verneglobal

RENEWABLE ENERGY AND THE VALUE OF ENERGY PRICE STABILITY

I. Introduction

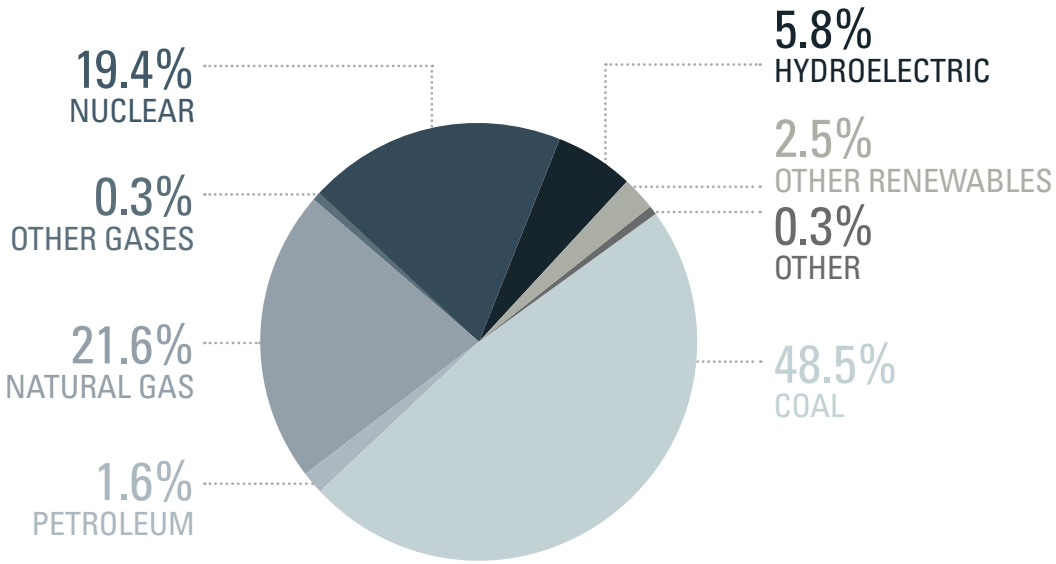
With the growing focus on carbon footprint reduction, data centers worldwide are beginning to take major steps to minimize their environmental impact. Efforts range from conducting basic energy assessment programs to enacting green design initiatives to searching for green power sources. However, with today's economic crisis, businesses have to venture carefully into these new programs. It is no longer just a matter of going green for the sake of being environmentally friendly, but doing so without negatively impacting profitability.

When evaluating green power sources from this perspective, there are two key factors that play a primary role in end-user energy costs. The first is the cost of producing and distributing the energy, which varies greatly depending on the energy source and the grid system involved. The second factor is price stability. Price volatility in fossil fuels can drive huge increases in electricity prices, as experienced during the past decade. This white paper will look at both of these factors and highlight several of the effects they have on data center deployment.

II. The Promise of Renewable Energy

Public and private sector investment and technological advances are driving down the average production cost of renewable energy, to the point where it approaches the production costs of traditional fossil fuels. For example, hydroelectric power generation costs have dropped as low as US$30–40 per MWh as of 2004.[1] Geothermal production costs have fallen to between US$60–100 per MWh on average,[2] and wind has gone from US$800 per MWh in 1980 to as low as US$30–40 at the most efficient plants in 2007, according to the International Energy Agency.[3] However, in most countries, hydroelectric and especially geothermal and wind power remain more expensive to produce. Customers must pay a premium as a result.

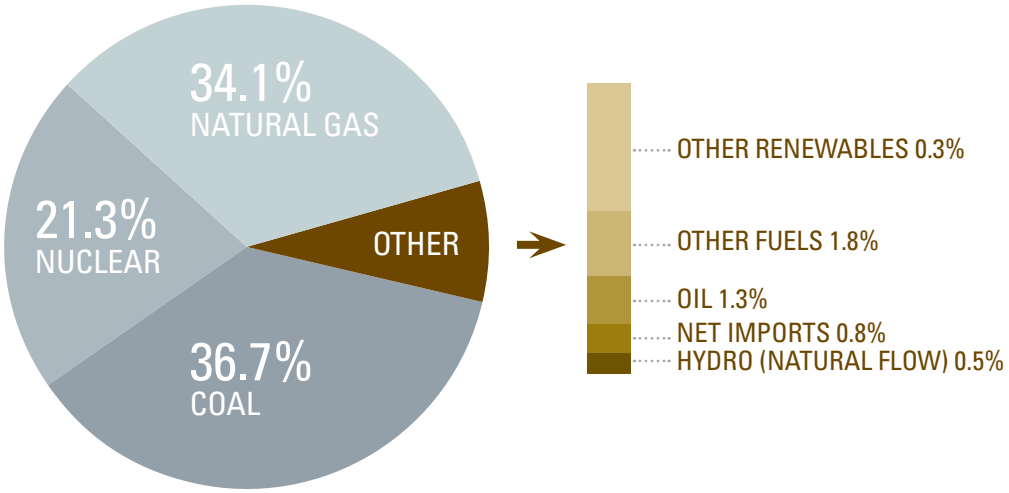
U.S. Electric Power Industry Net Generation, 2007[4]



[1] "Renewables in Global Energy Supply: An IEA Fact Sheet," Jan. 2007, Organisation for Economic Co-operation and Development (OECD)
[2] Rebecca Smith, "The New Math of Alternative Energy," *The Wall Street Journal*, 23 Feb. 2007
[3] *Id.*
[4] Energy Information Administration, Form EIA-923, "Power Plant Operations Report" and predecessor form(s) including Energy Information Administration, Form EIA-906, "Power Plant Report," and Form EIA-920, "Combined Heat and Power Plant Report."

