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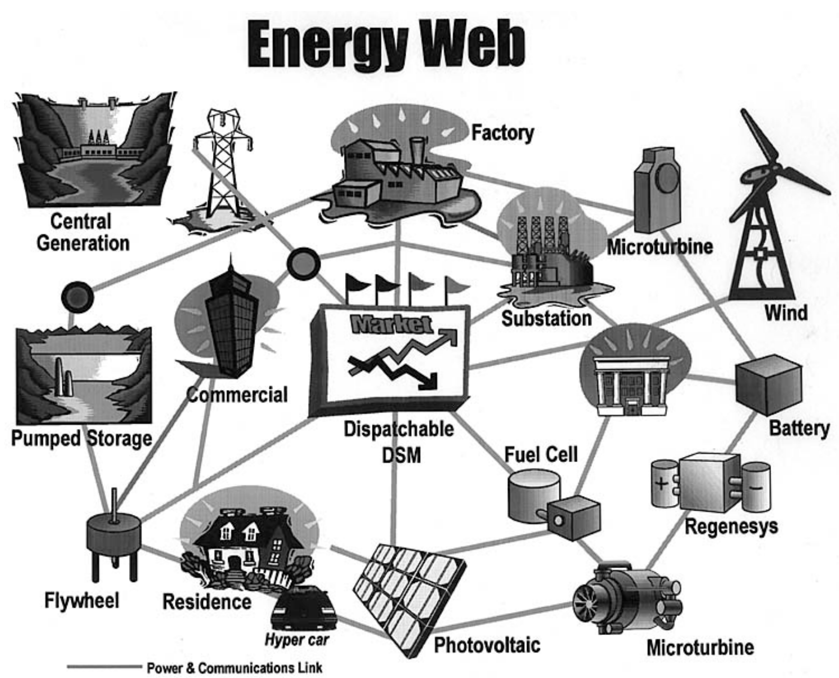
Distributed Energy: The Way Forward



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* Energy Web Image from the Bonneville Power Administration, Portland, OR

Table of Contents

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Introduction

The current US energy economy has been characterized by electricity shortages, escalating fuels costs, and concerns about the reliability of the power system. In recent years, events such as the California energy debacle and the massive 2003 grid failure in the Northeast have called into question the integrity of the national electric grid that emerged after deregulation. Furthermore, in its 2007 summary for policy makers, the Intergovernmental Panel on Climate Change concluded with 90% certainty that human actions, particularly th e burning of fossil fuels, are responsible for global warming. It has never been more urgent to develop a viable alternative to our current means of energy production.

Overview

Large power plants and central generation currently dominate the national electricity infrastructure, supported by regulatory policies preserving the present structure of power generation and distribution. Incentives shaped by the policy and financial environment have discouraged both innovation and efficiency. Rather, these policies have encouraged the development of a radial system of centralized stations (dominated by the need to secure capital and to assure bondholders that the asset will be repaid), costly investments in transmission and distribution lines, and inefficiencies and perverse incentives stemming from the failure of the price of energy to reflect its true cost. Compounding the problem is a regulatory model that gives utilities no incentives to minimize fuel, operations, or capital costs.

While the hub and spoke model of the traditional power system buttressed vertically integrated utilities, it has proven inadequate under a deregulated system where transmission and distribution utilities cannot also own generation facilities. This system faces serious shortcomings in efficiency (low fuel conversion efficiency and high transmission and distribution losses) and reliability (excessive outages and distribution systems that are over-stressed). In addition, the vulnerability of highly congested transmission lines and central plants raise concerns about energy security. At the same time, emissions from large power plants present environmental challenges, as current systems and their supportive policies force citizens to contribute to greenhouse gas emissions and other air pollutants.

These challenges must be confronted in a context in which there is now a backlash against restructuring because of the perception that it drives up costs. Similarly, capacity expansion is constrained by the high costs associated with switching to gas or with building new cleaner coal generation facilities, especially since new coal plants are required by the Clean Air Act to install expensive pollution control equipment while older plants are not. As a result, thermal efficiency has remained stagnant and the median power plant is now over forty years old.

Our current energy system could be improved by transforming the outdated hub and spoke model into a dynamic network with multiple production nodes, much like the Internet. This network would be comprised of locally-sited units designed for on-site, grid-connected or stand-alone power production as well as systems that combine distributed power generation with heating and cooling. Current rules prevent the construction of many small installations, instead favoring single large plants. From a financial perspective, distributed energy relies on private investment associated with the customer, creating a potential win-win situation for investors and developers.

