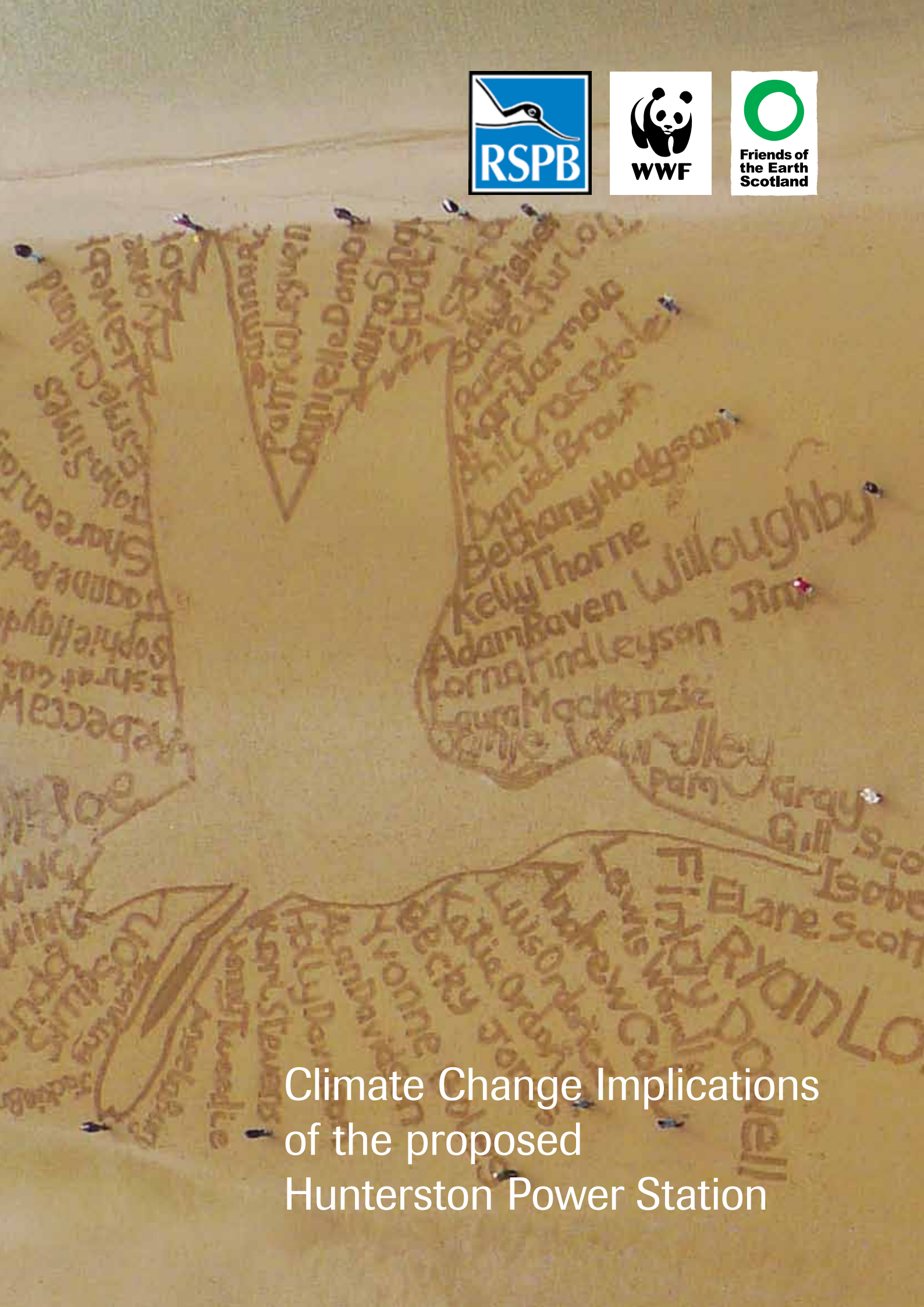
RSPB
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Climate Change Implications of the proposed Hunterston Power Station

Climate Change Implications of the proposed Hunterston Power Station.
A summary report of the carbon and climate change implications of the proposed Hunterston coal-fired power station.

