

Turning Green into Gold: Lessons Not Learned, Energy 101 – Part Two

by Alan Whitson

Electricity is our most widely used form of energy. It touches every aspect of our lives. Yet, despite the importance of electricity to us, few people understand the generation, transmission and distribution of electricity.

This is understandable since much of the discussion about electricity in the United States is so highly technical that even an electrical engineer may feel intimidated. Another factor is the quantity, quality and complexity of the information. The purpose of Part Two is to give you enough background information and context on electricity so that Part Three can focus on the possible solutions to our energy problems.

While electricity occurs in nature, to be useful it must be manufactured or “generated.” Electricity is a secondary energy source; this means we get it by converting a primary energy source, such as coal, natural gas, oil, nuclear,

and other natural sources. Although the energy sources used to make electricity can be renewable or non-renewable, electricity is neither renewable nor non-renewable.

Most of the electricity in the United States is generated by converting mechanical energy into electrical energy. Typically, this is done by using turbines. A turbine converts the kinetic energy of a moving fluid (liquid or gas) into the mechanical energy that turns a shaft connected to the electric generator. Overall, this process is about 35% efficient. This means, for every 100 units of energy used to create electricity only 35 units become usable electrical energy.

Interestingly, most of the debate about energy is not about how to increase the efficiency and reliability of the generation, transmission, and distribution of electricity; the debate is

focused on the fuel types used to generate electricity. While the mix of fuel types has been altered over the years due to changes in political, economic and environmental forces, we continue to use more electricity every year. (See Chart 1)

The nation’s electric utilities have over 140 million customers in three broad sectors: Residential (122 million customers; 37% electricity sales); Commercial (17 million; 35% sales); and Industrial (<1 million; 28% sales). From 1970 to 2006, these sectors have increased their electricity use by 165%. (See Chart 2)

Looking Forward

The Energy Information Administration has forecasted that the nation’s total electricity consumption will grow from 3,814 billion KWH in 2006 to 4,972 billion KWH in 2030 – a 26% increase.

Electricity Generation by Fuel Type - Billion KWH

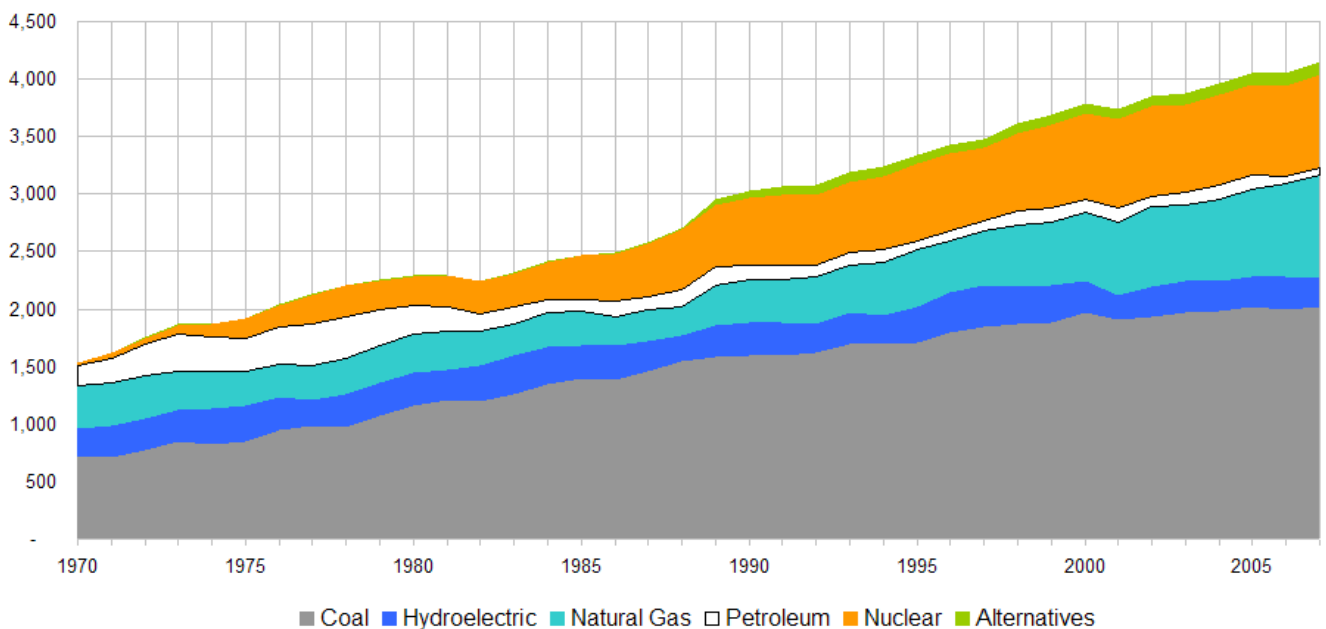


CHART 1

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Electricity Use by Sector - 1970 to 2030 - Billion KWH

