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IBR PLANT MODEL DEVELOPMENT DEVELOPER/OEM/ERCOT INTERACTIONS

ERCOT IBRWG Meeting
January 12, 2024

Siddharth Pant
Solar & Storage Solutions

Topics

- Introduction to GE Vernova
- GE Vernova Solar & Storage Solutions (S&SS) Products
- OEM/Developer/Consultant/Utility interactions
- Potential gaps
- Considerations for improvements

GE Vernova Portfolio of Businesses: **One-of-a-Kind**

CONVENTIONAL POWER

Gas Power

- Heavy Duty Gas Turbines
- Aeroderivative Gas Turbines
- Steam Turbines/Generators
- Services

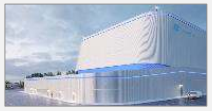
Steam Power

- Post Rochambeau
- US Nuclear, Global Coal
- Steam, Generators, Boilers
- Services

Hydro

- Hydro Turbines/Generators
- Pumped Storage

Nuclear



- Boiling Water Reactors
- Fuel
- Small Modular Reactors

WIND

Onshore Wind

- 2 -3.5 MW platform
- 5 – 6 MW platform
- Services & repowering

Offshore Wind

- Haliade-150 (6 MW)
- Haliade-X (14 MW)

LM Wind Power

- Onshore wind blades
- Offshore wind blades (Haliade-X)

ELECTRIFICATION

Grid Solutions

- Transmission
- Power Transformers
- Grid Automation

Power Conversion

- Oil & Gas electrification
- Naval electrification
- Microgrids

Solar & Storage Solutions

- Inverter platform
- Energy storage system
- Plant controls

Digital

- Grid Software
- Opus One Platform
- Manufacturing
- Power, Oil & Gas
- Aviation

ACCELERATORS

Advanced Research

- Fundamental and applied research and support GE Vernova business segments
- Funded internally and externally

