SOLAR AND WIND POWERED RENEWABLE ENERGY STRATEGIES FOR INSTITUTIONS AND ORGANIZATIONS: A CASE STUDY OF UNIVERSITY OF MARYLAND INSTITUTIONS

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ABSTRACT

Organizations and institutions are constantly seeking ways to improve effectiveness and efficiency in its processes especially in the procurement of renewable energy. This paper examined strategies that are being used by higher educational institutions to procure solar and wind powered renewable energy in the State of Maryland. The University System of Maryland and its eleven institutions were examined and it was found that the solar powered renewable energy strategies were driven by regulatory mandates, institutional objectives, environmental factors, technology, and the procurement environment.

INTRODUCTION

Institutions and organizations are constantly looking for ways to improve their business processes aimed at reducing operational costs, reducing greenhouse gas emissions, and improving the environment. Renewable energy has been defined by Random House dictionary as "any naturally occurring, theoretically inexhaustible source of energy such as biomass, solar, wind, tidal wave, and hydroelectric power that is not derived from fossil fuel or nuclear" (Random House, 2013). With increased education on climate change and the efforts to continue to improve the quality of the environment, the use of renewable energy has continued to gain ground in the U.S. and among institutions and organizations. Recent studies show that the consumption of renewable energy in the U.S. has increased from 6.04 quadrillion British Thermal Units (BTUs) in 1990 to 8.08 quadrillion BTUs in 2010 (U.S Census Bureau, 2012). The U.S. Energy Information Administration (EIA) observed in 2012 that the generation and of use of renewable energy such as wind, solar, and biomass are projected to have increased from approximately 50 gigawatts in 2010 to nearly 120 gigawatts in 2035. Though, according to the EIA, wind power dominates the renewable energy capacity growth of solar and biomass; however, it continues to gain high market share. Wind generation capacity in the U.S. is expected to grow from 55 gigawatts in 2010 to 70 gigawatts in 2035. According to the EIA, consumption of renewable sources in the U.S. totaled about 9 quadrillion BTUs – or about 9% of all energy used nationally in 2011. About 35% of U.S. electricity was generated from renewable sources in 2011. As governments continue to look for alternative sources of clean energy, investment in the use of renewable energy is said to be both encouraged and required by a range of State and Federal government's incentives and legislations. With the increased cost of energy coupled with interests to reduce greenhouse gas emissions, institutions and organizations are focusing on strengthening the generation and use of solar and wind renewable energy.

LITERATURE REVIEW

According to the Center for Sustainable Systems (2012), public policy initiatives addressing alternative energy and the engagement of the industrial, residential, and commercial sectors have advanced the use of renewable energy. The supportive public policy programs include Renewable Portfolio Standards that mandate certain levels of renewable power use in organizations. Incentives for renewable energy at Federal

and State levels vary by means of technology employed, by production tax credits, grants, and based on the way each government structures the incentives. The elimination of subsidies for fossil and nuclear energy may also advance renewable energy use as this may spur growth on alternative energy investment portfolios. Net metering programs which allow customers to sell back to utilities surplus renewable energy generated for the public use also serve as a vital incentive program. Renewable Energy Certificates (RECs) are also sold by green energy producers. Organizations and institutions can buy them to offset their usage of fossil fuel generated power. The U.S Environmental Protection Agency (EPA) in 2013 Renewable Energy Certificates indicated in their report that "the property rights to environmental, social, and other non-power qualities of renewable electricity generation…and its associated attributes and benefits, can be sold separately from the underlying physical electricity associated with a renewable-based generation". In the same way, renewable energy certificates provide buyers the flexibility in procuring green power across a diverse geographical area and in applying the renewable attributes to the electricity use at a facility of choice – thus giving organizations the opportunity to support renewable energy development and protect the environment without developing such energy locally. The sale of RECs helps renewable energy development and drive market competitiveness.

The University System of Maryland Institutions are signatories to the American College & University Presidents' Climate Commitment (ACUPCC). This organization plays a very visible and durable role in addressing climate change through the elimination of greenhouse gas emissions in their campus operations. The leadership of this organization developed a framework that will assist institutions to develop social, economic, and technological solutions to reverse global warming. According to ACUPCC, the institutions are committed to complete a campus wide greenhouse gas emissions inventory and, within two years, set a target date and milestones for becoming climate neutral. Also, the institution will have a net zero carbon emission, take immediate steps to reduce greenhouse gas emissions, integrate sustainability into curriculum or part of an educational experience, and develop and make the institutions' climate action plan, emission inventory and progress reports publicly available. In an effort to keep up with commitment to ACUPCC, institutions have become engaged in energy renewable projects and are consuming more green energy directly through the purchase of RECs.

