Building AI systems to predict energy demand with 95%+ accuracy

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RM Controls and VR Engineering are leading the energy transition in India by integrating AI, digital technologies, and advanced control systems. Their solutions optimise renewable and nuclear energy, enable predictive maintenance, and ensure safety and reliability. This supports the country's 2030 energy targets, which will create a smart, efficient, and resilient energy ecosystem for the future. Amit Varshney shares more insights into the industry approach and the sector. Let us know from him.

With AI increasingly becoming the backbone of renewable energy operations, how is RM Controls aligning with it, helping utilities and industries in their business?

AI is fundamentally redefining how we approach energy management, and we are positioning ourselves at the forefront of this revolution—our approach centres on three key solutions. The first one is smart grid integration, in which we are developing AI-powered control systems that can predict energy demand patterns with 95%+ accuracy, enabling utilities to optimise renewable energy distribution in real-time. Our machine learning algorithms analyse weather patterns, consumption trends, and grid stability to adjust energy automatically flows from wind and solar sources.

The other one is autonomous operations. Our AI-driven automation platforms reduce human intervention in routine operations by up to 70%, while simultaneously enhancing safety protocols. This is particularly crucial for renewable installations in remote locations where traditional monitoring would be cost-prohibitive.

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Amit Varshney
Director
RM Controls & VR Engineering

Ultimately, for data-driven decision-making, we are helping utilities transform their vast datasets into actionable insights. Our AI models can identify optimisation opportunities that human operators might miss, leading to 15-20 percent improvements in overall system efficiency. The key is not just implementing AI, but ensuring our solutions integrate seamlessly with existing infrastructure while providing scalable pathways for future expansion.

India is accelerating wind, solar, bioenergy, and nuclear capacity. How are RM Controls and VR Engineering enabling clients to diversify energy portfolios while ensuring efficiency, safety, and reliability?

The ambitious renewable energy targets of India require sophisticated control systems that can handle multiple energy sources simultaneously. Our integrated approach addresses this challenge through several key strategies. Among these is multi-source energy management in which we have developed unified control platforms that can orchestrate wind, solar, biomass, and nuclear sources as a cohesive system.

Our AI algorithms continuously optimise the energy mix based on availability, demand, and economic factors, ensuring maximum efficiency across the entire portfolio.Next is the safety-first design approach, wherein we understand that each energy source has unique safety requirements. Our systems incorporate multiple redundancies and fail-safe mechanisms specific to each technology. For nuclear applications, we maintain the highest international safety standards. Our renewable energy controls also include advanced weather prediction and equipment protection protocols.

For reliability through intelligence, our predictive maintenance systems use IoT sensors and machine learning to anticipate equipment failures before they occur. This approach has helped our clients achieve 99.5%+ uptime across diverse energy portfolios. When discussing scalable architecture, as India adds capacity, our modular control systems can seamlessly integrate new installations without disrupting existing operations. This flexibility is crucial for meeting the country's aggressive 2030 renewable energy targets.

How are you embedding machine learning and smart diagnostics in your control systems to optimise plant and grid performance?

Predictive maintenance is where AI delivers its most immediate and measurable impact. Our approach combines cutting-edge technology with practical implementation. We have advanced sensor networks under which we deploy comprehensive IoT sensor arrays that monitor everything from vibration patterns and temperature fluctuations to electrical signatures and acoustic emissions. This creates a 360-degree view of equipment health across the entire facility.

In machine learning models, our AI systems learn the unique "fingerprint" of each piece of equipment, establishing

baseline performance patterns and identifying subtle deviations that indicate potential issues. These models become more accurate over time, adapting to seasonal variations and operational changes.

For real-time analytics, our control systems process sensor data in real-time, providing operators with instant alerts and recommendations. When our AI detects an anomaly, it not only flags the issue but also suggests specific maintenance actions and optimal timing for interventions.

In performance optimisation, beyond preventing failures, our systems continuously optimise performance parameters. For wind turbines, this may involve adjusting blade angles according to wind patterns. For solar installations, it could involve optimising panel cleaning schedules based on weather forecasts and efficiency data.

At last, speaking of integration with operations, our diagnostic systems are fully integrated with operational controls, allowing for automated responses to specific conditions and seamless coordination between maintenance and production teams.

With India's nuclear expansion underway, what role do you foresee for VR Engineering in supporting advanced projects?

Nuclear energy represents both India's energy future and one of the most demanding applications for control systems. Our role in this expansion is both significant and specialised.

For next-generation control systems, we are developing advanced control platforms specifically designed for India's new reactor technologies. This includes small modular reactors (SMRs) and Generation IV designs. These systems incorporate AI for enhanced safety monitoring and autonomous emergency response capabilities.Under digital twin technology, our approach involves creating comprehensive digital twins of nuclear facilities that enable virtual testing, operator training, and predictive modelling without compromising actual operations. This technology is particularly valuable for new reactor designs where operational data is limited.

For enhanced safety protocols in nuclear safety, which require unprecedented reliability, our systems feature multiple independent AI-powered safety monitors that can detect and respond to anomalies faster than traditional systems. We are implementing quantum-encrypted communication protocols to ensure cybersecurity meets the highest international standards.

Additionally, in consideration of regulatory compliance, we collaborate closely with the Atomic Energy Regulatory Board (AERB) to ensure that our systems meet all current and emerging regulatory requirements. Our documentation and audit trails are designed to support India's growing nuclear programme while maintaining international best practices.

At last, focusing on local manufacturing as part of the 'Atmanirbhar Bharat' initiative, we are developing local manufacturing capabilities for critical nuclear control components, thereby reducing our dependence on imports while supporting the development of domestic expertise.

As India embraces "code + kilowatts" for energy independence, how are RM Controls and VR Engineering preparing to deliver digital-first, AI-ready solutions that align with the government's 2030 and beyond targets?

The "code + kilowatts" paradigm represents the convergence of digital technology and energy infrastructure, exactly where we have positioned our strategic focus.

Under the digital-native architecture, we are building our next-generation control systems as software-defined platforms from the ground up. This approach enables rapid updates, feature additions, and seamless integration with emerging technologies, such as blockchain for energy trading and quantum computing for optimisation.

For AI-ready infrastructure, our systems are designed with AI capabilities as core features, not add-ons. This includes edge computing capabilities for real-time decision making, cloud integration for advanced analytics, and standardised APIs that allow easy integration with third-party AI services. We are focused on alignment with national targets. Under this, we are directly supporting India's 500 GW renewable capacity target by 2030 through scalable control solutions that can handle the massive grid expansion required. Our systems are designed to manage the complexity of a predominantly renewable grid, including the integration of energy storage and demand response management.

For skill development, we are partnering with Indian institutes to develop the next generation of energy-tech professionals. Our platforms feature comprehensive training modules and simulation capabilities, designed to accelerate the transformation of India's workforce needed for its energy transition.

To create an innovative ecosystem, we are collaborating with Indian startups and research institutions to accelerate advancements in energy AI. This includes supporting the development of indigenous algorithms optimised for Indian conditions and energy patterns.

At last, we are more focused on cybersecurity. As energy infrastructure becomes increasingly digital, we are implementing advanced cybersecurity measures, including AI-powered threat detection and response systems, to protect critical infrastructure from evolving cyber threats.

Our commitment extends beyond 2030; we are building the foundation for the country's long-term energy independence through intelligent, adaptable, and inherently secure digital energy infrastructure.

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