INTERCONNECTION INNOVATION e-XCHANGE
U.S. DEPARTMENT OF ENERGY

# Queue Management & Cost Allocation
# Queue management (BPS) | 5/11/23

*An initiative spearheaded by the Solar Energy Technologies Office and the Wind Energy Technologies Office*

# Meeting Notes

Notes synthesizing keys points, insights and questions from the meeting can be found here: Box Link

The first half of this Teams call is being recorded and may be posted on DOE's website or used internally. If you do not wish to have your voice recorded, please do not speak during the call. If you do not wish to have your image recorded, please turn off your camera or participate by phone. If you speak during the call or use a video connection, you are presumed consent to recording and use of your voice or image.

# Agenda

- Introduction to i2X Solution e-Xchanges (5 min)
- Stakeholder Presentations (45 min)
  - SPP
  - Enel
  - ERCOT
- Interactive Group Discussion (70 min)
  - Integrating transmission planning and interconnection process
  - POI upgrades vs. network system upgrades
  - Interregional coordination of affected system studies
  - Navigating project withdrawals

# Interconnection Innovation e-Xchange (i2X)

**Mission:** To enable a **simpler**, **faster**, and **fairer** interconnection of clean energy resources while enhancing the **reliability**, **resiliency**, and **security** of our **distribution and bulk-power electric grids**

## Stakeholder Engagement

Nation-wide engagement platform and collaborative working groups

## Data & Analytics

Collect and analyze interconnection data to inform solutions development

## Strategic Roadmap

Create roadmap to inform interconnection process improvements

## Technical Assistance

Leverage DOE laboratory expertise to support stakeholder roadmap implementation

# Key Outcomes from Our e-Xchange Meetings

- Inform and formulate a ***publicly available***, strategic roadmap for interconnection
  - Topical challenges and issues
  - Practical solutions to implement and scale
  - Knowledge and data gaps and new solutions to pilot
  - Success goals and measures of success

- Summary documentation for each meeting regarding ideas discussed and opportunities for targeted stakeholder action

- **Longer term vision** → Solution e-Xchanges to continue building a national forum for all stakeholders as a community of practice, excellence, and innovation

# Key Themes from 4/13 Meeting on Pre-request Information

- There may not be a perfect solution
- Having better information around what's causing a potential issue might give developers a better sense of upgrade costs
- Timeliness of information - most information is outdated by the time it reaches developers
- Developers have varying levels of sophistication in siting analysis – open-source software and standardization might help to make that analysis more widely available
- Relationship between queue processing time and information needs: reforms that reduce the study process time would also reduce the need for more accurate pre-request information

Review a more detailed notes document here:

https://app.box.com/s/a6676dmn7a273jcyyxig03vxf2t84pfc

# Upcoming Solution e-Xchanges to Consider Joining

**BOLDED ITEMS FOCUS ON BULK POWER SYSTEM TOPICS**

1. May 17, 2-4 p.m. ET: EEJ Interconnection Considerations and Approaches
2. May 24, 2-4 p.m. ET: DER Interconnection Process Approaches & Flexible Interconnection
3. **May 31, 2-4 p.m. ET: Limitations and Barriers to Improving DER and BPS Pre-Application Data Transparency**
4. **June 7, 2-4 p.m. ET: BPS Interconnection Cost Allocation: Perspectives and Options for Reform**

Follow the schedule of events on the i2X website.
https://www.energy.gov/eere/i2x/i2x-solution-e-xchanges

# Virtual Meetings Code of Conduct

1. *Assume good faith and respect differences*
2. *Listen actively and respectfully*
3. *Use "Yes and" to build on others' ideas*
4. *Please self-edit and encourage others to speak up*
5. *Seek to learn from others*

Mutual Respect . Collaboration . Openness

# Introduction of Stakeholder Presentations

# Interactive Group Discussion Topics

# Topic #1: How to more seamlessly coordinate and integrate transmission planning and interconnection processes?

## Today

### Generator Interconnection

- Individual project or cluster analysis
- Transmission upgrades only focused on a specific project/cluster
- Short-term horizon
- Generator/cluster impact analysis only
- "Snap-shot" analysis
- Worst-case dispatch for new and heuristic-based dispatch assumptions for existing generation
- Focus on reliability

### Regional Transmission Planning

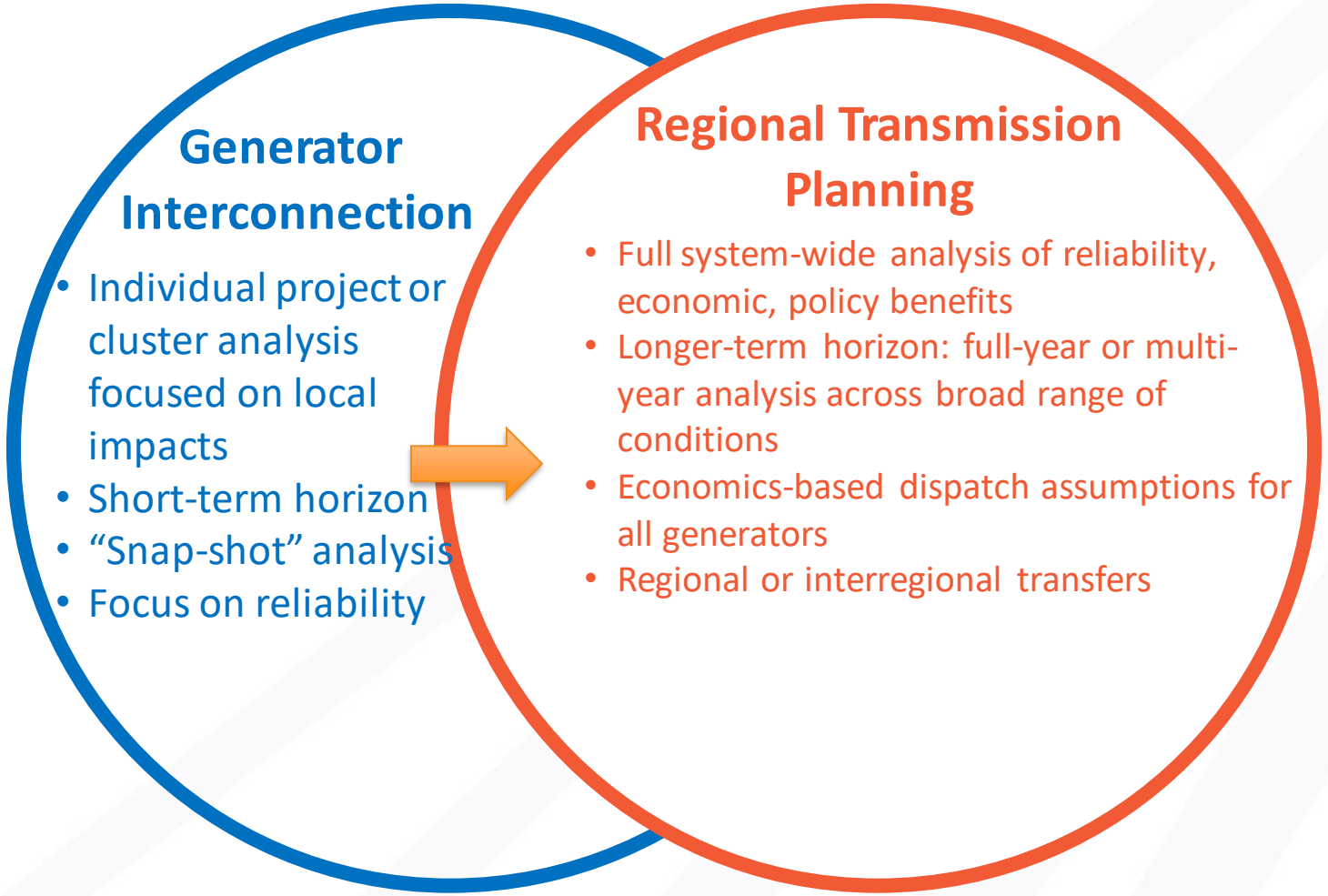
- Full system-wide analysis of reliability, economic, policy benefits
- Longer-term horizon: full-year or multi-year analysis across broad range of conditions
- Economics-based dispatch assumptions for all generators
- Regional or interregional transfers

**Limited overlap & coordination**

Source: Adapted from Telos Energy

# Topic #1: How to more seamlessly coordinate and integrate transmission planning and interconnection processes?

Future?




**Reforms to transmission planning could reduce pressure on interconnection**

- Proactive, scenario planning
- Wider range of benefits in benefit-cost analysis
- Longer planning horizons

# Poll Question Icebreaker:

How can we more tightly integrate and coordinate transmission planning with the interconnection process?

[Go to **slido.com** and enter event code **i2x11**, then go to **Polls** tab]

# Topic #1: How to more seamlessly integrate and coordinate transmission planning and interconnection processes?

- Please go to slido to make comments / questions of your own: **slido.com** and enter event code **i2x11**

- For verbal commentary, please use the raise hand feature and we will call on you

- Additional related / associated questions:
  - What are the pros and cons of integrating and coordinating transmission planning and interconnection processes?
  - How could such integration and coordination more practically be done? Interconnection request windows coincident with planning process cycles?
  - What tools and processes need to be better integrated to achieve a more realistic and integrated view (e.g. load flow and production cost modeling to predict system conditions).

*Discussion Best-Practices*

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# Topic #2: Are there opportunities for separating POI vs. network upgrades? – Background

Since Order 2003, FERC jurisdictional transmission providers have been required to offer two kinds of interconnection service:

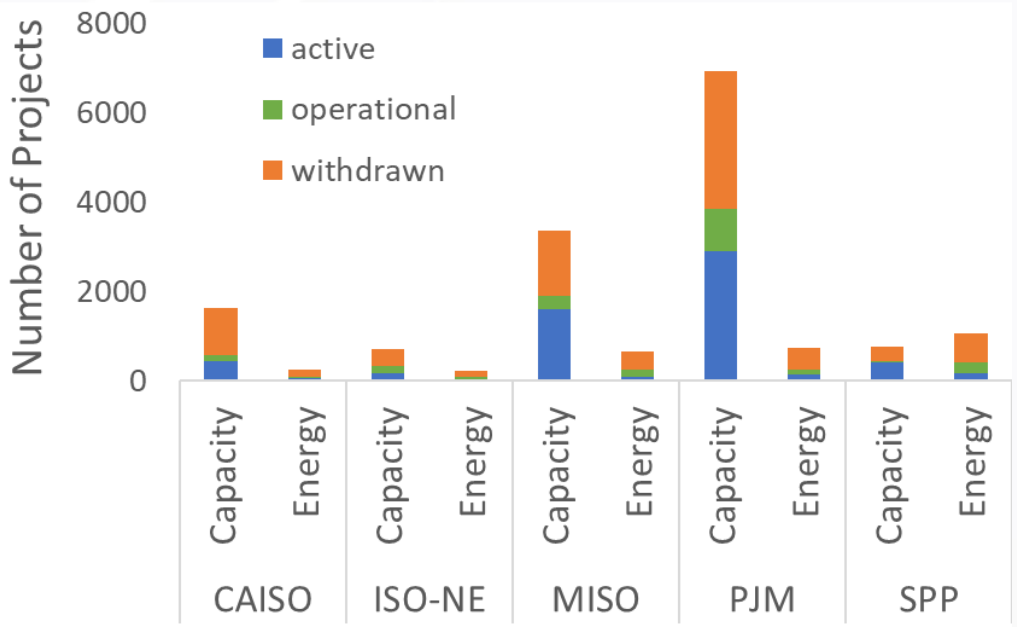
Energy-only interconnection – "basic or minimal service"

Capacity interconnection – "more flexible and comprehensive service"

Actual definitions, assumptions, and criteria for these concepts differ by jurisdiction:

- While energy-only interconnection conceptually means basic service, using existing transmission, in some jurisdictions transmission upgrades are still assigned to energy-only projects with certain TDF thresholds.
- While capacity interconnection conceptually means new generation capacity can be relied on for reliability, in some jurisdictions capacity interconnection does not guarantee physical transmission rights.

## Energy vs. Capacity designation within queues of select ISOs



# Topic #2: Are there opportunities for separating POI vs. network upgrades? – Background

Energy-only and capacity interconnection are critical concepts and will show up throughout the solutions exchanges; for instance:

**Queue management** – how can energy-only interconnection be fast tracked through the interconnection process?

**Cost allocation** – should energy-only interconnection requests be responsible for network upgrades that create additional transmission capacity? Should customers with capacity interconnection be compensated for required network upgrades that create benefits for other transmission customers?

**Interconnection studies** – how should energy-only and capacity interconnection studies differ?

# Topic #2: Are there opportunities for separating POI vs. network upgrades?

- Please go to slido to make comments / questions of your own: **slido.com** and enter event code **i2x11**

- For verbal commentary, please use the raise hand feature and we will call on you

- Additional related / associated questions:
  - How do developers decide between energy-only vs. capacity interconnection?
  - How can energy-only interconnection be fast tracked through the interconnection process?
  - Can upgrades closer to a POI (needed exclusively by an interconnection project) be evaluated separately?
  - How can energy-only and capacity interconnection concepts apply if interconnection process and transmission process are more tightly integrated?

*Discussion Best-Practices*

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# Wordcloud question Icebreaker:

What are the main barriers to interregional interconnection coordination (e.g. affected system studies)?

[Go to **slido.com** and enter event code **i2x11**, then go to **Polls** tab]

# Topic #3: What interregional coordination is needed between areas?

- Please go to slido to make comments / questions of your own: **slido.com** and enter event code **i2x11**
- For verbal commentary, please use the raise hand feature and we will call on you
- Additional related / associated questions:
  - Should affected system studies be a part of interconnection process or addressed in transmission planning?
  - Should improving affected system studies be a key priority?
  - What are best practices for affected system studies?
  - How can affected system studies and joint transmission planning be better coordinated?

*Discussion Best-Practices*

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# Topic #4: Can project withdrawal be managed more efficiently?

- Please go to slido to make comments / questions of your own: **slido.com** and enter event code **i2x11**
- For verbal commentary, please use the raise hand feature and we will call on you
- Additional related / associated questions:
  - How can study results from withdrawn projects be better utilized?
  - How can impacts from withdrawals be limited/mitigated under cluster study approach? Can other changes (e.g., limiting clusters, lowering TDF thresholds) help to reduce the impacts of withdrawals?
  - How can impacts of withdrawals be limited/mitigated under integrated planning framework?

