

Essential Role of Fossil Fuels in Future Economic Growth

Essential in the 20th Century,
And in the 21st



BY ROGER H. BEZDEK

In part I, on pages 26 through 31 of the August issue of *Public Utilities Fortnightly*, I noted that the recent book by Robert Gordon, *The Rise and Fall of American Growth*, has generated enormous controversy.¹ Dr. Gordon's thesis is that the incredible technological innovations of the period from 1870 to 1920 were a one-time-in-history event that cannot be replicated.

According to Gordon, no other similar period in history has brought comparable progress. Or, more importantly, is likely to again. The U.S., and the world, should get used to annual productivity and growth rates of about one percent or less, instead of nearly three percent.

This is a huge difference. Further, he contends that there is little that governments can do in terms of monetary, fiscal, tax, or other policies to measurably change this. This is a pessimistic message with profound economic, social, and political implications.

The firestorm of debate Gordon has generated focuses on whether he is correct in concluding that the U.S. faces an inevitable future of anemic growth. However, a critical issue is not being discussed.

Nowhere in Gordon's entire 762-page book does he give credit to fossil fuels for the economic miracle of the past two centuries. Or indicate their importance for future economic and technological progress.

World economic growth over the past two centuries was powered largely by fossil fuels. What energy sources are forecast to power future world economic growth?

That is, what energy sources are required to enable the world to continue to increase technology, income, wealth, productivity, and standards of living, and lift billions of people out of poverty?

This is the issue I address here in part II.

The answer to the questions posed above is straightforward. Fossil fuels will remain the essential global energy sources. Population increase, income growth, and continued urbanization are the major drivers behind the growing demand for energy.

World population is forecast to reach 8.8 billion by 2035. World gross domestic product is forecast to double. An additional one-and-a-half billion people will require access to energy.²

Further, the world is urbanizing as a means to a better life. The United Nations expects an increase of 1.4 billion people in cities by 2035.³ More than seventy-five million people are being added to cities globally each year, nearly ten times New York City, driving greater energy and infrastructure needs.

As Edward Glaeser notes, "cities are expanding enormously because urban density provides the clearest path from poverty to prosperity."⁴ These massive new urban areas in developing

Demand for energy will increase forty-eight percent by 2040.

nations will require vast amounts of energy, which only fossil fuels will be able to provide. As the world economy grows, nearly fifty percent more energy will be required over the next two decades to meet the increased level of demand. According to the International Energy Agency and U.S. Energy Information Administration, fossil fuels (oil, natural gas, and coal) will continue to meet most of the world's increasing energy needs over this period.

These fuels represented over eighty percent of the 2010 primary fuel mix. They will remain the dominant source of energy through 2040 in all of the International Energy Agency scenarios. And account for about eighty percent of total energy supply in 2040.

The demand for oil, natural gas, and coal is projected to increase substantially in both absolute and percentage terms over the next several decades. This provides the opportunity for continual global economic growth, increased incomes, higher living standards, expanding cities, and poverty reduction.

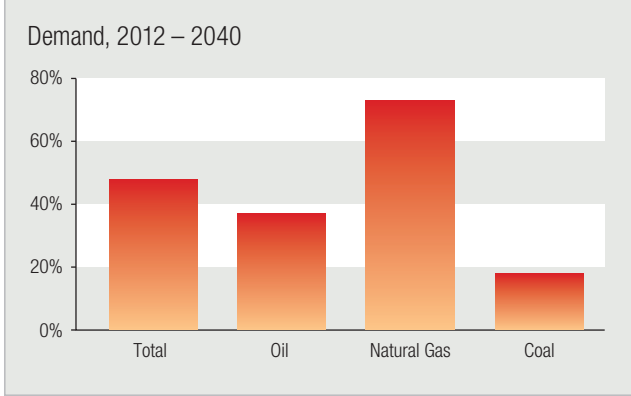
For example, as shown in Figure 1, the Energy Information Administration projects that total demand for energy will increase forty-eight percent by 2040. Demand for oil will increase thirty-seven percent. Demand for natural gas will increase seventy-three percent. Demand for coal will increase eighteen percent.

