

# Nodal Economic Analysis

## At a glance

The power industry no longer relies on typical power analysis tools and expertise to determine the impact on a transmission-distribution system and the reliability of planning and operations of the power grid. The power market will have a keen sense of both the physical electrical and economic behavior of the power system.

Assessing the viability of any major energy sector project, apart from accounting for the cost of the project itself, requires an estimate of revenue and an identification of uncertainties and risk factors. In today's competitive environment, the determination of quantity and price must consider the factors of competition and deliverability, in addition to generator technology and fuel cost. These factors impact both the quantity of energy that is required from a power plant and the anticipated price.

Siemens Power Technologies International (Siemens PTI) provides consulting services covering both power flow and production cost analyses. Focusing on Production Cost Analyses, we can enhance your business through:

- Network transmission experts who also have complementary skills in production cost analysis to capture cost/benefits, location marginal price, revenues, cost-of-service, etc.
- Curtailment analyses
- Revenues analyses
- Cost/Benefit analyses for project ranking
- System costs and expectations
- Integrated resource planning
- Transmission congestion analysis

## The challenge

Market simulation relies on sophisticated security-constrained unit commitment (SCUC) and security-constrained economic dispatch (SCED) programs. These are used to simulate the daily market clearing process that determines prices and schedules. Very briefly, the SCUC determines when generators will be started and stopped; the SCED determines generator schedules (quantities) and prices, from which revenues are determined.

The price of electric energy at a particular location (the locational marginal price or LMP) can vary widely throughout the day. LMP also has

seasonal changes and variations based on daily profiles. The demand for energy also exhibits these variations and is a major factor in projecting LMP. Determining price and quantity, subject to competition and deliverability, requires SCUC and SCED to evaluate the complex interactions among all competitive resources in the constrained electric system.

Resource owners / developers require a host of information in order to maximize the capabilities of their planned and existing generating facilities.

Transmission planners, Independent System Operators, Transmission Developers, etc., are seeking economic analysis to provide input on project costs and cost/benefit analysis.

Integrated Resource Plans now include full nodal analysis, whether looking at a single resource or an entire plan that bridges a number of years.

## Our solution

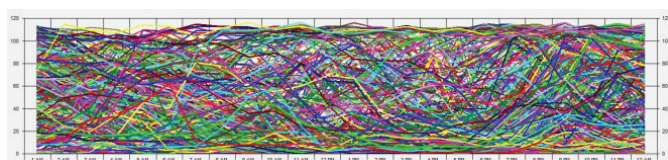
In addition to our traditional transmission planning, Siemens PTI provides services for the economic analysis of transmission systems and financial feasibility of projects. These include the assessment of electricity prices and generator schedules based on market simulation. Siemens PTI combines physical and economic analysis services to bring together the necessary factors to perform these complex studies.

Faced with confidentiality arrangements, critical infrastructure issues and the need to provide a level of service to load and generator customers alike, Siemens PTI has strengths to provide consulting services needed to fully evaluate the power grid and provide answers to complex questions for each of the players in the power grid market.

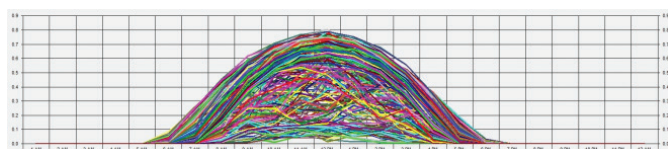
### Renewable resource modeling

Utilizing climate data from various sources, Siemens PTI can provide hourly output models for multiple years.

Wind data is utilized to determine Wind Farm output. The MW output is determined utilizing the specific capability of the wind turbine, climate data and other factors like “shading”. Below we see the output for 8,760 hours for a 120 MW wind farm.



Solar modeling from irradiance data – using irradiance data from climate data and output from programs like PVSyst, Siemens PTI can provide hourly models. Depicted below is an example of an 8,760 hour per unit model for a solar farm in a specific location.



Because of the granularity of the model, the resource owner/operator can select low output periods to consider facility maintenance.

### Curtailment analysis

Production cost analysis provides the system costs for a system with and without a project. Within the calculations determined are the Curtailment and Emergency Energy required in a production cost year. The Curtailment of the specific farm can be determined as a factor between a non-project and project run or it can be viewed as a probability that can point directly at the resource under study. Where curtailment is a higher probability the resource owner/operator can select to perform facility maintenance.

### Congestion analysis

Foremost on the mind of the resource owner/operator is the possibility of being curtailed due to transmission limitations. Coupled with power flow analysis, Siemens PTI can provide the owner/operator with the anticipated limitation(s), the contingencies driving those limitations, and the possibility that the limitation will impact the site over the year(s), etc., which provides the owner/operator with an estimation of the full impact of transmission congestion.

### Revenue analysis

Based on the model provided or determined, Siemens PTI can determine the Location Marginal Price (LMP) at the specific node the resource is injecting into the system. This LMP and

the resource output can provide the owner/operator with the anticipated revenues for the facility.

### Cost / benefit analysis

Various entities involved in transmission expansion, upgrades or other physical changes to the transmission/distribution system are all concerned about the cost of the project and whether there are other project(s) that accomplish the same affect at a lesser cost. This points to the need for cost / benefit analysis of projects. Siemens PTI performs this economic analysis over a period of a year, looking at system costs with and without projects to determine the difference in system costs. The lower the cost, the better the cost / benefit ratio. The ratio for each project evaluated provides a ranking for which project accomplishes the most at the least cost.

### FERC Order 1000

An extension of the Cost / Benefit Analysis, the same process is applied in weighing the cost / benefit between potential projects that are introduced in the FERC Order 1000 process.

### Integrated Resource Plans

Integrated Resource Plans (IRPs) are a cost / benefit analysis of resource expansion plans for various portfolios, futures, etc. The economic analysis provided through Nodal Economic Analysis provides a key foundation through which the IRP possibilities can be evaluated and eventually ranked.

### How to get started

For further information, please contact Siemens PTI consulting sales at [pti-consulting.ptd@siemens.com](mailto:pti-consulting.ptd@siemens.com) or +1 518 395 5000.

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