

André Dorsman · John L. Simpson  
Wim Westerman *Editors*

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 Springer

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# Foreword

## The Value of Energy Economics and Financial Markets

More than ever, energy dictates our lives. Once viewed as a utility, an enabler with limited consumer interest, energy is now the key word in our struggle for a sustainable future. Public involvement is tremendous, ranging from household production to smart (semi-)professional consumption management. The need for sustainability has turned energy into a highly relevant product, even approximating a lifestyle item. It is fair to state that when it comes to energy, we are indisputably experiencing a big shift in value perception, stretching far further than just utilitarian or even economical value.

Drivers for energy consumption still show significant geographical differences. Yet, the energy transition from carbon fuels to renewables and the associated market model changes from the background against which the current energy market developments can be painted. The energy transition is no longer a choice nor a wish. It is more like a force of nature that will overcome the market and will drive the energy market participants for the next decades. To successfully make this switch, we need optimization of existing processes, smart technology, and decision support at all levels up to the end consumer. The value of innovation and agile operations will determine the future value of energy.

With even single household production companies, nowadays, the market's entry barrier has never been so low, while the market complexity has never been so high. More than ever, we are in need of specialists with a thorough understanding of the industry, its rules, regulations, and its specific processes. Clear frameworks, alignment of structures, and performance measurement, are all minimal requirements to operate in this specific domain. From market design to effective operational management, in-depth knowledge is the key to success—and sharing this knowledge is the only way to increase value. Rather than excelling in isolation, market specialists should exchange insights to jointly provide the ever so necessary clarity and guidance to the market and its various participants.

In multiple ways, this book discusses both the value and the valuation of energy. The well-chosen structure of themes and chapters allows the readers to

gain useful insights into the fundamental economic forces determining the global energy supply and demand. It addresses transitional issues, and also explains the connections of these to the related financial derivatives and primary markets.

GEN's practice touches on many of the subjects addressed in this book: improving the intelligibility of energy through market model analyses, process implications, and hard-core performance indicators. Our tagline is 'Adding Value to Energy'. For this book specifically, I would like to stress the way its articles add value to the evolution of the energy markets. Being a co-production between a wealth of scientists and practitioners, it supports the creation of a more uniform framework for the different operating mechanisms in the economics and finance-related parts of the energy sector. It is worth reading and holds an invitation from the authors, but definitely also from me personally, to add to the insights offered and contributed to building the firm knowledge base that will guide us to the future.

Sam Collot d'Escury  
CEO GEN

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# Chapter 1

## Introduction: Energy Economics and Financial Markets

John L. Simpson, Wim Westerman and André Dorsman

**Abstract** Energy issues feature frequently in the economic and financial press. It is argued that the importance of energy production, consumption and trade and raises fundamental economic issues that impact the global economy and financial markets. Specific examples of daily energy issues stem from various countries and can often be related to economics and finance. It is shown that energy economics and financial market research issues can be grouped under the themes of supply and demand, environmental impact and renewables, energy derivatives trading, as well as finance and energy.

**Keywords** Supply and demand • Environmental issues and renewables • Energy derivatives trading • Finance and energy

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## 1.1 Introduction

There are many critical areas of interest that relate either generally or specifically to fossil fuels and alternatives, energy efficiency, energy independence and security, energy safety issues, climate change, sustainability and renewables, the transportation of energy resources, connecting energy suppliers and consumers, electricity generation and so on. This book in some way touches all of those broad issues explicitly or implicitly. The book cannot deal with all of the current energy issues in detail, but it does represent a genuine effort to draw attention in applied research in several important areas of energy economics and financial markets.

This chapter begins with a discussion of the importance of energy production, consumption and trade and raises fundamental macro-economic issues that impact the global economy and financial markets. The chapter then provides specific examples of daily energy issues from various countries and relates them to economics and finance. Energy economics and financial market research issues are related to the themes of supply and demand, environmental impact and renewables, energy derivatives trading, as well as finance and energy. A discussion of headlines of the several chapters of the book shows the relevance of academic research in the area for energy economics and financial market researchers, practitioners and policy makers alike.

## 1.2 The Importance of Energy in Financial Economics<sup>1</sup>

Why are energy issues in financial economics so important? The dominance of energy in global markets is re-emphasized by the reporting of recent energy production, trade and consumption numbers. Looking first at production, the numbers reported quantify natural energy resources extracted or produced and include coal, gas, oil, electricity, and heat and biomass production. For gas, quantities flared or reinjected are included. The production of hydro, geothermal, nuclear and wind electricity is excluded from the numbers as this is considered primary production.

