

Towards a European Strategy for the Security of Energy Supply

A response to the European Commission's Green Paper from the Institute of Biology, British Crop Protection Council, British Ecological Society, and the British Society for Soil Science

1. The Institute of Biology is the independent and charitable body for professional bioscientists charged by Royal Charter to represent the scientific interests of UK biology and biologists. Its 16,000 members and 75 specialist learned societies affiliated to it, make it ideally placed to respond to this consultation's biological dimensions. This response also contains the expert views of the **Institute of Biology** and the following specialist affiliated societies: the **British Crop Protection Council, British Ecological Society, and British Society for Soil Science**... The views herein arise out of the Institute of Biology's Environment Committee and the co-authoring Affiliated Societies. However while each society may support a number of the points being made, because each society has a highly specialist focus it cannot approve all the ground that is covered, only that relating to its area of expertise.

Summary

2. This response's principal points include:
 - i. This consultation is extremely important and most welcome. Dependence on finite fossil fuels is not sustainable in the long-term (paragraphs 7, 22 and 26) and there are major global environmental impacts from greenhouse gases (paragraph 12).
 - ii. Non-European Union (non-EU) *per capita* demand for energy is increasing and this is being compounded by a growing World population (increasing by 50% by 2050). It is vital that the EU becomes largely energy self-sufficient. (See paragraphs 7, 22 and 26 below.)
 - iii. Environmental externalities and opportunity costs of any energy use need to be accounted. (Paragraphs 25 and 27.) Biofuel's opportunity cost for EU food production needs to be noted and accounted. (Paragraphs 9 and 34).
 - iv. EC (European Commission) nations' research into alternative energy sources is extremely limited. This must be addressed with marked investment. (Paragraph 27.)
 - v. The Green Paper's climate change concerns are well-founded, but the Paper fails to note the substantial risk Western Europe faces from possible regional winter cooling as well as the vulnerability of its many ecotones to change. (Paragraph 12.)
 - vi. EC policy needs to: encourage alternative energy sources (wind, solar, tidal and biofuel), examine nuclear options once concerns have been satisfied, promote energy efficiency and discourage profligate consumption. It must have majority support. (Paragraphs 24 and 33.)

General points

Biologists have much to contribute to the energy and environmental debate. This is reflected in the range of specialist Affiliated learned biological societies involved in this response

3. Biologists and specialists from the various biosciences have much to contribute to the energy and environment debate. Fossil fuels' origin is biotic, bio-fuels are biological, and the exploitation and use of *all* energy resources has an environmental impact. There have also been studies on the human ecology of energy use both past and present. That biology has much to contribute is reflected in the range of specialist Affiliated learned biological societies involved in this response

The professional body for UK biologists has regular energy and environment dialogue with its counterparts for chemistry and physics

4. Science – chemistry and physics in addition to biology – has much to contribute to the energy and environment debate, and the Institute of Biology, the professional body for UK biologists) regularly discusses energy and environment issues with its cousin Royal Chartered scientific bodies, the Institute of Physics and Royal Society of Chemistry. These other bodies will be making their separate responses to this consultation.

This consultation is extremely important. Profligate energy consumption and self sufficiency are incompatible, while dependence on finite resources has no long-term viability

5. This consultation is extremely important and as such is most welcome. The Green Paper is correct to state, as it does in part 1.I (pp13-31) that it is impossible to achieve energy self sufficiency, but with one important caveat. Self sufficiency will be impossible while EU citizens consume energy in a profligate way, and while alternatives to conventional sources are not exploited with vigour. Dependence on finite fossil fuels has no long-term viability, either in consumption terms or in terms of reducing environmental impact.

Changes in patterns of energy consumption, improved energy efficiency and diversity of resources exploited are required

6. Nonetheless, it should be possible to stabilise demand in the medium-term so allowing, with greater efficiency, some modest continued growth in *per capita* consumption in the longer term without increasing our demand on fossil resources. However patterns of energy consumption would have to change. There would need to be greater efficiency of resource use, and a greater variety of energy sources would need to be exploited. Efficiency standards of machinery, the standard of houses' insulation, etc might be raised. This may require legislation in the light of best practice elsewhere in Europe.

Failure to increase self-sufficiency places the EU at considerable strategic risk.

