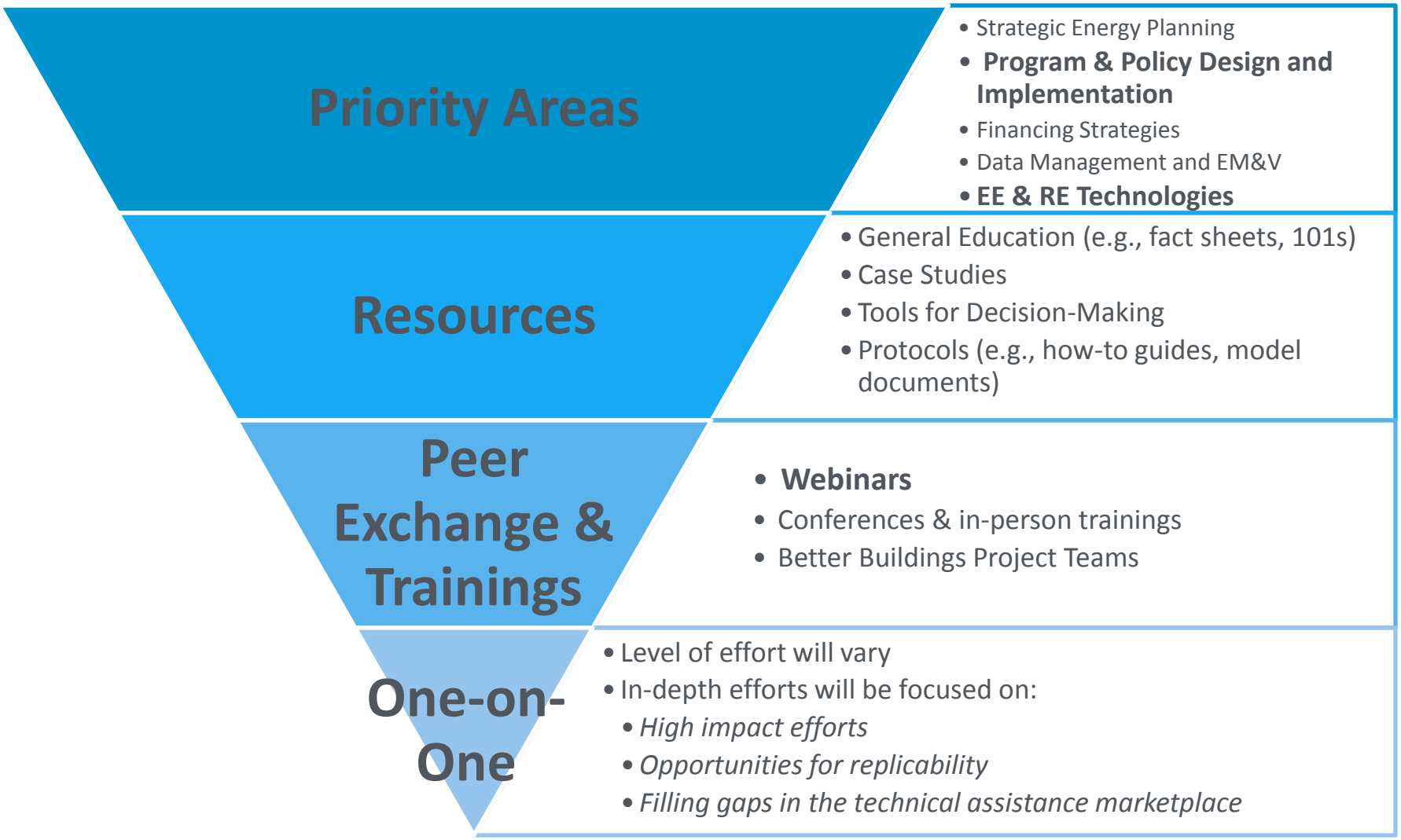
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

States & Emerging Energy Technologies

August 15, 2013

DOE's State and Local Technical Assistance Program

DOE's Technical Assistance Program



Priority Area: EE & RE Technologies

- **Trainings, peer exchange, and partnering with DOE**
  - Upcoming TAP Webinars:
    - Energy Efficiency in Water and Wastewater Treatment Facilities, 9/11
    - States Applications for Combined Heat and Power Technologies, 9/25

    www.eere.energy.gov/wip/solutioncenter/wip_events.html
  - Better Buildings Alliance & Technologies Solutions Teams
    www.eere.energy.gov/alliance/activities/technology-solutions-teams
- **Resources**
  - Building Technologies Office's Emerging Technologies page
    www.eere.energy.gov/buildings/technologies/index.html
  - DOE's Solar Energy Resource Center
    www.eere.energy.gov/solar/sunshot/resource_center/
  - DOE's Alternative Fuels Data Center
    www.afdc.energy.gov/fuels/
  - Updated Solution Center resource portal for technology deployment live later this year

How to Tap into These and Other TAP Offerings

- Visit the ***Solution Center***
  www.eere.energy.gov/wip/solutioncenter/

- Submit an ***application*** for assistance
  www.eere.energy.gov/wip/solutioncenter/technical_assistance.html

- Sign up for ***TAP Alerts***, the TAP mailing list, for updates on our latest and greatest
  TechnicalAssistanceProgram@ee.doe.gov

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

TAP Webinar: Emerging Technologies

Alicen Kandt

National Renewable Energy Laboratory

August 15, 2013

Introduction

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Senior Mechanical Engineer

National Renewable Energy Laboratory

August 15, 2013

Emerging Technologies

Outline

- Emerging Technology Definitions: *The What, Why and How?*
- Program Examples
  - Federal
  - State/Utility
- Questions

PIX: 20311

Background: *What?*

What is an emerging technology?

- An emerging technology is a product or practice that hasn't yet been widely adopted by customers for various reasons, yet has the potential for large energy, water or cost savings
    - In the majority of programs, the product is commercially available.

Background: *What?*

What is an emerging technology demonstration program?

- Act as a bridge to help energy efficiency and renewable energy technologies overcome the “valley of death” between early innovation and widespread market adoption.

Background: *What?*

What is an emerging technology demonstration program?

