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HECO Smart Grid High Level Vision

HCEI Plenary Session

April 21, 2009

Overview

- What is a Smart Grid?
  - Many different meanings to different entities
- HECO/HELCO/MECO already engaging in "Smart Grid" Technology
- Explanation of HECO's Smart Grid Path

Characteristics of a Smart Grid

- Enable active participation by consumers
- Accommodate all generation and storage options
- Enable new products, services and markets
- Provide power quality for the digital economy
- Optimize asset utilization and operate efficiently
- Anticipate and respond to system disturbances (self-heal)
- Operate resiliently against attack and natural disaster

From the National Energy Technology Laboratory part of DOE's National Laboratory System

HECO's Modern Grid

- State of the art EMS and Dispatch Center
  - State Estimator/Contingency Analysis
  - Dispatch Training Simulator
- 100% of the transmission system has SCADA
- 20% of HECO's distribution circuits have SCADA
- Wireless Fault Indicators/Fault Indicator status to EMS

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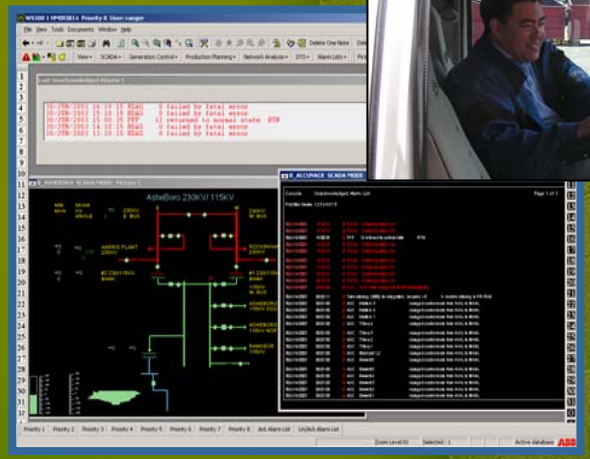
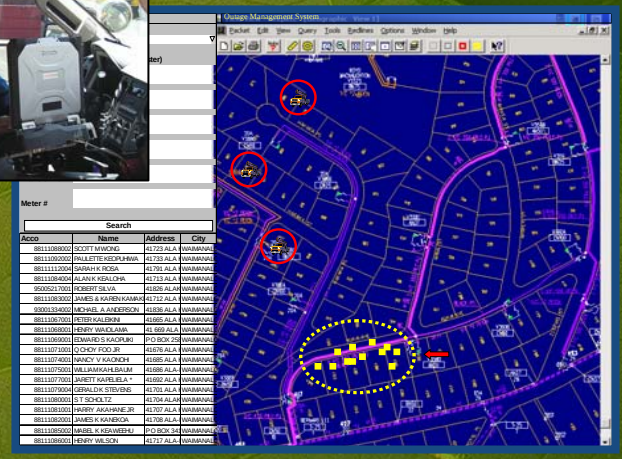
Interoperability Already Created

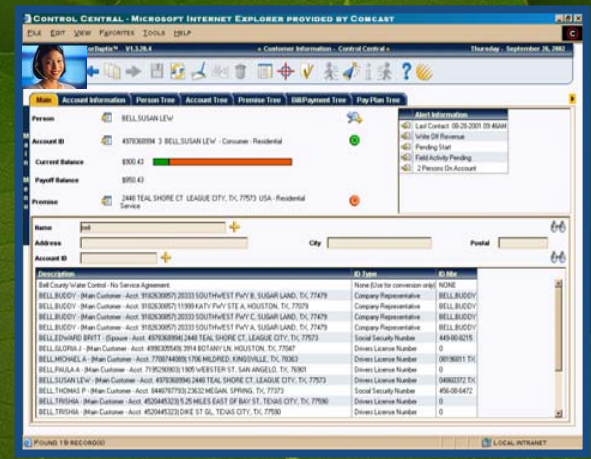
EMS

OMS

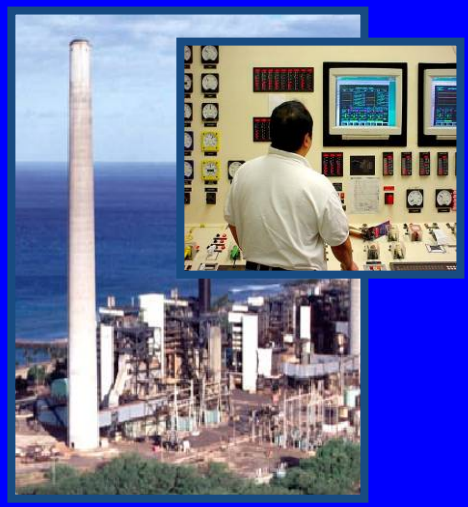
CIS







Power Plant Control Rooms



System Operation Dispatch Center

Customer Service Call Center

HELCO's Modern Grid

- State of the art EMS
  - State Estimator
  - AGC tuning to mitigate over-control problems due to a high penetration of wind
- 100% of the transmission system has SCADA
- 82% of HELCO's distribution circuits have SCADA
- HELCO installed microprocessor relays to improve the protection schemes
  - Interface to bring back fault distance and other system data
- Installed MOS to sectionalize faults on its transmission system
- Communication system upgrade to digital microwave
- Auto reclosing functions on breakers

