



CARBON DIOXIDE MITIGATION TECHNOLOGIES

4 ECTS

AGH University of Science and Technology

Course responsible:

Course overview

The course gives the overview of options of CO₂ reduction., the methods of CO₂ capture, CO₂ transport and storage, dangers of storage, as well as direct and indirect industrial utilization of carbon dioxide and new technologies of CO₂ chemical utilization under study. Students will be provided with related papers and books on the subject. students will be required to prepare and deliver process design of basic carbon capture technologies integrated with energy generation technologies or technologies used for chemicals production or coking.

The course is built of two parts: lectures and project.

Lectures content: World needs to develop a balanced portfolio of energy generation mix that will address climate change concerns. The knowledge of “climate portfolio” needs to be developed by better understanding the science and the potential impacts, developing technological responses for adaptation and mitigation, and formulating policies that take into account the economic costs. The purpose of this course is to discuss an important opportunity which we should consider as part of technological response, namely the capture and sequestration of CO₂ from large stationary sources. We will first discuss the motivation for developing CO₂ capture and sequestration technologies and then provide some background information, looking at both the history and economics of this mitigation option. Next, we review the major technological components - capture technology, geological storage., and direct utilization. An important issue of system integration will be provided including economy of energy generation. Particular attention will be paid to carbon dioxide direct utilization in chemical processes. Carbon dioxide is considered to be main challenge for power generation as well as for any other industrial application of coal. Poland’s energy sector is primarily based on coal combustion that covers almost 96% of demand. Future development of that sector depends on the restriction on carbon dioxide emission or trading value of allowances. There are three main technological approaches to the development of new coal based generation capacity, namely:

- Air blown combustion and carbon dioxide separation from flue gases by chemical absorption.
- Oxy – combustion of coal and separation of carbon dioxide by water vapors condensation.
- Gasification of coal and carbon dioxide separation by physical absorption.

The fossil fuel power plants development strategy and technologies will be evaluated including:

Options of CO₂ reduction. The methods of separation of CO₂ from combustion gases - the state-of-art and emerging technologies: chemical absorption, physical absorption, adsorption, cryogenic separation, membrane methods. Industrial examples of coal-fired plants with CO₂ capture. CO₂ transport. CO₂ storage: maturity of technologies. Dangers of storage. Direct and indirect industrial utilization of carbon dioxide. New technologies of CO₂ chemical utilization under study.

Projects: students will be provided with related papers and books on the subject. students will be required to prepare and deliver process design of basic carbon capture technologies integrated with energy generation technologies or technologies used for chemicals production or coking.

Projects:

1. Post - combustion technological concept of carbon dioxide capture; efficiency penalty; energy generation cost
2. Pre - combustion technological concept of carbon dioxide capture; efficiency penalty; energy generation cost
3. Oxy - combustion technological concept of carbon dioxide capture; efficiency penalty; energy generation cost
4. Chemical use of carbon dioxide - polygeneration of energy and chemicals
5. Carbon footprint of other coal conversion processes

Outcome of the course

After this course the student should:

- Have the knowledge of methods leading to the reduction of CO₂ emissions – the methods of CO₂ capture and sequestration, as well as possibilities of chemical utilization of carbon dioxide;
- be able to discuss the advantages and disadvantages of methods of CO₂ emission reduction;
- propose the method of CO₂ utilization.

Course coordinator & teachers

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