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John Rhys. Senior Research Fellow. Oxford Institute for Energy Studies.

CLIMATE POLICY IN CRISIS. THE ISSUES.

This paper draws extensively on the presentations and discussions in the 2013 and 2014 series of BIEE "Parker seminars" on energy policy and climate change issues which are available, with summary and accompanying presentations, on the BIEE site.[1] As such it does not aim to present any detailed material or new empirical analysis on aspects of climate science[2] or economic impacts, but rather to offer some wide-ranging reflections on fundamental issues for policy and presentation in the climate debate.

- The limitations of cost benefit analysis and social cost pricing
- Decision theory or risk management approaches
- Irreversibility, options theory, and urgency
- Arguments over the costs or economic consequences of climate policies
- Policy conflicts
- Markets or strategic direction

The conventional economic calculus of cost benefit analysis

Given a scientific prognosis pointing to very substantial risks of severe adverse or even catastrophic global outcomes, formal arguments over the economic case, may appear redundant in relation to essential precautionary measures. However the public case needs to be made and there is now a widespread recognition of the weaknesses of conventional applied economics, especially cost benefit analysis, in dealing with issues of this magnitude.

Some of the weaknesses are conceptual, in dealing, inter alia, with risk and uncertainty (where there is no empirical basis for assessing probability distributions), non-linearity, non-marginal changes and non-market effects, the distributional inequalities of first round impacts, and inter-generational discounting.

These might all be considered major and intractable problems, but even more serious is the inability of conventional macro-economic or integrated assessment models to capture the complexities, or indeed the potential scale, of major disruptions caused by climate. The judgment from academics on existing models is damning. So-called integrated assessment models of climate change come "close to assuming directly that the impacts and costs will be modest, and close to excluding the possibility of catastrophic outcomes", according to Nicholas Stern. In other words they largely assume away the problem they are supposed to be analysing.

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[1] Link: https://www.biee.org/climate-policy-crisis-position-paper/

[2] The mainstream science on climate matters is not discussed in any depth in the paper but is now widely accepted among decision makers. In this context the recent recognition of the gravity of the issue by senior figures in the US Republican party is particularly noteworthy.

A comprehensive demolition of the credibility of IAM models is provided by Pindyck. [3]

A plethora of integrated assessment models (IAMs) have been constructed and used to estimate the social cost of carbon (SCC) and evaluate alternative abatement policies. These models have crucial flaws that make them close to useless as tools for policy analysis: certain inputs (e.g., the discount rate) are arbitrary, but have huge effects on the SCC estimates the models produce; the models' descriptions of the impact of climate change are completely ad hoc, with no theoretical or empirical foundation; and the models can tell us nothing about the most important driver of the SCC, the possibility of a catastrophic climate outcome. IAM-based analyses of climate policy create a perception of knowledge and precision, but that perception is illusory and misleading.

To quote Robin Harding in the FT[4],

For example, one standard model only gives damage greater than 50 per cent of output with 20^{o}C of warming. Combine that with the assumption that the economy will be many times bigger in the future and the problem is clear. Your grandchildren might be cooking in their own fat on the London Underground, but rather than regarding them as dead, these economic models would regard them as wealthier than you.

It does not stop there. The reason most models have these estimates is because they barely even allow for extreme cases of warming. ... It is like an analysis from the subprime era that ignores the possibility of all mortgages defaulting at the same time.

This general weakness has implications for attempts to define an appropriate carbon price (or tax) based on the long term economic and social damage resulting from major climate change. This is illustrated by a casual analysis of even the carefully constructed estimates of the social cost of carbon provided in UK Treasury guidance. These suggest that the total (global) social cost from one year of current UK CO_2 emissions would be a little above £50 per tonne. Combined with an annual emissions estimate of about 500 million tonnes of CO_2, this gives a social cost of around £ 25 bn, or around 1% of UK GDP.

This is broadly equivalent to the estimate on a global basis (attributed to Stern) of the cost of action necessary to curtail emissions to a “safe” level, and explains why much of the early debate around the Stern review was focused on attempts to unpick detailed assumptions and analysis, including assumptions about the appropriate discount rate, on the basis that even minor adjustments to assumptions might reinforce or negate the case for action. Some of this debate might have been unkindly compared to that of mediaeval scholars over the relative size of angels and pins.

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[3] Pindyck, Robert S. 2013. *"Climate Change Policy: What Do the Models Tell Us?"* Journal of Economic Literature, 51(3): 860-72.

[4] Robin Harding. 2014. *“A high price for ignoring the risks of catastrophe.”* Financial Times. 18 February 2014.

