KM3NeT INFRADEV – H2020 – 739560

Renewable energy support and funding schemes, plans for the future

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Abstract

The document presents the various support schemes in Italy and Greece regarding the renewable energy technologies (RETs) that the KM3NeT-INFRADEV project is interested in. It explains the main supporting mechanisms and provides a historical review of how these schemes were applied in the two countries. Furthermore, the report discusses the current situation of the RET support schemes in these countries. It has been found that, especially for Italy, it would be beneficial to proceed the soonest with this kind of investment. The timing coincides with the EU funding for RET and the new incentives that have been announced by the Italian government and they will be valid till January 2021. Finally, the net metering option for Greece seems to match well with the objectives of the KM3NeT IFRADEV project. It is in accordance with the energy laws and covers the experiment's energy needs in a cost-efficient and environmentally friendly way.

I. DELIVERY SLIP

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III. APPLICATON AREA

This document is a formal deliverable for the GA of the project, applicable to all members of the KM3NeT INFRADEV project, beneficiaries and third parties, as well as its collaborating projects.

IV. TERMINOLOGY

A complete project glossary is provided below:

CHP: Combined heat and power
CSP: Concentrated solar power

FiP: Feed-in premium
FiT: Feed-in tariff
IEA: International Energy Agency
IPEX: Italian Power Exchange
NSFR: National Strategic Reference Framework
PV: Photovoltaic
RES: Renewable energy source
RET: Renewable energy technology
SME: Small and medium-sized enterprise
TGC: Tradable green certificate

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VII. PROJECT SUMMARY

KM3NeT is a large Research Infrastructure that will consist of a network of deep-sea neutrino telescopes in the Mediterranean Sea with user ports for Earth and Sea sciences. Following the appearance of KM3NeT 2.0 on the ESFRI roadmap 2016 and in line with the recommendations of the Assessment Expert Group in 2013, the KM3NeT-INFRADEV project addresses the Coordination and Support Actions (CSA) to prepare a legal entity and appropriate services for KM3NeT, thereby providing a sustainable solution for the operation of the research infrastructure during ten (or more) years. The KM3NeT-INFRADEV is funded by the European Commission's Horizon 2020 framework and its objectives comprise, amongst others, activities on the preparation for establishing KM3NeT as a Zero Carbon Footprint research infrastructure (work package 10).

VIII. EXECUTIVE SUMMARY

Following the research of the previous deliverables of WP10, this report analyses further the supporting mechanisms of solar and wind energy technologies in Italy and Greece. The reason behind this study was to investigate the current status of the schemes in two of the three countries where the KM3NeT has its facilities. Hence, a historical review of the schemes in the two countries is provided and the main supporting mechanisms are analysed. It is suggested that it would be profitable to proceed with the installation of the examined RET systems (i.e. deliverable: KM3NeT-INFRADEV-WP10-D10.03) for the facilities in Italy. Finally, it was found that the current scheme status in Greece might not be as attractive as in Italy, but it constitutes a cost-effective and environmentally friendly solution, which is in line with the objectives of both KM3NeT project and Kalamata's municipal. Finally, it has to be stated that for the site in Toulon, France, it was decided that green energy will be bought from renewable energy suppliers in order to cover the experiment's energy needs.

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1. Introduction

Following the deliverable titled: *"Report on the techno-economic study"* [1] of the KM3NeT-INFRADEV project (work package (WP) 10), the work presented here is a complementary deliverable analysing the support schemes of solar and wind energy technologies in two of the three countries where the KM3NeT has its facilities. For the site in Toulon, France, it was decided that carbon free energy will be bought from already existing RET installations so it is not considered in this analysis.

In the techno-economic study, the renewable energy technologies (RETs) and the policies of the two countries were mentioned (Section 6.1.2) and the supporting mechanisms concerning the RET types were briefly analysed [1]. The aim of this deliverable is to present further the various support schemes for the relevant RET systems in Italy and Greece in order to provide a holistic view regarding these systems' financing. Hence, the objectives of this work are: a) to present the various support schemes, b) to provide a historical review of the schemes that were implemented in the two countries during the last years, and c) to discuss their current status and future plans.

According to the International Energy Agency (IEA), Italy has set clear targets regarding its energy policy in the publication of the National Energy Strategy in 2013 [2]. The main targets were to reduce the energy cost, to improve the security of energy supply, to adopt sustainable economic growth and to meet their environmental goals. Generally, Italy is in favour of the renewable energy technologies and has been successful in the implementation of various RET systems. Furthermore, Italy has made progress in its electricity grid infrastructure by improving the transmission lines and in the market coupling as, in general, the wholesale prices used to be higher than other European countries [2]. Below are presented two example graphs by Aleasoft concerning the wholesale prices of the European electricity markets. Aleasoft is a Spanish company, whose services are in the field of energy demand, renewable energy sources (RES) and electricity market price forecasting [3]. Figure 1 shows the wholesale electricity prices from 1st August to 27th September 2019 while Figure 2 is from 1st November to 11th December [4, 5]. These two graphs are a very good example to demonstrate the daily volatility of the wholesale electricity prices in the various European markets. Regarding the Italian Power Exchange (IPEX) market (Greek market is not depicted in these graphs), it can be observed that it has the highest prices most of the days during last August and September [4] while UK market seems to be the highest during last November [5]. However, the Italian average wholesale price from 1st November to 11th December remains the highest, with an average of €49.96/MWh, followed by the UK market with an average of €46.64/MWh. Moreover, in the 8th of December there was a general drop in all European market prices (Figure 2) that is mainly attributed to: a) warmer temperatures that caused a decrease in electricity demand, b) high wind energy production, and c) solar energy production in the case of Spain and Italy [5].

