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Working Group on Environment, Renewable Energy Sources and Energy Efficiency (RES WG)

Analysis of auction mechanisms to promote RES

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Abstract

This document (Med19-28GA-3.2.2) seeks to analyse the renewable energy auction mechanisms applied in the Mediterranean basin and on the international level. It describes various types and aspects of renewable energy auction schemes, drawing on the actual experiences of the countries under study. It also assesses the applicability of different auction types to renewable support under different market countries, identifying the strengths and weakness of RES-E auctions. Furthermore, it determines the auction types and design specifications that suit particular requirements and policy targets in each country under study. Additionally, through an analysis of empirical experiences and certain case studies, the most effective practices in designing auctions for renewable support are identified.

About MEDREG

MEDREG is the Association of Mediterranean Energy Regulators that brings together 27 regulators from 22 countries, spanning the European Union, the Balkans and the MENA region. Its secretariat is located in Milan, Italy.

Mediterranean regulators work together to promote greater harmonisation of the regional energy markets and legislations, seeking progressive market integration in the Euro-Mediterranean basin. Through constant cooperation and information exchange among members, MEDREG aims to foster consumers' rights, energy efficiency, infrastructural investment and development based on secure, safe, cost-effective and environmentally sustainable energy systems. MEDREG serves as a platform that provides information exchange and assistance to its members as well as capacity development activities through webinars, training sessions and workshops to its members.

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Executive summary

The perfect auction design does not exist. Auction designs should consider and accommodate policy goals and the current market situation of each country. It should be monitored to implement adjustments according to updated policy goals and market environments. The extent to which each of the strengths and weaknesses affects the outcome of auctions depends significantly on the auction design.

Background

The RES WG focuses on the legislative and regulatory mechanisms used to promote renewable electricity generation and energy efficiency and encourage the deployment of RES in the Mediterranean area. One of its objectives in the 2019 Action Plan (MED18-26GA-4.1) is the "implementation of harmonised regulatory options to promote RES in a cost-effective way". To fulfil this objective, the 2019 Action Plan defines the "analysis of auction mechanisms to promote RES" as a deliverable for RES WG.

This focus on RES auctions is located against the backdrop of several trends at the international level. According to the International Renewable Energy Agency (IRENA), 67 countries relied on RES auctions in 2016; this demonstrates an increasing interest across the world in this particular support RES mechanism.[1] Over the last decade, costs in renewable energy technologies – notably, onshore wind power and solar photovoltaic (PV) generation – have decreased by high margins; this can be attributed to an increased reliance on auctions to determine the price of RES support. At the level of the European Union, of which some MEDREG member countries are Member States, RES auctions are at the crux of rules such as the 2018 Renewable Energy Directive or the 2014 State aid Guidelines before it.

The RES WG, therefore, considers it appropriate to examine the practices of MEDREG members in RES auctions, with a view of identifying common features and formulating recommendations.

Objectives and Contents of the Document

The objective of this document is to gather and share information regarding the RES auction practices of MEDREG member countries across the wider Mediterranean region.

The report summarises the predominant features of RES auctions and, in particular, their main characteristics and the associated legislation in different MEDREG countries. The report subsequently provides a comparative analysis of the various auction systems along general criteria and characteristics. It assesses the strengths, weaknesses, opportunities and threats linked to RES auctions and describes the RES auction experiences of countries that are not members of MEDREG. The report concludes with a set of recommendations for MEDREG member countries.

[1] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 16.

Related Documents

MEDREG documents

- "Benchmarking Assessment", MEDREG, December 2017, Ref: MED17-24GA-5.3.1, http://www.medreg-regulators.org/Publications/Renewables.aspx

External documents

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List of abbreviations

Term	Definition
AGEN-RS	Energy Agency of the Republic of Slovenia
ARERA	Autorita di Regolazione per Energia Reti e Ambiente - Italy
AURES	Auctions for Renewable Energy Support
CERA	Cyprus Energy Regulatory Authority
CHP	Combined Heat and Power
CRE	Commission de Régulation de l'Energie
CREG	Electricity and Gas Regulation Commission – Algeria
EgyptERA	Egyptian Electric Utility and Consumer Protection Regulatory Agency
EMRA	Energy Market Regulatory Authority – Turkey
EMRC	Energy and Minerals Regulatory Commission – Jordan
EoI	Expression of Interest
ERE	Albanian Energy Regulator Authority
ERSE	Energy Services Regulatory Authority – Portugal
FIT	Feed in tariff
FIP	Feed in premium
HERA	Croatian Energy Regulatory Authority
IRENA	International Renewable Energy Agency
LCEC	Lebanese Center for Energy Conservation
MEDREG	Association of Mediterranean Energy Regulators
NRA	National Regulatory Authority
PERC	Palestinian Electricity Regulatory Council
PPA	Power Purchase Agreement
PUA	Public Utility Authority – Electricity – Israel
PV	Photovoltaic
RAE	Greek Regulatory Authority for Energy
RES	Renewable Energy Sources
RES WG	Working Group on Environment, Renewable Energy Sources and Energy Efficiency
RfP	Request for Proposal

1. Introduction

The following paper is developed by the Environment, Renewable Energy Sources and Energy Efficiency Working Group (RES WG) and is an analysis of the auction mechanisms that have been established in MEDREG member countries for promoting electricity generation using renewable energy sources (RES).

This analysis is based on the responses recorded to a questionnaire circulated among MEDREG members during the first quarter of 2019. The following fifteen (15) members who responded are presented as case studies: Albania, Algeria, Croatia, Cyprus, Egypt, France, Greece, Italy, Israel, Jordan, Lebanon, Palestine, Portugal, Slovenia and Turkey.

The first chapter introduces this undertaking and elaborates on the structure followed in it. The second chapter, "Renewable Energy Auctions", discusses the primary features and characteristics that should be considered in auctions and tendering mechanisms. The options adopted in the design of auctions are fundamental to the success of the tendering procedure. A poorly designed auction mechanism, moreover, may be detrimental.[2]

The third chapter, "Case Studies", features a description of the results obtained via the questionnaire. The questionnaire intended to gather information regarding the support mechanisms for promoting RES – auction mechanisms and other mechanisms such as feed-in tariff, feed-in premium and other issues – that occurred in the countries surveyed. The data from the countries covers the period between 2013 and 2018.

Following the presentation of the specific case studies, a summary of the results is presented in the fourth chapter in order to identify the similarities and differences among MEDREG countries in terms of the established auctions schemes and other support schemes. Additionally, a SWOT analysis of the implementation of competitive auction schemes to promote RES generation is designed.

Through the analysis of the empirical experiences and case studies from specific countries, the most effective international practices are identified in chapter five.

In chapter six, a summary of the conclusions formed is provided and some recommendations are made; these suggestions can aid policymakers in drawing RES support mechanisms, such as competitive auctions.

[2] The Oxford Institute for Energy Studies (2019), *The Limits of Auctions*, p. 16.

2. Renewable Energy Auctions

This chapter seeks to describe the predominant features of auction and tendering procedures for the production of energy from RES.

Auctions and tendering schemes for RES are competitive mechanisms for allocating financial support to RES projects. Both auctions and tenders are organised by public authorities, who hold the responsibility for preparing the tender documents, publishing the tender, evaluating the bids and selecting the winning bids.

Decisions made while designing the tendering process may have implications on price formation but can also promote certain country-specific goals.[3] It is of the utmost importance to inform policymakers of such characteristics in order to ensure the designing of tendering procedures which best suit their countries' requirements.

For clarity in exposition, we specify the important aspects of the auction process prior to explaining their relevance.

Administrative parameters of the auction

The set-up of a competitive bidding scheme may vary substantially, depending on political priorities, the competitive market environment of RES technologies and the legal framework in each country. Tendering designs can encompass a significant number of criteria that can be combined within one bidding scheme. The figure below presents the primary RES auction design elements that should be fulfilled.

Figure 1 RES auction design elements

The following parameters should be defined in more detail prior to the auction.

The **product** is what is being auctioned. In the context of auctions to support the deployment of RES, the product is usually **energy contracts (MWh)** or **capacity contracts (MW).**[4]

[3] IRENA (2019), Renewable Energy Auctions: Status and Trends beyond Price (Preliminary Findings), p.3.

[4] The Oxford Institute for Energy Studies (2018), Renewable Auction Design in Theory and in Practice: Lessons from the Experiences of Brazil and Mexico, p. 7.

Defining the product is instrumental since products that are too broadly defined or defined with too stringent criteria can lead to inefficient results.[5]

Volume refers to the quantity of the product being auctioned. The volume of an auction can be expressed in terms of technical quantity (capacity or energy) or in terms of budget. In other words, an auction defined in technical quantities will find the market price for that quantity whereas an auction defined in budget terms will find the quantity that the market is willing to provide within that budget.

Technology is what produces electricity. Tenders are **technology neutral** if they don't discriminate a priori between productive technologies. Auctions or tenders that apply exclusively to RES sources are, by definition, not technology neutral. In extremis, auctions can exclusively apply to one technology.

Prerequisites are the set of administrative requirements that participants have to fulfil in order to qualify for the auction. This includes but is not limited to the documentation the participants need to present, such as proof of past experience, proof of financial adequacy or the fees they have to pay in advance.

Auction characteristics are the decisions concerning the process by which the auction occurs. This includes the bidding model, the establishment of safety net prices, the pricing rule or the platform on which the auction occurs.

The **bidding model** describes the process by which participants interact and state their intentions to the auctioneer. The bidding models used by the countries surveyed can be categorised into three: **descending auctions, ascending auctions** and **sealed-bid models**. In the descending bid model, the auctioneer requests for a price (usually above what is reasonable) and will progressively lower it until a given bidder accepts the quoted price or until a minimum (safety-net) price is reached. In ascending bid models, the auctioneer asks for a price and the competition between the participants will increase the price. In sealed bid models, each participant bids their proposal and the best bid wins. **Safety-nets** are administratively set prices, defined ahead of the auction and that aim to guarantee that the price result in the auction is not disadvantageous to the auctioneer.

The **pricing rule** concerns the manner in which the strike price is set. There are two alternative methods: pay-as-bid and pay-as-cleared.[6] Pay as bid can discriminate the price between bids, whilst pay-as-cleared (or uniform pricing) applies the clearing price to all units.

<u>Relevant considerations when designing an auction</u>

The choice of the parameters of the auction is based on the desire to produce the best outcome possible; i.e., ensuring that the auction results are economically efficient and with no unintended consequences.

Concerning the volume of the auction, it is worth noting that auctions with large volumes allow for the quick deployment of technologies but may imply that the auction is uncompetitive.

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[5] Ibid. p. 16

[6] CEER (2017), Tendering Procedures for RES in Europe: State of Play and First Lessons Learnt, p. 24.

Competition in auctions is predicated by the fact that bidders are competing with each other for scarce and desirable resources and are unable to undermine the outcome by colluding.

As mentioned previously, the volume of an auction can be set in terms of **capacity**. This holds the advantage of planning the electrical system in order to accommodate the results and reducing risk for developers but also has the downside of not ensuring generation.[7] Auctions that are defined in terms of **energy** facilitate planning and monitoring. However, they are disadvantageous because they carry the risk of the costs resulting from the auction being higher than expected. Furthermore, since energy is a time-independent quantity and bidders offer a certain energy output, the risk of the developers not being able to provide what they have offered – owing to the lesser flexibility of some RES – is also prevalent. Lastly, auctions defined in terms of budget provide certainty regarding the costs of the auction but are detrimental to certainty regarding the amount of capacity or energy that will be provided.

The choice of the technology of the energy choices should be based on the two things discussed below.

First, **non-neutral auctions** can result in higher costs.[8] This happens because the decision to exclude some technologies from bidding implies that the optimum price will be selected from a smaller subset of producers. On the other hand, technology-neutral tenders select the optimum price from the pool of all available producers.

Second, **the choice of a given technology** has system-wide implications.[9] The benefits of an auction that produces an optimal price for a given RES may be offset by the balancing and transmission costs. Therefore, decisions to exclude one or more technologies should pursue deliberate policy goals such as increasing the security of supply or increasing renewable energy production whilst bearing in mind the costs that may emerge as a consequence of such policies.

Administrative prerequisites may refuse entry to bidders. This is to winnow serious participants from those who may enter the bid without the ability to commit. However, by mandating a fee or documentation from bidders, the auctioneer may also discourage participants from competing.[10]

Concerning the terms and conditions that MEDREG countries apply to their auctions, we emphasise that these administrative prerequisites can be **fixed** – equally applied to all technologies – or **variable** – designed differently according to the technology being procured. To review the results of our survey regarding the legal requirements that countries should fulfil, please consult chapter four.

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[7] The Oxford Institute for Energy Studies (2018), Renewable Auction Design in Theory and in Practice: Lessons from the Experiences of Brazil and Mexico, p. 8

[8] Ibid., p. 7

[9] The Oxford Institute for Energy Studies (2019), *The Limits of Auctions*, p. 6

[10] The Oxford Institute for Energy Studies (2018), Renewable Auction Design in Theory and in Practice: Lessons from the Experiences of Brazil and Mexico, p. 10

2.1. Renewable Energy Legislation

Each country follows its own legal system; therefore, concrete legislation for each surveyed country is described in the case studies chapter. Furthermore, the overall general trends can be identified as follows:

Main trends in legislation:

Our survey indicates that countries usually establish several mechanisms to support the development of renewable energy (see Table 2 in Chapter 4). Countries can provide as few as one support mechanism (Algeria and Croatia) to as many as six (Greece).

Regarding the mechanism used, our survey indicates that the most ubiquitous are feed-in tariffs and competitive auction schemes (twelve and thirteen of the countries surveyed, respectively, claimed to have used them).

With respect to the role of the regulator, our survey concludes that there is significant discrepancy in auction schemes regarding the role of the regulator. The regulator can play a prominent role, such as in countries where the regulator conducts the auction; it plays either an active role – where the regulator provides an opinion or some sort of informal guidance – or a negligible role, where it has no role in the auction.

European Union Legislation:

Since legal texts of the European Union apply to several MEDREG members, we briefly describe their primary provisions.

Directive 2009/28 on the promotion of the use of energy from renewable sources contains the main body of the EU’s current renewable energy policy. Adopted in April 2009, the directive provides a common framework for the promotion of energy from renewable sources in all the EU Member States. The act specifies binding national targets for the share of renewable energy (as a percent of gross final energy consumption) for each Member State, which together amount to an EU-wide target of 20%. EU Member States that are MEDREG members have transposed the provisions of the said directive into their national law and certain regulatory measures have been adopted for the implementation of the directive. Directive 2009/28 specifies that Member States may apply support schemes to attain their national targets. However, it does not set any requirements for how these support schemes should be structured.

