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LĪMEŅATZĪMES METODE SILTUMNĪCEFEKTA GĀZU EMISIJU IEROBEŽOŠANAI

BENCHMARK METHODOLOGY FOR REDUCTION OF GREENHOUSE GAS EMISSIONS

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Introduction

Latvia is placed among the European countries with the higher technical potential to improve energy efficiency and to reduce greenhouse gas (GHG) emissions [1]. In order to achieve GHG emission reduction in energy generation sector, it is necessary to make an investigation on the most suitable economical tools that could promote the implementation of measures in local energy installations, including boiler houses, cogeneration plants and industrial installations.
The aim of this research study "Benchmark methodology for elimination of greenhouse gas emissions" financed by Ministry of Education and Science and Riga Technical University is the development of a methodology that could help to reduce the impact on climate change from energy installations in Latvia by analyzing possible GHG emission reduction scenarios. Following tasks were defined:

1) To develop benchmarks for the evaluation of energy generation sector in Latvia from engineer-technical and impact on climate point of view.
2) To calculate GHG emission reduction possibility and analyze the results obtained.
3) To develop recommendations for owners of energy production sources on how to determine and evaluate GHG emission benchmarks.
4) To advice the Ministry of Environment the range of GHG emission benchmarks for different kind of energy production sources.

The aim of this paper is to give an overview on the results obtained from the first investigation of energy installations on regional level in Latvia. This investigation is a first step to identify regional GHG emission indicators necessary for calculation of benchmark values.

Research methodology

Identification of regional GHG indicators consists of three following steps [2,3]:

1) Data collection on fuel consumption and related regional statistics;
2) Calculation of GHG emission amount in each region;
3) Development of first regional GHG indicators.

Detailed research methodology and data sources used schematically are shown in the flow chart below in Fig.1.
Step 1. Data collection.
Two kinds of data were collected – existing fuel consumption used for heat generation in all biggest heat sources in Latvia and different statistical figures at regional level. The real fuel consumption was obtained from state statistical database "2-Gaiss" where all significant energy installations with their capacities and fuel consumption by different year are included. The analysis was made for reporting year of 2006 and in total more than 2500 heat generation sources were covered.
The second kind of data collected was regional statistics necessary for development of regional CO_2 emission indicators. For data collection the statistical database of Central Statistical Bureau (CSB) of Latvia was used.

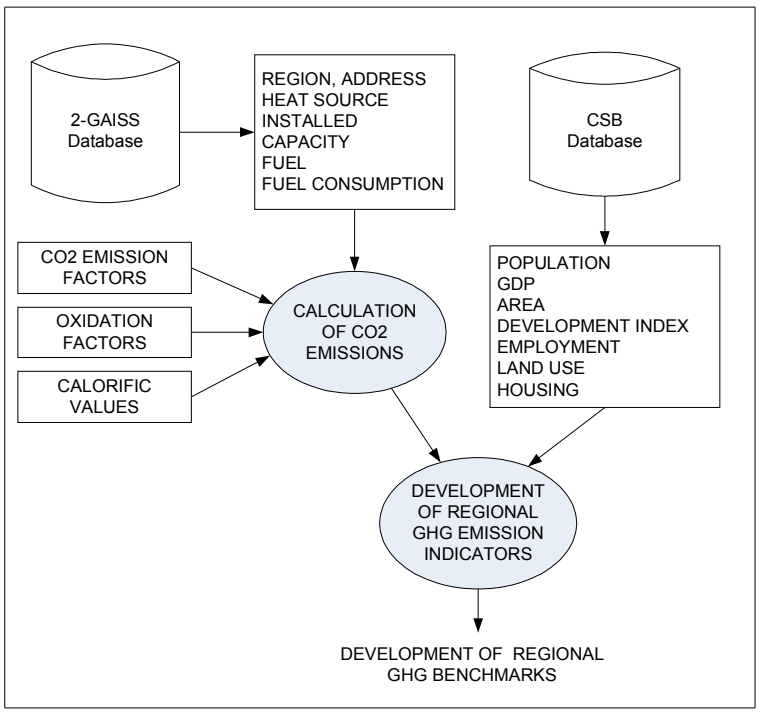

Figure 1. Methodology for calculation of regional GHG emission benchmarks

Step 2. Calculation of CO_2 emissions.

