

Implementation of EU environmental directives and Kyoto Protocol requirements in Lithuanian power and district heating sectors

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The article deals with the implementation strategies of EU environmental directives relevant to power and district heating sectors and requirements of Kyoto Protocol to UNFCCC (United Nations Framework Convention on Climate Change) in Lithuania. The main environmental directives which regulate energy sector are Directive 2001/80/EC (further LCP directive) on the limitation of emissions of certain pollutants into the air from large combustion plants (LCP) and Directive 1999/32/EC (further Sulphur Directive) on reduction in the sulphur content of heavy fuel oil (HFO) to 1%. The aim of the article is to suggest the implementation measures and necessary investments needed for the implementation of the main environmental requirements relevant to Lithuanian energy sector.

Key words: LCP directive, Sulphur Directive, Kyoto Protocol

1. INTRODUCTION

Lithuania provisionally closed Chapter 22 on Environment in 2001 and Chapter on Energy in 2002. The Chapter on Environment covers the issues of air protection and industrial pollution control relevant to energy sector. The main directives from the air quality sector have to be transposed into the national legislation before 2004. They are: the EC Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (LCP) and Directive 1999/32/EC on reduction in the sulphur content of heavy fuel oil (HFO) to 1%. These EC directives are being considered as another step at tackling emissions on an international scale and therefore are a further sign of how seriously governments are taking air quality issues and not only for GHG as classified under Kyoto Protocol.

Decree No. 438/268/266 on environmental indicators of fuel quality approved by Ministers of Environment, Economy and Transport on 31 August 2001 transposes the requirements on the use of HFO prescribed in Directive 1999/32/EC. According to the decree from 1 January 2004, it will no longer be allowed to use HFO with a sulphur content exceeding 1%, unless SO₂ emissions are kept below 1700 mg/Nm³.

Limitation of emissions from large combustion plants was approved by the Decree № 468 of 28 Sep-

tember 2001 of the Minister of Environment. This legal act has set standards for pollutants emitted from stationary combustion sources with a thermal input of 50 MW or more. A large number of the requirements of the Directive 88/609/EEC and Common Position (EC) No 52/2000 on amending this Directive by a new one (Directive 2001/80/EC) have been transposed by this legal act. Limitations of emissions from combustion plants (hereinafter LAND 43–2001) approved by the same Order № 468 of 28 September 2001 of the Ministry of Environment of the Republic of Lithuania sets the standards for pollutants emitted from stationary combustion sources with a thermal input of 0.12 to 50 MW.

Implications of all environmental requirements imposed by legislation described above were analysed and evaluated by special studies [1–6] and taken into account when preparing Lithuanian national strategy [7], least cost power sector development plan [8], economic analysis of Lithuanian power sector [9].

The purpose of this paper is to present data and analysis which will constitute the basis on which strategies for the implementation of the two EU directives are developed. With respect to the Sulphur Directive, the present article will deal with the implementation of the parts of the Sulphur Directive that concern the use of heavy fuel oil in large combustion plants.

The main purposes of the paper are:

- to analyse requirements of LCP and Sulphure directives;
- to describe requirements of Kyoto Protocol and implications of its commitments on Lithuanian power and district heating sectors;
- to investigate the possibilities to implement the requirements of these directives in Lithuanian power and district heating sector;
- to propose strategy for the implementation of these directives in Lithuania;
- to define necessary investments for the implementation.

The methods applied: economic analysis and synthesis.

2. LCP DIRECTIVE AND ITS REQUIREMENTS

The LCP directive came into force on 27 November 2001 and amends Directive 88/609/EC, which regulated the emissions of large combustion plants. Adopted on 24 November 1988, the original directive aimed to gradually reduce annual emissions of SO₂ and NO_x from the existing plants and to lay down emission limit values for SO₂, NO_x and dust in the case of new plants. They are estimated to contribute approximately 63% of total SO₂ and 21% of total NO_x emissions in the EU. Large combustion plant means that its rated thermal input is equal to or greater than 50 MW, while combustion plant is defined as a stationary installation in which fuels are oxidised for the purpose of energy production. Among plants not covered by this directive are those powered by diesel, petrol and gas engines, as well as gas turbines used on offshore platforms and installations, where the combustion products are used directly in manufacturing processes. The new directive was conceived on 8 July 1998 when the EC submitted an initial proposal to increase the scope and severity of emission limit values. The initial proposal included recommendations for updating the emission limit values applicable to LCP licensed after 27 November 2002, these values being differentiated on the basis of the size of the installation and type of fuel used. The proposal recommended to extend the scope of the original directive to include gas turbines and to update the scope of fuels covered, including clarifying the relationship of the new directive with other directives that deal with waste incineration and addressing the use of biomass as sources of energy. Reinforcement of provisions concerning the monitoring of emissions, including those from existing installations, are in compliance with emission limit values.

