IENE Conference, 21-22 May 2008

2nd South East Europe Energy Dialogue

Toward Greek RESourceFULLness by 2020

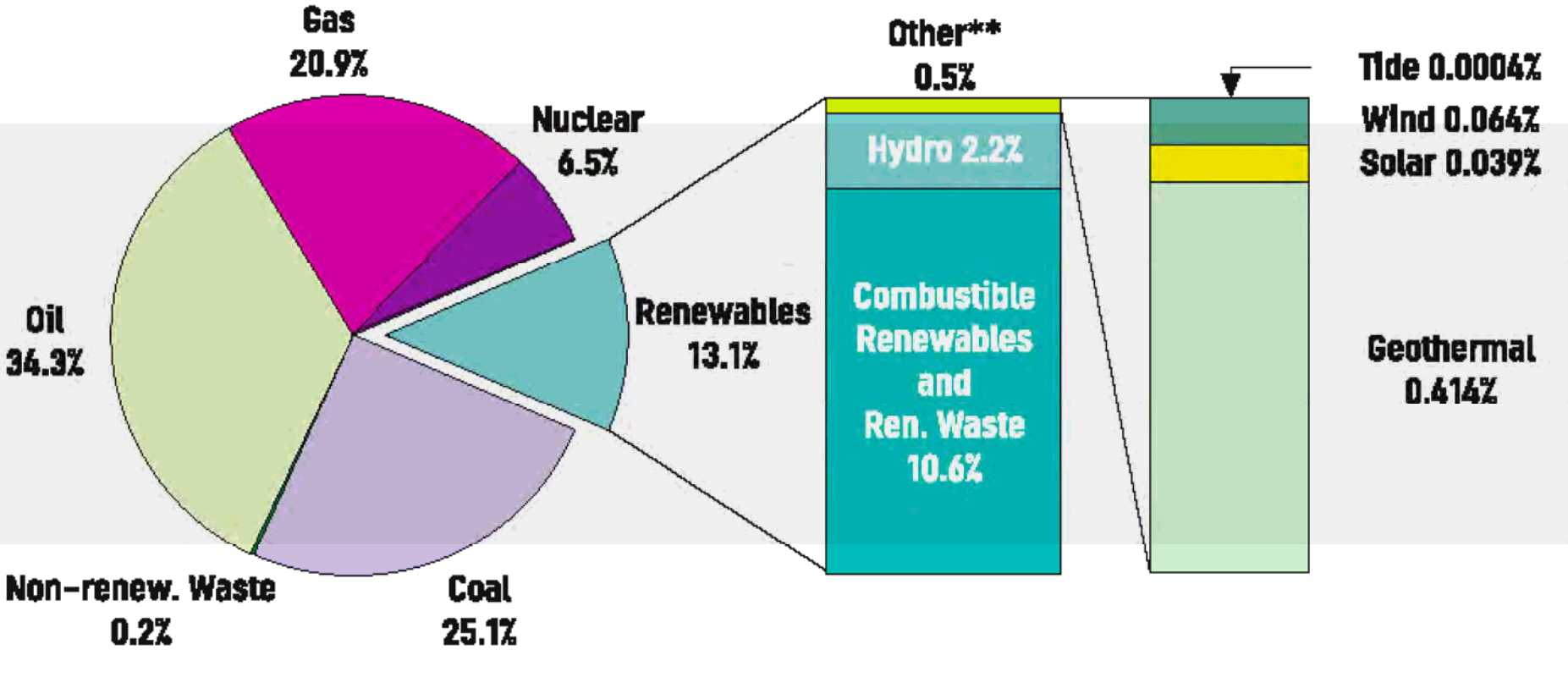
Dimitri Lalas

ELETAEN

EU World Energy Outlook (WETO) Reference Scenario 2006 (POLES)

WORLD	1990	2001	2010	2030	2050	Annual % change 1990/10	2010/30	2030/50
Key Indicators								
Gross Inland Cons/GDP (toe/M$95)	290	236	205	157	134	-1,7%	-1,3%	-0,8%
Gross Inland Cons/capita (toe/cap)	1,6	1,6	1,8	2,1	2,5	0,4%	0,7%	0,9%
Electricity Cons/capita (kWh/cap)	1 832	2 077	2 554	3 688	5 529	1,7%	1,9%	2,0%
Transport fuels per capita (toe/cap)	0,3	0,3	0,3	0,3	0,3	0,0%	0,4%	0,5%
CO_2 emissions/capita (tCO_2/cap)	3,8	3,9	4,3	4,8	5,0	0,5%	0,6%	0,2%
% of renewables in Gross Inland Cons	13,4	13,5	12,8	12,0	15,3	-0,2%	-0,3%	1,2%
% of renewables in electricity	20,1	18,7	18,2	20,6	25,0	-0,5%	0,6%	1,0%
Primary Production (Mtoe)	8 834	9 836	12 346	16 853	22 276	1,7%	1,6%	1,4%
Coal, lignite	2 207	2 408	2 937	3 976	5 678	1,4%	1,5%	1,8%
Oil	3 234	3 487	3 951	5 385	5 984	1,0%	1,6%	0,5%
Natural gas	1 708	1 929	3 164	4 075	4 084	3,1%	1,3%	0,0%
Nuclear	525	671	739	1 425	3 185	1,7%	3,3%	4,1%
Hydro, geothermal	216	232	275	357	417	1,2%	1,3%	0,8%
Biomass and wastes	939	1 101	1 261	1 462	2 261	1,5%	0,7%	2,2%
Wind, solar	0	7	21	174	686	21,9%	11,2%	7,1%
CO_2 Emissions ($MtCO_2$)	20 161	23 566	29 055	38 749	44 297	1,8%	1,4%	0,7%
of which:								
Electricity generation	7 433	8 932	10 562	13 747	16 065	1,8%	1,3%	0,8%
Industry	4 653	4 812	6 045	7 656	7 971	1,3%	1,2%	0,2%
Transport	3 982	5 056	5 461	6 815	7 263	1,6%	1,1%	0,3%
Household, Service, Agriculture	3 191	3 198	4 128	6 488	7 891	1,3%	2,3%	1,0%
CO_2 Sequestration ($Mt\ CO_2$)	0	0	0	271	2 545	na	na	11,9%

