Jobs in Scotland's New Economy

A report commissioned by the Scottish Green MSPs

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Picture credit: Bilfinger SE / www.flickr.com

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Introduction

The North Sea oil industry says jobs are threatened by falling oil prices. But a better future for Scotland is possible. More and better jobs. A safer and more stable economy. Stronger communities. A long-term future as an energy exporter. Moving from energy colonialism to energy democracy.

This better future won't come with tax cuts for oil corporations and trying to extract every last barrel. It means changing direction – towards a rapid transition away from fossil fuels. This will require a wholescale change of UK economic policy away from austerity and toward investment in the new economy.

This report shows that sustainable sectors in the new economy can employ significantly more people than currently work in fossil fuel industries. Scotland can create stable jobs for those who need them, wipe out fuel poverty, do its bit to stem climate change and re-localise economies.

We researched and analysed existing and potential employment in offshore wind and marine energy, forestry and sustainable biomass, retrofitting buildings, decommissioning the North Sea, synthetic gas, and training and research. Projections were built on conservative estimates of the jobs required for a rapid and ambitious energy transition.

We didn't include new jobs in public transport, solar, waste, renewing the electricity grid, energy storage or climate adaptation.

Our calculations show that there are 156,000 workers employed in fossil fuel extraction in Scotland, of which one third are export-oriented jobs. The new economy could in comparison employ more than 200,000 in 2035.

The transition proposed is ambitious and would involve major hiring programmes and a drastic reduction in Scottish unemployment. This paper lays out the necessary policy proposals to maximise job creation and a just transition. These jobs in the new economy should be better jobs for the workers and for all of us: jobs in an industry which is growing not declining, which create a safer, rather than a more dangerous world.

For workers employed in North Sea oil or part of the supply chain, concerns about job losses are legitimate. Hence we have analysed and compared not only job totals between fossil fuels and the new economy, but also the skills components and likely locations.

The transformation we are proposing involves reducing dependency on distant multinationals, and centring the public sector, workers and energy-users co-operatives as well as small and medium Scottish companies. Building a non-extractive future in every sense: the pollution stays in the ground, and the money and skills stay in the community.[1]

Unions and shopfloor workers need to be at the centre of this transition, redesigning supply chains and guiding the transformation. Energy workers laid the foundations of parliamentary democracy in the UK, played a central role in the formation of unions and won crucial struggles over

1 Paraphrasing Jihan Gearon of the Black Mesa Water Coalition

workplace rights. Today's energy workers in Scotland will play a crucial role in building the new Scotland, both as individuals with essential skills and collective groups. We can't afford to squander the creativity, knowledge and abilities of engineers, skilled trades and production workers.

A just transition would see a flourishing of Scottish and UK industry, by fusing industrial concerns with climate concerns. That involves:

- Creating public sector jobs and guaranteeing work for those losing work in fossil fuels.
- Giving the state a significant role in offshore wind and marine energy, while taking back control over parts of North Sea oil and key refining assets at Grangemouth.
- Ending tax cuts to private fossil fuels companies.
- Support for trade unions in organising new sectors and a major public training/retraining programme.
- Setting strong, long-term climate targets alongside ambitious renewables generation – so that supply chain companies set up in Scotland.
- Coupled with regulation and incentives to ensure that companies “buy-local” and “hire-local”.

The alternative is allowing multinational companies and neoliberal forces to shape the transition. This means failing to hit the necessary climate targets and increasingly precarious workplaces. Fighting inequality on every front and through multiple means is a central strategy in the battle against climate change. We need a coherent and sweeping vision - the response to climate change must be a jobs creator and a community rebuilder.

The falling oil prices have highlighted the volatility of the fossil fuel industry. But they also create an opportunity. The companies operating in the North Sea are profit-heavy multinationals that exploit the overly-generous UK tax system to subsidise drilling elsewhere. Between 2009 and 2014, oil companies made £48.7 billion in profits.

Rather than tax cuts that primarily benefit distant shareholders, this is the moment to take back public control over key parts of the North Sea. By part-nationalising the oil, slowing the extraction rate and maximising the revenue per barrel, Scotland could both finance the transition and meet its climate responsibilities by leaving fossil fuels in the ground. This report assesses the revenues missed out on by the current fiscal regime.

The plans described here are ambitious and would mean comprehensive changes to UK economic policy. They aim to generate far more energy than Scotland needs. Scotland could be powered entirely on renewables, and position itself as an important electricity exporter to Northern and Western Europe. Decentralized economic decision-making could be combined with an industrial renewal. An energy and a social transformation, both grounded in justice, that transfers economic power from multinationals to workers and communities.

Work in the New Economy

The transition away from fossil fuels in Scotland will involve significant electricity production from wind, wave, tidal, hydro and solar PV, as well as energy contributions from heat exchangers and sustainable biomass, geothermal and solar heating. New energy storage will need to be installed, and energy usage can be brought down through energy efficiency measures and switching transport and heating to electricity.

The new economy will feel both familiar and different. It will involve major new industrial sectors including offshore wind and marine energy. Expanded ports and revived dockyards for ship-building. A scaling up of existing public services including roads, buses and city-wide composting. Construction of new infrastructure (e.g. railways, an expanded and renewed grid, energy storage) and new supply chain factories. A shrunken oil & gas extraction sector, with a supply chain focused on decommissioning. Petrochemicals retrofitted to focus on synthetic gas. Expanded forestry, as woodland is increased. A country-wide retrofitting of insulation to building stock, alongside a switch to either electrified or district heating, aimed at reducing energy use and the ending of fuel poverty.

The decentralised nature of renewable energy means that there will be increasingly close linkages with traditional sectors of economy including farming, waste management, forestry, energy management and construction.[2] Communities will benefit through training opportunities, creation of skilled jobs and supply chain contracts for local companies. Particularly in areas of Scotland which are suffering from population decline due to limited opportunities and job prospects.[3]

By making a commitment to a massive scale-up in renewables and creating a national offshore wind company, Scotland can grow an industrial and knowledge base capable of installing its own offshore energy capacity, and export to other countries.

The new economy will rely on significant public innovation.[4] As such the benefits must not be captured by distant corporations. Maximising the social and economic justice benefits of the transition means prioritising public-public partnerships between a diverse set of institutions. At a local level, many of these will be small-scale, including renewable energy and sustainable biomass/CHP co-operatives. At a medium scale, councils and cities can operate energy utilities and expanded public transport, and worker-run co-operatives can play a major role in the new supply chains. At a national level, the Scottish and UK governments will need to take responsibility for large-scale nationalised or public-private industries and operations, including a retrofitted Grangemouth synthetic gas plant and a Scottish offshore wind and marine energy company.

This report examines the potential for different sectors to play a role in the new economy, both in terms of jobs and provision of public benefit. We will assess numbers of jobs and locations over the coming 20 years. The aim here is not to be comprehensive and there are many omissions, but to

2 http://www.marineenergypembrokeshire.co.uk/wp-content/uploads/2010/03/REA_Renewable-Energy-Report-Made-In-Britain.pdf

3 http://www.scottish-enterprise.com/~/media/se_2013/knowledge%20hub/insight/scotlands%20offshore%20wind%20route%20map.pdf

4 http://marianamazzucato.com/the-entrepreneurial-state

highlight key examples.

New jobs will amongst many others include electrical engineers, geologists, biochemists, foresters, pipefitters, bus drivers, organic waste collector, crane operators, welders, helicopter pilots, designers, manufacturing engineers, construction workers, environmental impact assessors, surveyors, engineering analysis, offshore maintenance, seafarers and shipbuilders.

a) Offshore Wind

Scotland is rich in offshore wind potential. This means that offshore wind will most likely be the dominant source of Scotland's electricity if carbon emissions are to be reduced to the extent required. By maximising offshore generation, Scotland can export electricity thus earning revenues and helping neighbouring countries meet their climate obligations.