Directive 2018/2001 on the promotion of the use of energy from renewable sources (henceforth 2018 RES Directive) is the most recent legal document at the EU level. Since it is a directive, it leaves some margin of discretion to the Member States when transposing it into national law.

The 2018 RES Directive includes a binding renewable energy target of 32% for the European Union for 2030 with an upwards revision clause by 2023. The rules also serve to create an enabling environment to accelerate public and private investments in innovation and modernisation in all the key sectors. It aims to provide guiding principles on financial support schemes for RES, renewable energy self-consumption, energy communities and district heating. It seeks to enhance mechanisms for cross-border cooperation, simplify administrative processes, strengthen the sustainability and greenhouse gas emissions savings criteria for biofuels and mainstream the use of RES in the transport and the heating and cooling sectors.

Similar to Directive 2009/28 preceding it, the 2018 Directive allows the establishment of support schemes that can exist in several forms (see 2018 RES Directive, Article 2, number 5 for the legal definition of support schemes). However, it sets more detailed requirements than the current directive; it, notably, specifies that such support schemes "shall provide incentives for the integration of electricity from renewable sources in the electricity market in a market-based and market-responsive way" (Article 4, paragraph 2). It also states that "support for electricity from renewable sources is granted in an open, transparent, competitive, non-discriminatory and cost-effective manner" (Article 4, paragraph 4).

Concerning tendering procedures, the 2018 RES Directive states that tendering procedures may be limited to specific technologies under given conditions (Article 4, paragraph 5). Where tendering procedures are used to support production from renewable electricity sources, Member States should "establish and publish non-discriminatory and transparent criteria to qualify for the tendering procedure and set clear dates and rules for delivery of the project" and also "publish information about previous tendering procedures, including project realisation rates" (Article 4, paragraph 6). Member States may adapt financial support schemes in outermost regions or islands (Article 4, paragraph 7). The conditions foreseen for producers as a result of support for renewable energy projects cannot be revised in a way that negatively impacts these producers.

The 2018 RES Directive is not the first instrument to regulate support schemes and tenders. From 2014 onwards, EU Member States have been progressively adapting their schemes to comply with the general conditions for support to energy from renewables as set by the European Commission in its Guidelines on State Aid for Environmental Protection and Energy (EEAG). In the context of the EU competition policy, these guidelines apply to subsidies provided by Member States to certain undertakings and industries (State aid). If a particular policy measure meets the State aid criteria, the Member State has to notify the measure to the Commission for approval and will have to comply with the criteria set out in the State aid guidelines. The EEAG –applicable from 2014 to 2020 – mandated that State aid for renewable electricity production should be tendered and that competitive bidding procedures should be open to all RES technologies (technology neutrality). However, the guidelines also allow for derogations to both principles, notably for small installations.

The EEAG, however, does not apply to support schemes that do not meet the definition of State aid. With the adoption of a revised Renewable Energy Directive as well as the revised Electricity Directive, the key principles of competitiveness, non-discrimination and cost-effectiveness set out in the EEAG will become the standard criteria for RES support schemes across Europe from 2021 onwards.

References in RES legislation in countries of the med region

While the European Union Member States that are members of MEDREG are obliged to harmonise their national legislation with the European Directives and Regulations, the following legal texts on renewables apply to the remaining members of MEDREG.

Albania:

The law on the promotion of Renewable Energy Sources N.7/2017 that has been effective since September 2017.

Egypt:

Below, an overview of renewable energy support policies, legislation and regulations in Egypt is provided.

Legislation	Type
Law No. 102 of the year 1986 establishing the New and Renewable Energy Development and Usage Authority (as amended in 2015)	• Establishes the NREA. • The NREA has the primary role in promoting and developing renewable energy in Egypt.
The Constitution of the Arab Republic of Egypt, 2014 (Article 32)	• To gain optimum benefits from renewable energy, promote its investments, and encourage R&D, in addition to local manufacturing.
Renewable Energy Law (Decree Law 203/2014)	• To support the creation of a favourable economic environment for a significant increase in renewable energy investment in the country.
Cabinet Decree No. 1947 of the year 2014 on Feed-in Tariff	• Establishes the basis for the FIT for electricity produced from renewable energy projects and encourages investment in renewable energy.
Prime Ministerial Decree No. (37/4/15/14) of the year 2015	• Regulations to avail land for renewable energy projects.
New Electricity Law No. 87 of 2015	• To provide legislative and regulatory frameworks needed to realise the electricity market reform targets.
Investment Law No. 72 of the year 2017	• Ensures investment guarantees and amendments as of May 2017. • Establishes a new arbitration centre for settling disputes. • Codifies social responsibility. • Instigates foreign investment in Egypt.

Figure 2 RES policies, legislation, regulation (Renewable Energy Outlook Egypt, IRENA, 2018)

<u>Israel:</u>

The Israeli RES market framework was defined through two main government decisions:

1. Decision number 4450 from January 2009 that included an objective of 10% electricity production from RES sources by 2020.
2. Decision number 3484 from July 2011 that ratified the objective determined in 2009 and also defined specific quotas for installations for each technology.

<u>Jordan:</u>

3. Renewable Energy & Energy Efficiency Law no 13, 2012 and its 2014 amendment.
4. Direct Proposals Bylaw (No.50/2015).
5. The mechanism for the calculation of electrical energy purchase prices from RES.
6. Directive governing the sale of electrical energy generated from RE systems, pursuant to article 10/B of RE law (net metering).
7. RES/EE Tax Exception Bylaw No. 13 of 2015 as amended by Bylaw No. 50 of 2018.

8. Electricity wheeling directives, pursuant to article 17 of RE law.
9. Guide to connect RE systems (net metering).
10. Guide to connect RE (wheeling).

Lebanon:

Laws 462, 288, 54 and 129 regulating the electricity sector allow private electricity generation. Law 462 was passed in 2002 but is still not ratified. This law organises the electricity sector in Lebanon and allows the private sector to participate in electricity generation. Law 288/2015 is an amendment of Law 462 that states, "Provisionally and for a period of two years, until the appointment of the Regulatory Authority members, electricity production licenses are granted by a decision of the Lebanese Council of Ministers upon the proposal of Ministry of Energy and Water and Ministry of Finance."

Law 54/2015 extends Law 288/2014 for two more years from April 2016 to April 2018. Law 129/2019 extends Law 288/ 2014 for three additional years (from April 2019 to April 2022).

The Ministry of Energy and Water and the Lebanese Centre for Energy Conservation, in collaboration with the European Bank for Reconstruction and Development (EBRD), are currently drafting "The Lebanese Distributed Renewable Energy Generation Law", encompassing all types of distributed renewable energy systems. This law will set a basis for promoting distributed renewable energy generation by establishing the main principles for the realisation of projects using net metering in all of its forms and peer-to-peer (distributed) renewable energy (only) trading through direct power purchase agreements (PPAs) and/or renewable energy equipment leasing.

2.2. Support Schemes for RES-E Development

This section explains the different types of support that can be provided to promote RES development.

As per the 2018 RES Directive, a support scheme is "any instrument, scheme or mechanism (...) that promotes the use of energy from renewable sources". A non-exhaustive list of mechanisms for promoting RES stated in the directive includes the following:

1. Measures that reduce the cost of renewable energy, increase the price at which it can be sold or increase the volume of such energy purchased. Examples include the following:
    a. Investment aid;
    b. Tax reductions or exemption;
    c. Tax refunds;
2. Direct price support;
    a. Feed-in tariff
    b. Feed-in premium (sliding or fixed)
3. Tradable green certificates

Types of support schemes:

Investment Aid (or **Investment Grant**) is a fixed payment (from public money), usually upfront, which supports the initial costs but doesn't support the operational costs of running production facilities.

Tax reduction and tax exemption are ways to reduce the costs of running production facilities since they reduce or remove costs in the form of taxes. **Tax refunds** do not exempt a producer from paying taxes but returns some of the taxation to the producer.

Direct price support schemes pertain to the market price of the commodity. The most common form of direct price support is the **feed-in tariff (FIT)**, which is a tariff payed to a producer per unit of energy injected into the grid. The purchase agreements are typically offered within contracts ranging from 10 to 25 years and are extended for every kilowatt-hour of electricity produced. The payment levels offered for each kilowatt-hour can be differentiated by the technology type, project size, resource quality and project location to better reflect actual project costs.

Feed-In Premium (FIP) is a type of price-based policy instrument whereby eligible renewable generators are paid a premium price that is a payment in addition to the wholesale price. This premium can be fixed or floating; a floating premium is calculated as the difference between an average wholesale price and a previously defined guaranteed price. Under contracts for difference, additionally, generators are required to pay back the difference between the guaranteed price and the wholesale price if the wholesale price rises above the guaranteed price.

Tradable green certificates are a tradable commodity proving that a certain amount of electricity is generated using RES. Typically, one certificate represents the generation of one Megawatt-hour of electricity. What is defined as renewable varies between certificate trading schemes. Green certificates represent the environmental value of the renewable energy generated. The certificates can be traded separately from the energy produced.

2.3. Trends in Renewable Energy Auctions

Renewable energy auctions are one of the tools available in many countries to promote RES generation.

According to the IRENA report,[11] "Renewable energy auctions continue to support the deployment of renewable-based power, revealing competitive prices in many regions of the world."

The report[12] states that the use of auctions to procure renewable energy generation has increased. Between 2017 and 2018, approximately fifty (50) countries have used auctioning mechanisms; half of these countries performed an auction for the first time, probably driven by the success of using this tool to achieve lower prices.

This report also emphasises that, in this period, global onshore wind prices and solar PV prices have stabilised or slightly increased. This might be because most of the volumes auctioned

[11] IRENA (2019), Renewable Energy Auctions: Status and Trends beyond Price (Preliminary Findings), p.28

[12] Ibid, p.4

were from newcomer countries, where investors might have demanded a higher rate of return to invest.[13]

Global trends in renewable energy auctions can be differentiated in terms of the following:

- technology and
- price.

Trends in technology

According to IRENA's report, there is still a preference for proven technologies. Solar PV and onshore wind are the most searched for, followed by offshore wind and a residual number of others such as biogas and biomass.[14]

Trends in price

Various factors affect the price resulting from an auction. IRENA's report summarises them into four (4) categories: 1) country-specific conditions such as resource availability and costs of finance, land and labour, 2) investors' confidence, 3) other policies related to renewable energy (grid policies, priority dispatch, local content rules) and 4) the design of the auction.

Between 2010 and 2018, global average prices witnessed a remarkable decrease in the cost of RES. While solar PV prices declined by 73%, the onshore wind prices decreased at a lower rate (-36%). As mentioned before, solar PV power continued to decrease between 2017 and 2018 while the costs of onshore wind power rose slightly.

Auctions are a useful tool for countries that seek an economic efficiency solution to enhance RES generation. However, this mechanism is only a part of the equation. IRENA concludes in its report that "beyond their potential to achieve low prices, renewable energy auctions are increasingly used to achieve objectives beyond price. Indeed, auction design elements can provide an effective way for countries to integrate other practical or policy objectives".

[13] Ibid, p. 9.

[14] Ibid, p. 4.

3. Case Studies

3.1. MEDREG Members

In April 2019, a questionnaire on RES auction schemes was circulated among the MEDREG members of the RES WG. The drafting team received fifteen (15) answers in total, which are analysed in this chapter. The questionnaire comprised of multiple-choice questions but also provided the NRAs the space to further elaborate on a question and was divided into four sections; the format followed is briefly presented in the table given below.

Section	Title	Content
Section A	Overview of support schemes	- Policies - Eligible technologies - Authorities in charge - Finance - Nature of support level
Section B	General questions	- Imbalances - Priority for RES electricity plants - Connection charge - G component
Section C	Competitive auction schemes	- Weighted average price - Capacity auctioned - Type of auction - IT tool/ instrument - Competent authority - Safety net value - Terms and conditions concerning the bidders - Duration of the winning bid - Materialisation period of the projects - Detailed description of the auction schemes - Future plans - Strengths and benefits of RES auction schemes - Weaknesses and threats of RES auction schemes
Section D	Other support schemes	- Tariff set for FIT or FIP schemes - Date of the tariff set - Duration of the tariff - Installed capacity

Table 1 Questionnaire on RES auction mechanisms

3.1.1. ALBANIA (Albanian Energy Regulator Authority – ERE)

According to Law No.17/2017, the Albanian RES electricity support scheme is based on FIT (that are differentiated by technology and installed capacity) and “contracts for difference” based on a variable remuneration. The authorities responsible are both the government and the regulator. The RES electricity support scheme is financed by non-tax levies paid by the consumers via their electricity bill. The support level concerns operational aid per KWh produced.

In Albania, a competitive auction scheme was proposed by the Ministry of Infrastructure and Energy for the first time in 2018. The Regulator did not play any role in the procedure. The capacity auctioned was 50MW. The 50MW will be treated with FIT with a price of 59.9 €/MWh.

3.1.2. ALGERIA (Electricity and Gas Regulation Commission – CREG)

In Algeria, competitive auctions will be applied for PV and onshore wind technologies. The first operation launched by the Regulator is still in progress. For small capacities of up to 20GWh per year, the Regulator is the competent authority. For capacities beyond 20GWh per year, the energy ministry is in charge. In the second case, the Regulator provides an opinion on the price of the lowest tender to define whether it is acceptable or not.

A fund dedicated to RES is available for compensating the difference between the price of conventional and renewable kWh of electricity.

The Regulator prepares and launches the call for tenders and responds to all of the candidates’ requests. It receives and declares the admissibility of technical and financial bids. The bids are compared with each other, technically and financially, without the use of an IT tool. The regulator treats the offers and claims the winners. Finally, it follows the winners until all the conditions for implementing the contract are satisfied. This type of auction mechanism is aligned to the lowest price proposed in the sealed-bid auction. The competent authority sets a ceiling price beyond which tenders are rejected. This price also helps avoid unsuccessful auctions where only one offer is proposed. In this case, the regulator accommodate the unique bidder if his price is under the price cap.

3.1.3. CROATIA (Croatian Energy Regulatory Authority – HERA)

An FIT scheme has been in place in Croatia since 2017. The Renewable Energy and High-efficient Cogeneration Act prescribes that the “old” FIT scheme (which was effective from 2007 to 2016) is no longer open (and only active for those who have already signed the FIT contract). Instead, two new schemes are to become active – the “new” FIT scheme (power plants up to and including 500 kW) and FIP (power plants above 500 kW). Prices (HRK/kWh) for individual power plants entering these schemes will be determined with competitive tendering procedures. First, a tendering procedure should be held later this year when all sub-legal acts are brought into force. There are no power plants under the new schemes yet.

