Bloomberg BNA

Daily Environment Report™

ENERGY

CLIMATE CHANGE

Climate change, energy independence, and health and welfare are policy rationales for alternate sources of electricity. Advances in technology have generated six choices for generating electricity: nuclear, coal, natural gas, wind, solar and hydro power. The policy rationales and choices need to be part of a coherent national energy policy, which the U.S. lacks. Acknowledgment that climate change is real and that alternative technologies can mitigate it would help to initiate a coherent policy.

An Analysis of U.S. Energy Policy Objectives: Green and Brown Power Options Examined

By David Burton

America's Energy Options

As the nation's population and economic activity increase, so does its need for electricity. Today's technology provides the nation with choices beyond fossil fuels. Below the policy rationales for alternative sources of electricity are explained. Then the widely available technologies for green and brown power are evaluated against the rationales for alternative energy.

Electricity generation is estimated to contribute 38 percent of American carbon dioxide emissions. The second-largest contributor is transportation at 27 percent, with 41 percent of that contribution coming from passenger cars. As the generation of electricity is the largest contributor, it is the focus of the discussion below.

Policy Rationales for Green Electricity

There are three typical policy rationales provided to justify the higher cost of green electricity. The first is ''climate change.'' The idea of climate change is that carbon dioxide and other greenhouse gasses from fossil fuel emissions are either causing the earth's atmosphere to warm or are otherwise causing a change in the oceans and associated weather patterns.

Even to a non-scientist, merely observing changes in recent climate patterns suggests that the climate is changing. These changes include the melting of ice that has permitted ships during summer months to use an arctic passage that prior to 2009 was impassable by commercial vessels; the increase in severe weather like

 ISSN 1060-2976

Hurricanes Sandy and Irene in 2011 and 2012 in the Northeast; and rising oceans eating away at coast lines. National Geographic predicts that by the end of this century, coastal areas such as Miami Beach will be underwater. Many scientists believe these changes to be caused by the emission of carbon dioxide and related pollutants into the atmosphere; certainly as such emissions have increased with industrial development, so have these changes in the climate.

The second rationale is ''energy independence.'' One aspect of this rationale is that as energy is the lifeblood of the American economy, the nation should not be dependent on other nations for it. A second aspect is that the world's largest oil deposits are in the Middle East, which has a history of instability and strife, and the second-largest deposits are in Russia, which has a history of being a geopolitical competitor of the U.S. Finally, importing oil contributes to the American trade deficit, which weakens our economy and fills the coffers of countries that often are not governed by democratic principles.

The third rationale is health and welfare. This rationale comes in several flavors. The first flavor relates to pulmonary disease and other illnesses as reflected in a 2009 quote from the Environmental Protection Agency: ''increases in ground-level ozone pollution [are] linked to asthma and other respiratory illnesses.'' The Chinese have recognized this reality as they recently banned the construction of coal-fired power plants in Beijing, Shanghai and Guangzhou in order to limit air pollution.

The second is that developed nations will be able to address the rising oceans by investing in civil engineering improvements that will protect their coastal communities, while developing nations will lack the resources to make such investments. Thus, the use of alternative energy resources helps reduce the risk of immeasurable damage to coastal regions in the developing world.

The final flavor is described as one of ''equity'' by the United Nations. It has asserted that developed countries that benefited the most from the industrial revolution (and the associated increase in the use of fossil fuels) should change their behavior to address fossil fuel emissions, rather than asking developing nations whose peoples are just starting to benefit from energy generated from fossil fuels to curtail their economic ascendancy.

America's Choices for Electricity Production

To generate incremental energy, America has effectively six choices: nuclear, coal, natural gas, wind, solar and hydro. They each have different cost benefit analyses and different levels of feasibility.

No new nuclear plant in the U.S. has started construction in the last 40 years. After the Fukushima nuclear disaster in Japan, many analysts believe it would be impossible to obtain the permits necessary to construct a nuclear plant in the U.S. In 2011, the nation's 65 nuclear power plants provided more than 19 percent of its electricity generation. As those plants are decommissioned due to age and/or safety concerns, that power will need to be replaced by another source.

Similarly, there are no realistic plans to build new coal-fired plants in the U.S. This is due to environmental regulations and opposition from the public due to health and environmental concerns. For instance, President Barack Obama has instructed the Environmental Protection Agency to issue regulations that would require newly constructed coal-fired plants to use expensive carbon capture and sequestration technology. Coal currently provides approximately 36 percent of the nation's electricity. Some existing plants are being shuttered due to their inability to operate profitably while complying with environmental regulations. Like nuclear, the power from those plants will need to be replaced by another source.

New natural gas-fired plants are being built, and the shale gas revolution has created an abundance of American natural gas. Economists have asserted that the availability of such natural gas is enabling America to more quickly recover from the great recession than European nations have. Infrastructure that had been constructed to import liquefied natural gas is now being reconfigured to export it. Today, natural gas is approximately twice as expensive as coal per Btu of energy produced. The cost to construct a highly efficient combined cycle natural gas plant is approximately a dollar per Watt of electric generation capacity. A combined-cycle plant generates electricity from a turbine fueled by natural gas and a steam turbine fueled by waste heat from the gas turbine. A single-cycle, gas-fired plant only has the steam turbine and costs approximately thirty percent less to construct than a combined-cycle plant.