*Discussion Best-Practices*

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# Presentation for i2x

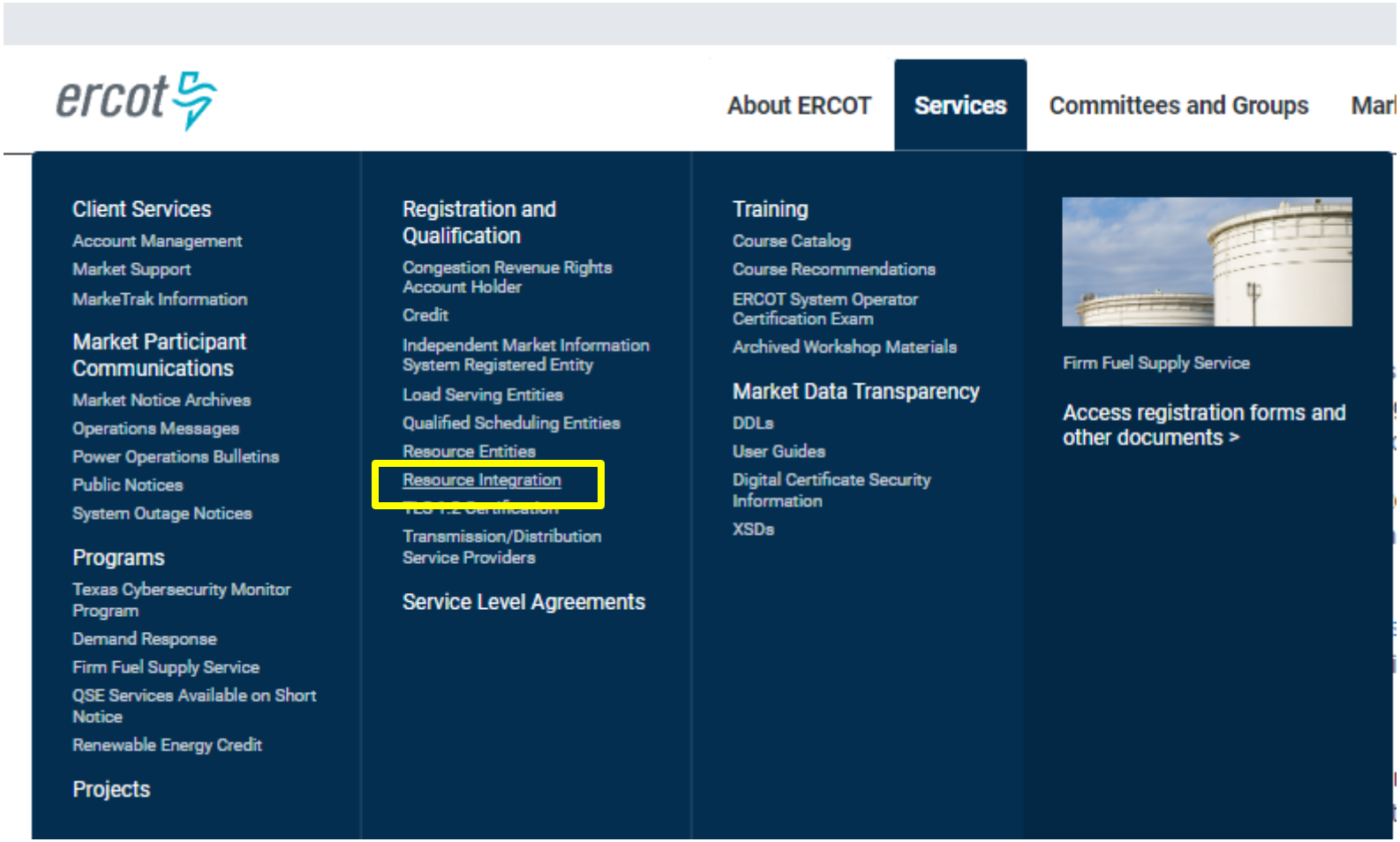
May 11, 2023

Jenifer Fernandes
Supervisor (Large Generation), Resource Integration

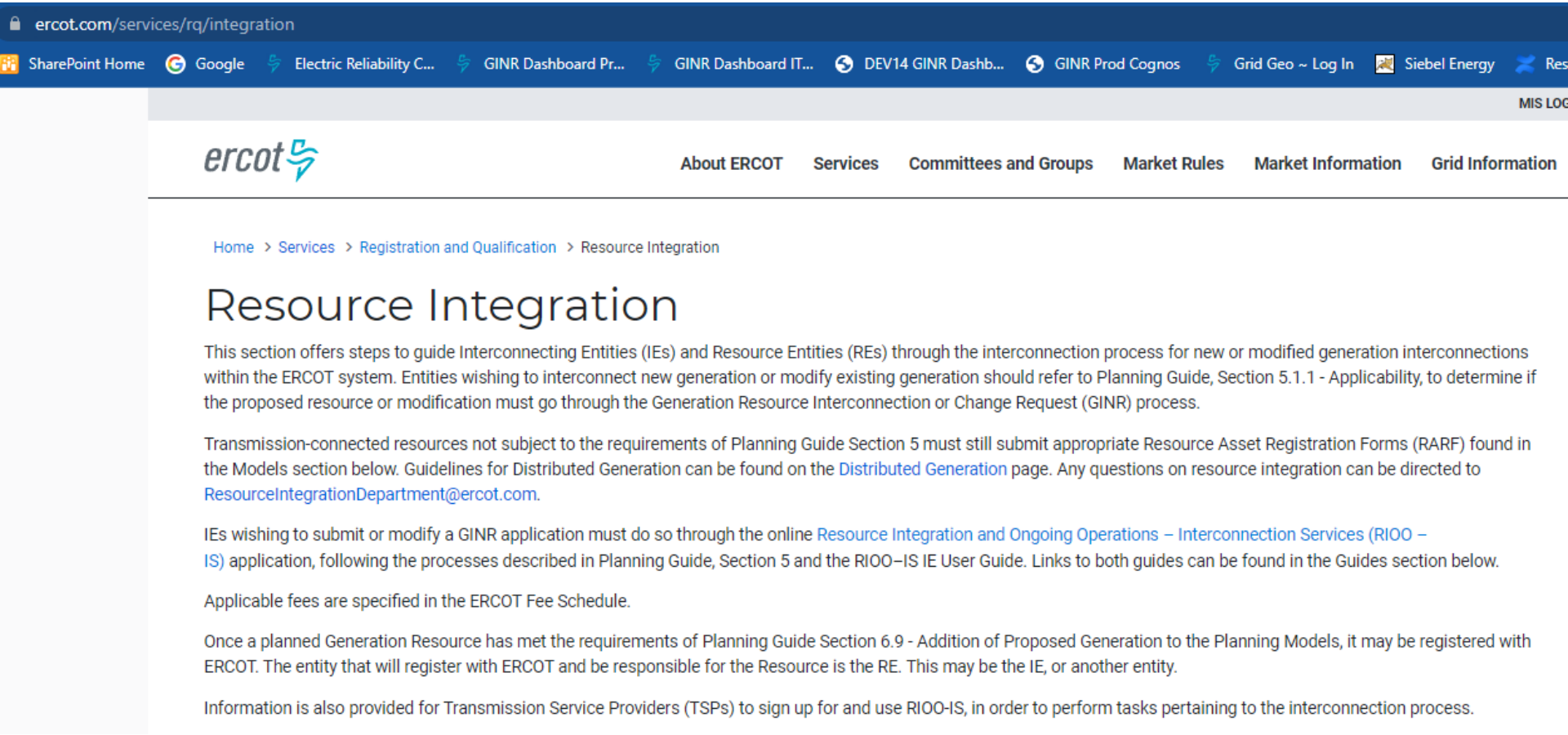
# Overview

- Resource Integration Overview
- Large Gen and Small Gen Modifications
- Resource Integration Large Gen Process:
  - Stage 1: Interconnection Request Application to QSA
  - Stage 2: Registration and Modeling
  - Stage 3: Energization, Synchronization & Commissioning.
- Resource Integration Small Gen Process
- Interconnection Application Counts and MWs

# Interconnection Information on ERCOT.com



# Resource Integration page



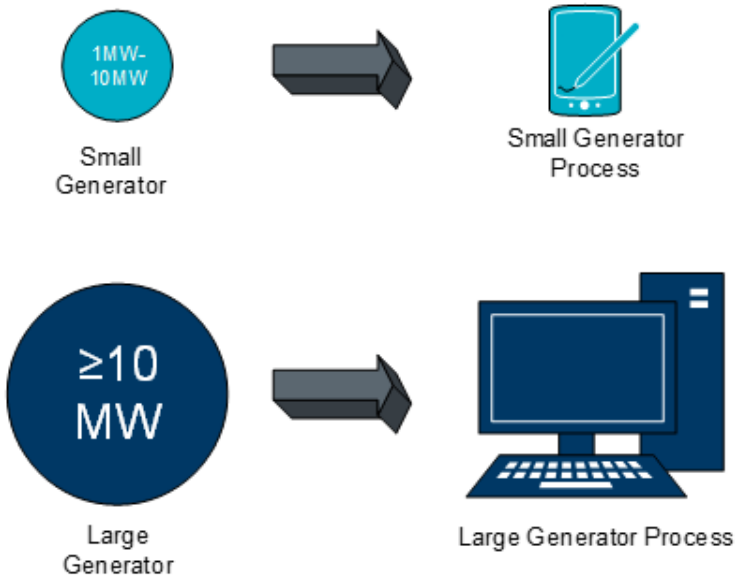
# Resource Interconnection Handbook

## Guides

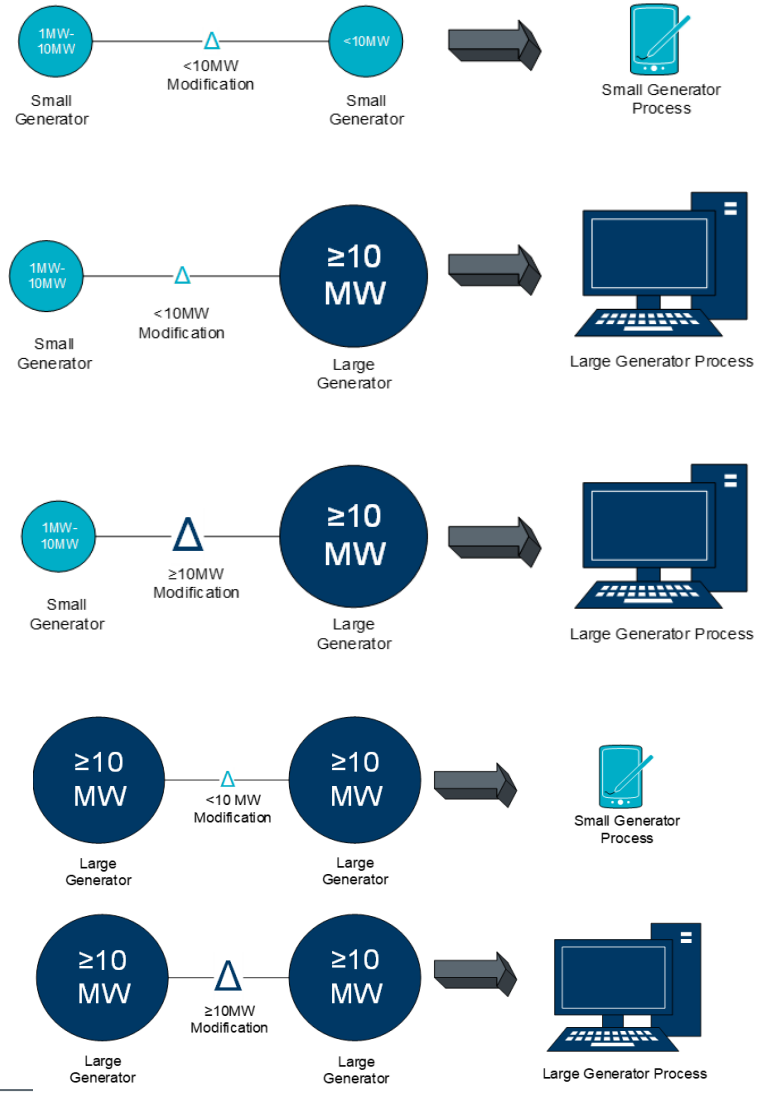
| | |
|---|---|
| Model Quality Guide<br>Assists REs/IEs submit stability models per Planning Guide Section 6.2, including the new Model Quality Testing requirements. Also includes the UDM Model Guideline and PSCAD Model Guideline. | Aug 12, 2022 - zip - 1.6 MB |
| Self Limiting Facilities In the Interconnection Process<br>This document describes the process to submit Self-Limiting Facilities in the Generation Resource Interconnection or Change Request (GINR) Process prior to full implementation of NPRR1026. | Mar 30, 2021 - docx - 161.6 KB |
| Planning Guide<br>Section 5, Generation Resource Interconnection or Change Request (GINR), defines the requirements and processes used to facilitate new or modified generation interconnections. | |
| Resource Interconnection Handbook<br>Provides an overview of the Generation Interconnection or Change Request (GINR) process that Interconnecting Entities/Resource Entities must follow in order to add new generation/modify existing generation connected to the ERCOT Transmission Grid. | Jun 21, 2022 - docx - 1.4 MB |

# Planning Guide Section 5 Small/Large Interconnections

## New Units




## Changes to Existing Units



# Resource Interconnection Process – Large Generation

**Stage 1: Interconnection Request Application to Quarterly Stability Assessment**

**Stage 2: Registration and Modeling**

**Stage 3: Energization, Synchronization and Commissioning**

**Figure 1: Generation Resource Interconnection Process Flow**


- GINR Application and Fees
- Security Screening Study
- Full Interconnection Studies
- Subsynchronous Resonance Study
- Standard Gen. Interconnection Agreement
- Resource Integration and On-Going Operations data submittal
- Compliance with Operational Standards
- Reactive Study

- RE Registration
- Resource Integration and On-Going Operations data submittal
- ERCOT Polled-Settlement Meters and ESI ID Requirements
- Telemetry and ICCP Requirements

- TSP: 1: Request to Energize POI
- Commissioning Plan Template
- New Generator Commissioning Checklist
- 1: Request to Energize
- 2: Request for Initial Synchronization
- 3: Request to Commission a Resource
- Reactive Capability & Performance

# STAGE 1 – Generation Interconnection Request Application to QSA

## Security Screening Study

For each GIM (GINR) request submitted, ERCOT will conduct a high-level, steady-state Security Screening Study (SSS), including power-flow and transfer studies, based on the proposed Commercial Operation Date (COD) and a single Point of Interconnection (POI). **The main purpose of the study is to provide an indication of the level at which the proposed generation can expect to operate simultaneously with other known generation in the area before significant transmission** additions or enhancements may be required.

