Study Framework:
Interregional Transfer Capability Study (ITCS)

Purpose

The purpose of this project is to conduct a study on the reliable transfer of electric power between neighboring "transmission planning regions".[1] Specifically, the project focuses on:

Who: NERC, in consultation with each regional entity and each transmitting utility[2] in a neighboring transmission planning region.

What: A study of total transfer capability between transmission planning regions.[3] In accomplishing this work, the study should include:

1. "Current total transfer capability, between each pair of neighboring transmission planning regions." (This objective aims to determine the current maximum potential capacity for electric power transfer between neighboring regions. Current transfer capability includes currently planned transfer capability in the near term and long-term i.e., one year and 10-years out.);[4,5]
2. "A recommendation of prudent additions to total transfer capability between each pair of neighboring transmission planning regions that would demonstrably strengthen reliability within and among such neighboring transmission planning regions." (This objective focuses on identifying reliable options that increase the amount of electric power that can be transferred between neighboring areas in support grid reliability and resilience); and
3. "Recommendations to meet and maintain total transfer capability together with such recommended prudent additions to total transfer capability between each pair of neighboring transmission planning regions." (This objective entails evaluating proposing policies and recommending measures to achieve and sustain the identified transfer capability and any recommended enhancements).

When: NERC must file with FERC within 18 months of enactment of the bill. Public comment period will occur when FERC publishes the study in the Federal Register. After submittal, FERC must provide a report to Congress within 12 months of closure of the public comment period with recommendations (if any) for statutory changes.

A Canadian addendum report will be created to study the Canadian province-to-province interfaces and will be provided to Canadian regulators.

ERO study filing deadline: On or before December 2, 2024

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[1] Legislative Directive: https://docs.house.gov/billsthisweek/20230529/BILLS-118hrPIH-fiscalresponsibility.pdf
[2] "means an entity (including an entity described in section 201(f)) that owns, operates, or controls facilities used for the transmission of electric energy—(A) in interstate commerce; (B) for the sale of electric energy at wholesale." [FPA, Section 3(23)]
[3] (a) IN GENERAL.—The Electric Reliability Organization (as that term is defined in section 215(a)(2) of the Federal Power Act), in consultation with each regional entity (as that term is defined in section 215(a)(7) of such Act) and each transmitting utility (as that term is defined in section 3(23) of such Act) that has facilities interconnected with a transmitting utility in a neighboring transmission planning region, shall conduct a study of total transfer capability as defined in section 37.6(b)(1)(vi) of title 18, Code of Federal Regulations, between transmission planning regions that contains the following:" [1-3 bullets quoted above]
[4] **Total transfer capability**: means the amount of electric power that can be moved or transferred reliably from one area to another area of the interconnected transmission systems by way of all transmission lines (or paths) between those areas under specified system conditions, or such definition as contained in Commission-approved Reliability Standards. [18 C.F.R. Section 37.6(b)(1)(vi)]
[5] **Neighboring transmission planning region**: implicitly means facilities connecting two adjacent systems or control areas.

Background

NERC recognizes that strong and flexible electric transmission systems capable of coping with a wide variety of system conditions are necessary for a reliable supply and delivery of electricity. Electric power transfers have a significant effect on the reliability of the interconnected electric transmission systems. Recent and continuing resource mix changes require greater access and deliverability of resources to maintain reliability—particularly during extreme weather and environmental conditions.

Currently, transmission planners analyze the connections between transmission planning areas to determine the maximum level of transmission transfer capability, as well as scenarios that might limit the capability. This capability is used to address reliability concerns, enable firm or economic transfers, and enable emergency purchases. There currently isn't a criteria or protocols for the amount of transfer capability, and it therefore varies across the nation depending on local needs, and investment. One of the goals of this study is to explore defining a minimum interregional transfer criteria. Further, the ITCS will ~~consider~~ develop~~ing~~ a metric and method that will aid transmission planners to determine the incremental increase in interregional transfer capability needed to address reliability concerns ~~in neighboring areas~~ (e.g., essential reliability services, energy sufficiency). Some of the recent concerns include widespread, long-term impacts from an extreme event (such as extreme weather and wildfires that threaten electric system reliability) or uncertainties resulting from a changing resource mix.

The Interregional Transfer Capability Study (ITCS) aligns with the ERO's obligation to perform long-term reliability assessments for several reasons:

- **Independent and Objective:** The ERO's independence and objectivity provide assurance that the study on interregional transfer capability will be conducted with integrity, technical expertise, and a focus on the best interests of the reliability and security of the bulk power system. By leveraging its independence and credibility, the ERO can ensure that the study's findings and recommendations are reliable, objective, and trusted by industry stakeholders and regulatory authorities.
- **System-Wide Perspective:** The study examines the interregional-transfer capability across the United States, considering the interaction and reliability of neighboring areas. By assessing the ability to transfer electric power between regions, the ERO can gain insights into the overall reliability of the interconnected bulk power system and report on them.
- **Risk and Reliability Analysis:** The study evaluates the existing import and export transfer capability and identifies prudent increases in total transfer capability to enhance the reliability of neighboring areas impacted by reliability risks such as extreme weather. By analyzing various scenarios and considering potential risks, such as transmission constraints or disruptions, the ERO can provide recommendations to mitigate reliability risks, maintain long-term system adequacy, and increase resilience for power delivery.
- **Collaboration and Coordination:** The study involves collaboration with Regional Entities, industry, and a special stakeholder Advisory Group. This approach fosters coordination and information sharing among different entities, promoting a collective understanding of interregional transfer capability and its impact on long-term reliability.
- **Strategic Planning:** Long-term reliability assessments are crucial for strategic planning within the electric power industry. The interregional transfer capability study provides valuable insights into the capacity and flexibility of the transmission system, enabling industry, planners, and policymakers to make informed decisions for future infrastructure development, resource additions, resource allocation, and reliability enhancement.

By conducting the interregional transfer capability study, the ERO fulfills its role as the trusted authority for BPS reliability. The study contributes to ERO's ongoing commitment to ensuring the reliability, adequacy, and resilience of the bulk power system.

Project Goals and Objectives:

- Conduct a comprehensive study of existing interregional transfer capability across the United States (between each transmission planning region) to assess currently available transfer capability between neighboring areas and the future need for additional transfer capacity to ensure reliability under various system conditions including extreme weather.
- Provide reliable and data-driven recommendations for "prudent" additions to the amount of electric power that can be moved or transferred between neighboring transmission planning regions.
- Recommend approaches to achieve and maintain an adequate level of transfer capability.
- Engage stakeholders and gather inputs, assumptions, and conditions from Regional Entities, industry, and a special stakeholder Advisory Group to ensure a comprehensive and inclusive study.
- Identify expectations for next steps and continuing analysis to reinforce the Long-Term Reliability Assessment.

