

Section 1: Process Overview

In this section you will find an overview of PJM's transmission planning process that culminates in the Regional Transmission Expansion Plan (RTEP). This process (referred to in this Manual interchangeably as the RTEP process or more generically as the PJM regional transmission planning process) is one of the primary functions of Regional Transmission Organizations (RTOs.) As such, PJM implements this function in accordance with the Regional Transmission Expansion Planning Protocol set forth in Schedule 6 of the PJM Operating Agreement.

As further described in following portions of this manual, the PJM RTEP process consists of baseline reliability reviews as well as analysis to identify the transmission needs associated with generation interconnection and merchant transmission interconnection. PJM implements the planning of interconnections as part of the broader RTEP process pursuant to the PJM Open Access Transmission Tariff (OATT.) The relationship between Interconnection planning and the RTEP is discussed in later sections of this manual and in related manuals.

1.1 Planning Process Work Flow

The Manual 14 series provides information regarding PJM's regional transmission expansion planning protocol (RTEPP) to complement planning provisions in the PJM Operating Agreement, Schedule 6 and the PJM Open Access Transmission Tariff (OATT), Attachment M-3 (Attachment M-3 Process). These agreements can be found on-line at <https://www.pjm.com/library/governing-documents.aspx>.

This ongoing process has continued to evolve since 1997, when PJM's RTEPP (codified in PJM's Operating Agreement, Schedule 6) was approved by the Federal Energy Regulatory Commission (FERC). Since that time, the process has been expanded and enhanced in response to member and regulatory input as documented in the Operating Agreement, Schedule 6; OATT, Attachment M-3; and the PJM Manual 14 series. The current PJM regional transmission expansion plan (RTEP) process includes ample opportunity for stakeholder input through frequent oral and written exchange of information and reviews via the Transmission Expansion Advisory Committee (TEAC) and PJM's three (3) Subregional RTEP Committees (Mid-Atlantic, Southern and Western).

PJM and PJM Transmission Owners' planning processes are incorporated in an 18-month overlapping planning cycle which begins in September of the previous calendar year and extends through a full calendar year to the February of the next calendar year. This overlapping planning cycle is illustrated in Exhibit 1 in this Manual.

The PJM planning process activities, culminating in PJM's annual RTEP, constitute PJM's single, Order No. 890 compliant, transmission planning process.

All PJM OATT facilities are planned through and included in this open, fully participatory, and transparent process.

There are three (3) planning paths that ultimately culminate in the PJM RTEP base case, also referred to as the planning model. Facilities identified in each path allow for the opportunity for early, full and transparent participation by interested PJM stakeholders. The three paths include planning activities associated with: (i) Regional RTEP Project and Subregional RTEP Project (baseline upgrades), (ii) Supplemental Projects; and (iii) Customer-Funded Upgrades. Baseline upgrades include projects planned for (i) reliability, (ii) operational performance, (iii) FERC

Form No. 715 criteria, (iv) economic planning, and (v) public policy planning (State Agreement Approach). Supplemental Projects refer to transmission expansion or enhancements not needed to comply with PJM reliability, operational performance, FERC Form No. 715, economic criteria or State Agreement Approach projects; Supplemental Project drivers, or needs, are “supplemental” to those Operating Agreement specified criteria. Transmission Owners plan Supplemental Projects in accordance with the OATT, Attachment M-3 Process. Projects planned through the Attachment M-3 Process include those that expand or enhance the transmission system. By way of example, a Supplemental Project could include a Transmission Owner project needed to address transmission facilities at the end of their useful life, which, in accordance with good utility practice, is not determined by the facility’s service life for accounting or depreciation purposes. Customer-Funded Upgrades refer to Network Upgrades, Local Upgrades or Merchant Network Upgrades identified pursuant to OATT Parts II, III and VI and paid for by the Interconnection Customer or Eligible Customer or voluntarily undertaken by a New Service Customer in fulfillment of an Upgrade Request.

Planning of Baseline Upgrades:

Baseline upgrades are produced from PJM’s planning cycle activities described in this manual, Operating Agreement Schedule 6, and illustrated in Exhibit 1 in this Manual. PJM leads the analysis and development of baseline upgrades related to reliability, operational performance, FERC Form No. 715 criteria and economic planning for all facilities 100 kV and above under PJM’s operational control. These facilities are designated as Bulk Electric System (BES) facilities and are subject to the North American Electric Reliability Corporation (NERC) standards and criteria for such facilities. The PJM analyses ensure compliance with NERC, PJM and any applicable Regional Entity criteria (e.g. Reliability First (RF) or SERC Reliability Corporation (SERC)). In addition, the PJM-led analyses also include analysis of and solutions for transmission facilities with nominal voltages below 100kV to the extent such facilities are under PJM’s operational control (see <http://www.pjm.com/markets-and-operations/ops-analysis/transmission-facilities.aspx>). The TEAC and Subregional RTEP Committees provide the opportunity for stakeholders to engage in the PJM transmission planning process of such facilities, as described in this Manual.

