



Electric Distribution Transformation Program

Program Overview

Electric Distribution Transformation Program

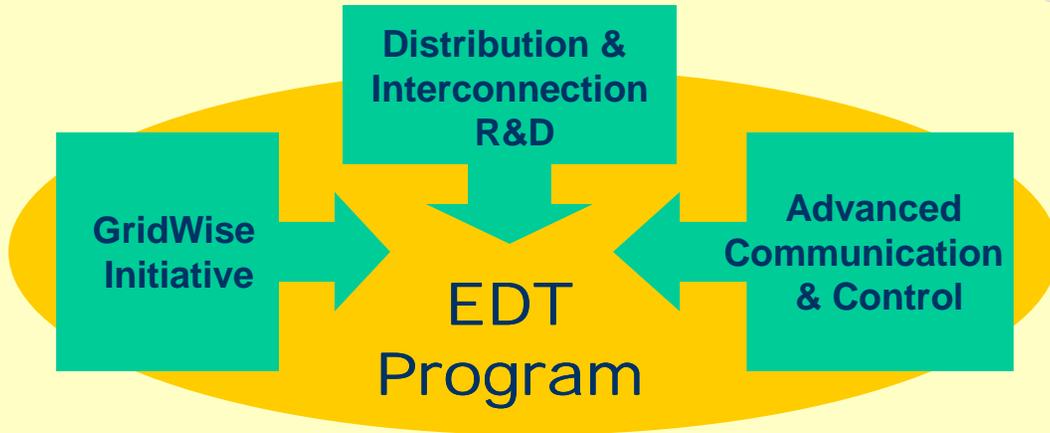
Eric Lightner
Program Manager
October 28, 2003

FY03 Major Accomplishments



Electric Distribution Transformation Program

INTEGRATION



IEEE 1547 STANDARD

Interconnecting Distributed Resources with Electric Power Systems -- approved in June 2003

Potentially affecting >3,000 utilities in formulating interconnection agreements



FIVE AWARDS

ACCP FY03 solicitation
Proof-of-design testing on system integration concepts

FY03 Major Accomplishments



Electric Distribution Transformation Program

GRIDWISE ALLIANCE DECLARATION

Signed by IBM, Alstom, PJM, UAI, Sempra, Rockport Capital and Battelle (September 2003)

