COMMISSIONING PLAYBOOK – SOLAR POWER PROJECT

Comprehensive Commissioning Guide for Solar Project Execution

Part 6/6 | Playbook Series for Project Nav Saksham

Developed for Torrent Power

Revision	Date	Purpose of Issue	Prepared by	Reviewed by	Approved by

Contents

Abstract

This playbook is a comprehensive guide to the Commissioning of solar projects at Torrent Power. Its primary objective is to standardize, streamline, and optimize Commissioning activities, ensuring continued execution excellence as the organization scales up the RE portfolio.

Each chapter outlines clear process steps, process maps, RACI matrices, and KPIs to further streamline operations, ensuring consistency and efficiency across projects. By establishing standardized operating procedures (SoPs) and integrating best practices, this playbook will support Torrent Power in scaling its solar projects more effectively, while maintaining high standards of quality and performance.

Objectives

- **Establish a Standardized Approach –** Provide a unified, repeatable methodology for the Commissioning function, ensuring consistency across all solar projects
- **Streamline Commissioning Processes** – Optimize key stages through well-defined steps and roles, enabling efficient project execution
- **Support Scalable Growth** – Facilitate Torrent Power's expansion in solar energy by developing a robust Commissioning framework that adapts to increasing project complexity
- **Enhance Collaboration** – Foster seamless communication and decision-making by clearly defining processes, roles, and stakeholder expectations

Scope

This playbook outlines the structured approach to Commissioning of solar projects at Torrent Power. The scope includes:

- **Process Steps –** Detailed guidelines for each stage of the Commissioning process, from visual inspections to equipment testing to first-time charging and commercial operation. These steps ensure a standardized, systematic approach to Commissioning activities, aligning with project objectives and timelines.
- **Process Maps –** Visual representations of key commissioning steps, illustrating the sequence of activities, approval stages, and decision points. These maps enhance clarity, improve cross-functional collaboration, and ensure alignment across teams.
- **KPIs** – Defined metrics to track performance throughout the commissioning process, covering areas such as pre-commissioning testing, approval success and timelines, and performance testing.
- **RACI –** Clear RACI matrices that define roles and responsibilities for each step of the Commissioning process. This fosters accountability and transparency, ensuring each stakeholder understands their involvement at every step, from grid compliance check to commercial operation.

This playbook serves as the foundation for establishing consistent and efficient Commissioning practices, supporting the successful execution of future solar projects at Torrent Power.

Coverage

The document covers the processes that make up the Commissioning stage. It is structured as follows –

- **Chapter 1 – Construction Inspection –** Outlines the procedure that ensures all infrastructure is physically complete and verified through joint inspections before moving to the pre-commissioning tests.

- **Chapter 2 – Pre-commissioning Testing –** Describes the process that validates the functionality and safety of installed equipment through structured testing and certification by respective OEM and Third-party testing agency.

- **Chapter 3 – Approvals for First-time Charging**

    - **Chapter 3.1 – RLDC User Registration –** Describes the process that registers the project with the Regional Load Dispatch Centre.
    - **Chapter 3.2 – CEIG Approval and FTC Intimation to RLDC –** Describes the process that secures regulatory approvals required to energize the system for the first time and begin commercial operation.

- **Chapter 4 – First-time Charging and Commercial Operation –** Describes the process that facilitates the energization and testing of system components, leading to issuance of successful trial and COD certificates.

- **Chapter 5 – Performance Testing & EPC HOTO –** Describes the process that starts off with successful performance testing followed by the handover to the Project Team by EPC Team and finalization of EPC obligations.

- **Chapter 6 – Project Handover to O&M Team –** Describes the process that ensures the formal transfer of operational responsibility that follows successful performance testing, and consists of O&M team training, and contractual compliance checks.

Who is this playbook for?

- **Project Team** – Coordinates overall execution, defines testing procedures, and ensures compliance with project timelines and technical requirements. Verifies and signs off at key commissioning stages.

- **Regulatory Team** – Ensures all regulatory, safety, and contractual obligations are met during commissioning. Supports dispute resolution and prepares necessary legal documentation for COD and HOTO.

- **EPC Team** – Oversees infrastructure completion, engages third-party testers, and resolves commissioning issues. Provides technical documentation, testing certifications, and supports fault resolution.

- **O&M Team** – Assumes responsibility for plant operation post-commissioning, participates in testing, and reviews equipment handover, ensuring smooth transition into long-term operations.

- **Commercial Team** – Tracks COD milestones, and ensures commercial terms align with project progress. Supports financial approvals tied to commissioning and performance.

Chapter 1 – Construction Inspection

1.1 Process Steps

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
S	– EPC Project Manager (EPM) informs the Project Manager (PM) that at least 'N'[1] DC blocks'[2] infrastructure and the entire AC Infrastructure[3] has been completed *EPC Project Manager serves as the EPC SPOC for the entire commissioning process*					-
P1	– PM informs Chief O&M that construction is complete and requests him to appoint a Commissioning POC (CPOC) – PM directs Site Manager (SM) to conduct the inspection of the completed construction					-
P2	– SM directs the Site QHSSE and CPOC to conduct an inspection of the block					-
P3	– SITE QHSSE requests EPC SPOC to individually appoint respective Civil and Electrical EPC engineers for the inspection of the DC blocks[4]					0.5
P4	– EPC SPOC appoints Civil and Electrical EPC engineers for the inspection					
P5	– SITE QHSSE requests Site Civil and Electrical Heads, and CPOC, to accompany him for the respective inspection					
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] N will be defined in the Power Purchase Agreement as the minimum number of blocks (in MW) that can be commissioned at once
[2] 12.5 MW block size is considered here
[3] AC Infrastructure consists of the Inverter Control Room, Main Control Room, Switchyard, DP Yard and Transmission Lines with associated earthing and cabling
[4] Inspection of Inverter, IDT and ICR will be done with every DC block. Inspection of AC Infrastructure along with PSS and EHV will take place for the first set of DC Blocks.

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
P6	– SITE QHSSE leads the inspection of the block, and logs all the deviations into a punch point list *Construction checklist will also be checked to ensure open observations / NCRs have been closed*	**I1**	Inspection Checklist	**O1**	Punch Point List	0.5
P7	– SITE QHSSE ensures signatures on the punch point list from the EPC Engineer and respective Site Functional[1] Head *Commissioning POC has an observatory role at this stage*					-
P8	– EPC SPOC closes all the critical punch points and prepares the compliance report			**O2**	Compliance Report	2
P9	– EPC SPOC shares the compliance report with the SITE QHSSE for approval					0.5
P10	– SITE QHSSE provides feedback and requests EPC SPOC to re-share for approval					
P11	– SITE QHSSE signs-off[2] on the compliance report and shares it with the SM and PM					
P12	– PM directs SM to begin pre-commissioning					-
E	– SM notifies the EPC SPOC, SEL and CPOC to initiate the pre-commissioning tests					***Total –*** *3 – 4 weeks*
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] Civil or Electrical
[2] SITE QHSSE ensures all critical punch points have been resolved

