



Generation Interconnection and Transmission Planning Reform Proposal

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ESIG/NAGF/NERC/EPRI Generation Interconnection Workshop



Agenda

- Overview of Enel whitepaper
- GI NOPR Recommendations

For more detail, please see Enel's whitepaper and Advanced Energy Economy's ANOPR filing (pg 45-49)

Many concepts would benefit today's interconnection process even if integrated interconnection and transmission planning process is not adopted

<https://www.enelgreenpower.com/content/dam/enel-egp/documenti/share/working-paper.pdf>

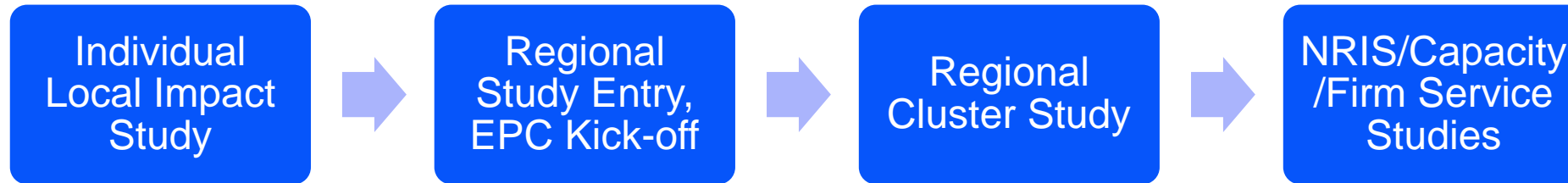


Plugging In: A Roadmap for Modernizing & Integrating Interconnection and Transmission Planning

Creating a more efficient interconnection and transmission planning process to unleash America's clean energy economy.

