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Integration of Nuclear Turbine Exhaust with Spiral Wound Membrane Distillation Systems

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The ongoing global energy crisis, driven by increasing demand and growing environmental concerns, has intensified the need for sustainable and integrated solutions particularly in the field of water desalination. Desalination technologies are known for their high energy requirements and reliance on fossil fuels, resulting in elevated operational costs and significant environmental impact. In contrast, membrane distillation (MD) has gained recognition as a viable alternative due to its compatibility with low-grade heat sources. Nuclear power plants, although primarily engineered for electricity generation, discharge a substantial amount of thermal energy, especially through steam exhausted from the low-pressure turbine stage. This waste heat is typically underutilized, representing a missed opportunity for energy recovery. In this study, the feasibility of integrating this residual thermal energy with a spiral-wound membrane distillation system is investigated. The main analysis parameters are varying steam extraction pressures on key performance metrics of the MD process, including permeate flux and gained output ratio (GOR). This integrated approach not only addresses the need for more efficient solutions but also demonstrates the potential for improved energy utilization in nuclear facilities.

Technical Track

Nuclear Thermal-Hydraulics

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