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Investments in Energy Efficiency and Renewable Energy Projects in Latvia in 2018

AUTHORS:

Agris Kamenders
Claudio Rochas
Aleksandra Novikova

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Abstract

The present report summarises information on investments made in energy efficiency and renewable energy projects in Latvia in 2018. The report describes the study methodology, provides the key data sources and creates a funding flowchart reflecting the funding sources, beneficiaries and financial instruments that have been used to finance climate and energy projects. The report has been elaborated under project CIC2030 (Climate investment capacity 2030).

Briefly on CIC2030

Pursuant to the Regulation of the European Parliament and of the Council on the Governance of the Energy Union, each Member States shall prepare a national energy and climate plan for the period of 2021-2030, setting out the new energy and climate targets.

In order to achieve the energy and climate targets, targeted policies, as well as investments from the EU, national, local and private level are needed to allow the implementation of new energy efficiency and renewable energy projects.

Under the CIC2030 project and in cooperation with policy makers, scientists from the Riga Technical University, the Czech Technical University in Prague and the Institute for Climate Protection, Energy and Mobility collaborated to examine the adequacy of funding for the achievement of the energy and climate goals. The overall objective of the project CIC2030 study was to identify the investment amount, the potential sources of funding and the financial instruments necessary to achieve the energy and climate targets by 2030. This is the first out of three study under the project CIC2030 aimed at identifying the level of investment in energy efficiency and renewable energy projects.

Disclaimer

The present CIC2030 project is part of the European Climate Initiative (EUKI – www.euki.de). The EUKI is a project financing instrument by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). It is the overarching goal of the EUKI to foster climate cooperation within the European Union and reduce greenhouse gas emissions. The findings referred to in this report express solely the opinion and responsibility of the authors and do not necessarily reflect the views of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

For more information and feedback on the report

Dr. sc. ing., **Agris Kamenders**

Riga Technical University
Āzenes iela 12/1, Riga, LV-1048
e-mail: agris.kamenders@rtu.lv

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Abbreviations

Acronyms	
NECP	National Energy and Climate Plan for 2021–2030
CHP	Combined heat and power
CIC2030	Project "*Climate Investment Capacity 2030*"
EU	European Union
RES	Renewable energy sources
EE	Energy efficiency
ETS	Emissions trading scheme
LULUCF	Land use, land-use change and forestry
GHG	Greenhouse gases
FM	Ministry of Finance
EM	Ministry of Economics
VARAM	Ministry of Environmental Protection and Regional Development
ZM	Ministry of Agriculture
CFCU	Central Finance and Contracts Unit
ALTUM	Development finance institution *ALTUM*
RSS	Rural support service
LVIF	Ltd. "Environmental Investment Fund"

Acronyms	
EIB	European Investment Bank
EBRD	European Bank for Reconstruction and Development
LABEEF	Latvian Baltic Energy Efficiency Facility
CSP	Central Statistical Bureau

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Summary

The achievement of Latvia's energy and climate policy targets depends basically on the availability of a sufficient amount of permanent and efficient investment in sustainable energy and climate projects. In order to achieve the objectives of the Energy and Climate Plan 2021-2030, a transparent and sufficient level of investment must be ensured for both renovation of buildings, modernisation of production facilities, wider use of renewable and local resources and development of science and new technologies.

Thus, under the project *Climate Investment Capacity 2030* (CIC2030) and in cooperation between scientists from three countries and three research institutions (Riga Technical University, Institute for Climate Protection, Energy and Mobility and the Czech Technical University in Prague) we strived to identify the investment amount and the potential sources of funding necessary to reach the 2030 energy and climate targets. In the context of this report we tried to identify the scale of the investments made in climate and energy projects. This report provides an opportunity to understand the total amount of investment, the existing sources of funding and the financial instruments used to implement existing projects.

The current investments relate largely to the availability of EU funds. Nearly all EU funds for energy and climate projects are used in the form of grants, besides there are virtually no permanent financial instruments available, that would allow planning and developing of projects gradually, thus investments in energy and climate projects are characterized by an uneven nature and uncertainty. Investments made in different years may vary significantly, but we have sought to gather and assess the latest information available for 2018.

The aim of this report is to identify the volume of investment made in climate and energy projects in 2018, by analysing three sectors that are important in terms of energy consumption and emissions: buildings, energy and industry. The methodology developed can be used, assessing other sectors as well.

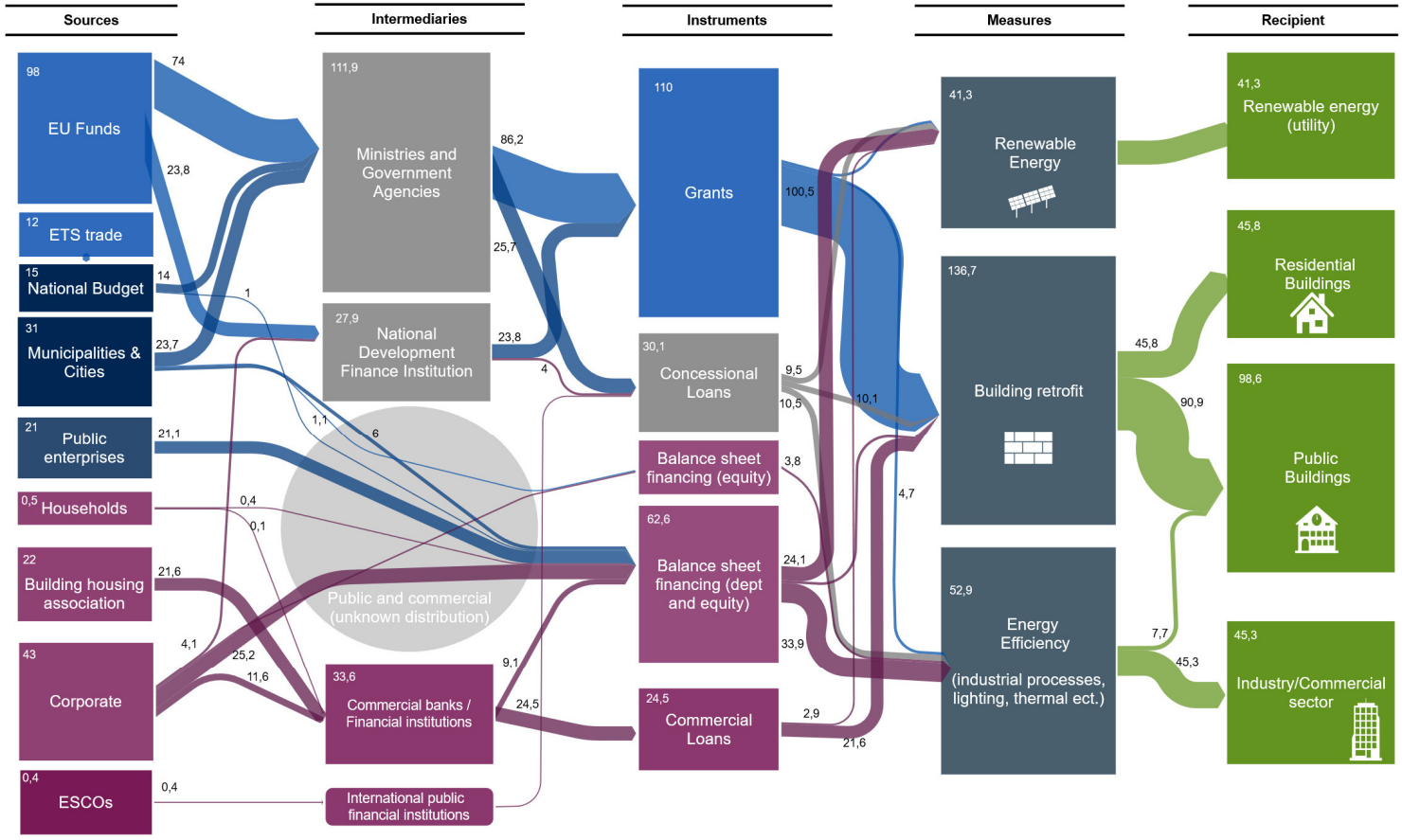

Figure 1: Climate and energy investment map for Latvia 2018: the energy industry, buildings and businesses, EUR

1. Introduction

1.1. The aim of the study

Assessment on climate change [IPCC 2014; IPCC 2018] reveals that in order to keep global warming below 1.5°C in comparison to the pre-industrial levels, we significantly need to change the way energy is produced and consumed and resources are used. Additional investment in energy and climate projects is needed to make this possible. Even though the European Union (EU) is one of the world's leaders in terms of decarbonisation of its economy, it is expected that the "Clean Energy for All Europeans" package will require additional EUR 117 billion of investment per year by 2030. As the public budgets are limited, this means that most investments should be private [EC 2016].

