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EXPLORING PUBLIC SUPPORT FOR CLIMATE ACTION AND RENEWABLES IN RESOURCE-RICH ECONOMIES: THE CASE OF SCOTLAND

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7 October 2019

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Exploring public support for climate action and renewables in resource-rich economies: The case of Scotland

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1. Introduction

Oil and gas wealth offers countries and regions the opportunity for national transformation, as in the case of, say, Norway or Qatar, but their economic and political systems are often distorted by the rent-seeking nature of the industry and they end up suffering from the 'resource curse' (Ross, 1999) while still finding it difficult to shift away from resource extraction. Simultaneously, virtually all nations have signed up to ambitious climate goals of keeping global average temperature rise below 2°C above pre-industrial levels. A transition to renewable energy sources and low-carbon emission technologies are laid out in 2015 Paris Climate Agreement pledges, but these currently fall short of what is required to do so; even if the Nationally Determined Contributions (NDCs) were to be achieved, this would only constitute around one third of what is required (UNEP, 2018). Global emissions in both 2017 and 2018 have increased (Jackson et al, 2018). Thus, research has found that keeping climate change below 2°C will be "highly unlikely" under the status quo (Raftery et al., 2017).

To avoid temperatures rising above 2°C will require deep decarbonization, which includes not just the power sector and light-duty transportation, but also harder-to-reach sectors including heavy-goods, maritime and air transportation, heat, and energy-intensive industries which will call for technologies like carbon capture and storage (CCS) (Davis et al., 2018). Although there have been efforts to develop roadmaps for 100% renewable energy in many countries (Jacobson et al., 2017) and renewables remain popular, critics have expressed skepticism at the potential to achieve a purely renewable-based solution (Clack et al., 2017).

With the notable exception of Norway, most resource-rich economies tend to be laggards on climate action (Burck et al., 2018). Similarly, resource-rich regions (e.g., West Virginia in the US or Saskatchewan in Canada) have often acted to restrain or undermine national ambitions (Rabe, 2008; Besco, 2018; Carter, 2018; Hunter, 2019). Ultimately, a well of political and public support will be required to undertake measures that have

proven difficult in most major producers, so we seek to explore public sentiment on the subject in a country which has undertaken such a transition.

As a case study, we explore public views of decarbonization in Scotland, which has been notably successful in setting an ambitious climate policy and transitioning to renewable energy, despite a longstanding history of fossil fuel extraction in the North Sea. The United Kingdom (UK) currently holds the second-highest oil and gas reserves in Europe, behind Norway (BP, 2017), virtually all of which is offshore of Scotland. However, climate and energy policies in the UK, and Scotland in particular, that aim to reduce greenhouse gas (GHG) emissions have enabled a rapid transition to renewable energy sources. Scotland had reduced GHG emissions by 47% from its 1990 baseline levels as of 2017 (Scottish Government, 2019) and produced 74.6% of its electricity from renewable sources by 2018 (Matthews and Scherr, 2019). Almost half of that reduction in emissions is a result of a 73.5% reduction in emissions in the energy sector even though it is only responsible for 15% of emissions. By contrast, in the European Union (EU) as a whole, only 28.8% of its electricity was generated from renewables in 2015 (EEA, 2017).

Over the past fifteen years, the UK has ratcheted its target of cutting greenhouse gas emissions from 60% to 80% and most recently to 100% below 1990 levels by 2050, i.e., net-zero emissions for the UK overall, similar to other national targets set in Sweden (2045) and Finland (2035) (Walker et al, 2019). Individual countries within the UK can set their own targets and 'reflecting its… circumstances', the Committee on Climate Change has suggested that Scotland adopt an even more aggressive target to achieve net-zero by 2045 (CCC, 2019).

In this context, we explore how the general public in Scotland perceive their country's path to decarbonization. Are members of the general public, even in regions where fossil fuel extraction is the predominant industry, supportive of the approach the government has taken? What are their views on climate policy, renewable energy, and other low-carbon technologies in such as CCS and what are the policy implications of those views? We conducted focus groups and citizens' juries in regions where the local economy is

highly reliant on fossil fuel extraction, and regions where the oil and gas industry employ a smaller proportion of the local population to determine whether public opinion on these subjects varies by location. These findings aim to serve as a case study of Scotland's path to decarbonization and illuminate how other countries with a longstanding history of fossil fuel extraction may be able to rapidly decarbonize. In the process, we explore the implications for policy-makers and project developers of engaging in such public engagement exercises.

2. The Context for Scottish Energy and Climate Policy

2.1. A Brief History of UK and Scottish Energy Policy

Following a series of major discoveries in the North Sea off the northeast coast of Scotland in the 1970s, the UK became a major oil and gas producer (Kemp, 2011). From 1981 to 2003, the UK became energy independent and was a leading global exporter (BEIS, 2018d). In 1999, oil production peaked at 6 million barrels and gas extraction peaked in 2001. Since then, there has been a gradual decline in production (with occasional upticks), with revenues fluctuating between £6 and £10 billion between 2004 and 2013. (Scottish Government, 2018c). Although significant volumes of oil and gas continue to be extracted from the North Sea, since 2004, the UK has become a net importer of oil and gas, with the share of imports rising steadily to roughly 50% by the mid-2010s (BEIS, 2018d). With falling production, a major review led by Sir Ian Wood in 2014 sought to explore how to maximize economic recovery from the UK Continental Shelf (Kemp and Stephen, 2017). Simultaneously, both government and industry have increasingly focused on decommissioning oil and gas infrastructure, which is creating a burgeoning industry (Oil and Gas UK, 2018; McCauley, 2018).

Since 1999, as a result of devolution, Scotland has had increased powers to legislate on matters related to environment (and transport, education, and some taxation powers), but other matters remain reserved for the UK government and Parliament in Westminster including energy, trade and industry. Thus, questions of energy and climate change policy cut across domains of responsibility of different levels of government.

Given the volume of revenues at stake in the North Sea, unsurprisingly, control over those resources has played a central role in the imagination of Scottish nationalists, led by the Scottish National Party (SNP). Future revenues from the North Sea played an important role in the Scottish independence referendum campaign of 2014 since these revenues were seen as critical to the viability of an independent Scotland (Johnson and Phillips, 2012). In its topline summary report on government finances, the Scottish government (led by the SNP) continues to regularly present summary values for revenues as two figures – excluding and including North Sea revenue (Scottish Government, 2018c).

Another important difference from the rest of the UK arose from the 1989 Electricity (Scotland) Act, which allowed for separate planning consent from England for both overhead transmission lines and large generation facilities including onshore wind farms. The Scottish government also operated its own distinct Renewables Obligation to promote renewable energy investments. As a result, Scotland, with a population one-tenth that of England, has more than double the onshore wind capacity (7.5 GW versus 3.1 GW) (BEIS, 2018c).

