RAP | Energy solutions for a changing world

Topics in Industrial Self-Generation and Energy Efficiency

A Webinar for NGA Alabama Policy Academy

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Introducing RAP and Rich

- RAP is a non-profit organization providing technical and educational assistance to government officials on energy and environmental issues. RAP Principals all have extensive utility regulatory experience.
  - Richard Sedano directs RAP's US Program. He was commissioner of the Vermont Department of Public Service from 1991-2001 and is an engineer.

Industrial CHP

- Generally a derivative of other distributed generation
- Specific topics for today:
  - Interconnection
  - Buy back rates (time sensitivity)
  - Stand by rates
- Applicable Legislation and Orders
  - http://www.dsireusa.org/

Typical Statute Details

- There will be rules
- Consumer-generators can sell
- Utilities must buy
- MORE
- According to Dsire database, 26 states have interconnection rules
  - more have written guidelines

(b) Each electric public service company, municipal electric energy cooperative and municipal electric utility **shall**: (1) **Purchase** any electrical energy and capacity made available, directly by a private power producer or indirectly under subdivision (4) of this subsection; (2) **sell** backup electricity to any private power producer in its service territory; (3) **make such interconnections** in accordance with the regulations adopted pursuant to subsection (h) of this section necessary to accomplish such purchases and sales; (4) upon approval by the Department of Public Utility Control of an application filed by a willing private power producer, **transmit** energy or capacity from the private power producer to any other such company, cooperative or utility or to another facility operated by the private power producer; and (5) offer to **operate in parallel** with a private power producer. In making a decision on an application filed under subdivision (4) of this subsection, the department **shall consider** whether such transmission would (A) **adversely impact the customers** of the company, cooperative or utility which would transmit energy or capacity to the private power producer, (B) result in an uncompensated **loss** for, or unduly **burden**, such company, cooperative, utility or private power producer, (C) **impair the reliability** of service of such company, cooperative or utility, or (D) impair the ability of the company, cooperative or utility to provide **adequate service** to its customers. The department shall issue a decision on such an application not later than **one hundred twenty days** after the application is filed, provided, the department may, before the end of such period and upon notifying all parties and intervenors to the proceeding, **extend** the period by thirty days. If the department does not issue a decision within one hundred twenty days after receiving such an application, or within one hundred fifty days if the department extends the period in accordance with the provisions of this subsection, the **application shall be deemed to have been approved**. The requirements under subdivisions (3), (4) and (5) of this subsection shall be subject to **reasonable standards for operating safety and reliability and the nondiscriminatory assessment of costs** against private power producers, approved by the Department of Public Utility Control with respect to electric public service companies or determined by municipal electric energy **cooperatives** and **municipal** electric utilities.

And more from CT statute about the commission role

(c) The Department of Public Utility Control, with respect to electric public service companies, and each municipal electric energy cooperative and municipal electric utility **shall establish rates and conditions of service** for: (1) The **purchase** of electrical energy and capacity made available by a private power producer and (2) the **sale** of backup electricity to a private power producer. The rates for electricity purchased from a private power producer shall be based on the **full avoided costs** of the electric public service company, municipal electric energy cooperative or municipal electric utility, regardless of whether the purchaser is simultaneously making sales to the private power producer. Payment for energy and capacity purchased from a private power producer by any such company, cooperative or utility shall be pursuant to such rates and conditions or the terms of a contract between the parties. The rates and conditions of service for the purchase of energy and capacity established by the department pursuant to this subsection shall include **specific schedules** for pricing **in long-term contracts** for the sale of electricity from small renewable power projects to electric public service companies by private power producers. Such schedules shall not exceed the present worth of the projected avoided costs of the electric public service company over the term of the contract. The department shall apply to a proposed contract filed with the department after January 1, 1992, by a private power producer for a small renewable power project the rates and conditions of service, including the pricing schedule, in effect on the date the private power producer submits its proposed contract to the department, regardless of the subsequent creation of differing schedules or the subsequent amendment of existing schedules.

