Electricity and CHP production from biomass – R D & D priorities and investment needs.

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INTERNATIONAL ENERGY AGENCY

Heat, Electricity and CHP production from biomass – and biofuels too!

R D D & Deployment priorities and investment needs.

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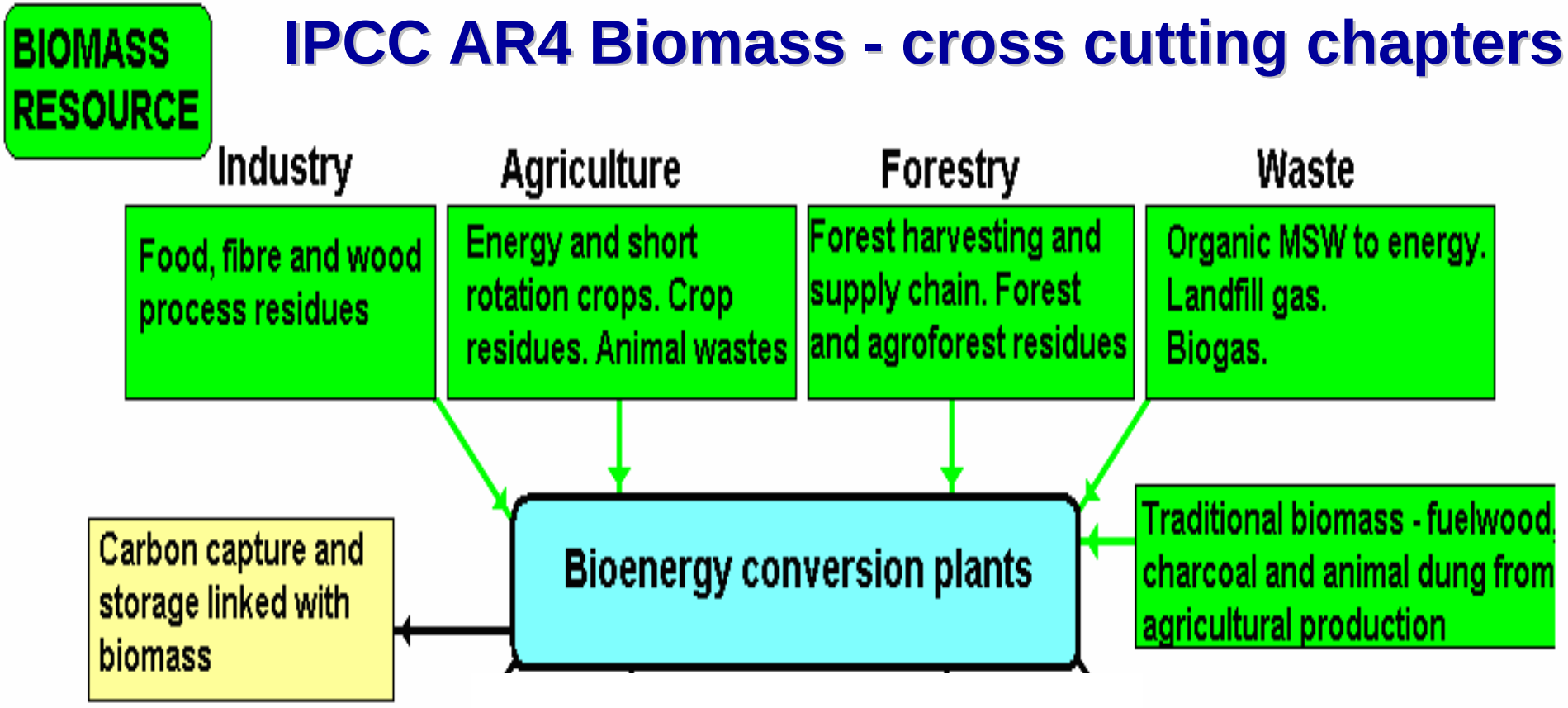
IPCC AR4 Biomass - cross cutting chapters

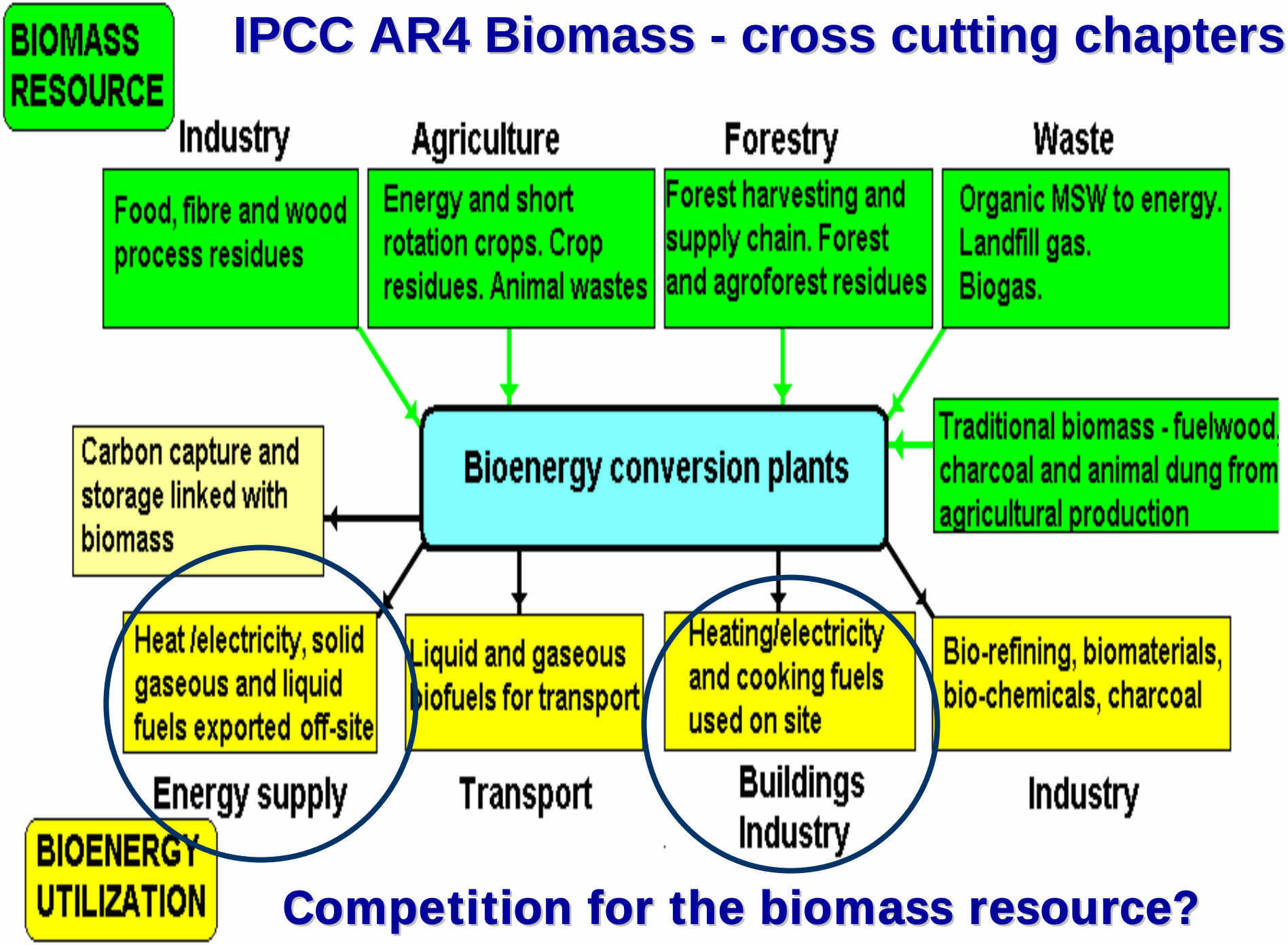
BIOMASS RESOURCE

Industry	Agriculture	Forestry	Waste
Food, fibre and wood process residues	Energy and short rotation crops. Crop residues. Animal wastes	Forest harvesting and supply chain. Forest and agroforest residues	Organic MSW to energy. Landfill gas. Biogas.

