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978-1-107-00850-2 - The Future of Electricity Demand: Customers, Citizens and Loads

Tooraj Jamasb and Michael G. Pollitt

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## 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.

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# The Future of Electricity Demand

*Customers, Citizens and Loads*

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Tooraj Jamasb

Michael G. Pollitt



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Contents

<i>List of figures</i>	page xii
<i>List of tables</i>	xvii
<i>List of boxes</i>	xix
<i>List of contributors</i>	xxi
<i>Foreword</i>	xxv
<i>Preface</i>	xxvii
<i>Acknowledgements</i>	xxviii
 Introduction and overview of the chapters	 1
TOORAJ JAMASB, LAURA M. PLATCHKOV AND MICHAEL G. POLLITT	
Opening remarks	1
Structure of the book	2
Overview of the main chapters	4
Part I: The economics	4
Part II: Technology	6
Part III: Social dimensions	8
Part IV: Policy and regulation	10
Conclusions	13
References	14
 <b>Part I: The economics</b>	
 1 The economics of energy (and electricity) demand	 17
LAURA M. PLATCHKOV AND MICHAEL G. POLLITT	
1.1 Introduction	17
1.2 The long-run macroeconomic context of energy demand	19
1.3 The long-run microeconomic context of energy demand	29
1.4 Conclusions on the economics of electricity demand	43
References	45
 2 Energy scenarios and implications for future electricity demand	 48
GRAHAM AULT, DAMIEN FRAME AND NICK HUGHES	

vi	Contents	
	2.1 Introduction	48
	2.2 Overview	49
	2.3 Scenarios	52
	2.4 Big transmission and distribution ('switch me on')	55
	2.5 Energy services companies ('fix it for me')	61
	2.6 Distribution system operators (government-led green agenda)	67
	2.7 Microgrids (dynamic green markets)	74
	2.8 Discussion with respect to future electricity demand	80
	2.9 Implications and conclusion	84
	References	86
3	Demand-side participation: price constraints, technical limits and behavioural risks	88
	JACOPO TORRITI, MATTHEW LEACH AND PATRICK DEVINE-WRIGHT	
	3.1 Introduction	88
	3.2 The constraints to demand-side participation	90
	3.3 Overview of European experiences on demand-side participation	94
	3.4 Description of the social aspects of flexibility in demand response, particularly issues of psychological motivation and social acceptance	97
	3.5 Incentivizing demand-side participation through incentive/payment schemes for the end-user	98
	3.6 Conclusions	102
	References	103
4	Review of recent developments in economic modelling of energy demand	106
	JEVGENIJS STEINBUKS	
	4.1 Introduction	106
	4.2 Input substitution	107
	4.3 Energy efficiency	116
	4.4 Change in industrial structure	118
	4.5 Technological change	119
	4.6 Conclusions	121
	References	122

**Part II: Technology**

5	Demand-side management and control in buildings	129
	JUN HONG, CAMERON M. JOHNSTONE, JAE MIN KIM AND PAUL TUOHY	
	5.1 Introduction	129
	5.2 Drivers for DSM and control within buildings	129
	5.3 DSM	133
	5.4 Micro-level demand-side management and control (DSM+c)	136

Contents	vii
5.5 Strategic- and operational-level DSM+c algorithms implementation	148
5.6 Future uptake	157
References	158
6 Smart metering: technology, economics and international experience	161
AOIFE BROPHY HANEY, TOORAJ JAMASB AND MICHAEL G. POLLITT	
6.1 Introduction	161
6.2 Context for smart metering	162
6.3 Economic assessment of smart metering	169
6.4 Lessons from international experience	175
6.5 Conclusions	180
References	181
7 Smart domestic appliances as enabling technology for demand-side integration: modelling, value and drivers	185
VERA SILVA, VLADIMIR STANOJEVIC, MARKO AUNEDI, DANNY PUDJANTO AND GORAN STRBAC	
7.1 Introduction	185
7.2 Role of smart appliances	186
7.3 Consumer acceptance	190
7.4 Framework to quantify the value of smart appliances as a source of flexibility	193
7.5 Quantification of the value of smart appliances	197
7.6 Conclusion	210
References	210
8 The scope for and potential impacts of the adoption of electric vehicles in UK surface transport	212
GREGORY MARSDEN AND STEPHANE HESS	
8.1 Transport and energy in the UK	212
8.2 Technological prospects	215
8.3 Consumer preferences and adoption rates	218
8.4 Impacts on the demand for electricity	221
8.5 Other supporting policies	223
8.6 Conclusions	224
References	225
<b>Part III: Social dimensions</b>	
9 From citizen to consumer: energy policy and public attitudes in the UK	231
ELCIN AKCURA, AOIFE BROPHY HANEY, TOORAJ JAMASB AND DAVID M. REINER	
9.1 Introduction	231

