ENERGY FOREST

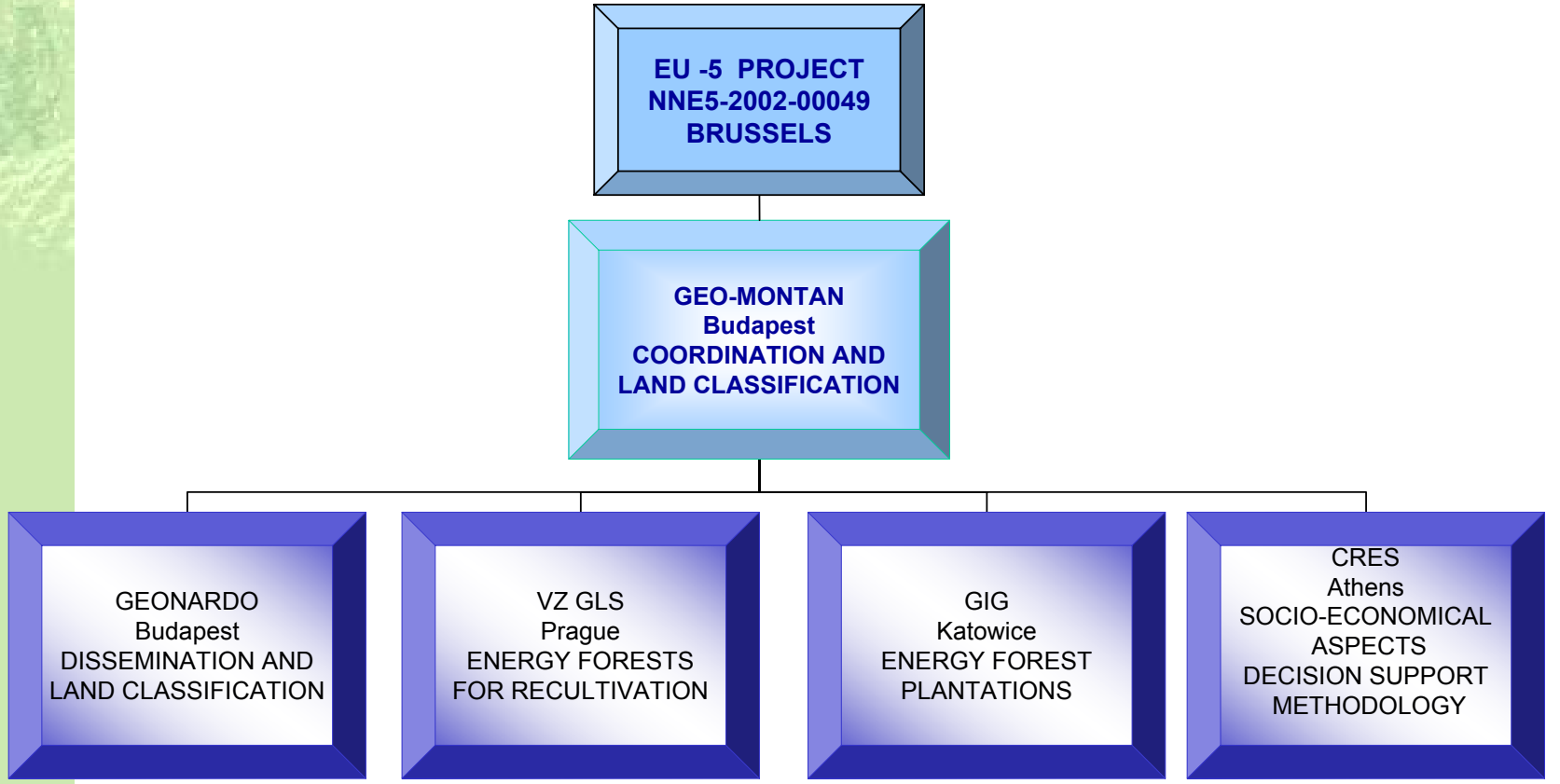
NNE5-2002-00049

ENERGY FOREST DEVELOPMENT ON AREAS IN CENTRAL-EASTERN EUROPE, WHERE AGRICULTURAL PRODUCTION IS UNECONOMICAL

BIO-ENERGY
ENLARGED PERSPECTIVES

Budapest ,16-17 October 2003

PROJECT STRUCTURE



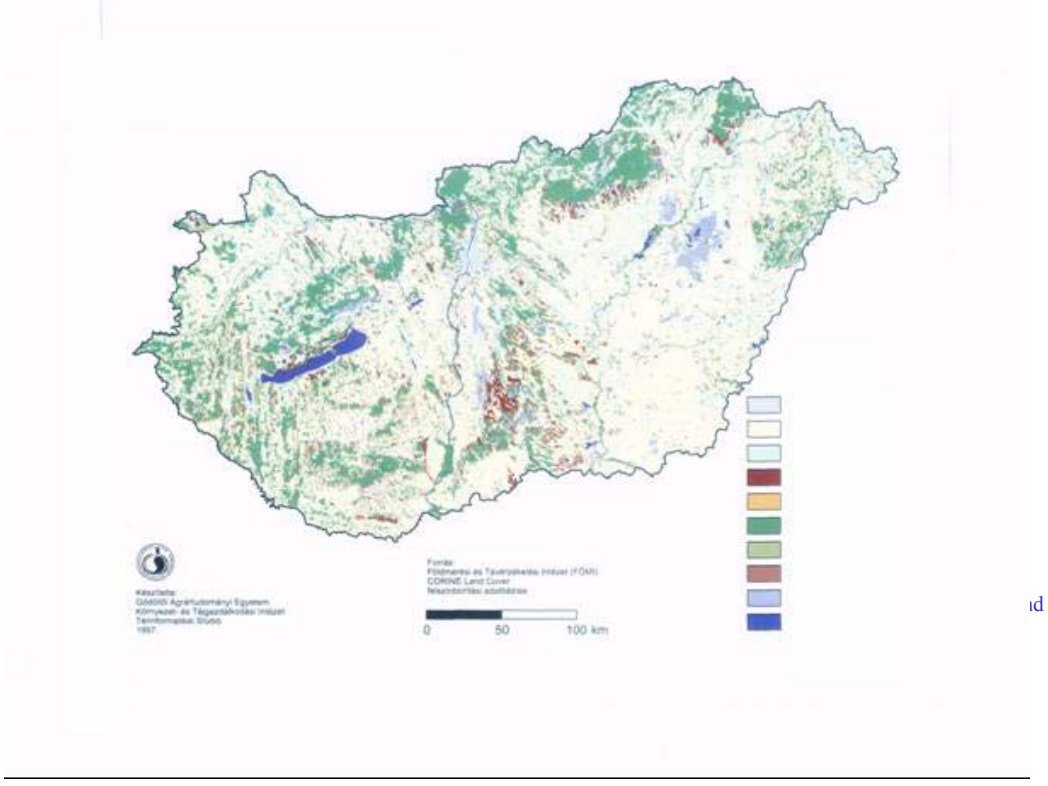
MAIN OBJECTIVE

TO DETERMINE HOW MUCH ENERGY COULD BE PRODUCED FROM WOOD IF ENERGY FORESTS WERE PLANTED ON UNPRODUCTIVE LANDS

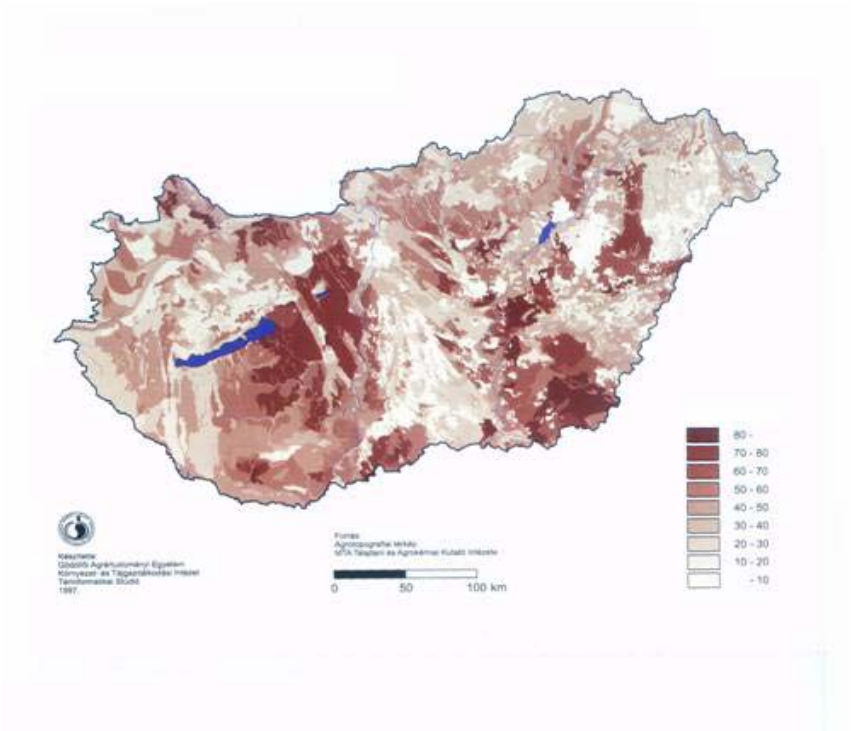