CO_2 emissions for each region were calculated based on real fuel consumption obtained from state statistical database "2-Gaiss". Emission, oxidation factors and calorific values used and other assumptions made are summarized in Table 1.

Table 1.

Regional GHG emission indicators used for research

Fuel	Calorific value, GJ/t	CO_2 emission factor, kg/GJ	Oxidation factor
Coal	26.22	94.08	0.98
Wood fuel (W=55%)	6.70	109.98	0.98
Peat (W=40%)	10.05	105.99	0.98
Heavy fuel oil	40.60	77.36	0.99
Light fuel oil	42.49	74.74	0.99
Natural gas	33.66	56.10	0.995
LPG	45.54	62.75	0.995
Shale oil	39.35	76.19	0.99
Coke	26.37	88.75	0.98

Step 3. Development of regional GHG emission indicators.

The next step was to develop regional GHG emission indicators. Indicators were calculated by relating CO_2 emission (t) to selected regional statistical value. This allows comparing different regions and different energy installations that could not be compared using absolute values of CO_2 emission [4,5].

After the development of the GHG indicators, the next step will be the calculation of benchmark values and after ranging and evaluating different regions according those benchmarks. The development of benchmarks will give the possibility to compare similar heat sources with standard values or best available technologies, as well as to motivate less efficient energy sources to implement energy efficiency measures in order to reach a determined benchmark value. Together with improvement of energy efficiency, GHG emissions are reduced. Development of benchmarks will be described in the further publications after implementation of the next steps of this research study.

Analysis of the results from the first investigation

Distribution and consumption of the main fuels by 5 regions (Kurzeme, Zemgale, Vidzeme, Latgale and Riga region) is shown in Figure 2.

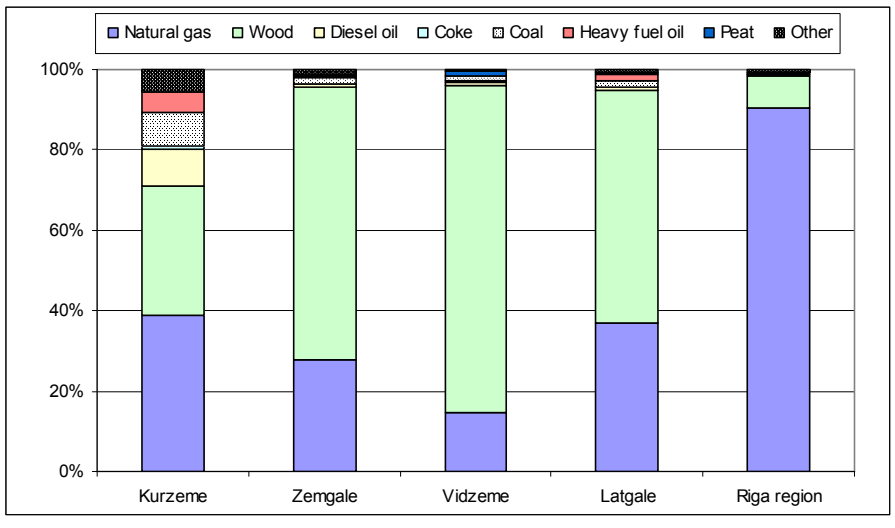

Figure 2. Share of fuels in 5 regions

As shown in the Fig.2 in the energy installations included in this study mainly is used natural gas (75%) and wood resources (22%). In Riga region the share of natural gas reaches approximately 91%, however greatest fuel diversification is in Kurzeme region, where besides natural gas and wood resources as well as diesel oil, coal, heavy fuel oil and other fuels are used. In the meantime wood resources mainly are used in Vidzeme (approx. 81%), which likely is explained with the high share of forested area in the region (around 52% of total area of the region) like in Kurzeme region. Percentage of total CO_2 emissions from the selected energy installations by regions in 2006 is showed in Figure 3 below.