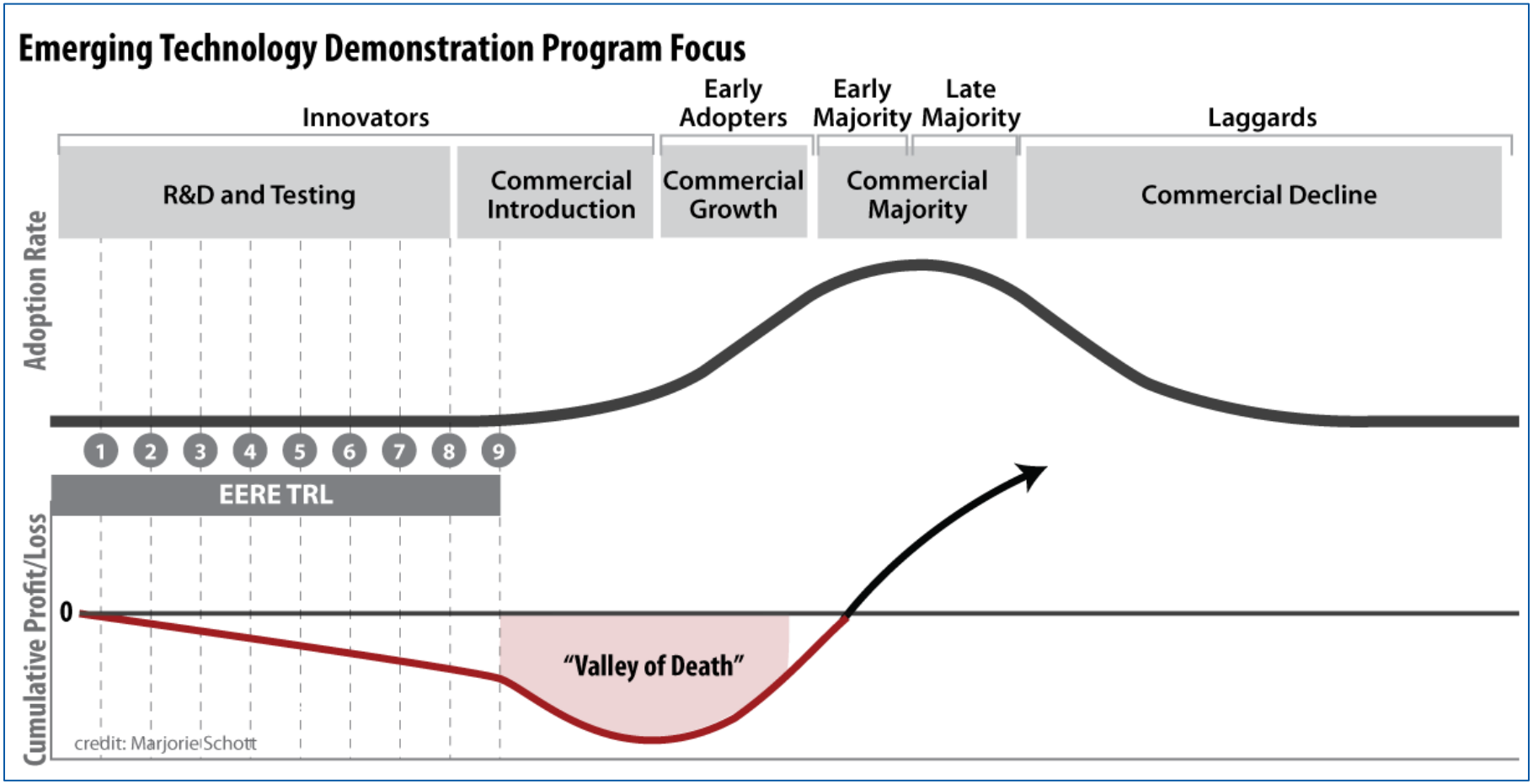


Image by Marjorie Schott, NREL

Background: *What?*

What are the goals of an emerging technology demonstration program?

- Reduce user risk, and ultimately increase the adoption rates for promising technologies.
  - Validate the performance of emerging technologies, as well as installation procedures, operations and maintenance impacts, and occupant impact
- Identify appropriate applications for a technology
- Identify appropriate mechanisms to support adoption of a technology, such as through a utility's rebate programs.

