State of Modeling the Electric Grid

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February 3, 2020

Energy for What's Ahead℠

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Agenda

- SCE's Perspective on Modeling

- What Models are Being Used?
  - SCE's Current Electric Grid Models

- How do these Models Support Decisions?

- Grid Modeling Challenges

- Recommendations for Improving Models in the Future

SCE's Perspective on Modeling

SCE's Perspective on Modeling

SCE 's objective is to keep the electric grid safe and reliable (in light of the ever changing technology and political landscape) for the future by:

- Identifying issues before they happen

- Creating solution(s) / fix(es) in place before the issue(s) arises

Accurate models help meet the objective by quantifying the issues so that solutions / mitigations can be implemented and tested

Without accurate models, it is very difficult to establish the necessary purpose and need for new projects / solutions.

What Models are Being Used?

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SCE's Current Electric Grid Models

- SCE simulates the electric grid using at least 5 different models:
    - Power Flow Model
    - Transient Stability Model
    - Electromagnetic Transient Model
    - Short Circuit Model
    - Production Cost Model

    Focus of this workshop

- Each model has its own specific set of assumptions, requirements, and data to meet a specific purpose.

- Collectively the models are integral in achieving the overall goal of providing safe, reliable, clean, and affordable energy to SCE's customers.
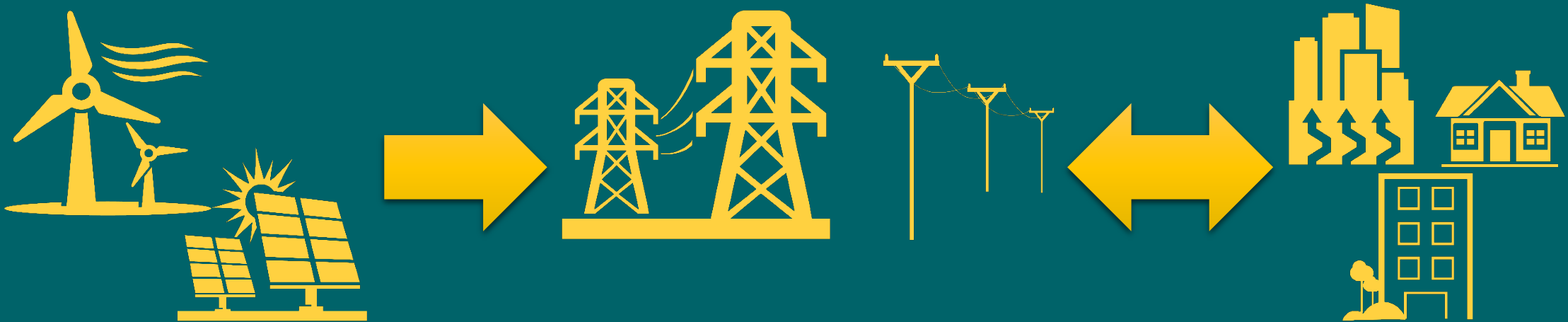
How do Models Support Decisions?

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Models' Role in Decisions

Each model is used for a specific purpose and collectively are used to justify (establish purpose and need) SCE's infrastructure investment, for example:


- A **power flow model** identifies a specific substation / transmission / distribution line(s) is outside its voltage or thermal limits due to changes to the grid. SCE would then evaluate the data and invest in either upgrading the line / adding a new line / procure generation resources / install VAR devices / etc.

Models' Role in Decisions

Each model is used for a specific purpose and collectively are used to justify (establish purpose and need) SCE's infrastructure investment, for example:

- A **short circuit model** determines if the protection relays and associated breakers can safely open the faulted equipment to protect the electrical system and persons around in the area. If it exceeds equipment ratings then it is upgraded accordingly
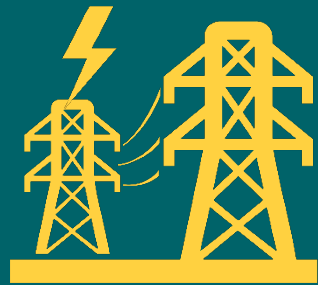
- A **transient stability model** simulates the reaction of the electric grid due to disturbances in the ~0.01 sec timeframe. If it exceeds specified thresholds, then projects will need to be implemented such as new lines / static and dynamic Voltage resources / etc.

Grid Modeling Challenges

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Grid Modeling Challenges Themes

- Inverter-based Resources
  - Correctly capturing the capability of the resources for the models

- Network Model Data Quality
  - Correctly translating resource and load characteristics from transmission and distribution to the models

- Volume of Data
  - Due to uncertainties such as resource intermittency and load composition, more scenarios need to be simulated which results in an exponential rise in the input and output of the models.
  - "Big Data" Issues

- Regulator Acceptance of Models

Recommendations for Improving Models in the Future

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Model Improvements

- Better ways to translate resource plant capabilities / settings to model variables

- Hybrid models between:
  - Power Flow and Transient Stability
  - Transient Stability and Electromagnetic Transient
  - Power Flow and Short Circuit
  - Transient Stability and Short Circuit
  - Distribution to Transmission

- Better tools to analyze and verify the output of the models with an emphasis on inverter based technology

Ideas and collaboration opportunities are welcomed and can be proposed at: www.sceideas.com

Q & A

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