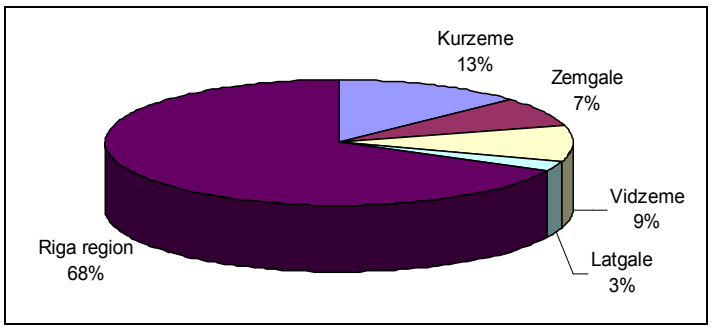

Figure 3. Percentage of CO_2 emissions by regions in 2006

Amount of CO_2 emissions depend from the fuel used and amount of energy produced. Riga region is the most economically active and populated region in Latvia and therefore share of CO_2 emissions is the highest – 68% of total. Though the largest part of renewable energy sources used is in Vidzeme region, Latgale region emits less CO_2 emissions – only 3% of total CO_2 emissions.
Analysis of regional energy use (by 26 regions), excluding 7 largest cities (Riga, Daugavpils, Jelgava, Jurmala, Liepaja, Rezekne and Ventspils), shows that in 14 regions more than 80% are renewable energy sources and moreover in 7 of these – it is even more than 90% (see Figure 4). Natural gas is available in 14 regions with the highest consumption and share in Riga, Bauska and Ogre regions. Only one region – Saldus – has more diversified energy sources that could be explained due to large emitters in this region, like cement factory that use coal and waste fuel (tires etc.) for production.

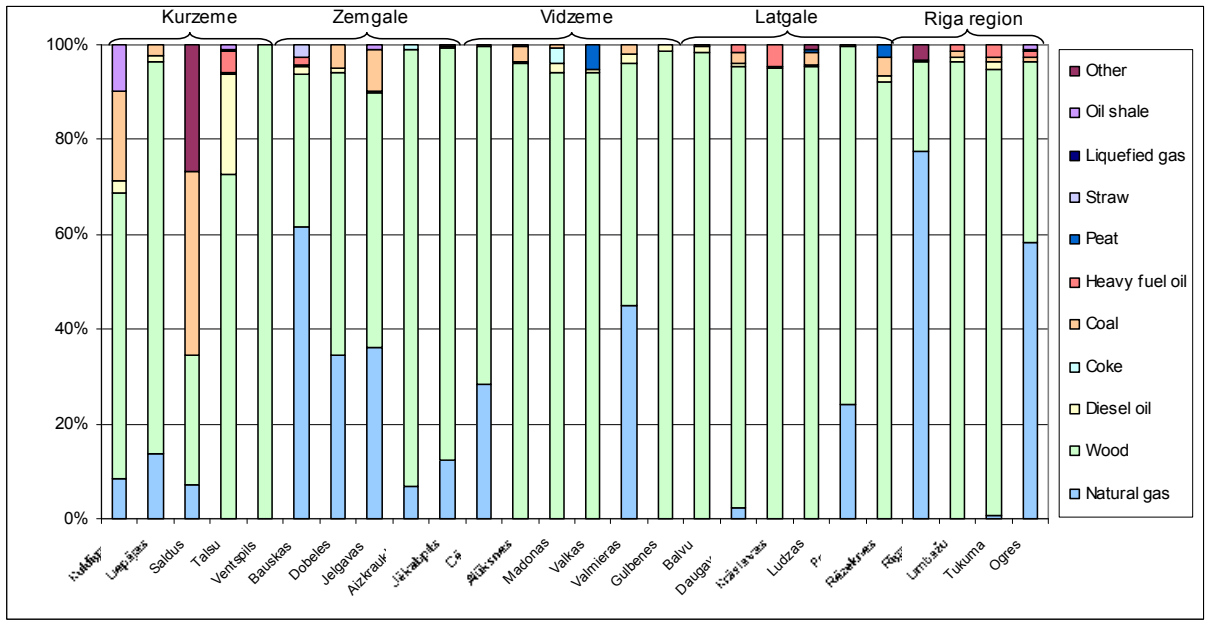

Figure 4. Share of fuel used by energy installations in 26 regions in 2006

To estimate any regional benchmark values, analysis of different GHG indicators was done. One of the first indicators – CO_2 emissions per capita per region – was estimated (see Fig. 5).