In addition, for transmission facilities under PJM operational control, the Transmission Owner may submit its local planning criteria in its FERC Form No. 715 filing.

Transmission Owner Supplemental Projects:

Supplemental Projects refer to a transmission expansion or enhancement not needed to comply with PJM reliability, operational performance, FERC Form No. 715 or economic criteria. Transmission Owners plan Supplemental Projects in accordance with the Attachment M-3 Process. Projects planned through the Attachment M-3 Process could include those that: (i) expand or enhance the transmission system; (ii) address Transmission Owner zonal reliability issues; (iii) maintain the existing transmission system; (iv) comply with regulatory requirements or (v) implement Transmission Owner asset management activities (which could include needs related to a transmission facility approaching the end of its useful life, which, in accordance with good utility practice, is not determined by the facility’s service life for accounting or depreciation purposes). Each Transmission Owner shall annually present the details of its mandatory Transmission Owners End of Life (EOL) program that include a discussion of the program/process for (i) asset condition assessments which may consider frequency of assessments based upon age and (ii) EOL determination process which may consider industry averages, manufacturers recommendations and Good Utility Practice. This presentation

should coincide with the presentation of assumptions for the annual RTEP and Attachment M-3 activities.

Pursuant to the Attachment M-3 Process, Supplemental Projects are presented through the TEAC (230 kV and above facilities) or the Subregional RTEP Committees (below 230 kV facilities) for review and comment in a three-part meeting process that includes at a minimum (i) an Assumptions Meeting, (ii) a Needs Meeting and (iii) a Solutions Meeting. The Solutions Meetings are followed by a round of comments before the Transmission Owners finalize the Supplemental Projects. The stakeholders are provided a final comment period before the Supplemental Project is included in the Local Plan. Supplemental Projects included in the Local Plan are provided to the TEAC and the PJM Board as informational before integrating the Supplemental Project into the RTEP base case. Supplemental Projects are not approved by the PJM Board.

It should also be noted that prior to integrating a Supplemental Project into the RTEP base case PJM performs a “do no harm study” to evaluate whether a proposed Supplemental Project will adversely impact the reliability of the Transmission System as represented in the planning models used in all other PJM reliability planning studies. If as a result of the do no harm study, system upgrades are required, such upgrades will be considered part of the Supplemental Project and are the responsibility of the Transmission Owner sponsoring the Supplemental Project.

As part of the review of Supplemental Projects, PJM will inform stakeholders if PJM determines that a proposed Supplemental Project does not meet the Operating Agreement definition of a Supplemental Project. Additionally, PJM will monitor the status of the projects being developed through the Attachment M-3 Process in order to associate the Supplemental Project with the need identified by the Transmission Owner in the Attachment M-3 Process. For Supplemental Projects, the transparent identification of the need is important to PJM’s regional planning process and, accordingly, the identification of the need should include a description of the need in sufficient detail that together with the applicable criteria and supporting documentation stakeholders are capable of reviewing the Transmission Owner’s need determination as well as replicating the results of the planning studies.

A Project proposed as a Supplemental Project that does not meet the definition of Supplemental Project or cannot be associated with the need identified by the Transmission Owner in the Attachment M-3 Process will not be included in the Local Plan. Supplemental Projects, to the extent they are developed through the Attachment M-3 Process and can be associated with a supplemental need(s) identified by the relevant TO, will be included in the next annual RTEP base case.

Through the Attachment M-3 Process, Supplemental Projects are subject to similar open, transparent and participatory PJM committee activities, as are baseline upgrades developed through the TEAC and the Subregional RTEP Committee meetings (see discussion of TEAC and Subregional RTEP Committees).

As part of the review of Supplemental Projects PJM will also apprise the relevant Transmission Owner if a baseline upgrade might alleviate or partially mitigate the need for a Supplemental Project. In addition, PJM will determine if a Supplemental Project might impact a baseline need identified through the RTEP process, which might be in progress. A discussion of guidelines associated with potential for overlapping needs is included in this Manual below in section 1.4.2.

Planning for Customer-Funded Upgrades is performed through PJM’s New Services Queue and includes Network Upgrades, Local Upgrades or Merchant Network Upgrades identified pursuant

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Furthermore, by virtue of its regional scope, the RTEP process assures coordination of expansion plans across multiple transmission owners' systems, permitting the identification of the most efficient or cost-effective expansion plan for the region. The RTEP developed through this process is reviewed and approved by PJM's Board of Managers. The Supplemental Projects are integrated into the RTEP, however the Board does not approve individual Supplemental Projects. The following Section 2 describes the PJM RTEP Process analysis.

