Attachment Rec 1-1: Study Process Document

Distribution Planning Study Process

1. Introduction

In order to maintain a consistent approach to distribution planning, it is necessary that uniform planning criteria be followed and that there is well executed coordination among stakeholder departments/groups. This document has been prepared to provide guidance on the performance and expected work product of distribution area planning studies.

2. Purpose

This document details the Distribution Planning and Asset Management study process for system planners, the functions that support them, and the stakeholders reliant on their work product. It is expected that execution of a well defined study process will result in timely delivery of infrastructure development recommendations having thoroughly defined project scopes that satisfy the needs and expectations of all stakeholders (especially customers). In addition, it enhances the organization's ability to meet its obligation to provide safe, reliable, and efficient electric service for customers at reasonable costs.

3. Applicability

All personnel within Distribution Planning and Asset Management when assigned to work on:

- Area Studies
- Program Studies (initial or modification)
- Complex Customer Service Requirements Studies – Typically, large services requests, generally 8MW or greater and/or greater than 5MW with requirements for service redundancy

Members of departments that support the study process and associated work product development should be trained in and/or aware of this process.

4. Process

Distribution planning studies will typically be assigned to central planning engineers in the Distribution Planning and Asset Management group by their department manager. Assignment of a study to other engineers in the Distribution Planning and Asset Management group (ex: field engineers) is also possible.

The prioritization of area planning studies to be executed and the engineering analysis conducted within an area study is supported by the Annual Planning Screening Process. This process is a recurring annual effort which aides in the identification of thermal system performance concerns. As part of this effort, the following is recorded or estimated:

Area (feeder, substation, and supply line) summer* peak loads (date, time, and value) both coincident and non-coincident with the system peak load.

System summer peak load (date, time, and value).

*In areas that are winter peaking and winter limited, winter peak load data will be collected.

Distribution Planning Engineers are responsible for assembling, screening, and recording of facility peak loads. Peak load data will be stored in FeedPro and the annual planning screening spreadsheets. Load forecasts will be applied to facility peak loads and recorded in the annual planning spreadsheets.

As already noted, the Annual Planning Screening Process work product facilitates the prioritization of area studies to be conducted. Once a decision has been made to execute a specific area study, the assigned engineer will bring the effort through the following major milestones:

- Scoping Activities
- Initial System Assessment
- Study Kickoff
- Detailed System Assessment / Engineering Analysis
- Plan Development and Project Estimating
- Identification of Recommended Plan
- Technical Review
- Documentation
- Sanctioning

Further detail on each of these milestones follows:

4.1. Scoping

The study engineer starts by preparing to execute the study. All area distribution studies will require the same basic preparation steps. The engineer will:

- Gather the most recent version of the Distribution Planning Guidelines ("DPG")
    - Upon consultation with the manager, gather any other emerging guidelines that have not been formally incorporated into the DPG (ex: grid modernization or volt-var optimization guidelines).
- Gather equipment rating data, settings data, specifications data, etc.
- Gather the most recent Distribution Standards including, but not limited to:
    - Overhead conductor ratings (section 6.0)
    - Generic underground cable ratings (section 35.14)
    - Latest recloser controls (pages 12-338 to 12-340)
    - Latest capacitor controls (pages 15-335 to 15-336, 15-404 to 15-405)
    - Latest sensor controls (page 15-600)
    - Storm Hardening (section 4.0)
- Define the electrical scope (lines and substations to be studied)
- Define the geographic scope (towns and portions or towns to be included in study)
- Building/correcting/updating system models in CYME, PSS/e, ASPEN
- Gather the latest forecast and review/refine the area/facility load and expected load growth from the present to the study's horizon year (typically 15 years)
- Gather service territory maps
- Gather large commercial and industrial customer load data[1]
- Gather or request asset condition reports[2]
- Identify all infrastructure development limitations (ex: river, highway, state forest, etc)
- Gather documentation of existing system performance concerns (ex: thermal, reliability, voltage, reactive support, arc flash, fault duty, etc.)[3]

[1] Consult with Customer and Community
[2] Consult with Substation O&M Services
[3] At a minimum, include annual plan screening information. Consult with area engineering and operations experts as time allows.