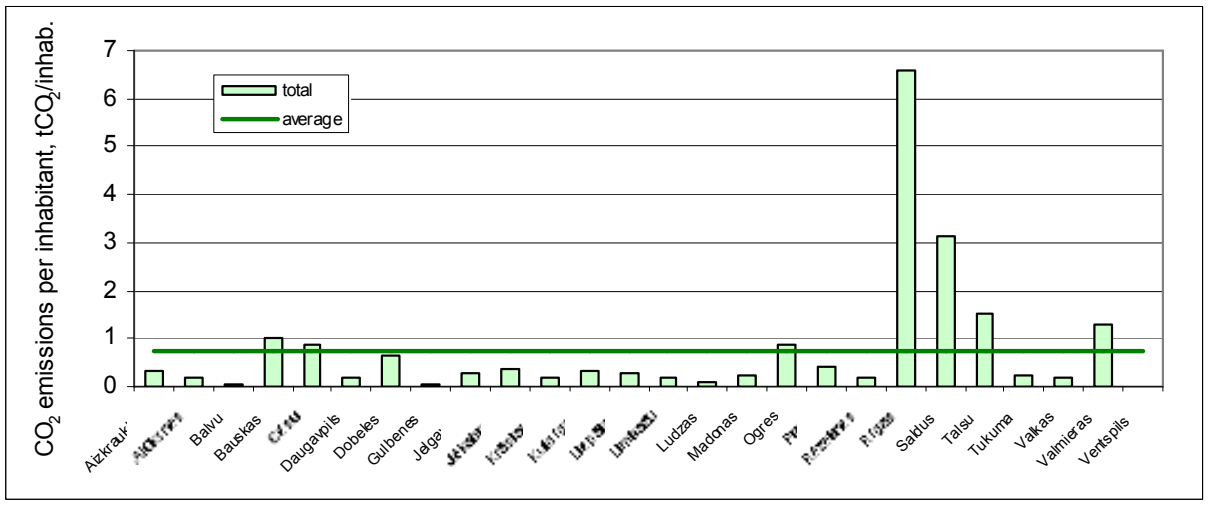

Figure 5. CO_2 emissions per capita per region in 2006

As it can be seen, the highest CO_2 emissions per capita in 2006 are in Riga region (6.57 tCO_2/capita) followed by Saldus region (3.12 tCO_2/capita) and Talsi region (1.5 tCO_2/capita). As mentioned already above, the high value of this GHG indicator for Riga region (average for Latvia – 0.756 tCO_2/capita) can be explained due to economical activity in the region. This could be explained by the next figure (Fig. 6) regarding GDP versus CO_2 emissions in 2006. However this is a first tentative of GHG indicator development and benchmark value calculation and this should be still verified for previous and following years.