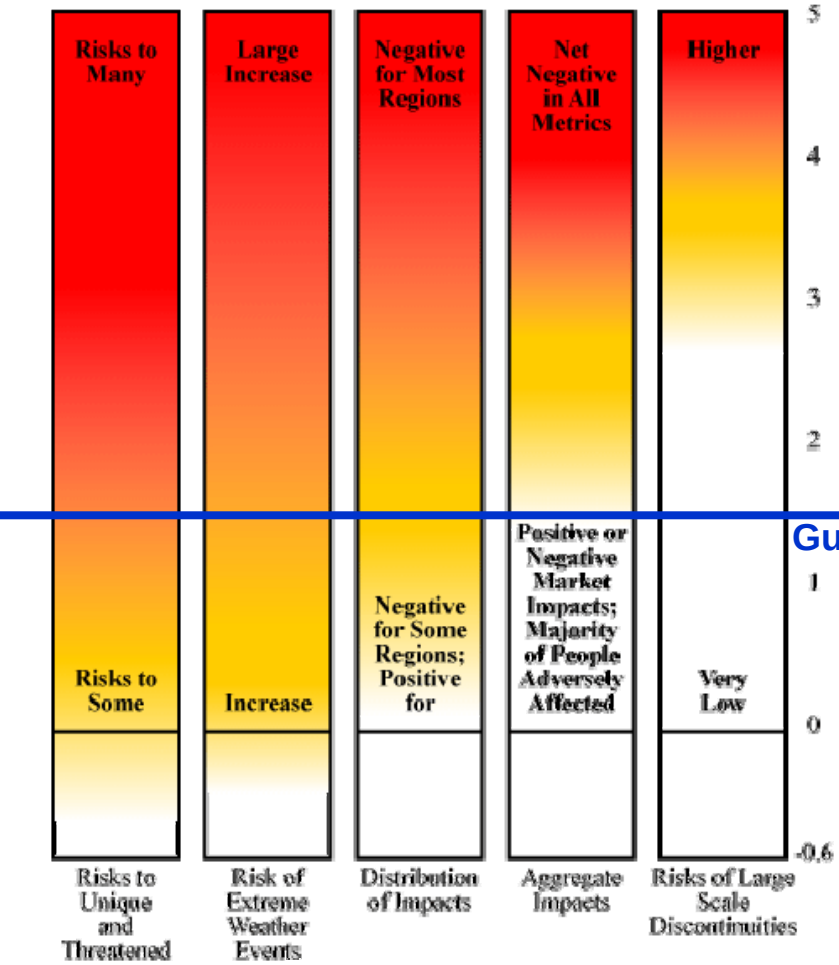
Energy Production Distribution at Global level (2004) IEA



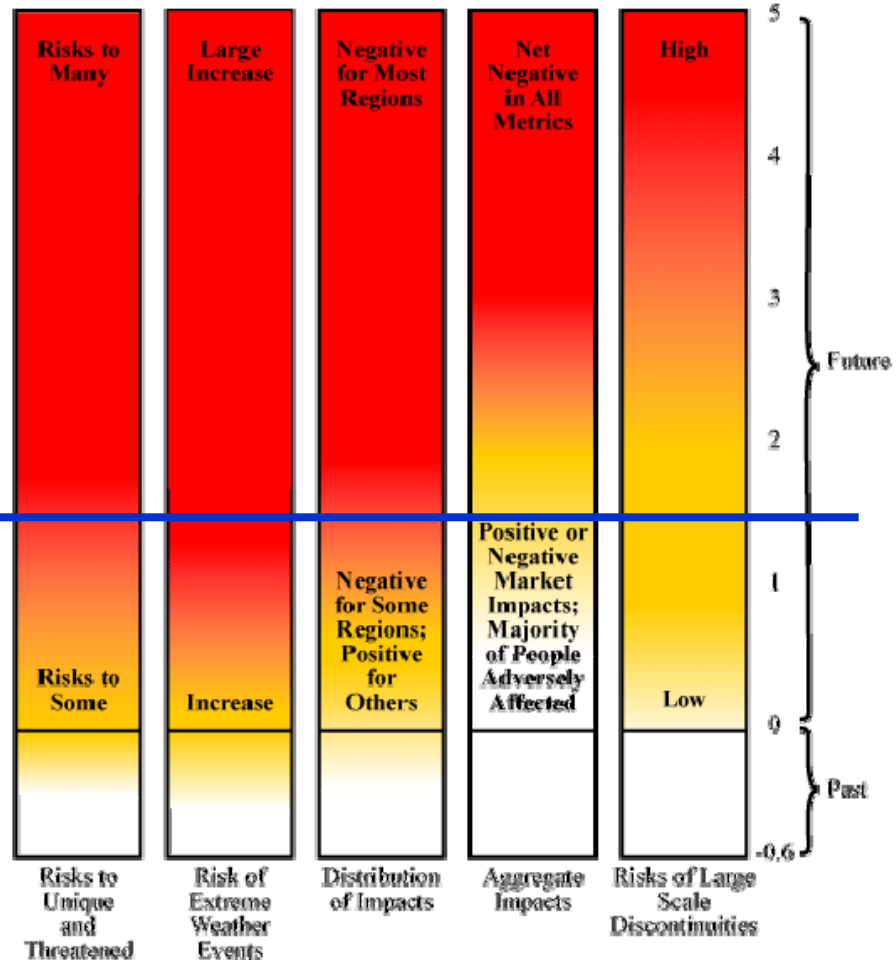
EU WETO-2050 Reference Scenario (POLES 2006): Electricity

