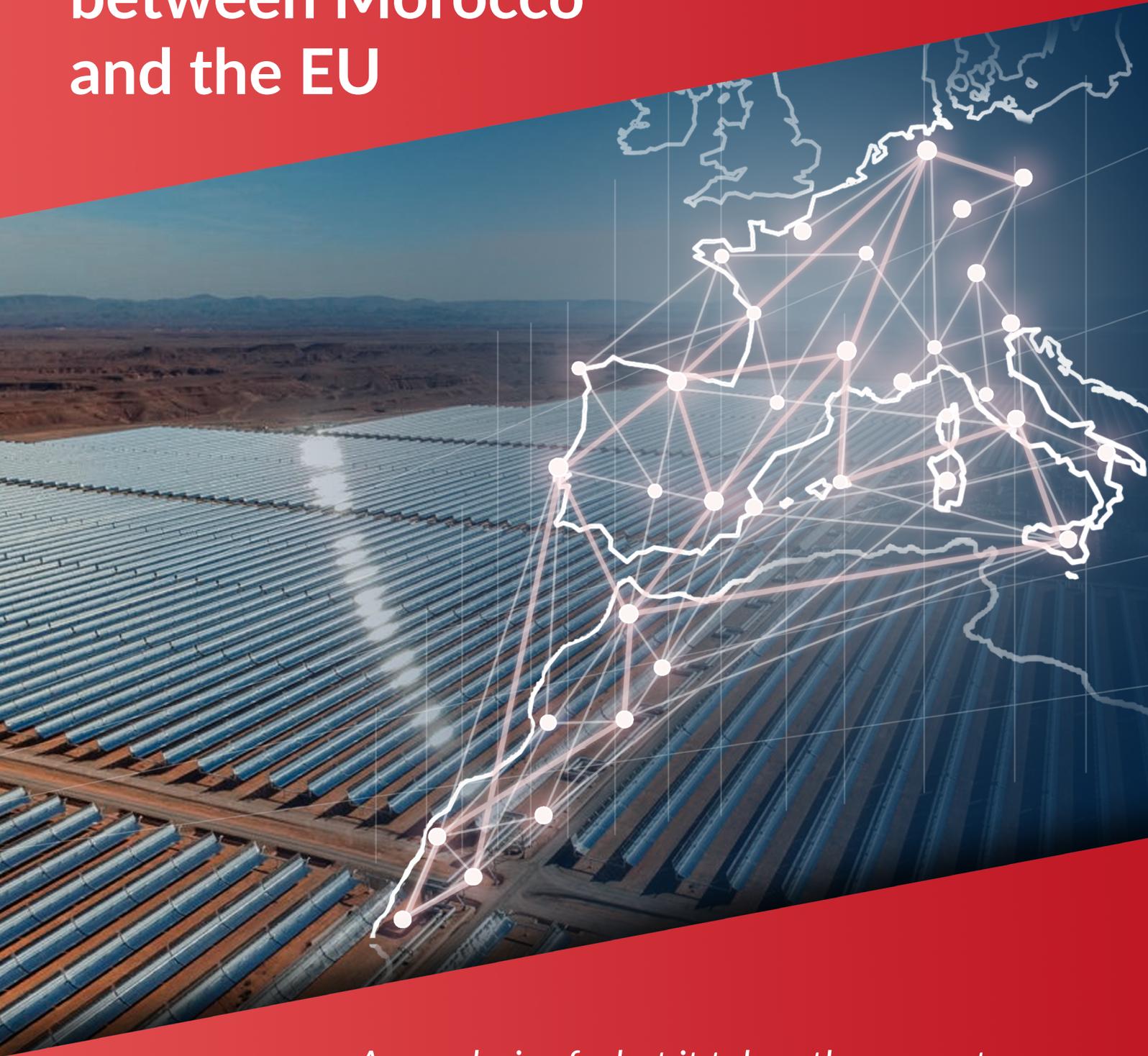


# Pursuing cross-border PPAs between Morocco and the EU



*An analysis of what it takes, the current gaps,  
and recommendations for  
how to bridge them*



## **Contributors to the study**

RES4Africa Foundation: Ilaria Urbani, Rima Jreich, Giorgio Dell'Orto, Federico Ferrante

PwC Advisory: Paolo Gentili, Jasmina Hodzic, Simona Benedettini, Giulia Ghiglione

PwC Tax and Legal: John Shehata, Giulia Bandera

## **RES4Africa Foundation and PwC - April 2021**

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# LIST OF ACRONYMS

<b>ANRE</b>	Moroccan Electricity Regulatory Authority
<b>BRP</b>	Balance Responsible Party
<b>CB</b>	Cross-Border
<b>CE4ALL</b>	Clean Energy for all Europeans
<b>CEF</b>	Connecting Europe Facility
<b>COD</b>	Commercial Operation Date
<b>CSP</b>	Concentrated solar power
<b>DSO</b>	Distribution System Operator
<b>EC</b>	European Commission
<b>EEM</b>	Energie Eolienne du Maroc
<b>EHV</b>	Extra High Voltage
<b>EU</b>	European Union
<b>GO</b>	Guarantees of Origin
<b>HV</b>	High Voltage
<b>HVAC</b>	High Voltage Alternate Current
<b>IEA</b>	International Energy Agency
<b>IPP</b>	Independent Power Producer
<b>IREC</b>	International Renewable Energy Certificate
<b>IRENA</b>	International Renewable Energy Agency
<b>IRESEN</b>	Institute for Research into Solar and Renewable Energies
<b>LCOE</b>	Levelized Cost of Electricity
<b>LV</b>	Low Voltage
<b>m/s</b>	meters per second
<b>MAD</b>	Moroccan dirham
<b>MASEN</b>	Moroccan Agency for Sustainable Energy
<b>MED-TSO</b>	Mediterranean Transmission System Operators
<b>MEMDD</b>	Ministry of Energy, Mines, and Sustainable Development
<b>MIBEL</b>	Mercado Ibérico de Electricidade
<b>MS</b>	Member State
<b>MV</b>	Medium Voltage
<b>MoU</b>	Memorandum of Understanding
<b>NPV</b>	Net Present Value
<b>O&amp;M</b>	Operation & Maintenance
<b>OMIE</b>	Operador do Mercado Iberico de Energia
<b>ONEE</b>	National Office of Electricity and Drinking Water
<b>PCI</b>	Project of Common Interest
<b>PHS</b>	Pumped Hydro Storage
<b>PPA</b>	Power Purchase Agreements
<b>PV</b>	Photovoltaic
<b>RE</b>	Renewable Energy
<b>REC</b>	Renewable Energy Certificate
<b>RED</b>	Renewable Energy Directive
<b>REE</b>	Red Electrica Espana
<b>REN</b>	Redes Energéticas Nacionais
<b>RES</b>	Renewable Energy Sources
<b>SET</b>	Sustainable Electricity Trade
<b>SGG</b>	General Secretariat of the Government
<b>SIE</b>	Société d'Investissements Énergétiques
<b>SNI</b>	National Investment company
<b>TSO</b>	Transmission System Operators
<b>TWh</b>	Terawatt-hour
<b>USD</b>	United States dollar
<b>WACC</b>	Weighted Average Cost of Capital

# FOREWORD

As long-term advocates and proponents of a clean and sustainable energy transition in Morocco, the RES4Africa Foundation and PwC are glad to present the results of the study examining the barriers to cross-border PPAs between Morocco and the EU. The Foundation has for nearly a decade now served as a bridge between the European private sector and Morocco's policy makers, providing a platform for policy dialogue and fostering knowledge transfer. PwC has acted as knowledge partner, providing expert analysis and independent thinking on some of the most pressing topics of our times.

The purpose of this study is to identify barriers to cross-border green corporate PPAs between Morocco and the EU, and to propose a set of recommendations to Morocco's policy makers for how to address them. The study has been prepared through a collaborative effort between the RES4Africa analyst team and PwC. With this, we hope to open a new chapter of even closer cooperation in the field of renewables policy and capacity building development.

We wish to thank the partners from industry and policy making who generously provided their knowledge and insights. Their input contributed to making this study an example of solid, analytical work which the RES4Africa Foundation and PwC strive to deliver.

We consider this study another small step in the direction of greening Morocco's energy sector, for the benefit of its citizens and of the planet.

**Roberto Vigotti**

*Secretary General RES4Africa*



**Giovanni Poggio**

*Partner PwC*



**Fabrizio Acerbis**

*Partner PwC*



# EXECUTIVE SUMMARY

In 2016, Morocco and four EU member countries including Spain, Portugal, France and Germany signed the SET Roadmap, committing to trade RES-generated electricity via green corporate cross-border PPAs, with Morocco acting as an exporter. The intent of this study is to identify existing barriers for this kind of trade and present a set of policy recommendations for their effective removal. These recommendations are guided by international best practices, but also by recognition of Morocco's unique context.

## The policy context

The commitment to corporate cross-border PPAs comes at a time of growing ambition on climate change and renewable energy, especially in the EU. The new policy framework set by the European Green Deal foresees a steep increase in the EU's renewable generation capacity. Meeting the targets in a cost-effective manner requires the renewable energy to be sourced in countries with the lowest generation costs, including in places like Morocco. This cost aspect of reaching EU climate targets, along with the need for ever greater grid flexibility, has driven policy makers to foster cross-border cooperation in the electricity sector including with Third countries (i.e. non-EU countries)

## The barriers identified

This study analyzed and grouped barriers in three categories: regulatory, infrastructure, and market.

**Regulatory barriers** are primarily related to inadequate implementation of existing laws in Morocco. When it comes to institutions, severe delays in the setup of Morocco's independent regulator ANRE caused a knock-on effect in the implementation of a series of other provisions on grid access, grid management and dispute resolution. Grid access for IPPs is a source of a series of barriers, most notably including:

- IPPs are de-facto excluded from some segments of the market despite legal provisions that in theory grant them access to all networks (HV, MV and LV).
- New RES projects are not guaranteed a grid connection; instead they are subject to a positive opinion from ONEE on the compatibility of their project with the grid. Given the poor state of the grid, a high share of projects do not receive the authorizations needed. Many developers also report long lead times to obtaining a connection.
- The existing system of grid fees discourages investments in the south of Morocco, which is an area of very high RES potential.
- Grid fees are set in a non-transparent manner, and many investors consider the current level of grid fees to be excessively high.
- The grid code is subject to negotiation between ONEE and the investors and can change from one project to another

- There are no clear grid management and balancing rules. Related to this is the fact that investors have little clarity on what happens in case of curtailment.

