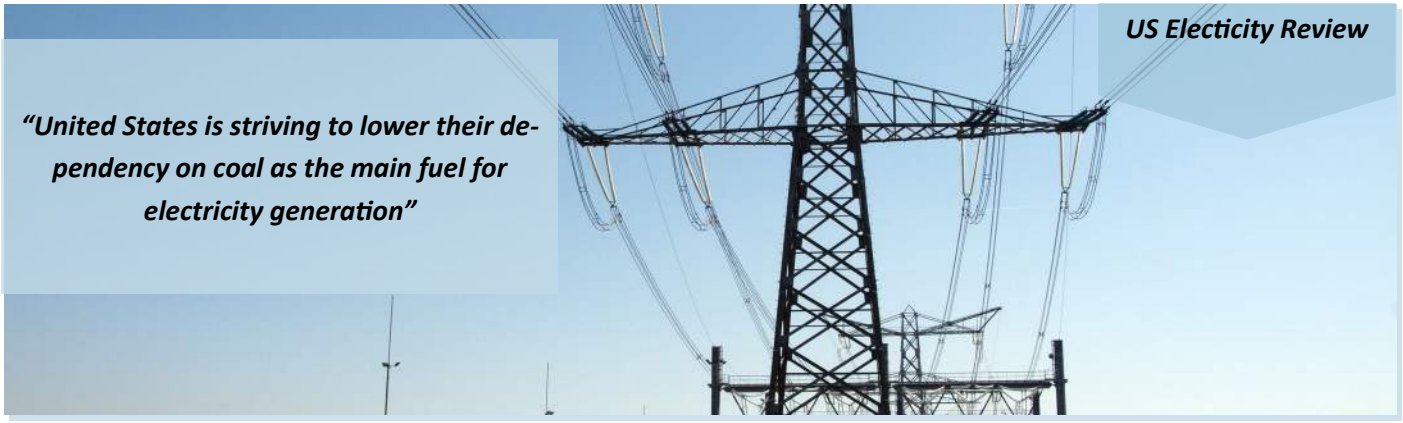
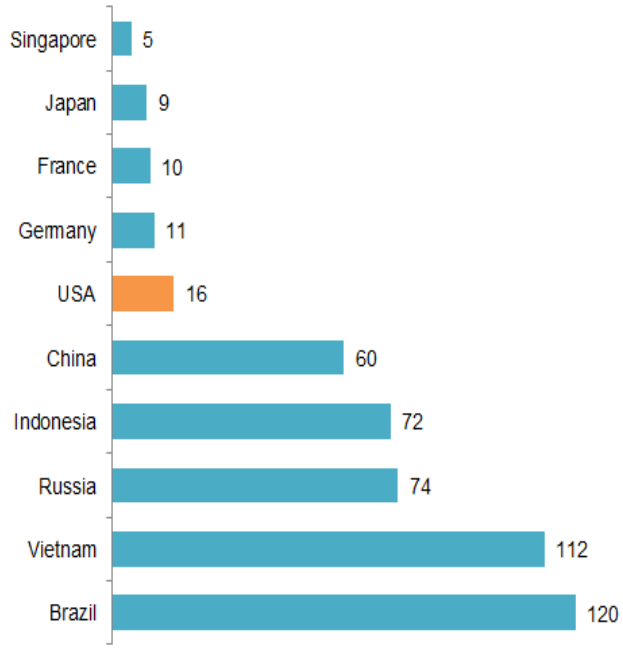


*US Electicity Review*

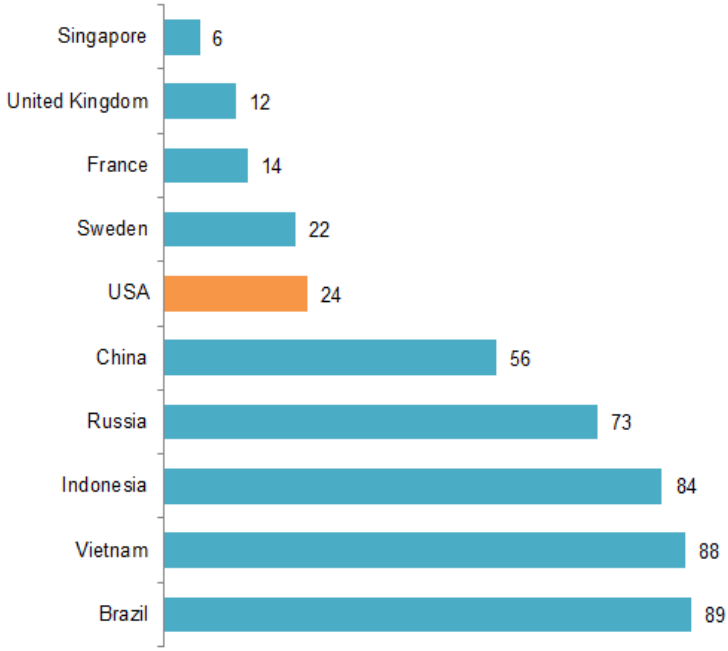
***"United States is striving to lower their dependency on coal as the main fuel for electricity generation"***

