YOUR GUIDE TO THE MACEDONIAN SECOND BIENNIAL UPDATE REPORT ON CLIMATE CHANGE

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The Second Biennial Update Report on Climate Change is a significant national contribution to fulfilling the country's commitments to the UNFCCC.

LIST OF EXPERTS

UNFCCC NATIONAL FOCAL POINT

Ministry of Environment and Physical Planning
Dr. Teodora Obradovikj Grncharovska

Project Manager
Pavlina Zdraveva, BSc.

National Expert, Chief Technical Advisor
Prof. Dr. Natasa Markovska

International Expert
Prof. Dr. Neven Duic

Faculty of Mechanical Engineering and Naval Architecture

University of Zagreb, Republic of Croatia

(Inventory, Mitigation)

GHG INVENTORY TEAM

Research Center for Energy and Sustainable Development, Macedonian Academy of Science and Arts (RCESD MASA) Team
Acad. Gligor Kanevce

M.Sc. Verica Taseska-Gjorgievska

M.Sc. Aleksandar Dedinec

Dr. Aleksandra Dedinec

B.Sc. Vasil Bozhikaliev

B.Sc. Vladimir Gjorgievski

Sectoral Experts
Prof. Dr. Sreten Andonov

Prof. Dr. Ordan Chukaliev

Prof. Dr. Dusko Mukaetov

Prof. Dr. Ljupco Nestorovski

Prof. Dr. Nikola Nikolov

M.Sc. Elena Gavrilova

M.Sc. Emilija Poposka Kardaleva

M.Sc. Igor Ristovski

MITIGATION SCENARIOS TEAM

RCESD-MASA Team
Acad. Gligor Kanevce

M.Sc. Aleksandar Dedinec

M.Sc. Verica Taseska-Gjorgievska

Dr. Aleksandra Dedinec

B.Sc. Vladimir Gjorgievski

B.Sc. Vasil Bozhikaliev

Sectoral Experts

Prof. Dr. Sreten Andonov

Prof. Dr. Ordan Chukaliev

Prof. Dr. Dusko Mukaetov

Prof. Dr. Ljupco Nestorovski

Prof. Dr. Nikola Nikolov

CONSTRAINTS AND GAPS, OTHER RELEVANT INFORMATION

Center for Climate Change, Gevgelija Team

Dr. Daniela Mladenovska, *Capacity Building Expert*

Filip Stojanovski, *Technology Transfer Expert*

Risto Pecurovski, *Budget Planning Expert*

Bojana Stanojevska Pecurovska, *Technical Coordination*

MONITORING, REPORTING AND VERIFICATION OF MITIGATION ACTIVITIES

Metodija Dimovski, MSc.

In close cooperation with:

Dr. Teodora Obradovic Grncarovska

Prof. Dr. Natasa Markovska

Prof. Dr. Neven Duic

Implemented by the United Nations Development Programme

B.Sc. Anita Kodzoman

B.Sc. Pavlina Zdraveva

M.Sc. Jasmina Belcovska Tasevska

Global Support Programme

Damiano Borgogno, MSc.

Eva Huttova, MSc.

Ministry of Environment and Physical Planning

Public relations Office team

Vanco Angelovski

Angelina Barbarovska

Snezana Gjorgjieva

Angelina Jovanovikj

Jugoslav Jovanovikj

Spresa Ramadani

Saso Sekulovski

Dijana Sokolovska

Innovation and data science

Prof. Dr. Dimitar Trajanov

M.Sc Kostadin Mishev

Compiled by

Susan Legro, M.I.A., M.P.H.

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INTRODUCTION

WHAT IS A BUR?

A BUR is a **Biennial Update Report**, or a report that is submitted every two years, to the United Nations Framework Convention on Climate Change **(UNFCCC)** by Parties that have ratified the Convention.

BURs are comprised of several major parts:

- A **greenhouse gas (GHG) inventory**. This section lists all of the estimated emissions of different greenhouse gases in different sectors. The inventory also estimates how much carbon is *sequestered*, or stored, in forests and soils. This section also describes changes relative to the base year for measuring emissions (in the Republic of Macedonia, the base year is 1990) and describes other trends over time.
- **Actions to mitigate GHG emissions**. This section lists and describes steps that the country is taking to offset or reduce GHG emissions. It also uses the results of computer modeling to describe the impact of different policies and measures on emissions.
- **Gaps, Needs, and Resources received**. This section reports gaps countries face in taking action against climate change; the institutional, technical, and financial resources they need to address them; and the financial resources they have received from multilateral organizations, financial institutions, and other donors and sources of financing.
- **Measurement, reporting, and verification**. This section describes systems that countries are using or plan to use to report effectively on their emissions and on measures they are taking to combat climate change.

Countries also provide information on their national circumstances and on other climate change-related topics where they would like to report activities.

REPORTING ON CLIMATE CHANGE: A QUICK HISTORY

Reporting on climate change to the UNFCCC Secretariat is nothing new. The text of the UNFCCC, which dates from 1992, requires all countries to report on their actions and plans to implement the convention.[1] All 196 Parties of the UNFCCC are to prepare reports on the state of climate change and climate action that are submitted to the UNFCCC Secretariat; these reports are known as **National Communications**.

Reporting requirements are different depending on the country's status under the convention. **Annex 1 parties**, a group of industrialized nations and the European Union, had the strictest reporting requirements with a mandate to file National Communications according to set deadlines (the Sixth National Communication was due in January 2014). **Non-Annex 1 parties** such as the Republic of Macedonia were originally requested to submit National Communications without a binding timetable. Macedonia, which ratified the UNFCCC in 1998, has prepared and submitted three National Communications (in 2003, 2009, and 2014).

At the 2007 CoP in Bali, Indonesia, Parties agreed on the principle of applying **monitoring, reporting, and verification (MRV)** for non-Annex 1 countries as well as for Annex 1 countries.[2] In 2011 and 2012, the annual Conferences of Parties, or the **CoPs**, set guidelines and timetables for how information should be reported. Currently, Annex 1 countries have the strictest reporting requirements and must file National Communications, Biennial Reports, and an annual report on their GHG emissions inventory. Non-Annex 1 countries, such as the Republic of Macedonia, must file National Communications and BURs. In January 2015, Macedonia became the eleventh country in the world to submit a BUR.

1 Articles 4.1 and 4.2.

2 See the "Bali Road Map" here: http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf

Under the **Paris Agreement** within the UNFCCC, which was signed in April 2016, countries also agree to provide information on their **Nationally-Determined Contributions (NDCs)** to the goals of the agreement: Holding the increase in global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the increase to 1.5 °C. Macedonia submitted its *intended* NDCs in August 2015.

WHY IS THE SBUR IMPORTANT?

The SBUR is a requirement under the UNFCCC, but it is important for other reasons as well. This SBUR, like other BURs, gives people in Macedonia (and around the world) a snapshot of GHG emissions in the country and an overview of what Macedonia is doing to address climate change. It also provides an opportunity to look at policies and investments in Macedonia and to see whether they are aligned with climate action. Furthermore, it helps to identify priority areas for investment, training, and education.

The work conducted under the SBUR also supports Macedonia's priorities that are reflected in its status as a Contracting Party of the Energy Community (EnC) and as a candidate country for EU accession. The capacity that is developed under the BUR process moves Macedonia closer to being able to meet the more rigorous requirements of these two bodies.

However, in addition to the report's findings, the process of compiling the SBUR is important. It brings together policy-makers and scientists from many different sectors, ranging from energy and industry to agriculture and forestry and even public health and disaster management. It develops recommendations on how to improve monitoring and reporting, and it creates a situation where many different institutions must work together on a regular basis. Finally, it fosters a partnership between science and policy-making, as each report must consider the quality of the information and approaches and the continuity of the process.

HOW DOES THIS GUIDE WORK?

The subsequent part of this report gives an overview of the main findings from the different sections of the SBUR along with some additional information about climate change in Macedonia. A text box at the beginning of each section explains what the chapter includes, and it is followed by the main findings. These sections do not include the formal language and labels required by the UNFCCC for the official report, and they do not focus on the technical details behind the findings that are presented.

The complete, official SBUR is available at the national Climate Change website (see Figure 1). Even that official report is a summary of other, more detailed technical reports on each section of the SBUR. Those background reports are also available at the Climate Change website.

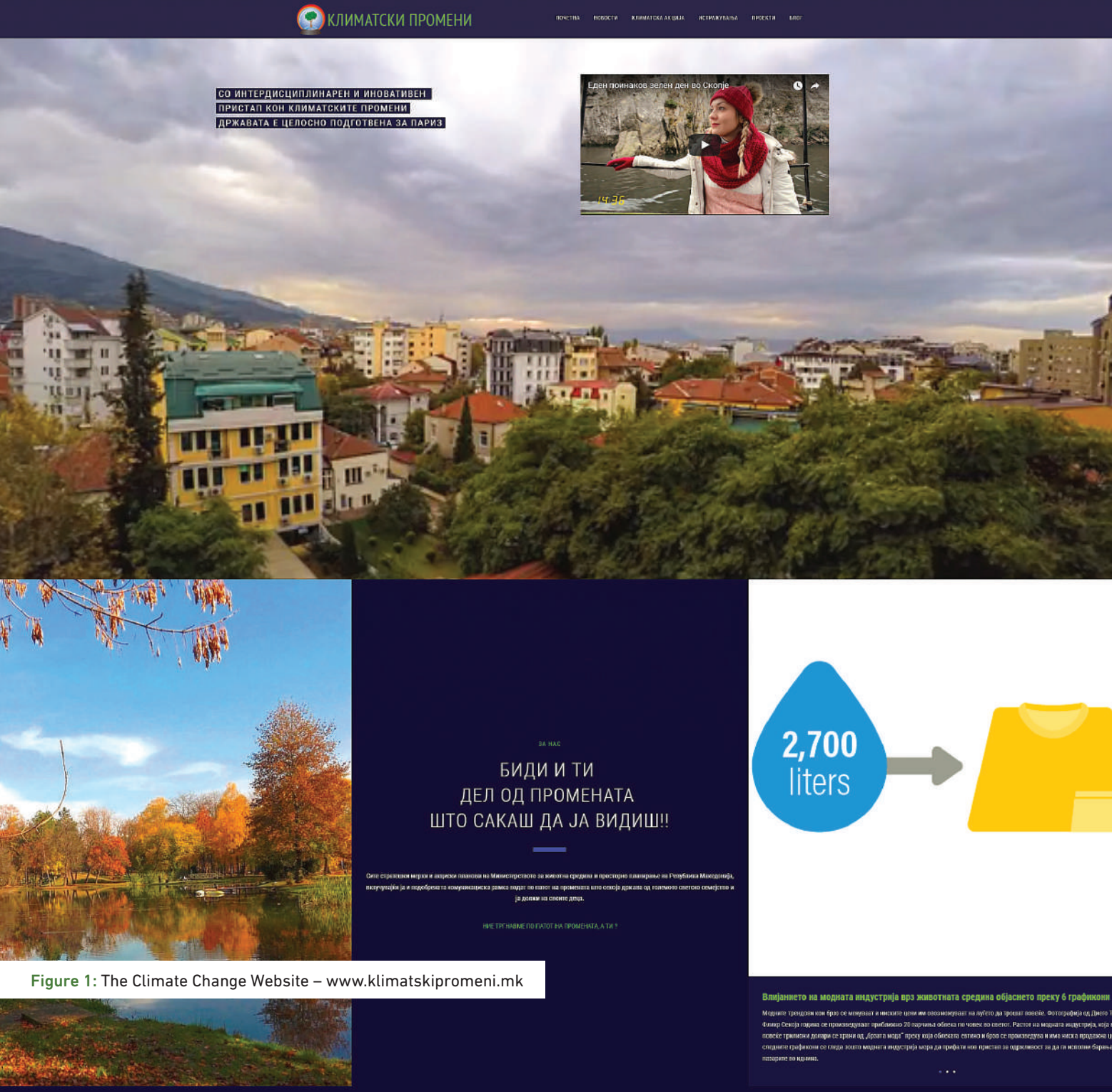

Figure 1: The Climate Change Website – www.klimatskipromeni.mk

NATIONAL CIRCUMSTANCES

The national circumstances chapter of the SBUR is designed to report on two main areas:

- Basic features of the country that affect its greenhouse gas emissions, such as energy use, agriculture, industrial production, or waste disposal; and
- Institutions that are involved in climate action, including the preparation of the SBUR.