The Regulation on the Governance of the Energy Union 2018/1999 obliges each EU Member State to develop and implement a national energy and climate plan (NECP) [EC 2018], which contains information on current and planned investments in climate and energy projects.

The aim of this report is to contribute to this debate in Latvia by helping to assess investments made in energy efficiency and renewable energy projects in 2018 (the last full year for which the latest data are available).

1.2. Necessity of the assessment

Owing to the large hydroelectric power stations and the large consumption of biomass in the household sector, Latvia has managed to become one of the leaders in terms of the use of renewable energy resources, even though the recent years show no significant growth in Latvia neither in terms of the use of renewable energy sources nor tackling the energy efficiency challenges. Now, with the new NECP it is important to not only agree on climate and energy goals and appropriate policy measures, but also identify ways for financing new projects to achieve these goals.

As part of this report, our aim was to look at how projects have been financed, who have been major investors, how much was invested and in which sectors in Latvia in 2018. The aim of the study was to prepare an investment flowchart that would help find the answer to the following survey questions:

- How much money was invested in energy efficiency and renewable energy projects in 2018?
- Who were the biggest investors?
- Which financial instruments were most prevalent?
- Which sectors were supported and what type of technological equipment was financed?

- What methodology and data sources should be used for such an annual assessment to be carried out?

The report has four chapters. The introduction is followed by the second chapter discussing the methodology of the study. The third chapter describes the results obtained. The conclusions and the discussion part summarise the main conclusions and recommendations for future developments related to climate investment assessment. The annexes provide more detailed information on the data sources, as well as assumptions and references used in this report.

1.3. Latvia's climate and energy objectives

In 2018, the total energy consumption was 201.2 PJ, but the final energy consumption – 178.8 PJ. Overall, the final consumption of Latvian energy sources has not changed significantly over the last ten years. The most energy demanding sectors in 2018 were the transport sector with around 30 % consumption, household sector with around 29 % consumption and the industry and construction sector with around 23 % consumption. The most used energy sources in Latvia include biomass (38 %), natural gas (26 %) and petroleum products (34 %) [*CSP*]. In recent years, the use of biomass for heating and power generation has increased, although the total consumption of petroleum products has remained high at 34 %, which can mainly be explained by the increase in energy consumption in the transport sector.

By 2020 Latvia aims to ensure a 40 % share of renewable energy sources (RES) in gross final energy consumption and a 50 % share of renewable energy sources in final energy consumption in 2030, reducing Latvia's energy dependency on energy imports. The share of Latvian RES in final energy consumption varies every year, which is mainly affected by power generation in the large hydroelectric power stations and the consumption of certain biomass in households. According to *CSP* data, the share of energy produced from RES in gross final energy consumption has varied between 37 % and 39 % (see Table 1).

Table 1: Share of energy produced from RES in gross final energy consumption

Year	2013	2014	2015	2016	2017
Share of energy produced from RES in gross final energy consumption, %	37,04	38,63	37,54	37,14	39,01

Due to the Pļaviņas hydroelectric power station of 908 MW, the Riga hydroelectric power station of 402 MW and the Ķegums hydroelectric power station of 248 MW, the energy balance of electricity has a high share of local sources and RES. In total, around 54 % of all electricity produced in Latvia in 2017 was produced from RES. The heating and cooling also has a high share of RES – 55% (2017) [*CSP*], which is mainly related to the use of biomass in local heating systems and individual boilers. Natural gas is primarily used for provision of district heating from the operation of CHP1 and CHP2. However, the consumption of natural gas in the energy transformation sector has gradually decreased compared to 81 % in 2010 and 59 % in 2018 [*CSP*], which is mainly due to the decrease of thermal energy consumption and the replacement of natural gas by RES in district heating. Nevertheless, it should be noted that in the energy transformation sector the consumption of natural gas also depends on power generation in hydroelectric power stations, which is in turn affected by the amount of water in Daugava and the demand for electricity on the market.

Despite the relatively high share of RES in the overall energy balance, which was historically shaped by the large hydroelectric power stations and the use of biomass in households, in the last five years show no significant increase in new RES capacity and the development of new RES projects, which makes one be critical of the achievement of the existing 2020 RES target: a target of 40 % share of RES in gross final energy consumption by 2020. Given the current lack of support and uncertainty in the RES sector, it is difficult to predict the achievement of the 2030 target of 50 % share of RES in the gross final energy consumption. The total energy consumption in Latvia by fuel type is shown in Figure 2.

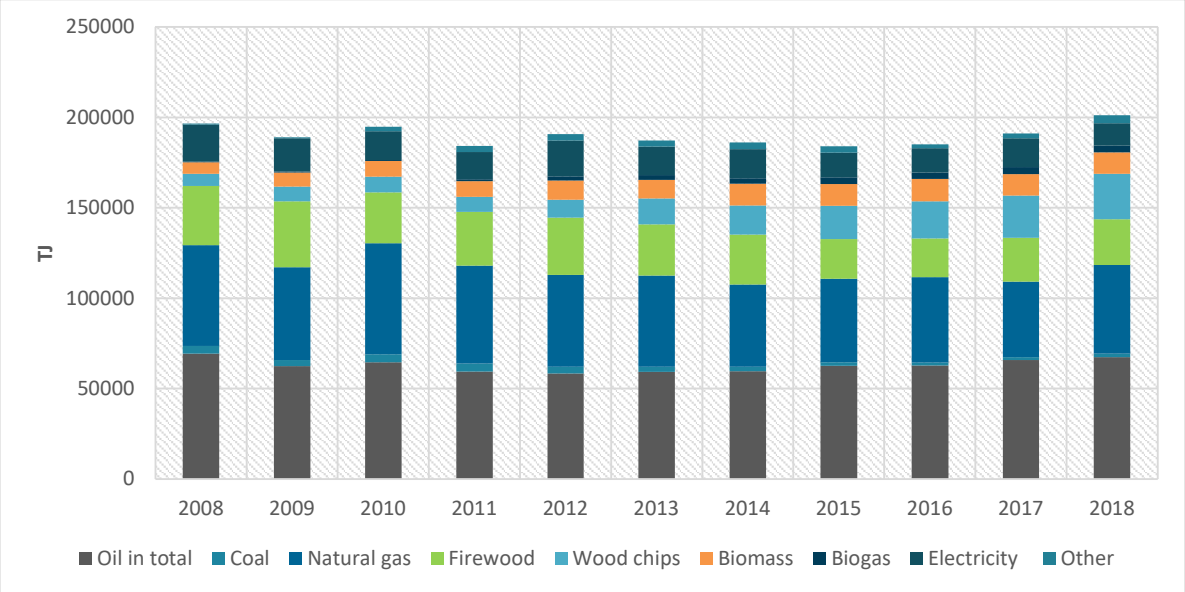

Figure 2: The total energy consumption in Latvia, TJ

A sector-by-sector analysis of changes of energy consumption shows an increase of the final energy consumption in the transport, agricultural and forestry sectors in recent years and a slight decrease in energy consumption in the household sector.