In 2010 world primary energy production increased by 4 %. This is significant when it is considered that there was a 0.6 % reduction in 2009. The driving force emanated from Asia, which was responsible for nearly half of the increase and currently represents around 30 % of total energy production. Coincidentally perhaps, this amount of production is the same as that for all OECD countries. In China production grew by 8 % and represents 18 % of the total. In Russia the growth was 6 % due largely to the growth in LNG. The OECD produced a modest increase of 2.3 % driven primarily by growth rates in the US and to a lesser extent in the EU. The Middle East had growth rates of 3.6 % and in Latin America the 6.6 % growth rate was mainly due to the strength of Brazil.

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<sup>1</sup> For the data in this section see Global Energy Statistical Yearbook (2011), <http://yearbook.enerdata.net>.

In regard to energy consumption, a slight reduction in 2009 was followed by a 5.5 % growth in 2010. All G20 countries experienced energy consumption growth, underpinned by a resumption in strong OECD growth following an upturn in economic activity. Consumption grew by 6.7 % in Japan, 4 % in Europe and 3.7 % in the US. China and India accounted for a 6 % increase with a strong demand for all forms of energy. China is the largest consumer of energy (at 11 % above the US) and India ranks number three.

When global trade is considered, the Middle East in 2010 again confirmed its status as the largest net exporter of energy. Russia, due to its exports of natural gas to Europe, increased its net exporter position and, oddly, in a time of concerns regarding global warming and unclean energy, the US reduced its net importer position by exporting larger amounts of coal. The net importing position of Asia deepened by a further 15 % driven largely by China, where net imports rose by 24 % in 2010. However, this increase was down from 55 % in 2009, perhaps showing the impact of the GFC on Chinese industry and infrastructure growth. In Europe the trade deficit increased by 2.9 % in 2010, impacted by increased imports of energy.

Important questions in relation to global economics and financial markets arise out of the foregoing numbers (Energy Insights 2011). Will the global economy demand more energy in the future? Where will the energy come from? Will large developed countries experience electricity blackouts? In answer to the first question the view is put firmly that more energy will be demanded. For example, oil demand is expected to increase from 70 million barrels a day to 150 million barrels a day by 2010. Chinese and Indian demand will drive a global doubling for numbers of automobiles by 2020 and gas demand will rapidly escalate in the Asia Pacific with coal demand increasing significantly. Increasing global GDP, populations, wealth expectations, and standards of living will require substantially more energy. The figures are astounding. For example, China's GDP will probably be higher than that of the US by 2040. India's GDP is also increasing rapidly.

Energy is a commodity where production and consumption are differently located. An increase in energy consumption means an increase in transport of energy, for example, by long distance imported pipeline gas and LNG shipped by sea. Middle Eastern oil supply though OPEC will expand as will the supplies of Russian oil. Coal production will probably expand (mainly in India, Bangladesh, US and China). The growth of fossil fuels exports will be less rapid due to renewables growth. For example, solar in sunny Florida, California and Spain and wind in the UK, The Netherlands, Denmark and parts of the US (Energy Insights 2011). Also, Australian coal and natural gas will remain very important global energy sources over the next few decades. Other sources such as hydrogen for hybrid automobiles may provide inroads in replacing oil imports, but it is expected that oil prices will continue to increase from their current levels of around USD100 per barrel.

The final broad question is whether or not the threat of electricity blackouts in larger developed countries is real. The answer to this question is, it might be! Capital investment in power generation has fallen behind GDP increases in most industrialized countries and this is partly due to market liberalization where privatized producers operate with lower spare capacity than previously. Low prices

of electricity between 1998 and 2003 did not incentivize investment, but this perhaps is changing. In 2003–2004 with greater demand, higher prices, and spare capacity shortages blackouts actually occurred in the US and in Europe.

The investment problems need to be resolved given that electricity investment is often not perceived to be attractive at the time. The investment will probably need to be made more attractive with some form of government involvement. Electricity investment is capital intensive, there is a long investment time frame, it has low expected rates of return and such investment needs to compete with other areas of financial markets which are more attractive in risk and return characteristics.