IPCC AR4 Biomass - cross cutting chapters

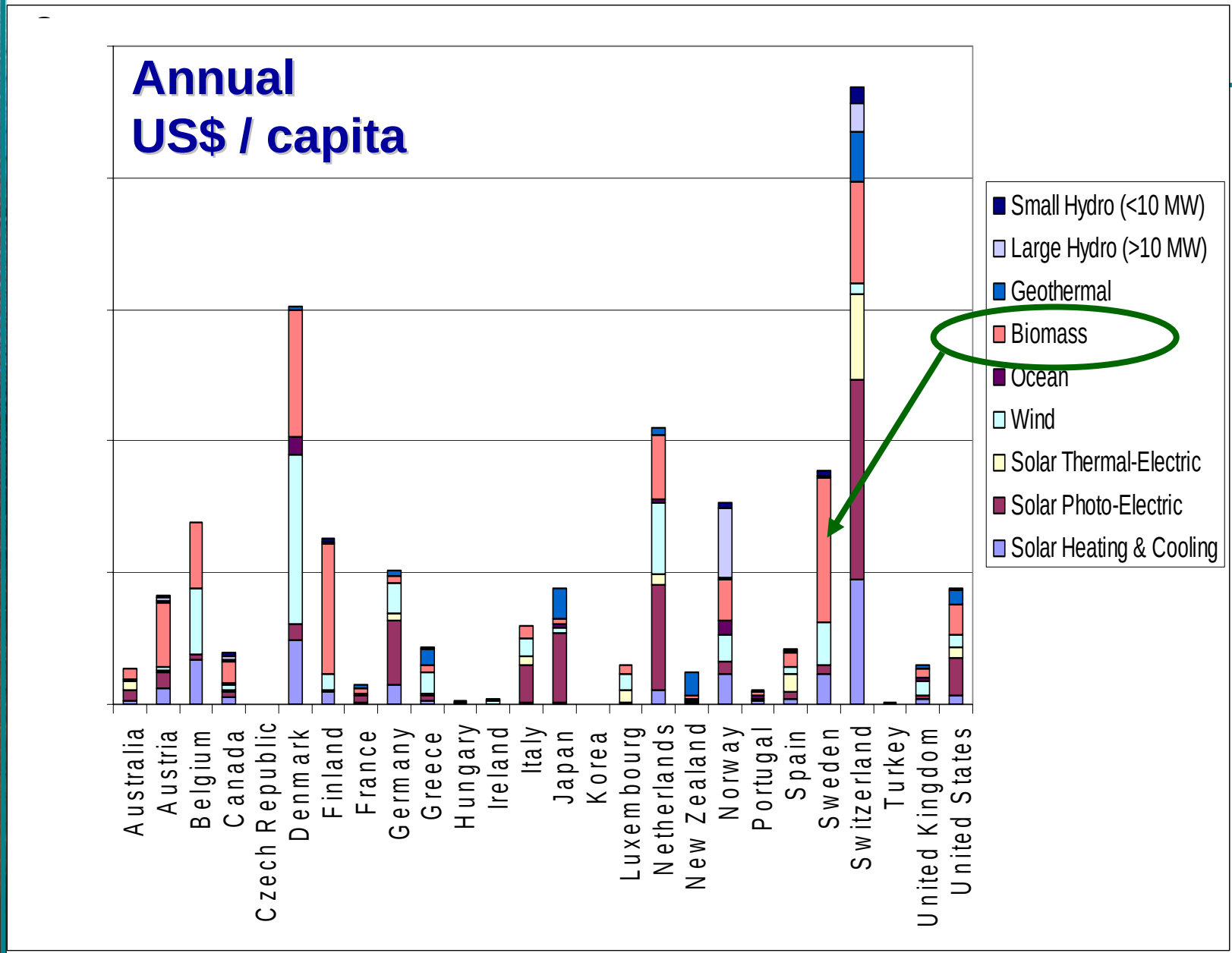


IPCC AR4 Biomass - cross cutting chapters

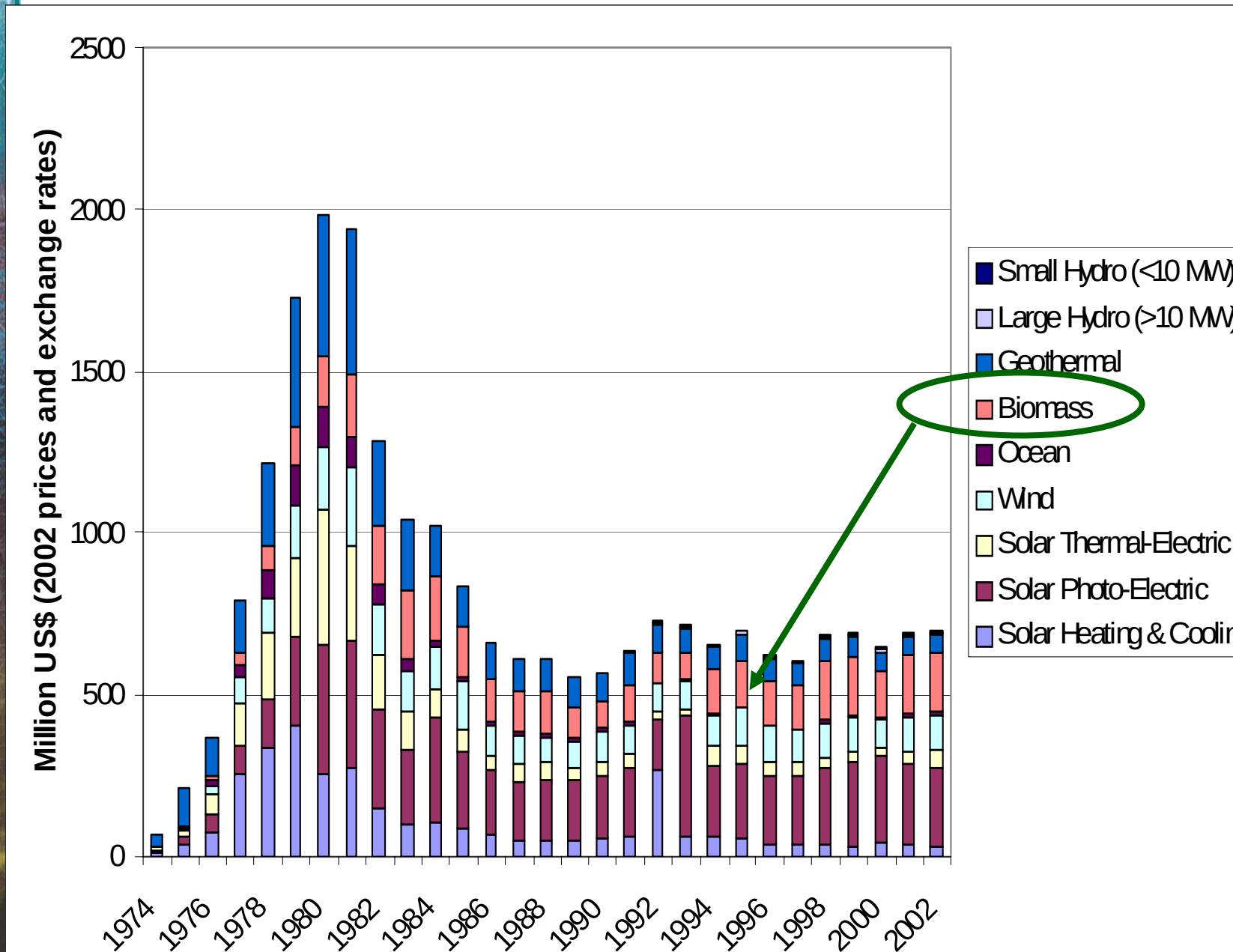


Competition for the biomass resource?

Public R D & D investment in Renewables for IEA member countries (1990-2003 average)



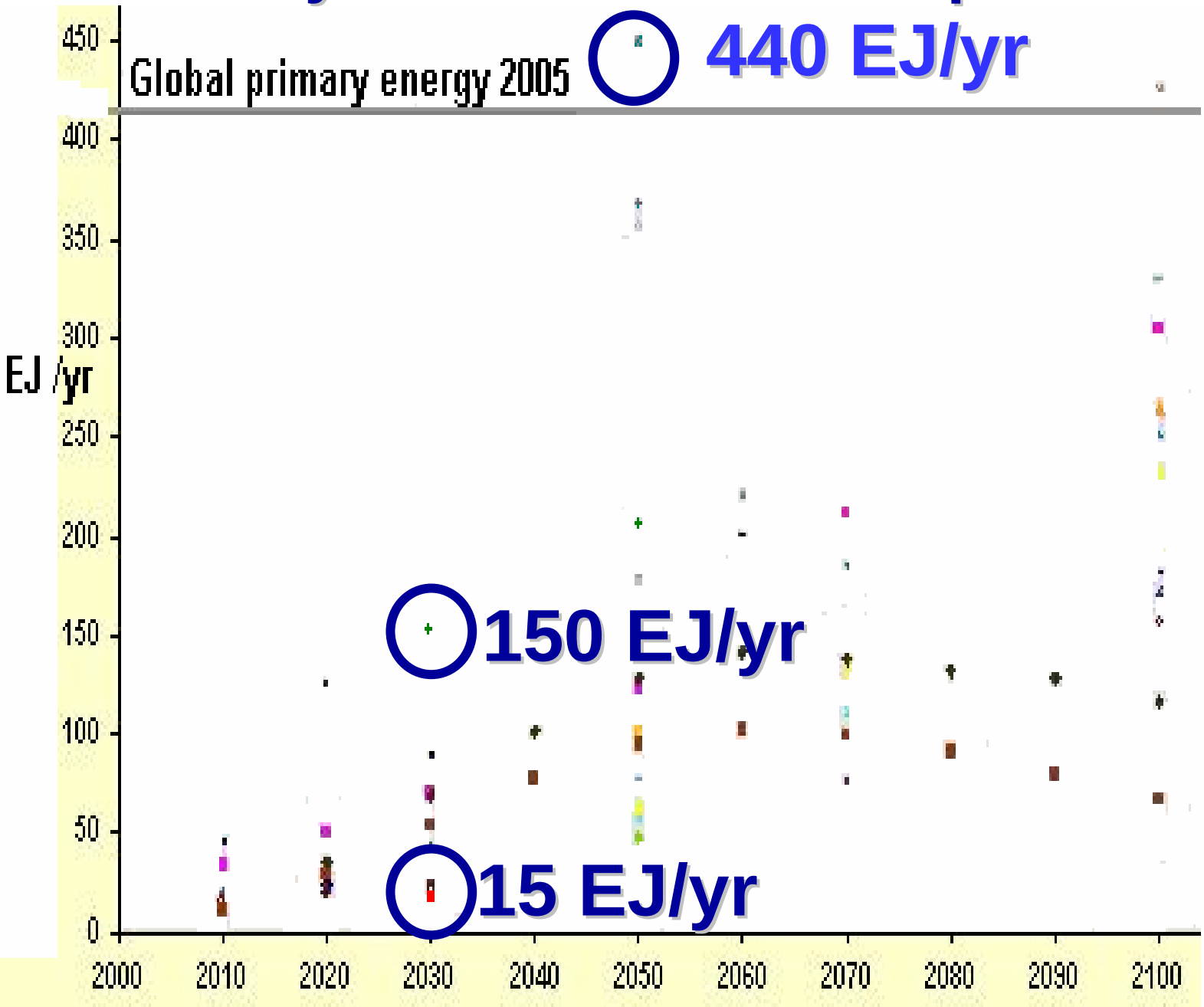
Renewable energy R & D budgets



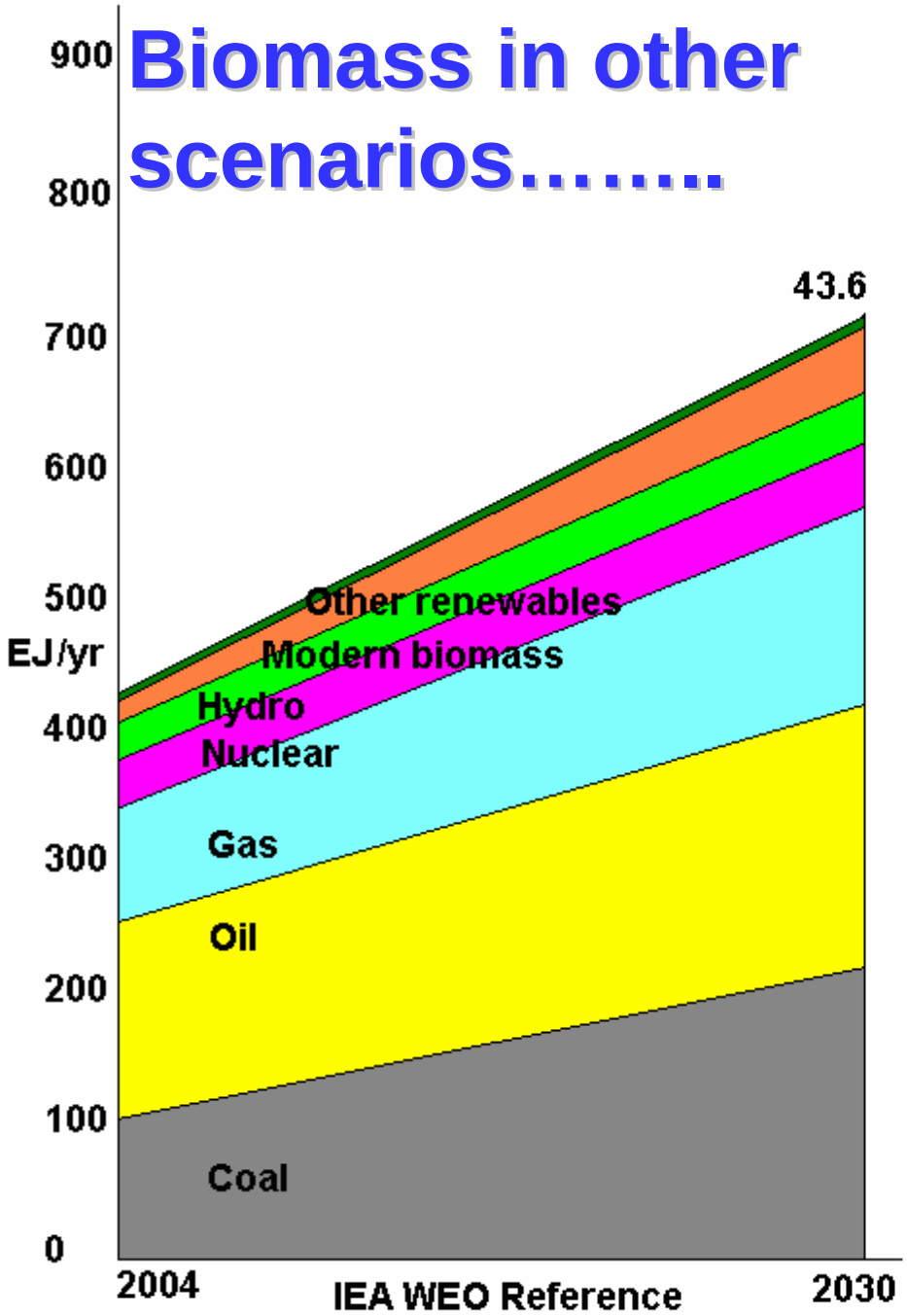
Biomass potential is very uncertain

- Biomass sourced from crop and forest residues and organic wastes has a *technical* potential of around 100 EJ/yr.
- Increasing the *market* potential of biomass will require integrated production of agricultural and forest systems and improved supply chain logistics.
- The present contribution from dedicated energy crops of 0.3 EJ/yr is projected to increase significantly over the next few decades – but competing land uses, water and nutrients are possible constraints.
- Present average crop yields of 5 - 20 oven dry t/yr (100 - 400 GJ/ha/yr) may be increased through genetic modification.
- Various analyses and projections for biomass uptake by 2030 at competitive costs range between 15 – 150 EJ/yr.