Over the past five years the energy consumption has increased by 12.8 % in the industry, reaching 41.1 PJ in 2018. The largest energy consumption of 2018 was evident in the production of wood, wood products and cork products: 20.7 PJ or 50.4 % of the total final energy consumption in the industry [*CSP*]. The forestry and logging industry has grown by 21 % over the previous year. The largest emitters in Latvia include the energy (34 %), transport (29 %) and agriculture (25 %) sectors (see Figures 3 and 4).

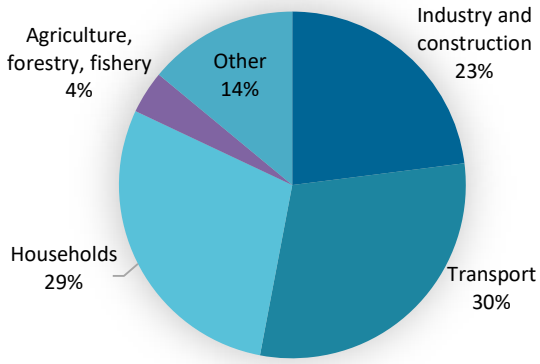

Figure 3: Final energy consumption by sectors (2018)

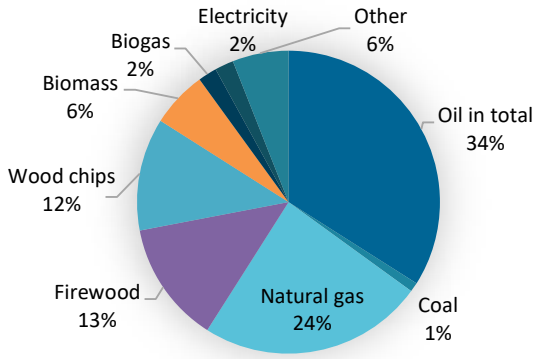

Figure 4: Total energy consumption by types of sources (2018)

In general, the largest greenhouse gas (GHG) emitting sector in Latvia is the non-Emission Trading Scheme (ETS) sector (78 %), while the ETS sector accounts for 22 % of total emissions. The number of companies in the ETS sector is not high, thus changes in the ETS sector depend on the performance of individual companies. The volume of production in combined heat and power (CHP) and cement companies has a major impact. For example, in the ETS sector, as with the overall generation of RES, the total emissions depend largely on the amount of water in the Daugava. In cases where power generation in the large hydroelectric power plants is declining, but power generation from natural gas-powered CHP is increasing, thus the overall emissions of the ETS sector are also increasing rapidly.

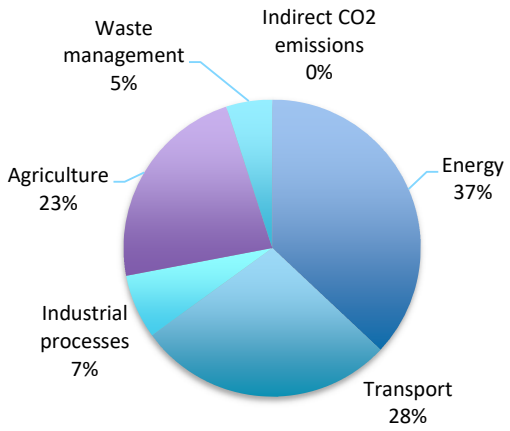

Figure 5: GHG emissions by sector (2018), excluding land use, land-use change and forestry - LULUCF (calculated) [Meteo]

In order to reduce GHG emissions, it is necessary to reduce the consumption of petroleum products in the energy sector, the transport sector in particular. The agricultural sector also plays a very important role. Given the large impact of the non-ETS sector on overall emissions, all companies not included in the ETS sector have an important role to play; therefore it is necessary to further improve the performance indicators of buildings, heat plants and industrial enterprises and to promote the transition to RES.

In line with its NECP, Latvia has set the following climate and energy targets for 2030:

- **6 %** reduction in non-ETS GHG emissions compared to 2005 and not less than **3.1 million tonnes** removal of **CO_2** units in the LULUCF accounting categories. The total reduction of GHG emissions by 55 % compared to 1990;
- **50 %** share of renewable energy sources in the final energy consumption;
- **7 %** share of RES in the final energy consumption in the transport sector;
- At least **57.59 %** share of RES in generation of heating and cooling energy. An indicative share of above **60 %** of RES is envisaged in power generation;

- Compulsory national energy efficiency target is defined as the cumulative savings of the final energy consumption, being **74.31 PJ** or **20 473 GWh**. Latvia must annually provide new savings of 0.8 % from the annual final energy consumption, by estimating it as the average indicator from the last three years before January 1, 2019;

- Non-compulsory reduction of the primary energy consumption is set at **170 PJ (47 222 GWh)** and the final energy consumption – at **145 PJ (40 278 GWh)**. In 2018, the total energy consumption was 201.19 PJ and the final energy consumption was 178.8 PJ, which means that, compared to 2018, the energy efficiency target was set to a 15 % reduction of the primary energy consumption and an 18.9 % reduction of the final energy consumption.

In terms of various energy efficiency projects, the compulsory national energy efficiency target would mean around 3000 renovated multi-apartment buildings or around 23 000 renovated private houses by 2030.

RES target would mean approx., 12 new 45 MW_{th} biomass cogeneration plants by 2030.

2. Methodology

2.1. Analytical framework

The key result of the report is a flowchart of Latvia's climate and energy investments. This report defines investment in climate and sustainable energy projects as investments by public and private players in projects (fixed capital formation) that contribute to the reduction of GHG emissions and the achievement of the objectives of the National Energy and Climate Plan of Latvia covering the period of 2021-2030. In accordance with the EUROSTAT guidelines [ESA 2010], investment in fixed capital formations covers costs for purchasing physical assets such as buildings, boilers and other infrastructure. The report looks at investments in energy efficiency and renewable energy projects in the energy industry, buildings, and businesses.

The investment flowchart reflects investments, showing both funding sources, institutions involved and sectors in which investments were made. The elaboration of the investment flowchart is based on a bottom-up approach, gathering data on projects and technologies used, as well as the energy efficiency measures first at sectoral and then – national level. The investment flowchart shows how much was invested and where, as well as what sources of finance and financial instruments were used to finance energy efficiency (EE) and RES projects.

When elaborating the Latvian climate investment chart, the experience and methodology used in similar types of studies was taken into account. The methodological framework used in this report replicates the methodology of the 2016 Climate and Energy Investment Map prepared for Germany (Novikova et al. 2019). The development of a methodology that would help track investment and build investment flowcharts was started with the CPI 2011 report on investments in climate projects around the world "Landscape of Climate Finance Diagram" [Buchner et al. 2011]. Similar analysis and investment flowcharts have been developed in Germany [Juergens et al. 2012]. Following the example of Germany, the Climate Economy Institute (I4CE) adapted and improved the methodology to use the approach for drawing up a French climate investment chart for 2011; furthermore presently such an assessment is made every year [Hainaut et al. 2018] allowing for the follow-up of investments made in climate projects.

2.1.1. Sources of investment

The investment flowchart divides between public and private investment. Public investments are those made from the **EU, national and local government budgets**. Investments from the EU budget reaches projects through EU funds, including the European Agricultural Fund for Rural Development,

the European Agricultural Guarantee Fund, the European Energy Programme for Recovery, the European Regional Development Fund and the Connecting Europe Facility. These investments can be divided in two parts: **direct investments**, such as investments in energy efficiency projects in public and municipal buildings, and **indirect investments** that can contribute to the development of such projects, but do not provide direct capital investment in specific projects.

