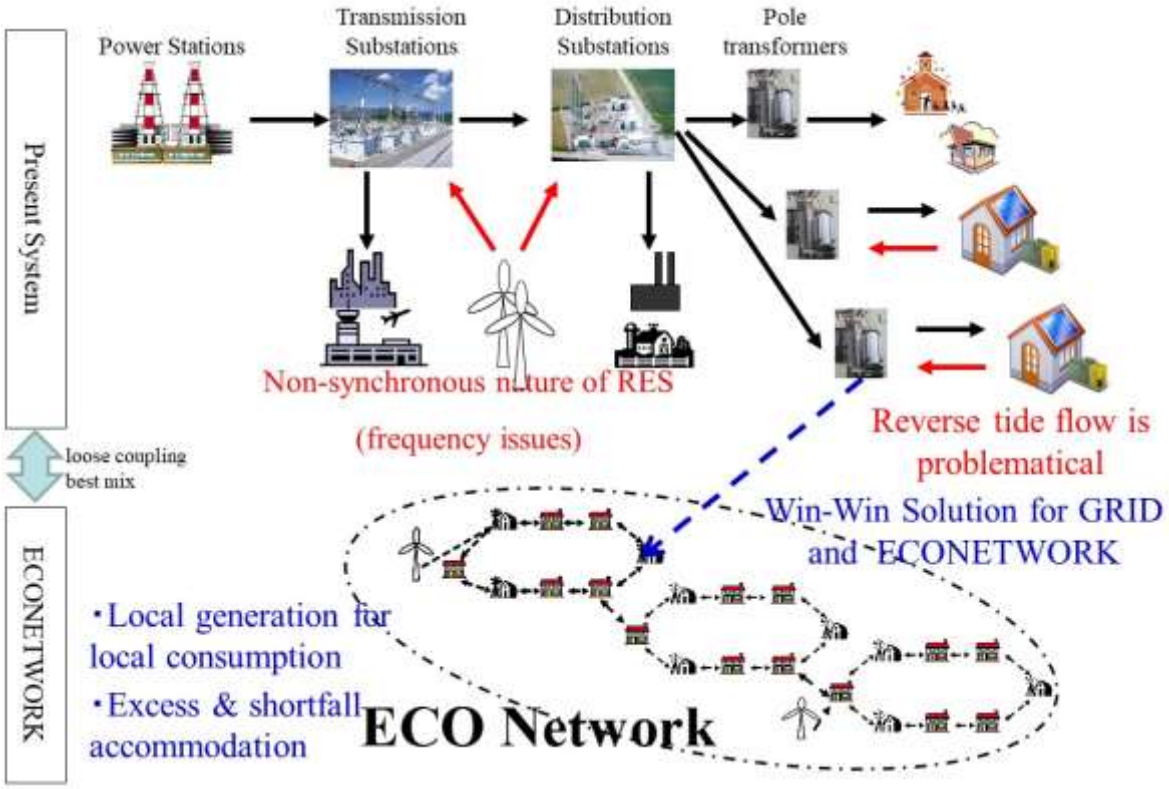
VPEC Inc. & BESST Pty Ltd:
Response to P2025 Market Design Consultation Paper

We propose Energy Security Board, ESB, to look at Variable Renewable Energy, VRE, integration issue in wider view. The paper indicates that ESB is trying to solve the issues within the framework of Nichola Tesla system, GRID, i.e., only one single frequency system from generators to consumers. It seems even the Local network is in the same frequency with GRID. In addition, market design concerns, GRID and Local networks are controlled same principle, i.e., centralized control.

We propose ESB to look at the loose coupling of GRID & Local Network, for example, ECONetwork®, Electricity Cluster Oriented Network, in which frequency, voltage and phase are controlled independently from GRID. By separating frequency, voltage and phase, many issues are solved easily.
National market doesn't need to watch the detail of local network. It can know the situation of local networks simply looking at the State of Charge, SOC, of a battery in the local network.



GRID & Local network can achieve prosperous coexistence better, as you perceive.

It has become clear that GRID is a superb system for synchronous generators, but not good for VRE.

