Aspenall Energies, LLC

Distributed Renewable Energy Generation for Puerto Rico: Facts & Resources

Introduction

Electricity supply in Puerto Rico is dominated by the Puerto Rico Electric Power Authority (PREPA), a public corporation which functions as a state-owned monopoly. PREPA came into being during the 1950's, when electricity expanded to touch almost every aspect of daily life. This expansion, "and its concomitant regulation as a public utility... gradually converged to enable the network of gigawatt-scale thermal power plants located far from urban centers that we know today."[1]

But times change, and technologies evolve. While the need for electricity continues to grow, our reliance on large centralized generating facilities which burn fossil fuel and distribute that electricity over long distances is technically inefficient and environmentally unsustainable. Moreover, given the EPA's recent endangerment finding on Greenhouse Gases, it is fiscally imprudent.[2]

The following paragraphs explore a different vision of electric power generation, through the inclusion of distributed small-scale, user initiated facilities based on renewable energy sources. Specifically, we look at: a) a definition of distributed generation and its advantages, b) a definition of renewable energy and its advantages; and c) the barriers inhibiting the development of distributed renewable energies in Puerto Rico. We conclude by identifying some steps which can be taken to create an enabling environment for distributed renewable energies.

Distributed energy offers solutions to many of the nation's most pressing energy and electric power problems, including blackouts, brownouts, energy security concerns, power quality issues, tighter emissions standards, transmission bottlenecks, and the desire for greater control over energy costs.
- US Department Of Energy[3]

I. Distributed Generation

A. What is Distributed Generation?

Distributed generation refers to the production of electricity on or near the site of use. It differs from traditional generation in that the generating facility is: a) near the user, b) modular in technology, and c) small scale in size - in the hundreds or thousands of kilowatts in contrast to the hundreds or thousands of megawatts of large central facilities. Distributed generation includes traditional forms such as Combined Heat and Power (CHP), industrial gas turbines, and small petroleum generators, as well as the new wave of scalable renewable energies such as solar and wind power. These newer technologies will undoubtedly grow in prominence over the foreseeable future.

B. Benefits of Distributed Generation

Distributed generation provides a variety of direct and indirect benefits to the final power users, to the power authorities, and to the community at large.

- **Increased electric system reliability and improved power quality and infrastructure resilience.** As there are more diffused providers of energy, the system as a whole is more stable and less vulnerable to power bottlenecks and demand spikes.
- **Less power lost through transmission.** As the power is generated locally, less is lost through grid transmission.
- **Greater synchronization of demand and supply.** Distributed generation brings the user directly into the heart of capacity planning and installation. Distributed facilities are comparatively small and can be brought on-stream in much shorter time frames than large central generating facilities.[4] Actual demand for power can thus be more effectively matched with actual installed generating capacity.
- **Offset to public investments in generation, transmission and distribution facilities.** Distributed generation lowers the demand for public generation and distribution, which leads to lower need for public investment. Given the extreme straights of Puerto Rican public finances, this benefit seems important.
- **Local ownership and investment opportunities.** Distributed generation encourages local savings, reduces capital outflow, and circulates the returns on this investment into the local economy as both return on investment and reward for entrepreneurship.
- **Improved maintenance and operation.** Local ownership creates an incentive for keeping the facility in good running order. Because the facility is close at hand and its actual owners/users have been involved in its selection and installation, cumbersome bureaucratic structures for managerial oversight and control are less necessary. Local ownership also minimizes problems that can occur with absentee owners.[5]
- **Smaller risk of catastrophic incident.** A distributed generation facility does not present the scale of human and environmental risks which are inherent in large generating facilities with their corresponding large fuel storage needs (for example, CAPECO). This is particularly significant for Puerto Rico, with its high population density.
- **Increased productivity for business clients.** Distributed generation makes the overall electrical system stronger and more reliable. Productive activities which depend upon electricity function more reliably and with fewer power-related stoppages. This permits more reliable planning of productive activities, with productivity gains such as improved inventory management and better planning of desirable work stoppages, such as preventive maintenance.
- **Greater job creation impact**. While the specific employment impact will vary from facility to facility and between generating technologies, the installation of many small-scale facilities will create more jobs than the installation of a single large facility. One study of distributed wind generation demonstrated that both construction and operations impacts were 1.1 to 2.8 times higher for distributed, locally owned projects.[6]

Ultimately, wind projects are a source of jobs and economic development... The extent of increased impact is primarily a function of local ownership and return on investment. As such, policies that prioritize higher levels of local ownership are likely to result in increased economic development impacts.