General Approach:

1. **Engage Executive Leadership Group:** For ERO-wide strategic leadership, concurrence on study design and approaches, and support for the project manager of this project. Form an ERO project team that will be responsible for developing the overall project execution strategy, monitoring, and oversighteeing of the project progress.
2. **Collaborate with Regional Entities and industry to collect necessary data and information:** Work closely with Regional Entities and industry stakeholders to gather relevant data, build system models, and reports required for the study. Develop input assumptions, including loads, resources, transmission topology, extreme weather conditions utilizing external consulting and industry expertise.
3. **Engage a special stakeholder Advisory Group composed of representation from all planning areas to gather inputs and ensure a comprehensive study:** Form a stakeholder Advisory Group consisting of representatives from all planning areas to provide insights, expertise, and inputs to the study, study scope, and study results.
4. **Conduct comprehensive analysis and modeling of interregional transfer capability:** Perform detailed analysis and modeling of the transmission systems to assess the current and potential transfer capability between neighboring areas. Assumptions will need to be internally consistent and consider scenarios and conditions that impact long-distance power transfers. The study will also consider factors such as generation mix, load growth projections, various high-risk scenarios, and emerging environmental policy impacts to various inputs such as loads/generation etc. in the study.
5. **Evaluate existing transmission infrastructure, system constraints, and potential areas for improvement:** Assess the current transmission infrastructure, identifying system constraints, and identifying opportunities for improvement to enhance interregional transfer capability.
6. **Identify potential reliability challenges and propose solutions to enhance interregional transfer capability:** Identify existing transfer capability between transmission planning areas, potential reliability challenges associated with interregional transfers and recommendations to address them.
7. **Develop a final report with actionable recommendations for enhancing interregional transfer capability:** Compile all study findings, analysis, and stakeholder inputs into a comprehensive final report that provides

actionable recommendations for improving interregional transfer capability based on a quantifiable and objective metric and criteria.

Project Management Structure:

To expedite this project, existing structures, programs, and governance will be used for executive, management, and project guidance and decisions. While the project management structure will be used to support governance, decision making, and convening input, the project is under the direct management of NERC's Chief Engineer. The OLT and RAPA-SG, while part of the ERO Enterprise's programmatic activities, are not part of the direct reporting/approval process for actions related to the ITCS.

- **ERO Executive Leadership Group** – Provide Strategic Leadership and coordinate with the ERO Project Team (dotted-line) and will include:
  - NERC SVP and Chief Engineer
  - NERC SVP, General Counsel, and Corporate Secretary
  - NERC SVP of External Affairs
  - VP of Communications (liaison with ERO Enterprise Communicators Group)
  - One or more Chief Executives or appointees from the ERO Regional Entities
  - NERC Staff Project Manager and Director, RAPA.
  - Executive consultant to provide insights and advice.
- **Operations Leadership Team (OLT)**– Provides operational leadership to the project .
- **RAPA-SG** – Manages and coordinates the oversight of the ERO's Reliability Assessment Program, requirements, and coordinating regional activities. ITCS falls within the ERO's Reliability Assessment Program.

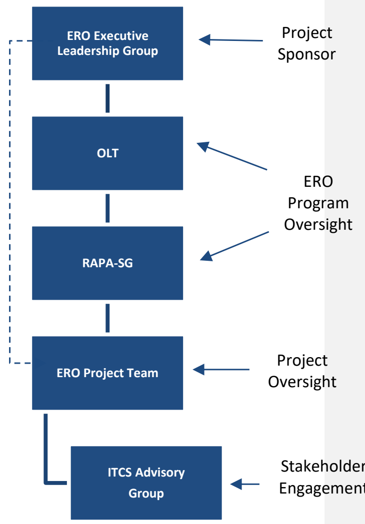


Figure 1: ITCS Management & Operational Groups

- **ERO Project Team** – ERO Staff Team (NERC and Regional Entity Staff) will develop the Statement of Work for any consulting work needed to conduct ~~the~~ engineering studies.
- **ITCS Advisory Group**: Stakeholder advisory group commissioned by a NERC Staff~~ Project Manager~~. Stakeholder membership advises and provides input to the ERO Project Team. This group will help provide input to ERO and stakeholders on the study scope, approach, results, and recommendations. ~~Group constituency, representation, and structure is to-be-determined by the ITCS's ERO Project Team and the ERO Executive Leadership Group.~~

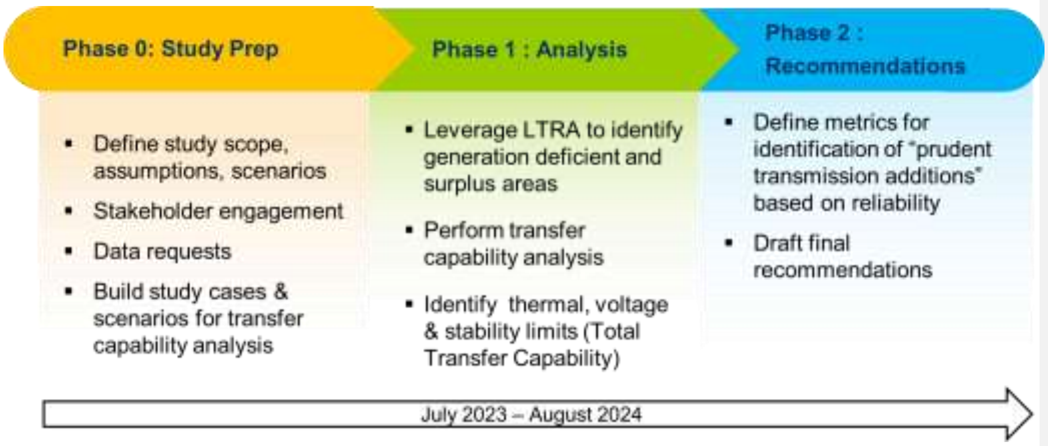


Figure 2: ITCS Phased Approach

Project Plan and Schedule:

- **PHASE 0**
  - **Kickoff Phase (Months 1-2):** Establish the Executive Leadership Group and ERO Project Team. Initiate the project, define objectives, and finalize the project plan. Define roles and responsibilities of NERC Staff, Regional Staff, and any consultants and/or contractors.
  - **Stakeholder Engagement Phase (Months 3-5):** Establish the special stakeholder Advisory Group, conduct workshops and meetings, gather input, and incorporate stakeholder feedback into the study. Post study scope for stakeholder comment (21 days). Gather input and feedback on scenarios, assumptions, and case development.
  - **Data Requirements, Collection Phase (Months 4-5):** Determine necessary data and information to perform study. Regional Entities collect and validate the data from transmission planners; conduct detailed data analysis.
- **PHASE I**
  - **Base Case and Scenario Development Phase (Months 3-8):** Develop the steady state and dynamic models for the study; Create transmission system models with appropriate base level transfers, assess system constraints, and evaluate various scenarios to identify potential enhancements.
  - **Perform Transfer Capability Study & Scenario Analysis (Months 8-11):** Perform study of existing transfer capability, and study various scenarios to identify potential enhancements.
  - **Define Metrics for System Enhancements Phase (Months 8-10):** Determine approach for quantifying increased transfer capability needed for reliability.
- **PHASE II**
  - **Define Metrics for System Enhancements Phase (Months 8-10):** Determine approach for quantifying increased transfer capability needed for reliability.

- **Identify Transmission Capability Needs (Months 11-14):** Analyze study findings, identify reliability challenges, and formulate recommendations on any prudent additions to transfer capability in the interest of reliability as well as measures to help achieve any such additions.
- **Final Report Preparation Phase (Months 15-16):** Compile study results, develop a comprehensive final report, review and validate the report with stakeholders, and address any feedback received.
- **Stakeholder Comment Phase (Months 17-18):** Solicit comments through an open stakeholder process and incorporate them into final report.

- **Submit to FERC (Month 18): December 2, 2024**
- **FERC Review (Month 18-30): Provide support to FERC and Canadian regulators, as needed. Possible reply comments.**

Resource Needs

This project will use a mix of in-house experts and consulting support. The ERO Project Team will determine the best use for consulting support.

