Integration of electricity from renewables to the electricity grid and to the electricity market – RES-INTEGRATION

National report: Cyprus

Client: DG Energy

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Berlin, 20 December 2011

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Interviewed Experts

We would like to thank all interviewed experts for their very valuable input and their support for this study. We highly appreciate their expert knowledge and their availability in the framework of the RES Integration Project on behalf of the European Commission.

For this country study, the following experts were interviewed:

Anastasiades Evangellos, Assistant Director, EAC (Electricity Authority Cyprus)

Aggelides Kyriakos, Executive Secretary, SEAPEK (Cyprus Association of Renewable Energy Enterprises)

Andreas Theophanous, Former Director, Cyprus TSO (Transmission System Operator)

Executive summary

Grid connection	
Effect on integration of RES-E	Negative
Obligation to reinforce if necessary	No
Distribution of costs	Shallow
Relevant grid level	Transmission
Main barriers to integration	Bureaucracy, Lengthy Grid Connection Procedure

Grid operation	
Effect on Integration of RES-E	Neutral
Purchase obligation	Yes
Occurrence of grid curtailment	No
Main barriers to integration	New big RES-Plants connected to the grid No regulation for curtailment Isolated system

Grid development	
Effect on Integration of RES-E	Neutral
Regulatory instruments	No
Nationwide grid development studies	Existent
Main barriers to integration	None, given low share of RES-E

Market design	
Functioning markets	No functioning wholesale and Balancing market
Intraday market and gate closure	No intraday market, gate closure at 20 pm day-ahead
Main issue	De facto monopoly

Support scheme	
Support scheme	Fixed feed-in
Market integration and/or risk sharing elements	Not available
Balancing responsibility for RES producers	No balancing responsibility yet

Table 1: Overview on grid and market integration Cyprus

The Grid Connection process follows a procedure formulated in the Law Regulating the Electricity Market (LREM) and the Transmission and Distribution Rules (TDR 2.0). There is a differentiation between grid levels and between small and large plants. The TSO is obliged to formulate a connection offer to every producer applying for connection to the grid. Until now, no application was rejected and consequently there is no legal precedent concerning the enforcement of the producer's legal rights. Administrative issues and planning consent appear to be two major obstacles in the grid connection phase.

The legal framework regarding the operation of the grid favours the deployment of RES-E installation because of the existing purchase obligation from EAC. Due to the very limited installed capacity, so far the discussion on ancillary services and curtailment has not yet taken place. However, the increased attention on the potential for RES generation might bring this issue on the agenda. Curtailment is not presently regulated. This, however, together with Cyprus being an isolated system, could become a pressing issue in the future due to expected increase in capacity.

In Cyprus, the development of the transmission and of the distribution grid follows a carefully defined procedure, which takes into account the current and future needs of the system and in which the main stakeholders are involved. Cyprus, in any case, has a very low share of RES-E. With their growth, problems may arise.

The electricity market in Cyprus is characterised by its isolated position which does not allow cross border activities and the monopoly position of one company. Hence, there is no competition and the wholesale market and balancing market cannot function yet. Nevertheless, it must be noted that market rules were already established in 2009. Trading is mainly based on bilateral agreements, no day-ahead or intraday market is available in Cyprus.

The support scheme for RES-E is based on a fixed feed-in tariff, which is applied for Wind, Biomass and Solar energy. The amount of the tariff depends on the technology. The support scheme has several restrictions concerning the maximum installed capacity of each renewable source. RES-E producers are not charged for balancing costs.

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Renewable electricity deployment

This chapter aims at providing a general introduction to the context for the deployment of renewable electricity in Cyprus in terms of electricity production, consumption, and grid operation.

Cyprus has a population of approximately 750.000. Cyprus has an isolated power system without interconnections (Υπουργείο Εμπορίου, Βιομηχανίας και Τουρισμού, 2010).

Costs of electricity have been strongly increasing, due to the fact that 99% of the power generation is based on oil, and due to the dramatic increase of electricity consumption: During the last two decades Cyprus had the highest growth rates in consumption in the EU27.

It should be noted that the report was written before the tragic incident in Cyprus on the 11 July 2011, which caused the killing of 12 people and the destruction of the newest power plant in Cyprus (Vassilikos), which had a capacity of 750 MW (Guardian, 2011; Cyprus Mail, 2011).

Current generation mix and net generating capacity

A graphical overview of Cyprus' electricity generation mix in 2010 is shown in Chart 1.

Power generation is absolutely dominated by crude oil and diesel (99,4%), the rest being supplied by wind.. In 2010, total electricity generation amounted to 5,27 TWh (PAEK, 2010), this is 8% more than in 2008 and 3,3% more than in 2009 (ENTSO-E, 2011). Electricity production came exclusively from crude oil or diesel (Υπουργείο Εμπορίου, Βιομηχανίας και Τουρισμού, 2010; EC, 2010). RES plays an almost minimal role as they account for 0.6% of total electricity generation in 2010(62.958MWh) (ENTSO-E 2011).

