Green Indicator

Subsidised Algae and Oil-refieneries

In this issue of the green indicator we will have a closer look at the prospect of algae feedstocks for fuels and chemicals production. We will briefly review the limitations in the cultivation of algae and its current and future uses and necessary development steps perceived at the moment.

We will also have a closer look on the latest exciting developments in the use of low-blend renewable feedstocks into selected petroleum refinery unit operations in this issue of CatScan. Finally we will start of this series of answers with insights from the venture capital world with respects to tax incentives for the production of bio-products.

/ Christian Hulteberg

The Answer

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

*given by **Brook Porter**, at Kleiner Perkins Caufield & Byers*

Government's role in defining tax policy should be to incentivize behaviors that are seen as beneficial and deter those seen as unfavorable. In the case of energy, fuels, and chemicals, it is becoming increasingly clear to the broader public that the true costs of fossil-based energy is much higher than what is paid for 'at-the-pump'. It is therefore in policy makers' best long term interest to begin using more honest and holistic accounting of true costs, including previously omitted externalities such as environmental, social, and health costs associated with petroleum based products. Examples include the environmental destruction in the Gulf of Mexico, health costs from the widespread use of phthalates and plasticizers such as Bisphenol-A, groundwater pollution, climate change, etc. The list is long. True costs should also include direct financial subsidies, such as military protection and preferential tax-free corporate structures. Once these externalities are well understood, policy makers can more easily and effectively design targeted legislation with tax-incentives to compensate for these discrepancies.

Without tax incentives, or some equivalent mechanism for

Green Indicator #6, September 2010

Renewables in Oil-refineries

Using alternative feedstocks in the petrochemical industry is of interest from both a cost and sustainability perspective. A petroleum refinery is built up of a multitude of unit operations and in some of these there is a possibility for including a fraction of non-petroleum feedstock. One of the most investigated unit operation in this respect is the fluid catalytic cracker (FCC).

There has always been a driver for expanding the use of the FCC to include heavier residues, such as atmospheric distillation residue, coker and visbreaker naphtas etc. There is now however a drive to also expand the potential feedstock to include dissolved plastics, plastic pyrolysis waxes and biomass-derived oxygenates. These are mostly considered as a mixture with traditional FCC feedstock such as vacuum gas-oil, but also independently.

fuels or chemicals to compete with their heavily subsidized fossil-based incumbents. Furthermore, adoption of biochemicals will happen slowly, with probable fits and starts, while society and tax-payers continue to bear the large majority of the costs of the aforementioned externalities. However, with the right tax policy government can create an environment to stimulate innovation, entrepreneurship, and investment in a growing industry that will bring tremendous long-term benefits to society. From job creation, to reduced social and environmental costs, the cost-benefit analysis of tax-incentives can be easily defended and supported. To get there takes the courage and will to first make an honest assessment of the true costs of fossil-fuel dependence and then the commitment to reduce them with tax-incentives that support the lower-true-cost alternatives.

Heading to Algae

There has been a tremendous surge in the research and publications in the field of algae over the last three to five years. The development has triggered exciting advances in this field, ranging from algae-strain development to the implementation of new photo-bioreactor concepts. In this area, for the production of fuels and chemicals, it is usually micro-algae that is considered and discussed why this article will leave the macro-algae out of the equation for now.

Algae hold a prospect of using waste carbon dioxide from e.g. the chemical, petrochemical or power generation industry along with sunlight to produce triglycerides for fuel production. Traditionally the largest costs in algae systems arise in the pump-around and rupture of the algae cells for the harvesting of the actual product, as well as the need for nutrients added to the system. The largest drawback of algae at present is the cost-of-production, which is in no way competitive with current crude oil prices.

This is off course true for the production of bulk chemicals or fuels from the growth of algae, but as a matter of fact there is already profitable production of fine and specialty chemicals including dyes and nutrients. The key to a more profitable production would be to improve the algae system in a couple of ways. First it would be desired not to continue the current practice where algae is grown, harvested and disrupted. Instead strings with slow growth and an ability to release its oil-produce to the surrounding growth media would be preferable, and developments in this area are well underway. Another potential benefit would be the ability to tailor the actual composition of the triglycerides to be able to use the produce as not only a fuel, but as specialty oil in some cases as well as perhaps co-

Suggestions on feedstock additions include such compounds as glycerol, ethanol, bio-derived Fisher-Tropsch waxes etc. These feedstocks are in many respects different to the ones traditionally used, especially with respect to oxygen and ash content, but better with respect to e.g. sulphur. The advantage with the FCC system is that it already handle coking issues, making heavier fractions such as lignin (either dispersions or liquefied) or other biomass derivatives potential feedstocks.

In the end however, it is the overall economics that will determine this use further. On the beneficial side, there is no investment barriers and already a solution to coking issues. On the negative side, feedstock variability and ash content will have to be dealt with. It is undoubtedly a very good way to implement renewable fuels into the existing fuel infrastructure without prohibiting investment costs.

Author: Christian Hulteberg,
christian@hulteberg.com
+46 733 969420

Editor: Andreas Leveau,
andreas@hulteberg.com
+46 733 969423

string.

In summary the use of algae is a potentially exiting future source of chemicals and fuels that most likely will be a part of the future energy mix. There is still a lot of work that is needed in the area though, but with the current resources spent on the area, there is good hope that the technology will mature sometime in the near future.

About HC&E