DECISION
No. 179, dated 28.3.2018

ON APPROVAL OF THE NATIONAL ACTION PLAN FOR RENEWABLE ENERGY SOURCES,
2018-2020

Pursuant to Article 100 of the Constitution and point 3 of Article 5 of Law No. 7/2017 "On the promotion of use of renewable energy sources", upon the proposal of the Minister of Infrastructure and Energy, the Council of Ministers

DECIDED:

1. Approval of the National Action Plan for Renewable Energy Sources, 2018-2020, according to the text attached hereto.
2. The Decision of Council of Ministers No. 27, dated 20.1.2016 “On Approval of the National Action Plan for Renewable Energy Sources, 2015-2020" is hereby repealed.
3. Ministry of Infrastructure and Energy shall be responsible for the enforcement of this decision.

This decision shall enter into force after its publication in the Official Journal.

PRIME MINISTER
Edi Rama

NATIONAL ACTION PLAN FOR RENEWABLE ENERGY SOURCES IN ALBANIA (REVISED) 2018-2020

LIST OF ACRONYMS

NANS	National Agency of Natural Sources
EU	European Union
RES	Renewable Energy Sources
RES-E	Renewable Energy Sources for Electricity Production
RES-H&C	Renewable Energy Sources for Heating and Cooling
RES-T	Renewable Energy Sources for Transport
EE	Energy Efficiency
ERE	Energy Regulatory Authority
EUROSTAT	European Statistics
IMF	International Monetary Fund
HPP	Hydropower Plant
SHPP	Small Hydropower Plant
INSTAT	Institute of Statistics
EFGC	Energy final gross consumption
ktoe	Kilogram to tonne of oil equivalent
CoM	Council of Ministers
MEI	Ministry of Infrastructure and Energy
OST	Albanian Operator of Transmission System
GDP	Gross Domestic Product
NAPEE	National Action Plan for Energy Efficiency
NAPRES	National Action Plan for Renewable Energy Sources
PNUD	United Nations Development Program
TFE	Total Energy Supply
TPK	Total Final Consumption
TVSH	Value Added Tax
UNFCCC	United Nations Framework Convention on Climate Changes
VNM	Environmental Impact Assessment

1. Summary of the amendments to the NAPRES 2015-2020

The revision of the National Action Plan for Renewable Energy Resources (NAPRES), 2015-2020 is a legal obligation stemming from Article 5 of Law no. 7, dated 2.2.2017 "On the promotion of Renewable Energy Resources", as well as one of the obligations of Albania under the Energy Community Treaty. NAPRES is related to the decision-making and commitment of the Albanian government to achieve the national energy production objective within the territory of Albania, from Renewable Energy Resources (RES) at 38% in relation to gross final energy consumption (EFGC), by 2020. NAPRES approved by the Council of Ministers' Decision No. 27, dated 20.1.2016, set ambitious objectives to complete the primary and secondary legislation for renewable energy to meet the national objective by 2020: 38% of the energy produced in Albania, compared to the EFGC, will be of renewable, non-fossil origin.

This commitment is also introduced in the framework of the National Strategy for Energy

2017-2030 (draft) and the National Plan for European Integration (revised), which includes short term and medium term measures to reach RES generation by 2020, with a view that Albania has fully approximated the legislation in accordance with the EU *Acquis* for Energy, where all sectors affected by energy meet the standards set out in the *Acqui*s chapters.

1.1 Need for revision of the National Renewable Energy Resources Plan for the period 2018-2020.

The Law 7/2017 "On the promotion of the use of renewable energy sources" was adopted on 2 February 2017. This law is harmonized with Law 43/2015 for the Energy Sector and fully reflects the access to the liberalized market of the electric power of generators from renewable sources. Law No. 7/2017, *inter alia*, reflects the almost complete transposal of the Directive 2009/28 / EU and takes into account not only the small hydro power plants and the feed-in stimulated tariffs for the preferred producers, defining OSHEE sh. a. as the only buyer, but also the promotion of other sources of renewable origin such as eolines, PV, biomass etc.

In this framework, the following recommendations are made to anticipate reforms in the energy sector and to achieve the objective of 38% of RES in EFGC, in the revised NAPRES of the remaining 2018-2020 period:

i) effective measures for the approval of the sub-legal framework, foreseen by Law No. 7/2017 and the inclusion and diversification of renewable resources in Albania;

ii) broader technical and economic analysis of the interests of all renewable resources market operators in the application of "support schemes" for the promotion of RES without distinction; and

iii) further enhancement of biogas legislation in the transport sector in terms of sustainability, information/reporting requirements and the adoption of measures to promote their trade to the end-user.

The National Action Plan for Renewable Energy Sources (2015-2020) defines the roadmap of achieving the national objective for the percentage of energy from renewable energy sources consumed in the energy sector (RES-E), transport (RES) and in the heating and cooling sector (BRE-H& C) by 2020. NAPRES also sets quantitative and specific indicative objectives for electricity generation technology from renewable energy sources.

Law No. 7/2017, via the responsible agencies for renewable energy sources, will ensure that information on the benefits, costs and practical details of the development and use of energy from renewable sources and about supporting measures will be made available to all stakeholders, such as consumers, developers, drafters, sponsors, investors, financial institutions, builders, installers, architects and suppliers of heating and cooling equipment and systems and other equipment using renewable energy from renewable sources.

As soon as the implementation of Law No. 7/2017, dated 2.2.2017 "On the promotion of use of renewable energy sources" started, the first step of the immediate application of promotional schemes up to 2 mw for photovoltaic plants (PV) and 3 mw for wind plants, was made possible. In April 2017, MEI proposed "Methodology to determine the purchase price of electricity produced from small renewable resources (sun and wind)", which was approved by Council of Ministers' Decision No. 369, dated 26.4.2017. Three months later, on 27.7.2017, ERE adopted this methodology, which set the promotional tariff of 100 € / mwh for PV plants up to 2 mw and 76 €/mwh for wind farms up to 3 mw installed. ERE will review this promotional price based on the above methodology according to the well-known principles of the *Levelized Cost of Energy* (LCOE) for promotional schemes, with prices based on the trend of prices of these plants in the international market and to return investment within reasonable timeframe. Until December 31, 2017, at least 30 applications have been submitted to MEI for PV plants up to 2 mw and 6 of them are supplied with "Final Approval", where 3 companies have signed the MEI contract for the construction of solar energy farms. As regards wind farms up to 3 mw of installations, no applications have been filed to date. NAPRES 2015-2020 has foreseen 50 mw solar PV plants and 30 mw wind plants.

In June 2017, MEI signed a Memorandum of Understanding with the EBRD for technical

assistance on the organization of auctions for schemes over 2 MW per PV. Assistance will be active in May 2018 and will complement the legal framework related to the application of schemes over 2 MW per PV. Assistance will be valid for two years for the MEI and will prepare the ground for organizing auctions. MEI is under preparatory period to consider the land/site on which their installation is more favourable.

By virtue of the Decision of Council of Ministers No. 27, dated 17.1.2018 "On approval of the methodology to determine the purchase price of electricity produced by small generators with renewable sources from the biodegradable fraction of solid waste utilizing industrial, urban and rural waste", is taking another step for renewable sources from the incineration of urban and rural waste, converting biodegradable waste into energy. The prices proposed by MEI are based on the National Integrated Urban and Rural Waste Management Strategy for the biodegradable fraction, which is estimated at 60%. This potential will also give rise to the further development of waste disposal plants, significantly reducing their dumping at hot spot environmental facilities. As far as this is concerned, the ERE approval is expected shortly.

Notwithstanding all the rapid measures after the promulgation of Law No. 7/2017, RES in Albania are dominated by financial support schemes and the potential access to electricity grid produced from hydric sources. The state policy, with a view of promoting energy investment, generally created a favorable climate of concessions for the construction of electricity production works and the guarantee of energy pre-emption for a 15-year period. During this decade the Albanian state has provided about 194 concessions for the construction of around 540 small HPPs across the country. At present, until February 2018 SHPP has installed by concession only 27% thereof, representing 31% of the scheduled generation, which is only 43% of the electricity consumption expected by 2020. Hydropower SHPPs predictability in a construction stage can increase by about 8% hydric production by 2020. NAPRES 2015-2020 has foreseen 750 mw small HPPs of which 163 mw have been built.

Law No. 7/2017, "On promotion of the use of renewable energy sources" is also a legal basis for a number of by-laws related to SHPP, which in respect of law, ensure continuity of contracts with the Albanian government. Thus, based on Article 22, points 2 and 3 of Law No. 7/2017, Council of Ministers Decision No. 687, dated 22.11.2017 "On approval of the methodology to determine the purchase price of electricity to be paid to the existing producers with priority" is approved. The annual purchase price of electricity to be paid to the existing producers with priority, from the calculations made under the methodology and approved by the Energy Regulatory Entity, for the year 2018 has been reported in the amount of 8.56 ALL / kWh. This price will be paid to the private producers of HPPs by OSHEE sh.a. with which they also have a contract. Compared to 2017 and 2016, when the price was the same fixed at 7.4 ALL, there is a 15% increase. This approach provides effectiveness of the producers' investments and consumer protection by temporary distortions that may result in a market under different conditions. Further, this methodology takes into account the return of investment calculated for the residual share of concession.

However, Law No. 7/2017 requires a greater effort regarding the bylaws to be approved by the Council of Ministers, such as:

1. Draft Act on methodology of calculation of the "National Objectives";
2. Identification of the agency responsible for renewable energy sources;
3. Draft act for the support of "Contracts on Difference", so that RES are integrated into the electro-energetic system according to the liberalized market rules;
4. Draft act for "Net energy measurement schemes" for self-consumption up to 500 kW PV installations;
5. Draft act for the determination of "Renewable Energy Operator";
6. Draft act for "Network Access" and "Network Connection" rules;
7. Draft act on "Guarantees of Origin" of renewable resources, with the aim of renewable energy exchange, to reach objectives in other countries that can invest in RES.

The revision of the National Action Plan for Renewable Energy Sources, 2018-2020, apart from the above measures in the legal framework, sets out the methodologies for setting the purchase price of energy through "Financial Support Schemes" as a direct commitment of the Albanian government in order to achieve the national objective.

The revised NAPRES 2018-2020 is in line with the directive, conducting the evaluation and then analyzing the facilitation and barriers of national administrative procedures for the promotion of renewable resources. Based on the principle of "who comes first - the first is served" the procedures have been significantly facilitated, however, the concessions of SHPP-s have been provided on the basis of a bidding competition process and authorizations for electricity generation with renewable sources, as well as authorizations for PV up to 2 mw and eolic ones up to 3 mw, to date, provided on a transparent basis.

1.2 Situation of Renewable Energy Sources until December 2017

1.2.1 Renewable sources for electric power generation (RES-E)

1.2.1.1 Hydric sources

Albania represents a special case in the region, because currently the electric power generation in the country is realized by large, medium and small hydropower plants. Yet, the fact that Albania supports the basis of electricity consumption in hydric energy renders it vulnerable to changes of hydrological conditions and this has significantly reduced the security of electricity supply. Accordingly, despite the record year 2016when Albania was net exporter of energy, in 2017 it was almost clear that electric power generation from hydropower plants is lower than average multi-year value (4,682 gwh). However, after 2000 Albania is the net importer of electricity[1], imports varying subject to the conditions, between 30 and 60% of the demand for electricity[2].

Referring to the introductory table on renewable sources input for achieving the objective of 38%, it is deemed that the progress of commissioning of hydropower plants for the period 2015-2020, follows this pace. In 2015, 32 mw are commissioned, with annual output of 58 gwh. For 2016, 25 HPP-s have been commissioned for the first time, with a total installed capacity of 116 mw and production of 133 gwh, while for 2017, 15 mw hydropower plants are commissioned with annual output of 26 gwh. Based on such progress of commissioning of the HPPs by 2020, only 330 mw will be commissioned, with an annual output of only 458 gwh.

During the last 10 years, most of discussions regarding the promotion of RES in Albania have been focused on financial support schemes and the option of access to electricity grids produced from hydric sources. The state policy, in order to stimulate investment in energy, generally created a favorable climate of concessions for the construction of RES-E production works. According to the NANS, during 2002 - January 2018, the Albanian state has awarded about 194 concessions for the construction of about 540 HPPs across the country. The award of concessions in these years have been dependent on state policies and not on a sustainable energy policy.

