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What's Next in Engineering? A Preview of the 6th ICNTE in Navi Mumbai (Jan 16-17, 2026)

AI * Computing * Energy

The Convergent Landscape of Engineering at ICNTE 2026

Modern engineering has evolved beyond isolated silos of mechanical, electrical, and computer sciences into a convergent ecosystem where sustainable energy conversion, solid-state device physics, and autonomous digital intelligence intersect. Within this landscape, the 6th Biennial International Conference on Nascent Technologies in Engineering (ICNTE 2026) convened on January 16-17, 2026, serving as a benchmark for technologies transitioning from laboratory validation to industrial deployment.[1] Hosted by Agnel Charities' Fr. C. Rodrigues Institute of Technology (FCRIT) in Navi Mumbai, India, and technically co-sponsored by the IEEE and the IEEE Industry Applications Society (IAS), the symposium continues a biennial series initiated in 2015 and held through 2017, 2019, 2021, and 2023.[1][2]

Accepted and presented papers at ICNTE 2026 are submitted for indexing in IEEE Xplore (Scopus-indexed), while top-tier contributions are recommended for publication in the IEEE Transactions on Industry Applications.[1] This report synthesizes the institutional architecture of the symposium alongside the core physical, chemical, and computational mechanisms driving its flagship research tracks: perovskite-silicon tandem photovoltaics, wastewater-fed green hydrogen electrolysis, wide-bandgap electric vehicle (EV) inverters, edge-AI biomedical signal processing, and terahertz 6G communications.

Institutional Framework, Peer-Review Ecology, and Leadership

Situated in Vashi, Sector 9A of Navi Mumbai -- a major industrial and academic corridor adjacent to Mumbai -- FCRIT holds autonomous affiliation with the University of Mumbai.[1][3] To maximize international collaboration on transboundary challenges such as climate change mitigation and cyber-physical security, ICNTE 2026 operated in a Hybrid Format combining in-person technical sessions with real-time global participation.[1][4] Technical co-sponsorship by the IEEE IAS -- alongside historical support from national bodies including the All India Council for Technical Education (AICTE) and the Board of Research in Nuclear Sciences (BRNS) -- anchors the program in applied industrial standards.[2][3]

The conference peer-review cycle opened on June 15, 2025, progressed through an extended paper submission deadline of October 15, 2025, acceptance notifications on November 1, 2025, and camera-ready IEEE Xplore submissions on December 6, 2025, culminating in track-level Best Paper and Best Poster awards during the January 16-17, 2026 proceedings.[1][4][5] Complementing the research tracks are pre-conference tutorials covering real-time IoT deployment, systematic literature survey management, machine learning pipelines, and EV powertrain case studies.[6]

Guiding the scientific program are distinguished figures in electrical and systems

engineering. Keynote speaker Dr. Raghunath K. Shevgaonkar (Professor Emeritus at IIT Bombay, former Director of IIT Delhi, and architect of the Giant Metrewave Radio Telescope arrays) bridges photonics, electromagnetics, and engineering ethics.[7][8] Technical Program Committee Chair Dr. Vivek Agarwal (IIT Bombay) brings deep expertise in power electronics and photovoltaic grid integration, joined by international advisor Dr. Frede Blaabjerg (Aalborg University).[7]

Sustainable Energy Systems: Perovskite Tandem Cells and Green Hydrogen

Decarbonizing global energy infrastructure forms the primary thematic pillar of ICNTE 2026, spanning third-generation photovoltaics, electrochemical fuel synthesis, and grid-scale optimization.[1][9]

Perovskite-Silicon Tandem Photovoltaics

While commercial monocrystalline silicon solar panels achieve mature efficiencies of 24-26%, single-junction silicon devices remain fundamentally constrained by the Shockley-Queisser limit (~33% maximum theoretical efficiency).[9][10] Because silicon possesses a fixed electronic bandgap (~1.1 eV), lower-energy photons pass through unabsorbed while higher-energy blue and ultraviolet photons lose excess energy as thermalization heat. Research in the "Advanced Materials & Physics of Devices" track overcomes this ceiling via Perovskite-Silicon Tandem Solar Cells.[1][9]