1.2 – RACI

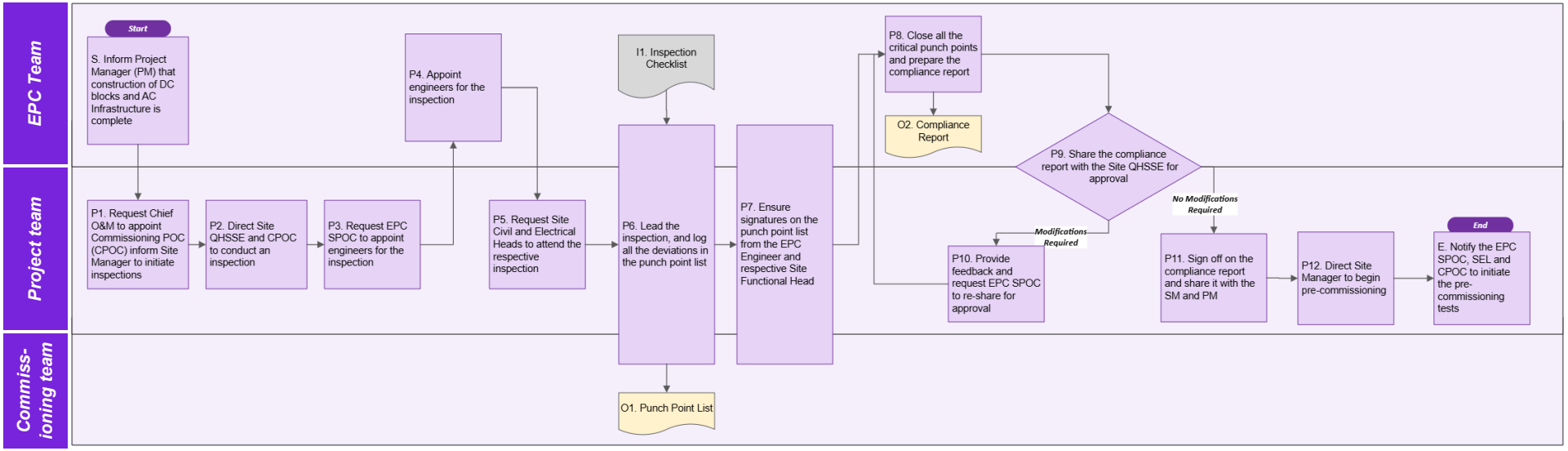
#	Key Task	Responsible	Accountable	Consulted	Informed
S	Inform Project Manager (PM) that construction of DC blocks and AC Infrastructure is complete	EPC SPOC			Project Manager
P1	Inform SM and Chief O&M about construction completion and request for Commissioning POC appointment	Project Manager			Chief O&M, Site Manager
P2	Direct Site QHSSE and Commissioning POC to conduct an inspection	Site Manager			Site QHSSE, Commissioning POC
P3	Request EPC SPOC to appoint EPC engineers for the inspection	Site QHSSE			EPC SPOC
P4	Appoint Civil and Electrical EPC engineers for the inspection	EPC SPOC			EPC Engineers
P5	Request Site Civil and Electrical Leads and CPOC to attend the respective inspection	Site QHSSE			Site Civil Lead, Site Electrical Lead, CPOC
P6	Lead the visual inspection of the block, and log all the deviations in a punch point list	Site QHSSE		EPC Engineers, Site Civil Lead, Site Electrical Lead, CPOC	
P7	Ensure signatures on the punch point list from the EPC Engineer and respective Site Functional[1] Head	Site QHSSE	Site QHSSE	EPC Engineers, Site Civil Lead, Site Electrical Lead, CPOC	
P8	Close all the critical punch points and prepare the compliance report	EPC SPOC			
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End					

[1] Civil or Electrical

#	Key Task	Responsible	Accountable	Consulted	Informed
P9	Share the compliance report with the SITE QHSSE for approval	EPC SPOC		Site QHSSE	
P10	Provide feedback and request EPC SPOC to re-share for approval	Site QHSSE			EPC SPOC
P11	Sign off on the compliance report and share it with the SM and PM	Site QHSSE	Site QHSSE		Site Manager, Project Manager
P12	Direct Site Manager to begin pre-commissioning	Project Manager			Site Manager
E	Notify the EPC SPOC, SEL and CPOC to initiate the pre-commissioning tests	Site Manager	Site Manager		EPC SPOC, Site Electrical Lead, Commissioning POC

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

1.3 – Process Map



[1] **Map Glossary** - **QHSSE:** Quality, Health, Safety, Security, Environment

Chapter 2 – Pre-commissioning Testing

2.1 Process Steps

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
S	– Site Manager (SM) notifies the EPC SPOC, Site Electrical Lead (SEL) and Commissioning POC (CPOC) to initiate the pre-commissioning tests of the DC Block					-
P1	– EPC SPOC identifies all the major[1] equipment that must be tested *For major equipment, Third-party Testing is done in the presence of OEM*					-
P2	– EPC SPOC selects Third-party Testing (TPT) agencies to conduct the requisite tests			**O1**	List of selected TPT agencies	0.5
P3	– EPC SPOC notifies the SEL and CPOC of the selected TPT agencies for each major equipment *Each TPT agency nominates an engineer to serve as the TPT SPOC*	**I1**	List of selected TPT agencies			-
P4	– EPC SPOC prepares and shares the testing procedure and pre-commissioning checklist, as per FQAP, with the SEL			**O2** **O3**	Testing Procedure Pre-commissioning checklist	-
P5	– SEL shares the documents with CPOC and requests for sign-off					-
P6	– CPOC recommends changes, if required, and provides sign-off on the documents – CPOC shares the documents with SEL					0.5
P7	– SEL incorporates recommended changes, signs-off on the documents and shares them with the EPC SPOC					

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

[1] Major equipment includes Inverter Duty Transformer (IDT), HT Panel, LT Panel, Inverter

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
P8	– EPC SPOC shares the approved testing procedure document and pre-commissioning checklists with the TPT SPOC					-
P9	– TPT SPOC conducts the requisite tests, in the presence of OEM SPOC, SEL, EPC SPOC and CPOC, and documents the results in the checklist	**I2**	Pre-commissioning checklist			1
P10	– TPT SPOC signs the checklist containing the test results and shares it with the OEM SPOC and EPC SPOC					-
P11	– OEM SPOC reviews the checklist and releases the OEM Clearance Certificate to the EPC SPOC			**O4**	OEM Clearance Certificate	0.5
P12	– EPC SPOC, for the non-major equipment, assigns testing engineers to conduct the pre-commissioning tests					-
P13	– EPC Testing Engineers conduct the tests, in the presence of EPC SPOC, SEL and CPOC, and documents the results in the pre-commissioning checklist	**I2**	Pre-commissioning checklist			1 (parallel to P9)
P14	– EPC SPOC signs off on the pre-commissioning checklist and shares it with the CPOC, along with the OEM Clearance Certificates					-
P15	– CPOC signs-off on the checklist and shares it with the SEL					0.5
P16	– SEL signs off on the checklist and shares with the Site Manager and PM – SEL informs them that pre-commissioning tests are complete					
E	– Project Manager gives clearance to the EPC SPOC					***Total – 3 – 4 weeks***

