

UCC

Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland



International Energy Agency Task 39 Biofuels Symposium

Jerry D Murphy

Department of Civil and Environmental Engineering
& The Environmental Research Institute
University College Cork, Ireland

jerry.murphy@ucc.ie www.ucc.ie/serg/jerry.html

UCC Biofuels Symposium

16th September, 2008

Welcome and Thanks

IEA Task 39

- ▶ Jack, Warren, Emmanuel (Canada) and all delegates who travelled

UCC

- ▶ Prof Patrick Fitzpatrick, Head of SEFS
- ▶ Food Training: Mary McCarthy Buckley & Deidre Crone

EPA

- ▶ Dr Brian Donlan, Dr Shane Coglan

ERI

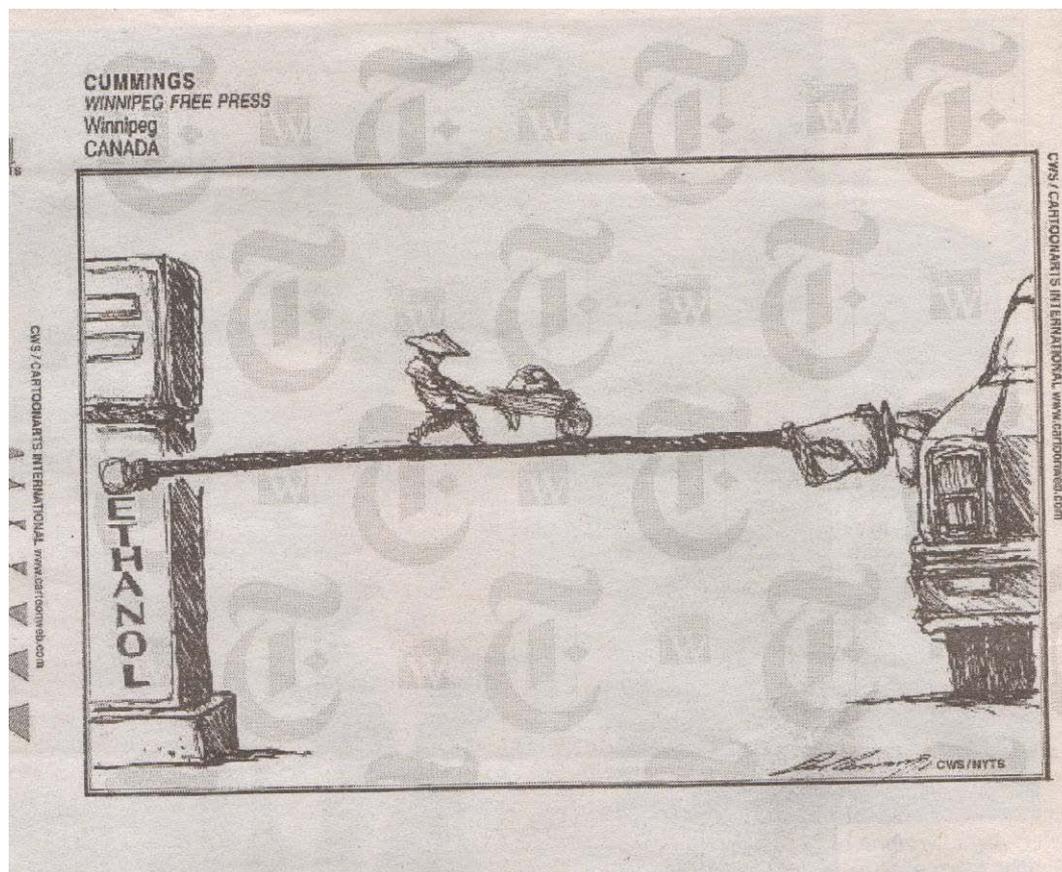
Senator Dan Boyle, Chair of the Green Party