This brings on discussion about the role of the financial markets in the energy sector under the current circumstances. The energy markets are now the place to be. After the bond markets in the 1950s, the stock markets in the 1960s and the 1970s, the option market in the 1980s and the 1990s of the last century it is now the turn of the energy markets. Bonds, stocks, and options are products created in the minds of people. The prices of one of these products should be universally more or less the same. Deviations in prices of the same product are due to imperfections. That is not true for energy and energy-related products. The price of these products depends on time and location. On top of that, transport of energy—from production place to consumption place—expends energy. Financial models that are true for imaginary goods are too simple for energy. Armed with the knowledge of the markets of imaginary goods it is important to expand knowledge of the energy markets.

Due to the fact that consumers and producers of energy are not equally distributed over the world, it is logical that there is an apparent value shift from consuming countries to producing countries. However, production of oil and gas is not unlimited. The welfare obtained by oil and gas wells will disappear when the production of fossil energy substantially decreases. Energy producing countries look at alternatives, such as renewables (solar and wind energy) or creating financial institutions. After the financial crisis 2007–2008 there were doubts about the solvency of American and European banks. It is unusual to many, that, over the period of the global financial crisis, there was little discussion about the viability of Russian Banks.

### **1.3 Energy Economics and Financial Markets: Specific Issues of the Day**

More specific energy issues are fixed topics in the economic and financial press. For example, one of the important recent newsworthy events in oil production and exploration was the approval by the United States Bureau of Ocean Management and the anticipated approval by other environmental regulatory bodies of the re-entry by BP into oil exploration in the Gulf of Mexico. Up to four wells have been approved and this is will be the first exploration activity by the company in the Gulf since the explosion aboard the Deepwater Horizon rig in April 2010. This example raises issues of a broader nature than just plain vanilla economics and finance.

Such developments in the real world will drive research. The above events have an important impact on oil supply at another point when issues relating to peak oil keep coming to the fore-front of thinking in those markets. The events in the Gulf of Mexico also triggered questions relating to the prices and price movements in oil markets and also in individual oil companies and supply and demand aspects, but overwhelmingly, questions arise on the real world issue of environmental damage, sustainability, the desirability of fossil fuels in general in preference to a more rigorous development of renewable energy resources.

Another timely real world issue may be one where there has not been a large amount of focus. For example, again in the United States the issue of the regulation and control of fracking wastewater has more recently arisen. The disposal of the water from hydraulic fracturing in shale gas and coal-bed methane operations has raised not only positive news about alternative cleaner burning fossil fuels and methods of extraction that add to the supply of energy resources in an era of rapidly increasing demand, but it is very important that the environmental impact be considered and in this case also the impact on water resources.

Alternatives for fossil energy include renewables such as wind and solar energy. However, these energy sources are also permeated with challenges. See for example the political and economic effect of the recent financial problems of the US solar firm Solyndra, which experienced problems despite a substantial government guarantee from the Democratic Obama administration. Apart from the blow to renewables advocates in practice as well as in research, the Republican opposition appear to feel that they have gained some political advantage to help them push hard for the desirability of an “addiction” to fossil fuels.

Energy is a commodity, which means that time and location matter. As a consequence of location differences between producers and consumers of fossil energy, transport of energy is a major economic activity. A hot topic refers to the economics of pipeline gas when a specific issue is raised at a time in the global economy and certainly in the developed economies where interest rates are low and stock markets are volatile, but weak. Yet in taxation effective environments the attractiveness of low risk, low return pipeline gas might be an attractive investment in some countries where it is appropriate. Still, this would probably suggest a need for study in areas that are as yet not well exploited.

An issue for Australia and other fossil fuel exporters is the important need to diversify exports away from an excessive reliance on only two or three importing countries. On the importer’s side it is important for energy importers such as countries in Western and Eastern Europe and also Turkey to consider the diversification of their pipeline gas supplies from one or two countries that from all possible considerations have to be considered as high political risk countries. Stability and security of energy supply is an important issue that may interest energy economists amongst others.

For countries such as Australia, an increasingly important exporter of natural gas,<sup>2</sup> the issues considered by many are whether or not Australia should “sell the

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<sup>2</sup> It is expected that by 2020 Australia will overtake Qatar as the largest global exporter of LNG. See Forbes (2012).

mine” or focus on “selling the product”. Australia is a wealthy, developed, low political risk country and is very much part of the globalization process, but questions are arising from many economists as to the cost benefits of excessive inward foreign direct investment in the form of equity. Cost may not only be economic in nature. There is a strategic and a political consideration. Does dividend outflow outweigh the economic benefit if foreign equity grows too large? Should not foreign debt investment be on offer and encouraged with attractive coupon rates on the bond instruments, rather than raising the funds through sale of equity? Clearly such research, especially from financial economists, is desirable.

