Nonsense on stilts?

Investigating the discourse around policies and consumer bills: A case study on the Policy Exchange research note on the full cost of renewable energy policy

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Dr Robert Gross (robert.gross@imperial.ac.uk)

Imperial College Centre for Energy Policy and Technology

Background

In recent months sections of the British media have paid considerable attention to the impact of support for alternative energy, particularly renewables, on consumer prices. In some instances coverage is explicitly anti-renewables and seems intended to entertain rather than inform[1]. In others the impacts on costs have been exaggerated. Recent reporting in the Daily Mail, for example, had to be corrected – repeatedly – because it was not accurate[2]. Sources for press reports vary in quality and motivation. Lobby groups opposed to particular renewable technologies, or environmental regulation in the round, turn out studies that highlight, or exaggerate, the costs[3]. These are seldom subject to rigorous scrutiny or peer review. The renewable industry duly responds, but it often seems as if there are no sources of independent analysis available, since everyone in the debate has an angle. Meanwhile the government department in charge of energy, DECC, has maintained in press reports that its policies will *reduce* household fuel and electricity bills by 2020[4]. This is a confusing arena, in part because protagonists in the debate often fail to distinguish clearly between bills, prices, and wider costs.

In December 2011 the Committee on Climate Change (CCC) issued a short paper on consumer bills. This provides a clear and evidence-based review of the relative role of wholesale fossil fuel prices, renewable energy policies, energy efficiency policies, transmission and distribution upgrades and the EU carbon price in bill formation[5]. DECC has also clarified the government position, their website now features the graphic reproduced in Figure 1, which plainly lays out the relative impacts of policies that increase bills (for example the emissions trading scheme) and policies to decrease bills (for example various energy efficiency policies). It is notable that some policies push in two directions, for example the Renewables Obligation subsidises renewable energy (increasing bills) but the increasing role of renewables depresses wholesale electricity prices (decreasing bills).

Despite the clarifications issued by DECC and the CCC the debate over the bill impacts continues, fed in large part by various ‘think tank’ publications. This raises important issues about the capabilities needed to do analysis of energy policy and the quality of the analysis informing the media debate.

This paper therefore examines in some detail a recent addition to the debate, from Policy Exchange (PX), published in January 2012.

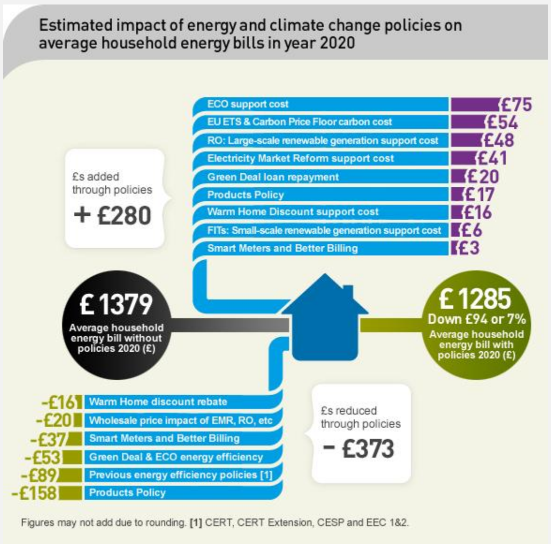

Fig 1. DECC policy impacts Q&A tool[6]

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[1] http://www.telegraph.co.uk/comment/columnists/christopherbooker/9000132/Chris-Huhne-is-piling-on-the-make-believe.html

[2] The Daily Mail was obliged by the Press Complaints Commission to publish three corrections to claims about the cost of renewable energy policies http://www.carbonbrief.org/blog/2011/12/mail-makes-third-correction-to-energy-bills-coverage

[3] http://www.civitas.org.uk/economy/electricitycosts2012.pdf
http://fullfact.org/blog/figures_civitas_wind_power_report_res-3290

[4] http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/236-impacts-energy-climate-change-policies.pdf

[5] http://www.theccc.org.uk/reports/household-energy-bills

[6] www.decc.gov.uk/en/infographics/houshold_bill.aspx

The Policy Exchange research note

Amongst the numerous reports in the headlines recently a report from Policy Exchange (PX) provides an interesting case study[7]. Unlike some think tanks, PX is not arguing against climate policies *per se*. PX argues that we *should* have policy to support low carbon energy, but that the current policy mix is too expensive and that the government understates the true extent of the costs of renewable energy policies.