Analyses of the biomass potential



Biomass in other scenarios……..



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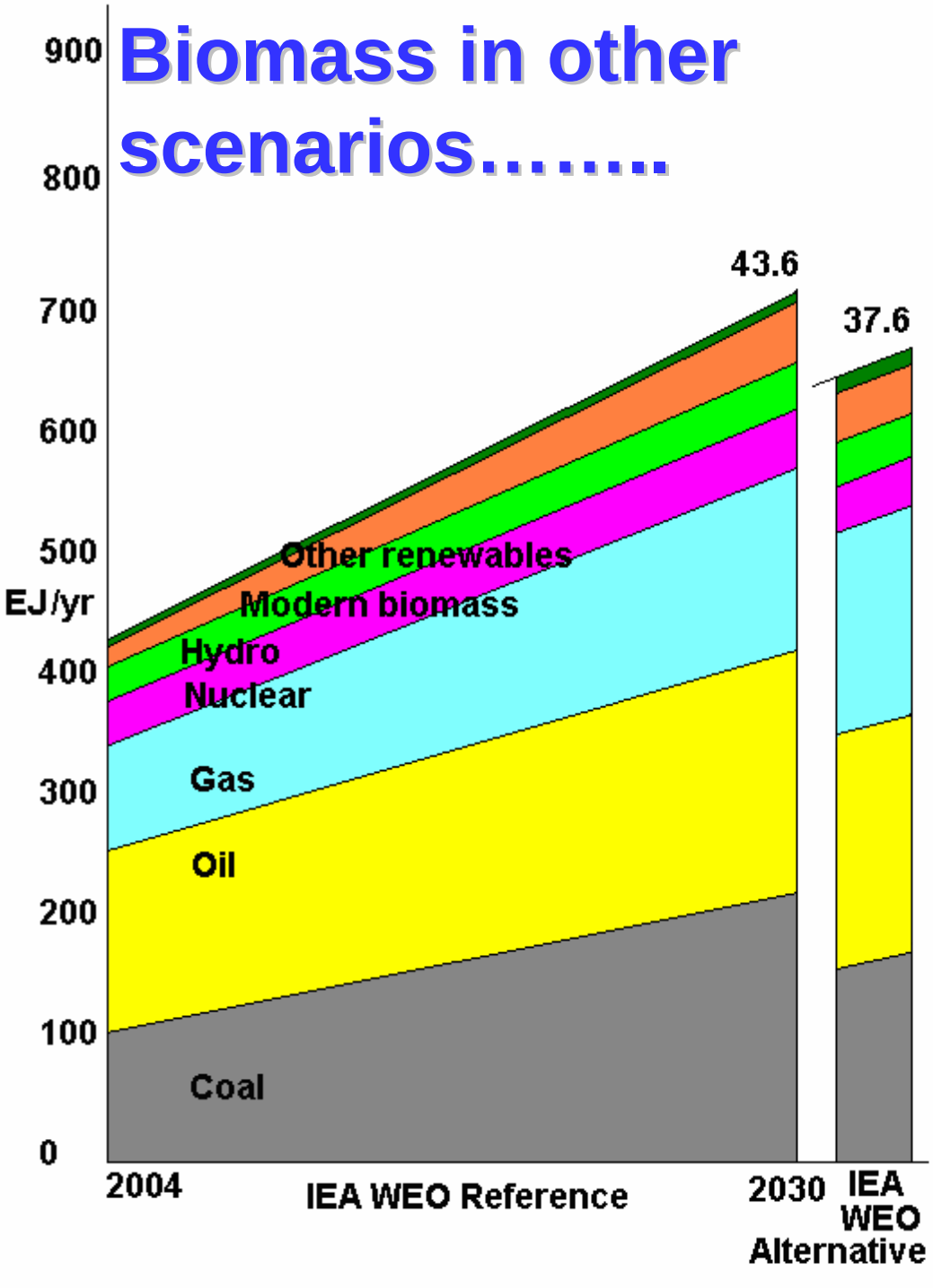

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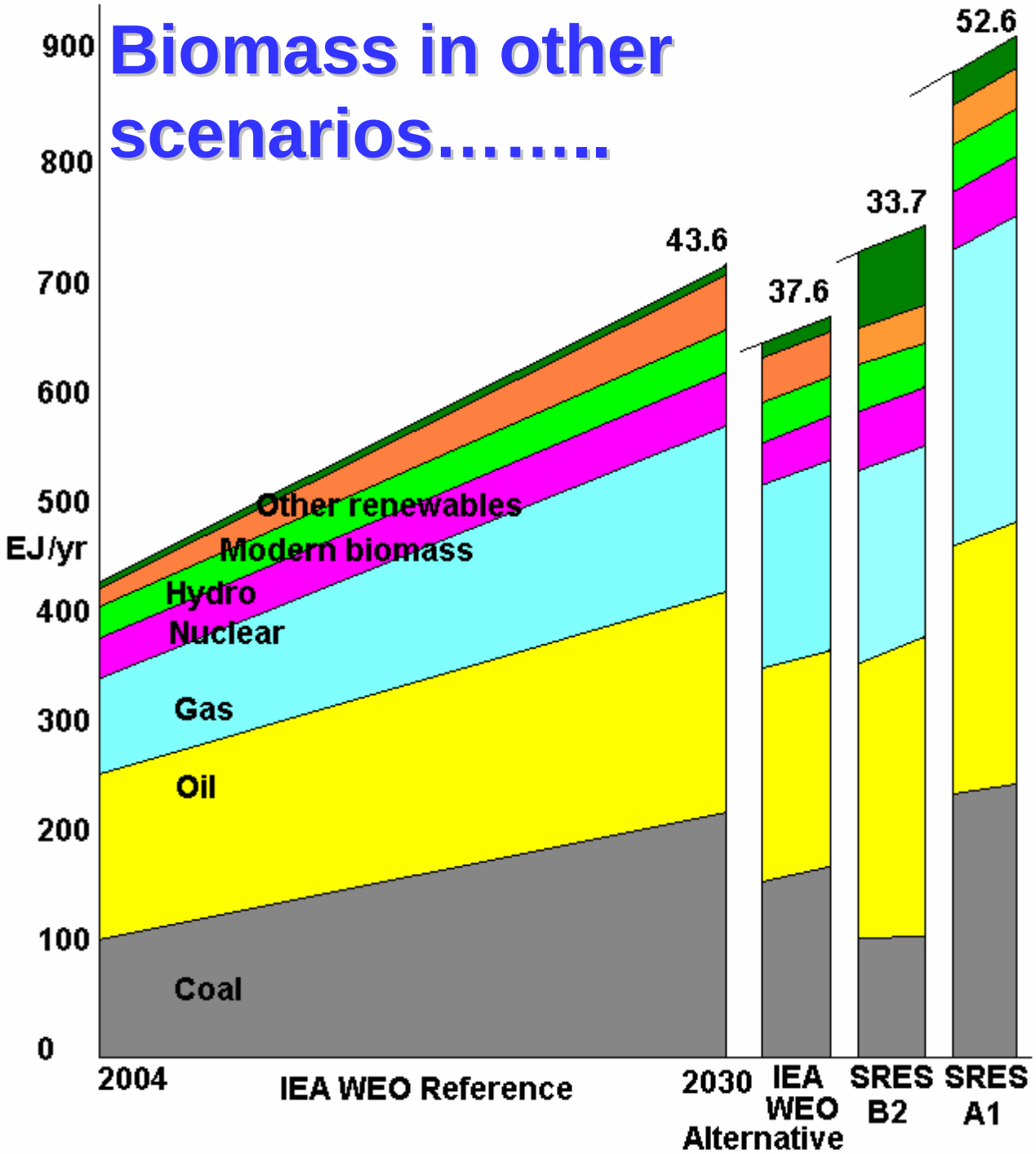
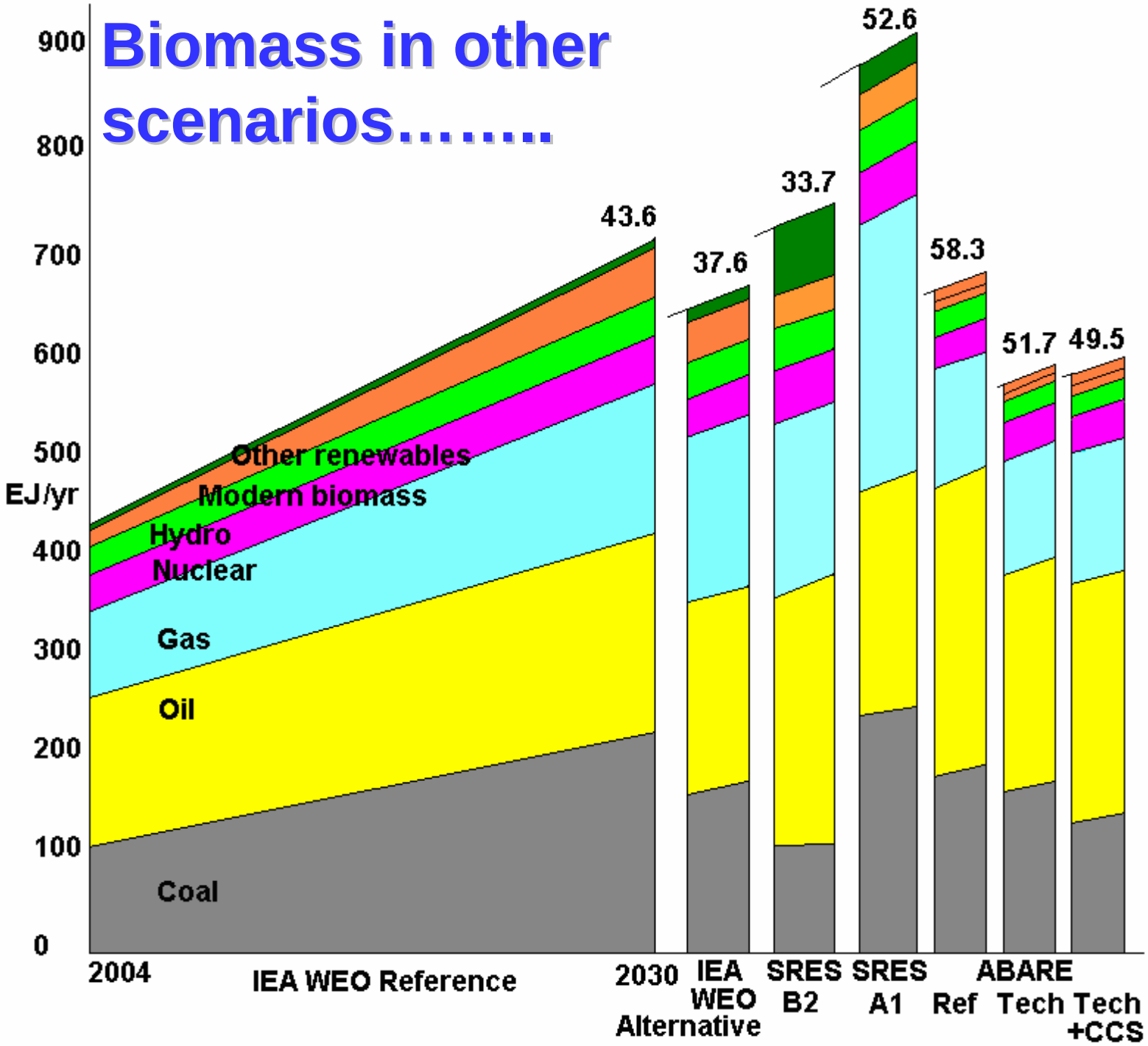
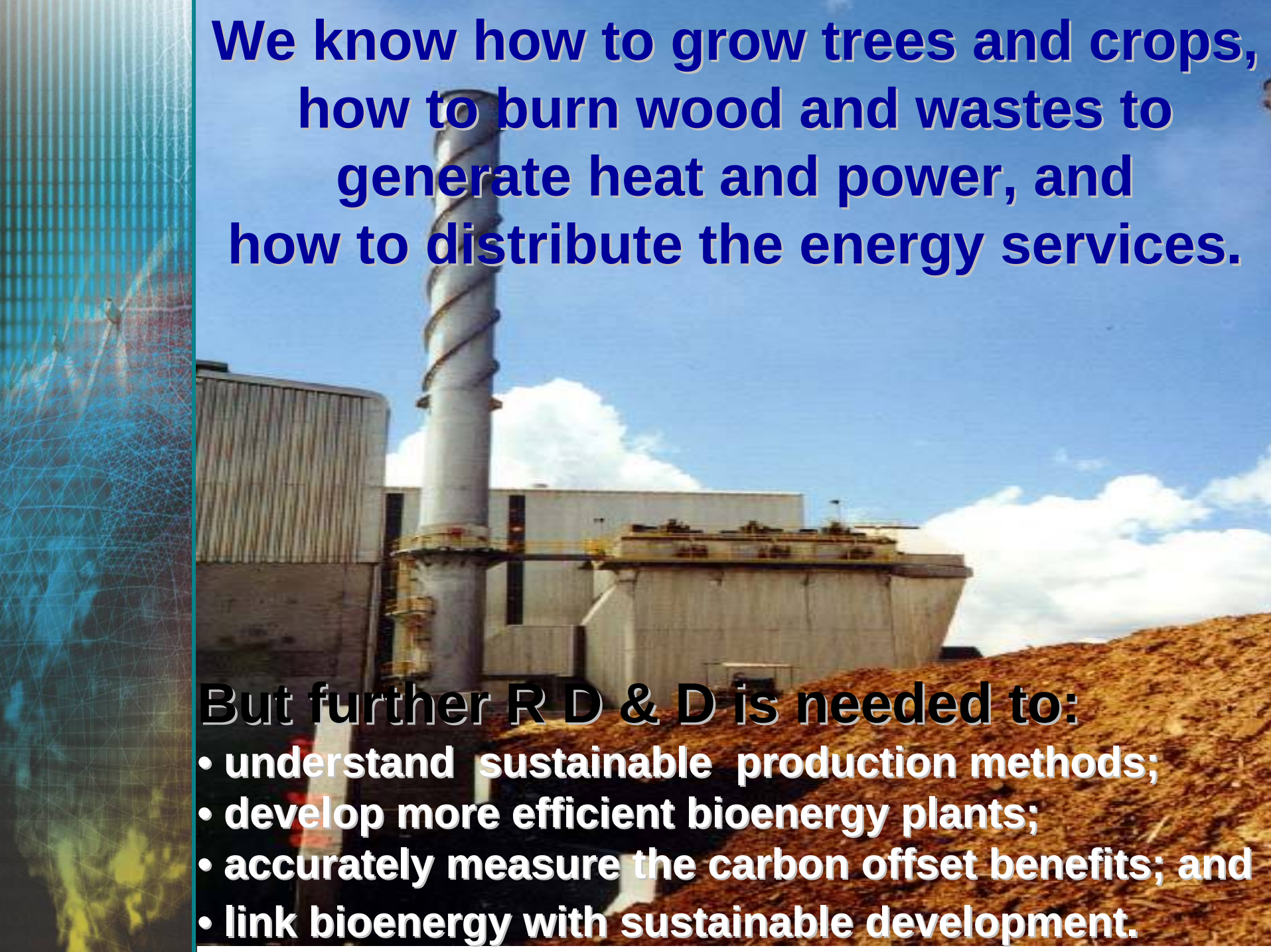