In the densely populated Netherlands, where it is estimated that what was once the world’s largest natural gas field, situated in the north of the country, has only about 30 years of supply left, the energy alternatives being considered will have to include importation of coal, oil and gas, nuclear solutions, wind and solar power generation. However, in such a developed and democratic country the people may be balking at the excessive costs of wind power and also the visual and noise pollution associated. Nuclear power, although being produced in the country for a long time, is viewed to become less attractive as an alternate source following the 2011 Japanese tsunami impact.

Lastly, by the end of 2011, the Dutch firm New Sources Energy had to postpone plans to issue new shares in order to develop activities in the renewable energy area, in particular solar energy. The current economic climate was blamed for this. Indeed, at the time the Dutch economy was in a recession. This event and similar examples shed a new light on ongoing competitive advertising campaigns by local financial institutions, fuelling the public in its intentions to invest in an often ethically favored renewables sector. Again, both energy economy and financial market specialists may be asked to shed light in the darkness of apparently confusing information.

It is clear that there are many issues that are topical and require investigation. They are often of a complex nature, such as many of the above examples show. This book will touch on many of the central energy economics and financial markets issues in real life, including some of the aforementioned issues in some way, but overall the book deals with attempted resolution of the issues with worthwhile applied research in the above mentioned fields.

## **1.4 Energy Economics and Financial Markets Research: Issues Covered in this Book**

Returning now to research issues, this book starts from a general perspective and moves to a specific perspective. The text addresses macroeconomics, microeconomics and financial markets, whereby the actual focal attention has been laid on four groups of timely topics. Part I covers issues on supply and demand for energy. The second part of the book has a theme of environmental issues and renewables.

Part III examines the dynamics of energy derivatives trading. The fourth part deals with issues on the intersection of finance and energy. In this way the book itself is organized into a total of twelve topical chapters.

Within Part I, which deals with supply and demand, one chapter is about energy security in Asia, highlighting inter-country differences on specifically natural gas. Helen Cabalu and Cristina Alfonso propose a composite gas supply security index with four indicators: a gas consumption efficiency ratio, a gas import dependency ratio, a gas production versus consumption ratio, and a geopolitical risk index. The composite index is used to describe the situation in six important Asian countries. China appears to be the least vulnerable country, whereas Thailand has become the most vulnerable country.

Another chapter covers aspects of energy pricing and the pricing of finance for buyers of energy resources, using country risk ratings. Author John L. Simpson assumes that natural gas export returns represent the change in the amount of export finance that might be required as buyer credit. Using country risk ratings, a risk premium is ascribed to this buyer credit. Evidence suggests that Chinese buyer credit from Australia is subject to a substantially larger credit risk than US buyer credit from the same country. It is also shown that long-term equilibrium relationships exist in the early 2000s. The author therefore concludes that country risk needs to be considered in loan pricing for gas exports.

The final chapter of the section deals with the drivers of energy demand in developing countries. Here, Ayhan Kapusuzoglu and Mehmet Baha Karan suspect a growing mismatch between energy demand and supply, which underlines the need for research. They study 1971–2007 data for 30 developing countries. Energy consumption is related to measures of not just gross domestic product (GDP), but also rural population, total population, consumer prices (CPI) and CO<sub>2</sub> emission. The study signals common relationships in various directions between energy consumption and the other factors studied.

The second part of the book deals with environmental issues and renewables. Specifically investigated in the first chapter are renewable energy production capacity and consumption, and their effects on economic growth and global warming. Henk von Eije, Steven von Eije and Wim Westerman study global relationships between gross domestic product (GDP) growth, CO<sub>2</sub> emissions, fossil fuel consumption, renewable energy consumption and also renewable energy production variables. The authors show that renewable energy production reduces both fossil fuel use and economic growth in the long run.

The following chapter is written by Tony Owen. It deals with “carbon pricing” instruments aimed at reducing the demand for power and stimulating low-carbon power generation technologies. Both emission trading schemes and carbon taxes are theoretically least cost economic instruments if it comes to tackling climate change. Factors that can in practice lead to significant levels for one instrument relative to the other include transparency, operating costs, public acceptability, dynamic efficiency, revenue and distributional issues, as well as international harmonization.