West Virginia Statute

- **§24-2F-8. Net metering and interconnection standards.**
  (a) The commission **shall adopt a rule** requiring that all electric utilities provide a rebate or discount at fair value, to be determined by the commission, to customer-generators for any electricity generation that is delivered to the utility under a net metering arrangement.
- (b) The commission **shall also consider** adopting, by rule, a requirement that all sellers of electricity to retail customers in the state, including rural electric cooperatives, municipally owned electric facilities or utilities serving less than thirty thousand residential electric customers in this state, offer net metering rebates or discounts to customer-generators.
- (c) The commission shall institute **a general investigation for the purpose of adopting rules** pertaining to net metering and the **interconnection** of eligible electric generating facilities intended to operate in parallel with an electric utility's system. As part of its investigation, the commission shall take into **consideration rules of other states** within the applicable region of the regional transmission organization, as that term is defined in 18 C.F.R. §35.34, that manages a utility's transmission system in any part of this state. Furthermore, the commission shall consider increasing the allowed kilowatt capacity for commercial customer-generators to an amount not to exceed five hundred kilowatts and for industrial customer-generators to an amount **not to exceed two megawatts**. The commission shall further consider interconnection standards **for combined heat and power**.

Rule Details

- Size levels
- Inverter or not?
- “parallel” service
- “area”/”spot” net.
- Isolation practice
  - Utility access**
- Dealing with faults, etc.

- Process issues
  - Fielding I. request
    - standing
  - Cost, Forms to apply
  - Time to eval.
  - Time to process
  - Queue
  - Utility records
  - Utility contact
    - PSC may want a contact

Rule Details

- Total Mva
  - On site
  - On a circuit
  - On a system
- Large Units
  - Meetings
  - Feasibility study
  - Facilities study

- Terms and Conditions
  - Construction
  - Interconnection
  - Operation
  - Testing
  - Access
  - Routine Disconnection
  - Indemnification
  - Insurance, Liability
  - Disputes
  - Etc. typical for contacts

Connecticut

- Conn. Gen. Stat. § 16-243a
- CT DPUC Decision, Docket No. 03-01-15RE01

West Virginia

- W. Va. Code § 24-2F-1 et seq.
- West Virginia PSC 150-33-1

FERC Small Generator Interconnection Rule

- http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06R&re=1&ee=0
- A model for states for interconnections 10 MW and smaller interconnecting to distribution
  - Directly applicable to interconnections to transmission

Mid-Atlantic Distributed Resources Initiative Model Interconnection

- http://sites.energetics.com/MADRI/pdfs/inter_modelsmallgen.pdf
  - Annotated with comments to give prospective users the opportunity to make choices based on priorities or concerns
- Used as a basis for rules in several other states
  - including MD, PA, NJ, OR, at least

Stand by Rates, setting them fairly

- Back up power – unscheduled outage
- Maintenance power – scheduled outage
- Supplemental power – during operation
- Reservation Charge (a minimum)
- Coincidence factor
    - Monthly or annually
- Forced outage Rate

Stand by (Partial Service) Rate Practices

- Do not assume all forced outages occur at the same time, and at peak
- Unbundle charges
- Generation reservation demand charge based on utility cost and utility FOR
  - Stand by service interruptible
- T&D demand charge based on load diversity
- Pro-rated, daily, as used demand charges

Stand by (Partial Service) Rate Practices

- Rates assume outages are coordinated
- Supplemental power charge based on charges in full requirements

Cutting Edge Issue: VARs

- In many places Industrial CHP can operate in parallel and sell back power
- In most places, same units also produce VARs valuable for voltage support, but cannot sell this service
  - Value of service is not covered in tariffs
  - Requires assessment of value
    - And change in attitude that CHP is valuable resource to be mined and compared with alternatives

Industrial Energy Efficiency

- Money collected in general rates to support energy efficiency because avoiding inefficient load is cheaper than acquiring the supply and other resources needed to serve that load
  - i.e. cost-effective energy efficiency is cheaper

A focus on industrial energy efficiency?

- In states that support energy efficiency in rates, programs are offered to all customers. Why?
  - Social
  - Economic
- Industrial programs are important because these customers are important
  - Many states retain a “self direct” option

One example of Industrial EE from Dsire: Entergy Arkansas

- Entergy Arkansas has several programs to help commercial and industrial customers increase the energy efficiency of eligible facilities.