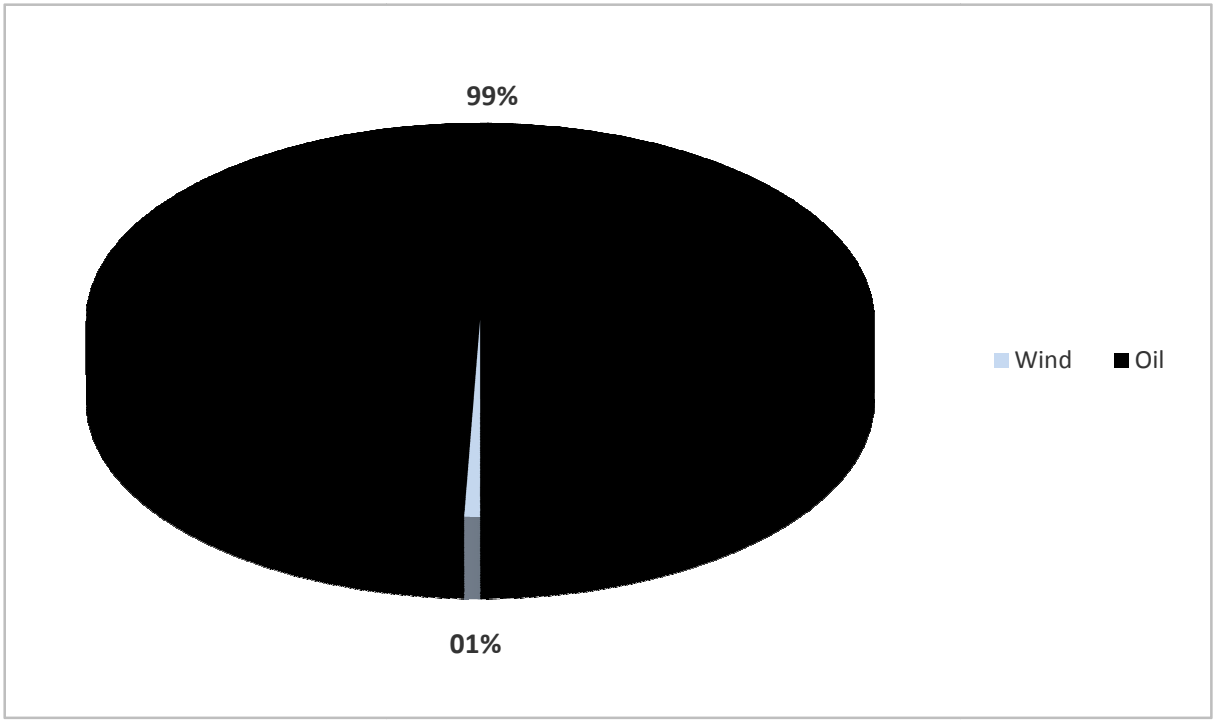

Chart 1 – Generation Mix - 2010 (%), Source: own elaboration of Entso-e online database of Detailed Monthly Production. Sources not explicitly mentioned are included either in other renewable or other fossil fuels.

The net generating capacity is provided in Chart 2.

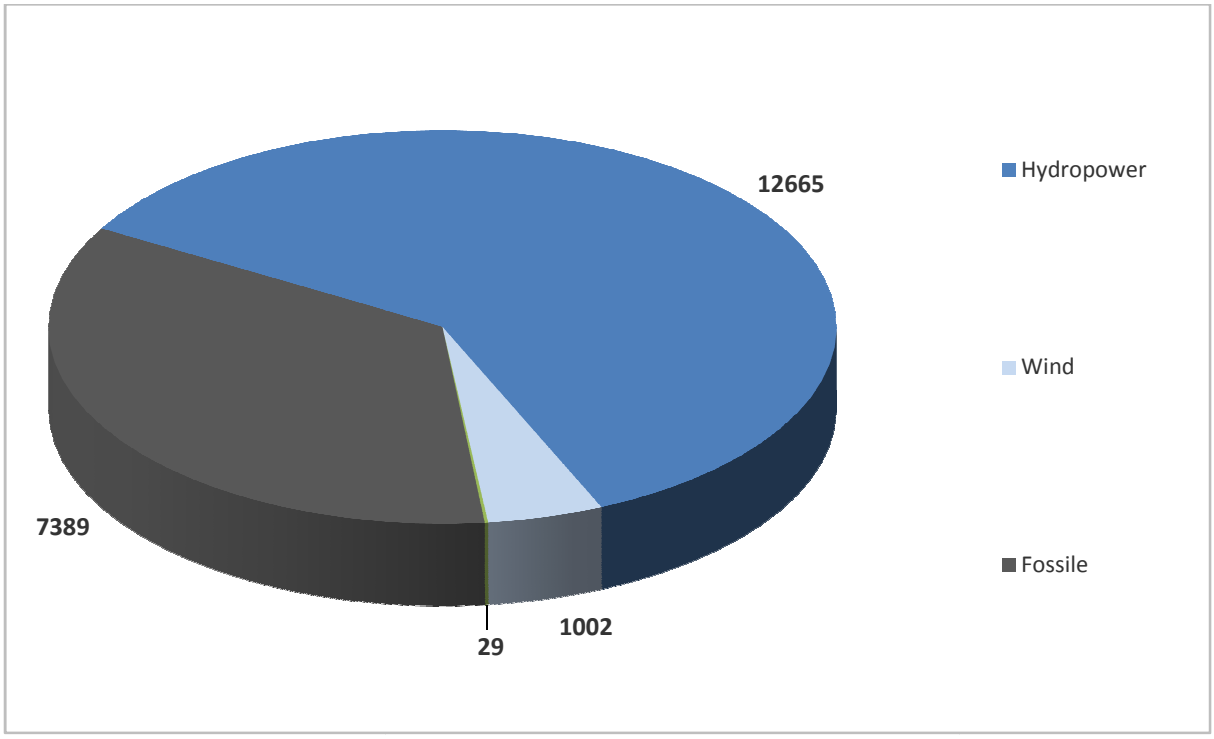

Chart 2: Net generating capacity - 2010 (MW), Source: own elaboration of Entso-e online database of Net Generating Capacity.

Electricity consumption

In 2010, Cyprus consumed 5.2 TWh (ENTSO-E 2011), i.e. circa 6.5 MWh per inhabitant. This is slightly above the EU average of 6.2 MWh per inhabitant (ENTSO-E 2011, Eurostat 2011). In terms of electricity intensity of the economy, in 2010 Cyprus consumed 299.1 MWh / million EUR GDP. This is above the EU average, of 257.7, and 25% more than Greece (230 MWh / million EUR GDP).

Considering the development of electricity consumption in time (EEA 2010), Cyprus' consumption grew by circa 5.5% per year from 1990 to 2007. This is the highest growth in the EU 27.

A substantial share of this growth is linked with air conditioning. Cyprus peak demand is in summer. As for hot water, it is mainly covered with solar heating systems, whereas there hardly is any consumption for space heating.

All this suggests that bringing the growth of consumption under control is crucial to reach the renewable energy targets.

RES-E share

Chart 3 provides an indication of Cyprus' total electricity consumption and RES electricity production up to 2020, according to the submitted action plan (NREAP). In other words, this is not a forecast, but the plan according to the government. It should be underlined that after the tragic incident in Cyprus the following data are under review, as the main power plant of Cyprus is cut off, the Cypriot government intends on facilitating the RES development in the upcoming months.

