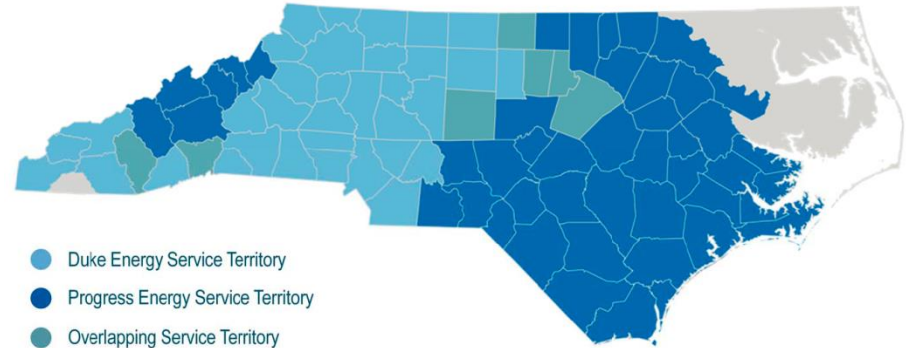


Welcome & Integrated System & Operations Planning (ISOP) Overview, Energy Systems Integration Group Fall Conference

October 29, 2019

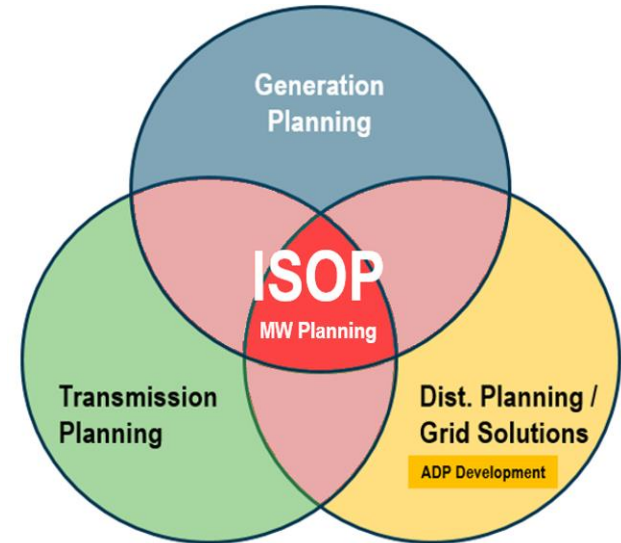
Duke Energy – North Carolina

- 115 years of service
- 3.4 million retail customers in 83 counties
- 15,880 employees; 10,700 retirees
- \$158 million in property taxes to local governments
- 56,000 square miles of service territory
- More than 32,000 megawatts of electric generating capacity in the Carolinas
- Two utilities
 - Duke Energy Carolinas
 - Duke Energy Progress
- Donated more than \$26 million to charitable causes in North Carolina in 2018
- Helped attract about \$2.4 billion in capital investments and more than 4,360 jobs to the state in 2018

