Distributed Generation: Policy Framework for Regulators

An Arthur D. Little White Paper

ARTHUR D. LITTLE

For more than a century, Arthur D. Little has been a leader in the consulting industry. Founded in 1886 by Arthur Dehon Little, it is the world's first consulting firm. Today, it still is one of the world's premier consulting firms, with over 3,500 staff members based in 51 offices and laboratories around the globe.

Arthur D. Little has been the world's leading consultant to the energy industry since the mid-1960s. We provide consulting services to the full gamut of industry players-major, independent, and national oil and gas companies; public and private utilities; independent power producers; government institutions; suppliers and contractors, and financial institutions and funding agencies. Bringing to all these assignments tailored, multi-disciplinary case teams, Arthur D. Little provides a range of services in strategy development, organizational design and implementation, business-process redesign, technology and product innovation, and environmental, health, and safety consulting.

DISCLAIMER

Funding for this white paper was provided to Arthur D. Little, Inc., by the sponsoring organizations for an objective analysis and discussion of important issues related to the use of distributed generation. This white paper is intended for general information and not as an endorsement of any product, process, or point of view.

Executive Summary

Distributed generation (DG) is the integrated or stand-alone use of small, modular electric generation close to the point of consumption. It is installed for the benefit of a specific customer, and/or an electric system. DG is emerging as a result of three independent trends - utility industry restructuring, increasing system-capacity needs, and technology advancements - that are concurrently laying the groundwork for its possible widespread introduction.

DG technology, which has drawn strong interest and surfaced an expansive set of policy questions, differs fundamentally from the traditional model of central generation and delivery. The major differences are that DG can be located near end-users within an industrial area, inside a building, or in a community, and can be operated remotely for use in a broad range of customer-sited and grid-sited applications where central plants would prove impractical. Due to the potential benefits and risks offered by these differences, policymakers in several states are already being asked to settle issues regarding the role of DG. Active debate about DG is also under way in other states and at the federal level in Congress and Executive Branch agencies.

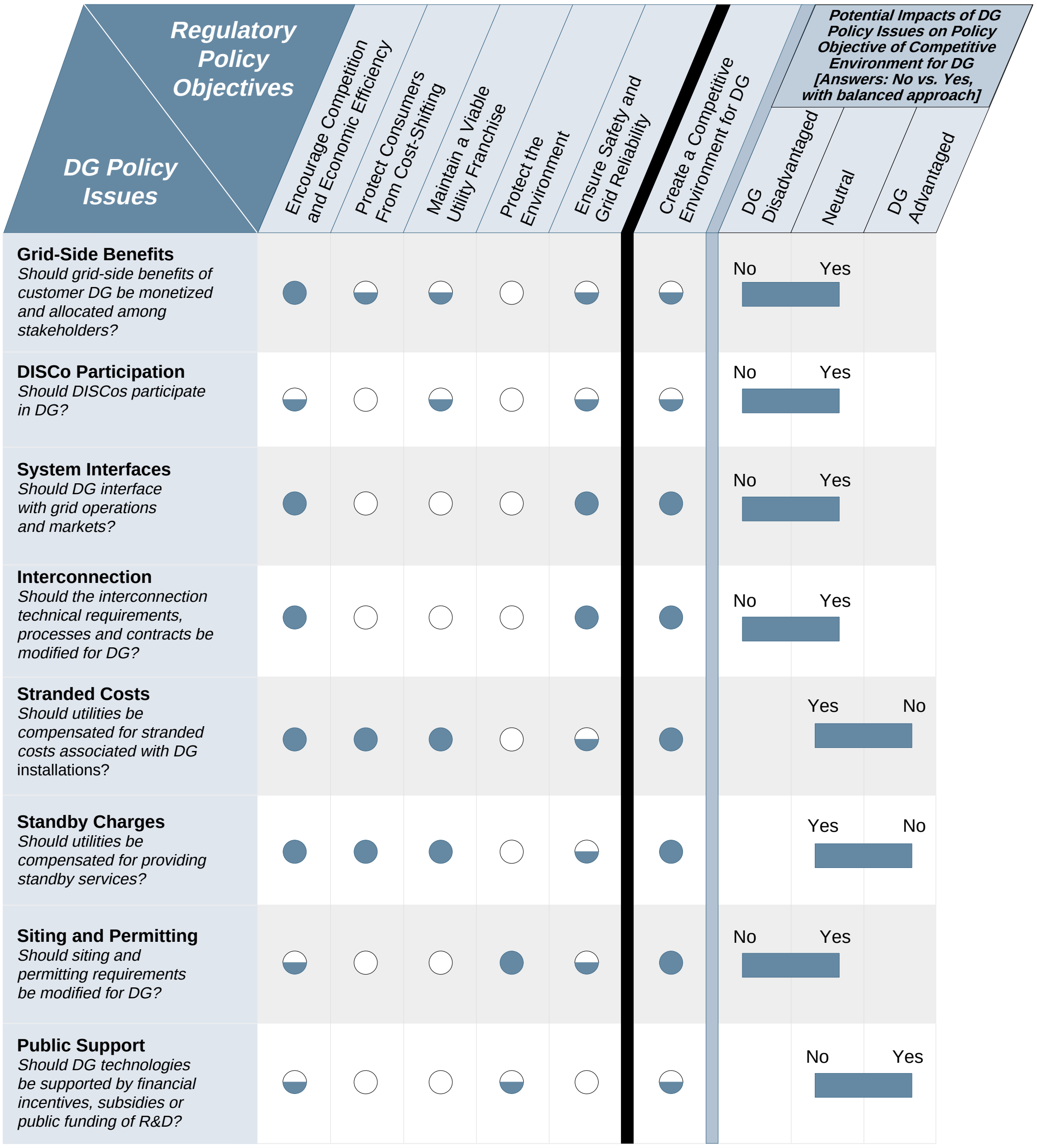
This white paper is intended to inform decisionmakers and provide a platform for DG policy analysis by framing the debate. It does not specifically answer any policy questions, but rather is designed to provide a balanced, concise representation of major high level arguments on different sides of each issue. The full range of DG-related questions being asked by stakeholders today might initially seem disparate. However, after analysis they coalesce around several defining topics relating to technical, economic, market, and environmental/siting aspects of DG. This paper presents eight fundamental policy issues distilled from a comprehensive spectrum of individual DG-related questions.

Figure E-1 presents the issues, each illustrated by a specific question, and indicates the impact each would have on relevant policy objectives. A detailed discussion of the supporting methodology is provided in Section II, Mapping the Issues.

> *This white paper is intended to inform decisionmakers and provide a platform for DG policy analysis by framing the debate. It does not specifically answer any policy questions, but rather is designed to provide a balanced, concise representation of major high level arguments on different sides of each issue.*

All jurisdictions will eventually address these DG issues either explicitly or implicitly. Regulators and legislators will prioritize and focus on some or all of the eight individual DG issues according to the particular needs and goals of their jurisdictions.

Figure E-1: Issue Mapping Process



DG Policy Issues / Regulatory Policy Objectives	Encourage Competition and Economic Efficiency	Protect Consumers From Cost-Shifting	Maintain a Viable Utility Franchise	Protect the Environment	Ensure Safety and Grid Reliability	Create a Competitive Environment for DG	Potential Impacts of DG Policy Issues on Policy Objective of Competitive Environment for DG [Answers: No vs. Yes, with balanced approach]		
							DG Disadvantaged	Neutral	DG Advantaged
Grid-Side Benefits *Should grid-side benefits of customer DG be monetized and allocated among stakeholders?*	●	◒	◒	○	◒	◒	No	Yes	
DISCo Participation *Should DISCos participate in DG?*	◒	○	◒	○	◒	◒	No	Yes	
System Interfaces *Should DG interface with grid operations and markets?*	●	○	○	○	●	●	No	Yes	
Interconnection *Should the interconnection technical requirements, processes and contracts be modified for DG?*	●	○	○	○	●	●	No	Yes	
Stranded Costs *Should utilities be compensated for stranded costs associated with DG* installations?	●	●	●	○	◒	●		Yes	No
Standby Charges *Should utilities be compensated for providing standby services?*	●	●	●	○	◒	●		Yes	No
Siting and Permitting *Should siting and permitting requirements be modified for DG?*	◒	○	○	●	◒	●	No	Yes	
Public Support *Should DG technologies be supported by financial incentives, subsidies or public funding of R&D?*	◒	○	○	◒	○	◒		No	Yes

Legend: ○=No Impact ◒=Moderate Impact ●=High Impact ▬=Range of potential impacts of specific policy on competitiveness of DG

All jurisdictions will eventually address these issues either explicitly or implicitly. Regulators and legislators will prioritize and focus on some or all of the eight individual DG issues according to the particular needs and goals of their jurisdictions. The analysis presented here also identifies the scope of impacts that each of the eight issues may have on five relevant public policy objectives, plus one DG-specific objective. This perspective on the potential effects of decisions (or indecision) on DG issues can help policymakers establish priorities for when and how to address them.

Although all of these policy issues could affect the relevant regulatory policy objectives selected for this analysis, they link most directly with two of them. The strongest linkage is with the objective to Encourage Competition and Economic Efficiency, followed by the need to Ensure Safety and Grid Reliability. This is a reasonable outcome because while DG may help reshape the competitive market landscape, it also poses substantial technical challenges that must be met before it can be successfully integrated with grid operations.

The analysis also suggests that the five DG policy issues rated as having high impact on the policy goal of a competitive environment for DG are particular priorities for consideration by regulators and legislators. Depending on how these issues are resolved within the context of local market and regulatory conditions, they could place DG at either a significant disadvantage or advantage in the market. Proactive, balanced regulatory initiatives on these high impact issues could be critical in ensuring a neutral playing field for DG. These priority DG issues include:

- *System Interfaces*
- *Interconnection*
- *Siting and Permitting*
- *Stranded Costs*
- *Standby Charges*

Policymakers in some states actively formulating DG policy have concentrated on interconnection issues early in their deliberations. They have determined that these questions may be researched and answered relatively quickly to provide the credible technical foundation for subsequent deliberation on other DG issues.

Although it is tempting to simplify the policymaking process by considering specific trade-offs on an issue-by-issue basis, the impacts of policies tend to be additive in nature. Decisionmakers therefore need to be cognizant of the cumulative impact of their actions on DG and the public interest. For example, all DG policy issues identified in this analysis have a moderate to high impact on the broad goal of encouraging competition and economic efficiency. Thus, the collective effect of individual decisions on the types of issue questions raised here could be substantial for the marketplace in general, as well as for DG in particular.

