Power Grid Study Component Ancillary Services Search Results

Given the importance of the transmission grid ancillary services needed to keep the lights on I assumed that these services would be addressed in the Power Grid Study documents. In order to determine if that was the case, I searched documents for terms that I believe should be associated with this requirement using the following search terms: "Synchro", "Ancillary", "Frequency", "Inertia", "Reactive" and "Vars".

Initial Report on the New York Power Grid Study

Search terms:

Synchro

- Static synchronous series compensators
    - FACTS Devices. Fast, real-time control of flow on specific transmission paths can be achieved through Flexible AC Transmission devices such as thyristor-controlled phase angle regulators (TCPAR) and static synchronous series compensators (SSSC). These devices offer the operating flexibility to avoid congestion in meshed networks and provide an effective solution to congestion that may arise from VRE

Ancillary

Frequency (only reference in context of electric system)

- Smart Inverters. One side of the smart grid paradigm are devices that have the capability to make grid-impacting decisions on a local basis. This is especially important as Advanced Monitoring and Control technology are still in process of development and implementation that puts DER devices and lower voltage systems beyond reach. Smart inverters address some of the concerns and challenges associated with high VRE integration into the electric grid via sophisticated monitoring and communication of the grid status, and the capability to make autonomous decisions to maintain grid stability and reliability. Many existing and proposed DER already have this capability but need the overall monitoring and control infrastructure to enable their use. In addition to system benefits, these types of inverters can also:
    - Provide ride-through capability for frequency and voltage fluctuations that would typically trip the inverters
    - Regulate the use of ancillary services that may be provided by solar or storage devices.

Inertia

- No references

Reactive

- No references

Vars

- No references

Appendix C: Utility Transmission & Distribution Investment Working Group Study

Search terms:

Synchro

- Figure 57: LIPA "Phase 2" Transmission projects Summary
    - New Synchronous Condenser Installation(s) $200 million
    - A potentially major issue on the transmission system with the significant increase of inverter-based resources (IBR) and concurrent retirement of conventional fossil power plants is the weakness of the system and the potential for adverse IBR behavior due to this weakness, as well as voltage instability. This Report does not attempt to quantify

this risk. It is very likely that new synchronous resources will be required (or alternatively, existing resources not being retired and run uneconomically) to strengthen the system such that these new IBR as well as the overall power system can operate in a stable manner. Therefore, we believe that it is reasonable to include a proxy project for at least one synchronous condenser installation on the LIPA system

- Figure 85: Avangrid Solution Summary Table
  - Genesee Valley Area Phase 2 Upgrades
    - Build a new 115 kV station, bring in a new source, and add a new transformer at multiple substations. Add Power Flow Control Device - Static Series Synchronous Compensator
  - Geneva Area Phase 1 Upgrades
    - Install 115 kV Power Flow Control Device - Static Series Synchronous Compensator
  - Oneonta Area Phase 1 Reinforcement
    - Reconductor 115 kV line, upgrade terminal equipment at multiple 115 kV substations. Install 115 kV Power Flow Control Device - Static Series Synchronous Compensator technology
  - Power Flow Control Devices: This technology was proposed at several locations including three (3) different technologies (Series Reactors, Phase Angle Regulators, and Static Series Synchronous Compensator devices). Series Reactors were found to have the lowest cost but also provide the least amount of real time operational flexibility as they are static or fixed flow control devices. PAR's tended to be the most expensive but also provided maximum flexibility in responding to varying system power flow conditions. Static Series Synchronous Compensator devices are a newer technology that may offer a balanced solution between cost and flexibility although there is limited industry experience with these and they are not widely available across multiple vendors. Although this study made preliminary recommendations in some cases, further study will be necessary to make a final determination
- IV. POTENTIAL TECHNOLOGY SOLUTIONS
  - C. Energy storage for T&D services:
    - Energy storage is increasingly being considered for many transmission and distribution (T&D) grid applications to potentially enhance system reliability, support grid flexibility, defer capital projects, and ease the integration of variable renewable generation. Central to the State's policies and mandates is the need to enhance power system flexibility to effectively manage renewable energy deployment and the associated increase in variability. As power systems begin to integrate higher penetrations of variable, renewable, inverter-based generation in place of conventional fossil-fuel fired synchronous generation, grid-scale energy storage could become an increasingly important device that can help maintain the load-generation balance of the system and provide the flexibility needed on the T&D system. Pumped hydro storage (PHS) and compressed air energy storage (CAES) are long-established bulk energy storage technologies.
    - Utility-scale lithium ion battery storage has expanded dramatically, as decreasing lithium ion battery costs make this an increasingly cost-effective solution to meet T&D non-wire, reliability, and ancillary service needs. Redox flow batteries, sodium sulfur batteries, thermal energy storage (both latent and sensible heat), and adiabatic compressed air energy storage are all in various

