonetheless, it is anticipated that ASC Backup Providers will be allowed to compete in the SWEM and generate energy during Singapore’s initial years of electricity imports. EMA had earlier decided that during the first years of a licensed electricity importer’s project, the importer would be provided with a 5-year grace period to achieve a 75% quarterly load factor. This means that there is no load factor requirement during the first 5 years of an imports project. Should a significant portion of Singapore’s initial electricity imports come from overseas solar PV generation, there may be times during the day where imported electricity is not available (e.g. due to weather conditions). ASC Backup Providers could use their resources to provide energy during such periods. The frequency of such events is expected to reduce over time once the various imports projects achieve their 75% quarterly load factor requirement.
- 6.3. Hence, the following specifications are additional specifications that are unique to the ASC Backup product.
- 6.4. **Response time of product:** ASC Backup shall have a unique response time calibrated to the specifications of the resources that provide this product. EMA will calibrate the response time to the specifications and condition of individual CCGT under ASC Backup. Upon activation by PSO, resources are expected to achieve maximum output within 4 to 14 hours, if they are in a “cold start” condition.
- 6.5. **SWEM bidding requirement:** Providers are allowed the freedom to bid into the SWEM to provide energy, until otherwise informed by the EMA. Upon activation by PSO (e.g. due to an outage event), such Providers must bid at their respective Short-Run Marginal Cost (SRMC) into the SWEM for the duration of its activation and the contracted quantity.
- 6.6. **Operations:** Upon an outage event, ASC Backup Providers may be instructed by PSO to run up. Such instructions will be conveyed via dispatch instructions from PSO, taking references from Directed SLF Scheme. For ASC Backup Providers that happen to be providing energy during PSO’s activation, such ASC Providers must comply with PSO’s instructions. Testing shall be conducted on a monthly basis, unless there was an activation within the same month.

- 6.7. **Variations in output upon activation:** PSO may instruct Providers to generate electricity based on a specific half-hourly profile, as it may be necessary to match the generation of electricity with the changing intra-day electricity demand profile.
- 6.8. **Anticipated generation technology:** ASC Backup is anticipated to be provided by end-of-life CCGTs, which could be refurbished and kept at cold start conditions.
- 6.9. **Procurement method:** As there are a limited number of end-of-life CCGT units with unit-specific capabilities (e.g., response time), direct negotiations with interested generation companies would be more suitable than open tender. Generation companies that wish to plant new backup capacity that may be more cost-effective than end-of-life CCGT units, are also welcomed to express interest.
- 6.10. **Fuel stockpile requirement:** ASC Backup providers must maintain at least 60 days of fuel stockpile for 24/7 operations, which would enable it to continue generating power in the event that natural gas supplies are unavailable. Of the 60 days of fuel reserves, the ASC Backup providers must have exclusive right of use of the fuel reserves on-site² to last at least 30 days of operation. For fuel reserves located at the premises of fuel suppliers, the ASC Backup providers must have plans and/or arrangements for the delivery of the fuel reserves from the premises to the ASC Backup providers' premises, securely and reliably at all times, to ensure continuous and uninterrupted operation of the ASC Backup. In addition, ASC Backup providers are required to have exclusive right of use of storage tank capacity on site to last at least 60 days.
- 6.11. **Possible displacement by other generating units:** Upon activation, Providers must bid at their respective SRMC into the SWEM for the duration of activation. It is possible that other generating units in the system may bid lower than the Provider's SRMC, thus displacing the Provider. During such situations, the Provider will not be dispatched, and will not be in breach of its ASC conditions, but should continue to bid at SRMC for subsequent periods.
- 6.12. **Market Rules Penalties:** Upon activation, PSOD will issue instruction to specific ASC Backup units to bid in at SRMC for a specific quantity for each period. If scheduled, the units are expected to deliver the energy. Failure to deliver the scheduled energy will incur the Automatic Financial Penalty Scheme

² "On site" means at the ASC Backup provider's premises or such other premises which are connected to the ASC Backup provider's premises by dedicated pipeline, or at such other premises in Singapore as approved by the EMA and subject to any conditions as the EMA may specify, where fuel can be delivered from such premises to the ASC Backup provider's premises securely and reliably at all times to ensure continuous and uninterrupted operation of the ASC Backup.