Sources of **private investment** relate to households and businesses (power generation and industry).

2.1.2. Institutions involved

The financing and support of energy efficiency and renewable energy projects involve both public and private financial institutions, public authorities at national and local level, as well as private enterprises. In Latvia the investments relate largely to the availability of EU funds, therefore institutions that elaborate and administer programmes for the RES and EE sectors and are supported by the EU funds, e. g. the *FM*, *EM*, *VARAM*, *ZM*, CFCU, *ALTUM* and *LAD*, are very important. As auctioning the CO_2 allowances generates revenues, the use of EU funds is supplemented by the use of revenues gained from the trading of CO_2 allowances, which is administered by *VARAM* and the *LVIF*. Municipalities and companies may borrow funds at the Treasury or commercial banks of Latvia, which is also very important. International financial institutions, such as the EIB, the EBRD, which are very important in other countries, have funded a very small number of projects in Latvia so far, mainly due to the lack of adequate financial instruments and large projects. The EBRD has financed *LABEEF* which allows re-financing of ESKO projects in the multi-apartment building sector, but the EIB supports companies in preparing energy efficiency projects through the ELENA programme (see Figure 6).

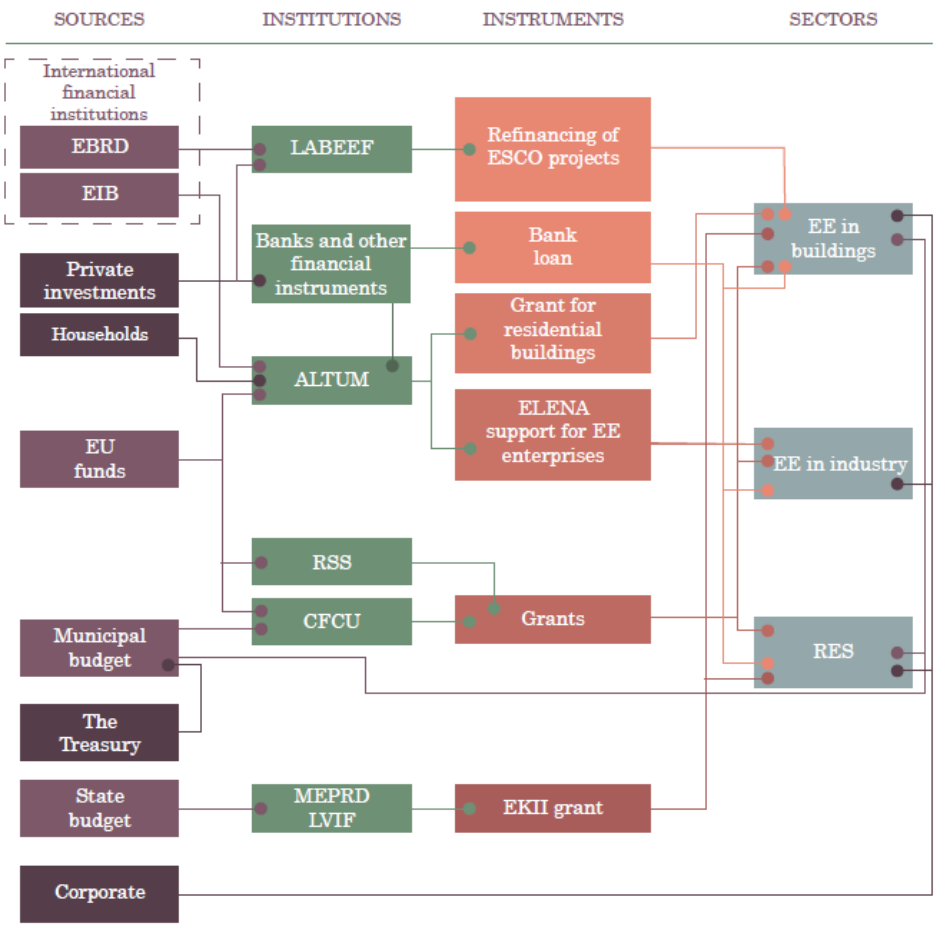

Figure 6: Financing of energy efficiency and renewable energy projects

Private financial institutions are represented by various actors, such as commercial banks, investment funds and others. Though they have a very important role in financing the reduction of climate change, their investment flows are not calculated due to the lack of data.

2.1.3. Financial instruments

The existing EU support has mainly been used in the form of grants. So far financial instruments that support long-term development and financing of EE and RES projects have not been used in Latvia. The implementation of projects through grants is linked to the implementation of campaign-like EE and RES projects, leading to higher project costs, difficulties in implementing large number of projects in the short run (due to lack of technology and job resources) and a reduction in the quality of project implementation. Furthermore, the lack of long-term support instruments prevents municipalities and entrepreneurs from planning their development in the long term.

Currently, the green bonds issued by *ALTUM* make it possible to take loans for energy efficiency and RES projects. Similarly, the *Sunshine*, *Accelerate Sunshine* and *LABEEF* projects supported by Horizon 2020 have made it possible to develop the first financial instruments that can help attract international financial institutions and private investors to finance new projects.

In line with the methodology used in "Landscape of Climate Finance in Latvia 2010" [Juergens et al. 2012], this study, too, lists only the primary investment flows, namely funds directly invested in assets to cover expenditure incurred in implementing the projects [2019, I4CE].

To avoid double counting of investments, this study does not cover risk management instruments such as guarantees or green bonds. Even though these financial instruments play an important role in reducing climate change and promoting investment, they are not considered to be direct investment in projects. More details on financial instruments can be found in the latest CPI's *Global Landscape of Climate Finance* [*Buchner et al.*, 2017].

2.1.4. Sectors analysed

The report deals with energy efficiency and renewable energy investments in the energy industry, buildings, and businesses. For the energy industry, it focuses on investment in centralized renewable electricity generation, transmission, and distribution, as well as heat production and distribution at cogeneration and district heat plants and its distribution - all accounted for in the energy balance as the "energy transformation sector". We refer to this sector as the energy industry sector in the diagram. For the buildings sector, we focused on investment in energy efficiency of buildings and systems as well as fuel switching, i.e. the installation of building-integrated renewable energy systems in residential, commercial, and public buildings. For businesses, we focused on investment in energy efficiency of industrial buildings and technologies, and in renewable energy projects in the industrial sector.

Table 2: Sectors analysed

Sector	Sector boundaries
Buildings	Investments to improve the energy efficiency of buildings have been reviewed. Multi-apartment residential houses, schools, offices, commercial and other buildings are included. Investments for building renovation (insulation of the building and restoration of the building's engineering communications, heating and hot water systems) have been taken into account. The building renovation project has been reviewed as a whole, taking into account the overall costs, including, for example, the renovation of the ventilation system and the cold water system and other works which may not directly help reduce energy consumption, but should be considered as an integral part of the

	project without which the renovation of the building as a whole would not be possible.
Industry	The reviewed projects include investments in improving energy efficiency of industrial buildings and technologies, including in renewable energy projects in the industrial sector.
Energy industry	Direct investment in renewable energy projects have been reviewed, for example, the installation of solar PV systems, the installation of biomass cogeneration plants and the improvement of the overall energy efficiency of power supply systems, such as investments in district heating system.

This study does not cover projects in the transport, agricultural and forestry sectors and other climate projects such as investments in water management, waste management, remediation of contaminated sites, conservation of natural resources and other measures.