Comprehensive Reform Proposal

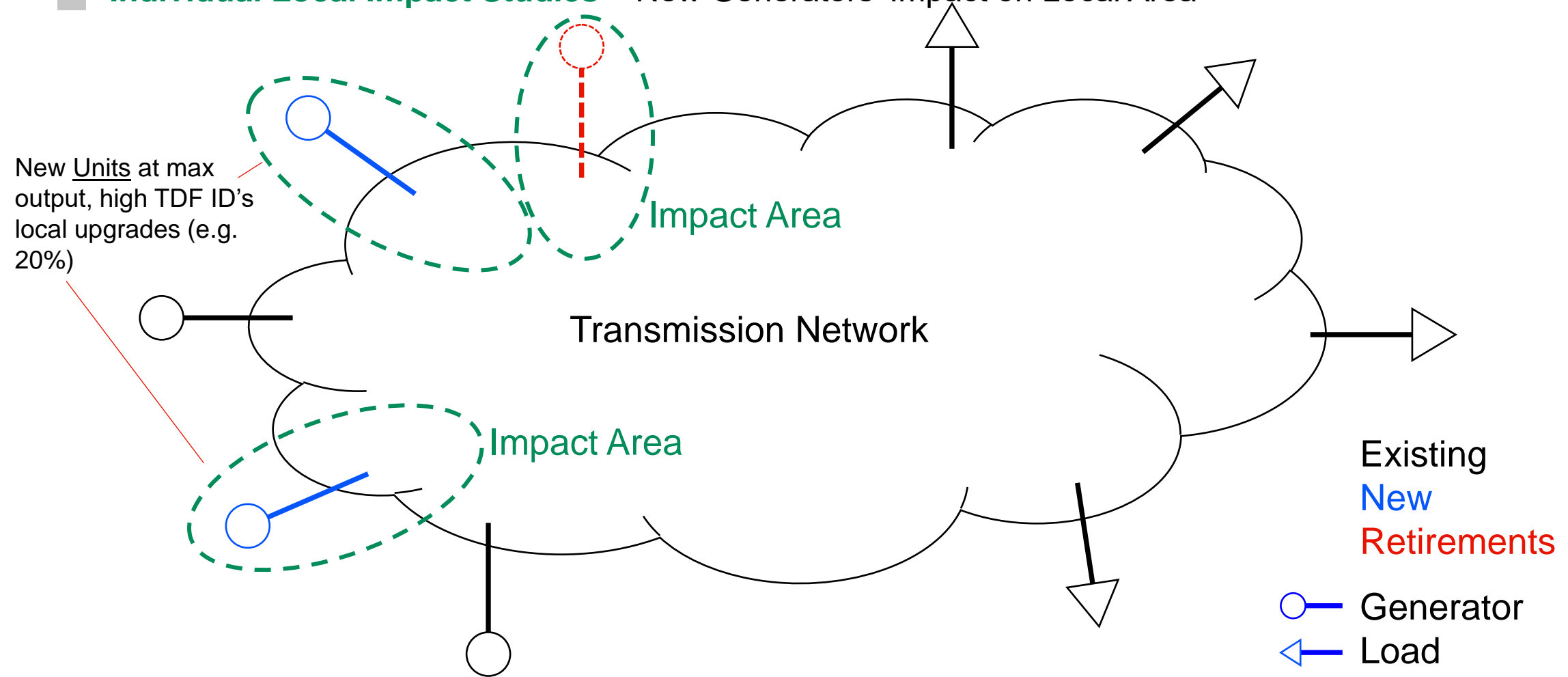
30,000 ft. view



- **Individual Local Impact Study** - Individual binding system impact study identifies local issues only, produces binding ERIS results
- **Project Commitment and EPC Kick-off** - High readiness hurdles to enter regional cluster study, 100% non-refundable security. Earlier start to facility study and EPC work coupled with competitive process accelerate overall interconnection timeline.
- **Regional Cluster Study** – Regional transmission designed efficiently in regional cluster study, focus on reliability and economic benefits for load.
 - Could be either new interconnection study step or consolidated into regional planning process
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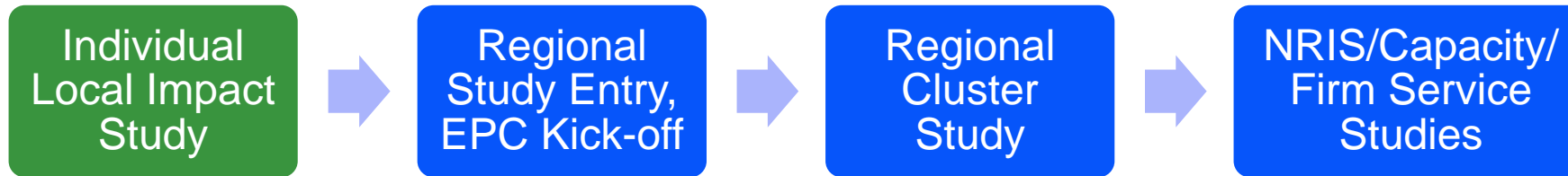
Interconnection Reform Concept

Individual Local Impact Studies – New Generators' Impact on Local Area



Individual Local Impact Study

Proposal Overview



- **Purpose:** Provides generators close to meeting readiness with binding ERIS costs to inform project development process.
- **Study specifics**
 - Target local constraints through high TDF criteria (suggest 20% PTDF/OTDF, 1% voltage change/100 MW)
 - Optimize project size and POI during power flow analysis, then run stability, short circuit, and other studies
 - Fuel based dispatch with reasonable interconnection assumptions (or consider economic studies)
 - Individual study for all types of changes (gen addition, load addition, retirement, TSR, etc).
 - TP must complete studies prior to regional planning window.
 - Does not commit project to regional process
- **Results**
 - Costs would be limited to those local upgrades with obvious benefit to “as available” interconnection service.
 - Any constraints beyond the local area would be optimized in the regional planning process in light of other generators in the regional cluster for more efficient design
 - Generator receives high cost certainty for basic interconnection. Additional costs during regional/capacity study phases are associated with quantified congestion/capacity revenues in excess of incremental cost

Real Life Example

300 MW ERIS SPP Interconnection

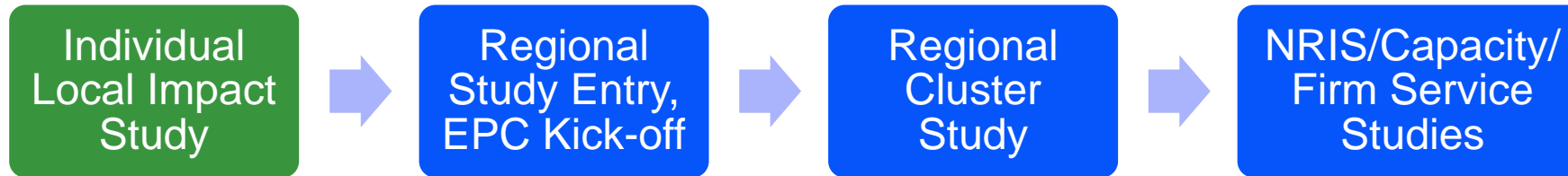
- Upgrades shared with 14 SPP projects
- 4 SPP, 5 MISO, 3 AECI studies so far
- Upgrade criteria and distance
 - **SPP**
 - >3% TDF under N-0
 - 2% voltage change (cluster impact)
 - Transformer and capacitor
 - **MISO**
 - 1% voltage change (cluster impact)
 - Capacitors/statcoms
 - **AECI**
 - 3% of facility rating (cluster impact)
 - 8 69 kV lines and transformers