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

2.2 – RACI

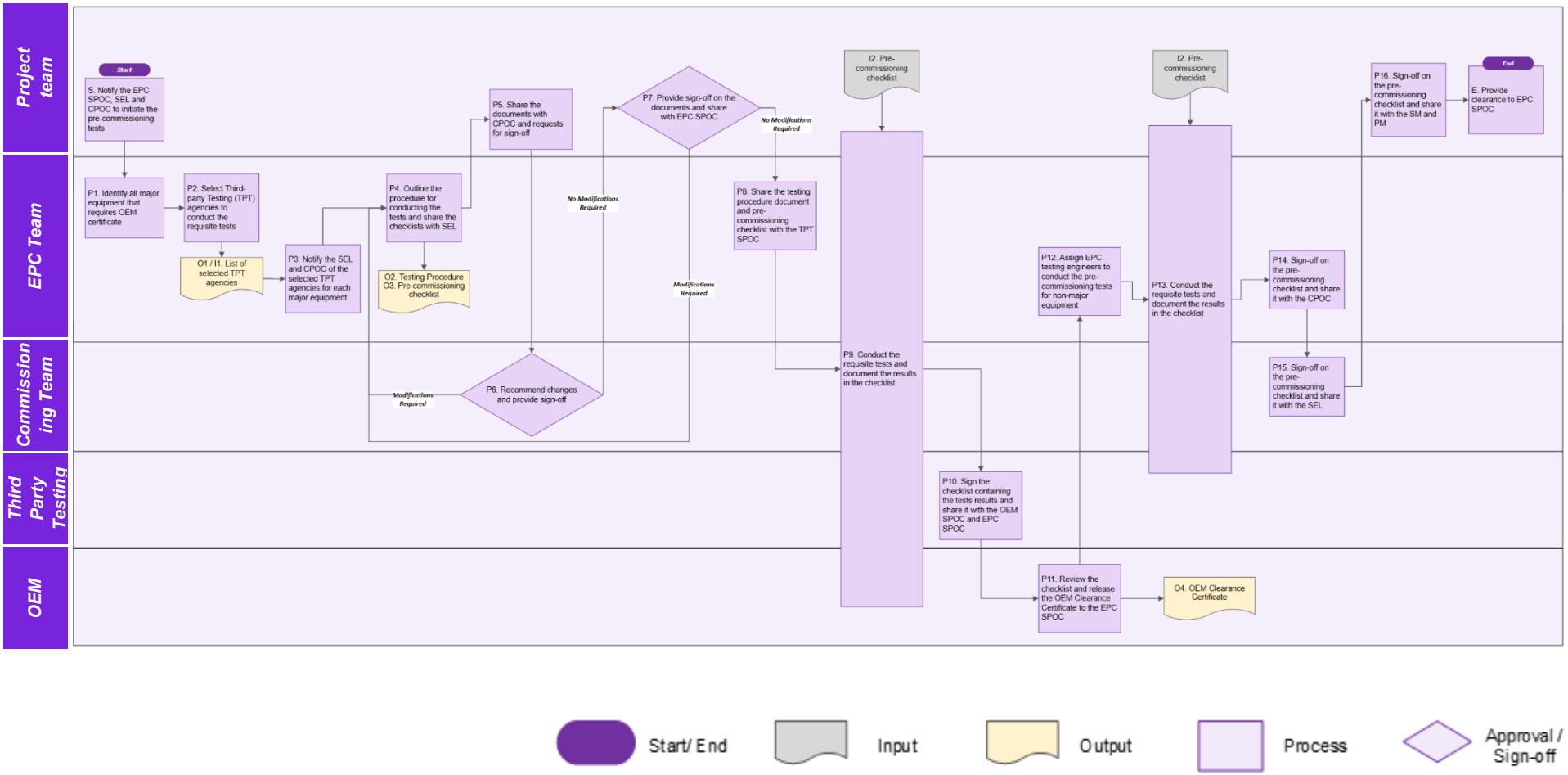
#	Key Task	Responsible	Accountable	Consulted	Informed
S	Notify the EPC SPOC, SEL and CPOC to initiate the pre-commissioning tests	Site Manager			EPC SPOC, SEL, CPOC
P1	Identify all major equipment that requires OEM certificate	EPC SPOC			
P2	Select Third-party Testing (TPT) agencies to conduct the requisite tests	EPC SPOC			
P3	Notify the SEL and CPOC of the selected TPT agencies for each major equipment	EPC SPOC			SEL, CPOC
P4	Outline the procedure for conducting the tests and share the checklists with SEL	EPC SPOC			SEL
P5	Share the documents with CPOC and requests for sign-off	SEL		CPOC	
P6	Recommend changes and provide sign-off	CPOC			SEL
P7	Provide sign-off on the documents and share with EPC SPOC	SEL			EPC SPOC
P8	Share the approved testing procedure document and pre-commissioning checklist with the TPT SPOC	EPC SPOC			TPT SPOC
P9	Conduct the requisite tests and document the results in the checklist	TPT SPOC		SEL, OEM SPOC, EPC SPOC, CPOC	
P10	Sign the checklist containing the tests results and share it with the OEM SPOC and EPC SPOC	TPT SPOC			OEM SPOC, EPC SPOC

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

#	Key Task	Responsible	Accountable	Consulted	Informed
P11	Review the checklist and release the OEM Clearance Certificate to the EPC SPOC	OEM SPOC			EPC SPOC
P12	Assign EPC testing engineers to conduct the pre-commissioning tests for non-major equipment	EPC SPOC			EPC Engineers
P13	Conduct the tests and documents the results in the pre-commissioning checklist	EPC Engineers		EPC SPOC, SEL, CPOC	
P14	Sign-off on the pre-commissioning checklist and share it with the CPOC	EPC SPOC			CPOC
P15	Sign-off on the checklist and share it with SEL	CPOC			SEL
P16	Sign-off on the checklist and share it with SM and PM	SEL			SM, PM
E	Provide clearance to EPC SPOC	Project Manager			EPC SPOC

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

2.3 – Process Map



[1] **Map Glossary** - **PM:** Project Manager

Chapter 3 – Approvals for First Time Charging

Chapter 3.1 – RLDC User Registration

3.1.1 Process Steps

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
S	– Chief Regulatory directs Regulatory Approvals Head (RAH)[1] to initiate the RLDC[2] approval process for First Time Charging (FTC)					-
P1	– RAH initiates collection[3] of documents required for RLDC User Registration *RLDC User Registration requires (i) grid compliance report and (ii) technical and modelling data*					-
P2	– RAH requests the EPC SPOC to prepare the grid code compliance report					-
P3	– EPC SPOC selects and onboards a third-party consultant to prepare the grid code compliance report					-
P4	– EPC SPOC ensures the consultant conducts the required simulations – EPC SPOC receives the grid code compliance report from the consultant			**O1**	Grid Code Compliance Report	3
P5	– EPC SPOC shares the Grid Code Compliance Report with the RAH					-
P6	– RAH reviews the report and seeks clarifications if any					-
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] The RAH's position has been defined in the to-be organizational structure, as part of the regulatory team
[2] RLDC for CTU connectivity and SLDC (State Load Dispatch Centre) for STU connectivity
[3] This typically takes place a year prior to the anticipated FTC date

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
P7	– EPC SPOC provides answers for any clarifications from the RAH					0.5
P8	– RAH requests Solar Engineering Head (SEH) to provide the necessary technical and modelling data, and shares the relevant annexure templates containing data requirements	**I1**	Data Requirement Annexures			-
P9	– RAH receives the requisite data from SEH and prepares the annexures[1] required for user registration	**I2**	Technical and Modelling Data	**O2**	RLDC User Registration Document	0.5
P10	– RAH shares the RLDC User Registration Document with Chief Regulatory for sign-off					-
P11	– Chief Regulatory signs-off on the RLDC User Registration Document and shares the signed copy with RAH					0.5
P12	– RAH submits the user registration documents with the RLDC					-
P13	– RAH receives queries, if any, from the RLDC – RAH shares answers for the queries with the RLDC					0.5
E	– RAH receives confirmation of User registration from the RLDC, and informs the Chief Regulatory and Project Manager					***Total –*** *5 – 6 weeks*
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] This takes place atleast 6 months prior to the anticipated FTC date

