

Crossing the Rubicon: The 2015 Renewable Electricity Reforms and Implications for Scotland

Anna L. Berka, Jelte Harnmeijer and Bill Slee

8.1 INTRODUCTION

On 18 June 2015, the UK put in place a number of policy amendments signalling an intention to phase out most technology-specific support schemes for low carbon energy. The reforms came 26 years after the introduction of the UK's first renewable energy support scheme. In spite of the Conservative Party manifesto commitments to reduce support for some types of renewables, the speed and extent of the proposed changes caught industry analysts by surprise. Within months following the UK General Election in May 2015, the sector saw the abandonment of at least 23 large-scale projects representing around 2.7 GW, including one of two carbon capture and storage projects, with crowdfunded loan providers such as the Trillion Fund halting renewable energy loans and public loan providers across the UK halting ongoing loan negotiations.

A.L. Berka (✉)

Department of Forest Sciences, University of Helsinki, Helsinki, Finland
e-mail: anna.h@scene.community

J. Harnmeijer

University of Edinburgh, Edinburgh, Scotland, UK
e-mail: Jelte.Harnmeijer@hutton.ac.uk

J. Harnmeijer · B. Slee

James Hutton Institute, Dundee, Scotland, UK

© The Author(s) 2017

G. Wood and K. Baker (eds.), *A Critical Review of Scottish Renewable and Low Carbon Energy Policy*, Energy, Climate and the Environment, DOI 10.1007/978-3-319-56898-0_8

DECC stated that 7 GW of onshore wind projects in planning were likely to miss the early April 2016 deadline for the expiration of the Renewable Obligation and risked being stranded, adding uncertainty as to how the UK would meet its 2020 targets (EU Commission 2015). RenewableUK threatened legal action, drawing on a clause under the Levy Control Framework (LCF) that stated that the government would ‘*not make retroactive changes to support levels to maintain investor confidence*’. Within months, the UK dropped out of the top ten countries in the Renewable Energy Country Attractiveness Index (RECAI) (Ernst and Young 2015).

The policy shock has been sufficient to draw comments from senior commentators such as Professor Jacqueline McGlade, chief scientist of the United Nation’s (UN) environment programme, who argued: ‘*What’s disappointing is when we see countries such as the United Kingdom that have really been in the lead in terms of getting their renewable energy up and going—we see subsidies being withdrawn and the fossil fuel industry being enhanced*’. However, the reforms mirrored ongoing policy shocks in Spain, Italy, Germany and Denmark—all global leaders in renewable energy that have scaled back on renewable energy support as a result of a resurgent discourse around short-term competitiveness and consumer protection (Lauber and Jacobsson 2016). In Germany and Denmark alike, Conservative Party majorities elected in the aftermath of the financial recession provided an opportunity for dormant but long-standing opposition to public support for renewable energy to manifest itself in the form of annual caps and steeper subsidy depressions (Lauber and Jacobsson 2016). These events highlight the formidable challenge of the renewable energy transition in reforming reigning structural, technical and market formations, and resulting political struggles that emerge when renewable energy deployment reaches 15–40% of total electricity supply, where it begins to challenge incumbent utilities and where fundamental market restructuring becomes necessary (Klessmann et al. 2008).

In what follows, we outline the 2015 UK policy reforms and discuss the likely consequences for Scotland, focusing on renewable electricity policy. We place these events in a historical and international context, elaborate on the politics of the affordability and subsidisation of renewable energy and analyse these reforms in the context of emerging renewable energy innovation systems. Drawing on similar policy shocks in Spain, Australia and Germany, we discuss the likely implications of the 2015 policy reforms for the renewable energy industry in Scotland. Specifically, we ask whether the Scottish Government has the capacity to

provide public support for a sector which it has promoted so actively and review the prospects for ‘subsidy-free renewable energy’.

8.2 AN OVERVIEW OF 2015 UK POLICY REFORMS

Three key support mechanisms currently support renewable electricity generation by independent power producers in the UK: the Renewables Obligation (RO), the Feed-in Tariff (FiT) and the Contracts for Difference Feed-in Tariff (CfD FiT). Between them, this triad of mutually exclusive mechanisms spans the breadth of major renewable energy technology types and capacity classes. Although there are major differences in how they operate, all three subsidise renewable energy output over time. As a result, expectations about their future form and function play a major role in building—or undermining—investor confidence. The following outlines the policy amendments introduced in 2015 for each scheme.

8.2.1 *Renewables Obligation*

Replacing the nine year old Non-Fossil Fuel Obligation (NFFO), the RO was introduced in England, Wales and Scotland in April 2002, and in Northern Ireland three years later. Unlike the NFFO, which was originally conceived to support nuclear power, the RO was specifically designed to support renewable electricity generation (Mitchell and Connor 2004). The RO operates as a green certification mechanism and is a classic market-based technology performance standard. RO certificates (ROCs) are sold to electricity suppliers to meet their annual incremental quota for renewable electricity delivery, with annual targets set by the Scottish Government (Mackenzie 2009). Suppliers that do not meet targets pay into a buy-out fund at a rate that is pegged to the Retail Price Index (OFGEM 2011). The buy-out fund is annually redistributed amongst suppliers according to the number of ROCs submitted, rewarding ROC acquisition below supplier obligation levels and reducing consumer electricity cost where supply companies submit relatively large numbers of ROCs. Because ROCs are traded at market price, their value fluctuates annually depending on quota levels in relation to the number of ROCs available on the market. While the advantage of the RO is that it allows control over expenditures, the disadvantage of the RO is that generators are exposed to the political and commercial risk of changing annual targets and ROC prices.

The RO has seen several revisions since 2002, most notably the introduction of technology-specific banding in 2009 which was implemented in order to increase the competitiveness of less mature technologies. With few exceptions, any ‘large-scale’ (>5 MW) installation commissioned after 2002 and before the recent CfD FiT auction under the EMR has benefitted from the sale of certificates. The RO also supports virtually all renewables projects (of all scales) in Northern Ireland, where small-scale FiTs are not available. As a result, the RO support mechanism has underpinned the majority of renewables capacity developed in the UK and has been the most important mechanism for progress towards achieving the UK’s national 2020 target of 15% of total energy to come from renewable sources.