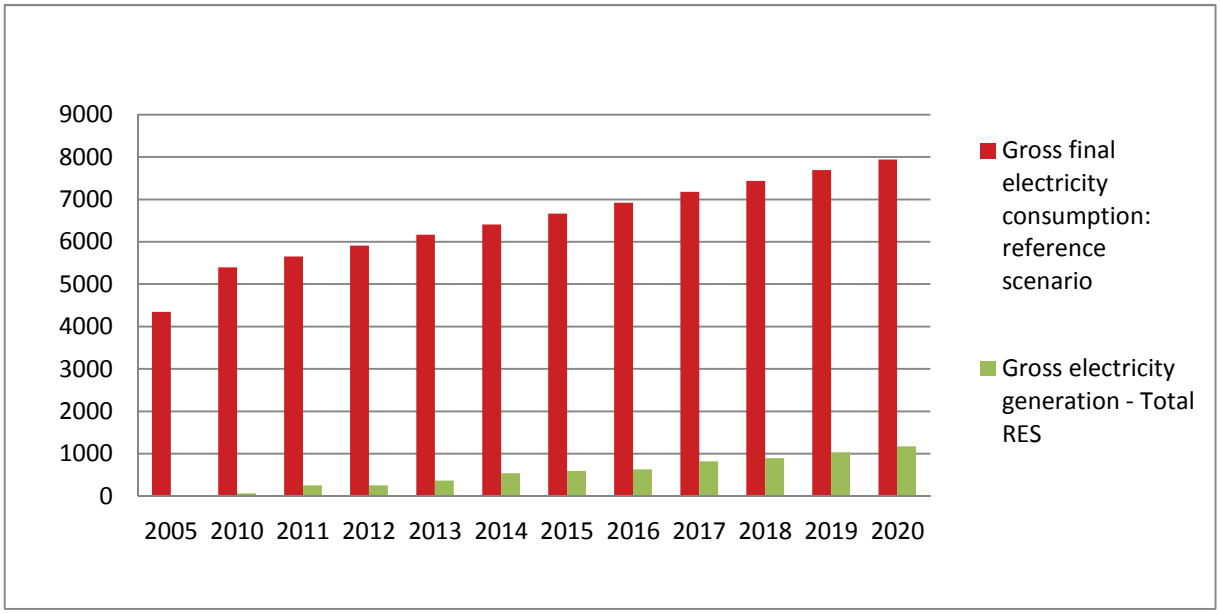

Chart 3 Electricity consumption and RES-E generation (GWh). Source: own elaboration of Cyprus' NREAP

According to the Cypriot NREAP, gross final electricity consumption is forecasted to grow from 5,396 GWh to 7,943 GWh between 2010 and 2020 (47%). RES-E production, in the same period, should grow from 67 GWh to 1,175 GWh (1631%).

Accordingly, the share of RES-E generation over gross final electricity consumption should grow from 1.26% in 2010 to 14.79% in 2020. In comparison, historical data indicate that the share of RES-E generation over consumption went from 0% in 2003 to 0.3% in 2008 (Eurostat 2011).

The evolution of renewable electricity generation is further broken down in Chart 4, which outlines the generation shares of wind, solar, hydropower and other RES-E to 2020.

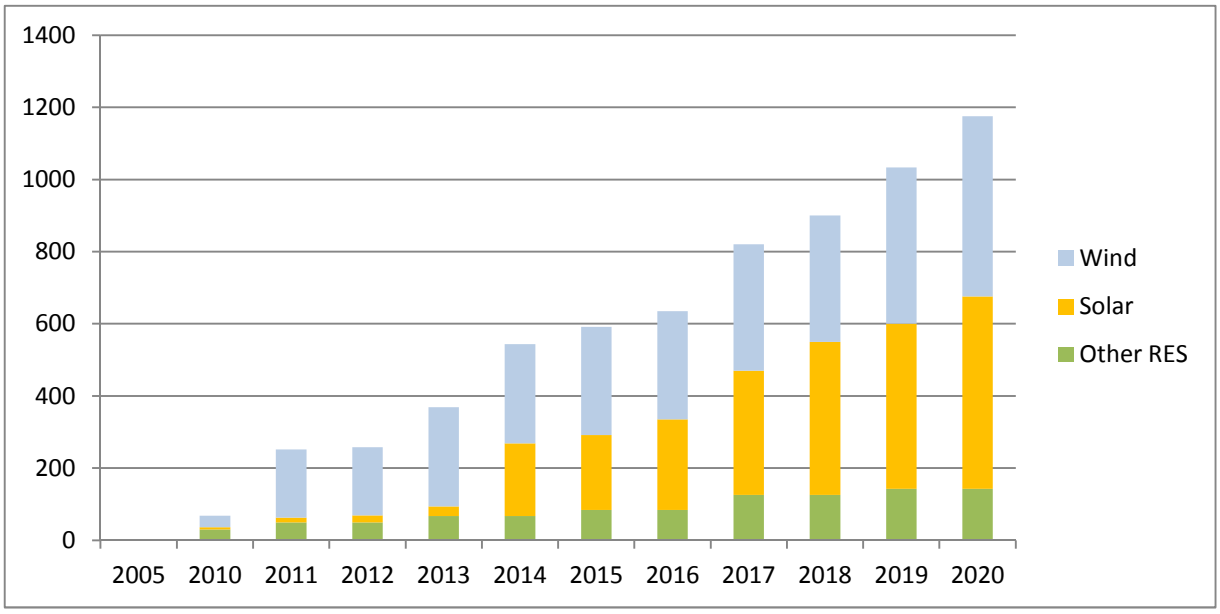

Chart 4 –RES-E generation (GWh). Source: own elaboration of the Cyprus NREAP

According to the NREAP, wind is expected to generate 499 GWh in 2020 (all onshore), PV 309 GWh and CSP 224 GWh. Variable generation will become an issue. The grid must be adapted.

Natural resources and geographical structure

Following the context description, this section outlines some elements of the natural renewable resources of the country, and their geographical distribution. This is not meant as in-depth analysis, but rather as a rapid background for the analysis and recommendations in the following chapters.

Wind

Cyprus wind resources are limited, as shown in Figure 1. However, in some areas where the conditions are favourable, especially taking into account the very high marginal costs of oil power generation (Χριστοφόρου, 2009; Υπουργείο Εμπορίου, Βιομηχανίας και Τουρισμού, 2010).

Solar

Cyprus has excellent solar resources, with more than 300 sunny days per year and a mean sunshine duration, which ranges from 9,8 hours a day in December to 14,5 hours a day in June, it is obvious that

the meteorological factors favor the development of solar power in the island (Χριστοφόρου, 2009; Υπουργείο Εμπορίου, Βιομηχανίας και Τουρισμού, 2010).

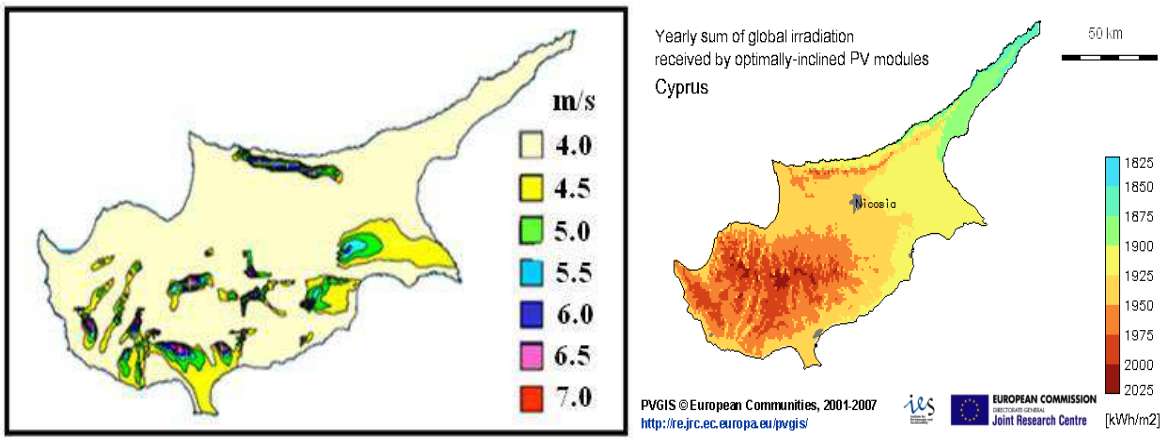

Figure 1&2: ***Mean annual wind speed in Cyprus. (Χριστοφόρου, 2009) and*** **Yearly sum of global irradiation on optimallyinclined surface, 8-years average of the period 2001-2008 [kWh/m2]. (Source: EC JRC 2007)**