TRENDS IN KEY SECTORS

In Macedonia, there are four significant areas for reporting: the energy sector, industry, agriculture and forestry, and the waste sector.

ENERGY: The energy sector generates by far the largest share of GHG emissions in the Republic of Macedonia. Fossil fuels, primarily coal, account for over 80% of total energy demand. The SBUR found that while the consumption of fossil fuels has gone down in the past several years, this decrease is mostly due to increasing electricity imports, which rose from 3% in 2003 to 10% in 2014. Currently, Macedonia imports about half of the electricity that it uses.

The SBUR also found that the share of renewable energy in total energy demand has increased from 10% in 2012 to 15% in 2015. However, in-country production of renewable energy stayed constant at 11% of all energy produced in Macedonia.

The average citizen of the Republic of Macedonia emits 30% fewer emissions than an average citizen in the EU-28, or approximately the same as an average citizen in Romania or Hungary.

However, the total amount of energy required to produce a unit of GDP in Macedonia is around four times higher than the average of European developed countries.

Because Macedonia uses a large share of fossil fuels, including lignite (a low-energy, high-sulphur type of coal) to produce electricity, and it uses these fuels less efficiently than many European countries, *there is a great deal of potential to reduce GHG emissions*.

INDUSTRY: A large share of GHG emissions in industry come from metallurgy, mostly from the production of ferroalloys, which are used in the iron and steel industries. Cement production is the second largest source of GHG emissions in industry. Almost all of the rest of industrial GHG emissions are produced from chemicals used for refrigeration and air conditioning.

AGRICULTURE AND FORESTRY: Forests and forest lands are important in the SBUR, because they are the main CO_2 *sinks*, or places that absorb more CO_2 than they emit, in Macedonia. The SBUR found that land use in Macedonia has changed rapidly since 2009. Areas classified as pastures have increased by more than 150,000 hectares, while total forest area in the period 2010-2015 has increased by more than 100,000 hectares.

Agriculture is an important economic sector in Macedonia because it contributes nearly 10% of GDP (in 2016) and it employs more than 17% of the country. It is also relatively vulnerable to climate change impacts, particularly flooding. In the area of GHG emissions, the largest source is livestock production, when methane is emitted by livestock and their manure. Other GHG emissions in agriculture are produced when farms use too little or too much fertilizer, when soil quality decreases, and when agricultural land is farmed too intensively.

WASTE: The waste sector is the second largest source of greenhouse gases in Macedonia. In 2014, approximately 370 kg per capita of communal waste was generated, and 75% of that waste was taken to landfills. The remainder was disposed of through incineration or open burning. The Drisla Landfill, which serves the Skopje region, is the only permitted landfill in Macedonia. In rural areas, at municipal landfills or dumpsites, the waste is simply dumped by communal enterprises. Composting is still at a very early stage--only 1.945 tonnes of biological waste was composted in 2014. Finally, many Macedonian mining and processing industries that generated hazardous waste have closed down, abandoning their on-site waste dumps with little or no information on the history of these dumpsites.

CLIMATE CHANGE INSTITUTIONS IN MACEDONIA AND THE SBUR

The *Ministry of Environment and Physical Planning (MOEPP)* has been designated as the National Focal Point to the UNFCCC. Other ministries that have responsibilities related to climate change aspects are the Ministry of Agriculture, Forestry and Water Economy, the Min-

istry of Economy, the Ministry of Transport and Communication, the Ministry of Health and the Ministry of Finance. The Office of the Deputy Prime Minister for Economic Affairs is responsible for the achievement of the Sustainable Development Goals, and it is also a National Designated Entity for the Green Climate Fund. Furthermore, as one of the strongest national institution in the country, the Office of the Prime Minister for Economic Affairs strongly supports climate and energy-related projects around Macedonia.

The National Council for Sustainable Development is responsible for mainstreaming sustainable development into national economic policies. The *National Climate Change Committee (NCCC)* provides high-level support and guidance for the overall climate change policies in the country. The list of organizations on the NCCC is provided in Figure 2.

The process for producing National Communications and Biennial Reports for the UNFCCC is led by MOEPP, which is the institution responsible for climate change policies and national focal point for the UNFCCC. The National Climate Change Committee (NCCC) and the Technical Group at the National Sustainable Development Council also participate in this this process as well as other key stakeholders in government and in civil society.

International institutions and donors, specifically the Global Environmental Facility (GEF) and the United Nations Development Program (UNDP), have provided financial and technical support for this reporting pross.

NATIONAL CLIMATE CHANGE COMMITTEE

Ministry of Environment and Physical Planning
Teodora O. Grncarovska, PhD, *UNFCCC Focal Point*

Macedonian Academy of Sciences and Arts
Prof. Natasa Markovska, PhD, *Committee Chair*

Office of the Vice President of the Government responsible for economic issues

Ministry of Economy

Ministry of Agriculture, Forestry and Water Economy

Ministry of Culture

Ministry of Foreign Affairs

Ministry of Education and Science

Ministry of Transport and Communications

Ministry of Finance

Secretariat for European Affairs

Economic Chamber of Macedonia, Administrative Office of the Economic Chamber of Macedonia

National Hydrometeorological Service

Crisis Management Centre

Macedonian Red Cross

ZELS - Association of Units of Local Self-Government of the Republic of Macedonia

Tehnolab

Climate Reaction Network

State Statistical Office

Ministry of Health

Institute of public health

Institute of Occupational Medicine

Figure 2: Institutional Members of the National Climate Change Committee

GREENHOUSE GAS INVENTORY

The inventory chapter of the SBUR provides information on total GHG emissions in Macedonia of greenhouse gases: CO_2, CH_4, N_2O, PFCs, and HFCs. It also reports on emissions of CO, NO_x, NMVOC and SO_2.[3] Emissions are calculated for previous years, starting with the baseline year of 1990, and this SBUR presents information about emissions in 2013 and 2014, which is new. The chapter describes emissions in two ways: 1) by the sector where the emissions occur; and 2) by the type of greenhouse gas that is emitted. The inventory also estimates how much carbon is sequestered in carbon sinks. Finally, the inventory provides information about the level of uncertainty about these estimates.

3 As the Inter-Governmental Panel on Climate Change describes them, "Carbon monoxide (CO), Nitrogen oxides (NOx) and NMVOC in the presence of sunlight contribute to the formation of the greenhouse gas ozone (O_3) in the troposphere and are therefore often called 'ozone precursors.'" (IPCC 2006).

TOTAL EMISSIONS

Aggregate GHG emissions and removals (net emissions), which are the amount of GHGs that are generated minus the amount of GHGs that are sequestered, total **10,720.7 Gg CO_2-eq in 2013 and 9,023 Gg CO_2-eq in 2014**. These levels are lower than the peak emissions year of 2008 and also lower than base year emissions in 1990.

EMISSIONS BY SECTOR

Table 1 and Figure 3 show the estimates of emissions and removals over time, including net emissions (in CO_2-eq), from 1990 to 2014. As the table and figure show, the energy sector is consistently the largest source of CO_2 emissions. Forests and non-agricultural lands are usually a GHG sink. However, in 2000, 2007, 2008 and 2012, wild fires generated so much CO_2 that it outweighed the CO_2 that was sequestered.

Sector	1990	2003	2008	2012	2013	2014
Energy	9,415.5	8,887.7	9,026.7	9,450.6	8,419.4	7,957.5
Industrial Processes and Product Use	941.8	845.2	1,132.1	776.4	923.1	921.6
Agriculture	1,327.7	1,071.6	1,072.3	1,019.4	989.2	1,001.8
Forestry and Other Land Use	-220.0	-3,757.9	1,351.0	1,914.8	-1,837.0	-3,181.1
Waste	1,391.5	1,550.7	1,765.5	2,146.8	2,226.1	2,323.4
Total Sources Minus Sinks (Net Emissions)	**12,856.5**	**8,597.3**	**14,347.7**	**15,308.0**	**10,720.7**	**9,023.2**
Total Sources Only	**13,076.6**	**12,355.2**	**12,996.7**	**13,393.3**	**12,557.7**	**12,204.3**

Table 1: GHG emissions and removals by sector (in Gg CO_2-eq)

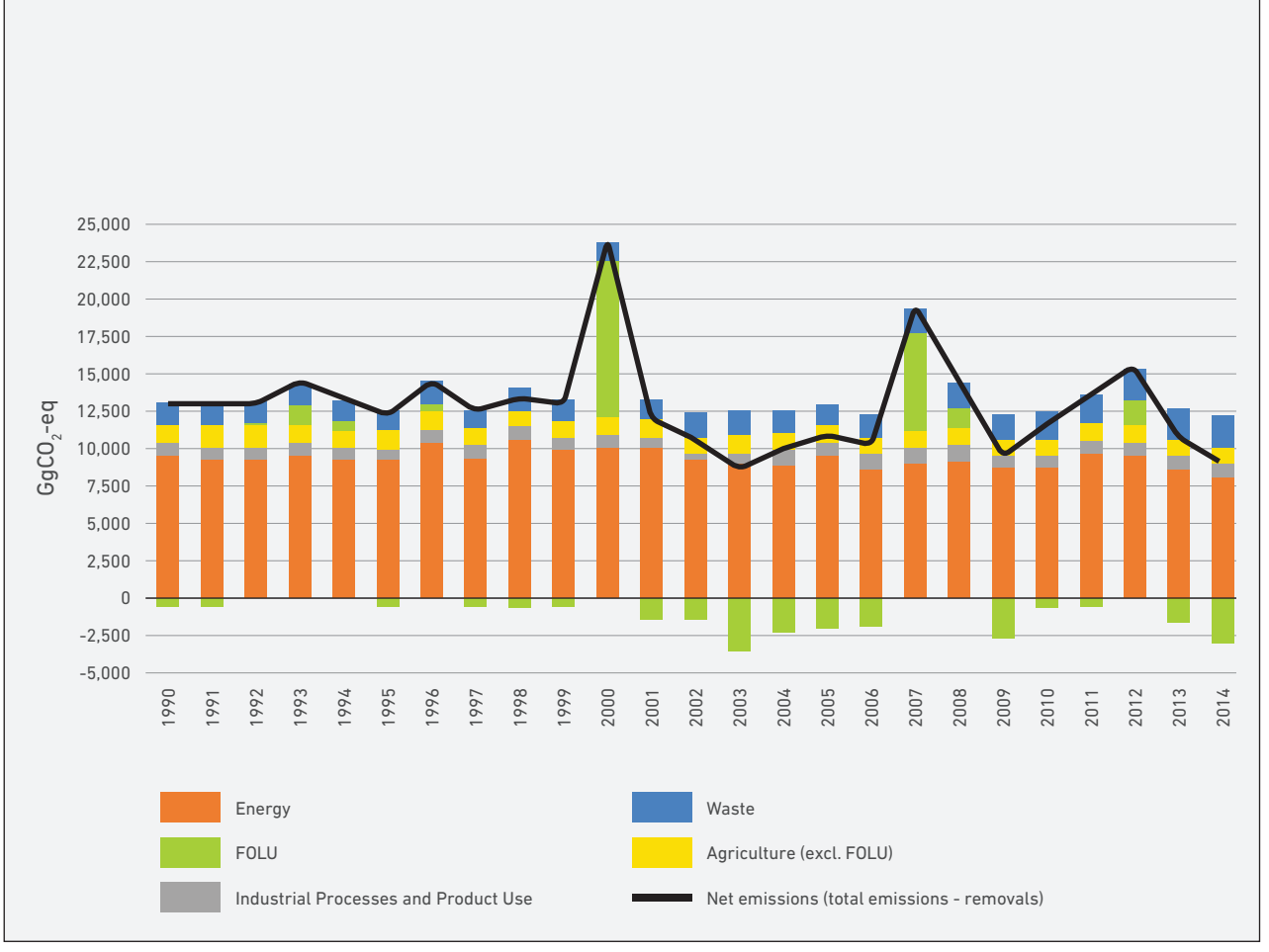

Figure 3: GHG emissions and removals by sector (in Gg CO_2-eq)

The SBUR also breaks down information about emissions for each important sector. One example of this is the Energy sector, which dominates GHG emissions in Macedonia. Figure 4, illustrates estimated GHG emissions in the energy sector by category (in Gg CO_2-eq).