Recently, more new electric generation capacity was added by new wind farms than by new natural gas-fired power plants. The construction of a wind farm is approximately twice as expensive as the construction of a combined-cycle natural gas plant: approximately $2 per Watt of electric generation capacity. However, once the plant is constructed, the wind is free (in contrast to natural gas).

A problem with wind is that the dense population areas that require more electricity are generally on the East Coast and West Coast, while the wind blows the strongest and most consistently in states like that are far from the coasts, such as South Dakota. The infrastructure to economically transmit electricity from the middle of the nation to the coasts does not exist. Further, there is no good way to increase the rates paid by California customers to fund the construction of transmission lines in South Dakota to bring wind energy to homes and businesses in California.

Rooftop solar power avoids the challenges of transmission that confront wind: the electricity created by rooftop solar is used by the building the solar panels are installed on and the excess is sold to the local utility in an arrangement known as net metering. The sun, like the wind, is a free resource, but the construction of each Watt of rooftop solar electric generation capacity costs two to three times as much as wind.

Utility-scale solar projects cost less than rooftop solar to construct due to economies of scale; however, the most efficient areas on which to build them are places that are flat and sunny: the desert. But desert regions are often far from energy-hungry population centers; thus, similar transmission challenges arise as in wind. The construction of each Watt of utility-scale solar electric generation capacity costs one and a half to two times as much as wind.

Occasionally, a new hydroelectric dam is built in the U.S., but they are relatively rare. First, there is a limit on the number of suitable locations. Second, it is difficult to obtain approval to build them due to concern

  DEN ISSN 1060-2976

about the fish population and other ecosystem consequences.

Comparing the Options to the Objectives

In the first section, three objectives were outlined: mitigate climate change, energy independence and improve the health and welfare of people here and abroad.

The generation of electricity is the largest contributor of carbon dioxide emissions in the U.S. Almost none of the feedstock for the generation of electricity comes from abroad. The U.S. has substantial coal deposits, so it exports more coal than it imports. Further, the shale gas revolution has resulted in an abundance of natural gas here. A minimal amount of uranium is being imported for the nation's nuclear power plant fleet. Thus, the nation's electric generation capacity is not dependent on imports, so there is no need for energy independence to be a factor in the electric generation equation. (America does import some petroleum for cars and other modes of transportation. Further, some buildings and residences are heated with oil that may be imported. In addition, the energy needs of military units stationed abroad raise true security problems that have placed the Pentagon on the cutting edge of the green energy movement.)

If the sole policy focus is climate change, wind, solar, hydro and nuclear are all viable options. Natural gas-fired power plants are approximately twice as clean as their coal-fired cousins and technological improvements have made today's natural gas plants cleaner than those constructed in past decades. The nation is for the most part only constructing wind, relatively clean and efficient natural gas and solar power plants. Thus, the nation in terms of the construction of new electric generation capacity should be given high marks with respect to mitigating climate change.

However, the growth in wind and solar over the last five years has been supported by tax credits. The tax credit for wind lapses this year and the tax credit for solar declines by two-thirds after 2016. If these tax credits are not extended, the nation's climate change marks for electricity generation will likely be much lower in future years.

The National Renewable Energy Laboratory recently estimated that in the Western U.S., wind and solar will be competitive with natural gas without the tax credits by 2025. The investment bank Lazard recently published a report concluding that the cost of energy generated by wind and utility-scale solar had declined 50 percent in the last four years. Given that the oil and gas industry has received tax benefits and other government subsidies for more than a century, another twelve years of wind and solar tax credits is a drop in the bucket. Further, the tax breaks would appear to be a prudent investment for the nation given the gains in efficiency that wind and solar have made in the last four years.

In terms of health and welfare, the leading options are solar and wind. Hydro is arguably a good option, if one believes the ecological consequences are appropriately mitigated. The examples of the nuclear disasters in Fukushima and Chernobyl would suggest that nuclear power is inconsistent with health and welfare policy objectives; however, France generates the majority of its electricity from nuclear plants and France has never had a nuclear disaster. At the moment, the whole nuclear power debate in the context of constructing new generation is almost irrelevant as the low price of natural gas has undercut the commercial motivation for building new nuclear power plants.

The final question is how are these choices and policy rationales reflected in national policy? The unfortunate answer is that there is no coherent national energy policy. The closest Congress has come is the tax credits referenced for wind and solar, but they have always been enacted with a sunset date that prevents investors from engaging in long-range planning. In addition, Congress also provides tax benefits to the oil, gas and coal industries, and those benefits do not have a sunset date. Thus, Congress is driving with one foot on the gas and one foot on the brake.

A first step toward a coherent national energy policy would be agreement with respect to the relevant facts. This would require an acknowledgment that a concern about dependence on energy imports is not a justification for wind, solar, hydro or nuclear power because the nation does not import meaningful levels of natural gas or coal. On the other side of the table, it would require acknowledgement that climate change is a real concern and that alternative energy technologies are the most viable means to mitigate it.

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