2.2. Limitations of the study

The aim of the study was to analyse investments of one year made in sustainable projects that help achieve the national energy efficiency and renewable energy targets. **The chosen reference year was 2018, thus most up-to-date information available was gathered.** However, it should be noted that investments in energy efficiency and renewable energy projects in Latvia are highly cyclical and mainly related to the use of EU funds. The support programmes are generally characterized by marked gaps and cyclicality with diverse levels of investment over various years. As stated in the *FM* information report on the status of implementation of investments of the EU Structural Funds and the Cohesion Fund, in 2016 EUR 204.3 million (64.9 % realization) were disbursed to project beneficiaries from the EU funds' investments, EUR 346.4 million in 2017 (79.5 % realization) and EUR 610.0 million (92 % execution) in 2018 [Status of the EU Structural Funds and the Cohesion Fund 2018].

2.2.1. Investments: direct and indirect investments in climate action

Based on Juergens et al. (2012), investments *vis-à-vis* climate change reduction targets can be divided between direct and indirect investments.

- **Direct investment in climate change mitigation efforts** is investment aimed at reducing GHG emissions. The measures taken reduce GHG emissions and/or increase CO_2 removals[1].

[1] The texts provide one more definition, which includes not only investment in climate change mitigation but also in climate change adaptation action [OECD 2016; EC 2014]. However, this investment accounting approach was criticised by the European Court of Auditors (2016). The authors of this report share this criticism, since adaptation to climate change and climate change mitigation are different objectives and thus investments should be listed separately.

These are, for example, investments in renewable energy sources that help replace fossil fuels or in energy efficiency projects that help reduce resource consumption.

- **Indirect investments in climate change mitigation measures** are investments that are not targeted nor impact the reduction of GHG emissions, yet they finance measures that can also contribute to the reduction of GHG emissions. An example is the training of building managers on correct adjustment of the building heating systems and the optimal selection of energy efficiency packages, which can lead to a reduction in energy consumption, however such training does not constitute a direct investment in climate mitigation action. Indirect investments are, for example, investments in information campaigns or training, or support for the preparation of technical documentation for projects or research. Where both direct and indirect investments were made in the framework of a project, only direct investments were listed in this report. Where those could not be identified, the investments were excluded completely from our calculation.

2.2.2. Volume of investment: total and eligible project costs

The costs of the energy efficiency or renewable energy projects are often divided between eligible costs and total costs of the project. The costs directly related to the reduction of energy consumption in the building, such as the insulation of the walls of the building's facade, should be considered as eligible costs, while the renewal of the drainage system of the building should not be directly linked to the energy performance of the building, even though it is essential as it ensures the longevity of the façade's insulation and allows renovation of the building in general. The renovation of the building's

Climate indicators for tracking climate-related expenditure from the EU funds

In 1998 the Development Assistance Committee of the Organisation for Economic Cooperation and Development (OECD) introduced the so-called Rio markers to help assess investments under the Rio de Janeiro Convention on Biological Diversity, the Convention on Combating Desertification and the Convention on Climate Change.

In 2014, the European Commission took over the Rio markers approach to determine the share of climate-related investment from the 2014-2020 EU investment funds. The financed projects may have a direct positive impact or an indirect positive impact on climate objectives, or no impact on the targets, thus the investments made are assessed as being 100 %, 40 % or 0 % in line with the climate targets. The EC and the OECD-DAC published an example of how climate markers should be used (EC 2014, p. 29-30 and OECD 2016, p. 61-81). The European Court of Auditors recently published an assessment of the achievement of 20 % of the EU climate funding target in the framework of the multiannual financial budget and identified opportunities to improve performance, including with regards to the application of climate markers. A large number of problems were identified that ought to be addressed, taking the application of climate markers and better traceability of investment into consideration (European Court of Auditors, 2016).

This report includes investments that have a direct positive impact on the achievement of the energy and climate objectives.

balconies, too, does not directly relate to the energy performance of the building, yet such a measure is essential both in terms of safety and the renovation of the building.

We believe that the technical, social and economic sustainability of a project can only be achieved if the system is considered as a whole to increase the overall energy efficiency, longevity and environmental performance of the system as a whole. Therefore, when preparing the report, the information on the total costs of the project was collected, from which later the eligible costs were isolated. This gives a better understanding of the volume of investments directly attributable to GHG reductions (see Table 3).

Table 3: Summary on the breakdown of investments and costs

	Climate-related eligible investments		Climate-related non-eligible investments	
	Additional costs	Total investment	Additional costs	Total investment
Tangible investment	Building sector: energy efficient appliances and energy efficiency measures in existing and new buildings*. Industry sector: energy efficient technologies and solutions.	Energy sector: energy generation from renewable energy sources and infrastructure of the relevant transmission and distribution networks. Industry sector: energy from renewable energy sources, energy efficiency and efficiency of production processes. Building sector: costs of renovation of the building and energy from renewable energy sources integrated into existing and new buildings.		
Intangible investment	Drafting of technical documentation, development of policy planning and energy plans, R&D, information campaigns, training and capacity building, implementation of energy audits and energy management systems.			

Included in the report Excluded from the report

Note: the report assesses investments that are targeted at renovating buildings and achieving energy savings.

This approach makes it possible to better understand and assess the overall amount of the funding necessary to implement projects and achieve the climate objectives set out. However this approach has a significant disadvantage – it is difficult to calculate the costs needed to achieve the reduction in the energy consumption and CO_2 emissions. For example, the report by Juergens et al. (2012) highlights the many indirect costs related to energy efficiency or the use of renewable energy sources

in projects of energy-efficient buildings or renewable energy, such as painting the building's facade, the refurbishment of the building and other works. Therefore, costs relating to energy efficiency or the use of renewable energy sources are often overestimated.

As for renovation of buildings, in order to determine the costs directly related to energy efficiency, it would be appropriate to compare building renovation without insulation and with insulation of the building's facade, additionally calculating only the costs associated with the purchase of thermal insulation material and the costs of additional work.

2.3. The data used and the availability of data

In order to gather information on investments made in energy efficiency projects for buildings, information on EU fund support programmes (SAM 4.1.1, SAM 4.2.1.1, SAM 4.2.1.2, SAM 4.2.2, SAM 8.1.2, SAM 8.1.2 and SAM 8.1.3) was used. This information is readily available and is sufficiently detailed for further analysis. Furthermore information on projects implemented within the framework of the EKII support programme was used. In order to carry out further analysis and to determine the exact actual amount of co-financing of the programmes, the data were compared and detailed with the help of representatives from *VARAM* and *LVIF*. Information on *ALTUM* loans for energy efficiency and RES projects was collected together with representatives from *ALTUM*. Information on major energy consumers was specified on the basis of information provided by the *EM*. Due to the lack of data, the present report does not include information on investments made by the large enterprises. Information regarding investments made by local government and local government capital companies was specified using information provided by the Treasury, as well as publicly available information on loans by local governments. The work process included a survey of major commercial banks and other financial institutions to identify investments made by individuals in EE and RES projects. However, this type of information is not being collected and information is available only on energy efficiency projects for multi-apartment buildings. Compiling the data, it was assumed that multi-apartment buildings were renovated with the support of EU funds, so these investments were assessed based on data on the use of EU funds.

Information on the SAM 4.3.1 programme supported by the EU funds, as well as the breakdown between energy efficiency (investment for the replacement of district heating lines) and project descriptions based on the RES projects was used to identify investments made for the RES. Information on investments made by *Latvenergo* is based on publicly available information on the company's webpage. In order to identify investments made by individuals and other economic operators for the generation of RES electricity, we used information provided by representatives of AS *Sadales tīkls* on the planned connection capacity. This study failed to collect information on investments made by individuals for the generation of RES thermal

energy, as there is currently no information available on either private loans aimed at using EE or RES, or on the number of devices sold, which would allow the calculation of the amount of investments made.