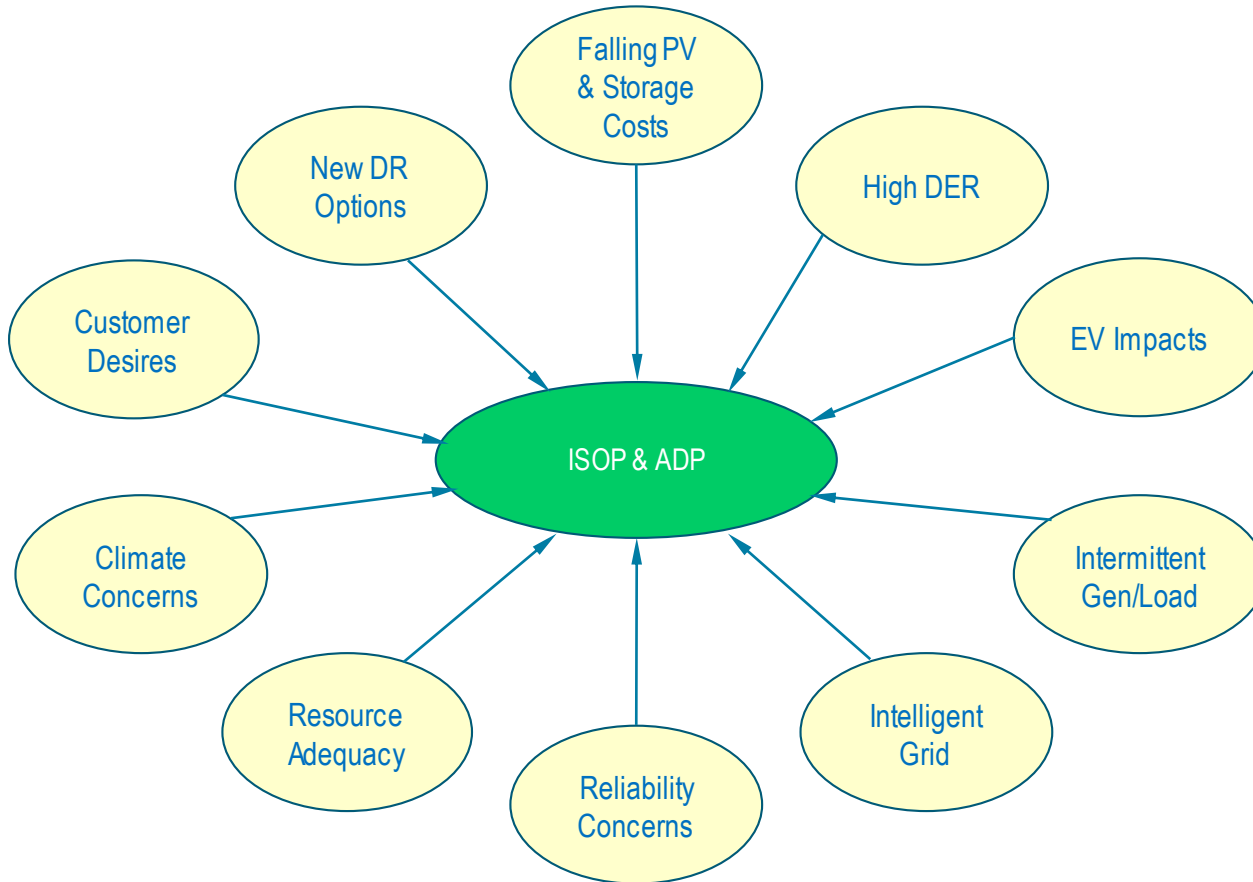


The Integrated System & Operations Planning (ISOP) vision is a planning framework that optimizes capacity and energy resource investments (MW/MWh) across Generation, Transmission, Customer Delivery and Customer Solutions. The framework will address:

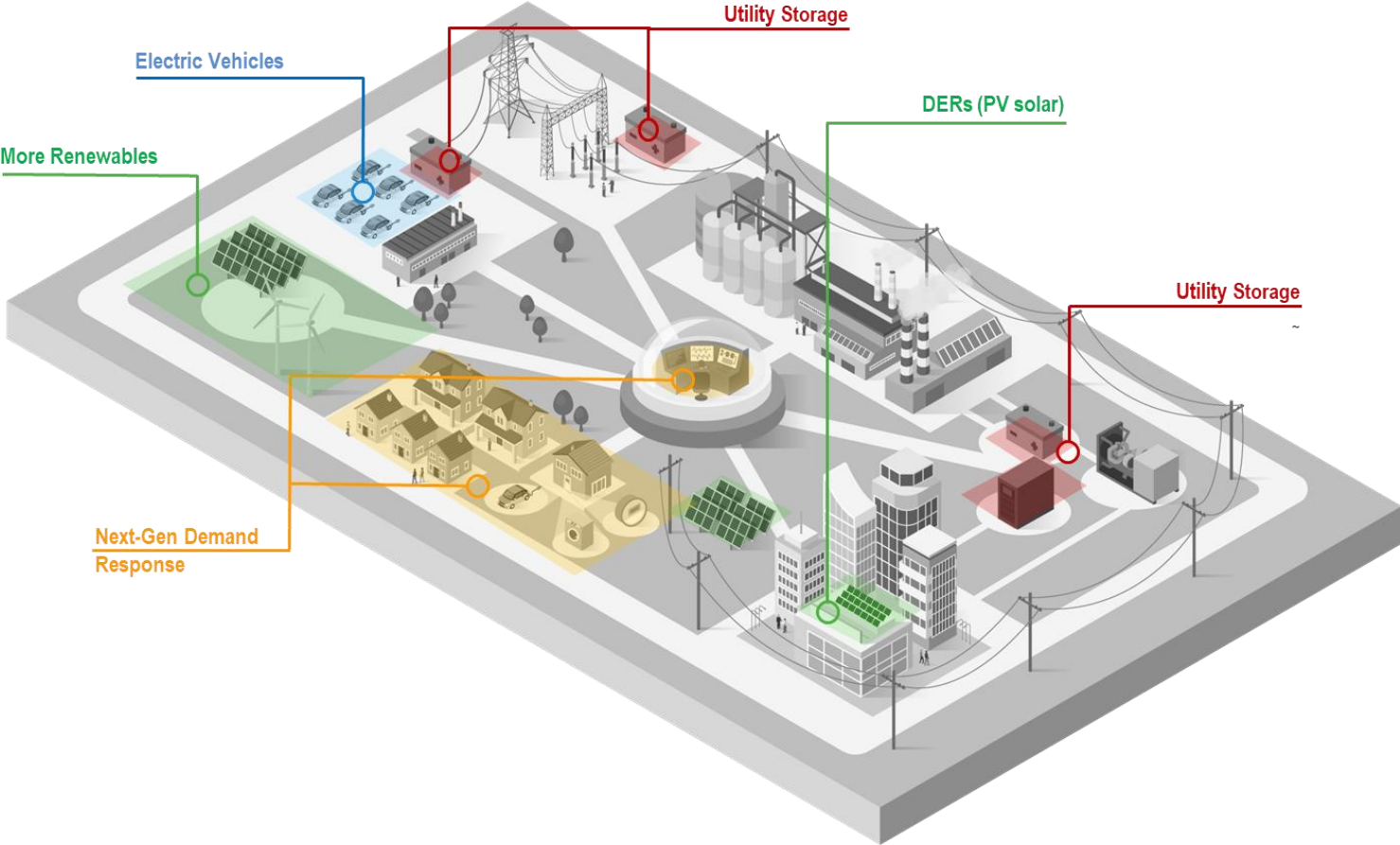
- Operationally feasible plans while accommodating rapid renewable growth
- Enhanced modeling to value new technologies such as energy storage, electric vehicles, and intelligent grid controls/customer programs (non-traditional solutions for Distribution and Transmission)
- Ability to evaluate different asset portfolios across a broader range of potential future scenarios



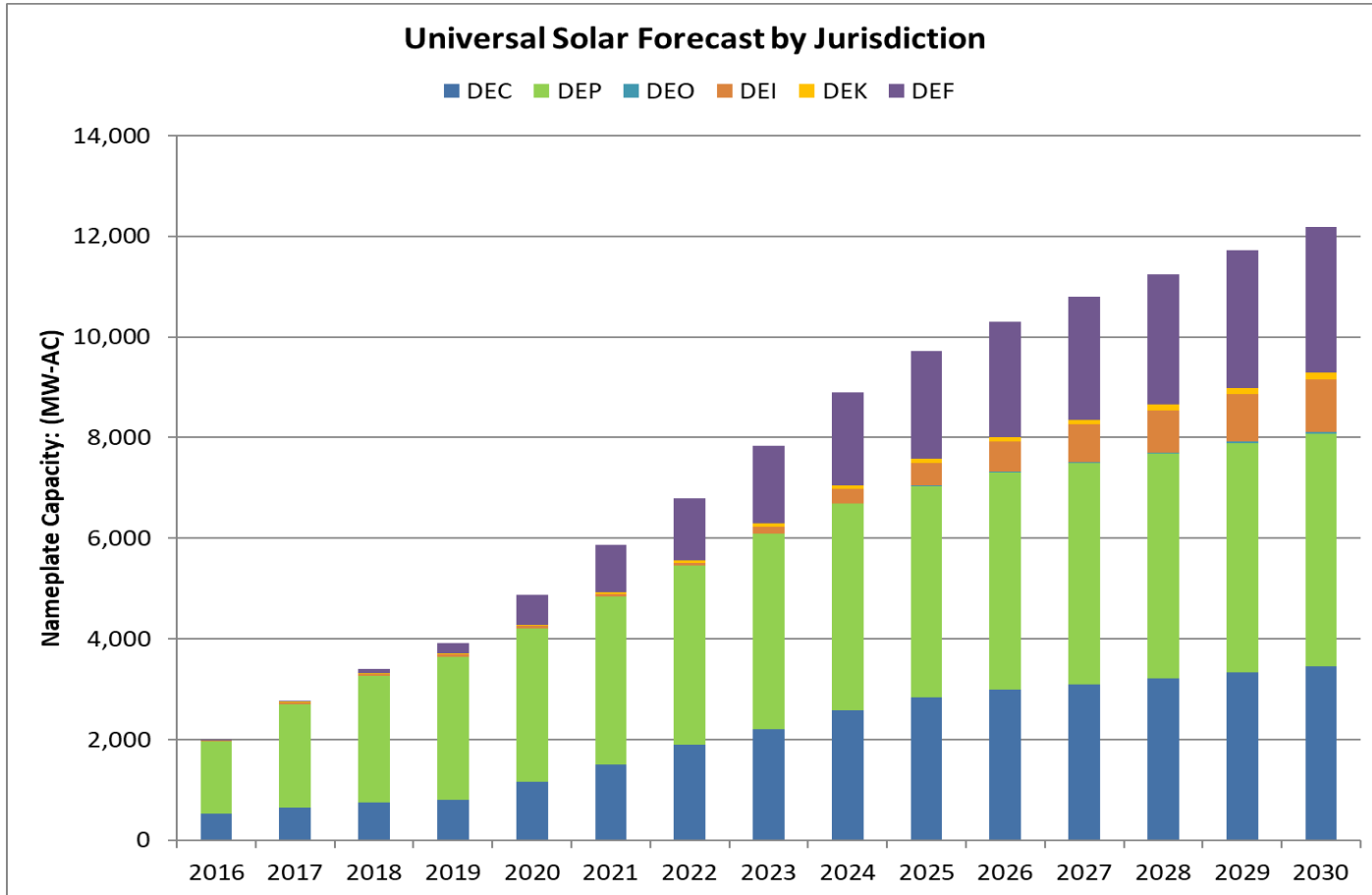
What's driving the need for Integrated System & Operations Planning?