Initially it was proposed not to include updating emission limits for plants licensed before 1 July 1987,

however, on 14 April 1999, at the first reading of the proposal, the European Parliament adopted 15 amendments. In particular, these were aimed at including pre-1987 plants within the scope of the directive, since this category of plants emits substantial amounts of SO₂. It was decided that although the original directive had imposed national ceilings on total emissions from this type of plant, existing plants were expected to continue to emit considerable amounts of SO₂ and NO_x. It was evaluated that without the provisions of the proposed directive mentioned above, the existing plants were likely to be responsible for about 44% of total sulphur dioxide emissions and 12% of NO_x emissions until at least 2010 [10].

During several years European Parliament and the Commission were unable to agree on the final text following a second reading of the proposed directive on 14 March 2001. Finally, an agreement was reached on the main issue being the question of whether further reductions of NO_x from the use of solid fuels should be included.

According to the LCP, the existing plants may be exempt from obligations concerning new emission standards if they undertake, via written declaration to the relevant body before 30 June 2004, not to operate the plant for more than 20 thousand operational hours between 1 January 2008 and 31 December 2015. Further, plants with a rated thermal output of 400 MW, that do not operate more than either 2 thousand hours a year until 31 December 2015, or 500 hours a year from 1 January 2016, will be subject to a more generous limit value for SO₂ emissions of 800 mg/Nm³.

By 31 December 2004, the EC must submit a report, which will conclude whether further measures are necessary, cost effectiveness and advantages of further emissions reductions; the effect of the emission limits set and the competitiveness of the energy market and national emission reduction plans.

3. SULPHUR DIRECTIVE AND ITS REQUIREMENTS

The main requirement of this directive is to ensure that from 1 January 2003 the heavy fuel oil (HFO) used within territories of EU Member States does not exceed the sulphur content of 1.00% by mass.

- Requirements for gas oils, including marine gas oils, are not to exceed their sulphur content of 0.20% by mass from 1 July 2000,
- of 0.10% by mass from 1 January 2008.

There are a few exemptions, which can be applied according to the Directive:

1. If provided that the air quality standards for sulphur dioxide laid down in Directive 80/779/

EEC(10) are respected and the emissions do not contribute to critical loads being exceeded in any Member State; a Member State may authorise heavy fuel oils with a sulphur content between 1.00 and 3.00% to be used in its territory.

2. Subject to appropriate monitoring of emissions by competent authorities, the requirement not to exceed the sulphur content of 1.00% shall not apply to heavy fuel oils used:

a) in combustion plants which fall within the scope of Directive 88/609/EEC, which are considered new plants and which comply with the sulphur dioxide emission limits for such plants set out in Article 4 of and Annex IV to that Directive;

b) in other combustion plants, which do not fall under the scope of (a), where the emissions of sulphur dioxide from the plant are less than or equal to 1700 mg/Nm³ at an oxygen content in the flue gas of 3% by volume on a dry basis;

c) for combustion in refineries, where the monthly average of emissions of sulphur dioxide averaged over all plants in the refinery, irrespective of the type of fuel used, shall not exceed 1700 mg/Nm³.

Member States shall take the necessary measures to ensure that any combustion plant using heavy fuel oil with a sulphur concentration higher than 1% shall not be operated without a permit issued by a competent authority, which specifies the emission limits.

The provisions of the Sulphur Directive have in Lithuania been transposed into Decree No. 438/268/266. The implementation strategy will ensure compliance with this decree approved by Ministers of Environment, Economy and Transport on 31 August 2001, as well as with the Large Combustion Plant Directive of 2001.

4. IMPLEMENTATION OF LCP AND SULPHUR DIRECTIVES IN LITHUANIA

The effect of implementing Council Directive 1999/32/EC is tightly related with the implementation of LCP Directive 88/609/EEC and its amendment, Directive 2001/80/EC, not only because the exemptions defined in Directive 1999/32/EEC refer to the LCP Directive. The main issue is that sulphur content in HFO is directly related to the limitations of sulphur dioxide emissions laid for large combustion plants in LCP Directive. Figure presents average SO₂ concentrations at an oxygen content in the flue gas of 3% by volume on a dry basis, calculated according to sulphur content in the HFO and taking into account the efficiency of boilers and the calorific value of HFO as well [4].

