



# Improved Operational Performance Achieved Through Smart Grid Technology

Vic Hatridge  
October 18, 2011

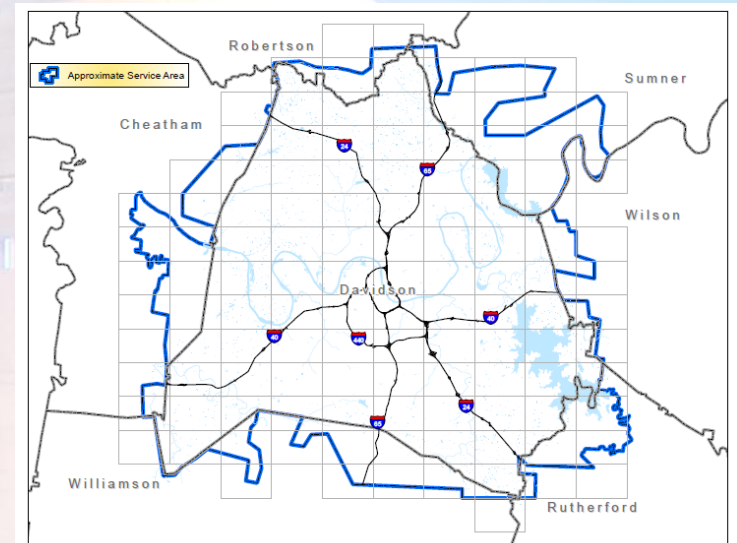
NASHVILLE ELECTRIC SERVICE |





# NES is the 12<sup>th</sup> largest public power utility in the US

- Established in 1939
- About 360,000 customers
- About 700 square miles of Davidson County and portions of 6 others
- 2,700 MW peak demand
- 52 substations and about 300 feeders
- Purchase all power from TVA