stages of demonstration. This information provides a concise overview of a wide variety of existing and emerging energy storage technologies being considered for T&D systems. It describes the main technical characteristics, application considerations, readiness of the technology, and vendor landscape. It also discusses implementation and performance of different energy storage technologies. In this Report, energy storage systems greater than 10 MW and four or more hours of duration, are considered as bulk and transmission and sub- transmission-connected energy storage.

Ancillary

- IV. POTENTIAL TECHNOLOGY SOLUTIONS
  - C. Energy storage for T&D services:
    - Utility-scale lithium ion battery storage has expanded dramatically, as decreasing lithium ion battery costs make this an increasingly cost-effective solution to meet T&D non-wire, reliability, and ancillary service needs.
- APPENDIX A: TRADITIONAL PLANNING CRITERIA
  - A. Production Cost Modeling
    - Production cost modeling is a tool for simulating and studying the electric market in a defined area. Typical uses include day-ahead market simulation, long-term market impact studies, future year production cost, planning and market efficiency simulation, multi-day resource and ancillary services optimization, and congestion and outage analyses. For production cost modeling many available tools are available to utilize. For example, a Linear Programming- based Security Constrained Economic Dispatch (SCED) and/or Security Constrained Unit Commitment (SCUC) can be used to perform both short- and long-term market simulation.
- ii) Proposed Regulatory Frameworks for Equitable Cost Recovery of CLCPA Projects
  - 4. Renewable Generator Sponsorship
    - Unlike the other three options, this approach would result in the cost burden of projects being directly assigned to unbottled generators. Cost allocation would still be regional, to the extent that generators recover the transmission investment costs they incur to utilities through the REC or OREC payments or NYISO market revenues (energy, capacity, and ancillary services, as applicable) they receive. However, this approach could raise free ridership concerns, as a generator may benefit from a project funded by another generator, and, unlike other ISOs such as PJM Interconnection Inc., the NYISO does not administer any firm transmission rights to guarantee delivery.
- Part 2: Technical Analysis Working
  - vi) Other Key Assumptions
    - The DSIP analysis focused on typical 1-in-2 impacts for which a market driven battery storage charge / discharge profile was used. The key objective of the CLCPA 70x30 analysis is to identify grid constraints under minimum net load and maximum net load conditions so the nameplate capacity was applied to reflect a scenario where battery storage is not managed by the utility, but managed by developers and customers. It is possible that battery storage could be operated under conditions which align with local need, thereby increasing headroom. However, for planning purposes battery storage is assumed to be operated by the battery owner or developer. In effect, because battery storage is not

operated by the utility it could be managed to align with other needs such as ancillary services which may be misaligned with local needs.

Reactive

- 4. LIPA Phase 2 projects
  - c) Protection Projects
  - The "Phase 2" Protection projects which have been included are based on following assumptions:
    - Install 48 line regulators and/or capacitors on DER feeders to maintain to provide reactive compensation for DER inverters and associated voltage control.

