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SUBJECT: PRELIMINARY POSITION PAPER OF PSSEA ON THE INTEGRATED ENERGY + STORAGE SOLUTIONS (IRESS) AS PROPOSED BY THE DEPARTMENT OF ENERGY FOR THE GREEN AUCTION PROGRAM 4

Greetings from the Solar Industry!

With Philippines' rigorous effort in fully embracing renewable energy (RE, for brevity) in the country, adopting relative technologies particularly Integrated Energy + Storage Solutions (IRESS) is a commendable approach and is warmly welcomed by the energy industry. Developers, Battery Suppliers, and EPC Providers are beyond grateful for your good office in including and taking cognizant of IRESS' indispensable function in swiftly transitioning into a greener and cleaner energy. Through the help of IRESS, Philippines' RE target will be attained in no time.

Due to the novelty of IRESS in the Philippines, the Technical Working Group of Philippine Solar and Storage Energy Alliance (PSSEA) for IRESS convened and collaborated on what kind of IRESS and how this technology can be fully maximized when used in the Philippine setting. They considerably discussed the model that may be used in the country. As a result of which, a Position Paper for your perusal with intricate details and explanations regarding IRESS in the Philippines was made.

The Position Paper prepared by the Technical Working Group is composed of Developers, Battery Suppliers, and EPC Providers. It was also passed by all the members of the Board of Trustees. It reflects the general consensus of our members and represents the voice of the Solar and Storage Industry. We humbly ask the DOE and the ERC to review our inputs and give it with much consideration as you always do.

PSSEA is looking forward to the success of the upcoming Green Energy Auction Program including IRESS as a new RE technology. May PSSEA and your good office continuously work harmoniously for the advancement of the energy industry and for the benefit of the common good of the Filipino people.

Respectfully,

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POSITION PAPER

INTEGRATED RENEWABLE ENERGY + STORAGE SOLUTION (IRESS) AS PROPOSED BY THE DEPARTMENT OF ENERGY FOR THE GREEN AUCTION PROGRAM 4

A. Introduction

The Philippine Solar and Storage Energy Alliance (PSSEA) continually supports the Philippines' Department of Energy (DOE) to guide the energy industry in reaching its renewable energy targets of 35% by 2030 and 50% by 2050. As one of the means to accelerate in reaching those targets, it is an opportune time for the DOE and Energy Regulatory Commission (ERC) in introducing the Integrated Renewable Energy + Storage (IRESS) for the upcoming Green Energy Auction Program 4 (GEAP4). This approach is highly endorsed by PSSEA members for its alignment with national renewable energy goals.

With the purpose of accelerating renewable energy (RE) development in the industry, it is only deemed proper that the IRESS GEAP 4 be designed to ensure an optimised auction implementing sound design principles in a pro market manner.

By definition, an IRESS auction is agnostic to both the renewable energy source and the storage type; regardless of the technologies. Regardless of the technologies implemented, the IRESS GEAP4 winning bidders would be required to optimise the combination of the RE and storage technology to provide the highest throughput of kWhs at the lowest kWh for a prolonged period of time on a grid utilising the existing available transmission capacity. Given that intermittent RE (wind and solar PV) is continuing to provide the lowest marginal cost of generation coupled with the ever decreasing costs of battery storage, the optimisation solution should look to also minimise curtailment while also allowing to maximise the capacity of existing transmission.

In line with the Government of the Philippines objectives, it is PSSEA's understanding that the purpose underlying an IRESS approach to the GEAP is intended to address the following;

i. accelerate the 2030 and 2050 RE generation targets;

ii. utilise existing transmission / node capacity;
iii. minimise curtailment on any transmission or node, and;
iv. provide a market competitive PHP/kWh rate to end users;

B. Design Principles

The above criteria are aligned with the structuring and execution of a pro-market favourable tender, ensuring the above criteria are incorporated into the IRESS tender and thus project outcomes. It is our community organisation's humble opinion that the below design principles are incorporated, to ensure this first IRESS GEAP 4 leads to a pro-market, meaningful and successful awarding of projects that will see through to operation between 2027 to 2028.

1. ***New build***. All projects eligible for the IRESS tender need to be "new build". A tender allowing for an existing solar plant to then submit for IRESS to incorporate a BESS will not provide a competitive environment for new projects. It is suggested an alternative mechanism be provided to RE projects experiencing excessive curtailment to competitively acquire a BESS with demonstrable curtailment impacts to minimise the short fall in the developer/operators investment. The purpose of IRESS as part of GEAP4 is to add new capacity.

