INDUSTRIAL ENERGY EFFICIENCY

DEVELOPMENT OF INDUSTRIAL ENERGY EFFICIENCY IN LATVIA, LEGISLATION AND STATISTICS

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ABSTRACT

This article analyzes the legislation of the Republic of Latvia and available statistical data about industrial energy efficiency. The European legislation in the sector of industrial energy efficiency is reviewed and compared to the Latvian legislation. LR and EU statistics is summarized, data of OECD countries in respect of energy consumption by industries and savings estimates are informatively reviewed. Latvian industrial energy efficiency scenarios are estimated based on EU and OECD studies. Recommendations include the need for a more detailed analysis of data on industrial energy consumption by sectors, strategic choice of a best available technology (BAT) development scenario; and the need for support measures in the SME sector.

Key words: industrial energy efficiency, industrial statistics, legislation in energy efficiency

INTRODUCTION

This article is devoted to the manufacturing industries, not including construction industry. The data collection methodology includes collection of data from the Central Statistical Bureau (hereinafter – CSB) with required indicators, however, in cases when CSB statistical data are collected under a joint sector "Industry and Construction", they are shown together. Market influence, energy efficiency incentives; availability of funding, energy consumption benchmarks, energy price increase dynamics, CO_2 saving and balances and other factors available in studies of the Ministry of Economy and other sources, as well as in state reports are beyond the scope of this article. Measures performed within the CCFI state support programme and their impact on energy efficiency in industries are analyzed in the article "Energy Consumption and its Decrease Potential in Industry Sectors", authors A. Kursiša, L. Gleizde.

EUROPEAN LEGISLATION ON ENERGY EFFICIENCY IN INDUSTRIES

The most topical document describing and determining energy efficiency measures binding for industrial companies currently is Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, hereinafter – the Directive. The Directive supports 20% primary energy saving (p.(2)) by 2020, and to perform further measures (p.(7)) to achieve these targets. Furthermore, Paragraph 56 provides that "*Directive 2006/32/EC requires Member States to adopt, and aim to achieve, an overall national indicative energy savings target of **9%** by 2016, to be reached by deploying energy services and other energy efficiency improvement measures.*" Paragraphs referring to the industrial sector determining measures for enterprises in general *"2. Member States shall develop programmes to encourage SMEs to undergo energy audits and the subsequent implementation of the recommendations from these audits. 4. Member States shall ensure that enterprises that are not SMEs are subject to an energy audit carried out in an independent and cost-effective manner by qualified and/or accredited experts or implemented and supervised by independent authorities under national legislation by 5 December 2015 and at least every four years from the date of the previous energy audit.*" (Directive 2012/27/EU of the European Parliament and of the Council, Article 8 Energy audits and energy management systems, p.(2), p.(4))

Article 1(2) provides that "*The requirements laid down in this Directive are minimum requirements and shall not prevent any Member State from maintaining or introducing more stringent measures. Such measures shall be compatible with Union law. Where national legislation provides for more stringent measures, the Member State shall notify such legislation to the Commission."* (Directive 2012/27/EU of the European Parliament and of the Council, Article 1 Energy audits and energy management systems, p.(2))

Directive implementation deadlines by sections are defined, in some cases allowing Member States to define them individually, however in compliance with the provisions of the Directive.

LATVIAN LEGISLATION IN ENERGY EFFICIENCY SECTOR

In Latvia, energy efficiency directions in general and by sector are defined by documents of the European Commission, and subsequently adopted laws of the Republic of Latvia and Regulations of the Cabinet of Ministers.

In this article we note only those documents that directly refer to energy efficiency in industrial sectors, focusing more on manufacturing industry.

Law on Energy Efficiency of Buildings

The Law on Energy Efficiency of Buildings, in force since 06.12.2012, reviews issues related to buildings, the building envelope, and high efficiency engineering systems in buildings.

Section 3 provides that "*Minimum requirements of energy efficiency are applicable to buildings to be reconstructed or to be renovated, if: 1) the design documentation for reconstruction applies to more than 25 percent of the surface of the building envelope; 2) a reconstruction or renovation of utilities of the building is performed.*"

Section 5 defines high efficiency systems, the description of which is largely applicable also to industrial buildings and objects, and they are also a component of energy efficiency specification:

(1) When designing buildings, the possibility to use the below mentioned high efficiency systems must be evaluated: 1) decentralized energy supply systems using renewable energy resources;

2) cogeneration systems for simultaneous generation of heat energy and electric energy or mechanical energy; 3) systems using heat pumps that transfer heat from its natural environment to buildings or utilities of buildings by changing natural heat flow; 4) centralized heat supply or centralized cooling systems, especially those using renewable energy resources, and which are used for several buildings or territories by transferring energy from the central energy generation source.