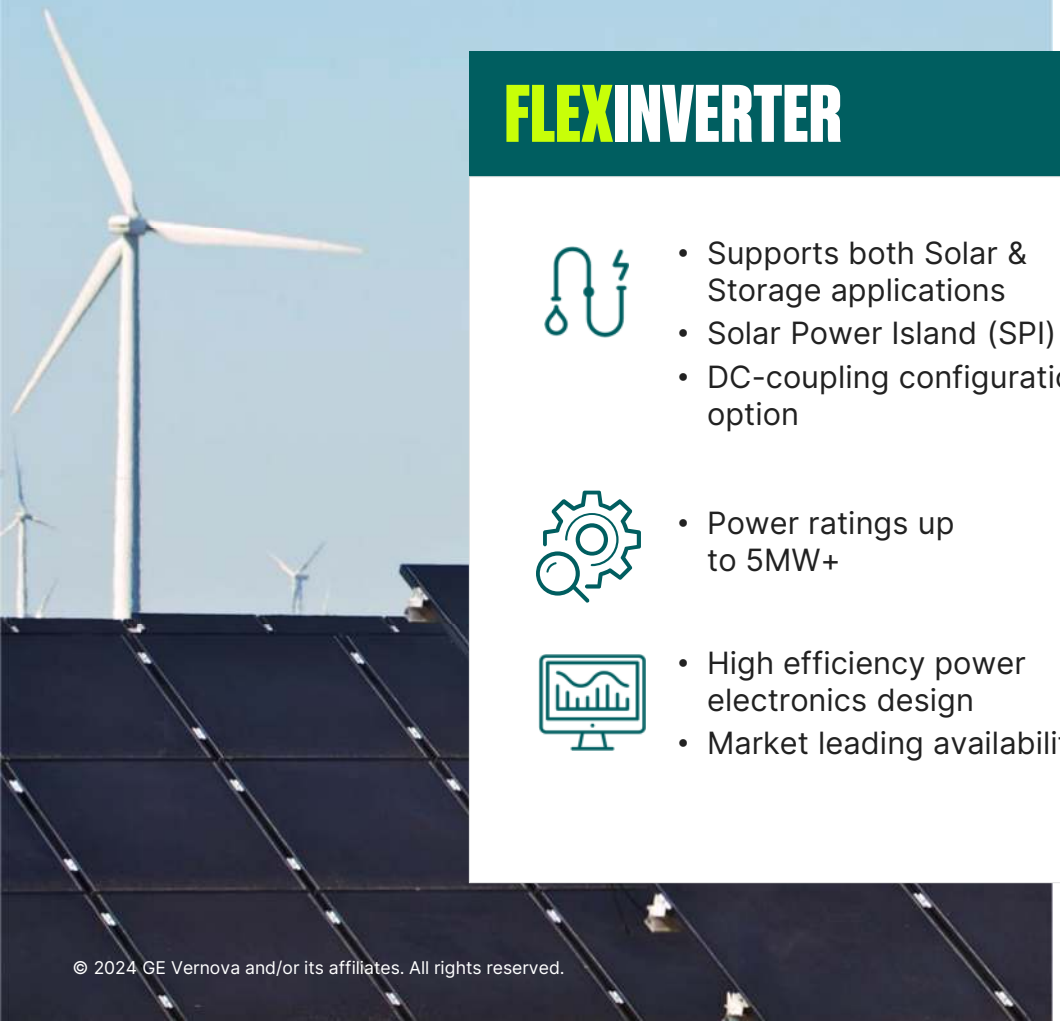
Consulting Services

- Energy consulting services to external customers
- Support GE Vernova business segments
- PSLF platform owner

Financial Services

- 3rd party financing support e.g., Export Credit Agencies (ECAs), governments, banks
- Direct financing though equity

Inverter Technology



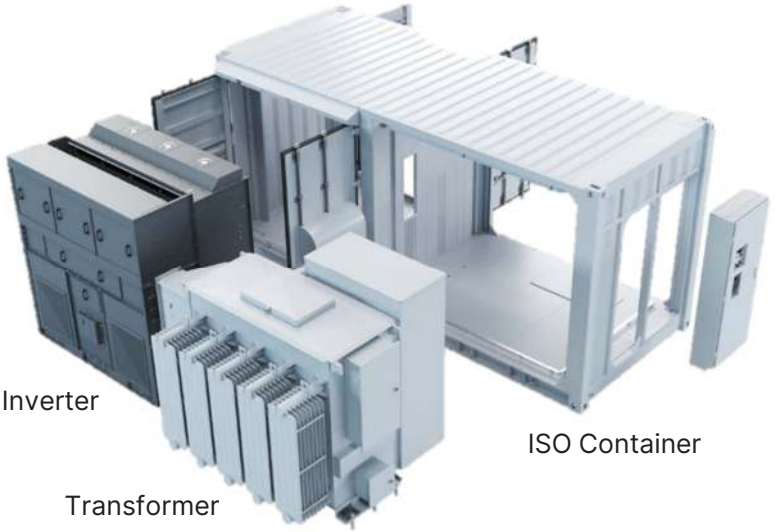
FLEXINVERTER

- Supports both Solar & Storage applications
- Solar Power Island (SPI)
- DC-coupling configuration option