2. ***Fixed dispatch time period***. A continuous dispatch time period of at least 15 consecutive hours that must include the period between 18:00 and 21:00. This will allow for the delivery of power for a prolonged period of time to deliver required power during the general peak demand period of each of the countries three grids, potentially alleviating peak demand prices as experienced by the WESM.

3. ***Utilise existing transmission / node capacity***. An existing bottleneck in the acceleration of RE in the Philippines (and globally) is transmission congestion constraints. By ensuring that all developers are proposing project activities that are lower than or equal to the existing and available transmission capacity on a given node, then there should be zero delays in anticipation of existing transmission to increase capacity.

4. ***Project sizes & tender capacity***. PSSEA is very well aware of the impacts an under-subscribed GEAP can have on the market and the subsequent round of pricing. We also take note that the purpose of the IRESS is to drive the national RE targets. We

would humbly like to propose to split the 2GW into 1GW delivered by 2027 and 1GW to be delivered in 2028. There is little benefit to having IRESS projects for two significant reasons. Firstly, a relatively small RE + BESS project equal to or around 50MW, the economies of scale will currently disincentivize developers to come to market. Secondly, developers need to deliver projects which sit around at least the 100MW mark or above to ensure profitability but are still constrained by available transmission capacity to have an impact on market supply and price dynamics, specially during the peak periods. A 2 GW IRESS tender size might seem ambitious, but is large enough to take away key lessons learned while still having an impact on the market without net negative spillover costs.

5. ***Must dispatch***. In line with existing regulation, RE are a Must Dispatch technology. IRESS GEAP4 should likewise enjoy this category. However, IRESS Must Dispatch shall apply on the designated time defined by the Auction Design.

6. ***Pre-qualification criteria and post-qualification requirements***. It is universally apparent and agreed upon by various stakeholders that previous GEAP rounds unfortunately relied on substantial guarantees from developers to ensure that projects would see through to delivery. Moving away from this approach is warmly welcomed by PSSEA members, while ensuring that each project has seen a level of development and opportunity that would provide a greater level of assurance to see the project through to operation.

With IRESS being auctioned for the first time, a Letter of Intent in lieu of the Solar Energy Operating Contract application should suffice for a renewable energy developer to qualify as Qualified Bidder. In addition, the EVOSS application process for RE projects is closed for the time being and will only open in December.

In addition, we pray that as a post-regulatory requirement for GEAP, the National Grid Corporation of the Philippines, upon receipt of Notice of Award from GEAP, should be directed to commence the conduct of System Impact Study (SIS) not later than ninety (90) days for speedy development and compliance to the declared commercial operation of projects.

7. ***Capacity Factor vs. Solar to BESS Ratio***. The CF approach offers a pro-market dynamic measure of how much energy will be optimally delivered to the grid, constantly pushing for a fixed capacity, compared to a fixed ratio approach. Even if

all developers only submit a proposal comprised of solar PV plus a Lithium Iron Phosphate (LFP) battery chemistry, there is currently enough variation of solar PV panel performance and even greater variation in LFP performance that a fixed RE to BESS ratio will unfairly support some technologies and developer know how over others, while not addressing configuration optimisation. In addition to the fixed ratio approach not meeting the government's IRESS GEAP4 approach there are a considerable number of other benefits lost to a fixed ratio approach.

i. Incentivizes System Optimization

Using the CF as a benchmark encourages developers to optimise the integration of RE and BESS, focusing on maximising energy output, storage efficiency, and dispatchability. Developers are incentivized to design a system that balances renewable energy generation with effective storage management to meet demand and maximise grid contribution.

A set RE-to-BESS ratio might lead to suboptimal design choices, as developers would be focused on meeting a fixed ratio requirement rather than optimising the system for actual energy delivery and grid reliability. It may not guarantee the most efficient or cost-effective use of storage, as the ratio doesn't reflect how the storage is used.

ii. Reflects Real-World Grid Impact

The CF directly reflects how much usable energy is being delivered to the grid. For governments managing grid stability and energy security, this is a crucial metric because it quantifies the actual performance of the RE+BESS system in meeting energy demand, rather than just the theoretical capacity.