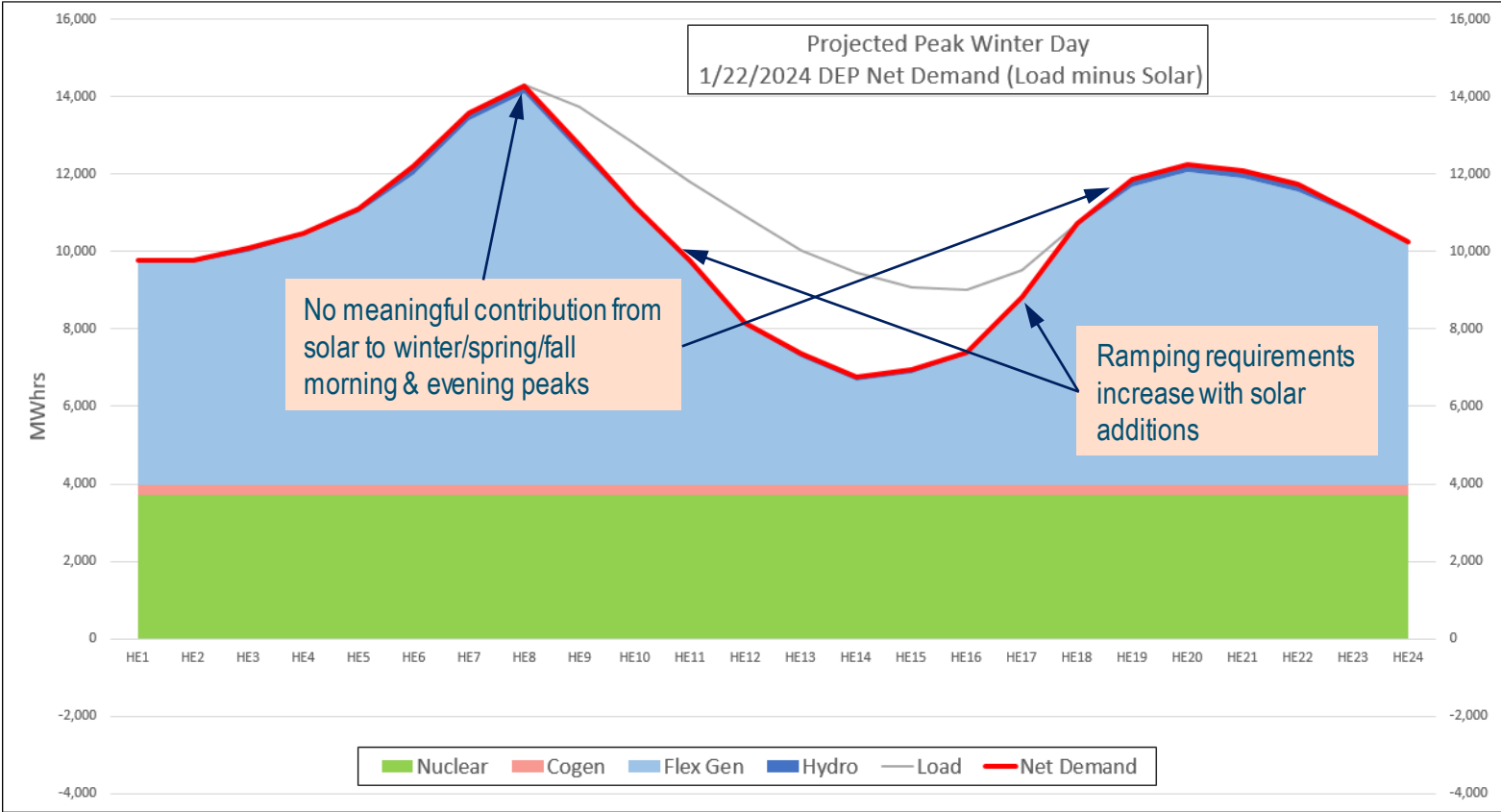
Emerging grid and customer-side technologies will impact supply/demand balancing



