

REPUBLIC OF MACEDONIA
MINISTRY OF ECONOMY

**FIRST MACEDONIAN PROGRESS REPORT ON THE PROMOTION
AND USE OF ENERGY FROM RENEWABLE SOURCES**

**under Article 22(1) of Directive 2009/28/EC
on the promotion of the use of energy
from renewable sources**

Introduction

Greater involvement of renewable energy sources in energy consumption are one of the major strategic objectives in energy sector of the Government of the Republic of Macedonia. This is very important for safety and economical supplying the energy consumers, and creating conditions for sustainable energy development in the state in framework for sustainable energy development in the region and widely.

In the area of renewable energy sources a number of sub laws document was adopted in the previous period in order to create conditions for the promotion of renewable energy sources and greater participation of the same in the final energy consumption.

Policy of utilization of renewable energy sources is strategically set in the Strategy for utilization of RES in the Republic of Macedonia until 2020, which is adopted by the Government in 2010.

In February 2011 Energy Law was adopted by the Parliament of the Republic of Macedonia in which there is separate chapter for RES. This Law determinates measures and activities which will provide conditions for transposing and implementing the part of the Directive 2009/28/EC of the European Parliament. Supporting schemes, as guarantees of origin and obtaining status of preferential producer, are precisely defined with this Law. Also, with this Law is defined that the electricity transmission or distribution system operators, within the operational possibilities in the relevant system, shall provide priority access to electricity systems for the electricity generated from renewable sources.

In accordance with the Energy Law the following sub legislation are already adopted Decree for feed in tariffs for electricity, Decision for total installed capacity of preferential generators for each renewable energy source separately, Decision for the target share of energy produced form the RES in the total energy consumption, as well as the manner and dynamic for reaching the target share and Rulebook for renewable energy sources.

In accordance with the decision of the Ministerial Council of the Energy Community (EC) for the implementation of Directive 2009/28 and amendments to Article 20 of the Treaty establishing the EC of October 18, 2012 (2012 / 04 / EnMC), Republic of Macedonia should comply fully national legislation with the Directive 2009/28 on the promotion of RES. Therefore during 2014 within the IPA project the first draft Law on Energy and Draft Law on biofuels was prepared in which provision from the Directive 2009/28 are implemented.

Under the Law on biofuels and in order to stimulate the production and use of biofuels in transport, the Government, on the proposal by the Ministry of economy, should adopt a National Action Plan for biofuels for the period of ten years.

In the next period bylaws in order to implement changes in the Energy Law and the Law on Biofuels whose basis is Directive 28/2009 / EC will be prepared and adopted.

In accordance with the Energy Law every five years the Government of the Republic of Macedonia shall adopt the Strategy on RES covering the period of the next ten years. Under the IPA Project preparation of Strategy for RES until 2025 is ongoing, and it is planned to be adopted in 2015.

In order to implement the Strategy, National Action Plan for RES should be adopted. During 2015 further analysis of energy consumption in households in the country, including biomass, will be conducted based on a survey that will be realized by the State Statistical Office with technical assistance by Energy Community Secretariat. Based on these activities adoption of Action plan for RES will continue.

In accordance with the Article 15 from the Decision (2012/ 04/ EnMC) Ministry of economy prepared First Macedonian progress report on the promotion and use of energy from RES. This report was made in accordance with the template recommended by the European Commission, under Article 22(1) of Directive 2009/28/EC.

Data on energy consumption and production for 2012 and 2013 are taken from the Energy balance for 2013, released by the State Statistical Office on Oct 10, 2014. In the Energy balance, the final data for 2012 and preliminary data for 2013, are presented. The State Statistical Office prepares the Energy balance in accordance with Eurostat methodology. Data on the installed capacity of hydropower is taken from the annual reports for 2012 and 2013 from the Energy Regulatory Commission. The data on installed capacity of solar and wind power is also taken from the annual reports for 2012 and 2013 of the Energy Regulatory Commission.

1. Sectoral and overall shares and actual consumption of energy from renewable sources in the preceding 2 years (n-1; n-2 e.g. 2013 and 2012) (Article 22 (1) a of Directive 2009/28/EC)).

Table 1: The sectoral (electricity, heating and cooling, and transport) and overall shares of energy from renewable sources¹

	2013 Year n-1	2012 Year n-2
RES-H&C ² (%)	22.5%	26.7%
RES-E ³ (%)	18.4%	17.0%
RES-T ⁴ (%)	0.2%	0.0%
Overall RES share ⁵ (%)	15.1%	16.8%
Of which from cooperation mechanism ⁶ (%)	0	0
Surplus for cooperation mechanism ⁷ (%)	0	0

Table 1.a: Calculation table for the renewable energy contribution of each sector to final energy consumption (ktoe)⁸

	2013 Year n-1	2012 Year n-2
(A) Gross final consumption of RES for heating and cooling	153.68	205.00
(B) Gross final consumption of electricity from RES	132.59	127.75
(C) Gross final consumption of energy from RES in transport	0.90	0.23
(D) Gross total RES consumption ⁹	287.17	332.97
(E) Transfer of RES <u>to</u> other Contracting Parties or Member States	0	0
(F) Transfer of RES <u>from</u> other Contracting Parties and 3rd countries	0	0
(G) RES consumption adjusted for target (D)-(E)+(F)	0	0

¹ Facilitates comparison with Table 3 and Table 4a of the NREAPs.

² Share of renewable energy in heating and cooling: gross final consumption of energy from renewable sources for heating and cooling (as defined in Articles 5(1)b) and 5(4) of Directive 2009/28/EC divided by gross final consumption of energy for heating and cooling. The same methodology as in Table 3 of NREAPs applies.

³ Share of renewable energy in electricity: gross final consumption of electricity from renewable sources for electricity (as defined in Articles 5(1)a) and 5(3) of Directive 2009/28/EC divided by total gross final consumption of electricity. The same methodology as in Table 3 of NREAPs applies.

⁴ Share of renewable energy in transport: final energy from renewable sources consumed in transport (cf. Article 5(1)c) and 5(5) of Directive 2009/28/EC divided by the consumption in transport of 1) petrol; 2) diesel; 3) biofuels used in road and rail transport and 4) electricity in land transport (as reflected in row 3 of Table 1). The same methodology as in Table 3 of NREAPs applies.

⁵ Share of renewable energy in gross final energy consumption. The same methodology as in Table 3 of NREAPs applies.

⁶ In percentage point of overall RES share.

⁷ In percentage point of overall RES share.

⁸ Facilitates comparison with Table 4a of the NREAPs

⁹ According to Art.5(1) of Directive 2009/28/EC gas, electricity and hydrogen from renewable energy sources shall only be considered once. No double counting is allowed.