Fossil fuels currently provide about eighty-four percent of world energy. In 2040, they will still provide nearly eighty percent of world energy. Thus, fossil fuels are the world's irreplaceable energy sources of past, present, and future.

The electric power sector is forecast to remain among the most dynamic areas of growth among all energy markets. Electricity is

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FIG. 1 FORECAST GROWTH IN WORLD ENERGY DEMAND



the world's fastest-growing form of end-use energy consumption, as it has been for many decades.

Power systems have continued to evolve from isolated non-competitive grids to integrated national and even international markets. The strongest growth in electricity generation is forecast to occur among the developing non-OECD nations.

Increases in non-OECD electricity generation are expected to average two and a half percent annually from 2012 to 2040. As rising living standards and urbanization increase demand for home appliances and electronic devices, as well as for commercial services, including hospitals, schools, office buildings, and shopping malls.

Developing countries will use the least expensive form of electricity that is available. This is usually generated from coal and natural gas. Thus, we are witnessing the work of fossil fuels in action to help develop economies around the world. It is what Gordon missed in his book.

As shown in Figure 2, the Energy Information Administration forecasts that world net electricity generation will increase seventy percent. It will increase from twenty-two trillion kilowatt hours in 2012, to thirty-seven trillion kilowatt hours in 2040.

The world's energy growth will continue to be in the power sector as the long-run trend toward global electrification continues. Figure 3 shows that the global share of energy used for power generation is forecast to increase from twenty-eight percent in 1965 to forty-five percent by 2035.

More than a third of the growth in power generation takes place in regions where a large part of the population lacks adequate access to electricity: India, other developing countries in Asia, and Africa. These regions and countries are deploying fossil fuels for their electricity needs. These fuels will thus remain the essential source for electricity production.

Indeed, greater utilization of fossil fuels may be required than is currently forecast. For example, the International Energy Agency finds that, even with the anticipated increase in economic growth and fossil fuel utilization, nearly one billion people will be without electricity in 2030. And 2.3 billion people will still

FIG. 2 WORLD NET ELECTRICITY GENERATION

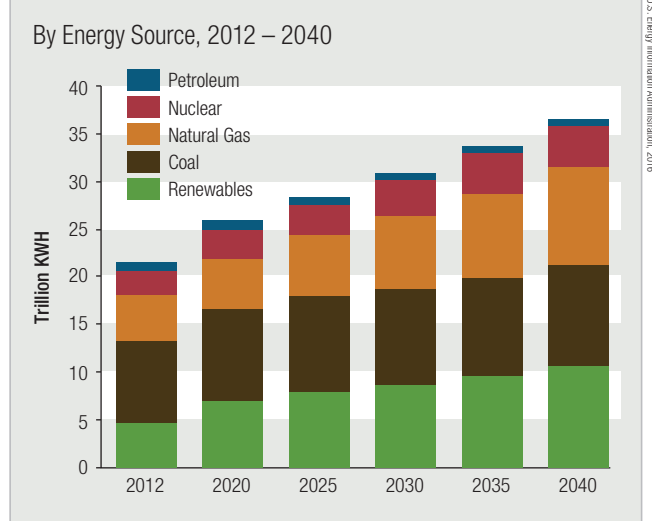
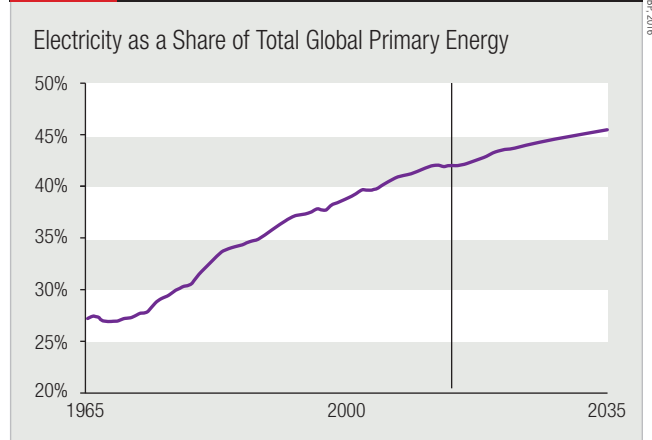


FIG. 3 ELECTRICITY, GLOBAL PRIMARY ENERGY



The grid is absolutely necessary for the future of renewables.

be without clean cooking facilities.