Based on research conducted by Element Energy.

Commissioned by RSPB Scotland, WWF Scotland and Friends of the Earth Scotland.
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October 2011.

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Summary

Plans to build the first new coal fired power station in Scotland since the 1970s are completely at odds with the climate threat we face. Opposition to the proposed coal fired power station at Hunterston in North Ayrshire is widespread at a local, national and international level. Given the apparent inconsistencies in the application, RSPB Scotland, WWF Scotland and Friends of the Earth Scotland commissioned consultants Element Energy to undertake an independent review of the climate implications of the proposal[1&2] and the main conclusions are summarised here.

Key findings

- Emissions from year one would be equivalent to adding 63% to Scotland's annual power sector emissions;
- By 2050 emissions could be equivalent to 57% of all the emissions allowed, from all sectors, under the Climate Change (Scotland) Act 2009;
- Even if the plant is fully retrofitted with carbon capture technology in the 2020s, lifetime emissions will significantly exceed those from a practical alternative portfolio of renewables backed up by gas and pumped storage;
- Co-firing with biomass would not only result in negligible carbon emissions savings but is also contrary to Government policy on the utilisation of biomass;
- The Hunterston proposal is incompatible with the Scottish Government's commitment to decarbonise electricity supply by 2030;
- The proposals could impose unnecessary additional costs on electricity consumers and taxpayers of at least £500m.

This briefing also explains why the development is not needed for Scottish national energy security; and why it is unlikely to deliver national economic benefits.

! By 2050, emissions from Hunterston could be equivalent to 57% of all the emissions allowed, from all sectors, under the Climate Change (Scotland) Act 2009

1. In particular to examine the calculations made for Ayrshire Power by Eunomia consultants in their report: *Analysis of CO_2 Emissions from Hunterston.*

2. The full report from Element Energy is available at www.wwfscotland.org.uk/hunterston

To date more than 19,000 objections to the application have been submitted by members of the public

The proposal

In June 2010, Ayrshire Power Limited (APL), a subsidiary of Peel Energy, submitted an application to build a new 1852 megawatt (MW) coal-fired power station at Hunterston in North Ayrshire. The proposed station would be operational in 2017 and capable of generating the equivalent of more than 25% of Scotland's electricity consumption. The proposed site is on intertidal sand flat habitat and would destroy much of the Portencross Coast SSSI, a nationally designated wildlife site[3].

Coal is among the most carbon intensive of fuels for generating electricity. Scottish Government policy requires that any such proposal demonstrates technology to capture and store carbon emissions. APL has proposed to fit novel carbon capture and storage (CCS) technology to 327MW of the plant from the outset, and expects to be required to retrofit CCS to the remaining capacity in the 2020s, most likely by 2025[4], even though CCS is as yet unproven at a commercial scale.

The proposal has already proved highly controversial. In January 2009 James Hansen[5] (one of the world's leading climate scientists) wrote to Alex Salmond, urging him to halt such plans[6]. The Scottish Parliament voted strongly against the Hunterston proposal in March 2010, and the constituency MSP has clearly stated his opposition[7]. To date more than 19,000 objections to the application have been submitted by members of the public. The inclusion of Hunterston as a national development in the National Planning Framework is also subject to an ongoing Judicial Review.

The application now sits with Scottish Ministers for consideration. While Ministers are not obliged to refer the application to a Public Local Inquiry unless the local planning authority objects, it would seem politically unwise not to do so, in the face of thousands of public objections.

3. http://gateway.snh.gov.uk/pls/portal/Sitelink.Show_Site_Document?p_pa_code=1308&p_Doc_Type_ID=1

4. Scottish Government Action on CCS: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/traditional-fuels/new-technologies/SGactionCCS

5. James Hansen Biography: http://www.giss.nasa.gov/staff/jhansen.html

6. Letter from James Hansen to Alex Salmond, published in The Scotsman, 31 January 2009: http://thescotsman.scotsman.com/latestnews/In-full-Letter-to-the.4932922.jp

7. Kenneth Gibson MSP for Cunninghame North voiced his opposition to the proposed Hunterston Power Station (15 September 2010): http://www.theyworkforyou.com/sp/?id=2010-09-15.28572.0

Hunterston and Southannan Sands is the largest mudflat on the Ayrshire coast, and is designated as an important wildlife site.

