



Working to Perfect the Flow of Energy

PJM Manual 14E

Merchant Transmission Specific Requirements

Revision: 02

Effective Date: July 5, 2005

Prepared by

System Planning Division

Transmission and Interconnection
Planning Department

© PJM 2005



PJM Manual 14E: Merchant Transmission Specific Requirements

Table of Contents

Table of Contents..... ii

Table of Exhibits iv

Approval 1

Revision History..... 1

Introduction 2

 ABOUT PJM MANUALS2

 ABOUT THIS MANUAL3

Intended Audience3

References.....4

 USING THIS MANUAL4

What You Will Find In This Manual4

Section 1: Overview and Agreements Applicable to Merchant Transmission Projects..... 5

 OVERVIEW5

 PJM'S INTERCONNECTION PROCESS7

Getting the Process Going.....8

 RIGHTS, OBLIGATIONS AND AGREEMENTS8

Rights Available to Merchant Transmission Owners8

Obligations of Merchant Transmission Owners.....9

Merchant Transmission Owner Related Agreements.....10

Section 2: Rights Applicable to Merchant Transmission Projects 12

 SUMMARY OF TRANSMISSION INJECTION RIGHTS (TIRs) AND TRANSMISSION WITHDRAWAL RIGHTS (TWRs)12

Procedure to Determine Transmission Injection Rights (TIRs) and Transmission Withdrawal Rights (TWRs).....13

 INCREMENTAL AVAILABLE TRANSFER CAPABILITY REVENUE RIGHTS14

Procedure to Determine Incremental Available Transfer Capability Revenue Rights (ATCRRs) 16

 INCREMENTAL AUCTION REVENUE RIGHTS16

Procedure to Determine Incremental Auction Revenue Rights (ARRs).....18

 INCREMENTAL DELIVERABILITY RIGHTS18

Procedure to Determine Incremental Deliverability Rights (IDRs).....19

 HVDC PROJECTS20

Additional Studies in the Facility Study Phase.....20

 TYPES OF STUDIES:.....20

Studies required by Interconnected Transmission Owner's FERC-715 report.....22

 TYPES OF DATA REQUIRED FOR THE STUDIES:.....22

Table 1 - AC Power System Characteristics at the Point of Interconnection.....22



**Section 3: Design, Construction, Operation and Maintenance Requirements
Applicable to Merchant Transmission Facilities 24**

TECHNICAL DESIGN REQUIREMENTS24

Reactive Power Design Criteria24

Voltage Operating Criteria25

Payment for Reactive Power.....25

CONSTRUCTION REQUIREMENTS25

Cost Responsibility.....25

Construction Service Agreement.....26

Option to Build.....26

Project Controls.....26

Construction Standards and Technical Requirements26

OPERATIONAL AND MAINTENANCE REQUIREMENTS.....27

General.....27

Transmission Service Rate for TWR.....28

Operation and Maintenance of Merchant Network Upgrades28

Operation across Control Area Boundaries.....28

Provisions included in other PJM Manuals.....29



Table of Exhibits

Exhibit 1: List of PJM Manuals..... 2
Exhibit 2: Process Flow Merchant Transmission Projects..... 6



Approval

Approval Date: 06/06/05
Effective Date: 07/05/05

Approvals:
Scott W. Gass, Manager
Transmission Planning Department

Revision History

Revision 02 (07/05/05)

This document has been reviewed per PJM procedures.
Updated Exhibit 1 to include new PJM Manuals.

Revision 01 (08/17/04)

Revision includes the addition of study requirements for HVDC Projects at the end of Manual Section 2 and the addition of transmission service requirements for transactions over a merchant transmission HVDC facility in Manual Section 3.

Revision 00 (10/31/03)

This document is the initial release of the PJM Manual for **Merchant Transmission Specific Requirements (M-14E)**.

Manual M-14, Revision 01 (03/03/01) has been restructured to create five new manuals:

- M-14A: "Generation and Transmission Interconnection Process Overview"
- M-14B: "Generation and Transmission Interconnection Transmission Planning"
- M-14C: "Generation and Transmission Interconnection Facility Construction"
- M-14D: "Generation Operational Requirements"
- M-14E: "Merchant Transmission Specific Requirements"



Introduction

Welcome to the PJM Manual for **Merchant Transmission Specific Requirements**. In this Section you will find:

- What you can expect from the PJM Manuals in general (see “About PJM Manuals”).
- What you can expect from this PJM Manual (see “About This Manual”).
- How to use this manual quickly and easily (see “Using This Manual”).

About PJM Manuals

The PJM Manuals are the instructions, rules, procedures, and guidelines established by the PJM OI for the operation, planning, and accounting requirements of the PJM Control Area and the PJM Energy Market. Exhibit I.1 lists the PJM Manuals.

Transmission	M01: Control Center Requirements	M02: Transmission Service Requests	M03: Transmission Operations
	M04: PJM OASIS Operation	M05: Power System Application Data	M06: Financial Transmission Rights & Auction Revenue Rights
PJM Energy Market	M09: PJM eSchedules	M10: Pre-Scheduling Operations	M11: Scheduling Operations
	M12: Dispatching Operations	M13: Emergency Operations	M15: Cost Development Guidelines
	M36: System Restoration		
Generation and Transmission Interconnection	M14A: Generation and Transmission Interconnection Process Overview	M14B: Generation and Transmission Interconnection Planning	M14C: Generation and Transmission Interconnection Facility Construction
	M14D: Generator Operational Requirements	M14E: Merchant Transmission Specific Requirements	M16: eDART Operations
Reserve	M17: Capacity Obligations	M19: Load Data Systems	M20: PJM Reserve Requirements
	M21: Rules & Procedures for Determination of Generating Capability	M22: Generator Resource Performance Indices	M23: PJM eGADS User Manual
	M24: PJM eCapacity	M25b: eFuel 2.0 – User Manual	
Accounting & Billing	M27: Open Access Transmission Tariff Accounting	M28: Operating Agreement Accounting	M29: Billing
PJM	M33: Administrative Services for PJM Interconnection Agreement	M35: Definitions and Acronyms	

Exhibit 1: List of PJM Manuals

About This Manual

The PJM Manual for **Merchant Transmission Specific Requirements** is one of the family of PJM Procedure manuals. This manual focuses on the specific requirements for interconnecting Merchant transmission facilities under PJM's Regional Transmission Expansion Planning Process.

This manual describes the various rights available and agreements required to complete the Merchant transmission interconnection planning process.

This PJM Manual for **Merchant Transmission Specific Requirements** consists of three sections. The sections are as follows:

- Section 1: Overview and Agreements Applicable to Merchant Transmission Projects
- Section 2: Rights Applicable to Merchant Transmission Projects
- Section 3: Design, Construction and Operational Requirements Applicable to Merchant Transmission Projects

Note: While the PJM Manuals provide instructions and summaries of the various rules, procedures and guidelines for Generation and Transmission Interconnections, the PJM Open Access Transmission Tariff contains the authoritative provisions for the PJM interconnection process.

Intended Audience

The intended audiences for this PJM Manual for Merchant Transmission Specific Requirements are:

- Merchant Transmission Developer's engineering staff.

Note: The term "**Transmission Developer**" refers to those separate and independent entities proposing to install new or upgrade existing transmission facilities - a Merchant Transmission developer - rather than an existing Transmission Owner on the PJM System that installs Regional Transmission Expansion Plan "baseline projects" or its own Transmission Owner initiated projects.

- Transmission Service Customers.

Note: The term "**Transmission Customer**" refers to any entity requesting or utilizing transmission service on the PJM Transmission System.

- Transmission Owner's respective engineering staff.
- PJM Members.

- PJM Staff.

