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Cost Allocation in Integrated Nuclear Desalination Plants

In a single-purpose nuclear or desalination plant, the production cost of power (electricity) or desalinated water is readily obtained by dividing the annual total costs by the production rate of power or water. For integrated nuclear desalination plants which produce both power and water from the same source of energy, cost allocation is necessary to distribute the expenses between the two products. The issue is how to fairly allocate the costs associated with the production of electricity and water. Power allocation method and heat allocation method are often used. They are simple and relatively easy to implement. In the power allocation method, the costs are assigned based on the amount of electricity used by each product. It ignores the thermodynamic quality and exergy of energy. The heat allocation method allocates the cost based on the thermal energy consumed by each product. It is still not considering the useful work potential (exergy) of energy. Methods used for cost allocation may be classified into three main groups: engineering-based methods (e.g. separable costs and marginal costs), market-based methods (e.g. alternative market value and power credit method) and thermodynamic methods (e.g. electrical equivalent method, energy method, exergy method). Each method offers unique approaches to achieving the delicate balance, and understanding their strengths and limitations can help determine the most suitable method for a specific situation. To demonstrate the advantages of the exergy method in providing a comprehensive analysis of the cogeneration system and reflecting the true value of energy, it will be applied to a simplified integrated nuclear desalination flow diagram in this work.

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