FORECAST OF ENERGY-RELATED CARBON DIOXIDE EMISSIONS IN LITHUANIA

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Overview

The stabilization of climate change by significantly reducing greenhouse gases (GHG) emissions is one of the main energy policy priorities. The first commitment period of the Kyoto Protocol expired in 2012. Therefore currently there are intense international negotiations for an effective new global agreement [1]. Lithuania together with other EU countries have agreed for a second commitment period of Kyoto Protocol to reduce GHG emissions by 20% compared to the 1990 level. During the UN Climate Change Conference in Warsaw countries agreed that final global agreement will be reach in the UN conference in Paris, in 2015. Countries decided to intensify domestic preparation for their intended national contributions towards that agreement, which will come into force beyond 2020. This paper presents an analysis of current status and future trend till 2050 of energy-related GHG emissions in Lithuania.

Method

The combustion of fossil fuel generates the biggest part of Lithuanian GHG emissions. Therefore to forecast carbon dioxide emissions for the long-term period it is necessary to perform detailed analysis of the energy sector development scenarios. Long-term energy sector development planning has two stages: firstly, energy demand forecasting; secondly, optimization and analysis of the sector development scenarios. Energy demand forecast was based on econometric model, and the optimization modelling tool MESSAGE was applied for investigation of possible options of the energy sector development and projections of energy-related carbon dioxide emissions based on various scenarios of the energy sector development.

Results

The most important GHG emission in Lithuania is carbon dioxide (CO_2). The largest source of CO_2 emission is the energy sector that accounted about 80% of the total national CO_2 emission in 2012. Energy-related GHG emissions have decreased by almost 2,7 times from 32,7 Mt CO_2 eq. in 1990 to 11,9 Mt CO_2 eq. in 2012 [2]. Significant decrease of emissions was mainly due to economic slump in 1991-1994 period. During the fast economic growth over the period 2000-2008 GHG emission in the energy sector was increasing about 2,2% per annum. The global economic recession had impact on GHG reduction in the energy sector by 9,5% in 2009. The closure of Ignalina nuclear power plat stipulated significant increase of electricity import from neigboring countries, increased use of renewable energy sources and natural gas. These changes in the energy sector stipulated decrease of GHG emissions in 2011, particularly in public electricity and heat production sector.
Historically the energy industries accounted for the largest share of GHG emission from the energy sector. In 1990, energy industries accounted for 41,7% of total GHG emission from the energy sector, transport - 23%. In 2012, share of transport increased till 39,1% and energy industries accounted for 38%. The energy industries remain a major source of GHG emissions, therefore implementation of emission reduction measures in this sector plays a very important role.

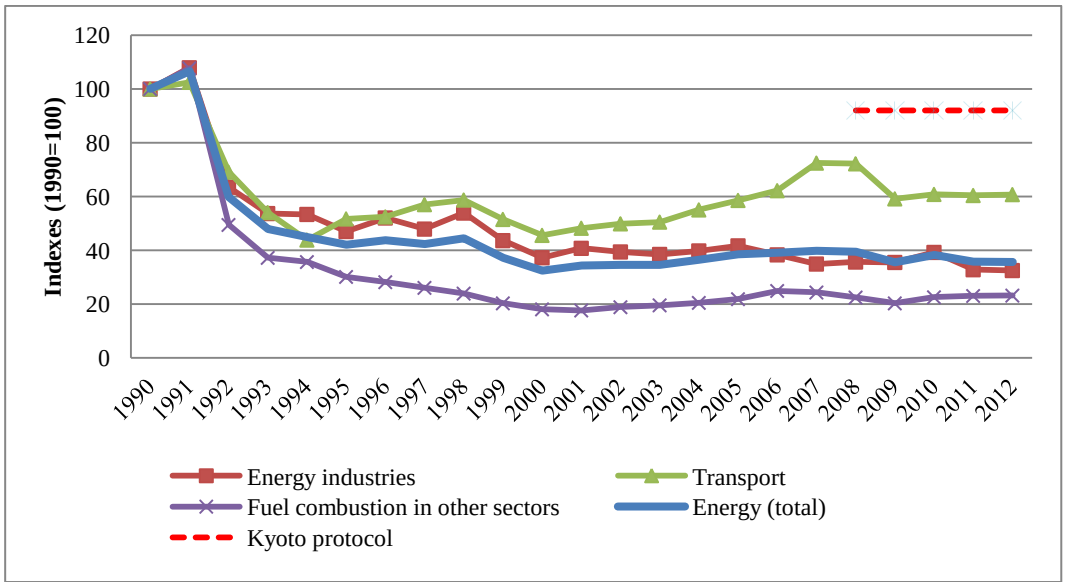

Fig. 1. GHG emissions indexes in respective subsectors of energy sector

In 2012, the energy-related GHG emissions accounted only 35.7% of the 1990 level. As shown in Figure 1, the first Kyoto protocol commitment to reduce GHG by 8% within the 2008-2012 period in comparison to the 1990 level in Lithuania was fully satisfied.