A fixed RE-to-BESS ratio does not directly inform how much energy will be delivered to the grid. Even with a large BESS, the system's contribution to the grid may remain intermittent if renewable generation is too variable or the storage is not properly sized or utilised.

iii. Performance-Based Measurement vs. Static Design Metric

The CF measures actual energy output over time, providing a performance-based metric that reflects how efficiently the system (RE + BESS) operates in real-world conditions. It takes into account factors such as generation patterns, storage usage, and grid demand.

A set RE-to-BESS ratio is a static design parameter that simply defines how much storage capacity is paired with a given amount of renewable generation capacity. It doesn't account for the actual performance or energy output of the system. For example, a high RE-to-BESS ratio doesn't guarantee that the system will operate efficiently or deliver consistent energy to the grid.

iv. Better Adaptation to Resource Variability

CF accounts for the natural variability of renewable energy sources, such as solar or wind, and how well BESS compensates for this variability by storing and dispatching energy when needed. It reflects the system's overall effectiveness in providing continuous, reliable energy, regardless of fluctuating generation patterns.
A set RE-to-BESS ratio does not address how the system responds to variability. Even if a system has a large amount of storage relative to its renewable generation, it might not be used optimally if the generation is too intermittent or if the energy dispatch strategy is not aligned with grid demand.

v. Flexibility Across Different Projects and Locations

CF allows flexibility in project design, as it lets developers and operators adjust the size and operation of RE and BESS components according to specific conditions (e.g., solar/wind resource availability, grid demand profiles). This is especially useful because different geographic regions have different renewable energy potentials, and a one-size-fits-all RE-to-BESS ratio may not be effective across all projects.

A set RE-to-BESS ratio is rigid and might not be suitable for all types of projects or locations. For instance, a project in a region with highly variable renewable energy generation may need a higher storage capacity relative to RE, while in other regions with more stable generation patterns, a smaller BESS may suffice. Using a set ratio could lead to over or under-sizing storage capacity, which would impact both project economics and performance.

vi. Encourages Cost-Effectiveness

CF focuses on the effective use of resources, ensuring that the energy generation and storage components of the project are utilised to their maximum potential. This helps ensure cost-effectiveness for both the project developers and the government, as incentives or contracts can be based on actual energy delivered to the grid.

A set RE-to-BESS ratio could lead to unnecessary capital expenditures on storage capacity that may not be fully utilised. If storage is overbuilt relative to the actual energy production from the renewable resource, it adds cost without necessarily improving system performance.

vii. Supports Dynamic Policy and Incentive Structures

CF allows governments to structure performance-based incentives, subsidies, or contracts that reward projects for delivering reliable energy over time. It enables the government to guarantee that energy delivered to the grid aligns with demand, making the system more adaptable to changing conditions.

A fixed RE-to-BESS ratio does not offer the same flexibility for dynamic policy design. It is a one-time design requirement that may not align with long-term energy performance goals, grid needs, or evolving energy demand patterns.

Using the CF as a performance metric ensures that RE+BESS projects are evaluated and incentivized based on how well they actually perform, delivering reliable, predictable energy to the grid. For this reason, the requirements of developers to ensure that systems are operating optimally to meet their prescribed capacity factor through monitoring and management of their system, will provide all the necessary inputs and results for the DOE to ensure that the agreed upon capacity factor is met.

One metric is to increase the installed capacity in the Philippines to meet the 2030 and 2050 targets, however, this does little to express the actual dispatchable production that will meet real demand. The above design principles will ensure that what available transmission capacity is available is met by a solar PV plus BESS system combination to maximise the dispatchable generation, delivering beyond installation capacity.

C. IRESS Models

The PSSEA-IRESS TWG has collectively simulated and discussed 6 different models, or approaches to IRESS, each providing a guaranteed capacity and/or energy for a prolonged period. The intent for this section is to provide insights on the various various implications of each model and to simply assess if they address the above requirements.

For comparative purposes, each model has been simulated with 4 sunlight hours and required to deliver a constant power of 100 MW across a different time periods, which subsequently will require different combinations of solar PV and storage capacity. Even though the recommendation is to dispatch for 15 consecutive hours, a shorter time period has been used for

The first three scenarios provide an analysis of different mid-merit models across 3 varying time periods. The 4th model delivers 100MW from 1800H to 2100H representing night time peak hours, while the 5th model presents a "supplemental" solution for additional PV and new BESS to an existing plant.

