



NNFCC

Biomass policy and industrial applications

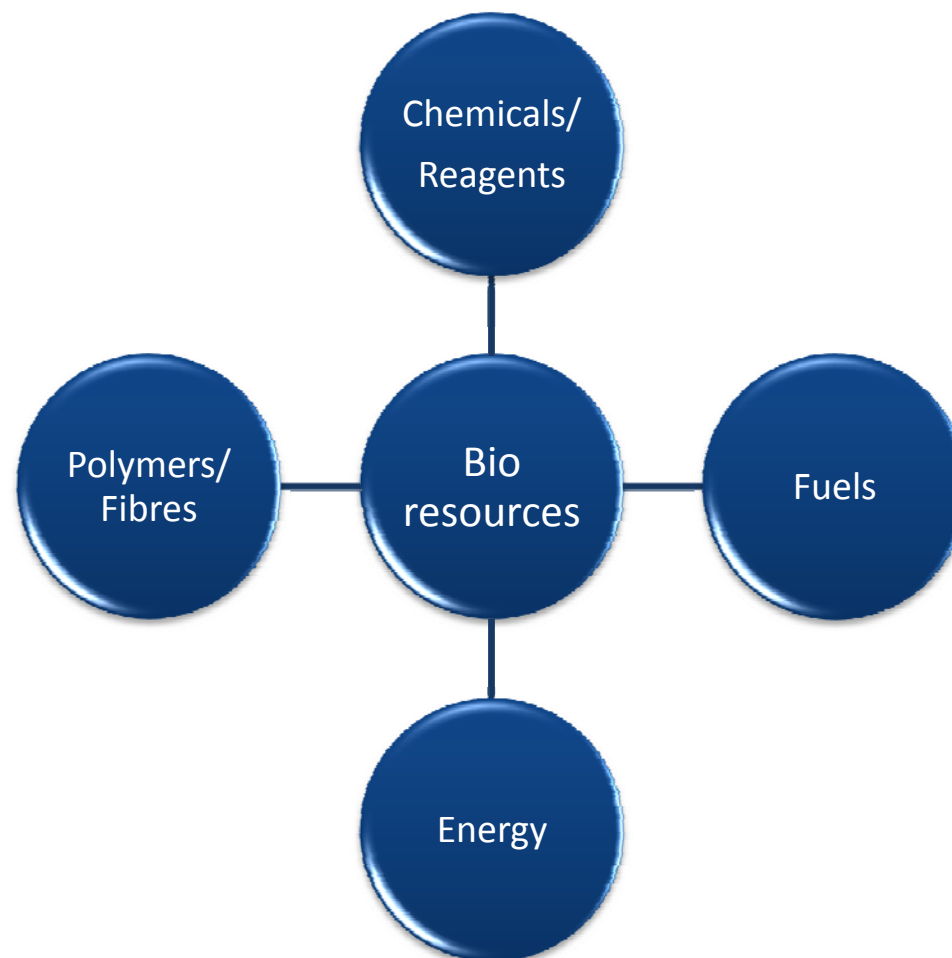
Jeremy Tomkinson

10th November 2010



NNFCC

The Bio Economy





The Targets

- 80% carbon emissions reduction by 2050
 - UK first country to set a legally binding target
 - The EU also has target of 20% reduction on 1990 levels by 2020
 - European and global ambition may be strengthened following Cancun negotiations in December 2010
- 15% of all energy consumed to come from renewables sources by 2020 (as part of EU target for 20% by 2020)
 - In 2009, 3% energy generated from renewables sources
 - Electricity sector likely to be the major contributor