- Gather recently completed area projects or ongoing area projects within the work plan. This will set the base year and base configuration.[4]
- Gather existing and in-queue distributed generation or distributed energy resources
- Gather state information or policies regarding distribution planning or distributed energy resources

The engineer will then develop a scope that details the study area boundaries and concerns. The study scope will be reviewed by their respective manager. The manager must approve the study scope before next steps are executed.

The final scoping activity is to request study team members. The study engineer will request formal team members from the following departments, via Study Engineering Request form.

- Transmission Planning
- Transmission Line Engineering
- Substation Engineering
- Protection Engineering (Relay, Communications, and Controls and Integration)

The following additional departments may be expected to provide input during various stages of the study and will be included in study meetings as required:

- Substation O&M Services Operations
- Transmission Control Center and/or Regional Control Center
- Project and Program Management
- Community and Customer Management
- Distribution Design
- Safety
- Environmental
- Legal
- Real Estate

All study contributors will be provided proper accounting to charge their time in support of the study. Once a study team is formed, the study engineer will schedule the study kickoff meeting.

4.2. Initial System Assessment

Study area initial system assessment consists of a quick analysis of facilities and system performance within the identified study geographic and electric scope. As part of the assessment, the study engineer will conduct the following:

- Existing and in-queue distributed generation and distributed energy resources
- A review for compliance with Planning Guidelines:

[4] For example a study starting in year X may set a base year of X+3 if substantial system modification will be completed in year X+3.

  - Thermal (load vs. capability) issues using the annual planning screening spreadsheet, CYME, and PSS/e
  - Voltage – using CYME, PSS/e
  - Reactive Support
- Asset condition assessments and consideration of active asset programs including, but not limited to:
  - Breaker Replacement
  - EMS
  - Metal Clad Substations
  - Indoor Substations
  - Underground Cable
  - Distribution Line Inspection & Maintenance
- Screening review of arc flash and fault duty data
- Screening review of CKAIDI and CKAIFI reliability indices[5] against state targets or average values

Initial system assessment is completed when the planner has enough information to consult with the wider group of subject matter experts and internal departments at the study kickoff. A careful balance of analysis to ensure study timeline efficiency is required. Too little analysis leaves the planner unable to lead a robust discussion during the kickoff meeting to gather those asset, operational, and construction complexities that help refine issues and generate comprehensive alternatives. Too much analysis may lead to rework by the planner should new information result from the kickoff. It is preferable that high level alternative concepts are developed during Initial System Assessment simply to generate discussion. Never should alternatives be fully developed or considered final within this step. Throughout the Initial System Assessment, it is expected that informal and regular consultations will be required with Transmission Planning, Distribution Design, Substation Engineering, Transmission Line Engineering, Substation O&M Services, and/or Operations.

4.3. Study Kickoff

The study kickoff is a meeting held to inform the larger stakeholder group that an area study is underway and to solicit inputs from those with knowledge of the system infrastructure in the area under review.

The study engineer will invite the following groups/representatives to the Kickoff meeting:

- Community & Customer Management
- Operations:
  - Distribution Line (OH & UG) Supervisors
  - Substation O&M Supervisors
  - Distribution Design
- Substation O & M Services
- System Control Center
- Project Management
- Program Management (Substation and Line)
- Distribution Engineering and Asset Management

[5] 5 year reliability data is preferred. 3 year data may be used to avoid years of significant major storm activity or significant system reconfiguration.

  - Field Engineer
  - Field Engineering Manager
- Transmission Engineering and Asset Management
  - Transmission Planning Engineer
  - Transmission Asset Management Engineer
- Transmission Line Engineering
- Substation Engineering
- Protection Engineering
- Resource Planning
  - Short Term Resource Planning
  - Long Term Resource Planning
- Product Energy Services (NWA)
- IT/ IS

The study engineer will present the following:

- Proposed study electrical and geographic scope
- Recent area studies and infrastructure development projects impacting the area
- Study area load and initial understanding of load growth expected in the area
- Known concerns in the area
- Using one-lines, possible infrastructure development plans for discussion
- Using area maps, possible distributed energy resource ideas fro discussion
- Study schedule and the names of representatives of departments assigned to support it