3.1.2 – RACI

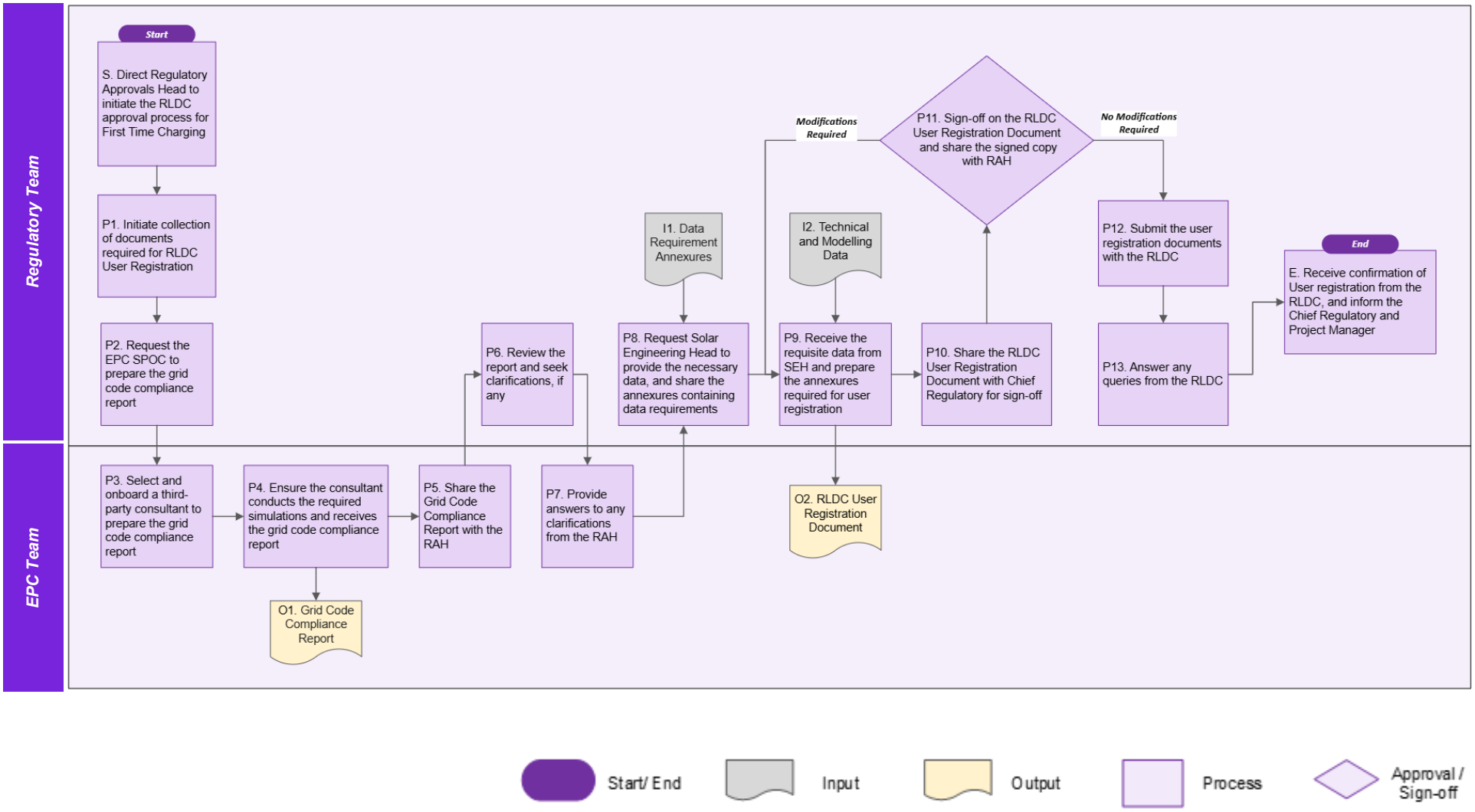
#	Key Task	Responsible	Accountable	Consulted	Informed
S	Direct Regulatory Approvals Head (RAH) to initiate the RLDC approval process for First Time Charging (FTC)	Chief Regulatory			Regulatory Approvals Head
P1	Initiate collection of documents required for RLDC User Registration	Regulatory Approvals Head			
P2	Request the EPC SPOC to prepare the grid code compliance report	Regulatory Approvals Head			EPC SPOC, Project Manager
P3	Select and onboard a third-party consultant to prepare the grid code compliance report	EPC SPOC			Project Manager
P4	Ensure the consultant conducts the required simulations and receives the grid code compliance report	EPC SPOC		Third Party Consultant	
P5	Share the Grid Code Compliance Report with the RAH	EPC SPOC			Regulatory Approvals Head, Project Manager
P6	Review the report and seek clarifications, if any	Regulatory Approvals Head			
P7	Provide answers to any clarifications from the RAH	EPC SPOC			Regulatory Approvals Head
P8	Request Solar Engineering Head (SEH) to provide the necessary technical and modelling data, and share the relevant annexure templates containing data requirements	Regulatory Approvals Head			Solar Engineering Head
P9	Receive the requisite data from SEH and prepare the annexures required for user registration	Regulatory Approvals Head			

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

#	Key Task	Responsible	Accountable	Consulted	Informed
P10	Share the RLDC User Registration Document with Chief Regulatory for sign-off	Regulatory Approvals Head		Chief Regulatory	
P11	Sign-off on the RLDC User Registration Document and share the signed copy with RAH	Chief Regulatory			Regulatory Approvals Head
P12	Submit the user registration documents with the RLDC	Regulatory Approvals Head			
P13	Answer any queries from the RLDC	Regulatory Approvals Head			
E	Receive confirmation of User registration from the RLDC, and inform the Chief Regulatory and Project Manager	Regulatory Approvals Head			Chief Regulatory, Project Manager

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

3.1.3 – Process Map



[1] **Map Glossary** - **RLDC:** Regional Load Dispatch Centre, **RAH:** Regulatory Approvals Head

Chapter 3.2 – CEIG Approval & FTC Intimation to RLDC

3.2.1 Process Steps

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
S	– Project Manager (PM) informs the Regulatory Approvals Head (RAH) that the pre-commissioning tests have been completed and that the blocks are ready to be charged *CEIG Approval is required before requesting FTC and trial run approval from the RLDC*					-
P1	– RAH notifies the CEIG (Chief Electrical Inspector to the Government) to approve the plant drawings and conduct an inspection and provide the Electrical Safety Approval (ESA) for first-time charging (FTC)	**I1**	Plant Drawings			1.5
P2	– RAH resolves any queries on the drawings and schedules the CEIG inspection and informs the Site Manager (SM) of the same					
P3	– SM accompanies the CEIG during the ESA inspection					0.5
P4	– Post inspection, RAH receives the order for compliance from the CEIG					
P5	– RAH prepares the compliance report and shares it with CEIG	**I2**	Order for Compliance	**O1**	Compliance Report	
P6	– RAH receives the ESA certificate from the CEIG[1]			**O1**	ESA Certificate	
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] If approval is denied, RAH requests the PM to make the required changes and schedules another inspection (process repeats from P3)

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
P7	– RAH intimates the RLDC for pre-data validation of plant, as per approved single-line diagram of plant, at least 10 days before the anticipated FTC date – RAH shares the ESA certificate and requisite data[1] with the RLDC	**I1** **I2**	ESA Certificate Validated data as per SLD	**O2**	RLDC Intimation Notice	1
P8	– RAH receives queries, if there are any, from the RLDC, and resolves them					
P9	– RAH receives confirmation from the RLDC that all the documents are in order					
P10	– RAH submits First-time Charging (FTC) request and trial run notice to the RLDC – RAH submits the requisite documents[2] to the RLDC	**I3**	FTC Undertakings	**O3**	FTC Request Notice	0.5
P11	– RAH receives queries, if any, from the RLDC – RAH shares answers for the queries with the RLDC					
P12	– RAH receives approval for trial run from the RLDC, along with the grid charging code, and shares it with the PM and SM			**O4** **O5**	Trial Run Approval Grid Charge Code	
E	– PM directs the SM, EPC SPOC and Site Electrical Lead and CPOC to prepare for FTC and trial run					***Total –*** *3 – 4 weeks*

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

[1] SCADA points, energy meters, connection agreement, sire responsibility schedule, and other required data documents
[2] Undertaking in Protection System, Telemetry and Communication, Energy metering, Statutory clearances, Cyber security requirement