Climate implications of the proposal

The review undertaken by Element Energy suggests that APL's figures downplay the serious climate implications of the proposal in several ways. They:

- **Overstate the apparent reduction in emissions.**
- **Downplay the critical importance of the timing of retrofit** for the cumulative impact on emissions.
- **Draw misleading conclusions** with respect to the consequences for overall emissions in Scotland.

Table 1 outlines APL and Element Energy's calculations of the likely carbon intensity of electricity produced at Hunterston. The plant, with partial CCS, would generate 587-650 grams of CO_2 emitted per kWh of electricity generated. With full retrofit,

Table 1

Comparative carbon intensity: grams of CO_2 emitted per kWh of electricity supplied

Scenario	APL figures	Element Energy figures	Relevant CCC permissible grid average
Baseline coal plant with no CCS	910	730	n/a
Hunterston with partial CCS (current application)	587	650	300 (by 2020)
Hunterston with full CCS (after retrofit in 2025)	106	110	50 (by 2030)
Hunterston lifetime average (with initial partial CCS and retrofit full CCS after 2025)	202	218	n/a
Typical modern gas combined cycle gas turbine (CCGT) with no CCS	330	320	n/a

! The Hunterston proposal is incompatible with the Scottish Government's commitment to decarbonise electricity supply by 2030

emissions would fall to 106-110 gCO_2 per kWh[8]. However, the UK Climate Change Committee (CCC) recommends that far lower average grid emissions would be required in order to meet our climate change targets. The Scottish Government has accepted the CCC's recommendations, and made a commitment to decarbonise electricity supply by 2030[9]. The Hunterston proposal would be completely at odds with that commitment.

Carbon savings are overstated

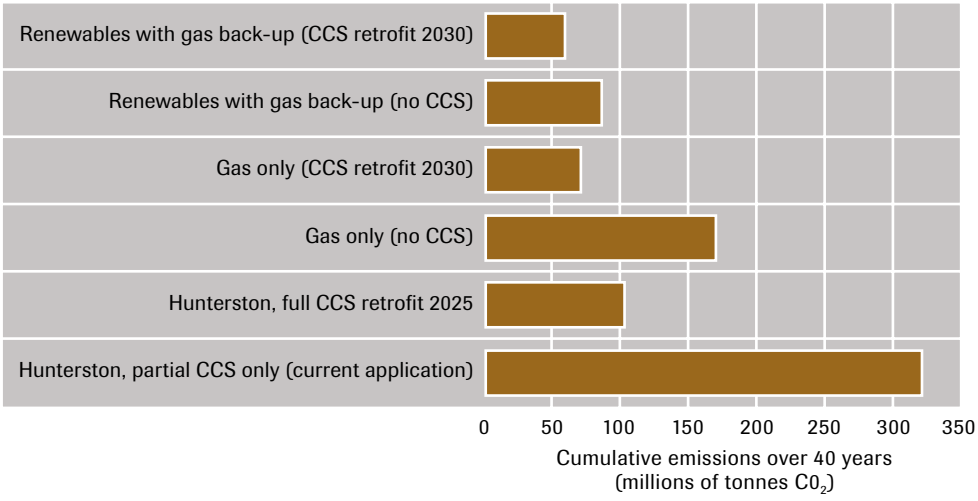
APL claim that *"During the early years of its operation ... with demonstration scale CCS [Hunterston] would emit approximately 34% less CO_2 per kilowatt hour supplied than a **conventional** coal fired power station"* (emphasis added). Elsewhere APL has claimed that 25% of the station's CO_2 emissions will be captured in the plant's initial configuration[10]. However, it is unreasonable to compare the Hunterston proposal with a "conventional" coal-fired power station, since any new or replacement plant constructed in the UK would be of a more efficient design. Therefore, when compared with a more realistic, modern, efficient but unabated new coal plant by Element Energy, then just 11%[11] of CO_2 emissions would be captured. In addition, if full CCS were to be fitted, Element Energy's calculations show that APL overestimate the level of emissions captured by half, with 15% of emissions remaining unabated.

