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Using Integrated Resource Planning to Encourage Investment in Cost-Effective Energy Efficiency Measures

Driving Ratepayer-Funded Efficiency through Regulatory Policies Working Group

September 2011

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List of Acronyms

BPA	Bonneville Power Administration
EPA	U.S. Environmental Protection Agency
IRP	integrated resource plan
MW	megawatt
NYSERDA	New York State Energy Research and Development Authority
PM	portfolio management
PUC	public utility commission

Executive Summary

An integrated resource plan (IRP) is a long-range utility plan for meeting the forecasted demand for energy within a defined geographic area through a combination of supply side resources and demand side resources. Generally speaking, the goal of an IRP is to identify the mix of resources that will minimize future energy system costs while ensuring safe and reliable operation of the system.

Thirty-four states currently require some sort of IRP process for electricity planning. Thirteen of those states also use IRP processes for natural gas planning. Significant variation exists concerning whether IRPs are acknowledged or approved by each state's public utility commission (PUC) and the authority accorded to the plans.

In the process of developing an IRP for electricity, planners may consider adding generation capacity, encouraging customer-owned generation and combined heat and power facilities, adding transmission and distribution lines, reducing line losses in the transmission and distribution system, implementing demand response programs, and investing in energy efficiency programs to reduce future demand. Analogous supply side and demand side options exist for natural gas planning.

An IRP can be a powerful impetus for energy efficiency and other demand management alternatives to new supply, especially where the planning process is mandatory and overseen by a PUC, because the IRP may require utilities to consider demand side resources that benefit ratepayers even if those resources do not benefit utility shareholders. The availability of energy efficiency and other demand side resources at very low costs and in significant quantities was often ignored in traditional planning processes that focused exclusively on supply side resources.

For an IRP process to successfully encourage all cost-effective energy efficiency, the process must at a minimum be built upon credible load forecasts; use credible information about the costs and availability of new generation assets, transmission and distribution lines, and demand side measures; and evaluate demand side resources equally and fairly in relation to supply side resources. In addition, the very best IRP processes employ most or all of the practices in the left-hand column of Table 1. The right-hand column shows resources for more information on the best practices.

Federal and state policies can strongly influence the extent to which IRPs and other similar planning processes are used as well as how effective they are at promoting energy efficiency. As of the end of 2009, only six states had active policies in place that required fair consideration of demand side resources, not just in electric generation planning but also in electric transmission and distribution planning and natural gas planning. In addition to considering state policy changes, all stakeholders can seek to improve existing planning processes by replicating the best practices described above and by learning from successful examples of IRP processes in other jurisdictions.

IRP processes are not appropriate for all utility types, but alternative planning processes exist to effectively promote energy efficiency services in those cases. In the fifteen states that have restructured their electric industry to promote retail competition, consumers may choose from whom to buy their power. Regulated distribution utilities —as the "default" provider or the "provider of last resort"—are typically responsible for procuring power on behalf of consumers who do not choose a competitive generation supplier. Because of the more limited responsibilities of utilities in competitive retail markets, comprehensive IRP processes are generally not appropriate. Instead, distribution utilities in these markets can effectively promote energy efficiency through at least three alternative, but similar, planning processes:

- One option is for the distribution utility to use a "portfolio management" process for default services, whereby energy needs are planned for and procured by evaluating a variety of demand side and supply side resources, or energy suppliers are required to include demand side resources in their offers. Under this option, only default service customers may receive energy efficiency services.

- A second option is for the distribution utility to employ a scaled-down version of IRP, where demand side resources are evaluated as alternatives to transmission and distribution facilities.
- The third option is for the distribution utility to be responsible for implementing cost-effective energy efficiency programs relative to generation, transmission, and distribution facilities, regardless of the fact that generation services are provided through the competitive market. This option can be combined with the second option and enables all utility customers to participate in energy efficiency.

Three successful efforts are summarized to provide examples of best practices.

- The Northwest Power and Conservation Council developed an IRP in 2010 for the Bonneville Power Administration after evaluating the costs and risks of thousands of possible resource portfolios against 750 different future scenarios, all over a 20-year planning horizon. Through the IRP process, the council determined that 85% of its projected growth in demand over the next 20 years can be met through energy efficiency.
- PacifiCorp, a utility serving 1.7 million customers, filed its latest IRP with regulators in six western states in 2011. This IRP is based on recent (2010) potential studies that developed levelized cost curves for the agricultural, residential, commercial, and industrial sectors specific to each state served by the company, and here again energy efficiency represents the largest resource added through 2030.
- Con Edison provides an example of a successful alternative planning process from a distribution utility that operates in a competitive retail market. In 2003, Con Edison saw that specific parts of its distribution network were approaching capacity limits while load continued to grow. Even though the utility was not subject to an IRP or similar planning mandate, managers decided that demand side resources should be compared on an equal basis to supply side resources. Following a request for proposals, Con Edison contracted with energy service companies that succeeded in procuring 89 megawatts (MW) of targeted savings and saved over $223 million in capital expenditures.

Table 1. Best Practices to Encourage All Cost-Effective Energy Efficiency in an IRP Process

Best Practices	Resources for More Information
Credible load forecasts: model a range of possible load forecasts, not just the reference case **Generation resources:** model a range of possible costs for each supply side technology, considering uncertainties	Webinar: • *"Integrating the Impact of Energy Efficiency Programs into Resource Planning"*
Transmission and distribution resources: consider new transmission lines as a possible resource, but also consider distribution system improvements as a way to reduce line losses and reduce the need for generation	Publications: • *National Action Plan for Energy Efficiency Guide to Resource Planning with Energy Efficiency*
Energy efficiency and other demand side resources: create levelized cost curves for demand side resources that are comparable to the levelized cost curves for supply side resources and allow the model to choose an optimum level of investment	• *National Action Plan for Energy Efficiency Vision for 2025: A Framework for Change*
Modeling: use simulation models that evaluate the cost and risk of multiple possible resource portfolios under dozens or hundreds of future scenarios, where risk is measured by looking at how often each portfolio ends up being one of the most expensive of all the portfolios	• *National Action Plan for Energy Efficiency Guide for Conducting Energy Efficiency Potential Studies*
Environmental Regulations: assess the compliance costs associated with a range of possible future environmental regulations and consider those costs in their modeling	• *State and Local Energy Efficiency Action Network Setting Energy Savings Targets for Utilities*
Stakeholder participation: engage stakeholders early and in meaningful ways	• *Energy Portfolio Management: Tools and Resources for State Public Utility Commissions*
Scale: model at a regional scale or otherwise acknowledge that utilities operate within the context of a regional electricity grid	

