Interconnection Service Agreement Implementation Education

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Learning Objectives

Review the role of the PJM Infrastructure Coordination Department in the Interconnection Queue Process

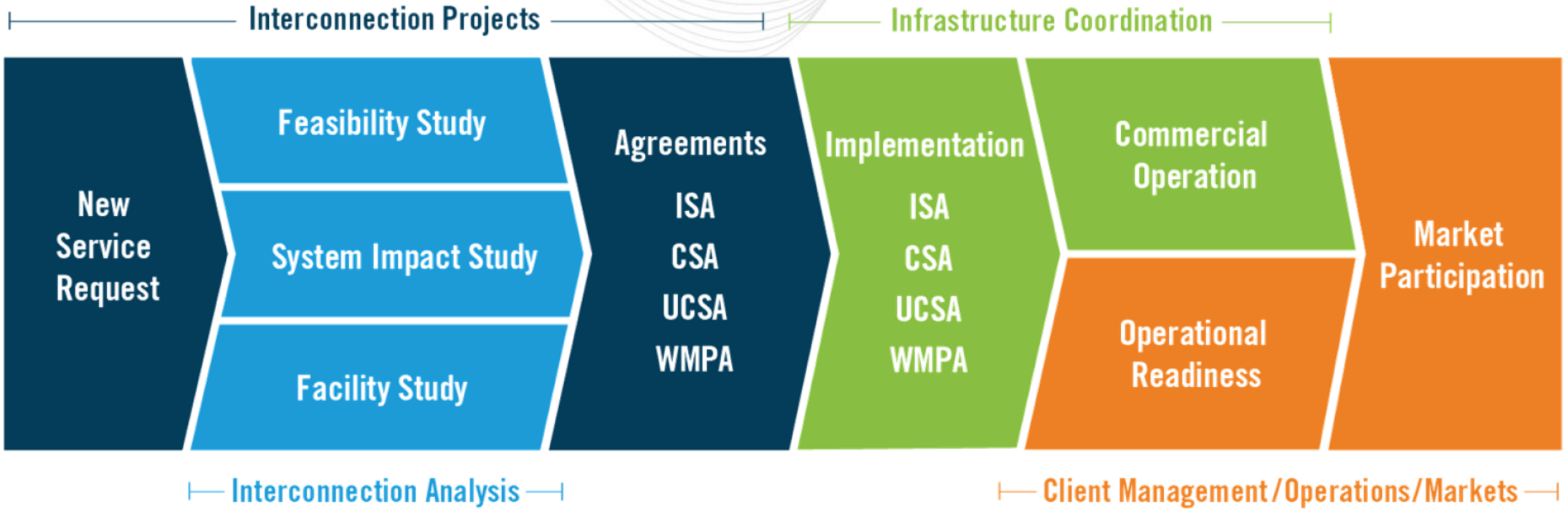
- Overview of Agreements
- Implementation Kick-Off
- Engineering and Construction
- Pre-Commissioning
- In-Service
- Miscellaneous
- Client Mgmt/Ops/Markets

