

SPACE POWER SYMPOSIUM (C3)

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SPACE AID FOR ENERGY NEEDS ON EARTH

Abstract

Humans' conversion and uses of energy are not globally sustainable. Not only are fossil resources being depleted, but also current energy generation methods cause very significant environmental and economic problems that will, if not dealt with effectively, lead to political upheavals and more human misery worldwide. Furthermore, although alternatives to fossil fuels are being developed, it is possible that these may not be ready in time or in sufficient quantity before existing fuels are depleted. This is particularly the case as far as liquid fossil fuels are concerned. Beyond this, energy source requirements can be divided broadly into three categories. Firstly, compact, highly energy-dense mobility fuels are necessary to power transportation. Secondly, reliable, continuous base-load electricity is needed for normal, 'every-day' use. Thirdly, highly-responsive, short-duration peak-use electricity sources are required to support demand surges. In principle, solutions to these needs are or will be available in the form of nuclear-, wind-, hydroelectric-, tidal- and solar-power. However, none of them fulfil the ideal requirements to be sustainable, environmentally friendly, low-cost and continuous while also providing the global population with a standard of living equal to (or, ideally, higher) than they have at the moment. The question posed, then, is "How can 'space' help?", where 'space' here refers to the combined intellectual capabilities and expertise of the global space community in the broadest sense, as well as the infrastructure and facilities at its disposal.

A number of possible answers have been posited. For example, space can encourage unconventional thinking. Space has wide experience at dealing with complex, multi-faceted problems. In the near-term, space can provide a means for bringing the urgency of the problem to the fore in the minds of the global population and their governments, both through relevant scientific research and through worldwide communications. Space is also well-equipped to offer actual solutions such as more efficient energy-generation systems and better control of energy distribution. In the longer term, space might also deliver extraterrestrial materials and energy for use on Earth, e.g., space solar power or Lunar Helium-3 powered fusion.

This paper will present the results of a project conducted by an independent team of graduate students and young professionals at the 2009 summer session of the International Space University at the NASA Ames Research Center with the aims of defining and documenting the world's energy problems by means of a review of pertinent literature, with particular reference to greenhouse gas emissions and their effects, critically assessing current proposed solutions, emphasizing what policy changes are needed and what obstacles make them difficult to effect and implement, and determining how expertise and tools developed for space applications might be applied in the near-, mid- and far- terms. In conclusion the paper will document a progressive program of technical and non-technical measures leading to better worldwide energy applications.