Biomass in other scenarios……..





We know how to grow trees and crops, how to burn wood and wastes to generate heat and power, and how to distribute the energy services.

But further R D & D is needed to:

- understand sustainable production methods;
- develop more efficient bioenergy plants;
- accurately measure the carbon offset benefits; and
- link bioenergy with sustainable development.


Sustainable?
Or not sustainable?
Certification and world trad
IEA Bioenergy IA Task 40 and GBE

Aim for multi – product, biorefineries and to better understand all co-benefits.

In Western Australia oil mallee trees have been planted in strips on arable land to overcome dryland salinity problems on 50 million ha.

Trees are to be harvested every 3 – 4 years and processed through a gasifier to give:

- fine oils for the pharmaceutical industry;
- activated carbon for air filters, industrial applications etc;
- electricity generation from residues;
- renewable energy certificates;
- carbon credits.

Other co-benefits: What do people want?

Technical solutions??

Social benefits??

Equity

New skills

Wealth retention in communities

Social cohesion

Local investment

Pride and independence

Protection of recreational areas

Improved quality of life

Stable climate

Good health

Secure energy supplies

Employment

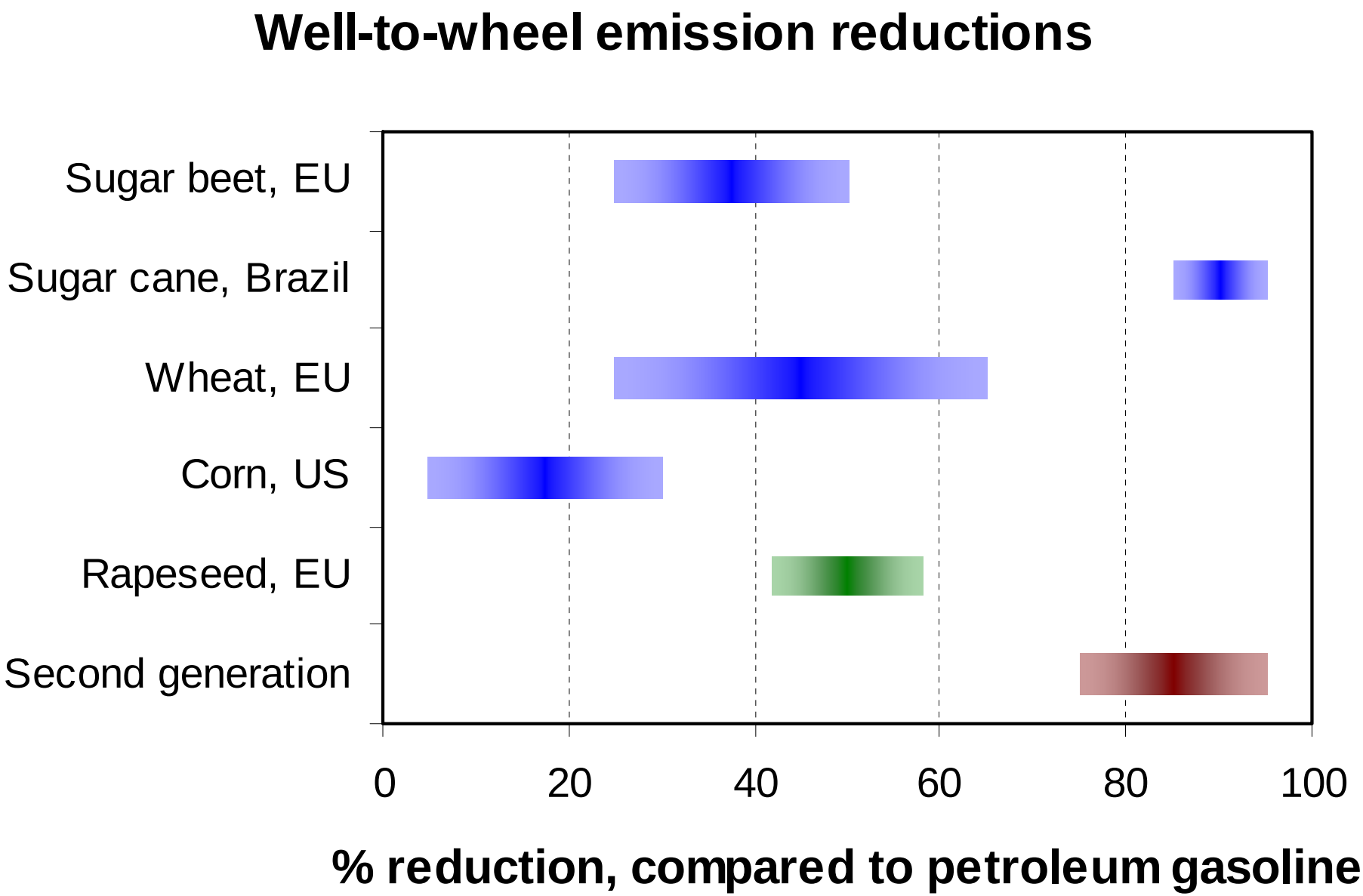
Happiness…….

Harvesting new energy crops remains a major challenge.