With a great deal of relatively shallow water on the continental shelf, stretching far out to sea, Scotland has a possible 46 GW of capacity that could be generated by fixed turbines, with foundations on the shallow seabed.[5]

Where the sea is too deep for fixed foundations, floating turbines can be deployed that are anchored to the ocean floor by cables. Full-scale prototypes of this technology have successfully been tested for years off Norway and Portugal. The 65 m tall floating Hywind turbine operated in 200 metre waters off the coast of Norway, surviving 90 mph winds and 19 metre wave heights. Statoil is planning to install five 6MW turbines in 100 metre deep waters off Peterhead in Aberdeenshire.[6]

The Offshore Valuation Group, composed of government and industry organisations, assessed that Scotland has a theoretical 122 GW of floating wind capacity, especially in the deep Atlantic waters of off the west and north coast of Scotland. 70% of this - 86 GW – is estimated as practical.

This means Scotland has a total practical wind power resource of 132 GW. Rather than assume that all of this will be developed, our calculations assumed that only 50% of the practical offshore wind resource will be installed over the coming 20 years – 66 GW.

This is equivalent to an annual installation rate of 3.3 GW. Given that in early 2015 there was only 4.5 GW of installed capacity in all of the UK, these might seem overly aspirational.[7] However, the Crown Estate's leasing rounds already enable a capacity of over 49GW.[8]

The 3.3 GW annual installation rate we are working from is less than the 3.59 GW in Campaign against Climate Change's One Million Climate Jobs proposal, and only marginally above the 3.22 GW in Centre for Alternative Technology's Zero Carbon Britain.[9]

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5 http://www.ppaenergy.co.uk/web-resources/resources/467ac5b8919.pdf

6 http://www.statoil.com/en/TechnologyInnovation/NewEnergy/RenewablePowerProduction/Offshore/HywindScotland/Pages/default.aspx?redirectShortUrl=http%3a%2f%2fwww.statoil.com%2fHywindScotland

7 http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA-European-Offshore-Statistics-2014.pdf

8 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/338750/DUKES_2014_printed.pdf

9 Neither of these give specific annual figures for Scotland. We calculated this based on their respective UK-wide figures of 9.8 and 8.8 GW per year. We assumed that installation is proportional to the 36.61% of the UK's total practical offshore wind being located in Scotland, according to the Offshore Valuation Group. http://www.ppaenergy.co.uk/web-resources/resources/467ac5b8919.pdf

Job Numbers

Such a rapid scale-up of offshore wind will require a lot of workers, to build the turbines and the ships to install the turbines, to assemble the turbines and take them out to sea, to manage operations, conduct impact assessments and maintain the new infrastructure once operational.

We calculate that installing 3.3 GW of offshore wind per year for 20 years would rely on between 101,000 - 107,000 workers employed directly and indirectly in the supply chain. These figures assume that early years will require more jobs in construction and installation, and that by later years this will have become more efficient requiring less jobs. However, maintenance needs will have increased twenty-fold to 43,560. Even if 66 GW is the maximum capacity installed, wind energy infrastructure (and wave and tidal stream) will need to be repowered every 20 years, "creating a self-sustaining industry".[10]

We assessed jobs per GW figures by starting with a report by the Global Wind Energy Council, which assessed the employment in manufacturing and installation created by onshore wind power in four different European countries. The report estimated 15,000 direct and indirect jobs per GW installed. Over time, this number will decrease with increased learning, optimised processes and higher employment productivity – reaching 11,000 jobs by 2030. Maintenance jobs were estimated at 330 per installed GW.

Offshore wind requires significantly more workers – the turbines are larger, the engineering more complicated. Working at sea requires more infrastructure and marine support. Adverse weather conditions increase strain and require greater maintenance. As a result, offshore wind is approximately twice as expensive to install and maintain.[11] While capital costs are greater, employment will also be much greater. Hence we assumed it reasonable to also double the number of jobs required for construction & installation, as well as maintenance. So we estimate 660 maintenance jobs per GW in offshore installed capacity, and 30,000 jobs per GW installed, dropping to 22,000 by 2030 and continuing to fall at the same rate after that.[12]

These figures are for total jobs in manufacturing as well as installation and maintenance. As a result, there is no guarantee that they would be located in Scotland. The UK government estimates that the UK content for an offshore wind farm was about 25% in 2012.[13]

However, by bringing much of the infrastructure into the public sector through a National Offshore Wind Company, Scotland can boost local job content. Also, employment per GW tends to increase as installed capacity increases as benefits within domestic supply chain and export potential increases with scale.

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10 http://www.ppaenergy.co.uk/web-resources/resources/467ac5b8919.pdf

11 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223940/DECC_Electricity_Generation_Costs_for_publication_-_24_07_13.pdf

12 We follow the approach of the One Million Climate Jobs Technical Note http://www.climate-change-jobs.org/sites/default/files/Jobs%20&%20Capacity%20in%20Renewables%20-%20tech%20note%201.pdf and Campaign Against the Arms Trade's Arms to Renewables briefing https://www.caat.org.uk/campaigns/arms-to-renewables/arms-to-renewables-background-briefing.pdf

13 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/243987/bis-13-1092-offshore-wind-industrial-strategy.pdf

Scotland already lacks the facilities required for a domestic renewable industry when compared with the north of England. For example the ORE Catapult blade testing facility in Blyth, JDR cables in Hartlepool and Technip Umbilicals in Newcastle. By committing to such a large scale-up in investment and putting the right policies in place, Scotland can re-position itself as an offshore wind hub and push the supply chain to open factories in Scotland. Scotland has significant under-utilised industrial capacity and ports (e.g. Clydeside docks) that would be well-suited.

In 2011, RenewableUK argued that the industry view was that "as long as the UK can consistently deliver at least 3GW of new offshore wind capacity a year from 2016, there will be sufficient turbine demand to convince manufacturers to locate here."[14] More detail on measures to ensure buy-local and hire-local practices are in Section 5.

b) Marine Energy (Tidal Stream & Wave)

Scotland is also endowed with important wave and tidal stream potential. Wave power can be harnessed out at sea or near the shoreline, although it is strongest where strong winds have travelled over a long distance, and before friction with the seabed occurs nearer the coastline. Energy can be generated from tidal stream by placing devices in the normal tidal flow. Their potential is greatest where there is a large tidal range and the shape of the coastline funnels the currents, amplifying them.

Around 50% of the UK's practical wave energy resource stretches out from the west of the Hebrides, with a further 25% found off North Scotland, around Orkney and Shetland.[15] The largest tidal stream resources are in northern Scotland, concentrated in the Pentland Firth between the Scottish mainland and Orkney Islands. But there are also substantial resources down the west coast of Scotland.[16]

Although Scotland's wave and tidal energy potential isn't on the same scale as offshore wind, it is still substantial. The race to harness this potential faced recent setbacks with the loss of jobs at Pelamis and Aquamarine Power, but with support and investment this industry will grow. Offshore engineering skills from the North Sea coupled with the testing facilities at the European Marine Energy Centre in Orkney and significant support from Wave Energy Scotland could make up for lost ground. An open licensing policy for Wave Energy Scotland's testing data could help new companies innovate quickly.

Estimates for how much of Scotland's marine energy can be practically harnessed varies widely, between 11 to 18 GW for wave and 11 to 22 GW for tidal stream. We've taken an ambitious aim of 11 GW of installed wave capacity and 8 GW of installed tidal stream capacity as targets. Over twenty years, this is equivalent to an annual installation of 0.55 GW for wave energy and 0.4 GW for tidal stream. Of course, given the relative infancy of the industry installation rates would have to start out low and rise in coming years.

14 http://www.renewableuk.com/en/publications/reports.cfm/Working-for-a-Green-Britain-Volume-2

15 http://www.carbontrust.com/media/202649/ctc816-uk-wave-energy-resource.pdf
http://www.thecrownestate.co.uk/media/5476/uk-wave-and-tidal-key-resource-areas-project.pdf

16 http://www.thecrownestate.co.uk/media/5476/uk-wave-and-tidal-key-resource-areas-project.pdf

Job Numbers

Because the wave and tidal stream energy sectors are both still in their infancy, they will require significant research, development and testing. The first rounds of consenting for a new technology are labour intensive. While this means greater costs, it also means more jobs per GW of installed capacity. According to the Renewable Energy Association, the sector has high levels of employment relative to electrical output, "reflecting the work-intensive nature of R&D and testing for emergent technologies".[17] It is expected that the number of jobs available in R&D will move to other areas over time, as the industry arrives at a standardised design for power generation. The contribution of R&D to the job market will nonetheless be significant in the initial conversion period.