1.4.2 Coordination of Baseline Upgrades, Supplemental Projects and Customer-Funded Upgrades

Changes to the transmission system are incorporated into the RTEP base case based on the process drivers outlined in section 1.4.1 above in the form of three different types of upgrades or projects: 1) baseline upgrades (see sections 1.4.1.1 – 1.4.1.4); 2) Supplemental Projects (see sections 1.4.1.5); and 3) Customer-Funded Upgrades (see sections 1.4.1.6).

During the course of reviewing any upgrade or project, PJM will work with stakeholders to identify any upgrades or projects, or portions thereof that interact electrically. By doing so, PJM is able to determine the proper classification of a project based on one or more types of drivers, as well as develop the more efficient or cost-effective solutions.

1.4.2.1 When a Need is identified in the Attachment M-3 Process that requires development of a Supplemental Project (not yet included in RTEP base case)

During a review of the RTEP analysis, it may become apparent that a supplemental need identified in the Attachment M-3 Process may interact with an identified violation, system condition, economic constraint, or public policy requirement posted on the PJM website. In this case, PJM will provide notice of the potential interaction associated with the posted system condition by posting the newly available information to the PJM website and provide notification to stakeholders. In addition, PJM may determine whether to lengthen an open proposal window in order to permit project proposers additional time to consider the availability of new or changed information. PJM can consider proposals, including proposals in its open proposal window that more efficiently and cost-effectively address both the identified baseline need(s) and any related needs identified in the Attachment M-3 Process.

1.4.2.2 When a Supplemental Project is submitted for inclusion in the Local Plan (not yet included in RTEP case)

During a review of the RTEP analysis, including input from stakeholders, it may become apparent that a Supplemental Project submitted for inclusion in the Local Plan, but not yet included in the RTEP base case, may interact with an identified violation, system condition, economic constraint, or public policy requirement posted on the PJM website. In this case, PJM will provide notice of the potential interaction associated with the posted system condition included in the PJM open proposal window. In addition, PJM may determine whether to lengthen the open proposal window in order to permit project proposers additional time to consider the availability of new or changed information regarding the facilities associated with the open proposal window, including any related needs identified in the Attachment M-3 Process.

In the development of the RTEP, PJM shall examine whether a possible baseline upgrade would more efficiently and cost-effectively address the identified regional need, as well as a supplemental need addressed by a proposed Supplemental Project.

If PJM identifies that a possible baseline upgrade would more efficiently and cost-effectively address the identified regional need, as well as a supplemental need, PJM will discuss with the relevant Transmission Owner and other stakeholders at the next appropriate Subregional RTEP or TEAC meeting. PJM shall submit the proposed baseline upgrade to the PJM Board for inclusion in the RTEP.

The Transmission Owner shall determine whether the baseline upgrade meets the supplemental need addressed by the proposed Supplemental Project and, if so, the Transmission Owner will withdraw the project from inclusion in the Local Plan. The Transmission Owner will inform PJM and the stakeholders at the next appropriate Subregional RTEP or TEAC meeting that the Supplemental Project will not be submitted for inclusion in the Local Plan.

If the Transmission Owner subsequently determines that the supplemental need is not met, the TO at the next appropriate Subregional RTEP or TEAC meeting will: (1) provide documentation to PJM and the stakeholders on the rationale supporting its determination; and, (2) inform PJM and the stakeholders that the Supplemental Project will be submitted for inclusion in the Local Plan. Accordingly, PJM will include the proposed Supplemental Project in the next RTEP base case. After discussion with the relevant Transmission Owner, PJM will notify the relevant regulatory siting authority, if applicable, when a Supplemental Project is being reviewed that PJM has identified a baseline violation for which the baseline solution may impact the supplemental need for the Supplemental Project.

Any disputes arising under Attachment M-3, including any substantive and procedural disputes arising from the transmission planning process, may be resolved in accordance with the dispute resolution procedures in Schedule 5 of the Operating Agreement.

