Review of the Adequacy of Rules and Procedures for Battery Energy Storage System (BESS) Participation in the WESM

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This Report is prepared by the
Wholesale Electricity Spot Market (WESM) –
Technical Committee (TC)

EXECUTIVE SUMMARY

Energy Storage System (ESS) is considered as one of the technologies intended to mitigate the intermittent generation output of variable renewable energy (VRE) resources. However, noting the many purposes of such technology, the TC believes that there is also a need to consider each purpose in formulating policies and rules to further accommodate and maximize the potential of ESS in the grid.

In this study, the TC focused its review on existing relevant WESM Rules and procedures to determine if these are adequate to support the participation of BESS and other ESS in the WESM. This report also further expounds the comments of the TC to the draft final report of the study, Upgrading, Design and Implementation of Energy Battery Storage Market Mechanism of the Philippines Electricity Market Mechanism, performed by Nel Consulting Limited (NCL)/Intelligent Energy Systems (IES) consultants for the Philippine Electricity Market Corporation (PEMC).

Based on the review and assessment, Manuals, the TC concludes that the existing WESM Rules and relevant Manuals need further revisions and update to properly accommodate the ESS' participation in the WESM and into the Grid. The same conclusion may apply to the current provisions of the Philippine Grid Code (PGC) and Philippine Distribution Code (PDC).

Furthermore, there is a need to delineate ESS according to its connection as either stand-alone or hybrid noting that ESS connection to the Grid (stand-alone) and integration to conventional or RE generating plants (hybrid) are two different development approaches. Although stand-alone and hybrid ESS can integrate to the grid to participate in the WESM, their connection standards and operational requirements vary widely.

Given the increasing interest in BESS and ESS, the TC believes that the following recommendations should be considered with urgency by the concerned organizations:

- Modify the WESM rules and procedure recognizing ESS operator as a new trading participant in the market with uniform treatment as load and generation resources.
- Update the PGC and PDC to provide the minimum standards for connection and operation of ESS in the grid which recognize their capabilities and limitations.
- Review policies and regulations relating to ESS recognizing their potential contribution to market efficiency, grid reliability, and the environment.

Contents

1.0 INTRODUCTION

This report provides an assessment of the relevant WESM Rules and Procedures relating to the participation of BESS and other energy storage systems (ESS) in the WESM. The TC also used the draft final report of the study, Upgrading, Design and Implementation of Energy Battery Storage Market Mechanism of the Philippines Electricity Market Mechanism, performed by Nel Consulting Limited (NCL)/Intelligent Energy Systems (IES) consultants for PEMC as reference in the assessment on the subject matter.

This assessment report is intended to complement the comments[1] earlier provided by the TC focusing on the review of the WESM Rules and Procedures which concerns the participation of BESS and other ESS in the market. The assessment also includes clarifications and corrections on the earlier TC comments where appropriate. Other relevant documents such as the Philippine Grid Code (PGC), Philippine Distribution Code (PDC), as well as pertinent Department of Energy (DOE) policies and Energy Regulatory Commission (ERC) rulings dealing with this topic were briefly scanned to provide a wider perspective on the subject matter.

1.1 Purpose of the Document

This document aims to provide the following:

a. Review the existing provisions in WESM Rules and Manuals and policies to assess if these provisions are responsive to the unique characteristics of BESS.
b. Recommendations on the effective participation of BESS in the WESM.

Basic Considerations for Assessment

This report was based on two basic considerations concerning the participation of BESS/ESS in the WESM and their integration into the Grid:

1) Level Playing Field – equal treatment of participant according to Law

- Barrier to entry – avoid unreasonable requirements or favorable exemptions
- Dispatch and Pricing – no priority dispatch or special pricing arrangements
- Development and Ownership – COC licensing: no conflict of interest and unfair competition

2) Reliability and Safety

- Minimum safety and technical standards - compliance to latest Edition of the PGC, PDC and the Philippine Electrical Code (PEC - Article 7.6 for ESS)
- Operational safety – adequate internal health and safety procedures (i.e., new technology)
- Environmental concerns – address recycling or disposal of toxic waste (i.e., old batteries)

The above considerations provide a useful guide to TC in reviewing and assessing other WESM documents, DOE policies, and ERC regulation even if they are not directly addressed in the documents that were assessed.

[1] See Appendix 1, Matrix of TC Comments on the Draft Final Report (DFR) on Battery Energy Storage System (BESS) Study by Intelligent Energy Systems (IES) for PEMC

2.0 RELEVANT DOCUMENTS

The following documents were reviewed and considered in the preparation of this report:

1. WESM Rules
2. Philippine Grid Code
3. Philippine Distribution Code
4. WESM Manual on Dispatch Protocol
5. WESM Manual on Market Network Model Development and Maintenance – Criteria and Procedures
6. WESM Manual on Price Determination Methodology
7. WESM Manual on Registration, Suspension and De-Registration Criteria and Procedures

3.0 ASSESSMENT APPROACH

In the draft final report by NCL/IES on BESS, they have reviewed 28 documents to which only 5 have been modified to accommodate ESS. Table 1 provides the list of documents impacted by the entry of ESS.

Table 1. WESM Documents Impacted by ESS[2]

Modified Documents to accommodate ESS	Documents with indirect impact on the entry of ESS	Documents for modification to accommodate ESS participation
• WESM Rules • WESM Manual on Dispatch Protocol • WESM Manual on Market Network Model Development and Maintenance – Criteria and Procedures • WESM Manual on Price Determination Methodology • WESM Manual on Registration, Suspension and De-Registration Criteria and Procedures	• Disclosure and Confidentiality of Retail Customer Information • Green Energy Option Program Procedures • Constraint Violation Coefficients and Pricing Re-Runs • Dispute Resolution • Enforcement and Compliance • Market Operator Information Disclosure and Confidentiality Manual • Market Surveillance • PEM Audit Market Manual • Procedures for Changes to the WESM Rules, Retail Rules and Market Manuals • Technical Committee Market Manual • WCO Certification and Registration Manual • Penalty Manual	• Metering Standards and Procedures • Market Transactions Procedures • Registration Criteria and Procedures • Rules for Competitive Retail Electricity Market (Retail Rules) • Billing and Settlement • Procedures for the Monitoring of Forecast Accuracy Standards for Must Dispatch Generating Units • Guidelines on Significant Variations in and between Trading Intervals • Load Forecasting Methodology • Metering Standards and Procedures • Protocol for Central Scheduling and Dispatch