The United States is one of the competitive countries in regards to electricity. The entire nation has been electrified and it ranks among the top countries in the Electricity Supply Quality and its overall infrastructure quality. The US is striving to shift its electricity generation dependency from coal based to renewable energy sources for the next decade. Below is the US competitiveness index in electricity sector:

**Quality of Overall Infrastructure (ranks)**




**Quality of Electricity Supply Ranking**



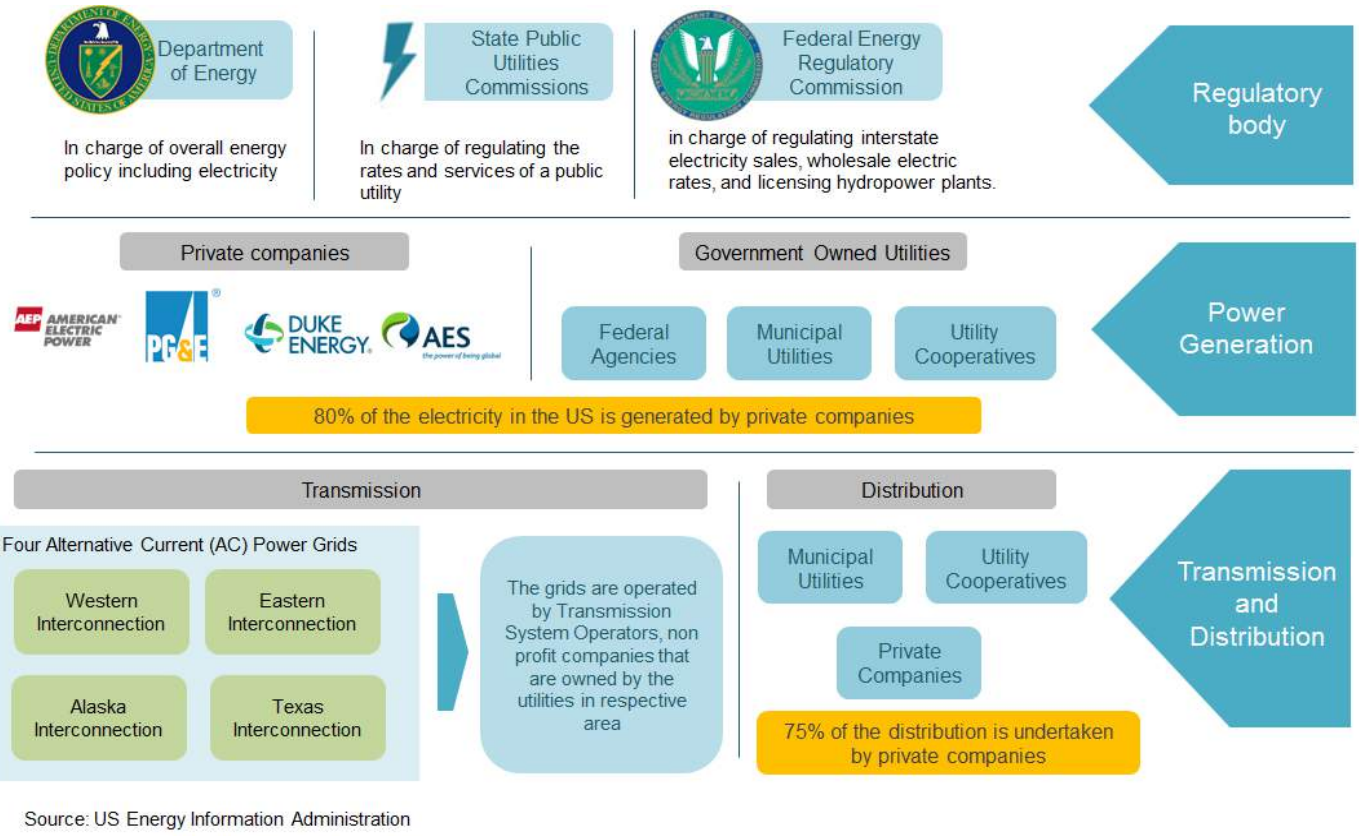

*Source: World Economic Forum: Global Competitiveness Report 2014-2015*

## US Electricity Sector Governance

The electricity sector of the United States includes a large array of stakeholders that provide services through electricity generation, transmission, distribution and marketing for industrial, commercial, public and residential customers. It also includes many public institutions that regulate the sector.

the U.S. electricity sector are regulated by different public institutions with some functional overlaps: The federal government sets general policies through the Department of Energy, environmental policy through the Environmental Protection Agency and consumer protection policy through the Federal Trade Commission. The safety of nuclear power plants is overseen by the Nuclear Regulatory Commission. Economic regulation of the distribution segment is a state responsibility, usually carried out through Public Utilities Commissions; the inter-state transmission segment is regulated by the federal government through the Federal Energy Regulatory Commissions.