WORLD	2001	2010	2030	2050	Annual % change 2001/10	2010/30	2030/50
Electricity Production (TWh)	15468	21113	36295	60040	3,5%	2,7%	2,5%
Thermal, of which :	10074	14669	23809	31584	4,3%	2,5%	1,4%
Coal, lignite	5848	7600	12689	19066	3,0%	2,6%	2,1%
of which advanced coal	0	2022	9122	15964	192,7%	7,8%	2,8%
Gas	2934	5823	8760	9072	7,9%	2,1%	0,2%
of which combined cycle	944	2885	5233	4300	13,2%	3,0%	-1,0%
of which cogeneration (industry)	250	356	865	1954	4,0%	4,5%	4,2%
Oil	1136	804	988	1200	-3,8%	1,0%	1,0%
Biomass	155	442	1372	2246	12,3%	5,8%	2,5%
Nuclear	2653	3049	6328	14866	1,6%	3,7%	4,4%
of which new design	0	0	0	3401	na	na	na
Hydro (large)	2613	3088	3943	4588	1,9%	1,2%	0,8%
Hydro (small)	90	110	205	265	2,3%	3,1%	1,3%
Wind	37	188	1880	6433	19,9%	12,2%	6,3%
Solar	1	7	91	1493	19,7%	13,9%	15,0%
Hydrogen	0	2	39	811	na	15,3%	16,4%

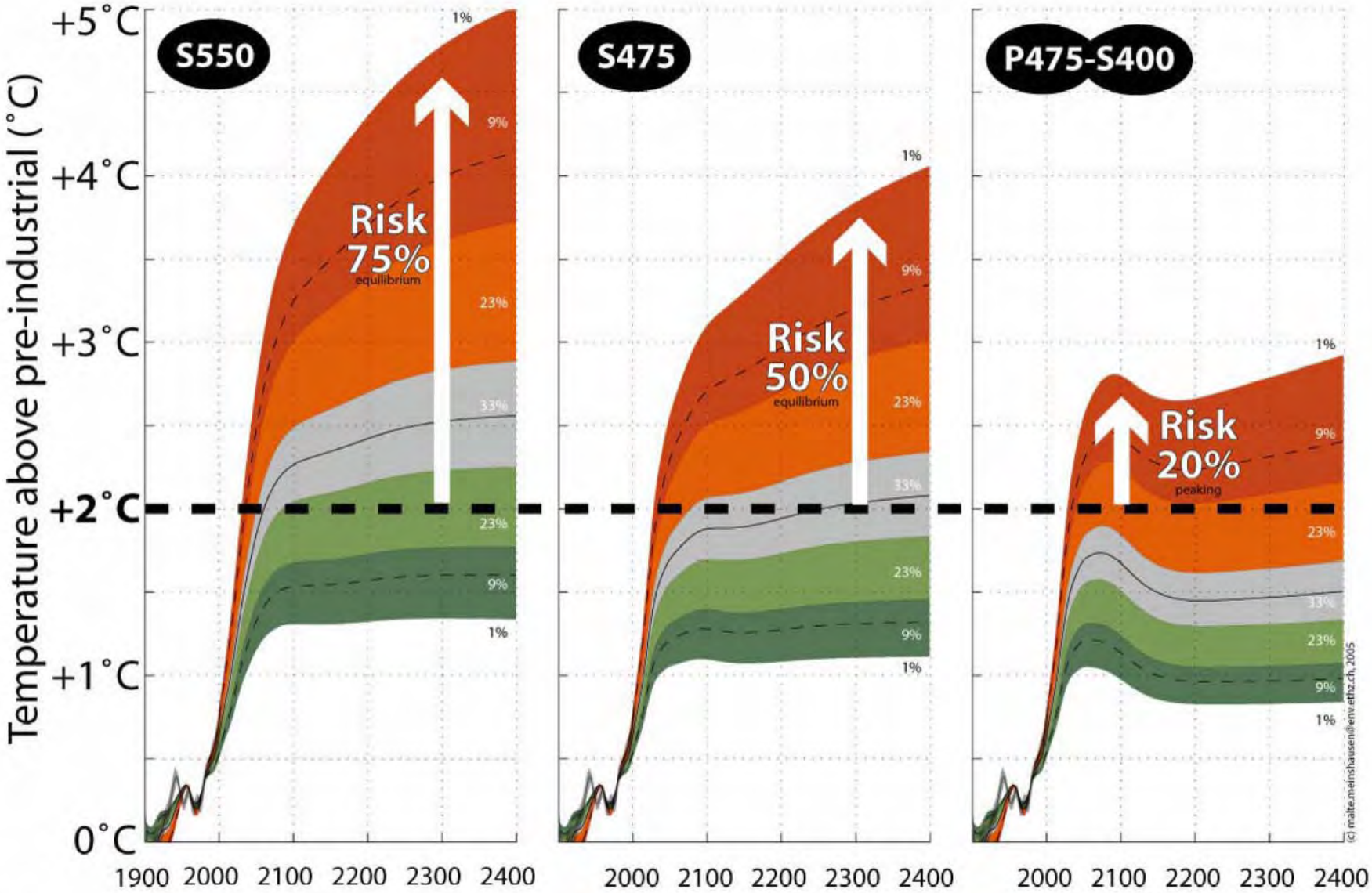
TAR Reasons For Concern



AR4 Reasons or Concern



Probabilities to exceed 2°C



Source: Malte Meinshausen, 2005

The 2007 Spring Summit Decisions (7-8 March 2007)

Unified Energy and Environment Planning, Policies and Measures

- Energy conservation: **20%** by 2020
- Internal market unbundling & Energy Regulatory Authorities upgrades
  - ✓ important for proper functioning of EU ETS
  - ✓ obstacle reduction for RES penetration
- RES: **20%** of Final Energy Consumption by 2020
  - ✓ differentation of targets between MS on GNP and current mix
  - ✓ Flexibility through trading of certificates of Guaranteed Origin
- Biomass: **10%** contribution to transport fuel by 2020 for all MSs
- Nuclear: up to each MS
- Development of sustainable energy use from fossil fuels with near zero emissions (mainly CCS)
- Development of a strategic plan for promotion of sustainable energy technology development
- Reduction by 2020 of GHG emissions by **20%** and up to **30%** if other states follow and take on similar obligation

