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Editorial Note

Bridging Technological Sovereignty and Global Progress through Open Science

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The global innovation landscape is currently witnessing a profound tension. On the one hand, we see the rise of Technological Sovereignty—a strategic movement where nations prioritize the development of independent capabilities in critical sectors such as Artificial Intelligence, semiconductors, and, most crucially, sustainable energy systems. On the other hand, the most pressing challenges of our century—the climate crisis and the transition to Net Zero—demand a level of cooperation that transcends national borders.

The Paradox of Energy Independence

This urgency has been starkly highlighted by ongoing geopolitical fractures in the Middle East and surrounding regions, resulting in direct disruptions to key energy transit chokepoints. The choking of global oil and gas supplies due to these volatile events serves as a grim reminder of how import-dependent, developing, and emerging economies are exposed to distant geopolitical shocks.

Consequently, the pursuit of localized renewable energy is no longer just an environmental goal; it is a necessity for national security and economic resilience. However, this valid pursuit of technological sovereignty carries the risk of "innovation silos." If breakthroughs in renewable storage or green methodologies remain shielded behind proprietary walls or strict national boundaries, the global pace of decarbonization slows down. The mathematical reality of innovation suggests that collaborative networks yield the following exponential results:

$$\text{Global Energy Transition} \approx \int_0^t \left(\sum_{i=1}^{n} \text{Regional Innovation}_i \times \text{Open Data Share} \right) dt$$

For an archipelagic nation like Indonesia, technological sovereignty in energy is not just a policy goal but a necessity for national resilience, as highlighted by the Just Energy Transition Partnership (JETP)'s localized solutions required for microgrids and geothermal optimization. In our continuous effort to showcase this spirit of balancing local execution with global frameworks, we reflect on highly impactful studies that tackle these exact paradigms that were previously featured in our journal. For instance, Brazovskaia and Gutman, 2021 emphasized the necessity of classifying regions according to climatic characteristics to optimize the localized use of renewable sources, proving that one-size-fits-all energy models are insufficient. Building directly upon this need to understand localized potential, Saroji et al., 2022 demonstrated

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a comprehensive framework to optimize power generation development, thereby efficiently increasing the utilization of these renewable sources. Finally, Zaytsev et al., 2021 provided a vital assessment of the innovative potential of alternative energy specifically within the context of transitioning to a circular economy by looking at the macro-level sustainability of these systems.

Together, these studies represent the exact intersection of localized expertise and global relevance that we champion. We encourage our future contributors to consider how their work contributes to these global "commons" of energy knowledge.

Open Science as a Strategic Bridge

At IJTech, we posit that Open Science (OS) is the essential framework required to resolve this tension. Open Science is not merely about "free access" to PDFs; it is a fundamental shift in how we approach the energy transition. It encompasses:

- Transparency in Energy Modeling: By encouraging authors to share raw datasets and simulation parameters (e.g., for solar irradiance or grid stability), we ensure that local energy sovereignty is based on verifiable, peer-reviewed truth.
- The Indonesian Perspective: Within Southeast Asia, and specifically through the research ecosystem at Universitas Indonesia, we are seeing a surge in "frugal innovation"—engineering solutions that are high-impact yet cost-effective. Open Science ensures these regional breakthroughs in renewable energy are visible to the Global North, creating a truly reciprocal international dialogue.
- Collaborative Sovereignty: We advocate for a model in which nations are self-reliant in their energy infrastructure but collaborative in their scientific discovery.

IJTech maintains a rigorous gatekeeping role as an indexed journal in Scopus and Web of Science, upholding stringent peer-review standards to ensure that only the most robust research is published. However, rigor and openness are not mutually exclusive. In fact, Open Science fundamentally enhances scientific rigor.

Open energy models are immediately subject to wider global scrutiny, allowing independent researchers to audit the code, stress-test the assumptions, and replicate the findings under different regional constraints. Furthermore, when methodologies are fully transparent and raw datasets are accessible, they invite continuous global refinement rather than static acceptance. This open validation loop actively discourages "black-box" simulations and prevents research failures from being duplicated. For IJTech, fostering this level of transparency does not dilute our editorial standards; rather, it elevates them, ensuring that the technology we publish is not only theoretically sound but also globally verifiable and practically deployable.

This issue

The compiled studies showcase cutting-edge technologies and strategies in energy efficiency, advanced materials, and manufacturing. Notably, this volume strengthens its focus by ensuring that environmental sustainability and human well-being are at the core of technological innovation.

The first study, written by Cordova-Uvidia et al., 2026, presents a low-cost IoT-based hybrid renewable energy system for rural electrification in Ecuador's High Andean region. This study integrates solar, wind, battery storage, and cloud-based load management using low-cost ESP32/ESP8266 controllers to improve affordability and reliability. It achieves an LPSP below 5% and competitive LCOE, offering a practical roadmap for sustainable off-grid energy access in remote communities (Cordova-Uvidia et al., 2026).

