Energy Transformation and Regional Integration of Power Systems: Scene Setter

Abu Dhabi

September 11, 2019
A MULTI-LATERAL LEARNING PLATFORM
FOR ENERGY TRANSFORMATION

MULTILATERAL SOLAR & WIND WORKING GROUP
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

CARBON CAPTURE, UTILIZATION & STORAGE
ACCELERATING CCUS TOGETHER
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

Global LEAP
Lighting and Energy Access Partnership

CLEAN ENERGY MINISTERIAL
Advancing Clean Energy Together

NUCLEAR INNOVATION:
Future CLEAN ENERGY FUTURE
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ELECTRIC VEHICLES INITIATIVE
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CLEAN ENERGY SOLUTIONS CENTER
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REGIONAL & GLOBAL ENERGY INTERCONNECTION
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H2 INITIATIVE
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CLEAN ENERGY INVESTMENT AND FINANCE
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

ISGAN INTERNATIONAL SMART GRID ACTION NETWORK
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

Participating countries:
- Brazil
- China
- India (co-lead)
- Denmark
- Finland (co-lead)
- Mexico (co-lead)
- South Africa
- Spain (co-lead, under review)
- United States (co-lead, under review)
CHALLENGES FACING ENERGY TRANSFORMATION

- Perceived high cost
- Institutional inertial/lack of capacity/how to start?
- Vested interests/political economy
- Perception that VRE is unreliable
- Technical challenges of operating grid with high shares of VRE and low inertia
- Cross-sector coordination (transport-power, transport-buildings)
- Long-term storage needed?
- Market design for low-marginal cost generators
Variable renewable energy costs continue to decline
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LITHIUM-ION BATTERIES: FOLLOWING PV?

Lithium-ion battery price survey, 2010-18 ($/kWh)
*Source: Bloomberg New Energy Finance (March 2019)*

Lithium-ion battery price survey results: volume-weighted average

Battery pack price (real 2018 $/kWh)

85% cost reduction since 2010 due to technology improvements, economies of scale, manufacturing competition

Projected Cumulative Global Storage Deployment 2016-30 (GW)
*Source: Bloomberg New Energy Finance (November 2017)*

To-date, storage deployment following similar trajectory to PV deployment in early 2000s
KEY CHALLENGES FOR ENERGY TRANSFORMATION: INTEGRATION AND FLEXIBILITY

RELATIVE ECONOMICS OF INTEGRATION OPTIONS

- Involuntary Load Shedding
- Residential Demand Response
- Industrial & Commercial Demand Response
- Joint Market Operation
- Increased Ancillary Service Liquidity
- Improved Energy Market Design
- Coal Ramping
- CT and CCGT Gas Ramping
- Hydro Ramping
- Advanced Network Management
- Transmission Expansion
- Transmission Reinforcement
- Pumped Hydro Storage
- Thermal Storage
- Chemical Storage

Option costs are system-dependent and evolving over time

Type of Intervention

MARKETS
LOAD
FLEXIBLE GENERATION
NETWORKS
STORAGE

Strategic RE Curtailment
Expanded Balancing Footprint/Joint System Operation
Sub-hourly Scheduling and Dispatch
RE Forecasting
Grid Codes
SYSTEM OPERATION

Cost
GRID-INTEGRATION STUDIES CAN MOTIVATE REGIONAL INTERCONNECTION

WECC (high_solar) + ERGIS (RTx30)
05-12 03:00 EST

Brazil  China  India (co-lead)  Denmark  Finland  Mexico (co-lead)  South Africa  Spain  United States (co-lead, under review)
FOR MORE INFORMATION

www.21stcenturypower.org

www.cleanenergyministerial.org

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