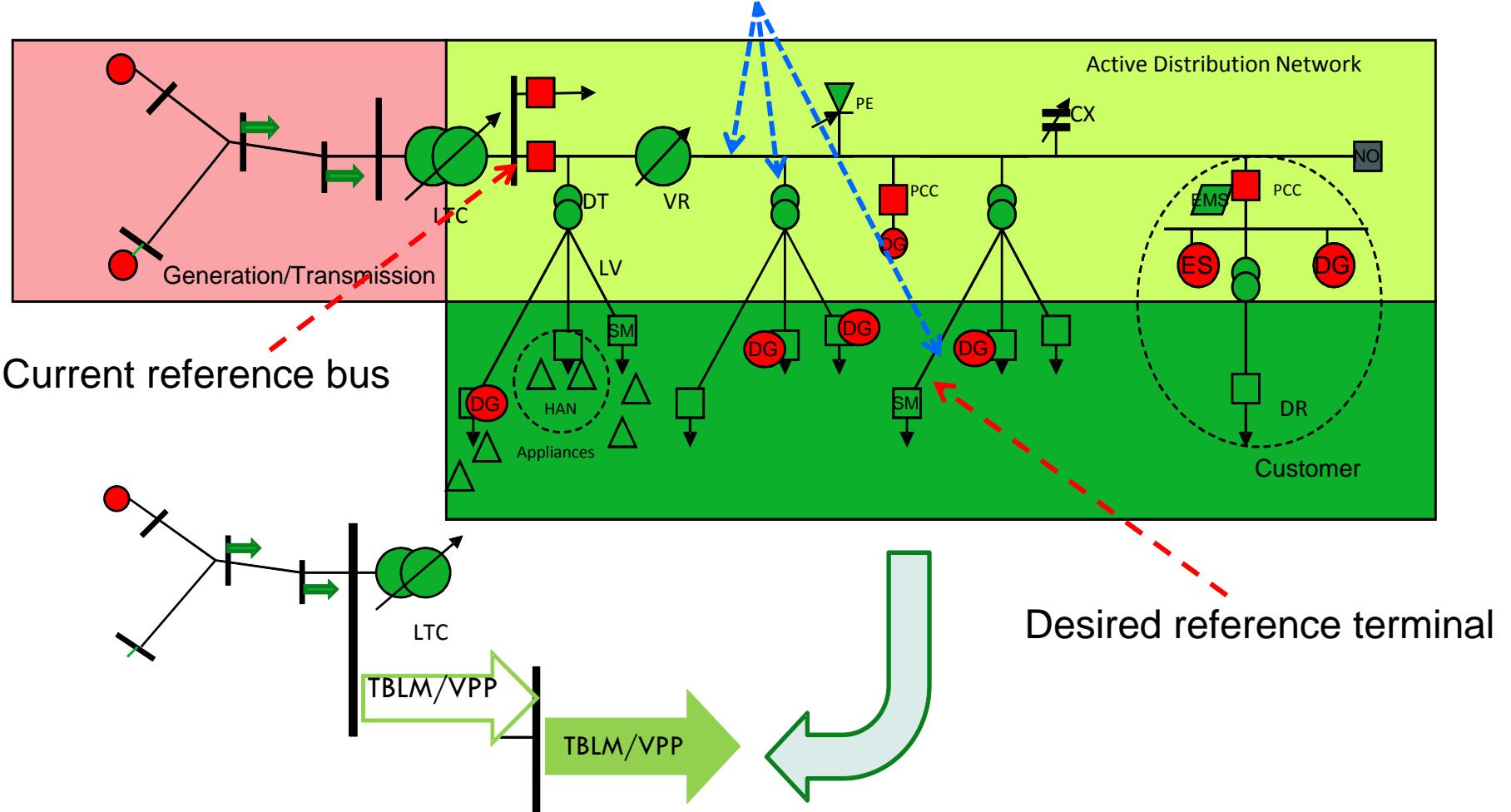


AMI Information Support for Transmission and Distribution Management

Nokhum Markushevich
Presentation to TnD DEWG
02/22/2012

Background components of TnD Object/Data Models

Components of model errors



Component Errors in Voltage Modeling

- Measurements of the reference voltages
 - Modeling the voltage transformation by voltage regulators (bandwidth error)
 - Modeling the voltage drops in the feeder primaries
 - Modeling the voltage drops in distribution transformers
 - Modeling the voltage drops in the secondary (LV) circuits
- Of the 5 types of errors listed above, the last three are closely related to the AMI-supported information
- ❖ Assuming random independent component errors, the composite error is defined as follows:

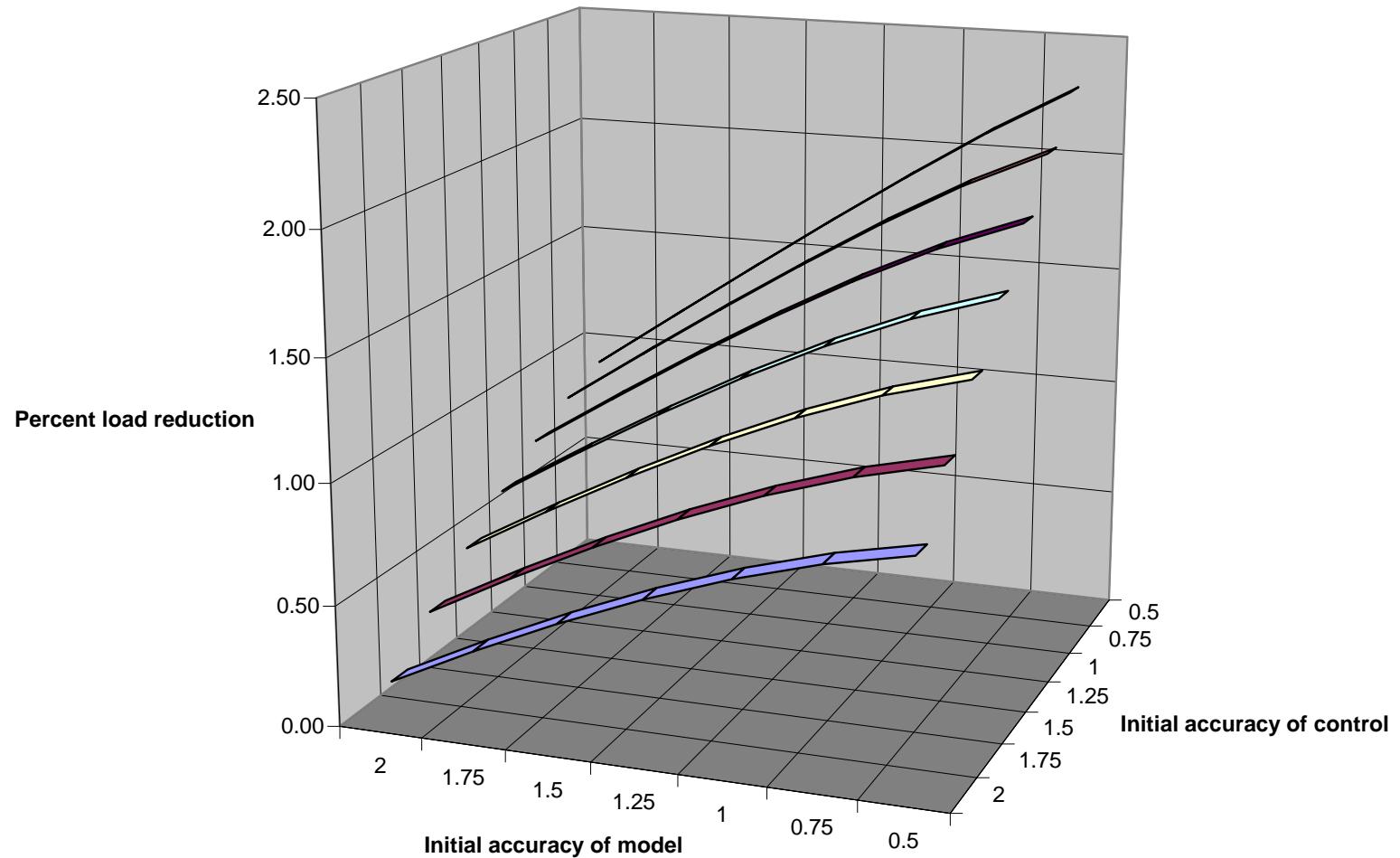
$$\Delta V_{lv} = [(\Delta V_{mv})^2 + (\Delta V_{Ddt})^2 + (\Delta V_{Dsec})^2]^{0.5}$$

