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## Coal Lifts Billions from Energy Poverty and Increases Access to Low-Cost Electricity at Scale

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**February 2014**

Access to affordable energy, socioeconomic security and a clean environment are inalienable human rights. If the world's goal truly is the eradication of poverty and environmental improvement, then coal, our most abundant source of electricity, must be an integral part of the solution.

The contributions of coal to societal progress are far reaching. In the United States, coal has provided over 50 percent of electricity for the last century – a period that saw the United States move to the center of the world's economic stage, population increase 225 million, life expectancy increase by 30 years and the rise of the Internet. Just as importantly, according to the Energy Information Administration's latest projection in its Annual Energy Outlook 2014, coal will still supply 11 percent more U.S. electricity in 2040 than it did in 2012.



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***“Coal-fired electricity will be fed into national grids and it will bring energy access to millions and support economic growth in the developing world,”***  
***World Energy Council, October 2013.***

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On the other side of the globe, since 1990, China has used coal-based energy to lift 650 million people out of poverty, reduce female illiteracy by almost 80 percent and decrease infant mortality by 70 percent. Clean coal technologies, including the construction of highly efficient supercritical power plants, provide the opportunity for the rest of the developing world to utilize coal to eradicate the specter of energy poverty that haunts billions.

Every single one of the United Nations' Millennium Development Goals depends upon adequate energy. By 2050, the world's population will exceed 9.6 billion people and over two-thirds will live in cities, requiring vast amounts of power, steel, cement and the other commodities for modern life. Coal, with almost 1 trillion tons of global proven reserves, is the only fuel that can meet such demand at scale.

Clean coal technologies in use today should continue to be widely deployed to help meet electricity demand, elevate the global quality of life and significantly reduce emissions from power generation.

Importantly, clean coal by wire helps eliminate use of the primitive stoves and furnaces that are responsible for deteriorating air quality, illness and mortality.

In the developing world, as many as 4 million people die from indoor air pollution each year. Electrification is the foundation of the societal trends central to eradicating such global poverty: urbanization, industrialization and modernization.

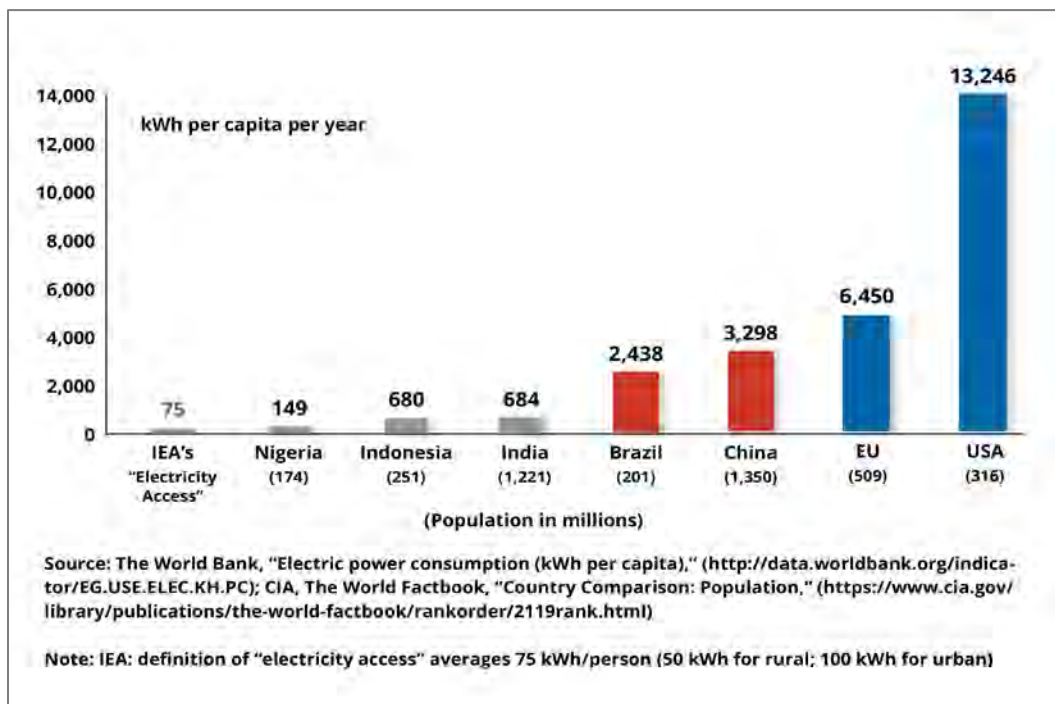
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## Electricity is the Lifeblood of Modern Society and Essential for Health and Longevity

The U.S. National Academy of Engineering identified societal electrification as the “The Greatest Engineering Achievement” of the 20<sup>th</sup> Century. Electricity is the lifeblood of modern society, and coal has been, is and will continue to be the world’s most important source of power. From 1990 to 2010, coal-based generation nearly doubled from 4,400 to 8,700 terawatt hours (TWh) to account for over 40 percent of all electricity supply. Coal now provides enough global power to fully sustain Japan for over eight years.