- **Project Manager:** A dedicated project manager responsible for leading and coordinating all aspects of the study and stakeholder/management engagement. The Project Manager will coordinate with the Executive Leadership Group, ERO Project Team, and commission the industry advisory group.
- **~~Executive~~ Technical Consultants:** To advise and prepare materials and results to the Executive Leadership Team and ERO Project Team.
- **ERO Project Team (Engineering and Modeling Experts):** Skilled professionals from NERC and the Regional Entities proficient in transmission engineering, modeling techniques, and scenario assessments. A combination of new FTEs, existing FTEs, and consultants/contractors will support NERC and the Regional Entities. Contractors will coordinate with the ERO Project team and perform analysis as needed.
- **Industry Stakeholders:** Technical experts from transmission planning areas who provide expertise and insights throughout the study and analysis phase.
- **ITCS Advisory Group:** Subject Matter Experts with deep knowledge of transmission systems, interconnection studies, study processes, and NERC Reliability Standards. May include Registered Entity stakeholders, state regulators, or other industry experts.

Deliverables

1. **Finalized Study Framework:** Describes the overall framework and governance of the project, general scoping, objectives, and roles and responsibilities. (this document)
2. **Interim Progress Reports:** Regular updates on project milestones, findings, and emerging recommendations. (September 2023, then quarterly)
3. ~~2.~~ **Study Scoping Document:** Documents system analysis methodology, approach, and scope for each phase of the project
4. ~~3.~~ **Draft Study Report:** A preliminary report shared with stakeholders for review and feedback. (June 2024)
5. ~~4.~~ **Final Study Report:** A comprehensive report outlining the study method, findings, recommendations, and supporting analysis. (November 2024)

Project Communication Plan

- Working with the ERO Communication Group, develop a communication strategy for sharing study progress, milestones, and deliverables with FERC, Congress, and other relevant entities.
- Identify key stakeholders to communicate with, including Regional Entities, Registered Entities, state regulators, and the special stakeholder Advisory Group.
- Establish regular communication channels to provide updates, gather feedback, and address stakeholder queries.
- Conduct stakeholder meetings, workshops, preparing and responding to comments, answering questions, and webinars to ensure effective communication and engagement.

Risk Management Plan

While the interregional transfer capability study presents a valuable opportunity, it is important to be aware of potential risks that could affect or delay its successful completion. Some of the risks associated with this project may include:

- Data Availability and Quality
- Stakeholder Engagement and Coordination
- Regulatory and Legislative Changes
- Resource Constraints and Expertise
- Technical Complexities
- Time Constraints
- External Dependencies
- Communication and Coordination Challenges
- "Scope Creep"
- Lack of Clear Expectation

To mitigate these risks, it is crucial to implement a robust risk management plan that includes proactive risk identification, regular monitoring, contingency planning, and clear communication channels. Maintaining open dialogue with stakeholders, conducting thorough quality assurance, and adapting to any unforeseen challenges will help ensure the successful completion of the interregional transfer capability study. See Appendix II.

Technical Study Approach

The ERO Project Team ~~and the Project Manager~~ will define the study approach and build off this starting point.

The study is divided into three parts that are aligned with the legislative language in the 2023 FRA. The three parts are:

1. **Transfer Capability Analysis**
    a. For this phase, the ERO is required to study total transfer capability and calculate "current total transfer capability", which is defined as the amount of electric power that can be moved or transferred reliably from one area to another area of the interconnected transmission systems by way of all transmission lines (or paths) between those areas under specified system conditions, or such definition as contained

in Commission-approved Reliability Standards.[6] The current transfer capability will be calculated for the planned system in the near term and long-term i.e. one-year and ten-years out. See Appendix I for a description of a general transfer study process.

b. The requested study is a multi-area system assessment ~~system planning study and is used to~~ designed to ~~define~~calculate transfer limits between neighboring regions~~in multi-area system assessment studies, such as Loss-of-Load Expectation studies or other system adequacy studies. This is not an operational study, and operational practices and non-firm transfers will not be evaluated~~. The study will be conducted in the planning time horizon.

c. Study scope and approach will be developed by the ERO Project Team.

d. Studying the simultaneous power transfers or point-to-point interfaces ~~is something that~~ will be considered on a case by case basis~~need to be resolved~~.

e. ~~Studying~~ RAS/SPS ~~could~~ will be studied where necessary. ~~be a major effort depending on how many transfers are being simulated.~~

f. Transfer capability calculations are ~~available from~~ performed by many organizations across North America. These limits may be ~~due to a number of~~based on several factors such as thermal, voltage, dynamic stability limits. We will review ~~these~~the relevant studies, realizing that there might be some differences in methods employed by~~there are a number of inconsistencies across~~ organizations across North America. ~~resulting from assumptions from software algorithms and methods.~~ITCS seeks to employ a consistent approach across all regions.

g. Because all Assessment Areas are required to conduct their multi-area probabilistic adequacy studies, transfer capabilities (also referred to as tie benefits, tie transfers, planning transfer capability) are ~~already~~ also calculated today to ensure sufficient transfer capability exists for imports. The challenge to this phase will be gaining a level of consistency across different areas.

   i. Eastern Interconnection (ERAG) + Québec

   ii. Western Interconnection (WECC)

   iii. Texas Interconnection (ERCOT/TRE)

h. Areas will be defined based on existing transmission areas (NERC Assessment Areas) and generally represent the "ORDER 1000" regions + Texas Interconnection. Because of study requirements, adjustments to Order 1000 transmission planning regions may be needed. The ERO will rely on existing Regional frameworks and processes, and bolster them with additional 1) case development and 2) study requirements and scenario development.

[6] The definition of Interregional Transfer Capability is consistent with total transfer capability as defined in the Commission's regulations. In the context of Interregional Transfer Capability, an "area" in the above definition would be a transmission planning region composed of public utility transmission providers.

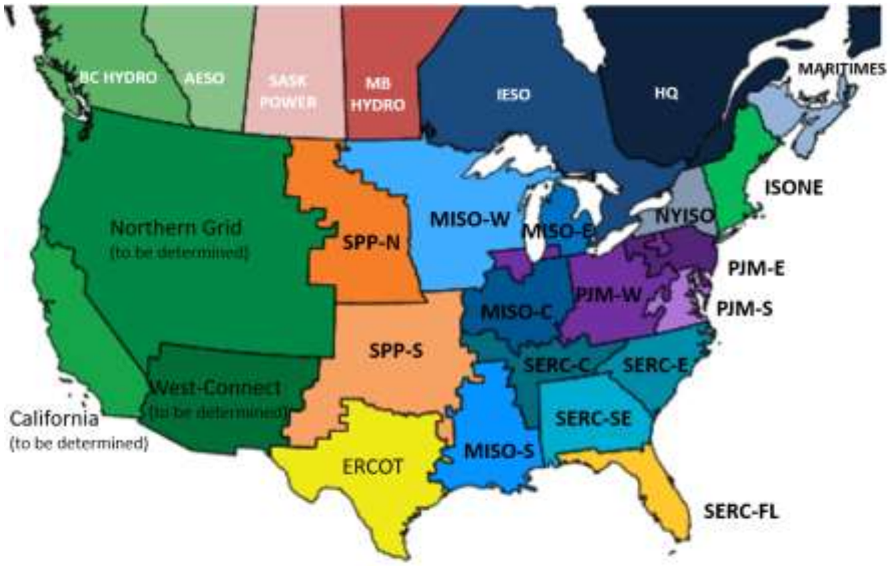


Figure 3: ITCS Areas of Study based on FERC Order No. 1000 Transmission Planning Regions

i. Additional support will be needed to gather regional and interconnection-wide results, and determine wide-area impacts through a common overlay representation.

