



THE SOCIAL DYNAMICS OF CARBON CAPTURE AND STORAGE

UNDERSTANDING CCS REPRESENTATIONS,
GOVERNANCE AND INNOVATION

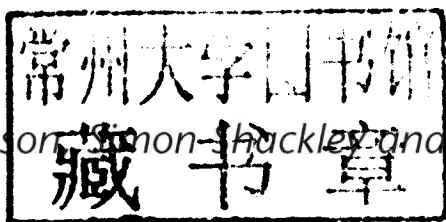
EDITED BY
NILS MARKUSSON, SIMON SHACKLEY
AND BENJAMIN EVAR

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THE SOCIAL DYNAMICS OF CARBON CAPTURE AND STORAGE

Understanding CCS Representations,
Governance and Innovation

*Edited by Nils Markusson, Simon Shackley and
Benjamin Evar*



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THE SOCIAL DYNAMICS OF CARBON CAPTURE AND STORAGE

Carbon capture and storage (CCS) has emerged rapidly as a crucial technological option for decarbonising electricity supply and mitigating climate change. Great hopes are being pinned on this new technology but it is also facing growing scepticism and criticism. This book is the first to bring together the range of social and policy issues around CCS, shedding new light on this potentially vital technology and its future.

The book covers many crucial topics including the roles and positions that the public, and different NGOs, industries, political parties and media are taking up; the way CCS is organised, supported and regulated; how CCS is being debated and judged; how innovation, demonstration and learning are occurring and being conceptualised and promoted; and the role of CCS in the transition to a low carbon energy future.

The authors draw on a variety of approaches, concepts, methods and themes and provide a new understanding of innovation in the energy and climate change fields. It tackles the many issues in a way that speaks not only to those concerned to understand these developments, but to those who are involved in the scientific and technological work itself, as well as those charged with evaluating and making decisions relevant to the future of the technology.

Nils Markusson is a Research Associate at the School of Geosciences, University of Edinburgh, UK.

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DEDICATION

This book was conceived in 2010 as a result of discussions between ourselves and Dr Stewart Russell. Stewart, Deputy Director of Science, Technology and Innovation Studies at the University of Edinburgh, was to have been one of the editors. As the project progressed, Stewart fell seriously ill and died in September 2011. We miss you greatly as a friendly soul and a stimulating colleague and collaborator! We dedicate this book to you – it could have been a better one with your insights.

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Nils Markusson has 15 years' experience in the area of innovation and technology studies. After working for the Swedish government, he undertook a PhD at the University of Edinburgh on cleaner technology and firm organisation. He currently works as a Research Associate at the Scottish Carbon Capture and Storage research centre at the University of Edinburgh on several projects on aspects of CCS innovation. Throughout he has sought to understand how we use technology in society with as little environmental impact as possible, and what policy is needed to that end. He has published in journals such as *Global Environmental Change*, *Energy Policy* and *Journal of Cleaner Production*.

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Simon Shackley has a long-standing interest in low-carbon technologies with a special interest in carbon dioxide capture, removal and storage – both via CCS and biochar. He has undertaken a number of public and stakeholder CCS perception and engagement studies in the UK and is interested in how to design projects to more effectively incorporate community preferences. He is also interested in the relationship between energy and climate policy, particularly the appropriate balance between market-based, community and government-led mechanisms.

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Yue Liu currently is a research assistant at the Centre for Research in Energy and Minerals Economics (CREME) at Curtin University, Australia. She has been awarded the Curtin Strategic International Research Scholarship and will start her PhD study from the beginning of 2012 at Curtin University. Her research interests focus on the economic and policy study of carbon dioxide capture and storage and the renewable energy technologies. She received her bachelor degree from China Agricultural University, Beijing, China, and obtained her MA degree from Clark University, Massachusetts, USA.

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Vivian Scott, PhD

Trained as a physicist, Vivian Scott has a PhD in climate modelling where he studied models of the ocean carbon cycle used in global circulation models to predict the future climate. He works on CCS as a climate mitigation technology, researching policy and commercial progress towards the large-scale testing and deployment of the technology. He is currently engaged in policy development relating to the delivery of the EU CCS demonstration programme as part of Europe's wider climate mitigation and energy strategies, collaborating with representatives of the EU Commission, national and regional governments, industry, environmental NGOs and academic colleagues.