Grid operators & dominant generators

Dominant generators

The national power company has the lion's share, as it has generated 98,7% of the total electricity production and autonomous producers were limited to 0,6% (34.152 MWh) (PAEK, 2010).

Grid Operators

The TSO is until now not *"ownership unbundled"*. Cyprus is free from that obligation because of its structural characteristics (small, isolated system) (CERA,2010)

With its entry to the EU and consequently the adoption of the "Acquis Communautaire" Cyprus established in 2004 an independent TSO (CERA, 2010). Moreover, both the transmission and distribution network belongs to EAC but the TSO "*functions independently in terms of organisation and decision making from EAC and from its activities of production, distribution and supply, in order to safeguard third party access onto the transmission network and equal treatment of all users of the said network*"(CERA, 2010). EAC, as the owner of the distribution network, has been appointed DSO. Although it cannot be seen as an independent organization such as the Cypriot TSO it shares the same responsibilities in relation to the distribution network.

Literature and other sources

CERA (2010): Cyprus Energy Regulation Authority, *Report to the European Commission in line with the Electricity and Gas Directives for the period July 2009 to July 2010*. Available at : <http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/NATIONAL_REPORTS/National%20Reporting%202010/NR_En/E10_NR_Cyprus-EN.pdf> (last accessed 1 June 2011)

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Eurostat (2011): *European Online Database*. Available at: <http://ec.europa.eu/eurostat> (last update on 23.08.2011).

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Υπουργείο Εμπορίου, Βιομηχανίας και Τουρισμού (2010): *Εκπαιδευτικό Πρόγραμμα για την Ενέργεια*, Κύπρος, 2010.

Χριστοφόρου (2009): Χριστοφόρου, Μ.Α. και Χαραλάμπους Π.Ι.: *Το Ηλεκτρικό Σύστημα της Κύπρου. Παρούσα Κατάσταση και Σενάρια Μελλόντικής Εξέλιξης*, Διπλωματική Εργασία Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, Θεσσαλονίκη, Ελλάδα, 2009.

Grid Connection

Summary

The Grid Connection process follows a procedure formulated in the Law Regulating the Electricity Market (LREM) and the Transmission and Distribution Rules (TDR 2.0). There is a differentiation between grid levels and between small and large plants. The TSO is obliged to formulate a connection offer to every producer applying for connection to the grid. Until now, no application was rejected and consequently there is no legal precedent concerning the enforcement of the producer's legal rights. Administrative issues and planning consent appear to be two major obstacles in the grid connection phase.

Relevant legal sources

The process of the connection of a RES-E plant to the transmission and distribution grid is regulated mainly by the Transmission and Distribution Rules (TDR 2.0[1]). Further relevant sources are the Law Regulating the Electricity Market (LREM No.122(I)/2003[2]) and the yearly published Support Schemes for Electricity Generation from Wind Energy, Solar Energy and Biomass (known as SSRES 2009-2013 and SSRES 2011 for the version of 2011[3]), which include provisions concerning the connection to the transmission of distribution grid.

Connection procedures, deadlines, and information management

A prerequisite for the connection to the grid is the possession of an operating licence, which is issued by the Cyprus Energy Regulation Authority (CERA.) (Art. 34 LREM). However, small facilities with capacity < 5MW are free from that obligation (Art.32 (2)(b) LREM). Apart from that, the grid connection process is the following:

- Application for grid connection: the application should be submitted either to the Distribution Grid Operator (the Electricity Authority of Cyprus - E.A.C.) or to the Transmission Grid Operator (TSO).That depends on the plant capacity. (Art.83 (1), (2) LREM and T 2.4.3 TDR 2.0). The application should be accompanied by the necessary technical information (T 2.A2.1 TDR 2.0).
- Review of the application and grid connection offer: After the submission and the review of the application, the grid operator should formulate a grid connection offer in 90 days (T 2.4.5.1; T 2.4.6, D 1.4.1 TDR 2.0). At that stage, the plant operator can apply to the

[1] Transmission and Distribution Rules TDR 2.0 (in English) http://www.dsm.org.cy/media/attachments/Transmission%20and%20Distribution%20Rules/TDR_ISSUE_2.0.0.en.pdf
[2] Law Regulating the Electricity Market No. 122(I) 2003 (in Greek) http://www.dsm.org.cy/media/attachments/Section4/4.3_Electricity_Market_Regulation_Law_of_2003_gr.pdf
[3] Support Schemes for Electricity Generation from Wind Energy, Solar Energy and Biomass 2011 (SSRES 2011) (in Greek) http://www.cie.org.cy/menuGr/pdf/sxedia-xorigiwn/Sxedio_Xor_APE_gia_hlektroparagwgh-2011.pdf

Special RES Fund of the Ministry of Commerce, Industry and Tourism for the feed-in tariff (Ch.5 Par. 2 SSRES 2011).

- Grid connection agreement: The plant operator must sign the grid connection agreement within the period mentioned in the grid connection offer (T 2.4.5.1 TDR 2.0).

The exact date of grid connection is included in the grid connection agreement (T 2.4.5.1 TDR 2.0). Moreover, there are deadlines for the review of the grid connection application (90 days) and concerning further technical details of the plant, after the Grid Connection Agreement is accepted by the plant operator (60 days) (T 2.4.5.1 and T 2.4.6. TDR 2.0).

