

Remember to give feedback in the Kaiku-system to get the final grade.

DEE-53106 Introduction to Renewable Energy Sources

Examination on 20.4.2017

1. Which of the following statements are true and which are not? Answer just true or false. Answer only when you are sure that the answer is correct. (12 points)
 - a) Oil is the largest known resource of non-renewable primary energy in the world.
 - b) Solar PV power will dominate the global electricity production in the future on long term.
 - c) Peat is the second largest known resource of primary energy in the world.
 - d) About 20% of the global primary energy consumption is used to generate electricity.
 - e) Discoveries of new oil fields is less than the consumption of oil.
 - f) Coal has the highest energy density (in TJ/kg) of all fossil energy sources.
 - g) The efficiency of a thermal power plant is typically below 40 %.
 - h) The CO₂ content in the atmosphere will decrease back to the original level in 500 years, if emissions to the atmosphere are stopped completely at once.

2. a) Name the top primary energy resources (and technologies) by added net electricity production capacity in Europe during the last years. In net capacity additions, the decommissioned old power plant capacity is subtracted from the new installed capacity. (3 points)
b) The global production capacity of wind energy was 432 GW at the end of the year 2015. How much is the global production capacity at the end of the year 2019 and 2023, if it increases annually by a factor of $2^{1/4}$? (3 points)

3. a) How and with what technology geothermal energy is used to produce electrical energy? (3 points)
b) What form of water related energy is used globally most to produce electrical energy and how is the energy of water converted to electrical energy? (3 points)

4. a) What energy conversion processes (principles) are used to convert the energy of fossil primary energy sources to electrical energy? (3 points)
b) Draw current and power as a function of voltage for a PV module having 60 series connected silicon solar cells, when the open circuit voltage of each cell is 0.6 V and the short circuit current is 10 A. (3 points)