ERCOT is allowed **90 days** to perform the Screening Study. During this time, ERCOT will contact the IE if additional information is needed, and the IE will have 10 Business Days to respond without impacting the study timeline.

Upon completion of the Security Screening Study, ERCOT will share the report with the IE using the RIOO-IS system. The report shall indicate study assumptions, transfer analysis results, and whether a SSR study is required. See below for more information on SSR.

# STAGE 1 – Full Interconnection Study

## Full Interconnection Study (FIS)

Within **180 days** of the date ERCOT notifies the IE of the SSS results, the IE must submit a change request on the RIOO-IS system to indicate its desire to pursue a Full Interconnection Study, or the GIM (GINR) will be cancelled.

## FIS Scope Meeting

Within **10 Business Days** of receiving the RIOO-IS change request to proceed with the FIS from the IE, ERCOT will designate the lead TSP for the FIS. The lead TSP will then arrange a FIS kick-off meeting with ERCOT, the IE and other TSPs desiring to participate in the study.

## FIS Study Process

The TSP(s) will examine normal transmission operating conditions as well as potentially adverse, or contingency, conditions.

The TSP(s) will consider such information as interconnection cost and construction schedule, impact to short and long-range reliability, operational flexibility, and compatibility with future transmission plans. The TSP(s) may also consider interconnection alternatives not suggested by the IE or ERCOT.

Following the completion and review of the FIS studies by the TSPs and approval by ERCOT, the report will be deemed complete, and the IE and TSP may execute a SGIA.

# STAGE 1 – Full Interconnection Study-TSP

- **Steady State Analysis:**

  The TSP(s) shall perform contingency analyses as required by the NERC Reliability Standards, Protocols, this Planning Guide and the Operating Guides and will identify contingencies that may cause unacceptable thermal loading and/or unacceptable voltages.

- **Short Circuit Analysis:**

  The TSP will determine the maximum available fault currents at the interconnection substation for determining switching device interrupting capabilities and protective relay settings.

- **Dynamic and Transient Stability Analysis:**

  Transient stability studies will analyze the performance of the proposed generator and the ERCOT System in terms of angular stability, voltage stability and excessive frequency excursions.

- **Facility Study:**

  The facility study provides complete details of the transmission and substation facilities needed to connect a generator to a new or existing substation on the ERCOT Transmission Grid. These details include conceptual design descriptions, construction milestones, and cost estimates.

# Planning Guide Section 5.3.5 QSA – Large Generation

**Generation not included in the quarter shown in the Initial Synchronization Quarter column in the table below will not be eligible for Initial Synchronization during that three-month period:**

| Generation Resource Initial Synchronization Quarter | Last Day for an IE to meet prerequisites as listed below | Completion of Quarterly Stability Assessment |
|---|---|---|
| Upcoming January, February, March | Prior August 1 | End of October |
| Upcoming April, May, June | Prior November 1 | End of January |
| Upcoming July, August, September | Prior February 1 | End of April |
| Upcoming October, November, December | Prior May 1 | End of July |

The IE must have met the following requirements before being allowed to synchronize new or modified generation:

- Completed the requirements of Planning Guide Section 6.9, Addition of Proposed Generation to the Planning Models.
- Completed the following:
  - FIS studies;
  - Reactive Power Study;
  - System improvements or mitigation plans that were identified in studies
  - Initial Compliance with Operational Standards review.

# Stage 2: Registration and Modeling

The Resource Integration and Ongoing Operations – Interconnection Services (RIOO-IS) is the application used to contain the generator and associated equipment modeling data needed for ERCOT systems. The contents of RIOO-IS are governed by the Resource Registration Glossary. Each field in RIOO-IS must be submitted at certain times during Stage 1, 2 and 3 as indicated by the following columns in the Glossary:

- Full Interconnection Study (FIS)
- Planning Model (to meet PG 6.9)
- Full Registration

The first Resource Data is due at FIS. This data is then expanded for the Planning Model. At Full Registration, all Resource data must be submitted in RIOO-IS. **The RE should reach out to ERCOT at least 30 days prior to the deadline for their Production Load Date (PLD) to allow for calls and review of the resource data.**

For Full Registration, Resource data must be submitted **at least 15 days** prior to the ***Deadline for Model Change Submit Before*** date for the desired PLD. **Data submitted within 15 days of the deadline may not get processed in time to be included in the desired PLD!**

Once the data has reached the Production Load Date (PLD) where the generator(s) are modeled in the Network Operations Model and preparing for energization, the RE shall use RIOO-Resource Services (RIOO-RS) to submit any changes to that data.

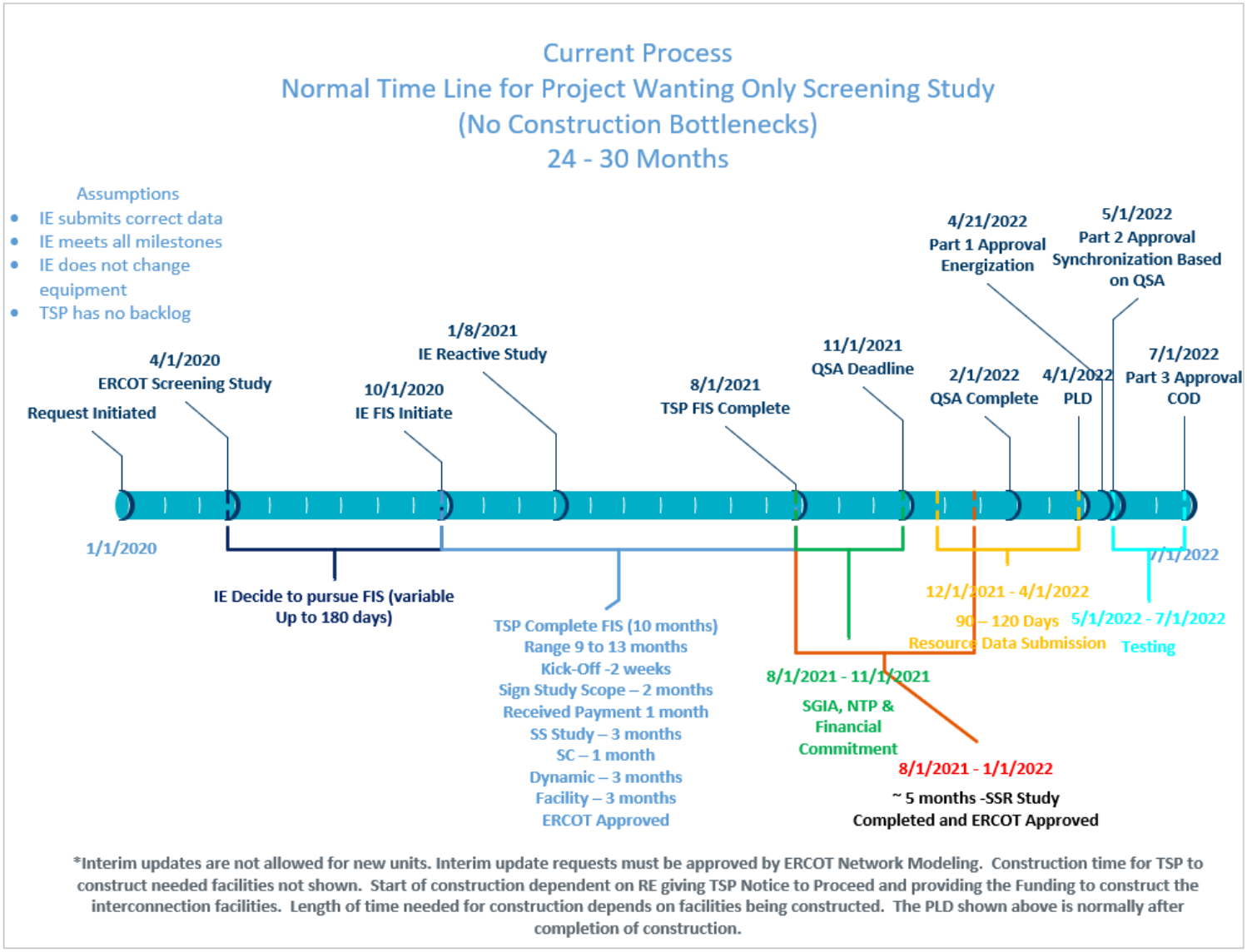
# STAGE 3: Energization, Synchronization and Commissioning

**ERCOT New Generator Commissioning Checklist**

The three-part ERCOT New Generator Commissioning Checklist is designed to coordinate the energization, synchronization, and commissioning of a new or modified generator once all qualification measures have been met to the satisfaction of ERCOT.

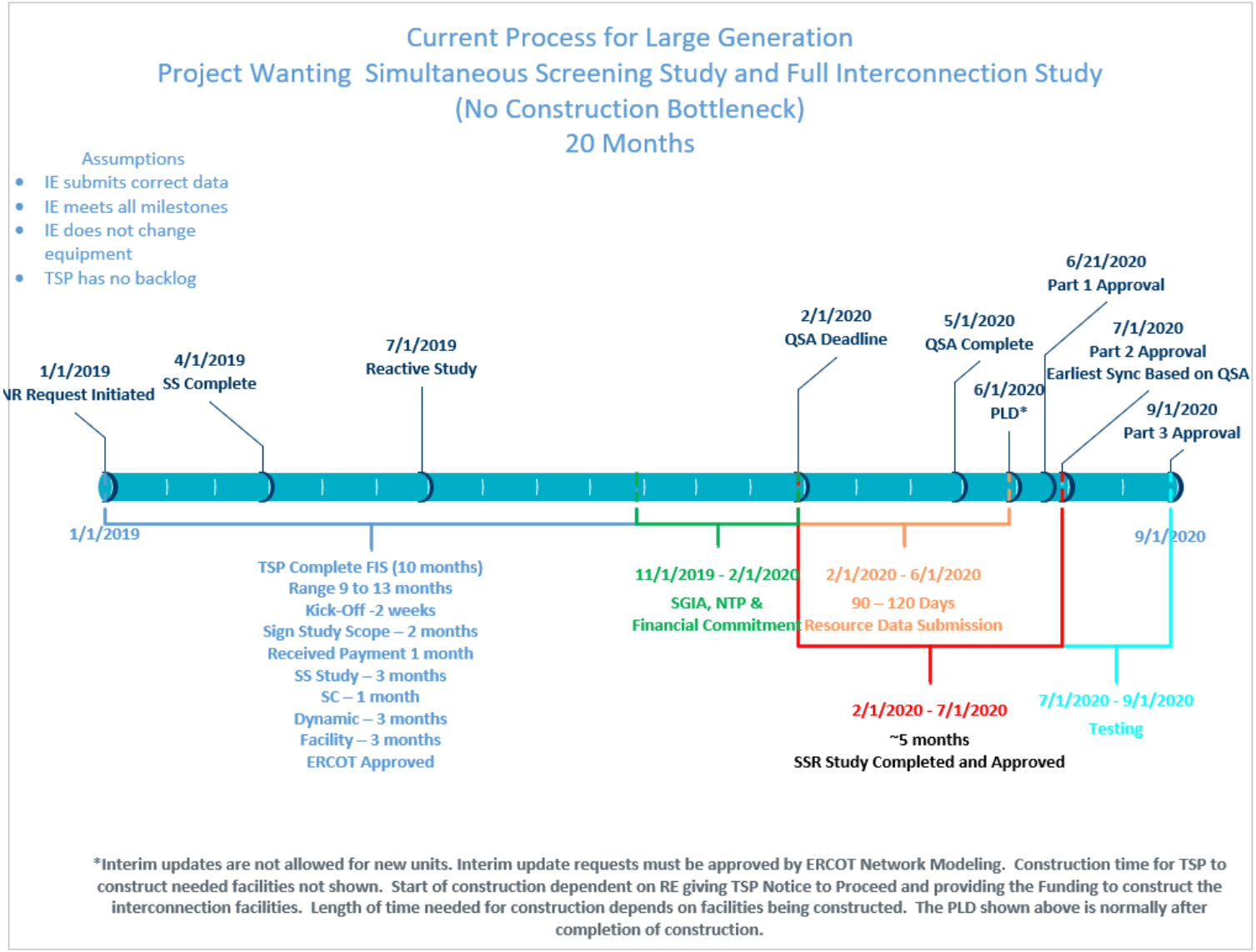
- Part 1: Request for Energization of Resource Entity Equipment
- Part 2: Request for Initial Synchronization (up to 20 MVA, > 20 MVA)
  - IRR Curtailment Test
  - Reactive Power Capability Test
  - Voltage Support Service (VSS) Test (Calculated)
  - Automatic Voltage Regulator (AVR) Test
  - Primary Frequency Response (PFR) Test
  - Power System Stabilizer (PSS) Test
- Part 3: Request to Commission a Resource
- Generator has now completed the interconnection process.

# Large Generation Timeline for Screening Study only




*Interim updates are not allowed for new units. Interim update requests must be approved by ERCOT Network Modeling. Construction time for TSP to construct needed facilities not shown. Start of construction dependent on RE giving TSP Notice to Proceed and providing the Funding to construct the interconnection facilities. Length of time needed for construction depends on facilities being constructed. The PLD shown above is normally after completion of construction.