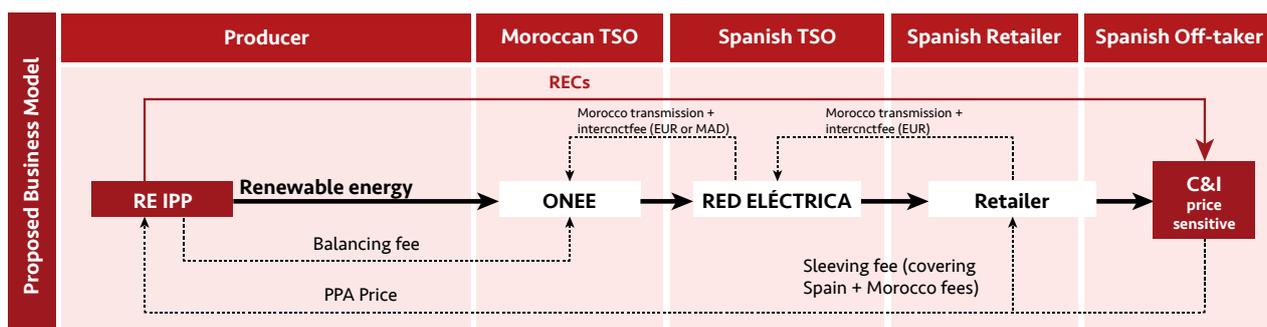
An additional set of barriers stems from regulation on interconnector capacity management. The Morocco-Spain interconnector capacity is not allocated via a capacity allocation mechanism and there is currently no possibility to book long-term capacity. This in effect leaves little to no room for the conclusion of a corporate cross-border PPA. ONEE acts as the sole exporter of electricity from Morocco and there is no precedent for a private operator booking the Morocco-Spain interconnector capacity. Lastly, the lack of a developed and mutually recognized system of Guarantees of Origin in Morocco is a barrier as it complicates the process of certifying green credentials of the potential corporate offtaker.

**Infrastructure barriers** are mostly related to Morocco’s deteriorating internal grid, where the need to increase investments are acutely felt. The absence of long-term grid investment plans is not helping with investor confidence. Interconnection infrastructure is less of an issue as there appears to be sufficient spare capacity on the Morocco-Spain connection. But as noted earlier, regulatory aspects of interconnector capacity allocation need to be addressed.

We also identify two **market barriers**. First, the absence of a competitive wholesale and balancing market in Morocco complicates the contracting process for PPAs. Second, the relative price advantage of Morocco’s electricity - which is the *conditio sine qua non* of exporting - is strongly affected by transmission and interconnection costs, which appear to be rather high.

## Policy recommendations

Despite these barriers, a reasonable basis for cross-border trade exists. Illustrated below is a business model for a physical (sleeved) cross-border PPA which could feasibly be implemented under the condition that a set of policy actions is pursued. Those policy actions are laid out in the table on the next page.



## Recommended policy actions needed to make the proposed business model feasible



### Political

- Reinvigorate the pace of cooperation on the Sustainable Energy Trade Roadmap by signing the Memorandum of Understanding.
- Commit to implementing a pilot green corporate cross-border PPA project between Morocco and Spain.
- Pursue topics of cross-border PPAs in other ongoing high-level initiatives.
- Pursue a systemic energy policy view cognizant of potential synergies between hydrogen and cross-border electricity trade.
- Continue to promote RES development and the PPA market in Morocco more broadly.
- Strengthen the domestic Renewable Energy Certificates market by stimulating demand.



### Regulatory

#### Area 1: internal functioning of Morocco's electricity market

- Introduce full transparency, visibility and predictability of all relevant grid fees.
- Ensure that ANRE has the administrative and capacity and political backing needed to manage grid fees and guarantee a level playing field.

#### Area 2: incentivization of cross-border PPAs

- Scrap the export fee.
- Scrap the potential reinforcement and grid upgrade fees.
- Revisit the level of other grid fees.

#### Area 3: greater regulatory and grid code harmonization between Morocco and Spain

- Introduce a harmonized, transparent and competitive capacity allocation mechanism for the existing interconnector between Morocco and Spain.
- Create a standard methodology for calculating interconnection charges across both sides of the Gibraltar.
- Ensure mutual recognition of Guarantees of Origin.



### Infrastructure

- Prepare credible and implementable long-term grid investment plans.
- Increase investments in flexibility solutions for the domestic grid, with the view to integrate ever growing share of variable RES in the power mix.
- Accelerate works on the 3rd Morocco-Spain interconnector, with a view to capitalize on its systemic benefits.
- Consider interconnection capacity constraints between Spain and other EU SET countries.



### Market

- Strive to introduce a degree of transparency on the electricity price level.
- Create a framework agreement between ONEE and RED Eléctrica governing the payment of Moroccan transmission and interconnection fees, to simplify procedures and reduce currency risk.
- Create a standard contract for physical cross-border PPAs, to reduce transaction costs and improve bankability.

# 1. INTRODUCTION

At the COP22 held in Marrakech in November 2016, Morocco, Spain, Portugal, France and Germany signed the Sustainable Energy Trade (SET) Roadmap agreement, committing to deepen their trade in electricity generated from renewable energy sources (RES). About two years later, they signed a new agreement in which they specified that they intend to trade via green corporate cross-border Power Purchase Agreements (PPAs). They also committed to identify and remove regulatory barriers to this kind of trade, in the interest of ever deeper market integration. Morocco and the four European countries have been having periodic meetings to discuss the SET Roadmap, though its finalization is behind schedule due to the COVID-19 pandemic.

The contracting practice that these countries committed to, namely corporate PPAs, has been a topic of major interest for European policy makers. It has been promoted as a practice of great potential for galvanizing private participation in greening the energy mix, especially that of industrial consumers.

In a green PPA, a corporate consumer (also known as offtaker) agrees to buy renewable energy (RE) from a producer over a long-term period against a set price or pricing structure. But a cross-border variation of this type of contracting is rather rare. In fact, only a few examples of cross-border PPAs have been seen to date, even between highly integrated EU markets. The reason for this is that they require a high degree of harmonization between the countries involved in at least two broad areas: regulation & wholesale market prices (where wholesale markets exist). They also require the presence of sufficient cross-border interconnection capacity able to accommodate the physical energy flows. And most of all, they require that a relative price advantage exists, i.e. that the price of electricity of the country of the buyer is higher than at the country of the seller.

Morocco and the four European countries certainly don't have the ideal level of regulatory and market harmonization required for a green corporate cross-border PPA. But they are interconnected via two subsea cables with a total commercial capacity of 900 MW. Morocco also does indeed seem to have a mild relative price advantage in its ability to generate RE (as will be seen in the following chapters) and the EU remains a keen potential buyer.

Indeed, the EU's Green Deal policies place a major emphasis on the need for green cross-border cooperation for the purpose of both procuring the required gigawatts of RE at the lowest possible cost, as well as for providing grid flexibility solutions. For all of these reasons, cross-border PPAs between Morocco and the EU remain a practice worth pursuing despite the multitude of obstacles emerging from their many differences.

The purpose of this study is to look at the barriers to cross-border PPAs between Morocco and the EU and, based on those, to propose a set of recommendations for Morocco's policy makers on how to address them, laying a proposal for a concrete business model which could be within reach if certain policy actions are taken.

The document proceeds as follows. In Chapter 2 we start by looking at the SET Roadmap and the underlying motivations for green cross-border trade for both the four European countries and Morocco. Chapter 3 lays out the common requirements for cross-border PPAs, categorized into political, regulatory, infrastructure and market considerations. Chapter 4 proceeds to analyse the current conditions in Morocco to assess gaps related to such requirements. In Chapter 5, we present a potential business model for a green cross-border physical (sleeved) PPA between Spain and Morocco and lay out a set of policy recommendations for how to bring that business model within reach.

## 2. THE POLITICAL COMMITMENT TO CROSS-BORDER ELECTRICITY TRADE

### 2.1 The Sustainable Electricity Trade Roadmap

Morocco and Spain already trade electricity by way of two subsea interconnectors. On average, Morocco covers 14% of its electricity yearly demand by imports from Spain, where trade is carried out by TSOs of each country.<sup>1</sup> Both countries also have a fairly active PPA market. On the other hand, trading via cross-border PPAs occurs only very rarely even in highly integrated markets such as the EU. In the case of Morocco and EU, the main impetus for cross-border electricity trade is political and moves from a diplomatic initiative, the Sustainable Electricity Trade Roadmap.

The Sustainable Electricity Trade (SET) Roadmap is an intergovernmental agreement signed between France, Germany, Portugal, Spain and Morocco in November 2016, during COP22, in which signatories committed:

- to promote renewable energy trade between them in pursuit of the objectives of the Paris Agreement;
- to facilitate exchanges of renewable electricity through the gradual integration of their electricity markets.<sup>2</sup>

In September 2017, a follow-up initiative was launched to prepare a set of studies whose objective was to chart the pathway for the Roadmap's implementation. More specifically, the objective of the studies was:

- to conduct a full cost-benefit analysis of increased RES electricity exchanges between signatories
- to analyse the legal, regulatory and market framework for electricity trade between the SET Roadmap participants and assess what could be improved to allow free electricity trade between them.<sup>3</sup>

Such studies confirmed electricity market integration has significant benefits for all SET countries in terms of meeting demand at a lower cost, sharing and more efficient use of flexibility solutions, operational cost reduction, and more efficient grid integration of renewables.<sup>4</sup>

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<sup>1</sup> IEA, 2019, Energy policies beyond IEA countries Morocco, Paris

<sup>2</sup> EC, 2016, Joint Declaration on the establishment of a Roadmap for Sustainable Electricity Trade between Morocco and Europe Internal Energy Market, Brussels [available at [https://ec.europa.eu/energy/sites/ener/files/documents/2016\\_11\\_13\\_set\\_roadmap\\_joint\\_declaration-vf.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/2016_11_13_set_roadmap_joint_declaration-vf.pdf)]

<sup>3</sup> Source: <https://cmimarseille.org/menacspkip/studies-support-sustainable-electricity-trade-roadmap-preparation/>. The preparatory studies are not available publicly. They were guided by a Steering Committee composed of Ministries from each signatory Country, with Masen acting as Secretariat and technical assistance by the World Bank

<sup>4</sup> Source: ATA Insights webinar "The opportunity of clean energy trade across the Mediterranean", held on 22/04/2020.

