Renewable Energy Sources for Non-RPS States

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ABSTRACT

Through 2030 the nominal electricity requirements of the United States are forecast to increase by 30 percent over 2006 demand.[i] Renewable energy sources and technologies, in conjunction with existing sources, will be required to meet this demand. Furthermore, carbon-reduced sources of energy will become increasingly compelling as public policy seeks to reduce the impact of carbon emissions.

Renewable Portfolio Standards (RPS) have been used to catalyze the deployment of renewable energy in a twenty-nine states. Sixteen states do not have RPS policies. This paper argues that many non-RPS states have renewable energy feedstocks and technologies that are scalable and viable for electricity generation that are currently dormant.

Keywords: renewable energy, renewable portfolio standard (RPS)

1 FORECAST DEMAND

1.1 National forecasts

The Energy Information Agency forecasts that total electricity sales in the United States will increase from 3.6B kilowatt-hours in 2006 to 4.7B kilowatt-hours in 2030 or 29 percent, nominally. Based on economic conditions, high growth or low growth scenarios forecast a range of 39 to 18 percent growth. The nominal forecast reflects commercial sector growth of 49 percent, residential growth of 27 percent and industrial growth of 3 percent.[ii]

1.2 Regional forecasts

Although most areas of the US have excess power generation capacity, all areas are expected to add capacity between now and 2030. Florida and the Southeast are expected to add the largest amount of new capacity to accommodate growth projected to be well above the national average.[iii] When capacity expansion forecasts through 2017 are extended into 2030, the SERC region, which covers most of the Southeast excluding Florida, is predicted to grow overall by 53 percent.[iv] Florida's electricity capacity, as represented by the FRCC, is forecast to grow approximately 85 percent in the same time period.[v]

2 RENEWABLE PORTFOLIO STANDARD (RPS)

2.1 Definition

A Renewable Portfolio Standard (RPS) is a legislative mandate, heretofore passed by individual states, that requires specified percentages of electricity produced for residential, commercial or industrial use be produced from energy sources deemed renewable. Specific production goals and deadlines exist. In lieu of a RPS, voluntary Renewable Energy Goals have been established in some states.

To this point, RPS requirements have been established by individual states. Action by the US Congress for creating a uniform national RPS is anticipated during 2009.[vi]

2.2 States With RPS Programs

As of January 31, 2009, twenty-nine states have established RPS programs. Five states have created Renewable Energy Goals. The most populous states, e.g., California, Texas, New York, Illinois and Pennsylvania, have RPS programs in place. (Florida, the fourth most populous state, is considering a RPS program in February 2009.) States with RPS programs account for 72 percent of the US population and represent 63 percent of the net electricity generated in this country.

2.3 States Without RPS Programs

Sixteen states do not have RPS programs. While distributed nationwide, states without RPS programs are clustered in three distinct blocks, the Southeast (and W. Virginia and Indiana), the Central Plains, and the northern Rockies.[vii]

The cumulative population of these states is 58 million or 19 percent of the US population. Within this group, Georgia is the ninth most populous state (9.7 million) and Wyoming is the least populated state with 500,000. The average non-RPS ranks twenty-seventh in population and thirty-sixth in per capita income.[viii]

Furthermore, these 16 states produce 29 percent of the net electricity generated in the US. Alabama produces 3.5 percent of the nation's electricity while Georgia and Indiana produce 3.1 percent. As an average, a non-RPS state ranks eleventh in terms of electricity consumption. Six states, Wyoming, Louisiana, Kentucky, Alabama, West Virginia and Indiana, are top ten consumers of electricity on a per capita basis. Nineteen percent of the nation's electricity is consumed in these 16 states.[ix]

From a GHG perspective, non-RPS states are responsible for generating at least one-third of the US's emissions, specifically, 33 percent of CO^2, 38 percent of SO^2 and 37 percent of NOx. In this context, Indiana is the largest emitter of with 4.9 percent of the nation's CO^2, 7.0 percent of the nation's SO^2 and 5.5 percent of the nation's NOx. West Virginia, Kentucky, Alabama and Georgia are the next tier of GHG emitters with ranges from 4.6 percent to 2.8 percent of US national emissions.[x]