- The Small Business Program is an energy efficiency program designed to provide financial incentives for the installation of a wide range of simple energy efficiency measures that provide energy savings in facilities. This program is available for any non-residential customer of Entergy Arkansas with a peak connected load of less than 100 kW. Projects that benefit from this program are prescriptive measures that do not require measurement and verification (as listed in the eligible technologies).
- The Commercial & Industrial Prescriptive Program is an energy efficiency program designed to provide financial incentives for the installation of a wide range of simple energy efficiency measures that provide energy savings in facilities. This program is available for any non-residential customer of Entergy Arkansas. Projects that benefit from this program are prescriptive measures that do not require measurement and verification (as listed in the eligible technologies). Program benefits include information on energy efficiency best practices, program documentation assistance, savings calculations, and financial incentives.
- The Commercial & Industrial Custom Program provides incentives to C&I customers for the installation of energy efficiency measures that provide energy savings in facilities. Non-residential customers with a peak demand of 100 kW or greater are eligible for this program. Projects that benefit from this program include prescriptive measures (lighting, HVAC, etc.) as well as complex commercial or industrial projects requiring measurement and verification. Program benefits include information on energy efficiency best practices, program documentation assistance, benchmarking, savings calculations, measurement and verification, and financial incentives. The tiered incentive structure provides bonus incentives for comprehensive projects. View the program web site for more information on these programs as well as incentives for feasibility studies.

Process for Consumer-Funded EE

- Cases
  - Some states figure out energy efficiency through a dialogue over time between the PSC and the utility (typical of early adopters)
- Rules
  - Some states have rules to create clear structure and expectations (tend to be later adopters)
- Non-utility Administration
  - Some states have taken the responsibility and assigned it to a third party

Screening Energy Efficiency: What is "Cost-Effective?

- There are many energy efficiency measures that would use less energy than what is in place, or what would be usual and customary in a newly constructed building
- Some are cost-effective, meaning the cost to install and operate is less than the benefits
  - How to decide?

Standard Methods Reflect Key Questions

- Following slides use material from National Action Plan for Energy Efficiency "Guide to Understanding Cost-Effectiveness of Energy Efficiency Programs"
- http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf

How do we measure value for energy efficiency programs?

- Benefit/Cost tests are common in all states with energy efficiency programs
- There is a range of standard B/C tests
  - Each asks the question from a point of view

PCT
- Participants (marketing programs and services)

UCT
- Utility (total system costs, EE as a resource)

RIM
- Non-participants (what will rates do?)

TRC
- General Economy (quantified effects)

SCT
- General Economy (quant + unquantified factors)

Defining Cost Tests: 5 points of view

Cost Test	Acronym	Key Question Answered	Summary Approach
Participant Cost Test	PCT	**Will the participants benefit over the measure life?**	**Comparison of costs and benefits of the customer installing the measure**
Utility/Program Administrator Cost Test	UCT/PAC	**Will utility bills increase?**	**Comparison of program administrator costs to supply side resource costs**
Ratepayer Impact Measure	RIM	**Will utility rates increase?**	**Comparison of administrator costs and utility bill reductions to supply side resource costs**
Total Resource Cost	TRC	**Will the total costs of energy in the utility service territory decrease?**	**Comparison of program administrator and customer costs to utility resource savings**
Societal Cost Test	SCT	**Is the utility, state, or nation better off as a whole?**	**Comparison of society's costs of energy efficiency to resource savings and non-cash costs and benefits**

Key Benefit/Cost Factors

- What benefits are included?
- Discount Rate
- Savings Attribution (Gross and Net)

- And applied how:
  - portfolio, program, project, measure

- Test most broadly used in US :
  - **Total Resource Cost Test** (TRC)
- What does this mean?
  - A state preferring the Utility Cost Test places highest value on energy efficiency effects on the utility system
  - Use of TRC enables consideration of other effects from the programs (gas, water, more)

Very Important Question about Energy Efficiency

Compared to what?

- Value flows from avoiding a worse thing (plus investment in community)
  - Large assets, Small assets, Associated air, land, water and non-energy impacts, Losses, Using commodities (from insecure places), Higher clearing prices, Risk

Table 4-1. Universe of Energy and Capacity Benefits for Electricity and Natural Gas

Electricity Energy Efficiency	
Energy Savings	**Capacity Savings**
Market purchases or fuel and operation and maintenance costs	Capacity purchases or generator construction
System losses	System losses (peak load)
Ancillary services related to energy	Transmission facilities
Energy market price reductions	Distribution facilities
Co-benefits in water, natural gas, fuel oil, etc.	Ancillary services related to capacity
Air emissions	Capacity market price reductions
Hedging costs	Land use
Natural Gas Energy Efficiency	
Energy Savings	**Capacity Savings**
Market purchases at city gate	Extraction facilities
Losses	Pipelines
Air emissions	Cold weather action/pressurization activities
Market price reductions	Storage facilities
Co-benefits in water, natural gas, fuel oil, etc.	LNG terminals
Hedging costs	