The schemes are financed by non-tax levies paid by customers in their electricity bill. Electricity suppliers are obligated to purchase 70% of the electricity produced by the power plants on a monthly basis (depending on their market share). The other 30% is sold in the electricity market. Proceedings from these sources and the levies paid by all customers are deposited in an account from which the schemes are financed.

There are three sets of tariffs for the “old” FIT. The first was implemented in 2007, but it has been annually changing since 2007. The change depends on consumer price indices. This 2007 tariff set is valid for all power plants that signed the contract before 2012.

The second tariff was set in 2012 and the third one in 2013. The 2012 and 2013 tariffs also change with consumer price indices; however, the change is individual for each type of power plant, depending on the commencement of the contract. For example, consider two power plant of the same type; if one started producing under FIT in 2013 and the other started production in 2015, their starting price would be the same.

The duration of the contract based on the first set of tariffs (from 2007) was 12 years. The duration of the contract based on the tariffs from 2012 and 2013 was 14 years. The same applies for all technologies and capacity categories.

3.1.4. CYPRUS (Cyprus Energy Regulatory Authority – CERA)

An FIT scheme is in place in Cyprus that was introduced by the Ministry of Energy, Commerce and Industry’s grants scheme and was active from 2009 to 2013 and pertained to PV, on-shore wind and biomass technologies. Presently, the total installed capacity under the FIT scheme is 76.93MW for PV systems, 157.5MW for on-shore wind parks and 9.71MW for biomass installations.

In 2017 and 2019, support schemes for the production of electricity from RES in the transitional electricity market, adjusted with the final acquisition and the integration of the projects in the competitive electricity market were announced. The selected applicants will enter a contract with the Electricity Authority of Cyprus (EAC), which will purchase the electricity produced at the respective avoidance cost determined by CERA. 12 months after the date of implementation of the competitive electricity market, the projects will automatically switch to the competitive electricity market. The RES systems with capacity less than 1 MW will participate in the competitive electricity market through bilateral contracts with suppliers or aggregators in the day-ahead market. No public aid is granted under this scheme.

Moreover, the Ministry of Energy, Commerce and Industry, in view of reducing the energy costs of consumers as well as to achieve the Republic’s 2020 targets for RES penetration and energy efficiency, announced an investment scheme in March 2019 to encourage the use of RES and energy efficiency in buildings. According to the scheme, a) a grant of €250 per installed kW (with maximum grant amount €1000) is awarded for the installation of small PV systems; b) a grant of €900 per installed kW (with maximum grand amount €3600) is awarded for the installation of small PV systems for vulnerable consumers (families with low income, persons with disability etc); c) a grant of 30% of the eligible costs of each ceiling thermal insulation (with maximum grand amount €1500 for each home) is allocated; d) for combination of ceiling thermal insulation and PV systems, a grant of 35% of the eligible costs of each ceiling thermal insulation (with maximum grand amount €1800 for each home) is offered and a grant of €300 per installed kW (with maximum grant amount €1200) is given for the installation of small PV systems installed after 1st November 2018.

The Ministry of Energy, Commerce and Industry also announced the implementation of an investment scheme in June 2019 for the promotion of energy audits in small and medium-sized businesses; this will be funded by the RES and Energy Savings Fund. The scheme seeks to promote energy audits in regions where small and medium-sized enterprises operate and where energy is consumed (buildings, industrial plants and processes, agricultural installations and transport). The total project budget is 200,000 euros and is expected to cover approximately 100 applications. The scheme will be accessible until the available budget is exhausted. The scheme provides a 30% public funding rate on the cost of energy audits with a maximum grant of €2,000 per business.

The Regulator provides its approval prior to the publication of the support schemes.

In January 2013, an auction procurement for the licencing of 50MW of PV power plants was undertaken. Four separate auctions were held, one each for projects up to 1.5MW, up to 3MW, up to 5MW and up to 10MW. 16 projects of up to 1.5MW were awarded a price range of 0.0943–0.0990€/KWh. Five projects of up to 3MW were awarded a price range 0.0781–0.0898€/KWh. Two projects of up to 5MW were awarded a price range 0.0815–0.0851€/KWh. One project of up to 10MW was awarded a price 0.0741€/KWh but was not implemented. The duration of the winning bid was set at 20 years.

Auctions in all four categories were completed within 30 minutes. During the auction, the participants received an opportunity to submit as many bids as desired (FIT to the grid in €/kWh). Each subsequent bid should have been lower than the previous one. For the offered prices to remain within reasonable limits, the Ministry of Energy, Commerce and Industry set a limit FIT called a safety net, below which bids were excluded. The safety nets were not announced before the tender and were intended to serve as an exclusion criterion for any project bidding at a lower price. Although the final prices were significantly below the safety net, the competent authority decided not to exclude the winning projects because a majority of the bids were below the set limit. A special IT platform was developed specifically for carrying out the auctions.

The Regulator informally provided its guidance.

There are no active RES auction schemes at the moment but depending on the achievement of the RES-E 2020 targets and the future, the government might consider implementing RES auction schemes.

3.1.5. EGYPT (Egyptian Electric Utility and Consumer Protection Regulatory Agency – EgyptERA)

Egypt adopted its first renewable energy strategy in 1982, targeting the production of 5% of the generated electricity from renewable energy resources by 2000. However, this target was not attained due to the relatively high cost of renewable energy technologies and the heavily subsidised energy prices during this period.[15]

In February 2008, following the emergence of the energy supply/demand gap in 2007, the SEC approved a new target – to source 20% of the generated electricity from RES by 2022. The SEC planned to achieve its ambitious targets through the deployment of a variety of RES, including 12% wind, 2% solar and 6% hydropower.[16]

To realise these targets, the majority of the total capacity planned for installation is intended to be implemented by the government and the remainder by the private sector. By January 2011,

[15] Renewable Energy Outlook Egypt, IRENA, 2018

[16] Ibidem

political instability, coupled with economic uncertainty, meant that the strategic renewable energy targets had not been implemented.[17]

In January 2013, the Government of Egypt started developing its new 20-year strategy – the Integrated Sustainable Energy Strategy (ISES) 2015 to 2035 – through a project funded by the European Union and implemented in co-operation with all relevant national partners. In October 2016, the SEC agreed to establish a new energy strategy for Egypt, under the TARES approved in 2016.[18]

The support schemes applied in Egypt include FIT, competitive auctions, net-metering and tax and independent power producers. The support schemes are financed by non-tax levies paid by customers with their electricity bill.

More specifically, the following schemes are applied for the implementation of renewable energy projects in Egypt:

Competitive bidding: In the early 1990s, the NREA initiated a competitive bidding process for renewable electricity generating capacity through government projects. In 2009, EETC launched the first auctions for large-scale private projects using the BOO scheme, where the NREA secured land and data on resources. In the following years, a number of other tenders were launched by EETC – 200 MW of solar PV in 2013 and 250 MW wind, 200 MW solar PV and 100 MW CSP in 2015.[19]

Due to the declining cost of RES, in 2017, Egypt moved to the auction mechanism (competitive bidding) for large-scale solar and wind projects. Auctions for large-scale solar PV projects were announced to be carried out under state-owned EPC contracts with the NREA or under a BOO scheme with an IPP through PPAs with EETC. In this regard, EETC issued a tender for 600 MW of PV capacity in the West of Nile region in December 2017.[20]

BOO scheme with PPAs: As of July 2015, the IPP scheme has been adopted by the Egyptian power sector and EgyptERA issued the relevant regulations and contracts to provide developers with the necessary level of certainty. The generated electricity is sold directly to either the end users or the distribution utilities depending on the scale of the consumer. In the situation where surplus electricity is generated, it is consumed to satisfy the developer's own electricity demands (EU, 2015a). The IPP scheme alleviates upfront costs for project development and ensures continuous investment due to increased competition.[21]

EETC has announced bidding processes for wind, solar PV and CSP projects with a total capacity of more than 1000 MW through the BOO scheme in Gulf El Zayt, including consortiums with Italgen, Lakela and Engie-I[22]. Additionally, 100 MW of CSP and 1000 MW of

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[17] Ibidem

[18] Ibidem

[19] Ibidem

[20] Ibidem

[21] Ibidem

[22] EEHC (2016b), Egypt Renewable Energy Plan.

solar PV projects under three competitive bidding schemes, as well as a 600 MW project under direct negotiation, have all been approved by the cabinet.[23]

The aforementioned 600 MW solar PV BOO plant will be completed under direct negotiation and was approved by the cabinet in December 2017. In this context, EETC will be the off-taker of electricity under the usufruct agreement with the NREA for a project lifetime of 25 years.[24]

3.1.6. FRANCE (Commission de Régulation de l'Energie – CRE)

France applies a variety of different support schemes: The support can take the form of FIT, FIP, or tax exemptions and incentives. Depending on their characteristics, support beneficiaries will be selected through competitive auctions or through open window procedures.

For RES electricity, the support mechanism varies according to the size of the installation.

- Smaller installations receive FIT, whereas installations with a capacity of 500 kW or higher receive FIP, requiring them to sell their electricity on the market. For onshore and offshore wind projects, only FIP are available; no tariffs apply.
- Smaller to medium-sized installations are selected through open window procedures whereas larger ones are selected through auctions. The threshold is usually set at 1 MW, except for PV (auctions start at 100 kW) and onshore wind (auctions start at 3 MW or 7 generators) projects.
- Tax incentives are used for the support of renewable heat and biofuels.

Since January 2016, support for RES falls under the general state budget and is financed through a dedicated purpose fund; the provision of this is annually decided by the Parliament through the Finance Law. Currently, the fund is financed from the proceeds of internal taxes on fossil fuels that are collected from fuel suppliers.

Operational aid per kWh produced is granted for all technologies (except for small scale solar plants, which are also granted an investment premium when a part of the energy is self-consumed). Experimentation projects (such as tidal turbines) may also benefit from local, state or European direct investment subsidies.

With regards to the more recent PV auctions that have been carried out since 2016 ("CRE4" generation), the average levelised cost of energy (LCOE) ranged from 62 to 99 €/MWh for a 20-year support duration:

- 62–77 €/MWh for ground-based installations;
- 85–93 €/MWh for roof-top installations and
- 93–99 €/MWh for installations on parking shelters.

The decision to organisen ew RES auctions lies with the government. Under the legislation in France, the predominant criterion to select the winning bids is price; however, other objective and non-discriminatory criteria such as the quality of the bids (in terms of technical and

[23] Renewable Energy Outlook Egypt, IRENA, 2018

[24] Ibidem

environmental performance and innovative character) and contribution to the security of electricity supply can also be taken into account.

The indicative planning of auctions (which includes the frequency of auctions and their design in terms of technology and capacity), as well as its terms of reference (cahiers des charges) are determined by the government. The regulator is consulted on both the planning and terms of reference. The terms of reference of auctions are published in the Official Journal of the European Union and on CRE's website.

The competent authority for carrying out the auction is the regulator. A web platform, dedicated to the RES auctions, is set up by the regulator to allow the applicants to submit the required documents (https://cre.achatpublic.com/sdm/ent/gen/ent_recherche.do). The regulator examines the bids that are submitted within the deadline. It subsequently communicates a list of all the bids that comply with the auction conditions, a ranking of the bids and its recommendations with regard to the winning bids to the Minister of energy (the responsible government entity). On this basis, the Minister determines the winning bids. The Minister can also decide to cancel the auction if bids sufficient in number compared to the auction capacity are not procured.

At the time of preparing this manuscript, several auctions are ongoing. Some of these auctions are targeted at certain regions, notably France's island systems (non-interconnected zones). Other auctions focus on specific technologies – onshore wind projects, small hydropower installations, innovative solar installations, ground-based PV or roof-top PV plants. The list of all RES auctions can be found on CRE's website: http://www.cre.fr/documents/appels-d-offres

3.1.7. GREECE (Greek Regulatory Authority for Energy – RAE)

The support schemes applied in Greece include FIT, FIP, competitive auctions, investment grants, tax exemptions/incentives and Guarantees of Origin. It should be noted that, according to Greek Law 4399/2016, PV and wind power plants are not eligible for receiving investment aid in the form of investment grants, tax exemption and other incentives.

With regards to the FIT support scheme,

- all RES and high-efficiency cogeneration projects connected to the non-interconnected network of the Greek Islands receive support in the form of FIT,
- innovation projects installed by the Centre of Renewable Energy Sources and Saving (CRES), university foundations, research bodies and institutions as part of a wider programme and for as long as the programme lasts receive support in the form of FIT.

With regards to the FIP support scheme,

- biomass/biogas and other RES and high-efficiency cogeneration projects over 500kW receive support in the form of a sliding FIP and based on a reference price defined under Greek Law 4414/2016.

With regards to competitive auction schemes,

- the only technologies that are currently eligible for the competitive auction schemes are PVs and onshore wind farms.
  - PV projects with an installed capacity of less than 500kW receive support in the form of FIT for which the reference price can either be the one defined in Official Government Gazette no 1103/02.05.2013 and its relevant amendments or can be decided through

auctions. For PV projects installed by Energy Communities, the capacity threshold is 1MW.

- Onshore wind farms with an installed capacity of less than 3MW receive support in the form of FIT for which the reference price can either be the one defined in Ministerial Decision 25511/882 on 20.03.2019 or decided through auctions. For onshore wind projects installed by Energy Communities, the capacity threshold is 6MW.
- All other PV and onshore wind projects receive support in the form of a sliding-FIP for which the reference price is set through auctions.

- Two types of auctions are currently carried out in Greece; one refers to technology-neutral auctions that both PV and onshore wind projects can participate in and the other refers to technology-specific auctions that only either PV or onshore wind projects participate. The thresholds that apply per technology for the aforementioned types of auctions are given below:
  - Technology-neutral auctions: PV projects with an installed capacity of more than 20MW and onshore wind projects with an installed capacity of more than 50MW can participate.
  - Technology-specific auctions: PV projects with an installed capacity of up to 20MW and onshore wind projects with an installed capacity of up to 50MW can participate.

For the FIT, FIP and auction mechanisms, both the government and the Regulatory Authority are responsible pursuant to the relevant legislative provisions. For the Guarantees of Origin, the party in charge is the Greek Operator of RES and Guarantees of Origin (DAPEEP).