The Chancellor of the University System of Maryland (USM) has mandated that System institutions comply with the ACUPCC and the State of Maryland greenhouse gas emission reduction standards. The State of Maryland has mandates for organizations and institutions in the State to reduce greenhouse gas emission and targets have been set. These regulatory mandates have a positive effect driving institution strategies for renewable energy use and generation.

METHODOLOGY

Public information on sustainability and climate change on the University System of Maryland and its eleven institutions was reviewed. Individual campus renewable energy and sustainability web sites as well as public information reported to the American President's Climate Commitment.org by each institution were also reviewed.

FINDINGS

Regulatory Mandates

Many institutions and organizations are looking for ways to provide cost effective solar and wind renewable sources and programs on the campuses. The strategies used in providing renewable energy resources and

services vary from one organization to another. A review of the University System of Maryland Institutions shows that regulatory mandates affected solar and wind renewable energy strategies.

Signatories to the ACUPCC are mandated to develop Climate Action Plans (CAP) and the plans set immediate, short term, intermediate, and long term greenhouse gas emission reduction targets which are intended to ultimately lead to a zero or carbon neutral campus. The University of Maryland Eastern Shore (UMES) which produced 30,053.2 metric tons of carbon dioxide equivalent (MT-CO2e) in 2008 set targets of 12% reduction for 2015, 25% reduction for 2025, with a 50% reduction in 2030, and a 100% reduction in 2050 (UMES, 2011). The State of Maryland Greenhouse Gas Reduction Act of 2009 did set targets of reducing greenhouse gas by 25% in 2020 and by 90% by 2050. The University System of Maryland institutions engage in renewable energy strategies to reduce greenhouse gas emissions and purchase RECs to offset carbon emissions.

Institutional and Organizational Objectives

Institutional and organizational objectives assist in determining desirable solar and wind renewable energy strategies. The University of Maryland Eastern Shore pursued a strategy of land use resource management and a long term predictable energy cost pricing. In a public/private partnership (PPP) venture, SunEdison developed a 2.2 megawatts solar farm on a 17 acre site at the UMES campus. Through a Power Purchase Agreement (PPA), UMES will consume all green power generated at the site within a twenty year period. Current data from the UMES Solar Web indicates that the solar farm is producing over 3,000 megawatt hours of green energy annually.

The University of Maryland College Park (UMCP) has a student approved "Green Fee" program that is used to purchase 66 million kilowatt hours of clean wind power. The green fee refers to students' fees for sustainability or an increase in students' fees to fund the installation of renewable energy technologies on campus. The Association for the Advancement of Sustainability in Higher Education (ASHE) has a list of institutions with such fee increases and the fee ranges from $3 to $40 per term. In addition, UMCP, in its sustainability strategy, installed more than 2,600 solar panels at its project called the Severn Solar Array. In its infrastructure development strategy, it installed 20 solar hot water panels providing 30% of the building's hot water. The Cole Field House is said to have a photovoltaic (PV) solar array that provides 5.25KW of energy to the building.

The University System of Maryland and the State of Maryland Department of General Services (DGS) engaged in power purchase contracts for renewable energy. In this contract, the organizations purchased 16 megawatts of solar powered green energy at Mount St. Mary's University, 10 megawatts of wind project at Western Maryland, and 55 megawatts of wind energy in West Virginia. These lump sum renewable energy contracts are paid for through a campus consumption share program by the USM institutions as part of the initiative to support green energy use and technology. The Renewable Energy Certificates are also retained by the participating institutions.

Frostburg State University's (FSU) intensity on renewable energy research has earned it commendation and awards from the Second Nature, an organization dedicated to Education for Sustainability. As noted in the citation by Second Nature (2013):

> "Frostburg State University (FSU) is positioning itself to become a national leader in renewable energy through the construction of its Sustainable Energy Research Facility (SERF)." The Facility

> is designed to be "completely off grid and slated for completion in 2012. SERF will house the FSU Renewable Energy Center, where Frostburg's faculty, students and their project partners can develop and conduct research on renewable energy applications and provide education and community outreach programs to homeowners, farmers and entrepreneurs interested in harvesting renewable energy sources and energy security".

Frostburg State University's Renewable Energy Center organizes and presents workshops on wind and solar energy that provide education experiences leading to certifications, as well as engages in constructing buildings that are solar and wind energy powered and that are off the grid. This positions Frostburg State University as one of the leading institutions in constructing non fossil fuel energy independent buildings.

Environmental Factors

It can be observed that the geographical location of an institution plays a key role in its strategy for solar and wind renewable energy. Institutions located in rural or semi-urban areas can easily accommodate ground based solar or even wind based renewable energy strategies. Urban campuses on the other hand appear to be limited in their application of solar energy and may find it much harder incorporating wind energy except through power purchase agreements, independent renewable generators, or through public/ private partnerships.

