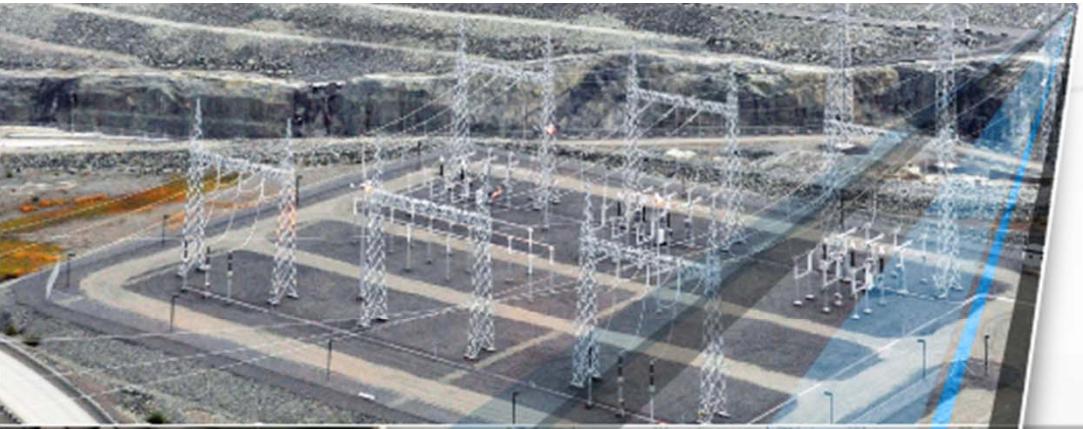
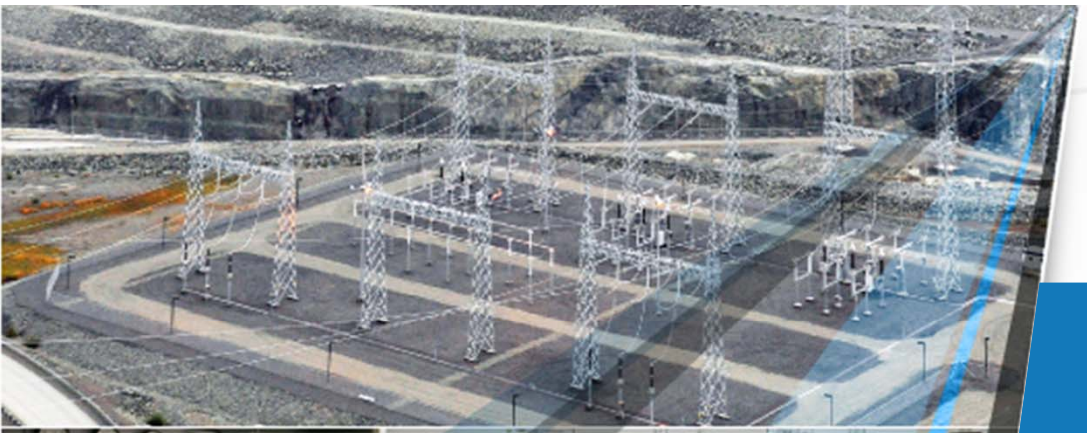


Hydro Québec TransÉnergie

INFORMATION AND DISCUSSION ON TRANSMISSION SYSTEM PLANNING

MAIN SYSTEM

Montréal, March 31, 2017



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NERC RELIABILITY STANDARDS REGARDING THE SUBMITTAL OF TRANSMISSION SYSTEM MODELING DATA

- NERC MOD-032-1 standard
- Hydro-Québec TransÉnergie requirements and procedures regarding the submittal of transmission system modeling data

1 MOD-032-1 STANDARD
DESCRIPTION

- General objectives
  - Provide a framework for the collection of data used to model the Hydro-Québec transmission system
  - Improve the quality of modeling data collected from the various functional entities connected to the transmission system
  - Improve the accuracy of system models used by Hydro-Québec TransÉnergie planners to perform system studies and analyze system reliability