viii	Contents	
	9.2 Public attitudes, behaviour and energy policy	232
	9.3 EPRG survey design and implementation	236
	9.4 Survey results	239
	9.5 Conclusions	246
	References	247
10	The local dimension of energy	249
	SCOTT KELLY AND MICHAEL G. POLLITT	
	10.1 Introduction	249
	10.2 Defining local energy	251
	10.3 The context for local energy solutions	254
	10.4 Reconciling local government strategy with local energy solutions	256
	10.5 Lessons learned from the localization of energy generation in Europe	260
	10.6 Local dimensions of energy demand in the UK	264
	10.7 Conclusion	275
	References	275
11	Centralization, decentralization and the scales in between: what role might they play in the UK energy system?	280
	JIM WATSON AND PATRICK DEVINE-WRIGHT	
	11.1 Introduction	280
	11.2 What is ‘decentralized energy’?	281
	11.3 Scale and the current energy system	283
	11.4 Drivers for changes in scale	284
	11.5 Conclusions	293
	References	295
12	Equity, fuel poverty and demand (maintaining affordability with sustainability and security of supply)	298
	CATHERINE WADDAMS PRICE	
	12.1 Introduction	298
	12.2 The citizen and consumer in energy markets	298
	12.3 Fuel poverty in the UK	305
	12.4 Public response and policies for reducing fuel poverty	309
	12.5 Fuel poverty and policies in other countries	311
	12.6 Concluding remarks	314
	References	315
13	Energy spending and vulnerable households	318
	TOORAJ JAMASB AND HELENA MEIER	
	13.1 Introduction	318
	13.2 Background and past studies	319
	13.3 Types of vulnerable households	321
	13.4 Data	323
	13.5 Vulnerable households and energy spending	324

Contents	ix
13.6 Drivers of fuel poverty	328
13.7 Discussion and conclusions	331
References	332

**Part IV: Policy and regulation**

14 Demand-side management strategies and the residential sector: lessons from the international experience	337
AOIFE BROPHY HANEY, TOORAJ JAMASB, LAURA M. PLATCHKOV AND MICHAEL G. POLLITT	
14.1 Introduction	337
14.2 The residential energy demand: key features	339
14.3 Barriers to energy efficiency in the residential sector	344
14.4 Demand-side management policies	347
14.5 Policy packages and the importance of comprehensiveness	367
14.6 Conclusion	372
References	374
15 Electricity distribution networks: investment and regulation, and uncertain demand	379
TOORAJ JAMASB AND CRISTIANO MARANTES	
15.1 Introduction	379
15.2 Distribution networks and their operating environment	380
15.3 Regulation of active network and demand	383
15.4 Demand for distribution services and drivers of investment	385
15.5 Model description	387
15.6 Relevance of the model for active network and demand and concluding remarks	398
References	399
16 The potential impact of policy and legislation on the energy demands of UK buildings and implications for the electrical network	401
JOE A. CLARKE, JUN HONG, CAMERON M. JOHNSTONE, JAE MIN KIM AND PAUL G. TUOHY	
16.1 Introduction	401
16.2 EU policy, legislation and standards relating to energy performance of buildings	401
16.3 UK policy, legislation and standards relating to energy performance of buildings	404
16.4 The probable buildings of the future?	407
16.5 Other factors influencing the probable buildings of the future	413
16.6 Impact of probable future buildings on energy demand and supply choices	417