[2] Draft Final Report, Upgrading Design and Implementation of Energy Battery Storage Market Mechanism of the Philippines Electricity Market Mechanism, Intelligent Energy Systems (IES), 2022

Modified Documents to accommodate ESS	Documents with indirect impact on the entry of ESS	Documents for modification to accommodate ESS participation
		of Energy and Contracted Reserves • System Security and Reliability Guidelines

Given the sheer number of documents, the TC found it better to present their assessment by concentrating on the WESM Rules and grouping the review of procedures and protocols based on the following major market processes (governance processes excluded):

- Participant Registration
- Bids and Offer Submission
- Scheduling, Dispatch and Pricing
- Revenue Metering
- Financial Settlement

Lastly, the integration into the grid is distinct but complementary to WESM participation. The WESM like any market espouses competition by uniformly trading commodities in a fair and transparent manner between suppliers or customers (in this case energy and reserve). Integration into the grid, on the other hand, requires minimum standards (i.e., PGC, PDC or PEC) for safety and reliability of connection and operation of facilities such as the ESS. They are complementary since the grid provides the physical platform for WESM operations. To address this, the TC briefly scanned the PGC and PDC documents and provided some general comments and recommendations.

4.0 WESM RULES

Based on the current version of the WESM Rules, ESS facilities are currently categorized as a generator in the WESM. Moreover, sections relating to participant registration data, bid/offer submission, dispatch scheduling and pricing were also revised to consider the ability of ESS to inject and draw power to and from the grid. Subsequently, these modifications were reflected in other WESM Manuals on Dispatch Protocol, Market Network Model, Price Determination Methodology, and Registration.

An ESS installation can have many applications when integrated into the grid depending on the technology and business model with which they are designed and developed.

To explain further, ESS installations can be classified as either “stand-alone” or “hybrid[3]”. A stand-alone installation is not attached to any generating plant while the hybrid installation is connected to generating plants. Table 2 below shows how these ESS categories should be considered for market participation and grid integration.

[3] Hybrid generating plant is also referred to as integrated generating plant.

Table 2. Market participation and ESS installation type

Basic Requirements	Installation Type	
	Stand-alone	Hybrid
ERC – ownership and COC licensing	Energy Storage System Operator	Generator
Asset Boundary/Connection Point Agreement	Connected to the Grid	Connected to Grid thru a generating plant
WESM Market Resource Classification	Energy Storage System	Generator
Market Participation	Load; Supply of energy and reserve	Supply of energy and reserve

The following are the general comments and recommendations of the TC in the modifications of the WESM Rules to accommodate BESS and PSH market participation:

- There should be a new category of WESM membership for "stand-alone" ESS operators. BESS, PSH, and other forms of "stand-alone" ESS should be registered in this category.
- Only hybrid ESS should be registered with Generator members as part of their generation resource. Their connection points and operations shall be directly linked to the generation resource.
- ESS should be "technology neutral" to maintain a level playing field in the market. There should be no unreasonable requirements or exemptions for specific types of ESS. This should apply to existing and future ESS technologies particularly in the dispatch and pricing process.

4.1 Participant Registration

Based on the WESM Rules Clause 2.3.1.2, battery energy storage system has its own classification as a WESM member under the Generation Company category. BESS is defined in the WESM Rules as a facility or a group of facilities connected at a common connection point that is capable of storing energy through chemical reactions from which it is able to charge or discharge electrical energy to the power system and that can be dispatched to any operating level within their entire capacity range but are also constrained by a MW or MWh limit to (1) generate energy, (2) curtail the consumption of energy in the case of demand response, or (3) consumer energy.

BESS shall be operated in accordance with the scheduling and dispatch procedures described in the WESM Rules and within the dispatch conformance standard in accordance with Clause 3.8.5 of the WESM Rules when it is scheduled to operate as generation.

In addition, DC 2019-08-0012 defined the regional thresholds to be considered in the mandatory participation of ESS in the WESM. Table 3 shows the number of BESS that shall register in the WESM based on the regional thresholds. This is based on the DOE's list of Committed BESS project as of 30 June 2022.

Table 3. Registration of Committed BESS Projects in the WESM

Region	Total Installed Capacity (MW)	Total No. of Projects
Luzon	1480.00	44
Visayas	310.125	16
Mindanao	280	12

All committed projects are mandated to register in the WESM since these projects met the regional threshold set by the DOE.

The registration of these facilities is likewise covered by the WESM Manual on Registration, Suspension and De-Registration Criteria and Procedures. The recommended general modifications on this market process are as follows:

- Membership category – as previously discussed, a new membership category in the WESM for stand-alone ESS should be added to the registration criteria and procedures.
- Classification of ESS – there should be a distinction between hybrid and stand-alone ESS installations: hybrid ESS should be registered as Generators while stand-alone ESS are registered as ESS Operators.
- Trading participation – in terms of trading, only (stand-alone) ESS Operators may exercise demand bidding and offering of supply in the WESM
- PSH registration – PSH should be registered with an ESS Operator as a stand-alone ESS not as a Generator

4.2 Bids and Offer Submission

To be considered in the scheduling processes of the WESM, trading participants must submit generation offers for their facilities to the market operator prior to the gate closure. Under Clause 3.5.5.1 of the WESM Rules, each Generation Company including Generation Companies with bilateral contracts shall submit a standing market offer for each of its scheduled generating units, battery energy storage systems and pumped-storage units for each dispatch interval in each trading day of the week in accordance with the timetable. The standing market offer shall apply until revised or updated by the Generation Company. Generation companies may then submit a revised offer for any dispatch interval of the current week-ahead horizon in accordance with the timetable and subject to Clause 3.5.11.4 of the WESM Rules.

For BESS, a market offers either to supply or purchase electricity shall be submitted or may be revised by the Generation Company to the Market Operator in accordance with Clauses 3.5.5, 3.5.9, 3.5.10 or 3.5.11 of the WESM Rules.