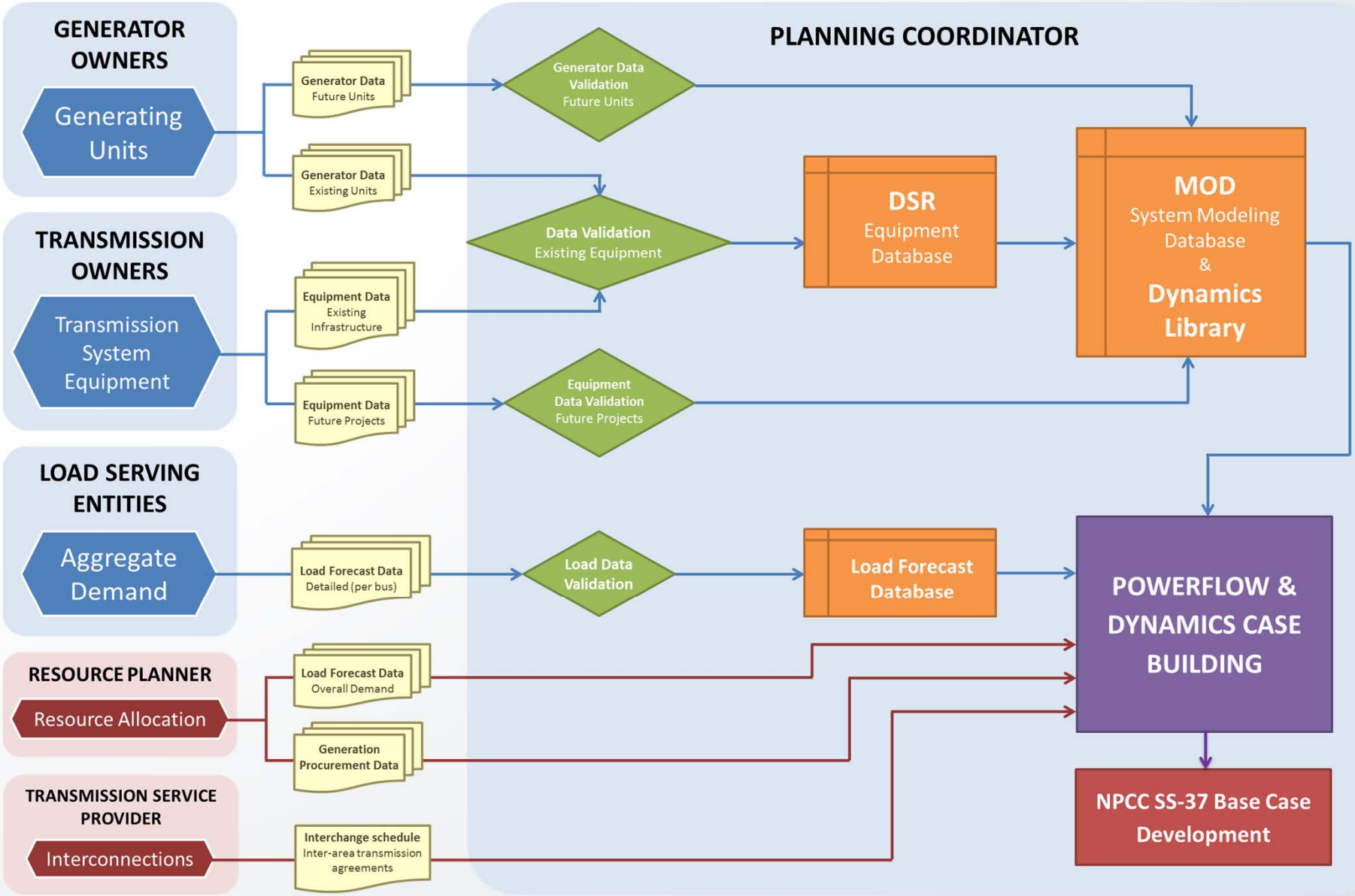
MOD-032-1

- Objectives
  - To establish steady-state, dynamics and short-circuit modeling data reporting requirements and procedures
  - Supersedes MOD-010, MOD-011, MOD-012, MOD-013, MOD-014 and MOD-015
- Applicability
  - Balancing Authority
  - Generator Owner
  - Load-Serving Entity
  - Planning Coordinator (HQT)
  - Resource Planner
  - Transmission Owner
  - Transmission Planner
  - Transmission Service Provider

MOD-032-1

- Effective date:
  - Effective within NERC as of July 1, 2015
  - Requirement R1 will come into effect at the Régie de l'Énergie on April 1, 2017. The remaining standard requirements applicable to registered entities within the Québec Interconnection will come into effect on January 1, 2018