The RO scheme was envisaged to remain open until 31 March 2017, when it was to be fully replaced by the CfD scheme. However, citing unexpectedly rapid uptake of solar PV, the scheme was closed early to ‘large-scale’ (>5 MW) solar on 1 April 2015 (DECC 2014a). On 18 June 2015, Secretary of State for Energy and Climate Change Amber Rudd announced that the RO scheme would close a year earlier (on 1 April 2016) for onshore wind (Rudd 2015a). At the time, it was left unclear as to under which circumstances onshore wind projects would be eligible for an RO ‘grace period’, initiating a chaotic back-and-forth dialogue between government and industry bodies.

18 June 2015 marked the beginning of a period of heightened uncertainty for the UK wind industry, which was soon to spread to other generation technologies less exposed to critique on the grounds of cumulative landscape visual impact. A month later, on 22 July 2015, DECC published a consultation on closing RO support for solar < 5 MW as of 1 April 2016 (DECC 2015a). This consultation also raised the spectre of English and Welsh solar projects accredited after 22 July not receiving RO grandfathering rights, greatly diminishing expected project value and heightening risk. The decision associated with this consultation, which closed on 2 September 2015, was still pending at the time of writing, but few industry insiders expect significant modifications of the changes proposed. In Northern Ireland, meanwhile, the Department of Enterprise, Trade and Investment (DETI) launched a two-week consultation on 30 September to close the Northern Ireland RO for new onshore wind projects on 1 April 2016, in line with closures already committed for England, Scotland and Wales. In October 2015, onshore wind developers were offered some respite when DECC

announced that the grace period for RO projects meeting certain criteria would be extended by up to a maximum of nine months, to January 2017.

8.2.2 *Feed-in-Tariff*

FiTs were introduced in April 2010 with the specific aim to support smaller scale low carbon energy generation and are globally amongst the most popular ‘off-the-shelf’ policy instruments for incentivizing renewables generation. Generators receive an inflation-linked generation tariff based on generation output for 20–25 years, that is, set at or prior to a project going live. Where electricity is not used locally (‘direct supply’) but rather exported to the grid, generation tariffs are supplemented with a fixed minimum export tariff or a price of electricity settled through a Power Purchase Agreement (PPA). With their relative predictability and simplicity, FiTs go a long way to removing overall project risk, improving the ease of forecasting cash flow and lowering barriers to entry for non-specialists such as households, community groups and rural businesses. While minimum export tariffs are fixed and technology-blind, FiT generation tariffs are cost and technology-dependent and, together, they have allowed wide and rapid uptake for projects with capacities under 5 MW.

As a technology becomes mainstream and its technology costs decrease, FiT generation tariffs are degressed for new installations. Thus, FiTs have been subject to amendment based on rates of technology uptake. The 2015 reforms differed in that they represented an increase in the speed and extent of degression as well as the possibility of complete removal of FiTs should spending surpass the proposed cap (DECC 2015b). Specifically, the consultation document read: ‘... *if [proposed changes] cannot put the [FiT] scheme on an affordable and sustainable footing then there should be an end to generation tariffs for new applicants as soon as legislatively possible, which we would expect to be January 2016*’. The largest proposed cuts fell on generation tariffs for solar PV and onshore wind, with cuts of up to 87% on prevailing rates (see Table 8.1).

Early parliamentary motions had announced the removal of all subsidies for new onshore wind, but had included explicit statements on the need to protect non-specialist renewable energy generators from reforms. Specifically, Amber Rudd stated: ‘*I do not wish to stand in the way of local*

Table 8.1 Proposed reductions in feed-in-tariffs, October 2015

<i>Technology</i>	<i>Band</i>	<i>Before^a</i>	<i>After^b</i>	<i>Reduction</i>
	(kW)	(p/kWh)	(p/kWh)	(%)
Hydro (run-of-river)	0–15	15.45	10.66	31
	15–100	14.43	10.66	26
	100–500	11.40	9.78	14
	500–2000	8.91	6.56	26
	2000–5000	2.43	2.18	10
	0–4	12.47	1.63	87
Solar PV	4–10	11.30	1.63	86
	10–50	11.30	3.69	67
	50–150	9.63	2.64	73
	150–250	9.21	2.64	71
	250–1000	5.94	2.28	62
	1000–5000	5.94	1.03	83
	Stand alone	4.28	1.03	76
	0–50	13.73	8.61	37
Wind (onshore)	50–100	13.73	4.52	67
	100–500	5.89	4.52	23
	500–1500	5.89	4.52	23
	1500–5000	2.49	0	100

^aBefore Ofgem tariffs for installations with an eligibility date on or after 1 October 2015;

^bAfter Proposed Generation Tariffs for January 2016

communities coming together to generate low carbon electricity in a manner that is acceptable to them, including through small scale wind capacity (Rudd 2015a). The fact that small-scale local projects, including even those adopting the controversial technology of wind turbines, should be singled out raised hopes amongst small-scale renewables developers as well community and local energy practitioners that FiTs might somehow find respite within the storm of reform. Just over a month later, however, DECC published a consultation for the elimination of FiT pre-accreditation—one of the few renewable energy policy provisions that gives leeway specifically to communities (DECC 2015c). The consultation document of 21 July 2015 proposed the removal of pre-accreditation for new anaerobic digestion and hydro of all capacities, and solar PV and onshore wind projects with capacities over 50 kW. Despite a lobbying and petitioning campaign by the fledgling community energy sector, DECC announced on 9 September that it was to remove pre-accreditation by October 2015 (DECC 2015c). The ‘pre-registration’ option, introduced

to protect small school and community (<50 kW) rooftop solar PV projects from tariff degressions, was also removed.

The outcome and deadline for the FiT tariff review were not known at the time of writing, but related policy reforms suggest that the 2015-elected government was broadly not supportive of decentralised and local renewable energy development.

8.2.3 *Contract for Difference*

Of the triad of major renewable electricity support mechanisms in use in the UK, the CfD is without question the most complex. A CfD is a financial instrument that takes the form of a contract in which a buyer pays a seller the difference between the current value of an asset and its value at contract time and can be thought of as an auction-based Feed-in-Tariff. The application of CfDs to energy markets is unique to the UK and Germany. Theoretically, the value of the asset is determined through a competitive bidding process, and ‘the buyer’ is the purpose-built government controlled entity called the ‘Low Carbon Contract Company’ that acts as a subsidiary to DECC. In practice, allocation across several pots for technology clusters of different levels of maturity is very much a negotiated process and has left little room for competitive deployment of lowest cost technologies.

