# Response for the Cabinet Office Performance and Innovation Unit Energy Review from Biox Consultants Limited

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**Background**

This paper is presented by Elizabeth Marshall, the Managing Director of Biox Consultants Limited, who has had a lengthy involvement with the UK Energy industries and Energy policy matters since 1974. She was elected a Fellow of the Institute of Petroleum in 1978, was executive Director and company Secretary to the British Institute of Energy Economics from 1984-92, and has consulted on energy matters and sustainable development issues in both UK and internationally for the past 16 years. In this capacity she has been an expert adviser to the IJNECE Energy 2000 and now Energy 21 programmes in Geneva since the Agenda 21 meeting at Rio de Janeiro in 1992,and continues to be active with the work of the Sustainable Development Committee, especially in energy and energy policy matters, in Geneva.

## l.0.Introduction

### 1.1.The present Scenario

International research work, especially with the European gas industries and European Business Congress, and attendance at presentations from the Gas Centre in Geneva, confirms a scenario of great resistance to the liberalisation of gas markets as proposed by the European Commission. The gas industries are adamant that they will not fund new pipelines and networks which will be necessary to achieve liberalised European gas markets, as open access means they cannot have long-term forward contracts against which to arrange finance.

**1.2**.The UNECE Gas Centre estimates that to achieve liberalised European gas markets would require an increase of 60 to 100 percent of additional capacity to the existing gas pipeline network in Europe.

**1.3**.Within the European Commissions plan there appears to be no mechanism envisaged as to how this additional capacity is to be financed and no budgets of the member governments appear to be tailored to meet such a large requirement.

**1.4.** Both France and Germany have postponed the liberalisation of their markets and full open access to their pipeline systems.

**1.5**.This is one of the key concerns and problems that has not been addressed and which could have adverse affects on UK, when major imports of gas from Europe are projected within 4 years or less as the UK North Sea production declines. Without additional capacity there will inevitably not be liberalised markets and security of supply and pricing issues become paramount.

**1.6**.A previously projected UK energy policy, to consider up to 75 percent our future energy supplies, as being reliant on imports of gas from Europe requires to be revisited and costed in terms of—

- The lost revenues from the UK North Sea
- The input-output analysis resulting-lost jobs, taxes
- The cost of imports in terms of foreign exchange
- The possibility of UK becoming vulnerable to pay a premium for gas, at whatever prices gas producers and traders deem fit.

**1.7.** The present scenario is therefore seen as a particularly challenging one, where the true cost to the British taxpayer of such a large volume of imports, coupled with the imminent loss of net self sufficiency and loss of North Sea oil revenues, may be very high or difficult to justify as sustainable, if we are to maintain our current standards of living.

**2.0.Timescale for an accelerated development programme 2001-2006.**

**2.1**.With the abovenoted scenario to the forefront, I and my expert network in the energy industries, all being specialists in new projects and innovation, have been looking to alternative sustainable possibilities for UK energy supply, given that there is an urgent need for action now within the timescale 200 1-2006.

**2.2**.The reason for urgent action is not just that by 2005/6 there will be a significant increase in UK gas imports from Europe.
[These imports are projected continue to rise until full depletion of the UK reserve is achieved, currently estimated as in 2020].

**2.3**.The reason is a combination of funding restrictions and the need for testing and developing or adapting new and existing technologies.

**3.0.Funding restrictions —2001-2003**
3**.1.**One of the most significant funding restrictions identified is that of the European Regional Development Funding infrastructure funds. These funds are available to Objective One and Objective One transitional area until 2006.However, for the bulk of the funding for infrastructure the cut-off period is only two years from now, If urgent action is not taken hundreds of millions of pounds of resource could be lost,

**3.2**.Of particular interest are the areas of the Highlands and Islands of Scotland, Wales and Cornwall. These are the areas not only eligible for ERDF infrastructure funds, but areas which are very rich is renewable energy resources, wind, hydropower, tidal stream, wave power and geothermal energy.

**3.3**.Of the renewable energy resources in these areas, wind power, hydropower and tidal stream energies look to be the most prospective.

**3.4**.However, with respect to the Highlands and Islands there is a problem in the lack of grid availability, and new grid links require to be laid.

**3.5**.A seabed survey has already been conducted from Shetland and Orkney to Banff, and linkages look possible. In respect of the western seaboard, using Stornoway as a hub and laying a new cable subsea from Lewis to either Carlisle or Liverpool looks possible. This would overcome the problem of the overloaded Scottish-English interconnector, and would also probably be quicker and cheaper than laying on land. The alternatives need to be costed,

**3.6**.In order to proceed sufficiently rapidly to access ERDF matched funds for such projects, it is absolutely vital that a further Regulatory/Planning Directive is issued. This would allow the state to compulsorily purchase, if necessary, the best wind power sites, and to proceed whatever the minor local planning objections, in view of

the national interest. It is to be hoped that the majority of local people in these peripheral areas would agree to new renewable schemes, especially on the basis of a local tariff, which would provide some income to the local authority for the common good.

