Smart Energy, Sustainable Future

POLICY FRAMEWORK FOR ENERGY STORAGE SYSTEMS IN SINGAPORE

CONSULTATION PAPER

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POLICY FRAMEWORK FOR ENERGY STORAGE SYSTEMS IN SINGAPORE

1 Introduction

1.1 Energy storage is the ability to capture energy produced at a particular time to be used later. Technological improvements in Energy Storage Systems (“ESS”) have reduced the cost of deployment and increased the range of applications and services that ESS can provide to the power system. For example, ESS can provide services that are currently offered by power generation plants such as fast response services and capacity to meet peak demand. On the consumer-end, examples of ESS applications include protection against voltage dips and demand-side management services to optimise energy consumption.

1.2 In Singapore, there is growing interest to deploy ESS, in part because of the increased adoption of Intermittent Generation Sources (“IGS”), and also because of the growing awareness of the potential for demand-side management (“DSM”) activities in the energy market. Due to the unique nature of ESS – it has characteristics of both a load (during the charging process) and a generator (when discharging power) –the industry wants to better understand how ESS can be integrated into the energy market and power system.

1.3 The Energy Market Authority (“EMA”) is reviewing the regulatory framework for ESS in Singapore to ensure that the relevant regulations keep pace with the development of ESS technologies, and support evolving business models and innovations. This review also complements the efforts of EMA to provide the industry and consumers with more opportunities to participate in the electricity market, through initiatives such as the Interruptible Load and Demand Response programmes, as well as enhancements to facilitate the entry of IGS.

1.4 In this consultation paper, EMA seeks views on the following areas: (i) the possible ESS business models applicable in the Singapore context; (ii) the regulatory and market frameworks to support ESS deployment; and (iii) the possible options for the electricity grid operator to utilise ESS in Singapore. The feedback received from this consultation process will enable EMA to better understand the ESS landscape in Singapore and to enhance the regulatory framework for such technologies. This will in turn provide the industry and consumers with greater certainty on the role of ESS in Singapore’s energy market to catalyse industry innovation and facilitate new business models.

2 Overview on Energy Storage Systems

2.1 Background

2.1.1 ESS is unique due to the following characteristics: (i) it can absorb, store and dispatch energy; (ii) it can charge and discharge power rapidly; and (iii) it has a limited duration of continuous charging or discharging.

2.1.2 There is growing interest in Singapore to deploy ESS for the following reasons:

(a) ESS is increasingly becoming a cost-effective option for companies to provide services and value-added applications to stakeholders in the energy market, such as network operators. This is accelerated by the improvements in ESS technologies with respect to their efficiency and reliability, as well as the decline in cost of deployment;

(b) The capacity of IGS, in particular solar photovoltaic ("PV") systems, is expected to grow in Singapore over time. As IGS is weather dependent, the generation output from such sources is intermittent. Resources are therefore increasingly required to maintain system reliability and resilience as solar PV capacity expands. The use of ESS is one means by which intermittency issues may potentially be addressed, and could support the deployment of higher levels of IGS in the longer term; and

(c) There is interest from electricity retailers and consumers to implement more DSM initiatives, including ensuring uninterruptible power supply to mitigate the risk of voltage dips, and better optimisation of energy consumption. ESS is potentially an enabler of such DSM initiatives.

2.1.3 Figure 1 shows examples of the different forms of ESS, including mechanical energy storage, solid state batteries and flow batteries.

Figure 1: Examples of ESS technologies

Mechanical energy storage	Mechanical energy storage stores energy produced by motion. This includes flywheels, pumped hydro storage and compressed air storage.
Solid state batteries	Electrochemical batteries store energy through reversible electrochemical reactions. Several different combinations of electrode materials and electrolytes are used, including Lithium-ion, Zinc-air and Lead acid.
Flow batteries	Rechargeable flow batteries consist of two liquids with dissolved chemical compounds, separated by a membrane. An electric current is generated by ion flow through the membrane or plating process. Different variants include Vanadium Redox, Zinc-Bromine and Iron-Chrome.

