Solar Integration and Batteries at Xcel Energy

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Xcel Energy CO Energy Supply

**Colorado**

2015 Electricity Supply by Energy Source

- Natural Gas: 23.5%
- Wind: 19.3%
- Coal: 52.9%
- Other Renewable: 3.4%
  - Hydro: 2.0%
  - Solar: 1.3%
  - Biomass: 0.1%
- Other: 0.9%

23% Carbon-free Electricity

**Projected 2020**

- Natural Gas: 22%
- Wind: 28%
- Coal: 43%
- Other Renewable: 7%
  - Solar: 6%
  - Hydro and Biomass: 1%
- Other: 0.9%
Past Battery Projects

**Wind to Battery**
(Luverne, MN)
- Sodium Sulfur battery
- Store excess wind energy
- Power 500 Homes for 7 hrs

2010

**Community Energy Storage Project**
(SolarTAC Aurora, CO)
- 25 kW battery connected to a simulated 4 home neighborhood

2012

**Solar2Battery**
(SolarTAC Aurora, CO)
- 1.5 MW battery connected to a simulated 4 home neighborhood
- Solar time shift, smoothing
Panasonic Microgrid Project

- Partnership with Panasonic Enterprise Solutions & City of Denver, CO
- 1 MW/2 MWh Li-Ion Younicos Battery Energy Storage System
- 1.3 MW Carport PV at Transit Station & 250 kW rooftop solar
- Feeder approaching ~20% PV penetration
- Performing multiple functions with the battery is key to making these systems more cost effective
Stapleton Project

- Located in Stapleton neighborhood of Denver, CO
- 6 utility-sited batteries
- 6 customer-sited, utility-owned, behind-the-meter batteries
- 2015: Feeder ~18.5% PV penetration
Thank You