(AFPS) as per the existing Market Rules. If not scheduled as the unit was outbid by more competitive units in the SWEM, it would not be penalised as it was not called to deliver energy.

7. Recovery Approach

- 7.1. The fixed cost of ASC Fast Primary, ASC Contingency and ASC Backup will be borne on a shared basis by all electricity importers. EMA will calculate a uniform Fixed Backup Charge (currently estimated to be \$15/MWh) that is charged to all importers based on their projected annual quantity (in MWh) of imported electricity for the prevailing year.
- 7.2. The Fixed Backup Charge is expected to be adjusted annually, to account for changes in the total licensed capacity of electricity imports, as well as changes in load factor for each importer.
- 7.3. As actual imported electricity quantities may differ from projected quantities, the collected quantum of the Fixed Backup Charge may be higher or lower than actual. Over-and-under collected revenues will be accounted for during the annual adjustment of the Fixed Backup Charge. between projected energy imported and actual energy imported.
- 7.4. The Fixed Backup Charge will be levied on a monthly basis at the beginning of each month.
- 7.5. Any Provider's unrecovered variable cost (which may be incurred if Provider's variable cost exceeds nodal clearing price) over a month, will be recovered from the errant generating unit(s) or importer(s) whose outage(s) had led to the activation of the relevant ASC product.

8. Request for Feedback

- 8.1. This paper seeks views/comments from the industry on the consultation paper, including but not limited to the following:
- a. Planning philosophy for backup capacity
 - b. General product specifications proposed
 - c. Unique product specifications proposed for ASC Fast Primary, ASC Contingency, and ASC Backup
 - d. Cost recovery approach proposed
- 8.2. Please submit your written response via this [survey](#) or through the QR code link appended below by **4pm on 27 June 2022**. Anonymous submissions will not be considered.



<https://go.gov.sg/imports-backup-consult>

- 8.3. For clarifications, please contact EMA Energy Connections Office (ECO) at kim_jin@ema.gov.sg and jansen_toh@ema.gov.sg.
- 8.4. The EMA reserves the right to make public all or parts 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. EMA will take it into account regarding the disclosure of the information submitted. EMA may also approach the respondents for clarification while the consultation is ongoing.

9. Call for Expression of Interest to provide backup capacity

9.1. Through this EOI exercise, EMA wishes to understand the following from companies:

- a. Ability and interest to offer the ASC product in specific years
- b. Technology of the generation resource providing the ASC product
- c. Envisaged quantity of the generation resource providing the ASC product
- d. Envisaged location of the generation resource providing the ASC product. This helps EMA to understand how the generation resource might be connected to the grid if there are locational challenges that may require EMA's facilitation to overcome.
- e. Envisaged challenges and facilitation needed from EMA

9.2. Interested companies may submit to EMA Section 5 responses in the following format, with attachments as needed, to kim_jin@ema.gov.sg and jansen_toh@ema.gov.sg, by 27 June 2022.

Start year of availability	
End year of availability	
Technology of imports backup measure (E.g.. BESS, Diesel Generator, Open Cycle Gas Turbine, Combined Cycle Gas Turbine) *Please note whether it will be a legacy unit or new planting	
Response timing needed following PSO notification	
Quantity of the imports backup measure available Intended service(s) to be provided: ASC Fast Primary, ASC Contingency and/or ASC Backup	
Location of unit (if existing unit) /potential location of new unit	

(indicate if you have private land/connection feasibility)	
Emissions Intensity of unit and max runtime (in hours) that this unit can provide in a year	

END