Upon completion of this presentation, the study engineer will open the meeting for group discussion. Specific input that the study engineer is looking for includes:

- Acceptance of electrical and geographic boundaries
- Operational concerns, examples:
  - Switching flexibility
  - Restoration areas of concern (ex: rights-of-way, direct buried cables)
- Asset condition concerns not already identified
- Safety by Design
- System performance concerns not already identified, examples:
  - Reliability
  - Voltage
  - Loading
- Details on any significant near term load additions in the area not already identified
- Details on any significant distributed energy resources in the area not already identified
- Details on potential alternative ideas or concerns, examples:
  - Locations that should/could be considered for new substation development
  - Substation expansion opportunities
  - Feeder routing (new feeders and feeder ties)
  - Local issues that might impact infrastructure development options, examples
    1. Local regulations requiring underground vs. overhead construction
    2. Status of community relationships with the Company
- Details on any distributed energy resource opportunities that should be considered

Representatives assigned from all groups are expected to support the study throughout the entire process and document any concerns their department may have along the way.

All individuals invited to the kick off meeting should be asked to forward the meeting notice to any other individuals they would like to have take part in the meeting.

It is expected that the study engineer will prepare minutes of this meeting. Minutes will be shared with all those invited to participate in the meeting.

4.4. Detailed System Assessment / Engineering Analysis

The study engineer will utilize input received at the study kickoff meeting in subsequent detailed analysis and comprehensive plan development. All area distribution studies will require the same basic analysis steps.

The study engineer should look to optimize existing system performance and identify any common infrastructure development needs of the area prior to engaging in the detailed analysis associated with finalizing the development of alternative plans. Simple no-cost or low-cost system adjustments such as switching or load balancing can be progressed immediately by the planner and do not need to be formally included in the study report. Instead the study base case should be adjusted to include these simple changes.

The study engineer should:

- Conduct system fault studies, associated protective device coordination, and breaker capability reviews
- Conduct incident energy calculations (arc flash)
- Conduct system thermal assessments
- Conduct system loss studies
- Conduct system reliability assessments
- Conduct system voltage performance evaluation
- Analyze Distributed Energy Resources (DER) impacts

Typical Analysis tools:

- PSS/e load flow software for analysis of:
  - Supply system (transmission and sub-transmission)
  - Network system
- CYME and other radial distribution feeder analysis software
- CYME, ASPEN, and other protective device coordination software including short circuit analysis
- ArcPro for Arc Flash analysis
- GIS systems
- Annual Planning Screening Spreadsheets
- Equipment ratings programs
- Cascade and other asset information systems

Note that the presentation of results and defense of recommendations is significantly enhanced by the functionality of these tools (particularly load flow and radial distribution feeder analysis software). These

tools will strengthen response to questions posed during the review of recommendations. These tools enable quick evaluation of "what if" questions that could otherwise cause unacceptable delays in study delivery.

4.5. Plan Development and Project Estimating

Once the engineering analysis is performed, the study engineer develops and refines alternative infrastructure development and non-wires alternative plans and updates associated plan one-lines. The plans should be technically comparable to the furthest extent possible. Infrastructure and non-wires alternatives can be combined to create comparable plans.

The following team members/departments will provide a feasibility review of these one-lines:

- Field Engineer
- Substation Engineer
- Transmission Line Engineer
- Distribution Design Engineer
- Operations
- Transmission Planning

OPTIONAL - It is suggested the planner gather all internal stakeholders[6] at a Plan Development meeting to review and gain acceptance of the various plans immediately prior to requesting estimates. It is important that the various engineering functions understand the interrelationship between their individual portions of the comprehensive plans. Without this review, it is often difficult for the engineering functions to understand the segmented nature of estimate requests.[7]

As the one-lines and plans are modified with this cross functional input, engineering analysis will be refined as needed to accommodate for any scope changes. Once the plans and one-lines are completed, the study engineer will request study estimates from the respective team members (substation engineer, transmission line engineer, and distribution design engineer) for all alternative plans.[8]

It is expected that estimates will be returned within 8-12 weeks of the request date. Estimators will use primary equipment scope and known field conditions along with recent costs for comparable projects to develop estimates. Field visits are not required, but are encouraged especially if constructability or future system maintenance (ex. R/W accessibility) is a concern. Estimates are expected to be suitable for plan comparison/selection and enable initial partial sanction of more detailed engineering activities. Substation and transmission line conceptual engineering reports and estimates may be requested if they can be completed within the 8-12 weeks. Distribution line estimates can be completed by the planner using the Company's Success Enterprise estimating tool and can be considered at a conceptual level of accuracy.