Table 1.b: Total actual contribution (installed capacity, gross electricity generation) from each renewable energy technology in [Contracting Party] to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in electricity¹⁰

	2013 Year n-1		2012 Year n-2	
	MW	GWh	MW	GWh
Hydro ¹¹ :	616.9	1,542.0	595.4	1,485.7
non pumped	616.9	1,584.0	595.4	1,040.8
<1MW	14.4	-	9.5	-
1MW–10 MW	40.8	-	34.8	-
>10MW	561.7	-	551.1	-
pumped	0	0	0	0
mixed ¹²	0	0	0	0
Geothermal	0	0	0	0
Solar:	7.22	9.05	3.79	2.84
photovoltaic	7.22	9.05	3.79	2.84
concentrated solar power	0	0	0	0
Tide, wave, ocean	0	0	0	0
Wind:	0	0	0	0
onshore	0	0	0	0
offshore	0	0	0	0
Biomass ¹³ :	0	0	0	0
solid biomass	0	0	0	0
biogas	0	0	0	0
bioliquids	0	0	0	0
TOTAL	624.1	1,551.1	599.2	1,488.5
of which in CHP	0	0	0	0

"-"not available

Table 1c: Total actual contribution (final energy consumption¹⁴) from each renewable energy technology in Macedonia to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in heating and cooling (ktoe)¹⁵

	2013 Year n-1	2012 Year n-2
Geothermal (excluding low temperature geothermal heat in heat pump applications)	7.3	8.9
Solar		
Biomass ¹⁶ :	146.3	196.1
solid biomass	146.3	196.1
biogas	0	0
bioliquids	0	0
Renewable energy from heat pumps:		
- of which aerothermal	-	-
- of which geothermal		
- of which hydrothermal		
TOTAL	153.7	205.0
Of which DH ¹⁷	0	0
Of which biomass in households ¹⁸	134.0	178.6

¹⁰ Facilitates comparison with Table 10a of the NREAPs.

¹¹ Normalised in accordance with Directive 2009/28/EC and Eurostat methodology.

¹² In accordance with new Eurostat methodology.

¹³ Take into account only those complying with applicable sustainability criteria, cf. Article 5(1) of Directive 2009/28/EC last subparagraph.

¹⁴ Direct use and district heat as defined in Article 5.4 of Directive 2009/28/EC.

¹⁵ Facilitates comparison with Table 11 of the NREAPs.

¹⁶ Take into account only those complying with applicable sustainability criteria, cf. Article 5(1) last subparagraph of Directive 2009/28/EC.

¹⁷ District heating and / or cooling from total renewable heating and cooling consumption (RES- DH).

“-”not available

Table 1d: Total actual contribution from each renewable energy technology in Macedonia to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in the transport sector (ktoe)^{19, 20},

	2013 Year n-1	2012 Year n-2
Bioethanol/ bio-ETBE	0	0
<i>Of which Biofuels²¹ Article 21.2</i>	0	0
<i>Of which imported²²</i>	0	0
Biodiesel	0.90	0.23
<i>Of which Biofuels²³ Article 21.2</i>	-	-
<i>Of which imported²⁴</i>	-	-
Hydrogen from renewables	0	0
Renewable electricity	0	0
<i>Of which road transport</i>	0	0
<i>Of which non-road transport</i>	0	0
Others (as biogas, vegetable oils, etc.) – please specify	0	0
<i>Of which Biofuels²⁵ Article 21.2</i>	0	0
TOTAL	0.90	0.23

“-”not available

- 2. Measures taken in the preceding 2 years and/or planned at national level to promote the growth of energy from renewable sources taking into account the indicative trajectory for achieving the national RES targets as outlined in your National Renewable Energy Action Plan. (Article 22(1)a) of Directive 2009/28/EC)**

¹⁸From the total renewable heating and cooling consumption.

¹⁹For biofuels take into account only those compliant with the sustainability criteria, cf. Article 5(1) last subparagraph.

²⁰Facilitates comparison with Table 12 of the NREAPs.

²¹Biofuels that are included in Article 21(2) of Directive 2009/28/EC.

²²From the whole amount of bioethanol / bio-ETBE.

²³Biofuels that are included in Article 21(2) of Directive 2009/28/EC.

²⁴From the whole amount of biodiesel.

²⁵Biofuels that are included in Article 21(2) of Directive 2009/28/EC.

Table 2: Overview of all policies and measures

Name and reference of the measure	Type of measure*	Expected result**	Targeted group and or activity***	Existing or planned****	Start and end dates of the measure
Amendments to the Law on Urban and Spatial Planning	Regulatory (Primary legislation)	Expanding the scope of use of the infrastructure project as new type of urban plan in the Law on Spatial and Urban Planning. One of the most complicated and time-consuming procedures within the RE investment process shortened and facilitated	Investors in certain RE technologies (SHPP), planners, architects, public administration	Existing	2013
Amendments to the Law on Construction	Regulatory (Primary legislation)	Introducing possibility for applying for construction permit before solving all the land titles. Construction of the power plants not prevented by partially unsolved property issues.	Investors RE, Public administration	Existing	2013
New Law on Spatial and Urban Planning	Regulatory (primary legislation)	Further simplify the administrative procedures and shorten the timeframe of the investment process	Investors in certain RE technologies (SHPP), planners, architects, public administration	Planned	
Law on biofuels	Primary legislation	Clear rules for biofuels	Energy sector stakeholders connected with biofuels	In process of preparation	2015
National Biofuel Action Plan	Secondary legislation	Setting the annual share of biofuels to be attained in the total fuels for transport quantities	Refineries and distribution companies of oil derivatives	In process of preparation	2015
Grid rules	Regulatory	Procedure for connection of the producer is more transparent, simplified, shortened, and technical criteria are defined with greater precision thus removing possibilities for ambiguity and different interpretation	RES Electricity Producers	Existing	2014
Support schemes for installation of solar panels	Financialincentives, Investmentsubsidies	Increase share of RES	Households	Existing	2007

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	(non-refundable financial incentives, loans)				
Credit lines for promotion of the RES and EE	Financial	Increase share of RES	Investors in RES and EE projects	Existing	
Rulebook for energy characteristics of building	Secondary legislation	Energy efficiency of buildings through measures and activities for efficient use of energy	Investors in construction of new buildings or reconstruction of existing one	Existing	2013
Decree on Feed-in-tariffs	Secondary legislation (according to Article 150 of Energy Law)	Transparent and non-discriminatory instrument to support RES electricity generating projects	Potential investors and developers, energy companies. In the future: communities, small businesses, households	Existing	17/04/2013
Energy law changes, harmonization with the Directive (third package RES Directive)	Primary legislation	Clear rules for energy sector	Energy sector stakeholders	In process of preparation	2015
Guidelines for investors in RE	Secondary legislation	Simple and up to date information on all legal aspects related to investments in RE for the potential investors.	Investors in RE technologies, public administration	Planned	Second half of 2015
Update of the Strategy For Utilisation Of Renewable Energy Sources	Secondary legislation	Increased share of RES in GFEC in 2020 following a planned trajectory	Energy Companies, businesses, households	In process of preparation	Second half of 2015
Revised Transmission Grid Code	Regulatory (according to Article 69 of the Energy law)	Improved connection rules for wind generation	RES Electricity Producers	Under preparation	TBD

* Indicate if the measure is (predominantly) regulatory, financial or soft (i.e. information campaign).

**Is the expected result behavioural change, installed capacity (MW; t/year), energy generated (ktoe)?

***Who are the targeted persons: investors, end users, public administration, planners, architects, installers, etc? or what is the targeted activity / sector: biofuel production, energetic use of animal manure, etc)?

**** Does this measure replace or complement measures contained in Table 5 of the NREAP?

2.a Please describe the progress made in evaluating and improving administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy. (Article 22(1)e) of Directive 2009/28/EC).

Macedonia is continuing its efforts to improve the legal framework in order to improve the administrative procedures for development of the renewable energy (RE) projects, thus encouraging investments in renewable energy sources (RES).

Based on most of the studies and analysis conducted in this respect, land titles, procedures for obtaining the construction permits and adoption or amendment of the urban plans have been identified as biggest issues and barriers to development of RE projects.