Even if the plant is fully retrofitted with carbon capture technology in the 2020s, lifetime emissions will significantly exceed those from a practical alternative portfolio of renewables backed up by gas and pumped storage

In practice, existing Government policy prevents any new unabated coal plants being constructed[12]. Any comparison with unabated coal is therefore misleading. In reality, the alternative to Hunterston would be a portfolio of renewables, backed up by gas-fired generation and electricity storage, supported by additional efforts in energy efficiency. This scenario broadly reflects Scottish Government policy as set out in the Renewables Routemap[13] published in 2011.

Figure 1

Lifetime cumulative CO_2 emissions: various scenarios[14]



8. Element Energy cite slightly higher emissions factors, noting that they assume a lower electrical generation efficiency than Ayrshire Power.

9. http://www.scotland.gov.uk/Publications/2011/03/21114235/6

10. This figure is from the *Hunterston Environmental Statement, Non Technical Summary*, however it is not clear how it was calculated i.e. the load factor and % biomass cofiring: http://www.ayrshirepower.co.uk/images/downloads/planning_application/Non-technical-summary_NTS/100524_NTS_final%20draft.pdf

11. This figure is calculated as the reduction in carbon intensity of each unit of electricity generated by the plant in its initial configuration (650gCO_2/kWh), compared with that of a similar new coal plant with no CCS (730gCO_2/kWh) (table 1). It assumes the plant would be operating at a high load, and without any biomass cofiring. APL's figure of 34% appears to have been derived in the same fashion from intensity estimate of 587gCO_2/kWh (with no biomass, and high load) compared with the benchmark provided in their report, of a conventional coal plant (910gCO_2/kWh).

12. Scottish Government Policy on CCS: http://www.scotland.gov.uk/News/Releases/2009/11/09170209

13. 2020 Routemap for Renewable Energy in Scotland: http://www.scotland.gov.uk/Publications/2011/08/04110353/0

14. In Figure 1 the policy scenario of more renewables, and more energy conservation with pumped storage and gas backup is termed "Renewables with gas backup". All scenarios assume 83% utilisation throughout.

Element Energy contrast the Hunterston proposal with such a scenario, revealing the true comparative emissions (see Figure 1). They also consider the possibility that retrofit may not ever be commercially viable. APL has claimed its proposal would be preferable to gas-fired generation, but that assumes – misleadingly – that the alternative would be to generate the same amount of electricity using *only* gas (not a mix of renewables and gas), *and* that the Hunterston plant would be retrofit by 2025, *and* that gas power would never be retrofitted with CCS[15].

Emissions from year one would be equivalent to adding 63% to Scotland's annual power sector emission

Waiting for retrofit will add to emissions

Total emissions depend on both emissions intensity and utilisation rate. At a high utilisation rate (83%), Hunterston, as proposed (with partial CCS), would produce around 8 million tonnes (Mt) of CO_2 a year. Following the expected closure of Cockenzie in 2015, but assuming no other changes in fossil fuelled capacity or operating rates, this would **add 63% to Scotland's annual power sector emissions in 2018**.

Looking ahead to 2050, in the worst case, that Hunterston is never retrofitted (and is utilised as base-load at 83%), emissions from the plant would be equivalent to **57% of the total emissions allowed from all sectors in 2050 under the Climate Change (Scotland) Act 2009**. Even if utilisation fell to 50%, emissions would be equivalent to 34% of the total allowed.

Over a forty year lifespan, with only partial CCS, Hunterston would emit almost four times more CO2 than the alternative renewables/gas portfolio. Even if fully retrofitted in 2025, Hunterston would still generate around 20% more CO_2 than the renewables/gas portfolio over 40 years (see Figure 1). For the Hunterston proposal to generate lower cumulative emissions in comparison to the renewables/gas portfolio (without gas CCS retrofit) it would need to retrofit implausibly early, by 2022 (within five years of initial commissioning)[16].