**The 2016 SET Roadmap committed to achieve the following objectives:**

- better use of resources across the regions, by developing RES capacity where it is the most cost-effective.
- better use of existing flexibility solutions and sharing of flexibility services.
- facilitate the integration of increasing renewables electricity on both sides.
- increase the security of supply through reserve sharing.
- increase the load factor for existing power plants.
- meet demand at lower costs.
- create substantial mutually beneficial investment opportunities for the parties involved.
- generate a significant number of jobs.
- help in decreasing operational cost through better use of existing assets and, more in general, the value of the power sector decarbonisation.

**The cost-benefit analysis of the SET Roadmap found that:**

- Interconnections reduce the needs for other flexibility measures, lead to synergies from existing flexibility solutions.
- which allow to reduce investment needs.
- Electricity market integration allows to better tap into RES resources in all five countries.
- Operational costs are reduced thanks to a better use of existing assets, and access to cheaper flexibility solutions allows for more renewable energies to be deployed.

*Box 1: Sustainable Electricity Trade Roadmap: objectives and benefits.<sup>5</sup>*

About a year later, in December 2018, the SET Roadmap parties signed another joint declaration which, for the first time, laid out an explicit ambition to pursue cross-border trade via green corporate PPAs, while initiating actions for electricity market integration.

Yet after a period of intense initial diplomatic activity, progress on the SET Roadmap appears to have slowed down. Between 2018 and today no new developments have been reported. The Moroccan Agency for Sustainable Energy (MASEN), which acts as a Secretariat of the SET Roadmap, is reportedly preparing a Memorandum of Understanding on cross-border PPA which would spell out the action plans of each country, though its signature has fallen behind schedule and is expected to take place in the first half of 2021. It's true that Morocco and Spain have been holding periodic meetings concerning the development of the 3rd interconnector and the related Committee of Energy Partnership, most recently in July and November 2020.<sup>6</sup> But lately the topic of green hydrogen seems to have taken top spot in the policy priority list, reflecting on the EU's hydrogen strategy ambitions. This need not be the case; cross-border PPAs and green hydrogen can well be complementary and exert synergies. We lay out a case for synergies in the policy recommendations chapter.

<sup>5</sup> Source: ATA Insights webinar "The opportunity of clean energy trade across the Mediterranean" held on 22/04/2020

<sup>6</sup> Source: <https://energycentral.com/news/morocco-spain-discuss-means-strengthen-partnership-energy-sector>

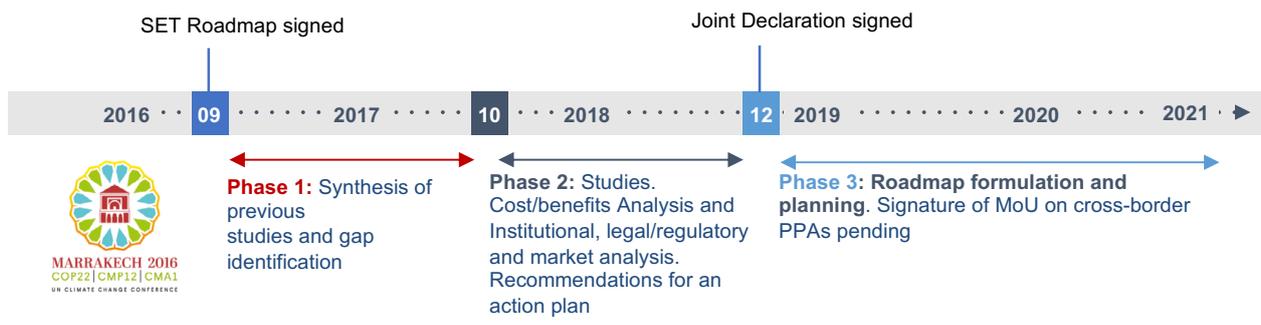


Figure 1: SET Roadmap Process <sup>7</sup>

## 2.2 EU’s motivations for cross-border power trade: reaching climate targets at low costs

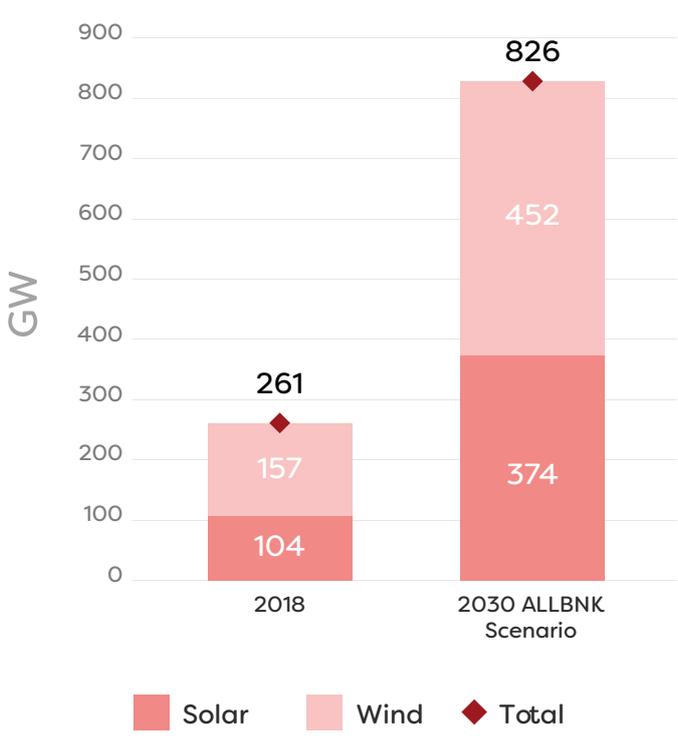


Figure 2: EU renewable energy capacity: installed and target by 2030

In December 2019, the European Commission introduced the European Green Deal, an ambitious proposal to make the EU carbon neutral by 2050. Meeting that goal and achieving the associated decoupling of carbon emissions from economic growth requires a radical rewiring of the European economic system; most of all, it requires an immense amount of clean energy.

Most measures refer to decarbonizing the power sector. Waiting for the implementing acts of the new Energy strategy, current targets are still governed by the Clean Energy for all Europeans (CE4ALL) Package issued in 2018, which lays out a 2030 target of 40% reduction of carbon emissions and 32% share of renewable energy in gross final energy consumption.

<sup>7</sup> Source: RES4Africa webinar series “Advanced Training Course”, session on North Africa held on 27/01/2021

Yet the Commission is looking to step up the ambition: in December 2020, the European Council agreed on a 2030 target of 55% emissions cut and a 38-40% share of renewables.<sup>8</sup> That is an ambitious target even at current levels of electricity demand, implying a near-doubling of the current renewables share. But electricity demand is not static; rather it is expected to increase as other sectors such as transport and industry switch to electricity. Green hydrogen is expected to provide an immense additional pull on renewable energy, on the back of a vision to replace fossil fuels by hydrogen in subsectors such as steel production, long-haul trucking, aviation, and shipping.<sup>9</sup>

What does this mean in terms of GW of renewable energy required? The impact assessment accompanying the Commission's proposal for a step-up of the 2030 targets offers some preliminary scenario modelling. By 2030, total installed wind and solar capacity would increase from 260 GW in 2018 to 826 GW in 2030 (see Figure 2).<sup>10</sup> These figures include the 120 GW of renewable energy needed to feed electrolyser capacity for green hydrogen production.

The impact assessment does not tackle the question of where the additional capacity would come from, but the hydrogen strategy does. European hydrogen industry is pioneering the 2x40GW initiative, whereby 40 GW of electrolyser capacity is to be installed in the EU and another 40 in North Africa and the Ukraine. Costs are a primary motive. To make the Green Deal targets affordable, renewable energy capacity needs to be installed in countries where generation costs are expected to be lower – including Morocco. In turn, tapping into those low-cost resources and letting the energy flow freely from where it's cheap to where it's needed requires a high degree of regional market integration. Interconnecting regional energy markets also increases system flexibility at lower costs, facilitating a seamless grid integration of renewables.

For this reason, one of the Green Deal highlights is the need to increase cross-border and regional cooperation, to better share clean energy sources, and to interconnect energy systems including with Third countries (i.e. non-EU Member States). CE4All put in place a series of dedicated cooperation mechanisms through which EU countries can meet their national RES targets via projects located outside their borders. Chapter 4.1.4 offers more details on those cooperation mechanisms and their role as enablers of cross-border PPAs. In sum, the EU's pursuit of cross-border electricity trade via initiatives such as the SET Roadmap is central to domestic policy objectives concerning climate, energy and the economy more broadly.

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<sup>8</sup> State of the Union: Commission raises climate ambition.

[https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip\\_20\\_1599/IP\\_20\\_1599\\_EN.pdf](https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_20_1599/IP_20_1599_EN.pdf)

<sup>9</sup> EC, 2020, A hydrogen strategy for a climate-neutral Europe, Brussels

<sup>10</sup> Figures refer to the ALLBNK Scenario. EC, 2020, Impact Assessment accompanying the document Stepping up Europe's 2030 climate ambition: Investing in a climate-neutral future for the benefit of our people.

## 2.3 Morocco's motivations for cross-border power trade: untapped RES potential

Morocco's motivations for corporate cross border electricity trade are rooted in its commitment to develop its renewable energy industry, including by liberalizing its energy market and attracting private investment. Having little to no own fossil fuels reserves (oil, gas or coal), Morocco depends on imports for 91% of its energy needs.<sup>11</sup> The financial and strategic implications of this import dependency have been a major concern in the political discourse, especially given the country's abundant RES potential. Solar is undoubtedly the most important RES source with 2900 hours per year of sunshine, while average wind speed along its coast stands at 8 m/s.<sup>12</sup>

For this reason, diversifying the electricity mix is stated as a priority of Morocco's 2009 National Energy Strategy. The path to diversification is charted by tapping into the country's RES potential and strengthening regional cooperation with Europe and Africa, including via deeper market integration. In terms of concrete targets, Morocco is aiming to reduce its carbon emissions by 17% by 2030 in fulfilment of its Paris Agreement commitment which, in terms of ambition level, categorizes Morocco among top commitments globally.<sup>13</sup> The targets of renewables share of RES generation were set at the level of 42% by 2020 (6 GW capacity) and 52% by 2030 (10 GW).<sup>14</sup>

Although implementation has not been smooth, the country appears to be broadly on track. In 2020, some 36% of Morocco's installed capacity was made up of RES,<sup>15</sup> and capacity installed stood at 10 557 MW. That is shy of the full target achievement, though the Climate Action Tracker platform estimates that recent acceleration puts the country on track (see also Figure 3).