Planned investments in HPP-s for concessions by 2020 are estimated to be over 275 billion ALL, with an installed capacity of 1390 mw and annual output of RES-E, around 5901 gwh. If we also consider annual production by KESH sh.a. with an average of 4,000 gwh, then the annual output forecast by KESH and concession-based hydroelectric plants is approximated to the country's energy demands by about 10,000 gwh by 2020. The current transmission network has a spare absorbing capacity of 180-200 mw and in order to enable such forecasts, the transmission and distribution network should be further strengthened by at least 1,251 mw by 2025.

- However, facts show that out of the 540 HPPs under concession, 147 with an installed capacity of 833 mw have started production, while 109 HPP-s are in construction phase with a capacity of 557 mw and 284 thereof have not begun construction yet (Table 1). The projection of concessions for the production of electricity from hydric resources until January 2018 has reported:

[1] In addition to year 2010.
[2] In addition to year 2016.

In the production phase:
- 27% realized by the number of HPPs (147 out of 540);
- 32% realized by installed capacity (833 out of 2594 mw); and
- 31% from projected production (3467.1 out of 11292.8 gwh).
In the construction phase:
- 53% in construction from the number of HPP-s (109 out of 540);
- 22% in construction from installed capacity (557.8 out of 2594 mw); and
- 22% will be added by projected production (2,434 out of 11292.8 gwh).
Hydropower plants that have not started construction:
- 20% by the number of HPP-s (284 out of 540);
- 46% by the installed capacity (1203 out of 2594 mw) and
- 48% of the projected output (5391 out of 11292.8 gwh).

Table 1. Situation of SHPP-s by concession until January 2018

January 2018 Current phase of concession (2003-January 2018)	**Number of HPPs**	**Installed capacity (mw)**	**Production forecasted in gwh**	**Investment value (billion ALL)**
In the construction phase	109	557.8	2,435	162
Without the commencement of construction	284	1,204	5,391	160
In the production phase	147	833	3,467	113
TOTAL	**540**	**2594**	**11293**	**435**
Forecast within 3-4 years	14-39%	30-46%	27-41%	12-60%

1.2.1.2. Photovoltaic Solar Energy (PV)

The National Renewable Energy Resources Action Plan (NAPRES), 2015-2020, foresees the necessary capacity of solar PV plants to reach the national objective for 2020 by installing 50 MW of solar PV. In the framework of this forecast, during the period of July 2017 - January 2018, MEIs, roughly 58 applications have been reserved at MEI during 2017 for plants up to 2 mw PV. This situation requires the revision of NAPRES at the end of February 2018, as provided for in Law No. 7/2017.
The new law (7/2017) provides for setting FIP (*Feed-in-Premium*) tariffs through a competitive, non-discriminatory tendering process for new installations over 2 mw, while new installations up to 2 mw are excluded from the competitive process with the ceiling price to be determined, based on the methodology approved by the Council of Ministers Decision No. 369, dated 26.4.2017 and approved by ERE by virtue of the Decision No. 120, dated 27.7.2017. The new law is also planned to promote the development of a net metering system for units up to 500 kW per unit. For this purpose, MEI has prepared the relevant draft act.
In Albania, the only photovoltaic plant with installed capacity of about 1 mw, currently operating, comes from the company "UKKO" sh.a. Korçë. Under the "self-producer" status, this company has started producing electricity for its own demands. The self-production status envisages the exchange of electricity with the distribution network and the annual energy output balance from the photovoltaic plant, less than the company's annual demands. In this meaning, UKKO sh.a. Korçë is not a producer of electricity, but its customer.
The average electricity generation capacity of the photovoltaic plant for the measurements carried out in the 1-year period 2016-2017 was 92.8 toe or 1,080 mwh and operated at full load (8: 30-16: 30), averaging 1290 hours /year. The peak electric power value was reached in May 2016 with about 7.1 mwh. The load factor for this experimental plant is 18%.
1.2.1.3 Competitive costs to produce electricity from PP

Due to the potentially high sources of solar energy (over 1700 kW /m2/ year), in limited regions, the unexploited potential for PV installation on infertile land is up to 1,900 mw (for instance, in saline lands up to 4,500 hectares). This source is now the “golden” opportunity of Albania has and can now be considered, together with wind energy, as an alternative to the diversification of renewable resources in Albania, in order to achieve the national objective of 2020, which is 38%.

A question naturally arises: what is the energy price (€ / mwh) or LCOE, “*Levelized Cost of Energy*" and how is an investment in PV and wind energy in Albania affected? There are two factors: capital cost and risk influence.

MEI has undertaken a more comprehensive analysis of capital costs, considering recent studies conducted at the international level, especially for countries in the SEE region, which are experienced in PV. The studies are focused on the best practices of IRENA (International Renewable Energy Agency) for countries in the Western Balkans, including Albania and also in the ECOFYS 2017 study:

-"Electricity production from renewable sources at competitive costs: Potential throughout Southeastern Europe" (2017)[3].

-Formulation of capital cost for wind and solar energy in Southeastern Europe member states (2017)[4].

The methodology for assessing the cost of renewable energy sources is based on the LCOE, known as the average energy cost (LEC) cost and is the net current cost value of the electric power unit (kWh) throughout the life cycle of a generation unit.

This cost value is considered as "tariff" representing the average price that the generation unit is required to obtain in a market to return the investment over a reasonable period, as provided by Law No. 7/2017 "On Promotion of the Use of Energy from Renewable Resources". This calculated value is an economic first order cost estimate of the competition of energy generation system (in this case PV) that includes all the costs over its life span, such as:

- Initial investment;
- Expenses for operation and maintenance;
- The cost of fuel that in the case of PV systems is generally related to land use taxes, local taxes, rent etc. According to the legislation in force, the cost which in the case of fossil energy plants, in addition to the above, is fuel cost and
- Capital cost.

The cost of electric power generation from renewable sources has only one formula that calculates LCOE, which is the net current value of all costs during the life of the generation unit proportional (divided) to the total electricity production of the unit during the whole operational period until destruction.

The formula for LCOE calculation is shown below:

$$LCOE = \frac{\Sigma \text{ of the life cycle costs}}{\Sigma \text{ of energy produced during the life cycle}} = \frac{\Sigma^{n}_{t=1} \frac{I_t + M_t + F_t}{(1+r)^t}}{\Sigma^{n}_{t=1} \frac{E_t}{(1+r)^t}}$$

Where: I_t - Investment expenditures in year t

M_t - Operations and maintenance expenses in year t

Ft - Fuel expenditures in year t (annual tax, land use, rent etc.)

Et - Electricity generated in year t

r - Plant cost interest rate

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[3] *January 2017 - IRENA, JOANNUM RESEARCH — “Cost-competitive renewable power generation: Potential across South East Europe”* http://www.irena.org/DocumentD(ownloads/Publications/IRENA Cost-competitivepower potentialSEE 2017.pdf

[4] *January 2017 - ECOFYS, ECLAERON “Mapping the cost of capital for wind and solar energy in South Eastern European Member States”* http://www.ecofys.com/files /files lecofys-eclareon-2016-wacc-windpv-south-east-europepdf

n - The economic life cycle of the generation unit

In this context, it must be noted that usually for generating electricity with renewable energy technologies, LCOE is calculated in the design lifecycle of a generation unit, which is usually 20 to 40 years. Based on Law No. 7/2017, "On the promotion of use of renewable energy sources", LCOE should be considered for a shorter period (not exceeding 15 years), a period which necessarily requires higher financial support even though the duration of the unit is longer. In the absence of experience in these facilities and available data for shorter periods of time, LCOE is reasonable, in the case of PV, to be calculated for a period of 25 years, the period during which the plant produces considerable profit. This period for wind farms is more than 25 years.

In the January 2017 study, IRENA combines in detail the potential of renewable resources with the real cost data of the project collected through confidential data that the construction companies of renewable plants in the Western Balkans have with IRENA. The geographic coverage of the report includes all Contracting Parties to the Energy Community Treaty, specifically Albania, Bosnia and Herzegovina, Kosovo, Montenegro, the Republic of Moldova, Serbia, Macedonia and Ukraine. In this framework, the study results show real costs for installations.

Further, referring to the studies in this field, one of Europe's most prestigious ECOFYS companies, published in January 2017, entitled "Formulation of capital cost of wind and solar Energy in Southeastern European Member States", provides data on Southeastern Europe region, presenting the capital cost for PV resources, as well as the debt cost, debt ratio with capital and installed capacity.

Apparently, the study has taken into account the country's "risk" cost, as well as the "risk" of energy policies for promoting renewable resources backed by *Feed-in-Premium* tariffs. For each member state in the Balkans region, it is indicatively shown which part of the capital cost is due to the country's "risk" compared to the risks of renewable energy policies under the given market situation. In addition, it provides the calculation of policy risk premium in the wind LCOE and PP for each member state in Balkans. The study refers to countries in the region and beyond, mainly presenting data that serve as a re-verification of IRENA's study results. In particular, the data of Greece and Hungary have been selected as similar to the PP technology in Albania.

The great potential of solar energy, especially the high demand of investors, suggests that the revision of generation capacities with solar power generation plants should be proposed at levels over 120 mw, compared to 50 mw under NAPRES 2015-2020.

1.2.1.4 Wind (eolic) energy

The use of wind energy in Albania has not started yet, but there is a great deal of interest from foreign investors during 2009-2010, who partially seek to adapt to the new legislation (Law No. 7/2017). In this framework, some of the regions of our country are under study by some foreign companies. By the end of 2014, ERE has licensed 15 companies to produce electricity from wind farms, with an installed capacity of about 1,600 mw, which are mainly located in the coastal area of the country, ranging from the County of Lezha in the north to Saranda region in the south. Currently, no investments have started.

The National Renewable Energy Resources Action Plan (NAPRES), 2015-2020, foresees the capacity required to reach the national objective for 2020, projecting the installation of up to 30 mw wind generators. To date, no wind plant has been built during 2015-2017 under this projection due to the low capacity already in the existing plan and lack of development of wind energy auctions. This situation requires the revision of NAPRES at the end of January 2018.

Law No. 7/2017 provides for the establishment of FIP (*Feed-in-Premium*) tariffs through a competitive, non-discriminatory competitive process (auctions) for new installations over 2 mw, while new installations up to 2 mw are excluded from the competitive process with the ceiling price will be determined, based on the methodology approved by Council of Ministers Decision No. 369, dated 26.4.2017 and approved by ERE by virtue of the Decision No. 120, dated 27.7.2017.

The high potential of wind energy in limited locations, but also the high demand of investors to invest in high capacities suggests that the revision of generation capacities with wind energy generation plants proposed at levels at 70 mw, compared to 30 mw under the NAPRES 2015¬2020.

1.2.1.5 Electricity generation from the degradable fraction of solid urban, industrial and rural waste (SUW)

Waste biomass, which is represented by the biodegradable fraction of urban solid waste, including biological waste (biodegradable waste of gardens and parks, food and kitchen household waste, restaurants, catering services and retail premises and similar waste from food processing enterprises), waste landfill gas, biodegradable fraction of industrial waste (including paper, cardboard, pallets) and sewage sludge are potentially only an opportunity for energy production.

The adoption of the National Waste Management Strategy and the Law on Integrated Waste Management in 2013 have, inter alia, considered as a main duty, the reduction of waste through prevention and exploitation of energy from the biodegradable fraction of industrial, urban and rural waste through incineration. Combustible waste are generally known as solid urban waste (SUW).

Additionally, in the framework of the National Waste Management Strategy, the policy of the Albanian government for sustainable waste management is defined by 2025, which is divided into 3 operational phases over 5 years each. In 2013 targets, the strategy predicted that by 2015, 25% of municipal waste would be recycled / composted. By 2020 it is intended to stop the increase of municipal waste produced by the recycling / composting of 55% of municipal waste and by 2025 start to recover energy from 15% of municipal waste.

The following table clearly shows that information about available quantities of biomass is insufficient. However, during 2015-201, the situation has not changed, but after 2016 the descending trend of firewood should be replaced by industrial biomass, which foresees the incineration of briquette waste and /or pellets for heating purposes and industrial energy consumption.

The legal framework for renewable energy investments by SUWs is a duty and measure that the NAPRES 2015-2020 did not take into account, but in the meantime Law No. 7/2017 foresees the installation of biomass energy production units or unlike the biodegradable fraction of solid urban waste.