The power sector also benefited from the major gas resource discoveries, helping fuel the so-called ‘dash for gas’, which saw some 20 GW of new gas-fired capacity added over the course of the 1990s, largely at the expense of coal and so CO_2 emissions began to fall dramatically (Newbery, 2005). Thus, by the time climate change targets were being debated in Europe and internationally in the mid-1990s, Britain was well situated to be a ‘leader’ since its emissions were falling relative to 1990.

2.2 Climate Policy in the UK

Under the 1997 Kyoto Protocol, the EU pledged to reduce its overall greenhouse gas emissions by 8% below 1990 levels between 2008 and 2012, but the UK (along with Germany) took a disproportionately large share of that commitment by agreeing to a target of 21% below 1990 levels. The main elements of UK climate policy include participation in the EU Emissions Trading Scheme (ETS) which covers approximately

45% of EU emissions, as well as a series of domestic measures including a Climate Change Levy first implemented in 2001, followed by a series of Climate Change Agreements (Bowen and Rydge, 2011).

However, it was the UK's Climate Change Act of 2008 which set the legal framework for reducing GHG emissions in the UK by at least 80% below 1990 levels by 2050. The UK aims to accomplish this reduction in emissions by setting 5-year carbon budgets created by an independent Committee on Climate Change (CCC), which seeks to ensure the targets are met. In 2013, the UK introduced a carbon price support (CPS) which set a carbon price floor and has helped lead to the decline of coal-fired generation (House of Commons, 2018).

In the 1990s and early 2000s, the UK had been a relative laggard in terms of renewables penetration (Kern et al, 2014). Since the mid-2000s, however, driven by the EU Renewables Directive which called for a 20% share of renewables in in total primary energy, the UK dramatically increased its ambition. The UK Government provided renewable support through a series of policies that have led to rapid growth in electricity generation capacity from onshore wind (12.85 GW), offshore wind (6.99 GW), solar (12.78 GW) and biomass (4.28 GW) (BEIS, 2018c). These critical policies have enabled the UK to become a global leader in reducing its GHG emissions. This was accomplished despite the British government ruling out the cheapest scalable renewable option in England – onshore wind development – due to opposition within the governing Conservative Party (Kirkup, 2015).

As of 2017, UK GHG emissions have fallen by 43% from 1990 levels despite GDP rising by over 70% during this time (CCC, 2018a). Total GHG emissions in 2017 were 456 $MtCO_2$ equivalent, and reduction in emissions since 1990 can be primarily attributed to the reduction in the use of coal for energy production. However, the energy sector still remains the leading emitter in the UK, contributing 23% (BEIS, 2018a). The most recent CCC progress report to Parliament recommended that government take four key actions: support low-emissions reduction strategies (ex. wind and solar); create consistent policies

rather than “chopping and changing” them; set and enforce stricter standards (ex. fuel efficiency); and invest in long-term emissions reduction infrastructure (e.g., CCS) (CCC, 2018a).

Despite emissions reduction progress, the CCC found that meeting the fourth (2023-2027) and fifth carbon budgets (2028-2032) without the use of CCS would be “highly challenging and likely to be much more costly to achieve” (CCC, 2018b). Moreover, although CCS is associated with the fossil fuel industry, the expectation has been that, if risk communications were done well, CCS facilities would be successfully sited (Lofstedt, 2015).

2.3. Climate and Renewable Energy Policy in Scotland

Scotland has sought to exceed the UK in its level of ambition on climate action (Royles & McEwen, 2015; McEwen & Bomberg, 2014). In the past decade, Scottish GHG emissions have been reduced significantly and renewable energy production has increased rapidly despite continued oil and gas extraction in the North Sea. Scotland’s Climate Act of 2009 established its own target of 42% reduction in GHG emissions by 2020 in addition to the UK’s own 2050 target of an 80% reduction. The Act created a Scottish Committee on Climate Change which the Scottish Executive would need to heed in addition to the UK’s Committee on Climate Change.

Scotland’s strategy to reduce GHG emissions includes an energy efficiency plan (Scottish Government, 2010b) and an 80% renewable electricity generation target by 2020 (Scottish Government, 2010a). To ensure this goal would be achieved, a 2020 ‘routemap’ was developed, providing details related to phasing out nuclear energy, supporting innovation, training the workforce needed, investing in the grid, and identifying actions by sector (Scottish Government, 2011; Scottish Government, 2015). As part of its new Climate Change Plan, Scotland would set a goal to achieve 50% of its total energy for transportation, heat, and electricity from renewable sources by 2030 (Scottish Government, 2018d). Scotland’s low-carbon economic strategy aims to create 60,000 green jobs as renewable energy production increases (Scottish Government, 2010a).

Unlike the British government, however, the Scottish government strongly supported a continued role for onshore wind while opposing any role for nuclear power as part of the portfolio (Scottish Government, 2017c).

Most recently, the Scottish government introduced a bill in May 2018 proposing a 90% emissions reduction target by 2050, and 100% reduction "as soon as possible" (Scottish Parliament, 2018). Despite exceeding the UK government target, some environmental organizations have been critical of the bill, stating it is not ambitious enough (Keane, 2018). Sweden, for example, has set a target of reaching net-zero emissions by 2045. The Environment Committee of the Scottish Parliament and groups such as the Church of Scotland and WWF-Scotland have supported a commitment to net-zero emissions (Carrell, 2019). The 2018 Committee on Climate Change report on reducing emissions in Scotland noted that emissions reduction in the power and waste sector has been significant, but little progress has been made in other sectors, particularly in agriculture, transportation, and for heating non-residential buildings (CCC, 2017; CCC, 2018c).

The Scottish government has also been exploring the possibility of state enterprises in the energy sector. In October 2017, the First Minister Nicola Sturgeon pledged to establish a state-owned household energy supplier to compete with private electric and gas utilities and its design has been actively debated (Low, 2018). A consultancy report found that such a state-owned firm would cost £3.5 million to set up, £9 million in running costs and face stiff competition from as many as 42 other firms in the market (EY, 2018). Moreover, half of those firms (including two of the so-called Big 6) were loss-making. The report also highlighted that many in Scotland were particularly loyal to existing 'Scottish' brands Scottish Power (owned by Iberdrola) and Scottish Hydro (owned by SSE). Moreover, some jurisdictions, such as Edinburgh and Aberdeen already have their own local energy companies to pursue options such as district heating (Fraser, 2018).

