Electricity in a Climate Constrained World

By Peter Corcoran

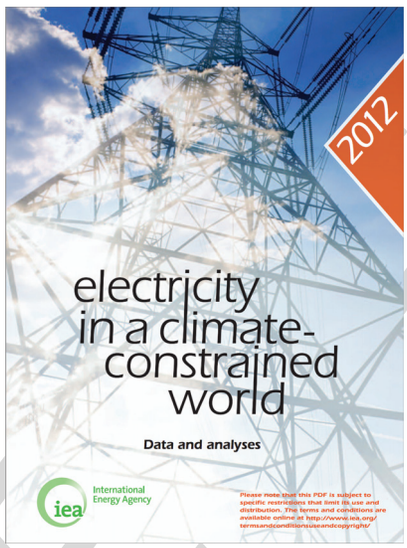
More than a year ago, I authored a "Soapbox" article about the potential impact of emerging consumer electronics (CE) technologies on global electricity consumption [1]. If you found that article interesting, you will also be interested in this latest study by the International Energy Agency (IEA) **<AU: Please check whether IEA is spelled out correctly.>** on world electricity consumption, its current status, and the most likely developments we are going to see during the next few years.

If you are familiar with other IEA reports [2], you may find this one a bit of a change as it is not just a detailed collection of data, an account of the methodology applied, and the resulting statistical analysis. In this particular study, the IEA has also included a set of more general topical essays from various experts within the organization. There are actually ten of these essays/chapters in the first part of the book, but I will focus my review on just a few of these that I feel are of most interest to readers of *IEEE Consumer Electronics Magazine*.

A SOMBER INTRODUCTION

The introduction of this book opens with a pretty blunt message to the reader:

> *Electricity in a Climate Constrained World opens with a sobering message: the latest IEA energy statistics show that total energy-related CO2 emissions reached their highest global level at 30.5 gigatonnes (GtCO2) in 2010, a 5% increase from 2009. The 1.8% drop in 2009, largely a result of the global economic crisis, was unfortunately not indicative of a new trend. Electricity accounted for about half of the global growth in emissions in 2010. The growth in electricity demand (and associated heat production) rose again in 2010, reaching an estimated 23 192 terawatt-hours (TWh), 6.5% above the 2009 level.*



It goes on to emphasize that the world is now looking at a 4° overall rise in temperature no matter what measures are taken, and it is now time to assess the likely impacts of such a rise in global temperature, including the likely effects on electricity generation. This leads into the first essay, which is appropriately titled, I am sure you will agree!

"SAVING ELECTRICITY IN A HURRY: AN UPDATE"—BY S. BRYAN PASQUIER AND G. HEFFNER, THE ENERGY EFFICIENCY UNIT OF IEA

This article focuses on how prolonged electricity shortfalls undermine economic activity; it considers a number of recent practical examples, particularly in Japan, but also cites recent cases from the United States, South Africa, New Zealand, and Chile. The authors reinforce three well-established steps to developing energy-saving programs: 1) understanding electricity shortfall cause and duration, 2) identifying energy-saving opportunities, and 3) implementing a package of demand-side energy-saving measures. Insights into best practices for emergency energy-saving programs are presented, and recommendations on how officials can use communication, price, rationing, and technology tools to achieve fast energy savings are provided. The authors also describe how emergency energy-saving measures can lead to sustained energy savings.

"HOW CAN WE MAKE AN INTERNET-SURFING MICROWAVE OVEN GO TO 'SLEEP'"—BY V. ROZITE FROM THE ENERGY EFFICIENCY UNIT OF IEA

This article is one that I am sure will resonate with many of our readers. In

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this article, the authors explain how this apparently bizarre question actually goes to the heart of an important emerging issue in the area of energy efficiency. These smart network-connected appliances are dubbed as such because of their ability to access information from, as well as provide information to, networks, other appliances, users, and even electricity providers. Expert projections indicate that the number of networked appliances will reach 100 billion during the next five to ten years (Hammersmith Group, 2010).