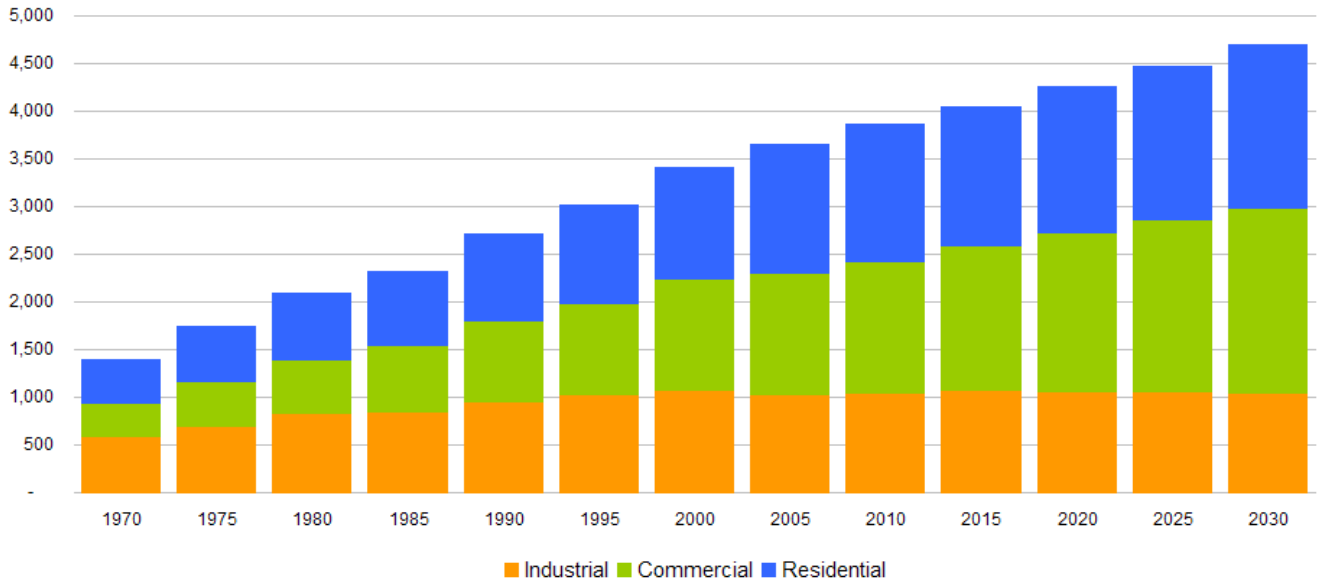


CHART 2

2007 Electricity Net Summer Capacity by Fuel Type - Million Kilowatts

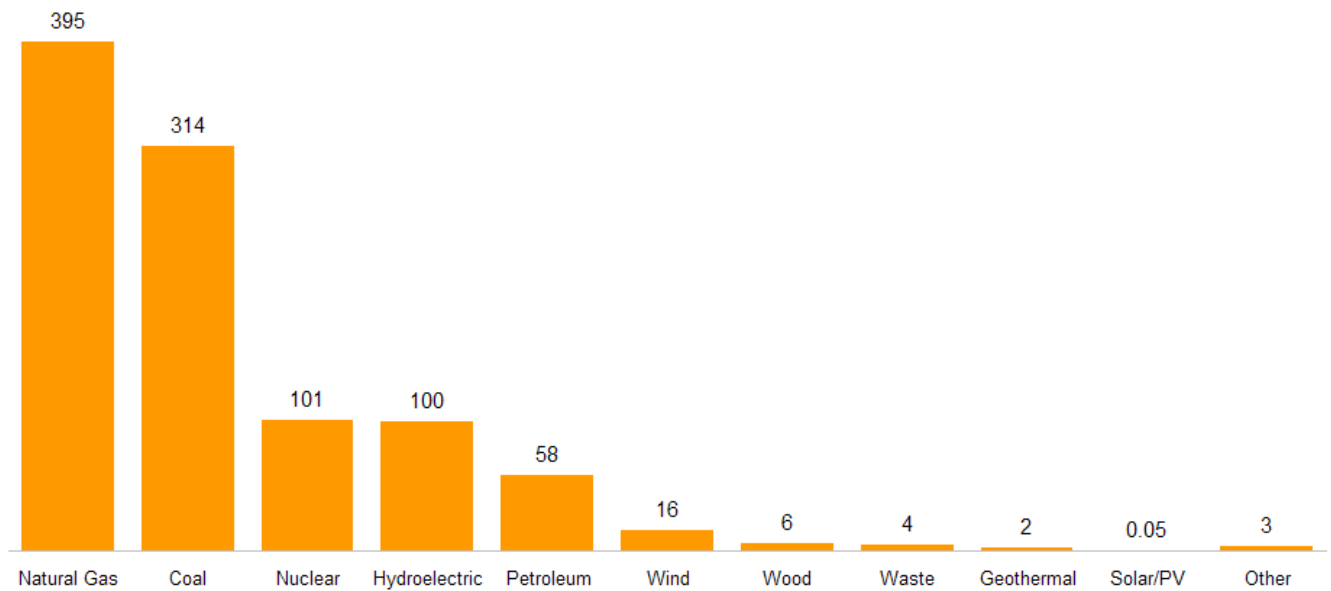


CHART 3

This reflects an average annual increase of 1.1%. By comparison, electricity use grew by annual rates of 4.2%, 2.6%, and 2.3% in the 1970s, 1980s, and 1990s, respectively. The EIA forecast assumes slower economic growth, the imposition of new efficiency standards, and higher electricity prices.

> **Coal**, continues to be the fuel of choice for generating the majority of electricity used in the United States. In 2006, 49% of the country's electricity was generated by burning coal. By 2030, coal will account for 54% of electricity generation – 2,787 billion KWH, a 42% increase.

> **Nuclear power** generated 19% of the nation's electricity in 2006. While the number of nuclear power plants in the United States has declined, the amount of electricity generated by nuclear power continues to rise. By 2030, nuclear power will account for 18% the nation's electricity – 917 KWH, a 17% increase as new nuclear power plants are projected to come online.

> **Natural gas**, besides being burned to turn water into steam, is also burned to produce hot combustion gases for gas turbines used to generate electricity. Gas turbines have become the most common fuel type for plants used to meet peak demand loads. (See Chart 3) In 2006, 19% of the nation's electricity was generated by burning natural gas. By 2030, natural gas will account for 9.8% of electricity generated – 504 billion KWH, a 31% decline reflecting its higher cost. (See Chart 4)

> **Hydroelectric** was responsible for 7% of the nation's electricity in 2006. There are two types of hydroelectric systems used to produce electricity. In the first, flowing water collects in a reservoir behind a dam; the water flows through a pipe called a penstock and turns a turbine to drive the generator to produce electricity. The second is called run-of-river, this uses the force of the river's current to turn a turbine blades to produce electricity. By 2030, hydro will account for 6% of U.S. electricity – 299 billion KWH, an increase of 5%.

> **Petroleum** or residual fuel oil is the petroleum product used by electric plants. The use of petroleum to produce electricity has declined steadily since 1978. In 2006, petroleum generated less than 2% of all electricity in United States. By 2030, petroleum will account for just over 1% of the electricity generated – 57 billion KWH, almost a 3% decline.