This has not deterred utilities and governments from bringing more renewable energy on line, but the amount pales in comparison to electricity generated from fossil fuels. This is particularly true in the countries where a lion's share of global data center energy consumption takes place, the United States and United Kingdom. In the U.S., only 8.3% of electricity came from renewable sources including hydro in 2007.[5] In the U.K., the figure stood at only 4% in 2004. Britain has more recently vowed to build massive wind-generation farms along its seashore, but with the economic downturn, it remains to be seen if these plans will reach fruition at any time in the foreseeable future. The election of a new American president has also increased hopes for government-funded, large-scale green energy projects in the U.S., but how far any proposals can go will, as in Britain, likely be mitigated by economic realities.

Fuels Used in U.K. Electricity Generation, 2004[6]



Renewable energy, then, remains relatively expensive to produce and, to provide a significant percentage of total electricity production, would demand infrastructure development taking years to complete, even if it could be funded. In the U.S. and U.K., renewable generation may also have to take a back seat to a much more pressing issue: the condition of the national electricity grid. The U.K. grid is more than 50 years old and the U.S. grid more than 40 years old. Both are overburdened to the point of instability, and both are in only the early stages of upgrades which will take massive investment and a decade or more to complete. All of this adds to the cost of distribution, and in the end to the cost that customers pay for electricity.

However, large-scale energy generation from renewable resources can indeed be a realistic, viable option. Proof can be found in the island nation of Iceland. The country committed to exploitation of its ample hydro and geothermal resources decades ago, and has built a modern electricity production infrastructure that delivers power at a price that's among the lowest in the world. Geothermal production costs range from US$15–25 per MWh, only one-quarter of the world average. As of 1 January 2009, base load contracts with Iceland's largest electricity supplier were available at US$29.59–33.45 per MWh.[7] In contrast to the U.S. and U.K., Iceland generates 100% of its electrical output from geothermal and hydro power, arguably the most consistent and cost-effective carbon neutral energy sources available. The country's electricity supply is therefore immune to the price shocks and long-term upward price trend of fossil fuels. In addition, Iceland's electricity grid is merely a decade old. Being so new, the grid is inherently more efficient. Not only is the power green, but it is tremendously abundant. In 2003, the country currently used a mere 17% of its viable renewable energy potential (8,490 gWh used, 50,000 gWh/year potential). The total US$8.2 billion

[5] Energy Information Administration, Form EIA-923, "Power Plant Operations Report" and predecessor form(s) including Energy Information Administration, Form EIA-906, "Power Plant Report," and Form EIA-920, "Combined Heat and Power Plant Report."
[6] Department for Business Enterprise and Regulatory Reform, "Digest of UK Energy Statistics 5.4"
[7] http://www.lv.is/EN/category.asp?catID=437
[8] Jessica Alred, "Iceland's Energy Answer Comes Naturally," Guardian.co.uk, 22 April 2008

that Iceland estimates it has saved by switching from fossil fuels to geothermal energy is merely scratching the surface.[8] The abundance of renewable energy in countries such as Iceland means that data centers in those regions will likely not exceed power production capacity for many decades. Further, as new plants come on line and investments continue to be made in renewable energies, data centers will be able to scale without the historical lag time attributable to increased power demand. Iceland also has the potential to scale its power supply to meet a large percentage of the increasing global demand for data center power, without incurring increased marginal production costs. In fact, production costs will likely continue to decrease as a result of new technologies, such as tools to drill geothermal boreholes to a depth of 5 km.

According to the U.S. Environmental Protection Agency, American data centers alone consumed 61 million MWh of electricity in 2006 (US$4.5 billion in total expenditures), more than double the amount consumed for the same purpose in 2000.[9] During the same period, many major U.S. and European cities were also facing 15% annual price increases for fossil fuels. The years since have been no kinder. Britain's electricity costs jumped nearly one-third in 2008 alone in response to oil price spikes, and even though oil has plummeted from 2008 levels, the price of electricity has fallen only about 1% in the first quarter of 2009.[10] These power cost increases are causing significant upscope in total cost of ownership (TCO) over the life of data center contracts and making it progressively more difficult for customers to forecast their data center expenditures.

Prices for renewable energy, on the other hand, will likely remain stable and potentially decrease over the long term, even with growing demand. This will no doubt encourage investment in renewable energy by both the private and public sectors, as economics allow. Data center customers can take advantage of current and future renewable energy opportunities to alleviate the data center power crisis and dramatically reduce their TCO over the long term.