The Purpose and Use of Integrated Resource Planning

The National Action Plan for Energy Efficiency (the Action Plan) was developed by a broad group of stakeholders in 2008 because "improving the energy efficiency of homes, businesses, schools, governments, and industries—which consume more than 70% of the natural gas and electricity used in the United States—is one of the most constructive, cost-effective ways to address the challenges of high energy prices, energy security and independence, environmental concerns, and global climate change in the near term."[1] The State and Local Energy Efficiency Action Network (SEE Action) builds on the foundation of the Action Plan and broadens the effort, with a goal of taking energy efficiency to scale and achieving all cost-effective energy efficiency by 2020. The primary goal of this paper is to explain how integrated resource planning can serve as an effective tool for promoting energy efficiency and other demand side resources. Some of the alternatives to an integrated resource plan (IRP) that have proven effective in states with competitive retail markets are also briefly explained.

What is an Integrated Resource Plan?

An IRP is a long-range utility plan for meeting the forecasted demand for energy within a defined geographic area through a combination of supply side resources and demand side resources.[2] Generally speaking, the goal of an IRP is to identify the mix of resources that will minimize future energy system costs while ensuring safe and reliable operation of the system.

IRP processes are commonly used to analyze alternatives for meeting future demand for electricity. Less commonly, IRP processes are used to ensure that adequate, reliable, and affordable supplies of natural gas will be available as well. Because the planning process is more complex with respect to electricity, most of the emphasis in this paper will be on IRPs for electricity.

An IRP may be developed by a utility or power marketing administration for its service territory in one or more states, by a utility commission for its entire state, or by a regional transmission organization or independent transmission system operator (ISO) for a multistate region. In some states, utility plans serve as a blueprint for resource acquisition decisions and are subject to approval by the public utility commission (PUC). Plans covering a multistate area are more likely to be used for educational purposes only.

What Kinds of Alternatives are Considered in an IRP?

In the process of developing an IRP, planners may consider a wide range of alternatives to meet future energy needs. For electricity plans, the alternatives can include adding generation capacity, encouraging customer-owned generation and combined heat and power facilities, adding transmission and distribution lines, reducing line losses in the transmission and distribution system, and implementing demand response programs. But the primary focus of this paper is another alternative, which is now included in IRP processes in more than 30 states, and that is investing in energy efficiency programs to reduce future demand when it is cost effective to do so. Analogous supply side and demand side options exist for natural gas planning.[3]

In planning to meet future energy needs, nearly all utilities and utility regulators across the country have practiced least-cost resource planning for decades. In many cases, these least-cost resource plans exclusively considered procurement of supply side resources. The availability of energy efficiency and other demand side resources at very low costs and in significant quantities was often ignored in the planning process. An IRP can be very similar to

[1] National Action Plan for Energy Efficiency, Vision for 2025: A Framework for Change, available at www.epa.gov/cleanenergy/documents/suca/vision.pdf.

[2] Demand side resources can include energy efficiency, demand response, and customer-owned generation sized to meet the customer's needs. The term demand side management (DSM) has essentially the same meaning and is commonly used, but that term may hinder one of the goals of this paper, which is to encourage planners to treat demand side and supply side resources equally.

[3] Not every IRP considers every alternative listed. The alternatives considered will vary based on state and local regulatory requirements and based on what type of entity is developing the plan.

a traditional least-cost resource plan, with the distinction that a process or plan that doesn't consider demand side resources is not an IRP.

Distinction between Uses of IRP as a Regulatory or Non-regulatory Planning Tool

Resource planning requirements are not consistent across the United States. Some states require utilities to develop IRPs, whereas others do not. Planning requirements may be embodied in state statutes, administrative rules, or PUC orders. It should also be understood that all utilities do some sort of long-range planning based on least-cost procurement of resources, and some may develop an IRP even in the absence of a regulatory requirement. Figure 1 indicates those states that have adopted IRP requirements.

The 34 states shown in blue in Figure 1 require IRP or some sort of similar process for electricity planning. Although not indicated on the map, thirteen (13) of those states also use IRP processes for natural gas planning.[4]