We calculate that installing 0.5 GW of wave energy and 0.4 GW of tidal stream per year for 20 years would require between 49,000-57,000 workers. Initially, only a small number would be in maintenance, rising to over 12,000 after 20 years. However, overall numbers would decline, due to increased efficiency with time. Similarly to offshore wind, the infrastructure for tidal stream and wave would need to be repowered after 20 years.

The job per GW figures are derived from RenewableUK's projections in Working for a Green Britain.[18] RenewableUK's High Scenario is based on 2 GW of tidal stream and wave energy installed capacity by 2021, after eight years, so an average annual deployment of 0.25 GW. It estimates 15,000 jobs (9,400 directly employed, and 5,600 in the supply chain) would be necessary for this level of installation. This is equivalent to around 60,000 full time jobs needed per GW of capacity installed.[19] We estimated that this would drop to 44,000 jobs per GW over 20 years. We used the same maintenance figures as with offshore wind: 660 jobs per GW.

While some of these jobs – especially in installation and maintenance, would necessarily be based in Scotland, many could theoretically be located elsewhere. However, if Scotland makes this level of commitment to marine energy and pro-actively builds the supply chain, it could, as for offshore wind, lead to substantial jobs and exports.

c) Sustainable biomass & re-foresting

Restoring important habitats such as peatland, and substantially expanding forested areas, can capture carbon, increase the local energy supply, improve biodiversity, provide wood products for buildings and infrastructure, improve flood management and provide more natural spaces for everybody to enjoy.

Scotland has a low percentage of woodland cover compared with other countries in Europe: only 17%[20] compared to the EU average of 37%[21]. Relatively little new forest has been planted over recent decades, and the majority of British conifer forests are due for felling in the next 10-20

17 http://www.marineenergypembrokeshire.co.uk/wp-content/uploads/2010/03/REA_Renewable-Energy-Report-Made-In-Britain.pdf

18 http://www.renewableuk.com/en/publications/reports.cfm/Working-for-a-Green-Britain-Volume-2

19 Here we are following the same calculation process as used by Campaign Against the Arms Trade in the Arms to Renewables report https://www.caat.org.uk/campaigns/arms-to-renewables/arms-to-renewables-background-briefing.pdf

20 http://www.snh.gov.uk/land-and-sea/managing-the-land/forestry-and-woodlands/expanding/

21 http://www.woodlandtrust.org.uk/mediafile/100229275/stake-of-uk-forest-report.pdf?cb=8248e0ebcb0c4a78886b5f5046c1fcc9

years.[22] UK timber supplies, which store carbon in wood products, are projected to decrease.[23]

Any significant increase in forested land will require careful management and siting to balance land-use needs and to maximise economic, social and environmental benefits. This will involve assessing the effects on employment in previous land use, timber and biomass demand and effect on carbon stores.

Timber can be used in construction, while sustainable biomass from Short Rotation Coppice and Short Rotation Forestry biomass can burnt directly for heat in buildings (especially with district heating) and industry. Sustainable biomass can also be used to make biofuel or biogas directly, or to produce synthetic biogas, bioplastics or synthetic liquid fuels. Agro-forestry practices can allow tree species which require several decades to grow, sometimes stretching across generations of farmers, to be inter-planted with other crops. Silvopasture enables the farming of livestock ranging from poultry, pigs and sheep to cattle alongside trees providing short–medium term profitability.

With this in mind, Scotland can increase its forest area by 50% from 17% to 25%, on the way to the EU average of 37%.

There are currently 11,800 jobs[24] in forestry associated with the use of timber. This doesn't include 17,900 jobs related to tourism and recreation.[25] We have assumed a 50% increase in forested area will translate to the same rise in employment over 20 years – 17,700 jobs. In reality, there will need to be an initial jump in employment, due to people planning the reforesting programme, identifying appropriate sites, minimising negative side-effects – and doing the actual planting.

The reforesting programme should run alongside a significant expansion of the existing Peatland Action restoration programme run by Scottish Natural Heritage.[26] More than 20% of Scotland is covered by peat, but the majority has been damaged by years of burning, over-grazing and erosion. However, we have not included jobs related to peatland restoration.

d) Building Retrofitting

There is an urgent need to repair and retrofit the Scottish building stock, both residential and non-residential. This includes basic watertight repairs as well as insulation, draught-proofing, glazing, replacing inefficient boilers and installing solar hot water, solar PV, heat pumps or other renewable energy technology.

A shocking 39.1% of Scottish households lived in fuel poverty in 2013 – 940,000 households.[27] This figure will have fallen somewhat since then due to lower fuel prices, but it remains extreme. The Scottish government has pledged to end fuel poverty by November 2016, as far as practicable. Fuel poverty is caused by low incomes and high fuel prices, as well as poor housing. Improving the underlying standards of buildings will reduce fuel poverty, as well as energy use and carbon

22 http://www.woodlandtrust.org.uk/mediafile/100229275/stake-of-uk-forest-report.pdf?cb=8248e0ebcb0c4a78886b5f5046c1fcc9

23 http://www.confor.org.uk/upload/documents/37_woodfibreavailabilitydemandreportfinal.pdf

24 http://www.forestry.gov.uk/pdf/FCRN102.pdf/$FILE/FCRN102.pdf

25 http://www.forestry.gov.uk/pdf/SERG_Valuation_of_F4P_in_Scotland.pdf/$FILE/SERG_Valuation_of_F4P_in_Scotland.pdf

26 http://www.snh.gov.uk/climate-change/taking-action/carbon-management/peatland-action/

27 http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/TrendFuelPoverty

emissions.

Building-related energy usage is high. Excluding the transport sector, approximately 40% of energy consumption (from electricity and heat) is consumed domestically. Consumption rates in Scotland are the highest in the UK – domestic electricity consumption per household in Scotland was 4.6 MWh in 2012, compared to a UK average of 4.2 MWh. Scottish domestic gas consumption per consumer stood at 14.8 MWh, with the UK average at 14.1 MWh.[28]

Gas and electricity use have decreased in recent years, as a result of improved energy efficiency of the housing stock. Between 2010 and 2013 the energy needed to meet the standard heating regime for the average Scottish household fell by almost 8%.[29] While levels of loft insulation, cavity wall and solid wall insulation all improved dramatically, there is still a long way to go – in 2010, loft insulation was only in place in 26% of households.[30]

Reducing building-related energy use to the necessary level will require a massive retrofit programme, covering public and private, residential, industrial and commercial buildings. The priority should be proven and established solutions: loft and wall insulation, boiler replacement, installing double or 'secondary' glazing and draught-proofing windows and doors.

The retrofit effort should also install either sustainable biomass-driven district heating, or electric heating powered by renewable energy from the grid. There will be an electricity surplus in future years as all the offshore power comes on stream, providing cheaper heating than gas (with less volatile prices).

This programme will be most efficient if “retrofit teams” can do all the jobs together, for neighbouring households. That way, a team of workers can do whole streets at a time, cutting both labour time and inconvenience. As well as insulating, the retrofit teams could install solar hot water, ground source heat pumps or solar PV on site, depending on the suitability of local roofs and gardens.

There are 2.4 million households in Scotland – 10.8% of UK households.[31] The Campaign against Climate Change’s One Million Jobs report estimates a UK-wide 20-year mass retrofit programme would need need 100,000 workers to renovate homes, with a further 25,000 workers to convert buildings to renewable electricity, and 50,000 workers to renovate public, industrial and commercial buildings.[32] Necessary jobs would include trained energy assessors, construction workers, boiler engineers, renewable energy fitters and building inspectors.

This is equivalent to a total of 18,900 jobs in Scotland to fundamentally transform the Scottish building stock. This would require investment on a vast scale and necessitate a wholescale reworking of the UK’s economic, finance and housing policy but it would deliver a transformative change in people’s homes, health, well-being and energy consumption.

