Pioneer Valley Planning Commission

REGULATORY ASSESSMENT

A Review of Regulatory Issues Concerning Development of Small Scale Renewable Energy and Distributed Generation in the Pioneer Valley region of Western Massachusetts

Pioneer Valley Planning Commission

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1.0 INTRODUCTION

1.1 PURPOSE

The Pioneer Valley Planning Commission has undertaken this Regulatory Assessment to examine potential local barriers to development of small- to mid-scale distributed generation and renewable energy facilities. For the purposes of this report, "distributed generation" refers to electric generating units located at or near to the customer site. The broad term encompasses advanced combustion technologies such as microturbines, reciprocating engines and fuel cells, as well as non-combustion options like photovoltaic cells and wind turbines. (See Appendix A for description of the technologies). In turn, renewable energy describes the inputs or fuels used to power distributed generation units. Renewable energy sources include wind, sun, biomass/biodiesel, methane from landfills (a.k.a. landfill gas or LPG), and water. Definitions of scale will be discussed in detail below.

Growing interest in renewable energy and distribution generation for electric supply, combined with residents' concerns for the economic and environmental well-being of the region, has prompted the need for this examination. Differences among DG units and energy sources regarding physical form and impacts, land requirements, and appropriateness in relation to local energy demands will necessitate a comprehensive, regional approach to energy planning. Thus, the goal of the Assessment is to consider municipalities not as separate entities, but as linked, mutually-dependent, and potentially cooperative localities.

1.2 BACKGROUND

Advances in technology, restructuring of utility companies, and formation of competitive markets following industry deregulation are creating unique historic opportunities in the electric industry. In the near term, upgrading of policies and regulations can provide a framework for greater use of small- and mid-scale generation technologies that offer economic, environmental, and reliability benefits. Small-scale projects here include residential units and units that power a single business or small group of businesses, i.e., those units that generate power solely for use by their owners. Small scale facilities typically fall into a range of 5 kW to 1 MW. Mid-scale in turn refers to larger municipal or commercial projects that create (excess) energy for transmission into the grid. Here wattage may be in the range of 1 to 10 MW. Further down the road, development of distributed generation infrastructure may also offer opportunities for integration with communications technologies to create "smart buildings" or "smart cities" and local electric grids. These developments together can result in greater reliability, lower costs, self-reliance, and greater efficiency for electricity consumers.

At the current stage, key challenges for most emerging distribution generation technologies relate to market development, equipment improvements, and reduction of manufacturing costs (and hence retail prices) through mass production. Significant policy-related challenges and barriers, however, also exist at the federal, state, and local levels. Difficulties arise from problems with utility interconnection, a lack of standards and insufficient regulatory experience, and the absence of policies and rules that apply to small generators. How distributed generation facilities develop and the extent to which they enter service over the next few decades will depend in part on public policy developed to guide markets and operations.

Substantial progress is being made on the above policy issues. At the federal level, work is currently underway to establish uniform technical standards and market policies to facilitate development of distributed generation. In turn, the Massachusetts Department of Telecommunications and Energy has initiated a process to establish uniform policies for utility interconnection for generation 60kW and below. State renewable energy portfolio requirements (known as "renewable portfolio standards" or RPS) and a market for renewable energy certificates have been put in place. At both the federal and state levels, significant financial incentives exist in the forms of grants and tax credits for installing and operating distributed generation units.

Municipal governments, in the region and elsewhere, also are beginning to examine and formulate rules and regulations for distributed generation. For example, as will be discussed in more detail below, the town of West Springfield includes a provision in its zoning by-laws entitled Energy Use and Conservation. The provision's purpose is to encourage "alternative sources of energy" and to accomplish the goals and policies of the Town's Master Plan; it contains detailed regulations for wind facilities. Several other towns allow exemptions for wind turbines that would otherwise violate height restrictions. The role of local governments is a key issue because most distributed generation units fall below state and federal permitting thresholds regarding size and/or operations. An energy generation facility must qualify as "major" to be federally regulated under the Clean Air Act. Small to mid-scale DG and renewable energy facilities typically fall below this threshold. Thus, local jurisdiction will primarily determine the siting and permitting of these facilities. Development of local government policy and permitting is vital to the regulation of distributed generation.

1.3 SCOPE AND METHODOLOGY

The focus of this study is on local zoning requirements, building codes, health and safety regulations and rules, and planning requirements. To this end, the Regulatory Assessment reviews current municipal zoning policies for the 43 Pioneer Valley Planning Commission member communities. It also evaluates restrictions and requirements of local "historic" districts.

The Assessment utilized a document survey and interview process, with peer review. Key documents were identified and reviewed, and discussions were conducted with specific individuals who formulate, interpret and work within the framework of municipal and regional policies, as well as past DG and renewable energy applicants. The results of the research were compiled in draft form, which local and regional planners and the Pioneer Valley Renewable Energy Advisory Committee then reviewed.

1.4 SUMMARY OF FINDINGS

Examination of municipal-level issues related to distributed generation is in the beginning stages. Conditions vary significantly from municipality to municipality. Nevertheless, general findings show the types of local barriers that may be anticipated upon the emergence of any new technological development. These barriers as applied to distributed generation include:

General

- Overall lack of [interest in] understanding about and awareness of distributed generation technologies in the regulatory and policy-making communities
- Differential knowledge of various distributed generation technologies
- Overall exclusion of biomass

Municipal Zoning By-Laws

- Lack of clarity regarding the threshold between accessory use and primary use for distributed generation facilities
- Lack of consistent definition and interpretation of distributed generation as a primary use
- Inconsistent attention to the permitting of power generation in local by-laws
- Uncertain permitting pathways due to an absence of appropriate use terms to cover distributed generation
- Extensive review processes and potential for excessive time delays arising from the need for special permits, variances, or zoning amendments to accommodate distributed generation facilities
- Inconsistent treatment of wind facilities
- Lack of height exemptions for wind facilities
- Omission of less familiar technologies, such as biomass and landfill gas
- Failure to extend protections, in effect for solar and wind, to biomass

Historic Commissions

- Absence of consideration for wind power generating facilities
- Incompatibility of modern wind towers with historic district requirements
- Absence of exemption from historic district regulation for public utilities

Environmental

- Potential for Conservation Commission review and ensuing appeals/time delays
- Possible delays from more rigorous environmental standards imposed on renewable energy versus conventional energy generation

Local Administration of State Codes

- Possible delays from building, electrical, and plumbing code enforcement where independent engineering review is required
- Additional construction costs from compliance with fire safety requirements
- Possible referral by Board of Health to State Department of Environmental Protection of potential air pollution problems where facilities use less clean fuels, as with wood-burning biomass facilities

2.0 Knowledge of the Town Codes' and Local Regulator's Roles in Distributed Generation and Renewable Energy

As stated above, the development of distributed generation and renewable energy in the Pioneer Valley will call into play local laws, regulations, and enforcement. Lack of familiarity with the technologies among lawmakers and regulators can be a substantial barrier to proliferation of distributed generation and renewable energy. In such an atmosphere, zoning code provisions developed for other land uses may serve as unduly restrictive or overbroad proxy regulations. Such provisions are likely to delay and increase the costs of, and impose unnecessary requirements on, DG facilities. A more detrimental scenario can exist where local bodies have inaccurate knowledge (as opposed to a simple lack of information) regarding DG. Here, town lawmakers may erect explicit legal barriers to DG development based on erroneous conceptions of the technologies' potential impacts on the community. Similarly, but where explicit barriers do not exist, poorly informed enforcers may use generally applicable performance, impact and dimensional standards to block DG projects.

An understanding of the various DG and renewable energy technologies can reduce or eliminate these roadblocks. Exposure to existing successful projects can also guide local lawmakers in designing tailored provisions that better anticipate the true impact of DG development. Education of local regulators can ensure that the case-by-case enforcement of these provisions proceeds by taking into account the particular impact and benefits of each project or category of projects. Finally, informed lawmakers will be better equipped to consider DG's larger context and make appropriate forward-looking laws. Addressing DG's context may, for example, necessitate the creation of a regional body charged with matching the inter-municipality allocation of DG to energy needs.

During our research, we encountered very little awareness of the term "distributed generation" among public officials. Within the category of renewable energy, greater awareness existed of more common technologies such as photovoltaic cells and wind turbines. However, local officials still viewed these technologies in the context of the first wave of interest in renewable energy, i.e., associated with individuals who went "off-grid" for personal purposes. They did not have awareness of new and updated technologies, or the cost-savings that these technologies could provide schools and municipal buildings. Importantly for the Pioneer Valley, local officials had little knowledge of biomass technologies. These technologies are highly appropriate renewable energy choices for the region due to its large volume of readily available organic fuel from significant local farm, forestry, and other land-based sectors. Overall, local officials lacked a sense of what role distributed generation and renewable energy technologies may play in an integrated and dynamic network of more efficient and cost-effective energy supply resources. This latter context for any of the technologies appears to be quite absent at nearly all levels of local government.

2.1 MUNICIPAL LAND USE REGULATION

Two main regulatory mechanisms govern the physical development of land under Massachusetts law. Zoning by-laws generally determine the comprehensive layout of all compatible land uses throughout a community. In turn, subdivision controls and planned unit development (PUD) provisions constitute a set of regulations aimed specifically at residential development, although the latter also is specifically adapted for application to mixed use projects. A municipality's authority to issue and enforce subdivision controls arises under enabling legislation separate from the zoning enabling law. PUD regulations, in contrast, are usually contained in the zoning by-law, as their statutory authority arises under the special permit provision of the Massachusetts' Zoning Act.

2.1.a Zoning Overview

Massachusetts General Laws (MGL), Chapter 40A, commonly referred to as the Zoning Act, provides for municipal regulation of the use of land and structures in Commonwealth of Massachusetts communities. The specific provisions of Chapter 40A temper the constitutional authority to zone land in any Massachusetts community. This chapter of the law sets forth what localities may regulate by specifying the particular limitations on the content and scope of local zoning regulations.

As such laws pertain to (DG) facilities, local zoning regulations are an intricate maze of interpretation issues, nuances, and gray areas, especially in the area of use provisions. However, there are also some very direct and easy-to-understand provisions that may serve as partial barriers to deployment of DG facilities in Pioneer Valley communities. These provisions include the status of such facilities as structures (or parts thereof) which require compliance with building setbacks from property lines, observance of total site coverage requirements, and adherence to building height limitations.

Zoning also impacts subdivision control to the extent that subdivisions must be laid out in agreement with local zoning standards as well as local subdivision regulations. Where zoning encourages grid style subdivisions to occur, as opposed to cluster or open space development, less opportunity exists to incorporate shared power generation facilities because all of a project's land typically is dedicated to roadway and lots. Also, the grid approach may render house lots difficult to build on for optimal solar access if, for example, the new street runs north/south and houses must face the street. Open space subdivision regulations, in contrast, allow a developer to set aside land for a generation facility and the increased ability to design home sites for solar access.

2.1.b How Zoning Directly Regulates Land Use: Use Provisions

The Zoning Act provides for the establishment of regulations governing classes or categories of land use with the express requirement that all uses in a particular class or category are regulated in the same manner. Zoning bylaws spell out, in either a comprehensive table or narrative form by zoning district, the uses permitted in each zoning district. Use schedules further specify whether each use is allowed by right, conditionally, or by special permit. They also indicate which uses are not allowed at all. When uses are allowed and they involve new construction, all required approvals and conditions under zoning as well as other land use regulation (Conservation, Historic, Health, Building Code, etc.) must be obtained prior to the issuance of the building permit. (See Chart 1, which outlines the permitting process described below.)

2.1.c Primary versus Accessory Uses

The term "primary use" is largely self-explanatory. Typically, factors such as the intent of the owner, design and/or arrangement of the parcel, intensity of the use relative to other uses occurring on the premises, and degree to which the use generates income for the property owner determine whether a use is primary for zoning purposes. The main permit governing a parcel will be issued in reference to the parcel's primary use. Thus, where a use qualifies as primary under criteria like those listed above, the by-law must specifically permit the use as allowed (whether by right, conditionally, or by special permit, see below) in the zoning district in which it is proposed.

Zoning law considers those additional uses of a parcel which are incidental to or supportive of the primary use as accessory uses. Such uses are not subject to independent scrutiny or any separate permitting requirements under local zoning codes. Local permitting boards exercise some discretion in determining whether a use is accessory or whether it crosses the line into primary. Thus, the primary-accessory distinction introduces a layer of potential uncertainty for DG development.

2.1.d By Right Uses

Zoning Codes may specify that certain uses are allowed by right (sometimes expressed as "as-of-right") in a given district. In such cases, a proponent merely submits an application for a building permit to establish the proposed use on a parcel of land, including detailed plans for the proposed structure or activity. If all setbacks and other "bulk" or dimensional provisions are satisfied and the reviewing building official agrees that the use is permitted by right under the use schedule, the town issues the building permit. In most cases, uses other than single-family detached residential are subject to site plan review. This assessment seeks to assure safe and functional site design and to confirm compliance with applicable development standards in the zoning by-law. Other than site plan review, by right uses usually face no additional permitting requirements.

2.1.e Conditional Uses

A conditional use provision imposes a level of requirements slightly above that of a straightforward by right use provision. Rather than simply list an unqualified allowed by right use, a conditional use provision adds criteria that an applicant must meet prior to obtaining a building permit. Such criteria may include, e.g., limited hours of operation or dimensional restrictions. Unlike special permit determinations (see below), issuance of a building permit pursuant to a conditional use provision involves clear, specific and consistent standards that usually create only a minimal barrier to development.

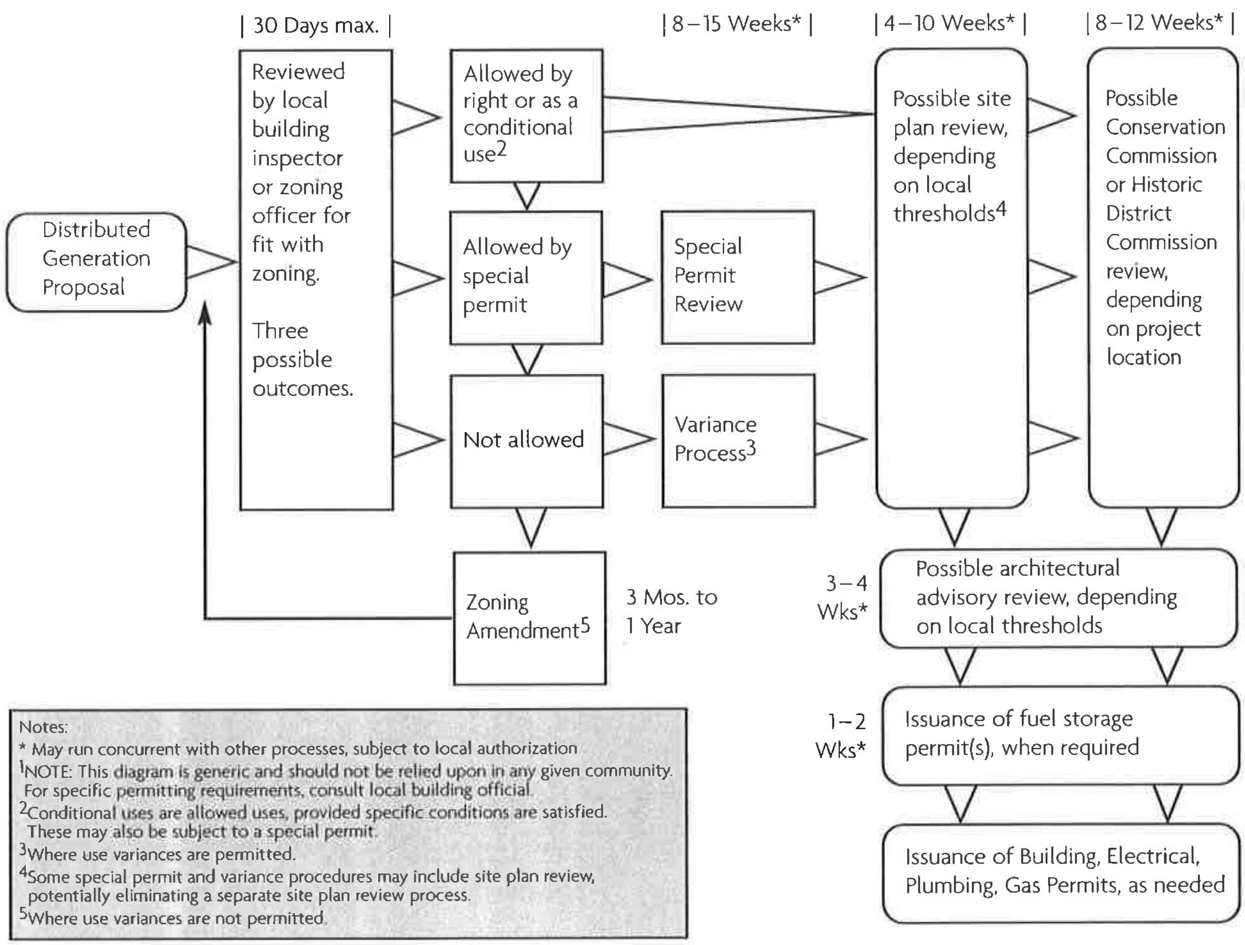
2.1.f Special Permit Uses

Zoning by-laws also may specify that certain uses require issuance of a special permit. Such permits may be issued by the Special Permit Granting Authority (SPGA)—usually the Zoning Board of Appeals (ZBA) or the Planning Board (PB), as specified in the by-laws. A special permit determination can be much more subjective than issuance of a by right or conditional use permit. Most zoning codes mandate that the special permit granting authority (usually ZBA or PB) make a determination based on specific criteria stated in the by-law before issuance of the permit. These criteria vary greatly in their scope and substance from town-to-town. Of particular importance to DG development is MGL 40A Section 9's grant of authority to issue special permits for planned unit development.