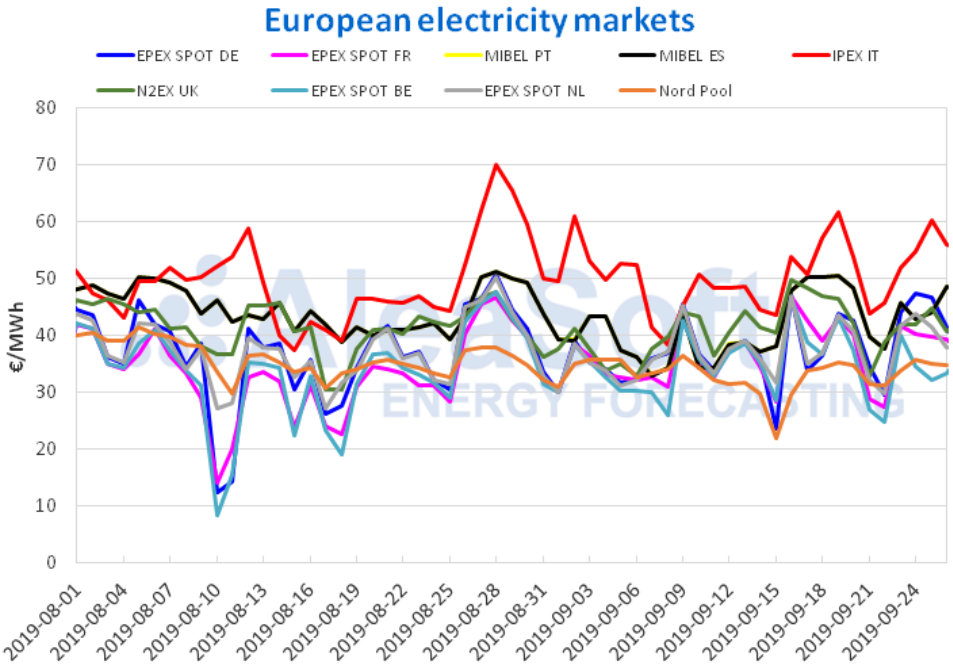

Figure 1: European electricity markets (1st August-27th September 2019) [4]

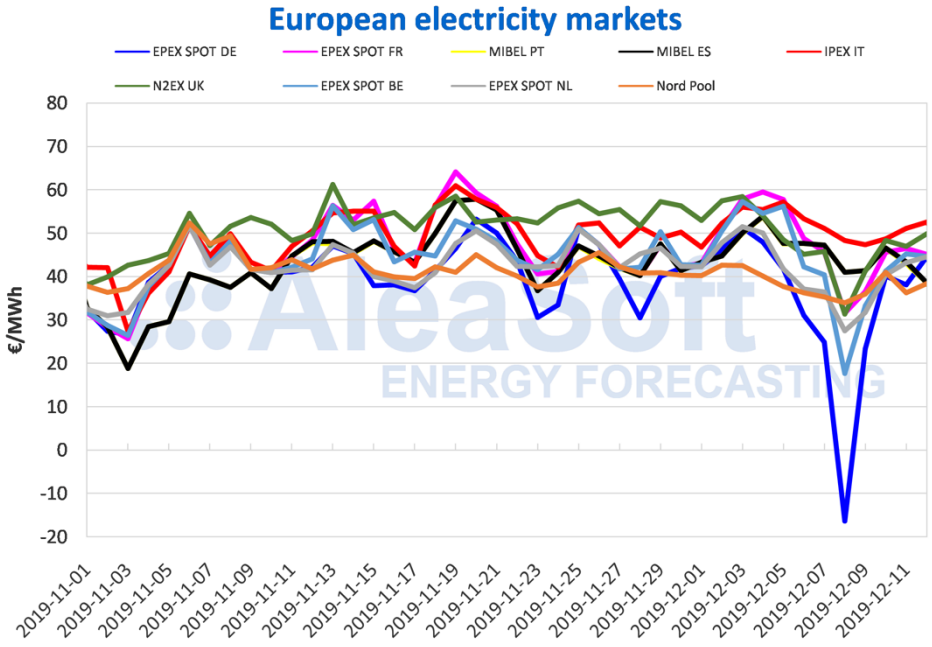

Figure 2: European electricity markets (1st November-11th December 2019) [5]

Regarding Greece, IEA reports that it has increased its renewable energy production and has over-passed the targets set for solar photovoltaic (PV). However, a further exploitation of the country's renewable energy potential can provide a better energy mix and enhance its energy security [6]. The last IEA review about the energy policies in Italy was published in

2016 while for Greece was published in 2017. Both reports present analytically the status of the energy market in the two countries and provide recommendations for further policy improvements [7,8].

2. Support schemes

The European Council has adopted the EU's (European Union) 2030 Energy and Climate framework in 2014 that sets a target of 27% energy generation from renewable energy sources. This target is a combined target for all EU members since EU no longer sets individual targets at a national level for each country. Hence, each country, depending on its resources, can draw its energy policies and decide if and which supporting mechanisms may be implemented for the deployment of RETs. This sector presents the main supporting schemes that have been used and/or are still in use from the different EU members.

