

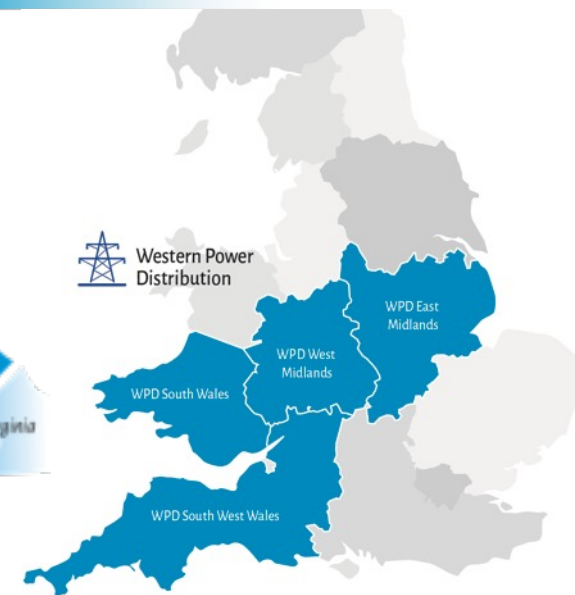
DER Impact on Distribution Planning & Operations

MADRI Working Group Meeting – June 19, 2018

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PPL Electric Utilities:

- Headquartered in Allentown, Pa.
- Serves about 1.4 million customers in 29 Pennsylvania counties
- Maintains 48,000 miles of power lines

Louisville Gas and Electric and Kentucky Utilities:

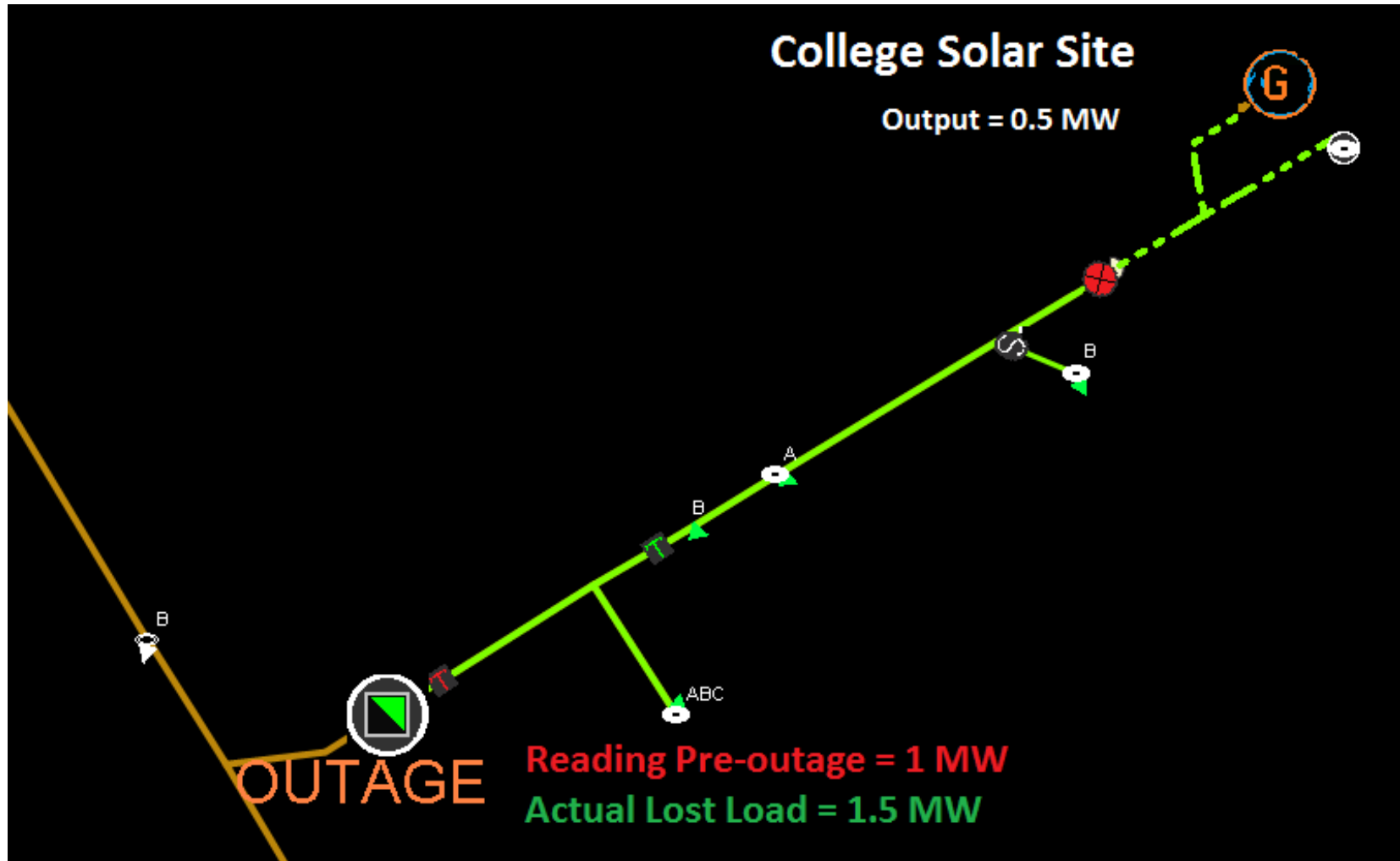
- Headquartered in Louisville, Ky.
- Serve 1.2 million customers in almost 100 counties across Kentucky and Virginia
- Produce more than 8,000 MW of power generation capacity