2.1.4 Depending on the characteristics of the respective ESS technologies, some are better suited for specific applications, as shown in Table 1 below.

Table 1: Suitable ESS technologies for different ESS applications

Application type	ESS technology type
Fast response **(e.g. frequency control, voltage control)**	Emphasis on power, ramp rate (e.g. Li-ion batteries, flywheels)
Sustained response **(e.g. wholesale market price arbitrage, peak load shaving)**	Emphasis on energy, efficiency (e.g. Vanadium redox flow batteries)

2.1.5 Figure 2 summarises the recent ESS developments in Singapore.

Figure 2: Recent developments on ESS in Singapore

Allowing ESS to participate in regulation market	EMA and Energy Market Company ("EMC") implemented a rule change in the electricity market in 2015 to allow ESS to participate in the regulation reserves market[1]
Pairing of solar with ESS to be deemed non-IGS	EMA determined in 2014 that IGS integrated with technological solutions (such as ESS) will not be classified as intermittent if they are dispatchable[2]
ESS Test-Bed to study grid-level storage	EMA launched a Request-For-Proposal with Singapore Power ("SP") to test-bed ESS technologies in 2016 to evaluate their performance for grid applications. Results from the test-bed will help establish technical standards/guidelines for deployment and guide policy and regulatory framework development for ESS[3]

[1] Energy Market Company, "Provision of regulation by batteries". https://www.emcsg.com/f1380,101679/EMC321-EMA-JO.pdf
[2] Energy Market Authority, "Enhancements to the regulatory framework for intermittent generation sources in the National Electricity Market of Singapore" (1 Jul 2014). https://www.ema.gov.sg/cmsmedia/Consultations/Electricity/Proposed%20Modifications%20to%20the%20Transmission%20Code/1July2014Final_Determination_Intermittent_Generation_Sources_-_1_July_2014_Final_.pdf
[3] Energy Market Authority, "Energy Storage Programme". https://www.ema.gov.sg/Energy_Storage_Programme.aspx

2.2 Areas of review of policy framework

2.2.1 Given the unique characteristics and wide ranging applications of ESS, EMA is seeking feedback on key policy and regulatory issues for ESS to provide a level playing field for all market participants, and support the deployment of ESS where commercially viable. The questions and issues EMA is seeking feedback on can be categorised into the following main areas:

(a) **Business Models**: Given the characteristics of the Singapore electricity sector, what are the potential business models and key applications that could facilitate the deployment of ESS in Singapore?

(b) **Regulatory and Market Framework**: As electricity storage is not specifically defined under the regulatory framework, how should ESS be regulated? What are the potential changes to the market and regulations required to enable the participation of ESS and support new business models?

(c) **Framework for Grid Operator to Utilise ESS**: Given the potential for ESS to support the grid owner and operator in their objective of maintaining grid network reliability, what would be the most appropriate framework to govern how the grid owner and operator obtain services from ESS?

3 ESS Business Models

3.1 Key Technologies and Applications

3.1.1 ESS can be used for a wide range of applications to bring value to different stakeholders in the electricity sector. For example, ESS can be used to enhance network capability, such as enabling voltage control and supporting grid network expansion. With respect to the wholesale electricity market, ESS can provide frequency control and other ancillary services. It can also facilitate DSM, by either operating ‘behind the meter’ within customers’ premises or being directly connected to the grid.

3.1.2 Examples of potential ESS applications are as shown in Table 2 below.

Table 2: Examples of Potential ESS Applications

Network Applications	• Voltage Control/Reactive Power Support • Network Support • Grid Network Enhancement
Market Applications	• Frequency Control/Spinning Reserves • Demand response/Interruptible Load • Black Start Services
Consumer Applications	• Wholesale Market Price Arbitrage • Peak Load Shaving • Uninterruptible Power Supply Services • Renewable Integration • Island/Micro Grid Applications

3.1.3 The commercial viability of different ESS applications will differ depending on a jurisdiction's electricity system and its attendant characteristics. In Singapore's case, our geographical and climatic conditions, wholesale electricity prices, load profile, and predominant use of gas-fired Combined Cycle Gas Turbines ("CCGTs") for power generation will likely influence which ESS technologies and applications have the greatest potential for deployment here.

