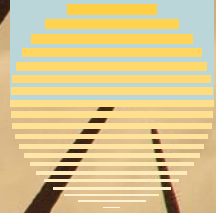


ENERGY,  
CLIMATE AND  
THE ENVIRONMENT



A CRITICAL REVIEW OF  
SCOTTISH RENEWABLE  
AND LOW CARBON  
ENERGY POLICY

EDITED BY  
GEOFFREY WOOD  
AND KEITH BAKER



# Energy, Climate and the Environment

Series editor  
David Elliott  
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**Aim of the Series**

The aim of this series is to provide texts which lay out the technical, environmental and political issues relating to proposed policies for responding to climate change. The focus is not primarily on the science of climate change, or on the technological detail, although there will be accounts of this, to aid assessment of the viability of various options. However, the main focus is the policy conflicts over which strategy to pursue. The series adopts a critical approach and attempts to identify flaws in emerging policies, propositions and assertions. In particular, it seeks to illuminate counter-intuitive assessments, conclusions and new perspectives. The intention is not simply to map the debates, but to explore their structure, their underlying assumptions and their limitations. The books in this series are incisive and authoritative sources of critical analysis and commentary, clearly indicating the divergent views that have emerged whilst also identifying the shortcomings of such views. The series does not simply provide an overview, but also offers policy prescriptions.

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Editors

A Critical Review of  
Scottish Renewable  
and Low Carbon  
Energy Policy

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*To Mark Rylatt, in lieu of beer, and to Yana,  
Katya and Ira, my motivation.*

## SERIES EDITOR PREFACE

Concerns about the potential environmental, social and economic impacts of climate change have led to a major international debate over what could and should be done to reduce the emissions of greenhouse gases. There is still a scientific debate over the likely *scale* of the severity of climate change and the complex interactions between human activities and climate systems, but global average temperatures have risen, and the cause is almost certainly the observed build-up of atmospheric greenhouse gases.

Whatever we now do, there will have to be a lot of social and economic adaptation to climate change—preparing for increased flooding and other climate related problems. However, the more fundamental response is to try to reduce or avoid the human activities that are causing climate change. That means, primarily, trying to reduce or eliminate the emission of greenhouse gases from the combustion of fossil fuels. Given that around 80% of the energy used in the world at present comes from these sources, this will be a major technological, economic and political undertaking. It will involve reducing demand for energy (via lifestyle choice changes and policies enabling such choices to be made), producing and using whatever energy we still need more efficiently (getting more from less), and supplying the reduced amount of energy from non-fossil sources (basically switching over to renewables and/or nuclear power).

Each of these options opens up a range of social, economic and environmental issues. Industrial society and modern consumer cultures have

been based on the ever-expanding use of fossil fuels, so the changes required will inevitably be challenging. Perhaps equally inevitable are disagreements and conflicts over the merits and demerits of the various options and in relation to strategies and policies for pursuing them. These conflicts and associated debates sometimes concern technical issues, but there are usually also underlying political and ideological commitments and agendas which shape, or at least colour, the ostensibly technical debates. In particular, at times, technical assertions can be used to buttress specific policy frameworks in ways which subsequently prove to be flawed.

The aim of this series is to provide texts which lay out the technical, environmental and political issues relating to the various proposed policies for responding to climate change. The focus is not primarily on the science of climate change, or on the technological detail, although there will be accounts of the state of the art, to aid assessment of the viability of the various options. However, the main focus is the policy conflicts over which strategy to pursue. The series adopts a critical approach and attempts to identify flaws in emerging policies, propositions and assertions. In particular, it seeks to illuminate counter-intuitive assessments, conclusions and new perspectives.

The present text is no exception in exploring the ambitious renewable energy programme underway in Scotland. Scotland is aiming to expand the output of renewables, so that they generate the annual equivalent of all its electricity consumption by 2020. At the time of writing, it has reached over 60%, well ahead of most other countries in the world, apart from those with large existing hydro capacities.