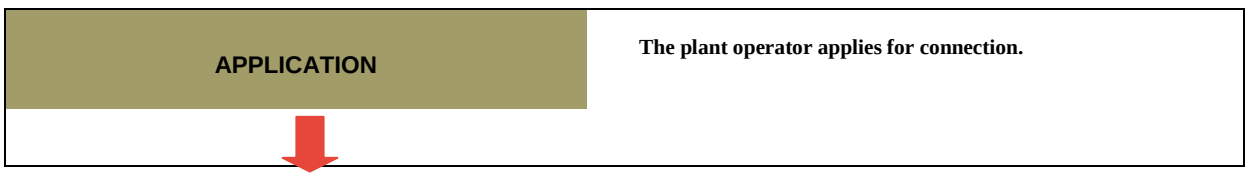
With the application for a grid connection, the RES Producer must describe the technical details of the plant. With the review of the application, suggestions about the technical compliance of the RES Plant with the Transmission or Distribution Grid can be made by the grid operator and are included in the grid connection offer (Ch.6 SSRES 2010 and T2.4.5.1. TDR 2.0). The RES Producer is obliged to conform to those guidelines and the TSO/DSO is obliged to control the compliance with those technical rules (Ch. 6 SSRES 2010).

It can be considered as a barrier to the development of RES due to the fact that if both parties conform to the specific rules this will facilitate the smooth function of the transmission and distribution system.

The renewable energy association SEAPEK indicates that most of the problems arise at this stage of the procedure (SEAPEK, 2011). The main barriers occur even before the application for an operating licence to CERA, and specifically when the RES producer is obliged to obtain a building permit. According to SEAPEK, this procedure takes excessive time, as it requires approval from 19 different offices in order to come to a conclusion (AEON, 2010). In some cases, CERA issues an operating license, while the applicant is still waiting for the building or other permits (Theophanous, 2011). Moreover, the same documents need to be sent for approval to various ministries, to CERA, to the Cypriot TSO and to EAC (AEON, 2010). This prolongs unnecessarily the duration of the project development and forces the plant producer to engage in “a labyrinth of bureaucracy” (SEAPEK, 2011). Nevertheless, under the pressure of the recent accident in Cyprus which completely destroyed the newest power plant of Cyprus with a capacity of 750 MW the government of Cyprus has decided to accelerate at first phase the licensing of 100MW of PV power plants, so as to tackle with the increasing electricity demand, leaving aside the bureaucratic procedures (Theophanous, 2011).

A simplification of the grid connection procedure is needed. More specifically a better coordination of the authorities engaged in that process is advisable. Some authorities engaged in that process are not even directly linked to that procedure and perhaps their omission could contribute to the acceleration of the grid connection procedure. That combination will ease the administrative burden and facilitate the interested RES investors to realize their works.

A schematic representation of the grid connection process is presented below



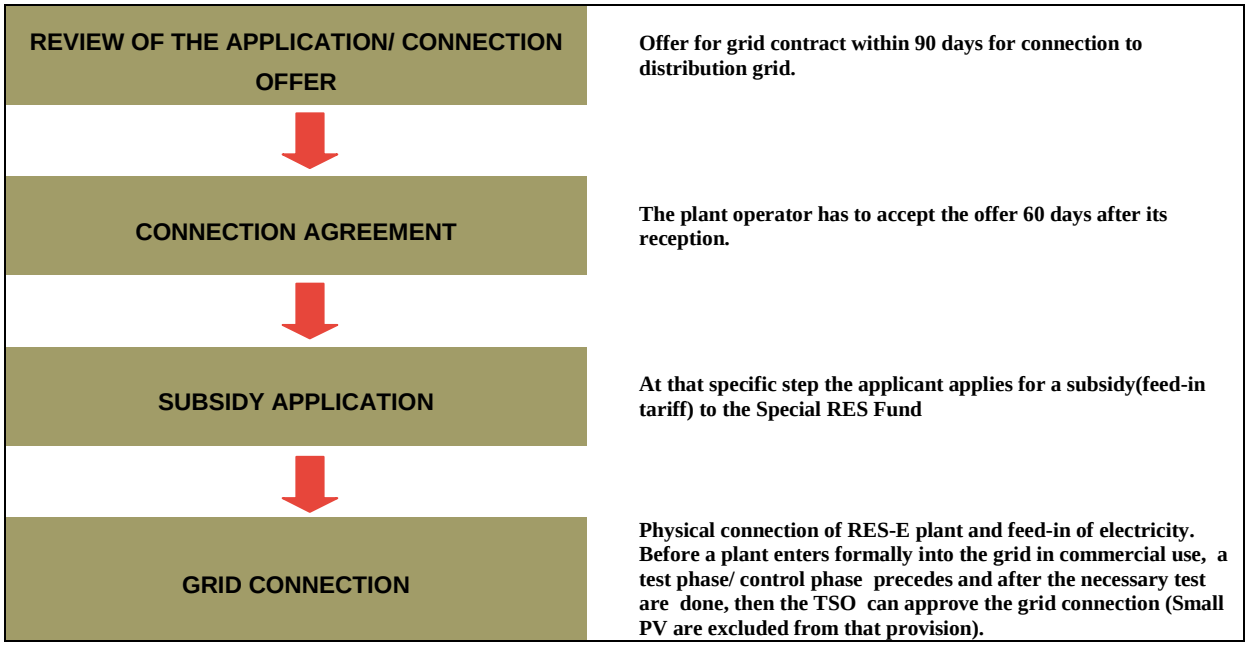


Diagram 1: Connection Procedure for RES plants

Obligation, legal responsibilities and enforcement of legal rights

The Cypriot TSO is obliged to make a proposal for grid connection to every electricity producer applying for connection to the grid (Art. 83Par.1 LREM).

The connection offer contains details about the grid connection and about the necessary grid reinforcement (Art. 83Par.3 LREM and T2.4.3. TDR 2.0).

All stakeholders agreed that that there has been no complaints from the side of RES producers. One of them stated that EAC (as the owner of the transmission grid) is so well ahead that no RES Producer can complain(EAC,2011). In any case, according to CERA , the RES producer has the possibility to undertake legal action, in case of disagreement with a decision taken by one of the authorities invoked in the licensing issues) (Art. 23 LREM).

Costs of grid connection

Cyprus follows a shallow cost approach (T 16.7.2.2 TDR 2.0). Costs are evenly shared between the grid operator and the plant operator (T 16.7.2.2 TDR 2.0). However, the owner of the (transmission or distribution) grid can cover the costs from the "Use of System Charges", which will be paid by the (transmission or distribution) regulator respectively and then charged on users (T 16.7.2.2 TDR 2.0).

Stand Alone	Barriers identified		Solution proposed	Detailed description (Page)
	Cause	Consequence		
	Complex administrative procedures	**Extremely long lead times**	Simplification of the procedure	16
	Complex administrative procedures	**Request of the building permit follows a different speed than the one of the operating license**	Simplification of the procedure	16

Table 2: Connection: Summary of identified barriers and proposed solutions to overcome barriers

Literature and other sources

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Grid Operation

Summary

The legal framework regarding the operation of the grid favours the deployment of RES-E installation because of the existing purchase obligation from EAC. Due to the very limited installed capacity, so far the discussion on ancillary services and curtailment has not yet taken place. However, the increased attention on the potential for RES generation might bring this issue on the agenda. Curtailment is not presently regulated. This, however together with Cyprus being an isolated system, could become a pressing issue in the future due to expected increase in capacity.

