The Future of Electricity Demand

What will electricity and heat demand look like in a low-carbon world? Ambitious environmental targets will modify the shape of the electricity sector in the twenty-first century. 'Smart' technologies and demand-side management will be some of the key features of the future of the electricity system. Meanwhile, the social and behavioural dimensions will complement and interact with new technologies and policies. Electricity demand will increasingly be tied up with the demand for heat and transport.

The Future of Electricity Demand looks into the features of the future electricity demand in light of the challenges posed by climate change. Written by a team of leading academics and industry experts, the book investigates the economics, technology, social aspects, and policies and regulations which are likely to characterize energy demand in a low-carbon world. It provides a comprehensive and analytical perspective on the future of electricity demand.

TOORAJ JAMASB is the SIRE Chair of Energy Economics at Heriot-Watt University, Edinburgh. He was previously Senior Research Associate in the Faculty of Economics and at the ESRC Electricity Policy Research Group (EPRG) at the University of Cambridge.

MICHAEL G. POLLITT is Reader in Business Economics at the Judge Business School, University of Cambridge and Fellow and Director of Studies in Economics and Management at Sidney Sussex College, Cambridge. He is also an assistant director of the ESRC Electricity Policy Research Group (EPRG).

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Customers, Citizens and Loads

Tooraj Jamasb
Michael G. Pollitt

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Contents

Figures

Tables

Boxes

Contributors

ELCIN AKCURA is a PhD Candidate at the Electricity Policy Research Group, Faculty of Economics, University of Cambridge.

GRAHAM AULT is Professor at the Institute for Energy and Environment, Strathclyde University.

MARKO AUNEDI is Research Assistant at the Control and Power Research Group, Department of Electrical and Electronic Engineering, Imperial College London.

RÉGINE BELHOMME is Project Manager, Senior Engineer, EDF SA, Research & Development Division, France.

FRANÇOIS BOUFFARD is Assistant Professor at McGill University, Canada. He was previously Lecturer at the School of Electrical & Electronic Engineering, University of Manchester, UK.

AOIFE BROPHY HANEY is a PhD Candidate at the Electricity Policy Research Group, Judge Business School, University of Cambridge.

RAMÓN CERERO REAL DE ASUA is a Control Systems Senior Engineer at Iberdrola Distribución Eléctrica, SAU, Spain.

YU-FOONG CHONG is Consultant at IPA Energy + Water Economics.

JOE A. CLARKE is Professor at the Energy Systems Research Unit, Department of Mechanical Engineering, University of Strathclyde.

FRÉDÉRIC DESOBRY is Research Associate in Signal Processing at the Department of Engineering, University of Cambridge.

HANNAH DEVINE-WRIGHT is Director at Placewise Ltd. She was previously at the University of Manchester.

PATRICK DEVINE-WRIGHT is Professor in Human Geography, University of Exeter and was previously Reader at the School of Environment and Development, University of Manchester.

ALIOUNE DIOP is Engineer at EDF SA, Research & Development Division, France.

DAMIEN FRAME is Research Assistant in the Institute for Energy and Environment, University of Strathclyde.

ELISABETH GARNSEY is Emeritus Reader in Innovation Studies, Institute for Manufacturing, University of Cambridge.

STEPHANE HESS is Reader in Choice Modelling at the Institute for Transport Studies, University of Leeds.

SIMON HILL is Research Associate in Signal Processing at the Department of Engineering, University of Cambridge.

JUN HONG is Research Fellow at the Energy Systems Research Unit, Department of Mechanical Engineering, University of Strathclyde.

NICK HUGHES is UKERC Research Student, Imperial College London and University of Strathclyde.

TOORAJ JAMASB is the SIRE Chair of Energy Economics at Heriot-Watt University, Edinburgh. He was previously Senior Research Associate in the Faculty of Economics and at the ESRC Electricity Policy Research Group (EPRG) at the University of Cambridge.

CAMERON M. JOHNSTONE is Senior Lecturer, Energy Systems Research Unit, Department of Mechanical Engineering, University of Strathclyde.

SCOTT KELLY is a PhD student at the Centre for Climate Change Mitigation Research (4CMR) and the Electricity Policy Research Group (EPRG) at the University of Cambridge.

JAE MIN KIM is Senior Research Fellow at the Energy Systems Research Unit, Department of Mechanical Engineering, University of Strathclyde.

MATTHEW LEACH is Professor in Energy & Environmental Systems and Director of the Centre for Environmental Strategy, University of Surrey.

PEDRO LINARES is Associate Professor at the Universidad Pontificia Comillas, Spain.

CRISTIANO MARANTES is Low Carbon London Solution Manager, at UK Energy Networks in London, UK.

GREGORY MARSDEN is Senior Lecturer in Transport Policy and Strategy at the Institute for Transport Studies, University of Leeds.

HELENA MEIER is Lecturer in Economics at Department of Economics, Heriot-Watt University, Edinburgh, and was previously visiting Researcher at the EPRG.

LAURA M. PLATCHKOV is Research Assistant at the Faculty of Economics, University of Cambridge.

MICHAEL G. POLLITT is Reader in Business Economics at the Judge Business School, University of Cambridge and Fellow and Director of Studies in Economics and Management at Sidney Sussex College, Cambridge. He is also Assistant Director of the ESRC Electricity Policy Research Group.

DANNY PUDJIANTO is Research Associate at the Control and Power Research Group, Department of Electrical and Electronic Engineering, Imperial College London.

DAVID M. REINER is Senior Lecturer in Technology Policy and Course Director of the MPhil in Technology Policy at the Judge Business School, University of Cambridge.