IV. Value of Energy Price Stability

As discussed above, electricity price stability is a key factor in projecting data center operational costs over time. Achieving substantial cost benefits comes both from contracting for low power pricing today and limiting price inflation over the lifetime of a data center contract. The degree of lifetime pricing favorability is wholly dependent on the power generation and delivery infrastructure of the region involved. This is clearly illustrated by comparing a typical American data center with one located at the Verne Global facility in Iceland, where renewable energy allows for a low rate over the duration of the contract. The potential savings in a hypothetical case are shown in the accompanying table. The case assumes a data center deployment of 3MW. Note that potential efficiency gains from locating in Iceland, including the use of 100% free cooling, are not included in this analysis – each facility is assumed to have the same degree of efficiency (same PUE or DCIE).

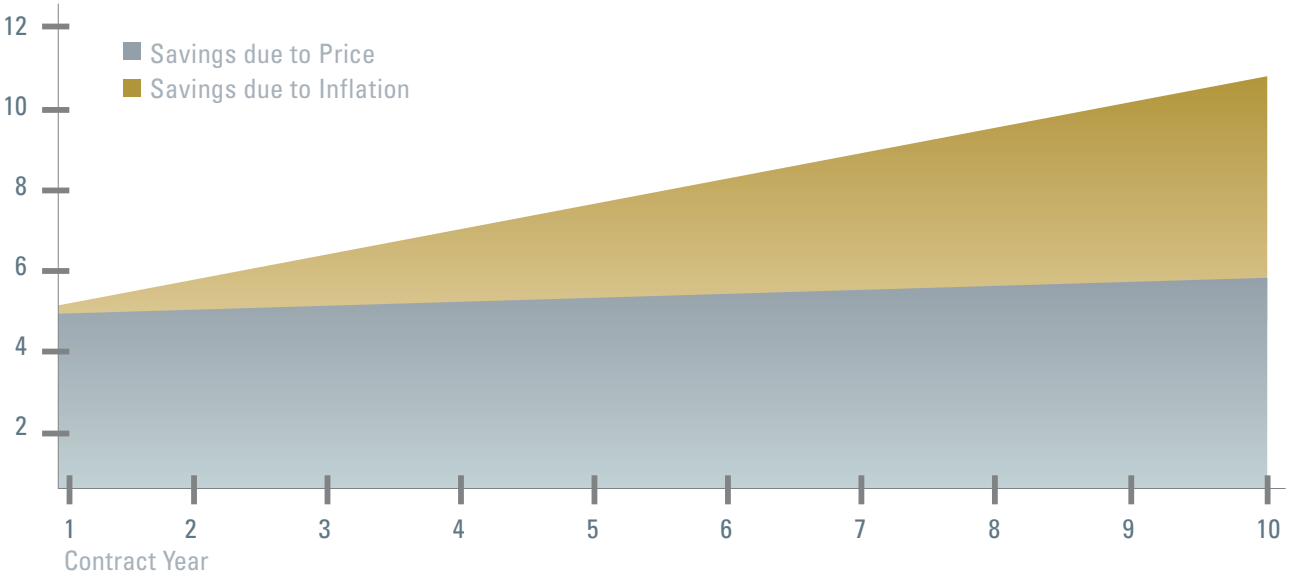
	Sample U.K.-based Data Center	Iceland Data Center
Critical Power Requirement	3 MW	3 MW
Electricity Price Per kWh	$0.12	$0.04
Annual Energy Price Inflation	7%	3%
Nominal Spending Over 10 Years	US$101 Million	US$25 Million

Under this scenario, total nominal energy savings over this period are US$76 million, or a 75% decrease in energy cost. As this example shows, low power cost combined with energy price stability creates significant financial savings for the data center customer.

[9] "Report to Congress on Server and Data Center Energy Efficiency Public Law 109-431," U.S. Environmental Protection Agency, 2 Aug. 2007

[10] Kaya Burgess , "Office for National Statistics says prices really are falling," *The Times*, 24 March 2009, and "First Release: Consumer price indices, March 2009," Office for National Statistics, 9 April 2009

Hypothetical Annual Electricity Savings (in Millions)



IIV. Conclusion

Fossil fuels are finite in their short-term supply, subject to short-run price increases due to supply shocks, and are most commonly used to generate the large majority of electricity in regions burdened by old, inefficient energy infrastructures. In contrast, the current supply of renewable energy sources, including geothermal and hydro power, are relatively abundant and essentially inexhaustible. Countries such as Iceland have conclusively confirmed the potential benefits of large-scale renewable energy use. The use of technological developments has allowed production costs to match or fall below fossil fuel-based systems, and customer prices can be kept low over an extended period due to underlying resource price stability. A falling production cost, combined with a nearly inexhaustible supply, translates into a form of power whose overall price will remain competitive despite growing demand. This makes renewable energy very attractive for use in data centers, and positions it as the solution to the growing global data center energy crisis. Data center customers can take advantage of this solution today at facilities such as Verne Global in Iceland, and can expect similar renewable energy opportunities in the years to come as investment in production and delivery continues to grow around the world.