1.4.2.3 When a Transmission Owner identifies an End of Life (EOL) candidate list to PJM for consideration in the RTEP studies

On an annual basis, but no later than February 1, each Transmission Owner shall provide to PJM a 5-year EOL retirement/replacement candidate projection list (limited to transmission lines, including associated transmission line support equipment such as tower structures, and transformers) which shall be designated the EOL Candidate Projection List. The facilities on the EOL Candidate Projection List shall be maintained as confidential except as described below. During a review of the RTEP analysis, it may become apparent that a facility on the EOL Candidate Projection List supplied to PJM may interact with an identified violation, system condition, economic constraint, or public policy requirement that is or may be posted on the PJM website. In this case, PJM will provide notice of the potential interaction associated with the posted system condition by posting the newly available information to the PJM website and provide notification to stakeholders. Where no interaction with the facilities on the EOL Candidate Projection List exists, the EOL Candidate Projection List facilities will remain confidential and subject to the Attachment M-3 Process if and when applicable. In addition, PJM may determine whether to lengthen an open proposal window in order to permit additional time to consider the availability of new or changed information. PJM can consider proposals, including proposals in its open proposal window that more efficiently and cost-effectively address both the identified baseline need(s) and any related needs identified for the facilities on the EOL Candidate

Projection List.

1.4.2.31.4.2.4 When a baseline upgrade is included in RTEP base case (in a prior RTEP cycle) and a Supplemental Project or Customer-Funded Upgrade is identified which interacts with the need for the baseline upgrade

PJM will review the needs for each of the upgrades or projects and review these needs with the stakeholders. This review will include, but is not limited to, the determination of how each upgrade or project may or may not satisfy the needs of one or more of the processes, and a review of the proposed schedules for the upgrades or projects and the system timing needs in order to inform these discussions.

Following a review of the applicable information, PJM shall determine the steps to be taken in order to preserve baseline reliability while also accommodating other system needs for the M-3 and the New Services Queue processes. Stakeholders will be provided an opportunity to discuss PJM's findings prior to PJM making a decision as to how PJM will proceed.

The Transmission Owners provide status updates in accordance with Section 6 of Manual 14C. Such status updates should include an indication of any relevant regulatory siting authority approval necessary for the project and the status of such approval. If at any time, PJM identifies a baseline need where a possible baseline upgrade would more efficiently and cost-effectively address the baseline need, as well as the identified needs for any proposed Supplemental Project, PJM will notify the relevant regulatory siting authority where the Supplemental Project is being reviewed that PJM has identified a baseline violation for which the baseline upgrade may impact the supplemental need for the Supplemental Project.

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uplift. Upgrades will be considered to mitigate uplift payments that are expected to continue in the future.

PRA evaluation uses an economic analysis of the cost of the investment that mitigates a risk and the dollar value of the avoided risk. The mitigation strategy cost, prime rate and payback period are used to determine if the strategy cost is less than the value of risk. Projects with lower cost than risk are candidates for the RTEP.

2.7.2 Probabilistic Risk Assessment of PJM 500/230 kV Transformers

One significant element of PJM's operational performance reviews involves a risk evaluation aimed at anticipating significant transmission loss events. PJM integrates aging infrastructure decisions into the ongoing RTEP process: analysis, plan development, stakeholder review, PJM Board approval, and implementation, over PJM's entire footprint. Thus, the aging infrastructure initiative implements a proactive, PJM-wide approach to assess the risk of transmission facility loss and to mitigate operational and market impacts of such losses.

PRA's initial implementation at PJM is a risk management tool employed to reduce the potential economic and reliability consequences of transmission system equipment losses. In collaboration with academia, vendors and member TOs, PJM integrated various input drivers into a transformer PRA initiative to manage 500/230 kV transformer risk. In the case of the 500/230 kV transformers, risk is the product of the probability of incurring a loss and the economic consequence of the loss. Probability of loss is determined based on the individual transformer unit's condition assessments and vintage history. Economic loss impact is based upon the duration of the loss and the accumulation of unhedgeable congestion costs, or the increased cost of running out of merit generation to meet load requirements after a transformer loss. If lead times for 500/230 kV transformer units are as great as eighteen months, then outage durations can be long if adequate loss mitigation is not in place. The PRA outputs the annual risk to the PJM system of each transformer unit in terms of dollars. The annual risk dollars are then used to justify mitigating solutions such as redundant bank deployment, proactive replacement or adding spares. The deployment strategy chosen will depend on the level of risk mitigation and reliability benefit.

While initially developed for aging 500/230 kV transformers, the PRA tool is capable of assessing other equipment types and other transformer voltage classes. The PRA tool is commercially available software.

2.8 End of ~~Useful~~-Life Issues

For each transmission need identified pursuant to FERC Form No. 715 or other Transmission Owner planning criteria addressing the end of ~~useful~~-life of an existing facility, which, in accordance with good utility practice, is not determined by the facility's service life for accounting or depreciation purposes, each Transmission Owner should provide information, to the extent available, that supports the need for the project consistent with the Transmission Owner's planning criteria in accordance with the RTEP process or Attachment M-3 Process, as applicable. The presentation of these EOL needs shall be consistent with the assumptions as outlined in the annual presentation of the Transmission Owners EOL program.