Although it is tempting to simplify the policymaking process by considering specific trade-offs on an issue-by-issue basis, the impacts of policies tend to be additive in nature. Decisionmakers therefore need to be cognizant of the cumulative impact of their actions on DG and the public interest.

By understanding these issues and determining the value of DG to their stakeholders, regulators and legislators will position themselves well to develop informed policies that will shape the future of the U.S. electricity industry.

The United States is in the early stages of its DG debate. As this discussion expands and the number of participants grows, more policymakers will be challenged by stakeholders to:

- *Maximize the operational benefits of DG to both DG owners and the U.S. electric power system without jeopardizing safety or grid reliability*
- *Allocate the economic benefits and costs of DG and grid-related operations fairly among DG owners, utilities and other market players, and customers*
- *Address possible economic and regulatory market barriers for DG*
- *Provide public financial support to encourage DG research, development and demonstration (RD&D) to obtain significant public benefits.*

By understanding these issues and determining the value of DG to their stakeholders, regulators and legislators will position themselves well to develop informed policies that will shape the future of the U.S. electricity industry.

Preface

This white paper is one in a series of discussion documents designed to assist regulators, legislators, and other interested parties in understanding and evaluating issues associated with distributed generation (DG). The analysis presented here frames the DG policy debate by condensing a wide range of questions into a group of eight fundamental policy issues that all jurisdictions will eventually address, either explicitly or implicitly. This paper does not specifically answer any policy questions, but rather is designed to provide a balanced, concise representation of major high level arguments on different sides of each issue. An understanding of the range of impacts that each issue has on broader policy goals enables policymakers to set priorities for investigating their concerns and preparing responses. By understanding the value of DG to their stakeholders, they will position themselves well to develop informed policies that will shape the future of the U.S. electricity industry.

I. Introduction

Distributed generation (DG) is the integrated or stand-alone use of small, modular electric generation close to the point of consumption. It is installed for the benefit of a specific customer and/or an electric system. DG is emerging as a result of three independent trends–utility industry restructuring, increasing system capacity needs, and technology advancements–that are concurrently laying the groundwork for its possible widespread introduction. The technology differs fundamentally from the traditional model of centralized electric power generation and delivery. It can be located near end-users within an industrial area, inside a building, or in a community. In addition, DG facilities can be operated remotely and used in a broad range of customer-sited and grid-sited applications where central plants would prove impractical. This nontraditional operating model has drawn strong interest because of its potential to cost-effectively increase system capacity while meeting the industry restructuring objective of market-driven, customer-oriented solutions.

DG is a nontraditional operating model that has drawn strong interest because of its potential to cost-effectively increase system capacity while meeting the industry restructuring objective of market-driven, customer-oriented solutions.

Many distinctly different power generation technologies are classified as DG. These technologies vary by size, application, and efficiency. Some, such as reciprocating engines and gas turbines, have been commercially successful for decades. Others, such as fuel cells and microturbines, are relative newcomers to this classification, with substantial technical improvements expected within the next few years.

DG provides policymakers, regulators, and the market with flexible options to address the challenges posed by system capacity shortfalls. Long-term demand is now expected to grow faster than projected at a time when planned generating capacity is not keeping pace. Exacerbating this problem, few bulk transmission additions are anticipated, and industry restructuring has resulted in substantial reduction–and in some cases outright confusion– in the coordination of generation and transmission planning. There is a particular need for corrective action in certain capacity-constrained distribution systems, typically in older, densely populated urban areas. Such system upgrades generally require significantly higher levels of investment per kilowatt than standard generation and transmission improvements. Under these conditions, it can be extremely expensive to pursue traditional engineering solutions that use the central plant model to increase generation, transmission, and distribution capacity. Furthermore, that process typically requires years for design, approval, and installation. As the market seeks solutions to system capacity constraints, proponents suggest that the most

Nevertheless, DG does pose important technical and policy concerns, and will not be the superior solution in every situation. Markets and infrastructures vary dramatically across the United States, and DG must be evaluated against local conditions.

cost-effective sources of new power might frequently be distributed generators; that is, smaller, strategically located facilities that avoid transmission and distribution (T&D) infrastructure costs while offering the end-user higher power quality and overall reliability than grid power alone. DG could give capacity-constrained utilities an innovative opportunity to simultaneously meet load growth and relieve transmission constraints.

DG also offers regulators and legislators important ways to meet the industry restructuring objective of market-driven solutions. DG can be a suitable application in a variety of technical and business settings. It can be deployed in different types of locations in the distribution system, and may be implemented by a range of market participants, from regulated vertically integrated utilities and distribution companies (DISCos), to business entities resulting from power industry restructuring, to the actual end-use customer. Regulated entities could use DG to provide important benefits to the T&D system while avoiding direct, less cost-effective T&D investments. Unregulated market competitors could adopt DG to lower costs to their customers, provide additional services, and possibly export power. End-use customers could install DG to reduce energy spending and obtain other benefits such as increased reliability and power quality.

Nevertheless, DG does pose important technical and policy concerns, and will not be the superior solution in every situation. Markets and infrastructures vary dramatically across the United States, and DG must be evaluated against local conditions. In addition, serious issues have been raised about DG in relation to both the protection of the grid's integrity and the economics of shifting to new sources of power while still meeting existing infrastructure and financial commitments. Industry restructuring is changing the rules for power market participation in many states, and DG presents some complications for such reforms.

This white paper is a concise framework to assist regulators, legislators and other interested parties as they navigate these key issues. Additional context for these policy discussions is provided by two other white papers in this series. The first, "Distributed Generation: Understanding the Economics," profiles several DG technologies and addresses the key questions related to costs, benefits and competitiveness of DG compared to traditional central plant solutions. The second, "Distributed Generation: System Interfaces," offers a detailed examination of issues surrounding interconnection and the interface of DG with the electric power system.

II. Mapping the Issues

Due to DG's emergence, policymakers now face a wide-ranging set of questions related to DG technology, its operational impacts, economics, siting and permitting, and competitive issues. While these questions might initially seem disparate, after analysis, they coalesce around several defining topics. This conclusion is supported by a structured three-step analysis conducted for this white paper in which an exhaustive list of questions has been distilled and mapped into a focused set of eight fundamental DG policy issues.

Due to DG's emergence, policymakers now face a wide-ranging set of questions related to DG technology, its operational impacts, economics, siting and permitting, and competitive issues. While these questions might initially seem disparate, after analysis, they coalesce around several defining topics.

Figure 1 below summarizes the overall analytical approach to organizing and understanding these key issues.

Figure 1: Issue-Mapping Process

Identify the Issues

Develop comprehensive list of DG questions through:
- Analysis of regulatory actions
- Interview program
- DG case studies

Organize the Issues

Conduct issues analysis and topic affinity assessment to group questions into policy areas.

Rationalization

Distill questions into eight fundamental DG policy issues.

In Step 1, an extensive list of questions about DG was assembled from several sources designed to represent the broad range of interests in DG. These sources included reviews of current regulatory actions and debates on the state and federal levels, case studies of DG installations, and interviews with state regulators, legislators, utilities, and equipment manufacturers. In Step 2, the issues were organized into separate policy areas. Once the policy issues were grouped together, rationalization (Step 3) produced a natural consolidation into a minimum number of mutually exclusive yet comprehensive issues for debate. An illustrative question was included to capture the nature of each policy issue.

The eight fundamental DG policy issues are as follows:

1. *Grid-Side Benefits: Should grid-side benefits of customer DG be monetized and allocated among stakeholders?*
2. *DISCo Participation: Should DISCos participate in DG?*
3. *System Interfaces: Should DG interface with grid operations and markets?*
4. *Interconnection: Should the interconnection technical requirements, processes, and contracts be modified for DG?*
5. *Stranded Costs: Should utilities be compensated for stranded costs associated with DG installations?*
6. *Standby Charges: Should utilities be compensated for providing standby services?*
7. *Siting and Permitting: Should siting and permitting requirements be modified for DG?*
8. *Public Support: Should DG technologies be supported by financial incentives, subsidies, or public funding of R&D?*

III. The Policy Questions Framed

Introduction

It is within the purview of regulators to design a strategy dictating when and how these eight fundamental DG policy issues are resolved for their jurisdictions. What follows is a framework to help policymakers understand what is at stake for each issue, including some of the trade-offs between competing policy considerations. For each issue, we describe the crux of the debate, the policy objectives that the issue will affect, and the range of potential impacts that could emerge from certain policy responses.

The policy analysis presented in this paper measures the potential impact of each of the eight DG policy questions on five relevant public policy objectives as well as a sixth DG-specific policy goal.

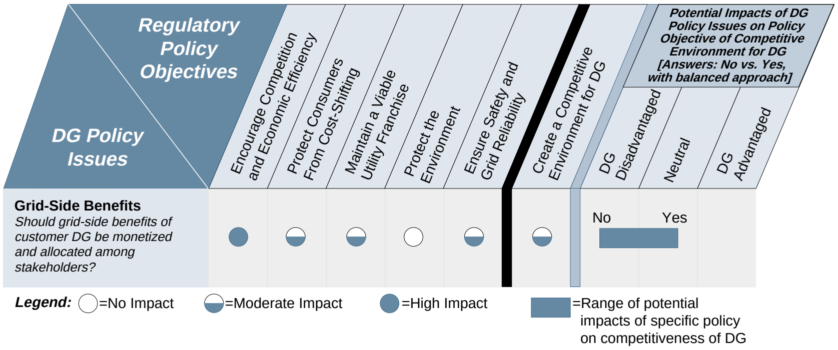
The policy analysis presented in this paper measures the potential impact of each of the eight DG policy questions on five relevant public policy objectives as well as on a sixth DG-specific policy goal. The following are the five relevant public policy objectives:

- *Encourage competition and economic efficiency*
- *Protect consumers from cost-shifting*
- *Maintain a viable utility franchise*
- *Protect the environment*
- *Ensure safety and grid reliability*

The DG-specific public policy objective–Competitive Environment for DG–is a subset of the broad overall objective of encouraging competition and has been included to show how individual decisions affect the competitive environment for DG in particular. This policy objective is stated as the creation of a competitive environment in which DG can compete based on its full range of attributes, without unfair support or constraint. The objective does not stipulate that DG must necessarily be successful. While this objective might not be a priority for every decisionmaker, it represents a perspective that may be useful for those evaluating DG policy options.