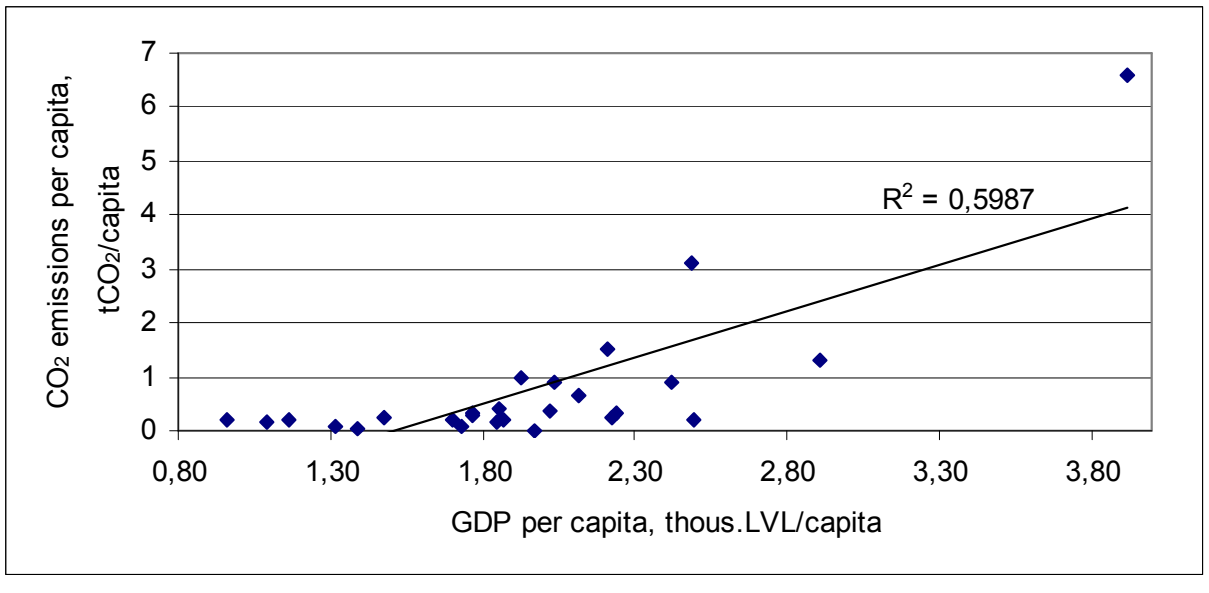

Figure 6. GDP per capita versus CO_2 emissions per capita in 2006

Though the correlation coefficient is moderate (R^2=0.598), Figure 6 illustrates the trend of economical impact on CO_2 emissions, i.e. higher GDP per capita higher CO_2 emissions. In the meantime high correlation has been observed when CO_2 emissions have been looked from the perspective of number of households (see Fig. 7).

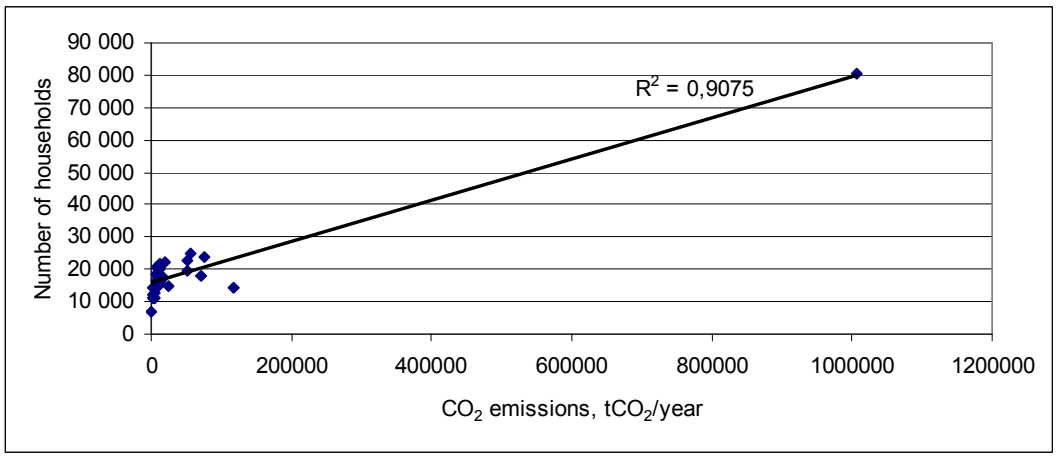

Figure 7. CO_2 emissions versus number of households

The good correlation (R^2=0.9) could be explained due to the characteristics of the energy installations – large share of these installations are district-heating companies providing heat to households however this will be still verified during the next steps of this research study.