Therefore amendments to the respective legislation and new law have been adopted aimed at shortening the deadlines, reducing the number of documents that need to be submitted and number of procedures that need to be followed by the investors in RES.

Amendments to the Law on Urban and Spatial Planning

Amendments to the Law on Urban and Spatial Planning (Official Gazette No. 55/13), effective as of April 2013, enabled expanding the scope of application of the infrastructure project, as a simplified type of urban plan, for SHPP. Application of the infrastructure project for SHPP, shortened and facilitated the procedure for adoption of the urban plans, that was one of the most complicated and time consuming procedure. With this some of the steps that were required for this type of procedure were eliminated, thus reducing the time, paper work, and consequently the costs of investors. In addition it is expected that new Law on Spatial and Urban Planning is adopted that will further simplify the administrative procedures and shorten the timeframe of the investment process

Law on Construction

With the amendments to the Law on Construction, (Official Gazette No. 163/13), possibility for applying for construction permit before the land titles issues are resolved, was introduced. Based on this, the approval for construction of the power plant can be obtained prior to resolving the land title issues, by a statement of the investor that during the construction process all land title issues will be resolved. This amendment enabled construction of the power plants not to be prevented by partially unsolved property issues. However to further shorten and simplify the administrative procedure in this respect, new set of amendments to the Law on Construction are drafted and will be adopted soon.

USAID launched a 3-year project (from April 2013 – March 2016), Clean Energy Investment Project (CEI) in Macedonia. CEI project intends to support the Government of Macedonia (GoM) in their efforts on improving renewable energy, improving the legal framework in planning, launching and implementing Low Emissions Development Strategies (LEDS) processes and procedures to advance economic growth, improve environmental management and meet country's development objectives. Within the project Analysis with findings and recommendations for streamlining of RE procedures was developed. Based on this analysis, recommendations for improving licensing procedures by elimination and/or merging some of them, transferring competencies from one institution to another, shortening certain deadlines and requirements for duplication of documents and procedural steps to be deleted were proposed. All these were used for development of the Roadmap for

streamlining of RE procedures that will be used as basis for amending respective legislation in accordance with the recommendations proposed. In addition the Project together with IFC and Association of RE producers organized four RE Stakeholders Forums. The Forum's gatherings, are foreseen as a public-private dialogue mechanism for project developers, investors, local organizations, staff from relevant ministries and agencies, and from funders of RE-related programs to discuss issues that may adversely impact the implementation of RE projects, and to encourage the responsible institutions to take appropriate measures

Within the first half of 2015, with support of the IPA funded project - Strengthening the administrative capacity of the Energy Department in the Ministry of Economy and the Energy Agency and USAID funded CEI project, new updated Guidelines for investors are planned to be developed. These Guidelines will provide simple and up to date information on the legal aspects related to investments in RE for the potential investors, especially those that are foreign. In addition the Energy Law in the beginning of 2015 is expected to be amended with support by the abovementioned projects for its full harmonization with the RES Directive as well as for streamlining the procedures for obtaining the status of preferential producer.

Other reports and studies evaluating administrative procedures for RE project development:

- Benchmarking the Renewable Energy Development Process, by USAID. As part of the USAID Europe and Eurasia Regional Energy Security and Market Development (RESMD) Project, International Resources Group (IRG) has prepared this benchmarking study of the renewable energy project development process in Macedonia. The objective is to provide the GoM with an accurate accounting of specific issues with respect to Macedonia's renewable energy development process as set forth by laws, regulations, precedent, and established procedure; identify critical barriers that are hindering or slowing down renewable energy investments in the country; and provide targeted conclusions and recommendations for overcoming identified barriers. It will also better inform the development of new secondary legislation required under the recently passed Energy Law (September 2012).
- Findings and recommendations on legal, technical and investment promotion issues regarding the tenders for concession of small hydropower plants in Macedonia by IFC (March 2013)
- Report on present procedures and practices for development of SHPP in the Republic of Macedonia prepared by DNV KEMA Energy and Sustainability, financed by IFC, by the end of 2013. Objective of this report is to investigate reasons for relatively low response of the investors to the offered concessions for the construction of small hydro power plants (SHPP), and even smaller actual utilization of the granted concessions (small number of completed projects, i.e. SHPP in operation). Analysis of the previous tenders for SHPP concessions (contents, data, agreements,...), together with other activities such as analysis of the legislative framework, technical aspects of the connections to the electrical grid, administrative issues, etc., identified critical issues concerning SHPP projects development. Output of the report is set of recommendations for responsible institutions in the Republic of Macedonia on measures and activities that should be undertaken in order to improve utilization of the available national potential for the development of SHPP.

Law on biofuels

Ministry of Economy has drawn up the draft version of the law on biofuels, and is planned to be adopted in the first half of 2015.

This law governs:

- 1) the legal framework establishing and implementing the policy aimed at promoting the production and use of biofuels for transport;
- 2) the supply of biofuels in transport;
- 3) the use of biofuels for transport purposes;
- 4) the formulation of the programmes and plans for the promotion of the production and use of biofuels in the transport sector;
- 5) the introduction and implementation of sustainability criteria for the production and supply of biofuels and bioliquids;
- 6) the measures to support production and use of biofuels in transport;
- 7) the general principles for the calculation methodology of the greenhouse gas impact of biofuels and bioliquids; and
- 8) other issues of importance pertaining to the biofuel sector of the Republic of Macedonia.

Article 18 of the draft version of the law on biofuels stipulated that the production of biofuels shall be supported by the payment of monetary incentives to eligible biofuel producers, which shall be calculated on the basis of the quantity of biofuels that are produced and supplied in the Republic of Macedonia to the obligatory biofuel quota suppliers or to end users. The Government of the Republic of Macedonia shall adopt the Ordinance on the promotion of the production of biofuels for transport, which shall prescribe:

- 1) the methodology for the calculation of the maximum sale price of biofuels based on the average net value of quotations of fossil fuels (diesel and petrol) on the reference international market;
- 2) the methodology for the calculation of the yearly amount of monetary incentives to be allocated for the production of specific types of biofuels, which shall be expressed in Macedonian denars per litre;
- 3) the rules for the calculation of the share of the excise duties revenues that will be allocated on a yearly basis for the payment of monetary incentives for biofuel production;
- 4) the specific types of biofuels whose production will be eligible for support under the support schemes prescribed in the present Law and the relevant bylaws,;
- 5) the rules for providing the monetary incentives for biofuel production, which are prescribed in the present Law and the relevant bylaws.

According to the law and in order to stimulate the production and use of biofuels in transport, the Government, by proposal of the Ministry of Economy, should adopt a National Action Plan on biofuels for a period of ten years. This Action Plan shall contain: a review of the transport sector in the country in terms of the structure of the vehicles, the cost of fuel, requirements for quantities of fuels and environmental impact; trends and projections of final energy consumption in the domestic transport sector; estimated trajectory for the share of energy from all types of biofuels in transport with defined annual targets; measures for implementation and responsible bodies to increase the production and use of biofuels in the

transport sector. The National Action plan is been prepared within the IPA project and it is planned to be adopted in 2015.

In order to successfully transpose the provisions of biofuels, on October 31, 2014 a Workshop on sustainability criteria for biofuels under Directive 2009/28 was organized in Skopje by the Secretariat of Energy Community.

In the next period regulations aimed at implementing the Law on biofuels will be developed and adopted.

2.b Please describe the measures in ensuring the transmission and distribution of electricity produced from renewable energy sources and in improving the framework or rules for bearing and sharing of costs related to grid connections and grid reinforcements. (Article 22(1)f) of Directive 2009/28/EC).

