TITLE: *Energy in a Planetary Context*

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ABSTRACT: The potential present day habitability of solar system bodies beyond Earth is limited to subsurface environments, where the availability of energy in biologically useful form is a paramount consideration. Energy availability is commonly quantified in terms of molar Gibbs energy changes for metabolisms of interest, but this can provide an incomplete and even misleading picture. A second aspect of life's requirement for energy – the rate of delivery, or power – strongly influences habitability, biomass abundance, growth rates, and, ultimately, rates of evolution. We are developing an approach to quantify metabolic power, using a cell-scale reactive transport model in which physical and chemical environmental parameters are varied. Simultaneously, we evaluate cell-specific energy flux requirements and their dependence on environmental "extremes". Comparison of metabolic power supply and demand provides a constraint on how biomass abundance varies across a range of environmental parameters, and thereby a prediction of the relative habitability of different environments. We are evaluating the predictive capability of this approach through comparison to observed distributions of microbial abundance in a range of subsurface (predominantly serpentinizing) systems.