INFORMATION & TOOL DEVELOPMENT TO SUPPORT CONSIDERATION OF FUTURE REGULATORY MODELS

DOE Electricity Advisory Committee – Smart Grid Subcommittee

The Premise

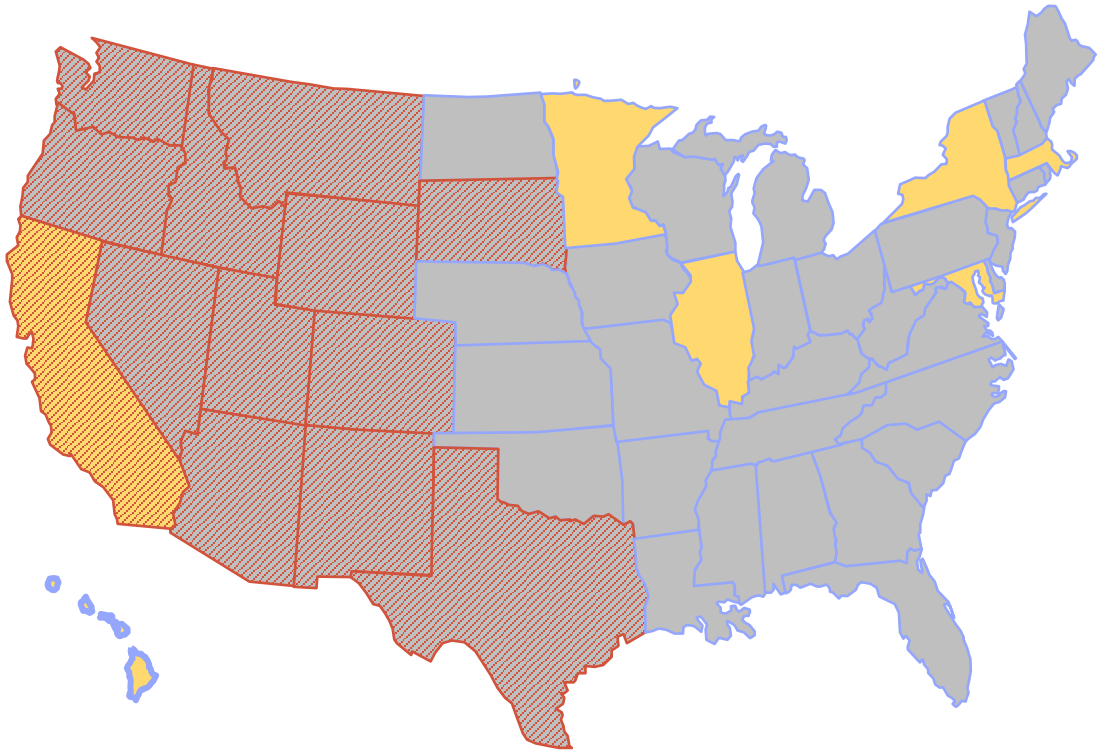
- Electric Distribution Utilities are being asked to:
  - Replace Aging Infrastructure
  - Provide Higher Levels of Resilience and Reliability
  - Enable Customers to Efficiently Manage their Use of Power
  - Integrate Volt-VAR Optimization
  - Integrate Variable Renewable and Distributed Generation
  - Protect the Grid from Cyber and Physical Attack
  - Manage Workforce Transition
- Requires Significant New Investment in a Period of Slowly Growing or Declining Sales
- Requires Integrated Real-Time Distribution System Operations vs. “Build to Fit” & “Float on Transmission”
- Utilities and Regulators Challenged to Develop New Business & Regulatory Models

Summary: DOE can Develop Information & Tools, Convene Discussions on How Best to Meet Emerging Requirements

- Subcommittee Paper:
  - Reviews the current regulatory and policy discussions, supports continued exploration of issues
  - Discusses emerging requirements
  - Summarizes adaptations of the traditional cost of service regulatory model, alternative and emerging regulatory models
    - Recognizes differences among jurisdictions and does not endorse or recommend any model
  - Recommends Department develop information and tools in 9 areas to assist in consideration of different models
  - Recommends Department use its convening authority to support discussions of emerging requirements and how those requirements can best be met