IMPACT OF MODEL UNCERTAINTY ON BENEFITS

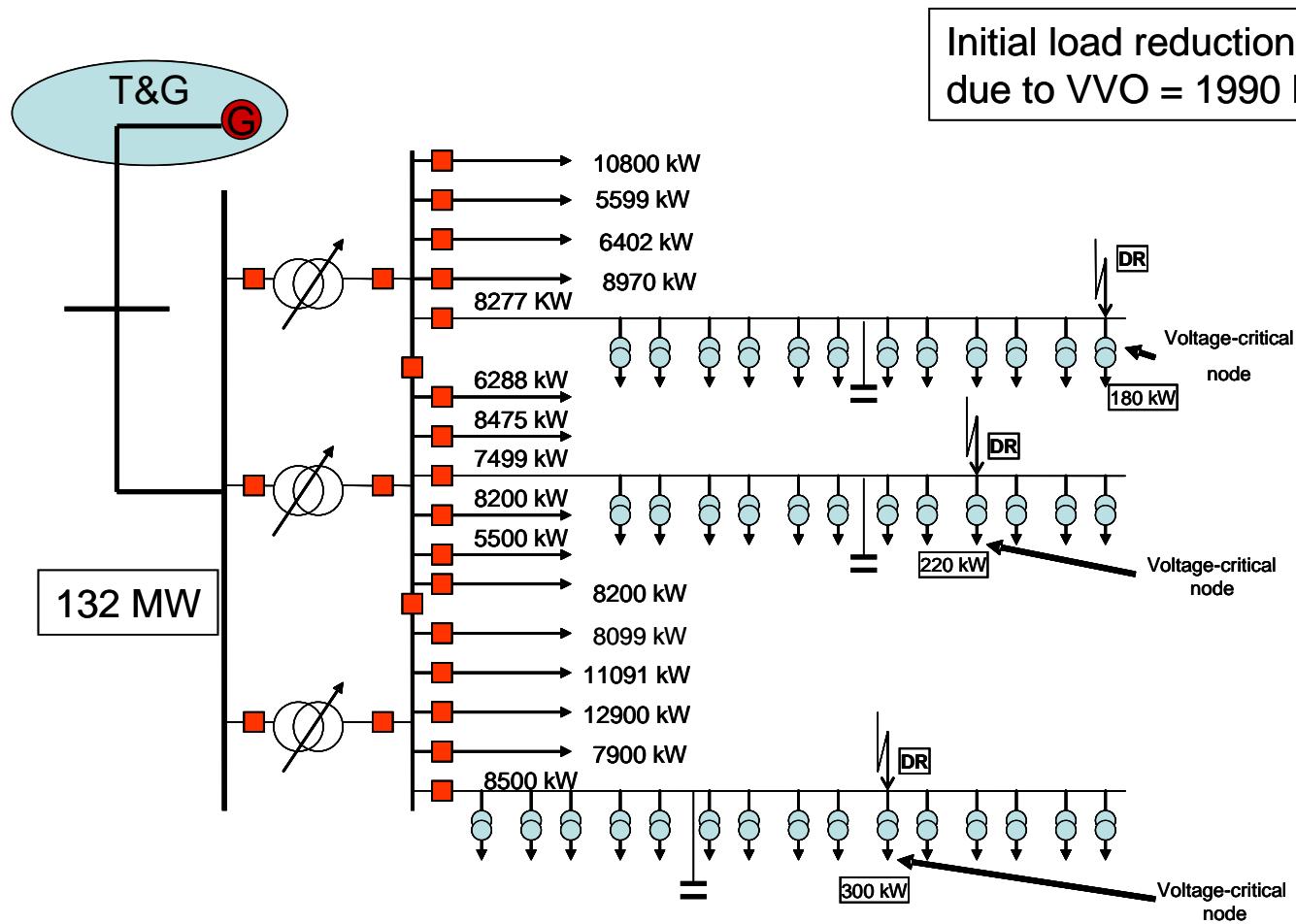
Examples

Load reduction due to IVVO

Realized benefits in load reduction vs accuracies of control and model
Potential benefits = 3%