PX maintains that the full *cost* to households of UK renewable energy policies *alone* (not all low carbon policies) in 2020 will be £400 per year. This estimate has been reproduced in the Daily Mail, Telegraph and on ITV television. As well as a stark contrast to DECC's headline contention that government policies will *decrease* bills by 7% in 2020 relative to 'business as usual', the estimate is also dramatically higher than that of the CCC. The CCC, which is independent of the government, estimates the cost of *all* low carbon policies to be around £130 per household in 2020. This compares to a total cost of current green policies of around £85, and bill increases in the period from 2004 to 2010 of around £290 due to rising international gas prices[8]. PX's note was published *after* the CCC review. It is therefore reasonable to assume that PX does not find the CCC review convincing or sufficient.

PX's report on household energy costs is interesting for three reasons: Their claims are high profile, cited in the national press and TV; they accept some of DECC's data and appear to attempt a degree of rigour (absent from some 'think tank' reports); and they claim to have identified 'hidden' costs that amount to a *threefold increase* in household costs compared to DECC official data. PX also appeared surprised when former Secretary of State Chris Huhne declared that their report was 'nonsense on stilts'[9].

Do their claims stand scrutiny? This discussion considers three aspects of the Policy Exchange paper:

- That the focus should be on prices, not bills, because energy efficiency policies may not deliver
- That there are significant hidden costs in the government's policies
- That policies are not cost effective, in particular that support for offshore wind is excessively burdensome

Prices, costs and bills

Bills or prices – does energy efficiency work?

PX maintains that the government is misleading consumers by subtracting the efficiency gains that some policies provide (hence helping to reduce bills) from the price rises that other policies cause. The argument for focusing on bills is that if policy can reduce demand through energy efficiency then the amount households pay for their heating, lighting and other energy services can come down, even if the price of power and gas go up. PX maintains that this is sleight of hand; "*the headline message obscures the fact that energy prices will be substantially inflated by government policies*[10]*.*"

Is it fairer to focus on prices than on bills? Objectively neither presenting *only* bills nor presenting *only* prices (in a discussion about *costs*) is transparent and correct. A fully transparent approach would present bills both with and without the effects of energy efficiency policy, but presenting bills and prices does have the disadvantage of

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[7] http://www.policyexchange.org.uk/environment-and-energy
[8] http://www.theccc.org.uk/reports/household-energy-bills
[9] Policy Exchange news digest email, January 2012
[10] http://www.policyexchange.org.uk/environment-and-energy

complexity. Perhaps the key question is whether prices or bills provide the most convenient shorthand for how much low carbon policies are costing us.

The answer depends in part on whether the energy efficiency policies in question work. Household energy consumption fell 15% from 2004 to 2009 (the last year for which weather adjusted data are available), in large part because both appliance and building energy efficiency improved[11]. Whether consumption can be *reduced further* as modelled by DECC remains to be seen. However it makes little sense to assume that policies to promote renewable energy *are bound to succeed* and increase the price of power, whilst policies to promote energy efficiency and reduce bills *are bound to fail*. The success or failure of policies is an empirical matter. International experience suggests that with the right incentives renewable energy can grow quite rapidly[12]. It also suggests that policies can drive efficiency improvements and that similar sectors in different countries can have radically different energy consumption[13].

If debate is to focus on *prices alone,* as the best shorthand for policy costs, then it needs to be demonstrated that energy efficiency policy doesn't (or won't) work, has hidden costs of its own, or both. In this regard a number of comments about efficiency are made by PX.

The first comment PX make about efficiency policies is that the less well off are likely to replace their appliances less often and more likely to buy second hand. This is *prima facie* reasonable, but how impactful? No evidence is provided. An equally compelling counter case can be presented: The second hand market is small and goods turnover rapidly because they simply don't last very long (most appliances last around 5 - 8 years). White goods are replaced because they break or wear out and are frequently scrapped at that point as it is not economic to repair them. Laws relating to refrigeration fluids removed many old fridges/freezers due to concern about ozone depletion, and since retailers 2007 are obliged to take back old appliances[14]. Fridges and freezers have been subject to EU minimum efficiency standards since 1998, and therefore even older fridges are now quite efficient. There is hardly any market for second hand boilers, because boiler installations are tightly regulated[15] and there is obviously no market for second hand light bulbs. PX also overlooks the potential for policies such as the Energy Companies Obligation to explicitly target appliance subsidy to the less well-off, addressing this very problem head on.

