PJM Incremental Auction Revenue Rights Model Development and Analysis

PJM

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Contents

1.0 Summary

Incremental Auction Revenue Rights (IARRs) are additional Auction Revenue Rights not previously feasible, created by the addition of Incremental Rights-Eligible Required Transmission Enhancements, Merchant Transmission Facilities, or of one or more Customer-Funded Upgrades.[1] These rights are available through the PJM Interconnection queue process. IARRs are granted to the customer only if the Transmission Enhancement provides incremental capability that makes the IARR request feasible. The objective is to ensure that existing ARRs and requested IARRs are simultaneously feasible to ensure there are sufficient congestion revenues to satisfy all ARR/FTR obligations. PJM will use a markets model as defined in the PJM Tariff to perform the simultaneous feasibility test.[2]

This document describes the PJM Incremental Auction Revenue Rights (IARR) model development and evaluation process for reviewing IARR requests under Section 7.8 of Schedule 1 of the Operating Agreement and Tariff. This document describes the process used for evaluating IARR requests through the Elective Upgrade Auction Revenue Right process (initiated through a request using Attachment EE) and the Merchant and Generation Interconnection process. A step-by-step guide of the IARR process is provided in outline form in Appendix A. Examples of IARR requests and the evaluation process are provided in Appendix B. A procedure for a customer to perform an IARR analysis is provided in Appendix C. Language governing the PJM-MISO IARR Coordinated Studies process is provided in Appendix D. This document is a guide to the rules governing IARRs and is not a substitute for the PJM Tariff, Operating Agreement, or Manual Language.

2.0 Market and Planning Models

The Incremental ARR Model and the 10-year Stage 1A ARR Model (collectively the IARR Market Model) are market models used to evaluate IARR requests. The Incremental ARR Model and the 10-year Stage 1A ARR Model do not include any flows based on actual physical generators or load because the flows represented in the IARR Market Models are caused by the sources and sinks of requested ARRs for the most recent planning period for which an annual ARR allocation has been conducted. The IARR Market Models utilize the same transmission system model that is used in the annual ARR process, with the

[1] PJM Tariff § **1.14B Incremental Auction Revenue Rights:** The additional Auction Revenue Rights (as defined in § 1.3.1A of Schedule 1 of the Operating Agreement), not previously feasible, created by the addition of Incremental Rights-Eligible Required Transmission Enhancements, Merchant Transmission Facilities, or of one or more Customer-Funded Upgrades.

[2] PJM Tariff § 7.5 (a) The Office of the Interconnection shall make the simultaneous feasibility determinations specified herein using appropriate power flow models of contingency-constrained dispatch. Such determinations shall take into account outages of both individual generation units and transmission facilities and shall be based on reasonable assumptions about the configuration and availability of transmission capability during the period covered by the auction that are not inconsistent with the determination of the deliverability of Generation Capacity Resources under the Reliability Assurance Agreement. The goal of the simultaneous feasibility determination shall be to ensure that there are sufficient revenues from Transmission Congestion Charges to satisfy all Financial Transmission Rights Obligations for the auction period under expected conditions and to ensure that there are sufficient revenues from the annual Financial Transmission Right Auction to satisfy all Auction Revenue Rights obligations.

exception that any modeled transmission outages are removed. The removal of the transmission outages may result in a new set of constrained facilities in the IARR analysis. It is necessary to utilize the same market model for the IARR analysis as for the annual ARR allocation to ensure that the IARR evaluation is consistent with existing ARR rights. If the incremental market flows created by the IARR request create limited facilities or increase the market flow on already limited facilities in either the Incremental ARR Model or the 10-year Stage 1A ARR Model this indicates that increased system capability, termed IARR Incremental Capability Required, is required to grant the IARR request. The prospective IARR customer is only responsible for correcting their incremental contribution to the binding of any identified constraints. Any additional capacity created by the upgrade, over the IARR flow, will be allocated to the system, and not the IARR requestor.

The IARR analysis determines the incremental impact of the requested IARR path, given existing ARR rights, on the transmission system but does not determine the actual physical upgrades required to provide the requested IARRs.

The evaluation of the physical upgrades required to provide the Incremental Capability Required to grant an IARR request is determined using the Planning Model. The Planning Model is the Regional Transmission Expansion Plan model used by PJM's Planning Group to study system needs and proposed projects five years ahead. The Planning Model used to evaluate IARR requests is made up of a Planning System Model combined with modeled in-service and planned generation and forecasted load. The Planning System Model will include transmission system upgrades that are ahead of the proposed IARR project in the planning queue. IARR upgrades must achieve additional incremental capability over and above any planned baseline or supplemental upgrades, including supplemental upgrades with a projected in-service date later than the applicable planning case year. The rules and procedures for the RTEP process are set forth in schedule 6 of the Operating Agreement.

Table 1 provides an overview of the key differences between the IARR Market Model, which includes a representation of the current ARR market flow model, and the Planning Model, which is a physical representation of future transmission system.

Table 1: IARR Market Models vs. Planning (Physical) Model

	IARR Market Models	Planning Model
IARR evaluation purpose	Determines incremental ARR capability required	Used for determining actual physical upgrades
Topology	Markets As-Is topology used in Annual ARR/FTR process (no outages modeled)	Future RTEP Topology
Load	Sink of ARR, IARR, or uncompensated flow withdrawal location	Forecasted Load
Generation	Source of ARR, IARR, or uncompensated flow injection location	In-Service and planned generation from PJM Queues
Point-to-Point Transmission	Includes eligible Firm Point-to-Point modeled as nodal ARR transfers	Includes all Firm Point-to-Point and modeled as slice of system transfers
Future Approved Transmission upgrades	Not included[3]	Included
Transmission Limits	Market Limits (As-Is physical limits adjusted for historical market impacts)	Physical Planning Limits

Figure 1 demonstrates the IARR Incremental Capability Required for an IARR upgrade and the differences between the system capability represented in the IARR Market Model and in the Planning Model. In Figure 1, there is 200 MW of market flow capability (the black line at 200 MW in the image on the left of the figure) available in the IARR Market Model that is fully used by ARR market flow (the yellow rectangle area) allocated through the annual ARR allocation process. An IARR request creates IARR Incremental Capability Required (the tan rectangle) that is 25 MW in excess of the 200 MW of market flow capability used by the cleared ARR market flow.

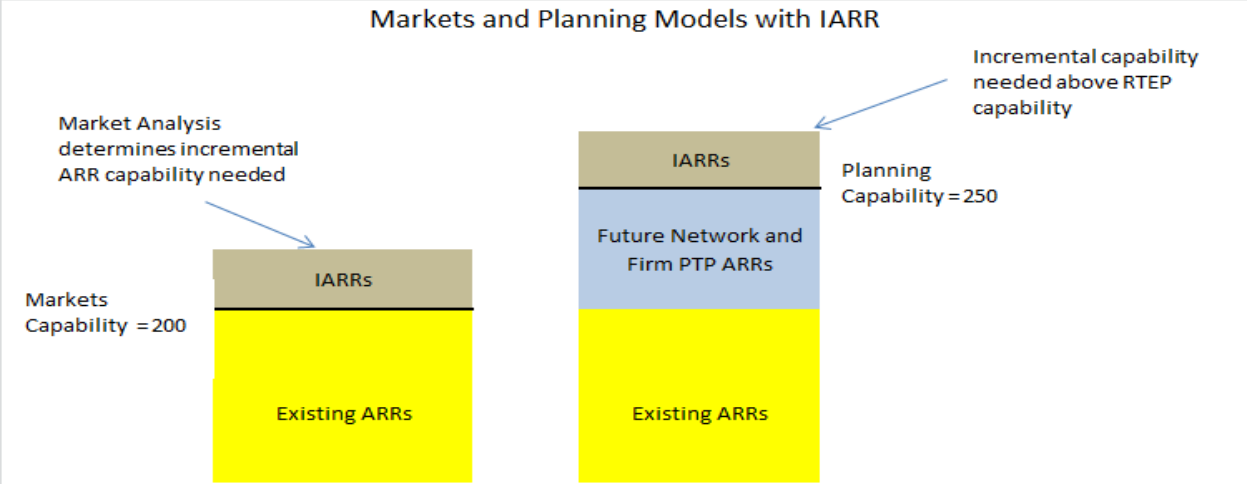
The Planning Model capability is 250 MW (indicated by the black line in the image on the right of the figure). The Planning Model includes approved Regional Transmission Expansion Plan (RTEP) upgrades (the blue rectangle area in the image on the right side of the figure) that were not part of the available physical system at the time of the ARR allocation process and therefore not included in IARR Market Model. The costs for these RTEP upgrades are allocated to the Transmission Zones and Firm customers who serve load or have Firm Withdrawal Rights. These customers have first rights to the ARRs on the

[3] The Annual ARR and subsequent IARR model will include significant future upgrades expected to be in service by June 30th of each year as posted in the Annual ARR section of the PJM webpage (http://www.pjm.com/markets-and-operations/ftr.aspx).

system necessary to hedge their load from congestion. Therefore, the capability in the blue rectangle area is not available to the prospective IARR customer.

To acquire the requested IARR, the IARR Incremental Capability Required (25 MW) will need to be added to the 250 MW of system capability found in the Planning Model. This addition of the IARR Incremental Capability Required is necessary to support the IARR request and must be provided above the planning capability of 250 MW to ensure the future ARR capability created from the planning upgrades is first reserved for the Network and Firm PTP ARR holders. The planning analysis is not necessary to perform the markets IARR analysis, but it is necessary to determine the necessary upgrades needed to provide the incremental capability to support the IARR request.

Figure 1: Market and Planning Model ARR Capability with an IARR



The planning process will typically result in upgrades to system capability above what is necessary to support identified needs (such as IARR requests, Interconnection Rights, and Reliability violations) because upgrades are rarely available to provide the exact incremental system capability MW required[4]. However, just as the Annual ARR holder might realize the benefit of the excess MW associated with the IARR upgrades, the IARR holder also realizes the benefit of already in-service RTEP upgrades that created excess capability beyond what was necessary for base line reliability and market efficiency upgrades not necessary to support annual ARRs.

3.0 Base Market Model Development

The Incremental ARR Model is used to conduct the IARR analysis. The Incremental ARR Model is based on the Base Market Model used to allocate ARRs in the Annual ARR allocation process.

The Base Market Model is constructed for the Annual ARR allocation process to help

[4] Available Interconnection rights and PJM's Reliability and Market Efficiency processes are described in the Manual 14 Series of the PJM manuals (http://www.pjm.com/library/manuals.aspx).

ensure that FTR revenue adequacy can be achieved, as required per PJM Tariff. FTR revenue adequacy is achieved when there are sufficient revenues from Transmission Congestion Charges to satisfy all Financial Transmission Rights Obligations and when there are sufficient revenues from the Annual Financial Transmission Rights Auction to satisfy all Auction Revenue Rights obligations. The IARR analysis determines the incremental impact on facilities in the annual ARR markets model if an IARR were to be granted. Therefore, the Base Market Model is important and a key input to the IARR analysis. This Base Market Model is available to customers to perform their own IARR analysis (see Appendix A). It is not necessary for participants to duplicate the Base Market Model in order to conduct their own IARR analysis.

