Reesbe
Resource-Efficient Energy Systems in the Built Environment

Catalogue of Reesbe Courses

Aug. 2014

SAMARBETSPARTNERS

Seminar Course with Scientific Writing, part I and II

Extent
2,5 + 2,5 ECTS

Objectives
The main objective of the course is to train the doctoral student in communicative tasks and procedures encountered in doctoral studies and research. This includes various aspects of scientific writing, publication and presentation of research outcomes, as well as exercises and preparation for licentiate seminar and doctoral dissertation. Another objective is to provide a forum for the preparation of proposals of PhD projects.

Contents
Part 1:

- autumn 13: proposals of own project, literature search;
- spring 14: sustainability in the energy sector from a macroeconomic perspective;
- autumn 14: critical literature review, reference management systems;
- spring 15: poster preparation, using own material, and;
- autumn 15: scientific writing (own publication), plagiarism.

Part 2:

- spring 16: rehearsal before licentiate seminar;
- autumn 16: papers in process, oral presentation and opposition/preparation of applications for funding;
- spring 17: papers in process, oral presentation and opposition;
- autumn 17: papers in process, oral presentation and opposition, and;
- spring 18: rehearsal before doctoral dissertation.

The contents are preliminary and open to suggestions on thematic topics in participation with the companies.

After completed course
The doctoral student should:

- be able to use scientific databases to find relevant literature;
- demonstrate ability to critically, independently, and creatively, and with scientific accuracy identify and formulate research questions and to plan and use appropriate methods to conduct research and other advanced tasks within specified time frames and to review and evaluate such work;
- be able to critically review literature;
- be familiar with major reference management systems;
- demonstrate ability to provide proper poster presentations;
- be aware of plagiarism issues;
- be oriented in writing applications for funding;
- be able to make proper references and citations, and;
- be able to make oral presentations and oppositions with authority.

Teaching format
Seminars

Course literature
No compulsory course literature. The student has to independently search for information. Reference documents supporting particular areas will be provided in due time before the respective seminar.

Examination
Seminars
Oral presentation and opposition
Accepted scientific papers

Coordinator
Per Jernberg

Academy
University of Gävle, Academy of Technology and Environment, Department of Building, Energy and Environmental Engineering

Energy Systems

Extent
7,5 ECTS

Objectives
The main objective of the course is to provide broad knowledge and a systematic thinking and understanding of energy systems, including the steps of conversion, distribution, and usage. Particular focus is put on energy efficiency together with the environmental and economic implications. Introduction of renewable energy in energy systems and the role of energy systems in the built environment are other major topics.

Contents
- Introduction to energy systems
- Energy in a systems perspective
- Energy systems – definition and examples
- Socio-technical energy systems
- Policy incentives in built environment
- Obstacles and drivers for energy efficiency
- A system perspective on energy and buildings
- Energy efficient neighbourhoods
- Energy efficient cities
- Solar energy in energy systems
- Some examples of renovation of Million programme buildings
- Energy and environmental aspects – problem shifting
- Users within the energy system
- Renewable energy in energy systems
- Environmental assessment of buildings
- Individual project works

After completed course
The doctoral student should:
- be able to explain and analyse the design, operation, and utilization of energy systems;
- demonstrate broad knowledge and a systematic understanding and thinking within the research area energy systems, particularly regarding energy efficiency, sustainability, and environmental issues, and;
- demonstrate an understanding of the possibilities and limitations of energy systems, their role in the built environment, the responsibility for how they are used, and future needs.

Teaching format
Lectures, seminars, and study visits. The language may vary between English and Swedish.

Course literature
The literature will consist of different kinds of handouts delivered during the course.