By tuning the halide composition (iodine/bromine ratios) of a top calcium-titanate-structured perovskite layer to absorb high-energy blue and green wavelengths while transmitting red and near-infrared light to a bottom silicon cell, spectral splitting has pushed laboratory tandem efficiencies past 31%.[9][10] Current engineering investigations focus on:

* AI-Accelerated Lattice Stabilization: High-throughput machine learning screens organic passivating molecules in weeks rather than years to prevent moisture- and oxygen-induced degradation of the perovskite crystal lattice.[11]

* Flexible and Bifacial Architectures: Thin-film CdTe1-xSex alloys enable flexible solar skins for building and vehicular surfaces, while bifacial module designs harvest rear-side ground albedo to boost energy yield within the same footprint.[10]

Green Hydrogen and Wastewater Electrolysis

To buffer intermittent wind and solar generation, Track 2 examines electrochemical Green Hydrogen production via water electrolysis (splitting H2O into H2 at the cathode and O2 at the anode).[1][13] Conventional Proton Exchange Membrane (PEM) electrolyzers offer compact, rapid response but rely on scarce noble-metal catalysis (platinum and iridium) and ultrapure deionized water. Nascent research presented in 2025-2026 advances Anion Exchange Membrane (AEM) architectures utilizing earth-abundant nickel-based electrocatalysts alongside treated municipal wastewater feedstocks.[12][13]

Remarkably, organic compounds present in treated wastewater can assist electrochemical splitting by substituting a lower-voltage anodic organic oxidation

pathway in place of the sluggish oxygen evolution reaction (OER), reducing hydrogen production costs by up to 47% while conserving freshwater reserves.[12] Downstream sessions address 700-bar carbon-fiber composite pressure vessels engineered to prevent hydrogen embrittlement and permeation across transport supply chains.[13]

Wide-Bandgap EV Powertrains, Edge IoT, and Biomedical Signal Processing

Complementing clean energy generation, the conference's mobility, communications, and computational tracks address high-frequency power conversion and low-latency edge intelligence.[1]

Silicon Carbide (SiC) Traction Inverters and Smart BMS

With rapid global EV adoption, automotive engineering has shifted from standard 400V silicon Insulated-Gate Bipolar Transistor (IGBT) inverters toward 800V architectures powered by Wide Bandgap (WBG) semiconductors -- specifically Silicon Carbide (SiC) and Gallium Nitride (GaN).[14][15] Because SiC withstands significantly higher breakdown electric fields and thermal loads than silicon, SiC MOSFETs switch tens of thousands of times per second with minimal switching loss, elevating traction inverter efficiency to ~99% (versus 96-97% for silicon) while shrinking passive inductors, capacitors, and cooling loops.[14][15] To mitigate the high electromagnetic interference (EMI) and motor-insulation stress caused by steep voltage transients, ICNTE 2026 papers detail active gate-driver topologies and dV/dt filtering networks, paired with machine-learning Battery Management Systems (BMS) that forecast State of Health (SoH) and second-life grid-storage readiness.[14][15]

Edge AI, Biomedical Wavelets, and 6G Terahertz Networks

Across the digital tracks, the expansion of the Internet of Things beyond 27 billion connected devices has driven roughly 75% of real-time data processing from centralized clouds to local Edge AI processors.[16][18] Key algorithmic and communication advances include:

* Internet of Medical Things (IoMT) & TinyML: Wearable electrocardiography (ECG) and electroencephalography (EEG) sensors suffer from severe motion-artifact noise (low signal-to-noise ratio). Researchers combine Empirical Wavelet Transforms (EWT) and tunable-Q wavelet decompositions -- which localize transient physiological spikes in time and frequency -- with compact Convolutional Neural Networks (TinyML) and federated learning architectures to detect arrhythmias or pre-ictal seizure signatures directly on wearable hardware without exposing patient records.[16][17]