MARIA SEBASTIAN-VIANA is an Expert Engineer at EDF SA, Direction Optimisation and Trading Division, France.

VERA SILVA is a PhD Candidate at the Control and Power Research Group, Department of Electrical and Electronic Engineering, Imperial College London.

VLADIMIR STANOJEVIC is Research Assistant at the Control and Power Research Group, Department of Electrical and Electronic Engineering, Imperial College London.

JEVGENIJS STEINBUKS is Research Associate at the Faculty of Economics and Director of Economic Studies, Sidney Sussex College, University of Cambridge.

GORAN STRBAC is Professor of Electrical Energy Systems, Control and Power Research Group, Department of Electrical and Electronic Engineering, Imperial College London.

JACOPO TORRITI is Fellow in Environment at the London School of Economics. He was previously Research Associate at the Centre for Environmental Strategy, University of Surrey.

PAUL TUOHY is Lecturer, Energy Systems Research Unit, Department of Mechanical Engineering, University of Strathclyde.

GIOVANNI VALTORTA is Head of Network Operation and Maintenance at ENEL Distribuzione S.p.A., Italy.

CATHERINE WADDAMS PRICE is Director of the ESRC Centre for Competition Policy at the University of East Anglia and Professor in Norwich Business School, University of East Anglia.

JIM WATSON is Director of the Sussex Energy Group, SPRU, University of Sussex.

CHERRY YUEN is Group Leader Utility Solutions, ABB Switzerland Ltd, Switzerland.

Foreword

Until the oil shocks of the 1970s, electricity demand growth was rapid, but then slowed dramatically in developed economies, with subsequent excess capacity. Falling fuel and electricity prices from 1986 then directed attention away from the demand side. That situation has now changed. Ambitious environmental targets, rising electricity prices, rapid technical progress, combined with cheaper and better information and communication technologies, will have a dramatic impact on the electricity sector of the twenty-first century. 'Smart' technologies and demand-side management will be key features of this new electricity system. Social and behavioural changes are also likely to play an important role. Decarbonizing the economy means increasing the share of electricity, which will power cars and heat pumps, reducing the importance of oil and gas but creating new and more concentrated demand patterns. New intermittent low carbon generation and new heavy demand uses will require more flexible and responsive demand, which will require major changes to the design and operation of the electricity system, further increasing its complexity.

The UK led the world in electricity reforms starting in 1990, providing a valuable case study for other countries to learn how, and to what extent, the management of electricity demand can – or cannot – be successfully combined into a competitive energy market environment. The next wave of required reforms offers new opportunities for learning, and although this book concentrates on the UK, it draws numerous insights from, and for, other countries.

This need to reconsider the design and management of the electricity sector led the Engineering and Physical Sciences Research Council (EPSRC) to extend the SuperGen FutureNet Research Programme from 2006 for a further four years with the FlexNet Programme. This had funded a consortium of seven UK university groups bringing together a range of fruitful interdisciplinary collaborations to address the issues. The Flexnet Research Programme builds on the achievements of FutureNet and lays out the major technical, economic, market design, public

acceptance and other steps required to create flexible networks. An important part of the project is to showcase lessons to be taken up by the commercial sector, government and regulators. It has studied technologies and options needed for a more flexible energy system, and characterizes future energy demand in a low-carbon world. This will require radically new ways to produce, use, and value and price electricity, while maintaining productivity, comfort and security.

The demand side will need to become more flexible and to allow dynamic interaction between producers and consumers. This was the focus of the 'Customers, Citizens and Loads' (CCL) work stream, coordinated by the University of Manchester, which is the source of the material in this book. The CCL work stream has examined all aspects of electricity demand – economic, technical, political and social – as well as drawing on the expertise of and results from the rest of the FlexNet Programme.

We published the first book based on this work, *Future Electricity Technologies and Systems*, in 2006. It concluded that a low-carbon electricity system by 2050 was technically feasible. In 2008, a second volume – *Delivering a Low-Carbon Electricity System* – outlined what important steps needed to be undertaken by 2020 to put us on track towards such a system. *The Future of Electricity Demand* focuses on a somewhat neglected part of the electricity system, where interdisciplinary work continues to offer significant insights and where there is much to be gained from the sort of research collaboration that has produced this book. We trust you will find it as exciting as we did.

PROFESSOR DAVID NEWBERY
Director of Research,
ESRC Electricity Policy Research Group
Professor of Economics
Faculty of Economics
University of Cambridge

PROFESSOR TIM GREEN
Professor of Electrical Power Engineering
Department of Electrical and Electronic Engineering
Imperial College London

Preface

Ambitious environmental targets will modify the shape of the electricity sector in the twenty-first century. 'Smart' technologies and demand-side management will be some of the key features of the future of the electricity system in a low-carbon world. Meanwhile, the social and behavioural dimensions will complement and interact with new technologies and policies. Moreover, electricity demand will increasingly be tied up with the demand for heat and transport.

The Future of Electricity Demand explores the features of the future electricity demand in light of the challenges posed by climate change. Written by a team of leading academics and industry experts, the book investigates the economics, technology, social aspects, and policies and regulations which seem likely to characterize energy demand in a low-carbon world. The book begins by looking at the economics and the modelling of energy demand. Next, it examines the technological solutions for achieving active demand, such as smart meters, smart appliances and electric vehicles. It then turns to the social dimensions of energy, and finally to policy and regulatory instruments. It thus provides a comprehensive and analytical perspective on the future of electricity demand.

TOORAJ JAMASB
MICHAEL G. POLLITT

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TOORAJ JAMASB
MICHAEL G. POLLITT