The minimum requirements of a special permit under the state enabling statute are that the proposed use would not be detrimental to the neighborhood or derogate from the intent and purpose of the zoning by-law. A special permit provision thus, for example, may explicitly require that a proposed project be in keeping with the General Purpose Statement of a town's zoning by-laws. This requirement can be particularly onerous for developers, as general purpose provisions typically list broad value statements that may be widely interpreted by town officials. In the specific case of distributed generation, two commonly seen general purposes may be of particular concern, especially for combustion technologies: 1) conserving health and 2) securing safety from fire, flood, panic, and other dangers. Also, a standard general purpose statement includes a list of infrastructure and amenities for which the zoning by-laws will "facilitate the adequate provision." The list includes "transportation, water, water supply, drainage, sewerage, schools, parks, open space and other public requirements." It rarely, if ever, mentions energy, even though many towns until recently relied on power from municipal power plants. Under a general purpose statement that omits energy from the infrastructure list, town zoning officials have no affirmative obligation to balance energy interests against other values encoded in the statement. Several towns have taken action in this area by amending their general purpose statements to recognize renewable energy as a value. These towns have done so by adding a statement encouraging renewable energy development, as opposed to including energy in the infrastructure list.

In addition to the above state statutory requirement, most Pioneer Valley zoning by-laws include a lengthy set of special permit criteria determined at the local level. Provisions cover matters such as environmental protection; avoidance of noise, odors, dust, glare, and vibration; traffic generation and safety; screening and landscaping; and compatibility with certain municipal planning objectives, principles, and standards. In the last category, a zoning code may require that decisions are consistent with a town's comprehensive plan (for in-depth discussion of comprehensive planning, see below). Here a comprehensive plan that lays out a strategy for encouraging renewable energy development may be used in the permitting process in favor of an individual DG proposal, assuming that consistency can be demonstrated.

CHART 1. GENERALIZED PERMITTING PROCESS OVERVIEW[1] ZONING AND OTHER LOCAL REGULATIONS APPLICABLE TO DISTRIBUTED GENERATION



Notes:
* May run concurrent with other processes, subject to local authorization
[1]NOTE: This diagram is generic and should not be relied upon in any given community. For specific permitting requirements, consult local building official.
[2]Conditional uses are allowed uses, provided specific conditions are satisfied. These may also be subject to a special permit.
[3]Where use variances are permitted.
[4]Some special permit and variance procedures may include site plan review, potentially eliminating a separate site plan review process.
[5]Where use variances are not permitted.

The discretionary nature of special permit decisions and the required vote by a 2/3 or 4/5 majority (depending on the size of the board) make for great uncertainty. A special permit is not something to which an applicant is entitled. Rather, the reviewing board must determine whether the applicant is in compliance with the typically qualitative criteria listed above, a role which involves a great deal of interpretative discretion. For example, as stated above, a special permit provision may require that the board's determination be in keeping with the by-laws' broadly worded general purpose provision. A board may deny a special permit upon issuing written reasons. MA courts have given wide latitude to local boards regarding their bases for denying an application, provided the reasons bear some relation to a specific provision of the by-law. Thus, the special permit process represents a significant potential barrier to DG development. Only after multiple experiences with DG proposals in a particular community would applicants enjoy some predictability regarding the likely outcome of a special permit proceeding.

Procedural requirements above those required for a by right or conditional use may create additional challenges, uncertainty and delays for special permit applicants. For example, abutters must receive notice of the public hearing required for these types of permits. A special permit granting authority furthermore may defer action, extend the public hearing or otherwise not act on the special permit application for a period of up to 120 days after the close of the public hearing. Following the filing of the decision, a thirty day appeal period must lapse before a building permit can be issued. All abutters to any land affected by a subject development proposal must receive notice of a special permit determination, and have legal standing to then appeal a decision to grant a special permit. Such litigation can delay project implementation for years. In addition to uncertainty in the initial proceeding, the right of abutters to appeal a special permit decision constitutes a wild card with special permit uses. This source of uncertainty will exist even after local regulators amass experience with DG. The net effect of a protracted appeal may be to render the proposal financially infeasible, especially if the appellants seek monetary or other forms of mitigation.

2.1.g Prohibited Uses

At the most stringent level of use regulation, zoning by-laws may explicitly prohibit certain uses in some or all zoning districts in a community. A zoning by-law also may prohibit a use by omission: in standard zoning enforcement practice, when a zoning by-law does not mention a specific use in its section on permitted uses and the use does not fit within the definition of any other use in said section, the use is considered specifically prohibited. When a use is specifically prohibited, a developer proposing such a use may not obtain a building permit unless the local ZBA issues a use variance. In a town that does not allow use variances, the only recourse for a proponent of an omitted or prohibited use is to petition the town for an amendment to the local zoning by-law so as to permit the desired use. For any DG facilities that may fall into this particular category, zoning can be a formidable barrier that could be difficult to surmount. An amendment may be particularly hard to obtain where the by-laws explicitly prohibit the specific use and/or similar uses, as the proponent may face an uphill battle against negative perceptions—often erroneously based on dissimilar technologies—in the municipality.

2.1.h Use Variances

Chapter 40A grants municipalities the authority to issue use variances. To exercise this authority, a town must include an express statement in its zoning by-law that the ZBA has the authority to grant use variances. As the statutory grant is discretionary, some towns do not authorize their ZBA to grant variances for use. Study area communities that do not authorize granting use variances are identified below in the section on zoning review by town. (See the discussion and town-by-town zoning summary on Table 1, Section 5.)

In order to grant a variance for use, the ZBA must hold a public hearing for which notice has been issued. With regards to substance, the ZBA must find that the applicant or the community would suffer a hardship, financial or otherwise, if the relief were not granted. It must also find that granting the use variance would not substantially derogate from the intent and purpose of the zoning by-law. A ZBA need not make its determination based solely on the use as proposed by the developer. Rather, the ZBA may exert control over the use by imposing conditions, safeguards and limitations both of time and of use on the proposed project (although such provisions may not be conditioned upon the applicant's continued ownership of the land and/or structures that are the subject of the application). The specific requirements for approval of a variance are found in MGL Chapter 40A, Section 10.

2.1.i Preferred Uses: Incentives

A town looking to encourage certain uses may do so through overlay districts and/or incentives, both of which must be provided for in the zoning by-law. The subject matter of the preferred use is at the discretion of the implementing municipality, pursuant to any restrictions imposed by state and federal law. For example, these two zoning tools have enjoyed recent popularity with towns seeking to revitalize their downtowns, where preferred uses may consist of civic space and affordable housing. An overlay district may offer incentives in the form of dimensional bonuses, e.g., extra square footage or height allowances above those permitted by right, to developers who propose preferred use projects. Other incentives may include expedited review or waiver of application fees. Overlay districts need not include incentives, but alternatively may promote environmentally-friendly uses by restricting otherwise allowable uses that degrade green space. In addition, an overlay district may convert a previously prohibited or special permit use to a by right or conditional use across one or more existing districts without changing other features of said district(s). An overlay district similarly may sanction a new use in one or more existing districts. No municipality in the Valley currently employs any of the above incentive tools in the areas of distributed generation or renewable energy.

2.2 TREATMENT OF DG AS A USE

2.2.a DG as a Primary Use

Where a DG facility would qualify as the primary use of a parcel of land, as is likely with mid- to large-scale projects, distributed generation or an analogous use term must be specifically permitted in zoning district in which it is proposed. This single aspect of zoning regulations poses a substantial barrier to proliferation of higher output DG facilities in the study area. If a DG facility were proposed as a primary use, it most likely would be labeled and regulated as "power generation" or a "power plant" under local zoning codes.

2.2.b DG as Power Generation

One option for including DG in zoning by-laws is to define a general category of "power generation" that stands alone or is accompanied by further definitions of different types of power generation (such as fossil fuel or renewable fuel-based). Most local by-laws examined for this assessment do not explicitly list power generation as a use, and thus are likely to be read as prohibiting it. Moreover, power generation use provisions, where they do exist, support only public power generation. Zoning codes thus do not specifically sanction power generation by private entities like those businesses currently defining the distributed generation market.

One exception to these general barriers is the requirement imposed by the Massachusetts Solar Access Law, MGL Chapter 40A, Section 3. The law specifically prevents a municipal zoning by-law from prohibiting or unreasonably regulating the installation of solar energy systems or the building of structures that facilitate the collection of solar energy, except where necessary to protect the public health, safety or welfare. Solar access is further discussed in the section on incentives.

Electric distribution facilities (as opposed to generation facilities or power plants, see below) tend to be allowed in all zones, exclusive of buildings used in connection with such facilities. This widespread positive treatment likely results from the federal definition of electric distribution facilities, adopted at the state level, which includes power lines.

2.2.c DG as a Power Plant

Typically, power plants, if they are allowed at all, are permitted only in industrial zones. When power plants are permitted, they are usually subject to the issuance of a special permit. Due to power plants' eligibility for zoning exemptions pursuant to MGL c40A §3, many towns may have intentionally left this use term out of the by-laws. The majority of local zoning codes thus would not permit most forms of larger scale DG under the use term "power plant," and the matter would go before the Zoning Board of Appeals in towns where a use variance may be issued. Another option is that a party may appeal the Building Inspector's decision to call the project a power plant (commonly called an "interpretation appeal"). In the DG applicant's favor, an appeal would enable Board of Appeals review and re-categorization of the proposed DG use into a permissible use category. The appeals process also may go the other way and affirm the Inspector's decision, thereby closing the door on zoning relief through the Board of Appeals.

At any time in the process, a DG power plant proponent may petition the local town meeting or town council for a zoning amendment that would allow the power plant use in an acceptable location(s). Towns who agree to an amendment must pass generally applicable, carefully constructed use provisions to avoid "spot zoning" legal challenges. Such a challenge holds that the amendment impermissibly singles out a parcel of land for a use classification that is different and inconsistent with the surrounding area, such that the owner of the property benefits and other property owners incur costs. In the context of DG as a power plant, a spot zoning allegation may be anticipated from, e.g., abutters who object to development of a mid-size facility based its noise and visual impacts. Generally speaking, nevertheless, the zoning change route has some merit for DG power plants: they are clean energy sources as opposed to the traditional, air-polluting power plant. The individual town can accommodate the specific design of a DG with the knowledge that green power may come from it and that the generating capacity would be limited to a reasonable level. (See Section 7 for more discussion on zoning strategies.)

2.2.d Specific DG Technologies as Uses

Most zoning codes lack specific reference to any of the forms of DG examined in this report, except for scattered references to solar and wind generation facilities (see below). As stated above, the codes instead occasionally mention "power plant", "power generation", or "public utility" as a specifically permitted or prohibited use. Where codes encourage and/or reference solar or wind facilities, DG facilities that fall into these general categories and meet all general and/or specific applicable requirements (dimensional, performance, etc.) should face no use regulation barrier.

2.2.e DG as an Accessory Use

When DG facilities are only part of the power supply facilities of a single residential, commercial or industrial parcel or site, they are universally considered accessory uses. One possible argument supporting this interpretation is as follows. All permitted land uses do not now need separate permission to have a connection to the existing power supply grid. In other words, the use of electricity is implicitly allowed via the standard form of delivery, which is by way of overhead and underground power supply cables. A distributed generation unit within the context of a commercial or residential primary use simply offers an alternative form of delivery, and should be allowed by right as part of the building permit for the primary use.

However, when such facilities involve generating power to be delivered to the power grid, these otherwise accessory uses may be subject to widely different interpretations according to local building officials interviewed on this question. The selling of power over the property line could potentially put the formerly accessory use into a commercial use category, subject to a proper fit in the zoning by-law as if it were a primary use. Thus the interpretation of accessory vs. primary use for a particular DG facility may pose a substantial barrier for units that could deliver power to the regional electric grid. When a fuzzy interpretation situation arises at the local level, as it might with DG facilities designed for more than back-up power generation, the local building official charged with interpreting the zoning regulations would be likely to send the matter to the Zoning Board of Appeals (ZBA), rather than risk being responsible for a potentially controversial ruling.

Federal precedent does exist, however, for treating some DG facilities that deliver energy to the grid as accessory uses. A 2001 ruling by the Federal Energy Regulatory Commission held that net-metering does not constitute a "sale." This reading of commercial purpose strongly suggests that residentially and commercially-sited DG facilities that periodically deliver energy back to the grid, but still produce less than the associated residence or business' total energy needs (on a monthly/quarterly/annual basis), should be treated as accessory uses. Such an interpretation would likely be subject to each state's definitional limitations on net-metering. For example, a Massachusetts qualifying facility must be less than or equal to 60 MW; under the above interpretation, DG facilities of this size that meet the state's remaining standards for net-metering should not be considered primary uses.

In sum, the primary-accessory issue may be viewed as breaking down DG facilities into four tiered categories. The categories and their likely treatment are as follows. Facilities that produce energy solely for on-site consumption and those that qualify for net-metering status under state legislation will be held accessory and thus allowed under the consuming use's permit. In contrast, facilities that produce energy for on-site consumption, deliver energy back to the grid and exceed the 60 MW net-metering threshold may be considered prohibited primary uses where not otherwise authorized under a power plant or technology-specific provision. Those DG facilities that exist solely for the purpose of generating energy for delivery to the grid will presumptively be treated in the same manner. The battle ground is likely to be over the third category and whether local regulators should go beyond the state definition of net-metering to consider the ratio of a facility's generation for on-site consumption to its grid delivery output. This discussion is meant only to discuss possible treatments of DG by local officials based on output and degree of on-site energy use; it is not a specific statement of how local officials have actually treated DG in the past.

2.2.f DG as a Use Accessory to Scientific Research

MGL Chapter 40A requires all municipal zoning codes to include an allowance for uses accessory to a permitted scientific research use that may include production, provided such activities are necessary in connection to the scientific research. Such accessory uses and production may be on a separate lot from the permitted primary use. Towns allow such activities by special permit. This provision, while not necessarily an easy route, is a possible early initial option for DG deployment in all study area towns until other remedies to zoning barriers are implemented. Many existing DG facilities in the Valley and environs, like Mt. Wachusett Community College's biomass facility and the Mt. Tom wind turbine, are demonstration projects with significant research components. These facilities are likely to automatically qualify for the scientific research exemption.

2.3 HOW ZONING INDIRECTLY REGULATES LAND USE

2.3.a Site Development Requirements

In addition to directly regulating uses, zoning by-laws may indirectly and significantly impact DG development through the application of site development requirements. These regulations, also known as "dimensional" regulations or schedules, govern the physical form of a structure on a given piece of land, assuming that the parcel's use is allowed under the by-laws' use schedule. The main categories of dimensional requirements relevant to DG development include setbacks, site area ratios, height limitations, and floor area ratios. Descriptions of and justifications for dimensional requirements are as follows:

- *Setback.* A required distance that a structure must be from the property line. Separates residences and businesses from street noises, adds to the aesthetic quality of environments, and ensures access to light and air.
- *Site Area Ratio.* Specifies the maximum percentage of a lot that a structure may occupy. Controls density, in conjunction with height limitations, by limiting the square footage allowed in a building.
- *Height Limitations.* Specifies the maximum height, in feet and/or floors, of a structure. Controls density by limiting the building bulk allowed by, e.g., a site area ratio alone.
- *Floor Area Ratio.* Specifies a ratio between the square footage allowable in a structure and the square footage of a lot. Allows more flexibility in design than under a more traditional site area ratio plus height limitation scheme.

Whether dimensional requirements apply to DG development depends on qualification of a given DG unit as a structure or building under the by-laws. A unit that does not meet the definition of a structure will escape generally applicable dimensional requirements. Alternative requirements may exist for units that fall below the structure threshold.

Dimensional requirements may negatively impact DG developments that do qualify as structures in several ways. Setback requirements and height limitations can be especially onerous for wind turbines, whose efficiency is dependent on height. Overly restrictive height limitations may block efficient turbines absolutely; stringent setback requirements, most notably those that vary in relation to height, may similarly limit turbine development on smaller lots. Site and floor area ratios may prevent installation of on-site DG units where the lot in question is already at maximum build-out. To overcome these barriers to renewable energy development, some towns allow exemptions from dimensional requirements for DG projects. Examples include height exemptions for wind turbines, as well as for solar panels whose presence on structures otherwise in compliance with height requirements would place the structure in non-compliance.

2.3.b Site Plan Review

Site plan review is a zoning tool used by municipalities to control the site details of a given commercial or industrial development, including the site development requirements listed above as well as aesthetic, safety, and environmental impacts. It typically applies to large buildings, intensive uses, changes in use, new commercial uses, and the like. Thus, site plan review is analogous to subdivision regulation (see below), but covers non-residential development where subdivision does not occur. Issuance of a special use permit generally requires site plan review; site plan review may also attach to an as-of-right use, where it is used to impose reasonable conditions. When required, site plan review must occur prior to issuance of a building permit. Site plan review varies widely in its scope, filing requirements, review process, notification of abutters, etc. This is due to the lack of specific guidance in the State zoning legislation (MGL Chapter 40A), which contains no specific mention of site plan review. While the statute is silent on site plan review, local zoning codes have been amended (amended with the approval of the state Attorney General's Office, which affirms that a by-law is not inconsistent with state statutes or the State Constitution) so as to include some form of plan review for commercial, industrial, institutional, and some types of larger residential development. The state Attorney General's Office has affirmed that a by-law is not inconsistent with state statutes or the State Constitution. In addition, Massachusetts courts have recognized site plan review as ancillary (1) to the issuance of a special permit where otherwise required, and (2) to the issuance of the building permit where special permits are not required.