For example, the sulphur content of 1% enables to comply with EU requirements for SO₂ emission

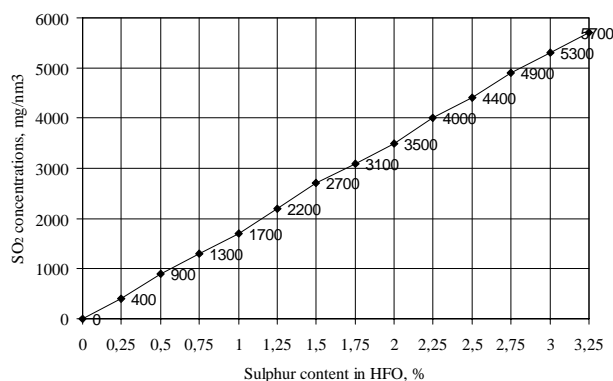


Figure. Emissions of sulphur dioxide from the plant at an oxygen content in the flue gas of 3% by volume on a dry basis calculated according to sulphur content in HFO

limits for new large combustion sources with the capacity higher than 50–300 MW.

Seeking to apply exemptions of Directive 1999/32/EC for combustion plants falling within the scope of LCP Directive, which are considered new plants and which comply with the sulphur dioxide emission limits for such plants set out in Article 4 of and Annex IV to that Directive, it is necessary to compare the limits of Lithuanian emissions with those set in the Directive.

In 1996, when the Government of Lithuania approved normative values for emissions from steam and water heating boilers, the pollution norms of EC were taken as a basis. The new, stricter standards were introduced since January 1996 and amended in 1998 by adopting LAND 12–98 for the marginal values of pollutant concentrations in flue gases of stationary combustion sources.

Limitation of emissions from large combustion plants approved by the Decree No. 468 of 28 September 2001 of the Minister of Environment sets the standards for pollutants emitted from stationary combustion sources with a thermal input of 50 MW or more. A large number of the requirements of the Directive 88/609/EEC and Common Position (EC) No 52/2000 on amending this Directive with a new one (Directive 2001/80/EC) have been transposed by this legal act. Limitations of emissions from combustion plants (hereinafter LAND 43–2001), approved by the same Order No. 468 of 28 September 2001 of the Ministry of Environment of the Republic of Lithuania, sets the standards for pollutants emitted from stationary combustion sources with a thermal input from 0.12 to 50 MW.

The part of the Decree that is relevant for large combustion plants prescribes that from 1 January 2004 it will no longer be allowed to use HFO with a sulphur content exceeding 1%, unless the emissions of SO₂ are kept below 1700 mg/Nm³. It is possible to comply with this emission requirement,

if HFO with a sulphur content exceeding 1% is co-combusted with either natural gas or with biomass. Thus, HFO (with a sulphur content 2.2% can be used by LCPs, if it is co-combusted with at least 55% of natural gas or 55% of biomass (in terms of energy input). In this case, the concentration of SO₂ in the flue gas will be kept below 1700 mg/Nm³. Similarly, orimulsion should be co-combusted with at least 75% of natural gas. The requirements on use of HFO prescribed in EU-Directive 1999/32/EC are transposed to Decree No. 438/268/266. Article 3 of the Directive concerns the use of HFO.

For the group of the existing large combustion plants, Lithuania can choose either to comply with individual emission limit values for each and all plants, or to comply with requirements for a common emission ceiling for all existing large combustion plants (refer paragraphs 1, 3 and 6 of Article 4 of the text of the Directive). The required reduction in emissions from existing large plants should be obtained by 1 January 2008 at the latest.

The two alternative requirements (individual emission limit values and common emission ceiling) are summarised below.

Alternative 1 – individual emission limit values. Each and all plants shall comply with the emission limit values presented in Table 1.

Plant size (MW thermal input)	SO ₂ emissions (mg/Nm ³)		NO _x emissions (mg/Nm ³)		Dust emissions (mg/Nm ³)	
	HFO	Natural gas	HFO	Natural gas	HFO	Natural gas
50–300	1700	35	450	300	50	5
300–500	1700–400 (linear decreasing)					
> 500	400		400	200		

For multi-firing units, the emission limit value shall be determined as a fuel-weighted emission limit (for each fuel, the above individual emission limit is multiplied by the thermal input from the concerned fuel, and these figures are subsequently summed up and divided from the total thermal input delivered by all fuels).