(2) If it is planned to reconstruct or renovate the utilities of buildings, the possibilities of use of the high efficiency systems must be evaluated.

In an ideal situation, such reconstruction must be applicable in any case, when plant management plans any renovation works, even more in the case, if energy efficiency is the only and primary objective of the works.

Regulations on industrial energy audit

Regulations on industrial energy audit (Draft, version of 08.11.2012.) are made as a support document for the successful implementation of the Directive in respect of industrial energy audit, and defines: "*1.2. requirements for the performance of industrial energy audits set in respect of legal entities;*

1.3. significant requirements to the evaluation of compliance of an industrial energy auditor and a mechanism of surveillance of observance of these requirements;

1.4. responsibility of an industrial energy auditor."

This draft legislation, in the context of the Directive, refers to large enterprises, and energy auditors who will perform audits in large enterprises. Audits and industrial audits of SMEs may be performed voluntarily, this draft legislation does not envisage any state support mechanism or quality control for them. With regard to the fact that "*the category of micro, small and medium-sized enterprises is made up of enterprises which employ less than 250 people and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million*" (Directive 2012/27/EU of the European Parliament and of the Council, Article 2, Definitions, p. (26)), there is a risk that such companies with high energy consumption, that is significant by Latvian standards, may stay outside the framework of enterprises to be audited, will not receive information about energy saving possibilities, thus not including energy efficiency measures in the plans of the enterprise, until forced to do so by the economic situation – tariffs or decrease of competitiveness.

STATISTICAL INDICATORS IN ENERGY EFFICIENCY IN COUNTRIES OF THE EUROPEAN UNION, OECD AND THE REPUBLIC OF LATVIA

One of the comparative indicators used in the European Union is **energy consumption of kg or ton of fuel equivalent (kg/T of oil equivalent) per 1000 EUR of gross domestic product (GDP)**. This indicator is closely related to the economic development, because it includes energy consumption not in manufacturing only, but also in the households, service and transport sector, as well as GDP growth.

LR document "On Guidelines for Energy Sector Development for 2007-2016", CM Order No.571 of 01.08.2006, Sec.4, provides that: "Energy intensity (The ratio between the total consumed amount of primary energy resources and the GDP unit, "On Guidelines for Energy Sector Development for 2007-2016", CM Order No. 571, 01.08.2006) in 2010, 2015 and 2020 shall reduce to 0.35, 0.28 and

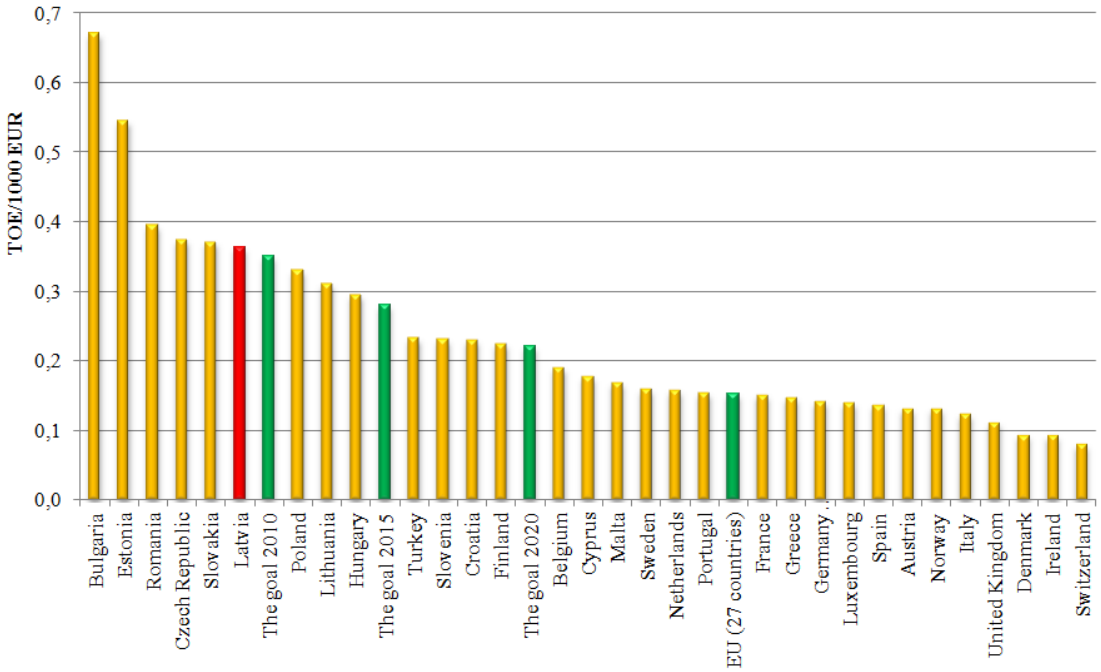


Figure 1. Energy use intensity in Europe and Latvia in 2010: country indicators, Latvian target indicators for 2010, 2015, 2020. Source: Eurostat

0.22 TOE/1000 EUR, respectively". In accordance with Eurostat data, Latvia showed 0.363 TOE/1000 EUR GDP in 2010 compared to the target index 0.350 TOE/1000 EUR GDP.