Note that the decrease in energy sector emissions in 2013 and 2014 is *not* due to reduced energy consumption. Electricity production in Macedonia (under the "Energy Industries" category) has been replaced largely by electricity imports.

Transportation, which is counted under the energy sector, accounts for 8.2% of all emissions in Macedonia and has fast-changing emission trend.

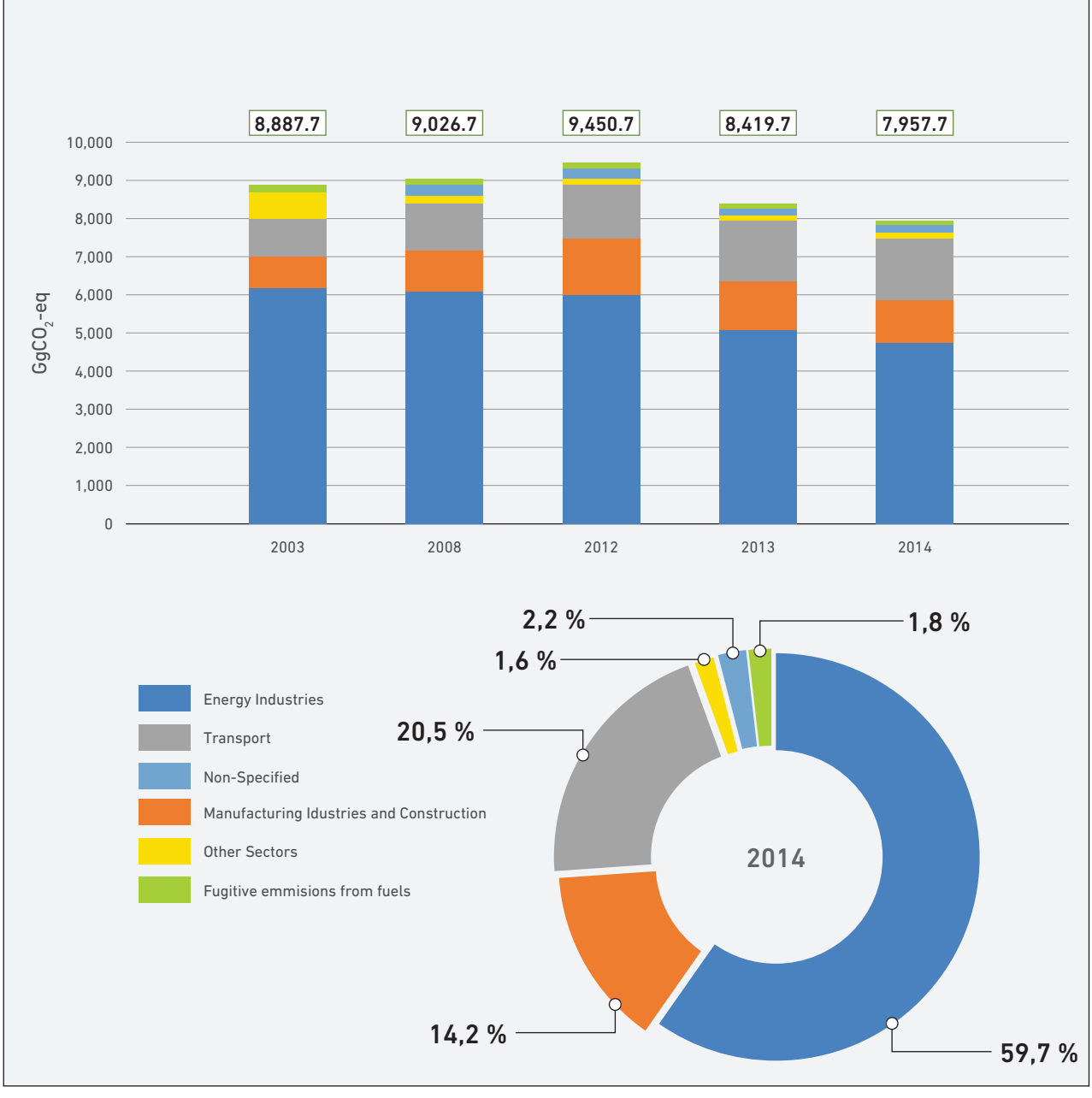

Figure 4: GHG emissions in Energy sector by category (in Gg CO_2-eq)

EMISSIONS BY TYPE OF GREENHOUSE GAS

Looking at emissions by different types of GHGs (**Table 2** and Figure 4), it is clear that CO_2 emissions are by far the most significant: they contribute 69.3% of all emissions in 2014, followed by CH_4 emissions (25.6%), N_2O emissions (3.6%) and all F-gases (1.5%).

Table 2: GHG emissions by gas (in Gg CO_2-eq)

Gas	1990	2003	2008	2012	2013	2014
CO_2 including forests and other land use	9,814.7	5,554.5	10,832.4	11,766.2	7,097.0	5,272.7
CO_2 excluding forests and other land use	10,034.7	9,312.4	9,481.4	9,851.4	8,934.0	8,453.8
CH_4	2,456.9	2,475.0	2,640.3	2,989.9	3,018.0	3,125.6
N_2O	470.5	424.6	484.7	449.2	439.0	441.5
HFCs	0.0	89.8	390.1	96.7	165.2	183.5
PFCs	114.5	53.4	0.2	6.0	1.4	0.0
SF_6	0.0	0.0	0.0	0.0	0.0	0.0
Total Sources Minus Sinks (Net Emissions)	**12,856.5**	**8,597.3**	**14,347.7**	**15,308.0**	**10,720.7**	**9,023.2**
Total Sources Only	**13,076.6**	**12,355.2**	**12,996.7**	**13,393.3**	**12,557.7**	**12,204.3**

UNCERTAINTY ANALYSIS

The SBUR uses two different mathematical approaches for calculating the uncertainty of the estimates that is presents for GHG emissions in different sectors. The GHG inventory for Macedonia has very low uncertainty in areas where data are available and relatively easy to obtain: the energy sector and certain types of industrial emissions, such as the use of ozone-depleting substances for refrigeration and air conditioning. In the waste sector, however, uncertainty is very high, because it is difficult to obtain accurate data on waste generation and disposal. The SBUR inventories chapter also discusses quality assurance and quality control in preparing the inventory, and it provides recommendations for reducing uncertainty in future nventories in each sector.

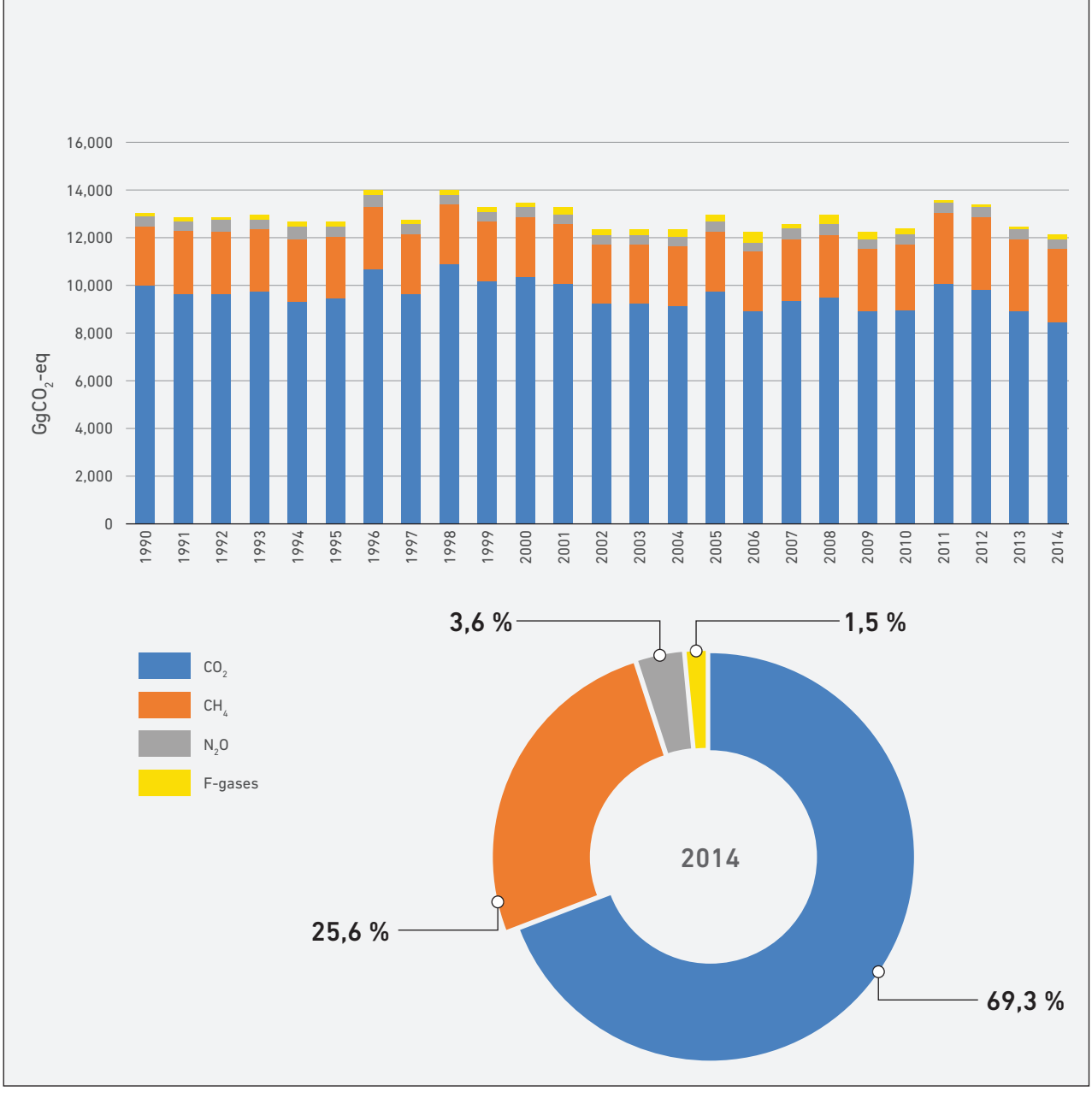

Figure 5: Total GHG emissions by gas, excluding forests and other land use (in Gg CO_2-eq)

CLIMATE CHANGE MITIGATION

The mitigation chapter of the SBUR gives an updated description of national programs and measures to address climate change, either by reducing GHG emissions or increasing GHG sinks. The chapter describes measures that are ongoing and measures that are planned or are being considered. Countries can also provide information about how they prioritize these measures based on social, economic, and other factors.

The SBUR explores the impact of ongoing, planned, and potential measures through three scenarios: 1) The **Survival Scenario** (a reference scenario); 2) the **Safe Way Scenario** (a scenario with existing measures); and 3) the **Climate Champion Scenario** (a scenario with additional measures). These scenarios cover the period from 2012 to 2035.