Co-firing biomass would offer negligible climate benefit

None of the above figures take account of the prospect of co-firing biomass as a partial alternative to coal. Element Energy however conclude that there would be little if any carbon benefit: *"The carbon benefits from co-firing biomass, even at 14%, are negligible, even with optimistic assumptions … When land-use and carbon debt factors are accounted for, or with pessimistic assumptions co-firing could raise net emissions over the 40 year lifespan of the plant"*. In any case, Scottish Government policy is that biomass should be *"deployed in heat-only or combined heat and power schemes, off gas-grid, at a scale appropriate to make best use of both the available heat, and of local supply"*[17]. The Hunterston proposals are not compatible with this policy.

Therefore, co-firing with biomass would not only result in negligible carbon emissions savings but is also contrary to Government policy on the utilisation of biomass.

Costs to consumers and taxpayers

It is difficult to assess the implications of this proposal in terms of the costs to electricity consumers or to the taxpayer, as the UK Government has neither concluded its electricity market reform process, nor determined how the installation of CCS might be financed. Nor is it possible to accurately predict the future prices of coal and carbon emissions, which are critical to determine whether retrofitting CCS on such a plant will ever be commercially viable without additional public subsidy.

Nonetheless, the costs are substantial. Element Energy suggest that consumers will be expected to bear the majority of the costs of a demonstration installation of partial

15. Although UK Government policy is that gas should be retrofitted by 2030.

16. Retrofit in 2025 anticipates a decision to do so in 2018

17. Scottish Government, Draft Electricity Generation Policy Statement, November 2010

The proposed site is on intertidal sand flat habitat and would destroy much of the Portencross Coast SSSI, a nationally designated wildlife site which supports large numbers of wintering birds such as redshank. Photo © Andy Hay rspb-images.com

CCS, estimated at approximately £500 million (discounted cost). In addition, if full retrofit is not commercially viable without further subsidy – a situation which seems increasingly likely given the slow pace of global CCS development – consumers would also bear the cost of retrofitting (estimated to lie between £200m and £80m (discounted, depending on timing)). These costs would be paid through a subsidy per ton of CO_2 stored (for the first 20Mt) estimated at £118-137. However these subsidy estimates are highly sensitive to future commodity prices, and could rise by 50-60% if prices are low.

! Co-firing with biomass would not only result in negligible carbon emissions savings but is also contrary to Government policy on the utilisation of biomass

Moreover, APL appears to have seriously underestimated the likely cost of the plant. APL's website claims that Hunterston would cost £1.5-2bn. The latest DCC-commissioned analysis costs the same scale of plant at £2.98bn (not including CCS)[18].

Other studies have shown that in terms of value for money in demonstrating CCS on new plants, full scale demonstration on a supercritical coal plant such as the Hunterston proposal is more expensive (per MW) than demonstration on either new integrated gasification combined cycle (IGCC) coal[19] or gas power[20].

There is no energy need for the plant

The theoretical case for thermal power generation is to provide flexibility and effectively back-up intermittent renewables. However, both greater interconnection and more electricity storage can provide a similar service. Previous research for WWF Scotland, RSPB Scotland and Friends of the Earth Scotland has shown that with moderate investment in interconnection and storage, Scotland could phase out thermal power by 2030[21].

18. Electricity Generation Cost Model - 2011 Update for DECC: http://www.decc.gov.uk/assets/decc/11/about-us/economics-social-research/2127-electricity-generation-cost-model-2011.pdf

19. Future value of coal carbon abatement technologies to UK industry – AEA report for DECC, December 2008, http://www.aeat.co.uk/cms/assets/MediaRelease/PR_190609.pdf

20. Relative costs of CCS on gas and coal plants – sent with letter to Chris Huhne, June 2010, http://hmccc.s3.amazonaws.com/gas%20CCS%20letter%20-%20final.pdf

21. The Power of Scotland Secured: http://www.rspb.org.uk/Images/POSS_FinalReport_tcm9-272152.pdf

The proposals could impose unnecessary additional costs on electricity consumers and taxpayers of at least £500m

A more conservative analysis for the Scottish Government was published in the November 2010 Draft Electricity Generation Policy Statement (DEGS). It states that *"as a result of renewable generation ambitions and interconnection upgrades there is no current need for an increase in overall thermal capacity"* – even with the coming closures of Cockenzie and the Hunterston B power stations.