Abbreviation Glossary

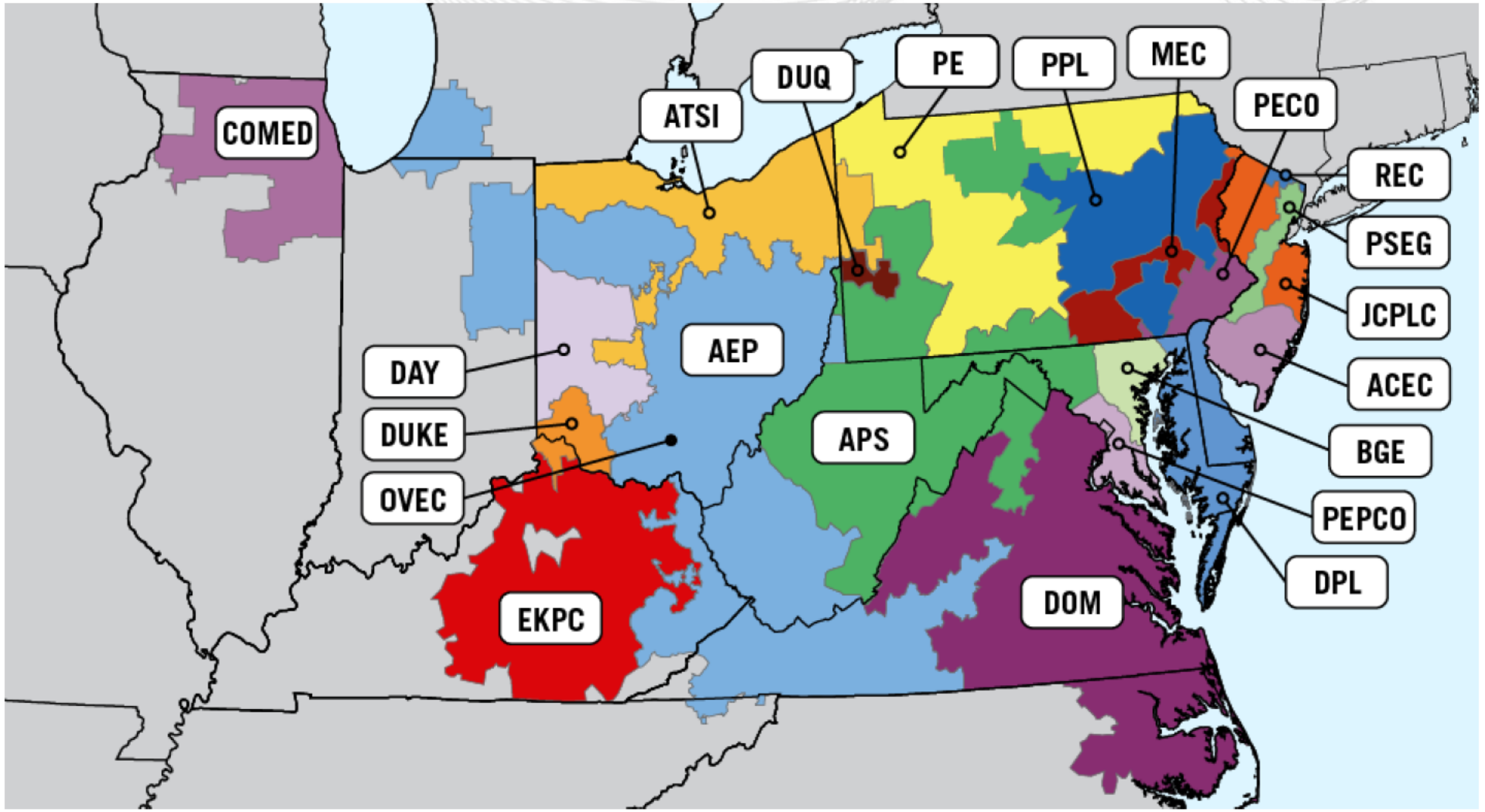
- **CSA/ICSA** – Interconnection Construction Service Agreement
- **IC** – Interconnection Customer, Generator Owner
- **ISA** – Interconnection Service Agreements
- **MFO** – Maximum Facility Output
- **PJM** – Infrastructure Coordination Department
- **TO** – Transmission Owner
- **UCSA** – Upgrade Construction Service Agreement
- **WMPA** – Wholesale Market Participation Agreements

Overview of Agreements

New Generation Process Diagram



PJM Transmission Owner Zones



ISA, CSA and WMPA Overview

Agreement Type	New Service Customer	FERC Jurisdiction?
Interconnection Service Agreements (ISA)	Generation/Transmission Interconnection Customer	Yes
Wholesale Market Participation Agreements (WMPA)	Generation Interconnection Customer	No
Interconnection Construction Service Agreement (CSA)	Generation/Transmission Interconnection Customer	Yes
Upgrade Construction Service Agreement (UCSA)	Transmission Interconnection Customer (Merchant Network Upgrades)	Yes

Implementation Kick-Off

Project Communications and Milestone Tracking

Construction kickoff meeting:

- Transmission Owner
- Interconnection Customer
- PJM

Monthly meetings to review:

- Milestone tracking
- Engineering and design
- Construction status update
  - Site work
  - Equipment delivery
  - Commissioning
- Estimated cost

Security

- Protection for TO and other IC affected by construction work required in dependent ISA
- Security is not a deposit
- Deferred security (optional)
  - Security collection deferred by 120 days
  - At least $200,000 deposit collected, of which $100,000 is non-refundable