- *Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation* [7]

- **Increased property values.** Distributed generation facilities allow previously unused parts of a specific site - such as roofs and back lots - to be put to economic use. This brings value to unused spaces and enhances the economic prospects of the property as a whole.
- **No need to be 'hidden away' in isolated 'parks'.** Distributed generation brings power generation to where it is needed. This reduces land-use effects and right-of-way acquisition costs - especially significant in Puerto Rico, which has no vast stretches of empty hinterland.
- **Reduced terrorism or sabotage risk.** Distributed generation by its nature presents no attractive target to someone wishing to damage or sabotage the electrical supply system for political reasons.

The US Department of Energy sums up the advantages of distributed energy generation as follows:

> The benefits associated with... (Distributed Energy Resources)... DER installations are often significant and numerous. They almost always provide tangible economic benefits, such as energy savings or transmission and distribution upgrade deferrals, as well as intangible benefits, such as power quality improvements that lengthen maintenance or repair intervals for power equipment. Also the

benefits routinely are dispersed among end users, utilities, and the public. For instance, an end user may use the DER to reduce their peak demand and save money due to lower demand charges. Reduced end user peak demand, in turn, may lower a distribution system peak load such that upgrades are deferred or avoided. This could benefit other consumers by providing them with higher reliability and power quality as well as avoiding their cost share of a distribution system upgrade. In this example, the costs of the DER may be born by the end user, but that user reaps only a share of the benefits.[8]

'The Answer to the Energy Problem' (Forbes.com)

Before John McCain and Barack Obama say another word about America's energy future, maybe they should go to Denmark.

Denmark has done what other countries only dream of doing: achieved energy independence. While Europe's overall energy imports rose 2.4% in 2006, Denmark's energy imports fell to -8%. In fact, the European Union as a whole scored 54% on the scale of energy dependancy. Denmark scored -37%.

"Denmark is the model that the United States should be following," said Steve Pullins, executive director of the U.S. Department of Energy's Modern Grid Initiative.

How'd they do it? Distributed energy.

II. Renewable Energy

A. What is Renewable Energy?

Renewable Energies are energies which do not use finite inputs like fossil fuels. Classic forms of renewable energies are wind, hydroelectric, geothermal, and biomass (typically wood & wood waste). Over the past thirty years, this definition has grown to include solar, wave power and, in some cases, municipal solid waste (although this inclusion is highly contentious and typically confined to its biogenic component).

Currently, fossil fuels are the most commonly used means of electricity generation. As already known, fossil fuels:

- produce emission that **pollute** the air we breathe and the world we live in;
- **emit carbon** when consumed and are understood to be a major contributor to **global warming**;
- are **not local** to Puerto Rico, and therefore must be imported;
- are a **finite** resource;
- are **heavily subsidized**. According to a study by the Environmental Law Institute, the US Government offered over two times more subsidies to fossil fuels than they did to renewable energies between 2002-2008 ($72 billion, as opposed to $29 billion).

In essence, not only are fossil fuels noxious and bad for our society, but the costs of using them have been gravely understated.

B. Advantages of Renewable Energy

The advantages of using renewable energies include the following:[9]

- Renewable energies are resources that are replaced by nature at a faster rate than they are consumed, and therefore **cannot run out**.
- Renewable energies are **local**, and do not need to be imported.
- With the exception of biomass, renewable energies are not subject to fuel cost risk, as they do not consume commodity fuels.
- Many forms of renewable energies emit little or nothing, and do not **pollute** the world we live in.
- Many forms of renewable energies emit little or no carbon, or emit carbon from a source that is quickly replaced and reabsorbs that carbon, and therefore do not contribute to **global warming**.
- Certain forms of renewable energies, like wind and solar power, integrate very easily into a distributed generation paradigm.

Renewable Energies are not without problems. Both wind and solar are intermittent, and grids must be adjusted to accommodate this variability. However, most societies agree that the benefits far outweigh the difficulties. Unlike fossil fuels, the problems they present are surmountable.

III. Barriers to Developing Distributed Renewable Energies

The following are generally understood to be the chief barriers which inhibit distributed energy generation:[10]

- **A lack of uniform technical standards** or procedures that allow for quick, inexpensive and

simple interconnection of small generators with utility systems
- **Prolonged permitting delays**
- **Burdensome distribution system operating and planning requirements**, which may result in unfair treatment of non-utility distributed generation technologies
- **Concentrations of market power** which restrict the development of markets that distributed generation technologies might serve
- **Procedural or actual difficulties in selling power** from on-site generation to utility or other customers
- **Utility rate structures** which base revenue on power sold
- **Ambiguous jurisdictional authority** that hinders the business climate necessary for private investment.

