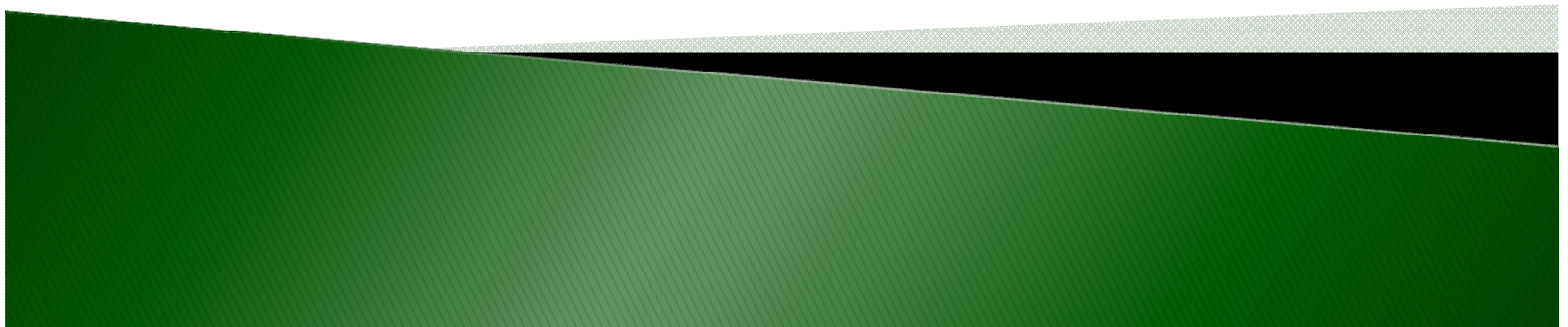


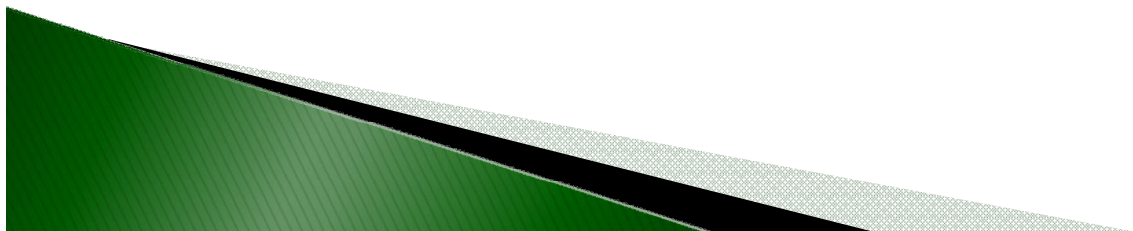
# Least-Cost Recycling of Food Wastes to Produce Sustainable Energy

Bill Butterworth  
Recycle-to-Land Research Ltd





"Would you tell me, please, which way I ought to go from here?"  
"That depends a good deal on where you want to get to," said the Cat  
"I don't much care where" said Alice  
"Then it doesn't matter which way you go," said the Cat



There are three ways of losing money;

wine, women and technology

Wine is the most pleasant

Women are the most fun

Technology is the most certain





DTI in the early 1990's asked Land Network International to look at using urban wastes as a bridge between the urban and rural economies.

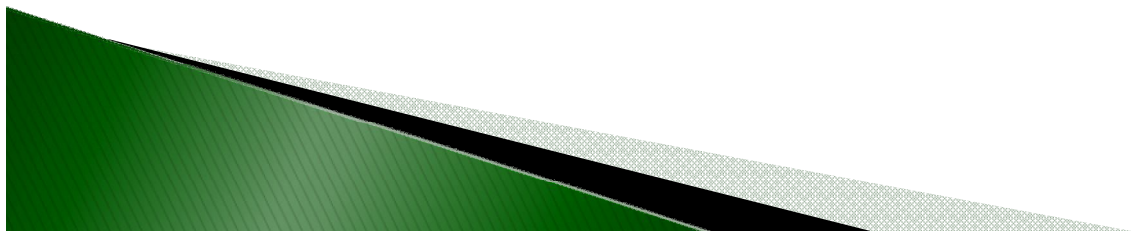
Land Network in the UK is a "reverse franchise" of farmers recycling Controlled Wastes to farm land, mainly by composting. Some of these farms produce biodiesel or PPO (Pure Plant Oil) to drive diesel engines.

