

WHY FUSION MAY BE WORTHWILE, ANYWAY

P. Kurz¹, H.E. Klingelhöfer²

¹ *Ernst-Moritz-Arndt-Universität Greifswald, Greifswald, Germany*

² *Tshwane University of Technology, Pretoria, South Africa*

Corresponding author: peter.kurz@uni-greifswald.de

While commercial fusion power is not expected to be available before the middle of this century, the need for new energy sources as a response to climate change and scarcity of fossil fuels has become more and more pressing. This has led to increased efforts to improve and promote low- or zero-CO₂ technologies like carbon capture and storage or renewables like wind and solar power. High-voltage direct current transmission and improvements in thermal storage have directed considerable attention to the possibilities of concentrated solar power in the MENA-region. A European super-grid is likely to allow for wider use of wind and solar power by offering low-loss transport of electricity, thereby reducing volatility in power prices and the need for backup plants and spinning reserve. This increase in competition will make it harder for nuclear fusion to enter the market, at least in the medium term.

This is mostly due to the fact, that fusion power is expected to be relatively costly. The large initial investments lead to high capital costs which make up the bulk of the cost of generating electricity from fusion. Also, in today's markets, the energy industry seems to be more and more reluctant to bear the high risk of large capital investments.

Standard cost based comparisons, however, are rarely sufficient for the appraisal of power plant investments. For example, on a market with a high share of renewables, in the absence of feed-in tariffs, revenues from wind power will significantly suffer from price volatility while security of supply may become more expensive. Also, the political risk of energy dependencies may cause additional market regulations that can have significant impact on the merit order of energy supply.

We have developed different future electricity market scenarios and in the present paper, their impact on the competitiveness of a future fusion power plant is studied. We use simultaneous planning of investment, finance, production and sales to examine the effects of varying market environments, changes in fuel prices, cost of emissions and capital, and the investor's objective system and decision field. While independent power producers will typically strive to maximize their economic success, utility companies also need to satisfy electricity demand. Public utilities, however, are responsible to cover demand while minimizing the price of electricity, in addition to their typically lower cost of capital. We demonstrate, based on the modeled investor's profiles, that public entities are more likely to invest in nuclear fusion than private investors. Also, in certain cases, the additional restriction of meeting volatile electricity demand, which applies to both private and public utility companies, may increase the value of flexible power sources. Here, provided that nuclear fusion will combine flexible supply with firm power, the potentially higher cost of electricity could well be compensated.