It shall be taken into account that Latvian statistics shows a negative GDP increase for the period from 2008 to 2010. In 2011 the GDP increase was 5.5%, in 2012 - 5%. The Ministry of Economy (Informative Report "On the Performance of Objectives Set in the Guidelines for Energy Sector Development for 2007-2016") forecasts a GDP increase of 4-5% per year till 2020. As far as energy consumption in the industrial sector is about 20% from the total energy consumption (2011), while industry in total makes 27% from GDP, the decrease in the energy intensity index depends on several factors:

- increase of GDP in general, incl. the industry sector;
- decrease in the energy consumption in the country in general, incl. the industry sector. Furthermore, households are significant energy consumers (32% in 2011, CSB), while they do not cause a GDP increase.

"Energy Efficiency Monitoring Report for 2011" prepared by the Ministry of Economics in 2012 provides: "*In the time period from 2000 to 2007 GDP increased faster than energy consumption affected by the energy efficiency improvement both in energy generation and management, and in energy end consumption sectors. Positive example of other countries (Denmark) shows that countries with high energy efficiency may ensure a GDP increase while energy consumption remains unchanged.*" In Latvia, the negative line of development of energy intensity is also confirmed by statistics of the last years.

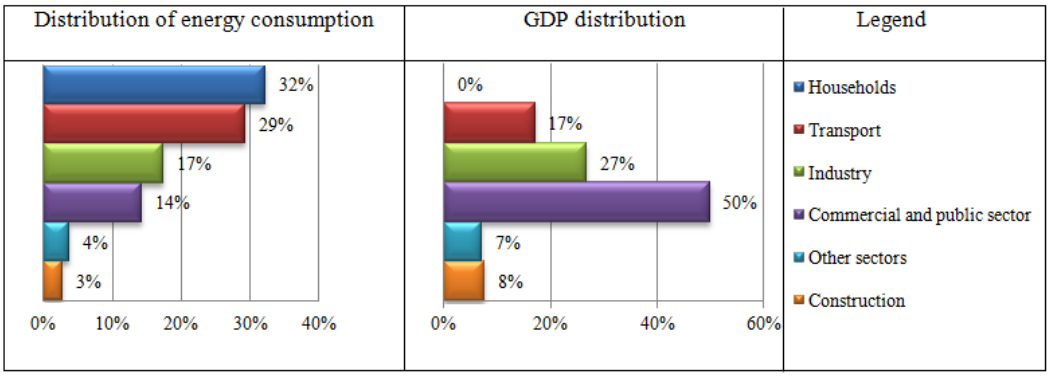


Figure 2. Distribution of energy resources consumption and GDP consumption in Latvia. (Source: CSB (2011))

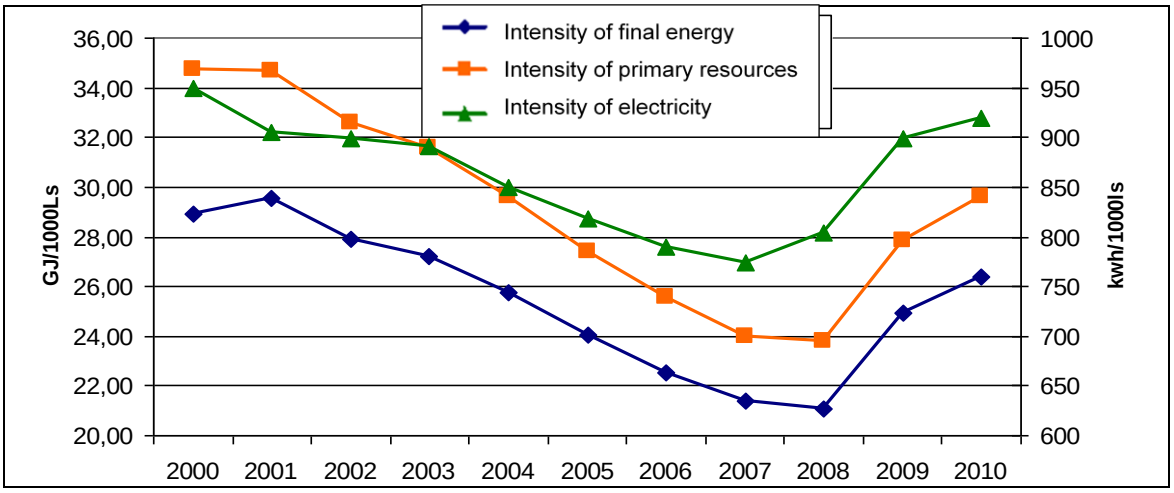


Figure 3. Changes in energy intensity indicators in Latvia in 2000-2010 (in prices of 2000). ("Energy Efficiency Monitoring Report for 2011", ME)