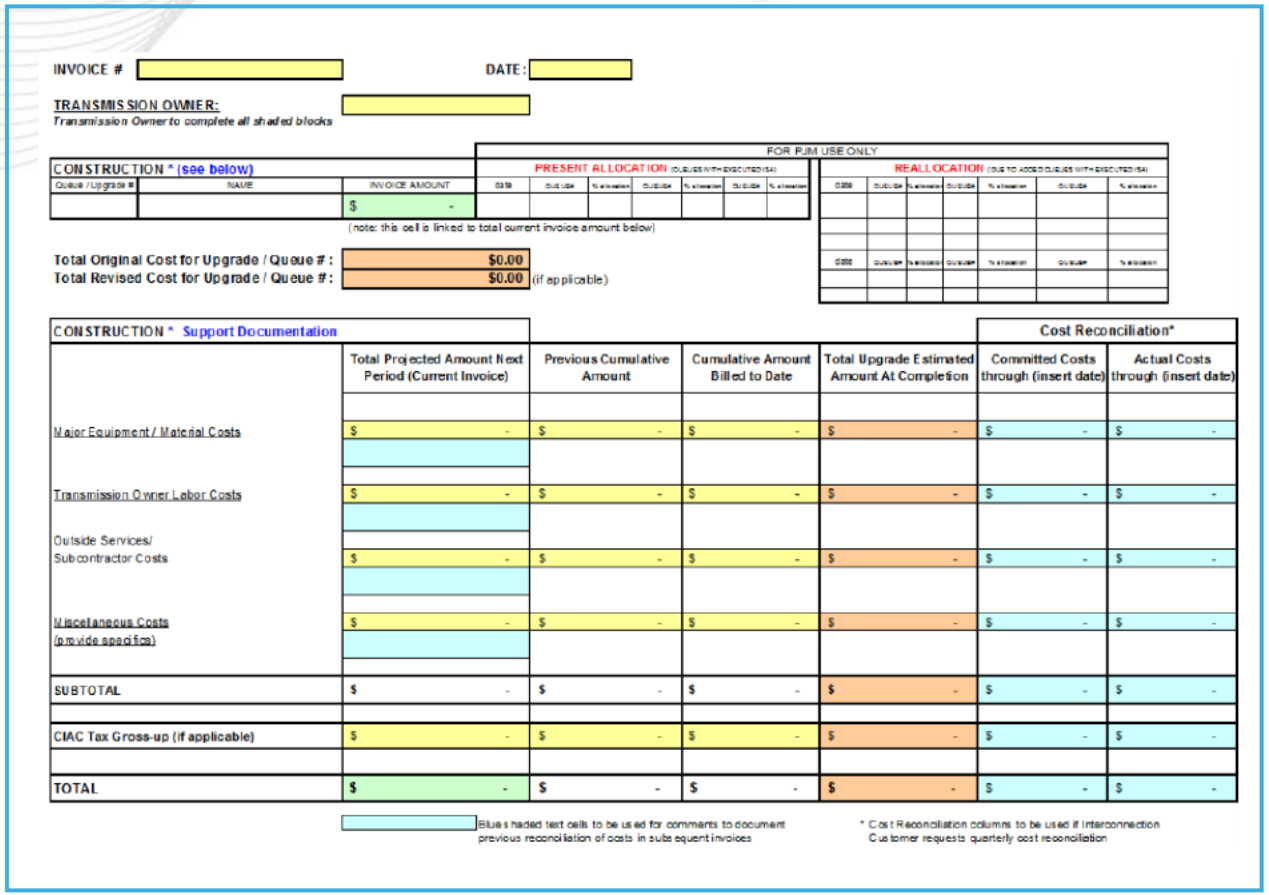
Project Billing Process

Interconnection Service Agreements

- IC responsible for all interconnection facility costs
- Cost tracking
- PJM will send quarterly invoices to IC
- Transmission Owner Standard Invoice Form F
- Refer to invoice for payment information

Wholesale Market Participation Agreements:

- Typically billing directly between TO and IC



INVOICE # _____ DATE: _____

TRANSMISSION OWNER: _____

Transmission Owner to complete all shaded blocks

CONSTRUCTION * (see below)			FOR PJM USE ONLY						
			PRESENT ALLOCATION (QUEUES WITH EXECUTED ISA)						
Queue / Upgrade #	NAME	INVOICE AMOUNT	GWB	QUEUE#	% allocation	QUEUE#	% allocation	QUEUE#	% allocation
		$ -							

(note: this cell is linked to total current invoice amount below)

		FOR PJM USE ONLY						
		REALLOCATION (DUE TO ADDED QUEUES WITH EXECUTED ISA)						
		GWB	QUEUE#	% allocation	QUEUE#	% allocation	QUEUE#	% allocation
		GWB	QUEUE#	% allocation	QUEUE#	% allocation	QUEUE#	% allocation

Total Original Cost for Upgrade / Queue # :	$0.00
Total Revised Cost for Upgrade / Queue #:	$0.00 (if applicable)

CONSTRUCTION * Support Documentation					Cost Reconciliation*	
	Total Projected Amount Next Period (Current Invoice)	Previous Cumulative Amount	Cumulative Amount Billed to Date	Total Upgrade Estimated Amount At Completion	Committed Costs through (insert date)	Actual Costs through (insert date)
Major Equipment / Material Costs	$ -	$ -	$ -	$ -	$ -	$ -
Transmission Owner Labor Costs	$ -	$ -	$ -	$ -	$ -	$ -
Outside Services/ Subcontractor Costs	$ -	$ -	$ -	$ -	$ -	$ -
Miscellaneous Costs (provide specifics)	$ -	$ -	$ -	$ -	$ -	$ -
SUBTOTAL	$ -	$ -	$ -	$ -	$ -	$ -
CIAC Tax Gross-up (if applicable)	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL	$ -	$ -	$ -	$ -	$ -	$ -

Blue shaded text cells to be used for comments to document previous reconciliation of costs in subsequent invoices

* Cost Reconciliation columns to be used if Interconnection Customer requests quarterly cost reconciliation

Interim Interconnection Service Agreements

- Initiates project engineering and procurement prior to completion of Facilities Study
- Binds IC for all costs incurred under Interim ISA
- Does not permit operations
- CSA required before construction