3.2.2 – RACI

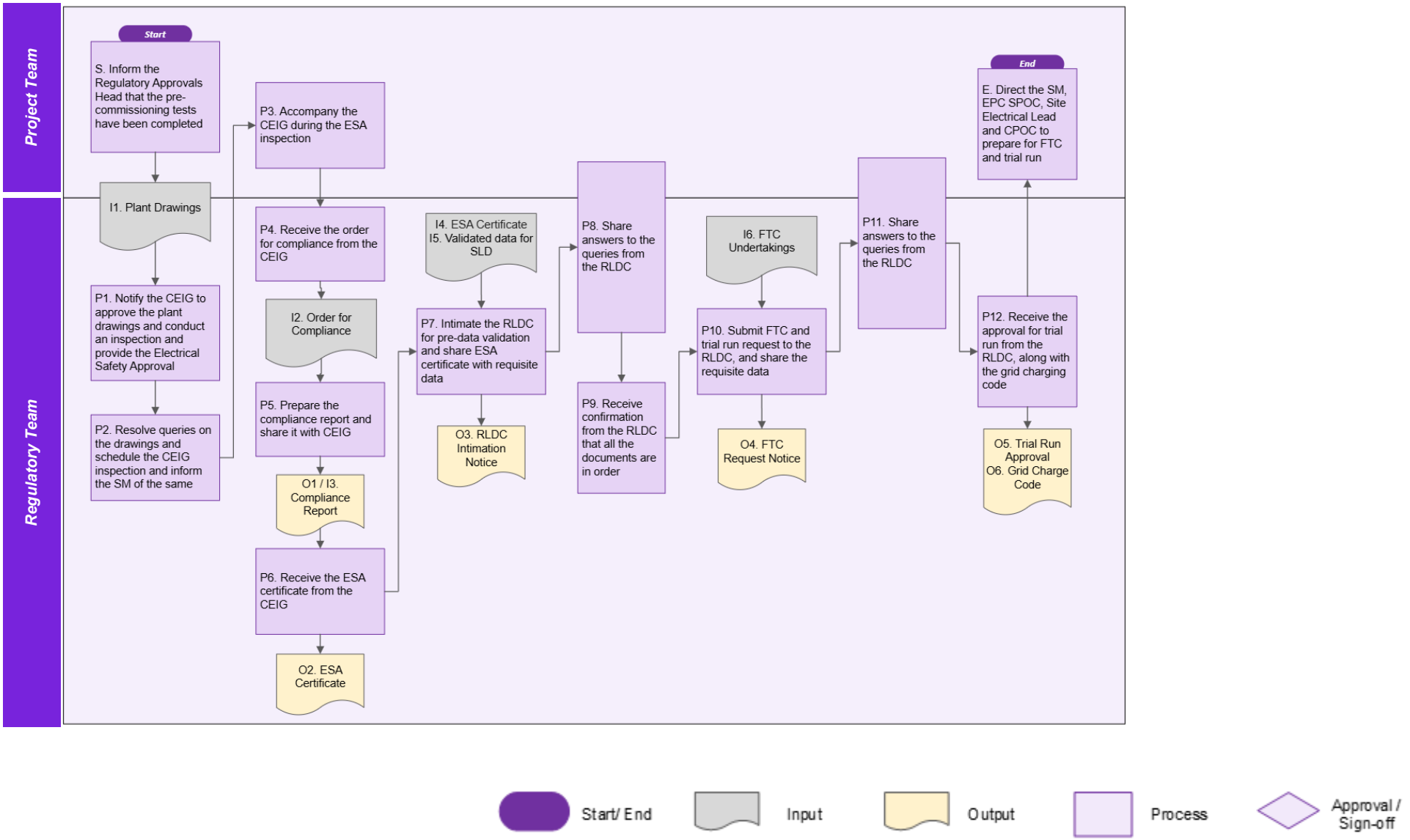
#	Key Task	Responsible	Accountable	Consulted	Informed
S	Inform the Regulatory Approvals Head (RAH) that tests have been completed and blocks are ready to be charged	Project Manager			Regulatory Approvals Head
P1	Notify the CEIG to approve plant drawings and conduct an inspection and provide the ESA	Regulatory Approvals Head			
P2	Resolve any queries on the drawings and schedule the CEIG inspection	Regulatory Approvals Head		Project Manager	Site Manager
P3	Accompany the CEIG during the ESA inspection	Site Manager			
P4	Receive the order for compliance from the CEIG	Regulatory Approvals Head			
P5	Prepare the compliance report and share it with CEIG	Regulatory Approvals Head		Project Manager	
P6	Receive the ESA certificate from the CEIG	Regulatory Approvals Head			Project Manager
P7	Intimate the RLDC for pre-data validation for FTC and share ESA certificate with requisite data	Regulatory Approvals Head			
P8	Share answers to the queries from the RLDC	Regulatory Approvals Head		Project Manager	

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

#	Key Task	Responsible	Accountable	Consulted	Informed
P9	Receive confirmation from the RLDC	Regulatory Approvals Head			
P10	Submit FTC and trial run request to the RLDC, and share the requisite data	Regulatory Approvals Head			
P11	Share answers to the queries from the RLDC	Regulatory Approvals Head		Project Manager	
P12	Receive the approval for trial run from the RLDC, along with the grid charging code	Regulatory Approvals Head			Project Manager
E	Direct the Site Manager, EPC SPOC, Site Electrical Lead and CPOC to prepare for FTC and trial run	Project Manager			Site Manager, EPC SPOC, Site Electrical Lead, CPOC

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

3.2.3 – Process Map



[1] **Map Glossary** - **RLDC:** Regional Load Dispatch Centre, **CEIG:** Chief Electrical Inspector to the Government, **FTC**: First Time Charging, **ESA**: Electricity Safety Approval

Chapter 4 – First Time Charging (FTC) & Commercial Operation

4.1 Process Steps

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
S	– Regulatory Approvals Head (RAH) shares the Grid charge code and approval for FTC with the Project Manager (PM)					-
P1	– PM directs the Site Manager and EPC SPOC to prepare for FTC, and shares the grid charge code with them					0.5
P2	– EPC SPOC[1] back-charges the AC infrastructure[2] using power from the grid	**I1**	Grid Charge Code			
P3	– PM requests the RLDC for the trial run charge code					-
P4	– PM receives the trial run charge code and shares it with the Site Manager and EPC SPOC					-
P5	– EPC SPOC initiates the trial run and brings the DC block online	**I2**	Trial Run Charge Code			-
P6	– EPC SPOC collects operational data[3] over the duration of the trial run			**O1**	Trial Run Data Record	-
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] In self-EPC of plant commissioning, AC infrastructure will be back charged by the commissioning team
[2] AC Infrastructure consists of the Inverter Control Room, Main Control Room, Switchyard, DP Yard and TL
[3] SCADA values of active and reactive power flows, interface energy meter readings, numerical relay, disturbance recorder and station event logger, among others

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
P7	– EPC SPOC shares the trial run data with the Site Electrical Lead (SEL)					-
P8	– SEL reviews the trial run data and seeks clarifications[1] from the EPC SPOC					0.5
P9	– SEL shares the trial run data with the SM and PM, once all clarifications have been received					-
P10	– PM approves and shares the trial run data with the RAH					-
P11	– RAH prepares the trial run data in the requisite format and submits it to the RLDC	**I2**	Trial Run Data	**O2**	Trial Run Data Report	0.5
P12	– RAH receives queries, if any, from the RLDC and resolves them					0.5
P13	– RAH receives the successful trial run certificate and Commercial Operation Date (COD) certificate from the RLDC			**O3** **O4**	Successful Trial Run Certificate COD Certificate	
E	– RAH notifies the PM, EPC SPOC, Commissioning POC and Chief Commercial Officer of the successful trial run certificate and COD certificate					***Total –*** *1 – 2 weeks*

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

[1] Trial run may be conducted multiple times (as permitted by the RLDC) till satisfactory data values are observed