x	Contents	
	16.7 Discussion	419
	16.8 Conclusions	421
	References	421
17	The ADDRESS European Project: a large-scale R&D initiative for the development of active demand	423
	FRANÇOIS BOUFFARD, RÉGINE BELHOMME, ALIOUNE DIOP, MARIA SEBASTIAN-VIANA, CHERRY YUEN, HANNAH DEVINE-WRIGHT, PEDRO LINARES, RAMÓN CERERO REAL DE ASUA AND GIOVANNI VALTORTA	
	17.1 Introduction	423
	17.2 The ADDRESS architecture	425
	17.3 Needs and expectations of power system participants with respect to active demand	427
	17.4 Active demand services and products	428
	17.5 The need for aggregation	431
	17.6 The value of active demand and its markets	432
	17.7 Active demand process architecture	434
	17.8 A simple example of market clearing process	438
	17.9 The potential benefits and acceptance of active demand	441
	17.10 Conclusion	443
	Acknowledgement	443
	References	443
18	Daylight saving, electricity demand and emissions: the British case	445
	YU-FOONG CHONG, ELIZABETH GARNSEY, SIMON HILL AND FRÉDÉRIC DESOBRY	
	18.1 Introduction	445
	18.2 Background	445
	18.3 Evidence and policy	446
	18.4 US and UK clock time policy	450
	18.5 Activity patterns of the UK population	451
	18.6 Analyzing the potential for winter daylight saving	453
	18.7 Peak demand and cost effects	456
	18.8 The impact of advancing the clock by an hour all year	457
	18.9 Scottish and European Union issues	457
	18.10 Implications and conclusions	459
	References	460
19	Concluding reflections on future active networks and the demand-side for electricity	464
	TOORAJ JAMASB AND MICHAEL G. POLLITT	
	19.1 Introduction	464
	19.2 Technology and R&D	465

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Frontmatter  
[More information](#)

Contents	xi
19.3 Utilities, consumers and communities	466
19.4 Economics and policy	467
19.5 Society and political economy	468
References	468
<i>Index</i>	469

Figures

1.1 UK final electricity consumption by sector, 1960–2009	<i>page 18</i>
1.2 UK domestic energy consumption by end use, 1970–2008	18
1.3 Income as a driver of energy consumption – energy use per head versus GDP per head, 1972–2008	20
1.4 Price as a driver of energy consumption – energy intensity versus energy prices	20
1.5 Price as a driver of electricity consumption: 2008 data	21
1.6 The role of relative input prices in long-run economic development: price of labour relative to energy, early 1700s	22
1.7 How long-run technological change drives prices of energy services: price of light 1800–1950	23
1.8 How falling prices have driven long-run demand for energy services: demand for light	24
1.9 UK energy expenditure as a percentage of GDP	26
1.10 UK energy and communications services expenditure as a percentage of GDP	28
1.11 Shares of different devices in household electricity demand in the UK, 1970–2009	37
1.12 UK daily power prices, 2009	39
1.13 The components of household energy demand at system peak	40
2.1 LENS scenario terminology	49
2.2 Key to pictogram symbols	54
2.3 Big T&D pictogram	59
2.4 ESCO pictogram	65
2.5 DSO pictogram	72
2.6 Microgrids pictogram	79
5.1 Load shift module identifying whole load shift	141

