GOOD PRACTICES IN POLICIES AND MEASURES TO REDUCE GHG EMISSIONS IN THE SLOVAK REPUBLIC

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Abstract: *An integrated strategy in Slovak Republic related exclusively to the climate change issues and reduction of GHG emissions is under development now. Slovak Republic shall participate in on-going international efforts developed in the framework of the UN FCCC in line with the world-wide division of responsibility and meet accepted commitments. For attainment of global objective from the view of the Slovak Republic, the main goals are defined for short-term, medium-term and long-term periods. In the framework of the medium-term strategy (2003 to 2008) the objective is to achieve such development of greenhouse gas emissions until 2005, which shall provably allow to meet the commitment of the Kyoto Protocol - 8% reduction of aggregated GHG emissions compared to the base year 1990 in the commitment period of the years 2008 to 2012. National environmental policy observes also the principles of sustainable development and under its long-term objectives includes the implementation of the National Program of GHG Emissions Reduction.*

National frame for environmental policy making and legislative process

The decision-making activity and authorities in area of environmental protection are conferred to the Ministry of Environment and its administrative bodies in lower levels. This ministry, together with the other authorities involved into the effort to mitigate negative impacts of climate change, has developed conceptual documents as well as proposals of mitigating and adapting measures (energy, transportation, industry, agriculture and residential sectors). Main principles of Slovak strategy for P&M to mitigate GHG could be generally defined as follows:

- Priorities of national environmental strategy
- Environmetal effectiveness – P&M should be preferentially focused on the most crucial areas in view of sector and/or gas;
- Economic efficiency – the larger share of reduction potential will be covered, the greater economic efficiency relative to P&M could be achieved;
- Administrative feasibility – to minimize institutional and financial requirements for implementation of new P&M by utilization of existing, easy manageable structures;
- Dynamic adjustment in time and efficiency (this is maybe the case especially for countries with economy in transition) - it seems to be effective to tailor already implemented P&M with good response and effects, developed know-how as well as expert's and institutional network.

Environmental effectiveness of P&M

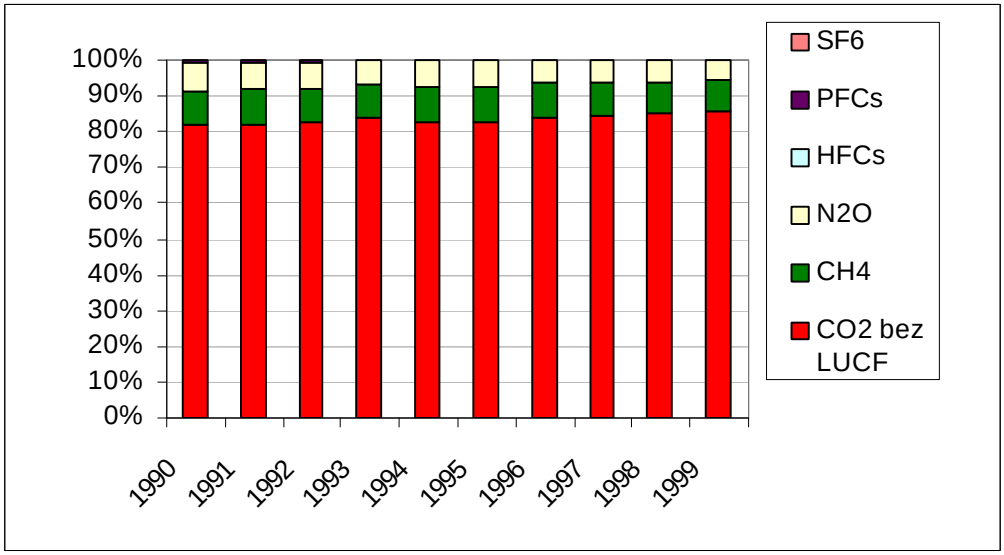
Updated aggregated GHG emissions in Slovakia both by gases and sectors (as per January 2001) converted using the revised methodology of IPCC 1996 [1] show that CO_2 emissions contribute by more than 80% to the total aggregated GHG and that the major source of CO_2 emissions in Slovakia is fossil fuel combustion and transformation (95%) – the energy sector in Figure 2. Combustion of motor fuels in transportation is also considered in this sector.

Energy intensive industry (iron&steel, cement, aluminium production, chemicals and refineries) is the second, however much less important source of CO_2 in Slovakia. According to the existing development we can suppose that in 2001 total greenhouse gas emissions will not exceed the level of the year 1990. However the Slovak Republic, as similarly the EU, committed itself to an 8% reduction of emissions compared to the base year 1990 in the Kyoto target period of the years 2008 to 2012.

On the basis of expected development of GHG emissions in other sectors (agriculture, forestry, non-energy related CO_2 emissions in industry, etc.) based on past projections indicated in the Slovak Second National Communication, the average annual level of CO_2 emissions from fossil fuel combustion and transformation, which would allow for Slovakia to meet Kyoto reduction target was provisionally determined (by the Slovak Ministry of Environment) at the amount of 51 066 Gg CO_2 emissions.

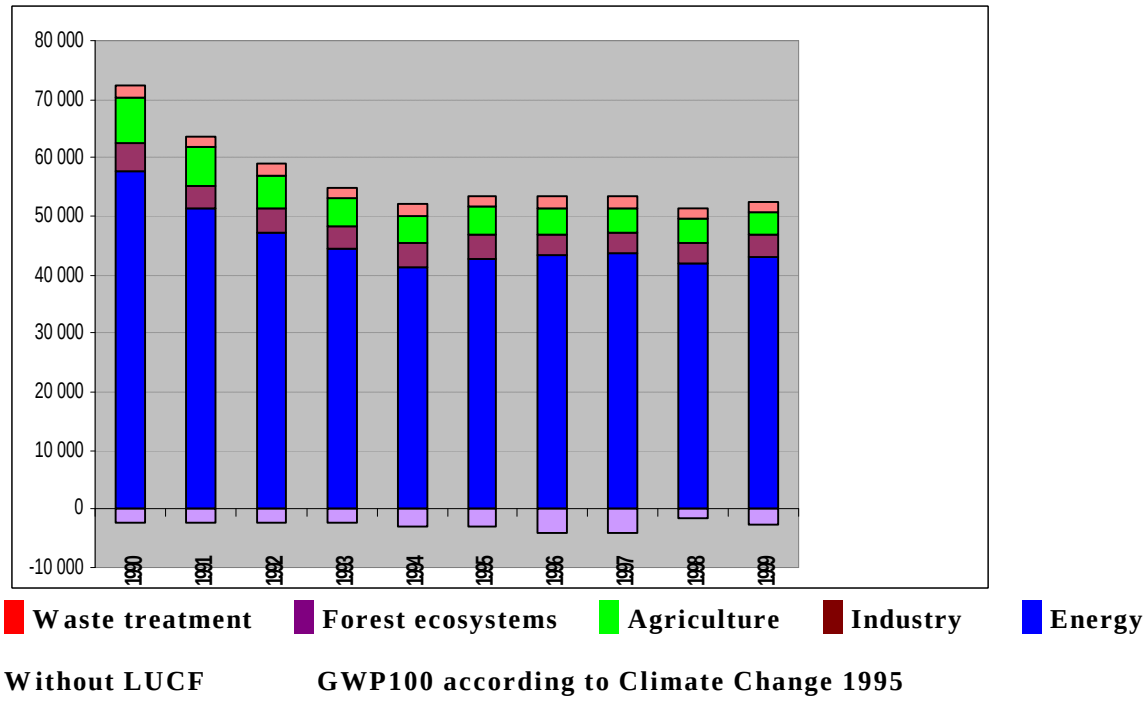
To achieve both the environmental and economical efficiency, the energy sector represents the most decisive area due to contribution on total GHG and in view of the largest potential for implementing of mitigation measures.

Fig.1 Aggregated GHG emissions by gases in period 1990-1999[%]



Source: The Third National Communication on Climate Change – Final Draft, Slovak Republic, 2001

Fig.2 Aggregated GHG emissions by sectors in period 1990-1999[GgCO_2 equiv]



Source: The Third National Communication on Climate Change – Final Draft, Slovak Republic, 2001

Selection and evaluation of P&M

Final decision on selection and implementation of individual P&M is usually in the intersection of environmental, political, economical, technical and social priorities of all involved subjects. Complexity of this issue in EIT countries due to on-going changes in economy asks for flexible approach with maximum utilisation of existing know-how, experts' and institutional capacity and minimum requirements on financial resources.

Priorities of national environmental strategy

Among others, increase of renewable sources share on energy production, increase of energy efficiency in industry, increase of energy efficiency in healthcare, agriculture, food industry, municipalities are the very priorities of current strategy. For decision making purposes these priorities should be evaluated in context with technically usable potential versus availability of technologies and financial resources (RES), legislation requirements (BATNEEC for emission sources), requirements on the reliability and security of supplying (increase in gas consumption in the energy sector- CC, district heating, industrial CHP) and others. The share of energy generation from the total technically usable potential of RES in Slovakia in 1997 was for biomass 29%, hydro 57%, geothermal energy only 5%, solar energy 0.1% and no utilization of wind energy. There is evident disproportion between these two parameters, namely for geothermal and solar energy which is given by additional impacts such as: availability of technology and financial resources, legislative support for implementation, past experiences with utilization, etc..

Environmental effectiveness

As we have already mentioned, the energy sector represents the most decisive area to gain both the environmental and economical efficiency, due to its share on total GHG and in view of the largest potential to implement mitigation measures. Although focused mainly on the base pollutants (SO_2, NO_x, CO, solid particles and other) one of the most important tool to reduce CO_2 emissions (by-side effect) in Slovakia is cross sectorial measure - Act No. 309/1991 on Protection of the Air . This law in its first version established the use of BATNEEC for new and retrofitted units as well as air pollution charges related to determined emission standards for middle and large-scale sources.

Further cross sectorial measures with significant impact on the environmental efficiency are the Act No. 286/1992 on Income Tax with 5 –year tax allowance for operation of small hydro and implementation of combined cycles and renewable energy sources and Liberalisation of energy and fuel prices. Although the energy sector in its existing structure has the character of natural monopoly, resulting in the need for state regulation of fuel and energy prices, it has observed positive changes motivated by the effort at full price liberalisation, against the situation of the year 1997. In addition to ambitions for integration, the reason for elimination of all types of subsidies to energy prices - including those cross sectorial - is the prepared restructuring and privatisation in the electrical and gas industries and the endeavour at rational function of the market.

Environmental effectiveness of P&M in industry

After a many-year transformation process, metallurgy, chemical, engineering and foodstuff industries remain bearing branches of Slovak industry, i. e. branches with high demands on raw materials, energy and transport and with a low degree of processing still prevail. Although the shutdown of some less-effective production units and reduction of the production volumes in the elapsed period were followed by reduction of CO_2 emissions too, in case of economic growth other reserves of reduction of fossil fuel consumption should be found in modernisation and restructuring of industrial production. All above mentioned measures, especially the synergetic effect of the Act on Protection of the Air, measures for energy savings and the prepared liberalisation of raw material and energy prices, play an important role in reduction of CO_2 emissions in this sector, too.

Analyses of flow diagram for CO_2 equivalent in industry, i.e. CO_2 equivalent in energy carriers during the process of transformation and distribution until the final energy consumption, show that large share of fuels is used directly in technologies where mitigation potential is strictly limited to the increase in efficiency of technological heating and/or fuel switching . It is difficult to apply mitigation measures at the technological batches of fuel, where the type and amount is given by the technological process. The measure to apply with high environmental efficiency would be therefore industrial restructuring. Relatively large room for implementing of CO_2 mitigation measures in industry lies also in industrial CHP, where measures, such as fuel switching (gasification of coal boilers usually connected with increase in energy efficiency), utilisation of renewable sources (including utilisation of waste heat),

increase in boiler efficiency, increase in turbine efficiency as well as decrease in own energy consumption, could be applied.

Iron&steel production in VSŽ,a,s Košice represents the highest share on industrial CO_2 emissions. Technology of continual steel casting has already been applied. Analyses showed, that the maximum input of CO_2 equivalent for this technology is in the coking coal technological batch. As far as there is no possibility for fuel switching directly in technology, the coking coal will still remain as the significant source of CO_2 emissions in volume related to the production amount. To meet current environmental standards of air protection in the internal heating plant, low- sulphur coal (0.6%) is burnt in five boilers and the sixth boiler is gasified and serves to combustion of waste gases only.

Assessment of mitigating potential for P&M to reduce energy related CO_2 emissions

To quantify the effect of individual measures on emission trajectories for projections of energy related CO_2 emissions in Slovak Third National Communication were measures introduced and modelled gradually [1]. Table 1 provides data of reduction potential for modelled scenarios developed with following assumptions:

- Without measure – extrapolation of the current stage in view of energy source structure and fuel consumption;
- EL ZZL – impact of legislation frame in the area of air protection – emission limits for basic pollutants and charges for their nonobservance;
- CC – represents reinforcement of the effect of previous measures by utilisation of combined cycles in public PP and industrial CHP(considered as a replacement of coal heating plants only);
- RES – gross effect of previous measures is supplemented by the utilisation of renewable energy sources in frame of energy balance;
- DSM – potential of measures in previous step will be extended by the effect of thermal insulation of buildings (decrease in heat consumption in apartments and public buildings);
- TRANSP – considered measures in previous step are extended by effect of shifting in transport outputs from individual to public mode (decrease in gasoline, increase in diesel consumption);

Table 1 Projections of CO_2 emissions in cross years and KP target period [Gg CO_2]

Scenario	2000	2005	2010	2015	2008-2012
Without measure	37 169	37 884	41 500	43 011	41 295
EL ZZL	36 911	36 519	40 128	41 669	39 922
Combined Cycles	36 927	35 547	39 314	40 758	39 108
RES	36 768	34 409	37 457	38 424	37 254
DSM	36 768	34 331	36 654	37 790	36 579
TRANSP	36 768	34 199	36 385	37 385	36 312

Source: The Third National Communication on Climate Change – Final Draft, Slovak Republic, 2001

Economic efficiency

Based on the inventories in Fig.2 and 3 as well as on the projections of energy related CO_2 emissions in the Third Slovak NC we can state that in case of relatively balanced economic development Slovakia has a real chance to meet the reduction commitment under the Kyoto Protocol. Nevertheless, further analyses and studies have been carried out to find additional CO_2 reduction potential in Slovakia, which would allow to meet more severe commitments in the following target period (post-Kyoto period), as well as to use eventual emission reduction reserve in the framework of Kyoto flexible mechanisms (JI and IET) for acquisition of investments and/or innovation of technologies.

Comprehensive evaluation of reduction potential for individual measures involving also economical criteria has been worked out in the Action Plan of Fulfilment the Kyoto Protocol Commitments of the UN FCCC [2] . This study has thoroughly analysed direct and indirect mitigating measures from the view of their CO_2 reduction potential, investment intensity and time horizon for implementation.

The analysis has been focused on the energy sector and following measures:

Measures on the energy demand side

- Improvement of thermal characteristics of building in housing communal sector.
- Shifting of outputs from individual road transport mode to public one.

Measures on the energy supply side

- Utilisation of combined cycles (CC) with electricity and heat cogeneration in the public power plants (Public PP) .
- Utilisation of combined cycles (CC) with electricity and heat cogeneration in industrial selfproducers power plants (Industrial CHP) .
- Utilisation of biomass in the Industrial CHP.
- Utilisation of biomass in the central district heating system (DHS).
- Utilisation of geothermal energy in the central heating system.
- Utilisation of biomass for individual heating.
- Utilisation of solar energy for heating and conditioning of hot supply water.

Total mitigation effect may be reduced due to interaction of individual measures. For example, thermal insulation of buildings reduces the effect of measures implemented at the heat production in district heating systems. On the other hand, the introduction of combined cycles in industrial PP reduces the potential for the utilisation of biomass etc. Table 2 provides output data of study.

Table 2 –Evaluation of measures for reduction of energy related CO emissions

Measure	Abatement costs range [US$/t CO_2]	D $CO_{2\ KP}$ [kt/year]	Implement. until 2005	2010	2015
CC in industrial CHP	23.1	230	126 MW_e	283 MWe	40 MWe
CC in public PP CC in public PP with thermal insulation	26.9 27.0	541 - 585	year 2004	242 MWe	
Biomass in industrial CHP with parallel CC implementation	-27.2 -42.3	328	9% 3028 TJ year 2002	18% 4468 TJ	24% 5225 TJ
Biomass in DHS without effect of thermal insulation	-26.5 -41.2	386	10% 3059 TJ year 2000	20% 6162 TJ	30% 9265 TJ
Biomass in DHS with effect of thermal insulation	-25.0 -45.7	307	9%	14%	21%
Biomass in individual heating	-20.0 -22.7	685	5483 TJ year 2000	7313 TJ	7313 TJ
Geotherm.energy in DHS without effect of thermal insulation	-39.3 20.5	217	102 MWt	229 MWt 3705 TJ	355 MWt 5759 TJ
Geotherm.energy in DHS without effect of thermal insulation	-39.3 19.2	165	163 TJ year 2001	229 MWt	355 MWt
Solar heating in individual .heating	8.6 34.4	174	10% 2208 TJ year 2000	326 TJ	
Biomass in heat monoproduction at industrial CHP	-11.1 4.7	267	1172 TJ	20% 3866 TJ	
Biomass in cogeneration at industrial CHP	-41.1	77		1128 TJ	

Source: Action Plan of Fulfilment the Kyoto Protocol Commitments of the UN FCCC, The Ministry of the Environment of the Slovak Republic , 2000

In Table, 2Δ $CO_{2\ KP}$ [kt/year] is reduction potential of measure expressed in terms of average decrease in the energy related CO_2 emissions during the first Kyoto commitment period. Total estimated CO_2 mitigation potential of measures evaluated in study represents average annual decrease in emissions by 9% related to the without measure scenario.

Dynamic adjustment of P&M in time and impacts

Considering the uncertainties accompanying on-going changes in economy development for EIT countries it seems to be useful and effective to adjust already implemented P&M in close correlation with decisive changes in external conditions. We can introduce the Act on Protection of the Air (cross- sectorial measure) in Slovakia like a very example for this approach. The only measure with good response in past, high administrative feasibility based on available experts' and institutional networks and

clearly defined rules for adopting (executive decrees and promulgations) can be with benefits.

Evolution from the Act on Protection the Air to the SO_2 emission quotas

Act No.309/1991 on Protection of the Air has been initially focused on the regulation of emissions of basic pollutants - SO_2, NO_x, CO, solid particles and other. This law established the only use of BATNEEC for new and retrofitted units together with charges for non-compliance of introduced emission standards. Among other positive effects, significant reduction of CO_2 emissions as result of practical implementing (fuel switching, mostly gasification of large and middle-scale sources, increase in boiler efficiency) of Act adoption has been occurred.

Amendments of this Act were reflecting both the needs of clear executive rules as well as changes in external economic conditions. Last amendment introduces for the existing sources not meeting the concentration emission limits of the basic pollutants in the initial time limit (before 31 December 1998) the possibility of their further operation until 31 December 2006, after their classification to so-called class "B".

The classification of a source of pollutants to the class "B" means, in addition to higher basic charges for pollutants, their further increase throughout coefficients determined until 2006.Under the said amendment, a mechanism of declaring so-called "emission quotas ", i. e. maximum allowed amounts of pollutants, which may be emitted by a group of sources in the country, a district, or as individual source, was introduced to the environmental protection legislation frame. Main principles and technical rules for practical implementation of SO_2 emission quotas and domestic trading are briefly compiled in paragraph below [7].

SO_2 quotas - principle and current stage

Allocation scheme:

<u>A.phase</u>

Historical levels ⇒ Ministry of Environment ⇒ District (∑ Districts =Country)

<u>B. phase</u>

District administration ⇒ Company (∑ Companies = District)

Timing of Allocation:

<u>A. phase</u>

∇ Ministry for Districts

18 months ahead

Decree No.127/2000 ⇒ Quotas for years 2002, 2003,2004 (available from May 2001)

Yearly descending tendency of allocated quotas should enable for Slovakia to meet international commitments *(Protocol on Reduction of Acidification, Eutrofication and Ground Level Ozone- Slovakia 130 kt NO_x and 110 kt SO_2 in 2010)*

<u>B phase</u>

∇ Districts for Companies:

9 months ahead

Quotas for companies operating large scale sources of pollution (> 50 MWt) for the year 2002 are already available on the web site: www.lifeenv.gov.sk
Quotas are not transferable from one year to another !

Technical rules for allocation of quotas for districts:
Allocation of SO_2 emission quotas has been based both on volume of SO_2 pollution from the large scale sources in districts during the period 1996 – 1998 and on data from the National Register of Air Pollution Sources (REZZO).

Terms:
Goal emissions ↔ will depend on the accepted international commitments, at present 105 thous. tones (all source categories) to meet commitment of 110 thous. tones SO_2 in 2010

Specific emissions ↔ number of district residents multiplied by per capita emissions from the large sources in 2010 estimated according the goal emissions' level

Zero emissions ↔ emissions in district lower than 10% of the specific emissions in the district with the lowest residential number

Procedure

- Districts with zero emissions will be allocated with the 10% of specific emissions' level quota

- Districts with decrease in emissions during last 3 years will be allocated with the 110% of 3 years average emissions quota

- Districts with the third year emissions higher than these ones in the first year will be allocated with the 110% of the highest emission level from three years period quota

- Allocated quotas will be decreased yearly so that until 2009 could be achieved level of 80% from the national goal emissions. Quotas for districts with zero emissions will not be decreased.

Due to time schedule we cannot provide you now with data on effect achieved by implementing the measure on SO_2 quotas. Regardless of reduction share which will be really achieved we must stress that we suppose satisfactory benefit not only due to low financial and capacity needs to implement, but also due to possible utilization of gained experiences and executive procedure in frame of prepared CO_2 Cap & Trade System in Slovakia.

Conclusions

1. P&M from category “good practices “ should combine high environmental and economic efficiency with technical, administrative and social feasibility in the most effective way.

2. Dynamic adjustment of “good” P&M in time and impacts can be the way (namely for EIT countries) how to compensate efficiently existing imperfections and on-going changes in economical, social and political development.

3. Further analyses and dealing with synergy effect of P&M in more details could contribute to the corrections in assessment methodology.

4. New prepared legislation frame in the energy sector (elimination of all types of subsidies to energy prices, restructuring and privatisation in the electrical and gas industries and free electricity market) should be the early subject of modeling and evaluation in Slovakia.

References

1 Third National Communication on Climate Change – Final Draft, Slovak Republic, 2001

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3 Energy Policy of the Slovak Republic, The Ministry of Economy of the SR, 2000

4 Second National Communication on Climate Change, The Ministry of Environment of the SR, 1997

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