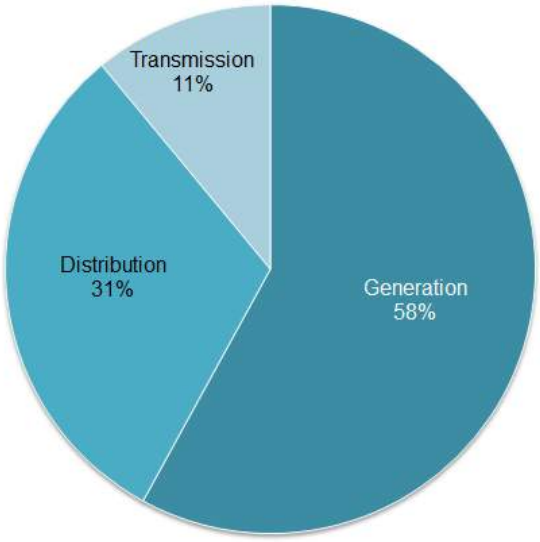
Below is the complete map of US electricity:




Source: US Energy Information Administration

## Electricity Tariff Components

**Electricity tariff components (2013)**




*Source: US Energy Information Administration*

More than half of US electricity tariff components is Generation, followed by Distribution (31%) and Transmission (11%). These tariff components are proposed by the electric companies involved within the value chain and reviewed by Public Utilities Commissions (PUC) in every State. The PUC then conduct public hearing to gain public inputs on the tariff components before finalizing the final retail price.

Electricity prices generally reflect the costs to build, finance, maintain, and operate power plants and the electricity grid (the complex system of power transmission and distribution lines). Some for-profit utilities also include a return for owners and shareholders in their prices.

Electricity prices are usually highest for residential and commercial consumers because it costs more to distribute electricity to them. Industrial consumers use more electricity and can receive it at higher voltages, so it is more efficient and less expensive to supply electricity

Electricity prices are usually highest for residential and commercial consumers because it costs more to distribute electricity to them. Industrial consumers use more electricity and can receive it at higher voltages, so it is more efficient and less expensive to supply electricity to these customers. The price of power to industrial customers is generally close to the wholesale price of electricity. In 2014, the average retail price of electricity in the United States was 10.45 cents per kilowatt-hour (kWh).

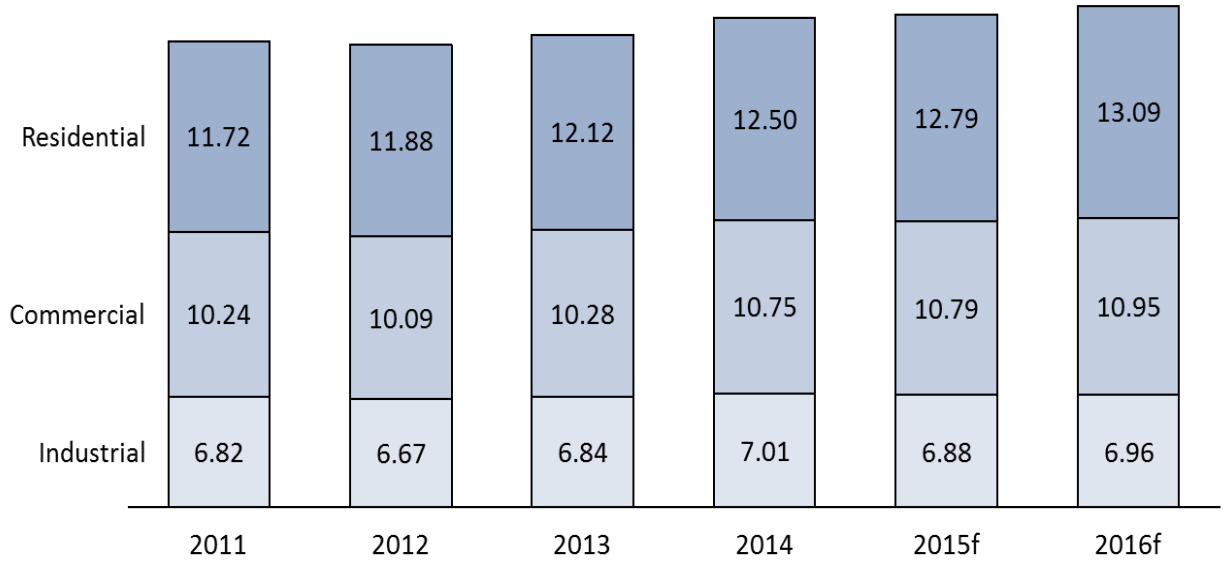
**Components of electricity retail price**

