



**Ministry of environmental Protection, Physical  
Planning and Construction**

**View on Climate Change mitigation strategy in Croatia- roll of CO<sub>2</sub>  
Capture and storage**

**Carbon Capture and Storage – Response to Climate Change**  
Regional Workshop for CE and EE Countries  
27-28 February 2007 in Zagreb, Croatia



# Kyoto Protocol

- **obligation for Croatia: to reduce its greenhouse gas emissions by 5% in the first commitment period between 2008 and 2012 compared to the base year.**
- **signed in 1999**
- **greenhouse gas emission of the base year 1990 calculated according to the guidelines given by the Convention Secretariat does not reflect specific circumstances with regard to Croatia's having been integrated into the common economic, energetic and infrastructure system of former state**
- **Croatia was allowed to increase the base year emission by extra 3.5 million t CO<sub>2</sub> eq.**
- **ratification: June 2007**



## Croatian Greenhouse Gas Inventory

-annually prepared from 2003 in conformity with the guidelines of the Convention Secretariat

Sector	1990.	1995.	2000.	2001.	2002.	2003.	2004.	Average growth 2000. - 2004. %
Energy	22.489	16.391	18.858	19.907	21.137	22.536	22.050	3,8
Industrial processes	3.930	2.021	2.840	2.816	2.704	2.823	3.181	2,8
Agriculture	4.406	3.121	3.095	3.196	3.235	3.278	3.558	3,4
Waste management	298	380	475	504	533	555	642	7,2
Total emission	31.124	21.913	25.268	26.424	27.609	29.192	29.432	3,7
Land use change and forestry	-	-	-	-	-	-	-	-
	14.437	20.535	19.285	17.777	16.796	16.648	16.321	-4,2
Net emission	16.687	1.378	5.983	8.647	10.813	12.544	13.111	17,8

Greenhouse gas emissions/removals by sectors, 1990-2004 (Gg CO<sub>2</sub> eq)

Greenhouse gas	1990.	1995.	2000.	2001.	2002.	2003.	2004.
Carbon dioxide (CO <sub>2</sub> )	23.035	16.250	19.417	20.434	21.498	22.883	22.551
Methane (CH <sub>4</sub> )	3.233	2.532	2.544	2.690	2.745	2.925	3.015
Nitrous oxide (N <sub>2</sub> O)	3.920	3.123	3.284	3.251	3.317	3.221	3.677
Hydrofluorocarbons (HFC, PFC), SF <sub>6</sub>	937	8	23	49	49	164	189
Total emission	31.124	21.913	25.268	26.424	27.609	29.192	29.432
Carbon dioxide (CO <sub>2</sub> ) (removal)	-14.437	-20.535	-19.285	-17.777	-16.796	-16.648	-16.321
Net emission	16.687	1.378	5.983	8.647	10.813	12.544	13.111

Greenhouse gas emissions/removals by individual gases, 1990-2004 (Gg CO<sub>2</sub> eq)

# Asumptions

- to raise the average GDP growth rate in real terms over the next seven years to a level of 6% p.a., or specifically by 5.1% from 2006 to 2009 and by 7% p.a. from 2010 to 2013;
- to keep the inflation low within the range of 2.0-2,5% p.a.;
- to reduce the unemployment rate to less than 9% immediately after the EU accession;
- to further increase the ratio of the net foreign capital inflow to the GDP, especially the ratio of the direct to portfolio investments;
- to stop the growth of foreign debt at the current level and
- to keep the public debt/GDP ratio permanently below 60%.

# Implementation of the measures

## Energy sector

- power generation
  - wind power plants
  - small hydro power plants
  - biomass use in cogeneration plants
  - solar energy
  - geothermal energy
  - heat generation efficiency increase
- transpotation
  - Increase in biodiesel, bioethanol use
  - heavy-duty trucks transported by railway
  - urban passanger transport
- residential and services
  - DSM measures
  - solar energy use increase
  - distr. heating and cogen.use increase
  - Insulation improvment
  - geothermal energy use increase
  - biomass in cogen. and boiler plants

# Implementation of the measures, cont.

- **Industry**
  - non-selective catalytic reduction to cut emissions of dinitrogen oxide (N<sub>2</sub>O)
  - increasing of energy efficiency
  - koogenerations
  - fosil fuel substitution in cement industry using alternative fuels coming primarily from the waste
- **Waste management**
  - integrated waste management system
  - use of methan for the energy production
  - use of biogradible part of waste as alternative fuel
- **Agriculture**
  - improvements in use of organic and mineral fertilizers in order to reduce N<sub>2</sub>O emissions such as reduction in fertilization by nitrogen, increase in its utilization and introduction of a system to include this plant feed into the economy balance;
  - measures to enhance carbon uptake by agricultural soils, such as the way of using the soil to change the organic matter content, crop rotation and the organic matter content in the soil, impact of fertilization on the organic matter content, use of lime materials and soil cultivation (*no-tillage*, minimum cultivation, areas lying fallow);
  - use of stable manure for the production of biogas and electricity
- **Forestry**
  - increasing carbon stocks in existing forests;
  - increasing efficiency of timber use and
  - increasing exploitation of forests and using growing stock as a replacement for fossil fuels.