Results of the first allocation round were published on 26 February by DECC and National Grid. Preliminary assessments of expenditures under the LCF suggest that low electricity prices resulted in high payouts under the first auction round of the Contracts for Difference in 2014. Despite this and some other teething problems (related for instance to entry criteria and risk of strategic bids by participants who had hoped to partake under the ROC), the process was widely considered to have been more or less successful. Strike prices were in the realm of £80/MWh for onshore wind, waste-CHP and most solar PV bids (DECC 2015d), and developers started preparing for a second allocation round scheduled for October 2015.

Published CfD allocations for 2015–2023 suggested that relatively small annual budgets would be allocated to mature (CfD “Pot 1”) technologies in an attempt to force them to compete.¹⁸ This left the largest proportion of annual CfD allocations for less mature (“Pot 2”) technologies, including offshore wind, wave, tidal stream, advanced conversion, anaerobic digestion, dedicated biomass with CHP and geothermal (DECC 2014b). However, preparations for the second CfD FiT round

Table 8.2 Overview of onshore renewable electricity policy mechanism announcements, October 2015

	<i>Technology</i>			
Policy shock	Anaerobic Digestion	Hydro (run-of-river)	Solar PV	Wind (onshore)
ROC termination date			Closure brought forward	Closure brought forward
CfD auction no. 2	Postponed	Postponed	Postponed	Postponed
FiT pre-accreditation	Removed	Removed	Removed	Removed
FiT levels	Consultation expected late 2015	Curtailed, and may be removed, as of January 2016	Curtailed, and may be removed, as of January 2016	Curtailed, and may be removed, as of January 2016

were thrown into disarray following Amber Rudd's announcement on 18 July, which was closely followed by an email from DECC to developers that read: '*There will be no CfD round this October. In the autumn, the Government will set out its plans in respect of the next CfD allocation round*' (Rudd 2015a). The announcement that a second CfD auction would be postponed came in parallel with the previously described cessation of the RO scheme for onshore wind being brought forward. The combined changes raised the spectre of expensive multi-year projects awaiting a planning determination being stranded in a 'support mechanism no-man's land' (see Table 8.2). An emergency meeting hastily convened in Glasgow on 9 July by Scottish Energy Minister Fergus Ewing drew over two hundred wind industry representatives.

8.2.4 Summary of Recent Policy Announcements

In summary, support for dominant technologies (hydro, solar and wind) has been removed altogether for new projects at large scale (ROCs and CfDs) and curtailed for new projects in smaller capacity bands (FiTs). With ROCs for less common technologies set to be phased out across the board by April 2017, the uncertainty surrounding a second CfD auction leaves other large-scale renewables initiatives, including those looking to harness less mature technologies such as wave and tidal,

precariously exposed. Announcements about FiT adjustments for anaerobic digestion are expected in late 2015, and here it remains unclear whether changes for smaller scale projects will stretch to other technologies that have thus far seen lower cumulative uptake, such as CHP and geothermal. References in policy documents released to date make it highly unlikely, however, that these technologies will escape unscathed.

Meanwhile, the RHI, which acts much like FiTs do but for heat rather than electricity, has thus far remained conspicuously untouched. However, the RHI was set up to last until March 2016 and is currently under review. With funding for parallel schemes such as the Green Deal Home Improvement Fund removed in July 2015, it is unlikely to be extended. In contrast to the renewable electricity support mechanisms discussed in this chapter, the RHI is not supported through the LCF (see below) but funded directly by the state. As overspending under the latter budget forms the overarching justification for the policy changes to date, the RHI represents something of a litmus test: just how comprehensive will the roll-back on renewables technology support be?

8.3 EXPLAINING 2015 POLICY REFORMS: RATIONALE AND HISTORICAL CONTEXT

The policy reforms described here can be characterised as knee-jerk efforts to quell unexpectedly rapid deployment, particularly for onshore wind and solar PV under the RO and FiT schemes, in the context of a limited budget and in which increasing the budget is politically undesirable. The main justification given for FiT and RO reforms was overspending under the LCF and its implications for consumer electricity bills and European Commission State aid approval (Rudd 2015b). In a hearing with the Commons Energy and Climate Change committee, the then new Energy Secretary Amber Rudd stated that *'grid parity projections for the early 2020s were overly pessimistic'* and that *'we should have confidence that renewables will continue to deploy in a way that costs will continue to come down [without subsidies]'*, drawing on private discussions with three large onshore wind developers who had stated their willingness to continue building in the absence of subsidy support (Rudd 2015c). Pervasive in the statements and speeches that followed was the notion that the climate debate can and needs to be reclaimed by right-wing politics as an issue that can feasibly be tackled using market-based

approaches that are first and foremost ‘pro-growth and pro-business’ (Rudd 2015a).

While the 2015 policy reforms sent shock waves throughout the renewable energy industry, those who witnessed policy developments leading up the 1990 Electricity Act may recognise the broad lines of an old debate. Historical energy policy reviews, such as those by Mitchell and Connor (2004) and Gross and Heptonstall (2014), characterise UK renewable energy policy as reactive and opportunistic, stemming from a fundamental and persistent lack of consensus within Whitehall over the rationale, objectives and benefits of renewable energy (Gross and Heptonstall 2014; Mitchell and Connor 2004). Although the 2008 Climate Change Act is a manifestation of a long-term cross-party mandate to reduce the national greenhouse gas emissions balance, there was never an equivalent commitment towards renewable energy *per se*. At the core of this long-standing debate is and has always been the question: is there a compelling case to support renewable energy development because it provides benefits that nuclear and gas technologies cannot provide, or are its benefits limited to carbon reduction? This chapter illustrates how this question is at the heart of cross-party issue framing on climate change as being a problem that can be solved through simply internalising a politically acceptable carbon pricing mechanism into a pre-existing institutional framework, or an issue that requires far-reaching institutional reform as well as citizen engagement.

The politics of public intervention around renewable energy extends well beyond UK national boundaries. The reforms would not have been possible were it not for UK’s role in eliminating European national renewable energy targets in 2014 on the basis of the need for ‘*national flexibility to develop a diversified, secure and sustainable energy mix cost-effectively*’. In David Cameron’s leaked non-paper for the upcoming 2014 EU Energy Strategy meeting, he argued that climate mitigation and energy security needs should be met through a combination of renewable, CCS, indigenous shale and nuclear projects. The 2015 policy reforms around renewable energy were therefore in part a manifestation of David Cameron’s desire to demarcate legislative independence from the European Commission. In this chapter, however, we focus primarily on the key components of the domestic institutional framework governing the UK’s energy transition: a revenue-neutral renewable energy subsidy mechanism that finances renewable energy subsidies from a tax on consumer energy bills (the LCF), run in parallel to an imperfect

downstream carbon tax on non-domestic consumption for gas, electricity, coal and liquefied petroleum gas (the Climate Change Levy, CCL).