Alternative 2 – to comply with LCP requirements – is the common emission ceiling. The common emission ceiling is calculated as the emission level (sum of individual plant emissions) that would have been achieved by applying the above-mentioned individual emission limit values to the existing plants in operation. The emissions will be calculated on

the basis of each plant's actual annual operating time, fuel used and thermal input, averaged over the last five years of operation up to and including 2000. It was foreseen to be less costly to comply with a common emission ceiling for NO_x than to comply with individual plant requirements for NO_x.

Compliance with the common emission ceiling will make it possible to a certain extent to continue the use of HFO by co-combusting HFO (with a sulphur content higher than 1%) with natural gas or biomass. Such co-combustion will not be possible if individual plant requirements were to comply with. But, on the other hand, compliance with the common emission ceiling will force all LCP to reduce significantly HFO consumption (up to 10% in co-combusting with natural gas) or to switch completely to natural gas [6], because the national emission ceilings are set on the basis of the fuel used and the thermal input averaged over the last five years of operation up to and including 2000. Since 1996 energy consumption was very low because of economic crisis in Lithuania, all power plants were run on a very low capacity and the share of nuclear power made more than 80% of all electricity produced in Lithuania. When the economy will recover and the Ignalina NPP will be closed (unit 1 up to 2005 and unit 2 up to 2010), it would

be very problematic for Lithuania to maintain these emission ceilings from LCP set on the basis of the years 1996–2000. Moreover, an exact calculation of the ceilings as per the Directive should await the issuing of a guidance document on the preparation of national emission reduction plans for large combustion plants. The guidance document was issued by the European Commission in 2002.

So, for the implementation of LCP in Lithuania, in the implementation strategy it is suggested

to reach the compliance with individual emission requirements [4]. The alternative has been selected, because the LCP with a capacity lower than 300 MW will be allowed to keep the same SO₂ value (1700 mg/m³ after 2008) and no more investments will be needed. Only the largest power plants will need to install flue gas desulphurisation in order to burn HFO. Besides, this pollution control method is well known and has been used in Lithuania since 1993, and it requires less institutional capacities to monitor emissions as compared to national emission ceilings.

Table below is included in order to illustrate the extent of the emissions from large combus-

Pollutant:	Emissions in 1990			Emissions in 1999			National emission ceiling in 2010 according to Gothenburg Protocol
	From LCP	Stationary sources	Total for Lithuania	From LCP	Stationary sources	Total for Lithuania	Total for Lithuania
SO ₂ (tonnes per year)	107,244	213,000	222,000	46,017	68,900	70,000	145,000
NO _x (tonnes per year)	27,947	77,000	158,000	9,865	22,000	54,000	110,000
CO ₂ equivalent (thousand tonnes)			42,800	4,500	14,300	17,900	n.a.

tion plants in relation to the total emissions in Lithuania [3].

5. KYOTO PROTOCOL REQUIREMENTS

The two EU directives described above and dealt with in the present project concern the emissions to the air of SO₂, NO_x and dust, while the Convention on Climate Change concerns the emission of greenhouse gases (GHG). Considerations of the Convention on Climate Change are included in the present project, because upgrading of the large combustion plants to comply with the two EU directives may have a great effect on the emission of CO₂. As an example, conversion of an existing boiler to operate on biomass instead of HFO might be considered. This could not only reduce emissions of SO₂, NO_x and dust, but it would also eliminate the emissions of CO₂.

Countries that signed the Convention on Climate Change agreed upon the Kyoto Protocol in 1997. Lithuania signed the protocol in 1998 and has thereby committed itself to reduce the emission of GHG in 2008–12 by 8% compared to the 1990-level of emissions. It should be noted that the Kyoto Protocol has not yet been ratified. Ratification of the Kyoto Protocol requires that 55% of the parties or parties responsible for 55% of the GHG emissions ratify the protocol. This is currently not the situation. Lithuania on 19 November 2002 ratified the protocol. The designation GHG comprises CO₂, CH₄, N₂O, HFCs, PFCs and SF₆. They are measured as CO₂ equivalents according to their global warming potentials as defined by IPCC. A

survey of the current emission of GHG in Lithuania compared with the Kyoto commitment is presented in Table 3 [6].

LUCF is an abbreviation of Land Use Change and Forestry. According to the Kyoto Protocol, emissions and removals of CO₂ by sinks from Land Use Change and Forestry (e.g., through afforestation and reforestation) are to be included in the national inventories of GHG emissions. However, agreement on the guidelines and rules on how to include – and to which extent – the removal of CO₂ by sinks has not yet been reached between the parties.