NASHVILLE ELECTRIC SERVICE |





## Technology that Benefits Operational Performance

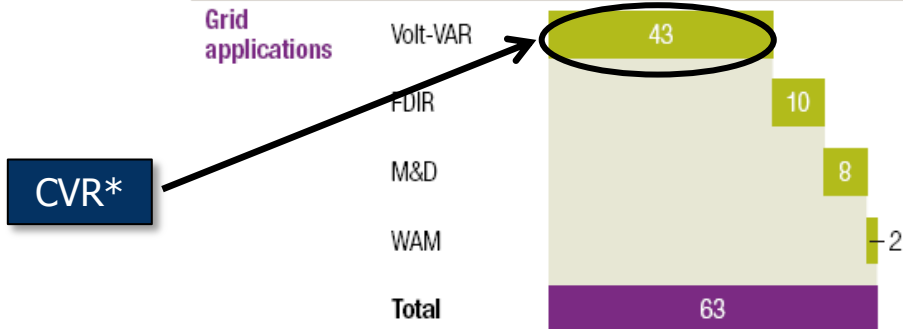
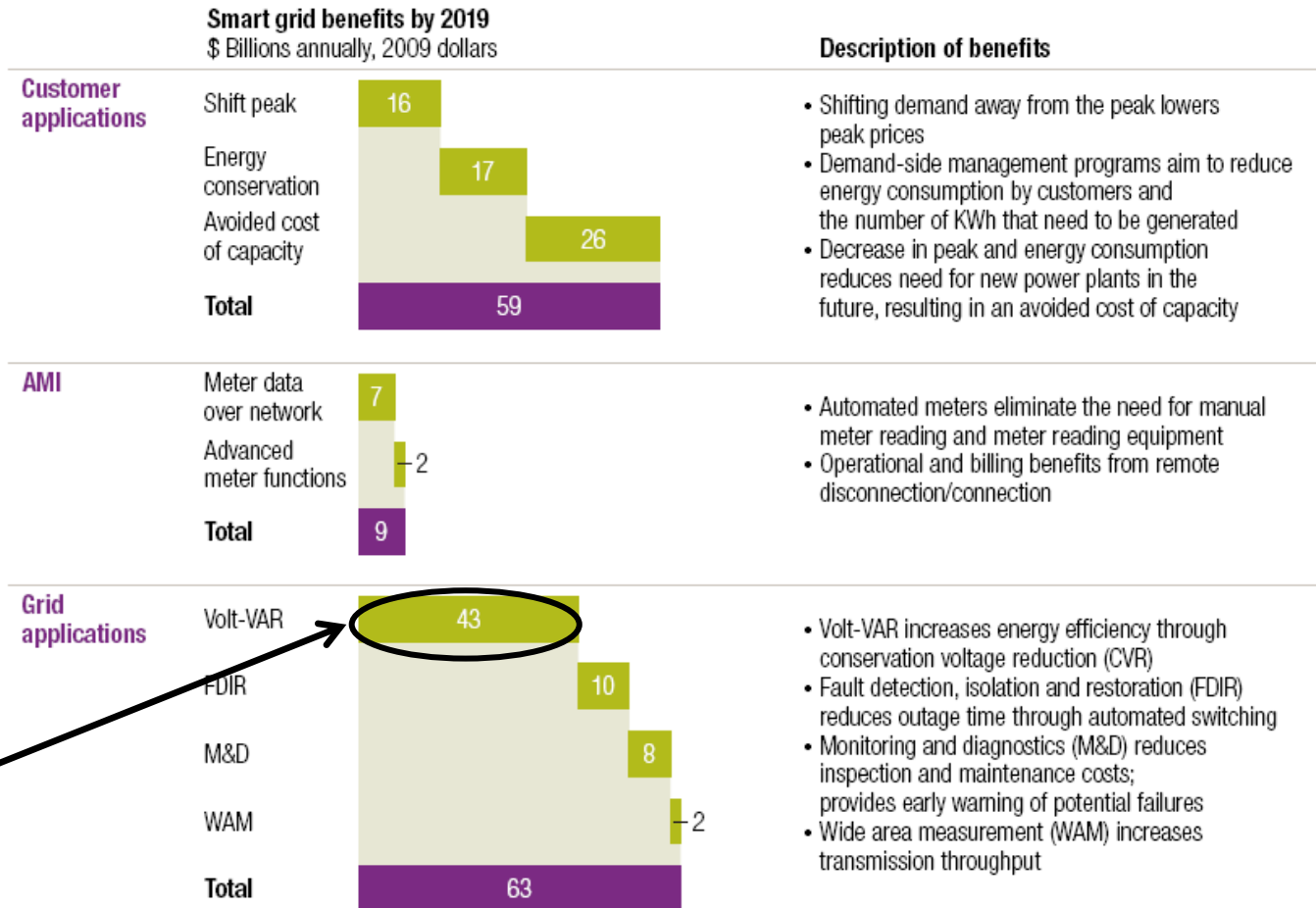
- **Email**
- **GIS**
- **Outage Management System with IVR**
- **New Radio System with Voice Recording**
- **Automated Vehicle Tracking**
- **Garmin's for Directions to Utility Assets**
- **Mobile Dispatching of Field Service Orders**
- **Smart Grid**



# Sizing & Seizing the Smart Grid Opportunity

Exhibit 1  
**The \$130 billion question**

The U.S. smart grid value at stake is over \$130 billion annually.



\* 2019 value including societal and GHG benefits

Source: McKinsey on Smart Grid, Summer 2010





## Technology that Benefits Operational Performance

- **Automated Metering (AMI)**
- **Outage Management**
- **Peak Demand Management**

NASHVILLE ELECTRIC SERVICE

NASHVILLE ELECTRIC SERVICE |





## Technology that Benefits Operational Performance

- **Automated Metering (AMI)**
  - Meter reading
  - Remote disconnect/reconnect
  - Tamper/theft detection
  - Prepaid metering

NASHVILLE ELECTRIC SERVICE

NASHVILLE ELECTRIC SERVICE |





# Technology that Benefits Operational Performance

- **Outage Management**
  - Outage reporting
  - Remote restoration confirmation

NASHVILLE ELECTRIC SERVICE

NASHVILLE ELECTRIC SERVICE |







## Technology that Benefits Operational Performance

- **Peak Demand Management**
  - Voltage optimization
  - Direct load control
  - Time-of-use pricing

