Implementation of PSS/E 36 version in Fingrid and effect on modelling of power generating facilities and grid energy storage systems

1 Introduction

The Grid Code Specifications for Power Generating Facilities (VJV2018) [1] and Grid Code Specifications for Grid Energy Storage Systems (SJV2019) [2] require simulation models for Type C and D. According to VJV2018, Chapter 15 covers synchronous power generating modules, while Chapter 20 addresses power park modules. For SJV2019, the relevant information is found in Chapter 15.

Synchronous power generating modules are typically presented as documented standard models or detailed block diagrams, which can accurately represent the behaviour of the power plant. Power park modules and energy storage systems (ESS) operate based on programmed logic, and there are no standardized models available that can capture the correct behaviour of these plants. Therefore, detailed manufacturer specific simulation models are required for power park modules and energy storage systems. These models are typically delivered as black-boxed models to specific software version.

Stage 1 is a planning phase in the connection process. Once the connectee has delivered the Stage 1 data and carried out a real-time measurement, an interim operational notification (ION) can be granted, and plant can start the production. ION is a notification from the relevant network operator allowing the temporary operation of a power-generating module using the grid connection to initiate compliance tests and ensure compliance to relevant specifications and requirements. [3]

Stage 2 is a commissioning and compliance phase in the connection process. Once the connectee has delivered the Stage 2 data and carried out the measures, a final operational notification (FON) can be granted. FON is a notification from the relevant network operator allowing the operation of a power-generating module to use the grid connection. [3]

The stages of the connection process for Type D plants are detailed in chapter 6.4.3 of both VJV2018 and SJV2019. [1] [2]

More detailed simulation model requirements are provided in the modelling instructions document [4].

2 Background for change of PSS/E version

The PSS/E 36 version was released in December 2023. Fingrid currently uses PSS/E 35 for simulation studies but is transitioning to the latest version. For the dynamic studies Fingrid simulates power system in a Nordic Model, which includes network data from other transmission system operators (TSOs) in the same synchronous area. The Nordic TSOs have jointly decided to move towards PSS/E 36 in the Nordic modelling process and year 2025 will be the transition year.

Additionally, Siemens PTI has released the end-of-life version of PSS/E 35, meaning that there will no longer be support for the PSS/E 35 version. The dynamic modelling architecture has been changed from PSS/E 35 to PSS/E 36, so that the user-defined

models cannot any more access PSS/E internal data structures directly. Instead, the models access data structures through API functions. This approach ensures that the model will be future-compatible with upcoming PSS/E versions, which was not the case with PSS/E 35 models.

It is important to note that model DLL files created for PSS/E 35 will not be compatible with PSS/E 36. Siemens PTI has released a conversion tool to convert model source code to be compatible with PSS/E 36. The model conversion tool is included in the Environment Manager that comes with PSS/E 36. Siemens PTI has also highlighted the importance of this version update and has guaranteed that support cases for PSS/E 36 model conversion are given the highest priority.

3 PSS/E 36 Version Implementation Requirements

Fingrid will implement the version change requirement in different phases, depending on the project status and type. Effect on customer projects (power plants and energy storages) is described in this chapter.

3.1 Simulation models for Type C plants

PSS/E 36 models are required if grid compliance tests are done after 1.1.2026. PSS/E 36 models can be delivered for all models after 1.1.2025.

3.2 Simulation models for Type D plants

PSS/E 36 models are required for:

1. Stage 1 models (before ION), if the planned Stage 1 model delivery[1] is after 1.1.2026.
2. Stage 2 models (before FON), if the planned start of production[2] is after 1.1.2025.
3. Stage 2 models, if the planned start of production was before 1.1.2025, but the Stage 2 model is delivered after 1.1.2026.

In case there are modifications to existing plants, a new plant model that captures the new behavior of the plant is needed. If the modification is done after 1.1.2025, the model shall be delivered as PSS/E 36 compatible. All delivered models shall comply with the modelling instructions in force at the time of the model preparation [4].

PSS/E 36 models can be delivered for all models after 1.1.2025.

[1] The planned Stage 1 model delivery is always 6 months before the planned start of production.
[2] The planned start of production is the date informed to Fingrid prior to signing of the connection agreement.

4 References

[1] Fingrid Oyj, ”Voimalaitosten järjestelmätekniset vaatimukset VJV2018,” 16 November 2018. [Online]. Available: https://www.fingrid.fi/globalassets/dokumentit/fi/palvelut/kayttovarma-sahkonsiirto/vjv2018.pdf.

[2] Fingrid Oyj, ”Sähkövarastojen järjestelmätekniset vaatimukset SJV2019,” 28 February 2020. [Online]. Available: https://www.fingrid.fi/globalassets/dokumentit/fi/palvelut/kulutuksen-ja-tuotannon-liittaminen-kantaverkkoon/sahkovarastojen-jarjestelmatekniset-vaatimukset-sjv2019.pdf.

[3] EU commission regulation, ”establishing a network code on requirements for grid connection of generators,” 14 April 2016. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2016_112_R_0001#d1e320-1-1.

[4] Fingrid Oyj, ”Modelling instruction for PSS/E and PSCAD models,” [Online]. Available: https://www.fingrid.fi/globalassets/dokumentit/fi/palvelut/kulutuksen-ja-tuotannon-liittaminen-kantaverkkoon/fingrid-modelling-instruction-for-psse-and-pscad-models-2024_01_12-002.pdf.