1 MOD-032-1 STANDARD
DATA SUBMITTAL PROCESS

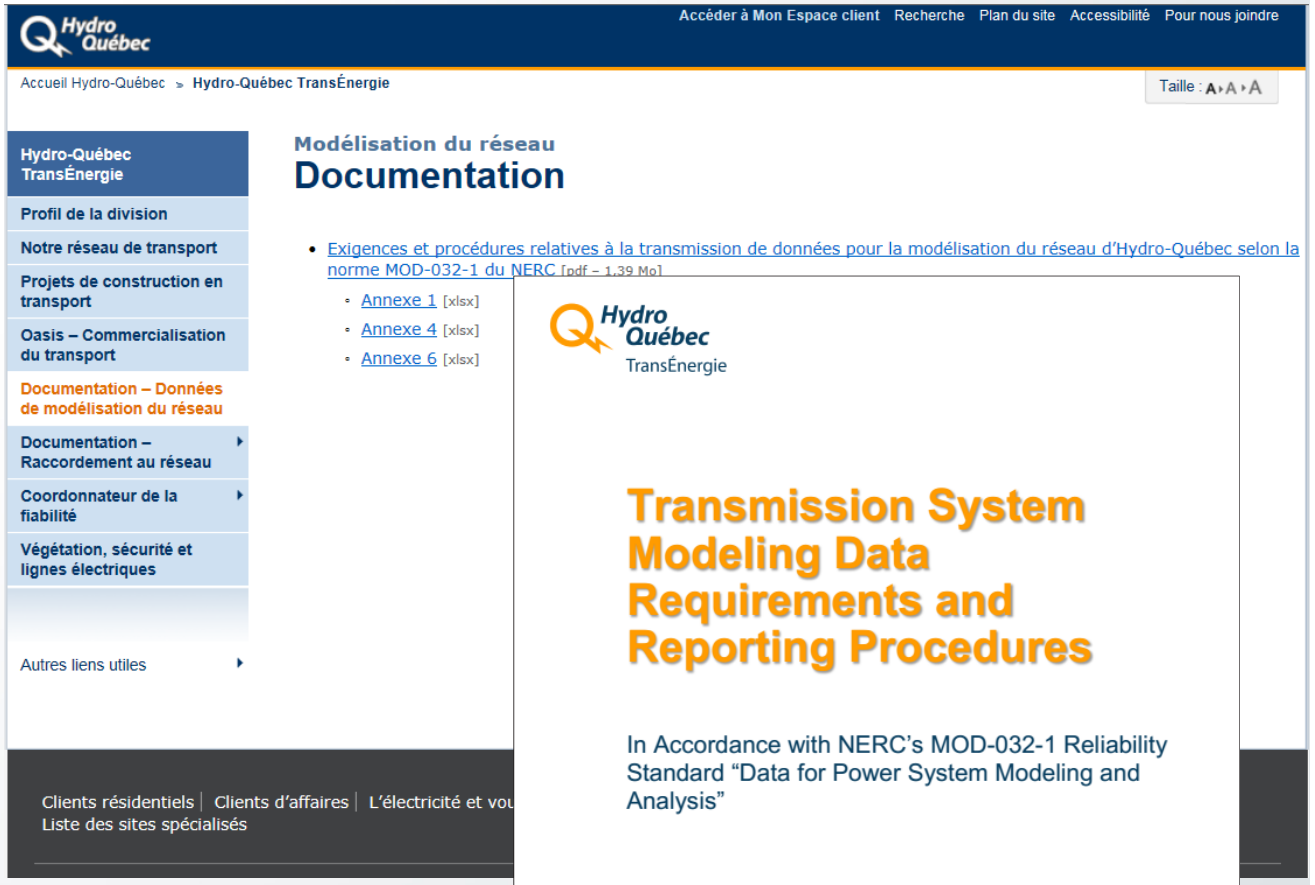


MOD-032-1 STANDARD
PLANNING COORDINATOR (HQT) REQUIREMENTS

- MOD-032-1 compliance
  - Implementation of new annual reporting process for modeling data
  - All Load-Serving Entities, Generator Owners and Transmission Owners connected to the Québec interconnected transmission system must provide valid modeling data for their existing and future facilities to the Planning Coordinator on an annual basis
  - Release of new HQT modeling data submittal requirements for generation, transmission and distribution facilities

