

Impact of the Stochastic Behaviour of Renewable Resources on Power System Reliability



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Carbon Emissions → Clean Energy

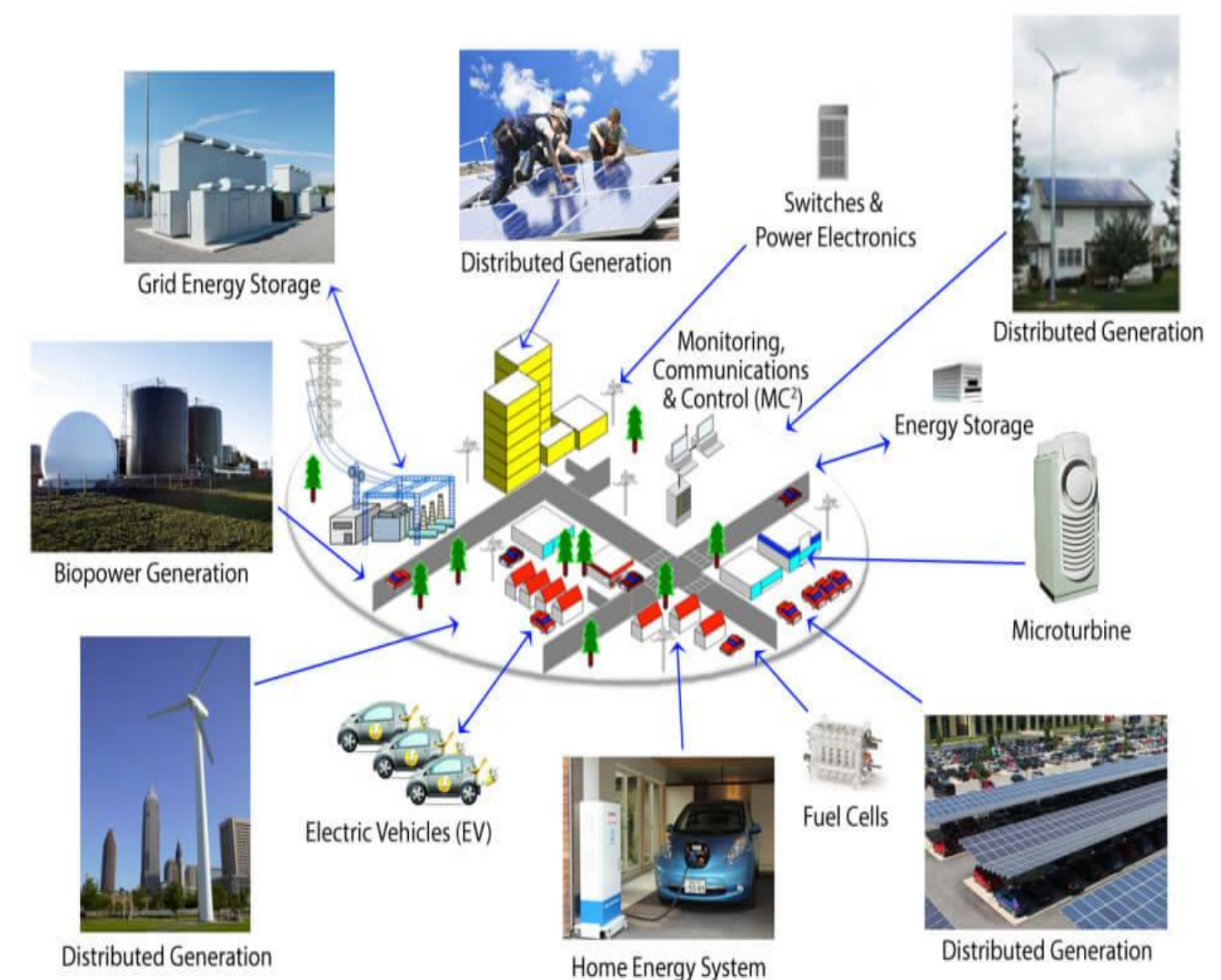
Widespread development of renewable energy technologies in power system networks promises to substantially improve energy efficiency, economy and consumption.