3.1.4 Some local companies have already been exploring the potential for ESS to be deployed in Singapore. For example, ATEN and Power Automation are piloting various types of batteries supporting high levels of solar penetration as part of the Pulau Ubin Micro-grid Test Bed[4]. EMA and SP are also taking the lead to test and evaluate various technologies and grid applications to determine which are best-suited for Singapore's operating environment through the EMA-SP ESS Test-bed.

3.1.5 To better understand the possibilities for ESS, EMA would like to seek views from industry on which ESS technologies and applications have the greatest potential in the Singapore context.

Feedback Sought

Q1 What are the most suitable ESS technologies for Singapore?

Q2 What are the key applications of ESS for potential deployment in Singapore?

[4] Energy Market Authority, "$5 million for two energy technology projects at Pulau Ubin" (6 Nov 2015). https://www.ema.gov.sg/media_release.aspx?news_sid=20151106WCtGvmGXZGa5

3.2 Possible Business Models

3.2.1 Various business models for ESS have been developed in other jurisdictions to address local challenges and circumstances. For example, in the Pennsylvania – New Jersey – Maryland ("PJM") market in the United States ("US"), the bulk of deployed ESS comprises larger grid-level ESS providing market services like fast-response frequency regulation services. One energy storage company specialising in the design and operation of flywheels – Beacon Power – had commissioned a 20MW/5MWh flywheel plant in 2014 in Pennsylvania specifically to provide frequency regulation in the PJM market. They are able to compete with the incumbent players as their flywheel systems can respond to the system operator's control signal at a rate that is 100 times faster than traditional generation resources.

3.2.2 Another business model is the use of ESS for renewables integration. In 2014, Green Mountain Power commenced the development of the Stafford Hill Solar Farm in Vermont, which comprises a micro-grid connecting 7,700 solar PV panels – capable of producing 2MW of power – with 4MW of battery storage (2MW of lead-acid storage and 2MW of lithium-ion storage). The use of ESS addressed the intermittency associated with solar energy and facilitated the delivery of clean renewable energy to the local community. In addition, the micro-grid supported by the ESS allowed the system to be disconnected from the grid during times of emergency to enhance system resilience.

3.2.3 ESS is also being deployed at the end-consumer level. Sonnen, a German residential battery manufacturer, launched a peer-to-peer trading platform in 2015 called sonnenCommunity. This platform has enabled homeowners with solar PV systems to store and trade surplus power using an integrated lithium-ion battery solution.

3.2.4 Table 3 shows some examples of possible business models involving ESS technologies for Singapore.

Table 3: Possible Business Models

Business model	Description
Grid-level ESS	Large-scale ESS connected directly to the grid provide services to the electricity market and network such as frequency control and voltage support.
Renewables integration	ESS deployed together with intermittent generation sources help smoothen output and enable such sources to be dispatchable.
Consumer-level ESS	ESS deployed at consumer premises provide services such as peak shaving and voltage control to the end-user.
Aggregation and control services for ESS	Distributed ESS are coordinated to optimise utilisation and provide value-added services such as frequency control to the market.

3.2.5 The commercial viability of the business models are driven by different factors and are often context-specific. In Singapore, the use of ESS could be driven by several factors, such as to manage intermittency in view of the increase in IGS deployment over time, to enhance the grid network, and to provide DSM applications. EMA would like to seek feedback from the industry on the potential business models for ESS in Singapore[5], and the possible factors that would support the deployment of viable business models.

Feedback Sought

Q3 What are the potentially viable business models for ESS in Singapore?

Q4 In particular, what factors affect the commercial viability of business models?

Q5 What ecosystems of related businesses are needed to support deployment of ESS and the viability of different business models? What are the other possible impediments to the deployment of ESS?