According to one state official active in the renewable energy field, site plan review is the most common route by which towns deal with DG and larger scale renewable energy facility development. Site plan review governs how something is developed (as opposed to whether it should be developed) and is usually aimed at making sure all other local zoning laws are satisfied. Thus, it is important to note that site plan review does not represent a significant barrier to DG development when compared to use restrictions, other than time delay of up to two months or possibly longer for processing. If a proposed project is noncompliant, then the applicant can correct it and eventually obtain site plan approval.

Given the current application of site plan review to the types of proposals listed above, site plan review would probably not be required unless a proposed DG unit was a primary use. However, thresholds may change. Therefore, it would be appropriate to consider a model to deal with the relationship of site plan review to DG facilities, both large and small.

2.3.c Planned Unit Development

Chapter 40A Section 9 gives municipalities the explicit authority to issue special permits for planned unit development (PUD), i.e., mixed-use single projects that may include single- and multifamily dwellings as well as office and commercial space. In Massachusetts, the mix of uses and structures must be deemed advantageous enough to justify the project's exemption from otherwise applicable requirements of the zoning district. The goal of planned unit development regulation is to provide a set of standards for the approval of a PUD in an administrative review process. Reviewing the project as a single entity allows improved comprehensive siting and higher densities combined with open space. Thus, PUD may be well-suited to DG development: higher densities mean that economies of scale may be achieved for each DG unit, while open space set-asides and comprehensive siting allow installation of a DG in a proper on-site location. PUD regulation is similar to site plan and subdivision review, but typically grants more discretion to the reviewing authority. Similar issues about DG arise under PUD regulations as under site plan and subdivision review.

2.3.d Subdivision Control Regulations

MGL Chapter 41 Sections 81K to 81GG is known as the Subdivision Control Law, a separate enabling statute from the Zoning Act. Under the authority of the Subdivision Control Law, municipalities adopt regulations governing the subdivision of land. At their essence, these regulations dictate the process for creating new roads. By extension, subdivision regulations guide the process for ensuring that development is orderly and safe. Lot layout, road construction standards, provision of amenities like street trees, access, and the provision of infrastructure are all determined by these regulations. The Subdivision Control Law outlines discretionary topics which a planning board may regulate, as well as several mandatory rules and restrictions. Subdivision regulations are promulgated by the Planning Board; their passage thus requires a public hearing and a simple majority vote. This process makes modifying subdivision regulations much easier than amending the zoning bylaw under the town meeting or council super majority requirement. Most communities require applicants to submit some sort of development impact statement (DIS), which allows Planning Boards to assess the impacts of a subdivision on natural resources, traffic, and infrastructure.

Subdivision regulations can encourage residential subdivision design that facilitates DG, although few in the Pioneer Valley address this issue. For example, in some of the Pioneer Valley communities, DIS reference renewable energy technologies. Perhaps the most significant way in which subdivision regulations can reduce the barriers to DG is through encouraging street and lot layouts that take advantage of solar orientation. By laying streets out on a west to east axis and by orienting building so that their longest sides face within 30 degrees of south, solar access can be optimized. This has advantages for maximizing solar heat gain during the winter months, as well as providing a potential for utilizing photovoltaic technology. Other measures might include requiring siting of street trees so as to avoid blocking solar access.

As previously discussed, open space (also known as cluster or conservation) subdivisions have the potential to use a part of the open space to generate electricity. Communities that have not adopted the open space form cannot provide this opportunity, as all property in a given subdivision must be used for residences. At the same time, the communities that have adopted this type of subdivision option may need to modify their bylaws to allow and encourage renewable energy development. Often, an open space subdivision regulation contains language mandating that the protected open space remain in a natural state; it may also provide that some portion of the open space can be used for accessory buildings or recreation. Neither of these types of regulations contemplate construction of an energy producing facility in the open space.

3.0 Zoning Findings Overview

3.1 GENERAL INTERPRETATION, PROCEDURAL, AND GOVERNANCE ISSUES

Each town in the Valley regulates distributed generation uses and equipment differently, according to the specifics in each town's zoning by-law. As stated above, in most cases the local zoning regulations do not even mention such a use or any of its component forms other than wind generation or solar access (i.e., no mention of microturbines or reciprocating engines, photovoltaic generation). Our local zoning bylaw research confirms that DG facilities are generally not allowed as primary uses, but may be readily permitted as accessory uses up to the point of the design exceeding the energy needs for the primary use. The limitation on primary use is that "power generation" or "power plant" terms are either not included at all in the list of permissible uses, are explicitly allowed in only a few districts (and thus are implicitly prohibited in others), or have sufficiently vague definitions in the by-laws so as to result in DG power generators being sent to the Board of Appeals for interpretations or use variance consideration.

As discussed above, two remedies exist if a DG use is rejected by the Building Inspector under any of these limitations (or others). First, an applicant may seek a review of the Building Inspector's decision through an application to the Board of Appeals; the applicant alternatively may petition the Town for a zoning amendment. A zoning amendment requires a two-thirds majority vote of a town meeting quorum or two-thirds of all members of a town council. Such a vote may be significantly harder to obtain under the town meeting format, as the presence of a resident/special interest-opposition group may leverage enough votes to prevent a pro-DG super-majority. The town meeting form of local government also poses a public relations challenge for distributed generation developers, as the developer must undertake a general public campaign rather than rely solely on petitioning council members. A general public campaign is highly desirable from the viewpoint of participatory democracy. The reality, however, is that such a campaign can result in substantially higher outreach and public relations costs for distributed generation developers, who may already face widespread ignorance about or animus towards certain technologies.

3.2 EXPLICIT TREATMENT OF SOLAR POWER AND WINDMILLS

Community by-laws in the review that speak of specific distributed generation and renewable energy technologies mention only two particular DG types: solar power and windmills. Solar energy is the most commonly referenced form of distributed generation and/or renewable energy, ostensibly due to the Massachusetts' Solar Access Law. While the Solar Access Law does not require that a town pass explicitly protective zoning provisions, several towns have amended by-laws that include general provisions in favor of solar power and specific regulations aimed at protecting solar access.

Where specifically mentioned, towns typically allow windmills or wind turbines as accessory uses in most zoning districts. However, no state law analogous to the Solar Access Law exists with respect to wind; height limitations in some communities thus pose limitations on the efficiency of such devices. In absence of state law, some municipalities have taken it upon themselves to protect and encourage wind power. These towns explicitly allow windmills and accompanying height exemptions to encourage energy production efficiency. Another recurrent issue with windmills is a setback provision under which the amount of land required increases with the height of the proposed windmill. Such a requirement may necessitate dedication of a prohibitively large amount of land to accommodate a tall windmill. While justifiable under safety considerations, a setback requirement may block installation of the most efficient (i.e., tallest) wind turbines. (See the Town-by-Town Zoning Review Summary below in Section 5 for specific issues in each town). Several wind-friendly towns in the study group allow exemptions from setback requirements for qualifying wind turbines.

3.3 IMPLICATIONS FOR REGIONAL PLANNING

Clearly, there are significant barriers to DG deployment nestled within the various zoning codes of the study area towns. Different issues in each community mean that a single solution would need to transcend all of the obstacles. Addressing these issues town-by-town with specific zoning amendments would be tedious, time-consuming, and questionable as to the chances for universal success in producing consistent regulations for DG uses. However, if energy load centers can be identified and the needed DG technology and capacity can be specified, then the local zoning by-law amendment approach could be productive by focusing efforts just on the towns containing the load centers.

3.4 HISTORIC COMMISSIONS

Many Pioneer Valley communities have one or more historic districts, which have been established pursuant to MGL Chapter 40C. This state law provides for protection of historic resources through enactment of local historic district regulations. These codes act in a manner similar to zoning rules in that before a building permit is issued, compliance with the requirements of the historic district regulations must be demonstrated.

A proponent of a structural change or addition on a parcel in a Chapter 40C sanctioned historic district must first file an application for a determination of appropriateness (DA) with the local historic district commission before seeking a building permit for the proposed change. The Historic District Commission schedules a public hearing on the proposal and following the hearing, makes its ruling on whether the proposed new construction or change is in keeping with the character of the historic district.

Distinct from zoning regulations, the Chapter 40C approach to development regulation can scrutinize every aspect of the appearance and placement of a proposed structure. Any new structure, including a DG unit, may be subject to scrutiny for compatibility with the proposed setting, compatibility with existing structures in the area, placement on the lot, screening and landscaping, noise levels, structural design, size, and color. Some historic district commissions publish guidelines for compatibility while others consider applications independent of guidelines or treatment of other proposals. Conversely, the Zoning Act does not allow detail-oriented regulation of materials and colors, even under special permit review. Building aesthetics are the sole domain of historic district regulations, except that DRI review by a regional commission may involve scrutiny of aesthetics.

Since historic district commission review is a very subjective process, it can therefore represent a fairly unpredictable obstacle to installation of a DG unit. However, the good news is that such commission must express in its negative determination why the proposal did not meet the commission's approval. This gives the proponent direct feedback on how to change the project design so as to obtain approval via a new, revised submittal.

Regarding windmills in historic districts, these structures would probably not pass muster due to the sleek, modern designs required for optimal efficiency, according to all historic district administrators interviewed.

Photovoltaic equipment and structures do not enjoy the same protection from undue regulation under Chapter 40C (Historic Commissions) as they do under Chapter 40A (Zoning). However, rooftop placement of photovoltaic panels would likely be found acceptable if they were hidden from view from the street level. Panels mounted on a rack in a side or rear yard might also be found acceptable if they were well-screened from street-level views.

Finally, there appears to be no parallel provision for exempting public service utility corporations from the requirements of local historic district regulations, as may occur under zoning.

3.5 OTHER POTENTIAL BARRIERS

3.5.a Governmental Environment

Both the policy-making and regulatory functions of local and regional government need to be informed about the specific issues and opportunities regarding distributed generation. Educational efforts must go into the leadership, governance, constituent and consumer levels to enable all of the above to do their respective roles in making DG deployment feasible and effective at what it can do.

During our research, we encountered very little awareness of the term "Distributed Generation" among public officials. There was a much greater awareness of some of the more common and renewable DG technologies—photovoltaic and wind power generation. However, these were still viewed in the context of their former associations and not with an awareness of what role they may play in an integrated and dynamic network of more efficient and cost-effective energy supply resources. This latter context for any of the DG technologies appears to be quite absent at nearly all levels of government.

3.5.b Conservation Commissions

Given existing state and local regulations it is assumed that placement on a lot of any DG facilities (considered structures for the purpose of regulation) would need to respect the requirements of wetland regulations. Such requirements are typically part of local wetland by-laws, which are typically more restrictive than the default state regulations governing wetland protection (MGL, Chapter 131). The default regulations apply in all communities. Local wetland regulations are typically part of a town's general by-laws and not part of zoning.

DG structures and any earth disturbances related thereto in connection with installing them or their appurtenant subsurface cables must abide by the wetland setback regulations for all structures and earth disturbances. Most wetland regulations provide for a fixed distanced to serve as a buffer area within which no work shall occur without review by the local conservation commission and issuance of an approval. Such approvals take one of two forms. One is an Order of Conditions, which sets forth how work may be done within and around the affected wetland resource area(s). Typical orders of conditions involve placement of erosion prevention barriers, minimization of vegetation removal, and appropriate mitigation of any foreseen impacts.

The other form of approval is a Determination of Non-Applicability, which the local conservation commission issues when it sees no significant impacts from the proposed work. The conservation commission may place reasonable conditions on the validity of such determinations.

In order to obtain review by a conservation commission, one must file a Notice of Intent, which sets forth a description of the proposed work, distances to wetland resources, and a description of probable impacts. The burden of delineating the exact location of protected wetland areas rests with the proponent, subject to verification by the local conservation commission itself or its agent. Filing a Notice of Intent triggers notification to abutters of the public hearing required prior to action on application. Abutters have standing to appeal a conservation commission's approval and may delay the issuance of an Order of Conditions while the appeal is processed.

Due to the lack of awareness of certain DG technology, neighbors may be sensitive to distributed power generation proposals, even at relatively low levels. This sensitivity may lead to aggressive opposition at every level of permitting, including any conservation commission review.

3.5.c Architectural Review

Outside historic districts that are regulated pursuant to MGL, Chapter 40C or in the absence of such districts, some communities have a requirement for commercial and industrial uses and signs to undergo an advisory architectural review prior to issuance of a building permit. Since this type of review is not binding and does not involve a public hearing process with notice to abutters, there is very little potential for such review to serve as a barrier to DG deployment. At most, a project may be delayed four to five weeks while the architectural review application is processed.

3.5.d Flood Regulations

Most zoning by-laws and/or subdivision regulations reviewed had specific provisions for regulation of flood prone areas and structures. These universally addressed the design of utilities in the same manner. They all required the design and placement of all utilities, including electrical supply, to be able to continue uninterrupted operation and avoid any damage during a flood up to the base flood elevation. The base flood elevation is the predicted level of flood water expected from a 100-year intensity storm.

Flood regulations, therefore, may pose a cost barrier in flood prone areas if the required design includes too much expense for constructing damage-proof facilities. In most cases involving DG facilities, though, the solution would simply be erection of a flood-safe platform upon which to mount the generation and interconnection equipment, if any.

3.6 LOCAL ADMINISTRATION OF STATE CODES

Each of the study area towns has local officials charged with interpreting and enforcing statewide regulations dealing with construction standards in the following technical areas:

3.6.a Building Code, Electrical Code, Plumbing Code

These regulations, found in the Code of Massachusetts Regulations (CMR), empower local officials to regulate local construction activity in terms of materials used, installation methods, required performance ratings, etc. All but one of these regulations do not specifically address DG as a separate item. The Electrical Code contains provisions for wiring photovoltaic and other types of generators. The role of the local official is to enforce the respective code when considering DG. In the absence of specific regulations for the DG facilities covered by this report, these officials will rely on the specifications of the manufacturer, provided it is Underwriters Laboratory (UL) listed. The UL lists products that have been reviewed for consistency with accepted standards for assembly, design, operation, and safety. Any technologies not UL listed are likely to trigger review by an independent engineer, at the request of the local code official and at the expense of the applicant.

These three state codes do not appear to be much of a barrier but local handling of new technologies may be a bottleneck with additional expense in the regulatory process when independent engineering review is required. It is very probable that when DG is commercially viable and widely available, UL registration will support local approval and independent engineering review will be very unlikely.

3.6.b Fire Code

The CMR provides for regulation of fuel storage facilities under the Massachusetts State Fire Code. This set of rules is enforced at the local level by local fire inspectors. Certain DG technologies will require fuel storage where natural gas is not available. LP gas is a readily available fuel source for DG facilities and this gas must be stored on site in containers (tanks), which may vary in size, according to the needs of the DG unit(s). The installer of such a tank must first obtain a fuel storage permit from the local Fire Department. Tanks up to 2,000 gallon capacity need only the Fire Department permit. Tanks greater than 2,000 gallons but less than 12,000 gallons need the Fire Department permit plus a license from the Board of Selectmen or Town Council. Storage of more than 12,000 gallons requires both previously mentioned permits, plus approval from the State Fire Marshall's Office. The Fire Department permits are typically not an obstacle as they usually only require siting the tanks a reasonable distance away from dwellings and other occupied structures. The latter two permit types may include a requirement for fire suppression apparatus, in addition to proper siting.

Fuel storage in large quantities would encounter very restrictive regulation under local zoning when such activity is the primary use on a parcel of land. However, the accessory storage of fuel needed for a permitted primary use would not be subject to such regulation.

A connection to the local natural gas network simply requires a permit from the local gas inspector, which is obtained by the gas company that makes the connection.

3.6.c Health Regulations

While local Boards of Health are not anticipated to be concerned with directly regulating DG facilities, they may serve as an intermediary in the referral of a suspected air pollution generator to the State Department of Environmental Protection. The State's air quality standards would govern the treatment of any DG facility that exceeded the permissible discharge pursuant to current regulations. DG units may involve some air quality issues when diesel fuel is used. However, the focus of this report is on the cleaner applications of DG, which either involve "zero emissions" in the cases of solar and wind or involve use of low emissions natural gas and LP gas.

Future concerns with Board of Health involvement regarding air quality may arise when small scale biomass DG technologies become available on the market. Biomass facilities generally emit a greater level of criterion pollutants than do the aforementioned DG technologies. However, new combustion technologies and methods of emissions control can keep such levels to a minimum. To the extent that new biomass DG units are viewed as contributing to air quality problems, local Boards of Health may seek to intervene with their development. It is important that future regulations and enforcement in this area recognize differences in biomass technologies, and do not impose unnecessarily burdensome negative presumptions against biomass technologies.

3.6.d Water Withdrawal

Any entity that proposes to withdraw more than 100,000 gallons per day of groundwater must obtain a water withdrawal permit from the Massachusetts Department of Environmental Protection. This threshold would be unlikely to affect water-using DG units on the scale contemplated for the study area.

4.0 Summary of Local and Regional Regulation of Specific DG Technologies

4.1 TURBINES AND RECIPROCATING ENGINES

See discussions of DG as accessory use and primary use in Sections 2.2 a-f.

4.2 FUEL CELLS

See discussions of DG as accessory use and primary use in Sections 2.2 a-f.

4.3 WIND TURBINES

For larger scale wind projects that plan to produce excess power, 13 towns in the Pioneer Valley may have the wind resources to support such a project according to wind speed maps available from MTC. Using wind power for site-specific uses throughout the region, is also a possibility.

Various towns in the Pioneer Valley have zoning regulations governing "windmills," "wind generating machines," and "wind energy conversion systems." They are handled quite differently in each town. Some regulations consider them only as accessory uses while others allow them as primary uses. In most cases where they are allowed, a special permit is required. In some towns, the regulations make no allowance for exceeding the standard height limitation for structures (typically 28 to 35 feet), resulting in the requirement for a height variance.