Relevant legal sources

As far as grid operation is concerned, the legal framework for the integration of renewables as is regulated by the Law for the Promotion and the Encouragement of the Use of RES and Energy Efficiency (N33(I)2003[4]), and more specifically by the yearly published Support Schemes for Electricity Generation from Wind Energy, Solar Energy and Biomass (known as SSRES 2009-2013 and SSRES 2011 for the version of 2010). Further relevant legal source can also be the Transmission and Distribution Rules (TDR 2.0).

Obligations, legal responsibilities and enforcement of legal rights

The support scheme established by the N33(I)2003, includes the main provisions related to the purchase obligation of electricity generated by RES plants.

The owner of both transmission and distribution system, namely EAC, is responsible for purchasing electricity generated from RES plants (Chap. 5 Par.1 SSRES 2010) as long as the plant operator fulfils the obligations and requirements of connection to the transmission or distribution grid and above all he/she signs a purchase contract with EAC (Chap. 5 Par.1 SSRES 2011). Moreover, RES plant operators enjoy priority access to the grid and dispatching (T16.5.1.1-2 TDR 2.0).

There is no special regulation as far as the provision of ancillary services from RES producers is concerned (TSO Cyprus, 2011). This is due to the so far limited RES generation capacity in Cyprus (Theophanous, 2011). RES producers do not pay any fees related to ancillary services (T.16.7.3.1 TDR 2.0). At this point it is interesting to highlight that wind farms in Cyprus have so far never not been disconnected, even in case of abrupt drop in voltage (Theophanous, 2011).

A problem emerged during the last years is over frequency when the system is in full operation (EAC, 2011).

[4] Law for the Promotion and the Encouragement of the Use of RES and Energy Efficiency (N33(I)2003) (in Greek) http://www.cie.org.cy/laws/RES_ECON_N.33%28I%29_2003.pdf

Grid curtailment

Curtailment is not regulated at all. Given the technical nature and the vertical integration of the Cypriot power system, it has not been an issue so far (TSO Cyprus, 2011). In theory, the grid operator lacks legal means to curtail and could be sued by the curtailed operator for doing so. However, this issue is being tackled(Theophanous, 2011; NREAP, 2010). The existing TDR are currently under review and a provision for curtailment in case of an emergency situation is expected (TSO Cyprus, 2011).

In relation to the subject of curtailment, it should be noted that the new TDR is expecting to consider curtailment as a measure, which is going to be used in the future based on the fact that Cyprus is an isolated system on the one side and on the other side due to the connection of new RES plants with greater capacity (TSO Cyprus, 2011). The new TDR (TDR 3.0) have already been published and they contain a special regulation as far as curtailment is concerned.

Barriers identified			Solution proposed	Detailed description (Page)
Stand Alone	Cause	Consequence		
Curtailment more frequent in the future due to the fact that Cyprus is an isolated system			The new TDR (TDR 3.0) have already been published and they contain a special regulation as far as curtailment is concerned.	22

Table 3: Operation: Summary of identified barriers and proposed solutions to overcome barriers

Literature and sources

Theophanous, Andreas (2011): Theophanous Andreas, Energy Regulator, *Cyprus Electricity Regulatory Authority*. Interview on 8 April 2011

EAC (2011): Anastasiades Evangellos, Assistant Director, *Electricity Authority Cyprus*. Interview on 8 April 2011.

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TSO Cyprus (2011): Anonymous, *Transmission System Operator Cyprus.* Interview on 7 April 2011.

Grid Development

Summary

In Cyprus, the development of the transmission and of the distribution grid follows a carefully defined procedure, which takes into account the current and future needs of the system and in which the main stakeholders are involved. Cyprus, in any case, has a very low share of RES-E. With their growth, problems may arise.

Relevant legal sources

The development of the electricity is regulated by the Law Regulating the Energy Market of 2003 (N122(I)2003-LREM). The law describes the responsibilities of the relevant parties concerning grid development and regulates how the grid development should take place. Apart from that, the Transmission and Distribution Rules (TDR 2.0) describe the technical details on how the development of the transmission and distribution should be realized and it includes some specific provision with respect to RES plants.

Regulatory framework for grid development

As mentioned above, EAC is simultaneously the owner of both the transmission and distribution grid in Cyprus. LREM mentions that the Electricty Authority of Cyprus, EAC, is responsible *"for the construction and maintenance of an efficient, safe, reliable and economic viable transmission (Art. 45 LREM) and distribution grid (Art. 50 LREM)"* respectively.

With respect to the transmission grid, EAC as the owner of the grid is also responsible for any necessary works for the development of the transmission grid (Art. 46 Par. a LREM) with the assistance of the Cypriot TSO, which is responsible *"for the operation and the development of an efficient, safe, reliable and economic viable transmission grid"* (Art. 61 Par 1a LREM). This is due to the fact that the TSO is until now not *"ownership unbundled"*. Cyprus is free from that obligation because of its structural characteristics (small, isolated system)(CERA,2010)

The cooperation between the Operator and the Owner of the transmission system is realized through the "Ten Year Grid Development Plan" of the transmission grid. The Cypriot TSO composes a "Ten Year Grid Development Plan" which is revised annually and takes into account any new application for grid connection and any necessary work needed to be undertaken. (Art. 62 LREM). The Programme is finally submitted to CERA which approves it (Art. 62 Par. 4 LREM). The triangle TSO-CERA-EAC takes part in the composition of that Programme and is submitted for public consultation (Theophanous, 2011).

As far as distribution system is concerned, EAC, as the owner and operator of the distribution grid, makes a 5 Year Programme, which includes all possible grid development works based on the existing masterplans (EAC,2011).

Obligations, legal responsibilities of the grid operator in relation to the RES-E producer

The conclusion of a contract between EAC and the (RES-E) producer legally binds both parties as regards the realisation of grid development works (T. 2.4.5.2 TDR 2.0). The experience so far has showed that all the necessary works on grid development are undertaken by EAC (EAC, 2011).

So far there is no legal precedent regarding the enforcement of the interests of a plant operator (Theophanous, 2011). By successfully fulfilling the principal requirements for grid connection, the necessary grid development works were realized.

In respect to that, it is very interesting to pinpoint that sometimes the design of a development/ reinforcement of the grid can take into consideration the future accessibility and integration of RES Plants and it is preferred although it can cost more (Theophanous, 2011).

RES producers from their side don't express any complaint in relation to grid development. They argue that because of the fact that Cyprus is currently at the early stages of RES development, obstacles concerning that field cannot be expressed, as the main problems can be identified at the early stages of grid connection, as it was previously mentioned (SEAPEK, 2011).