[5] As EMA understands that companies may be wary of revealing their plans for ESS deployment for commercial reasons, companies can provide such feedback on their potential business models on a confidential basis. EMA will take this into account regarding the disclosure of the information submitted.

4 Regulatory and Market Frameworks for ESS

4.1 Licensing Requirements for ESS

4.1.1 The existing legislation prohibits a person from carrying out certain electricity related activities unless he is authorised under a relevant licence or is otherwise exempted. The legislation is silent on electricity storage.

4.1.2 Depending on the intended applications of ESS, there are several options in formulating the licensing framework for ESS:

(a) **ESS as a generation activity:** Most ESS, in particular batteries, physically convert electrical energy to be stored in other forms (such as chemical energy) during the charging process, before being converted back to electrical energy during the discharging process. Electricity is generated during the discharging process, in which case they could be licensed as generators.

(b) **ESS as a load:** During the charging process, ESS draws power from the network and therefore can be viewed as a load, which, if curtailable, can be used and licensed for demand side participation under the Interruptible Load program and Demand Response program.

(c) **ESS as a combination of generator and load:** Due to the characteristic of ESS as both a generator and load, one possible option is to require ESS asset owners to be licensed concurrently as a generator and as a provider of demand side services in the wholesale electricity market.

(d) **ESS as a distinct activity:** Another option is to license ESS as a distinct activity considering that ESS is both a generator and load.

4.1.3 Stakeholders in different jurisdictions have taken different views on the appropriate approach to licensing ESS, taking into consideration the context of their respective electricity markets. For example, the Australian Energy Market Commission ("AEMC") undertook a review of the existing regulatory framework for ESS in Australia. It concluded that the existing framework in the Australian market was fit for purpose and that the definitions of 'load' assets and 'generation systems' within their rules are sufficiently broad to encompass ESS[6]. In contrast, some stakeholders such as the UK Power Networks, a distribution network operator in the United Kingdom ("UK") running an ESS testbed under the funding of Ofgem's Low Carbon Network Fund, had recommended that ESS be separately defined and licensed as part of their findings from the testbed[7].

4.1.4 While most of the existing rules and regulations should be applied consistently on ESS, there may be specific instances when the distinct nature of ESS may warrant a different treatment, similar to how a specific framework has been established to facilitate the entry of IGS in Singapore. As part of this consultation process, the industry is requested to provide feedback on whether there are any specific regulations EMA should consider when determining the regulatory framework for ESS. Identifying the appropriate framework would be important in ensuring a level playing field for ESS, and give greater certainty to investors.

Feedback Sought

Q6 What specific applications of ESS require licensing?

Q7 Do the various business models and applications of ESS require changes to the existing licensing framework? Should a new class of licensing be set up specifically for energy storage?

Q8 Are there any rules and regulations that warrant a different treatment for ESS?

[6] Australian Energy Market Commission, "Integration of Energy Storage – Regulatory Implications Final Report" (Dec 2015). http://www.aemc.gov.au/Major-Pages/Technology-impacts/Documents/AEMC-Integration-of-energy-storage,-final-report.aspx

[7] UK Power Networks, "Smart Network Storage – Recommendations for regulatory and legal framework (SDRC 9.5)" (30 Sep 2015). http://innovation.ukpowernetworks.co.uk/innovation/en/Projects/tier-2-projects/Smarter-Network-Storage-(SNS)/Project-Documents/Report+9.5+19Oct_v2.1_%28Final+Photos%29.pdf

4.2 Changes to Market Mechanisms

4.2.1 The current wholesale market was designed for a traditional electricity system that comprises conventional generators delivering power to end-consumers. However, with the development of new technologies like ESS and distributed generation, the existing market mechanisms may need to be reviewed to ensure that such technologies can be optimally leveraged when they are commercially viable.

4.2.2 For example, in the US, the Federal Energy Regulatory Commission ("FERC") had issued a number of rulings in recent years to revise the design of market mechanisms for ancillary services, specifically:

(a) FERC Order 755 directed system operators to implement a two-part payment for frequency regulation – a capacity payment and a payment for performance which reflects the quantity of frequency regulation service provided; and

(b) FERC Order 784 required transmission providers to take into account the speed and accuracy of resources in determining its reserve requirements when procuring from ancillary service markets.