State & Multi-state Consideration of New Regulatory Models

- California: More than Smart Grid – Rulemaking on Distribution Resources Plans
- Hawaii: Commission Inclinations on the Future of Hawaii's Electric Utilities
- Illinois: Energy Infrastructure Modernization Act
- Maryland: Utility 2.0 Plan & Staff Report on Performance Based Rates
- Massachusetts: Grid Modernization Working Group & Proceeding
- Minnesota: e21 Initiative Stakeholder Collaborative
- New York: Reforming the Energy Vision
- Western Interstate Energy Board: New Regulatory Models



Drivers of Emerging Requirements

- Changing standards for reliability, resilience and adaptation
- Renewable and other clean and distributed energy resources
- Electricity usage management tools and precision in demand management
- Environmental concerns and requirements
- An increase in consumer engagement
- Need to integrate the operation and planning of distributed energy resources, distribution, transmission, and central station generation
- Technological advances and innovation
- New business models, e.g. Distribution System Platform Providers (New York) and Distribution System Operators (California)

Regulatory Adaptation and Alternative Regulatory Models

- ***Ex Post* Models Lean Toward Supporting Investment**
  - Constructive PUC / utility relationship needed: May involve advance planning & after the fact prudence reviews
  - Regulators may be concerned with limited incentives to reduce costs or improve productivity and efficiency
  - Seldom provide opportunities to enhance earnings through superior performance

Model	Examples	Form	Key Implications
Capital Expenditure Tracker	Pennsylvania, California, Ohio	Separate rider for investments	Incents investment, retains incentive to reduce other costs
Formula Rate	FERC, EIMA	Reported costs + return on capital	Little efficiency incentive, any regulatory risk reduces spending

- **Multi-year *Ex Ante* Models Lean Toward Incenting Efficiency**
  - Strong incentive to cut costs between rate proceedings (may share cost savings)
  - Require strong incentives & a basis in business plan or may be associated with reduced reliability & investment

Model	Examples	Form	Key Implications
Multi-year Revenue or Price Cap	CMP, NSTAR, VT, PacifiCorp, PS of CO, Alberta	Set steps or Price index – productivity +/- extraordinary items	Indices may not be representative during an investment cycle (Earnings sharing mechanism or savings reflected in next cap)
Sliding Scale Formula	Southern Company	Earnings sharing with triggers for reopener or rate change if earnings outside approved band	*Ex ante* with *ex post* sharing of earnings above/below target among utility & customers, May be a component of a multi-year revenue or price cap
Results-Based Regulation	U.K. (RIIO), Ontario, Potentially: NY	Multi-Year Utility Plan, Information Quality & Output Incentives	Provides incentives for investment that delivers value to customers, May provide incentive for utility to disclose efficient costs

Regulatory Models

- **Issue:** Emerging requirements are leading to consideration of a range of alternative and emerging regulatory models. Not all policymakers, regulators, and stakeholders are equally informed about various models or how they might facilitate meeting emerging requirements.
- The Department can be a credible source of factual analysis and information about alternative models.
- **Recommendation #1:** DOE should develop a whitepaper on alternative regulatory models and how those models can play a role in meeting emerging requirements.

Evaluation and Use of Data on Distribution Reliability

- **Issue:** Following a recommendation by LBNL researchers, U.S. EIA is starting to gather new information from utilities on reliability metrics:
  - System Average Interruption Frequency Index (SAIFI) which indicates how often the average customer experiences a sustained interruption (of over five minutes)
  - System Average Interruption Duration Index (SAIDI) which indicates the total duration of interruptions in minutes per year for the average customer
- Such metrics provide a new potential means of benchmarking or tracking utility performance.
- **Recommendation #2:** The Department should evaluate the reporting of [reliability metrics] data under the modified EIA form [EIA-861] and prepare a whitepaper describing the available data and how it might be useful to utilities and regulators.

