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Abstract In the discussion on innovations for sustainable development, radical innovations are frequently called for in order to transform society into a system perceived as sustainable successfully. The reason for this is the greater environmental efficiency of these innovations. This hypothesis is, however, not supported by empirical evidence. Given the background of a global increase in coal-fired power plants and the consequent environmental impacts to be expected, the hypothesis that radical innovations are superior to incremental innovations and will thus be introduced to the market is reviewed on the basis of fossil fuel power plants. In this paper we examine the diffusion of incremental and radical innovations in the field of power plants and the basic obstacles confronting these innovations. For example, we compare Pressurized Pulverized Coal Combustion (PPCC) as a radical innovation and supercritical coal-fired power plants as an incremental innovation. PPCC failed due to technological uncertainty. We show in an ex-post analysis of the German R&D portfolio for power plants in the past three decades from an environmental viewpoint that, for radically innovative technologies, it was difficult to be accepted by possible investors. The future potential of radical innovations in the field of power plant technology is to be regarded as relatively low, especially due to technological uncertainty, market uncertainty and sunk costs. The conclusion for future R&D work in the sector of large-scale power plants is that an innovation is more likely to succeed if it follows established technological trajectories. In the context of energy market liberalization, hardly any radical innovations are expected in the technology of power plants. The findings of this paper may also be helpful to evaluate risks or probabilities of success of technologies being developed currently. We discuss for example the technological trajectories currently favored in CO₂ capture.

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