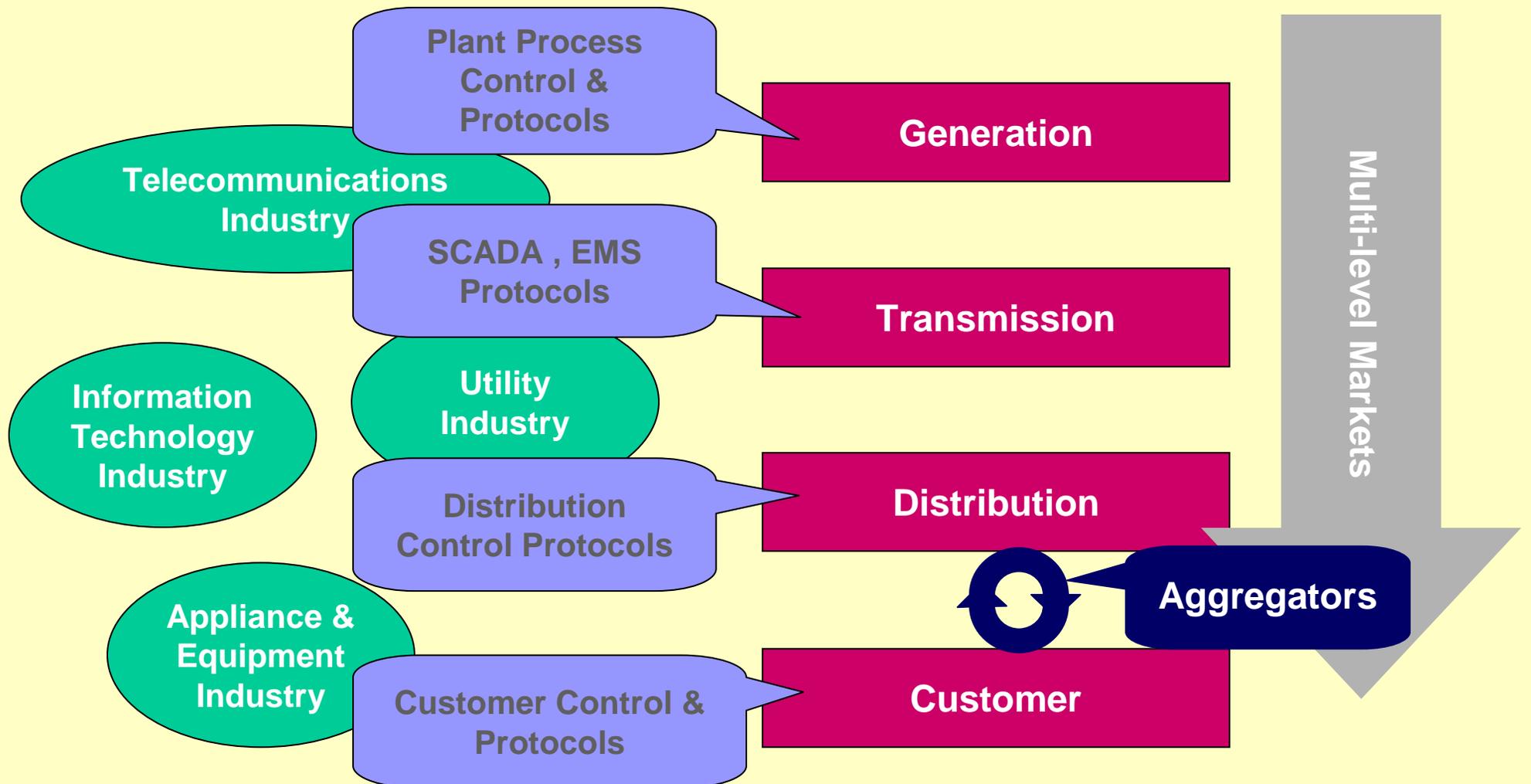
Alliance incorporated, with Executive Director active in recruiting members



System Architecture & Standards



Electric Distribution Transformation Program



System Architecture & Standards



Electric Distribution Transformation Program

Description

Develop, with stakeholder acceptance, an architectural reference guide and associated standards for integration of communications, information system, control, and market systems