Delegates for attending

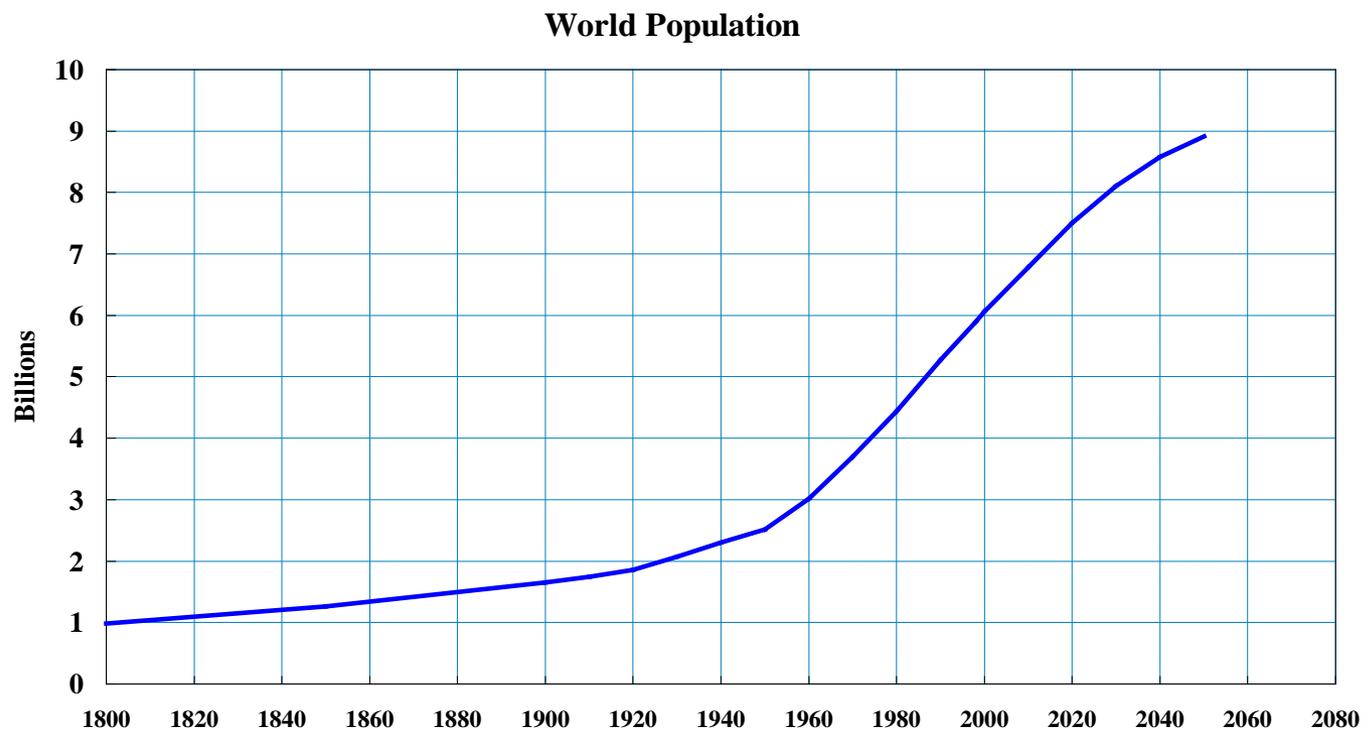
Which has the priority: energy or food?



Is it ethical to make fuel from food?



Feed the World???



- ▶ 8kg plant protein yields 1 kg meat protein
- ▶ Should we all become vegetarian?

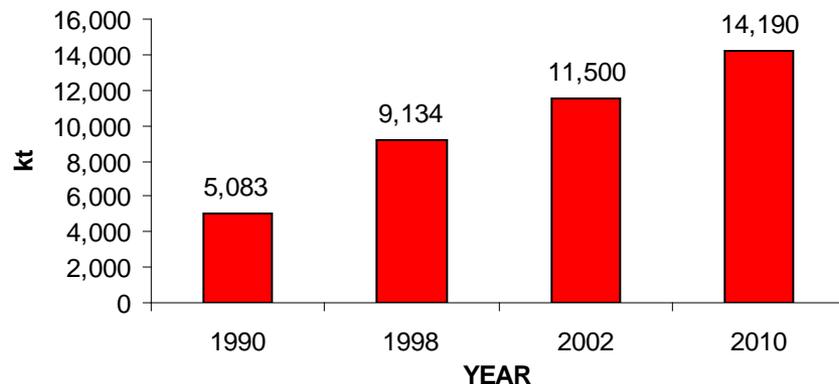
Sustainability of transport energy systems.