PX also makes an unsubstantiated remark related to the higher prices of more efficient products – these "*must cost the manufacturers of the products more*". PX provides no evidence to support this contention either, but again it does not stand very much scrutiny. Energy efficient products that unequivocally do cost more than their predecessors (for example condensing boilers and compact fluorescent bulbs) pay for themselves within a very short period of time, through energy savings. But for many items it is by no means obvious that more efficient means in any material sense more expensive. A more efficient fridge may have a larger volume of insulation material in its structure, but the material in question is merely an expanded polymer, similar to polystyrene – so cheap it is disposable. Better *design* can create more efficient products, yet the cost per unit is often negligible. Electronic controls to reduce standby electricity

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[11] http://www.decc.gov.uk/assets/decc/11/stats/publications/dukes/2311-dukes-2011-long-term-trends.pdf
[12] See e.g. http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf and http://www.iea.org/Textbase/npsum/DeployRenew2008SUM.pdf
[13] A good review is provided by Vaclav Smil in his 2005 book *Energy at the Crossroads* (MIT PRESS).
[14] WEEE rules apply to refrigerators other appliances
[15] Householders and landlords must comply with CORGI regulations for gas installations, and boiler efficiency rules require the fitment of modern condensing boilers.

waste often add mere pence to electronic devices[16]. The most energy efficient laptops are the cheaper 'netbook' models and smaller, less powerful cars tend to be both cheaper and more fuel efficient than luxury models.

In short, for most products, efficiency improvements often have a vanishingly small impact on product prices and save money through bill reduction. The price effects of product policies are almost indiscernible against the backdrop of retail price competition and appliance innovation. The vast raft of options to improve efficiency at little or low cost is precisely why there is widespread international consensus that energy efficiency offers a highly cost effective way to save carbon[17]. There is a similarly strong consensus that a variety of non-price market barriers often impede the uptake of energy efficiency, even where it is cost saving in the short run[18]. Hence appliance, building and vehicle regulations all offer an economically efficient route to improved overall welfare as well as lower carbon emissions. Non-price market failures respond very poorly to price based signals, which is the reason regulation and behaviourally focused interventions will be needed alongside any developments to price carbon[19].

There are very real difficulties associated with the government's new energy efficiency flagship, the Green Deal[20]. Yet the evidence is that previous policies, the carbon emission reduction target (CERT) and energy efficiency commitments, combined with more stringent building and appliance regulation have had a meaningful impact on energy use[21]. The real debate about energy efficiency policy going forward is an important one. It is absent from the PX note.

Conclusions on bills and prices

PX is right to identify concern about the effectiveness of energy efficiency policies, their distributional impact, and to note that it is disingenuous to disguise costly policies by netting them against cost saving ones.

However, PX use anecdote and unsubstantiated assertion to support the contention that energy efficiency policies won't work, or cannot be relied upon and may penalise the poor. Efficiency improvements often have a vanishingly small impact on product prices and save money through bill reduction. Non-price market barriers often impede the uptake of energy efficiency, even where it is cost saving in the short run. Product regulation often offers an economically efficient route to carbon abatement.

PX overlooks most of the positive outcomes associated with energy efficiency policy. Their paper then shifts from discussing *bills* to discussing *prices* as if there is no distinction between the two. This is misleading. A fully transparent approach would clearly articulate *both* price *and* bill impacts.

Missing costs?

PX argues for a move from *bills* to *prices.* They then take a further step and discuss householder *costs.* Many of these do not show up in household *energy* bills at all, but affect the wider cost of household goods. PX maintains that the DECC data ignore key

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[16] See the IEA report 'things that go blip in the night' and related material http://www.iea.org/subjectqueries/standby.asp

[17] See e.g. http://www.mckinsey.com/Client_Service/Sustainability/Latest_thinking/~/media/McKinsey/dotcom/client_service/Sustainability/cost%20curve%20PDFs/Climate_Change_Business_Executive_Summary.ashx

[18] The Stern Review (2006) provides and excellent overview of the barriers to energy efficiency

[19] Ibid

[20] http://www.ukerc.ac.uk/support/tiki-index.php?page=inputs+to+policy (click 'response to green deal...')

[21] Ibid

costs that end up in household budgets. These include transmission upgrades and the cost of intermittency (PX estimates £75 per household), policies funded through taxation not bills (the Renewable Heat Incentive or RHI, PX estimate £55 per household) and the impact of policies on commercial energy bills – which themselves turn up in household prices (PX estimate £185 per household).

PX rounds these costs to £300 – Three quarters of the total cost per household PX promulgated so enthusiastically to the mainstream media. How rigorously have they been estimated? Does ascribing policies funded through taxation or commercial bills to household energy bills make sense?

Transmission upgrades

Accounting for the costs of grid upgrading is complicated. As well as renewable connections, additional transmission and distribution (T&D) costs result from a range of factors including the replacement of old infrastructure, demographic shifts and demand growth (particularly in some urban areas), requests to connect from conventional power stations and assumptions about prospective nuclear power stations.

Transmission costs are included in DECC analysis and Annex 5 of DECC's note on the subject refers specifically to assumptions related to upgrading. However, PX is right that the DECC note does not provide clarity on their assumptions about transmission costs that can be attributed to renewables.