Forecast of energy-related CO_2 emissions till 2050 according to the analyzed possible scenarios of the energy sector development was performed applying national emissions factors, which are used for preparation of national GHG emission inventory considering UNFCCC and Kyoto protocol requirements [3].

The main attention in the energy sector development scenarios was pointed to the country's energy security, fuel prices and the role of new nuclear power plant. Performed analysis showed that the highest level of CO_2 emissions predicted in the case of intense requirements for energy security (i.e. 80% of electricity will be produced in the Lithuania). In this case CO_2 emissions in 2030 will reach 12.4 Mt, 2050 - 13.9 Mt. The average annual grow rate of CO_2 emissions will be 0.4%. In the case, when no any limitations for electricity import CO_2 emissions in 2030 will reach 11.5 Mt, 2050 - 12.4 Mt. The average annual grow rate of CO_2 emissions will be 0.1%. Installation of the new nuclear power plant will reduce CO_2 emissions about 0.7 Mt.

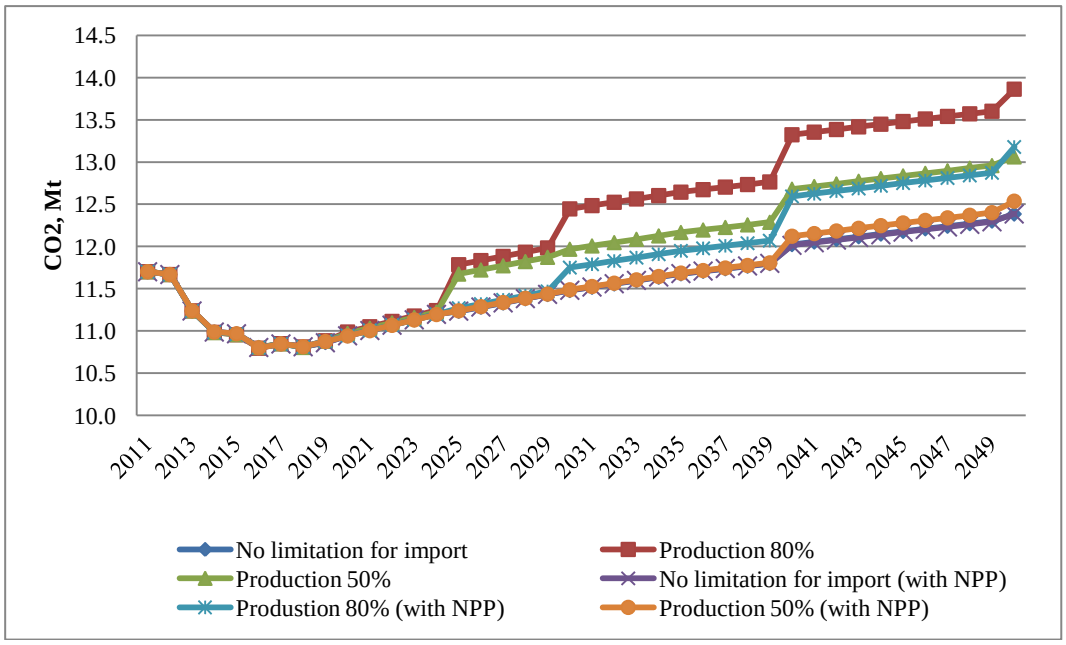

Fig. 2. Scenarios of energy-related CO_2 emissions development by 2050:

No limitation for import - no any limitations for electricity import, moderate fuel prices scenario, no new NPP; Production 80% – 80% of electricity production in the Lithuania, moderate fuel prices scenario, no new NPP; Production 50% - 50% of electricity production in the Lithuania, moderate fuel prices scenario, no new NPP; No limitation for import (with NPP) - no any limitations for electricity import, moderate fuel prices scenario, new NPP (total capacity 1384 MW, share of Lithuania 657 MW) since 2025; Production 80% – 80% of electricity production in the Lithuania, moderate fuel prices scenario, new NPP since 2025; Production 50% - 50% of electricity production in the Lithuania, moderate fuel prices scenario, new NPP since 2025;

Conclusions

Performed analysis showed that in any case CO_2 emissions will not exceed the 2020 target, for which Lithuania together with other EU countries agreed - to reduce GHG emissions by 20% in comparison to the 1990 level. However, national GHG emissions limits will be exceeded if GHG emission reduction target for 2030 will be related with the 2005 level according to the international agreement.

In the long term perspective seeking to comply with international obligations for climate change mitigation and to implement requirements of the EU directives, it is necessary to use properly renewable energy sources, to increase significantly energy efficiency and to continue perform research and development for innovative, clean energy technologies.

References

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