MECO's Modern Grid

- State of the art EMS
  - State Estimator
  - AGC tuning of generator units at Maalaea Power Plant
- 100% of the transmission system has SCADA
- 63.5% of the distribution circuits have SCADA
- Hana DG units
- Completion of Maui System Model used for grid analysis
- Deployment of AMR meters in East Maui and Lanai
- SCADA and relay protection work at Kaheawa, Makila Hydro and Lanai PV farm substation

Future "Smart Grid" Technologies

- HECO/HELCO/MECO – AMI Deployment
  - PUC Application filed in December 2008
  - 100% Smart Meter Deployment
  - AMI network installed
  - MDMS installed
- HECO Asset Management System
- HECO/HELCO/MECO Smart Grid Task Force

Future "Smart Grid" Technologies

- HELCO
  - Additional adjustments to the AGC to allow for adaptive generating unit limits in the EMS
  - Continuous improvement for plant responsiveness
  - Indications of lockout relay conditions from the field
- MECO
  - Increase Distribution SCADA
  - Lanai SCADA, Molokai SCADA
  - Relay Upgrades
  - Recloser installations
- MECO – DOE Smart Grid Project

What do you target the Smart Grid to Solve?

- 7 Characteristics of a Smart Grid
- Solving Distribution Reliability?
- Targeting Energy Efficiency or Customer Interaction?
- Integrating Distributed Generation?
- Preventing Island Wide Blackouts?

Distribution Operations Focus on Reliability

Outage Location	Outage Statistics*	Contribution to Reliability Calculations*	Solution Focus
Substations	1%	5%	EMS Integration with DMS
Primary Distribution Circuits	44%	87%	Delivery Grid Design, DA, DER, DMS
Secondary Distribution	55%	8%	MDMS/AMI Integration with DMS

* Source: EPRI DA Report 2005

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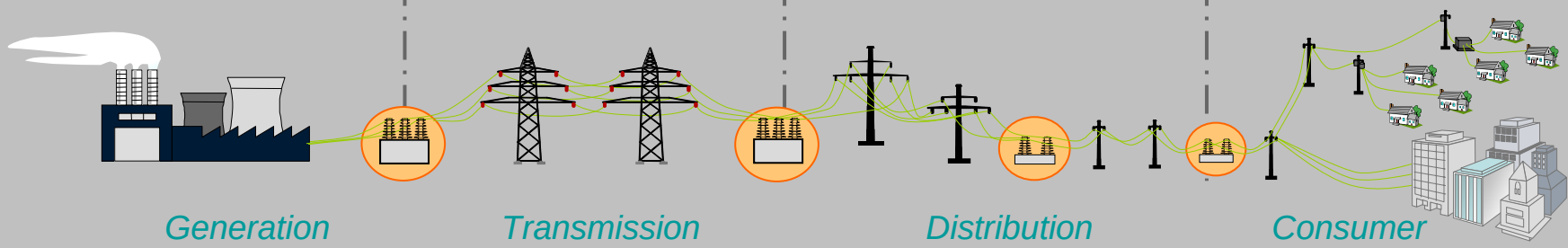
Solutions Landscape: Elements

SIEMENS

	Generation	Transmission	Distribution	Consumer
Enterprise	▪ Asset Performance Management System ▪ Generation Planning ▪ Common Modeling ▪ Historical Information ▪ Engineering & Planning (T&D)			
Analysis	▪ Energy Market Management (P) ▪ Gen Optimization	▪ Energy Market Mgmt (O) ▪ Trans Network Analysis ▪ Op Training Simulator	▪ Dist Network Application ▪ Dist Training Simulator	▪ Dist Network Application ▪ Dist Training Simulator
Control	▪ Distributed Control System	▪ SCADA ▪ Auto Gen Control	▪ Distribution SCADA ▪ Outage Mgmt Sys ▪ Mobile Work Force Mgmt	▪ Demand Side Mgmt/Response ▪ MDMS
Communi-cations	▪ In Plant (LAN)	▪ Satellite ▪ µWave ▪ Fiber ▪ Radio	▪ Cell ▪ Telephone ▪ BPL ▪ Fiber ▪ µWave ▪ Radio	▪ PLC, WIFI, WIMAX ▪ BPL ▪ Manual
Apparatus & Device	▪ RTUs, Data Concentrators ▪ GTs, CCP, ST, WP	▪ Breakers ▪ Cap Banks ▪ Xfrmrs ▪ FACTS/SVCs ▪ Volt Regs ▪ Environ	▪ Dist Auto ▪ Reclosers ▪ Cap Banks ▪ Tiered Cont. ▪ Switches ▪ Xfrmrs	▪ Auto Meter Reading ▪ DSM (Customer)