Closer inspection of statements regarding the 2015 energy policy reforms suggests that arguments used to justify reforms around baseload power, affordability, energy security and democratic planning processes were used inconsistently with respect to renewable energy vis-à-vis alternative low carbon technologies (nuclear and shale gas). For instance, subsidy changes were explicitly linked to the commitment to '*give local communities the final say over any new wind farms*' (Rudd 2015d), at the same time as provisions to override local planning authorities on shale gas planning applications were put in place (DECC 2015c). While insulation from external supply shocks is the most prominent aspect of energy security (Watson and Scott 2009) and nuclear and shale gas developments were justified on the basis of energy security (Rudd 2015c), that same logic was not put forward to protect the existing wind or solar industry. Nuclear and shale gas developments were also justified on the basis of providing baseload power (Rudd 2015c), yet mature renewable generation technologies capable of providing baseload power such as biomass and run-of-river hydro (Matek and Gawel 2015) were not exempted from policy reforms. Finally, high levels of financial support for nuclear development at Hinkley Point C were justified on the basis of the immaturity of nuclear technology (Rudd 2015c), while little consideration of the learning curves for renewable energy technologies was in evidence. For example, fledgling technologies such as high-enthalpy geothermal, wave or tidal electricity generation were not singled out as also deserving of special consideration. All in all, these inconsistencies suggest that objectives around energy security, grid stability and local preferences may not in fact be driving these energy policy reforms, as much as being framed to fit an incoherent and multi-stranded anti-renewables ideology. Furthermore, since August 2015 renewable generators have been made subject to the CCL, raising serious doubts over the current government's commitment to climate mitigation more generally.

The arguments put forward to justify the reforms highlight how public discourse around renewable energy subsidies is dominated not by the relative benefits of different energy technologies but by their relative cost, the implications for heat and electricity prices, their visual intrusiveness and repercussions on the competitiveness of UK industry. The rationale is strongly aligned to neoclassical regulation theory in that it

is seemingly singularly geared towards minimising the per-kWh cost of delivering low carbon energy, and sidesteps considerations to do with technological lock-in, the nurturing of a domestic renewable energy industry, or the potential of distributed energy to generate local benefits that are not accounted for through energy bills. Even here, however, the reforms are not consistent with cost-efficiency arguments insofar as nuclear technologies are capital-intensive and not unambiguously more competitive than solar or wind, as demonstrated by the outcome for the first round of the CfD FiT allocations (DECC 2013a). Furthermore, significant uncertainties surround both their final delivery timescale and capital cost, as demonstrated by severe problems in meeting construction timescales and budgets for identical EPR reactors at Flamanville and Olkiluoto. High levels of financial support for nuclear development were justified on the basis that baseload power requires a price premium (Rudd 2015c), but baseload power plants produce electricity at lowest cost.

A report by Howard (2015) entitled ‘The Customer is Always Right: Putting consumers back at the heart of UK energy policy’ endorsed by the Energy Secretary provides recommendations that are somewhat consistent with the 2015 policy reforms and sheds light on what appears to be the underlying rationale. Howard suggests that the low carbon energy objective has trumped the objective to provide consumers with affordable energy. Specifically, he argues that network costs and clean energy policy costs managed by DECC under the LCF are responsible for 50% of price hikes in both gas and electricity during the period 2009–2014, which increased by 185 and 120%, respectively. Based on the notion that renewable energy subsidies have been implemented with a lack of centralised overview and consideration for consumer energy bills, he goes on to recommend the halt of public support for ‘*expensive technologies [including] wave and tidal stream, solar thermal and heat pumps*’, suggesting that government ought to ‘*pick winners over propping up losers*’ (Howard 2015). His recommendation is for competitive and technology-neutral allocation of subsidies under the CfD to support low-cost mature technologies such as medium and large-scale solar PV and wind, with limited support for pre-commercial technologies and/or small-scale installations, pending their ability to demonstrate potential for cost reduction. While policy statements fully embraced Howard’s line of reasoning (DECC 2015c; Rudd 2015b), the reforms that were implemented have done the opposite. Specifically, they have pushed

lowest cost renewable energy technologies such as onshore wind out of the market altogether, continued to provide support to small-scale less mature technologies, and put in place ambiguity over the continuation of support for less mature technologies above 5 MW. It is a moot point as to whether Howard's recommendations find expression in the high levels of public support given to immature technologies and nuclear power developments at Hinkley Point.

The emerging rationale is characteristic of technology-neutral approaches to climate mitigation policy, in that it does not take account of the systemic factors that constrain and enable the emergence of cost-competitive technology—including requirements and compatibilities of different technologies in relation to demand profiles, structure of the existing power market supply, risk premiums facing new technologies or externalities that are a function of increased adoption (such as innovation and learning spillovers, imperfect competition, supply chain co-ordination effects, and legitimacy costs) (Foxon 2005; Kalkuhl et al. 2013; Lehman et al. 2012). These factors drive internal and external increasing returns-to-scale that underlie technology learning curves at various stages of maturity. The role of technology learning curves in determining costs has meant that the cost-efficiency of support policies has been higher where they have effectively facilitated rapid deployment and industry consolidation (International Renewable Energy Association (IRENA), 2015; Lauber 2015). The decision of a national government not to stimulate a domestic renewable energy market therefore reflects a lack of confidence in the ability of its domestic industry to compete on the national and international stages, representing instead a wait-and-see policy that depends on technology and service imports (Gross and Heptonstall 2014). For example, technology learning curves for solar PV continue to surpass predictions, exhibiting 75% cost reductions since 2009 (IRENA 2015). Following pure cost-efficiency arguments would have required dismissing early stage deployment of solar PV and foregoing the development of a domestic market. In summary, while cost-efficiency and affordability are legitimate concerns, taken alone they are not a sufficient basis on which to evaluate public intervention for pre-commercial technologies. A more constructive policy assessment would focus on the design of the feedback and decision-making mechanisms that enable DECC to provide transparency and long-term stability around demand incentives, while enabling it to monitor learning curves and allocate resources to highest potential technologies. Such a mechanism

would acknowledge the unique benefit and constraints of contending technologies to provide low carbon heat and electricity and enable informed resource allocation that takes into account estimated short- and long-term costs and benefits.