The measures in the Safe Way and Climate Champion Scenarios were selected from national strategic and planning documents. A total of 46 measures (35 in the Energy sector, 8 in the AFOLU sector, and 3 in the Waste sector) were prioritized by assessing their economic effectiveness; i.e. how many euros must be spent for a given measure

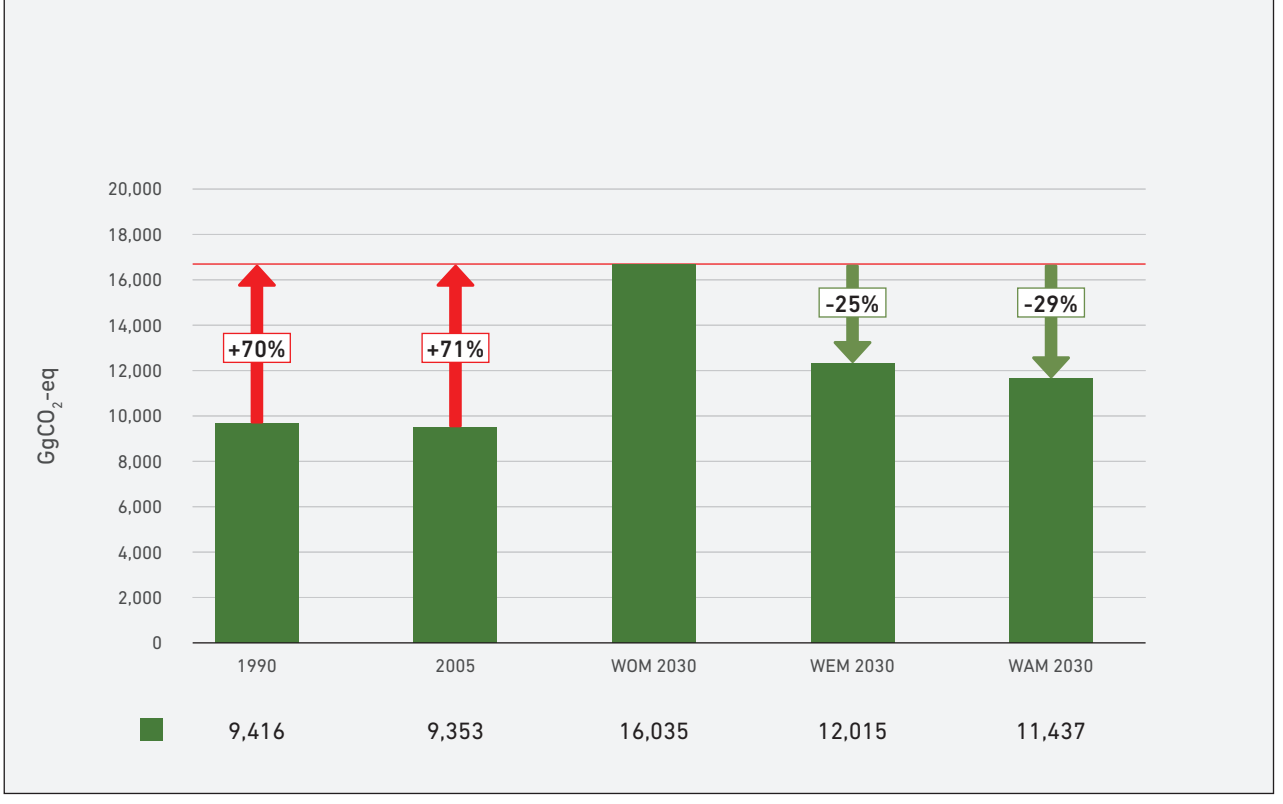

Figure 6: Comparison of GHG emissions from the energy sector in 1990 and 2005 with emissions in 2030 in the Survival, Safe Way, and Climate Champion scenarios (Gg CO_2-eq)

to reduce a ton of CO_2 equivalent. They were also prioritized by their mitigation potential; i.e. the total tons of CO_2 equivalent that the measure could mitigate.

Figure 6 compares the level of GHG emissions in the energy sector in 2035 for all three scenarios compared to the base year of 1990 and the year 2005.

As it turns out, about 80% of all emission reductions can be achieved through policies and measures with negative specific costs, or measures that actually save money. These are known as **win-win measures,** because they not only reduce emissions, but they also create financial savings. These policies and measures were also analyzed for their potential for green job creation. Policies and measures that also created green jobs are considered **win-win-win measures**, because they generate economic, environmental, *and* additional benefits.

The SBUR also compared its scenarios with the first BUR (the FBUR) and with Macedonia's Intended Nationally Determined Contributions (INDCs), which were developed as the country's participation in the Paris Agreement under the UNFCCC. It was not possible to compare the scenarios directly with the INDCs for several technical reasons, but the SBUR team was able to compare CO_2 emissions (without electricity imports).

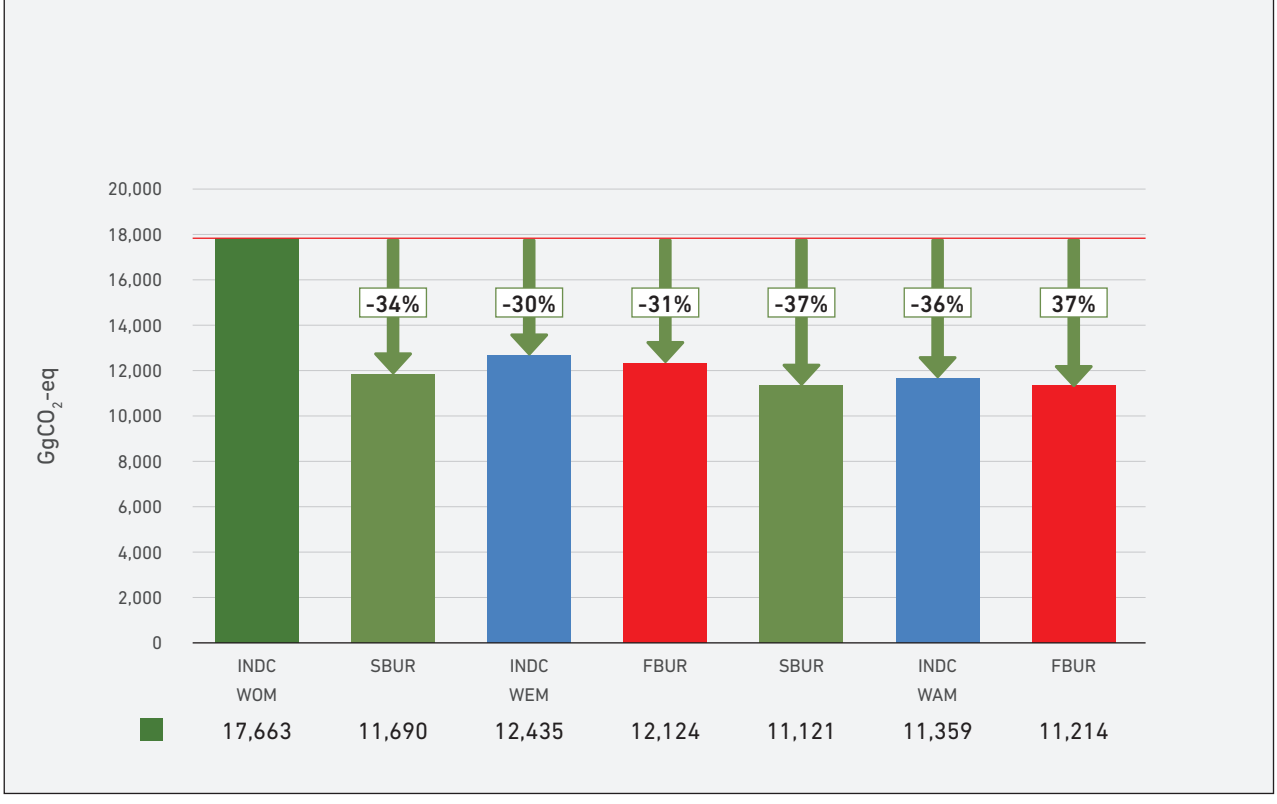

Figure 7: Comparison of the SBUR, INDC and FBUR, Mitigation and the Climate Champion Scenario for the energy sector with the INDC Reference Scenario, 2030 (in Gg CO_2-eq)

Figure 7 shows the results and indicates that the INDC targets for the energy sector can be achieved under the policies and measures that are planned for Macedonia.

POLICIES AND MEASURES THAT CAN MITIGATE CLIMATE CHANGE

Table 3 provides a list of the planned and potential mitigation measures for Macedonia and describes how they work. The left-hand column of the table indicates whether the measure is in the Safe Way Scenario, the Climate Champion Scenario, or both.

Table 3: Overview of mitigation measures selected for inclusion in the Safe Way and/or Climate Champion Scenarios

ACTION AND SCENARIO	DESCRIPTION
Reduction of distribution losses *(Safe Way and Climate Champion)*	Operating and constructive measures necessary for losses reduction, implemented by distribution networks operators. Energy suppliers and distribution companies are required to achieve a certain amount of annual energy savings at the end-user level.
Large hydro power plants *(Safe Way and Climate Champion)*	Construction of new large hydro power plants
Small hydro power plants. *(Safe Way and Climate Champion)*	Construction of new small hydro power plants and introduction of flexible feed-in premium tariffs to stimulate the construction
Solar power plants *(Safe Way and Climate Champion)*	Construction of solar power plants (larger than 10 kW) and introduction of flexible feed-in premium tariffs to stimulate the construction
Solar rooftop power plants *(Safe Way and Climate Champion)*	Construction of solar rooftop power plant and introduction of "net metering"
Wind power plants *(Safe Way and Climate Champion)*	Construction of wind power plants and introduction of flexible feed-in premium tariffs to stimulate the construction
Biogas power plants *(Safe Way and Climate Champion)*	Construction of biogas power plants and introduction of flexible feed-in premium tariffs to stimulate the construction
Biomass power plants (CHP optional) *(Safe Way and Climate Champion)*	Construction of biomass power plants (CHP optional) and introduction of flexible feed-in premium tariffs to stimulate the construction
Bitola district heating *(Safe Way and Climate Champion)*	Construction of district heating system in Bitola and utilization of the waste heat from TPP Bitola
Natural gas power plants (CHP) *(Climate Champion only)*	Construction of natural gas power plants (CHP)
Solar thermal collectors *(Safe Way and Climate Champion)*	Installation of solar thermal collectors for hot water

ACTION AND SCENARIO	DESCRIPTION
Labeling of electric appliances and equipment *(Safe Way and Climate Champion)*	Labeling of electric appliances and equipment to provide relevant information on the energy consumption of the products. The application of the labeling and eco-design of the products is necessary to ensure that the products sold in Macedonia are in compliance with the EU regulations.
Phasing out of resistive heating devices and introduction of more heat pumps *(Climate Champion only)*	Phasing out heating devices with resistive heaters and their replacement with heat pumps in compliance with EU Climate and Energy Policy
Public awareness campaigns and network of Energy Efficiency (EE) Info Centers *(Safe Way and Climate Champion)*	Establishment of EE info centers in municipalities or regional centers, in which energy advisors will operate, will share free advice to the interested citizens about the possibilities of saving energy and saving money in their homes
Retrofitting existing residential buildings *(Safe Way and Climate Champion)*	Reconstruction of residential buildings including windows replacement, initiated by the owners and/or supported by commercial banks and funds which exist in the Republic of Macedonia This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for commissioning the reconstructed buildings.
Retrofitting existing public buildings *(Safe Way and Climate Champion)*	Reconstruction including windows replacement of existing public buildings under jurisdiction of the central government or municipal government. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for commissioning the reconstructed buildings.
Retrofitting existing commercial buildings *(Safe Way and Climate Champion)*	Reconstructions of existing commercial buildings including windows replacement, initiated by the owners and/or supported by commercial banks and funds which exist in the Republic of Macedonia This measure will provide issuing of certificates for energy performance of buildings as a prerequisite for commissioning the reconstructed buildings.
Construction of new buildings *(Safe Way and Climate Champion)*	Construction of new buildings in compliance with the Directive on energy performance in buildings. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation

ACTION AND SCENARIO	DESCRIPTION
Construction of passive buildings *(Climate Champion only)*	Construction of new passive residential buildings in compliance with the EU Directive 2010/31/EU. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation
Phasing out incandescent lights *(Climate Champion only)*	Replacing incandescent light bulbs with halogen ones (at the beginning) and later with compact fluorescent (CFL) and LED
Improvement of municipal street lighting *(Safe Way and Climate Champion)*	Replacement of the existing lamps with sodium and LED lamps
Green procurement *(Climate Champion only)*	Intensified activities to ensure legal and technical knowledge and skills of public sector entities for inclusion and evaluation of requirements for energy efficiency in public procurement procedures by applying the criteria of most economically advantageous tender.
Gasification (residential, commercial, and public sector) *(Climate Champion only)*	Gasification of residential and commercial and public sector through construction of a gasification network
Increased use of district heating systems *(Climate Champion only)*	Increased use of the existing central heating systems through implementation of information campaigns for connecting new consumers, including those who have been disconnected from the system in the past.
Utilization of district heating systems in combination with solar collectors for hot water in the buildings sector. *(Climate Champion only)*	Obtaining sanitary hot water by combining district heating with solar collectors
Energy management in manufacturing industries *(Safe Way and Climate Champion)*	Implementation of obligatory energy audits of manufacturing industries and implementation of ISO 50001 standard
Introduction of efficient electric motors *(Safe Way and Climate Champion)*	Introduction of efficient electric motors in manufacturing industries
Biofuels 5% *(Safe Way only)*	5% share of biofuels by 2020

ACTION AND SCENARIO	DESCRIPTION
Biofuels 10% *(Climate Champion only)*	10% share of biofuels by 2020
Increased use of railways *(Climate Champion only)*	Increased use of the railway though awareness rising to use the railway for long-distance traveling and by improving the conditions of the companies
Renewing the national passenger car fleet *(Safe Way and Climate Champion)*	This measure consists of successively organized and well-planned steps for faster renewal of the vehicle fleet of passenger cars.
Renewing of other national road fleet (light duty and heavy goods vehicles and buses) *(Safe Way and Climate Champion)*	This measure involves introduction of a regulation that will enable renewal of the vehicle fleet of light-duty trucks, freight vehicles, and buses
Increased use of bicycles, walking and introduction of parking policy *(Safe Way and Climate Champion)*	Conducting campaigns/providing subsidies and systems for use of new or rented bicycles, walking, and introduction of parking policies that would reduce the use of cars in the city area
Construction of the railway to the Republic of Bulgaria *(Climate Champion only)*	Construction of the railway to the Republic of Bulgaria
Electrification of Transport *(Climate Champion only)*	This measure consists of successively organized and well-planned steps for faster renewal of the vehicle fleet through introduction of electric vehicles
Enteric fermentation in dairy cows *(Safe Way and Climate Champion)*	This measure involves modifying the feed composition and nutrition practice for dairy cows in order to reduce CH_4 emissions due to enteric fermentation through practical training and demonstrations for farmers.
Manure management in dairy cows *(Safe Way and Climate Champion)*	This measure involves modifying the manure management of dairy cows in order to reduce NO_2 emissions through subsidies for adopting new practices and incentives for modified farm design and construction.
Manure management at swine farms *(Safe Way and Climate Champion)*	This measure involves modifying manure management at swine farms to reduce NO_2 emissions through subsidies for adopting new practices and incentives for modified farm design and construction.

ACTION AND SCENARIO	DESCRIPTION
Decreasing the number and extent of forest fires *(Safe Way and Climate Champion)*	This measure would protect forested areas by preventing forest fires and the resulting damages
Change of quality of forests through the afforestation of transitive forest land *(Safe Way and Climate Champion)*	This measure would improve forest quality through the afforestation of transitive forest land with higher quality tree species: coniferous, deciduous and mixed forests
Conversion of crop land in areas with more than a 15% incline to other uses *(Safe Way and Climate Champion)*	This measure involves the conversion of inclined crop land into perennial grassland (pastures, meadows) in order to decrease the intensity of soil organic matter depletion and soil carbon emissions, creating a carbon sink. Areas above 15% inclination by law should not be cultivated and are not considered to be agricultural land.
Contour farming on croplands on an inclined terrain (5-15% incline) *(Safe Way and Climate Champion)*	This measure involves reducing the quantity of soil carbon released during downslope cultivation of cropland by encouraging farmers to adopt contour farming on terrain with a 5-15% incline through a systematic awareness-raising campaign.
Perennial grass in orchard and vineyards on inclined terrain (>5%) *(Safe Way and Climate Champion)*	This measure would plant perennial grass in vineyards and orchards using downslope cultivation in order to reduce erosion, protect organic matter in soil, and reduce carbon emissions from soil.
Closure of existing landfills *(Safe Way and Climate Champion)*	This measure would reduce emissions of CH_4 and CO_2 by rehabilitating existing landfills and illegal ("wild") dumpsites with very high, high, and medium risk ratings in each of Macedonia's five waste management regions through measures such as covering existing non-compliant landfills, supplemented by gas extraction and flaring.
Mechanical and biological treatment (MBT) in new landfills with composting *(Safe Way and Climate Champion)*	This measure would reduce emissions of CH_4 and CO_2 opening new regional landfills in all waste management regions that feature systems for the mechanical and biological treatment of solid waste and composting.
Waste paper collection *(Safe Way and Climate Champion)*	This measure would reduce emissions of CH_4 and CO_2 through the installation of containers for collecting of selected waste, mainly paper.

"WIN-WIN" MITIGATION MEASURES

The SBUR team developed a **marginal abatement cost curve** that calculated the marginal costs of reducing an additional ton of CO_2 equivalent for all of the policies and measures listed in the previous section. This cost curve is shown in Figure 8.

The total emission reductions that can be achieved by implementing all of the policies and measures by 2030 are estimated at more than 10,940 Gg CO_2 equivalent, or nearly half of all emissions in 2030 under the Survival Scenario. Furthermore, almost 80% of these reductions can be achieved with policies and measures that have negative costs. These options are mostly inexpensive measures that change consumer behavior, and their implementation should be a high priority for Macedonia.

The SBUR team then considered the mitigation potential of all of the measures. The top five measures with the highest potential were the inclusion of more heat pumps, phasing out incandescent lights, decreasing the number and extent of forest fires, introducing natural gas-fired combined heat and power plants, and public awareness campaigns and networks of EE information centers. All of these measures had either negative or very low specific costs.

When abatement costs were cross-referenced with the total GHG reductions, the following significant win-win options appeared:

- Renewing the national car fleet;
- Energy labeling for electric appliances and equipment;
- Improvement of street lighting in municipalities;
- Introducing more heat pumps;
- Energy management in manufacturing industries; Phasing out incandescent lights;
- Public awareness campaigns and a network of Energy Efficiency info centers;
- Solar thermal collectors;
- Introduction of efficient electric motors;
- Reduction of distribution losses in the power grid; and
- Solar rooftop power plants.

Some of the policies and measures that have reasonably small costs (e.g. wind power plants, retrofitting existing residential buildings, introduction of biofuels, reducing methane emissions in dairy cows, afforestation, and conversion of land use away from field crops above a 15% inclination) should also be considered.

MEASURES THAT CREATE GREEN JOBS, OR WIN-WIN-WIN MEASURES

As shown in Figure 9, over 6,200 green jobs[4] can be expected in 2035 by implementing energy efficiency measures in buildings and low-carbon energy supply (renewable sources and gas).

4 This figure does not include approximately 14,000 additional green jobs created outside of Macedonia.

Figure 8. Marginal abatement cost curve for 2030

Figure 8: Marginal abatement cost curve for 2030

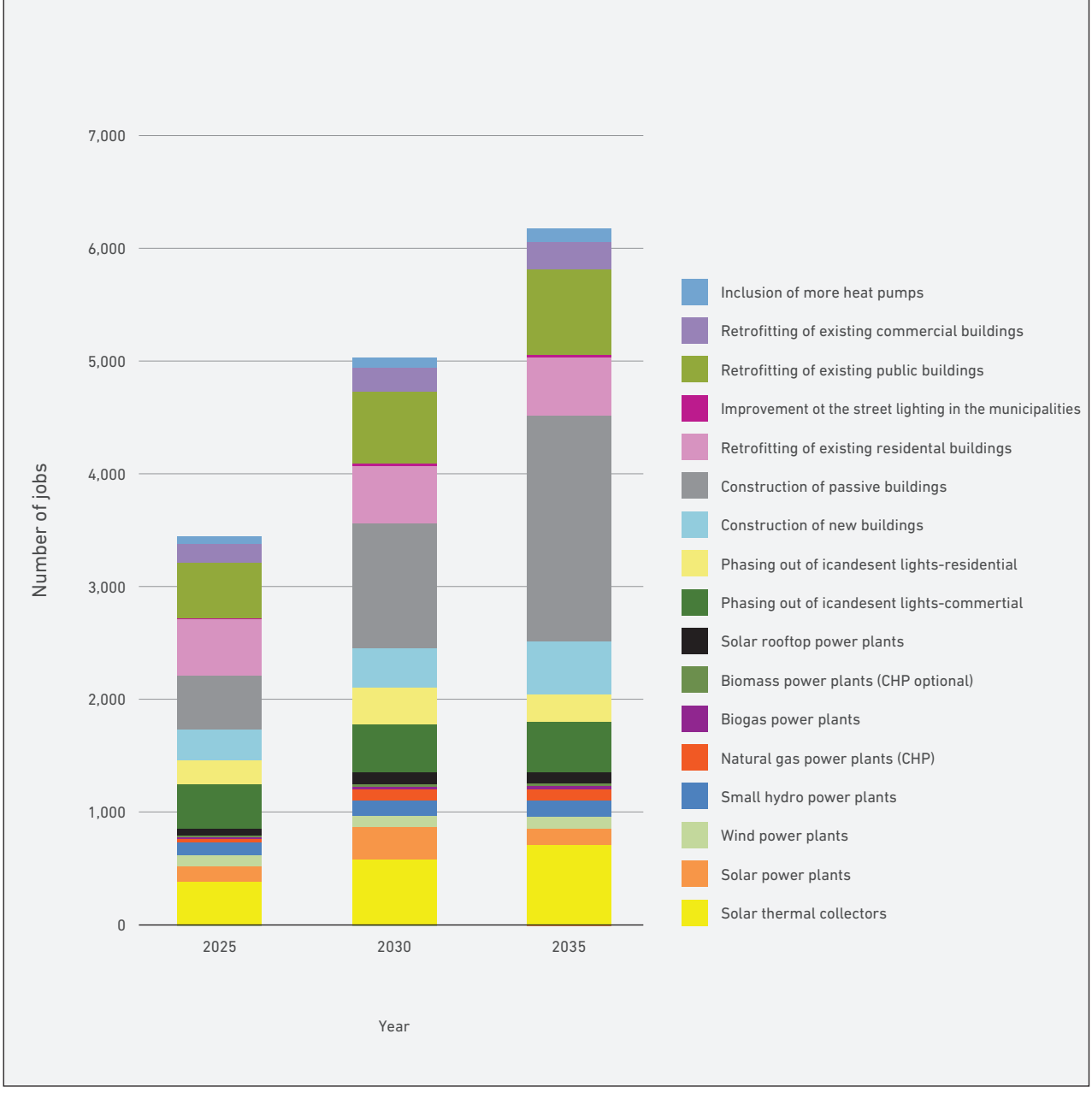

Figure 9: Number of domestic green jobs

MEASUREMENT, REPORTING, AND VERIFICATION (MRV)

This chapter of the SBUR looks at Macedonia's commitments to the UNFCCC and to other bodies, such as the Energy Community. It examines the legal framework for measuring and reporting climate change-related information to the UNFCCC, it studies whether the reporting obligations are being met, and it makes recommendations on how to improve the system and adapt it to meet Macedonia's present and future needs.

The Republic of Macedonia is in a unique situation when it comes to its international obligations regarding monitoring, reporting and verification. Macedonia is a Party to the UNFCCC, but it does not have quantified commitments. In spite of this, Macedonia is voluntarily attempting to incorporate more rigorous reporting as much as possible into the framework of its National Communications and Biennial Update Reports.

Macedonia also has the status of a Candidate Country for EU membership, which also carries certain obligations. Under their UNFCCC status, the European Union and its Member States are required to report annually on their GHG emissions. They must also report regularly on their climate change policies and measures through National

Communications. The annual EU GHG inventory report is prepared on behalf of the European Commission by the European Environmental Agency each spring. Finally, Macedonia is a Contracting Party of the Energy Community (EnC), which is rapidly implementing many policies that are directly related to the issue of MRV.

