Parallel Session 2

Forests, agroforestry and bioenergy

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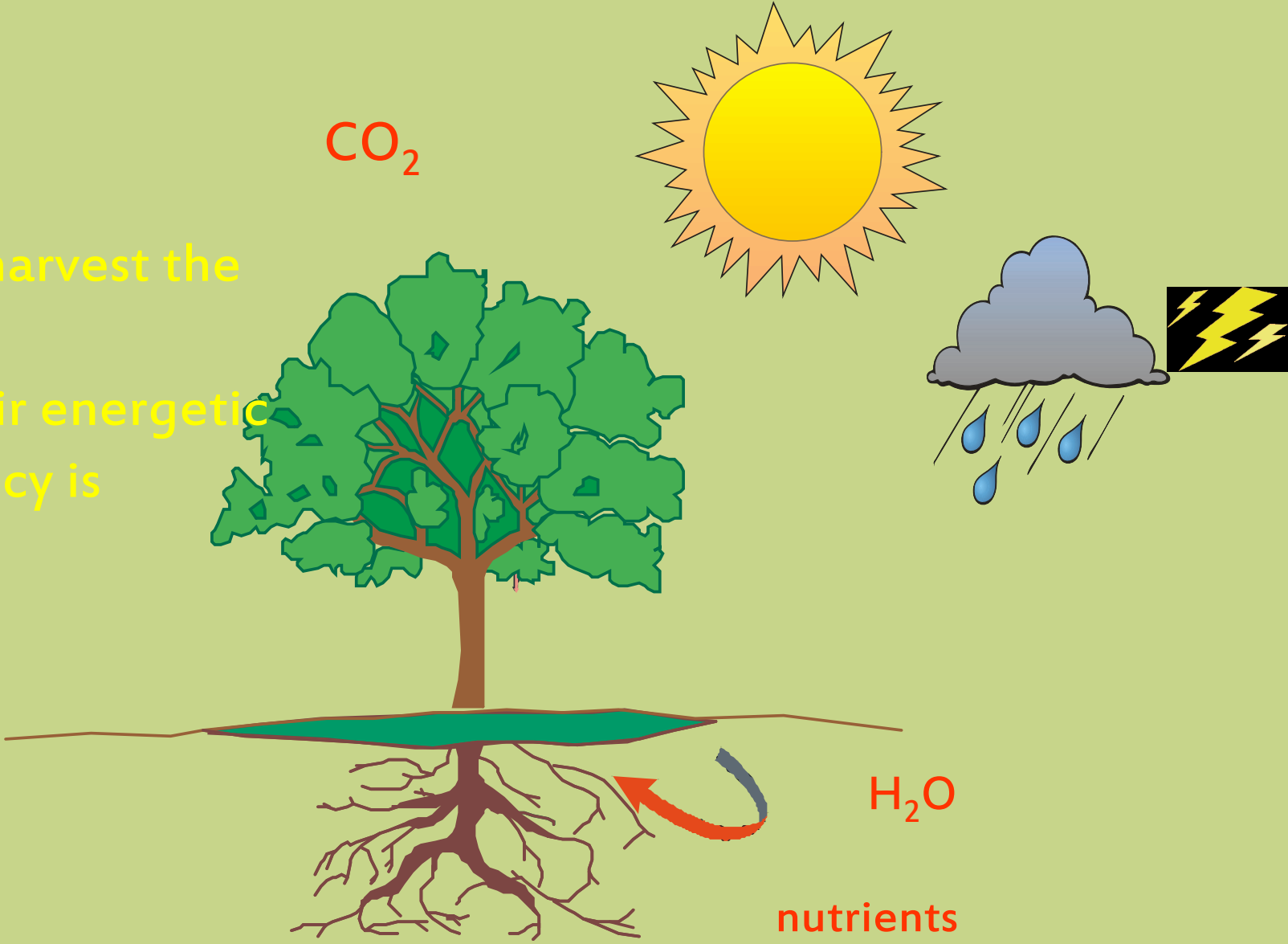
Plants harvest the sun,
but their energetic efficiency is modest



Research should work to increase this efficiency

Bioenergy in the Italian context

Total energy need = 190 MTep

Renewable energy = 17 MTep (9%)

Biofuels = 5 MTep (3%)