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### Electricity Deprivation in Developing Nations is Severe



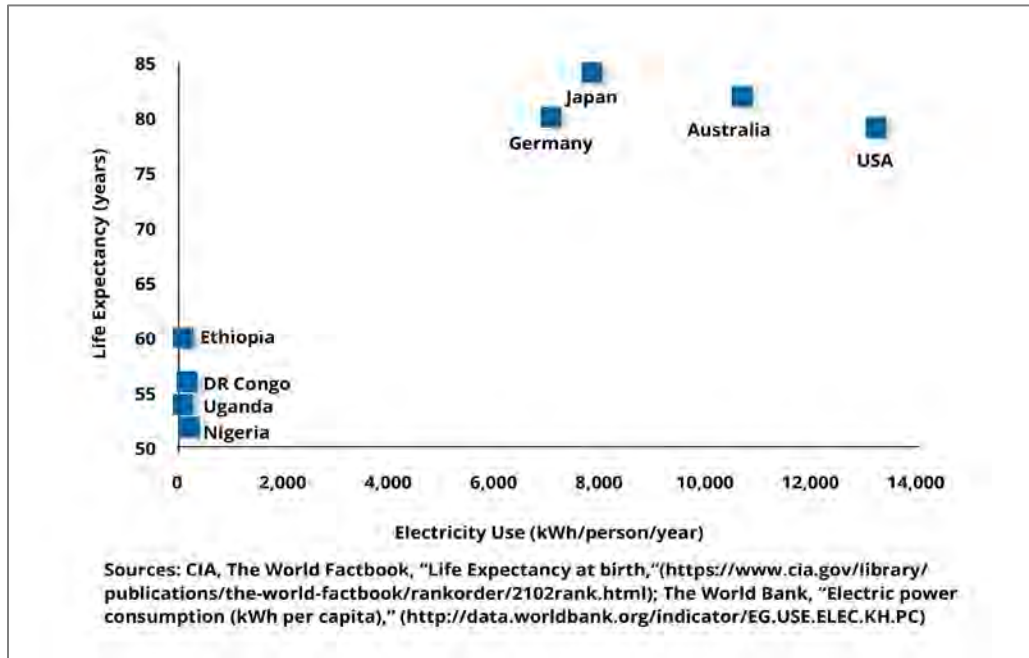
*Many citizens in developing nations have access to only a tiny fraction of the power needed to achieve the higher levels of the UN Human Development Index. The world will need energy from coal and all power sources to end the human crisis of energy poverty.*

During the present decade, coal power will increase by an additional 2,500 TWh – more than the combined increase from gas, nuclear and solar. Over the 30-year period, coal-based electricity will have contributed to a global increase in life expectancy of around nine years, supported a 125 percent increase in real global GDP, and met a large part of the energy needs of an additional 2 billion people. Yet, despite these contributions of coal the world still needs a substantial increase in coal-fueled energy.

More than 1.2 billion people have no electricity at all, and billions more have inadequate access to power. Overall, at least 5.9 billion people, 83 percent of the world's population, use less than 6,500 kWh per year – the average consumption of a typical resident of the European Union.

- This inequitable access to energy has far-reaching socioeconomic consequences. The Infant Mortality Rate in Germany is four per 1,000 live births. In Nigeria, it is 73. In the European Union, virtually 100 percent of the population has improved sanitation. In Indonesia alone, 115 million people lack such sanitation.
- No nation is more mired in energy poverty than India. At least 300 million people have no power whatsoever and more than 700 million people lack access to modern energy services for lighting, cooking, water pumping and other productive purposes. One hundred million do not have an improved water supply and over 800 million lack access to an improved sanitation facility. These problems will only intensify going forward as India has about 630 million people less than 25 years old and will surpass China as the most populated nation before 2030.
- Sub-Saharan Africa, a region with a population of more than 900 million people, uses less electricity per year (145 TWh) than the state of Alabama (153 TWh) with just 4.8 million. There is only enough electricity generated in Sub-Sahara to power one light bulb per person for three hours a day. Africa has 15 percent of the world's population, but 50 percent of the population lives without electricity. In fact, of the 25 nations at the bottom of the U.N. Human Development Index, 24 are in Africa.
- In Cambodia, 69 percent of the population lacks access to electricity, in Pakistan it is 33 percent and in Uganda an astounding 92 percent. Of the almost 250 million people in Indonesia, 68 million of them have no access to any sort of electric power.
- As backdrop to this bleak setting, the International Energy Agency's (IEA) definition of electricity access is totally inadequate. The IEA's assumption that 50 kilowatt hours per person per year in rural areas defines "access," is radically removed from levels of modern consumption where Germany uses approximately 7,100 and France 7,300 kWh. Rather, the IEA defines electricity access akin to consumption of Ethiopia where 29 percent of children are malnourished, 70 percent of the women cannot read and life expectancy is 20 years below the European average.
- The United Nations goal of "sustainable energy for all" means just that, modern electricity for the global community. All humanity has the right to the same quality and expectancy of life.