Fortunately the complexities of the transmission requirements associated with the government's plans for renewable energy have been assessed in great detail by a combined team of network operators, utilities and other stakeholders, reporting to DECC and Ofgem. This Electricity Network Strategy Group (ENSG) first reported on the transmission costs of the 2020 targets in 2009[22]. The estimates were updated in February 2012[23]. The ENSG estimate from 2009 was that around £4.7 billion in total investment in transmission upgrades would be needed to accommodate a mix of onshore and offshore wind, together with other changes to the generation mix.

Total investment should not be conflated with annual costs. Electricity network infrastructure lasts decades, so the full costs should be annualised, if the goal is to gauge impact on annual bills. The December 2011 report from the CCC[24] annualised the ENSG expenditure of £4.73 billion, and distributed it over anticipated electricity demand[25]. The resulting 0.1 p/kWh on bills is reported in the CCC note on bills[26]. The annualised cost amounts to £275 million per year. Using the 29 million households in 2020 suggested by PX, with households accounting for around 30% of demand, the annual cost is around £3.20 per household per year. The latest ENSG capital cost estimate is rather higher at £8.8 billion. Very approximately therefore the estimated transmission cost per household due should be increased by 80%, to around £5.70 per year. From here on the figures are rounded to £3 and £6.

However PX does not refer to the ENSG research *at all.* Instead PX cites a non-peer reviewed paper written by a retired National Grid engineer for the lobby group Renewable Energy Foundation (REF). It provides an estimated cost of £5 billion *per year*. The estimate has been roundly criticised, for double counting and error[27]. It is clearly

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[22] http://webarchive.nationalarchives.gov.uk/20100919181607/http://www.ensg.gov.uk/assets/ensg_transmission_pwg_full_report_final_issue_1.pdf
[23] http://www.decc.gov.uk/en/content/cms/meeting_energy/network/ensg/ensg.aspx
[24] http://www.theccc.org.uk/reports/household-energy-bills
[25] 320 TWh - Personal Communication with the CCC secretariat, Feb 2012
[26] http://www.theccc.org.uk/reports/household-energy-bills
[27] http://fullfact.org/blog/figures_civitas_wind_power_report_res-3290

completely out of step with the opinion of National Grid now, since National Grid is a member of the ENSG.

Having drawn attention to an estimate that is extremely high, PX cites a 2010 book chapter by Richard Green, suggesting (by comparing to the extremely high REF report) that the figures therein are conservative. PX attributes to Prof. Green an annual figure of £1.2 billion for transmission and state this is compatible with 1 – 2 p/kWh of intermittent generation produced by the CCC in a 2008 report[28]. It is surprising that PX cite CCC's 2008 report rather than the CCC 2011 Renewable Energy Review, which is more recent, specifically focuses on renewables, and also has analysis of the cost of intermittency and transmission. The CCC 2011 renewable energy review, based on analysis by Poyry, provides an estimate of the combined effect of transmission upgrades and intermittency (including costs of interconnection, pumped storage, smart meters, and additional investment in transmission and distribution) of around 1 p/kWh of additional intermittent generation[29]. The CCC figure is for the *combined effect* of intermittency and transmission upgrading *not* for transmission alone, or for intermittency alone. Notional comparability with the CCC therefore may amount to double counting.

Green's data is itself sourced from a submission to a 2008 Select Committee enquiry by National Grid. It is not clear what assumptions were made by National Grid in their 2008 submission. However, Green's estimate of £1.2 billion was for onshore and offshore network costs combined, which was appropriate for adding to station costs when estimating the *total cost* of renewable generation (the main focus of this particular piece of work). When calculating price/bill impacts, however, the offshore network costs would be paid for by generators and hence already show up in DECC and other analyses of the costs of the RO. Only the onshore costs (a small part of the total) should have been included in any estimate of the impact of transmission costs on bills and prices, as offshore costs are paid for out of generator revenues, an inconsistency Prof. Green now acknowledges[30]. Moreover, it is also reasonable to assume that the ENSG data provides a more up to date view of National Grid's position, since National Grid is part of the ENSG. It is certainly far more detailed and transparent.

PX cite a figure of £5 billion, use an out of date and partially double counting figure of £2.5 billion (£1.2 billion for transmission), wrongly equate this to a 2008 CCC report and ignore the clearest and most authoritative estimate available when they published – that from ENSG, which is equivalent to £275 million per year. As a result, PX's estimate of the cost of transmission upgrades is around three times higher than the ENSG data from 2009 suggest, and more than double that suggested by the most recent ENSG data.

