

**Graduate Studies in
Sustainable Energy Systems Engineering
At
The Department of Electrical and Computer Engineering
Texas A&M University**

Sustainability science and engineering will be one of the most important areas of development in the 21st century. This endeavor is larger in magnitude and more critical in nature than any other activity undertaken by mankind. The long term survival of the human race on the planet depends on it. This topic has become critical now because of the accelerated rate of growth of human technological activities since the advent of industrial revolution. The planet can no longer support the unmanaged growth of demand on the natural resources, or the pollution effects of their utilization. This is becoming progressively evident in shortages of energy and material resources and environmental impact of human activity on land, sea and air qualities.

Primary among the sustainability science and engineering fields is the production and utilization of energy and electric power. Electric power production is the lifeblood of modern human activities. It will become even more dominant as our vehicles and our knowledge systems are becoming progressively more dependent on it. Furthermore, the planetary limitations and impact of electric power production and utilization technology complex is more significant than the rest the human technological activities, combined. One particular interest in our department is the implications of sustainability for transportation and vehicles which have particular energy challenges with significant environmental impact.

Electrical engineers have a unique knowledge base to understand the sustainability of energy, and more specifically, vehicular energy systems. The electrical engineers of the 21st century will have to be well educated in the systematic science of sustainability and the engineering challenges of production and utilization of electric power. This new knowledge in electrical engineering is not only new and emerging but also inherently complex and interdisciplinary. We now understand that no single source of energy will sustain our society. Integrating multiple energy sources, including renewable sources, requires understanding the fundamental characteristics of each including their technical limitations, variability, availability, scarcity and price volatility.

The Department of Electrical and Computer Engineering at Texas A&M University has been a leader of the various aspects of sustainable power and vehicle technologies over the past two decades. Our research papers, books, courses and our graduates, in

industry and academia, have been leading the development of sustainable vehicles and sustainable electric power system technologies. We are now consolidating this experience in sustainable electric power systems and sustainable vehicle engineering by introducing an organized curriculum of academic courses, textbooks, and graduate research areas.

Below are the partial list of courses recommended for students who are interested in graduate work leading to MS and Ph.D. in Electrical Engineering with specializations in Sustainable Power Engineering and Sustainable Vehicle Engineering. The specific set of courses to be taken from by a student will depend on his or her particular interest and research area.

ECEN 611 General Theory of Electromechanical Motion Devices
ECEN 612 Computer Aided Design of Electromechanical Motion Devices
ECEN 613 Rectifier and Inverter Circuits
ECEN 630 Analysis of Power Electronic Systems
ECEN 632 Motor Drive Dynamics
ECEN 668 High Voltage Direct Current (HVDC) Transmission
ECEN 686 Electric and Hybrid Vehicles
ECEN 711 Sustainable Energy and Vehicle Systems Engineering
ECEN 489/689 Physical and Economical Operations of Sustainable Energy Systems
ECEN 689 Power Electronics for Sustainable Energy Systems

The faculty specializing in Sustainable Energy/Power Engineering and Sustainable Vehicle Engineering are:

R. Balog, Senior Member IEEE
M. Ehsani, Fellow IEEE, Fellow SAE
L. Xie, Member IEEE

Some of the books co-authored by this faculty for the above specialization are:

- Converter Circuits for Superconductive Magnetic Energy Storage, Co-Author: R. L. Kustom, Texas A&M University Press, 1988.
- More Electric Vehicles, CRC Handbook of Power Electronics, 2002.
- Hybrid Electric Vehicles, SAE SP-1633, published in 2001.
- Vehicular Electric Power Systems, Marcel Dekker, Inc. 2004.
- The 42-Volt Electrical System, Society of Automotive Engineers, Inc. PT-99, ISBN 0-7680-1297-X, 2003.
- Hybrid Drive Trains, Handbook of Automotive Power Electronics and Motor Drives” CRC Press, 2005.

- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles – Fundamentals, Theory, and Design, CRC Press, Second Edition, 2010.
- Encyclopedia of Sustainability Science and Engineering, Springer, 2012.
- M.D. Ilić and L. Xie, editors, Engineering IT-Enabled Electricity Services: The Tale of Two Low-Cost Green Azores Islands, Springer, 2012 (to appear).
- A. Kwasinski, W.W. Weaver and R. S. Balog, Micro-Grids in Local Area Power and Energy Systems, Cambridge University Press, 2013 (to appear).