Evaluating the availability of data, it can be concluded that information on projects supported by EU funds is available, but there is no information on investments made by individuals, enterprises, local governments and power supply enterprises. For example, in France the government is required to report annually on investments made by state and local governments in climate projects, as stipulated by the Energy transition and Green Growth Act. The aforementioned report assesses even investments made by individuals [Hainaut et al]. 2017]. The Institute for Climate Economics has developed a methodology for mapping and surveying climate investments; and this methodology is used to identify investments made. The survey was conducted by the French Energy Management Agency (*ADEME*)[2]. Using this methodology and survey, an assessment of climate investment in France has been carried out since 2011. In 2017, the European Commission proposed guidelines to map climate investments, i. e., "Climate mainstreaming in the EU Budget: preparing for the next multiannual financial framework for climate investment mapping" [European Commission 2017].

[2] https://www.i4ce.org/publications/

3. Results

The GDP in Latvia was EUR 29.5 billion at current prices in 2018. Revenues from the national consolidated budget were projected at EUR 8.75 billion in 2018, while expenditure was planned to EUR 8.95 billion.

In 2018 household consumption and increase in investments were the main contributors to growth. Investment increased by 16.4 %, driven mainly by investments in the housing, buildings and constructions (annual increase of 23 %). This was facilitated by a high demand based on an increased intensity of implementation of the EU Structural Fund projects, as well as private investment in various construction projects (*CSP*). At the same time, foreign direct investment in Latvia decreased in 2018. Loans and direct investments made by financial institutions are one of the sources of investment that allows new projects to be developed. The largest public and private investment in energy and climate projects relate to the support of EU funds. In line with the EU Council decision on the EU's multiannual financial framework for 2014-2020, Latvia received a total of EUR 4.4 billion (EUR 4 418 233 214) to implement cohesion policy objectives through EU funds (ERDF, ESF and CF). According to the results of the CFCU, 544 projects of EU funds have been concluded in 2018 for a total of EUR **1.5 billion** (EUR 1 520 022 523).

3.1. Investments in renewable energy projects

Data by the *CSP* show that in 2017 RES accounted for 39 % of the fuel consumed in Latvia, while fossil fuels accounted for 61 %. The proportion of fossil fuels for heat generation is high in Riga, Daugavpils, Rēzekne and Valmiera, where natural gas consumption dominates. The Riga region consumes approximately 52 % of the district heating in the country, and Riga generates the majority of the amount of heat produced in the district heating systems, 90 % of which is generated in cogeneration in CHP1 and CHP2. Over the last five years, renewable energy consumption has increased by 2 %. In Latvia the generation of heat and electricity is mainly based on fossil energy resources – natural gas – with its share gradually decreasing in the energy transformation sector: 81 % in 2010, 60.1 % in 2016 and 56.1 % in 2017. In 2018 the electricity consumption reached 7.4 million megawatt hours (MWh). In Latvia power generation depends directly on the amount of water in Daugava. In 2018, local electricity producers covered Latvia's electricity consumption at a level of less than 88 %, while just a year earlier they produced a 101 % of the electricity needed in the country [AST 2018].

3.1.1. Amount of total direct investments in renewable energy projects

In order to identify investments made in RES and energy efficiency improvement projects, we analysed projects implemented with the support of EU funds and those implemented solely through private investment.

Information on the implementation of EU funds shows that in 2018 projects for the total amount of EUR 172 606 911.41 (project eligible costs EUR 51 311 900) were approved under SAM 4.3.1 activity "Energy Efficiency of District Heating"; of that amount EUR 84878521.81 was to be directed to improve energy efficiency (49 %), mainly to reconstruct heat networks, and EUR 42278504.26 for investments in RES (24 %), mainly to use wood chips; the remaining 26 % of the total project amount was envisaged for both activities.

According to the *FM* report on the status of the implementation of EU funds in 2018, payments amounting to EUR **4 761 771** have been made from EU funds and, assuming an average aid intensity of 30 %, the total investment has been estimated to be EUR **15 872 570** and, by assuming the average breakdown between EE and RES projects, it can be estimated that the amount invested in energy efficiency projects is EUR 7.81 million, but the amount invested in RES projects – EUR 3.89 million. Other projects include activities relating to both the promotion of EE and the use of RES – EUR 4.18 million.

Currently there is no information available or aggregated on projects implemented without the support of EU, by households or power supply enterprises. However, in order to identify the potential total volume of investment, including private investments, we used data provided by the AS *Sadales tīkls* on newly issued authorisations and connections to the network. The calculation does not include information on systems that are not connected to the distribution networks. By applying indicators on specific investments, we identified the total amount of investment in the RES sector (see Table 4).

Table 4: Investments made in RES projects, 2018

	Authorisations issued to connect to the network, kW	**Assumed specific investment, *euro*/kW**	**Investment in total, *euro***
Biogas	1500	3 800	5 700 000
Biomass	765	4 000	3 060 000
The Sun	2087	1 300	2 713 100
		Total	**11 473 100**

The estimated total approximate investment in new capacity in the RES sector could reach EUR 11.47 million. It should be noted that part of the investment can be related to the use of EU funds, therefore, assuming that around EUR 8.07 million of investments are linked to the co-financing of EU funds for RES, investments without EU support in the RES sector are set at EUR **3.41** million (investment flowchart shows that these investments are made by private enterprises (EUR 2.91 million) and individuals (EUR 0.5 million)). Publicly available information reveals that in 2018 EUR 21.1 million was invested in the hydraulic unit reconstruction programme of the Daugava hydroelectric power station. The programme envisages reconstruction of 11 hydraulic units, four of which are already reconstructed. The reconstruction is scheduled to be completed in 2022 and the total costs of the programme could exceed EUR 200 million (https://www.latvenergo.lv/lat/par_mums/razosana/hes/).

The specific costs for biogas and biomass plants are taken from the guidelines developed in 2016 by Prudentia Energy Markets Ltd. "Guidelines on the calculation of the internal rate of return (IRR) for the prevention of overcompensation for operators who have received the right to sell electricity under the mandatory procurement or receive a guaranteed fee for the installed electrical capacity, deliverable 2", by using reference values for biogas stations from 1 MW to 2 MW and biomass stations from 1 to 4 MW. The costs of solar energy were taken from the 2018 study of the Boston consulting group "Klimapfade fur Deutschland".

Taking these indicators into consideration, a total of **EUR 40.378 million** was invested in the RES sector. The report does not address investments in power transmission systems (smart meters, establishment of interconnections, etc.), which are also significant to promote the use of RES as a whole.

3.1.2. The technologies financed

Analysis of the available information on projects supported by EU funds shows that investments were mostly made in boiler houses that use wood chips, replacement of district heating lines and in flue gas condensers. Very little has been invested in other energy efficiency measures and technologies.

Wider use of RES:
- 24 projects with woodchip boiler;
- 4 projects with woodchip and pellet boilers;
- 1 project with woodchip and biogas boilers;
- 1 project with woodchip boiler and solar panels;
- 1 project with biogas;
- 3 unspecified projects.

Improvement of energy efficiency:
- 39 projects on construction/renovation of district heating lines;
- 2 projects for the installation of a flue gas condenser;
- 1 project with a multi-functional boiler;
- 2 projects with a storage system;
- 5 projects of other processes.

Projects that envisage both using RES and implementing energy efficiency measures:
- 4 projects on construction/renovation of woodchip boilers and a district heating line;
- 3 projects that envisage measures on woodchip boilers and other EE measures;
- 7 projects including woodchip boiler and flue gas condenser;
- 1 project that envisages the construction/renovation of a district heating line and a bio-fuel boiler.

Analysis of the data on authorisation to connect to the network reveals that investments have been made in solar technologies as well.

3.1.3. Main investors and the way projects were financed; financial instruments used

According to the information gathered, the key investors were the power supply enterprise *Latvenergo*. Due to the lack of data, it is difficult to identify the amount of investment in RES made by households and other economic operators, who may have used only their own funds or bank loans; however, given the *Sadales tīkls'* data on authorisations issued for connecting to the network, it can be concluded that around 17 % of the total investment could also have been made by households and economic operators. This assessment does not include investments by households in low-capacity heating boilers and back-boilers.