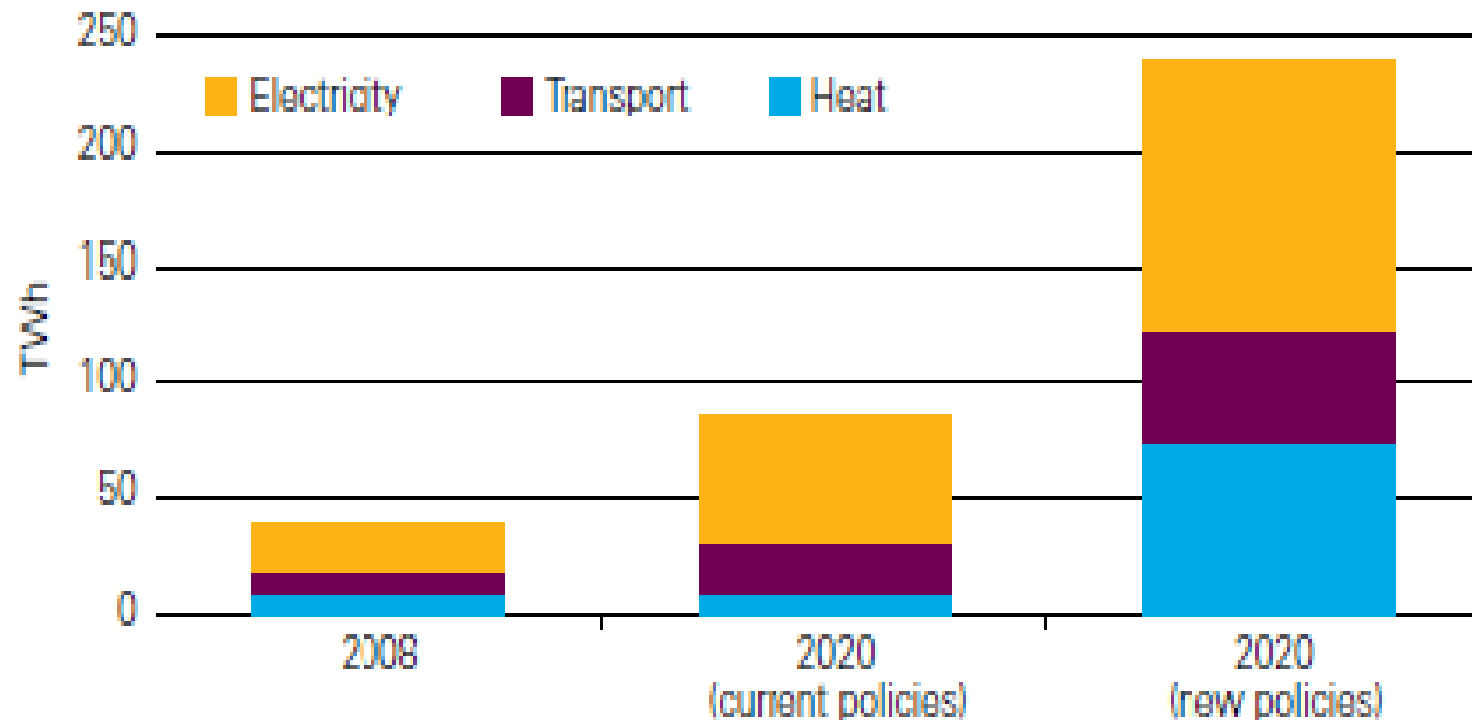
EU Renewable Energy Directive

- Mandatory EU target of a 20% share of renewable energies in overall energy consumption by 2020. This target covers **electricity**, **heat** and **transport fuels**.
- National targets for share of renewable energies in overall energy consumption. UK target is 15% by 2020. This is about 240 TWh of energy.
- Interim targets also set. The UK's interim targets are 4.0% for 2011/2012, 5.4% for 2013/2014, 7.5% for 2015/2016 and 10.2% 2017/2018.



We face a huge challenge

The size of the challenge: A potential scenario to reach 15% renewable energy by 2020



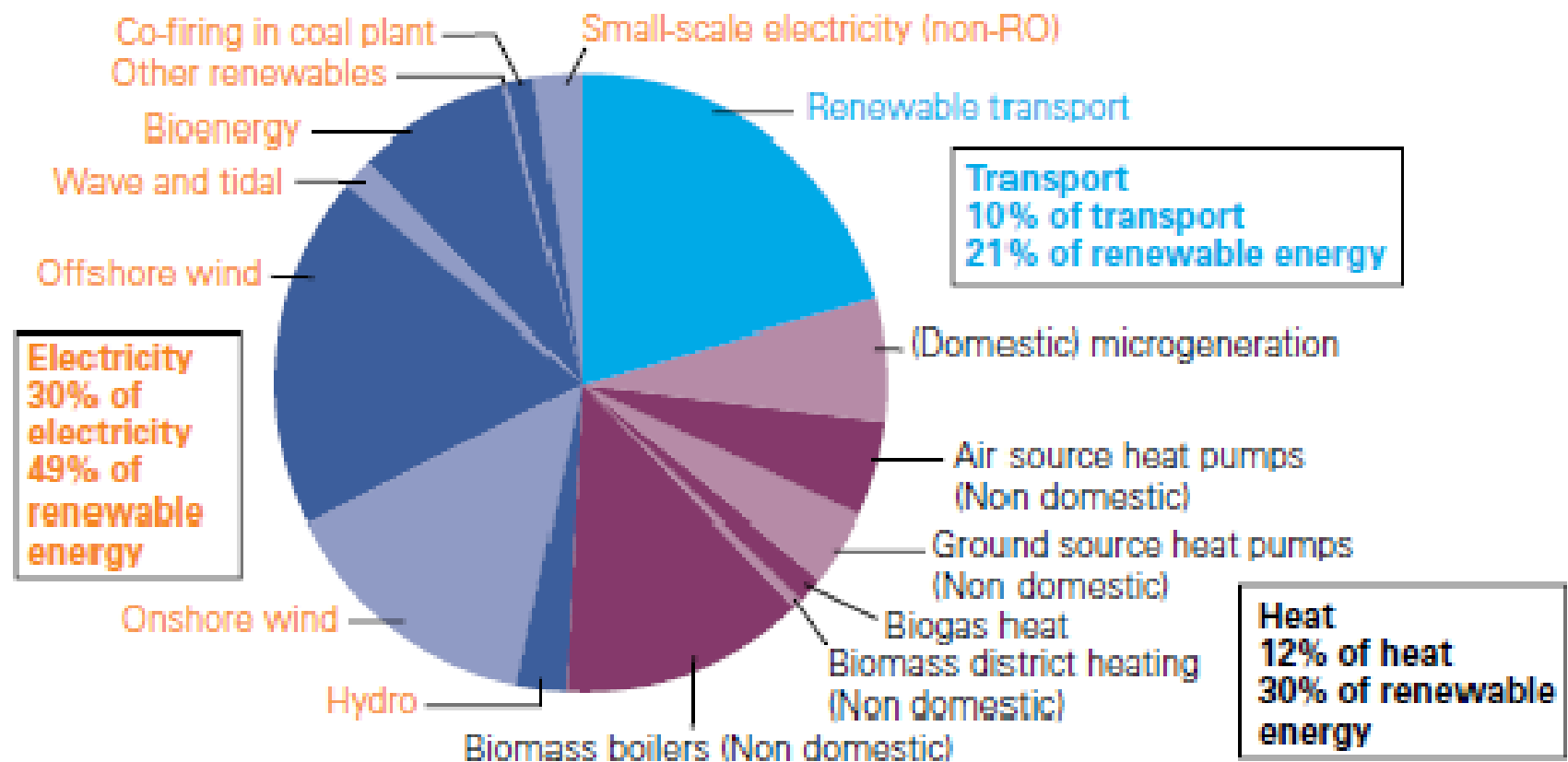
Source: Energy Trends June 2009 and DECC internal analysis



NNFCC

What might 15% renewables look like?