Also, Law No. 7/2017, adopted in February 2017, provided a support scheme for other renewable energy sources (in the framework of the liberalized electricity market and the fulfillment of obligations to meet the national RES objective, with 38% in 2020. In addition, this law provides for the imposition of FIP (*Feed-in-Premium*) tariffs through a competitive, non-discriminatory bid (auction) via CfD contracts, while new installations up to 2 mw are excluded from the competitive process with the ceiling price to be determined based on SUW's methodology, currently approved by the Council of Ministers' Decision No. 27, dated 17.1.2018.

As a primary measure in the SUW strategy, industrial and urban waste inherited from the past and deposited in some local landfills were required to be a priority for their treatment and disposal via clean technologies. One of the measures in this regard has foreseen: "Installation of the incinerator near any of the cement factories for the incineration of hazardous and urban waste for the use of energy produced for industrial production purposes". Furthermore, Law no. 7/2017, "On the promotion of use of renewable energy sources" provides for that such technologies need support as envisaged by Article 10, point "a", "... for the production of electricity from small renewable energy sources for the preferred producers with an installed electric power capacity of up to 2 mw ".

Promotion of this kind of resource is a well-known practice in EU countries and is related to the disposal of biodegradable waste for the purpose of waste (*Waste to Energy*). As in these countries, the purchase price of electricity in Albania, from any producer of this nature, must be a promoter and compliant with the methodology approved by the Council of Ministers. The methodology defines the criteria for calculating the price, based on the

reasonable restitution of the value of investments, according to the type of technology used.

Also, in accordance with and a recommendation in the framework of the "Implementation of Waste Management Plan 2010-2025" is the establishment of administrative units at national, regional and local level for the further strengthening of waste management. Solid urban waste management systems with low environmental waste, which protect the health and safety of residents foresee, *inter alia*, waste disposal with a view of energy production which, compared to landfill, is a technology of minimum environmental impact.

1.2.2 Energy from biomass for heating (RES-H & C)

1.2.2.1 Wood biomass

Firewood consumption decreased by about 45 ktoe during the period 2015-2017 as a result of the forest moratorium in 2016. However, the consumption of 2017 was about 180 ktoe and includes only the consumption of firewood used in urban and rural mountain areas. After March 2016, the consumption of firewood has decreased and is expected to decline in 2018-2020, not only as a result of the moratorium but also due to rising prices by their imports, as well as the replacement of this heating source with electricity. Wood processing fuels such as wood chips, pellets and briquettes are not massively used because of their high price and underdeveloped supply system. In the absence of statistics it is judged that during 2012-2016 the production of pellets for export has significantly increased, especially in neighboring Italy. Traditionally, wood burning continues to be used in traditional stoves used for heating and cooking. It should be noted that most of the forest biomass heaters, stoves and chimneys are old and inefficient, with heat losses of up to 50-60%. Heating with high efficiency pellets for local heating systems is still underdeveloped and in the initial steps.

The use of biomass is dominated in urban and rural areas such as Diber, Kukes, Korçë and Gjirokastër, where at least 96-99% of households are heated by woody biomass and less than 15-20% biomass is used in the districts of Tiranë, Durres, Elbasan, Vlorë and Fier.

However, a TSEC secretariat report for 2009, including Albania, on the "Biomass Consumption Study Between Contracting Parties to the Energy Community Treaty (TIKE)"[5], has considered that the consumption of biomass presents some results comparable to the INSTAT declarations during previous periods (2000-2005). The study based on national surveys was developed especially for the residential sector (private and public - services), while for other sectors such as industrial, agricultural and transportation, which are known as small biomass users, depending on their availability, the study made pre-selected evaluations. However, INSTAT has published that the firewood has a nearly constant contribution of 10-11% to EFGC.

Table 4. INSTAT, Firewood contribution to EFGC (ktoe)

Name/Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Contribution %	10%	10%	10%	10%	9%	9.66%	10.9%	9.73%	8.7%
Firewood	**213**	**205**	**208**	**207**	**202**	**193.2**	**225**	**200**	**180**
Final consumption	2,104	2,106	2,162	2,014	2,122	2,090	2,065	2,056	2,070

It is clear that information about the available real quantities of biomass is inadequate. Without doubt, INSTAT and NANS should make more efforts to develop and implement an information system related to the sources of wood biomass and especially forest cadaster.

1.2.2.2 Biomass from agriculture, poultry and waste

Energy biomass from agricultural crops, such as biomass from the direct supply of biomass products to energy production, are significant in Albania. Energy potentials from agricultural crops (cereals, oilseeds, sugar beet, silage maize), fast growing cycle trees, herbs and algae even if they can be used there are no energy statistics.

Similarly, agricultural byproducts such as waste from processing, as well as byproducts of poultry for energy production (straw, manure, animal fat, flour from the meat and bones,

[5] https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2514178/Study_on_the_Biomass_Consumption_cover+annexI.pdf

olive oil residues, fruit biomass, fishing by-products, cut branches from vineyards, olives, fruit trees etc.) are potentially untapped potentials.

1.2.3 Biofuels (RES-T)

In Albania, biofuels have started production in 2008, according to Law No. 9876, dated 14.2.2008, as a fresh component for the Albanian hydrocarbon processing industry, when the first bio-refinery in Albania was built at Porto-Romano, Durres. This plant, owned by the *Green Fuel* company, is a joint venture of "Kastrati sh.a" and "B.P.P. S.p.A", with an initial investment of 5 million EURO. The plant has a production capacity of 120,000 tonnes per year.

The basic products of this plant are: biodiesel (mixed diesel- mixture fuel with organic matter of plant origin - vegetable oil); and bioethanol (benzene mixed with organic matter derived from the fermentation of products rich in sugar- sugar cane, sugar beet etc.). However, the Albanian and EU legislation recognize biogas, bioethanol, Bio-ETBE (*Ethyl-Terbutyl-Ether*), Bio-MTBE (*Methyl-Temo-Butyl-Ether*), Synthetic Biofuels etc. Based thereupon, state policy is formulated by Law No. 9876/2008 "On the production, transport and marketing of biofuels and renewable fuels, for transport", has defined the minimum annual quantity of biofuels and other renewable fuels that should be traded for the transport sector. This quantity cannot be less than 3%, starting from 2010, while from 2015 onwards this amount cannot be higher than 7-10%.

However, a legal initiative was launched in 2016 by MEI, which concerned the promotion of the production and use of renewable energy sources for the transport sector through the use of biofuels to replace some part of oil by-products with non-fossil fuels for internal combustion engines. In this framework, Albania is committed to meet the National Renewable Energy Objective, whereby the share of biofuels accounts for 10% of this objective for renewable energy consumption at national level, with 38% in 2020, compared to the year when the obligation for SAA began.

In the framework of NPC-s (Nationally Determined Contribution or NDCs) to reduce greenhouse gases in the transport sector, the law aims to promote contribution for the fulfillment of commitments for the emissions of gases from the consumption of hydrocarbons in this sector. For Albania, transport is the largest contributor to CO2 in road transport and is estimated to be 740 ktoe in 2016 and 750 ktoe for 2017, which based on the country area/size, have a significant impact on climate change. The law has foreseen objectives, timescales and roles with clearly defined responsibilities.

Although the purpose of law is to formulate incentive policies for the cultivation of energy plants in Albania, to protect the environment by respecting the sustainability criteria and their verification in the production of biofuels, bio-liquids and biogas, as provided for in Directive 2009/28 / EC, the law is still at the Parliament to obtain final approval.

This legal initiative is related to the fact that existing Law No. 9876, dated 14.2.2008 "On the production, transport and marketing of biofuels and other renewable fuels for transport" has been drafted in accordance with Directive 2003/30, which is replaced by the requirements of Directive 2009 /28. Meanwhile, EU Directive 2003/30 /EC[6] aimed at biodiesel use as a means replacing petroleum or benzene for transport, this being a protective measure to ensure an environmental-friendly behavior for the promotion of renewable energy sources in this sector (RES-T).

Without focusing on the retail market analysis over the last two years, only 10 to 15 tonnes per year have been consumed for transport purposes, with standards recognized by the competent local authorities. Although the production capacities are applicable for 100 ktonnes, the raw material or all raw materials (vegetable oils) are imported and most of the biodiesel produced is exported to Italy, therefore biofuels are generally not intended for the Albanian market. The quantity released per consumption for 2014 for the biodiesel product according to the Customs Code is: (i) code 2710 20 11 - quantity 28,757 tonnes; (ii) Code

[6] Replaced by the Directive 2009/28/EC

3826 00 10 - quantity 7,060 tonnes. In fact, these codes identify customs references in "Preferential Tariffs ... for 2015[7]". The codes refer to the "biodiesel product and their mixtures containing not less than 70% by weight of petroleum oils or ...". The CTI also confirms that "the quantities shipped prior to the clearance of biofuels in mixed form" for 2014-2015 are shown as in table 7.

Table 7. IQT data

Year	Product 7% FAME	Quantity (tonnes)	FAME (tonnes)
2016	Gasoil SSHEN 590:2103	115,263	8,068
2017	Gasoil SSHEN 590:2103	196,000	13,720

Finally, MoF confirms that about 15.5 ktonnes are consumed in Albania during 2016 and 18.1 ktonne during 2017, used for the transport sector with a mixture for which the amount of renewable energy sources does not exceed 7% . However, standards and information on biofuel consumption in Albania are almost missing.

1.3 Quantitative status of RES during 2009-2017 and status of the national objective

1.3.1 The status of RES in the national balance of energy consumption

Based on the national energy balance confirmed by INSTAT, RES consumption status during 2009-2017 was as follows:

ktoe	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
RES-N&F	219.7	211.7	219.7	218.3	213.4	205.3	204.3	189.8	179.2
RES-E	408.0	413.6	337.6	406.3	598.2	390.5	507.1	473.6	328.2
RES-T	-	-	-	-	8.1	10.5	11.0	8.2	13.7
RES Total	**627.6**	**625.3**	**557.3**	**624.6**	**819.7**	**606.3**	**734.8**	**685.4**	**565.2**
EFGC	2,103.9	2,105.5	2,161.8	2,014.2	2,345.9	1994.2	2065.3	2056.3	2070.2
RES %	**29.8%**	**29.7%**	**25.8%**	**31.0%**	**34.9%**	**25.9%**	**35.6%**	**33.3%**	**27.3%**

By interpreting the latest energy balance for Albania, issued by the National Agency of Natural Resources (NANS) for 2017, from the final gross consumption of primary energy sources, EFGC, of 2070 ktoe, 328.2 ktoe have been consumed by hydric sources which for 2017 have been minimal. The input of biomass and solar energy for sanitary hot water was respectively 180.0 and 12.1 ktoe (total 213.3 ktoe) and biofuel consumption was 11.5 ktoe. The total of RES consumed in our territory is equal to 606.3 ktoe and constitutes 32.0% of EFGC.

1.3.2 Status of RES

In May 2009, the Energy Community Secretariat started to implement the Directive 2009/28/EU at the level of the contracting countries of the Treaty, which also includes Albania. By virtue of the Decision of Council of Ministers of the Energy Community Treaty, 2012/04 / MC-EnC[8], Albania assumed the obligation to implement the new Directive on Renewable Energy 2009/28 /EC. In Annex 4 of this decision, the obligation to increase the percentage of renewable energy in the total energy consumption (as base year, 2009), in particular for Albania, is confirmed as 38% by 2020.

In view of the foregoing, calculations show that the national objective during 2009-2017 has been quite unstable, taking the minimum values of 25.8% (2011) to the maximum of 35.6% (2015). This explains once again the fact that Albania is mainly based on hydropower

[7] http://www.dogana.gov.al/sq/detaje

[8] https: //www.energy-community.org/portal/page/portal/ENC_HOME/ENERGY_COMMUNITY/Legal/Decisions

production that has a major impact on the volatility of the national objective of RES. Calculations show that during 2009-2017 Albania consumed on average 32.0% of RES in the final consumption of energy sources (EFGC).

1.3.2.1 Residual percentage of the national RES objective for the period 2018-2020

The contribution that Albania will continue to provide with RES consumed by 2020 will be based on projections based on the gross domestic product (GDP) per capita. The same approach has been applied for contracting parties to the Energy Community. Specifically, in order to express this residual percentage as part of the objective for year 2020, there is also a need for the projection of final consumption of energy sources, EFGC (final consumption of energy sources in 2020.