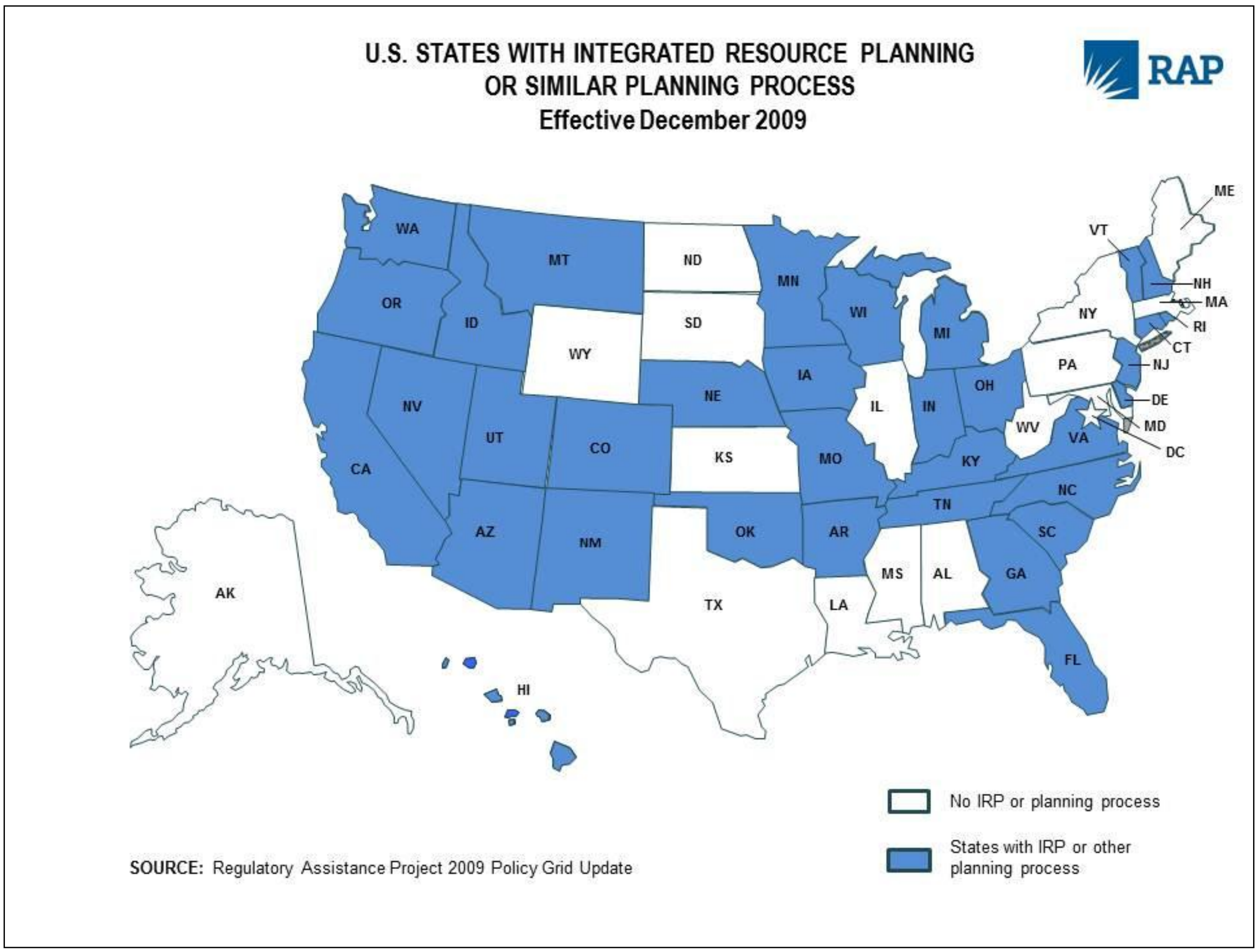

Figure 1. States with integrated resource planning or similar processes[5]

[4] Some of the states that do not require an IRP process nevertheless have strong energy efficiency policies. IRP is only one of many effective policy tools for encouraging energy efficiency.
[5] Source: http://raponline.org/document/download/id/4447. Because actual requirements vary widely from state to state, readers are encouraged to refer to the source document for details.

In states that require some form of IRP, there is significant variation in the role assigned to the PUC. The PUC may perform any of the following:

- Develop an IRP based on data provided by utilities
- Acknowledge receipt of IRPs developed by utilities
- Approve IRPs filed by utilities, with modifications if necessary
- Convene an IRP process with opportunities for stakeholders to intervene prior to a PUC decision.

Another area of significant variation is the official status or treatment of an IRP that has been approved or acknowledged by a PUC. At one end of the spectrum is Nevada, where PUC approval of an IRP is tantamount to approval for the utility to construct or acquire the resources (supply side or demand side) described in the plan.

More commonly, IRP approval by the PUC does not relieve a utility from the need to ultimately demonstrate that its investments are optimal and consistent with the plan given actual (as opposed to forecast) conditions. PUC approval may, however, convey a rebuttable presumption that the projects described in the plan are necessary and prudent. In Oregon, for example: "Consistency with the plan may be evidence in support of favorable rate-making treatment of the action, although it is not a guarantee of favorable treatment. Similarly, inconsistency with the plan will not necessarily lead to unfavorable rate-making treatment, although the utility will need to explain and justify why it took an action inconsistent with the plan."[6] Similarly, in Idaho the PUC stated that it would "continue to hold that the plans are not to be given the force and effect of law, [but] we presume that utilities intend to follow the plans after they have been filed for our acceptance. Deviations from the integrated resource plans must be explained. The appropriate place to determine the prudence of an electric utility's plan or the prudence of an electric utility's following or failing to follow a plan will be in general rate case or other proceeding in which the issue is noticed."[7]

Finally, there are states in which a PUC-acknowledged IRP serves more as a reference document than as an actual plan. In Wisconsin, for example, utility IRPs are not required, but funding levels for mandatory utility investments in energy efficiency are determined by the Public Service Commission through a quadrennial planning process. The results of that process are then incorporated into biennial, statewide Strategic Energy Assessments developed by the Commission with input from utilities and other stakeholders. These assessments evaluate most of the same supply, demand, and transmission questions that underlie an IRP. They guide the Commission in a variety of general policy discussions, and they provide the public with useful information. But utility supply side resource investments are reviewed in separate cases, and Wisconsin statutes ensure that the Strategic Energy Assessments have no binding significance in those cases.

How IRPs Can Promote Energy Efficiency and other Demand Side Resources

An IRP can be a powerful impetus for promoting energy efficiency and other demand management alternatives to new supply. Although the amount of available cost-effective energy efficiency will vary based on local circumstances, some quantity will probably always be available at a lower levelized cost per megawatt-hour than supply side alternatives.[8] Thus, because of this basic economic fact, any planning process that requires utilities to consider demand side resources as part of an integrated strategy to meet customer demand is likely to promote energy efficiency. This is especially true where IRP processes are mandatory and overseen by a PUC, because the IRP requirement may require utilities to consider demand side programs that benefit ratepayers even if the

[6] Oregon PUC Order No. 89-507 at 7.

[7] Order 25260 from Case #GNR-E-93-3.

[8] See, for example, the Lazard estimates presented to the National Association of Regulatory Utility Commissioners in June 2008, available at www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20(2).pdf.

programs do not benefit shareholders. In some circumstances, cost-effective energy efficiency measures may even be available in sufficient quantities to satisfy all of the projected load growth within the planning timeframe.[9]

Approaches for Including Demand Side Resources in an IRP

Planners can use at least three different approaches for including demand side resources in an IRP. The first two approaches incorporate these resources in forecasts of future demand for energy, whereas the third approach treats these resources as assets that can be deployed to meet forecasted demand if doing so is less costly than deploying supply side resources.

One way for planners to include demand side resources in the future load forecast is to build in the effects of an energy efficiency policy as a defined model input. For example, if a state has a requirement that utilities achieve annual energy savings equal to 1% of the prior year's load, planners can adjust their future demand forecast to ensure that the results of the policy are included. This approach is the simplest of the three approaches described in this paper and may be the best option in cases where planners have limited information about the costs of demand side resources. This approach, however, will not necessarily result in the least-cost resource plan, because it presupposes a certain level of demand side resources before evaluating the cost-effectiveness of all options for meeting demand. It also will not encourage investments in energy efficiency beyond the minimum level specified by the policy.

