

Renewable energy system integration

Power system consulting over the entire value chain

Over the last decades, renewable energy sources (RES) have gained high momentum as a sustainable form of energy to achieve the environmental policies which have been set forth to reduce greenhouse gas emissions. The lucrative governmental support in the form of subsidies and priority of sale as well as continuously decreasing manufacturing costs have led to an ever increasing share of RES being installed in transmission grids all over the world.

The planning and operation of a transmission grid with a high share of RES comes with numerous challenges which require proper investigation by power system consulting experts in each step, from planning and quantifying the grid impact to investigations during RES power plant operation.

Siemens PTI provides power system consulting services to accompany a successful integration of RES into the transmission grid, along the entire value chain and for all important stakeholders.

Renewable integration and grid impact studies for transmission system operators

The transmission system operator (TSO) is responsible for securing a reliable operation of the transmission grid under normal conditions, as well as for minimizing the influence of outages and emergency events on the consumers. This is generally achieved by a proper planning and operation of the transmission grid. Once a governmental policy is set to introduce or increase the share of RES generation in the energy mix, the TSO will investigate the feasibility of the proposal, and assess the resulting impact on the grid.

Siemens PTI supports TSOs with a series of power system studies, including – but not limited to – steady-state and dynamic analyses. On this basis, the TSO will be able to quantify and materialize the operational requirements and grid reinforcements needed to achieve the set RES targets, while maintaining a reliable and secure grid operation.

Through a similar set of power system studies, Siemens PTI can offer support in identifying the realizable share of RES an existing transmission grid can integrate without additional reinforcements.

Feasibility studies for RES plant developers

Once the feasibility of the RES targets for a transmission grid have been confirmed, the TSO will identify the connection points and ratings of the future RES plants. Based on the published tenders, RES plant developers propose the best solution at the best price, while considering all technical and economical requirements.

Siemens PTI assists RES plant developers by confirming the feasibility of the proposed RES plant connection point as well as its rating. By the virtue of this analysis, the RES plant developer's risks are highly reduced or even eliminated.

Design and technical compliance studies for RES plant contractors

Once the RES plant developer is confident about the planned investment, it will team up with an RES plant contractor, i.e. RES plant EPC, to design, engineer, procure and construct the RES plant.



Figure 1: Value chain of a typical renewable plant project

Siemens PTI supports the RES plant EPC to evaluate if any additional equipment needs to be installed to fulfill the requirements and specifications of the RES plant. In a preliminary power system study, Siemens PTI can help the EPC to determine how the RES plant can meet the applicable transmission grid requirements, i.e. grid code.

Siemens PTI provides further services to EPCs from RES plant execution to the moment it is commissioned, including:

- Design support and dimensioning of RES plant equipment (through steady-state studies)
- Design of the RES plant's electrical system including protective grounding, neutral grounding, and lightning protection
- Dimensioning and coordination of the RES plant protection equipment and surge arrestors through insulation coordination studies, protection philosophy and settings calculation
- Verification of grid code compliance through steady-state studies, harmonic analysis, transient studies, and dynamic studies
- RES plant simulation model validation

Product modeling and verification for RES generator manufacturers

Original equipment manufacturers (OEM) are the providers of the main equipment for any RES project, i.e. RES generators. The delivered equipment might include wind turbine generators, photovoltaic inverters, central control units, or plant control systems for instance. The OEM is responsible for delivering a validated simulation model of its product to the TSO by the time the RES plant is commissioned. The simulation model shall be delivered to the TSO according to defined requirements.

Siemens PTI supports OEMs in developing the appropriate equipment simulation models. Our services include:

- Model development for the root mean square (RMS) domain in PSS[®]E, PSS[®]SINCAL and DigSILENT PowerFactory software simulation packages, among others
- Model development for the electromagnetic transients (EMT) domain in PSS[®]NETOMAC, PSCAD[™], and DigSILENT PowerFactory software simulation packages, among others
- Simulation model validation

Power system simulations for RES plant operators

At plant commissioning, the operational risk will be transferred from the EPC to either the developer or the RES plant operator. (However, this does not release the RES EPC from its responsibility to ensure a proper, reliable and secure design of the RES plant.)

Drawing from a broad technical portfolio in power system consulting, Siemens PTI can provide assistance to RES plant operators in any operational difficulties or on-site problems. Through re-creating and analyzing the on-site conditions in a simulation environment, the root causes can be identified and, based on the results, suitable mitigation measures can be proposed to the operator.

Further information

If you are interested to learn more about Siemens PTI's consulting offering for the integration of RES or in our experiences gained in previous studies, please contact us – we will be glad to provide more information on our services.

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