In Macedonia, The Law on Environment[5] currently regulates the issue of monitoring of anthropogenic emissions by sources and sinks of greenhouse gases. Sectoral laws and strategies provide some guidance on monitoring and reporting on policies and measures, such as the Law on Energy, the Strategy for Use of Renewable Energy Sources, and the Law on Vehicles. In conclusion, though national legislation clearly indicates that monitoring systems should be established, and several systems are under development or testing, none of the responsible institutions have comprehensive, fully-operational systems in place. The SBUR team also identified several systems that were relevant to monitoring and reporting sectoral data related to climate change commitments and activities. These systems included software to automate collection of data for the energy balance, software to monitor energy consumption in municipalities, emission monitoring software for industry, and the national vehicle registry, among others. All of the systems identified were either in the planning or testing stages.

Given Macedonia's status as a non-Annex I Party to UNFCCC, a Candidate Country for EU membership, and a Contracting Party of the Energy Community, the SBUR recommends that Macedonia should immediately begin to adjust its national legislation in order to adopt the provisions of EU Regulation No 525/2013 on mechanisms for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change (the MMR). The SBUR also recommends a design for a national system for MRV for policies and measures to mitigate climate change (Figure 10). This scheme will require some changes in national legislation in order to incorporate existing monitoring systems, which should be obliged to report to MOEPP. In other cases, organizations may have to adjust their current systems in order to provide information in the format and standards required by Macedonia's international obligations.

5 "Official Gazette of the Republic of Macedonia" 53/2005, 81/2005, 24/2007, 159/2008, 83/2009, 48/10, 124/10, 51/11, 123/12, 93/13, 42/14 and 44/2015)

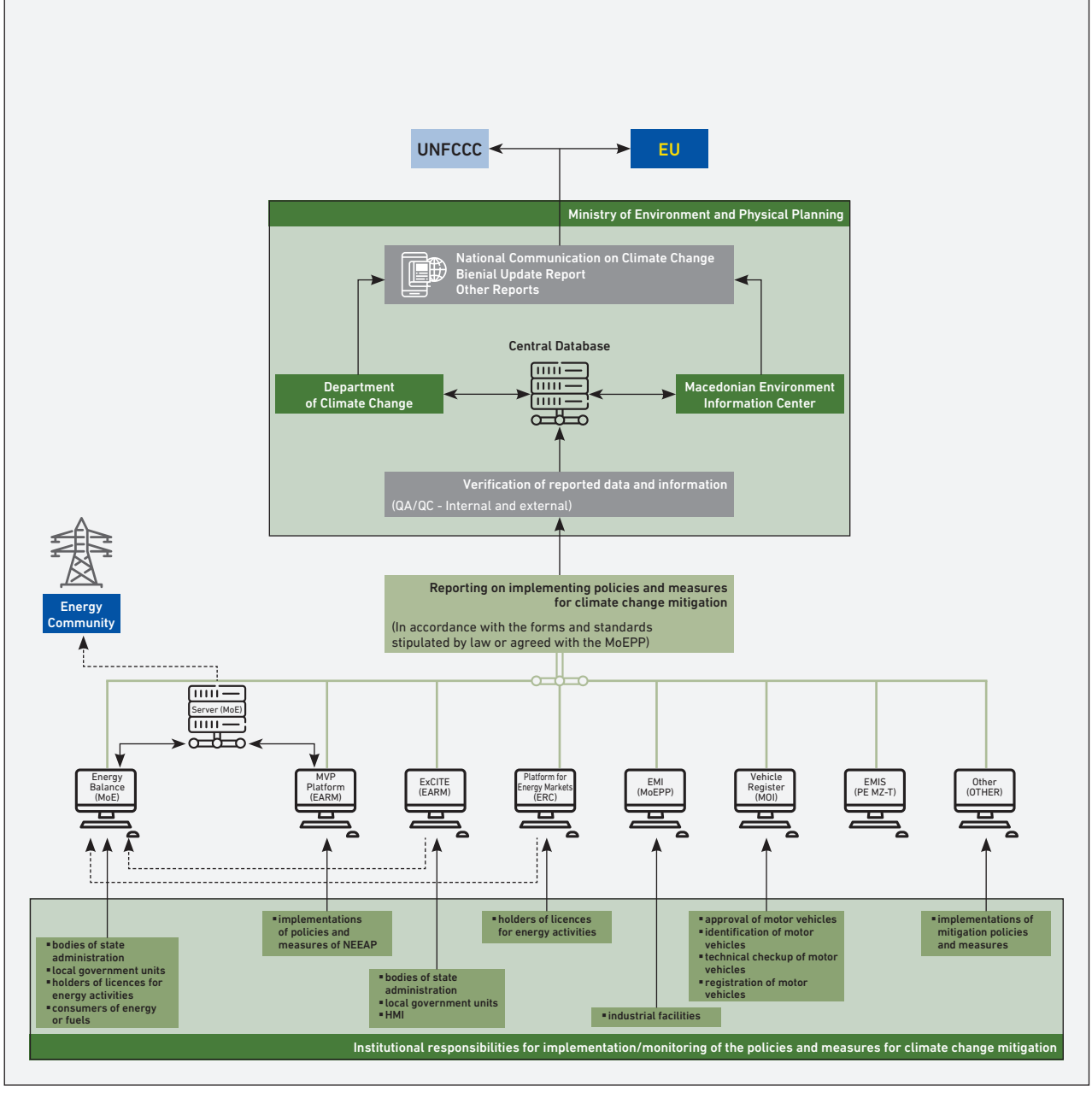

Figure 10: Proposed Organization of an MRV System for Policies and Measures

OTHER INFORMATION

Countries may choose to use the SBUR to report on other relevant information related to climate change. This SBUR mentions four areas: 1) public opinion and knowledge about climate change in Macedonia; 2) the national climate change communication strategy; 3) gender mainstreaming; and 4) using innovation to address climate change in Macedonia.

CLIMATE CHANGE SURVEY

In December 2016, UNDP and MOEPP conducted an online survey in order to provide a current snapshot of public knowledge about climate change and their perceptions of the issue. The results from this survey update the results of the public survey conducted in November 2014 under the preparation of the Third National Communication on Climate Change about key incentives for and challenges to environmental and climate-conscious behavior. The current survey also provides updated information on respondents' main sources of information about climate change and the per-

Figure 11: "Do you Care about Climate Change?" (Facebook Advertisement)

ceived visibility of this topic in the media, as well as the visibility of various climate change campaigns and projects.

The on-line survey was conducted in the Macedonian language. It consisted of a questionnaire with 22 primarily close-ended questions, which were divided into four sections: *General Questions; Climate Change Perceptions; Behavioral Aspects;* and *Information Sources*. Most of the questions in the latter three sections were multiple-choice. Because the survey was hosted on an interactive, on-line platform, the participants' answers could be tabulated immediately after they were submitted. In this way, participants could submit their responses and then immediately see how they fit into the overall survey findings.[6]

The on-line survey was distributed through professional mailing lists and promoted through social media outlets, such as Facebook and Twitter. The survey was also sent to 791 recipients from government, the private sector, academia, NGOs, and the media. A total of 88 Macedonian online news portals (49 Mace-

6 The interface of the automatic results analysis from the last page of the survey is available for viewing at (http://klimatskipromeni.mk/UNDP/SURVEY/SurveyResultsEN.html)

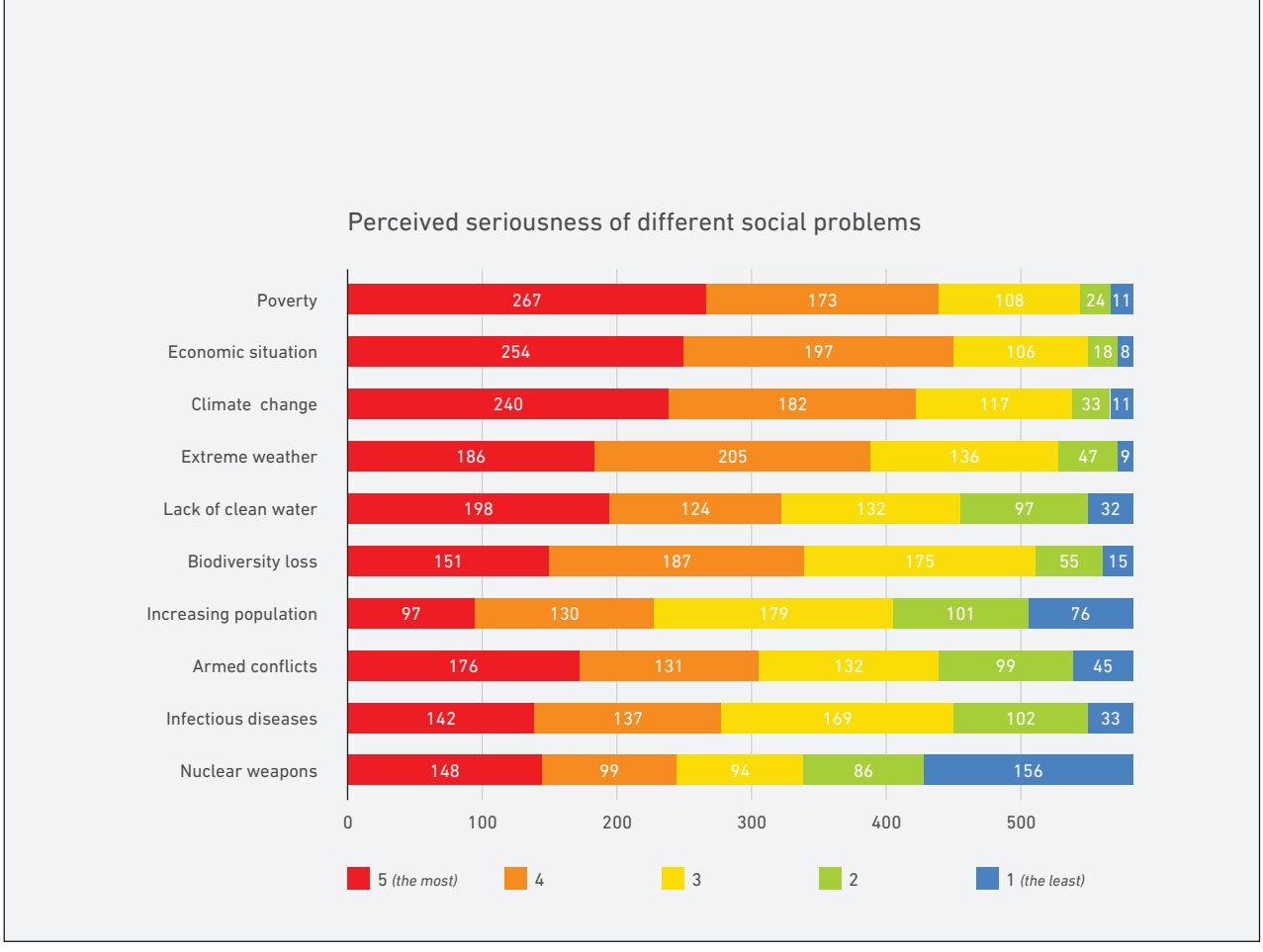

Figure 12: Ranking of the seriousness of possible threats to society

donian-language portals and 39 Albanian-language portals), including the MIA (Macedonian Information Agency), Sitel, and Popularno.mk, also distributed links to the survey.[7] In addition, the survey was published on the MOEPP website and at the Macedonian climate change website.[8] Finally, the public was invited to participate through advertisements on Facebook (Figure 11). The target audience was specified by location in Macedonia. The survey based on the Facebook advertising campaign was run for 14 days, and the questionnaire was also promoted through various Twitter accounts.

