

Stakeholder Workshop

26 August 2009

Economic implications of climate change

Franz Prettenhaler & the WP4 Team
Plamen Mishev, Maria Vincze, Dan Balteanu

Budapest, Hungary

JR, UNWE, UBB, IG

OUTLINE

- Agriculture
- Energy
- Tourism
- Public Sector

Agriculture Results

- Bulgaria: the potential impact of climate factors on yields for the period 2005 – 2050 for all three climate scenarios (A1B-REMO, A1B-LMDZ and B1-LMDZ)
 - to some extent positive or neutral for wheat and sunflower
 - strongly positive for barley and
 - slightly negative or neutral for maize.

5

Future development... Simulating the impact of climatic factors on yields

- Projected yields (tons per hectare) in 2025

	Wheat	Barley	Maize	Sunflower
Baseline	4.833	4.208	4.671	1.939
Scenario A1B REMO	4.950	4.467	4.310	2.054
Scenario A1B LMDZ	5.216	4.867	5.026	2.029
Scenario B1 LMDZ	4.910	4.529	4.860	2.026

Economic meaning of the changes on agriculture

- Economic impact of climate changes (million leva) in NER ncrease ~ 190 – 340 Mio €)

	Baseline	Scenario A1B REMO	Scenario A1B LMDZ	Scenario B1 LMDZ
Value of crops analysed	812,0	905,4	1000,1	966,1
Total crop output	1288,9	1437,1	1587,5	1533,5
Gross agricultural output	2614,4	2915	3219,9	3110,7

Economic meaning of the changes on agriculture

- Results:
 1. The variation of GAO due to the climate changes is positive.
 2. The estimated impact is between 11% and 23%,
 3. But due to the inequity in variations of some of the climate variables the positive impact could be overestimated.

Agriculture Results

- Romania:
- REMO 5.7 : decreasing yields are projected to appear in the case of
 - wheat, maize, barley, potatoes, Lucerne.
- LMDZ B1 indicate mainly positive impacts:
 - increases concerning
 - wheat, maize and potatoes yields are projected –
 - slight increase for barley yields and
 - decrease of Lucerne.
- LMDZ A1B indicate minor impacts (slightly negative):
 - strong increases regarding wheat yields
 - decreases will appear in the case of maize, barley, potatoes, Lucerne, clover yields.

9

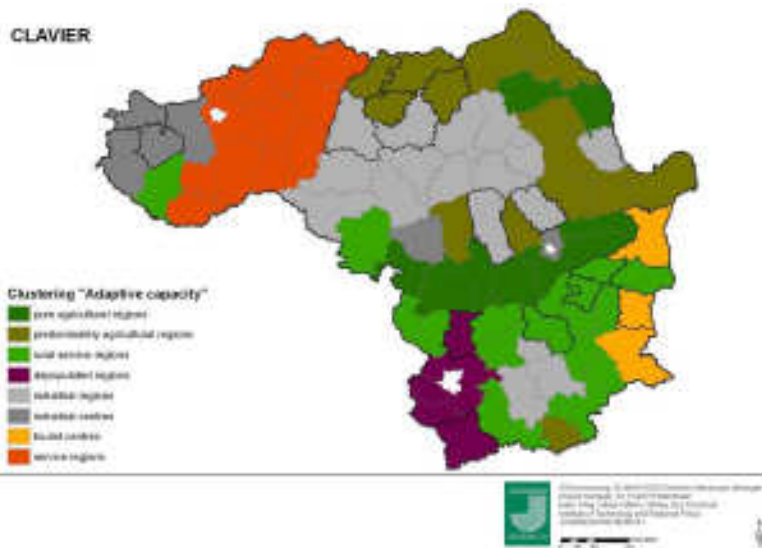
What is important for adaptation:

- Agriculture is an extremely local specific activity (local education!).
- Introduction of a drought resistance crop variety and moisture saving technologies.
- Improvement in data collection and provision on the regional scale
- Improvement of the agricultural insurance system.