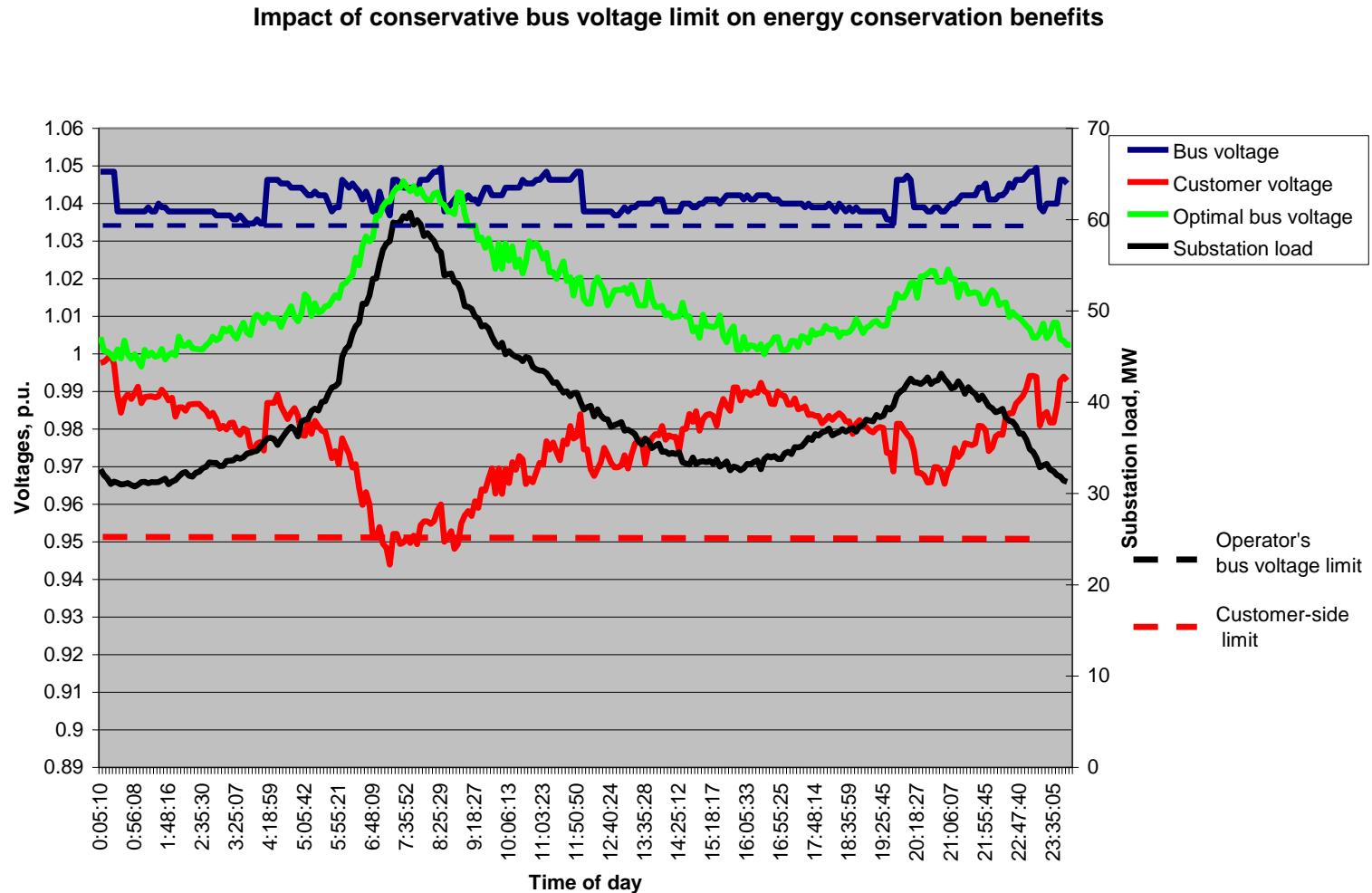


Benefits of accurately determined voltage-critical nodes with DR

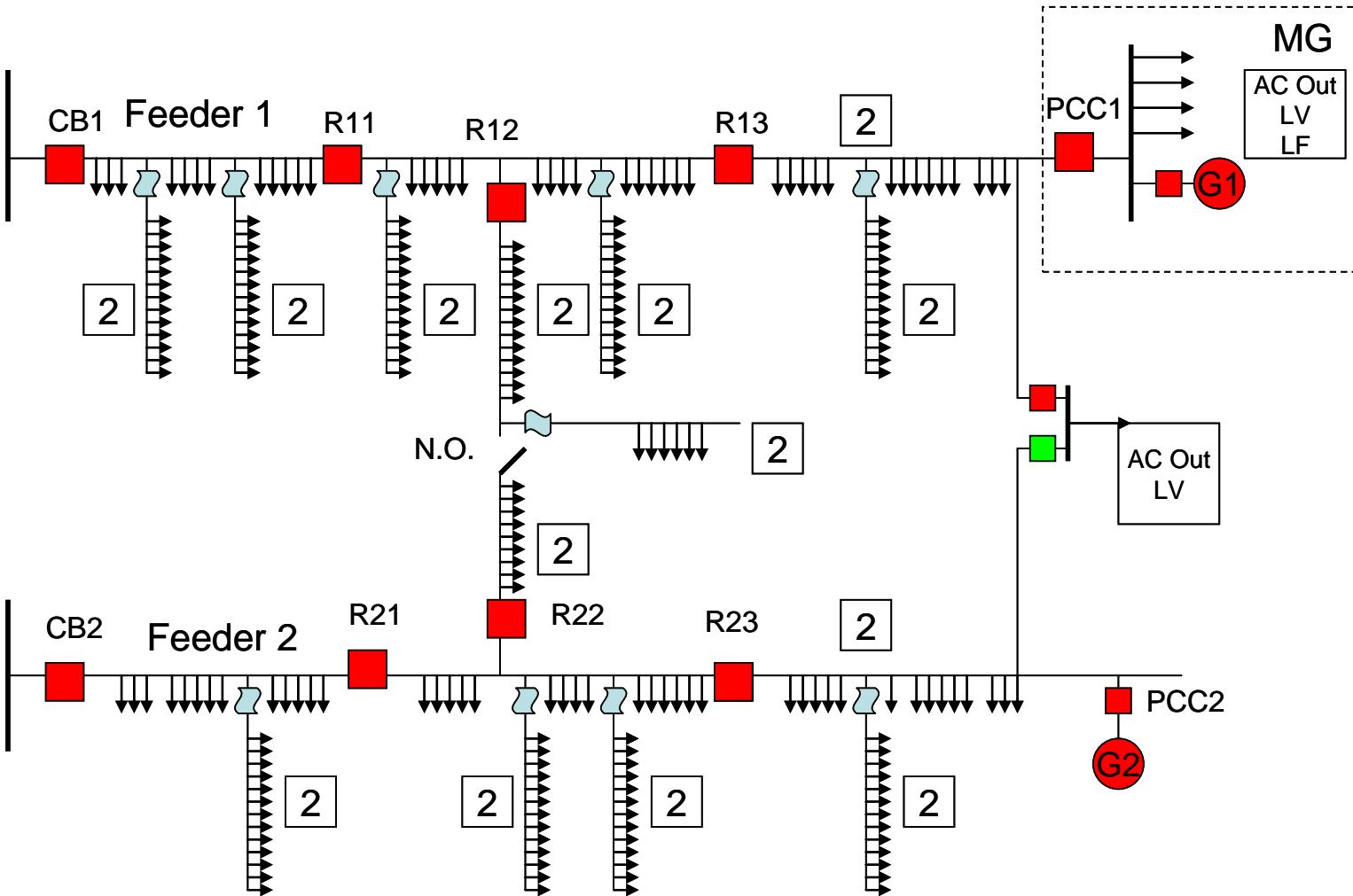


Total DR = 67 kW; Additional Load Reduction by VVO = 614 kW; Ratio = 