Peak Oil

- ▶ Present production: 86 million barrels/day;
- ▶ Expected demand 2015: 120 million barrels/day;
- ▶ Ability to produce 2015: 100 million barrels/day.
- ▶ Shortfall 2015: 20 million barrels/day

When do we start to ration oil?

Greenhouse Gas Emissions from Transport in Ireland



800,000 private cars in 1990; 1.8 million private cars in 2005.

Rise in use of fuel, and associated emissions, of 152% in 2005; heading for 180% by 2010.

Agriculture in Ireland

	Area		Production	
	kha	t/ha	kt/a	
Total agricultural land	4,445			
Cereals	300			
Wheat	95.7	8.3	794	
Barley	183.1	6.5	1,190	
Oats	21	7.4	155	
Total			2,139	
Sugar beet	32	55	1,760	
Potatoes	14			
Forage maize	20			
Rape	2	3	6	
Total arable	400			

- ▶ 90% of land under grass; only 10% arable;
- ▶ Arable land has a function: beer, whiskey, bread or fuel?

Land Take for Biofuels

Biofuel Requirement 2010

Fuel type	1/a * 10 ⁶	MJ/1	PJ/a	%
Road fuel	6,184		194.2	100
Biofuel			11.3	5.75
Ethanol	535.5	21.1	11.3	5.75
Biodiesel	332	34	11.3	5.75