The EU-15 member states have made a burden-sharing agreement, which “overrules” the 15 countries’ individual Kyoto commitments. Instead of individual commitments, the EU-15 member states have as a whole accepted a reduction of 8%. Thus, some member states have accepted to undertake a larger reduction than 8%, while others will be allowed to reduce emissions by less than 8%. It is not considered likely that the burden-sharing agreement will be adjusted in connection with negotiations with accession countries. Therefore, it is expected that Lithuania will have to comply with its Kyoto commitment of reducing greenhouse gases by 8%.

Table 3. Commitments and emissions according to 1st National Communication and Inventory 2000

	Aggregate (CO ₂ equivalent) emissions excl. LUCF*		Aggregate (CO ₂ equivalent) emissions incl. LUCF*	
	Mton	% of base-year	Mton	% of base-year
Base year, 1990	51.458	100	42.700	100
Kyoto commitment, 2008–12	48.970	92	39.284	92
Emissions, 1998	23.851	46	31.563	74

The Framework Convention on Climate Change was ratified by the Parliament of Lithuania in 1995. Countries signing the Convention should prepare national or regional strategies for the reduction of greenhouse gas emissions. Lithuania has prepared the National Strategy in 1996, as well as the First National Communication on Climate Change in 1998. In the National Climate Change Strategy, some steps were foreseen for improving the integration of Lithuania into the climate change regulation process. The steps are to improve data collection, to continue inventory of greenhouse gas emissions, to compare data received during the emission inventory with data from other studies, etc. Further, the strategy describes how the economy of the country would be affected by the climate change and greenhouse gas emissions and what measures could be implemented for the climate change mitigation.

In 1998, the First National Communication on Climate Change was prepared, and it was based on the approved National Implementation Strategy of the United Nations Framework Convention on Climate Change [5]. The projections for greenhouse gas emissions by 2000 and 2010 have been based on "Projections of Economic Development in the Republic of Lithuania" prepared by the Ministry of Economy. The Communication states that the National Implementation Strategy of the Convention on Climate Change is the first step in evaluating the country's impact on the climate change, in adapting to it, and in foreseeing means and measures for climate change mitigation. In future, when new information on climate change is acquired, the national program should be revised and enhanced.

6. FINANCING PLAN FOR IMPLEMENTATION OF LCP AND SULPHUR DIRECTIVE

These two directives should be taken into account together when preparing the implementation strategy, because their requirements are inter related and they supplement each other. The financing plan encompasses measures necessary for the implementation of both directives.

There are about 40 LCP in operation and about 680 small and medium combustion plants heaving licences for the emissions. It was proposed to identify the LCP that will not operate for more than 20000 hours starting 1 January 2008. The plants may be exempted from compliance with the emission limit values. It is also necessary to evaluate the expected energy demand and possibilities to reduce authorized capacities of existing plants in order to be subjected to a lower thermal rating.

As from 1 January 2004 all plants will only be allowed to use 1% S HFO or co-combust 2.2% S

HFO with at least 55% biomass or natural gas (based on energy input), the plants that have no access to natural gas need to be converted to biomass or connected to a gas pipeline.

At present, the following large combustion plants have no access to natural gas: Druskininkai BH, Druskininkai, Raseiniai BH, Raseiniai, Rokiškis BH, Rokiškis, Varėna BH, Varėna, JSC "Simega", Kupiškis, Mažeikiai BH, Mažeikiai CHP, Mažeikių Nafta, Beržė BH, Tauragė, Tauragė BH, Tauragė.

Evaluation of compliance costs based on forecast prices of gaseous, liquid and biomass fuels indicates the expediency to convert Raseiniai BH, Rokiškis BH, Varėna BH, JSC "Simega", Mažeikiai BH, Beržė BH to biomass. It is recommended to close Tauragė BH because energy supply from Beržė BH is sufficient to cover the demand in this region. The total investments needed for biomass conversion amount to 37.8 mill. LTL. These projects can be joined into one project and apply for ISPA funding, because 5 mill. EUR is required per project to be eligible for ISPA funding. The detailed investments needed for boiler conversion to burn wood waste were evaluated in study [4] and are presented in the financing plan (Table 4).

The Ignalina NPP BH and Druskininkai BH should be connected to natural gas up to 01 January 2004 and should be able to co-combust HFO with natural gas. Total investments needed for boiler conversion to natural gas are evaluated at 7 mill. LTL and for gas pipeline construction 78 mill. LTL. The detailed split of investments needed is presented in the financing plan (Table 4). Conversion to natural gas will increase the costs of energy production by 1.2–3.3% (0.5 ct/kWh).