Distributed energy units with cogeneration capabilities make use of the waste heat that would otherwise be thrown away through fuel conversion inefficiencies and line losses. Such units can reach overall energy conversion efficiencies of around 80%, while traditional steam-based central power plants are only 30% efficient once line losses are taken into account. By reducing these losses, distributed energy makes better use of the existing grid system and can offset investments in the grid by reducing the need to build new transmission lines. For consumers, this would translate into lower energy costs, greater choice, and quicker response to increased demand due to an enhanced ability to make incremental capacity additions.

Presently, the technical potential for distributed energy in the Northeast and Mid-Atlantic is estimated to be around 24,000 MW. This capacity could lead to up to $1 billion in fuel cost reduction. Moreover, due to their relatively small size and their potential to also use renewable resources (which have few or no emissions) or combined heat and power systems (which can achieve greater fuel utilization factors), distributed energy results in cleaner operations and reduced carbon dioxide emissions. Thus, the 24,000 MW in the Northeast and Mid-Atlantic could also result in up to 122 million tons of greenhouse gas reduction per year[1].

As with nearly any endeavor, the benefits of a transition to an energy system with significantly more distributed energy depend on how that transition takes place. Not all distributed generation is uniformly benign, particularly if traditional diesel generators are used. Diesel generators comprise the majority of capacity of distributed energy installations, but are used mostly as backup for power outages rather than for continuous power generation. Also, the advent of low sulfur diesel fuel and NOx reduction has improved the environmental performance of these systems. Other—more benign—technologies have become available and competitive for use in distributed energy installation. Their increased use for base load and peaking power could contribute to reducing carbon dioxide emissions, air pollution, and fuel and transmission costs, while increasing reliability of the overall electric power system.

Report Methodology

Despite the substantial benefits associated with distributed energy, these benefits are not always tangible or broadly understood, inhibiting the development of a consensus around this issue and therefore effective actions to achieve those benefits.

Consensus often forms after an emergency. In California in 2001, the LA county government adopted measures to limit street lighting. This could have been done much earlier, but it took an emergency to actually spur change. This report and the process used to develop it seek to contribute to a similar consensus on the expansion of distributed energy in New England, bringing together diverse stakeholders from utilities to CHP developers and renewable energy advocates. In the past year, we have entered a new era of consensus about the causes of global

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[1] Regional Greenhouse Gas Initiative, "Public Benefits Set-Aside and Complementary Energy Policy Recommendations" memo from RGGI staff working group, June 24, 2005.

climate change and the pressing need to revamp our national energy policy. As a means of forwarding this promising momentum, this report has been prepared at The Fletcher School of Law and Diplomacy at Tufts University, with the aim of identifying and developing key tools and strategies to support wider use of distributed energy in New England.

The purpose of our initiative is to:

- ◊ Help stakeholders better understand each other's concerns;
- ◊ Provide stakeholders with specific tools they can use to overcome roadblocks to implementing distributed energy technologies.

Through our assessment, we have sought to accomplish the following goals:

- ◊ Identify issues that affect the future of distributed energy in New England;
- ◊ Explore and specify the interests and concerns of each stakeholder group and consider the breadth of differences among the parties;
- ◊ Investigate stakeholders' willingness and capacity to participate in collaborative problem-solving dialogue; and,
- ◊ Assess the feasibility of instituting specific recommendations that would be acceptable to the stakeholders and would effectively address all the key issues of concern.

We have interviewed a diverse range of stakeholders to gather information and to learn more about their views, questions, and concerns and to explore ways these concerns might be addressed. Our interviewees are included in Appendix B, but in order to maintain the confidentiality of our interviewees, specific comments will not be attributed to any stakeholder by name or organization.

Goals of the Stakeholders

The success of distributed energy lies with the actions of its stakeholders, namely the distributed energy industry, legislators, and utilities. For the distributed energy industry, the need to expand development of distributed generation facilities and combined heat and power systems has led to a push to obtain ready access to the electric grid and favorable regulatory structures. However, efforts to move forward in these areas have been hindered by a lack of cohesiveness in the distributed energy community, with individual groups (e.g. those promoting renewables or CHP) each pursuing goals separately.