Benefits

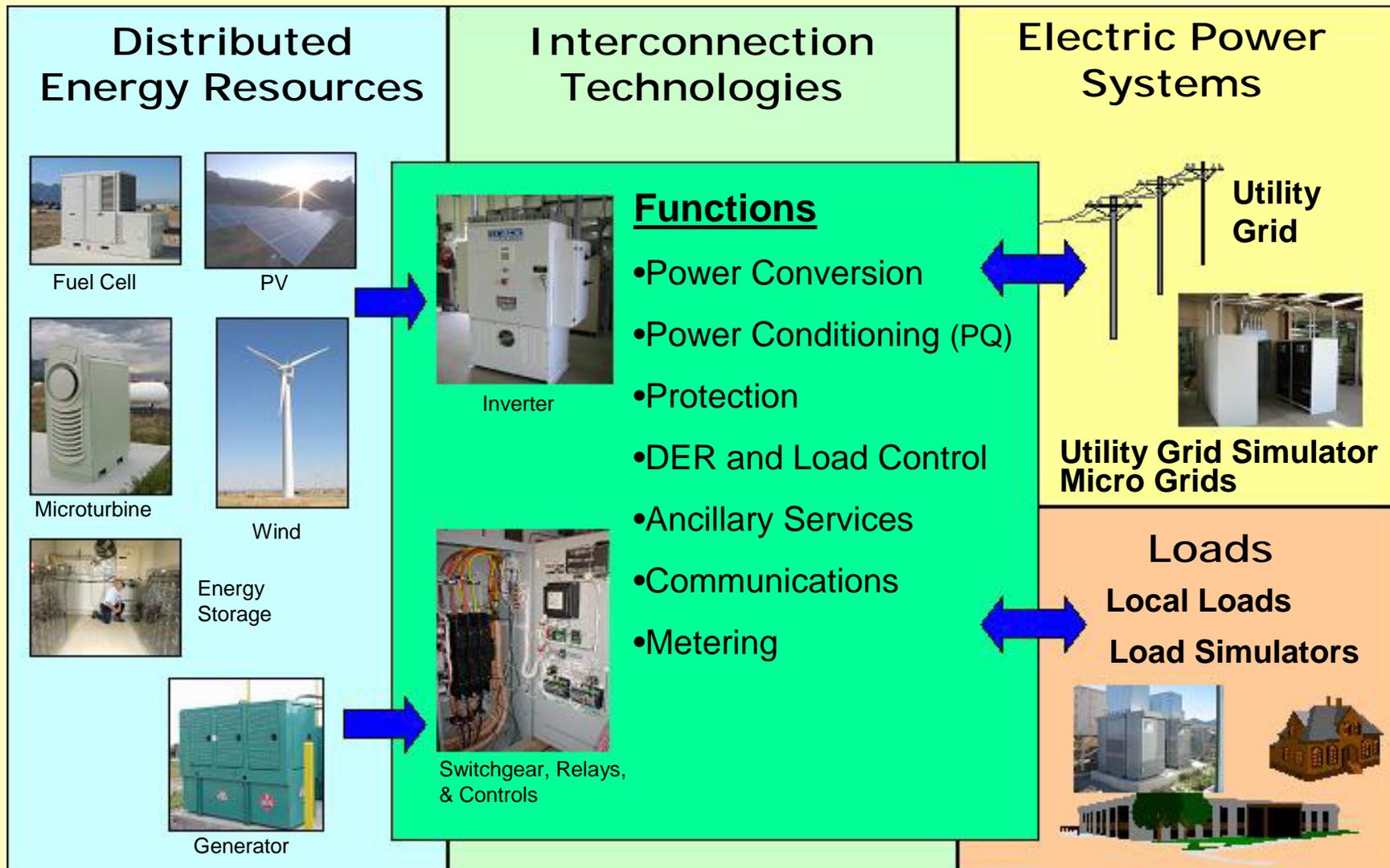
Provide enabling platform to integrate electric delivery services with market operations to provide customer choice for quality and economics

Interconnection Standards & Technologies



Electric Distribution Transformation Program

Interconnection Technology and System Integration



Interconnection Standards & Technologies



Electric Distribution Transformation Program

Description

Develop P1547 Series of Standards for Interconnection

Develop advanced modular plug-and-play interconnection and control technologies for integrating DER with electric power system and local loads for seamless operations

Benefits

Provide inverter-based interconnection systems across multiple DER technologies (2-500 kW)

Provide fully integrated utility-grade interconnection systems with switchgear for synchronous machines (<3 MW)

Reduce the overall cost of interconnection; increase the MTBF for interconnection technologies

Distributed Sensing, Intelligence, & Control Technologies



Electric Distribution Transformation Program

Description

Develop distributed intelligent agents to diagnose local faults; provide autonomous control and protection at the local level

Develop smart agents to coordinate with power electronics and other existing, conventional protection schemes to enhance the reliability of the grid

Benefits

Provide remote detection, protection, control, and contingency measures

Achieve optimized control of a large, complex network of DER systems

Enable adaptive "islanding" more resilient to disruptions from either natural or man-made events

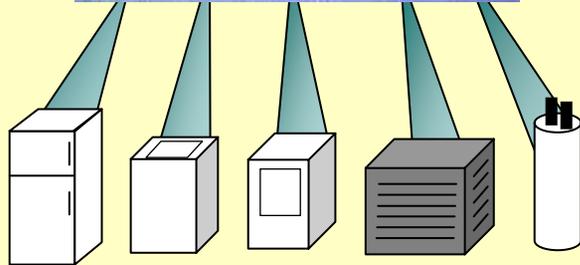
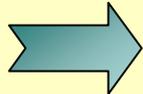
Distributed Sensing, Intelligence, & Control Technologies



Electric Distribution Transformation Program

Grid-Friendly™ Appliance (GFAs) Controller

Millions
of GFAs



*eliminate need for 100s
of new power plants,*



*saving tens of billions of
dollars over 20 years.*



Grid-friendly appliances ...