The experts have used a top-down econometric approach to determine this baseline level of forecasts for updating energy policies for Albania. The International Monetary Fund (IMF) projections for the GDP increase[9] for April 2015 are used as a basis for this calculation. IMF estimates go up to 2018, hence the extrapolation until 2020 was made using the same real annual growth rate as that of the 2013-2016 period, when the forecasts aimed to achieve a stable situation after the recession[10].

Therefore, the residual percentage is developed in this table.

A	**Share of RES consumed versus EFGC during years 2009-2014**	**%**	**2015-2017** **31.20%**	**2018-2020** **32.00%**
B	Objectives of RES to be produced in proportion to EFGC in 2020	%	**38.00%**	**38.00%**
C	RES trajectory in EFGC during 2009-2017	ktoe	**666.7**	**651**
D	EFGC for Albania during 2009-2017	ktoe	**2,281.50**	**2,070.00**
E	Expected EFGC for Albania by 2020 (with EE)	ktoe	**2,678.50**	**2,319.00**
F	Annual quantity of additional RES for the achievement of objective by 2020	ktoe	**397**	**230.22**
G	Total annual quantity of RES to be consumed in 2020	ktoe	**1,017.20**	**881.22**

In analyzing the aforementioned table, two components are of key importance:

1. $EFGC_{2009\text{-}2017}$- 2,070.0 ktoe and
2. $EFGC_{2020}$ = 2,319.0 ktoe.

Both values are compliant with the Albanian energy balance for 2009-2017 and energy forecasts calculated according to the 2020 energy scenario, based on a 3.5% increase over the years 2018-2020. It is also worth stressing that all future calculations to meet the RES objectives are based on the target value to produce 38% in relation to the EFGC forecast for 2020.

Based on the above analysis, the final conclusion is: The final maximum objective for RES for Albania will be 38%. This percentage will continue to be the national objective for RES for 2020. It is also worth emphasizing that all future calculations to meet the RES objectives are based on 38%.

As it appears from the huge interest of investors, the situation of Renewable Energy Resources in Albania is complex and constantly developing. In this respect, meeting the objectives and compliance with the directive has been recalculated in the context of the new RES policy commitments and wider review of existing legislation. Based on the time when the objective of 38% has been projected, our estimates have modified the projection for 2020. Based on the RES legislation, legal measures will continue to be taken to prepare the

[9](European trends for energy in 2030 – Updated in 2009, the General Directorate for Energy of the European Commission (4 August 2010).

[10] (Nominal GDP projections are expressed in real terms of year 2014, in order to be compliant with PRIMES projections using GDP individual deflators for each contracting party and converted in Euro at the historic exchange rate of year 2005, obtained from the IMF International Financial Statistics.)

ground for setting up liquidity schemes for financial support, regulatory conditions and strategies by policy-making institutions.

1.4 Quantities of RES to achieve the national objective of 38%

As a starting point, the national objective for RES will be 2009, in which the EFGC was 2.104 ktoe and RES percentage in consumption terms was 29.5%. By applying the method set out in the directive, the technologies provide basic data for the promotion of RES.

1.4.1 Renewable Energy for the Transport Sector (RES-T)

In order to reach the national objective of RES consumption by 38% in 2020, it is necessary to produce within the territory of Albania a quantity of 3% of ECF or mixture in the amount of up to 7% in the volume of fuels of renewable fuels (FAME), consumed in the transport sector. This quantity is equal to at least 65 ktoe (65,000 tonnes / year FAME) for the transport sector by 2020. This amount of renewable biofuels takes into account the increase of at least 10,000 tonnes in 2020 compared to 2015.

1.4.2 Renewable Energy for Heating and Cooling (RES-H & C)

In order to reach the national objective of RES consumption by 38% in 2020, it is no longer necessary to increase consumption by biomass, therefore the share of FFH reflects a 0% increase in the heating and cooling sector, RES-H & C. This means that there will be no additional increase in the amount of heat, specifically 0 GWh / year in 2020 or increase in the annual consumption of RES-H & C of 0 ktoe heat from wood / industrial biomass / residues.

1.4 Renewable Energy for Electricity Generation (RES-E)

In order to reach the national objective of RES consumption by 38% in 2020, it is necessary to increase the additional amount of electricity consumed from renewable sources by at least 172 ktoe (2,044 gwh) by 2020. This means also an average increase of electricity generators from renewable sources of 798 mw (20-35% capacity factor), which are proposed to be analyzed by summary table.

Table 1. Summary table of RES for heating/cooling, transport and electricity, to be added after 2015 to the final gross consumption of energy in Albania by 2020

		NAPRES					
		2015-2020	**2018-2020**	**2015-2020**	**2018-2020**	**2018-2020**	**2018-2020**
	RES additional technologies	***Quantity***		***Generation***		***Installation***	
	2015-2020	**ktoe**		**gwh / vit**		**mw**	
1. RES-E	**SHPP** until 15 mw **(SHPP)**	200	**135.0**	2,326	**1.600**	750	**600**
	Eolic (*Wind)*	30	**18.1**	233	**210**	30	**70**
	Photovoltaic (PV)	40	**15.0**	582	**174**	50	**120**
	From SUW (*waste to energy)*	0	**5.0**	0	**60**	0	**8**
	Total 1 (ktoe)	***270***	***172***	***3.140***	***2.044***	***830***	***798***
	% in EFGC	**25%**	**35%**				
2. RES-H&C	***Biomass***	52				-	
	Total 2 (ktoe)	***52***	***0***				
	% in EFGC	**10%**	**0%**				
3. RES-T	***FAME biofuels***	75				-	
	Total 3 (ktoe)	***75***	***65.0***				
	% in EFGC	**3%**	**3%**				

RES	**Total 1+2+3**	***397***	***233.8***				
	% in EFGC	**38%**	**35%**				

2. Action Plan for RES for the accomplishment of RES objective in Albania

2.1 Indicative objectives for renewable energy by 2020

Pursuant to Article 4 of Directive 2009/28 /EC and the requirements of Law No. 7/2017, the contracting parties to the EC Treaty are required the distribution of their indicative objectives for the share of renewable energy sources for 2020, such as: i) heating and cooling (RES-H & C); ii) Electricity (RES-E); and iii) Transport (RES-T).

In the 2017 Law, Article 4, Albania has demonstrated that it is committed to accomplish this international obligation and referring to Annex 1 to the law, has declared the trajectory of achieving the national objective of 38%. This trajectory of Annex 1 provides for, according to the following table, the achievement of the target of 35.6% for the average of years 2017-2018.

Share of renewable energy of Albania in 2009	**Average for years from:**				**Objective for the renewable energy of Albania by 2020**
	2011 -2012	**2013-2014**	**2015-2016**	**2017-2018**	
31.2 %	**32.6 %**	**33.2 %**	**34.3 %**	**35.6 %**	**38 %**

Further, Albania signed the UNFCCC Framework Convention, the national objective for greenhouse gas reduction (NDC) to the extent of -11.5%, referring to the expected consumption of 2030. This objective derived from the Paris Agreement (COP21). In this context, NCCP 2017-2020 sets the national objective in accordance with this Convention.

The following table is updated with records from 2015-2017 and making comments, we conclude that generation of energy from renewable sources for the year 2018 remains highly ambitious.

Table 2. Specific objective for 2020 and estimated energy trajectory by RES in heating and cooling, electricity and transport (figures apply to the scenario with NEEAP implementation)

RES (with EE)	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
RES-N&F (%)	10%	10%	10%	11%	9%	9%	9.89%	9.23%	**8.7%**	**8.0%**	**7.2%**	**9.0%**
RES-E (%)	19%	20%	16%	20%	26%	19.6 %	24.5%	23.0%	**15.9 %**	**34%**	**27%**	**29%**
RES-T (%)	0%	0%	0%	0%	0%	0%	1%	2%	**2%**	**2.5%**	**2.8%**	**3%**
RES total (%)	**30%**	**31%**	**29%**	**32%**	**33%**	**32%**	**35.4 %**	**34.2 %**	**26.6 %**	**44.5 %**	**37%**	**42%**
Average, Law No. 7/2017			**32.6%**		**33.2%**		**34.3%**		**35.6%**		**37%**	**38%**

Graph

2.2 Summary of policies and measures to promote the use of energy from renewable sources. Why are in place policies on the diversification of renewable resources in Albania?

Albania has undertaken a number of steps to include its energy policy into the requirements of the EU directives on common rules for the creation and development of internal energy market and the promotion of production and consumption of renewable energy sources. The RES Directive for the promotion of electricity produced from renewable energy sources in the domestic electricity market has been transposed into the new RES Law

adopted in February 2017 and in the draft amendments to law on biofuels and other RES law for use in the transport sector, adopted in February 2008.

One of the main objectives of the National Action Plan for Renewable Energy Resources 2015-2020 was that Albania diversified its renewable energy sources to achieve political and macroeconomic security of energy production. Hydropower resources now represent almost 98% of the power generation in the country. Hydropower production is uneven and fluctuating throughout the year and especially during 2017 has resulted in high energy imports, both in terms of quantities and prices. Finally, new hydric sources, which are currently supplied with concession permits, have little or no onsite progress due to the duration of such investments.

Drawing due attention, in the framework of Law No. 7/2017, MEI has promoted and encouraged other sources of energy to start preemption contracts for electricity for non-concession-generating works, thus demonstrating the diversified policy of renewable energy sources. This is also due to the advancement of electricity production from renewable sources with technologies other than the one dominating the current domestic electricity production, only with hydric sources, as well as the rapid reduction of costs for the production of electricity from solar (PV) and wind (eolic) energy, which are globally the main sources of energy capacity increase in the wholesale market.

Also, studies have shown that Albania has great, still untapped potential for the production of electricity from solar (PV) and wind sources in a large part of Albania. Likewise, given that the project development cycle for wind and solar power plants is obviously shorter than hydric resources, in recent months a high level of interest has been observed by foreign investors in the establishment of large solar and wind power plants at large scale.

Accordingly,, from the perspective of investment, solar and wind plants can be built in about 12 months based on capacity, while hydropower plants require more than 4-5 years. Since the objectives must be achieved within 2 years, it is necessary to focus on resources that can be generated in shorter timeframes.

2.2.1 Policy Strategic Objectives Recommended for RES

The Energy Strategy (draft) addresses the new laws, regulations and institutional reforms currently ongoing in Albania, including incentives for EE and RES, the reform of electricity tariffs, market development and integration with the EU and regional markets. With the implementation of the National Energy Strategy, Albania aims to achieve even more advanced RES results.

The strategic objectives of the Albanian Government for the development of renewable energy potential are as follows:

- The growing use of RES technologies, based on minimum cost planning, methodology for electricity purchase price from technologies for the production of energy based on the LCOE and return of investment within a reasonable time limit;
- Ensure diversification of renewable resources by investing in complementary low cost systems, such as PV and wind energy, climate action and environmental protection;
- Based on the governmental policies regarding investments in RES, to ensure observance of agricultural land relations and criteria for the efficiency of its use, localization of these plants in unusable (saline) lands, specifically in non-arable lands, in locations not rich with natural resources and in areas without high concentration of the population, allowing no competition between other industrial projects, as well as between land use for energy production and food production. For this purpose, the responsible institutions decide on the change of bonity/bonification, if necessary and the provision of these lands as alternatives for potential strategic investors for the construction of RES;
- To ensure a stable balance between the promotion of investments from PV and to guarantee the sustainability of the energy distribution and transmission system, the electricity quantities envisaged in NAPRES 2018-2020, to be produced from photovoltaic plants up to 2 mw or above 2 mw and which will benefit from the support schemes provided by Law No. 7/2017 "On promotion of use of renewable energy sources" will be determined by the minister responsible for energy;

- In order to achieve the objectives of the NAPRES 2018-2020 and in absence of the creation of an organized electricity market, adoption of measures to develop support mechanisms for the promotion of foreign direct investment in renewable resources sector of Albania, based on transparent auction organization schemes for building capacities and guaranteeing, inter alia, the purchase of energy for plants over 2 mw, which provide the exploitation of unused resources to date, such as solar PV systems and wind farms;

- Law No. 7/2017 "On the promotion of use of renewable energy sources" affords the possibility to support with incentives via the NAPRES not only small HPPs of electricity producers, PV, wind and SUW (generation of biodegradable waste) plants. Pursuant to Article 8, "Supportive measures for the production of electricity from renewable sources" link the achievement of the national renewable energy objective with the decisions to be taken by the Council of Ministers by adopting concrete measures to promote the use of electricity from renewable resources, which in any case are provided in harmony with the applicable legislation on state aid;

- Also, Article 10 of Law No. 7/2017 enables the applications for the producers of hydropower, PV, wind and SUW technologies, providing feed-in support, with the aim of promoting and initiating diversification of renewable resources;

- Development of sub-legal framework on the method of application of feasibility projects and in line with strategic objectives, with the aim of granting policy-based authorizations in accordance with the development of energy market and cost per customer;

- Development of a policy framework for energy (including energy efficiency) in transport, based on the transport sector strategy (DCM No. 811, dated 16.11.2016) and the introduction of electric cars in this sector.