The Energy Law is the primary legislation that governs the transmission and distribution of electricity, as well as the market and grid rules, meaning those rules are adopted in line with the requirements set in the Energy Law.

The grid infrastructure authorization procedures are addressed with the transmission and distribution grid rules whether it is about electricity consumer or generators from renewable or other sources of energy. Power connection of an electricity generator requires more information and takes longer time to get approval compared to an electricity consumer. The grid codes describe in detail the authorization procedures and at the current state the grid operators keep to the timetables as defined in the respective grid codes. Until now, the practice shows that there were no issues regarding connection of new renewable energy plants to the grid.

The construction of new electricity distribution systems is performed by legal entities on the basis of issued authorization. EVN, which is distribution grid operator, regularly performs updates of the grid development studies, taking always into account expected development of the distributed generation. Current update of the distribution grid development study was presented on June 11th, 2013, dealing with the period up to the year 2030. Same timeline is used for the transmission grid development study. Transmission grid in Macedonia is very strong both in terms of internal and cross-border capacities. Transmission grid practically has no limits of connection of new generation.

The relevant energy transmission or distribution system operator, as part of the relevant Grid Code, shall be obliged to stipulate the connection rules for the relevant grid and the connection charge-setting methodology. The connection rules shall take due consideration of the consequences caused by the connection and affecting other grid users, the connection points at plants, facilities and devices and type of installation required for grid connection. The grid connection charge and the charge for altering energy parameters as defined in the connection approval for existing users shall be settled by the user and shall be comprised of the connection construction charge or existing connection upgrade charge, as well as users' share in the costs incurred for the provision of technical conditions in the system to which new users are to be connected or increasing the capacity of existing connections. The charge shall be calculated pursuant to the methodology stipulated in the relevant Grid Code.

The relevant energy transmission or distribution system operator shall be obliged to provide the entities applying for grid connection with detailed cost assessment as regards the

connection and the provision of technical conditions in the grid. The rules governing connections have been published by the Transmission and Distribution System Operators in the Transmission Grid Code and the Distribution Grid Code, previously approved by the Energy Regulatory Commission.

According to the Energy Law (Article 122), transmission and/or distribution system operators are obliged to allow access to the relevant system in a transparent and objective manner that prevents discrimination of system users. Further, the electricity transmission or distribution system operators must provide priority access to electricity systems for the electricity generated from renewable sources, taking due consideration of technical limits on the electricity system.

To improve the procedure for grid connection, an initiative for introduction of new better, more efficient and more transparent procedure was introduced. Hence the distribution grid rules have been amended, and became officially in force as of beginning of 2014.

These Rules introduce new chapter - Connection of producers to the distribution network and new amended (simplified) application form for connection. The application for connection to the grid can be initiated prior to obtaining the construction permit – shortening the procedure.

In addition the procedure for connection of the producer is more transparent, technical criteria are defined with greater precision thus removing possibilities for ambiguity and different interpretation.

3. Please describe the support schemes and other measures currently in place that are applied to promote energy from renewable sources and report on any developments in the measures used with respect to those set out in your National Renewable Energy Action Plan. (Article 22(1)b) of Directive 2009/28/EC).

*It is suggested that **table 3** is used to provide more detailed information on the support schemes in place and the support levels applied to various renewable energy technologies. Contracting Parties are encouraged to provide information on the methodology used to determine the level and design of support schemes for renewable energy.*

Support schemes for installation of solar panels

In order to stimulate the use of solar energy in the country, the Ministry of Economy on several occasions (2007, 2009, 2011, 2012, 2013 and 2014) successfully conducted activities for the implementation of subsidies through reimbursement of part of the cost for purchased and installed solar thermal collector systems in households.

The Government of Macedonia subsidized 3.021 households - 500 households in 2007; 500 households in 2009; 420 households in 2011; 481 households in 2012, 514 households in 2013 and 606 households in 2014. From 2012 this subsidies is realized through public drawing of people who can gain the right to compensation of expenses for purchased. In 2012 around 2030 applicants submitted documents to the Ministry that they have already installed thermal solar collectors, and in 2013 around 3000 applicants submitted documents to the Ministry that they have already installed thermal solar collectors in their households.

For this purpose, about 42.9 million denars are paid so far, from the Budget. This incentive provides a refund of part of the money spent on the provision of solar thermal collector systems up to 30%, but not more than 300 Euros per household.

In the Budget for 2015, 6 million denars are ensured for reimbursement of the cost of purchasing and installing solar thermal collector systems in households for 2015.

In 2007, in order to support the development of the solar collector market, the Government adopted a decision lowering the VAT rate for solar collector systems from 18% to 5%.

Support for electricity produced from renewable sources – feed in tariffs

According to the Energy law adopted by the Government, for the purpose of stimulating construction of new power plants using renewable energysources or high-efficiency cogeneration plants, the said generation facilities can obtain the status of preferential generator, and thereby the right to sell electricity under feed-in tariffs.

Detailed description regarding the given feed-in tariffs during the years 2012 and 2013 are shown in the following two tables.

Table: Feed in tariff for electricity production in 2012

Generation capacity	Feed in tariff for electricity production in 2012 (€/kWh)	Period of support (years)
Hydro power plants (installed capacity less or equal to 10MW)	for monthly amount of electricity delivered by units: I unit: 12.00 ($\leq 85,000$ kWh) II unit: 8.00 ($> 85,000$ и $\leq 170,000$ kWh) III unit: 6.00 ($> 170,000$ и $\leq 350,000$ kWh) IV unit: 5.00 ($> 350,000$ и $\leq 700,000$ kWh) V unit: 4.50 ($> 700,000$ kWh)	20
Wind power plants (installed capacity less or equal to 50 MW)	8.9	20
Photovoltaic power plants (installed capacity less or equal to 1 MW)	30 ($\leq 0,050$ MW) 26 ($> 0,050$ MW)	15
Biomass thermal power plants (installed capacity less or equal to 3 MW and share of fossil fuels in the total energy value of the consumed fuels less or equal to 15%)	11 (≤ 1 MW) 10 (> 1 MW)	15
Biogas thermal power plants (installed capacity less or equal to 2 MW and share of fossil fuels in the total energy value of the consumed fuels less or equal to 10%)	15 ($\leq 0,5$ MW) 13 ($> 0,5$ MW)	15

Table: Feed in tariff for electricity production in 2013

Generation capacity	Feed in tariff for electricity production in 2013 (€/kWh)	Period of support (years)
Hydro power plants (installed capacity less or equal to 10MW)	for monthly amount of electricity delivered by units: I unit: 12.00 ($\leq 85,000$ kWh) II unit: 8.00 ($> 85,000$ и $\leq 170,000$ kWh) III unit: 6.00 ($> 170,000$ и $\leq 350,000$ kWh) IV unit: 5.00 ($> 350,000$ и $\leq 700,000$ kWh) V unit: 4.50 ($> 700,000$ kWh)	20
Wind power plants (installed capacity less or equal to 50 MW)	8.9	20
Photovoltaic power plants (installed capacity less or equal to 1 MW)	16 (≤ 0.050 MW)	15
	12 (> 0.050 MW)	
Biomass thermal power plants (installed capacity less or equal to 3 MW and share of fossil fuels in the total energy value of the consumed fuels less or equal to 15%)	15	15
Biogas thermal power plants (share of fossil fuels in the total energy value of the consumed fuels less or equal to 10%)	18	15

Macedonia has established feed-in tariffs for small hydro, wind, solar PV, and power plants using biogas and biomass, starting from 2007. The Act for electricity feed-in tariffs stipulates in detail the specific terms and conditions required from any power plant in order to qualify for obtaining the status of preferential electricity generator, the upper threshold of power plant's installed capacity, the electricity feed-in tariffs and the period of their application.