References

- There are other PJM documents that provide both background and detail on other topics.
 - ☞ Manual M-01: “Control Center Requirements”
 - ☞ Manual M-02: “Transmission Service Requests”
 - ☞ Manual M-03: “Transmission Operations”
 - ☞ Manual M-06: “Financial Transmission Rights”
 - ☞ Manual M-14A: “Generation and Transmission Interconnection Process Overview”
 - ☞ Manual M-14B: “Generation and Transmission Interconnection Planning”
 - ☞ Manual M-14C: “Generation and Transmission Interconnection Facility Construction”
 - ☞ Manual M-14D: “Generator Operational Requirements”

Using This Manual

We believe that explaining concepts is just as important as presenting procedures. This philosophy is reflected in the way we organize the material in this manual. We start each section with an overview. Then we present details, procedures or references to procedures found in other PJM manuals.

What You Will Find In This Manual

- A table of contents.
- An approval page that lists the required approvals and the revision history.
- This introduction.
- Sections containing the specific guidelines, requirements, or procedures including Transmission Developer, Transmission Customer and PJM OI actions.
- Attachments that include additional supporting documents, forms, or tables in this PJM Manual.



Section 1: Overview and Agreements Applicable to Merchant Transmission Projects

Welcome to the Overview and Agreements Applicable to Merchant Transmission Projects section of the PJM Manual for **Merchant Transmission Specific Requirements**. In this section you will find the following information.

- An overview of the process that a Merchant Transmission developer should follow to complete the interconnection of Merchant Transmission Facilities with the PJM Transmission System (see “*Overview*”).
- A description of PJM’s interconnection process as outlined in the Manual 14 series (see “*PJM’s Interconnection Process*”).
- A description of the various “Types of Rights” choices available to Merchant Transmission developers and corresponding Agreements to acquire such rights (see “*Rights, Obligations and Agreements*”).

Overview

The PJM Regional Transmission Organization (RTO) has the responsibility for planning the expansion and enhancement of the PJM Transmission Grid on a regional basis. As the RTO, PJM administers the connection of generators and new transmission facilities to the PJM Transmission Grid. In this role, PJM coordinates the planning process for connection of new generation and/or new transmission facilities, coordinates the reliability studies for the operation of new generation and/or new transmission facilities and oversees the construction of the required Interconnection Facilities. As specified in Part IV, Subpart B, Section 41.1 of the PJM Open Access Transmission Tariff (OATT), a party wishing “to interconnect or add Merchant Transmission Facilities to the Transmission System, or to increase the capacity of existing Merchant Transmission Facilities interconnected with the Transmission System shall submit to PJM a Transmission Interconnection Request.” The Transmission Interconnection Request provides PJM with the information that it requires to initiate appropriate system reliability studies for connection of the proposed new Merchant Transmission Facilities.

The basic process to arrange for interconnection of Merchant Transmission facilities with the PJM Transmission Grid is described in the preceding volumes of PJM’s M-14 series of Manuals (M-14A, M-14B and M-14C). This Manual, M-14E, provides those additional requirements and procedures specific to the interconnection of Merchant Transmission Facilities, including the selection of Merchant Transmission Rights. Exhibit 2 portrays the pertinent planning, facility construction and operational requirements necessary to implement a Merchant Transmission interconnection with the PJM Transmission Grid.

A summary of PJM's Interconnection Process and the selection process for Rights available to Merchant Transmission developers follow in the remainder of this Manual, M-14E.

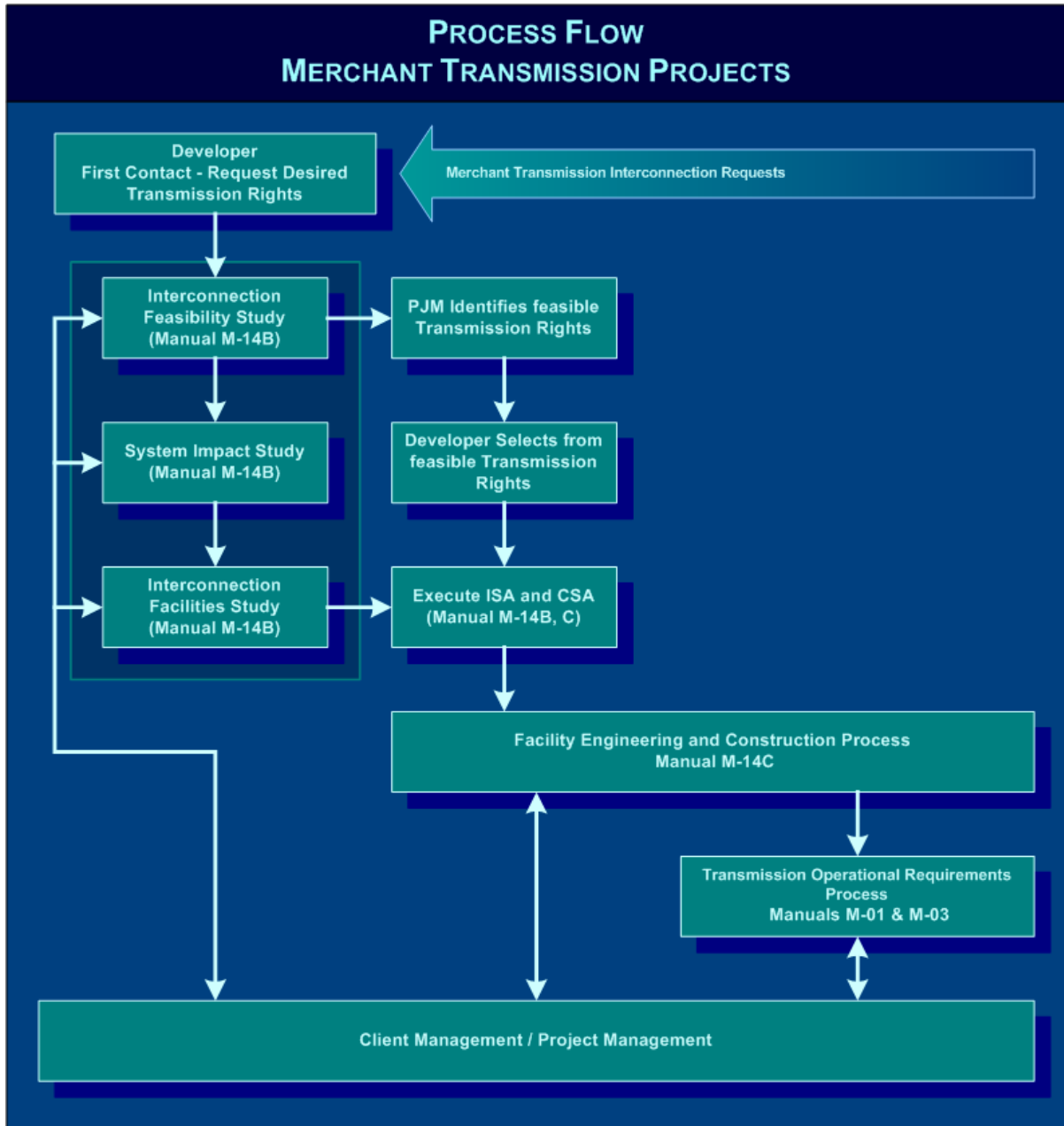


Exhibit 2: Process Flow Merchant Transmission Projects



PJM's Interconnection Process

PJM recommends that any Merchant Transmission developer/owner first review the whole interconnection process as outlined in the Manual 14 series:

- Manual M-14A: "PJM Manual for Generation and Transmission Interconnection Process Overview"
- Manual M-14B: "PJM Manual for Generation and Transmission Interconnection Planning"
- Manual M-14C: "PJM Manual for Generation and Transmission Interconnection Facility Construction"
- This Manual M-14E: "PJM Manual for Merchant Transmission Specific Requirements"

The details of each part of the planning and implementation process are explained in PJM's M-14 series of Manuals. Manuals M-14A, M-14B and M-14C and the remainder of this Manual, M-14E, are referenced here to provide the Merchant Transmission developer/owner with a guide to the steps in the interconnection process.

