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Exploration and Potential of Geologic Hydrogen Production in the Eastern Snake River Plain, Idaho, USA: A Pathway to Net-Zero Emissions

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A significant component to international energy net-zero emission goals is the exploration, production, and utilization of hydrogen. It is estimated that the International Energy Agency's goal to reduce emissions will require approximately 550 megatons of hydrogen annually. While traditional generation methods through electrolysis (green hydrogen) and from fossil fuels (blue hydrogen) are potential pathways, they each come with challenges in terms of critical minerals consumption and CO2 sequestration. An alternative and promising source of meeting these goals is geologic hydrogen, naturally produced within the Earth's subsurface. Recent studies estimate that over 20 megatons of hydrogen seep from various geological formations annually. A team led by industry pioneers, Pristine Energy and researchers from the Idaho National Laboratory aim to explore the potential of geologic hydrogen in the Eastern Snake River Plain (ESRP), Idaho, USA. The ESRP is characterized by iron-rich basalt formations and mid-crustal mafic sills, both conducive to hydrogen production through serpentinization. Additionally, geothermal gradients and geochemical fingerprinting suggest the potential for rapid serpentinization at depth, giving insight into geologic hydrogen conversion kinetics. This project will proceed through a systematic approach including a thorough literature review, detailed field sampling, field instrumentation and measurements, lab characterization, and preliminary modeling. Gas, water, and soil samples will be collected from identified fissures, faults, hot springs, and existing wells to identify source and estimate rates and quantities of generated hydrogen. Hydrogen concentrations will be measured using advanced sensors and characterized via gas chromatography-mass spectrometry (GC-MS). High-seepage locations will undergo continuous monitoring to understand seasonal variations in hydrogen emissions. This innovative approach leverages the unique geological attributes of the ESRP to contribute significantly to geologic hydrogen exploration and assessment workflows, and ultimately to the global hydrogen supply, supporting net-zero emission goals.