The response of legislators at federal, state, and local levels has been mixed. On the one hand, most legislators recognize the importance of ensuring that the energy system is available, reliable, affordable, sustainable, and efficient. Increasingly, many prioritize achieving greenhouse gas reductions through mechanisms such as renewable portfolio standards and legislation such as the Regional Greenhouse Gas Initiative (RGGI), which institutes an emissions cap and trade program. Unfortunately, despite their enthusiasm for environmentally responsible initiatives, many policy makers do not fully recognize the woefully inefficient state of the current electric system and have not acted sufficiently to remedy the situation.

Utilities need to be able to see a return that enables them to grow and to be attractive to investors on Wall Street. Thus, any movement towards distributed energy will need to satisfy the profit motive if it is to elicit cooperation from utilities. Utilities have expectations of paybacks of five to seven years since the regulatory structure guarantees a fair return on prudent capital. For now, however, the regulatory model gives utilities few incentives to minimize operating or capital costs. In fact, regulations cause utilities to be very reluctant to expend their overhead in pursuit of cost savings, since the regulators will – in all likelihood – simply pass those savings along to the rate payers. As a result, while it is certainly necessary to create a profit incentive for utilities, doing so requires a regulatory change that would allow them to keep some of the operating savings that distributed energy provides, not simply assessing whether the payback is sufficient to incentivize their capital deployment.

In the specific case of distributed energy, utilities require assurance that all electric suppliers provide electricity that meets quality, reliability, and safety standards, and that it is possible to match supply with demand at all times. To the extent that some utilities fear competition and a lack of appropriate standards from distributed energy facilities, they have blocked distributed energy providers from integrating into the current system.

There is evidence that this attitude is changing, however, and progressive leaders such as National Grid can make a major impact among utilities. Companies such as National Grid, ConEd, and NStar have found that investments in distribution infrastructure frequently are not fully recovered in their rates. Since the growth in distribution requirements is not necessarily beneficial to them, utilities may see an advantage in expanding the use of distributed energy themselves. At the same time, utilities have expressed concerns about cross-subsidization (e.g. a project receiving credit through both a portfolio standard and CHP programs), particularly if such subsidization is partially or entirely funded by the utility.

Barriers to Distributed Energy Implementation

Distributed energy providers face several fundamental obstacles, which can be classified as technical, financial, and regulatory. These barriers are compounded by a general lack of public awareness about the importance of modernizing the current electric system and promoting distributed energy as a viable alternative.

Technical Barriers

On the technical side, a lack of national interconnection standards and unclear requirements for safety measures have been previously cited as significant barriers to the expansion of distributed energy systems in some areas. However, the interconnection standard barrier has largely been overcome as interconnection standards are now fairly uniform across states, based on IEEE standards. It appears that more attention to reducing technical barriers has been applied in Europe, which has much more thermal and renewable distributed energy generation.

A more pressing barrier relates to the difficulties associated with net metering, by which small grid-connected installations are able to both generate electricity for and draw electricity from the grid, paying only for their net electricity consumption. The availability of net metering is critical to the expansion of distributed energy, especially for systems that have the potential for grid export. The current system of paying retail for electricity from the grid, but being paid only wholesale rates for supplying electricity to the grid, discourages most actors from developing a grid connected power generating system.

In addition, the location of a particular installation – particularly whether it connects to the transmission system or the distribution system – can make a significant difference in how difficult it is to connect that installation. Because distributed energy investors must pay for the interconnection costs specified by utilities, the costs in technically challenging areas are exaggerated. Also, it is much more complicated to put in CHP or other distributed energy in a secondary network than in the radial network. However, large sections of the transmission and distribution system are due to be replaced in the relatively near future, which presents an opportunity to restructure the T&D system to facilitate the expansion of distributed energy.

Addressing these difficulties is complicated by a critical shortage of skilled engineers, particularly engineers who are focused on finding solutions to the technical problems already described: in the past, engineers managing grids have often been conservative with respect to possibilities for change and innovation in this area. This conservatism is magnified by the fact that engineers are held accountable if the system fails, but any economic gains they may achieve are usually passed along to the rate payer, producing no real financial benefit for the utility.