10

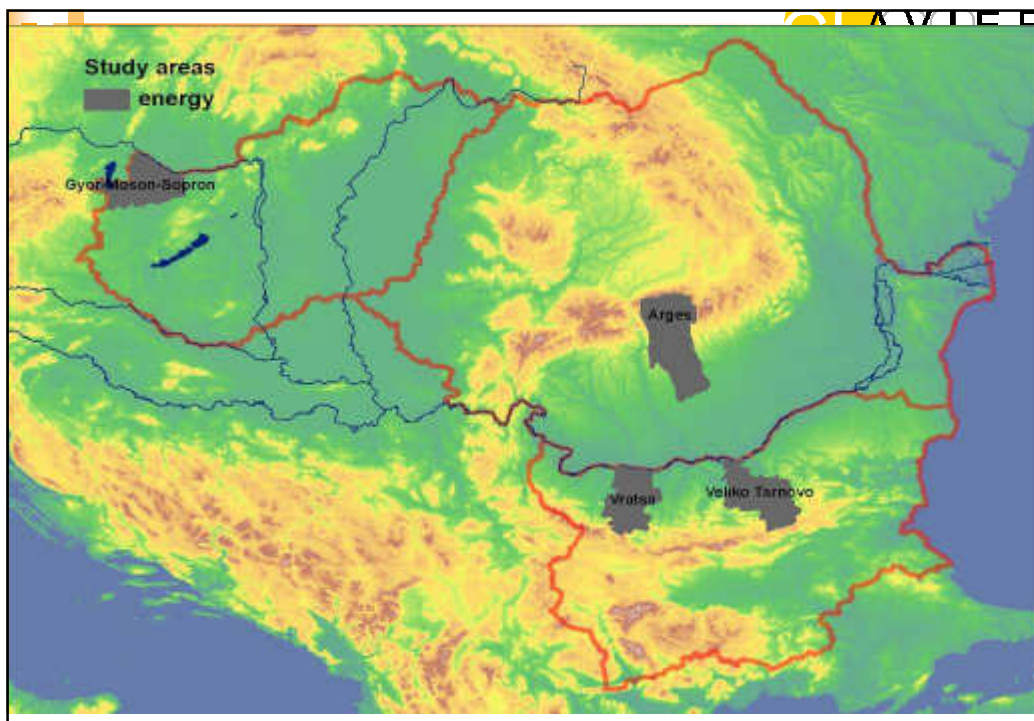
Adaptive Capacity matters!

CLAVIER



OUTLINE

- Agriculture
- Energy
 - Wind Energy (HU)
 - Hydropower (ROM)
 - Nuclear Power (BUL)
- Tourism
- Public Sector

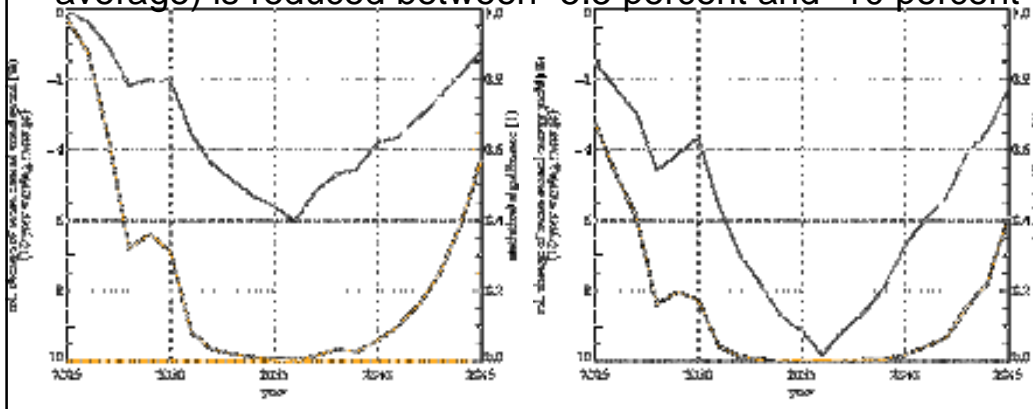


CLAVIER

- **Wind energy in Hungary (Győr-Moson-Sopron)**
 - In 2007 the largest Hungarian wind farm became operational.
 - Through the geographic position of the region – the extension of the Burgenland wind channel guarantees average wind speeds of 30-40 km/h - unique conditions for wind farming