In some other towns, exceptions to height regulations may be applied to wind machine towers. In such cases, the regulations require a "fall zone" within which the wind tower could collapse from structural failure without threatening adjacent properties. These fall zones are typically determined by the height of the tower, plus the rotor length, plus 10-20 feet for equipment dispersion from the impact. For a fall zone of 150 feet, a minimum parcel area of 300' by 300' (90,000 square feet or 2.07 acres) would be required.

This regulation, while protecting the health, safety and general welfare of a community's residents, establishes a formidable economic barrier to development of efficient, high-capacity wind generation facilities, due to the high cost of land. This land cost is not just the per acre cost of acquisition and real estate taxes but also the lost opportunity cost from unrealized economic return from a more profitable use of the land other than power generation.

However, smaller scale wind generation facilities may not be so burdened. A fall zone of 50 feet would necessitate a minimum open land area of only 7800 square feet, which would probably fit in many rear yard areas of typical single-family residential parcels.

Proponents of wind machines can expect other structure-based regulations to apply as discussed above. Of particular concern is the potential conflict between rural, forested ridgelines and landscapes and the sleek, modern-looking wind machines needed for efficient power generation. Issues of aesthetics are often raised by wind project opponents. Examples from the Berkshires indicate that by addressing the concern early and by using photo simulation, opposition on these grounds can be overcome.

4.4 PHOTOVOLTAICS (PV)

This technology has been in use for many years in the study area on a limited number of properties, mostly single-family residential. No local zoning limitations for accessory installation of PV panels were discovered other than the need to observe rules for structure placement. Building code (attachment and load bearing) and electric code (wiring design) requirements for mounting PV panels on structures would apply, as would the need to obtain location approval from any local historic district commission having approval jurisdiction of the subject property. (See the separate discussions above on DG as primary use in Section 4.1.4 and accessory use in Section 4.1.5.) It is also important to note that Massachusetts law prohibits zoning regulations from unreasonably denying "solar access"—the access of a solar energy system to direct sunlight. This can be done by regulating the orientation of streets, lots, buildings, and placement of vegetation. Communities can also develop by-laws to provide for the issuance of special permits that protect access to direct sunlight for owners of solar energy systems.

5.0 Town-by-Town Zoning Review, with Notes Regarding Existing DG Facilities

5.1 AGAWAM

- No mention of power generation
- Windmills exempt from 35' height limit

5.2 AMHERST

- The Farmland Conservation Development Standards encourage siting of dwelling units and other structures to take advantage of solar heating and other climatic site characteristics.
- Points can be awarded under the Phased Growth Bylaw allowing for a faster development schedule for site design "which maximizes energy efficiency including, but not limited to, passive and active solar energy."
- "Energy facility or use" allowed by Special Permit in most districts and by Site Plan Review in two districts.
- No use variances

Existing/proposed projects:

1) landfill gas facility;
2) Bioshelters—solar-heated greenhouse

5.3 BELCHERTOWN

- No mention of power generation

5.4 BLANDFORD

- No mention of power generation
- Wind-friendly

5.5 BRIMFIELD

- No mention of power generation
- No use variances
- Wind-friendly

5.6 CHESTER

- No use variances
- Height limits can be exceeded for towers
- Wind-friendly

5.7 CHESTERFIELD

- No use variances
- No mention of power generation
- Wind-friendly

5.8 CHICOPEE

- No mention of power generation
- No use variance

Existing projects:

1) 3 landfill gas facilities

5.9 CUMMINGTON

- No mention of power generation
- Wind-friendly

5.10 EAST LONGMEADOW

- No mention of power generation
- No use variances

5.11 EASTHAMPTON

- In Open Space Residential Developments, building lot layout and siting "should be grouped in locations so that the greatest number of units can be designed to take advantage of solar heating opportunities..."
- Height exemptions by Special Permit
- Power plants allowed in two districts by Special Permit
- No use variance

5.12 GOSHEN

- Public utilities are allowed by Special Permit
- Wind-friendly

5.13 GRANBY

- No mention of power generation
- 35' height limitation

Existing projects:

1) landfill gas facility—Granby Sanitary Landfill;
2) Granby Elementary School—geoexchange loops

5.14 GRANVILLE

- No mention of power generation
- Wind-friendly

5.15 HADLEY

- No mention of power generation

5.16 HAMPDEN

- Hampden's PURD language is similar to Wilbraham's: Building location and orientation shall reflect views and solar access.
- Solar panels above the roof are exempted from the height regulations.

5.17 HATFIELD

- Public utilities allowed through Site Plan Review in all zones, does not include fossil fuel related industries.
- No use variances

5.18 HOLLAND

- Public utilities allowed in two Business Districts by Special Permit
- Wind-friendly

5.19 HOLYOKE

- Includes definitions of power plants
- Permitted use in two districts
- No use variances

Existing projects:

1) UMass RERL wind turbine, Mt. Tom;
2) Holyoke Gas & Electric Dept. hydropower facility

5.20 HUNTINGTON

- Windmills and other power facilities, excluding hydro, by Special Permit in all districts
- Hydro by Special Permit in Industrial District
- No use variances

5.21 LONGMEADOW

- No mention of power generation
- Height limits do not apply to towers

5.22 LUDLOW

- Utilities allowed by Site Plan Approval in all zones but Residential A-1
- Windmills exempted from height restrictions
- No use variances

5.23 MIDDLEFIELD

- "Services of a public utility" by Special Permit in Business Zone
- 50' height limitation for towers
- No use variances
- Wind-friendly

5.24 MONSON

- No mention of power generation
- Wind-friendly

5.25 MONTGOMERY

- No mention of power generation

5.26 NORTHAMPTON

- Power plants allowed by Special Permit in Industrial District
- Private utilities allowed by Special Permit in all zones
- Small scale hydro allowed by Special Permit in all but one districts
- Use variances allowed

Existing/proposed projects:

1) landfill gas facility

5.27 PALMER

- Special Permit criteria in the Village Center Districts allow proposals "that exceed maximum building height, the applicant shall demonstrate that the portion of the proposed structure does not significantly degrade solar access to surrounding properties."
- "Basic utilities" allowed by Special Permit in three Residential Districts
- Public utilities allowed by Special
- Permit/Site Plan Approval in Industrial B

Existing/proposed projects:

1) landfill gas facility

5.28 PELHAM

- No mention of power generation
- No use variances

5.29 PLAINFIELD

- No mention of power generation
- Wind-friendly

5.30 RUSSELL

- No mention of power generation
- Height exemptions for towers

5.31 SOUTH HADLEY

- In the General Provisions of their bylaw, an entire section is devoted to solar access. Solar energy for heating, cooling, and hot water is encouraged through protecting solar access. Definitions are provided for "solar collector, "solar energy", and "solar skyspace." Using solar energy collectors for heating and cooling is a permitted use in all zoning districts. Language authorizing dimensional variances allowing solar collectors unimpeded access to the sun is also included.
- Height regulations do not apply to solar energy collectors or related equipment, provided that the solar access of other buildings is not impeded.
- "Wind Energy Conversion Systems" are allowed to exceed the by-right height requirements with a Special Permit. Additional criteria for the issuance of a SP include the submittal of technical and performance data, the setback on a one to one basis, the Town reserves the right to rescind the permit if electromagnetic interference results, and a fence at least 6' high must surround the tower.
- No use variances

5.32 SOUTHAMPTON

- Public utilities allowed by Special Permit
- No use variances

5.33 SOUTHWICK

- Public utilities permitted in Industrial Zone I
- Height not applicable to tower

5.34 SPRINGFIELD

- Public utilities are permitted in the Industrial Park District. Accessory towers are exempted from height limits.

Existing projects:

1) landfill gas facility—Bondi's Island, operated by Phillips Energy/Springfield Energy,
2) Gasoline Alley—feasibility study for photovoltaic and wind-powered central facility

5.35 TOLLAND

- Public utility by Special Permit
- No use variance

5.36 WALES

- Public utilities allowed by Special Permit
- No use variances
- Wind-friendly

5.37 WARE

- Solar systems are allowed as accessory uses to residential uses.
- Public or investor-owned utilities are allowed by Special Permit/Site Plan Approval in a Rural Residential Zone and in the Highway Commercial District. It is allowed by Site Plan Approval in the Industrial Zone.

5.38 WEST SPRINGFIELD

- There is a section for Energy Use and Conservation regulations. The purpose is to encourage "alternative sources of energy" and to accomplish the goals and policies of the Town's Master Plan. The rest of the section deals exclusively with wind, including definitions. If not operated for two years or if designated a safety hazard, the owner must immediately dismantle the windmill. Access to the tower is limited. Excessive noise or electromagnetic interference is prohibited. Windmills are not allowed in front or side yard areas.
- Windmills not described and regulated in this section are not permitted unless a variance is obtained.
- By-right: Freestanding windmills in any zoning district are allowed to be 75' tall, have a rotor diameter of 35', and must be setback 1.75 times the height. Roof mounted windmills are permitted in residential zones with a height of 15', diameter of 6', and are permitted in other districts to be 25' tall and have a 16' diameter. Free-standing windmills under 25' if used for agricultural purposes or not connected to building systems do not require a building permit.
- Special Permit: Freestanding windmills in any district may be up to 100' with a rotor diameter of 65'. Setback is two times the height. Residential roof-mounted systems can be 25' tall and 16' wide. Roof-mounted windmills in all other districts may be up to 40' tall and 20' wide. Criteria for the SP include that no substantial detriment to public safety occur, that the windmill not adversely affect the environmental and visual quality of the town, and that maintenance and repair responsibility is sufficient.
- Special Permit optional criteria include provisions for energy conservation, for the use of renewable energy resources, and for protection of solar access.

5.39 WESTFIELD

- The "Regulations Governing the Erection of Energy Generating Wind Power Devices," is very similar to West Springfield's bylaw.
- Unless otherwise noted, windmills not described in this section are not permitted unless a Special Permit is obtained.
- If not operated for two years or if designated a safety hazard, the owner must immediately dismantle the windmill. Access to the tower is limited. Excessive noise or electromagnetic interference is prohibited. Windmills are not allowed in front or side yard areas.
- Freestanding windmills permitted in any district can be up to 100' tall, with a rotor diameter of 65'. In residential zones, roof-mounted windmills may be 25' tall and 16' wide. In all other zones, roof-mounted machines can be 40' tall and 20' wide.
- The 35' height restriction does not apply to windmills and solar panels.
- The Open Space Communities development method states that lots and access streets shall be "grouped in locations to take advantage of solar access opportunities."

Existing/proposed projects:

1) landfill gas facility

5.40 WESTHAMPTON

- Power generation is not permitted
- Use variances allowed

5.41 WILBRAHAM

- Small scale, site-dependent solar energy devices and "wind energy conversion systems" are considered accessory uses. Rear yard-setbacks are reduced by 1/3 and height limitations do not apply to such systems. For wind systems, the bylaw requires the electricity to be used on-site or excess credited by the utility. This indicates that systems would have to be under 60 kilowatts.
- As a primary use, electricity generation is expressly prohibited.
- For Planned Unit Residential Developments, building location and orientation are to reflect solar access "in order to enhance occupant's interests."
- In the Adult Care Facilities District, building location and orientation are also required to reflect solar access.
- Use variance not allowed

5.42 WILLIAMSBURG

- No mention of power generation

5.43 WORTHINGTON

- No mention of power generation
- No use variance
- Wind-friendly

6.0 Summary of Local/Regional Barriers

6.1 LOCAL MUNICIPAL ZONING

- Lack of clarity about threshold for transition from accessory use to primary use for DG facilities
- Lack of consistent definitions and interpretation of DG as a primary use
- Inconsistent attention to permitting power generation in local by-laws
- Absence of appropriate use terms to cover DG provides for uncertain permitting pathway
- Inconsistent treatment of wind machines
- Lack of height exemptions for wind machine towers
- Extensive review process and potential for excessive time delays due to need for special permits, variances, or zoning amendments to accommodate DG facilities

6.2 HISTORIC COMMISSIONS

- Absence of consideration for wind power generating facilities
- Incompatibility of modern wind towers in historic areas
- Absence of exemption from historic district regulation for public utilities

6.3 OTHER LOCAL REGULATORY BARRIERS

- General lack of understanding about DG technologies in the regulatory and policy-making communities
- Potential for Conservation Commission review and possible appeals/time delays
- Costs of flood-proofing structures pursuant to local flood regulations may make DG projects in flood zones economically infeasible

7.0 Policy Options at the Local Level

7.1 MUNICIPAL ZONING STRATEGY OPTIONS

7.1.a Identify Energy Demand Load Centers

Since local zoning issues are unique to each town, understanding where the first few DG facilities would be most effective at reducing peak demand on the power grid would be of great benefit to the overall process of overcoming zoning barriers. This could be a combination of DG development at distribution substations or feeders, or at the customer's site. This way zoning remedies could be focused on just those communities that contain the load centers while a more comprehensive solution is crafted. Knowledge of load centers and their respective current and projected peak demands would be valuable to the design of any DG facilities. Such information would also inform the process with critical intelligence so that appropriate generating capacity can be planned and the proposed zoning amendments can be specific to the needed design capacity. Local planning boards and town meetings/ town council would be more receptive to a proposed zoning amendment that specifies both the look and limits of a new land use than one that is open-ended and speculative in its form and operation.

7.1.b Model Regulations

The PVPC is available and eager to work with communities to develop model zoning regulations that would eliminate the current barriers and uncertainty for DG facilities. These regulations need to address the following concerns:

- Interpretation issues for thresholds for when DG should be treated as an accessory use and when it would become a primary use.
- Amendments to the sections of local zoning by-laws dealing with (1) purpose statements that promote renewable energy, and (2) allowed uses so as to provide a defined use term specific to DG facilities and authorizing such use in all zoning districts.
- Uniform and streamlined processes for permitting wind machines, including appropriate height limits for efficient power production by wind facilities.
- Treatment of DG uses under site plan review needs to be clarified as to applicability thresholds with a goal of exempting DG from site plan review entirely.
- Inclusion of the protections for solar power generation and passive solar access as noted in Section 4.6.4.
- Incorporating lesser—known DG technologies like biomass and landfill gas.
- Inclusion of additional incentives for open space development to enable flexibility for subdivision layouts to facilitate optimal solar access.
- General incentive provisions aimed at encouraging a range of DG development in specific projects, as well as in districts as a whole.

These model regulations would be most effectively developed in cooperation with the professional and volunteer planners from the 43 communities of the Pioneer Valley. Efforts should be focused on those planners with a greater interest in DG development and where energy demand centers are located.

7.1.c Propose Legislation

While specific zoning amendments are pursued with individual towns as described above, the PVPC could work through the Western Massachusetts legislative delegation to develop a proposal to amend MGL, Chapter 40A to include provisions that authorize zoning exemptions for the cleaner combustion (i.e. not diesel or gasoline-fueled) and renewable DG facilities and/or set limits for the regulation of such facilities. This approach has significant merit considering the fact that Chapter 40A already contains amendments that address energy issues, as discussed above. In addition, as noted in Section 2.3 the federal government in interested in a transition toward more decentralized power supply infrastructure, in the interest of national security. This, in turn, has supported the U.S. Department of Energy efforts to promote appropriate state code modifications to facilitate deployment of distributed generation.

New legislation could be very effective at eliminating the zoning barriers identified above. A similar situation existed for the telecommunications industry. When wireless communications were emerging as an essential component in the nation's communication infrastructure in the late 1980s, the Federal Telecommunications Act cleared the way for the deployment of the towers needed to build a still-evolving network of facilities to carry out this national initiative. The end result was development of local permitting processes to accommodate wireless facilities rather than prohibit them. State level legislation can be just as effective as Federal legislation in bringing about a more direct and permissive approach to DG facilities.

Regardless of which strategies are pursued, developing an outreach and education campaign should be initiated immediately. As with most things new and technical, there will be a learning curve for the people and organizations that need to embrace the value of promoting DG deployment. The uptake may be slow at first but through the deliberate and continuous exposition of the need for DG implementation in various venues, the appropriate level of understanding and acceptance can be achieved.

7.2 PVPC STRATEGY OPTIONS

7.2.a Education

The PVPC could plan and carry out one or more educational forums specifically for Commissioners and staff at the Pioneer Valley Planning Commission. The primary objectives of these meetings should be to educate the participants on all the relevant aspects of DG facilities and to obtain a commitment and date to commence the development of revisions to the respective existing regional plans.

7.2.b Collaborate on Revisions to Regional Plans

The PVPC could complement the educational forums proposed above by taking a pro-active role in organizing and conducting one or more joint workshops for the express purpose of drafting revised energy sections in the respective regional plans. These revisions should:

- Address the absence of DG facilities as a viable and necessary component in the region's energy infrastructure and the reasons therefore, including express policy statements regarding encouragement of these technologies.
- Suggest appropriate town actions to carry out the regional energy section policies on DG facilities. They should also provide for reasonable standards for such facilities at the local level, consistent with what is developed under the zoning recommendations discussed above.
- Finally, there should be express language in the regional development regulations that sets a threshold for when a DG facility should be referred for review as a DRI (if at all) and what types of DG are categorically exempt from DRI review.

7.3 HISTORIC DISTRICTS AND OTHER STRATEGY OPTIONS

7.3.a Historic Districts

The PVPC could pursue the following actions to minimize the identified barriers to DG in the Pioneer Valley:

- Focus on promoting compatible types of DG facilities in historic districts
- Develop model guidelines for local historic commissions to adopt on how to regulate DG "boxes" or photovoltaic panels, such as ways to screen or camouflage these facilities. This should be done with the participation of representatives from area historic district commissions.
- Explore with Western Massachusetts legislators and representatives of local historic districts the possibility of proposing amendments to MGL Chapter 40C concerning possible categorical exemptions of certain DG facilities from historic district commission regulation.

