

UKRAINIAN EMISSION TARGETS FOR THE POST-KYOTO PERIOD

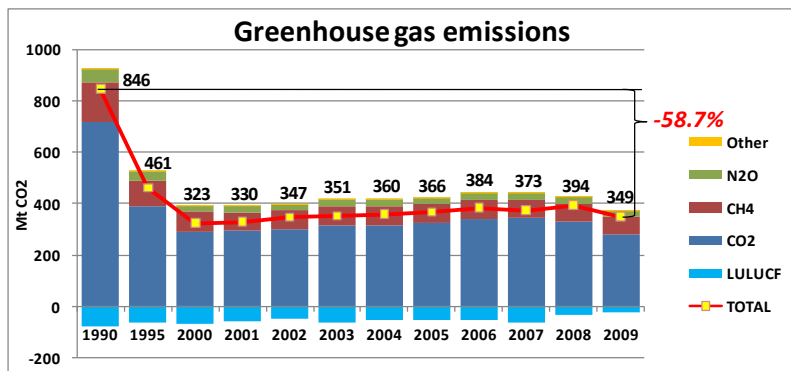
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Total direct GHG emissions, Mt CO₂e

- in 1990 Ukraine ranked sixth in the world for GHG emissions and fifth for emissions per capita;
- by 1998 GHG emissions decreased twice;
- moderate economic growth from 2000 to 2008 on the existing technological base;
- in 2009 overall emissions decreased by 58.7% compared to 1990.



Total direct GHG emissions by sector, Mt CO₂e

According to the Inventory, the largest contributions to the total GHG emission in Ukraine make three sectors: Energy, Industrial processes and Agriculture. Their share in total emission is about 97.7%.

Sector	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Diff, %
1. Energy	685.5	387.8	271.7	268.2	274.7	288.8	285.8	294.4	304.4	298.3	292.6	258.7	-62.3
2. Industrial processes	128.7	60.3	75.2	76.2	77.7	82.8	85.6	85.6	92.5	99.8	90.6	71.3	-44.6
3. Solvent and other product use	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-11.5
4. Agriculture	104.2	67.6	36.9	37.6	38.0	34.8	34.3	33.1	33.4	32.5	34.5	33.9	-67.5
5. LULUCF	-81.3	-63.5	-69.4	-61.6	-52.9	-64.8	-55.0	-56.9	-56.2	-67.2	-33.8	-24.9	-69.4
6. Waste	8.4	8.5	8.7	8.8	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	15.5
Total (with NET LULUCF removals)	845.9	461.1	323.5	329.5	346.9	350.9	360.3	365.9	383.9	373.1	393.9	349.1	-58.7
Total (without NET LULUCF removals)	927.2	524.7	392.8	391.1	399.8	415.8	415.3	422.7	440.1	440.3	427.7	374.0	-59.7

Commitments on GHG emissions: official position

Ukraine supports the efforts of international community aimed to limit and reduce the emissions of greenhouse gases, and practically prove the viability of Kyoto Protocol idea. Ukraine supports the establishment of quantitative obligations relating to the reduction of emissions for the period to 2020, remaining 1990 as a base year, and also extension of the operation of Kyoto flexible mechanisms.

Ukraine assumes an obligation of such a level of greenhouse gases emissions, which will not exceed 80% of the level of 1990 for the period to 2020. Ukraine is ready to consider and approve more hard limitations of emissions of GHG, if it would open an access to the financial and technological resources for introduction of low-carbon energy efficient technologies.

Ukrainian delegation, Cancun, 2011

Commitments on GHG emissions: *alternatives*

- Ukrainian NGOs: stabilize the GHG emissions at the level of 2004-2008 with further subsequent reduction to 45% as compared to 1990.
- European Commission: if the countries of Appendix 1 would collectively undertake the emissions reduction by 30% to 2020 as compared to 1990, the obligation for Ukraine could be established on 60% reduction (40% as compared to 1990).
- IIASA GAINS project report: in 2020 the emissions in Ukraine could level 42% as compared to 1990.

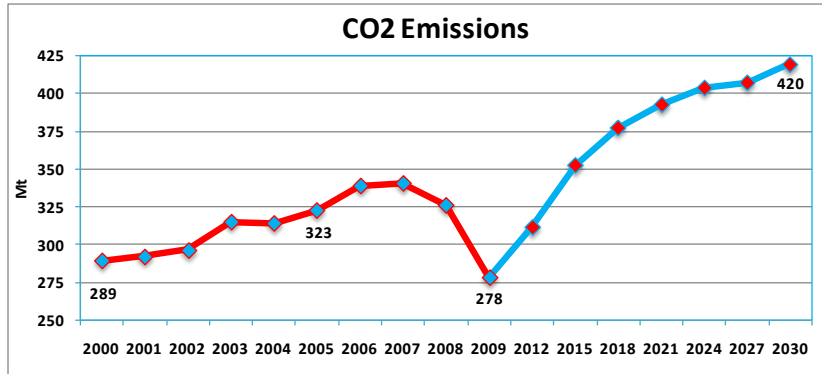
How much feasible these commitments are in order not to turn Ukraine from the seller into the buyer on the international ERU market and which consequence could have the implementation of such policy?

TIMES-Ukraine Model Development

- Work on TIMES-Ukraine started at IEF in 2006 as a special research project of Ukrainian National Academy of Sciences.
- In 2009, after joining USAID/Hellenic Aid SYNENERGY Project and with guidance from IRG and CRES experts, the initial TIMES-Ukraine model was established.
- The base year is 2005, in order to reflect the impact of the world economic crisis, with the model calibrated for 2006 and 2009 data as well.
- The structure of the model was designed considering existing statistical classifiers and based on the primary statistical forms of the National Statistic Committee.

CO2 Emission

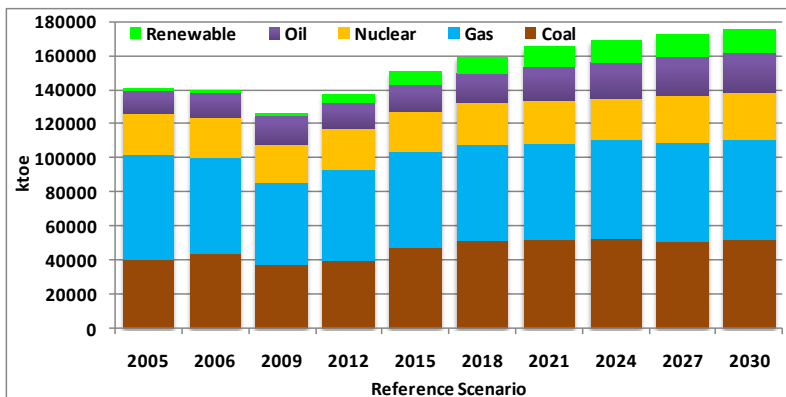
CO2 emissions in 2020 will amount to no more than 55% from the level of 1990 and 60% in 2030



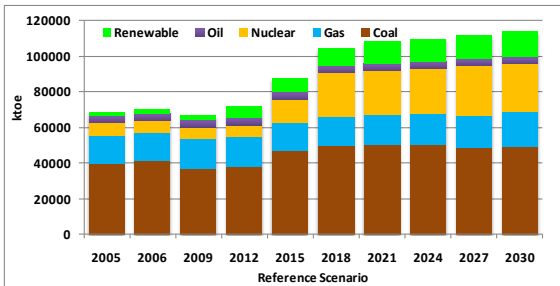
CO2 emissions (excluding LULUCF) in 1990 was 719.1 Mt

Total Primary Energy Supply

- TPES is expected to reach the pre-crisis level by 2014 after having fallen 10.4% in 2009. TPES increases 31.5% in 2020 and 40.1% in 2030 relative to 2005.
- The share of renewable energy in TPES reaches 7.4% in 2021 and 8.1% in 2030.
- The share of imports in TPES decreases from 61.1% in 2005 to 39.5% in 2030, mainly due to no nuclear and less gas.

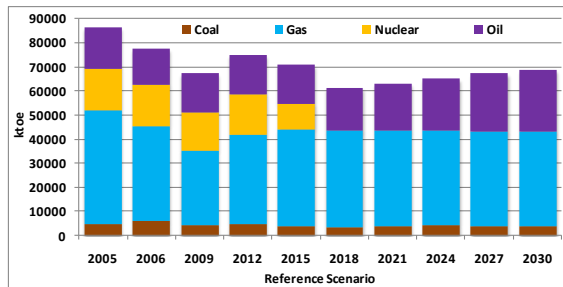


Domestic Production and Import of the Main Energy Resources



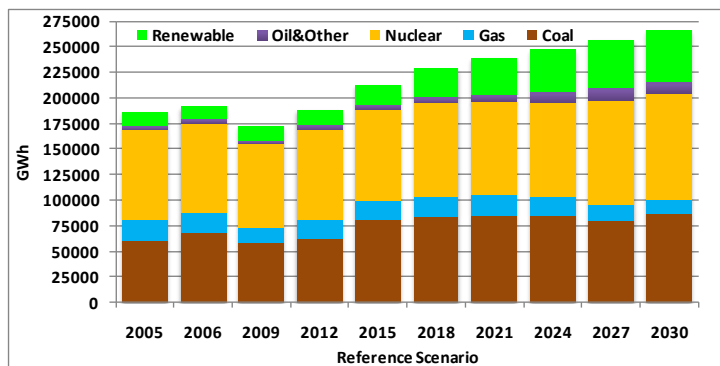
- Uranium production increases to a level that satisfies domestic needs.
- Sector of fossil fuel continues under current conditions, allowing to raise production of gas by 11% in 2021 and 21% 2030 compared to 2005.

- Overall fossil fuel imports are - 8.5% less in 2021 and -0.4% in 2030 compared to 2005.
- Natural gas imports in 2030 will be 17.5% lower relative to 2005 and equal to 49.7 billion cubic meters.



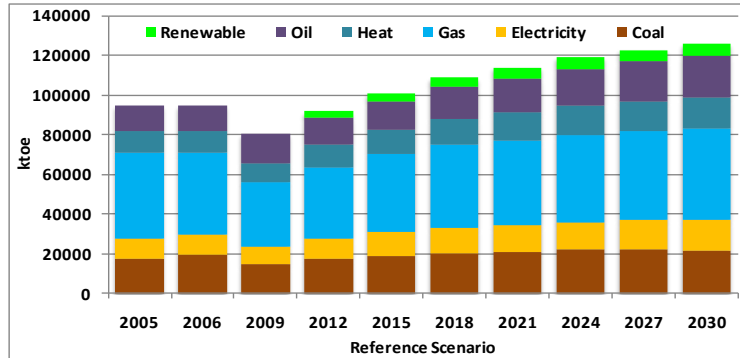
Electricity Generation

- A total of 20.8GW of new capacity needs to be built, requiring lumpy investment of 50.2€Billion.
- Electricity production increases by 42.6% in 2030 compared with 2005, to 264.4 billion kWh per annum.
- Generation mix remains essential the same, although the shares of renewable together with big hydro generation will increase from 6.7% (2005) till 15% в 2020 and 19.3% in 2030.



Total Final Energy Consumption by Fuel

- Natural gas will continue to dominate, though less than current levels - 36% in 2030 and 46% in 2005.
- The share of coal drops from 18.4% in 2005 to 16.6% in 2030, though actual consumption grows by 317 kt per annum.
- Consumption of electricity grows by 52.8% to reach 11.8% in 2030.
- The share of oil products increases from 13.5% in 2005 to 16.5% in 2030.
- The share of renewable energy in TFEC rises from 0.2% in 2005 to 7.3% in 2030.



CO2 Scenario Assumptions

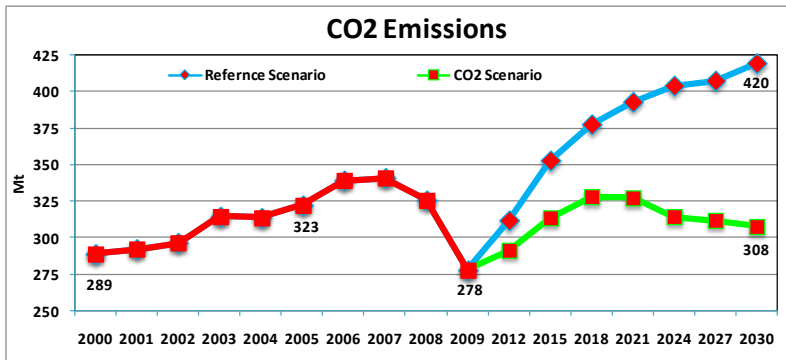
	Reference Scenario	CO2 Commitments Scenario
RE Target	No targets	7.5% RE(as share of GFEC) in 2020, and 15% in 2030
CO2 emissions constrains	No constrains	Average annual CO2 emissions not exceed the level of 2005
Technologies of steel production	Martin processes will be shut down by 2030, share of oxygen steelmaking can reach 80%	Martin processes will be shut down by 2020, share of oxygen steelmaking can reach 90%
Cast iron production technologies - share of new technologies	Not to exceed 5% by 2030	Not to exceed 25% by 2030
New technologies in ferrous metallurgy, cement and paper industry	The share of new technologies will not be more than 5% by 2030	The share of new technologies will not be more than 10% in 2020 and 25% by 2030
Production of electricity by TPP and CHP	New TPP or modernization of existing coal-fired TPP not more than 10% by 2020 and 15% by 2030 of total	New TPP or modernization of existing coal-fired TPP not more than 20% by 2020 and 50% by 2030 of total
New technologies in the residential, budget and commercial sectors	New devices for heating, water heating and air conditioning may be up to 2% in 2020 and 5% in 2030	New devices for heating, water heating and air conditioning may be up to 20% in 2020 and 50% in 2030
Heat production by municipal boiler	At least 40% of the total production in 2013 and at least 32% by 2030	At least 40% of the total production in 2013 and at least 15% by 2030
Heat production by municipal gas boiler houses	Not less than 95% from total heat production by boiler houses by 2015, and 80% by 2030	Not less than 90% from total heat production by boiler houses by 2015, and 50% by 2030
Fuel consumption by road transport by 2030	No constrains	Biofuels — not exceed 10%
	No constrains	Consumption by electric vehicles will not exceed 5%

Key Indicators

		Reference Scenario	CO2 Scenario	Difference
Savings	2005M€	873,508	861,654	-1.4%
Primary Energy	ktoe	4,567,483	4,274,339	-6.4%
Imports	ktoe	1,862,133	1,675,338	-10.0%
Power Plant Builds	GW	21	41	96.6%
Final Energy	ktoe	2,927,499	2,711,941	-7.4%
Cum. CO2 Emissions	kT	9,858	8,425	-14.5%
Fuel Expenditure	2005M€	653,787	564,754	-13.6%
PP Investment	2005M€	50,214	124,608	148.2%
Electricity Consumption	kWh/cap	6,188	6,079	-1.8%
Energy Consumption	toe/cap	4.08	3.43	-26.6%
CO2 Emissions	kg/cap	9,758	7,160	-16.0%

Comparison of Scenarios: CO2 Emission*

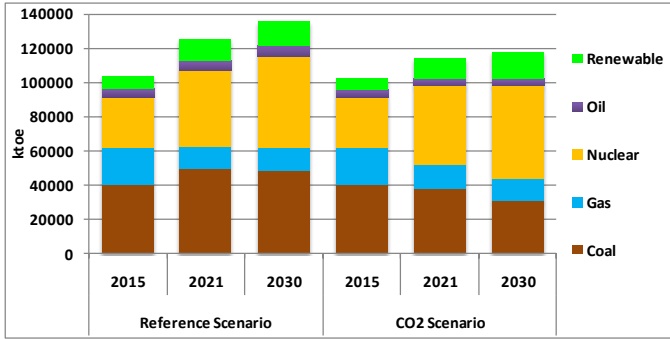
CO2 Emissions (2005), tones/cap			
	2005	2030	
World	4.27	REF Scenario	CO2 Scenario
EU	8.98		
Ukraine	6.85	9.76	7.16



* CO2 emissions (excluding LULUCF) in 1990 was 719.1 Mt

Comparison of Scenarios: Total Primary Energy Supply

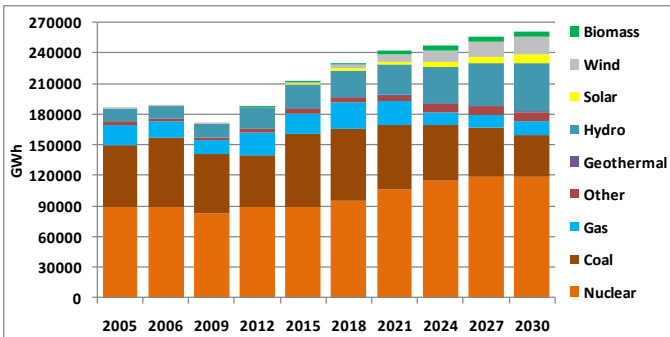
Energy Consumption (2005), toe/cap			
	2005	2030	
World	1.778	REF Scenario	CO2 Scenario
EU	3.773		
Ukraine	2.98	4.08	3.43



Cumulative TPES will be less by 6.42% or 18.9 m toe per year comparing to the Reference scenario

CO2 Scenario: Electricity Generation

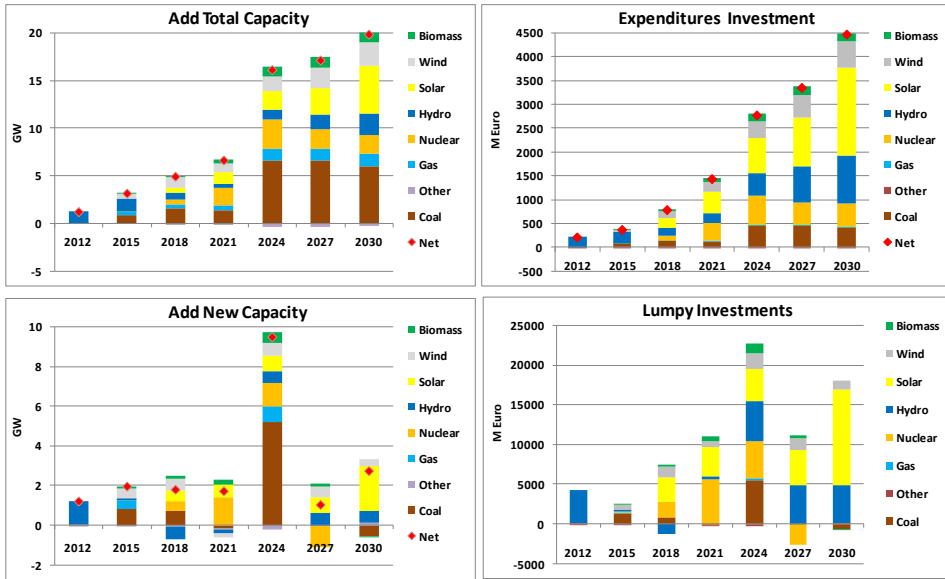
Electricity Consumption, kWh/cap			
	2005	2030	
World	2,595	REF Scenario	CO2 Scenario
EU	6,009		
Ukraine	3,928	6,188	6,079



The share of renewable in electricity generation fuel mix could exceed 32% (including big hydro).

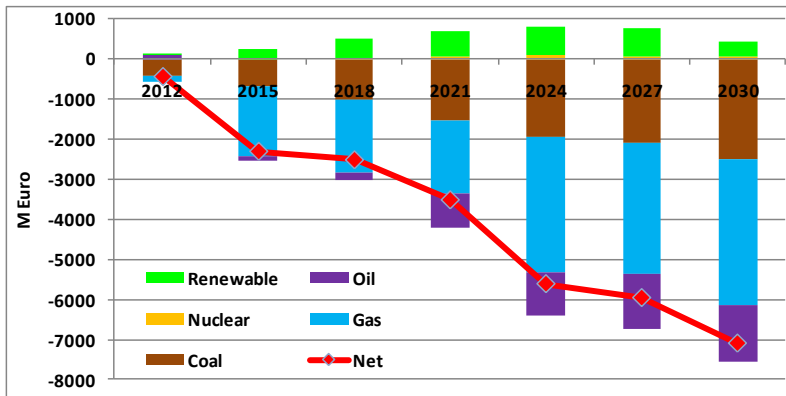
The share of hydro will increase from 6.7% in 2005 to 18.0% by 2030, wind – from 0.02% to 6.5%, solar – from 0% to 3.2%.

Comparison of Scenarios: Power Plant Capacity Additions



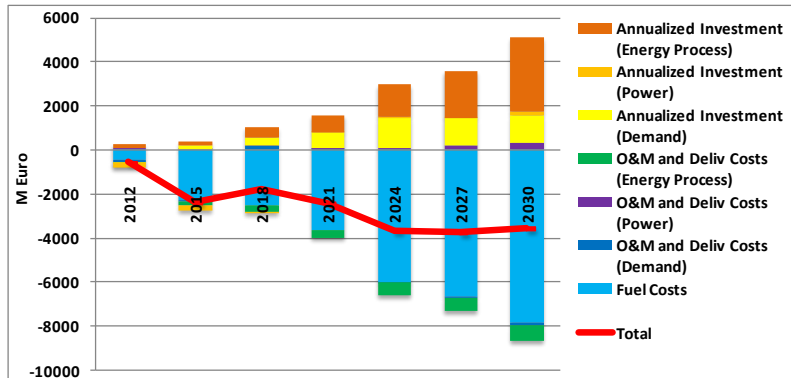
Comparison of Scenarios: Change in Fuel Cost

Due to reduction of cumulative import of coal by 19 mln t, natural gas by 177 bln cub. m and oil by 38 mln t the savings from energy imports could reach 65 bln Euro



Comparison of Scenarios: Change in Annual System Cost

- Fuel savings (in light blue) can be seen in CO2 scenario, reaching a cumulative reduction of 11,854€M.
- The CO2 Scenario achieves an overall savings of 456€M per year by 2030



Conclusions

- Traditional “economically reasonable” measures would be definitely not enough to reach 60% reduction of CO2 emissions comparing to 1990
- Radical environmental policy will require significant additional investments against the background of reduction of earnings from emissions trading
- Possibilities for increasing the share of renewable in electricity generation will require additional studies (with the help of power generation system models)
- More detailed representation of costs for transmission modernization, coal sector restructuring etc. will further increase the need for investment and could even level savings from reduction of energy imports

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