In general, the various supporting schemes include fiscal incentives, regulatory policies and public financing. Namely, the main schemes are the followings [9]:

- Feed-in tariffs (FiT)
- Feed-in premiums (FiP)
- Quota obligations with tradable green certificates
- Loan guarantees
- Soft loans
- Investment grants
- Tax incentives
- Tendering schemes

From the eight main supporting schemes, four of them are analysed below while for the remaining four their definition is provided. Hence, loan guarantee is "a loan that a third party guarantees – or assumes the debt obligation for –" [10] while soft loan is "a loan with no interest or a below-market rate of interest" [11]; so, it has favourable terms for the borrower. Moreover, investment grants usually "consist of capital transfers in cash" [12] and finally the tax incentive "is a government measure that is intended to encourage individuals and businesses to spend money or to save money by reducing the amount of tax that they have to pay" [13]. In general, out of the eight mechanisms the most popular ones were the FiT followed by the Quota obligations which have been gradually succeeded by the FiP and the tendering schemes during the recent years.

The feed-in tariff is a fixed retail price that is paid to the RET owners for a pre-determined period (usually 20 years) per generated kWh by the system. The cost of such agreements in each country could be covered through tax revenues or through the electricity suppliers and network operators, "who then socialise these costs among electricity consumers" [9]. The rate of FiT varies depending on the size and the technology. Because of its fixed price, it provides security to individual producers and investors in regard to revenues of their investment [9].

On the other hand, FiP is a volatile price paid to the RET owners for a pre-determined period (usually 20 years). FiP is affected by the wholesale electricity market price of the country where the RET system is installed and it is divided in two economic models: the constant FiP and the sliding FiP. The constant FiP is a pre-determined payment on top of the wholesale electricity market price while the sliding FiP is an adjustable amount paid on top of the changing wholesale electricity market price in order to limit both the price risks for RET owners and electricity network suppliers/operators. More analytically, the constant FiP is not affected by changes that occur over time and it is provided regardless of any augmentation of the electricity prices. The sliding FiP has been designed in order to address some challenges of the constant FiP. The main challenges are the over and/or under payments to the RET owners as the wholesale electricity price might be considerably increased and/or dropped during the scheme time period. Hence, the investment risk increases compared to the FiT supporting mechanism. In the case of the overpayment, the investor is benefited but the cost burdens the society through the taxes and/or electricity network suppliers. However, in the case of underpayment the RET owners and/or the investors might have significant losses as a low premium might make the project unprofitable [14]. Therefore, the sliding FiP is constituted by the continual calculation of the difference between technology-based market prices that are frequently averaged for a specific time period, e.g. one month, and a predetermined reference tariff level. The FiP is usually not paid in the case that market prices are higher than the reference tariff level [15]. Additionally, the constant and sliding FiP sometimes are combined with predetermined minimum and maximum prices, which are called floor and cap and are implemented either on the FiP or on the total remuneration (FiP + market price) [14, 15]. This way, the over and/or under payments to the RET owners are avoided and the cost efficiency is improved.

At this point, some general information is provided regarding the wholesale electricity market as a reference to the reader. The field concerning the sale and purchase of electricity is generally known as the electricity market. In order to establish the price, this market considers the supply and demand. There are contracts and long-term trades, same to power purchase agreements, that two parties use as the bi-lateral transactions. A market operator or independent entity handles the wholesale electricity prices and transactions. The settlement of the trades depends on these operators, who also contribute to maintaining a balance between load and production. A part of the electric market constitutes the electricity spot market, which has a minor difference concerning sale and purchase and handles forwarding electricity prices. “It trades net generation output in increments of 5, 15 and 60 minutes” [16]. Currently, the spot market informs its prices every thirty minutes. In general, these prices are low in the morning and start to increase progressively depending on the augmentation of the consumption. Spot prices have the tendency to reach their peak in the mid-afternoon, which is the time that most of the residential and commercial consumers use the most power. The wholesale electricity prices are formed based on the following basic energy cost components: energy, capacity, ancillary services, transmission congestion & losses. Trade flexibility is provided by spot markets to both the generators and

consumers as compared to the long-term bi-lateral contracts. Traders can manage the “day-ahead” market, which means trading programs only one day before the trade [16].

Continuing, the cost-effectiveness of the sliding FiP seems better than the constant FiP economic model. The advantage of the sliding FiP is that it reduces the possibility of wide divergences between FiT payment levels and actual generation costs. Furthermore, since FiT payments remain responsive to market prices under sliding-premium structures, they follow the direction of the market on premium-price designs, whose payments are proportionately influenced by the augmentation of the electricity prices. This can maintain the motivation to generate electricity in demanding time periods but also remove the artificial division between renewable and conventional electricity in electricity markets. Due to the sliding-premium model, the spot market price can determine the first part of the total payment to be made but also grant a sliding payment in order to recuperate the difference and secure project profitability. The meaning of this is that renewable electricity continues to be sold on the spot market, “rather than in the context of separate, fixed-price purchase guarantees” [14]. This constitutes a way to promote the merging of renewable and conventional electricity markets. Although a sliding premium-price FiT is more complicated, it can be useful in avoiding some drawbacks of having a continuous suplement, especially due to the unpredictable electricity market price [14].

Generally, FiP can be distinguished based on technologies, size and location, similarly to FiT. Moreover, there is the likelihood to pay extra technology bonuses in addition to the FiP. In some cases, a management bonus is paid for the purpose of addressing the extra costs of the RET owner associated with the direct sale of electricity on the spot market (i.e. cost of balancing services and administrative costs for electricity trading) [15].