Tools for evaluating distribution and distributed technology investments

- **Issue:** Utilities and regulators are evaluating major investments in modernizing and improving the reliability of distribution systems, deploying and integrating distributed energy resources, and developing the information and control systems that will be needed to operate a system with distributed energy technologies.
- Such evaluations involve new and complex issues:
  - Lack of agreement regarding energy and capacity costs avoided with distributed generation
  - How the costs and impacts of distributed resource vary and depend on where it is located and the characteristics of the distribution system
  - The probable impacts on distribution reliability of distribution automation, hardening, infrastructure replacement, & other investments in areas with different vulnerabilities
  - How to direct and manage development of new information and control architectures and systems to integrate distributed energy technologies
- Conducting such evaluations will require new tools for:
  - Distribution planning
  - Evaluating economic and financial implications
  - Developing ways to efficiently integrate the growth in distributed energy technologies

Tools for evaluating distribution and distributed technology investments

- **Recommendation #3**: It is the understanding of the EAC that the DOE Grid Tech team has already begun to examine this critical set of issues [Development of tools for evaluating distribution investments and distributed energy technologies and integrating distributed energy technologies into system operations]. The EAC strongly supports this effort and urges the DOE to:
  - Support the development of distribution planning models and tools, performance and cost data, and supporting information and methodologies that can be used by regulatory commissions and utilities to identify the likely benefits and costs of specific applications of distributed energy technologies, distribution investments, and forward-looking distribution investment plans. This should include consideration of Reference Network Models comparable to those being used in regulation outside the U.S.;
  - Support the development of economic valuation and financial models that can be used by policymakers and regulators to evaluate the potential impacts of distributed energy technologies and related pricing and policy options;
  - Support the development of models, management systems, tools, and approaches, including federated information and control architectures and market structures, that may be needed to support the efficient integration of distributed energy technologies into system operations and distribution level markets; and
  - Provide technical assistance, information, tools and training to state regulatory commissions, policy-makers, and their staffs, and make such information and tools available to interested utilities to enable them to better evaluate distributed technology deployments, distribution investments, and forward looking distribution investment plans

Updated Estimates of Customer Outage Costs

- **Issue:** DOE's Interruption Cost Estimation (ICE) uses some of the best available data sets, but is based on older data (only 2 datasets include surveys after 2000), does not include data from the Northeast or Mountain West, and does not cover outages longer than 8 hours
  - Lack of alignment between how customers value uninterrupted electric service and utility expenditures can retard needed investment & shift significant outage costs onto customers
- **Recommendation #4**: The Department should work with the industry to develop and make available additional data on the cost of outages to customers and improve the granularity and quality of data available for estimating differences in the cost of outages for different customer segments. Such additional data should be considered for inclusion in the Department's ICE calculator as it becomes available.

Smart Devices: Automating Demand Participation

- **Issue:** Smart devices are poised to optimize the timing and use of electricity. This could provide significant savings to customers, improve in utility asset utilization, enhance reliability, and facilitate renewable resource integration.
  - Most uses of electricity have thermal inertia (heating and cooling buildings, heating water, and refrigeration) or flexibility in the timing of power use (pumping loads, batch processes, dishwashers, and charging electric vehicles and other devices)
  - Potential benefits are very large and the costs are low and falling with the cost of information and networking technology
  - Many of the barriers are regulatory: Adoption of common standards, wholesale settlement practices, and failure of RTOs and ISOs to disclose indicative “look ahead” price forecasts
- **Recommendation #5:** The Department should prepare an analysis of how best to remove barriers to enable efficient responses from smart devices. It should support development of a benefit-cost framework, a common standards-based approach for communicating with smart devices, and, where cost-effective from a systems perspective, inclusion responsive capabilities in DOE energy efficiency standards. Such steps could provide FERC and state commissions the opportunity to ensure that smart energy using devices can contribute to the reliable and efficient operation of the power system.