Cost-effectiveness Framework

Testing whether an alternative plan is lower cost is the basic building block of CE analysis

Step 1 Evaluate the costs of EE program

Step 2 Evaluate the change in costs of your preferred resource plan ("avoided costs")

- These are the 'benefits' of implementing your program

Step 3 Compute the difference (or ratio)

More formally, net present value difference of benefits and costs…

Net Benefits (difference)	Net Benefits$_a$ (dollars)	= NPV $\sum$ benefits$_a$ (dollars) -NPV $\sum$ costs $_a$ (dollars)
Benefit-Cost Ratio	Benefit-Cost Ratio$_a$	$= \frac{\text{NPV} \sum \text{benefits}_a \text{ (dollars)}}{\text{NPV} \sum \text{costs}_a \text{ (dollars)}}$

Summary of Costs and Benefits

- High level summary of costs and benefits included in each cost test
- Each state adjusts these definitions depending on circumstances
- Details can significantly affect the type of energy efficiency implemented

Component	PCT	UCT	RIM	TRC	SCT
Energy and capacity related avoided costs.	-	Benefit	Benefit	Benefit	Benefit
Additional resource savings	-	-	-	Benefit	Benefit
Non-monetized benefits	-	-	-		Benefit
Incremental equipment and install costs	Cost	-	-	Cost	Cost
Program overhead costs	-	Cost	Cost	Cost	Cost
Incentive payments	Benefit	Cost	Cost	-	-
Bill Savings	Benefit		Cost	-	-

Table 3-9. Total Resource Cost Test for SCE Residential Energy Efficiency Program

TRC Calculations		
	Benefits	**Costs**
Program overhead		$ 3,494,619
Program incentives		
Measure costs (net)		$ 41,102,993
Energy savings (net)	$ 187,904,906	
Bill savings		
Monetized emissions (net)	(included in energy savings above)	
Non-energy benefits		
Total	**$ 187,904,906**	**$ 44,597,612**
Net benefit	**$143,307,294**	
Benefit-cost ratio	**4.21**	

Table 6-4. Benefits and Costs Included in the Total Resource Cost Test

Benefits and Costs from the Perspective of All Utility Customers (Participants and Non-Participants) in the Utility Service Territory	
Benefits	**Costs**
▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution ▪ Additional resource savings (e.g., gas and water if utility is electric) ▪ Monetized environmental and non-energy benefits (see Section 4.9) ▪ Applicable tax credits (see text)	▪ Program overhead costs ▪ Program installation costs ▪ Incremental measure costs (whether paid by the customer or the utility)

Source: Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects.

The TRC shows the net benefits of the energy efficiency program as a whole. It can be used to evaluate energy efficiency alongside other regional resources and communicate with other planning agencies and constituencies.

TRC/SCT and Non-Energy Benefits (NEBs)

- TRC/SCT only provide "societal perspective" if NEBs included
  - Comfort
  - Health and safety improvements
  - Business productivity improvements
  - …and many others!
- Studies suggest NEBs are often very large
  - 50 to 100% or more of energy benefits
- NEBs rarely included in TRC/SCT
- Exclusion of NEBs from TRC/SCT increasingly important
  - Eliminates cost-effective programs at time of aggressive goals
  - Sophisticated programs emphasize "selling" NEBs to customers

One Recent Response to NEBs Issue

Vermont regulators:

- Adopted 15% NEBs adder to energy benefits
  - Intended to address only comfort, health & safety, productivity, etc.
  - Environmental externalities, water savings, O&M savings to be separately quantified
- Stated 15% is conservative, but good place to start
  - Adder to be revisited every two years

Utility (Program Admin) Cost Test

- 100% focus on utility
  - Savings and costs to system
    - Cost of customer incentives
  - Participant costs don't count
  - Other resource values don't count

A positive PACT indicates that the total costs to save energy are less than the costs of the utility delivering the same power. A positive PACT also shows that customer average bills will eventually go down if efficiency is implemented.

The TRC is more restrictive than the PACT because it includes the full cost of the energy efficiency measure and not just the incentives paid by the utility. As a result, a program may have a positive PACT and PCT but still not pass the TRC, because the utility and customer pay a fraction of the total measure cost that is included in the TRC.