Vars

- No references

Frequency

- No relevant references

Inertia

- No references

Appendix D: Offshore Wind Integration Study

Search terms:

Synchro

- No references

Ancillary

- Table 3-7. Sensitivity Conditions - Scenario 1

Sensitivity	Description	Analysis*	Study Years
Ancillary services	Co-optimize Energy & AS (enforce NYISO AS requirements)	PCM	2035

- 3.4.4.2 Production Cost Modeling / Economic Analysis Results
  - The additional sensitivities shown in Table 3-7 did not reveal significant OSW curtailment or transmission system weaknesses; in nearly all cases curtailment remained zero or negligible:
    - The scenario enforcing NYISO ancillary services requirements showed 2,421 MWh of curtailment. It was considered that enforcing ancillary services might force more thermal generation online and therefore increase offshore wind curtailment. However, since most ancillary service requirements can be met by power plants anywhere in NYISO, offshore wind curtailment was not significantly impacted.
- 8.2 Offshore Costs
  - 8.2.1 General Assumptions
    - Market fluctuations and location-specific cost drivers are excluded from the offshore cost estimation. The cost estimation for 2020 is based on historical cost data from year 2017. The cost of each OSW project could be impacted by certain specific cost drivers such as required ancillary services, redundancy level, the scope of service contract, ambient temperatures, water depth, and cable routing. Except for offshore platforms, those specific drivers will not be considered at each OSW project level, instead they were considered on an average basis.

Reactive

- 3.2.3 Modeling Assumptions
  - Phase Angle Regulators (PARs), switched shunts, and load-tap-changing (LTC) transformers were allowed to regulate in pre-contingency conditions; they were locked (non-regulating) in post-contingency conditions. Static var compensator and Flexible AC transmission system devices in NYCA were set to zero reactive power output pre-contingency but were allowed to regulate up to their full output post- contingency.

- 5.1.1 HVAC Technology
  - HVAC illustrates the Radial connection approach used by the offshore wind industry to date with more operating experience and industrially mature technology. This technology requires reactive compensation schemes at cable terminals and midpoints in case of transmission distances beyond 70 miles. Long HVAC cable systems (> 70 miles) have also been observed to result in challenges related to harmonics, control interactions, operational configuration management and voltage regulation

- Table 8-6. The Comparison of Combined CAPEX of the Three Variants

Reactive Compensation	47	8	115	20	175	30

- 8.2.4 Levelized Transmission Cost of Energy (LTCOE)
  - The baseline uncertainty in the onshore and offshore cost estimates of ±30% combined with the ±9.5% uncertainty due to the technology learning curve applied to model reduction in costs over time, directly translates into the LTCOE uncertainty, presented in the second column of Table 8-8. The Meshed design has all the components from the Radial design plus added cables and reactive compensation. This means there is no situation where the Meshed design would have a lower LTCOE than the Radial design due to uncertainty span in the estimates.

Vars

- No references

Frequency

- 5.1.2 HVDC Technology
  - HVDC converters can be divided in two main technologies: Line Commutated Converters and insulated bipolar transistor based Voltage Source Converters (VSC). Since line commutated converters need to be connected to a relatively strong AC network, which is rare in coastal urban regions, VSC technologies are the superior and technically feasible HVDC option for OSW connections. VSC technologies can also be controlled to provide voltage and frequency support to the onshore grid and have black-start capabilities. For the purpose of this Study, 320 kV symmetric monopole and 525 kV symmetric bi-pole HVDC technologies were considered.

Inertia

- No references

Appendix E: Zero-Emissions Electric Grid in New York by 2040 Study

Search terms:

Synchro

- No references

Ancillary

- Ramping Adequacy and Flexibility Ramping Adequacy
    - Flexibility reserve (Flex) is a relatively new type of ancillary service product that has been implemented in CAISO (California) and MISO energy markets to address the increasing need for resources that can rapidly ramp up or down to respond to the changes in the intra-hour production of renewable resources. The study estimated the Flex adequacy requirements in supply portfolios based on the estimated sub-hourly variation in renewable energy production and load.

Reactive

- No references

Vars

- No references

Frequency

- No relevant references

Inertia

- No references