7. Failure to increase self-sufficiency places the EU at considerable strategic risk. World population is likely to increase by at least about 50% in the first half of the 21st century if UN projections are to be believed. Much of this growth will take place outside the EU and will lead to greater competition for energy resources. Secondly, much of this growth will take place in less-developed nations, whose citizens currently consume on average a quarter as much energy as the average EU person and whose energy consumption *per capita* is already growing. In short, for these two compounding reasons, competition for energy on the international market will increase dramatically during the 21st century. The mid-21st century will be a particularly critical time with the

World population close to its peak and with the depletion of both easy-access and low-refining cost oil reserves. (Hard-to-reach, hence expensive reserves may possibly still be still available. High sulphur oil reserves (such as orimulsion) may also be available but these are more expensive to process for clean combustion.) (See paragraphs 22 and 26 below.)

- The Green Paper is correct in being concerned regarding EU over-dependence on oil*
8. The concern within Part II (p39 onwards) of the Green Paper that the EU is increasingly dependent on non-EU sources of oil is well founded. Oil has for over a century in real-terms been beguilingly cheap. This is due to oil, as an energy source, being a concentration of fossilised photosynthetic energy in which the concentrating agencies have all been 'natural' (independent of human action) and which have taken place over tens-to-hundreds of millions of years outside of human economic timeframes. That is to say that humanity has not had to pay for crude oil's formation. In economic parlance, we have been benefiting from a sizeable 'externality'. (Switching to fuels based on contemporary photosynthesis (biofuels), for instance, or ambient energy flows would result in a far greater land area to be devoted to fuel generation, and less concentrated energy flows. In short, renewable energy is more expensive in real-terms than oil has been throughout much of the 20th century.)

- Biofuel research welcome, but conflicting biofuel and food demands need to be reconciled and other rural functions taken into account*
9. The call (p49) for research into biofuels is welcome. However, if the EU were to embark on a major biofuel programme, very real choices would have to be made between using EU agricultural land for biofuels as opposed to food production. Just as non-EU energy demand will increase through to the mid-twenty-first century, so will the demand for food as the World population increases by roughly 50%. Secondly, the other principal uses of potential agricultural land within the EU include amenity (landscape for recreation) and wildlife conservation (biodiversity). However within the EU these functions are frequently intertwined with agricultural use or agricultural use near by. These other rural land-use functions will need to be taken into account when implementing any extensive biofuel programme.

- Currently the level of EU biofuel research (and into other alternatives) is extremely low*
10. Nonetheless the Green Paper's recommendation (p49) that research into biofuels should be intensified is vital if the EC is to a) maximise its options, and b) have informed policy to ensure that it arrived at optimal energy strategies. Currently the level of investment in biofuel research (and that of other alternatives) is extremely low: recklessly so given the EU's fundamental dependency on considerable energy use.

- The Green Paper's greenhouse gas induced climate change concerns are well founded*
11. The Green Paper's concerns (page 54 of the Green Paper) that climate change is taking place and will largely continue to do so even if the Kyoto Protocol targets' are met are well founded. It is clear from scientific research, and from the InterGovernmental Panel on Climate Change's three assessments, that there is considerable evidence, and little doubt, that human releases of greenhouse gases are affecting the climate.

- The Paper does not refer to the particular vulnerability of W.Europe to climate change*
12. However the EC consultation does not mention that the European peninsula and its islands are particularly vulnerable to climate change. This vulnerability is largely due

to two reasons. A) The European peninsula contains numerous ecotones between small (in continental terms) biomes. Such an ecologically fragmented landscape is sensitive to climatic change as it restricts corridors of migration available to species. B) There is evidence that the warm North Atlantic drift has shifted in the past due to the shutting down of the Broecker Salt Conveyor (or thermohaline circulation) as a part of past global climatic change. This has resulted in even greater regional climate change for Western Europe (especially far cooler winters). This problem is currently the subject of a UK Natural Environment Research Council research programme being conducted in partnership with Norwegian researchers. Should the North Atlantic thermohaline circulation shut down, and the western part of the European peninsula experience colder winters, then this would further increase EU energy demand.

Part 2. I. of the Green Paper

EU energy policy is required

13. We concur with the EC consultation (as summed up in conclusion p67 of the Green Paper) for the need for EU energy policy for both energy efficiency and renewables.

The Green Paper fails to emphasis that greenhouse and sustainability policies are largely synonymous

14. But the Green Paper could emphasis the convergence of greenhouse and sustainability concerns. Not only is our current use of energy resources causing climate problems, but even if we wanted to continue with the way the EU currently exploits energy, current energy use is not sustainable. Current energy polices have no long-term viability and Europe would have to accept that a significant proportion of its energy demand would remain unfulfilled.