7.3.b Other Initiatives

Education - As discussed under zoning options above, education of the area's regulators, policy makers, and electricity consumers will be key to making needed corrections to the current barriers to DG deployment.

Appropriate Siting—Conservation commissions are obligated to protect local natural resources and their regulations are aimed at that primary purpose. It would be inappropriate for DG structures to have an exemption from these regulations. Therefore, the Compact could emphasize planning DG facilities for areas that would be outside the jurisdiction of local conservation commissions, in order to avoid potential delays and project cost increases for mitigation.

Best Development Practices—The PVPC could consider developing with area conservation professionals a set of best development practices for local conservation commissions to adopt and follow when DG facilities are before them. These would also serve to guide the designers of DG facilities in sensitive areas. It may also streamline the review process and help avoid currently unpredictable reactions to DG proposals.

Flood Zone Issues—Since flood-proofing is a standard requirement for electric power appurtenances in flood prone areas, the PVPC could explore with a qualified engineer how flood-proofing measures would impact the economic viability of DG facilities. The results of this investigation should then guide the formation of a policy regarding promoting or discouraging locating DG facilities within designated flood zones.

Local Tax Incentives—Tax incentives can offer a very useful tool for helping to overcome cost barriers for emerging technologies such as photovoltaic systems and fuel cells. Local governments could consider offering property tax credits to help offset the costs of these systems. Pilot efforts could be undertaken with capped amounts and limited terms in a manner that could pose little impact on overall tax revenues, but result in significant gains for installing technologies that provide models and valuable experience for the community.

8.0 Policy Options At The Regional Level

The Pioneer Valley Planning Commission is taking the lead in formulating a renewable energy strategic plan for the Pioneer Valley. The plan is in the form of a funding proposal currently, but when it is funded it will lay out the road map for the region with respect to renewable energy generation. At the same time, the PVPC is working to promote renewable energy in the Valley by sharing information, encouraging communities with potential wind turbine sites to participate in the MTC's community wind collaborative, and by applying for funding to promote biomass in the region.

8.1 SUMMARY

The Pioneer Valley Planning Commission (PVPC) proposes to collaborate with the newly formed Pioneer Valley Renewable Energy Collaborative (PVREC) and the Franklin Regional Council of Governments (FRCOG) to continue the excellent work launched by Year One funding from the Massachusetts Technology Collaborative to promote renewable energy in the Pioneer Valley. The proposed project will create a renewable energy strategic plan for the Pioneer Valley of Western Massachusetts. Work products will include:

- Regionally adopted goals for renewable energy generation designed to ensure the region's contribution towards meeting or exceeding the state's renewable portfolio standard
- Regionally adopted goals for energy conservation
- Site selection criteria for each RE technology (micro-hydro, biomass, wind and solar power)
- Strategies to increase the percentage of renewables in the regional energy mix
- A Strategic Plan with detailed assignment of responsibilities and a timeline for implementation of RE projects
- Targeted education efforts to raise local leaders' awareness of their role in promoting renewable energy in the region

In 2003-2004 MTC funded the Pioneer Valley Planning Commission to: 1) research renewable energy activity in the region, 2) identify regulatory barriers to renewable energy and 3) develop some models to overcome identified barriers. In the course of completing this work, PVPC unearthed the need for a strategic plan for RE in the Valley. There are many reasons why a strategic RE plan would be useful, two of the most compelling are:

1. By MTC's own estimates, the Pioneer Valley is home to 1,500 RE entrepreneurs. This constitutes a 'cluster' in economic development terms, and this cluster could be driving the region's economic development. And yet, it is not, and there is no mention of renewable energy technology in the Commonwealth of Massachusetts cluster-based economic development plan, nor is there mention in the region's about-to-be-released economic development plan—the Plan for Progress. The FRCOG does include this emerging cluster in their Comprehensive Economic Development Strategy in recognition of several key businesses and organizations in the Franklin County region. The support of this sector from an economic development standpoint would be greatly enhanced by a Strategic Plan for the entire Pioneer Valley.

2. Not only is there a plethora of RE entrepreneurial activity, but there is also great potential for significant megawatts of RE to be generated in the Valley. There are over 50 possible sites for wind turbines, an extremely advanced photovoltaic industry, and there are also hundreds of saw mills and thousands of acres of forest and farmland which could drive a powerful biomass energy initiative. PVPC has applied to the U.S. Department of Energy for half a million dollars to promote biomass energy in the region and entrepreneurs are looking at possibly siting a facility in the Town of Russell.

Because there are so many Renewable Energy activities happening in the Valley which are not being coordinated, opportunities are being lost. We need a strategic plan for renewable energy.

II. PROJECT DESCRIPTION AND PARTNERS

A. The Project

Overall Objectives

We have two primary process objectives to be achieved through this project:

- Assign sub-regional goals for MW generation of RE in the Pioneer Valley
- Coordinate RE efforts in the Pioneer Valley to maximize economic benefits to the region

Our three primary outcome objectives include:

- Generate renewable energy in the Pioneer Valley—specifically, support regional efforts to attain a realistic portion of Massachusetts's renewable portfolio standard goals.
- Conserve energy in the Pioneer Valley
- Activate Pioneer Valley opinion leaders/ decision makers about the benefits of distributed generation, including:
    - * direct benefits when used in government buildings;
    - * improving the environment;
    - * economic development;
    - * electrical system reliability for constituents;
    - * protecting constituents from high electricity prices; and
    - * disaster relief support.

Over the course of two years we will follow a traditional strategic planning process, with a few twists. Because we have the Massachusetts Renewable Portfolio Standard of 750 MW of RE by 2010, we do not need to invest a lot of time articulating our mission—instead we need to determine an equitable share of the 750 MW for the Pioneer Valley and we need to capture municipal decision-makers interest in committing to a portion of our region's RE MW responsibility. We do recognize that opposition to RE has been emerging across the Commonwealth—driven in large part by aesthetic and environmental concerns about wind turbines off the Cape and in the Berkshires. So we expect to spend some time getting people on board to support RE. Once we have a sense of our mission and our vision of RE for the Valley, we will move on with an asset-based assessment of our region's opportunities. Finally, having determined what we want and identified the means we have at our disposal to 'get there' we will map out specific assignments at local and regional levels to assure we (the region) reach our goals. Because this proposed project is as far from a stand alone project as possible we will emphasize integrating into existing planning processes (local, regional, and state) as well as facilitating planned RE projects where possible versus initiating anything new.

We will start our work building on the products of our Year One funding from MTC, updating background research and our review of ongoing RE efforts, projects and the state of the art of the RE field in the Pioneer Valley. Then we will describe all the RE work planned or underway in the Valley. Thanks in large part to MTC there is a significant amount of new RE activity in the last year. Concurrently, our Consultant team will be working to articulate site selection criteria for each RE technology. We will create a GIS product displaying what we learned on the ground so we can identify gaps and best locations for additional MW of RE. [months 1-6]

Deliverables 1) Technology specific site selection criteria developed by RE consultants to identify potential locations and projects for each RE technology. 2) GIS mapping and analysis using existing datalayers and site selection criteria developed to identify potential locations and projects. 3) Written report and GIS products and accompanying narratives of proposed projects accompanied by technology specific site selection criteria.

Once we know who is doing what, what is planned in the Valley, and what we need to site the various RE technologies, we will work with our Consultants and Advisers to identify the essential people who must be involved creating the Valley's RE strategic plan and build productive working relationships with them. [months 4-9] Possible participants include:

- elected officials
- municipal government staff including but not limited to: planners (professional and volunteer), department of public works staff, utility staff, building inspectors, school officials
- entrepreneurs
- advocates
- educators
- farmers
- opinion leaders
- consumers
- emergency government personnel
- environmentalists

Deliverables: 1) Twelve education/municipal outreach sessions (8 in PVPC region; 4 in FRCOG region) for municipal and regional officials to learn about RE and their benefits and the results of the GIS mapping and analysis of potential sites and projects and 2) Presentation materials prepared by RE Consultants, PVPC and FRCOG which can be utilized by other regions in the State.

Once we know where we are going and who is coming along, we will facilitate 'conversations,' and educational sessions as needed, among and between stakeholders working to complete an asset-based renewable energy development assessment. At the same time our Consultant team and Advisors will stay abreast of planned RE projects in the region and do whatever is possible to move projects ahead. [months 9-18]

Finally, we will work with all parties to take make a commitment to RE generation in the Valley. Municipal governments will have the most important role to play as they can commit to hosting RE power facilities in their communities, converting municipally owned buildings into 'green buildings' and/or building only 'green buildings', and facilitating use of RE by residential and commercial land developers by amending their zoning and sub-division regulations. Individual consumers have an important role to play as well—as their investment in 'green power' tells financial institutions that there will be a market for the RE power to be generated by the RE facilities seeking their investments. Of course RE entrepreneurs are essential as it is they who take the financial risks to bring RE products to the market. [months 19-24]

Deliverables 1) Six focus group meetings (4 in PVPC region; 2 in FRCOG region), notes and other documentation from meetings and educational sessions/events, status report on RE projects with before/after photos, lessons learned etc. and 2) PVPC and FRCOG will collaborate to prepare a Strategic Plan for the region which incorporates the results of the education sessions, municipal and business outreach and the technology specific site selection criteria. The Strategic Plan for RE will be a 10 year plan including GIS products that shows the types and potential locations for RE facilities, potential buildings that can be 'greened,' where potential green buildings can be constructed, the relative RE-friendliness of the regions communities and suggestions for modifying land use regulations to make the communities more RE friendly over time. The Strategic Plan will include regionally adopted goals for renewable energy generation designed to ensure the region's contribution toward meeting the state's renewable portfolio standard goals in order to increase the percentage of renewables in regional energy mix. The plan will identify specific strategies and assign responsibilities and a desired timeline for implementation.

Relationship of the project to the region

This project has regional, statewide, and national significance. Based on preliminary research we have found only scant evidence of regional plans to promote renewable energy. The majority of existing plans are developed by utility companies, and while private sector efforts are commendable, they have not secured commitments from local government to act. A regional plan developed by municipal officials and regional planners in conjunction with other local officials, entrepreneurs, activists, and area utilities will focus attention on and stimulate public action. This plan will serve as a model to the other 11 Regional Planning Agencies in Massachusetts and will help the state to achieve the RPS goals of 750 MW of renewable energy by 2010. The products developed to implement the plan will serve as models for the rest of the Commonwealth and will be available to other regions and communities. The project will serve the region and enhance existing efforts.

Relationship of the project to existing processes and information

Too often, individuals and organizations with good intentions fail to research others' efforts and coordinate limited resources. There is a significant amount of renewable energy-related activity already underway in the Pioneer Valley region of western Massachusetts, as well as significant potential to generate renewable energy while also conserving existing resources. The Massachusetts Technology Collaborative funded the PVPC in 2003-4 to begin the process of documenting this RE activity. This plan will harness the region's wealth of existing activity, capture our potential and hopefully launch the Pioneer Valley into the forefront of renewable energy activity in the state. In particular, we will capitalize on the estimated 15,000 workers in the renewable energy business cluster about whom MTC staff met with WMECO staff in January, 2004. PVPC, in collaboration with the PVREC, has submitted a half a million dollar proposal to the USDOE/USDA to promote Biomass in the region via bylaw and subdivision regulations combined with a large-scale public information and education campaign. This proposed strategic plan for RE will dovetail nicely with the proposed Biomass effort and with other regional plans being developed by PVPC and FRCOG.

The PVPC and FRCOG develop regional transportation, economic development and land use plans. RE should be integrated into all of these plans. PVPC and FRCOG have recently been awarded grants to develop natural hazards plans for their regions and are in the midst of conversations with the Department of Homeland Security to develop disaster plans for the region. It is very timely that these plans will be developed at the same time as we are creating this strategic plan for RE. Alternative energy sources are essential to disaster planning.

Role of the project in relation to proposed renewable energy facilities

This project will facilitate siting of renewable energy facilities in the region and advance proposed facilities. It expands development and adoption of local regulations necessary for municipalities to site renewable energy facilities, and it educates the decision makers about the need for, benefits of, and process for developing renewable energy facilities. Finally it ensures ongoing support for renewable energy in the Pioneer Valley. Project staff and volunteers will work with community advocates and developers on proposed projects in Chester, Russell, Chesterfield, and wherever new RE projects are developed.

The project's ability to obtain the end product

This project will most certainly produce a regional plan for renewable energy. It will definitely document barriers to renewable energy and produce specific suggestions for overcoming identified barriers. The project will generate an education campaign and produce GIS maps siting planned, proposed and recommended renewable energy facilities. In addition we believe that the planning process and accompanying products will generate new megawatts of renewable energy. PVPC and FRCOG have 40 years of success planning for the region. We have facilitated numerous regional plans and we lead the region in promoting economic development.

Replicable components

Both PVPC and FRCOG have established themselves as regional planning agencies committed to replicable products. All the products developed as part of this project will be replicable—including the plan itself.

B. Applicant and Partners

Applicant:

This proposal is being submitted by the Pioneer Valley Planning Commission and the Franklin Regional Council of Governments, and it includes work that will be sub-contracted to a number of consultants who are also project partners. The proposal is being submitted to the MTC and to a consortium of area utilities for funding consideration. We hope to receive partial funding from both groups. In addition to sub-contracted partners, staff from the consulting businesses will continue to volunteer on the Pioneer Valley Renewable Energy Collaborative along with area renewable energy advocates, planners and academics.

The Pioneer Valley Planning Commission (PVPC) is the regional planning agency for the 43 cities and towns that compose the Pioneer Valley Region in mid-western Massachusetts' Pioneer Valley. PVPC performs myriad services—from economic development planning and promotion to writing grant proposals and facilitating both regional and community plans—in a wide range of planning areas: economic development, transportation and transit, environment and land use, community development and historic preservation. We are also the region's Geographic Information System (GIS) center and the regional center for census and other standardized data. PVPC promotes regional collaboration among its member communities and is the primary agency responsible for increasing communication, cooperation, and coordination among all levels of government as well as private business and civic sectors in order to benefit the entire Pioneer Valley region and to improve its residents' quality of life. Since our formation in 1962 we have been the region's primary consensus-building force. June 2004 will mark the completion of a project to inventory both renewable energy resources and barriers in the Pioneer Valley and implement local zoning reform to facilitate renewable energy in at least one community. Catherine Miller, M.S., Senior Planner, Environment and Land Use section will be the lead investigator for PVPC on this project. Denis Superczynski, AICP, will lead the regulatory reform work. Combined, Ms. Miller and Mr. Superczynski have over 40 years experience with state, regional and municipal land use reform, community and economic development and public information and education.

The Franklin Regional Council of Governments is the regional planning agency for the twenty-six communities located in the upper Connecticut River Valley in mid-western Massachusetts. Bordered on the north by New Hampshire and Vermont, on the west by the Berkshires, and on the east by the central uplands, the region shares major economic, transportation and natural resource corridors with the greater Pioneer Valley to the south. The most rural area in Massachusetts, the region covers 740 square miles and is populated by approximately 72,000 people. Building upon the strengths of our member communities and their sense of regional identity, the Franklin Regional Council of Governments is a catalyst and resource for the coordination of public policy and service delivery.

Similar to PVPC, the FRCOG provides a variety of services to its communities from planning to engineering. We are also the region's Geographic Information System (GIS) center and the regional center for census and other standardized data. The Franklin Regional Council of Governments is dedicated to providing a variety of services and products to our member communities and their residents. The Franklin Regional Council of Governments integrates regional and local planning, human services advocacy and coordination, and municipal services to secure our regional goals of: balancing economic development with the protection of our natural and cultural resources, and our rural character and heritage; ensuring the most economical creation and delivery of public services in a rural region comprising many political subdivisions, and; building healthier communities by developing and connecting broad-based coalitions to raise the level of expectations for community achievement FRCOG promotes regional collaboration among its member communities and is the primary agency responsible for increasing communication, cooperation, and coordination among all levels of government as well as private business and civic sectors in order to benefit the region and to improve its residents' quality of life.

Peggy Sloan, Director of Planning and Development, Bill Labich Land Use Program Manager, and Jessica Atwood, Economic development Planner will be the staff assigned to this project. Peggy Sloan, Director of Planning & Development, has been with the FRCOG for eleven years and has worked extensively on economic development issues at the regional and local level. She is responsible for the FRCOG's Brownfields program sponsored by the EPA which has already resulted in the clean-up of two properties. These sites may be future potential location for renewable energy projects (brownfields to brightfields). Ms. Sloan graduated cum laude from Smith College where she majored in economics, with a specialization in energy economics. Her undergraduate education was followed by six years of work in commercial and investment banking where she specialized in project financing for large-scale natural resource and infrastructure projects including energy projects such as cogeneration facilities. She returned to graduate school where she obtained Masters Degrees in Regional Planning and Landscape Architecture. Ms. Sloan has 14 years of public education and outreach experience and works extensively with municipal officials on zoning and subdivision regulations. Bill Labich, Land Use Program Manager has been with the FRCOG for over five years and has an extensive background in community development planning, forestry, and public education. Bill is the Project Manager for numerous community development and natural resource grants and has a Masters Degree in Regional Planning. Jessica Atwood has been with the FRCOG for over seven years and has been involved with grant administration, data analysis, transportation planning and economic development planning activities. In her capacity as Economic Development Planner, she has in depth knowledge and experience with the regional economic development challenges and opportunities available in the greater Franklin County region. Ms. Atwood is the staffperson primarily responsible for preparing the Comprehensive Economic Development Strategy for the region which includes the emerging renewable energy cluster. Educated at the University of Massachusetts at Amherst, Ms. Atwood has a Bachelor of Arts Degree in Geography and Communications and a Master's Degree from the Master's of Business Administration Professional Program.