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28 http://www.gov.scot/Resource/0044/00444530.pdf

29 http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/TrendFuelPoverty

30 628,000 households http://www.gov.scot/resource/0039/00398798.pdf

31 http://www.ons.gov.uk/ons/rel/census/2011-census/population-estimates-by-five-year-age-bands--and-household-estimates--for-local-authorities-in-the-united-kingdom/stb-population-and-household-estimates-for-the-united-kingdom-march-2011.html

32 http://www.campaigncc.org/sites/data/files/Docs/one_million_climate_jobs_2014.pdf

e) Decommissioning the North Sea

After four decades of extracting large amounts of oil and gas from the Scottish North Sea, a vast area is pockmarked with ageing platforms, wells and networks of pipes. Almost all the North Sea's remaining 470 platforms, as well as 10,000km of pipelines and 5,000 wells will need to be decommissioned over the next 30 years. Shell alone has more than 30 platforms that need dismantling and removing. Some of these are larger and heavier than the Empire State Building. Clearing up the sea in a safe and responsible manner in one of the harshest maritime environments represents an enormous engineering challenge.[33]

Costs over the next decade are estimated at £14.6 billion by Oil & Gas UK, rising to £40bn by 2040.[34] Annual spending on decommissioning could pass £2 billion by 2018.[35] Tasks include the separation of topside steel superstructures (such as drilling rigs and accommodation blocks) from underwater concrete legs, lifting them onto giant ships and shipping them to the mainland, as well as the processing of waste in underwater storage tanks.

Shell's enormous Brent Delta platform is to be partially dismantled in 2015. Its topside structure will be shipped to Teesside in northeast England, where apparently 97% of it will be recycled, including into washing machine parts.[36] It will take at least 12 years to dismantle the entire Brent oil field infrastructure[37], and require around 1,000 skilled people working offshore as well as more people working onshore.[38]

Decommissioning is only just beginning to play a significant role in the North Sea. As a result, Scottish companies have not prioritised developing these skills and services. However, as North Sea fossil fuel extraction shuts down, thousands of jobs can be maintained and created in the decommissioning industry.

The work will involve

- The actual offshore removal of existing rigs, including subsea operations to deal with the underwater pipelines and storage infrastructure.
- Onshore dismantlement, safe disposal of drilling waste, and recycling of metals
- Supply chain work, ranging from new R&D for dealing with toxic materials, to building the specialist ships like the giant Pioneering Spirit (formerly Pieter Schelte) needed to pick up the rig topsides and carry them to shore
- Project management, logistics and planning, environmental assessments

The Scottish Government could position Aberdeen as a centre of expertise and skills to decommission not only the North Sea, but oil infrastructure globally. Recognising that in the coming decades we will likely see a large-scale shut down of many rigs and pipelines globally, Scotland has the ability to take a leadership position, by identifying the engineering, legal and financial services that will be in demand.[39] Scottish companies that develop expertise in the North

33 http://www.raeng.org.uk/publications/reports/decommissioning-in-the-north-sea
34 http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/OP098.pdf
http://www.ft.com/cms/s/0/f0691186-aab4-11e4-91d2-00144feab7de.html#slide0
35 http://www.thejournal.co.uk/business/business-news/decommissioning-north-sea-oil-infrastructure-8955086
36 http://www.ft.com/cms/s/0/f0691186-aab4-11e4-91d2-00144feab7de.html
37 http://www.raeng.org.uk/publications/reports/decommissioning-in-the-north-sea
38 http://www.theguardian.com/environment/2015/feb/03/uk-can-become-a-world-class-hub-for-decommissioning-oil-platforms
39 http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/OP098.pdf

Sea will be ahead of the game and able to share it internationally. This will require a dedicated decommissioning strategy and sufficient early planning, strengthened by a commitment to leave fossil fuels in the ground.

A number of Scotland's ports on the east coast have the deep water and onshore capacity to take on the dismantling of large offshore modules. However, only a small trickle of work has been awarded to yards in Scotland so far, with most decommissioning contracts going to Norway, Denmark and England. For example, the Brent Delta platform dismantlement could have also been conducted at Lerwick.[40]

Scotland would be in a better position to conduct decommissioning work if the Scottish Government adopted a maritime policy that aimed to bring as much work as possible to Scotland's ports. Alf Baird, professor of Maritime Business at Edinburgh Napier University, argues that "The problem we have in Scotland is that our port authorities, even the trust ports, are profit oriented. Ports in the Netherlands, Belgium, Germany and Norway are either publicly or municipally owned and those countries regard ports as strategic assets for economic growth whereas we regard our ports as any other business in the economy."[41]

There are important questions over who will pay for the decommissioning effort. The standard principle of “Polluter pays” is being subverted by the Decommissioning Tax Relief Deed, which in effect means the government is currently expected to shoulder 50% (and in some cases 70%) of the costs.[42] This in effect dumps the clean-up costs on future generations of the public.

Job numbers

Press reports estimate that decommissioning could create nearly 40,000 new jobs.[43] However, we haven't identified how this figure was calculated. Most likely, there will be more jobs per pound spent on decommissioning than there were per pound spent on building the North Sea – as the capital costs of building the infrastructure were significant.

If the jobs to investment ratio is the same as for the North Sea oil industry in recent years, we estimate 18,720 workers employed in decommissioning the North Sea, both directly and in the supply chain. This rises to 26,650 including export-oriented jobs, assuming the current ratio of export to domestic.

This is based on £40 billion expenditure on decommissioning between 2014 and 2040, with an average of £1.53 billion each year for 26 years, and based on a 5-year average of £8.68 billion in annual investment into North Sea oil from 2009-2013, calculated from DECC statistics.[44] It also works from the current 106,200 employed directly and indirectly in North Sea oil (151,200 including exports).[45]

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40 http://www.heraldscotland.com/business/company-news/end-of-a-north-sea-era-could-the-dismantling-of-the-brent-field-spark-a-decomm.118932248

41 http://www.heraldscotland.com/business/company-news/end-of-a-north-sea-era-could-the-dismantling-of-the-brent-field-spark-a-decomm.118932248

42 http://www.thejournal.co.uk/business/business-news/decommissioning-north-sea-oil-infrastructure-8955086 http://www.theguardian.com/environment/2015/feb/03/uk-can-become-a-world-class-hub-for-decommissioning-oil-platforms

43 http://www.thejournal.co.uk/business/business-news/decommissioning-north-sea-oil-infrastructure-8955086

44 https://www.gov.uk/government/statistics/uk-energy-sector-indicators-2014

45 See next section on current oil & gas employment

As decommissioning is more labour intensive than building the infrastructure or operating oil extraction, the decommissioning industry will most likely employ somewhere between 20,000 and 40,000 in dismantling North Sea oil infrastructure.

This is roughly equivalent to between one-fifth and one-third of the current workforce engaged in North Sea oil extraction. As the North Sea oil industry shrinks and fossil fuel extraction is phased down, the decommissioning industry will provide an option for those workers who don't want to work in the New Economy. Many of the supply chain companies that serviced extraction can repurpose themselves to focus on decommissioning instead.

f) Synthetic fuels & a publicly-owned Grangemouth

The Grangemouth refinery and petrochemical plant on the Firth of Forth is Scotland's only refinery. Currently owned by Ineos and Petrochina, it was the site of a major labour dispute in 2013, during which the operator Ineos threatened to close the site completely. The chemical plant employs around 800 staff, with a further 570 workers in the refinery, and an estimate 2,000 in sub-contractor jobs.

Grangemouth has an important role in the future Scotland. While renewable-generated electricity can meet most of Scotland's needs, there are some systems and processes that will be difficult to electrify. For example, most transport can be switched to very efficient electric vehicles. But some road vehicles (e.g. off-road, heavy commercial vehicles like HGVs, tractors and diggers, or those requiring longer range), as well as ships and aeroplanes, will continue to need liquid fuels.

There is a need to explore ways to retool and retrofit Grangemouth refinery to produce synthetic gas and synthetic liquid fuels from feedstock such as sustainable biomass and hydrogen produced using surplus renewable electricity.[46] The biomass could be sourced from the new Short Rotation Coppice woodlands. Synthetic gas and biogas can also be produced by anaerobic digestion from sewage, manure and agricultural and crop residues.[47]

The Grangemouth chemicals plant will also play an important part in Scotland's new economy, providing the manufacturing infrastructure for necessary plastics and other synthetic products. Currently the plant uses US-sourced ethane gas. It will need to be reworked to run on oil and gas from the North Sea and synthetically-generated ethane gas.