Regulatory instruments to encourage grid development

The "Ten Year Grid Development Plan" is as it was mentioned the main instrument in relation to grid development, where the future deployment of RES plants is taken into consideration (EAC, 2011). Apart from that no other incentives for grid developments related to integration of RES-E are currently applied (EAC, 2011).

Grid development studies and planned improvements

Apart from the aforementioned "Ten Year Grid Development Plan" which constitutes the basic instrument for the realization of the development of the transmission grid and the respective "Five Year Programme" for the distribution grid, further improvements are currently reviewed, with the development of storage facilities for RES-E as a priority (EAC, 2011).

Costs

With respect to the costs related to grid development, since the current Use of System Charges (Transmission and Distribution) are not charged to producers using RES and since the Cyprus Energy

Regulatory Authority has decided to charge these expenses to the customers, all Use of System Charges shall be covered by the customer demand collected by the TSO and forwarded to EAC(the System Owner) on a monthly basis for completion of the development programme.(NREAP, 2010).

Barriers identified			Solution proposed	Detailed description (Page)
Stand Alone	Cause	Consequence		
No Barriers detected				

Table 4: Development: Summary of identified barriers and proposed solutions to overcome barriers

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Market integration

Summary

The electricity market in Cyprus is characterised by its isolated position which does not allow cross border activities and the monopoly position of one company. Hence, there is no competition and the wholesale market and balancing market cannot function yet. Nevertheless, it must be noted that market rules were already established in 2009. Trading is mainly based on bilateral agreements, no day-ahead or intraday market is available in Cyprus.

The support scheme for RES-E is based on a fixed feed-in tariff, which is applied for Wind, Biomass and Solar energy. The amount of the tariff depends on the technology. The support scheme has several restrictions concerning the maximum installed capacity of each renewable source. RES-E producers are not charged for balancing costs.

Achievements

- Market Rules (Trading and Settlement Rules) are established.
- Liberalisation of approx. 67% of the electricity market.
- Fixed feed-in tariffs since 2009

Barriers

- No competition in the Wholesale and Balancing market
- EAC maintains its monopolistic position
- Low share of installed renewable capacity (~ 0.6%).

Relevant Legal Sources

The main Act about the establishment of s support scheme design for RES-E is the Law No. 33 I 2003 on the Promotion of Renewable Energy and Energy Efficiency (LPRES). The LPRES stipulate the fund that finances the feed-in tariff and other costs from RES-E generation as well as the requirements for use of the grid. The individual feed-in tariffs are specified in the “Support Scheme 2009-2013 for Electricity Generation from Wind Energy, Solar Energy and Biomass” (SSRES).

The relevant legal source concerning the market design is the Regulation of the Electricity Market Law (N122(I)2003). According to Article 79 par. 2 of the Law the TSO had to publish the “Trading and Settlement Rules” approved by the Minister of Commerce, Industry and Tourism and entered into force on 1 January 2009. Also the Transmission and Distribution Rules were published by the TSO and concerns the technical aspects of planning and operating the transmission and distribution systems.

Market Design

General availability of markets

Cyprus is still on its way to a fully liberalised electricity market. Since 2009 the market has been liberalised for "non domestic" consumers, which corresponds to approx. 67% of the annual electricity consumption in Cyprus. Until 2014 full liberalisation shall be reached, so that every consumer can choose its electricity supplier. However, the Electricity Authority of Cyprus (EAC) is still the only supplier in Cyprus, so that it is not possible for customers to switch (CERA 2010). Also on the generation side EAC still operates as the only generator in Cyprus covering the whole demand of the country.

In 2010 the major installed generation capacity of 1438 MW is provided by the power plants of EAC (mainly Heavy Fuel Oil and Diesel), another 26.63 MW is provided by independent producers for own use and 8.42 MW from RES-E (mainly Photovoltaic and Biomass). Future plans include the construction of sizeable wind parks which shall lead to a more diverse generation mix. The first wind park (82 MW) has been in commercial operation since February 2011 (TSO Cyprus, 2011b; CERA 2010).

Due to the absence of competition in the electricity market, according to the Cyprus Energy Regulatory Authority (CERA) no wholesale market is envisaged to function in the near future. Nevertheless, the Trading and Settlement Rules (Market Rules) have been established and regulate the way market participants can trade electricity (CERA 2010).

Cyprus as an Island has no cross-border connections with other countries and operates as a small isolated system. Until now there is no Natural Gas connection to the island despite the government's plan to use Natural Gas as the main fuel for the production of electricity in the future. According to CERA the absence of Natural Gas is the main bottleneck in the development and integration of the electricity market (CERA 2010).

Cyprus has established a single TSO that is unbundled in legal and management terms from the System Owner which is responsible for the electricity market operation. The TSO has to ensure the availability of generation resources and ancillary services on a day-to-day basis and coordinates the actions taken for the repair and clearing of faults occurring in the Generation (CERA 2010).

The electricity market in Cyprus is still based on bilateral agreements. According to the market rules, the electricity producer has to notify generation forecasts to the TSO at 20:00 p.m. for the following day (Interview: TSO-Cyprus 2011b). The communicated production of the producer of conventional power plants to the TSO must be in a range of ± 10 % of their customers' demand. Forecasts of RES-E producers have to be accurate within ± 20 % (TSO Cyprus 2006). All imbalances are settled through the balancing mechanism, which includes only the TSO and EAC as participants (CERA 2010).

Gate closure

As mentioned above the producers are obliged to inform the TSO about their planned production at 20:00 p.m. for all settlement periods of the following day. According to The Trading and Settlement Rules after the gate closure time no updated bids or offers may be submitted. The dispatch day includes 24 hours and starts at midnight (TSO Cyprus 2009a). In the Transmission and Distribution Rules under Chapter 16 "Additional Provisions for Power Stations using Renewable Energy Sources" the above mentioned Gate Closure Time applies only for RES-E producers with an installed capacity not exceeding 5 MW (TSO Cyprus 2011b). All RES-E producers with Generation Registered Capacity above 5 MW have to submit generation schedules to the TSO according to the Nominations Time schedule published in the Trading and Settlement Rules. There are no exceptional times for wind or other RES-E producers. Submitted nominations will receive priority at all times unless system constraints demand otherwise (TSO Cyprus 2009b)

Intraday-market

There is no intraday market available in Cyprus.

Existence of a balancing market

Beside the wholesale market also a balancing market has been established. Due to the absence of any other market participant than EAC, the TSO can only buy or sell balancing energy from EAC. Hence, for balancing purposes bilateral agreements are the norm in Cyprus (TSO Cyprus, 2011a). Currently RES-E producers will not participate in the balancing mechanism (TSO-Cyprus, 2011b).