Interim Deliverability Study

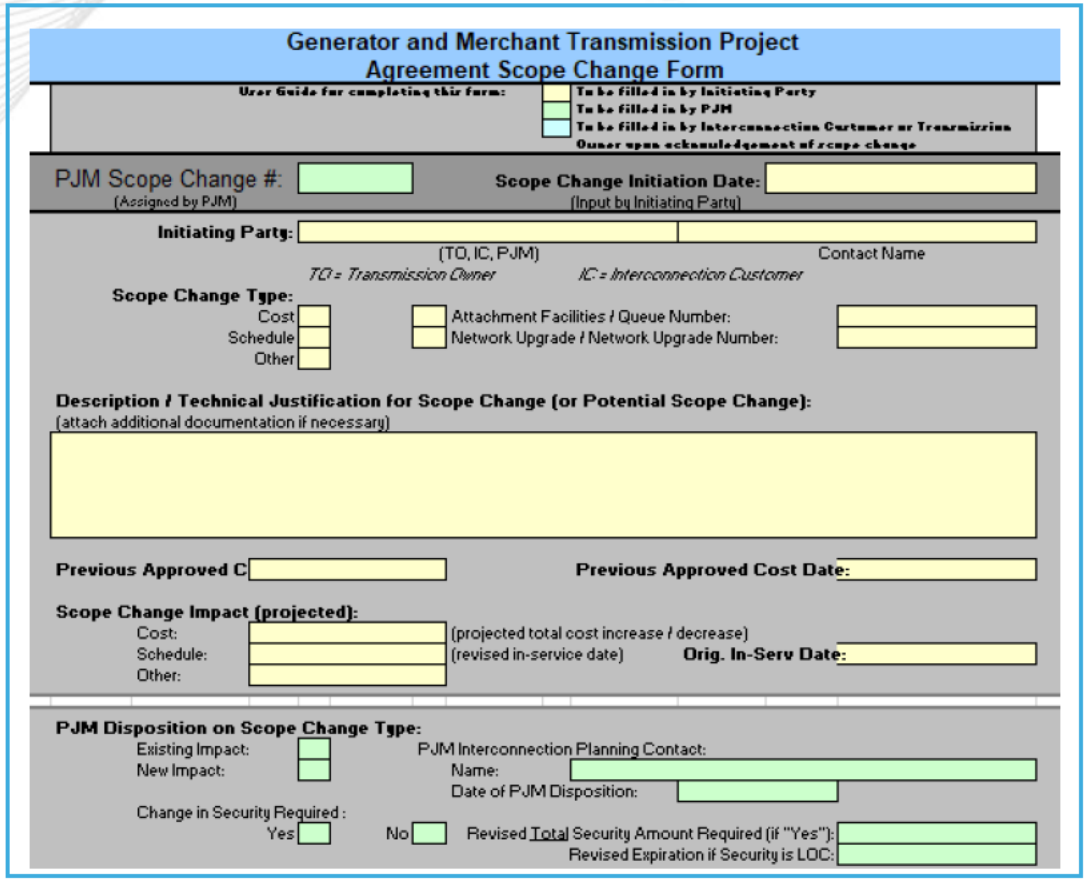
Interim deliverability study required if commercial operation occurs:

- Before the delivery year that the project was evaluated in
- Before completion of all required Upgrades
  - IC will send request for interim deliverability study to PJM if required
  - Study may grant interim Capacity Interconnection Rights

Engineering and Construction

Scope Change Process

- Method of documentation for project changes, including cost or schedule
- Initiated by TO, IC or PJM
- **Not used to change:**
  - Fuel type
  - MFO
  - Interconnection Customer
  - New network upgrades
- **Reference** - Manual 14C, Section 3.4



Generator and Merchant Transmission Project
Agreement Scope Change Form

User Guide for completing this form:
- To be filled in by Initiating Party
- To be filled in by PJM
- To be filled in by Interconnection Customer or Transmission Owner upon acknowledgement of scope change

PJM Scope Change #: (Assigned by PJM)

Scope Change Initiation Date: (Input by Initiating Party)

Initiating Party: (TO, IC, PJM) Contact Name

TO = Transmission Owner *IC = Interconnection Customer*

Scope Change Type:
- Cost
- Schedule
- Other
- Attachment Facilities / Queue Number:
- Network Upgrade / Network Upgrade Number:

Description / Technical Justification for Scope Change (or Potential Scope Change):
(attach additional documentation if necessary)

Previous Approved C

Previous Approved Cost Date:

Scope Change Impact (projected):
- Cost: (projected total cost increase / decrease)
- Schedule: (revised in-service date)
- Other:

Orig. In-Serv Date:

PJM Disposition on Scope Change Type:
- Existing Impact:
- New Impact:

PJM Interconnection Planning Contact:
- Name:
- Date of PJM Disposition:

Change in Security Required:
- Yes
- No

Revised Total Security Amount Required (if "Yes"):

Revised Expiration if Security is LOC:

Outage Coordination

- TO submits all outages for interconnection
- PJM will coordinate outages with TO
- Outage submittal rules:
  - **≤ 5 days,** submit before the first of month, prior to the month of requested start of outage
  - **> 5 days**, submit before the first of month, six months before the start of outage
  - **> 30 days,** submit before Feb. 1 preceding the planning year

Telemetry

CRITERIA

- Capacity resources
- 10 MW (Maximum Facility Output) or larger; greater than 3 MW for solar
- 50 kV or greater
- Meteorological data required for solar and wind

NETWORK TYPE

PJMnet

- Aggregate Generator Facility size greater than 100 MW
- Communication protocol of DNP or ICCP