The potential impacts of the eight key policy issues on this DG-specific objective are measured in two ways. The first measure summarizes the overall magnitude of impact, as was done for each of the other five broad policy objectives, without describing the actual nature of the impact. The second measure, which is applied only to the DG-specific policy objective, describes potential impacts of two possible answers to the illustrative questions provided for each policy issue. One possible answer is "No" ; the other is "Yes, with a balanced approach," which indicates that an equitable solution is developed which reflects a reasonable or fair compromise among the major parties in the debate. We do not suggest what this solution would be, as it will no doubt vary across jurisdictions, depending both on the interests of stakeholders and regulatory and market conditions. It is also possible that decision-makers will not develop "balanced" policies and, therefore, could create disadvantages or advantages for DG not reflected in our results. As an example of our approach, Figure 2 below shows the potential impacts of the Grid-Side Benefits policy issue.

Figure 2. Range of Impacts for Grid-Side Benefits Issue



The symbol ◒ indicates that the issue would have an overall moderate impact on the policy objective of creating a competitive environment for DG. Depending on how the illustrative question is answered, the actual impact could range from Neutral to DG Disadvantaged, as shown by the positioning of the bar in relation to the three columns on the right side of the figure. In other words, a "No" decision that would not monetize and allocate any grid-side benefits from customer DG could, at worst, limit the competitive environment for DG. A "Yes, with a balanced approach" decision that would distribute any grid-side benefits from customer DG in a balanced manner could, at best, make the competitive environment Neutral for DG.

Grid-Side Benefits

A key question in the policy debate is whether the grid-side benefits of customer DG should be monetized and allocated among stakeholders. Customer-side DG could provide several grid-side benefits to its host utility:

- *Deferment of T&D investment*
- *Reduction of T&D losses*
- *Relief of transmission congestion*
- *Reduction of spinning or reserve margins*
- *Provision of reactive power*
- *Assistance in "black start"*

Most participants in the DG debate agree that DG will provide grid-side benefits in at least some situations, but disagree about their economic value. To date, no regulatory authority and few, if any, DG contracts have quantified the grid-side benefits of customer-side DG. To resolve this issue, individual jurisdictions should calculate the grid-side benefits of customer DG. If those benefits are shown to be significant, as is assumed for the purpose of this discussion, then the debate can resume as to whether and how to monetize and allocate them.[1]

Most participants in the DG debate agree that DG will provide grid-side benefits in at least some situations, but disagree about their economic value. To date, no regulatory authority and few, if any, DG contracts have quantified the grid-side benefits of customer-side DG.

Proponents argue that DG can provide the most economically efficient solution to infrastructure needs if the market sends the correct price signals by compensating DG owners for the benefits they provide to the grid. Utilities counter that calculating these benefits is not a simple matter, and that it is impossible to generalize about the value of the possible grid benefits of customer DG. They point out that DG may even add cost to the utility (and the grid) under some circumstances. This suggests that the policy issue challenge is to facilitate sending the correct market signals given local conditions, which will vary–often significantly–in different geographic markets.

A critical factor in quantifying these benefits is explicit recognition of their highly location-specific value. For instance, DG has the highest value in deferring T&D investment when the distribution system is near its maximum capacity. There are also important potential grid-side costs of DG, such as the need to equip and manage the distribution system to handle reverse flows of power. Added DG costs to the grid are just as site-specific as the benefits. Thus, the practice of compensating distributed generators for the average net benefit (benefit minus cost) to a particular T&D system may send price signals that are just as distorted as no compensation. This issue of averaging is not limited to DG, however. It can be argued that distribution companies (DISCos)[2] charge customers based on the average cost to serve, even though the real costs vary greatly by location. Regulators, therefore, may be asked to consider new rate structures, including geographic pricing within the distribution system or an average value of the cost/benefit of DG.

Utilities often also maintain that grid-side benefits are meaningful only when DG is used as part of utilities' long-term T&D planning. (The issue of DISCo participation in DG is discussed as a separate policy issue below.) Arthur D. Little interviews with DISCos indicate that most utilities appear to view DG as a short-term fix to defer T&D investments. In this case, its value is difficult to quantify outside the broader planning context. Utilities are skeptical about planning system capacity on the basis of peak shaving conducted independently by the customer. Ultimately, utilities are responsible for system reliability, yet they may not be assured of control over por-

---

1. Additional discussion of the financial aspects of grid-side benefits is presented in Distributed Generation: Understanding the Economics.
2. A DISCo is defined as a regulated wires-only company.

Many observers recognize that DISCos may be in the best position to identify favorable locations for DG from the perspectives of both the customer and the distribution network.

tions of their systems involving customer-side DG. Consequently, utilities are likely to discount customer-side DG in their planning unless they have control over the equipment, either through direct dispatch control or through contracting.

As seen in Figure 2, this issue primarily affects public policy objectives relating to competition (both generally and for DG) and economic efficiency, protection of consumers from cost shifting, utility franchise viability, and safety and grid reliability. Grid-side benefits affect market competition and economic efficiency because they potentially influence the price competitiveness of DG and encourage the selection of the most cost-effective solution for infrastructure upgrades. The allocation of grid-side benefits could create financial imbalances that lead to cost-shifting among consumers. Grid reliability is a significant potential grid-side benefit of DG, especially if price signals in the market encourage increased recognition and utilization of DG for grid reliability.

Decisions regarding grid-side benefits could have impacts of either Neutral or DG Disadvantaged on the policy objective of a competitive environment for DG, as also seen in Figure 2 above. If grid-side benefits of customer DG are found to be significant, but are not monetized and allocated, then DG owners will not be compensated for them. In a worst-case scenario, this could reduce the overall incentives for customer-side use of DG and specifically lower the probability that DG would be fully utilized to benefit the grid. In contrast, under best-case assumptions, if grid-side benefits are fairly allocated so customers are rewarded for what they offer the grid, this would help create a competitive market environment that is Neutral for DG. Under these conditions, DG would be on a level playing field against competing alternatives, based on its full range of attributes. DG could not be certain to win in any given situation, but it would be judged in the marketplace in part by the economic value of its grid-side benefits.

DISCo Participation

The second major question is whether DISCos should be allowed to participate in DG. As electric utility restructuring sweeps across the nation, many states are unbundling vertically integrated utilities, opening up generation and retail operations to competition. At the same time, transmission and distribution functions are remaining regulated entities known as TRANSCos and DISCos respectively. Many observers recognize that DISCos may be in the best position to identify favorable locations for DG from the perspectives of both the customer and the distribution network. Opinions diverge, however, on how this unique position and understanding should translate into good public policy.

From a policy perspective, one of the principal reasons for the required divestitures associated with utility industry restructuring is to prevent utilities from having market power and privileged access to customers. DISCo ownership of DG resources could create market power on a localized scale through the DISCo's unique access to customers. This could threaten open markets and customer choice. Indeed, those who argue that DISCos should not be allowed to own DG believe that separating the power transportation and competitive functions is the only means of ensuring that all energy service providers (ESPs) have open and nondiscriminatory access.

DISCo ownership of DG resources could create market power on a localized scale through the DISCo's unique access to customers. On the other hand, depending on local conditions, DISCos may have the opportunity to use DG to provide important benefits to the T&D system while avoiding direct, less cost-effective T&D investments.

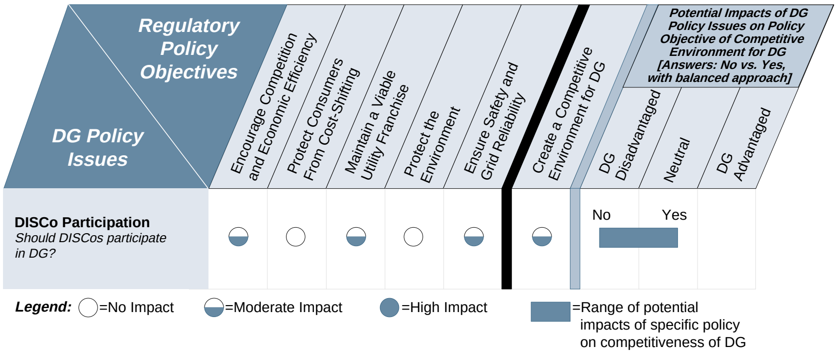
On the other hand, depending on local conditions, DISCos may have the opportunity to use DG to provide important benefits to the T&D system while avoiding direct, less cost-effective T&D investments. Clearly, many DISCos are in an ideal position to realize the grid-side benefits of DG under current rate structures. The cost of providing distribution services can vary widely, even within a particular utility's service territory. In general, rate structures do not reflect this cost variability. Therefore, it is the distribution utility, rather than the customer, that is in the best position to recognize the price signal indicating where and when DG can provide the greatest benefit to the system. Indeed, even third-party developers of DG are not strategically positioned to recognize this price signal. If performance-based ratemaking (PBR) mechanisms give the DISCos incentives to reduce costs, then those companies can capture the grid-side benefits of DG through distribution capacity planning. Some have argued that for this approach to be realistic and for full grid-side benefits to be achieved, a DISCo must have dispatch control over the DG capacity.

If, under certain technical and market conditions, DG can be the most economical and sensible solution for strengthening the T&D system, this suggests that DISCos should be allowed to own DG, but there are other possible solutions as well. These approaches could allow DISCos to use DG for effective distribution-system planning without direct ownership. For example, a DISCo or an independent third party could solicit bids for DG capacity within its system. If a DG bid is less expensive than the equivalent wires solution, then the winning bidder would build, own, and operate the DG unit and enter into a capacity contract with the DISCo.

As indicated in Figure 3, the DISCo participation issue primarily affects policy objectives relating to competition (both generally and for DG) and economic efficiency, utility franchise viability, and safety and grid reliability. The role for DISCos in DG clearly affects competitive market dynamics and economic efficiency. Their ability to participate and the conditions for participation may influence their business performance, especially in areas where DG becomes broadly adopted. The question of DISCo deployment of DG, possibly to enhance the local T&D network, will also have ramifications for grid reliability.

