BSEN 5540/6540 Biomass and Biofuels
Instructor: Sushil Adhikari
Problem Set 1 (Due: August 22, 2016 at 10:00 am)

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1. **In your opinion, what are the main benefits of using biomass derived liquids fuels and/or electricity?**

   Ans:

   Biomass derived energy is considered renewable in nature and is supposed to replace fossil fuels as a sustainable energy source. In my opinion, using biomass derived fuels will benefit in the following ways:

   i) Biomass fuels, being carbon neutral, ensure that we are emitting lesser amount of CO2 in the atmosphere. This is because, biomass absorbs CO2 from the atmosphere in the process of photosynthesis and the same is released when we burn the fuels derived from them. Whereas, in the case of fossil fuels, we take out carbon from the sources below the ground and put the extra carbon into atmosphere.

   ii) The sources of fossil fuels are depleting. Hence it is very important to find alternate sources of energy which can take care of world's requirement when the non-renewable sources are exhausted. Biomass derived fuels/electricity are a good option for world's energy security when fossil fuels deplete.

   iii) Biomass energy can be an excellent way of minimizing waste. In household as well as industrial processes, a large amount of organic waste is generated, which can be converted into fuels and energy via various processes. This way, the amount of waste going to dumping ground is minimized, which will help avoiding the land and water pollution.

   iv) The sources for biomass energy will never run out, as they can be grown easily or collected from waste streams of municipalities and industries. Except the difficulties in harvesting and collection, these sources are abundant and easily available as compared to fossil fuels. Hence, it can very well be established as a source of energy parallel with fossil fuels.

2. **Name at least three things that one should consider while producing biomass for bioenergy.**

   Ans:

   i) Bioenergy potential of the biomass: The calorific value of the biomass is an important factor which will determine the end product value of the biofuel derived from it. Hence, the biomass with higher carbon content and smaller mineral content should be preferred.

   ii) Growth rate of biomass: If the biomass takes a long time to grow before it can be harvested, then the payback time will be very high and hence it will no more be lucrative to produce fuels from it. Hence, the biomass with high growth rate should be chosen for use as a feed material for biofuels.

iii) The cost of transport of biomass: Often, the biomass one uses for production of bioenergy is very low in bulk density. Hence, the cost of transport per ton of biomass turns out to be very high. Sometimes, it is so high that it makes no economic sense to transport biomass to the facility for its conversion. It is preferable to produce biomass which will need less compaction before transport.

iv) The use of bioenergy: Fuels and energy derived from biomass is not necessarily in the most convenient form. Sometimes, it will not meet the fuel standards already set for the equipment. Hence, it is important to consider the application for which the biofuel will be used and the necessarily steps required to reach that quality. Considering the type of fuel that can be produced from a particular biomass is very important.

3. **What is the role of biobased energy in President Obama's climate action plan (2nd anniversary progress report, June 2015)?**
[https://www.whitehouse.gov/sites/default/files/docs/cap_progress_report_update_062514_final.pdf]

Ans:

President Obama's climate action plan acknowledges the role of bio-based energy in replacing the fossil fuels, which in turn will help building carbon neutral energy cycles.

a) USDA supports wood based energy by way of granting upto $12.5 million for projects involving biomass production for bioenergy. Also, $1 million are granted to find and develop innovative ways to use leftover wood for energy production.

b) US military's defense logistics agency, showed an interest in buying 37 million gallons of biofuels in the upcoming bulk fuels purchase. The Federal Aviation Administration is also working on development and deployment of biofuels for aviation. In a recent move, a drop-in aviation biofuel (used with the same infrastructure as that for fossil fuels) was approved for commercial air travel.

4. **What was the share of bioenergy in U.S. total energy consumption in 2014? For reference, please refer to Annual Energy Outlook 2015 (http://www.eia.gov/forecasts/aeo/).**

Ans:

For transportation in 2014 in USA: 5% share of biofuels was observed.
In 2015, biomass provided 5% of the total energy used in USA.