- Manual M-14A introduces the overall process flow for generator and transmission interconnections in order to guide developers through the planning, facility construction and implementation process described in detail in Manuals M-14B, M-14C, M-14D (Generator Operational Requirements) and M-14-E .
- Manual M14B describes the planning process for expansion and/or enhancement of the PJM transmission system, including the interconnection of Merchant Transmission projects. The requirements for executing Interconnection Service Agreements and Construction Service Agreements to establish and implement the interconnection of Merchant Transmission facilities with the PJM transmission grid is also described in Manual 14B.
- Manual M-14C describes the engineering and construction process to complete the interconnection of new facilities with the PJM Transmission Grid. The standardized terms and conditions for completing interconnections and for operation and maintenance of interconnection facilities are included in Manual M-14C. Manual M-14C also addresses Transmission Owner's technical requirements applicable to interconnections. Developers will thus know from the outset the technical requirements for the interconnection of their facilities. PJM will facilitate any compliance issues.
- Manual M-14E describes those additional procedures applicable to Merchant Transmission projects including PJM identification of the feasible "Types of Rights" choices available to Merchant Transmission developers, when and



how the developer selects from the feasible rights and the corresponding Agreements to acquire such rights. Merchant Transmission developers must also work with PJM staff to meet the business and operating requirements of the PJM Operating Agreement, including metering requirements. Refer to Section 3 of this Manual for the Design, Construction and Operational requirements for Merchant Transmission facilities.

Getting the Process Going

As Manual M-14A indicates, the Interconnection Planning Process is triggered by the developer executing a Transmission Interconnection Feasibility Study Agreement (OATT Attachment S) and submitting the required \$10,000 study fee. Executing the Attachment S Agreement requires the developer to elect to receive certain transmission rights based on the A.C. or D.C. operating technology of the developer's proposed facilities as discussed in further detail below.

Rights, Obligations and Agreements

As specified in the PJM OATT and Schedule 6 of the PJM Operating Agreement, the owners of Merchant Transmission Facilities that interconnect with the PJM Transmission System may be entitled, subject to certain restrictions, to select from a choice of "Rights" that are created by the addition of the Merchant Transmission facilities.

Rights Available to Merchant Transmission Owners

Merchant Rights for D.C. Transmission Facilities - The developer of Merchant D.C. Transmission Facilities that will interconnect with the PJM Transmission System and with another control area outside the combined PJM Region may elect to receive, based on the developer's own economic analysis, either (a) Transmission Injection Rights (TIR) and/or Transmission Withdrawal Rights (TWR), or (b) Incremental Deliverability Rights (IDR), Incremental Auction Revenue Rights (IARR) and Incremental Available Transfer Capability Revenue Rights (IATCRR), associated with the capability of the proposed Merchant D.C. Transmission Facilities.(OATT at 46.1) The selection of the (a) set of rights will also recognize whether the rights will apply to Firm transmission service (capacity and energy) or Non-Firm transmission service (energy only). The selection of the (b) set of rights requires the developer to designate the applicable IDR receipt location.

Note: Merchant D.C. Facilities having all terminals located within the PJM Region are eligible to receive only the (b) set of rights.

Merchant Rights for A.C. Transmission Facilities - The developer of Merchant A.C. Transmission Facilities that will interconnect with the PJM Transmission System may only elect to receive Incremental Deliverability Rights, Incremental Auction Revenue Rights and Incremental Available Transfer Capability Revenue



Rights associated with the capability of the proposed Merchant A.C. Transmission Facilities. The selection of these rights requires the developer to designate the applicable IDR receipt location.

Merchant Rights for Fully Controllable A. C. Transmission Facilities – The developer of Merchant A. C. Transmission Facilities that are fully operationally controllable such that they effectively function like D.C. facilities and that will interconnect with the PJM Transmission System and with another control area outside the combined PJM Region may elect the same “Rights” as those for D.C. facilities described above. PJM will review requests for fully controllable A.C. facilities on a case by case basis to determine and verify whether or not they are “Fully” controllable.

Note: Like Merchant D.C. Facilities, Fully Controllable A.C. Facilities having all terminals located within the PJM Region are eligible to receive only the (b) set of rights.

Any such rights available to and selected by a Merchant D.C. or a Merchant A.C. Transmission developer shall become effective pursuant to the applicable Interconnection Service Agreement and upon commencement of Interconnection Service thereunder. [\(OATT at 47.3\)](#)

Section 2 of this Manual M-14E describes each of the specific “Rights Applicable to Merchant Transmission Project” developers and the process for the developer to select the desired rights as described in OATT Sections 46 through 49. The process involves the developer requesting the desired transmission rights, PJM determining the transmission rights that are feasible and the developer then selecting from the feasible rights.

Obligations of Merchant Transmission Owners

Signatory to PJM Transmission Owners Agreement - In order to obtain the rights associated with Merchant Transmission Facilities (other than Merchant Network Upgrades)¹ provided under the PJM OATT, prior to the commencement of Interconnection Service associated with such facilities, the Transmission Interconnection Customer/Developer that interconnects or adds Merchant Transmission Facilities (other than Merchant Network Upgrades) to the Transmission System must become and remain a signatory to the applicable PJM Transmission Owners Agreement. [\(OATT at 49A.1\)](#)

¹ Merchant Network Upgrades are those Merchant A.C. Transmission Facilities that are additions to, or modifications or replacements of, physical facilities of the Interconnected Transmission Owner that, on the date of the pertinent Transmission Interconnection Customer/Developer's Interconnection Request, are part of the Transmission System or are included in the Regional Transmission Expansion Plan.



Maintenance of Merchant Transmission Facilities – Each Merchant Transmission Facility owner shall maintain, or shall cause the maintenance of, its facilities in a safe and reliable manner in accord with (i) the terms of Part IV, Subpart E of the PJM OATT; (ii) Applicable Standards²; (iii) applicable rules, procedures, and protocols set forth in the PJM OATT and the Operating Agreement that may be amended from time to time; (iv) Applicable Laws and Regulations, and (v) Good Utility Practice. **(OATT at 55.1)**

Unless otherwise provided in the Interconnection Service Agreement, the interconnected Transmission Owner that owns the Transmission System facilities to which any Merchant Network Upgrades are connected shall maintain such Merchant Network Upgrades (a) on behalf and at the expense of the Interconnection Customer/Developer that constructed or caused construction of the pertinent Merchant Network Upgrades and (b) in accordance with Part IV, Subpart E of the PJM OATT and with an agreement between the Interconnected Transmission Owner and the Interconnection Customer/Developer regarding such maintenance. **(OATT at 55.2)**

Additions to or Upgrades of Merchant A.C. Transmission Facilities - In the event that PJM determines in accordance with the Regional Transmission Expansion Planning Protocol of Schedule 6 of the Operating Agreement that a future addition or upgrade to Merchant A.C. Transmission Facilities is necessary, the owner of such Merchant A.C. Transmission Facilities shall undertake such addition or upgrade and shall operate and maintain all facilities so constructed or installed in accordance with Good Utility Practice and with applicable terms of the Operating Agreement and the applicable Transmission Owners Agreement. Cost responsibility for each such addition or upgrade shall be assigned in accordance with Schedule 6 of the Operating Agreement. Each Transmission Owner to whom cost responsibility for such an upgrade is assigned shall further be responsible for all costs of operating and maintaining the addition or upgrade in proportion to its respective assigned cost responsibilities. **(OATT at 49A.2)** See Attachment B to Manual M-14B for a description of PJM Generation and Transmission Cost Allocation Methodologies.

Merchant Transmission Owner Related Agreements

Study Agreements – The study agreements for Feasibility, System Impact and Facilities Studies are described in detail in Manual M-14B. OATT Attachment S, “Form of Transmission Interconnection Feasibility Study Agreement”, requires the Merchant Transmission developer to indicate the transmission rights to be evaluated by PJM.