To these barriers we must include all the core barriers to renewable energies, such as:[11]
- **Subsidies for competing fuels**
- **High initial capital costs** and higher necessary amounts of financing (re. capacity)
- **Unfavorable power pricing rules**
- **Higher transaction costs per kW** due to the generally smaller size than conventional energy projects and the fact that they are new and unfamiliar technologies
- **Lack of a legal framework for independent power producers**
- **Restrictions on siting** and construction
- **Difficulties with transmission access** and pricing
- **Onerous utility interconnection requirements**
- **Onerous liability insurance requirements**
- **Uncertainty due to 'new' technologies**

In many countries, power utilities still control a monopoly on electricity production and distribution. In these circumstances... independent power producers may not be able to invest in renewable energy facilities... or utilities may negotiate power purchase agreements on an individual ad-hoc basis, making it difficult for project developers to plan and finance projects on the basis of known and consistent rules.
- Renewable Energy Policies and Barriers [12]

Myth: "Back-up Generation is Needed for All Wind Turbines"

Because of the grid's inherent design,there is no need to back up every megawatt of wind energy with a megawatt of fossil fuel or dispatchable power. The electric grid is designed to have more generation sources than are needed at any one time because no power plant is 100% reliable... One of the most authoritative studies, conducted in 2004 for the Minnesota Department of Commerce found that adding 1,500 megawatts (MW) (enough wind to meet the needs of more than 400,000 homes) to the system of a major utility, Xcel Energy in Minnesota, would require only an additional 8 MW of conventional generation to deal with added variability.

Many sources of electricity considered highly reliable suffer from unexpected outages: for instance nuclear reactors and coal plants that shut down, often at short notice, for safety repairs or maintenance. Yet no one proposes to back up a coal or nuclear power plant with a similar amount of dedicated generation from another plant. The reality is that wind energy is naturally variable but not unreliable. Wind farms are built in windy areas, and seasonal and daily wind generation patterns can be anticipated. Denmark and utility systems in regional areas elsewhere in Europe operate with 10-15% or more of their power coming from wind, without increased reliability problems or need for additional back-up power plants.

IV. Creating An Enabling Environment For Distributed Renewable Energy In Puerto Rico

It is clear from the above that distributed renewable energy would be a tremendous good for Puerto Rico. It is clear, also, that it faces formidable obstacles. Most of these are of a political and administrative nature, rather than a technical one. The following specific actions would, we believe, foster an environment which would enable the creation of a distributed renewable energy industry in Puerto Rico.

1. **Define a Clear National Goal for Distributed Renewable Energy** within the rubric of statewide Renewable Portfolio Standards (RPSs).
2. Designate investments in distributed renewable energy businesses as eligible for **a "Most Favored Tax Status",** similar to the one currently enjoyed by tourism. The most obvious applications would be the allowance of *Sociedades Especiales* for renewable

energy companies operating under the Industrial Incentives Acts, and the transferability of tax credits generated by installed renewable energy equipment, two opportunities currently allowed only to hotels.

3. **Exempt Distributed Renewable Energy Generation from having to function under the Public Private Partnership Authority** which is onerous and only cost effective for large scale energy generation.
4. **Designate Distributed Renewable Energy** as a "Pioneer Industry" under Act 73.
5. Define a **centralized and simplified permitting process** for the planning and installation of distributed renewable energy facilities.
6. **Design procedures that allow for non-utility scale energy production**. In particular, do not demand the same levels of setbacks that an industrial scale installation might necessitate.
7. Establish a preferential PREPA **Feed-In Rate Schedule and Administrative Protocols.**
8. Establish **Training and Accreditation Systems** for Distributed and Renewable Energy engineers and technicians.
9. Establish renewable energy subsidies such as **Renewable Energy Credits** or some sort of a Carbon Tax to fund and promote the industry.

This list is not exhaustive. Ironically, in many cases the laws and amendments have already been written. But the laws must be passed - and the regulatory bodies must implement them - if distributed renewable energy generation is to become a reality in Puerto Rico.

On-Line Resources

There are literally thousands of documents available on the subjects of distributed generation and renewable energies. Please find below only a meagre selection of resources available on the internet:

1. **US Department of Energy: Office of Electricity Delivery and Energy Reliability**
   - EERE Distributed Energy Program
   - US Department of Energy: Office of Electricity Delivery & Energy Reliability: Renewable Energy Integration
   - 'Connecting Distributed Energy Resources to the Grid: Their Benefits to the DER Owner/Customer, Other Customers, the Utility, and Society' Poore, Stovall, Kirby, Rizy, Kuek, and Stovall.
   - 'The Potential Benefits of Distributed Generation and the Rate-Related Issues That May Impede Its Expansion: Report Pursuant to Section 1817 of the Energy Policy Act of 2005'
   - 'Customer-Owned Utilities and Distributed Energy: Potentials and Benefits' Haley, Stovall and Van Dyke.
   - 'Competition in Wholesale and Retail Markets for Electric Energy - Section 1815 of the Energy Policy Act', the Electric Energy Market Competition Task Force.
   - Page on Wind Power http://www.eere.energy.gov/de/wind_power.html
   - Page on Solar PV Power http://www.eere.energy.gov/de/solar_electric.html