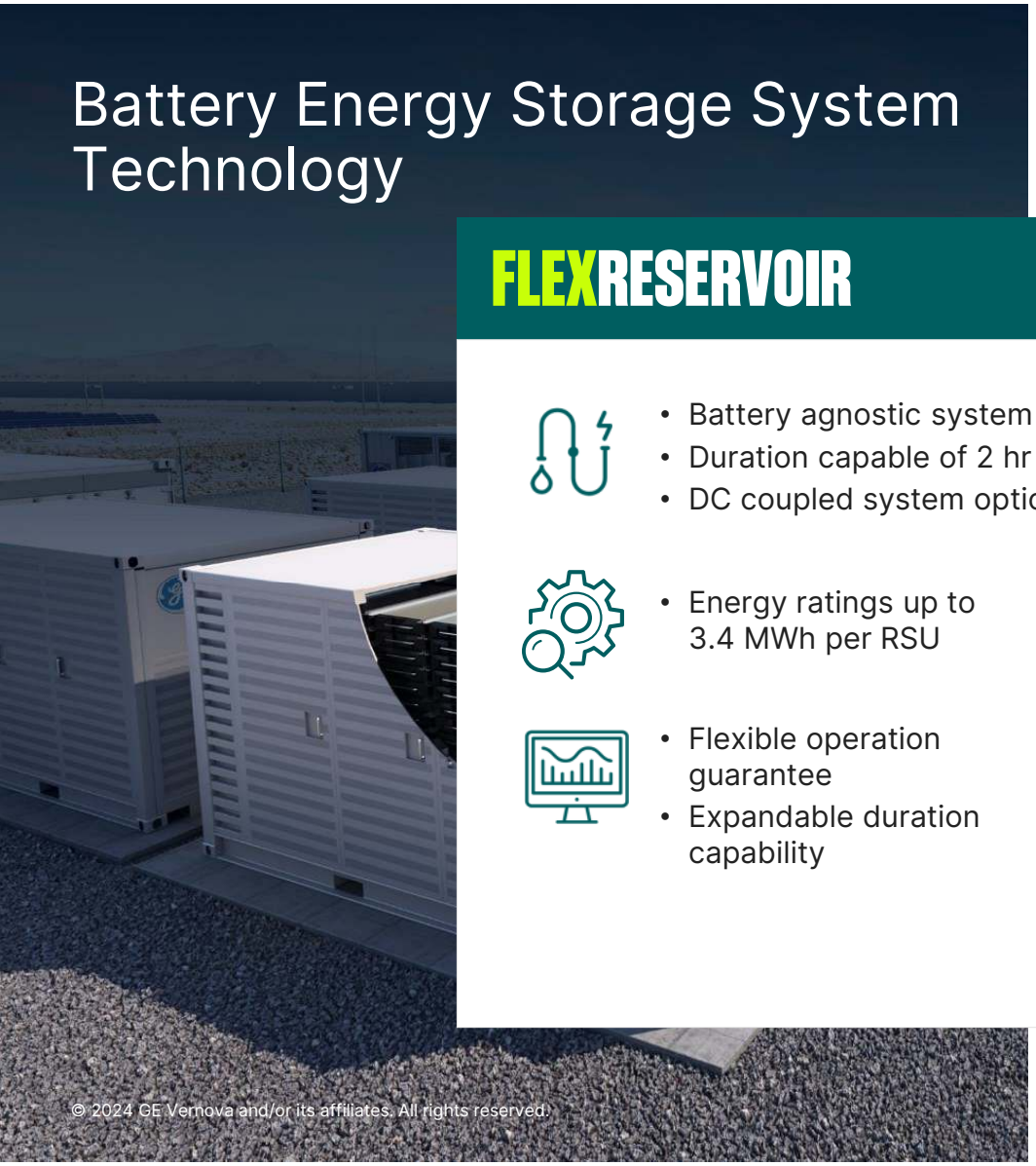
- Power ratings up to 5MW+

- High efficiency power electronics design
- Market leading availability

Power Station



Battery Energy Storage System Technology



FLEXRESERVOIR

- Battery agnostic system design
- Duration capable of 2 hr to 4 hr+
- DC coupled system option

- Energy ratings up to 3.4 MWh per RSU

- Flexible operation guarantee
- Expandable duration capability

Reservoir Storage Unit (RSU)

ISO Container

Battery Modules

- Electrical Connections
- System Controls
- Safety Systems

Controls Technology

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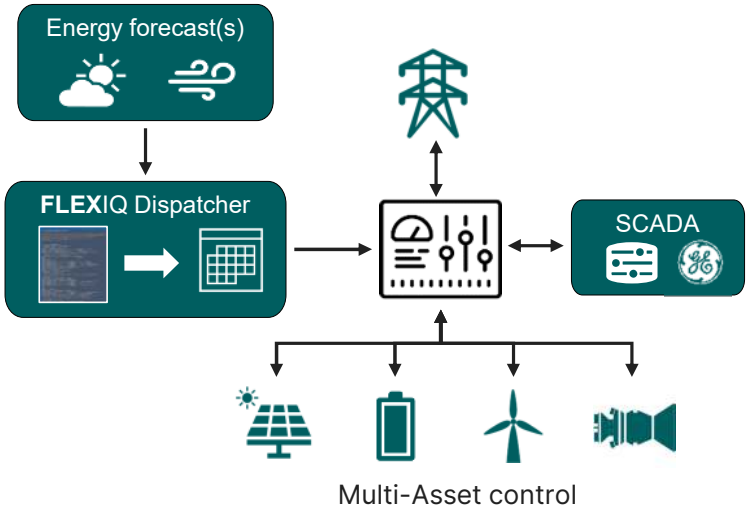
FLEXIQ