Behind this remarkable acceleration in RES instalment stands a concerted effort on the part of the Moroccan legislator to reform the energy sector and liberalize access to Independent Power Producers (IPPs) (see Chapter 4.1). What is certain is that a pursuit of deeper cross-border electricity trade is part and parcel of Morocco's energy strategy and is interlinked with the strategic objective to diversify the energy mix by way of pursuing renewables. The EU and its industrial stakeholders are a natural partner due to the geographic proximity and long-standing historical ties.

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<sup>11</sup> IEA, 2019, Energy policies beyond IEA Countries Morocco, Paris

<sup>12</sup> For comparison, Germany has 1768 hours of sunshine and wind speeds of 5 m/s. Source: Parema <https://www.energypartnership.ma/home/>

<sup>13</sup> Out of 32 Countries and the EU analysed, Morocco and the Gambia are the only Countries whose pledges are compatible with the 1.5°C target, according to estimates by the Climate Action Tracker platform. <https://climateactiontracker.org/Countries/>

<sup>14</sup> More specifically, the 2020 target was for 2 GW of solar, 2 GW of wind and 2 GW of hydro, and for 2030 4.56 GW of solar, 4.2 GW of wind and 1.33 GW of hydro. Sources: IEA, 2019, Energy policies beyond IEA Countries Morocco, Paris and IEA, 2019, Morocco Renewable Energy Target 2030, Paris

<sup>15</sup> Source: ONEE, 2019, Bilan à fin des réalisations de l'ONEE <http://www.onee.ma>

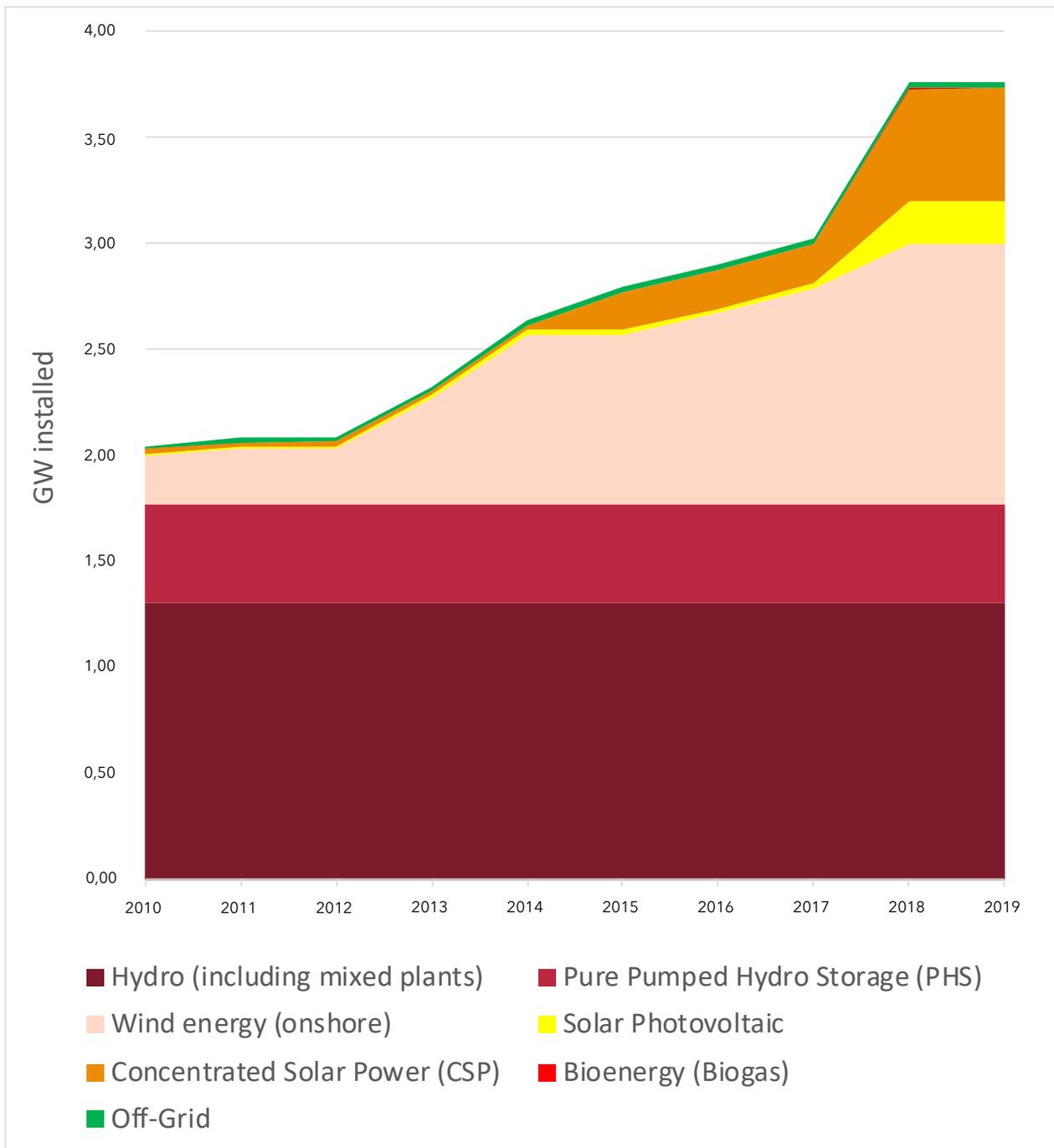
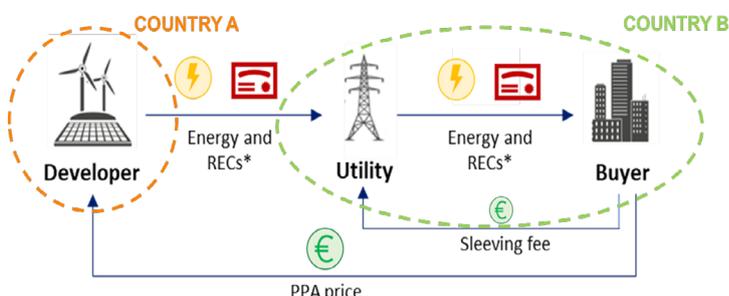


Figure 3: Renewable capacity evolution and renewables capacity breakdown 2019<sup>16</sup>

<sup>16</sup> Source: IRENA 2020

# 3. ANALYTICAL FOUNDATIONS OF THE STUDY

## 3.1 Cross-border PPA schemes as a reference



Cross-border Power Purchase Agreements are contracts signed between two parties for the longterm exchange of power at a set price (or price structure). They differ principally in the type of the offtaker (corporate or wholesale) and the kind of power exchange

(physical or financial). For the needs of this study, two main cross-border PPA schemes are distinguished: the physical sleeved PPA and the financial (or virtual) PPA.

In a **cross-border physical PPA** the offtaker agrees to purchase renewable energy (RE) electricity from the producer of another country and receives it through the international power interconnection and the national grid. Usually, the offtaker will engage a utility to manage the balancing services (relative to the variable nature of RE) and any other grid duties and / or fees. For these services the utility will charge a 'sleeving fee'. The final price that the offtaker pays is a function of the contracted PPA price plus any additional fees due to the sleeving utility for the transmission and balancing of the electricity. To formally guarantee the renewability of the electricity produced and sold, PPA contract often includes the exchange of renewable energy certificates (RECs) that have to be officially recognised by both the Countries.

In a **cross-border financial PPA**, the physical exchange is replaced by a financial structure that creates a similar economic effect for both parties. In a financial PPA, the real-time electricity balance does not occur. Due to the absence of a wholesale market in Morocco and other limits imposed by the design of EU cooperation mechanisms, financial PPAs are not feasible in trade between Morocco and the EU. Therefore they are not considered in this study.

	Advantages	Disadvantages
 Physical PPA	<ul style="list-style-type: none"> <li>• A close association with the generating asset (buying actual power).</li> <li>• Flexible price structure: Floating (discount-to-market) or Fixed.</li> </ul>	<ul style="list-style-type: none"> <li>• In case of a CB PPA, subject to interconnector capacity limitations.</li> <li>• Exposure to sleeving costs (including costs emerging from grid congestion in another country).</li> </ul>
 Financial PPA	<ul style="list-style-type: none"> <li>• Possibility to aggregate demand across multiple regions, exploiting economies of scale.</li> <li>• Simpler structure with fewer contracts compared to a sleeved PPA.</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to basis risk (i.e. mismatch of electricity prices between the delivery point and the trading point).</li> <li>• Not feasible in the absence of a well-functioning wholesale market.</li> </ul>

Table 1: Advantages and disadvantages of physical vs financial PPAs

## 3.2 Common requirements for cross-border PPAs

A standard approach to identify and analyse barriers to green corporate cross-border PPAs between Morocco and the EU would be based on the following methodology:

- Benchmark and analyse international best practices in order to identify the replicable common elements and minimum requirements for cross-border PPAs.
- Analyse the gap between international best practices and the current state in Morocco.
- Identify actions needed to bridge the gap between best practices and the current state.

Yet cross-border PPAs are a frontier practice encountered only in highly integrated EU markets, whose limited replicability makes it difficult to speak of best practices in the standard sense of the term. For this reason, we opted for a **hybrid methodological approach**. Rather than look at best practices, we've identified **a set of common requirements for cross-border PPAs on the basis of a literature review**. We grouped them into three categories: regulatory, infrastructure, and market requirements. A fourth category, political commitment to cross-border PPAs, is a natural prerequisite and the previous chapter already illustrated the political drive embodied in the SET Roadmap.