# Large Generation Timeline Simultaneous SS and FIS



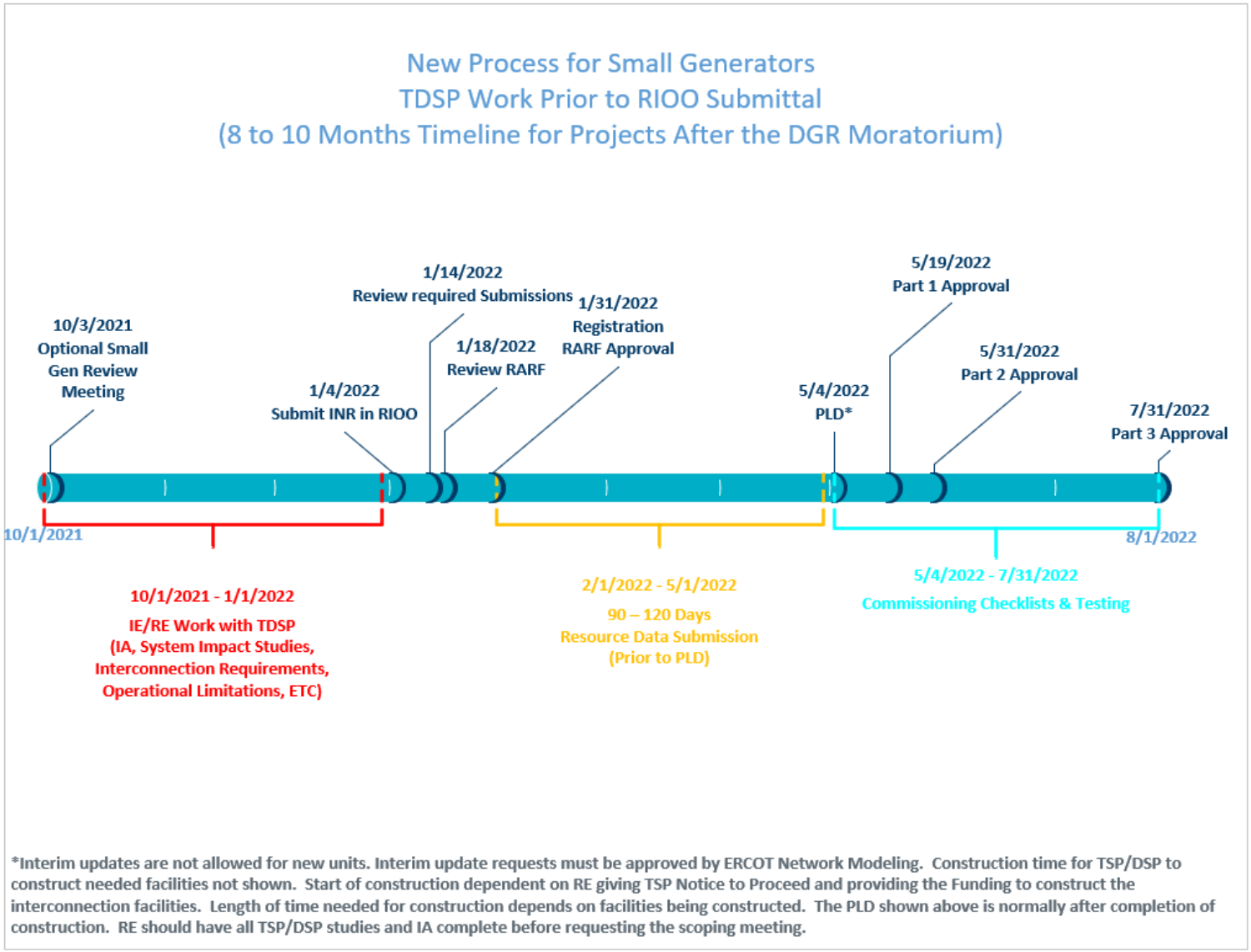
# Small Generation Process

The Small Generation process is governed by Planning Guide Section 5.4.

RIOO-IS Small Generation Initial Application Checks:

- One-line diagram (Need the Load Transformer name on the One-Line)
- Valid Load/Load Transformer information in RIOO-IS to describe where it is connected
- Site Photos, .kmz files, and/or Maps
- Proof of Site Control
- Signed Declaration of Department of Defense (DOD) Notification
- Payment for Small Gen application
- System Impact Study – Conducted by TDSP (Operating Guide Section 2.9 [VRT], Operating Guide Section 2.6 and 2.9 [FRT and VRT] and Planning Guide Section 5.4.2)
- Resource Data Submission – Entered into RIOO by IE/RE
  - Include the TDSP Station Name and Code for the Resource Site Name/Code
  - All Operation Limitations should be reflected
  - Include Load Resource INR if BESS (Until ESR data entry is created)

# Small Generation Timeline

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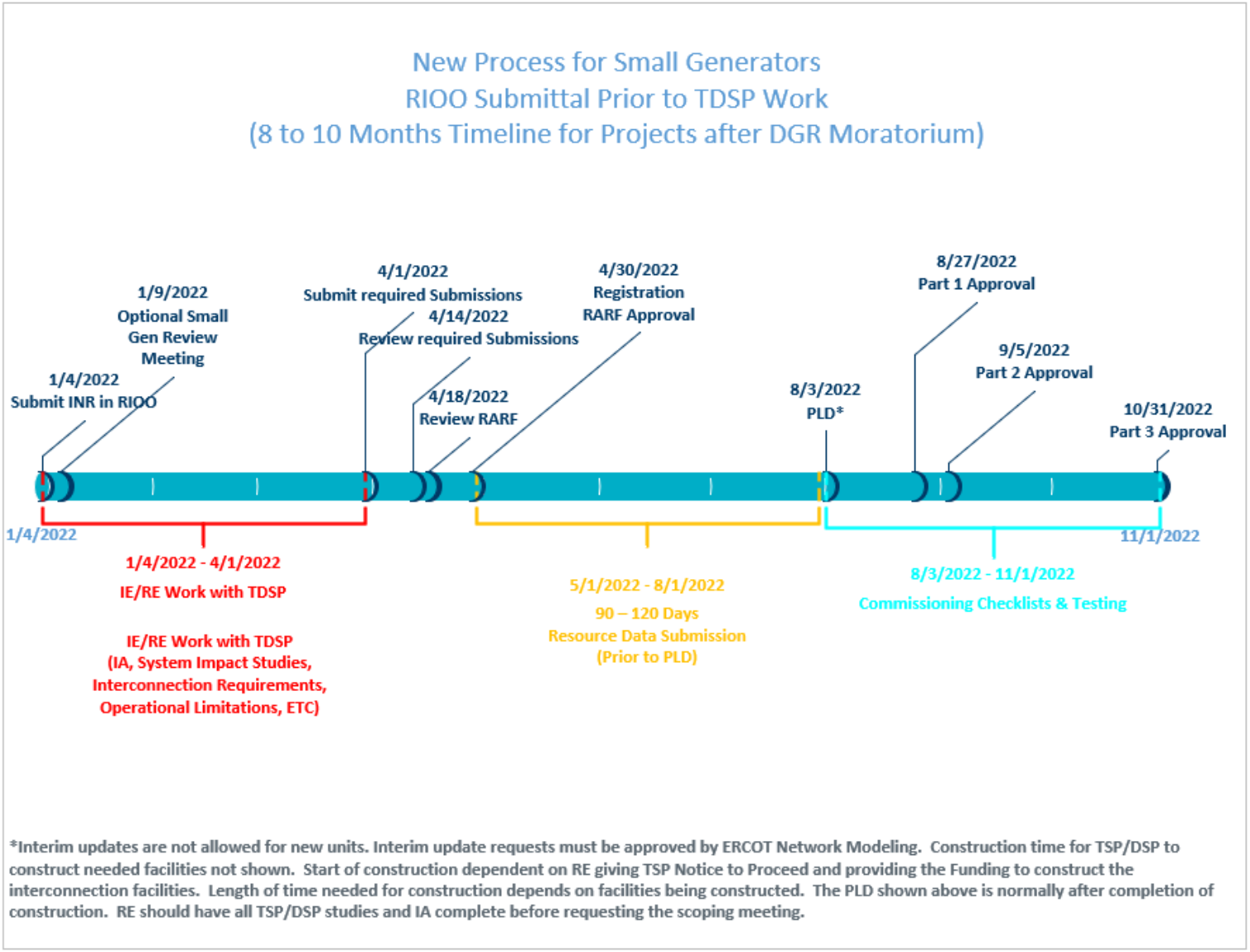
# Small Generation Timeline

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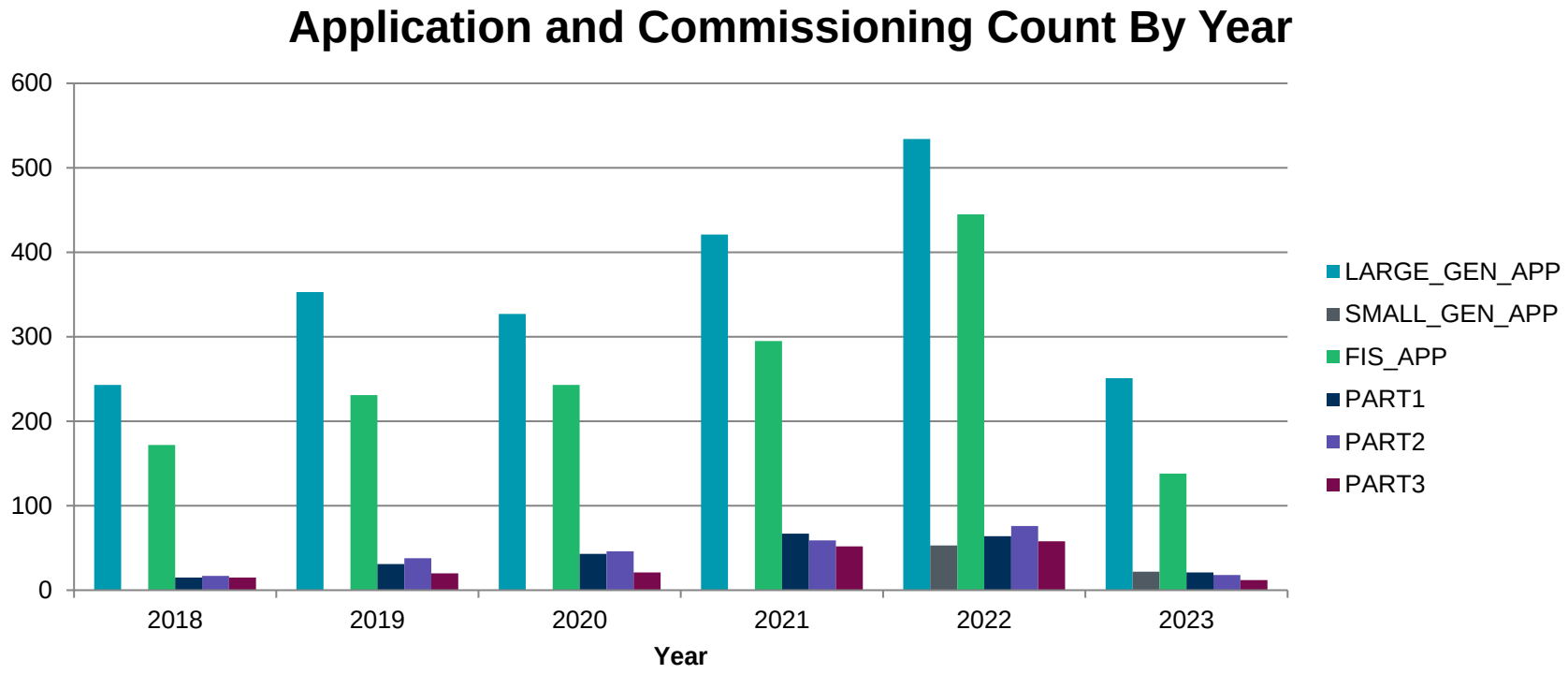
# Interconnection Application Counts

**As of 04/26/2023**

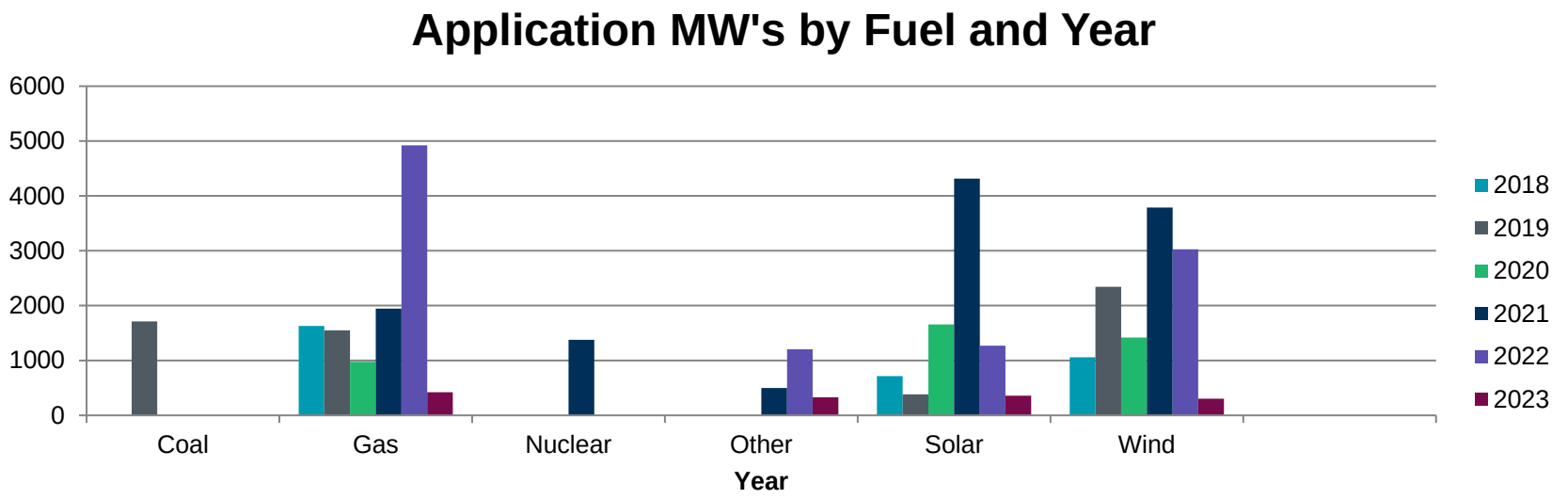
| YEAR1 | LARGE_GEN_APP | SMALL_GEN_APP | FIS_APP | PART1 | PART2 | PART3 |
|---|---|---|---|---|---|---|
| 2018 | 243 | 0 | 172 | 15 | 17 | 15 |
| 2019 | 353 | 0 | 231 | 31 | 38 | 20 |
| 2020 | 327 | 0 | 243 | 43 | 46 | 21 |
| 2021 | 421 | 0 | 295 | 67 | 59 | 52 |
| 2022 | 534 | 53 | 445 | 64 | 76 | 58 |
| 2023 | 251 | 22 | 138 | 21 | 18 | 12 |