Examination

Examination of individual project work 1, oral presentation
Examination of individual project work 2, oral presentation
Written exam

Coordinator
Mathias Cehlin

Academy
University of Gävle, Academy of Technology and Environment, Department of Building, Energy and Environmental Engineering

Energy Efficient Buildings

Extent
7,5 ECTS

Objectives
This course will provide a sound knowledge regarding building technology and building services engineering (HVAC) that contribute to a low demand for purchased energy to buildings. The course will also provide additional knowledge regarding building physics, ventilation technology, and indoor climate, etc. that provide a better understanding of building-related problems of various kinds, in order to apply technologies that will contribute to both energy efficient and healthy buildings.

Contents
Calculations of the energy balance of buildings without available software, primarily monthly calculations for one-family houses. Building and HVAC technology for extremely energy efficient buildings, e.g. passive houses. Experiences from existing extremely energy efficient buildings. Building technology with respect to moisture, etc. Investigations and calculations relating to moisture problems. Building materials. Mould. Radon. Building acoustics. Energy efficiency and healthy buildings – potential contradictions. Building planning for healthy and energy efficient buildings. Thermal indoor climate. Indoor air quality. Building related problems (sick building syndrome – SBS), health issues. Ventilation requirements and design with different methods. Possibilities and limitations of different ventilation systems. Ventilation efficiency. Air filters. Electric efficiency of fans, pumps, etc. Energy saving by means of heat exchangers, heat pumps, and solar collectors.

After completed course
The doctoral student should:

- demonstrate ability to calculate the energy balance of buildings without the help of available energy calculation programs (existing software);
- be able to evaluate different possibilities to save energy with measures regarding both building technology and building services engineering in both new and existing buildings;
- be able to assess the existence of a potential conflict between energy conservation and indoor climate for different energy saving measures;
- independently and critically be able to both analyze and interpret results relating to energy and indoor climate in buildings based on both measured values as well as calculations, and;
- demonstrate ability to work independently to investigate energy and indoor climate issues of buildings and to present the results both orally and in writing in a well-prepared technical report.

Teaching format
Lectures, supervision (tutorials), study visits, seminars, and presentations. Written and oral presentations, study visits, seminars, opposition and some supervision are compulsory.

Course literature
Electronically available documents

Examination
Written exam (grade 3, 4, or 5)

Coordinator
Robert Öman

Academy
Mälardalen University, School of Business Society and Engineering, Department of Energy, Building and Environment

District Heating and Cooling

Extent
3 ECTS

Objectives
The course covers how district heating systems are constructed, operated, and managed as well as the significance of district heating for sustainable development.

Contents

- The role and usefulness of district heating in the energy system
- The heat demands in buildings including hot water preparation
- Distribution losses in district heating networks
- Heat loads in substations and heat supply plants
- Heat generation and heat recovery from combined heat and power, waste incineration, industrial waste heat, geothermal, and difficult fuels as well as heat storage
- The environmental impact from heat supply to district heating systems
- Heat distribution with different routing policies
- Substations with connection principles, heat exchangers, and heat metering
- System operation with pressure losses, pressure maintenance, combined temperature, and flow control, and the overall system control with four independent control systems
- Economics with distribution costs, heat supply optimization, cost allocation in joint production, pricing methods, and balancing supplies and demands

After completed course
The doctoral student should be able to:
Knowledge and understanding

- describe how district heating systems are constructed, operated and managed;
- explain the basic idea of district heating in relation to sustainable development;

Skills and abilities

- apply a variety of energy technologies in problems relating to heating systems;
- identify and describe the different interacting subsystems within a district heating system regarding technology, function, and economy;

Judgement and approach

- conduct technical, economic, and environmental evaluations of district heating systems, and;
- assess the efficiency of the heating system compared with other parts of the energy system.

Teaching format
Lectures, discussions in group and plenary, and study visits

Course literature

- Frederiksen & Werner, District Heating and Cooling. Studentlitteratur 2013

Examination

Reesbe
Resource-Efficient Energy Systems in the Built Environment

Written exam

Coordinator
Sven Werner

Academy
Halmstad University, School of Business and Engineering, Energy Technology

Science for Behavioural Scientists and Engineers

Extent
10 ECTS

Objectives
The overall aim is to provide students with the opportunity to systematically reflect on their own research in a broader philosophical and epistemological perspective, and also to raise awareness of the general methodological issues. Key issues and problems concerning the nature of scientific knowledge will be discussed and addressed in seminars.