Land Take 2010

1% of agricultural land = 1% of transport fuel

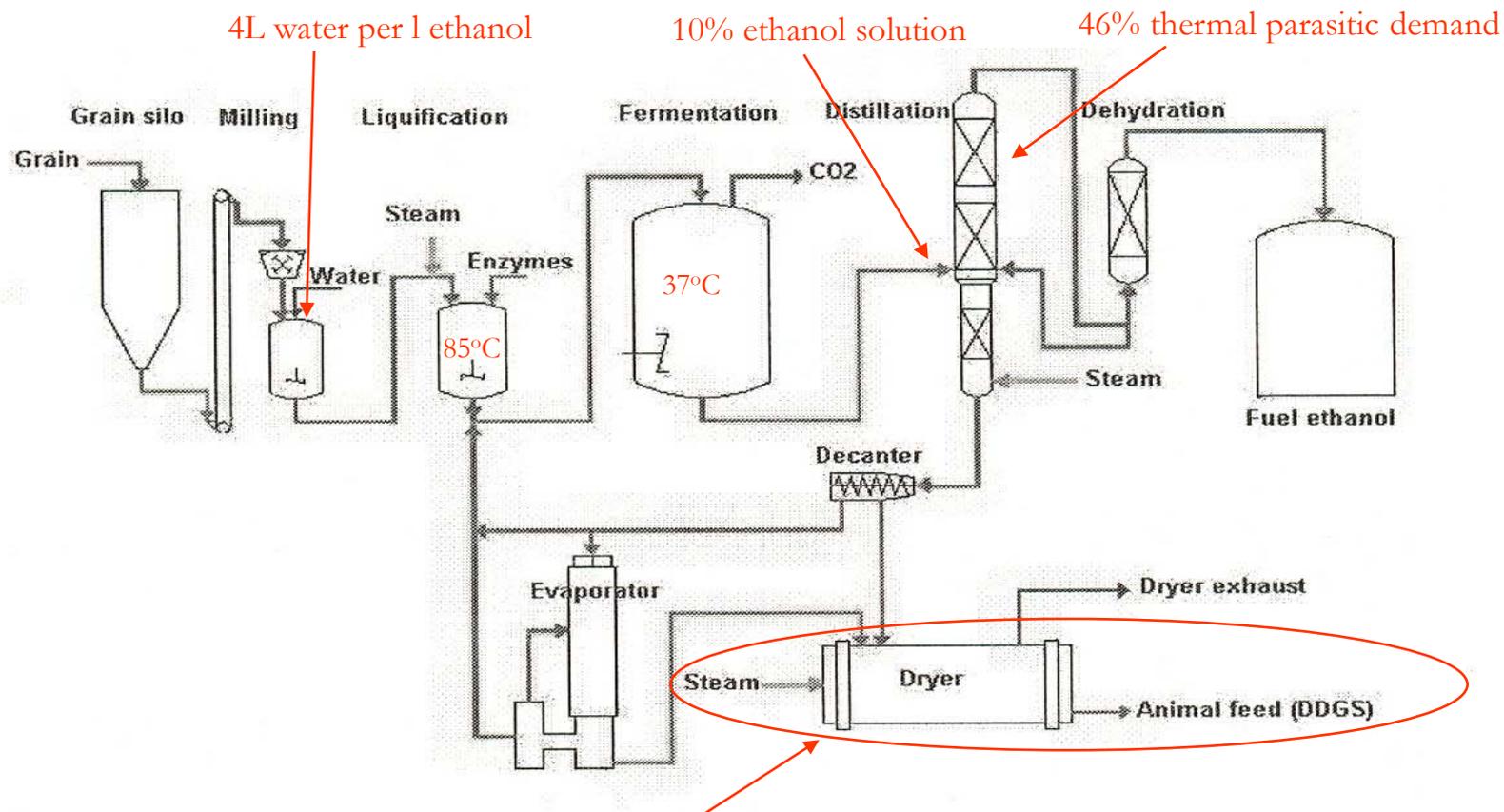
Fuel	Crop	% of agricultural land	% of arable land
Biodiesel	Rape seed	5.7	63
Ethanol	Wheat	3.9	43
Ethanol	Sugar beet	2.4	26

Biofuels required to fuel a bus

	Crop t/ha	Fuel/t	Fuel/ha	Energy /ha/a	Land required ha/a	Rotation	Land to be contracted Ha
Biodiesel from rape seed	4	0.3t	1.2t oil	42	24	1 in 5	120
Ethanol from sugar beet	55	100 l	5500l/ha	115	8.8	1 in 3	26.4
Ethanol from wheat	8.4	375	3150l/ha	66	15.3	2 in 3	23
Biogas from sugar beet	55	128 m ³ /t	7047 m ³ /a	146	6.9	1 in 3	21
Biogas from wheat	8.4	420 m ³ /t	3528 m ³ /a	74	13.7	2 in 3	21
Biogas from silage	60	123m ³ /t	7380m ³ /a	155	6.5	every year	6.5

Table 9. Land required to power one Dublin Bus

Flow chart of ethanol from grain facility



35% of thermal parasitic demand is used to dry the wet distillers grain and solubles (WDGS) to dry distillers grain and solubles (DDGS).

Gross Energy of Ethanol from Wheat

Wheat	8.4 t/ha	375 l/t	3150 l/ha	66.5 GJ/ha/a
-------	----------	---------	-----------	---------------------

Net Energy of Ethanol from Wheat

Gross Energy 66.5GJ/ha/a

Energy used in process 41.5GJ/ha/a.

Energy in agriculture 21 GJ/ha/a.

Net energy 4GJ/ha/a

We can modify the system: source of energy, use of more of crop etc...

The Draft Renewable Energy (RED) Directive {Com (2008) 30 Final}

To be counted towards the 2020 biofuel target

- ▶ The greenhouse gas emissions of biofuels are reduced by 35% compared to the alternative fossil fuel use;
- ▶ No damage is done to sensitive or important ecosystems.