The weaknesses of feed-in premiums are that support schemes such as FiP are more suitable for dispatchable RETs such as biomass and geothermal or RETs that can be integrated with storage (hydro-power, concentrated solar power (CSP)). Variable RESs, as wind and solar, have a limited likelihood to adjust to market price signals by tailoring their supply. For these technologies, FiP schemes have extra costs in order to provide balancing service. Moreover, system prognostics, balancing services and electricity trading, which are the outcome of the direct sale on the electricity market, increase the complexity and the costs for the energy producers. Hence, it can be more difficult for small-scale RES operators to engage in a FiP scheme.

In Italy, RES plants with a capacity of above 1 MW (and those with a capacity below 1 MW not opting for the FiT) are obliged to trade their generation on the electricity market. In addition to these revenues, they obtain “a feed-in premium that is equal to the difference between the base FiT and the monthly zonal electricity price (for dispatchable RES) or the hourly zonal electricity price (for variable RESs)” [15]. These zonal prices consider regional diversities in the supply and demand of electricity. FiPs for larger RET projects are shaped by tenders [15].

An additional choice for RET support is to utilise tender or auction schemes for the purpose of assigning financial support to various renewables technologies and to determine the level of support from other types of support schemes, as for example feed-in tariffs, in a competitive bidding process. There are various ways to plan an auction; however, the static sealed-bid and the dynamic declining clock auction or an amalgamation of the two have been mostly utilised to facilitate new renewable energy plants. Various alleviation measures exist to guarantee that winning bidders efficiently apply their project.

Numerous EU members have also established quota obligations. Comparing to FiT / FiP, this indicates that quantities are set by governments while price is determined by the market. A minimum portion of the electricity supply needs to come from RESs, and this portion increases gradually. If suppliers cannot produce the minimum portion, they may trade certificates for electricity from RESs. The certificates need to be submitted to the responsible authority. The power is traded on conventional markets. “The key benefits of the quota obligation with tradable green certificate (TGC) markets are the high compatibility with market values and the competing price determination” [9]. However, the policy cost is increased by the certificates and high-risk premiums that ensues from the ambivalent development of the prices of electricity. Quota obligations are used both for facilitating the development of RES electricity and for augmenting renewable energy in the transport sector through biofuel support policies, as for example blending obligations.

In the recent years, quota schemes have been weakened. For example, the Italian quota system, established in 2001, was substituted in 2013 by a tender scheme for large-scale power plants while smaller-scale requests receive FiT. Gradually, more countries, as for example the Netherlands, use sliding feed-in premiums and tendering schemes. In principle, the auction is accessible to most renewable technologies but, in reality, less mature and more cost-intensive technologies, as for example wind offshore, have a small likelihood to obtain a premium under the Dutch auction scheme [9].

3. Historical review

This section describes briefly a variety of support schemes that have been implemented for the solar and wind energy technologies in Italy and Greece. Some of them might still be in use (modified or not) but the discussion for the current support mechanisms follows in the next section.

3.1 RET supporting mechanisms in Greece

Greece has introduced various supporting mechanisms regarding RETs during the last years. The majority of them is discussed in brief below.

1. Net metering [17]: "Primarily, the electricity produced by an installation or plant is offset with self-consumed energy. Any surplus electricity is fed into the grid without any obligation for remuneration. Apart from that, PV installed on public buildings in the context of the EU funded programmes can receive up to 20% of the value of the total annual electricity production (art.14A par.4 Law No.3468/2006)."

2. Subsidy [17] (Subsidies I, Development Law): "To be eligible for support, minimum investment should amount to (art.5 par.3 Law No. 4399/2016):

- Large enterprises: € 500,000
- Medium enterprises: € 250,000
- Small enterprises: € 150,000
- Very small enterprises: € 100,000
- Social cooperatives/ cooperatives: € 50,000 RESs for self-consumption can make up to 15% of eligible regional support.

In addition, support for RESs used for self-consumption only is also foreseen (art.7 par.8 Law No.4399/2016). The Development Law alternatively offers the following types of support (art. 10 Law No. 4399/2016): 1. Subsidies 2. Leasing subsidies 3. Subsidies for the creation of new jobs. Eligible for leasing subsidies and subsidies for the creation of new jobs are general entrepreneurship and supporting innovation for small and medium-sized enterprises (SMEs) (art.38 and art. 48 Law No.4399/2016). New independent SMEs are eligible for all three categories of support: subsidies, leasing subsidies and subsidies for the creation of new jobs (art.43 Law No.4399/2016). Further support between 5%-15% is foreseen if the investment takes place in certain regions specified in the Regional Support Map (C (2014) 2642/7.5.2014), which is approved by the European Commission."

3. Feed-in-tariff [17]:

"a) Feed-in tariff I: The feed-in tariffs vary according to the renewable energy source and are set at the levels indicated below (ch. D art. 13 Par. 1 b Law No. 3486/2006).

Photovoltaic (PV) generation:

Table 1: Feed-in tariff for photovoltaic energy technology [17]

PV	Interconnected system		Non-interconnected islands
€/MWh	up to 100 MW	> 100 MW	
From February 2014	115	90	95
From August 2014	115	90	95
From 2015	1.2 * MASPv-1	1.1 * MASPv-1	1.1 * MASPv-1

where, MASPv-1= Marginal Average System Price of the previous year (art. 15 par. 1 Law No. 3468/2006 in conjunction with FEK B΄ 97/2012)

b) Feed-in tariff II (rooftop PV): Since February 2017: € 105 per MWh (art. 3 par. 3 FEK 1079/2009)".

Wind Energy Feed-in tariff I:

"The feed-in tariffs for wind power are set as follows (art. 13 par. 1 Law No. 3468/2006).

