

Nuclear-renewables-oil shale hybrid energy system

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The Idaho National Laboratory and the Massachusetts Institute of Technology are working to determine if a hybrid energy/fuel production system can be economically developed via use of a light-water reactor (LWR) for (1) electricity generation at times of high electricity demand and (2) heat production for oil shale retorting at times of low electricity demand. Based on known reserves, this conceptual nuclear hybrid energy system (HES), if fully developed, could deliver up to 5 million barrels per day of high-quality petroleum products for hundreds of years. A systems dynamics model will be developed to assess potential application of this HES for the Western grid as a function of LWR capacity using hourly price data. The base-load LWR would produce steam for shale oil production and electricity for the grid that could (1) reduce use of fossil fuel based electric plants for electricity production, and thereby reduce greenhouse gas emissions, (2) enable increased use of renewable energy (wind, solar) by providing hourly to seasonal electricity backup, and (3) produce low-cost shale oil with low-cost heat on the scale needed to significantly reduce consumption of imported oil. This approach provides a novel means of meeting highly variable electricity demand while using low-demand electricity to supply heat for hydrocarbon fuel production. This is possible because heat transfer in the subsurface is slow enough that months to years are needed for retorting, so the heat input can be varied without significant economic penalties. The proposed HES could represent a major market for small modular reactors because (1) resource heat requirements may limit heat demand at a single site, (2) arid western sites are amenable to dry cooling and (3) rail access is frequently available for the large equipment needed.