A descending-bid auction is used. The predominant characteristics of the bidding procedure are the following:

- a 40% rule of a minimum level of competition decided by the Greek regulator to ensure competition;
- all the applications are submitted electronically and the projects that pass successfully through phase A (administrative check) can participate in the bidding procedure (phase B) using the electronic platform, where the auctions take place;
- Letter of Guarantee of Participation and Letter of Guarantee of proper performance: A letter of guarantee at the level of 1% of the total investment cost per project (using typical project cost per technology) was mandated for all participants in order to ensure participation in the auction procedure. Additionally, following success in each category, each participant was obliged to cover a “4% guarantee of proper performance”. This implies that each participant must submit to the Greek Regulator an additional letter of guarantee, completing the sum of all the letters of guarantee submitted, to reach the amount defined by the 4% rule of the total investment cost for each project.
- the auction performed is a variation of the Yankee auction type. The basic “RULE” of this auction is that all the accepted bids are registered in the ascending order of the submitted price; the auction is carried out as follows:
  - Each participant submits his offer as a €/MWh figure, which refers exclusively to the total energy that will be generated by the RES plant participating in the competitive bidding process.

- During the electronic competitive bidding process, each participant can access information regarding the portion of capacity (in W) out of the total auctioned capacity that they have temporarily reserved, based on the last bidding offer submitted via the electronic auction platform. They can subsequently decide on improving the offer. This improvement can be undertaken by lowering the previously submitted €/MWh figure.
- The offer with the lowest €/MWh figure is preferred. The system temporarily reserves at that €/MWh price the amount of capacity corresponding to the installed capacity of the plant that the participant with the best offer enrolled in the auction. The system subsequently continues to the next best offer, reserving some of the remaining auctioned capacity following the same process; this continues until exhausting the unreserved auctioned capacity or until all the remaining RES plants have more installed capacity than the unreserved auctioned capacity.
- It should be noted that if the installed capacity of an offer is higher than the remaining auctioned capacity, then this offer is not reserved and the system proceeds to the next available submitted offer.
- In cases where two submitted offers propose the same €/MWh value, the one relating to the RES plant with the least installed capacity is considered to be the best offer.
- In cases where two submitted offers propose the same €/MWh value and the same installed capacity, then the best offer is the one that was submitted first on the electronic auction platform.
- At the end of the bidding process, based on a priority list of all the temporarily reserved best offers, the final winning participants are decided and their respective temporarily reserved offers become their final offers.

3.1.8. ITALY (Italian Regulatory Authority for Energy, Network and Environment – ARERA)

RES incentives schemes in Italy

In Italy, different incentive schemes have been followed over time for electricity RES power plants; these include economic price instruments such as the FIT (for the electricity injected into the grid) and the FIP (for the electricity produced), as well as obligations (such as the obligation for the installation of RES power plants in the case of construction of new buildings or significant interventions) and other instruments (such as tax exemptions, locally assigned non-repayable grants and various exemptions).

The following economic price instruments are available in Italy:

1. CIP 6/92: It defined different values of FITs for the energy injected into the grid by renewables or equivalent energy sources granted from 8 to 20 years, depending on the sources. It is no longer applicable to new projects.
2. FIPs that have replaced Green Certificates since 2016: It is applied to energy produced by power plants that have been supported by the Green Certificates mechanism, which is no longer in force for new projects. The premium, different for each source, is granted for 12 years for power plants that commenced operation between April 1999 and December 2007 and for 15 years for power plants that started operation after 1st January, 2008.

3. FIT referred to Law 244/2007: It is applied to energy injected into the grid by RES power plants, except for PV power plants with a capacity lower than 1MW (0.2MW for wind power plants) and in operation before 31st December 2012. Tariffs, different for each source, are granted for 15 years. It is no longer effective for new projects.
4. FIP for PV power plants: It is applied to energy produced by PV power plants in operation before 27th August 2012. Different values, depending on the power plant size, are granted for 20 years;
5. Incentives for PV power plants: As described below, they are applied for PV plants in operation between 27th August 2012 and 6th July 2013 and are granted for 20 years. In detail, they are applicable
   - in case of PV power plants with capacity up to 1MW: providing FIT for electric energy injected into the grid and FIP for self-consumption energy and
   - in case of PV power plants with capacity higher than 1MW: providing FIP, computed on an hourly basis as the difference between the total tariff and the zonal energy price, for electric energy injected into the grid and FIP for self-consumption energy.
6. Incentives, defined by the Ministerial Decree of 6th July 2012, for RES power plants except for PV power plants: They are applied as described below and are granted for different time periods, depending on the source (from 15 up to 25 years). In detail, they are applicable
   - in case of power plants with capacity up to 1 MW: FIT (different for each source) for electric energy injected into the grid;
   - in case of power plants with capacity over 1 MW: FIP (different for each source) for electric energy injected into the grid. The premium is calculated on an hourly basis as the difference between the total tariff, different for each source, and the hourly zonal energy price. Furthermore, the premium value is determined through descending bid auctions for the largest plant (capacity over 5 MW, augmented to 10 MW for hydro plants and to 20 MW for geothermal plants).

It is no longer effective for new projects.

7. Incentives, defined by the Ministerial Decree of 23rd June 2016, for RES power plants except for PV power plants: They are applied as described below and are granted for different time periods, depending on the source (from 15 to up to 25 years). In detail, it is applicable:
   - in case of power plants with capacity up to 500 kW: FIT (different for each source) for electric energy injected into the grid;
   - in case of plants with capacity over 500 kW: FIP (different for each source) for electric energy injected into the grid. The premium is calculated on an hourly basis as the difference between the total tariff, different for each source, and the hourly zonal energy price. Furthermore, the premium value is determined through descending bid auctions for the largest plant (capacity over 5 MW);
8. Incentives, defined by the Ministerial Decree of 4th July 2019, for RES power plants (wind, hydroelectric, waste gas treatment and PV power plants): They are applied as described below and are granted for different time periods, depending on the source (from 20 to up to 30 years). In detail, they are applicable:

- in case of power plants with capacity up to 250 kW: FIT (different for each source) for electric energy injected into the grid;
- in case of plants with capacity over 250 kW: FIP (different for each source) for electric energy injected into the grid. The premium is calculated on an hourly basis as the difference between the total tariff, different for each source, and the hourly zonal energy price. Furthermore, the premium value is determined through descending-bid auctions for the largest plant (capacity over 1 MW).

RES schemes of descending bid auctions: Cases from Italy

RES schemes of descending-bid auctions in Italy, as governed by the relevant ministerial decrees, provide that the Gestore dei Servizi Energetici S.p.A. (GSE, Italian public company under the Ministry of Economic Development's mandate that is tasked with assessing RES power plants' requirements and granting access to incentives mechanisms) manages the auction mechanisms in accordance with the provisions of the same ministerial decrees.

In particular, for incentives defined by the ministerial decree of July 4th 2019, GSE publishes notices related to the auctions and registration procedures according to seven deadlines (September 30th 2019, January 31st 2020, May 31st 2020, September 30th 2020, January 31st 2021, May 31st 2021 and September 30th 2021) and in the following ways:

- the period for submitting applications is 30 days starting from the date of publication of the notice;
- the ranking is formed and published on the GSE website within 90 days from the closing date of the calls.

The calls are organised into three groups:

- Group A:
  i. wind power plants
  ii. PV power plants
- Group B:
  iii. hydroelectric power plants
  iv. waste gas treatment power plants
- Group C: Power plants subject to total or partial renovation and that fall within the types referred to in Group A, entry i. and group B, entries i. and ii.

For each call and for each group, a maximum value of power is provided.

With reference to the methods of conducting the auctions, it is expected that

- the discount auction is carried out by means of percentage reduction offers on the reference tariff
- reduction offers of less than 2% of the auction base and those above 70% are excluded from the evaluation.

3.1.9. ISRAEL (Public Utility Authority: Electricity – PUA)

In Israel, the support schemes include FIT, competitive auctions and tax exemptions/incentives. Auctions that have been held so far concerned only PV technology. The Regulator is the competent authority.

In December 2012, the Israeli NRA approved a new net-metering regulation for RES systems with implementation starting in 2013. The net-metering system is capped to support a maximum of 400 MW capacity and replaces FIT schemes established in 2009.

Owning an RES system enables self-consumers to save their electricity retail tariff through self-consumption; however, they will be charged for the grid balancing cost estimated at NIS 0.015/kWh.

Generation surplus will be inserted into the grid and rewarded by credit, which will be reduced from the consumer's electricity bill at the end of the month (production surplus will be by consumption surplus). For the use of the grid by the consumer, a tariff charge for grid integration costs (e.g. NIS 0.013–0.014/KWh for high-voltage consumers) will be reduced from the value of credit to the consumer in accordance with the consumer's grid voltage line (high/low) and the time of grid-use. It will be possible to accumulate and transfer credit up to a maximum period of two years. The NRA also approved the possibility of selling credit surplus to the grid and other consumers.

3.1.10. JORDAN (Energy and Minerals Regulatory Commission – EMRC)

The support schemes in Jordan include investment grants, open window, tax exemptions and incentives, a direct proposal scheme, a wheeling scheme and a net-metering scheme.

In the direct proposal scheme, the investors can identify and develop renewable grid-connected electricity projects and propose these to MEMR. Developers are required to set a fixed tariff in their proposal before being approved. Additionally, the National Electric Power Company will purchase all electricity produced with RES and cover the cost of grid connection for developers. The law provides that the tariff which the project developer sets out in their proposal will be within an acceptable range according to the reference price list. The reference price list is prepared by Jordan's Electricity Regulatory Commission together with relevant bodies. It defines the mechanism for pricing electricity from RES.

The direct proposal scheme process holds the following characteristics:

- The tender process is not limited to only one renewable energy technology;
- The tender package includes all the necessary project agreements such as PPA, Grid Connection Agreement, Government Guarantee Agreement and the Lenders Direct Agreement.
- The tender is structured as a two-envelope process where technical compliance is established at first, followed by the opening of the financial proposal and the ranking of tariffs.
- The submitted tariffs by the developers should be lower than the ceiling reference price that is calculated based on the mechanism issued by the EMRC (the mechanism issued is based on Article 2 of the RE&EE Law 13/2012 and Article 4/C of the instructions of the reference pricelist record for the calculation of electrical energy purchase prices from RES).

3.1.11. LEBANON (Lebanese Center for Energy Conservation – LCEC)

In 2012, the first Expression of Interest (EOI) for procuring wind farms in Lebanon was published by the Ministry of Energy and Water. The Request for Proposal (RfP) was published in March 2013 and descending-bid auctions were used. The results were based on qualification (technical qualifications before the financial evaluation), scoring and lowest price of the qualified bidders and followed by a negotiation phase. Three projects were selected with proposed capacities of 62.1MW, 62.1MW and 82.5MW for a 20-year PPA. The first PPA was signed on 1st February 2018. The Council of Ministers is the competent authority for signing the PPA with the private sector.

The first PPA with three winning companies (Hawa Akkar, Lebanon Wind Power and Sustainable Akkar) on three sites signed on the 1st of February 2018 with USD 10.45 cents/kWh for the first three years and USD 9.6 cents/kWh for the next 17 years.

The proposed capacities are 62.1 MW, 62.1 MW and 82.5 MW. The conditions are cited below:

- 20-year PPA
- Land acquisition
- Environmental impact assessment
- Interconnection on high voltage networks according to EDL requirements

The second round of wind bids tackles the implementation of 200 to 400 MW. The submission of EOIs has been completed. 42 EOIs were submitted from 21 different countries, including Lebanon, UAE, China, Denmark, France, Spain, Italy and UK. The Italian company that expressed interest in this bid is “Building Energy”.

The RfP was launched at the International Beirut Energy Forum (IBEF 2019) on the 27th of September at le Royal Hotel-Dbayeh. The capacity has been increased to 500 MW and the construction is expected in 2021–2025.

In 2017, the Ministry of Energy and Water launched the first round of large-scale solar PV to build between 120 and 180 MW of solar PV farms by the private sector based on PPAs with the national electric utility EDL. The deadline for submitting the RfP related to the construction of 12 solar PV farms in different districts of Lebanon, each with a capacity ranging between 10 MWp and 15 MWp, was 17th August 2017. The solar farms are to be built by the private sector using PPA and based on permits from the Council of Ministers. The lowest price, as announced by the Minister of Energy and Water during IBEF (2019) in September 2019, is USD 5.7 cents/kWh in the Bekaa region. All other winning bidders in the different Lebanese regions have to comply with this price.

Several solar PV projects based on the same scheme are under development. These solar PV projects provide a storage of 210–300 MW and the deadline for the EOI was 12th July 2018. The systems possess battery energy storage of a minimum of 70 MW power and a minimum of 70 MWh of storage capacity per site. Hydro energy is also counted in the future plans. The first round deadline for EOIs for hydro projects of 300 MW was 20th June 2018, and the RFP is expected to be launched soon.

3.1.12. PALESTINE (Palestinian Electricity Regulatory Council – PERC)

An FIT support scheme is effective in Palestine, which is financed through the national budget. The Regulator is responsible for studying the licences granted and monitoring the projects after their implementation.

3.1.13. PORTUGAL (Energy Services Regulatory Authority – ERSE)

The Portuguese RES electricity support scheme is based on FITs that are differentiated by technology. The values of FIT per technologies were determined primarily through parameters defined in legislation. The relevant legislation for the remuneration of RES producers with FIT and the parameters required for its calculation have changed several times in Portugal. Moreover, the value of FIT earned by each producer in a specific year depends on other factors such as the generation profile and the update with the consumer's price index. For onshore wind, some tenders of grid connection capacity have been made since 2009, whose values of FIT arose from the best offers of the participants in those tenders.

In July 2019, the government organised an auction exclusive for solar photovoltaic installations. The auction was designed to be a multi-unit, single-product auction; the product was grid injection capacity since it was deemed the predominant bottleneck that explained the low penetration of solar power in Portugal, a region with highly favourable conditions for solar power.[25] 24 units were up for auction, and each unit gave the winner one or more injection points to the grid with a given capacity. The total volume of the auction was 1400 MW (of which 1150 MW were assigned). The auction model was an ascending clock model with several rounds and pay-as-bid price. It used a purpose-built IT platform to which participants who had passed the administrative prerequisites were granted access.

Two possible remuneration schemes were in place – a guaranteed remuneration scheme and a general remuneration scheme. The participants input a pair of price/quantity for a given unit. Although the quantity was always expressed in MW, the price was different depending on the remuneration scheme. In the general remuneration scheme, the price is a compensation in euros paid by producers to the National Electric System. These different price inputs were converted to a common unit called NPV (Net Present Value, stated in terms of EUR/MW), which had been defined and announced before the auction to ensure transparency. The winner of each auction was the party that offered the best price, measured in EUR/MW according to the NPV. The results of the auction led to an average FIT set at 20,33 €/MWh and to an average of 21,35 €/MWh in case producers have to pay to the National Electric System.