2.4. Evolution of Energy Production, Consumption, and Emissions in Scotland

Scotland's evolution is one of continued abundance but shifting from fossil dominance to greater reliance on renewables. Over 2009-2017, the share of renewables in gross final

energy consumption rose from 8% to 20% in Scotland. By comparison, renewables' share in the EU overall only increased from 12.6% to 17.5%, whereas in the England the share increased from 3.3% to 10.2% (Matthews and Scherr, 2019), This 12.5% percentage-point increase in Scotland was the second largest in the EU after Denmark (ibid).

In 2018, 74.8% of its electricity generation came from renewable sources with a goal of 100% by 2020 (Matthews and Scherr, 2019). The leading sources of renewables capacity were onshore wind (7.54 GW), and hydro (1.64 GW) followed by solar (310 MW), offshore wind (246 MW), and biomass (250 MW) although in terms of generation, hydro (5395 GWh) and biomass (1484 GWh) fare better than variable sources such as onshore wind (16860 GWh) and solar (275 GWh) (BEIS, 2018c). Carbon intensity of electricity has declined dramatically from 389.8 g CO_2/kWh in 2000 to 150.6 g CO_2/kWh in 2015 to 54.4 g CO_2/kWh in 2016 (Matthews and Scherr, 2019). Moving towards 2050, the Scottish government's has placed greater emphasis on local energy generation (Scottish Government, 2017d).

Scotland remains a major exporter although this now includes electricity – in 2016, 13,736 ktoe of energy (13%) was for domestic consumption while 88,742 ktoe (87%) were exported or lost. Of the energy consumed in Scotland, 24% was used for electricity, 25% for transportation, and 51% for heating, buildings and in industry in 2016 (Scottish Government, 2018c). Scotland has also managed to surpass its energy efficiency goal of 12% by 2020 – by 2015, it had reduced its energy consumption by 15.4% from its 2005/2007 baseline.

GHG emissions in the UK have fallen more rapidly than in any other major industrialised economy, dropping over 40% from 797 $MtCO_{2,eq}$ in 1990 to 471 $MtCO_{2,eq}$ in 2016 (Brown et al., 2018). Scotland's emissions have decreased even more dramatically from 75.6 $MtCO_{2,eq}$ in 1990 to 38.6 $MtCO_{2,eq}$ in 2016, a reduction of almost 50% and thereby exceeding the 42% target set in Scotland's Climate Act several years early (Scottish Government, 2018c). In 2009, Scotland set an ambitious target to reduce emissions by

42% from 1990 levels by 2020. By 2017, emissions had been reduced by 46.8% from 1990 levels to 40.5 $MtCO_2eq$, however, accounting for the Scotland's participation in the EU Emissions Trading Scheme (ETS), which is the formal basis for assessing its target, emissions were 46.1 $MtCO_2eq$, which only translates to a 39% reduction from the baseline, just missing its annual target for 2017 established in the Climate Change (Scotland) Act 2009.

2.5. CCS Technologies in the UK and Scotland

The Intergovernmental Panel on Climate Change (IPCC) has stated with high confidence that global climate change is not likely to be limited to 2°C without employing CCS technology (IPCC, 2014), a view echoed at the UK level with regard to meeting its 80% target for 2050 (RAEng, 2015; CCC, 2018b) The Scottish Government has stated it supports further development of CCS to mitigate climate change at the lowest cost (Scottish Government, 2017d). Moreover, energy firms would be well positioned to transition from resource extraction to CCS because of their subsurface expertise (Reiner, 2019). Past studies have found that Scots were less opposed to shifting away from fossil fuels and viewed oil in a less unfavourable light (Demski and Pidgeon, 2013).

However, CCS deployment globally has been modest, particularly when compared to the 4,000 million tonnes of CO_2 that the International Energy Agency argued should be captured and stored in 2040 to stay under 2°C (IEA, 2016). As of November 2018 there were 18 large-scale CCS projects capturing almost 40 million tonnes per year, with current proposals for almost doubling the number and scale (Global CCS Institute, 2018), but the history of CCS development is littered with a litany of failures globally and in the UK (and Scotland) in particular (Reiner, 2016).

The first major project announced for the UK was BP's proposal in 2002 for its first 'decarbonized fossil' plant (DF-1), to be carried out at Peterhead in northeast Scotland. The leader of the Scottish National Party and local member of parliament for the Peterhead, Alex Salmond, was an enthusiastic backer of the project and even many Greens were supportive (Banks, 2006), but ultimately it was cancelled by BP when the

British Government refused to ‘pick winners’ (Scrase and Watson, 2009; Bowen, 2011). In 2005, the UK had announced it would aim to become a global leader in demonstrating CCS technology following the House of Commons inquiry into CCS (House of Commons, 2006). After the collapse of BP’s Peterhead project, in 2007, the British Government launched a competition for the first CCS demonstration project competition, and in 2010, announced £1 billion would be available in capital funding, although competition was restricted to coal power plants. A project to retrofit Scottish Power’s coal-fired Longannet station was the last finalist standing in negotiations with the Department of Energy and Climate Change (DECC) when the Department decided in October 2011 to terminate further negotiations. However, the £1 billion in funding would remain available through a new competition launched in 2012 (NAO, 2012) and DECC reaffirmed its commitment to support CCS deployment in its CCS Roadmap (DECC, 2012).

During the second competition to develop the UK’s first commercial-scale CCS projects, four projects were shortlisted in October 2012, and ultimately narrowed to two: one in Yorkshire in northern England and a new project in Peterhead led by Shell. The Peterhead Project would capture 1 million tonnes of CO_2 per year from a combined cycle gas turbine (CCGT) (Cotton et al, 2017). However, on 25 November 2015, the British Government cancelled the competition without warning before it had reached a conclusion. The Treasury cited several factors for the cancellation including: high costs to the consumer, that CCS was not yet cost-efficient, the competition would not necessarily yield future CCS expansion, and "there were better uses for the £1 billion" (NAO, 2017). In reviewing lessons from the experience, however, the National Audit Office (NAO) argued there were numerous flaws in the process including in the design of the mechanism to support operating costs of CCS, the lack of any agreement between DECC and Treasury over costs, and that numerous stakeholders believed that government needs to carry more risk to make CCS more affordable to consumers, Ultimately, the NAO argued that the £168 million government spent over the course of the two competitions did not deliver value for money.

2.5. Energy and Climate at the Local Level: Edinburgh, Aberdeen, and Peterhead

We employ focus groups and citizens' juries to answer a series of interrelated questions on climate policy, renewable energy, and other low-carbon energy technologies in Scotland. We seek to understand the extent of the public's awareness of ongoing debates related to climate policy and the impact of wider concerns over energy affordability, energy security, and climate change.