There is a cap on total installed capacity of each technology that will receive feed-in tariffs. Currently the limits are:

- No limit for small hydro
- 50MW for wind until 2015, 65 MW for wind until 2016, 100 MW until 2020 and 150 until 2025
- 18 MW for solar PV at the moment
- 10 MW for biomass
- 7MW for biogas.

For solar PV, there is a 4 MW cap on installations up to 50 kW, and a 14 MW cap on installations between 50 kW and 1 MW.

The construction of SHPP has positive impact on the promotion of RES and their greater involvement in the final energy consumption, in terms of achieving the prescribed goals. The production of electricity from SHPP will contribute to reduce the import of electricity. Currently, 25 SHPP with investment over 30 million are built, while 21 SHPP with an investment of more than 20 million are under construction. At the stage of providing documents to start construction of SHPP are another 20 locations. Based on the proceedings conducted by the Ministry of Environment and Physical Planning, the Government has

adopted 23 decisions on selecting the best bidder for the construction of 32 SHPP to be built by the end of 2018.

Regarding the construction of the PV, up to August 2014, 63 power plants are built with total installed capacity of 11.6 MW, of which 2.1MW are smaller than 50kW. Additionally, 42 are in process of construction with total capacity of 6.1 MW, of which 1.7MW are smaller than 50kW.

The construction of the first wind power plant started on May 2013 and in 2014 has started with production. Its installed capacity is 36.8 MW.

Regarding the power plants on biogas in Macedonia, in the process of construction are four power plants with total installed capacity of around 6MW

Table 3: Support schemes for renewable energy

RES support schemes year 2012		Per unit support (MWh)	Total (M€)* without VAT
Installation of solar panels		(€/unit)	
Instrument	Investment subsidies (capital grants)	up to 30% not more than 300 (€/unit), supported 481 units	0.10
Hydro power plants		Euro/MWh	
Instrument	Production incentives		
	Feed-in tariff	95.14	1.45
Photovoltaic power plants		Euro/MWh	
Instrument	Production incentives		
	Feed-in tariff	371.14	1.05
Total annual estimated support in the electricity sector			2.50
Total annual estimated support in the heating sector			0.10
Total annual estimated support in the transport sector			

RES support schemes year 2013		Per unit support (MWh)	Total (M€)* without VAT
Installation of solar panels		(€/unit)	
Instrument	Investment subsidies (capital grants or loans)	up to 30% not more than 300 (€/unit)	0.10
Hydro power plants		Euro/MWh	
Instrument	Production incentives		
	Feed-in tariff	90.46	2.69
Solar power plants		Euro/MWh	
Instrument	Production incentives		
	Feed-in tariff	296.93	2.58
Total annual estimated support in the electricity sector			5.27
Total annual estimated support in the heating sector			0.10
Total annual estimated support in the transport sector			

Credit lines for promotion of the RES and EE

In accordance with the Government promotion of the RES and EE, several banks in the country support projects in the area of RES and EE through several credit lines. . This credit

lines offer to the customers the option to invest in new, innovative projects through the use of renewable energy sources, improving energy efficiency and saving energy. There are credit loans for individuals intended to fund projects to improve living conditions for the following purposes: insulate the walls, roofs and floors, change the windows and doors, heating and cooling and etc. Also there are credit lines for the company for EE improvement. This credit lines are intended for investment in equipment and real estate, where can be achieved measurable energy savings.. By investing in energy efficiency, companies not only save direct costs of operations that can be ranging up to 35% of total operating costs in the industry, but through this credit line directly improve competitiveness by reducing interruptions of work, automation and reducing bottlenecks in manufacture.

Rulebook for energy characteristics of building

In 2013, the Government has adopted a Rulebook for energy characteristics of building whose purpose is to achieve a policy for energy efficiency of buildings through measures and activities for efficient use of energy, providing services for energy efficiency and meeting the obligations of the public sector in terms of energy efficiency and energy savings.

This Rulebook stipulates that during the design and construction of new buildings some of the following highly efficient alternative systems or their combinations should be applied if they are available and if their application is technically, environmentally and economically justified:

- 1) Decentralized systems for energy supply based on the use of renewable energy sources
- 2) Combined systems for simultaneous production in a unique process of heat and electricity and /or mechanical energy;
- 3) Systems for central heating or cooling in parts of buildings, especially those that are fully or partially based on the use of renewable energy and
- 4) Heat pumps.

According to the Rulebook, the certificates for the energy characteristics of the buildings among other data should contain the early consumption of energy and the share of renewable energy source in the total energy consumption.

3.1. Please provide the information on how supported electricity is allocated to final customers for purposes of Article 3 (6) of Directive 2003/54/EC. (Article 22(1)b) of Directive 2009/28/EC).

Electricity bills which are paid by final customers except the general charges for the electricity system also includes the costs of incentive renewable energy sources. When calculating the regulated cost for the transmission operator MEPSO, the Energy Regulatory Commission of the Republic of Macedonia includes the expenditures that the transmission operator has given to the preferential generators for the produced amount of electricity.

4. Please provide information on how, where applicable, the support schemes have been structured to take into account RES applications that give additional benefits, but may also have higher costs, including biofuels made from wastes, residues, non-food cellulosic material, and ligno-cellulosic material?) (Article 22 (1)c of Directive 2009/28/EC)).

There was no support schemes structured to take into account RES application that give additional benefits, in 2012 and 2013. But, in 2014 the Ministry of Economy has drawn up the final draft version of the law on biofuels. The draft law defines the national overall target for the placement of biofuels on the market to be the minimum mandatory target for placement of biofuels for transport on the market in the Republic of Macedonia. The percentage of the minimum mandatory target will be expressed as a percentage in the National Biofuel Action Plan.

Article 8, paragraph 3 of the draft version of the law on biofuels, stipulates the rules for calculation methodology which shall establish whether the national target has been met. Among other things this article stipulates that the energy produced from biofuels made from waste, residues, non-food cellulosic material and ligno-cellulosic material shall be calculated as double compared to the biofuels made from other raw material, while electricity from renewable sources used for electrical road vehicles shall be calculated as 2.5 times energy used.

Additionally, according to the draft version of the law on biofuels the Government of the Republic of Macedonia shall adopt the Ordinance on the promotion of the production of biofuels for transport (described in details in part 2 of this report).

5. Please provide information on the functioning of the system of guarantees of origin for electricity and heating and cooling from RES, and the measures taken to ensure reliability and protection against fraud of the system. (Article 22(1)d of Directive 2009/28/EC)).

Pursuant to Article 148 paragraph (1) of the Energy Law, the Government adopted Rulebook for renewable energy sources (25.08.2011) in which, among other things closely stipulates:

- The manner of issuing, transfer and withdrawal of guarantees of origin of electricity produced from renewable energy sources
- The manner, procedure and conditions for recognition of guarantees of origin issued abroad and
- The content, form and manner of keeping the electronic register of issued certificates of origin of electricity from renewable energy sources

Under the Rulebook for RES, a guarantee of origin of electricity produced from renewable energy sources is a document issued by the Energy Agency in order to provide evidence to consumers that a certain part or a specific amount of energy is produced from renewable energy sources. Guarantee of origin can be issued to an electricity generator that produces electricity from renewable energy sources if it is registered in the Register of power plants and if it has no status preferential producer.

