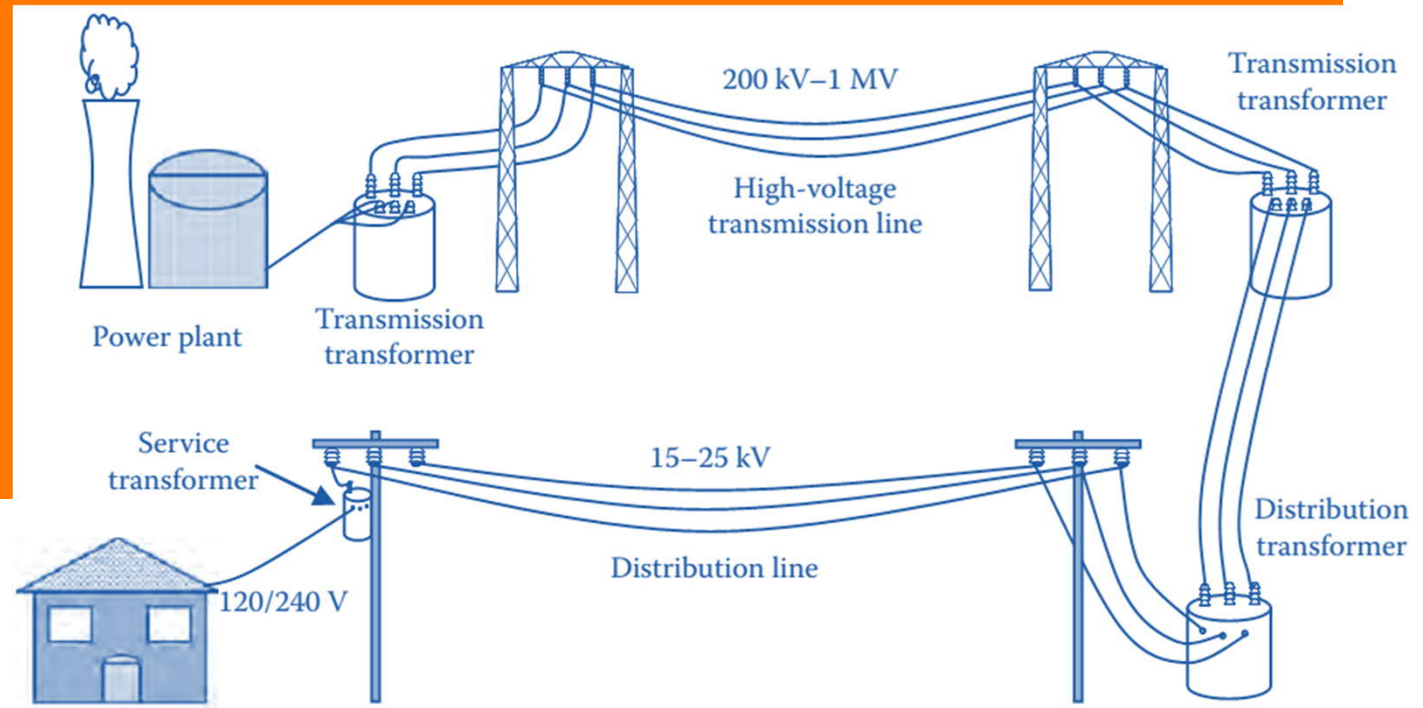




Aalto University
School of Electrical
Engineering

ELEC-E8422 Introduction to electric energy, 5 op

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Course material

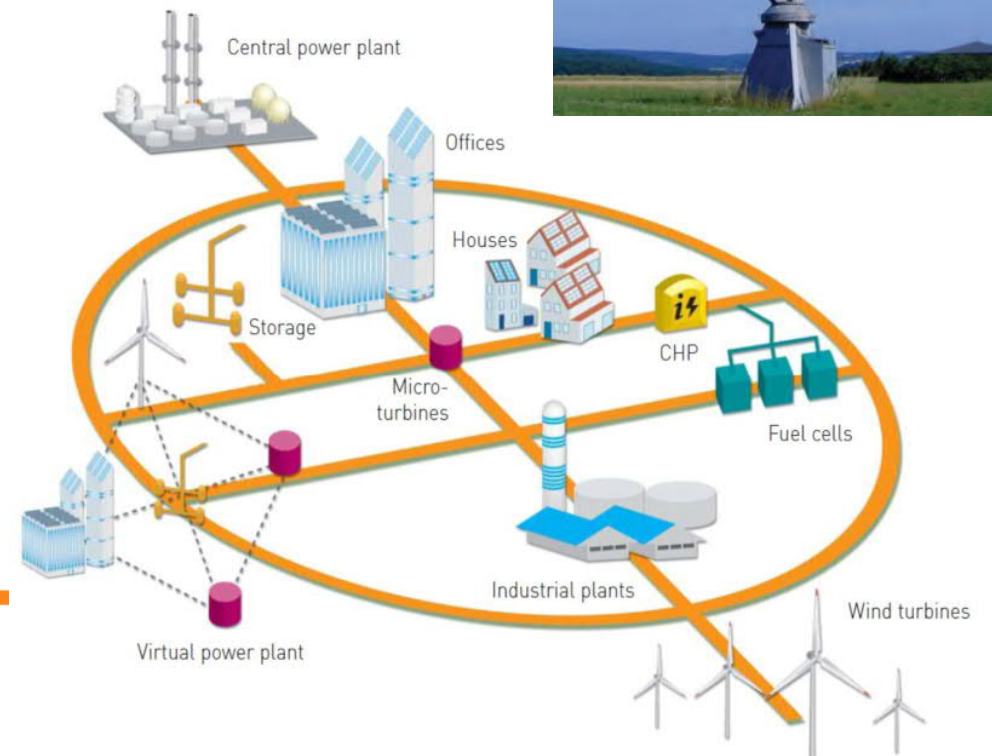
- **Book:**
 - Mohamed A. El-Sharkawi, Electric Energy, An Introduction, 3rd Edition, CRC Press, ISBN 978-1-4665-0303-8
<http://proquestcombo.safaribooksonline.com/book/electrical-engineering/9781466504318>
- **Lecture slides:**
 - Based on the book but have also some additional material
 - MyCourses
- **Exercises and homework:**
 - MyCourses

