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SMUD

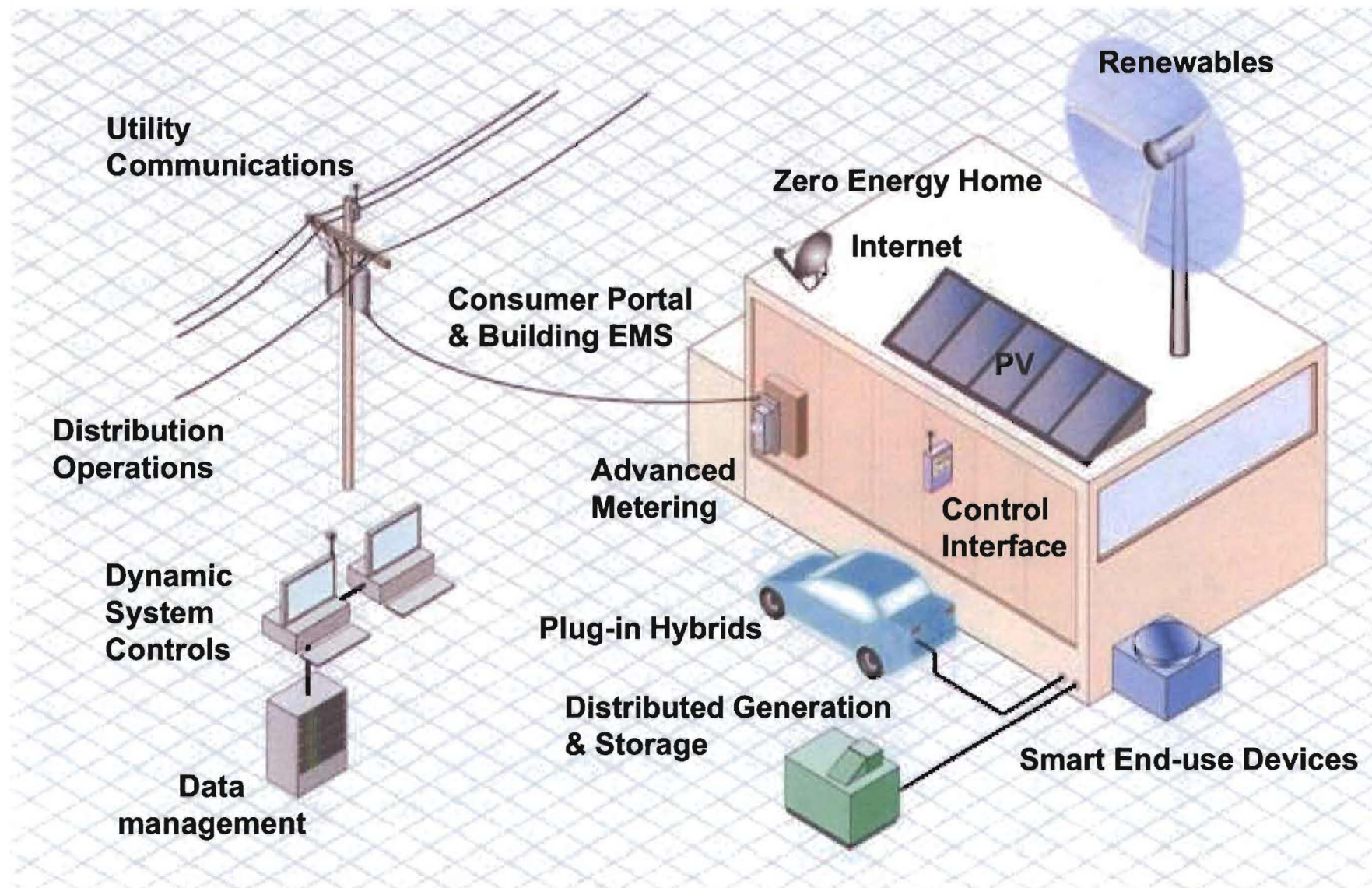
DR Enabling Technologies at SMUD

Jim Parks

**CEC Load Management Standards
Enabling Technologies Workshop**

June 19, 2008

Smart Grid Vision



Source: EPRI



Automated Metering Infrastructure

- **AMI RFP is on street, due June 27, 2008**
- **AMI Requirements:**
 - Two-way communications
 - **Communications protocol interoperability (coexist with legacy systems)**
 - Robust, secure, and scalable
 - Interval data and TOU capabilities
 - **Home/Business Area Network interoperability**
 - **Enables programmable communicating thermostat control and in home displays**
 - **Enables end-to-end system efficiencies (from generator to end use)**
- **AMI full deployment scheduled for 2009 - 2012**

SMUD Strategies

- **Leverage existing programs as launch pads for new communications system technologies**
 - Transition current residential ACLM customers to new technology over 5 year period
 - Provide more program options (temperature reset + cycling)
 - Reduce ongoing O&M costs
 - Ensure equipment is in place and operating through 2-way communication
- **Develop non-incentive programs as training grounds for control and pricing programs**
 - Offer incentives for installing enabling technologies (PCTs, in-home displays, EMS)—not for participation
 - Customers learn new behaviors and to use equipment

SMUD Strategies (cont.)

