Digitally-Enabled Outcomes for the Grid

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Connected Intelligence, from Edge to Cloud

EDGE

Growing observability:
- 300,000+ GE assets connected to cloud-based monitoring
- 10,000+ PMUs deployed globally

Computing power accelerating:
- Wind turbine control >15X in '07-'17
- Substation controller 30X in '07-'17

UTILITY OPERATIONS

Growing number of controlled assets:
- Up to 3X assets in control by EMS, '07-'17
- 20+% CAGR in DERMS/Microgrids market
- MMS – Retail electricity markets coming

Computing power accelerating:
- 3X EMS computation burden '07-'17
- 2X Phasor Data Concentrators '07-'17

CLOUD

Asset RM&D becoming mainstream
- 10X data volume (MB/day), '07-'17

Ideal for heavy computation
- Dynamic contingency analysis
- Fleet-based analytics
- Asset Digital Twins

Emerging platform for future SCADA

Powerful outcomes possible by leveraging intelligence across all levels

Digitally-Enabled Outcomes

BETTER GRID UTILIZATION

DIGITAL TOOLS:

- **Sensors and PMUs** – reduced uncertainty, stability assessment

- **Smart Energy Mgmt & Protection** – relief of constraints
  - **Remedial Action Schemes** – N-1
  - **FACTS dispatch** – stability
  - **Dynamic Ratings** – thermal margin

- **IVVC and CVR** – more efficient operation of distribution networks

IMAGINE **30+%**

HIGHER UTILIZATION OF CONSTRAINED ASSETS

MORE RENEWABLE ENERGY

DIGITAL TOOLS:

- **Smarter Renewables** – ancillary service enabled

- **Sophisticated Energy Management**
  - **Market functions** –ancillary services, peer-to-peer transactions
  - **New flexibility levers** – storage, DERs, DSM, fast start gen
  - **Larger/faster inter-area balancing**
  - **DERMS and Microgrids**

IMAGINE **50+%**

PENETRATION OF VARIABLE RENEWABLES

BETTER RELIABILITY

DIGITAL TOOLS:

- **Asset Performance Mgmt** – every asset connected to RM&D

- **Digital Twin** – on-line model, tracking degradation and remaining useful life

- **Distribution Automation** – Faster fault detection, isolation & restoration

- **Black Start** – Enable functionality in large renewables and MicroGrids

IMAGINE **90+%**

ELIMINATION OF EQPT-FAILURE OUTAGES

Partnering with our customers on what matters

- **New grid productivity**, unleashed by the power of optimizing controls

- Connecting **cleaner** and locationally **valuable energy resources**

- Incentivizing **DER growth** and **engaged prosumers** with vibrant markets

- **Delivering reliable electricity** their customers can count on