OMNETRIC Congestion Mitigation Model

Extracted from Watch out! Congestion ahead
Grid management in times of customer centricity
A point of view for the power utilities sector in North America
Gladville has historically been a bedroom community for Big Metro City. Recently, Gladville was also voted as #5 in the “Top 10 Small Towns to Live in the US” and is seeing rapid growth. Furthermore, with its proximity to three major universities and a major metro airport, Gladville has made the short list of cities identified by online retailer Mega River, Inc., as a potential site for a second hub.

Model parameters:
1. The utility is a regulated local distribution company focused on distribution of electricity to the end customer. It is the single source of supply in its service territory and does not have the charter to provide deregulated value-added services. The utility does not have any additional ways to drive economic benefit such as special tariff packages or flexibility services. Therefore, the distribution utility needs to be incentivized to operate efficiently through its distribution rates.

2. The utility’s regulatory ratemaking process allows it to recover all capex and O&M expenditure associated with enabling integration of customer or third-party energy resources under the various scenarios described. It also allows for recovery of lost energy revenue from integrating customer-side resources via a lost revenue adjustment mechanism. This does not automatically mean that customers will have to pay for grid upgrades in all cases, because the rate increase could be mitigated by competitive market mechanisms. However, in this simplified model, we have assumed a favorable regulatory environment, wherein the utility is able to maintain cost and revenue neutrality for infrastructure investments and the reliable integration of third party energy resources.
Gladville’s current generation capacity of 25MW connected to its distribution network will almost double over the course of the next three years.

5MW of rooftop solar capacity will be added to the grid in year one thanks to an incentive program.

15MW of solar capacity will be added to the grid via an investor-owned solar farm to be installed over three years, adding 5MW of additional capacity per year.

The utility serving Gladville realizes that the increased local generation may help mitigate some of the demand growth, but that the current grid set-up will not be able to cope with the impact of these developments. The utility is evaluating four options to master the congestion threat:

- Infrastructure enhancements
- Battery storage integration
- Demand response program
- Distributed energy resource management system (DERMS)

Model parameters:
3. The financial implications for the distribution utility were calculated over a time span of ten years. This reflects an average, market-compliant scope for investments and business case calculations, considering the projected life of inverters and battery systems. The ten-year approach may be conservative for certain classes of utility assets, but caps the benefit streams to realistic timeframes and simplifies the modeling for the out-years (when additional investments may be needed to address increased demand and equipment end-of-life).

4. The model incorporates a multitude of further key assumptions (e.g. regarding cost structures, technological feasibility and market acceptance) that are based upon data from well established, market-leading sources like EPRI and NREL.
Four options to master the congestion threat

1. **Infrastructure enhancements**
   - **Benefits**: All costs are completely recovered via rate relief and while there are no incremental financial benefits to the utility, it remains revenue neutral.
   - **Challenges**: This solution does not yield any financial benefit beyond cost recovery.

2. **Battery storage integration**
   - **Benefits**: Financial benefit over ten years is in the region of $1.5M. This translates to a yield of $7K per MW of DER capacity added to the grid (from renewables and storage) per year.
   - **Challenges**: The battery storage solution incurs almost double capital expenditure investments compared to the infrastructure enhancements route, but ongoing O&M costs are lower.

3. **Demand response program**
   - **Benefits**: Financial benefit over ten years is in the region of $3M—twice that of the battery storage integration route. This translates to a yield of $14K per MW of DER capacity (from renewables and demand response) added to the grid per year.
   - **Challenges**: The industry does not have extensive experience with the technical, performance and financial characteristics of battery storage over time.

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4. **Examples of utility-scale storage in the US to date are limited and it is difficult to determine whether regulation would currently fully support recovery of all battery costs via rate relief.**
Our simplified modeling shows that utilities can take a number of approaches to mitigating congestion, and that these approaches can also deliver financial benefit.

The model shows that the most convincing solution in economic terms is the implementation of a DERMS. This approach optimally leverages the potential of software-, behavior- and asset-driven actions to offer the flexibility required for increased capacity and resilience.

Nevertheless, all scenarios represent viable options to improve grid capacity, optimize grid management and counter congestion.

The model does not factor in the scarcity of resources (e.g. investment, personnel) and lack of experience with new technologies that could impact the feasibility and success of the DERMS route. Indeed, implementing a DERMS could call for a multi-stage approach with pilot projects to determine the optimal combination of asset-, behavior- and software actions.

All scenarios assume that the utility can fully recover capital expenditure, and operational expenditure associated with infrastructure improvements, enablement of DERs and demand response programs. Additionally, it is assumed that regulatory policy allows for a lost revenue recovery mechanism for enablement of demand response and third party DER integration. See the “Modeling parameters” footnote on pages 11 and 12 for additional information.
About OMNETRIC

OMNETRIC is dedicated to helping energy providers reap the benefits of the digital energy system by integrating their energy operations with IT to support their business goals.

Our global team of engineering, IT, security and data experts brings extensive industry experience to help customers discover and exploit data intelligence to capitalize on industry change, and realize new business models.

Helping customers since 2014, we are an inventive, technology services company. For more, visit www.omnetric.com.

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