9.2; 30% increase of load reduction by VVO

Lost benefits due to lack of confidence in secondary voltage models



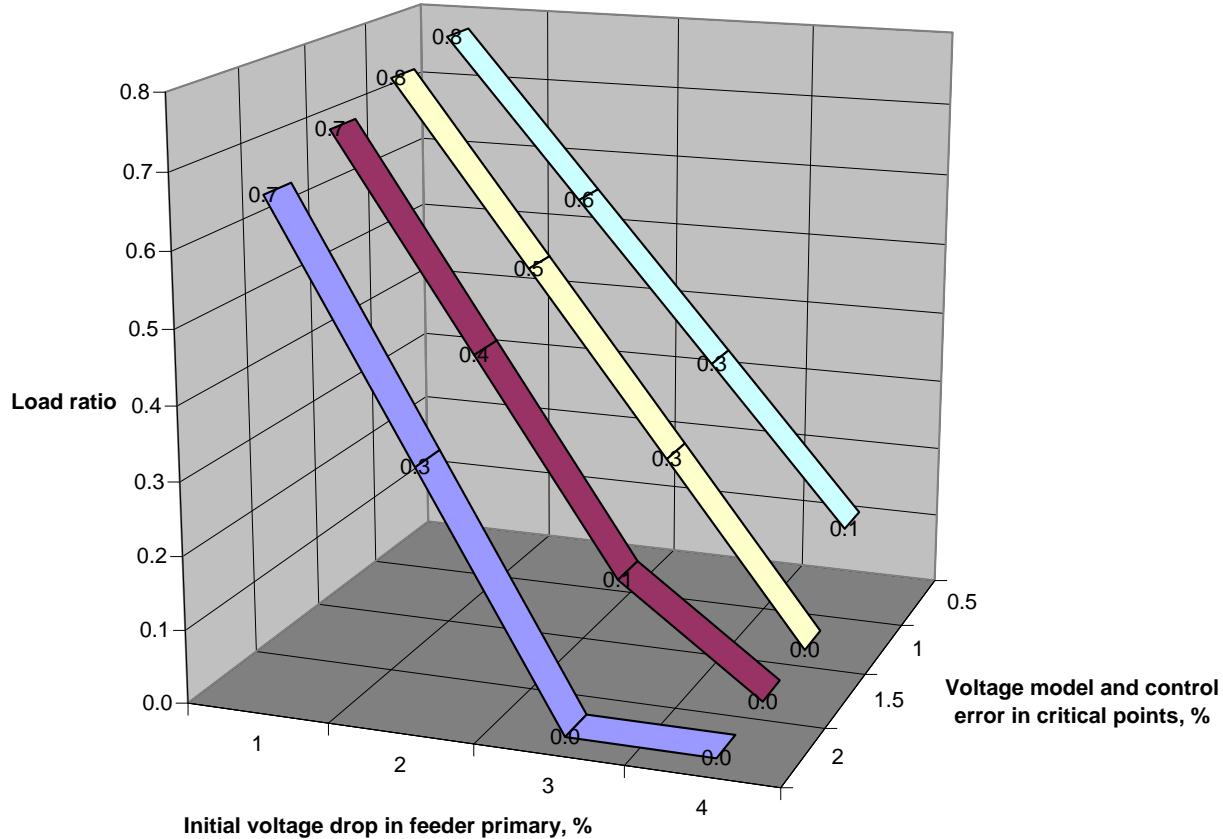
FLIR Benefits due to AMI (fault detection by bellwether meters)