EXAMPLE OF HUNGARY

- TOTAL AREA: 9 303 000 HA
- CULTIVATED LAND: 7 596 000 HA
- FOREST LAND: 1 760 000 HA
- AGRICULTURAL LAND: 5 744 000 HA
- ARABLE LAND: 4 500 000 HA
  - EU SUBSIDISED: 3 488 000 HA
- LOW QUALITY LAND: 1 790 000 HA

LAND CATEGORIES



SOIL CLASSIFICATION



LAND POTENTIAL

- After the accession of Hungary to the EU
  1 million ha of arable land can be afforested.
- A considerable part of which can be **energy-forest.**

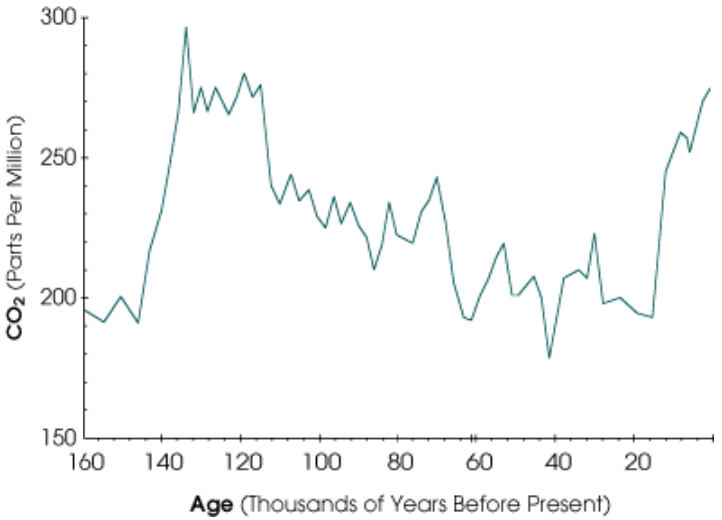
THE SHARE OF RENEWABLES IN THE ENERGY SUPPLY

- The Hungarian renewable energy consumption today is 38 PJ/year, (3,6 % of the total consumption). About 2,8% of all renewables is biomass, mainly firewood. By 2010 the share of renewables will have to be raised to 12%. **Only 0,5% of the total Hungarian electricity supply has come from renewables in 2003.** By the end of the decade this should be increased sevenfold to 3,6%.

