

PRGR 617

Energy Efficiency in Agriculture: Evaluation and Design (2 credits)

Catalog description (2 credits):

The course will address energy use and conservation in agriculture and food production systems. The course will explore energy conservation improvements through reduced fossil fuel dependency and use of renewable resources.

No pre-requisite courses are required.

References:

- Pimentel, D., G. Rodrigues, T. Wang, R. Abrams, K. Goldberg, H. Staecker, E. Ma, L. Brueckner, L. Trovato, C. Chow, U. Govindarajulu and S. Boerke Renewable Energy: Economic and Environmental Issues. *BioScience* 44, no. 8 (Sept. 1994): 536– 547.
- Pimentel, D., G. Berardi, and S. Fast. Energy Efficiency of Farming Systems: Organic and Conventional Agriculture. *Agriculture, Ecosystems, and Environment* 9 (1983): 358–372
- Cleveland, C. J. 1995. The direct and indirect use of fossil-fuels and electricity in USA agriculture, 1910-1990. *Agriculture, Ecosystems & Environment* 55(2): 111- 121.
- Dalgaard, T., N. Halberg, and J. R. Porter, J. R. 2001. A model for fossil energy use in Danish agriculture used to compare organic and conventional farming. *Agriculture, Ecosystems & Environment* 87(1): 51- 65.
- Giampietro, M., G. Cerretelli, and D. Pimentel. 1992. Energy analysis of agricultural ecosystem management: human return and sustainability. *Agriculture, Ecosystems & Environment* 38(3): 219-244.
- Hansen, B., H. F. Alroe, and E. S. Kristensen. 2001. Approaches to assess the environmental impact of organic farming with particular regard to Denmark. *Agriculture, Ecosystems & Environment* 83(1-2): 11- 26.
- Odum, H. T. 1984. Energy analysis of the environmental role in agriculture. In *Energy and Agriculture*, G. Stanhill (ed.), pp. 24-51. Berlin and New York: Springer-Verlag.
- Pervanchon, F., C. Bockstaller, and P. Girardin, 2002. Assessment of energy use in arable farming systems by means of an agro-ecological indicator: the energy indicator. *Agricultural Systems* 72(2): 149- 172.
- Pimentel, D. 1992. Energy inputs in production agriculture. In *Energy in Farm Production (Volume 6)*, edited by R. C. Fluck, pp. 13-29. Amsterdam: Elsevier.
- Piero Conforti, and Mario Giampietro. 1997. Fossil energy use in agriculture: an international comparison. *Agriculture, Ecosystems & Environment* 65(3): 231–243.
- Smil, V. 2001. *Enriching the Earth : Fritz Haber, Carl Bosch, and the Transformation of World Food Production*. Cambridge, MA: MIT Press.
- Vitousek, P. M., P. R. Ehrlich, A. M. Ehrlich, and P. A. Matson. 1986. Human appropriation of the products for photosynthesis. *BioScience* 36(6): 368 - 373.

Coordinator:

Mohamad G. Abiad, Assistant Professor, Food Processing and Packaging, American University of Beirut (ma192@aub.edu.lb)

Prerequisite by Topic:

No pre-requisite courses are required for this course.

Educational Objectives/Learning Outcomes

After the successful completion of the course, students will be able to evaluate energy use in various agriculture and food production systems. They will gain a better understanding of the concepts of sustainability and energy conservation and be able to implement proper energy management through the selection of energy efficient agriculture technologies. The students will also have a better view of available technologies that utilize renewable resources thus decreasing the carbon footprint, greenhouse gas emissions and fossil fuel dependency of the agriculture sector.

Topics covered

- Energy use in crop production
- Energy use in tillage and irrigation
- Energy use in livestock production
- Energy use in food processing, packaging, and refrigeration
- Environmental impacts of energy use in agriculture
- Energy conservation
- Renewable energy systems

No lab required.

Assessment and grades

- Class Participation (10%)
- Homework assignments (20%)
- Project (30%)
- Exam (40%)

Resources for the course

- Course handouts and slides
- Case studies
- Web-based Material