3.1.14. SLOVENIA (Energy Agency of the Republic of Slovenia – AGEN-RS)

In Slovenia, FIT and FIP support schemes were active until September 2014. Since December 2016, public calls (tenders) are in place. Bids for RES and CHP projects are invited by publishing a tender and accepting formal offers to set the amount of assets offered. FIT/FIP is still active for plants that were connected to the grid until September 2014; however, newer ones must attend public calls. The authority in charge is the Regulator.

The support schemes are financed by non-tax levies paid by customers via their electricity bill. Contributions by final customers vary depending on the power and voltage levels of the entry-

[25] Portuguese Solar PV auction (ppt), Pöyry, 2019

exit point, category of the client and purpose of the consumption of energy and are calculated per kW power of the end-client account on a monthly basis.

Since 2016, pursuant to Article 373 of the Energy Act, the Energy Agency publishes public calls for proposals for generation plants for the production of electricity from RES and CHP, where potential producers of electricity place competitive bids in an open or closed format and the assets reach the best bidder (according to the auction conditions). At the public calls, a certain annual amount of financial assets is offered for support purposes, whereby the offered price of the electricity for participants should not exceed the price cap set (which is adjusted by the results after every call). The assets go to several participants with the lowest offered prices of electricity (divided into different kinds of technologies) up to the use of offered funds and taking into account all the other tendering conditions.

In the last call, June 2019, the total amount of funds available under the call for proposals was €10,000,000.00, intended for investors to provide support for electricity that will be produced annually in RES and CHP generating plants from the selected projects. The resources available will be distributed as part of a two-round competition procedure. The deadline for submission of applications expired on 30th August 2019.

3.1.15. TURKEY (Energy Market Regulatory Authority – EMRA)

In Turkey, FITs are used for wind, solar, geothermal, biomass and hydroelectric power plants whose reservoir area is under 15 km. FITs are applicable for 10 years after the initial commissioning of the power plant. An additional local content tariff is also applied for five years for the locally manufactured equipment in the plant.

Competitive auctions are also utilised for capacity allocation for wind and solar energy projects. For biomass/biogas and geothermal projects, a first-come, first-served system is under effect. For hydroelectric power plants, auctions are conducted by the general directorate of state hydraulic works for appropriate water usage and not for capacity. An RE-zone tender (YEKA in Turkish) is another capacity procurement mechanism for which the Ministry of Energy and Natural Resources is responsible. For YEKA projects, all the technologies are allowed to be tendered; however, only technology-specific auctions (i.e. wind and solar) have been conducted so far.

In 2015, solar PV auctions were based on the highest contribution margin price per MW through the capacity approach. In 2017, wind auctions were based on reduction from FIT and negative bids were allowed as well. YEKA tenders follow reduction from a predetermined ceiling price as sealed-bid type; an open session is then held for further reduction of the auction price by the participation of five minimum price offers. Special IT tools for auctions have not been developed yet.

For licensed projects, the EMRA is responsible for receiving the pre-license applications and the pre-evaluation of these applications. The projects that pass the pre-evaluation phase (both in terms of technical and financial eligibility) are sent to the Turkish TSO (TEIAS) for auctions. For YEKA projects, the EMRA holds no responsibility in the application and tendering sessions; it only carries out the licensing operations after the tender is completed.

For auctions conducted by TEIAS for wind and solar, the lowest FIT price is initially bid (in US cents/kWh) by starting from the FIT price currently applied. The lowest bid wins the capacity and no base price is specified. For YEKA tenders, the bidding starts with the lowest price as the ceiling price, which is determined and announced prior to the tenders. After sealed bids are collected, an open session follows with the participation of five minimum bids and the lowest of them wins the tender.

4. Results and SWOT analysis

4.1. Summary of Responses and Results

Overview of support schemes: What kind of policies do you use?
Of the fifteen countries that answered the questionnaire, with the exception of Algeria, Jordan and Lebanon, all use Feed-in Tariff (FIT) support schemes. In Croatia, FIT is the only support scheme enforced. In Albania and Portugal, the RES electricity support scheme is based on FITs that are differentiated by technology and installed capacity. Croatia mentioned that the data described in the questionnaire pertains to the old FIT schemes that are no longer attainable and are active only for already signed contracts. Two new schemes, “new” FIT and FIP, are scheduled to become active soon. In France, for RES electricity, the support mechanism varies according to the size of the installation. Smaller installations will typically receive an FIT, whereas installations above a certain capacity threshold (usually 500 kW) will receive an FIP. Moreover, smaller installations can apply for support through open-window procedures whereas larger installations are selected through auctions. Thirteen countries reported that competitive auction schemes are or were used at some point. In Albania, competitive auctions were first used in 2018; 50MW capacity was auctioned for a PV power plant at the auction price of 59.9€/MWh. In Algeria, competitive auctions are the only effective support scheme; the first round of auctions, launched in 2018, are still ongoing. In Cyprus, competitive auctions were performed only in 2013; these were for the licencing of 50MW of PV power plants. In France, competitive auctions are performed for PV, on-shore wind, biomass and hydro installations. In Greece, since December 2016, nine successful auctions were performed for PV and on-shore wind technologies. PV and on-shore wind projects with an installed capacity of up to 500kW and 3MW respectively can choose whether they want to take part in technology-specific auctions or not. Additionally, one successful technology-neutral auction was held in April 2019 for PV and on-shore wind projects with an installed capacity larger than 20MW and 50MW respectively.[26] In Italy, competitive auctions were performed from 2013 to 2018 for on-shore and off-shore wind, biomass/biogas and geothermal projects.

[26] There are two more auctions scheduled for 12th December 2019 where PV projects of installed capacity up to 20MW and on-shore wind installations up to 50MW can participate.

Five competitive auctions have been performed in Israel since 2017; however, these have only been for PV technology.

In Slovenia, competitive auctions haven't been performed since 2016 for PV, on-shore wind and biomass/biogas projects.

In Turkey, competitive auctions are utilised for capacity allocation for wind and solar energy projects since 2015.

Eight countries reported that they use tax exemptions or incentive policies.

In Cyprus, a) a grant of €250 per installed kW (with maximum grant amount €1000) is awarded for the installation of small PV systems; b) a grant of €900 per installed kW (with maximum grand amount €3600) is awarded for the installation of small PV systems for vulnerable consumers (families with low income, persons with disability etc); c) a grant of 35% of the eligible costs of each ceiling thermal insulation (with maximum grant amount €18500 for each home); d) for the combination of ceiling thermal insulation and PV systems, a grant of 35% of the eligible costs of each ceiling thermal insulation (with maximum grand amount €1800 for each home) and a grant of €300 per installed kW (with maximum grand amount €1200) are awarded for the installation of small PV systems installed after 1st November 2018.

France predominantly uses tax incentives for the support of renewable heat and biofuels.

In Greece, PV and wind power plants are not legally eligible for receiving investment aid in the form of investment grants, tax exemption and other incentives.

In Italy, tax exemptions are expected only for PV power plants; this exemption, in particular, includes a fiscal subtraction equal to 50% of the costs incurred and is eligible for costs up to € 96,000.

In Turkey, a 50% discount on the transmission system utilisation fee during the first five years of operation, waiver of the license fee for eight years from the date of completion of the plant and stamp duty exemption during the construction period are available.

Other support schemes include net-metering (Cyprus, Egypt, Greece, Jordan and Lebanon), net-billing (Cyprus), green loans (Lebanon), independent producers/self-generation (Cyprus, Egypt), direct proposal (Jordan), wheeling (Jordan) and guarantees of origin (France, Greece).

Jordan reported that they have in place a direct proposal scheme where investors can identify and develop renewable grid-connected electricity projects and propose them to the Ministry of Energy and Mineral Resources. Direct proposals can be classified as a type of auction since the Ministry announces the area to be auctioned and bidders make direct proposals after taking into account the tariff range approved by the Regulator.

	Feed-in tariff (FIT)	Feed-in premium (FIP)	Tradeable Green Certificates (TGC)	Competitive auction schemes	Investment grants	Open window	Tax exemptions/ incentives	Other
Albania								
Algeria								
Croatia								
Cyprus								
Egypt								
France								
Greece								
Israel								
Italy								
Jordan[27]								
Lebanon								
Palestine								
Portugal								
Slovenia								
Turkey								

Table 2 Overview of support schemes

Overview of support schemes: How are the support schemes financed?

Slightly more than half of the countries that answered the questionnaire (53%) reported that support schemes are financed through non-tax levies paid by consumers via their electricity bills. This includes Albania, Croatia, Cyprus, Egypt, Italy, Portugal, Slovenia and Turkey. Only France and Portugal use taxation paid by all citizens. The remaining countries use other kinds of finance.

In Algeria, a fund dedicated to renewable energy will composite the difference between the price of the conventional and renewable KWh of electricity.

In France, since January 2016, support for RES falls under the general state budget and is financed through a dedicated purpose fund; the provisioning of this fund is annually decided by the Parliament through a Finance Law. Currently, the fund is financed from the proceeds of internal taxes on fossil fuels, which are collected from fuel suppliers.

In Greece, RES operators receive monthly payments for their RES electricity production from the Operator of RES and Guarantees of Origin (DAPEEP S.A.). These payments originate from the RES and CHP Special Account established by the provisions included in

[27] Direct proposal scheme

Article 40 of Law 2773/1999 and amended by the provisions of Article 143 of Law 4001/2011. The Special Account is managed by DAPEEP S.A.

The difference between the electricity price in the wholesale market and the RES tariff is covered mainly through a special levy – the Special Fee for the Reduction of Greenhouse Gases Emissions, ETMEAR – charged to the final electrical energy consumers and collected through electricity bills. Since the beginning of 2016, a new RES support scheme has been established. Given that the purpose of the new support scheme is the promotion of the actual participation of RES and HECHP producers in the market, changes were also introduced in the structure of the Special Account. Particularly, according to the provisions of Law 4414/2016, the RES and CHP Special Account of Article 40 of Law 2773/1999 is split into the following: a) the RES & CHP Special Account of Interconnected System and Network (Special Account I) and b) the RES & CHP Special Account of Non-Interconnected Islands (Special Account II). The Special Account I is further divided into two sub-accounts: a) the Electricity Market sub-account and b) the Operation Aid sub-account. The Special Account I's inflows are defined as Electricity Market Revenues and Operation Aid Revenues.

In Israel, the support schemes are financed through the electricity tariff.

Most RES projects in Jordan are owned by private companies. The government projects are funded by grants.

The financing mechanisms in Lebanon (NEEREA through the Central Bank of Lebanon) are PPAs for large scale projects and public initiatives for turnkey projects.

In Palestine, the FIT support scheme is financed through the national budget.

In Portugal, a part of the overall RES' costs is supported by the state budget through a part of the revenues from ETS and special levies such as CESE.

	Taxation paid by all citizens	Non-tax levies paid by customers via the electricity bill	Other
Albania			
Algeria			
Croatia			
Cyprus			
Egypt			
France			
Greece			
Israel			
Italy			
Jordan			
Lebanon			
Palestine			
Portugal			
Slovenia			
Turkey			

Table 3 Support schemes finance

Overview of RES Auction Technologies (year and capacity auctioned)

The countries which responded stated that they use competitive auctions for different kinds of technologies; the most dominant one was PV installations, followed by onshore wind installations.

In Albania, competitive auctions were used for the first time in 2018. A 50MW capacity for PV technology was auctioned at the price of 59.9 Eur/MWh. The auctions were performed by the Ministry of Infrastructure and Energy. The Regulator played no role in the process.

In Cyprus, in January 2013, an auction procurement was conducted for the licencing of 50MW for PV power plants. Four separate auctions were held: for projects up to 1.5MW, up to 3MW, up to 5MW and up to 10MW. 16 projects of up to 1.5MW were awarded at a price range of 0.0943–0.0990€/KWh. Five projects of up to 3MW were awarded at a price range 0.0781–0.0898€/KWh. Two projects of up to 5MW were awarded at a price range 0.0815–0.0851€/KWh. One project of up to 10MW was awarded a price of 0.0741€/KWh but was not implemented. There are no RES auction schemes active currently. Depending on the achievement of the RES-E target 2020 and the performance in the future, the government might consider implementing RES auction schemes.

In France, competitive auctions are performed for PV, on-shore wind, biomass and hydro installations. With respect to the more recent PV auctions that have been carried out since 2016 ("CRE4" generation), the average levelised cost of energy (LCOE) ranged from 62 to 99 €/MWh for a 20-year support duration:

- 62–77 €/MWh for ground-based installations;
- 85–93 €/MWh for roof-top installations;
- 93–99 €/MWh for installations on parking shelters.

In Greece, the only technologies that are currently eligible for participating in the competitive auction schemes are PV systems and on-shore wind farms. There are two types of auctions currently carried out in Greece; one refers to technology-neutral auctions that both PV systems and on-shore wind projects can participate in and the other to technology-specific auctions where only PV systems or on-shore wind projects take part.

	PV (Category I) $P_{PV} \leq 1MW$	PV (Category II) $1MW < P_{PV} \leq 20MW$	Onshore wind (Category III) $3MW < P_{PV} \leq 20MW$	PV & Onshore Wind (Category IV) $P_{PV} > 20MW$ / $P_{wind} > 50MW$
Dec 2016**	98.78€/MWh	83.30€/MWh	N/A	N/A
July 2018	78.42€/MWh	63.81€/MWh	69.53€/MWh	N/A
Dec 2018	66.66€/MWh	70.39€/MWh (cancelled)	58.58€/MWh	N/A
Apr 2019***	N/A	N/A	N/A	57.03€/MWh

	PV (Category I) $P_{PV} \leq 1MW$	PV (Category II) $1MW < P_{PV} \leq 20MW$	Onshore wind (Category III) $3MW < P_{wind} \leq 50MW$	PV & Onshore Wind *** (Category IV) $P_{PV} > 20MW$ / $P_{wind} > 50MW$
Dec 2016**	4.8MW	35.2MW	N/A	N/A
July 2018	53.52MW	53.40MW	176.39MW	N/A
Dec 2018	61.95MW	86.47MW (cancelled)	160.94MW	N/A
Apr 2019***	N/A	N/A	N/A	437.78MW

**Technology specific pilot auction (only for PVs)

***First technology-neutral RES auction in Greece

In Slovenia, public calls (tenders) have been effective since December 2016. Bids for RES and CHP projects are invited by publishing a tender and accepting formal offers to set the amount of assets offered.

In Turkey, competitive auctions are utilised only for wind and solar energy projects. In 2017, two tenders were issued for PV and on-shore wind projects for 1000MW each.