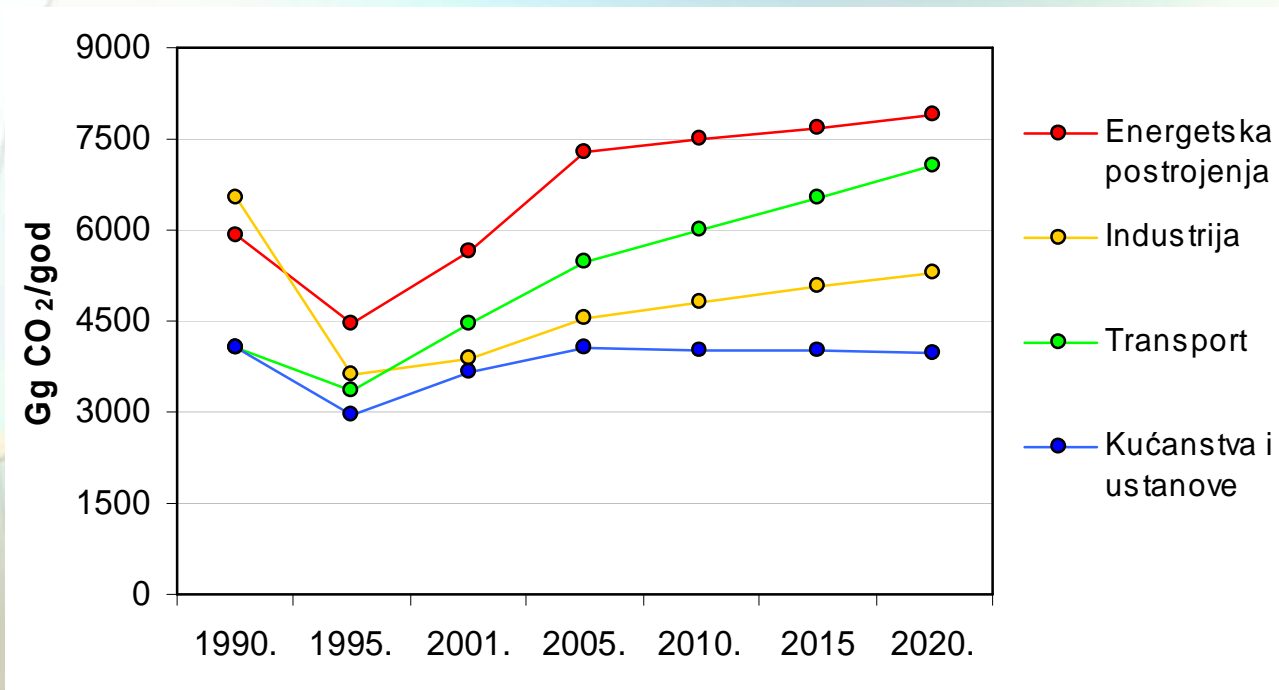


## Potentials of measures for the reduction of greenhouse gas emissions in the energy sector

Emission reduction measures	2010				2020			
	CO <sub>2</sub> (kt)	CH <sub>4</sub> (t)	N <sub>2</sub> O (t)	CO <sub>2</sub> eq (kt)	CO <sub>2</sub> (kt)	CH <sub>4</sub> (t)	N <sub>2</sub> O (t)	CO <sub>2</sub> eq (kt)
Wind power plants	108.9	2.1	1.3	109.4	285.1	3.6	3.4	286.3
Small hydropower plants	64.2	1.2	0.8	64.4	125.1	1.6	1.5	125.6
Use of biomass in cogeneration	44.1	1.1	0.2	44.2	204.9	5.1	0.8	205.2
Fuel cells	14.0	0.3	0.2	14.0	48.8	0.6	0.6	49.0
Biodiesel and hydrogen	53.8	4.4	0.4	54.1	261.7	27.7	2.2	263.0
Solar energy	311.6	15.4	3.4	313.0	624.8	32.7	6.0	627.3
Geothermal energy	239.1	11.0	2.6	240.1	539.2	25.8	5.3	541.4
More efficient heat generation	33.7	2.7	0.5	33.9	78.6	6.5	1.2	79.1
<b>TOTAL</b>	<b>869.4</b>	<b>38.2</b>	<b>9.4</b>	<b>873.1</b>	<b>2168.2</b>	<b>103.6</b>	<b>21.0</b>	<b>2176.9</b>



# Projections



“with measures scenario”-projections for energy sector



# Mitigation scenario

- long term goal: maintaining of the emissions under the base year emission level, at least 5% till 2020, gradually reduction
  - in conformity with EU efforts
  - renewable energy sources, energy efficiency,
  - measures in transport sector
  - effects on policies and measures - in 3-5 years time

measures for the significant emission reduction:

- extensive afforestation measures
- carbon capture and storage
- nuclear energy
- Kyoto Protocol mechanisms