## Electricity Use and Life Expectancy Are Closely Correlated



*There is a clear correlation between life expectancy and energy use. All of society deserves basic access to energy as an essential part of life.*

Across the world, electricity deprivation takes a mighty toll. The impact on children and women is stark: 25,000 children die each day, mainly from lack of the resources that electricity can bring to bear – clean water, better sanitation, adequate food, medicine and education. At least 1.5 billion women and girls live on less than \$2 per day and this feminization of poverty is endemic to areas without electric power. Merely gathering fuelwood takes a large part of a woman's day throughout the developing world. Girls are kept out of school to obtain fuel. In areas such as South Darfur, women walk up to seven hours per day to collect fuelwood, making mothers and their daughters highly susceptible to robbery, violence and rape.

About 3 billion people use rudimentary stoves to burn wood, coal, charcoal and animal dung, releasing dense black soot into their homes and the environment. Annual deaths from this household air pollution exceed 4 million per year. This gathering and burning of wood and other biomass leads to deforestation, erosion, land degradation and contaminated water supplies.

China has demonstrated that coal is the solution to such debilitating energy deprivation. Over the last 20 years, China has utilized coal to lift over 650 million people out of poverty. In fact, at the global level, over 90 percent of people lifted from poverty since 1990 are Chinese as power generation from coal increased 700 percent and GDP per capita rose 630 percent.

China will continue to rely on coal for electrification and is proceeding to replace older coal plants with advanced coal units as well as using substitute gas from coal in a range of applications. These steps will reduce China's widely publicized air quality problems and allow continued economic growth. Coal conversion to liquid fuels, chemicals and substitute natural gas can alleviate emerging shortfalls in conventional production for China and the entire developing world.

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## **The Rising Drumbeat of Electricity Demand Can Only Be Met By Coal**

Apart from the urgent need for more clean coal to help reduce poverty, the empirical realities of general societal trends demonstrate the magnitude of the emerging need for coal power:

1. **Population:** By 2050, the world will add 2.4 billion people – 70 million every year and 192,000 every day. In essence, the population of Rome is added to the global roles every 21 days.
2. **Urbanization:** Movement into urban areas is occurring on an unprecedented scale. In 1990, the world had 10 cities of over 10 million people. By 2050, the World Energy Council reports that there could be 100 such “megacities.” Urbanization in India alone will increase by 11 million people per year – equivalent to the population of Delhi proper. Cities cannot be built without electricity, steel, cement and associated materials. The level of production required for these materials depends on adequate coal power and metallurgical coal for steel being available.

All viable electricity sources will play roles in coming decades, but coal is the only sustainable fuel with the scale to meet the electricity needs of the world's rising populations and economies. Since 1970, the demand for electric power has more than quadrupled from approximately 5,200 to 22,550 TWh, with much of this incremental demand being met by coal. Over the next 20 years, demand is expected to increase to nearly 40,000 TWh, and coal is projected to continue to provide nearly 40 percent of global electricity, enough to power the European Union for five years.

Replacing coal in this growth context would be impossible. Forecasters are already projecting major increases in gas, nuclear and wind generation. If these optimistic forecasts of alternative sources are not met, the call on coal will be even greater.

Coal is already the world's fastest growing energy source, set to surpass oil in coming years. Clean coal technologies are in use today and allow for the consumption of more coal with greatly reduced emissions. New pulverized coal combustion systems, utilizing supercritical technology, operate at increasingly higher temperatures and pressures and therefore achieve higher efficiencies than conventional plants.

More than 400 gigawatts of supercritical units are in operation or planned around the world, but many more are needed. Highly efficient modern coal plants emit up to 40 percent less CO<sub>2</sub> than the average currently installed coal plant. Importantly, these supercritical plants are a prerequisite for the next generation development of carbon capture, utilization and storage, which itself is broadly recognized as necessary for near-zero emissions from coal.

The world has a unique opportunity to deploy clean coal technologies to not only give billions a higher standard of living but also to satisfy environmental goals. Proposals to constrain 21<sup>st</sup> Century clean coal technology would forgo an opportunity to help meet electricity demand, elevate the global quality of life and significantly reduce emissions from power generation. In short, more coal-based electricity is needed for the world community to achieve the goal of poverty eradication. Without coal, economic growth will be stunted, the environment will be degraded and the crisis of energy poverty will not be solved.

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