While the DEGS did suggest that replacements or upgrades of existing plant may be needed in the 2020s, it concluded that *"By 2030 fitting full CCS to either upgraded or replacement thermal plant and maintaining a minimum thermal electricity capacity of above 2.5GW would satisfy security of supply concerns and would be consistent with a long-term path towards decarbonisation."*

Subsequently, Scotland's renewable energy target has been raised to the equivalent of 100% of domestic consumption, (implying commensurate increases in transmission capacity). The SNP manifesto for May 2011 stated that *"increased renewable generation means there is now no energy need for additional thermal generation plants"*.

In other words, the minimum thermal capacity identified in the DEGS could be reduced further. But even if 2.5GW is still taken as a minimum, Hunterston is unnecessary. Longannet and Peterhead power stations could provide up to 4GW of thermal capacity in 2030 should they succeed in their aspirations to demonstrate CCS on coal and gas respectively, and upgraded and retrofitted in line with Scottish Government policy.

Economic benefits are highly uncertain

There are a number of uncertainties which suggest that the developer's claims with respect to economic and employment benefits from the development cannot be relied upon, including:

- **The costs of demonstration and CCS retrofits are high**. At present, funding from UK and EU sources has not been secured. The potential blight arising if the development were approved without finances in place would be considerable.
- **Limited transmission capacity**. If approved Hunterston may compete with renewables for limited transmission capacity, either damaging the prospects of those renewable generators, or undermining Hunterston's own economic viability. Even though Hunterston is well located with respect to the existing Scottish transmission network, there are significant constraints between Scotland and England (the main market for power exports). It is far from certain that these will be completely removed, especially with the higher rates of renewables development now foreseen. Element Energy conclude that the prospect that *"transmission infrastructure per se will pose a material threat to the economics of fossil power generation by the time the proposed Hunterston project would be operational"* cannot be ruled out.
- **Competition with Longannet**. Approval for Hunterston may reduce the expected viability of Scottish Power's proposals for a CCS trial, by competing with Longannet for the same market niche with a newer plant. Element Energy state that *"for plants using the same fuel source, typically newer power plant (in this case Hunterston) would ... be more competitive than older power plant"*. At best this could mean that any economic and CCS market gains at Hunterston were simply offset by losses at Longannet. At worst, given the inevitable uncertainties about Hunterston, by increasing the uncertainties about Longannet, Scotland may end up with neither investment.
- **The availability and cost of carbon storage**. Although Scotland seems blessed with significant potential, our exhausted oil and gas fields comprise a limited storage resource, and most proven capacity is under the North Sea (off the opposite coast of Scotland from Hunterston). The Climate Change Committee has already warned UK Governments that it might be best to reserve most carbon storage capacity for future industrial users, rather than for power sector emissions. APL's proposal to use exhausted gas fields in Morecambe Bay for storage could put them in direct competition with potential industrial users in NW England.

- **Coal power creates approximately two-thirds as many jobs as renewable energy.** According to an analysis of 13 independent studies, renewable technologies create more jobs than coal, both per megawatt of power generated, and per dollar invested. Over a 10 year period the wind energy industry generated 5.7 jobs pmillion dollars in investment, and the coal industry only 3.96[22].

Conclusions

A new coal-fired power station at Hunterston is not required for energy security reasons. Even with demonstration CCS, it would generate very significant levels of climate changing emissions compared with practical alternatives, seriously damaging Scotland's reputation as a global leader on climate change action.

Achieving even the proposed small levels of partial abatement could impose unnecessary and significant additional costs on electricity consumers and taxpayers. There is also considerable uncertainty about the potential wider economic benefits claimed for the development.

The revisions to the APL application presented in the addendum do not materially change the case with respect to carbon emissions and climate change or the need for the plant. Ministers should reject this proposal, and remove the plan from the National Planning Framework.

In order to meet Scotland's target to decarbonise electricity generation by 2030, Scotland must focus on renewable technologies and energy efficiency. Photo © Laurie Campbell rspb-images.com

22. http://rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf

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