1. **Fuels**
   Fuel costs can vary based on the per unit cost, such as dollars per ton for coal or thousand cubic feet for natural gas, and the relative cost, in dollars per million Btu equivalent. Electricity generators with relatively high fuel costs tend to be used most during periods of high demand.
2. **Power Plants**
   Each power plant has construction, maintenance, and operating costs.
3. **Transmission and Distribution**
   Maintaining and using the transmission system to deliver electricity contributes to the cost of electricity.
4. **Weather Conditions**
   Rain and snow can provide water for low-cost hydropower generation. Extreme temperatures can increase the demand for electricity, especially for cooling. Severe weather can also damage power lines and add costs to maintain the electricity grid.
5. **Regulations**
   In some states, prices are fully regulated by Public Service Commissions, while in others there is a combination of unregulated prices (for generators) and regulated prices (for transmission and distribution).

*Source: US Energy Information Administration*

**US Electricity Retail Price with 2015 and 2016 Projection**

**(USD Cents per kWh)**




*Source: US Energy Information Administration*

## Did You Know?

The cost to supply electricity actually varies minute-by-minute.

During the course of a single day, the wholesale price of electricity on the electric power grid reflects the real-time cost for supplying electricity. Demand for electricity is a major factor affecting the cost to supply electricity. Electricity demand is usually highest in the afternoon and early evening (so called *peak* hours), and costs to provide electricity are usually higher at these times.

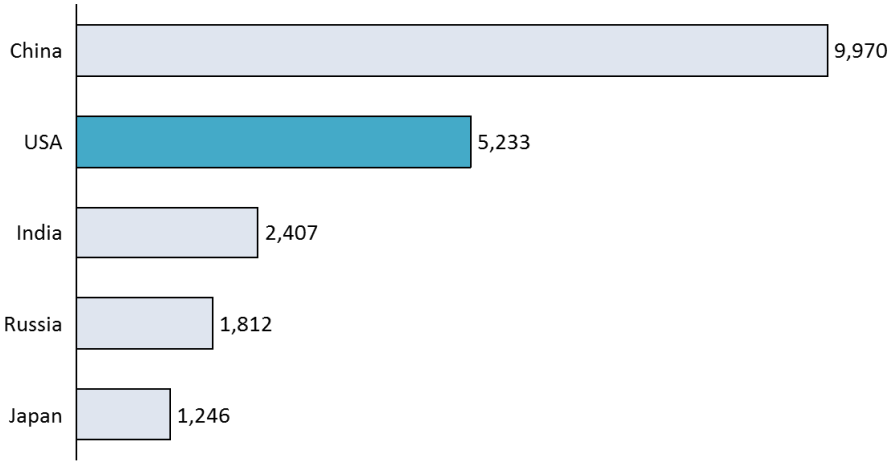
Most consumers pay prices based on the seasonal average cost of providing electricity so they do not experience these daily price fluctuations. Some utilities offer their customers t*ime-of day* pricing to encourage conservation and to reduce peak demand for electricity.

Electricity prices are relatively in a stable condition with low price volatility from 2011 to the 2016 projection. Residential electricity price is increasing over the past 5 years with projected price in 2016 to reach 13.09 cents/kWh. The increasing price for residential is due to the increasing distribution costs over the years.

Commercial electricity price is also increasing over the years from 10.24 to 10.95 cents/KwH. The increase is in alignment with the growth of commercial areas within the country. The distribution costs of electricity to the commercial area are also high.

Electricity price for industrial area includes projected lower price in 2015 and 2016 after increasing from 2011 to 2014. The price in this area is mostly affected by the US economy and the shifting energy source of industrial buildings from fuel based to self–sustain renewable energy, and therefore lowering the demand for the electricity provider.