j. ERO-Project Team will also identify requirements to study inter-Interconnection transfers (Phase I) and potential for increased transfer capability across interconnection tie lines (Phase II). The ERO Project Team, with agreement from the Executive Leadership Group will define the Study Scope and determine the specific objectives and scope of the interregional transfer study. Also, the ERO Project Team will define the study period and study requirements.

k. The year of the study needs to be clearly defined before any work begins in order to identify the proposed projects and retirements consistent with the ISOs/RTOs interconnection queues, the expectation for future electric demand (e.g., building electrification, EV charging, and anticipated behind the meter solar installations), and the expected in-service dates of transmission projects already under construction.

l. The study will leverage as much existing information as possible and require the following at minimum:

   i. **Gather Data:** Study groups will gather relevant data for both the source and sink regions involved in the study. This includes information on generation capacity, fuel types, load profiles, transmission infrastructure, interconnection points, system operating characteristics, and any existing or planned interties between the regions.

   ii. **Develop Metrics and Criteria:** A common set of metrics should be applied consistently across all areas and interconnections, with appropriate flexibility for physical regional differences.

   ~~iii.~~ **Develop Load and Generation Profiles:** Create load and generation profiles for the regions under study. This involves understanding the expected power demand and supply patterns, considering factors such as seasonal variations, peak load periods, renewable energy generation, and the availability of reserve resources. ~~The assessment will focus on extreme conditions. This does not need to "start from scratch" and we will leverage existing data and information. In some instances, load/generation forecast data may not be available (e.g., 20 years into the future for some areas of~~

the system). In such situations appropriate datasets will need to be developed utilizing various tools such as capacity expansion modeling, production cost modeling, etc. Appropriate policy drivers may also need to be considered in order to determine impacts to load and resource development.

iv.iii. **Develop Extreme Weather Scenarios:** Certain extreme weather events and scenarios will need to be developed to ensure the appropriate stressed system conditions are simulated. Climate modeling will need to inform the extreme weather scenarios that should be studied (extreme cold, extreme heat, wildfires, droughts etc.). Further analysis will need to determine how such extreme events impact resources resource availability, resource output, etc., as well as transmission system availability and outages.

v.iv. **Evaluate Transmission Capacity:** Develop the study approach (including constraints and test scenarios) and assess the transmission capacity between the regions. This involves analyzing the existing transmission infrastructure, including line ratings, facility ratings, thermal limits, voltage stability, and any congestion management measures in place.[7] Identify any transmission bottlenecks or limitations that could affect interregional transfers.[8]

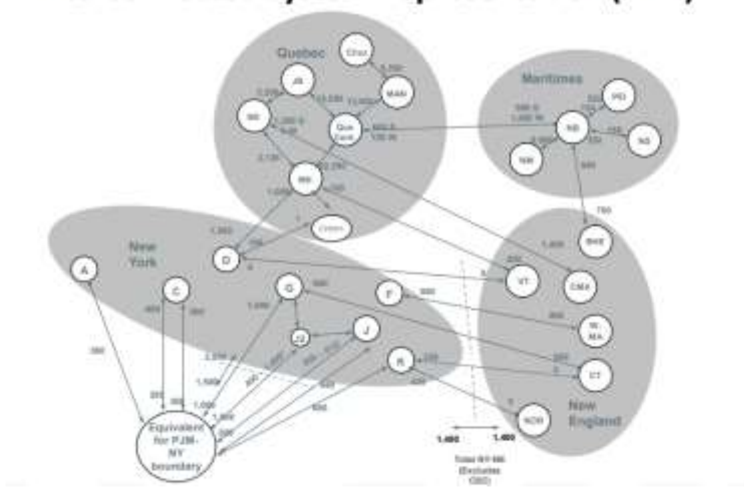
vi.v. **Analyze Power Flow and Stability:** Perform power flow and stability studies (as necessary) to evaluate the impact of potential interregional transfers on the overall system. Simulate power flow scenarios considering different transfer levels, generation dispatch patterns, and system contingencies to ensure grid stability and reliability. Review the existing reliability standards, guidelines, and performance metrics to determine whether the current transfer capability meets the established criteria (e.g., TPL-001-4).

OUTCOMES: Goal is to have a U.S. and Canada (taking into account transfer risks from Canada) view similar to the following example (excluding internal transfer capability analysis), which represents regional system transfer limits:

[7] Depending on complexity, this may not be possible. Rather, the study will establish a baseline and recommend infrastructure that transcends the need for congestion management.

[8] The initial results may identify numerous thermal overloads that result in fixing substation terminal limitations. ERO staff would not be aware of these limitations based on model data and would rely on asset owners to provide detail. This may result in lengthy iterations between the ERO and industry. A way to expedite this would be to request the overhead line rating for the circuits with identified thermal overloads from the analysis. Another way around this is to assume any thermal violation violated the overhead line rating and requires new infrastructure (have seen this assumption in other large-scale studies).

Interconnected System Representation (MW)



2. **Recommendations on prudent additions to transfer capabilities**
To determine whether increases in transfer capability are prudent and needed for reliability, an engineering analysis and assessment will be conducted, considering technical, regulatory, and stakeholder aspects. The intent is not to propose specific projects . One of the most important and challenging part of this study will be to develop a consistent criteria to determine reliability benefit and transfer capability needs. Additionally, incorporating assumptions around new future generation into the power system models that are not already planned will be challenging. It is important that the assumptions used in the analysis are closely aligned with the planned system.~~troublesome~~. The results of these analyses, along with the identified risks and benefits, can inform the recommendation for increased transfer capability, ensuring that it is aligned with the reliability objectives and requirements of the interconnected bulk-power system.

While increasing transfer capability and expanding the AC system can provide benefits in certain contexts, it is important to recognize that ~~more~~ where on one hand increased transfer capability ~~does not necessarily equate to improved reliability in all cases~~provides benefits under certain circumstances, on the other hand it can introduce additional reliability challenges that would need to be carefully considered when recommending prudent additions to transfer capability. Key considerations when evaluating the impacts of expanding transfer capability on reliability include:

- **Cost and Efficiency:** Expanding transfer capability often requires significant investments in infrastructure, including new transmission lines and associated equipment. These costs can be substantial and may not always be justified by the incremental improvements in reliability they offer.
- **System Complexity:** As the transfer capability increases and the AC system expands, the overall system becomes more complex. Managing and operating a larger and more intricate network introduces new challenges in terms of system coordination, control, and stability. The complexity can increase the risk of operational errors, cascading failures, and challenges in maintaining overall system reliability.
- **Integration of Variable Energy Resources:** With the growing integration of ~~renewable~~ variable energy sources such as wind and solar power, the reliability considerations become more nuanced. Expanding transfer capability alone may not address the intermittent nature and geographic dispersion of

renewable variable energy resources. System operators need to carefully balance the variable generation patterns with load requirements and consider alternative solutions like energy storage, demand response, and grid modernization to ensure a reliable and resilient system.