4.2.3 In the UK, the transmission network operator National Grid has also taken steps to revise its process of procuring ancillary services, by tendering for new fast response capacity. This capacity is required to supply power in less than one second, which generally can only be met by batteries and interconnectors rather than traditional ancillary services providers.

4.2.4 In Singapore, with more deployment of IGS over time, a possible new mechanism may be a fast-ramping service to cater to the intermittency of IGS. In addition, with more consumers being aware and interested in demand-side participation in the electricity market, there may be scope for more mechanisms such as demand-side bidding. The characteristics of ESS, such as the ability to respond to supply and demand conditions within short periods of time, could catalyse the development of such market mechanisms. As such, EMA would like to seek views from the industry on whether any changes to the existing suite of market mechanisms are required.

Feedback Sought

Q9 Can the current market mechanisms in Singapore appropriately reflect the value of ESS?

Q10 Are there any new market mechanisms that should be introduced? How would ESS participate in such new mechanisms?

4.3 Changes to Market Settlement & Other Charges

4.3.1 The NEMS is designed as a "gross" market, where all electricity must be sold and bought through a clearing platform operated by the EMC. Energy prices and market-related charges (such as allocated regulation prices, reserve charges, EMC fees, etc.) are settled based on the classification of the activity. For example, most charges for generators and loads are applied on a "gross" basis, while a hybrid model applies for embedded generators (i.e. load facilities with self-generation capacity)[8]. Due to ESS's unique characteristics where ESS can be either considered as a generator, a load or both, the framework for how the charges should be applied to them may need to be reviewed.

4.3.2 Given that the nature of ESS allows it to switch continuously between charging from and discharging to the network, even within the half-hour trading period, it may be necessary to review whether a "net" injection or withdrawal approach is more appropriate. For example, if the ESS withdraws 2MWh of energy and injects 3MWh of energy within a particular trading period, should the ESS be charged 5MWh for market-related charges ("gross" basis) or only 1MWh ("net" basis)? This is particularly pertinent in the case of ESS providing market services like frequency regulation, when it is required to frequently switch between charging and discharging to help maintain system balance.

4.3.3 This issue has similarly been raised in other jurisdictions. For example, in the UK, the National Infrastructure Commission ("NIC"), a special government body set up to provide expert advice to the UK Government on infrastructure challenges, issued a report promoting the use of ESS to develop a more flexible UK network[9]. The issue of double charging of different charges and levies on both charging and discharging of the ESS was identified by the NIC as a regulatory barrier to ESS, and the NIC proposed that charging levies on the "net" injection/withdrawal would be a better approach.

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[8] Non-reserve charges, such as EMC and PSO fees, are applied on a "net" basis while reserve charges, such as allocated regulation prices, are applied on a "gross" basis. For more information, please refer to EMA's decision paper on the review of policy on direct supply of electricity by generating sets to onsite loads (5 Jul 2010). https://www.ema.gov.sg/cmsmedia/Consultations/Electricity/4c319fca8c79a5_July_2010_EMA_s_Assessment_and_Decision.pdf

[9] National Infrastructure Commission, "Smart Power: A National Infrastructure Commission report" (4 Mar 2016). https://www.gov.uk/government/publications/smart-power-a-national-infrastructure-commission-report

4.3.4 Providing clarity on how the relevant market charges would be applied will enable ESS service providers to determine when business models are commercially viable. As such, EMA would like to seek feedback from the industry on this issue.

Feedback Sought

Q11 How should the cost of energy charged/discharged in the process of providing market services be settled?

Q12 How should market and other system charges be applied to ESS?

5 Framework for Grid Operator to Utilise ESS

5.1 Options and Considerations for Grid Operator to Utilise ESS

5.1.1 ESS has the potential to provide services to enhance the reliability of the grid network. Examples of such services include improving voltage control of the network and managing the intermittent output of IGS.