3.1 Base Market Model

The Base Market Model, along with supporting files, is posted on the PJM FTR Web Page Annual ARR and model sections at the below link.

http://www.pjm.com/markets-and-operations/ftr.aspx

The Base Market Model is based on the day-ahead market dispatch model of the transmission system in use at the beginning of a relevant planning period. The Base Market Model begins with the physical line limits used by PJM's day-ahead market dispatch model. The Base Market Model is adjusted to reflect expected market capability over the relevant (next) planning year, to accommodate Stage 1A rights and to align expected FTR total target allocations with expected congestion.

The key inputs to the Base Market Model are as follows.

A. **Annual Stage 1A ARRs**: During each round of the annual ARR allocation, load-serving entities may request ARRs that source at generator locations and sink at the location where they are serving load. In addition, Firm Point to Point Transmission customers may request ARRs consistent with the source and sink of their Point-to-Point reservation. In Stage 1A of the Annual Allocation, all ARRs requested are guaranteed to be allocated per PJM Operating Agreement and Tariff requirements. Therefore, infeasible Annual ARRs may be allocated each year. PJM is required to expand system capability through modeling upgrades to alleviate the qualified infeasibilities if there are not already upgrades approved in the existing PJM RTEP. Therefore, ARRs may have been over allocated prior to any IARR requests in the Base Market Model. However, IARR holders are only responsible for addressing the incremental impact of their IARR requests on the transmission system, not meeting system feasibility.

B. **Uncompensated Power Flow**: Uncompensated power flow, or loop flow, is considered external flow's contribution on the PJM system. PJM will model this flow based on historical flows from neighboring external systems. On each of the PJM external interfaces, the scheduled and actual interchange fluctuate in real time and are not always equal to each other. This results in the loop flow impacts on each of PJM transmission facilities. Within the Base

Market Model, injection and withdrawal points at external locations are used to simulate loop flow as follows.

Procedure for determining Loop Flow Model

1. PJM will review the historical schedule and actual interchange between PJM and its neighboring areas at http://www.pjm.com/markets-and-operations/ops-analysis.aspx.

2. PJM will prepare a power flow case for the study using the network model published at the follow link located in the Model section of the PJM FTR webpage.

   http://www.pjm.com/markets-and-operations/ftr.aspx

3. PJM will identify all external withdrawal/injection locations from the power flow that are also modeled in the PJM markets software.

4. PJM will utilize a power flow program, such as TARA, to identify the precise withdrawal/injection locations to effectuate the historical interchange between PJM and its neighboring areas.

C. **External Flowgate Data**: Coordinated flowgates within external areas are modeled to ensure that PJM does not allocate rights in excess of the allowed entitlements or limits. These entitlements/limits are honored by PJM in the allocation process to ensure revenue adequacy on these facilities. The final flowgate list, and their FFE value, is posted at the following link located in the Annual Auction Revenue Rights (ARR) Allocation section of the PJM FTR webpage:

   Name: MISO Market-to-Market Firm Flow Entitlements Utilized

   http://www.pjm.com/markets-and-operations/ftr.aspx

D. **Reactive Interfaces**: In PJM real-time operations, the Transfer Limit Calculator (TLC) simulates transfers in order to assess voltage collapse conditions for reactive interfaces. The Base Market Model needs to include these reactive interfaces, with appropriate market limits. The reactive interfaces that are used within the Base Market Model are the same as those monitored in the PJM Real-time market provided on the PJM OASIS. These market limits are derived from previous year's average historical values, for periods with no regional transmission outages, using the publically available RTO Transfer Limit & Flows file at the following link:

   http://www.pjm.com/markets-and-operations/ops-analysis.aspx.

E. **Transmission Topology/Market Limits**:

1. The topology used for the Base Market Model consists of the as-is system model with the inclusion of modeled transmission outages expected for the planning period. PJM provides the list of modeled transmission outages and a detailed description of the outage modeling process in a document that is posted each year in the Annual ARR section of the FTR web page at the below link. Transmission outages that will affect expected FTR funding are included in the Base Market Model. Transmission outages are not modeled in the actual IARR analysis.
http://www.pjm.com/markets-and-operations/ftr.aspx

2. Substantive transmission upgrades that are expected to in service can be included in the topology of the Base Market Model (increasing system and/or line capability beyond the initial market dispatch model).

3. Operational considerations, voltage limitations (internal interface approximations) and closed loop interfaces that can affect FTR funding are included as thermal constraints (additional constraints that limit system capability).

4. Thermal limits in the Base Market Model can also be adjusted on paths that have historically contributed to underfunding to reflect uncompensated flow contributions

   PJM provides a list of facilities that are modified from the original thermal limit each year in the annual ARR section of the FTR web page at the below link.

   http://www.pjm.com/markets-and-operations/ftr.aspx

   In addition, the IARR model posted on the Planning IARR page at the below link already has these limits incorporated.

   http://www.pjm.com/planning/arr-analyses.aspx

4.0 IARR Market Models Development:

The IARR Market Model is based on the Base Market Model with the modifications listed below, and is provided on the PJM Planning IARR web page at the below link.

http://www.pjm.com/planning/arr-analyses.aspx

Incremental ARRs are evaluated utilizing two separate market flow models: the Incremental ARR Model and the 10-year Stage 1A ARR Model.

The IARR Market Models are based on the Base Market Model, with the modifications listed below. All PJM monitored facilities, market contingencies, and other necessary facilities and modeling in the Base Market Model are included.

4.1 Incremental ARR Model

A. Fundamental point of this IARR model evaluation is to determine any incremental effect of an IARR request on existing limitations in the base transmission model.

B. All transmission outages modeled in the Base Market Model are removed.

C. The Injections (Sources) and Withdrawals (Sinks) in the Incremental ARR Model consists of approved annual ARRs, approved IARRs, uncompensated power flow (Loop Flow), grandfathered transmission rights[5] plus any ARR requests that were prorated. ARRs are prorated in Stage 1B and each round of Stage 2 of the Annual ARR Allocation based on the requested ARR paths and the impact on each constraint. Proration results in ARR requests not being fully awarded. For example, if there is a single line overloaded because of the requested ARRs then PJM will prorate the requested ARRs that have an impact on the this line until the flow is reduced at or below the limit of the facility. Within the Base Market Model, the capability of some facilities may be reduced to less than the line rating, identified as the market limit, to account for operational impacts. Such operational impacts in the Base Market Model could be a result of transmission or generator outages, switching, voltage surrogates, PAR impacts, and any other proxy type rating used to operate the system in a reliable and efficient manner. In the Incremental ARR Model ARRs prorated in the Base Market Model are no longer prorated and are fully allocated because prorations are typically due to modeled outages.

D. Transmission facilities that were limiting in the Annual ARR allocation are identified and monitored in all IARR analysis. These facilities were fully allocated in the Annual ARR allocation process, which resulted in Network and Point-to-Point customers not acquiring all of their requested ARRs. Additional IARRs cannot be added that impact any of these monitored facilities without the need for upgrades, unless the removal of the outages from step B removes the facility from being limiting, and the addition of the IARR does not cause the resulting market flow to exceed the facility's capability. In many instances, multiple facilities in the same electrical vicinity

[5] Grandfathered transmission rights are those transmission service contracts established prior to FERC's open access policy through order 888.

are overloaded because of the requested Annual ARRs. In these situations, PJM must select one of these overloaded facilities to use for prorating the requested Annual ARRs. The selection will be based on the degree of violation of the overloaded facilities because of the requested Annual ARRs. The impact of prorating Annual ARR requests for one facility may be a reduction of flow in the other overloaded facilities in that same electrical vicinity. The result may be that although multiple facilities were overloaded, only one facility was required to be prorated. The entire set of overloaded facilities is actually limiting in the allocation, and will be reported, although only one facility may have been prorated (see Example 3 in Appendix B of this document).

4.2 The 10-year Stage 1A ARR model

A. The fundamental point of this model is to determine whether load growth associated with the existing ARR requests would result in constraints that must be considered in reviewing IARR requests.

B. All transmission outages modeled in the Base Market Model are removed.

C. The Injections (Sources) and Withdrawals (Sinks) consist of approved annual Stage 1A ARRs, requested IARRs, uncompensated power flow (Loop Flow), and Grandfathered Transmission Rights.

D. Injections and Withdrawals are adjusted to reflect increased ARR requests associated with using a new Zonal Base Load projection calculated from the 10-year Load Forecast zonal growth rate.

   1. The zonal growth rate is applied to each zone's base load to develop a zonal base load for years 2 through 10. Additional ARR MWs are assumed from capacity remaining on eligible Stage 1 resources that have a historical LMP that is lower in value than the historical zonal LMP. ARR MW are delivered from such Stage 1 resources up to the maximum MW capacity of the resource until the historical LMP of the next highest price resource exceeds the historical zonal LMP or until the zonal base load is met.

E. Transmission facilities that were over allocated in Stage 1A of the Annual ARR allocation are identified along with any other new facility because of the increased ARR requests. IARRs cannot be added that impact any of these facilities without the need for transmission upgrades. Note that overloads on facilities identified as over allocated or infeasible in stage 1 A do not have to be relieved with IARR requests. Only the incremental impact, as measured using the IARR request impact on the facility, will need to be addressed.

The IARR models, with supporting files, are available to participants on the PJM Planning IARR web page: http://www.pjm.com/planning/arr-analyses.aspx.

5.0 IARR Process Overview

Incremental Auction Revenue Rights (IARRs) are available through two mechanisms: Customer Funded (Elective Upgrade Auction Revenue Rights) requests and Merchant Transmission and Generation Interconnection requests.