A better option for including demand side resources in the future load forecast is to evaluate supply side options against *multiple* load forecasts. For example, planners can develop one forecast based on the minimum level of efficiency investments required by state policies, another forecast based on increased investments, and a third based on investing in all cost-effective efficiency measures. The costs of "minimum efficiency," "more efficiency," or "all cost-effective efficiency" are then added to the costs of supply side resources to evaluate plans. This approach is preferable to the first option because it allows planners to consider the overall system cost implications of different levels of energy efficiency investments; it presupposes, however, that credible information is available on the costs of achieving each level of load reduction.

Finally, planners can develop a forecast of future energy demand that assumes no demand side resource investments beyond the ongoing impacts of existing policies and programs. Instead, additional demand side investments are treated as resources that can "generate" negative energy and demand at specified costs. Thus, a kilowatt of demand or a kilowatt-hour of energy can be served through either demand side resources or supply side resources. This approach will not only result in a true least-cost plan and (in most cases) high levels of energy efficiency investment, it will also provide useful information about the true value of demand side resources as an alternative to supply side resources. This approach would normally be considered the best option, provided that cost curves are available for supply side and demand side resources alike.

[9] The Vermont Energy Investment Corporation, which administers ratepayer-funded programs throughout that state, reported in 2008 that energy efficiency measures had for the first time turned load growth negative in 2007. Since very few states even attempt to achieve all cost-effective energy efficiency, it is not known how replicable that result might be. Refer to: http://eec.ucdavis.edu/ACEEE/2008/data/papers/10_355.pdf.

Recommendations for Successful Integrated Resource Planning

The goal of the State and Local Energy Efficiency Action Network (SEE Action) is to achieve all cost-effective energy efficiency by 2020. Integrated resource planning is one way to take a comprehensive look at cost-effectiveness. In an IRP, the central question is not "does this efficiency measure pay for itself?" but rather "is efficiency likely to be less costly than other alternatives for meeting customer demand, taking into account uncertainty and risk?"

Prerequisites for a Successful IRP

The process of developing an IRP can be a powerful force for encouraging investment in demand side resources. It is perhaps noteworthy that 17 of the top 20 states, in terms of per capita utility investments in energy efficiency, have IRP requirements.[10] For an IRP process to successfully encourage all cost-effective energy efficiency, however, there are certain prerequisites that must be met.

Credible Load Forecasts

To begin with, projections of future load should be based on realistic assumptions about local population changes and local economic factors. Because of demographic and economic considerations, load growth will vary across utility service territories, from state to state within a region, and from region to region across the country. Locally relevant data are needed. The load forecast used in an IRP process must also take into consideration policies and programs that are already on the books. In states where energy efficiency policies and programs are well established and stable, future load growth might look very similar to recent past load growth. But in states that have newly adopted demand side policies and programs, estimates of the impacts of those policies and programs must be developed and incorporated into future load forecasts.

Credible Information about Costs and Availability of Resources

In most cases, planners will determine that load is expected to grow and will find that current supply side and demand side resources are not sufficient to meet future energy needs. Additional resources will need to be acquired. To determine the types and amounts of resources to acquire, planners need the best possible information about the availability and expected costs of new generation assets, transmission and distribution lines, and demand side measures. In the case of energy efficiency, it is critically important to have a potential study or other assessment in order to know how much demand reduction can realistically be achieved.[11]

Fair and Equal Consideration of All Resources

An IRP will not be truly integrated and won't encourage energy efficiency unless demand side resources receive fair consideration. Most investor-owned utilities have the opportunity to earn a return on their investment when they build new supply side resources, but not when they purchase or fund demand side resources. Unless the IRP process itself is one that requires the utility to treat these resources equally, the utility might have an inherent preference for the more profitable supply side resources.[12]

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[10] www.cee1.org/ee-pe/docs/Table%206.pdf.

[11] For more information on this topic, see the National Action Plan for Energy Efficiency Guide for Conducting Energy Efficiency Potential Studies, available at www.epa.gov/cleanenergy/energy-programs/suca/resources.html.

[12] The National Association of Regulatory Utility Commissioners has long recognized the importance of overcoming a utility's inherent disincentive to invest in energy efficiency, adopting a resolution in 1989 to "reform regulation so that successful implementation of a utility's least-cost plan is its most profitable course of action." For more information on this topic, see the National Action Plan for Energy Efficiency Aligning Utility Incentives with Investment in Energy Efficiency, available at www.epa.gov/cleanenergy/energy-programs/suca/resources.html.

IRP Best Practices

The goal of an IRP is to identify the portfolio of resources that performs best with respect to a stated objective, such as "minimize net present value system cost while meeting all system reliability requirements," under a wide variety of possible future scenarios.[13] To maximize the chance of successfully attaining this goal, it is not enough to merely satisfy the minimum prerequisites listed above. All of the following ideas can be replicated across the country to improve IRP processes.

Load

The best IRP processes model a range of possible load forecasts, not just the one most likely forecast (i.e., the "reference case"). Probabilities can be assigned to each forecast for risk analysis purposes. This is the most straightforward way to acknowledge and address uncertainty about future energy prices, and the induced effect on demand, as well as uncertainty about demographic and economic variables. The process need not be complicated; for example, planners can develop a low load growth forecast and a high load growth forecast as alternatives to their reference case, making use of low-end and high-end estimates of local load growth in industry or government reports.[14]

Generation Resources

Rather than using only a single reference value for the assumed cost and availability of each generation technology, the best IRP processes model a range of possible costs, considering uncertainties in the availability and costs of raw materials and skilled labor, construction schedules, and future regulations. A good IRP process will consider multiple scenarios entailing a range of possibilities.

Transmission and Distribution Resources

Some IRPs do not evaluate these resources on a comparable basis to generation or demand side resources. The best IRPs, however, not only consider new lines as a possible resource but also consider distribution system improvements as a way to reduce line losses and reduce the need for generation.