Lastly, the 5th model proposes a "baseline" scenario, solely to compare the relative differences between and PV plus BESS requirements. It is assumed that for all models, at any given point in time of operation, the BESS will be available to provide 100% capacity, hence including a 100MW proposed capacity.

Scenario	Constant Power (MW)	Levelized Hours	Capacity Factor	Solar PV (MW)	Solar Energy (MWh)	BESS Power Capacity (MW)	BESS Energy Capacity (MWh)
1	100	4	50%	294	1176	100	227
2	100	4	50%	294	1176	100	421
3	100	4	63%	368	1472	100	460
4	100	4	13%	74	296	100	300
5	100	4	50% (Supplemental) (Existing plant)	194 100	776 400	100	227
6	100	4	100%	588	2,352	198	1300

Table 1. Model simulation results

i. Day time mid-merit

The Daytime Mid-Merit model aims to deliver consistent renewable energy output during daylight hours, ensuring energy stability with minimal reliance on battery storage. A mid-merit project would traditionally bridge the gap between baseload and peak demand, however, in the application of renewable energy plus battery storage the models leverage the flexibility of both renewable energy and battery storage to provide reliable and firm grid-supporting power for a prolonged period of time.

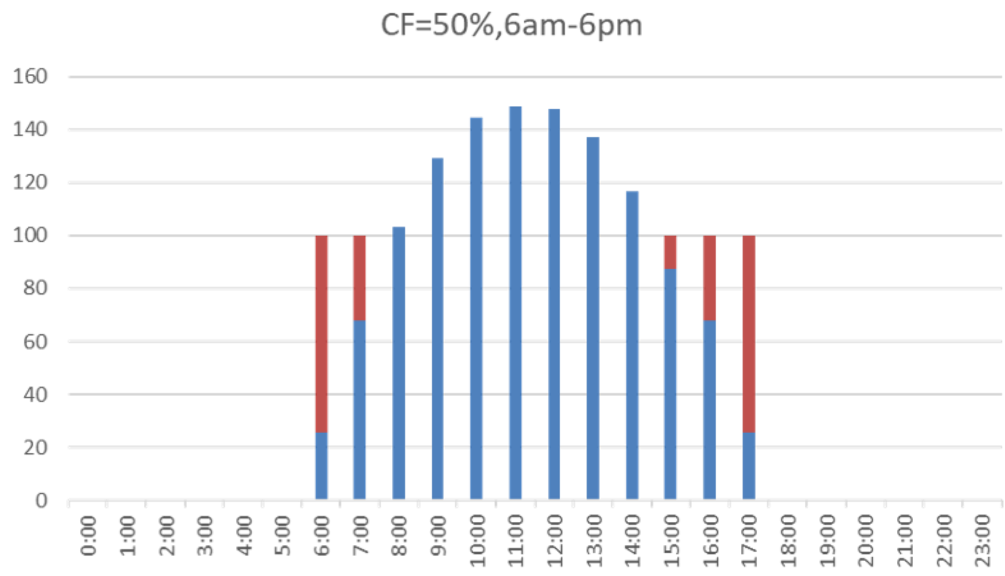

Fig. 1 Day mid-merit model simulation.

The day time mid-merit project simulation is modelled to provide 100MW of energy between 0600H to 1800H with a CF of 50%. This approach, modelled for a 100MW output from 0600H to 1800H, addresses intermittency issues and maximizes available grid capacity during the day while requiring the least amount of storage investment

ii. Afternoon/Evening mid-merit

The Afternoon/Evening Mid-Merit model is designed to extend renewable energy supply into the evening, providing critical support during peak demand hours from 1800H to 2100H. This IRESS simulation shifts the entire BESS application use to the afternoon and evening including providing power during the evening peak hours from 1800H to 2100H. It is also able to realistically provide a capacity factor of 50% for a 12-hour period.

