

Energy Sources & Conversion
Final test – 3 February 2011

Name:

Part 1 – Multiple choice test

More than 1 correct answer per question is possible. Selecting any incorrect answer cancels any points for correct answers to the same question.

1. Which of the following are fissile isotopes?
 - a. U-235
 - b. U-238
 - c. Th-232
 - d. Pu-239
2. Spent nuclear fuel:
 - a. Is highly radioactive
 - b. Can be disposed of by incineration
 - c. Can be reprocessed in order to recover unused fissile isotopes
 - d. Is kept in a water pool near a reactor for several years after being removed from the core.
3. Boiling water reactor:
 - a. Is cooled and moderated by the same flow of light water/steam
 - b. Is cooled with boiling water and moderated by liquid water in a separate tank called "calandria"
 - c. Can be fuelled with natural uranium
 - d. Is an old technology, no longer built in any country.
4. VVER type nuclear reactor:
 - a. Is a Soviet/Russian counterpart of BWR technology
 - b. Was used at Chernobyl-4 nuclear power generation unit
 - c. Is cooled and moderated with light water
 - d. Is safely operated by several EU member states.
5. Electric power is transmitted at high voltages due to:
 - a. Lower losses
 - b. Lower cost
6. Polish power transmission grid is:
 - a. Connected to Swedish grid by synchronous AC line
 - b. Connected to Slovak grid by synchronous AC line
 - c. Connected to Lithuanian grid via DC link
 - d. Connected to Lithuanian grid via synchronous AC line
7. Flash-steam type geothermal power plant:
 - a. Uses steam coming directly from the ground
 - b. Uses steam generated directly from geothermal hot water by sudden decompression
 - c. Uses steam generated in a boiler heated by geothermal water
8. Lower heating value of solid biomass:
 - a. Is much lower than of coal and lignite – always below 9 MJ/kg
 - b. Can be similar as that of fossil fuels, usually between 10 and 20 MJ/kg
 - c. Significantly depends on humidity
 - d. Is comparable with good quality hard coal, being always above 20 MJ/kg.
9. Biogas:
 - a. Has a lower heating value lower than natural gas from the Polish grid (GZ-50 or E type)
 - b. Consists mainly of methane and carbon dioxide
 - c. Consists mainly of carbon monoxide and oxygen
 - d. Can be combusted by gas turbines.
10. Steam district heating systems:
 - a. Are still operated in some cities, but not constructed anymore
 - b. Have been replaced with hot water systems in some cities
 - c. Are still more popular than hot water systems
 - d. Are cheaper to operate than hot water systems
11. Hot water parameters in a typical Polish district heating system in the summer are approximately:
 - a. 130/70°C
 - b. 130/50°C
 - c. 70/50°C
 - d. 70/35°C.

12. In perfect conditions (i.e. return water temperature approximately 35°C) total energy conversion efficiency in a reciprocating engine CHP plant can reach approximately:
 - a. 65%
 - b. 75%
 - c. 85%
 - d. 95%.
13. In a gas turbine combined cycle CHP plant heat for district heating applications is recovered from:
 - a. Exhaust gas directly after the turbine
 - b. Exhaust gas after heat recovery steam generator
 - c. Steam turbine bleed or discharge
 - d. Lube oil cooler.
14. Pelton water turbines are used:
 - a. For low-head, high-flow applications
 - b. For high-head, low-flow applications
 - c. In run-of-the-river hydroelectric plants
 - d. In the largest hydroelectric plants in the world.
15. The largest tidal power station in the world has a capacity of:
 - a. 25 MW
 - b. 240 MW
 - c. 660 MW
 - d. 22500 MW.
16. Typical capacity factor of a barrage-type tidal power plant is:
 - a. 25-30%
 - b. 60-80%
 - c. 90%
17. Wood gas:
 - a. Is generated by wood gasification
 - b. Was popularly used for vehicle propulsion before World War II
 - c. Has calorific value comparable to natural gas
 - d. Is not transported due to low calorific value
18. Nuclear power stations:
 - a. Cannot deliver any heat to district heating systems due to safety regulations
 - b. Cannot deliver any heat to district heating systems due to specific turbine design.
 - c. Sometimes deliver some heat to local towns (turbine bleeds are used as a heat source)
19. Largest wind turbines commercially available nowadays:
 - a. Have outputs of 3-5 MW
 - b. Are of vertical axis type
 - c. Are of horizontal axis type.
 - d. Have outputs of 5000-1000 kW
20. Biodiesel is normally used:
 - a. As a fuel for power industry due to its standardized properties
 - b. As a fuel for turbojet engines
 - c. As a fuel for spark-ignited car engines
 - d. As a fuel for car diesel engines.

Part II – This part can modify the basic mark given for the test (up to 1 full grade up or down).

Back in 1970s it was planned to construct the so-called “Lower Vistula cascade” – a series of dams on the lower section of the Vistula River in Poland. Eventually only one dam was built in the city of Włocławek – with a hydroelectric plant of 160 MW. That dam however has not been designed for standalone operation (as the water level difference is higher than expected) and is in poor technical condition. Theoretically three solutions are possible: constructing all the remaining dams, constructing just one dam downstream from Włocławek or demolishing existing dam. Present shortly pros and cons of each solution – from the power industry’s and environmental points of view. Select the solution you personally prefer and briefly justify your choice.