

SMART INFRASTRUCTURE ADVISORY GROUP



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Energy Technology Systems Integration

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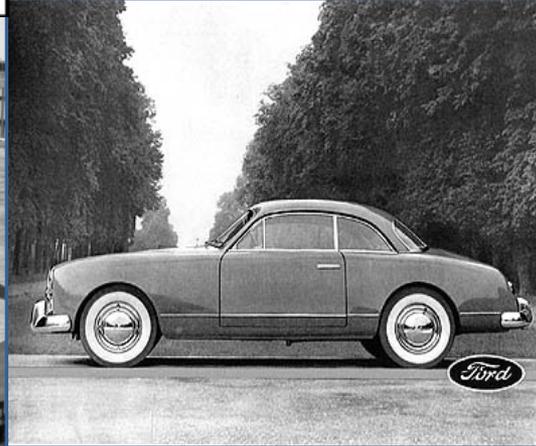
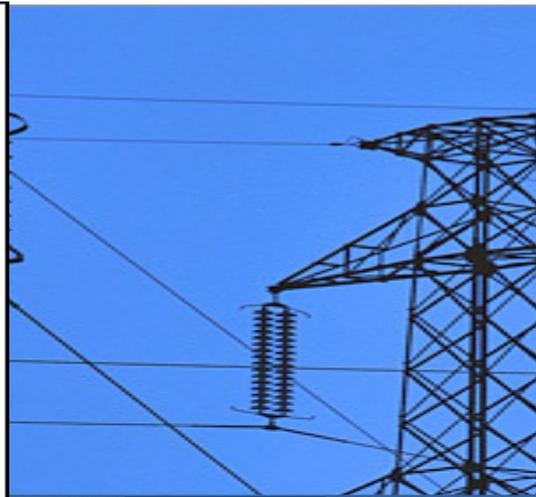
Goals

Research to...

- Lower overall system costs, increase system reliability, and provide ratepayer benefits
- Enable integration of renewables, distributed generation, demand response, and energy storage to the grid
- Improve capacity, utilization, and performance of transmission and distribution systems
- Ensuring smart grid security
- Develop knowledge base for future decision-making, integration, and infrastructure policy relative to electricity



YESTERDAY



TODAY



General Approach

TECHNOLOGY ELEMENTS

TECHNOLOGY INTEGRATION

SMART GRID



Underground Cables



Phasor Measurement



Flywheel Energy Storage



Automated Metering Infrastructure



Demand Response



Pole Top Transformers

Research Focus on Developing & Improving Devices

2 to 1 investment ratio

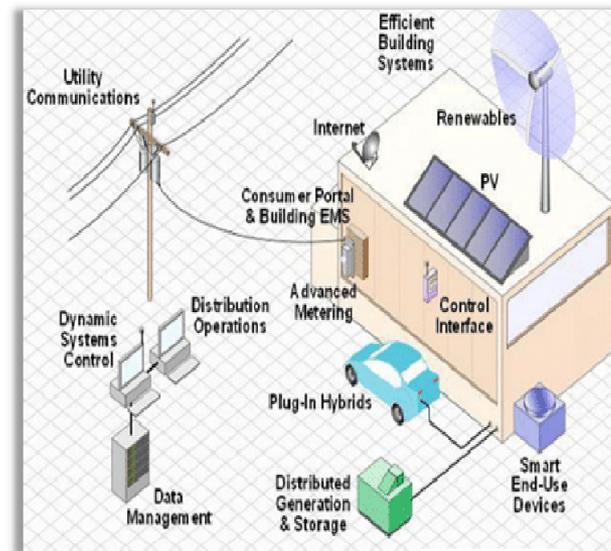
General Approach

TECHNOLOGY ELEMENTS

TECHNOLOGY INTEGRATION

SMART GRID

- Integration of renewables, PHEV's, and electric energy storage devices
- Grid more reliable and efficient
- Micro Grid scale research
- Partner with Utilities & National Laboratories



Research Focus on Integration of Devices into a grid system

2 to 1 investment ratio

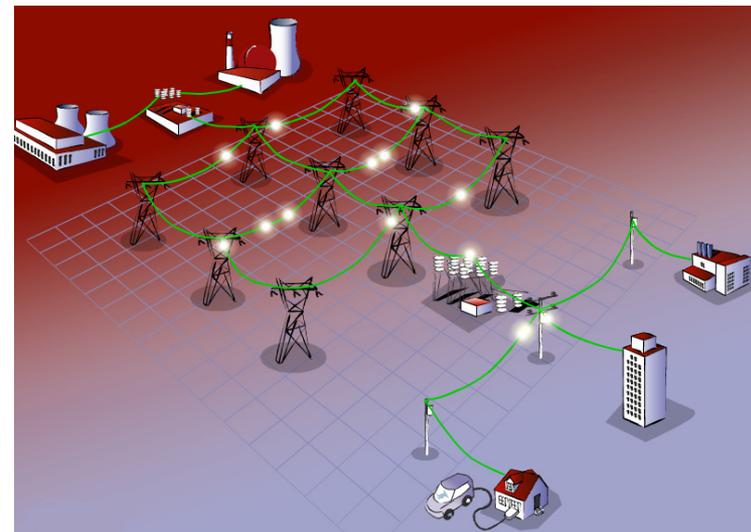
General Approach

TECHNOLOGY ELEMENTS

TECHNOLOGY INTEGRATION

SMART GRID

- Large scale integration of renewables to meet RPS goals (33%)
- Plug-in-Hybrid's/Electric Vehicle's
- Electric Energy Storage/Auto DR
- More Reliable & Efficient Grid
- Community & Multi-Utility scale project



