

Mechanical-to-Electrical Energy Conversion

1. Introduction

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Mechanical-to-Electrical Energy Conversion

Contents of this course:

- Electric power generators
- Principles and characteristics generators
- Grid connection operating performance
- Systems with power converters
- Variable speed operation
- Control methods
- Applications to hydro and wind power plants



The Aim of this Course

1. Structure and principle of generators
2. Operating characteristics of generators
3. Characteristics of systems with converters
4. Restrictions of generators and converters.
5. Select a suitable generator and converter



Lecture Schedule

1. Electric generators and mechanical to electrical energy conversion
2. Electromagnetic induction and electromagnetic force
3. Fundamental of mechanical to electrical energy conversion
4. Fundamental of ac electric generators
5. Synchronous generators
6. Characteristics of synchronous generators connected to a utility grid



Lecture Schedule (cont.)

7. Stability of synchronous generators
8. Summary of the first half
9. Variable speed electric generators
10. Power converters for variable speed operation
11. Variable speed operation of synchronous generators
12. Variable speed operation of induction generators



Lecture Schedule (cont.)

13. Doubly-fed induction generators

14. Applications to hydro power generation

15. Applications to wind power generation

and Final Exam. (Open book maybe)

Grading: Reports on the discussions (50%)

Final examination (50%)



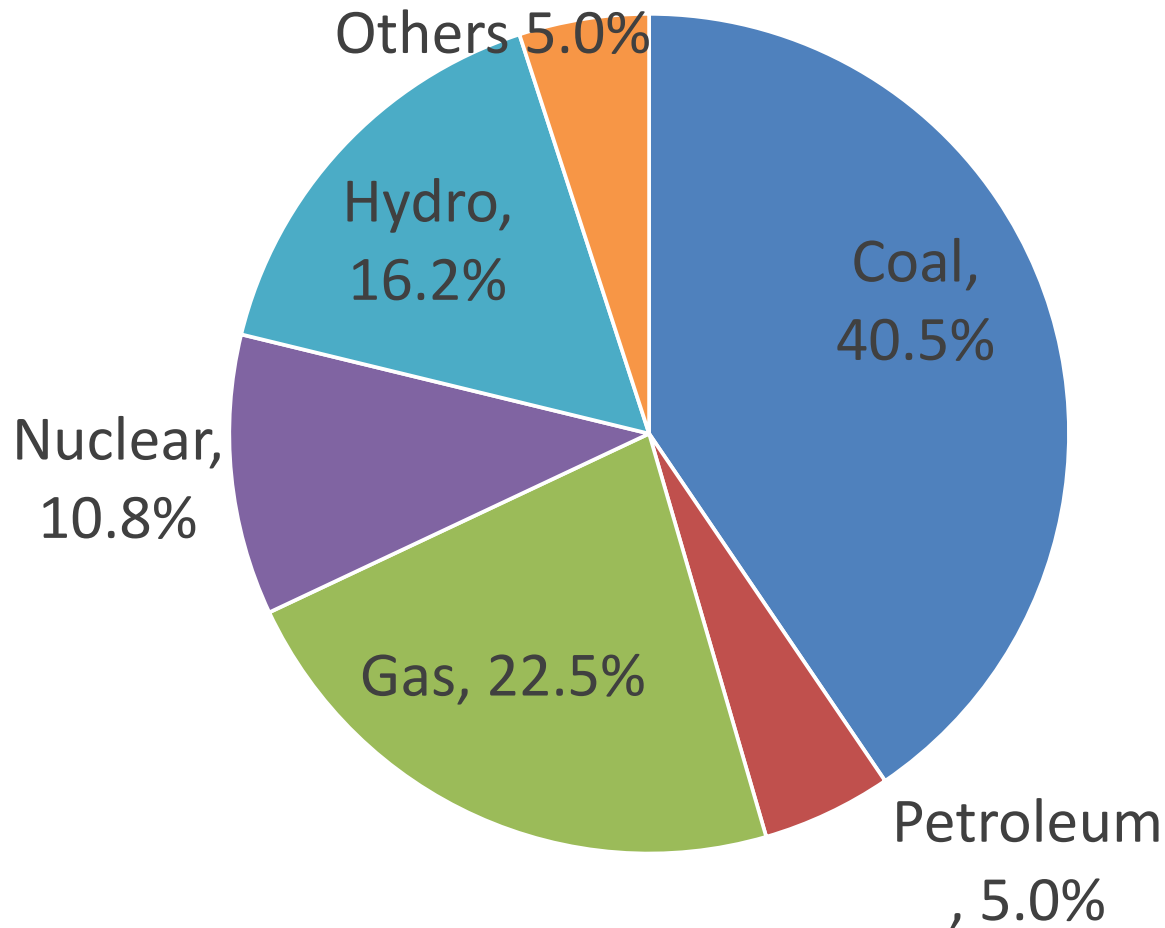
Course outline

- Lecture on topic of the day
Outline, Theory, Derivations, Application.....
about 60 minutes
- Discussion on the topic among students
Questions, Calculations, Discussion.....
about 20 minutes
- Presentation of the results of the discussion
about 10 minutes
- Report on the discussion (by the next class)



Electricity Generation

- World Electricity: 22,700 TWh (2012)



Energy Resources for Electricity

- Hydro Power
- Nuclear
- Fossil Fuel (Coal, petroleum, and gas)
- Wind power
- Geothermal
- Biomass
- Solar cells
- Fuel cells (Hydrogen, methane)



To be Continued in the Lecture.....