Partners:

The content partner on this project is the Pioneer Valley Renewable Energy Collaborative (PVREC). The funding partner is a consortium of area utilities.

PVREC members include:

- Bart Bales, Bales Energy Associates
- Dwayne Breger-Team Leader, Renewable Energy and Climate Change, Massachusetts Division of Energy Resources
- Don Campbell-solar energy consultant
- Keith Davis-mechanical engineer
- John Fable-entrepreneur
- Wayne Feiden, M.S. AICP-City of Northampton Planning and Community Development;

- Seth Fischer-Northampton Energy Committee and ISO New England
- Teresa Jones-Greenfield Community College, Math, Science, Business & Information Technology Division
- Ann-Renee Larouche, renewable energy marketing consultant
- Paul Like, Sustainable Step New England
- Peggy MacLeod, Marketing Director-Center for Ecological Technology
- John Pepi-solid waste management professional
- Robert Rizzo, Mount Wachusett Community College project manager for the National Renewable Energy Laboratory, the USDA Forest Service; Forest Products Laboratory, and Community Power Corporation; and the Small Modular Biomass Gasification Research and Demonstration project
- Sally Wright, M.S. Mechanical Engineering, UMASS Renewable Energy Research Laboratory (RERL) Center for Energy Efficiency and Renewable Energy (CEERE)
- Catherine Miller, Pioneer Valley Planning Commission—staff

WESTERN MASSACHUSETTS ELECTRIC UTILITIES AND GENERATORS

Investor-Owned Utilities

Western Massachusetts Electric Company

West Springfield, MA 01089
Edgar Allejandro,
small grants program manager

Massachusetts Electric

55 Bearfoot Rd, Northborough, MA 01532
(508) 860-6000
John Cochrane,
Senior Vice President, Chief Financial Officer and Treasurer

Bay State Gas

2025 Roosevelt Ave, Springfield, MA 01104
(413) 781-9200
Northampton (413) 584-1088

Municipal Utilities

Holyoke Gas and Electric

99 Suffolk Street
Holyoke, MA 01040-4457
Main Office (413) 536-9300
FAX - Business Office (413) 536-9315

Westfield Municipal Gas & Electric Light Dept

100 Elm Street - P.O. Box 990
Westfield, MA 01086
Phone (413) 572-0100
Fax (413) 572-0104

Chicopee Electric Light

725 Front Street - PO Box 405
Chicopee, MA 01021-0405
Phone: 413.598.8311

MA Municipal Wholesale Electric Company

Moody Street - P.O. Box 426
Ludlow, MA 01056
Phone (413) 589-0141
Fax (413) 547-1585
General contact:
David Tuohey, tuohey@mmwec.org

Chester Municipal Electric Light Department

2 Town Rd, Chester, MA 01011 or,
15 Middlefield Rd, Chester, MA 01011
(413) 598-7811

Russell Municipal Electric

(413) 862-4045

Additional Partners:

The Plan for Progress Trustees is the region's economic development planning advisory board. Co-chaired by Paul Tangredi of Western Massachusetts Electric Company and Tim Brennan, Executive Director of PVPC, the Trustees are responsible for implementing the region's economic development plan, The Plan for Progress.

Pioneer Valley chapter-Business Alliance for Local Living Economy

A network of local business owners whose mission is to create, strengthen and connect local businesses, advocates and consumers dedicated to building a strong local living economy.

III. TECHNICAL PROPOSAL

Work Plan and Schedule

This project is planned to take two years.

Year One: PVPC, FRCOG and PVREC reach out to stakeholders and involve them in the process.

Year Two: PVPC, FRCOG and PVREC facilitate the plan and refine region-specific technologies.

There are 8 tasks described in the detailed budget, plus administration/evaluation and replication.

Task 1 Research/Literature Review

Task 2 Technical Assessment of Renewable Energy Technologies

Task 3 Overlay Technology with Geography

Task 4 Stakeholder Analysis and Identification

Task 5 Stakeholder Outreach and Relationship Building

Task 6 Asset-based RE development assessment, identification and analysis—Issues Clarification

Task 7 Taking Ownership for the Pioneer Valley's portion of Massachusetts' Renewable Energy goals

Task 8 Drafting the Plan

Deliverables

- Technical assessment of RE technologies in the Pioneer Valley, a written report on existing RE activity in the region, and a GIS product with images and accompanying narratives of projects and proposed projects
- Annotated resource list of stakeholders with all contact information and notes from preliminary interviews and targeted education campaign for regional leaders with notes from sessions and all materials
- Series of focus group meetings, notes and other documentation from meetings, status report on RE projects with before/after photos, lessons learned, issues raised, priorities identified, etc.
- Strategic plan for RE—10 year plan with GIS version that shows how and where RE facilities can be located, where and how buildings can be 'greened' or where and how green buildings can be constructed, the relative RE-friendliness of the regions communities and how and when land use regulations can be amended to make the community more RE friendly over time
- Regionally adopted goals for renewable energy generation designed to ensure the region's contribution toward meeting the state's renewable portfolio standard goals
- Increased percentage of renewables in regional energy mix
- Action Plan with detailed assignment of responsibilities and a timeline for implementation

Management and Staffing/Qualifications

Staff: Catherine Miller, Senior Planner/Section Manager and Denis Superczynski, Senior Planner/Section Manager in PVPC's Land Use section will co-manage this project for PVPC. Ms. Miller is responsible for the Commission's sustainability initiatives. She has 20 years experience facilitating grassroots community development at the local, regional, state and federal level. Mr. Superczynski has 14 years experience with municipal zoning and community design. Bill Labich, Land Use Program Manager and Jessica Atwood, Economic Development Planner will co-manage this project for FRCOG. Combined they have over twenty years of experience in planning, economic development and public education.

Consultants:

Sustainable Step New England (SSNE) recently completed work for Connecticut's Clean Energy Fund, where SSNE brought together 27 leading environmental organizations' energy experts to explore their generally successful opposition to siting biomass power generation facilities in the NE. The results included: (1) a catalog of research, information needed and actions to be taken to address participants' concerns and enlist their support, (2) strategies for NGO and public education, and (3) an outline and cost estimates for a scale-able, multiphase environmental NGO/public education initiative designed to create long term support for renewable energy generation in general, and reliable local grown power in particular. Contact: Paul Lipke, Wood Scientist, Director of Programs and Training.

Since 1976, the non-profit Center for Ecological Technology (CET) has offered environmental consultation to businesses, schools and individuals with the goal of researching, developing, demonstrating and promoting those technologies which have the least disruptive impact on natural ecology. CET's staff houses expertise in municipal and business program development and implementation, organizational development and advocacy, and education on technical matters. Contact: Peggy MacLeod, Marketing Director.

Bart Bales, Bales Energy Associates—Bales Energy Associates is a consulting firm specializing in building-related energy analysis, management, research, and engineering since 1990. Bales Energy Associates is committed to personalized professional service and to quality energy analysis giving rise to effective energy conservation efforts. Services include: green advising and collaboration; solar and renewable energy evaluations and project development; fuel cell feasibility studies; technical energy audits, studies, and preliminary design; performance and feasibility analyses for on-site cogeneration applications; building energy modeling; ongoing energy management for commercial and institutional clients; software and seminar development for energy analysis; operations, maintenance, and energy management consulting for improved efficiency and reduced cost; strategic energy planning; effective meeting facilitation services for productive strategic planning.

John Fabel—Renewable Energy Advocate /Marketing Entrepreneur

NESEA—Northeast Sustainable Energy Association

Don Campbell—Solar Energy Consultant

Advisors:

The Forest and Wood Products Institute (FWP) at Mt. Wachusett Community College is lead by Robert Rizzo, primary investigator for a National Science Foundation Grant that will develop an Advanced Technological Education project focused on renewable biomass energy technologies and policies. Mr. Rizzo has served as the College's project manager for the National Renewable Energy Laboratory, the USDA Forest Service; Forest Products Laboratory, and Community Power Corporation; and the Small Modular Biomass Gasification Research and Demonstration project that was to be installed at Mount Wachusett Community College. He is currently working with the USDA Forest Service, Forest Products Laboratory on biomass feedstock densification for gasification technologies, and is coordinating the efforts of the eleven northeast states to encourage state agencies to procure biobased fuels and products under grant funding from the US Department of Energy. He is a member of the northeast Regional Biomass Program Steering Committee and is an active member of the Massachusetts Biomass Energy Working

Group. He is also the project manager for the College's newly installed biomass hydronic heating system, and will serve as the project coordinator for the College's new child care facility which will be a green certified building utilizing a Community Power Corporation 15 KwH combined heat and power downdraft biomass gasifier. This project is in the architectural design stage with construction anticipated in late 2004, early 2005. Mr. Rizzo has been employed in the forest products industry since 1976 and joined the team at the FWP in 1997. He is a licensed Massachusetts Forester and he is also a nationally Certified Forester. Mr. Rizzo has delivered numerous national and regional presentations on biomass energy including Bioenergy 2002. He has also published many articles and white papers on forest products utilization and biomass energy.

The Renewable Energy Research Laboratory (RERL), a research program in UMass Amherst's Mechanical and Industrial Engineering Department, focuses on renewable energy systems; with UMass' Center for Energy Efficiency and Renewable Energy (CEERE), RERL serves as a DOE Combined Heat and Power (CHP) site. Sally Wright (M.S. Mechanical Engineering), Research Fellow and staff engineer, is involved in various aspects of wind power, including technical support to Massachusetts communities, statewide wind resource assessment, permitting, and assessing feasibility for offshore, inland and island sites in Massachusetts. Ms. Wright has over ten years of experience in power engineering. Before coming to RERL, she worked in industrial energy conservation, specifically steam turbine cogeneration and combined heat and power. There she specialized in industrial power generation equipment, controls design, power system integration, distributed power & interconnection, and project management.

Dwayne Breger is the Manager of the Renewable Energy and Climate Change Group at the Massachusetts Division of Energy Resources. His group implements the Massachusetts Renewable Energy Portfolio Standard and participates in the Northeast Regional Greenhouse Gas Initiative. He serves on the steering committee of the Northeast Regional Biomass Program, and on the Board of Directors for the non-profit Biomass Energy Resource Center. Prior to this position, he worked on the faculty of Lafayette College and as a research associate at UMass Amherst. At Lafayette College, he established the first dedicated energy crop site trial in Pennsylvania, using salix (willows) in association with the SUNY- College of Environmental Science and Forestry. He holds BS, MS, and Ph.D. degrees from Swarthmore College, MIT, and UMass Amherst, respectively.

9.0 Glossary of Terms

Accessory Use

A zoning term meaning a use of land that is not the primary or principal use but is ancillary and secondary to a principal permitted use.

Architectural Review

Advisory review process for development proposals in which scrutiny is applied to architectural features of a proposed structure or structures.

Building Inspector

Local official charged with interpreting and enforcing the State Building Code. May also be responsible for interpretations and enforcement of local zoning by-law. Building Inspector may delegate zoning interpretation and enforcement duties. Issues building permits and inspects permitted work. Determines permitting path of a development proposal.

Building Permit

The final approval before new construction may begin in a municipality, issued by the Building Inspector. Prior to issuance of a building permit, all other required local and regional approvals must be issued and valid.

By-Right

A phrase used to describe land uses that are allowed by zoning regulations without a special permit, variance, or other type of land use permit.

Chapter 30B

The Massachusetts law governing how public entities spend public dollars to purchase goods and services. (see Procurement)

Chapter 40A

The Massachusetts law governing how communities may regulate the use of land (zoning).

Chapter 164

The Massachusetts law governing Public Service Corporations that are formed for the purpose of providing electric or gas utilities.

Code

Any set of laws or regulations. Used herein to refer to building, electric, fire, plumbing, health, zoning, conservation requirements.

Conservation Commission

The official group in a municipality charged with enforcing any local wetland protection regulations and the Massachusetts Wetlands Act.

Development of Regional Impact (DRI)

Used herein as any development that is accepted for regional regulatory review by the Pioneer Valley Planning Commission. A DRI is presumed to be of such scale or impact that it would affect an entire region of one or more communities. DRI review is conducted against a series of development policies and may include conditions of approval to mitigate the expected impacts.

Historic District Commission

The local regulatory agency charged with reviewing proposed development or structural and appearance modifications within an historic district designated pursuant to MGL, Chapter 40C. There may be multiple historic districts and an equal number of historic district commissions in any one municipality.

Land Use

The primary or accessory activity on a parcel of land. Typical land use categories include residential, accessory, recreational, agricultural commercial, industrial, institutional. There may be many specific activities under each of these categories in a local zoning by-law, which is the principal local instrument for regulating what may take place on every parcel in a community.

MGL (Mass. General Laws)

The collection of State statutes governing all aspects of regulation in the Commonwealth of Massachusetts.

Permit

A document that certifies that a development project meets the requirements of the law governing such project. A project usually requires multiple permits with each one addressing a set of regulations concerning a particular topic, such as zoning, wetlands protection, health, etc.

Primary Use

The principal or main use of a parcel of land, as determined by the local building inspector. Examples of primary uses may include: dwellings, stores, warehouses, power plants.

Procurement

The process of purchasing goods or services. In the public sector, procurement is governed by MGL, Chapter 30B, which sets forth requirements on how public agencies shall purchase goods and services. This includes requirements regarding when the lowest bid must be accepted and what types of purchases are exempt from certain purchasing procedures.

Prohibited Uses

Uses of land that are not allowed in one or more zoning districts in a municipality.

Regional Commission

In this report, regional commission means the Pioneer Valley Planning Commission.

Site Plan Review

A development review process that is usually administrative, rather than a permit procedure, that is usually required for larger, intensive uses of land. Site plan review may be conducted by different groups from town-to-town and specific requirements and procedures may vary greatly.

Special Permit

A specific type of land use permit contained in a local zoning by-law or ordinance, consistent with the provisions of MGL, Chapter 40A, Sec 9, that authorizes the use of land for a specified purpose, following a prescribed review process. Most special permits are issued by the local Board of Appeals but certain ones be issued by the Planning Board in a community. Special permits require a public hearing with notice to abutters who have legal standing to challenge a vote to grant a special permit. Reasonable conditions may be imposed with the granting of a special permit. Special permit proponents must demonstrate compliance with the special permit requirements contained in the local zoning code but do not have to demonstrate hardship.

Variance

A specific type of permit contained in a local zoning by-law or ordinance that may authorize a use of land that is not permitted in one or more zoning districts in a town or to vary the specific physical limits contained in such by-law or ordinance. Variances in Massachusetts communities may only be issued by the Board of Appeals. Use variances must be expressly authorized by the local zoning code. All variance processes require a public hearing and notices to abutters who have legal standing to challenge a vote to grant a variance. Variance proponents must demonstrate some form of hardship that would occur if the zoning relief is not granted

Zoning Bylaw

A law approved to regulate land use or structures within a municipality under MGL Chapter 40A.

Appendix A Description of Technologies

Excerpt from: *Local Government and Distributed Generation;* Prepared by Ridley & Associates for the Cape Light Compact; September 2000

There is a range of distributed generation technologies that use fossil fuels or renewable resources. Some, such as reciprocating engines, are already in widespread use as back-up units. Other new technologies are entering the electric industry from a variety of sources. Fuel cells are being developed in part by automakers. The military developed microturbines as a power source for M-1 tanks and missile launchers. High-efficiency jet turbines developed by the aero-space industry have contributed to improvements in the combined cycle plant, and in options for mobile and quickly-installed small gas turbine peaking capacity. New data and control technologies from the computer industry are making use of smaller distributed power units and efficiency of appliances and industrial electric motors more versatile.

The generally accepted approach is that no single technology, but a variety of technologies based on best-application-for-use, will be employed to provide beneficial distributed generation. While many of these technologies are available and in growing use today, most are still in continuing stages of development. Those described below are the most common commercial technologies currently considered for use in distributed generation.

RECIPROCATING ENGINE

Reciprocating engines are internal combustion engines that are piston-driven, and are widely familiar from their use in the automotive industry. In the utility industry they are well known for their use as back-up generators, and in applications of combined heat-and-power (cogeneration). They are typically less than 20 kilowatts in size, and offer low cost ($400-600 per kilowatt), flexibility in fuels (diesel, natural gas, waste fuels), and are easily maintained and operated. They are the most common form of distributed generation and may be either consumer-owned, or owned by a utility or independent power supplier. Their low capital cost and easy operation advantages are expected to make reciprocating engines an attractive option for onsite power production while more advanced technologies such as small gas turbines, microturbines, fuel cells, and photovoltaics attain mass production and resulting cost reductions. Disadvantages are low efficiencies (less than 40 percent), regular maintenance requirements, fuel costs, and emissions at rates higher than other distributed energy sources.

Applications: Reciprocating engines are considered primarily for peaking-shaving or short-term emergency or back-up applications.

SMALL GAS TURBINES

Small gas turbines incorporate advances in combustion technology and high-efficiency turbines resulting from advances in aerospace technology. They are greater than one megawatt in size (as differentiated from microturbines described below) and consist of three primary components: 1) a compressor that pressurizes air and transmits it to the combustion chamber; 2) the combustion chamber in which air and gas fuel are mixed and burned at a very high temperature (3,500 degrees Fahrenheit); 3) a power turbine consisting of a series of fixed and rotating blades that are turned by hot, expanding gases released from the combustion chamber. Basic costs start at $400-900 per kilowatt and siting and other project development requirements which can add 150-300 percent to the total cost. Although they produce much lower levels of NO_X and CO than reciprocating engines, environmental control systems and noise abatement measures may be needed. Development is on-going and the U.S. Department of Energy has announced creation of a 4.3 megawatt natural gas fired system with a 40 percent thermal efficiency and extremely low nitrogen oxide and carbon monoxide emissions. Among the challenges for utilization of this technology is that the typical range of gas pressures in local distribution systems is substantially below the range needed for gas turbine generation.