First conclusions and future work

At this point of the study is hard to make any early conclusions, as more parameters for analysis should be included. Additionally comparison with other EU member countries should be done. One of the next steps will be exclusion of Riga region from the further evaluation due to the large differences in economical development, number of inhabitants, intensity etc. observed at this stage.

Acknowledgement

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Dzene I., Rošā M., Rochas C. Līmeņatzīmes metode siltumnīcefekta gāzu emisiju ierobežošanai

Latvija atrodas starp tām Eiropas Savienības valstīm, kurās ir augsts tehniskais potenciāls siltumnīcefekta gāzu (SEG) emisiju samazināšanai. Lai sasniegtu SEG samazinājumu, ir jāizpēta ekonomiskās pieejas, kas būtu piemērotas, lai veicinātu SEG samazināšanas pasākumu ieviešanu vietējos uzņēmumos. Izpētes mērķis ir izstrādāt metodi Latvijas energoiekārtu izvērtēšanai inženiertehniskajā un ietekmes uz klimata pārmaiņām aspektā. Pirmā izpētes daļa ir reģionālo SEG indikatoru izveide, izmantojot datus par emitēto CO_2 apjomu katrā reģionā (aprēķināts no reālā kurināmā patēriņa) un attiecīgo reģionu statistiskos datus. Šī ir tikai pirmā publikācija vairāku publikāciju ciklā, kas tiks veidots iepriekšminētās izpētes laikā. Šīs pirmās publikācijas mērķis ir sniegt pārskatu par sākotnējās izpētes laikā iegūtajiem rezultātiem par Latvijas energoavotiem reģionālajā līmenī. Sākotnējā izpēte ir pirmais solis, lai noteiktu SEG emisiju indikatorus, kas tālāk tiks izmantoti līmeņatzīmju vērtību aprēķināšanai. Līmeņatzīmju aprēķina process šī pētījuma ietvaros tiks aprakstīts un analizēts nākamajā publikācijā.

Dzene I., Rošā M., Rochas C. Benchmark methodology for elimination of greenhouse gas emissions

Latvia among the European countries with high technical potential to improve energy efficiency and to reduce greenhouse gas (GHG) emissions. In order to achieve GHG emission reduction, it is necessary to investigate economic tools suited to promote the implementation of GHG emission reduction measures in local companies. The aim of the research is to develop a methodology for the evaluation of energy production sources in Latvia from the perspective of engineer-technical solutions and impact on the climate. The first part of the investigation is the development of regional GHG indicators using data on the amount of CO_2 emissions in each region (calculated from actual fuel consumption) and related regional statistics. This is only the first publication in a series of publications that will be written during the above mentioned research. The aim of this first publication is to give an overview on the results obtained from the first investigation of energy production sources on the regional level in Latvia. This investigation is the first step to identify regional GHG emission indicators necessary for the calculation of benchmark values. The development of benchmarks will be described in the next publication.

Дзене И., Роша М., Роша К. Использование метода эталонного теста для ограничения выброса газов с тепличным эффектом

Латвия находится среди тех стран Европейского союза, в которых установлен высокий технический потенциал по снижению выброса газов с тепличным эффектом (ГТЭ). Чтобы достичь снижения ГТЭ, необходимо проводить исследования экономических подходов, которые были бы подходящими для поощрения введения мероприятий по снижению ГТЭ среди местных предприятий. Цель исследования -разработать метод оценки Латвийского энергетического оборудования с инженерно-технической точки зрения и с позиции влияния на изменение климата. Первая часть исследования, это создание региональных ГТЭ индикаторов, используя данные об объёмах выбросов CO_2 в каждом регионе (подсчитано от реального расхода топлива), а также статистические данные соответствующих регионов. Это только первая публикация из цикла статей, которые будут созданы во время упомянутого ранее исследования. Цель этой публикации, дать представление о результатах, полученных, при первичном исследовании Латвийских энергоисточников на региональном уровне. Первичное исследование – это первый шаг, чтобы определить индикаторы выбросов ГТЭ, которые в дальнейшем смогут использоваться для расчёта величины эталонного теста. Процесс расчёта эталонного теста в рамках этого исследования будет описан и проанализирован в следующей публикации.