The second study, written by Burlutskaya et al., 2026, presents an intelligent decision support system for oil and gas field development based on multi-agent interaction models. This

study combines hierarchical BDI agents with simulation modules to optimize crew allocation, drilling, and geological–technical operations across production levels. It shows that the multi-agent system improves regional production by approximately 4%–4.5%, outperforming alternative optimization methods (Burlutskaya et al., 2026).

The third study, written by Leerojanaprapa et al., 2026, models equivalent circulating density during drilling in the Gulf of Thailand using real-time sensor data and five machine learning algorithms. This study compares SVM, RF, ANN, GB, and XGBoost on 38,863 training records and 24 variables. It identifies Random Forest as the best model, achieving the lowest RMSE (0.031) and supporting accurate real-time wellbore pressure prediction (Leerojanaprapa et al., 2026).

The fourth study, written by Widjaja et al., 2026, investigates biofuel production from cooking oil waste using a Cu-MOF/K2O catalyst through pyrolytic catalytic cracking. This study examines catalyst synthesis, deoxygenation performance, and product selectivity under different operating conditions. It shows that Cu-MOF/10-K2O achieves near-complete hydrocarbon conversion at 400°C, producing biogasoline, biokerosene, and green diesel with promising fuel properties (Widjaja et al., 2026).

The fifth study, written by Fadhil et al., 2026, proposes a PSO-based framework for dynamic grid reconfiguration in hybrid renewable microgrids with peer-to-peer energy trading. This study evaluates PV, wind, and reconfigured network scenarios on the IEEE 84-bus TPC system to reduce losses, stabilize voltage, and lower operating cost. Coordinated reconfiguration with hybrid renewables achieves the best performance, cutting costs to 1.954 $/MWh and losses to 0.002 MW (Fadhil et al., 2026).

The sixth study, written by Phetpan et al., 2026, compares low-cost shortwave and longwave diode-array NIR spectrometers for rapid prediction of biodiesel acid value, viscosity, density, and water content. This study applies PLS regression with spectral preprocessing to evaluate predictive accuracy under practical QA/QC conditions. It shows that the shortwave NIR system performs best overall, highlighting its promise as an affordable tool for real-time biodiesel quality monitoring (Phetpan et al., 2026).

The seventh study, written by Rajprasad et al., 2026, investigates the use of e-waste plastic powder-coated recycled concrete aggregates to improve sustainable concrete performance. This study evaluates mechanical strength, durability, and microstructural behavior of M30 concrete at different replacement levels. It identifies 20% coated aggregate replacement as the optimum level, achieving near-control compressive strength with improved tensile strength, durability, and chloride resistance, supporting circular construction applications (Rajprasad et al., 2026).

The eight study, written by Primantara et al., 2026, presents a machine-learning-based voltage and air-pressure regulator for automated fertilizer bagging. This study integrates Random Forest prediction with SCADA sensor data and actuator control to stabilize gate-valve response time, air pressure, and package weight. It achieves highly accurate bag-weight prediction and improves process consistency, reducing off-spec products, and enhancing packaging efficiency (Primantara et al., 2026).

The ninth study, written by Khachatryan et al., 2026, examines how sustainable human capital development and digital technologies drive socio-economic consolidation in Armenia. This study constructs a composite Human Capital Sustainability Index for 2000–2024 and analyzes its links with GDP per capita using PCA, clustering, and causality tests. It shows that digitalization is the main transmission channel, while innovation and labor-market weaknesses remain key bottlenecks to human-capital-led growth (Khachatryan et al., 2026).

The tenth study, written by Jamkamon et al., 2026, investigates the machinability of stepped cylindrical electrodes in deep-hole drilling electrical discharge machining. This study varies land height and shank size to improve debris flushing, material removal rate, and dimensional accuracy when machining AISI P20 steel. It shows that modified relief-angle and shoulder designs significantly enhance machining efficiency while reducing electrode wear and hole concavity compared with conventional electrodes (Jamkamon et al., 2026).

The eleventh study, written by Suwannapong et al., 2026, proposes a constrained adaptive exponential backoff (CAEB) algorithm for more effective retransmission timeout estimation in CoAP-based IoT networks. This study adapts backoff timing using retransmission count and active node density, and evaluates performance under continuous and periodic traffic in the Cooja simulator. It shows that CAEB reduces latency, packet loss, and retransmissions while improving throughput over conventional BEB (Suwannapong et al., 2026).