> *If DISCos are not allowed to participate directly in DG, then other mechanisms will be necessary to ensure that the correct price signals for the distribution system reach market participants, including customers.*

Figure 3. Range of Impacts for DISCo Participation Issue



The influence of DISCo participation in DG on a competitive environment for DG could range from Neutral to DG Disadvantaged. If DISCos are denied any positive business role in the use of DG, these companies would be motivated to pursue alternative non-DG strategies that provide acceptable business value. In this case, the policy objective of a competitive DG market environment, particularly for proving T&D benefits, could, at worst, be negatively affected. In this case, de facto barriers against DG would be created as DISCos pursued alternatives, primarily on the basis of the allocation of economic benefits. Conversely, policies could allow DISCos to benefit from deployment of DG in a balanced manner that encourages DG competition in T&D solutions. Under these conditions, the potential impacts on this objective would be Neutral, with the technology being allowed to compete for all its potential applications, including T&D support.

Ultimately, policymakers will need to weigh the merits of maintaining a pure transportation DISCo versus allowing DISCos to use DG as a tool to expand and operate their systems more cost-effectively. If DISCos are not allowed to participate directly in DG, then other mechanisms will be necessary to ensure that the correct price signals for the distribution system reach market participants, including customers. In this case, the allocation of grid-side benefits and costs becomes increasingly important (refer to Grid-Side Benefits issue).

System Interfaces

The third critical question in the debate involves DG interfaces. Interfaces are at the point of interaction between DG and the energy infrastructure. Today, these interfaces are generally physical, but in some instances can include a market dimension as well. Physical interfaces are mainly concerned with issues such as safety, protocols, system impacts, reliability, standards, and metering. The market interface covers how the DG unit or its owner reacts or competes with other suppliers in the marketplace. The market interface includes concerns over dispatch, tariffs, pricing signals, response, and business and operational decisions. A detailed analysis of the issues is presented in "Distributed Generation: System Interfaces."

Policy decisions about system interfaces will need to weigh the costs of increased complexity against the DG owner's benefits of operational flexibility and access to power markets.

Few of the DG installations today interface extensively with energy markets or infrastructure, and doing so presents potentially significant technical and business challenges. Broad adoption of this practice will increase greatly the number of market participants and linkages between DG installations and the grid, and result in higher levels of operational complexity. While the required distribution network architectures and procedures are not yet in place for extensive DG interface with the grid, supporters contend that their absence should not discourage a decisionmaker from taking steps towards this goal. They point to the gradual development of the current deregulated telecommunications system as a useful analogy. The complexity of that system, which evolved over time to meet increasing market demands, now accommodates many different types of users, equipment, and activities. Policy decisions about system interfaces will need to weigh the costs of increased complexity against the DG owner's benefits of operational flexibility and access to power markets.

A major consequence of increasing complexity is that system operation and transaction costs may increase. Current control and operations systems were established for fewer, larger generators. Depending on how it is operated, DG may ultimately necessitate investments aimed at increasing the capacity of these control and communication systems. Some observers argue that it may be premature to develop these systems until DG technologies prove themselves to be economically and technically viable solutions for customers. Transaction costs per unit of energy could also increase from DG market activity and settlements, since they are generally dependent on the number, rather than size, of transactions.

At the same time, DG may be attractive to more customers if they gain increased market access and operational flexibility. DG owners could sell their surplus power to the grid, thereby creating an additional stream of income that could further justify a DG investment. Power sales might be particularly lucrative during peak grid consumption periods when the cost of DG power is less than market clearing prices.

DG proponents contend that for DG to reach its highest potential, distributed generators must gain full access to power markets. It can be argued that without access to energy, capacity and other ancillary service markets, distributed generators will not be able to take advantage of the full value of their DG systems. Market access could

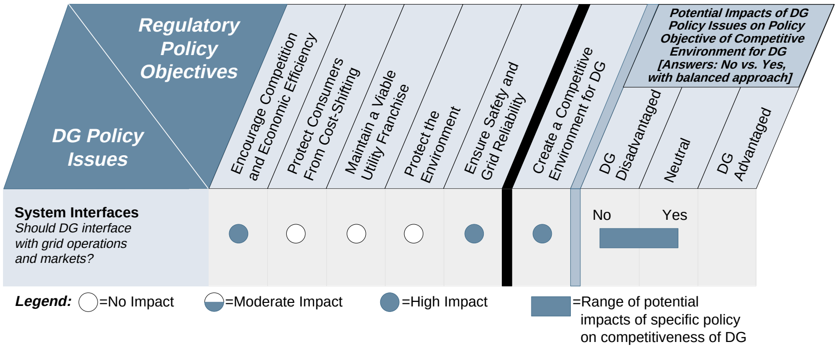
Depending on how it is operated, DG may ultimately necessitate investments aimed at increasing the capacity of these control and communication systems.

require the development of bidding, scheduling and dispatch protocols that take DG into account, as well as the technical infrastructure to support them and ensure the integrity of the grid.

Potential policy outcomes lie on a continuum of market access and complexity. At one end, distributed generators are given zero access, and are only allowed to use DG for on-site demand. Under these conditions, DG is very similar to demand side management (DSM) and adds little complexity to grid operations beyond interconnection requirements. At the other end of the policy continuum, DG units are dispatched either individually or together with other DG installations and given access to the same markets as central-station plants. Alternative options exist between these two extremes, such as allowing DG owners access to markets, with specific limitations on factors such as minimum size, bidding and dispatching. Net metering could monitor customer power-usage patterns and account for both customer purchases from the grid and the delivery of electricity to others via the distribution system.

Figure 4 shows that DG system interface primarily affects public policy objectives relating to competition (both generally and for DG) and economic efficiency, and safety and grid reliability. Competition and economic efficiency could be influenced by the possible presence of new, competitive sources of power in the market that might enhance grid operations. Similarly, grid safety and reliability are key concerns related to grid interconnection due to the potential to increase technical risk as well as opportunity.

Figure 4. Range of Impacts for System Interfaces Issue



Regulatory Policy Objectives / **DG Policy Issues**	Encourage Competition and Economic Efficiency	Protect Consumers From Cost-Shifting	Maintain a Viable Utility Franchise	Protect the Environment	Ensure Safety and Grid Reliability	Create a Competitive Environment for DG	*Potential Impacts of DG Policy Issues on Policy Objective of Competitive Environment for DG [Answers: No vs. Yes, with balanced approach]* DG Disadvantaged	Neutral	DG Advantaged
System Interfaces *Should DG interface with grid operations and markets?*	●	○	○	○	●	●	No ▬	▬ Yes	

Legend: ○=No Impact ◒=Moderate Impact ●=High Impact ▬=Range of potential impacts of specific policy on competitiveness of DG

Policy decisions on DG system interfaces with the grid could have an impact on a competitive DG environment ranging from Neutral to DG Disadvantaged. A public policy that prohibits DG interfaces has, at worst, the potential to significantly limit the competitive environment for DG. Under these circumstances, potential DG customers may be dissuaded from adopting DG if they do not have the ability to sell power or services to others. If interface is allowed, there could be, at best, a Neutral impact that would enable the market to evaluate DG technology on the basis of its full range of capabilities.

Regulators and legislators must weigh the benefits of additional power sources for the grid, and the business opportunities that this approach offers, against potential downside concerns. These concerns include the technical risks posed by such a system of electrical interfaces, as well as the operational and financial impacts of new DG installations on the existing power system and market participants in their jurisdictions. While individual parties could either benefit or be threatened by various DG interface scenarios, the ultimate decision criterion must be the cumulative effect that such changes might have on the public good, as defined by the policymakers' responsibilities.

Although interconnection requirements are already in place in utilities across the United States, in the vast majority of cases they are not adequately defined for consideration of DG as it now exists.

Interconnection

The fourth essential question in the debate on DG concerns the interconnection aspect of the electrical interface. Interconnection technical requirements, processes, and contracts are currently receiving high levels of attention and visibility. Although it is possible to operate DG equipment in "island mode," isolated from the grid, many DG customers are expected to prefer or require interconnection. There are several reasons for this (as discussed in the previous section on System Interfaces), including a customer's possible desire to use the grid to supply part of their load, provide back-up for their equipment, and/or enter into commercial bilateral contracts to sell power. The key element in the interconnection issue is the balance between efficiency and fairness on one hand and safety and reliability on the other.

The cost of grid interconnection could be a major barrier for customer-sited DG. A key focus of this discussion is the potentially excessive cost associated with the technical requirements, processes, and contracts for interconnection. Although interconnection requirements are already in place in utilities across the United States, in the vast majority of cases they are not adequately defined for consideration of DG as it now exists. Current technical, procedural, and contractual practices for interconnection were developed under the vertically integrated, regulated monopoly paradigm for Qualifying Facilities (QF) under PURPA[3] . Utilities designed these practices to apply to typical QF designs, which were large (5 to 50 MW) customized installations. Today, utilities still consider DG interconnection primarily on a case-by-case basis. While this may be adequate for large industrial cogeneration facilities, each

---

3. Public Utilities Regulatory Act of 1978.

Electric utilities in most jurisdictions currently develop and administer interconnection requirements. The present patchwork system of utility-level control has created non-uniform technical requirements.

with a unique engineering design, it may be overly cumbersome and restrictive for smaller (2 kW to 20 MW), mass-produced DG technologies with standardized performance profiles.

Electric utilities in most jurisdictions currently develop and administer interconnection requirements. The present patchwork system of utility-level control has created non-uniform technical requirements. The complexity, documentation, and cost of these interconnection requirements vary widely by utility. Many utilities require spe-

Interconnection Standard Development Activity

Some states have already undertaken initiatives to provide more uniformity in DG interconnection. New York issued guidelines in December 1999 for DG interconnections of 300 kVa or less linked via a radial distribution system. Texas issued enforceable interconnection requirements for DG installations of 10 MW or less in November 1999, and is preparing a detailed interconnection manual for release in 2000. In support of the California Public Utilities Commission, the California Energy Commission has initiated a series of workshops to explore revisions to the current interconnection rules that will be complete by early 2001. A similar process is underway in Arizona.

There are some common approaches emerging in DG policy development at the state level. Interviews with regulatory staff in California, New York and Texas revealed that policymakers there view the resolution of the interconnection issue to be an appropriate early step in setting DG public policy because it establishes technical ground rules and credibility for DG in the subsequent phases of policy development. Moreover, interconnection questions are fundamentally technical in nature, and can be addressed relatively quickly and in a straightforward factual manner. Other regulatory debates on topics such as the allocation of economic benefits and costs are expected to require more time to resolve, and cannot realistically proceed without agreement on interconnection standards and approval processes.