3 RPS CONSIDERATIONS

3.1 Pros

A RPS is a public policy tool that mandates that power generation available on the grid comes from renewable resources. States have adopted RPS programs for various purposes that include meeting future electricity demands, Green House Gas (GHG) reductions and cleaner air, job creation and economic development, and energy security.[xi]

3.2 Cons

The largest negative against a RPS has been the concern about increased electricity costs. [xii] These concerns revolve around issues of technology maturity and scalability, deployment costs, cost recovery, and public demand. Other considerations include land use.

4 SOURCES FOR RENEWABLE ENERGY

4.1 Definition

The Federal definition of renewable energy is electricity generated from solar, wind, geothermal and ocean sources [current, wave, tidal, and thermal], biomass [non-hazardous, lignen-based material which is a waste by-product or cellulosic-based material derived from wood, wood waste, municipal solid waste, or agriculture waste or a plant grown exclusively as fuel for electricity production], landfill gas and hydropower.[xiii]

While percentage requirements for electricity generated by each of the above categories have not been established at a national level, overall requirements for phase-in of renewable energy are under consideration in the US Congress, currently.[xiv]

Furthermore, state RPS programs often include renewable energy credit trading programs and renewable energy purchase programs.

4.2 Example

Many states with RPS programs use the same basic framework as above and specify requirements by energy source. The Texas RPS program, which has been extremely successful, is an effective model for consideration.

In 1999 the Public Utility Commission of Texas established a renewable portfolio standard, a renewable-energy credit (REC) trading program, and renewable-energy purchase requirements for competitive retailers. The 1999 standard called for 2,000 megawatts (MW) of new renewable energy to be installed in Texas by 2009, in addition to the 880 MW of existing renewable energy generated at that time. In August 2005, Texas increased the renewable-energy mandate to 5,880 MW by 2015 (about 5% of the state's electricity demand), including a target of 500 MW of renewable-energy capacity from resources other than wind. Wind accounts for nearly all of the current renewable-energy generation in Texas. The 2005 legislation also doubled renewable energy capacity by 2025.

Within Texas, qualifying renewable energy sources include solar, wind, geothermal, hydroelectric, wave or tidal energy, biomass, or biomass-based waste products, including landfill

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gas. Qualifying systems are those installed after September 1999. The RPS applies to all investor-owned utilities and to municipal and cooperative utilities that voluntarily elect to offer customer choice.

The initial ten-year RPS goal was met in six years. In addition, approximately $1 Billion has been invested in Texas wind power since 1999.[xv]

5 RENEWABLE ENERGY RESOURCES IN NON-RPS STATES

Each non-RPS state has renewable energy resources distinctive for that geographic location. In fact, some of these resources extend throughout a region.

5.1 Solar

NREL data indicate that all 16 non-RPS states, whole or in-part, annually receive 4-5 kWh/m^2/day solar radiation.[xvi] Exceptions are the northern portions of West Virginia, Indiana and Idaho, which receive 3-4 kWh/m^2/day.[xvii] While not as compelling a location as the Southwest, photovoltaic applications are feasible. (Germany, which has the largest PV deployment in the world, receives annual average solar radiation of 3.3 kWh/m^2/day.)[xviii]

At utility scale, generation costs for photovoltaic range from $0.16-0.25/kWh[xix] while solar thermal costs span $0.15-0.17/kWh.[xx] The solar energy profile for non-RPS states, excluding Idaho, is suitable for photovoltaic deployment. Solar thermal use will be concentrated in the Southwest US.[xxi]

5.2 Wind

Wind analysis by NREL indicates multiple wind applications among the non-RPS states.[xxii] While inland and coastal applications are feasible, to date, only inland applications have been exploited. Over 21,000 MW is produced by wind nationally. Non-RPS states generate 2,151 MW (10.2 percent of the total amount.) Oklahoma, Kansas and Wyoming are the leading producers of wind energy in the non-RPS states.[xxiii]

Those states with coastline—Georgia South Carolina, Alabama, Louisiana and Indiana—have fair to excellent wind resource potential. Small pockets for wind power labeled fair to good are found interspersed in Idaho and in the eastern mountains of Tennessee, Kentucky and West Virginia. Central Indiana has "fair" wind resources. The largest concentration of wind resources is located in the central plains states and Wyoming. A number of "excellent" to "superb" sites are located in Wyoming.