- **Develop automated, real-time M&V through AMI so operators can measure and predict load drop**
- **Monitor CA statewide AMI and DR activities to learn and benefit from others' experiences**
- **Continue research on pricing and enabling technologies, and share results**

SMUD DR Behavioral Research

1. Power Choice (TOU) Home Energy Display Pilot

- Measures effects of concerns, capacity and conditions on response to TOU rate
- Offers education plus usage feedback devices to existing residential TOU customers – **advanced meters + in-home displays**
- Collaboration with Research Into Action, Dethman Associates, and Washington State University, funded by the CEC through the DRRC

2. Small Business Summer Solutions Pilot

- Measures effects of pricing (TOU/CPP) and control incentives on load response
- Offers education plus PCTs with new critical peak rate or direct load control program to small commercial customers – **advanced meters + PCTs**
- Collaboration with Heshong Mahone Group, Roger Levy Associates and Mithra Moezzi, funded by the CEC through the DRRC and SMUD

3. Near Zero Energy Home Display Pilot

- Measures effects of consumption/production feedback on load and consumption
- Offers education plus usage/production feedback devices to existing energy efficient/solar homeowners – **advanced meters + in-home displays**
- Collaboration with ConSol, General Electric, Florida Solar Energy Center, California State University Chico, National Renewable Energy Laboratory (NREL), funded by the Building Industry Research Alliance (BIRA) and Building America (US DOE)

- **EcoSmart Home**

- Build near Zero Energy Home—a home with very low annual electric or natural gas utility bill, and *zero net electric demand during summer peak periods*
 - Annual source energy: 80% reduction
 - Zero net summer peak electric demand: 4pm to 8pm
- Develop new package of advanced (not yet commercialized) EE and DR measures, solar PV and solar thermal
 - Super tight envelope - advanced framing, SIPS
 - Evaporative condensers
 - Home automation for pre-cooling, price signaling and in-home display of production/consumption
- Funded by SMUD, In collaboration with RCS, GE, NREL and DOE

Zero Energy Homes



SMUD Energy Storage Research

1. Vanadium Redox Battery System Demonstration - VRB Power Systems

- Demonstration of a 20kW x 9hr (180 kWh) system at a Sacramento Sprint Nextel facility
- Project Objectives:
 - Enable peak load shifting; reduce utility costs
 - Replace existing lead acid battery UPS system
- Installation planned in 2008

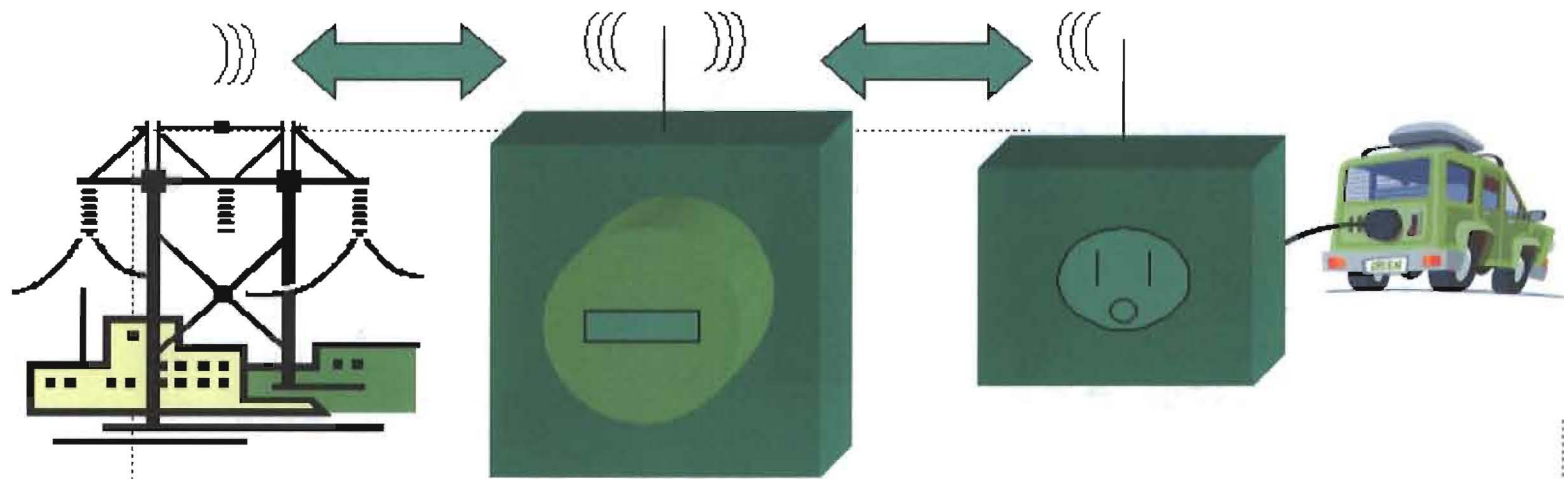
2. New SMUD Storage R&D Program in 2008

- Conducting technology benchmarking to understand commercial status and costs
- Assessing benefits of deployment at higher value sites in T&D system

3. Plan to install energy storage systems in zero-energy home pilots to mimic plug-in hybrid V2H or V2G

4. Energy storage on light rail system – ultra caps

110V Off-board PHEV/EV Meter



Household Smart Meter

- Advanced Metering Infrastructure (AMI)
- 2 way communication
- Time of use (TOU) pricing capability
- Outage notification
- Remote service connect / disconnect
- Demand response capability
- Home Area Network potential
- Multi-channel metering potential (electricity, gas, water, PHEV, etc.)

110V PHEV/EV Meter

- Wall outlet or pedestal mounted
- Metrology grade billing meter
- Vehicle interlock capability
- Lockout timer / TOU capability
- Communication with Smart Meter
 - RF or PLC (Open source)
- Potential Utility on-off control for future demand response capability
- Potential PIN code or card swipe