□ 12 wind turbine masts were erected in the community of Level generating 2 MW each

- In period 2021-2030 the mean annual energy yield is expected to be insignificantly reduced by -1.5 percent.
- Significant changes occur later in the future: between 2031 and 2041 the mean annual energy yield (10 year moving average) is reduced between -5.5 percent and -10 percent



Main results for Bulgaria: under the three climate models A1B REMO, A1B LMDZ and B1 LMDZ **no drastic changes** in climate parameters can be expected until the mid of 21st century. Definitely, there will no extreme values of the maximum and minimum daily temperatures, the heat wave duration index, the maximum precipitation and the precipitation intensity index.

Therefore, these parameters will remain within the limits of the design characteristics of the KNPP. They are not expected to influence the safety of the plant.



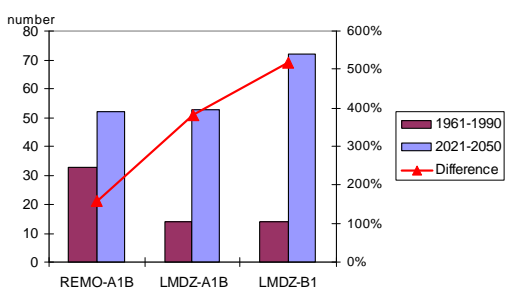
Efficiency of cooling process

Average number of days per year with T > 30 °C

Scenario	REMO-A1B	LMDZ-A1B	LMDZ-B1
1961-1990	33	14	14
2021-2050	52	53	72
Difference	+ 159%	+ 381%	+ 519%

Average number of days per month with T > 30 °C in the future 2021-2050

Month	REMO-A1B	LMDZ-A1B	LMDZ-B1
1	0,0	0,0	0,0
2	0,0	0,0	0,0
3	0,0	0,0	0,1
4	0,3	0,8	0,8
5	2,7	2,5	3,7
6	11,1	10,0	15,1
7	17,7	15,8	21,9
8	14,7	18,4	21,5
9	4,9	5,4	8,8
10	0,3	0,2	0,6
11	0,0	0,0	0,0
12	0,0	0,0	0,0



Economic meaning of changes

Expected yearly losses at KNPP caused by climate change in 2021-2050

Scenario	Average number of days per year with T > 30 °C in summer months (days)	Decreased electricity production (GW.h)	Economic losses (thousand BGN)
REMO-A1B	43	100.4	10 568.26
Share of total production in 2007		0.7%	
LMDZ-B1	59	137.7	14 500.64
Share of total production in 2007		1%	



Results Romania

- Vidraru Reservoir (Argeş River Basin)
- low impacted, but signals of decreasing amount of available water resource,
 - reducing run-offs in mountain tributary basins,
 - lower frequency of heavy rainfalls
 - higher frequency of dry days were noticed over the simulated period (even if they were not showed statistically significant all the time.