Western Power Distribution:

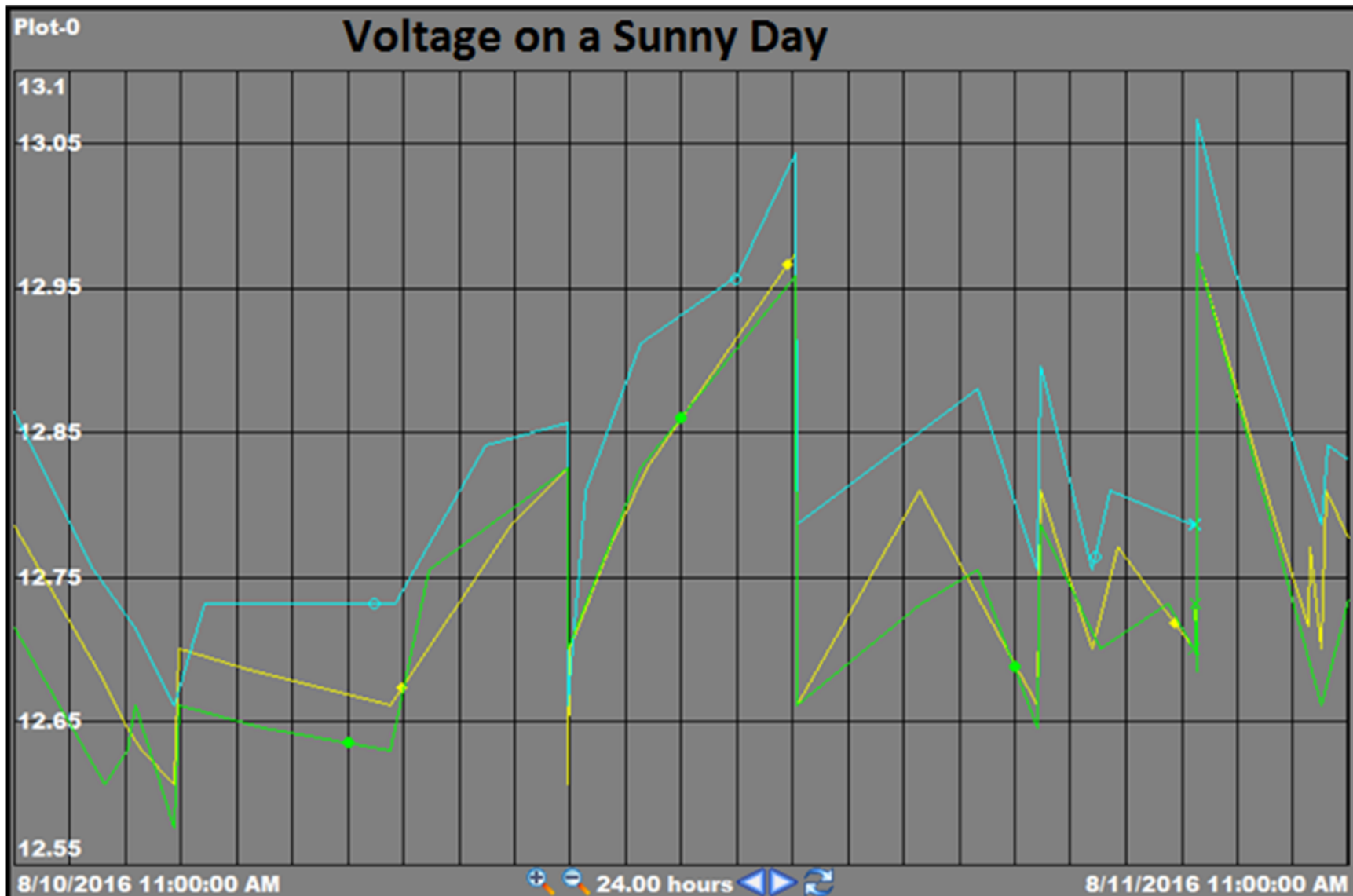
- Headquartered in Bristol, United Kingdom
- Delivers electricity to more than 7.8 million customers in the Midlands, South West England and Wales
- 138,000 miles of power lines