Guarantees of origin are issued in electronic form and contain the following information:

- The date and country of issuance, the start and end date of the period of generation, date to which the guarantee of origin applies to and unique ordinal number of the guarantee of origin
- Register code of the power plant that produces electricity, which includes information on the type of power plant and the type of renewable energy source that is used for electricity production, and the date when the power plant was put into operation
- Information whether the power plant used some form of investment or other production support

Article 21 of the Rulebook for RES defines how guarantees of origin from the holder can be transferred to another person that has a license in the Republic of Macedonia for trade or supply of electricity.

Cases in which the Agency may cancel or revoke the guarantee of origin from the Register of guarantees are defined in Article 22 of the Rulebook for RES. Cancellation of the guarantee of origin can be made if the Agency receives notification from a competent authority of another country that the guarantee of origin is registered in the appropriate register of guarantees in that country. The Agency may revoke the guarantee of origin if it is found that the submitted documents by which the guarantee is issued or recognized is false in some parts or that the guarantee was issued on the basis of false representation, statement or activity.

The content, form and manner of recognition of guarantees of origin issued by a competent authority of another country and its registration in the Register of guarantees in RM is stipulated in Article 23 of the Rulebook for RES.

The Agency sets up and maintains a Register of guarantees of origin issued, in electronic form, which is made available on its website and is regularly updated. This Register of guarantees of origin of electricity produced from renewable energy sources contains data for issued, transferred, cancelled and revoked guarantees of origin, as well as recognized guarantees of origin issued by competent authorities in other countries. The content, form and manner of keeping the electronic register of guarantees of origin of electricity from renewable energy sources are defined in Articles 24, 25, 26, 27 and 28 of the Rulebook for RES.

6. Please describe the developments in the preceding 2 years in the availability and use of biomass resources for energy purposes. (Article 22(1)g) of Directive 2009/28/EC).

* Amount of raw material if possible in **m³for biomass from forestry** and in **tonnesfor biomass from agriculture and fishery and biomass from waste**

** The definition of this biomass category should be understood in line with table 7 of part 4.6.1 of Commission Decision C (2009) 5174 final establishing a template for National Renewable Energy Action Plans under Directive 2009/28/EC

Table 4a. Current domestic agricultural land use for production of crops dedicated to energy production (ha)

Land use	Surface (ha)	
	2013 Year n-1	2012 Year n-2
1. Land used for common arable crops (wheat, sugar beet etc.) and oil seeds (rapeseed, sunflower etc.) (Please specify main types)	-	-
2. Land used for short rotation trees (willows, poplars). (Please specify main types)	-	-
3. Land used for other energy crops such as grasses (reed canary grass, switch grass, Miscanthus), sorghum.(Please specify main types)	-	-

"-" not available

7. Please provide information on any changes in commodity prices and land use within your Contracting Party in the preceding 2 years associated with increased use of biomass and other forms of energy from renewable sources? Please provide where available references to relevant documentation on these impacts in your country. (Article 22(1) h) of Directive 2009/28/EC).

In order to stimulate the use of biomass, during the period of the European financial crises, the Government decided to decrease the price of wood biomass for 10% for individuals and 20% for welfare recipients in 2012 and first quarter of 2013. The price of beech was set to 2133 denars (34.7 Euros) for individuals and 1896 denars (30.8 Euros) for welfare recipients. The price of oak was 2205 denars (35.8 Euros) for individuals and 1960 denars (31.9 Euros) for welfare recipients.

During the last three quarters of 2013 the price was set to 2500 denars (40.6 Euros) for beech and 2600 denars (42.3 Euros) for oak.

8. Please describe the development and share of biofuels made from wastes, residues, non-food cellulosic material, and lingo cellulosic material. (Article 22(1) i) of Directive 2009/28/EC).

Table 5: Production and consumption of Art.21(2) biofuels (Ktoe)

Article 21(2) biofuels ²⁶	2013 Year n-1	2012 Year n-2
Production – Fuel type X (Please specify)	-	-
Consumption – Fuel type X (Please specify)	-	-
Total production Art.21.2.biofuels	-	-
Total consumption Art.21.2. biofuels	-	-
% share of 21.2. fuels from total RES-T	-	-

"-" not available

²⁶Biofuels made from wastes, residues, non-food cellulosic material, and lignocellulosic material.

There were no producers of biofuels from waste, residues, food cellulosic material or ligno-cellulosic material in Macedonia in 2012 and 2013.

The progress of the legislation development in the field of biofuels made from wastes, residues, non-food cellulosic material, and lingo cellulosic material is described in more details in part 4 of this report.

9. Please provide information on the estimated impacts of the production of biofuels and bioliquids on biodiversity, water resources, water quality and soil quality within your country in the preceding 2 years. Please provide information on how these impacts were assessed, with references to relevant documentation on these impacts within your country. (Article 22 (1) j) of Directive 2009/28/EC).

Because in Macedonia in 2012 and 2013 there was no production of biofuels and bioliquids, there is no assessment of impacts.

10. Please estimate the net greenhouse gas emission savings due to the use of energy from renewable sources (Article 22 (1) k) of Directive 2009/28/EC).

The methodology for calculation of the GHG emission savings is described in details in APPENDIX I

Table 6: Estimated GHG emission savings from the use of renewable energy (t CO₂eq)

Environmental aspects	2013 Year n-1	2012 Year n-2
Total estimated net GHG emission saving from using renewable energy²⁷	3,902,171	3,518,498
- Estimated net GHG saving from the use of renewable electricity	2,537,765	1,684,940
- Estimated net GHG saving from the use of renewable energy in heating and cooling	1,362,982	1,833,201
- Estimated net GHG saving from the use of renewable energy in transport	1,424	357

11. Please report on (for the preceding 2 years) and estimate (for the following years up to 2020) the excess/deficit production of energy from renewable sources compared to the indicative trajectory which could be transferred to/imported from other Contracting Parties, Member States and/or third countries, as well as estimated potential for joint projects until 2020. (Article 22 (1) l, m) of Directive 2009/28/EC).

²⁷The contribution of gas, electricity and hydrogen from renewable energy sources should be reported depending on the final use (electricity, heating and cooling or transport) and only be counted once towards the total estimated net GHG savings.

Table 7: Actual and estimated excess and/or deficit (-) production of renewable energy compared to the indicative trajectory which could be transferred to/from other Contracting Parties, Member States and/or third countries in Macedonia (ktoe)^{28, 29},

	2012	2013	2014	2015	2016	2017	2018	2019	2020
	<i>Year n-2</i>	<i>Year n-1</i>							
Actual/estimated excess or deficit production (Please distinguish per type of renewable energy and per origin/destination of import/export)	0	0	-	-	-	-	-	-	-

“-” not available

11.1. Please provide details of statistical transfers, joint projects and joint support scheme decision rules. If a Contracting Party decided to implement Article 8 and/or 9 of the Ministerial Council Decision it should report on the measures taken to arrange for an independent external audit, in accordance with Article 13 of Ministerial Council Decision.

12. Please provide information on how the share for biodegradable waste in waste used for producing energy has been estimated, and what steps have been taken to improve and verify such estimates. (Article 22 (1) n of Directive 2009/28/EC).

There were no production of biodegradable waste used for producing energy in Macedonia in 2012 and 2013.