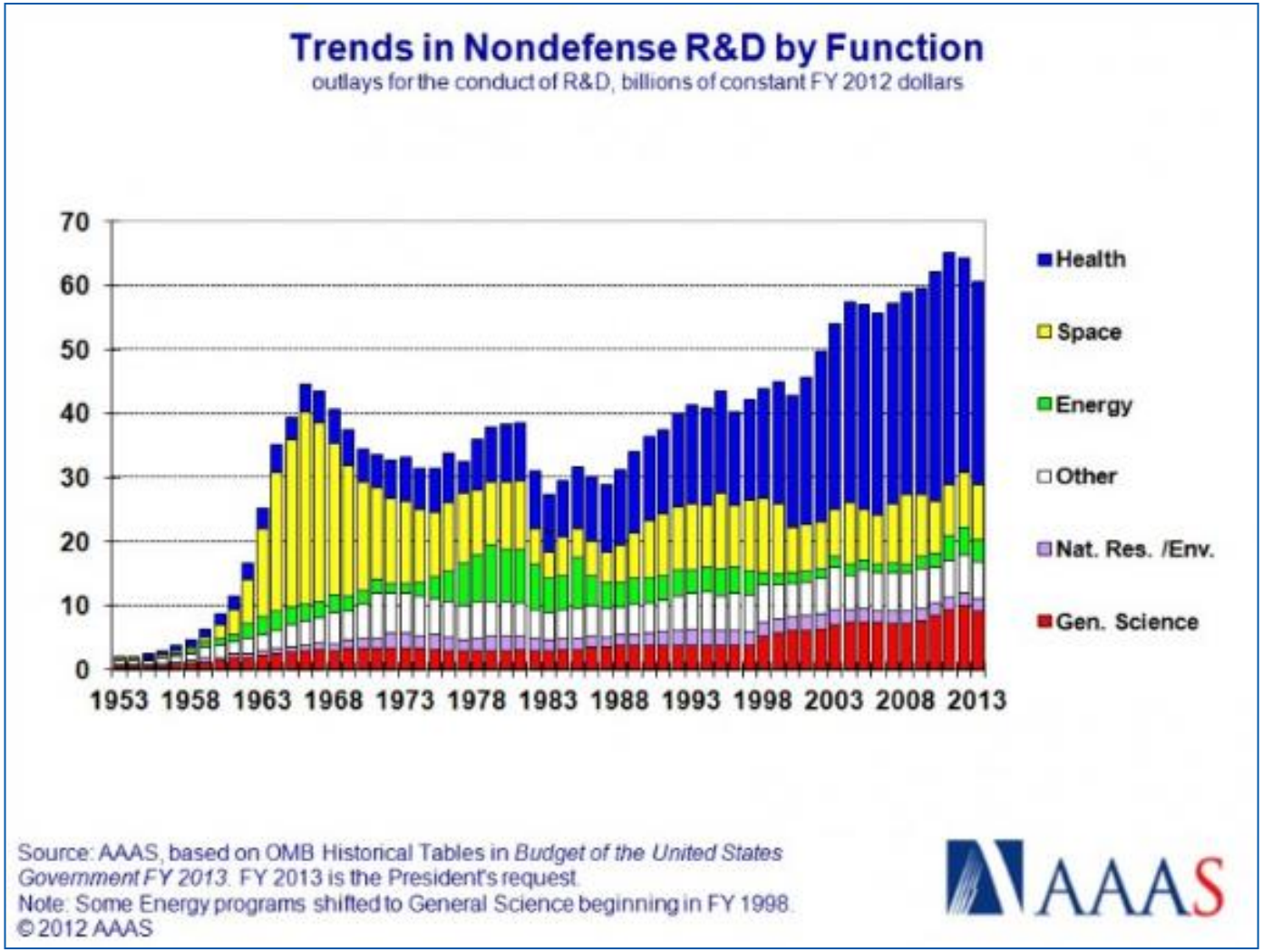
Background: *Why?*

Why are emerging technologies important?

- Many high-performing technologies are not readily adopted in the marketplace due to lack of information about their real-world performance.
- Efficient new building technologies can help meet energy and GHG reduction goals, stimulate U.S. manufacturing, create jobs, and improve the environment.
- New, innovative technologies are necessary to meet energy and greenhouse gas reduction goals; more R&D investment is needed.

Background: *Why?*

Why are emerging technologies important?



Background: *How?*

How can this information be useful for state and local stakeholders?

- Become aware of energy saving technologies
- Encourage the support of emerging technology programs through policies
- Help businesses reduce energy use and become more competitive
- Help consumers reduce energy bills in a tough economy

Background: *How?*

How can this information be useful for state and local stakeholders?

- Help cities and states achieve their goals for energy savings and greenhouse gas reduction
- Promote green jobs that benefit communities more than energy purchases.

TAP State and Local Solution Center:
http://www1.eere.energy.gov/wip/solutioncenter/one-on-one_technical_assistance.html

Example Programs: *Federal*

The U.S. Department of Energy's (DOE) Technology Demonstration Program:
www1.eere.energy.gov/buildings/commercial/techdemo.html

- **Focus:** Technologies that are energy-efficient, market-ready, cost-effective, and create U.S. jobs
- Coordination with other federal programs
- Two DOE programs (the Federal Energy Management Program and the Building Technologies Office) are leading the development of Technology Performance Exchange (TPE)

Example Programs: *Federal*

The U.S. Department of Defense's (DoD) Environmental Security Technology Certification Program (ESTCP): www.serdp.org

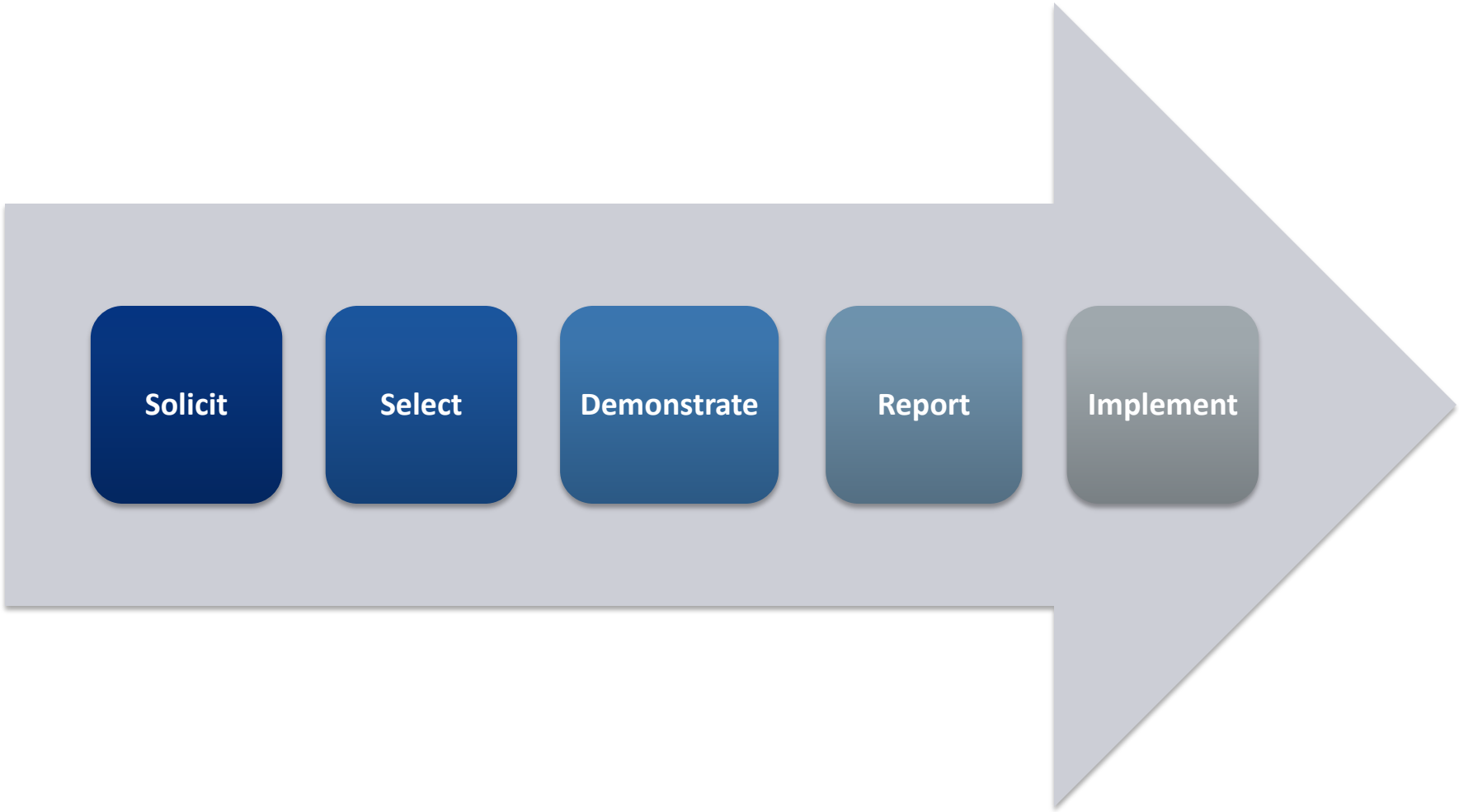
- **Focus:** Innovative technologies that have successfully established proof of concept to field or production use
- Identifies and demonstrates the most promising innovative and cost-effective technologies and methods that address DoD's high-priority environmental requirements
- Ten completed and 83 active projects: www.serdp.org/Program-Areas/Energy-and-Water/(list)/1/