	PV	Wind on shore	Wind offshore	Biomass	Other
Albania	**2018** (50MW)				
Algeria	(150MW)	no value			
Croatia					
Cyprus	**2013** (40MW)				
Egypt	no values	no values			
France	**2017** (1575MW) **2018** (1902MW)	**2018** (626MW)		**2018** (53MW)	**Hydro** **2016** (27MW) **2018** (30MW)
Greece	**2016** (40MW) **2018** (169MW)	**2018** (337MW)			**Neutral technology** (PV & wind) **2019** (438MW)
	2019, 2020	**2019, 2020**			
Israel	**2017** (355MW) **2019** (700MW)				
Italy		**2013** (400MW) **2014** (356MW) **2016** (800MW)	**2016** (30MW)	**2013** (34MW) **2014** (18MW) **2016** (20MW)	**Geothermal** **2016** (20MW)
Jordan	**2015** (200MW) **2018** (250MW)	**2015** (117MW) **2016** (80MW) **2018** (170MW)			
Lebanon	**2019** (180MW)	**2018** (226MW)			**Hydro**

	PV with battery energy storage				
Palestine					
Portugal	**2019** (1400MW)				
Slovenia	**2016** (3.7MW) **2017** (3.1MW) **2018** (16MW)	**2016** (25MW) **2017** (81MW) **2018** (109MW)		**2016** (2.2MW) **2017** (0.4MW) **2018** (1.4MW)	
Turkey	**2015** (600MW) **2017** (1000MW)	**2017** (4000MW) **2019** (1000MW)			**Geothermal**

Implemented	No plans so far	Future plans

Table 4 Overview of RES Auction Technologies (Year and capacity auctioned)

Overview of the weighted average price per MWh and per technology: Cases from latest auction in each country
The countries answering the questionnaire stated that they use competitive auctions for different kinds of technologies and that they have secured different levels of prices per technology. The next table presents the Weighted Average Price per MWh and per technology from the latest auctions in each country. The available data indicates that the lowest price for PV was secured by Portugal in the auction held in 2019, the lowest price for onshore wind was secured by Greece in the 2018 auction and the lowest price for biomass was secured by Italy during the 2016 auction.

	PV	Wind on shore	Wind offshore	Biomass	Other
Albania	**2018** (59,9€/MWh)				
Algeria	no value	no value			
Croatia					
Cyprus	**2013** (93€/MWh)				
Egypt	no value	no value			
France	**2017** (62-77 €/MWh for ground-based installations 85-93€/MWh for roof-top installations 93-99€/MWh for installations on parking shelters)	**2018** (65,4€/MWh)		**2018** (122,5€/MWh)	**Hydro** **2018** (89,9€/MWh)
Greece	**2018** (66,66€/MWh) for Ppv≤1MW **2018** (63,81€/MWh) 1MW<Ppv≤20MW	**2018** (58,58€/MWh)			**Neutral technology** (PV & wind) **2019** (57,03€/MWh)
Israel	**2019** (47,5€/MWh)				
Italy		**2016** (66€/MWh)	**2016** (161,7€/MWh)	**2016** (112,87€/MWh)	**Geothermal** **2016** (82,32€/MWh)
Jordan	**2018** (….€/MWh)	**2018** (…€/MWh)			
Lebanon	**2019** (51,22€/MWh)	**2018** (84.14€/MWh for the first 3 years and then 77.30€/MWh for the			

		remaining 17 years)[28]			
Palestine					
Portugal	**2019** (20,33€/MWh				
Slovenia	**2018** (67,4€/MWh)	**2018** (63,7€/MWh)		**2018** (147,17€/MWh)	
Turkey	**2017** (63,5€/MWh)	**2019** (….€/MWh)			

Implemented	No action	

Table 5 Overview of the weighted average price per MWh and per technology resulting from the latest auction in each country

[28] Corresponds to 10.45 UScents/kWh for the first three years and 9.6 UScents/kWh for the remaining 17 years. The rate of conversion used is USD to euro as of 1st February 2018 (1 Euro=1.24190 USD)

Competent authorities

Algeria, Egypt, France, Greece, Israel, Jordan, Slovenia and Turkey responded that the Regulator is one of the competent authorities for the auctions performed in their countries. The rest of the Regulatory Authorities noted that the competent authority is a Ministry, with the exception of Lebanon, where the competent authority is the Council of Ministers. In Albania, Italy and Lebanon, the Regulator does not play any role in the procedure; in Algeria and Cyprus, however, the Regulator provides its guidance.

	Competent Authority	Comments
Albania	Ministry of Infrastructure and Energy	The Regulator does not play any role in the procedure
Algeria	Ministry of Energy or Regulator	For small capacities of up to 20GWh per year, the Regulator is the competent authority. For capacities beyond 20GWh per year, the energy Ministry is in charge. In the second case, the Regulator provides an opinion on the price of the lowest tender to define whether it is acceptable.
Croatia	Not applicable	
Cyprus	Ministry of Energy, Commerce and Industry	The Regulator informally provided its guidance
Egypt	Government and Regulator	
France	Regulator	The Regulator provides its guidance for the planning of the auctions and is the competent authority for carrying out the auction
Greece	Government and Regulator	
Israel	Regulator	
Italy	Ministry of Economic Development	The Regulator does not play any role in the procedure
Jordan	Government and Regulator	
Lebanon	Council of Ministers	The council of Ministers is currently the competent authority that signs the PPA with the private sector
Palestine	Not applicable	
Portugal	Government	
Slovenia	Regulator	
Turkey	Ministry of Energy and Natural Resources, TSO and Regulator	For Licensed Projects: EMRA (NRA) is responsible for receiving the pre-license applications and making the pre-evaluation of these applications. The projects passing the pre-evaluation phase (both in terms of technical and financial eligibility) are sent to TEIAS (TSO) for conducting auctions. For YEKA (Gov.) projects: EMRA holds no responsibility in the application and tendering sessions; it only carries out the licensing operations after the tender is completed.

Table 6 Competent authorities

Overview RES Auction Technologies (Type, tool, safety value)

Four of the countries utilising competitive auctions indicated the descending-bid auction as the preferred type. Descending-bid auction refers to an auction in which the auctioneer starts with a high asking price and lowers it until some participant accepts the price or it reaches a predetermined reserve price. Algeria reported that alignment to the lowest price proposed via sealed-bid auction is used. France indicated pay-as-bid as the preferred type while Israel stated that both first-price sealed bid auction and second-price sealed bid auction are used. Slovenia reported that potential producers of electricity place competitive bids in an open or closed format and the assets go to the best bidder. Turkey answered that PV and wind auctions were based on competitive auctioning (PV auctions were based on the highest contribution margin price per MW owns the capacity approach and Wind auctions were based on reduction from FIT; negative bids were allowed as well). RE-zone tenders (YEKA in Turkish) were performed by reduction from a predetermined ceiling price as the sealed-bid type, followed by an open session for further reduction of the auction price with the participation of five minimum price offers.

Six countries – Cyprus, Egypt, France, Greece, Portugal and Israel – developed an electronic platform for conducting the auctions with Cyprus indicating that the special IT platform was developed solely for conducting the 2013 auction scheme.

Regarding the setting of a safety net value, the countries were divided. Algeria reported that the competent authority sets a ceiling price beyond which tenders are rejected. This price also helps in avoiding an unsuccessful auction in case only one offer is proposed. In this case, the capacity for the unique bidder is allowed only if the price is below the price cap. In Cyprus, safety nets were not announced prior to the tender and were intended to serve as an exclusion criterion for any project bidding at a lower price. Although the final prices were significantly below the safety net, the competent authority decided not to exclude the winning projects because the vast majority of the bids fell below that limit. In Turkish YEKA tenders, bids should at least be zero; no negative bids are allowed. For PV and biomass auctions in France, maximum and minimum values are set, beyond which bids are excluded. For on-shore wind, no minimum value was available and only a maximum value was set. The values, furthermore, are different depending on the technology. In Greece and Israel, the competent authority sets a maximum allowable bidding price that is different per bidding category. In Slovenia, participants' bids should not exceed the price cap set (which is adjusted based on the results after every call).

	Type of auction used	Special IT tool	Safety net value
Albania	N/A	N/A	N/A
Algeria	Sealed-bid auction Alignment to the lowest price	No	Yes
Croatia	N/A	N/A	N/A
Cyprus	Descending-bid auction	Electronic platform	Yes
Egypt	No information	Electronic platform	No
France	Pay-as-bid	Electronic platform	Yes
Greece	Descending-bid auction	Electronic platform	No
Israel	First-price sealed bid auction Second-price sealed bid auction	Electronic platform	Yes
Italy	Descending-bid auction	No	No
Jordan	Direct proposal scheme	No	No
Lebanon	Descending bid auction	No	No
Palestine	N/A	N/A	N/A
Portugal	Ascending clock model with several rounds and pay-as-bid price	Electronic platform	Yes
Slovenia	Lowest offered price of electricity up to the use of the offered funds	No	Yes
Turkey	Several types (e.g. reduction from a predetermined ceiling price as the sealed-bid type followed by an open session for further reduction of the auction price by the participation of five minimum price offers)	No	No

Table 7 Overview RES Auction Technologies (Type, tool, safety value)

Overview RES Auction Technologies (terms and conditions)

The most common requirements set by the competent authorities concerning the bidders are legal requirements and the guarantee from the bank or credit institution. In both categories, 80% of the countries utilising competitive auctions set the above-mentioned conditions. The proof of financial adequacy is followed by 70% and technological and professional requirements by 60%. Both location constrains and grid access permit are set by 50% of the countries. Past experience is set only by 30% of the countries (Algeria, Egypt and Lebanon). Lebanon stated that the Environmental Impact Assessment and France stated that the pre-qualification materials vary from one auction to the other (according to the technology and size of the installations) but typically include the administrative identification of the bidder, commitments or proof regarding the certification of the equipment, financial resources and grid connection, business plans, environmental permits etc.

Cyprus further explained that location constraints refer to the following:

- legal evidence to permit the use of the site for a period of 20 years or more,
- each installation must be at least 1Km away from adjacent photovoltaic parks, unless all of them have a total installed capacity of less than 10MW,
- the proposed site should be easily accessible and distance should not be a limiting factor for connection purposes with the electricity grid,
- the location should be selected in accordance with the Ministry of Interior's spatial policy,
- it is forbidden to implement facilities on a designated coastline and any nature protection area unless the proposal is accompanied by a relevant permit.

	Legal Requirements	Proof of financial adequacy	Past experience	Technological & professional requirements	Location constraints	Guarantee from a bank or credit institution	Grid access permit	Other	Same terms apply for all eligible technologies?
Albania	No available information								
Algeria									No
Croatia	Not applicable								
Cyprus									N/A
Egypt									
France									No
Greece									Yes
Israel									No
Italy									Yes
Jordan									Yes
Lebanon									Yes
Palestine	Not applicable								
Portugal					Predefined location				N/A
Slovenia									
Turkey									No

Table 8 Overview RES Auction Technologies (terms and conditions)

4.2. SWOT Analysis

The use of auctions entails several new implications that often policymakers have not had to deal with before: ensuring sufficient competition for a well-functioning price formation, avoiding undesired strategic incentives, collusion and other market distortions and, importantly, dealing with the risk of low realisation rates, e.g. caused by underbidding or the existence of non-cost barriers. Often, the specific design solutions for these issues are highly context-specific and solutions effective in one market are not necessarily applicable in another. Additionally, different design elements might mitigate some issues but affect other factors; e.g. pre-qualification rules and penalties can increase realisation rates but can also increase the risk and, subsequently, the costs for bidders. Additionally, policymakers often pursue other policy goals (secondary objectives) with energy support policy; e.g. increasing the security of supply or encouraging actor diversity. Striking a balance between encouraging different policy goals without compromising on well-functioning price formation is a challenging task.

Prior to an auction is implemented to promote RES-E investments, governments must consider whether it is an appropriate mechanism by taking into account their energy policy priorities. The market should analysed, including considering potential bidders, potential barriers to RES-E deployment, the situation of the supply chain, grid infrastructures, and so forth. Specific design elements can subsequently be selected, and there is no one solution that fits all because of the presence of highly context-specific factors.

Auctions have gained popularity in different contexts, owing to their flexibility of design, the increased certainty they lend to prices and quantities, the degree of commitment and transparency they create, and most importantly, their potential for real price discovery. However, there are several associated risks with fierce competition in the market and they also face several challenges.

Strengths

Cost efficiency due to price competition

The predominant strength of auctions is the increased cost efficiency resulting from direct competition between market participants. Well-designed auctions can provide real-world prices for RES-E and can aid in avoiding windfall profits or underfinanced projects that are not realised. Project developers possess more information on expected costs than the government. If project developers determine the level of RES support in their bids, the information asymmetry is decreased. This is especially important because the economies of RES technologies are still developing at a fast pace and, therefore, the level of support required is decreasing.

A healthy auction is effective at reducing costs because it not only initiates competition between the interested investors and allows for more flexibility under the market rules but also evokes the honesty of the investors regarding the actual costs of the specific RES technology. Competitiveness among investors lowers the costs of the RES technology and, consequently, also decreases the energy prices.

Investors' security linked to long term PPAs

Using standardised PPAs with conditions known in advance to bidders can help limit risks and uncertainties. A PPA is signed with the awarded bidder and provides the renewable generators with a fixed price for a certain number of years and a guaranteed purchase for all the generation, which can be used as the basis for financing the project.

A well-designed auction results in a contract between the project developer and the regulator. This provides transparency and states the commitment and liabilities of each party. The contract offers a secure investment environment for further project development and increases the commitment to build the project and limits investment risk.

Useful for volume and budget control

Unlike other support instruments, auctions have an in-built feature for providing volume and budget control. This is positive both in terms of controlling the overall costs of policy costs and in facilitating grid integration of RES-E generation.

There are three predominant ways to set the volume auctioned: capacity, generation and budget. With regards to the electricity generation targets, bids are awarded per kWh or MWh and there is a goal of a total amount of MWh. Concerning capacity targets, a total quantity in terms of MW is auctioned. With respect to budget targets, there is an overall amount of support that should be provided.

Max ceiling prices

Maximum ceiling price refers to the maximum price in an auction and bids above which are disqualified. In multi-technology auctions and uncertain competitive situations, ceiling prices can help to differentiate between bidder groups and orient stronger bidders towards the ceiling price instead of weaker bids; this is beneficial for competition. If fewer bids are offered than the auctioned volume, ceiling prices can save the auction by providing an objective award price. They also put a cap on the total support costs and thus increase budget certainty for years in advance.