2.2.2 Strategic Objectives and RES

Implementation of the NAPRES 2018-2020 is in line with the energy strategy and aims to increase the security of energy supply in Albania and the integration of RES in the Albanian energy market and in regional and European markets. This updated plan supports the overall objectives of the country's economic development and is based on an optimal energy scenario that balances national interests with those of different energy sub-sectors. In addition, NAPE 2018-2020 has been designed to support social development objectives by increasing employment through the promotion of the energy sector in harmony with the environment, stimulating competition in the Albanian energy market, ensuring supply stability, shifting towards regional markets, minimizing energy supply costs for Albanian citizens and businesses and minimizing adverse environmental impact.

2.2.3 NDC and actions for climate changes

Albania has signed the Paris Agreement on 22 April 2016, stepping into the new era of the process of climate international policy. Albania joined the UN Framework Convention on Climate Changes (UNFCCC) in 1995 and Kyoto Protocol in 2005.

Albania has started the process of changing status from a developing country to a developed country, in the context of the UNFCCC. This process is an integral part of the European Union integration process and includes capacity building at national level for annual monitoring and reporting of greenhouse gases (GHGs), the formulation and implementation of policies to reduce GHG and adaptation to climate change, transposal and implementation of the European Union Acquis on Climate Change. In accordance with the EU 20-20-20 objectives, Albania has provided a Specific National Contribution within the Paris Settlement Process in September 2015, being committed to reduction of CO2 emissions compared to the baseline scenario in 2016 and aiming at a reduction by 11.5% in 2030.

The level of national contribution will be revised and further elaborated under the Integrated Energy and Climate Plan to be adopted in 2018.

2.3 Methodologies approved by the Council of Ministers' Decision on the determination of prices for SHPP, PV, eolic and SUW technologies, the promotional tariff methodology currently used for SHPP.

During the last 10 to 12 years, the debate about small HPPs (up to 15 mW of installations)

is focused on purchasing electricity from more advanced producers, who state they are "unable" to afford capital costs, those of operation and maintenance, as well as costs related to amendments in the legislation for the period of self-payment of the investment. In this framework, what concerns MEI and ERE is the purchase price of energy from these producers and the observance of the terms of concession contracts. It should be noted that in this relationship, MEI and ERE have often faced a lack of transparency regarding capital costs in these facilities. In these circumstances, MEIs have undertaken a fuller analysis of these costs, considering the studies that have been undertaken internationally and especially in the countries of SEE region. Studies are focused on the best practices of IRENA (International Agency for Renewable Energy) concerning two issues.

- "HPP Cost Analysis" (2012)[11] and
- "Producing renewable energy at competitive cost: Potential throughout Southeastern Europe" (2017)[12],

as well as 2 ECOFYS studies:

- Evaluation methodology of LCOE - 2014;
- Formulation of the capital cost for hydropower, wind and solar energy in Southeastern Europe member states, 2017.

The methodology for assessing the cost of energy from renewable sources is based on the "level of electricity cost" ("LCOE"). This method is also used to exploit hydropower sources of renewable energy. LCOE, known as the average power cost level (LEC), is the net current cost value of the electricity (kwh) per lifecycle of a hydropower generation unit up to 15 mw. This cost value is taken as the representative fee for the average price that the generation unit is required to receive in a market to return the investment over a reasonable period as provided by Law No. 7/2017 "On the Promotion of Use of Energy from Renewable Resources" This parameter is an economic assessment of the first order of competition cost of a system (in this case HPP, PV, eolic ones) of generating electricity that includes all the costs over its life span, such as:

- Initial investment;
- Expenses for operation and maintenance;
- Fuel cost, which in the case of hydropower systems, is generally related to taxes on use of water and / or land use, according to the legislation in force and
- capital cost.

The LCOE can be estimated approximately as the net present value of all costs during the lifecycle of the generation unit in proportion to the total production of the unit's electricity during the entire working period until destruction. The formula for LCOE calculation is the same for all generation units and in the case of hydrogen, it takes into account:

It - Investment expenses in year t

Mt - Operations and maintenance expenses in year t

Ft - Fuel expenses in year t (annual tax on water use)

Et- Energy generated in the year t

r- Cost interest rate

n-Economic life span of the generation unit

In the case of supporting scheme of Albania for renewable resources, LCOE should be considered for a shorter period (15 years), which necessarily requires higher financial support even though the unit duration is longer than 30-40 years. In the absence of available data for shorter periods of time, LCOE would be properly calculated for a period of 20 years, a period during which a reasonable profit is derived.

The new promotional tariff system introduced by the amendments to the law on RES (Law No. 7/2017), which are being drafted, considering that tariff rates, will have to consider the type of technology and efficiency of generating equipment. Also, the new law on RES provides other incentives such as:

- Their compulsory connection to the network with transmission and distribution companies;

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[11]IRENA- *Renewable Energy Technologies: Hydropower Cost Analyses (2012).*

[12] *IRENA- Cost-competitive renewable power generation: Potential across South East Europe*

- The payment of only direct cost of connection to the transmission and distribution networks of RES-E;

- Long-term agreements on the purchase of electricity produced (15 years for electricity produced from hydropower plants);

- Compulsory purchase of electricity produced by small HPPs.

To determine whether a hydropower plant in the selected site is economically feasible, its LCOE is compared to the LCOE of a fossil fuel generation plant, more specifically coal, lignite, and natural gas plants.

In these conditions, WACC - the weighted average capital cost should be equal to the average rate of return that a company expects to compensate all its various investors, which are part of any source of funding in the structure of the company's targeted capital.

Given that a comparison should be made with the cost of the CCGT (*Combined Cycle Gas Turbine*) as the most efficient band of the combined cycle in gas turbines, LCOE of the selected renewable energy source (in this case SHPP) is influenced by the average capital cost (WACC), which increases with the increase in the potential of renewable sources. In Albania, this cost increased as a result of the "high potential" of SHPP-s during years 2007-2013. Thus, LCOE for hydropower installations up to 2 mw can be compared to the cost of energy with CCGT and renewable technologies are more economical than the generation of fossil fuels. In this framework, SHPP-s up to 15 m will necessarily require the *Feed-in-Tariff* financial support, which would make them develop and return the cost of invested capital.

Based on the analysis conducted by MEI and the referred studies, in order to determine the purchase price of energy produced from hydric resources with priority, the methodology takes into account the above factors. Therefore, it is proposed that the purchase price should be equal to the average price of the relevant year of the Hungarian (HUPX) stock exchange electricity market in Euro-cent / kwh multiplied by the promotion bonus of 1.30, multiplied by the average Euro exchange rate / ALL for the last year.

This reference is made to to the cost of the Hungarian stock exchange, taking into account the support in covering total generation costs, which is an approximate indicator also in the cost estimation of facilities for our generators. This is a first-rate economic assessment of the competition costs of an electricity generation system, which includes all costs over the duration of the investment return, such as initial investment, operation and maintenance, capital cost and expenses for taxes. The 1.30 coefficient includes the bonus for the promotion of renewable resources, estimating: i) the average rate of reasonable return on the value of renewable resources investments (which, according to the analysis and the above calculations, is averaged to 8.8%); ii) the effect on the reduction of technical losses in the transmission and distribution network as a result of the supply of electricity at the connection points of these hydropower plants with the high and / or medium voltage power network; and iii) the diverted costs of the transmission service and the costs of allocating of energy interconnection capacity from the import.

In order to have price stability for the purchase of energy from these sources, the methodology has set some limits to accept the risk of price volatility in the market, based on a pre-accepted reference price value of 2016 and not exceeding 15% of this price. This would be the maximum price for purchasing energy under extreme supply conditions, i.e. the purchase price ceiling. Meanwhile, the price of the stock exchange bears per se the average calculation of the offers in the market according to the *merit order* method. In realistic conditions, this method would bring an average fluctuating stock exchange price, which depends on various real-time conditions, such as the level of demand, hydro power situation, price of fuel in the market etc.

Setting these limits would protect producers from price reductions, as in feasibility studies conducted, these investors have referred to the existing price and on the other hand, setting a ceiling price would also protect consumers from rising market prices at different times.

Accordingly, in real terms the price fluctuation will be in the range of 7.48 ALL / kwh to 8.6 ALL / kwh. This approach provides the effectiveness of the investments of producers, while protecting consumers from temporary distortions that may result in the market under different conditions. It also considers the fact that the return on investment is calculated for the remainder of the concession, since most of them have joined production for an average period of 3-4 years.

It is also worth noting that upon the entry into force of Law No. 7/2017 "On the promotion of use

of energy from renewable sources", Law No. 138/2013 "On Renewable Energy Sources", as amended, has been repealed. As a result, the by-laws issued for the implementation of the latter have also been repealed.

2.3.1 Promotion tariff methodology for determining the purchase price of electricity produced from small renewable sources (PV and wind ones)

The new Law No. 7/2017, approved in February this year, guaranteed the support scheme to comply with existing hydropower concession contracts and, above all, paved the way for the future of other sources of renewable energy within the liberalized market and fulfilling the obligations to reach the national objective of RES by 38% in 2020.

The National Renewable Energy Resources Action Plan 2015-2020 envisages the capacity required to achieve the national objective for 2020, envisaging the installation of 30 MW of wind generators and 50 MW solar PV one. To date, under this projection only 150 mw units of small HPPs and no PV or wind power plants have been built after 2015. This situation requires the revision of the NEAP by the end of 2017.

Law No. 7/2017 envisages setting FIP (*Feed-in-Premium*) tariffs via a competitive, non-discriminatory bid (auction) through CfD contracts, while new installations up to 2 mw are excluded from the competitive process of price ceiling set, based on this methodology. This law also foresees the promotion of the development of a net metering unit system for self-producer unit up to 500 kw.

Due to the potentially high sources of solar energy (over 1700 kw /m^2 /year) and moderately satisfactory wind speeds (3.3-9.6 m / s) in limited regions, the unused potential for the installation of PV in non-fertile land is up to 1,900 mw (e.g in saline land up to 4,500 hectares), as well as the ability to install wind generators varies from 980 to 2,100 mw. These two renewable sources can now be considered as alternatives to the diversification of renewable resources in Albania, in order to achieve the national objective of 2020, i.e. 38%.

A question naturally arises: what is the price of energy (€ /mwh) or the "leveled cost of energy" ("LCOE"[13]), and how is an investment in PV and wind power in Albania affected? There are two factors: capital cost and risk influence.

LCOE-supporting analysis studies

MEI has undertaken a fuller analysis of capital costs, considering recent studies conducted at the international level, especially for SEE countries, which have PV and EOL experience. The studies are focused on the best practices of IRENA (International Renewable Energy Agency) for countries in the Western Balkans, including Albania and also in the ECOFYS 2017 study:

- "Producing electricity from renewable sources at competitive cost: Potential throughout Southeastern Europe" (2017)[14];
- Design of capital cost for solar and wind energy in Southeastern European member states (2017)[15].

The methodology for assessing the cost of energy from renewable sources based on LCOE, known as the average energy cost (LEC), is the net present value of the cost-unit of electricity (kWh) over the life cycle of a generation unit.