Results Romania

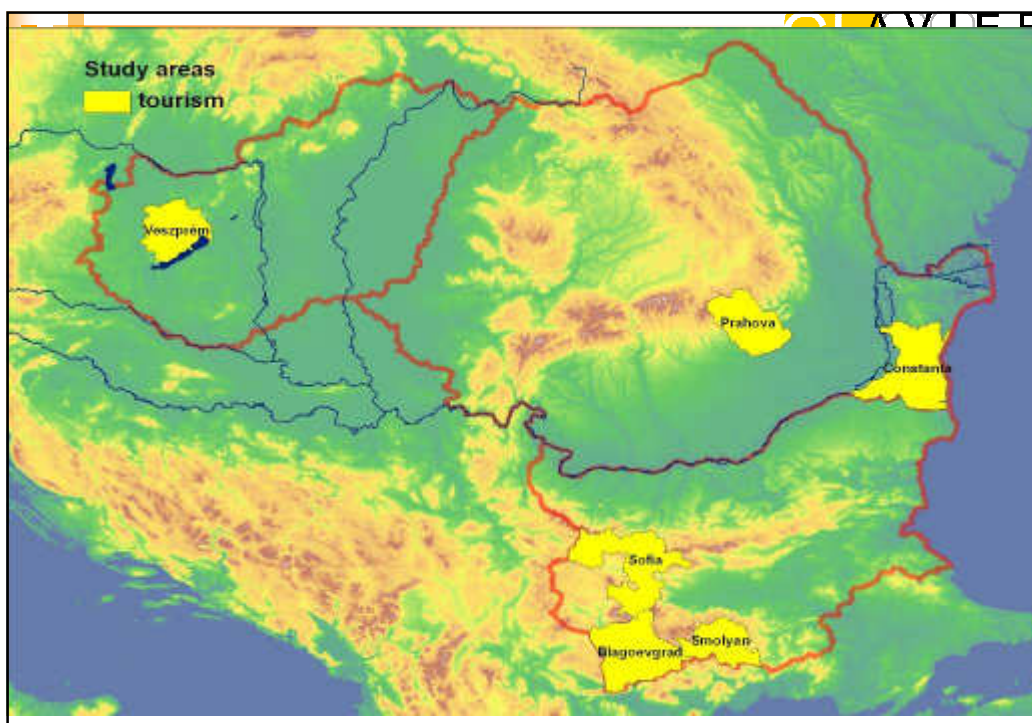
- rather low economic implications in terms of future estimated hydropower production (e.g. < 5% decade of annual energy output of Corbeni Hydropower Plant)
- Corbeni Hydropower Plant counts up to 33% in the overall electricity output of Curtea de Arges Subsudarity and up to 3% in the overall output of Hydroelectric Company.

What is important for adaptation:

- Wind: Overcome grid problems first: The harvesting of national potentials is limited by severe safety problems in the power supply grid, the capacity of each installation is limited to 330 MW per installation
- Nuclear: Better planning of the regular annual maintenance when unit is shut down – choosing the hottest periods of the year – choosing the hottest periods of the year.

OUTLINE

- Agriculture
- Energy
- Tourism
 - Summer in HU (Balaton)
 - Winter in BUL (Borovets)
 - Summer and Winter in ROM (Constanta, Prahova Valley)
- Public Sector

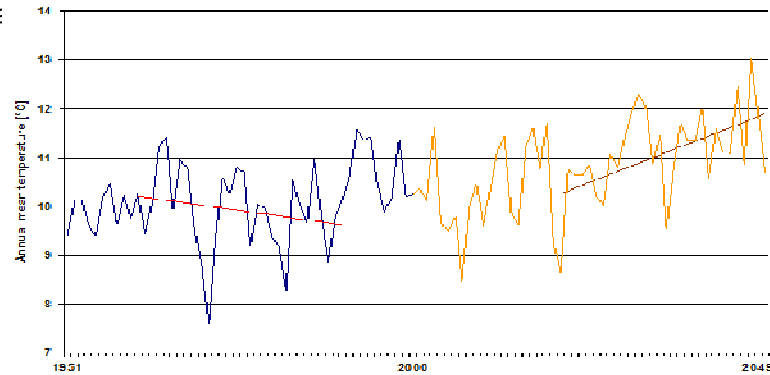


THE CASE STUDY REGION

- **GDP per capita:** 6,581.2 Euro (Veszprém, 2005 – rank 10/90)
- **unemployment rate:** 5.3% (Veszprém, 2005)
- the second most important **tourist attraction** in Hungary, after Budapest
- Tourism accounts for 4% of employment in HU (only direct)
- **peak season** for tourism: eight weeks during the summer vacation period for schools in the sending countries (55% of all visitors)
- **Gross revenue from accommodation fee** at Lake Balaton Priority Resort: 21,417 million HUF [=15% of all HU; 13,537 million HUF (+6.5%) domestic; 7,880 million HUF (-2.2%) international tourists (2008)]
- international guests: Germany (24%) / Austria (7%) / Great Britain and America (each app. 6%)
- 16% out of 27,064 **employed in public accommodation establishments** in Hungary (31st December 2008)
- 23% out of 19,822,000 **tourism nights** in Hungary (2008)