Energy Efficiency and Other Demand Side Resources

In many IRP processes, demand side resources are considered only to the extent that mandatory investments or standards are factored into future load forecasts. The very best IRPs either supplement this approach or take a completely different approach. Specifically, the best IRPs create levelized cost curves for demand side resources that are comparable to the levelized cost curves for supply side resources.[15] In the case of energy efficiency, these curves should be derived from recent, local potential studies developed consistent with the Action Plan Guide for Conducting Energy Efficiency Potential Studies.[16] Developing a locally specific potential study may be more costly than applying the results from a potential study for a broader geographic area, or a nearby area, but it can also produce data of much higher quality and value. By developing cost curves for demand side options, planners allow the model to choose an optimum level of investment.[17] So if demand side resources can meet customer demand

[13] Because the optimum portfolio may vary from one scenario to the next, planners seek to identify a robust portfolio that performs relatively well across all scenarios.
[14] The multiple load forecasts described here are based solely on different economic and demographic assumptions for the geographic area covered by the IRP. Variations in load that might arise from assumptions about demand side investments will be discussed separately.
[15] Recent experience with energy efficiency cost curves indicates that the costs of some measures can vary significantly depending on program design and delivery methods. For example, the cost of an integrated, whole-building approach to energy efficiency retrofits may differ from the aggregated costs of discreet building efficiency measures. Economies of scale may also affect cost curves. Planners and other stakeholders should seek to understand any assumptions about program design, delivery, or scale that are built into the cost curves.
[16] www.epa.gov/cleanenergy/documents/suca/potential_guide.pdf.
[17] Potential studies will normally distinguish between the technical or theoretical potential for energy savings, the economic or cost-effective potential, and the achievable potential considering real-world practicalities. Determining what level of savings is realistically achievable can be a

for less cost than supply side resources, as is frequently the case, this approach may result in more than the minimum investment levels required under other policies.

Model

All IRP efforts use simulation models to identify a least-cost (in terms of net present value) resource portfolio based on assumptions about the future values of variables, i.e., the reference case. In most cases, planners will then evaluate multiple alternative scenarios, with each scenario representing a different set of assumptions about some of the model inputs that have more uncertain future values. This consideration of multiple scenarios allows planners to identify a portfolio of resources that has low costs across most or all scenarios, instead of automatically choosing the one portfolio that looks best under the reference case. The very best IRP efforts, however, take this idea even further. The best efforts use simulation models that evaluate the cost *and risk* of multiple possible portfolios under dozens or even hundreds of future scenarios. Risk, in this context, might be measured by looking at *how often* each portfolio ends up being one of the most expensive of all the portfolios. With this kind of modeling, planners can choose a resource portfolio that is “robust” in the sense that its *average* cost across all scenarios is low, and in very few scenarios does it fare much worse than other possible portfolios.

Environmental Regulations

Rather than assuming that the regulatory landscape never changes, or assuming that future regulations are utterly predictable, the best IRPs are developed after considering a range of possible future regulations. For example, the Environmental Protection Agency (EPA) is currently considering whether to regulate coal ash as a hazardous waste. If EPA does so, the cost of disposing coal ash may be significantly greater than otherwise. Another obvious example relates to the stringency of future federal or state greenhouse gas regulations. These regulations will make fossil fuel generation more expensive in at least some cases, but it is too early to know which sources will be affected and how costly it will be to comply. Although planners cannot know for sure what future regulations will be implemented, the best efforts assess the potential costs of a range of possibilities and consider those costs in their modeling.

Stakeholder Participation

The best IRP processes provide opportunities for consumer advocates and other stakeholders to review the modeling assumptions and the list of scenarios to be modeled and suggest changes or additions. These stakeholders frequently identify problems and opportunities that planners may have overlooked. Furthermore, stakeholders should have the chance to review modeling results before the IRP is finalized and (where applicable) approved by regulators. In general, the entire process should be conducted with a reasonable level of transparency, while of course respecting any confidential utility information that is included. Without transparency and stakeholder participation, public confidence in the IRP may be in jeopardy, and this could have negative ramifications when the plan is implemented.

Scale

With few exceptions, utilities operate within the context of a regional electricity grid where the cost and value of supply side and demand side resources cross service territories and state boundaries. The optimal way to meet customer demand for an entire regional electricity grid is likely to be different from what appears to be optimal when planning occurs only at the utility or state level. Because of this simple fact, regional resource planning represents another best practice, provided that it is done in a way that complements rather than supersedes more localized planning.

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contentious issue. If the cost curves are based on technical or economic potential, the model may identify an optimum level of investment that exceeds achievable potential. In this case, planners may feel that it is necessary to include a suboptimal level of energy efficiency in the portfolio, whereas some stakeholders may feel that such a decision undermines the results.

Table 2. Best Practices to Encourage All Cost-Effective Energy Efficiency in an IRP Process

Best Practices	Resources for More Information
Credible load forecasts: model a range of possible load forecasts, not just the reference case	
Generation resources: model a range of possible costs for each supply side technology, considering uncertainties	Webinar: • *"Integrating the Impact of Energy Efficiency Programs into Resource Planning"*
Transmission and distribution resources: consider new transmission lines as a possible resource, but also consider distribution system improvements as a way to reduce line losses and reduce the need for generation	Publications: • *National Action Plan for Energy Efficiency Guide to Resource Planning with Energy Efficiency*
Energy efficiency and other demand side resources: create levelized cost curves for demand side resources that are comparable to the levelized cost curves for supply side resources and allow the model to choose an optimum level of investment	• *National Action Plan for Energy Efficiency Vision for 2025: A Framework for Change*
Modeling: use simulation models that evaluate the cost and risk of multiple possible resource portfolios under dozens or hundreds of future scenarios, where risk is measured by looking at how often each portfolio ends up being one of the most expensive of all the portfolios	• *National Action Plan for Energy Efficiency Guide for Conducting Energy Efficiency Potential Studies*
Environmental Regulations: assess the compliance costs associated with a range of possible future environmental regulations and consider those costs in their modeling	• *State and Local Energy Efficiency Action Network Setting Energy Savings Targets for Utilities*
Stakeholder participation: engage stakeholders early and in meaningful ways	• *Energy Portfolio Management: Tools and Resources for State Public Utility Commissions*
Scale: model at a regional scale or otherwise acknowledge that utilities operate within the context of a regional electricity grid	

The Impact of Applying IRP Best Practices

An IRP process that is based on the best practices described above is very likely to result in the selection of a portfolio that includes a substantial amount of energy efficiency, if not all cost-effective efficiency. There are two factors above all others that lead to that result. First, some amount of energy efficiency is virtually always achievable at a cost that is less expensive than new generation resources. When given a chance to compete on a fair basis with supply side resources, those energy efficiency measures will emerge as a preferred resource on cost alone. In fact, any IRP process that does not allow demand side resources to compete fairly is unlikely to identify a true "least-cost" portfolio. Second, the models that evaluate risk tend to find that demand side resources are much less risky than supply side options.

