# Battery Energy Storage System – the Key to Powering a Decentralized Grid

ELECTRIC POWER ENGINEERS
ENERGY ENGINEERING EXPERTS
GENERATION | TRANSMISSION | DISTRIBUTION

## Introduction

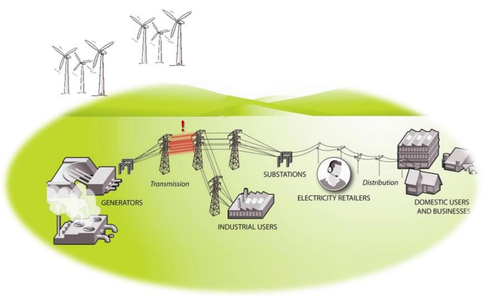
BESS has come the key to powering a decentralized grid. With the current trends such as standalone and hybrid BESS, Distributed Generation Integration, Behind the meter (BTM) and Private Use Networks (PUN), Data Centers and Crypto Mining as well as Storage as a Transmission Asset, EPE hopes to close the gap between various technologies and application considerations and help the BESS developers to develop their projects strategically.

## Due Diligence Factors

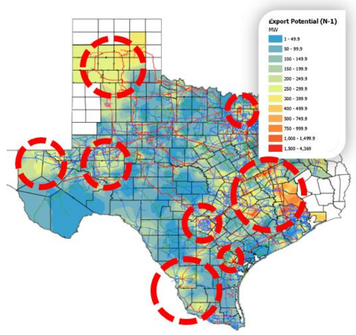
- It is important to evaluate a variety of factors that can impact the overall health of a generation interconnection, including but not limited to:
- Land
- Ownership (site control or exclusivity)
- Potential flood plain or other environmental issue
- Enough acres to fit the project size
- Studies
- Red flags in any studies
- Reliability concerns such as thermal overloads
- Assumptions used for the studies
- Impact of neighboring or future projects
- GIA language
- Economic
- Has an LMP analysis been performed?
- Do the results show that the project will be profitable over time?
- Is there are known constraint or congestion that will cause a material impact?

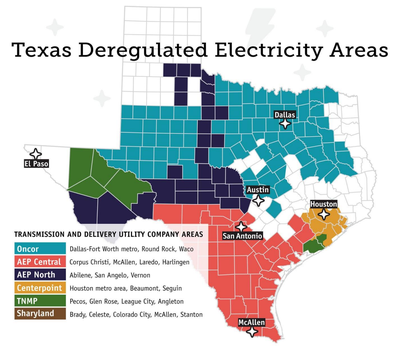
## Transmission Export Analysis

- Evaluates the export potential at a given POI
- Typically examines one or two snapshots in time:
  - Summer “Peak” conditions and/or
  - Winter “Low Load” conditions




## BESS Site Selection

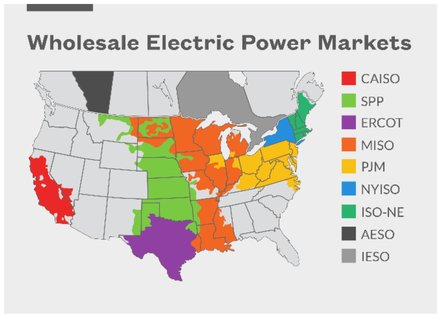



- Ease of attaining site control/exclusivity
- Price per acre. As a rule of thumb:
  - Sizing BESS: 160 MWh per acre
  - Sizing Solar: 1 MW every 4-6 acres
- Proximity to:
  - Nearby transmission/distribution infrastructure with adequate export potential
  - Load pockets or load centers (solar)
  - Volatile nodes (BESS)
- Low interconnection facility cost (gen tie, direct cost, and CCN)
- Ability to relieve (and not contribute to) existing system congestion
- Ease of attaining permits and right-of-way for gen-tie
- Export potential at the point of interconnection (POI)
- Locational marginal prices (LMP) and proximity to major biding constraints

## Energy Markets

- Coordinate the production of electricity on a day-today basis
- Market “Clears” when supply meets demand
- Regional Transmission Organizations (RTO’s)
  - Day-ahead Markets (95% of transactions)
  - Real-time Markets (hourly & 5-minute)
- Capacity Markets
  - Only in ISO-NE, PJM, CAISO, MISO and NYISO
- Ancillary Services Market – Maintaining grid frequency and other services




## Locations Marginal Prices Analysis

- Locational Marginal Price (LMP) is defined as marginal cost of supplying an additional increment in load without violating the security limits
- Reflects the price of electricity and the cost of congestion and losses at points across the grid
- Fundamental to competitive wholesale power market transactions
- May be used to influence decisions about infrastructure investment

LMP = System Marginal Price + Congestion Component + Marginal Loss Component

## Production Load Modeling

- Analyze a complex system of interconnected generators in an hourly chronological security constrained unit commitment & economic dispatch simulation
- Minimize costs while satisfying a wide range of operating conditions
- Analyze the impact of changes in the system (ex: retirement/addition of capacity) on system Operation
- Uses linearization of the AC powerflow
- Assess transmission congestion and locational marginal prices (LMP)

## Distributed Generation (DG)

- Interconnection to a distribution circuit or substation
- The generation interconnection process is typically much faster than transmission-connected projects
- Project sizes vary from 1 to 20 MW
- Each utility has their own process which usually consists of:
- System Impact Study
- Facility Study
- GIA
- Ability to participate in the energy markets