★ Project



Individual Local Impact Study

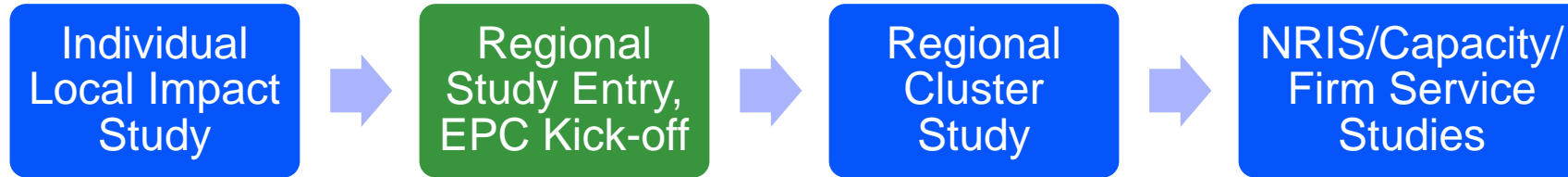
FERC Interconnection NOPR Recommendations



- **Informational study and Cluster Study (NOPR proposed solution):**
 - Non-binding studies have rarely been used (e.g. optional feasibility, MISO's SPA, SPP's PISIS)
 - Results are not dependable without knowing the joint impacts of cluster
 - Recommendation: Either implement individual study with binding upgrades (as proposed here) or, for initial Cluster Study proposed in NOPR, perform power flow only and allow customers flexibility to optimize project after seeing initial results with their cluster.
 - SPP, MISO, and Minnkota Power all perform power flow first and allow optimization such as project size reductions, dropping NRIS, and making improvements to project configurations prior to adding dynamics in Phase 2
 - Allowing for project optimization once the generation in the cluster is known and initial binding results have been provided increases the likelihood of project success and reduces withdrawal and queue churn
 - Need further clarification from FERC on appropriate constraint criteria (e.g. TDF, change in voltage, etc), contingency types, etc. for each interconnection and transmission service type.
 - Individual Transmission Provider's criteria should be included in Tariff along with criteria for cost allocation and contingent facilities

Project Commitment to Regional Study

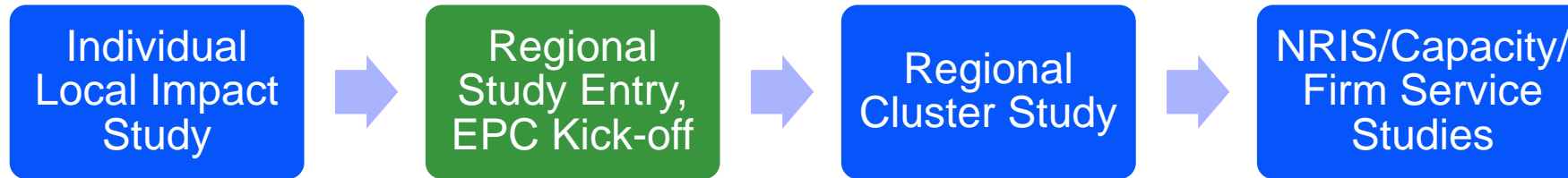
Proposal Overview



- **Purpose:** Generators provide close to 100% financial security in exchange for 100% certainty in basic interconnection costs. High readiness requirements limit the volume of requests moving forward to Cluster Studies and improves the ability of Transmission Providers to process interconnection queues
- **Entry Requirements**
 - Generators enter ONLY when they are ready to build - shown by 100% site control for generator, interconnection facilities and POI, development milestones, financial commitment, others?
 - 100% of identified local upgrade cost required in at-risk security to enter regional study
 - Minimum \$/MW security requirement, refunded at COD if above actual costs

Project Commitment to Regional Study

FERC Interconnection NOPR Recommendations



- **Readiness**

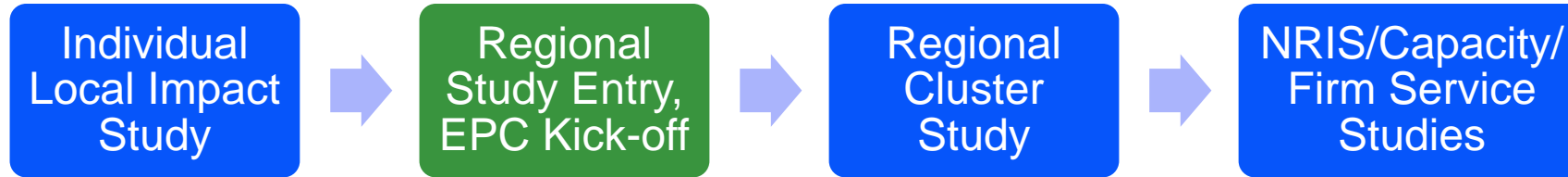
- No generation project is fully developed and “ready” without binding interconnection results
- Further consideration should be given to ensure companies which monetize projects without selling to the local utility are not unfairly subjected to more risk. Encourage IPPs to review and respond to NOPR (NOPR p128-137)