Financial Barriers

There are a variety of financial barriers to the deployment of distributed energy installations, but they generally fall into three categories: the difficulty of obtaining sufficient project financing; fees and other charges associated with the installation of distributed energy; and the failure of the current system to properly account for externalities (positive and negative).

Project Financing

Private sector firms impose extremely high hurdle rates for non-core investments, including energy productivity investments. US Steel, BP and DuPont, for example, each tell plant managers they will not typically approve capital investments in non-core investments with longer than a one year payback -- with over a 100% return on investment. Extensive examples have been reported of waste energy recycling projects ranging from 2 to 120 megawatts at the firms mentioned above as well as most other industrial firms that are not funded by the respective corporate finance decisions. Currently, there are 64,000 MW of potential projects using industrial waste energy that would burn no incremental fossil fuel or emit any incremental greenhouse gas. These projects would provide prices below the best, lowest cost long run marginal cost of any central plant base load generating plant option, including T&D capital and line losses[2]. The high hurdle rates partially explain why these firms continue to vent their waste energy. An additional study concludes that there is the potential to provide 19% of U.S. electricity from wasted transformational energy without increasing carbon dioxide emissions at

[2] T. Casten and R. Ayres, in *Energy and American Society – Thirteen Myths, Chapter 9,* Benjamin K. Sovacool and Marilyn A. Brown, editors, 2007

costs in the range of a few cents per kwh. Most of these savings would occur at distributed sites rather than at traditional central power stations.[3]

Other factors also prevent investors from fully supporting distributed energy initiatives. For example, investors face the risk that the host of a distributed energy project may decide to close down. Accordingly, they require insurance for their investments. By contrast, in the rest of the electricity industry, companies are not required to undertake risk without equity return guarantees. Also, within the distributed energy industry, the need for investments to be truly cost-effective and the difficulty of achieving economies of scale (given that relatively few distributed energy units are currently being installed in the United States) present two additional barriers to obtaining adequate financing

Fees and Other Charges

An additional set of barriers result because few incentives exist for utilities that manage the transmission and distribution system to welcome new suppliers. Volume-based utility revenue models coupled with monopoly power give rise to numerous obstacles. Furthermore, grid managers generally do not account for unregulated generators or the benefits they create including potential lower rates to utility customers.

Consequently, distributed energy faces the following costs:

- expensive feasibility studies and insurance requirements
- high buy back rates, uplift tariffs, and exit fees for leaving the system
- excessive supplemental and standby power charges
- lack of favorable discounting
- lack of adequate dispute resolution
- asymmetric payment for exported generation at wholesale prices, and must still purchase from the grid at retail prices

These various tariff barriers and fees are often so high that they discourage any alternative to the status quo. For example, Boston University was offered a large grant and a 10 MW fuel cell system at well below the market rate plus installation assistance from the Massachusetts Technology Collaborative. However, when confronted with potentially high standby rates and other potential impediments by the utility, the university decided not to go forward with the project.

Externalities

Up until recent years, many considered energy to be a public good, to which all citizens were entitled cheap, unlimited access. To this end, preserving a natural monopoly was deemed to be the best means for structuring the electric system. However, the last decade has ushered in a substantial shift away from this mentality towards a market-based approach to pricing an ever-scarcer supply.

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[3] O. Bailey and E. Worrell, *Clean Energy Technologies a Preliminary Inventory of the Potential for electric Power Generation, Lawrence Berkeley national Laboratories, LBNL 57451, 2005.*

Despite this tendency toward deregulation—seen in locational marginal pricing for electricity for example—there has remained a systematic reluctance to fully embrace competitive markets. The fallout from the California energy crisis, in particular, has tempered tolerance for true deregulation. As a result, transmission and distribution (the most capital-intensive part of the grid) and heat losses from central generation both remain relatively immune to competitive pressure. This backdrop creates an environment with few financial incentives for structural change.

Similarly, the regulations governing the electricity system—including the immunity of certain aspects of electricity generation and transmission and distribution to competitive pressures—distort the prices paid to different types of suppliers. Typically, the distortions do not favor distributed energy producers. For example, a cogeneration project at the Trigen Philadelphia steam plant struggled to be economically viable because PECO/Exelon was allowed to buy Trigen's excess power at their so-called "avoided cost", but this avoided cost was set, with commission approval based on the cost of a remote plant in rural Pennsylvania, with no consideration for the location-specific value of power in downtown Philadelphia. Having purchased energy at that heavily discounted rate, the utility was then able to re-sell the power to customers in Philadelphia at full retail rates, thus reaping monopoly rents at the expense of those who built the cogeneration facility. This example is typical, and causes significant misallocation of capital in the electric grid, since those who create system benefits cannot realize compensation for them.