Example Programs: *Federal*

The U.S. General Services Administration's (GSA) Green Proving Ground (GPG) Program: www.gsa.gov/portal/category/102491

- **Focus:** Commercial, underutilized, innovative technologies
- Leverages GSA's real estate portfolio to evaluate innovative sustainable building technologies
- Demonstrates about 12 technologies/year in Federal buildings

Federal Process Outlined



GPG: Demonstrated Technologies

HVAC/Energy Management
Chilled Beams
Commercial Ground Source Heat Pump
Condensing Boilers
Magnetic Bearing Compressor
Plug Load Control
Variable Refrigerant Flow
Variable-speed Chiller Plant Control
Wireless Sensor Networks
Central Plant Optimization Strategy
Wireless Pneumatic Thermostat

Building Envelope
High R-Value Windows
Smart Windows
Electrochromic Windows
Glazing Retrofit Coating
Vacuum Sealed Roof Insulation

GPG: Demonstrated Technologies

Lighting	Water	On-Site Power Generation
Integrated Daylighting Systems	Non-chemical Water Treatment	Photovoltaics (PV)
Occupant Responsive Lighting	Nonchemical Prevention of Hard Water Scale	PV with Solar Water Heating
LED Retrofit Luminaire	Wireless Moisture Sensing Irrigation System	Wood-Pellet Biomass Boiler
Wireless Lighting Control System	Wireless Weather Station Irrigation Control System	Honeycomb Solar Thermal Collector

GPG: Example Findings

Plug Load Reduction: *Technology Overview*

An advanced power strip (APS) can control plug-in devices by deploying three key strategies:

1. **A timer** which sets the day and time that a circuit will be turned on/turned off (e.g., ON: Monday at 8am and OFF: Monday at 5pm);
2. **A load-sensing control** monitors a specific device's power state and will turn off auxiliary devices if the master device drops below a predetermined threshold;
3. **An occupant sensor** detects when a user is not present and deactivates controlled loads.

* Metering is an additional capability that can be paired with any of these strategies.

