

## Nuclear fusion and sustainability

A. M. Bradshaw

Max Planck Institute for Plasma Physics, Boltzmannstr. 2, 85741 Garching, Germany

T. Hamacher

Institute for Energy Economy and Application Technology, Technical University of Munich, Arcisstrasse 21, 80333 Muenchen, Germany

For a word which has only recently been taken up into the English language "sustainability" has already acquired several shades of meaning. Its strict application in terms of the definition given by the Brundtland report results in a very negative balance for most currently used energy sources, but less so of course for the so-called renewables. Developing nuclear fusion as a future alternative for base-load electricity supply by the middle of this century is one of the professed aims of R&D policy in many countries. If we can assume for fusion that recent favourable prognoses concerning nuclear waste (1) hold true, then the sustainability discussion centres on lithium and its availability. This issue has been treated by several authors, e.g. (2, 3), but has recently become acute, because of the projected future demand for lithium-ion batteries. Fusion scientists (and politicians) must become aware of the fact that the automobile industry may acquire, and according to some estimates even use up, all the known lithium reserves and resources (excluding seawater) in the next few decades. The present authors note that such a rare element should actually be re-cycled in applications where this is possible, but that this is illusory at a time when the ready availability of lithium in South American brine deposits keeps the kilogram price of lithium carbonate extremely low. They therefore plead for a massive R&D programme in alternative battery technologies, such as the zinc/air device. Moreover, the extraction of lithium from seawater in an environmentally friendly way at low cost must also be vigorously pursued. Otherwise, fusion is likely to lose the epithet "almost sustainable".

1. I. Cooke et al, European Power Plant Conceptual Study, UKAEA report (2005).

2. D. Eckhardt, J. Fusion Energy, 14 (1995) 329.

3. D. Fasel and M.Q. Tran, Fusion Eng. Des. 75-79 (2005) 1163.