

NDE 4.0 for the Electric Power Industry Low Carbon Energy Future

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The energy and electric power industry is decarbonizing; progressing through a transformative change called the Low Carbon Energy Future (LCEF). Globally, electric power production is evolving; increasing power generation with low to no carbon energy resources, i.e., wind, solar, hydropower and advanced nuclear. Hydrogen, carbon capture utilization and storage (CCUS), advanced nuclear, and novel power cycles will be the catalysts to extend beyond 50% reduction by 2030 to achieving net-zero carbon energy by 2050. NDE 4.0 will redefine how non-destructive evaluation (NDE) technology and processes will transition to meet the changing demands for the LCEF electric power industry. Increased power production from low to no-carbon energy resources offers new and diverse asset management challenges. Utilization of different materials, i.e., composites for wind power, piping, and concrete repairs; higher thermal operating ranges for advanced power sources; and operating generation sources in more flexible operating schemes pose unique challenges for implementation of NDE. Integrating structural health monitoring and advanced NDE 4.0 technology must become an essential part of the power system design and asset management plan for these low carbon energy assets. Additionally, performance of NDE needs to factor the future workforce; taking the human out of harms way; harmonizing their skills and expertise in symbiosis with machines as automation and artificial intelligence becomes the norm. Within this research, the Electric Power Research Institute (EPRI) will develop a strategic research plan to assimilate NDE 4.0 to meet the asset management challenges for the LCEF. The NDE 4.0 plan will comprise of research-based roadmap that identifies key focus areas for successfully adopting NDE 4.0 technologies within the inspection process. This research will provide an overview of NDE 4.0's value to the industry and an update of EPRI's roadmap to execute a NDE 4.0 program for a decarbonized electric power industry.