- ... instantaneous, automatic response to grid crises
- ... displace need for spinning reserves
- ... allow grid to run “closer to the edge” safely
- ... 10 min. interruptions unnoticeable by consumer
- ... mass marketing/mass customization opportunity
- ... platform for active communication & control
 - pre-heat/pre-cool to coast through peaks
 - utilize & value thermal storage
- ... increase reliability & security

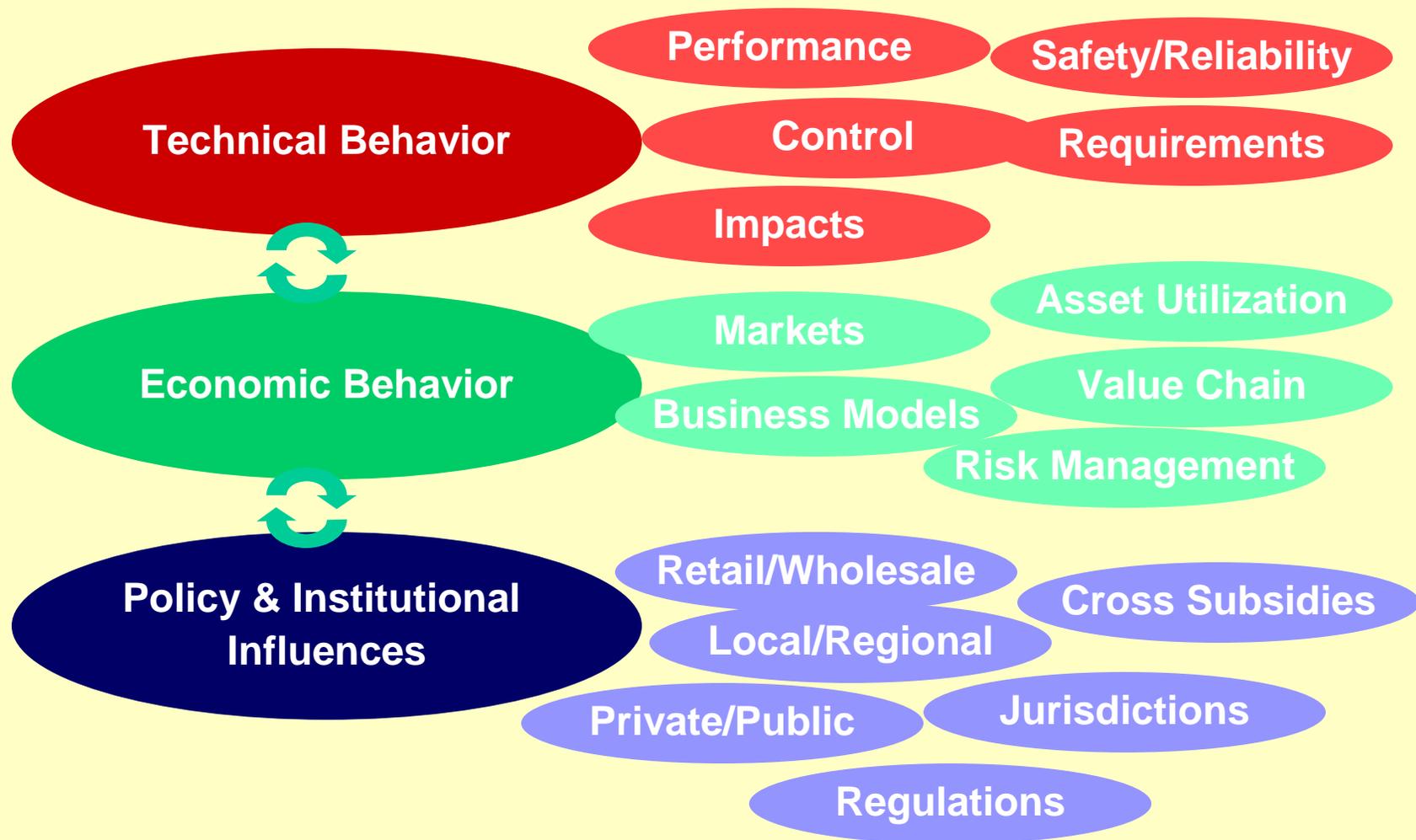
**“...given enough ants, you
can move a mountain!...”**