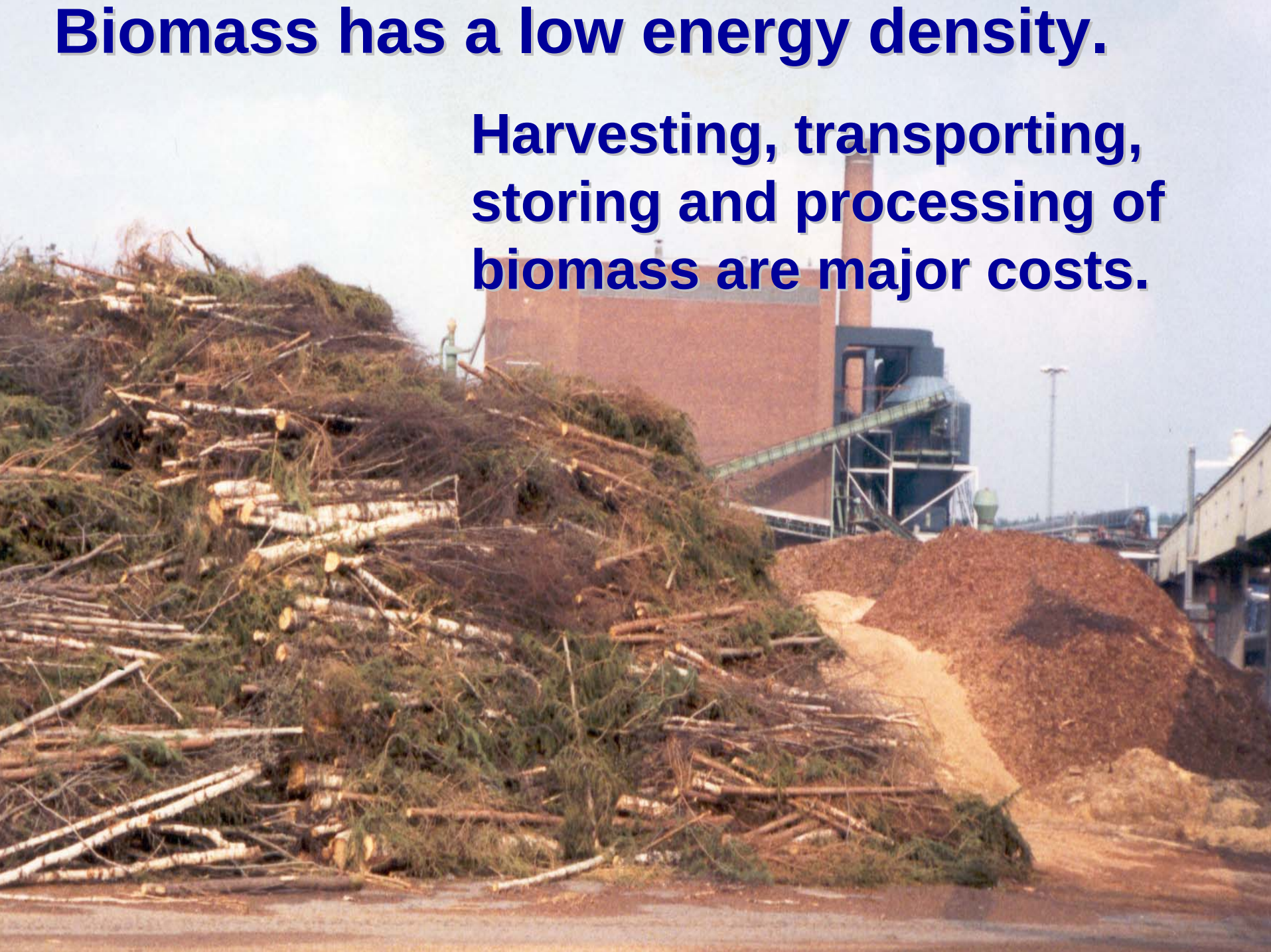
Energy input / output ratios for the entire biomass / bioenergy system are not yet well understood.

The carbon mitigation potential is also uncertain since it varies with the system employed.

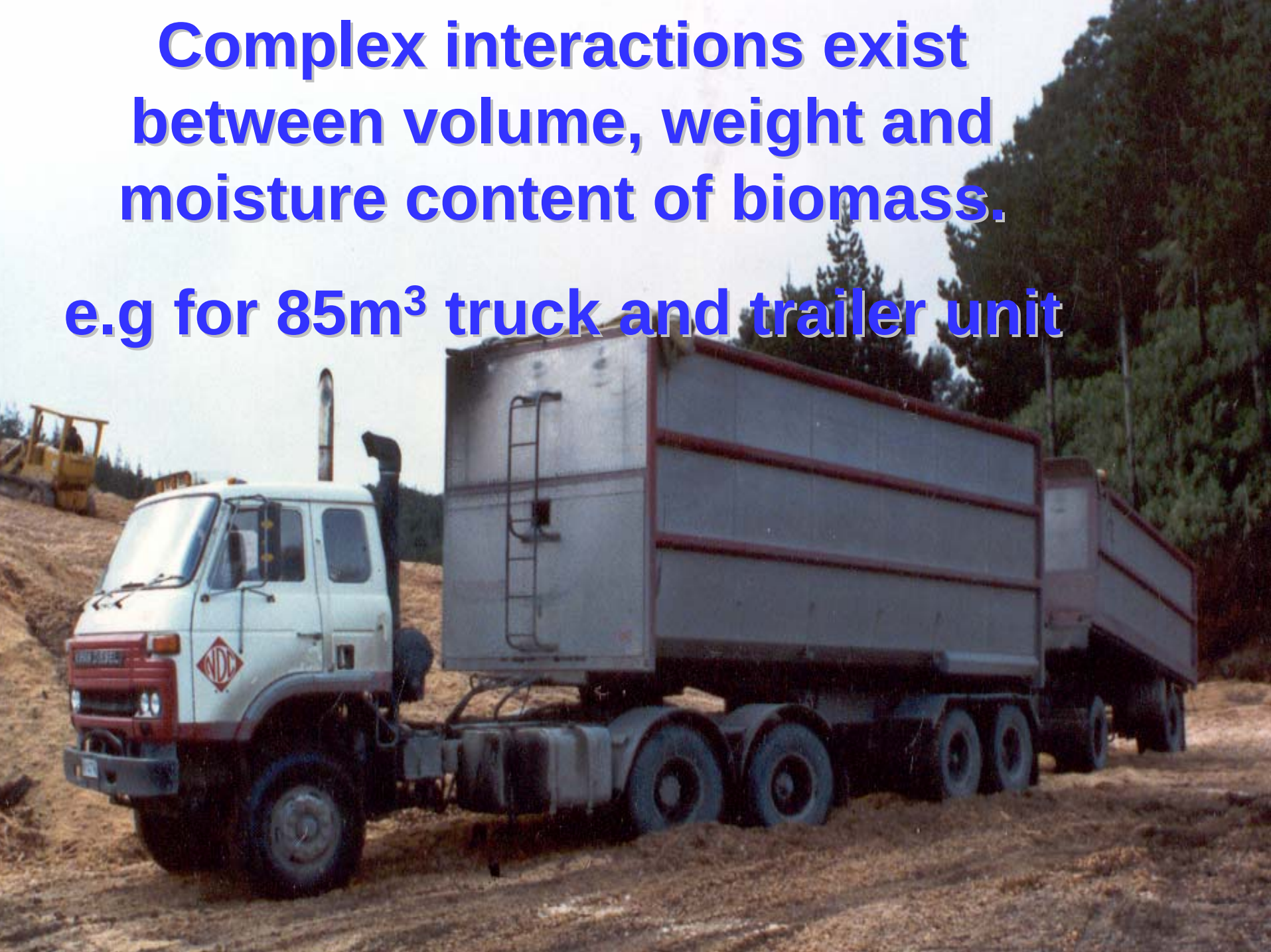
Biofuels greenhouse gas abatement potential



Biomass has a low energy density.



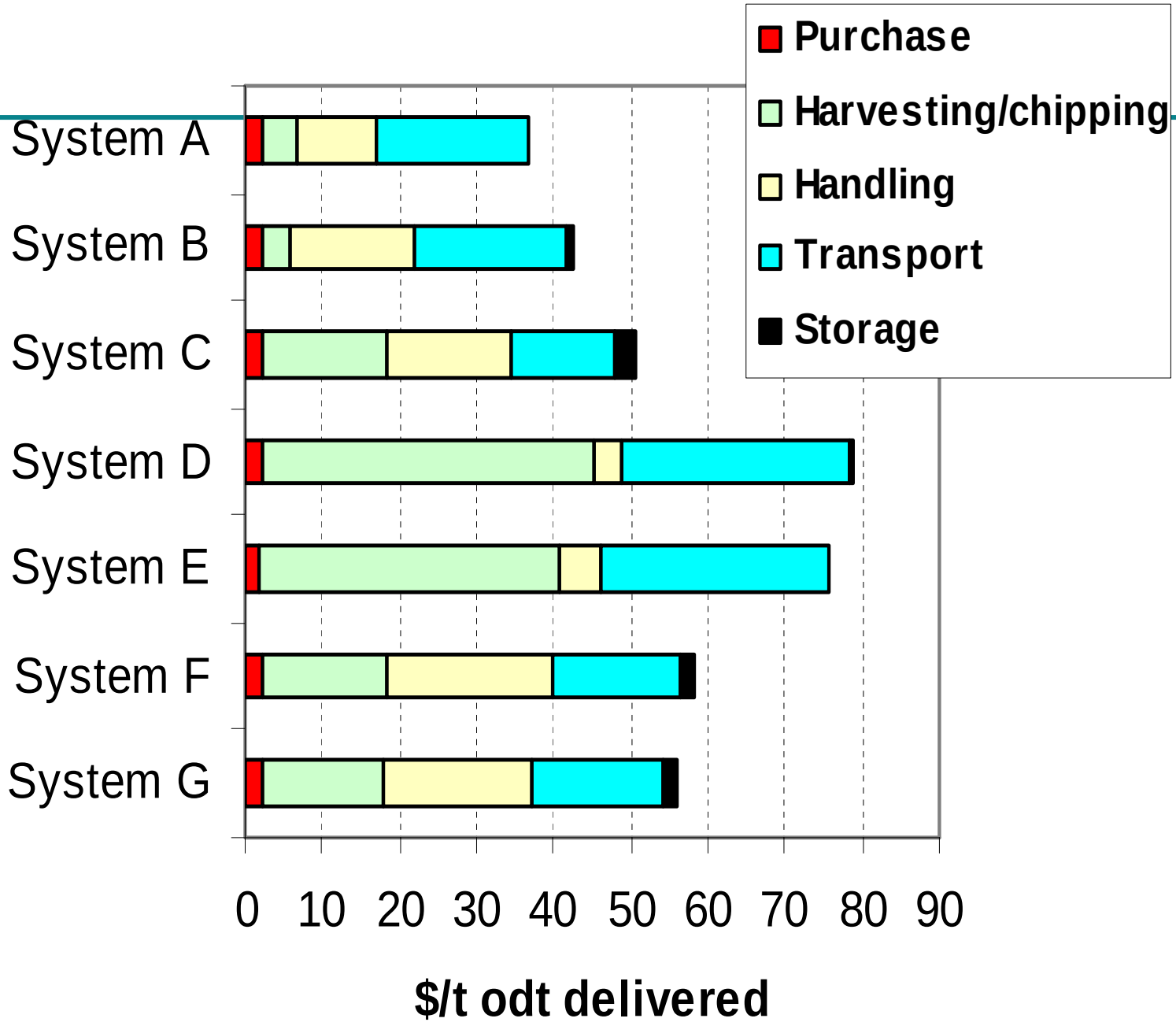
Harvesting, transporting, storing and processing of biomass are major costs.