1 MOD-032-1 STANDARD
PLANNING COORDINATOR (HQT) REQUIREMENTS

- New modeling data submittal requirements
- Purpose of document:
  - Set out requirements for steady-state, dynamic and short circuit modeling data
  - Describe data reporting procedures

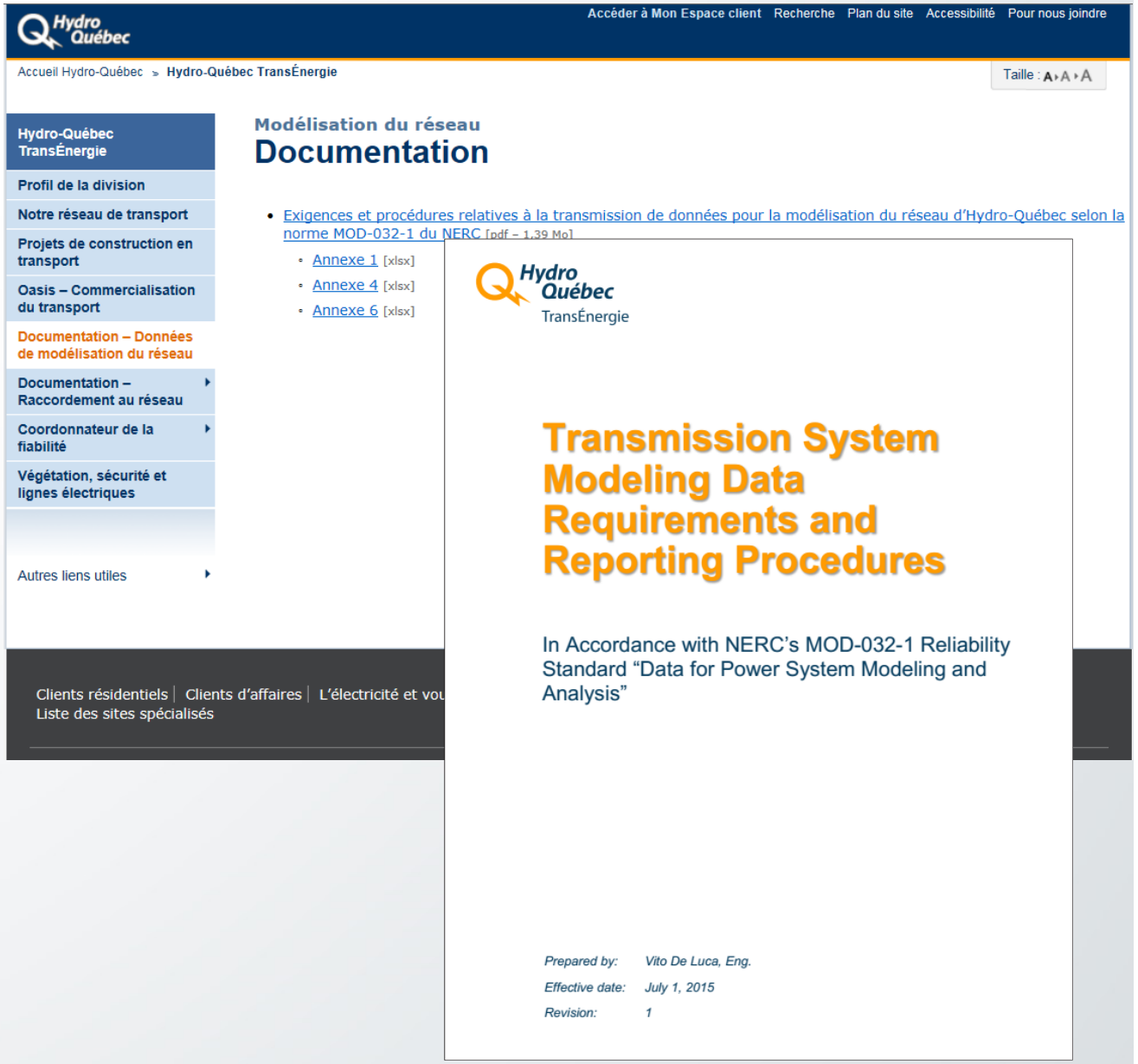


- Available on the Planning Coordinator's web site:

  http://www.hydroquebec.com/transenergie/fr/modelisation.html

1 MOD-032-1 STANDARD
PLANNING COORDINATOR (HQT) REQUIREMENTS

- Must serve as a reference for all functional entities
- References all relevant HQT technical documents and procedures to which entities must refer to in order to comply with modeling data requirements (i.e. Requirements for Connection)
- Templates, appended to the document, are provided to entities to streamline data reporting