# Interconnection Applications MWs

**As of 04/26/2023**

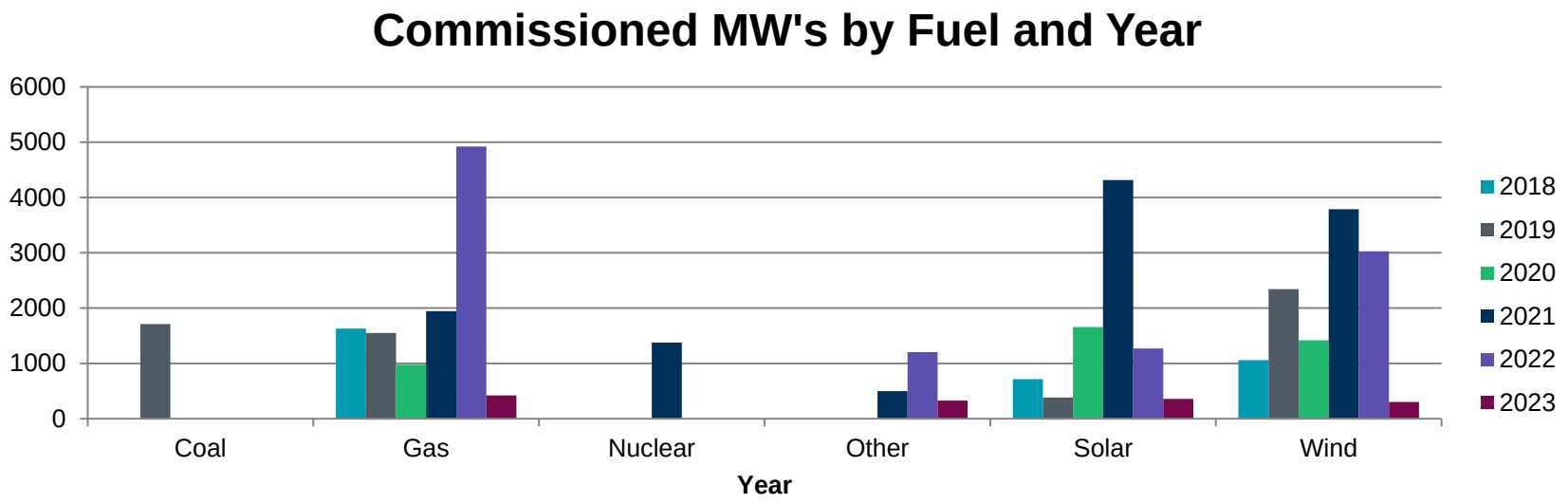
| FUEL | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Biomass | | | | 53 | | |
| Coal | | 1710 | 420 | | | |
| Gas | 7877.5 | 8994.6 | 4945.4 | 17059.8 | 5885.72 | 561 |
| Nuclear | | 1375 | | | | |
| Other | 1991.34 | 9082.91 | 18616.3 | 34088.64 | 50972.05 | 19311.1 |
| Solar | 25624.17 | 44291.9 | 40704.85 | 36367.09 | 41072.8 | 12788.95 |
| Wind | 17640.24 | 7664.93 | 3522.92 | 3572.99 | 8236.02 | 4466.62 |



# Commissioned MWs

**As of 04/26/2023**

| FUEL | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Coal | | 1710 | | | | |
| Gas | 1629 | 1550 | 975 | 1946 | 4921.5 | 421.5 |
| Nuclear | | | | 1375 | | |
| Other | | | | 497.08 | 1203.84 | 327.56 |
| Solar | 714 | 383 | 1656.57 | 4313.72 | 1269.82 | 356.93 |
| Wind | 1058 | 2341.88 | 1418.2 | 3786.13 | 3027.16 | 302 |



## Questions?

SPP Southwest Power Pool

# SPP INTERCONNECTION IMPROVEMENTS

ESIG MAY 11, 2023

# PURPOSE

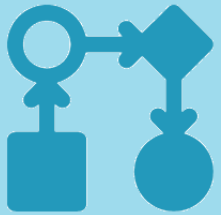
- Reminders:
  - SCRIPT recommendations
  - GI Readiness Criteria Changes
- Consolidated Planning Process
  - Objective
  - Draft process flow
  - Draft cost allocation considerations

# BACKGROUND

# ANTICIPATED VALUE OF SCRIPT & CPPTF EFFORTS

**Reduce Queues & Improve Services**

**Streamlined & Optimized Planning**



**Improved Cost-Sharing**

SCRIPT: Strategic and Creative Re-engineering of Integrated Planning Team
CPPTF: Consolidated Planning Process Task Force

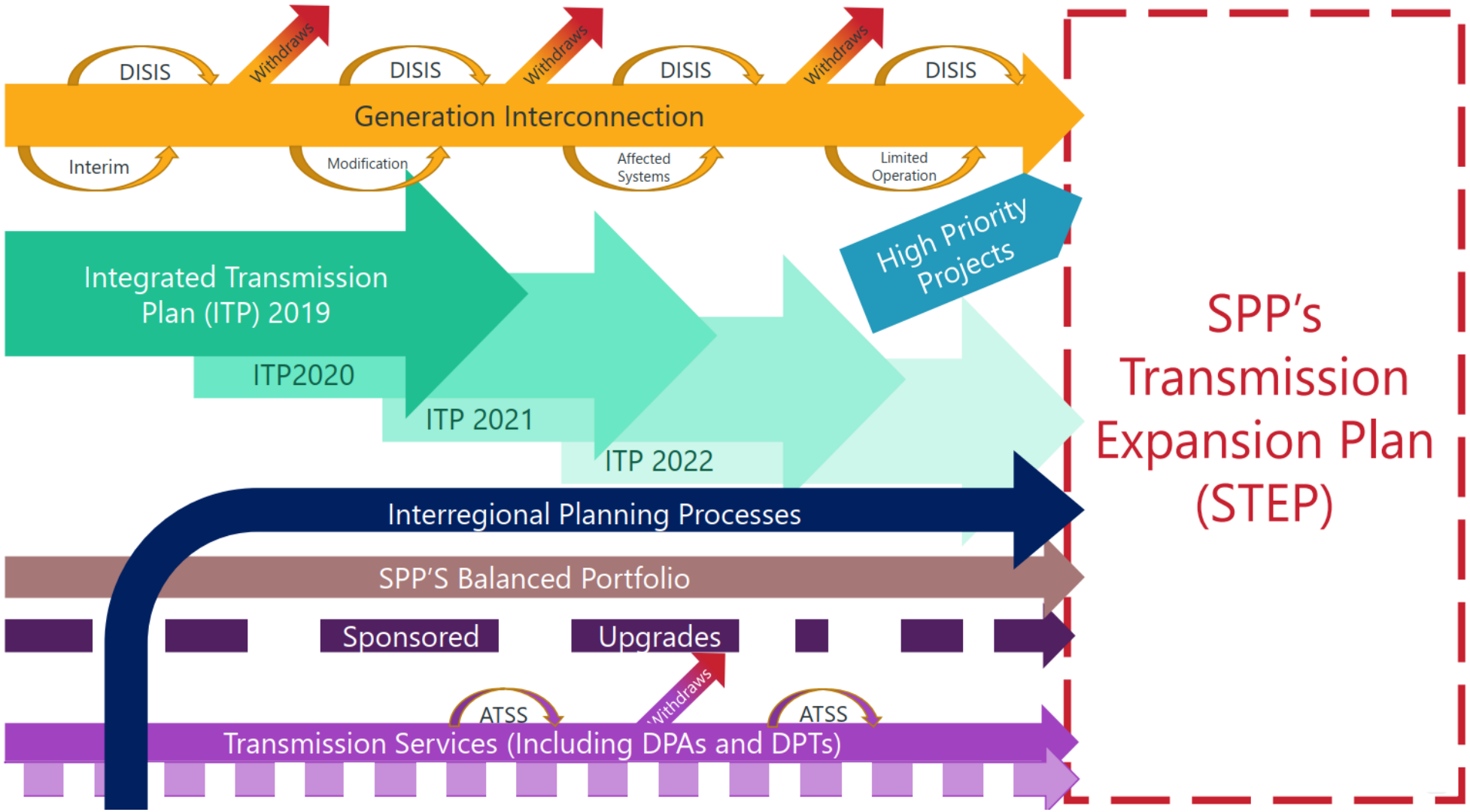
# GI READINESS CRITERIA CHANGES

| | GI Backlog | Previous State |
|---|---|---|
| Decision Point 1 | Initial Submission > Entry to Reliability Study | Initial Submission > Entry to DISIS Phase 1 |
| Financial Security | $4,000/MW | $2,000/MW |
| Site Control | 100% generating plant<br>50% gen lead length or $80,000/mile | 100% generating plant<br>50% gen lead length or $80,000/mile |
| Development Milestone | At least one from list of options<br>• Power Purchase Agreement<br>• Long-Term Transmission Service Reservation<br>• Authorization to construct from a Gov/Reg Agency<br>• Financing commitment evidence<br>• Additional Security Deposit $4k/MW | None |
| Layout Diagram | Final PE-certified layout diagram | One-line diagram |
| Decisions Point 2 | Entry to Regional Study | Decision Point 1 > Entry to DISIS Phase 2 |
| Financial Security | 10% of assigned upgrade costs* | 10% of assigned upgrade costs* |
| Site Control | Gen Lead Site Control (50%) OR<br>Effective Interim GIA | Confirm previous site control |
| Cost Limit | Network Upgrade Cost Tolerance $/MW | |
| Decisions Point 3 & GIA | Entry to Facilities Study | Decision Point 2 > Entry to Facilities Study |
| Financial Security | Add'l 10% of assigned upgrade costs | Add'l 10% of assigned upgrade costs |
| Site Control | | 75% gen lead length AND<br>100% new POI substation |
| Development milestone | | At least one from list in Section 11.3 |

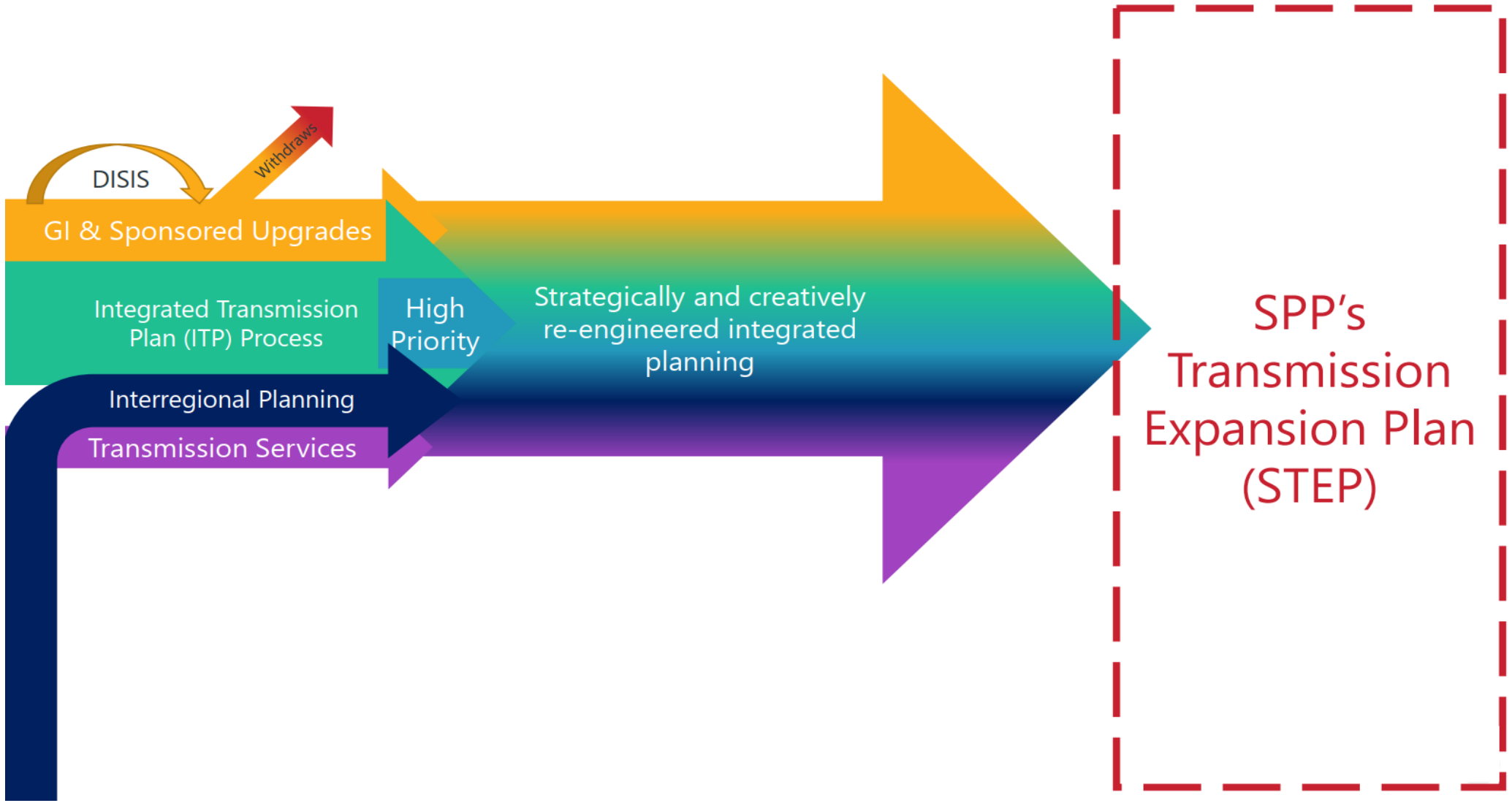
*10% of the Financial Security 2 Cost Factor, less Financial Security 1; or $4,000/MW additional