7 Located at http://www.mia.mk/, http://sitel.com.mk/, and http://www.popularno.mk/, respectively.

8 Located at www.klimatskipromeni.mk.

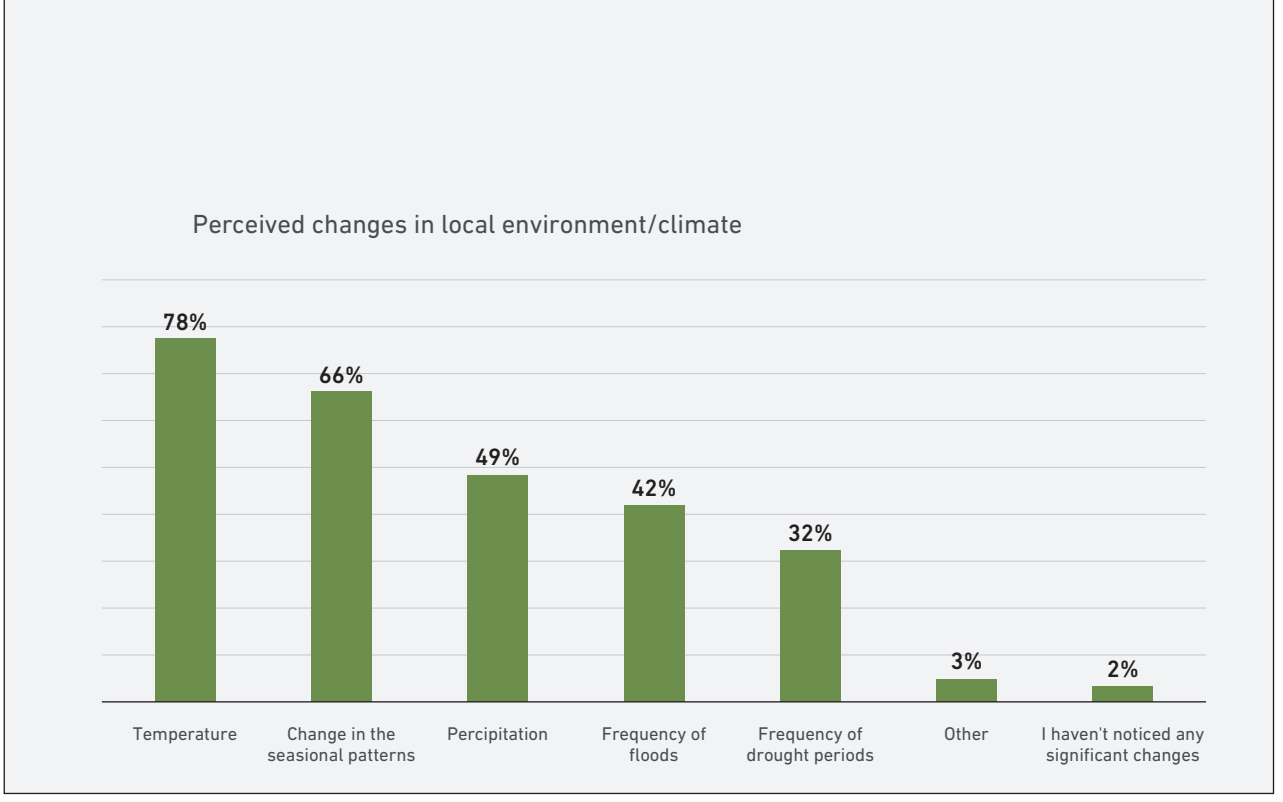

Figure 13: Environmental/climate changes noticed in the past 10 years

A total of 583 completed surveys were collected in a two-week period, with 71% of respondents from the ten municipalities of the city of Skopje and the rest from an additional 45 municipalities outside of the capital. Participants belonged to various age groups with the exception of persons over 65, and there were 5% more female respondents than male respondents. The majority of participants (474) held a university degree, and together with those with masters or PhD degrees, they represented 85% of the sample.

Compared to the previous on-line survey,[9] respondents felt more knowledgeable about climate change. Half of the participants considered that they were informed about a variety of climate change impacts and consequences, and they identified the most visible climate change impacts as extreme temperatures and irregularities in seasonal shifts and precipitation patterns. In the same line, participants reported an increase in climate change topics in the media, and half of the respondents related this increase to more frequent occurrences of extreme weather events.

9 UNDP and MOEPP (2014). "Climate change perception and awareness level: an online survey of the citizens of the Republic of Macedonia."

Figure 12 shows how participants ranked the seriousness of possible threats to society, where 5 represents the most serious and 1 the least serious threat. Poverty was perceived as the most serious threat by majority of participants (46%), followed by the economy (30%); climate change was ranked third. Respondents were least concerned about nuclear weapons proliferation.

Most respondents perceived some changes in the environment or climate in the past 10 years (Figure 13). In particular, 78% of the respondents noted the occurrence of extreme temperatures, such as periods of extreme heat and cold, while others perceived irregular seasonal shifts (66%) and changes in precipitation patterns (49%). Other changes not listed in the survey but reported as perceived by the participants included a lack of snow and an increased occurrence in temperature inversions, leading to smog.

In the area of climate action, the majority of the respondents had heard about the Paris Agreement and its status as the first universal, legally-binding global compact to combat climate change. Nearly all respondents (94%) considered it important to fight against climate change, while most (368) thought that this should be done by reaching a global climate change agreement. When asked about their opinions on the Paris Agreement, most survey respondents considered that all countries, including their own, should contribute to addressing climate change. However, the second largest group of respondents (80), representing around one quarter of the sample, expressed doubts that individual countries would respect the targets and actions in the agreement.

In addition, participants were not satisfied with the extent to which authorities, corporations and industry—or even citizens themselves—were contributing to the fight against climate change. Similarly, 34% reported that one obstacle to environmental and climate-conscious behavior was a feeling that it is not the duty of citizens, but that of the government, companies and industries. Conversely, 61% of the participants thought that it was their duty as citizens to protect the environment. This finding signals that citizens are progressing along a learning curve in their understanding about how individuals can contribute to tackling climate change. It is also encouraging that only 2% of the sample thought that it was too late to act against climate change, compared to 14% in the previous survey.

In other encouraging findings, most of the respondents reported that they took the environment and climate into consideration when making everyday decisions, as Figure 14 demonstrates. The majority of respondents reported making efforts to reduce energy and water consumption and to insulate their homes to reduce the amount of energy used for heating. More than half of respondents reported buying environmentally-friendly products and recycling their waste. Reducing the use of disposable items and purchasing local products were less popular options. Finally, the least popular measures were the installation of renewable energy equipment, the purchase of fuel-efficient cars, and the use of alternative transport. The lack of popularity of purchasing equipment and fuel-efficient cars could be explained by the fact that this would imply investing a substantial sum of money that might not be available to the majority of the respondents. The fact that poverty and the economy are perceived as the most serious social problems supports this assumption. However, the reasons behind the low popularity of alternative transport are not as clear and merit further examination.

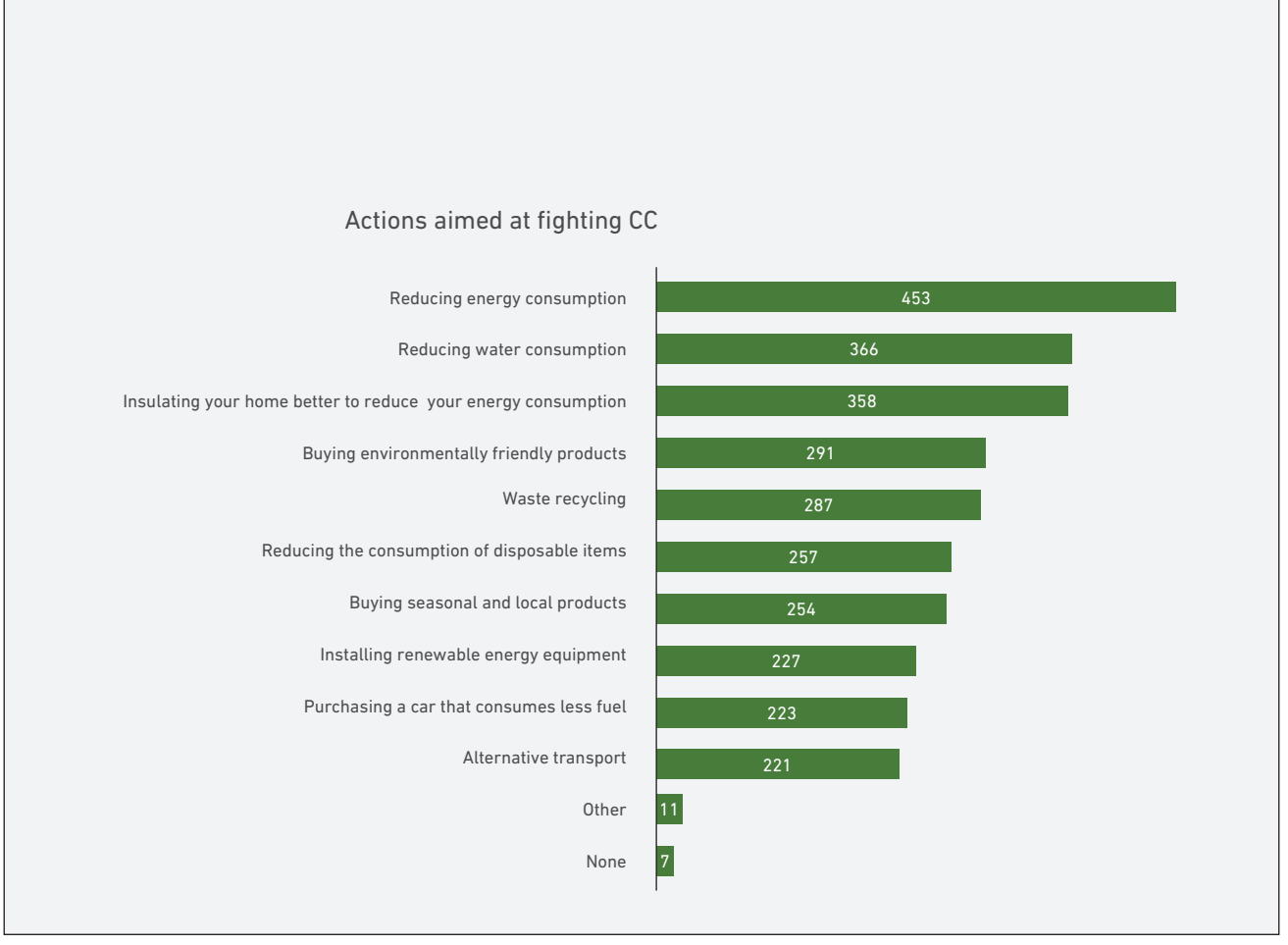

Figure 14: Environmental and climate friendly activities practiced by participants

Survey respondents stated that they were motivated to pursue a path of more environmentally-friendly behavior, and almost all participants said that they would be willing to use renewable energy. The main motivation for more environmentally-friendly behavior is a desire to live in a healthy and clean environment. By and large, the results reflect a more optimistic spirit within the Macedonian population when it comes to tackling climate change than in 2014.

Figure 15 shows that participants felt that they were informed about a variety of climate change impacts and consequences, as well as of different causes of climate change. However, the citizens of Macedonia felt that they were missing further information on ways to fight climate change, and especially on how to adapt to climate change.