NASHVILLE ELECTRIC SERVICE

NASHVILLE ELECTRIC SERVICE |







## Why manage peak demand?

- **The Tennessee Valley is transitioning to time differentiated rates which has created significant interest in demand response**
- **NES has a strategy that creates many benefits:**
  - Reduces demand and energy requirements
  - Mitigates purchased power costs
  - Helps maximize efficiency from the generator to the customer. Reduces wasted electricity (system losses & Var flow) optimize voltage levels and relieves T&D congestion.
  - Increases grid asset utilization



1

CONSERVATION VOLTAGE REDUCTION (CVR) AT NORTHEAST UTILITIES

D. M. LAURIA  
 Member, IEEE  
 NORTHEAST UTILITIES  
 P.O. Box 270  
 Hartford, Connecticut 06151-0270

1987 Study 1% energy reduction  
 for 1% Voltage Reduction

2



NORTHWEST  
 ENERGY  
 EFFICIENCY  
 ALLIANCE

Distribution Efficiency Initiative Study: 2003-2007

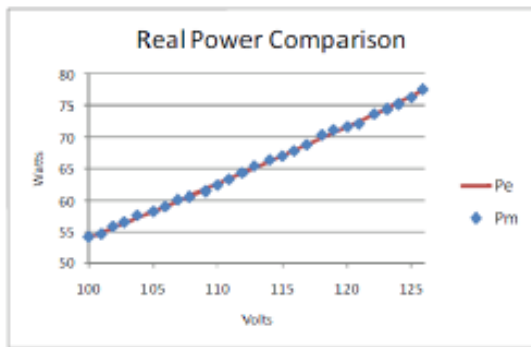
Where it is practiced, voltage reduction has been proven to reduce energy consumption, by an overall factor of 0.8 – meaning that a 1% reduction in voltage results in, on average, a 0.8% reduction in energy consumption. This “CVR Factor,” is defined as the percentage

3

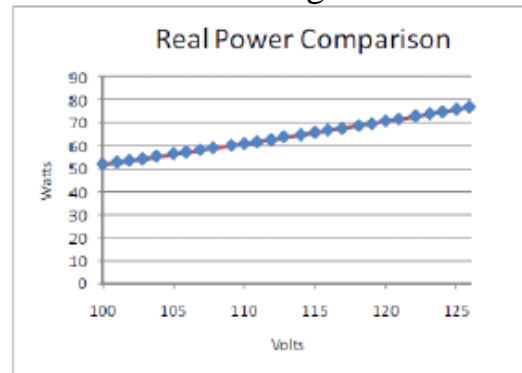


Circuit	Monitor days	Linear model R2	Average voltage reduction	Energy reduction (95% confidence interval)	CVR factor
A	362	0.953	3.62%	2.71% (2.20, 3.22)	0.75
B	289	0.984	2.81%	2.47% (2.01, 2.93)	0.88
C	345	0.989	3.57%	2.38% (1.93, 2.82)	0.66
D	153	0.981	1.89%	1.64% (1.24, 2.04)	0.87
E	153	0.993	1.89%	1.73% (1.27, 2.19)	0.92
F	64	0.937	2.76%	1.82% (0.07, 3.57)	0.66