² Applicable Standards are those requirements and guidelines of NERC, the Applicable Reliability Council and the Control Area in which the Customer/Developer Facility is electrically located, the PJM Manuals and Applicable Technical Requirements and Standards.



Interconnection Service Agreement - Any applicable rights available to and selected by a Merchant Transmission developer shall become effective pursuant to the applicable Interconnection Service Agreement and upon commencement of Interconnection Service thereunder. ([OATT at 47.3](#)) See Manual M-14B, Section 5 for a complete description of the requirements for executing an Interconnection Service Agreement (ISA) prior to commencing Interconnection Service and the rights and obligations conferred through execution of ISA.

IDR Transfer Agreement – A Merchant Transmission developer may obtain Incremental Deliverability Rights (IDR) associated with its Merchant Transmission Facilities. Such IDR may be sold or otherwise transferred at any time after they have been assigned to the Merchant Transmission developer subject to execution and submission of an IDR Transfer Agreement in accordance with Section 49B of the PJM OATT. ([OATT at 49.1 and 49.5](#))

An Interconnection Customer/Developer³ (hereafter the “Buyer Interconnection Customer”) may acquire Incremental Deliverability Rights (IDR) from another Interconnection Customer (hereafter the “Seller Interconnection Customer”) who has been assigned IDRs by entering into an IDR Transfer Agreement with the Seller Interconnection Customer. Subject to the terms of Part IV, Subpart D, Section 49B of the PJM OATT, the Buyer Interconnection Customer may rely upon such IDRs to satisfy, in whole or in part, its responsibility for Network Upgrades and/or Local Upgrades otherwise necessary to accommodate the Buyer Interconnection Customer’s Interconnection Request. A Buyer Interconnection Customer may rely upon Incremental Deliverability Rights to satisfy, in whole or in part, the deliverability requirements applicable to its Interconnection Request only if it submits to PJM an IDR Transfer Agreement executed by both the Buyer Interconnection Customer and the Seller Interconnection Customer and only if such agreement meets all of the requirements specified in Section 49B.2.1 of the PJM OATT. ([OATT at 49B](#))

³ An Interconnection Customer/Developer is a Generation Interconnection Customer/Developer and/or a Transmission Interconnection Customer/Developer.



Section 2: Rights Applicable to Merchant Transmission Projects

Welcome to the *Rights Applicable to Merchant Transmission Projects* section of the PJM Manual for **Merchant Transmission Specific Requirements**. In this section you will find an overview of the rights available to Merchant Transmission projects.

- Injection rights and withdrawal rights available to Merchant D.C. and Merchant Fully Controllable A.C. Transmission project developers (see “*Summary of Transmission Injection and Withdrawal Rights*”).
- Transfer capability revenue rights available to Merchant Transmission project developers (see “*Incremental Available Transfer Capability Revenue Rights*”).
- Incremental auction revenue rights available to Merchant Transmission project developers (see “*Incremental Auction Revenue Rights*”).
- Incremental deliverability rights available to Merchant Transmission project developers (see “*Incremental Deliverability Rights*”).

Summary of Transmission Injection Rights (TIRs) and Transmission Withdrawal Rights (TWRs)

Only Merchant D.C. Transmission Facilities and Fully Controllable A.C. Transmission Facilities may receive Transmission Injection Rights and Transmission Withdrawal Rights - The assignment of TIRs and TWRs associated with new Merchant D.C. or Fully Controllable A.C. Transmission Facilities will be made in accordance with Section 47 of the PJM Tariff and may depend upon the capabilities of the facilities and upgrades necessary to accommodate other Interconnection Customers/Developers’ Interconnection Requests. ([OATT at 41.5.3](#))

The holder of TIRs is entitled to schedule capacity and/or energy on the associated Merchant D.C. or Fully Controllable A.C. Transmission Facilities for injection into the PJM Transmission System at the defined Point of Interconnection between the Merchant D.C. or Fully Controllable A.C. Transmission Facilities and the PJM Transmission System. TWRs entitle the holder to schedule energy on the associated Merchant Transmission Facilities to be withdrawn from the PJM Transmission System at the defined Point of Interconnection between the Merchant D.C. or Fully Controllable A.C. Transmission Facilities and the PJM Transmission System. ([OATT at 1.3E, 1.11B & 47.1](#)) This capability to inject capacity/energy at a defined Point of Interconnection with the PJM Transmission System is directly comparable to the capability of generation facilities to inject capacity/energy into the PJM Transmission System. Similarly, the capability to withdraw capacity/energy at a defined Point of Interconnection with the PJM Transmission System is directly comparable to the capability of load to withdraw capacity/energy from the PJM Transmission System.



TIRs and TWRs are available to developers of Merchant D.C. or Fully Controllable A.C. Transmission Facilities only if the developer has elected, pursuant to Section 41.1 of the PJM Tariff, to receive Transmission Injection Rights and Transmission Withdrawal Rights in lieu of Incremental Deliverability Rights, Incremental Auction Revenue Rights, and Incremental Available Transfer Capability Revenue Rights. The holder of TIRs and TWRs for Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities that interconnect with the PJM Transmission System and with a control area outside the combined PJM Region shall be entitled to receive Transmission Injection Rights and/or Transmission Withdrawal Rights at each terminal where such Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities interconnect with the PJM Transmission System. **(OATT at 47.2)** The MW value of TIRs requested and/or held at one terminal of a D.C. or Fully Controllable A.C. transmission facility shall be the net of all losses on the Merchant facility. The value of TWRs requested and/or held shall be the actual MW value to be withdrawn.

A Transmission Interconnection Customer/Developer⁴ or other party may hold TIRs and TWRs simultaneously at the same terminal on the PJM Transmission System, subject to PJM evaluation and approval. However, neither the aggregate TIRs nor the aggregate TWRs held at a terminal may exceed the Nominal rated Capability (as defined in Section 50.42 of the PJM Tariff) of the interconnected Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities, as stated in the associated Interconnection Service Agreement. **(OATT at 47.2.1)**

Subject to the terms of Section 47.7 of the PJM Tariff, TIRs and/or TWRs received by a party shall be effective for the life of the associated Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities. **(OATT at 47.4)**

No TIRs or TWRs shall be received by a party with respect to transmission investment that is included in the rate base of a public utility and on which a regulated return is earned. **(OATT at 47.5)**

TIRs and/or TWRs may be sold or otherwise transferred subject to compliance with such procedures as PJM may establish regarding such transfer and required notice to PJM of use of such rights after the transfer. The transfer of TIRs or of TWRs shall not itself extend the time periods set forth in Section 47.7 of the PJM Tariff regarding loss of such rights. **(OATT at 47.6)**

Procedure to Determine Transmission Injection Rights (TIRs) and Transmission Withdrawal Rights (TWRs)

Transmission Injection Rights (TIRs) are the rights to inject capacity and/or energy into the Transmission System at a Point of Interconnection of a Merchant D.C.

⁴ A Transmission Interconnection Customer/Developer is an entity that submits an Interconnection Request to interconnect or add Merchant Transmission Facilities to the Transmission System or to increase the capacity of Merchant Transmission Facilities interconnected with the Transmission System in the PJM Region.



and/or Fully Controllable A.C. Transmission Facility with the Transmission System. TIRs are determined through the use of industry power flow software and analytical techniques to be the amount of capacity and/or energy that can be reliably accommodated for injection into the Transmission System at the Point of Interconnection. The studies to determine Capacity (Firm) TIRs are conducted under the same reliability criteria as studies for projects requesting Capacity Status and RTEP Baseline studies. Studies to determine Energy (Non-Firm) TIRs are conducted under the same reliability criteria as studies for projects requesting only Energy Resource Status and RTEP Baseline studies.