Scotland remains part of the UK, at least for the present, but it has a devolved government, led by the Scottish National Party (SNP), and its policies on energy are clearly different from those of the Westminster Government, including its opposition to new nuclear. The UK's vote in 2016 in favour of leaving the EU may lead Scotland to seek another referendum on independence from the UK, since the EU referendum showed a significant majority of Scots wanted to stay in the EU. In which case, its energy policy could diverge even more. That is speculative, but what is no longer speculative is Scotland's ability to install and operate increasing amounts of renewable capacity.

That is not to say there are no critics of Scotland's renewable energy programme; some depict it as foolish or at least of limited value and high cost. Some of the criticisms are simply due to disbelief that renewables



such as wind energy (now the dominant renewable in Scotland) can work effectively on a very large scale, without massive backup. Certainly, balancing issues are coming to the fore. Some critics also resent the SNP's opposition to nuclear power, which they see as a vital component of a balanced system. The chapter on nuclear in this book reflects that view and suggests a rethink may be in order, or at least full consideration of what the phase-out of the two Scottish nuclear plants would imply. Much of the rest of the book, in effect, offers some ideas for new areas of development, in addition to wind power (which seems likely to remain the main option), with chapters on marine energy (wave and tidal), community energy projects and energy efficiency, including heating issues, a key area for the future, so far poorly addressed in Scotland, as in the UK.

Clearly, there are many options and some urgent policy and development issues to be faced, and this book offers a guide to how a devolved, and possibly independent, Scottish Government could address them. Not all of the issues are addressed fully in this book. Although it sets the wider scene, it focuses on non-fossil energy options: renewables, nuclear power and energy efficiency. So it does not cover fossil fuel issues in any detail, apart from CCS, and only delves briefly into transport issues, focusing on user behaviour rather than technology. Nevertheless, it still provides a timely and critical account of the potential and likely problems of what many see as a brave attempt to accelerate renewables, so that they can meet most energy needs, while also allowing for continued export of electricity.

Milton Keynes, UK

David Elliott

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# ABBREVIATIONS

AGR	Advanced Gas-Cooled Reactor
ASHP	Air Source Heat Pumps
BREDEM	Building Research Establishment's Domestic Energy Model
CARES	Community and Renewable Energy
CCL	Climate Change Levy
CCS	Carbon Capture and Storage
CE	Crown Estate
CERT	Carbon Emissions Reduction Target
CES	Community Energy Scotland
CESP	Community Energy Saving Programme
CfD FiT	Contract for Difference Feed-in Tariff
CHP	Combined Heat and Power
CO <sub>2</sub>	Carbon Dioxide
CoE	Cost of Energy
DCC	Data Communications Company
DECC	Department for Energy and Climate Change (closed as of 2016 with the energy component merged into the new Department for Business, Energy and Industrial Strategy)
DEMScot2	Domestic Energy Model for Scotland
DETI	Department of Enterprise, Trade and Investment (Northern Ireland)
DNV	Det Norske Veritas
EAP	Energy Assistance Package
ECI	Energy Consumption Indicators
ECO	Energy Company Obligation
EDF	Electricité de France

EES	Energy Efficiency Commitment
EIA	Environmental Impact Assessment
EIS	Enterprise Investment Scheme
EMEC	European Marine Energy Centre
EMR	Electricity Market Reform
ENSG	Electricity Networks Strategy Group
ENTSO-E	European Network Transmission System Operator—Electricity
EPSRC	Engineering and Physical Sciences Research Council
ERDF	European Regional Development Fund
EST	Energy Saving Trust
ETI	Energy Technologies Institute
ETP	Energy Technology Partnership
EU	European Union
FiT	Feed-in Tariff
GB	Great Britain
GHG	Greenhouse Gas
GSHP	Ground Source Heat Pumps
HICEC	Highlands and Islands Community Energy Company
HIE	Highlands and Islands Enterprise
HIS	Home Insulation Scheme
IEA	International Energy Agency
IRENA	International Renewable Energy Association
kV	Kilovolt
LCF	Levy Control Framework
LCoE	Levelised Cost of Energy
LEED	Leadership in Energy and Environmental Design
LRRG	Land Reform Review Group
MEA	Marine Energy Accelerator
MEAD	Marine Energy Array Demonstrator
MEG	Marine Energy Group
MESAT	Marine Energy Supporting Array Technologies
MFA	Marine Farm Accelerator
MRCF	Marine Renewables Commercialisation Fund
MRPF	Marine Renewables Proving Fund
NERC	Natural Environment Research Council
NFFO	Non-Fossil Fuel Obligation
NGO	Non-Governmental Organisation
NIE	Northern Ireland Executive
NIRO	Northern Ireland Renewables Obligation
NPF	National Planning Framework (Scotland)
O&G	Oil and Gas
OECD	Organisation for Economic Cooperation and Development