Common requirements for cross-border PPAs	
 <b>Regulatory</b>	<ul style="list-style-type: none"> <li>• Third Party Access to grids and interconnections, with possibility to gain long-term rights to transmission.</li> <li>• Clear, transparent and predictable fee regime concerning grid access and all related charges.</li> <li>• Independent regulator to promote transparency, ensure a level playing field, promote a correct functioning of the competitive free market, and handle disputes.</li> <li>• Transparent, traceable and mutually recognized Guarantees of Origin system.</li> </ul>
 <b>Infrastructure</b>	<ul style="list-style-type: none"> <li>• Stable and flexible national grids, with sufficient capacity to integrate additional volumes of variable RES capacity.</li> <li>• Stable and flexible cross-border interconnectors, with sufficient spare capacity to accommodate cross-border flows.</li> </ul>
 <b>Market</b>	<ul style="list-style-type: none"> <li>• Presence of an open, competitive wholesale market with transparent and reliable day-ahead and futures power prices.</li> <li>• Presence of a balancing market, including to cover potential generation shortfalls.</li> <li>• Existence of arbitrage opportunities or a relative price advantage.</li> </ul>

Table 2: Common requirements for cross-border PPAs

**Regulatory** requirements broadly refer to developing a general framework for cross-border power exchange on the principles of transparency, competitiveness and non-discrimination.<sup>17</sup> **The OECD report *Enhancing market openness through regulatory reform*** affirms that regulatory frameworks need to be guaranteed, foreseeable and harmonised across all jurisdictions to facilitate the purchase and deployment of renewable energy, regulate access to the grids and interconnections, and grant long-term transmission rights. Additionally, **the EUI policy brief *Transparency in the European Wholesale Energy Markets*** points out that transparency and full disclosure of information is fundamental when regulating the power trade. Transparency promotes a sound functioning of markets by ensuring that operators have an adequate understanding of the market and that available data (prices, quantities) provide them the right signals. Moreover, transparency enhances competition. Operators holding market power enjoy an information advantage which they can use to deter entry and limit fair competition.<sup>18</sup> An independent regulator plays a vital role in promoting transparency and cost-effectiveness of the bidding processes, licensing facilities, arbitrating disputes, evaluating the prudence of contracts (without engaging in retroactive regulation), and setting the terms and conditions for access to interconnection capacity.<sup>19</sup> Moreover, **the IRENA report *Corporate Sourcing of Renewables*** confirms that compatibility between renewable schemes and Guarantee of Origins is needed. Regulatory development should enable an adequate Guarantee of Origin system that fosters transparency and traceability of green energy.<sup>20</sup> Indeed, a fundamental requirement for green cross-border PPAs is the existence of a certification system for renewable energy officially recognised in both countries.

Adequate grid **infrastructure** is fundamental for green cross-border PPA, both in terms of domestic grids and interconnection capacity. The trading countries need to assure that their national grids are sufficiently flexible and stable to ingrate variable renewable energy, and that interconnectors between them have sufficient stability and capacity needed to manage the flow of energy. **The IEA report *Status of Power System Transformation 2019*** defines power system flexibility as “the ability of a power system to reliably and cost-effectively manage the variability and uncertainty of demand and supply across all relevant timescales, from ensuring instantaneous stability of the power system to supporting long-term security of supply.”<sup>21</sup> Grid flexibility is vital to ensure that the integration of variable renewable generation is balanced at all times to maintain power system stability.<sup>22</sup> Grid stability is also a necessary requirement when integrating renewable energy into the grid. **The IRENA report *Renewable Energy Integration in Power Grids*** affirms that the integration of a significant share of variable renewables into power grids requires substantial investments to increase grid flexibility. Regional market integration via interconnector

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<sup>17</sup> OECD, 2001, *Enhancing market openness through regulatory reform*, Paris

<sup>18</sup> EUI, 2011, *Transparency in the European Wholesale Energy Market: Filling the regulatory gaps*, Florence

<sup>19</sup> Ferry S. and Cabraal A., 2006, *Power purchase agreement for small power producers*, Knowledge Exchange Series 7

<sup>20</sup> IRENA, 2018, *Corporate Sourcing of Renewables: Markets and industry trends*, Abu Dhabi

<sup>21</sup> IEA, 2019, *Status of Power System Transformation 2019*, Paris

<sup>22</sup> EC, 2013, *DG ENER Working Paper The future role and challenges of Energy Storage*, Brussels

assets can provide system flexibility at a lower cost, as it can allow power to flow from regions with an ample availability of renewables to regions with high power demand. Besides, the interconnection capacity is an essential aspect of implementing cross-border PPAs. The aforementioned IRENA report asserts that higher interconnection and transmission capacity enable the optimal use of surplus generation, alleviate the problem of daily and seasonal demand peaks, reduce the requirements for regulation reserves, enhance congestion management and reduce the need for new (and back-up) generation capacity.

**Market** elements include having an open, competitive market and ensuring economic convenience to establishing cross-border PPA. The first requirement is the presence of a fully competitive market in which any buyer or seller may trade and in which prices are determined by competition. **The DENA report on *How to use PPAs for cost-efficient extension of renewable energies*** asserts that transparent and reliable power market prices, as well as the availability of forecasts of future prices, are necessary to evaluate the convenience of a cross-border PPA. Usually, in countries where advanced power markets exist, reference prices are represented by wholesale market prices.<sup>23</sup> Besides, economic convenience for the producer and buyer is a fundamental requirement when trading energy. To guarantee convenience to the buyer, **the WEC report *Roadmap towards a Competitive European Energy Market*** states that the cross-border PPA must be competitive with the market price of the buyer's country over the contract period. From a producer perspective, the competitiveness of the cross-border PPA is assessed relative to the local market. The cross-border PPA should guarantee the producer higher revenue relative to selling the power in their home market, and vice versa from the buyer's perspective.<sup>24</sup> Therefore, it is necessary to have reference market prices as well as forecasts on future market prices and evaluate all costs to assess if a cross-border PPA is competitive to the end-users' market.

This chapter laid out a set of common requirements that are needed for a successful pursuit of green corporate cross-border electricity trade via PPAs. In Chapter 4, we turn our attention to the current situation in Morocco and the EU to benchmark the extent to which those requirements are met. The analysis will serve to identify gaps between the theoretical requirements and the situation on the ground, with a first view of how those gaps can be bridged.

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<sup>23</sup> German Energy Agency (DENA) 2019, *How to use PPAs for cost-efficient extension of renewable energies - Experiences with Power Purchase Agreements from Europe and the U.S. / Lessons learned for China, Germany*

<sup>24</sup> World Energy Council, 2010, *Roadmap towards a Competitive European Energy Market*, London

## 4. WHAT IS MISSING TO ENABLE MOROCCO-EU CROSS-BORDER PPAs

### 4.1 Analysis of Requirement 1: Regulatory Framework

Chapter 3 noted how regulatory requirements for cross-border PPAs span a broad set of measures including the existence of a liberalized, transparent and non-discriminatory set of rules for access to grid infrastructure, the presence of an independent regulator to set those rules and enforce a level playing ground, and the existence and mutual recognition of a system for Guarantees of Origin. The section that follows provides an assessment of Morocco's regulatory framework, particularly Law 13.09 and Law 40.19 that govern renewable energy PPAs. Subsequently we look into how Spain regulates electricity trade with Morocco. Lastly we look into a series of EU mechanisms that act as enablers of cross-border cooperation with Third countries.

#### 4.1.1 Morocco's regulatory framework for cross-border PPAs

##### *Electricity market organization*

Morocco undertook a systematic electricity sector reform over the last two decades which entailed a gradual and selective introduction of private sector participation, while retaining a strong vertically integrated publicly owned utility operating as a single seller. Table 3 offers an overview of the main actors active in Morocco's energy sector.

The electricity market has been partially liberalised in the generation segment. Therefore, in the Moroccan electricity system, power is generated by a mix of IPPs (also from non-renewable power plants), ONEE's installations, and MASEN's renewable plants developed through public-private partnerships. ONEE acts as a single buyer by purchasing the energy produced by IPPs and by MASEN's projects through long-term PPAs.<sup>25</sup>

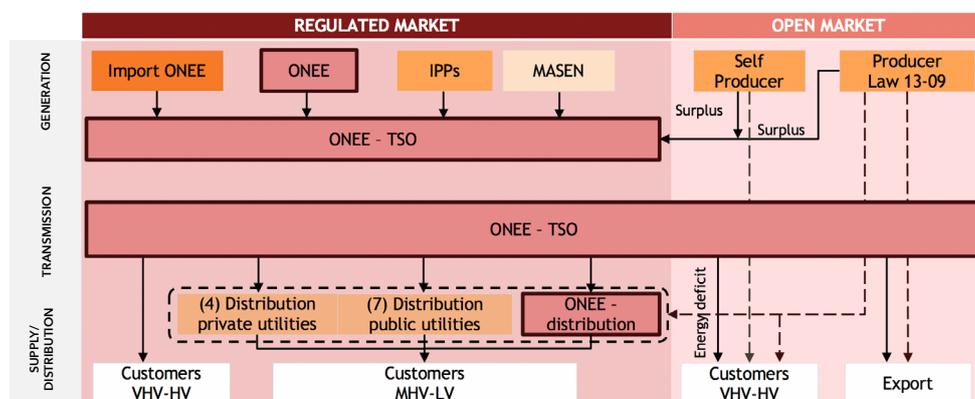


Figure 4: Morocco's electricity market structure<sup>26</sup>

<sup>25</sup> Except in the 13-09 framework where C&I purchase the electricity, while ONEE acts as a grid operator.

<sup>26</sup> Source: IEA 2019

ONEE manages the entire national transmission infrastructure, including power interconnections with Third countries. By extension, ONEE is the only Moroccan entity managing electricity import and export. The Moroccan power sector is characterised by an absence of separation between the distribution and retail sectors. ONEE owns part of the distribution network and delivers around 58%<sup>27</sup> of the total electricity, while the remaining electricity is distributed by other 11 entities: 7 public municipal utilities and 4 private concession holders.<sup>28</sup>

<b>Production</b>	ONEE production (29%)	IPP Production (53%)	Interconnectors (15%)	Self-generation (3%)
<b>Trade</b>	ONEE is the single buyer of electricity in Morocco (35.4TWh)			
<b>Transmission</b>	ONEE operates and manages the transmission of electricity			
<b>Supply</b>	ONEE (58%)		Delegated utilities (42%)	

Figure 5: Morocco’s electricity market ownership structure<sup>29</sup>

<sup>27</sup> IEA, 2019, Energy policies beyond IEA Countries, Morocco

<sup>28</sup> Public utilities include RADEEL (Larache), RAK (Kenitra), RAEEF (Fes), RADEEM (Meknes), RADEEJ (El Jadida), RADEES (Safi) and RADEEMA (Marrakch). Private concession holders include Amendis (Tetouane) Amendis (Tangiers), Redal (Rabat and Sale) and LYDEC (Casablanca)