The next study, written by Maulana et al., 2026, analyzes the applicability of Tesla valve geometry manufactured by polymer 3D printing for a rifle silencer. This study designs and tests ABS-GF silencers with different partition configurations to evaluate sound pressure reduction and bullet velocity. It shows that the two-partition Tesla valve design provides the best acoustic performance, achieving a noise reduction of 7.03 dB, although with a ballistic trade-off in projectile speed (Maulana et al., 2026).

The thirteenth study, written by Subramonian et al., 2026, reviews the evolution, technologies, challenges, and future prospects of lights-out factories in fully autonomous manufacturing. This study synthesizes literature and industrial case studies, especially FANUC and Tesla, to examine how robotics, AI, and IoT enable continuous production with minimal human intervention. It highlights lights-out factories as a promising pathway toward efficient, data-driven, and sustainable manufacturing, despite integration and cost challenges (Subramonian et al., 2026).

The fourteenth study, written by Pasila et al., 2026., proposes a Takagi–Sugeno neuro-fuzzy model for MSME credit risk assessment integrated with DMAIC-based quality management. This study trains the model on 1,200 Indonesian MSME credit records to replicate expert-assigned credit scores and benchmark them against conventional machine learning models. It shows that the optimized M10 configuration achieves the best accuracy, supporting more consistent, transparent, and governance-oriented MSME credit evaluation (Pasila et al., 2026).

The fifteenth study, written by Kadyanan et al., 2026, proposes a hybrid recommender system to address cold-start problems in traditional craft recommendation. This study combines Slope One, the hybrid method of item-based clustering, and simple additive weighting to recommend both Balinese craft products and production locations. It achieves low MAE values and demonstrates reliable recommendation performance, supporting digital promotion and preservation of local cultural heritage (Kadyanan et al., 2026).

The sixteenth study, written by Laksono et al., 2026, investigates Ag-modified Sn–0.7Cu–7Zn lead-free solder alloys to improve sustainable electronic packaging. This study examines microstructure, melting behavior, wettability, density, and hardness as Ag content increases from 0 to 4 wt%. It shows that Ag promotes $AgZn_3$ formation, enhances wettability and density, narrows the melting range, and raises hardness to 16.36 Hv, highlighting 4 % Ag as the best-performing composition (Laksono et al., 2026).

The seventeenth study, written by Liswani et al., 2026, develops a tri-polymer injectable hydrogel based on carboxymethyl cellulose, sodium alginate, and chitosan crosslinked with $CaCl_2$ for minimally invasive biomedical use. This study evaluates gelation, injectability, swelling, degradation, rheology, and morphology to identify an optimal formulation. It highlights the 3%:2%:2% composition as the best-performing hydrogel, showing rapid gelation, controlled degradation, low swelling, and high elastic stability (Liswani et al., 2026).

The eighteenth study, written by Jap et al., 2026, explores pH-controlled hydrothermal synthesis of SnO_2 nanomaterials from locally sourced Indonesian $SnCl_4$ for methylene blue degradation. This study examines how pH affects crystallite size, morphology, surface area, and adsorption–photocatalytic performance. It shows that the synthesized SnO_2 achieves over 95% dye degradation under UV light, highlighting local precursors as a promising route for cost-effective photocatalyst development (Jap et al., 2026).

The next study, written by Ariatedja et al., 2026, evaluates how fiber orientation and laminate configuration affect the tensile and flexural behavior of sisal- and kenaf-reinforced epoxy composites using finite element analysis. This study compares multiple stacking sequences to assess strength–stiffness trade-offs under tensile and bending loads. It shows that 0° plies domi-

nate load-bearing capacity, sisal favors strength, and kenaf offers higher stiffness for lightweight structural applications (Ariatedja et al., 2026).

The twentieth study, written by Diyasa et al., 2026, proposes an ensemble deep learning framework for brain tumor classification from multi-section MRI images. This study combines Xception, EfficientNetV2S, and ResNet50 with Grad-CAM to improve classification accuracy and interpretability across four tumor categories. It achieves 99.18% accuracy and strong localization agreement, highlighting its potential as a reliable and explainable AI tool for smart medical diagnosis (Diyasa et al., 2026).

The twenty-first study, written by Indraprastha et al., 2026, proposes abstraction–reconstruction as a pedagogical lens for computational design thinking in parametric design and BIM education. This study evaluates 84 multidisciplinary students through workshops, assignments, and performance indicators covering design and parametric skills. It shows that BIM better supports parametric skill development through structured object-based workflows, while abstraction remains the main cognitive challenge in computational design learning (Indraprastha et al., 2026).

The "International" in International Journal of Technology is more than a label; it is our mission. As we navigate an era of increasing fragmentation, let us use the tools of Open Science to ensure that energy technology remains a bridge rather than a barrier. We invite our readers and authors to join us in fostering an open and innovative research ecosystem.

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