The singular focus on cost-efficiency driving the 2015 policy reforms does not bode well for future support for small-scale technologies under the FiT and RHI schemes, for which public support is often legitimised on the basis of a number of soft positive externalities and indirect effects. Due to the distributed nature of renewable energy generation, renewable energy development is able to attract capital locally and generate socio-economic benefits over and above those brought by nuclear and gas technologies that merit public support. For instance, there is evidence that it has spurred new domestic industry in rural areas with longer-term knock-on effects, resulting in income diversification and rural socio-economic resilience (Allan et al. 2011). Engaging the public in energy generation is thought to generate awareness and buy-in for renewable energy (Hvelplund 2006; Walker and Cass 2007), a notion that is supported by the fact that democracies with high levels of renewable energy deployment such as Germany, Denmark and Sweden also demonstrate high levels of local ownership (Roberts and Bodman 2014). Furthermore, historic breakthroughs in cost-reduction have come from FiT-supported small-scale renewable energy technologies (Fouquet and Johansson 2008; Lauber 2015). This suggests that public support for pre-commercial small-scale technologies pays off in the form of technological learning, price reductions, new employment and exports. In conclusion, if the rationale is to achieve socially optimal public interventions in the energy sector, portraying renewable energy subsidies under the LCF as a public over-investment on a £-per-kWh basis rests on a short term and incomplete analysis, but above all on a decision to exclude or discount benefits that are more challenging to internalise in the market.

The analysis so far suggests that within this current institutional framework, the UK has limited its rate of renewable electricity deployment to the rate at which subsidies can perceivably be levied directly from energy consumers. However, there has been no inclusive and transparent dialogue around public acceptance of renewable energy levies, nor on the larger question of who should fund large infrastructural transitions from a social justice standpoint (Dresner et al. 2006). A great deal is known about the relative theoretical efficiency and welfare effects of different mitigation policies, including distributional and energy price

effects (Fisher 2010; Kalkuhl et al. 2013; Pearce 2006). Because renewable energy penetration reduces average wholesale electricity costs, temporary renewable energy subsidies in fact serve to ease distributional effects of taxes on carbon at reasonable additional cost and are seen by many economists as a second-best alternative to perfect (but unpopular) carbon taxes. Where renewable energy subsidies are financed from non-renewable energy production taxes, electricity prices will not rise as long as the renewable energy sector is able to respond to electricity price changes and displace non-renewable generators (Pearce 2006). This means that the efficiency and effectiveness of renewable energy subsidies cannot be assessed without also examining the UK CCL.

Non-domestic high energy consumers are eligible for 80% reduction on the CCL, and the CCL is currently recycled into the industry in the form of savings on labour insurance. With fossil fuel generators subject to substantial tax increases under the Carbon Price Support since April 2015 (HM Revenue and Customs 2015) and renewable generators newly subjected to the CCL (since August 2015), the CCL appears to be moving ever closer to a general energy tax. Even where effective carbon prices are in place, however, consumers can only respond to carbon price signals if technology-specific policies succeed in making low carbon alternatives available (Anderson et al. 2001). Furthermore, a recent cross-country comparative study has shown that demand pull and supply push policies in low carbon industries that successfully engage the wider public in renewable energy generation are likely to bring voters and economic constituencies into coalitions for decarbonisation, which subsequently fosters political support for more comprehensive carbon pricing policies (Meckling et al. 2015). In summary, if the current government was committed to climate mitigation, it would need to revisit its ambitions for a carbon tax and consider alternative financing options in which renewable production subsidies and associated transmission and balancing costs are distributed across a broader range of actors.

While it is easy to find fault in government policy, coaxing the power market through a low carbon transition is a difficult balancing act. Where generation incentives effectively attract renewable energy deployment, average wholesale electricity prices decrease and further renewable energy penetration risks pushing existing balancing services with higher marginal cost out of the electricity market (Klessmann et al. 2008). The National Grid is anticipating continued increase in embedded generation (up from 8 to 16 GW from 2014 to 2016), expressing concerns over its

ability to put in place coping mechanisms to prevent grid management issues around forecasting, inertia and frequency response (National Grid 2015). Given low gas and oil prices and declining wholesale electricity prices since October 2014, the UK government is likely under pressure to protect industries supplying balancing power in addition to reining in upward pressure on electricity retail prices. Nevertheless, the 2015 policy reforms demonstrate the fragility and temporality of policy paradigms and public support frameworks enabling renewable energy deployment. Clearly, previous studies outlining a ‘paradigm shift’ in UK energy policy underestimate the role of deep-seated cross-party politics and the mutability of institutional reform (Holburn 2012; Kern et al. 2014).

In summary, it was the scrapping of national renewable energy targets under the European Renewable Energy Directive combined with the recession and the 2015 Conservative Party election outcome that created the political opportunity for parliamentary discourse to sway back towards technology-neutral carbon mitigation policies. Despite targets to eliminate coal power by 2023, the speed and extent of reforms singularly targeting renewable energy technologies strongly suggests that consumer protection and short-term cost-efficiency have taken precedence over climate mitigation. It is possible that such wait-and-see policies will become more prominent as conservative resistance to public support frameworks take hold and Europe lowers its climate mitigation ambitions (Wyns et al. 2014). Wait-and-see policies may also be encouraged by the emergence and consolidation of global renewable energy industry leaders, which leaves new entrants too far behind to catch up, especially for renewable energy technologies that are some years off grid parity. In the following section, we summarise the likely implications of the 2015 policy reforms for the Scottish renewable energy industry.

8.4 CONCLUSION: EXPLORING THE IMPLICATIONS OF 2015 RENEWABLE ENERGY REFORMS

Although some elements of renewables regulation such as planning are controlled from Holyrood, the key regulatory powers in terms of design, grace periods and eligibility criteria for renewable energy support incentives are governed by the UK Government as per the 2013 Energy Act. Under the RO, the Scottish Government used its power over grandfathering and support levels to maintain certificate prices

and grandfathering policies for solar PV until April 2016, but stated it did not have the power to prevent a Whitehall imposed closure after April 2016 (Ewing 2015), demonstrating how Scottish ambitions with respect to renewables development are largely at the mercy of Whitehall politics.