The Mažeikiai CHP and Mažeikių Nafta would also be connected to the gas pipeline by 2005–2006, and in the case of joining these large combustion plants into one complex it would be allowed to maintain the common emission limit value of 1000 mg/Nm³ from 1 January 2008 by co-combusting HFO with natural gas for the Refinery own needs. Mažeikiai CHP conversion to use natural gas would require 20 mill. LTL and the pipeline construction to Mažeikiai 120 mill. LTL.

The largest power plants, such as Lithuanian PP, Vilnius CHP-3 and Kaunas CHP (those with thermal input higher than 500 MW) need flue gas desulphurisation to be installed so as to comply with the requirements of Directive 2001/80/EC on LCP since 01 January 2008 and to be able to burn high sulphur liquid fuels. In other case, they will be allowed to burn only natural gas since 1 January 2008. The investments needed for FGD, electrostatic precipitator and low NO_x burners installation in Kaunas and Vilnius CHP would require about 180 mill. LTL.

Table 4. Financing plan for compliance with the LCP Directive 2001/80/EC and Sulphur Directive no 1999/32/EC, mill. LTL

Upgrade to be implemented	Investments needed up to 01.01.2004		Investment needed up to 01.01.2008		Total
	LCPP	Gas pipeline	LCCP	Gas pipeline	
Boilers and CHP connected to natural gas pipelines	Negligible				
Ignalina NPP BH connection to gas pipeline	5	70			75
Druskininkai BH connection to gas pipeline in Belarus	2	8			10
Mažeikiai CHP connection to gas pipeline	20	120			140
Raseiniai BH partial conversion to biomass	4.2				4.2
Varėna BH partial conversion to biomass	5.4				5.4
JSC "Simega" in Kupiškis partial conversion to biomass	3.6				3.6
Mažeikiai BH partial conversion to biomass	14.4				14.4
Beržė BH partial conversion to biomass	6				6
Rokiškis BH partial conversion to biomass	4.2				4.2
Lithuanian TPP flue gas desulphurisation			525.5		525.5
Low NOx burners at Lithuanian TPP			44		44
Vilnius CHP flue gas desulphurisation and low NOx burners			100		100
Kaunas CHP flue gas desulphurisation and low NOx burners			80		80
Monitoring equipment	11				
Underground gas storage				600	600
Residue hydrotreating units at Mažeikių Nafta for HFO desulphurisation			1720		1720
Total	75.8	198	2469.5	600	3343.3
Total without hydrotreating units at Mažeikių Nafta	75.8	198	749.5	600	1623.3

Implementation of desulphurization processes in Vilnius CHP-3 and Kaunas CHP will increase the costs of energy production by 6–8%.

Installation of FGD and electrostatic precipitators in Lithuanian TPP would require 525.5 mill. LTL. Additional investments of about 44 mill. LTL will be needed for the installation of low NOx burners at Lithuanian TPP. The costs of energy production related to installation of FGD units in Lithuanian PP will rise by 7–9% (0.8–1 ct/kWh) in the case of orimulsion firing and 1.3–1.5 ct/kWh for HFO.

For monitoring equipment in order to comply with Directive 2001/80/EC requirements, 11 mill. LTL will be needed.

To ensure the security of energy supply, installation of underground natural gas storage is needed. Total investments needed are about 600 mill. LTL. For the diversification of fuel supply, as an alternative installation of residue hydrotreating units for HFO desulphurisation at Mažeikių Nafta can be considered seeking to ensure utilization of 1% S HFO produced at Mažeikių Nafta in Lithuania. The investments needed would amount to 1360 mill. LTL. The forecast of about 800,000 t of 1% S HFO

annual consumption is calculated since 2008 in Lithuania.

The total investments needed to comply with Directives 2001/80/EC and 1999/32/EC would make **from 1.6 to 3.4 billion LTL** depending on whether the investments for residue hydrotreating units at Mažeikių Nafta for HFO desulphurisation are included or not. A detailed financing plan for the implementation of the projects related to the implementation of Directives 2001/80/EC and 1999/32/EC is presented in Table 4 [4].

7. CONCLUSIONS

- The implementation strategy of LCP and Sulphur directives should be considered as a guideline for rehabilitation and/or change in the use of fuel at individual plants, enabling compliance with future requirements to the emissions to the air from large combustion plants in Lithuania.