Research Focus on Entire Grid System

20 to 1 investment ratio

Benefits

CONSUMERS

- Allow Consumer Information
- Reduce Cost
- More options to meet energy needs
- Provide Environmental Value

TO UTILITIES

- Better Use of Existing Assets
- Reduce Carbon Emissions
- Enable Renewable Resources
- Increase Reliability

THE ENVIRONMENT

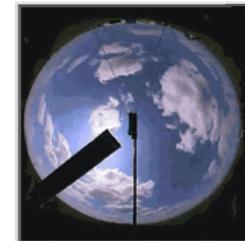
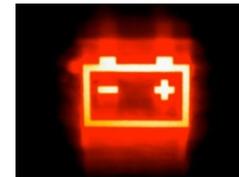
- Carbon Emission Reduction
- Renewables Integration
- Incentives for Conservation
- Demand Response for Managing Air Pollution

THE ECONOMY

- Green Job
- Higher Paying Jobs
- Investment In Entrepreneurs
- New Manufacturing Base
- Global Competitiveness

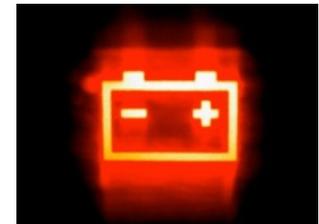
On-Going Research

- **Storage**
 - ✓ More than 12 projects (ARRA included)
- **Automated Demand Response**
 - ✓ Ancillary Service
- **Distribution Impacts**
 - ✓ Electric Vehicle Simulator
- **Forecasting**
 - ✓ Short term forecasting (less than 1 hour)



On-Going Research

- **Microgrid Visibility to CAISO**
 - ✓ Providing operation oversight of a microgrid to CAISO
- **Electric Vehicle Integration**
 - ✓ DC Charging from PV (improved efficiency)
- **Distributed Electric Storage System**
 - ✓ DC charging of Storage System from PV (improved efficiency)
- **PV Clustering**
 - ✓ Determining best placement of storage to mitigate renewable impacts



Proposed Initiative

Distribution Research To Meet Goal of 20,000MW

- Characterization of sample feeders
- Local DG impact assessment
- Information sharing /build partnerships
- Coordinated data analysis
- Feeder modeling for future DG and EV impact predictions
- Implementation of broader feeder monitoring where indicated
- Distributed resource behavior specifications
- Distribution system Research Road Map



Proposed Initiative



Distribution Research Benefits

- Safe and reliable distribution system operation with increasing presence of distributed generation and EVs
- Visibility for transmission operators beyond the substation
- Informing DG specifications and interconnection standards
- Informing needs for strategic upgrades

Proposed Initiative

PIER WIDE SOLICITATION

- **All PIER Program Areas to participate**
 - ✓ Build upon existing research efforts (RESCOs, Microgrids)
 - ✓ Demonstration Project to promote PIER funded technologies
 - ✓ Zero Net-Energy Building Demonstration
 - ✓ Linking of multiple microgrids

Innovative technologies and solutions

- **Target**
 - ✓ IOUs
 - ✓ Local Governments
 - ✓ Universities and National Labs

Proposed Initiative

PIER WIDE SOLICITATION

- Does it make more sense to have one large demonstration project or several smaller projects?
- Who are the best targets for this solicitation?
- Should proposals build off of existing PIER projects or should new projects be considered as well?
- What are the key research questions to address?

QUESTIONS?

Proposed Initiative

Integrating Demand Response & Energy Storage

- DRRC:
 - ✓ Open Automate DR
 - ✓ National Standards Development
 - ✓ Estimating 2020 Capabilities
- Lawrence Livermore National Lab
 - ✓ Modeling Entire California Grid
 - ✓ Assessing Energy Storage/Auto-DR/New Generation Needs
- Energy Storage
 - ✓ AB2514 Activities
 - ✓ California ARRA Energy Storage Projects
 - ✓ Assessing Energy Storage Need to Meet RPS

Game Changer

Venture Capital Forum June 7, 2011

- **Build Bridge :**
 - ✓ How Do Venture Capitalists evaluate prospective technologies?
 - ✓ How do we better invest and leverage PIER funds?
 - ✓ How do we encourage higher levels of VC investment in PIER technologies?
- Create effective forums for long term relationships to increase path to market



Outcome

- More than 300 participated
- Legislative Representation
- Connected PIER projects with VCs
- Planned event in Southern CA in Fall

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