impromptu reaction from a utility power engineer

System Simulation & Analysis



Electric Distribution Transformation Program



System Simulation & Analysis



Electric Distribution Transformation Program

Description

Develop simulation and analysis tools to support detailed analyses of complex interactions of loads, resources, controls, and policy/institutional influences

Benefits

Provide virtual test-bed for development of technologies and applications

Establish technology targets, quantify benefits, and provide viable business models for DER

Test Beds & Field Demonstration



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Characterization R&D Testing

- Work with industry to characterize and improve electrical interfaces of DR before field testing
- Test for compliance to Interconnection Standards
- Test small scale integration issues with multiple DGs



Field Testing

- Test integration of DRs with electric power systems in controlled setting including effects of DR on distribution system protection equipment
- Test for compliance to Interconnection Standards in field setting
- Test large scale integration/aggregation issues with multiple DRs
- Test integration advanced communications, controls, and markets
- Advanced distribution system technologies

Test Beds & Field Demonstrations



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Description

Conduct a phased demonstration of system integration concepts, progressing from the packaged system, to facility, utility, and smart utility levels

Demonstrate optimized operation of aggregated MW outputs from DER systems

Benefits

Provide real performance data on grid penetration effects

Provide advanced distribution system operation concepts for improved protection, reliability, and economics

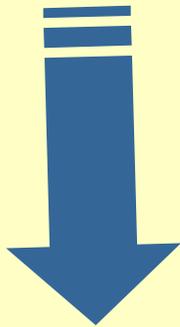
Open niche markets for DER in peak shaving, ancillary services, and premium power