Annex VII – Greenhouse gas impact of biofuels

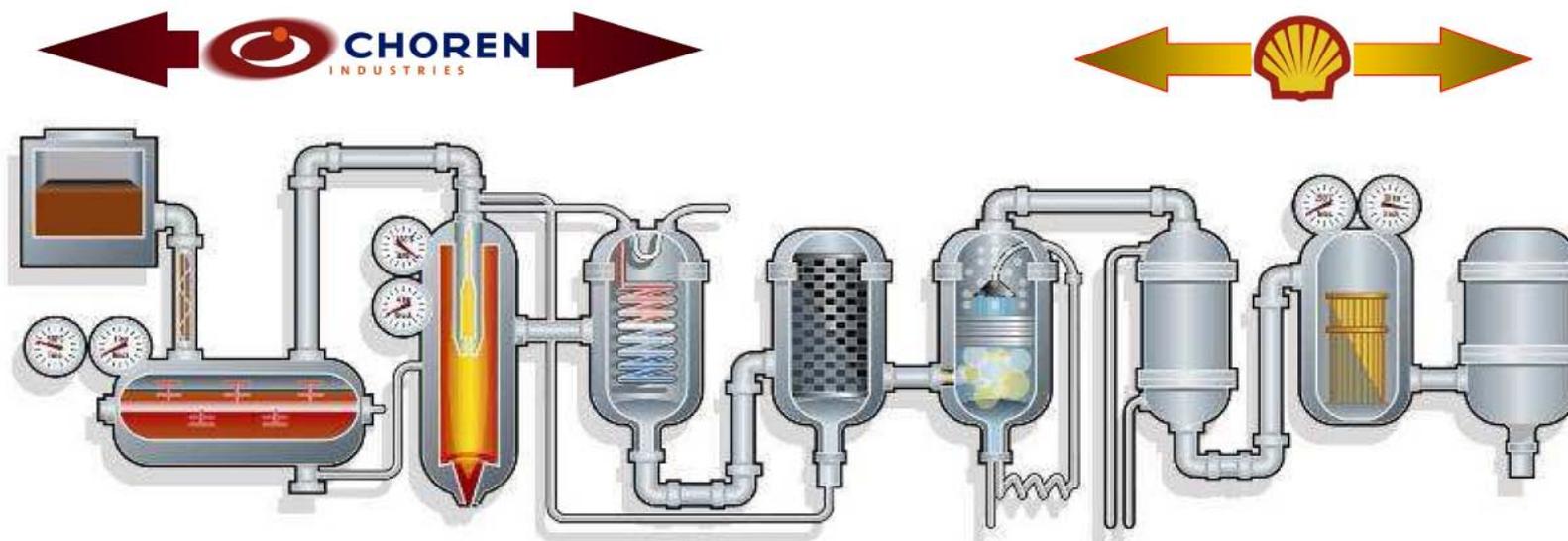
biofuel production pathway	typical greenhouse gas emission saving	default greenhouse gas emission saving
sugar beet ethanol	48%	35%
wheat ethanol (process fuel not specified)	21%	0%
wheat ethanol (straw as process fuel in CHP plant)	69%	67%
rape seed biodiesel	44%	36%
sugar cane ethanol	74%	74%
biogas from municipal organic waste as compressed natural gas	81%	75%
biogas from wet manure as compressed natural gas	86%	83%
biogas from dry manure as compressed natural gas	88%	85%

- We can vary the system and improve the foot print
- Tropical feedstocks have better carbon foot prints
- Gaseous transport fuels..biogas and biomethane score very well
- Residues make good biofuel feedstocks.

Where are second generation biofuels at?

- ▶ 2nd generation diesel?
- ▶ 2nd generation ethanol?