Illustrative mix of technologies in lead scenario, 2020 (TWh)





NNFCC

Focus on action in 4 key areas



Better financial incentives



Faster deployment



Exploiting new technologies



Encouraging mass participation

building sustainable supply chains



Government Instruments

- Several Instruments already available
 - Renewables Obligation (RO) - Electricity production over 5MWe
 - Feed In Tariff (FIT) - Electricity production below 5MWe, includes Anaerobic Digestion (AD) for power
 - Renewable Transport Fuel Obligation (RTFO) - mandates the use of biofuel in increasing volumes - soon to be subsumed in the RED mechanism, e.g. sustainability reporting and possibly iLUC after 2012
- From April 2011
 - RHI – Renewable Heat Incentive, includes AD for on site combustion, biomethane injection to the gas grid, district heating and CHP from biomass wastes and energy crops



Supporting Renewable Electricity – The Renewables Obligation

- The Renewables Obligation is the main incentive for renewable electricity production for process above 5MWe.
 - Law recently extended to 2037 with indicative annual growth levels.
- 1 renewable Obligation Certificate (ROC) per MWh deployed
- Law was extended in the 2009 banding review to further reward processes according to 'efficiency' levels and type of feedstock used

Banding of ROC's	ROC's per MWh
Co-firing of non-energy crop biomass	0.50
Co-firing of <u>energy crops</u> , Energy from waste with CHP	1
Dedicated regular biomass (>90% biomass) – co firing of <u>energy crops</u> with CHP	1.5
Advanced conversion technologies (<u>including AD</u>), dedicated biomass burning <u>energy crops</u> (with or without CHP), dedicated regular biomass with CHP, gasification	2



Supporting Renewable Electricity – The Feed In Tariff (FIT)

- The FIT's were launched in April 2010 to support renewable electricity production below 5MWe
- The FIT supports the following technologies:
 - Anaerobic digestion
 - Solar PV
 - Onshore Wind
 - Hydro
- Provides a guaranteed payment to the generator for each unit of power deployed - which means used or placed on the grid.
 - a. Generation tariff
 - 11.5 p/kWh (**£115 per MWh**) if 500kW or less
 - 9 p/kWh if > 500kW
 - b. Export tariff
 - 3.0 p/kWh



Value of feedstock for RO and RTFO

- RO (Electricity)
 - 1 tonne of dry biomass at 30% energy efficiency will yield about 1.6 MWh of electricity
 - £65-£72 approx sale price
 - £70-75 ROC income (£150 for adv processing)
 - **Total potential income ca £220 per tonne of biomass**
- RTFO (Fuel)
 - 1 tonne of dry biomass at 45% energy efficiency will yield about 270 litres of synthetic diesel (equivalent 2.4 MWh)
 - £80 approx sale price
 - 1 Fuel certificate awarded for each litre of fuel deployed
 - Current value around 12p per RTFC – ca £35 (£70 for adv fuels)
 - **Total potential income ca £150 per tonne of biomass**



Renewable Heat Incentive

- The Renewable Energy Strategy (July 2009) suggested that 12% of UK heat could be generated from renewable sources, up from <1% in 2009
- Tariff levels are proposed to provide a rate of return of 12% on the additional capital cost over conventional heat systems.
- Tariffs will be fixed (grandfathered) for 10-20 years
- Users will be required to report on biomass sustainability including fuel source, sustainability and usage for boilers above 45kW.



RHI Example: 4-bed detached with cavity walls

- Using 2,500 litres of heating oil per annum @ 10.27kWh per litre
- Oil boiler cost (10 – 20kW output) = £2,500
- Fuel cost @ 45ppl = £1125 per annum
- Total heat demand = 20,686 kWh per annum
- RHI tariff (< 45kW boiler) = 9 p/kWh

	Space Heating	Hot Water	Total
Annual usage	16,944 kWh	3742 kWh	20686kWh
RHI Payment	£ 1524.96	£ 336.78	£1860
Fuel cost (pellets)	£ 729.8	£ 160.20	£890

- Pellet boiler cost (10 – 20kW output) = £12 – 14k
- Pellet boiler payback = 6 years (incl. fuel cost saving and RHI payments)