Production of distributed solar electricity is at a peak during hot summer afternoons when power demand is high for air conditioning, yet producers of that power do not receive the high market price that utilities may pay traditional peak power suppliers, but instead receive only the average wholesale price. Hence the comparative advantage that solar power has for clean production during high demand times that often correspond to high levels of air pollution is not adequately compensated.

Many of the benefits of distributed energy described earlier (environmental, security, etc.) are in fact positive externalities. While the end use customer does benefit from the reliability and efficiency of such systems, the total value of the increased use of distributed energy in the electricity system is much greater for society as a whole than it is for individual end use customers. The failure to incorporate such positive externalities into the prices paid to distributed energy suppliers creates a barrier to the expansion of distributed energy.

Such misalignments of incentives occur in many other situations as well. For example, landlords have little incentive to make investments in rental properties since it is tenants who pay the heating and electricity bills that will be the main beneficiaries. Thus, while there are many recognized benefits that accrue from distributed energy deployment, only a handful create financial value for distributed energy owners, given the current system's inadequate accounting of the financial and non-financial benefits of such installations. As will be discussed in the next section, regulations need to build externalities into prices, thus generating rewards for positive action and creating incentives for socially, environmentally, and economically beneficial changes to the electricity system.

Regulatory Barriers

The current regulatory structure discourages implementation of distributed energy projects. The Clean Air Act, last amended in 1990, contains provisions which act as a barrier to distributed generation systems because of the manner in which air emissions are defined without giving credit for the useful thermal production in CHP. In addition, public utility commissions have not been positioned to take sufficient action due to chronic understaffing (although some have sought to bridge these divisive issues and have met with some success in California). While the Environmental Protection Agency has created the CHP Partnership Program, regulations are highly precedent-driven, which can slow the introduction of innovation and new technologies.

In some cases, regulatory barriers could be removed with relatively small changes. For instance, it is illegal for a private wire to cross a public street, making it difficult for installations on large universities and other campuses to use the electricity they generate. This rule contributed to the difficulties encountered by Trigen-Philadelphia, as well as by many other organizations seeking to install distributed energy.

On the financial side, the current regulatory system – by effectively guaranteeing equity returns for regulated utilities – effectively lowers the debt service costs for those power plants built by monopolies regardless of their underlying economic value. By contrast, a private developer seeking to invest in on-site power generation will pay 200 – 300 additional basis points in debt service, thus creating an artificial market bias for the largest and most inefficient power sources. Similarly, the opening of energy wholesale markets has not been accompanied by guarantees on infrastructure. Without regulations to ensure that these loans and guarantees exist, investments will not be made in the new infrastructure required. These contribute to the financial challenges already discussed. Creating regulations that do not disadvantage distributed installations relative to traditional central ones would help address this unequal treatment.

More generally, the presence of unrewarded positive externalities associated with distributed generation causes inefficient resource allocation. Fair pricing for distributed energy—which would incorporate such externalities—could help overcome some of the financial barriers described above. While "fair pricing" could be interpreted as a subsidy, subsidies to electric utilities are quite common, and this is one that could correct market failures rather than distort the market. Net metering rules that facilitate lowest social cost should be pursued to address these issues.

Decoupling electricity sales from revenues would address the negative incentives and encourage utilities to invest in energy efficiency. By itself, however, decoupling does not create any *positive* incentives for improvements in efficiency, which would require additional measures. At the same time, the design of decoupling regulations is also critical because some variants can actually be detrimental to efficiency and distributed energy goals.

There is currently momentum for decoupling, but substantive changes will require significant time investment by policymakers and an ability to overcome resistance from those who will pay more under decoupling. While some states, including California, have successfully been able to incorporate decoupling, electric utilities are generally opposed to decoupling. For further progress to be made, involvement from other stakeholders – such as the CHP and renewable communities and potential hosts – will be necessary.