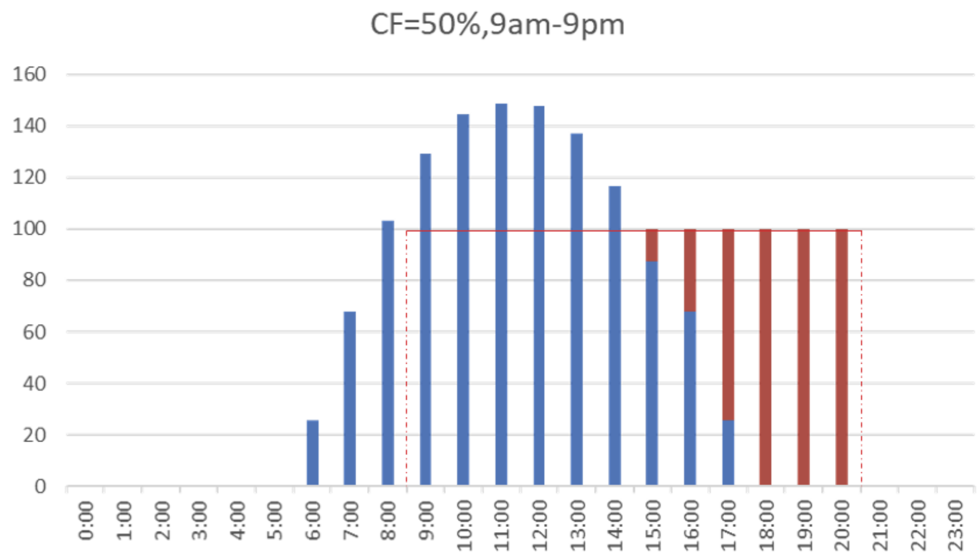

Fig. 2 Mid-merit model simulation

While this model meets the evening demand and has a capacity factor of 50% over a 12-hour period, it also necessitates higher storage capacity to handle nighttime peaks, leading to increased capital expenditure.

iii 15 hour mid-merit

This model targets continuous energy supply across the day and early evening, with a focus on providing stable power over a prolonged period, from 0600H to 2100H. The third "mid-merit" model is similar to the Meralco Terra Solar project in that it offers a prolonged delivery of energy at a constant power. In this model, 100MW for 15 hours from 0600H to 2100H. This model provided a higher CF of 65% because it requires a significantly larger BESS to solar PV to cover morning, late afternoon and early evening power delivery.

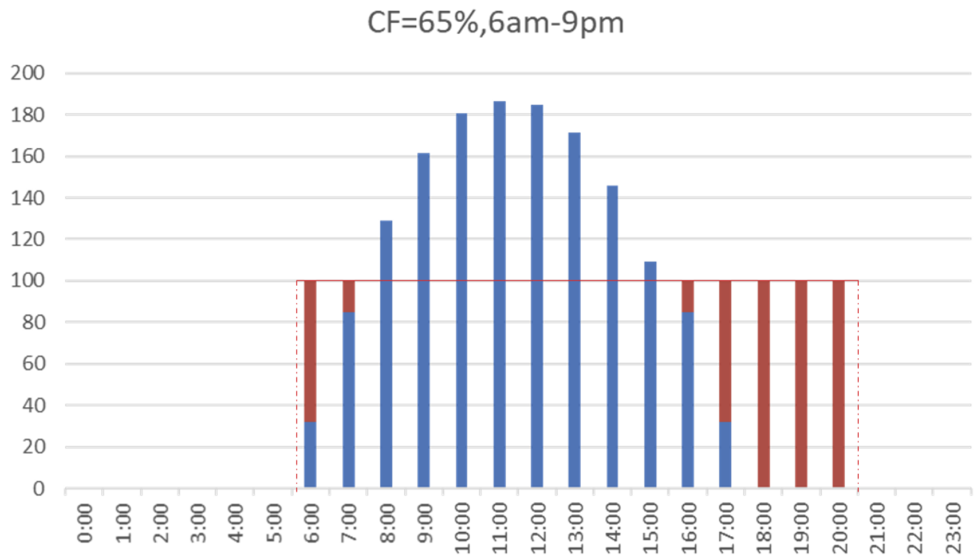

Fig.3 15 hour mid-merit

iv. <u>Night Peak</u>

The Night Peak model is specifically configured to meet the high demand from 1800H to 2100H by storing daytime generation for nighttime discharge, maximizing RE impact during critical hours. The sole purpose of this model is for IRESS to provide 100MW for three hours from 1800H to 2100H to solely address nighttime peak demand. The entire day time generation will be stored and then discharged at night. This approach involves the smallest solar PV capacity but requires a battery storage capacity of 300MWh, making it a cost-effective solution focused solely on alleviating peak demand pricing.