Thus, if there is sufficient competition in the auction (a pre-condition for successful auctions), the potential distortion introduced by the ceiling price should be compensated because bidders still have the incentive to place competitive bids. Thus, ceiling prices can do more good than harm.[29]

Flexibility of design

Another strength of RES-E auctions is the flexibility of design, which makes it possible to combine and tailor different elements to meet deployment and development objectives and cater to a country's economic situation, the structure of its energy sector, the maturity of its power market and its level of renewable energy deployment.[30]

<u>Opportunities</u>

Potential for real price discovery in auctions

The potential of auctions to achieve low prices has been a major motivation for their adoption worldwide. The falling cost of technology has led policymakers across the world to consider

[29] Auctions for Renewable Energy Support – Taming the Beast of Competitive Bidding, Final Report of the AURES Project Report D9.2, December, 2017, p. 16

[30] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 17

auctions as a way of determining the market price of renewables in their specific context and avoiding windfall profits for developers. It seems that competition in the market that is created by an effectively designed auction can reduce the price of renewable energy projects more efficiently than other support mechanisms.[31]

Establishment of cost-based FIT levels for certain RES technologies

Moreover, auctions can play an integral role in guiding the evolution of the price trends since the results from past auctions tend to set expectations for future results within a given country and also globally. Winning prices resulting from healthy competitive bidding can be used for establishing cost-based FIT levels for certain RES technologies.

Development of different RES technologies

Both with technology-oriented auctions as well as technology-neutral auctions, there is an opportunity for developing different types of RES technologies. Especially with technology-oriented options, the government can promote certain types of RES.

<u>Weaknesses</u>

Auctions lead to higher market concentration and penalise small bidders

Auctions can lead to higher market concentration and penalise small bidders. Auctions are usually cost-based, i.e. those bidders who can offer the lowest bids are awarded. Low costs can be offered especially by large and established companies, making use of economies of scale or a vertically integrated value chain. In the long run, when these bidders are frequently successful, smaller entities may be pushed out of the market.[32]

Long, expensive and cumbersome administrative procedures

Administrative procedures such as pre-qualification requirements and penalties are standard measures to ensure the sincerity of bidders and that winning projects are built. However, if they are set too stringently, they may discourage actors; increasing the costs of participation leads to lower levels of competition and higher bid prices and policy costs.

Furthermore, auctions contain relative high transaction cost, for both the project developer – who has to take part in costly administrative procedures before the auction takes place – and the auctioneer, who has to setup the design and monitoring of the mechanisms and handle the evaluation and comparison of various bids. Ideally, a continuous improvement process is also foreseen that leads to improved efficiency in auction execution and target achievement. High transaction cost can become a barrier to entering the market, particularly for small players. This may reduce competition and bears the risk of a few, dominant players controlling the market and auctions bids. Eventually, it can lead to higher-than-necessary price levels and prevent cost-efficiency targets. The extent to which each of the strengths and weaknesses affects the outcome of auctions significantly depends on the auction design.[33]

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[31] Ibid, p.16–18

[32] Auctions for Renewable Energy Support – Taming the Beast of Competitive Bidding, Final Report of the AURES Project Report D9.2, December, 2017, p. 23

[33] The Economies of Support Policies for Renewables, Money Well Spent, Effective Allocation of Financial Support and Enhancement of System Integration of Renewable Energies", Deutsche Energie-Agentur GmbH (DENA), December 2018, p.11

Threats

Irregular or infrequent auctions

Irregular or infrequent auctions can cause detrimental consequences to the market, where losing in an auction implies a long waiting time for project developers until further support options become available. This can lead to underbidding, high investor risks and financing costs, low effectiveness, low participation and issues with competition.

If a single auction is undertaken without any envisaged repetition for the next years, it may push bidders to bid (too) aggressively and potentially underbid. This is because when there are no obvious possibilities for obtaining support at a later point in time, developers may try to limit their losses; this is especially true when they are already in late project realisation phases. Auctions may then seem successful since they result in low support levels. However, this may eventually lead to low realisation rates if the bidders cannot cover their costs with the awarded support level.[34]

Too regular and predictable auction timetables

Too regular and predictable auction schedules might increase the possibility of simultaneous strategic behaviour by larger market players.

Maximum ceiling price

Several arguments are in place against max ceiling prices in RES auctions. They could limit competition and work as a focus point for bids. This can distort the price signal of the auction when bidders orient their bids towards the ceiling prices rather than their actual costs. Overly aggressive ceiling prices can also be distorting since they may make an auction unattractive for investors, potentially resulting in situations where not all the auctioned volume is awarded (no market-clearing).[35]

Strategic supply reduction and reduced competition in favour of higher support levels

Strategic supply reduction is a phenomenon that, on the one hand, can occur if at least one bidder is interested in realising more than one project and consequently submits more than one bid in the same auction. These multi-project bidders consider before as well as during the auction, especially in dynamic auctions, whether it is better for them to bid on all units they are interested in or to withhold some bids in order to generate more profitable support levels for the remaining ones. If a bidder can increase the expected rent by waiving additional units, they will reduce their bids accordingly. This behaviour is called strategic supply reduction and leads to a reduced competition in favour of higher support levels. On the other hand, the issue of strategic supply reduction is also relevant in the background of repeated auction rounds since bidders may have incentives to reduce their supply in particular rounds and instead coordinate their total supply over multiple auction rounds.

Risk of winner's curse and underbidding

As much as a decrease in prices is a desired outcome of an auction, there is a major concern among policy makers and industry players that the actual costs of renewable energy can be

[34] AURES (December 2017), Auctions for Renewable Energy Support – Taming the Beast of Competitive Bidding", Final report, Report D9.2, p. 8

[35] Ibid, p. 16

underestimated in auctions. In a situation where prices are reducing fast (as is the case currently with solar PV and onshore wind), developers may be tempted to keep up with the trend, adjusting their estimates based on past auction results and other players' bids. This can result in the winner of the auction facing very low or even negative profits. Although the winner's curse tends to manifest itself most often in the transitory stage when bidders are still learning about the technical, economic and regulatory aspects of a market, it could still come into play in a more mature auction climate owing to overly aggressive bidding.[36]

The risk of underbidding is distinguished from conscious underbidding for strategic reasons and unconscious underbidding which may occur if bidders have not calculated their costs appropriately. Though a rational bidder would never unconsciously underbid, conscious underbidding may occur in real-world applications due to securing long-term market power through crowding out.

The winner's curse refers to a phenomenon according to which the winner of an auction faces losses after underestimating the cost of the project. The winner's curse tends to be more prevalent where uncertainty regarding a project's valuation is significant. As the market matures, agents typically learn to adjust their bids to correct for this effect.[37]

Delay in delivering

A predominant threat of auctions is the risk of underbuilding and delays in the development and construction phases. Competitive bidding can result in considerably low bids that do not represent real prices. Underestimations or highly optimistic cost development estimations can cause the same effect. This may lead to non-fulfilment of RES deployment targets and potential political consequences.[38]

Failure to attain the RES-E targets/goals

For underbidding cases as well as for immature RES technologies, competitive auction mechanisms face several challenges. Investors often appear to issue bids of unrealistically low costs that cannot recover their development and running costs and, resultantly, fail to deliver on their projects. Consequently, countries that have legally binding goals of RES such as EU Member States easily fall behind on their plan and targets.

[36] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 22–23

[37] Ibid, p.18

[38]The Economies of Support Policies for Renewables, Money Well Spent, Effective Allocation of Financial Support and Enhancement of System Integration of Renewable Energies", Deutsche Energie-Agentur GmbH (DENA), December 2018, p.11

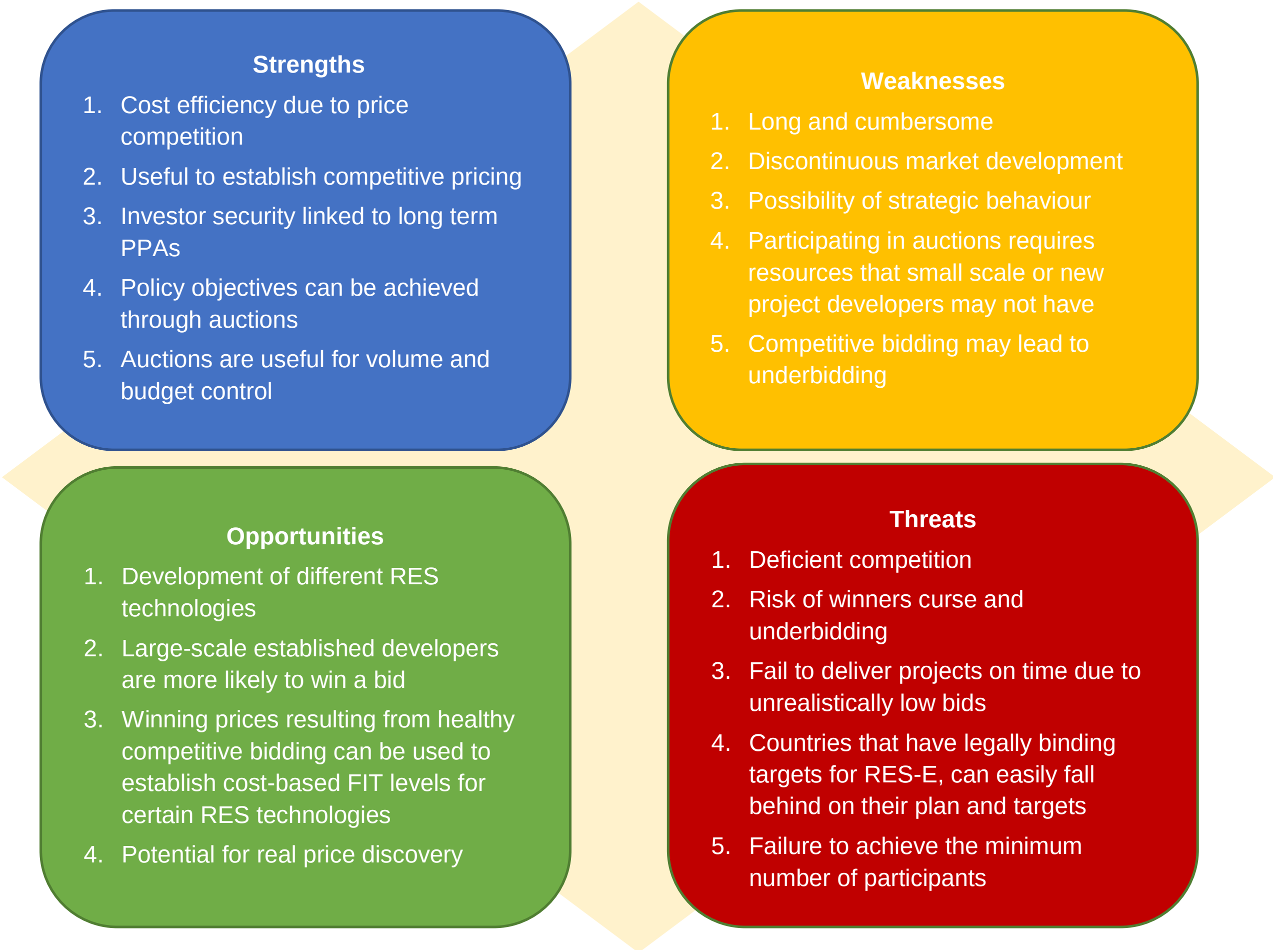

Figure 3 SWOT analysis

5. Best Practices: International case studies

According to IRENA, the number of countries that rely on auctions to award support for renewable energy production reached 67 in 2016; there were only six such countries in 2005.[39] Resultantly, there is an increasing body of experience on RES auctions at the international level.

For instance, auctions organised in different countries throughout 2016 led to record low prices, thereby confirming the trend of falling costs. This was the case, for instance, in the United Arab Emirates for solar PV projects (USD29.1/MWh) and in Morocco for onshore wind (USD30/MWh) projects.[40] Given that topographic, climatic and socio-economic conditions vary significantly between countries, these price levels may not be comprehensively replicable in other regions. Nevertheless, other countries' experiences constitute a useful benchmark for governments and regulators who wish to start using RES auctions or to improve their auction practices.

The following examples from various countries shed light on different elements of the auction design and of the socio-economic and regulatory context in which auctions occur.

<u>The merits of auctions: Germany</u>

IRENA lists several advantages of RES auctions: their flexible design (allowing policymakers to tailor them to specific objectives and circumstances); their potential in helping public authorities, who usually do not possess all the available information, discover the actual price of renewable energy; the better predictability with regards to the volumes of renewable energy that is procured and the costs associated with its procurement. IRENA also flags some of the disadvantages, which include the risk of aggressive bidding and subsequent default of some project developers (underbuilding). Auctions also carry high transaction costs for both the public authorities that organise them and for the private operators that wish to bid on them.[41] The Auctions for Renewable Energy Support (AURES) Project echoes some of these strengths and weaknesses and notes that auctions may not be the appropriate policy option in some contexts (such as in small markets with a limited number of players or with regard to a new and immature technology).[42]

The case of Germany is suitable for illustrating some of these points. Germany has been an early mover in adopting policies to develop RES, starting as early as 1991. In this respect, the country initially relied on administratively set FITs that were probably justified at a time when RES technologies were not yet mature.

The German authorities only introduced RES auctions in 2015. While there were several reasons for gradually phasing in auctions, one objective was to achieve better control over the volumes contracted and the costs – something which was more difficult to achieve with a system exclusively based on FITs and an open window selection of RES producers. As some RES technologies, notably solar photovoltaic (PV) and onshore wind, were described as

[39] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p.16.

[40] Ibid, p.14.

[41] IRENA and CEM (2015), "Renewable Energy Auctions – A Guide to Design", p. 14–15.

[42] AURES (December 2017), Auctions for Renewable Energy Support – Taming the Beast of Competitive Bidding", Final report, Report D9.2, p. 4.

having "grown up" in the meantime, auctions were considered as a useful instrument to better monitor their continued growth in terms of costs and capacities.

Germany's pilot auction in 2015 yielded a price that was slightly higher than the comparable FIT effective at the time. According to IRENA, this higher price may have been partly due to the upfront transaction costs that bidders had to incur since it was the first RES auction ever to be organised in the country. Subsequent auctions led to falling prices, thus confirming the suitability of the mechanism for price discovery, subject to sufficient competition and mature enough technologies.[43]

Later in 2017, when Germany held its first auction for offshore wind power, several projects placed a bid with a strike price of 0EUR/MWh. In other words, the bidders expressed confidence in not requiring any support from the state by the time their plants would go online; they stated they could cover their costs from selling their electricity on the market.[44]

The effect of the learning curve: South Africa

South Africa experienced a sharp decrease in prices resulting from auctions on solar PV generation. A general trend can be observed of various countries leaning towards a greater maturity of solar PV production over the last decade. However, the reduction of prices was especially marked in South Africa, falling from USD345/MWh in 2011 to USD64/MWh in 2015.[45]

IRENA's analysis ascribes this important cost reduction to the effect of the learning curve. Starting with the first RES auction, project developers and other stakeholders such as banks and lenders become more experienced with the particular technology and with the business and regulatory environments. They can, thus, save costs and lower their risk premiums in the following auctions – the auction process actively incentivises them to do this.[46]

One important element in gradually lowering the prices in South Africa seems to have been the regularity with which the authorities organised auctions. The country's Renewable Energy Independent Power Project Procurement Programme (REIPPPP) is characterised by a predictable schedule of recurring auctions. This element of regularity enabled stakeholders to become more knowledgeable about the process, improve the quality of their bids (as evidenced by higher qualification rates) and reduce their costs and, susbequenlty, the bid prices.[47]

Counterparty risk: India

Another element that drives prices resulting from renewable energy auction is the risk assumed by the bidder. Once the winning project developer has built its renewable energy plant and started producing renewable energy, it will depend on the payments made by the entity that

[43] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 58–61.