> **Wind Power** is the conversion of the energy contained in wind into electricity. Wind power, produced less than 1% of the nation's electricity in 2006; nevertheless, it is expected to expand rapidly due to government incentives. By 2030, wind power could provide 2.4% of the nation's electricity – 123 billion KWH, a 378% increase.

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2008 Events to Boost Your ROI

1. High Performance Hospitals: Hospitals & Medical Research Facilities

Minneapolis	September 15
New Jersey/NY	September 18
Dallas	September 26
Seattle	October 7
Los Angeles	October 23
Chicago	October 30
Boston	October 31

2. Model Green Lease At Greenbuild 2008

Register at www.greenbuildexpo.com

Boston	November 21
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> **Geothermal Power** comes from heat energy buried beneath the earth's surface. In areas where enough heat rises close enough to the surface to turn underground water into steam, it can be tapped to drive steam-turbine plants. This energy source generated 0.4% of the electricity in the country in 2006. By 2030, the use of geothermal is forecasted to provide 0.6% of the nation's electricity – 31 billion KWH, a 109% increase.

> **Municipal Waste and Biomass**, includes the incineration of wood, municipal solid waste (garbage), and agricultural waste. In 2006, this accounted for about 1% of the electricity generated in the United States. By 2030, municipal waste and biomass will account for 2% of the electricity generated – 102 billion KWH, a 400% increase.

> **Solar power** as a method of generating electricity faces a number of challenges. It is one of the most expensive ways to produce electricity, and it is only available when the sun is shining. In 2006, less than 0.01% of the nation's electricity came from solar power. By 2030, solar power will account for 0.06% of the nation's electricity – 3.2 billion KWH, a 5,400% increase.

Key Take Aways

> Coal and nuclear power will continue to be major fuel sources for the United States.

> While the 2006 to 2030 growth forecast for alternative energy is an impressive 154%, alternative energy will only provide 6.2% of our 2030 electricity needs.

> 93.8% of our electricity in 2030 will be generated by conventional fuel sources.
 > Electricity use between 2006 and 2030 is expected to grow by 26%.
 > Conservation and improved efficiency is still the most cost effective way to provide future generation capacity. ■

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Electricity Generation by Fuel Type - 2006 vs. 2030 - Billion KWH