Transmission Withdrawal Rights (TWRs) are the rights to withdraw capacity and/or energy from the Transmission System at a Point of Interconnection of a Merchant D.C. and/or Fully Controllable A.C. Transmission Facility with the Transmission System. TWRs are determined through the use of industry power flow software and analytical techniques to be the amount of capacity and/or energy that can be reliably accommodated for withdrawal from the Transmission System at the Point of Interconnection. The studies to determine Firm and Non-Firm TWRs are conducted under the same reliability criteria as applied in the RTEP Baseline studies.

PJM shall include in the System Impact Study an evaluation of the feasibility of the Transmission Injection Rights and the Transmission Withdrawal Rights (including the quantity of each type of such rights) requested by the Transmission Interconnection Customer/Developer at the terminal(s) where the pertinent Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities interconnect with the PJM Transmission System. Such rights shall become available to the Transmission Interconnection Customer/Developer pursuant to the Interconnection Service Agreement and upon commencement of Interconnection Service thereunder. [\(OATT at 47.3\)](#)

Incremental Available Transfer Capability Revenue Rights

Available Transfer Capability (ATC) represents the amount of energy above “base case” conditions that can be transferred reliably from one Control Area to another over all transmission facilities without violating any pre- or post-contingency criteria for the facilities in the PJM Region under the specified system conditions. ATC of a particular path is an approximate indication of the anticipated transmission transfer capability remaining on the transmission network that could be scheduled for further energy transfers relative to the designated path under the conditions studied. PJM posts firm and non-firm ATC projections on its OASIS for interfaces between the PJM Region – including all PJM TOA and PJM West TOA signatories – and neighboring Control Areas. [\(OATT – ATTACHMENT C\)](#)

The addition of a Merchant Transmission Facility (and the additional transmission enhancements that may be required to accommodate the Merchant Transmission Facility) may create additional, incremental ATC. Incremental Available Transfer Capability Revenue Rights are the rights to revenues that are derived from



incremental Available Transfer Capability created by the addition of a Merchant Transmission Facility or a new transmission facility or upgrade resulting from the accommodation of an Interconnection Request(s) pursuant to Part IV of the PJM Tariff. **(OATT at 1.14C)** A Merchant Transmission developer may elect to receive Incremental Available Transfer Capability Revenue Rights as part of the set of rights available in lieu of TIRs and TWRs.

A Transmission Interconnection Customer/Developer may request PJM to provide a non-binding estimate in the Transmission Facilities Study of the Incremental Available Transfer Capability Revenue Rights associated with the Merchant Transmission Facilities or with the required facilities or upgrades for which the Transmission Interconnection Customer/Developer has cost responsibility. The ultimate assignment of Incremental Available Transfer Capability Revenue Rights associated with the Merchant Transmission facilities or with the required facilities or upgrades for which the Transmission Interconnection Customer/Developer has cost responsibility will be made pursuant to the process set forth in Section 48 of the PJM Tariff. **(OATT at 41.5.4)**

An Interconnection Customer/Developer that interconnects a Customer/Developer Facility⁵ with the Transmission System shall be entitled to receive any Incremental Available Transfer Capability Revenue Rights that are associated with the interconnection of such facility as determined in accordance with Section 48.1 of the PJM Tariff. In addition, an Interconnection Customer/Developer that (a) pursuant to Section 36.8.1 or 41.7.1 of the PJM Tariff, reimburses PJM for the costs of, or (b) pursuant to Section 83.2.3 or section 83.5 of the PJM Tariff, undertakes responsibility for, constructing or completing required Network Upgrades and/or Local Upgrades to accommodate its Interconnection Request shall be entitled to receive any Incremental Available Transfer Capability Revenue Rights associated with such required facilities and upgrades as determined in accordance with Section 48.1 of the PJM Tariff. **(OATT at 48.1)**

Incremental Available Transfer Capability Revenue Rights received by an Interconnection Customer/Developer shall be effective for thirty (30) years from commencement of Interconnection Service for such customer/developer or the life of the pertinent facility or upgrade, whichever is shorter, subject to any subsequent pro-rata reallocations of all Available Transfer Capability Revenue rights (including Incremental Available Transfer Capability Revenue Rights). **(OATT at 48.4)**

No Incremental Available Transfer Capability Revenue Rights shall be received by an Interconnection Customer/Developer with respect to transmission investment that is included in the rate base of a public utility and on which a regulated return is earned. **(OATT at 48.6)**

⁵ A Customer/Developer Facility is a Generation Facility and/or a Merchant Transmission Facility interconnected with or added to the Transmission System pursuant to an Interconnection Request under Subparts A or B of Part IV of the PJM OATT.



Procedure to Determine Incremental Available Transfer Capability Revenue Rights (ATCRRs)

Available Transfer Capability Revenue Rights (ATCRRs) are the rights of a Transmission Owner to the revenues for Available Transfer Capability that are made possible by the Transmission Facilities installed by the Transmission Owner. Incremental ATCRRs are those additional ATCRRs, not previously feasible, created by the addition of Merchant Transmission facilities, or a new transmission facility or upgrade resulting from the accommodation of an Interconnection Request. The incremental ATCRRs are determined to be the difference between the ATCRRs that are available after the installation of the additional transmission facilities and the ATCRRs that were available immediately prior to the installation of the additional transmission facilities. The incremental ATC created by the addition of Merchant Transmission facilities are determined through the use of industry power flow software and analytical techniques. The studies to determine the incremental ATC are conducted under the same reliability criteria as applied in the RTEP Baseline studies.

Incremental Auction Revenue Rights

Incremental Auction Revenue Rights are the additional Auction Revenue Rights (as defined in Section 1.3.1 of Attachment K to the PJM Tariff), not previously feasible, created by the addition of Merchant Transmission Facilities, or a new transmission facility or upgrade resulting from the accommodation of an Interconnection Request⁶ pursuant to Part IV of the PJM Tariff. **(OATT at 1.14B)**

The Transmission Interconnection Customer/Developer may request PJM to provide a non-binding estimate in the Transmission Interconnection Facilities Study of the Incremental Auction Revenue Rights associated with the Merchant Transmission Facilities or with the required facilities or upgrades for which the Transmission Interconnection Customer/Developer has cost responsibility on up to three (3) pairs of point-to-point combinations. The ultimate assignment of Incremental Auction Revenue rights associated with the new Merchant Transmission Facilities proposed by the Transmission Interconnection Customer/Developer or with the required facilities or upgrades for which the Transmission Interconnection Customer/Developer has cost responsibility will be made pursuant to the allocation process set forth in Section 46 of the PJM Tariff and may depend upon the point-to-point combination requests and cost responsibilities of other Interconnection Customers/Developers requesting interconnection under Part IV of the PJM Tariff. **(OATT at 41.5.5)**

⁶ Accommodation of an Interconnection request is to install those Network Transmission Facilities required to fully support a Generation Interconnection Request, a Transmission Interconnection Request and/or an IDR Transfer Agreement.