# CONSOLIDATED PLANNING PROCESS UPDATE

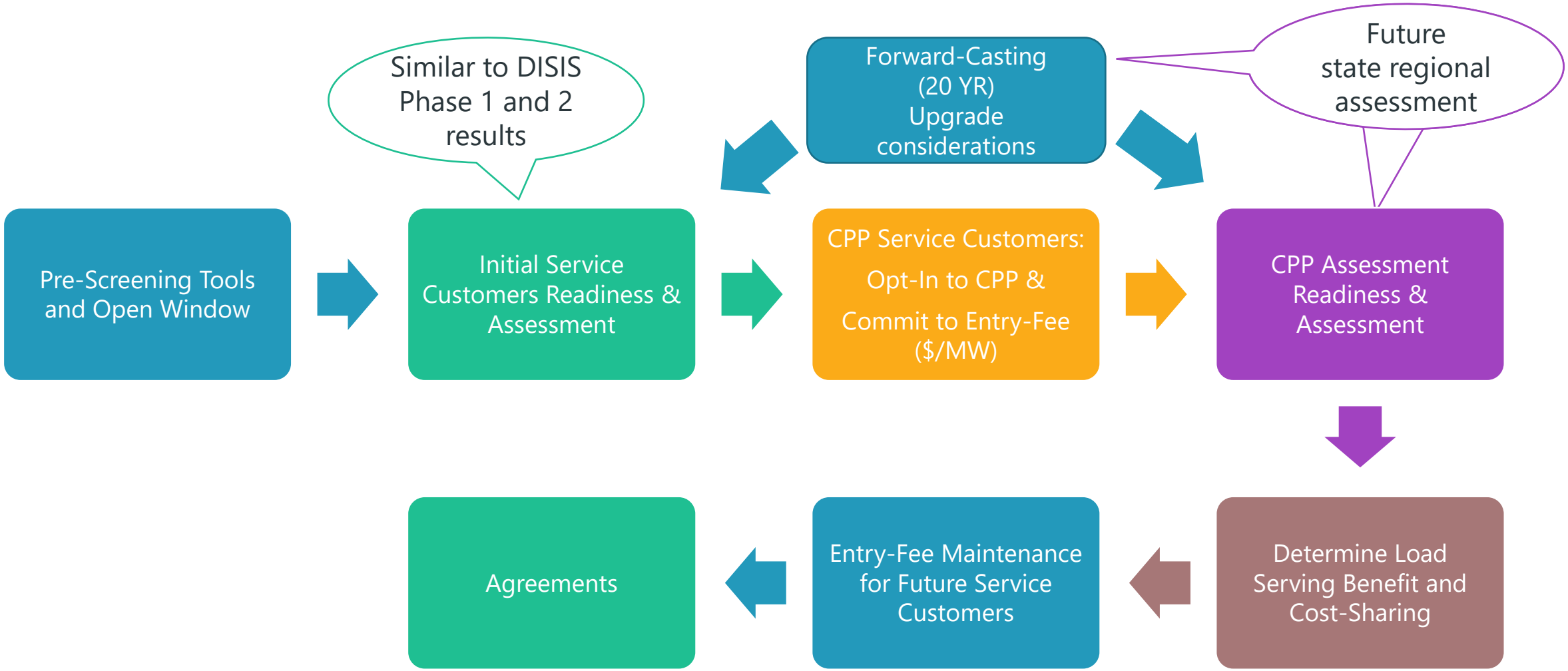
# CURRENT PLANNING PROCESS



# PROPOSED PLANNING PROCESS



# DRAFT CPP PROCESS FLOW



# WHAT STUDY TYPES WILL BE IN CPP PHASE 1?

| Study | Study Type | Phase 1 |
|---|---|---|
| **Load Connection** | Delivery Point Addition (DPA) | **Yes** |
| **Load Connection** | *Delivery Point Transfer (DPT) [depends on progress SPP revision request progress]* | ***TBD*** |
| **Transmission Connection** | NTC Modification/Re-evaluation | **Yes** |
| **Transmission Connection** | Transmission Owner Project Evaluation<br>*(for those routed to ITP assessment and ITP supplemental study)* | **Yes** |
| **Generator Connection** | Definitive Interconnection System Impact Studies (DISIS) | **Yes** |
| **Generator Connection** | Affected System Impact Studies (ASIS) | JTIQ Cost Commitment<br>SPP Customer Study |
| **Generator Connection** | Interim Studies | **Yes** |
| **Generator Connection** | Modification Studies | **Yes** |
| **Generator Connection** | Limited Operation Studies | **Yes** |
| **NERC Planning Assessments** | NERC Planning Assessments | TPL-001<br>FAC-002 |

# DRAFT CPP PROCESS CYCLE

## CPP Cycle

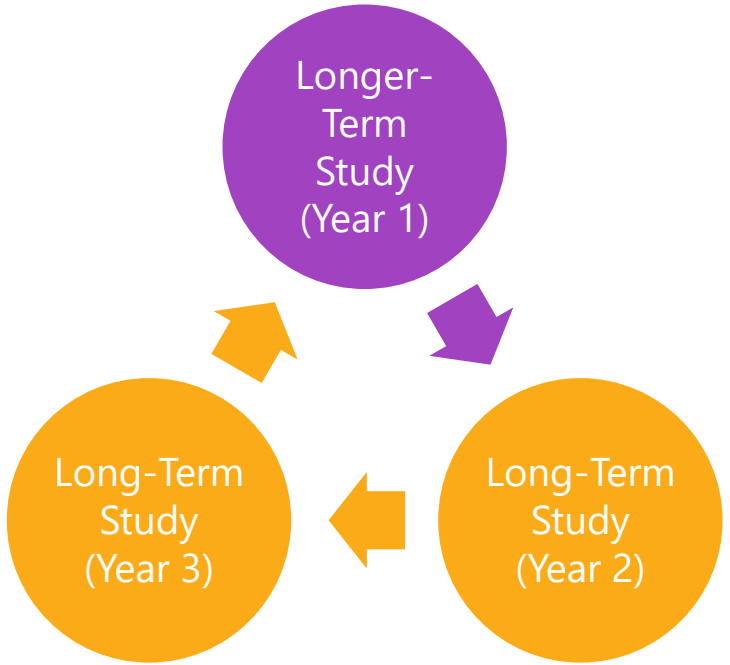
- Defined multi-year plan for up to three annual studies

## Long-term assessment

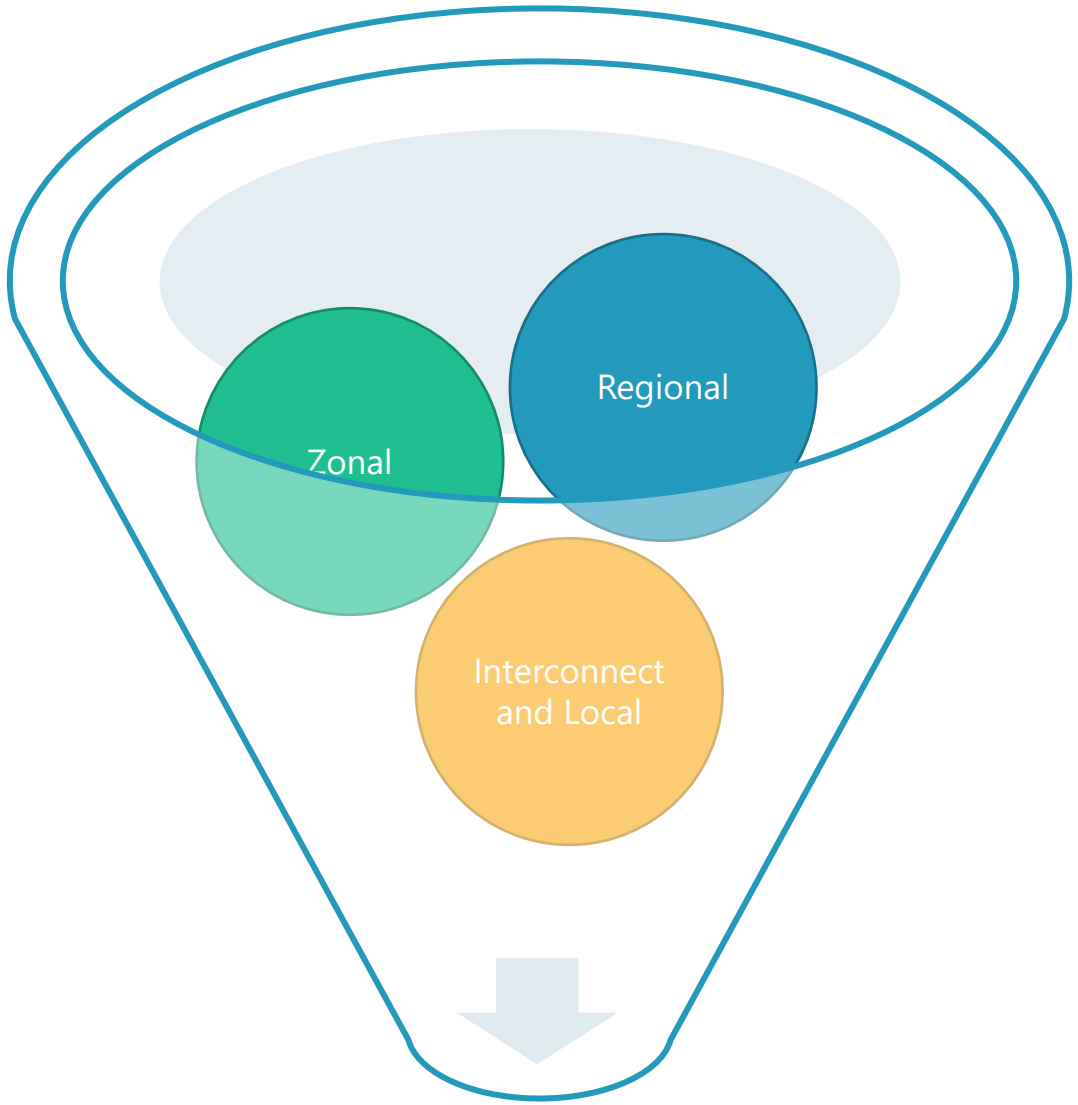
- 10 year horizon assessment (e.g. 2023 ITP)
- Built to include CPP Phase 1 study-type inclusions
- Ability to refine futures and scenario assumption

## Longer-term assessment

- 15 or 20 year horizon assessment
- Includes long-term assessment scope for 10 year horizon
- Provides infrastructure vision and opportunity for commitment across three long-term assessments within the CPP Cycle
- Robust regional planning futures and scenario assumptions for CPP cycle (up to three studies)



# WHAT MIGHT GO INTO THE ENTRY FEE?




## Regional

- $/MW commitment to aggregation of regional planning upgrades
- System upgrades potentially identified in longer range (15 or 20 year) planning assessment

## Zonal

- $/MW for upgrades required beyond regional upgrades for specific needs of the zone
- Potentially identified in initial assessment

## Interconnect and Local

- Direct assignment cost of specific network or transmission owner facilities upgrades at the Point of Interconnection
- Potentially identified in initial assessment

# Generation Interconnection and Transmission Planning Reform Proposal

5/11/2023

Aaron Vander Vorst, P.E.
Head of Growth and Transmission Strategy
Enel North America

i2X Solution e-Xchange: Queue Management & Cost Allocation

codensa

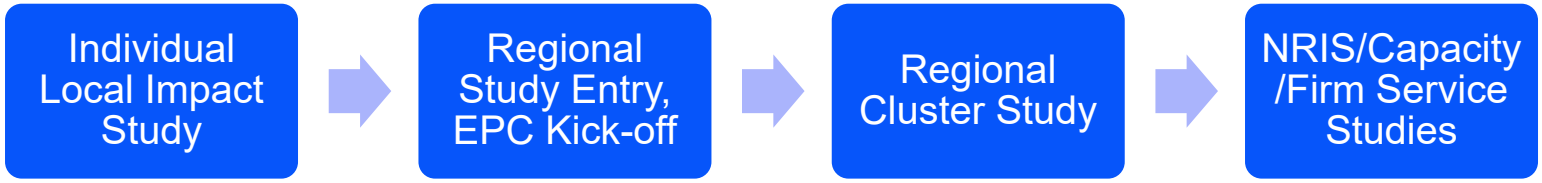
# Agenda

- Overview of Enel whitepaper
- GI NOPR Recommendations

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

# Comprehensive Reform Proposal

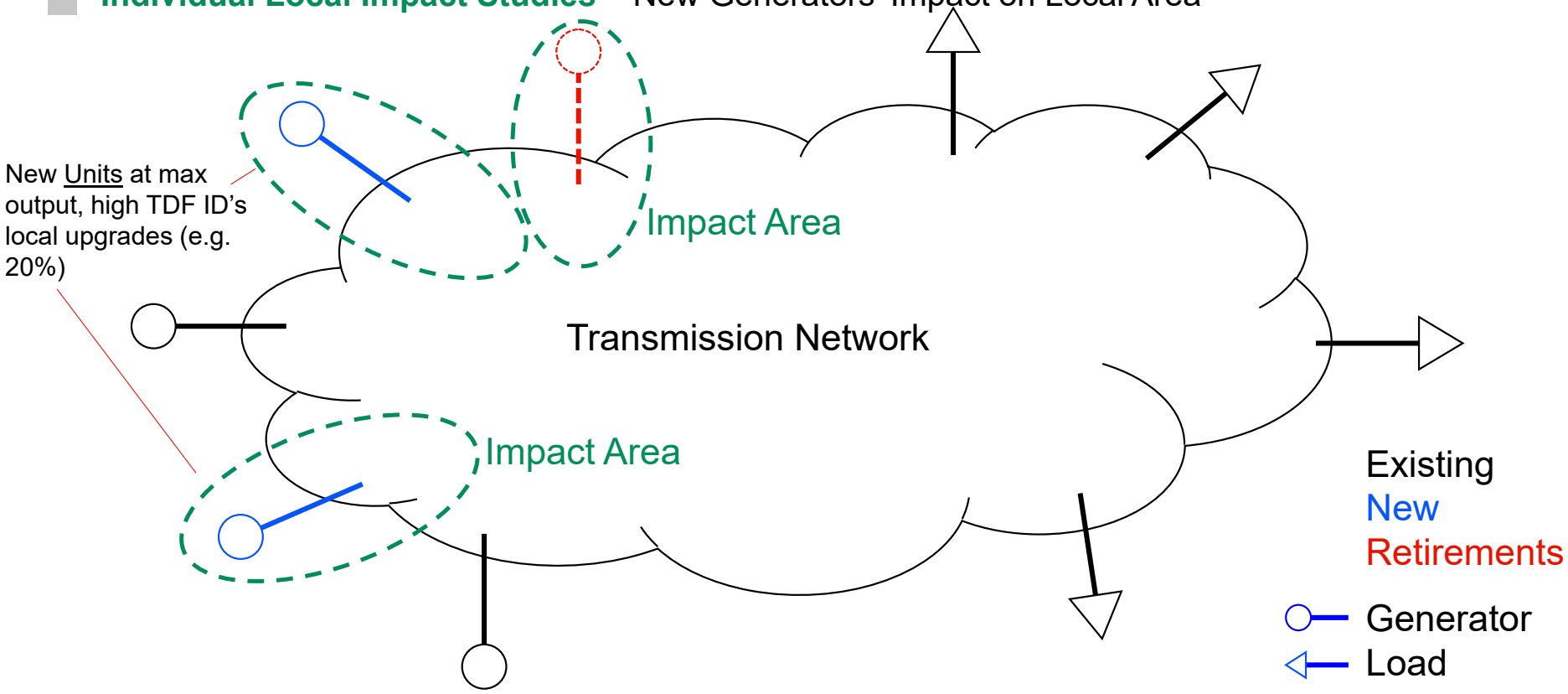
30,000 ft. view




- **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
- **NRIS/Capacity/Firm Transmission Service Studies** – Individual units requesting new or increased NRIS, capacity interconnection rights, transmission service, etc. receive individual studies at the requested levels.