Outdoor composting is aerobic and the lowest capital cost, the lowest running costs and can be run on a proximity principle basis.

When run on farms, with product for the farm's own use, Land Network estimates a 65-85% saving in tonne-truck miles compared with centralised processing.

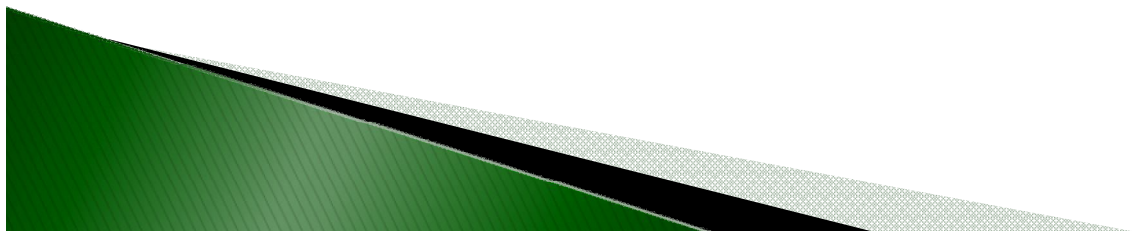
BUT, it is not legal for ABPR wastes.

However, do it inside and call it "In Vessel" and it can be ABPR compliant.



## ***AD – ANAEROBIC DIGESTION***

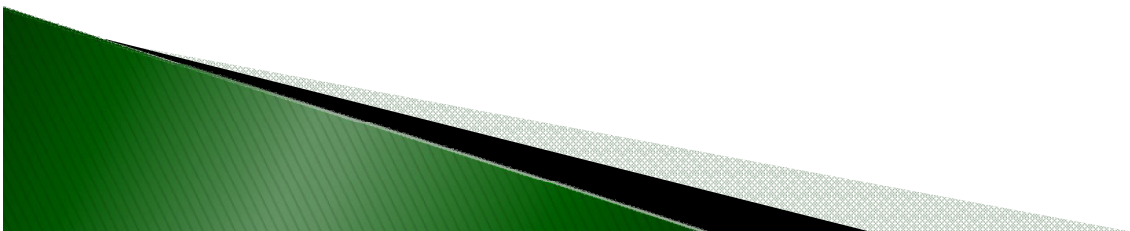
- Is legal for ABPR wastes
- Will produce “renewable” electricity in the same facility
- Has a comparatively high capital cost  
(a 30,000tpa facility might cost £10-20million and that is a useful guide to how much energy is used to make the construction as a whole)
- As a process, produces a high odour fertiliser with an anaerobic micro-organism population



## ***OTHER TECHNOLOGIES***

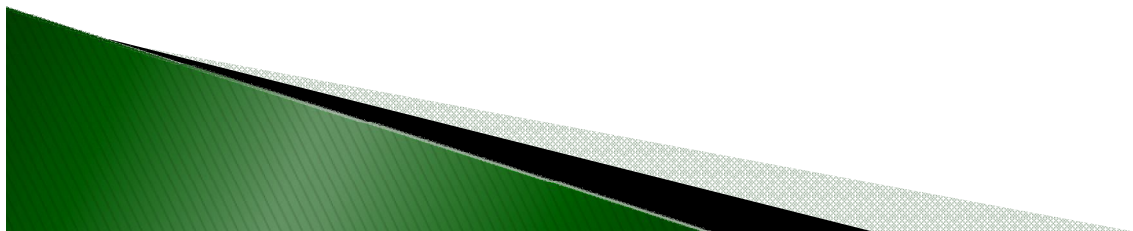
- Gasification
- Pyrolysis
- Autoclaving
- Microwaving

-- All very high capital expenditure --



“Nobody ever got fired for buying IBM”

Buck Rodgers

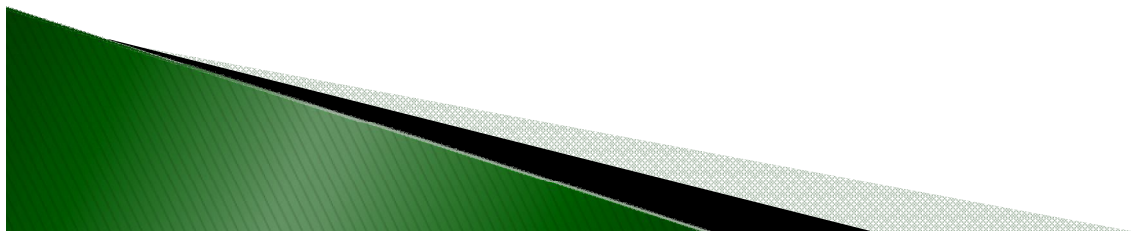




## ***TAD – THERMOPHYLIC AEROBIC DIGESTION***

- Is legal for ABPR wastes
- Will NOT produce “renewable” electricity from the same process
- Has a comparatively low capital cost  
(a 30,000tpa TAD facility might cost £2-5million including a CHP and that is a useful guide to how much energy is used to make the construction as a whole)
- As a process, produces an agriculturally attractive fertiliser with an aerobic micro-organism population

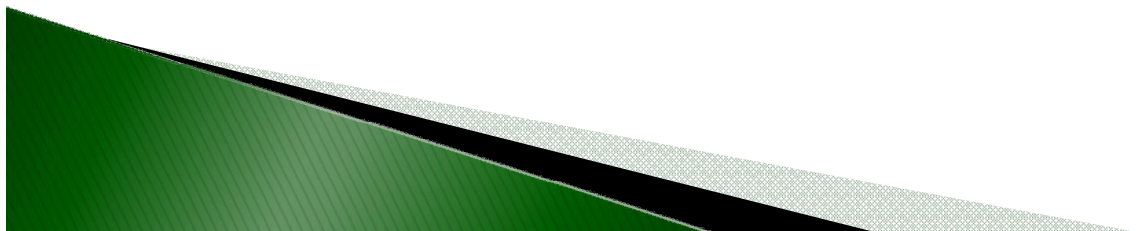
This is what Land Network is recommending as a farm-based facility



History is littered with governments choosing to back a particular technology which failed.

Government does have a duty to back principles and the principle of producing electricity appears good – but only if it is **sustainable**.

If the generators and distributors of electrical power were asked to produce a target from sustainable sources, and let industry choose the technology, it would save the taxpayer very large sums.



## RENEWABLE is not the same as SUSTAINABLE

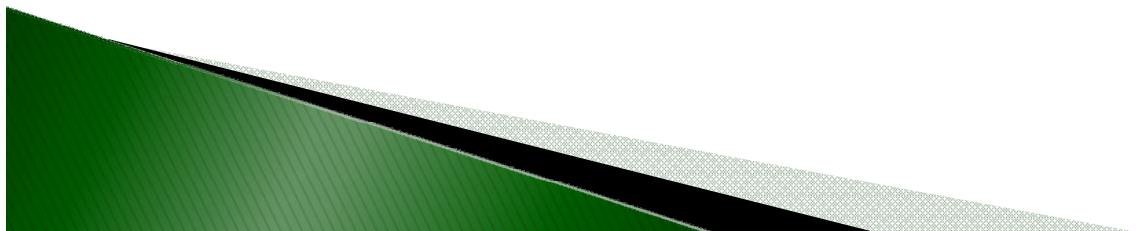
Double ROC's are available for electricity from an AD facility

1.5ROC's are available if a farmer, for example, produces an oil seed rape (OSR) crop, harvests the crop, presses the oil and uses that to drive a diesel engine and generator.

That looks fine but the ROC's are available even if the OSR crop was grown with mineral fertilisers. (Which were made and transported using energy!) This may be renewable but it is NOT sustainable.

TAD can be used to produce fertiliser, to grow OSR and to produce electricity. It can claim 1.5ROC's. Why is a kWh worth more from an AD facility which took more energy to build it than a kWh from a TAD?

Currently, growing a crop especially to feed all or in part the feedstock for an AD facility is common in Europe and being recommended here. Do that and get 2ROC's. Even if the crop was grown with mineral fertilisers.



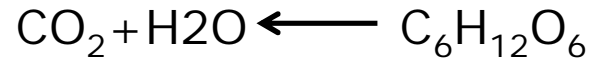
There is only one proven technology which is available to produce sustainable electricity *and* reverse global warming



# The Basic Equations in Managing Real Sustainability

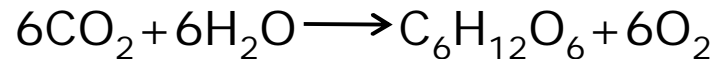
Energy from the sun

Plants take CO<sub>2</sub> and water  $\longrightarrow$  To make large Carbon molecules

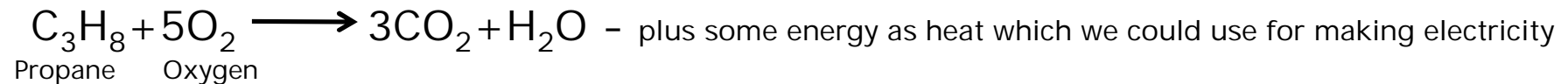


$\longleftarrow$  Animals & incineration push  
this the other way

The balanced chemical equation reads:



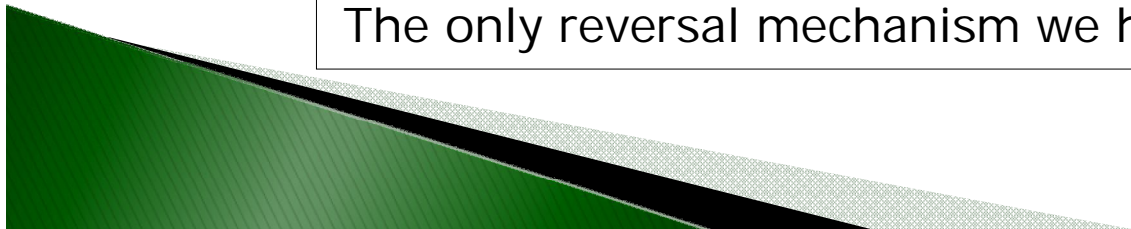
Burning a small Carbon molecule reverses this process:



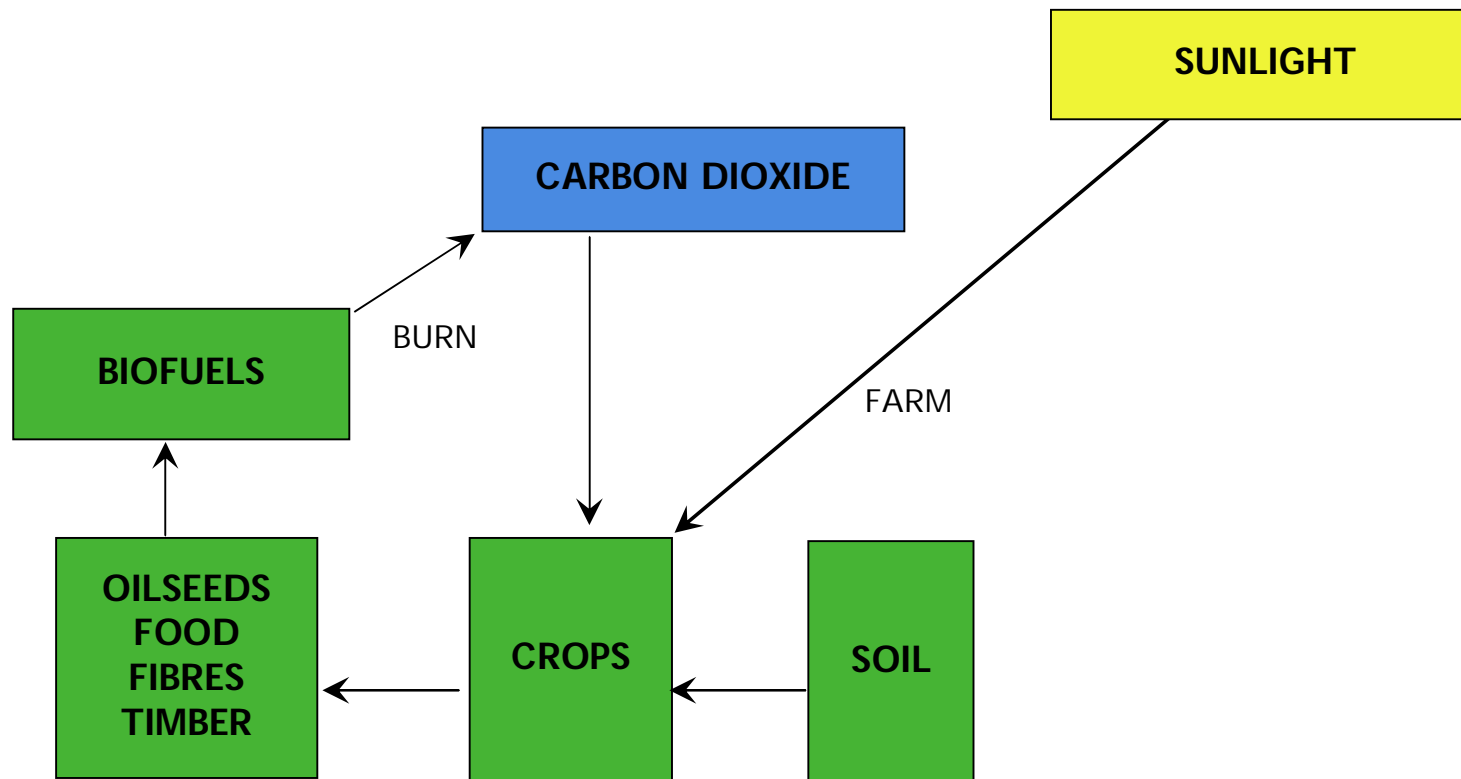
Burning a big Carbon molecule would read:



Never mind the **Carbon dioxide**, where is the **Oxygen** going?  
The only reversal mechanism we have right now is the **green leaf**.

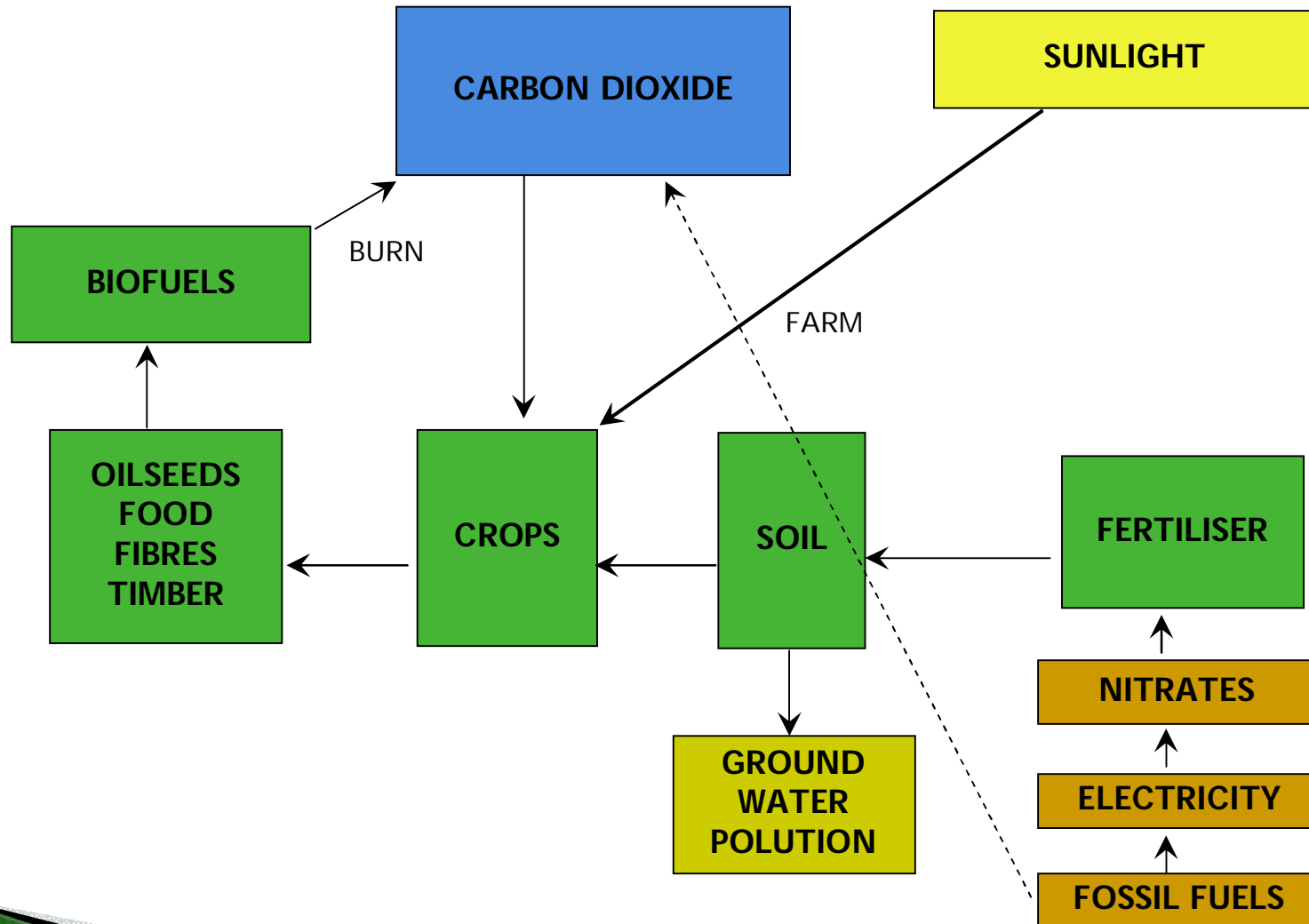


## CROPS TO BIOFUELS - The Basic Route

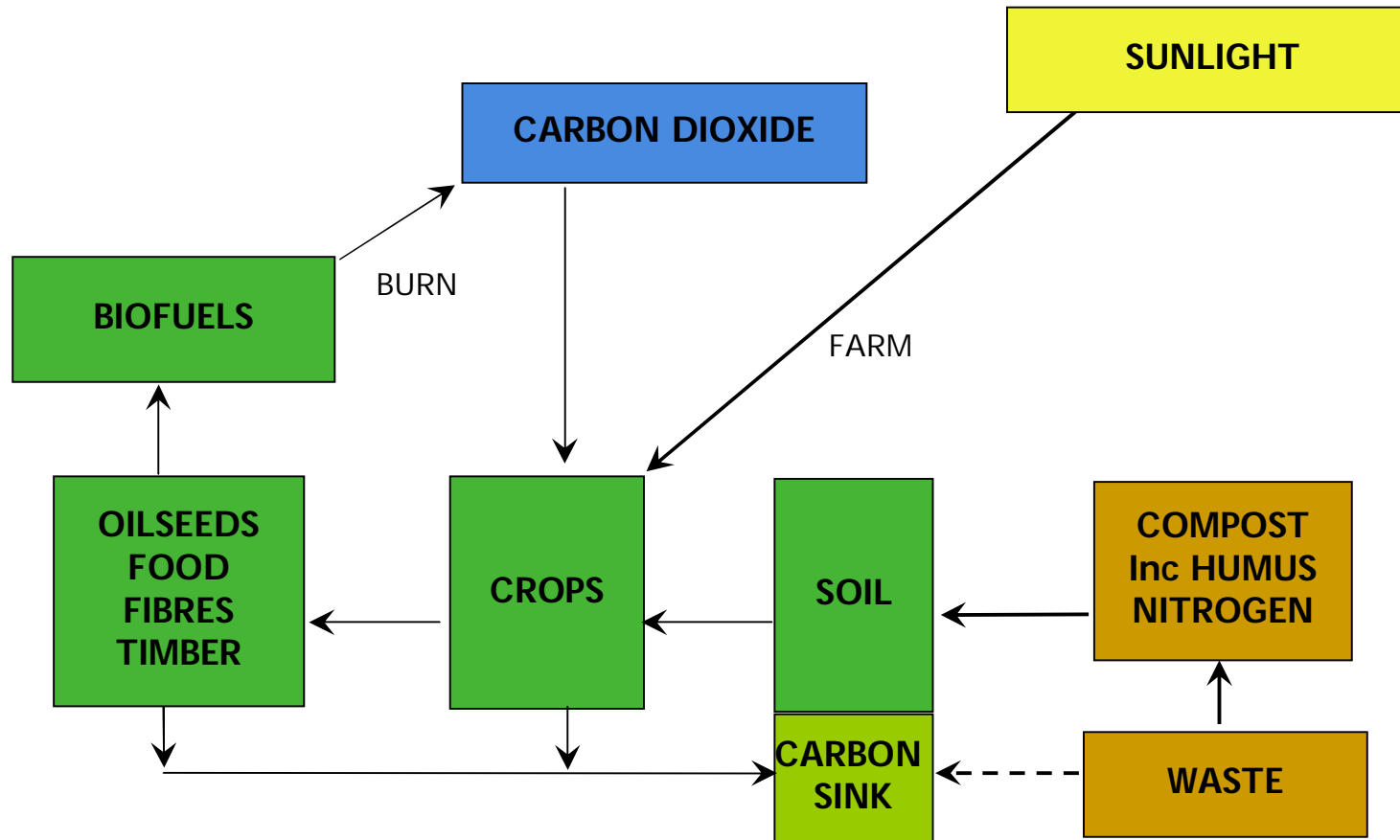




## CROPS TO BIOFUELS – Mineral Fertiliser



## CROPS TO BIOFUELS – From “Waste”



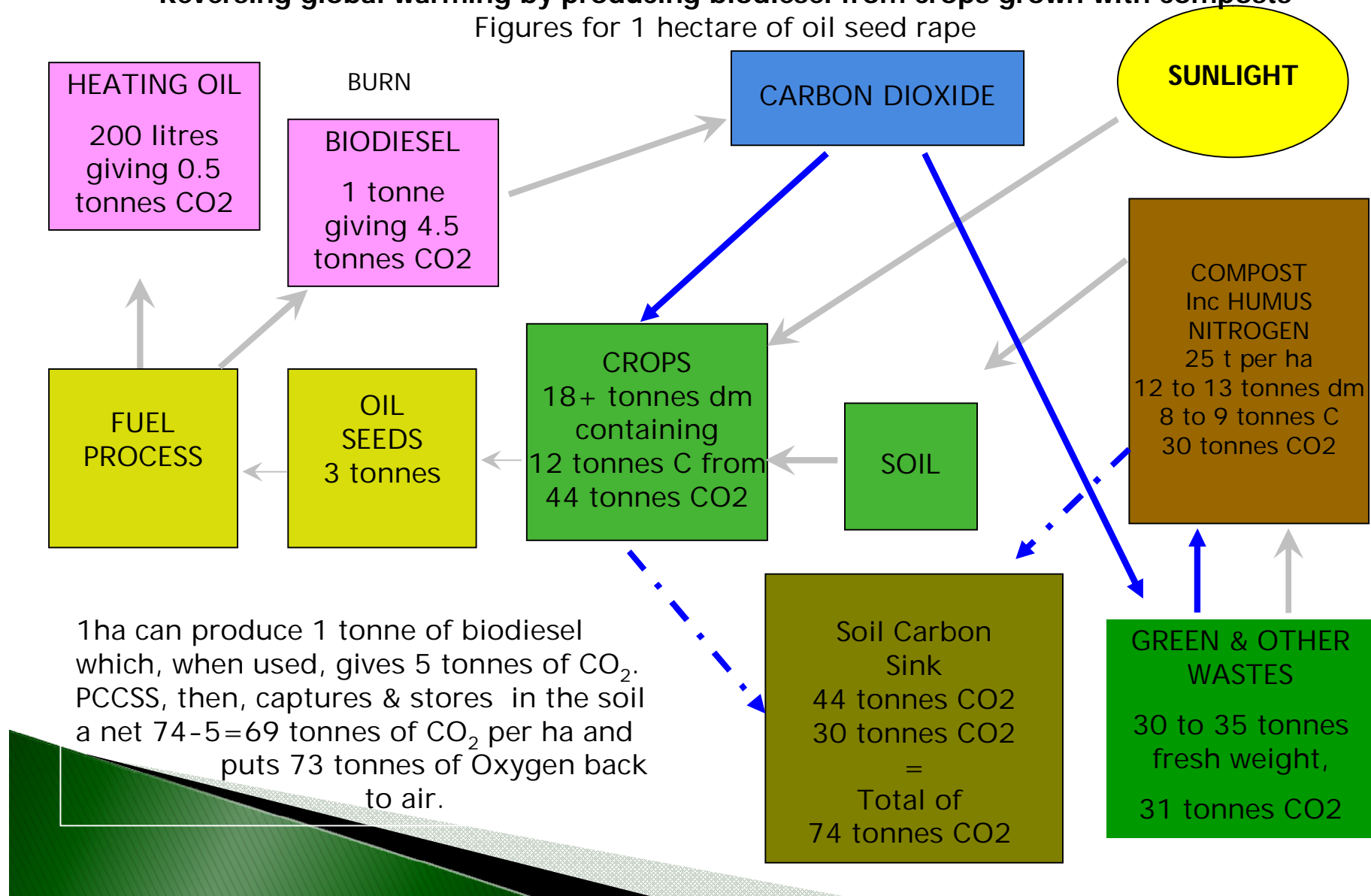
1 ha can produce 1 tonne of biodiesel which, when used, gives 5 tonnes of CO<sub>2</sub>. PCCSS, then, captures & stores in the soil a net  $74 - 5 = 69$  tonnes of CO<sub>2</sub> per ha. It also releases about 73 tonnes of Oxygen.



# PCCSS – Photosynthetic Carbon Capture and Storage in Soils

Reversing global warming by producing biodiesel from crops grown with composts

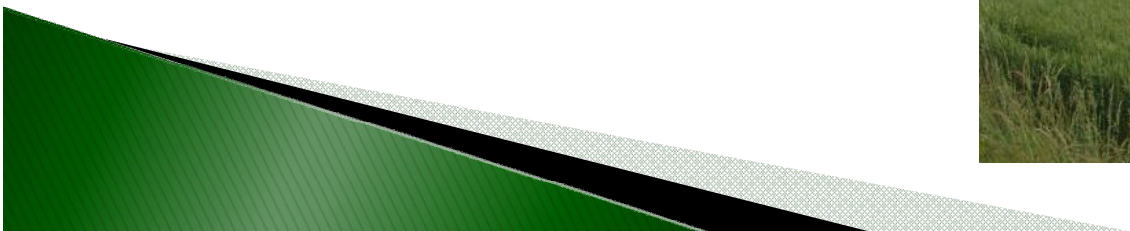
Figures for 1 hectare of oil seed rape



## ***1:9 FUEL LAND TO FOOD LAND RATIO***

Land Network (Gainsborough) Ltd worked with CNH (the global tractor company) and Volvo truck on an R&D programme and has delivered taking a range of municipal and industrial “wastes” to make compost, so eliminating the use of mineral fertilisers, to grow good crops safely and these include oil seed rape which is used, on the same farm, to produce biodiesel to EN14214.

They calculate that taking 1 hectare of oil seed rape grown this way will produce enough energy to run a farm of 10 hectares, including all the field work and all the houses of the families who work that land.

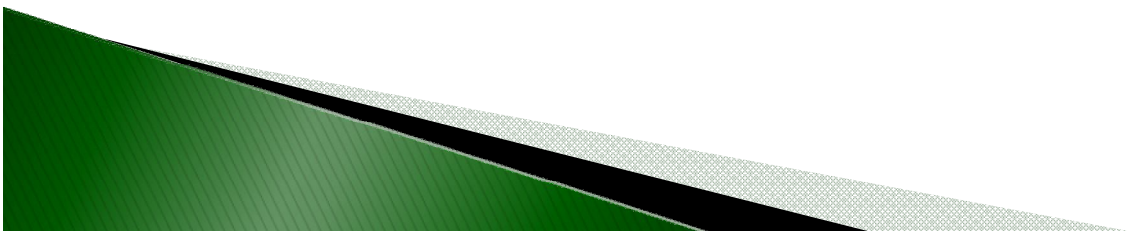


British farming purchases, mainly by import, around £2.4billion worth of mineral fertilisers per annum.

Land Network estimates there is enough wastes of the right type to replace over 80% of that, maybe all, provided we see “wastes” as resources and by-products.

Farm land could produce biofuels in quantities enough to make a serious contribution to the national economy.

**It is at least worthy of debate as to whether the available organic matter should be used to produce methane and electricity directly, or, with the inorganic by-products of industry, be put to land to produce crops and, in turn, food, electricity and heating oils AND save £2.4 billion imports.**





# Reversing Global Warming for Profit

Subtitled

**If it isn't financially sustainable, it isn't environmentally sustainable**

By **Bill Butterworth**

Published by **MX Publishing**