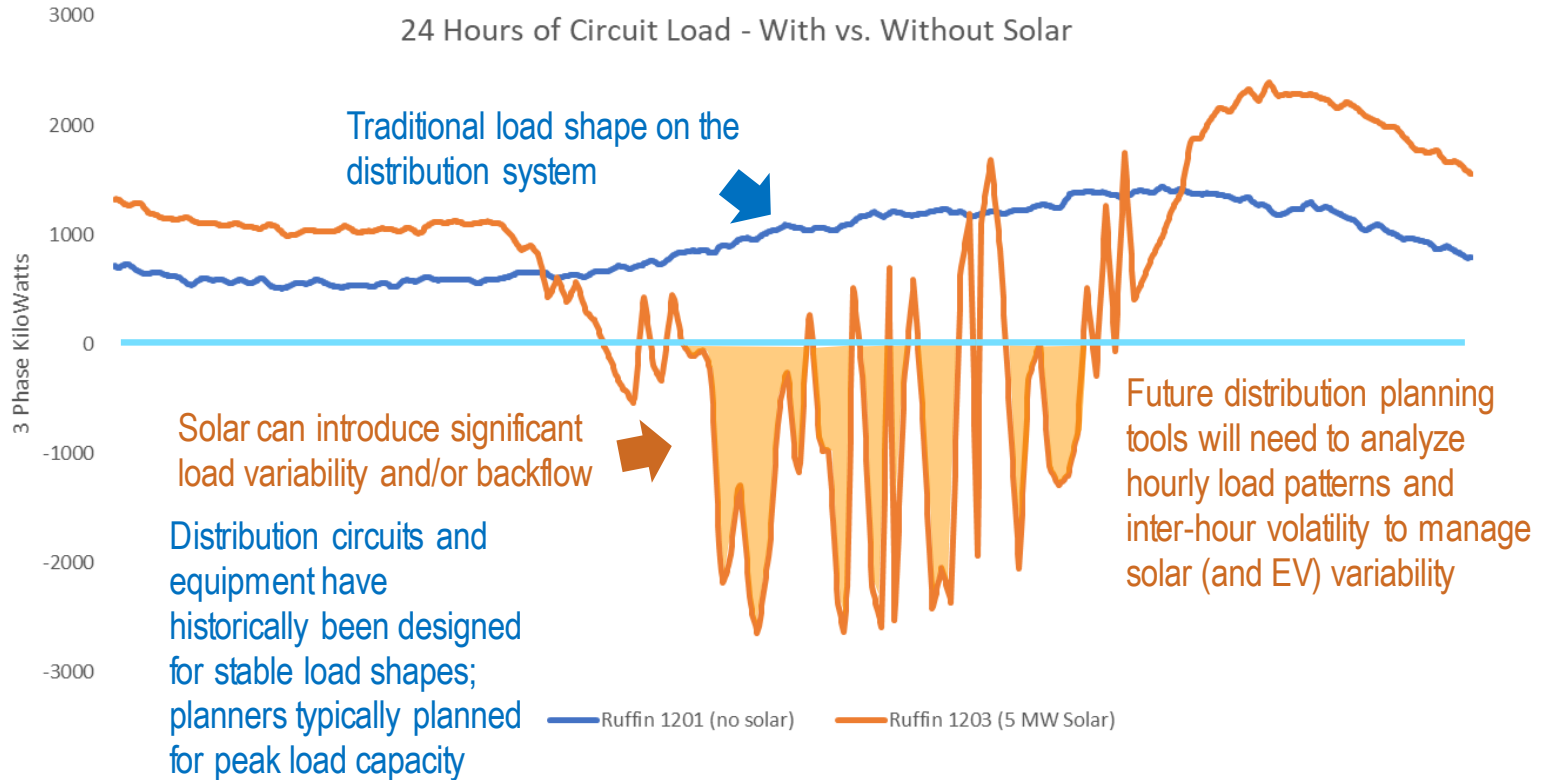
Rapid Solar Growth in the Carolinas – NC #2 in the nation in solar capacity