- **Financial security**

- Best practice: require financial security in proportion to cost of assigned interconnection upgrades
 - Provides proper signal for generators to proceed or withdraw based on results
- Security and potential withdrawal penalty should both increase in studies progress
 - Increase security and/or risk after each study to motivate timely withdrawal
 - Withdrawal penalty should only offset actual, specific harm including restudy cost & increased upgrades
 - Penalty free withdrawal should include both \$/MW and % increase thresholds (reference SPP and MISO)
 - SPP, MISO, and PJM use/have proposed similar \$/MW to enter, 10% after a 1st study, 20% after a 2nd study
 - Best practice: SPP’s cost allocation square factor is a best practice, limiting the magnitude of security when exorbitant first phase costs are identified prior to withdrawals

EPC Kick-off and New Competitive EPC Option

Proposal Overview



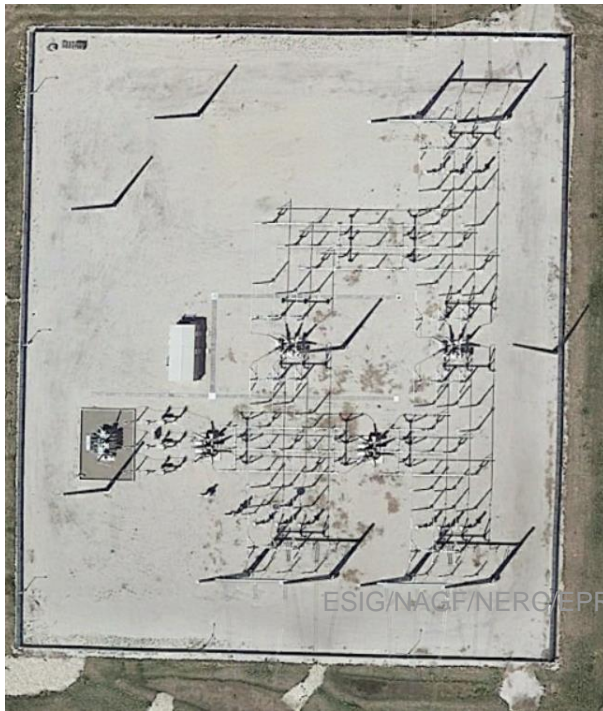
- **Upgrade construction**

- Traditional or competitive facility study bid process starts upon readiness demonstration and security payment (IC election)
- New IC option for competitive bid
 - Bid process replaces facility study. Timely bids required to be selected
 - Standalone upgrades (new lines & substations) can be designed, built and owned by any party
 - Existing transmission operator would operate new equipment to reduce operational complexity
 - Proposals accepted for traditional or alternative technology upgrades for constraints on existing facilities
 - Top few bidders split facility study deposit
 - TP approves acceptable solutions; IC selects bid with preferred cost and schedule
 - Incumbent utility could have ROFR option to match winning bid and schedule if its own bid was not selected
 - Winning bidder sets design parameters, designs, procures materials, constructs, owns, and maintains facilities
 - Winner receives fixed percentage above bid or reasonable rate of return (5-7%?), but bears cost overruns & is penalized for delays
 - Network Upgrade O&M costs passed to load as is done today, possibly rate of return as well

