Distributed Energy Resource (DER) Circuit-Level Allocation Methodology

April 18, 2018

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Electric Vehicles

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Data Suppliers

- California Dept. of Motor Vehicles*
- SDG&E - Electric Vehicles Program Management
- IHS Markit

*If such data becomes available

Inputs

- Vehicle registration data by ZIP code
- Planned EV charging stations
- EV rate enrollment

Process

- Establish key charging categories
- Categorize IEPR EV forecast
- Allocate ZIP code based adoption
- Evaluate plausibility of utilizing a Bass adoption model (Time-series DMV data required)
  - -OR-
- Use simple proportional allocation w/ existing snapshot data

Output

- Applied to each distribution circuit and substation bus

Uses

- Distribution, Transmission, Operations Planning

Energy Efficiency

Data Suppliers

- California Public Utilities Commission
- SDG&E – Energy Efficiency Program Management
- US Census Bureau

Inputs

- 2018 Potential and Goals Study
- SDG&E EE enrollment database
- Building types and NAICS codes

Process

- Establish appropriate sectors and segments* from PG study.
- Use PG study to determine relative (proportional) AAEE savings across programs and sectors
- Scale to IEPR EE forecast by sector
- Allocate to circuit based on sector and segment data

*Segment data must be aggregated up to a practical level

Output

- Applied to each distribution circuit and substation bus

Uses

- Distribution, Transmission, Operations Planning

Load Modifying Demand Response

Data Suppliers

- SDG&E – Demand Response Program Management

Inputs

- SDG&E – Annual Load Impact Reports
- SDG&E- CPUC Monthly DR Report

Process

- Incorporate monthly DR report to allocate system-wide forecast across customer sectors
- Use annual impact report to then apply sector percentages, geospatially to substations.
- Use customer counts by sector on circuits to further disaggregate from substation to circuit

Output

- Applied to each distribution circuit and substation bus

Uses

- Distribution, Transmission, Operations Planning

Photovoltaics

Data Suppliers

- California DGStats database
- NREL
- SDG&E – Electric System Planning
- Integral Analytics

Inputs

- Connected PV
- New residential construction data
- GIS and parcel data

Process

- Retrofit
  - Utilize historical data and building stock to calibrate Bass diffusion model to zip code
  - Allocate to circuits
- New Construction
  - Allocate IEPR AAPV to new construction
  - Utilize Integral Analytics GIS tool to geospatially estimate new development

Output

- Applied to each distribution circuit and substation bus

Uses

- Distribution, Transmission, Operations Planning

Energy Storage

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Data Suppliers

- SDG&E – Photovoltaics Study

Inputs

- Results of photovoltaics analysis

Process

- Use same allocation percentages calculated in the photovoltaics analysis
- Apply percentages to best available system-wide forecast, e.g. AB2868

Output

- Applied to each distribution circuit and substation bus

Uses

- Distribution, Transmission, Operations Planning

BTM PV: Case Study

Suppliers

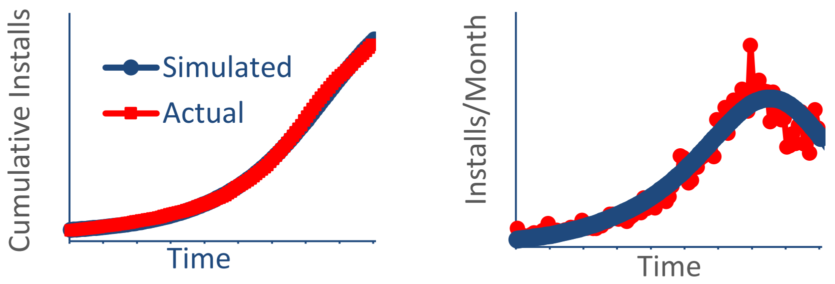
- SDG&E
- NREL
- New Solar Homes Partnership

Inputs

- Historical PV adoption from SDG&E interconnection database
  - aggregated to zip code level
  - segmented by sector
- Building stock growth forecast
- Assumed percentage of new homes built to current standards (consistent with IEPR assumptions)
  - distinguish b/w base case & "additional" PV due to SB 350
- PV generation load shapes
- Mapping of customers to substations and circuits

Process

- Simulate adoption using a Bass diffusion model (S-curve), using a System Dynamics framework
- Calibrate diffusion coefficients to historical adoption, by sector and zip code
  - Calibrate circuit-level coefficients only where sufficient adoption history warrants (minority exception)