This cost value is taken as the "fee" representing the average price that the generation unit is required to receive in a market to return the investment during a reasonable period, as provided by Law No. 7/2017, "On the Promotion of Use of Energy from Renewable Resources". This calculated value is an economic assessment of the first order of competition cost of a system (in this case PV, wind) of generating electricity that includes all the costs over its life span, specifically:

- Initial investment;
- Operating and maintenance costs;
- Fuel cost, which in the case of PV /wind systems is generally related to land use taxes, local taxes, rent etc., according to the legislation in force, a cost which, in the case of fossil-power plants, in

[13] EIA - *Annual Energy Outlook* 2016 https://www.eia.gov/outlooks/aeo/pdf/electricitygeneration.pdf

[14] January 2017 - IRENA, JOANNUM RESEARCH - "*Cost-competitive renewable power generation: Potential across South East Europe" http://www.irena.org/DocumentDownloads/Publications/JR ENA Cost-competitivepowerpotential SEE 2017pdf*

[15] January 2017- ECOFYS, ECL AERON "Mapping the cost of capital for wind and solar energy in South Eastern European Member States" http://www.ecofys.com/files/fiels/ecofys-eclareon-2016-wacc-wind-pv-south-east-europe.pdf

addition to the above, is the cost of fuel and

- Capital cost.

The cost of electricity generation from renewable sources has only one formula that calculates LCOE, which is the net current value of all costs during the life span of the generation unit in ratio (divided) to the total electricity production of the unit during the whole working period until destruction.

The formula for calculating LCOE is shown below:

$$LCOE = \frac{\Sigma \text{ of the life cycle costs}}{\Sigma \text{ of energy produced during the life cycle}} = \frac{\Sigma^{n}_{t=1} \frac{I_t + M_t + F_t}{(1+r)^t}}{\Sigma^{n}_{t=1} \frac{E_t}{(1+r)^t}}$$

Where: It – Expenses for investments in the year t

M_t- Maintenance operations and expenses in the year t

F_t- Fuel expenses in the year t (annual tax, land use, rent etc.)

E_t- Energy generated in the year t

r- Interest rate of the plant cost

n- Economic life cycle of the generation unit

In this context, it must be stressed that as a rule, for the energy generation via renewable source technologies, LCOE is calculated in the life cycle of the design of a generation unit, which is commonly 20 to 40 years. Pursuant to Law No. 7/2017 “On the promotion of use of energy from renewable sources”, LCOE must be considered for a shorter period (at the latest for a period of 15 years), which necessarily requires a higher financial support, although the unit duration is longer. In absence of experience at these plants and available data for shorter periods of time, LCOE in the case of PV should be reasonably calculated for a period of 25 years, during which the plant derives considerable profit. This period for wind plants is more than 25 years.

According to studies, Albania is classified among the countries of an average risk. The recent legal and regulatory framework, by Law No. 7/2017 "On the promotion of the use of renewable energy sources" has addressed the promotion of renewable resources and according to it, through NAPRES 2018-2020 the government intends not only to draft the plan and set objectives, but also to review every two years the compulsory national objectives for the share of renewable resources in gross final consumption by 2020. The law also provides for that a number of bylaws to be adopted by the Council of Ministers during 2017-18, enable the implementation of a policy for diversifying renewable resources, with the aim of investing in these resources. Thus, in addressing the risk deriving from the legal and regulatory framework, this document reflects the changes to the NPAG 2017-2020, in order to ensure the achievement of the national objective. This means that the ratio of installations provided for in the NAPRES 2015-2020 should be changed in terms of increasing the investments of PV and wind power plants in order to guarantee the diversification of renewable resources in Albania.

Conclusions of the methodology applied in the price policies. Theoretically and practically, WACC - The weighted average cost of capital should be equal to the average return rate that a company expects to compensate all its various investors being part of any source of funding in the company intended capital structure. This applies to companies wishing to invest in wind and PV technologies.

Cost proposals are assessed in this analysis, with a view of setting a ceiling price (initial) for electricity produced by wind and PV plants. The purpose is to set the initial price based on this LCOE and WACC calculation methodology, under the conditions where Albania has no experience to invest in these technologies. The initial calculated value also serves as the maximum level and is set as one of the elements for the purpose of organizing auctions.

Considering that comparison is made with the Southeastern Europe countries (WB6), including

Albania, which generally have low prices of electricity, competition prices for the generation of PV and wind plants have a major impact on low prices. By contrast, EU countries in this region, which have the highest market prices, are also reflected in the costs of generation of these plants, offering high competition prices. Our analysis has been conducted, taking into account two trends. As it appears from the above examples, e.g. PV in Greece is 120 Euro/mwh (EU country under natural conditions similar to Albania), while for wind plants it is 96 Euro/mwh.

In conclusion, following the application of the LCOE formula, taking into account the IRENA and ECOFYS studies, as well as calculating LCOE and WACC for the conditions of Albania, according to the following table, the average price for each technology is proven as follows:

Technology		PV	Eolic (Wind)
LCOE	2017 (€/mw)	1,400	1,450
	2018 (€/mw)	1,200	1,200
	2019 (€/mw)	900	1,150
WACC	2017 (%)	8.8	8.8
	2018 (%)	8.0	8.0
	2019 (%)	7.5	7.5
Average price for year 2017	(€/mwh)	100	76

Based on the Law No. 7/2017, Article 10, point 3, the Energy Regulatory Entity will approve the average purchase price of electricity produced from small renewable solar and wind sources for the upcoming years, in accordance with the projections of this methodology, as far as LCOE and WACC are concerned.

This price shall serve as a price rate on the basis of which the beneficiaries of the support scheme, according to the contract on the difference, will be selected as one of the elements of the competitive procedure under the provisions of Article 9, points 2, 3 and 4 of Law No. 7/2017.

2.3.2 Methodology for calculating the cost of electricity produced by combustion technology of SUW with recovery of energy

The adoption of the National Waste Management Strategy and the Law on Integrated Waste Management in 2013 have considered, *inter alia*,, as a main duty, the reduction of waste through prevention and the exploitation of energy from the biodegradable fraction of industrial, urban and rural waste via incineration. Combustible waste is generally recognized as solid urban waste (SUW).

Also, in the framework of the National Waste Management Strategy, policy direction of the Albanian Government for the sustainable management of waste is determined by 2025, divided into 3 operational phases of 5 years each. The objectives of 2013 provided for that by 2015, 25% of municipal waste would be recycled / composted. By 2020, the aim is to prevent the increase of municipal waste produced by recycling /composting of 55% of municipal waste, while by 2025, energy recovery from 15% of municipal waste.

The National Renewable Energy Action Plan (FAPC) 2015-2020 does not foresee the capacity required to reach the national objective for 2020, envisaging the installation of biomass power generation units or unlike the biodegradable fraction of solid urban waste. In this framework it is necessary that these capacities be programmed in accordance with the development of these generators used for the production of electricity up to 2 mw from the biodegradable fraction of SUW. However, Law No. 7/2017 envisages setting FIP (*Feed-in-Premium*) tariffs through a competitive, non-discriminatory bid (auction) via CfD contracts, while new installations up to 2 mw are excluded from the competitive price process ceiling that is established based on this methodology.

As a primary measure in the SUW strategy, industrial and urban waste (SUW - urban solid waste) inherited from the past and dumped to some local landfills were required to be prioritized for their treatment and disposal via clean technologies. One of the measures in this regard has foreseen: "Installation of the incinerator near any of the plants for the incineration of hazardous and urban waste for the production of energy produced for industrial production purposes". Further, Law No. 7/2017, "On the promotion of use of renewable energy sources" provides for that such technologies need support as provided for in Article 10, point "a", "... for the production of electricity from small renewable sources for preferred producers, with installed capacity of up to 2 mw electricity ". In addition, Article 10, point 3 stipulates: "The purchase price of electricity from any other preferred producers shall be compliant with the methodology approved by the Council of Ministers, upon the proposal of the Minister responsible for energy. The methodology determines the pricing criteria, based on the reasonable return on the value of investments, according to the type of technology used"

A recommendation in the framework of the "Implementation of the Waste Management Plan 2010-2025" is the establishment of administrative units at the national, regional and local level for the further enhancement of waste management. Solid urban waste management systems with low environmental waste, which protect the health and safety of residents, foresee, *inter alia*, the disposal

of waste in order to generate energy, which compared to landfill, is the technology with the minimum environmental impact.

At present, there is a growing interest in Albania in the application of clean methods of electricity generation from renewable sources through SUW utilization plants at the level of annual waste generation from 80 to 120 thousand tonnes /year (40 to 65 thousand tonnes of combustible SUWs). The renewable energy production technologies from the biodegradable fraction of solid waste can be calculated at the level of 1 to 2 mw of local installations installed at SUW landfills, which are flexible for the disposal chain of these biodegradable wastes in the concentrations near the moderately large centers in Albania. After an analysis conducted by the Ministry of Environment[16], higher priority is attached to the districts like Tirane with waste generation up to 310 thousand tonnes /year (which exceeds installations up to 2 mw), Durres with 210 thousand, Elbasan with 110 thousand, Fier with 190 thousand tonnes / year etc, with the following projections:

1. The annual solid waste generation from waste for the number of local residents ranging from 350,000 to 550,000, does not exceed 100 to 110 thousand tonnes per year (0.25-0.30 tonnes per inhabitant / year[17]) and

2. Early SUW collection exceeds their dumping/landfilling for a previous period of 10-15 years.

Following this analysis, there is a real possibility for a 12 to 15 year period to reach the biodegradable waste chain disposal using "unlimited" installed capacity for all SUW deposited capacity at regional level. Unlimited annual capacity means generation of electricity from small installed generators (up to 2 mw), with renewable sources, using the biodegradable fraction of SUW[18], which is not only generated every year, but also uses the deposited share which, although degraded, has calorific value that can be exploited.

The installation of the incinerator at SUW landfill, in order to use the heat for the production of energy with overheated steam turbine, requires additional costs which, compared to the construction of the landfill as storage unit, can financially justify the incineration of the biodegradable fraction (including waste disposal). From quantitative and qualitative analysis, the "Waste Management Plan 2010-2025""[19], the technology for production of electricity with limited capacities of up to 2 mw is found supported, using renewable energy from biodegradable fractions found in SUW. Installations of this nature are widespread in Europe and the current *Waste-to-Energy*[20] technology, as a technology for the production of energy from renewable sources for the biodegradable fraction of the industrial, urban and rural solid waste, is solving the problem of land occupancy from the landfill. However, combustion or incineration is a known method for the disposal of solid urban waste. In recent years, incineration plants, as well as other waste-to-energy methods, such as gasification and pyrolysis, have had a growing interest.

The methodology for calculating the cost of electricity production from the biodegradable fraction as a renewable source for the SUW exploitation is intended to determine the costs of all processes associated with the development of waste incineration or urban waste incineration projects. The elements that make up the costs of producing electricity from these small projects in general are:

1. Type of SUW incineration technology (solid urban waste), based on the energy efficiency (output) of the generator for the production of electricity from the thermal plant as a reference to the combustible amount generated in the SUW content;

2. SUW energy content (calorific power);

3. "LCOE - Leveled Electricity Cost", quotes in Euro / mwh, represents the total cost over the life cycle for the production of one mwh of electricity, using a certain technology to make use of the biodegradable fraction as a renewable source for industrial, urban and rural waste. This is the determining factor for the necessary support for all renewable sources in general, with the following components:

a) Costs or capital cost of investment, C_r, includes the total cost of development and construction of the plant, costs related to the connection to the electricity network;

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[16] http://www.m)edisi.gov.al/files/userfiles/Monitorim Mjedisor/Mbetjet.pdf

[17] "Cost of Energy Technologies" (Source: www.worldenergy.org: World Energy Perspective).

[18] This is based on the Polytechnic University study. Londo. A, Alcani. M, 2016.

[19] http://www.aspa.gov.al/images/DLDP/plani%20kombetar%20%20i%20menaxhimi%20te%te%20mbetjeve%20-final.pdf

[20] http://www.cewep.eu/members/countries/index.html

b) "Operating Costs, $C_{O\&M}$" includes total annual operating costs since the first year of project operation for the period of self-payment; this being per unit of installed capacity;

(c) "Load factor" means the ratio between the amount of electricity generated in mwh / given year n to the electricity that would be generated for full and continuous load during a continuous year or for 8760 full hours.

The most applicable ones from the perspective of size of the installation in Albania can be the incinerators, which can handle within a reasonable time, the disposal of SUWs deposited over years. As the UPT study envisages, up to 2 m of solid waste incineration installations are suitable for the abovementioned landfills. This compatibility is also consistent because Law No. 7/2017, "On the promotion of use of renewable energy sources" supports these types of plant with preferential prices. This support is indispensable and regulates the high cost of energy. Among the energy-recovery SUW incineration technologies, the two most commonly used are: rotary kiln furnaces and fluidized bed furnaces. These two types of furnaces vary in many aspects:

In a rotary kiln furnace, combustible substance is placed in the upper part of the kiln. As it moves across the kiln, it is firstly dried and then burned, while the ash is accumulated at the bottom of the kiln hearth. The combustion air is given in two parts: as primary air from the part underneath the grate and as secondary air above the fuel. This is used for a full contact between fuel and air.