World Energy Consumption (PJ/yr) - Scenario 2°C

	2003	2010	2020	2030	2040	2050
Total	435,120	428,060	421,580	414,800	420,920	422,430
Fossil	348,560	333,200	303,450	269,410	239,370	212,000
Hard coal	107,900	90,130	70,860	51,530	39,720	31,820
Natural gas	93,230	98,990	103,980	107,020	100,820	93,050
Crude oil	147,430	144,080	128,610	110,860	98,830	87,130
Nuclear	28,810	22,840	14,520	710	0	0
Renewables	57,750	72,020	103,610	144,680	181,550	210,430
Hydro	9570	11,260	13,160	14,520	15,850	16,950
Wind	230	1250	8380	16,180	21,120	25,730
Solar	160	1740	6920	17,910	30,230	42,280
Biomass	46,450	54,700	68,470	84,730	97,680	105,140
Geothermal	1340	3050	6570	11,110	16,270	19,790
Ocean Energy	0	20	110	230	400	540
Share renewables (%)	13	17	25	35	43	50
Savings compared to 'Reference'		59,260	141,740	224,870	296,210	386,780

(Krewitt et al., Energy Policy, 2007)

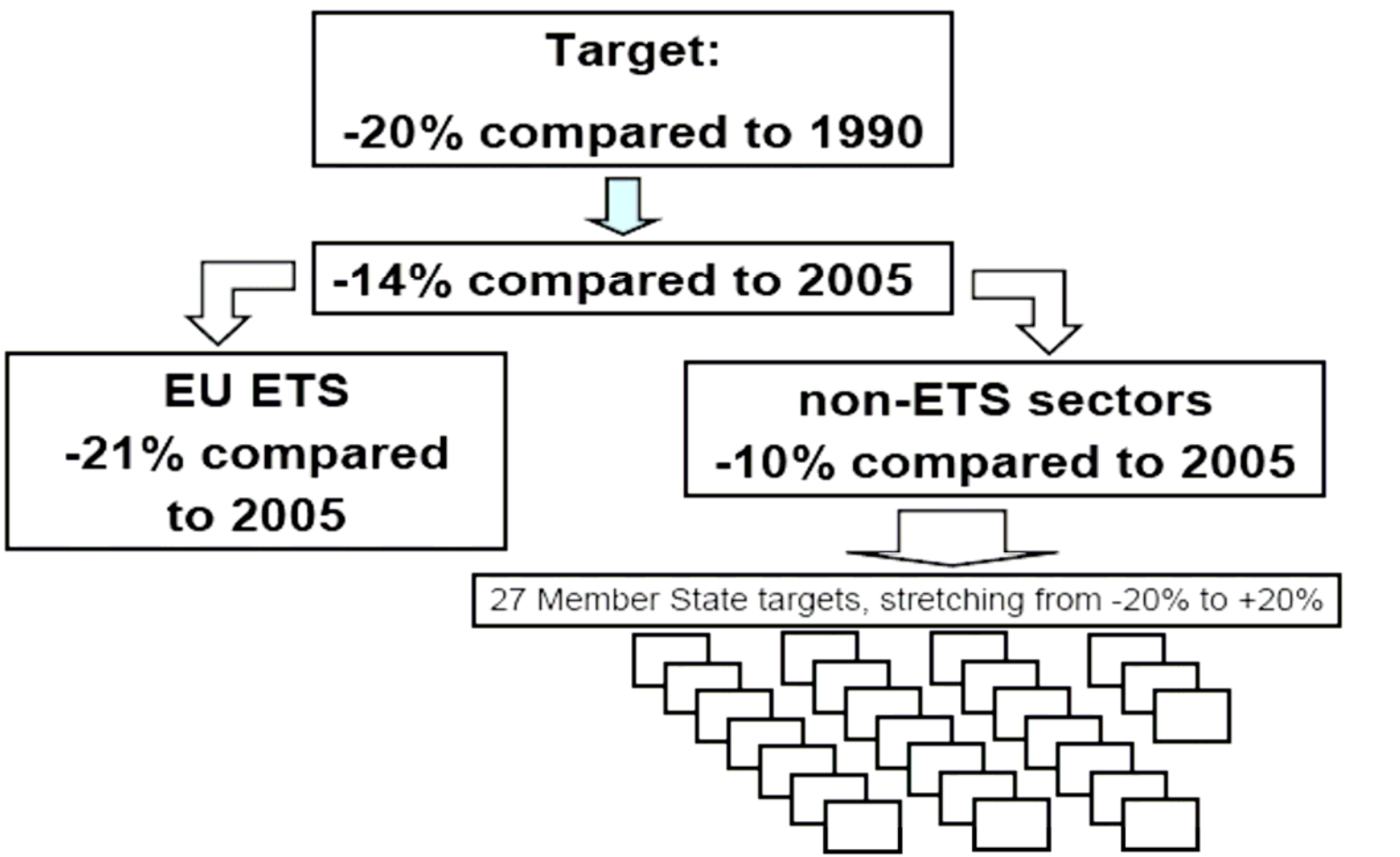
World Electricity Production (TWhr/yr)- Scenario 2°C

60040

	2003	2010	2020	2030	2040	2050
Total generation	16,662	17,314	20,250	23,290	27,020	30,940
Fossil	11,015	11,110	1,1220	10,630	10,000	94,90
Coal	5841	5560	4760	3500	2970	2690
Lignite	714	580	360	160	35	0
Natural gas	3295	4180	5670	6760	6920	6780
Oil	1165	790	430	210	70	20
Nuclear	2641	2090	1330	70	0	0
Renewables	3007	4114	7700	12530	17020	21450
Hydro	2659	3130	3660	4030	4400	4710
Wind	64	350	2330	4490	5870	7150
PV	0.6	30	270	1000	1840	2840
Biomass	228	480	1000	1700	2350	2940
Geothermal	54	110	210	360	560	730
Concentrating Solar power	0.5	9	200	950	1890	2930
Ocean energy	1	5	30	60	110	150
Share renewable electricity (%)	18	24	38	54	63	69
Share CHP electricity (%)	10	12	13	15	16	16

(Krewitt et al. 2007)

The 20-20-20 by 2020 EC Proposals (23-1-2008)
Emission Reductions



The 20-20-20 by 2020 EC Proposals (23 Jan 2008)

Three sectors for the utilization of RES:

- Electricity
- Heating and cooling
- Transport (petrol and diesel fuel)

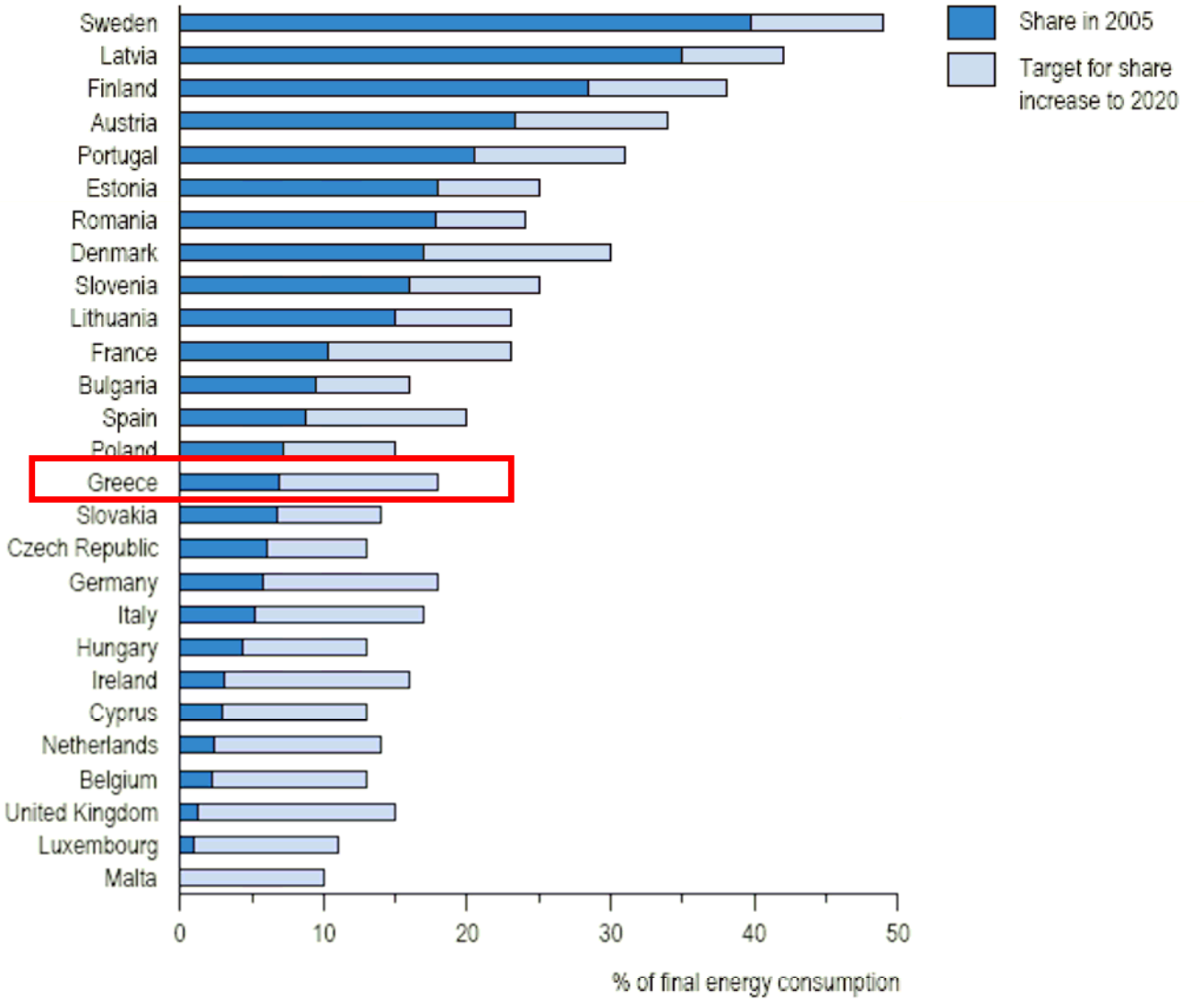
Tradable Guarantees of Origin (GO)

- MS will be able to buy GOs from other MS where RES is cheaper to produce.
- Imported electricity from RES outside the EU may count towards MS targets
- No limits proposed yet.