Access to electricity is particularly crucial to human development. Electricity is indispensable for basic industrial, commercial, and residential activities and cannot easily be replaced by other forms of energy. Individuals' access to electricity is

one of the most clear and undistorted indications of a country's energy poverty status.

Long-run causality exists between electricity consumption and five basic human development indicators: per capita GDP, consumption expenditure, urbanization rate, life expectancy at birth, and the adult literacy rate.

In addition, the higher the income of a country, the greater is its electricity consumption. And the higher is its level of human development. Further, as income increases, the contribution of electricity consumption to GDP and consumption expenditure increases.

Electrification is the future of world energy and economic

development. It powers modern civilization and redefines the human environment.

The United Nations links affordable energy to quality of life, and life expectancy, educational attainment, and lower poverty levels. These all require high levels of electricity use.⁵

Greater electricity use improves human development. According to the UN Environmental Program, “electricity contributes to longer lives, and adequate access to electricity increases longevity nearly ten years.”⁶

Similarly, “access to electricity is strongly correlated with every measurable indicator of human development.”⁷ Thus, electricity access is increasingly at the forefront of governments’ preoccupations, especially in the poorest countries. Figure 2 shows that fossil fuels will continue to generate the world’s electricity.

Reliable, abundant, and affordable energy alone may not be sufficient for creating the conditions for economic growth. But it is absolutely necessary.⁸ It is impossible to operate a factory, run a store, grow crops, deliver goods to consumers, or run the twenty-first century economy without using some form of energy, especially electricity. Energy and electricity mean fossil fuels both now and in the future.

In his concluding chapter, Gordon discusses various factors that may inhibit future global economic growth, including changing demographics, excessive debt levels, and faltering educational systems. He also identifies several policies that may increase economic growth, including reforming occupational licensing⁹ and less regulation. Unfortunately, none of the regulatory reforms he recommends deal with energy, energy access, or energy innovation.

For example, he never discusses the harmful impact of the increasing widespread trends in the U.S. and globally toward constraining fossil fuel development, deployment, and utilization. He thus errs by failing to recognize the threat that increasing harmful energy regulations could have on future fossil fuel production, energy costs, technological innovation, and economic growth.

Conclusions

Robert Gordon has convincingly shown that the process of economic growth and increasing standards of living is not a given. And that maintaining the economic and technological progress that the world has become accustomed to, may be much more difficult than is generally assumed.

Unfortunately, Gordon’s otherwise commendable book is marred by three serious flaws. He fails to identify the critical

role of energy in past economic growth. He fails to appreciate the essential role of energy in future economic growth. And his recommendations for regulatory reform fail to identify the policies necessary to prevent fossil fuels from being artificially constrained in the future.

For example, Gordon states that, “Electricity shares with the internal combustion engine the gold medal for the two most important inventions of all time.” But how important would these two inventions be without fossil fuels?



The extraordinary world of economic and technological progress over the past two centuries would not have been possible without the use of fossil fuels. Further, vast increased quantities of oil, natural gas, and coal will be required in the coming decades both to sustain continued economic progress, facilitate urbanization, and to lift billions of people out of poverty.

Fossil fuels were the essential energy sources of the twentieth century and they will continue that role in the twenty-first century. Just as the developed nations once relied on the most affordable and reliable energy to which they had access, the developing nations in the world are doing so. That energy derives from fossil fuels.

