



▶ Transactive Energy

Senior Design Project

The Team

Senior Team:

Joshua Ropp
Matthew Springer
Fan Meng
Liwei Liu
Zhiyu Chen

Sponsors:

Avista

Clients:

Dr. Yacine Chakhchoukh
Dr. Daniel Conte de Leon

Advisors:

Dr. Herb Hess
Dr. Brian Johnson
Dr. Hangtian Lei
Dr. Li Feng
Andrew Miles
Hussain Beleed

Value Proposition

- Data analytics to increase efficiency in the distribution system
- Profitable electric power pricing for Avista and the homeowner(Prosumer)
- Possibility of semi-automated trading of power

Product Requirements

We are using OpenDSS to handle the modeling aspect of this project. The reason is, it's open source so we don't have to deal with licensing.

The OpenDss Model needs to be changed dynamically.

Since we are dealing with renewable energy, we will have to consider how to implement PV panels.

Progress

- Created a PV profile for a summer and winter day, week, and month.
- Implemented a 13-bus system in Simulink and OpenDss without PV for our base case

The model does not include the regulating transformer between nodes 650 and 632

$P = [17 \ 66 \ 117] * 1e3 / 2 \text{ W}$
 $Ql = [10 \ 38 \ 68] * 1e3 / 2 \text{ var}$
 $Qc = [0 \ 0 \ 0] \text{ var}$

632 Yg PQ

632 Swing bus
 1.0210 pu -2.49
 1.0420 pu -121.72
 1.0174 pu 117.83



632

632



646_Z
 $P = 230e3 \text{ W}$
 $Ql = 132e3 \text{ var}$
 $Qc = 0 \text{ var}$

646

645-646

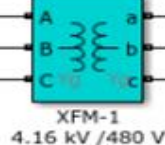
645

632-645

632-633

633

633



634



634 Yg PQ
 $P = [160 \ 120 \ 120] * 1e3 \text{ W}$
 $Ql = [110 \ 90 \ 90] * 1e3 \text{ var}$
 $Qc = [0 \ 0 \ 0] \text{ var}$

PQ
 $P = 170e3 \text{ W}$
 $Ql = 125e3 \text{ var}$
 $Qc = 0 \text{ var}$

632-671

$P = [17 \ 66 \ 117] * 1e3 / 2 \text{ W}$
 $Ql = [10 \ 38 \ 68] * 1e3 / 2 \text{ var}$
 $Qc = [0 \ 0 \ 0] \text{ var}$

671 Yg PQ



Power-Flow Results

Phasor 60 Hz
 powergui

671



$P = [385 \ 385 \ 385] * 1e3 \text{ W}$
 $Ql = [220 \ 220 \ 220] * 1e3 \text{ var}$
 $Qc = [0 \ 0 \ 0] \text{ var}$

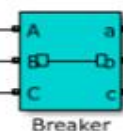
671 D PQ

Power-Flow Results

Phasor 60 Hz
 powergui

692

675



692 D I
 $P = [1e-6 \ 1e-6 \ 170] * 1e3 \text{ W}$
 $Ql = [0 \ 0 \ 151] * 1e3 \text{ var}$
 $Qc = [0 \ 0 \ 0] \text{ var}$

675



675 Yg PQ
 $P = [485 \ 68 \ 290] * 1e3 \text{ W}$
 $Ql = [190 \ 60 \ 212] * 1e3 \text{ var}$
 $Qc = [0 \ 0 \ 0] \text{ var}$

675 Yg Z
 $P = [0 \ 0 \ 0] \text{ W}$
 $Ql = [0 \ 0 \ 0] \text{ var}$
 $Qc = [200 \ 200 \ 200] * 1e3 \text{ var}$

611 Z

$P = 0 \text{ W}$
 $Ql = 0 \text{ var}$
 $Qc = 100e3 \text{ var}$

611 I

$P = 170e3 \text{ W}$
 $Ql = 80e3 \text{ var}$
 $Qc = 0 \text{ var}$

611

684-611

684

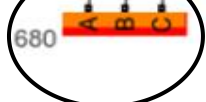
671-684

671-680

684-652

652

652 Z
 $P = 128e3 \text{ W}$
 $Ql = 86e3 \text{ var}$
 $Qc = 0 \text{ var}$



IEEE 13 Node Test Feeder

?

Future Plans

1. We will implement a PV panel at bus 680 and analyze the voltage and power at every bus
2. Create at least five different scenarios consisting of more PV's at different bus locations
 - Analyze how the voltage and power at the buses change
3. We will use Simulink and OpenDss to compare our results to test the accuracy of the programs

PV (Photovoltaic) Panels

- Generate power through solar radiation given off by the sun.
- Clean Energy.
- Homeowners can use them to generate their own power.
- Must be in sunlight in order to work.