EXPECTED CHANGE OF THE RELEVANT PARAMETERS

- Tendency towards increasing **air temperature** during each season until 2050 (A1B scenario)



Annual mean temperature on the catchment of Lake Balaton between 1951 and 2050 REMO 5.7 - A1B [source: VITUKI]

- **precipitation** in the catchment of Lake Balaton (A1B scenario): slight decline; varying according to season: slightly increasing in spring; declining trend lines in autumn, summer and winter

25

THE ECONOMIC MEANING OF CLIMATE CHANGES

- **THI = $T - (0.55 - 0.0055RH)(T - 14.5)$ °C**
- **Balaton:** increasing number of uncomfortable days and extension to May and September; days where most of the population feels discomfort will appear and increase slightly
- **Budapest:** increasing number of uncomfortable days; uncomfortable days occurred and are expected to occur more often in Budapest than at Lake Balaton
- -> **expected positive effects for the region (Budapest, shoulder season)**

26

THE ECONOMIC MEANING OF CLIMATE CHANGES

- Forecasted arrivals vary slightly based on different temperature scenarios

	Balaton		Veszprém	
	2016-2025	2041-2050	2016-2025	2041-2050
Forecasted arrivals				
Monthly mean (July, August)	197.2	193.9	86.3	84.4
Monthly median (July, August)	199.7	192.5	85.7	83.3
Sum	3,944.7	3,878.5	1,725.4	1,688.5
Total marginal impact of discomfort	29.8	23.2	20.4	15.9
Average marginal impact of discomfort (July, August)	1.5	1.2	1.0	0.8
Total marginal impact of air temperature	-21.4	-54.8	-69.7	-81.7
Average marginal impact of air temperature (July, August)	-1.1	-2.7	-3.5	-4.1
Sum of the marginal effects	8.4	-31.6	-49.3	-65.8
Tourist expenditures				
Sum of the marginal effects	2,772	-10,428	-16,269	-21,714
Total monthly marginal impact of air temperature and discomfort (July, August)	138.6	-521.4	-813.5	-1,085.7

Forecasted arrivals (results in 1,000) and change in tourist expenditures (results in 1,000 €) on the basis of regressions considering future air temperature and THI in Budapest (in terms of D31-Dn) scenario derived from the REMO 5.7 simulations for the A1B scenario)

- Almost negligible results: other driving factors need to be considered more intensive

27

What is important for adaptation:

Balaton

- overcome the effects of **increasing number of uncomfortable days** the installation of infrastructure like pools and air conditioning is necessary.
- enhance the attractiveness of **shoulder seasons** weather independent attractions and infrastructure are needed: Therefore the fortification of qualitative offerings concerning wellness, culinary, wine, congresses etc.
- attract weekend-guests from **Budapest** (also at shoulder seasons) special offers, cultural events etc. are necessary.
- turn the decreasing trend of **international tourists** the marketing needs to communicate the Lake Balaton as a qualitative tourist centre possessing a specific regional image concerning culinary, friendliness, wellness as well as the explanation of the relative advantages the region possesses compared to the Adriatic and the Baltic Sea.

28

OUTLINE

- Agriculture
 - Energy
 - Tourism
 - Public Sector
- Insurance to natural catastrophes in HU, ROM, BUL

Comparison of the risk transfer schemes

	BULGARIA	HUNGARY		ROMANIA
Insurance Carrier	Private Insurance Companies	Public Sector (WM-Flood Fund)	Private Insurance Companies	Romanian Catastrophe Insurance Pool
Monopoly	No	No	No	Yes (for mandatory basic coverage)
Mandatory insurance	No	No	No	Yes
Obligation to contract	No	Yes (for floodplains)	No	Yes (for mandatory basic coverage)
Bundle of natural hazards	Depends on insurance company and type of NH	No	N/A	Yes
Role of the state	Ad hoc relief	Provision of insurance coverage in floodplains		State guarantee
Premium design	EQ: risk-related FL: uniform plus risk loading Other NHs: flat	Risk-related	N/A	Flat; subsidies for poor households
Coverage against catastrophic losses	Reinsurance, Limits of Liability	State guarantee	Reinsurance	Catastrophe Insurance Pool, state guarantee
Further issues	Low insurance penetration		Flood coverage extremely limited	