In view of the foregoing, the following general modifications are recommended:

- A registered ESS Operator (stand-alone ESS) may submit demand bid and supply offer for energy or reserve. Below are the details of bids and offers as specified in the WESM Rules:

Generation Offers	Demand Bids
• May include up to ten (10) *generation* offer blocks per (aggregate) unit, and the maximum combined capacity of *generation* and *reserve offers* must not be less than the maximum available capacity of the generator; • Shall be for a minimum block size of one (1) MW; • Shall have monotonically increasing prices and quantity, starting from *zero generation;* • May include negative prices; and • Shall include up to three (3) segments of ramp rate profiles for different quantity break-points. The ramp up/down rates shall range from the minimum to the maximum registered ramp rates.	• Shall have up to 10 bid blocks per take-off point; • Shall have a minimum block size of one (1) MW; • Shall have monotonically decreasing prices; • Shall start from a zero offtake; • May have bid prices that are negative; and • Shall include a validity period of bids.

- Hybrid ESS registered as Generator shall submit supply offer for energy or reserve. Rules and exceptions for non-scheduled generation should apply. Although it can be argued that Variable Renewable Energy (VRE) resource integrated with BESS can become “dispatchable”.
- A registered ESS Operator who does not intend on exercising demand bid should submit load forecast data.
- Price response – accuracy problems may arise in load forecasting if an ESS Operator without demand bid responds unilaterally to spot price and deviates from submitted forecasts. Specific rules and procedures to cover this condition is needed.

4.3 Scheduling, Dispatch and Pricing

This process is covered by the following documents: (a) Market Network Model Development and Maintenance - Criteria and Procedures, (b) Load Forecasting Methodology, (c) Dispatch Protocol, (d) Price Determination Methodology, (e) Protocol for Central Scheduling and Dispatch of Energy and Contracted Reserves, and (e) Chapter 2 and 3 of the WESM Rules.

For scheduling and dispatch procedures, the term “dispatchable” should be clearly understood as it applies to generation, load, and energy storage facilities. In the WESM Rules, Dispatchable Load is defined as “load which is able to respond to dispatch instructions and so may be treated as a scheduled load in the dispatch process”. For Generators, this is characterized by a “Scheduled Generating Unit”, but the definition of this term differs from Dispatchable Load. BESS and PSH are not classified as “Scheduled Generating Unit” even if they are registered as Generators. The following are proposed modifications to address this issue:

- Dispatchability – introduce and define this term: “the ability of a generation, load or energy storage facility to follow dispatch schedules or instruction (within specified tolerance)”.
- Market Resource – expand concept in the MNM manual to include “energy storage resource” in addition to generation and load resources. The concept should also be applied to relevant dispatch and scheduling procedures.

- Hybrid ESS – should be classified as “Scheduled Generating Unit” and modelled in the MNM as generation resource. It can be argued that integration with BESS will make VRE a dispatchable resource.
- Stand-Alone ESS – BESS (not hybrid) and PSH should be classified as energy storage resources and considered as dispatchable
- Ancillary Service (AS) – ESS can provide reserve and black-start ancillary services subject to SO pre-qualifications. Reserves can be directly contracted with SO or offered in the reserve market.
- Price responsiveness – an energy storage resource may exercise demand bid, supply offer, or simply respond to spot prices by withdrawing or injecting power. Energy storage resource should submit their load forecast in lieu of demand bid. However, it can inject power only through scheduling and dispatch. There should be rules and procedures for price response.

4.4 Revenue Metering

This is covered by Metering Standards and Procedures as well as Chapter 4 Metering of the WESM Rule. The current rules and procedures already addressed the bi-directional active power and energy flow in the metering standards, an essential requirement for ESS. Registration of metering installations to ESS Operators as trading participant is also covered. No modification necessary as viewed by TC.

4.5 Financial Settlement

This is covered by Billing and Settlement procedure and Section 3.15 Prudential Requirements of the WESM Rules. There are no modifications required but a review of the provisions is recommended by TC to be certain.

- Aggregate Trading Amount – the formula should be reviewed for consistency when applied to ESS Operator as a trading participant.
- Prudential requirements – the Aggregate Trading Amount provides the basis for determining the maximum trading exposure of the participants and the prudential requirement. Review is also recommended.

5.0 ESS INTEGRATION TO THE GRID

As earlier pointed out, integration into the Grid is distinct but complementary to market participation. Integration requires minimum technical standards to complement the WESM Rules and Procedures. At the wholesale market, the Philippine Grid Code (PGC) is the primary reference while the Philippine Distribution Code (PDC) is for the retail market. A brief scan of these two documents indicated that there were no provisions relating to ESS or BESS while PSH were categorized as generating plant. There was a brief mention of BESS as a new technology for providing reserve. The VRE integration into the Grid was addressed in the PGC but hybrid ESS was not mentioned.

Chapter 4 of the NCL/IES draft final report listed the challenges of ESS integration (i.e., market participation) and provided a readiness (maturity) assessment of the WESM as compared to other jurisdictions. Five stages of maturity were described in the report: (1) Initial: building awareness, (2) Managed: implementing best practices (3) Defined: standardization and continuous improvement, (4) Integrated: integration and alignment and (5) Optimized: continuous innovation. The assessment indicated that the WESM is bordering between stage (2) and (3) but because there was no reference to clear PGC or PDC in the report, the TC thinks WESM is bordering between (1) and (2) only.

For TC there are three technical concerns that should be addressed in both PGC and PDC documents to help BESS/ESS grid integration: (i) connection standards for BESS/ESS using grid inverter technologies, (ii) operational (dispatch) procedures for ESS injecting and drawing power to and from the Grid, and (iii) uniform technical specifications and performance standards for stand-alone and hybrid ESS.

5.1 Policies and Regulations

In terms of policy and regulation, the TC suggests three focus areas for ESS developments: (1) Stand-alone installation, and (2) Hybrid ESS. This implies that ESS connection to the Grid and integration to conventional or RE generating plants are two different development approaches. Although stand-alone and hybrid ESS can integrate to the Grid to participate in the WESM, their connection standards and operational requirements vary widely.