Significantly lower fossil fuel subsidies would make conventional refineries economically vulnerable. This, coupled with the retrofit described above would provide Grangemouth workers with a long-term and important role in Scotland's energy future. At least as many as the current workforce of 1,300 direct employees and 2,000 contractors will be needed in the long-run. However, significantly greater numbers of workers will be needed during the retrofitting phase and in integrating new supply lines of sustainable biomass.

Private investors like Ineos are not interested in the long-term commitment to Grangemouth that is needed to guarantee its place in the new economy, focusing instead on making profits by sourcing the cheapest feedstock and cutting back on workers' rights. Taking the refinery and the chemical

46 Synthetic gas and liquid fuels require less biomass than pure biogas and biofuel to produce the same amount of gaseous or liquid fuel. http://www.zerocarbonbritain.org/images/pdfs/ZCBrtflo-res.pdf

47 http://www.zerocarbonbritain.org/images/pdfs/ZCBrtflo-res.pdf

plant at Grangemouth into a form of public ownership can guarantee the infrastructure is retooled to serve Scotland's needs and to cut carbon emissions as necessary. This will also be an opportunity to increase the role of workers in managing the plant, and make many of the contractors direct employees.

g) Training, education and research

The programme we've described so far involves a massive recruitment drive, including over 200,000 new jobs by 2035. Many of the new workers will already have the necessary skills and know-how, but many will not. Even those that have relevant skills – there is much engineering overlap in the supply chain to offshore oil and offshore wind – will still need the specialist training for the new task.

Making this a reality will require significant training and re-training. Even small efforts by local authorities in London to increase building retrofitting were restricted by shortage of skilled workers, and a need for further education colleges to expand training for the new economy.[48]

Ensuring the right people are available in the right place and at the right time relies on education and training infrastructure. Bottlenecks can only be avoided by resourcing colleges and universities appropriately.[49]

Some workers will need block training for six months or a year, others will need day release, and some will need both. In the early years the demand will be greatest, but trainers and support staff will still be needed in subsequent years – especially as the required skills will change over time. Such a rapid and ambitious transition will require hundreds of educators and trainers we have assumed 2,000 in 2035.

Many new workers will be needed in research and development as well, in universities, research centres, public bodies, and elsewhere. We need to develop new knowledge in offshore renewable energy, offshore oil decommissioning, low carbon architecture, sustainable biomass, forestry, synthetic fuels and new processes for industry. We estimate 2,000 – 3,000 researchers and support staff.

h) Other elements of the New Economy

There are many other parts of the new economy that will both play an important role in generating jobs and in meeting energy and other needs.

Sectors for which we haven't tried to identify likely employment figures include increased public transport, onshore wind, geothermal energy, waste, climate change adaptation, solar, renewing the electricity grid, building international interconnectors, energy storage infrastructure and electrification of transport and industry.

48 http://www.lwbooks.co.uk/journals/soundings/pdfs/s52sitkin.pdf

49 http://www.scottish-enterprise.com/~/media/se_2013/knowledge%20hub/insight/scotlands%20offshore%20wind%20route%20map.pdf

Work in the fossil fuel industry

The oil industry is a major employer in Scotland, claiming to employ 200,000 people. However, this includes not only those employed by the operating companies (direct jobs) and those working in the supply chain (indirect jobs), but also jobs induced by the economic activity and spending of the direct and indirect workers. Assessing induced employment is imprecise and such figures are frequently used by different industries to hype their economic contribution to society.

So for the sake of this report, we will not assess "induced" employment – either in relation to the oil & gas sector, or the new economy including renewables.[50]

According to the Scottish Government's official figures, the Scottish energy sector (including renewables) employed 63,400 people in 2012.[51] The UK's Office for National Statistics figures indicate less than 30,000 working on North Sea oil, with less than 10,000 directly employed in the "extraction of crude petroleum and natural gas", and 18,700 in "Mining support service activities" in Scotland in 2012.[52]

However, in calculating figures for the oil & gas sector, we did not want to under-estimate employment. Hence our primary figures are derived from those published by oil industry lobby group Oil & Gas UK.

Using 2014 figures published by Oil & Gas UK[53], we calculated an upper limit for numbers employed by the North Sea oil & gas sector in Scotland as around 106,200. This includes both direct and indirect jobs. There are a further 45,000 in exports, bringing the total to 151,200. This doesn't take account of jobs lost since the oil price dropped.

Our figure is derived from Oil & Gas UK's total UK jobs of 36,000 in operating companies, 200,000 in the supply chain and 100,000 in the export of goods and services (so not supplying the North Sea). The lobby group states that 45% of this is Scotland.

	UK	Scotland
Direct (in operating companies)	36,000	16,200
Indirect (in supply chain)	200,000	90,000
Export (of goods and services)	100,000	45,000
Total (working on North Sea)	236,000	106,200
Total (North Sea + exports)	**336,000**	**151,200**

In reality, the 45% Scottish portion of industry employment will not be the same for direct, indirect and export. Most likely, there are a greater portion of direct employees in Scotland, with a smaller

50 This doesn't mean that we can ignore induced employment in terms of policy. We still need support mechanisms for those who would lose these jobs when the oil industry shuts down.

51 http://www.gov.scot/Resource/0044/00444530.pdf

52 http://www.gov.scot/Resource/0044/00444530.pdf

53 http://www.oilandgasuk.co.uk/publications/viewpub.cfm?frmPubID=835

portion of supply chain.

Also, the decades of outsourcing by the oil & gas industry have seen a greater number of jobs moved from direct employment to indirect that would not usually be thought of as supply chain. For example, in 2013 the UK total number of people travelling offshore as part of the industry reached 61,892 – far more than the direct employees at 36,000.[54]

So we will not be using the direct and indirect breakdown as a comparison in the report, but primarily refer to the 106,200 North Sea total and 151,200 including exports.

Note that while we here are using Oil & Gas UK's figures, we feel they deserve more careful investigation. A 2014 report from the Scottish Government claimed that in 2012 there were 63,400 employed in all energy jobs in Scotland – including those connected to oil extraction, as well as refining and shipping, and renewable energy jobs. To state the obvious, 63,400 is significantly less than 106,200 and 151,200.

The vast majority of Scottish workers in the oil industry are based in Aberdeenshire. There are four UK Parliamentary constituencies with over 25,000 workers: Gordon, Aberdeen North, Aberdeen South and West Aberdeenshire and Kincardine. Beyond this five others have 1,000 – 2,000 jobs attributable to the sector: Linlithgow and East Falkirk, Banff and Buchan, Glasgow Central, Edinburgh East, and Orkney and Shetland.[55]

Figures from the Office for National Statistics give an insight into the different type of work involved in the sector. A large proportion of employment is in engineering construction (16%), structural metal products (10%) and technical consultancy (9%), followed by significant employment in legal services (5%), business and professional services (5%), public administration (4%) and renting of machinery (3%).

There is a shortage of qualified and experienced workers, primarily onshore roles including project management, design, subsea and drilling engineering, and geosciences.

Other fossil fuel employment

There are a further 3,000-3,500 jobs in the refining and processing of oil and gas. These jobs are focused in Grangemouth. As mentioned above, 1,370 are direct jobs on site – 570 in the Grangemouth refinery and 800 in the petrochemicals plant. There could be a further 2,000 in sub-contractor jobs associated with the site, but precise figures were not available.[56] This workforce and these jobs would be retained in the New Economy, as Grangemouth is switched over to producing synthetic fuel and gas.