4.2 – RACI

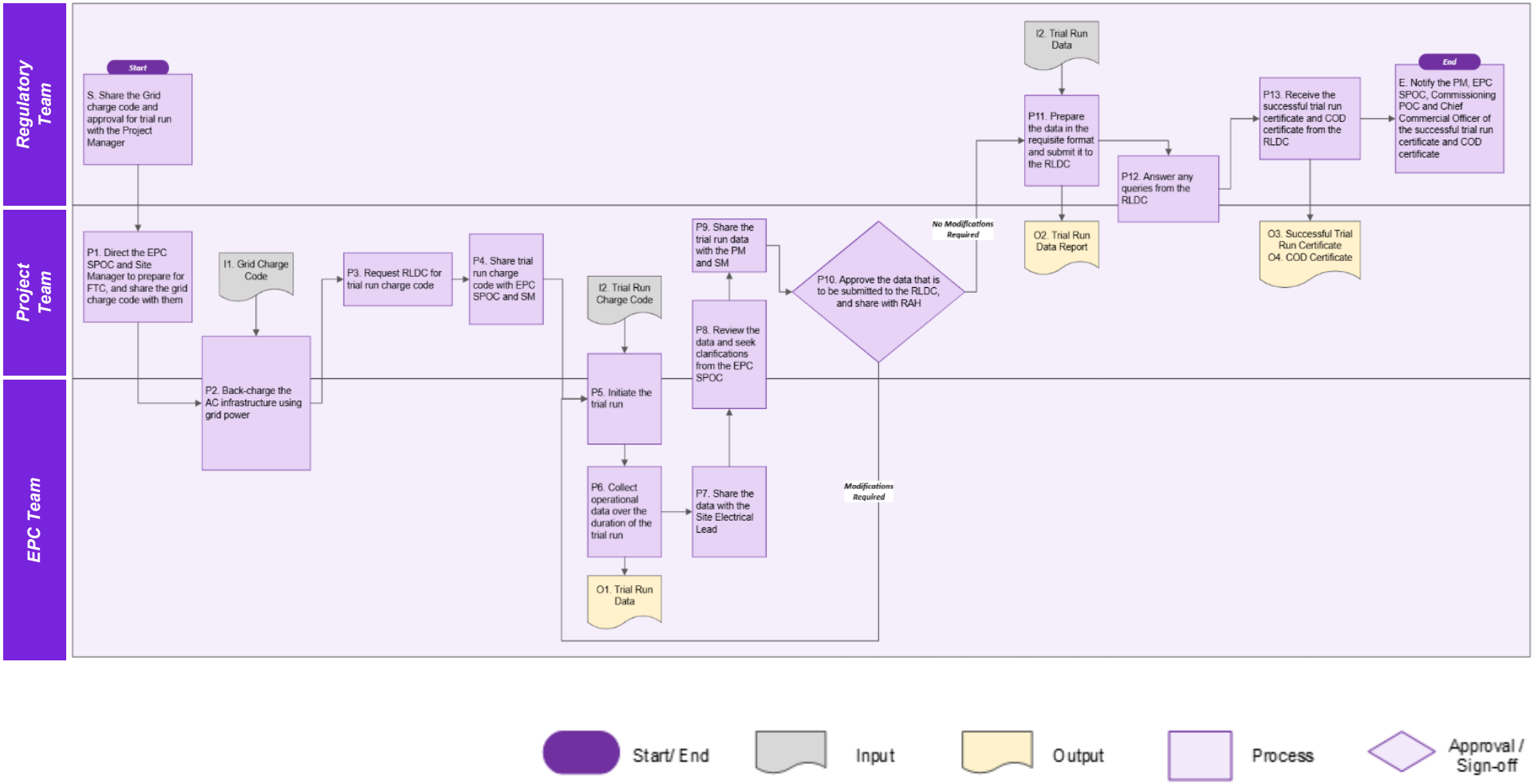
#	Key Task	Responsible	Accountable	Consulted	Informed
S	Share Grid charge code and approval for FTC with the PM	Regulatory Approvals Head			Project Manager
P1	Direct the EPC SPOC and Site Manager to prepare for FTC, and share charge code	Project Manager			EPC SPOC, Site Manager
P2	Back-charge the AC infrastructure using grid power	EPC SPOC		Site Electrical Lead, SM	Project Manager
P3	Request RLDC for trial run charge code	Project Manager			
P4	Share trial run charge code with EPC SPOC and SM	Project Manager			EPC SPOC, Site Manager
P5	Initiate trial run and bring DC block online	EPC SPOC		Site Electrical Lead, SM	Project Manager
P6	Collect operational data over the duration of the trial run	EPC SPOC			
P7	Share the data with the Site Electrical Lead (SEL)	EPC SPOC			
P8	Review the data and seek clarifications from EPC SPOC	Site Electrical Lead			EPC SPOC

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

#	Key Task	Responsible	Accountable	Consulted	Informed
P9	Share the trial run data with the PM and SM	Site Electrical Lead			Project Manager, Site Manager
P10	Approve and share the data for submission to the RLDC	Project Manager			Regulatory Approvals Head
P11	Prepare the data in the requisite format and submit it to the RLDC	Regulatory Approvals Head			
P12	Answer any queries from the RLDC	Regulatory Approvals Head		Project Manager	
P13	Receive the successful trial run and COD certificate from RLDC	Regulatory Approvals Head			
E	Notify regarding the trial run certificate and COD certificate	Regulatory Approvals Head			PM, EPC SPOC, CPOC, Chief Commercial Officer

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

4.3 – Process Map



[1] **Map Glossary** - **RLDC:** Regional Load Dispatch Centre, **RAH:** Regulatory Approvals Head, **COD**: Commercial Operation Date

Chapter 5 – Performance Testing & EPC HOTO

5.1 Process Steps

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
S	– RAH notifies the Project Manager (PM) of the successful trial run certificate and COD certificate, of the last DC block					-
P1	– PM directs the Site QHSSE to ensure closure of all punch points					-
P2	– SITE QHSSE ensures closure of all critical punch points, signs-off on it and takes sign-off from EPC SPOC and Commissioning POC (CPOC) – SITE QHSSE shares the punch point list with the PM and SM			**O1**	Punch Point List	1
P3	– PM directs the EPC SPOC to initiate the performance test of the plant					-
P4	– EPC SPOC conducts the performance test as outlined in the EPC contract					4
P5	– EPC SPOC calculates the performance ratio (PR) over the test period and shares the results, including calculation sheet, with the PM *If results are not satisfactory, PR Test may be repeated as per outlined in the contract*			**O2**	Performance Test Results	
P6	– PM reviews the test procedure and data, and requests clarifications from the EPC SPOC, if required					-
P7	– PM signs-off[1] on the performance test findings, once all clarifications have been received					-
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] EPC Contract terms outline the escalation chain and dispute management procedure, if resolution of dispute is required

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
P8	– PM directs EPC SPOC to provide HOTO of the plant to the Site Team					-
P9	– EPC SPOC prepares Plant HOTO checklist			**O3**	Plant HOTO Checklist	-
P10	– EPC SPOC conducts Knowledge Transfer (KT) sessions with the Site team, and provides HOTO as per the Plant HOTO checklist	**I1**	Plant HOTO Checklist			1
P11	– Site Manager signs-off on the Plant HOTO checklist and shares it with the PM					-
E	– PM reviews the Plant HOTO Checklist and shares it with the Order Manager, for completion of contractual obligations					***Total –*** *5 – 6 weeks*
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