Contents
In order to enhance the general knowledge of basic science philosophy, the first part of the course will treat concepts like determinism, induction, deduction, and paradigms. The course will also include lectures on ontological, epistemological, and theoretical perspectives, as well as research ethics. The latter part of the course will be more focused on epistemological and practical implications and epistemological applications in contemporary research.

After completed course
The doctoral student should be able to:
Knowledge and comprehension

- identify and compare theoretical perspectives;
- describe the meaning of the central epistemological concepts;
- identify and describe ontological perspectives;
- identify and describe the epistemological perspectives;
- identify problems related to research ethics;

Skills and abilities

- discuss central epistemological issues in the natural and behavioural sciences;
- discuss problems related to research ethics;

Judgement and approach

- evaluate ontological and epistemological views within a specific research area;
- evaluate perspectives on philosophy of science, and;
- evaluate problems related to research ethics.

Teaching format
Lectures and seminars

Course literature

- Bem, S., & De Jong, H. L. (2005). Theoretical issues in psychology: An introduction. Sage Publications Ltd
- Chalmers, A. F. (1999). What is this thing called science? An assessment of the nature and status of science and its methods. Open University Press
- Kuhn, T. S. (1996). The structure of scientific revolutions. University of Chicago Press

- Rosenberg, A. (2011). Philosophy of science: A contemporary introduction. Routledge.
- Russel, B. (1999). The problems of philosophy. Dover Publications

Recommended literature:

- Von Wright, G. H. (1993). Logik, filosofi och språk – strömningar och gestalter i modern filosofi. Bokförlaget Nya Doxa

Examination

Written exam

Coordinator

Patrik Sörqvist

Academy

University of Gävle, Academy of Technology and Environment, Department of Building, Energy and Environmental Engineering

Philosophy of Science

Extent
7,5 ECTS

Objectives
The course aims to impart familiarity and knowledge of the philosophy of science at the postgraduate level.

Contents
The course is mostly thematic with starting points in learning outcomes and is based on old as well as modern scientific theoretical directions. Furthermore, general theory of science and philosophy of science are problematized:

- scientific knowledge in relation to other forms of knowledge;
- differences between forms of scientific knowledge;
- links between scientific theory and scientific research methodologies, and;
- central epistemological concepts, such as rationalism, empiricism, realism relativism, objectivity and truth, and their respective meanings.

The course deals with different perspectives on knowledge and science development: rational/cumulative and paradigmatic, knowledge of the differences and similarities between the theoretical approaches of social/human sciences and natural sciences. The course orients on different ontological conceptions such as idealism, materialism, existentialism and dialectics. The course deals with epistemological questions: What do criticism and critical thinking mean? How can different epistemological positions (e.g. relativism, constructivism and functionalism, hermeneutics, positivism, relativism, and phenomenology) be criticized? The course discusses methodological (ideographic, nomothetic, inductive, deductive, abductive, and descriptive) approaches, as well as concrete method application in data collection and processing.

After completed course
The doctoral student should be able to:

- systematically and critically evaluate and compare science and scientific research in a broader philosophical and epistemological perspective;
- based on the problem area of his or her own research area, operationalize and argue for/against issues and problem formulations mentioned in the literature, and;
- evaluate and discuss different scientific traditions and knowledge areas in terms of purpose, problem definition, methodology, and theoretical framing.