Intermittency

The costs and impacts of the 'intermittent' nature of wind any other renewables has been comprehensively studied by academics, utilities and consultancies from around the world. A thorough systematic review and meta-analysis by the author in 2006, with input from a wide spectrum of leading experts, indicated that the cost of intermittency amounted to around 0.5 to 0.8 pence per kWh of wind generation, should intermittent generation reach 20% electricity supplied[31]. This work needs updating to reflect 2012

[28] Committee on Climate Change (2008), Building a low carbon economy

[29] Personal Communication with the CCC secretariat, Feb 2012

[30] Personal Communication with Richard Green, Feb 2012

[31] See http://www.ukerc.ac.uk/support/Intermittency and - Gross R, Heptonstall P, The costs and impacts of intermittency: An ongoing debate "East is East, and West is West, and never the twain shall meet.", ENERG POLICY, 2008, Vol:36, Pages:4005-4007, ISSN:0301-4215(doi); Skea J, Anderson D, Green T, et al, Intermittent renewable generation and maintaining power system reliability, Generation, Transmission & Distribution, 2008, Vol:2, Pages:82-89, ISSN:1751-8695(publication doi); Gross, R , Heptonstall, P , Renewables and the grid: understanding intermittency, Energy Vol., no. 1, pp.–, Vol:160, Pages:31-41

costs, which will be higher, since electricity related costs have risen. However the more recent analysis of the CCC (and consultants, Poyry), combined with the ENSG data provides an indication that the 0.8 p/kWh figure is broadly consistent with contemporary analysis. The CCC's 2011 total figure is 1 p/kWh for intermittency and transmission combined, and as noted above, the transmission cost element is around 0.1 p/kWh of intermittent renewable. For comparison with the PX figure - 0.8 p/kWh of wind is equivalent to annual expenditure of approximately £600 million, at 20% renewables, or £740 million for 25% renewables. Assuming the domestic sector bears 30% of this, the cost per household for intermittency in 2020 is around £6 to £8 per year[32].

This author – whilst noting the need for more detailed and disaggregated work – therefore suggests that using best available data approximate costs for transmission and intermittency lie in the range £9 to £14[33] per household.

PX is right to identify the need for greater clarity about the costs of both intermittency and transmission upgrading. However they use out of date data, ignore the excellent ENSG data and considerably oversimplify the intermittency issue. PX also assumes that households bear 80% of the cost of transmission upgrading and intermittency, on the basis that commercial sector price increases eventually turn up in wider household costs (not just energy bills). For reasons discussed below this is highly questionable and it certainly doesn't add clarity if the goal is to calculate a cost that is absent from DECC data on *bills*. If we assume simply that the fraction of upgrading costs borne by households is in proportion to the domestic fraction of total sales then even using the transmission/intermittency data PX cite the cost per household is only £25 per year[34].

The £75 PX adds to bills for transmission and intermittency is poorly substantiated and far higher than the data available can support. This is an important area for more detailed analysis, but the ENSG, UKERC and CCC data briefly reviewed above suggest that the transmission upgrade and intermittency costs that would appear in household bills in 2020 are less than £15 per year.

Should tax funded schemes be ascribed to household bills?

A fundamental and profound question arises with regards to policies funded through taxation or paid by non-energy sector businesses – on what grounds is it appropriate to treat these as a fraction of household bills? A key rationale for shifting aspects of the low carbon agenda *away* from electricity or gas bills (the RHI, the carbon capture demonstration programme) is to protect the poorest, since taxing energy is regressive and (one hopes) general taxation is not. For this reason it is highly questionable to consider the RHI as if it were in the average householder's bill. The £55 per household that appears in the PX report is misleading for two reasons: First because only a first and rather modest phase of the RHI is current policy. Second and more fundamental, because now the policy is tax funded the notion of it appearing in an average household bill no longer makes any sense at all. High earning households will pay a higher fraction of the cost of this policy and the poor will pay much less.

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[32] Assumes 29 million households and electricity sales of 370 TWh, households 30% of sales. The UKERC work also notes that cost estimates lie in a range, which depends upon the nature of the system (extent of interconnection, availability of demand response, mix of fossil/nuclear plant) mix of renewables and operational rules for the System Operator.

[33] £9 = 2009 ENSG cost and 20% intermittent renewables. £14 = 2012 ENSG costs and 25% intermittent renewables.

[34] £2.5 billion per year, with 29 million households, householders paying 30% of the total

Do all commercial sector price increases feed through to households?

PX claims that renewable energy policies will lead households to pay around £185 per year for more expensive products and services. The logic being that everything will be more expensive because policies are pushing up commercial prices as well as domestic prices. It is correct that in theory, in a competitive market, if the commercial sector experiences a generalised rise in input prices these will tend in time feed through into higher consumer prices. However the PX number – nearly half of their total headline estimate – is pure guesswork. A sophisticated, sector differentiated, macro-economic modelling effort would be needed to work through the implications of commercial sector energy price rises for consumers. In the absence of such an effort we simply do not have data on the relationship between commercial electricity prices and the cost of domestic goods and services.

