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******* CALL FOR PAPERS *******

SPECIAL SESSION ON

Innovative Approaches to Downstream Energy Utilisation from Solar Irrigation Pumps: A Convergence of Agrivoltaics, Smart Agriculture, Energy Systems, and Agribusiness Intelligence

SESSION ORGANIZERS

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SESSION DESCRIPTION

The global agriculture sector is undergoing a paradigm shift driven by climate variability, energy transition, and digital transformation. Solar-powered irrigation systems have emerged as a widely adopted decentralized renewable energy solution for agricultural water pumping, particularly in South Asia, Sub-Saharan Africa, and increasingly in developed regions for climate-resilient farming. Despite their success, a critical systemic inefficiency persists: solar irrigation pumps operate under a highly intermittent load profile, in which peak photovoltaic (PV) generation often exceeds irrigation demand. This results in curtailed or underutilised energy, representing a missed opportunity for productive energy reuse in rural systems. This challenge has led to the emerging concept of Downstream Energy Utilisation (DEU)—the

systematic capture, management, and productive application of surplus solar energy for agricultural, domestic, and productive rural loads.

Simultaneously, the convergence of:

- Agrivoltaics (dual land-use PV-agriculture systems)
- Smart agriculture (IoT, AI, sensor-driven farming systems)
- Edge and distributed energy systems
- Data-driven agribusiness models

is redefining how energy-agriculture ecosystems are designed and optimised.

However, the current literature remains fragmented across power systems engineering, agricultural engineering, computer science, and rural economics, with limited integrated frameworks addressing energy-flow optimisation, multi-objective control, and socio-economic deployment models. This Special Issue aims to bridge this gap by developing a systems-level, interdisciplinary understanding of solar irrigation ecosystems as intelligent energy-agriculture nodes.

RECOMMENDED TOPICS

Topics of interest for this special session include, but are not limited to:

Advanced Energy Systems and Control

- Dynamic modelling of solar irrigation pump load profiles
- Optimal control of PV-driven irrigation and auxiliary loads
- Power electronics integration for multi-load agricultural systems
- DC microgrid architectures for rural irrigation clusters
- Energy forecasting using AI/ML models for solar-agri systems

Downstream Energy Utilisation (DEU) Architectures

- Multi-tier energy allocation frameworks (irrigation + productive loads)
- Real-time energy scheduling and prioritisation algorithms
- Integration of battery storage, thermal storage, and hybrid systems
- Off-grid and weak-grid rural energy optimisation

Agrivoltaics and Land-Use Energy Systems

- Performance modelling of agrivoltaic irrigation systems
- Crop yield–energy yield co-optimisation models
- Shading effects, microclimate modulation, and evapotranspiration dynamics
- Hybrid PV-agriculture-water nexus systems
- GIS-based agrivoltaic deployment optimisation

Smart Agriculture and Digital Intelligence

- IoT-enabled irrigation and energy monitoring systems
- AI-driven crop-water-energy optimisation models
- Digital twins for solar-powered agricultural systems

- Edge computing for real-time farm energy decision-making
- Sensor fusion and predictive analytics in irrigation networks

Agribusiness and Socio-Economic Systems

- Productive use of surplus solar energy in rural enterprises
- Value-chain integration through energy-enabled agriculture
- Business model innovation for decentralized solar agriculture systems
- Rural entrepreneurship enabled by solar irrigation infrastructure
- Economic viability, cost–benefit, and lifecycle analysis

Sustainability, Climate, and Policy Systems

- Carbon reduction potential of integrated solar irrigation systems
- Climate resilience modelling of energy-agriculture systems
- Policy frameworks for agrivoltaic and DEU deployment
- Financing models (PPP, carbon credits, green bonds)
- SDG-aligned impact assessment methodologies

SUBMISSION PROCEDURE

Researchers, academicians, and industry practitioners are invited to submit original research papers to this **special session on Innovative Approaches to Downstream Energy Utilisation from Solar Irrigation Pumps: A Convergence of Agrivoltaics, Smart Agriculture, Energy Systems, and Agribusiness Intelligence** by **20 May 2026**.

All submissions must be original and should not be under review or published elsewhere. Papers must be prepared and submitted in accordance with the conference manuscript submission guidelines available at: <https://icicesconference.com/paper-submission>

All submitted papers will undergo a double-blind peer review process.

IMPORTANT NOTE

While submitting the manuscript, authors must clearly mention the Special Session Title at the top of the first page of the paper (above the paper title) to ensure correct consideration under this special session.