Teaching format
Lectures and seminars

Course literature
Link to NYMUS

Examination

Required seminar 1, 1,0 ECTS
Required seminar 2, 1,0 ECTS
Required seminar 3, 1,0 ECTS
Individual assignment, 4,5 ECTS

Coordinator
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Academy
Mälardalen University

Energy Optimization for Buildings

Extent
7,5 ECTS

Objectives
The course will provide further knowledge about the energy balance, etc. of buildings, comprising calculations and parameter studies, analyses, and critical evaluations. This knowledge should contribute to the design of buildings with low energy requirements, good economy, and a favourable indoor climate.

Contents
Calculations, analyses, and parameter studies of the energy balance of buildings (with and without computer). Comparisons and analyses regarding energy consumption based on measurements as well as calculations. Thermal inertia, and thermal indoor climate, etc. Practice in critical evaluations and understanding and utilization of results taking different limitations into account.

After completed course
The doctoral student should:

- demonstrate ability to calculate the energy balance of buildings with as well as without the help of available energy calculation programs (existing software);
- be able to perform calculations regarding different energy saving measures in buildings and to assess both the profitability and the influence on the indoor climate;
- independently and critically be able to both analyze and interpret results relating to energy in buildings based on both measured values as well as calculations, and;
- demonstrate ability to work independently to investigate energy issues for buildings and to present the results both orally and in writing in a well-prepared technical report.

Teaching format
Project work in the form of one group project supported by regular supervision and a few lectures.

Course literature
No compulsory course literature. The student has to independently search for literature and information. Some documents supporting the computer calculations and a few lectures will be available.

Examination
Written technical report and oral presentation (grade 3, 4, or 5)

Coordinator
Robert Öman

Academy

Mälardalen University, School of Business Society and Engineering, Department of Energy, Building and Environment

Business for Sustainability

Extent
5 ECTS

Objectives
The course aims to provide a deeper understanding of theoretical perspectives and a deeper ability to critically analyze and evaluate data related to sustainable development. The course will also impart a thorough knowledge of the work on environmental and social issues in business. The aim is that the student after completing the course should have the ability to, within the working life, actively address issues with respect to sustainable development.

Contents
The course covers concepts such as sustainable development, CSR, green business, key stakeholders and their views on corporate responsibility and critical perspectives on corporate environmental and social commitments.

After completed course
The doctoral student should be able to:

- demonstrate an understanding of the theoretical perspectives in relation to sustainable development;
- demonstrate in-depth knowledge of the work on environmental and social issues in business, and;
- on a scientific basis, critically analyze and evaluate information related to sustainable development.

Teaching format
Lectures, seminars, and tutorials

Course literature

- Guziana B. (2013). Corporate greening. Product and Production Perspectives. Doctoral Thesis 137, Mälardalen University Press

Examination
Assignments

Coordinator
Bozena Guziana

Academy
Mälardalen University, School of Business Society and Engineering, Division of Natural and Environmental Science

Advanced Measurement Techniques for Building Energy and Indoor Climate

Extent
5 ECTS

Objectives
The course deals with practical measurement techniques in the area of energy and fluid mechanics, with particular reference to energy consumption of buildings and factors in the indoor environment that affect health, comfort, and working performance of people.

Contents
The main measurement items are:

- temperature (incl. IR-thermography);
- pressure;
- fluid flow rate;
- air velocity and flow visualization;
- thermal comfort;
- building tightness and air leakage;
- air change rate (tracer gas techniques);
- wind effects on buildings and power stations;
- humidity and moisture in buildings;
- power and energy consumption of electrical appliances, and;
- instrument calibration and uncertainty.

After completed course
The doctoral student should:

- be able to give an account of the measurement techniques dealt with in the course regarding
  - underlying physics
  - essential technical functioning of measurement instruments, and;
  - applicability and limitations;
- show practical ability regarding the measurement methods and instruments dealt with in the laboratory work of the course;
- be able to calculate and present the uncertainty of measurement results in accordance with international standards;
- be able to suggest appropriate measuring strategies for practical cases;
- be able to present results of laboratory experiments orally and in written reports according to international scientific practice, and;
- be able to evaluate and critically discuss measurement reports in view of method and uncertainty aspects.