The most seriously misleading implication of this analysis however is that this is not a number that could or should excite excessive attention. It is certainly not commensurate with the real threats to humanity posed by the risks of climate change as perceived through mainstream science. While in most contexts 1% of GDP is a substantial quantity, it is only of the same order as, for example, the financial burden on the UK of an increase in oil and gas prices of (say) $30 per barrel. Actual increases or changes of this order have been absorbed by the global and national economies in the past without huge dislocations, and indeed are well within normal margins of forecasting error. Indeed bigger problems, if they occur, usually result from the nature of the macro-policy responses to the initial shock.

Similarly any costs of mitigation, conventionally estimated at around 1% of GDP, are also substantial but they are, from a macro-economic perspective, commensurate with, or much smaller, than the frequent shocks to the global economy associated with for example commodity prices, or to national economies as result of shifts in public policy towards more or less government spending. They are much smaller than, for example, estimates of the loss of output stemming from the recent post 2008 recession, at around 15% for many economies. Future events evaluated at a cost of 1% of GDP do not necessarily keep policy makers awake at night.

We can return to these broad macro comparisons in evaluating the cost of measures to mitigate GHG emissions, but an immediate conclusion might be that these rather poorly framed estimates of "damage" go at least some way to explaining the low level of political and public concern with what ought, on the basis of the scientific evidence, to be regarded as one of the most serious global risks to humanity.

The correct deduction was again aptly summarised by Robin Harding.

After the financial crisis, the world did not construct vastly complicated models to estimate the chances of another meltdown and the damage it would cause. Policy makers simply recognised that regulations such as the US Dodd-Frank Act are a small price to pay for preventing a repeat performance. It is time to take a similar risk-based approach to the greater problem of climate change.

Decision theory and risk management approaches

A better approach must be to focus on the risk of catastrophe. The issues are so serious that they do deserve more effort to spell out the case in a fuller and more rigorous way, set in a decision theory context that deals explicitly with issues of risk and uncertainty, the costs of mitigation or remedial action, the feasibility of "magic bullets" (such as low cost carbon sequestration), and maintaining options that provide for or guarantee an acceptable future.

What is required is a much more rigorous focus on risk, uncertainty and other concepts of decision theory, and an analysis much closer to some of the "risk of ruin" approaches adopted in the insurance industry, and building on the insights of

Weitzmann[5] and others. To do this effectively should over time improve the ability to achieve public acceptance of policies for damage limitation.

Such a major effort is beyond the scope of this paper. However the essence of the case is clear. If, as the mainstream science indicates, there is a significant risk of truly severe adverse or even catastrophic effects from climate change, then we should note that the costs, even of the very substantial actions to mitigate change, are in reality comparatively modest in relation to other shocks that global and national economies have endured in recent decades, including oil price shocks and recessions induced by financial sector mismanagement. In terms of an insurance analogy the premiums would be very modest in relation to the scale and risk of the really adverse outcomes, even if these were of relatively low probability (itself a fairly optimistic assumption).

In a recent presentation with a strong actuarial approach to risk, actuary Oliver Bettis[6] suggested that a risk model based on approaches to acceptable risk common in the insurance industry would produce some policy recommendations dramatically different from those that currently form part of the climate consensus in the energy policy debate. These included the following.

- CO_2 already released (400ppm) produces an unacceptable risk of ruin – emergency decarbonisation of the economy may be the correct risk management response
- Allowing for slow feedbacks, the right target might be below 350 ppm
- The need to remove CO_2 from the atmosphere should be investigated.

Irreversibility

There are further features of our understanding of the mechanics of climate change whose implications have been seriously understated or ignored in policy making at all levels, not least in the context of decision theory. These are the cumulative nature of emissions, especially for CO_2, the irreversibility of the processes involved, and the long time lags between cause (atmospheric concentration levels) and their full effect on climate. These factors should lead to adoption of the following principles.

The first is recognition that the real target for policy must be the cumulative stock of CO_2, not the level of annual emissions per se. Inter alia this attaches a significantly higher value to reducing current and near term emissions[7], since early emissions that persist indefinitely have an effect for longer and will bring forward particular atmospheric concentration milestones and climate consequences, reducing the options for future amelioration or adaptation. It is likely, therefore, that national targets for cumulative emissions will, for equity and other reasons, need to feature in

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[5] Martin L. Weitzman. *A Review of the Stern Review on the Economics of Climate Change.* Journal of Economic Literature. Vol. XLV (September 2007), pp. 703–724

[6] *Risk Management and Climate Change Risk of Ruin.* http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/01/Oliver-Bettis-Risk-Management-and-Climate-Change-Risk-of-Ruin.pdf

[7] John Rhys. *Cumulative Carbon Emissions And Climate Change. Has The Economics Of Climate Policies Lost Contact With The Physics?* OIES Working Paper. July 2011.

any well designed global agreement. The notion of historic responsibility, however hard it may be to measure, is already a feature of the global debate, and will undoubtedly impact at some point on negotiation of national limits.