The Merchant Transmission project developer may request Incremental Auction Revenue Rights associated with the facilities and upgrades that the developer (a) reimburses PJM for the costs pursuant to Section 36.8.1 or 41.7.1 of the PJM Tariff, or (b) undertakes responsibility for constructing or completing Network Upgrades and/or Local Upgrades to accommodate its Interconnection Request pursuant to Section 83.2.3 or 83.5 of the PJM Tariff. Incremental Auction Revenue Rights are available to developers of Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities only if the developer has elected, pursuant to Section 41.1 of the PJM Tariff, to receive Incremental Auction Revenue Rights, Incremental Deliverability Rights and Incremental Available Transfer Capability Revenue Rights in lieu of Transmission Injection Rights and/or Transmission Withdrawal Rights. **(OATT at 46.1)**

PJM issues Incremental Auction Revenue Rights in a three-round allocation process. A requester must specify a specific point-to-point combination for the desired Incremental Auction Revenue Rights. In round one of the allocation process, one-third of the Incremental Auction Revenue Rights available for each requested point-to-point combination requested in that round will be assigned to the requesters of the specific combinations. In round two, two-thirds of the Incremental Auction Revenue Rights available for each requested point-to-point combination in that round will be assigned. In round three, all available Incremental Auction Revenue Rights will be assigned for the requested point-to-point combinations in that round. In each round, a requester may request the same point-to-point combinations as in the previous rounds or submit a different combination. In rounds one and two, requesters may accept the assignment of Incremental Auction Revenue Rights or refuse them. Acceptance of the assignment in rounds one and two will remove the assigned Incremental Auction Revenue Rights from availability in the next rounds. Refusal of an Incremental Auction Revenue Transmission Rights Assignment in rounds one and two will result in those Incremental Auction Revenue Rights being available for the next round. The Incremental Auction Revenue Rights assignments made in round three are final and binding. **(OATT at 46.2)**

Incremental Auction Revenue Rights received by an Interconnection Customer/Developer are to be effective for thirty (30) years from the commencement of Interconnection Service for the Interconnection Customer/Developer or for the life of the associated facility or upgrade, whichever is less. At any time during the thirty-year period (or the life of the facility or upgrade, whichever is less), in lieu of continuing this thirty-year Auction Revenue Right, the Interconnection Customer/Developer shall have a one-time choice to switch to an optional mechanism, whereby, on an annual basis, the customer/developer has the choice to request an Auction Revenue Right during the annual Auction Revenue Rights allocation process (pursuant to Section 7.4.2 of the Appendix to Attachment K of the PJM Tariff) between the same source and sink, provided the Auction Revenue Right is simultaneously feasible, pursuant to Section 7.5 of the Appendix to Attachment K



of the PJM Tariff. An Interconnection Customer/Developer may return Incremental Auction Revenue rights that it no longer desires at any time, provided that PJM determines that it can simultaneously accommodate all remaining outstanding Auction Revenue Rights following the return of such Auction Revenue Rights. In the event an Interconnection Customer/Developer returns Incremental Auction Revenue Rights, the Interconnection Customer/Developer shall have no further rights regarding such Incremental Auction Revenue Rights. **(OATT at 46.5)**

No Incremental Auction Revenue Rights shall be received by an Interconnection Customer/Developer with respect to transmission investment that is included in the rate base of a public utility and on which a regulated return is earned. **(OATT at 46.4)**

Procedure to Determine Incremental Auction Revenue Rights (ARRs)

Auction Revenue Rights (ARRs) are the rights of an ARR holder to an appropriate portion of the revenues from the annual FTR Auction. Incremental ARR are those additional ARRs, not previously simultaneously feasible, created by the addition of Merchant Transmission Facilities, or a new transmission facility or upgrade resulting from the accommodation of an Interconnection Request. The incremental ARRs are determined to be the difference between the ARRs available after the installation of the additional transmission facilities and the ARRs available immediately prior to the installation of the additional transmission facilities. The incremental ARRs created by the addition of Merchant Transmission facilities are determined through the use of industry power flow software and analytical techniques. The studies to determine the incremental ARRs are conducted under the same reliability criteria as Capacity Resources and Baselines.

Note: Further information about the request and allocation process for FTRs and ARRs may be found in PJM Manual M-06 “Financial Transmission Rights” available on the PJM Website.

Incremental Deliverability Rights

Incremental Deliverability Rights are the rights to the incremental ability, resulting from the addition of a Merchant Transmission Facility, to inject capacity and energy at a point on the Transmission System, such that the injection satisfies the deliverability⁷ requirements of a Capacity Resource. **(OATT at 1.14D)**

A Transmission Interconnection Customer/Developer shall be entitled to receive the Incremental Deliverability Rights associated with its Merchant Transmission Facilities as determined in accordance with Section 49 of the PJM Tariff, provided, however, that a Transmission Interconnection Customer/Developer that proposes to

⁷ Deliverability is the determination that the aggregate of regional capacity resources can be utilized to deliver energy to the aggregate of regional load consistent with the requirements of the Reliability Principles and Standards of the applicable regional reliability council.



interconnect Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities that connect the Transmission System with another control area outside the PJM Region shall be entitled to Incremental Deliverability Rights associated with such Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities only if the Interconnection Customer/Developer has elected, pursuant to Section 41.1 of the PJM Tariff, to receive Incremental Deliverability Rights, Incremental Auction Revenue Rights and Incremental Available Transfer Capability Revenue Rights in lieu of Transmission Injection Rights and/or Transmission Withdrawal Rights. **(OATT at 49.1)**

Incremental Deliverability Rights assigned to a Transmission Interconnection Customer/Developer shall be effective until one year after the commencement of Interconnection Service. **(OATT at 49.4)**

No Incremental Deliverability Rights shall be received by a Transmission Interconnection Customer/Developer with respect to transmission investment that is included in the rate base of a public utility and on which a regulated rate of return is earned. **(OATT at 49.8)**

Procedure to Determine Incremental Deliverability Rights (IDRs)

Deliverability Rights are the rights to inject capacity and energy at a point on the Transmission System, such that the injection satisfies the deliverability requirements of a Capacity Resource. Incremental Deliverability Rights (IDRs) is the additional reliable injection capability at that same point on the Transmission System created by the addition of a Merchant Transmission Facility. IDRs represent the additional Deliverability Capability created by the addition of Merchant Transmission Facilities, or a new transmission facility or upgrade resulting from the accommodation of the Merchant Transmission Interconnection Request. The IDRs are determined to be the difference between the Deliverability Capability available at that point after the installation of the additional transmission facilities and the Deliverability Capability available at that point immediately prior to the installation of the additional transmission facilities.

PJM shall include in the Transmission Interconnection Feasibility Study a determination of the IDRs associated with the Transmission Interconnection Customer/Developer's Merchant Transmission Facilities. PJM shall post on its OASIS the IDRs that it assigns to the Transmission Interconnection Customer/Developer. **(OATT at 49.2)**. The incremental IDRs created by the addition of Merchant Transmission facilities are determined through the use of industry power flow software and analytical techniques. The studies to determine the incremental IDRs are conducted under the same reliability criteria as studies for projects requesting Capacity Status and RTEP Baseline studies.

Note: Refer to Attachment E of Manual 14-B for a full description of the deliverability testing methodology.



HVDC Projects

Additional Studies in the Facility Study Phase

In addition to the facilities studies normally required for AC interconnection during the Facility Study phase by PJM and Interconnected Transmission Owner for interconnection and integration of the project in PJM, several other studies are required among PJM, Interconnected Transmission Owner, and the Project Developer to facilitate proper design of the HVDC facility. Though many of the studies listed below will be required by the project developer for proper design of the HVDC facilities, PJM and member Interconnected Transmission Owners require verification of the expected performance of the facilities being interconnected.

The developer requires PJM and the Interconnected Transmission Owner to provide necessary system data and other information about 24 months ahead of the scheduled in-service date. This data is required in a timely fashion to complete detailed engineering and design studies that specify majority of the HVDC equipment and to meet the equipment manufacturers' lead time requirements.

Types of Studies:

1. Dynamic Performance Analysis:

This study assesses the dynamic performance of an HVDC project to disturbances on both the DC and AC system. It is typically performed using various simulation tools like PSS/E, EMTDC, EMTP, HYPERSIM, MATLAB/SimPower, etc. The dynamic performance is demonstrated by time domain analysis for a list of system disturbance cases generally based on applicable NERC, Regional, PJM and Interconnected Transmission Owner criteria that will include, but not limited to;

- DC side faults
- Energization of DC Facility
- DC facility step response
- Blocking and De-Blocking of DC facility
- AC side faults (Temporary or Permanent, single phase or multi-phase) considering reclosing, breaker failure, delayed clearing, and loss and recovery performance of DC tie for faults near converter or inverter terminal.
- Tripping of generation or Switching of large loads in the proximity of DC terminal

Assessment of the dynamic performance will also include analysis of possible dynamic overvoltages/undervoltages on the AC network. In addition to the above listed phenomena, additional events to be studied, but not limited to

- Switching of HVDC facility's AC filters, bus voltage control devices
- Switching of nearby transformers, reactors, capacitor banks etc.