This is expected to improve climate by reducing carbon emissions and promoting a clean energy future.



Smart Grid Functionality

Intelligent implementation of 'smart grid' network functionality will improve the quality of supply experienced by the end customers.



Renewable-based small-scale generation technologies allow for the deferral of (usually exorbitant) capital investment for network area reinforcement.

Spatial and Temporal Variability ?

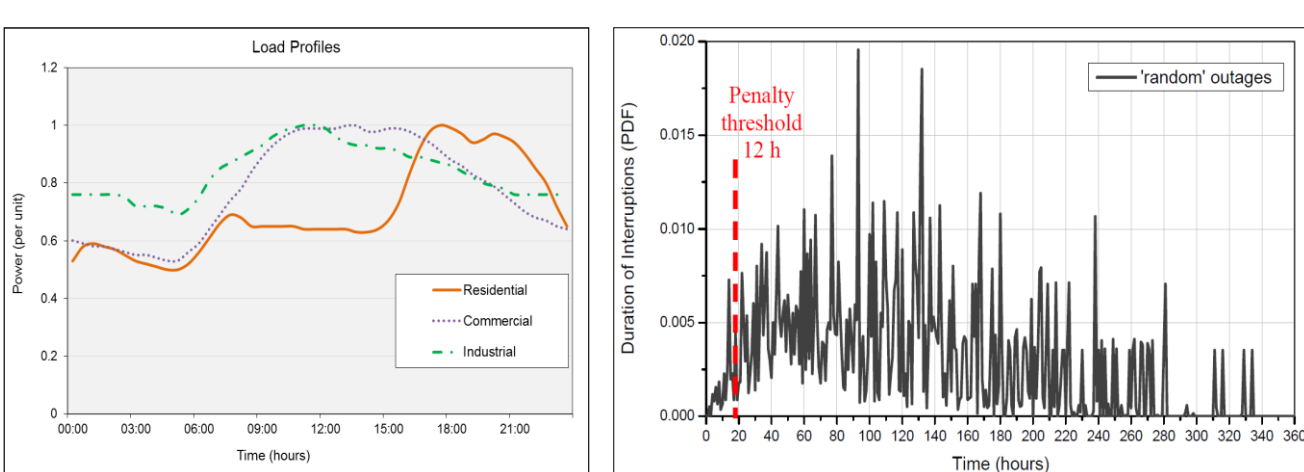


Unpredictability of solar irradiance and wind profiles, failure rates of associated equipment and consumers' energy-use patterns creates substantial uncertainty about the impact on reliability.