At the same time the total energy consumption of industry sectors increases. The Figure 4 shows that percentage of industrial energy consumption in the total energy consumption in 10 years has increased by 11%. The last 2 years showed an especially fast increase, showing that the percentage of the industry sector in the total energy consumption has a growing trend. Figure 5 shows the largest energy consumers in the industry sector. If we further review the development of these four sectors in the 5-year run (Figure 6), it is seen that the consumption in the "Manufacture of food and beverages" reduces with a minimum trend. The fastest increase in energy resources consumption is in the "Wood industry" having consumed 46% of all consumers of energy resources in the industry sector in 2011.

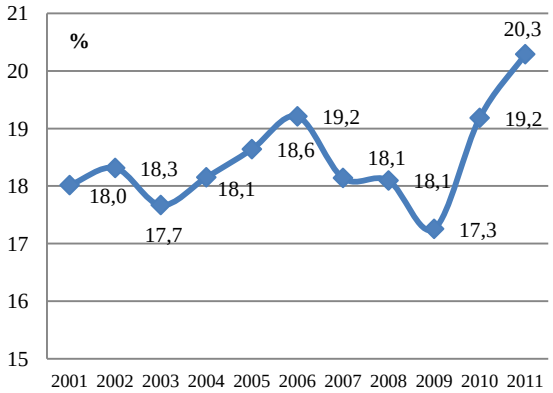


Figure 4. Energy consumption of industry sectors, % of the total consumption. (Source: CSB)

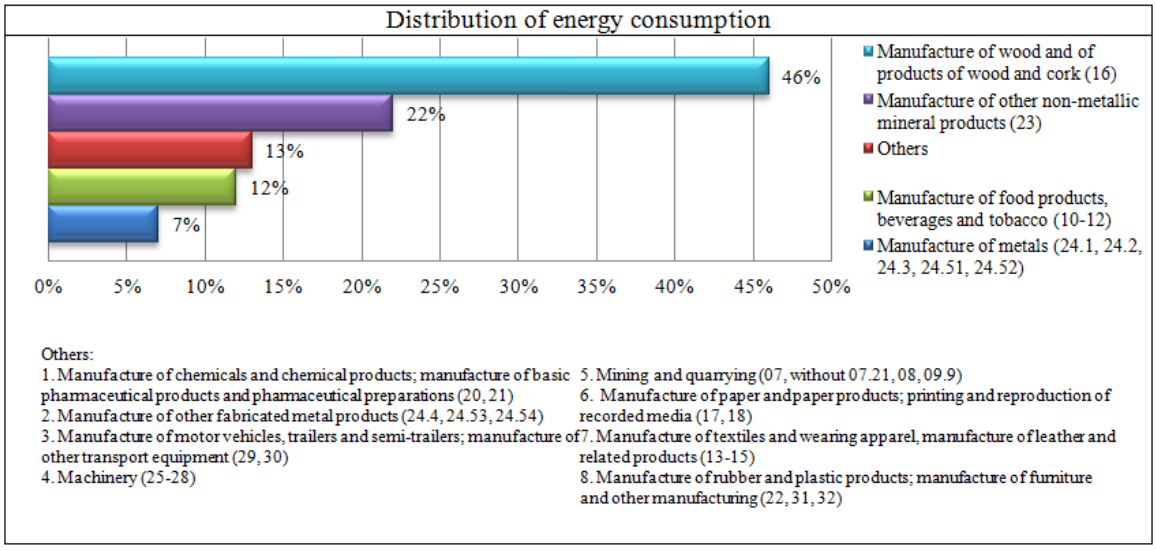


Figure 5. Most energy-intensive industry sectors according to NACE 2 code classification. (Source: CSB (2011))