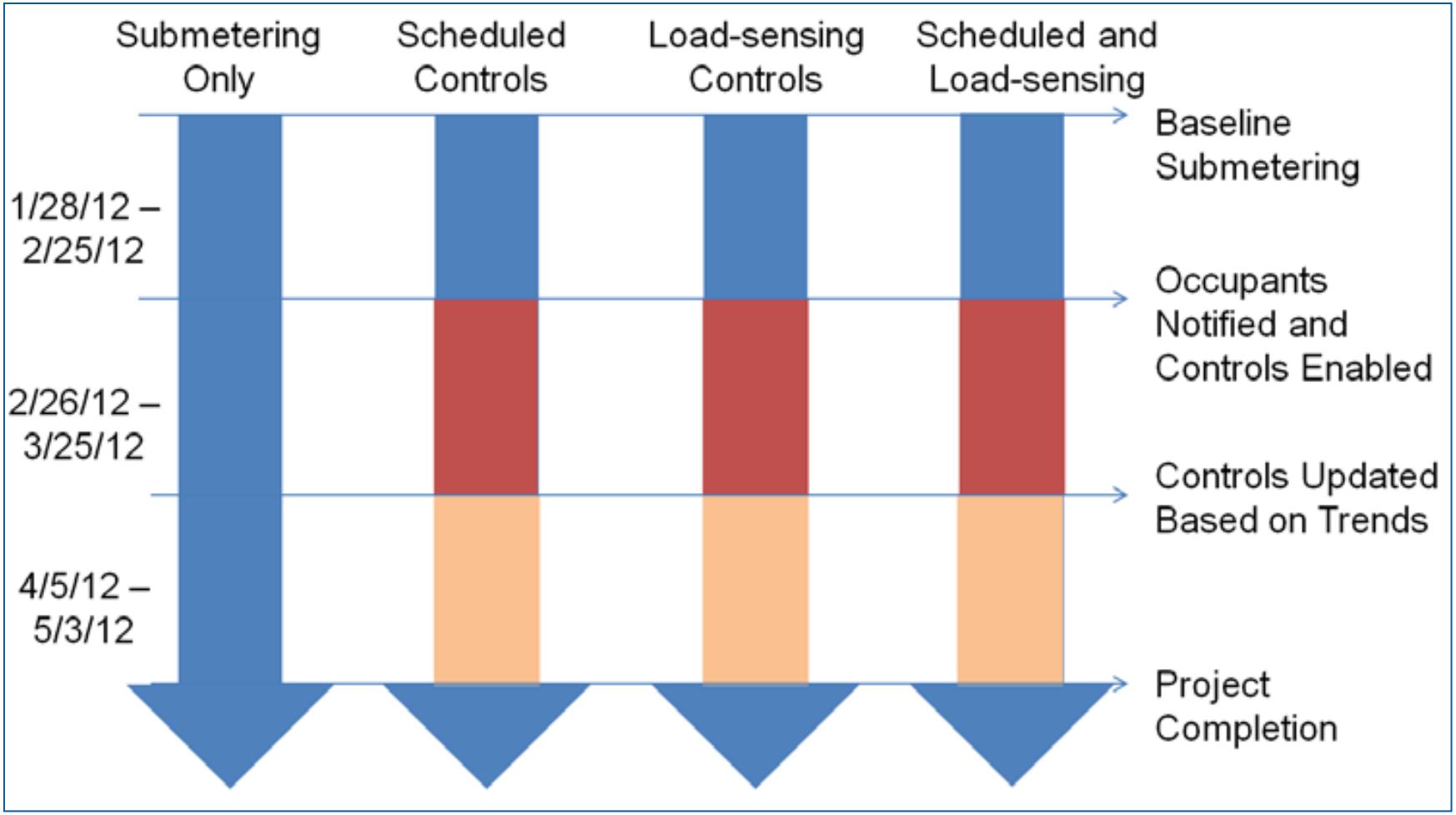
GPG: Example Findings

Plug Load Reduction: *Project Overview*

- In eight GSA buildings, approximately 12 standard power strips with no control capability were replaced with advanced power strips (APSs).
- 96 APS were deployed, which monitored and provided power to 295 devices.
- Three separate phases:
  - Inventory and Baseline
  - Initial Controls Deployed
  - Controls Refined

GPG: Example Findings

Plug Load Reduction: *Project Overview*



GPG: Example Findings

Plug Load Reduction: *Findings*

- The schedule timer control was the most successful strategy
  - Average energy savings of 48%
  - Largest savings achieved when schedule timer controls were applied to devices that were powered 24/7

- Simple payback at the demonstration project locations for the schedule timer was less than 8 years in all applications
  - Kitchens/Breakrooms (0.7 years)
  - Printer rooms (1.1 years)
  - Workstations (7.8 years)

GPG: Example Findings

Plug Load Reduction: *Findings*

		Printer	Laptop	Monitor	Under-Cabinet Light	Misc. Equipment	Kitchen Equipment	Total
Schedule timer	Edward A. Garmatz U.S. Courthouse	68%	13%	14%	14%	25%	13%	43%
	William J. Green, Jr. Federal Building	31%	54%	27%	34%	67%	79%	52%
Load-sensing	Robinson and Merhige Courthouse	69%	-4%	-6%	n/a	51%	n/a	23%
	Veteran Administration Building	-5%	16%	11%	0%	54%	n/a	10%
Both	Robert C. Byrd U.S. Courthouse	18%	35%	-2%	22%	40%	n/a	23%
	Cohen Complex	27%	14%	-1%	-1%	68%	n/a	12%
Average	Average	35%	21%	7%	14%	51%	46%	27%

Example Programs: *Utility*

California Investor-Owned Utilities' Emerging Technologies Coordinating Council:

www.etcc-ca.com

Bonneville Power Administration's Emerging Technologies for Energy Efficiency (E3T) Initiative

www.bpa.gov/energy/n/emerging_technology

In Closing

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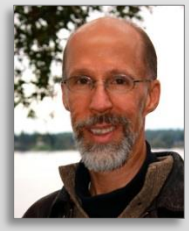
E3T Energy Efficiency Emerging Technologies

Washington State University Extension Energy Program

Sharing Objective Assessments of Emerging Technologies

U.S. Department of Energy
Technical Assistance Program (TAP)