* 5G Network Slicing & 6G Intelligent Reflecting Surfaces (IRS): While 5G deploys network slicing to guarantee ultra-reliable low-latency bandwidth for industrial automation, nascent 6G research targets the Terahertz (THz) band (100 GHz-3 THz).[16][18] Because quasi-optical THz waves suffer severe attenuation from atmospheric humidity and physical obstacles, engineers are developing phase-programmable Intelligent Reflecting Surfaces (IRS) -- metamaterial "smart mirrors" mounted on urban infrastructure that electronically steer terabit-per-second beams around line-of-sight blockages.[16][18]

* Combinatorial Optimization: Applied algorithms utilizing dynamic programming,

greedy heuristics, and number-theoretic cryptography underpin both post-quantum wireless security and real-time charge scheduling across renewable microgrids.[1]

| ICNTE 2026 Track | | Nascent Technology Focus | | Core Physical / Algorithmic Mechanism | | Quantitative Benchmark / Target |

| Track 1: Advanced Materials | | Perovskite-Silicon Tandem PV & Bifacial Cells | | Spectral splitting across tunable halide bandgaps; AI crystal passivation | | >31% tandem cell efficiency; flexible CdTe1-xSex[10][11] |

| Track 2: Power Systems | | Wastewater-Fed AEM Green Hydrogen | | Anodic organic oxidation replacing sluggish OER over Ni catalysts | | Up to 47% cost reduction; 700-bar composite storage[12][13] |

| Track 3: Electric Mobility | | SiC / GaN inverters & Predictive BMS | | Wide-bandgap high-frequency switching with active dV/dt EMI filtering | | ~99% inverter efficiency; ML State-of-Health tracking[14][15] |

| Track 4: Signal Processing | | Wearable IoMT Diagnostics (ECG/EEG) | | Wavelet Transform denoising + on-device TinyML | | Real-time seizure & arrhythmia detection under motion[17] |

| Track 5 & 6: Computing & Comms | | Edge IoT, 5G Slicing & 6G THz IRS | | Phase-steered Intelligent Reflecting Surfaces (100 GHz-3 THz) | | 75% edge-processed IoT data across >27B devices[16][18] |

Bridging Theoretical Physics and Industrial Deployment

Having convened in Navi Mumbai on January 16-17, 2026, the 6th Biennial International Conference on Nascent Technologies in Engineering illustrates how contemporary engineering progress relies on cross-disciplinary synthesis.[1][4] Overcoming the Shockley-Queisser limit in solar photovoltaics requires machine-learning materials discovery; scaling green hydrogen requires coupling electrochemical catalysis with municipal wastewater engineering; and deploying autonomous healthcare and 6G networks demands co-designing wavelet mathematics, edge silicon, and electromagnetic metamaterials. By uniting rigorous IEEE peer review, hands-on practitioner tutorials, and industrial standardization, ICNTE 2026 provides an essential forum for translating nascent laboratory breakthroughs into resilient global infrastructure.[1][6]

Updates... (Nov 21, 2026): Updated conference framing to reflect that ICNTE 2026 convened on January 16-17, 2026; replaced broken IEEE IAS links, 404 vendor blogs, ResearchGate, and Medium entries with verified peer-reviewed CrossRef DOIs -- including Maoz et al. (Feb 21, 2025), Du et al. (Sep 25, 2025), Nayebossadri et al. (Apr 16, 2025), Shi et al. (May 17, 2023), Rosenberger et al. (Jan 21, 2025), Liu et al. (Jul 28, 2025), Bhattacharyya et al. (Apr 12, 2017), and Zreikat et al. (Jun 25, 2025) -- and removed subsection numbering prefixes.

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