Summarizing sector data (EM, Energy Efficiency Monitoring Report for 2011) on energy efficiency, ME concludes: *"...in the woodworking sector, the manufacturing of products, including for export, is done with comparatively low energy efficiency.*
Taking into account the high percentage of woodworking in the total energy consumption of industries, the total energy saving in industries has a minus sign, or there were no energy savings in the industry sector. It should be noted that at the same time many sectors show a positive trend, such as food industry, light industry and machinery manufacturing. Energy efficiency measures implemented with a state support up to now were mostly directed to the improvement of energy efficiency of industrial buildings."
To perform a more detailed study of the relation between energy consumption and the development of industry sectors, we analyze the added value factor. The added value is "*A value an enterprise has added to purchased raw materials, materials, semi-finished products during the manufacturing of goods (or rendering of services). Δ is calculated by subtracting the value of purchased material resources used for manufacturing a product (or rendering a service) from the sales price of the product (or the service).*" Unfortunately, due to confidentiality issues, these data were not available about the metal industry sector. The data on 2011 shown in Figure 7 are estimates, they were not confirmed at the time of conducting this study. These data let conclude that in three sectors about which comparable data are available:

- in the sector of non-metal mineral products the energy consumption curve follows the added value curve;
- in the manufacture of food it was possible to reduce energy consumption at the same time maintaining a stably changing added value;

a negative trend is found in woodworking sector – on the background of 50% added value drop, the energy consumption from 2007 to 2011 had a double increase, i.e. – energy intensity per added value worsened four times in a short period of 5 years.

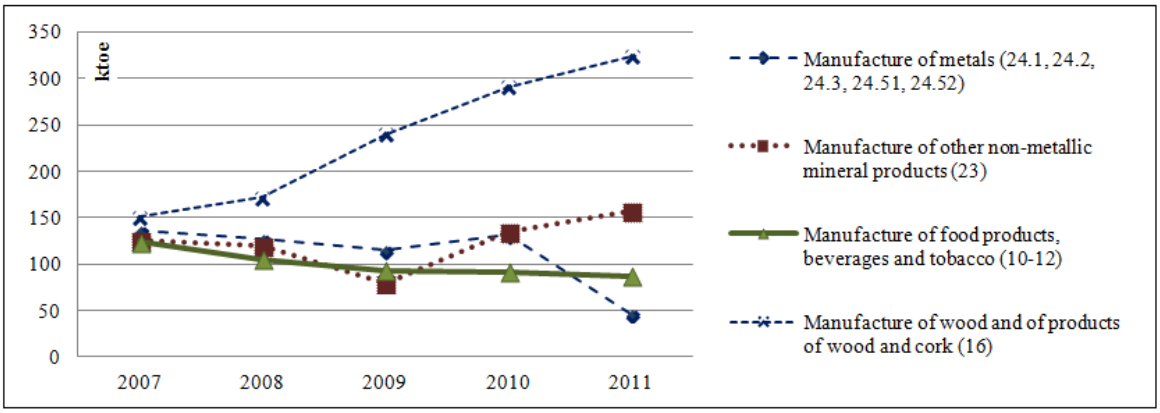


Figure 6. Changes in energy consumption in main industry sectors. (Source: CSB)

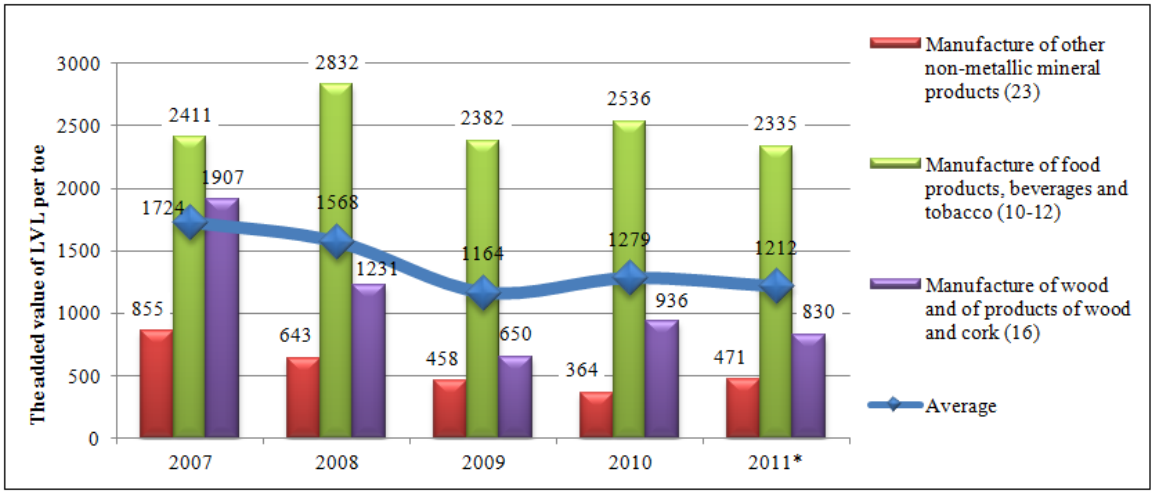


Figure 7. Added value created by main industry sectors per energy consumption unit. (Source: CSB)