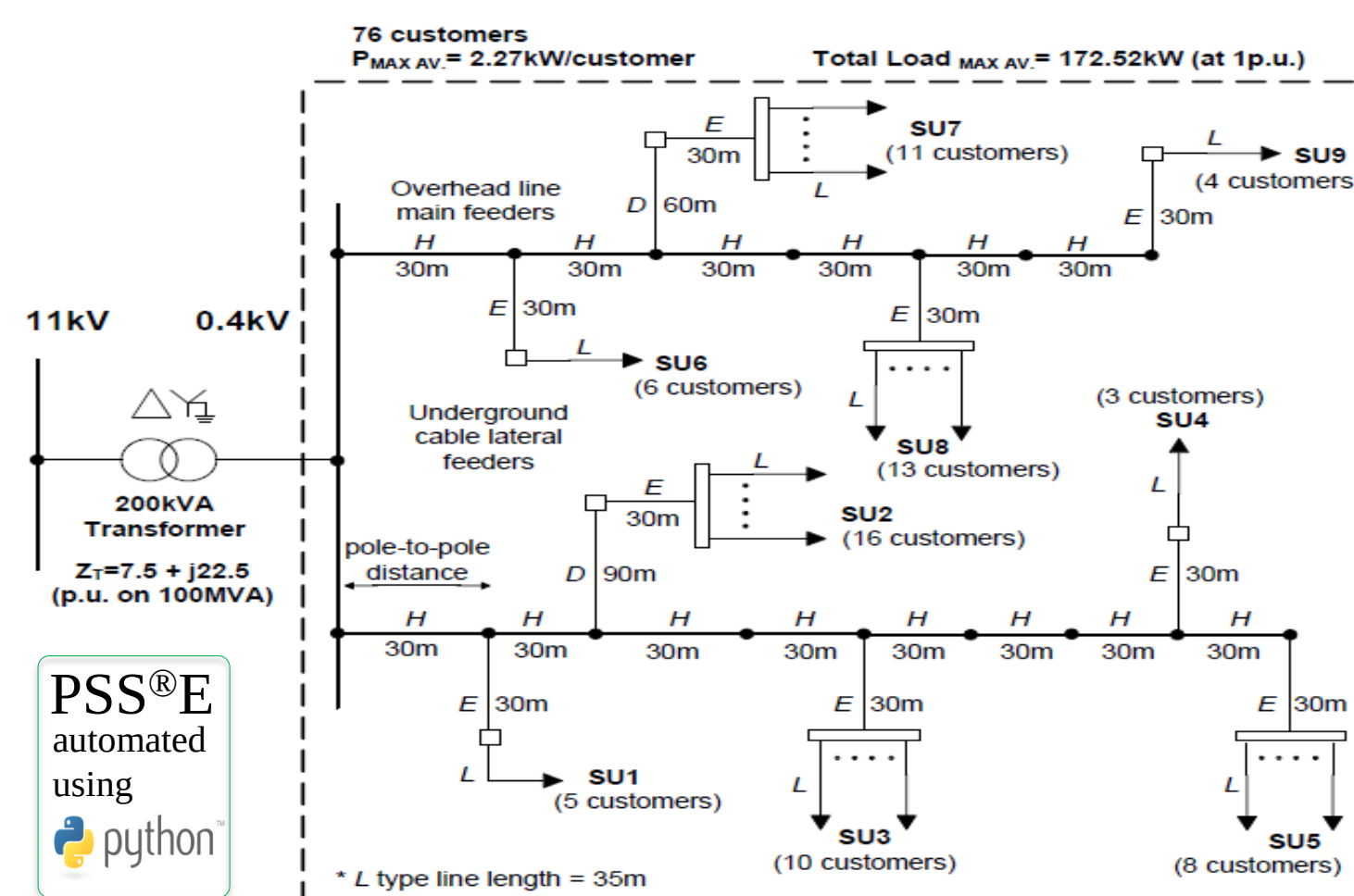


Methodology – Integrated Quality of Supply Analysis

Improving conventional **Monte-Carlo simulation** (using MATLAB) by including time-variation of electricity demand profiles and power components' failure rates.



