

Future Challenges to Sustainability for Land-Based Industry

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What does sustainability mean?

Sustainability is a function of economic viability, cost of environmental impact and social/cultural acceptability.

It does NOT mean that one person can go on for ever doing whatever it is! Sustainability really needs to be taken at a continental or even worldwide level in the longer term.

Becoming sustainable will entail radical changes in lifestyles.

Impact of policy making

- 2013 a revision of CAP. What will this mean to land-based industry esp in terms of economics of production? Food will cost more?
- land and water Directives -will constrain some current agricultural practices
- European Parliament - reducing pesticide use-looking to potential hazard not actual risk. Can land-based industry adapt to this?
- Biofuels eg in USA -land use change impacts

More on policy impact

- Land use for environmental purposes may reduce crop areas for food production
- Responses to global warming and to water management may mean land coming out of arable crop use and going into grassland or forestry to preserve soils and avoid erosion. So less area for food production.
- An emphasis on bio/organic farming - cannot provide the world with current levels of food

We are in a rapidly changing world

- Global warming because of GHG production from our 'decadent' lifestyles
- Biodiverse ecological systems are declining
- Land area available for food and feed is declining but population/migration will increase
- Many policy makers have no scientific skills and therefore cannot make clear policy judgements without specialist assistance
- Education has focussed on service industry not science or subjects associated with land-based industry subjects

Some governments are urging action for example in biorenewables, The Nuremburg Declaration

- Set targets for bioenergy (ie renewable and sustainable)
- Realise value of renewable resources
- Ensure sustainability in production methodologies
- Promote innovative science
- Expand industrial use of biorenewables

AND, EU HAS SET TARGETS FOR SUSTAINABLE, SECURE AND AFFORDABLE SUPPLIES OF ENERGY

- 20% reduction in primary energy consumption by 2020
- 20% reduction in greenhouse gases by 2020 (Based upon 1990)
- 20% renewable energy in overall energy mix by 2020.
- 10% min biofuels for vehicles by 2020

RENEWABLE ENERGY DIRECTIVE FROM EC- SUSTAINABILITY CRITERIA

- Minimum GHG savings should be 35%
- Do not come from raw materials obtained from land with high biodiversity value eg natural protection areas; wild forest; high biodiversity grassland
- Do not come from raw materials obtained from high carbon containing land eg permanent farmed forests; wetlands

Biodiversity - a shrinking phenomenon with a range of impacts on land-based industry

- Decline in biodiversity has cost over £50 billion sterling so far.
- 85% of rainforest could be killed off in the next 100 years if temperatures rise by 4 C degrees. Water; CO₂; land availability ?
- 25 to 40% of African species become extinct if temperatures rise 3 C degrees.

Where do we get our genetic biodiversity for future plant breeding etc needs? What of future sustainable land availability? What of international agreements?

Global warming means a totally new lifestyle for all and new challenges for land-based industry

Some impacts of GW

- Major droughts or storms. General deficit in water supply. Erratic rainfall patterns
- Great Barrier Reef disappears - no tourism
- 3 to 5000 extra heat-related deaths per year in Australia (but NB France in 2008/9) .Mass migration from S. Europe & impact on land availability in N Europe. Africa ?
- Declining food supply and therefore food choice. Declining land areas as countries or regions disappear: Bangladesh; Mauritius; Eastern part of England

More GW related problems

- New diseases of animals/people eg Blue Tongue and malaria now appearing in NW Europe. Have we controls and are we moving fast enough to find them?
- New & increased disease & pest spectrum for crops- but pesticides declining in EU
- Need for new approaches to plant breeding to obviate GW impact. What of GM and biotech generally? Are there alternatives?
- Need for reappraisal of most production techniques for plants and animals esp H2O

Lifestyle change -some visual warnings











And don't forget recycling is an essential way of reducing greenhouse gases but that this may compete with agricultural or forestry produce

Competition from valueless wastes.

New plastics recycled from old stockings

Patrick Walter

Old stockings and body armour could be taken apart into their basic building blocks and reused to produce fresh, high quality plastics with a new processing technique that can recycle polyamides.

Researchers at Yamaguchi University in Japan depolymerised polyamides like 6-nylon by adding the polymer to an ionic liquid – a liquid that contains only ions. This mixture was then heated at 300°C for an hour under a nitrogen atmosphere. Caprolactam, the building block of nylon, was then collected by distillation at reduced pressure. Using this technique, caprolactam yields of up to 85% were achieved (*Organic Letters* 2007, **9**, 2533).

Currently, the majority of plastic recycling involves shredding and melting down of the waste plastic followed by remoulding into new shapes. Unfortunately, plastics produced using this process tend to be of a lower quality and cannot be used in applications like food containers. Attempts to depolymerise plastics have also been attempted but these have had to be carried out at pres-

ures as high as seven atmospheres, which requires special apparatus.

One of the inventors of the technique, Akio Kamimura, said that ionic liquids were chosen because of their low volatility and relatively poor inflammability at high temperatures.

The biggest advantage of their method, according to Kamimura, is that the ionic liquids can be used again and again – up to five times with no loss in yield of caprolactam. However, he is unsure whether polymers could be commercially recycled with this method, saying that it very much depends on the price of ionic liquids.

Victor Castaño, a polymer researcher at the Universidad Nacional Autonoma of Mexico, said that what is so important about this technique is that it can be carried out at normal or reduced pressure. 'The technology is simple enough as to be, in principle, scaled-up to industrial levels at a cost unmatched by other methods,' he added.

Kamimura now plans to investigate whether this technique can be used to depolymerise other polymers.



An idea: that stands out from the crowd

Chemistry & Industry — 9 July 2007

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Sustainability means joined up thinking!!

- For example in motor transport:
 - Lighter vehicles using plant fibres instead of fibre glass- less energy in making and driving
 - Utilisation of wastes in body shell construction?
 - Low fuel-demand tyres using nano-starch
 - Recognition of potential of hydrogen (from waste biomass) & fuel cells to replace gasoline or diesel
 - Sensible speed limits

The wider issues for sustainable land-based industry

- Whilst global warming and water availability in particular will be key drivers affecting sustainability it must not be forgotten that policy makers are not necessarily fully linked into the system and do not necessarily understand fully the needs of land-based industry. Steps are needed to inform policy making and indeed the general public about challenges and opportunities. NB joined-up policies

A way forward- but is it realistic?

- An ideal world needs a fully integrated strategy for sustainable land use and for production and utilisation of plant/animal material. It must be international.
- We need to create awareness at all levels- NB. IENICA showed that industry did not know the options. More data 'metabolism' is needed. Can we encourage change?
- Somehow we need to manage water at a strategic level - is this really possible?

In projects like this one and others in and formerly in existence, R&D has highlighted many opportunities for sustainable land - based industry. They now need to be introduced to political strategy and to the general public.

At the same time we need more technology transfer at the practical level.



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