Jetstream

- Aggregate Generator Facility size less than or equal to 100 MW
- Communication protocol of DNP only

Phasor Measurement Unit (PMU)

- Measures electrical wave forms on the grid in real-time, using a common time source for synchronization
- Required for interconnections 100 MW or larger that entered PJM's queue on or after Oct. 1, 2012
- PMU setup reviewed during telemetry installation
- PMU Guidelines: PJM.com > Media > Markets-Ops > Ops-Analysis

Revenue Metering

- Generator revenue data used for Power Meter submissions

  Power Meter is a tool used to submit generator values for real-time/ balancing energy market settlements

- Ownership identified in ISA

Project Modeling

Network Model

- PJM network model is updated quarterly each year
- PJM adds interconnections to the network model typically one year before in-service
- Required before generator test energy

Build Year	Build	Data Close Date	Target Production Date	Actual Production Date
2020	Spring	11/29/2019	03/10/2020	03/10/2020
	Summer	01/24/2020	05/27/2020	05/27/2020
	Fall	05/01/2020	09/15/2020	
	Winter	08/21/2020	12/08/2020	
2021	Spring	11/13/2020	03/09/2021	
	Summer	01/22/2021	05/18/2021	
	Fall	04/30/2021	09/14/2021	
	Winter	08/27/2021	12/07/2021	
2022	Spring	11/12/2021	03/08/2022	
	Summer	01/21/2022	05/17/2022	
	Fall	04/29/2022	09/13/2022	
	Winter	08/26/2022	12/06/2022	

Voltage Schedule

PJM Default Generator Voltage Schedules									
Voltage Level (kV)	765	500	345	230	161	138	115	69	66
Schedule (kV)	760.0	525.0	350.0	235.0	164.0	139.5	117.0	70.0	67.0
Bandwidth (+/- kV)	+/- 10.0	+/- 8.0	+/- 7.0	+/- 4.0	+/- 4.0	+/- 3.5	+/- 3.0	+/- 2.0	+/- 1.5

TO will provide voltage schedules and bandwidth or specify the PJM default voltage schedule

Breach / Cure / Default

- **Examples of breach:**
  - Missed milestones
  - Non-payment of invoices
- An IC in breach is provided a breach notice from PJM describing steps required to cure the breach
- IC is required to clear the breach within 30 days
- An IC that does not cure the breach will be found in default of their agreement

Pre-Commissioning

Operational and Market Readiness

- Six months prior to energization, Infrastructure Coordination coordinates with the Client Manager Project Team to prepare the resource for operational and market readiness
- Client Manager Project Team role:
  - Coordinate with IC and various PJM departments
  - Ensure all proper market documents are in place
  - Further details on these procedures will be forthcoming in a future education session in 2021

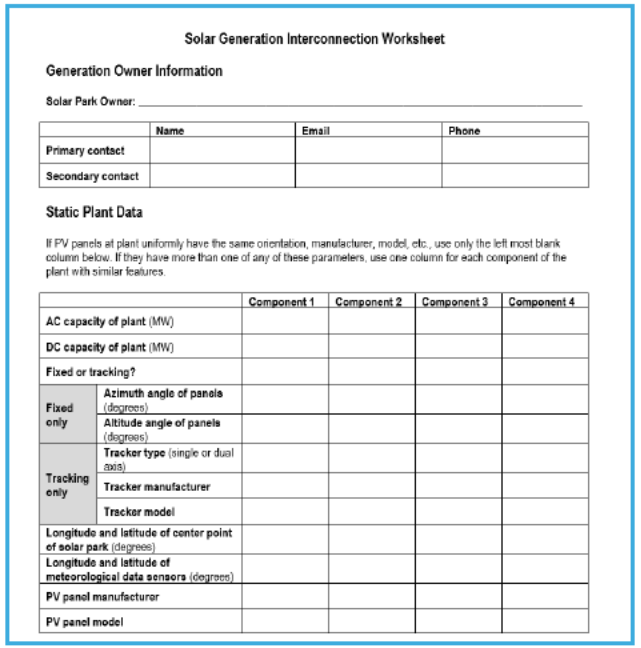
Solar and Wind Forecast Worksheets

DATA

- IC is required to provide solar panel or wind turbine data to PJM
- PJM sends forecast data request to IC

FORECAST

- Forecast data request worksheet must be sent back to PJM two months before in-service
- After generator is producing at or near full capacity and good quality real-time data is obtained



Solar Generation Interconnection Worksheet

Generation Owner Information

Solar Park Owner: _____

	Name	Email	Phone
Primary contact			
Secondary contact			

Static Plant Data

If PV panels at plant uniformly have the same orientation, manufacturer, model, etc., use only the left most blank column below. If they have more than one of any of these parameters, use one column for each component of the plant with similar features.

