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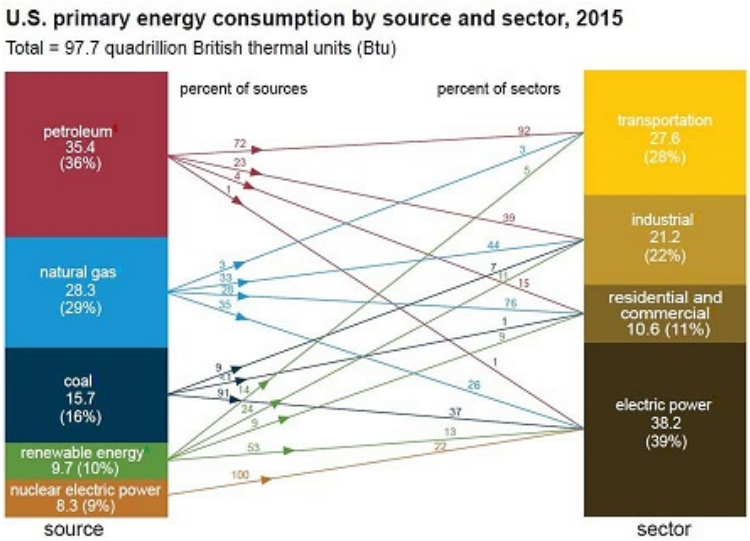
Renewable Energy Considerations (Part Three) – Dollars and Sense

Overview

Modern renewable energy technologies produce less pollution than burning fossil fuels, especially when considering net emissions of greenhouse gases. Renewable energy resources also represent secure and stable sources of energy and potential sources of economic development. Although the cost of electricity produced from renewable sources is approaching the cost of generating power from conventional sources, efforts are being made to offer even lower energy cost in the near future. Each renewable energy technology is economically feasible depending on the application. The energy consumption by source and sector in the US in 2015, shown in Figure 1 below, shows the percentage of the various energy sources, including renewables, applicable to each sector. For example, 53% of the renewable energy is used to generate electric power, while 24% is used for industrial purposes.

Figure 1 - U.S. Energy Consumption by Source and Sector, 2015[1]



Renewable Energy Sources – Highlights and Challenges

As demand for power increases, renewable energy sources are being considered for their environmental friendly and sustainable characteristics. Unlike non-renewable sources of energy such as coal, fossil fuels and natural gas, renewable sources of energy are unlimited and less affected by production fluctuation, triggering price variation with economic consequences.

Renewable energy offers reliability and abundant opportunities for future lower energy cost. According to the Department of Energy FY 2018 Congressional Budget Request, the Assisting Federal Facilities with Energy Conservation Technologies (AFFECT), subprogram of the Department of Energy (DOE), provided direct funding for renewable technology deployment in 2017.[2] In FY 2018, agencies will be expected to use technical assistance offered by Federal Energy Management Program (FEMP) in conjunction with their own funding and authorities to implement well-designed and meritorious energy management projects that increase energy efficiency, conserve water, and increase renewable energy generation at Federal facilities.

It is important to note that there are also some shortcomings and challenges with renewable energy sources, and large-scale renewable technologies should be carefully analyzed. Choosing the most appropriate location for wind, solar and hydroelectric power requires areas with suitable weather conditions for maximum energy production without being vulnerable to adverse weather that can restrict energy production. Some of the considerations for six renewable energy sources discussed in the Part 2 of this series are addressed below.[3]

Wind Power: Wind energy is increasingly competitive, becoming one of the most affordable forms of electricity today.[4] Wind power produces no water or air pollution, wind farms are economical to build and farmers can receive an income from electricity generation while the land can grow crops. Challenges include the significant visual impact wind farms create, and the need of constant wind and large areas of land.

Solar Power: Solar power, also known as photo-voltaic (PV) power does not produce water or air pollution and there is an unlimited supply of solar energy. PV can be used for power generation as well as a direct source for water heating. Challenges include dependability of sunlight, large energy storage requirements and back-up.

Geothermal Power: Geothermal power plants can count on an unlimited supply of energy and produce no air or water pollution. However, it is only available in certain areas of the world, causes pipe corrosion and has a high start-up cost.

Hydroelectric Power: Hydroelectricity is renewable, reliable and flexible. As no fuel is involved, hydroelectric power is safer than nuclear and fossil fuels. Challenges include the high cost of building dams and turbines, and dependability on weather (i.e. in times of drought, power generation may be negatively impacted by the need for safeguarding aquatic life).

Biomass Energy: Biomass such as crops, manure and garbage (waste) is abundant and renewable. After a breakdown process, municipal solid waste can produce methane used to produce heat. On the negative side, burning biomass can create pollution and may not be cost-effective.

Hydrogen Power: Hydrogen fuel is abundant, very efficient and sustainable. Although the National Aeronautics and Space Agency (NASA) has been using liquid hydrogen since the 1950's, hydrogen fuel cells are mostly used for generating electricity for both vehicles and emergency power generators. It produces power without moving parts and sound. Hydrogen power is challenged by issues such as high cost of production, safety and unavailability of adequate infrastructure for its delivery.

Energy Sources - Cost Comparison - 2016

Based on the Figure 2 currently solar power energy have higher cost than nuclear and fossil-based energy.[5] The cost per kW-hr shown in the table includes many factors such as capital investments (initial), operating cost, fuel, maintenance, as well as life cycle costs, not including federal or state incentives. Additionally, the cost shown in the table represents levelized energy cost (LEC), for comparison purposes. Federal facilities can get financial assistance to meet the Executive Order and the Energy Independence Act of 2007 for renewable energy also known as "Non-Disposable Technologies." Some of the programs include Federal Energy Efficiency Fund, Federal Finance Facilities Available for Energy Efficiency Upgrades and Clean Energy Deployment, through Energy Savings Performance Contracts (ESPCs). [6]

Figure 2 - U.S. Energy Cost 2016

Power Plant Type	Cost $/kW-hr
Coal	$0.095-0.15
Natural Gas	$0.07-0.14
Nuclear	$0.095
Wind	$0.07-0.20
Solar PV	$0.125
Solar Thermal	$0.24
Geothermal	$0.05
Biomass	$0.10
Hydroelectric	$0.08

References

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