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- Duncan McLaren, former Chief Executive of Friends of the Earth Scotland

Finally, we want to thank Lindsay Terrell for great help with the formatting, and Moyra Forrest for superb indexing.

ABBREVIATIONS AND ACRONYMS

ACC	anthropogenic climate change
ACCSEPT	Acceptance of CO ₂ Capture, Storage, Economics, Policy and Technology project
ACF	advocacy coalition framework
AEP	American Electric Power
AIDS	auto immune deficiency syndrome
ANT	actor network theory
BECCS	biomass energy with carbon dioxide capture and storage
BUND	Bund Für Umwelt und Naturschutz Deutschland (FoE Germany)
CATF	Clean Air TaskForce
CCGT	Combined Cycle Gas Turbine
CCJ	<i>Carbon Capture Journal</i>
CCS	carbon dioxide capture and storage
CCSA	Carbon Capture and Storage Association
CDM	clean development mechanism
CFC	chlorofluorocarbons
CH ₄	methane
CHP	combined heat and power
CO ₂	carbon dioxide
COP	Conferences of the Parties
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSLF	Carbon Sequestration Leadership Forum
CSP	concentrated solar power
DECC	Department of Energy and Climate Change
DNV	Det Norske Veritas
DOE	US Department of Energy
DTI	Department of Trade and Industry

KEPCO	Kansai Electric Power Co.
KLIF	Norwegian Climate and Pollution Agency
kWh	kilowatt-hour
LTS	large technical system
m ³ /day	cubic metre per day
MAC(s)	marginal carbon abatement cost(s)
MACC	marginal abatement cost curve
METI	Ministry of Economy, Trade and Industry, Japan
MHI	Mitsubishi Heavy Industry Ltd
MIT	Massachusetts Institute of Technology
MLP	multi-level perspective
MPE	Norwegian Ministry of Petroleum and Energy
MRCSP	Midwest Regional Carbon Sequestration Partnership
MW	megawatt
NDMA	N-Nitrosodimethylamin
N ₂	nitrogen
NER	new entrants reserve
NETL	National Energy Technologies Laboratory
ng/m ³	nanogrammes per cubic metre
NGO	nongovernmental organisation
NILU	Norwegian Institute for Air Research
NIMBY	not in my back yard
NIPH	Norwegian Institute of Public Health
NMF	Norwegian Ministry of Finance
NMTI	Norwegian Ministry of Trade and Industry
NOAH	FoE Denmark
NOK	Norwegian krona
NO _x	nitrous oxides
NPD	Norwegian Petroleum Directorate
NSM	new social movement
NUMBY	not under my back yard
NZEC	Near Zero Emissions Coal project
OECD	Organisation for Economic Co-operation and Development
Ofgem	Office of the Gas and Electricity Markets
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environments of the North-East Atlantic
PIU	UK Cabinet Office's Performance and Innovation Unit
ppmv	part per million by volume
PTRC	Petroleum Technology Research Centre
PV	photovoltaics
R&D	research and development
RCEP	Royal Commission on Environmental Pollution
RD&D	research, development and demonstration
RDM	robust decision-making

xxiv Abbreviations and acronyms

REACH	EU Regulatory Framework for the Management of Chemicals
SACROC	Scurry Area Canyon Reef Operators Committee
SBSTA	UNFCCC Subsidiary Body for Scientific and Technological Advice
SCCS	Scottish CCS
SCOT	social construction of technology
SP	Scottish Power
SRCCS	IPCC Special Report on CCS
STS	science and technology studies
t/day	tonne per day
TCM	Test Centre Mongstad
tCO ₂	tonne CO ₂
TIC	Technology and Innovation Centre
TIS	technical innovation systems
TNS	Taylor Nelson Sofres PLC
toe	tonne of oil equivalent
TSB	Technology Strategy Board
TWh	terawatt-hour
UAE	United Arab Emirate
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute
WWF	Worldwide Fund for Nature
ZEP	Zero Emissions Platform
ZERO	Zero Emission Resource Organisation

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