- It is proposed in implementation strategy to comply with individual emission requirements set by LCP directive. This alternative has been selected, because the LCP with the capacity lower than 300 MW will be allowed to keep the same SO₂ value

– 1700 mg/m³ after 2008, and no more investments will be needed. Only the largest power plants will need to install flue gas desulphurisation in order to burn HFO. Compliance with the common emission ceiling will force all LCP to reduce significantly HFO consumption (up to 10% in co-combustion with natural gas) or to switch completely to natural gas.

- The implementation strategy is prepared based on a set of preconditions, including scenarios for the development of the heat and power sector. Local conditions as well as the actual development of the heat and power sector may diverge from the preconditions set out in the implementation plan. For this reason, implementation of the plant upgrades should be subject to an analysis of local conditions as well as an updated evaluation of the validity of the preconditions applied in the current project.

- UNFCCC was ratified by Lithuania in 1995 and the Kyoto Protocol to UNFCCC was signed in 1998. Signing the Kyoto Protocol to UNFCCC, Lithuania committed itself to reduce the GHG emissions in 2008–2012 by 8% compared to the 1990 emission level. The UNFCCC National Implementation strategy was adopted in 1996. Lithuanian obligations under the Kyoto Protocol are 39 284 Mt. The actual emission in 1998 was 31.6 Mt and made up to 74% of the 1990 level. Implementation of EU Directives and Kyoto commitments should be evaluated together for electricity and district heating sectors.

- A review of the national ISPA strategy of the environmental sector is necessary in order to provide the financial source for the projects related to the implementation of the Council Directives 2001/80/EC and 1999/32/EC, aiming to reduce air pollution. Up to now, there are no projects for ISPA funding. The proposals and the implementation plan of the relevant directives should serve for the strengthening of project pipeline management in air sector by identifying and prioritizing projects for ISPA funding in power and heat sector.

- The main way to comply with sulphur directive requirements for small combustion plants is fuel conversion from high sulphur HFO to biomass. Biomass resources for energy production amount to about 0.31 mill. t of forestry residues and 0.25 mill. t of waste from wood industry. Maximal demand of biomass fuel for energy production is estimated by 0.18 mill. t per year after 2004. The regulation for supply of wood waste fuel for energy production is needed to ensure steady long-term contracts for wood waste fuel and stability of its price.

- The total investments needed to comply with directives 2001/80/EC and 1999/32/EC would make **from 1.6 to 3.3 billion LTL** depending on whether the investments for residue hydrotreating units at

Mažeikių Nafta for HFO desulphurisation are included or not.

- Lithuanian energy and power sector policy fully corresponds to EU policy. The main requirements for power sector development in Lithuania are imposed by environmental requirements of signed international conventions in the field of air pollution and EU environmental directives. Lithuanian Energy Strategy reflects the main targets of the State and directions of their implementation by modernizing the energy sector, keeping it all-round in line with the growing State demand and the most recent international requirements in aspects of efficiency, reliability, environmental and management improvement.

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EUROPOS SAJUNGOS APLINKOSAUGINIŲ DIREKTYVŲ IR KIOTO PROTOKOLO REIKALAVIMŲ ĮGYVENDINIMAS LIETUVOS ELEKTROS IR CENTRALIZUOTO ŠILUMOS TIEKIMO SEKTORIUOSE

S a n t r a u k a

Straipsnio tikslas – parengti įgyvendinimo strategiją bei įvertinti būtinas investicijas Europos Sąjungos (ES) Tarybos

direktyvų 88/609/EEC ir 2001/80/EC „Dėl tam tikrų teršalų, išmetamų iš didelių kurą deginančių įmonių (DKDI), ribojimo“ bei ES Tarybos direktyvos 1999/32/EC „Dėl sieros kiekio mažinimo tam tikrų rūšių skystame kure“ reikalavimams įgyvendinti.

Siekiant nustatyti (88/609/EEC ir 2001/80/EC) direktyvų įgyvendinimo sąnaudas, siūloma vietoj ribinės bendrosios taršos skaičiavimo, kaip siūlyta kitose studijose [2, 3], taikyti išlakų ribojimo reikalavimus pavieniams įrenginiams. Pirmiausia todėl, kad Lietuvoje daugelis DKDI, kurių galia yra mažesnė nei 300 MW, ir toliau be jokių papildomų investicijų degins mazutą su gamtinėmis dujomis ar biokuru tuo pačiu santykiu ir neviršys SO₂ emisijų – 1700 mg/Nm³ reikalavimo. Be to, ribinė bendroji tarša skaičiuojama, remiantis kiekvieno 2000 m. veikusio įrenginio faktiniais duomenimis dėl darbo valandų, šiluminio galingumo (nominalaus) ir deginamo kuro, naudojant pastarųjų 5 metų iki 2000 m. imtinai duomenų vidurkius. Iš principo neteisinga direktyvoje nurodomas 1996–2000 m. energijos gamybos sąlygas Lietuvoje pritaikyti rezultatams dėl išlakų pasiekti 2010 m., nes uždarius Ignalinos AE, bus visai kitokia energijos gamybos struktūra [3].