Fluidized bed furnaces use an aggregate such as sand, which serves to disperse fuel during the incineration process. There are two types of fluidized bed furnaces: with boiling fluid layer and circulating fluidized bed, which basically differ from the airflow velocity in the combustion chamber. To separate the aggregate from the exhaust gas flow, a cyclone separating device is used after the combustion chamber. The aggregate is recirculated in the kiln.

Yet, there are two main differences between the two main incineration techniques:

(a) Incineration temperature, which is higher in the rotary kiln furnaces than in fluidized bed ones;

b) For fluidized bed furnaces, the material to be fed to the furnace must be subjected to a homogenization process by means of a prior treatment of fractioning to enable its fluidization.

At present, rotary kiln furnace is the most widely used and well-tested technology for SUW incineration.

SUW energy content. The energy recovered from SUW incineration treatment can be used as steam for various technological processes, for regional heating and energy production. The best option for the conditions of Albania is the production of electricity, which we will treat in the future. The first step in calculating the amount of electricity that can be recovered from the energy recovery from SUW incineration is the calorific value of SUW. The SUW calorific power depends on a number of SUW physical and chemical parameters, which vary from one area to another. In this framework, following the analysis of the biodegradable fraction content, we emphasize that SUW is a non-homogeneous fuel that is quite different from fossil fuels. Therefore, the calculation of SUW calorific power is complex and can lead to serious errors, if it is not performed correctly. For this purpose, UPT study made the selection of the sample for analysis, which is one of the most critical stages and is analyzed with special consideration from the declared samples, though the study sees this moment as one of the most complicated variations.

However, for our country the data published in the paper "Implementation of the National Plan for Approximation of Environmental Legislation in Albania, National Waste Management Plan 2010-2025" are nationally standardized and contain a very important data for the biodegradable fraction of SUW, resulting in 62.3% by mass.

Waste streams	% average for dumping of municipal waste	Weight of municipal waste of Albania/day (0.7kg/person/day)	Weight of municipal waste of Albania/year (266 kg/person/year)
		2,335 T/Day	852,360 T/year
Organic	47.36	1.106	403.690
Wood	1.43	33	12,045
Paper	5.37	125	45.625
Cardboard	8.13	190	69,350
Biodegradable total	62.3	1.454	530.710

There are two methods to determine the low calorific power $Q^{p}{}_{u}$ as the most important parameter in the recovery of energy through the calorific power content of SUW:
a) The first method does not take into account ash and water (Q_{pa} (W + A)) and expresses the low calorific power of the combustible fraction given in kJ / kg (1 kJ = 00028 kwh);
b) The second method is the most accurate one to determine the quality of urban solid waste as fuel, based on its distribution according to the content of:
- Commodity/merceological components (organic waste, plastics, paper and paperboard, aggregates etc.);
- Water content (W in%);
- The content of ashes (A in%); and
- The content of the combustion fraction (C in%).
Plant costs. The costs of an incinerator plant for SUW consist of total investment costs and operating and maintenance costs. The actual cost of investment for an incineration plant depends on a large number of factors, such as size or plant capacity, low calorific power, land purchase price etc. The costs of operation and maintenance consist of:
1. Fixed operating costs;
2. Variable operating costs;
3. Maintenance costs.
Incineration or combustion treatment is the most direct and used technology to recover energy from biomass (biodegradable fractions) and solid waste and involves the incineration of this mass to produce heat, hot water and steam generation. When it comes to electricity generation from solid urban waste incineration (SUW), the economy of these plants significantly changes from the case where biomass is used as fuel because according to the above-explained reasoning for SUW properties/characteristics as a fuel in relation to other combustible fuels, rather than incinerator plant to pay for the amount of solid urban waste coming into the plant, these plants benefit from what is referred as the *gate fee* as a waste disposal income, which varies across different countries.
Leveled Electricity Cost (LCOE). The costs of a project for the production of energy from a renewable energy source include the financing cost, as well as the cost of equipment, installation, operation and maintenance, as well as the cost of fuels. For each technology, the four main parameters that affect the cost of production are:
a) Expenditures or capital cost of investment, C_I. This cost includes the total cost of development and construction of the plant, including costs for connection to the electricity grid;
b) The operation cost, $C_{O\ \&\ M}$ includes the total annual operating costs since the first year of operation of the project, per unit of the installed capacity;
c) Load factor is the ratio between the amount of electricity generated in mwh in a given year to electricity that would be generated for full and continuous loads over a year or for a total of 8760 hours;
d) *The levelized cost of electricity* (LCOE) expressed in USD or Euro / mwh represents the total cost during the lifecycle for the production of a power mwh, using a certain technology. LCOE is calculated with the expression:

$$LCOE = \frac{\Sigma \text{ of the life cycle costs}}{\Sigma \text{ of energy produced during the life cycle}} = \frac{\Sigma^{n}_{t=1} \frac{I_t + M_t + F_t}{(1+r)^t}}{\Sigma^{n}_{t=1} \frac{Et}{(1+r)^t}}$$

LCOE is the price to be paid for an *output* unit as payment for the produced power, in order to achieve a certain financial restitution or simply fixing the price that the project should acquire for mwh, in order to achieve *break-even* or revenues equalize production costs.
The critical parameters required to calculate LCOE for power generation systems from biomass and solid waste are:
1. Initial Investment Capital Cost (CI);
2. Actualization rate (r in%);

3. The economic life cycle of the plant (n);
4. Cost of combustible material ($C_{\text{combustible mat.}}$);
5. Operation and Maintenance Costs (CO & M);
6. Power efficiency of the plant power generation.

In the case of SUW incineration for energy production, LCOE represents only the cost of generating electricity and not the total cost of distribution or energy supply, specifically network connection or balance costs. Also, this does not include the required costs for support capacity based on conventional thermal plants, as well as incidental costs for capacity reduction and other additional costs. Assumptions during the LCOE calculation have resulted from the survey of data for these types of plants[21].

The actualization (or discount) rate to be used to represent the capital cost for power generation from SUW incineration is assumed to be 10%. The LCOE of such a facility is generally responsive to the current rate of use. As with other power generation technologies from plants using renewable energy sources, the capital cost in Albania does not go beyond the above assumption. The economic life cycle of SUW incineration plants with recovery of energy is generally assumed to be 20-25 years.

The values that can be taken into account to calculate LCOE are selected among the various technological options and refer to the production of electricity by SUW incineration with energy recovery. These values based on UPT study are accepted:

1. Capital investment cost, for incineration installations up to 2 mw CI = 2.05 - 2.30 (million Euro / mw) according to the technology provided;
2. The cost of operation and maintenance, CO & M = 150,000 (Euro / mw / year);
3. Plant use factor: 85% or 7500 hours of work / year;
4. LCOE = 100 (Euro / mwh).

Apparently, the LCOE of electricity produced from SUW incineration plants is slightly higher, compared to other conventional energy systems due to three impact factors:

1. Due to the strict legal framework for pollution from SUW incineration plants, by applying advanced pollution control technologies, which also lead to higher LCOE values;
2. SUW incineration plants are generally more expensive, because they use low calorific fuel (compared to conventional fuels such as coal, oil, natural gas) for generating electricity, so that LCOE is even higher than conventional power systems;
3. Another factor is the typical commodity/merceological composition of the SUW in Albania, where the organic fraction is on average 47.36% of SUW, while the moisture content of the organic fraction is assumed to be about 70%. They cause a lower SUW calorific power and reduction of the amount of energy that can be consumed by them.

Finally, according to this study Albania can be classified among high-risk countries. The legal and regulatory framework, recently by Law No. 7/2017 "On the promotion of the use of renewable energy sources" has addressed the promotion of renewable resources and according to this law, through the NAPRES 2015-2020, the government "is obliged" not only to draft the plan and set objectives, but also to review in every 2 years the mandatory national objectives for the contribution of renewable resources to gross final consumption by 2020.

The law also provides for that a number of bylaws expected to be approved by the Council of Ministers during 2017-2018 will enable the implementation of a policy for diversification of renewable resources, with the aim of investing in these resources. Thus, in addressing the risk deriving from the legal and regulatory framework, Albania should begin to reflect changes to NAPRES 2016-2020, in order to ensure the achievement of the national objective. This means that the ratio of installations provided for in NAPRES 2016-2020 has to be changed in terms of increasing the investments of PV and wind power plants, in order to guarantee the diversification of renewable resources in Albania

Table 4. Summary of all policies and measures

[21] *IRENA, 2012: Renewable Energy Technologies: Cost Analysis Series, "Biomass for Power Generation*

Name and reference of the measure	Type of measure	Expected results	Target group and/or activities	Existing or planned	Date of commencement and completion of the measure
Draft act on the methodology of the calculation of “National Objectives”	Regulatory	Correction of RES national objective	MEI, investors and market operators	Planned	To be completed in October 2018
“Procedure on auctions” for broad-scale PV technology above 2 mw	Regulatory	Requirement of Law No. 7/2017. Transparent process for the delivery of PV generation capacities	MEI, investors and market operators	Planned	To be completed in October 2019 with EBRD
Review of the DCM No. 822/718, “On the procedures of applications of generation works that are not subject to concession for RES” from hydropower, wind and PV	Regulatory	Improvement of procedures after the promulgation of Law No. 7/2017	MEI, MEI, investors and market operators	New	To be completed in December 2018
Establishment of the agency responsible for renewable energy sources	Regulatory	Requirement of Law No. 7/2017	MEI	Planned	To be completed in December 2018
Draft act on the support to “Contracts on difference”	Regulatory	Requirement of Law No. 7/2017. RES are integrated into the electro-energetic system according to the rules of liberalized market.	MEI, investors	New	The measure will continue after 2020 until the creation of market
Draft act on “Schemes of energy net measurement” for self-consumption up to 500 kw PV installations	Regulatory	Requirement of Law No. 7/2017 Energy produced (ktoe)	MEI, OSHEE, investors	Planned	To be completed in April 2018
Draft act on the designation of the “Renewable Energy Operator”	Regulatory	Requirement of Law No. 7/2017 Energy produced (ktoe)	MEI	New	To be completed in March 2019

Draft act on the rules of “Access to network” and “Connection to the network”	Regulatory	Requirement of Law No. 7/2017 Energy produced (ktoe)	MEI, ERE, OSHEE, investors	New	To be completed in December 2019
Draft act on the “Guarantees of origin” of intentional RES	Regulatory and financial	Exchange of RES to achieve objectives in other potentially investing countries Requirement of Law No. 7/2017	MEI, ERE, investors	New	To be completed in December 2019
Draft law on biofuels	Administrative	Use of biofuels for transport	MEI, distributors and end users	Existing	To be completed in January 2019
Biofuel stability criteria	Administrative	Use of biofuels for transport	MEI, distributors, end users	New	To be completed in January 2019
Biofuel verification criteria	Administrative	Energy saving and energy produced (ktoe)	Investors and end users (industrial)	New	To be completed in January 2019
Diversification of renewable sources for the energy production from PV/wind	Administrative	Optimisation of RES produced energy	MEI, consultancy, investors	Existing EBRD/KfW	June 2018 -2019
Studies for the identification of RES-H&C indicator at national level	Administrative	Energy identified as RES for heating and cooling Key statistical information	Public or private buildings constructed, new or existing ones	New	January 2019

2.3.3 Solar Energy Potential

The "Sun in Action" study showed that there is a great potential for solar heating systems, not only for the EU region, but practically all over the world, including states within the UNFCCC. It has also been shown that a number of obstacles have to be overcome to develop the market for this long-lasting technology. Generally speaking, solar energy market can be described as a stable, market-driven market with long-standing technology. However, parts of the public and commercial sectors are still unaware of these facts and are surprised by short-term profit objectives. Therefore, industry, private and public housing companies, and public utility enterprises constitute only a small part of solar heating system installations. The aim of this analysis is to describe the potential of solar water heaters and the expected market growth, as well as the main bottlenecks in order to highlight the opportunities to spread the use of solar heat to the energy market and the housing sector.