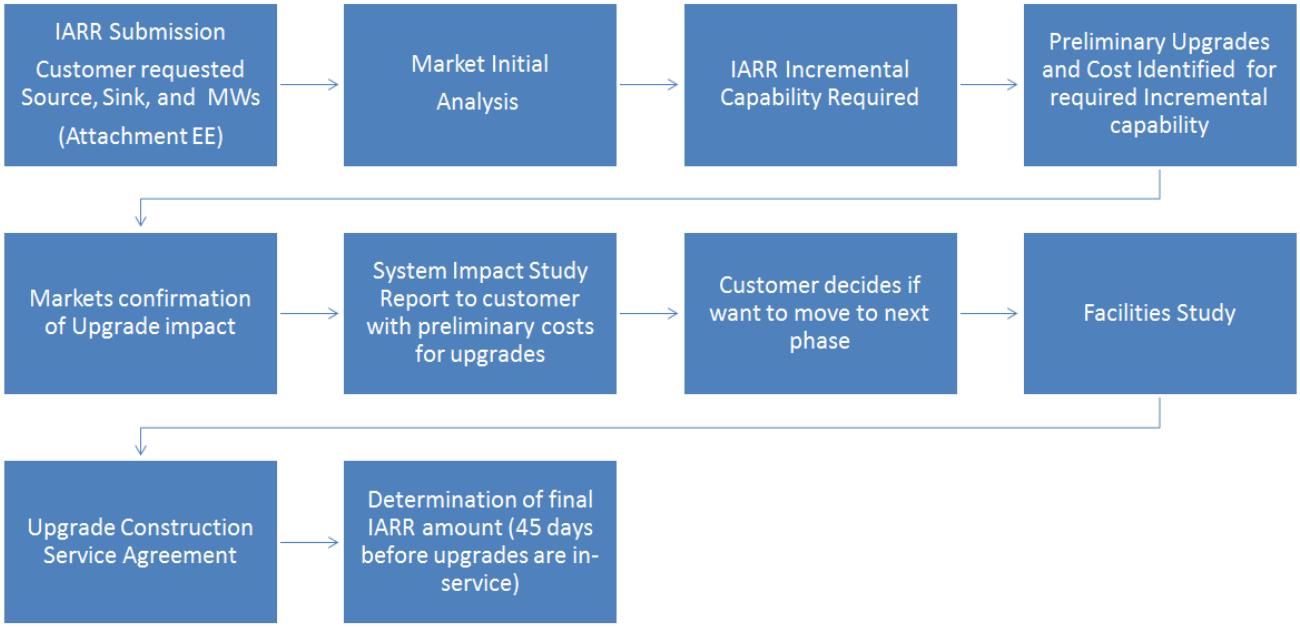
The holder of IARRs has the right to collect FTR auction revenues on a defined contract path in return for funding the transmission upgrades that created the incremental transmission capability. The two IARR mechanisms are described below.

5.1 Customer Funded (Elective Upgrade Auction Revenue Rights) Requests

The Customer Funded (Elective Upgrade Auction Revenue Rights) request approach is defined in Section 7.8 of Schedule 1 of the Operating Agreement and Tariff. This type of request, made through Attachment EE in the PJM Tariff, permits any party to request and obtain IARRs by agreeing to fund upgrades necessary to support the requested rights. Requests will specify a source, sink, and MW amount. PJM will assess the simultaneous feasibility of the requested IARRs against the Incremental ARR Model capability and 10-year Stage 1A ARR Model. Based on this preliminary assessment, conducted by the Markets department at PJM, the PJM Planning department will conduct studies to determine the upgrades required to accommodate the requested Incremental ARRs, and ensure that all existing ARRs and requested IARRs are simultaneously feasible in the Incremental ARR Model. These results will be communicated to the IARR requester. If a party elects to fund the upgrades, PJM will notify the party of the preliminary amount of Incremental ARRs that will be awarded based on the allocation process, established pursuant to Section 231 of Part VI of the Tariff. The final, and binding, IARR assignment shall in no event be less than 80% and no greater than 100% of the preliminary estimate of IARRs provided to the IARR requestor. Ensuring the final and binding IARR assignment is no less than 80% protects the customer's investment and eliminates the risk of future conditions that may result in less capability. For example, if the final IARR capability was 70% of the preliminary requested capability than the customer would still receive 80% of the initial request. The additional 10% of unavailable capability (80%-70%) would be incorporated into the RTEP and potentially trigger RTEP transmission upgrades through the PJM Market Efficiency or Stage 1A 10-year process. However, the IARR customer is not required to fund additional upgrades. In addition, if the final IARR capability is greater than 100% of the original requested IARRs, the customer would not be allocated IARRs in excess of the initial requested IARRs. The capability over the initially requested amount would be available for the good of the system and factor into future Annual ARR allocations.

Figure 2 illustrates the high-level process for the Customer Funded IARR requests. Appendix A of this document provides an example of this process.

Figure 2: Process Flow for Customer Funded IARR Requests



5.1.1 IARR Submission

For a customer funded IARR request, the customer must submit a source, sink, and the desired MW. This request is made using the Attachment EE form:

http://pjm.com/planning/rtep-development/expansion-plan-process/form-attachment-ee-control.aspx.

In addition, Section 4 of PJM Manual 14E labeled "Additional Information for Upgrade and Transmission interconnection Projects" provides more detailed information about this process:

http://www.pjm.com/~/media/documents/manuals/m14e.ashx

5.1.2 Markets Initial Analysis

During the initial phase of the study, the PJM Markets Group conducts an analysis as detailed in this document to determine the impact of the IARR request on facilities monitored in the IARR Market Models. The analysis includes a transfer analysis using software such as PSS/E MUST. The analysis will determine the flow impact of the requested IARR on facilities that limited annual ARR allocations, facilities as identified in the Stage 1A 10-year analysis, and new facilities for which the requested IARR increased flow above the market limits. In addition, the Markets analysis may identify the need to coordinate the study of the IARR request with the Midcontinent ISO (MISO) as part of the

PJM/MISO Joint Operating Agreement[6] and described in Appendix D.

5.1.3 IARR Incremental Capability Required

Results of the Markets Initial Analysis are communicated from the PJM Markets Group to the PJM Planning Group. These results include the identification of facilities for which increased capability is required and the MW capability necessary to accommodate the IARR request.

5.1.4 Preliminary Upgrades and Cost Identified for required Incremental capability

The PJM Planning Group receives the list of facilities for which increased capability is required, with required MW capability, from the PJM Markets Group to determine the necessary upgrades. The PJM Planning Group first determines the correct queue case to use for the identification of upgrades that is consistent with the queue in which the initial request was made. This case is also used to identify upgrades to support the requested IARRs. Using the results of the analysis performed by the Markets Group, the facilities in the planning queue case are matched with the facilities from the markets case (Note: due to the difference in the markets and planning cases, the facilities identified in the markets case may not match the facilities identified in the planning case). These differences are resolved between the PJM Markets and Planning Groups by determining the equivalent representation of the facilities in the planning model to match the constrained facilities.

After the facilities are identified from the planning case, they are provided to the transmission owner(s) for identification of upgrades required to achieve the increased capability.

IARR related upgrades must achieve additional incremental capability over and above any higher-ordered (previously publicly announced or posted RTEP need) baseline or higher-ordered supplemental upgrades, including baseline upgrades and supplemental upgrades with a projected in-service date later than the applicable planning base case year. IARR related upgrades must also provide incremental capability above all higher-ordered New Service Requests' rights from Network Upgrades. However, if a higher-ordered New Service Customer Requests' Network Upgrade has excess capability that satisfies the IARR incremental requirement and all higher-ordered New Service Customer(s) with cost responsibility towards that Network Upgrade do not claim PJM Tariff rights associated with the excess capability, then the IARR Upgrade Customer will receive a cost allocation towards that Network Upgrade as described in section 231.4 of the PJM Tariff.

5.1.5 Markets Confirmation of Upgrade Impact

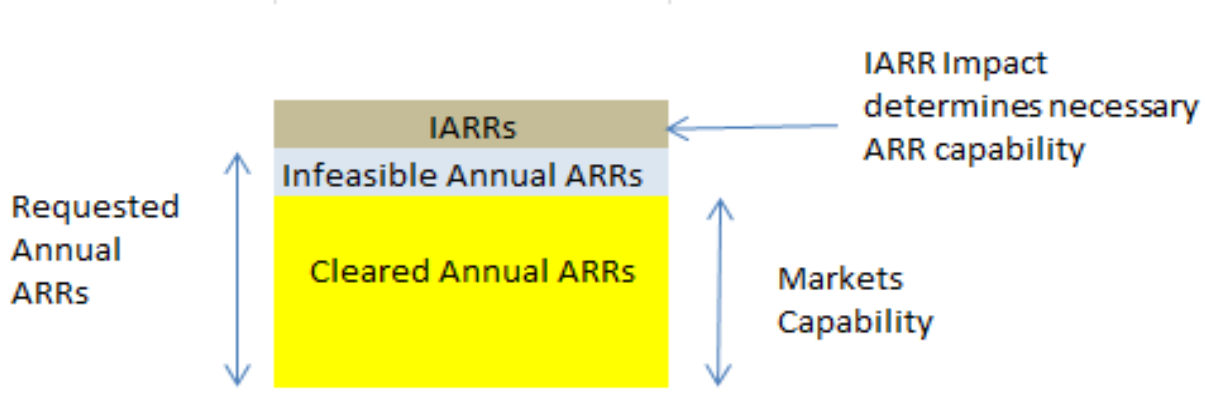
Upon PJM Planning Group's receipt of the required upgrades proposed by the transmission owner(s), the modeling information is provided to the PJM Markets Group so that the upgrades can be tested to determine if the identified ARR violation has been

[6] MISO-JOA ARTICLE IX - COORDINATED REGIONAL TRANSMISSION EXPA -->MISO-JOA 9.3 Coordinated System Planning.

removed prior to approving the IARR request. This analysis will be performed utilizing the markets Incremental ARR Model and 10-year Stage 1A Model.

If the upgrade results in a topology change, such as a new line, then a comparison is made between the flow on the limited facility that had IARR Incremental Capability Required before the upgrade (without the IARR request) and after the upgrade (with the IARR request). If, after the upgrade (the new line/change in topology), the flow on the facility which required increased capability is less than or equal to the flow before the upgrade, then the upgrade is sufficient to meet the IARR Incremental Capability Required because the IARR's incremental impact will not cause any additional flow than that generated prior to the IARR request. The upgrade does not need to remove any pre-existing violations or infeasibilities, as previously displayed in Figure 1, which may have occurred from annual ARR requests. For example, in Figure 3, the region in brown is the only necessary capability required for the IARR upgrade. The prospective IARR customer is not responsible for making the facility fully feasible, only for the IARR Incremental Capability Required they place on the facility with their request.

Figure 3: Incremental ARR Model Capability



If the upgrade addresses voltage limitations, then the market test would be conducted for such upgrades. In the event the market test does not meet the flow relief obligation, then the PJM Planning Group's analysis of the required upgrades will be performed again to meet the flow relief obligation. When the new upgrades are provided, the Markets Group will re-test. If the upgrades provide the required increase in ARR capability then the PJM project manager can prepare the System Impact Study report.

5.1.6 System Impact Study Report

The System Impact Study Report will contain the information for all the initially estimated upgrades required to achieve the ARR capability identified in the markets analysis. This information includes the Network Upgrade identification numbers for each upgrade, the description of the upgrade(s), the estimated cost of the upgrade(s), and the estimated time to complete the construction of the upgrade(s). The results of the System Impact Study, which is a deskside estimate, may be refined later through the Facilities Study. In addition, the estimated costs and time to perform the Facilities Study will be provided to the customer.

