

Elective course

Plumbing vocational Training

Energy 2020 - 2050

The future production, transmission and consumption

1. Course Title

Energy 2020 - 2050 – The future production, transmission and consumption.

2. Course Duration

36 lessons (9 modules á 4 lessons).

3. Course Objective

The main objective of the course is to provide the students with basic knowledge and skills related to the future production, transmission and consumption of energy.

The specific objectives of the elective is that the student in an action-oriented context obtains:

- a. Knowledge of current forms of energy production, distribution and consumption.
- b. A specific knowledge of state of the art for co-generation of heat and electricity from small co-generational plants with and without the use of alternative energy sources (biomass, wood pellets, straw, ethanol, hydrogen, fuel cells).
- c. A future workshop (zukunftsworkstatt based on this background information on future energy production, distribution and consumption 20 and 50 years from now.
- d. Writing and transfer of a presentation of present and potential future technologies for energy production, distribution and consumption.
- e. Technical knowledge and environmentally sound attitudes relating to the future energy technology and energy policy.

4. Content, didactic organisation and student activities

Content

The elective contains the following content phases:

- Co-generation (kraft og varme) as an element in national and regional energy policy.
- Project formulation & project planning, groups of 2-4 students.
- Mapping of existing R & D-projects, pilot projects and full scale plants.
- Excursions, company visits, external lecturers.
- Software simulations programmer for nye energiformer og -systemer.
- Future workshop.
- Preparation and transfer of project presentation.
- Evaluation.

Didactic organisation

The teaching and learning forms are based on the principle of " the student is a co-worker on his/her own learning process".

Active forums for student co-decisions in the learning process acts as stimulants for the students motivation to learn, for the active participation in the general school curriculum and in the positive end result of the overall students training program .The presence of a co-decisional process is an important precondition when the development of the core competences and key qualifications are addressed.

Teachers/trainers and students cooperate in the planning and furthering of the learning processing. in order to qualify the student in this co-worker-role, and the student is involved in the evaluation of her own obtained qualifications and competences.

It is important that the elective course contains democratic fora. It is however equally important that the limits for this student influence are described, within which the concurrent discussion and dialogue of the course content can take place.

The co-decision process is thus an important means to achieve the technical, common and personal objectives of the course.

Organisation

It is the basis of the description below that the elective is carried out over a period of 9 weeks organised as modules of 4 lessons each. It is equally possible to organise the course as 5 weeks of 7 lessons, or perhaps as a continuous course of one week's length.

Student Activities, described as 9 modules á 4 lessons

1st and 2nd module, 8 lessons (2 modules á 4 lessons)

Contents:

- Presentation of the Energy 2020 - 2050 course structure and content.
- The teacher lectures on the general principles in present energy supply, and relates this on a national and european level. Special emphasis is placed on the present strengths and weakness of conventional energy production, distribution and consumption, and on the environmental consequences of conventional as compared to future energy supply systems.
- A focal point should be the limitations of conventional energy supply systems and on related building legislation at new building or major urban renewal work.
- The students carry out library and on-line research and use ICT as the main tool throughout during the course.
- Introduction to the ICT by teacher/trainers as required
- The student group prepares for excursion at manufacturer/sales company or main user of alternative or co-generational plants.
- The students divide into groups and each group formulate their project formulation and prepare a project plan for comments and approval by teacher/trainer.

3rd module, 4 lessons

Contents:

- The groups carry out their excursion to suppliers of the newest alternative energy supply systems and to users of such systems. The suppliers and users should be covered by the groups as a whole.
- The students collect information on how a co-generator is produced and functions, and collect other information relevant for later modules
- Should there be no future-oriented energy installations in the school vicinity, the internet can be used as a source instead of an excursion., for instance www.mvk.dk, www.senertec.com, or www.cogeneration on smaller cogeneration; www.fuelcells.com or www.ballard.com on fuel cells, and www.bioscan on heat/power from biogas production.
- The students collect information on the design, installation and function, and asks supplementary questions in relation to their project formulation and project plan, especially relating to module 7 and 8.