- Asset to cloud integration
- Multi-Asset control capability
- Maintains system safety and compliance

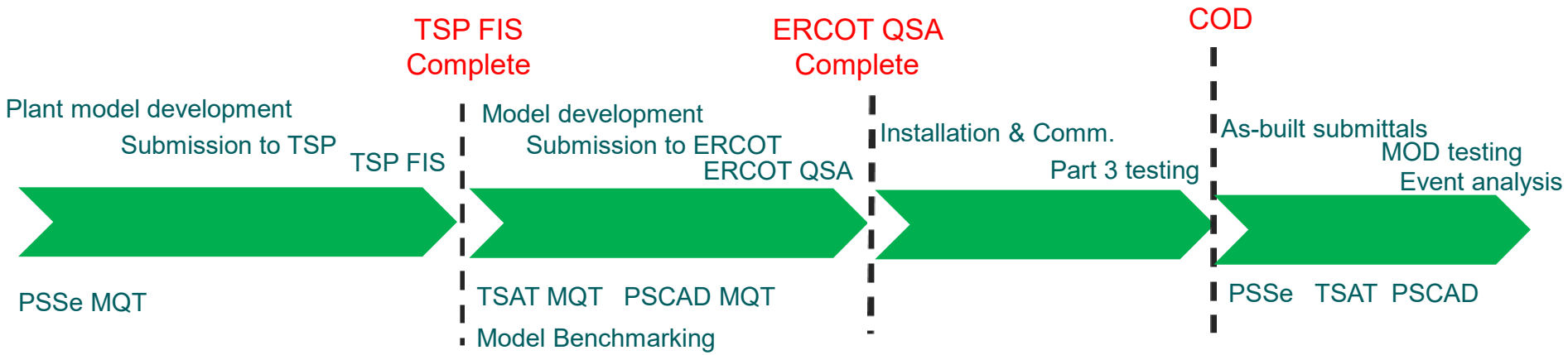
- 19 Active & Reactive power control features

- EMS: MarkVI™ based platform
- Dispatcher: capability to yield revenue over rules-based technology

FLEXIQ – EMS & Dispatcher



ERCOT Project Plant Model Interactions



- S&SS interacts with developer, consultant, or none.
- Model parameters may require changes
- Internal S&SS discussions between modeling and design teams.

- S&SS interacts with developer, consultant.
- Models and parameters may require changes
- Internal S&SS disc. between modeling and design teams
- Final model parameter changes communicated to S&SS design team.

- S&SS interacts with developer
- Equipment parameters may require changes
- Internal S&SS discussions. between commissioning & design teams

- S&SS interacts with developer for as-built submissions
- S&SS interacts with owner during MOD testing
- S&SS interacts with owner, possibly ERCOT, for event analysis
- All the above may result in parameter changes

Potential Gaps

- Consultant may not be aware of who is supplying what equipment and model for a project
- Developer/consultant may use models that they have from previous projects or use a generic model
- Developer/consultant may make model parameter changes without consulting with the OEM
- Lack of definite acceptance criteria for model performance may cause consultant & OEM to extend model tuning time
- Developer/consultant may not provide as-tuned parameters to the OEM
- OEM may not set the equipment parameters to the model parameters or their equivalents

Considerations For Improvements

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During model development and TSP FIS phase

- Developer - clarify scope of equipment and model supply to consultant
- Developer & OEM - use latest appropriate unit models from OEM
- Developer & OEM - consult regarding parameter changes
- Developer - provide as-submitted and tuned parameters to OEM

During ERCOT QSA phase

- Developer & OEM - use the latest models from the OEM
- Developer & OEM - consult regarding parameter changes
- Developer – provide final as-submitted and tuned parameters to OEM
- ERCOT - when available, and as appropriate, use IEEE P2800.2 procedures for model validation and design evaluation

Post-commissioning, MOD testing and Event analysis

- Owner & OEM - consult regarding for parameter changes
- Owner & ERCOT – Follow IEEE P2800.2 procedures, when available


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