- Department Circulars

  Based on the draft final report of NCL/IES, there were two DOE department circulars which provided policy directions and support to the participation and integration of the BESS/ESS into the industry, namely:

  - DC2019-08-0012 Providing a Framework for Energy Storage System in the Electric Power Industry, August 2019
  - DC2018-08-0022 Adopting Further Amendments to the Wholesale Electricity Spot Market Rules (WESM) and Market Manuals on the Participation of Battery Energy Storage System and Pumped-Storage Units in the WESM, August 2022

  Specifically, DC 2018-08-0022 introduced battery energy storage system as an additional category in the WESM Rules Clause 2.3.1.2 – Generation Company for the participation of battery energy storage systems. DC 2019-08-0012 on the other hand aims to further increase the penetration of VRE in the grid by recognizing Energy Storage System (ESS) as one of the technologies to manage intermittent operations of the VRE-generating plants' output. This circular specified that these ESS shall operate within the framework of Generation Companies whose facilities supply electricity to the Grid or the distribution system to maximize its benefits. The circular also introduced and defined the following ESS technologies which is designed to receive, store, and convert such energy to electricity:

    - Battery Energy Storage System or BESS
    - Compressed Air Energy Storage or CAES
    - Flywheel Energy Storage or FES
    - Pumped-Storage Hydropower or PSH

  With regard to the ESS participation in the market, the Circular defined the following ESS which shall register in the WESM and be subjected to central dispatch by the SO:

  a. ESS connected to the Transmission System; and
  b. ESS connected to the Distribution System with a capacity equal to or above the following regional thresholds:

     - 10MW for Luzon Grid;

- 5MW for Visayas Grid; and
- 5MW for Mindanao Grid.

ESS connected to the Distribution System, which has a capacity less than the above threshold may register in the WESM on a voluntary basis.

The TC assessment of the DC-2019-08-0012 is presented in Table 2 with comments and recommendation on specific sections and clauses of the document.

Table 2. Assessment of DC-2019-08-0012 dated August 2019.

Section	Provision	Comments and Recommendations
Section 4. Duties and Responsibilities		
Clause 4.1.1	Generators may own and operate stand-alone or integrated ESS facilities	No cross-ownership prohibition for Generators
Clause 4.1.2	Stand-alone ESS shall be registered separately; integrated ESS shall be registered with Generators	It is recommended that a membership category for stand-alone ESS be introduced
Clause 4.2.1	Distribution Utilities (DU) develop business process for ESS connection and operation	No cross-ownership prohibition stated for DUs
Clause 4.3.1	Directly connected customer may own and operate ESS only to manage their load	No power export to the Grid
Clause 4.4.1	End-Users may own and operate ESS only to manage their load	No power export to DU network PEC should be reviewed (utilization sector)
Clause 4.6.1	Transmission Network Providers (TNP) and small grid operators may not own or operate ESS	Cross-ownership prohibition even for stand-alone BESS which has network application potentials
Clause 4.8.1	Market Operator (MO) shall submit to the Rules Change Committee (RCC) amendments to support this policy	See comments and recommendations on modified WESM Rules and Procedures
Clause 6.3	All ESS shall comply with Safety, Health and Environmental rules and regulations including waste disposal	DENR rules and regulations on handling, operations and disposal of storage batteries should be reviewed
Section 9.	ERC is directed to provide regulatory support to accommodate ESS in the PGC, PDC, Open Access Transmission Service (OATS), AS and small grid operations.	This assessment report provides the comments and suggestions for this section.
Sections 10.	Professional Regulation Commission (PRC), Department of Environment and Natural Resources (DENR), Department of Labor and Employment (DOLE), Department of Trade and Industry – Bureau of Philippine Standards (DTI-BPS) and other relevant government agencies to update their regulations to consider ESS	These are not part of the TC assessment report but very relevant to new technologies like BESS.

Section	Provision	Comments and Recommendations
Section 11.	DENR regulations on disposing and recycling of toxic wastes under R.A. 6969 DENR AO2013-22	These documents were not reviewed in the TC assessment report but are applicable to BESS which uses large capacity batteries.

In addition to the provided comments above, the TC wishes to highlight the need to formulate additional policy and regulatory guidelines to accommodate and maximize the potential of ESS in the grid, specifically its purpose to provide transmission or distribution facility upgrades deferment and transmission congestion relief. The TC believes that by adding an additional category for ESS, instead of classifying them as a generator, it would be easier for the policy and regulatory body to address issues and concerns on ownership and licensing, among others.

Comments on the second DOE circular (DC2018-08-0022) were already presented in the assessment of the WESM Rules and Procedures.

Aside from the two previously mentioned department circulars, the DOE also published in 2020 a circular entitled “Providing a National Smart Grid Policy Framework for the Philippine Electric Power Industry and Roadmap for Distribution Utilities (DC 2020-02-003)”. This circular introduced the Smart Grid Vision of the DOE to improve overall reliability, power, quality, security, efficiency, and management of the electric grid with full cybersecurity and interoperability. The Circular also recognized the integration of ESS in the distribution utility to achieve a Smart Distribution Utility which promotes consumer empowerment and influence consumer behavior towards efficient utilization of energy.

- **Regulatory Rulings**

A ten-year scan (2012-2022) of ERC Rulings have shown no BESS-related documents to guide the participation and integration of this relatively new technology entering the industry. There was an issuance of Resolution 13 series of 2021, “Rules for the Monitoring of Variable Renewable Energy (VRE) Generating Facilities Performance”, dealing with VRE but no mention of hybrid BESS.

Earlier in 2013 “A Resolution Adopting and Approving Addendum to Amendment No. 1 of the Philippine Grid Code (PGC) Establishing the Connection and Operational Requirements for Variable Renewable Energy (VRE) Generating Facilities” was issued by ERC. However, this amendment addendum only covered VRE generation without integration to any BESS facilities.

The TC believes that regulatory rulings are necessary to provide guidance to industry players who would like to invest in ESS facilities. Importantly, these rulings should complement the policy thrusts of DOE.

- **Environmental and Safety Concerns**

Although these considerations were not adequately addressed in this assessment report, the TC strongly agrees with sections 10 and 11 of DC-2019-08-0012 requiring inter-agency cooperation on the matter.

The DENR should assist the DOE on regulating disposal and recycling of spent batteries as their market applications grows globally not only in the power industry but also in other fields such as electric vehicles, mobile electronics, and cordless power tools. Among their many potential

applications, the entry of BESS in the industry will require relative larger amounts of batteries given the capacities that are being designed and developed.

