

**PERANCANGAN *MODEL* PREDIKSI PENELIHARAAN
DESALINASI *PLANT* TIPE *MULTISTAGE EVAPORATOR* BERBASIS
MACHINE LEARNING (KNN) PADA PLTGU CILEGON**

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ABSTRAK

Meningkatnya kebutuhan listrik menuntut pembangkit beroperasi andal dan efisien, termasuk ketersediaan air baku dari desalination plant di PLTGU Cilegon. Penjadwalan pemeliharaan unit masih banyak bergantung pada evaluasi manual, sehingga berisiko terlambat mendeteksi penurunan performa. Penelitian ini bertujuan merancang model prediksi pemeliharaan *desalination plant* tipe *multistage evaporator* dengan metode *K-Nearest Neighbors* untuk mengklasifikasikan kondisi operasi menjadi *Good*, *Degradation*, dan *Action Needed* sebagai dasar pembentukan *health index*. Data historis operasi diolah dalam bentuk *time-series* interval 15 menit pada periode 2 Januari 2020 sampai 23 Desember 2022, dengan empat fitur utama yaitu *Sea Water Supply Flow*, *LP Steam Temperature*, *Brine Temperature*, dan *Distillate Water Flow*. Setelah proses *cleaning*, dataset final berjumlah 14.592 baris. Penentuan parameter tetangga dilakukan melalui pengujian nilai 3 sampai 20 dan menghasilkan nilai terbaik 9 dengan akurasi 79,04 persen pada data uji. Evaluasi menunjukkan kesalahan paling dominan terjadi pada transisi *Degradation* dan *Action Needed*, serta terdapat risiko prediksi *Action Needed* menjadi *Good* sebesar 13 persen. Model selanjutnya dirancang untuk diintegrasikan ke sistem pemantauan agar menghasilkan peringatan dini berbasis kondisi.

Kata Kunci : *desalination plant*, *health index*, *klasifikasi kondisi*, *PLTGU Cilegon*, *predictive maintenance*

DESIGN OF A PREDICTIVE MAINTENANCE MODEL FOR A MULTISTAGE EVAPORATOR-TYPE DESALINATION PLANT BASED ON MACHINE LEARNING (KNN) AT PLTGU CILEGON

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ABSTRACT

The increasing demand for electricity requires power plants to operate reliably and efficiently, including the availability of make-up water supported by the desalination plant at PLTGU Cilegon. Maintenance scheduling is still largely based on manual evaluation, which may delay the detection of gradual performance Degradation. This study aims to design a predictive maintenance model for a multistage evaporator desalination plant using the K-Nearest Neighbors method to classify operating conditions into Good, Degradation, and Action Needed as the basis for a health index. Historical operating data are processed as a time series with a 15-minute sampling interval for the period from 2 January 2020 to 23 December 2022, using four main features: Sea Water Supply Flow, LP Steam Temperature, Brine Temperature, and Distillate Water Flow. After data cleaning, the final dataset contains 14,592 records. The number of neighbors is selected by testing values from 3 to 20, and the best performance is achieved with 9 neighbors, reaching 79.04 percent accuracy on the test set. The evaluation indicates that most errors occur at the transition between Degradation and Action Needed, and the main operational risk is predicting Action Needed as Good at a rate of 13 percent. The model is then prepared for integration into a monitoring system to support condition-based early warning.

Key Words : desalination plant, health index, klasifikasi kondisi, PLTGU Cilegon, predictive maintenance