On a national level, the Institute of Electric and Electronic Engineers (IEEE) is now developing a universal set of interconnect requirements that will be available in the year 2002. These are expected to provide highly credible, standardized technical guidance on this topic. (These IEEE standards will address the technical requirements, but will not address the process or contracts that DG must undertake in order to interconnect.) Until IEEE standards are released, state regulators may choose to develop their own interconnection standards, or they may be requested to rule on the adequacy and fairness of technical requirements imposed unilaterally by individual utilities.

cific technology solutions using equipment from particular vendors for interconnection, rather than stipulating functional requirements. This situation makes standardized interconnection designs across utilities impossible.

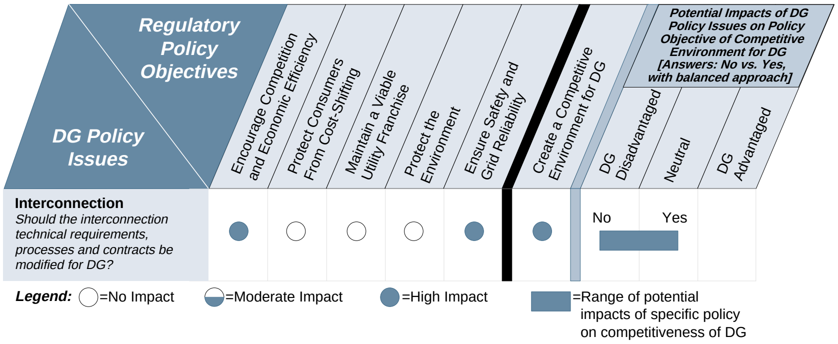
Distribution companies are reluctant to simplify processes and contracts or reduce technical standards in their interconnection requirements. They view these processes, contracts and technical requirements as their primary means of ensuring the safety and reliability of their systems and the protection of their employees. Utilities consider this issue to be a particularly important one, given the complex operational issues that will arise if DG connections to the grid increase substantially. These issues are discussed in greater detail in "Distributed Generation: System Interfaces."

Utilities view interconnection processes, contracts and technical requirements as their primary means of ensuring the safety and reliability of their systems and the protection of their employees.

This issue primarily affects broad public policy objectives relating to competition (both generally and for DG) and economic efficiency, and safety and grid reliability. Interconnection requirements and costs may influence how DG is deployed, and the degree of competition and efficiency in the electric power supply marketplace. These requirements will also directly influence safety and grid reliability through the technical standards adopted, as well as through the extent to which they determine the scale of impacts by influencing DG market penetration.

Figure 5 indicates that the interconnection issue presents potential policy impacts on a competitive environment for DG that range from Neutral to DG Disadvantaged. If the technical requirements and the approval and contracting processes for interconnection are unreasonably rigid, lengthy, and costly, the competitive environment will place DG at a disadvantage. DG proponents argue that with the exception of some states now acting on this issue, the current set of public policies, which were not designed to create a competitive environment for DG, represent real barriers to market adoption. Thus, no changes in policy would reflect an implicit decision to restrain DG. At worst, this could harm the competitive environment for DG by reducing customer choice and limiting potential energy options, cost savings opportunities, and other possible benefits for some customers and regions.

Figure 5. Range of Impacts for Interconnection Issue



Regulatory Policy Objectives / DG Policy Issues	Encourage Competition and Economic Efficiency	Protect Consumers From Cost-Shifting	Maintain a Viable Utility Franchise	Protect the Environment	Ensure Safety and Grid Reliability	Create a Competitive Environment for DG	Potential Impacts of DG Policy Issues on Policy Objective of Competitive Environment for DG [Answers: No vs. Yes, with balanced approach]: DG Disadvantaged	Neutral	DG Advantaged
Interconnection *Should the interconnection technical requirements, processes and contracts be modified for DG?*	●	○	○	○	●	●	No ▬	Yes ▬	

Legend: ○=No Impact ◒=Moderate Impact ●=High Impact ▬=Range of potential impacts of specific policy on competitiveness of DG

Conversely, if interconnection policies could be designed in a balanced manner to both address public interest concerns and allow market consideration of DG's capabilities, DG would be moved to a Neutral position in a competitive environment. In this case, the key would be developing and administering standards that allow for efficient use of the latest interconnection technology that maintains today's high levels of grid safety and reliability.

Stranded Costs

The fifth key question in the DG debate is whether utilities should be compensated for stranded costs that result from DG installed at a utility customer's site. Stranded cost recovery is a balancing act between the rights and responsibilities of various stakeholders with different and potentially competing interests. One set of interests include meeting the financial obligations associated with investments to the power system, and protecting economic interests of those who rely on the grid for all their power requirements. Another set of interests includes encouraging new, innovative, energy-efficient technologies and minimizing energy costs to individuals through increased competition.

The debate centers around the financial implications of utility infrastructure that becomes redundant when customers install DG. Utilities have been allowed to use exit fees and competitive transition charges (CTCs) to be compensated for stranded investments.

The debate centers around the financial implications of utility infrastructure that becomes redundant when customers install DG. Utilities argue that if DG customers do not compensate utilities for stranded costs associated with DG, either utility shareholders or non-DG customers will ultimately bear the burden. Under the prior regulatory compact, utilities made investments in generation, transmission, and distribution with the assumption that they would receive a fair economic return on their assets. As a result, utilities have been allowed to use exit fees and competitive transition charges (CTCs) to be compensated for stranded investments.

CTCs have been used by many states during restructuring to pay for stranded generation assets that are no longer economic in an open power market. These charges are levied on all utility customers. The specifics of CTC accounting are critical to understanding which stakeholders would be affected by CTC exemptions for DG. In states with a fixed sum of stranded costs that may be recovered over an indefinite period of time (such as California[4]), CTC charges not paid by the distributed generator will be borne by non-DG customers. Utilities that structure their stranded cost recovery on a usage basis for a fixed period of time and allow CTC exemptions may lose some revenue unless there is sufficient demand growth to offset load lost through the exemptions.

---

[4] In California, the present status of CTC collections suggests that stranded costs will be recovered and CTCs terminated within a few years, perhaps prior to the adoption of DG rulemakings in that state.

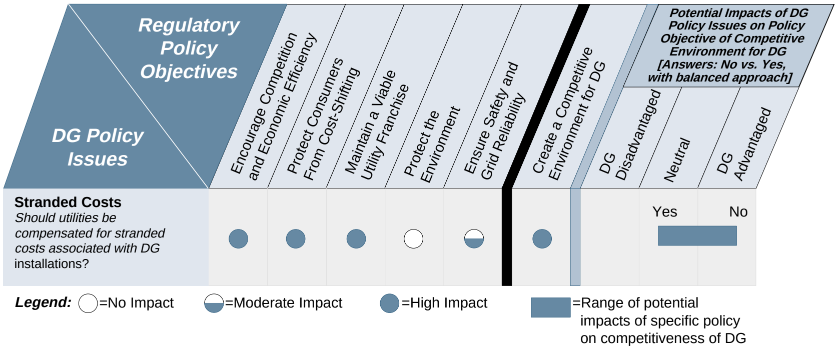
CTCs, which typically are in force for a limited period of time, are not likely to affect the long-range success of DG, but that might not be the case with exit fees. An exit fee is another form of stranded-cost recovery that a utility collects when a customer decides to leave the grid or reduce its load through DG. This charge is intended to compensate the utility for investments it has made in its systems on behalf of that customer. Utilities argue that exit fees are required by the regulatory compact to invest in infrastructure to serve all customers. When a customer decides to install DG and remove part of its existing load from the grid, this customer is responsible for stranding part of the investment and should be assessed an exit fee.

Some proponents of DG contend that the technology should be exempt from CTCs and exit fees because such charges discourage the adoption of innovative energy solutions, such as DG, that are more efficient and cost-effective, and in effect limit increased market competition. It is also argued that the amount of DG installed over the next several years is not likely to outpace demand growth, thus ensuring that the utility system experiences no net loss in load. Observers also have noted that some DG could have many of the same characteristics as DSM, including peak shaving and energy savings. When DG is characterized in this manner, public policymakers become concerned that they are discouraging energy-saving practices by assessing CTCs to customers who adopt DG.

Some proponents of DG contend that the technology should be exempt from CTCs and exit fees because such charges discourage the adoption of innovative energy solutions, such as DG, that are more efficient and cost-effective, and in effect limit increased market competition.

Figure 6 shows that this issue primarily affects policy objectives relating to competition (both generally and for DG) and economic efficiency, protection of consumers from cost-shifting, maintaining a viable utility franchise, and safety and grid reliability. Competition and economic efficiency are potentially influenced to the extent that stranded cost policy influences the market adoption of DG. The question of whether DG installations are exempted from stranded costs may determine whether cost-shifting occurs within the customer base, and also may raise considerations of financial repercussions that could affect the viability of the utility, as well as safety and grid reliability.

Figure 6. Range of Impacts for Stranded Costs Issue



Regulatory Policy Objectives / DG Policy Issues	Encourage Competition and Economic Efficiency	Protect Consumers From Cost-Shifting	Maintain a Viable Utility Franchise	Protect the Environment	Ensure Safety and Grid Reliability	Create a Competitive Environment for DG	Potential Impacts of DG Policy Issues on Policy Objective of Competitive Environment for DG [Answers: No vs. Yes, with balanced approach]: DG Disadvantaged	Neutral	DG Advantaged
Stranded Costs *Should utilities be compensated for stranded costs associated with DG installations?*	●	●	●	○	◒	●		Yes ▬	▬ No

Legend: ○=No Impact ◒=Moderate Impact ●=High Impact ▬=Range of potential impacts of specific policy on competitiveness of DG

Some policymakers have considered a balanced approach to be one in which new DG owners are charged an exit fee when the overall DG market penetration meets a certain threshold.

The stranded cost issue presents potential policy impacts on a competitive environment for DG that range from Neutral to DG Advantaged. If DG is completely exempted from any stranded cost recovery charges, it would hold an economic advantage in a competitive market environment over alternatives still subject to these charges. Conversely, if stranded cost charges are levied in a balanced manner on DG so that it is neither unfairly penalized or supported, the impact on the competitive environment for DG would be Neutral.

It should be noted that if utilities are allowed to impose stranded cost recovery charges that are not "balanced," but rather impose excessive costs on DG owners, DG could be disadvantaged. This is particularly important since this policy issue is rated as having a high impact on the DG competitive environment.

