Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Performance Assessment of a Wells Turbine with Morphing Blades KELLIS KINCAID, DAVID MACPHEE, The University of Alabama — Wells turbines are often used to harvest energy from ocean waves when paired with an oscillating water column. Due to the necessity of self-rectifying characteristics in this design, blades are typically mounted normal to the flow direction, resulting in a narrow effective operating region and unfavorable attack angles as flow rate through the turbine increases. Various methods have been proposed to solve this issue, including guide vanes, active and passively actuated blades, and a static blade setting angle which takes advantage of the asymmetric nature of the reversing flow through the turbine in realistic operating conditions. This work uses a solver based in the OpenFOAM framework to investigate any performance gains realized by incorporating a flexible or "morphing" trailing edge to the turbine blades. With this modification, blades can deflect passively due to aerodynamic forces, resulting in lower effective angles of attack, higher torque output, and delayed onset of stall. In this work, simulation results for both flexible and rigid turbines are analyzed and compared, with discussions on flow structures and material deformations as they relate to turbine performance.

David MacPhee
The University of Alabama

Date submitted: 31 Jul 2019 Electronic form version 1.4