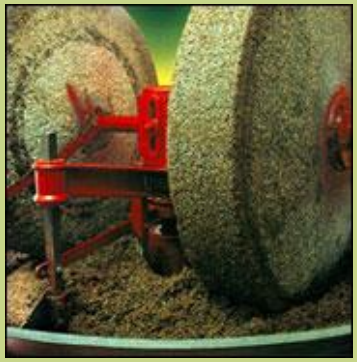
Bioenergy/RE = 30%

Bioenergy should, at least, double by 2020

Bioenergy fuels

Forest products and residues

Agricultural products



Agro-industry residues

Urban forestry

Agro-forestry

Bioenergy vs. Environment

No free lunch: no energy sources come without environmental impact

However, biofuels are critical if we want to meet the target of significant reduction of CO_2 emissions (80-90% reduction from fossil fuel per unit of energy production)

Bioenergia a confronto con altri sistemi

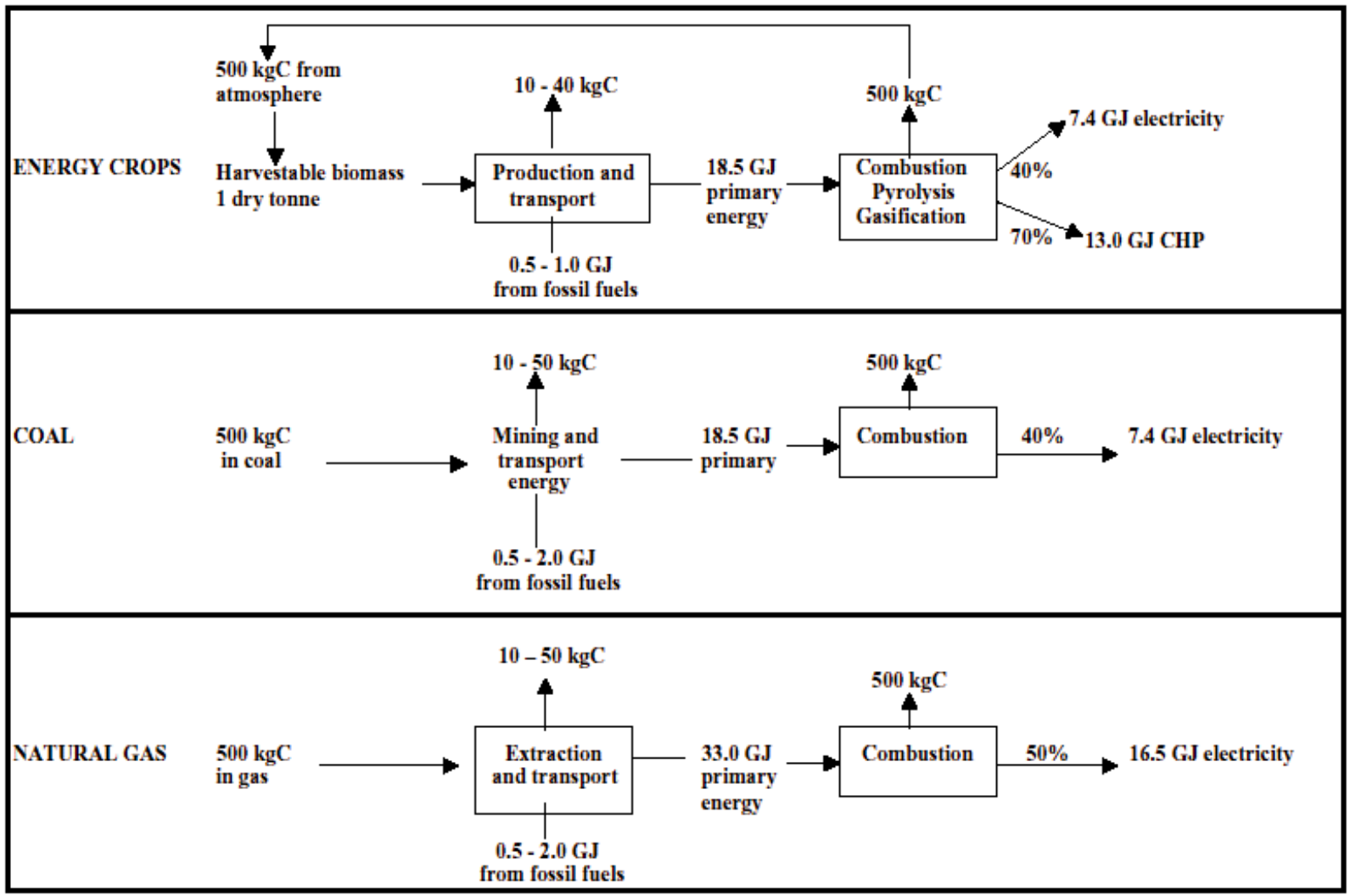
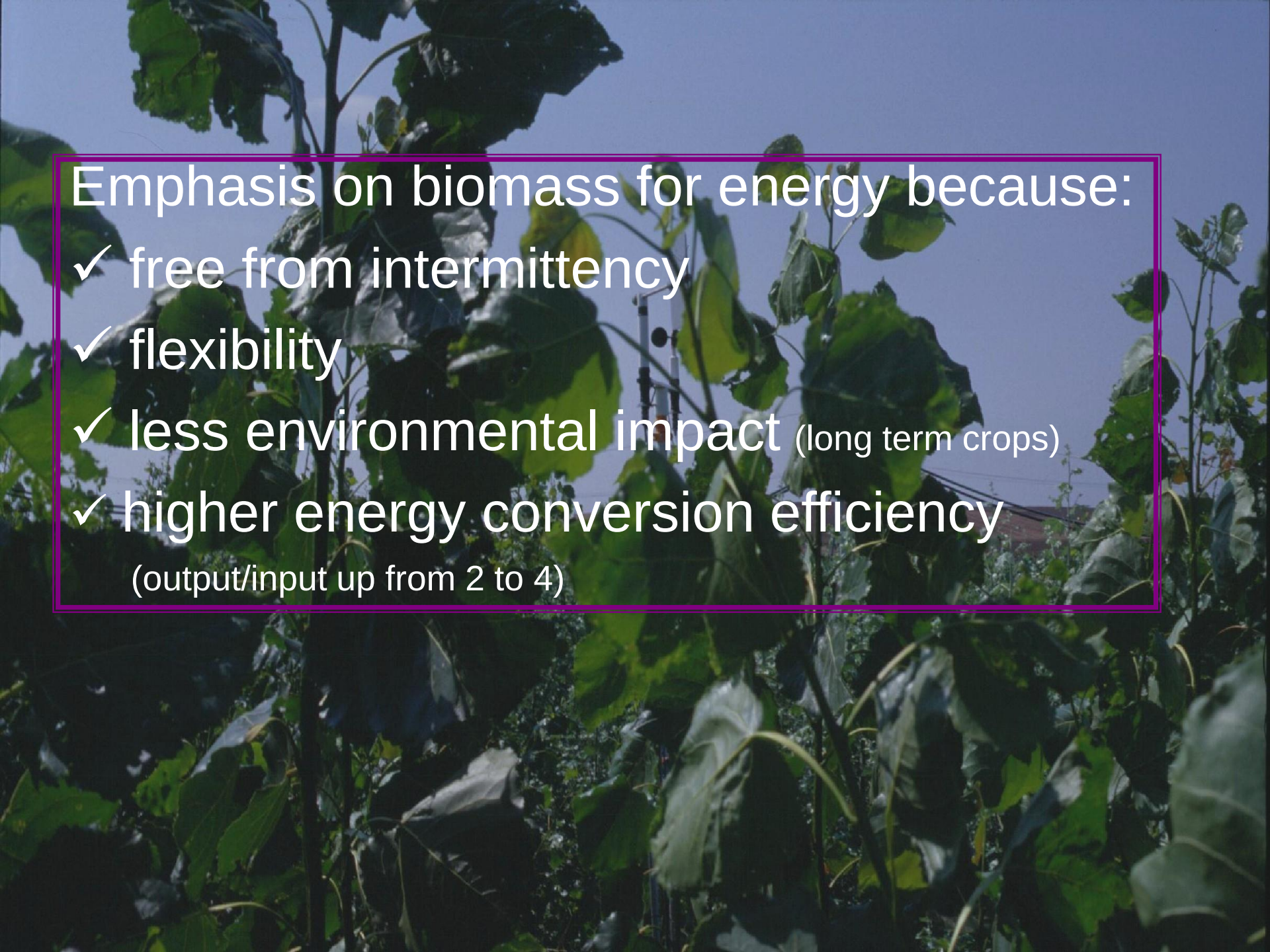


Fig. 1. Simplified schemes of the flows of energy and carbon when generating electricity from biomass, coal or natural gas. CHP is 'combined heat and power'.