There are around 2,000 direct and sub-contractor jobs in coal, gas and nuclear power stations in Scotland, with 230-270 employed at the Longannet coal-fired plant in Fife[57], 710 at Hunterston B[58] and 630 at Torness, both nuclear plants, with most of the remainder at SSE's Peterhead gas plant. Recent announcements from Scottish Power have confirmed that Longannet will shut down in

54 http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/EM013.pdf
55 Http://www.oilandgasuk.co.uk/templates/asset-relay.cfm?frmAssetFileID=669
56 http://www.scottisheconomywatch.com/brian-ashcrofts-scottish/2013/10/losing-grangemouth.html
57 http://www.theguardian.com/environment/2015/mar/23/longannet-power-station-to-shut-next-year
58 http://www.largsandmillportnews.com/news/fairlie/articles/2014/02/27/489877-where-are-the-hunterston-jobs-/

2016.

Trends in the North Sea oil industry

The number of jobs in oil & gas extraction in Scotland is on a long-term decline. Drilling in the North Sea is becoming increasingly capital intensive while using proportionally less labour - benefitting only the investor. The industry is shrinking, and even the most optimistic proponents admit that its days are numbers. The question is not whether it shrinks, but when.

Both the oil companies and the Westminster government use the threat of job losses to undermine the long-term organising ability of oil workers. Oil workers are made to feel dependent on their employers' goodwill and wellbeing.

This risks a situation where oil workers - understandably concerned for their jobs - are used manipulatively to defend corporate interests against the interests of the Scottish public - and the long-term interests of the oil workers themselves. This happened during Osborne's March 2015 budget, in which new subsidies for oil corporations were announced, that could have been invested instead in a truly just transition.

The Future for the North Sea

A safe and sustainable future for Scotland means slowing down extraction and preserving reserves. There is more oil and gas in the world than it is safe to burn – we know that the majority of fossil fuels must be left in the ground if global temperature rise is to be limited to 2 degrees centigrade.

If reserves are to be extracted, this should happen slowly, rather than as rapidly as possible. Benefits should accrue to the public, not primarily to distant corporate interests.

We propose an orderly and planned shrinking of the North Sea industry, as opposed to the existing chaotic and volatile fluctuations, that hurts both workers and the public.

As North Sea extraction shrinks, so will the workforce. But running it with part-public control (see below) and ensuring higher safety and labour standards will increase the labour ratio per barrel extracted. We estimate that a rapid slowing down of extraction would leave 10,000 jobs in North Sea oil in 2035.

Transitioning from the old to the new economy

a) Job numbers

Scotland's employment context would be boosted significantly by moving away from fossil fuels and focusing on the New Economy sectors identified here. A lot of people will be needed to make the transition a reality and keep it running. That means many new jobs – more than enough to employ everybody who currently works in fossil fuels, and to employ many new people.

	Old Economy[59]	**New Economy - 2035**[60]
North Sea extraction	151,200	10,000
Nuclear & fossil fuel plants	2,000	
Refining & Gas / Synthetic gas	3,500	3,500
Offshore Wind		106,700
Offshore Wave		28,300
Offshore Tidal Stream		20,600
Forestry		5,900
Building Retrofitting		18,900
Decommissioning		20,000
Training		4,000
Total	**156,700**	**217,900**

Because of the large amount of work necessary to start the transition and build the infrastructure for the new economy, large numbers of new jobs will exist from day one. Over time, there will be a shift from creating and building to maintaining and re-powering.

These would be better jobs for the workers and for all of us: jobs in an industry which is growing not declining, which create a safer, rather than a more dangerous world.

b) Skills

The more than 200,000 workers needed to make the transition to a healthy, sustainable and climate-safe society and economy will need diverse skills. The skills of somebody working in

59 This table does not imply that there are no current jobs in offshore wind, wave, forestry etc. The employment figures for these industries are blank in the 'old economy' column because the jobs we have assessed in the 'new economy' are all additional to those which already exist. For example, forestry jobs in new economy column are quoted as 5,900 not the full 17,900 (i.e. 11,800+5,900) as per section 2(c).

60 The number of jobs in 'Nuclear & fossil fuel plants' has been left blank as no assessment was made here. If no nuclear plants were operational in 2035 it is highly likely that decommissioning work will be on-going and requiring skilled labour.

forestry will necessarily be very different to someone working on building retrofits. Where these skills are not already in place, training will be needed - both on the jobs and beforehand.

The largest part of the new economy workforce will be building and maintaining offshore renewable energy infrastructure - over 150,000 people. There will be high demand for a wide range of engineers, machine operatives, helicopter pilots, surveyors, welders, amongst many others. This includes, but isn't limited to, those with Science, Technology, Engineering and Maths (STEM) skills.

Luckily, many of these experiences and skills are held by the current offshore oil & gas workforce, and those involved in the North Sea supply chain. The extraction of offshore fossil fuels requires a similar breakdown of skillsets and employs many of the same branches of engineering as offshore wind and marine energy. Many of the fundamentals are common. Coupled with targeted training, those directly and indirectly employed by North Sea oil are extremely well-placed to build Scotland's offshore renewable infrastructure. Both the oil and renewables industries already face a shortage of skilled offshore workers with mariner skills, including masters, chief officers, crane drivers, navigators, electrical engineers and riggers.[61]

In 2014, the Department for Business, Innovation & Skills published a report that assessed the UK offshore wind supply chain, existing capabilities and synergies with existing industrial sectors.[62] It compares the supply chain needed for offshore wind to existing supply chains for Aerospace, Automotive, Composites, Nuclear, Oil and gas, and Rail. The report identifies where there is existing UK expertise that has already been applied to offshore wind.

The offshore wind supply chain is analysed by breaking it down into six elements and 20 subelements - searching for synergies for each. Out of the 20 subelements, the report identifies existing overlap between the Oil & Gas sector to be "High" for 15, "Medium" for 4 and "Low" for 1. This means that for 75% of the offshore wind supply chain, there is existing expertise in the UK oil industry that has been applied to wind. For a further 20%, there is significant expertise, but it hasn't been applied to wind yet.

Areas of synergy between offshore wind and UK oil & gas industries[63]		
High	Medium	Low
Wind Farm design	Blades	Turbine nacelle assembly
Surveys	Drive train	
Castings & Forgings	Subsea export cables	
Towers	Concrete Foundations	
Subsea array cables		

61 http://www.scottish-enterprise.com/~/media/se_2013/knowledge%20hub/insight/scotlands%20offshore%20wind%20route%20map.pdf

62 This report examined the UK oil & gas industry, so not all of this expertise exists in Scotland. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277798/bis-14-578-offshore-wind-supply-chain-capabilities-and-opportunities.pdf

63 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277798/bis-14-578-offshore-wind-supply-chain-capabilities-and-opportunities.pdf

HVAC substations		
HVDC substations		
Monopile foundation		
Non-monopile steel foundations		
Installation Ports		
Foundation Installation		
Subsea Cable Installation		
Turbine Installation		
Operation & Maintenance		
Major service		

c) Locations

The jobs in the old fossil fuel based economy are heavily concentrated around Aberdeen. Some of the jobs in the new economy can be located in the same areas, especially sectors like decommissioning. As many supply chain companies that serviced the offshore oil industry will be able to refit themselves to support offshore wind and marine energy, it makes sense for these to remain in their current locations. Grangemouth's important role in producing synthetic liquid fuels and gas means that these jobs will remain in the same place. And other Scottish ports that have serviced oil & gas drilling, like Lerwick Harbour on the Shetlands, or Wick and Thurso on the mainland, with strategic locations near the Northern North Sea and the deep waters of the Atlantic, will be essential hubs for offshore wind. Leith, Dundee and Methill are ports ideal for serving offshore wind.

In the new economy, there will be a more even spread of jobs across Scotland's coastline than there currently is. While much of Scotland's fixed wind potential is off the east coast, the enormous possibilities for floating wind are mostly off North Scotland. Two thirds of Scottish wave energy lies to west of the Hebrides, with the remaining third around Orkney and the Shetlands. And Scotland's largest tidal stream potential is in the Pentland Firth, between the mainland and the Orkney Islands, with significant other possibilities down the west coast.

Once the offshore renewables infrastructure is up and running, the operational and maintenance work will need to be located near the renewable energy infrastructure, as speed of repair is important in maintaining a high generating capacity.