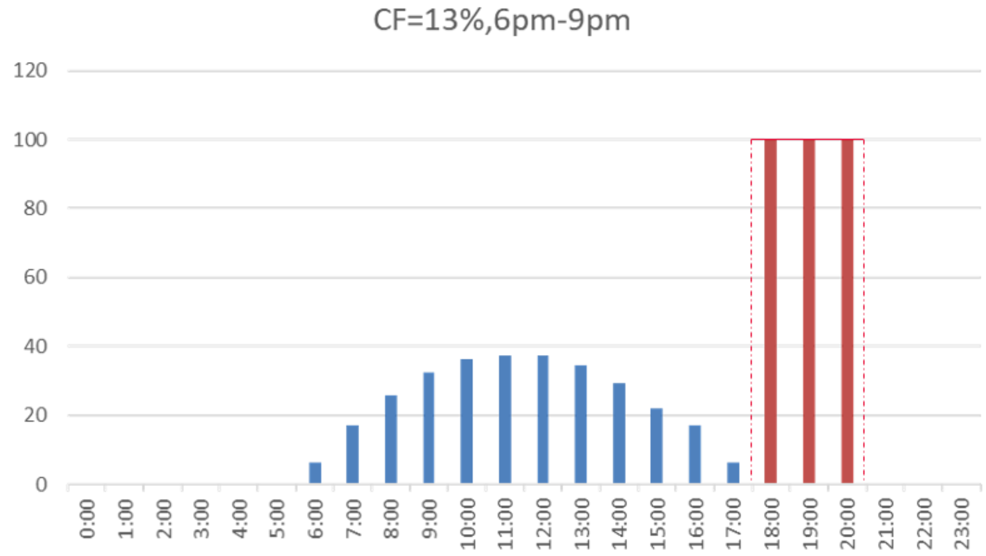

Fig.4 Night Peak

<u>v. PV Supplemental</u>

The PV Supplemental model explores integrating additional BESS to existing solar projects, leveraging remaining transmission capacity on nodes with excess grid capacity. In this case the existing plant is a solar PV plant and is proposed when an existing plant is operational on a transmission node which still has available capacity left. Given the IRESS would provide energy either at during peak hours or in the absence of renewable energy.

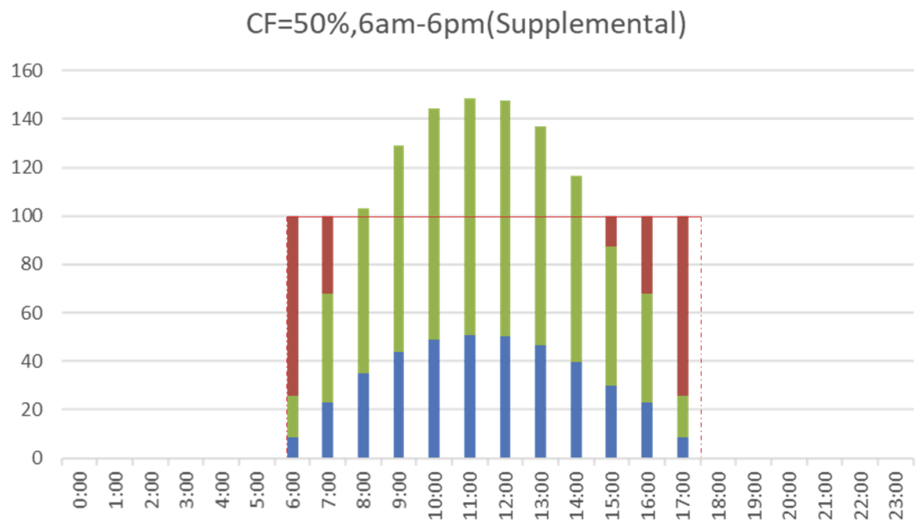

Fig.4 PV Supplemental

By adding flexible battery storage, this approach helps mitigate curtailment issues at congested nodes, making it an effective, lower-cost option for enhancing existing RE projects.

vi. Baseload Model

The Baseload model aims to deliver a continuous 100MW output over a 24-hour period, ensuring a constant energy supply to meet stable demand patterns. To provide 100MW of 24-hour power supply from solar PV coupled with a BESS, 100% capacity factor would be required and to ensure this the largest solar PV and BESS (MW & MWh) installed capacity is clearly required. The system will address intermittency, night time peak, but produce the highest PHP/kWh compared to all models. One would need to understand the baseline transmission situation to evaluate the impact of gird congestion. This model, given the higher storage requirements of 198MW, could even see time shifting towards all peak demand periods, dispatching at much higher value WESM periods.