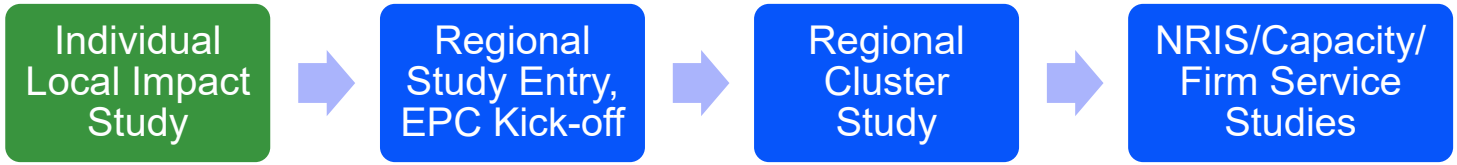

# Interconnection Reform Concept

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



# Individual Local Impact Study

## Proposal Overview

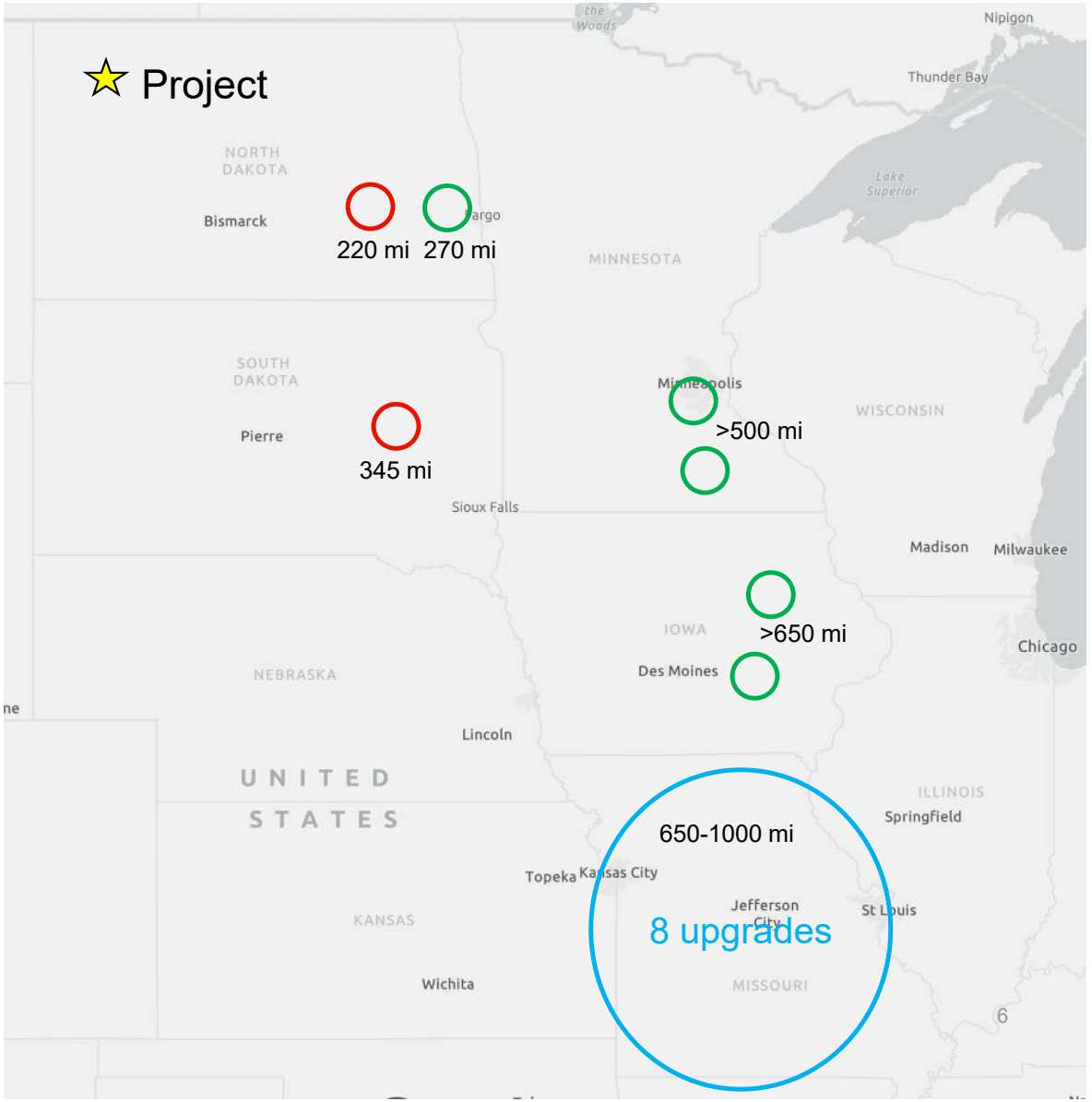



- **Purpose:** Provides generators close to meeting readiness with binding ERIS costs to inform project development process.
- **Study specifics**
  - Target local constraints through high TDF criteria (suggest 20% PTDF/OTDF, 1% voltage change/100 MW)
  - Optimize project size and POI during power flow 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

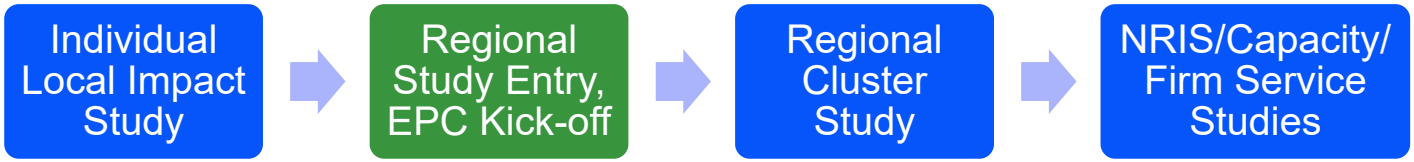
- Original upgrades shared by 14 projects
- 4 SPP, 5 MISO, 3 AECI studies so far
- Upgrade criteria violated
  - SPP
    - >3% TDF under N-0
    - 2% voltage change (cluster impact)
    - Transformer and capacitor
  - MISO
    - 1% voltage change (cluster impact)
    - Capacitors/statcoms
  - AECI
    - 3% of facility rating (cluster impact)
    - 8 69 kV lines and transformers
  - Note: withdrawals and re-studies have since impacted these results




5/11/2023

# Project Commitment to Regional Study

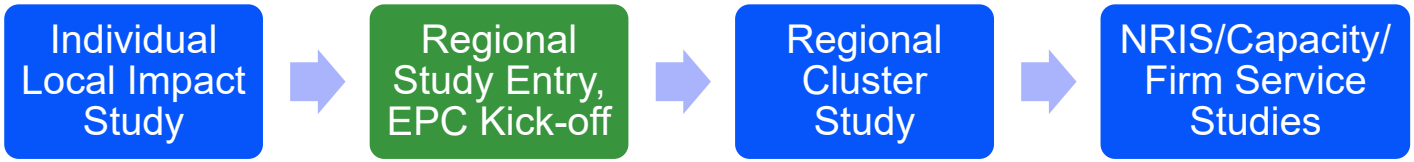
## Proposal Overview




- Key thought: No generation project is fully developed and "ready" without binding interconnection results
- **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

# EPC Kick-off and New Competitive EPC Option

## Proposal Overview

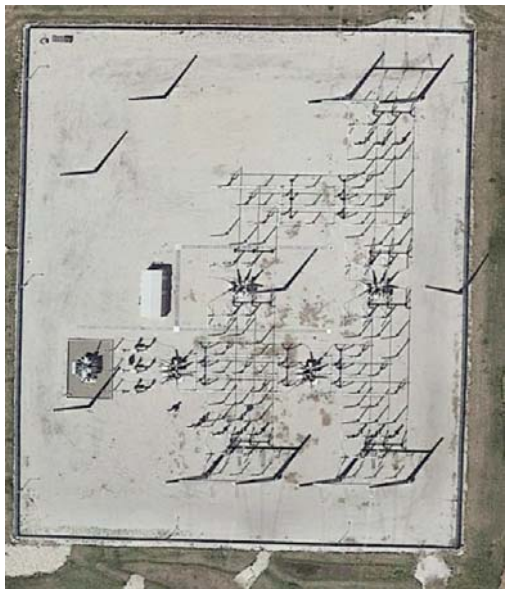


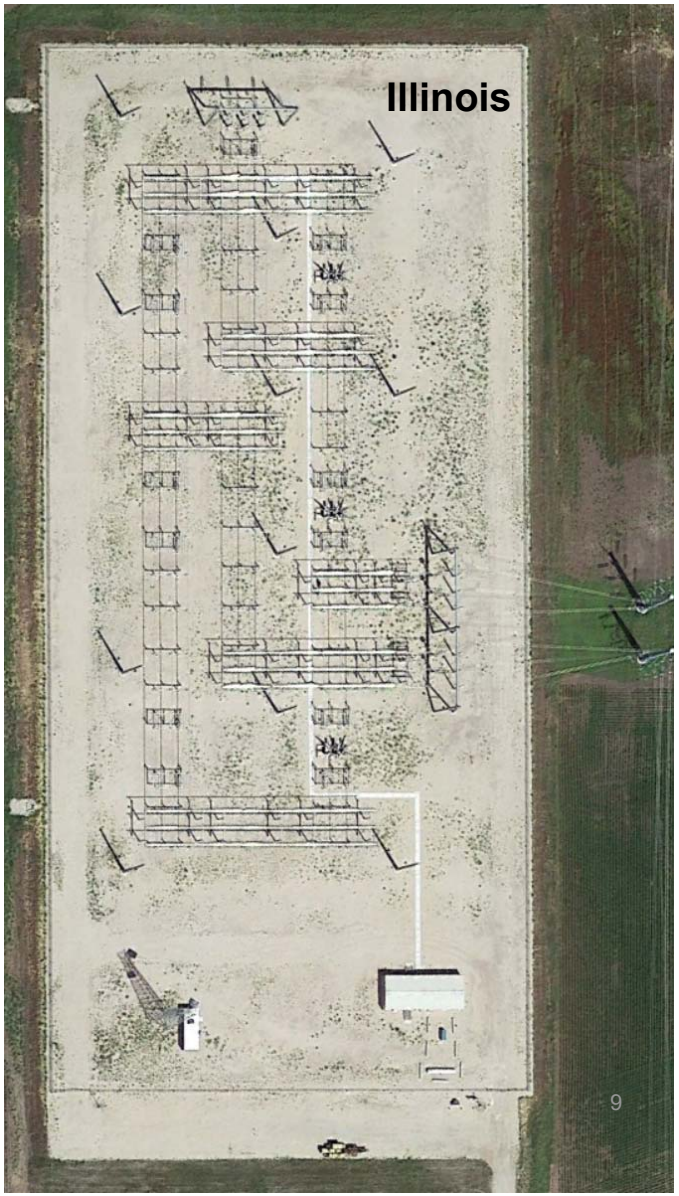

- **Upgrade construction**
  - Traditional or competitive facility study bid process starts upon readiness demonstration and security payment (IC election)
  - New IC option for competitive bid
    - Bid process replaces facility study. Timely bids required to be selected
    - Standalone upgrades (new 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
  - See page 52 of Enel's Generation Interconnection NOPR comments for more detail

