Potential temperature is the variable whose evolution equation has been treated as the oceanic version of the First Law of Thermodynamics; that is, we have regarded the advection and diffusion of potential temperature as the advection and diffusion of "heat". To date in physical oceanography we have treated potential temperature as though it were a conservative variable, however the non-conservative source terms that arise in the evolution equation for potential temperature are estimated to introduce errors in ocean models as large as 1.4 degrees Celsius in some regions of the ocean and are estimated to be two orders of magnitude larger than the corresponding source terms for Conservative Temperature. In this talk the non-conservative source terms of potential temperature, Conservative Temperature and entropy will be derived, then quantified using the output of a coarse resolution ocean model, and compared to the rate of dissipation of mechanical energy, epsilon. It is shown that the error incurred by ocean models in assuming that Conservative Temperature is conservative is approximately 120 times smaller than the corresponding error for potential temperature and at least 1200 times smaller than the corresponding error for entropy. Furthermore, the error in assuming that Conservative Temperature is conservative is approximately 6 times smaller than the error in ignoring epsilon. Hence Conservative Temperature can be accurately regarded as a conservative variable and therefore should now be used in place of potential temperature in physical oceanography, including as the prognostic temperature variable in ocean models.