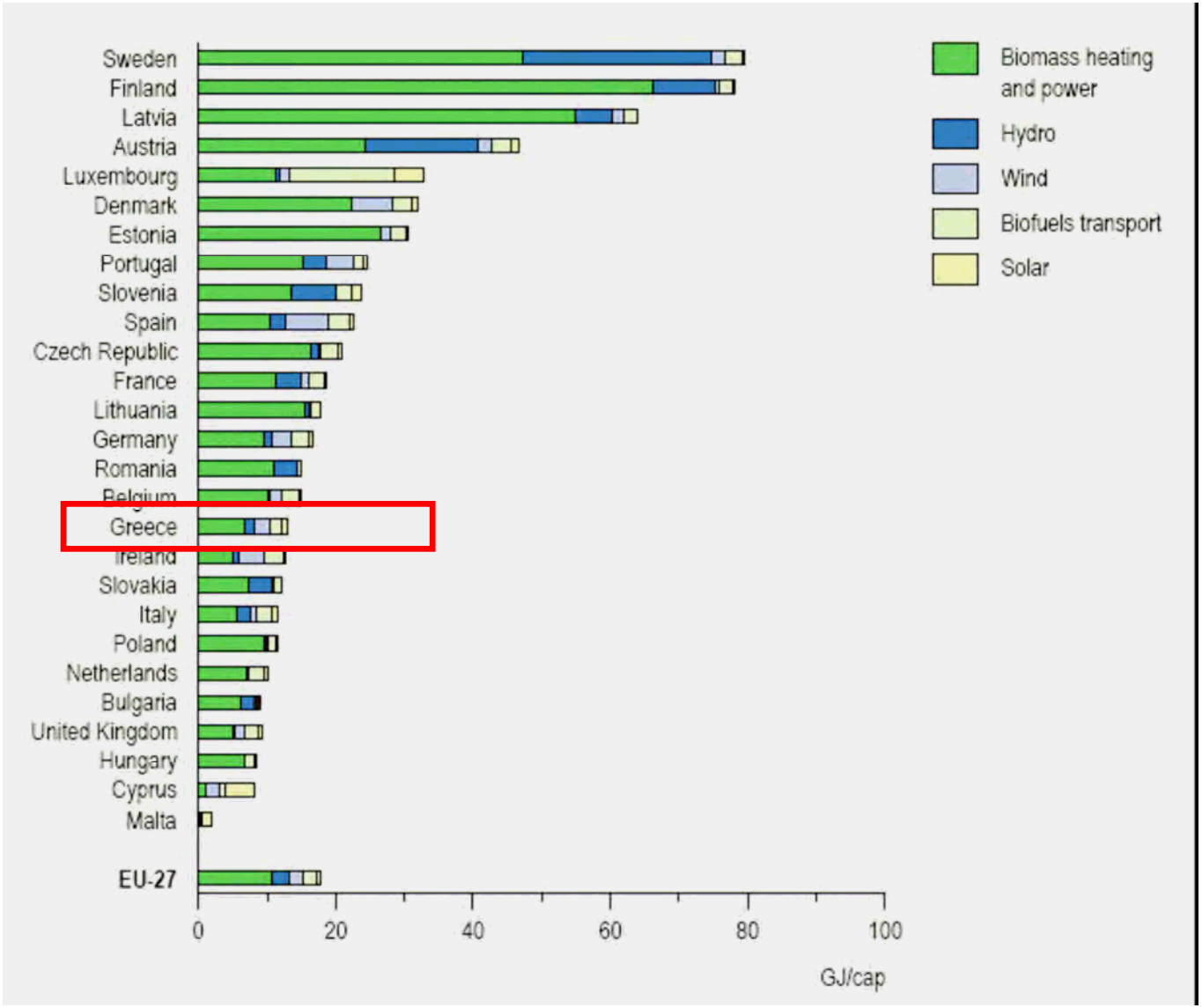
Sustainability Criteria (GHG savings & biodiversity) for biomass

- GHG savings of the biofuel mix of at least 35%
- Exclusion of biomass from forest undisturbed by significant human activity, from areas designated for nature protection or from highly biodiverse grasslands.
- Exclusion of raw material obtained from land with a high carbon stock (e.g. wetlands & continuously forested areas)

Share of RES and proposed targets in the EU MSs



Per cap use of RES in the EU MSs in 2020 in the BAU



The 20-20-20 by 2020 EC Proposals (23 Jan 2008)

For Greece

- Non-EU ETS Sectors, not to exceed **96%** of the 2005 GHG emissions levels (66.7Εκατ) by 2020
- EU ETS Sectors (2003/87/EC) reduction by 1.74% yearly of the mean yearly value of the 2009-12 emissions starting in 2013
- No free allowances to electricity generation installations
- RES: **18% final energy consumption** by 2020
- Obligatory 10% of transport fuel derived from biomass
- Energy conservation by 20% by 2020

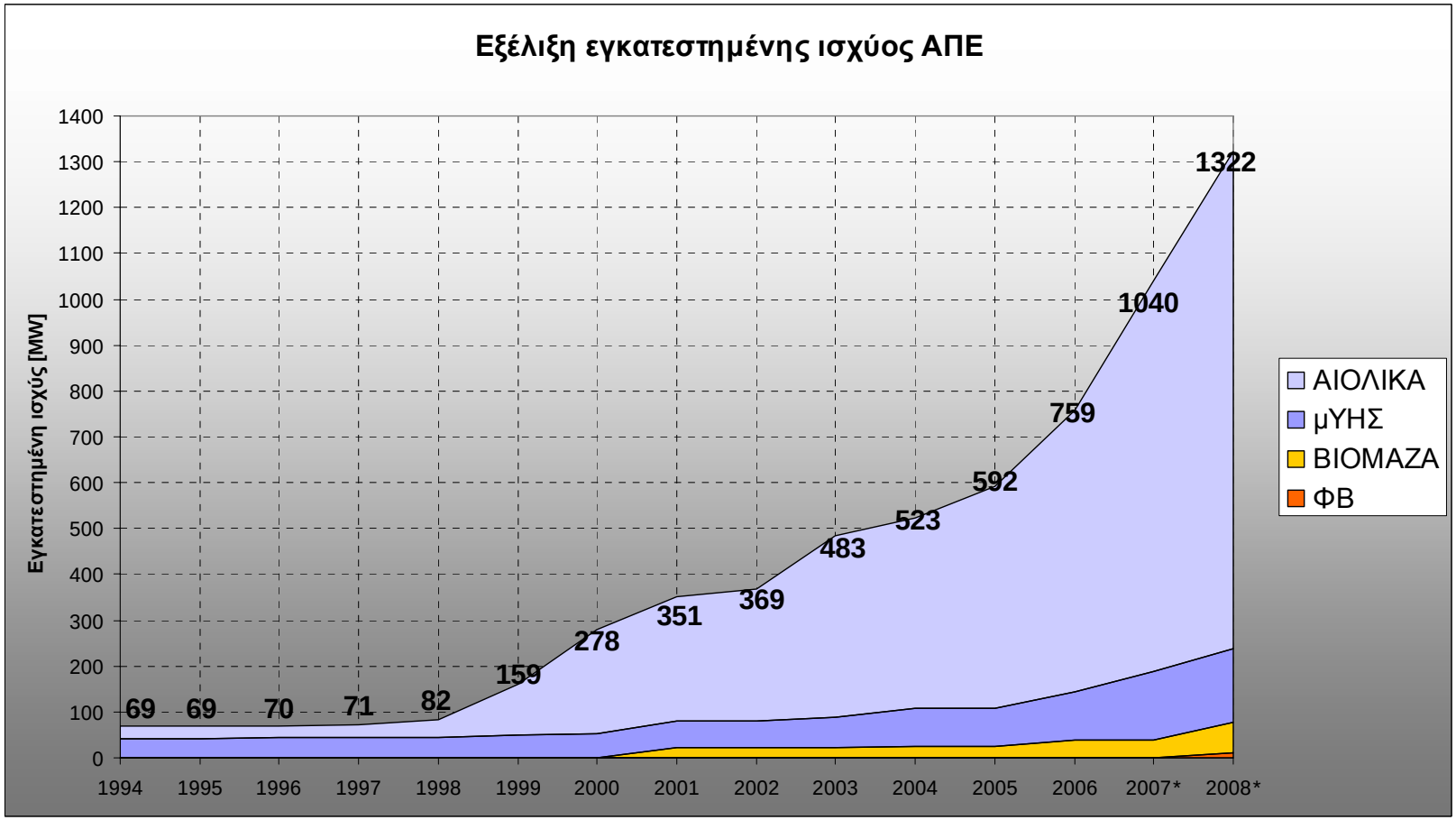
The 20-20-20 by 2020 EC Proposals (23 Jan 2008)

For Greece

Overall GHG emission ”target” : ca 122 Mt (64+58?)

- **+10%** wrt the Kyoto Protocol base year (111Mt)
- **-12%** wrt year 2005 (139Mt)
- **-30%** wrt BAU by 2020 (175Mt)
- **-16%** (and up to -24%) wrt the average yearly allocated emission allowances in the period 2008-12 to installations in the EU ETS (69Mt)

Present RES installed electricity generation capacity

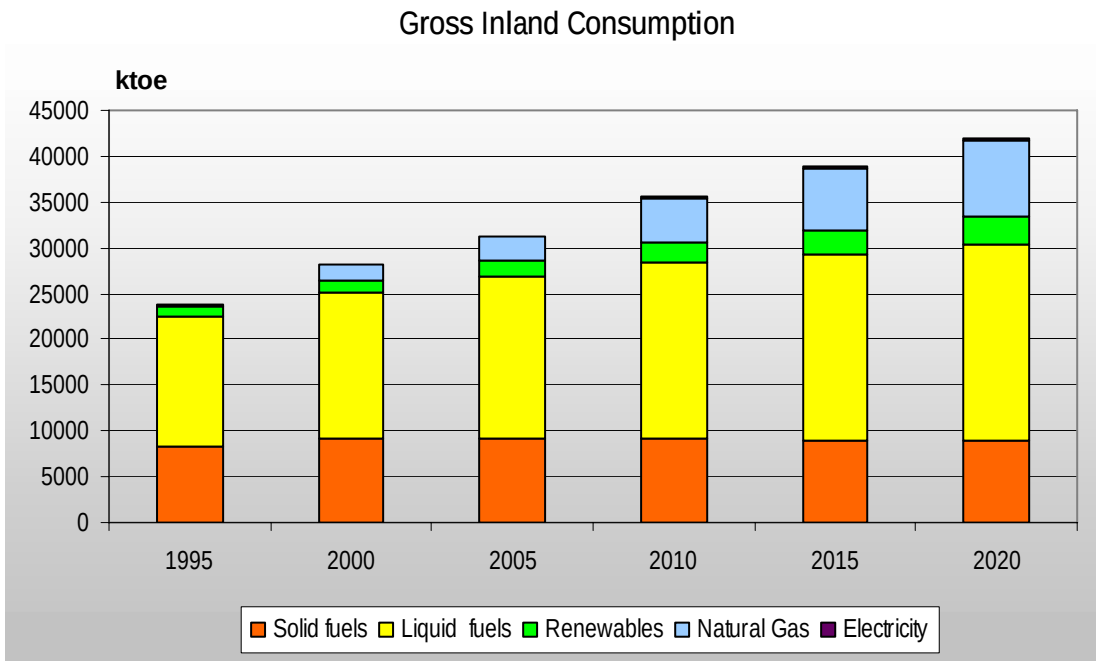


Needed to meet the 20.1% electricity target by 2010
Min. of Development 4th RES National Communication

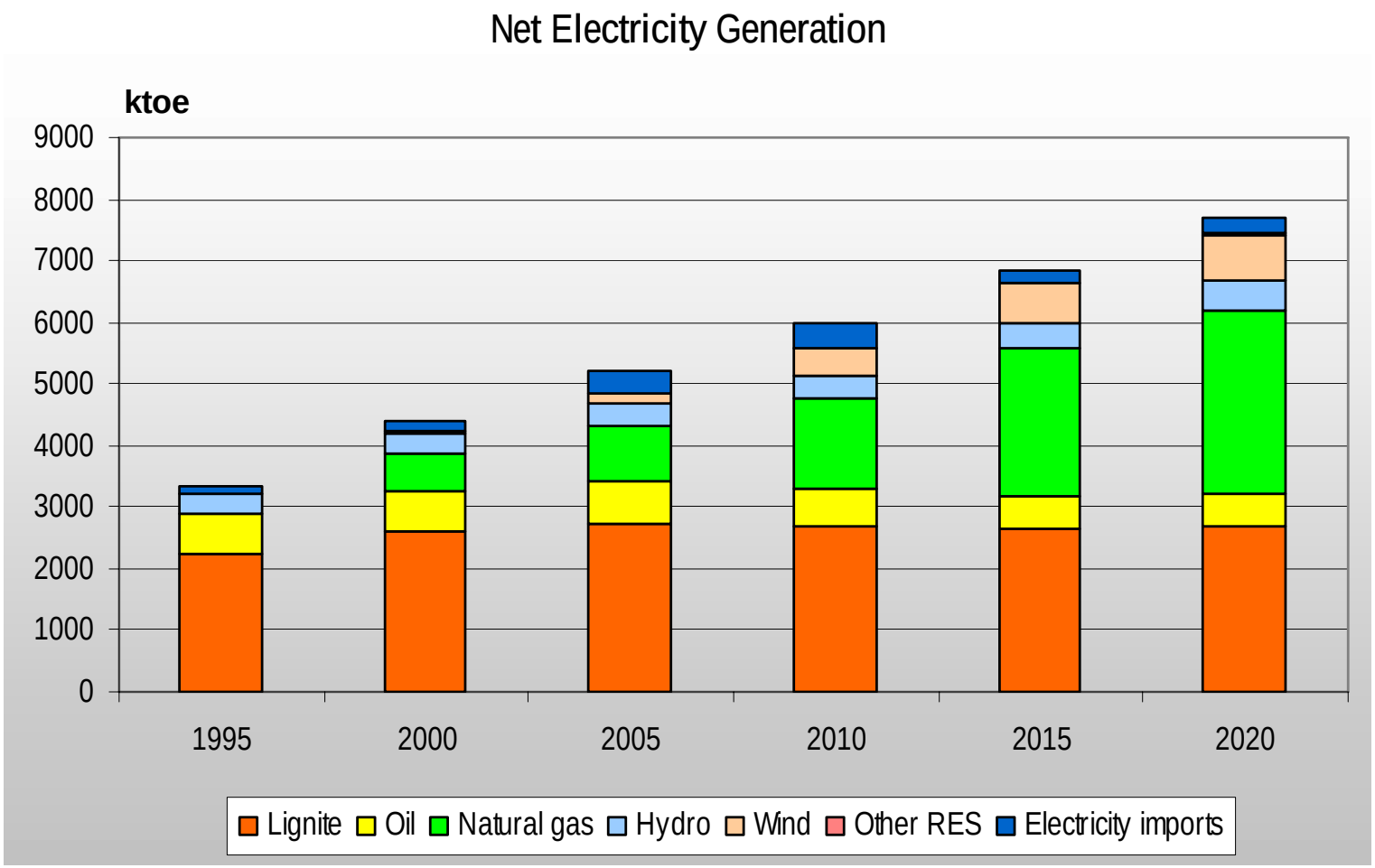
	Installed Capacity Needed by 2010 [MW]	*Electricity Production needed by 2010 [TWh]*	*% contribution by type by 2010*
Wind	3.648	7,67	10,67
Small Hydro	364	1,09	1,52
Large Hydro	3.325	4,58	6,37
Biomass	103	0,81	1,13
Geothermal	12	0,10	0,14
Photovoltaics	200	0,20	0,28
Total	**7.652**	**14,45**	**20,10**

Projections BAU Energy Sector – With Measures Scenario

- Gross Inland Consumption increases with an average annual rate around 2.0% for the period 2000-2020.
- Liquid fuels cover most of primary energy demand (57% in 2000, 54% in 2010).
- Small decreases for solid fuels consumption (about 1.9% from 2000 to 2020) and considerable penetration of natural gas.
- The energy intensity of the system is improving with an average annual rate of 1.4%. However, energy consumption per capita continues to increase.



Energy Sector Projections – BAU / Net Electricity Production



Energy Sector Projections - BAU

	2005 [2007]	2010	2015	2020
Gross Energy Consumption (ktoe)	31073	35989	39305	42420
Primary Energy Production -RES (ktoe)	1452	2189	2596	2967
Final Energy Consumption (ktoe)	21216	23720	26292	28577
Final Electricity Production (ktoe)	4708	5602	6692	7512
Electricity Production / RES (ktoe)	591 (12.5%)	811 (14.4%)	1071 (16.0%)	1249 (16.6%)
PV (MW with 1600kWh/kWstc)	[5]			30
Hydro Installed Capacity (MW)	3143 [3155]	3560	3733	3733
Wind Installed Capacity (MW)	**685 [853]**	**1742**	**2745**	**3303**
Other RES Installed Capacity (MW)	**22 [39]**	**60**	**75**	**90**

Energy Sector Projections - BAU plus meeting 20-20-20

	2005	2010	2015	2020
Gross Energy Consumption (ktoe)	31073	35989	39305	42420
Gross Energy Production (20% reduction)	24858	28791	31444	33936
Final Energy Consumption (ktoe) (15% reduction)	18034	20162	22348	24290
18% RES contribution to Final Energy Consumption (ktoe)	3427	3629	4023	4372
Energy for Transport (ktoe)	7540	8444	9396	10089
Final Energy Consumption for Transport (15% reduction)	6409	7177	7987	8576
10% Biomass in Transport	641	718	799	858

Projections BAU plus 20-20-20 / Implications for RES

	2005	2010	2015	2020
18% RES in Final Energy Consumption Τελικής (ktoe)	3427	3629	4023	4372
10% biomass in Transport	641	718[406]	799[467]	858 [501]
Biomass and waste in industry (ktoe)	235	332	452	604
Biomass in res-tertiary	482	426	366	315
Biomass-electricity (100MW)				**56**
Solar & other RES (ktoe)	108	133	154	179
Geothermal (100MW electric)				**56**
PV 750MW by L3468 plus (1600kWh/ kWstc)				**100**
Hydro (4100MW with 1.36GWh/ MW) (Ktoe)	[371]			**480**
Remaining – ??? (Ktoe) (**possibly > 9000MW wind**)				**(2648) 1724 19.99TWh**

Large RES Penetration Obstacles – Proposals / 1

Reshape national energy policy priorities and planning

- Initiate a public dialog on large scale penetration requirements and necessary policies and measures
- Take large penetration requirements in energy infrastructure decisions
- Resolve differences and align PAMs of different ministries

Expand and extend grids

- Review and streamline grid connection requirements by PPC
- Expand grid interconnections with neighboring countries
- Invest in grid and grid management capabilities
- Reduce number of isolated grids

Priorities reflected in subsidies and pricing

- Provide long duration guaranteed pricing
- Examine early implementation of GO system

Demand side management

- Metering and pricing
- Enforce energy conservation directives
- Facilitate energy services market mechanisms

R & D targeted programs

Large RES Penetration Obstacles – Proposals / 2

Land Use Proposals and permitting

- Change the philosophy of land use national plan to simply define excluded areas
- Admit that RES installations are not houses-simplify & speed up
- REDUCE BUREAUCRATIC OBSTACLES – universal No 1 goal

Encourage small scale RES use

- Drastically reduce regulatory steps
- Provide affordable financing to citizens

Public information dissemination

- Feasibility and strategic energy studies made public and scrutinized
- Provide information about RES to public and raise awareness

Dispute resolution and planning at municipal level

- Devise mechanisms for local conflict resolution in a transparent and effective manner to address legitimate local concerns

Thank you for your attention

facets

further action on climate, environment, energy, economy, technology & sustainability