5.1.2 ESS can also be used as an option for the grid operator to defer grid expansion. For example, during periods of peak demand, there may be constraints in certain areas of the grid. Instead of installing a new substation, the grid operator could potentially deploy ESS at the location of the constraint. The ESS could be charged during the off-peak periods and discharged during the peak periods to ease the constraint.

5.1.3 Currently, the transmission licence does not specify whether the grid operator is allowed to own and operate ESS. Given the potential for ESS to provide value-added services to the grid, EMA is reviewing whether and how ESS can be utilised by the grid operator. Clarity on this would provide greater certainty to all market participants and ensure a level playing field, while maximising the benefits of ESS to the network.

5.1.4 The options include:

(a) **Model A:** The grid operator owns and operates ESS as part of its network assets, but is not allowed to outsource ESS to third-party providers for non-network applications;

(b) **Model B:** The grid operator owns and operates ESS such that the ESS used for network applications forms part of its network assets, and is allowed to outsource any excess ESS capacity to third-party providers to provide non-network applications;

(c) **Model C:** The grid operator can only procure the relevant ESS services from third-party providers for network applications; or

(d) **Model D:** The grid operator has the flexibility to own, operate and/or outsource ESS assets, and/or procure ESS services from third-party providers.

5.1.5 In determining the appropriate framework, the key considerations are as follow:

(a) **Ensuring operational flexibility:** The grid operator needs to have sufficient levels of operational flexibility to utilise ESS to react to system conditions to ensure continued reliability of the electricity network. Allowing the grid operator to own the ESS assets would provide full operational flexibility and ensure a single point of responsibility for ESS utilisation. In contrast, operational flexibility could be compromised if the grid operator was only allowed to procure ESS services from third-party providers.

(b) **Optimizing utilization of ESS assets:** There is a need to ensure that the ESS assets are well utilised, especially when considering the model where the grid operator is allowed to own the ESS assets. Allowing the grid operator to outsource any excess ESS capacity could potentially improve the utilisation of the assets by allowing third-party providers to buy the excess ESS capacity for non-network applications.

(c) **Ensuring a level playing field:** In most liberalised markets, service providers in the non-contestable segments (such as the provision of grid services or market support services) are not allowed to engage in contestable businesses (such as the generation and retailing). This is to ensure a level playing field for stakeholders and minimise potential conflict of interests. Given the potential for ESS to “generate” when injecting into the grid during the discharging process, safeguards may be required to ensure a level playing field if the grid operator is allowed to own and operate ESS.

5.1.6 Table 4 below describes the considerations under each of the possible models.

Table 4: Considerations for different models for grid operator to utilise ESS

	Ensuring Operational Flexibility	**Optimizing Utilisation of ESS**	**Ensuring Level Playing Field**
Model A: Grid operator owns, but not allowed to outsource to third-party providers	Grid operator has full access to the ESS to ensure operational flexibility.	ESS assets may not be fully optimised, as there could be unused ESS capacity during certain periods where the ESS is not needed for network applications.	Safeguards may be necessary to ensure the grid operator does not engage in contestable activities.
Model B: Grid operator owns, and is allowed to outsource ESS assets to third-party providers	Safeguards need to be in place to ensure that the ESS assets are prioritised to meet the grid operator's obligations. For example, during times of emergency or unanticipated contingency events, the grid operator must ensure that its outsourcing arrangement allows it to use the ESS assets to maintain system reliability.	ESS assets would be better utilised if excess ESS capacity during certain periods can be used for non-network applications.	Safeguards may be necessary to ensure the grid operator does not engage in contestable activities. Further safeguards may be required if the ESS assets are outsourced to third-party providers which intend to use the services for contestable activities.
Model C: Grid operator only allowed to procure ESS services from third-party providers	Operational flexibility for the grid operator to use the ESS for network applications may be compromised. Safeguards need to be in place to ensure that the grid operator is able to access the ESS for network applications during unanticipated contingency events. As network applications tend to be location-specific, the grid operator has less flexibility to decide the locations to deploy ESS services	Utilisation of the ESS assets would depend on the business models of the third-party providers. Safeguards need to be in place to ensure that the grid operator procures ESS services at a competitive rate.	There would be fewer concerns when considering the issue of level playing field if the grid operator does not own ESS assets.
Model D: Grid operator has flexibility to own, and/or outsource and/or procure ESS services from third-party providers	Safeguards as discussed under Models B and C would apply.	The grid operator would "internalise" the cost of ESS services, which would facilitate more efficient investment decisions.	Safeguards as discussed under Models A and B would apply.