We conducted our research in three locations: Edinburgh, Aberdeen and Peterhead, each of which offers a quite distinct local context. Edinburgh, a city of 500,000, is the capital of Scotland and seat of the Scottish Government. As a center for banking, education and tourism, Edinburgh has one of the lowest unemployment rates and highest rates of high-skilled occupations (and GVA per capita) of major British cities (Edinburgh City Council, 2019).

Aberdeen is the third largest city in Scotland with a population of roughly 200,000, which has long been the hub for the oil and gas industry in the Northern North Sea and is often described as the Oil Capital of Europe. After boom years in the 1980s and 1990s, when it became a major international center for oilfield services, the future of Aberdeen is closely associated with the dwindling production from the North Sea. Although extraction of the remaining reserves and decommissioning still offer some opportunities, there has been a widespread recognition that Aberdeen faces an existential threat without rethinking its strategy, although energy remains a top priority. A recent regional innovation agenda developed by the city of Aberdeen and surrounding Aberdeenshire shows four of the top seven priorities involve energy (Aberdeen City Council et al, 2018). The first action listed in the regional economic plan is to 'Capitalise on our reputation as a global centre of excellence for subsea and underwater engineering and decommissioning.' Later elements expand the definition of energy to include 'supply chain development in alternative energies (including renewables and CCS/hydrogen action plan)'.

Finally, Peterhead is a town of 18,000 in Aberdeenshire, north of Aberdeen and is the largest fishing community in the UK but is considerably poorer than Aberdeenshire

overall (£25,800 versus £37,000) (Aberdeenshire Council, 2017). There is a large gas-fired power plant in the center of town run by SSE, which would have been the source of CO_2 in both the first and second CCS projects. The Shell Peterhead project would have been a major local employer, with an average of 400 people employed on site, rising to 600 at peak construction (Cotton et al, 2017). Shell began stakeholder engagement for its CCS project in 2012 "in a relatively lowkey and informal way" until late 2013 "when it became more proactive" by appointing "a part-time Community Liaison Officer" who was meant to be familiar with the region and local stakeholders leading what it described as a 'diverse and extensive range of mechanisms' for stakeholder engagement (Shell, 2016).

3. Methodology

3.1. Focus Groups

We conducted four focus groups in January 2017 with 36 citizens. Two focus groups were conducted in Peterhead (n=10 and n=9), one in Aberdeen (n=8), and one in Edinburgh (n=9). Participants were recruited by Ipsos MORI, an international market research firm. Focus groups provide the opportunity for group discussion and can yield a range of ideas and opinions in a more natural setting than one-on-one interviews (Liamputtong, 2011). Potential downsides of focus groups are that discussion may be relatively superficial, and dominant individuals may influence some of the responses of other group members (Krueger and Casey, 2015). Our focus groups were comprised of individuals from different age groups, social grades, educational background, employment status, and opinions on climate change (Table 1).

Focus Groups	
Location	**Specifications**
Peterhead 1	Gender □ Equal split of males and females Age □ At least 3 people aged 18-24, at least 3 aged 25-54 and at least 3 aged 55+ Social Grade □ All participants are ABC1 social grade □ A mix of working full time, working part time and not in employment □ At least 4 people who feel climate change is an immediate/ urgent problem; and at least 4 who feel it is more of a problem for the future, not really a problem, or are not convinced climate change is happening
Peterhead 2	□ Same as Peterhead 1 except: □ All participants are C2DE social grades
Aberdeen	□ Same as Peterhead 1 except: □ An equal mix of ABC1 and C2DE social grades □ 4 people with either HNC, HNC, degree, or postgraduate; 4 people with either O Grade, Standard Grade, A level or Higher; 2 people with no formal qualifications
Edinburgh	□ Same as Aberdeen

Table 1. – Focus group recruitment

3.2. Citizens' Juries

Citizens' juries aim to provide policymakers with recommendations from individuals that are representative of the general public. A group of 15 to 20 citizens are presented with information from experts, complete a series of deliberative activities, and then produce recommendations, which can be fed into the policy process (Crosby et al., 1986). By keeping the group moderate in size, perspectives can be explored in depth through group discussions (Smith and Wales, 2000). The opportunity to perform a variety of activities over the course of several days provides advantages over focus groups or surveys by offering extensive opportunity for deliberation. Although cost is often a constraint, this

methodology has been used in numerous environmental decision-making processes (Irvin and Stansbury, 2004). Moreover, in the UK context, the need to bring greater deliberation into environmental policy debates has long been highlighted (RCEP, 1998)

We conducted two citizens' juries in January and February 2017 following the initial focus groups. The juries took place over two consecutive Saturdays in Edinburgh (*n*=19), and in Aberdeen (*n*=19). Ipsos MORI recruited the panelists, moderated the sessions, and transcribed the focus groups and citizens' juries. We sought to ensure diversity in gender, age, social grade, educational background, employment status, and opinion on climate change (Table 2).

Citizens' Juries
Equal split of males and females
A mix of ages: at least 6 people aged 18-24, at least 6 aged 25-54 and at least 6 aged 55+
Equal split of ABC1 and C2DE social grades
A mix of working full time, working part time and not in employment
Educational attainment: 8 people with either HNC, HNC, degree, or postgraduate; 8 people with either O Grade, Standard Grade, A level or Higher; 4 people with no formal qualifications
At least 7 people who feel climate change is an immediate/ urgent problem; and at least 7 who feel it is more of a problem for the future, not really a problem, or are not convinced climate change is happening

Table 2. – Citizens' jury recruitment

3.3 Data collection

Focus groups were 90 minutes in duration – after some introductory discussion, an expert speaker provided a 10-minute presentation on low-carbon technologies, with a particular focus on CCS, followed by the opportunity to ask the speaker questions. The focus group concluded with discussion on the current energy situation in Scotland, the future of oil and gas production, renewable energy, and CCS. Short written questionnaires were administered upon arrival and after concluding the session.

Citizens' juries took place over a period of two days and explored the focus group themes in greater depth. Each day of the jury lasted approximately six hours. Five questionnaires

were administered – upon arrival, between activities, and at the end. During the initial icebreaker activity, participants were asked which words or phrases came to mind when thinking about energy in Scotland, and challenges they perceived Scotland faced in regard to energy. Next, the jury broke into two groups to discuss those challenges in greater depth and presented findings back to the full jury. A presentation on the current Scottish energy supply was delivered by an expert speaker, followed by a question and answer (Q&A) session. The jury discussed factors to consider when developing an energy policy in Scotland. A second expert speaker gave a presentation on low-carbon energy technologies including renewables, nuclear, and CCS. After Q&A with the second expert speaker, the day concluded with a summary, and final thoughts on day one.