Teaching format
Lectures of the course include measurement theory as well as demonstration and practical handling of a diversity of measurement equipment. At the end of the course, five laboratory works will be performed. Results of the laboratory works will be evaluated in groups and discussed at a concluding seminar.

Course literature
The literature will consist of different kinds of handouts delivered during the course.

Examination
Examination includes fulfilled assignments and active participation on the following items:
Laboratory work 1, 1 ECTS
Laboratory work 2, 1 ECTS
Laboratory work 3, 1 ECTS
Laboratory work 4, 1 ECTS
Laboratory work 5, 1 ECTS

Coordinator
Magnus Mattsson

Academy
University of Gävle, Academy of Technology and Environment, Department of Building, Energy and Environmental Engineering

Simulation and Optimization of Energy Systems

Extent
5 ECTS

Objectives
The purpose of the course is to present various computer tools for analyzing particular municipal energy and district heating systems from a system perspective. Environmental and economic impacts of the analyzed energy systems will be covered.

Contents
The course includes lectures on simulation and optimization software for energy system analysis. By means of the simulation and optimization programs MODEST and MARTES, local/regional energy systems will be studied and designed. The work includes energy supply, energy use and possibilities of energy efficiency, new investments, etc. The studies include energy analysis, identification of possible changes in the energy system, calculation of the appropriate measures, and suggestions on what should be implemented.

After completed course
The doctoral student should be able to:

- use generally proposed simulation and optimization programs and models for energy systems analysis;
- describe the most important details of the computer programs;
- analyze the result of the programs and perform sensitivity analyses.

Teaching format
Lectures, tutorials and projects

Course literature
The course literature will be available on Blackboard (www.lms.se).

Examination
Project MODEST, 2,5 ECTS
Project MARTES, 2,5 ECTS

Coordinator
Mathias Cehlin

Academy
University of Gävle, Academy of Technology and Environment, Department of Building, Energy and Environmental Engineering

Design of Solar Thermal Systems

Extent
6 ECTS

Objectives
The course aims to provide a practical understanding of solar thermal systems and components used in solar systems and also provide an understanding of how different design parameters influence the system performance and functionality. In the course, the student will, among other things, design and dimension a solar heating system. The aim is that the student after completing the course should have the ability to design effective and efficient solar installations.

Contents

- Thermal heat storage techniques
- Components of the solar system
- Thermosyphon, integrated collector/storage systems
- Operation and characteristics of different types of solar systems: large/small; hot water/combi systems/swimming pool; collector array; short term/interseasonal storage
- Operation and control strategies
- Calculation of thermal load
- Simulation program
- Case Study

After completed course
The doctoral student should be able to:

- describe and evaluate different types of thermal loads and estimate them using mathematical models;
- calculate the storage capacity of different technologies for heat storage, explain how they work and analyze their suitability for use at given boundary conditions;
- describe the function of the main components of a thermal solar system and European standards used to evaluate them;
- dimension a solar thermal system;
- demonstrate knowledge of different methods of freezing and overheating protection in the solar system and select the most appropriate method for a specific application;
- design solar collectors in a collector array;
- use simulation tools to calculate the energy efficiency of a solar heating system, and;
- analyze the function and characteristics of different types of solar systems and evaluate the impact of various design and operational parameters on the solar system.

Teaching format
Recorded lectures, laboratory work (on campus), exercises, homework, and seminars. The course is given in English.

Course literature

- Duffiee, John A., Beckman, William A. (2006) Solar engineering of thermal processes. 3rd ed. Hoboken, NJ: Wiley. (908 s). ISBN 0-471-69867-9
- Compendium from the department: Bales, C., Persson, T., Fiedler, F. Perers, B. Zinko, H. Solar heating systems and storage compendium, SERC, Högskolan Dalarna

Examination

Written exam and lab 2 ECTS (U, G, VG)

Homework 4 ECTS (U, G, VG)

Coordinator

Tomas Persson

Academy

Dalarna University, School of Technology and Society, Energy and Environmental Technology

Design of PV and PV Hybrid Systems

Extent
5 ECTS

Objectives
The course aims to provide a practical understanding of PV and hybrid systems and their components, and also provide an understanding of how different design parameters influence the system performance and functionality. In the course, the student will, among other things, design and dimension a PV or hybrid system. The goal is that the student after completing the course should have the ability to design effective and efficient PV and hybrid systems.

