La hibridación de renovables, clave de la transición energética

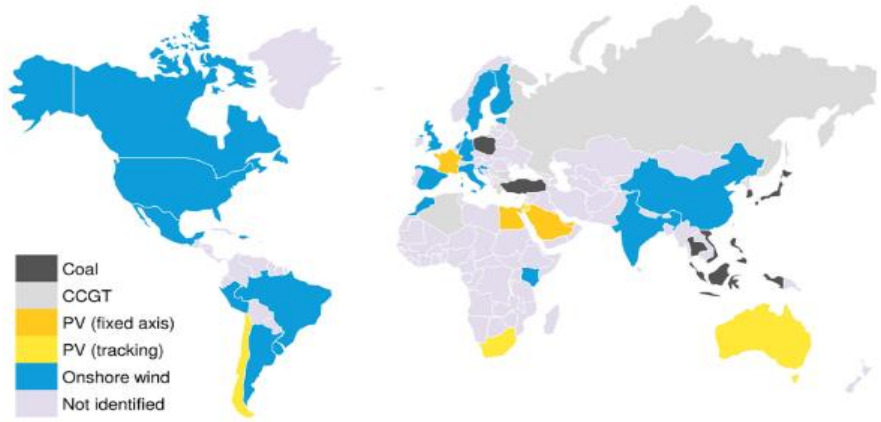
GE Renewable Energy

18 March 2020

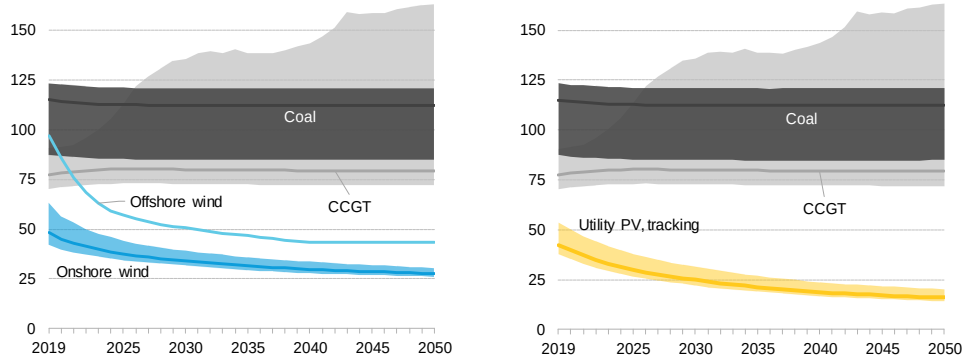
Renewable Energy is Mainstream

WIND & SOLAR CHEAPEST ENERGY SOURCES FOR 2/3 OF THE WORLD

Most competitive source of new bulk generation in 2019

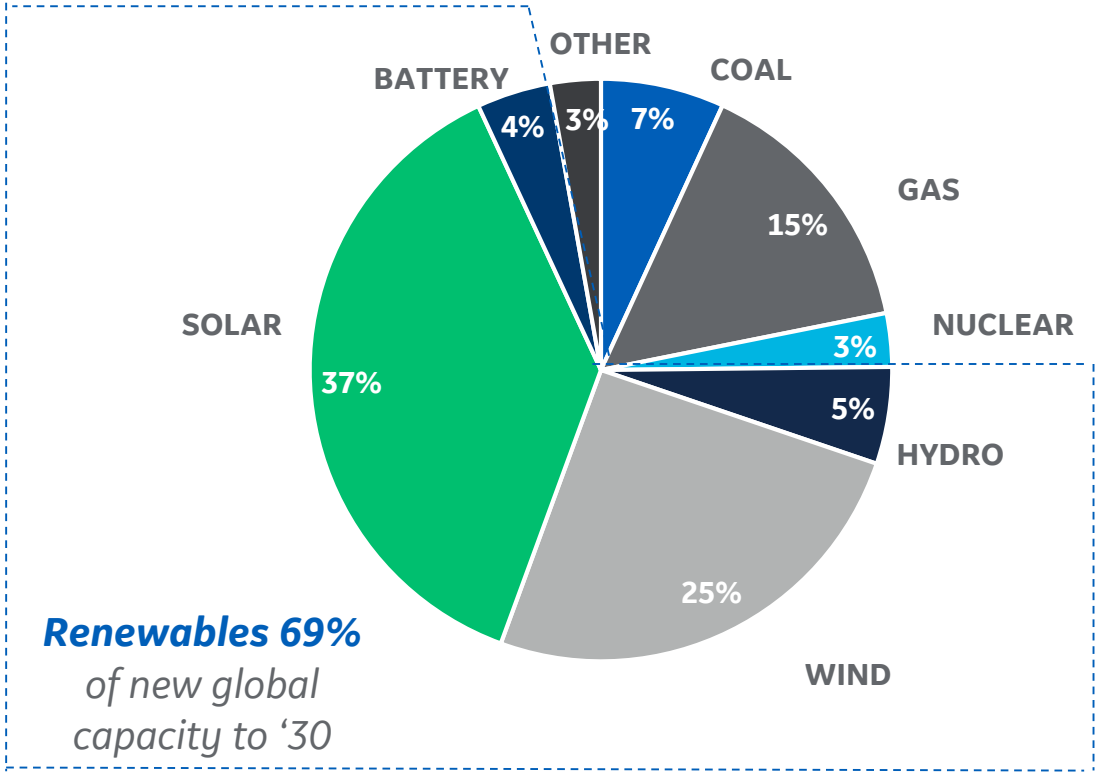


Wind and Solar projected LCOE ($/MWh, 2018 real)