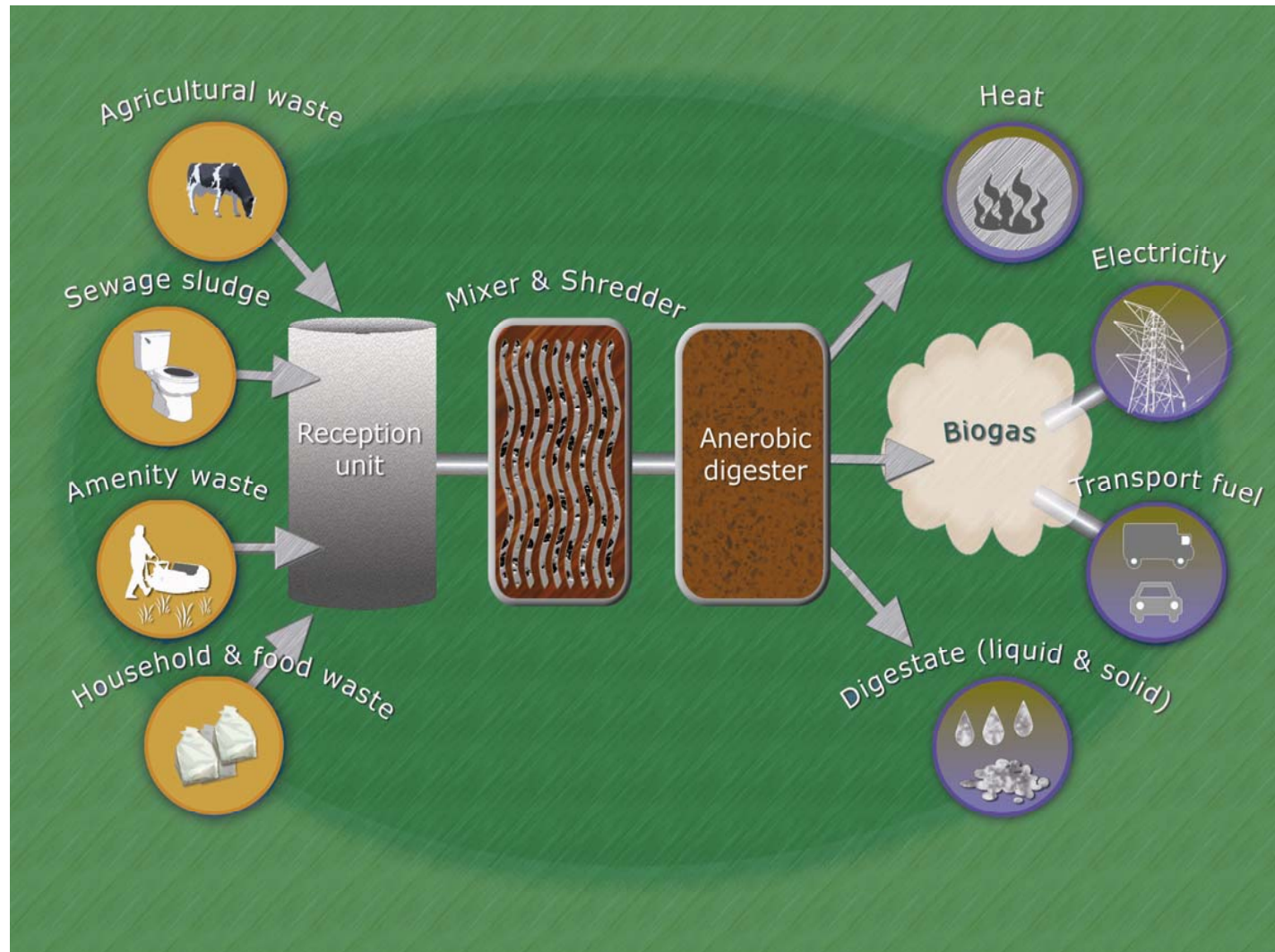
Summary – other technologies

Technology	Scale	Tariff (p/kWh)	Deemed or metered	Tariff lifetime (years)
Biogas on-site combustion	45-200 kW	5.5	Deemed	10
Ground source heat pumps	45-350 kW	5.5	Deemed	20
Air source heat pumps	45-350 kW	2	Deemed	20
Solar thermal	20-100 kW	17	Deemed	20
Biomethane injection	All scales	4	Metered	15



NNFCC

Anaerobic Digestion





What is Biogas and Biomethane

- **Biogas contains typically 65% methane, 35% CO₂ either from AD, Waste water and Landfill**
- **Biomethane is either;**
 - **biogas upgraded with the CO₂, H₂S containing around 98% methane or**
 - **bio Synthetic Natural Gas (bioSNG) from wood and dry wastes which is identical to natural fossil methane**
- **Both technologies are complimentary as one uses wet wastes eg food, the other dry feedstocks like wood and demolition wastes**
- **However the UK currently has insufficient compression outlets for use as a renewable vehicle fuel – needs ca 250 bar**



Bio Synthetic Natural Gas

- Bio Synthetic Natural Gas (bio SNG)
- Converts (dry) biomass e.g. energy crops, wood wastes and renewable plastics to methane through gasification and methanation
- Efficiencies markedly increase if gas pumped directly onto gas grid and electricity generated at large scale CHP plant with high heat demand
- 'Green gas' into peoples homes where heating efficiencies exceed 90%
- No expensive modifications required to allow consumers to benefit from renewable heat



Gas grid



- Gas sent to 7 reception points from 100+ offshore fields. LNG delivered by sea to the Isle of Grain.
- The National Transmission System feeds gas to power stations, large industrial consumers and the Local Distribution Zones (LDZs) that supply consumers.
- The 12 LDZs are managed within 8 distribution networks. Four of these are owned by National Grid, the others by Scotia Gas Networks, Wales and West Utilities and Northern Gas Networks.