Table 6-2. Benefits and Costs Included in the Program Administrator Test

Benefits and Costs to the Utility, Government Agency, or Third Party Implementing the Program	
Benefits	**Costs**
▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution	▪ Program overhead costs ▪ Utility/program administrator incentive costs ▪ Utility/program administrator installation costs

Source: Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects.

Jurisdictions seeking to increase efficiency implementation may choose to emphasize the PACT, which compares energy efficiency as a utility investment on par with other resources. Because the PACT includes only utility costs (and not customer contributions), the PACT is often the most permissive (and most positive) cost-effectiveness test.

Table 3-7. Program Administrator Cost Test for SCE Residential Efficiency Program

PACT Calculations		
	Benefits	Costs
Program overhead		$ 3,494,619
Program incentives		$ 15,457,880
Measure costs		
Energy savings (net)	$ 187,904,906	
Bill savings		
Monetized emissions (net)	$ 0	
Non-energy benefits		
Total	**$ 187,904,906**	**$ 18,952,499**
Net benefit	**$168,952,407**	
Benefit-cost ratio	**9.91**	

Source: E3 analysis; see Appendix C.

Applying the Tests

- A **screen**: program "passes" if B/C exceeds a threshold value (1? 2?) for a specific test
  - Budget limits may force portfolio choices among programs that pass
- A **guide**: program passes if regulator judges it passes after considering all B/C test results
  - and comparing with other programs if $ limited
- Either way, regulator decides what "passes"

Timing of Energy Efficiency Costs and Benefits

- Costs happen now
- Benefits accrue over time
- **Embracing energy efficiency means embracing a long view**
  - Consistent with other significant utility investments
- Most states expense costs, leading to immediate rate effects

Discount Rate: Valuing savings over time depends on perspective

Table 4-3. The Use of Discount Rates in Cost-Effectiveness Tests

Tests and Perspective	Discount Rate Used	Illustrative Value	Present Value of $1 a Year for 20 Years*	Today's Value of the $1 Received in Year 20
PCT	Participant's discount rate	10%	$8.51	$0.15
RIM	Utility WACC	8.5%	$9.46	$0.20
PACT	Utility WACC	8.5%	$9.46	$0.20
TRC	Utility WACC	8.5%	$9.46	$0.20
SCT	Social discount rate	5%	$12.46	$0.38

Source: Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects.

* This value is the same as not having to purchase $1 of electricity per year for 20 years.

Attribution
of savings to the actions of the administrator

- Net savings
  - Shows demonstrable value for consumers' money
- Gross savings
  - Shows gross savings to economy, environment