²⁸ Please use actual figures to report on the excess production in the two years preceding submission of the report, and estimates for the following years up 2020. In each report Contracting Party may correct the data of the previous reports.

²⁹ When filling in the table, for deficit production please mark the shortage of production using negative numbers (e.g. -x ktoe).

APPENDIX I Methodology for GHG calculation

1. Methodology for GHG emissions savings due to the use of renewable energy sources

This chapter describes the methodology for calculating the reduction of GHG emissions which occurs as a result of the use of renewable sources to produce electricity, heat and in the transport sectors.

1.1 GHG emissions savings due to the use of renewable sources for electricity production

The general equation for calculating GHG emissions savings due to the use of renewable sources for producing electricity is:

$$GHG\ savings\ [gCO_2eq] = \sum (\Delta E_{el}\ [gCO_2eq / MWh] * RES\ energy_{el}\ [MWh]) \quad (1)$$

Where:

$$\Delta E\ [gCO_2eq / MWh] = E_{F(el)} - E_{RES(el)} \quad (2)$$

$E_{F(el)}$ reference emission factor for electricity based on fossil fuel mix, called Fossil Fuel Comparator – FFC

$E_{RES(el)}$ emission factor of renewable energy source for electricity production

$RES\ energy_{el}$ quantity of electricity produced from renewable energy sources.

1.1.1 Method of calculating the reference emission factor for electricity

The reduction of GHG emissions are calculated as "savings" in relation to a reference emission factor of fossil fuels or in absolute terms. In fact, it is assumed that the output of electricity generated from renewable sources replaces the same amount of electricity produced by the fuels that are used to calculate the reference emission factor.

The reference emission factor for electricity is calculated as the sum of GHG emissions from the reference generation capacities in the system (generation capacities that use fossil fuels, or generation capacities that are used in the base year), which are connected to the network, divided by the total production of electricity from these facilities. This emission factor can be calculated based on the net output of each power plant and the emission factor for each power plant using the following equation³⁰:

³⁰UNFCCC (United Nations, Framework Convention on Climate Change), "Methodological tool: Tool to calculate the emission factor for an electricity system", Version 04.0, EB 75 annex 15, 2013

$$EF_{F(el),y} = \frac{\sum_m EG_{m,y} * EF_{el,m,y}}{\sum_m EG_{m,y}} \quad (3)$$

where:

$EF_{F(el),y}$ reference emission factor for electricity for year y expressed in ($tCO_{2\ eq} / MWh_{el}$)

$EG_{m,y}$ net generation of electricity produced and delivered to the grid from power plant m in year y (GWh)

$EF_{el,m,y}$ emission factor of power plant m in year y ($tCO_{2\ eq} / MWh$)

m all power plants serving the grid in year y

y appropriate year

The emission factor for each power plant can be determined in two ways³¹:

1. When data on the amount of fuel spent, the calorific value of the fuel and the amount of electricity generated are available for a certain power plant, the emission factor of net electricity generated can be calculated according to the following equation:

$$EF_{el,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO_{2\ eq},i,y}}{EG_{m,y}} \quad (4)$$

where:

$EF_{el,m,y}$ emission factor of power plant m in year y ($tCO_{2\ eq} / MWh$)

$FC_{i,m,y}$ quantity of a fuel i consumed in power plant m in year y (*mass or volume*)

$NCV_{i,y}$ net calorific value of the fuel i in year y ($TJ / mass\ or\ volume$)

$EF_{CO_{2\ eq},i,y}$ CO_2 emission factor for a fuel i in year y ($tCO_{2\ eq} / TJ$)

$EG_{m,y}$ net generation of electricity produced and delivered to the grid from power plant m in year y (GWh)

m all power plants serving the grid in year y

i all types of fuels consumed in power plant m for electricity production

³¹UNFCCC (United Nations, Framework Convention on Climate Change), "Methodological tool: Tool to calculate the emission factor for an electricity system", Version 04.0, EB 75 annex 15, 2013

y appropriate year

- If data on the type of fuel used and the efficiency of the power plant are available for a certain power plant, the emission factor can be determined based on the CO₂ emission factor of the fuel and the efficiency of the power plant using the following equation:

$$EF_{el,m,y} = \frac{EF_{CO_2 eq}^{m,i,y} * 3,6}{\eta_{m,y}} \quad (5)$$

where:

$EF_{el,m,y}$ emission factor of power plant m in year y ($tCO_2 eq / MWh$)

$EF_{CO_2 eq}^{m,i,y}$ mean CO₂ factor of fuel type i used in power plant m , in year y ($tCO_2 eq / TJ$)

$\eta_{m,y}$ mean net efficiency of power plant m , in year y

m all power plants serving the grid in year y

y appropriate year

If multiple types of fuels are used in a power plant, an emission factor is calculated using the fuel mix. For example, if a plant is using lignite to produce electricity, but additionally uses heavy fuel oil, the emission factor for this power plant can be calculated as follows:

$$EF_{el,lignite,y} = \frac{FC_{lignite,lignite,y} * NCV_{lignite,y} * EF_{CO_2 eq,lignite,y} + FC_{HFO,lignite,y} * NCV_{HFO,y} * EF_{CO_2 eq,HFO,y}}{EG_{lignite,y}} \quad (6)$$

where:

$EF_{el,lignite,y}$ emission factor of the power plant (that mainly uses lignite for electricity production), in year y ($tCO_2 eq / MWh$)

$FC_{lignite,lignite,y}$ quantity of lignite consumed in the power plant, in year y ($mass$)

$NCV_{lignite,y}$ net calorific value of the lignite, in year y ($TJ / mass$)

$EF_{CO_2 eq,lignite,y}$ emission factor of the lignite, in year y ($tCO_2 eq / TJ$)

$FC_{HFO,lignite,y}$ quantity of heavy fuel oil consumed in the power plant, in year y ($mass$)

$NCV_{HFO,y}$ net calorific value of the heavy fuel oil, in year y ($TJ / mass$)

$EF_{CO_2 eq,HFO,y}$ emission factor of the heavy fuel oil, in year y ($tCO_2 eq / TJ$)

$EG_{lignite,y}$ net generation of electricity produced and delivered to the grid from the power plant, in year y (GWh)

y appropriate year

The reference emission factor refers only to electricity delivered to the grid, not including the losses in transmission and distribution networks.

1.1.2 Method of calculating the emission factor for electricity production from renewable sources

When analyzing the reduction of GHG emissions due to the use of renewable energy sources, the fact that there are two types of renewable sources should be taken into account: one whose emission factor is zero and one whose emission factor is greater than zero. The first group includes renewable sources such as hydropower, solar energy, geothermal energy, wind energy, tidal, wave and ocean.

The second group includes biomass, biogas and bioliquids. The GHG balance of these three types of biofuels depends on the type of feedstock used, carbon stock changes due to land use, transportation, processing and efficiency of the technology for conversion into electricity. Usually, emissions from carbon stock changes due to land use (positive or negative) are not included in a standard analysis of the life cycle, because it is assumed that almost immediately there is a plant re-growth that absorbs the same amount of carbon³².