2. **The National Renewable Energy Laboratory**
   - 'Opportunities and Barriers to Distributed Generation', Nakarado.
   - 'Overcoming Technical and Market Barriers for Distributed Wind Applications: Reaching the Mainstream' Rhoads-Weaver and Forsyth.
   - 'Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation', Lantz and Tegen.
   - 'Comparing Statewide Economic Impacts of New Generation from Wind, Coal, and Natural Gas in Arizona, Colorado, and Michigan' by Tegen.
   - 'Wind Energy Guide for Country Commissioners' by Costanti, Beltros and the US Dept of Energy.

3. **Other Resources:**
   - 'Distributed Generation in Oregon: Overview, Regulatory Barriers and Recommendations', Schwartz.
   - 'Reducing Regulatory Barriers to Small-Scale Distributed Generation in Montana', the Technical and Financial Bureau of the Montana Department of Environmental Quality.
   - 'Prospects for Distributed Electricity Generation', the Congressional Budget Office.
   - 'An Approach to Quantify the Technical Benefits of Distributed Generation', Chiradeja and Ramakumar.
   - 'An Overview of Developments in Distributed Energy: with country, state and city examples from EU and

USA', McCormick, for VEIL and the Australian Centre for Science, Innovation and Society.

- **Energy Information Administration**, page on Renewable Energies.
- World Alliance for Decentralized Energy this links to a variety of different papers on the subject and its benefits.
- The American Council on Renewable Energy.
- Centre of Sustainable Electricity and Distributed Generation
- Center for Sustainable Energy California
- U.S. Government Website for the Asia-Pacific Partnership on Clean Development & Climate, page on Renewable Energy and Distributed Generation
- The Intergovernmental Panel on Climate Change
- The EPA Climate Change page
- The US Global Change Research Program
- 'Renewables: Global Status Report 2009 Update' by REN21, the Renewable Energy Policy Network for the 21st Century.

Further Reading on Renewable Energy Policy Recommendations

Fred Beck and Eric Martinot, Renewable Energy Policies and Barriers, Encyclopedia of Energy, Cutler J Cleveland, Academic Press/Elsevier Science, 2004

Policy Recommendations for Renewable Energies, International Conference for Renewable Energies, Bonn, 4 June 2004.

Endnotes:

[1] http://www.oe.energy.gov/DocumentsandMedia/1817_Report_-final.pdf

[2] http://www.eenews.net/public/25/13561/features/documents/2009/12/15/document_gw_02.pdf

[3] http://www.eere.energy.gov/de/

[4] From the testimony of Garry A Brown, Chairman of the New York State Public Service Commission on Behalf of the National Association of Regulatory Utility Commissioners before the US Senate Subcommittee on Energy and Natural Resources, May 7, 2009

[5] 'Customer-Owned Utilities and Distributed Energy: Potentials and Benefits' http://www.eere.energy.gov/de/pdfs/de_benefits_utilities_0602ornl.pdf

[6] pg. iii. 'Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation' http://www.windpoweringamerica.gov/pdfs/economic_development/2009/community_wind_projects.pdf

[7] pg. iii. 'Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation' http://www.windpoweringamerica.gov/pdfs/economic_development/2009/community_wind_projects.pdf

[8] pg 1 of 'Connecting Distributed Energy Resources to the Grid: Their Benefits to the DER Owner/Customer, Other Customers, the Utility, and Society' http://www.eere.energy.gov/de/pdfs/der_benefits.pdf

[9] There are other benefits of distributed renewable energies, such as energy access and poverty alleviation, which can become quite important in the developing world but which have less application in Puerto Rico. Please see the following web page for more details: http://www.app.gov/taskforces/renewable/index.htm

[10] Please see the two articles 'Distributed Generation in Oregon: Overview, Regulatory Barriers and Recommendations' http://www.oregon.gov/PUC/electric_gas/dg_report.pdf and 'Reducing Regulatory Barriers to Small-Scale Distributed Generation in Montana' http://www.mtclimatechange.us/ewebeditpro/items/O127F10782.pdf , as well as the testimony of Garry A Brown, Chairman of the New York State Public Service Commission on Behalf of the National Association of Regulatory Utility Commissioners before the US Senate Subcommittee on Energy and Natural Resources, May 7, 2009. Also, specific to wind power, the NREL article 'Overcoming Technical and Market Barriers for Distributed Wind Applications: Reaching the Mainstream' http://www.nrel.gov/docs/fy06osti/39858.pdf

[11] From Renewable Energy Policies and Barriers, by Beck and Martinot, http://www.martinot.info/Beck_Martinot_AP.pdf

[12] Same.