Cannell, *Biomass and Bioenergy*, 200



Emphasis on biomass for energy because:

- ✓ free from intermittency
- ✓ flexibility
- ✓ less environmental impact (long term crops)
- ✓ higher energy conversion efficiency

  (output/input up from 2 to 4)

Energy production from biomass (combustion, co-firing, gasification)

Conversion efficiency

heat 90%

electricity 30%

combined (heat + electr.) 80%

Figure 3-1 'Heat only' combustion plant

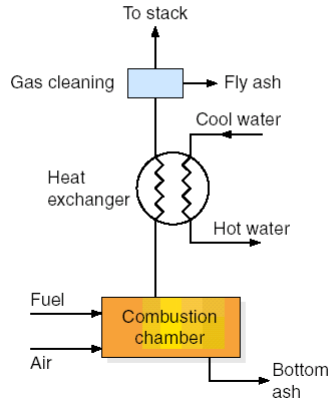


Figure 3-III Combined heat and Power (CHP) plant, using gas turbine for co-generation

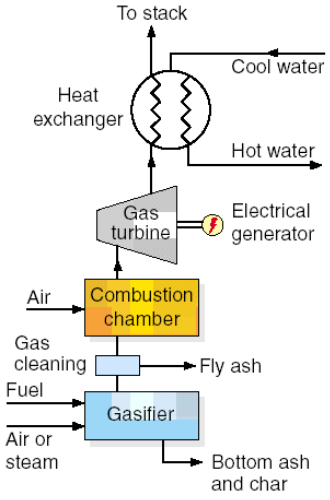
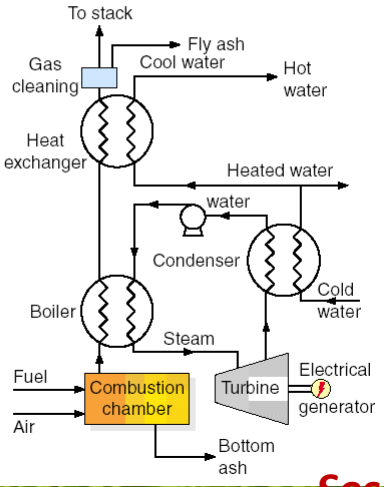


Figure 3-II Combined heat and Power (CHP) plant, using steam cycle for co-generation



(Royal Commission Environmental Pollution, 2004)