[44] Ibid, p. 84–85.

[45] Ibid, p. 20.

[46] Ibid, p. 20–21.

[47] IRENA and CEM (2015), "Renewable Energy Auctions – A Guide to Design", p. 24.

purchases the energy. Therefore, one element impacting the risk premium is the uncertainty regarding this counterparty defaulting.

The effect of the counterparty risk on renewable energy auction prices can be observed in India. The country has been relying on auctions for solar PV since 2008, thereby leading to a trend of decreasing strike prices. However, the outcome of the auctions has not been homogenous: Between 2015 and 2016, average prices in several auctions oscillated between 89 and 65USD/MWh, before falling below 50USD/MWh in 2017.[48] These auctions were organised by various actors, some at the national level and some at the regional level in different federal states. Consequently, one of the elements determining auction prices has been the creditworthiness of the entity designated to purchase the electricity produced by the bidder's installation. The Solar Energy Corporation of India (SECI), which is the off-taker of renewable electricity producers selected through auctions at the national level, enjoys a credit rating of AA+ (the rating improved after an agreement between the federal government, state governments and the Reserve Bank of India to protect SECI from default). Contrarily, the public utilities that are the counterparts of SECI at the state level have credit ratings ranging from C to A+. This discrepancy in creditworthiness is one of the factors that explains the lower strike prices that result from the auctions carried out within the framework of India's National Solar Mission at the federal level as opposed to some of the higher prices in the auctions at the state level.[49]

Technology-neutrality: EU state aid guidelines

The bigger the pool of potential bidders, the more competitive pressure the auction will generate, thereby bringing down prices and reducing the risk of the auction failing to attract a sufficient number of projects. One way of significantly increasing the pool of bidders is to open the auction to several technologies.[50]

The European Union (EU) has created a continent-wide internal energy market where electricity can freely flow across borders. To limit distortions to competition in the internal market, countries that are members of the EU have to comply with specific state aid rules. These rules regulate the manner in which national governments support certain enterprises or industries. In the field of renewable energy, the European Commission's guidelines on State aid for environmental protection and energy provide that, in principle, public authorities should select the beneficiaries of state subsidies for renewable electricity through auctions that are open to all renewable energy technologies, unless there are duly justified grounds for not relying on auctions at all or for limiting such auctions to certain technologies.

The justification for the principle that renewable electricity auctions should be, as far as possible, technology neutral is that this considerably increases the number of bidders and projects and helps lower prices. This, subsequently, helps with selecting the most competitive bidders and technologies, thereby limiting the adverse impact of state aid both on the functioning of electricity markets and on the public purse. However, the state aid guidelines also recognise that there may be cases where technology-neutral auctions are suboptimal. A

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[48] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 64.

[49] Ibid, p. 21, 66.

[50] Renewable Energy Auctions – A Guide to Design, IRENA and CEM, 2015, p. 17.

given renewable energy technology may have little chance of succeeding in a neutral auction where it has to compete with other cheaper technologies. However, that technology may have sizable advantages in terms of its long-term potential for diversification purposes, for its positive contribution to grid stability or to reducing system costs. In such duly justified cases, the EU rules allow national authorities to depart from the principle of technology neutrality and to organise auctions limited to some or even one technology.[51] For instance, Germany was able to demonstrate that to some extent, technology-specific auctions were necessary for the purposes of ensuring sufficient baseload capacity (since biomass projects suitable for baseload are unable to compete with solar PV or onshore wind projects) and overcoming grid constraints.

In the USA, the state of California has also organised a form of technology-specific auctions. The Californian authorities segmented the auction volume into different categories, such as baseload electricity and peak load electricity. Given the differences in technologies' generation profiles (biomass and geothermal power being suitable for baseload production, whereas intermittent solar PV production being useful for meeting peaks in demand), different technologies succeeded in the different categories of the auction.[52]

Locational signals: Mexico

The importance of locational signals is evidenced by multi-technology auctions carried out by the Mexican authorities in 2016.[53] The site where a renewable energy power plant is located is important for two reasons: the presence of RES and the availability of a well-developed grid.

- Solar PV and onshore wind installations are particularly dependent on favourable natural conditions on site (this is also applicable to biomass installations, albeit to a lesser extent, since the natural resource – namely the biomass combustible – can be sourced from other areas and transported to the plant). Favourable conditions on a particular site increase the power plant's capacity factor, which expresses its ability to produce electricity over a given period of time (e.g. one year).[54] A higher capacity factor will usually enable the project developer to bid at a lower price. In other words, good sun or wind conditions (depending on the technology) at the sites bidding in an RES auction will lead to a more favourable auction result. Therefore, the presence of the renewable resource in sufficient quantities is instrumental.
- A second locational factor is the availability of a power grid that is capable of absorbing the power plant's electricity production. The better the local grid can absorb the plant's electricity without the need for curtailment, the more predictable the plant's operation will be and the lower the price it can bid at in an auction. Therefore, the proximity of the purported plant site to a well-dimensioned power grid also influences the auction result.

In several cases, the sites that provide the most favourable natural conditions will not coincide with the spots that are best located in terms of grid connection. For public authorities that wish to include locational signals in their auction design, there will be a trade-off between the sites that are best-endowed in terms of natural resources (but possibly remote with regard to the

[51] European Commission, State Aid Guidelines (EEAG), no. 126.

[52] Renewable Energy Auctions – A Guide to Design, IRENA and CEM, 2015, p. 18.

[53] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 28–30.

[54] Ibid, p. 24.

power grid) and sites that are ideally located from a network perspective but poorer with respect to the natural resources.

This trade-off was at play in the auctions in Mexico. In the first round, the authorities had included locational signals that encouraged projects to select sites that were beneficial for the power system (as well as penalties for sites considered less appropriate). In the second round, the locational signals were largely cancelled out so that the criterion of natural resources became more important. This led to an average decrease in prices and higher take-up in terms of volume (even if the change in locational signals was not the only factor at play).[55] While bidders were thus able to select the better sites in terms of good insolation and wind conditions and reduce their bid price accordingly, it may not necessarily translate to lower costs for the public purse since sites that are less adequate in terms of their interaction with the power grid may entail higher system costs.

Reducing underbuilding: Denmark

RES auctions present the risk of a successful bidder being too aggressive or optimistic in its bidding strategy or of the project being delayed due to circumstances beyond its control. Since this has a negative impact on the realisation rate, governments which rely on auctions seek ways to disincentivise aggressive bidding strategies and to shoulder some of the risk that may otherwise discourage potential bidders.

In auctions for offshore wind power plants, Denmark has applied both. At the outset, the Danish authorities design the auction process in such a way that crucial preparatory steps are already undertaken before potential developers place their bids. Thus, in an effort to clear the path for bidders as much as possible, suitable sites for wind power installations are pre-selected by the government and the task of carrying out (costly) environmental impact assessments is entrusted to the transmission system operator. Consequently, bidders possess better information regarding the site and are able to measure the risks involved.[56]

On the other hand, Denmark imposes penalties in case of delays to the implementation of the projects. The remuneration is reduced for delays of up to one year and after one year, the project developer has to pay a penalty of USD71 million.[57] IRENA observes that the verdict on penalties is ambiguous. They may be effective in reducing delays and ensure the realisation of the project. However, if too strict, they may also have a chilling effect on potential investors and result in low participation in the auction.[58]

Changes in economic circumstances: Brazil

The outcome of an auction process cannot be dissociated from the overarching economic context. Brazil is an example of how changing economic circumstances also affect RES auctions. Brazil had been a pioneer in RES auctions, starting as early as 2004. However, between 2014 and 2016, an economic downturn led to reduced electricity demand, a deterioration of financing conditions and a fall in the local currency.

[55] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 28–30, 68–72.

[56] Renewable Energy Auctions – A Guide to Design, IRENA and CEM, 2015, p. 21.

[57] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 89–90.

[58] Renewable Energy Auctions – A Guide to Design, IRENA and CEM, 2015, p. 37;
Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 90.

Resultantly, not only did project developers face harsher conditions that led to higher bid prices in auctions held after the downturn. Project promoters who had already placed winning bids in auctions before the downturn struggled with higher procurement costs (due to the need to import equipment at an unfavourable exchange rate). Several projects were at risk of not being implemented. At the same time, some of the capacity was not required anymore. Consequently, the Brazilian authorities organised a de-contracting auction where project developers could bid for the right to have their project cancelled and avoid some of the penalties.[59] While this was hailed as an innovative and effective solution, it was also argued that public authorities should do their best to avoid such situations, notably through more conservative planning of the auctioned capacity, with a view of minimising the negative impacts on investor confidence caused by contracting overcapacity and later de-contracting.[60]

[59] Renewable Energy Auctions – Analysing 2016, IRENA, 2017, p. 19, 50–53.

[60] The Oxford Institute for Energy Studies (2018), Renewable Auction Design in Theory and in Practice: Lessons from the Experiences of Brazil and Mexico, p. 44.

6. Conclusions

6.1. Summary

Auctions have become significantly more prevalent across a wide variety of jurisdictions. They are regulated within the European Union by the new Renewable Energy Directive of 2018 and by state aid guidelines. They are reviewed and recommended by international institutions such as IRENA. Furthermore, they are applied by a number of MEDREG members within their own energy systems and under varying conditions.

This paper has sought to summarise the characteristics and merits of auctions for renewable energy and to map the experiences of MEDREG members with these auctions with a view of enabling all MEDREG members to benefit from that experience.

The second chapter provides an overview of the primary auction parameters and the considerations that governments and regulators should be aware of when designing their auctions. The chapter also discusses the relevant legislation in place in MEDREG member countries and identifies trends in renewable energy auctions, notably in terms of technology and prices.

The third chapter discusses the experiences of 15 MEDREG members with support schemes for renewable energy and, where applicable, auctions. It is based on the responses to a detailed questionnaire received from the national regulatory authorities of Albania, Algeria, Croatia, Cyprus, Egypt, France, Greece, Italy, Israel, Jordan, Lebanon, Palestine, Portugal, Slovenia and Turkey.

The fourth chapter provides a comparative analysis of the schemes in the 15 MEDREG member countries along some general criteria and characteristics, such as the type of support mechanisms used, their financing, the competent authorities, and the modalities of the auctions. The chapter concludes with an analysis of the comparative strengths, weaknesses, opportunities and threats to RES auctions (SWOT).

The fifth chapter illustrates the international experiences of countries that are not MEDREG members by focusing on certain salient features of their RES auctions (notably, on how they address risks such as counterparty default and underbuilding).

6.2. Recommendations

As a conclusion of the comparative analysis of MEDREG members' responses to the questionnaire as well as of a review of the available literature on RES auctions, the following recommendations can be made:

Appropriately evaluating the merits of RES auctions: For the public authorities that consider using RES auctions, particularly for the first time, the initial step is the accurate evaluation of the merits of auctions. In other words, they will have to determine whether auctions are the adequate tool for RES support in the specific context of the country's energy system. Auctions are a well-suited and flexible instrument for price discovery and for volume and budget control. However, auctions work most efficiently when certain conditions are met: a good degree of maturity of the technologies involved, stakeholders who have sufficient knowledge of the parameters of these technologies and a market environment that is adequately competitive (in order to ensure a high number of bidders). If the technology is still novel and untested, if the stakeholders are facing too many uncertainties with regards to the deployment of the technology or if the market is too small, then auctions will not serve as an optimal tool (some of these barriers, however, can be addressed by providing the adequate information to the stakeholders upfront). Public authorities should also be aware that the first auctions may entail comparatively higher strike prices due to the transaction costs that bidders incur when adapting to the new auction system.

Comprehensive definition of the auction objectives: In designing their auction, public authorities should set clear policy objectives. For instance, auctions can be used to procure a given volume of RES electricity at the cheapest cost to the state budget; in this case, the auction will be designed with the aim of maximising participation by technologies and professionalised and experienced bidders. In other cases, public authorities may wish to promote certain technologies because of their benefits in terms of innovation, environmental protection, system stability or regional diversification. Or it may be state policy for auctions should be targeted at small-scale investors such as households or for the purposes of domestic business opportunities and job creation. In such cases, cost efficiency will not be the exclusive objective and the auction design will be different in order to appropriately reflect the different policy goals.

Providing adequate and timely information to stakeholders: Educating potential bidders upfront and promptly is instrumental to the success of RES auctions and will aid in lowering strike prices. Information that authorities may want to share with stakeholders could include the following: a deployment path for the RES technology concerned and schedule of the auctions that the public authorities intend to conduct over a period of several years (in order to provide certainty); information regarding the modalities of the auction in terms of eligibility, procedural rules, the timeframe and support awarded (with a view to limiting bidders' transaction costs) etc. For instance, the Greek regulator RAE organises regional workshops with a view of educating the market about forthcoming auctions.

Ensuring a sufficient degree of competition: RES auctions will fall flat if the number of bids placed is not sufficient enough to generate competitive pressure. In this case, strike prices risk being too high and at times even prone to manipulation and the competent authorities may have to cancel the auction. There are different ways of broadening participation in auctions, notably by including several technologies (although this may have downsides; e.g. if one technology can systematically outcompete the others), by avoiding segmentation of auctions in terms of capacity or geography, by permitting participation of bidders from other countries etc. Public consultations and pilot auctions may be a way of gauging the interest and potential participation prior to the actual auctions.

Identifying and potentially removing barriers to entry: Bidders face different barriers that entail cost premiums and may even prevent them from participating in auctions. Construction and environmental permits have to be obtained, the grid connection has to be secured, and financing needs have to be located. Therefore, with a view of easing the burden on potential bidders, some jurisdictions ensure that permitting and preliminary studies are conducted by the state. Other examples include policies to de-risk RES investments, i.e. to lower bidders' borrowing costs through loans or guarantees from public banks or through the dissemination of information regarding successful projects and most effective practices.