- **Environmental and Permitting Challenges:** Building transmission often involves navigating complex regulatory and environmental processes. Building new transmission infrastructure may encounter challenges related to land use, permitting, and public acceptance. Delays or obstacles in these processes can impact project timelines and overall reliability improvement plans.
- **Focus on Local Solutions:** Reliability enhancement should also consider the effectiveness of local solutions. Addressing reliability challenges at the local level, such as implementing advanced grid technologies, demand-side management, voltage control, and local supply, in certain situations may provide more cost-effective and targeted improvements compared to solely relying on expanded transfer capability.
- **System Interdependencies:** Increasing transfer capability between regions can create stronger interdependencies among various systems. While interregional coordination is essential, over-reliance on interconnections can amplify the potential for cascading failures and simultaneous disruptions across interconnected systems. Assessing and managing these interdependencies is crucial to maintain overall system resilience and reliability. The concept of expanding the AC system may not be a good one in some circumstances because of declining synchronous resources. Expanding DC ties and clustered systems should also be considered.

Prior to conducting analysis, the project will require the review of existing transmission studies, includingsuch as -DOE off-shore wind and national corridor findings.

While increasing transfer capability can offer certain benefits, it is essential to evaluate the trade-offs and consider the specific circumstances. The study will require:

- Identification and development of metrics for evaluating transfer capability increases—prudent for reliability.
- Current and projected electricity demand patterns, existing and projected resource mix and extreme generation and demand outage scenarios in the regions involved
  - Energy adequacy assessment to determine if the existing transfer capability is sufficient to meet the future needs reliably.
  - Generation outage scenarios needed from GADS
  - Assess the impact of renewable energynew resource integration, potential retirements of conventional generation, and the need for transmission upgrades and increased transfer capability to accommodate these changes.
  - Consider the variability and uncertainty of renewable generation and its effect on transfer capability requirements, particularly during extreme weather. Storage should also be considered.
  - Interconnection queues may provide a signal for where future resource additions might occur. However, interconnection queues may also include speculative generation that may never come to fruition.Should we consider interconnection queues as a way to gauge areas that would be "ready to connect" resources where transfer upgrades could be necessary?
- Identify energy constrained areas and solve energy deficiency by increasing transfer from neighboring areas with resource opportunities.

- Consider the impact of changes in one system on the reliability and operation of the interconnected systems.
- Identify the opportunities and constraints that could be alleviated with increased transfer capability. This includes assessing the potential benefits of leveraging surplus generation in one region to meet the demand in another region, identifying the need for new transmission infrastructure or upgrades, and considering any regulatory or policy barriers that may impact the feasibility of transfers.
- Consider the minimum level of support each region ~~should~~ may be ~~prepared~~ able to provide to one another.

- Evaluate the potential benefits and risks associated with increased transfer capability
  - Evaluate the potential benefits such as improved system stability, increased access to diverse energy resources, and enhanced reliability coordination.
  - Assess the risks, including potential congestion, voltage stability issues, transmission line limitations, operational challenges, reserve requirements, impact of large weather systems (i.e., heat domes, polar vortex, etc.), and resource adequacy needs.
- What are the stakeholder perspectives and considerations
  - Engage stakeholders, including utilities, regulators, market participants, and consumer representatives, to gather their input on the need for increased transfer capability.
  - Consider stakeholder perspectives on reliability, market efficiency, cost implications, and environmental impacts.

3. **Recommendations on how these additions can be achieved**

Recommendations to “meet and maintain total transfer capability” must consider the generation and transmission assets needed to implement an effective strategy that will rely on increased interregional transfer capability. The ERO must consider the changes to the future to generation assets or transmission assets that may affect transfer capability. While more transfer capability may exist between areas, resource planning must also account for and provide the resources when and where they are needed.

Therefore, one consideration is to commit to a process that studies interregional transfer capability and energy adequacy, periodically, to continuously evaluate changes to the BPS and evaluate reliability and transfer capability is increased, as well as evaluate any transfer capability that is eroding by changes in resource plans.

OUTCOMES: ERO will provide recommendations for generation and transmission needs to support system reliability under a variety of scenarios (from Phase II). ERO will not make any ~~specific~~ recommendations for specific generation or transmission projects. We expect FERC and Canadian regulators to lead in developing specific statutory framework to ensure minimum transfer capabilities are achieved~~recommendations~~ after our initial report is filed in December 2024. ~~FERC should identify and propose recommended solutions to ensure minimum transfer capabilities are achieved.~~

High-Level Analysis Plan

The ITCS will follow this high-level analysis plan. The plan is derived from the requirements of the 2023 FRA. Each part requires a certain level of analysis and engineering skills, and the process must be done in a particular order while keeping in mind that there may be overlaps between certain steps as well as some of the analysis performed in the latter steps may inform and help refine the analysis done at the beginning.

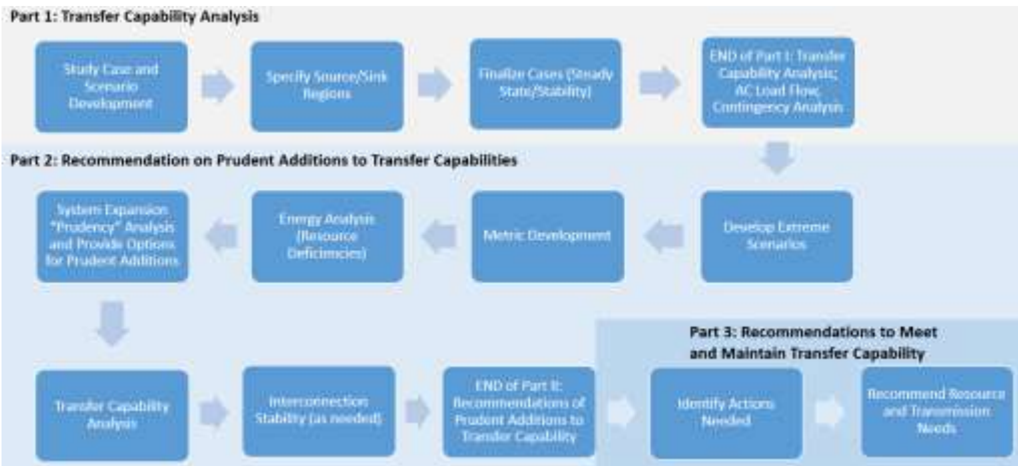


Figure 4: ITCS General Study Steps

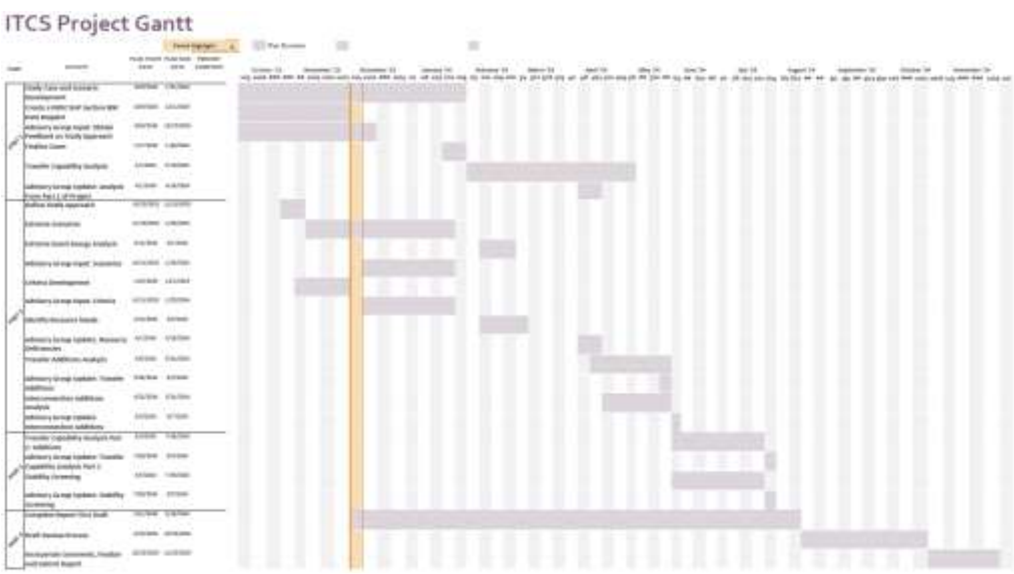


Figure 5: ITCS Project Plan – Gannt Chart

Detailed Study Steps

Part 1: Study Case and Scenario Development

Description: NERC and the ERO Project Team will develop scenarios and study cases representing expected (normal) conditions; define the transfer analysis approach to be used in the ITCS, and document assumptions. ITCS Advisory Group will provide feedback and input.