The breakdown of work in developing, manufacturing, constructing and installing offshore wind can be assessed through a report commissioned by E.ON Climate & Renewables about its Robin Rigg wind farm.[64] Most of the installation and commissioning work (36% of the cost) needs to be based near the eventual site. Manufacture of the turbine itself (around 19% of costs) and the turbine foundations can both be anywhere on the coast, although proximity is useful.

Other components, including the subsystems and components for the turbine (estimated at 19% of the costs), and the electrical system for the offshore and onshore substations, can be built

64 http://www.eon-uk.com/E.ON_Robin_Rigg_UK_content_report_October_2011.pdf

anywhere. This means that many supply chain jobs could also be located anywhere in the country, as could the bulk of project management and design.

A large number of ships and specialised vessels will need to be built, for the construction and maintenance of renewables and the decommissioning of the oil and gas sector. Scotland will need many shipbuilders and seafarers. It would make sense to re-open Clydeside ship-building docks, and make Glasgow a hub for renewables engineering.

Increased forestry jobs will be spread across Scotland according to most suitable sites. Given the need to limit distances for sustainable biomass, some of the new forest will be near urban areas, with some more remote.

The work of retrofitting Scottish buildings to improve insulation and glazing while installing localised renewable energy generation will be matched with Scottish building stock. This means that most jobs will be located in cities and large towns, in rough proportion to the existing population.

This means that many of those currently working in the fossil fuel sector can transition into jobs in the new economy that are based out of the same location. It also means that there will be many new jobs in parts of Scotland that currently have weak employment prospects and face declining populations as people move away.

As much of the supply chain (e.g. component manufacture and project management) can be based anywhere, public policy can identify sites that make sense practically and logistically, and also in terms of employment, by targeting areas where unemployment is high. This means that overall, in the new economy, there will be a more even spread of jobs across Scotland.

The North Sea must change

The North Sea tax system was already broken before the oil price crashed. Osborne's 2015 changes have made it even more so. Rather than protect the public interest, the response has been to slash taxes and increase subsidies.

The regulatory, fiscal and political structures that govern North Sea oil are designed to extract as much crude as fast as possible. When corporate profits are threatened, taxes are cut even further. Private interests and the short-term demands of the government in London shape policies in a manner inconsistent with present wellbeing or the needs of future generations. Disproportionate revenues are accumulated by distant investment firms as well as the oil companies themselves.

The fall in the oil price highlights why dependence on a declining industry is a bad idea. It also showed that the large parties all expect the public to pick up the pieces when things go wrong.

Oil companies made massive profits for a decade. Rather than re-investing those profits locally to protect workers and business operations in a downturn, companies like BP and Shell used low UK tax rates to subsidise drilling in other parts of the world.

Our calculations, based on UK government figures, show that between 2009 and 2014 when the oil price was high, companies generated huge profits from UK North Sea oil, with £48.7 billion in free cash flow. That averages as £9.7 billion per year. This more than offset the 2014 negative cashflow

of £5.3 bn that the industry claimed as the argument for tax cuts.[65] According to the Office for National Statistics, between 2008 and 2014 oil companies in the UK North Sea achieved an average rate of return of 33%, compared to 10% achieved by the rest of the UK economy (excluding the financial sector).

	Gross Operating Surplus[66]	Total UKCS Fiscal Revenues (Special + Corporation Tax)[67]	Total Investment[68]	Free Cash Flow
	(£m)	(£m)	(£m)	(£m)
2009	23,055	5,921	5,300	11,834
2010	26,988	8,322	5,500	13,166
2011	30,198	10,872	8,400	10,926
2012	24,409	6,130	11,800	6,479
2013	23,405	4,671	12,400	6,334
Total				48,739

But after years of these extreme profits, the lower oil price created a “lean year” with reduced profits. The lobby association Oil & Gas UK argued intensely that the companies should not have to bear the impacts, invoking the threat of job losses. The Conservatives, Labour and the SNP all sided with the corporations, agreeing that the burden be transferred to the public. While the rest of the UK faced austerity, Osborne's tax cuts helped shield BP and Shell's global profits from the oil price drop.[69]

In future years, demands for the state to carry the consequences, costs and risks of oil extraction will intensify. The consensus is that the North Sea oil industry is in decline – the debate is how fast this will happen. As the North Sea becomes increasingly focused on ultra-high pressure, high temperature and frontier fields, scraping the bottom of the barrel will become less and less efficient. Despite short-term drops in operating costs (tied to lower oil prices), overall costs will continue rising, with ever greater operating expenditure and energy inputs required in parallel with lower extraction rates. Each barrel will demand more subsidies and bring with it greater carbon emissions.

65 http://www.oilandgasuk.co.uk/news/news.cfm/newsid/1190

66 Office for National Statistics: LRWX – ONS – Jan 2015 http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?cdid=BGYB&cdid=LRWX&cdid=LRWY&cdid=LRXB&cdid=LRXC&cdid=LRXD&cdid=LRXE&dataset=prof&table-id=4

67 HMRC – Statistics of Government revenues from UK Continental Shelf oil & gas – Dec 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/395682/Updated_commentary_for_UK_oil_and_gas_publication_Dec_14.pdf

68 DECC - UK energy sector indicators 2014 https://www.gov.uk/government/statistics/uk-energy-sector-indicators-2014

69 http://www.theguardian.com/business/2015/apr/30/shell-first-quarter-profits-more-than-halve-falling-oil-price

There's also a significant risk that after decades of profiteering, private oil companies will attempt to dump the very large costs of decommissioning onto the public. At the point when regulation finally ensures that fossil fuels are left in the ground, the companies will no longer be profitable. Despite having had ample warning and opportunity to set aside necessary funds to decommission, they could seek to argue that they can no longer afford to dismantle their offshore infrastructure, and expect the state to step in.

What next for Oil?

North Sea oil reserves are both a valuable public resource and a dangerous polluting threat.

The current low oil price creates an opportunity to re-assert democratic control over the North Sea. Now is the time to part-nationalise and harness oil policy to a rapid transition. That means maximising revenues per barrel, slowing extraction rates and building a future out of decommissioning. Achieving the best public good will require significant state investment, intervention, democratic engagement and accountability and an end to 'light touch' regulation. It will also require bravery, as companies in the North Sea have a history of resistance and corporate bluster when faced with moves that threaten their profit margins.

Beyond the immediate step of ending tax loopholes and breaks for the oil industry multinationals, Scotland's oil should be taken into partial public ownership. The low oil price makes this more feasible then when oil prices were high. Oil companies are arguing that they cannot keep operating without state support. Any such support should be tied to receiving a stake in oil fields through mandatory state participation in joint venture contracts. The state could thus take a significant stake of 30–60% in joint oil ventures through partial state ownership. Private oil companies should continue to pay royalties and taxes on the share of crude that the companies take.

Taking a majority stake would not require the state to operate the fields. It's standard for private oil companies to be minority shareholders, while operating the concessions. For example, Shell was the operator for the Kashagan field in Kazakhstan while owning 16.8%; BP owns 50% of the GUPCO joint venture in Egypt that it operates. In cases like this, standard international practice is for the private companies to cover, or “carry” the costs of the state's share. By not directly participating in running oil operations, the UK or Scotland would not need to build up a fully-fledged national oil company.

A practical and simple model would be to mirror Norway’s fiscal regime. The Norwegian state has a direct financial interest in 121 extraction licenses in Norwegian waters, and it levies a 50% Special Tax (compared to Britain’s 20% Supplementary Charge). These two measures generate 95% of Norway’s oil revenues, and provide a simpler mechanism, and would reduce the potential for tax avoidance. Despite generating vastly greater revenues for government (£74 billion more than if the UK’s tax regime was applied between 2002--2008), the Norwegian model doesn’t reduce the viability of investments for private companies. It is designed “so that an investment project that is profitable before tax would also be profitable after tax.”[70]

The standard industry response to such proposals is that the UK has higher costs than Norway. However, empirical evidence shows that in 25 out of 32 years between 1976 and 2008, Norwegian

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70 https://books.google.co.uk/books?id=tKifp4XEfDgC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

investment per barrel extracted was higher than that in the UK. And in two out of the only seven years in which UK costs were higher, this was due to the required safety investments after the Piper Alpha disaster.[71]

By bringing North Sea oil extraction, especially larger projects, under part public ownership, the state could ensure more control and accountability as a shareholder. With less need to incentivise future drilling, there will be reduced pressure for tax hand outs for the companies. Part-public ownership, as in Norway and most other oil extracting countries, would make it easier to boost the revenues per barrel.

