Green Indicator

With the advent of the first snow of this year in the southern parts of Sweden and with the harsh winter of 2009/2010 in fresh memory we dedicate this issue to electricity storage. We also continue our answer series with the words of Assoc. Prof. Jan Brandin at Biofuel-Solution on the topic of tax incentives. In the CatScan section we will have a look at how new renewable feedstocks create particulary interesting opportunities for combining catalysis with other unit operations.

/ Christian Hulteberg

The Answer

Is there a need for tax-incentives on biochemicals as well as biofuels?

*given by **Assoc. Prof. Jan Brandin**, at Biofuel Solution AB*

Yes, the main obstacle for the use of biofuels and bio-chemicals is the cost, they can't compete with the costs of fossil based fuels & chemicals. However, it does not take much of an imagination to realize that the price of fossil based fuels & chemicals will radicaly increase in the next decade. So to phase in renewable fuels & chemicals in time, avoiding being caught by surprise, a tax-incentive will probably be needed.

Electricity Storage

The nature of the electricity grid is changing. The demands for handling high peak-loads are more and more becoming an issue not only on the demand side, but also on the supply side. This is a natural progression from the introduction of more and more renewable power sources in the grids. The major types of renewable production in use are wind mills and solar panels, both generating fluctuating amounts of power given the current weather situation. This fluctuation is not really an issue until the production percentage of this type of energy becomes significant. In countries like Denmark and Germany for instance with high amounts of wind energy production, this is displayed by occasions of negative electricity prices. This is not a desired

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New Openings in Catalysis

The use of renewables creates interesting problems to address. One of these is caused by the low energy density of the feedstock. When processing crude oil, the energy density of the starting material is high and there is therefore no issue with increasing and lowering the temperature several times while processing the material; the heat lost in each cooling and reheating cycle is negligible compared to the overall energy content.

When starting with a renewable feedstock, this will contain much more oxygen than the traditional petrochemical feedstock. This means that the energy density will be lower and with this, the cooling and subsequent reheating of the process streams will cause significant losses of the inlet heat. This means that the temperature will have to be more carefully staged in this type of process, not increasing or lowering it too much and in too radical steps.

bulbs in their homes is not an energy-producers core business.

An area that will be more important with the higher percentage of fluctuating power sources in the grid will be smart grids and electricity storage. In this text, a number of methods for energy storage will be described as a general overview to the topic. Some of these have been in use for many years, like the pump hydro power plants. In this kind of plant, water is pumped from a reservoir to an elevated dam and the water is passed through a turbine on its way down. Another version of this technology uses air as the working media instead, compressing air into a large cavity such as an abandoned mineshaft. The air is then expanded through a turbine for producing electricity again.

Other methods use the ability of storing heat and cooling in different ways. In one example, cold water from one storage compartment is used for air conditioning during the summer time. The heated water is returned to a hot-water compartment, which is used during the winter time for heating the same buildings. Another version of this is to use ice as energy storage in warm countries. Ice is produced during nighttime when the grid is less utilized; this ice is then melted during the daytime to supply cooling.

There are also more traditional storage means such as batteries, e.g. lithium ion batteries that can be made with higher energy density than other types of batteries. Another type of batteries in discussion is the flow-through batteries in which a loaded electrolyte is used or charged depending on the utilization or storage of energy. Super-capacitors are also mentioned in this context, with higher lifetime than batteries but with lower energy densities.

Another popular topic for discussion is the production of hydrogen via electrolysis. This hydrogen is stored and can be used for the production of power in a fuel cell when there is a need of electricity. Another classical way of electricity storage is the use of flywheels that are spun at high velocity using off-peak electricity and the kinetic energy can then be used for producing electricity when it is required by the grid.

After listing these various methods of electricity storage, there is still a need for on-demand power production, when the reversed situation occurs: there is not enough production from the renewable resources. The use of smart storage can buffer this to some extent, but a need for fast start-up gas or oil turbines (running on renewables in the future) will be required in the short-term future.

more intelligently structured catalysts and combinations of different unit operations and catalysis. For instance in the gasification of biomass, tars are a significant byproduct and need to be eliminated before the gas can be used. This can be done e.g. in a tar-cracking catalyst. The gas also has a need for filtration before utilizing it in the downstream processes. One suggestion would be the combination of high temperature filtration and the tar-cracking; allowing for a combined unit operation lowering both the tar and the ash content of the gas and much better energy conservation.

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