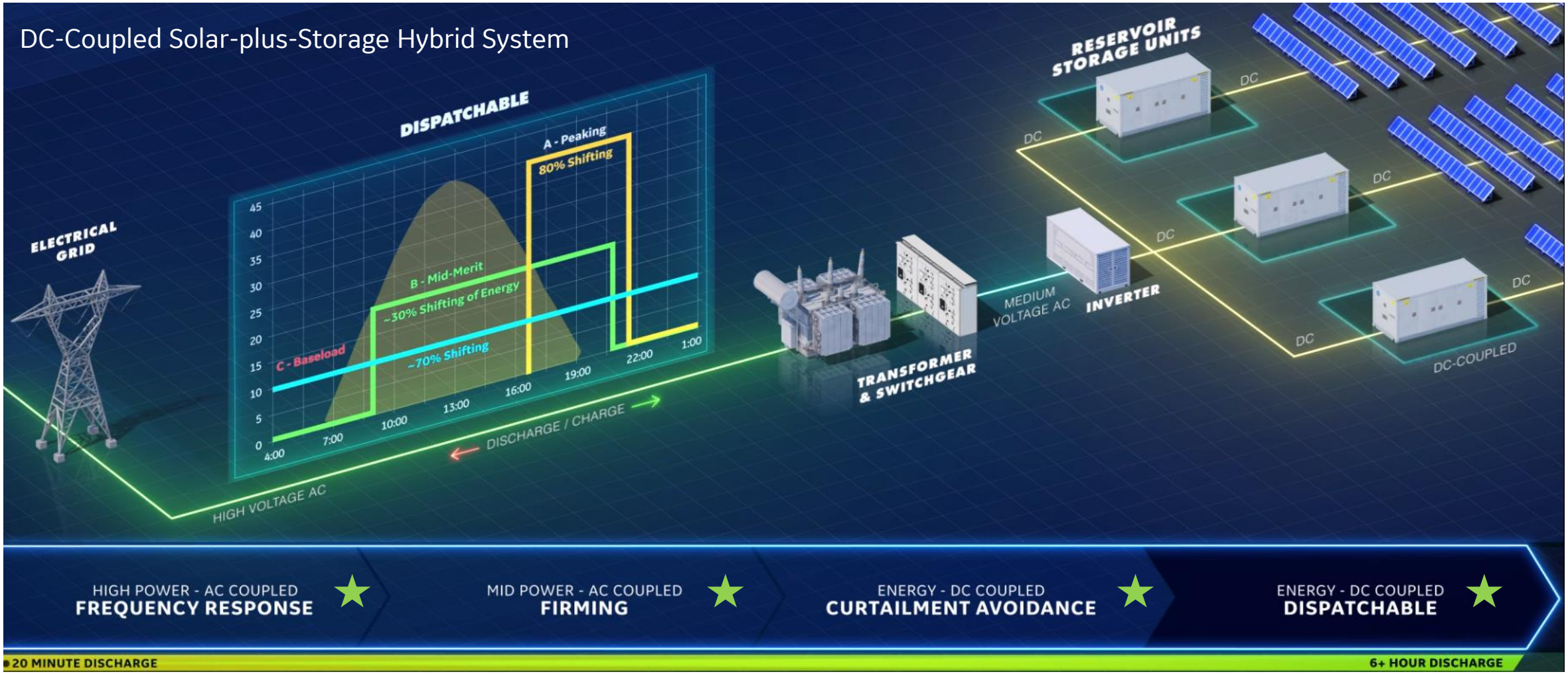
WIND, SOLAR & STORAGE INSTALLS CONTINUE TO GROW

Projected Capacity Additions 2019-2030



Source: BNEF

Hybrid Systems, enabled by **Power Electronics** and **Controls** can address the challenges of the energy transition



Regional dynamics drive different hybrid approaches

U.S./Australia – Solar + Storage

- Curtailment in high solar saturation regions
- Storage integration enables dispatchability
- Solar + Storage plants eligible for subsidies (ITC)

India – Wind + Solar

- National Wind-solar Hybrid Policy
- Optimal utilization of land & transmission infrastructure + better grid stability
- 1.9GW auctions executed (~$38/MWh)

Corporate PPAs/Captive

- Large industrial consumers to maximize self consumption
- Replacement of more expensive captive thermal generation
- Matching specific load requirements

Islands – Grid Stability

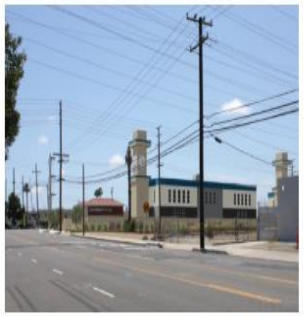
- Strict ramping requirements to grant grid Interconnection
- Hybrid integrated solution, including controls and optimization for compliance

Regulations have not kept pace with technology & markets: what's next?

