Submission on Fusion Power to the Energy Policy Review
UKAEA Fusion, September 2001

This statement is submitted by the EURATOM-UKAEA Fusion Association. The UKAEA is responsible for the implementation of the UK research and development programme on magnetic confinement fusion, and on behalf of Europe operates JET, which is the world's leading fusion experiment.

1. The Energy Policy Review is a review of "the strategic issues surrounding energy policy for Great Britain . . .within the context of meeting the challenge of global warming, while ensuring secure, diverse and reliable energy supplies at a competitive price". The timeframe under consideration is to 2050.

2. In this submission we say why developing electricity generation using fusion - the process that powers the sun - should be an important element of a sustainable energy strategy.

3. With increasing concern over the environmental effects of energy use and production, ever-expanding world energy requirements, and a need to guarantee security of supply for the future, it is vital to have a wide-ranging energy strategy given top priority by government and backed-up by sufficient resources. This should include:

- optimising the use of present technologies to minimise environmental impact;
- improvements in existing energy technologies, particularly in reducing emissions and improving efficiency of energy production and use; and
- development and introduction of a range of new energy technologies providing the options necessary to allow a gradual move to a radically different energy supply system and market.

Fusion and most renewables can contribute to the third category, and it is important that they are developed to their full potential.

4. Fusion can realistically be foreseen as making an important contribution to the above objectives because of (a) the abundance of its fuel supplies, (b) its significant safety and environmental advantages, and (c) progress developing the technology of fusion power in the last decade. These factors are summarised in the following paragraphs.

5. The fuels for fusion – deuterium and lithium – have widespread and abundant distribution at low cost.

6. Fusion power stations will have only limited stocks of energy that could drive accidents. It has been shown that the worst possible accident driven by in-plant energies would result in only very small hazards to the public. The consequences of an accident initiated, for example, by a very large earthquake would be small compared to the direct consequences of the earthquake itself.

7. Fusion power stations will make no contribution to global warming as greenhouse gases are not produced.

8. Fusion power stations will make no use of uranium, plutonium or other fissile materials. Although there is activation of the machine structure during the plant operations, this is sufficiently short lived that almost all the materials in a fusion power plant could be recycled at the end of the plant life. There is not a large waste burden for future generations.

9. Estimates of the cost of electricity from fusion power stations suggest that it should be acceptable in a future energy market, particularly one in which environmental concerns become increasingly important. The estimates are similar to those for clean coal (emission–abated coal power stations) and renewables (ignoring costs of energy storage for renewables). Unlike many renewables, fusion power would not be intermittent, nor be restricted to certain geographical locations.

10. There has been great scientific and technological progress in developing fusion over the last decade. Fusion power has been produced at levels up to sixteen MegaWatts. Improved designs of the burning-plasma core of a fusion power plant are being researched, such as more compact - and therefore possibly cheaper – systems led by UK scientists. In addition, prototypes of most of the components of a fusion power plant have been produced and successfully tested individually at close to the necessary conditions. The integration of all the required elements into reliable power plants is required, however, before we can be certain first of fusion's technical feasibility and later its economic feasibility.

11. No major breakthroughs are needed. These have already occurred. Further development can be envisaged broadly in two stages: firstly, the integration of the various elements in a device approaching power station size, together with testing of materials in conditions as typical as possible of a power plant; and secondly, the build-up of reliability in operation to confirm economic feasibility.

12. Fusion development has been undertaken as an international effort, by Europe, Russia, Japan, USA, and a number of other countries. Taking fusion forward to commercialisation, as sketched in the preceding paragraph, requires continued international collaboration. With the present sequential approach, commercialisation should be possible by 2050, and much earlier if the key steps are undertaken in parallel. The latter is within the capacity of the international fusion community if co-ordination is increased and focused solely on key deliverables linked to demonstrating the feasibility of fusion. This in turn requires sufficient political will and strong project management, with a remit to produce the electricity generating systems for the energy industries and utilities which will eventually manufacture and operate fusion power stations.