



Smart Energy, Sustainable Future

**EXPRESSION OF INTEREST TO
BUILD, OWN AND OPERATE ENERGY STORAGE
SYSTEMS (ESS) IN SINGAPORE**

Issued on 10 May 2022

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EXPRESSION OF INTEREST TO BUILD, OWN AND OPERATE ENERGY STORAGE SYSTEMS (ESS) IN SINGAPORE

1. INTRODUCTION

1.1 Energy Storage Systems (ESS) is a key tool in addressing solar intermittency and ensuring the reliability of the power system. As part of the Singapore Green Plan 2030, EMA announced a target to deploy at least 200MW of ESS beyond 2025.

1.2 EMA is exploring the use of ESS to provide 200MW/200MWh of spinning reserves to free up Combined Cycle Gas Turbines (“**CCGTs**”) for generation purposes. This will be implemented in Phase 1 of the ESS’ operations for a period lasting not longer than 2 years.

1.3 Subsequently, the ESS will be mainly used to provide frequency regulation to mitigate solar intermittency and ensure grid reliability during solar hours. This will be implemented in Phase 2 of the ESS’ operations for the remaining lifetime of the ESS.

1.4 Beyond this 200MW of ESS, EMA envisages that more ESS will need to be deployed to support the solar target of 2GWp by 2030.

2. PURPOSE OF EXPRESSION OF INTEREST

2.1 EMA would like to invite interested parties to each submit a **non-binding Expression of Interest (“EOI”)** to build, own and operate 200MW/200MWh of ESS in Singapore. The ESS must be commissioned and operational no later than 15 November 2022 to provide (i) spinning reserves during Phase 1, and (ii) regulation services (including but not limited to mitigation of solar intermittency) during Phase 2, for a total ESS lifetime of up to ten (**10**) years (EMA may determine a shorter total ESS lifetime of a period of less than 10 years as EMA deems fit after considering the EOIs submitted).

2.2 Proposals must include:

2.2.1 A breakdown of all Capital Expenditure (“**CAPEX**”) and Operation Expenditure (“**OPEX**”) costs, inclusive of premiums imposed for project returns, merchant risk, etc. A monthly service fee to EMA to provide the requested services shall be quoted as well.

2.2.2 A project timeline detailing key tasks and milestones, including but not limited to equipment procurement & delivery, regulatory approval & licensing, and installation & commissioning.

3. FORM OF EOI

3.1 EMA is open to either:

(a) ESS based on lithium-ion battery technology; or

(b) ESS based on vanadium flow battery technology.

3.2 Time is of essence. Proposals that do not meet the 15 November 2022 deployment deadline will not be considered/evaluated. Proposals must also fulfil and comply with the list of technical requirements outlined in **Appendix A**. Proposals from participants with experience in deploying large-scale ESS and in deploying ESS under local conditions will be favourably considered. For proposals that have been accepted, failure to meet the timelines/deadline and requirements in delivering the proposals/project may entail or result in penalties.

3.3 Proposals submitted the earliest that meet the requirements and specifications may be awarded forthwith on a 'first come, first served' basis, and each subsequent proposal received will then be evaluated against the proposals already awarded and will not be considered if it is at a higher cost/return than the awarded proposals. Once proposals for or totalling 200MW/200MWh of ESS have been awarded, EMA reserves the right not to consider or award other proposals submitted.

3.4 Interested Participants shall submit their EOI using the form set out in **Appendix A**.

4. ADMINISTRATIVE DETAILS

4.1 Please submit your EOI in **Microsoft Word** and **PDF** formats via email to:
EMA_Enterprise_Development@ema.gov.sg

4.2 The closing date for submissions is 25 May 2022.

4.3 EMA will acknowledge receipt of each submission via email.

4.4 EMA reserves the right to share any information submitted by Participants in their EOI. Any part of the submission that is considered by Participants to be confidential should be clearly marked. EMA reserves the right to aggregate/anonymise the information before sharing on a need-to basis. All EOIs submitted shall be on a non-binding basis and EMA shall not be bound or under any obligation to accept any EOI submitted.

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Form of EOI

Instructions: Please use this form to submit your EOI and include any supporting documents, justification or key assumptions where applicable.

1. Participant's name, registered business address, contact person's name, designation, email and contact number.
2. Profile of Participant and details of relevant experience.
3. Most recent 3 years' financial information in respect of the Participant.
4. Address and land area of the ESS deployment site(s), including specifications of the site(s). Participants must already have existing land or land that has been earmarked by the relevant authorities available for their proposed ESS to be deployed by 15 November 2022. Participants who have land that is earmarked shall demonstrate that the land will be available for ESS to be deployed by 15 November 2022.
5. Technical requirements for ESS:
 - (a) To indicate the following for the ESS deployment site(s):
 - i. ESS type, number and size of ESS modules;
 - ii. Rated power and capacity of each ESS module (MW/MWh);
 - iii. Round-trip efficiency of the ESS module;
 - iv. Expected technical and economic lifespan;
 - v. Expected planned and unplanned downtime of each ESS module;
 - vi. Project schedule for the ESS deployment including the proposed dates and periods (or expected duration) for design, procurement, implementation and on-site testing and commissioning of the generating source;
 - vii. Certifications and testing reports showing compliance to ESS fire safety standards in NFPA 855, BS EN, IEC and/or IFC; and
 - viii. Necessary regulatory approvals and/or licenses obtained from government agencies to deploy the ESS by 15 November 2022.
 - (b) Technical requirements for Phase 1 (spinning reserves)
 - i. The ESS operator ("**ESSO**") shall have operational control of the ESS with the primary purpose of providing spinning reserves for

Singapore's power system in accordance with EMA's instructions. The ESSO may offer to sell energy, regulation and/or spinning reserves into the Singapore Wholesale Electricity Market ("**SWEM**") only upon conditions as may be imposed by EMA.