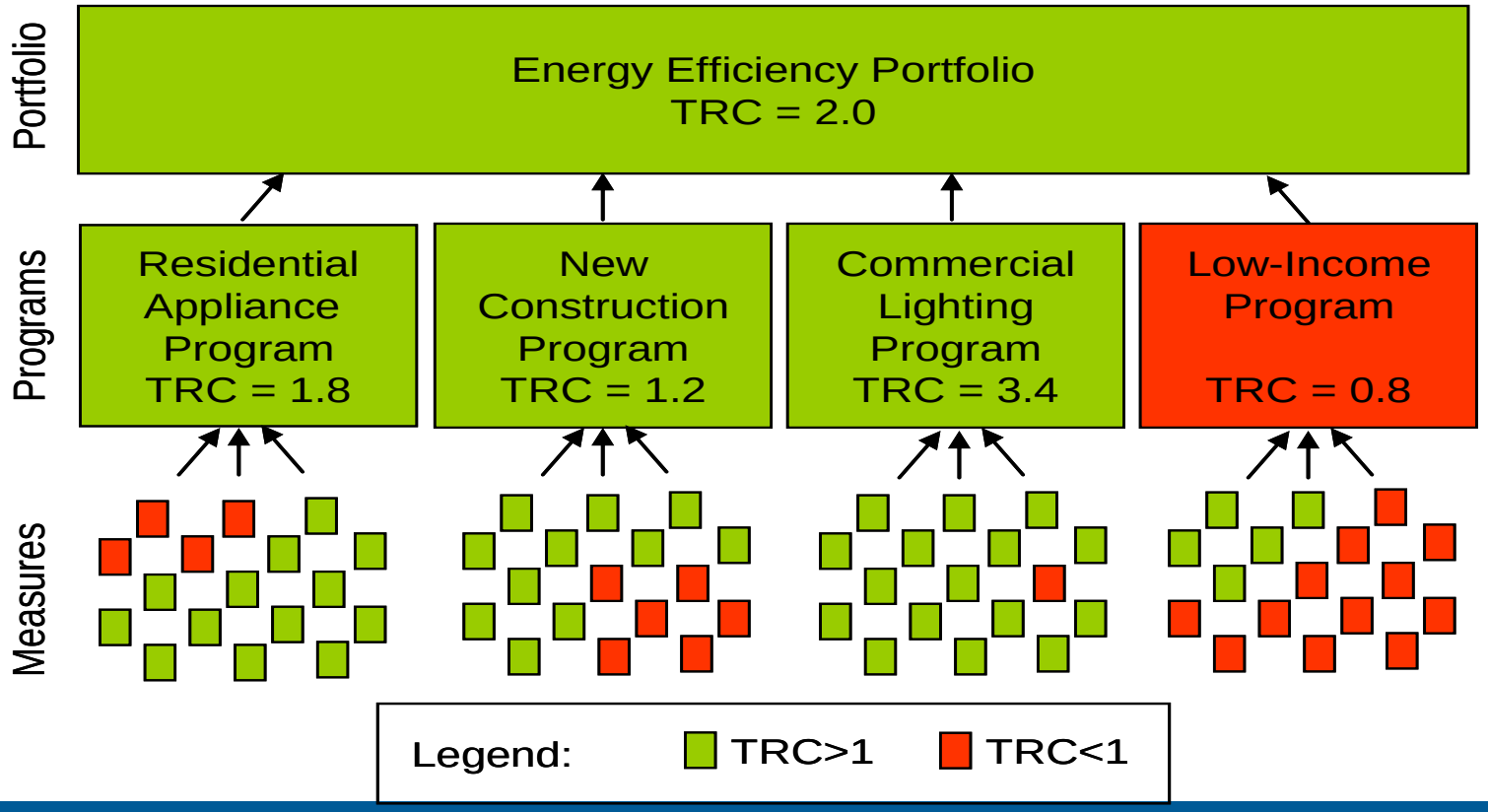
- What does consumer advocate want to know?
- What does system planner want to know?
- What does climate scientist want to know?
- How do we want to motivate the utility?

Attribution Dilemma

- Net Savings
  - Value for consumers' money
  - Oversight of administrator
- Gross Savings
  - Less expensive
  - Focus on societal effects
  - Avoid administrator gaming of savings
  - Promote administrator cooperation

Point of Cost-Effectiveness Measurement

- Application at portfolio level allows for inclusion of individual programs or measures that do not past cost test
  - Low Income, emerging technologies, market transformation



Using the Standard Tests

- Priorities: which questions are most important
  - Participant test is always important because it is always the customer's choice
  - Generally, the key question state face is whether to use the Total Resource Cost or the Utility Cost or both
    - Which question is compelling, or are they both?
  - Advice: don't change the tests

Legislation

Legislation comes in many forms

- Part of “safe and reliable service” (KS)
- Simple statement enabling EE (AR)
- Much more directed and prescriptive directions (most states)
  - How much or criteria perhaps increasing over time, for whom, screened how, evaluated how, delivered by whom, …

How to set EE goals

- Value-based – Useful if you have an integrated resource plan and can use avoided cost
  - Often expressed as "all cost-effective"
  - Can also be budget limited
- Target-based – Useful if you want to focus utility on a specific level of achievement
- Quick start – Useful if you are happy to crib likely winner programs from a near by state to get experience (temporary)

Other EE Program Issues

- Program plan cycles
  - Proposal, Approval, Execution, Evaluation, Monitoring and Verification, Report, Learn & Repeat
  - Plan cycles can be a year, or longer
    - Longer cycles have intermediate reporting and course correcting aspects

Don’t Forget Other Industrial EE Incentives (from Dsire, just “A” states)

- Alabama
  - AlabamaSAVES Revolving Loan Program
  - Local Government Energy Loan Program
- Alaska
  - Association Loan Program
  - Energy Efficiency Interest Rate Reduction Program
  - Energy Efficiency Revolving Loan Fund Program
  - Small Building Material Loan
- Arizona
  - Energy Equipment Property Tax Exemption
- Arkansas
  - Small Business Revolving Loan Fund
  - Sustainable Building Design Revolving Loan Fund

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

Please me contact with follow up questions: rsedano@raponline.org

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