List of figures	xiii
5.2 Load shift module identifying part load shift	142
5.3 Demand–supply appraisal flow chart	144
5.4 DSM+c algorithm when applied at the strategic level	149
5.5 Framework for implementing DSM+c at the operational level	152
5.6 Simulation-based DSM+c as applied at the strategic level	154
5.7 Internet-enabled energy system architecture	155
5.8 Case study architecture for demand control implementation	156
5.9 Case study results	158
7.1 Vision of smart appliances implementation structure	187
7.2 Payback effect generated by the process of energy restoration	188
7.3 Total demand from domestic appliances in the UK	189
7.4 Diversified demand of a WM in the UK	191
7.5 Consumption of a WM per washing cycle (reference temperature of 40°)	191
7.6 Appliance shifting algorithm	194
7.7 Structure of the system scheduling algorithm	196
7.8 Structure of the network congestion algorithm	197
7.9 Estimated number of appliances starting a cycle during a day	200
7.10 Annual value per appliance	200
7.11 Reduction in wind curtailed driven by smart appliances	201
7.12 Annual value per appliance for different appliances for the LF system	202
7.13 Reduction in CO <sub>2</sub> emissions driven by smart appliances	202
7.14 Annual savings from DD per appliance	204
7.15 Sixteen bus-bar representation of the UK system	207
7.16 Impact of the size of controllable load to the congestion costs and value of DSM	209
9.1 Top three choices of respondents on areas in need of urgent attention and improvement	239
9.2 National energy policy priorities	240
9.3 National energy policy priorities split by age	241
9.4 How concerned are you that UK is becoming dependent on foreign sources of energy?	242
9.5 To what extent are energy prices affecting your overall financial situation?	243

xiv	List of figures	
9.6	Household rating of electricity suppliers on maintaining reasonable prices	243
9.7	Number of blackouts experienced in the past year	244
9.8	Reasons for switching suppliers	245
10.1	Graphical representation between centralized energy, local energy, community energy and micro-energy	252
10.2	Trends in the annual mean installed power generation capacity of new power-generation facilities compared with the annual total number of new installations	254
10.3	Energy consumption from local authority buildings and facilities	257
10.4	Breakdown of CO <sub>2</sub> emissions from local authority-owned infrastructure (excluding social housing energy consumption)	258
10.5	The EU share of generating capacity coming from CHP	265
10.6	Growth of CHP capacity in the UK (1977–2006)	269
13.1	Real gas and electricity price index	324
13.2	Share of fuel-poor households subdivided into vulnerable groups	325
13.3	All and low-income households	326
13.4	All and pensioner households	327
13.5	All and IS/JSA recipient households	327
13.6	All and female single-parent households	328
14.1	UK energy consumption by end use, 1970–2008	342
14.2	Decomposition of changes in heating per capita, 1990–2005	343
14.3	Useful space heating intensity	343
14.4	Combined effects of MEPS, rebates and labels	366
14.5	Actors involved in DSM policies in the UK, Denmark and Germany	369
14.6	Type of measures implemented in the UK, Denmark and Germany	370
15.1	Average annual domestic electricity consumption per meter point	389
15.2	Comparison of measures of residential demand in three EDF energy networks service areas: LPN, SPN and EPN	391
15.3	Average annual industrial and commercial electricity consumption per employee	393
15.4	Regional demand growth in 2010, 2015 and 2020	394

List of figures	xv
15.5 Primary substations risk level in 2010, 2015 and 2020	396
16.1 The example office	409
16.2 Carbon performance and energy ratings for the naturally ventilated (NV) design options calculated using SBEM	411
16.3 Carbon performance and energy ratings for the mechanically ventilated (MV) design options with heat recovery and no cooling	411
16.4 Carbon performance and energy ratings for the mechanically ventilated and cooled (HVAC) design options	411
16.5 High-carbon-intensity grid similar to current situation with overall grid and carbon-fuelled generation intensities of 0.54 and 0.73 kgCO <sub>2</sub> /kWh respectively	414
16.6 Carbon intensity of grid with significant decarbonization, overall grid and carbon-fuelled generation intensities of 0.30 and 0.40 kgCO <sub>2</sub> /kWh respectively	415
16.7 Payback (years) analysis for individual measures applied to three different dwelling types for the higher feed-in tariff case	416
16.8 Energy demand (kWh/m <sup>2</sup> p.a.) for semi-detached dwelling to different standards	416
16.9 Delivered energy (kWh/m <sup>2</sup> p.a.) for semi-detached dwelling to different standards	417
16.10 Delivered energy (kWh/m <sup>2</sup> p.a.) by fuel type for semi-detached dwelling to different standards	418
17.1 Scope and simplified representation of the ADDRESS architecture	426
17.2 AD product standardized delivery process	430
17.3 Overview of an aggregator's internal functionalities	431
17.4 Process architecture diagram	435
17.5 UML diagram showing the commercial interaction between players	437
17.6 UML diagram showing the technical interaction between players	438
17.7 Uniform price market clearing	439
17.8 Principle of 'all-or-nothing' bids	440
17.9 Relationships between the market and its participants	440
18.1 Sleeping and waking patterns for selected sunrise and sunset times	452

xvi	List of figures	
18.2	UK leisure patterns – percentage of respondents engaged in leisure pursuits outside the home	453
18.3	Changes in average demand during weeks on spring clock changes	454
18.4	Changes in average demand during weeks on autumn clock changes	455