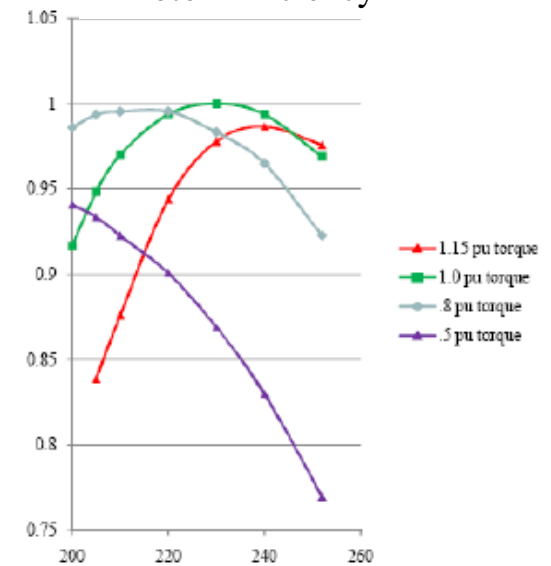
70 W Incandescent Light Bulb



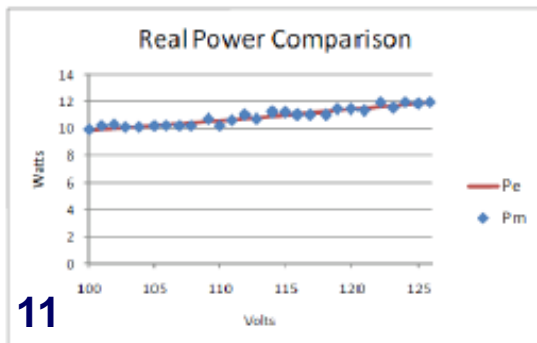
Oscillating Fan



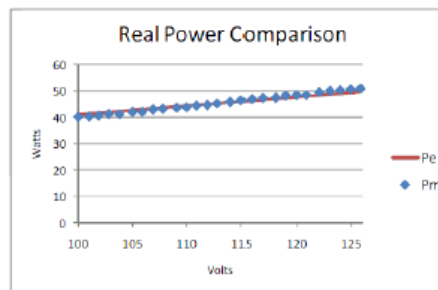
Motor Efficiency



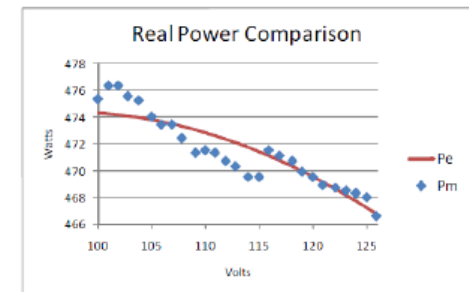
13Watt CFL



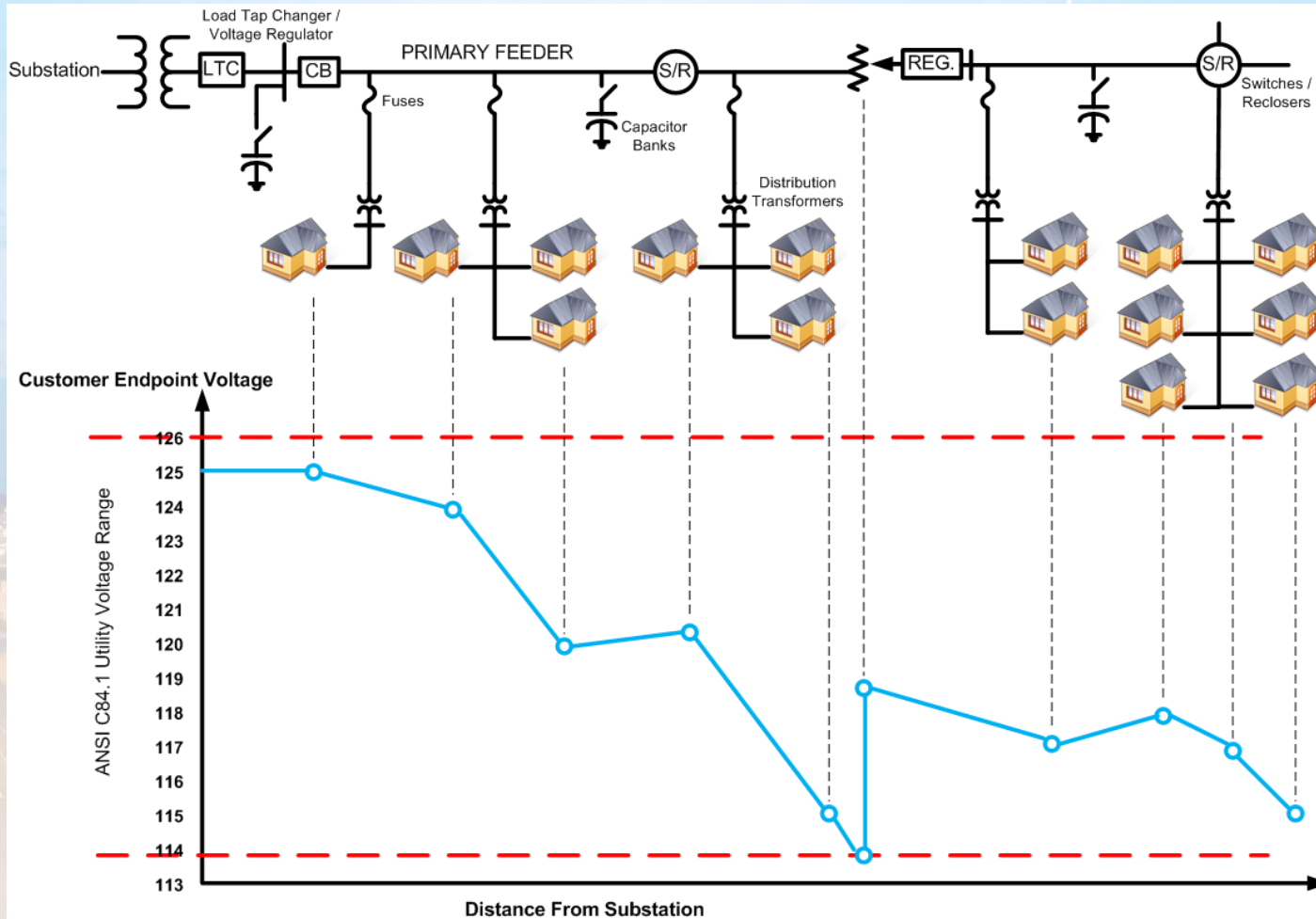
Television (Cathode Ray Tube)



Plasma TV









## Voltage Management Today

- Detailed NES engineering study and testing of 13.8kV and 23.9kV circuits.
- Utilizing 35 of 52 NES distribution substations
- Modified tap changer control (TCC) for 1.25% and 2.5% voltage offsets.
- Analytical process to determine when to manage peak demand based on input from Budget & Rates, Engineering, and System Control sections.
- Events initiated through existing SCADA in System Control.
- Dispatchers initiate event to four different groups of load (now switched simultaneously)
- In April – September 2011, NES executed 14 peak demand management events that averaged 10 MW reduction and saved \$460,000 in wholesale energy cost.



## Voltage Management June 2012

- Installation of approximately 140 capacitor banks with remote controls.
- Utilizing 52 of 52 NES distribution substations
- Modified tap changer control (TCC) for 1.25% and 2.5% voltage offsets
- Estimated reduction of 40 MW
- Will response to peak demand events called by TVA
- Will continue to initiate peak demand events internally to reduce wholesale energy cost.
- Events initiated through new Distribution Management System which will be able to analyze 5-minute instantaneous voltage readings from approximately 800 bellwether meters





## Direct Load Control June 2013

- Direct Load Control for 10.25 MW of peak load
- Targeting AC units of large commercial customers with demands between 50 and 300 kW
- Local Government, through Mayor's Office of Sustainability, has agreed to provide buildings for Proof of Concept in Summer 2012
- Considering annual payment for each controlled A/C

NASHVILLE ELECTRIC SERVICE

NASHVILLE ELECTRIC SERVICE |





## Time-of-Use Pricing TBA

- Various options being considered including a whole-house time-of-use rate for electric vehicle owners.

NASHVILLE ELECTRIC SERVICE

NASHVILLE ELECTRIC SERVICE |





Questions?

NASHVILLE ELECTRIC SERVICE

NASHVILLE ELECTRIC SERVICE |