A major threat to continued global technological and economic progress are regulations and policies that may artificially restrict fossil fuel development and utilization. This would result in billions of people continuing to be forced to live with energy deprivation and economic poverty. Such policies and regulations must be avoided. [PDF](#)

Endnotes:

1. Robert J. Gordon, *The Rise and Fall of American Growth: The U.S. Standard of Living Since the Civil War*, Princeton University Press, 2016. Roger H. Bezdek, “Unsung Role of Fossil Fuels in the Miracle of U.S. Growth: Past, Present, and Future, Part I,” *Public Utilities Fortnightly*, August 2016.

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a similar leveraging of existing or planned gas smart meter technology to support gas choice programs.

Thus far, feedback from suppliers has been very favorable. In addition to the process changes described here, suppliers are provided with custom reports via a shared internet portal. The reports detail average daily temperature for each gas day, alongside that day's forecasted delivery requirement, associated variance and other adjustments.

Providing this level of transparency and detail supports supplier efforts to predict future BGE gas delivery requirements on their own. This can assist them in procurement and financial planning.

Energy People: Bob Catell

(Cont. from p. 19)

when they think of you. Our readership includes thousands of present and future leaders. What advice would you give to them?

Bob Catell: I believe leadership starts by treating people with dignity and respect. Motivating them to do the best they can in their jobs and recognizing and rewarding their accomplishments. I think there are a lot of great leaders in the energy industry, particularly those in the utility sector, those in the technology sector, and I'll include regulators as well. Evidence of that is the proceeding going on in New York State, where, in the "Reforming

Essential Role of Fossil Fuels

(Cont. from p. 41)

2. International Energy Agency, World Energy Outlook, November 2015.
U.S. Energy Information Administration, International Energy Outlook, May 2016.
3. United Nations, World Urbanization Prospects, 2014 Revision.
4. Edward Glaeser, *Triumph of the City*, Penguin Books, 2012.
5. United Nations Development Program, 2016. International human development indicators.
6. HDI-vs-Electricity-Consumption-2005-07-18.pdf.
7. *Berkeley Science Review*. Association of Energy Engineers.
8. Roger H. Bezdek, Robert L. Hirsch and Robert M. Wendling, *The Impending World Energy Mess*, Toronto, Canada: Apogee Prime Press, 2010.
9. For the seminal analysis of the harmful economic effects of occupational licensing see Morris Kleiner, "Reforming Occupational Licensing Policies," Brookings Institution, 2015.

The efforts made by BGE to harness capabilities of gas smart meter technology to reduce supplier commodity costs and cost risks are viewed as a value-added service among most gas suppliers. Since rollout in 2014, we have continued to monitor and tweak the forecasting process and procedures, in a normal continuous improvement effort.

There's a consensus among both internal and external stakeholders. BGE has taken a significant step forward in its efforts to match supplier delivery and customer usage, with the implementation of this project. Along the way, the company has taken steps towards setting a new industry standard for Gas Choice Supplier delivery forecasting. [PDF](#)

the Energy Vision," regulators are taking a leadership role in the evolution of the energy industry.

I would say there are many opportunities that can be taken advantage of. The utility model is significantly changing. Leaders need to look for opportunities in the new utility industry, with the new business models that are evolving. They need to be willing to take some risk. It's not going to be the same old utility any more.

Having said that, with some foresight and with some innovative thinking, it can still be a very exciting and rewarding industry to work in, and by taking advantage of the new technologies that are becoming available in the marketplace, the consumers can be better served. [PDF](#)

Birthdays

(Cont. from p. 70)

Thomas Edison's **Pearl Street Station** in lower Manhattan was put into commercial operation on the afternoon of September 4, 1882. On Lewis Latimer's thirty-fourth birthday!

Edison, standing in the office of J.P. Morgan, gave the signal to close the switch to start delivering power from our industry's first central generating station. Its six dynamos could supply over seven thousand lights. But there were just eighty-plus customers that day with about four hundred lights.

Not fully comprehending the significance of the event, the *New York Times* published an account the next day under "Miscellaneous City News." A year later, Pearl Street Station was serving over five hundred customers with about ten thousand lights, including the *Times*. [PDF](#)