The Energy Storage World Forum[4] report – "Are Energy Storage Systems Facing a Battery Recycling and Disposal Crisis?" – explained: "Depending on the type of battery involved, incorrect disposal can cause a series of effects. Toxic chemicals can leak, making their way into water supplies and animal food chains. The tough battery components made to withstand these chemicals are clearly non-biodegradable, and in some cases, a battery wrongly disposed of can even explode. Due to these potential issues, disposal should only take place at dedicated waste management centers and in many cases are subject to standards or regulations relating to disposal of dangerous goods."

Lastly, there is also a need for the DOLE and the Department of Trade and Industry (DTI) to help the DOE address the issues of manpower and equipment safety in project facilities dealing with handling, installation, operation, repairs, and retirement of storage batteries with very large capacities such as BESS.

6.0 SUMMARY AND CONCLUSIONS

From the discussions presented in this assessment report, it can be concluded that the current version of the WESM rules and procedures need further revisions and update to properly accommodate the participation and integration of ESS in the WESM and into the Grid, respectively. The same conclusion may apply to the PGC and PDC.

The draft final report uses integration and participation. This assessment report does not intend to replicate the findings and recommendations of the NCL/IES consultants although the TC would tend to agree on some of them. Instead, the TC would like to provide more practical recommendations to the WESM rules and procedures grounded on the whole power industry. Hence, we delineate ESS according to its connection as either stand-alone or hybrid.

In summary, the recommendations of this TC assessment are as follows:

- Modify WESM rules and procedure recognizing ESS operator as a new trading participant in the market with uniform treatment as load and generation resources.
- Update the PGC and PDC to provide minimum standards for connection and operation of ESS in the Grid which recognize their capabilities and limitations.
- Review of policies and regulations relating to ESS recognizing their potential contribution to market efficiency, grid reliability, and the environment.

Given the increasing interest in BESS and ESS, the TC believes the above recommendations should be considered with urgency by the concerned organizations.

7.0 REFERENCES

- Upgrading Design and Implementation of Energy Battery Storage Market Mechanism of the Philippines Electricity Market Mechanism - Draft Final Report July 2022 by NCL/IES Consultants
- DC2019-08-0012 Providing a Framework for Energy Storage System in the Electric Power Industry, August 2019

[4] Energy Storage World Forum, https://energystorageforum.com

- DC2018-08-0022 Adopting Further Amendments to the Wholesale Electricity Spot Market Rules (WESM) and Market Manuals on the Participation of Battery Energy Storage System and Pumped-Storage Units in the WESM, August 2022
- ERC Resolution 13 series of 2021, “Rules for the Monitoring of Variable Renewable Energy (VRE) Generating Facilities Performance”

8.0 APPENDIX

Appendix 1 - Matrix of TC Comments on the Draft Final Report (DFR) on Battery Energy Storage System (BESS) Study by Intelligent Energy Systems (IES) for PEMC

SUBMITTED BY:

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Appendix 1. Matrix of TC Comments on the Draft Final Report (DFR) on Battery Energy Storage System (BESS) Study by Intelligent Energy Systems (IES) for PEMC

The comments and recommendations presented by the Technical Committee (TC) in this document are based solely on the opinions of its members and does not form a basis for acceptance or rejection of the subject report by PEMC Management. Below are the comments and suggestions that applies to the draft final report in general:

- Review of local technical standards such as the Grid Code, Distribution Code and Electrical Code to assess their adequacy for BESS/ESS conformance to safety, reliability and security would provide a more complete scan of the industry. Problems in the market such as SO intervention or non-compliance of participant often originates from lack of understanding of technical standards and practices.

- The phrase “technology neutral” should be defined clearly in the context of ESS participation in the WESM. Guiding principles for “technological neutrality” will also be helpful for consistency of application in the WESM.

- The TC suggests the use of the concept of Market Resource as used in the MNM and MDOM in introducing the ESS in registration, dispatch, and pricing. This will provide a structured and clearer understanding on the role of ESS in the market.

- Lastly, the decision to develop stand-alone BESS/ESS or hybrid system should be based on sound business decision and not necessarily by policy or regulation. The following should be considered:
  a) The benchmark life-cycle cost of energy (LCOE) of BESS (Appendix A: Figure 13 of draft report) is still way above solar and wind power technology as of 2019 even if there is a steep downtrend. The local taxes and other costs need to be considered since BESS is not covered by the RE Law and all these systems are imported.
  b) The realistic comparison of LCOE should include conventional power resources which were not shown in the said graph. This would be a better benchmark of competitiveness in the market.
  c) An integrated RE and BESS development will result in higher investment cost even if the latter is piggy backed to avail of the benefits from RE Law. On the other hand, a stand-alone BESS development cannot enjoy the benefits of RE Law and maybe subject to regulations that are yet to be defined. The resulting real LCOE from integrated and stand-alone developments should be closely compared considering these factors mentioned.
  d) While the primary objective of BESS/ESS development is to promote the RE policies of the government, it will have more far-reaching applications across the industry (i.e., wholesale power, distribution, and utilization). AS and DSB are obvious applications in the WESM but reliability and power quality solutions across the three industry sectors may also be driving increasing interest in BESS/ESS.
  e) Like any new technology application, BESS/ESS will have a point of saturation when increase in capacity investment will yield lower financial returns or economic benefits. Although it may still be at the infant stage, policymakers should keep this in mind.

Section/Title Number	Page Number	Statement/s from the DFR	Comment	Suggestions/ Alternatives considering the Comment	Commenting Party
Chapter 6: ESS and Market Conformance Standards	54-73	General Comments	In general, the Technical Committee (TC) noted the lack of reference to the following technical documents in the report: • Philippine Grid Code	Chapter 6 presented recommendations for ESS in general without differentiation of BESS. While the TC has no objection to the uniform treatment all types of ESS under the WESM (i.e., technology neutral), a more detailed explanation on this approach should have been provided at the beginning for clarity.	TC