# Real Life Example

345 kV Point of
Interconnection Substations

**Missouri**

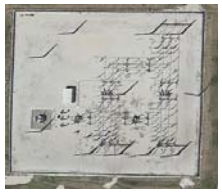


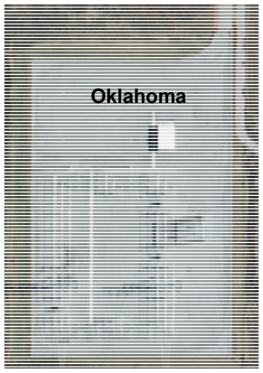



# Real Life Examples

345 kV Point of Interconnection Switching Station Designs

Missouri



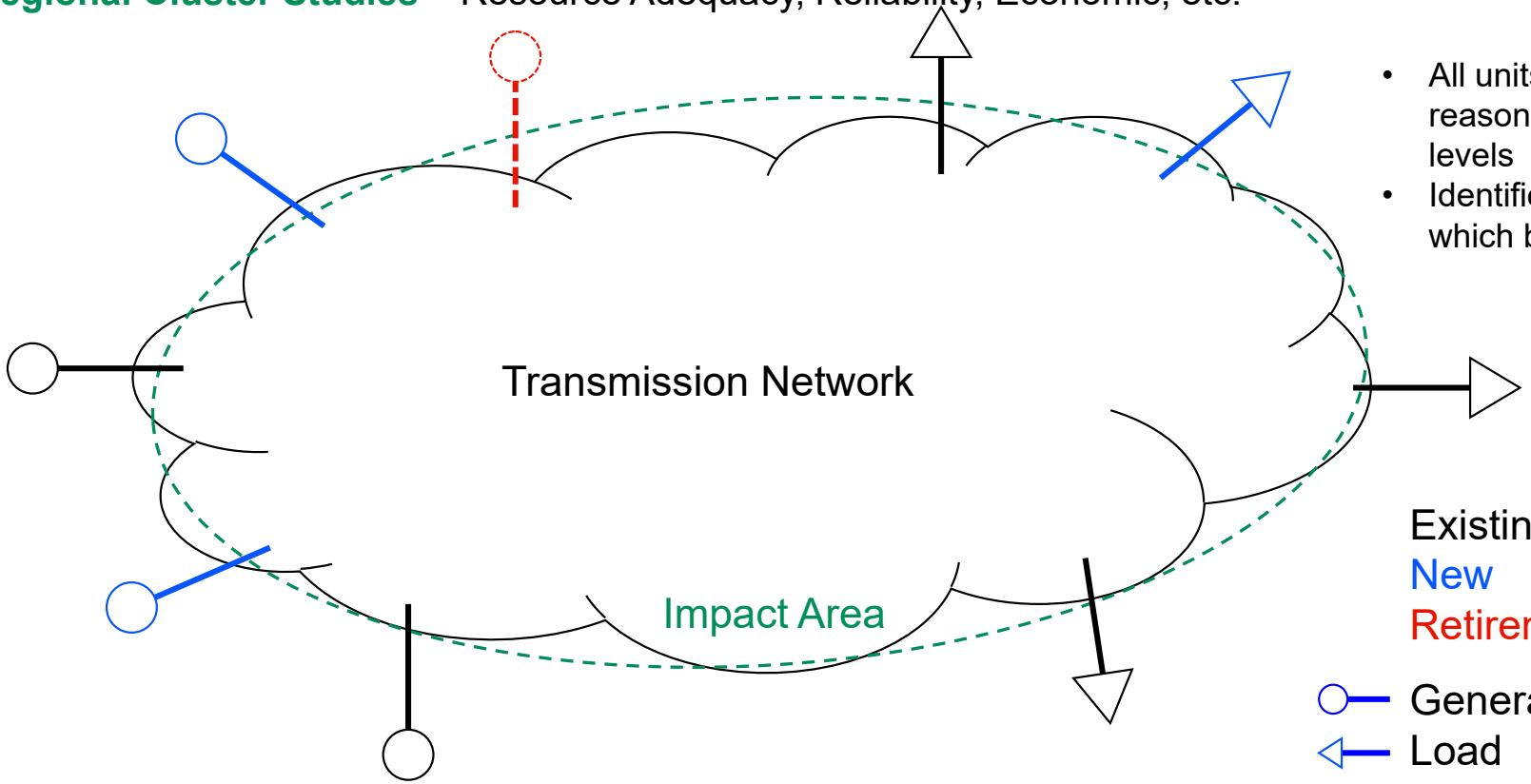




| State | Missouri | Oklahoma | Illinois | Low vs High |
|---|---|---|---|---|
| Initial Configuration | Ring | Ring | Ring | |
| Expandability | 1 spare position | 6 breaker ring or Breaker and a half | 6 breaker ring or Breaker and a half | |
| Station Area (acres) | 3.5 ac | 7 ac | 8.6 ac | 2.5x |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


# Interconnection Reform Concept

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



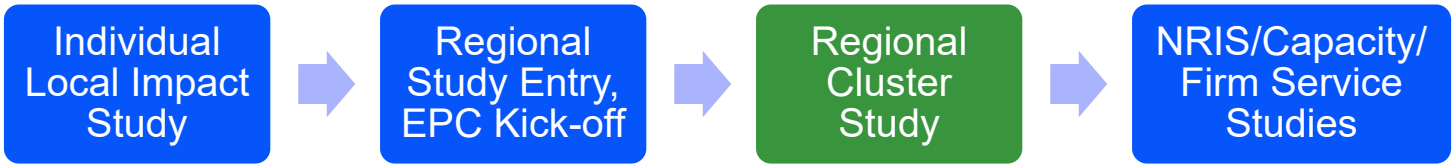

- All units studies at reasonable expected levels
- Identifies upgrades which benefit load

Existing
New
Retirements

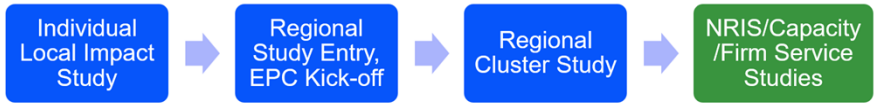
Generator
Load

# Regional Cluster Study

## Proposal Overview



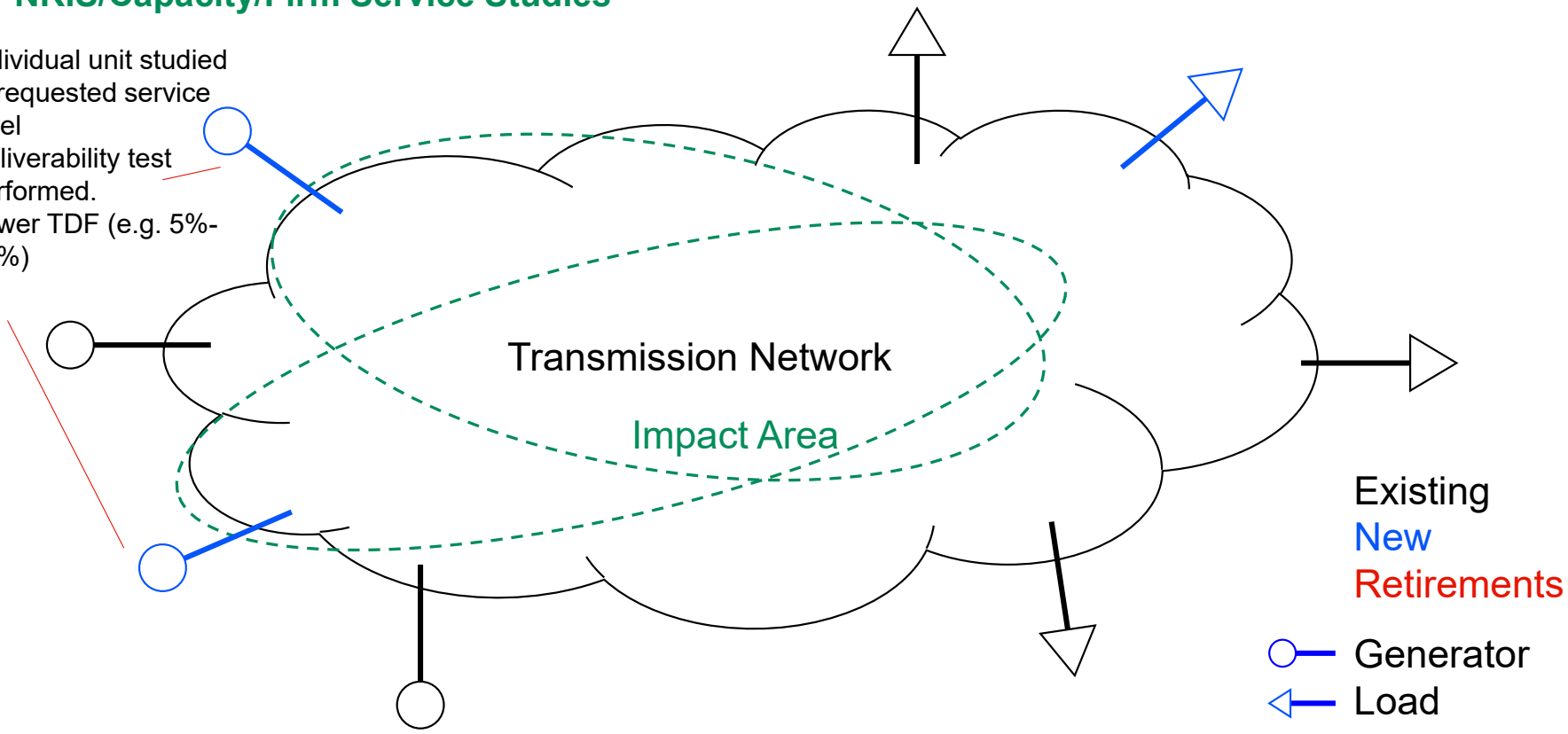

- **Purpose:** Resource Adequacy, Reliability, Economic, etc. studies done on new service requests to determine optimal Tx design
  - Could be combined with regional planning process as proposed in whitepaper, but not necessary.
  - Could serve as Resource Solicitation Cluster in non-RTOs
- **Results**
  - 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.




# Interconnection Reform Concept

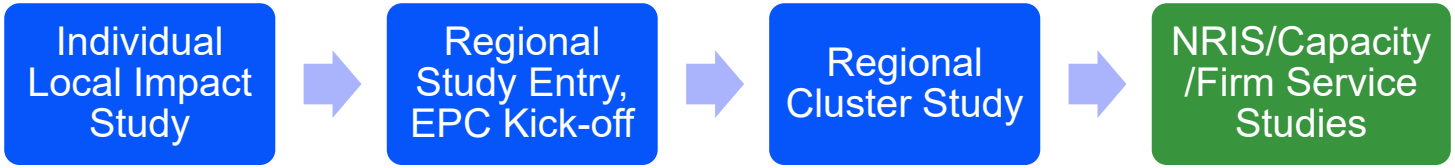
## NRIS/Capacity/Firm Service Studies

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



# Capacity/Firm Service Studies

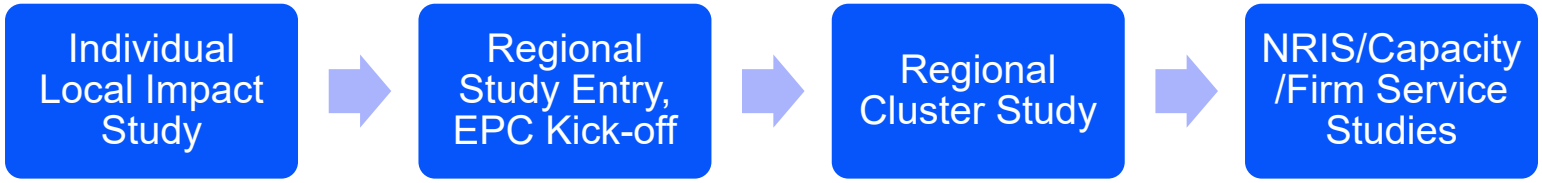
## Proposal Overview




- **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




- **Individual Local Impact Study** - Individual binding system impact study identifies local issues only, produces binding ERIS results
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  - Could be either new interconnection study step or consolidated into regional planning process
- **NRIS/Capacity/Firm Transmission Service Studies** – Individual units requesting new or increased NRIS, capacity interconnection rights, transmission service, etc. receive individual studies at the requested levels.

# For more information

For more detail, please see Enel's whitepaper and Generation Interconnection NOPR comments in Docket RM22-14 (See links below)

Or contact us at

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- Aaron.VanderVorst@enel.com


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

https://elibrary.ferc.gov/eLibrary/filedownload?fileid=87D3F238-EDCE-C3B8-9F81-83D301E00000

# Questions?

# i2x-QMCA2

09 - 12 May 2023

Poll results

# Table of contents


- How can we more tightly integrate and coordinate transmission planning with the interconnection process?
- What are the main barriers to interregional interconnection coordination (e.g. affected system studies)?

# How can we more tightly integrate and coordinate transmission planning with the interconnection process?

0 2 1

(1/6)

- My experience is that nearly all projects enter the process seeking a capacity interconnection and end up converting to energy-only once they find that there is no capacity available
- Integrated Grid Planning processes which identify growing loads and new generation potential regions and then publicly make available capacity and upcoming transmission building to reduce speculative projects clogging the queue and also reducing inefficient network upgrades through centralized construction done cost efficiently.
- Complete the studies in parallel but within the same time period (1 yr), and if similar upgrades are identified in the same studies, then have one process take precedence (transmission planning). Having separate but equal processes allows for

# How can we more tightly integrate and coordinate transmission planning with the interconnection process?

(2/6)

0 2 1

easier cost allocation. Gen planning is a "but for" planning process and the generator pays. Transmission planning is for the benefit of the load to ensure reliability. These studies are "beneficiary pay", therefore assigned to load.

- need to change the manner in which interconnections are handled. Need to create new process where generation may apply based on proven or expected system needs. this will provide certainty to the process
- Have RTO's dictate where generation is needed and have generation providers bid to server generation in those locations vs letting generation requesting interconnection locations.
- FERC can order formal integration with regional planning
- More like ERCOT existing

## How can we more tightly integrate and coordinate transmission planning with the interconnection process?

(3/6)

0 2 1

process, SPP's proposed process, or perhaps a blend of both.

- Looking more into which set of queued generators under study in the generation interconnection space should be included in the regional transmission planning process. Some areas only include those generators that are in construction, executed GIA or PPA. But that doesn't include projects even if they are under consideration for Resource Adequacy
- Comprehensive Network Upgrades and Cost Allocation to all benefactors (Generators, TOs, Load)
- Use the same sets of planning standards for transmission planning and generator interconnection planning. This isn't always done, depending on the transmission provider
- The assumptions and inputs for the interconnection process and transmission process should align well.

# How can we more tightly integrate and coordinate transmission planning with the interconnection process?

(4/6)

0 2 1

Interconnection process results should feed into the transmission process to identify least cost upgrades.

- transmission corridors and predictive projects
- More energy zones type approaches to send signals for both gen and transmission
- Identify competitive transmission corridors
- Consolidated/integrated transmission planning that considers interconnection queues and incorporating state resource goals into long term planning scenarios
- Global optimization - what combination of proposed generation and transmission projects provides the most value?
- Independent transmission monitor and removing IOUs from transmission planning
- you need to have a true certainty in the interconnection process. Generators speculate too much.

# How can we more tightly integrate and coordinate transmission planning with the interconnection process?

0 2 1

(5/6)

- Your slides assume that they are not tightly integrated today which is not necessarily true in all regions as the same reliability tests are run for both the annual transmission planning process and generation interconnection with the cost causer paying for the appropriate network upgrades.
- Focus the scope of interconnection studies on what's needed to reliably integrate injections from proposed gen, while studying deeper network upgrades through multi-value, scenario-based transmission planning
- Proactively plan transmission in areas of commercial interest/greatest potential renewable production
- Utilizing Flexible Interconnections
- Identify backbone upgrades through regional transmission planning. Can be informed

# How can we more tightly integrate and coordinate transmission planning with the interconnection process?

(6/6)

0 2 1

by GI process (see Duke Energy's Red Zone Expansion Plan)

- Super fast processing of interconnection applications with machine learning, etc.
- RTO formation
- Actually start by integrating and coordinating those processes
- More rigorous benefit-cost analysis in transmission planning
- Deregulation
- Consolidated process like SPP's

## What are the main barriers to interregional interconnection coordination (e.g. affected system studies)?

0 1 0