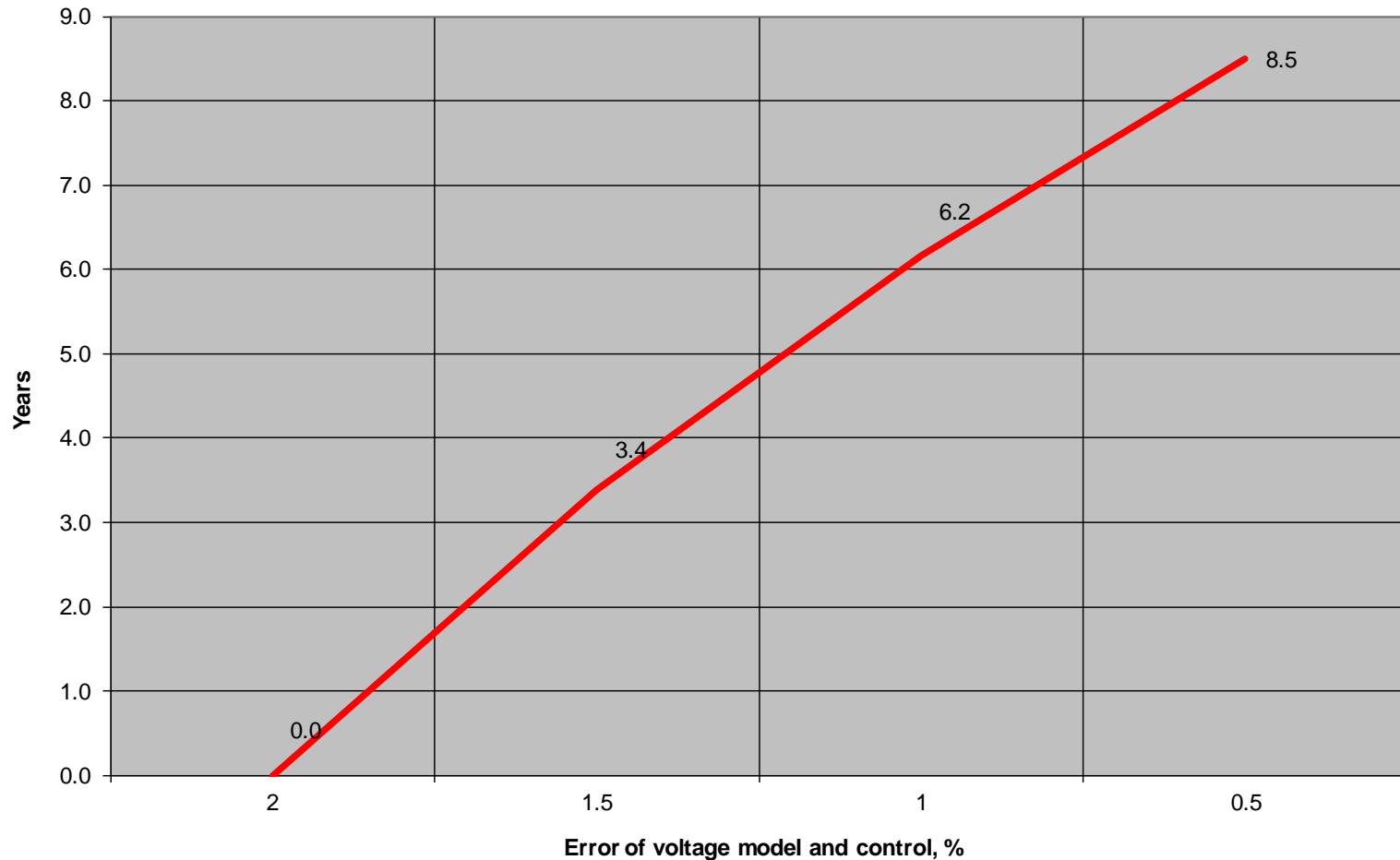
Impact of model errors on models of transfer capacity limited by voltage (5% limit)