The data summarized in Figure 8 show that the industries that have not achieved any energy saving are Manufacture of chemical products, Manufacture of non-metallic mineral products, and Manufacture of wood and products of wood, the latter being especially characterized by wastefulness of energy resources. The authors consider that part of this negative trend is formed by manufacture in non-heated, adjusted buildings, as well as energy Individual national industry structure, past development and expected industrial growth play major roles. A high achievement in the past relates to a low future potential, and vice versa. Good examples are Greece, Hungary and Latvia with a low potential". (Altmann M, Michalski J, Brenninkmeijer A, Tisserand P. 2010)

4 scenarios are modeled within the framework of this article: based on OECD study (Saygin D., Patel M.K., Gielen D. (2010)), and based on the summarized energy consumption in industries for 2011, and a conservatively accepted GDP increase of 4% ("Ministry of Economy forecasts a GDP increase of 4-5% per year by 2020, and 3-4% per year – by 2030" p.19, ME Report).

Energy efficiency is modelled based on OECD's estimated scenarios, EU research data (potential by 2020 >4%) are considered as a reference only.

resources required for driers that mainly consist of biomass – woodworking production residues with low market value. This sector needs special attention, because even if energy consumption is increased due to biomass, it has no economic character in respect of the abovementioned Added value factor.

REVIEW OF DEVELOPMENT SCENARIOS

In the Latvian state energy strategy, the energy consumption forecasts in industries are usually analyzed as a single factor – GDP increase curve, without any evaluation of energy efficiency. In reports of European and OECD countries, Latvian data are analyzed in a broader context. In general, the energy efficiency potential in industries by 2020 is evaluated below 4%, while in Europe it is above 6% (Altmann M, Michalski J, Brenninkmeijer A, Tisserand P. 2010, Sec.2.). If we calculate it arithmetically, it would be ~0.5 % per year in Latvia starting from 2013. Section 2 of this document also provides that after 2000, the rate of energy efficiency improvements reached the average of 1.7%. This EU document gives a positive evaluation to the previous Latvian performance, Section 29 provides that "This analysis shows that there is no simple rule for energy savings potentials in the 27 Member States.

In the CCFI state support programme, that is in the stage of implementation, the energy balance of enterprises embraced only 1.6% of the total energy consumption of industries, however, the total heat and electric energy saving is 0.4% of industries' total saving.

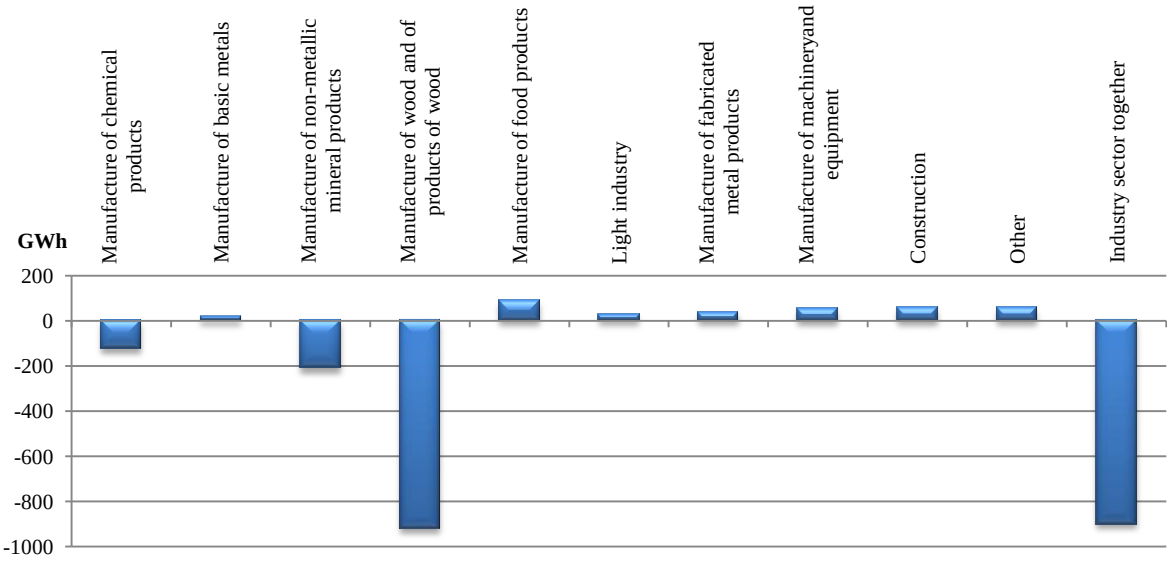


Figure 8. Energy consumption in industries in 2010, GWh. (Source: ME, Energy Efficiency Monitoring Report for 2011)