Currently Europe is unlikely to come close to meeting its existing Kyoto agreements

15. Europe has a major problem with its international greenhouse commitments. With regard to the Green Paper Part 3 I. A.4 (p77) the EC should note that Europe is most unlikely to meet its Kyoto targets by 2008. Whether it does so by 2010 will require major investment and re-structuring. Currently, the political statements from various EC countries, in recognition of greenhouse concerns, have not been accompanied by the appropriate action. Should lethargy continue, it is likely to lead in the short-to-medium term to a lack of belief in politicians' stated aims. Looking further ahead, there will probably be European-wide energy shortages and/or price rises. Finally, if the fuel-related events (demonstrations blockading oil refineries) in the UK and France of September 2000 are not anomalous, and matters are not handled with due diligence, then civil disturbance and economic disruption may be expected. (Also see paragraph 19 below.)

Part 3.I.B of the Green Paper

Europe's approach to nuclear power needs to be reconciled

16. It is clear from the Green Paper that Europe's approach to nuclear power needs to be reconciled. Biologists are acutely aware that *all* energy exploitation has environmental impacts (and this Institute has conducted a symposium on the impacts of renewables). The question should be how should these be minimised? To date the environmental

impact of W. Europe's mature nuclear industry (post 1960) has been minimal, and biologically no worse than that for fossil fuel. Nonetheless, the potential for nuclear power to have considerable environmental impact is real. Though a Chernobyl impact might not arise through modern nuclear station design *per se*, it could do if designs and operations were not properly implemented, or if terrorist intervention was successful. Nonetheless, despite this note of caution, the EC consultation's conclusions as to likely future scenarios (p78-81) appear to be sound.

The nuclear waste issue needs to be addressed as a matter of urgency

17. If the nuclear option were to be re-visited then the problem of long-term disposal of nuclear waste would need to be properly addressed as a matter of urgency. Though technical options are in theory available, it would be foolhardy to embark on a new nuclear programme without successfully tackling this problem to scientific and public satisfaction. (See paragraphs 21 and 29–31 below.)

Energy demand is far less elastic than price

18. The consultation addresses questions of elasticity of oil demand and price (pp 81). Energy, next to basic (not luxury) foods, is considered by many to be one of life's essentials. Research shows that people are prepared to pay quite a high proportion of their household income for basic food, domestic warmth and travel (broadly in that order of decreasing price elasticity). (Luxury foods are of far lower priority.) Warmth and travel are important drivers of EU energy consumption. Research also shows that above the poverty line many of those who have insulated their homes prefer to keep them at a higher temperature than receive lower fuel bills. (Similarly, there is evidence that, once a family's basic nutritional requirements are met, any surplus income in the household food budget goes on raising the proportion of protein in the familial diet. Energy and food (a biotic form of energy) consumption have been shown to be broadly analogous.)

The EU already has high energy prices but even higher prices may be required for alternative energy sources

19. However, the EU already has among the highest energy costs (in terms of purchasing parities) for users in the World. The even higher costs that may be required if alternatives – such as extensive biofuel use – are employed may not be palatable unless the public can be convinced of their necessity. (See paragraph 15 above.)

Part 3.II Tomorrows priorities

The Green Paper is correct in that prospects for hydro-electric power are limited

20. In the light of debate within the UK over reservoir creation, in which biologists have been involved in both water quality and environmental impact capacities, we would concur with the Green Paper (p85) that prospects within the EU for hydro electric power (HEP) improvement are limited.

The low-greenhouse nuclear option does deserve reappraisal

21. Given its potential to provide energy without generating greenhouse gases we concur with the conclusion (p 86) that the nuclear option deserves appraisal. We note and welcome the Green Paper's related priorities regarding waste disposal. (See paragraph 17 above and 29–31 below.)

The consultation's specific questions

(The consultation's numbered questions are in non-serif font. Only those relating to biology have been addressed)

1. Can the European Union accept an increase in dependence on external energy sources without compromising supply?

No. External competition for energy will increase markedly mid-twenty first century

22. No. Increasing dependence on external energy sources would compromise supply since external sources will be beyond EC control. This will be at a time (mid-21st century) when increasing energy demand *per capita* will be compounded by a growing World population. This will result in greater energy demand outside the EU than ever before and so would threaten any non-European energy resources on which Europe might depend. (See paragraph 7 above and 26 below.)

Raising prices by itself would make the EU uncompetitive without reducing oil dependence

23. Lowering demand *solely* by increasing prices would be unacceptable as this would make the EU uncompetitive, in relation to many of its activities, with the rest of the World and would not solve Europe's dependence on oil in the long-term.