Some policymakers have considered a balanced approach to be one in which new DG owners are charged an exit fee when the overall DG market penetration meets a certain threshold. In New Jersey, the legislature sought to ensure that exit fees would not become a disincentive for customer consideration of DG. The state's restructuring legislation dictates that exit fees be imposed only after DG activity (i.e., losses to the traditional utility load) represents 7.5 percent of the total utility load in the state. Regulators do not expect DG to trigger this threshold in the foreseeable future. A similar approach has been taken by Massachusetts lawmakers, with a 10 percent threshold.

Standby Charges

The sixth major issue concerns how utilities should be compensated for providing standby and backup services associated with DG installations. Standby services are a group of services that replace or supplement a customer’s usual source of power, and are available through connection with the utility[5]. Included in the category of standby services are backup services, which supply energy or capacity during unscheduled outages of onsite generation[6]. Utility charges for standby services are distinct from stranded cost charges in that they represent a cost for a specific service, rather than an attempt to recover past investment. Nevertheless, standby charges and stranded cost charges are both costs to the consumer for actions undertaken on their behalf by the utility and, therefore, share many common policy elements and concerns.

Most of a utility's cost for providing standby service is associated with the fixed cost of the T&D system. Customers purchasing standby service pay a tariff that is usually in the form of a monthly demand ($/kW) charge. If the standby charge associated

---

5. Source: Edison Electric Institute.
6. Source: Ibid.

Case Study

Failed Project

Despite the ease of operations and attractive economic returns, a 300 kW cogeneration system was *not* installed at a hospital in California. From the project developer's viewpoint, the hospital had little risk and much to gain by going forward with the project. However, after an unsettling discussion with the regional electric utility–which stood to lose a significant portion of this customer's total power demand–the hospital management believed the project presented more problems than it was worth.

The proposed cogeneration system was to consist of two kW gas reciprocating engines, which would cover approximately 30 percent of the hospital's electrical load. The system was to be installed free of charge, and the hospital was to pay for the steam and electricity as it used them. The hospital's economic savings were projected to be $32,000 per year, reducing electricity costs by 10 percent and hot water costs by 20 percent.

However, when approached by the hospital, the regional utility prepared a discouraging worksheet comparing the cost of cogeneration to grid electricity. According to the developer, the worksheet added additional, questionable charges, including competitive transition charges, a departure charge based on 300 kW and stand-by charges for 300 kW. These charges totaled $28,000 per year and would have all but wiped out any savings the hospital anticipated from the project. The California Public Utilities Commission (CPUC) suggested that a resolution would require formal proceedings. The hospital and developer concluded that this course of action was too costly and time-consuming. In addition, the hospital did not want to damage its relationship with the utility that would be satisfying the bulk of its electricity needs. So, in the final analysis, the utility's response was sufficient to dissuade the hospital from pursuing the project.

If the standby charge associated with DG is below the actual cost of providing this service, the cost will tend to be shifted to other customers. Alternatively, overstating standby costs might discourage DG that might otherwise be attractive.

with DG is below the actual cost of providing this service, the cost will tend to be shifted to other customers. Alternatively, overstating standby costs might discourage DG that might otherwise be attractive. Depending on the circumstances, overstatement of standby charges might also encourage a customer to abandon the grid altogether. The issue of balance and fairness in backup tariffs can be complicated by the fact that the actual cost to provide this service may vary considerably from customer to customer.

Some proponents of DG would like to see changes in existing standby rates to ensure that the tariffs are fair and reasonable. In fact some argue that DG should be exempt from standby charges completely. Critics of current utility practices argue that standby services are often overpriced and do not reflect the actual cost of providing the service. In particular, they believe that most utilities do not consider the combined reliability of DG units located at different facilities and assume a distorted worst-case scenario when developing standby rates.

Utilities maintain that actual standby service costs are dependent on a complicated mix of factors that affect combined reliability, including the DG customers' locations in the system, the reliability of the DG technology in general, and the quality and maintenance of each particular installation.

In addition, DG proponents support development of lower-priced standby rate choices that are more response to the needs of individual customers. Many utilities do not offer the customer any choice in the level of reliability or the amount (kW) of standby service that they receive. For example, if a facility with a 400 kW peak demand installs a 300 kW generator, current industry practice would be for the utility to charge the customer for 300 kW of standby service. A more flexible approach might be for the owner to be able to choose to rely on the utility for 100 kW of backup power and perform load shedding for the other 200 kW when the 300 kW DG unit is unavailable. This would provide better price signals to customers by lowering initial barriers and, equally important, would reward DG technologies for reliability. This approach also links prices more closely to the actual value of the service to the customer.

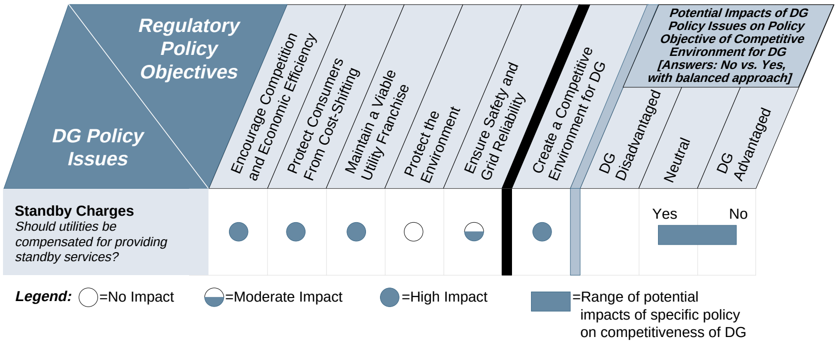
Many utilities agree that current standby rates are unfair and should be based on the cost of service. However, they contend that current standby charges are too low and do not fairly recover the full cost for providing this service. Often standby rates only cover the cost of T&D facilities and not other costs the utility can incur when providing this service (e.g., procuring back-up power for customers on spot markets). Some utilities also charge that customers in certain rate classes that have volumetric rates (e.g., small commercial and residential customers) are not paying the full costs of standby services provided to them when they install DG. These current artificially low rates can cause cost shifting and send inappropriate price signals to customers, causing them to reach economically inefficient decisions.

Utilities advise that when modifying the current rate structure to accurately reflect standby costs, regulators will have to study the physical limitations of the T&D system as well as gain a better understanding of the reliability performance of DG technologies. Flexibility in standby rate design is limited in that each customer has a dedicated portion of the T&D system that was installed solely for that customer and cannot be redeployed when the customer is not using the system. The cost of that portion of the system does not change regardless of the level of reliability the customer desires or the frequency of use by the customer. Utilities maintain that the cost of the portion of the system that a customer shares with other customers is dependent on the combined reliability of DG units and is now reflected in their rates. Moreover, actual standby service costs are dependent on a complicated mix of factors that affect combined reliability, including the DG customers' locations in the system, the reliability of the DG technology in general, and the quality and maintenance of each particular installation.

As seen in Figure 7, this issue essentially affects the same policy objectives as those for stranded costs, including competition (both generally and for DG) and economic efficiency, protection of consumers from cost-shifting, maintaining a viable utility franchise, and safety and grid reliability. Competition and economic efficiency, as well as safety and grid reliability, are potentially affected to the extent that standby-charge policy influences the market adoption of DG. The question of whether DG installations compensate utilities for these standby services -- and if so, whether it is done in an equitable manner -- may determine whether cost-shifting occurs within the customer base. It also affects decisions on the appropriate level of investment required to provide these services, which in turn could influence the viability of the utility.

Given the clear disagreements on this question, policymakers should consider what the appropriate methodology should be for the calculation of standby rates for DG facilities, including the factor for combined reliability.

Figure 7. Scope and Range of Impacts for Standby Charges Issue



The standby charge issue presents potential policy impacts on a competitive environment for DG that range from Neutral to DG Advantaged. If public policy provides a "No" response to the question as posed in this analysis, allowing customers to avoid paying for backup charges, or if it establishes a rate structure that is artificially low for the services offered, then DG would receive an advantage in the competitive market environment. In this case, the charges would not reflect the actual cost of providing the service (net of any DG benefits to the system as a whole). Other utility customers would be forced to subsidize DG through their own standby rates. Alternatively, a policy that responds "Yes, with a balanced approach" to the question would allow utilities to charge a standby rate that fairly compensates the utility for the services it provides. In this instance, the effect on the competitive environment would be Neutral, as standby charges would not unreasonably constrain DG.

It should be noted that if utilities are allowed to charge standby rates that are not "balanced," but rather impose excessive costs on DG owners, DG could be disadvantaged. This is particularly important since this policy issue is rated as having a high impact on the DG competitive environment.

Policymakers are now being asked to consider whether there are opportunities to reduce the time and cost associated with siting and permitting DG and still protect–and perhaps even strengthen–the environment, public health and safety, and other social priorities.

Given the clear disagreements on this question, policymakers should consider what the appropriate methodology should be for the calculation of standby rates for DG facilities, including the factor for combined reliability. In an environment that is placing increasing emphasis on more customer choice and flexibility, policymakers must weigh the value of offering a variety of standby service options and pricing structures against the utility's costs and business risks of doing so. This is particularly important for backup services provided during unscheduled outages. Strictly in terms of DG, supporters contend that consumers are poorly served if standby rates–the cost of the customer's power safety net–are used to discourage the adoption of DG installations that could help reduce system-capacity constraints and thereby increase grid reliability.

Siting and Permitting

The seventh question in the policy debate is whether siting and permitting requirements should be modified for DG. Policymakers are now being asked to consider whether there are opportunities to reduce the time and cost associated with siting and permitting DG and still protect–and perhaps even strengthen–the environment, public health and safety, and other social priorities. As pressures grow for access to increasingly efficient and environmentally friendly power, regulators and legislators are beginning to evaluate options to restructure environmental and siting requirements to remove potentially unproductive barriers to DG.

While many DG facilities are too small to trigger most states' power generation facility siting requirements, which were established for central plants, they may well be required to comply with local, state, and regional permitting requirements, as well as building and fire codes. Issues typically relate to location-specific concerns. The main focus is frequently air emissions, but other local sensitivities may include factors such as noise, aesthetics, land use, and risk communication. Local requirements may dictate an additional set of proceedings for issues related to the use of natural gas. Overall, there may be several applicable (and potentially overlapping) permits, codes, and requirements for a DG project, each with its own separate process, constituency and decisionmakers.