Coastal Georgia is estimated to have winds of 7.5-8.0 meters/sec winds, at a 90 meter height on the Continental Shelf which extends 80 miles.[xxiv] Data from a Navy platform 35 miles off the coast indicates consistent wind speeds of 7 meters/sec at 50 meters.[xxv] These constant winds are adequate enough to power ruggedized, marine wind turbines, which have recently become available.[xxvi]

Electricity produced by wind at utility-scale costs range from $0.03 to $0.20/kWh depending on site, capital costs and other variables.[xxvii]

5.3 Geothermal

Limited resources are found in most non-RPS states from this source. A geothermal profile of the US indicates that Wyoming and Idaho are the two best-suited states to utilize this source. Subsurface temperatures at depths of 4.5 to 6.5 km in the range of 200 to 300^o C exist in these states. Other potential locations include Arkansas and Louisiana with geothermal resources estimated to be 150 to 200^o C, and portions of Mississippi, Alabama and a small area in South Carolina have which have 150^o C subsurface temperatures.[xxviii]

Geothermal power is a mature technology that has been deployed successfully in limited areas in the US, specifically the West. It is a cost competitive utility-scale solution. Long project development times, and risks and costs of exploratory and production drilling are critical considerations.[xxix]

5.4 Ocean Sources

Tides and current energy are two potential sources of energy for non-RPS coastal states. The most significant potential source of energy is the South Atlantic Current, which flows several miles off the coasts of Georgia, South and North Carolina and joins the Gulf Stream. The South Atlantic Current flows at a consistent 2-3 miles per hour.

Use of ocean currents for power generation is in the developmental stage. The US Navy is

evaluating power generation using the South Atlantic Current near Ft. Lauderdale, FL.

Environmental impact is a critical consideration. Fundamental questions exist about resource quality and grid connection costs.

5.5 Biomass

A low emissions solution, biomass can be used effectively for electricity generation and transport fuel production. The highest and best use of biomass resources in terms of realizing economic potential is an important question for consideration. Likely, some biomass will be used for power and some will be used for fuel production. In either case, consideration of large-scale deployment is essential.

Industrial-scale biomass exists in a number of non-RPS states. Resources include corn and sugar cane residuals, switchgrass, and hardwoods and softwoods. Wood is a ubiquitous resource throughout the Southeast. Georgia, as an example, has over 13MM tons of biomass that could be converted to electricity or fuel every year.[xxx]

Wood-based power generation costs range from $0.02/kWh if the resource is free.[xxxi]

5.6 Landfill Gas/MSW

Twenty-eight percent of the nation's 2400 landfills are found in non-RPS states.[xxxii] Of the 319 landfills generating electricity nationwide, 55 (17 percent) are operated in non-RPS states. Based on LMOP data another 102 landfills could be utilized in non-RPS states.[xxxiii]

Generating electricity from landfill gas is a mature, cost-effective technology and process.

5.7 Hydropower

A mature technology, hydropower is commercially competitive. However, most cost-effective large-scale sites have been developed. In addition, significant environmental and social concerns exist about large-scale developments. The emerging field of micro-hydro may provide niche power generation solutions.

9 CONCLUSION

Core strengths, in terms of renewable energy resources, exist for each state and clusters of non-RPS states. Biomass, solar and wind are noteworthy for Southeast applications. Wind and solar can be effective in the central plains and northern Rockies. This being said, photovoltaic solar may well be a ubiquitous renewable energy solution as scale increases and costs decline.

Detailed, site-specific analysis is required wherever renewable energy is to be deployed.

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