Applications: Small gas turbines are considered a superior technology for combined heat-and-power applications. They provide the opportunity for more constant usage than reciprocating engines and can also be utilized by utilities in black-start conditions. It is expected that they will provide an attractive option for custom-tailored needs for large commercial and industrial consumers.

MICROTURBINES

High speed gas turbines in the range of 15 kilowatts to 500 kilowatts are generally considered microturbines. This technology has emerged from advances in four different areas: small gas turbines, auxiliary power units for aircraft, automotive gas turbines and automotive turbochargers. They are considered cleaner, quieter, and simpler mechanically than reciprocating engines. The key components are a high-speed compressor-turbine connected to a high-speed generator. They are sized to fit a specific facility or use and can maintain continuous operation. A 30 kilowatt system is the size of a refrigerator and generates enough power for a small business. The units can run on a variety of gaseous and liquid fuels and their advantage as fossil fuel burners are low emissions and low maintenance (once annually). More than 100 units are now in operation and field tests have been planned by a joint program of the National Rural Electric Cooperative Association and the Electric Power Research Institute. The largest challenge for microturbines is cost. Single units currently cost about $1,100 per kilowatt. Increased production at an annual volume of 100,00 units is anticipated to reduce costs by about half to the range of reciprocating engines. Microturbines also face engineering challenges with efforts now ongoing to create units in the 25 to 500 kilowatt range with 40 percent efficiency and with nitrogen oxide and carbon monoxide emissions of less than 10 parts per million and low levels of unburned hydrocarbons.

Applications: Microturbines offer the advantage of continuous small scale power generation in situations for peak-saving, prime power, and off-grid applications.

FUEL CELLS

Fuel cells have received growing attention for their versatility in application, low level emissions, and the potential they hold for power production. While advanced development and pilot projects are on-going, utilities and electric equipment manufacturers have begun marketing various models for homes and businesses. Sizes range from 2 kilowatt up to 250 kilowatts for low temperature fuel cells and 100 kilowatts to 1 megawatt for high temperature fuel cells. There is also the capability for fuel cells to be "stacked" to create 100 megawatt plants to add to utility baseload capacity and supply districts or small towns.

Fuel cells operate on an electrochemical process to convert a fuel directly into electrical energy. A fuel cell has no internal moving parts and operate similar to dry cell batteries, except that they produce a continuous production of electricity as long as fuel, normally hydrogen, is supplied. In a fuel cell power plant, natural gas or coal gas or similar fuels containing hydrogen is first cleaned, then converted to hydrogen-rich gas by a fuel processor or internal catalyst. The fuel is combined with an oxidant within the cell without burning, and transfers an electric charge between a positively charged anode and a negatively charged cathode plate. With hydrogen fuel, the byproducts are heat and water, with virtually zero pollutant emissions, natural gas fuel produces very low levels of NO_x, CO, and SO_x, with CO_2 emissions similar to those of a microturbine.

Fuel cells can operate as stand alone units, or connected to the grid. In residential or other individual facility applications they can produce both electricity and heat. They can also be operated as part of "hybrid" systems in conjunction with photovoltaics, wind turbines, or other systems.

Types of fuel cells commonly discussed are:

Molten Carbonate Fuel Cell (MCFC): a type of fuel cell that utilizes molten carbonate electrolytes. This system has the advantage of utilizing carbon monoxide as a fuel, allowing mixtures of carbon monoxide and hydrogen, such as those produced in a coal gasifier, to be used as fuel. With its higher operation temperature and higher efficiency it is viewed, along with SOFC's described below as suitable for power production, either as a stand-alone unit, or as part of a hybrid or grid-connected system.

Solid Oxide Fuel Cell (SOFC): a type of fuel cell that employs solid zirconium dioxide electrolytes. Suitable fuels include hydrogen, carbon monoxide, and methane. Solid oxide fuel cells have the advantage of being relatively insensitive to fuel contaminants such as sulfur and nitrogen compounds that impair the performance of other fuel systems.

Phosphoric Acid Fuel Cell (PAFC): a type of fuel cell that employs phosphoric acid electrolytes. It is the most commercially developed type of fuel cell, and can be used in vehicles such as buses and trains. This is viewed as the first generation of fuel cell products to enter the commercial market.

Proton Exchange Membrane Fuel Cell (PEMFC): a type of fuel cell that operates at relatively low temperatures, has high power density, can vary output quickly to meet shifts in power demand, and is suited for applications such as lighting, communications, and in automobiles.

The key challenges for fuel cells are engineering advances and reduction in cost. Costs are currently estimated at $3,750 per kilowatt and operation and maintenance costs at a low level of .0017 cents per kilowatt hour. More than 150 PAFC power plants are currently in use and Bonneville Power Administration developed a program to commercialize fuel cells for residential and commercial use. The program involves cost sharing by customer to install and test efficiency for 110 systems. Efficiencies for fuel cells are currently in the 40 to 57 percent range. Work is underway to develop large fuel cells with 60 percent efficiency and to reduce costs to $1,000 or less per kilowatt.

Applications: Because of their relatively high capital cost, fuel cells offer their best economy in situations for continuous, high quality power with low emissions and no noise. They may be utilized on or off-grid, and may be combined with solar or other technologies in hybrid systems. High-temperature fuel cells are also useful for combined heat-and-power applications.

HYDRO

Hydro power currently contributes 10 percent of the nation's total electric energy. There are three types of hydropower facilities. Impoundment Hydropower Plants use a dam to store water and direct it through a turbine. Diversion Hydropower Plants channel a portion of a running river through a canal or penstock where a turbine is placed. Pumped Storage Hydropower Plants utilize water pumped from a lower reservoir or water source at a time when electricity prices are low (at night). The water is released back to the lower reservoir when the cost to generate electricity is high (during the day, or peak periods).

Large hydro plants, greater than 30 megawatts in size are severely limited both by siting availability and restrictions and are not considered "distributed generation." Hydro plants less than 30 megawatts fall into three categories: 1) small hydro of 1-30 megawatts; 2) mini-hydro of 100-1000 kilowatts, and 3) micro-hydro of less than 100 kilowatts. Advances in generator and turbine technology have brought sites formerly considered marginal to consideration for development. The U.S. Department of Energy has estimated on a state-by-state basis that undeveloped capacity for hydropower totals approximately 30,000 megawatts. Hydro costs per kilowatt vary widely depending on the requirements for site development. Generation cost depends on the flow capacity of the water body—the levels water supply available on a year-round, or seasonal basis. Development is also restricted by environmental concerns for impacts on water quality and fish habitat.

Applications: Hydro power of less than 30 megawatts is most economical as baseload power, however, it is commonly seasonal in nature. These facilities may be grid-connected or off-grid in isolated areas. On a seasonal basis, depending on the size of the hydro facility, it may be utilized for central system dispatch to feed power into the grid.

WIND

Wind turbines are noted to be the fastest growing energy source in the world, with power production costs currently competitive with traditional power plants. Modern wind turbines, which have undergone significant advances in the last two decades, fall into two basic groups: the traditional propellers (rotors) on a tower, and the egg-beater style Darrieus model. Most common is the tower-and-rotor design that ranges in size from individual home-sized wind machines with rotors of 8 to 25 feet, to the large grid-connected models, the largest of which is in Hawaii that has rotors more than 300 feet long on a 20 story tower. Generally, grid connect machines have towers up to 200 feet high and have a capacity of 750 kilowatts to one megawatt. These may be grouped together into what is known as a "wind farm."

As wind technology has advanced, cost has dropped dramatically. Installation costs are currently about $1,000 per kilowatt, with 80 percent of the cost related to the machinery. Advantages include the fact that wind power produces no pollutants and provides more jobs per dollar invested than any other energy technology. Prices per kilowatt hour range from 3.2 to 7 cents, with the variance dependent upon wind availability. Wind resources are characterized by wind-power density classes. Good wind resources (class 3 and above) have an average annual wind speed of at least 13 miles per hour. These good wind density areas are common along the east coast, the Appalachian Mountain chain, the Great Lakes, the Pacific Northwest, the Midwest, and the Southwest.

There are numerous wind farm and pilot projects sponsored by utility systems and independent power producers. An Iowa wind farm sponsored by municipal utilities is targeting the "green" power market. Other systems are adding to the "green" mix in retail power sold to consumers—in some programs, with funds paid voluntarily as customer premiums.

Wind power development faces a number of challenges. The primary disadvantage of this technology is that it only produces power when the wind is blowing, and unless expensive battery systems are installed, it requires back-up power, or needs to be used in combination with another technology, such as fuel cells. Connection to the grid eliminates the problem of intermittent wind flow and power production, but can restrict siting. Good wind sites can be in remote locations, and sites close to the grid can draw public opposition due to aesthetic or noise concerns.

Costs of power production from wind technology are expected to continue to drop as this technology advances further. A federal target of 2.5 cents per kilowatt hour makes wind a highly attractive option for the power mix. The U.S. Department of Energy has announced goals to power at least 5 percent of the nation's electricity with wind by 2020.

> **Applications**: Wind generators provide intermittent power flow at economical rates and may be combined with other technologies in hybrid projects, or connected to the grid. While wind turbines may feed power into the grid they cannot be scheduled for central system dispatch because of the intermittent production.

PHOTOVOLTAIC

Photovoltaic (PV) solar technology uses semiconductor-based cells to directly convert sunlight into electricity. In the past two decades small calculators and watches have become common applications for PV, but the worldwide market to utilize PV cells for distributed generation is growing rapidly. There are many programs now promoting solar power systems such as the federal government's Million Solar Roofs program which targets placing one million solar power systems on rooftops by 2010. Parallel to this program the Long Island Power Authority has allocated $160 million to install 10,000 solar panels on Long Island by 2010.

A typical photovoltaic cell consists of a glass cover other type of transparent encapsulant weathersealed to a box containing the collection technology. The technology is constructed in layers: an anti-reflective layer to keep the cell from reflecting light away from the contact points; a top metallic grid or other electrical contact to collect electrons from the semiconductor and transfer them to the external load; and a back contact to complete the circuit.

Sizes of PV systems may range as low as one kilowatt—to one megawatt or more in large systems where cells are combined in a field. Applications for PV technology is usually grouped into six types: 1) simple, "stand alone" PV systems; 2) PV with battery storage; 3) PV with backup generator power; 4) PV connected to the local utility; 5) utility-scale PV power production; 6) hybrid power systems.

Simple Stand Alone PV Systems: These off-grid systems are considered for remote areas in applications for a specific job that does not require a constant flow of power, such as water pumps for irrigation or ventilation fans for air cooling. Complex wiring, storage, and control systems are not utilized. The system provides power only when there is adequate sunlight.

PV With Battery Storage: For situations in which a constant flow of electricity is needed, battery systems are incorporated. Battery storage is usually expensive, however, and does not guarantee reliability if there are extended periods of low intensity sunlight. This is also an off-grid application.

PV With Backup Generator Power: When a steady, reliable flow of power is needed in an off-grid application, an electric generator can be linked to the PV and battery storage system to assure that the batteries remain charged. In some systems, the generator can run simultaneous with PV production when demand is exceeding output of the PV modules and batteries. (See Hybrid System below.)

PV Connected to the Local Utility: Grid-connected PV systems can avoid the need for batteries or a generator by drawing power from the utility distribution system when it is needed. However, interconnection with the utility grid requires installation of protection equipment to separate the PV system from the grid when necessary. It also requires agreement with the utility on access to the shutoff to assure worker safety. Fees depend upon utility policies. Where net-metering is allowed, the grid-connected PV systems can transfer power back into the grid, allowing the customer meter to run backward, resulting in a customer credit on monthly utility bills.

Utility Scale PV Power Production: Utilities can combine may PVs in a field to produce a photovoltaic power plant. Such a plant can be constructed more quickly than a conventional power plan and can be located in the grid where they are most needed. They can also be expanded incrementally as power demand increases.

Hybrid Power Systems: These systems combine another technology with PV power production usually in an off-grid situation to meet the energy demand of a facility or community. PV can contribute to off-setting peak demand during the day for a system that also utilizes fuel cells, hydro power, gas turbines, or reciprocating engines. Essential to the hybrid system is knowledge of the demand of the facility or community.

The primary disadvantages of photovoltaic systems are cost and production capability that varies with sunlight. Current capital cost is estimated at $6,600 per kilowatt with total production prices ranging from 37 to 81 cents per kilowatt hour due to variations in geography, installation, incentives and financing terms. Off-grid systems provide benefits in situations where the location is remote and extension of distribution lines is too costly or infeasible. For grid-connected systems, net-metering may help to offset costs, however the cost of PV remains too high for it to be considered for the bulk power market.

PV costs are anticipated to continue to decline as the working life of PV cells is extended and as conversion efficiency (the proportion of sunlight energy converted to electrical energy) increases. Conversion efficiency is currently in the 6 to 19 percent range. The U.S. DOE projects costs will drop to 10 cents per kilowatt hour by 2010. At this price, PV may become a cost competitive power option in urban areas where transmission and distribution systems are constrained and in rural areas where distribution costs are high.

Applications: Photovoltaic systems are highly versatile and may be utilized in grid-connected or off-grid applications. These applications range from: electronic road signs in temporary or remote locations to water pumping stations and central plant production, to hybrid use with fuel cells or wind turbines for powering specific facilities. Because of their daytime production, PV technologies can provide peak-shaving benefits, but in most applications, like wind technology PV cannot be scheduled for centralized dispatch to provide system power to the grid.

BIOMASS

Biomass is trees, crops, and agricultural and forestry wastes that can be used to make fuels, chemicals, and electricity. Biomass is a clean, domestic, renewable source of energy. Renewable biomass energy will never run out. All it requires is sunlight, soil and water to grow, and a national commitment to research and development that is a tiny fraction of the amount we have spent to develop nuclear and fossil energy.

The United States has enough agricultural land available to produce enormous quantities of biomass in a sustainable way. As an example, the U.S. has the agricultural capacity to replace half of our gasoline usage, or our nuclear power usage twice over. The diversion of part of the $70 billion a year we now spend on imported oil would flow into rural economies to increase the economic viability of farms, establish local processing and associated job creation, and support a system of distribution to local consumers.

Biomass comes from in-state businesses that use local labor. Because of this, biomass fuel dollars stay in the local economy instead of going to foreign countries. It is estimated the 80% of every dollar spent on fossil fuel leaves the region, while 80% of every dollar spent on biomass field remains in the local economy. Increasing the use of biomass helps the local tax base and builds tax revenues.

SUMMARY

Comparisons between technologies are not simple, and for some elements such as heat efficiencies, comparisons may be apples-to-oranges. However, each technology has advantages and disadvantages to be weighed in terms of the type of use or application, and the relative types of benefits desired. Final cost will vary depending upon site and fuel specific conditions. The summary chart below outlines some of the general characteristics of each technology (not including Biomass).

Sources: Distributed Power Coalition of America; (www.dcp.org), Gas Research Institute, U.S. DOE

Table 1 COMMON DISTRIBUTED GENERATION TECHNOLOGIES

Technology	Power Cost cents/kW	Capital Cost $/kW	O&M Cost $/kWh	Capacity Range	Emissions NOx/CO/THC*	Dispatch
Reciprocating Engine	**	400-600	0.01	<100 kW >1 MW	2,100/340/150	Yes
Small Gas Turbine	**	400-900	.005-.0065	> 1 MW < 5 MW	25/ 50 /10	Yes
Microturbine	**	1,100	0.005-.01	15 kW 500 kW	9 / 25 / 9	Yes
Fuel Cell	10-12.5	3,750	0.0017	50 kW >1 MW	0/0/0****	Yes
Hydro	2.6-16.1	***	***	<30 MW	0/0/0	Yes
Wind	3.2-7.4	1,000	0.01	15 kW >1 MW	0/0/0	No
Photovoltaic	37-81	6,600	0.001-.004	1 kW >1 MW	0/0/0	No

Notes: * measured in parts per million
** depends significantly on fuel costs/and in-service time
*** wide variance depending upon fuel and size
**** near zero emissions based on hydrogen fuel; natural gas fuel will produce very low levels of NO_X, CO, and SO_X, with levels of CO_2 similar to microturbines

Endnotes:

[1] U.S. DOE Advanced Power Systems, "DOE Energy Resources R&D Portfolio FY 1999-2001," (February 2000) and also U.S. DOE EREN website for background on distributed generation technologies generally.

[2] ibid.

[3] ibid.

[4] ibid.

[5] ibid.

[6] ibid.

[7] ibid.

[8] ibid.

[9] ibid.

[10] ibid.

[11] ibid.

Appendix B
Key State and Federal Permit Thresholds

KEY STATE THRESHOLDS FOR ELECTRIC FACILITY PERMITTING

Massachusetts Environmental Policy Act (MEPA)

(Under Executive Office of Environmental Affairs)

Environmental Impact Assessment needed if:

- unit is greater than 25 MW
- includes a new fuel pipeline greater than 5 miles
- includes new transmission line greater than 69 kV
- includes new transmission line longer than 1 mile
- poses significant land/species habitat alteration, water withdrawal, sewer construction, waste disposal, air emissions, or impacts on areas of historical/critical concern

(This can trigger examination by other state environmental agencies.)

Energy Facilities Siting Board

(Within Department of Telecommunications and Energy, and includes board members from other agencies)

Provides approval to construct:

- units with size greater than 100 MW
- transmission line in a right of way 69 kV or greater and 1 mile or greater, or 115 kV and more than 10 miles

Department of Environmental Protection Air Program Planning Unit

Approves emissions plans:

- for units with heat rating input of more than 3 million Btu/hour

Examines noise impacts:

- for facilities that operate on a 4-hour per day minimum basis

DEP Water Pollution Program

Provides water quality certification concerning wastewater discharge

- units that require dredging, filling, or construction of intake or discharge structure in surface or groundwater

DEP Drinking Water Program

Examines present and future water use for units that extract water for heating/cooling purposes

- withdrawals of more than 100,000 gallons per day

Department of Public Safety

Requires permits for storage tanks for oil and other flammable fluids with capacity greater than 10,000 gallons.