NNFCC

Biomethane vehicles are available today



VW Caddy



VW Passat



Mercedes Sprinter



Mercedes Econic



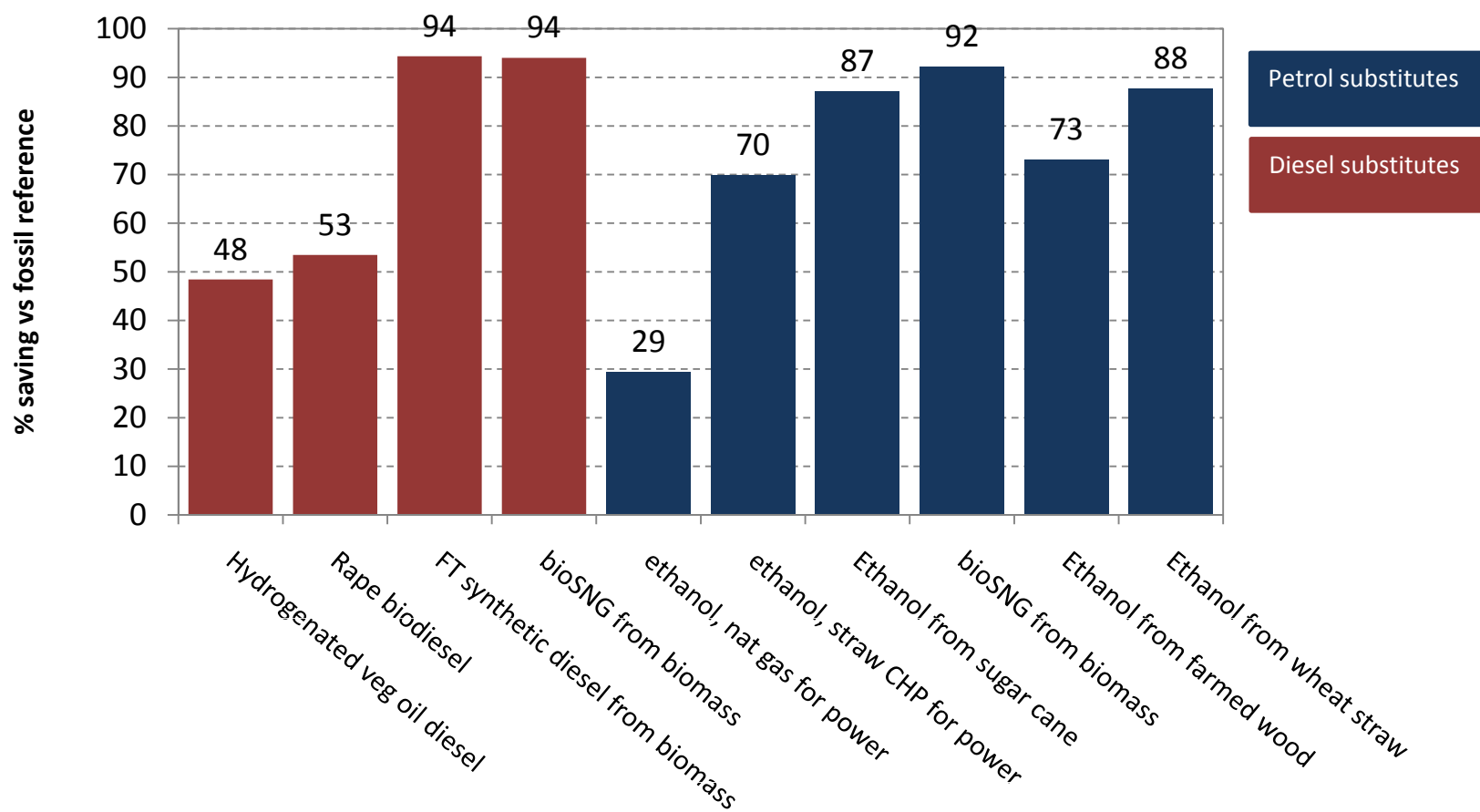
Optare



HGV 44T

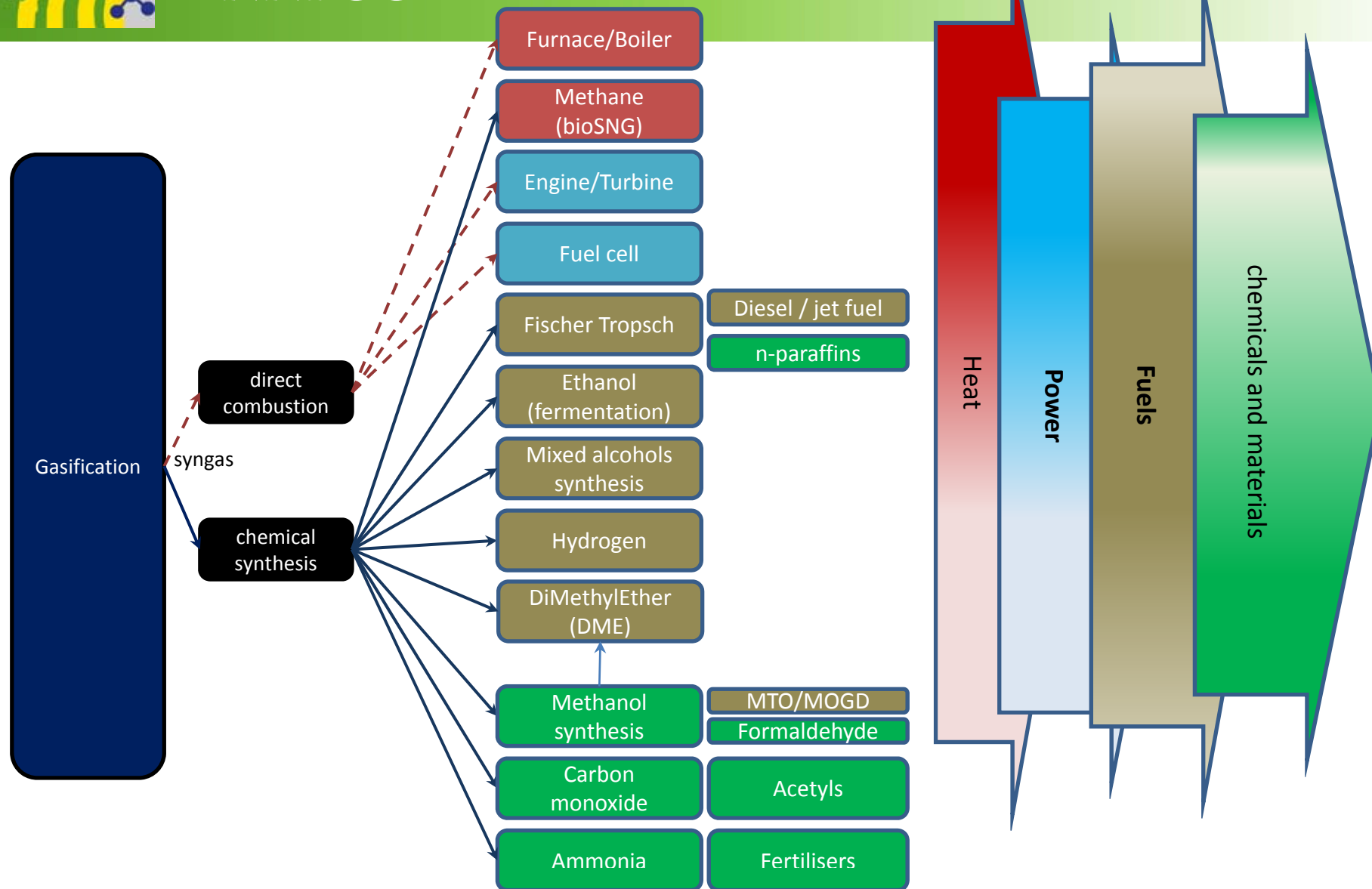


Biofuel % GHG Savings





NNFCC



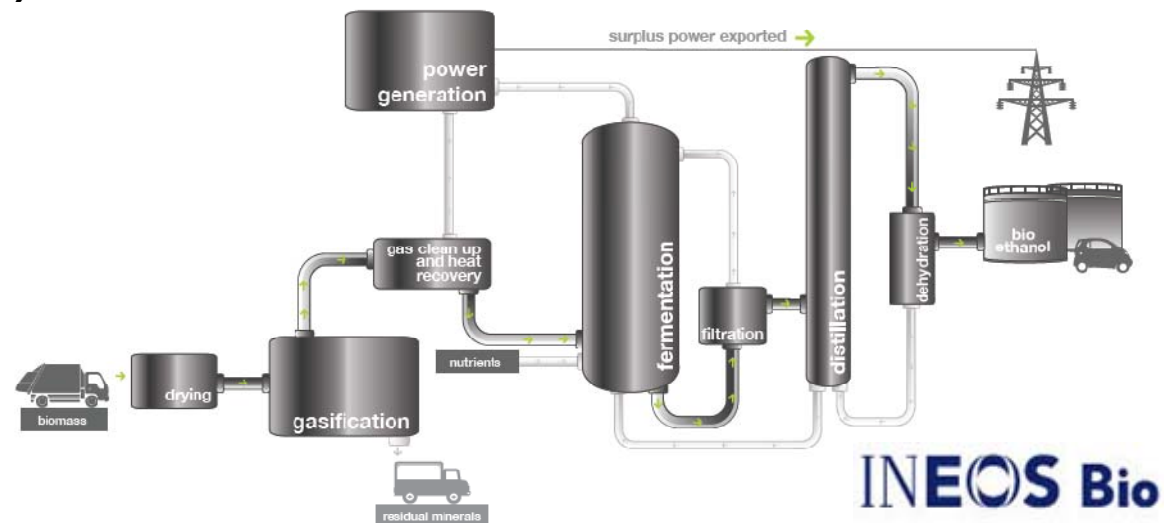
building sustainable supply chains



NNFCC

The UK is taking a world leading position with respect to BTL using waste derived biomass.