OES	Ocean Energy System
OFGEM	Office for Gas and Electricity Markets
ORE	Offshore Renewable Energy Catapult
OWCRTF	Offshore Wind Cost Reduction Task Force
PCA	Personal Carbon Allowances
PMSS	Project Management Support Services Limited
PPA	Power Purchase Agreement
PV	Photovoltaic (also called Solar Photovoltaic)
R&D	Research and Demonstration
RDF	Rural Development Fund (Scotland)
rdSAP	Reduced Data Standard Assessment Procedure
RECAI	Renewable Energy Country Attractiveness Index
RECO	Residential Energy Conservation Ordinance
REIF	Renewable Energy Investment Fund
RES-E	Electricity Generated from Renewable Energy Sources
RET	Renewable Electricity Technology
RHI	Renewable Heat Incentive
RO	Renewables Obligation
ROC	Renewables Obligation Certificate
ROS	Renewables Obligation Scotland
rUK	Rest of the UK (In the event Scotland becomes independent from the UK)
SAP	Standard Assessment Procedure
SBEM	Simplified Building Energy Model
SEEP	Scotland's Energy Efficiency Programme
SEIS	Seed Enterprise Investment Scheme
SEP	Smart Energy Profile
SHCS	Scottish House Conditions Survey
SMRU	Scottish Marine Research Unit
SNH	Scottish Natural Heritage
SNP	Scottish National Party
SO	System Operator
SPS	Strategy and Policy Statement
SROC	Scottish Renewable Obligation Certificate
TRL	Technology Readiness Level
TSB	Technology Strategy Board
UK	United Kingdom
UN	United Nations
US	United States (or United States of America)
WATERS	Wave and Tidal Energy: Research, Development and Demonstration Support
WEC	Wave Energy Converter
WHO	World Health Organisation

## NOTE ON UNITS

- Power units      The power using or generating capacity of devices is measured in watts, or more usually kilowatts (kW) ( $1 \text{ kW} = 1,000 \text{ W}$ ). Larger units are megawatts (MW) (1,000 kW), gigawatts (GW) (1,000 MW) and terawatts (TW) (1,000 GW).
- Energy units      The kilowatt-hour (kWh) is the standard unit by which electricity is sold—1 kWh is the energy produced/consumed when a 1 kW rated generator/energy-consuming device runs for 1 h. A megawatt-hour (MWh) is 1,000 kWh. Similarly,  $1,000 \text{ MWh} = 1 \text{ GWh}$  and so on.

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PART I

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Opportunities and Limitations

# Introduction: Aye. Naw. Mibbe.

*Geoffrey Wood and Keith Baker*

## 1.1 INTRODUCTION

*Aye. Naw. Mibbe.*<sup>1</sup> Three words that perfectly capture the astonishing and unparalleled series of recent events in Scottish politics held in a Death Star-like grip by the issues of independence, devolution, governance and the right for Scotland to gain increasing control over its own affairs. *Will we? Should we? Could we?* Vote for independence? Further devolution? Retain the existing settlement? Not as simple as they first seemed, these questions opened up the very nature of the existing and future relationship between Scotland and the United Kingdom (UK). In short, these interdependent, complex issues can be termed the ‘independence debate’, and it is one that shows no signs of resolution or fading away.