Real Life Example

345 kV Point of
Interconnection Substations

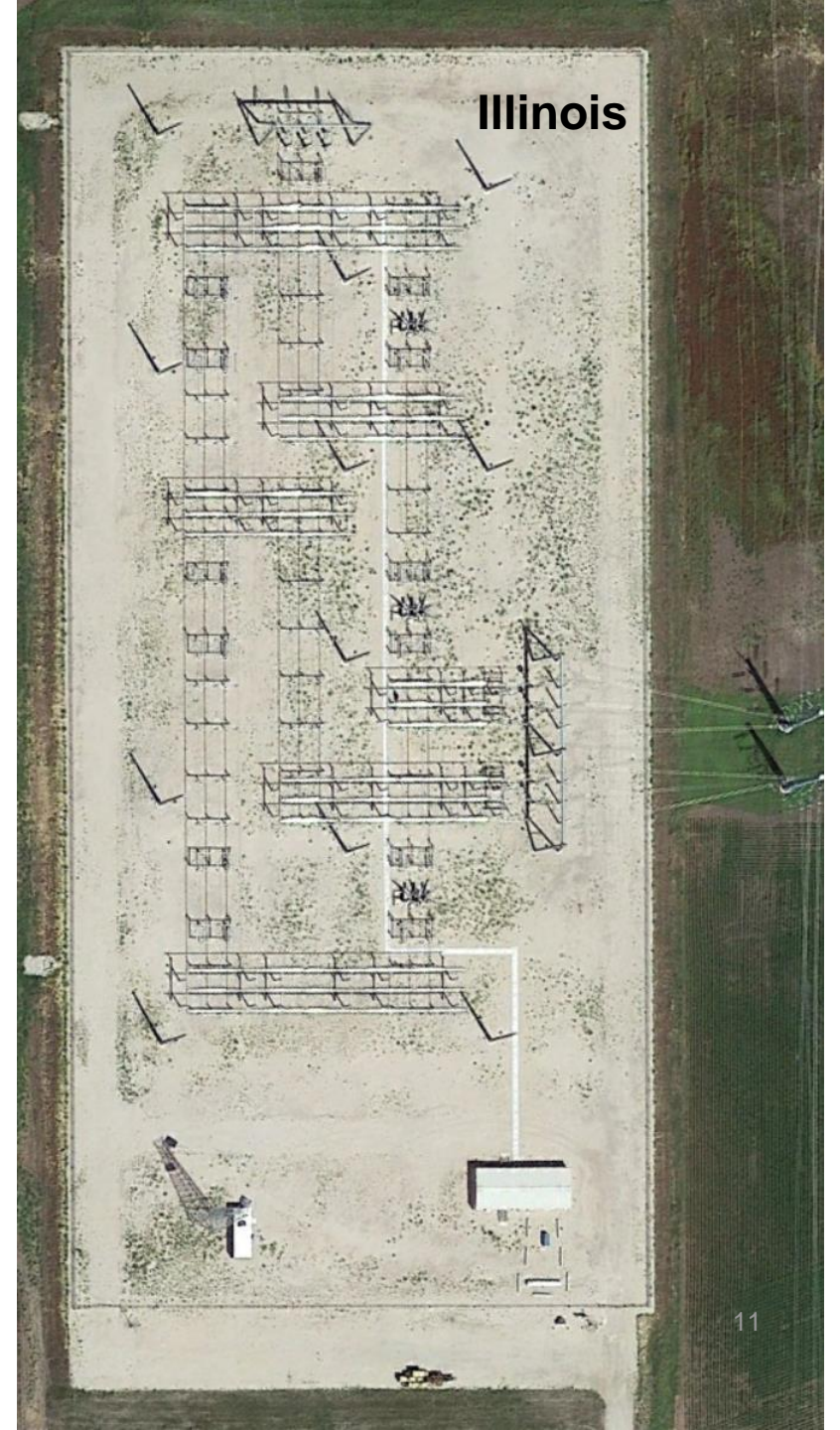
Missouri



Oklahoma

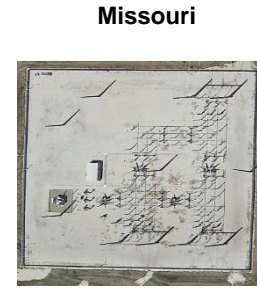


Illinois



Real Life Examples

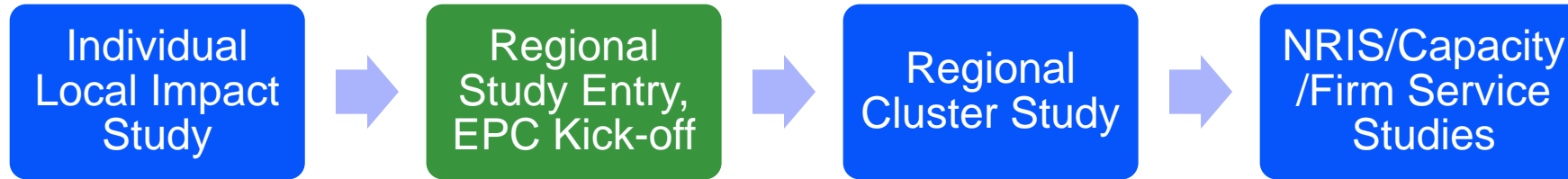
345 kV Point of Interconnection Switching Station Designs



State	Missouri	Oklahoma	Illinois	Low vs High
Initial Configuration	Ring	Ring	Ring	
Expandability	1 spare position	6 breaker ring or Breaker and a half	6 breaker ring or Breaker and a half	
Station Area (acres)	3.5 ac	7 ac	8.6 ac	2.5x
Perimeter (feet)	1565'	2433'	2660'	1.7x
Buswork (feet)	750'	1225'	2300'	3.1x