- Hold S-curve "shape" coefficients constant, & calculate circuit-level long-run market share that would result in same zip code-level adoption
- Scale spatial adoption to IEPR system forecast

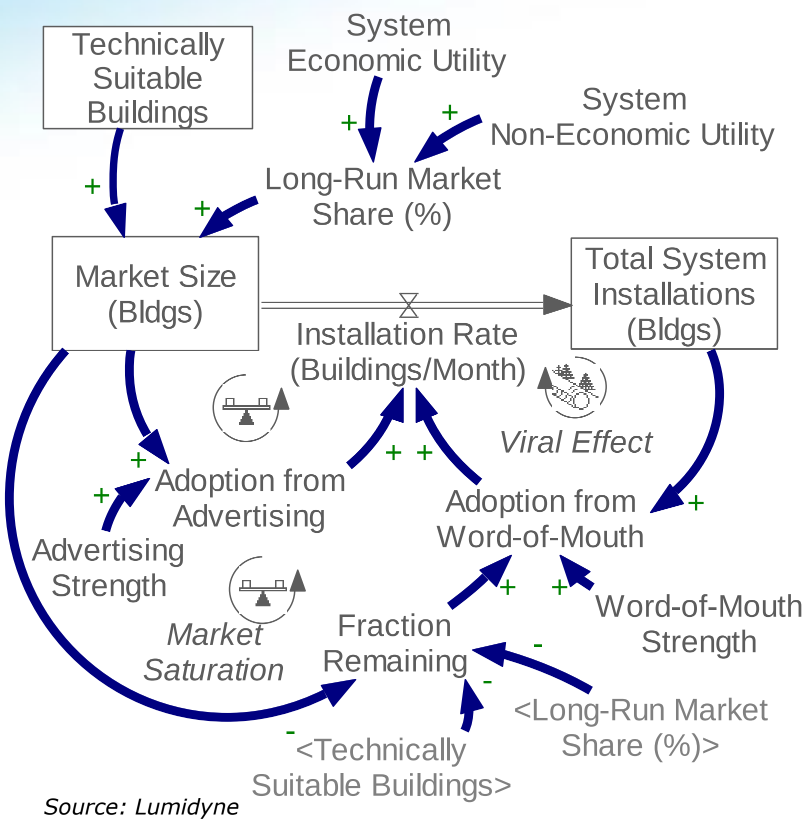
BTM PV: Case Study

Adoption Modeling

- Bass diffusion[1] in System Dynamics (SD)[2] modeling framework
  - well-established theory applied since 1969 to scores of technologies/industries
  - reprinted in 2004 when classified as among the 'Ten Most Influential Titles in "Management Science's" First Fifty Years '[3]
  - when implemented in SD framework, it readily permits time-varying inputs (costs, tax credits, rates, etc.)
  - ideally suited to solar PV adoption forecasting

System Dynamics (SD) Causal Loop Diagram

Each stock/flow is disaggregated as appropriate (e.g., to substation level)



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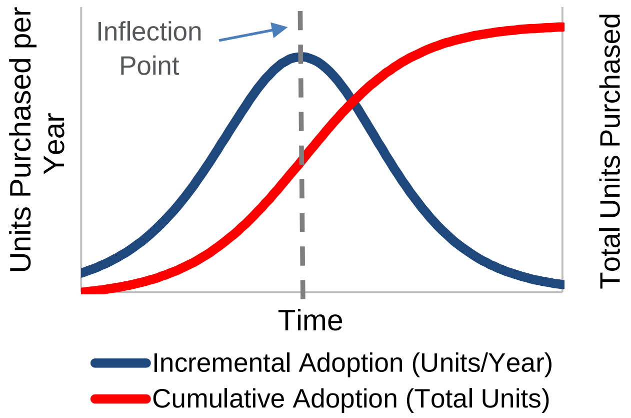

1. Bass, F. (1969). A New Product Growth for Model Consumer Durables. *Management Science*, *15*(5), 215-227. Retrieved from http://www.jstor.org/stable/2628128
2. Sterman. J (2000). "Business Dynamics: Systems Thinking and Modeling for a Complex World." McGraw-Hill. New York, NY.
3. Bass, F. (2004). A New Product Growth for Model Consumer Durables. Management Science, 50(12), 1825-1832. Retrieved from http://www.jstor.org/stable/30046153