A large body of literature demonstrates the effects of the premature withdrawal of policy support schemes and financial subsidies on renewables deployment (Barradale 2010; Dél Rio and Tarancon 2012; Meyer and Koefoed 2003; Nemet 2010). The nature of many renewable energy technologies brings considerable challenges to the design of robust, cost-effective support mechanisms. Renewable energy projects are characterised by large upfront investment costs, where energy yields needed to cover early capital outlays are often at the mercy of imperfectly predictable environmental conditions. Development timescales from inception to operation are generally in the order of years, easily outlasting election cycles and associated changes in dominant political agendas. This generic project risk profile carries a profound implication; from conception to financial close, the risk of renewables support mechanisms being adjusted or withdrawn can make or break a project. This is particularly true for less mature technology markets where markets and supply chains have not yet fully formed, and expertise may still be lacking, such that costs are high and uncertain. The risk of outright ‘renewables policy mechanism default’, in which policy interventions would affect actual operational projects, is carried throughout the expected lifetime of the project (15–25 years for most technologies). Fundamentally, for the current support mechanisms to be effective, developers and finance providers need to have faith in their continuity (Lüthi and Prässler 2011; Ulph and Ulph 2013).

While it is too early to assess the impacts of these changes on the Scottish (and wider UK) renewables sector empirically, it is possible to make an informed guess as to the impacts of these reforms, drawing on past policy shocks in Spain and Australia to provide some clues as to the fate of renewable energy development upon rapid removal of public support schemes. Deployment will decline after a rush to complete projects already in the pipeline within existing windows of opportunity which are determined by degressing FiTs, loss of pre-accreditation as well as the nine-month grace period for project eligibility for the RO after April 2016. Pending a second CfD auction round, the push towards a decarbonised energy sector may largely come to a halt once

existing projects are completed. In a more likely scenario, CfD auctions are continued (Rudd 2015c). However, annual CfD allocations are relatively small, ranging from 10 to 50% of past annual RO expenditures (DECC 2013b), and are likely to exclude onshore wind (Rudd 2015c). In this scenario, overall annual deployment rates will decrease substantially compared to the period 2009–2016. Despite the government's repeated emphasis on 'technology-neutral support', the reforms described in this chapter suggest that the UK government will in future be highly selective in those technologies that it supports. Based on CfD and FiT support in place at the time of writing, piecemeal development in offshore wind, geothermal, tidal and wave initiatives seem likely. Temperton and Schoenberg (2015) suggest that there is simply no LCF budget to ease less mature technologies gradually into the market, and that there is no budget for the majority of the offshore wind projects in the pipeline under the current allocation, such that they are de facto competing over remaining budget with far less mature technologies such as CCS and tidal projects. In this scenario, deployment may not drive learning and cost-efficiency improvements required for widespread diffusion. Mirroring events following policy shocks in Spain and Australia, it is likely that large established companies will look to expand renewable energy markets elsewhere, such as North America, Brazil, Chile and Mexico. Recent policy statements imply additional support for innovation around storage (Temperton and Schoenberg 2015) in an attempt to overcome continued grid capacity constraints associated with further penetration of intermittent renewable energy. Finally, deployment under proposed FiT rates for solar PV and onshore wind is likely to be restricted to remaining high capacity sites, although an anticipated drop in solar PV prices due to the expiry of import tariffs in December 2015 may improve the financial viability of solar PV projects.

Employment will decline as firms adjust and downsize to new market conditions, but some sectors may increase employment temporarily in the rush to complete projects before funding cliff-edges. The renewable energy sector in the UK employs around 112,000 people across the value chain in 2014 (Renewable Energy Association 2015), with over 21,000 direct jobs in generation and project development in Scotland (2015). Many of these jobs are located in the remote parts of Scotland, where renewable energy developments have supported economic diversification of rural economies.

It is hard to see how high levels of Scottish renewables deployment could continue in the absence of cross-border subsidy from UK consumers. A UK energy market and continued reliance on UK energy policies is part of the uncomfortable nature of the devolution settlement. The Smith Commission (2014) sets out proposals for ‘*a formal consultative role for the Scottish Government and the Scottish Parliament in designing renewables incentives and the strategic priorities set out in the Energy Strategy and Policy Statement to which OFGEM must have due regard*’. The post-Smith Commission White Paper alludes to the importance of not ‘*sacrificing the integrity or stability of the GB-wide energy market*’. However, there was little or no formal consultation and very little influence of the Scottish Government’s renewable policy priorities on the emergent renewables policies at the UK level (Ewing 2015).

It is probable that the survivors amongst the renewables companies will seek innovative ways to sustain activity, for instance through efficiency improvements in supply chains. Where there are significant buyers close to renewable energy production capacity, selling directly to final consumers and undercutting grid-provided electricity prices may offer a solution, in particular where cost-effective storage enables larger capacity installations and local grid solutions. For instance, if councils were to purchase local energy for schools or social housing, or private sector high energy consumers could connect to local suppliers, there may be possibilities of win-win outcomes. Large hotels in rural areas or energy intensive businesses provide nodes of demand that local renewables suppliers could connect to. Similarly, business models based on self-consumption for domestic housing and businesses are likely to increase and capacity size of installations likely to decrease accordingly. However, the loss of the security of income streams is likely to limit the scale of deployment.

Where might the Scottish Government have some influence? It can pump prime initiatives to provide novel solutions to energy storage, which are particularly important in isolated and island communities. It can fund initiatives exploring the deepening of opportunities for local grid provision and it can continue to fund initiatives with respect to community energy, albeit without the support of FiTs. These mostly small-scale action research projects are valuable pilots, but unless the pilots can show evidence of secure returns to investors, their further roll-out is likely to be constrained. The Scottish Government may oppose austerity politics but it lives in its shadow and its funding is constrained by austerity. European funding streams may offer a lifeline for some types of development.

The 2014–2020 Rural Development Programme at European level offers incentives for renewables development. The new Scottish Rural Development Programme (RDP) does not include these because it had almost certainly worked on the assumption that FiTs would trump RDP grant aid, but both farmers and community groups are potentially eligible for funding should measures be included. The European Social Fund and ERDF money could also be targeted at renewables support.

Energy policy is not unconnected to fuel poverty, and the recent policy desire to limit exchequer support for renewables connects to this issue. Fuel poverty has increased in Scotland almost threefold since 2002 to affect just under 40% of households. The Scottish Government launched a new scheme in April 2015 to ‘*install insulation, heating and low carbon or renewable measures in the homes of households who are identified as living in fuel poverty, with a wider range of options for people living off the main gas grid including solar thermal and biomass systems*’. As fuel poverty is especially high in more remote rural areas, connecting renewables development to reducing fuel poverty reduction could be an explicit goal of community-led renewables.