MOD-032-1 STANDARD
PLANNING COORDINATOR (HQT) REQUIREMENTS

- Implementation plan

Year 1
(2017)

- Planning Coordinator will provide generation and transmission equipment modeling data currently used in HQT's simulation software to all concerned entities
- Entities must validate data set and provide any missing data

Following years

- Entities must recertify modeling data for their installations in writing on an annual basis, or
- If modeling data changes, entities must clearly identify all changes and submit all modified modeling data

MOD-032-1 STANDARD
PLANNING COORDINATOR (HQT) REQUIREMENTS

- Modeling data reporting requirements
  - Accepted data formats
    - Tables: Entities may use templates appended *to Transmission System Modeling Data Requirements and Reporting Procedures*
    - Technical data sheets from PSS/E model library
    - PSS/E data in “RAW” and “DYR” formats
  - Reporting procedure
    - All communications regarding modeling data reporting must be sent to the following e-mail address: te_donneesdemodelisation@hydro.qc.ca.
    - Data must be sent electronically, by e-mail or via a secure FTP server

MOD-032-1 STANDARD
PLANNING COORDINATOR (HQT) REQUIREMENTS

Generating facility data reporting template (Appendix 4)

- List of models for each generator facility
- Steady-state and dynamic modeling data
- Block diagrams and modeling parameters associated with the various models used to represent generators, excitation systems, speed governors, etc.)
- Color coded to facilitate validation

Caractéristiques en régime dynamique

Nœud	Numéro d'installation	Centrale	Groupe	Réactances non-saturées						
				X'du Réactance transitoire longitudinale non-saturée	X"du Réactance subtransitoire longitudinale non-saturée	Xqu Réactance synchrone transversale non-saturée	X'qu Réactance transitoire transversale non-saturée	X"qu Réactance subtransitoire transversale non-saturée	X'ds Réactance transitoire longitudinale saturée	X"ds Réactance subtransi longitudi saturé
8925	99901	Centrale A	1	0.2560	0.1730	0.6500		0.3570		
8926	99901	Centrale A	2	0.2560	0.1730	0.6500		0.3570		
8927	99901	Centrale A	3	0.2560	0.1730	0.6500		0.3570		
8928	99901	Centrale A	4	0.2560	0.1730	0.6500		0.3570		
8929	99901	Centrale A	5	0.2560	0.1730	0.6500		0.3570		
8930	99901	Centrale A	6	0.2560	0.1730	0.6500		0.3570		
8970	99902	Centrale B	41	0.3130	0.2200	2.0470	0.4660	0.2180	0.2390	0.169
8971	99902	Centrale B	42	0.3020	0.2090	2.0170	0.4570	0.2080	0.2250	0.156
8972	99902	Centrale B	43	0.3130	0.2200	2.0470	0.4660	0.2180	0.2390	0.169
8973	99902	Centrale B	44	0.3130	0.2200	2.0470	0.4660	0.2180	0.2390	0.169
8826	99903	Centrale C	11	0.4060	0.2880	0.5400	0.5100	0.3050	0.3850	0.246
8827	99903	Centrale C	12	0.4060	0.2880	0.5400	0.5100	0.3050	0.3850	0.246
8828	99903	Centrale C	13	0.4060	0.2880	0.5400	0.5100	0.3050	0.3850	0.246
8829	99903	Centrale C	14	0.4060	0.2880	0.5400	0.7060	0.3050	0.3850	0.246
8830	99903	Centrale C	15	0.2550	0.1770	0.5300	0.5300	0.2130	0.2450	0.177
8831	99903	Centrale C	16	0.2430	0.1730	0.3200	0.5500	0.1760	0.2100	0.130
8832	99903	Centrale C	17	0.2550	0.1770	0.5300	0.5300	0.2130	0.2460	0.157
8833	99903	Centrale C	18	0.2550	0.1770	0.5300	0.53	0.2130	0.246	0.15
8834	99904	Centrale D	21	0.3630	0.2670	0.6710		0.2600	0.3200	0.190
8836	99904	Centrale D	22	0.3630	0.2670	0.6710		0.2600	0.3200	0.190
8837	99904	Centrale D	23	0.3630	0.2670	0.6710		0.2600	0.3200	0.190
8838	99904	Centrale D	24	0.3630	0.2670	0.6710		0.2600	0.3200	0.190
8839	99904	Centrale D	25	0.3630	0.2670	0.6710		0.2600	0.3200	0.190
8598	99905	Centrale E	1	0.2650	0.2540	0.5800	0.6600	0.2650	0.3160	0.192