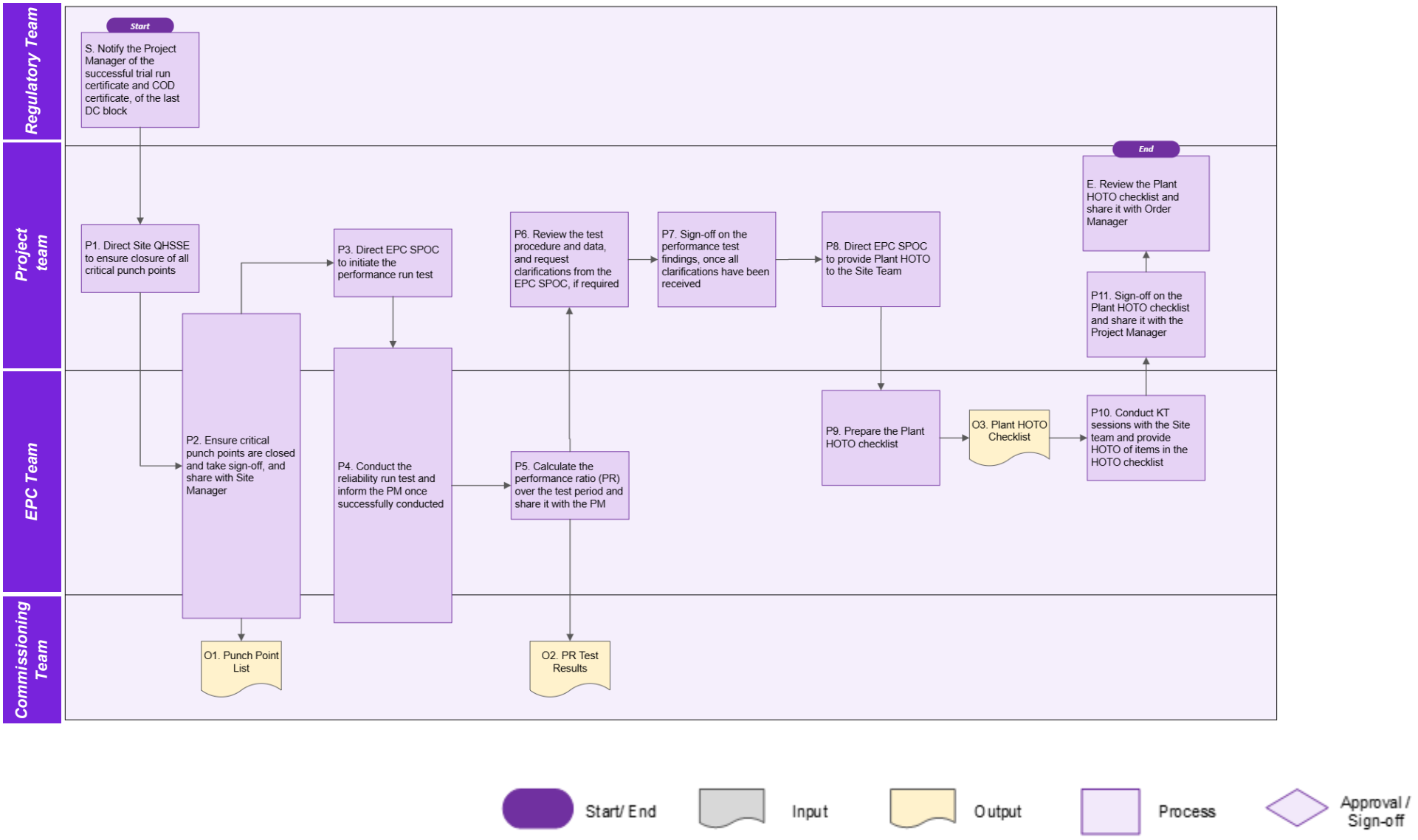
5.2 – RACI

#	Key Task	Responsible	Accountable	Consulted	Informed
S	Notify the Project Manager (PM) of the successful trial run certificate and COD certificate, of the last DC block	Regulatory Approvals Head			Project Manager
P1	Direct Site QHSSE to ensure closure of all punch points	Project Manager			Site QHSSE
P2	Ensure punch points are closed and take sign-off	Site QHSSE		EPC SPOC, CPOC	Project Manager, Site Manager
P3	Direct EPC SPOC to initiate the performance test	Project Manager			EPC SPOC
P4	Conduct the performance test as outlined in the EPC contract	EPC SPOC		Project Manager, CPOC	
P5	Calculate the performance ratio (PR) over the test period and share it with the PM	EPC SPOC			Project Manager
P6	Review the test procedure and data, and request clarifications from the EPC SPOC, if required	Project Manager		EPC SPOC	
P7	Sign-off on the performance test findings, once all clarifications have been received	Project Manager			
P8	Direct EPC SPOC to provide Plant HOTO to the Site Team	Project Manager			EPC SPOC, Site Manager
P9	Prepare the Plant HOTO checklist	EPC SPOC			

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

#	Key Task	Responsible	Accountable	Consulted	Informed
P10	Conduct KT sessions with the Site Team and provide HOTO of items in the HOTO checklist	EPC SPOC		Site Manager	
P11	Sign-off on the Plant HOTO checklist and share it with the Project Manager	Site Manager			Project Manager
E	Review the Plant HOTO checklist and share it with Order Manager	Project Manager			Order Manager
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End					

5.3 – Process Map



[1] **Map Glossary** - **PR:** Performance Ratio, **HOTO**: Handover Takeover

Chapter 6 – Project Handover to O&M Team

6.1 Process Steps

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
S	– Project Manager signs off on the Plant HOTO Checklist					-
P1	– Project Manager informs Chief O&M that Site Team has received plant HOTO from the EPC					-
P2	– Chief O&M requests Project Manager to provide Project Handover to the O&M Team, and shares the Project Handover Checklist			**O1**	Project Handover Checklist	-
P3	– Project Manager directs Site Manager to provide the Plant HOTO to the O&M Team					-
P4	– Site Manager conducts Knowledge Transfer (KT) sessions with the O&M team and provides the plant HOTO (including spares)					2
P5	– Project Manager requests Solar Engineering Head (SEH) to share the Engineering Documents listed in the Project Handover Checklist					-
P6	– SEH shares the requested engineering documents with the Project Manager	**I1**	Project Handover Checklist	**O2**	Engineering Documents	0.5
P7	– PM shares the Project Handover Checklist with the Regulatory Approvals Head (RAH), and requests him to share the approvals and permits listed in the checklist					-
P8	– RAH shares the requested permits and approvals with the PM	**I1**	Project Handover Checklist	**O3**	Project Permits and Approvals	0.5 (in parallel to P6)

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

#	Activity	#	Inputs	#	Outputs	Timeline *(in weeks)*
P9	– PM shares the Engineering Documents and Approvals with the Chief O&M, along with the Land and ROW-related[1] documents			**O4**	Land and ROW documents	-
P10	– PM shares the Physical Asset Verification list, along with the HOTO documents[2], listed in the Project Handover Checklist			**O5** **O6**	Physical Asset Verification List HOTO Documents	0.5 (in parallel to P6)
P11	– Chief O&M signs off on the Project Handover Checklist and shares it with the PM					-
E	– PM informs Chief Solar that the project handover to O&M Team is complete					***Total –*** *2 – 3 weeks*
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End						

[1] Lease / Purchase agreement, NOC for ROW, 7/12 (wherever applicable), among others
[2] Including but not limited to, Bill of Materials with Make, GTP, Warranty certificates, O&M Manuals, Factory and Field Acceptance Test Results, Supplier Escalation Matrix, Supplier PO Copies, Punch Point List, Work Completion Certificates and PR Test results