Environmental permitting and siting restrictions compound the difficulties that distributed energy providers face in establishing their systems. Many state environmental agencies ignore lower emissions associated with recovered heat. Instead, environmental regulations are assessed on a pass/fail basis that does not reward reductions beyond the minimum required. Thus, environmental testing and emissions requirements are often as stringent for small distributed energy units as they are for large power plants, even though smaller projects cannot bear costs on the same scale. In many cases, because distributed energy systems are considered new generation sources, they must meet significantly more rigid emissions requirements than older, more polluting units. Furthermore, combined heat and power systems are often assessed on the basis of their combustion efficiency—not overall output efficiency—and are thus not given credit for their use of thermal energy.

In many cases, regulatory barriers to distributed energy can be resolved at the state level through regulation changes. Addressing these concerns does not require changes of federal statutes, except for national environmental laws such as the Clean Air Act.

Analysis of Findings

Despite the various impediments that have stalled progress, distributed energy has tremendous potential to revolutionize the current state of the electric system. Progressive leadership on this issue exists in New York, Massachusetts, California, and other states. In New York City, for example, Mayor Bloomberg supports a policy requiring any large building project to provide its own electricity and heat. Encouraging and eventually requiring zero net buildings that generate their own heat and power should become a policy goal. In Pennsylvania, in addition to the renewable portfolio standard, generators have an obligation to purchase power from customers who have the ability to generate, while in Maine, forward capacity markets required by ISO-New England have been very successful in promoting distributed energy installations. Such markets can reduce dependence on subsidies for distributed energy. In Massachusetts, when MIT installed cogeneration, the project reduced MIT's entire carbon footprint by 30%, and the project took only five years to pay back. The large number of university and other campuses in the Northeast provide a significant opportunity to utilize distributed energy systems to address the "urban deficit" of power capacity in many cities.

As the Northeast ponders the need to meet future load growth, local governments can play a key role in the fostering of distributed resources. These entities can require feasibility studies by developers or the city planning staff that evaluates the infrastructure needed to accommodate distributed energy resources. So-called green communities where residential, commercial, light industrial, and mixed use sectors could choose to have the infrastructure built as part of their utility services would go far to advancing community choice and the environmental and sustainable energy goals of the Northeast.

It is essential that distributed energy industry leaders devote time and effort to mobilizing politicians, NGOs, environmentalists, local advocates and universities to support their cause. Public education about the implications of excessive energy demand is necessary to ensure a proper balance between supply and demand side solutions. However, given that increased demand for electricity is likely to increase before demand led actions can be implemented, the distributed energy industry should do everything it can to encourage cost-effective large-scale investments in combined heat and power and distributed renewable energy.

Supply side energy efficiency opportunities can also contribute to bridging the gap between electric demand and supply and the imperative to lower carbon intensity. For example, the Lieberman- Warner Climate Bill has incentives for both electric and natural gas utilities to increase energy efficiency programs. The implementers of such incentives should provide opportunities on both the demand and supply side, as well as, accommodating cross fuel total energy efficiencies.

Recommendations

Several specific options are available to policy makers who wish to facilitate distributed energy:

- First, lawmakers can implement energy efficiency resource standards, a market-based mechanism that encourages more efficient generation, transmission, and use of energy to achieve the set of electric and/or gas energy savings targets for utilities through trading;
- Second, legislators should work to expand renewable portfolio standards to include waste heat from combined heat and power;
- Third, regulators can extend current deregulation structures to include more than demand response and energy efficiency, and remove barriers to decoupling electric prices to reflect market-based costs;
- Fourth, measures to facilitate low interest loans and risk management would benefit efforts to finance distributed energy;
- Fifth, revise laws and regulations that simply block distributed energy systems;
- Sixth, implement laws and regulations that require much higher performance of buildings and industries including the requirement to build zero net energy buildings;
- Lastly, in order to build on the progress that has already been made, legislators should encourage a shift in focus from environmental end-of-pipe control requirements (such as in RGGI) to providing incentives for environmental benefits created from technologies such as distributed energy.

A number of measures can also be taken to ensure enhanced cooperation from utilities:

- First and foremost, the electric grid must be modernized into a more flexible, resilient, and multimodal version of the current grid;
- Clear technical interconnection performance standards that ensure safe reliable power from distributed sources should be developed;
- Clear limitations on standby and other fees must be set, and a grid manager attuned to the needs of a distributed supply system should ensure that an effective and transparent interconnection process is achieved;
- In order to ease the transition, electric utilities should be transformed into full service energy companies;

- Energy storage systems should be created to support renewable energy during peak load times;
- True net metering and time of day pricing should be instituted to promote efficient electricity production.