Complex interactions exist between volume, weight and moisture content of biomass.

e.g for 85m³ truck and trailer unit

FOREST RESIDUES - NELSON



The sugar cane industry is well experienced in handling, transport and processing of “biomass”

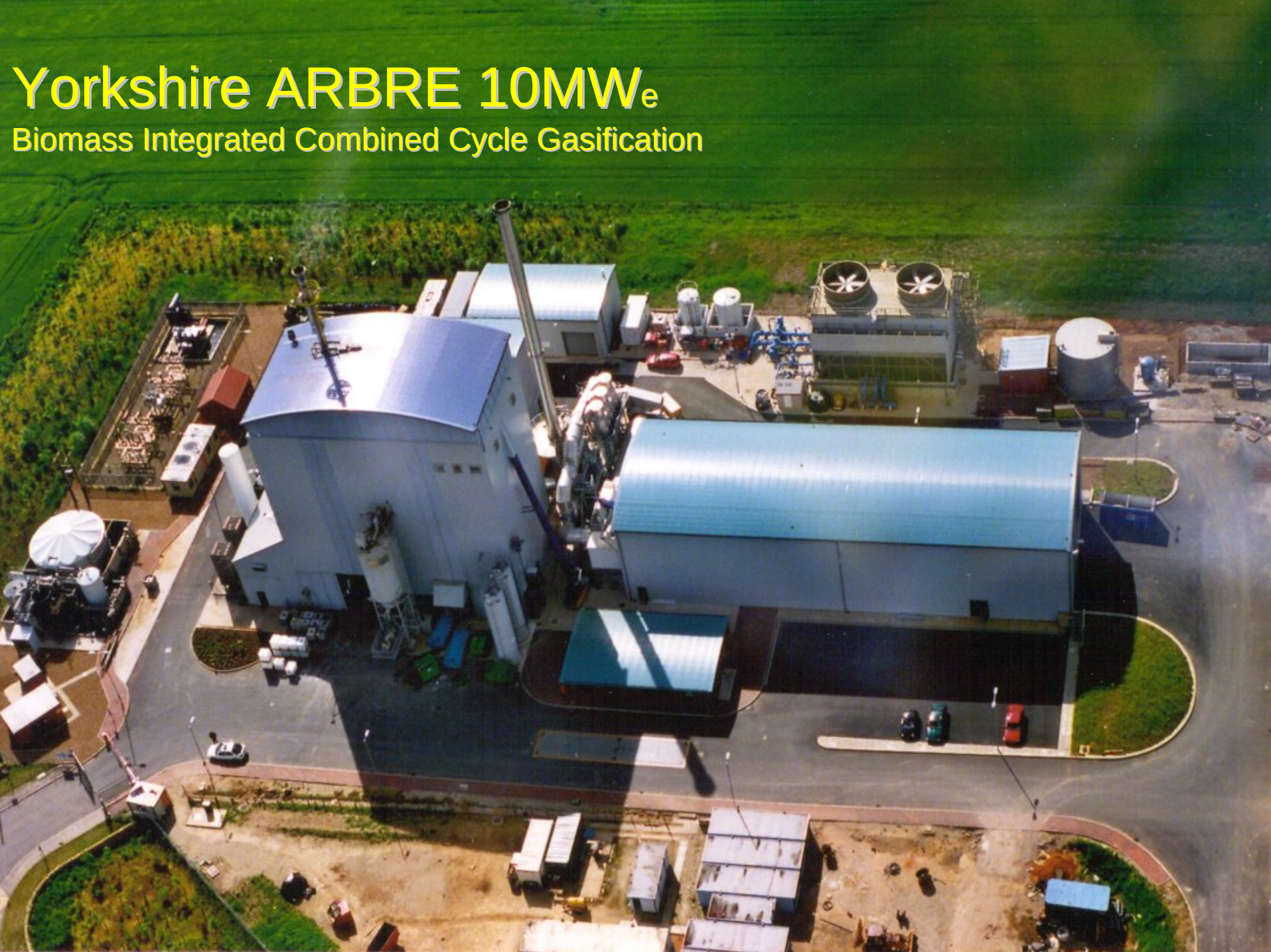
Large plant sizes (typically 300,000t / yr) necessitate maximizing payloads in order to minimize delivered costs over long distances.


FIBERPAC 375

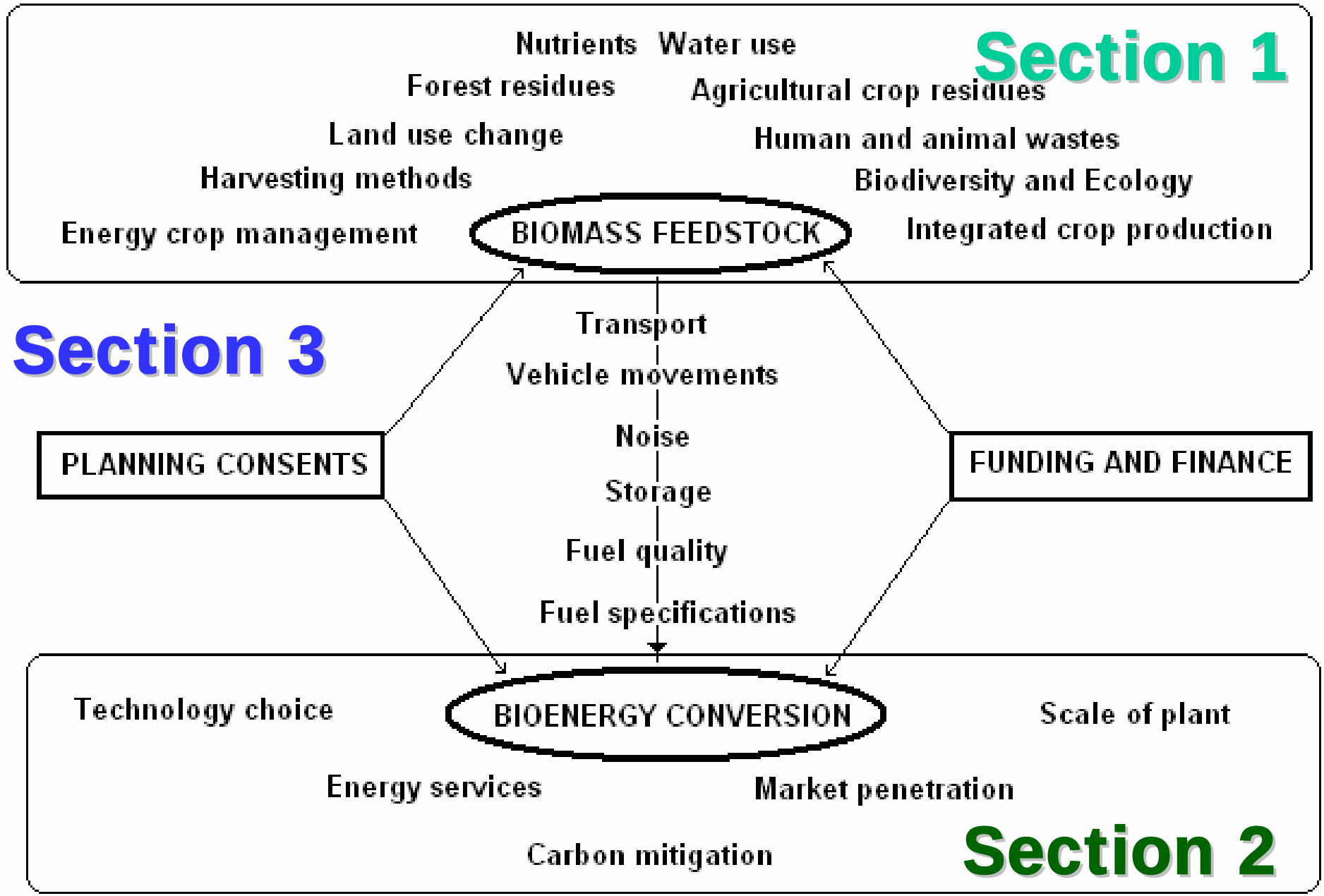

100MW steam
265 MW electric
60 MW district heating
66 bales / 60 t truck. Burns 400 bales / h

Yorkshire ARBRE 10MW$_e$

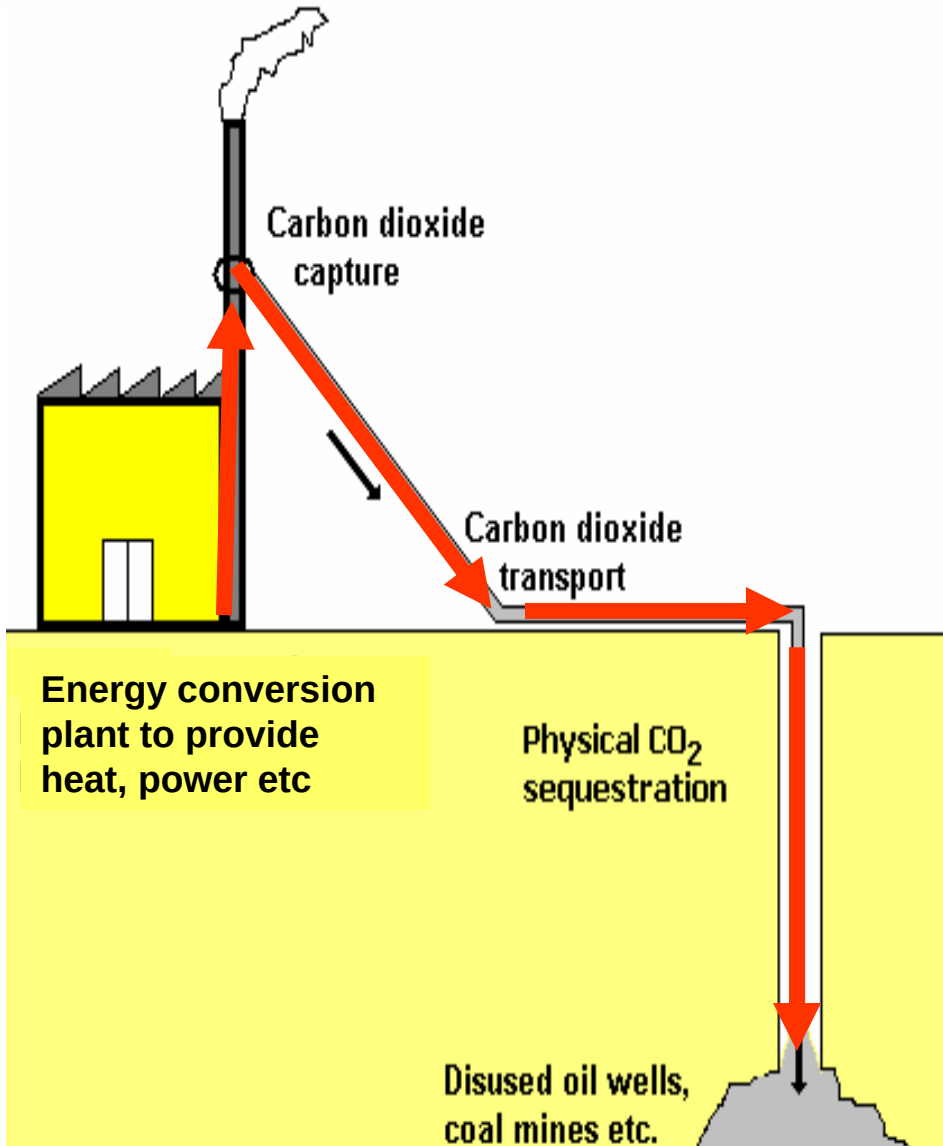
Biomass Integrated Combined Cycle Gasification