Estimated Time to Complete:

- 6-8 weeks

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in developing ~~study case and scenarios~~simulations to meet ITCS objectives
- Facilitate engagement with ITCS Advisory Group
- Build the base cases as needed (e.g., collect data, case updates and create cases.)

Critical Dependencies: Data availability, Staffing resources, Stakeholder input

Deliverables/Outputs:

- A documented description of the following included in the ITCS Scope:
  - MOD-032 Base Cases (or updated based case(s) for ITCS) and Years ~~F~~for Study
  - Transfer Analysis Scenarios specifying simulated source and sink regions, contingencies, and remedial action schemes
  - Key transfer analysis assumptions such as transfer steps, capacitor switching assumptions, whether to simulate transfers only in steady-state or both steady-state and dynamics.
  - ~~Identify scoping assumptions to incorporate inter-Interconnection transfers in the ITCS~~
  - Scenarios representing expected (normal) conditions
- Updated MOD-32 cases for use by Regional Entities and groups performing the ITCS

Part 1: Specify Source/Sink Regions~~Extreme Scenario Case and Assumptions Development~~

Description: NERC and the ERO Project Team will select regions for which transfer capability analysis will be performed. ITCS Advisory Group will provide feedback and input. In general, transfer capability will be calculated for FERC Order 1000 regions. Some regions may be divided into sub-regions where deemed appropriate. Also, parts of the system that are non-FERC jurisdictional will be included in the analysis. Imports to/from Canada will also be considered.~~**Description:** NERC and the ERO Project Team will develop scenarios and study cases representing extreme conditions (e.g., heatwave, cold snap, natural-gas availability, low-output Variable Energy Resource); define the transfer analysis approach to be used in studying extreme conditions transfer capability, and document assumptions. ITCS Advisory Group will provide feedback and input.~~

Estimated Time to Complete:

- 3-4 weeks

~~**Consultant Support:**~~

- ~~Provide expertise to assist NERC and the ERO Project Team in developing study cases and scenarios to meet ITCS objectives~~
- ~~Facilitate engagement with ITCS Advisory Group, National Labs and providers of extreme weather data or scenarios~~
- ~~Build the extreme scenario cases as needed (e.g., collect case updates and create cases.)~~

Critical Dependencies: Staffing resources, Stakeholder input~~Data availability, Staffing resources, Stakeholder input~~

Deliverables/Outputs:

- A Documented description of source/sink regions for which transfer capability will be calculated.~~A Documented description of the following included in the ITCS Scope~~
  - ~~Scenarios representing extreme conditions (e.g., wide area heat and cold events affecting demand and resource availability including fuel risks; wide-area wind drought; wildfire risk affecting transmission availability)~~
  - ~~Associated assumptions for each scenario~~

Part 1: Finalize Cases (Steady State/Stability)

Description: NERC and the ERO Project Team will ensure scenario and study assumptions have been applied; validate cases to ensure they reflect projected system conditions, and power-flow and stability cases are ready for transfer analysis. A data request will be submitted to all Planning Coordinators and data submitters to ensure the most up-to-date information is being used in the analysis.

Estimated Time to Complete:

- ~~2~~3-4 weeks

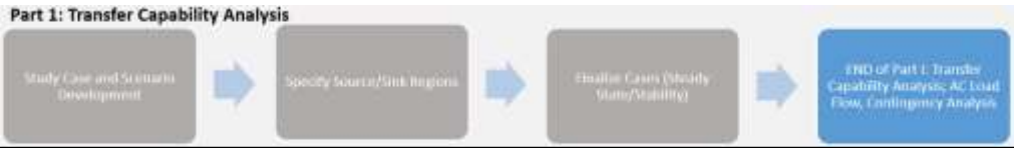
Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in finalizing cases.
- Coordinate with data providers for case validation

Critical Dependencies: Consultants, ERO staff availability, stakeholder review.

Deliverables/Outputs:

- Provide expertise to assist NERC and the ERO Project Team in finalizing cases.
- Coordinate with data providers for case validation



Part 1: Transfer Capability Analysis; AC Load Flow, Contingency Analysis

Description: Setup and run the simulations according to the ITCS Scope and compile transfer capability results.

Estimated Time to Complete:

- 3-4 weeks

Consultant Support:

- Assist the ERO Project Team in performing analysis, interpreting results, and identifying areas for further analysis

Critical Dependencies: Consultant, ERO staff availability. Review of analysis results and feedback.

Deliverables/Outputs:

- Documented summary of results describing ~~(i)~~ existing transfer capability between each region ~~and (ii) transfer capability between each reach for each scenario~~
- Raw output files from the analysis which includes analysis results, Transfer Capability (range in MWs) for each interface and each Transfer Analysis Scenario.

Part 2: Develop Extreme Scenarios

Description: NERC and the ERO Project Team will develop scenarios and study cases representing extreme conditions (e.g., heatwave, cold snap, natural-gas availability, low-output Variable Energy Resource); define the analysis approach to be used in studying extreme conditions , and document assumptions. ITCS Advisory Group will provide feedback and input.

Estimated Time to Complete:

- 3-4 weeks

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in developing scenarios to meet ITCS objectives.
- Facilitate engagement with ITCS Advisory Group, National Labs and providers of extreme weather data or scenarios.
- Build the extreme scenarios as needed (e.g., collect case updates and create cases.)

Critical Dependencies: Data availability, Staffing resources, Stakeholder input

Deliverables/Outputs:

- A Documented description of the following included in the ITCS Scope
  - Scenarios representing extreme conditions (e.g., wide area heat and cold events affecting demand and resource availability including fuel risks; wide-area wind drought; wildfire risk affecting transmission availability)
  - Associated assumptions for each scenario.
- Extreme conditions cases for use by Regional Entities and groups performing the ITCS.

Part 2: ~~Criteria~~ Metric Development

Description: The ERO Project Team, with ITCS Advisory Group and stakeholder input, will develop criteria for evaluating transfer capability increases that are prudent for reliability consistent with the ITCS Scope.

Estimated Time to Complete:

- 8-10 Weeks for Development and Stakeholder Feedback (concurrent with other phases)

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in developing metrics that support ITCS Scope
- Perform analysis, as necessary, to demonstrate the efficacy of proposed criteria
- Facilitate engagement with ITCS Advisory Group and stakeholders

Critical Dependencies:

- Stakeholder engagement and support/consensus

Deliverables/Outputs:

- Documented description of proposed criteria and justification
- Outreach materials for stakeholder engagement and feedback

Part 2: ~~Indetify~~ Energy Analysis (Regions with Resource Deficiencies)

Description: The ERO Project Team will use hourly demand and resource profiles to determine the amount of capacity or energy that deficient areas will need (shortfall) to meet demand under various extreme scenario conditions. ITCS Advisory group will provide feedback on results. Identify areas/regions with energy and capacity deficiencies and energy and capacity surpluses during the scenario years and under scenario assumptions. Resource portfolios provided by each region for the NERC Long-term Reliability Assessment will be used as a starting point. Adjustments may be made as updated information becomes available

Estimated Time to Complete:

- Could be completed within 3-4 weeks once all the scenarios are identified.