Finally, it is important to note that an IRP process that fairly considers demand side resources will help planners and stakeholders see those resources in a new light. For many utilities, investments in energy efficiency get expensed and end up as a rider on retail rates. It is typical and understandable in these cases for some stakeholders to resist such investments on the argument that retail rates will increase in the near term. What the best IRP processes do, however, is demonstrate in a rigorous fashion that investments in energy efficiency can play a large role in the "least-cost" resource portfolio for the long term. In other words, when energy efficiency is treated as an add-on to the resource portfolio, via a rider added to the base rates, it appears to be unfavorable from a "least-rate" perspective. But when efficiency is treated as an integrated part of the resource portfolio via an IRP, it proves to be preferable from a more comprehensive "least-cost" perspective.

Federal and State Policies that Create a Supportive Framework for Best Practice IRPs

A number of states have adopted public policies – through statute, regulation, or PUC order – that require utilities or some other entity to engage in IRP or similar planning processes. In addition, federal laws and policies include similar requirements for some federally established regional power authorities.

One of the metrics used to measure progress in implementing the Action Plan *Vision for 2025* is to identify whether states have adopted policies that recognize energy efficiency as a high-priority resource. More specifically, progress is measured based on whether state policy requires energy efficiency to be integrated into an active IRP, portfolio management (PM), or other planning process; whether energy efficiency is procured as a resource for default service/standard offer customers in restructured markets; and whether energy efficiency is considered as an alternative to transmission based on a long-term transparent integrated resource planning or transmission system plan.[18]

As of the end of 2009, only six states had active policies in place that required fair consideration of energy efficiency not just in electric generation planning, but also in electric transmission and distribution planning and natural gas planning: California, Montana, Oregon, Utah, Washington, and Vermont.[19] In terms of the comprehensive scope of the planning mandate, these states stand out as leaders in policy adoption. This does not necessarily mean that the IRP processes mandated in these states always conform to best practices. It may also be that the IRP processes in some other states are less comprehensive in scope but conform to best practices.

A good example of federal policy affecting regional power authorities is the *Pacific Northwest Electric Power Planning and Conservation Act of 1980,* which gives an even more powerful boost to demand side resources in planning processes. That law requires the Northwest Power and Conservation Council to develop IRPs that don't merely put demand side resources on an even footing with supply side resources but make energy efficiency the highest-priority resource for meeting electricity demand and assign it an assumed 10% cost advantage over supply side resources.

[18] Refer to Appendix D at www.epa.gov/cleanenergy/documents/suca/vision.pdf.
[19] Again refer to www.raponline.org/Feature.asp?select=116.

Alternatives to IRP in States with Competitive Retail Electricity Markets

In the United States, individual states are sometimes referred to as having "restructured" or "competitive" retail electricity markets if the state allows consumers to choose from whom to buy their power.[20] Prior to restructuring, which began in the 1990s, consumers across the country had no choice but to buy electricity from their local electric utility, whose rates reflected the cost of generating (or purchasing) power as well as transmission and distribution costs. This is still the norm in the majority of states. But now, in restructured states, companies compete to serve the power needs of consumers, and the role of the utility is limited to delivering power from the supplier of choice to the consumer.[21]

In competitive retail markets, distribution utilities have an obligation to serve customers regardless of which supplier the consumer chooses. The investments, expenditures, and rates of distribution utilities are still regulated by PUCs, but those of competitive suppliers are not. In addition, distribution utilities are also required in most restructured states to offer "default service" to customers who, for whatever reason, do not actually choose a supplier or cannot obtain service from a competitive supplier.[22] The prices and terms of this default service are also regulated by the PUC.

Because of the more limited responsibilities of utilities in competitive retail markets, comprehensive IRP processes are generally not appropriate. Instead, distribution utilities in these markets can promote energy efficiency through at least three different alternative processes, described below.

One option is to consider energy efficiency as part of a default service PM process. In recent years, the term "portfolio management" has been used in the electric industry to describe approaches that can be used by distribution companies to plan for and procure default services by purchasing a mix of supply side and demand side resources, using contracts with varying terms. The concept of PM as applied to default services is based on the concept of portfolio management for financial investments; i.e., it is based on the theory that a balanced portfolio is likely to reduce the customer's risk relative to placing all financial investments (or power purchases) into a very small, undiversified portfolio. In the context of power purchases, a balanced portfolio might mean, for example, (a) a mix of demand side and supply side resources; (b) a mix of short-term, medium-term, and long-term contracts; (c) a mix of fixed price contracts and indexed contracts; and (d) renewable contracts with fixed prices and fewer environmental risks. PM is based on the concept that many customers purchasing default service are not able or are not likely to switch to competitive retail suppliers, and, therefore, the distribution company has an obligation to provide those default customers with safe, reliable, low-cost power at stable prices. PM planning practices can resemble IRP practices in many ways, particularly in the way that demand side resources are compared on an equitable basis with supply side resources. Eight states with competitive retail markets currently require distribution utilities to procure energy efficiency as a resource for default service customers. In four of those states—Ohio, Delaware, Connecticut and Rhode Island—a PM or IRP approach is specifically required.[23] Under this option, only default service customers may receive energy efficiency services.

Another option is to employ IRP practices to transmission and distribution facilities only. Distribution companies need to ensure that they can provide low-cost, reliable transmission and distribution services to their customers, regardless of whether they provide any form of generation service. Some utilities may view this obligation entirely from a perspective of the need to build, maintain, and operate distribution lines and substations. But an increasing number of distribution utilities are adopting IRP or planning practices where demand side resources are seen as a

[20] Fifteen states plus the District of Columbia currently have competitive retail markets. Refer to www.eia.gov/cneaf/electricity/page/restructuring/restructure_elect.html. In half of these restructured markets, some form of IRP or an alternative process is mandatory, whereas more than two-thirds of the unrestructured states require some form of planning.
[21] In nearly all cases in the United States, customer service and billing is managed by the distribution utility. The utility purchases power from the competitive supplier and adds that cost to its own costs on the consumer's bill.
[22] Depending on the state, default service may be called "standard offer," "provider of last resort," or "basic generation service."
[23] Based on Action Plan Policy Grid Updates compiled by Regulatory Assistance Project through 2009. Refer to www.raponline.org/Feature.asp?select=116.

potential alternative to transmission and distribution facilities. One example of this, from Con Edison in New York, is summarized in the section "Examples of Successful IRP or Alternative Planning Efforts" below.

