

RE 2 “OPTIMIZATION OF BIOENERGY USE” 13.8.-17.8.2012

COURSE QUESTIONS (Obligatory for 2 ECTS, answers to be returned on Friday 17.8. before noon)

MAX. 150 WORDS PER ANSWER (NO ESSAYS OF SEVERAL PAGES!)

Savolainen: Future of bioenergy, scenarios and challenges

1. What are the main drivers of the global energy system?
2. What is the role of bioenergy in the global energy system?
3. What are the main environmental challenges caused by the increasing utilization of bioenergy?

Vakkilainen: Small-scale use of bioenergy, carbon balances

4. What is the most potential small scale process for thermal conversion of biomass?
5. What is biomass and what is not?
6. What are the components that form the price of biomass used for energy at usage point?
7. What is the most urgent need for biomass R&D?

Vakkilainen: Torrefaction & Pellets

8. What is happening to biomass components during it is heated?
9. What are the envisioned markets for ‘manmade’ solid biomass fuels?
10. Why are torrefaction & pellets & bio-oils interesting for EU?

Winter: Biomass combustion in fluidized beds

11. What are the advantages/limitations of fluidized bed combustors? Compare it to grate furnaces, fixed beds, pneumatic transport.
12. Calculate the minimum fluidization velocity of silica sand particles of 100 μm in air at 25°C and 900°C.
13. What are typical fuel characteristics of biomass - compare it also to coal and waste? - including kinetics, phenomenology and ash melting.

Winter: Emissions from thermochemical conversion of biomass

14. How is NO_x formed? What routes for NO_x formation exist?
15. What are the strategies to reduce NO_x ?
16. What are potential pollutants in general and what is their origin?

17. How does a flue gas cleaning concept for biomass combustion look like?

Konttinen: Gasification and gasification-based biorefineries

18. Considering the production of energy products (power, heat, liquid biofuels), compare the properties of biomass gasification and combustion.

19. Identify different types of gasification reactors and their main applications.

20. Cleaning the gasifier product gas/syngas: Identify different possible impurities, for what reasons they are problematic and what kind of technologies can be used for their removal?

21. What are the most typical challenges in the development of gasification-based processes a) for CHP application and b) for the production of liquid biofuels?

Larmi: Liquid transport fuels based on biomass, properties and availability

22. What are the most important physical and chemical properties of liquid or gaseous biofuels to be used in a) SI engines b) CI engines?

23. Compare ethanol and ethanol-gasoline blends with gasoline. What are ethanol pros and cons? How ethanol differs from butanol as a transport fuel?

24. Compare traditional biodiesel (FAME) with hydrotreated vegetable oil (HVO) and synthetic diesel fuels (BTL, GTL, CTL).. What kind of differences are there in the fuels' physical and chemical properties and how do they affect engine performance and emissions?