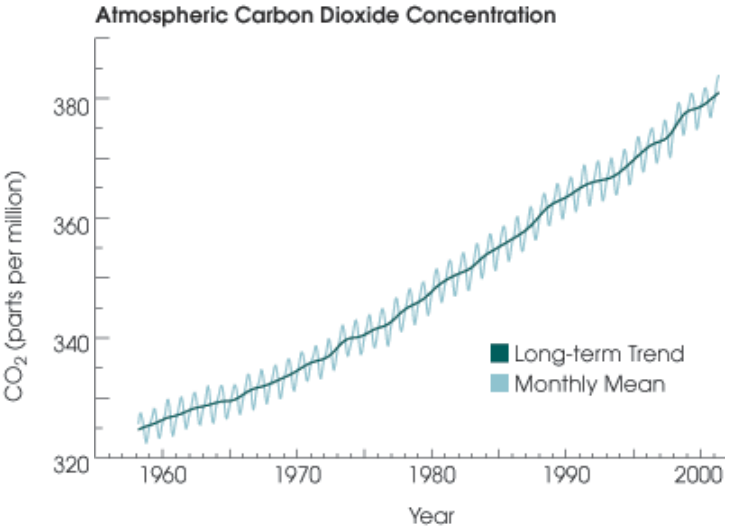
THE SHARE OF RENEWABLE ELECTRICITY IN THE EU

	1997 (TWh)	1997 (%)	2010 (%)
• **Belgium**	**0,86**	**1,1**	**6,0**
• **Denmark**	**3,21**	**8,7**	**29,0**
• **Germany**	**24,91**	**4,5**	**12,5**
• **Greece**	**3,94**	**8,6**	**20,1**
• **Spain**	**37,15**	**19,9**	**29,4**
• **France**	**66,00**	**15,0**	**21,0**
• **Ireland**	**0,84**	**3,6**	**13,2**
• **Italy**	**46,46**	**16,0**	**25,0**
• **Luxembourg**	**0,14**	**2,1**	**5,7**
• **Holland**	**3,45**	**3,5**	**9,0**
• **Austria**	**39,05**	**70,0**	**78,1**
• **Portugal**	**14,30**	**38,5**	**39,0**
• **Finland**	**19,03**	**24,7**	**31,5**
• **Sweden**	**72,03**	**49,1**	**60,0**
• **United Kingdom**	**7,04**	**1,7**	**10,0**
• European Union	338,41	13,9%	22,1%

CO_2 CONCENTRATION



The long-term record of atmospheric carbon dioxide obtained from Antarctic ice cores shows huge fluctuations over the past 150,000 years.
(Graph by Robert Simmon, based on data from Lorius, C., J. Jouzel, C. Ritz, L. Merlivat, N.I. Barkov, Y.S. Korotkevitch, and V.M. Kotlyakov. 1995. A 150,000-year climatic record from Antarctic ice.)



Carbon Dioxide in the atmosphere has been steadily rising since regular measurements began in 1958. The graph above shows both the long-term trend and the seasonal variation.
(Graph by Robert Simmon, based on data from the NOAA Climate Monitoring & Diagnostics Laboratory)

THE STATUS OF RENEWABLE ENERGIES WILL DEPEND ON:

- Price increases due to the liberalisation of the natural gas market.
- Environmental policy: change in priorities and subsidies.
- As the consequence of the EU accession:
  - the share of alternative energy in the total energy consumption in Hungary will have to be raised to 12% by 2010.
  - On 1 million hectare of arable land energy crops can be planted.
- The depletion of the Hungarian fossil fuel reserves: oil and natural gas will be enough for 19, coal for 14-15, lignite for 67 years.

BIOMASS POTENTIAL

- Hungary's estimated total biomass reserves are around 350-360 million tons, and the annual biomass formation is around 105-110 million tons. The gross energy content of the annual biomass formation is 1185 PJ. It is much larger than the country's total energy consumption, which is 1040 PJ/year. Vegetation stores about 30,4 million tons of carbon annually, which is more than twice as much as the carbon content of coal extracted from the mines.

