We present a formulation for the phonon spectral energy density which can predict phonon properties using *only* the velocities obtained from molecular dynamics simulations. This formulation of the phonon spectral energy requires no knowledge of the phonon properties (frequencies, eigenvectors) *a priori*. Using this formulation, we calculate the spectral energy density of 3 systems; Lennard-Jones argon, bulk silicon, and carbon nanotubes (CNTs). Using this formulation, phonon properties (frequencies, group velocities, and relaxation times) are measured and compared to anharmonic lattice dynamics (ALD) and normal mode decomposition (NMD).