EPC Kick-off and New Competitive EPC Option

FERC Interconnection NOPR Recommendations

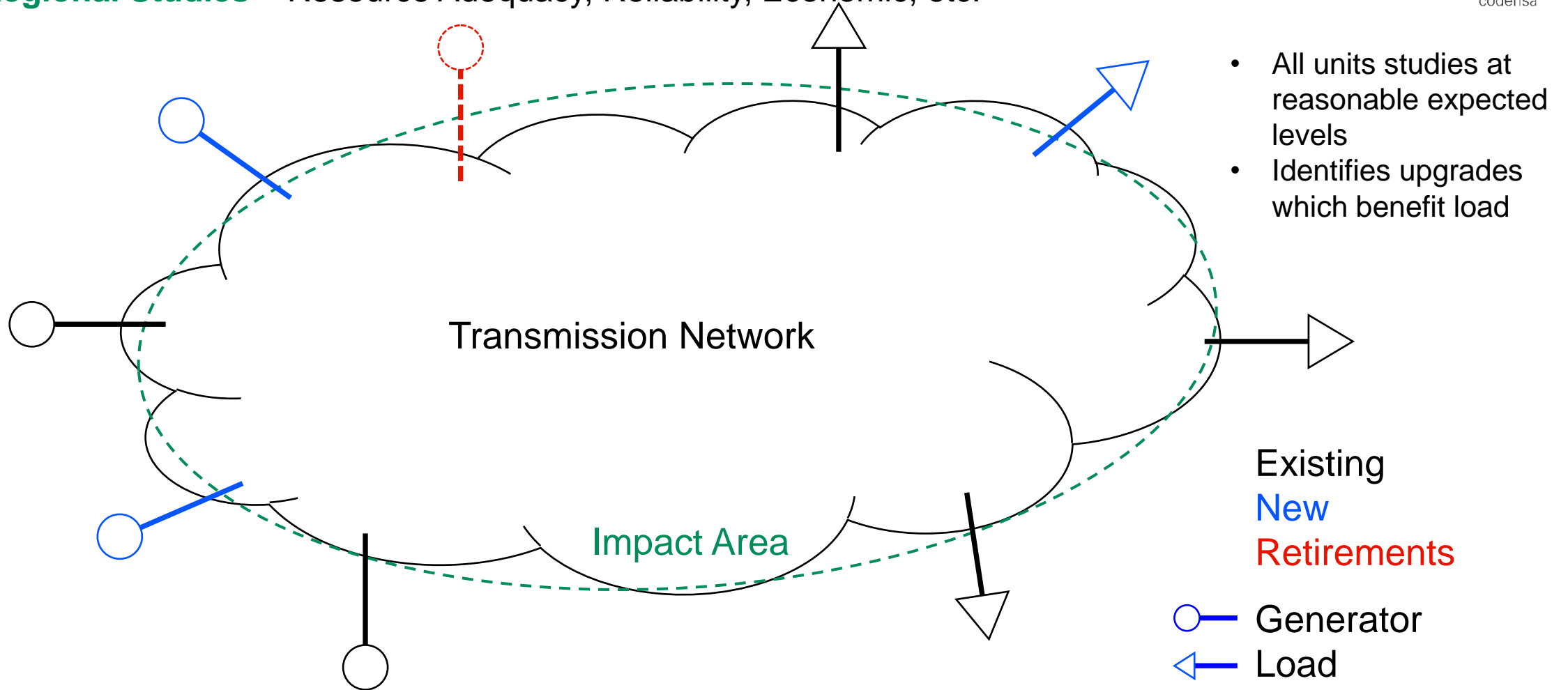


- **Elimination of Reasonable Efforts**

- Accountability for transmission owners is just as important as transmission providers
 - Facility study completion time in PJM has averaged over two years ([link](#))
 - Enel has received TO estimates of 4 years for engineering, procurement & construction of basic 69 kV POI stations
 - Entire renewable power plants, including project substations and tie lines, are typically built in 12-18 months
 - Many utilities are not reviewing and executing GIAs in a timely fashion (e.g. a utility recently took 11+ weeks to execute a minor GIA amendment)
- Recommendation: Competitive process would ensure facility study “bids” were completed on time and with reasonable mitigation designs, costs and schedules
 - Bid process would give opportunity for submittal of alternative technologies
 - Bid process and GIA execution would parallel regional studies and accelerate time to energization
- Recommendation: For Transmission Providers, need to ensure quality is not sacrificed for speed
 - In 2022 Enel has identified over \$180M of interconnection cost savings due to invalid results & minor optimizations
 - Recommend requirement to complete draft reports by deadline. ICs guaranteed a review period by tariff, after which the TP would be allowed time to implement changes.

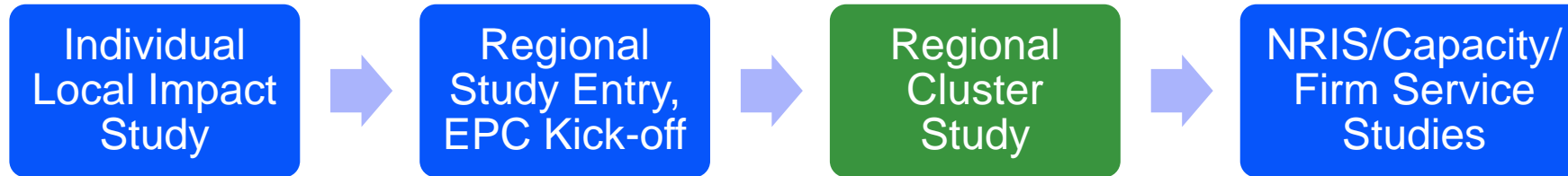
Interconnection Reform Concept

Regional Studies – Resource Adequacy, Reliability, Economic, etc.