<sup>29</sup> Source: IEA 2019

<b>Key Public Institutions</b>	
National Agency for Electricity and Water (ONEE)	ONEE is a state-owned vertically integrated utility that owns the transmission network, ~29% of generation assets, and ~ 58% of the distribution grid. ONEE Acts as a single buyer of electricity generated by other parties and manages the overall power demand including electricity imports/exports. Under Law 30-16 ONEE will transfer RE assets to MASEN.
Moroccan Agency for Sustainable Energy (MASEN)	MASEN is state-owned company created in 2010 under Law 57.09 to coordinate the National Integrated Project for Solar Electricity Production (later extended to all RES technologies). MASEN is responsible for leading and managing the development of RE at a technical, economic and financial level, and coordination activities through a one-stop-shop. Its mission includes the promotion and development of renewables at the African continental level.
Société d'Investissements Énergétiques (SIE)	SIE is a public energy investment company that supports national RE projects and energy efficiency as a lender, investor or project co-developer.
National Authority for Electricity Regulation (ANRE)	ANRE is responsible for regulating the open and competitive segment of the electricity sector. It was legally established in 2016 but only held its inaugural meeting in late 2020. Its responsibilities include regulating the grid fees/surplus tariff, networks access regulation, the definition of transmission and medium-voltage grid tariffs, ensuring of market efficiency and handling of disputes.
Institute for Research into Solar and Renewable Energy (IRESEN)	IRESEN is responsible for identifying, implementing and financing research priorities projects in the fields of renewables and energy efficiency.
<b>Ministries</b>	
Ministry of Energy, Mines, and Sustainable Development	MEMDD is primarily responsible for Morocco's overall energy policy, managing the low-carbon transition and safeguarding the security of supply. It is in charge of setting rules for energy markets and for authorising and supervising energy projects. MEMDD is also co-launching tenders for PPP schemes dedicated to the 13-09 market.
Ministry of Economy and Finance	Responsible for price and competition policy in Morocco and regulating the electricity and fuel prices (before final approval, proposed tariffs are reviewed by an inter-ministerial tariff committee that includes the MEMDD).
Ministry of Interior	Responsible for the organisation, policy and oversight of the electricity distribution (and water/sanitation) companies, the seven public municipal water and electricity distribution companies, and the four private ones, the so-called delegated authorities.

*Table 3: Actors involved in the energy market in Morocco<sup>30</sup>*

<sup>30</sup> Source: IEA 2019 and RES4Africa Foundation 2018

## Policy framework assessment

In 2009, Morocco adopted an ambitious **National Energy Strategy** aiming at diversifying the energy mix, reducing energy import dependency, promoting renewables and securing cost-effective access to electricity.

Two main laws stemmed from it: Law 13.09 on Renewable Energy introduced a framework for private investment and participation of IPPs, and draft Law 40.19 (to be adopted) that addressed some gaps of 13-09 and introduced a revised governance of the national utility ONEE.<sup>31</sup> In the following paragraph, a quick review of all regulatory aspects related to enabling cross-border PPA is provided.

	Main gaps versus the common requirements for cross-border PPAs
<b>Law n° 13.09 (2010)</b>	<ul style="list-style-type: none"> <li>- The Law has not been fully implemented.</li> <li>- No specific obligations to ONEE to guarantee grid connection. This uncertainty is a potential risk for the investor.</li> <li>- Insufficient detail on the grid upgrade financing and on fees to be paid.</li> <li>- No clear provision of the functional separation of ONEE's distribution activities from generation and transmission.</li> </ul>
<b>Law n° 58.15 (2015)</b>	<ul style="list-style-type: none"> <li>- Law not yet implemented.</li> <li>- Limit to sale of surplus energy at 20% of annual production. Industry sources report the tariff compensation for the surplus to be very low.</li> <li>- Implementation decree for RE connection to LV grid is not approved.</li> </ul>
<b>Decree n° 2-15-772 (2015)</b>	<ul style="list-style-type: none"> <li>- Law not yet implemented.</li> <li>- No penalties for distributors not complying with the minimum renewable integration obligation for DSOs (from 5% to 10% of the yearly distributor's MV sales).</li> </ul>
<b>Law n° 40.19 (2019)</b>	<ul style="list-style-type: none"> <li>- Law is not yet adopted.</li> <li>- Lack of secondary legislation providing details on tariffs, tariffs, agreements and grid code that would allow investors to have a full picture of the opportunity of a cross-border initiative.</li> <li>- No transparent capacity allocation mechanism for the interconnector.</li> </ul>

*Table 4: Gaps in Morocco's regulatory framework compared to the common requirements for cross-border PPAs*

**Third party access.** Law 13.09 from 2010 introduced the possibility for IPPs to develop RE projects and to sell the energy generated via PPAs to designated end-users (private-to-private power transactions). The law introduced grid access for IPPs spanning the EHV, HV and MV grid., although de facto grid access to the MV has not yet been implemented. The costs of grid connection are to be borne by the IPP, and priority dispatch is not foreseen.

<sup>31</sup> The regulatory texts were retrieved at <https://www.mem.gov.ma/en/pages/textesreglementaires.aspx>.

**Grid access.** IPPs applying for a permit need to receive a positive opinion from the ONEE on the compatibility of their project with the grid. Amid a growing deterioration of Morocco's grid, many projects do not receive the necessary approvals; those that do still face very long lead times. Where this happens and the national grid or existing interconnection capacity is deemed as insufficient, RE-IPPs are allowed to build transmission lines for their own use in the context of a concession agreement to be concluded with ONEE. Under this agreement, grid upgrade fees and transit fees are to be paid by the IPP to ONEE. Yet here again, Law 13.09 doesn't provide any further details on the grid upgrade financing nor on the fees to be paid.

**Grid access fees.** The conditions and level of fees for grid access<sup>32</sup> and use are not regulated in detail and are subject to private negotiations between RES-IPPs and the relative grid operator (ONEE or DSO). Additionally, the tariffs are subject to indexation during the life of the project (based on the general electricity prices indexation) and there is little to no ability to forecast the future evolution of the indexation. This low ability to plan future grid fees represents both a risk factor and a high transaction cost for IPPs, and acts as a barrier to green corporate cross-border PPAs (and PPAs more broadly).

**Right to export.** Law 13.09 explicitly foresees the possibility for IPPs to export the electricity produced, following the receipt of a favourable technical report by the ONEE. To do so, the RE-IPP is mandated to pay an annual fee for the use of national grid when exporting energy, though the specific fee level and regime governing the fee has not been elaborated. There is also no specific regime for capacity allocations on the interconnectors.

**Surplus energy sale.** Since 2010, several aspects of Law 13.09 have been updated. In late 2015, Law 58.15, amending Law 13.09, allowed private investors in renewable power to sell their surplus output to the grid (to ONEE or a distribution company).<sup>33</sup> This is limited to a volume of no more than 20% of their annual production. But the detailed conditions for selling the power surplus and the relative compensation regimes are yet to be defined in implementing acts. Law 58.15 opened the LV network to renewable energy previously limited to HV, EHV and MV (under Law 13-09, Article 5). Yet, the implementation decree for RE connection to LV grid is yet to be approved.<sup>34</sup>

**Curtailement risk.** Undelivered power resulting from a temporary reduction or interruption of the injection of power into the grid does not give rise to a financial or in-kind compensation for the power producer as long as the volume curtailed remains below a given threshold. These curtailment thresholds and the related remuneration amounts have not yet been defined.

A range of issues cited above can be solved by implementing the provision of the Law 48.15 approved in 2016, which established the National Regulatory Authority for Electricity (ANRE), whose mandate spans the "open market" segment.<sup>35</sup> Within this area, ANRE's functions include:

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<sup>32</sup> According to Law 160/2012 ANRE shall regulate the fees

<sup>33</sup> Morocco, 2015, Law no. 58.15, Rabat <https://www.chambrederespresentants.ma/sites/default/files/loi/58.15.pdf>

<sup>34</sup> IEA, 2019, Energy policies beyond IEA Countries, Morocco, Paris; RES4Africa Foundation, 2018, RES4Med Country Profile, Rome; RES4Africa Foundation, 2018, Accelerating the development of renewables on the MV market in Morocco, Rome

<sup>35</sup> Morocco, 2016, Law no. 48.15, Rabat [https://www.chambrederespresentants.ma/sites/default/files/loi/projet\\_loi\\_48.15\\_fr.pdf](https://www.chambrederespresentants.ma/sites/default/files/loi/projet_loi_48.15_fr.pdf)

- supervising ONEE's account unbundling into a national TSO and generation business;
- setting of the grid codes (standards and regulations approval);
- establishing a network access regulation;
- setting of the utilisation tariffs of the national transmission network and distribution grids;
- ensuring the efficient functioning of the open market.

ANRE was staffed by a Board of Directors in August 2020 and held its inaugural meeting in October 2020, over four years behind schedule. Its full staffing and smooth operation are expected in the coming months.

Many of the shortcomings and gaps of the existing regulatory framework are in the process of being amended by the **draft Law 40.19**, published on the website of the General Secretariat of the Government (SGG) on 6 December 2019.<sup>36</sup> The draft Law refers to several implementing regulations, mainly regarding the capacity of the national grid, the contribution to grid stability, the direct sales to DSOs, the sale of power excess and the energy export clarifications. Box 2 gives more details.

Although the draft Law 40.19 gives more emphasis to electricity export and focuses on the role of the independent regulator, the series of implementing regulations it refers to are still missing. The implementing regulation will need to provide details on the fees, tariffs, agreements and grid code that would allow investors to have the full picture on the opportunity for a cross-border initiative.<sup>37</sup>

**The contribution to grid stability:** System services and their charges were formalised under this Draft Law. This formal recognition induces more transparency on the fees to be paid to ONEE (which are currently bilaterally negotiated). All grid users contribute to the grid stability by paying a tariff set by ANRE upon proposal by the grid operator. Moreover, grid operator may also temporarily suspend/reduce the electricity produced by an operator up to a threshold determined by the regulation (if exceeded, a remuneration will occur).

**The direct sales to DSOs:** Operators can directly sell the renewable energy produced to DSOs, who can acquire from RES up to 40% of the total energy supplied to their customers (ceiling is set in place to safeguard grid stability). A penalty system to ensuring the respect of the ceiling has not been provided by this amendment.

**The sale of electricity excess:** The limit on the sales of RE surplus (20% of annual production) introduced by Law 13.09 is eliminated, while ANRE sets the tariffs for selling upon the relative DSO proposal.

**The energy exports clarifications:** The RE export will be subject to a prior technical opinion from the National TSO (ONEE) and secondly to approval from the local administration. Moreover, an "agreement" was introduced specifying the techno-economic conditions of access to power interconnections, in particular the loss rate, system services, and the transit fees.

**The capacity of the national grid:** RE plants will be connected to the national grid within the limits of carrying capacity, defined as the maximum RES capacity. Under this Law, the grid can accommodate without management constraints. Grid operators must publish and update the carrying capacity, while ANRE has to approve it.