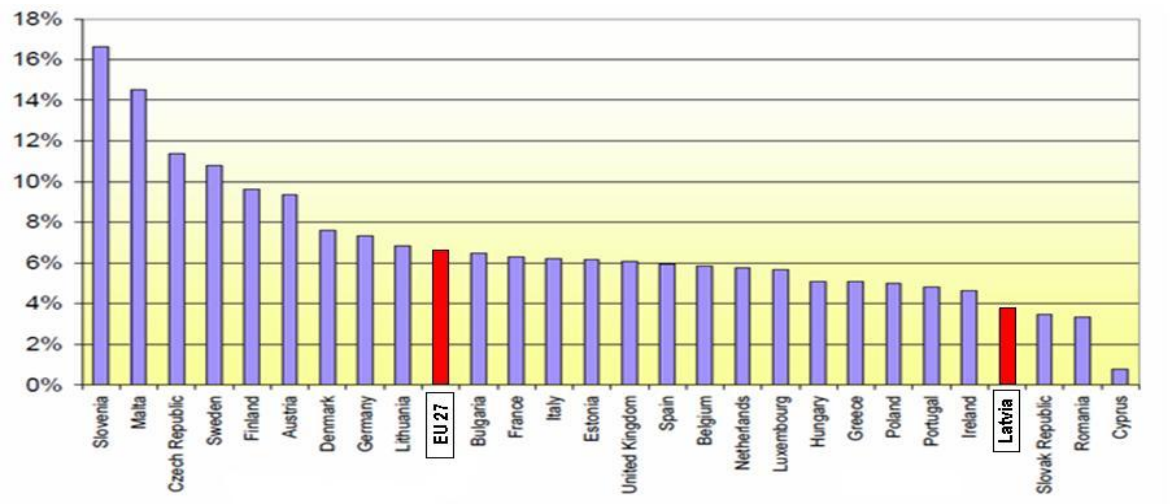
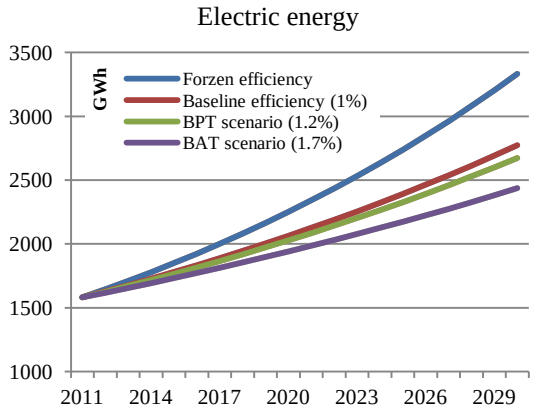


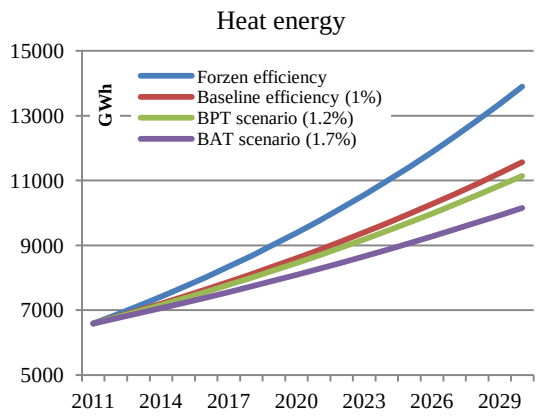
Figure 9. Energy savings potential in the HPI (High Policy Intensity) scenario by 2020

Table 1

Development scenarios

4 scenarios, according to OECD	Possibility in Latvia
Frozen efficiency: no additional energy efficiency savings are made, i.e. the current levels of energy efficiency are not improved upon	Such development forecast is hardly probable, because the increase in energy prices is a determining factor for energy efficiency as far as investment payback periods are relevant.
Baseline efficiency: energy efficiency improves at a rate of 1% a year	The scenario is close to the one evaluated in the EU study, when measures take place "by themselves", at the initiative of the market and entrepreneurs.
BPT scenario: all plants are operating at the current levels of **best practice technology** by 2030. This is equivalent to an energy efficiency improvement of 1.2% a year in the period 2007 to 2030	The best practice technology is a scenario, according to which Latvia continues (or would continue) state support programmes, such as CCFI, and implements measures of the Directive for large enterprises.
BAT scenario: all plants are operating at current levels of BAT by 2030. This is equivalent to an energy efficiency improvement of 1.7% a year in the period 2007 to 2030	The best available technology is a set of targeted measures combining support of state, ESCO and commercial banks with all the measures specified in the Directive – mandatory energy audits in large enterprises, technical support for SMEs, and introduction of a monitoring and benchmarking system.