		Component 1	Component 2	Component 3	Component 4
AC capacity of plant (MW)					
DC capacity of plant (MW)					
Fixed or tracking?					
Fixed only	Azimuth angle of panels (degrees)				
	Altitude angle of panels (degrees)				
Tracking only	Tracker type (single or dual axis)				
	Tracker manufacturer				
	Tracker model				
Longitude and latitude of center point of solar park (degrees)					
Longitude and latitude of meteorological data sensors (degrees)					
PV panel manufacturer					
PV panel model					

Test Energy

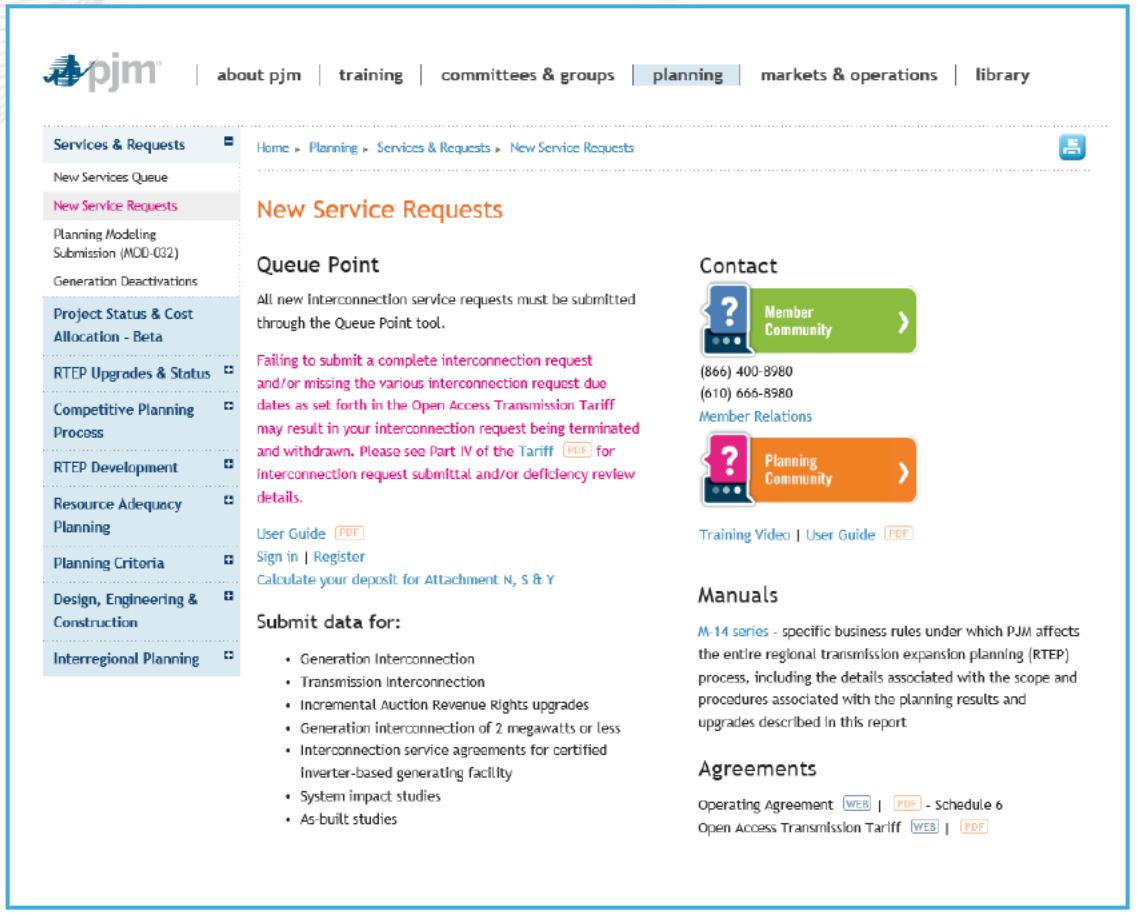
- Energy generated for a predetermined period by an IC interconnecting for the first time
- **IC responsibilities**:
  - Provide PJM with a test energy schedule
  - Notify Dispatch Operations at least 20 minutes prior to test energy
  - Verify real-time telemetry and billing account with PJM (required for Power Meter compensation)
- **PJM responsibilities:**
  - Validate facility output using real-time data
  - Update generator records on PJM.com
  - Check Power Meter account activation
- **For capacity resources**, refer to PJM Manual 21 for additional testing requirements

In-Service

As-Built Submission

- IC required to provide updated generator modeling data from ISA milestone requirements
- Required within one month following commercial operation
- **Submitted using Queue Point User Guide:**

  PJM.com > Media > eTools > Planning-Center



Final Invoice

Completion of Construction	▪ TO sends final invoice or credit, after a true-up of final costs, to PJM within 120 days after completion of construction
Cash Security	▪ Cash security can be used for the final invoice with approval from Interconnection Customer
Financial Closeout	▪ PJM will return remaining security to IC after financial closeout

Four Conditions to Terminate CSA:

Completion of Construction
All Interconnection Facilities

Transfer of Title
(if applicable)

Final Payment
of all costs

Delivery to the TO
of final as-built drawings

Miscellaneous

Billing Disputes

- PJM facilitates the dispute resolution process with the TO and IC for billing disputes
- A disputing party initiates in writing to PJM
- PJM responsibilities:
  - Confirm the dispute initiation documentation meets Tariff requirements
  - Identify an appropriate dispute resolution path that the issue will follow
- TO and PJM continue to perform responsibilities if IC follows Tariff requirements and
  - Makes payments that are not under dispute
  - Pays the portion of the invoice in dispute to the Transmission Provider or to an independent escrow account

Assignment

- IC may make an assignment of their agreement in connection with the sale of queue projects
- Agreement to Amend or Consent to Assignment
- PJM will coordinate the documentation for the assignment

Prior to execution, it is advisable to contact PJM Legal, the project PJM Client Manager, or the project PJM Interconnection Coordinator to ensure this document is the most recent Consent To Assignment Agreement template.