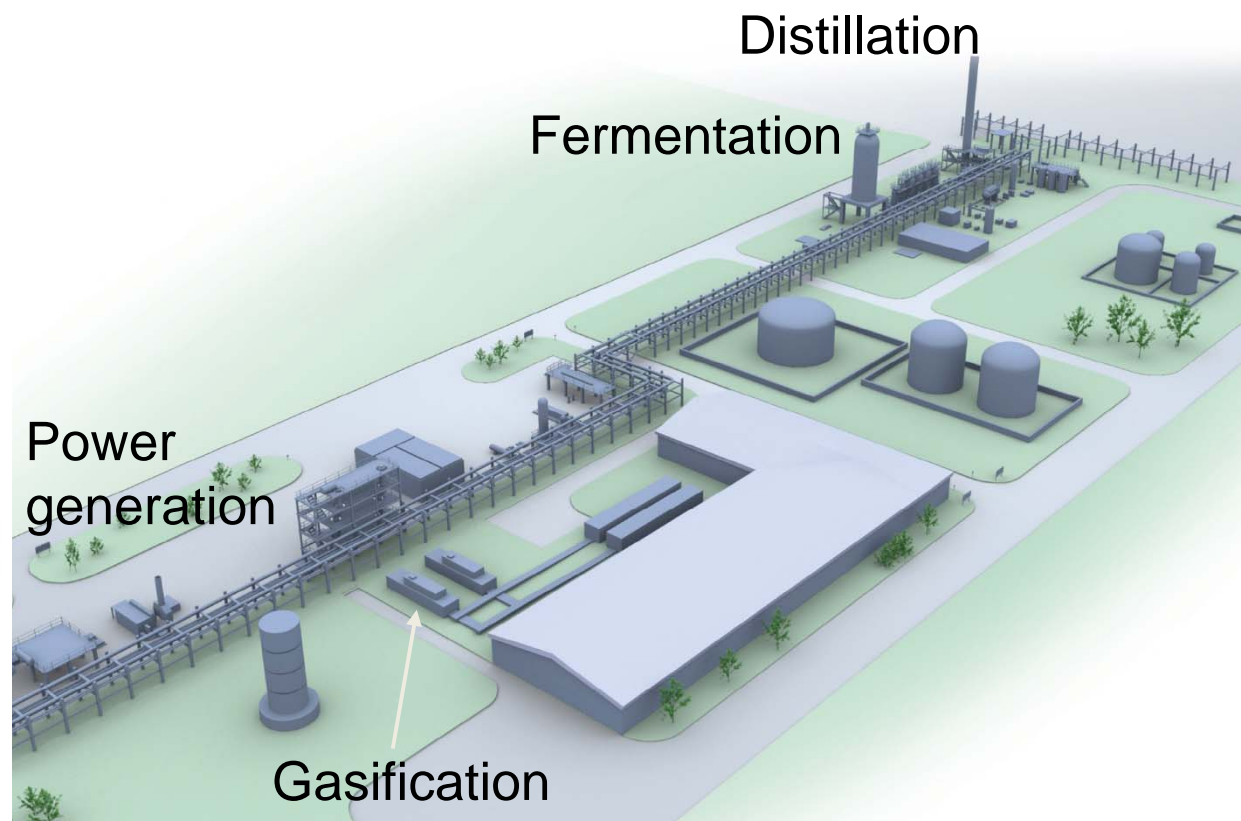
- Ineos Bio Process to produce ethanol via gasification is about to be demonstrated at commercial scale on Teesside (from 2012).
- BA project to produce jet fuel from wastes via gasification at commercial scale (East London, from 2014)
- AirProducts project to produce electricity and hydrogen from wastes via gasification (Teesside)