3.2. Investments in energy efficiency projects in buildings and businesses

3.2.1. Energy efficiency in buildings

Energy consumed in the building sector accounts for up to 40 % of all energy consumption, therefore the building sector has a significant potential to achieve the overall energy efficiency targets. The sector's growth and investment in energy efficiency projects in buildings is largely driven by the use of EU structural funds. Approximately half of the construction activity in Latvia is carried out, based on public funding. Investments in the construction sector and buildings are highly cyclical and linked to the use of EU funds. So far EU funds have been used in the form of grants, resulting in highly fluctuating construction costs, activity and the number of employees, even though entrepreneurs have been able to increase realization in markets outside Latvia in recent years. The increase in construction activity is also evident by an increase in the number of construction permits issued. Additional investments relate to the state budgetary funds, gained from the sale of emission

allowances. Generally, bank loans serve for co-financing of energy efficiency projects in the multi-apartment building sector, but state and local government buildings are renovated using loans from the Treasury. In the residential building sector projects have also been implemented with the necessary investments provided by energy-efficiency service providers (*ESKO*).

In Latvia, the total area of the housing fund at the end of 2018 was 76 million square metres, i. e. an average of 40 m^2 per capita. The majority of the residential buildings (by number) is single-family buildings, while in terms of living-space, the majority is composed of multi-apartment buildings. Multi-apartment buildings are mostly occupied by urban households, for example, in Riga 85 % of all households live in multi-apartment buildings. The majority of Latvian residents live in multi-apartment buildings that have not been effectively maintained and are currently technically unserviceable. As regards both the area and the number, most of Latvia's multi-apartment buildings were built between 1940 and 1992. These are followed by buildings built before World War II and after regaining Latvia's independence in 1991.

Taking the use and co-financing of EU funds into consideration, in 2018 EUR 45.80 million were invested in energy efficiency measures in the multi-apartment building sector – 5.4 million in public buildings, 9.7 million in municipal buildings, 46 million in buildings of general education institutions and EUR 15 million in buildings of vocational education and training institutions. As part of the EKII programme, in 2018, EUR 10.87 million were invested in the construction of low-energy buildings and EUR 3.97 million in State protected architectural monuments. According to the Treasury's figures, government loans issued in 2018 for costs to boost energy efficiency amounted to around EUR 30.25 million (EUR 30 252 927.15), representing a total of 66 projects and providing co-financing for EU projects. Analysis of the information on loans issued shows that the amount of loans granted to projects not linked to the provision of co-financing in EU projects is estimated to be around EUR 7.27 million, EUR 4.98 million of which is investment in energy efficiency projects in buildings and EUR 1.53 million investment in improving the energy efficiency of lighting, but EUR 0.75 million were invested in biomass boilers.

3.2.2. Energy efficiency in businesses

In general, the industrial sector is the third largest final consumer of energy in Latvia, representing around 18 % of the total of Latvia's final energy consumption. This is a relatively low indicator, if compared to other EU countries. However, it should be noted that energy consumption in the industrial sector is largely advanced by the general economic growth; for example, the economic crisis and the decline in exports decrease the volume of production, leading to a reduction in energy consumption, and vice versa – a large volume of production increases the total energy consumption

in the industrial sector. The key function of industrial buildings is the deployment of industrial technologies and/or provision of large number of jobs, therefore the energy efficiency of industrial buildings is generally low. Pursuant to the Energy Efficiency Law, large enterprises, large electricity consumers and power supply enterprises have an obligation to implement energy efficiency improvement measures.

To assess investments in EE and RES projects in the industrial sector, the evaluation by *EM* was used to gain data on compliance of large consumers, large enterprises and power supply enterprises with their obligations under the Energy Efficiency Law. Furthermore, information provided by the *CSP* and its surveys on business investment in environmental protection was used, as well as information on EU fund support programmes.

There is currently no information available on investments made by power supply enterprises. According to the *EM* data on 2017, the total investment in energy efficiency measures planned by large enterprises and large consumers amounted to around **EUR 24 million** in 2017. Considering that there is currently no information available on 2018, the calculation assumes that the level of investments made in 2018 will remain at the level of 2017, amounting to EUR 24 million. Under the EU support programme 4.1.1 "Energy Efficiency in Manufacturing Enterprises" in 2018 and assuming the aid intensity of 30 %, the total investment amounted to EUR 15.77 million. The analysis of the project organisation shows that presently investments were mainly made in energy efficiency measures and around EUR 2 million were invested in RES. Owing to *ALTUM* loans for sustainable projects in total loans amounting to EUR 6.45 million were provided in 2018.

3.3. Assessment of the investment in the National Energy and Climate Plan 2021–2030

According to the authors of the NECP:

"The amount of funding needed for the implementation of the objectives set out in the Plan and the actions included therein at the time of submission of the Plan to the European Commission – on December 31, 2019 – is to be calculated with a great uncertainty, given that this is a long-term (up to 2030) development planning document and that the policies of many of the sectors concerned have not been planned for the period after 2020. "[NECP Chapter 7 on the financial impact of the plan].

Thus, the plan does not yet contain precise information on investments needed to achieve the climate and energy objectives. The necessary information is planned to be included when finalising the

drafting of the NECP. The NECP provides an overview of the potential sources of funding. The main sources of investments are the state and the municipal budgets, EU funds and revenues from auctioning the emissions allowances during the ETS period 3, the Innovation Fund and the Modernisation Fund, although the amount of funds currently available is not yet known. Presently, the plan does not earmark investments by private companies and households in the EE and RES projects, although, given the amount of the investment needed, these sources of investment should be assessed separately in view of attracting them to new EE and RES projects.

4. Conclusions

The Regulation on the Governance of the Energy Union requires EU Member States to develop and implement a NECP, which sets new climate and energy targets. The achievement of the energy and climate targets is largely linked to the existence of appropriate policies and availability of investments in new EE and RES projects. In order to achieve these objectives, it is necessary to understand how much investment is needed in general and how much has been invested so far. This would help answer the question on the amount of additional investment needed for EE and RES projects.

The present report aimed to determine the amount of investment so far and identify the major investors and the projects that have received investments. The study included an analysis of the available literature on examples of climate investment mapping (Germany, France, the Czech Republic and other countries), as well as the development of a methodology for mapping climate investment in Latvia. The methodology developed and the analytical material drafted can serve as a prototype for evaluating future climate investment and/or analysing other sectors.

An analysis of the investments made shows that **in 2018 at least EUR 190 million were invested in energy efficiency measures in buildings**, **while EUR 41 million was invested in RES** (including EUR 21,1 million invested in Daugava hydroelectric power station). As it appears, in 2018 the investment in RES was nearly five times lower than that in EE projects. Reviewing the technologies and the projects that have received investments, it can be concluded that they were mainly made in comprehensive renovation of buildings, whereas in the RES sector investments were made in bio-energy projects. Another significant indication is investments in, for example, hydro-power projects made by large power supply enterprises such as *Latvenergo*. Currently there is no information available on investments made by power supply enterprises under the energy efficiency obligation scheme or investments made by private individuals, enterprises and other private parties in projects not related to the use of EU funds. In the municipal sector the investments made are also mainly linked to the use of EU funds and loans from the Treasury. For the time being, no local government climate projects have been implemented in Latvia, which would include attraction of private funds. Owing to the activities of *ALTUM* and *LABEEF*, presently the first financial instruments have been established to finance energy efficiency and RES projects, and furthermore they are not formed as a grant programme.

Reviewing the information available and the future sources of funding presented in the NECP, it seems that private investment is not being earmarked even though its importance should increase year by year. For example, the assessment carried out on climate investment in Germany shows that 83 % of

the total investment is private investment. Assessing the information available on investments made, it appears that the EU funds have a key role in project development. Presently, EU funds are mainly used in the form of grants.