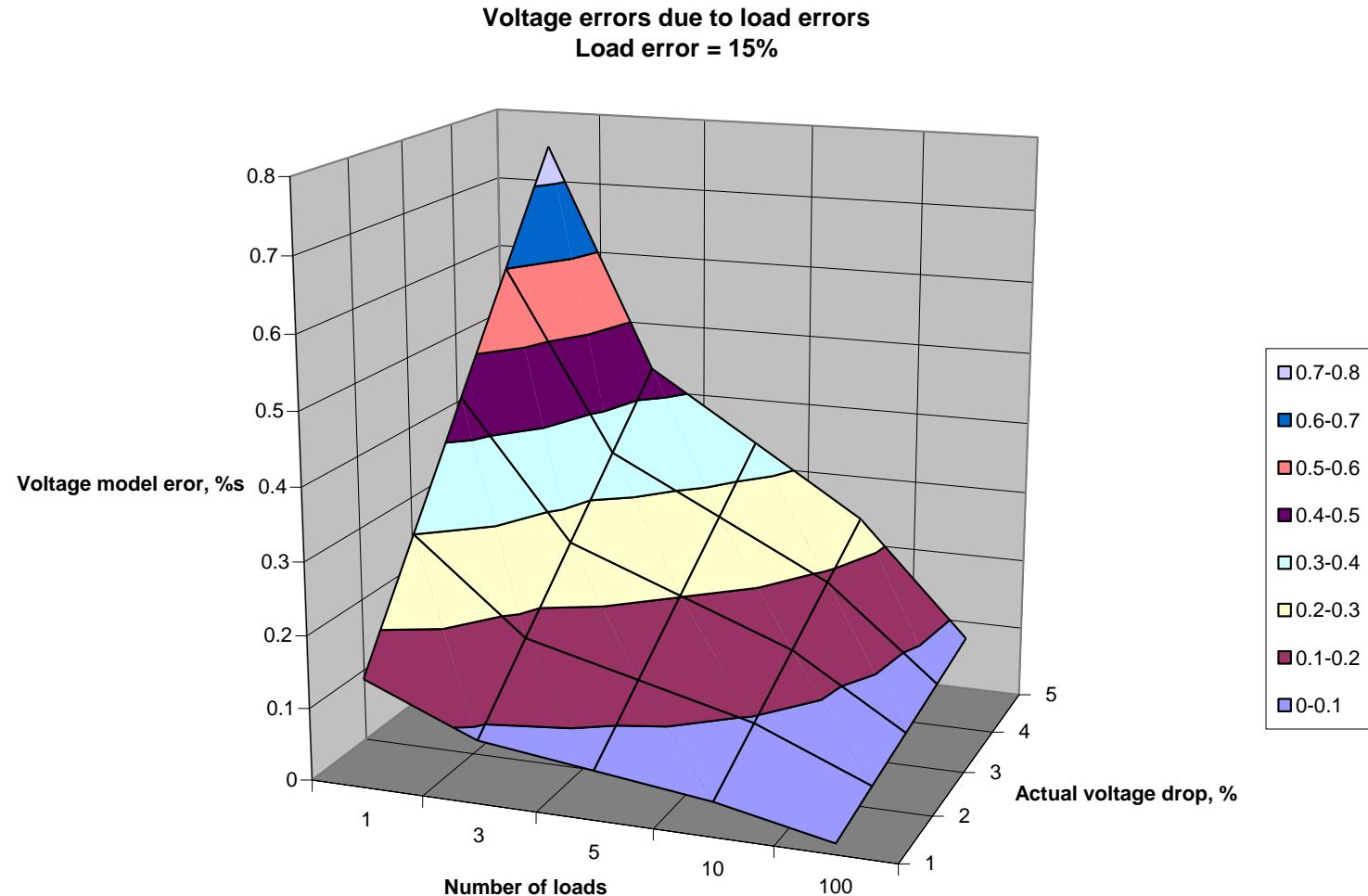
Ratio of transfer load over load of backup feeder after reconfiguration,
Available emergency voltage drop in primary 5%