A third option is for the distribution utility to be given full responsibility for implementing all energy efficiency resources that are cost-effective relative to generation, transmission, and distribution facilities. Although the distribution utility may have a limited role or no role at all in providing generation services (through default service), it is still considered appropriate for them to implement the energy efficiency associated with avoided generation costs as well as avoided transmission and distribution costs, because they are in the best position to implement those efficiency resources. Distribution companies can utilize a system benefits charge applied to all distribution customers, provide efficiency services to those same distribution customers, and act as a centralized, regulated agency with the public policy mandate to achieve all of the energy efficiency that is cost-effective for those customers. This approach has been used very successfully in California and Massachusetts, for example. It can be combined with the second option, and it enables all utility customers to participate in energy efficiency.

In the case of a distribution utility operating in a competitive retail market, some of the IRP best practices described above will not always be fully applicable. What matters, however, is that the utility takes an integrated approach where demand side resources have the opportunity to compete on a cost and risk basis with supply side and transmission and distribution assets.[24]

Examples of Successful IRP or Alternative Planning Efforts

Three very different examples of successful IRP efforts are noted below. They are presented to illustrate some of the concepts and all of the best practices described in this white paper. The processes and the results of these efforts will only be briefly summarized, but interested readers are encouraged to delve deeply into the documents referenced in footnotes for more detail and illumination.

Northwest Power and Conservation Council

As previously noted, the federal *Pacific Northwest Electric Power Planning and Conservation Act of 1980* requires the Northwest Power and Conservation Council, a regional planning organization, to develop IRPs for the BPA that don't merely put demand side resources on an even footing with supply side resources but make energy efficiency the highest-priority resource for meeting electricity demand and assign it an assumed 10% cost advantage over supply side resources. These plans have a profound effect on the operations of BPA in Washington, Oregon, Idaho, and Montana.[25]

The council adopted its Sixth Northwest Conservation and Electric Power Plan in February 2010 at the end of an IRP process that began in December 2007.[26] This plan provides an excellent example of all of the IRP best practices noted in this paper.

To begin with, the council acknowledged uncertainty about demographic and economic variables by developing three separate forecasts of future load—a baseline case as well as "high-" and "low-" growth cases. Planners also tested how sensitive their results were to a range of possible adoption levels for electric vehicles.

Detailed information was then developed about the levelized costs of generation, transmission, distribution, and energy storage resources, including consideration about cost uncertainties. Energy efficiency resource potential was estimated for the agricultural, residential, commercial, and industrial sectors, as well as for utility distribution systems and consumer electronics. Levelized cost curves were produced for each resource category.

[24] From the perspective of state policymakers, it can be uncomfortable to feel no control over the resource mix serving the state. This has led restructured states like Illinois, Maryland, and New Jersey to consider initiatives that would give the state some role in resource planning and acquisition.
[25] The council is funded by wholesale power revenues from the BPA, the federal agency that markets the electricity generated at federal dams on the Columbia River.
[26] www.nwcouncil.org/energy/powerplan/6/final/SixthPowerPlan.pdf.

The council's IRP included an evaluation of the costs and risks of thousands of possible resource portfolios against 750 different future scenarios, all over a 20-year planning horizon. This analysis included consideration, for example, of many different scenarios for the cost of complying with greenhouse gas regulations—ranging from no regulation ($0 per ton of carbon dioxide emitted) to $100 per ton emitted.

Finally, the planning effort was regional in scale, meetings were open to the public, documents were available on a Web site, and stakeholders were given the opportunity to review and comment on a draft plan before final decisions were made.

Through the IRP process, the council determined that 85% of its projected growth in demand over the next 20 years can be met through energy efficiency. On average, the council expects energy efficiency investments to cost just half as much as comparable supply side investments. The approved IRP includes 1,200 MW of energy efficiency savings in the first five years, and 5,900 MW over 20 years – the most aggressive targets in the nation.

The council has good reason to be confident that the Sixth Plan is not overly optimistic. Its evaluation of efficiency efforts from 1980 through 2008 found that nearly 4,000 MW of savings had been achieved, cutting demand growth in half and saving consumers $1.8 billion on electric bills.

PacifiCorp

PacifiCorp is a large utility serving 1.7 million customers in six western states. Five of those states—Utah, Washington, Oregon, Idaho, and California—require utilities like PacifiCorp to file an IRP with the state PUC. Wyoming is an unusual case in that it requires utilities to file an IRP with the PUC only if the utility is required to file an IRP in another state, as is the case for PacifiCorp. So this company files its IRP in all six states.

In March 2011, PacifiCorp filed its 11th IRP with state regulators.[27] Although it is too soon to know how the latest plan will be received by regulators, the planning process offers a good illustration of some of the best practices noted in this paper.

PacifiCorp, like the Northwest Power and Conservation Council, developed a baseline load growth forecast, along with low-growth and high-growth forecasts. For supply side resources, the company developed separate cost data for the eastern and western parts of its territory.

In terms of demand side resources, the IRP is based on recent (2010) potential studies that developed levelized cost curves for the agricultural, residential, commercial, and industrial sectors. The cost information is specific to each state served by the company. The IRP process undertaken by PacifiCorp is also interesting because in most of its service territory it administers energy efficiency programs, whereas in Oregon those programs are administered by a third party. Consequently, PacifiCorp used a hybrid approach to evaluating energy efficiency potential, combining data from the Energy Trust of Oregon with a separate potential study it commissioned for the rest of its territory.

PacifiCorp defined 67 separate scenarios for portfolio development, covering a range of alternative transmission configurations, greenhouse gas regulation costs, natural gas prices, renewable energy requirements and costs, load forecasts, and demand side resource availability. Each portfolio was modeled using three natural gas price forecasts. PacifiCorp then ran 100 simulations before selecting a preferred portfolio, based on low average cost (across runs), low worst-case cost, and other considerations.

PacifiCorp provided numerous opportunities for stakeholder input into the IRP. Five meetings and three conference calls were open to the public. To encourage broad participation, meetings were held jointly in Salt Lake City and Portland, with telephone and videoconference access as well.

[27] The 2011 Plan and the approved plan from 2008 are available at www.pacificorp.com/es/irp.html.

Finally, it is worth noting that PacifiCorp's IRP had a regional perspective; it was not an aggregation of six different state-specific plans.

The results of PacifiCorp's 2011 IRP are eye-catching. Energy efficiency represents the largest resource added through 2030 across all portfolios, with cumulative capacity additions exceeding 2,500 MW in the preferred portfolio. The preferred portfolio also adds over 250 MW of demand response in the first five years.