Course Contents

- Structure and operation of power system
 - Chapter 2, Chapter 8, Electricity production and consumption, 3 phase system
- Electrical energy conversion
 - Chapter 10, Chapter 11, Transformers and power electronics
- Electromechanical energy conversion and renewable energy
 - Chapter 6, Chapter 12, Renewable energy, generators and motors
- Power quality and electric safety
 - Chapter 9 and Chapter 13
- Grid failures and future Powers systems
 - Chapter 14, Chapter 15, Blackout and smart-grid

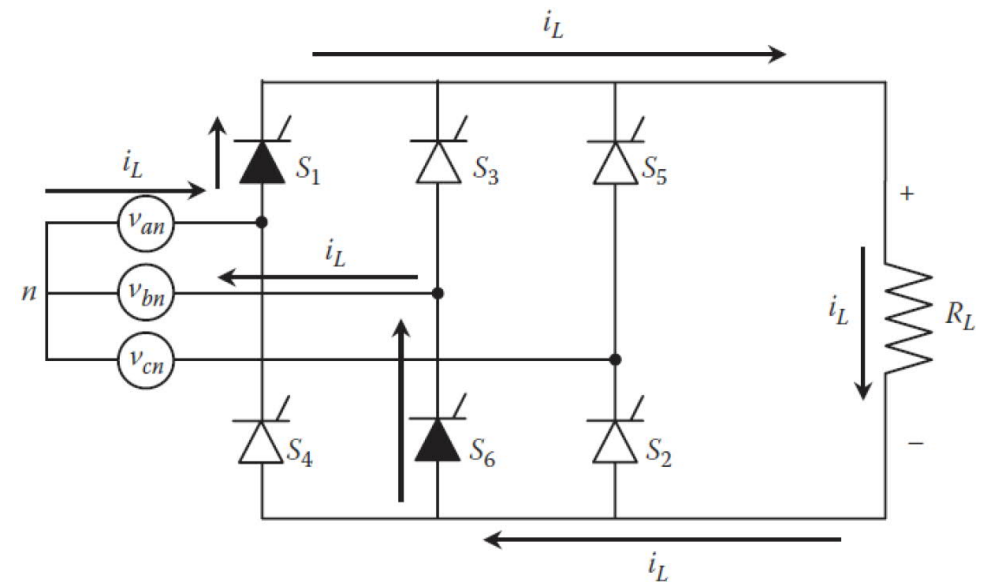
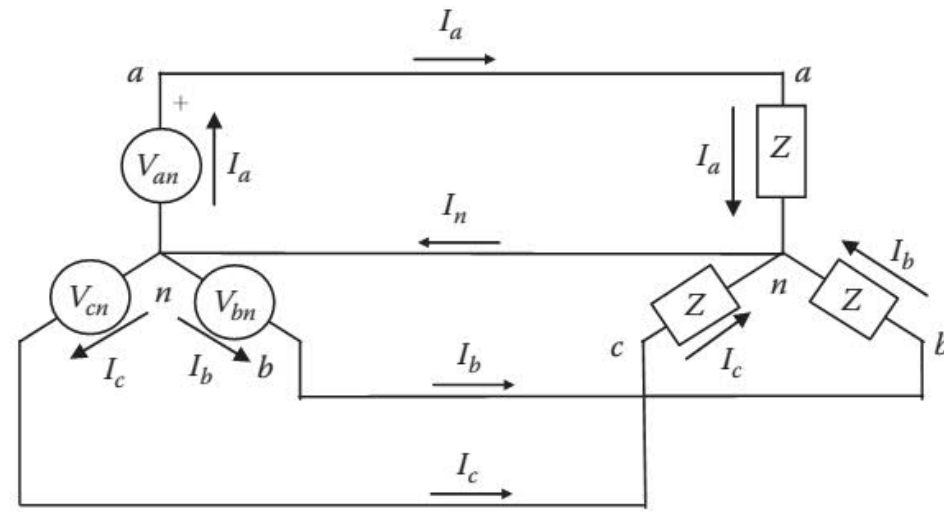
What we will learn?