Policy needs to combine: energy diversity, efficiency and economic instruments

24. EU policy needs to be a combination of: improving energy efficiency; diversification into non-fossil energy sources; and economic instruments (both taxation and subsidies). (See paragraph 33 below.)

3. Are tax and state aid policies in the energy sector an obstacle to competitiveness in the EU? Given failures should not the whole issue of energy taxation be re-examined taking into *account* of energy and environmental objectives?

EU energy accounting and economics needs assessing

25. Given the need to meet sustainability and environmental objectives, the whole question of energy pricing and the need to account for energy's environmental externalities needs to be examined. ('Re-examination' cannot take place until an initial examination has been undertaken and the EC has never formally examined in any rigorous way the 'whole issue' of energy taxation and pricing.)

5. Should more reserves and other fuels be stockpiled?

For seasonality yes, but not as an alternative to a sustainable energy supply

26. It would be prudent to stockpile to meet natural vagaries in the ability of energy supply to meet demand (unseasonal weather affecting demand, the seasonality of wind for wind power affecting supply and so forth). It would be foolish to rely on stockpiles to meet shortfalls in non-EU supply when the long-term trends are markedly clear that increasing non-EU demand will undermine supply (see paragraphs 7 and 22 above).

For this reason – as *per* the European nations' individual commitments to sustainability made at the 1992 UNCED – that the EC needs to include energy concerns as a major tranche of its sustainability policy. Stockpiles are a poor alternative, with limited effect, for sound sustainability policies.

7. The development on new renewables requires major R&D and operational aid. Should financial support include a contribution from other energy sectors?

Yes

27. It is clear that EU energy research (which has been woefully lacking outside of a few showcase projects) needs considerable investment. It is tempting to view existing technologies as sources of revenue for the development of energy alternatives. This institute in its responses to other energy consultations has always argued for the payment of environmental externalities. It would therefore be appropriate for existing technologies to make a contribution to a major EC R&D drive. However, if it is to be achieved a marked investment in R&D is required.

There are a number of alternatives to be considered

28. This might be done in a number of ways. For example: taxing the companies' profits; taxing companies' energy products, or the co-funding of public-private research ventures. The attraction of the latter option is that one other benefit of industrial taxation would be to facilitate existing fossil fuel industries to re-invent themselves. Policymakers need to consider which, and/or which combination, of the alternatives is most appropriate.

8. Nuclear energy is one of the elements that could help tackle climate and energy security, how can the Community find a solution to the problem of nuclear waste, safety and new reactor design (including fusion)?

The social and political problems are greater than the technical ones

29. There are technical solutions (such as vitrification) to the issue of nuclear waste. However there are social and political problems. Where can such waste be stored safe, and free from interference? These need to be resolved as a matter of urgency. While the technical once need to be solved to the public's satisfaction. (See paragraph 21 above.)

In terms of biological impact the nature of the nuclear epicycle is an important issue.

30. Much of the World's nuclear power is based on military style reactors whose prime purpose was either to be a source of transuranics for weapons (energy was simply a by-product) or to provide portable energy for discrete periods (to power military navel vessels). They were not designed for civil purposes: namely high safety, constant energy supply and low waste production. In terms of biological impact the type of reactor and the nature of the nuclear epicycle are important issues. These need to be addressed, as they will be central in determining the critical paths for radionucleotides from any civil nuclear power programme.

The public must be convinced the waste problem has been solved

31. The public must be convinced that the nuclear waste issue has been resolved and have confidence in any forthcoming nuclear programme (see also paragraph 37 below). Industrial and/or political preference for specific options may interfere with the public debate, its openness and complete transparency. Steps must therefore be taken so that the public is assured that the nuclear debate is completely impartial, fair, transparent and open. Unfortunately, as perceived by the general public, few public consultations on scientific issues run by UK civil servants, Government Agencies or Parliamentary bodies have been conducted with the degree of impartiality or fairness to engender public confidence. This Institute has made this observation on a number of occasions, and its views are broadly in line with a recent all-party Parliamentary enquiry into the Scientific Advisory System as well as a recent independent assessment of UK agricultural biotechnology.

Fusion is neither a cheap nor a likely practical option for the short-to-medium term

32. Though *theoretically* fusion potentially can solve energy supply problems, it may not be cheap. There are also radioactive waste problems – hence environmental impact concerns – with fusion as there are with fission. However the progress in research is not sufficiently fast as to make the prospect of a significant fusion contribution before the middle of the century at the earliest. Consequently, EC energy policy should not be dependent on fusion even though the EC might continue to support fusion research.