**3.7**.Given that it is possible to move quickly to institute such a policy, the logical objective is then to allow tenders from major developers of wind, hydropowered and tidal stream energies for the new sites. Their investment can then be matched by the investment of the ERDF, which will provide the cable.

**3.8**.Such a spinal chord from the north and West Coast of Scotland could also allow power generated from forest residues and other renewable energies to be transmitted to centres of population.

**3.9**.It is most important to realise that there is now new electrical technology available to allow high voltage DC links to the grid, and rural power generation sites can be linked together and into the grid.

**3.10**.There has been commercial resistance over a period of years from the major generators to allowing easy access to the grid to smaller producers. They have always complained of problems with fluctuations in power, and their obligation to maintain a steady supply. There are definitely no technical reasons to now accept such excuses. Competition from green energy sources has to be given a fair chance.

**3.11**.It is known that various green energy investors from Germany and other parts of Continental Europe and probably the USA would be interested investors in such proposed new sites, apart from UK investors.

**4.0.The Technology Race 2001-6**

**4.1**.There is also in progress a tremendous technology race at present, which vested interests in fossil fuels have been trying to stymie.

**4.2**.For example, in **terms of tidal stream energies,** there is a technology race on between turbine technologies and oscillating technology.

**4.3**.To date, the turbine technologies known in UK have been turbines with blades. These have problems underwater as the blades of the turbines create what is known as tip cavitation, a type of vacuum effect, and it is known that large windmills under water will not work efficiently, as they will require low speed gearboxes and other complex equipment.

**4.4**.There is also a new European invention of turbines without blades which initial UK engineering assessments suggest could work very well under water, and could be useful to develop here, but which have yet to be proved by prototype testing at good tidal stream sites.

**4.5**.In addition, there is the oscillating technology which has also been invented in UK, and which will work at lower current speeds that turbines-it has been estimated that oscillating technology could work at speeds as low as 3 knots, which would allow the tidal stream resource of much of the UK North Sea to be exploited.

**4.6.** Present cost estimates suggest these technologies could come under 4p/kwH given a

good five year programme of prototype development and testing.

**5.O.Other renewable technologies**
**5.1** In terms of **other renewable energies there** is also a major technology race in progress.

**5.2**.For example, in respect of **biomass and landfill gas utilisation** there is the latest pyrolysis technology with external combustion engines, which is just being brought to the UK from abroad now.

**5.3**. One is looking at the potential for fantastically reasonably priced small-scale power generation with such technologies, which can handle biomass with a moisture content up to 30 percent. First estimates suggest this could be cheaper than most conventional power generation technology by up to a factor of 6.

**5.4**.Pyrolysis can also be applied to energy crops.

**5.5**.More work is urgently needed to test the range of energy crops possible in UK, and assess their economic characteristics.

**5.6**.The energy crops which have been researched in England and Scotland have been willow coppice[ARBRE project] and miscanthus. Grants are offered by DEFRA in England to get farmers to plant these crops. However, they are both crops that would not be the first choice of most farmers, as they take up to 3 years to mature, and especially in the case of willow coppice, contaminate the land, losing flexibility in land use.

**5.7**.New work is now being proposed with grasses, such as rye, as energy crops. These have benefits, compared with miscanthus, costing £200 per hectare versus £2300 per hectare to plant, mature rapidly, and can be handled and harvested like grains, giving greater utilisation to existing farm machinery.

**5.8**.The objective of the proposed new work is to develop crops trials and combustion trials, Proposed technologies to test combustion of these crops will be using anaerobic digestion, gasification and the 300 kW size of engines for pyrolysis technologies. The engineering trials will include the associated power and heat generation systems, whether microturbines or external combustion engines, to trial the most economic result.

**5.9**.This work could be completed by 2005 at the latest, and allow a total new approach to land use and farming, if in effect, farmers can have their own small power and heat generation facilities. It has been estimated that it could cost as little as £ 150-200,000 for a new *1.5* MW facility using some of these new technologies.

**6.0. Integrating Technologies**
**6.1.**It is deemed essential to have an integrated new technology prototype programme, and link the biomass producers/farming community, with the engineering and machine experts.
**6.2**. A series of group projects in different areas of UK should be supported, trialling new crops and producing new seed ranges, and new technologies to achieve the best outcomes by 2006 of commercially sustainable energy crops production.

**6.3**. The integrated engineering and energy crop approach could then lead to a full

manufacturing programme in UK, with good opportunities in both the home markets and for export for the equipment, as well as improved farming economics and choices.

**6.4.**No comprehensive and reliable renewable energy potential calculation has yet been made for UK, as the technologies have not had the chance to come into their own.

**6.5**.A substantial funding for these technologies should be considered, beyond and in addition to the current Foresight Programme as the new technologies could provide probably as much as half of UK's future needs.

**6.6**.Also currently missing is integrated energy and other utility usage, such as water and wastes. This is both a structural problem [tax incentives to integrate might be considered] as well as an engineering and financial problem.

**6.7**.Local and planning authorities, as well as property developers and construction companies have not been targeted adequately to consider integrated projects.