NNFCC

FEED completed for initial plant at Teesside



INEOS Bio



Ineos Bio Programme

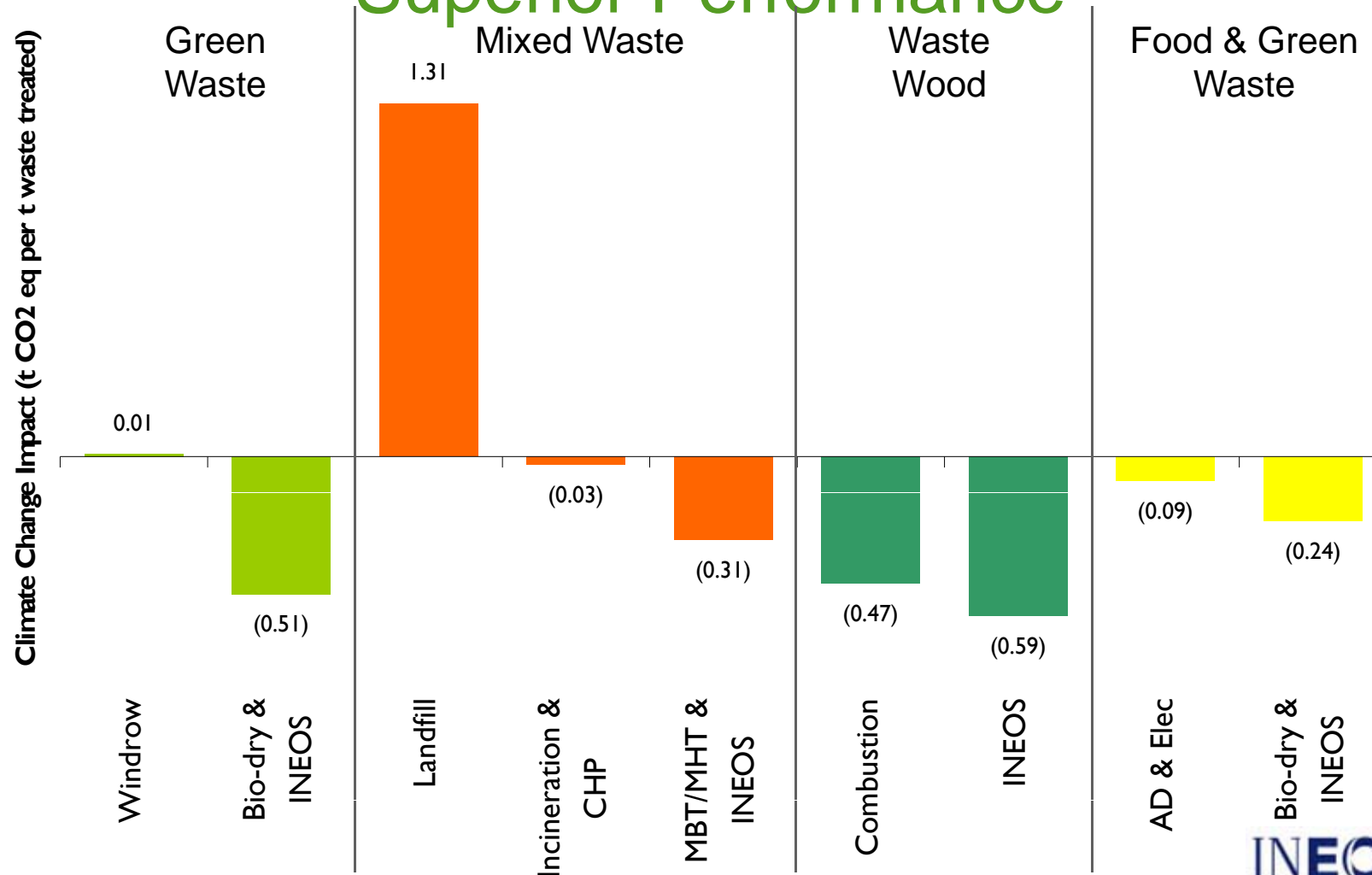
- 144 kt pa bioethanol
- 43 MW of gross renewable power
- Greater than 1 Mt pa of wastes diverted from Landfill
- Greater than 500 kt pa CO₂ avoided

	Ethanol (kt pa)	Gross Power (MW)	Exported Power (MW)	Feedstock Required (kt pa)	Start-Up
Phase A	24	7	3	124	2012
Phase B	120	36	20	621	2015
Integrated Facility	144	43	23	745	



