AI applications for energy and energy R&D

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The talk explores NREL's dual approach to Artificial Intelligence (AI) and energy: leveraging AI for energy applications and optimizing energy consumption for AI.

For "AI applications for energy," NREL deploys advanced AI solutions across energy systems. This includes scientific foundation models for renewable energy forecasting, Large Language Models (LLMs) and agents for accelerating research workflows, and AI for real-time control, manufacturing science, and grid optimization. Uncertainty quantification and multi-modal Bayesian neural networks are key aspects of NREL's commitment to fundamental methods development that underpin the applications.

Under the umbrella of "energy for AI," NREL pioneers computationally efficient algorithms and low-power computing. This involves low-precision calculations and ML pruning to reduce energy consumption during AI training and inference. Energy-aware AI extends to on-device forecasting, microgrid coordination, and fault-tolerant edge AI in constrained environments. These advances tie into NRELs datacenter R&D leadership, such as the chips-to-grid partnerships that couple the impacts of energy-efficient AI hardware with electrical infrastructure and developing the control system validation for grid interactive datacenters. NREL's holistic strategy aims for a secure energy future enabled by AI.