**Five largest Carbon Emission contributor (MtCO2), 2013**




*Source: Global Carbon Atlas*

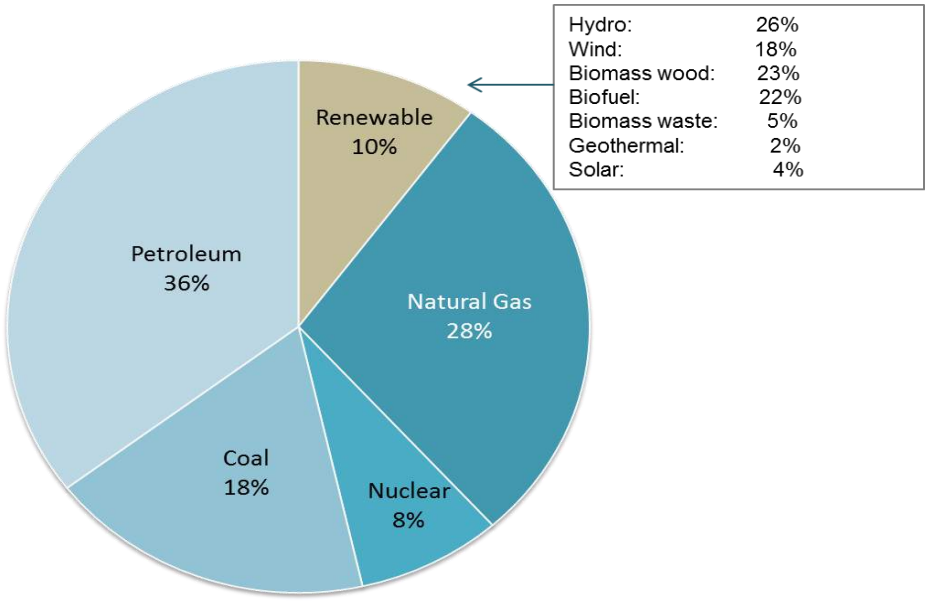
United States has been a major contributor for Global CO2 Emission. China is the biggest CO2 Emitter for 9,970 MtCO2, followed by USA with 5,233 MtCO2. The US Government has been introducing plans to lower their dependency on fossil fuel generated energy and turn for lower emission and renewable energy sources.

Electricity generation in the US has fluctuated in recent years with declining trend. In 2012, the U.S. generated 4,047,765 GwH for a population of 313,914,040—for a per capita production of 0.012895. That means per capita electricity production in the U.S. declined by about 6.6 percent in five years.

A large part of the decline in U.S. electricity generation has come from a decrease in the electricity produced by coal—which has not been replaced by a commensurate increase in the electricity produced by natural gas or the "renewable" sources of wind and solar. The chart below shows the sources of US Electricity Generation in 2014:

**US Energy Consumption by Energy Source, 2014**

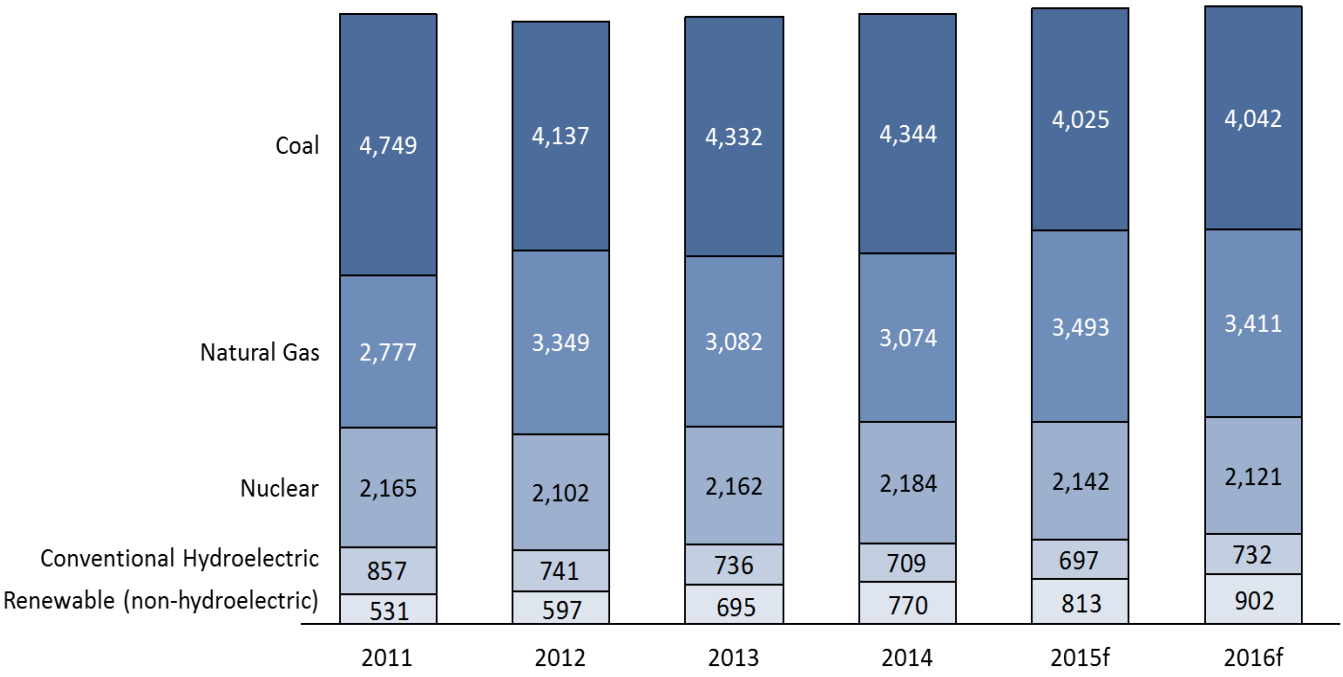
**Total = 98.3 quadrillion Btu**




*Source: US Energy Information Administration*

Coal remains the highest source of energy with 40% of the portion. However, the US Government is planning on reducing their dependency on Coal power plants. The outlook of electricity generation source for until 2016 is the renewable energy portion will be increased simultaneously while coal power plants are reduced. The chart below shows the energy generation sources mix with its projection until 2016:

**Generation electricity by source (million kWh per day)**




*Source: US Energy Information Administration*

The portion of renewable energy is to increase every year and in 2013 it reached 10%, two percentage higher than the previous year. California is a leading state and around 20 percent of California's electricity comes from RPS eligible renewable sources, and more if traditional hydropower sources are included.

The United States has some of the best renewable energy resources in the world, which have the potential to meet a rising and significant share of the nation's energy demand. A quarter of the U.S. land area has winds strong enough to generate electricity at the same price as natural gas and coal.

Many of the new technologies that harness renewables — including wind, solar, geothermal, and biofuels — are, or soon will be, economically competitive with the fossil fuels that meet 85 percent of U.S. energy needs. Dynamic growth rates are driving down costs and spurring rapid advances in technologies. Energy technologies also receive government subsidies. In 2010, federal government subsidies for electricity production from renewables, fossil fuels, and nuclear were $6560 million, $1843 million and $2499 million respectively.

All but four U.S. states now have incentives in place to promote renewable energy, while more than a dozen have enacted new renewable energy laws in recent years. The Department of Energy has urged that the incentives shall be implemented in all states.

Energy generation costs are different for each power plant type. The costs incurred are:

- **Civil and structural costs:** allowance for site preparation, drainage, the installation of underground utilities, structural steel supply, and construction of buildings on the site
- **Mechanical equipment supply and installation:** major equipment, including but not limited to, boilers, flue gas desulfurization scrubbers, cooling towers, steam turbine generators, condensers, photovoltaic modules, combustion turbines, and other auxiliary equipment
- **Electrical and instrumentation and control:** electrical transformers, switchgear, motor control centers, switchyards, distributed control systems, and other electrical commodities
- **Project indirect costs:** engineering, distributable labor and materials, craft labor overtime and incentives, scaffolding costs, construction management start up and commissioning, and fees for contingency
- **Owners costs:** development costs, preliminary feasibility and engineering studies, environmental studies and permitting, legal fees, insurance costs, property taxes during construction, and the electrical interconnection costs, including a tie-in to a nearby electrical transmission system