Additional recommendations to address barriers to distributed energy are shown in Table 1.

Table 1: Participant Recommendations

Barrier	Suggested Solution
Market design and externalities	Keep markets competitive as much as possible so that they provide appropriate incentives.
Market design and externalities	Reform utility rate structures, including decoupling utility revenues from electricity sales.
Market design and externalities; stakeholder cooperation	Allow utilities to own some generation capacity or allow them to finance generation, while also ensuring exposure to market discipline.
Market design and externalities	Encourage retail aggregators and bundling so that customers can get power from different sources.
Project financing; market design and externalities	Announce a program with a 50 MW exception to deregulation (such as a guaranteed feed-in tariff), which can pay for renewables such as wind, solar, and biomass.
Project financing	Require utilities to take on long term contracts for power from DE suppliers.
Project financing	Expand forward capacity markets nationwide to include distributed energy installations.
Project financing	Provide incentives for pilot projects, and low interest loans, tax breaks and credits available to DE installations. The governor's office can play an important role in accommodating private investment in DE.
Project financing	Make available insurance, revolving loans, and other mechanisms to address risk for technologies such as CHP and other DE infrastructure.
Project financing	Reframe RGGI to use funds from (RGGI) auctions to provide incentives for DE on the same basis as other options.
Lack of expertise and personnel at host institutions	Encourage long-term contracts between stable institutions (like universities) and companies, where the company purchases and operates DE installations and the host institution and DE company share the long-term savings.
Fees and other charges to suppliers	Make back up power for DE subject to fees based upon net costs or benefits.
Ensuring that DE meets environmental goals	Design regulations and incentives so that carbon reduction is the end goal, not just DE.
Ensuring that DE meets environmental goals	Monetize the climate value of CHP (such as through thermal credits); allowances can be created for RGGI, allowing the developer to go to the market place and create a value.
Technical improvements; ensuring that DE meets environmental goals	Lease plug in hybrid cars and other services.

Technical improvements and regulatory changes	Alter regulations to maximize total energy output from every BTU of fuel: 1) move the fuel to get more efficient energy production 2) move the fuel so we can capture low grade energy 3) use unconventional fuel sources such as landfill gas
Technical improvements: grid, storage, and end-use	Improve materials and technologies including tech-tronics (electronics and sensors) to allow agile production and flexibility.
Technical improvements: grid, storage, and end-use	Restructure grid as it is updated over the next decades to have capability for managing multiple distributed suppliers
Technical improvements: grid, storage, and end-use	Make the grid a "smart grid" with the ability to manage demand as well as supply, particularly during peak electricity demand time.
Environmental permitting, siting, and building codes	Require building projects above a specified size to do analysis and meet established criteria to meet CHP standards.
Lack of awareness	Educate legislators on DE.
Lack of stakeholder cooperation	Engage environmental activists on policy options for CHP.
Lack of stakeholder cooperation	Engage universities such as through pilot projects of various sizes.

Concluding Thoughts

While it is essential to consider the specific steps necessary to promote distributed energy, it is equally as important to consider the big picture motivations for reforming the energy system. Bob Ayres, long time director of the Centre for the Management of Environmental and Social Responsibility, argues that the only long-term predictor of GDP growth is falling costs of delivered, useful energy. On the one hand, there is cause for concern, given that real energy costs fell steadily from 1900 to 2000, with the exception of the energy shocks in the 1970s, but have now been rising rapidly every year since. On the other hand, there is cause for optimism, given the tremendous potential for reform and efficiency improvements within our current system. Distributed generation of electricity provides us with the opportunity to move in the right direction –economically *and* environmentally.

Appendix A: Interview Protocol

The purpose of our initiative is to:

- Help stakeholders better understand each other's concerns;
- Provide stakeholders with specific tools they can use to overcome roadblocks to implementing distributed energy technologies.

Through our assessment, we hope to accomplish the following goals:

- Identify issues regarding the future of distributed energy in New England (e.g. current legislative, financial, and technical barriers);
- Explore and specify the interests and concerns of each stakeholder group and consider the breadth of differences among the parties;
- Investigate stakeholders' willingness and capacity to participate in collaborative problem-solving dialogue; and,
- Assess the feasibility of instituting specific recommendations (e.g. present draft distributed energy legislation to lawmakers) that would be acceptable to the stakeholders and would effectively address all the key issues of concern.

