

### ***Water-Energy-Environment Nexus: Fallacy of Desalination Processes Comparison***

The major concern of desalination industry is the inadequate approach in energy efficiency of diverse seawater desalination processes by omitting the grade of energy supplied. These conventional approaches would suffice if the efficacy comparison were to be conducted for the same energy input processes. The misconception of considering all derived energies as equivalent in desalination industry has severe economic and environmental consequences. In the realms of the energy and desalination system planners, serious judgmental errors in process selection of green installations are made unconsciously as the efficacy data are either flawed or inaccurate. The inferior efficacy technologies implementation decisions were observed in many water stressed countries that can burdened a country's economy immediately with higher unit water and energy costs, as well as causing greater undesirable environmental effects to the surroundings. We proposed, a standard primary energy (SPE) based thermodynamic framework is presented that addresses the energy efficacy fairly and accurately. It clearly shows that thermally driven process consume 3-4% of SPE when combined with power plants. We also presented that standard universal performance ratio (SUPR) for all desalination processes varies from 13-20% of thermodynamic limit but with best technologies mix and proper economic analysis approach can help to save energy for future sustainability. We also proposed future roadmap that is important to achieve 2030 sustainability goals.