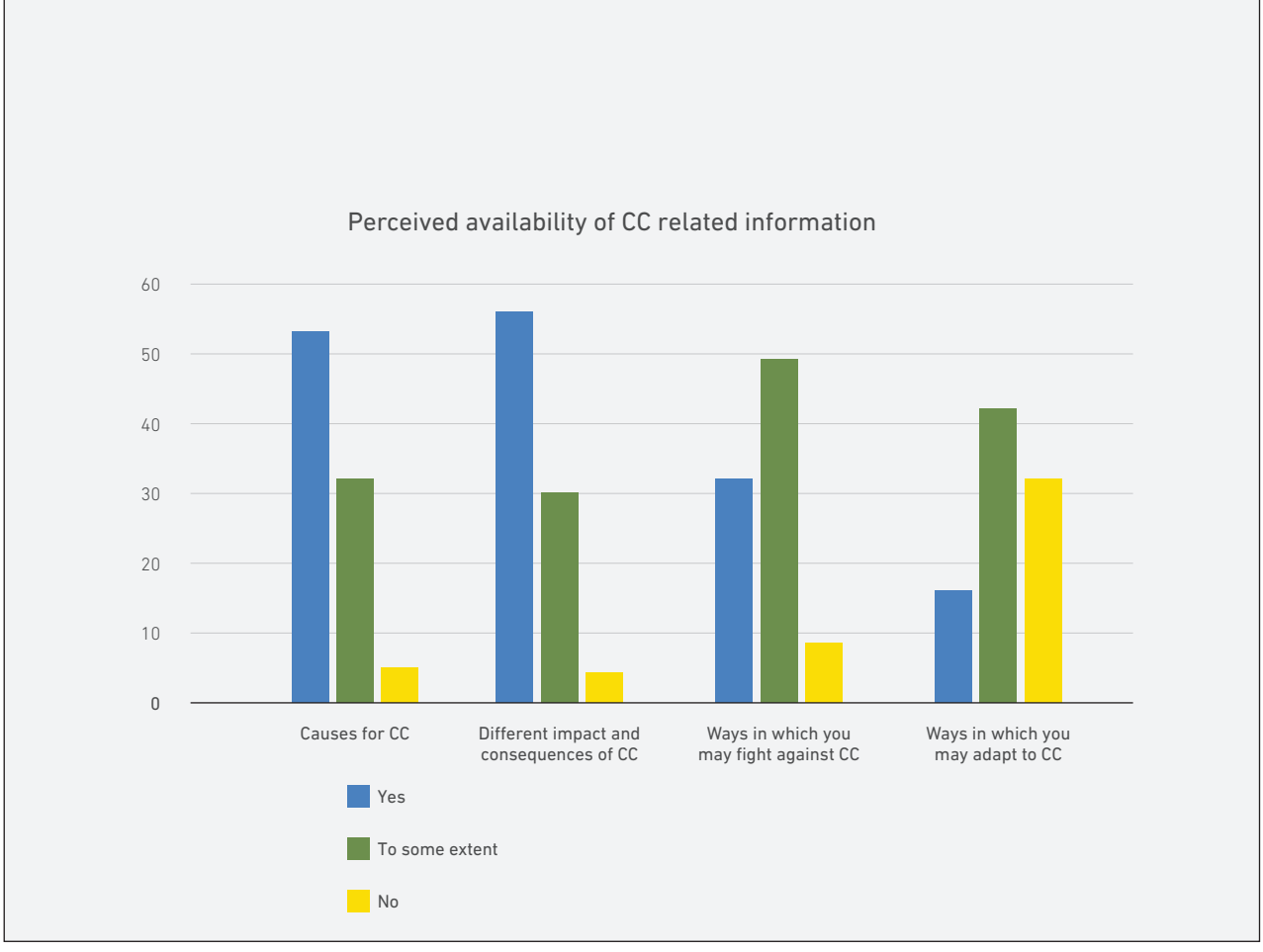

Figure 15: Familiarity with different climate change related issues

Survey participants reported obtaining most climate change-related information from the Internet (73%), followed by social media (51%) and television (50%). This confirms the trend noticed in the report from 2014 that social media were becoming an important way of disseminating climate change information. Respondents who identified themselves as decision-makers were more likely to report using MOEPP webpages, other specialized Internet portals, and project reports as sources of information. In addition, the Internet has now replaced television as the primary source of information about climate change for respondents who identified as decision-makers and for those who identified as members of the public. However, one concerning finding remained the same as in 2014: other than using the Internet (67%), most decision-makers

(61%) were still learning about climate change from television.

Once again, disseminating climate change-related information via e-mail turned out to be the least popular communication channel. However, it was interesting that in 2014, 23% of the respondents used scientific journals to become informed about climate change, while in the current survey, in spite of the high education level of the current sample, they were identified as the least popular source of information, with only 2 persons reporting using them in 2016. In addition, as suggested in the comments in the previous survey, many respondents linked the visibility of climate change issues with an increase in public awareness and interest in this topic in Macedonia. Participants were familiar with climate change campaigns organized by international organizations (in particular UNDP and USAID) and environmental NGOs. Furthermore, almost half of the respondents were also aware of climate change information campaigns organized by MOEPP.

Finally, the higher number of respondents compared to the survey conducted in 2014 is a sign that the issue of climate change is appealing enough to motivate participation. Macedonian citizens proved enthusiastic about collaboration on this topic and ready to be more actively involved in climate change governance. Decision-makers should build on the positive momentum already identified in 2014 and continue with participatory activities in the area of climate change information sharing and awareness raising.

A NATIONAL CLIMATE CHANGE COMMUNICATION STRATEGY

In 2013, Macedonia launched a national climate change communication strategy. The strategy used a three-year **action plan** with special activities for four target groups: the general public, cities, workplaces, and households. The results, as of 2017, were as follows:

In 2017, the results of the strategy were evaluated, and ratings ranged from "satisfactory" (for cities and households) to "significant" (workplaces), and "almost completely implemented" (the general public). Key achievements included the following:

- *The general public*: the project established a **social innovation center** and provided **training for 20 journalists** on climate change media coverage.
- *Cities*: The project developed eight local climate change strategies and implemented 20 adaptation measures under the **Municipal Strategy Project**,[10] which reached 127,213 citizens in 14 municipalities. It also developed the **Resilient Skopje** Climate Change Strategy for the capital, and it launched two **Climate Challenges**, which is described in the "Innovation and Climate Change" section below.
- *Workplaces:* The project improved information and benefits for companies applying for loans to improve energy efficiency by using the **WeBSEFF website**.[11] It also spread the word about good ideas for addressing climate change in Skopje through the **"Smart Mobility, Strong Economy" open forum**, and it cooperated with a USAID-fund-

10 These activities were carried out by Milieukontakt. Additional information available at http://milieukontakt.mk/mccsp/

11 See http://www.webseff.com/

Figure 16: The logo for the national awareness-raising campaign *"The Climate is Changing, it Depends on Us."*

ed project on climate change adaptation in agriculture that trained farmers and other villagers in 6 villages with a total population of 1500 people.

- *Households:* The project ran a multi-year awareness-raising campaign called "The Climate is Changing, it Depends on Us" (see Figure 16). It also ran two youth climate change summer camps, launched a web portal in Macedonia for energy efficiency,[12] introduced an award-winning "Energy Mathematics" campaign with the electric utility EVN, and celebrated European Mobility Week in 2014, 2015, and 2016.

The new action plan for 2017-2020 is now underway, and it is carrying out new activities for the same four target groups. One of the most important activities will be using new tools to communicate knowledge and messages about climate change to the public. These tools include Facebook, twitter, quizzes, and story-telling. Story-telling will be part of a global effort in 2018 to talk about climate change across different groups with respect and understanding in a process called the **Talanoa Dialogue**.[13]

INNOVATION AND CLIMATE CHANGE

Information and Communication Technologies (ICTs) are utilized in a variety of education and awareness-raising activities related to climate change in Macedonia, ranging from on-line surveys to outreach to cities, workplaces, and households. However, there has also

12 See http://energetskaefikasnost.info/

13 Talanoa, a word that comes from Fiji and the Pacific, means a process of sharing stories in order to come to the best decision for a group. This process involves sharing ideas without criticism and building trust and respect among the people who participate.

been a unique initiative to focus explicitly on *technological innovation* to address climate change challenges. In 2014, UNDP, USAID, the Swedish Embassy, the Social Innovation Hub, and MOEPP came together for a climate change project with a difference. While there was growing expert consensus on climate change, the project partners wanted to know what citizens themselves thought. The Hub led the creation of a nationwide **Climate Challenge**.

The Climate Challenge invited members of the public to submit their own innovative proposals for tackling climate change. The two-month publicity campaign involved celebrities, Social Innovation Camp Methodology along with traditional media, and pitch workshops in five cities. The campaigns resulted in a huge response on social media, with over 200 media reports and over 30,000 visitors to the challenge website. It also generated 129 applications to the challenge, resulting in 10 finalists and 2 winners. The winner, the "smart sole," enables shoes to generate small amounts of energy as their wearer walks. While this idea might seem like a gimmick, to a refugee in Skopje – traversing the city on foot and for whom the phone is a lifeline – the potential benefit is enormous. The video with this idea went viral, with more than 80,000 views in just a few days after going live.

In order to provide continuity to encourage citizens to come up with new ideas, a second Climate Challenge was launched in 2015. This challenge was more focused on urban resilience to climate change, concentrating efforts around issues such as waste, transport, and green space. The local authorities were more deeply engaged, ready and waiting to help the best idea with any possible obstacles such as permits, licenses, or regulations. This round of the challenge mobilized additional funds of approximately USD 70,000, and it supported a series of innovative events that raised awareness of the challenge among the media and the public, including contests for both of these groups.

This second challenge was very successful in many respects: the quality of the ideas received (68 in total and 28 long listed, compared to 2015 when 129 were received and only 28 long listed); the nature of the ideas and their phase of maturity; the quality of the 9 finalists' entries; the number of private companies that provided support (33 mentors helped the 9 teams at the weekend camp); and the public outreach surrounding the challenge, which included 120 media reports and over half a million social media impressions). The winner of the second challenge was ReBot, a solution for "smart recycling" that captivated the jury with a passionate and inspired presentation of an innovative solution for recycling and sorting plastic waste. The team feels "great and motivated" and now has all the resources needed to "wake people up about recycling."[14] As the prototype is being built, the ReBot team will conduct a nationwide recycling-awareness campaign so that people better understand the need to sort waste and to raise interest in the program. Although the scheme will launch on a small scale in Skopje (which generates one quarter of all waste generated in the country), the team is aiming high and hopes to expand not only to all regions in the country, but also to elsewhere in the Balkans.

14 UNDP (2016).

APPENDIX: SYMBOLS AND UNITS

GLOBAL WARMING POTENTIAL VALUES USED IN THE PREPARATION OF THE GHG INVENTORY

(100-year time horizon)

Gas	CO_2 equivalent
CO_2	1
CH_4	21
N_2O	310
HFC-125	2,800
HFC-143a	3,800
HFC-134a	1,300
HFC-32	650
HFC-227ea	2,900
CF_4	6,500
C_2F_6	9,200

Source: IPCC Second Assessment Report (SAR), 1996

CHEMICAL SYMBOLS USED IN THE SBUR

$CaCO_3$	Limestone
$CaMgCO_3$	Dolomite
CH_4	Methane
$CO(NH_2)_2$	Urea
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide equivalents
$HCO3^-$	Bicarbonate
HFCs	Hydro Fluorocarbons
N	Nitrogen
N_2O	Nitrous Oxide
Na_2CO_3	Sodium carbonate
NH_3	Ammonia
NH_4^{+2}	Ammonium
NMVOC	Non-Methane Volatile Organic Compound,
NO_3^-	Nitrate
NOx	Nitrogen Oxides
OH^-	Hydroxyl ion
PFCs	Per Fluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxides

UNITS AND METRIC SYMBOLS USED IN THE SBUR

UNIT	Name	Unit for
g	*gram*	mass
W	*watt*	power
J	*joule*	energy
m	*meter*	length
Wh	*watt hour*	energy
toe	*ton of oil equivalent*	energy

Mass Unit Conversion		
1 g		
1 kg	= 1 000 g	
1 t	= 1 000 kg	= 1 Mg
1 kt	= 1 000 t	= 1 Gg
1 Mt	= 1 000 000 t	= 1 Tg

Metric Symbol	Prefix	Factor
P	*peta*	10^{15}
T	*tera*	10^{12}
G	*giga*	10^{9}
M	*mega*	10^{6}
k	*kilo*	10^{3}
h	*hecto*	10^{2}
da	*deca*	10^{1}
d	*deci*	10^{-1}
c	*centi*	10^{-2}
m	*milli*	10^{-3}
µ	*micro*	10^{-6}
n	*nano*	10^{-9}
p	*pico*	10^{-12}

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