IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 60, Sept. 2025

Rapid Iteration of HTS Magnet Technologies for Levitated Dipole Systems

Rod Badcock, Sriharsha Venuturumilli, Konstantinos Bouloukakis, Theo Wordsworth, Nancy Zhou, Tom Simpson, Emily Kei-Brewerton, James Rice, Kris Chappell, Mick McCrohon, Zvonko Lazic, Bradley Leuw, Emily Hunter, Raymond Hu, Kent Hamilton, Matthew Lynch, Thomas Berry, Darren Garnier, Craig Chisholm, Josh Ellingham, Patrick Coulson, and Ratu Mataira

OpenStar Technologies Ltd., New Zealand

E-mail: rod.badcock@vuw.ac.nz

***Abstract*–OpenStar is advancing fusion energy generation through the development of a levitated dipole reactor, building on the Levitated Dipole Experiment (LDX) concept. This approach integrates high-temperature superconducting (HTS) magnets with an onboard superconducting power supply.**

Having successfully demonstrated the feasibility of integrating HTS magnets into the levitated dipole concept, OpenStar now focuses on an accelerated roadmap toward practical fusion energy. The levitated dipole concept features a highly decoupled system comprising of a magnet and a reactor container, enabling rapid iteration of magnet technologies without requiring significant modifications to the reactor's core components.

However, the pace of magnet technology development towards high performance, and the progress of plasma science, is inherently tied to the production timeline of innovative and gradually stronger magnets. To address this challenge, OpenStar prioritizes rapid iterations of magnets and their associated onboard technologies. Over the past two and a half years, OpenStar has successfully constructed two magnets and plans to deliver two more within the next 18 months.

These new magnets will feature improved levitation times (less than 2 hours) and/or enhanced magnetic field strengths, all leveraging coil-based technology. These magnets will be designed with modularity features and standardized interfaces for the surrounding systems to further support rapid iteration and innovation of magnet related technologies.

This presentation highlights OpenStar's advancements in coil-based HTS magnet technologies, showcasing their role in developing a rapid technology platform. It explores the design and the

contribution in accelerating fusion technology development of four conduction-cooled magnet designs, operating at temperatures ranging from 25K to 50K, achieving magnetic field strength from 3T to 12T, and current range from 700A to approximately 2 kA.

Keywords (Index Terms)–Levitation, Energy Transition, Flux Pump, Fusion, HTS Magnet

IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 60, Sept. 2025.
Presentation given at MT29, Boston, MA, USA, July 2025.