Second, in terms of decision theory, a proper understanding of options theory points to a much higher priority attaching both to early emissions reduction and to irreversibility. Improving future options by early action must be a high priority, since it is early action for immediate emissions reductions that provides more options for the future.

A general observation from options theory is that the highest benefit often attaches to making the choices which avoid irreversible actions. (suggested by the work of Dixit and Pindyck[8], for example). In relation to the global issue, it is current emissions that are irreversible actions. Early reduction in global emissions has several "option benefits". It postpones "climate milestones", the dates at which any particular concentration of CO_2 is attained. It therefore allows more time to develop low carbon alternatives. It also allows more time for more effective adaptation to the future adverse impacts of rising atmospheric concentrations of GHG.

A corollary of this is that early reductions in CO_2 emissions are essential, as these are both the largest component of emissions and have a very long life in the atmosphere. Correspondingly the cost of delay is high, emphasising the urgency of remedial action. The notion that options are kept open at low cost by a policy of "wait and see", pending some future appreciation of the long term economic and human consequences of inaction, is the opposite of the truth.

Overall Cost and Financing Issues

Climate and emissions policy emphatically does not currently, nor in the foreseeable future, present a major macro-economic problem. On a macro level, dealing with climate change, if done early enough, is relatively low cost and the investment and other expenditures involved are relatively small. To put into perspective, the cost of mitigation measures has typically been estimated to be around 1-2% of GDP.

This cost in relation to national economies is, as indicated earlier, comparable to, or smaller than, other movements of the last decade which most Western economies have handled without major disturbances. It is small in relation to, for example, differences between OECD countries in expenditure on health and defence. To give a few illustrations:

- UK spends 9.4% of GDP on health, Germany 11.3%, and the US 17.7% [9]
- UK spends 2.3% of GDP on defence, Ireland 0.55%, Spain 0.95%, while the EU average is 1.55% [10]

[8] Dixit, A.K. and Pindyck, R.S. *Investment under Uncertainty,* Princeton, NJ: Princeton University Press. 1994.
[9] OECD health data 2013

[10] Defence Data Portal. European Defence Agency

- It has been reported that Italy will in future include estimated dealings from drugs, arms trafficking and prostitution in its GDP, adding at least 1.3% to GDP. The Bank of Italy estimated the value of the criminal economy at 10.9 per cent of GDP in 2012.

In this context, the consequential impact of climate policies, on growth and standard of living, should therefore be treated as part of a choice that would be relatively easy to manage in financial and economic terms, readily absorbed within the differences already observed within other forms of spending, and not as a major economic or social shock.

Capital availability, likewise, should not, in principle, be a real constraint on mitigation. Globally, capital has rarely been so plentiful or so cheap. Its deployment in the energy sector, for low carbon generation, and "utility" and infrastructure activities, should be a low risk and hence modest reward set of investments. Any failure to secure investment capital on reasonable terms can only result from a poor allocation or appreciation of risk, of which the prime cause is poor or absent policy frameworks, policy uncertainty and lack of policy commitment.

French experience in the 1980s and 1990s, of effectively decarbonising the power sector, without adverse economic consequences, and indeed with an actual benefit in terms of lower energy prices, provides considerable encouragement to this optimistic perspective.

Tensions and conflicts in forming policies.

The first category of problem is simply the inevitable conflict with other policies, often associated with a failure to prioritise risks in a rational and appropriate manner. These micro-economic issues arise from the many distributional and perceived competitiveness impacts, and the effects on particular interest groups, and it is these that matter rather than any general threat that climate policies might pose to economic well-being. Several examples can be given.

Thus in Germany, the phase out of nuclear will substantially increase CO_2 emissions. In the light of the discussion above of climate change risks, this suggests a perverse overall approach to risk, and one that is driven more by short term political manoeuvring than by rational analysis. It highlights the inconsistency between Germany's green credentials and the reality of its actual carbon footprint and programme for new coal fired construction.[11]

The link between competitiveness and energy prices is frequently cited as an obstacle to effective emissions policies within the UK and the EU. However a rational debate on this should recognise some economic fundamentals.