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in identifying areas with resource deficiencies and surpluses under scenarios.

Critical Dependencies:

- ~~Phase 1 transfer values and~~Extreme scenarios
- Model/LTRA data
- Extreme Loss~~es~~ of Generation definitions
- Source & Sink definitions (~~TO/TOP-TO/TOP,~~ Assessment Area-Assessment Area, FERC 1000 Areas-FERC 1000 Areas, Regions-Regions)
- ~~TO/TOP-TO/TOP will have a high risk of Resource Deficiencies~~

Deliverables/Outputs:

- Listing of areas (as defined in Phase 1) with resource deficiencies and resource surpluses as defined in the

Part 2: System Expansion "Prudency" Analysis and Provide Options for Prudent Additions

Description: The ERO Project Team will identify potential additions to total transfer capability between neighboring pairs of transmission planning areas that can resolve resource deficiencies and meet criteria (previously determined). ITCS Advisory group will provide feedback on analysis and results. This will also include analysis of prudent additions between the Interconnections. Regions with surplus resources will be evaluated for prudent addition of transfer capability to supply energy to regions with resource deficiencies.

Estimated Time to Complete:

- 4 – 6 weeks

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in performing analysis and interpreting results
- Facilitate engagement with ITCS Advisory Group and stakeholders

Critical Dependencies:

- Case and scenario development
- Determination of resource deficiencies and surpluses
- Criteria development and acceptance

Deliverables/Outputs:

- Listing of interfaces where expansion can resolve resource deficiencies and meet criteria (previously determined);
- Value (expressed as a range, in MW) for transfer capability increase at each interface identified above

Part 2: Transfer Capability Analysis

Description: The ERO Project Team will perform additional transfer capability analyses with the identified transfer capability additions in place to demonstrate their efficacy in resolving resource deficiencies and meeting criteria (previously determined). ITCS Advisory group will provide feedback on analysis and results.

Estimated Time to Complete:

- 2-3 weeks once all the projects are identified and cases are built

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in performing analysis and interpreting results
- Facilitate engagement with ITCS Advisory Group and stakeholders

Critical Dependencies:

- Transfer capability analysis and results from previous steps

Deliverables/Outputs:

- Transfer ~~capability~~ analysis ~~and~~ results from at additional identified transfer capability level~~previous steps~~

Part 2: Interconnection Stability (Simplified)

Description: The ERO Project Team in coordination with ITCS Advisory group, industry groups, and consultants, will analyze results from the transfer capability analysis for system stability issues, where deemed necessary.

Estimated Time to Complete:

- 3 – 4 weeks

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in performing analysis and interpreting results
- Perform simplified stability analysis and document results
- Facilitate engagement with ITCS Advisory Group and stakeholders

Critical Dependencies:

- Transfer capability analysis and results from previous steps
- ITCS Advisory Group and stakeholder engagement

Deliverables/Outputs:

- Documented description of results including any identified stability issues
- Revised list of potential interfaces for transfer capability additions, if necessary, to address stability issues
- Documented methods and assumptions for stability analysis

Part 2: Recommendations of Prudent Additions to Transfer Capability

Description: The ERO Project Team in coordination with ITCS Advisory group, industry groups, and consultants, will analyze results from the simulations for system stability issues, and provide final recommendations of prudent additions to transfer capability based on results from Parts I and II of the analysis.

Estimated Time to Complete:

- 3 – 4 weeks

Consultant Support:

- Provide expertise to assist NERC and the ERO Project Team in evaluating recommended prudent additions
- Facilitate engagement with ITCS Advisory Group and stakeholders

Critical Dependencies:

- Transfer capability analysis, energy analysis and stability analysis results from previous steps
- ITCS Advisory Group and stakeholder engagement

Deliverables/Outputs:

- Documented description of recommendations of prudent additions

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Part 3: Identify Actions Needed/Recommend Resource and Transmission Needs

Description: Based on the results of the Transfer Capability Analyses and subsequent recommendations of prudent additions there may be a need to clearly identify what actions are needed to help ensure reliable power transfer between neighboring "transmission planning regions." The Transfer Capability Analyses study identifies areas with resource deficiencies and transfer limitations, in order toto achieve and sustain the recommended transfer capability further actions will need to be taken.

Estimated Time to Complete:

- 4 weeks

Consultant Support:

- Assist NERC and the ERO Project Team in developing documented processes and guidelines for incorporating transmission adequacy and transfer capability analysis in ERO Reliability Assessments on an ongoing basis.

Critical Dependencies:

- Gather input from Advisory Group
- Provide advice on the gaps and improvement areas identified in the analysis process.
- Suggestions for next steps
- Resources to allow subject matter experts to:
  - Gather relevant data
  - Build system models to allow comprehensive analysis
  - collaboratively provide an independent and objective analysis that will focus on the security and reliability of the bulk power system

Deliverables/Outputs:

- A clearly defined list of actions based on the resulting efforts
- Areas needed to be improved for future analysis (data inputs, modeling techniques, and relevant metrics).
- Expectations for next steps and continuing analysis (periodically) to identify future transfer capability issues.
- Identify generation resources needed to meet and maintain transfer capability.

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- Scenarios and Sensitivities to be considered for future studies.
- Identify transmission planning and generator interconnection process/requirements that are needed to achieve and maintain the recommended regional transfer capability. This could include revising existing and future (energy assessment) NERC standards.

Capacity Expansion Analysis: Methodical and quantifiable approach for identifying a mix of power system resources, taking into consideration factors such as new policies, technological advancement, changing fuel prices, and electricity demand projections, among other factors. It serves as a key tool for the development of power sector master plans or integrated resource plans.

Production Cost/Dispatch Modeling: Algorithmic approach to simulate chronological security constrained unit commitment and economic dispatch. For a given input of resource, demand, and conditions, the model provides electricity production costs, chronological dispatch, and reliability outcomes and their associated probabilities.

Transfer Capability Analysis: An engineering approach for determining Maximum Transfer Capability is determined by finding the point where an increase in power transfers causes a limit violation under pre or post-contingency conditions. The limits governing such power transfers are either based on thermal, voltage or stability constraints and are determined through a transmission security assessment. Various study area dispatch scenarios and system conditions shall be studied to fully assess transfer capability under all reasonably foreseeable stressed conditions.

Transmission Security Assessment: Transmission security is a deterministic analysis of credible combinations of system conditions which stress the system. The system is assessed for its ability to withstand the loss of specified, representative and reasonably foreseeable design criteria contingencies (N-1, N-1-1,) at projected customer demand and anticipated transfer levels. NERC Standard TPL-001~~-5~~ (Transmission System Planning Performance Requirements) requires several simulations of reliable operation of the power system over the planning horizon. Contingencies and system adjustments may be modeled with contingency analysis tools and analysis using a simulator's optimal power flow (OPF) or security-constrained optimal power flow (SCOPF) may help the system planner identify appropriate actions for system adjustments to mitigate transmission line or interface overloads.

Dynamic Stability Assessment: Engineering studies ~~used~~are used to determine stability limits within a power system. Dynamic analysis also can provide quantities of system conditions such as voltage levels for a given disturbance.