Energy plants with different scales and efficiency

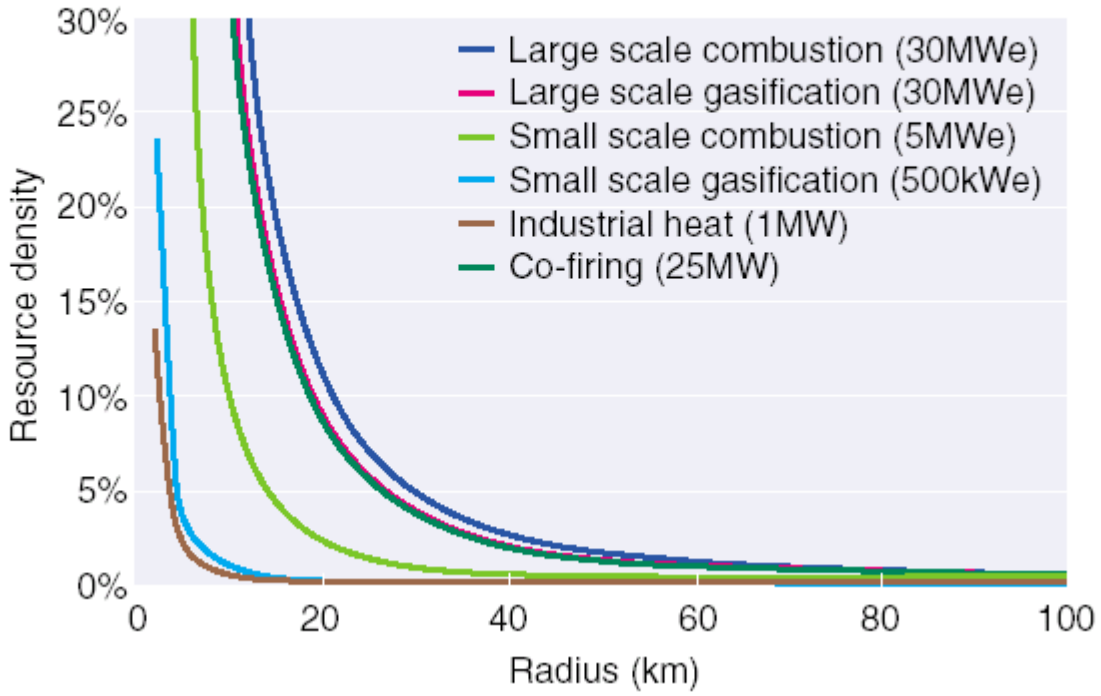
Table 4.5 Energy conversion facilities

Type	Efficiency	Fuel input	Output			Wood	Land use	Resource density
	%	(MW)	Heat (MWth)	Power (MWe)	Total (MW)	odt/y	hectares	%
Small heat-only	75	1.3	1	0	1	4,056	406	0.2
Large steam-cycle CHP	80	53	30	12	42	170,333	17,033	8.7
Small gasification/ pyrolysis	75	1.3	0.7	0.3	1	4,056	406	0.2
Large gasification/ pyrolysis	80	49	29	10	39	158,167	15,817	8.1

(Royal Commission Environmental Pollution, 2004)

Distance of the biomass source from energy plant is important

Figure 4-II Resource densities for biomass stations by collection radius.



(Royal Commission Environmental Pollution, 2004)

The expansion of the bioenergy option requires actions:
institutional (subsidies, bioenergy chain implementation, information) and research (productivity, technology)

based on current yields, our estimates of the gross margin for the farmer suggest that energy crop production is only attractive using set-aside land[78]. At current yield levels SRC willow is less attractive than barley, oats or winter wheat. The DTI commissioned a further assessment that showed that with a 30% increase in yield, energy crops would be an attractive alternative to barley. Without subsidies an economic case cannot currently be made for energy crops but carefully designed additional subsidies could encourage further uptake of energy crops by UK farmers. The critical issue for farmers is the security of a market for at least two to three crops. Without that the risks of establishing a crop with a lifetime of 15-20 years is too great.

(Royal Commission Environmental Pollution, 2004)

Potential of Short Rotation Forestry in Italy

800.000 ha (Mezzalira, 2004)
(cereals cropping area: 3,7 Millions ha, ISTAT 1997)

x 10-20 t dm ha^{-1} y^{-1}

=>12 Millions t dm y^{-1}
(Fuelwood in Italy: 5 M. m^3 from 3,9 M ha coppice stands)

SRF crops

Salicacee: Poplars and willows

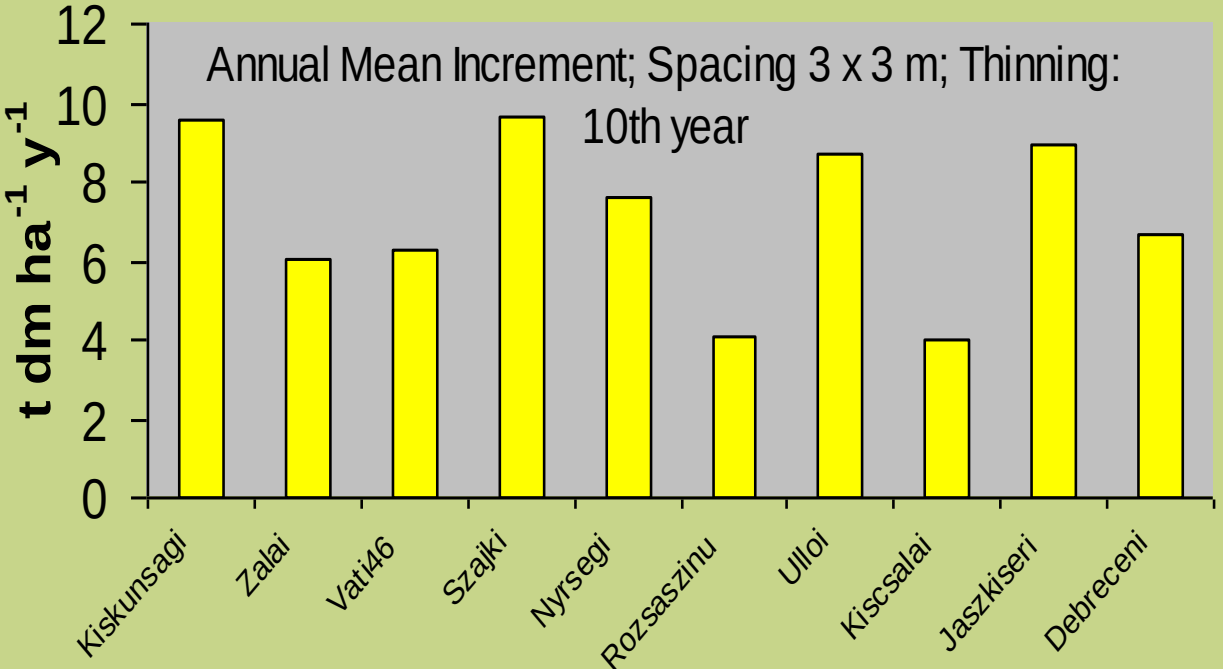
Robinia

Robinia Genetic Resources

Need of selected planting material of Robinia with improved yield

Collaboration with Hungary, where many robinia clones have been selected

Hungarian clones test plantation in Italy, Biagio-Orvieto (wheat yield 4,5 t/ha^{-1})