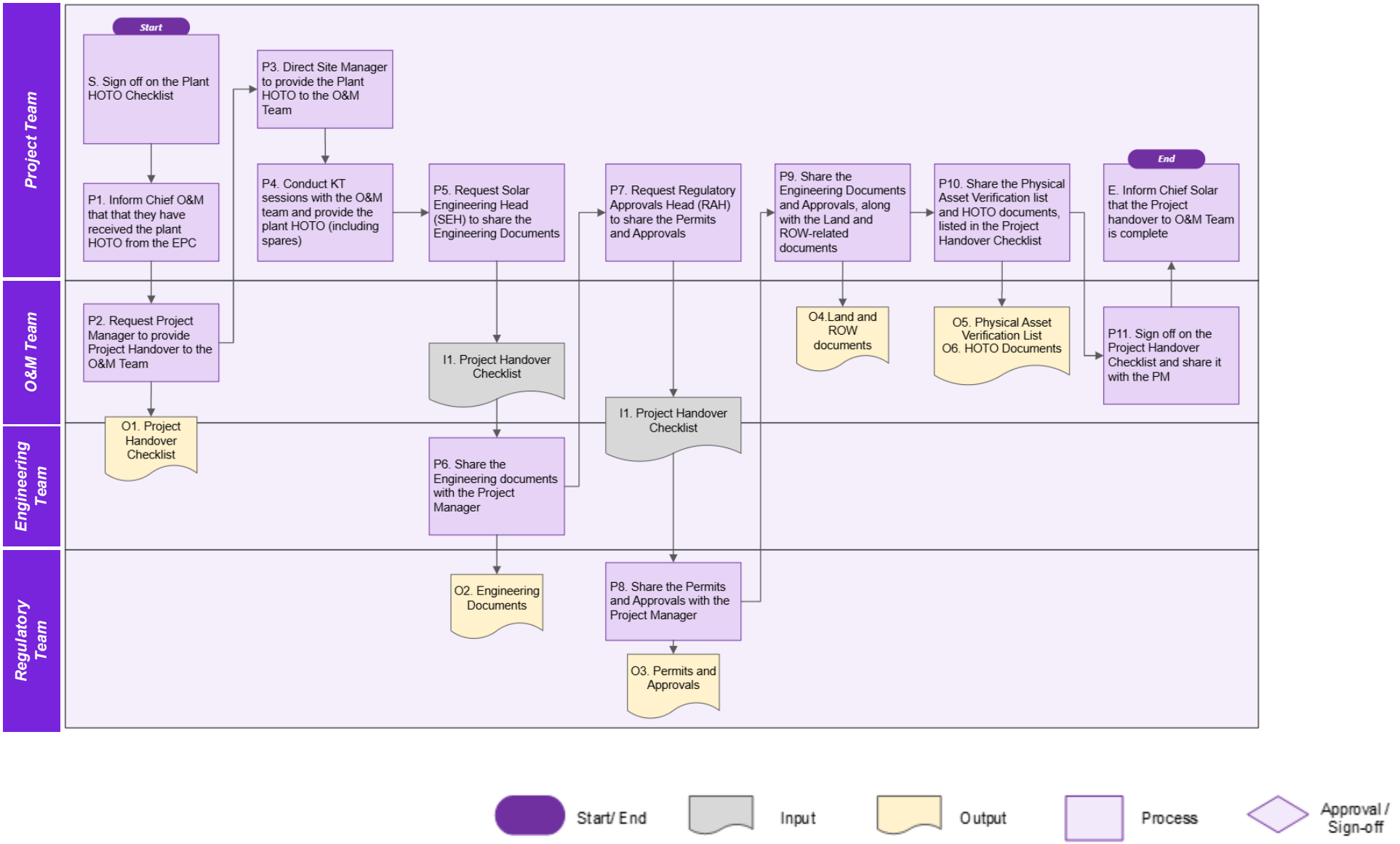
6.2 – RACI

#	Key Task	Responsible	Accountable	Consulted	Informed
S	Sign off on the Plant HOTO Checklist	Project Manager			
P1	Inform Chief O&M that that they have received the plant HOTO from the EPC	Project Manager			Chief O&M
P2	Request Project Manager to provide Project Handover to the O&M Team	Chief O&M			Project Manager
P3	Direct Site Manager to provide the Plant HOTO to the O&M Team	Project Manager			Site Manager
P4	Conducts KT sessions with the O&M team and provides the plant HOTO (including spares)	Site Manager		Site Team	O&M Team
P5	Request Solar Engineering Head (SEH) to share the Engineering Documents	Project Manager			Solar Engineering Head
P6	Share the requested engineering documents with the Project Manager	Solar Engineering Head		Engineering Team	Project Manager
P7	Request Regulatory Approvals Head (RAH) to share the approvals and permits listed in the Project Handover Checklist	Project Manager			Regulatory Approvals Head
P8	Share the requested permits and approvals with the PM	Regulatory Approvals Head		Regulatory Team	Project Manager
P9	Share the Engineering Documents and Approvals, along with the Land and ROW-related documents	Project Manager		Land Team	Chief O&M

KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End

#	Key Task	Responsible	Accountable	Consulted	Informed
P10	Share the Physical Asset Verification list and HOTO documents, listed in the Project Handover Checklist	Project Manager		Site Team	Chief O&M
P11	Sign off on the Project Handover Checklist and share it with the PM	Chief O&M		O&M Team	Project Manager
E	Inform Chief Solar that the project handover to O&M Team is complete	Project Manager			Chief Solar
KEY - S: Start | P: Process Steps | I: Input | O: Output | E: End					

6.3 – Process Map



[1] **Map Glossary** -

Key Performance Indicators

Metric	Definition	How to Calculate
Commissioning Schedule Variance *(calculated as a %)*	Variance in the actual commissioning schedule, with respect to the planned commissioning schedule.	Calculated as the difference in the actual number of days and the planned number of days for commissioning, divided by the number of planned days, taken as a percentage.
Test Pass Rate *(calculated as a %)*	Ratio of tests passed in the first attempt vs total tests conducted.	Calculated as the number of tests passed divided by the number of tests conducted, taken as a percentage.
Issues per block *(calculated as a #)*	Count of quality or safety issues raised during inspections and tests.	Calculated as the number of quality issues, across all blocks, divided by the number of blocks.

Glossary

Abbreviation	Expanded
C&P	Contacting and Procurement
CEA	Central Energy Authority
CEIG	Chief Electrical Inspector to the Government
COD	Commercial Operation Date
CTU	Central Transmission Utility
EPC	Engineering, Procurement, Construction
ESA	Electrical Safety Approval
FTC	First-time Charging
HOTO	Handover takeover
KT	Knowledge Transfer
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
PM	Project Manager
PPA	Power Purchase Agreement
PR	Performance Ratio
QHSSE	Quality, Health, Safety, Security, Environment
RAH	Regulatory Approvals Head
RLDC	Regional Load Dispatch Centre
ROW	Right-of-way
SCADA	Supervisory Control and Data Acquisition
SEL	Site Electrical Lead
SHE	Solar Engineering Head
SPOC	Single Point of Contact
STU	State Transmission Utility
TPT	Third-Party Testing

Annexures

Pre-commissioning Equipment Checklist Template[1]

Sr. No	Equipment Name	Result (Accepted / Not Accepted)	Remarks (Reasons for Not Accepted)
1	11 kV HT/ICOG Panel	Accepted	
2	ACDB Charging Checkpoints	Not Accepted	– Improper sealing of unused holes – Abnormality in alignment of base frame
3	Battery	…..	…….
4	Current Transformer		
5	DC/AC Cables		
6	DCDB Charging Checkpoints		
7	Earthing		
8	FCBC Charging Checkpoints		
9	IDT Transformer		
10	Indoor VCB Breaker		
11	Lightning Arrestor		
12	LT Panel		
13	Outdoor Isolator		
14	Power Transformer		
15	SF6 Breaker		
16	String Inverter		

[1] Detailed checklists for each equipment can be accessed in the templates folder

Sr. No	Equipment Name	Result (Accepted / Not Accepted)	Remarks (Reasons for Not Accepted)
17	Transmission Line		

Project Handover Checklist[1]

Sr. No	Section Name	Handover (Complete / Incomplete)	Remarks (Reason for Incomplete)
1	Physical Asset Verification	Complete	
2	Engineering Documents	Incomplete	– SCADA components list not received – Geotech and Soil Resistivity Report not received
3	Permits and Approvals	….	….
4	PV Module details		
5	HOTO Documents[2]		

[1] Detailed checklists can be accessed in the templates folder

[2] Including but not limited to, Bill of Materials with Make, GTP, Warranty certificates, O&M Manuals, Factory and Field Acceptance Test Results, Supplier Escalation Matrix, Supplier PO Copies, Punch Point List, Work Completion Certificates and PR Test results