AI-Driven Smart Microgrids Integrating Solar, Wind, Batteries, and Hydrogen for Resilient Energy Systems

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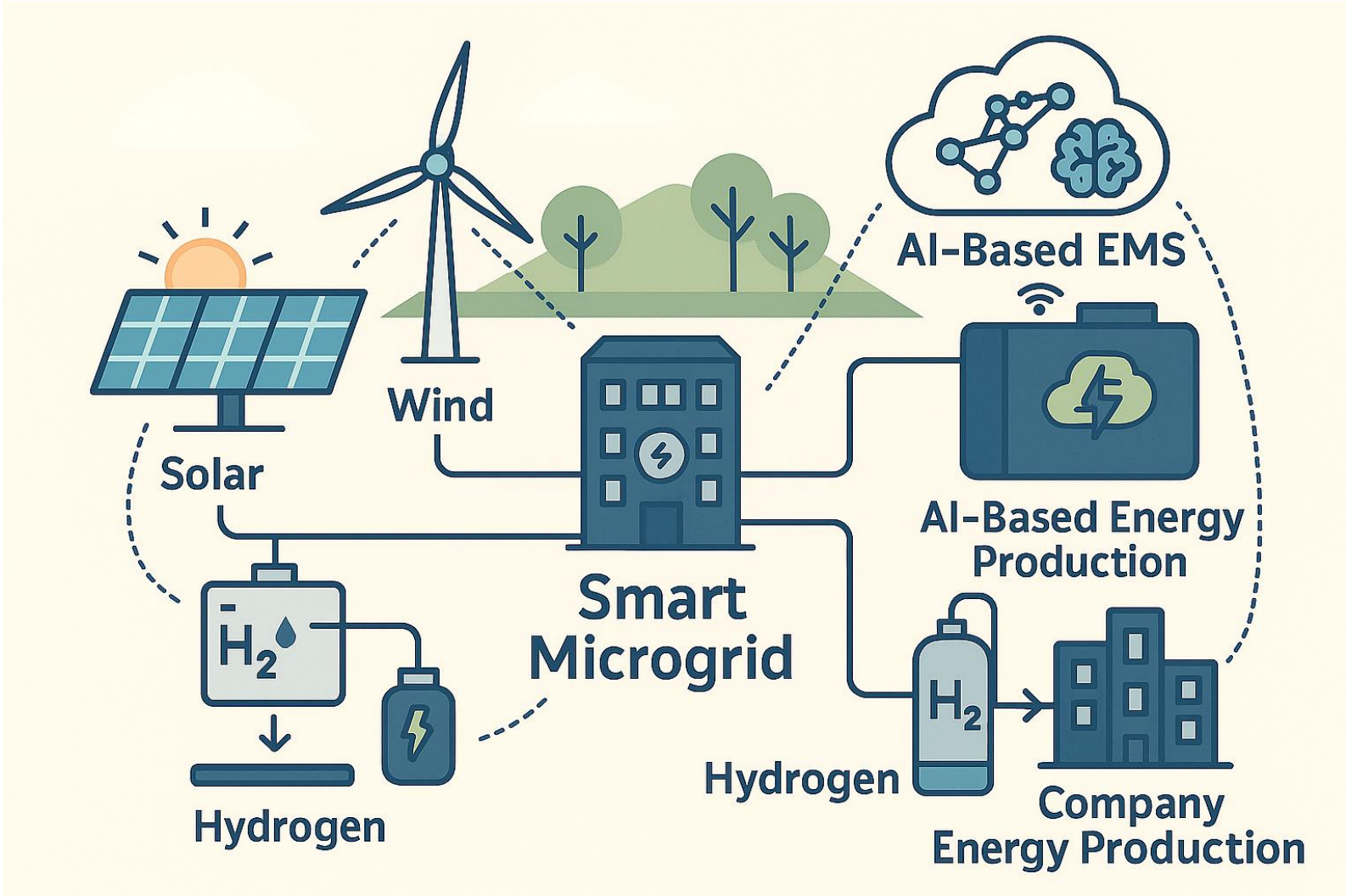
AI-Based EMS
Wind
Solar
AI-Based Energy Production
Smart Microgrid
H_2
Hydrogen
H_2
Hydrogen
Company Energy Production

Context & Challenge

In many rural or weak-grid regions—especially across Mediterranean—energy systems suffer from intermittency, low reliability, and lack of flexibility. Meanwhile, renewable sources like solar and wind are underexploited due to their variability. Traditional energy management systems struggle to integrate hybrid resources effectively.

Context & Challenge

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Our solution

HySmartGrid aims to develop and demonstrate a **smart, modular microgrid** that integrates:

Solar and wind generation

Battery storage for short-term balancing

Hydrogen system (electrolyzer + storage + fuel cell) for long-duration energy shifting

And most importantly, an **AI-based Energy Management System (EMS)** using forecasting and optimization algorithms to orchestrate energy flows across all components in real-time.

Our solution

This microgrid will be **digital by design**, relying on **IoT-connected devices**, local controllers (e.g. ESP32), and a **cloud-integrated EMS** capable of real-time load and generation forecasting via LSTM models, and dispatch optimization using Model Predictive Control (MPC).