The experiences of the last turbulent year have exposed the vulnerability of the Scottish renewables sector to major UK policy shifts. Looking forward, it is difficult to see any prospect of a devolved Scottish energy market. In its absence, policy diktats from the UK government will continue to frame Scottish possibilities. Some large-scale developments will continue, particularly in the marine-based technologies. And, at the margins, there is likely to be a little wriggle room in which Scotland can pilot novel approaches and keep the sector alive in ways that must of necessity be more cost effective, must deliver benefit to energy users and must sustain energy generators with reasonable returns.

Few anticipated the depth and breadth of the assault on UK renewables policy that will with certainty have devastating consequences on the sector. The early UK government rhetoric around renewables policy reform in 2015 still found space for support for community renewables but even this was subjected to a flood tide of policy change that has left much of the renewables sector with little or no confidence in future. Those in the sector were aware of the need for policy support degression and worked within those constraints. What they were unaware of was just how far a more doctrinaire (if at times inconsistent) neoliberalism had penetrated the new political administration and how much

coalition politics had tempered the support for renewable energy in the 2010–2015 coalition government.

REFERENCES

- Allan, G., P. McGregor, and L. Swales. 2011. The Importance of Revenue Sharing for the Local Economic Impacts of a Renewable Energy Project: A Social Accounting Matrix Approach. *Regional Studies* 45 (9): 1171–1186.
- Anderson, D., C. Clark, T.J. Foxon, R. Gross, and M. Jacobs. 2001. *Innovation and the Environment: Challenges and Policy Options for the UK*. London: Imperial College Centre for Energy Policy and Technology & the Fabian Society.
- Barradale, M. 2010. Impact of Public Policy Uncertainty on Renewable Energy Investment: Wind Power and the Production Tax Credit. *Energy Policy* 38 (12): 7698–7709.
- DECC. 2013a. Electricity Generation Costs—December 2013 (online). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/269888/131217_Electricity_Generation_costs_report_December_2013_Final.pdf. Accessed 17 Sept 2015.
- DECC. 2013b. EMR Delivery Plan, December 2013 (online). <https://www.gov.uk/government/publications/electricity-market-reform-delivery-plan>. Accessed 15 Oct 2015.
- DECC. 2014a. Government Response to Consultation on Changes to Financial Support for Solar PV—2 Oct 2014.
- DECC. 2014b. Draft Budget Notice for CFD Allocation Round 1 (online). <https://www.gov.uk/government/publications/indicative-cfd-budget-notice-for-the-autumn-2014-cfd-allocation-round>. Accessed 1 Oct 2015.
- DECC. 2015a. Consultation on Changes to Feed-in Tariff Accreditation—21 July 2015.
- DECC. 2015b. Consultation on a Review of the Feed-in Tariffs Scheme—27 Aug 2015.
- DECC. 2015c. Controlling Spending on Solar PV Projects of 5 MW and Below Within the Renewables Obligation—22 July 2015.
- DECC. 2015d. Contracts for Difference (CFD) Allocation Round One Outcome (online). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407059/Contracts_for_Difference_-_Auction_Results_-_Official_Statistics.pdf. Accessed 7 Sept 2015.
- DECC. 2015e. Faster Decision Making on Shale Gas for Economic Growth and Energy Security (online). <https://www.gov.uk/government/news/faster-decision-making-on-shale-gas-for-economic-growth-and-energy-security>. Accessed 27 Oct 2015.

- Dél Rio, P., and M. Tarancon. 2012. Analysing the Determinants of On-Shore Wind Capacity Additions in the EU: An Econometric Study. *Applied Energy* 95: 12–21.
- Dresner, S., T. Jackson, and N. Gilbert. 2006. History and Social Responses to Environmental Tax Reform in the United Kingdom. *Energy Policy* 34: 930–939.
- EU Commission. 2015. Commission Renewable Energy Progress Report (online). <http://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports>. Accessed 2 Sept 2015.
- Ernst and Young. 2015. Renewable Energy Country Attractiveness Index, Issue 45: September 2014 (online). www.ey.com/Publication. Accessed 2 Sept 2015.
- Ewing, F. 2015. Renewables Obligation Scotland—Solar PV Projects of 5 MW and Below, Open Letter from the Scottish Government, 22 September 2015 (online). <http://www.gov.scot/Resource/0048/00485675.pdf>. Accessed 20 Oct 2015.
- Fisher, C. 2010. Renewable Portfolio Standards: When Do They Lower Energy Prices? *The Energy Journal* 31 (1): 101–120.
- Fouquet, D., and T. Johansson. 2008. European Renewable Energy Policy at Crossroads: Focus on Electricity Support Mechanisms. *Energy Policy* 36 (11): 4079–4092.
- Foxon, T. 2005. UK Innovation Systems for New and Renewable Energy Technologies: Drivers, Barriers and Systems Failures. *Energy Policy* 33 (16): 2123–2137.
- Gross, R., and P. Heptonstall. 2014. Time to Stop Experimenting with UK Renewable Energy Policy. ICEPT Working Paper, October 2010.
- HM Revenue and Customs. 2015. A Guide to the Carbon Price Floor, (online). <https://www.gov.uk/government/publications/excise-notice-ccl16-a-guide-to-carbon-price-floor/excise-notice-ccl16-a-guide-to-carbon-price-floor>. Accessed 29 Oct 2015.
- Holburn, G. 2012. Assessing and Managing Regulatory Risk in Renewable Energy: Contrasts Between Canada and the United States. *Energy Policy* 45: 654–665.
- Howard, R. 2015. The Customer is Always Right: Putting consumers back at the heart of UK energy policy—Policy Exchange Report (online). <https://policyexchange.org.uk/?s=the+customer+is+always+right>. Accessed 10 Oct 2015.
- Hvelplund, F. 2006. Renewable Energy and the Need for Local Energy Markets. *Energy* 31: 1957–1966.
- IRENA. 2015. Renewable Power Generation Costs In 2014—January 2015 (online). https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf. Accessed 10 Oct 2015.