4th module, 4 lessons

Contents:

- Debriefing and short mutual exchange of excursion results

- desk research on alternative energy technologies, with environmental assessment, Life cycle analysis
- Planning and task distribution within group for execution of sub-project in module 7 & module 8.
- Library and on-line research on energy supply systems to be used in module 7 & module 8, including the use of product information and product/system software.
- discussion on strengths and weaknesses of individual energy supply systems.

5th and 6th module, 8 lessons

Contents:

- Lectures, experiments and practical assignments on components, equipment, installations and production methods, relating to function, design, structure, service and maintenance
- Skill Acquisition of specific competences, such as biogas production (www.vvsu.dk/biogas.htm), fuel cell function (www.vvsu.dk/elearning/)

7th module, 4 lessons

Contents:

Future workshop on possible scenarios of energy supply

- Fantasy phase.
- Problem phase.
- Reality- and action phase.

In the future workshop the following tools are recommended:

- META-plan method.
- Mind maps.
- Ishikawa diagrams (fishbone diagrams).
- SWOT analysis.

The Future workshop is carried out on a group basis with each group maintaining a workshop protocol for each phase of the workshop, with the results carried over to the work in module 8 and module 9.

8th and 9th module, 8 lessons

Contents:

- On a group basis, finalisation of report or other graphic presentation on project theme.
- Group present its report or other presentation for rest of class.
- The presentation must cover the three aspects of a) mapping of present technology, b) consequences of present technology, and c) possible action and development.
- Multi-SOL and other software can be used by the students for their desk research on CO₂, ozone, solar energy, alternative energy.
- Summing up on results in the presentations.
- General evaluation of project, process and product.
- Individual student evaluation on course process, in relation to own performance, participation and resulting qualifications and competence on course subject.

5. Evaluation

The teacher/trainer carries out a continuous evaluation of the group work with the aim of revision of the project plan and the task distribution within.

Within the technological curriculum content the teacher has the role of consultant, requiring the maximum participation from the student groups in the execution of the assigned tasks and exercises.

The school issues a certificate to all students who have satisfactorily completed the course.

6. Course economics

Books and software on the subject	1000,00
On-line research and communication	500,00
Components & equipment for practical assignments module 6-7 (in stock)	0,00
Lab equipment for biogas production/experiments	1000,00
Lab equipment for fuel cell demonstration and tests	2000,00
Travel costs for excursions	<u>1000,00</u>
In all	5500,00

All prices are in danish kroner and (7 kr =1 euro) and less value added tax.

7. Teacher/trainer qualifications

The teacher/trainer must:

- Have a teacher training equivalent to the level for basic vocational teachers course as offered by the Danish Vocational Teachers Institute (DEL).
- Have a theoretical, practical and updated education and knowledge within the plumbing sector or electrical sector, supported by a specialist background within present and future alternative energy technologies.

8. Teaching facilities and teaching materials

- Access to Internet.
- The search facility at VVS uddannelsesbiblioteket on <http://www.vvsu.dk>.
- E-learning site about Fuel cells at <http://www.vvsu.dk/elearning>.
- Rooms for group work and for future workshops og til fælles fremtidsværksted.
- Workshops for practical assignments in module 5 and module 6.
- Equipment for biogas production.
- Equipment for fuel cell experiments.

Descriptions and examples of the principles behind the future workshop tools (future workshop, Mind Maps, META- PLAN, Ishikawa-diagrams, SWOT-analysis) listed in module 7 can be found in the student files for the plumbing VET-apprentices, in the course file 1 and course file 2.

Key words and sources for project and group work

- Scenarios for future energy consumption, Energimiljørådet, (www.emraad.dk).
- Rocky Mountain Institute, american environmental think tank, (www.rmi.com).
- Danish suppliers and users of co-generational plants.
- The european market for co-generation (www.cogeneration.com).
- Senertec (www.senertec.com).

- Typical small co-generational plants (www.mkv.dk).
- DGCs statusrapport from 1996 (only gasdriven plants).
- Cadett no 2 juni 1998 (diana.goult@aeat.co.uk and novapro@inet.uni-c.dk).
- Statoil ´s magazine Synergi, 1999 og januar 2000, contact Stene/ Bak, 33 42 42 12.
- Bioscan (www.bioscan.dk).