Overview of DECC and Research Goals

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Overview

- **ORNL's goal is to develop methods for the independent, autonomous and scalable control of DE.**
- **We expect that in the future, DE will regulate local voltage under utility supervision.**
- **The goal is that the a local control method can be developed that only has utility overview: a voltage schedule, and the local DE will make the rapid control decisions.**

Local Voltage Control Can Improve:

- **Power quality by correcting unbalance and harmonics.**
- **Load efficiency by controlling voltage to the optimum level for efficiency**
- **Distribution efficiency by reducing losses.**
- **Reliability by increasing the margin to voltage collapse.**
- **Transfer capability, decrease congestion, and lower prices.**

Many Utilities Are Examining Voltage Issues

- **System contingencies can lead to micro voltage collapse on distribution circuits.**
- **Tight voltage control can lead to efficiency improvements.**
- **At least one utility is using local voltage control for revenue optimization.**

How Can a Local Voltage Control Method Be Applied to a Range of Distribution Systems?

- **It must be scalable – easily modified by changing control constants to go from large to small systems.**
- **It must be adaptable – easily changed from radial to network to other types.**
- **It must be autonomous – DE will be provided with a voltage schedule from the utility, but DE will respond rapidly to transients.**

We Will Develop the Scalable, Adaptable Algorithms in the DECC, then Apply in the Field

- **We will develop methods to find control constants.**
- **Methods must be simple, easy to use, similar to NEMA MG1 for motor application using nameplate data.**
- **We will perform simulations and preliminary testing here at the DECC laboratory which is connected to the ORNL distribution system.**

Some Utilities Are Using Extremely Tight Voltage Regulation

- **A utility in Oregon (SNOMISH) now has a maximum of 3% voltage drop from the transmission bus down to the feeder.**
- **Voltage at the customer is held at 119 volts.**
- **This utility has found a 0.5% loss reduction for every 1% reduction in voltage.**

We Are Studying Methods to Compensate Customers for Supplying Reactive Power

- **The payment must be greater than the cost to the customer for the needed equipment, operations and maintenance.**
- **The payment must be lower than the savings to the transmission system and distribution system operator.**
- **The savings should include reduced losses, released transmission and distribution capacity, expanded margin to voltage collapse, and improved power quality.**
- **A reasonable tariff would provide a payment somewhere in between the cost of supply and the value to the system operator and distribution company.**

Research Goals

- **Develop local control methods that are scalable, adaptable and autonomous.**
- **Test these methods at the DECC.**
- **Test the methods in an actual utility setting.**
- **Use the methods in a widespread distribution application.**
- **Evaluate the effect on distribution efficiency, increasing the margin to voltage collapse, and increasing transfer capability.**

Papers in Preparation

A Tariff for Reactive Power, Authors: Christopher Tufon, Alan Isemonger, Brendan Kirby, John Kueck This paper will be a thorough study using three sample customers. An abbreviated version will also be published in a Journal. We also have been invited to present this paper at the IEEE Power Engineering Society Transmission and Distribution Conference