Some key studies have been recently conducted on market development and the potential of solar energy systems. The market is very large and, taken as a whole, is growing steadily, although the growth rate greatly varies from country to country. In these studies it is shown that the potential of solar collectors for the housing sector and for the electricity production sector are significant. The minimum value represents the warmest climates and the high values of the climates of Northern and Central Europe. Studies also show that the number in question can reach up to 1 m^2 solar collector per inhabitant in warmer countries. There are excellent conditions in Albania for the production of PV energy via solar power systems. The annual solar radiation is high and theoretically can provide in Albania not only low-temperature water heaters for a period of time of at least (7-8) months, but also about 1500 sunny days per peak for PV panels electricity generation. The solar radiation regime and sunny hours during the year in Albania are shown in the figures.

Pictures of two maps

Figure and solar radiation (kwh / m^2year - kWh / m^2/year) and sunshine hours (hour / year) in Albania

2.3.4 Potential of wind energy

Wind power is used for pumping water, windmills and in the last decades the focus is shifted on the production of electricity. The machines operating with wind separate areas.

Wind energy is a considerable potential source of energy and is equally distributed all over the world. Windmills can be quickly installed and use a small land surface. In most countries, windmill installations are faced with a common concern, lack of continuous wind speed measurement and permanent wind shortage.

Pictures of two maps

Figure 21. Division into zones according to the amount of annual wind hours for an average wind speed value.

For this reason, different companies wishing to invest in this sector can hardly decide if it is worth investing in a particular region without these necessary data. The data obtained from different meteorological stations in Albania are rather inaccessible and unreliable because they are not collected for the specific purpose of wind energy measurement (table 14 and figure 21).

There are major plans for the development of wind energy in Albania in the coming years with significant investments, with a total of licensed wind farms with capacity of 1300 mw (licenses issued until 2010). In order to evaluate the potential of this source, it is estimated that the production level of wind farms scheduled for construction in Albania is about 2400 mw. Wind farm availability or load factor - the percentage of time during which wind turbines are in full load condition - is universally considered to be the most serious problem for wind energy. The uncertainty about the amount that will produce an eolic park is a separate challenge. Forecasting methodology and wind resource estimates are the duties of specialists. The annual average wind measurements between 5.8 m /s and 7 m / s in the required areas are promising. Following the studies, it can be observed that load factors typically range from 22% to 25%.

During the 2010-2014 period, licenses have continued to be issued and by the end of December 2014,

in Albania, their total is approximately 2548 mw, based on information provided by the former Ministry of Energy and Industry, with potential energy production of about 5 twh /year. The capacity of the Albanian power system to transmit and absorb wind power is estimated at approximately 180-200 mw.

2.3.5 RES contribution to electricity generation

In order to better prepare the implementation of Directive 2009/28 / EC, Albania, like all EU members and other contracting parties to the EC Treaty, has conducted an assessment of the potential available for the development of renewable energy sources for the production of electricity. Table 10, along with Tables 1 and 3 of the National Renewable Energy Action Plan have been used as a framework to summarize key findings.

For the energy sector, the estimated installed capacity (in mw) and annual output (gwh) are specified by each technology. For the hydric sector, there is a difference between the plants with installed capacity below 1 mw, between 1 and 10 mw and over 10 mw. For solar energy, details are furnished for contributions from solar power plants with solar photovoltaic panels and those with solar power systems. Data on wind onshore and offshore energy are shown separately. As regards the biomass used for electricity, it is necessary to distinguish between solid, gas and liquid biomass. Also, the relevant coverage for any plant (including RES plants) is given in Figures 22-26.

Table 22. Projected amounts of RES technologies for the period 2009-2015 and 2015-2020

Technologies	**2009**		**2010**		**2011**		**2012**		**2013**		**2014**	
	MW	**GWh**	**MW**	**GWh**	**MW**	**GWh**	**MW**	**GWh**	**MW**	**GWh**	**MW**	**GWh**
Hydric:												
< 1mw	19	53	21	69	23	91	25	101	33	122	45	164
1mw-10 mw	9	24	18	32	26	100	44	188	117	375	225	755
>10mw	1,460	5,900	1,460	7,743	1,460	4,158	1,460	4,725	1,483	6,586	1,506	4,058
Solar:												
Photovoltaic	-	-	-	-	-	-	-	-	-	-	-	-
Solar - WHSE	-	-	-	-	-	-	-	-	-	-	-	-
Wind:												
Onshore	-	-	-	-	-	-	-	-	-	-	-	-
Offshore	-	-	-	-	-	-	-	-	-	-	-	-
Biomass:												
Solid	-	-	1	4	2	8	3	12	4	16	5	20
Biogas	-	-	-	-	-	-	-	-	-	-	-	-
Bio-liquids	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	1,488	7,200	1,499	7,360	1,509	7,379	1,529	7,552	1,633	7,701	1,777	7,793
Of which in CHP	-	-	1	4	2	8	3	12	4	16	5	20
Technologies	**2015**		**2016**		**2017**		**2018**		**2019**		**2020**	
	MW	**GWh**	**MW**	**GWh**	**MW**	**GWh**	**MW**	**GWh**	**MW**	**GWh**	**MW**	**GWh**
Hydric:												
< 1mw	48	185	50	195	55	213	60	232	61	236	67	259
1mw-10 mw	248	941	272	1,035	315	1,197	360	1,368	369	1,402	423	1,607
>10mw	1,506	4,453	1,571	4,713	1,571	4,713	1,571	4,713	1,834	5,680	1,834	5,680
Solar:												
Photovoltaic	-	-	-	-	-	-	-	-	-	-	-	-
Solar - WHSE	-	-	-	-	-	-	-	-	-	-	-	-
Wind:												
Onshore	-	-	-	-	-	-	-	-	-	-	-	-
Offshore	-	-	-	-	4	8	10	20	20	40	30	60
Biomass:												
Solid	-	-	-	-	-	-	-	-	-	-	-	-
Biogas	-	-	-	-	-	-	-	-	-	-	-	-
Bio-liquids	-	-	-	-	-	-	-	-	-	-	-	-

TOTAL	1,803	8,095	1,995	8,396	2,052	8,697	2,114	8,998	2,405	9,299	2,483	9,600
Of which in CHP	-	-	1	4	2	8	3	12	4	16	5	20

Conclusions and recommendations

1.1 Renewable energy resources policies

During the last 10 years, the promotion of RES in Albania was focused on the financial support schemes and the option of access to the electricity grid produced from hydric sources. In order to stimulate energy investment, the state policy generally created a favorable climate of concessions for the construction of power generation facilities and the guarantee of energy pre-emption for a 15-year period. It should be stated that granting concessions in these years has been dependent on short-term policies rather than on a sustainable energy and environmental policy. Thus, from concessional HPP-s, only 25% of them are installed by 2014, representing 16% of the projected generation, which is only 14.5% of the 2020 projected consumption. By 2020, SHPP prospect at construction stage can increase hydric production by about 18%.

3.1.1 Legislation and *Acquis*

Law No. 7/2017 established the compliance with the international obligations deriving from the Energy Community Treaty, with a view of adopting a more consolidated and comprehensive legal framework in accordance with Directive 2009/28 /EC to meet the national objective to consume 38% renewable sources until 2020.

In this framework, NAPRES recommends: i) effective measures for the adoption of a more consolidated and comprehensive legal framework in accordance with Directive 2009/28/EC; ii) broader analysis of the interests of all renewable resources market operators in the application of "support schemes" for the non-discriminatory promotion of RES and iii) enhancement of the legislation on biofuels in the transport sector in terms of sustainability criteria, information / reporting, and the adoption of measures to promote their trade to the end consumer.

This commitment falls within the framework of the European Green Energy Strategy and the National Plan for European Integration, which includes mid-term and long-term measures by 2020, with a view of full approximation of the Albanian legislation in harmony with the EU Acquis for Energy.

3.1.2 Administrative Barriers

The NAPRES, in line with the directive, evaluates and then analyzes the feasibility and barriers of national administrative procedures for the promotion of renewable resources. Based on the principle of "who comes first - the first is served", the procedures have been significantly facilitated, nevertheless, the concessions of the SHPP have been granted on the basis of a bidding competition process and authorizations for the generation of electricity by renewable sources are provided on a transparent basis.

The National Renewable Energy Action Plan sets out the guideline for achieving the national objective for the share of energy from renewable energy sources consumed in the electricity, transport and heating and cooling sectors in 2020. The NAPRES sets indicative specific objectives for the energy technology produced by RES.

3.1.3 Financial Support Schemes

In addition to the above measures, the National Action Plan for Renewable Energy also defines the "Financial Support Scheme" as a direct commitment of the Albanian Government, in order to achieve the objective. Supporting scheme options are described in detail, but similarly with countries in the region, financial support means: i) direct investment support, capital grants, low interest loans, tax exemptions or reductions, tax reimbursement, bidding schemes, renewable energy obligations with or without green certificates (green marketable certificates); and (ii) the *Feed-in Tariff Scheme*, which means a preliminary agreement (PPA) for the purchase of electricity by a public supplier for small electricity producers.

As it appears from the great interest of investors, the situation of renewable energy sources in Albania is complex and constantly developing. In this respect, meeting the objectives and compliance with the directive needs recalculation, which, in the framework of the new RES commitments and broader review of existing legislation, starting from the time when the objective of 38% was projected , there will be a different projection for 2020. Regarding the RES legislation, the measures that will

continue to be taken will obviously prepare the ground for setting up liquidity schemes for financial support, regulatory conditions and strategies from policy-making institutions.

3.2 RES demand to achieve the National Objective of 38%

The year 2009 will be the benchmark in the National Objective for RES, during which the EFGC has been 2.104 ktoe and the percentage of RES in consumer terms was 29.5%. Using the method set out in the directives, the technologies provide the basic data for the promotion of RES:

Table 1. Summary table of RES for heating / cooling, transport and electricity to be added after 2015 in final gross consumption of energy in Albania by 2020

		NAPRES					
		2015-2020	2018-2020	2015-2020	2018-2020	2015-2020	2018-2020
	Additional RES technologies 2015-2020	Quantity		Generation		Installation	
		ktoe		gwh / vit		mw	
1. RES-E	SHPP up to 15 mw (SHPP)	200	135.0	2,326	1,600	750	600
	Eolic ***(Wind)***	30	18.1	233	210	30	70
	Photovoltaic (PV)	40	15.0	582	174	50	120
	From SUW (*waste to einrgy)*	0	5.0	0	60	0	8
	Total 1 (ktoe)	**270**	**172**	*3,140*	**2,044**	*830*	**798**
	% in EFGC	25%	35%				
2. RES-H&C	**Biomass**	52				-	
	Total 2 (ktoe)	**52**	**0**				
	% in EFGC	10%	0%				
3 RES-T	**FAME biofuels**	75				-	
	Total 3 (ktoe)	**75**	**65.0**				
	% in EFGC	3%	3%				
RES	Total 1+2+3	**397**	**233.8**				
	% in EFGC	38%	38%				

3.2.1 Renewable Energy for the Transport Sector (RES-T)

In order to achieve the national objective of RES consumption by 38% in 2020, it is necessary to produce in the territory of Albania a quantity of 3% of ECF or mixture in the amount of up to 7% in the volume of fuels of renewable fuels (FAME), consumed in the transport sector. This amount is equal to at least 65 ktoe (65,000 tonnes / year FAME) for the transport sector by 2020. This amount of renewable biofuels takes into account the increase of at least 10,000 tonnes in 2020 compared to 2015.

3.2.2 Renewable Energy for Heating and Cooling (RES-H & C)

In order to achieve the national objective of RES consumption by 38% in 2020, it is no longer necessary to increase consumption by biomass, therefore the share of EFGC reflects a 0% increase in the heating and cooling sector, RES-H & C. This means that there will be no additional increase in the amount of heat, i.e 0 gwh / year in 2020 or increase in the annual consumption of RES-H & C of 0 ktoe heat from wood / industrial biomass / residues.

3.2.3 Renewable Energy for Electricity Generation (RES-E)

In order to achieve the national objective of RES consumption by 38% in 2020, it is necessary to increase the additional amount of electricity consumed by renewable sources, at least 172 ktoe (2,044 gwh) by 2020. This will also mean an average increase of electricity generators from renewable sources of 798 mw (20-35% capacity factor), which are proposed to be broken down by the

summarized table 1.