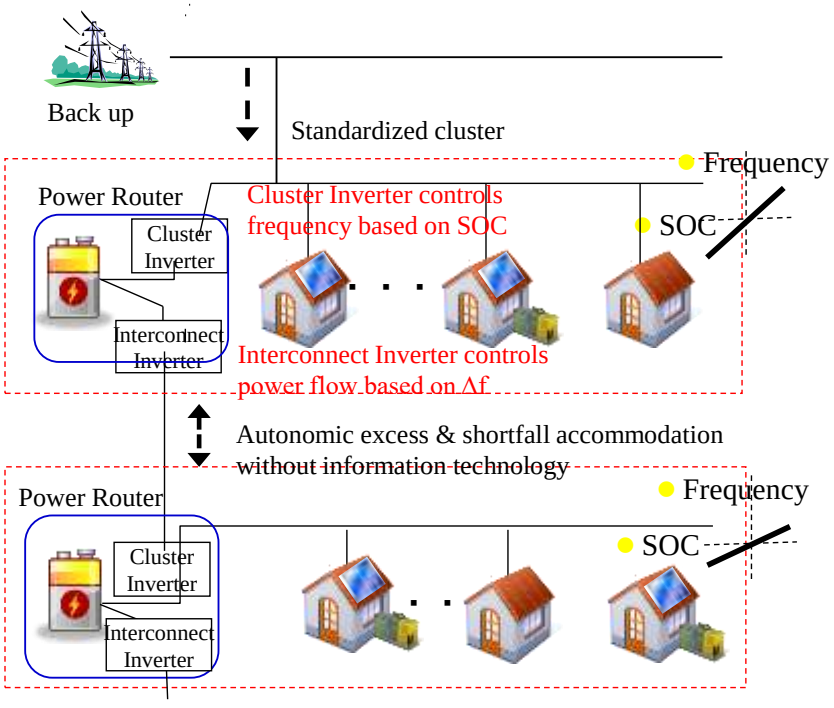
IEA indicates the stand-alone frequency and voltage control as the solution for phase-four in the table9 (p128) of System Integration of Renewables paper, 2018. In that paper Australia was defined as the phase-two, but the penetration of RES is faster, so, it is appropriate for Australian Network to apply the technology of stand-alone frequency and voltage control, which VPEC has invented and hold patent, earlier than phase-four, and propose the solution with us globally.

Table 9• Technical requirements for different phases of VRE deployment

	Always	Phase One	Phase Two	Phase Three	Phase Four
Technical requirements	- protection systems - power quality - frequency and voltage ranges of operation - visibility and control of large generators - communication systems for larger generators	- output reduction during high frequency events - voltage control - FRT capability for large units	- FRT capability for smaller (distributed) units - communication systems - VRE forecasting tools	- frequency/ active power control - reduced output operation mode for reserve provision	- integration of general frequency and voltage control schemes - synthetic inertia - stand-alone frequency and voltage control

ECONetwork control method is very simple.

A local network with generator and or battery and consumption, named a cluster, controls own frequency depending upon SOC of a battery in the cluster by a cluster inverter. Interconnect inverter decide which way power should go depending on Δ f of neighboring clusters.



The control is very simple and doesn't need Information infrastructure and central controlling equipment. Clusters can connect

progressively, and easy to disconnect. So, expandability, flexibility, resiliency is established in cost effective ways. Loose coupling with GRID is done easily through an interconnection inverter. GRID doesn't need to watch everything, it can know the situation of clusters, simply looking at the SOC of a battery interconnected to GRID. Under Tesla system, GRID must prepare for the fluctuation of VRE generators even VRE has batteries, because GRID has to control frequency and batteries don't have synchronous function. Under our proposal system, the fluctuation of VRE is controlled within each cluster, and clusters have leveling effects. By cooperative work of GRID and local network, GRID can supply back up power when GRID has more capacity, and thus GRID's performance could be better. ESB could make rule on this. Under GRID's blackout situation, clusters can survive. Consumers can know their situation by looking at the SOC of their cluster, so it is easy for them to take action.

This technology and controlling software are applicable not only for Local network but also High Voltage network as well as VRE generator itself. For example, if VRE generator has a small battery, and decide its frequency depending on the SOC of the battery, interconnection inverter controls the power flow autonomously, i.e., if GRID has more power, it stores power in the battery, and if GRID has more demand, it send the power to GRID. GRID can utilize VRE power finely, and VRE can reduce the curtailment loss.

We propose it is the time for ESB to look at a new architecture.

Best Regards

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