Tables

1.1 Global drivers of energy consumption: increase in energy consumption 1973–90	<i>page</i> 25
1.2 Lifetime costs of certain energy-related services	35
2.1 LENS scenarios and themes	53
2.2 Big T&D modelling results summary	60
2.3 ESCO modelling results summary	66
2.4 DSO scenario modelling results summary	73
2.5 Microgrid scenario modelling results summary	81
2.6 Total electricity demand across scenarios for years 2000, 2025 and 2050	82
3.1 EU 15 smart metering deployment and demand-side participation projections	95
5.1 Various control priorities, methods and durations for residential appliances	138
6.1 Smart meter functionality	168
6.2 Summary of international costs	170
6.3 Smart meter costs in the UK	171
6.4 Allocation of smart metering costs	175
6.5 Allocation of smart metering benefits	176
6.6 International roll-outs	177
6.7 Smart pricing trials	180
7.1 Smart appliances acceptance survey	192
7.2 Wind-installed capacity and penetration scenarios	198
7.3 Conventional generation plant mix	198
7.4 Smart appliances information	199
7.5 Capacity of different generation technologies in DD studies	203
7.6 Annual savings and emission reduction from dynamic demand	204
7.7 Range of smart appliances' value for different applications	205
7.8 Investment cost of different smart appliances	206
7.9 Generation data for 16-bus system	208
7.10 Impact of DSM on system resources utilization	208
	xvii



xviii	List of tables	
8.1	Energy consumption in the transport sector	213
8.2	Petroleum consumption for road transport 1997–2007	214
8.3	Electric vehicle specifications	216
8.4	Projections of demand for electricity from EV and PHEV	222
9.1	National Statistical Office survey results on percentage of sample that used the Internet in the past three months prior to the survey	238
9.2	Households with Internet access by region (%), UK, 2006, 2007	238
10.1	A framework to identify modes of governance for implementing local energy solutions	261
10.2	Energy intensity of the economy: gross inland consumption of energy divided by GDP at constant prices in 2006	263
11.1	The spectrum of energy system scales	282
11.2	Scale in the Foresight ‘SEMBE’ scenarios	284
11.3	Routes for public engagement and scales of energy systems	291
12.1	Characteristics of gas and electricity prepayment households, £s, 2004–5	304
12.2	Characteristics of prepayment and other domestic consumers	305
12.3	Overlap between fuel poverty and other measures of deprivation, average 2003–5, millions of households	306
12.4	Households in fuel poverty 1996–2010, UK	307
13.1	Mean values for different household types	329
14.1	Barriers to energy efficiency in the building sector	345
14.2	Major demand-side policies in the residential sector and their definition	349
14.3	Assessment of individual policies	352
14.4	Estimated impacts of some implemented policies	357
15.1	Measures of residential electricity demand	390
16.1	Key to graph labels for combinations of construction and system performance levels	412
16.2	Delivered energy by fuel type (kWh/m <sup>2</sup> p.a.) for semi-detached dwelling to different standards	419
17.1	Needs of system operators and their fulfilment by means of AD	428
17.2	AD products and their main characteristics	430
18.1	Studies on the impact of extending DST on electricity usage	447

Boxes

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2.1 ‘Big T&D’ scenario summary	<i>page</i> 55
2.2 ESCOs scenario summary	61
2.3 DSOs scenario summary	67
2.4 Microgrids scenario summary	74

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xxiv      List of contributors

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Tooraj Jamasb and Michael G. Pollitt

Frontmatter

[More information](#)

## Foreword

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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

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[More information](#)

xxvi Foreword

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.

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## Preface

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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.

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Frontmatter

[More information](#)

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