KEY FEDERAL THRESHOLDS FOR ELECTRIC FACILITY PERMITTING

Federal Energy Regulatory Commission

Approval of membership in ISO to sell on wholesale market

Certification required for determination as a "Qualifying Facility"

- for facilities of 80 megawatts or less that utilize biomass, waste, renewable resources, or geothermal
- "Qualifying Facility" must also be less than 50 percent utility-owned

U.S. Environmental Protection Agency

Requires an NPDES Permit for facilities that plan point source discharge of sanitary waste or gray water, or toxic pollutants including metals and non-conventional pollutants

Federal Aviation Administration

Agency approval required if facility is located within 20,000 feet of an airport runway and height exceeds 200 feet

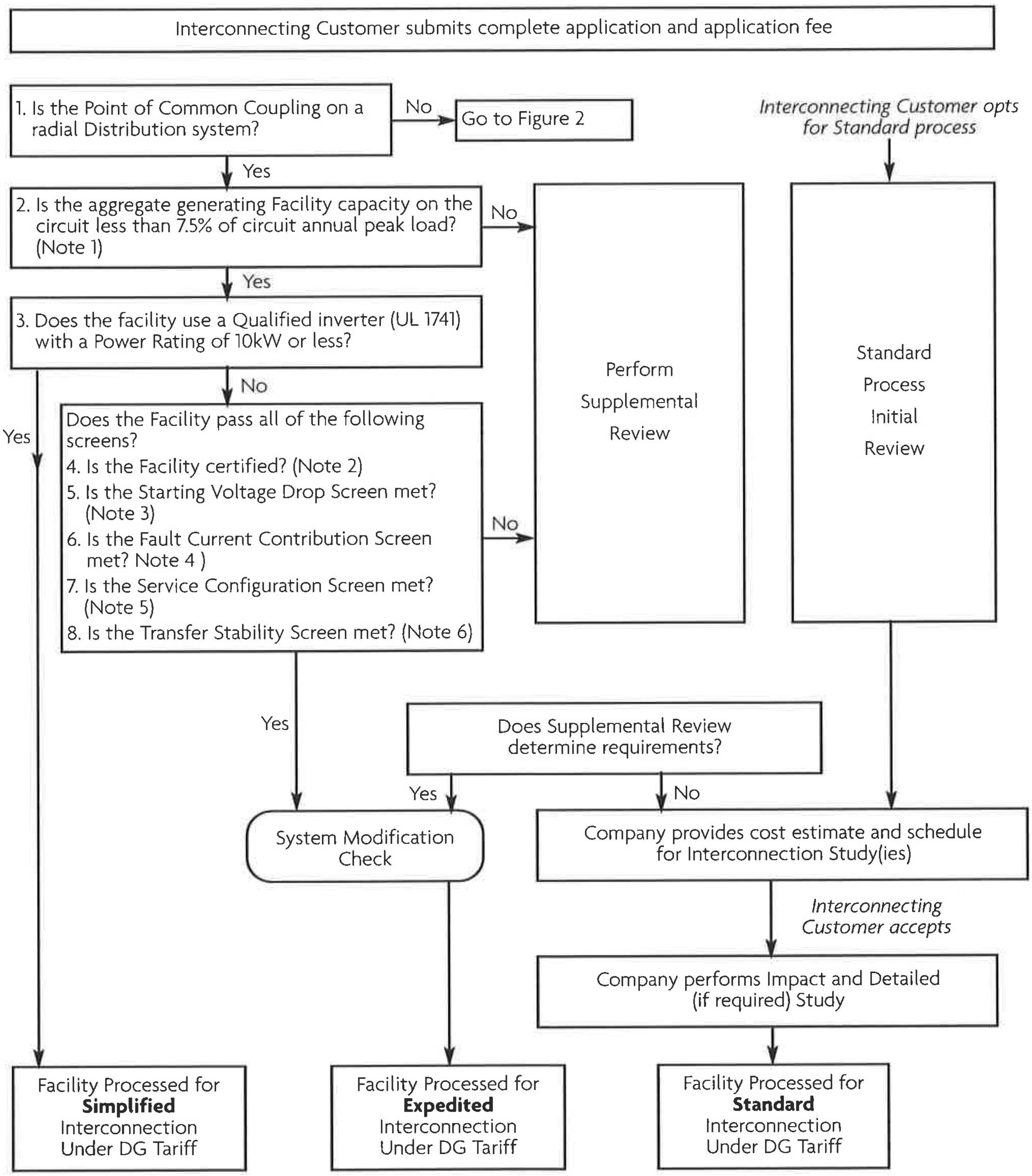
Federal Emergency Management Administration

Restrictions and requirements if facility sited within the 100-year flood plain

Appendix C Proposed Interconnection Process, Schedule & Fees

(Excerpt of Distributed Generation Collaborative Report filed with the Massachusetts Department of Telecommunications and Energy, May 14, 2003)

Figure 1 SCHEMATIC OF MASSACHUSETTS DG INTERCONNECTION PROCESS



EXPLANATORY NOTES TO ACCOMPANY FIGURE 1

Note 1:

On a typical radial distribution EPS circuit ("feeder") the annual peak load is measured at the substation circuit breaker, which corresponds to the supply point of the circuit. A circuit may also be supplied from a tap on a higher-voltage line, sometimes called a subtransmission line. On more complex radial EPSs, where bidirectional power flow is possible due to alternative circuit supply options ("loop service") the normal supply point is the loop tap.

Note 2:

California and New York have adopted certification rules for expediting application review and approval of Facility interconnections onto Company electric systems. Facilities in these states must meet commission-approved certification tests and criteria to qualify for the Expedited process. Since the certification criterion is based on testing results from recognized national testing laboratories, the Company will accept Facilities certified in California and New York as candidates for the Expedited process. It is the Interconnecting Customer's responsibility to determine if and submit verification that the proposed Facility has been certified in California or New York.

The above states and Massachusetts have adopted UL 1741, *"Inverters, Converters and Charge Controllers for Use in Independent Power Systems,"* for certifying the electrical protection functionality of independent power systems. UL 1741 compliance is established by nationally recognized testing laboratories. Interconnecting Customers should contact the Facility supplier to determine if it has been listed. The IEEE P1547 Draft Standard includes design specifications and provides technical and test specifications for Facilities rated up to 10MVA. To meet the IEEE standard, Interconnecting Customers must provide information or documentation that demonstrates how the Facility is in compliance with the IEEE P1547 Draft Standard. A Facility will be deemed to be in compliance with the IEEE P1547 Draft Standard if the Company previously determined it was in compliance. A registry of Facilities previously certified in other states or in compliance with the IEEE standard can be obtained from the Massachusetts Division of Energy Resources or as determined by the Department. Applicants who can demonstrate Facility compliance with either standard will be eligible for the Expedited process.

Note 3:

This screen only applies to Facilities that start by motoring the generating unit(s) or the act of connecting synchronous generators. The voltage drops should be less than the criteria below. There are two options in determining whether Starting Voltage Drop could be a problem. The option to be used is at the Companies' discretion:

Option 1: The Company may determine that the Facility's starting inrush current is equal to or less than the continuous ampere rating of the Facility's service equipment.

Option 2: The Company may determine the impedances of the service distribution transformer (if present) and the secondary conductors to the Facility's service equipment and perform a voltage drop calculation. Alternatively, the Company may use tables or nomographs to determine the voltage drop. Voltage drops caused by starting a generating unit as a motor must be less than 2.5% for primary interconnections and 5% for secondary interconnections.

Note 4:

The purpose of this screen is to ensure that fault (short-circuit) current contributions from all Facilities will have no significant impact on the Company's protective devices and EPS. All of the following criteria must be met when applicable:

a. The proposed Facility, in aggregation with other generation on the distribution circuit, will not contribute more than 10% to the distribution circuit's maximum fault current under normal operating conditions at the point on the high voltage (primary) level nearest the proposed PCC.

b. The proposed Facility, in aggregate with other generation on the distribution circuit, will not cause any distribution protective devices and equipment (including but not limited to substation breakers, fuse cutouts, and line reclosers), or Interconnecting Customer equipment on the EPS to exceed 85% of the short circuit interrupting capability. In addition, the proposed Facility will not be installed on a circuit that already exceeds 85 percent of the short circuit interrupting capability.

c. When measured at the secondary side (low side) of a shared distribution transformer, the short circuit contribution of the proposed Facility must be less than or equal to 2.5% of the interrupting rating of the Companies' service equipment. Coordination of fault-current protection devices and systems will be examined as part of this screen.

Note 5:

This screen includes a review of the type of electrical service provided to the Interconnecting Customer, including line configuration and the transformer connection to limit the potential for creating over voltages on the Company EPS due to a loss of ground during the operating time of any anti-islanding function.

If the proposed generator is to be interconnected on a single-phase transformer shared secondary, the aggregate generation capacity on the shared secondary, including the proposed generator, will not exceed 20 kVA. If the proposed generator is single-phase and is to be interconnected on a center tap neutral of a 240 volt service, its addition will not create an imbalance between the two sides of the 240 volt service of more than 20% of nameplate rating of the service transformer.

Note 6:

The proposed Facility, in aggregate with other Facilities interconnected to the distribution low voltage side of the substation transformer feeding the distribution circuit where the Facility proposes to interconnect, will not exceed 10 MW in an area where there are known or posted transient stability limitations to generating units located in the general electrical vicinity (e.g., 3 or 4 transmission voltage level buses from the PCC).

Primary Distribution Line Type	**Type of Interconnection to Primary Distribution Line**	**Result/Criteria**
Three-phase; three wire	3-phase or single phase, phase-to-phase	Pass screen
Three-phase, four wire	Effectively-grounded 3 phase or Single-phase, line-to-eutral	Pass screen

Figure 2 SIMPLIFIED INTERCONNECTION TO NETWORKS

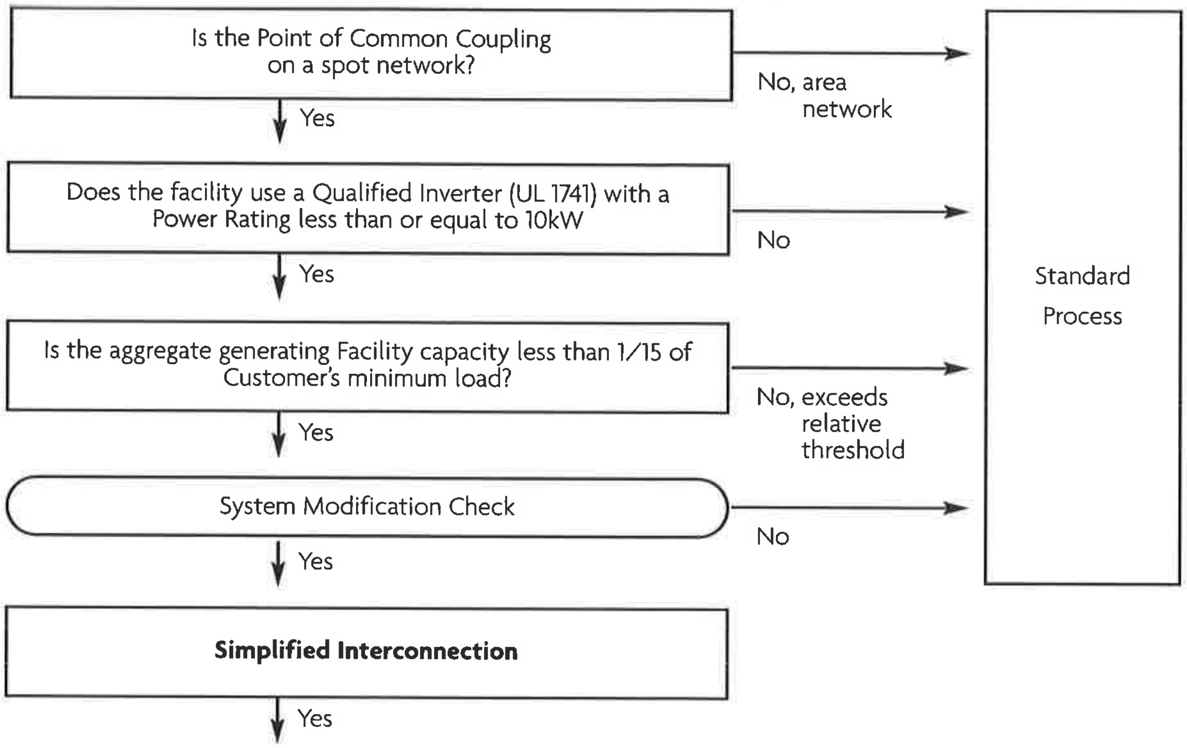


Table 1 TIME FRAMES[2] (Note 1)

	Certified Inverter =10 kW	Qualified DG	Any DG	Certified Inverter =10 kW
	Simplified	**Expedited**	**Standard**	**Simplified Spot Network**
Acknowledge Receipt of Application	(3days)	(3 days)	(3 days)	(3 days)
Review Application for completeness	10 days	10 days	10 days	10 days
Complete Review of All Screens	10 days	**25 days (RE: 15 days)**		Site review 30/90 days (Note 2)
Complete Supplemental Review (if needed)		**20 days (RE: 15 days)**		N/A
Complete Standard Process Initial Review			20 days	
Send Follow-on Studies Cost/Agreement			5 days	
Complete Impact Study (if needed)			55 days	
Complete Detailed Study (if needed)	N/A	N/A	30 days	N/A
Send Executable Agreement (Note 3)	Done	10 days	15 days	Done (Comparable Simplified Radial)
Total Maximum Days (Note 4)	15 days	**40/60 days (RE: 25-40 days) (Note 5)**	**125/150 days (RE: 65-80) (Note 6)**	40/100 days
Notice/Witness Test	‹1 day with 10 day notice or by mutual agreement	1-2 days with 10 day notice or by mutual agreement	By mutual agreement	1 day with 10 day notice or by mutual agreement

Table 2 FEE SCHEDULES

	Certified Inverter =10 kW	Qualified DG	Any DG	Certified Inverter =10 kW
	Simplified	**Expedited**	**Standard**	**Simplified Spot Network**
Application Fee (covers screens)	0 (Note 1)	$3/kW, minimum $300, maximum $2,500	$3/kW, minimum $300, maximum $2,500	=$3/kW, $100, >3kW $300
Supplemental Review or Additional Review (if applicable)	N/A	Up to 10 engineering hours at $125/hr ($1,250 maximum) (Note 2)	N/A	N/A
Standard Interconnection Initial Review	N/A	N/A	Included in application fee (if applicable)	N/A
Impact and Detailed Study (if required)	N/A	N/A	Actual Cost (Note 3)	N/A
Facility Upgrades	N/A (Note 4)	Actual Cost	Actual Cost	N/A
O&M (Note 5)	N/A	TBD	TBD	N/A
Witness Test	0	Actual cost, up to $300 + travel time	Actual Cost	0 (Note 7)

EXPLANATORY NOTES TO ACCOMPANY TABLES 1 AND 2

Table 1: Time Frames

Note 1:

All days listed apply to Company business days under normal work conditions. All numbers in this table assume a reasonable number of applicants under review. All timelines may be extended by mutual agreement. Any delays caused by Interconnecting Customer will interrupt the applicable clock. Moreover, if an Interconnecting Customer fails to act expeditiously to continue the interconnection process or delays the process by failing to provide necessary information within the longer of 15 days or half the time allotted to the Company to perform a given step, or as extended by mutual agreement, then the Company may terminate the application and the Interconnecting Customer must re-apply. However, the Company will be required to retain the work previously performed in order to reduce the initial and Supplemental Review costs incurred for a period of no less than 1 year.

Note 2:

30 days if load is known or can be reasonably determined, 90 if it has to be metered.

Note 3:

Company delivers an executable agreement form. Once the Interconnection Service Agreement is delivered by the Company, any further modification and timetable will be established by mutual agreement.

Note 4:

Actual totals laid out in columns exceed the maximum target. The Parties further agree that average days (fewer than maximum days) is a performance metric that will be tracked.

Note 5:

Shorter time applies to Expedited without Supplemental Review, longer time applies to Expedited with Supplemental Review.

Note 6:

125 day maximum applies to an Interconnecting Customer opting to begin directly in Standard process, and 150 days is for an Interconnecting Customer who goes through initial Expedited process first. In both cases this assumes that both the Impact and Facilities Studies are needed. If the Detailed Study is not needed, the timelines will be shorter.

Table 2: Fee Schedules

Note 1:

If the Company determines that the Facility does not qualify for the Simplified process, it will let the Interconnecting Customer know what the appropriate fee is.

Note 2:

Supplemental Review and additional review are defined in Section 3.2.

Note 3.:

This is the actual cost only attributable to the applicant. Any costs not expended from the application fee previously collected will go toward the costs of these studies.

Note 4:

Not applicable except in certain rare cases where a System Modification would be needed. If so, the modifications are the Interconnecting Customer's responsibility.

Note 5:

O & M is defined as the Company's operations and maintenance carrying charges on the incremental costs associated with serving the Interconnecting Customer.

Note 6:

The fee will be based on actual cost up to $300 plus driving time, unless Company representatives are required to do additional work due to extraordinary circumstances or due to problems on the Interconnecting Customer's side of the PCC (e.g., Company representative required to make two trips to the site), in which case Interconnecting Customer will cover the additional cost.

Note 7:

Unless extraordinary circumstance.