

This study was prepared by the Office of the Chief Economist (OCE) of the International Energy Agency in co-operation with other offices of the Agency. It was designed and directed by **Fatih Birol**, Chief Economist of the IEA. **Laura Cozzi** co-ordinated the analysis of climate policy and modelling; **Amos Bromhead** co-ordinated the analysis of subsidies and nuclear; **John Corben** co-ordinated the analysis of oil and natural gas; **Marco Baroni** co-ordinated the power-generation analysis; **Tim Gould** co-ordinated the Russia analysis; **Paweł Olejarnik** co-ordinated the coal analysis; **Dan Dorner** contributed to the analysis of global trends and co-ordinated the focus on energy access. Other colleagues in the Office of the Chief Economist contributed to multiple aspects of the analysis and were instrumental in delivering the study: **Prasoon Agarwal** (transport and buildings), **Maria Argiri** (natural gas), **Christian Besson** (oil and Russia), **Alessandro Blasi** (Russia), **Raffaella Centurelli** (energy access and buildings), **Michel D'Ausilio** (power and renewables), **Dafydd Elis** (power and climate analysis), **Matthew Frank** (natural gas and subsidies), **Timur Gül** (transport and climate analysis), **Shinichi Kihara** (nuclear), **Kate Kumaria** (climate analysis), **Jung Woo Lee** (subsidies and nuclear), **Katrin Schaber** (power and renewables), **Tatsuya Tomie** (coal and power), **Timur Topalgoekceli** (oil and natural gas), **Brent Wanner** (power and subsidies), **David Wilkinson** (power, climate analysis and nuclear), **Peter Wood** (oil and natural gas), **Akira Yanagisawa** (subsidies, industry and natural gas) and **Tatiana Zhitenko** (Russia). **Sandra Mooney** provided essential support.

**Robert Priddle** carried editorial responsibility.

The study benefitted from input provided by numerous IEA experts in the Energy Statistics Division, the Energy Markets and Security Directorate, the Directorate of Global Energy Dialogue, and the Energy Policy and Technology Directorate. The Communication and Information Office was instrumental in bringing the book to completion. In particular, Christina Hood, Carlos Fernandez Alvarez, Isabel Murray, Moritz Paulus, Johannes Truby, Nathalie Trudeau and Dennis Volk provided valuable contributions. Experts from several directorates of the OECD and the Nuclear Energy Agency also contributed to the report, particularly Ron Cameron, Rob Dellink, Bertrand Magné, Helen Mountford, Ron Steenblik and Robert Vance. Thanks also go to Debra Justus for proofreading the text.

Ian Cronshaw and Trevor Morgan provided valuable input to the analysis. The following experts also contributed: Igor Bashmakov, Jan-Hein Jesse, Tatiana Mitrova and Liu Qiang.

The work could not have been achieved without the substantial support and co-operation provided by many government bodies, international organisations and energy companies worldwide, notably:

The Department of Energy and Climate Change, United Kingdom; Department of State, United States; Edison; Electric Power Development Co. Ltd, Japan; Enel; Energy Forecasting Agency (APBE), Russia; Energy Studies Institute, Singapore; Eni; Foreign and Commonwealth Office, United Kingdom; Fortum Corporation; IEA Coal Industry Advisory Board (CIAB);

Institute of Energy Economics at the University of Cologne, Germany; International Institute for Applied Systems Analysis, Austria; Intergovernmental Panel on Climate Change (IPCC); Ministère de l'écologie, du développement durable, des transports et du logement, France; Ministry of Economic Affairs, The Netherlands; Ministry of Energy, Russian Federation; Ministry of Petroleum and Energy, Norway; Norwegian Agency for Development Cooperation (NORAD); Royal Ministry of Foreign Affairs, Norway; Peabody Energy; Ministry of Knowledge Economy, Korea; Japan Gas Association, Japan; Schlumberger; Shell; Shenhua Group; Statoil; Toyota Motor Corporation; United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO).

Many international experts provided input, commented on the underlying analytical work and reviewed early drafts of each chapter. Their comments and suggestions were of great value. They include:

Saleh Abdurrahman	National Energy Council of Indonesia
Ali Aissaoui	APICORP
Marco Arcelli	Enel
Gabriela Elizondo Azuela	World Bank
Pepukaye Bardouille	International Finance Corporation, United States
Andrew Barfour	Institution of Engineers, Ghana
Andrew Barnett	The Policy Practice, United Kingdom
Yuriy Baron	Ministry of Energy, Russian Federation
Paul Baruya	IEA Clean Coal Centre, United Kingdom
Igor Bashmakov	Centre for Energy Efficiency, Russian Federation
Nicolas Bauer	Potsdam Institute for Climate Impact Research, Germany
Georg Bäuml	Volkswagen
Johannes Baur	European Commission
Nazim Bayraktar	Energy Market Regulatory Agency, EPDK, Turkey
Chris Beaton	International Institute for Sustainable Development, Switzerland
Carmen Becerril	Acciona Energia
Rachid Bencherif	OPEC Fund for International Development
Kamel Bennaceur	Schlumberger
Bruno Bensasson	GDF Suez
Mikul Bhatia	World Bank
Sankar Bhattacharya	Monash University, Australia