Darbe pateiktos rekomendacijos ir įvertintos investicijos kiekvienai iš 40 DKDI minėtų direktyvų reikalavimams įgyvendinti. Rekomendacijos apima kelias alternatyvas priklausomai nuo kuro rūšių naudojimo. Pirmiausia įvertintos investicijos, reikalingos DKDI, kurios nėra prijungtos prie dujų tinklų, t. y. Ignalinos katilinei, Druskininkų katilinei, Raseinių katilinei, Varėnos katilinei, UAB „Simega“, Mažeikių katilinei, Mažeikių TE, „Mažeikių naftai“, Rokiškio katilinei, Beržės katilinei bei Tauragės katilinei (pastarąją rekomenduojama uždaryti). Joms siūlomi 3 variantai: prijungimas prie dujotiekio tinklų, o nuošaliau nuo dujotiekio esančioms DKDI siūloma deginti medieną arba mažai sieringą mazutą.

Įvertintas investicijų poreikis šalies mastu: apskaičiuotos investicijos, reikalingos DKDI katilų konversijai deginti biokurą bei DKDI pritaikymui deginti dujas, įtrauktos sąnaudos, reikalingos didžiausių elektrinių nusierinimo įrangai įdiegti, siekiant palaikyti jų normalų darbą, deginant mazutą, jeigu dėl kokių nors priežasčių sutriktų dujų tiekimas iš vienintelio šaltinio. Taip pat įvertintos sąnaudos, reikalingos dujotiekiams tiesti bei Vaškų požeminei dujų saugyklai, mazuto nusierinimo įrenginiams įmonėje „Mažeikių nafta“ statyti.

Raktažodžiai: DKDI direktyva, sieros ribojimo kure direktyva, Kioto protokolas

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ВНЕДРЕНИЕ ДИРЕКТИВ ЕВРОПЕЙСКОГО СОЮЗА ПО ОХРАНЕ ОКРУЖАЮЩЕЙ СРЕДЫ И КИОТОВСКОГО ПРОТОКОЛА В ЭЛЕКТРО- И ТЕПЛОСНАБЖЕНИИ ЛИТВЫ

Резюме

Цель данной статьи – представить стратегию и оценить инвестиции, необходимые для внедрения директив Европейского Союза (ЕС) 88/609/ЕЕС (По нормированию выбросов из крупных топливосжигающих источников (КТИ)) и 1999/32/ЕЕС (По нормированию количества серы в жидком топливе).

В статье предлагается для расчета издержек, обусловленных внедрением вышеназванных директив, вместо нормирования общих выбросов из КТИ применять метод нормирования индивидуальных выбросов. Это рекомендуется, прежде всего, потому, что в Литве КТИ, мощность которых в настоящее время не превышает 300 МВт, и в будущем без каких-либо дополнительных инвестиций смогут сжигать серистое жидкое топливо вместе с природным газом или биомассой, не превышая при этом норму, установленную для такого вида источников директивой ЕС, – 1700 мг/Нм³. Кроме того, согласно директиве ЕС, нормы общих выбросов устанавливаются на основе фактических данных о работе каждого источника, зарегистрированного в 2000 г. Для расчета норм используются усредненные данные о фактическом сжигании топлива, времени использования мощностей и номинальной тепловой мощности КТИ за 5 лет (1996–2000 гг.). В принципе для Литвы это некорректно, потому что низкий уровень выбросов в эти годы был обусловлен снижением использования энергии в условиях экономического кризиса. В то время в Литве все КТИ работали с пониженной мощностью и более чем 80% электричества в Литве производилось на Игналинской атомной электростанции.

В статье представлены рекомендации для 40 КТИ Литвы (>50 МВт) и рассчитаны инвестиции, которые потребует внедрение этих рекомендаций в отношении КТИ, не подсоединенных к системам газоснабжения. Показаны три возможности: присоединение к газопроводу, переход на сжигание биомассы или малосеристого мазута (S < 1%).

Ключевые слова: директива КТИ, директива по нормированию количества серы в топливе, Киотовский протокол