- How to model alternating current quantities
 - phasors
 - Power and power factor
 - Impedances and phase shift
- What is renewable energy
 - Wind, solar, hydro, geothermal, fuel cell
- Structure of the power system
 - Power plants, substations, lines
 - Failures and consequences
 - Power quality and future of power systems



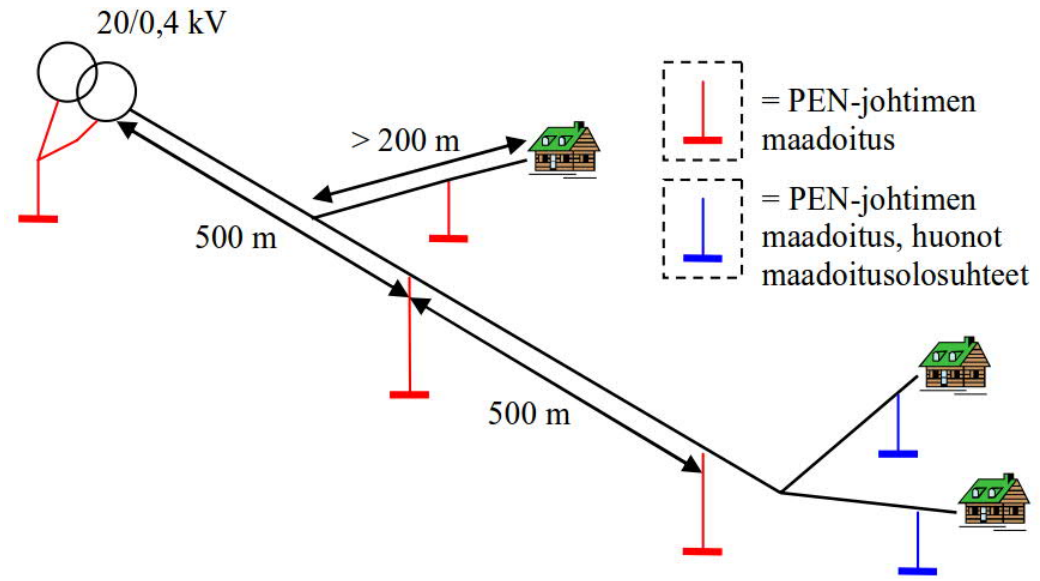
What we will learn?

- How the 3-phase system works
 - 3 phase voltages and currents
 - Star and delta connections
 - Line versus phase quantities
 - Equivalent single phase circuits
- What is power electronics and how it works
 - Applications and energy shaping
 - Component of power electronics
 - AC-DC; DC-AC, and AC-AC conversion
 - Waveforms and their consequences



What we will learn?

- **Electric safety**
 - Effect of electricity on humans
 - Safety limits
 - Grounding and protections
 - Safety requirements and regulation
 - Safety related authorities
- **Transformers and electrical machines**
 - Basic constructions
 - Operation principles
 - Usage of basic models



Learning outcomes

- On completion of the course the students will be able to
 - Explain the operation of the modern electric power system
 - Analysis the power system components using their mathematical models
 - Explain the electric and electromechanical energy conversion
- The power system is broad and its understanding requires knowledge of different parts of the system and their operation principles. In this course we will:
 - Derive accurate model of different parts of the system
 - Investigate the whole system at a qualitative level

Assessment

- Exercises:
 - Homework 11 problems x 3 p = 33 p
- Bonus points
 - 1 point per exercise session (max 5 p)
 - Upload the solution of 1 exercise with the HM

Grade	minimum p	maximum p
0	0	13
1	14	16
2	17	20
3	21	24
4	25	28
5	29	33