## Box 2: Key components of the Draft Law 40.19

<sup>36</sup> Morocco, 2019, Projet de loi n° 40.19 modifiant et complétant la loi n° 13.09 relative aux énergies renouvelables, Rabat [available at [http://www.sgg.gov.ma/portals/0/AvantProjet/194/Avp\\_loi\\_40.19\\_Fr.pdf](http://www.sgg.gov.ma/portals/0/AvantProjet/194/Avp_loi_40.19_Fr.pdf)]

<sup>37</sup> MEMEE, 2010, Loi n. 13.09 relatives aux énergies renouvelables. In particular Art 28 on Export of energy from renewable sources through cross-border interconnections with neighbouring countries (available at: [http://www.sgg.gov.ma/portals/0/AvantProjet/194/Avp\\_loi\\_40.19\\_Fr.pdf](http://www.sgg.gov.ma/portals/0/AvantProjet/194/Avp_loi_40.19_Fr.pdf))

Concerning grid access, efforts were made regarding the MV network but access to all other voltages remains very loosely defined. In particular, the 2015 **Decree 2-15-772** regulated access conditions and modalities for RE to the national MV market by putting in place a transparent, non-discriminatory and stable framework for investors. Moreover, it set a minimum renewable integration obligation for DSOs (from 5% to 10% of the yearly distributor's MV sales).<sup>38</sup> Despite its adoption, the Decree has not yet been implemented.<sup>39</sup> Additionally the lack of penalties for non-compliant distributors is still limiting the achievement of these targets.

#### **4.1.2 Regulatory framework for managing interconnector capacity**

Morocco and Spain are interconnected via a 400kV allowing 900 MW capacity transfer from Spain to Morocco and 600 MW in the opposite direction. On Morocco's side, the interconnector is managed by ONEE who currently acts as the sole exporter. Draft law 40.19 foresees the introduction of a fee for accessing interconnection capacity, however the implementing regulation has not been published. Therefore, there is no clear methodology for calculating the relevant fees. Capacity allocation also does not seem to follow a competitive logic.

On the Spanish side, the interconnector is managed by Red Eléctrica via a system of bilateral contracts. There is no competitive capacity allocation mechanism in place, although the possibility of introducing it is being considered. **Circular 3/2019** of the National Commission of Markets and Competition establishes the methodology for the operation of the wholesale power production market and the management of system operations.<sup>40</sup> Under its provisions, market participants may formalize bilateral contracts for physical delivery of power supply to the system operator.

Articles 14, 15 and 16 referring to the Spain-Morocco interconnector lay out a capacity management system which does not extend beyond the daily and intraday horizon. In practice, this means that **a PPA between Spain and Morocco is subject to the availability of residual capacity of the interconnection** (refer to Box 3). In absence of a long-term coordinated capacity allocation mechanism, international bilateral contracts govern this interconnection. On the daily and intraday horizon, the system operator in Spain (OMIE) determines the maximum value of capacity available in the two direction of power flow. For matching bids on the power market, bids are assigned using the European matching algorithm respecting the maximum value of capacity available for market transactions in each of the two directions of energy flow in the interconnection.

Within these provisions, **concluding a PPA between the two countries with a long-term capacity allocation mechanism is currently not feasible**. This may start to change: the EU Agency for the Cooperation of Energy Regulators (ACER) recently adopted a Decision on the common rules for cross-border participation in capacity mechanisms (intra-EU), and future work may be done to extend cooperation also to Third countries.<sup>41</sup>

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<sup>38</sup> Morocco, 2015, Decree 2-15-772, Rabat <https://www.mem.gov.ma/en/Pages/TextesReglementaires.aspx>

<sup>39</sup> Res4Africa Foundation, 2018, Accelerating the development of renewables on the MV market in Morocco, Rome

<sup>40</sup> National Commission of Markets and Competition, 2019, Circular 3/2019 de 2 Dic 2019, Boletín Oficial Del Estado, Madrid [available at [https://www.cnmc.es/sites/default/files/2762234\\_28.pdf](https://www.cnmc.es/sites/default/files/2762234_28.pdf)]

<sup>41</sup> European Agency for the Cooperation of Energy Regulators, 2020, [https://acer.europa.eu/Official\\_documents/Acts\\_of\\_the\\_Agency/Individual%20decisions/ACER%20Decision%2036-2020%20on%20cross-border%20participation\\_XBP%20CM.pdf](https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Decision%2036-2020%20on%20cross-border%20participation_XBP%20CM.pdf)

#### **Article 14. Management of interconnections with Third countries.**

1. The System Operator shall make available to the Market Operator, at least one week prior to the opening of the day ahead market, the maximum import and export capacity for each extra-EU interconnector for each programming period.
2. The System Operator shall make public the exchange capacities provided for each direction of energy flow at each extra-EU interconnector, for each programming period.
3. (...)
4. The System Operator shall receive from market undertakings authorised for the trade of international energy exchanges through each of these interconnections, the daily execution communications, in detail by programming period, of bilateral contracts with physical delivery in use of the energy exchange capabilities of these interconnectors. (...)

#### **Article 15. Management of the Spain-Morocco interconnection on the daily horizon.**

The management of exchange capacity in the interconnection with Morocco shall be carried out through the application of the following procedure:

1. Prior to the close of the daily market, and based on the total reported volume of energy for the execution of physical bilateral contracts through the interconnection with the Moroccan electricity system, the System Operator will determine the maximum amount of capacity available in each of the two directions of energy flow, and for each of the scheduling periods of the following day. (...)
2. Before each market session, the System Operator will make available to the Market Operator and publish the information regarding the exchange capacity available in the interconnection with the Moroccan system, in each of the two flow directions, importer and exporter, for their consideration in the matching process of corresponding offers.
3. In the process of matching bids on the electricity market, bids will be assigned using the matching algorithm, respecting the maximum value of capacity available in each flow direction.
4. In the event that the balance of the matched offers in the daily market in each extra-EU interconnector is less than the maximum value of the corresponding exchange capacity available for market transactions, **the unoccupied capacity may be used for acceptance of bilateral contracts with physical delivery through the interconnection**, when these have exceeded 50% of the exchange capacity published for that programming period, in the sense of the corresponding energy flow, always with respect to the exchange capacity values calculated and published by the System Operator.
5. In the event that the set of communications for daily execution of bilateral contracts with physical delivery through said interconnection, received by the System Operator, exceeds the value of the exchange capacity available in the corresponding programming period and direction of energy flow, once discounted the capacity occupied by the set of bids matched in the market session, the System Operator will proceed to award the available capacity in the interconnection to the bilateral contracts with physical delivery, using for this purpose the specific offers for the allocation of capacity, expressed in € / MW, which will have been presented to the System Operator by the holders of these bilateral contracts with physical delivery, together with the daily execution communication thereof.
6. In this case, **the capacity will be assigned to the bilateral contracts with physical delivery communicated, starting from the offer with the highest price until reaching the one that completes the capacity**. The price of the last offer assigned in each programming period and direction of energy flow will establish the marginal price of the allocation of capacity in the corresponding programming period, a price that will be used by the System Operator for the settlement of the allocation of exchange capacity to bilateral contracts with physical delivery through this competitive auction procedure.
7. The allocation of rights to use exchange capacity to bilateral contracts with physical delivery in this auction process will generate a firm payment obligation for the successful bidder, which will be a function of the price resulting from the allocation auction and the rights of use of the allocated exchange capacity in the same direction of energy flow. There will be no payment for the allocation of capacity in those cases in which the total number of requests for bilateral contracts with physical delivery does not exceed the capacity offered in said auction in the same direction of energy flow.

#### **Article 16. Management of the Spain-Morocco interconnection on the intraday horizon.**

1. The System Operator will make available to the Market Operator the update of the information related to the maximum import and export capacity available in the Spain-Morocco interconnection after the day ahead market session, for its consideration in the bid matching process of the complementary regional auctions.
2. In the process of matching bids on the intraday market of complementary regional auctions, they will be assigned by means of the matching algorithm for this purpose, taking into account the merit order of the bids presented in that scheduling period and respecting the maximum value of available capacity in each of the two directions of energy flow in the interconnection.

*Box 3: Chapter VI of Circular 3/2019: Article 14, 15 and 16*

### 4.1.3 Regulatory framework for Renewable Energy Certificates

The ability to issue and trade renewable energy certificates tends to be an enabler of PPAs, as it allows the buyer to guarantee its sustainability. This is especially the case if the buyer is consumer-oriented and is interested in furthering its green credentials. Therefore, if energy is being traded across borders, mutual recognition of national **Guarantees of Origin (GOs)** is essential.

The EU has in place a relatively well-developed electronic GOs system standardized by the Association of Issuing Bodies. Morocco does not have a market for Guarantees of Origin; to date only two RES installations with a combined capacity of 280 MW have been certified.<sup>42</sup>

When it comes to mutual recognition, article 19 of RED II states that: “Member States shall not recognise Guarantees of Origins issued by Third country except where the Union has concluded an agreement with that Third country on mutual recognition of Guarantees of Origin issued in the Union and compatible Guarantees of Origin systems established in that Third country, and only where there is direct import or export of energy.” As of today, there is no such agreement in place between Morocco and the EU. Therefore, any renewable energy generated in Morocco and exported to the EU cannot be certified as such in the EU market. Moreover, the requirement for energy to be directly exported into the EU is another limitation on financial PPAs, **de facto leaving physical (sleeved) PPAs as the only feasible business model.**

The Brussels Joint Declaration explicitly stressed the need for mutual recognition of renewable energy certificates between the EU and Morocco, and this is certainly a message worth reiterating. But besides mutual recognition, Morocco’s RES sector could benefit from a broader development of its renewable energy certificates market.

### 4.1.4 EU regulatory factors enabling cross-border PPAs

The EU has no regulatory framework that explicitly promotes green corporate cross-border PPAs. This is different from standard corporate PPAs, for which Member States are mandated to assess and remove unjustified barriers to their deployment.<sup>43</sup> Nonetheless the bloc does have a Free Trade Area agreement signed in 2000, which permits a free exchange of electricity, and a dispute settlement mechanism was introduced in 2011. Additionally, there are three notable EU mechanisms that can act as enablers of cross-border PPAs: cooperation mechanism in the form of joint projects, the Union Renewable Financing Mechanism, and CEF Cross-Border projects (see Table 5).