Modèles associés | Régime permanent | Régime dynamique | Charge_Services_Auxiliaires | GENSAL Data | GENSAL | GENROU Data | GENROU | IEEEX1 Data | IEEEX1 | EXST

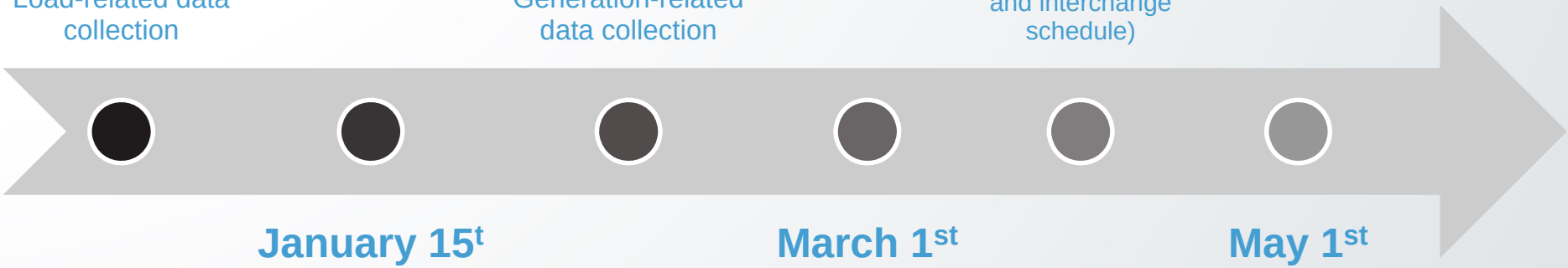
Missing data

Estimates provided by Planning Coordinator, to be validated

Data to be corrected

MOD-032-1 STANDARD
PLANNING COORDINATOR (HQT) REQUIREMENTS

- Data submittal schedule



October 1st
Load-related data collection

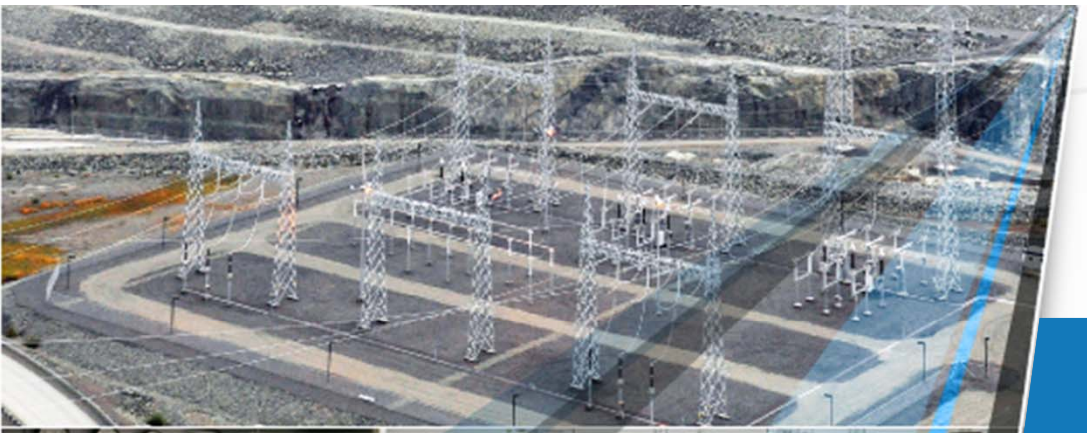
January 15th
Start of annual system modeling process

February 1st
Generation-related data collection

March 1st
Submittal of modeling data for changes or additions to transmission system (DSR and MOD)

April 1st
Integration of additional system data (outages, resource plan and interchange schedule)

May 1st
Delivery of final system models



DISCUSSION