- Kalkuhl, M., O. Edenhofer, and K. Lessmann. 2013. Renewable Energy Subsidies: Second-Best Policy or Fatal Aberration for Mitigation? *Resource and Energy Economics* 35: 217–234.
- Kern, F., C. Kuzemko, and C. Mitchell. 2014. Measuring and Explaining Policy Paradigm Change: The Case of UK Energy Policy. *Policy & Politics* 42 (4): 513–530.
- Klessmann, C., C. Nabe, and K. Burges. 2008. Pros and Cons of Exposing Renewables to Electricity Market Risks—A Comparison of the Market Integration Approaches in Germany, Spain, and the UK. *Energy Policy* 36 (10): 3646–3661.
- Lauber, V. 2015. Political Economy of Renewable Energy. *International Encyclopaedia of the Social & Behavioural Sciences* 18: 367–373.
- Lauber, V., and S. Jacobsson. 2016. The politics and economics of constructing, contesting and restricting socio-political space for renewables – the German Renewable Energy Act. *Environmental Innovation and Societal Transitions* 18: 147–163.
- Lehman, P., F. Creutzig, M.H. Ehlers, N. Friedrichsen, C. Heuson, L. Hirth, and R. Pietzcker. 2012. Carbon Lock-Out: Advancing Renewable Energy Policy in Europe. *Energies* 5: 323–354.
- Lüthi, S., and T. Prässler. 2011. Analyzing Policy Support Instruments and Regulatory Risk Factors for Wind Energy Deployment—A Developers' Perspective. *Energy Policy* 39: 4876–4892.
- Mackenzie, W. 2009. Scotland's Generation Advantage—A report to the Scottish Government (online). <http://www.scotland.gov.uk/Resource/Doc/295424/0091448.pdf>. Accessed 25 Aug 2011.
- Matek, B., and K. Gawel. 2015. The Benefits of Baseload Renewables: A Misunderstood Energy Technology. *The Electricity Journal* 28 (2): 101–112.
- Meckling, J., N. Kelsey, E. Biber, and J. Zysman. 2015. Winning Coalitions for Climate Policy. *Science* 349: 1170–1171.
- Meyer, N., and A. Koefoed. 2003. Danish Energy Reform: Policy Implications for Renewables. *Energy Policy* 31 (7): 597–607.
- Mitchell, C., and P. Connor. 2004. Renewable Energy Policy in the UK 1990–2003. *Energy Policy* 32: 1935–1947.
- National Grid. 2015. Electricity Customer Seminar, Glasgow, 6 Oct 2015.
- Nemet, G. 2010. Robust Incentives and the Design of a Climate Change Governance Regime. *Energy Policy* 38: 7216–7225.
- OFGEM. 2011. Renewables Obligation: Guidance for Licensed Electricity Suppliers (GB and NI), (online). <https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-guidance-licensed-electricity-suppliers-may-2013>. Accessed 25 Oct 2013.
- Pearce, D. 2006. The Political Economy of an Energy Tax: The United Kingdom's Climate Change Levy. *Energy Economics* 28: 149–158.

- Renewable Energy Association. 2015. Annual Report on the UK Renewable Energy Sector, (online). <http://www.r-e-a.net/resources/rea-publications>. Accessed 22 Sep 2015.
- Roberts, J., and F.R. Bodman. 2014. Community Power-Model Legal Frameworks for Citizen-Owned Renewable Energy. *ClientEarth*. <https://www.clientearth.org/reports/community-power-report-250614.pdf>. Accessed 31 May 2017.
- Rudd, A. 2015a. *Ending New Subsidies for Wind*, 18 June 2015. Written statement to Parliament.
- Rudd, A. 2015b. Speech on Climate Change—24 July 2015. In *Aviva Conference*, London.
- Rudd, A. 2015c. Commons Select Committee on Energy and Climate Change Questions the Secretary of State as Part of the Committee's Inquiry into the Department of Energy and Climate Change's (DECC) priorities for 2015 (online). <http://www.parliament.uk/business/committees/committees-a-z/commons-select/energy-and-climate-change-committee/news-parliament-2015/decc-priorities-2015/>. Accessed 22 Sept 2015.
- Rudd, A. 2015d. Statement from the Secretary of State for Communities and Local Government, 18 June 2015 (online). <http://www.parliament.uk/documents/commons-vote-office/June%202015/18%20June/1-DCLG-Planning.pdf>. Accessed 22 Sept 2015.
- Temperton, I., and M. Schoenberg. 2015. The Levy Control Framework Beer Mat, March 2015 Climate Change Capital Report (online). <http://www.climatechangecapital.com/thinktank/research/your-levy-control-framework-beer-mat>. Accessed 1 Mar 2015.
- The Smith Commission. 2014. Report of the Smith Commission for Further Devolution of Powers to the Scottish Parliament—27 November 2014 (online). http://www.smith-commission.scot/wp-content/uploads/2014/11/The_Smith_Commission_Report-1.pdf.
- Ulph, A., and D. Ulph. 2013. Optimal Climate Change Policies When Governments Cannot Commit. *Environmental & Resource Economics* 56 (2): 161–178.
- Walker, G., and N. Cass. 2007. Carbon Reduction, 'The Public' and Renewable Energy: Engaging with Socio-Technical Configurations. *Area* 39: 458–469.
- Watson, J., and A. Scott. 2009. New nuclear Power in the UK: A Strategy for Energy Security? *Energy Policy* 37: 5094–5104.
- Wyns, T., A. Khatchadourian, and S. Oberthür. 2014. EU Governance of Renewable Energy post-2020—Risks and Options, A Report for the Heinrich-Böll-Stiftung European Union (online). www.ies.be/files/eu_renewable_energy_governance_post_2020.pdf. Accessed 25 Sept 2015.

AUTHORS' BIOGRAPHY

Anna L. Berka is a graduate of the Universities of Oxford and Wageningen, with M.Sc. degrees in Economics and Environmental Science. She is an Early Stage Researcher with the European Union Marie Curie Innovative Training Network, Ph.D. candidate with the Department of Forest Economics at the University of Helsinki, as well as co-founder and research associate with Scene Consulting. She has led numerous events under the banner of social and organisational learning for the greening of both public and private enterprises, and coordinated the UK's first community energy database initiative in 2011–2012.

Jelte Harnmeijer A systems thinker and practitioner who strongly believes in integrating research with implementation, Jelte specialises in distributed low-carbon energy solutions. Jelte is the T.B. Macaulay Renewables Fellow at the James Hutton Institute, where he focuses on how community renewables can help address pressing challenges such as food and fuel poverty, inequality, and global climate destabilisation. He is a Founding Partner at Scene Consulting, an Edinburgh-based social enterprise that assists non-specialists in meeting their renewable energy development objectives. He holds concurrent fellowships in Carbon Economics and Carbon Finance at the University of Edinburgh.

Bill Slee is an Emeritus Fellow at the James Hutton Institute. His main interests include evaluation of rural development policies, including agri-environment policy, climate change and land use, forestry and community energy. He is active on two EU Horizon 2020 projects on innovative delivery of public goods and social innovation.