SYLLABUS FOR

Exergy Economics

7.5 ECTS

CODE

TER721

DECISION

Approved 2009-09-16 by The Faculty Board at Gotland University, revised 2010-xx-xx. Valid as from spring term 2011.

SUBJECT AND LEVEL

Energy engineering advanced level A1F.

LEARNING OUTCOMES

After completion the student should be able to:

- Analyse and optimize real systems with respect to exergy and total cost.
- Evaluate results as above with respect to sustainable development.

CONTENT

Unit 1. Exergy Economics Fundamentals, 2.5 ECTS: 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.

Unit 2. Exergy Economics Applications, 2 ECTS: 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.

Unit 3. Individual Project Report, 3 ECTS: Exergy economic analyses of real or realistic systems.

ENTRANCE REQUIREMENTS

Exergy Analysis 7.5 ECTS or equivalent.

TYPE OF TEACHING

Internet based with compulsory assignments, discussions and report.

EXAMINATION AND GRADES

Units 1 and 2 are examined by assignments and unit 3 by a report. Grades on units and course are Pass with distinction (VG), Pass (G), and Fail (U). The grade Pass requires Pass or higher on all units. The grade Pass with distinction requires in addition Pass with distinction on unit 2 and 3.

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.

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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.

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.