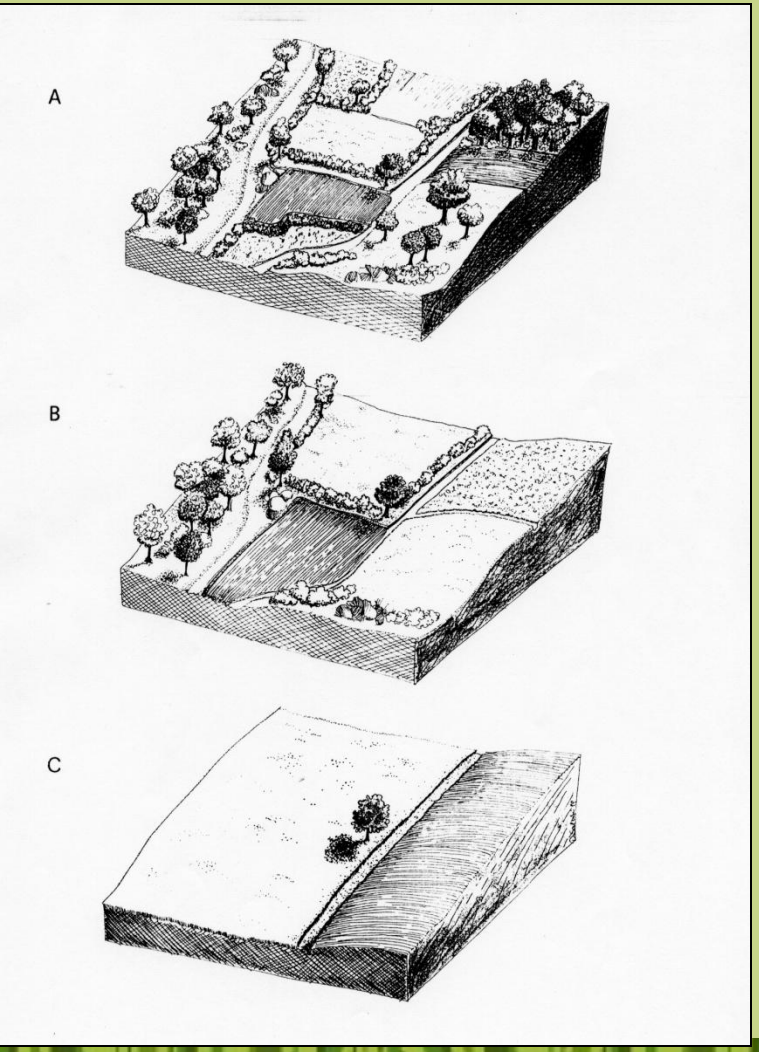
Production potentials of different poplar clones

Clone	Produz. sostanza secca fusto ton ha^{-1} $anno^{-1}$
Boccalari	8.90
I-214	13.10
BL Costanzo	14.91
L. Avanzo	21.29
Bellotto	23.52

Nel secondo ciclo incremento delle produzioni dal 10-15% per i cloni meno produttivi, al 30-35% per i più produttivi.

Da: Frison G., Bisoffi S., Allegro G., Borelli M., Giorcelli A. 1990 - Short rotation Forestry in Italy: past experience and present Situation. Energy Forestry Production System Workshop. Sept. 19-25 1990. Graz & Casale Monferrato. pp 42.

Agroforestry and wood production in Italy



<u>Before Word Word II,</u>
agroforestry systems:

12 Millions (M) m^3 wood <u>*vs*</u> 10,5 Mm^3 from forests (Mezzalira, 2001);

<u>Year 2000:</u>

Agroforestry: 1,3 Mm^3;
Forests: 7,9 Mm^3

(ISTAT, 2000)

Buffer strips to remediate groundwater pollution

Synthesis

- Need of close links between institutions, research and farmers
- Research programs in production biology and energy technology
- Develop the biomass-bioenergy-environment chain
- Bioenergy will be cost effective if multifunctional