When calculating the reduction of GHG emissions from the use of biomass the following equation should be considered³³:

$$E_{RES(el)} = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} \quad (7)$$

where:

$E_{RES(el)}$	total emissions from the use of the fuel before energy conversion
e_{ec}	emissions from the extraction or cultivation of raw materials
e_l	annualized emissions from carbon stock changes caused by land use change
e_p	emissions from processing
e_{td}	emissions from transport and distribution
e_u	emissions from the fuel in use
e_{sca}	emission savings from soil carbon accumulation via improved agricultural management
e_{ccs}	emission savings from carbon capture and geological storage
e_{ccr}	emission savings from carbon capture and replacement

³²SWD(2014) 259, "COMMISSION STAFF WORKING DOCUMENT, State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU", European Commission, Brussels, 28.7.2014

³³COM(2010) 11, "REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLAMENT on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling", European Commission, Brussels, 25.2.2010

1.2 GHG emissions savings due to the use of renewable sources for heat production

GHG emissions savings as a result of the use of renewable energy sources for heating and cooling can be calculated using the following equation:

$$GHG\ savings\ [gCO_2eq] = \sum (\Delta E_h\ [gCO_2eq / MJ] * RES\ energy_h\ [MJ]) \quad (8)$$

where:

$$\Delta E_h\ [gCO_2eq / MJ] = E_{F(h)} - E_{RES(h)} \quad (9)$$

$E_{F(h)}$ reference emission factor for heating and cooling based on fossil fuel mix, called Fossil Fuel Comparator – FFC

$E_{RES(h)}$ emission factor of renewable energy source for heat production

$RES\ energy_h$ quantity of heat produced from renewable energy sources as solar thermal, geothermal, heat pumps and biomass.

1.2.1 Method of calculating the amount of renewable energy produced by heat pumps

The amount of athermal, geothermal and hydrothermal energy produced by heat pumps, which is considered as energy produced from renewable sources, is calculated according to the following equation³⁴:

$$RES\ energy_{HP} = Q_{usable} * (1 - 1 / SPF) \quad (10)$$

where:

$$Q_{usable} = H_{HP} * P_{rated}$$

and where:

Q_{usable} estimate of the total usable thermal energy produced from heat pumps [GWh]

H_{HP} total working hours at full capacity [h]

P_{rated} installed capacity of the heat pump for cooling or heating, taking into account the lifespan of the various types of pumps [GW]

SPF estimate of the average seasonal performance factor (SPF). In case of heat pumps that use electricity this factor refers to the net seasonal coefficient of performance in active mode ($SCOP_{net}$), and in case of heat pumps that use heat this factor refers to net seasonal primary energy ratio in active mode – ($SPER_{net}$).

³⁴C(2013) 1082, “Establishing the guidelines for Member States on calculating renewable energy from heat pumps from different heat pump technologies pursuant to Article 5 of Directive 2009/28/EC of the European Parliament and of the Council”, Official Journal of the European Union L 62/27, 6.3.2013

As it can be seen from the equation, not all energy produced by these heat pumps are considered energy from renewable sources, but only the difference between the total useful (thermal) energy (Q_{usable}) and the energy spent for producing that useful energy (Q_{usable} / SPF).

The values for H_{HP} and SPF depend on the climate conditions of the country that is analyzed. Most commonly, standard values from C(2013) 1082³⁵ are considered, depending on whether the climate in the country is warm, moderate or cold.

For a heat pump, which runs on electricity, to be considered as a renewable source, SPF must be greater than 2.5. The efficiency of the energy system is taken as a fixed value of 45.5%. Heat pumps that work on thermal energy (directly or through combustion of a fuel) have efficiency of 1. For the energy of these pumps to be considered as energy from renewable source, the minimum SPF should be 1.15.

1.2.2 Method of calculating the reference emission factor for heat

The reference emission factor for heat can be calculated as the sum of all the emission factors of the heat production technologies multiplied by the share of the fuel used by the technology for heat production.

$$EF_{F(h),y} = \sum_m EF_{h,n,y} * share_{n,y} \quad (11)$$

where:

$EF_{F(h),y}$ reference heat emission factor, in year y ($gCO_{2\ eq} / MJ_{heat}$)

$EF_{h,n,y}$ reference heat emission factor for technology n , in year y ($gCO_{2\ eq} / MJ_{heat}$)

$share_{n,y}$ share of technology n in year y

n all technologies that are used for heating in year y

y appropriate year

The emission factor for each technology n can be determined in a similar way as for electricity. If there are data on the type of fuel used and the efficiency of the technology, the following equation can be used:

$$EF_{h,n,y} = \frac{EF_{CO_2n,j,y}}{\eta_{n,y}} \quad (12)$$

where:

$EF_{h,n,y}$ heat emission factor of technology n in year y ($gCO_{2\ eq} / MJ_{heat}$)

³⁵C(2013) 1082, "Establishing the guidelines for Member States on calculating renewable energy from heat pumps from different heat pump technologies pursuant to Article 5 of Directive 2009/28/EC of the European Parliament and of the Council", Official Journal of the European Union L 62/27, 6.3.2013

$EF_{CO_2n,j,y}$	emission factor of fuel type j used in technology n , in year y (gCO_2_{eq} / MJ)
$\eta_{n,y}$	efficiency of the technology n , in year y
n	all technologies that are used for heating in year y
y	appropriate year

When using electricity in households for different purposes, in order to calculate the emissions from that energy consumed, it is necessary to include the losses in the transmission and the distribution networks. This emission factor is calculated as follows:

$$EF_{T(el),y} = \frac{EF_{F(el),y}}{1 - L_T} \quad (13)$$

$EF_{T(el),y}$	emission factor of the transmission network in year y (tCO_2 / MWh_{el})
$EF_{F(el),y}$	reference emission factor in year y (tCO_2 / MWh_{el})
L_T	transmission losses [%]

$$EF_{D(el),y} = \frac{EF_{T(el),y}}{1 - L_D} = EF_{CO_2_{eq}(el),y} \quad (14)$$

$EF_{D(el),y}$	emission factor of the distribution network (final consumer) y (tCO_2 / MWh_{el})
$EF_{T(el),y}$	emission factor of the transmission network in year y (tCO_2 / MWh_{el})
L_D	distribution losses [%]

1.2.3 Method of calculating the emission factor for heat production from renewable sources

As with electricity, there are two types of renewable energy sources, one with zero emission factor and other with emission factor different from zero. For biomass (solid biomass, biogas and bioliquids), the emission factor is calculated using the equation given in section 1.1.2.

1.3 GHG emissions savings due to the use of renewable sources in the transport sector

Emission savings due to the use of renewable energy in the transport sector are calculated using the following equation:

$$GHG \text{ savings } [gCO_2eq] = \sum (E_t [gCO_2eq / MJ] * RES \text{ energy}_t [MJ]) \quad (15)$$

where:

$$E_t[\text{gCO}_2\text{eq} / \text{MJ}] = E_s[\%] * E_f[\text{gCO}_2\text{eq} / \text{MJ}] \quad (16)$$

and where:

E_t emissions reduced due to the use of renewable energy sources in the transport sector [$\text{gCO}_2\text{eq} / \text{MJ}$]

E_s savings realized [%]

E_f fossil fuel comparator for the transport sector

GHG savings realized as a result of the use of biofuels and bioliquids can be calculated using the equation³⁶:

$$E_s[\%] = \frac{E_f[\text{gCO}_2\text{eq} / \text{MJ}] - E_b[\text{gCO}_2\text{eq} / \text{MJ}]}{E_f[\text{gCO}_2\text{eq} / \text{MJ}]} \quad (17)$$

where:

E_s savings realized [%]

E_b emission factors of the biofuels and bioliquids calculated according to equation (7).

³⁶DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Official Journal of the European Union L 140/16, 5.6.2009