However there are good reasons to seriously doubt the usefulness of the PX 'estimate'. A few points stand out:

- Around 40% of UK output (by economic value) is exported and does not affect UK consumer prices at all.
- Similarly, a large fraction of UK manufactured products are imported. The UK runs a balance of payments deficit, particularly in the 'visible sectors' (physical products); more of our products are imported than exported. There is a very real concern that the 'UK carbon footprint' is larger than domestic emissions. However for this very reason it is clear that domestic consumer good prices are only partially affected by the energy prices paid by UK manufacturers.
- The vast bulk of UK commercial activity is not energy intensive. In the financial service industries, retail and light commercial sectors energy bills typically amount to between 1 and 2% of total expenditures. In many sectors the figure is below 1%[35]. Power price increases for commercial customers in 2020 are of the order of 30%[36], gas much less. Energy price increases due to policy therefore amount to a fraction of a percent of total costs.
- The ability of businesses to pass through particular input price increases are a function of a complex interplay of the economic cycle, degree of within-sector competition, changes to other input prices, potential for international competition, level of taxation and so on. It is by no means obvious that a tiny fractional overall cost increase will pass through - 100%, 80% or at all.
- In many cases in the non-intensive sectors there is great potential for cost effective energy savings, just as in the domestic sector, which suggests that at least some of the price increases could be offset by efficiency gains.

There is a legitimate debate around whether the impact of policy on industrial and commercial bills has the potential to damage competitiveness, particularly in the energy intensive sectors. However the PX proposition, that we should ascribe £185 per *household* per year to a generalised rise in the price of products specifically because of support for renewable energy is completely unsubstantiated. It is misleading in the extreme because we have absolutely no idea whether it is remotely accurate, yet it amounts to half of the PX headline grabbing number. PX would be quite right to argue for a proper analysis of how electricity prices feed through into product and service prices – because at present we *do not know*. Since we do not know it is simply not appropriate to hazard a guess and present this as a core part of a hard estimate.

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[35] Data taken from Chapter 11 of the Stern Review and cross checked with Office of National Statistics data for energy intensity. The Stern Review (2006) contains a more detailed breakdown than is currently available on the ONS website. Energy prices have increased since 2006, but percent expenditures will still be extremely small for the non-energy intensive sectors.

[36] http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/236-impacts-energy-climate-change-policies.pdf

Conclusions on the PX missing cost estimates

PX ascribes £75 to intermittency and transmission upgrades, but the estimate is simplistic, uses out of date or non-peer reviewed sources and ignores the best available data. Prospective costs are uncertain, and a range is more appropriate than a single estimate. **Based on the data reviewed above the author suggests that a figure below £15 is more accurate.**

PX ascribes £55 to the RHI, but this is paid for through tax, so should not be added to bills. And it is not certain that a £2 billion programme for the RHI will be part of the government's 2020 policies.

PX claims that commercial price increases will cost households £185 per year. This is essentially guesswork.

The poor value for money of existing schemes

Offshore wind

The final strand of PX argumentation is that existing schemes to promote low carbon energy are poor value for money. PX takes particular exception to the support given to offshore wind. PX select a particularly high estimate of the levelised cost of round three offshore wind (£190 per MWh), and argue that this would displace CCGT costing £80/ MWh able to deliver electricity at 300g CO_2 per KWh. This leads them to conclude that offshore wind costs £366 per tonne CO2 saved.

The estimate is wrong for several reasons. First, CCGT does not deliver electricity at such low levels of CO_2. Currently the best achievable performance in a new CCGT would be around 56% efficient[37], implying around 360g/KWh, neglecting losses. Emissions as low as 300 g/KWh would require efficiency of 66%, well beyond what many believe to be the limits of current designs[38]. Current and future costs of offshore wind lie in a range[39]. £190/MWh is the highest of a considerable range of costs provided by Mott Macdonald. It would not be financially viable under current ROC multiples. UKERC reviewed the reasons that offshore wind costs have gone up and prospects for them to come down, and provided a 'best guess' of costs in the period from 2020 to 2025 of around £116 per MWh. Using the UKERC 'best guess' rounded up to £120/MWh for offshore wind[40], £80/MWh for gas and emissions from gas of 360g/kWh, gives a £/t CO_2 figure of just £160, less than half the PX number.

Moreover wind would not be displacing brand new CCGT, because the electricity market is efficient at dispatch, and ensures that older, less efficient plant is turned off first. Recent research has estimated the UK marginal emission factor. In simple terms this is the average plant that is turned on and off in response to changing demand[41]. The marginal plant certainly will not be the latest CCGT. Marginal emissions are higher than system average emissions (annual TWh divided by annual CO_2), because average data is a basket of zero carbon nuclear and wind, new CCGT, and older gas, oil and coal stations.

