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SYLLABUS

Exergy Economics

200 HOURS

SUBJECT/LEVEL
Energy engineering graduate level.

LEARNING OUTCOMES
After completion of the course you will be able to:

- Ability to analyse and optimize real systems with respect to exergy use and total cost.
- Ability to judge results as above with respect to sustainable development.

COURSE CONTENTS
The course is divided into three parts:

Part 1. Exergy Economics Fundamentals, 70 hrs: Cost-benefit analysis including taxes and subsidies. Efficiencies of ideal and real processes. Optimization methods and their applications. Fundamental processes as heat exchanger and combustion.

Part 2. Exergy Economics Methods, 60 hrs: Thermoeconomics and cost functions for important unitary processes, Exergy Economic Accounting (EEA) and Exergy Economic Optimization (EEO). Design optimization techniques, e.g., Pinch Technology and "Energy Utility Diagram". Sensitivity analysis.

Part 3. Individual project report, 70 hrs: Exergy economic analysis of industrial processes.

RECOMMENDED REQUIREMENTS
Knowledge of exergy analysis.

TYPE OF TEACHING
The course is given as an Internet based academic course in English. Assignments are submitted on line and participants get personal feedback from the teacher. A forum for discussion is also available.

EXAMINATION AND GRADES
Examination by hand in exercises. Grades will be given according to the scale A to F, where A is highest and F is failed.

LITERATURE

Boyd, S. and Vandenberghe, L. *Convex Optimization* (2008) 730 p. Cambridge University Press, http://www.stanford.edu/~boyd/cvxbook/bv_cvxbook.pdf.

El-Sayed, Yehia M. "Thermodynamics and Thermoeconomics", Int.J. Applied Thermodynamics, Vol. 2 (No.1), pp.5-18, March-1999. http://www.icatweb.org/vol2/2.1/5-el-sayed.pdf

El-Sayed, Yehia M. *The Thermoeconomics of Energy Conversions* 2003 276 p. http://www.ebookee.com/The-Thermoeconomics-of-Energy-Conversions_193404.html

Gong, M. and Wall, G. *On Exergy and Sustainable Development, Part II: Indicators and Methods* (2001) 17 p. http://www.exergy.se/ftp/gw2exij.pdf.

Quantities, Units and Symbols in Physical Chemistry (1993) 165 p. Blackwell Science, http://www.iupac.org/publications/books/gbook/green_book_2ed.pdf.

The Exergoecological Portal, http://www.exergoecology.com.

Wall, G. *Thermoeconomic optimization of a heat pump system*, Energy 11, 957-967 (1986) and International Journal of Refrigeration14, 336-340 (1991) http://www.exergy.se/ftp/paper4a.pdf and http://www.exergy.se/ftp/paper4b.pdf.

SYLLABUS

Wall, G. and Gong, M. *Exergy Analysis versus Pinch Technology* (1996), presented at ECOS'96, Efficiency, Costs, Optimization, Simulation and Environmental Aspects of Energy Systems, June 25-27, 1996, Stockholm, Sweden, publ. P. Alvfors et al Eds., ISBN 91-7170-664-X, pp. 451-455 http://www.exergy.se/ftp/eavpt.pdf.

Wall, G. and Gong, M. *On Exergy and Sustainable Development, Part I: Conditions and Concepts* (2001) 18 p. http://www.exergy.se/ftp/wg1exij.pdf.

Wall, G. *Exergetics* (2009) 151 p. http://www.exergy.se/ftp/exergetics.pdf.

Göran Wall August 30, 2010