August 15, 2013

Rob Penney, PE

Washington State University Energy Program

Bonneville Power Administration

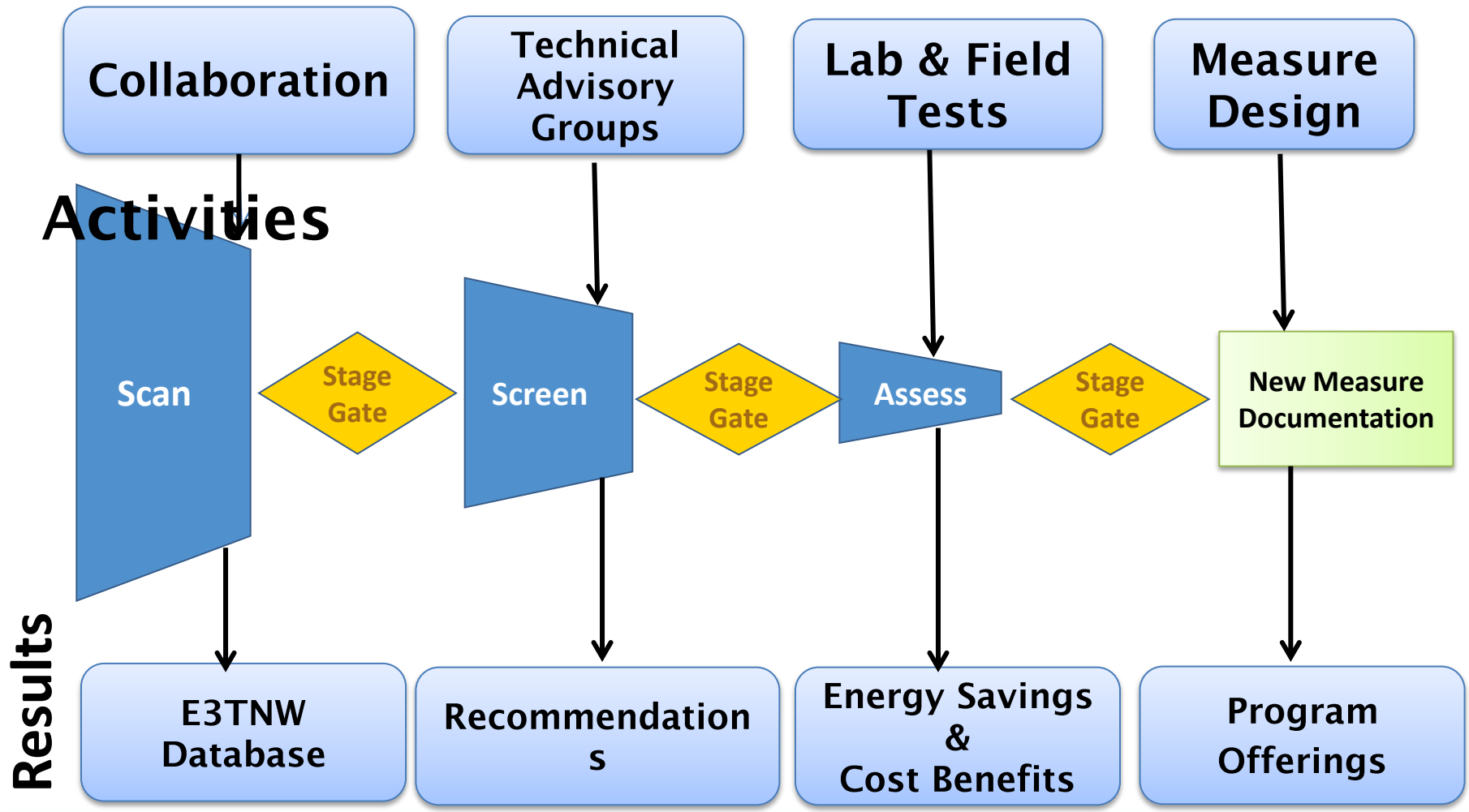
EnergyServices

Western Area Power Administration

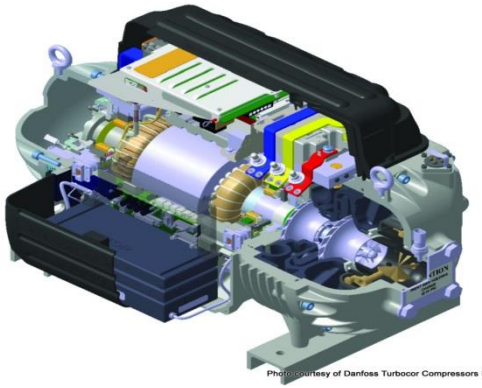
What To Expect in the Next 20 Minutes

- Overview of E3T Assessment
- Database of Technologies
- Sample Technologies
- Information resources

BPA E3T Framework



TAG Process Example: HVAC



WSU 153 Total ETs

TAG 56 ETs

Select HVAC ETs

38 HVAC ETs

94 ETs

TAG Rank

16 ETs

E3T Evaluates

4 ETs

Recommend to BPA

3 ETs

Technical Advisory Groups (TAGs)

- Lighting - 2009
- HVAC - 2009 & 2010
- Energy Management - 2011
- LED/SSL – 2012
- Smart Thermostats – 2012
- Lighting Controls – 2013

- Sm/Md Data Centers - 2013

Technical Advisory Group Partners

E3TNW Database

E3T Energy Efficiency Emerging Technologies

HOME ABOUT DATABASE TAG PORTAL WEBINARS SUBMIT NEW ET

Emerging Technologies Database:

Database | TAG

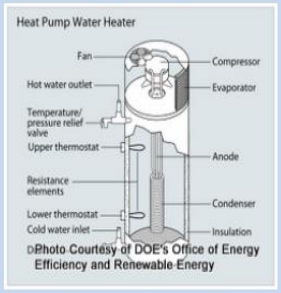
a collection of energy efficiency emerging technologies submitted and scanned by energy experts and engineers; the technologies consist of basic and detail level information that highlights commercially available electricity saving technologies. You may submit new technologies, use the search and browse features in the above menu, or see the complete list of technologies.

Featured Emerging Technologies

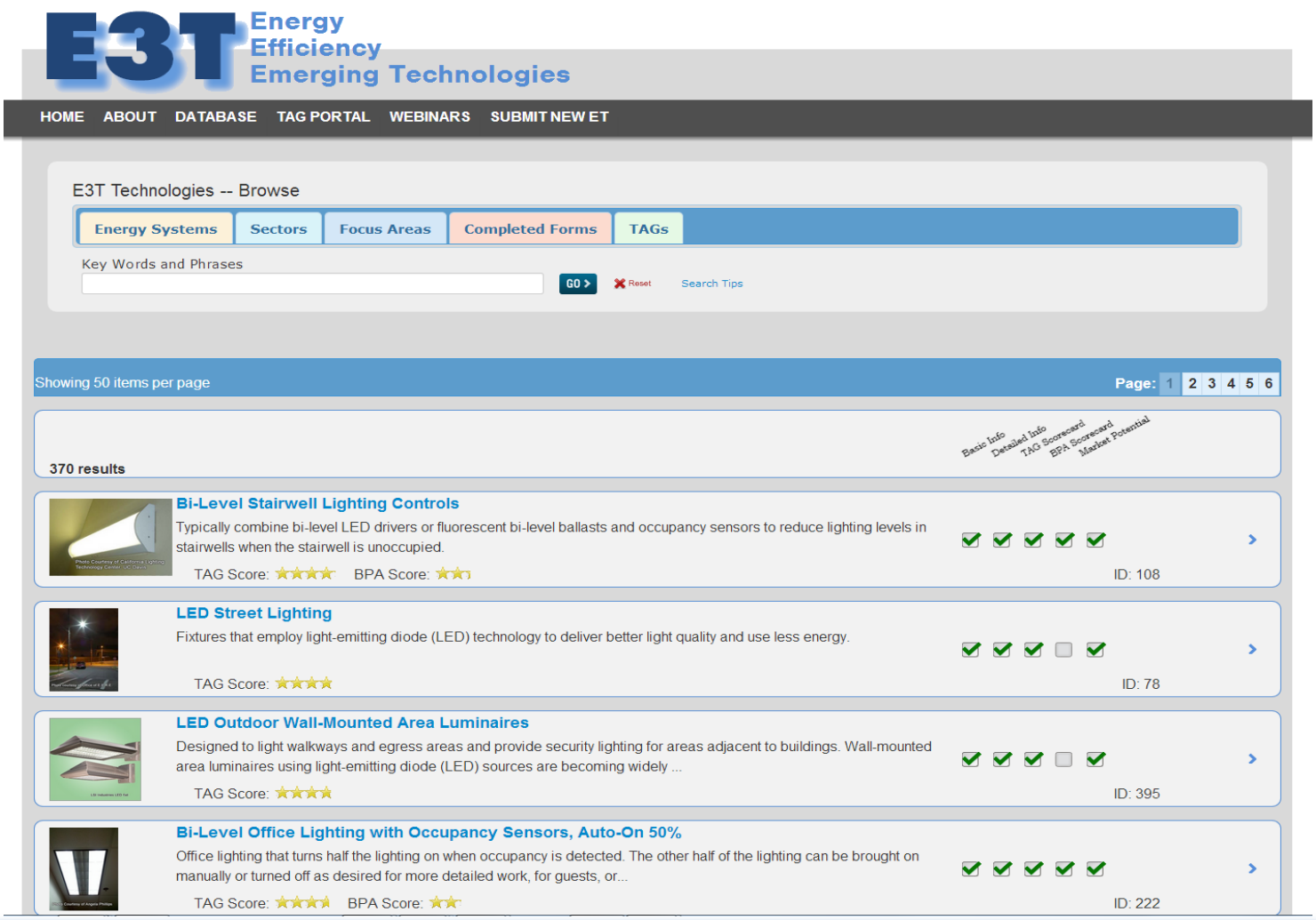
Lighting Technologies (by Energy System)

Energy Management Technologies (by Focus Area)

Residential Technologies (by Sector)



Browsing Technologies

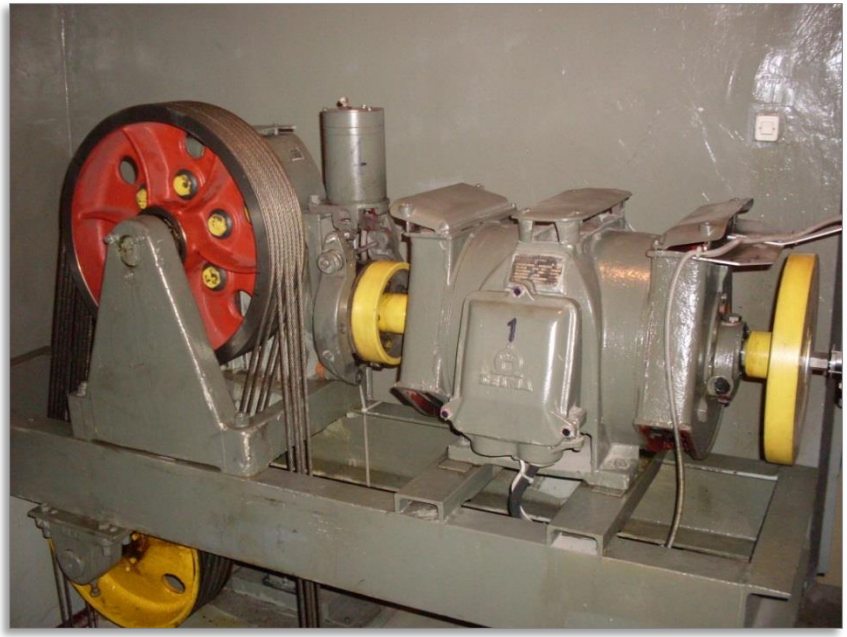


Assessment Information

- Synopsis
- Detailed description
- Standard practice
- Development status
- Energy savings claims, reliability, and dependencies
- Installed and O&M costs
- Effective life
- Non-energy benefits
- End-user drawbacks
- Competing technologies
- Prior assessment work
- Additional resources
- Performance trajectory
- Competing technologies

Efficient Elevators

- Gearless permanent magnet motors
- Advanced materials such as traction belts instead of steel ropes
- Motors with regenerative braking capability



Mirrored Light Pipe

- Translucent pipe that collects light from outside a building or from an artificial light source
- Conveys the light to locations within a building's interior where conventional daylight cannot reach directly

Low-E, High Visible Transparent Film

- Thermal efficiency equal or better than most films (U=.61)
- Visible transmittance is 70% on single pane
- Consumer selling point is light—happy people with great views using less electric lighting

Anti-Fog Film for Cold Cases

- Film installed inside reach-in supermarket refrigerated cases
- Reduces condensation and the need for anti-sweat controls, thus reducing energy use
- Reduces compressor load

Variable Refrigerant Flow (VRF)

- Heating and cooling distribution through refrigerant piping rather than ductwork
- Transfer heat among zones
- Variable-speed fans and compressors
- Very popular in Asia and Europe for decades

Photo Courtesy of Mitsubishi Electric Cooling and Heating Solutions

Smart LED Street and Parking Lights

- All the energy efficiency and long life of LEDs
- Controllable light levels for time-of-day, events, emergencies, and occupancy

CO_2 Heat Pumps

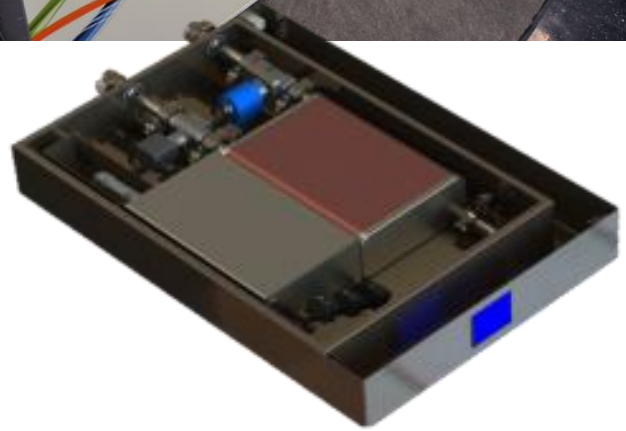
- Air- or water-source heat pumps that use CO_2 as a refrigerant, less GWP
- Produce hot air or water while generating chilled water or air
- Common in Japan
- Combined COPs up to 8
- Industrial model available, residential model soon

Smart Thermostats

- Web-enabled
- Smart-phone accessible
- Self-learning
- Occupancy sensors
- Weather forecast inputs
- Data sent to utilities and third parties
- Energy tips

Liquid-cooled Servers

- More efficient to cool a small amount of liquid than a lot of air
- Three examples:
  - Water-cooled server racks
  - Spray cooling
  - Submerged servers with dielectric oil



Circadian Light Color Tuning

Adjusting the level and color temperature of lighting at different times of the day can help avoid disrupting circadian rhythms, the biological cycles that can impact productivity and sleep

