

2016 John R. Freeman Lecture

# Desalination for water supply: Is energy consumption manageable?

**Prof. John H. Lienhard V**

*Director, Abdul Latif Jameel World Water and Food Security Lab  
Massachusetts Institute of Technology*

**April 11, 2016**

**Reception 6:00 pm; Lecture 7:00 pm**

**West Village F, Rm 020, Northeastern University**

<https://www.google.com/maps/place/West+Village+Residence+Complex+F,+40A+Leon+St,+Boston,+MA+02115>

**Abstract:**

The world's renewable fresh water supply may be considered to be the difference between precipitation over land and evaporation; and this supply is essentially fixed while world population rises and the water demands of growing economies rise. As a result, water scarcity is an increasing problem throughout the world, with water shortages impacting both rural and urban populations and with substantial environmental damage as a result of water diversions for human use.

Desalination has been deployed worldwide to expand the supply of freshwater, especially for coastal populations, and its use has increased rapidly, with more than 85 million m<sup>3</sup>/day of capacity now installed. The cost and lifetime of plants has also improved steadily. But concerns remain about the energy consumption of desalination. In this talk, we will discuss research directed at understanding the causes of energy inefficiency in various desalination processes and efforts to adapt concepts from thermal engineering to improve the design of both thermal and membrane desalination systems. Topics to be discussed include thermodynamic limits to performance, irreversibilities, and thermodynamic balancing, with examples drawn from reverse osmosis, humidification-dehumidification, forward osmosis, and the remediation wastewater from oil and gas production. Comparison will be made to the energy intensity of alternative sources of fresh water.