Section/Title Number	Page Number	Statement/s from the DFR	Comment	Suggestions/ Alternatives considering the Comment	Commenting Party
			• Philippine Distribution Code • Philippine Electrical Code The capacity sizes and potential application of BESS may vary considerably based on their intended application. Conformance to safety and reliability standards at the grid, distribution and utilization levels are equally important if not greater than market competitiveness. Although there were ample references to other jurisdictions, adequacy of the local standards was not assessed.		
Chapter 6.1: Introduction	54	It concludes with a summary of the recommendations related to conformance standards, thereby addressing the requirements of Output 1.	All three output recommendations in this chapter focused on Market Registration. None of the recommendations dealt with specific WESM regulatory, financial, or technical standards which would have addressed the issues that were raised in Chapter 5 – Developers Survey. Ample references to other jurisdictions were also noted but there was little or no comparison to local market conditions.	A more comprehensive scanning of applicable standards would have been helpful and informative.	TC
Chapter 6.5: Recommendations (Output 1) – Table 7	73	• Make clearer the key parameters that BESS units are to provide upon registration • Define process for updating them over the lifetime of the BESS • Indicate whether the BESS is providing AS for NGCP SO, as there are implications for dispatch	The TC agrees on clarifying the operating parameters and roles of BESS in the market from the onset of registration. However, the registration process should be in tune with dispatch and pricing principles of the market all the way.	The harmonization of the registration process with the dispatch and pricing principles of the market should start within WESM by expanding the concept of Market Resource which is illustrated in Table 1 below. Market Resources is a term defined in the Market Network Model Manual as: "…the objects defined in the Market Network Model to represent generators, battery energy storage systems, pumped-storage units, and loads", although the term is not included in the WESM Rules and is not explained adequately in the MNM Manual.	TC

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Table 1. Market Resource Classification
<table>
<tr><td>Market Resource</td><td colspan="2">Dispatchable</td><td colspan="2">Non-Dispatchable</td></tr>
<tr><td>Dispatch Scheduling</td><td>Priority</td><td>Auction</td><td>Grid</td><td>Embedded</td></tr>
<tr><td>Generator</td><td>Nomination</td><td>Offer</td><td>As available</td><td>DU Control</td></tr>
<tr><td>Load</td><td>Nomination</td><td>Bid</td><td>Forecasted</td><td>DU Control</td></tr>
<tr><td>Energy Storage</td><td>Nomination</td><td>Bid/Offer</td><td>Price-based</td><td>DU Control</td></tr>
</table>
Market Resources can be classified as dispatchable or non-dispatchable depending on their ability to follow dispatch schedules. Dispatchable market resources can be scheduled by priority or through normal bid/offer submission (auction). Non-dispatchable market resources cannot be scheduled in the market due current practices and regulations which recognize their operational limitations.

Grid-connected resources which are non-dispatchable, are run based on their availability, forecast or response to market prices. Other non-dispatchable resources are not part of the MNM because they are embedded in the distribution utility franchised network. Hence, the dispatch of these resources should be the responsibility of the distribution utility. For this purpose, the concept of Distribution System Operator (DSO) should be introduced (another suggestion from TC).

The TC believes that this concept will provide a clearer direction for registration, dispatch, and pricing principles not only for BESS but for all ESS in general. It also provides a logical differentiation of scheduled generating unit, must dispatch generating unit, priority dispatch generating unit, non-scheduled generating unit, and scheduled load in the dispatch scheduling process.
</td><td></td></tr>
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<tr><td>Chapter 6.5: Recommendations (Output 1) – Table 7</td><td>73</td><td>Provision PSH to be able to register loads as demand side bidding facilities</td><td>The participation of pump-storage hydro (PSH) in demand-side bidding should also apply to all ESS in general, including BESS. The current exception to the existing Kalayaan PSH is due to the block size of the pumping load which impact grid generation balance during start-up and shutdown specially during off-peak. Whether valid or not, this has been the long-standing practice of SO. The concept of “technology neutral” treatment of all types of ESS should be able to address this issue.</td><td></td><td></td></tr>
<tr><td>Chapter 6.5: Recommendations (Output 1) – Table 7</td><td>73</td><td>Make registration more technology neutral by allowing market participants to register units as bidirectional units, dispatchable loads, generating units without reference to the underlying technology.</td><td>The TC believes that “technology neutral” treatment of all types of ESS should be a fundamental principle in the market in both registration, dispatch and pricing. However, the wide variations in the technologies being applied in ESS development presents a challenge in the uniform and equitable treatment of ESS in the market. A glaring example is shown in the previous comment regarding Kalayaan PSH.

It could be noted that while the recommendation is acceptable, there were no details on how the principle of “technology neutrality” can be applied in the WESM. It was suggested in the first recommendation that key</td><td>Following this recommendation, the TC suggest the following operational parameters which should uniformly apply to all types of ESS in the registration and dispatch processes. Note that these are just preliminary examples of operational details and should be subjected to more thorough study.

Table 2. Sample operational parameters
<table>
<tr><th>Operational Parameters</th><th>Explanations</th></tr>
<tr><td>1. Discharge Operating Mode</td><td>Delivering energy or providing reserve capacity</td></tr>
<tr><td>- Maximum output capacity</td><td>Maximum rated capacity over specified duration</td></tr>
<tr><td>- Maximum output capacity block</td><td>Fractional dispatch is allowed</td></tr>
<tr><td>- Minimum output capacity block</td><td>No fractional dispatch</td></tr>
</table></td><td>TC</td></tr>
</table>

<table>
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<tr><td></td><td></td><td></td><td>parameters on BESS units be included in the registration process, but no details were presented, also.</td><td>
<table>
<tr><td>- Discharge ramp up/down rates</td><td>Standard definition applies</td></tr>
<tr><td>2. Storage Operating Mode</td><td>Withdrawing energy or providing dispatchable load</td></tr>
<tr><td>- Maximum input demand</td><td>Peak demand over specified duration</td></tr>
<tr><td>- Maximum input demand block</td><td>Fractional dispatch/forecast is allowed</td></tr>
<tr><td>- Minimum input demand block</td><td>No fractional dispatch/forecast</td></tr>
<tr><td>- Storage ramp up/down rates</td><td>Standard definition applies</td></tr>
<tr><td>3. Transition between modes</td><td>Shifting from storage to discharge mode and vise-versa</td></tr>
<tr><td>- Discharge start-up time</td><td>From dispatch instruction to target output capacity</td></tr>
<tr><td>- Storage start-up time</td><td>From dispatch instruction to target load/demand</td></tr>
<tr><td>- Storage to discharge mode</td><td>Minimum time to shift excluding start-up time</td></tr>
<tr><td>- Discharge to storage mode</td><td>Minimum time to shift excluding start-up time</td></tr>
</table>