**6.8**.Successful sustainable integrated energy and utility projects have been carried out by the World Bank [GAP programme] in Turkey for example. These are multi funded and multi technology sustainable projects.

**6.9**.Having more than one technology or source of funds is not a problem; it is done all the time in the construction industry, and with good project management controls superimposed works well.

**6.10**.It is therefore proposed that careful consideration be given to the redevelopment of brown field sites, and of any new energy supplies in the UK, to integrate the utilities with water and waste.

**6.11**.The PFI specialists have moved out of the Treasury, but some of their expertise could well be applied to getting new integrated public/private projects progressing.

**7.0**.Existing resources such as the BRECOM model of the Building Research Establishment **are under-utilised,** when considering energy strategies for heating and powering buildings.

**7.1. For example, strategies need to be reconsidered, and positive financial encouragement given to new initiatives such as the** use of the former British gas technology for very small microturbines[more like heat exchangers] to efficiently use gas. Similarly solar roof tiles in new buildings/retrofitting old buildings, and the use of geothermal energy for new buildings.

7.2.Similar in concept to the BRECOM model, **[1K needs a model of all its agricultural land and forestry land.** Such a model, giving soil and productivity characteristics, and crop tolerances, would be truly invaluable in making assessments of the untapped potential for biomass in UK, apart from many other commercial uses it might have when considering clustering of biomass powered generation or even clusters of farmland for various agricultural business purposes. The resource at Rothamsted [the oldest agricultural research station in the world] could be used as a centre for this work,

**7.3. Integrating technologies** should also be considered. For example, fuel cells with wind farms, and other machinery, which produces intermittent energy. There are huge savings to be made through integration.

7.4.Further, in respect of transport, emissions controls have been far from perfect. For example, in cars, the catalytic converters in many have used palladium, one of the worlds most toxic metals, traces of which are now found in the snows of Finland, having been exported from other parts of Europe in the atmosphere.
A proper costing of fuel celled transport technologies should be considered, with incentives for car manufacturers in UK producing 200,000 cars per year or more, to consider this technology. We have the resources to do this; they are presently unused.

7.5.Taxis and buses and other public transport should be encouraged to use fuel cells, and filling stations to provide recharging facilities. Financial incentives to do so would be sensible.

7.6.On the sea and lakes, where there are pleasure craft, which can have highly pollution engines, there should be a direction to use fuel cells.

7.7.In respect of water quality generally, this can be much improved if technologies are integrated. For example, farm slurries can be recycled with biomass and anaerobic digesters to produce clean water and fertiliser instead of polluting rivers.

7.8.Anaerobic digesters should be looked at; presently the stainless steel pressure vessels are overengineered and too expensive for common use. The invention of new superstrong composites should be considered as a replacement to make this technology more widely available at reasonable cost, To do this would also mean a change in Regulations in respect of the use of pressure vessels.

8.0. **Summary**

8.1.There is little time to act, if we are to start to get the essential new sustainable and energy saving technologies put into general use. The next five years are critical to the long term success of applying these technologies effectively on a large scale,

8.2.There should therefore be an urgent technology review undertaken with a range of manufacturers, and inventors, of new technologies as well as the integration and different applications of existing technologies. Investment in development and application of these technologies should be made an absolute priority.

8.3.If UK does not do this now we will lose out in the international technology race now in progress in the energy sector.

**8.4.** In the end it will cost the British taxpayer so much more to have to buy technologies from other countries which we can develop and provide for ourselves. We also need to avoid having to rely too heavily on energy imports.

8.5.It will probably result in a decline in living standards within the foreseeable future if no new policy action is taken now to develop the technologies we need for a sustainable and least-cost energy future.

**8.6. £100 million pounds is not enough for the investment needs of the next five years if we are to win the technology race and move forward on many fronts. These funds could however be most effectively used if existing resources were better utilised to support a programme using £100 million.**
**For example, either life extension of UK North Sea facilities to produce renewable energy or some scheme to encourage the oil and gas industries to re invest some of their North Sea earnings in a renewable energy producing programme leither onshore or offshore] which could be fairly wide-applying also to transport fuels/fuel cells and the development of more efficient gas utilisation technologies. This would require a Treasury North Sea Taxation review.**

8.7. A careful review of resources and utilisation of funds, matching public with private sector money, needs to be done. This may involve the creation of revolving funds and energy investment trusts with public and private sector funding involved.

8.8. This **review should involve the Treasury in tax incentive schemes for the major City pension funds who currently only pay lip service to ethical funding considerations. Only an attractive bottom line will allow to change to effect the release of the purse strings for the major investment needed.**

8.9. Green electricity should be made very attractive to the taxpaying public, as should investment in energy saving or efficient devices such as micro gas turbines or heat exchangers for household use.

**8.10.** Special measures should be considered to incentivise the agricultural community as important in the green energy future of UK, including the reassessment of farm businesses to include a component of income from power generation. The set-aside land resource could be considered in this equation.

These are some of the main observations I would wish to make in respect of a contribution to the Energy Review.

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