- ii. When the ESSO is not instructed by EMA to supply spinning reserves (subject to conditions imposed by EMA in accordance with subparagraph (i) above), the ESSO may offer to sell energy, regulation and/or spinning reserves into the SWEM from the ESS. Where the ESSO offers to sell into the SWEM from the ESS, the ESSO must comply with all applicable laws, rules, orders and regulations (including but not limited to the Singapore Electricity Market Rules).
- iii. EMA may at any time (by providing prior written notice) notify ESSO of a contingency event affecting Singapore's power system and instruct ESSO to operate the ESS to supply energy, regulation and/or spinning reserves into the SWEM, and the ESSO shall comply with such instructions accordingly. At any time during Phase 1, if the ESSO fails to comply with such instructions within the timeframe stated in EMA's written notice, penalties can be imposed by EMA.

(c) Technical requirements for Phase 2 (regulation)

- i. Daily from 7 a.m. to 7 p.m.:
 - I. The ESSO shall operate the ESS to provide frequency regulation for Singapore's power system as may be instructed by EMA and follow the Power System Operator's ("**PSO**") Automatic General Control ("**AGC**") commands to address solar intermittency.
- ii. Daily from 7 p.m. to 7 a.m.:
 - I. The ESSO shall operate the ESS to supply energy, regulation and/or spinning reserves, subject to such conditions as may be imposed by EMA. The ESSO shall restore the ESS' State of Charge ("**SOC**") to a fully charged condition before 7 a.m. each day.
 - II. Subject always to conditions imposed by EMA, the ESSO may offer to sell electricity into the SWEM from the ESS. If the ESSO offers to sell energy, regulation and/or spinning reserves into the SWEM from the ESS, the ESSO shall comply with all

applicable laws, rules, orders and regulations (including but not limited to the Singapore Electricity Market Rules).

III. EMA may at any time (by providing prior written notice), notify the ESSO of a contingency event affecting Singapore's power system, and instruct the ESSO to operate the SESS to supply energy, regulation and/or spinning reserves into the SWEM, and the ESSO shall comply with such instructions accordingly.

(d) Any other information, plans or proposals that the ESSO may deem relevant for the purposes of this EOI.

6. Technical requirements for grid connections infrastructure:

- (a) The ESSO shall ensure that the ESS is connected at the transmission level i.e. 66kV or above.
- (b) The ESSO shall either install the ESS (i) directly at their facilities with existing connections, or (ii) explore new connections to grid substations. The ESSO shall provide a detailed project implementation timeline covering all aspects including but not limited to connection to the power grid in time for the ESS to be deployed and commence commercial operations no later than 15 November 2022.
- (c) The ESSO shall provide the ESS' fault level contribution and, where applicable, the switchgear short circuit rating of any new or existing facilities necessary for the ESS connection. The participant shall ensure that the switchgear short circuit rating at the point of common coupling is not exceeded.
- (d) The ESSO shall demonstrate the impact of the ESS charging/discharging to the network in terms of power flow constraints.
- (e) The ESSO shall fully comply with the prevailing Transmission Code and System Operation Manual.
- (f) The ESSO shall take into consideration the ESS' fault current contribution as well as impact to network in terms of power flow constraints and concentration risks when proposing the grid connection.
- (g) The ESSO shall provide a schedule for development and implementation, including timeline for construction and operations.
- (h) Any other relevant technical information.

7. Commercial proposal:

(a) Breakdown of CAPEX costs, including but not limited to:

- i. Engineering, procurement, construction and installation of the ESS;
- ii. Testing and commissioning of the ESS;
- iii. Major equipment required for the deployment of the ESS, including ESS, Power Control System, Switchgears, Transformers, associated cabling works;
- iv. Civil works including for foundation, roads, substation (where relevant);
- v. SPPG connection fee;
- vi. Control and trading system and interface with PSO relating to the deployment of the ESS;
- vii. Land preparation costs;
- viii. Utilities and fire water provision;
- ix. Insurance during construction;
- x. Project Management.

(b) Breakdown of OPEX costs, including but not limited to:

- i. Maintenance and repairs;
- ii. Utilities and relevant grid charges (inclusive of Contracted Capacity Charges, if any);
- iii. License, permit or other fees payable;
- iv. Insurance;
- v. Operations & Maintenance manning and contractors;
- vi. Land lease and property tax incurred directly in relation to the deployment of the ESS;
- vii. IT and cybersecurity system/s;
- viii. Working capital;
- ix. Long Term Service Agreements (“**LTSA**”) with equipment suppliers;

(c) Provide the Weighted Average Cost of Capital (“**WACC**”) for the project, including assumptions for cost of equity, cost of debt, and project risk premium.

(d) Provide an indicative quote for the monthly service fee charged to EMA for the provision of services for Phase 1 and Phase 2.

(e) Financing plan with details of sources of capital.

8. Any other relevant information including but not limited to potential show-stoppers that may derail the technical and/or commercial viability of ESS and/or result in the delay of the ESS to be deployed.

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