5.1.7 Given that significant value from ESS could be derived by the grid operator, EMA would like to seek the views of the industry on the appropriate framework for the grid operator to obtain ESS services.

Feedback Sought

Q13 How should we optimise the value that ESS can bring into our system, particularly for network applications, without undermining market design principles? Which option should be allowed, or are there other possible options?

Q14 What are the relevant considerations and safeguards should we allow the grid operator to utilise ESS?

6 Summary of Feedback Sought

6.1 This paper has raised a number of questions that EMA seeks feedback and comments on. These questions are summarised below for ease of reference.

<u>**ESS Business Models**</u>

Q1 What are the most suitable ESS technologies for Singapore?

Q2 What are the key applications for ESS for potential deployment in Singapore?

Q3 What are the potentially viable business models for ESS in Singapore?

Q4 In particular, what factors affect the commercial viability of business models?

Q5 What ecosystems of related businesses are needed to support deployment of ESS and the viability of different business models? What are the other possible impediments to the deployment of ESS?

<u>**Regulatory and Market Framework for ESS**</u>

Q6 What specific applications of ESS require licensing?

Q7 Do the various business models and applications of ESS require changes to the existing licensing framework? Should a new class of licensing be set up specifically for energy storage?

Q8 Are there any rules and regulations that warrant a different treatment for ESS?

Q9 Can the current market mechanisms in Singapore appropriately reflect the value of ESS?

Q10 Are there any new market mechanisms that should be introduced? How would ESS participate in such new mechanisms?

Q11 How should the cost of energy charged/discharged in the process of providing market services be settled?

Q12 How should market and other system charges be applied to ESS?

<u>**Framework for Grid Operator to utilise ESS**</u>

Q13 How should we optimise the value that ESS can bring into our system, particularly for network applications, without undermining market design principles? Which option should be allowed, or are there other possible options?

Q14 What are the relevant considerations and safeguards should we allow the grid operator to utilise ESS?

6.2 Additional feedback and comments beyond that covered by the questions in para 6.1 but are deemed to be relevant for EMA's consideration in our review of the ESS policy framework, are welcomed.

7 Next Steps

7.1 The EMA wishes to seek the views of the public and the industry on the questions listed in Section 6 of this consultation paper.

7.2 The indicative timeline of the EMA's consultation process for the policy framework for ESS is summarised in Table 5.

Table 5: Indicative timeline for the EMA's consultation process

	Process	Date
1	Issue of the EMA's Consultation Paper	24 Oct 2016
2	Feedback from stakeholders on the Consultation Paper due	24 Mar 2017

REQUEST FOR COMMENTS AND FEEDBACK

The EMA invites comments and feedback to Section 6 of the consultation paper. Please submit written feedback to ema_policy@ema.gov.sg by 24 Mar 2017. Alternatively, you may send the feedback by post/fax to:

Attn: Ms Michelle Fung
Policy & Planning Department
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Anonymous submissions will not be considered.

The EMA will acknowledge receipt of all submissions electronically. Please contact Ms Michelle Fung at 6376 7523, Ms Lyana Yeow at 6376 7624, or Mr He Songhua at 6376 7473 if you have not received an acknowledgement of your submission within two business days.

The EMA can facilitate meetings with stakeholders on an individual basis to discuss their feedback to this consultation paper. Please contact the EMA via ema_policy@ema.gov.sg if you wish to arrange a meeting.

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 and placed as an annex which the EMA will take into account regarding the disclosure of the information submitted.