Note: When considering alternate locations for a new substation. The site where a new substation will be constructed should be selected by the sponsor with input from the project team. Where alternate sites are required for regulatory reasons or are desirable for other reasons, those alternate sites should also be selected by the sponsor. In addition to the engineering requests, sites should be assessed for other flaws that could warrant them unsuitable for use. These "due diligence" assessments for potentially "fatal flaws" should be performed by the following

[6] Similar to the kickoff meeting invite list
[7] For example a substation request that asks for a common item such as a capacitor bank to be estimated separately from a feeder position which may be an alternative plan.
[8] Requests should be well documented with clearly defined one-line scope diagrams, using

departments and reported to the sponsor: Environmental, Real Estate, Legal (Siting), Project Management, and Construction or Operations.

While estimates are under development, the planner should organize and document the technical benefits and issue resolution of each alternative. The planner has discretion to the level of analysis for alternatives that are expected to be economically non-competitive.

Once the study estimates are returned, the study engineer will review and finalize the identified plans. Study team members will be asked to note their agreement with the scope of projects estimated.

4.6. Identification of Recommended Plan

As part of this phase, the study engineer reviews the various alternatives with costs, identifies, and finalizes a recommended plan. Once the recommended plan is identified, the study engineer completes (with team member assistance as required):

- Economic comparison of plans
- Technical comparison of plans if not equivalent
- Performance of an environmental and safety review of recommended plan
- Identification of the system outages required to implement the recommended plan
- Statement or summary of alignment with Climate Resiliency standards[9]
- If not formally evaluated as a criteria, strategy, or program within the study, include a statement or summary of alignment with potential or pending Grid Modernization concepts.[10]
- Review of the recommended plan project implementation schedule[11]

The planner should summarize recommended plan risks to the furthest extent possible. For example, permitting or site acquisition delay risks could be noted with the system issues that may result. Potential mitigation concepts, including acceptance of risk, can be described. This is not intended to be an exhaustive review and it is noted that significant internal department consultation and support is necessary. Instead, this risk analysis is only intended to help or guide future efforts.

Once all this analysis is completed and documented, the study engineer updates the project team members on the final recommended plan.

4.7. Technical Review

This meeting will be held once the planner has completed the majority of the study analysis and after an internal review in Distribution Planning and Asset Management has been completed, but prior to the formal study document approval process.

The primary purpose of this meeting is to give those who will be asked to approve the area study report an opportunity to hear a presentation and ask their own questions on the overall study effort. It is expected that this meeting will facilitate the study report approval process that will in most instances follow soon after.

The presentation will provide a description of the issue identification efforts and a comparison of all plans, including estimated costs, describing the advantages and disadvantages of each.

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[9] All recommendation should be built to the latest storm hardening and substation flood mitigation standards
[10] For example, use of latest controls that prevent near term obsolescence
[11] Consult with Long Term Resource Planning for implementation schedule and cash flow assistance.

The planner will cover the following topics in presentation format during the meeting. The presentation will be split (between Distribution Planning and Transmission Planning) if study responsibility is split.

- Study scope (electric system one-lines and map of area)
- Study area load and load growth
- Additional study assumptions
- System performance concerns identified (existing and predicted)
- Plans considered to address concerns with detailed description of the scope of proposed projects, time and cost required to implement, technical differences, as well as unresolved stakeholder concerns
- Plan recommended to address concerns with detailed description of the scope of proposed projects, time, and cost required to implement

Meeting participants are expected to constructively challenge study assumptions and analysis (ex. load growth assumptions, load flow models, equipment ratings, interpretation of planning criteria in determining violations, etc.) and the plans developed to address area concerns. If a specific project's scope of work is in question (ex. asset condition concerns not addressed) and can not be resolved in this meeting, the Study engineer will set up subsequent meetings with the project team for more detailed discussion and problem resolution.