Adding solar helps reduce total carbon, but increases need for dispatchable capacity

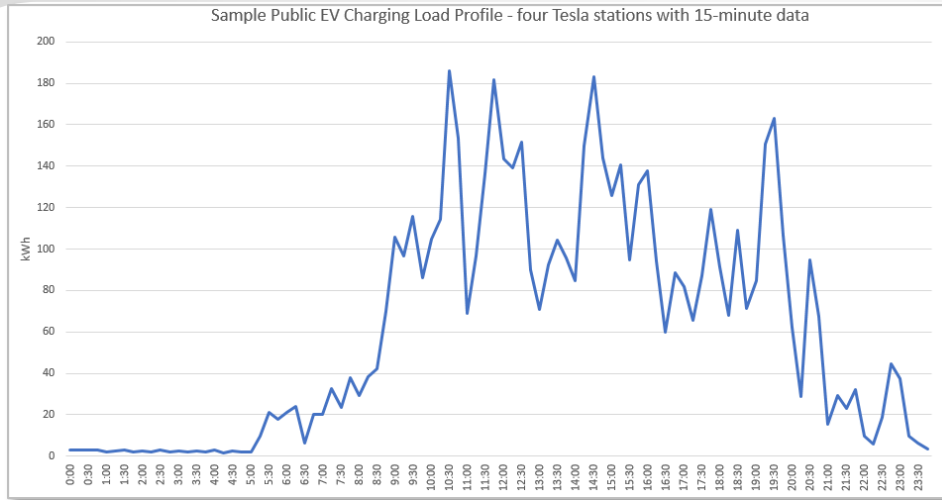


What does solar growth mean for Distribution and Transmission Planning?



Utility storage can help address intermittency and reverse flow challenges. Detailed hourly analysis is needed to assess costs and benefits for storage applications.

EV charging can introduce localized impacts on Distribution & Transmission Planning



Loading Example for Tesla Fast Charging Station

EV's are critical for reducing GHG, and also put downward pressure on electric rates, but can pose planning challenges in high penetration areas:

- Increase load volatility
- Concentrate large new delivery points
- Introduce short lead times for upgrades
- Accelerate circuit capacity needs

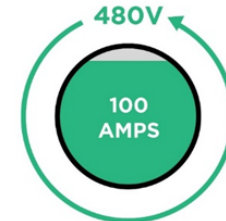
**Level 1
Charging**
2.5 kW



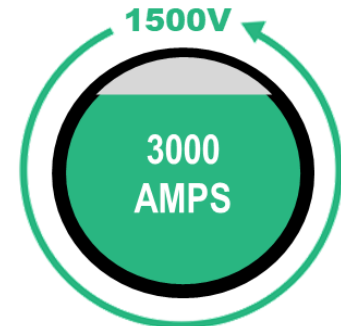
**Level 2
Charging**
20 kW



**CCS DC
Charging**
50 kW
(up to 350kW)



**Commercial
Vehicle
High Power**
(Up to 4.5 MW)



ISOP High Level Process Flow & Practical Applications