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Combined Elements of Siemens Smart Grid

Enterprise	▪ Generation Plan
Analysis	▪ Energy Market Management (P ▪ Gen Optimizati
Control	▪ Distributed Co System
Communi-cations	▪ In Plant (LA
Apparatus & Device	▪ RTUs, Data Concentrators ▪ GTs, CCP, ST,
	EMM (Participants)

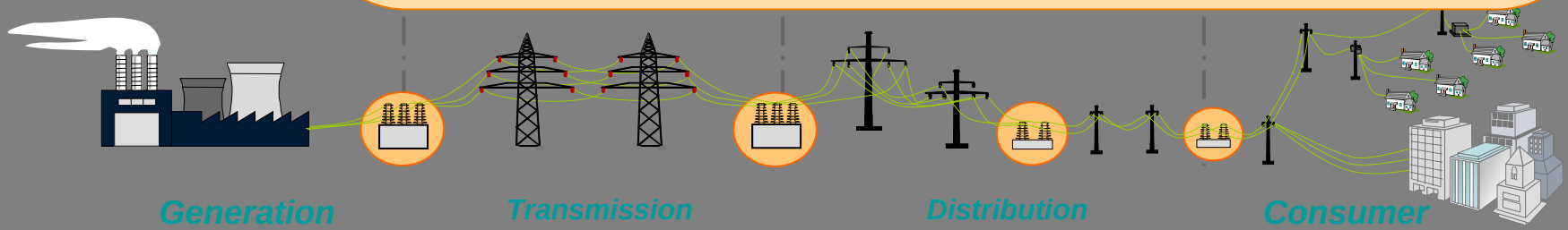
Enterprise/Back Office Integration

Asset Performance Management

EMS | **DMS** | **MDMS**

Microwave, Fiber… | **BPL, Cell, Radio…** | **BPL, PLC, WiFi**

Substation Automation | **Feeder Automation** | **AMI**



Customer Participation Focus

Measured Metric	Solution Focus	
Customer Satisfaction	•AMI Meters •AMI Network •MDMS	•OMS – outage portals •Payment options
Load Control/DSM	•Home Area Networks (HAN) •NEM	•Shifting Load use (i.e. ice storage)
Energy Efficiency	•AMI •HAN •NEM	

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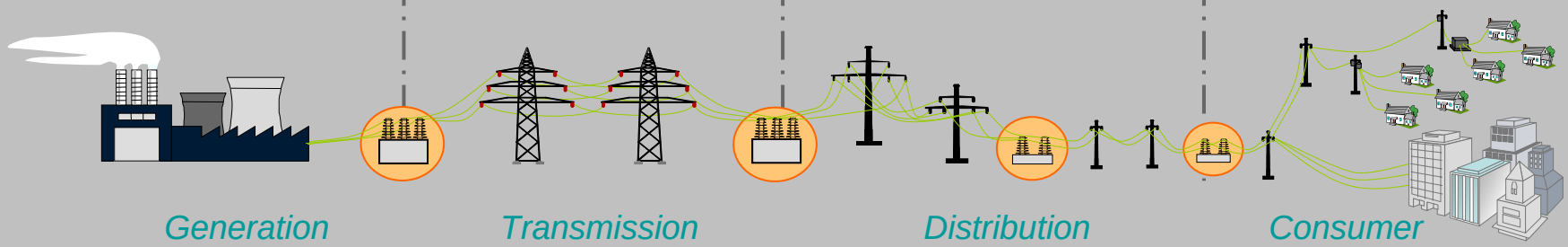

HECO's Smart Grid Progress

- Formed a Smart Grid Task Force/Solidified the Charter for the Task Force
- Developing a High Level Vision for the HECO Smart Grid
- Monitoring and Applying for Stimulus Package Funding
  - Wind Integration Stimulus Funding Submitted

Stimulus Funding

- HECO is monitoring various FOA
  - DOE/EERE
  - DOE/NETL
  - ARRA- Funding for Clean Diesel Emerging Technology Program
  - NETL – Recovery Act – Transportation Electrification
  - Advanced Synchrophasor Research
  - Enhanced Geothermal Demonstration Projects

Questions