Regional Cluster Study

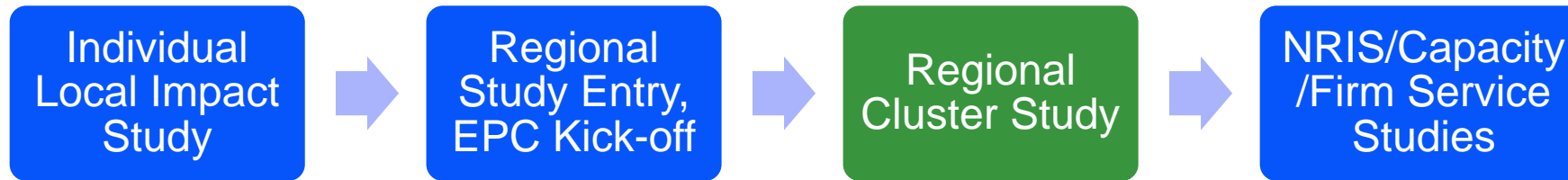
Proposal Overview



- **Purpose:** Resource Adequacy, Reliability, Economic, etc. studies done on new service requests to determine optimal Tx design
 - Could be combined with regional planning process as proposed in whitepaper, but not necessary.
 - Could serve as Resource Solicitation Cluster in non-RTOs
- **Results**
 - Regional Cluster Study identifies transmission and assigns costs to load if:
 1. Load's B/C threshold met or;
 2. Reliability projects are required that can't be dispatched around.
 - **Tx built by the load and for the load** - ensures cost certainty for new service projects and that the most efficient and beneficial transmission is built for load.
 - If B/C ratio is close to being met, new and existing generators can opt-in with a portion of their expected congestion benefits to reduce cost to load and push B/C over threshold
 - Generators can opt to fund Alternative Technologies (DLR & other Grid Enhancing Technologies) in place of upgrades and contribute saved costs to regional transmission. Technologies can also be used as a bridge until upgrades can be built.