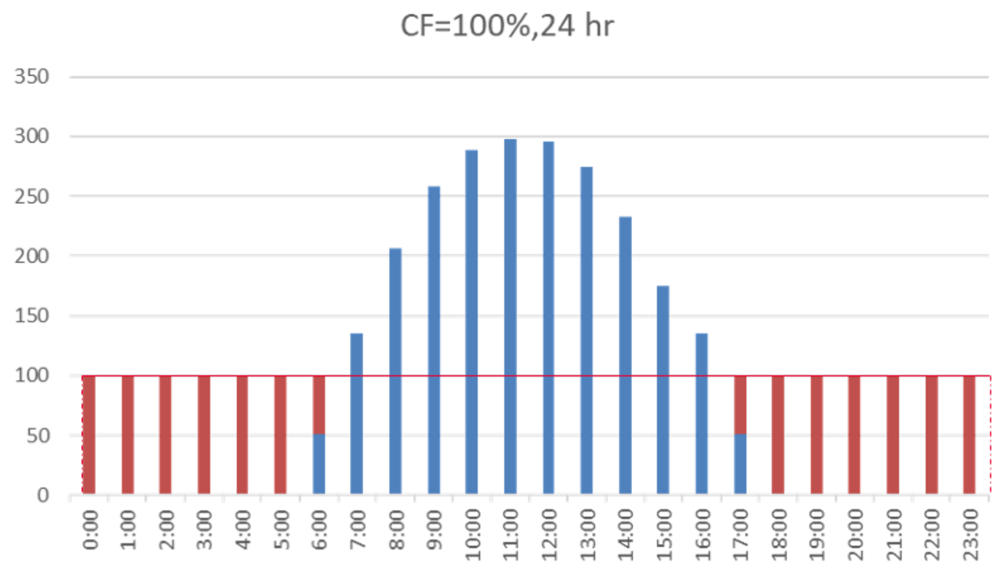

Fig. 5 Baseload

With the highest storage requirements, this model effectively addresses both day and nighttime demand but has the highest PHP/kWh rate due to its extensive BESS and solar PV needs, highlighting its utility in high-demand scenarios.

Given the short turn around to provide the various government entities with data-based modelling, PSSEA understands that the above illustrations only provide possible options on how the IRESS GEAP4 could be modelled and cannot comprehensively simulate the possible real world impacts of each. They propose options to think inside and outside the box, to what would be suitable for the Philippines in achieving its RE targets and a cost-effective undertaking.

A. Conclusion

In conclusion, the Philippine Solar and Storage Energy Alliance (PSSEA) strongly advocates for the adoption of the Integrated Renewable Energy + Storage Solutions (IRESS) within the Green Energy Auction Program 4 (GEAP4) as a pivotal strategy for accelerating the Philippines' renewable energy transition. The proposed design principles of IRESS, which prioritize new builds, fixed dispatch periods, and efficient utilization of existing transmission capacity, provide a robust framework that aligns with the national objectives of reaching 35% RE generation by 2030 and 50% by 2050. By fostering a competitive environment and ensuring that renewable energy and storage solutions are optimally combined to meet peak demand, IRESS can significantly reduce curtailment and enhance grid stability, ultimately benefitting end-users with more affordable and reliable energy.

Furthermore, the capacity factor-based approach to assessing IRESS projects incentivizes developers to maximize real-world energy delivery and grid impact rather than merely adhering to static ratios. This performance-based metric promotes dynamic system optimization, encouraging projects that can adapt to varying demand profiles and resource availability across regions. PSSEA's proposal underscores the need for a straightforward, pro-market tender design that will ensure both cost-effectiveness and high participation from the industry, driving innovation while minimizing barriers to entry. We urge the Department of Energy and the Energy Regulatory Commission to consider these recommendations, as they represent not only industry consensus but also a path forward for achieving the Philippines' renewable energy targets in a sustainable, efficient, and economically viable manner.