NNFCC

Accessing Waste – Must Demonstrate Superior Performance



INEOS Bio



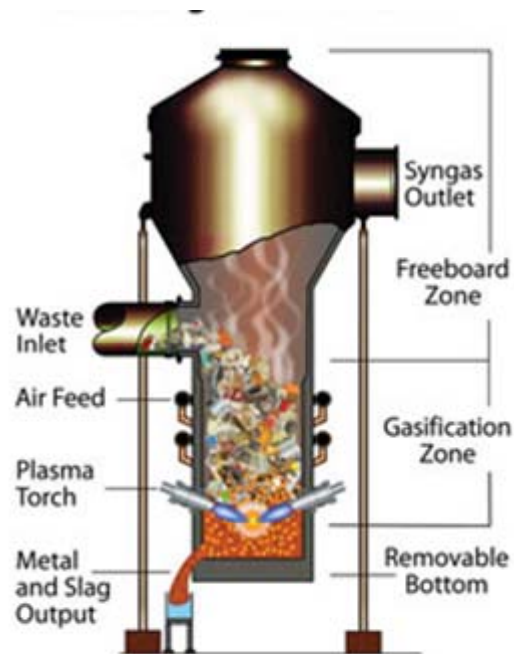
Advantages

- > 90% greenhouse gas savings vs. petrol / gasoline
- Potential for bioethanol to be cheaper than petrol
- Provides energy in addition to fuel
- High diversion of biodegradable wastes from landfill
- Wastes generated locally converted to clean fuel for local use
- Simple, energy-efficient process
- Platform to ethylene value chain

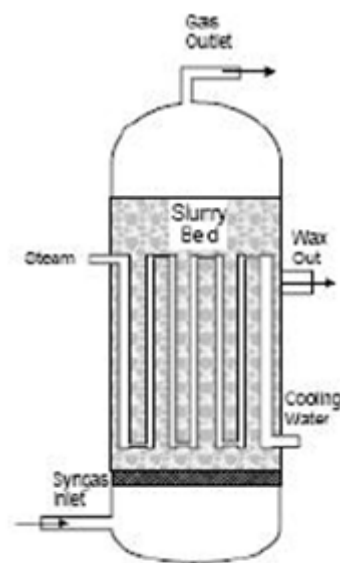


NNFCC

Illustrative BA/Solena Jet Fuel Plant Schematic



Gas cleaning /polishing and conditioning



Gasification

Syngas
cleaning &
conditioning

Fischer
Tropsch

Wax
upgrading

building sustainable supply chains



The Key Challenges

1. *Biomass is preferentially directed toward small scale heating and power generation.*
2. *Current incentives & mechanisms are unlikely to increase the supply of UK biomass at the necessary rate.*
3. *Current biomass supply chains need to be developed.*
4. *Integrated BTL processes have high capital costs & are at present unattractive to investors without a loan guarantee mechanism.*
5. *There remains some uncertainty with respect to support mechanisms for advanced biofuels.*
6. *The UK needs to be competitive at an international level.*



Conclusions

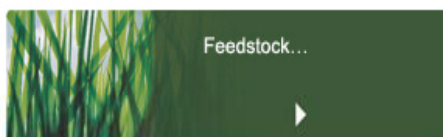
- **BTL and BioSNG are appropriate technologies for the UK situation**
 - Feedstock flexibility, use of waste raw materials
 - Production of mid distillate and gaseous fuels
- **The 2020 targets are achievable**
 - Two projects are significantly ahead of the roadmap time line and expect to deliver commercial quantities of BTL fuels into road and air transport from 2012 onwards.
- **There are six key challenges to the delivery of BTL in the UK**
- **Immediate action is required by Government and stakeholders**
 - Developing the biomass supply chain - standards
 - Market enabling structures to offset risk
 - Accessing waste feedstocks
- UK is starting to take a lead in advanced conversion processes for a range of wastes

You are in: [Home](#)

NNFCC is the UK's national centre for renewable fuels, materials and technologies

- We help to introduce renewable fuels and materials into the marketplace
- We provide independent information and advice to agriculture, academia, Government, industry, the media and the public

We work to **build sustainable supply chains** for products made from plants. So our website is arranged as a supply chain: from **feedstock**, through **manufacturers** to **consumers**. You can explore our site by **clicking one of the three icons below which is most relevant to you**:



Feedstock...

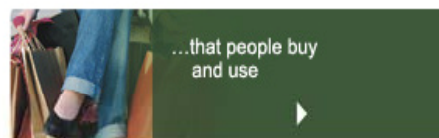
For growers and processors, section includes:

- All the crops
- Process on-farm?
- Economics and statistics

for industry to
manufacture
products...

About renewables industry, section includes:

- Commercial issues
- Markets overview
- Develop your supply chain

...that people buy
and use

Find sustainable products, section includes:

- NNFCC shopping guide
- Where to learn more
- Recycling and composting

Just Published

NNFCC Project 09-008 Review of Technologies for Gasification of Biomass and Wastes

[read more >>](#)

UPDATED - Energy Crops Calculator

[read more >>](#)

NNFCC Crop Factsheet: Echium

[read more >>](#)

NNFCC Crop Factsheet: Short Rotation Coppice Willow (SRC)

[read more >>](#)
[More publications >>](#)

NNFCC Events

Green Supply Chain '09 - (Leeds)

05 Nov 2009 - 06 Nov 2009

[read more >>](#)
[More events >>](#)

NNFCC in the News

NNFCC helps with making the most of packaging

[read more >>](#)

A farmers guide to Anaerobic Digestion

[read more >>](#)

New version of Energy Crops Calculator released

[read more >>](#)

NNFCC upcoming events June 2009

[read more >>](#)
[More NNFCC in the news >>](#)

Resource Centre

- ▶ [Join our Network and Subscribe](#)
- ▶ [Search for Contacts and Funding](#)
- ▶ [Documents, Links and Video](#)
- ▶ [Life Cycle Assessment](#)
- ▶ [Jargon buster](#)

News Stories

- [New survey for cleantech developers](#)
[read more >>](#)
- [Renewable heat for National Trust property](#)
[read more >>](#)
- [Manure to power town](#)
[read more >>](#)
- [Biomass-powered heating system for hospital](#)
[read more >>](#)
- [Shell sells biofuel from wheat-straw](#)
[read more >>](#)

[More News Stories >>](#)

News Feed

Virtual power plants could tame coming grid chaos



Packaging News (Environment News)

KLM uses Natureworks polymer for biodegradable hot drinks cup