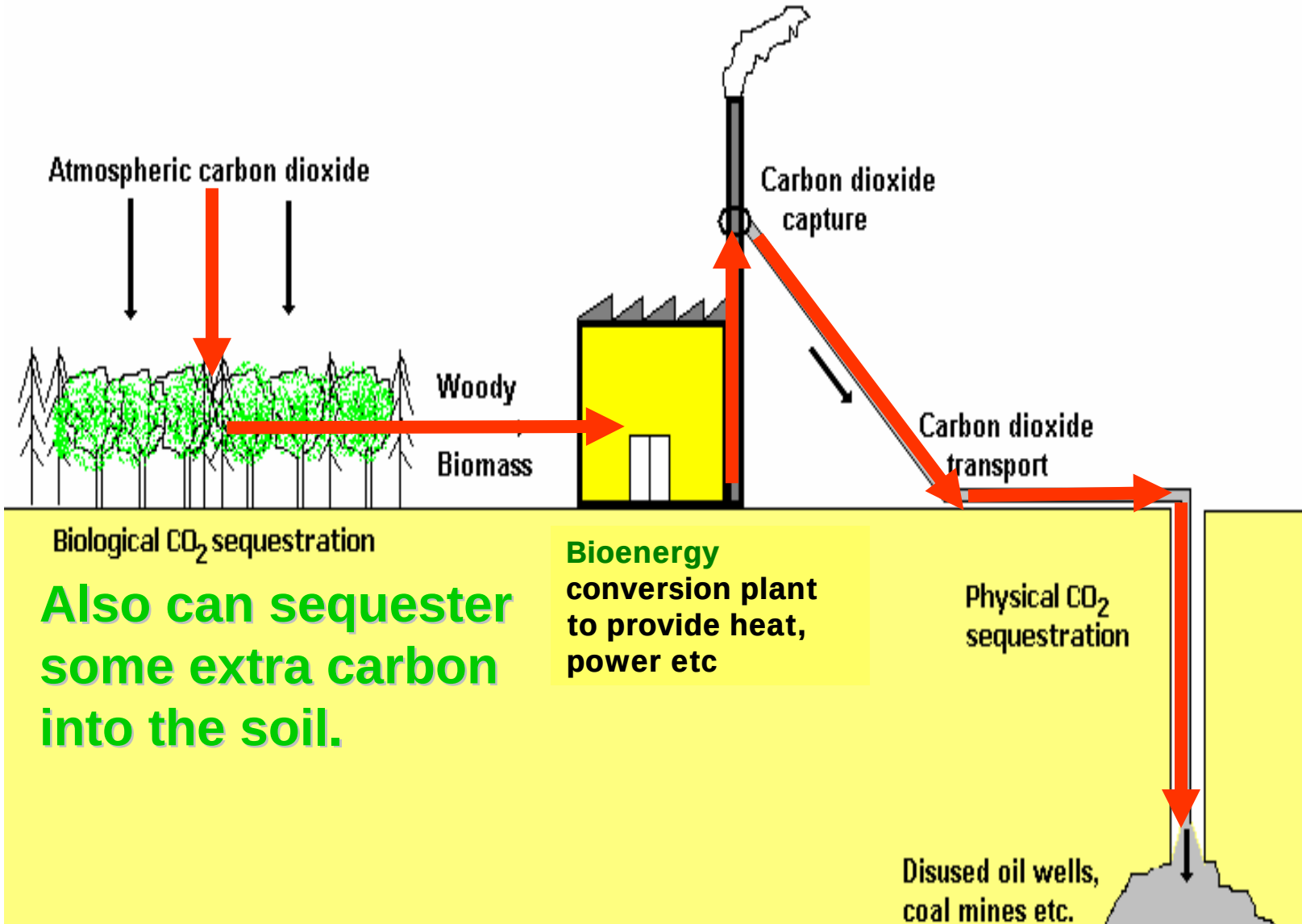
Deployment of bioenergy projects



CO_2 capture and storage.

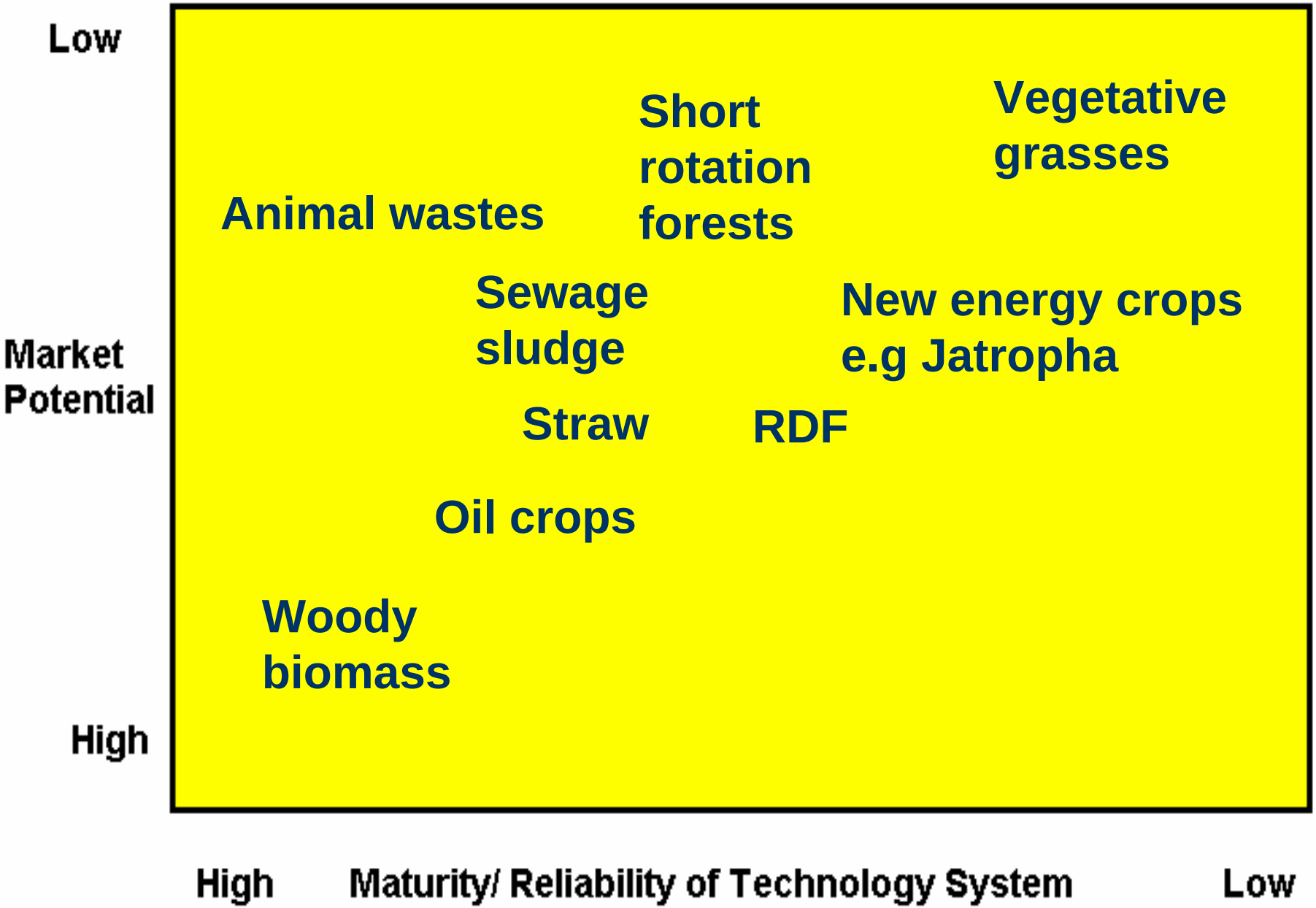


CO_2 capture and storage linked with bioenergy.

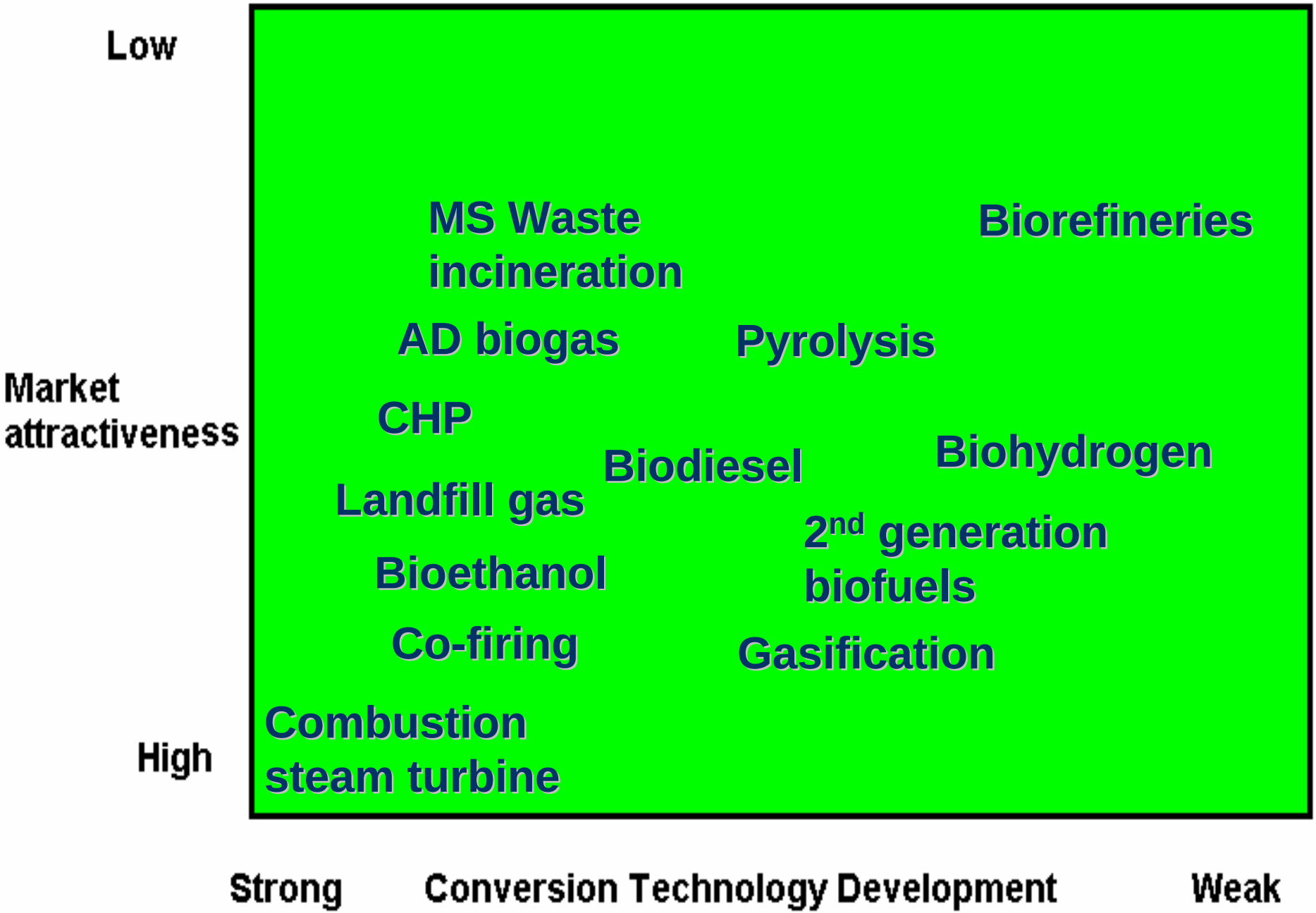


Also can sequester some extra carbon into the soil.