Indeed, it has become one of the defining points of the new millennium in Scotland and the wider UK, from the resurgence of the

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independence debate with the Scottish National Party (SNP) winning power in 2007 and every election north of the border since, to the 2014 independence referendum and the prematurely proclaimed demise of the idea, to an unexpected and painfully unprepared Brexit, and now on towards a second referendum and calls for a fundamentally altered UK, particularly in terms of how it is perceived and operates on the global stage.

This book, with its unique focus on Scottish renewable and low-carbon energy policy and practice that critically reviews the opportunities and challenges going forward, both real and plausible, is a contribution to this ongoing debate. It can be argued that the contemporary origins of the independence debate appeared with the discovery of commercially viable hydrocarbon reserves in the Scottish North Sea and the emergence of calls for independence culminating in the failed 1978 devolution vote. It is therefore right that renewable and low-carbon energy should play centre stage in the debate being carried out now, in a world facing the threat of climate change, energy security concerns and the potential economic and political gains from developing domestic and export capabilities and resultant job growth. The world is moving towards a sustainable low-carbon transition, with many arguing that renewable energy has already reached a tipping point<sup>2</sup> as sustainable technologies become economically viable, investment levels soar year-on-year and novel technologies become increasingly embedded within the political, industry and public consciousness and as what appeared only recently to be virtually impossible becomes more and more a reality.

For now, the people of Scotland have decided to stay as part of the UK, although by a slimmer majority than many on both sides of the debate thought possible. Despite the UK overall voting to leave the European Union (EU), Scotland (along with Northern Ireland and Gibraltar) also voted overwhelmingly to remain within the EU in contrast to England and Wales. Once again, the independence debate has arisen with a vengeance on the back of the EU referendum and the attitude of a UK government favouring a hard Brexit. And once again, further devolution or independence is firmly back on the political table. Although future developments are invariably difficult to determine in advance, it may seem strange to publish a book on Scottish energy policy before knowing the outcome of the ongoing debate; however, its timing is deliberate for a number of reasons. Let us explain why.

First of all, it allows us to present opinion that is agnostic of the results whilst being cognisant of the evidence of how things are likely

to change, or not, under either outcome. Secondly, either outcome will still lead to at least several years of negotiations over policies that will affect the populations of both sides of the border, with energy policy being a key and potentially highly polarising example. So, it would be unwise to assume Scotland's energy future will be dramatically different. But finally, and most importantly, and as discussed in the chapters to follow, the seeds of that energy future were sown long before the SNP took the power needed to enact its mandate of putting the question to the people, and the implications of long-term energy policies set years before the debate will be felt for many years to come and, to a greater or lesser extent, regardless of the outcome.

Ask any Scot what they think the country's biggest energy issues are and their likely answer will include the oil industry, wind farms or nuclear power. The majority of Scots oppose nuclear power, like wind farms, and would like a bigger share of the income from the oil industry, and so it came as no surprise when these became big political footballs in the lead up to the referendum. However, the outcome of the referendum will have little bearing on these issues—the development of any new wind farms or nuclear plants is already largely in the hands of the Scottish Government and in the long term the country will still need to wean itself off oil—so any future government would be unlikely to change direction on them without a significant shift in public opinion. As such they have served as convenient distractions from other more contentious games being played out in the run-up to the referendum, especially where their devolutionary status means they can be held hostages to fortune, and neither side can claim to be innocent of this.

For this reason, the emphasis of this book is very much on the *critical*, and so we have brought together contributions from experts from across the field of energy policy research and encouraged them to pull no punches in their analyses. Supporters of either side will find little solace here. Whilst the Scottish Government has racked up numerous achievements in decarbonising the energy sector, it has shied away from other opportunities to tackle both supply and demand, either directly or through influencing Westminster. And whilst there is little doubt that it has pursued a far more progressive strategy than that inflicted on England and Wales, this gulf between Scotland and the rest of the UK is significantly widened by the scale of Westminster's failures.

Our planet does not much care for the outcome of a decision that will affect the nature of an arbitrary line drawn across an island, and climate