

More Power. Less Plant.



Battery Energy Storage: Integrating Renewable Energy into the Power Grid June 16, 2015

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Are RE integration challenges real?

Will high levels of RE have an impact on grid system security and reliability?



What should we do about it?

INNOVATE

Battery Energy Storage Systems (BESS) for Renewable Integration



Batteries on the grid? Yes!



Advanced alternative and complement to transmission, generation, and distribution.



Battery Energy Storage systems consist of modular arrays of thousands of lithium ion batteries, integrated and controlled by advanced software.



"Energy storage is among the best means to ensure we can reliably integrate renewable energy resources into the grid" – Jon Wellinghoff, Chairman, U.S. Federal Energy Regulatory Commission

Proven	 Established technology based on patented software control system. Hundreds of MW deployed around the world, with thousands more in development.
Fast & Precise	 ✓ Fastest Response - <1 second to full capacity discharge (or charge) ✓ Extremely precise response in responding to grid events or requirements.
Flexible & Modular	 ✓ Can be a generator and a load, giving it significant flexibility over a conventional power plant ✓ Can be sized to fit the exact requirement and augmented as required.
Easily Sited	 Not tied to a fuel source (e.g. hydro), so can be placed anywhere the need is No emissions = no "NIMBY" phenomenon

Introduction of Variable RE amplifies existing grid challenges in the Philippines





NGCP wants ancillary services providers with fast ramping capabilities

Source: NGCP's presentation in the 4th Annual Generators' Conference 6 Nov 2014

BESS can respond precisely to grid events or signals (AES in the blink of an eye





BESS RESPONSE

- ✓ BESS responds with rapid increase of output from 0MW to 20MW
- ✓ Autonomous response according to programmed profile
- ✓ Output sustained until stability restored

RE Integration in Puerto Rico: Behind the Fence Application to Stabilize Solar Power Output





* Real irradiation data from a weather station in Guayama, PR



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RE Integration in PJM: Laurel Mountain has delivered precise frequency regulation service in PJM since 2011







-20,000

-30,000

00:00

00:10

00:20

00:30

00:

- Operating range of +32MW to -32MW
- Precise response to 4 second AGC
- Algorithm directs BES using wind data and PJM frequency signal as inputs
- Effective wind ramp control and frequency regulation

The world's leading grid operators are procuring ES for system reliability and renewable integration





Innovation, policies, and incentives can pave the way for BES to pave the way for renewables.