State of the art for Biomass Supply

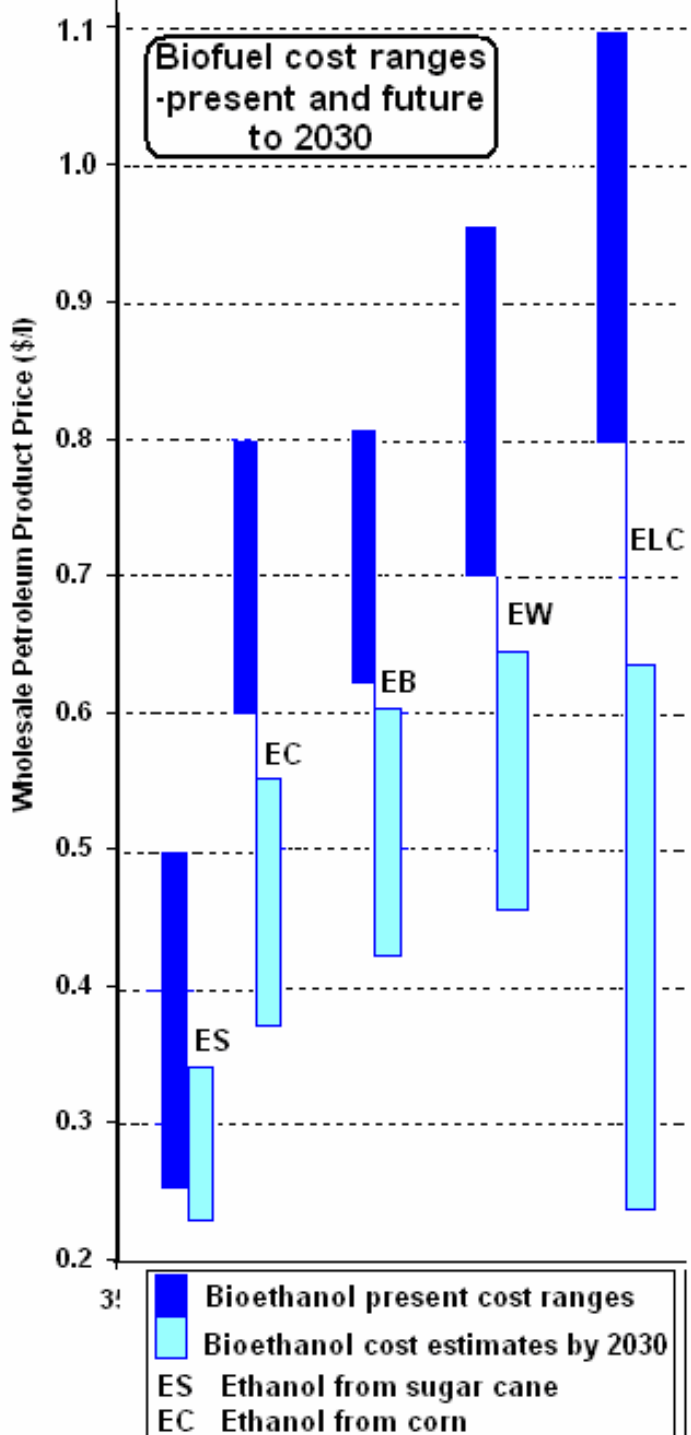


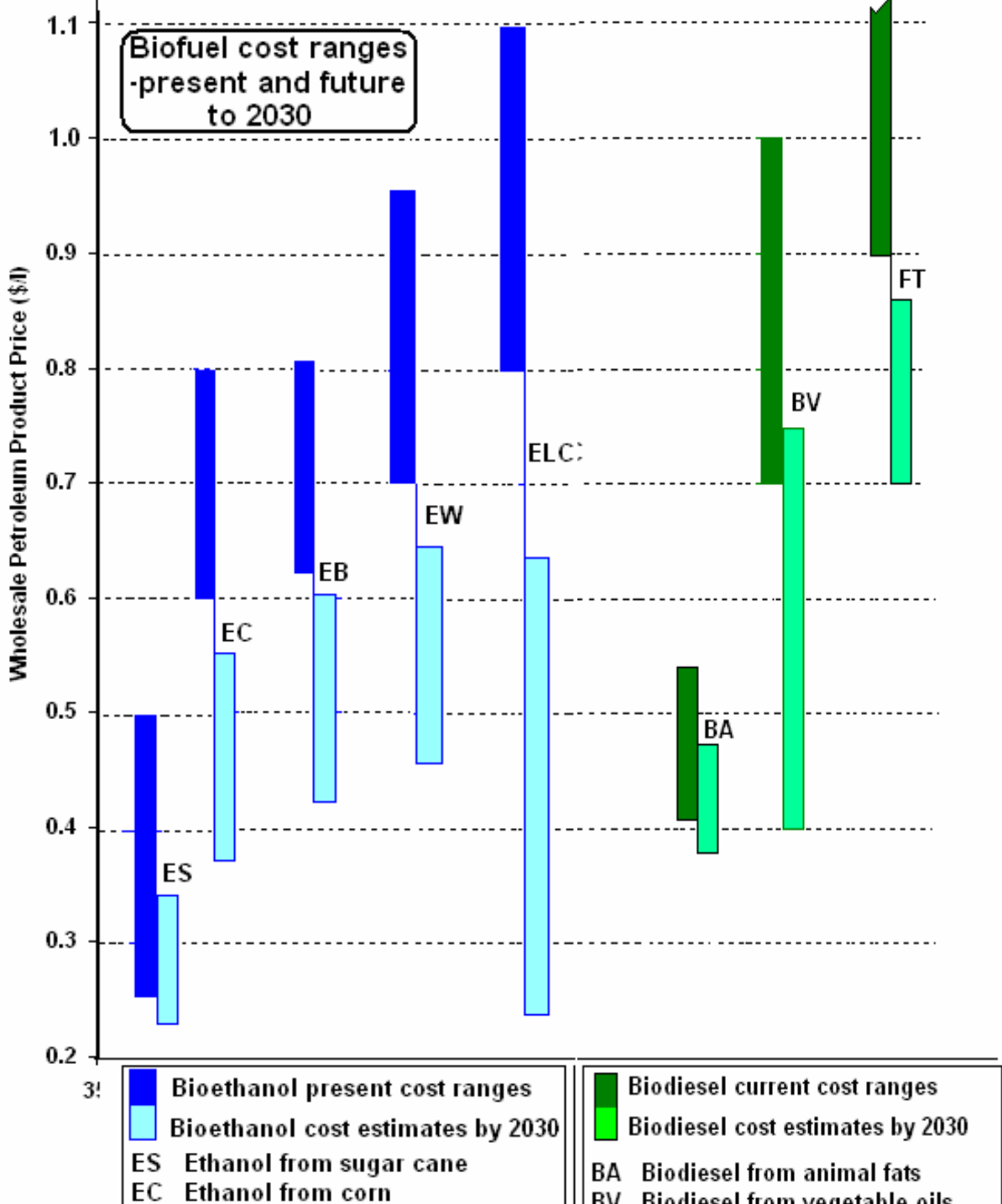
State of the art for Bioenergy plants



Biomass R D D & D summary.

- Better assessment of the available biomass resource.
- Supply chain logistics and storage.
- New energy crop production.
- New and improved efficiency of bioenergy conversion processes.
- Bio-refinery concept analysis.
- Guidelines for bioenergy project development.


Biofuel cost ranges
-present and future
to 2030
Wholesale Petroleum Product Price ($/l)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
ES
EC
EB
EW
ELC
Bioethanol present cost ranges
Bioethanol cost estimates by 2030
ES Ethanol from sugar cane
EC Ethanol from corn


Biofuel cost ranges -present and future to 2030
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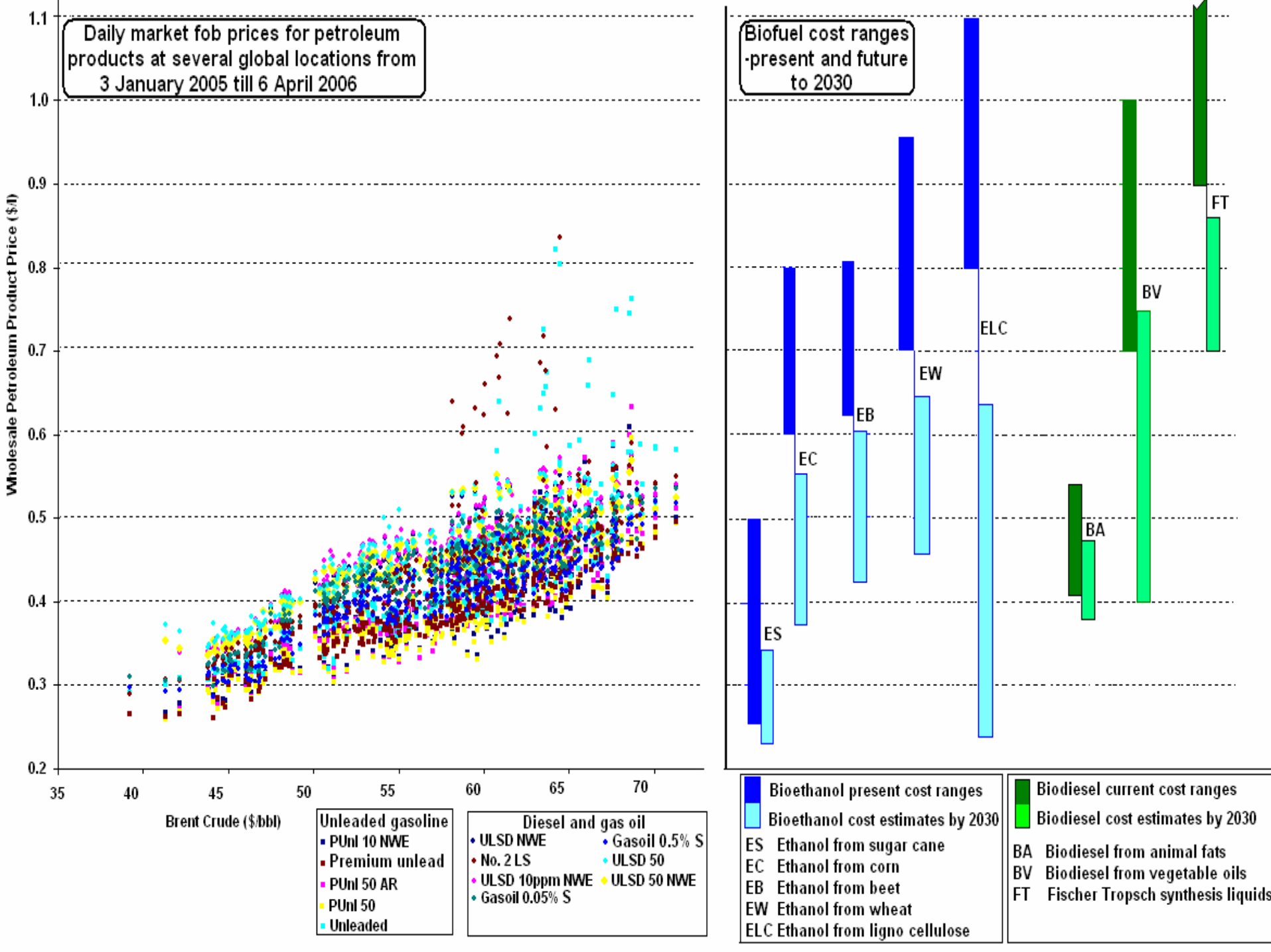
ES
EC
EB
EW
ELC
BA
BV
FT
Bioethanol present cost ranges
Bioethanol cost estimates by 2030
ES Ethanol from sugar cane
EC Ethanol from corn
Biodiesel current cost ranges
Biodiesel cost estimates by 2030
BA Biodiesel from animal fats


Daily market fob prices for petroleum products at several global locations from 3 January 2005 till 6 April 2006
Wholesale Petroleum Product Price ($/l)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
35
40
45
50
55
60
65
70
Brent Crude ($/bbl)
Unleaded gasoline
PUnl 10 NWE
Premium unlead
PUnl 50 AR
PUnl 50
Unleaded
Diesel and gas oil
ULSD NWE
Gasoil 0.5% S
No. 2 LS
ULSD 50
ULSD 10ppm NWE
ULSD 50 NWE
Gasoil 0.05% S
Biofuel cost ranges -present and future to 2030
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Bioethanol cost estimates by 2030
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EB Ethanol from beet
EW Ethanol from wheat
ELC Ethanol from ligno cellulose
Biodiesel current cost ranges
Biodiesel cost estimates by 2030
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FT Fischer Tropsch synthesis liquids