Table 2: Feed-in tariff for wind energy technology [17]

Wind	**Interconnected systems**		**Non-interconnected systems**	
€/MWh	NS	WS	NS	WS
up to 5 MW	105	85	110	90
> 5 MW	105	82	110	90

WS (With Support): The plant producer operator has received some kind of government support (fiscal or financial or subsidy) regulated by the Investment Law or within the frame of the European Union co-funded (such as the National Strategic Reference Framework) or not with other programmes (subparagraph IG2 case1 Law No.4254/ 2014). In order to be included in this category, the government support must exceed 20% of the total investment cost as of 12.2013 and has to be included in the respective financial statements. In addition, 50% of the support should have been paid off (subparagraph IG2 case1 Law No.4254/ 2014).
NS (No Support): If the plant producer operators which does not fulfil any of the requirements of the WS category, the plant producers fall into the NS category (subparagraph IG2 case2 Law No.4254/ 2014)".

4. Premium tariff (Feed-in Premium) [17]: "RES and CHP (combined heat and power) plants to be connected to the transmission system participate in the electricity market and are eligible for a sliding feed-in premium (called "Operating support based on a differential

compensation price") (art.3 par.1 Law No.4414/2016). The support is calculated as a difference between the Special Market Price for each renewable technology and the Reference Price stipulated in the Operating Support Contract (art.3 par.1 Law No.4414/2016). Special Market Price is defined as follows (art.6 Law No. 4414/2016):

- Wind, PV, small hydro: The monthly weighted average price of each respective technology is based on the Marginal Average System Price while other factors can be taken into account.
- Biomass, biogas, concentrated solar power, geothermal,CHP: The monthly average of the Marginal Average System Price.

The concrete methodology still has to be defined by the Ministry of Environment and Energy. Furthermore, wind power plants ≤3MW and other RESs ≤500kW (excluding PV) may be awarded Operating Support Contract (Fixed Price), which equals the Reference Price (art.3 par.5 Law No. 4416/2016). RESs on non-interconnected islands are also awarded Operating Support Contract (Fixed Price); however, only under the precautions stipulated in Law No. 4414/2016 (art.8 Law No. 4414/2016). Below, the Reference Prices for each respective renewable technology are provided (art.4 par.1b Law No.4414/2016). It should be noted that Reference Price is not applicable to plant operators that have won a tender. For tender winners the bid substitutes the Reference Price (art.3 par.3 Law No. 4414/2016).

Solar: PV ≤500 kW: 1,2* MASPv-1 (MASPv-1= Marginal Average System Price of the previous year (art.4 par.1b Law No.4414/2016).

Wind: 98 €/MWh (art.4 par.1b Law No.4414/2016)".

3.2 RET supporting mechanisms in Italy

Similarly, for Italy some of the supporting mechanisms are provided below.

1. Net metering [17] (scambiosulposto) [17]: "Plant operators receive as much energy for free as they produce (Art. 6 par. 2 570/2012/R/efr). Furthermore, in case the electricity fed in the grid is more than the one taken from the grid, plant operators are entitled to have an economic compensation, based on the formulas in Art. 6, 570/2012/R/efr."

2. Subsidy-Premium tariff (ritirodedicato) [17]: "The amount of payment decreases with increasing output and is adjusted for inflation (Art. 7.5, Annex A, AEEG 280/07). The updated formulas for calculating the exact guaranteed minimum price are available in Art. 7. 6, Annex A, AEEG 280/07."

3. Tax regulation [17]:
"a) Tax regulation mechanisms II (Reduction in real estate tax): The reduced real estate tax amounts to less than 0.4 percent. The reduction is valid for a maximum period of five years starting at the date of installation of the plant (Art. 1, c.6, l.a. L 244/07). This tax is determined at city council level".

b) Tax regulation mechanisms I (Reduction in value-added tax): The reduced value-added tax rate is 10 % (instead of 20 %)".

Further, Italy in the past years relied on feed-in tariffs for solar photovoltaics while for other RETs used the Tradable Green Certificates (Certificati Verdi), which constitute the Quota obligation scheme. This was used mostly for large-scale wind energy systems. For Italy though, this scheme proved to be costly; hence, from 2013 it has introduced various measures for all RET and Gestore dei Servizi Energetici (GSE) announced that it will stop buying Green Certificates from 2015. These measures included fixed feed-in tariffs, premium feed-in tariffs available through a tendering process, net-metering and self-consumption tariffs, etc. [18].

To summarise, this section provided to the reader an idea of how the various schemes have been implemented in the two countries for the RET systems during the last years. The most recent update of the support mechanisms in the two countries has already been provided in KM3NeT-INFRADEV-WP10-D10.03 (Section 6.1.2), which was actually the status of the supporting mechanisms for the RET systems that this study is interested in as it was in the beginning of 2019 and some of them are still valid.

4. Current status

4.1 Italy

The European Commission has accepted, according to EU State aid rules, a scheme to facilitate renewable electricity generation in Italy. This will contribute to the environmental aims of the EU without excessively distorting competition. Italy aims to establish a new aid measure to facilitate renewable electricity generation such as onshore wind, solar photovoltaic, hydroelectric and sewage gases. The scheme will assist Italy in achieving its renewable energy targets. This scheme will be applicable until 2021 with a total estimate of €5.4 billion.

Renewables installations, which benefit from the scheme, will be sustained through a premium in addition to the market price. This premium cannot overcome the difference between the average generation cost for each renewable technology and the market price.

Furthermore, the Italian scheme integrates a clawback mechanism. If, henceforth, the market price were to overcome the average generation cost for each renewable technology, the chosen installations would not obtain anymore a premium and would rather have to return to the Italian authorities the extra revenue. This guarantees that the state support is restricted to the needed minimum.