Manual 14A labeled “Generation and Transmission Interconnection Process” provides more detailed information about the System Impact report.

http://www.pjm.com/~/media/documents/manuals/m14a.ashx

5.1.7 Customer Decision

The next step is for the customer to review the System Impact Study Report and decide if they want to execute a Facilities Study Agreement. PJM will furnish a Facilities Study Agreement to the applicant, along with estimated cost of the study and the estimated time of completion. If the applicant decides to proceed, an executed Facilities Study Agreement must be submitted to PJM with the required deposit as specified in Section 206.2 of the PJM Tariff. The applicant must execute and return the Facilities Study Agreement (and the required deposit) within 30 days of receiving it. If an applicant fails to meet this deadline, the Interconnection Request will be deemed terminated and withdrawn. Attachment D of PJM Manual 14A labeled “Generation and Transmission Interconnection Process” provides more detailed information about the Facility Study process. The following is a link to this manual.

http://www.pjm.com/~/media/documents/manuals/m14a.ashx

5.1.8 Facilities Study

The purpose of the Facilities Study is to provide the refined upgrades, plus cost estimates and project schedules, to implement the conclusions of the System Impact Study regarding Network Upgrades and Local Upgrades (i.e. upgrades related to non-Tariff designated facilities) necessary to accommodate the request. Unlike the System Impact Study, which relies on initial deskside estimates, the Facilities Study is a more refined analysis that incorporates field data as appropriate.

5.1.9 Upgrade Construction Service Agreement

Following the completion of the Facilities Study the customer shall review the Facilities Study Report and decide if they want to pursue execution of an Upgrade Construction Service Agreement (UCSA) at which point a security deposit will be required. Upgrades associated with Customer Funded IARRs are owned by Transmission Owner(s). Since these customers will not own the Transmission Facilities that they are funding, the UCSA that they receive identifies and causes construction of the upgrade(s) to the system, obligates them to pay, identifies the applicable rights and establishes the term for those rights. IARR Rights shall become effective pursuant to the applicable UCSA and upon commencement of service. The term of rights is for the life of the facility or 30 years, whichever is shorter. Section 4 of PJM Manual 14E labeled “Additional Information for Upgrade and Transmission interconnection Projects” provides more detailed information about the Upgrade Construction Service Agreement. The link to this manual is provided below.

http://www.pjm.com/~/media/documents/manuals/m14e.ashx

5.1.10 Determination of Final IARR Amount

The final assignment of IARRs occurs no less than 45 days prior to the in-service date of the associated Network Upgrades. The reason for this process is that the financial viability of the rights is supported by the capability of the Transmission System, which can change subsequent to initial IARR estimates. Assigning the final determination of IARRs 45 days prior to the in-service date protects Auction Revenue Rights and Financial Transmission Rights holders from underfunding that may result from changes to the Transmission System that occur between the initial IARR estimate and the in-service date for the underlying upgrades.

Entities have a non-binding expectation of a certain amount of IARRs. To mitigate the potential for significant disparities between initial IARR requests, or estimates, and final determinations, an entity will receive a minimum of 80% and a maximum of 100% of the initial estimate of IARRs requested.

Evaluation of the final IARR is the same as the initial IARR evaluation process except the markets model used will be the current IARR market model at the time of the final IARR evaluation. This could be a different planning period than the initial IARR study was conducted. IARRs will become effective on the first day of the first month that the upgrade is included in the transmission system model for the monthly FTR auction. Incremental ARRs will be effective for thirty years or the life of the facility or upgrade, whichever is less. For IARRs that become effective at the beginning of a planning year, their value will be determined identically to that of annually allocated ARRs, based on the nodal prices resulting from the annual FTR auction. If IARRs become effective during a planning year, then their value for each month remaining in that planning year will be based on the results of the prompt-month FTR auctions. For each planning year thereafter, the value of IARRs will be determined identically to that of annually allocated ARRs, based on the nodal prices resulting from the annual FTR auction.

5.2 Merchant Transmission and Generation Interconnection requests

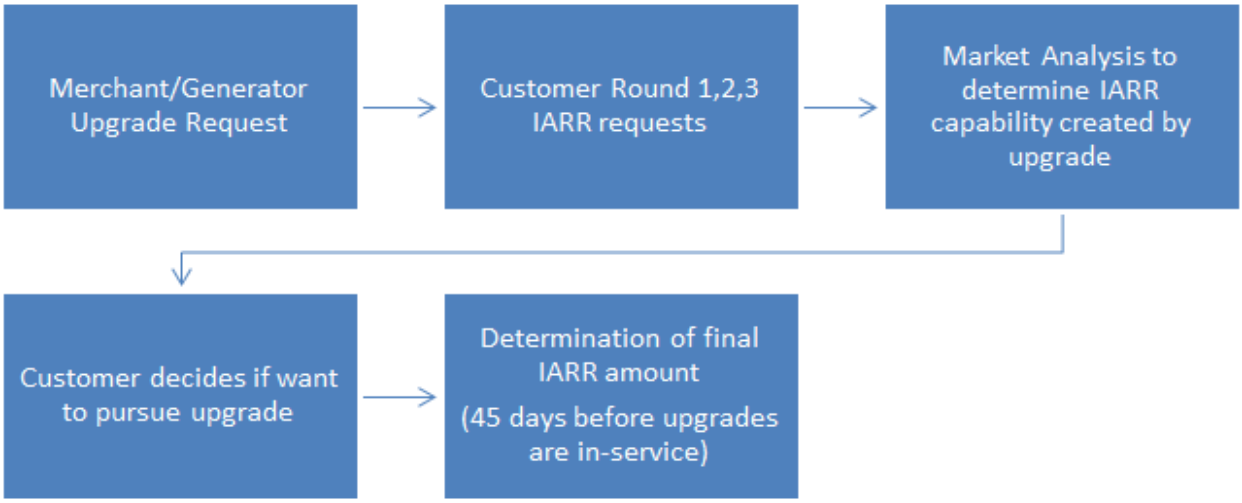
Certain eligible market participants may request and receive IARRs in ways other than the Customer Funded (Elective Upgrade Auction Revenue Rights) requests (Section 7.8). Specifically, transmission expansion projects associated with new generation interconnection and Merchant Transmission Expansion projects may be allocated incremental ARRs in a three-round allocation process in which the customer requests incremental ARRs for three pairs of point-to-point combinations (one point-to-point combination is requested per round). PJM will assess the simultaneous feasibility of the requested Incremental ARRs within the IARR Market Models. The IARR Market Models used for the markets study is the same as the model described in Section 2 of this document.

The available source and sink points for the IARR requests are limited to points that are available in FTR auctions. In each round, one-third of the Incremental ARRs potentially made available by the expansion project will be assigned to the requester. After each of rounds one and two, the requester may accept the assigned Incremental ARRs or refuse

them. Acceptance of the IARR assignment will remove the assigned IARRs from availability in the next rounds. Refusal of the assignment will result in the IARR capability being available for the next round. The IARR assignment made in round three will be final and binding. The final and binding IARR assignment for a requested point-to-point combination in each round shall in no event be less than one third of 80% and no greater than one-third of 100% of the non-binding estimate of IARRs for that point-to-point combination that was provided to the New Service Customer. Ensuring the final and binding IARR assignment is no less than 80% protects the customer's investment and eliminates the risk of future conditions that may result in less capability.

Figure 4 demonstrates the process for Merchant/Generator IARR requests.

Figure 4: Process Flow for Merchant Transmission and Generation Interconnection Requests



6.0 IARR Markets Transfer Analysis

This section provides a summary overview of IARR Markets Transfer Analysis. The PJM IARR market analysis is conducted using the same procedures and tools that are used to conduct all ARR allocations and FTR Auctions pursuant to the PJM tariff. Transfer and power flow analysis is used to determine the flow impacts on all constraints. In particular, the flow impacts on all the facilities which have IARR Market Models flows at or above their market limits will be evaluated along with additional facilities for which the IARR requests results in violations.

PJM posts the list of transmission facilities that were limiting, along with the IARR Market Models, so that participants can perform their own IARR Markets Transfer Analysis. This analysis can be done by performing a transfer analysis between the requested source and sink to identify the MW impacts of the IARR request on each facility. If the IARR request has a positive impact on any of the limiting facilities then that limiting facility will need increased IARR capability in order for the IARR request to be granted. For example, if the IARR request has a 10% impact on a posted limiting facility then the required increase in

ARR capability for that limiting facility will be equal to the requested IARR MW multiplied by the 10% impact.

Transfer Analysis of Market Facilities:

A. Obtain the Incremental ARR Model and 10-year Stage 1A ARR Model:

These models as described in Section 4 of this document.

B. Model the requested IARRs:

The IARR request will be evaluated using both the Incremental ARR Model and 10-year Stage 1A ARR Model. In this evaluation, PJM performs a transfer analysis using the requested IARR to determine the impacts on market model.

C. Identify affected facilities:

Facilities affected by the IARR request that were limiting in the IARR Market Models will be identified as well as any new facilities for which the IARR request causes flow to exceed its market limit. The list of affected facilities will be provided from the Market Group to the System Planning Group for identification of required upgrades.