- Traditional planning is centered around load forecasting and grid capacity investments
- High penetration of DG has presented new challenges to:
 - Grid Reliability
 - Power Quality
 - Grid Protection

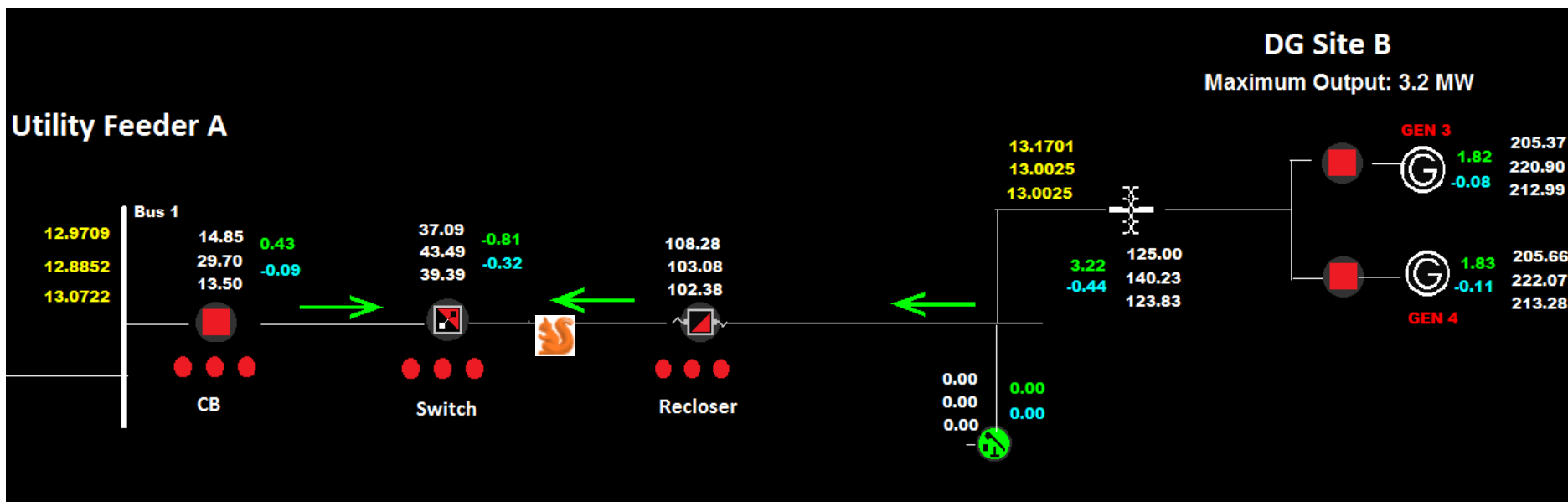
Example: Grid Reliability



Example: Power Quality

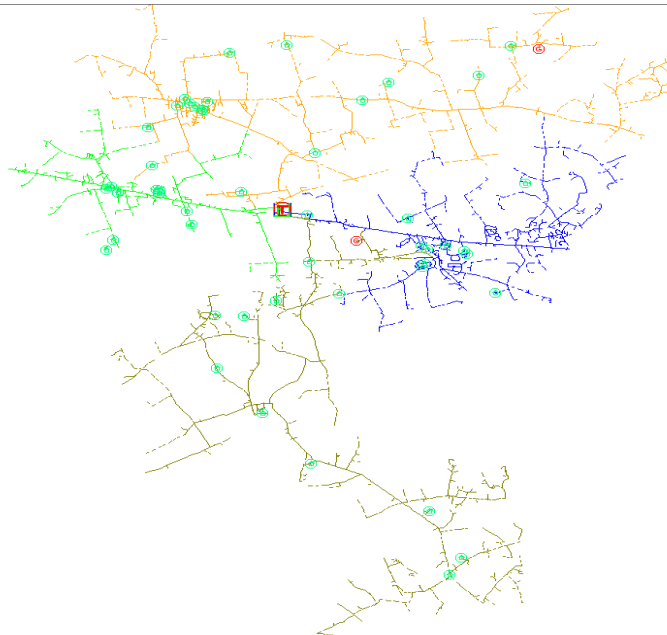


Example: Grid Protection



- Difficult to coordinate with different tripping times
- Unable to fully study DER's fault contribution without accurate modeling and complete data

- Better visibility of the grid
- Ability to forecast DG's growth and output
- Calculate DG's hosting capacity on a circuit level
- Identify the system upgrades required to mitigate the reliability and power quality challenges



Steps taken by PPL to prepare for future



- Customer facing DG Interconnection web portal
- Adopt energy storage with a battery pilot
- Enhance DMS to be DER aware