The premium for larger projects above 1 megawatt will be determined through a competitive bidding process accessible to all installation types, regardless of the renewable energy technology system. On the other hand, smaller projects will be chosen according to a mixture of environmental and economic criteria.

The Commission identified that the aid can be motivating since the market price does not entirely cover the costs of generating renewable electricity. Moreover, the aid is proportionate and restricted to the needed minimum because it only encompasses the negative difference between the electricity market price and the generation costs. The scheme guarantees that this will occur even if market prices increase unpredictably [19].

A Ministerial Decree, which will allow new incentives to renewable energy sources (so-called “FER1 Decree”), was signed on July 8 2019 by the Italian Government. Six years subsequently to the expiration of the fifth ContoEnergia, also photovoltaic plants can be currently advanced from new inducements. As it was mentioned above, the scheme benefits additional sources such as onshore wind, hydroelectric and sewage gases. Moreover, it will apply until the end of 2021 and will offer new inducements of approximately 1 billion euros per year. The Government foresees that it will permit the creation of new plants with approximately 8,000 MW of total capacity and with investments approximated to be in the region of 10 billion euros.

Among the eligible technologies under the FER1 Decree are the onshore wind and the PV solar. Based on the technology and the plant nominal capacity, diverse criteria apply for the measurement of the incentives. RES plants up to 250 kW have the right to obtain an overall feed-in tariff, which incorporates the sales price for the electricity that will be retreated by the GSE (the state-owned company paying the incentives – Gestore dei Servizi Energetici S.p.A.). The feed-in tariff is approved for the whole duration of the pre-defined life-cycle of the plant that differs based on the source:

Table 3: Feed-in tariff for PV and wind energy technologies [20]

Source	Power (kW)	Plant average lifecycle (years)	Overall Feed-in Tariff (Euro/ MWh)
PV Solar*	20<P≤100	20	105
	100<P≤1000	20	90
	P>1000	20	70
Wind Onshore**	1<P≤100	20	150
	100<P≤1000	20	90
	P>1000	20	70

* PV plants replacing asbestos coverings or rooftops are entitled to an increase of €12/MWh
** In case the wind plants qualified with the registers mechanism and using regenerated components, the incentive is reduced by 10%.

RES plants with over 250 kW but under 1 MW nominal capacity have the right to an incentive equal to the difference between the above shown Overall Feed-in Tariff and the hourly zonal electricity price. RES plants with a nominal capacity over 1 MW have the right to an incentive equal to the difference between the above shown Overall Feed-in Tariff, as decreased by the percentage showed in the bid for the auction, and the hourly zonal electricity price. Both the plants under the registers and those under the auctions have to trade the produced electricity privately or in the electricity market. If a negative difference between the above indicated Overall Feed-in Tariff and the zonal hourly price occurs, i.e. in case of the zonal hourly price surpassing the guaranteed tariff, the GSE offsets the payment or demands the producer to pay the difference to the GSE. Contingent upon hourly zonal prices equal to zero or negative for over 6 consecutive hours, the incentives are adjourned; the duration of the incentives is therefore broadened by the duration of such adjournments.

It is likely for plants to participate to the registers or auctions as a cluster if the nominal power of each plant within the cluster surpasses 20 kWp; the nominal power of each plant forming the cluster will be undertaken as the total nominal power of the cluster.

Specific Requirements for PV Plants will only provide access to the incentives under the FER1 Decree if they are newly built PV plants; using newly manufactured components only and not installed on agricultural land.

The FER1 Decree specifically benefits PV plants installed on rooftops in order to substitute asbestos coverages: there is a specific group reserved to each round of registers; and a €12/MWh premium is approved on top of the base incentive. Such premium is rewarded for the generated electricity, regardless of whether it is fed in the grid or self-consumed. The same stands for integrated photovoltaic systems built on schools, hospitals and other public buildings.

Incentives are accessed by plants from 1 MWp through the reverse auction system that is open several times between 2019 and 2021 for the MW budgets demonstrated in the table:

Table 4: Reverse auction system dates and installed capacity [20]

Round	Opening date	PV and wind (MW)
1	31 January 2019	500
2	31 May 2019	500
3	30 September 2019	700
4	31 January 2020	700
5	31 May 2020	700
6	31 August 2020	800
7	31 January 2021	1600

The application for the reverse auction system requires the applicant to submit: (i) a comfort letter issued by a financial institution confirming the economic and financial security of the responsible individual, or its undertaking to finance the project; (ii) a suitable capitalization related to the project; and (iii) a provisional bank assurance equal to 5% of the investment cost.

The FER1 Decree concludes its application on the first date between (i) 30 September 2021; and (ii) the date that the "average annual indicative cost" for incentives, without those approved for photovoltaic plants under ContoEnergia I – V, will reach 5.8 billion euros [20].

4.2 Greece

Regarding subsidies in Greece, it should be mentioned that some opportunities may appear through the NSRF (National Strategic Reference Framework), which is co-financed by the Greek government and the European Union. Furthermore, it has promoted the investments in RET this year by funding a certain number of small- scale projects (the application period was from end February to end of May 2019) [21]. Moreover, the National Bank of Greece in cooperation with the Infrastructure Fund of Funds – InfraFoF, has announced in June 2019 that offers funding for RET systems and that it also tries to attract private investors for the funding of RETs [22]. Additionally, there is also a new partnership agreement between the Ministry of Development and Investments and the European Union for the period 2021 to 2027 [23]. However, certain plans and funding programmes for RET installations have not been announced yet.

