

**DESAIN HYBRID RENEWABLE ENERGY SYSTEMS
BERBASIS METODE PENGAMBILAN KEPUTUSAN MULTI KRITERIA
CRITIC-TOPSIS**

SKRIPSI

Diajukan untuk memenuhi salah satu syarat untuk memperoleh gelar
Sarjana Teknik, Pada Program Studi Teknik Elektro



Oleh:

Yusril Nurhikam

E.5051.1902656

**PROGRAM STUDI TEKNIK ELEKTRO
DEPARTEMEN PENDIDIKAN TEKNIK ELEKTRO
FAKULTAS PENDIDIKAN TEKNOLOGI DAN KEJURUAN
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Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar
Sarjana Teknik Elektro pada Program Studi S1 Teknik Elektro

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LEMBAR PENGESAHAN

YUSRIL NURHIKAM

E.5051.1902656

**DESAIN HYBRID RENEWABLE ENERGY SYSTEMS
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CRITIC-TOPSIS**

Disetujui dan disahkan oleh pembimbing :

Dosen Pembimbing I



all 20/6 2023

Prof. Dr. Ade Gafar Abdullah, M.Si.

NIP. 19721113 1999903 1 001

Dosen Pembimbing II



20/6/23

all 20/6/23

Dr. Ir. H. Dadang Lukman Hakim MT.

NIP. 19610604 198603 1 001

Mengetahui,

Ketua Departemen Pendidikan Teknik Elektro



Dr. Yadi Mulyadi, M.T.

NIP. 19630727 199302 1 001

ABSTRAK

Peningkatan kebutuhan energi listrik mendorong pengembangan Sistem Energi Terbarukan Hibrida (HRES) di negara-negara berkembang dan daerah terpencil, Kelangkaan energi menjadi isu global utama saat ini. Hal ini mendorong masyarakat dunia untuk beralih ke sumber energi terbarukan, mengingat semakin menipisnya bahan bakar fosil dan ancaman pemanasan global. Namun, energi terbarukan memiliki kelemahan utama pada sifat stokastiknya, yang membuatnya tidak dapat diprediksi dan kurang dapat diandalkan. HRES hadir sebagai solusi dengan menggabungkan beberapa sumber energi terbarukan untuk mengatasi kelemahan dari satu sumber dengan sumber yang lain. Meskipun memiliki keunggulan seperti fleksibilitas dan polusi rendah, energi terbarukan tidaklah tanpa dampak lingkungan, pengembangan energi terbarukan perlu memperhatikan dampak lingkungan dan prinsip pembangunan berkelanjutan. Penelitian ini bertujuan untuk mencari konfigurasi sistem energi terbarukan hibrida paling optimal di kawasan IKN Nusantara. Pendekatan Geo spasial dilakukan untuk mengumpulkan informasi relevan, termasuk data potensi energi terbarukan seperti radiasi matahari, potensi *hydro power*, dan potensi biomassa. Perangkat lunak *Hybrid optimization model for electric renewables* (HOMER) dipergunakan dalam mendesain HRES, dan outputnya dioptimalkan dengan metode *Multi Criteria Decision Making* (MCDM) dimana hasil optimasi menunjukkan Desain 4 menjadi konfigurasi paling optimal, ditinjau dari aspek energi dan lingkungan dengan nilai kedekatan relatif terhadap solusi ideal sebesar 0.8566. Dengan demikian penerapan MCDM dalam menentukan konfigurasi terbaik HERS di kawasan IKN Nusantara layak dipertimbangkan untuk dikembangkan dalam penelitian lebih lanjut.

Kata kunci: HRES, Energi, Lingkungan, GIS, HOMER, CRITIC, TOPSIS.

ABSTRACT

The increasing demand for electrical energy encourages the development of hybrid renewable energy systems (HRES) in developing countries and remote areas. Energy scarcity is a major global issue today. This encourages the world community to switch to renewable energy sources, given the depletion of fossil fuels and the threat of global warming. However, renewables have a major drawback in their stochastic nature, which makes them unpredictable and less reliable. HRES comes as a solution by combining several renewable energy sources to overcome the weaknesses of one source with another. Despite having advantages such as flexibility and low pollution, renewable energy has an environmental impact. The development of renewable energy needs to pay attention to environmental impacts and the principles of sustainable development. This study aims to find the most optimal configuration of hybrid energy systems in the IKN Nusantara area. A geo-spatial approach is carried out to collect relevant information, including data on renewable energy potentials such as solar radiation, hydropower potential, and biomass potential. The Hybrid Optimization Model for Electric Renewables (HOMER) software is used in designing the HRES, and the output is optimized using the Multi Criteria Decision Making (MCDM) method. The optimization results show Design 4 to be the most optimal configuration in terms of energy and environmental aspects, with a relative closeness value to the ideal solution of 0.8566. Thus, the application of MCDM in determining the best HERS configuration in the IKN Nusantara area is worthy of consideration for further research.

Keyword: HRES, Energy, Environment, GIS, HOMER, CRITIC, TOPSIS.

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