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The Future of Distributed Generation and IEEE 1547

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IEEE 1547 background

- **Developed to facilitate connection of distributed generation (DG)**
  - Consensus based
  - Focused on safety and protecting power quality of grid from DG faults
  - Based on premise that DG not significant penetration
  - Incorporated into UL inverter standards.
- **Since widely adapted, gave inverter makers one standard to work to**
- **Key foundational piece for the DG industry we have today.**

Context for starting IEEE 1547 in 1999

- **DG is not significant power contributor on the grid**
- **DG should be prevented from causing a problem or safety hazard**
  - Anti-islanding is a prime focus
  - DG must not cause power quality issues
  - DG must disconnect if there is a grid system problem in power quality
  - Fault ride through or power quality support is not allowed

Changing situation

- **In some areas DG is a significant percentage of peak load on a feeder, or soon will be**
  - In Honolulu many distribution feeders hit 100% of minimum daytime load from PV.
- **Germany has hit 34% of country wide load from PV.**
  - Germany changing software for inverters greater than 10 kW installed after 2005 on low-voltage feeders.
  - This is to avoid sudden loss of large amount of PV power in a frequency event.

New situation

- With high penetrations of DG a present or looming reality the role of DG changes.
- Utilities cannot rely on conventional plants to provide all grid support services.
- DG must participate in provision of grid support services.

New boundary issues

- **When to help and how much?**
  - Will inverters provide grid support autonomously?
    - Will that create oscillation and stability issues?
  - Will inverters provide grid support on call?
    - How would that be managed?
  - Will utilities pay for ancillary services and capacity?
    - This is a key issue for storage, but will impact all DG.
    - Could drive big changes in DG revenue landscape.

What are new requirements in IEEE 1547?

- **Low voltage ride-through (LVRT)**
  - Currently required for large wind plants
- **Real and reactive power support**
- **Will they be set:**
  - In the new IEEE 1547?
  - By the utility or by utility to DG provider contract?
  - Dynamic response of network of DG.

Islanding issues

- **The capability of inverters to support frequency, voltage and power factor could make anti-islanding challenging.**
  - Will new approaches be required?
  - What about microgrids that will intentionally island?
  - Key concern of utilities

How significant is this change?

- **Development and adaption of IEEE 1547 is one of the keys to DG industry developed to date.**
- **The new IEEE 1547 will be one key to how the DG future develops.**
- **Distributed wind will be part of this market.**
- **Will we be ready to supply:**
  - Reactive power support
  - Frequency support
  - Low voltage ride through
  - Response to frequency events?

What does this mean for distributed wind

- **The new IEEE 1547 does not require real and reactive power support and LVRT**
- **Utilities may require these grid support functions**
  - HECO already does
- **What is the impact for distributed wind?**
  - Higher inverter costs possible
  - More expensive development and testing
  - PV leading the way.

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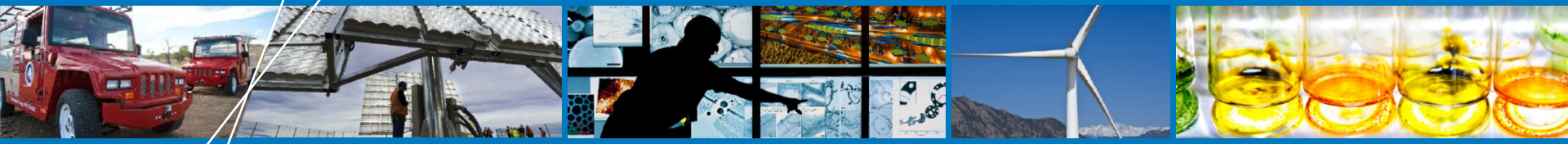

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