Of these various permitting considerations, DG supporters believe that several interrelated air permitting issues in particular deserve the serious attention of legislators and regulatory officials:

- *The context for air permitting decisions is typically "emissions per unit of fuel consumed," and not "emissions per unit of power produced," or, in the case of combined heat and power, "kilowatt-hours and equivalent energy produced." This perspective can serve to discourage energy efficiency and pollution prevention.*

- *The Clean Air Act in effect grandfathers many old, central power generation facilities with very high emission levels. As a result, new source performance standards typically encourage the use of existing power plants that may well have dramatically inferior emissions profiles. It is particularly difficult to site new, more environmentally friendly DG facilities in "non-attainment" locations with air pollution concentrations that exceed the requirements of the Clean Air Act, despite the possibility that these installations may eventually lead to overall emission reductions.*

- *The regulations dictating air permit requirements typically factor in State Implementation Plan (SIP) compliance under the Clean Air Act and the ability to trade emissions credits. The state and regional procedures for awarding these credits vary across the United States, and can serve to encourage or discourage the installation of increased energy-efficient technologies with reduced environmental profiles, especially when compared with traditional central plant power generation. Utilities in particular can exert substantial market power with respect to DG if they possess a substantial portion of allowable credits.*

Overall, there may be several applicable (and potentially overlapping) permits, codes, and requirements for a DG project, each with its own separate process, constituency and decisionmakers.

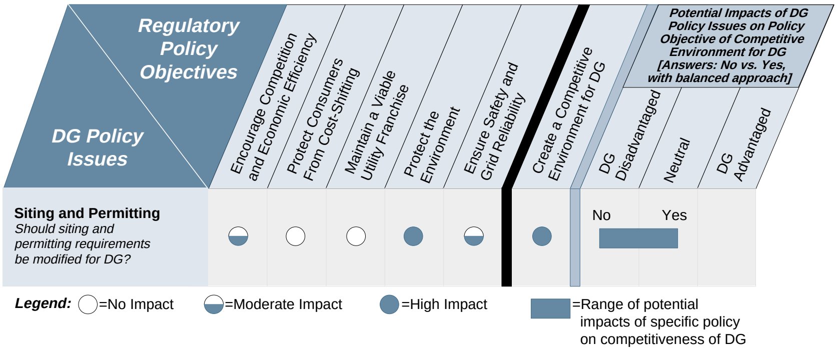
The structures of the permitting processes themselves often appear ill-suited to the concept of smaller, decentralized power generation facilities. Current time requirements (typically 6 to 18 months), codes, and emission standards are usually not standardized, but rather are developed on a project-specific basis. As a result, even though a DG project may be able to satisfy regulatory requirements, the time-consuming and expensive processes needed to demonstrate compliance could render the project economically unfeasible. The regulator, on the other hand, is concerned that the review process be consistent and ensure that all concerns can be addressed as completely as necessary. Those skeptical of potential permitting reforms maintain that a streamlined process designed to accommodate project timetables and economics might, at least in some cases, sacrifice the quality of review designed to protect the public interest.

DG proponents are urging the development of uniform, efficient permitting requirements and processes, particularly for environmental and safety concerns, that balance DG project economics and public policy objectives. One element of a revised approach is pre-certification, a practice already used for automobiles and a wide variety of other commercial and industrial products. Nationally recognized, independent (or government) testing laboratories would conduct initial testing and characterization of the emissions from DG products, and then recommend minimum requirements for DG technology emissions that local, state, and/or regional air pollution control agencies could then consider, possibly modify, and adopt. The laboratories would then test DG products and pre-certify that they meet those minimum regulatory requirements. This has the advantage of creating a streamlined and consistent process while allowing localities to retain their permit jurisdiction.

Those skeptical of potential permitting reforms maintain that a streamlined process designed to accommodate project timetables and economics might, at least in some cases, sacrifice the quality of review designed to protect the public interest.

Figure 8 demonstrates that this issue primarily affects policy objectives related to competition (both generally and for DG) and economic efficiency, and protection of the environment. Permitting and siting requirements have an impact on the objective of competition and economic efficiency to the extent that they may affect DG market adoption. These requirements also work directly to support environmental protection objectives.

Figure 8. Scope and Range of Impacts for Siting and Permitting Issue



The influence that permitting and siting requirements have on a competitive environment for DG ranges from Neutral to DG Disadvantaged. If a jurisdiction's permitting and siting requirements for DG projects are not modified to both protect the public interest and reasonably reflect timing and budget considerations critical to DG project success, then the competitive environment for DG would, at worst, be constrained. If, on the other hand, these permitting processes were modified in a balanced manner, then the issue would have a Neutral impact on the overall competitive market environment for DG. Under these conditions, public concerns would be effectively protected in such a way that the process itself neither favored nor hindered DG against other competitors.

Debate on appropriate permitting and siting process design is not unique to DG. Initiatives to refine the timing, requirements, and procedures for the approval of various types of projects, including energy facilities, are common on the local, state, and federal levels of government. The topics outlined in this section provide decision-makers with several areas to consider separately or in combination as they weigh modifying permitting for DG. If awareness and interest in the potential benefits of DG increase, effective and balanced regulatory project reviews may become an increasing priority. To be successful, however, permitting reforms must ensure that all high-priority public policy interests are protected, if not advanced.

Case Study

A Successful Project

With the occurrence of frequent power outages at a large grocery store on the West Coast, patrons' shopping trips were often cut short and business suffered. The store contracted with a local power system developer to install a back-up generator and cogeneration system that solved the power problem while providing an attractive economic return.

The store's investment in a 240 kW diesel-powered back-up generator was defrayed by the addition of a cogeneration system consisting of two 60 kW reciprocating natural gas engines. The time from initial discussions between the developed and the grocery store owner to start-up was 10 months. The interconnection was approved in three months, while the local, building, and fire code permits took three months.

The engines meet half of the store's daytime electricity needs and its entire nighttime load. The grocery store sells hot water provided by the engines to a neighboring retirement home. The system is owned by the supermarket and operated by the developer. The project results in a net operational cost of 1.7 cents per kWhr, leaving the store with a positive financial return after capital lease payments on both the back-up generator and the cogeneration system. Moreover, this DG solution means the business no longer experiences power outages, operations are more profitable, and customers can shop there confident that there will be no further interruptions.

Two recognized criteria for determining if public RD&D support for DG technologies is warranted are the technologies' state of commercialization and ability to provide public benefits.

Public Support

The final policy question under discussion is whether DG technologies should be supported by economic incentives, subsidies, or public funding for RD&D. In the past, public policymakers have often chosen to actively encourage commercialization of advanced technologies with the expectation that they would provide public benefits. Public policy also has the ability to inadvertently impede the progress of technology through strategies that support established practices at the expense of more innovative ones. Understanding the actual status, benefits, and limitations of current and future DG technologies will be important in these types of policy decisions. Many different power generation technologies are classified as DG. Some are now commercially available, while others are expected to be introduced or substantially improved within the next few years.

Two recognized criteria for determining if public RD&D support for DG technologies is warranted are the technologies' state of commercialization and ability to provide public benefits. Technologies in the early stages of the commercialization process or revolutionary improvements in commercial technologies could receive

Some observers question the value of this type of explicit public support for DG. They argue that there are ample incentives for the private sector to invest in the development and commercialization of new, efficient, cost-effective technologies.

public funding for RD&D projects. Government agencies generally do not support technologies that are already commercially viable unless significant public benefits could be obtained through additional public assistance. Examples of such significant public benefits include reduced impacts on climate change, substantial increases in energy efficiency, and reduced dependency on petroleum.

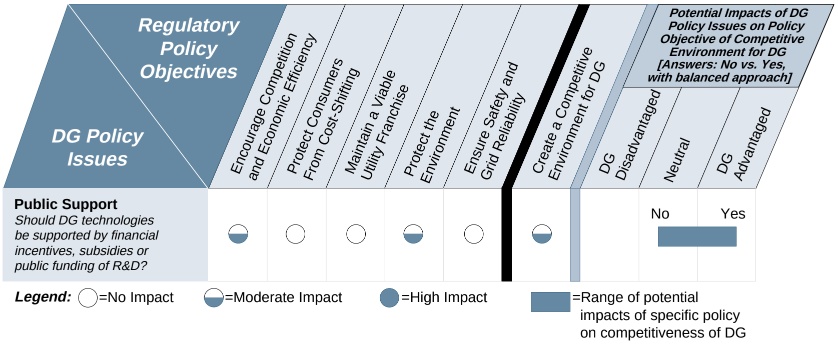
It has been suggested that regulators could also provide incentives for utilities to beta-test well-advanced technologies on their networks in an open, documented forum. This could provide valuable demonstrations of equipment performance under true operating conditions. Buy-downs, tax credits, special gas tariffs, or subsidized loans might also be used to support new technologies in the marketplace while they come down the cost curve on their way to becoming commercially viable.

Some observers question the value of this type of explicit public support for DG. They argue that there are ample incentives for the private sector to invest in the development and commercialization of new, efficient, cost-effective technologies. These incentives are particularly compelling in light of the capacity constraints now evident in portions of the US electric power system, and the current trends toward increased fuel prices worldwide. The current utility industry restructuring is creating new business entities that will be highly motivated to bring promising new technologies to the increasingly competitive marketplace. Public subsidies of new technologies such as DG could inappropriately distort the market's evaluation of competing energy alternatives through artificial price signals. The result may be the creation of unfair competitive advantage for certain technologies that leads to poor business decisions and unnecessary technical risk.

As seen in Figure 9, this issue's potential impacts on policy objectives relate to competition (both generally and for DG) and economic efficiency, as well as protection of the environment. Public support may increase DG market adoption, thereby affecting competition and economic efficiency. To the extent DG technologies may have economic and/or performance profiles superior to those of existing power generation technologies in a jurisdiction, public policy might seek to provide incentives for their use.

The issues relating to public support have potential policy impacts on a competitive environment for DG that range from Neutral to DG Advantaged. If no public support is provided, then there is a neutral impact on the competitive environment, with DG simply being assessed by the market on the basis of its own set of attributes without any additional assistance. Conversely, if programs to support DG are implemented, then DG might receive a competitive advantage against alternatives in an open, competitive market.