CONCLUSIONS AND RECOMMENDATIONS

The regulatory framework of EU and Latvia on the improvement of industrial energy efficiency is reasonable and its content is appropriate, however, it does not specify particular targets and measures to achieve a real improvement in energy efficiency in Latvia.

The European and OECD scenarios, reviewed in this article envisage an improvement in energy efficiency for Latvia from ~ 0.5% per year to 1.7%, or slightly less than 4% in total by 2020. At the same time, industry sectors in Latvia in total, as evaluated by the EP, have a low energy saving potential. Conversely, Latvia is one of the worst of EU Member in terms of energy intensity. OECD research (Saygin D., Patel M.K., Gielen D., 2010) provides that: "A high growth rate implies many new production facilities to be installed and put into operation, which in general have close to best available efficiency. Thus, by 2020, a large portion of the industrial installations will be efficient and have low potential for further efficiency improvements. Especially for energy intensive industries, new installations are often the only possibility for major energy savings. These energy savings will in general be realised without a need for targeted policies. (...) Romania and Latvia for example show a strong correlation of a low energy savings potential with a high projected growth rate of energy consumption in industry".

Along with a positive evaluation, energy efficiency of Latvian industries has not met focused planning yet. Therefore, despite the fact that an independent evaluation (OECD, EP) defines low energy efficiency potential, Latvia must make its own detailed and a substantive analysis.

To perform it, newly installed energy consumers (for instance, opening of new enterprises, or significant extension of existing ones) in the sector need to be separated in the future, that would allow to structure energy efficiency statistics both by actual saving and by restructuring. Currently available data can be analyzed only in respect of the added value increase.

In this context, the need to increase the competence of local professionals also in the industrial sector is explained in the Directive, Art.6 "*A sufficient number of reliable professionals competent in the field of energy efficiency should be available to ensure the effective and timely implementation of this Directive, for instance with regard to the compliance with the requirements on energy audits and implementation of energy efficiency obligation schemes. Member States should therefore put in place certification schemes for the providers of energy services, energy audits and other energy efficiency improvement measures."*

Therefore, a detailed evaluation of energy efficiency targets and scenarios by sectors must be performed, especially in the industries of Chemical products, Non-metallic mineral products, and paying special attention to Woodworking.

Reviewing several energy efficiency scenarios in industries, and taking into account both the problems reviewed in this article – lack of data and analysis by sectors; and opportunities of Latvia as a growing economy, the authors of this article recommend the **Best available technology** scenario as a target strategy. The BAT is a set of measures which combine support of state, ESCO and banks with all the measures specified in the Directive – energy audits in large enterprises, technical support for SMEs, and introduction of a monitoring and benchmarking system. The target audience should be split into groups by size, as the measures to be performed and the savings to be achieved by SMEs and large enterprises are radically different.

When planning energy efficiency measures, it should be taken into account that enterprises with high energy consumption are also addressees of Directive 2003/87/EC with regard to the emission allowance trading (ETS) system, therefore (p.(55)) "*...the Commission will have to monitor the impact of new measures on Directive 2003/87/EC establishing the Union's emissions trading scheme (ETS) in order to maintain the incentives in the emissions trading system rewarding low carbon investments and preparing the ETS sectors for the innovations needed in the future*". As industrial energy audits will be mandatory for large enterprises from 2014, these companies in general will be provided audit and monitoring procedures.

In its turn, SME's in the Latvian economics have a great impact both on employment and export, they form a significant portion of energy consumption, and however, they are frequently not provided with a technical information or financial support. P.41 of the Directive provides: "*...To help them adopt energy efficiency measures, Member States should establish a favorable framework aimed at providing SMEs with technical assistance and targeted information*."

Research limits. CSB statistics does not include the period during which measures of the CCFI were implemented, therefore the research must be continued, analyzing the monitoring data, and studying the impact on the sector in total. Other factors limiting the research must also be taken into account: the enterprises implementing energy efficiency without state support are not included. Also ETS is not included, and it "*... represents roughly 50% of the energy consumption in terms of total industrial final energy consumption. So far knowledge of the impacts of the ETS on energy efficiency is very limited."* (Altmann M, Michalski J, Brenninkmeijer A, Tisserand P., 2010).

ABBREVIATIONS

ECM – European Commission

ME – Ministry of Economy of the Republic of Latvia

EU – European Union

ECN – European Council

EP - European Parliament

GDP – Gross domestic product

CCFI – Climate Change Financial Instrument

LR – Republic of Latvia

NACE Rev.2 – Statistical classification of economic activities in the European Community

CM – Cabinet of Ministers of the Republic of Latvia

SME – Small and medium enterprises

OECD – Organisation for Economic Co-operation and Development

TOE – ton of oil equivalent

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