To stay connected to a network, most appliances today need to be switched on to receive network signals. Consequently, they do not power down to lower energy modes and will consume the same amount of energy irrespective of whether they are being used or just waiting to be used. The author then explains how many "small devices" can add up to large numbers in terms of electricity consumption:

> *A television's set-top box is a classic example of a networked appliance. Set-top boxes transform signals from cable, satellite, or other service providers into images on the television screen. More than 160 million set-top boxes were consuming energy constantly in the United States in 2010, all of them operating at near full power even when no one was watching TV or recording a broadcast. Collectively, when in standby, these boxes consumed an estimated 18 TWh in one year (equivalent to the annual output of six 500-megawatt coal-fired power plants), at a cost of US$2 billion to consumers and CO2 emissions of approximately 9.14 Mt (NDRC, 2011). The challenge is to get set-top boxes and other appliances to "go to sleep"—i.e., power down to low energy modes—while still providing necessary network capability.*

There is a bit of a challenge laid down to the engineers of the CE industry in the remainder of this article, and it is certainly one that will resonate with our readers.

OTHER ARTICLES

Other articles cover financing, regulatory, and policy issues as they relate to the electricity generating sector and its near- and longer-term evolution. There is an article on the importance of introducing an emissions trading system into the Chinese energy marketplace in an effort to reduce the dependence on "brown" electricity from coal-fired power plants. Another article tackles methodologies to track the adoption of clean energy within the sector.

Another article that may be of interest to some of our readers, particularly those with an interest in smart grid and concepts of grid storage, is provided by a mix of IEA and external reviewers.

"THE ROLE OF ELECTRICITY STORAGE IN PROVIDING ELECTRICITY SYSTEM FLEXIBILITY"—BY D. ELZINGA, J. DILLON, M. O'MALLEY, AND J. LAMPREIA

This article compares current storage technologies and considers how new opportunities for storage technologies are being created as we move toward a decarbonized operation of the electricity system. Much research and development work is under way internationally that explores new ways to achieve the benefits of storage at lower cost, reduce the costs of new and emerging storage technologies, and address the other barriers to increased deployment.

Readers with interests in electric vehicles and the smart grid will find this article useful in providing an overview of the existing storage infrastructure and related technologies that new solutions will need to integrate with.

Two final articles cover the "Potential for Bioelectricity in Brazil from Sugarcane Residual Biomass" and the somewhat more esoteric concept of negative emissions: "Bioenergy with Carbon Capture and Storage: The Negative Emission Concept."

NUMBERS AND STATISTICS

The remaining 25 pages or so are full of many detailed statistics and numerical analyses of electricity in a global context and also in the main geographical subregions of the Organization for Economic Cooperation and Development (OECD) **<AU: Please check whether OECD is spelled out correctly.>**, including the Americas, Europe, OECD-Asia/Oceania, and the developing world—Africa, non-OECD Americas (South and Central America), Asia, China, non-OECD Europe and Eurasia, and the Middle East.

REVIEWER'S ASSESSMENT

This book has all the latest data if you are working in an area associated with the global electricity industry. It also provides many insights into the current status of the electricity industry and, if you are concerned with such matters, you will find information on key trends and issues.

For researchers in the CE sector, there are probably only a couple of articles that are of direct interest. The article on connected devices is definitely of interest to many of our readers, but I am not sure that this single article is sufficient to justify buying the full book. **<AU: Please check whether the preceding edited sentence conveys the intended meaning.>**

However, we have featured articles in the past on the significance of electricity consumption and the growing role that consumer information and communications technology **<AU: Please check whether ICT is spelled out correctly.>** plays in electricity usage. From this perspective, I feel that it is important for many of us, bearing in mind our social obligations as engineers, to be aware of issues that affect the global population and consider such issues in our personal engineering work.

If you feel that it is important for you, as an engineer, to be informed on an up-to-date basis of the current state of the global electricity industry, then you will not find better than the

data and metrics presented here. This is definitely one to recommend to your university library for purchase or to consider for you local engineering library if you work in the industry.

REFERENCES

[1] P. M. Corcoran, "Cloud computing and consumer electronics: A perfect match or a hidden storm?," *IEEE Consumer Electron. Mag.*, vol. 1, no. 2, pp. 14–19, Apr. 2012.
[2] IEA—Publication (2013, Apr. 28). Gadgets and gigawatts: Policies for energy efficient electronics. [Online]. Available: http://www.iea.org/publications/freepublications/publication/name,3807,en.html

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