Consent Template for Interconnection Customer Assignments (except to Lenders)
April 20, 2020

CONSENT TO ASSIGNMENT AGREEMENT
By and Among
PJM Interconnection, L.L.C.
and
[Name of Interconnection Customer]
and
[Name of Assignee]
and
[Name of Interconnected Transmission Owner]
(PJM Queue Position #___)

DRAFT

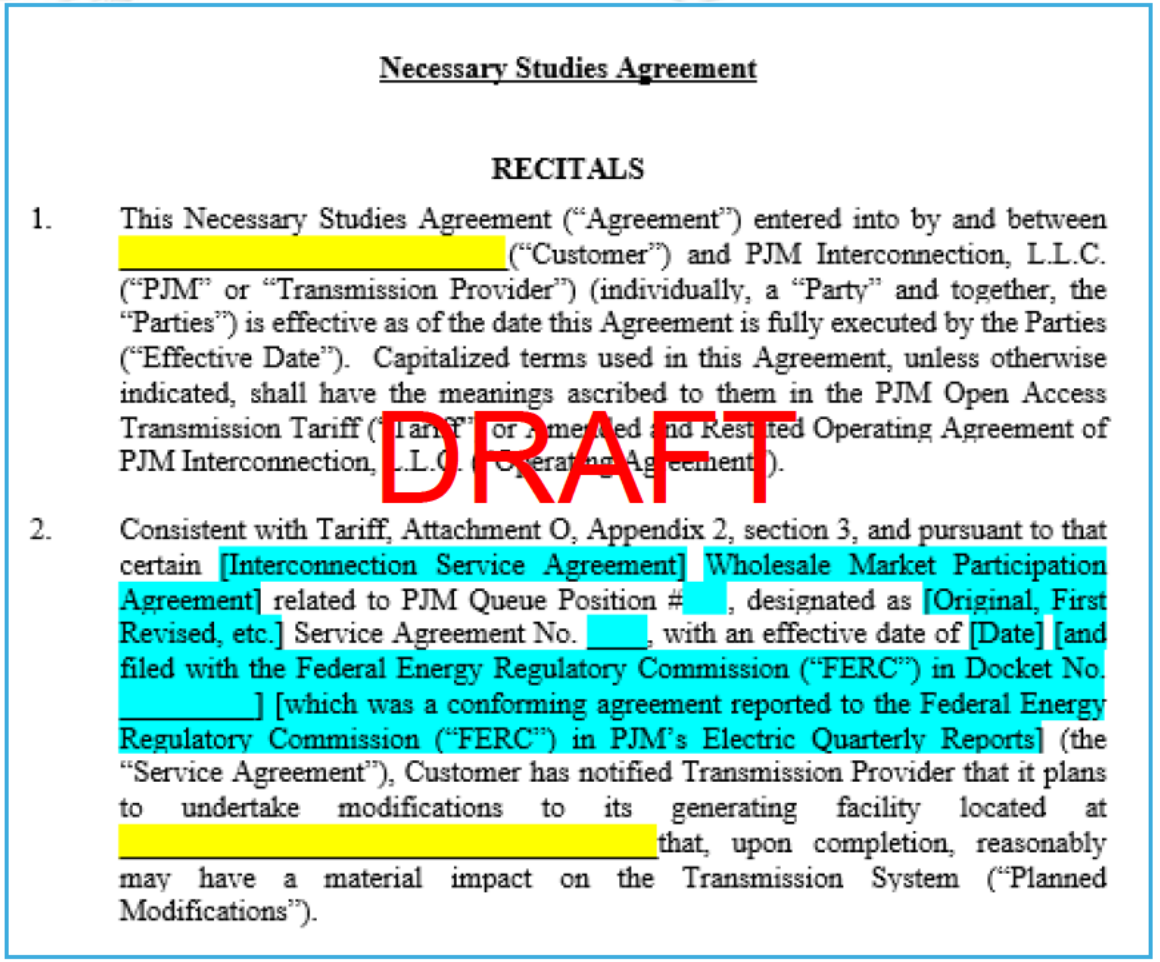
This Consent to Assignment Agreement ("Consent Agreement") is entered into by and among PJM Interconnection, L.L.C. ("PJM" or "Transmission Provider"), ("Interconnection Customer"), ("Assignee"), and ("Interconnected Transmission Owner") (each a "Party," and collectively, the "Parties").