Alexey Biteryakov	GazpromExport
Roberto Bocca	World Economic Forum
Jean-Paul Bouttes	EdF
Albert Bressand	Columbia School of International and Public Affairs, United States
Nigel Bruce	World Health Organization, Switzerland
Peter Brun	Vestas
Michael Buffier	Xstrata Coal
David Cachot	Trafigura Beheer B.V.
Guy Caruso	Center for Strategic and International Studies, United States
Milton Catelin	World Coal Association
Sharat Chand	The Energy and Resources Institute, India
Chris Charles	International Institute for Sustainable Development, Switzerland
Hela Cheikhrouhou	African Development Bank
Elisabeth Clemens	Norwegian Agency for Development Cooperation
Ben Clements	International Monetary Fund
Janusz Cofala	International Institute for Applied Systems Analysis, Austria
Dean Cooper	United Nations Environment Programme
Alan Copeland	Bureau of Resources and Energy Economics, Australia
Hans Daniels	Alpha Natural Resources, United States
Christian De Gromard	Agence Française de Développement
Michel Deelen	Ministry of Foreign Affairs, The Netherlands
Jos Delbeke	European Commission
Carmine Difulio	Department of Energy, United States
Mark Dominik	
Gina Downes	Eskom
Józef Dubinski	Central Mining Institute, Poland
Mohamed El-Ashry	UN Foundation
Kari Espegren	Institute for Energy Technology, Norway

Donald Ewart	Marston
Vladimir Feygin	Institute of Energy and Finance, Russian Federation
Christiana Figueres	UN Framework Convention on Climate Change
Peter Fraser	Ontario Energy Board, Canada
Irene Freudenschuss-Reichl	Ambassador, Austria
Hari Kumar Gadde	World Bank
Dario Garofalo	Enel
Francesco Gattei	Eni
Dolf Gielen	International Renewable Energy Agency
Duleep Gopalakrishnan	ICF International
Rainer Görgen	Federal Ministry of Economics and Technology, Germany
Michael Grubb	University of Cambridge, United Kingdom
Howard Gruenspecht	Energy Information Administration, United States
Antoine Halff	Department of Energy, United States
Ian Hall	Anglo American
Wenke Han	Energy Research Institute, China
Brian Heath	Coal Industry Advisory Board, International Energy Agency
Sigurd Heiberg	Statoil
James Henderson	Oxford Institute for Energy Studies, United Kingdom
Antonio Hernández García	Ministry of Industry, Tourism and Trade, Spain
James Hewlett	Department of Energy, United States
Masazumi Hirono	The Japan Gas Association
Neil Hirst	Grantham Institute on Climate Change, United Kingdom
Takashi Hongo	Japan Bank for International Cooperation
Trevor Houser	Peterson Institute for International Economics
Tom Howes	European Commission
Steve Hulton	Wood Mackenzie
Esa Hyvärinen	Fortum Corporation
Catherine Inglehearn	Foreign and Commonwealth Office, United Kingdom
Fumiaki Ishida	New Energy and Industrial Technology Development Organization, Japan

James Jensen	Jensen Associates
Jan-Hein Jesse	JOSCO Energy Finance & Strategy Advisors
Marianne Kah	ConocoPhillips
Bob Kamandanu	Indonesian Coal Mining Association
Shaanti Kapila	Asian Development Bank
Ryan Katofsky	Navigant Consulting
Marlin Kees	GIZ, Germany
Hisham Khatib	Honorary Vice Chairman, World Energy Council; and former Minister of Energy, Jordan
Lucy Kitson	International Institute for Sustainable Development, Switzerland
Mikhail Klubnichkin	PricewaterhouseCoopers Russia B.V.
David Knapp	Energy Intelligence
Oliver Knight	World Bank
Kenji Kobayashi	Asia Pacific Energy Research Centre, Japan
Masami Kojima	World Bank
Hans-Jorgen Koch	Ministry of Transportation and Energy, Denmark
Doug Koplow	Earth Track, Inc.
Ken Koyama	The Institute of Energy Economics, Japan
Igor Kozhukovsky	Energy Forecasting Agency, Russian Federation
Natalia Kulichenko-Lotz	World Bank
Rakesh Kumar	PTC India
Takayuki Kusajima	Toyota Motor Corporation
Sarah Ladislaw	Center for Strategic and International Studies, United States
Georgette Lalis	European Commission
Kerryn Lang	International Institute for Sustainable Development, Switzerland
Richard Lavergne	Ministry of Economy, Finance and Industry, France
Rima Le Gocuić	Agence Française de Développement
Man-ki Lee	Korea Atomic Energy Research Institute
Christian Lelong	BHP Billiton Energy Coal