Suburban distribution network

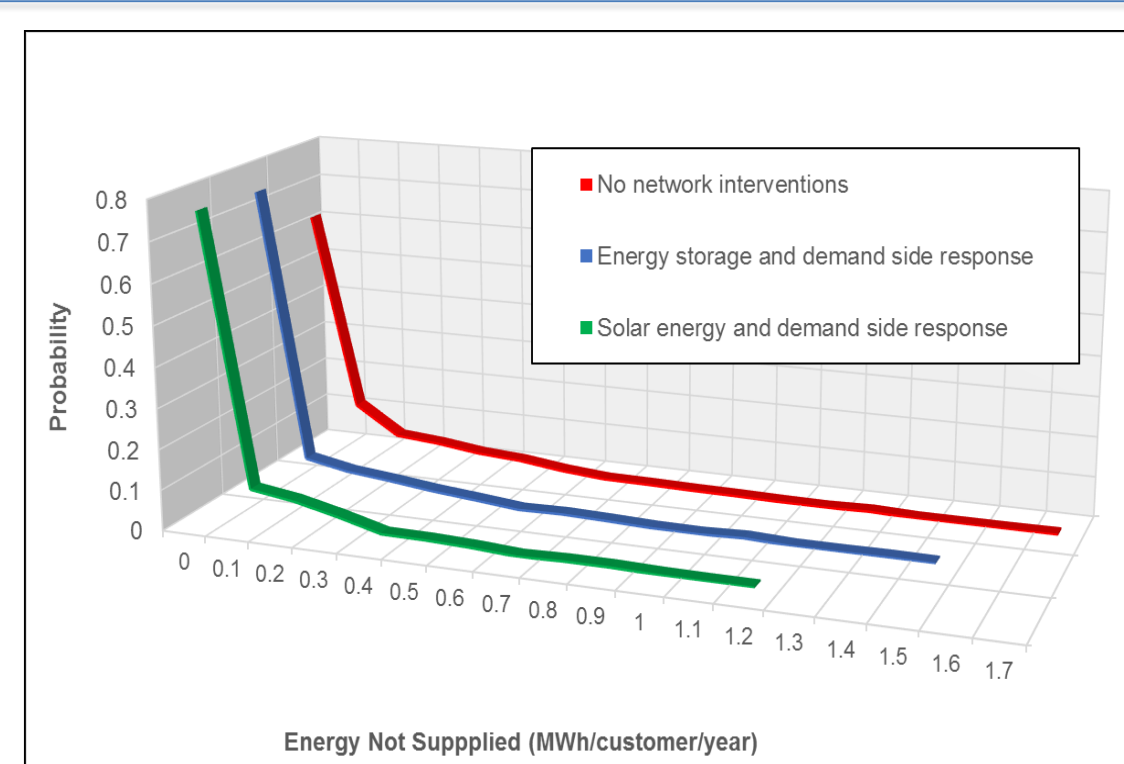
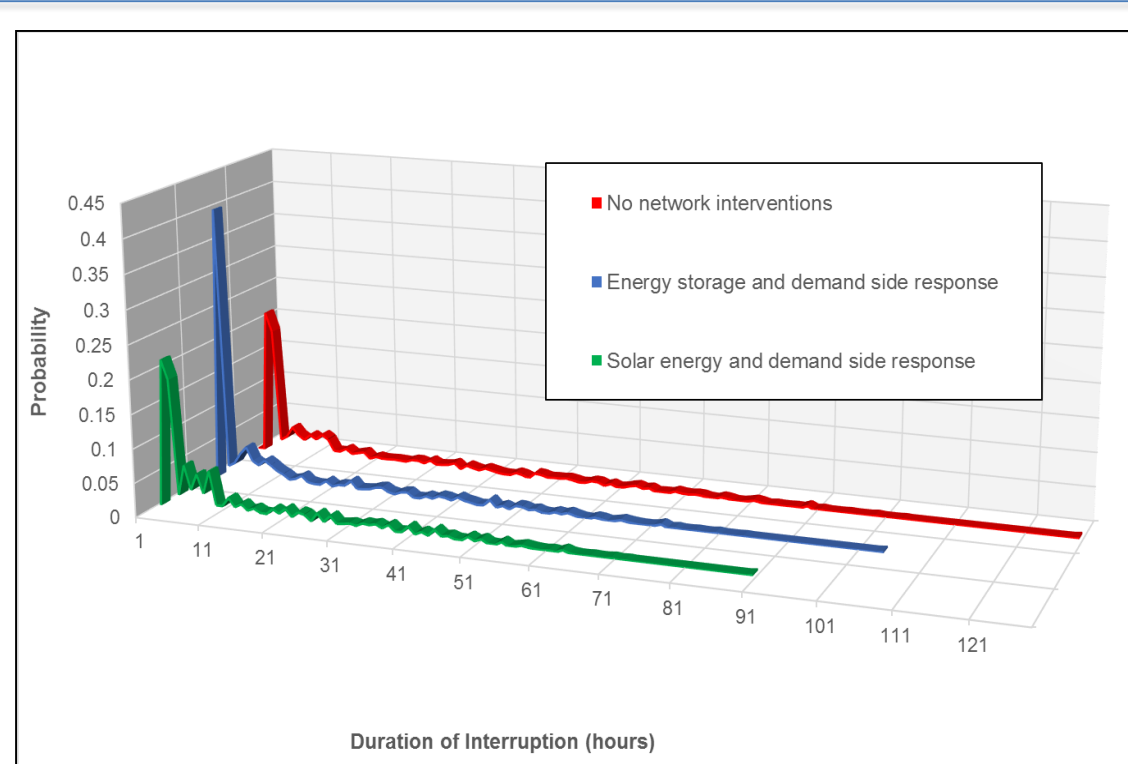
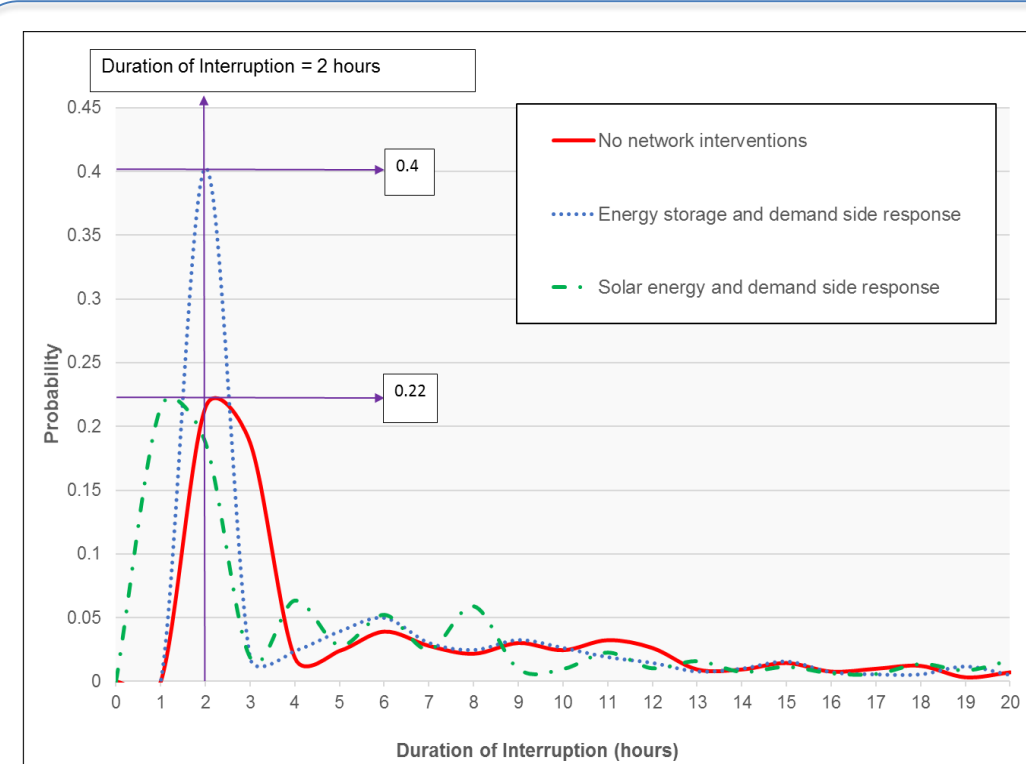


Calculate standard **reliability performance indices** – assessing frequency and duration of interruptions, energy not supplied, etc.

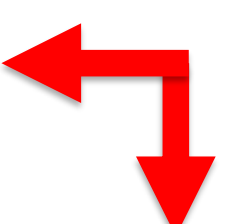
Model different 'smart' interventions



Results and Conclusions



Reductions in the frequency and duration of interruptions, and energy not supplied



Impact on duration of interruptions and energy not supplied

Fast-track development of planning and operation tools (integrating system reliability) **to increase energy efficiency** and most importantly, **save on energy cost**.

Further work will integrate power quality into the analysis and quantify the commercial benefits.