The “self-commitment” design of the MDOM may not require the Transition Parameters for dispatch but it will be useful for SO (and maybe later DSO) in managing reserves for demand supply balance. This can also be useful in the development and design of the day-ahead market if implemented in the future.</td><td></td></tr>
<tr><td>Chapter 7.0: Output 2 - WESM Protocols</td><td>74</td><td>General Comments</td><td>The TC have noted that the phrase “technology neutral” have been mentioned but there are no background explanations on how this</td><td></td><td>TC</td></tr>
</table>

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			applies in the context of ESS. In the ICT industry there where attempts to define the following principles of technological neutrality[5]: • Freedom of opportunity for all technically feasible solution to satisfy a technological requirement for public sector, private sector, academic or other. • No dependence on manufacturers, developers, suppliers or distributors of technology products or services. • Freedom of individuals to interact with an organization or institution, public or private, by electronic means, without it being imposed, de facto or explicitly, any specific technology. • Neutrality rules (laws, decrees or other) setting forth rights or obligations, without referring to technology or technological means required to fulfill these rules. • Normalization of information in digital files, that should be generated, stored, or transmitted in at least one open standard certificate format, being able to do also in others. While the electric power industry is less progressive than the ICT in terms		

[5] Mauro D. Rios, "Technological neutrality and conceptual singularity" (2013)

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			of technological development and deregulation, it would help to lay down some guiding principles to ensure consistency in the recommendations of this report.		
Chapter 7.3: Recommendations (Output 2) – Table 8	74	Interim AS Market is managed by SO separately to the WESM, with day-ahead scheduling of AS Providers for PRAS, SRAS and TRAS	There is no current AS Market. AS is procured thru bilateral contracting		TC
Chapter 7.3: Recommendations (Output 2) – Table 8	74	• NGCP SO needs to provide AS capacity and SOC requirements for BESS for PRAS, SRAS, and TRAS • Modifications required to the interface to IEMOP for declaration of AS schedules by SO	The TC agrees that the SO has the responsibility to the define the AS requirements of the grid. However, it should be obligated to determine the SOC of BESS when deciding the reserve resources to be used for PRAS, SRAS and TRAS. If this is the case, SO will have to consider PSH water storage, diesel plant fuel inventory, among others when dispatching AS providers. Otherwise, treatment to AS providers maybe considered discriminatory. The TC believes that the availability of energy and capacity for AS dispatch, whether ESS or conventional generator, is the responsibility of the providers. The opinion of the TC is there should not be any modifications in the MDOM to accommodate BESS alone but there should be an inclusion of ESS in general as a market resource in the MNM. Given the absence of any guiding principle, “technological		TC

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			neutrality" should apply to this recommendation.		
Chapter 7.3: Recommendations (Output 2) – Table 8	74	WESM Rules describing the MDOM optimization model and market processes (RTD, HAP, DAP, WAP) adjusted to ensure that the requirement to represent ESS/BESS in terms of SOC, and charging/ discharging, and bidirectional bids is included. This is important for ongoing IEMOP compliance to WESM rules. Also require that the SOC has a minimum level (which is specified as required for Interim AS market) – this can be provided with participant offers as well	The WESM resources are centrally dispatched, by design, but unit commitment is decentralized (i.e., self-commitment). Except for ramping from one dispatch interval to the next, other inter-temporal considerations such as SOC should not be considered in the market dispatch. The 5-minute RTD market should be an adequate means for any market resource to incorporate their inter-temporal concerns in the bids and offers. This is how TC understands the "technology neutral" approach in the market.		TC
Chapter 7.3: Recommendations (Output 2) – Table 8	75	As with earlier recommendations, requiring PSH to register pumping loads as dispatchable demand and using a demand-side bid will address this issue.	The TC believes that expanding the concept of market resource and inclusion of the ESS as a market resource in the MNM and MDOM is the first step in clearing and "levelling the playing field" for competition (technology neutral?). This means that all market resources are fairly and equitably treated when it comes to market dispatch and pricing according to their defined function (e.g., generator, load, or ESS; dispatchable or non-dispatchable). In the same token, PSH, BESS or any other ESS that may be developed in the future should be treated uniformly based on agreed operational parameters. If the recommendation is		TC

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			to allow PSH to exercise demand bidding, this should apply to all types of ESS (technology neutral?). However, for Kalayaan PSH, the SO will have to contend with the large load block size during storage start-up.		
Chapter 7.3: Recommendations (Output 2) – Table 8	75	Require PSH to register loads as dispatchable loads and submit demand-side bids for loading. This ensures that BESS and PSH are on an equal footing when operating in the market	Although demand-side bidding for all types of ESS is very desirable, the size of the demand block for Kalayaan PSH (e.g., ~160 MW pump motor load) which cannot be dispatch fractionally (marginally), can cause dispatch and pricing issues. This should be thoroughly assessed when pursuing the recommendation.		TC
Chapter 8: Output 3 – Compliance Monitoring	77	General Comment	The compliance standards for ESS as a market resource should be defined separately from load and generator resources, although there maybe similarities depending on their mode of operation. The TC believes that role of ESS in the market, not only BESS, will significantly increase with time.		TC
Chapter 8.2: Recommendations (Output 3) – Table 8	77	Adjust rule to ensure that coverage of PSH / BESS in the conformance standard	Adjustment to conformance standards should be for all ESS in general not just for PSH or BESS. (Technology neutral?)		TC
Chapter 8.2: Recommendations (Output 3) – Table 8	77	Monitoring the BESS to ensure it adheres to its dispatch targets and a maximum ramp rate for system	For practicality in dispatch monitoring, the size of the real-time quantities being monitored (demand/capacity		TC

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		normal operations. If the BESS is providing frequency regulation or responding to a contingency, then monitoring against a maximum ramp limit can be relaxed for those situations. Note: requires real-time SCADA data of BESS power output or 5-minute metering data	and block sizes) should be considered vis-à-vis the accuracy of measurement and monitoring systems.		
Chapter 9: Output 4 – Increased Levels of Competitiveness	79	General Comment	The TC noted that there were significant capacity additions in the committed BESS projects list of DOE shown in Appendix B. This was despite that unfavorable feedback and long list of action items gathered from the developer survey in Chapter 5, Section 5.5. Is this a correct observation? How is this analyzed in a results-based monitoring framework (RBMF)? The following is our limited understanding of RBMF as applied to this study and prescribed by the ETP: a) Impact level: Increased deployment of renewable energy and efficiency in Southeast Asia b) Long-term outcome: Participation of BESS and other ESS technologies in the WESM c) Intermediate Strategic (short-term) outcome: • RE and EE policies and plans contribute to Paris Agreement • De-risking investments in RE and EE Projects		TC