This does not mean that all North Sea oil fields should be taken into part public ownership. It's important to assess which fields should be shut down sooner, and which have any future.

And part-nationalisation should not be an opportunity for private companies to offload their decommissioning responsibilities onto the state. Just because the public takes a stake during the North Sea's twilight years, does not mean the public should underwrite the costs to clean up the private sector's mess. Responsibility for decommissioning should be assessed field by field, based in large part on who controlled and profited from extraction.

Finally, there are opportunities to increase revenues. The British state is known to capture a remarkably small portion of the enormous revenues that flow from the North Sea. In 2008, Norway’s average take per barrel was £27.50 - more than double that of the UK. In the past three decades Norway's take per barrel has been significantly higher than the UK's in 9 years out of 10.

Slow down extraction and preserve reserves

We know that there is more oil and gas in the world than it is safe to burn. The International Energy Authority estimate that “no more than one-third of proven reserves of fossil fuels can be consumed prior to 2050 if the world is to achieve the 2°C goal” (i.e. limiting global climate change to 2°C). Others, such as the Potsdam Climate Institute, estimate only one-fifth of proved reserves can be burned to limit the chances of the world exceeding 2°C of warming.

What does this mean for Scotland’s energy policy options? In our view, the most important outcome for energy policy is a just transition. This will not be achieved by rapidly shutting down the oil industry – the necessary investment in low-carbon infrastructure would disappear with economic recession. But a policy of maximising fossil fuel extraction rates is not compatible with the need to avoid dangerous changes to the stable climate in which human well-being has thrived.

Every barrel of oil extracted and burnt generates revenue but it also reduces the nation’s assets. In a future where natural resources, such as easily accessible oil and gas, are becoming increasingly rare it is prudent to maintain natural resources for the future.

Fossil fuels, despite their name, are not only used for fuel. Electronics, medicines, fertilizers and everyday plastics and chemicals such as paint and solvents, all rely on oil-based products. It is difficult in a market economy to make sure that extracted crude oil is put to non-fuel use but future resource and climate policy may well restrict the use of fossil resource in this way.

By implementing an energy policy which aims to slow down extraction, preserve reserves and

71 http://www.academia.edu/7288316/A_Requiem_for_the_North_Sea_Oil_Fiscal_Regime

maximise revenues, Scotland could create the conditions needed to transition to a low-carbon energy economy, retain natural assets for the future and play a fair role in tackling climate change.

Necessary policies for a just transition

We have shown that the new economy and climate transition can create more employment than the current fossil fuel economy. But it is important to look beyond the question of job totals.

Those working in the new economy should have decent jobs. That means safe, well-paid and unionised jobs, with permanent contracts.

Without strong policy guidance combined with bottom-up mobilisation, shifts to renewable energy can lead to more precarious jobs. The Energiewende in Germany has created 400,000 jobs in renewable energy[72] – but most of these are more precarious and less unionised than the 50,000 remaining coal jobs. “Green jobs” in themselves are not a panacea. The climate transition must not be used as a means to undermine organised labour and class solidarity. We need to face this risk head-on.

As the fossil fuel sector needs to be shrunk rapidly, that means that some people will lose their jobs. They must be protected. Anyone who loses a job in the fossil fuel sector should be guaranteed a job in the new economy. Apart from this being the just course of action, these workers have skills and expertise that will be essential in making the transition a reality.

A just transition is about more than just guaranteeing jobs to those in fossil fuel sectors. It's about building a more just economy. A reorientation of who the economy serves: communities, local businesses and workers, not distant profit centres.

Expanding energy production and distribution should be based on long-term planning of national need, not short-term profit for foreign investors. The urgency to the upscaling of renewable energy and infrastructure must not lead to foreign multinationals once again picking Scotland clean of its energy wealth. The benefits of the transition should reside with the public.

Policies and Institutions

Making sure that Scotland sees significant job creation will require long-term government planning and investment. It means giving the public sector a central role in the transition, and in running future energy generation and infrastructure. Increased self-reliance and control over public energy resources will allow the mutual development of shared assets for collective benefit.[73]

This process needs to be democratic, with workers and trade unions centrally involved in planning and structuring the transition. Some of the necessary policy steps for a just transition are laid out in the Energy Independence paper published in September 2014.[74] Specific policy proposals that go beyond these include:

72 http://www.rosalux-nyc.org/germanys-energiewende/

73 http://reidfoundation.org/wp-content/uploads/2013/10/Repossessing.pdf

74 http://www.scottishgreens.org.uk/wp-content/uploads/downloads/2014/09/Energy-independence-Green-Yes-briefing.pdf

Creation of a Scottish Public Offshore Wind Company and a Scottish Public Marine Energy Company
These will build, maintain and own a large proportion of offshore renewables infrastructure. This will ensure that the infrastructure is put in place as fast as possible, and that decisions are not made according to short-term profit. It also means the benefits will revert to the public, and can be used to set up an Offshore Wind Fund. These two companies do not need to run all offshore renewables. They can operate join ventures, and work together with regional energy co-operatives or public companies. For example, the Shetlands or Orkney might also have regional offshore public companies.

Take Grangemouth Refinery and Petro-chemical plant into public or part-worker-public ownership
This will make it easier to retool and restructure Grangemouth to make synthetic fuels and gas from sustainable biomass. Workers should take on a central role in the restructuring process and running of operations.

Launch a Public Retrofit Programme
An massively up-scaled national retrofit programme in which workers go street by street, insulating and glazing residential, commercial and public buildings.

Land reform to diversify ownership and deliver more land into public and community hands
Land ownership in Scotland is skewed towards a tiny number of very rich landlords. Helping communities take back control over land will boost local community-owned renewables projects. Taking back land into public ownership is also essential for the large-scale reforesting.

Strengthen labour laws
To allow workers to organise while banning exploitative employment practices.

Create public authorities and bodies with greater powers to oversee the transition
These should be publically accountable and have significant elected worker representation on the boards, similar to Denmark and Norway.

Maximise jobs in the supply chain through buy-local and hire-local legislation
A legal requirement to meet significant 'local content' quotas will nurture domestic industry for the long run, build a new skills base and invigorate local economies. This can be backed up with legislation that requires a local employment component for all renewable energy operations (production or transmission). This means that the supply chain supporting offshore renewables will rely on local workers and local components.

Centring the role of shopfloor workers
Many fossil fuel supply chain companies can be retooled to supply renewable energy and decommissioning sectors. The creativity of shopfloor workers will be central to adapting industrial and craft processes and should be given a structural role. Lessons should be learnt from the Lucas Aerospace experience and plans, in which engineering shop stewards sought to convert the company from manufacturing missiles to producing socially useful products.[75]

75 http://platformlondon.org/p-publications/energy-beyond-neoliberalism/

Education and training
Re-training schemes should be run at a local level, and be structured in part by those participating. Existing and new Union Learning Representatives should play an important role.

Support for fossil fuel workers
Other than guaranteed public-sector jobs in the new economy sectors, existing fossil fuel workers will need flexible support packages to enable their individual job transition. This support should include paid time off for education and re-skilling, compensation to cover relocation costs and consultation and involvement in the process.

Next steps

With limited resources we have made no attempt to quantify the level of investment required to finance this transition but it will require a wholescale change of UK economic policy away from austerity and toward investment. Political agreement on this change is a necessary prerequisite.

Planning a transition on this scale will require a detailed model for financing the investment. There are multiple opportunities for creating this investment and delivering these polices. Some are described above such as using the estimated one billion pounds a year subsidy[76] to the oil and gas industry to create a public-private industry as exists in Norway. Others options include the sale of infrastructure bonds or a programme of green infrastructure quantitative easing depending on the economic circumstance.

The next steps will require workers, unions and governments to come together to plan a just transition. The benefits will be a secure sustainable economy for workers of the future.

76 https://www.scottishgreens.org.uk/oil-and-gas-taxation/