The Trading and Settlement Rules provide all information concerning operation of the balancing market. Settlement of imbalances will be arranged on a monthly basis. The Settlement Period Duration is a period of 30 minutes. The minimum generation capacity for participation in the balancing market is 50 MW (TSO 2009a, CERA 2010).

Support Scheme Design

General support scheme design

The support scheme to promote RES-E is based on feed-in tariffs. The feed-in tariff scheme applies to wind, solar (thermal or PV) and biomass technologies (NREAP 2010, Fraunhofer ISI 2009). The Framework of the support scheme is regulated in the Support Scheme regulations (SSRES) and is valid from 2009 until 2013. The duration of the guaranteed payment under the support scheme is set to 15 years. The level of the support payment remains at the same level for the entire period. Since 2009 the support schemes are published in April each year and applications are received until the end of each year. Nevertheless, the call for applications ends long before the deadline, rendering many investors unable to realize their investment plans. According to the Cyprus Association of Renewable Energy Enterprises this uncertainty in the duration of the support scheme is the main barrier for the development of RES-E in Cyprus (SEAPEK, 2011).

Additionally, a feed-in premium is provided only for generation of electricity using biomass and biogas from Sanitary Landfills. For the first 20 years of operation the minimum sale price for biomass is 0.1179 Cent/kWh and 0.0974 Cent/kWh for Biogas released from Sanitary Landfills. The additional Premium on top of the minimum sale price is 1.71 Cent/kWh and is paid when the producer uses technologies such as fuel cells, cogeneration, gasification, dry fermentation etc. Producers get the Premium for 15 years, when the Power Generation is promoted within the Biomass Scheme of 2007 and 20 years within the Support Scheme SSRES of 2009. There is no cap in the total volume of electricity produced per year or of installed capacity for biomass and biogas from Sanitary Landfills (NREAP 2010).

The SSRES sets out technology specific restrictions of to the overall installed capacity which is promoted within the support scheme. For Wind Farms and Solar Thermal Systems the total installed capacity until 2013 is limited to 165 MW. Photovoltaic Systems of capacity between 21 kW and 150 kW are limited to a maximum installation of 2 MW each year from 2009 until 2013. Furthermore there is a cap concerning the payments of wind farms with a capacity over 30 kW. If the average electricity produced by one wind farm during a 4-year period is greater than 1750 kWh each year, the producer receive the standing rate only for the electricity which is generated above the 1750 kWh (NREAP 2010).

The electricity supported under the feed-in tariff is purchased by the EAC at the market price which is linked to the oil price and set by Energy Regulatory Authority (CERA). The difference to achieve the fixed feed-in tariff is covered through a flexible payment from a special “Energy Fund” which was created by imposing an energy tax for consumed electricity. For example: If the EAC purchase the electricity from PV plants for 0,14 Cent/kWh, the residual of 0,22 Cent/kWh will be paid as a subsidy from the special RES Fund to reach the guaranteed feed-in tariff of 0,36 Cent/kWh (Art. 5.2. SSRES 2010). There are plans to tender the sale price of electricity generated from solar thermal stations up to 25 MW. According to the proposal forwarded to the Council of the Ministers, the tender shall be carried out only once and the applicant with the lowest sale price for a station with a total capacity of 25MW will be selected (NREAP 2010).

Balancing Responsibility

There is no balancing responsibility for RES-E producers. They do not pay for Transmission Use of System charges, losses, ancillary services or any TSO operating costs (TSO Cyprus 2009b). RES-E Producers have to meet the electricity generation within ±20% of their forecasts. Any penalties that may apply to RES-E producers if they do not meet their forecast still need to be defined by the regulator and will be published at a later stage. Currently RES-E producers do not participate in the balancing mechanism (TSO-Cyprus 2011b).

Until know Cyprus is merely at an early phase as far as the development of RES on the island is concerned. According to the interview with the sole electricity enterprise EAC it mentioned that RES producers enjoy a privileged treatment. Once the RES-E plant is connected to the grid, the producers will be rest assured that they are not exposed to any kind of danger (EAC 2011)

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NREAP Analysis

The table below presents an overview on the identified national barriers of the RES Integration study as well as on the respective NREAP content. Throughout the study, the consortium carefully analysed, if the identified barriers of this study are addressed in the national energy action plan and whether or not the NREAP does foresee a solution approach:

- The column “Barrier identified in RES Integration Study” lists the various barriers, which the present study identified and addressed. The list contains barriers from the section connection, operation as well as development.
- The column “Is the barrier Contested?” would indicate, whether stakeholders in the country under concern would oppose to the identified barrier, namely if they do not see the listed issue as a barrier to the system.
- The column “Section in NREAP” identifies, if and where the respective NREAP is addressing the barrier under concern. The column would list the specific section of the national action plan.
- The column “Summary of foreseen Measure” would contain a short description of the foreseen measure of the NREAP, to overcome the addressed barrier. The column would be empty, if the respective NREAP does not identify the barrier, respectively if the NREAP does not propose a solution to the issue.
- The column “Comments & Evaluation” would contain a short analysis of the proposed NREAP solution and would evaluate, whether the solution is an appropriate and credible option to overcome the existing issue. If the NREAP does not identify the barrier, this section may also contain a short summary of the identified issue.

For a detailed description of the identified barriers in the framework of the RES Integration study, we kindly refer to the sections above, regarding connection, operation, development and market integration of RES-E installations.

Barrier identified in RES Integration Study	Is the barrier contested?	Measures foreseen in NREAP		
		Section in NREAP	Summary of foreseen Measure	Comments & Evaluation
Complex administrative procedures		**4.2.6 e)**	The authorisation procedure for the development of grid infrastructure is complex since it involves various agencies.	Problem acknowledged but no solution proposed
Extremely long lead times		**4.2.6 e)**	It has been detected that the issuance of licences and authorisations may take up to 10 years due to difficulties concerning the town planning licences as well as the reaction of local communities.	Problem acknowledged but no solution proposed
Request of the building permit follows a different speed than the one of the operating license		**4.2.6 l)**	It is shortly evoked that the licensing procedure takes more time than the construction period.	Problem acknowledged but no solution proposed
Obligation to confirm to technical guidelines of the DSO/TSO can be demanding			Not addressed in NREAP	
Over frequency when the system is in full operation			Not addressed in NREAP	
Curtailment more frequent in the future due to the fact that Cyprus is		**4.2.7 c)**	The TSO is not willing to change the legislation in order to introduce functional restriction for generation of RES-e. Instead	The introduction of storage facilities seems to offer a reasonable solution to the problem.

an isolated system			of allowing curtailment it encourages the development of storage facilities in order to promote the development of RES-e.	

Table 5: Summary of identified barriers and treatment of barriers in NREAP