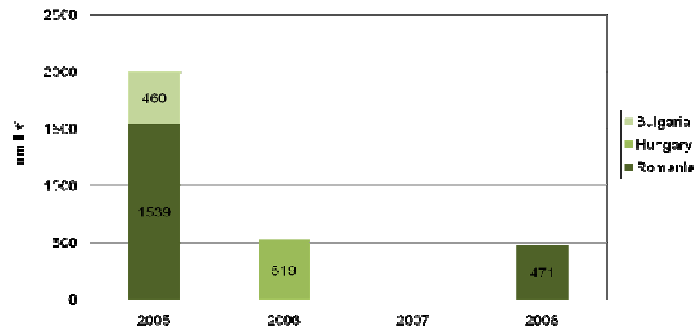
EU Solidarity Fund (2)

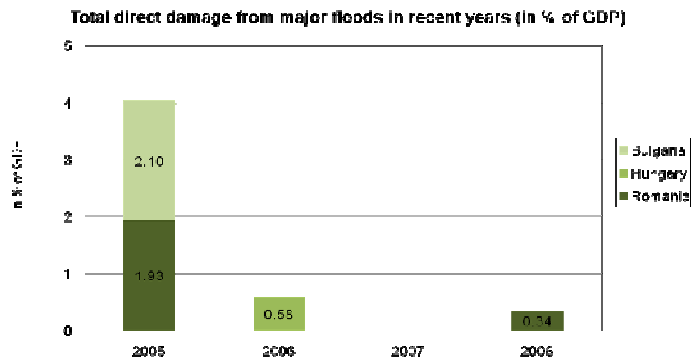
Country ranking according to the sum of aid received from the EU Solidarity Fund per capita and as a portion of GDP

Rank	Country	Sum of aid received per capita (€)	Rank	Country	Sum of aid received as a portion of GDP (%)
1	Sweden	17.86	1	Czech Republic	0.887
2	South Korea	12.62	2	Romania	0.885
3	Cyprus	8.61	3	Bulgaria	0.886
4	Sweden	7.89	4	Japan	0.874
5	Greece	6.89	5	Cyprus	0.867
6	Denmark	7.52	6	Lithuania	0.871
7	Malta	4.87	7	Denmark	0.877
8	Poland	4.27	8	Malta	0.833
9	Latvia	4.14	9	Thailand	0.822
10	Sweden	4.07	10	France	0.827
11	Romania	3.96	11	Denmark	0.827
12	Hungary	3.88	12	Romania	0.822
13	Switzerland	3.87	13	Hungary	0.825
14	Italy	3.89	14	Switzerland	0.849
15	Hungary	3.69	15	Slovakia	0.872
16	Sweden	3.87	16	Denmark	0.879
17	Sweden	4.95	17	Italy	0.881
18	Denmark	0.88	18	Denmark	0.898
19	Spain	0.64	19	Spain	0.884
20	Lithuania	0.71	20	Lithuania	0.872

Source: European Union Solidarity Fund Annual Reports, EUROSTAT

Total direct damage from major floods in recent years (in mill. €)





What is important for adaptation:

Bulgaria:

- Establishment of a (well coordinated) risk partnership between insurers, state and citizens
- Generation of a bigger risk collective (e.g. through the introduction of mandatory elements)
- Establishment of explicit rules for the handling of objects with very high damage frequency
- Improvement of the planning security regarding the financial involvement of the public sector

Hungary:

- Establishment of a (well coordinated) risk partnership between insurers, state and citizens
- Creation of socially acceptable premiums for 100% coverage (the premium rates of the state offered flood insurance are increasing with decreasing values of the buildings and seem rather expensive for small dwellings)

Romania:

- Better incentives for individual risk prevention (e.g. through the introduction of risk-based premiums and deductibles)



Thank you for your attention!