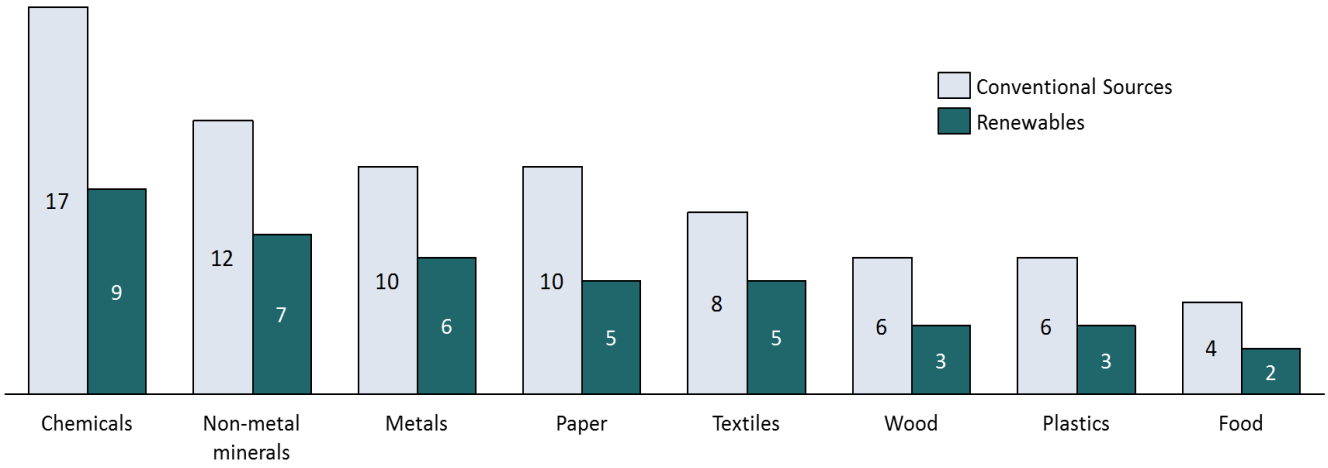
| | Plant Characteristics | | Plant Costs (2013$) | | |
|---|---|---|---|---|---|
| | Nominal Capacity (MW) | Heat Rate (Btu/kWh) | Overnight Capital Cost ($/kW) | Fixed O&M Cost ($/kW-yr) | Variable O&M Cost ($/MWh) |
| **Coal** | | | | | |
| Single Unit Advanced PC | 650 | 8.800 | $3.246 | $37,80 | $4,47 |
| Dual Unit Advanced PC | 1.300 | 8.800 | $2.934 | $31,18 | $4,47 |
| Single Unit Advanced PC with CCS | 650 | 12.000 | $5.227 | $80,53 | $9,51 |
| Dual Unit Advanced PC with CCS | 1.300 | 12.000 | $4.724 | $66,43 | $9,51 |
| Single Unit IGCC | 600 | 8.700 | $4.400 | $62,25 | $7,22 |
| Dual Unit IGCC | 1.200 | 8.700 | $3.784 | $51,39 | $7,22 |
| Single Unit IGCC with CCS | 520 | 10.700 | $6.599 | $72,83 | $8,45 |
| **Natural Gas** | | | | | |
| Conventional CC | 620 | 7.050 | $917 | $13,17 | $3,60 |
| Advanced CC | 400 | 6.430 | $1.023 | $15,37 | $3,27 |
| Advanced CC with CCS | 340 | 7.525 | $2.095 | $31,79 | $6,78 |
| Conventional CT | 85 | 10.850 | $973 | $7,34 | $15,45 |
| Advanced CT | 210 | 9.750 | $676 | $7,04 | $10,37 |
| Fuel Cells | 10 | 9.500 | $7.108 | $0,00 | $43,00 |
| **Uranium** | | | | | |
| Dual Unit Nuclear | 2.234 | N/A | $5.530 | $93,28 | $2,14 |
| **Biomass** | | | | | |
| Biomass CC | 20 | 12.350 | $8.180 | $356,07 | $17,49 |
| Biomass BFB | 50 | 13.500 | $4.114 | $105,63 | $5,26 |
| **Wind** | | | | | |
| Onshore Wind | 100 | N/A | $2.213 | $39,55 | $0,00 |
| Offshore Wind | 400 | N/A | $6.230 | $74,00 | $0,00 |
| **Solar** | | | | | |
| Solar Thermal | 100 | N/A | $5.067 | $67,26 | $0,00 |
| Photovoltaic | 20 | N/A | $4.183 | $27,75 | $0,00 |
| Photovoltaic | 150 | N/A | $3.873 | $24,69 | $0,00 |
| **Geothermal** | | | | | |
| Geothermal – Dual Flash | 50 | N/A | $6.243 | $132,00 | $0,00 |
| Geothermal – Binary | 50 | N/A | $4.362 | $100,00 | $0,00 |
| **Municipal Solid Waste** | | | | | |
| Municipal Solid Waste | 50 | 18.000 | $8.312 | $392,82 | $8,75 |
| **Hydroelectric** | | | | | |
| Conventional Hydroelectric | 500 | N/A | $2.936 | $14,13 | $0,00 |
| Pumped Storage | 250 | N/A | $5.288 | $18,00 | $0,00 |

## Way forward for renewable energy in the US

The urgency to further develop renewable energy is well acknowledged by the US Government. Besides its benefit to the environment, renewable energy sources also create lower cost for the people.

Renewable energy sources create significant energy-cost and input-cost advantages for many users including industry players and household. Those benefits are particularly large in petrochemicals and energy-intensive industries, though these low-energy cost benefits also flow to virtually all industries at some level. Such downstream advantages created by renewable energy sources are only just beginning to be realized. Low-cost gas and gas-fired power, particularly, benefit energy-intensive industries, which use gas and high levels of electricity to fuel foundries, paper mills, and other heavy industrial processes. It is estimated the cost savings from natural gas to be 4% or more of total manufacturing costs in a variety of industries, including minerals, metals, paper, and textiles.

**Natural Gas and Electricity Costs as a % of total manufacturing costs**

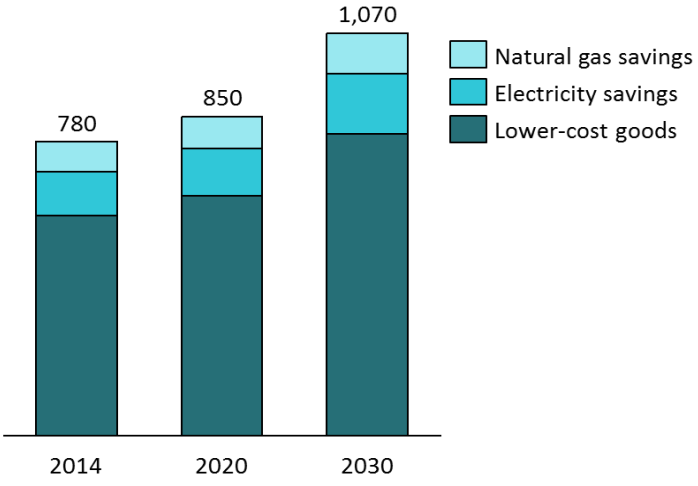



*Source: America's unconventional source of energy, HBS & BCG.*

Renewable energy also benefit households, local governments, the federal government, and communities due to lower costs, increased tax revenues, and spillover benefits to other local businesses.