Regional Cluster Study

FERC Interconnection NOPR Recommendations



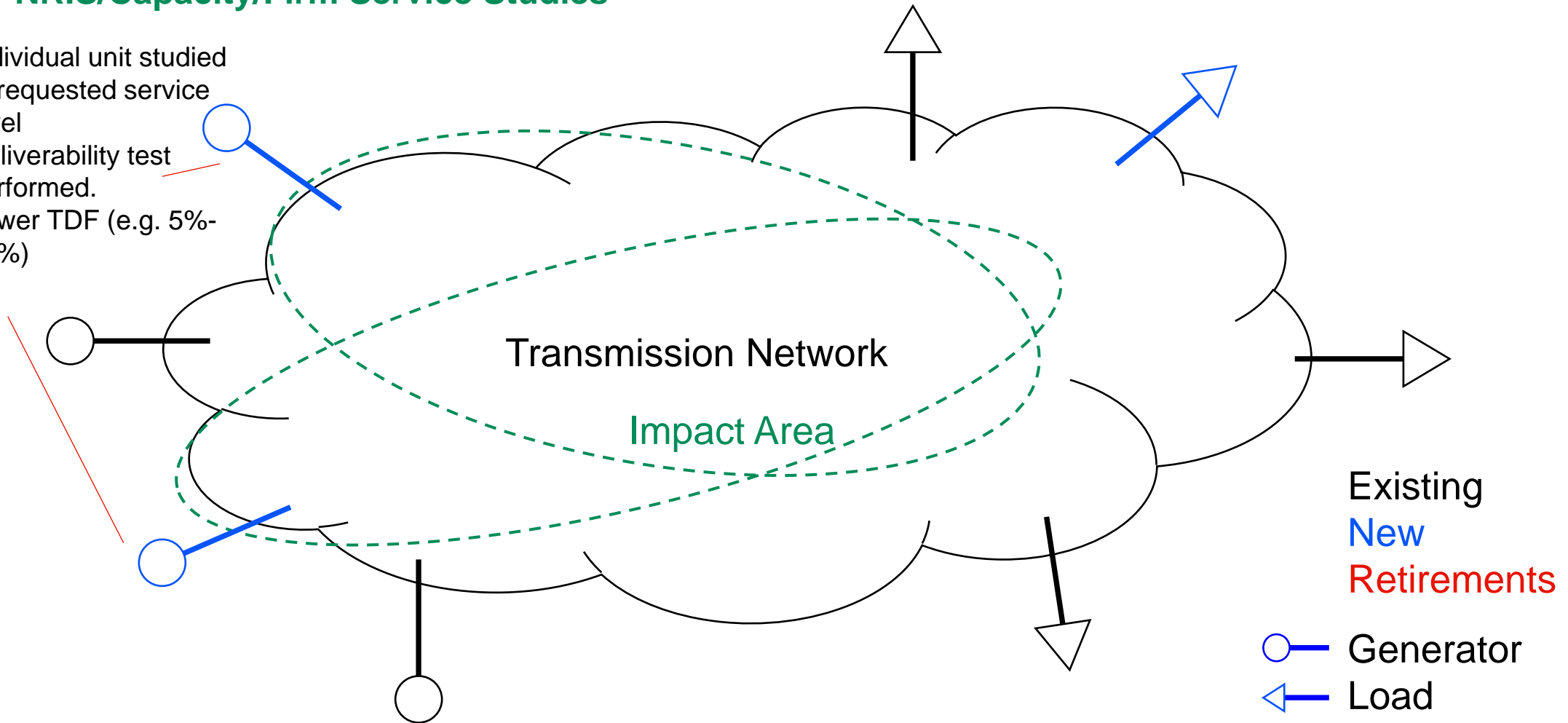
- **Cluster Study**

- Include resource adequacy and economic impact of new generation to more accurately capture value to both generation and load
- Allocate transmission costs to both generation and load based on value created by new generation
- Complete proposed Resource Solicitation Clusters during this phase
- Incorporate alternative transmission technologies as both bridge and permanent solutions
- During the first Cluster Re-study, complete a first facility study for point of interconnection-related upgrades (TPIF and NU).
 - Helps transmission owners spread facility study work across time
 - Provides more cost and schedule certainty earlier in process
 - Reference Phase 2 of MISO interconnection procedures for example of successful implementation

Interconnection Reform Concept

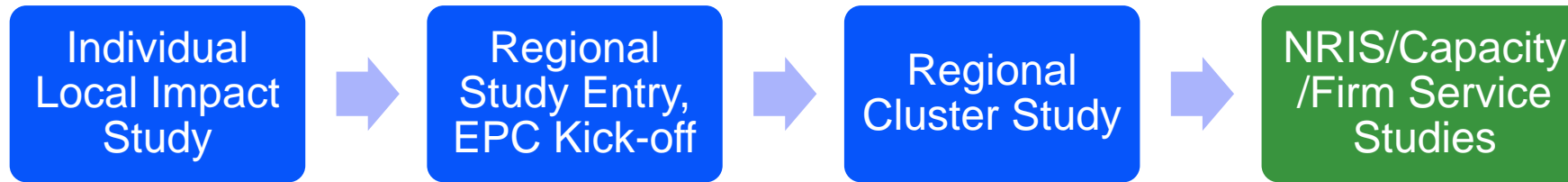
NRIS/Capacity/Firm Service Studies

- Individual unit studied at requested service level
- Deliverability test performed.
- Lower TDF (e.g. 5%-10%)



Capacity/Firm Service Studies

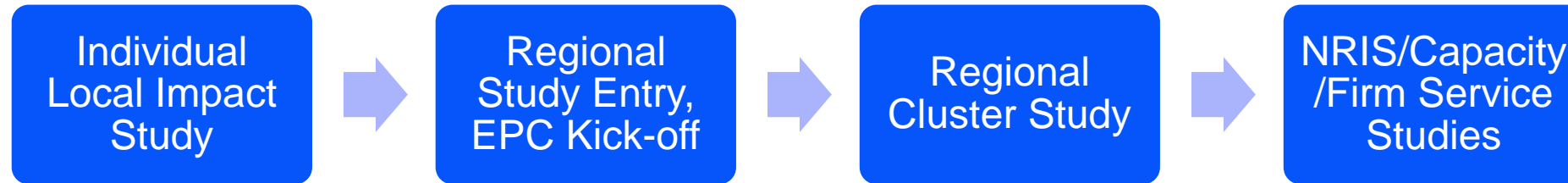
Proposal Overview



- **Purpose:** Grant higher levels of interconnection and transmission service, including NRIS, Capacity Interconnection, and/or TSRs
- Generators request desired levels of service and are studied with stricter TDFs.
- Transmission approved in local screening studies and regional cluster study included to increase probability of good capacity/firm service study results. This off-sets risk to generators of making investment decisions to enter regional study without knowledge of these rights and associated revenues.
- Consider including a preliminary deliverability study during the Individual Local Impact Study
- **Results**
 - Additional upgrades specific to the generator's enhanced interconnection/delivery rights are assigned to generators
 - Partial service can be granted if cost prohibitive upgrades are identified. This gives the highest likelihood of generators receiving critical capacity revenues and/or meeting resource adequacy requirements

Comprehensive Reform Proposal

Review



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Questions?