At the moment, the valid supporting scheme in Greece is the net metering scheme. Of course, there is also the possibility of tenders for large-scale RET projects as it has already been announced that during 2020 there will be auctions for PV and wind plants of a total installed capacity of 800 MW [24]. However, the RET systems proposed in this study might not fall in this category because of the purpose they serve that is to cover the energy needs of the KM3NeT research infrastructures. On the other hand, they are definitely eligible for the net metering scheme and in accordance with the current energy laws [25]. In general, the net metering scheme considers autonomous producers while the produced energy is balanced with the consumed energy. In case that the consumed energy is greater than the produced, the RET owner has to pay the difference to the electricity supplier while in the opposite case the energy is credited to the following electricity bill. The scheme is valid for 20 years and the offsetting of the energy follows a three-year cycle. PV and wind technologies are eligible for this scheme but only for public entities and non-profitable organisations, the scheme provides two extra beneficial regulations; the first is that the agreed capacity of the installed system can match the energy needs of the consumer, for systems up to 1MW, while the second is that it gives the virtual net metering option. This option means that the systems do not have to be installed in the exact location where the energy is consumed [26]. As it was mentioned in KM3NeT INFRADEV GA DELIVERABLE: D10.01, the installation of the RET systems for the KM3NeT project in Italy and Greece will be in collaboration with the local/regional authorities [27]. Both the National Scientific Research Centre "Demokritos" and the municipal of Kalamata are entitled to receive the produced energy by the aforementioned systems. In addition, the municipal of Kalamata has already founded an energy community, which is also entitled for the net metering scheme [28]. The main objectives of an energy community are: the promotion of RET installations and innovation, the public acceptance of RESs, the increment of the energy efficiency, and the reduction of the energy cost in vulnerable social groups [29]. It is obvious that these objectives are in good agreement with the KM3Net project objective for “Low-carbon footprint using renewable energy sources”.

5. Conclusions – Next steps

This report has analytically explained the various support schemes regarding the RETs. It has also provided a brief historical review of how these schemes were applied in two out of the three countries that KM3NeT project has its facilities. Finally, it discussed the current status of the RET support schemes in these two countries by focusing on the technologies that KM3NeT project is interested in.

In the "Report on the techno-economic study", it was discussed that the main RET systems to be installed in Kalamata (Greece) and Capo Passero (Italy) will be either a grid-connected fixed mounted PV plant or a large-scale wind turbine. The examined RET scenarios are summarised in the table below as a reminder to the reader (Section 5.1 in KM3NeT-INFRADEV-WP10-D10.03).

Table 5: Summary of RET scenarios

	Italy	Greece
Large-scale wind turbine	3 MW	2.35 MW*
PV plant	100 kW	400 kW
PV facades	4×10 kW	4×10 kW
Small-scale wind turbine	6×10 kW	6×10 kW

*It has to be noted that after considering the whole analysis in KM3NeT-INFRADEV-WP10-D10.03, it was recommended to replace the large-scale wind turbine with PV plants of a 2.6-2.8 MW total installed capacity in Kalamata, as it proved to be a more cost-effective solution for the specific location.

Furthermore, by reflecting on the RET scenarios (shown in Table 5) to the current incentives in Italy, it is observed that the PV plants up to 250 kW receive the overall feed-in tariff while RETs above 1 MW installed capacity follow the reverse auction system. In addition, a rooftop PV receives €12/MWh premium on top of the base incentive that might apply to the PV facades installations, which have been proposed in KM3NeT-INFRADEV-WP10-D10.03. Hence, it seems a very good opportunity for Italy to proceed in this kind of investment since this time period coincides with the EU funding for RES and the new incentives of the Italian government that have been announced last July.

On the other hand, Greece might not have at the moment as clear incentives as Italy but it was found that the net metering scheme serves well the objectives of the KM3NeT-INFRADEV project. Moreover, it is in accordance with the legal report that has been produced on behalf of the aforementioned project. Hence, it seems a good opportunity to cover the experiment's energy needs in a cost-efficient and environmentally friendly way. Finally, any surplus of energy will improve the energy efficiency of Kalamata's municipal properties.

In order to move forward and realise the work that was made through the WP10, the following steps should be followed:

- The KM3NeT-INFRADEV-WP10-D10.03 deliverable and the present one should be discussed by the KM3NeT collaboration, the Institution Board and the Resources Review Board in the context of agreeing to the final configurations and RET systems that will be proposed for installation in the KM3NeT sites.

- The results of this discussion should be disseminated not only to the scientific community but to the respective governments of the involved countries. In this way, an agreement might be finalised among the relevant bodies for the specific locations of the RET installations and the available funds. Of course, apart from the funds and the supporting mechanisms mentioned in this report, further subsidies may appear in a European and/or national level following the discussion.

- Finally, after having finalised the exact locations of the systems' installation, the type, the technology of the systems and the financial means that will be used in each case, a final study will be produced. This study will provide the expected outcomes (energy and cost/profit) of the installations just before the beginning of the installation work.

IX. REFERENCES

[1] Georgitsioti, T. (2019) 'Report on the techno-economic study', KM3NeT INFRADEV GA DELIVERABLE: 10.03.

[2] IEA (International Energy Agency) (2019) *Italy*, Available at: https://www.iea.org/countries/Italy (Accessed 18 December 2019).

[3] Alea Business Software S.L. (2019) *About Aleasoft*, Available at:https://aleasoft.com/about-us/ (Accessed 18 December 2019).