- Industry practices, market rules & regulations need to be updated to remove barriers to entry and allow hybrid resources to offer their full value to the power system
- Hybrid resources should be recognized as fully integrated systems, eligible for multiple revenue streams:
  - Market participants to make their own economic choices behind the POI, following reliability and market power rules
  - Freely add capabilities to new and existing projects as long as there is no impact on transmission system reliability
  - Change in evaluating hybrid resources for interconnection purposes. Resource to make economic decisions on tradeoff between grid upgrades & cost of congestion
  - Value stacking key for hybrid project economics to make sense – developers should determine capacity obligations based on economics, without duration restrictions

Highly variable and dynamic landscape… opportunity to align market needs, market policy and product capabilities

Hybrid projects have become a reality ….



The Stanton Energy Reliability Center (SERC) is a state-of-the-art hybrid energy storage system that will consist of two General Electric (GE) LM6000 based EGT®s. EGT® refers to the Hybrid technology jointly developed by General Electric International, Inc. (GE) and Wellhead Power Solutions. The EGT® combines a turbine with

GE Renewable Energy & Stanton Energy Reliability Center implement Hybrid Electric Gas Turbine (EGT*) System with LA Basin Project

Apr 15, 2019

- GE has reached agreement with Stanton Energy Reliability Center , LLC (SERC) to integrate Battery Energy Storage systems with two LM6000 Gas Turbines
- The project is currently under construction in the Los Angeles Basin and will support energy generation for local reliability in the West Subarea
- GE will provide the hybridization solution (EGT) for two Gas Turbines.

Phoenix, April 15, 2019: GE Renewable Energy announces today that it has reached agreement with SERC to integrate Battery Energy Storage systems with two LM6000 Gas Turbines. GE, along with Wellhead Power Solutions, will provide the Hybrid Electric Gas Turbine (EGT) modification solution to allow the two Gas Turbines to operate with the Battery Energy Storage systems as a 98 MW integrated hybrid resource.

GE's Largest Battery Deal Yet Will Support a 200MW Australian Solar Plant

The Solar River project in South Australia marks GE's first confirmed foray into large-scale renewables storage.

JULIAN SPECTOR | SEPTEMBER 19, 2019

A long-awaited validation for GE's energy storage program.

GE won its biggest grid battery deal so far, to supply a solar plant in South Australia.

TOP ARTICLES

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HYBRID POWER

Shades Of Green: Wind-Battery Hybrid System Debuts In Ireland

Nov 26, 2018 by Brendan Coffey

BRIEF

GE, Juhl partner for first commercial solar-wind hybrid generation project

(Credit: Depositphotos)

GE and Southern California Edison Debut World's First Battery-Gas Turbine Hybrid

Apr 17, 2017

- Helps meet immediate energy needs in California
- *Enhances flexibility, reliability and response time to custome*
- *Allows more effective use of renewables and faster r emands*
- *Reduces environmental impact and cost for S son's operations and its customers*

California, USA - April 17, 201 Southern Califor International (NYSE: EI veiled the world's first ba Norwalk, California of two units that GE has delivere announcing initial de plans of this innovative technology.

2017 Innovation of the Year!

This system, called the LM6000 Hybrid Electric Gas Turbine (Hybrid renewable energy capacity by providing quick start, fast ramping cap

GE Renewable Energy to Implement DC-Coupled Solar and Battery Energy Storage Hybrid System in Upstate New York

Apr 15, 2019

- GE has reached an agreement with Helios Energy to integrate two energy storage and solar systems together
- The hybrid system will be installed in upstate New York at the end of 2019 and is expected to reach commercial operation in the second quarter of 2020
- The innovative DC-coupled solution improves solar yield and overall efficiency of the system while enabling dispatchable renewable energy into the grid

Phoenix, April 15, 2019: GE Renewable Energy announces today that is has reached an agreement with Helios Energy to deliver two energy storage systems to be integrated with solar arrays for the Lenox

GE has all the components to play in Hybrids

ENABLERS

- Value Modelling
- Controls
- Digital Services
- Grid Solutions

RENEWABLE SYSTEMS

- Wind
- Hydro
- Solar

STORAGE SYSTEMS

- Hydro Pumped Storage (PSP)
- Battery Energy Storage (BESS)

GE PARTNERS

- GE Power
- GE Global Research Center
- GE Energy Consulting
- GE Energy Financial Services

How?

- Hybrid site configuration, design, engineering, optimization
- Provision of hybrid hardware (wind turbines, solar modules, inverters etc.) and related operations & maintenance services
- Provision of engineering, procurement and commissioning services, when required
- Design of a Hybrid Controls architecture / GE Hybrid Controller incl. Hybrids Dashboard and reporting