9. Which policies should permit the EU to fulfil its obligations under the Kyoto protocol?

One lowering carbon emissions while meeting long-term energy demands and services

33. Namely one that lowers greenhouse emissions while being able to meet long-term energy demands and fulfilling energy services. The EU would therefore require a policy that actively:–
- i. reduces fossil fuel consumption
 - ii. improves energy efficiency
 - iii. encourages biofuel production without compromising Europe's strategic abilities to meet its core food demands
 - iv. encourages solar, wind and tidal power
 - v. invests in research as well as development of the above
 - vi. invests in exploratory research into wave power
 - vii. invests in exploratory research into fusion
 - viii. invests in research into the environmental impact of energy use
 - ix. invests in environmental monitoring with a view to maintaining environmental quality and human well-being

Such policies and European examples of realistic goals appear in *Climate and Human Change Disaster or Opportunity* (Parthenon Publishing).

10. Can an ambitious programme to promote biofuels and other substitute fuels including hydrogen continue to be implemented by national initiatives or co-ordinated agricultural policy?

Yes, but the options are many and only the best should be adopted

34. Yes. But the range of possible biofuels and policy options is so great that tremendous care has to be taken to ensure that the correct policy is in place. Furthermore, a biofuels

policy should not undermine other concerns such as the security of Europe's food supply and environmental sustainability and biodiversity concerns. Consequently such a programme requires careful thought and proper preparation.

12. Energy saving in transport depends on re-assessing the imbalance between road and rail. Is this imbalance inevitable, or could corrective action be taken, however unpopular, to lower car use in urban areas?

It is vital that existing profligate energy consumption be reduced

35. Given that 90% of the anticipated increase in European carbon dioxide emissions between 1990 and 2010 will be attributable to transport, it is vital – if Europe is to attempt to meet its Kyoto obligations – that unnecessary trips and the use of inefficient transport systems be reduced. But, as an example, the lower car use should be achieved through providing attractive but energy efficient alternatives.

We know the sort of energy savings that could be made

36. Ironically, the oil demonstrations of September 2000 in Western Europe, especially in Britain and France, exemplified how much fuel could be saved. Indeed in urban areas congestion was so reduced that those still using the roads found their journey times markedly shortened and efficiency in their fuel use rise.

To avoid discord, policies must have the clear and obvious backing of the majority

37. However, as the consultation question alludes, such a move would be unpopular even if, following public education and debate, the majority agreed as to reducing road and increasing rail use. Given the history of strong feeling surrounding many scientific issues within Europe, it might be prudent to distance such proposals from party politics and, through referendum or some such mechanism, placing the decisions more into the hands of the people. In this way any vocal minority would have to recognise that it was being undemocratic and could not claim non-existent popular support.

13. How can we develop more collaborative visions and integrate the long-term dimension into deliberations and actions undertaken by public authorities and others. How are we to prepare the energy options for the future?

Linking long-term concerns to the welfare of electorate off-spring harnesses one of the most powerful biological behavioural imperatives

38. In biological terms most organisms with any degree of sophisticated behavioural patterns tend to focus on satisfying short-term requirements first. Only once these (clothing, food and shelter) have been satisfied are longer-term requirements considered. Fortunately most in the EU do have ready accesses to adequate clothing, food and shelter. One way to focus attention on longer-term considerations is to link these in with individuals' longer-term biological behavioural imperatives. Of these, one of the most powerful is the need to ensure one's offspring has good prospects. Indeed this imperative does readily lend itself to energy issues such as greenhouse concerns as well as future, or sustainable, access to supply.

Discussion

- There are considerable gains to be had by switching to non-fossil alternatives*
39. There is a view that fossil fuels represent a stock of energy built up over millions of years which is not (or only slightly) being replenished by contemporary natural processes, so that our use of these fuels is analogous to living on capital (rather than income). *If* non-fossil alternatives can become the major contributors to satisfying energy demand, then the balance of power will rest with those who have the technological know-how, capital equipment and appropriate societal structure to capture ambient energy flows, and not with those who have major fossil fuel reserves. In short there are considerable strategic and economic gains to be had by switching to non-fossil alternatives. To do this the EU must have holistic, and not counteracting, policies.

Openness

- This response is in the public domain*
40. In line with UK policies on openness, the EC is free to reproduce this response, as are each of the contributing bodies. Indeed a version of this response will shortly be placed on *www.iob.org* Should the EC have further queries then it should in the first instance address these to The Science Policy Unit, Institute of Biology, 20-22 Queensberry Place, London, SW7 2DZ.