Figure 9. Scope and Range of Impacts for Public Support Issue



Regulatory Policy Objectives / DG Policy Issues	Encourage Competition and Economic Efficiency	Protect Consumers From Cost-Shifting	Maintain a Viable Utility Franchise	Protect the Environment	Ensure Safety and Grid Reliability	Create a Competitive Environment for DG	Potential Impacts of DG Policy Issues on Policy Objective of Competitive Environment for DG [Answers: No vs. Yes, with balanced approach]: DG Disadvantaged	Neutral	DG Advantaged
Public Support *Should DG technologies be supported by financial incentives, subsidies or public funding of R&D?*	◒	○	○	◒	○	◒		No ▬	Yes ▬

Legend: ○=No Impact ◒=Moderate Impact ●=High Impact ▬=Range of potential impacts of specific policy on competitiveness of DG

Policymakers must decide this issue based on their judgement of what is in the public interest. For example, an analysis of the marketplace and benefits offered by the range of available power system solutions could conclude that DG may offer significant potential public benefit, but is unable to compete fairly against alternative energy solutions because of the established industry and market structure and economics. In this case, it could be considered in the public interest to provide support to DG in a way that allows it to be evaluated more fairly in the market. In the extreme, such support could provide DG with a clear advantage. On the other hand, regulators and legislators may decide that no such market inequities exist, or that the required remedies come at too high a price relative to the potential public benefit. In this scenario, it would be expected that DG would compete on its own in the market without the added assistance of economic incentives, subsidies, or other forms of public support.

IV. Conclusions

The issues posed by DG have clear relationships to other public policy goals. The strongest linkage is with the objective to Encourage Competition and Economic Efficiency, followed by the need to Ensure Safety and Grid Reliability.

The issues posed by DG have clear relationships to other public policy goals. All eight fundamental DG policy questions could effect the relevant regulatory policy objectives selected for this analysis, and they link most directly with two of them. As seen in Figure 10, the strongest linkage is with the objective to Encourage Competition and Economic Efficiency, followed by the need to Ensure Safety and Grid Reliability. This is a reasonable outcome because DG represents a potentially important, new, cost-effective power supply alternative that can help reshape the competitive market landscape. Furthermore, substantial technical issues must be resolved before DG can be successfully integrated with U.S. grid operations.

The analysis also suggests that the five DG policy issues rated as having high impact on the policy goal of a competitive environment for DG are particular priorities for consideration by regulators and legislators. Depending on how these issues are resolved within the context of local market and regulatory conditions, they could place DG at either a significant disadvantage or advantage in the market. Proactive, balanced regulatory initiatives on these high impact issues could be critical in ensuring a neutral playing field for DG. These priority DG issues include:

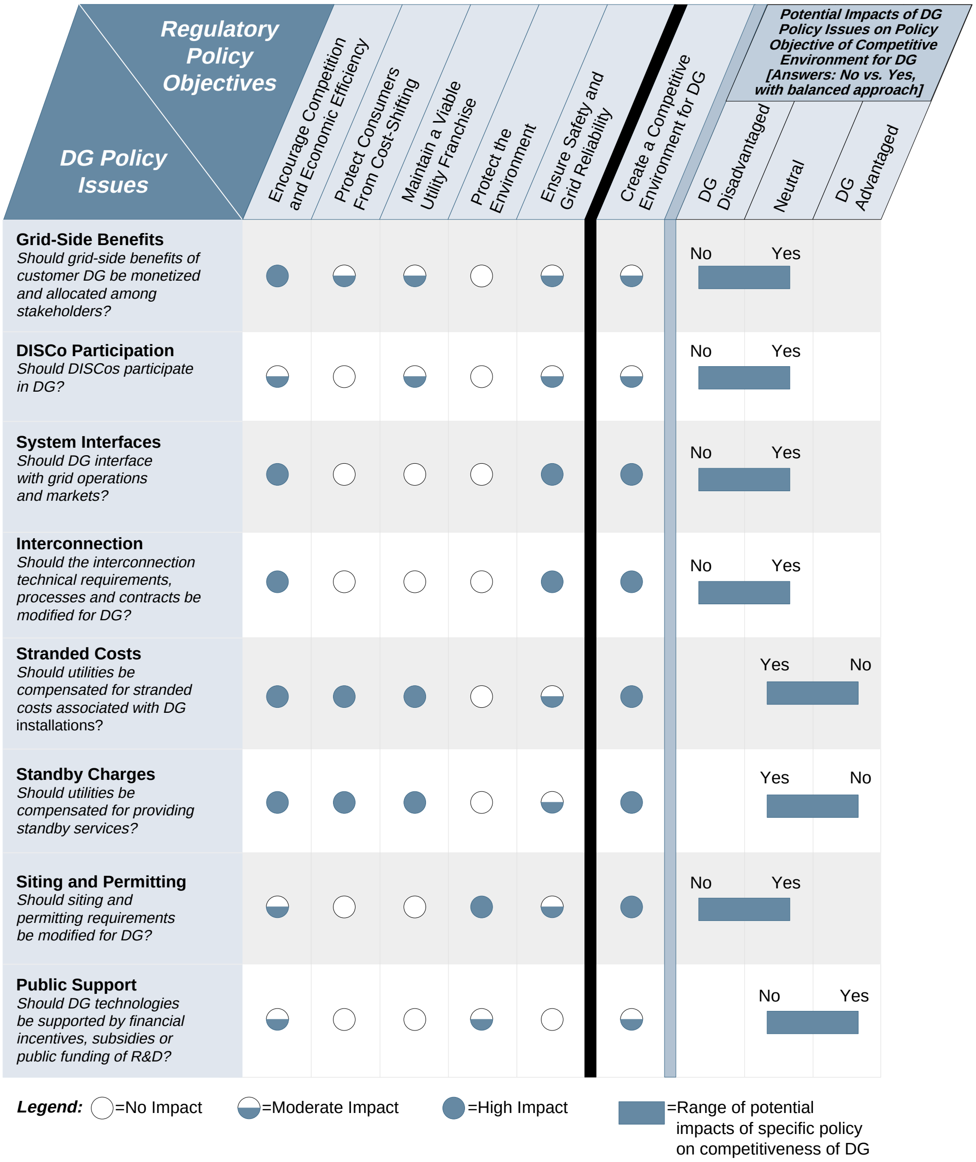
- *System Interfaces*
- *Interconnection*
- *Siting and Permitting*
- *Stranded Costs*
- *Standby Charges*

Stranded costs and standby charges were also identified as high-impact issues on a competitive market for DG. Proactive regulatory initiatives on these high impact issues could be critical to ensure a neutral playing field for DG.

Policymakers in some states now actively formulating DG policy have concentrated on interconnection issues early in their deliberations. They have determined that decisions on these questions may be developed relatively quickly and can provide the credible technical foundation for subsequent deliberation on DG issues.

Although it is tempting to simplify the policymaking process by considering specific trade-offs on an issue-by-issue basis, the impacts of policies tend to be additive in nature. Decisionmakers therefore need to be cognizant of the cumulative impact of

Figure 10: Fundamental DG Policy Issues With Range of Impacts



DG Policy Issues / Regulatory Policy Objectives	Encourage Competition and Economic Efficiency	Protect Consumers From Cost-Shifting	Maintain a Viable Utility Franchise	Protect the Environment	Ensure Safety and Grid Reliability	Create a Competitive Environment for DG	DG Disadvantaged	Neutral	DG Advantaged
Grid-Side Benefits *Should grid-side benefits of customer DG be monetized and allocated among stakeholders?*	●	◒	◒	○	◒	◒	No ▬	▬ Yes	
DISCo Participation *Should DISCos participate in DG?*	◒	○	◒	○	◒	◒	No ▬	▬ Yes	
System Interfaces *Should DG interface with grid operations and markets?*	●	○	○	○	●	●	No ▬	▬ Yes	
Interconnection *Should the interconnection technical requirements, processes and contracts be modified for DG?*	●	○	○	○	●	●	No ▬	▬ Yes	
Stranded Costs *Should utilities be compensated for stranded costs associated with DG* installations?	●	●	●	○	◒	●		Yes ▬	▬ No
Standby Charges *Should utilities be compensated for providing standby services?*	●	●	●	○	◒	●		Yes ▬	▬ No
Siting and Permitting *Should siting and permitting requirements be modified for DG?*	◒	○	○	●	◒	●	No ▬	▬ Yes	
Public Support *Should DG technologies be supported by financial incentives, subsidies or public funding of R&D?*	◒	○	○	◒	○	◒		No ▬	▬ Yes

Legend: ○=No Impact ◒=Moderate Impact ●=High Impact ▬=Range of potential impacts of specific policy on competitiveness of DG

their actions on DG and the public interest. For example, all DG policy issues identified in this analysis have a moderate to high impact on the broad goal of encouraging competition and economic efficiency. Thus, the collective effect of individual decisions on questions could be substantial for the marketplace in general, as well as for DG in particular.

The analysis also suggests that the five DG policy issues rated as having high impact on the policy goal of a competitive environment for DG are particular priorities for consideration by regulators and legislators. Depending on how these issues are resolved within the context of local market and regulatory conditions, they could place DG at either a significant disadvantage or advantage in the market.

The United States is in the early stages of its DG debate. As this discussion expands and the number of participants grows, more policymakers will be challenged by stakeholders to:

- *Maximize the operational benefits of DG to both DG owners and the U.S. electric power system without jeopardizing safety or grid reliability*
- *Allocate the economic benefits and costs of DG and grid-related operations fairly among DG owners, utilities and other market players, and customers*
- *Address possible economic and regulatory market barriers for DG*
- *Provide public financial support to encourage RD&D to obtain significant public benefits from DG*

By understanding these issues and determining the value of DG to their stakeholders, regulators and legislators will position themselves well to develop informed policies that will shape the future of the U.S. electricity industry.

Sponsoring Organizations

AlliedSignal Power Systems, Inc.

Automatic Switch Co.

Caterpillar Inc.

Elliott Energy Systems, Inc.

Encorp, Inc.

Enercon Engineering

Fairbanks Morse Engines

GE-Zenith Controls, Inc.

Kohler Power Systems

Rolls-Royce Energy Systems

Solar Turbines Inc.

Siemens Westinghouse Power Corp.

Teledyne Continental Motors

U.S. Department of Energy

For additional information contact:

Arthur D. Little, Inc.
Acorn Park
Cambridge, MA 02140
617-498-5000
www.arthurdlittle.com

David Kleinschmidt
Vice President

Stan Blazewicz
Senior Manager

A