Typical cost of Dynamics Study will be about \$30,000.

2. Subsynchronous Torsional Analysis

Torsional perturbations in a turbine-generator could cause modulations of the generator's rotor speed, which in turn could cause variations in the generator's terminal voltage. If a HVDC converter terminal is in the electrical proximity, this could cause variations in the DC side voltages and currents. Regulator within the DC terminal could respond to these changes, which in turn could cause changes in the machine's electrical torque. If this change in torque is out of phase with the change in speed, it could provide negative damping to the torsional vibrations amplifying their effects, which could damage the turbine-generator shaft.

The possibilities of torsional interactions between HVDC converter and the generator would depend on relative coupling between the two, their relative sizes, and the phase lag from perturbation in generator speed to the perturbation in generator electrical torque including the actions of the HVDC controls.

Typical studies would first involve a screening study to determine if there is any risk of torsional interactions over the entire range of expected operating conditions. If a risk of torsional interactions is identified, more detailed studies would be required to help design HVDC controls to minimize such a risk, and if necessary to design Torsional Protection for the generator at risk.

Expected cost of screening study will be about \$10,000.

If a need for more detailed study is identified, additional studies may cost about \$50,000.

3. AC System Harmonic Analysis

This study is to assess the impact of an HVDC project on the power quality of the local ac electrical system and to validate the suitability of the design of AC filters associated with the DC terminals over the range of operation of the facility. The study is performed to demonstrate that there will be no unacceptable harmonic impact of the ac system, and that the facility will meet performance criteria and standards on power quality. If necessary, mitigation solutions would be identified. IEEE Std. 519 will be used if no local utility standard is available.

Typical harmonic analysis will cost about \$20,000.



Studies required by Interconnected Transmission Owner’s FERC-715 report

In addition to the studies listed in 1-3 above, PJM and affected ITO will require verification of design and/or expected performance of the proposed HVDC facilities to meet requirements as listed in the ITO’s FERC-715 filing.

Types of Data Required for the Studies:

1. General AC Network Conditions and Parameters

In addition to the AC system topology, short circuit strength etc., PJM and/or the Interconnected Transmission Owner should provide data listed in Table 1 below to the project developer. Information included in Table 1 indicates the ac power system characteristics at the point of interconnection to be used in design of the project. If both converter terminals are within the PJM control area, information at each converter terminals point of interconnection with the AC system should be provided.

Table 1 - AC Power System Characteristics at the Point of Interconnection

AC Network Parameter	Substation No.1	Substation No. 2
Nominal AC Line Voltage	kV	kV
Base AC Voltage	kV	kV
Normal Operating Line Voltage (range)	kV	kV
Maximum Steady State Line Voltage	kV	kV
Minimum Steady State Line Voltage	kV	kV
Negative Sequence Voltage During Normal Operation	%	%
Nominal System Frequency	Hz	Hz
Steady State Maximum Frequency	Hz	Hz
Steady State Minimum Frequency	Hz	Hz
Frequent Disturbance Frequency Deviation	± Hz	± Hz
Infrequent Disturbance Frequency Deviation - 10 - 12 % Load Shedding	_____ % Load Shedding ± _____ Hz	_____ % Load Shedding ± _____ Hz
Infrequent Disturbance Frequency Deviation - 50% Load Shedding	≥ _____ Hz	≥ _____ Hz
Maximum Phase Current Unbalance	%	%
Maximum Short Circuit	_____ MVA, 3-PH _____ MVA, 1-PH	_____ MVA, 3-PH _____ MVA, 1-PH
Ultimate Maximum Short Circuit	_____ MVA, 3-PH	_____ MVA, 3-PH
Minimum Short Circuit	_____ MVA, 3-PH _____ MVA, 1-PH	_____ MVA, 3-PH _____ MVA, 1-PH
Maximum Positive Sequence System Impedance (100 MVA base)	___ +j ___ PU	___ +j ___ PU
Maximum Zero Sequence System Impedance (100 MVA base)	___ +j ___ PU	___ +j ___ PU
Minimum Positive Sequence System Impedance (100 MVA base)	___ +j ___ PU	___ +j ___ PU
Minimum Zero Sequence System Impedance (100 MVA base)	___ +j ___ PU	___ +j ___ PU



AC Network Parameter	Substation No.1	Substation No. 2
AC System Fault Clearing Time Normal	cycles	cycles
AC System Fault Clearing Time – Breaker Failure	cycles	cycles
Automatic Reclosing Time(1-PHASE)	cycles	cycles
(3-PHASE) Instantaneous	cycles	cycles
Delayed	cycles	cycles
Switchyard Equipment BIL (LIWL)	kV	kV
Switchyard Equipment SIL (SIWL)	kV	kV

2. Proposed DC facilities and their Dynamic Characteristics

The project developer needs to provide to PJM proposed operating performance specifications, dynamics characteristics and models of the HVDC facilities as they become available. This would include but not limited to

- Proposed control modes (e.g. Power control, power factor control)
- Proposed power modulation controls
- Expected recovery times after AC or DC side faults
- Proposed reactive compensation



Section 3: Design, Construction, Operation and Maintenance Requirements Applicable to Merchant Transmission Facilities

Welcome to the Design, Construction, Operation and Maintenance Requirements Applicable to Merchant Transmission Facilities section of the PJM Manual for **Merchant Transmission Specific Requirements**. In this section you will find an overview of the design, construction, operation and maintenance requirements applicable to Merchant Transmission projects.

- Description of the Technical Design Requirements applicable to Merchant Transmission Facilities (see “*Technical Design Requirements*”).
- Description of the Construction Requirements applicable to Merchant Transmission Facilities (see “*Construction Requirements*”).
- Description of the Operational and Maintenance Requirements applicable to Merchant Transmission Facilities (see “*Operational and Maintenance Requirements*”).

Technical Design Requirements

Reactive Power Design Criteria

The significant amount of power flow over D.C. and/or Fully Controllable A.C. Transmission Facilities result in (1) the capability to inject electrical capacity/energy into the PJM Transmission System at the defined Point(s) of Interconnection between the D.C. and/or Fully Controllable A.C. Transmission Facility and the PJM Transmission System and (2) the capability to withdraw electrical capacity/energy from the PJM Transmission System at that same defined Point(s) of Interconnection between the D.C. and/or Fully Controllable A.C. Transmission Facility and the PJM Transmission system. This capability to inject capacity/energy at a defined Point(s) of Interconnection with the PJM Transmission System is directly comparable to the capability of generation facilities to inject capacity/energy into the PJM Transmission System. Similarly, the capability to withdraw capacity/energy at a defined Point(s) of Interconnection with the PJM Transmission System is directly comparable to the capability of load to withdraw capacity/energy from the PJM Transmission System.

Injections and withdrawals of a significant amount of capacity/energy at various points on the PJM Transmission System affect the scheduled voltage profile necessary for reliable operation of the PJM Transmission System. The reactive power losses needed to support the power flows across the PJM Transmission System due to the injections/withdrawals at the terminals of D.C. and/or Fully Controllable A.C. Transmission Facilities have a significant impact on the PJM Transmission System voltage profile. The effect on the PJM Transmission System voltage profile due to such injections and withdrawals of capacity/energy at the



terminals of Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities can be best mitigated by compensating for the reactive power losses and the reactive requirements of the Merchant facility near their point of occurrence. Thus, it is necessary to require Merchant D.C. and/or Fully Controllable A.C. Transmission Facilities to provide reactive power support capable of maintaining a power factor near the D.C. and/or Fully Controllable A.C. Transmission Facility terminals of at least 0.95 leading and 0.95 lagging over its entire megawatt operating range. (OATT at 54.7.1)

Voltage Operating Criteria

Effective and reliable operation of the electric Transmission System requires scheduling a voltage profile for the system that must be followed within a narrow bandwidth. Maintaining a voltage profile across the Transmission System requires the capability to control voltage schedules at specific points on the Transmission System by implementing adjustments to voltage schedules at those locations. The terminals of D.C. and/or Fully Controllable A.C. Transmission Facilities are among the locations where appropriate voltage schedules and/or reactive power schedules must be controlled as specified by PJM or the Interconnected Transmission Owner's control center (acting on behalf of or at the direction of PJM) or that is consistent with Good Utility Practice. (OATT at 54.7.3)

Payment for Reactive Power

Any payments to the Interconnection Customer for reactive power shall be in accordance with Schedule 2 of the Tariff. (OATT at 54.7) Schedule 2 of the Tariff provides for payment for Reactive Supply and Voltage Control from Generation Sources Service. Merchant Transmission facilities are not eligible to receive payment for reactive power under the provisions of Schedule 2.

