

Westinghouse Electric Company LLC

The eVinci™ Micro Reactor Nuclear Demonstration Unit Readiness Project

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Pathway: First of a Kind Demonstration Project

Key Collaborators:

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Abstract

The mission of this project is for Westinghouse and the associated team to prepare for construction of the Nuclear Demonstration Unit (NDU) for the eVinci™ Micro Reactor through design, analysis, testing and licensing to fabricate, assemble and install it on site by 2022, with subsequent testing of the NDU by 2023.

The project will also solidify the necessary supply chain for the NDU and address the expected costs for the commercial deployment of the eVinci product by 2025. Specific objectives include completion of the basic design of the eVinci Micro Reactor that enables the detailed design of the NDU; addressing the significant technical uncertainties through testing, modeling and simulation; estimation of eVinci procurement and manufacturing costs; establishment of key supply chain needs and manufacturing capabilities for the NDU; selection and qualification of the probable site for the NDU; creation of an NDU project execution plan; and obtaining a license to construct the NDU at the selected site.

Project Description. The mission of this project is to complete all of the tasks necessary to prepare the project team to construct a NDU. The proposed project work scope entails five main categories: (i) eVinci Basic Design, (ii) Testing, (iii) NDU Detailed Design and Evaluations, (iv) Licensing, and (v) Program Administration. The completion of the proposed work scope will deliver a NDU project execution plan to fabricate and construct the NDU.

Major Tasks, Phases or Planned Approaches. The following major tasks are associated with this project.

eVinci Basic Design – At the beginning of the project, the eVinci program will be transitioning from the Conceptual Design phase to Basic Design phase. As such, this project will comprise of initiating and completing the Basic Design phase. The design process will be conducted using the IWEP (Integrated Work Execution Program) systems engineering process developed by Westinghouse for new reactor development. After Basic Design, the detailed design will branch off into two separate, parallel configurations of the Detailed Design: (i) Commercial eVinci and (ii) NDU.

Testing – Significant testing will be required to progress eVinci models to the level of certainty required for reactor licensing. Westinghouse will address this complex issue by using well established tools, such as a Phenomena Identification and Ranking Table (PIRT) and a Failure Modes and Effects Analysis (FMEA) to structure the testing and modeling programs. These testing programs are: Electrical Demonstration Unit (EDU) and Integral Effects Tests (IETs), Separate Effects Tests (SETs) and Fuel System Qualification Tests (FQTs).



NDU Detailed Design and Evaluations – Following Basic Design, the project will execute the Detailed Design of the NDU that will follow the Westinghouse IWEPE systems engineering process. Throughout the various stages of the NDU development, the project scope will demonstrate the functions, characteristics and performance of the NDU: (i) procurement, (ii) fabrication, (iii) assembly, (iv) construction, (v) safety, (vi) operation, (vii) transportation, (viii) accident mitigation, (ix) decontamination and (x) cost.

NDU Licensing – The safety case for the NDU will be developed based on pre-licensing engagement with the regulator using the guidance included in NUREG-1537 to generate the submittal. Westinghouse will complete the NDU Construction License application and gain regulatory acceptance of the application.

Program Administration – This work scope comprises the overall programmatic and business development support and schedule tracking, quality compliance, requirement management and configuration management within the prime, subrecipients and subcontractor organizations. This scope also includes business development and outreach activities.

Methods to be Employed. The Westinghouse Global Project Excellence Procedure (GPEP) W2-10.2-101 is the guiding instruction used by Westinghouse that provides a repeatable, standard project management process, to successfully deliver projects and programs. This procedure is founded on industry best practices and closely aligned with Project Management Institute (PMI®).

List of Major Deliverables. Within the proposed scope of work, the following are the major deliverables planned as a result of successful completion of the project:

- Basic Design Package for the eVinci Micro Reactor product
- Safety Analysis Document for the eVinci Micro Reactor design
- Detailed Design Package for the eVinci NDU
- Cost Estimate for the eVinci NDU
- Procurement and Manufacturing Plan for the eVinci NDU
- Site Selection and Qualification Plan for the eVinci NDU
- Project Execution Plan for the eVinci NDU
- Construction License Application for the eVinci NDU

Potential Impact of the Project. The deployment of the eVinci Micro Reactor will disrupt the energy and nuclear industry with a robust, yet versatile product that will differentiate it from current large nuclear technologies. The eVinci design is well positioned to be the product of choice for small generation needs and microgrid power sources. Based on the size of the eVinci Micro Reactor, energy generation consumers will now have a robust, reliable and non-carbon emitting alternative to the fossil fuel-based gas turbines, fuel cells and diesel generators in distributed generation. This cost-competitive energy source could create a paradigm shift in energy resilience needed for distributed generation, as well as other microgrids. The Westinghouse eVinci Micro Reactor development timeline is also aligned to fulfill the 2019 NDAA requirement to demonstrate a micro reactor for powering critical U.S. installations before 2027 using the NDU or a commercial pilot unit.

Major Participants. Westinghouse is leveraging key partners as subrecipients in the execution of this project scope. Westinghouse has established a strategic partnership with Los Alamos National Laboratory (LANL) for the application of heat pipe technology within the eVinci design. Additionally, Westinghouse is working closely with Idaho National Laboratory (INL) to qualify the fuel and to perform site assessments to host the NDU. To assist with reactor licensing, siting, microgrid interface and remote monitoring, Westinghouse has engaged Southern Company Services as a key partner as a power plant owner and operator to develop the microgrid interface and remote monitoring system. This combined team brings together the needed knowledge and experience to ensure success in the development, demonstration and commercialization of the eVinci Micro Reactor product.