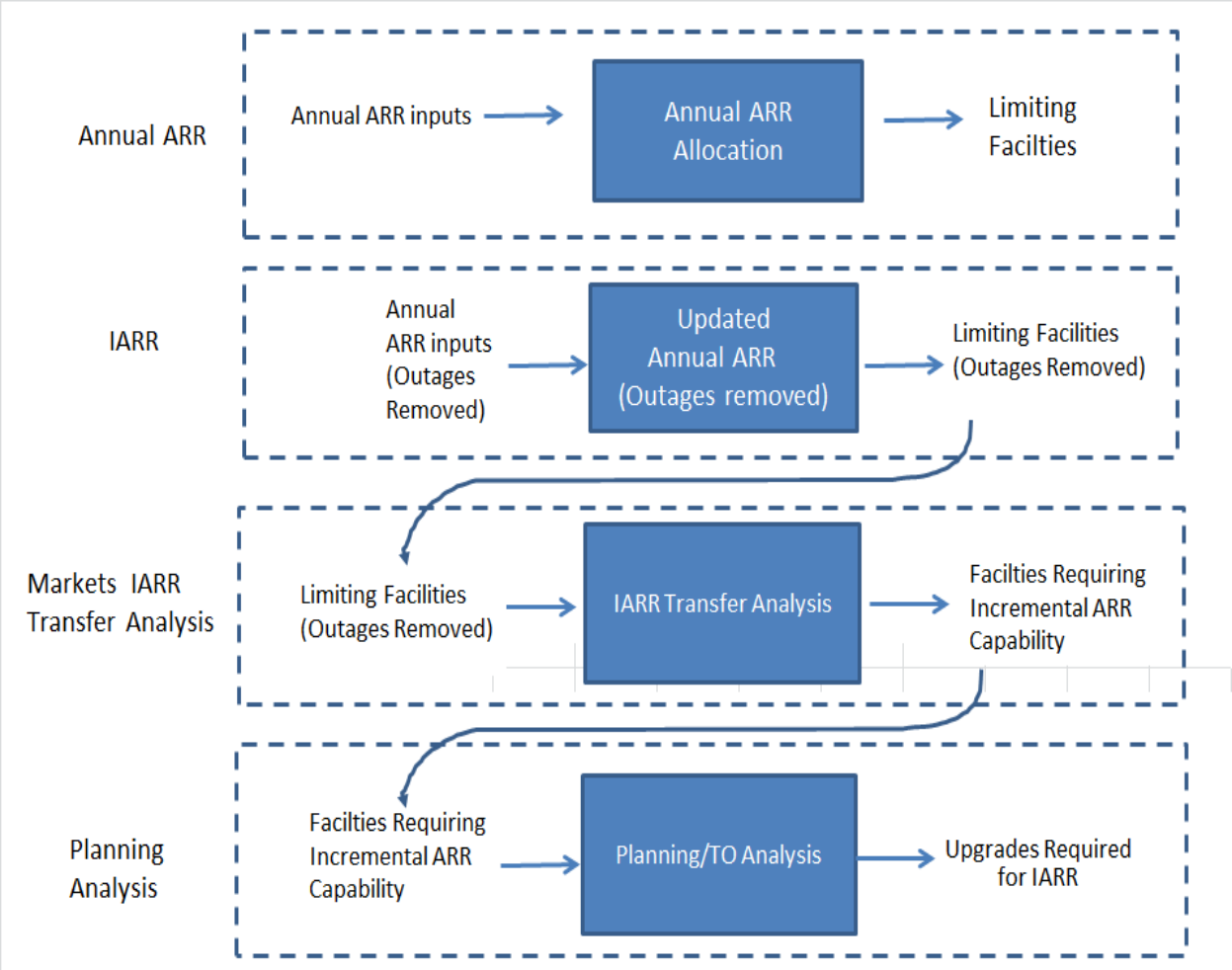
The limiting facilities are determined during the annual ARR allocation process and are updated to reflect the removal of transmission outages. These limiting facilities have resulted in Network Service and Firm PTP customers receiving less than their requested amount of ARRs. These limiting facilities, updated with impact of removed transmission outages, should be used as inputs to any IARR analysis.

PJM posts the list of limiting facilities on the PJM Planning IARR web page:

http://www.pjm.com/planning/arr-analyses.aspx.

Figure 5 provides the process flow for IARR Markets Transfer Analysis.

Figure 5: IARR Market Transfer Analysis



Appendix A: IARR Process Overview

IARR Process Overview:

1. **Customer Funded Elective Upgrade Auction Revenue Right: Incremental Auction Revenue Right (IARR) Request**

   A. The customer requests IARR using Section 7.8 of Schedule 1 of the Operating Agreement and Tariff.

      i. Customer IARR request will specify a source, sink, and MW desired.

      ii. This request is made using Attachment EE form: http://pjm.com/planning/rtep-development/expansion-plan-process/form-attachment-ee-control.aspx.

      iii. Section 4 of PJM Manual 14E labeled "Additional Information for Upgrade and Transmission interconnection Projects" provides more detailed information about this process: http://www.pjm.com/~/media/documents/manuals/m14e.ashx.

      iv. The date of the IARR request determines the Base Market Model used to evaluate the IARR request in terms of market model system impacts and the place in the queue among proposed projects when evaluated in the Planning Model.

   B. Market Analysis of the IARR Request by the Markets Group is performed using the Incremental ARR Model and the 10-year Stage 1A ARR Model (collectively the IARR Market Models). Both of these market models are developed from the Base Market Model from the most recent planning year.

      i. The Base Market Model is based on the day-ahead market dispatch model of the transmission system in use at the beginning of a relevant planning period.

         a. The Base Market Model begins with the physical line limits used by PJM's market dispatch model.

         b. The Base Market Model is adjusted to reflect expected system capability over the relevant (next) planning year and to align expected FTR total target allocations with expected congestion:

            i) Transmission outages that will affect expected FTR funding are included in the Base Market Model (reducing system capability)

            ii) Substantive transmission upgrades that are expected to in-service for the next planning period can be included in the

Base Market Model (increasing system and/or line capability beyond the initial market dispatch model).

iii) Modeled non-market flows (loop flows) can reduce system capability.

iv) Operational considerations, voltage limitations (internal interface approximations) and closed loop interfaces that can affect FTR funding are included as thermal constraints (additional constraints that limit system capability).

v) Line ratings in the Base Market Model can also be adjusted on paths that have historically contributed to underfunding to reflect uncompensated flow contributions.

vi) Electrically equivalent facilities are modeled as the single lines (the most restrictive constraint) but are considered as separate lines for purposes of determining constrained system elements in subsequent analysis.

vii) Stage 1A ARR requests must be granted. The Base Market Model, capability is adjusted to a level greater than actual (increased) to allow the simultaneous feasibility of Stage 1A ARR requests.

c. The Base Market Model is used to allocate ARRs through a multi-round set of ARR requests, subject to simultaneous feasibility of the resulting allocations.

i) Simultaneous feasibility requires the prorating of some Stage 1B and Stage 2 ARR requests due to binding constraints within the Base Market Model.

1) The multi-round ARR requests are examined and prorated until the system is simultaneously feasible.

2) Up until the last round, requests for ARR MW that exceed Base Market Model capability (and are therefore prorated) are carried over to subsequent rounds and can be used to request ARR MW on different paths.

3) The cleared ARR MW and the residual outstanding (due to proration) ARR MW requests are inputs in the Base Market Model used to study IARR.

d. The Base Market Model is converted into the Incremental ARR Model for use in evaluating the IARR request.

i) The Base Market Model is converted into the Incremental ARR Model by removing all outages (putting all lines into service that were modeled as being out of service in the annual ARR allocations process) and modeling desired market flows from the final set of total, non-prorated ARR MW requests as source and sinks. This final set of total non-prorated ARR MW requests is made up of all cleared ARRs from the multi-round clearing process, plus any ARR requests in excess of system capability from the last round of the ARR allocation process but not to exceed Network Service Peak Load values.

ii) The total market flow from the final set of ARR MW requests will cause some constraints to bind in the Incremental Base ARR Model.

iii) The IARR MW request is added as a modeled market flow from its proposed source to its proposed sink.

iv) The market flow effect of IARR MW request on every modeled constraint is determined.

1) Any incremental market flow on an already constrained line (from 4.1 D) is a constraint upon which the IARR request has a market flow impact.

A) The IARR customer will need to upgrade the facilities that define the identified constraint:

a) This MW amount is the IARR Incremental Capability Required on the constraint.

B) The IARR customer will only be responsible for upgrades that make its incremental market flow feasible, not upgrades that make all existing flows feasible.

2) Any incremental market flow that causes an unconstrained line to become constrained is a constraint upon which the IARR request has a market flow impact.

A) The IARR customer will need to upgrade the facilities that define the identified constraint so that the constraint is not violated.

a) This MW amount is the IARR Incremental Capability Required to remove the violation on the constraint.

e. The Base Market Model is then converted into the 10-year Stage 1A ARR Model for use in evaluating the IARR request.

i) The Base Market Model is converted into 10-year Stage 1A ARR Model by removing all outages (putting all lines into service that were modeled as being out of service in the annual ARR allocations process).

ii) The Injections (Sources) and Withdrawals (Sinks) in the 10-year Stage 1A ARR Model consist of approved annual Stage 1A ARRs, requested IARRs (existing previously approved IARRs that are requested by customers to be included in the stage 1A process) uncompensated power flow (Loop Flow), and Grandfathered Transmission Rights.

iii) The Stage 1A MW are adjusted by the forecasted 10- year load peak load growth to reflect projected increases in Stage 1A rights.

iv) The adjusted Stage 1A MW based market flows are examined for simultaneous feasibility.

v) Any transmission facilities that are over allocated are identified.

vi) The IARR MW request is added as a modeled market flow from its proposed source to its proposed sink.

vii) The market flow effect of IARR MW request on every modeled constraint is determined.

1) Any incremental market flow on an already constrained line (from 4.2 E) is a constraint upon which the IARR request has a market flow impact.

A) The IARR customer will need to upgrade the facilities that define the identified constraint so that the constraint is not violated.

a) This MW amount is the IARR Incremental Capability Required on the constraint.

B) The IARR customer will only be responsible for upgrades that its incremental market flow feasible, not upgrades that make all existing flows feasible.

2) Incremental market flow that causes an unconstrained line to become constrained is a constraint upon which the IARR request has a market flow impact.

A) The IARR customer will need to upgrade the facilities that define the identified constraint so that the constraint is not violated.

a) This MW amount is the IARR Incremental Capability Required on the constraint.

C. The System Impact Study and Determination of Preliminary Upgrades and Cost Identified for the Incremental Capability Required.

i. Results of the Incremental ARR Model and the 10-year Stage 1A ARR Model analysis are communicated from the PJM Market Group to the PJM Planning Group. These results include the identification of the facilities for which Incremental Capability Required is identified by the IARR request.

ii. The Planning Group, using the results of the analysis performed by the Market Group, matches the facilities in the planning queue case with the facilities from the markets case.

iii. The PJM Planning Group determines the correct queue case to use for the identification of upgrades that is consistent with the queue in which the initial request was made.

iv. Evaluation of the upgrades required to provide the Incremental Capability Required is determined using the Planning Model.

a. The Planning Model is the Regional Transmission Expansion Plan (RTEP) model that looks 5 years ahead.

b. The Planning Model uses modeled in-service and planned generation and forecasted load.

c. The topology and capability of the system in the Planning Model includes transmission system upgrades that are ahead of the IARR project in the queue.

d. IARR related upgrades must achieve additional incremental capability over and above any higher-ordered (previously publicly announced or posted RTEP need) baseline or higher-ordered supplemental upgrade, including baseline upgrades and supplemental upgrades regardless of the applicable planning base case year for which the previously identified upgrade is required. Upgrades must also provide incremental capability above all higher-ordered New Service Requests' rights from Network Upgrades.

e. The rules and procedures for the RTEP process are set forth in schedule 6 of the Operating Agreement.

f. Facilities requiring an upgrade in capability are identified from the Planning Model.

v. Facilities requiring an increase in capability are provided to the transmission owner(s) for identification of the transmission system upgrades required to achieve the increased capability.

a. Transmission owner determines the preliminary costs identified to accommodate the Incremental Capability Required on the physical system.

b. This is not a field study, but an estimate based on desk side analysis and general rules of thumb.

c. The transmission owners are responsible for indicating the assumptions used in the preliminary estimate.

d. The transmission owners provide their upgrade requirements to PJM's Planning Group and Market Group.

D. Markets Confirmation of Upgrade Impact on IARR Market Models.

i. PJM's Market Group reviews the upgrades proposed by the transmission owners to determine if the identified ARR Market Model violations have been removed.

ii. This analysis is performed utilizing an updated (updated with the proposed upgrades) Incremental ARR Model and Stage 1A 10-year model.

iii. Evaluation of the final IARR is the same as the initial IARR evaluation process except the markets model used will be the current IARR market model at the time of the final IARR evaluation.

iv. If the upgraded facility is a new line or a transmission system change to

address any thermal limitations, then a comparison is made between the flow on the triggering facility with IARR Incremental Capability Required before the upgrade (without the IARR request) and the flow on the facility after the upgrade (with the IARR request). If the flow on the triggering facility that had IARR Incremental Capability Required after the upgrade is less than or equal to the flow before the upgrade, then the upgrade is sufficient because the incremental impact will not cause any additional flow than what was there before the IARR request.

v. In the event the flow on the triggering facility is greater than the flow before the upgrade, then the upgrade is not sufficient and PJM planning analysis of the required upgrades will be performed again. When the new upgrades are provided, the Markets Group will re-test.

vi. If the upgrades provide the required increase in ARR capability then PJM will prepare the System Impact Study Report. Any capability in excess of the requested IARR flow is not eligible for the requested IARR.

E. The System Impact Study

i. System Impact Study Report is provided to the Customer requesting the IARR.

a. The System Impact Study Report will contain the information regarding the preliminary estimate of the upgrades and associated costs required to achieve the ARR capability identified in the markets analysis.

b. Manual 14A labeled “Generation and Transmission Interconnection Process” provides more detailed information about the System Impact report:
http://www.pjm.com/~/media/documents/manuals/m14a.ashx.\

ii. Information included in report:

a. The network upgrade identification numbers for each upgrade

b. The description of the upgrade(s)

c. The estimated cost of the upgrade(s)

d. The estimated time to complete the construction of the upgrade(s).

iii. The IARR Customer is also provided a Facilities Study Agreement.

F. The Facility Study Agreement.

i. The IARR customer reviews the System Impact Study Report and

decides if they want to execute a Facilities Study Agreement and move on to the next stage in the process. The Facilities Study is an on the ground assessment of projected costs.

ii. The Facilities Study Agreement includes an estimate of the cost of the facility study and the estimated time of completion of the facility study.

iii. If the applicant decides to proceed, an executed Facilities Study Agreement must be submitted to PJM with the required deposit as specified in Section 206.2 of the PJM Tariff.

a. The applicant must execute and return the Facilities Study Agreement (and the required deposit) within 30 days of receiving it.

b. If an applicant fails to meet this deadline, the Interconnection Request will be deemed terminated and withdrawn.

c. Attachment D of PJM Manual 14A labeled "Generation and Transmission Interconnection Process" provides more detailed information about the Facility Study process: http://www.pjm.com/~/media/documents/manuals/m14a.ashx.

G. The Facilities Study

i. The Facility Study is performed by the affected transmission owners.

ii. The Facilities Study provides a more refined estimate of the upgrades, associated upgrade costs using field data as appropriate.

iii. The Facilities Study also provides project schedules.

iv. Once completed, the Facilities Study is provided to the IARR customer for their review.

H. Upgrade Construction Service Agreement

i. The IARR customer will review the Facilities Study Report and decide if they want to pursue execution of an Upgrade Construction Service Agreement (UCSA).

ii. Upgrades associated with Customers Funded IARRs are owned by Transmission Owner(s). Since these customers will not own the Transmission Facilities that they are funding, the UCSA that they receive identifies and causes construction of the upgrade(s) to the system, obligates them to pay, identifies the applicable rights and establishes the term for those rights.

iii. IARR Rights shall become effective pursuant to the applicable UCSA and

upon commencement of service.

iv. The term of rights is for the life of the facility or upgrade or 30 years, whichever is shorter.

v. If there are no rights or if rights terminate, the UCSA also terminates.

vi. Section 4 of PJM Manual 14E labeled "Additional Information for Upgrade and Transmission interconnection Projects" provides more detailed information about the Upgrade Construction Service Agreement: http://www.pjm.com/~/media/documents/manuals/m14e.ashx.

I. Determination of the Final IARR Amount awarded by the IARR Project

i. The final assignment of IARRs occurs no less than 45 days prior to the in-service date of the associated Network Upgrades.

ii. IARR customers have a non-binding expectation of a certain amount of IARRs based on their request and investments. To mitigate the potential for significant disparities between initial IARR requests, or estimates, and final determinations, an entity will receive a minimum of 80% and a maximum of 100% of the initial estimate of IARRs requested.

iii. Evaluation of the final IARR is the same as the initial IARR evaluation process except the markets model used will be the current Incremental Base ARR model at the time of the final IARR evaluation.

iv. Incremental ARRs will be effective for thirty years or the life of the facility or upgrade, whichever is less.

v. IARRs will become effective on the first day of the first month that the upgrade is included in the transmission system model for the monthly FTR auction.

vi. For IARRs that become effective at the beginning of a planning year, their value will be determined identically to that of annually allocated ARRs, based on the nodal prices resulting from the annual FTR auction.

vii. If IARRs become effective during a planning year, then their value for each month remaining in that planning year will be based on the results of the prompt-month FTR auctions. For each planning year thereafter, the value of IARRs will be determined identically to that of annually allocated ARRs, based on the nodal prices resulting from the annual FTR auction.

2. IARR based on Merchant Transmission and Generation Interconnection requests

A. Transmission expansion projects associated with new generation interconnection and Merchant Transmission Expansion projects (New Service Customer) may be allocated incremental ARRs.

B. The allocation of IARR to Merchant Transmission and transmission upgrades associated with Generation Interconnection occurs through a three-round process in which the customer requests incremental ARRs for three pairs of point-to-point combinations (one point-to-point combination is requested per round).

C. PJM assesses the simultaneous feasibility of the requested Incremental ARRs against the base system ARR capability and Stage 1A ARR capability for the future 10-year period.

D. The IARR model used for this markets study is the same as the model used in Customer Funded Elective Upgrade Auction Revenue Right Incremental Auction Revenue Right (IARR) Request process.

E. The available source and sink points for the IARR requests are limited to points that are available in FTR auctions.

F. In each round of the allocation process, one-third of the Incremental ARRs made available by the expansion project will be assigned to the requesting New Service Customer.

G. After each of rounds one and two, the requester may accept the assigned Incremental ARRs or refuse them. Acceptance of the assignment will remove the assigned Incremental ARRs from availability in the next rounds. Refusal of the assignment will result in the Incremental capability being available for the next round. The Incremental ARR assignment made in round three will be final and binding.

H. The final and binding Incremental ARR assignment for a requested point-to-point combination in each round shall in no event be less than one third of 80% and no greater than one-third of 100% of the non-binding estimate of Incremental Auction Revenue Rights for that point-to-point combination that was provided to the New Service Customer.

I. Ensuring the final and binding IARR assignment is no less than 80% protects the New Service Customer's investment and eliminates the risk of future conditions that may result in less capability.

    i. For example, if the final IARR capability was 70% of the preliminary requested capability than the New Service Customer would still receive 80% of the initial request.

ii. The additional 10% of unavailable capability (80%-70%) would be incorporated into the RTEP and potentially trigger RTEP transmission upgrades through the PJM Market Efficiency or Stage 1A 10-year process.

iii. The IARR New Service Customer is not required to fund additional upgrades.

iv. If the final IARR capability is greater than 100% of the original requested IARRs, the customer would not be allocated IARRs in excess of the initial requested IARRs. Figure 4 demonstrates the process for Merchant/Generator IARR requests.

Appendix B: IARR Analysis Examples

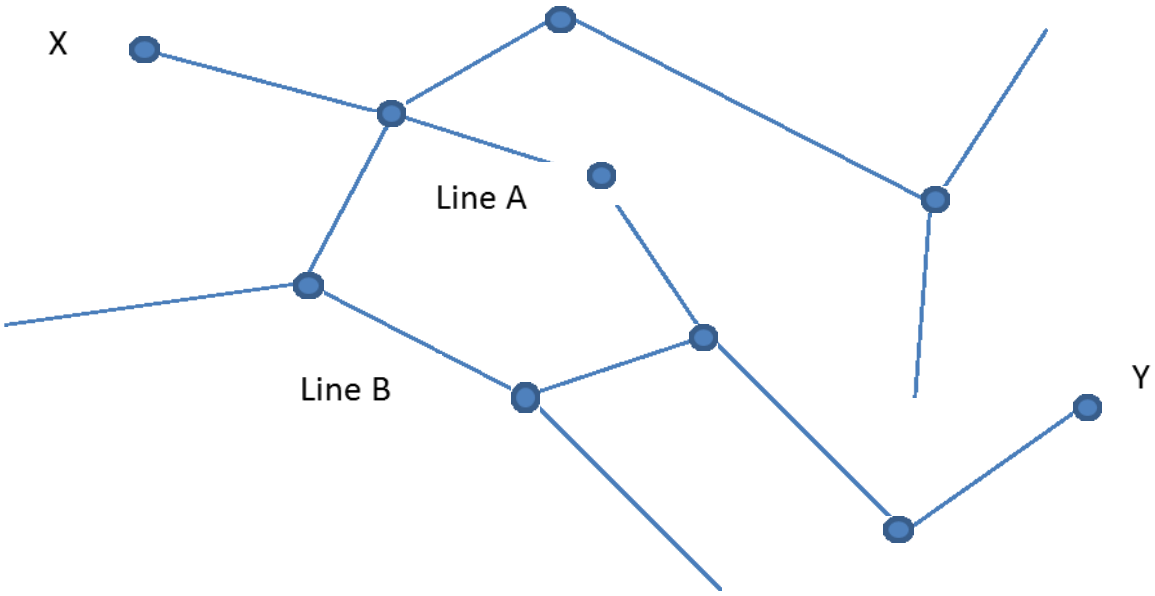
IARR Analysis Examples:

The following example demonstrates the step-by-step process for an IARR request associated with a Customer funded upgrade. It is intended as a basic example to demonstrate the process. The assumption is that the IARR requester can perform his/her own power flow and transfer analysis. Appendix C of this document provides a procedure for a customer to use posted information to perform an IARR analysis.

Example 1: Step-by-Step IARR Process

Figure B-1 shows a simple network consisting of ten stations identified with blue circles. Station X is the source of the IARR request and Station Y is the sink of the IARR request. The assumption is that transmission lines A and B are already limited in the Annual ARR allocation process and the other lines have excess capability.