[4] Aleasoft Energy Forecasting (2019) *The prices of most of the European electricity market decrease*, Available at:https://aleasoft.com/prices-most-european-electricity-markets-decrease/ (Accessed 18 December 2019).

[5] Aleasoft Energy Forecasting (2019) *The electricity market prices lower due to the increase in temperatures and wind energy production*, Available at:https://aleasoft.com/european-electricity-markets-prices-lower-due-increase-temperatures-wind-energy-production/ (Accessed 18 December 2019).

[6] IEA (International Energy Agency) (2019) *Greece* Available at:https://www.iea.org/countries/greece (Accessed 18 December 2019).

[7] IEA (International Energy Agency) (2016) 'Energy policies of IEA countries Italy-2016 Review' OECD/IEA, 2016

[8] IEA (International Energy Agency) (2017) 'Energy policies of IEA countries Greece-2017 Review' OECD/IEA, 2017

[9] Fruhmann, C. &Tuerk, A. (2014) 'Renewable Energy Support Policies in Europe', Climate Policy Info Hub, 3 November 2014. Available at: http://climatepolicyinfohub.eu/renewable-energy-support-policies-europe (Accessed 18 December 2019).

[10] Investopedia (2019) *Guaranteed Loan – Definition*, Available at: https://www.investopedia.com/terms/g/guaranteed-loan.asp (Accessed 18 December 2019).

[11] Investopedia (2019) *Soft Loan Definition*, Available at: https://www.investopedia.com/terms/s/softloan.asp (Accessed 18 December 2019).

[12] OECD (2001) *Investment Grands*, Available at:https://stats.oecd.org/glossary/detail.asp?ID=1452(Accessed 18 December 2019).

[13] Collins (2019) *Definition of 'tax incentive'*, HarperCollins Publishers, Available at: https://www.collinsdictionary.com/dictionary/english/tax-incentive(Accessed 18 December 2019).

[14] Hellenic Association of Photovoltaic Companies (2013) 'Feed-in-Tariffs vs Feed-in-Premium Policies', *Excerpt from NREL Technical Report "A Policymaker's Guide to Feed-in Tariff Policy Design", July 2010*. Available at: https://helapco.gr/pdf/FiT_vs_FiP_NREL.pdf (Accessed 18 December 2019).

[15] Energypedia (2019) *Feed-in Premiums (FIP)*, Available at: https://energypedia.info/wiki/Feed-in_Premiums_(FIP) (Accessed 18 December 2019).

[16] Green Coast (2019) *Electricity Spot Market*, Available at:https://greencoast.org/terms/electricity-spot-market/(Accessed 18 December 2019).

[17] Legal sources on renewable energy (2012) *Compare support schemes* (*Renewable energy policy database and support-European Commission)*, Available at:http://www.res-legal.eu/compare-support-schemes/(Accessed 18 December 2019).

[18] Renewable energy word (2012) *Italy Abandons RPS, Adopts System of Feed-in Tariffs*, Available at: https://www.renewableenergyworld.com/2012/12/06/italy-abandons-rps-adopts-system-of-feed-in-tariffs/#gref (Accessed 18/12/2019).

[19] European Commission (2019) *State aid: Commission approves €5.4 billion support for production of electricity from renewable sources in Italy*, Available at:https://ec.europa.eu/commission/presscorner/detail/en/IP_19_3000 (Accessed 18/12/2019).

[20] Dentons (2019) 'FER1 Decree 2019: Incentives Regime for Renewable Energy Plants'

[21] NSFR (2019) Partnership Agreement (2014-2020) Available at: https://www.espa.gr/el/Pages/ProclamationsFS.aspx?item=4215 (Accessed 18/12/2019).

[22] NSFR News (2019) Available at: https://www.espa.io/etep-kai-ethniki-trapeza-tis-ellados-neo-programma-gia-ependiseis-se-prasines-kai-astikes-ipodomes/ (Accessed 18/12/2019).

[23] NSFR (2019) Available at: https://www.espa.gr/el/Pages/newprogperiod21-27.aspx (Accessed 18/12/2019).

[24] HELAPCO – Hellenic Association of Photovoltaic Companies (2019) 'Ένας πρακτικός οδηγός για επενδύσεις στα φωτοβολταϊκά', Available at: https://helapco.gr (Accessed 18/12/2019).

[25] Perakis, M. (2018) 'Legal Opinion', KM3NeT INFRADEV GA DELIVERABLE: D10.02

[26] HELAPCO – Hellenic Association of Photovoltaic Companies (2019) 'Net-metering' Available at: https://helapco.gr (Accessed 18/12/2019).

[27] Markou, C. Beurthey, S. Papaleo, R. &Georgitsioti, T. (2017) 'Report on contacts/discussions with power companies/ local authorities /potential partners', KM3NeT INFRADEV GA DELIVERABLE: D10.01

[28] EnergyPress (2019) *Ενεργειακή Κοινότητα και άλλες δράσεις καινοτομίας και εξωστρέφειας του Δ. Καλαμάτας*, Available at: https://energypress.gr/news/energeiaki-koinotita-kai-alles-draseis-kainotomias-kai-exostrefeias-toy-d-kalamatas (Accessed 18/12/2019).

[29] EnergyPress (2017) *ΥΠΕΝ: Τι χρειάζεται να γνωρίζετε για τις ενεργειακές κοινότητες - Αναλυτικά παραδείγματα*, Available at: https://energypress.gr/news/ypen-ti-hreiazetai-na-gnorizete-gia-tis-energeiakes-koinotites-analytika-paradeigmata (Accessed 18/12/2019).