There is currently no precise information on the amount of investment needed to meet the climate and energy targets by 2030. It is estimated that around **EUR 6 billion** would be needed in next 10 years. For example, the 2017 ex ante evaluation on the financial availability of energy service enterprises notes that the total funding needed to implement energy efficiency measures in Latvia is at least EUR 8.49 billion. As the state budget and the EU funds cannot provide the necessary investment, we intend to continue our work and conduct a study to examine both the amount of investment needed in line with the NECP objectives and the examples for mobilising private investment in sustainable projects.

EU funds plays a big role in total investments and driving private investment. However existing EU support has mainly been used in the form of grants. Creating cyclicality with diverse levels of investment over various years. **Other financial instruments:** green bonds issued by ALTUM make it possible to take loans for energy efficiency and RES projects. And LABEEF have made it possible to develop the first financial instruments that can help attract international financial institutions and refinance ESCO projects. Data on public and EU investments are available, yet there is no information on investments made by private and private financial institutions. Systematic assessment for reporting and surveys of private investment would be needed.

The investment map allows understanding who and how much invests in EE and RES projects. During the construction of the map we used a bottom-up approach tracking investment at a project level, aggregating it on sector level and then on country level.

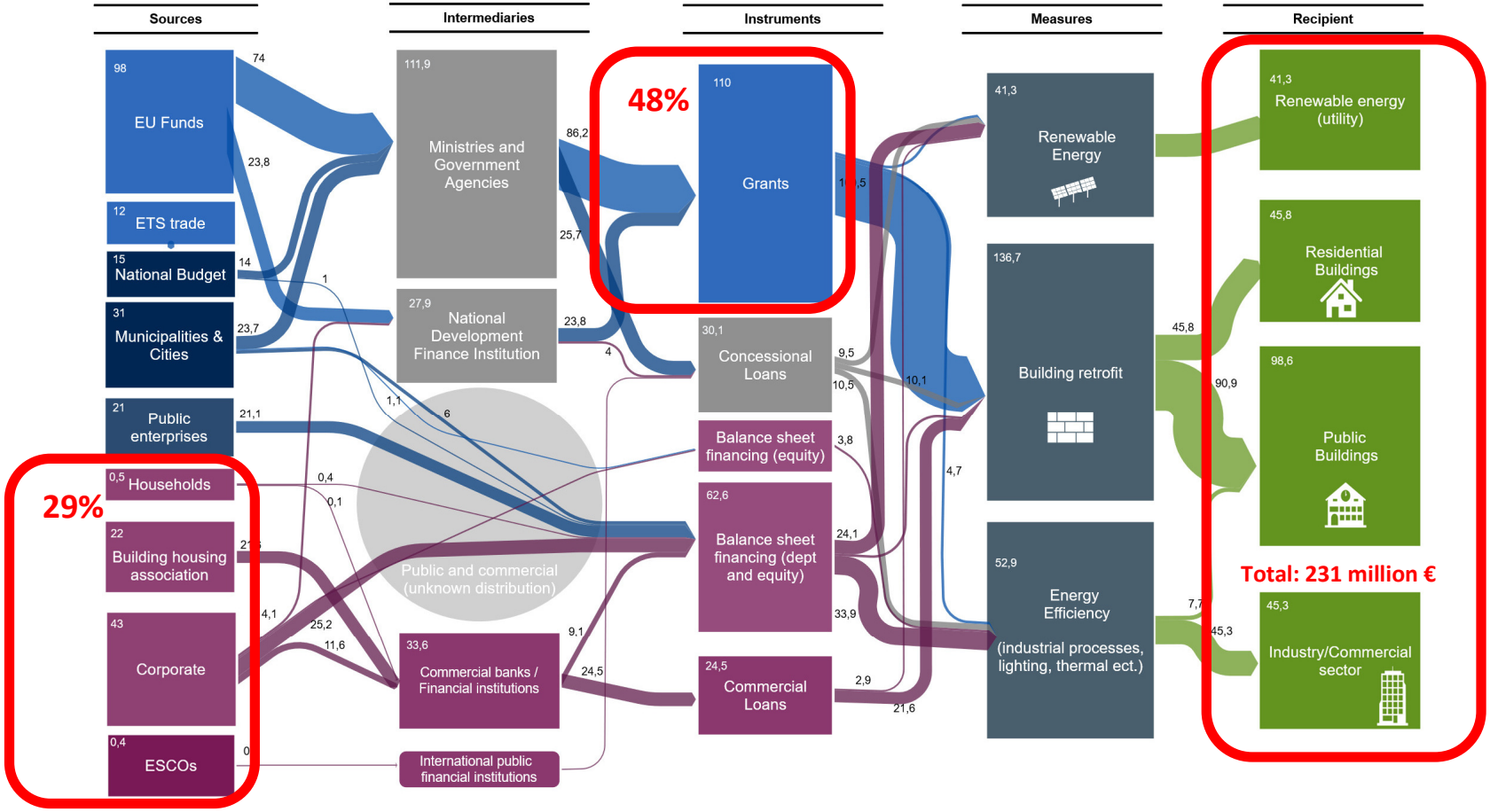

Figure 7: Climate and energy investment map for Latvia 2018: the energy industry, buildings and businesses, EUR

Currently EU grants contributions account of 42 % of the financing of climate investments in Latvia, 29 % coms from private sector and 29% form national budget. And it appears that in 2018 the investment in RES was nearly five times lower than that in EE projects. If we would take out the investment by national electricity utility company then we would see that investment in RES have decreased several times. 42% of investments goes to public buildings and investment in buildings accounts for 63% of total investments. Reviewing the technologies and the projects that have received investments, it can be concluded that they were mainly made in buildings renovation, whereas in the RES sector investments were made in bio-energy projects. EU funds plays a big role in total investments and driving private investment. However existing EU support has mainly been used in the form of grants. Creating cyclicality with diverse levels of investment over various years so investment in different years could be different. In the municipal sector and for public buildings investments made are also mainly linked to the use of EU funds and loans from the Treasury. For the time being, no local government climate projects have been implemented in Latvia, which would include private funds.

The biggest challenges are on data availability from private sector. During our analyses we have contacted the Association of financial institutions and the biggest commercial banks of Latvia, however we could clearly track only those investment with comes as co- financing to EU supported projects. Currently there is no date available on investments made by power supply enterprises under the energy efficiency obligation scheme or investments made by private individuals, enterprises and other private companies in projects not related to the use of EU funds.

Future work and tasks

The assessment of investments made in Latvia reveals that data on projects supported by the EU funds are currently available yet there is no information on investments made by private and financial institutions. Creditors should be informed on the purpose for the loan; currently investments are listed as made for “home improvement”, while it is not clear whether that includes the achievement of a reduction in energy consumption or not. The enterprises, too, may borrow funds to improve their production processes, but the purpose of the funding is not clear; therefore, the available data on the level of lending cannot be used.

Discussions should be continued on what is generally regarded as climate investment in Latvia and what part of investment is actually contributing to reducing the impact of climate change. The question remains whether investment in climate change adaptation measures should be included in the

analysis. Furthermore, ways to assess the volume of private investment in climate projects should be identified.

At the same time focusing on investments specific for achievement of climate and energy objectives alone excludes all other benefits that are crucial for sustainable development in general. For example, for building renovation projects it is important to assess not only the benefits regarding the reduction of the energy consumption and GHG emissions, but also those related to the health and economic advantages in general. Further discussions are needed on how and to what extent investment in climate-related measures can be considered: support for preparing the necessary documentation for projects, research and innovation, information campaigns, etc. Even though these investments do not directly apply to the reduction of energy consumption or GHG emissions, they are essential for the development of projects as a whole.

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