This scope and project plan will enable the ERO to effectively manage the interregional transfer capability study, engage stakeholders, develop robust recommendations, and ultimately deliver a final report that meets the requirements outlined in the FRA.

Appendix I: Transfer Capability Studies

The following types of analyses may be used to determine transfer capabilities[9]

- Thermal Analysis
  - DC load flow analysis to determine thermally constrained transfer limits.
  - AC load flow analysis to determine or verify thermally constrained transfer limits.
- Voltage Analysis
  - PV analysis to determine voltage constrained transfer limits.
  - AC load flow analysis to determine or verify voltage constrained transfer limits.
- Stability Analysis
  - Transient stability studies to determine stability constrained transfer limits

Typically, assessments of transfer capability adhere to the following steps:

1. Case selection and scenario development (study period, timeframe, demand levels, and generation)
2. Thermal analysis is first conducted on the interface under study. Pre and post-contingency system conditions are analyzed for thermal violations as power transfers across the studied interface are increased. The initial transfer capability limit is established as a result of thermal limitations under reasonable studied system conditions. Other limiting thermal limits may be recorded.
3. Voltage analysis is conducted to determine if the transfer capability limit(s) found in Step 1 meets all applicable voltage limits for all tested system conditions and contingencies. The transfer capability limit(s) remains unchanged if no voltage violations are found. Other limiting system conditions may be evaluated to identify a range of voltage limits. If voltage violations are found, additional analysis is conducted in order toto determine the range of power transfer at voltage limited system conditions and contingencies. The most restrictive power transfer level then becomes the transfer capability limit of the studied interface based on reasonably stressed conditions.
4. TBD/if needed -- Stability analysis is conducted to determine if the transfer capability limit(s) found in Step 2 meets all applicable stability performance requirements. The transfer capability limit(s) remains unchanged if no violations of stability criteria are found. Other limiting system conditions may be evaluated to identify a range of stability limits. If violations of stability criteria are found, additional analysis is conducted in order toto determine the range of power transfer at stability limited system conditions and contingencies. The most restrictive power transfer level then becomes the transfer capability limit of the studied interface based on reasonably stressed conditions. In cases where interface transfers are interdependent on other interface transfers, analyses will be conducted to obtain a region of operation that shows the interdependency of one interface transfer capability on the other. This region of operation can be translated into a range of possible transfer capabilities.

[9] Transfer capability assessments require that a source and a sink be defined in order to adjust transfers of power across the interface of interest, from a source(s) to a sink(s). This is done by increasing generation in the source while decreasing generation in the sink. As required, various dispatch scenarios will be studied to determine the impact that specific units may have on an interface's transfer capability. Therefore, a range of transfer capabilities may be determined and documented for certain interfaces.

Appendix II: Risk Management Plan

While the interregional transfer capability study presents a valuable opportunity, it is important to be aware of potential risks that could affect its successful completion. Some of the risks associated with this project may include:

- **Data Availability and Quality:** Obtaining accurate and comprehensive data from multiple Regional Entities and Registered Entities could be challenging. Incomplete or inconsistent data may impact the accuracy and reliability of the study's findings and recommendations.
  - **Risk:** Insufficient or inconsistent data from Regional Entities and utilities.
  - **Mitigation:** Establish clear data requirements, engage stakeholders early to ensure data availability, and implement data validation and verification processes.
- **Stakeholder Engagement and Coordination:** Engaging and coordinating with a diverse range of stakeholders, including Regional Entities, industry, and the special stakeholder Advisory Group, can present challenges. Conflicting priorities, differing perspectives, and limited stakeholder availability may hinder effective collaboration and input gathering.
  - **Risk:** Conflicting priorities, limited stakeholder availability, or difficulties in obtaining stakeholder input.
  - **Mitigation**: Develop a comprehensive stakeholder engagement plan, establish regular communication channels, and provide ample opportunities for stakeholder consultations and feedback.
- **Regulatory and Legislative Changes:** The regulatory landscape and legislative requirements may change during the course ofduring the study. New regulations or FERC oversight directives, requirements, or amendments to existing laws could impact the study's scope, timeline, or deliverables, requiring adjustments and potential delays.
  - **Risk:** Changes in regulations or legislative requirements that impact the study's scope, timeline, or deliverables.
  - **Mitigation:** Maintain close communication with regulatory bodies, monitor legislative developments, and proactively adapt the study to meet any new requirements.
- **Resource Constraints:** Adequate resources, including personnel, expertise, and budgetary allocations, are essential for the successful execution of the study. Limited resources or competing priorities within NERC and participating entities could affect the project's progress and quality.
  - **Risk:** Inadequate resources, including personnel, expertise, and budgetary allocations.
  - **Mitigation:** Conduct resource planning and allocation early on, secure necessary funding, and ensure the availability of skilled personnel with the required expertise.
- **Technical Complexities:** Modeling interregional transfer capability and evaluating system constraints involve technical complexities. Ensuring the accuracy of models, addressing uncertainties, and incorporating various scenarios require specialized expertise and sophisticated tools.
  - **Risk:** Challenges in accurately modeling interregional transfer capability and addressing system constraints.
  - **Mitigation:** Engage technical experts, use advanced modeling tools, conduct thorough quality assurance, and validate modeling results through peer reviews.
- **Time Constraints:** The study's timeline, as mandated by the FRA, presents a potential risk. Striving to complete a comprehensive study within the specified timeframe may put pressure on the project team, potentially impacting the depth and breadth of analysis and the level of stakeholder engagement.

- **Risk:** The study's mandated timeline may impose constraints and put pressure on the project team to complete a comprehensive analysis within the specified timeframe, potentially compromising the thoroughness and quality of the study.
- **Mitigation:** Develop a detailed project schedule with clear milestones and deadlines to monitor progress and ensure timely completion. Technical scoping must balance what can be accomplished within the timeline provided with ample time review time. Also, allocate adequate resources and staffing to support the project team's workload and mitigate time-related risks.

- **External Dependencies:** The study's success may depend on external factors such as timely access to necessary data, regulatory approvals, and the availability of stakeholders for consultations and reviews. Delays or limitations in these external dependencies could impact the study's progress.
  - **Risk:** The study's success may be contingent upon external factors such as timely access to necessary data, regulatory approvals, and stakeholder availability for consultations and reviews.
  - **Mitigation:** Identify critical external dependencies upfront and establish clear communication channels with relevant stakeholders.
- **Communication and Coordination Challenges:** Ensuring effective communication and coordination among the project team, stakeholders, and regulatory bodies such as FERC is critical. Miscommunication, misunderstandings, or inadequate coordination could lead to delays, misalignment, or potential misinterpretation of study outcomes.
  - **Risk:** Inadequate communication and coordination among the project team, stakeholders, and regulatory bodies such as FERC can lead to delays, misalignment, and potential misinterpretation of study outcomes.
  - **Mitigation:** Establish a comprehensive communication plan that outlines the frequency, channels, and methods of communication with stakeholders. We will also conduct regular meetings, workshops, and presentations to update stakeholders on the study's progress, findings, and key decisions. We will also appoint a dedicated project coordinator or liaison to facilitate effective coordination and collaboration between the project team, FERC, and other relevant stakeholders.

To mitigate these risks, it is crucial to implement a robust risk management plan that includes proactive risk identification, regular monitoring, contingency planning, and clear communication channels. Maintaining open dialogue with stakeholders, conducting thorough quality assurance, and adapting to any unforeseen challenges will help ensure the successful completion of the study.