Day two of the citizens' jury began with an introduction and recap of day one, followed by the third and final expert presentation on the future of Scottish energy systems followed by Q&A. The jurors broke into pairs to discuss their current opinions. The full jury then participated in forming an opinion grid along two axes “many risks” versus “few risks” and “many opportunities” versus “few opportunities.” Jurors began by standing in the center of the room, and for each option (onshore wind, offshore wind, nuclear, and CCS), moved to the part of the room that reflected their opinion of that technology. The jury then broke into small groups to discuss the most important factors to consider when developing an energy policy for Scotland. The moderators divided the factors into several themes. The jurors discussed why each factor was important and voted for the top five factors within each theme. Next, the jury then broke into small groups to discuss the recommendations they would give to the Scottish Government and presented their recommendations for the rest of the jury to react and comment. Each full jury voted on the recommendations they would give the Scottish Government.

4. Results

We completed our thematic analysis of the transcripts of the citizens’ jury and focus group sessions using NVivo. Recurring themes or ideas within the transcription were highlighted and assigned a code. The list of codes was then streamlined, condensed, and

the transcription was reviewed again (Saldana, 2009). The subtitles below reflect the major themes.

4.1. Focus groups in Peterhead, Aberdeen and Edinburgh

4.1.1. Scotland's Declining Oil and Gas Industry

Participants in all focus group locations perceived oil and gas to be a finite resource and had witnessed the impact of the declining oil and gas industry in Scotland. In Peterhead, residents stated that the oil and gas industry was "extremely important," particularly to the local economy in the Northeast of Scotland. Job loss was a major topic in the Peterhead focus groups, with several contributors providing anecdotes about job losses in their community:

> "...it's not just been that industry, for example, my lass works in a nursery near [area] and they have to get rid of their staff because their kid's parents have lost jobs and so have had to move" (Peterhead).

Topics such as "lower wages," falling house prices, and shop closures were also mentioned in Peterhead. One Aberdeen participant noted that "lots" of people were losing their jobs. Although there were fewer explicit mentions in Edinburgh of job losses, several noticed the effects on the declining oil and gas industry on the rest of the economy. However, some noted that conflicting information from government made it difficult to understand exactly how much oil and gas remained.

4.1.2. Climate Change and Renewable Energy

In all focus group locations, participants expressed a desire to conserve the environment for posterity:

> "I think climate change is such an important issue. We are worried about the risks of this, but we already know the risks of climate change and we should just try and do anything that we can to make any change" (Edinburgh).

There were several participants from Peterhead who were concerned that a transition to renewable energy sources could reduce job opportunities for people working in the oil and gas industry. Still, a large majority of citizens in all four focus groups viewed the transition to renewable energy sources positively and thought that more should be done by the government to expand renewable energy production. In Edinburgh, one contributor described other European countries as being more proactive in expanding their own renewable energy portfolios than the UK:

> "I think there has been quite a lot of missed opportunities in the UK especially in regards to wind, and if you look at somewhere like Germany they have really like made a real effort to support new types of energy…" (Edinburgh).

Overall, despite (or perhaps because of) the Scottish government having adopted a much more positive regulatory regime to support onshore wind, feelings towards onshore windfarms were somewhat negative due to appearance and noise while feelings towards offshore windfarms were generally neutral or positive.

4.1.3. CCS

In all three locations, awareness of CCS was very low. A majority of participants had not heard of CCS before, and had "no idea" what it was, while a small number stated they had heard the term but were not aware of any specifics about what the term meant. Peterhead residents were almost completely unfamiliar with the technology, despite the fact that the town had been the preferred location for a major CCS demonstration plant, which would have brought in significant investment. Only one participant (out of 19) in the two Peterhead focus groups was aware of CCS on a project-specific level and was able to provide concrete information about CCS (see Table 3).

	Peterhead 1		Peterhead 2		Aberdeen		Edinburgh	
View on CCS in:	Scot-land	Peter-head	Scot-land	Peter-head	Scot-land	Peter-head	Scot-land	Peter-head
Very bad idea	0	0	0	0	0	0	0	0
Fairly bad idea	0	0	0	0	0	0	0	0
Neither bad nor good	0	0	1	0	0	1	0	1
Fairly good idea	3	5	1	2	3	2	3	1
Very good idea	7	5	7	7	5	4	6	7
Not sure	0	0	0	0	0	0	0	0

Table 3. Overall perceptions of CCS in Scotland and in Peterhead by focus group

Major Drawbacks of CCS	Peterhead 1	Peterhead 2	Aberdeen	Edinburgh
Increased prices for electricity	0	2	1	0
Would prefer greater use of renewables	4	0	1	1
Makes us too reliant on fossil fuels	1	1	1	0
Risks from CO2 leaking	1	3	3	4
Not sure	3	1	1	3

Table 4. Perceived problems associated with CCS for the four focus groups

Once information was presented about CCS, questions arose related to the longevity, management, and safety of CCS projects (Table 4). Some Aberdeen residents wanted to understand how long it would take for the storage area to "fill up" and questioned whether the storage site would need to be "constantly" managed. However, the primary concern about CCS related to its safety. In Edinburgh, there was concern about whether a CO_2 leak could have a negative impact on sea life, and potentially affect the fishing industry. Safety concerns, including concern about potential risk of explosion, were the leading consideration and were echoed by a majority of those involved:

> "Is it safe stored? Obviously with the layers and everything on top, yes, but what if anything happens to it? For example, my flat is sinking slightly, apparently. What happens if the ground starts sinking and it's all released at once? That could be disastrous for the environment" (Aberdeen).

Despite these concerns, a majority in all focus groups considered CCS to be an option worth pursuing. Rationales for supporting CCS included environmental benefits, making use of existing infrastructure, and potentially providing job opportunities. Those most supportive saw the potential for CCS to reduce environmental impacts for posterity. Participants in the first Peterhead focus group indicated that they believed it would be beneficial for the existing infrastructure to be repurposed for CCS:

> "[The pipelines] are already in place, they are on the ground already, so why not use them, if they put money towards using them in the future" (Peterhead).

Several Aberdeen residents were interested in learning whether oil and gas workers might be able to obtain employment from CCS project development. They identified CCS as a potential means of increasing the number of jobs in the region.

4.1.4. The Role of Individuals and Companies in Reducing Emissions

The role individuals and companies could play in conserving the environment and reducing emissions also received attention. Panelists in Aberdeen and Edinburgh thought more should be done to educate the general public about the environment. In both Aberdeen and Peterhead, several participants pointed out that individuals could do more to minimize their personal impact through measures such as saving electricity and purchasing items that are more energy-efficient.

The Peterhead focus groups also believed it would be helpful if consumers were provided with more information on their electricity and heating use. They were unsure of their current energy use but felt could use this type of information to reduce their impact. Participants, particularly those in both Peterhead focus groups, believed that the oil and gas industry should bear greater responsibility for reducing emissions by taxing companies for producing CO_2 rather than funding CCS from taxpayers:

> "Put it back to the folk that are causing it" (Peterhead).

