

## Using Exergy to Enhance Ecological and Environmental Understanding and Stewardship



**Professor Marc A. Rosen**

Founding Dean

Faculty of Engineering and Applied Science

University of Ontario Institute of Technology

Oshawa, Ontario, CANADA

also: President-Elect, Engineering Institute of Canada

Email: [M.Rosen@uoit.ca](mailto:M.Rosen@uoit.ca)

**Abstract:** In efforts to understand ecological systems and environmental impact, techniques can be used which combine thermodynamics with environmental and ecological disciplines. Most such assessments consider thermodynamics in terms of energy, but it is believed by many that ecological and environmental factors are better understood using the thermodynamic quantity exergy. One rationale for this statement is that exergy, but not energy, is often a measure of the potential for ecological and environmental impact.

Here, a summary is presented of existing analysis techniques which integrate exergy and ecological and environmental factors, including exergy-based ecological indicators, exergy-based life cycle analysis and environomics. The goals of most such analysis techniques include improving our understanding of the impact on ecological systems and the environment of processes and the determination of appropriate ecological and environmental improvement measures. Several examples are considered, including the application of exergy to water-based ecosystems for understanding, predicting and improving their health. Thermodynamic, ecological and environmental data are examined, and show that correlations exist between exergy and environmental and ecological parameters. The existence of such correlations likely implies that exergy factors into environmental improvement and ecological stewardship.

### **Brief biography of the speaker:**

Dr. Marc A. Rosen is a Professor of Mechanical Engineering at the University of Ontario Institute of Technology in Oshawa, Canada, where he served as founding Dean of the Faculty of Engineering and Applied Science from 2002 to 2008. Dr. Rosen became President of the Engineering Institute of Canada in 2008. He was President of the Canadian Society for Mechanical Engineering from 2002 to 2004, and is a registered Professional Engineer in Ontario.

With over 60 research grants and contracts and 500 technical publications, Dr. Rosen is an active teacher and researcher in thermodynamics, energy technology (including cogeneration, district energy, thermal storage and renewable energy), and the environmental impact of energy and industrial systems. Much of his research has been carried out for industry.

Dr. Rosen has worked for such organizations as Imatra Power Company in Finland, Argonne National Laboratory near Chicago, and the Institute for Hydrogen Systems near Toronto. He was also a professor in the Department of Mechanical, Aerospace and Industrial Engineering at Ryerson University in Toronto, Canada for 16 years. While there, Dr. Rosen served as department Chair and Director of the School of Aerospace Engineering.

Dr. Rosen has received numerous awards and honours, including an Award of Excellence in Research and Technology Development from the Ontario Ministry of Environment and Energy, the Engineering Institute of Canada's Smith Medal for achievement in the development of Canada, and the Canadian Society for Mechanical Engineering's Angus Medal for outstanding contributions to the management and practice of mechanical engineering. He is a Fellow of the Engineering Institute of Canada, the Canadian Academy of Engineering, the Canadian Society for Mechanical Engineering, the American Society of Mechanical Engineers and the International Energy Foundation.