Time of feeder upgrade



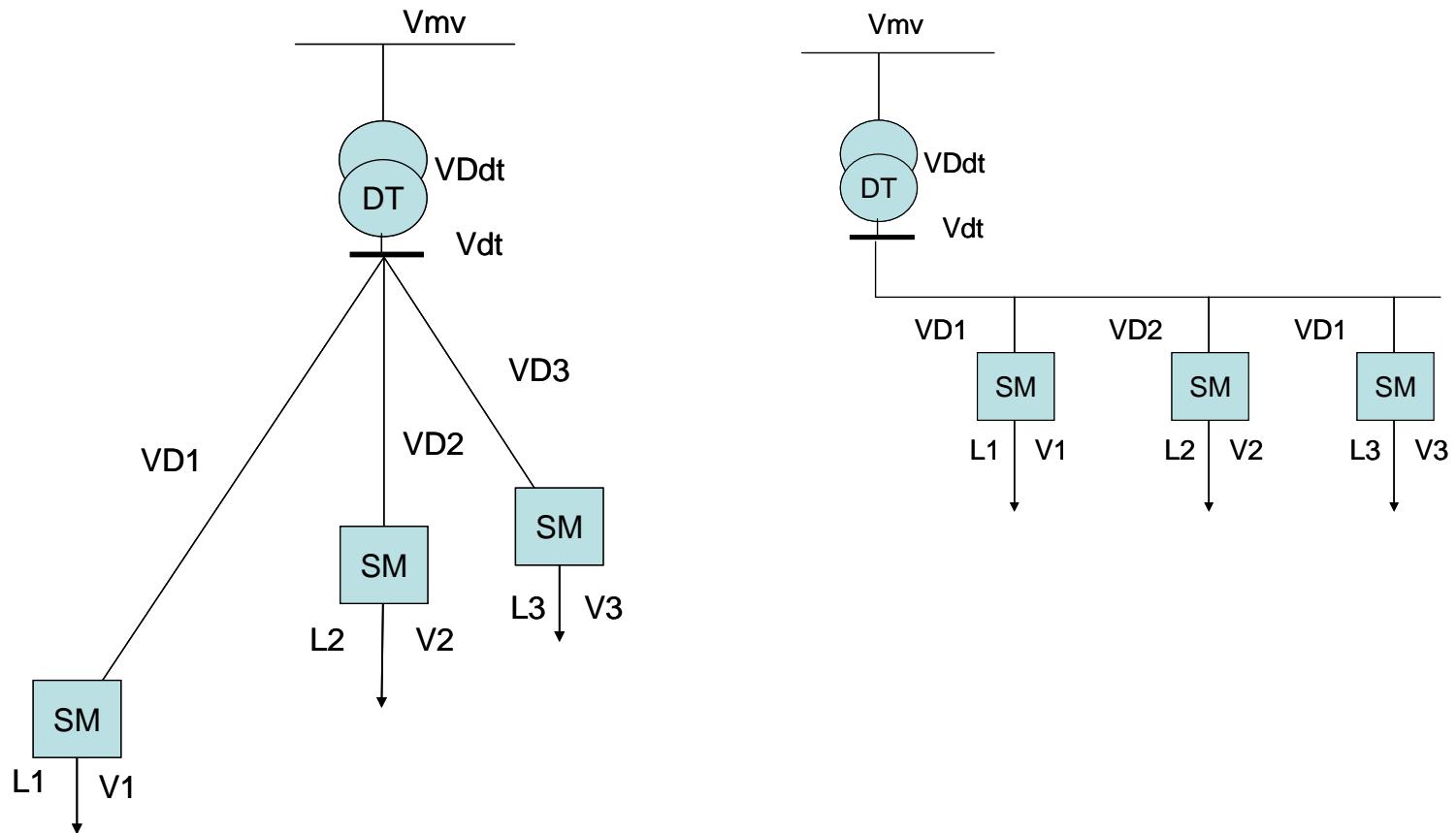
In the most loaded segments the errors in the voltage drop calculated by DSE do not exceed 0.1% of nominal voltage



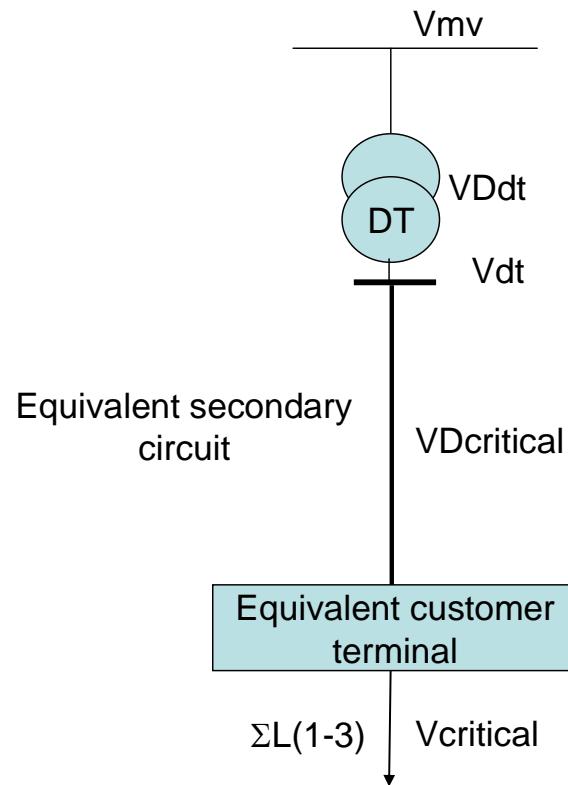
Voltage drop error in three-phase distribution transformer vs load model accuracy

		kvar errors, p.u. of kVA										
		-0.25	-0.2	-0.15	-0.1	-0.05	0	0.05	0.1	0.15	0.2	0.25
kW errors, p.u. kVA	-0.25					-0.43	-0.20	0.02	0.25	0.476		
	-0.2					-0.39	-0.16	0.07	0.29			
	-0.15					-0.35	-0.12	0.11	0.34			
	-0.1					-0.31	-0.08	0.15	0.38			
	-0.05				-0.50	-0.27	-0.04	0.19	0.42			
	0				-0.46	-0.23	0.00	0.23	0.46			
	0.05				-0.42	-0.19	0.04	0.27	0.50			
	0.1				-0.39	-0.15	0.08	0.31				
	0.15				-0.35	-0.12	0.12	0.35				
	0.2				-0.31	-0.08	0.15	0.39				
	0.25				-0.28	-0.04	0.19	0.42				

Sample Secondary Circuits



Equivalent Secondary Circuit



Assessment of Achievable Accuracy of VD by Utilizing AMI

$$\Delta VD = (0.1^2 + 0.5^2 + 0.5^2)^{0.5} = 0.7\%$$