4.2. Citizens' Juries in Aberdeen and Edinburgh

4.2.1. Energy Challenges in Scotland

During the opening discussions of each jury, participants divided into two groups to explore the energy challenges facing Scotland and the top three challenges identified by each group (Table 3). In Edinburgh, the top three challenges identified by group one included rising costs, declining fossil fuel resources, and Scotland's energy independence:

"…oil is a finite resource. No matter how much of it there is, eventually it will run out… I think it's good the Scotland is becoming more reliant on windfarms, turbine energy, solar energy. You know, basing everything on oil is quite foolhardy in my opinion" (Edinburgh).

Location	Group	Top Three Challenges
Edinburgh	1	1. Rising costs 2. Declining fossil fuel resources 3. Scotland's energy independence
Edinburgh	2	Undecided, but substantial conversation centering around cost, environment, safety, and energy independence.
Aberdeen	1	1. Decommissioning in the North Sea 2. Fracking 3. Energy affordability
Aberdeen	2	1. Transitioning to renewable energy 2. Potential implications of Brexit 3. Training the workforce to utilize new technologies

Table 5. Energy Challenges in Scotland by Citizen Jury Group

Other themes discussed but not selected as one of the top three challenges included renewable energy, technological development, growing demand, safety, concerns about Brexit, and the need to involve scientists in the policymaking process.

Group two in Edinburgh struggled to decide upon the top three challenges, but discussion primarily focused on cost, the environment, saving energy, safety, finding the right energy provider, recycling, and energy independence:

"I think cost is definitely the first thing. I'm definitely interested in the environment, but I think overall cost would have to come first." (Edinburgh).

A key topic of discussion in group two was finding an affordable energy provider. Jurors expressed uncertainty on how to find an "environmentally friendly" energy provider.

When the two groups merged to discuss their findings, corporate accountability emerged as a key challenge. One concern shared by several participants focused on energy tariffs:

> "Everybody has got different costings… people live next door and there's a completely different price. So, they have to be held accountable for how they sell the product…" (Edinburgh).

In Aberdeen, the top three challenges group one decided on were: (i) decommissioning in the North Sea, (ii) fracking (specifically safety and environmental impacts), and (iii) energy affordability. The greatest concerns in Aberdeen, perhaps unsurprisingly, related to the fate of the North Sea oil and gas industry, and whether companies would simply leave and in what manner:

> "I mean, if all the oil companies have been making these massive profits for like 30 or 40 years are they going to be putting that funding back into decommission the rigs effectively, or are they going to do what they do in other countries and just, you know, put like a little cap over it and see you later kind of thing. If you look at what oil companies have done in other countries that have allowed them to do it, they just go in and wreck the place..." (Aberdeen).

Concerns were raised over the safety of fracking and its environmental impacts, citing the US where fracking was having negative impacts on water systems. Group one also discussed recycling, potential energy rationing, transportation, economic efficiency of different energy resources, renewable energy, and energy independence.

In group two in Aberdeen, the top three challenges they perceived were: (i) the impacts of transitioning to renewable energy sources including both cost and environmental impacts, (ii) the implications of Brexit, and (iii) training the workforce to utilize new technologies.

> "…we're coming out of the single market, so we buy a lot of our energy from abroad, from Europe, so it's I guess a case of are they going to charge us more? Are we as a nation going to have to pay more, or are we going to invest in more renewable energy for ourselves?" (Aberdeen).

Other topics of discussion included the availability of gas, coal-fired power plants, renewable energy including nuclear, foreign investment in North Sea oil, energy storage and distribution to remote areas, and energy costs.

During the full group discussion, jurors realized they shared many of the same concerns. Additionally, energy affordability, particularly for those in poverty, was something many felt should be addressed:

> "…It shouldn't be a case of not having a meal to turn the heating on." (Aberdeen).

Citizens noted that government promotion of a technology did not necessarily mean it would come without risks. They were in agreement that there should be improved stakeholder engagement, and increased transparency from both companies and government. Very similar themes arose in both citizens juries, although the groups prioritized the energy challenges differently (Table 3).

4.2.2. Survey Responses

We administered surveys to jurors at multiple points in the process. Citizens in Edinburgh unsurprisingly did not find oil and gas extraction to be as important to the local area as citizens from Aberdeen. However, following the jury, citizens in both juries perceived continued oil and gas production from the North Sea to be less important (Figure 1). This may reflect information received about current and future energy prospects in Scotland subsequent to the deliberative process. Citizens were also asked before and after the jury

whether they accepted or opposed energy produced from a variety of sources. Following the jury, citizens in Edinburgh were slightly more in favor of energy from renewable sources than Aberdeen, while members of both juries expressed similar levels of acceptance for gas, and gas with CCS, that is, both juries saw slightly more than 50% in favor of gas, but relatively high levels of opposition of 30-40%, whereas gas with CCS had more don't knows, leading to slightly lower levels of support but much lower levels of opposition (Figure 2). Opposition to renewables was notably higher in Aberdeen than the Edinburgh jury but also higher than would be typical in surveys of the Scottish public, where typical levels of support for wind and especially solar will be 80-90% (BEIS, 2018b). Opposition to renewables in Aberdeen is reminiscent of the finding of Butler at al (2011) of greater skepticism towards wind in communities with nuclear power stations.