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			• Extending smart grids • Knowledge and awareness building • Base support for RE and EE transition agenda In this RBMF, approach is there a practical evaluation that could detect or anticipate potential failures in the change process. For example, is there a saturation point in the entry of BESS and ESS such that an increasing capacity development may not have the commensurate increase in RE/EE deployment? Was there a thorough analysis of the BESS/ESS business models which piggybacks on VRE projects? On a wider economic consideration would this business model increase or decrease the life-cycle cost of energy of VREs, or more importantly, electricity prices? The TC believes that the RBMF would be a useful high-level change management tool for policy makers and regulators. However, it should be augmented with ground level feedback information, (such as the questions raised above).		
Chapter 10.3: Recommendations	87	It is proposed that this be done as an extension to the stand-alone ESS enhancements. There are implications	The TC agrees with the first recommendation to allow market participation of BESS/ESS as a stand-alone or hybrid resource based on		TC

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		for conformance monitoring and the approach adopted for dispatch.	their technical and financial merits (i.e., "technology neutral" with no special treatment for dispatch). The conformance issues for hybrid system needs should be based on how the resource functions in the WESM (i.e., whether generator, load, or storage).		
Chapter 10.3: Recommendations	87	Important to implement ancillary service markets in the WESM as it supports the business case and hence promotes the investment in ESS in the WESM.	The TC cannot comment on the second recommendation since it has no information on the business models of hybrid systems. However, the TC would agree with the recommendation if it can be shown that prices for AS are undervalued in the existing market arrangements.		TC
Chapter 11.2: List of Specific Recommendations (Table 14)	90	• Make clearer the key parameters that BESS units are to provide upon registration • Define process for updating them over the lifetime of the BESS • Indicate whether the BESS is providing AS for NGCP SO, as there are implications for dispatch		Introduce ESS as a market resource in MNM/MDOM Key parameters should be for ESS not only BESS Suggestion to limit its capacity registration equivalent to net injection to the grid (charging levels shall be excluded as part of the maximum capacity)	TC
Chapter 11.2: List of Specific Recommendations (Table 14)	90	Provision PSH to be able to register loads as demand side bidding facilities		All ESS should be able to do DSB not just PSH or BESS	
Chapter 11.2: List of Specific Recommendations (Table 14)	90	Make registration more technology neutral by allowing market participants to register units as bidirectional units, dispatchable loads, generating units without reference to the underlying technology		Define "technology neutral" in the context of ESS (see Section 3 on ICT "technical neutrality")	TC

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Chapter 11.2: List of Specific Recommendations (Table 14)	91	• NGCP SO needs to provide AS capacity and SOC requirements for BESS for PRAS, SRAS, and TPAS • Modifications required to the interface to IEMOP for declaration of AS schedules by SO		SO should determine AS requirements only, not SOC of BESS BESS shall manage its SOC and shall be considered in their nominations No modifications to accommodate BESS	TC
Chapter 11.2: List of Specific Recommendations (Table 14)	91	WESM Rules describing the MDOM optimization model and market processes (RTD, HAP, DAP, WAP) adjusted to ensure that the requirement to represent ESS/BESS in terms of SOC, and charging /discharging, and bidirectional bids is included. This is important for ongoing IEMOP compliance to WESM Rules. Also require that the SOC have a minimum level (which is specified as required for Interim AS market) – this can be provided with participant offers as well.	WESM is “self-commitment” no intertemporal considerations for ESS. Only ramp rates. This applies to other market resources (load or generator). Only bi-directional bids/offers differentiates ESS		TC
Chapter 11.2: List of Specific Recommendations (Table 14)	91	As with earlier recommendations, requiring PSH to register pumping loads as dispatchable demand and using a demand-side bid will address this issue.	All loads and ESS resources can do DSB not just PSH.		TC
Chapter 11.2: List of Specific Recommendations (Table 14)	92	Require PSH to register loads as dispatchable loads and submit demand-side bids for loading. This ensures that BESS and PSH are on an equal footing when operating in the market		The exercise of DSB by loads or ESS resources should be subject to certain qualifications by SO	
Chapter 11.2: List of Specific Recommendations (Table 14)	92	As with earlier recommendations, requiring PSH to register pumping loads as dispatchable demand and	Duplication of recommendation 6		TC

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		using a demand-side bid will address this issue.			
Chapter 11.2: List of Specific Recommendations (Table 14)	92	Increasing the number of pricing bands from 10 to 20 would ensure bidirectional (BESS) are on equal basis with both generators & demand side players.	This can only be implemented with Demand-side bidding		TC
Chapter 11.2: List of Specific Recommendations (Table 14)	94	Adjust rule to ensure that coverage of PSH/BESS in the conformance standard.		Any adjustment should be for all ESS in general.	TC
Chapter 11.2: List of Specific Recommendations (Table 14)	94	Monitoring the BESS to ensure it adheres to its dispatch targets and a maximum ramp rate for system normal operations. If the BESS is providing frequency regulation or responding to a contingency, then monitoring against a maximum ramp limit can be relaxed for those situations. Note: requires real-time SCADA data of BESS power output or 5-minute metering data.		In monitoring real-time quantities, demand/ capacity should be considered vis-à-vis accuracy of measurement and monitoring systems.	TC
Chapter 11.2: List of Specific Recommendations (Table 14)	95	It is proposed that this be done as an extension to the stand-alone ESS enhancements. There are implications for conformance monitoring and the approach adopted for dispatch.		Hybrid systems should be uniformly treated with other types of ESS with no special treatment.	TC
Chapter 11.2: List of Specific Recommendations (Table 14)	95	Important to implement ancillary service markets in the WESM as it supports the business case and hence promotes the investment in ESS in the WESM	AS Market will provide objective and transparent reserve pricing which may or may not favor ESS business model		TC