Stakeholder & Institutional Adoption

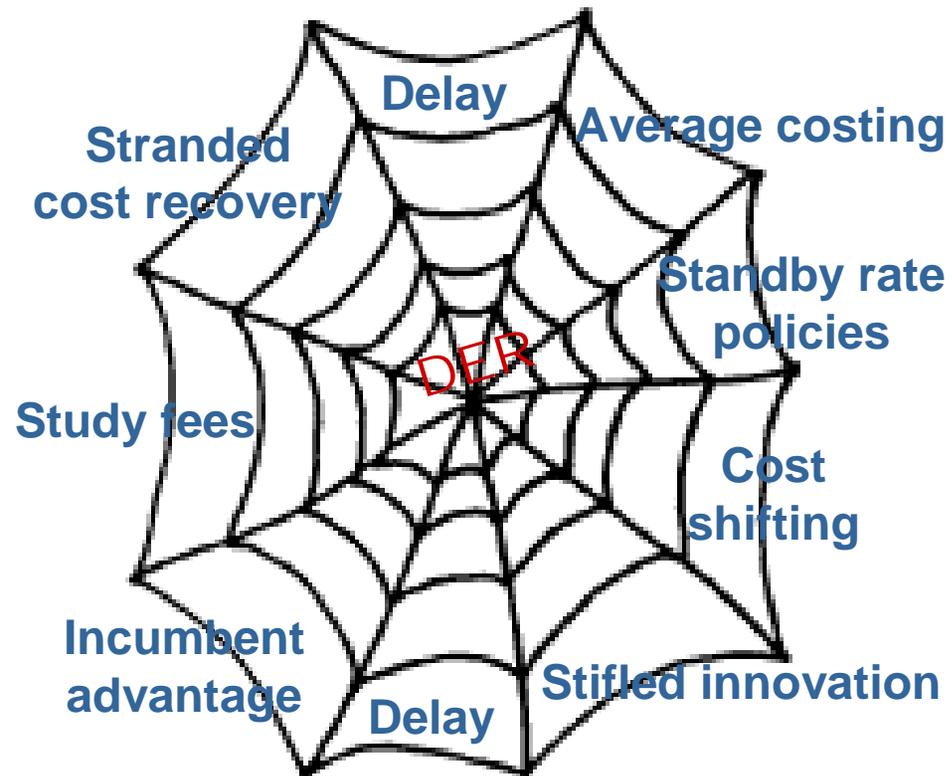


Electric Distribution Transformation Program

Past practices create a web of constraints and barriers.



EDT program works to reduce these barriers.



Stakeholder & Institutional Adoption



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Description

Promote standards for acceptance by regulatory and user entities

Support state regulatory reform to remove DER/CHP rate and tariff barriers

Collaboratively develop innovative regulatory approaches to integrate DER within state and regional systems

Support development of streamlined state & local siting and permitting

Benefits

Remove constraints and barriers that impede transformation of electric distribution infrastructure