Simply in terms of comparing the costs of goods in international trade, on an economy wide basis comparative energy costs are demonstrably of limited

[11] John Rhys. *A Comment on Current German Energy Policy- The "Energiewende". A UK and Climate Concern Perspective.* OIES Energy Comment. April 2013. Many of the observations in this comment were also published in March 2013 in The European, in German, under the title *Großbritannien: Eure Angst verpestet unseren Planeten.*

importance compared to real wages or exchange rate movements, and of little competitive significance for much of industry. Given that exchange rates adjust over time, to reflect inter alia trade surpluses and deficits, raising energy costs in an individual geography will lead to exchange rate adjustments that benefit less energy intensive local industries at the expense of the more energy intensive. Countries, in this respect, are not "competitive"; companies and industries are.

Adopting an alternative concept of competitiveness for national or regional economies, to mean those that appear innovative and capable of high growth, once again energy prices appear to have little influence. Germany is widely regarded as the most competitive economy in Europe but has had among the highest energy costs. Asia Pacific faces some of the highest wholesale gas import prices by a significant margin, but also has a very high proportion of high growth "competitive" economies.

The EU may need to accept that the US may have advantages in natural resource endowment that are not easily countered other than through exchange rate adjustment, and that these may confer comparative advantage in certain high energy content activities.

Other serious policy conflicts have arisen between measures for early emissions reduction, substantial and relatively easy to implement, and the norms of national competition policy. In the Netherlands plans by generators to substitute gas for coal were challenged on competition grounds, and similar issues are already evident at EU level in relation to single market, competition and state aids. Comparable questions may also arise in future in relation to WTO and global trade policy.

Some prime examples of policy failure and conflict also relate to the conflicts arising within and between EU-wide and national policies. These deserve a careful analysis of some of the logical inconsistencies and unintended consequences of a badly designed mix of policies.

<u>Market based approaches, regulation and central direction</u>.

The three main classes of policy remain: markets and price instruments, regulation and innovation. The challenge is to find the right balance so that these work in the same direction and are not in conflict.

The biggest single issue in terms of policy is the appropriate balance between markets on the one hand, and regulation and planning or central direction on the other. The dichotomy is to some extent a false one. There are clear examples, for example in the transport sector, where simple regulatory measures have worked very effectively without creating significant market distortions. Equally the importance of working with rather than against competitive markets ought to be obvious, with benefits to innovation and incentives for deployment of low carbon technologies.

However the prime problem is that market solutions are only possible within a context of interventionist policies that successfully reflect the externality of the damage caused by CO_2 emissions. Current policies (the EU ETS, for example) have produced low current carbon prices, with a vague indication of higher future prices,

even though the importance attaching to the cumulative stock of emissions should attach a very high priority to early emissions reduction. This provides very limited incentives either for current fuel substitution or for future investment.

In consequence some of the opportunities for early, and hence even more valuable, emissions reductions are being missed. This is particularly evident in the failure, in Europe, to engage in gas for coal substitution in power generation – a perverse outcome from a badly calibrated and inflexible policy framework for the EU carbon market, combined with the advent of cheap US coal exports.

The strengths and limitations of the marketplace have become a central tension in the whole of electricity policy. Carbon prices alone are not enough to drive through transforming technologies; frameworks and plans involving other types of policy instrument are necessary too. This has been very evident in the delays seen in bringing forward carbon capture (CCS) technologies. It is equally apparent in UK efforts to promote low carbon power sector investment.

Indeed there are whole areas of activity, especially in electricity capital investment, which will not now function at all without significant elements of government commitment to a course of action. Inevitably that is drawing governments in to decision making. The challenge is to make sure that this is done efficiently, and that may require some institutional change. In the UK, currently the only entity bearing any responsibility for key strategic decisions appears to be DECC. There is a case for assigning more explicit responsibilities to the industry in respect of reducing emissions, and for establishing an agency with an explicit remit to manage progress to a low carbon power sector.

Some General Conclusions

We need a renewed and improved assessment and statement of the real case for climate action. The conventional (cost benefit) analysis almost certainly understates the "risk of ruin" implicit in late realisation of the extent and nature of the dangers posed by (say) a $+4^{o}$ C world, and of the very severe economic and human costs of late mitigation or adaptation. It may also fail to create a sufficiently positive vision of the prospects offered by a low carbon economy.

Early action carries a double benefit in postponing adverse outcomes, and improving options both for mitigation and adaptation. Early abatement of CO_2 is especially important given that a large proportion of emissions persist in the atmosphere for centuries. Inter alia this implies action to accelerate early substitution of gas for coal in the EU; this is not taking place with current carbon markets, and has in some instances been inhibited by focus on policies, such as competition policy, which should be considered of lesser importance. Primacy of policy on climate is essential, even at the expense of other objectives.

The power sector remains the central focus of any effective policy to lower emissions, but the necessary investments require government commitments to both decarbonisation policy, and to the individual investments, to make them happen.

This inevitably draws governments into decision making, but currently they often lack the institutional framework to deal with this effectively.