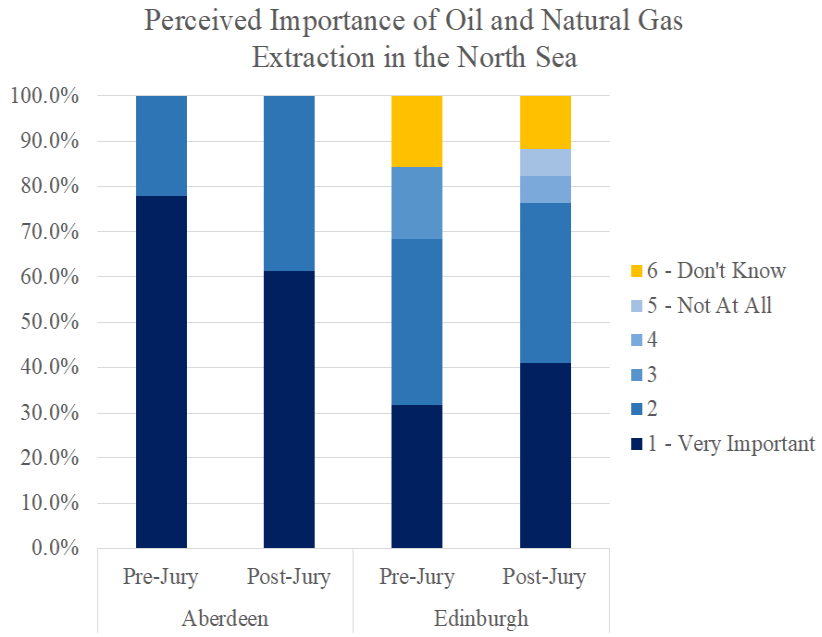

Figure 1. – Perceived importance of North Sea oil and natural gas extraction

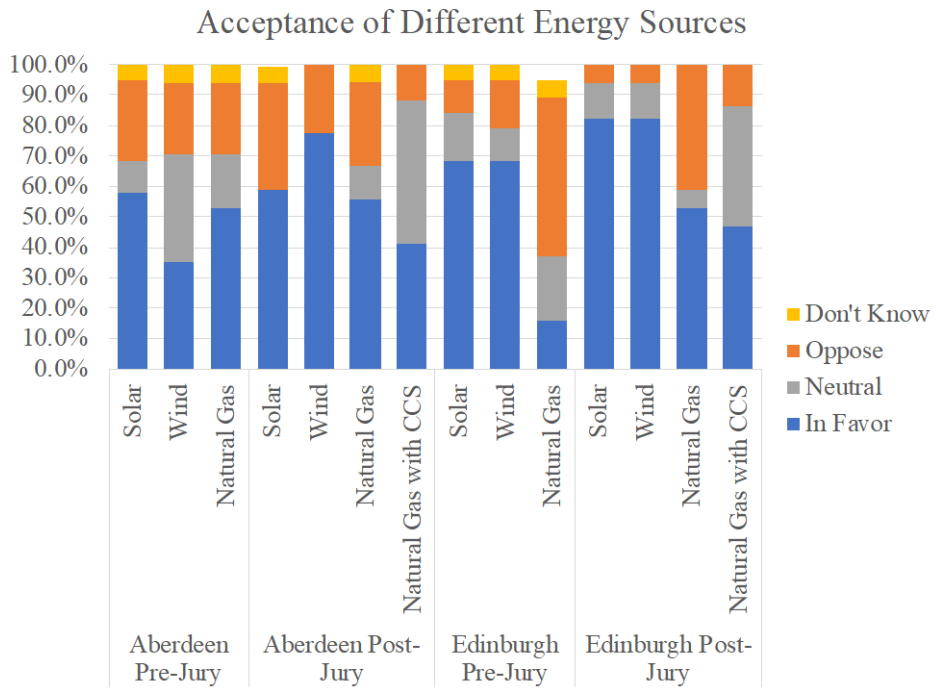

Figure 2. – Acceptance of different energy sources

4.2.3. Factors to Consider When Developing an Energy Policy for Scotland

Prior to making recommendations, the juries discussed factors to consider when developing an energy policy for Scotland. This process took into account the challenges facing Scotland, information provided by the expert speakers, and the pros and cons of different energy sources.

In Edinburgh, the environment and renewable energy were the central themes of discussion driven by concerns over climate change. Participants perceived societal awareness of climate change to be low and called for improved education related to energy and climate change. There was agreement that creating a diverse energy portfolio should be a priority supported by subsidies and incentives for renewable energy development:

> "… if people want to put solar panels on their house or even a windmill in their back garden or whatever, I think the subsidy needs to be much more generous than they are now…" (Edinburgh).

Edinburgh jurors were not convinced that companies were being penalized sufficiently for inflicting damage upon the environment and favored a higher carbon tax and were concerned about consistency in government policy:

> “Sometimes one government goes out, another government comes in, oh I don't like that policy, bin. I don't like that policy, bin. Nobody seems to be looking at the big picture” (Edinburgh).

This perception translated into one of the main recommendations presented by the group of the need for policy continuity, echoing the Climate Change Committee’s recent report (CCC, 2018a).

In Aberdeen, citizens also supported a diversified energy portfolio, stating that reliance on any one source of energy was unsustainable.

> “I think it's become clear that you can’t rely on one source, it's got to be a mix of everything that's available really” (Aberdeen).

In discussing various energy options including nuclear, wind, oil, gas, and fracking, the theme of safety arose. Although some were in favor of nuclear energy as a “consistent” and “reliable” energy source, others were concerned about safety, nuclear waste storage, and decommissioning. Fracking, in particular, was viewed as posing risks not worth taking.

> “Public safety is important... all the standards really need to be kept top notch for safety because they don't want either a nuclear power plant accident or Piper Alpha like accident, or even a dam bursting accident. That would be bad. So, really public safety is a top priority” (Aberdeen).

Many wanted clearer information from companies and government about how their energy was being produced, where it came from, and the profits companies were making.

Citizens thought government could do a better job educating the public about energy and engaging them in the decision-making process. Finally, the Aberdeen jury perceived both environmental impact and cost as important factors to consider but were concerned that they may be in competition. This was reflected in the final questionnaire responses – in Aberdeen, an equal number of participants ranked environment and cost as most important, while in Edinburgh, most people ranked environment first.

On the second day of the jury, citizens in each jury wrote down the factors they believed should be considered, which were then grouped into themes by the facilitators. This created a final list of unranked factors participants should consider before making their recommendations (Table 6).

Edinburgh	Aberdeen
Political considerations	Environment
Practicality	Safety
Research and development	Public awareness
Individual / public factors	Education
Environment	Cost
Safety and security	Sustainability

Table 6. Factors to consider when developing an energy policy in Scotland

4.2.4. Citizens' Jury Recommendations for the Scottish Government

Towards the end of the second day of deliberations, each jury developed a set of ranked recommendations for the Scottish government (Table 7). Although the juries were conducted independently in two distinct locations, the recommendations had many commonalities: government commitment to climate and environmental policy, a diverse (renewable-dominated) energy portfolio, and nationalization of Scotland's energy, with profits being fed back into local communities or research and development (R&D).

Location	Recommendations
Edinburgh	1) Legislation cannot be overturned 2) Invest in multiple energy types 3) Safety of CCS should be established by 2020, and a test project should be completed by 2025 4) Targeted initiatives for different demographic groups 5) Research alternative energy sources * 5) Renationalize utilities with money generated going into research and development * 5) Focus on renewables and clean fossil fuels *
Aberdeen	1) Nationalize energy 2) Establish an impartial authority to dictate energy futures in Scotland, ensure that more than one energy source is prioritized, and to look at cross-over energy sources 3) Profits made from energy production in Scotland to be fed back into communities 4) Public should be made aware of energy projects at the start – need consultations via many different platforms to involve them 5) Government should be committed to projects and not back out * 5) Increase in ecofriendly architecture and town planning as a way of off-setting CO_2 * 5) Education in schools through personal and social education courses about different types of energy in a reader-friendly way *

Table 7. Citizens Jury Recommendations for the Scottish government

* Received the same number of votes

5. Discussion

Public support for nationalization of Scotland's energy resources was a key finding of the citizens' juries, which appears to stem in part from a lack of trust in energy companies and a desire for energy-related profits to benefit local communities or support R&D. These findings align with the UK government public attitudes tracker, which found that the majority (53%) of the British public do not trust energy providers; Scottish respondents were very slightly less negative with 48% not trusting their energy providers, with only 4% expressing a lot of trust (BEIS, 2018b). In our consultations, participants called for greater transparency from energy companies and for profits to be redirected to projects that were seen as better serving the people.