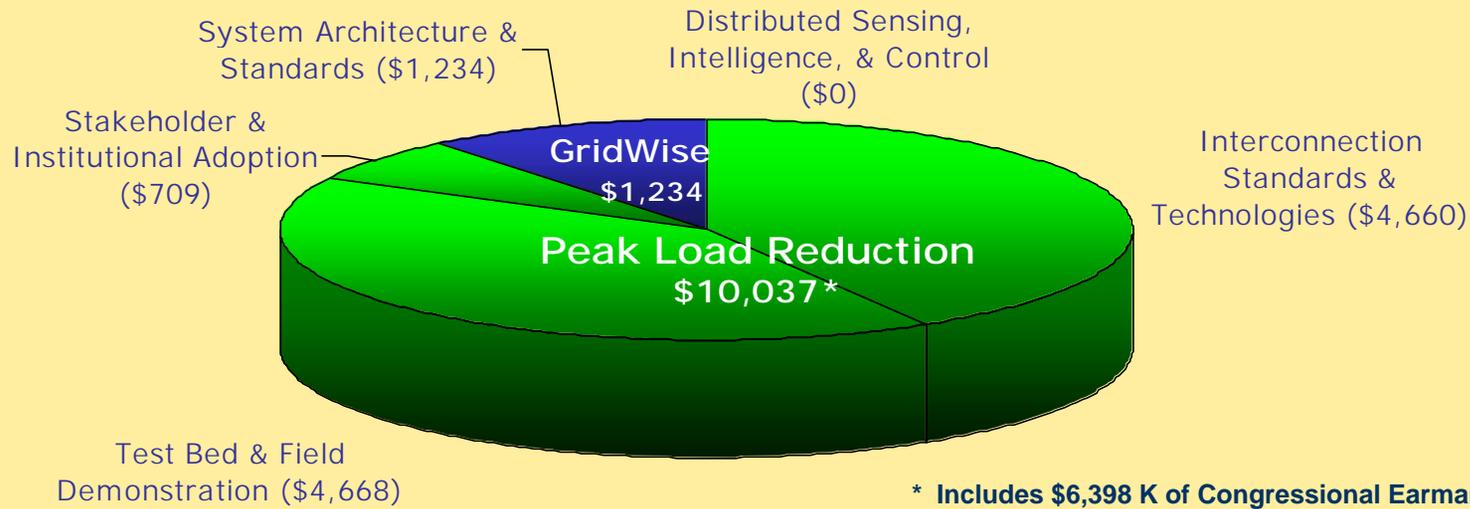
Gain stakeholder acceptance

Funding Allocations, by Activity and Program Areas

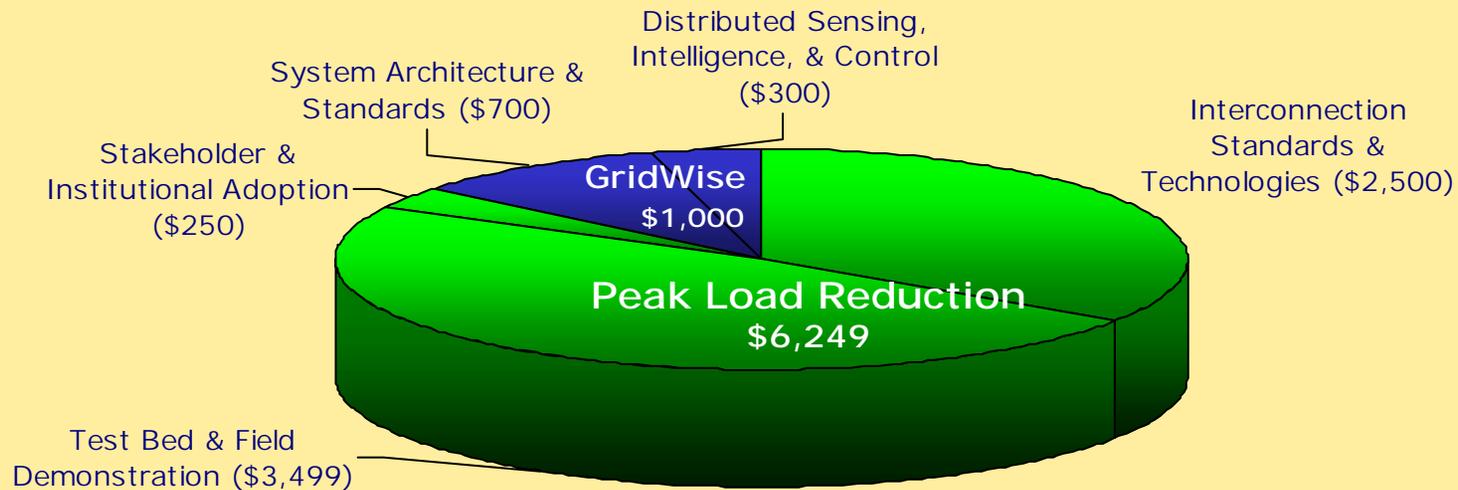


Electric Distribution Transformation Program

FY03
\$11,271* K



FY04
\$7,249 K



FY04 Funding Status and Plans



Electric Distribution Transformation Program

FY04 Funds Fully Obligated to Support Ongoing Activities

- Funding suffered from a loss of Interior appropriations in FY03/04
- No new activities for FY04 start
- Mortgages for LOI#1 and LOI#2 projects: \$2,331 K
- Mortgages for Phase-II ACCP awards: \$1,800 K

Collaborations: Multi-prong, Leveraging R&D Efforts



Electric Distribution Transformation Program

Federal Programs

- 2003 SBIR Topic: Sensor, Communication, and Control Technologies for Energy Efficiency
- 2003 SEP Topic: Electrical Interconnection Regulatory Education and Outreach

State Programs

- CEC, MicroGrid development
- NYSERDA, up to 30-MW DG Aggregation
- Connecticut Demand Response Program, aiming at 30-40% customer participation

Industry & Associations

- IEEE Standards, SCC21 Committee
- CEIDS, Steering Committee and PAGs
- GridWise Alliance
- Gateway Group, representing 7 major utilities

National Labs & Universities

- NREL, interconnection/system integration/regulatory issues
- PNNL, communications/simulation & modeling/GFA
- SNL & universities, microgrid development

International

- IEC TC8 organizational and leadership support
- Information exchanges with CESI (Italy) and two Spanish utilities

Program Performance Metrics



Electric Distribution Transformation Program

Long-Term Performance Goal 1

By 2010, achieve an overall interconnection cost reduction of 30%

Key Targets

By 2005:

15% cost reduction in inverter-based interconnection systems (2-500 kW) and switchgear-based systems (<3 MW), from the 2003 base

10-year MTBF for inverter-based interconnection systems, from current 3-5 years

Long-Term Performance Goal 2

By 2015, demonstrate smart, distributed utilities to achieve a 10% peak load reduction through improved asset use and demand/load management

Key Targets

By 2005:

10% energy cost savings through demand responsiveness, from the 2003 base

Complete field demonstration of system integration at > 1 MW

By 2008: Complete field demonstration of system integration at > multi-10s MW

By 2010: Complete field demonstration of system integration at > multi-100s MW

Anticipated Program Workshops in FY04



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- MicroGrids, joint planning with CEC
- Distribution Simulation and Modeling, in anticipation of a new solicitation
- Distribution System Automation (integration of sensing, C&C, intelligent decision making), in anticipation of a new solicitation

Program Communications



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Web Communications

<http://www.electricity.doe.gov/edt.htm>

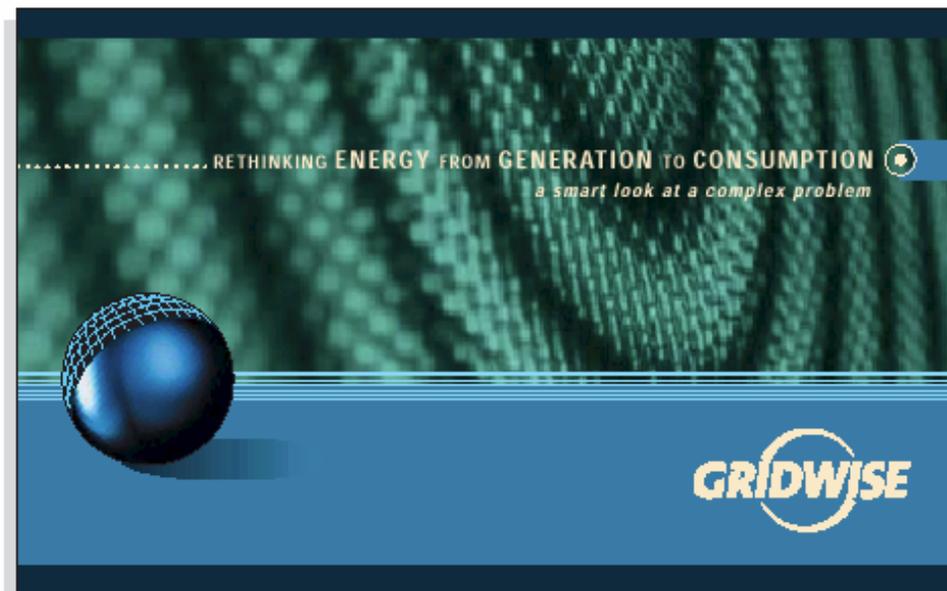
- Program Info
- Project Resources (publications, reports, review presentations, fact sheets, etc.)

<http://www.gridwise.org>

- In development, providing GridWise Alliance information

Print Brochures

- EDT Program Fact Sheet
- GridWise



End State Enabled by the EDT Program

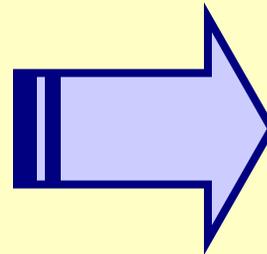


Electric Distribution Transformation Program

Transformation of Electric Distribution Infrastructure to Meet the Challenges Facing Today's Society

Current

- Infrastructure susceptible to physical intrusions and cascading failures
- Power disturbances weighing on economic productivity
- Limited practices for load/demand management
- Existing assets underutilized
- Barriers for a competitive market structure



End State

- Infrastructure secured from attacks and resilient to failures
- Reliable power delivery stimulating economic growth
- Broad customer participation in value-added services
- Economic dispatch of all existing assets
- Transparency of electric market/electric system operations