**Households.** Consumers across America are major beneficiaries of renewable energy, extending well beyond just the regions where significant production or conversion of gas and oil is occurring. It is estimated that the average U.S. residential household has enjoyed nearly $800 in annual savings from the availability of low-priced natural gas. That includes direct savings on household utility bills for electricity and heating, as well as savings from lower-cost goods and transport. The Department of Energy estimates that the fall in oil prices will save the average household an additional $750 in gasoline bills in 2015, compared with 2014.

**Annual household savings from low-cost energy (2014, US$)**




*Source: America's unconventional source of energy, HBS & BCG.*

**Governments.** Both state and federal governments have been major financial beneficiaries of unconventionals production and resulting economic growth. Governments collect revenues from unconventionals development in several ways: royalties and taxes on land leases from production, corporate taxes on businesses, and personal income taxes due to new jobs, wages, and royalty income.

The Obama Administration has rolled out the America's Energy Strategy that aims on reducing dependence of fossil fuel and turn into renewable energy. Below is the All-The-Above Energy Strategy with the main purpose to make America more energy independent and supporting jobs:

## 1 Reducing Dependence on Foreign Oil

The all-of-the-above energy strategy aims to harness American innovation and develop a diverse portfolio of American-made energy. The Government is safely and responsibly developing the energy resources while advancing cleaner forms of energy, such as natural gas and renewables.

As carbon emissions decrease, the economy continues to grow. The all-of-the-above approach is advancing energy independence, supporting American jobs, and building the foundation for a clean-energy economy.

## 2 Carbon Capture and Sequestration Technologies

Continued progress in reducing pollution to improve public health and the environment can be accomplished while supplying the reliable, affordable power needed for economic growth and advancing cleaner energy technologies such as carbon capture and sequestration (CCS). CCS is technologically feasible for implementation at new coal-fired power plants, and its core components — carbon dioxide capture, compression, transportation, and storage — have been implemented successfully at commercial scale.

As part of the President's Climate Action Plan, the U.S. has invested several billions of dollars into the research and development of CCS technologies, including those aiming to develop innovative, second-generation technologies that will help improve the efficiency and drive down the costs of carbon capture processes for new and existing coal-fired power plants.

## 3 Advancing Clean Energy and Energy Efficiency

The Obama Administration has made the largest investment in clean energy in American history and has launched several initiatives to advance clean energy deployment. Since President Obama took office, the U.S. has increased solar electricity generation by more than twenty-fold, and tripled electricity production from wind power.

Building on the progress of the first term, this Administration continues to take new action to drive clean, American-made energy. Through initiatives such as public-private partnerships and renewable energy projects on public lands, we are on track to meet our goals of installing 100 megawatts of renewable capacity across federally subsidized housing by 2020, permitting 10 gigawatts of renewable projects on public lands by 2020, deploying 3 gigawatts of renewable energy on military installations by 2025, and doubling wind and solar electricity generation in the United States by 2025.

Additionally, DOE develops energy conservation standards for appliances and equipment, which have cut consumers' electricity bills by hundreds of billions of dollars. Taken together, the final energy conservation standards completed during this Administration add up to more than 2 billion metric tons of carbon emissions by 2030, and we are on track to meet the Climate Action Plan's goal of cutting 3 billion metric tons of energy waste by 2030.

## 4 Investing in Coal Communities, Workers, and Technology: The POWER+ Plan

The United States is undergoing a rapid energy transformation, particularly in the power sector. Booming natural gas production, declining costs for renewable energy, increases in energy efficiency, flattening electricity demand, and updated clean air standards are changing the way electricity is generated and used across the country. These trends are producing cleaner air and healthier communities, and spurring new jobs and industries. At the same time, they are impacting workers and communities who have relied on the coal industry as a source of good jobs and economic prosperity.

To help these communities adapt to the changing energy landscape and build a better future, the President's FY 2016 Budget proposes the POWER+ Plan. The POWER+ Plan invests in workers and jobs, addresses important legacy costs in coal country, and drives development of coal technology.

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Ms. Astried Swastika Corporate Secretary PT SMI

Tel : +62 21 5785 1313

Fax : +62 21 570 9460

Email : corporatesecretary@ptsmi.co.id

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