

## ABOUT THE AUTHORS

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Dr. Morris Adelman was professor of economics at the Massachusetts Institute of Technology until his retirement in 1987. He taught industrial organization and conducted research into oil and energy markets. He is the author of several important books, including his most recent work entitled *The Genie Out of the Bottle: World Oil Since 1970*. He also served in 1981 as president of the International Association for Energy Economics.

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Meftun Erdogan completed a summer internship at ARCO Oil and Gas Company in 1993 and is currently completing her Ph.D. thesis, "Demand for Energy in Turkey," at the Colorado School of Mines. Her thesis is concerned with price responsiveness of energy demand and substitution possibilities between input choices (capital, labor, and energy) and fuel choices (coal, oil, electricity) at the aggregate and sectoral level. Upon completing her degree she will be an assistant professor at the department of mining engineering of Istanbul Technical University.

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**DERMOT GATELY**

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John Lichtblau is an international expert on petroleum economics and is president of Petroleum Industry Research Foundation, Inc. (PIRINC), a nonprofit group that provides analysis of public policy matters affecting the U.S. petroleum industry. He has written many articles on petroleum economics and has been a frequent witness at Congressional hearings on energy policy, and a lecturer at conferences including the World Petroleum Congress. In 1986, he received the International Association for Energy Economics annual award for *Outstanding Contributions to the Profession of Energy Economics*. He did post graduate studies at the New York University.

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John Mitchell is chairman of the Energy and Environmental program at the Royal Institute of International Affairs, London. He is also a research advisor to the Oxford Institute of Energy Studies, and honorary fellow of the Centre for Petroleum and Mineral Law Policy at Dundee University. He retired in 1993 from the position of special advisor to the managing directors of British Petroleum. He was formerly coordinator of BP's corporate affairs in North and South America, and a director of several BP subsidiaries. He was elected Energy Economist of the Year for 1993 by the British Institute of Energy Economists.

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Dr. Peter Odell is professor emeritus, Erasmus University in Rotterdam where until 1991 he was professor of energy studies and director of the Centre for International Energy Studies. He has been a visiting professor at the London School of Economics, and has written numerous books and articles on energy. He has been particularly interested in European energy issues and the North Sea, and has advised governments, international organizations and other institutions and companies on international oil and energy matters. In 1991 he was awarded the International Association for Energy Economics annual prize for *Outstanding Contributions to the Profession of Energy Economics* and its literature.

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Matt Rogers is a principal with Booz Allen & Hamilton, a consulting firm based in San Francisco, California (see Treat). Matt Rogers is specialized in strategic planning, supply chain management and risk management issues for energy companies.

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## **ABBREVIATIONS AND CONVERSION FACTORS**

<b>barrel</b>	= 42 U.S. gallons = 34.97 Imperial gallons = 158.98 litres.
<b>bbl</b>	barrel.
<b>Bcf</b>	billion cubic feet.
<b>Bcm</b>	billion cubic metres.
<b>b/d</b>	barrels per day.
<b>boe</b>	barrel of oil equivalent.
<b>Bboe</b>	billions of barrels of oil equivalent.
<b>Btu</b>	British thermal unit; a unit of energy; 1 Btu = 1 055 joules. One Btu is the heat required to raise the temperature of one pound of water through one degree Fahrenheit.
<b>CEC</b>	Commission of the European Communities.
<b>CFCs</b>	chlorofluorocarbons.
<b>CIS</b>	Commonwealth of Independent States, whose members are Russia, Belarus, Ukraine, Moldova, Armenia, Kazakhstan, Turkmenia, and Uzbekistan.
<b>CNG</b>	compressed natural gas.
<b>CO</b>	carbon monoxide.
<b>CO<sub>2</sub></b>	carbon dioxide.
<b>EC</b>	The European Community, whose members are Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom.
<b>ECU</b>	European Currency Unit.
<b>EIA</b>	Energy Information Agency (United States).
<b>FERC</b>	Federal Energy Regulatory Commission (United States).
<b>FGD</b>	Flue gas desulfurisation.
<b>FOB</b>	free on board; refers to the price of excluding cost of shipment and insurance.
<b>FSU</b>	Former Soviet Union.
<b>GATT</b>	General Agreement on Tariffs and Trade.
<b>GDP</b>	Gross domestic product. The total value of the output produced and income generated by economic activity within a given country.
<b>GNP</b>	Gross national product. The total value of a nation's annual output of goods and services; it differs from GDP by the addition of incomes earned abroad and the subtraction of incomes produced at home but earned by foreign residents.

GW	gigawatt, or 1 watt x $10^9$ .
GWh	gigawatt-hour = 1 gigawatt x 1 hour, or 1 watt 1 1 hour x $10^9$ .
IEA	International Energy Agency; an autonomous body of the OECD, which carries out programs of energy cooperation among 21 of the OECD's 24 member countries. Also coordinates the response to international supply disruptions.
IMF	International Monetary Fund.
kg	kilogram, 1 metric ton = $10^3$ kilograms.
km	kilometre, or 1 metre x $10^3$ .
kV	kilovolt, or 1 volt x $10^3$ .
kW	kilowatt, or 1 watt x $10^3$ .
kWh	kilowatt-hour.
LDC	Less developed country.
LNG	liquified natural gas.
LPG	liquified petroleum gas; refers to propane, butane and their isomers.
Mbd	millions of barrels per day.
Mbdoe	millions of barrels per day of oil equivalent.
MBtu	million British thermal units.
Mcf	millions of cubic feet per day.
mpg	miles per U.S. gallon.
MTBE	methyl tertiary butyl ether.
Mtoe	millions of metric tons on oil equivalent; see toe
MW	megawatt of electricity, or 1 watt x $10^6$ .
MWh	megawatt-hour = 1 MW x 1 hour.
NGL	natural gas liquids, including ethane, propane, butane, pentane, and the heavier hydrocarbons.
N <sub>2</sub> O	nitrous oxide.
NO <sub>x</sub>	nitrogen oxides.
NYMEX	New York Mercantile Exchange.
OECD	Organisation for Economic Cooperation and Development: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.
OPEC	Organisation of Petroleum Exporting Countries: Algeria, Gabon, Indonesia, Iraq, Iran, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela.



R&D	research and development.
R/P	Reserve/Production ratio; the number of years that a resource will last if produced at the current production rate.
SNG	synthetic natural gas.
SO <sub>2</sub>	sulfur dioxide.
SO <sub>x</sub>	sulfur oxides.
Tcf	trillion cubic feet (10 <sup>12</sup> ).
toe	metric ton of oil equivalent, defined at 10 <sup>7</sup> kcal.
TW	terawatt, or 1 watt x 10 <sup>12</sup> .
TWh	terawatt x one hour.
VAT	value added tax.
VOCs	volatile organic compounds, including hydrocarbon vapour emissions.
W	watt; the rate at which work is performed, or power, is measured in watts, and a watt is equal to one joule per second.

### Conversion Table to Mtoe, Kcal and MBtu

	Mtoe (=10 <sup>13</sup> Kcal)	MBtu (x 10 <sup>9</sup> )
Oil		
1 Mtoe	1.0	4.0
1 Mkl	0.83	3.3
1 Mbl	0.132	0.52
1 Mbd	48.2	191.0
Coal		
1 Mtce	0.7	2.8
Gas		
1 Bcm	0.82	3.3
1 Bcft	0.023	0.09
Nuclear: Input Base		
1 GW/GWe		
60% operation	1.3	5.2
65% operation	1.4	5.6
70% operation	1.5	6.0