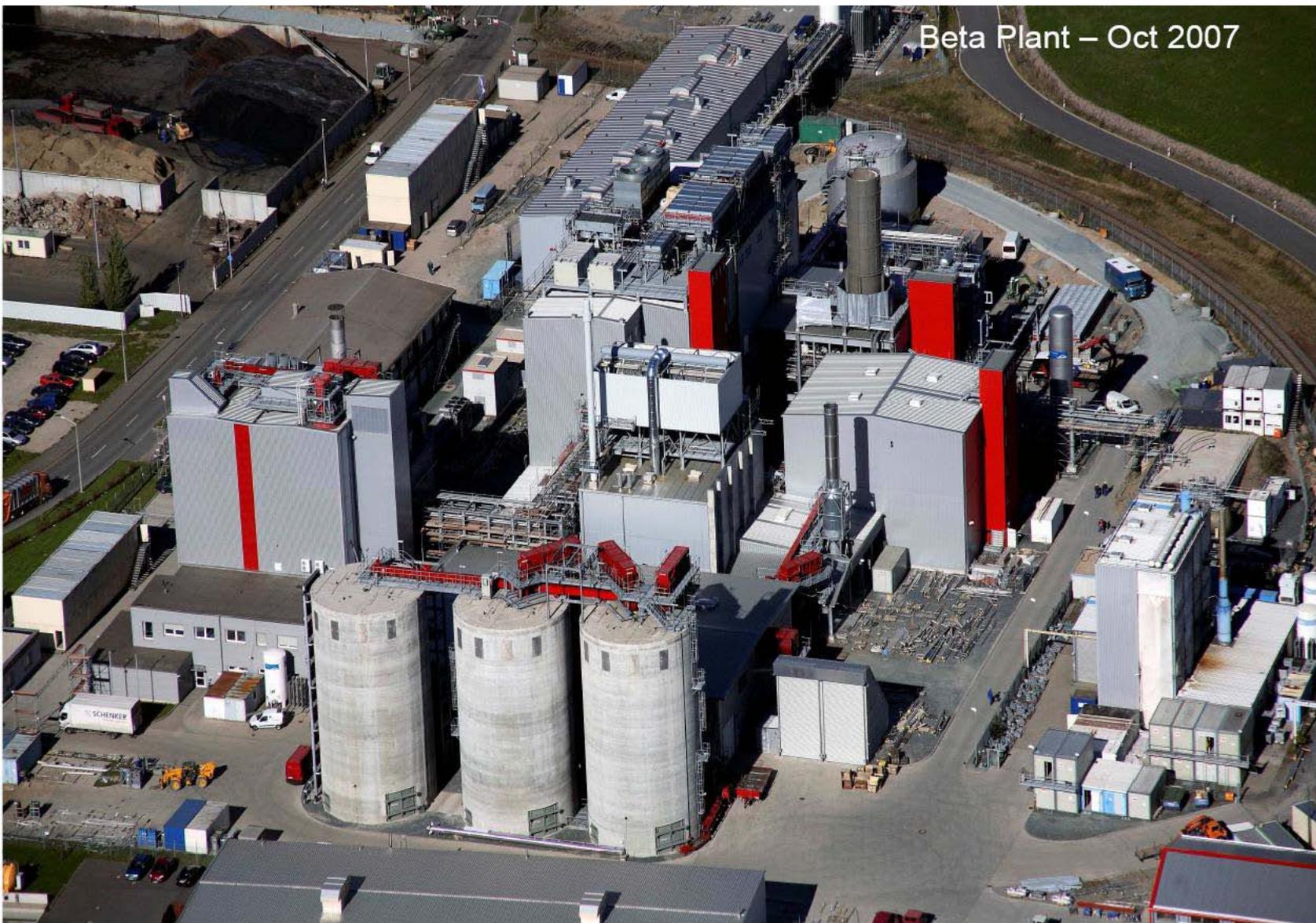
The Carbo-V[®] - Process



Three Phase
Gasification

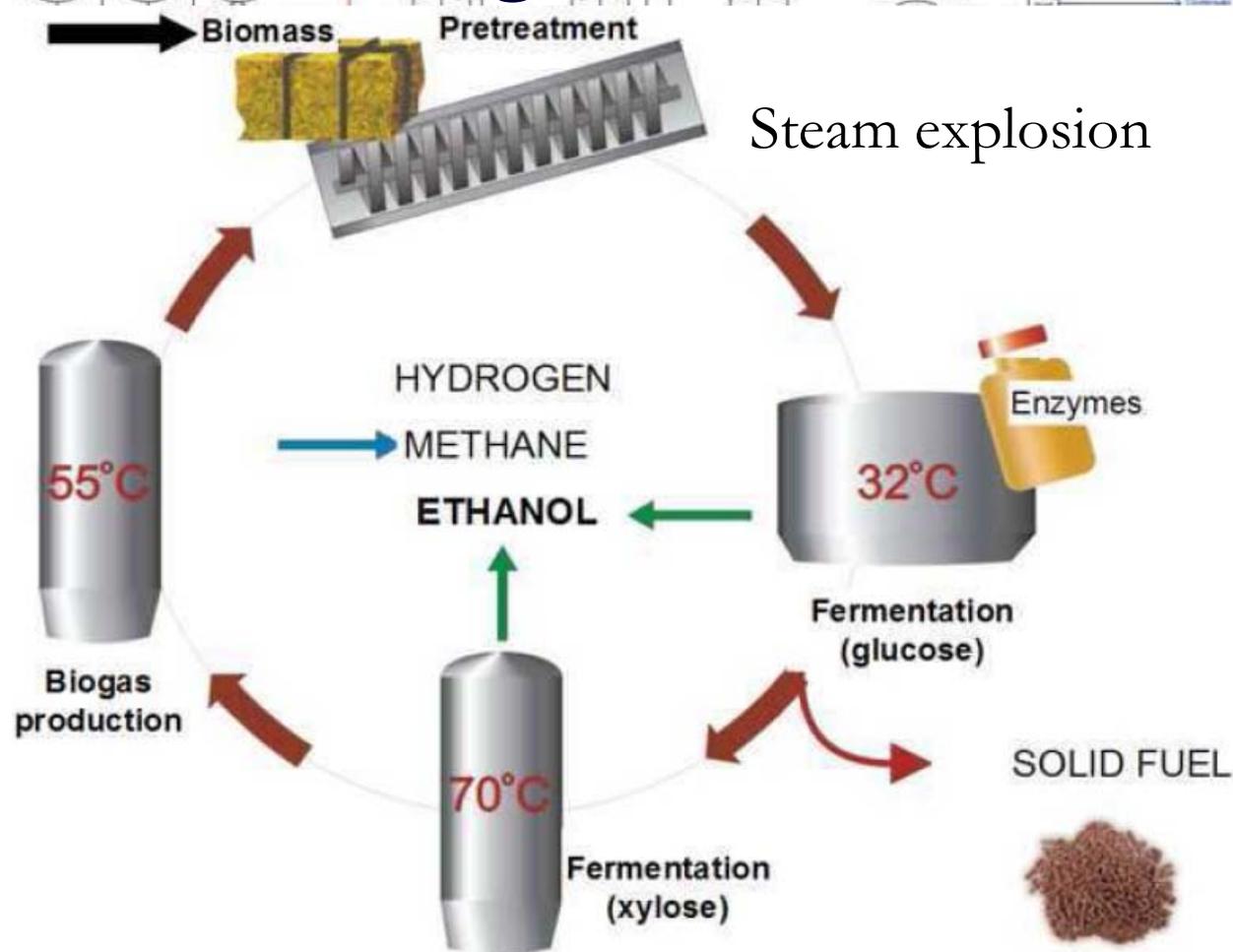
Gas Treatment

Fischer-Tropsch &
Hydrocracking



Beta Plant – Oct 2007

Maxifuel: 2nd generation ethanol



Programme for the Day

- ▶ Session I Opening Session
- ▶ Session II Biofuel policy and practice
- ▶ Session III Biofuel Producers
- ▶ Session IV Biofuels in Northern Europe
- ▶ Session V 2nd Generation biofuels in Ireland
- ▶ Session VI The Biofuel Debate