Figure B-1: Example 1 Network Diagram



Step 1: IARR submission

Participant submits IARR Request using Attachment EE form on PJM.com.

Source Location:	X
Sink Location:	Y
MW Requested	200 MW

Step 2: Market Initial Analysis

PJM Markets Group studies the IARR request to determine the necessary IARR capability. Facilities affected by the IARR request that were limiting in the Incremental ARR Market Model will be identified as well as any new facilities for which the IARR request causes

flow to exceed its market limit. In addition, facilities affected by the IARR request that were infeasible in Stage 1A or had a violation in the 10-year Stage 1A model will be identified. For this example, it is assumed that only Line A and Line B are limited, even after the market flows created by the IARR request are considered. These lines were already limiting in the Annual ARR allocation as shown in Table B-1. Additional facilities could become limited when the IARR is added, but for this example that is not the case. The impact of the IARR request from X to Y results in 50% of the flow moving across Line A and 50% of the flow moving across Line B. This impact is called the Dfax (distribution factor) and is shown in as 0.5. Therefore, the 200 MW IARR request will contribute to 100 MW of additional flow on Line A and on Line B. The result, as shown in Table B-1 is that the total flow on both Line A and Line B is equal to 600 MW, which exceeds the Market Limit of 500 MW.

Table B-1: Example 1 Annual ARR and IARR Flow Impacts

Line	Market Limit/Annual ARR Flow (MW)	Dfax Impact for X-Y IARR request	Impact of 200 MW IARR request on Line (MW)	Total flow (Annual ARRs and IARR) with upgrade (MW)
A	500	0.5	100	600
B	500	0.5	100	600

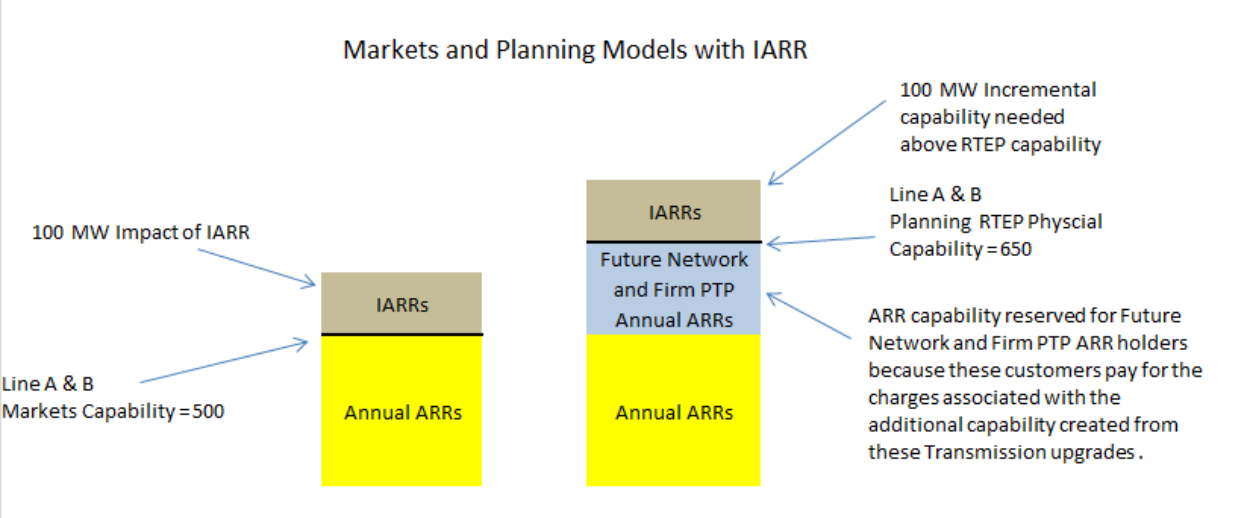
Step 3: Incremental IARR Capability Required

The Incremental IARR Capability Required to support this IARR request is equal to 100 MW on both Line A and on Line B, as shown in Table B-1 as the impact of the IARR requests. Both Line A and Line B were already reported as limiting in the Annual ARR allocation. These lines were not over allocated in the Annual ARR allocation, just at their market limits, so the full 100 MW impact will be the responsibility of the IARR customer. Had these lines been over allocated in the Annual ARR allocation, the IARR customer would only be responsible for their incremental flow on these lines (100 MW), not the entirety of the flow over the market limit.

Step 4: Preliminary Upgrades and Cost Identified

In this step, the PJM Planning Group coordinates with Transmission Owners to determine the necessary preliminary transmission upgrades to support the increase of 100 MW on both Line A and on Line B. It is important to understand that the determination of transmission upgrades will use the physical RTEP Planning Model, and not the Incremental ARR Market Model. Figure B-2 demonstrates the Incremental ARR Market Model vs. the Planning Model for this example.

Figure B-2: Example 1 Incremental ARR Market Model vs. Planning Model Capability



The Incremental ARR Market Model (left column), with a capability of 500 MW, does not include future RTEP upgrades that are included in the Planning Model. The Planning Model (right column) is the future RTEP model, which has physical capability equal to 650 MW due the inclusion of current queue projects scheduled to be complete when the IARR request is in-service. These projects will increase the capability of the facility by 150 MW, for a total of 650 MW of capability in the Planning model. The additional 150 MW of capability in the RTEP physical model is not available to the IARR holder because the transmission upgrades that created the additional 150 MW are funded by the PJM load customers, via the Network Service and Firm PTP charges, who are entitled to the ARRs first. Therefore, the necessary transmission upgrades to support the IARR request must create capability above the 650 MW physical capability represented in the Planning Model. The result is transmission upgrades required to increase the physical capability to 750 MW, 100 MW over the 650 MW Planning Model capability. The IARR requestor is not responsible for the entire 250 MW increase over the current 500MW capability from the Incremental ARR Market Model.

The preliminary upgrades required to support the IARRs in this example are determined to be re-conductors of both Line A and Line B.

Table B-2 shows the upgrades required along with the predicted costs and impacts of the prescribed upgrades. The transmission upgrades do not create the exact amount of increased capability of 100 MW. Instead, the upgrades identified create 120 MW of additional capability each, so the new physical capability is 770 MW in the Planning Model. However, the IARR holder is not eligible for the excess 20 MW created by the upgrades on each line. This is because the original IARR request was for 200 MW and cannot be changed. It is important to understand that the planning process will typically result in upgrades above what is necessary to support any rights, reliability violations, or market efficiency requirements because upgrades are rarely available to the exact incremental MW required. However, just as the Annual ARR holder might realize the benefit of the excess MW associated with the IARR upgrades, the IARR holder also realizes the benefit of already in-service RTEP upgrades that created excess capability beyond what was

necessary for base line reliability and market efficiency upgrades not necessary to support annual ARRs. In the network diagram from Figure B-1, the unlabeled lines can be considered transmission facilities the IARR holder does not need to upgrade, in this example, because excess capability was already created with baseline RTEP upgrades.

Table B-2: Example 1 Upgrade, Costs, and Impacts

Line	upgrade	Upgrade Costs ($millions)	Upgrade impact (MW)	New RTEP Physical Capability (MW)	New Markets capability (MW)
A	Re-conductor	15	120	770	620
B	Re-conductor	15	120	770	620

Step 5: Markets confirmation of upgrade impact

The preliminary upgrades identified in step 4 are added to the Incremental ARR Market Model and step 2 is then rerun to determine if the increased capability supports the requested 200 MW of IARRs from X to Y. For this example, the upgrades do support the required increased market capability.

Step 6: System Impact Study Report to customer

The System Impact Study Report will contain the information for all the initially estimated upgrades required to achieve the ARR capability identified in the markets analysis. This information includes the Network Upgrade identification numbers for each upgrade, the description of the upgrade(s), the estimated cost of the upgrade(s), and the estimated time to complete the construction of the upgrade(s). In addition, the estimated costs and time to perform Facilities Study will be provided in an email to the customer, which has the report attached.

Step 7: Customer Decision

The next step is for the customer to review the System Impact Study Report and decide if they want to execute a Facilities Study Agreement.

Step 8: Facilities Study

The purpose of the Facilities Study is to provide the refined upgrades, plus cost estimates and project schedules, to implement accurate estimates of the conclusions from the System Impact Study regarding Network Upgrades and Local Upgrades (i.e. upgrades related to non-Tariff designated facilities) necessary to accommodate the 200 MW IARR request from X to Y. Unlike the System Impact Study, which relies on initial deskside estimates, the Facilities Study is a more refined analysis that incorporates field data as appropriate.

Step 9: Upgrade Construction Service Agreement

Following the completion of the Facilities Study the customer shall review the Facilities Study Report and decide if they want to pursue execution of an Upgrade Construction Service Agreement (UCSA) at which point a security deposit is required. The customer signs the construction service agreement, which provides a commitment to move forward with the physical upgrades. This agreement identifies terms, conditions, and coordinates construction activities for the upgrades.

Step 10: Determination of final IARR amounts

The final and binding Incremental Auction Revenue Right assignment for a requested IARR shall in no event be less than 80% and no greater than 100% of the non-binding estimate from the IARR market model of Incremental Auction Revenue Rights for the IARR requested by the customer. The final IARRs are available after the physical upgrades necessary to support the IARR are complete. In this example, the full 200 MW of IARRs is awarded to the customer. The effective date of the IARR will be the first month for which the upgrades are modeled in an FTR auction and the duration of the IARR is for the lesser of life of the asset or 30-year period.

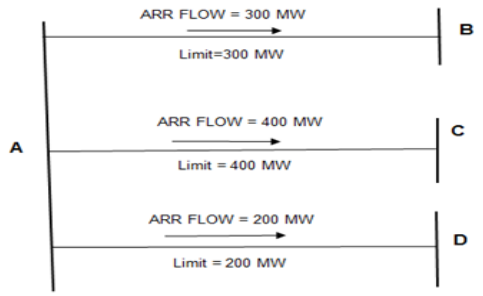
Example 2: Three bus example

The following example demonstrates an IARR request's impact on a three-bus system in which each transmission line is already fully subscribed in the Annual ARR allocation. Any IARR request that would increase the flow on any of these transmission lines would require an upgrade to the transmission line to allocate the IARR. If only transmission line A-C was upgraded with an IARR request, then zero IARRs would be awarded because transmission lines A-B and A-D were not upgraded, and would be oversubscribed. If the IARR was awarded without the necessary upgrades then the oversubscribed IARRs would result in market limit violations and infeasibilities.

Figure B-3: Example 2 IARR Request Impact

ARR Base Conditions after Annual Allocation – paths fully subscribed

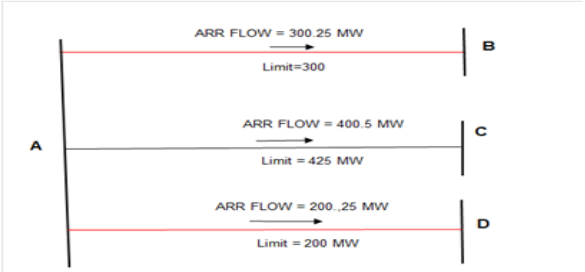
Diagram demonstrates that the flows on facilities after the Annual ARR allocation are fully subscribed



Transmission Line	Limit	Flow	Available ARR capability
A-B	300	300	0
A-C	400	400	0
A-D	200	200	0

ARR Conditions with upgrade modeled and 1 MW IARR request from A to C

Diagram demonstrates that Line A-C is upgraded but Line A-B and Line A-D are now oversubscribed because of the IARR request.



Transmission Line	Limit	Flow	Available ARR capability
A-B	300	300.25	-0.25
A-C	425	400.5	24.5
A-D	200	200.25	-0.25

	% flow from A-C		
Upgrade Path	A-B	A-C	A-D
A-C	25%	50%	25%

Example 3: Multiple Limiting Facilities

In many instances, there are multiple facilities in the same electrical vicinity that are overloaded in the annual ARR allocation process because of the requested ARRs. In these situations, PJM selects one of these overloaded facilities, based on the degree of violation, to use to prorate the requested ARRs in the annual process. The impact of prorating ARR requests for one facility may be a reduction of flow in the other overloaded facilities in that same electrical vicinity, which may alleviate any violations caused by the requested ARRs. The result is that although multiple facilities were overloaded and limiting, only one facility may have been prorated, and subsequently reported. The monitored facilities used in the IARR process must include all limiting facilities from the annual process, updated with the impact of removed transmission outages, which were initially overloaded. The monitored facilities reported will include the prorated facility, as well as any electrically equivalent facilities that were limited before proration.

An example of the impact of prorating and corresponding limiting facilities is provided below. In this example, Line A was selected to be prorated in the annual ARR allocation year 1. However, Line B could have been prorated instead. The result of prorating Line A was a decrease in flow on Line B, which resulted in Line B no longer requiring proration. However, both Line A and Line B are considered as limiting in the Annual ARR allocation process and are reported as such. The IARR request was made for 200 MW from point X to point Y. The impact of this IARR request is 100 MW on Line A and Line B. Therefore, the IARR requester must provide 100 MW of incremental capability on both Line and Line B. In year 2, which includes the IARR upgrades for Line A and Line B, the IARRs are guaranteed to clear and the network ARRs will continue to be prorated. The actual facility used for the proration in the year 2 allocation can be either Line A or Line B, similar to year 1.

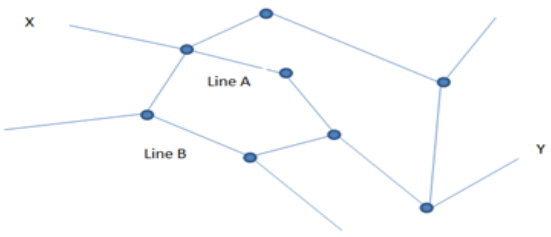
Figure B-4: Example 3 Limiting Facilities

Annual ARR Year 1

Line	ARR Capabiltiy	Initial Requested Network ARR Flow	Prorated Network ARR Flow	Prorated in Annual	Limitng Facility
A	500	700	500	Yes	Yes
B	500	700	495	No	Yes

IARR Request from X-Y for 200 MWs

Line	Dfax Impact for X-Y IARR request	Impact of IARR request on Line (Required increased in capability)
A	0.5	100
B	0.5	100



Annual Year 2

Line	ARR Capabiltiy	Initial Requested Network ARR Flow	IARR Flow	Prorated Network ARR Flow	Final ARR flow	Prorated in Annual	Limitng Facility
A	600	700	100	495	595	No	Yes
B	600	700	100	500	600	Yes	Yes

Appendix C: Procedure for customer to Perform IARR analysis

Procedure for customer to perform IARR analysis

The procedure for a customer to perform IARR analysis is provided in this Appendix C. It is assumed the customer already has the ability to run power flow analysis, transfer analysis, and understands the transmission system, PJM Markets, and PJM Planning processes. The necessary information to conduct this analysis is available on the PJM web pages. Software necessary to conduct the IARR analysis must be purchased separately by the customer. PJM does not provide training to use any third party software. In addition, some of the required files require CEII access/credentials. Request for the CEII access is available on the PJM web site at the following link: http://www.pjm.com/library/request-access.aspx. Finally, it is not expected that a customer can match PJM results exactly because PJM may use proprietary software and tools not available to customers. However, reasonable results can be expected if the customer can follow the procedures and is qualified to perform the analysis.

Steps to conduct IARR analysis

Step 1: IARR model

The analysis used for the Incremental IARR analysis utilizes the IARR model and the 10-year Stage 1A ARR Model. These models have the same topology and therefore both use the same power flow case. The 10-year Stage 1A ARR Model includes the addition of load growth and RTEP planned upgrades not included in the Incremental Base ARR Model. This case is posted on the IARR planning page at the below link.

http://pjm.com/planning/arr-analyses.aspx

CEII access is required to access these models and can be requested at this same location. This posted case is a PSS/E case and will already have the market limits, uncompensated power flow, and transmission topology incorporated. The facilities that are already limiting in the annual ARR allocation are also provided on the web page from the above link. Additionally, these facilities, and their limits, are already included in the model. Adding these facilities explicitly as binding constraints in the transfer analysis makes the identification of impacts easier.

Step 2: Model Annual ARR requests

The annual ARR requests will need to be added to the posted IARR model from step 1. These ARR requests are posted on the main FTR page under the annual ARR section. These ARR requests will not be available until 4 months after the start of each planning period to comply with FERC requirements. However, customers may use the previous year's ARR requests as an estimate if analysis is to be conducted during the first four months of the planning period. The customer will need to insert the ARR requests into the posted case from step 1 by adding the source location as generators and the sink locations as loads. PJM provides mapping files to map the ARR requests to PSS/E names/bus numbers. The IARR model will utilize all the ARR requests, including all Stage 1B and Stage 2 requests before proration, and the 10-year Stage 1A ARR Model will only utilize the Stage 1A ARRs. In addition, for the 10-year Stage 1A ARR Model, the Stage 1A

ARRs should be adjusted to account for the PJM load forecast growth rate for the 10-year period as provided on the PJM Planning Forecast Adequacy web page:

http://pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx.

Step 3: Incorporate Reactive Interface and Flowgate Limits

The models will also need to be updated to account for the Reactive Interface limits and the Coordinated Flowgates with external entities. These limits are posted on the main FTR page under the Annual ARR section:

http://www.pjm.com/markets-and-operations/ftr.aspx.

Often these limits are modeled explicitly in a .mon file used with a program such as MUST. The flowgate market limits are representative of the PJM flow impacts only, therefore the IARR modeling attempt must take into account the uncompensated power flow[7]. Often a program, such as MUST, can support this modeling.

Step 4: Conduct transfer analysis

The transfer analysis can be done in a program such as MUST. This transfer analysis will model the IARR source to sink transfer to determine the following.

A. Flow impacts of the transfer on all facilities in the model.

B. Identification of facilities that are showing violations from the transfer because these facilities are already limiting in the annual ARR process[8].

C. Identification of new facilities with violations created because of the IARR request.

Step 5: Apply transmission upgrades

The necessary identified or proposed transmission upgrades can be applied to the model, and step 4 can be completed again to measure the flow differences between the initial IARR case and the upgrade case. This will confirm if the flow impacts of the upgrade are sufficient to support the requested IARR incremental impact.

[7] Uncompensated power flow, also known as loop flow, is described in section 4.1 under the Key input assumptions for "*Procedure for determining Loop Flow Model"*

[8] Typically, a 1% cutoff is used for identification of facilities but ½% may be used for regional or significantly impacted facilities.

Appendix D: PJM-MISO IARR Coordinated Studies

9.3.5 Analysis of Incremental Auction Revenue Rights Requests.

The Parties will coordinate, as deemed appropriate, to conduct any studies in response to a request for Incremental Auction Revenue Rights ("Incremental ARRs") ("Incremental ARR Request") made under one Party's tariff to determine its impact on the other Party's system. Results of such coordinated studies will be included in the impacts reported to the customer requesting Incremental ARRs as appropriate. Coordination of studies and Network Upgrades will include the following:

(a) The Parties will coordinate the base Firm Flow Entitlement values associated with the coordinated Flowgates that may be impacted by the Incremental ARR Request.

(b) Upon receipt of an Incremental ARR Request or the review of studies related to the evaluation of such request, the Party receiving the Incremental ARR Request will determine whether the other Party is potentially impacted. If the other Party is potentially impacted, the Party receiving the Incremental ARR Request will notify the other Party and convey the information provided in the request in addition to but not limited to the list of impacted constrained facilities.

(c) During the System Impact Study, the potentially impacted Party may participate in the coordinated study by providing input to the studies to be performed by the Party receiving the Incremental ARR Request. The potentially impacted Party shall determine the Network Upgrades, if any, needed to mitigate constraints on identified impacted facilities. The Parties shall coordinate to ensure any proposed Network Upgrades maintain the reliability of each Party's transmission system.

(d) Any coordinated System Impact Studies will be performed in accordance with the mutually agreed upon study timeline requirements developed by the Parties. If the Parties cannot mutually agree on the nature and timeline of the studies to be performed, they can resolve the differences through the dispute resolution procedures documented in Article XIV of this Agreement in accordance with applicable tariff provisions.

(e) During the Facilities Study, the potentially impacted Party may conduct its own Facilities Study as a part of Facilities Study being conducted by the Party that received the Incremental ARR request. The study cost estimates indicated in the Facility Study Agreement between the Party receiving the request and the Incremental ARR customer will reflect the costs and the associated roles of the study participants, including the potentially impacted Party. The Party receiving the request will review the cost estimates submitted by all participants for reasonableness, based on expected level of participation and responsibilities in the study.

(f) The Party receiving the Incremental ARR Request shall collect from the Incremental ARR customer, and forward to the potentially impacted Party, the agreed upon payments associated with the performance of such studies.

(g) If the results of the coordinated study indicate that Network Upgrades are required in accordance with procedures, guidelines, criteria, or standards applicable to the potentially

impacted Party, the Party receiving the request will identify the need for such Network Upgrades in the System Impact Study prepared for the Incremental ARR customer.

(h) The construction of such Network Upgrades will be subject to the terms of the potentially impacted Party's tariff, the agreement among owners transferring functional control of transmission facilities to the control of the potentially impacted Party, and applicable federal, state, or provincial regulatory policy.

(i) In the event that Network Upgrades are required on the potentially impacted Party's system, the Incremental ARR will commence on a schedule mutually agreed upon among the Parties. This schedule will include milestones with respect to the Network Upgrade construction and the amount of service that can commence after each milestone.