NEURAL NETWORKS AND AI-DRIVEN DECISION MAKING FOR A MORE FLEXIBLE NUCLEAR INDUSTRY

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The nuclear industry, like many other sectors, is exploring new approaches with neural networks and AI-driven decision-making. Given the rapid advancements in artificial intelligence, it is crucial to consider the integration of these technologies into one of the most conservative industries-nuclear energy. Although the use of neural networks has been studied for decades, their real-world application in the nuclear field is only now gaining traction. These technologies have the potential to enhance the competitiveness of nuclear power by optimizing operation and improving efficiency. Predicting equipment failure can also result in an increase in the overall nuclear safety of a facility. The nuclear industry's strong focus on safety regulations presents an opportunity for AI to enhance operational efficiency, support decision-making, and further strengthen safety standards. This work presents a developed methodology for leveraging neural networks in various applications within the nuclear sector. Here, we demonstrate how AI and neural networks can support nuclear power plants in adapting to an evolving energy landscape, where renewables play an increasingly dominant role. Our approach suggests that nuclear power plants should not only be considered as baseload generation units but also as load-following sources capable of replacing fossil fuels in electricity grid regulation. The proposed methodology, featuring flexible tools for data preparation and neural network configuration, can be applied to multiple use cases. This poster highlights AI-driven applications such as predictive maintenance for equipment failure, optimization of task scheduling during planned outages, better nuclear fuel management and enhanced power regulation. Additionally, in the long term, AI integration may facilitate the use of nuclear power plants for industrial applications beyond electricity generation. As the energy sector continues to evolve rapidly, it is crucial for the nuclear industry to adapt and integrate emerging technologies to remain a relevant and viable option for the future.

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