Contents
The course covers electricity generation with solar cells in grid-connected and stand-alone systems and in hybrid systems where other types of generators, particularly wind power and diesel generators are included. The studies include the design, measurement and performance evaluation of components and complete systems. Simulations and design studies with computer programs PVsyst and Homer are included in system studies, concluding with systems analysis and evaluation. The course also includes elements of design of plants.

After completed course
The doctoral student should be able to:

- make the selection of components of PV and hybrid systems for electricity generation;
- describe the main types and concepts of PV and hybrid systems;
- independently dimension PV and hybrid systems based on basic design methods and calculations;
- use computer software for the design, optimization, and performance studies of common types of PV and hybrid systems;
- critically analyze and evaluate design and performance of components and complete PV and hybrid systems, and;
- describe the environmental and market economics of PV and hybrid systems.

Teaching format
Lectures, exercises, and project

Course literature

- Deutsche Gesellschaft für Sonnenenergie. (2007) Planning and installing photovoltaic systems: a guide for installers, architects, and engineers. 2 uppl. Earthscan. ISBN 1844074420
- Green, M. A., Watt, M. E., Wenham, S. R., Corkish, R. (2007) Applied photovoltaics. 2 uppl. London: Earthscan. (323 s). ISBN 978-1-84407-401-3

Examination
Written assignments of the project 2,5 ECTS (U, G)
Written exam 2,5 ECTS (U, 3, 4, 5)

Coordinator
Frank Fiedler

Academy
Dalarna University, School of Technology and Society, Energy and Environmental Technology

Sustainable Innovation Processes and Systems

Extent
7,5 ECTS

Objectives
This course focuses on concepts and methods for developing and managing sustainable innovation processes both within organisations and in collaboration between organisations.

Contents
Theories on sustainable innovation processes and systems:

- types of innovation and innovation processes;
- innovation management;
- technology strategies;
- sustainable innovation: continuous innovation and innovation driven by sustainability;
- knowledge in integration and innovation, and;
- open innovation.

Innovation in practice:

- examples of innovation processes and systems in practice;
- regional innovation systems;
- globalization of innovation, and;
- innovators in emerging economies.

After completed course
The doctoral student should be able to:

- describe, contrast and critically assess different concepts and methods for developing and managing sustainable innovation processes and systems;
- identify and analyse how sustainable innovation is applied and managed in organisations in different industries;
- apply relevant innovation concepts and methods for analysing and suggesting improvements in one organisation or a group of organisations, and;
- write a scientific paper on the topic.

Teaching format
The course is based on lectures, seminars, and supervision. It is organised in four two-day seminars, which combine lectures of academics and practitioners with analysis of literature. Prior to the seminars the student provides an analysis of the recommended literature. The final paper is presented and defended at a concluding literature seminar. The student is also active as opponent in this seminar.

Course literature
A literature list is provided at course start.

Examination

Literature reviews and active participation in seminars, 3 ECTS (A, B, C, D, E, and F (FX))
Final paper including presentation and opposition, 4,5 ECTS (A, B, C, D, E, and F (FX))

Coordinator
Lars Bengtsson

Academy
University of Gävle, Academy of Technology and Environment, Department of Industrial Development, IT and Land Management

Tips on courses from PhD students

Sustainable economy
http://www.handels.gu.se/english/education/master/graduate-school/msc-programmes/programmes-2013-2014/specializations/environmental-sustainability/

http://www.kth.se/student/kurser/kurs/MJ2350?l=en