WHEREAS, PJM, Interconnection Customer, and Interconnected Transmission Owner are parties to that certain [Interconnection Service Agreement] [Interim Interconnection Service Agreement] [Interconnection Construction Service Agreement] [Upgrade Construction Service Agreement] related to PJM Queue Position #___, designated as [Original, First Revised, etc.] Service Agreement No. ____, with an effective date of [Date] [and filed with the Federal Energy Regulatory Commission in Docket No. _____] [which was a conforming agreement reported in PJM's Electric Quarterly Reports] (the "Assigned Agreement(s)");

Necessary Study

- Required for updates to previously submitted data
- Changes to turbines, inverters and transformers
- **PJM responsibilities:**
  - Collect the study deposit
  - Coordinate the completion of the Necessary Study Agreement
  - Coordinate the submission of the Queue Point study data
- **Queue Point User Guide :**

  PJM.com > Media > eTools > Planning-Center



Necessary Studies Agreement

RECITALS

1. This Necessary Studies Agreement ("Agreement") entered into by and between _____ ("Customer") and PJM Interconnection, L.L.C. ("PJM" or "Transmission Provider") (individually, a "Party" and together, the "Parties") is effective as of the date this Agreement is fully executed by the Parties ("Effective Date"). Capitalized terms used in this Agreement, unless otherwise indicated, shall have the meanings ascribed to them in the PJM Open Access Transmission Tariff ("Tariff") or Amended and Restated Operating Agreement of PJM Interconnection, L.L.C. ("Operating Agreement").

2. Consistent with Tariff, Attachment O, Appendix 2, section 3, and pursuant to that certain [Interconnection Service Agreement] Wholesale Market Participation Agreement] related to PJM Queue Position # ___, designated as [Original, First Revised, etc.] Service Agreement No. ____, with an effective date of [Date] [and filed with the Federal Energy Regulatory Commission ("FERC") in Docket No. _____] [which was a conforming agreement reported to the Federal Energy Regulatory Commission ("FERC") in PJM's Electric Quarterly Reports] (the "Service Agreement"), Customer has notified Transmission Provider that it plans to undertake modifications to its generating facility located at _____ that, upon completion, reasonably may have a material impact on the Transmission System ("Planned Modifications").

Project Suspension

- One or three years available, depending on material modification study
- Milestone dates are extended coextensively based on the duration of suspension
- TO work is stopped during suspension
- IC is required to send a suspension letter to PJM
  - Must include expected duration of suspension

Operational and Market Readiness

Agreement Implementation (Construction)

PJM's Responsibilities:

- PJM Membership and/or Agreements
- PJM Settlement account
- Data communications and points exchange
- Market Model
- Market participation
- Revenue meter
- PJM Tool access
- PJM Operator training and certification

Key Takeaways

- Infrastructure Coordination is responsible to ensure all ISA/ICSA milestones are achieved during project implementation phase
- Status update meetings with IC and TO to review construction status
- PJM sends quarterly invoices to the IC for all interconnection facility costs
- PJM uses scope change process to document project changes
- PJMnet or Jetstream networks are used to communicate real-time telemetry with PJM
- Prior to generation, IC must communicate test energy schedule with PJM
- IC required to submit as-built data to PJM within one month following commercial operation
- IC required to send updates for previously submitted data to PJM for Necessary Study

Appendix

PJM Manual Reference

IMPLEMENTATION KICK-OFF

- **Project Communications and Milestone Tracking** – Manual 14C, Section 3.1 and 3.8
- **Security** – Manual 14C, Section 1.1.2 and Manual 14A, Section 5.4.3
- **Project Billing Process** – Manual 14C, Section 3.2 and 3.3
- **Interim ISA** – Manual 14C, Section 1.4
- **Interim Deliverability** – Manual 14C, Section 1.1.3.2

ENGINEERING & CONSTRUCTION

- **Scope Change Process** – Manual 14C, Section 3.4
- **Outage Coordination** – Manual 14C, Section 3.6 and Manual 03, Section 4.2.1
- **Telemetry** – Manual 14D, Section 4.1 and 4.2.2
- **Project Modeling** – Manual 3A, Section 1.2 and 3.2
- **Metering** – Manual 14D, Section 4.2 & Manual 28, Section 1A
- **Voltage Schedule** – Manual 03, Section 3.11
- **PMU** – Manual 14D, Section 4.3
- **Breach/Cure/Default** – Manual 14C, Section 3.11

PRE-COMMISSIONING

- **Operational and Market Readiness** – Manual 14C, Section 2.4
- **Test Energy** – Manual 14C, Section 3.8.4 and Manual 14D, Section 6.3.3 and Manual 21
- **Solar and Wind Forecast** – Manual 14D, Section 8.2.1 & 12.2.1

IN-SERVICE

- **As-Built Submission** – Manual 14C, Section 3.9
- **Final Invoice** – Manual 14C, Section 3.3.2.3
- **Termination of CSA** – Manual 14C, Section 1.2 and ICSA, Appendix 2, Section 14.1.1

MISCELLANEOUS

- **Dispute Resolution** – Manual 14C, Section 3.10
- **Assignment** – Manual 14C, Section 3.12
- **Suspension** – Manual 14C, Section 3.7