Con Edison

Con Edison is an electric distribution utility in the New York City area that operates in a competitive retail market. In 2003, Con Edison saw that specific parts of its distribution network were approaching capacity limits while load continued to grow. Building new lines and substations promised to be an incredibly expensive engineering challenge. Instead, building on its experience delivering broad-based energy efficiency programs, Con Edison launched a targeted demand management program focused on the nearly overloaded portions of its network. Even though the utility was not subject to an IRP or similar planning mandate, managers decided that demand side resources should be compared on an equal basis to supply side resources. The decision was made that wherever energy efficiency proved to be more cost-effective than transmission and distribution system infrastructure investments, efficiency would be implemented as the one and only solution.

Con Edison's planners began by estimating potential future peak loads throughout the network. A plan was created to address any forecasted shortfalls at the transmission, subtransmission, and area substation levels through load relief projects, e.g., by installing transformer cooling or an entirely new substation. Planners estimated the cost of each such project and then issued a request for proposals for energy efficiency services targeted to address the same shortfalls. Where viable bids were received at a cost less than the cost of the infrastructure project, energy efficiency was procured through a contract. Otherwise, the infrastructure project was executed.

Over the five years that followed, Con Edison contracted with energy service companies that succeeded in procuring 89 MW of targeted savings at a benefit/cost ratio of 2.8. These efforts saved the utility over $223 million in capital expenditures.[28] This example shows the value that utilities in competitive retail markets can derive from an IRP or similar planning process that values demand side resources, irrespective of any obligation to provide generation service. It is also a good example of best practices for looking at transmission, distribution, and demand side solutions in an integrated fashion.

Interaction of IRP and Alternative Planning Processes with Other Energy Efficiency Policies and Program Designs

The implementation of a best practice IRP process is compatible with mandatory energy savings targets, and it remains relevant in states where utilities do not administer energy efficiency programs.

IRP Processes in States with Mandatory Energy Efficiency Goals or Mandatory Demand Response Programs

In states that have mandatory demand side goals or programs, planners have options for how to develop an IRP that have already been mentioned. One good option is to include the effects of the mandates in load forecasts and then allow the model to consider supplemental demand side resources as an alternative to supply side resources. With this approach, it may be necessary to develop levelized cost curves that acknowledge potential differences between the mandated programs and the supplemental resources. An even better option is to include none of the demand side resources in the load forecasts but apply a single set of levelized cost curves to all the scenarios and let the model determine the optimum level of investment. This approach can provide helpful insights to planners

[28] http://eec.ucdavis.edu/ACEEE/2010/data/papers/2059.pdf.

and policymakers, such as insights on which measures are most valuable in terms of total system costs. For example, this approach may reveal situations where a resource that reduces demand during peak hours, or in an area of congested transmission, is more valuable in terms of total system cost than a less expensive measure that saves an equal amount of energy in a different time or place.[29]

IRP Processes in States with Third Party-Administered Energy Efficiency Programs

Some mandated energy efficiency programs are not administered by utilities but instead by a state entity or a third party that manages funds collected from utility ratepayers and/or taxpayers. New York offers the best known example of a state-run program, while Oregon, Vermont, and Hawaii offer examples of states that contract with a nongovernmental third party. Depending on the state, utilities may be specifically authorized to fully or partially opt out of the centralized program and administer their own program, or they may be authorized to supplement the centralized program with their own efforts.[30]

An IRP or PM process in these states need not be much different from those in states where utilities manage all of the energy efficiency programs. One difference is that planners will benefit from involving the program administrator in the development of model inputs, certainly with respect to cost curves and possibly with respect to load forecasts as well. For example, in Vermont the organization that currently administers efficiency programs (Vermont Energy Investment Corporation) also develops energy efficiency potential studies, which are a key input used by utilities in developing their mandatory IRPs. Another, more significant, difference may come if and when the IRP is implemented. If the IRP identifies an optimum portfolio that includes more energy efficiency than is mandated, a decision will need to be made as to whether the additional resources will be acquired by the utility independently or through the centralized program administrator.

Conclusion

IRP processes can stimulate investment in energy efficiency and other demand side resources by allowing those resources to compete on a fair and equal basis with supply side resources. The best IRP processes consider a range of possible values for the future cost and availability of all types of resources, as well as a range of possible future scenarios for demographic, economic, and regulatory changes.

IRP processes are most often found in states that have not introduced retail electric competition, where it is mandated by the legislature or PUC. In states with competitive retail markets, similar planning processes can be used to encourage distribution utilities to evaluate demand side and supply side resources on a comparable basis.

State policymakers can promote the Action Plan goal of all cost-effective energy efficiency by adopting IRP, PM, or other similar planning requirements where they do not currently exist or by improving existing planning processes to conform to best practices.

[29] Compare the relative impacts of an efficient air conditioner and an efficient light bulb. In terms of meeting a mandatory goal for energy savings, each kWh saved from each measure looks the same. But a resource planning perspective can reveal that a kilowatt-hour saved by the air conditioner on a hot summer day, when electric demand and costs are highest, is worth more than a kilowatt-hour saved by the light bulb on a cool fall evening, when demand and costs are low.

[30] In New York, responsibility for administering mandated programs is shared by NYSERDA (New York State Energy Research and Development Authority) and utilities. Hybrid models of shared responsibility are found in a few other states, and no states currently have a 100% government-administered program.

Additional Resources

The resources listed below may be useful to assist stakeholders with the integrated resource planning issues outlined in this paper.

Webinar

Messenger, M.; Eckman, T. (August 2010). "Integrating the Impact of Energy Efficiency Programs into Resource Planning." Hosted by the Regulatory Assistance Project. http://go.webpresentnow.com/2753647/vmeetings/7193406/viewer.php?&user=Mike%20Messenger&brand_url=http://go.webpresentnow.com.

Publications

National Action Plan for Energy Efficiency (November 2007). *Guide to Resource Planning with Energy Efficiency.* Prepared by Snuller Price et al., Energy and Environmental Economics, Inc. www.epa.gov/cleanenergy/documents/suca/resource_planning.pdf.

Steinhurst, W.; White, D.; Roschelle, A.; Napoleon, A.; Hornby, R.; Biewald, B. (October 2006). "Energy Portfolio Management: Tools and Resources for State Public Utility Commissions." Cambridge, MA: Synapse Energy Economics. www.naruc.org/Publications/NARUC%20PM%20FULL%20DOC%20FINAL1.pdf.

SEE Action Driving Ratepayer-Funded Efficiency through Regulatory Policies Working Group. (September 2011). *Setting Energy Savings Targets for Utilities.* www1.eere.energy.gov/seeaction/pdfs/ratepayer_efficiency_targets.pdf.

SEE Action
STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK