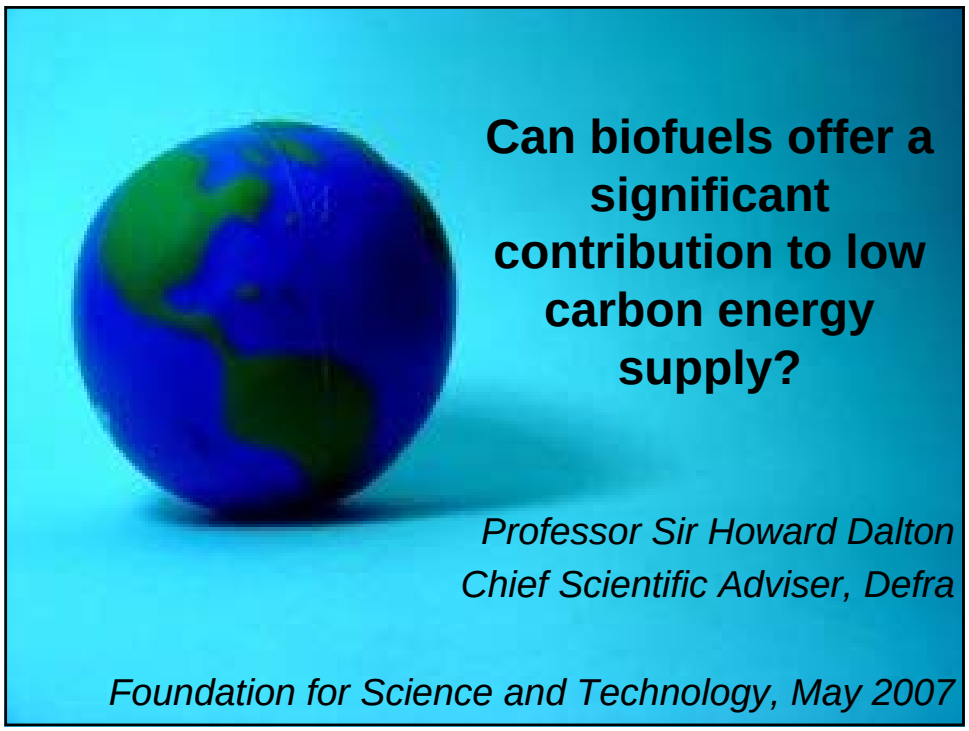
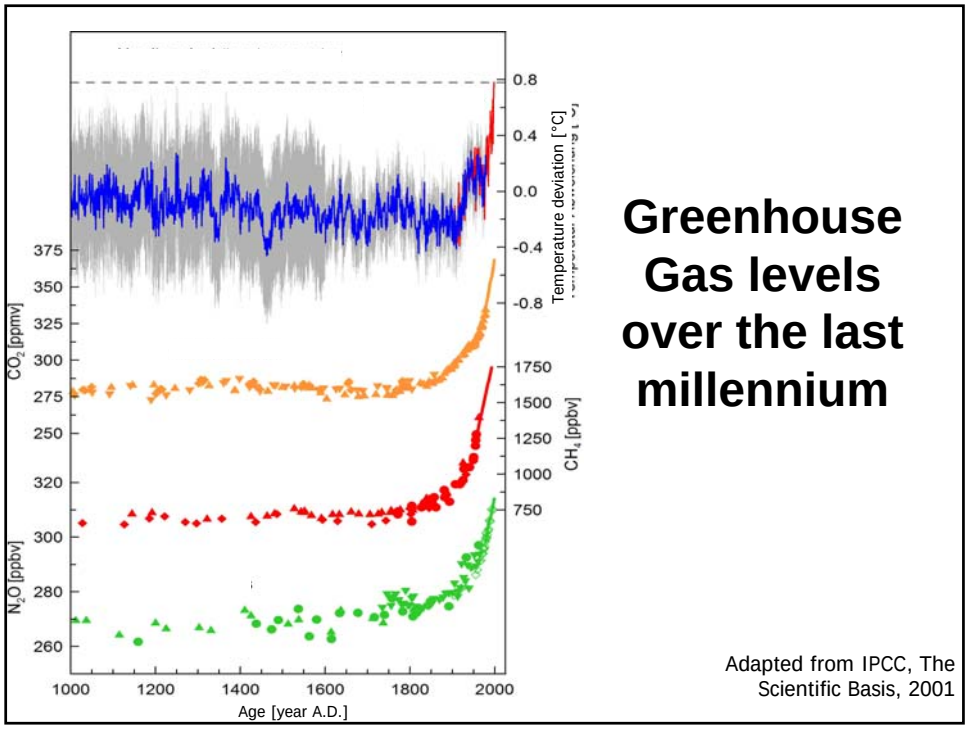
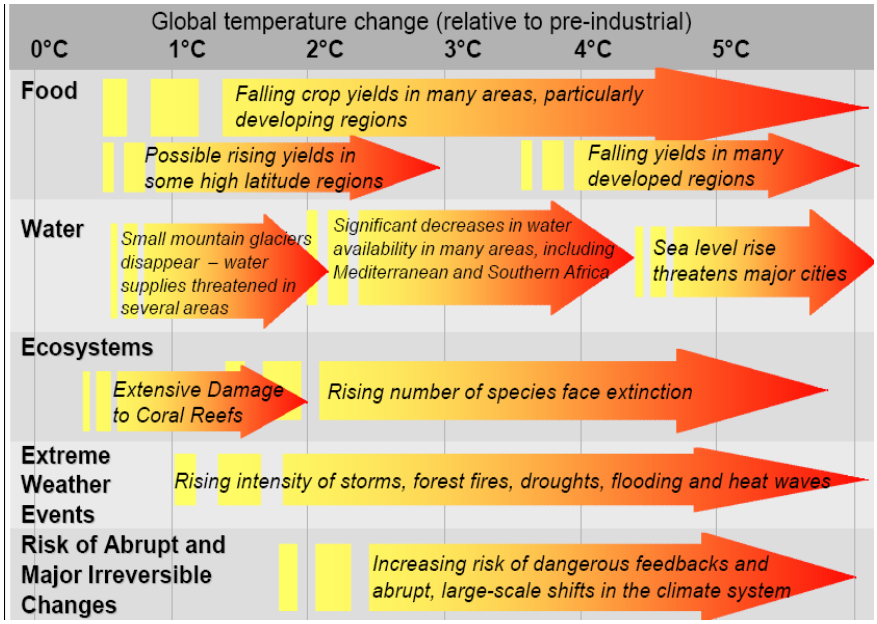

Can biofuels offer a significant contribution to low carbon energy supply?
Professor Sir Howard Dalton
Chief Scientific Adviser, Defra
Foundation for Science and Technology, May 2007

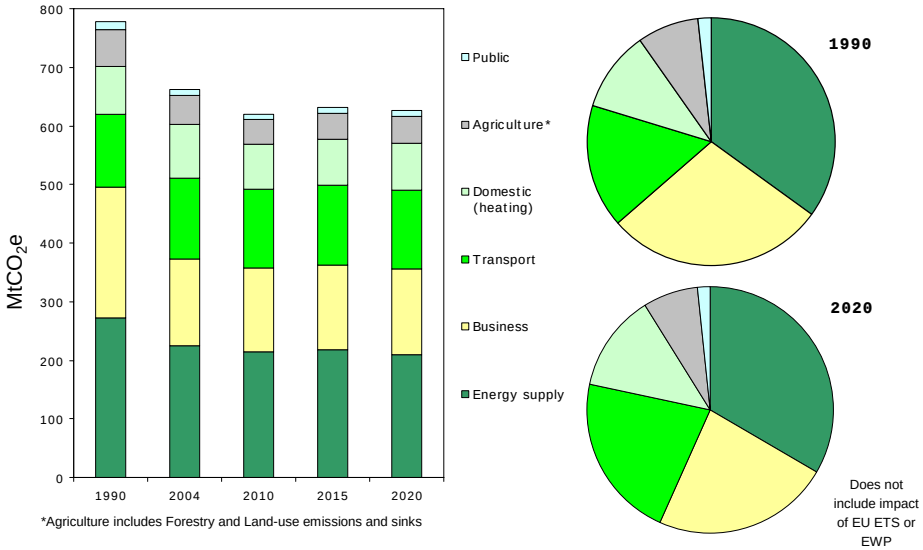

Greenhouse Gas levels over the last millennium
Temperature deviation [°C]
0.8
0.4
0.0
-0.4
-0.8
CO_2 [ppmv]
375
350
325
300
275
250
CH_4 [ppbv]
1750
1500
1250
1000
750
N_2O [ppbv]
320
300
280
260
1000
1200
1400
1600
1800
2000
Age [year A.D.]
Adapted from IPCC, The Scientific Basis, 2001

Projected impacts of climate change



Stern Review (2006)

Recent Emissions and Future Projections



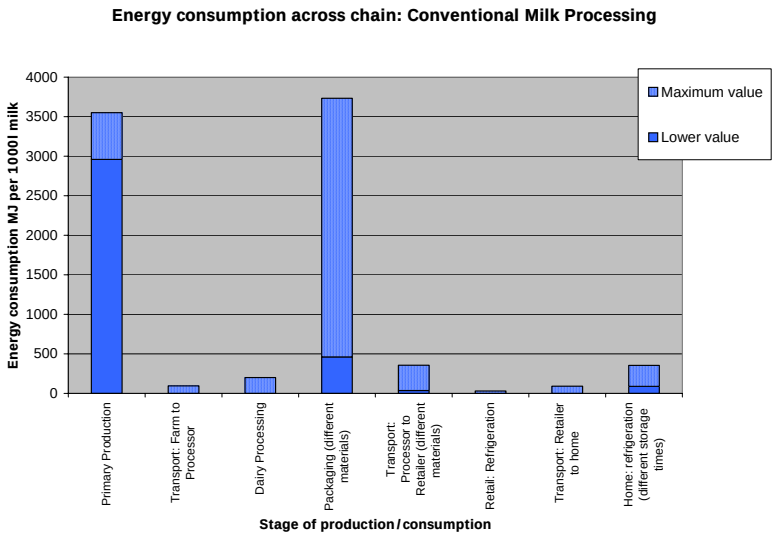
*Agriculture includes Forestry and Land-use emissions and sinks

Does not include impact of EU ETS or EWP measures

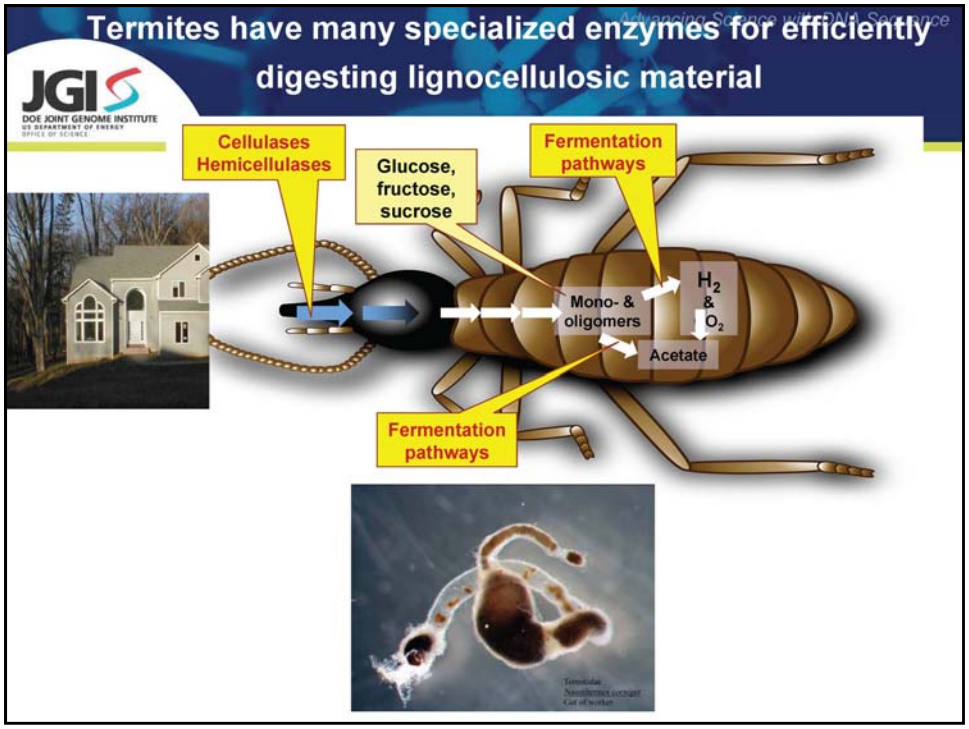
Sources: National Inventory Report Issue II, 2006. UK's Fourth National Communication, 2006. Climate Change The UK Programme, 2006. CESA division, DEFRA. Updated Energy Projections 26, 2006.

5% Biofuels by volume by 2010 – equivalent to taking a million cars off the road

Product lifecycle impacts: Milk

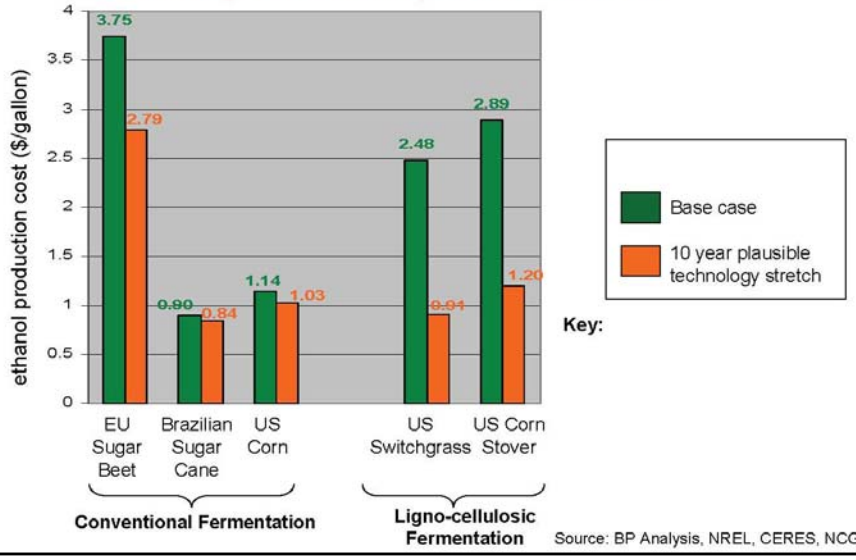


PLA Plant
Blair, Nebraska
January, 2002


Termites have many specialized enzymes for efficiently digesting lignocellulosic material
JGI
DOE JOINT GENOME INSTITUTE
US DEPARTMENT OF ENERGY
OFFICE OF SCIENCE
Cellulases
Hemicellulases
Glucose, fructose, sucrose
Fermentation pathways
Mono- & oligomers
H_2 & O_2
Acetate
Fermentation pathways

current and projected production costs of bio-gasoline components

Courtesy Steve Koonin, BP Chief Scientist



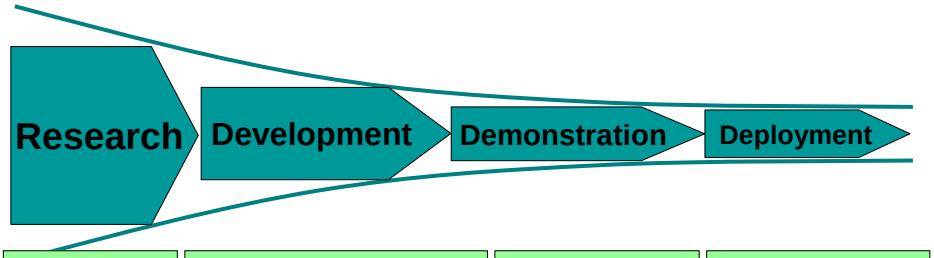
Source: BP Analysis, NREL, CERES, NCGA

Building Capacity for Renewable Fuels, Chemicals & Materials

Technology push & knowledge transfer...

... market pull & public policy

INDUSTRY



- BBSRC - Bioenergy Initiative - Biorefineries Club	-Energy Technologies Institute -DEFRA/BBSRC Renewable Materials LINK -IBTI -DEFRA Bioenergy R&D -Knowledge transfer, promotion, feasibility studies: KTNs and NNFCC	Environmental Transformation Fund IBTI	Policy -EU renewables targets -Biomass Strategy -Renewables Obligation + RTFO -Biomass and energy crop grants -Planning policy -RDA support -Woodfuel Strategy

Diseases in Winter Oil Seed Rape

Light Leaf Spot

Stem Canker

Pictures from Rothamsted Research

Contribution of Genetically Modified Crops

Using GM techniques we may be able to produce:

(i) plants that require fewer nutrients or less water than wild type cultivars;

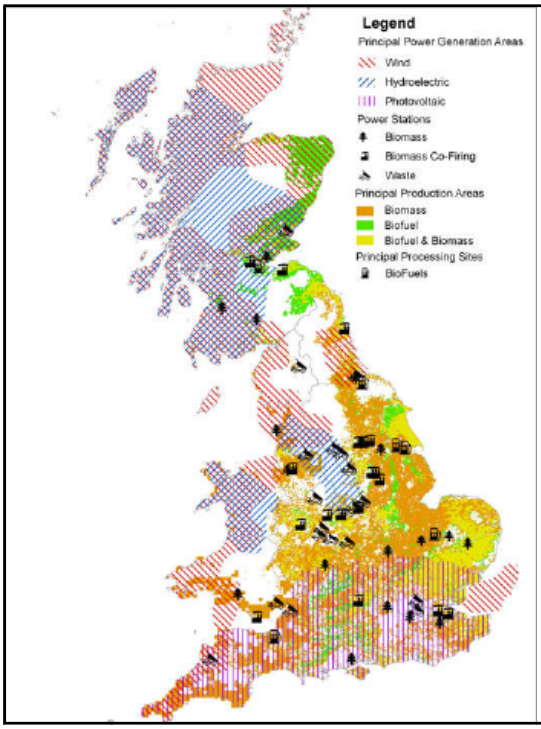
(ii) yeasts or bacteria that increase the efficient release of fermentable sugars from biomass feedstocks;

(iii) crops that are resistant to insects, pests and herbicides; and

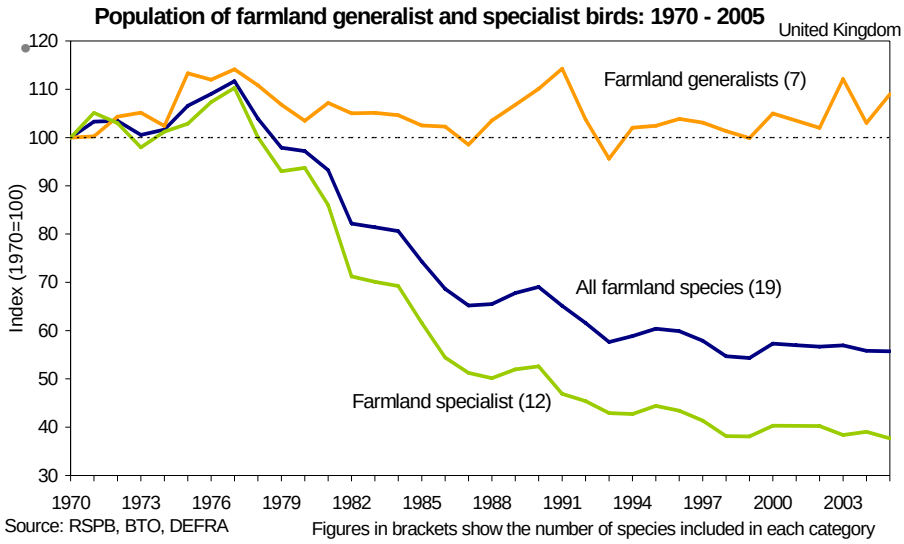
(ii) crops that produce higher yields or are easier to harvest or process.

Renewable Fuel Targets

- **RTFO**
  - **2.5% by volume by 2008/09**
  - **5% by volume by 2010**
- **Energy Policy for Europe**
  - **10% by energy content by 2020**



ADAS projection showing possible distribution of GB renewable energy sources in 2020 –

As much as 20% of land in the East Midlands region may be planted to willow and miscanthus.

Farmland Biodiversity