HUNGARY'S ENERGY SOURCE PRODUCTION IN 2001

Denomination	Quantity Mt	Quantity PJ	Ratio %
Coal	14,11	121,7	26,7
Crude Oil	1,1	43,7	9,6
Natural Gas	3,3	105,4	23,1
Gasoline	0,3	11,2	2,5
Mined Propane Butane Gas	0,3	9,8	2,1
Firewood	1,1	15,6	3,4
Nuclear Energy		141,3	30,9
Hydroelectric Power Plant		1,9	0,4
Other		6,0	1,3
Altogether		**456,6**	**100,0**

ENERGY IMPORT

- Hungary's energy demand has been around 1040 PJ /year in the last three years.
- About 60% of that (583 PJ) has been imported from other countries.

BIOMASS AS AN ENERGY SOURCE

- Out of the 105-110 million tons of annual biomass formation, 9 Mt come from forests.

- From the potential 105-110 million tons of annual biomass formation, 38-43 million tons can be regarded as energy source. Forestry comes in at about 10%, that is 3-4 million tons yearly (firewood, energy-forest).

ENERGY TREE TYPES

- **ENERGY TREE TYPES CHARACTERISTICS - LAND**

- WILLOW (SALIX) - FLOOD PLAINS
- POPLAR - FAIR QUALITY SOIL
- BLACK LOCUST (ROBINIA) - SANDY SOIL

POPLAR - 5 YEARS OLD TEST AREA IN TATA

POPLAR - 1 YEAR OLD - TATA

PLANTING PATTERNS

	RE-PLANTING	SHOOTING
DENSITY: STAND/HA	5-8 000 STAND/HA	13-15 000
ROTATION:	8-15 YEARS	2-4 YEARS
WOODMASS: TONS/HA/YEAR	8-15 TONS/HA/YEAR	11-20
ENERGY PRODUCTION: GJ/HA/YEAR	80-150 GJ/HA/YEAR	150-250

- Source: Prof. Dr. Marosvölgyi Béla

WOODMASS –TATA AREA

Species/ clone	Age year	stock/ha	kg/m	Biomass yield t/ha/year
Poplar/Pa	3	11000	9,3	15,5
Poplar/Kol	5	10000	15, 3	20,5
Poplar/Ra	5	7 800	14,6	19,5
Poplar/Beau	5	9 300	27,8	37,1
Robinia	4	12 600	13,1	17,5
Salix	1	12 700	3,3	22,1
Ailanthus	4	9 600	12,8	22,0

WOOD-SPLITTING MACHINE
Made in Hungary - OPTIGÉP

THE HUNGARIAN POSSIBILITIES

- THE HUNGARIAN ANNUAL ENERGY CONSUMPTION IS 1040 PJ
- ENERGY FORESTS IF PLANTED ON 1,79 MILLION HA LOW SOIL-QUALITY LAND COULD PROVIDE: 14,3 - 25,1 MILLION TONS OF WOODMASS WHICH IS EQUIVALENT TO 171 - 301 PJ OF ENERGY

OR

- ENERGY FORESTS IF PLANTED ON 1 MILLION HA OF NON-CULTIVATED ARABLE LAND COULD PROVIDE: 8-14 MILLION TONS OF WOODMASS WHICH IS EQUIVALENT TO 96-168 PJ OF ENERGY

CONCLUSION:

ENERGY FORESTS COULD MEET 9 - 29% OF THE ANNUAL HUNGARIAN ENERGY DEMAND (DEPENDING ALSO ON THE EFFICIENCY OF CONVERSION PROCESS)

SOCIAL AND ECOLOGICAL IMPACTS

- **SOCIAL IMPACTS:**
  - CREATION OF JOBS
  - RETENTION OF RURAL POPULATION

- **ECOLOGICAL IMPACTS:**
  - REDUCTION OF POLLUTANTS AND HARMFUL EMISSIONS
  - INCREASED SOIL PROTECTION
  - IMPROVEMENT IN MICROCLIMATIC CONDITIONS