Showcase Webinars

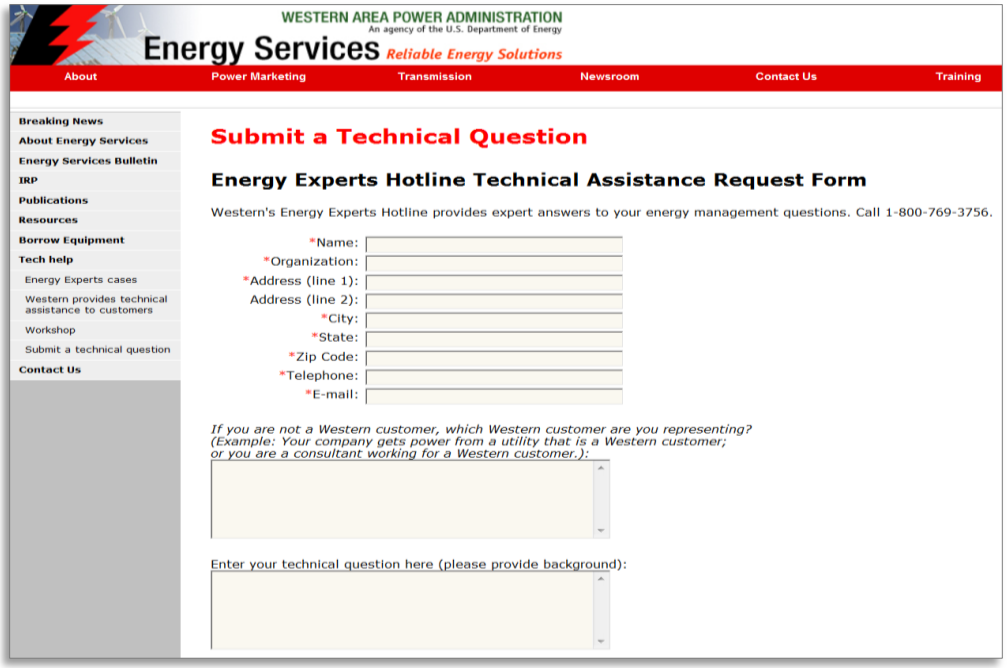
- LED Parking and Area Lighting
- Image Processing Occupancy Sensors
- Variable Refrigerant Flow (VRF)
- Smart Residential Thermostats
- Advanced Rooftop Unit Controls
- Demand Ventilation Control for Kitchens

Showcase Webinars

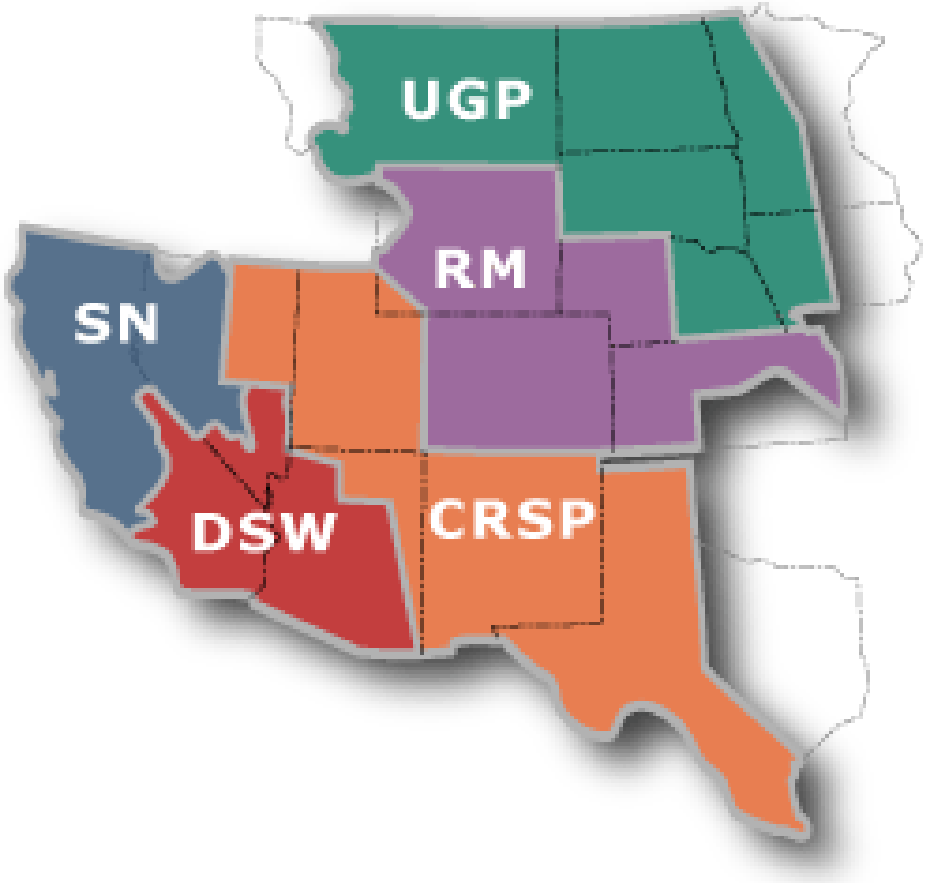
- Advanced Lighting Control Systems
- Low-Energy Precision Application
- Residential Window Treatments
- Behavior-Based Energy Efficiency Programs
- Non-Intrusive Load Monitoring

Western's Hotline

- Free technical assistance hotline for Western (WAPA) customers, including engineering assistance: (800) 769-3756



Western's Service Area



Energy Experts

www.EnergyExperts.org

Energy Solutions Database

Plant Operations Support Consortium

- **Mission**: To increase the efficiency and sustainability of facility operations by providing timely and creative technical assistance, education and consultation to support facility construction, operation and maintenance
- **Services**:
  - Equipment exchanges
  - Energy audits
  - Energy monitoring and reporting
  - Facility assessments
  - Capital needs assessment and planning
  - Hotline and solution sharing
- (360) 956-2230

SEE Action

- A state- and local-led effort facilitated by the U.S. DOE and EPA to achieve all cost-effective energy efficiency improvements by 2020
- Offers publications, events, and technical assistance to state and local decision makers
- www1.eere.energy.gov/seeaction/

SEE Action

STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

More Information

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E3T Database & Webinars: www.E3TNW.org

Got Questions?