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[37] http://www.powerengineeringint.com/articles/print/volume-18/issue-3/features/ccgt-breaking-the-60-per-cent-efficiency-barrier.html

[38] Ibid

[39] http://www.ukerc.ac.uk/support/tiki-index.php?page=Great+Expectations:+The+cost+of+offshore+wind+in+UK+waters

[40] Rounded from £116 per MWh from http://www.ukerc.ac.uk/support/tiki-index.php?page=Great+Expectations:+The+cost+of+offshore+wind+in+UK+waters

[41] Estimating Marginal Emissions, Hawkes A, Energy Policy, October 2010 http://www.sciencedirect.com/science/article/pii/S0301421510004246

The marginal emissions of the 2020 UK mix will be lower than they are today because some older coal and oil plants will not be on the system. On the other hand it is possible that relatively inefficient open cycle gas turbines will have been built to provide peak load and load following. The latest research into marginal emission factors suggests that a figure of just over 500 g/kWh would be reasonable in 2025[42]. Therefore assessments of £/t C should compare the levelised cost of wind and gas, using marginal emission reduction. Whether these are the same for wind and CCGT is an important consideration, with substantial bearing on emission abatement costs.

It is obviously possible to debate the future price of gas, future marginal plant, and future cost of offshore wind. All are uncertain. PX has produced an estimate that uses the high end of the range for offshore wind cost, and an efficiency assumption for CCGT that does not appear plausible. It does not attend to whether wind would displace less efficient/higher carbon plant. It is notable therefore that PX failed in this instance as in those outlined above, to undertake rigorous analysis and to attend to all the complexities. It is difficult not to form the opinion that the principal objective was polemical, with a line of argument decided ahead of the facts.

Understanding innovation: the need for technology policy

More fundamental than any specific estimate of carbon abatement cost, the RO and offshore wind ROC multiple are not intended as carbon pricing instruments. One of the most important goals is to create markets that help move relatively new and immature technologies towards maturity. Hence exactly what £/t figure one can arrive at only partially addresses the cost effectiveness or otherwise of the policy. This preoccupation with short run or static costs points up perhaps the most significant of all the failings in the PX analysis; it fails to properly understand the economics of innovation and how it links to policy.

PX argues that a carbon tax can deliver carbon abatement more cost effectively. But carbon taxes cannot deliver any abatement at all unless cost effective alternatives exist. The author has tackled the carbon tax contention elsewhere[43]. As numerous analyses versed in innovation systems (including the Stern Review) explain, technology policies (including support for deployment) and carbon pricing are complements, not alternatives. Abandoning renewable energy and other deployment support will set back, not advance, the cause of cost effective carbon abatement. Once the fundamentals of innovation are accepted, it is possible to proceed with a practical and pragmatic debate as to the appropriate mix and scale of incentives.

A pragmatic approach

Offshore wind is currently relatively expensive (at least compared to onshore wind), and the author argues in the UKERC review of offshore wind costs, and in peer reviewed papers on the subject that excessive reliance on offshore wind to meet the 2020 target risks pushing costs up[44]. This aligns with the careful and nuanced position taken by the CCC in their report on renewable energy[45], that offshore wind be rolled out with an eye on decarbonising the power mix to 2030, rather than focusing entirely on a short term target for renewables. The CCC also suggests that development beyond 10 GW could be conditional on costs coming down. The pragmatic debate is over what capacity at what cost offshore and the extent to which the 2020 target is a help or hindrance in the

[42] Ibid

[43] https://workspace.imperial.ac.uk/icept/Public/Time%20to%20stop%20experimenting.pdf

[44] http://www.ukerc.ac.uk/support/tiki-index.php?page=Great+Expectations:+The+cost+of+offshore+wind+in+UK+waters

[45] Committee on Climate Change, 2011, Renewable Energy Review

search for cost reductions. This is very different from the PX line that the UK should abandon its aspirations in offshore wind altogether.

PX makes much of the notion that by abandoning expensive options we can do more to promote cheaper ones. This is partially correct, since doing more to promote cost effective energy efficiency is a key policy goal and to this end the Green Deal needs serious attention[46]. However, reducing carbon emissions substantially also requires that we decarbonise supply. Carbon capture and storage (CCS), nuclear and wind power all offer large scale generation of zero carbon energy. Forthcoming research from UKERC demonstrates that estimates of their costs lie in an overlapping range and the uncertainties surrounding future costs are large. Bringing costs down requires deployment at scale, because learning by doing and economies of scale in construction and manufacture are keys to cost reduction.