Steve Lennon	Eskom
Michael Liebreich	Bloomberg New Energy Finance
Qiang Liu	Energy Research Institute, China
Massimo Lombardini	European Commission
Philip Lowe	European Commission
Matthew Lynch	World Business Council for Sustainable Development, Switzerland
Joan MacNaughton	Alstom Power Systems
Teresa Malyshev	UNDP
Claude Mandil	Former IEA Executive Director
Samantha McCulloch	Australian Coal Association
Michael Mellish	Energy Information Administration, United States
Lawrence Metzroth	Arch Coal
Ryo Minami	Ministry of Economy, Trade and Industry, Japan
Tatiana Mitrova	Skolkovo Energy Centre, Russian Federation
Klaus Mohn	Statoil
Lucio Monari	World Bank
Koji Morita	The Institute of Energy Economics, Japan
Yuji Morita	The Institute of Energy Economics, Japan
Ed Morse	CitiGroup
Richard Morse	Stanford University, United States
Dong-Woon Noh	Korea Energy Economics Institute
Petter Nore	Norwegian Agency for Development Cooperation
Martin Oettinger	Global CCS Institute
Patrick Oliva	Michelin
Simon-Erik Ollus	Fortum Corporation
Ayşe Yasemin Örücü	Ministry of Energy and Natural Resources, Turkey
Shonali Pachauri	International Institute for Applied Systems Analysis, Austria
Jay Paidipati	Navigant Consulting
Binu Parthan	Renewable Energy & Energy Efficiency Partnership, Austria
Christian Pichat	AREVA

Jeff Piper	European Commission
Oleg Pluzhnikov	Ministry of Economic Development, Russian Federation
Roberto Potì	Edison
Ireneusz Pyc	Siemens
Maggi Rademacher	E.ON
Gustav Resch	Vienna University of Technology, Austria
Brian Ricketts	Euracoal
Hans-Holger Rogner	International Atomic Energy Agency
David Rolfe	Department of Energy and Climate Change, United Kingdom
Bert Roukens	Ministry of Foreign Affairs, The Netherlands
Assaad Saab	EdF
Bernard Saincy	GDF Suez
Alain Sanglerat	GDF Suez
Steve Sawyer	Global Wind Energy Council, Belgium
Wendy Schallom	Arch Coal
Hans-Wilhelm Schiffer	RWE
Sandro Schmidt	Federal Institute for Geosciences and Natural Resources, Germany
Philippe Schulz	Renault
Adnan Shihab-Eldin	Arabdar Consultants
P.R. Shukla	Indian Institute of Management
Maria Sicilia Salvatore	Iberdrola
Adam Sieminski	Deutsche Bank
Laura Solanko	Bank of Finland
Benjamin Sporton	World Coal Association
Robert Stavins	Harvard University, United States
James Steele	Department of State, United States
Jonathan Stern	Oxford Institute for Energy Studies, United Kingdom
Michael Stoppard	IHS CERA
Ulrik Stridbaek	Dong Energy
Greg Stringham	Canadian Association of Petroleum Producers

Supriatna Suhala	Indonesian Coal Mining Association
Cartan Sumner	Peabody Energy
Philip Swanson	Energy consultant
Minoru Takada	United Nations
Kuniharu Takemata	Electric Power Development Co., Ltd. (J-POWER)
Nobuo Tanaka	The Institute of Energy Economics, Japan
Bernard Terlinden	GDF Suez
Sven Teske	Greenpeace International
Wim Thomas	Shell
Elsbeth Thomson	Energy Studies Institute, Singapore
Simon Trace	Practical Action, United Kingdom
Samuel Tumiwa	Asian Development Bank
Jo Tyndall	Ministry of Foreign Affairs and Trade, New Zealand
Oras Tynkkynen	Member of Parliament, Finland
Maria Vagliasindi	World Bank
Coby Van der Linde	Clingendael Institute, The Netherlands
Noe van Hulst	International Energy Forum, Saudi Arabia
Wim J. Van Nes	SNV Netherland Development Organisation
Adnan Vatansever	Carnegie Endowment for International Peace, United States
Umberto Vergine	Eni
Stefan Vergote	European Commission
Frank Verraastro	Center for Strategic and International Studies, United States
Heike Volkmer	GIZ, Germany
Graham Weale	RWE
Peter Wells	Cardiff Business School, United Kingdom
Liu Wenge	China Coal Information Institute
Jacob Williams	Peabody Energy
Steven Winberg	CONSOL Energy
Peter Wooders	International Institute for Sustainable Development, Switzerland

Liu Xiaoli	Energy Research Institute of NDRC
Vitaly Yermakov	IHS CERA
Shigehiro Yoshino	Nippon Export and Investment Insurance, Japan
Alex Zapantis	Rio Tinto

The individuals and organisations that contributed to this study are not responsible for any opinions or judgements contained in this study. All errors and omissions are solely the responsibility of the IEA.

## **WORKSHOPS**

A number of workshops and meetings were held to gather essential input to this study. The workshop participants have contributed valuable new insights, feedback and data for this analysis.

Outlook for Coal Industry and Markets, Beijing: 14 April 2011

Russia Energy Outlook, Moscow: 20 April 2011

Energy for All: Financing Access for the Poor, Paris: 13 May 2011