Located in Somerset County, Maryland, the University of Maryland Eastern Shore enjoys over 745 acres of its own land and was able to easily dedicate 17 acres of land to its solar farm that generates 2.2 megawatts of green energy. The other urban campuses such as University of Maryland College Park, University of Maryland Baltimore, and University of Baltimore are not so privileged to have such infrastructure on their campuses. On the other hand, such institutions may pursue limited strategies that may include a few solar panels for a dedicated green building or for demonstration or research on their campuses. Installing a wind turbine within an urban campus could be said to be next to impossible due to emerging and stringent regulations and codes.

A review of the University System of Maryland urban universities solar and wind renewable strategies indicates that these campuses are focusing more on Renewable Energy Certificates procurement and energy conservation strategies with selected utilities and providers. The University System of Maryland and State of Maryland Department of General Services power purchase contracts for renewable energy further supports the view that these renewable energy generation locations and the institutions that are not urban can easily accommodate the size of the wind and solar applications developed.

Each institutions' type of building and structure both existing and planned, will affect the strategy of the type of solar and wind renewable energy generated and used. A survey of institutions' building and roof type was conducted in 2012 by the Office of Capital Planning at the University System of Maryland to ascertain the institutions that can accommodate "roof-top" based renewable energy projects. Whereas the result of the survey is not yet published, institutions with buildings with flat roofs, and majority south facing hip or gable roofs will likely have a higher chance of getting proposals from vendors for installation of solar powered renewable energy.

Capital Project Process

The State of Maryland and the University System of Maryland Capital Projects Policy have mandated a minimum of Leadership in Environment and Energy Design (LEED) Silver Certification as a minimum for high performance buildings costing more than $10 million. This requirement is forcing institutions to

incorporate renewable energy and sustainability strategies to meet the minimum LEED Certification. Newer projects in the University System are getting LEED Gold and Platinum certifications.

Technology

Available technology in solar and wind renewable energy does impact on the strategies employed by the University of Maryland institutions. The storage limitations of the solar energy capacities make it much more difficult for users to dedicate their facilities solely to solar or wind energy use. Unless technology advances where storage capacities can increase and solar powered standalone facilities are available or built, the strategy will always be for operational augmentative purposes to the fossil fuel consumption. To improve renewable energy performance in buildings, designers and users are incorporating hybrid renewable energy systems where solar can be combined with geothermal systems. For some projects at appropriate remote areas, wind, solar and geothermal systems are combined. Simply put, the solar renewable energy alone will be used only as a helper in major projects' developments. On the other hand, the wind technology has stringent environmental limitations that include locational wind patterns, proximity to communities and developments, reliability of production, and so forth. Improvements in the solar and wind technologies will variously impact on the use of these renewable energy sources by each institution.

Procurement Environment

The renewable energy procurement environment has been an expensive one. The procurement environment is froth with incentives and tax credits and in some instances up to thirty percent of the cost of the renewable energy development. Investors are trading on the renewable energy certificates and the benefits include increases on renewable energy generation. The sizes of renewable energy generation sources in excess of 500 kilowatt hours in the University System of Maryland institutions seem to have been through a Power Purchase Agreement. The PPAs agreements may or may not include Renewable Energy Certificates. The institutions in the University System of Maryland are not for profit organizations and as such are barred from getting the 30% renewable energy credits for generation. However, they can purchase RECs to offset their fossil fuel use. If the higher educational non-profit organizations are allowed to get and use the tax credit incentives, such incentives would invariably help increase the rate of power generation in these institutions and organizations.

Furthermore, the economic downturn from 2008 to 2012 has affected capital improvement projects at the University System of Maryland institutions and the State of Maryland budget. The number of capital projects funded by the State of Maryland is lower when compared to actual requests by institutions in the last five years. Energy performance contracting seems to have gained much use in the institutions due to the flexibility inherent in the use of dedicated utility operational funds.

CONCLUSION

Institutions are poised to continue solar and wind renewable energy production and use. The U.S Energy Information Administration's renewable energy outlook for 2012 shows an industry on the rise. The industry is projected to have a renewable energy production growth of approximately 53 gigawatts in 2010, to approximately 120 gigawatts of green energy in 2035. The University System of Maryland and its institutions, committed to sustainability, reduction and ultimate elimination of the greenhouse gas emissions in its operations, are focused on enhancing solar and wind renewable energy use and generation. With commitment to greenhouse gas reductions and green energy development and use, the University System of

Maryland and its eleven institutions consider regulatory mandates, institutional objectives, environmental factors, technology, and the procurement environment in the development of their solar and wind powered renewable energy strategies for their campuses.

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