It is important to make sure that policy is not overly focused on one technology and the mix of policies is sensible. For example, the author is of the opinion that the UK could be much more effective in its efforts to promote CCS. However innovation and cost reduction cannot happen without *any* attempt to deploy technologies at scale. Numerous analyses explain that in the real world, where investor needs must be met and political realities faced, achieving this is best done through investable and tailored policies such as feed in tariffs[47]. We do not have a better option. PX's preference for a carbon tax *instead* of deployment support for renewables and other technologies flies in the face of numerous analyses of the economics of decarbonisation[48]. Carbon pricing is an important part of a sensible *mix* of policies to promote low carbon technology. For as long as the goal is to beget learning, and unless and until the costs of low carbon technology are far closer to those of conventional competitors it is *cheaper* to target subsidy than to seek deployment through Piguovian taxation alone[49]. PX exaggerates and bemoans expensive renewable energy policies. They do not provide a credible alternative approach.

Summary of key findings

The PX note is right to draw attention to some of the inadequacies of government reporting on the cost of renewable energy. PX is right to identify concern about the effectiveness of energy efficiency policies. Greater transparency is needed with regards to network upgrade and intermittency costs. However most of the estimates provided by PX are significantly flawed. In summary:

Bills and prices

PX is right to identify concern about the effectiveness of energy efficiency policies, their distributional impact, and that it is disingenuous to disguise costly policies by netting them against cost saving ones. However:

PX use anecdote and unsubstantiated assertion to support the contention that energy efficiency policies won't work, or may penalise the poor. Efficiency improvements often have a vanishingly small impact on product prices and save money through bill reduction. Product regulation often offers an economically efficient route to carbon abatement.

PX overlooks most of the positive outcomes associated with energy efficiency policy. Their paper then shifts from discussing *bills* to discussing *prices*. This is

[46] http://www.ukerc.ac.uk/support/tiki-index.php?page=inputs+to+policy (click 'response to green deal...')
[47] See e.g. http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2369.jsp and www.iea.org/g8/2008/G8_Renewables.pdf
[48] Ibid, plus the Stern Review, plus the IPCC renewable energy review (to name a few)
[49] Ibid

misleading. **A fully transparent approach would clearly articulate *both* price *and* bill impacts.**

Missing cost estimates

PX ascribes £75 to intermittency and transmission upgrades, but the estimate is simplistic and ignores the best available data. Prospective costs are uncertain, and a range is more appropriate than a single estimate. **More work is needed, but a figure below £15 appears reasonable.**

PX ascribes £55 to the RHI, but this is paid for through tax, so should not be added to bills.

PX claims that commercial price increases will cost households £185 per year. This is essentially guesswork. However there are good reasons to question it, given the small fraction of total costs associated with energy, open nature of the UK economy, and uncertainty over the ability of different sectors to pass price rises through to consumers.

The poor value for money of existing schemes

PX overstate the £/T costs of offshore wind. They neglect the need to *deploy* technologies to achieve cost reductions. **They do not provide a credible alternative to existing technologically targeted policies**.

Conclusions and remarks on the evidence base for energy policy debate

Overall, it appears that the Policy Exchange note, whilst thought provoking, contains considerable errors and overstatements. The headline £400 cost figure that Policy Exchange made available to the media is flawed. Given that the PX bills note is not derived from a detailed model of energy market bill formation, or the wider macro-economy, the fact that Policy Exchange got these numbers wrong is not terribly surprising. Deconstructing electricity price formation, policy costs and transmission/network operation costs is complicated. Trying to assess the wider economic pass-through from commercial energy bills to consumers is even more so.

Secondary research that interprets and synthesises existing studies can be useful to the debate provided it is well researched and does not overlook key sources of evidence. For this reason the UK Energy Research Centre has pioneered the use of systematic review in the energy arena[50]. Quality control matters, if 'nonsense on stilts' is to be avoided, and all sources of analysis are not equal. Analyses by government departments, and their consultants, are bound by stringent requirements with regards to quality and value for money. Academic analyses are subject to the scrutiny of peer review, both before funding is awarded and prior to publication. Many independent think tanks active in the UK energy policy debate also impose quality criteria upon their outputs, for example through expert steering groups or peer review. As it is not incumbent upon journalists to check the veracity of the groups feeding them stories this self imposed quality control is likely to make the difference between think tanks informing and misinforming popular opinion.

Policy Exchange asks important questions. Unfortunately it seems they strayed from asking sensible questions to postulating answers that could not do full justice to the complexities involved, were not fully conversant with the latest analysis, and were ultimately inaccurate. The £400 per year estimate was fed into mainstream media and

[50] http://www.ukerc.ac.uk/support/TPA+Overview

popular debate. It may therefore have added to a growing body of misunderstanding related to the cost of lower carbon energy.