In all focus groups and citizens' juries, there was strong support for Scotland having a diversified energy portfolio involving a significant share of renewable energy sources. Even in Aberdeen, where the local economy is highly reliant on fossil fuel extraction, there was widespread acknowledgement that the oil and gas industry was in decline and renewable energy production needed to be expanded. Citizens were also supportive of Scotland developing initiatives and incentives to increase renewable energy production on a local level, which aligns with Scotland's Energy Strategy goal of increasing local energy production.

Finally, most participants expressed support for further R&D for CCS technologies. Support stemmed from environmental concerns, making use of existing infrastructure from the oil and gas industry, and potentially providing job opportunities in communities located in proximity to the North Sea. The primary reservations related to costs associated with CCS and concerns about safety. Despite support for further R&D, citizens did not think it was appropriate for Scottish citizens bearing the costs of CCS projects while they perceived the oil and gas industry to be profiting from damaging the environment and lacking transparency with consumers. They also wanted the safety of CCS to be firmly established. In-depth interviews conducted in Scotland with informed members of the public on CCS have found that "many people in the sample struggled to see the point of CCS" and would rather see further investment in renewable energy sources (Mabon et al., 2014).

Previous studies have used deliberative processes to explore views on renewable energy and other low-carbon technologies in Scotland. A large group workshop held in 2011 in Edinburgh found strong support for renewable energy and pride in Scotland's achievements (Howell et al., 2014). During 2013 and 2014, three Scottish citizens' juries were conducted on wind power generation. Although the juries were held in diverse locations (one near an existing wind farm, another near a proposed wind farm, and the third in a location without a wind farm), generally, members of the juries felt climate change was an important issue and were supportive of renewable energy (Roberts and Escobar, 2015).

Other studies on CCS have found similar concerns about the safety of CCS. In 2012, prior to the second CCS competition, four focus groups conducted in London found low levels of public awareness of CCS. Once provided with some information about CCS, members of the public expressed concern about its safety, likening it to nuclear (Lock et al., 2014). However, having expert(s) available during our engagement exercises to answer questions related to CCS safety may have alleviated some concerns members of the public had about the technology.

Awareness of CCS was low in our study, where even in Peterhead itself only one member of the public knew about Shell's proposed project, despite claims of successful local outreach (Shell, 2016). Such failure to gain public attention even after more than a decade of proposed large-scale projects highlights the challenge of public engagement even in the most propitious setting. Of course inattention is better than outright opposition – in Barendrecht, the site of another proposed CCS project by Shell near Rotterdam, members of the public were not only aware of the project, but many had strongly negative perceptions of it primarily related to its safety, but also perceived potential negative impacts on property value, sentiments that they had not been consulted enough in the decision-making process, and distrust in Shell and the national government (Terwel et al., 2012). We only spoke with 19 randomly selected members of the public, so we should take care to avoid claims of representativeness. Nevertheless, the almost complete lack of awareness in Peterhead, a relatively poor town of approximately 18,000 people, of a project that would have resulted in up to a billion dollars of public funding and hundreds of jobs raises questions about the level of public engagement that occurred during the competition.

6. Conclusions and Policy Implications

The IPCC "Special Report on Global Warming of 1.5°" indicates global greenhouse gas emissions must be reduced by approximately 45% from 2010 baseline levels by 2030 to avoid the most catastrophic effects of global climate change (IPCC, 2018). Despite its abundance of fossil fuel resources, Scotland has notably achieved 47% emissions

reduction over two decades, approaching the rate at which the rest of the world will need to decarbonize as we approach 2030. Development of onshore wind production in particular has enabled Scotland to achieve 74.6% of its electricity from renewable energy sources. By contrast, England has effectively banned onshore wind and so overall UK progress in meeting its renewable targets has been notably slower and less ambitious than that of Scotland.

It is clear that lessons can be learned from Scotland's approach and could be applied elsewhere. One would expect tensions between existing economic and political interests in continuing to produce and consume fossil fuels versus ambitious plans to decarbonize would be particularly prominent in Scotland, which has been dependent upon revenues and employment from fossil fuel extraction. However, we learned through our series of public engagement exercises that the general public supported funding local renewable energy production, even, perhaps surprisingly, in communities historically reliant on jobs provided by the fossil fuel industry. The transition in energy-reliant communities may therefore be easier in energy-rich regions than presumed if these communities continue to see other viable local options (consider wind in Texas, geothermal in Indonesia or solar in the Persian Gulf). Moreover, despite the long history of energy firms being involved in communities such as Aberdeen, we found relatively little affection or goodwill and a good deal of skepticism about energy firms, which was not noticeably different from the views heard in more-distant communities such as Edinburgh. Nationalism and the potential for state intervention in the energy sector is found to be appealing in Scotland as well, which is partly driven by wider political forces but also by the perception that many energy companies are not acting in the interests of the environment or consumers. Our findings challenge the presumptions about the inevitable dominance of certain longstanding interest groups or the preference for private rather than public ownership.

Low-carbon technologies, such as CCS, may be critical for Scotland and other countries to achieve future emissions reduction targets. CCS has been seen as offering a lifeline to the oil and gas industry and therefore Aberdeen and surroundings would seem to be the ideal location for such a project and yet Shell's Peterhead project was cancelled with

relatively few repercussions. While members of the public in Scotland are generally supportive of CCS, most people are reluctant for its funding to come from taxpayers and would prefer for the "polluter" (i.e., oil and gas companies) to pay. Additionally, many of the participants expressed concerns about the safety of CCS. Although the series of CCS project cancellations can be ascribed to various reasons, it is also clear that the almost complete lack of awareness of CCS even in a community such as Peterhead that stood to benefit from significant public and private investments is a sign of the evident weakness of the effort to engage with local communities. Greater awareness might have been able to offer the projects potential wellsprings of support. Firms and governments seeking to deploy CCS plants will obviously need to consider the economic and technical challenges, but our findings indicate that it would also be important for greater developer engagement with local communities, not simply to ensure social license to operate, but also as a means of proactively garnering political backing for such projects.

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