The Assessment Process

As non-partisan neutrals, we will confidentially interview a diverse range of stakeholders to learn more about their views, questions, and concerns and to explore ways they might be addressed. We will conduct approximately 20 forty-five minute interviews with stakeholders.

We will summarize what we hear from stakeholders in the form of a draft report and list the people we have talked to in a "List of Interviewees." **Specific comments will not be attributed to any stakeholder by name or organization.** We maintain this confidentiality to protect your views and concerns, and to ensure that interviewees can be as honest and direct as possible. Everyone we speak with will have an opportunity to review and comment on the draft report before we finalize it.

We would also appreciate any suggestions you may have regarding other key individuals to interview. We will be sure to keep you updated about our findings and recommendations.

Interview Questions

The following are the questions we will be using to guide the interview process.

You and your organization

- Please tell us about yourself and/or your organization. What is your current title and contact information? How long have you been with this organization?
- In what ways do your work and/ or interests relate to the progress of distributed energy in New England? What role have you played in the distributed energy community?
- What are your objectives and goals regarding the future of distributed energy?

Feedback on Draft Report

- We have included with this protocol a preliminary report on the state of the distributed energy industry. We would appreciate any feedback you may have to offer or any suggestions for additions.

View of the Current Situation

- Which major issues pertaining to distributed energy do you find most relevant to your professional goals?
- Which strategies for building consensus about changes in energy policy have worked for you in the past?
- In general, what policies or programs would you recommend to advance distributed energy generation?
- How likely do you think it is that these policies/programs will be implemented?
- Who do you see as the major players/stakeholders in the debate over distributed energy?
- Did we correctly identify all of the significant current barriers to distributed energy in our preliminary report? Do you have any to add?
- What incentive structure would your recommend to convince utilities to support distributed energy initiatives?
- What specific recommendations do you have for interconnection standards and net-metering rules that would facilitate distributed energy systems?
- What is your view of renewable portfolio standards such as those adopted by New York and Rhode Island?
- Please describe any further research or technical advances that you feel is crucial to the development of distributed energy.
- Is there anything we haven't asked that is pertinent to the development of sound distributed energy policy?

Specific Questions for Legislators

- How would you describe the political climate in Massachusetts and/or New England regarding distributed energy?
- Which states do you view as models for successful distributed energy strategies? Which state level policies do you think should be imported to Massachusetts?
- How would you modify current environmental permitting and siting restrictions and emissions requirements to encourage distributed energy development?
- Are there any specific incentives you can offer traditional utilities to garner support for distributed energy?
- What do you see as the role of decoupling in the development of DE?

Specific Questions for Utility Representatives

- What are your major concerns regarding distributed energy?
- What incentives would you like to see offered to you in order to promote distributed energy development?
- Please identify areas where you see the best potential for compromise.

Specific Questions for Industry Officials

- What concessions would you like to receive from utilities?
- What means will you use to assure utilities of the reliability of your distributed energy systems?
- What measures have you taken, if any, to promote legislative change favorable to your industry?

Next Steps

- Would you be willing to participate in a collaborative problem-solving process that would include various stakeholders of an expanded distributed energy system?

Appendix B: List of Interviewees

Kurt Adams, Maine Public Utilities Commission
Jay Apt, Carnegie Mellon Electricity Industry Center
Ann Berwick, Massachusetts Executive Office of Environmental Affairs,
Gerry Bingham, Massachusetts Division of Energy Resources
Michael Bradley, MJ Bradley & Associates
Sean Casten, Recycled Energy Development, Chicago
Tom Casten, Recycled Energy Development, Chicago
Sarah Creighton, Tufts University Office of Sustainability
Fran Cummings, Massachusetts Technology Collaborative
Doug Foy, DIF Enterprises
Seth Kaplan, Conservation Law Foundation
Skip Laitner, American Council for an Energy-Efficient Economy
Jim Marzilli, Massachusetts Legislature
Rob Pratt, Kendall Foundation
Tim Roughan, National Grid
Art Smith, NiSource
Eric Svenson, PSE&G
Sue Tierney, Analysis Group
Eric Wong, Cummins Power Generation