The following groups/representatives are part of the Technical Review meeting governance:

- Asset Management (NY or NE), including:
  - Vice President Asset Management
  - Director Distribution Planning and Asset Management
  - Manager of Asset Management
  - Director of Transmission Planning and Asset Management
  - Manger of Transmission Planning
- Electrical Systems Engineering, including:
  - Vice President of Electrical Systems Engineering
  - Director of Substation Engineering Design
  - Director of Protection Engineering
  - Director of Transmission Line Engineering
- Operations (NY or NE), including:
  - Vice President of Operations
  - Director of Distribution Design
  - Director of Overhead Lines
  - Director and Manager of Substation O&M
- Dispatch and Control, including:
  - Vice President of Control Center Operations
- Jurisdictional Leadership, including:
  - Jurisdictional President
  - Community and Customer Management, Director
- Representatives assigned from all groups that are supporting the study (attendance required)

4.8. Documentation

The area study report is the primary documentation delivered upon completion of the area study. This report becomes a source document for many other forms and reports (used both internally and externally). As such, the importance of form and order in reports be as consistent as possible.

In order to properly complete the report template, the study engineer will need to have done the work necessary to prepare the following general report sections:

- Executive summary, including:
  - Explanation of why the study was done and the major concerns/needs for the area
  - A brief description of the alternatives considered
  - A brief description of the recommended plan
  - Reasons for the recommendation
  - Cost and cash flow of the recommended plan
- Introduction, including:
  - Purpose statement
  - Problem statement
- Background, including:
  - A statement on all items gathered in Section 4.1
  - Versions or dates of guidelines, standards, forecasts, databases, screening work, and software used
- Problem/Issue Identification, including:
  - A summary of all analysis done in Sections 4.2 and 4.4
- Plan Development, including:
  - A summary of all efforts done in Section 4.5
- Description of recommended plan, including:
  - A summary of the comparative analysis and conclusions made during Section 4.6
  - A clear summary of the sequencing of projects, project dependencies, proposed cash flow, and risks.
- Conclusion and factors affecting future studies
- Appendices, including but not limited to:
  - Geographic study area maps
  - One-line diagrams for stations, sub-transmission systems, and circuit tie maps - base case and recommended plan
  - Feeder rating sheets
  - Existing and in-queue Distributed Generation tables
  - Annual Plan screening tables – base case and recommended plan
  - CYME, PSSE, and Aspen screens and tabular exports - base case and recommended plan
  - Strategy or program tabular details including criticality rankings
  - Arc flash tables - base case and recommended plan
  - Reliability indices tables
  - Fault duty analysis tables - base case and recommended plan
  - Estimate data

Appendix A and B of this document provide a detailed outline of area study and program study report content respectively.

Study reports will be issued following the Study Results presentation (and resolution of any issues it raised). The report will be electronically issued with a cover letter to the following individuals for approval:

- Respective Manager of Distribution Asset Management
- Respective Director of Distribution Planning and Asset Management
- Vice President Asset Management

The study report will be electronically stored on Distribution Planning and Asset Management's SharePoint site.

It is expected that the Customer and Community Management group will communicate the recommended plan with external stakeholders as appropriate. Consultation with jurisdictional leader for approval of the external communication plans is required.

4.9. Sanctioning

Per the National Grid US Sanctioning Committee (USSC) Procedure, all investments must receive proper Delegation of Authority (DOA). The National Grid US Sanctioning Committee procedure and document templates can be found on the Investment Planning website.

It is expected that the study engineer will, upon study approval, seek initial sanction of any recommended projects having forecasted spending within the next three fiscal years. Long Term Resource Planning will track and schedule initial sanctioning activities for all projects that will be initiated beyond the first two full fiscal years from study completion.

5. Appendix A

Study Report Table of Contents

Appendix B

Program Report Table of Contents