Construction Requirements

Cost Responsibility

The Interconnection Service Agreement defines the obligation of the Merchant Transmission developer regarding cost responsibility for any required Transmission System upgrades.

Note: Further information on all terms and conditions to be incorporated and made part of the Interconnection Service Agreement may be found in PJM Manuals M-14B (Section 5) and M-14-C (Section 1) and in Part IV of the PJM Open Access Transmission Tariff (Subpart B at 41.7, Subpart E and Attachment O) available on the PJM Website, <http://www.pjm.com/>.



Construction Service Agreement

The construction of any Interconnection Facilities required to interconnect a Merchant Transmission project with the PJM Transmission Grid shall be performed in accordance with the Standard Terms and Conditions as specified in a Construction Service Agreement to be executed among the applicant for Interconnection Transmission Service (Merchant Transmission Interconnection Customer/Developer), the Transmission Provider and the affected Interconnection Transmission Owner(s). The form of a Construction Service Agreement may be found in the PJM Open Access Transmission Tariff as Attachment P.

Note: Further information on all terms and conditions to be incorporated and made part of a Construction Service Agreement may be found in PJM Manual M-14B (Section 5) and M-14-C (Section 1) and in Part IV of the PJM Open Access Transmission Tariff (Subpart F and Attachment P) available on the PJM Website.

Option to Build

In the event that the Transmission Interconnection Customer/Developer and the Interconnected Transmission Owner are unable to agree upon the terms of a Construction Service Agreement, the Interconnection Customer/Developer shall have the right, but not the obligation, to design and install all or any portion of the Transmission Owner Interconnection Facilities (“Option to Build”).

Note: Further information on all terms and conditions to be incorporated under the Option to Build may be found in PJM Manual M-14B, Section 5 and in Part IV of the PJM Open Access Transmission Tariff (Subpart F at 83.2.3) available on the PJM Website.

Project Controls

PJM believe that the effective use of project controls is essential to maintaining and monitoring cost and schedules during the construction phase of a Merchant Transmission interconnection project. Thus, PJM has established project controls concepts and tools to facilitate coordination of interconnection construction activities.

Note: Further information about Interconnection Coordination Project Controls may be found in PJM Manual M-14-C, Section 2.

Construction Standards and Technical Requirements

The facilities of the PJM System, while operated by PJM, are comprised of the physical facilities owned by the various Interconnected Transmission Owners (“ITOs”). While the facilities of the various ITOs are operated by PJM as a fully



integrated transmission network, the physical facilities of each individual ITO are designed to the particular construction standards of that ITO. While particular construction standards may vary among the various ITOs, all such standards are derived from those generally accepted industry standards developed by the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and the National Electric Safety Code.

The ITOs have selected their various construction standards to facilitate operation, maintenance and repair or replacement of the various components utilized on their portion of the overall PJM System. Thus, it is essential that any additions, upgrades or other changes to the transmission facilities of any particular ITO must be designed and installed to the construction standards of that ITO. PJM, as the Transmission Provider, will ensure that any Constructing Entities authorized to perform construction activities under the “Option to Build” provisions of the PJM OATT to interconnect with the facilities of an ITO or to install or upgrade facilities within the transmission system of an ITO has access to the established construction standards of that ITO. All such construction standards shall be stated in full in an appendix to the applicable Construction Service Agreement.

PJM will also ensure that the Interconnection Customer/Developer has access to the applicable technical requirements of the ITO for parallel operation with the ITO’s system and other matters generally included in Good Utility Practice. Pursuant to section 50.6 of the PJM Tariff, PJM makes documents containing Applicable Technical Requirements and Standards for each Transmission Owner available through its internet site at <http://www.pjm.com/>. Directions to complete a user ID and password for access to the Technical Requirements and Standards are included on the internet site.

Note: Further information about Construction Standards and Technical Requirements applicable to transmission interconnection projects may be found in PJM Manual M-14-C, Section 3.

Operational and Maintenance Requirements

General

Each Interconnected Entity shall operate and maintain, or shall cause the operation and maintenance of, its facilities in a safe and reliable manner in accord with (i) the terms of the PJM OATT, Subpart E; (ii) Applicable Standards; (iii) applicable rules, procedures and protocols set forth in the Tariff and the Operating Agreement, as any or all may be amended from time to time; (iv) Applicable laws and Regulations, and (v) Good Utility Practice. **(OATT at 54.1 and 55.1)**



Transmission Service Rate for TWR

There are two (2) components to transmission service requirements to deliver transactions out of PJM over a merchant transmission HVDC facility.

- *Subscription for transmission service over a HVDC merchant facility itself.*

Assuming that the HVDC facility developer/owner has elected transmission injection and withdrawal rights instead of possible ATC rights, 'transmission service' over the facility would be obtained and scheduled according to the developer/operator's "open season" subscription for service over the HVDC facility, regardless of which RTO retains operational control of the HVDC merchant facility.

- *Transmission service from the source(s) in PJM to the HVDC terminal in PJM.*

The transmission customer can choose either point-to-point transmission service or network service, depending on their respective circumstances. Only point-to-point service is available for service to non-designated loads. The only exception that provides for use of Network Service is for a Network Customer that requests transmission service for load outside of PJM and elects to include its entire load as Network Load for all purposes (**PJM OATT, Part III, Article 31.3**).

Operation and Maintenance of Merchant Network Upgrades

Unless otherwise provided in the Interconnection Service Agreement (Schedule G – Schedule of Non-Standard Terms & Conditions), the Interconnected Transmission Owner that owns the Transmission System facilities to which any Merchant Network Upgrades are connected shall operate and maintain such Merchant Network Upgrades (a) on behalf of and at the expense of the Interconnection Customer/Developer that constructed or caused construction of the pertinent Merchant Network Upgrades and (b) in accordance with the terms of the PJM OATT, subpart E and with agreement between the Interconnected Transmission Owner and the Interconnection Customer/Developer regarding such operation and maintenance. (**OATT at 54.2 & 55.2**).

Operation across Control Area Boundaries

Operation of transmission facilities that span from one control area to another control area require installation of interchange metering points. For additional details regarding operations that span control areas, see PJM Manual M-01, Section 4 and PJM Manual M-03, Section 1.



Provisions included in other PJM Manuals

PJM Manual M-01, “Control Center Requirements” - Refer to the following sections of PJM Manual M-01

- Section 3: Communications & Data Exchange Requirements
- Section 4: Billing Metering Standards, and
- Section 5: Meter Accuracy Standards.

PJM Manual M-02, “Transmission Service Request” - Refer to the following sections of PJM Manual M-02

- Section 1: Transmission Service Request Process
- Section 2: Available Transfer Capability Calculations
- Section 3: System Impact Study

PJM Manual M-03, “Transmission Operations” - Refer to the following sections of PJM Manual M-03

- Section 1: Transmission Operations Requirements
- Section 3: Voltage & Stability Operating Guidelines, and
- Section 4: Reportable Transmission Facility Outages.