Volt-VAR Optimization

- **Issue:** The Department's Smart Grid program demonstrated the potential of existing and new solid state Volt-VAR technologies to produce significant savings
  - Broader adoption is restricted by a lack of planning and evaluation tools and by disincentives to utility adoption of technology that reduces apparent (metered) power delivered to customers
- **Recommendation #6:** DOE should pursue the following developments to facilitate improved evaluation of volt-var optimization to unleash the predicted benefits that full-scale implementation can offer.
  - Business case calculator – This would help utilities evaluate the cost/benefit of enabling VVO on their system. This calculator would take into consideration regulatory incentives (e.g., federal, state, local), the cost of the system upgrades needed to enable the technology, and the estimated benefits that would be achieved (i.e., energy reduction, peak demand reduction and system loss reduction) when VVO was enabled.
  - Measurement & Verification tool – This would consist of a standard, recommended measurement techniques, and metrics applied consistently to measure and verify VVO. It is difficult to measure VVO results because the variability of the actual system can shadow the gains from optimization. There is a federal guideline around measurement and verification that DOE published that was focused on customer based energy efficiency projects. Work is also needed to capture and verify the benefits realized by the delivery system with some level of accuracy.
  - Planning tools – This would help utilities and regulators understand the potential benefits of applying VVO technology given a range of system conditions, technologies and optimization algorithms. A set of typical feeders could be identified that was representative of real-world load conditions. These would be used as a basis in models to design and apply VVO schemes to forecast benefits.
  - A VVO data base – this would showcases the results achieved on installed system. Regulators and utilities alike could benchmark their results against others, given a set of control parameters and system conditions.

Distribution Pricing

- **Issue:** Regulators are facing new issues in distribution pricing related to:
  - Recovering costs for enhanced reliability
  - Treatment of distributed energy resources
  - Assessment of distribution cost causation
  - Recovery of fixed distribution costs through volumetric rates in a period of slowly growing sales
- **Recommendation #7:** The Department should assist interested regulators and utilities in addressing these issues by preparing a whitepaper or a series of whitepapers on the following topics:
  - Issues and options related to providing and pricing enhanced levels of reliability for customers who place a high value on uninterrupted service;
  - Alternative approaches for recovery of fixed distribution costs;
  - Alternative methodologies and the development of distribution models that could facilitate efficient pricing of distribution for distributed energy resources, including approaches designed to incent the efficient siting and operation of distributed generation.
  - Methodologies for depreciation that can be applied to new smart grid technology such as software, inverter-based technology, micro-processors and communications that have a shorter life-cycle than traditional transmission and distribution units of property. Often the new technologies with shorter lives are integrated into devices that have been depreciated over 20 years or longer.

Social Cost Issues

- **Issue:** New issues that may not be addressed by conventional cost-of-service analyses are coming before regulators. These issues can involve social costs or impacts that may be new to commissions. The Department has an opportunity to play a constructive role by proactively identifying and providing information to help regulators, utilities, and other stakeholders assess these issues. Current examples include:
  - M&V methodologies for compliance with proposed Clean Air Act 111(d) rules
  - Valuation of the public health impacts of criteria pollutants
  - Impacts, including potential benefits, of time-varying pricing on low income consumers
- **Recommendation #8**: The Department, where practicable, should seek to make available to utilities, state commissions and their staffs objective information on social costs that otherwise might not be presented in a standard cost of service framework and that could help utilities and regulators evaluate performance metrics and alternative regulatory or business models. For example, the Department should work with U.S. EPA and the states to develop tools that would enable states to evaluate options and verify compliance with proposed EPA rules regulating greenhouse gas emissions from power plants under Section 111(d) of the Clean Air Act.

Strengthening the Energy Innovation System

- **Issue:** Policymakers and regulators in several states have recognized the need to support greater innovation for grid modernization, transitioning to a low carbon energy system, and to address other issues.
  - Utility R&D spending remains far below that in other sectors of the economy at 0.2% of revenue
  - Different models have been proposed that could provide a basis for state or rate funded initiatives to advance innovation and partner other public and private sector participants
- **Recommendation #9:** The Department should prepare a whitepaper on options for advancing energy innovation, including through state and regionally based institutions. The whitepaper should address the option that funding through utility rates could be one of several potential sources of support for energy innovation initiatives. Additionally, the Department should continue to foster coordination and partnerships between federal and state energy research, development, and demonstration programs.

DOE's Convening Authority

- **Issue:** There is growing interest across the country in new utility regulatory models to address the challenges of the energy sector. DOE can play an instrumental role in facilitating and fostering discussions of different models.
- **Recommendation #10:** Assist regulators, policymakers, utilities and stakeholders by convening/funding discussions on identifying emerging requirements and how those requirements could be addressed by alternative/emerging regulatory models and evaluated by using DOE-developed tools.