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<sup>42</sup> NOOR I solar station and Khalladi wind farm of 160 and 120 MW respectively, certified International-REC Standard (IRECs) issued by the Dubai Carbon Centre of Excellence. Source: I-REC Standard, <https://www.irecstandard.org/what-are-recs/>

<sup>43</sup> Article 15 of RED II, 2018/2001/EU refers to corporate PPA

Meeting the ambitious EU climate targets will be easier for some Member States than for others, depending on the amount of renewable energy potential they can tap into. To encourage States to work together towards the achievement of common goals in a cost-efficient manner, the Commission energy strategy has at its core the pursuit of cross-border cooperation, regional market integration, and greater physical interconnection of national electricity markets. In practical terms, the 2009 RED I Directive (Renewable Energy Directive, 2009/28/EC) and the 2018 RED II Directive (Recast Renewable Energy Directive, 2018/2001/EU) introduced a set of cooperation mechanisms which permit that electricity generated in one country can count towards the achievement of national climate targets by another country. These cooperation mechanisms can play a major role as enablers of cross-border PPAs between Morocco and the four European countries.

	 <b>Description</b>	 <b>Governance</b>	 <b>Conditions</b>
<b>Joint Projects</b>	A Member State supports energy generation in another country by providing an investment, including via private participation. The energy generated and exported counts towards the RES targets of that Member State.	Article 9 of RED I and Article 11 of RED II	<ul style="list-style-type: none"> <li>The electricity must be consumed within the EU (i.e. financial PPA is excluded).</li> <li>Must be produced in an installation that became operational after 06/2009.</li> </ul>
<b>Union Renewable Financing Mechanism</b>	A Member State supports energy generation in another country by providing an investment, including via private participation. The energy generated and exported counts towards the RES targets of that Member State.	Regulation (EU) 2020/1294	<ul style="list-style-type: none"> <li>The electricity has not received support from a support scheme of a Third country.</li> </ul>
<b>CEF energy cross-border projects</b>	The Connecting Europe Facility Energy dedicated 10% of budget (€980M) to cross-border renewable projects. The co-financing can be awarded via grants for studies and construction works, or blended funds.	Regulation (EU) 1316/201351	<ul style="list-style-type: none"> <li>Be designated as a Project of Common Interest (PCI).</li> <li>Project cannot get access to commercial funds (commercial viability gap).</li> <li>Significant EU-added value.</li> </ul>

Table 5: EU mechanisms acting as enablers of cross-border cooperation

Four cooperation mechanisms have been set up by RED I. Statistical transfers, joint projects between Member States, and joint support schemes refer to cooperation between EU Member States (and are therefore not applicable to Morocco). The last one, **Joint projects with Third countries**, governed by Article 9 of RED I, is relevant for Morocco as it allows for renewable energy from non-EU nations to be counted towards EU Member States renewable energy targets. A “joint project” is intended as a cooperation whereby a Member State supports energy generation in another country by way of providing an investment, and it is explicitly stated that the cooperation “may involve private operators”. The conditions under which the RE produced in a Third country can count towards EU Member States targets include:

- the electricity must be consumed within the Union (this de-facto excludes financial PPAs);
- the electricity is produced by an installation that became operational after June 2009;<sup>44</sup>
- the electricity produced and exported has not received support from a support scheme of a Third country.

Article 9 of RED I, and subsequently Article 11 of RED II, explicitly state that an investment by a Member State in an interconnector may also be considered a joint project (and accordingly RES produced abroad can count towards national targets) under conditions that:

- construction of the interconnector started by 31 December 2026;
- after it becomes operational, the interconnector will be used for the export to the Union of electricity from renewable sources;
- account can be taken of a quantity of electricity that is no greater than the quantity that will be exported to the Union after the interconnector becomes operational.

Another EU scheme that acts as an enabler of cross-border PPAs with Morocco is the **Union Renewable Energy Financing Mechanism (URFM)**, coming into operation in January 2021.<sup>45</sup> Under this mechanism, Member States can reach their RES targets by contributing financially to a financing scheme which will be used to tender support for new RES projects in any country - **including Third countries** - willing to host such a project. To the difference of joint projects, there is no direct link or negotiation between the contributing and hosting countries as the Commission runs the entire process. For projects in Morocco to benefit from financing in a URFM tender, the Moroccan

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<sup>44</sup> This to guarantee that the proportion of energy from renewable sources in the Third Country's total energy consumption is not reduced due to the import into the EU

<sup>45</sup> Introduced under the Regulation (EU) 2020/1294 of 15 September 2020.

government would need to submit a formal expression of interest to the Commission along with relevant technical specifications on RES potential that is being proposed. The same conditions apply as in the joint projects scheme, namely that the electricity needs to be physically consumed in the EU. Therefore, here as well financial PPAs are excluded, and only physical (sleeved) PPAs are viable.

A third EU scheme that offers a significant opportunity for Morocco and the EU is the **Connecting Europe Facility Energy**, which dedicated a new funding window specifically for cross-border renewable projects. Around 10% of the CEF Energy budget is dedicated to cross-border projects, or around €980M, which can be awarded in the form of technical assistance (e.g. pre-feasibility studies), grants (for studies or for works), or as blended finance supplementing a private financing offer. Eligibility to receive this kind of funding is the same as the CEF eligibility more broadly, and includes the key requirement to be listed as a Project of Common Interest (PCI). The CEF cross-border window presents an important funding opportunity for the 3rd Morocco-Spain interconnector, which we outline further in the policy recommendations chapter.

Summary of how Morocco meets the regulatory common requirements for cross-border PPAs

Summary of the Moroccan regulatory framework		General drawback	Barriers for cross-border PPAs
<b>Institutional framework</b>	<p>MEMDD is responsible for developing energy policies.</p> <p>MASEN is dedicated to RE development.</p> <p>ANRE is an independent regulator.</p> <p>Foreseen unbundling of ONEE (creation of separated TSO).</p>	<p>ANRE board of directors nominated. Operations are going slowly.</p> <p>ONEE unbundling is not completed.</p>	<p>Without a fully operative independent regulator, there is no guarantee of a level playing field and there is no clarity on how grid fees are being determined.</p>
<b>Grid Access</b>	<p>Access right guaranteed to RES on transmission and distribution network, from EHV to LV (in theory).</p> <p>Conditions for grid connection are bilaterally negotiated with TSO/DSO for EHV, HV and MV.</p>	<p>No public network code/ connection rules.</p> <p>No transparent and non-discriminatory connection rules.</p> <p>No rules for grid access for LV and MV.</p>	<p>No transparency on grid codes and methodologies for grid tariffs.</p>
<b>Grid Management</b>	<p>Curtailment rate bilaterally negotiated on HV/MV.</p> <p>RE dispatching priority guaranteed only on MV.</p>	<p>No public network code/ connection rules.</p> <p>No public information on grid status.</p> <p>RE dispatching priority not extended on HV and LV.</p>	<p>RE producers must negotiate grid access, use fees, and curtailment rules bilaterally with ONEE. This means that there may not be a level playing field (rules are not the same for everyone).</p>
<b>Network tariff and energy prices</b>	<p>Temporary general network tariff defined by Law.</p> <p>ONEE requires a standardized intermittence tax (balancing fee) which indistinctly penalizes producers.</p> <p>Price for the RE surplus / deficit acquired by/from TSO and DSOs is bilaterally negotiated.</p>	<p>No transparent methodology for grid codes and network tariffs.</p> <p>No regulation of compensation price for RE surplus and for energy deficit.</p>	<p>The need to negotiate bilaterally implies high administrative costs.</p>
<b>Electricity exports<sup>46</sup></b>	<p>Law 13-09 allows RES-IPPs to export energy.</p> <p>IPPs must bear costs for grid update, transmission fees and annual fees.</p>	<p>ONEE manages all power exports/imports.</p> <p>Residual capacity allocation.</p> <p>No details on fees applicable under Law 13.09.</p> <p>Different REC systems.</p>	<p>No transparency regarding the fees to be paid.</p> <p>No current mutual recognition of RECs. No possibility to buy long-term capacity.</p> <p>The need to pay export fees risks eroding the relative price advantage of the PPA.</p>

<sup>46</sup> It also includes the barriers deriving from the consideration of EU regulatory context.

## 4.2 Analysis of Requirement 2: Infrastructure Framework

Chapter 3 laid out the infrastructure requirements for green corporate cross-border PPAs. The section that follows provides an assessment of Morocco's internal grid infrastructure as well as its interconnectors with neighbouring countries.

### 4.2.1 The internal grid

The Moroccan transmission grid went through a period of rapid development in the 1990s but is **increasingly deteriorating**. The country had seen a remarkable expansion of its internal grid as part of the Global Rural Electrification Programme (PERG) launched in 1996, aiming to bring electricity to the entire country. The result was a **skyrocketing of energy access rates** from only 18% in 1990 to 99,7% in 2019.<sup>47</sup> Yet the southern part of the country, which offers significant wind potential, is considered least connected to the national grid.<sup>48</sup> In addition, **vast parts of the network are outdated and ageing**.<sup>49</sup> The result is that many RES projects have not received the necessary grid access authorizations which are usually granted in the permitting stage. The lack of long-term grid planning is a factor that erodes investor confidence. The regulator ANRE has been tasked with preparing multiannual grid investment plans, but the delay in the institution's start-up is having a knock-on effect on grid planning.

Power demand reached a historical record of 39 TWh in 2019 and is expected to reach 45 TWh in 2021.<sup>50</sup> To meet demand peaks, ONEE relies on **demand reduction from industrial users** (though peak/off-peak pricing), power imports from Spain (typically covering 14% of demand), peak production and storage at concentrated solar power plants, pumped hydro and combined-cycle gas turbines. To integrate the large targeted RES capacity (10GW by 2030), major investments are needed. Morocco has been pursuing grid flexibility through pumped storage hydropower, CSP with storage, and gas-fired generation. For example, the first CSP project in Ouarzazate was designed to have three hours of storage capacity to contribute to meeting peak demand actively. Morocco announced tendering and construction of solar PV-CSP hybrid plants (with thermal energy storage). In 2018, ONEE launched a roadmap to develop storage facilities by 2030. The most recent facility will be the Abdelmoumen Pumped Storage Plant expected to be operational by 2022.

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<sup>47</sup> ONEE, 2019, Rapport d'Activités 2019, Rabat

<sup>48</sup> Tizgui I., El Guezar F., Bouzahir H., Vargas A. N., 2018, Estimation and Analysis of Wind Electricity Production Cost in Morocco, International Journal of Energy Economics and Policy, 8(3), pp.58-66

<sup>49</sup> Shen et al, 2018, The state-of-the-arts of the study on grid interconnection between Iberian Peninsula and West Maghreb region, Global Energy Interconnection, 1(1), pp.20-28

<sup>50</sup> IEA, 2019, Energy policies beyond IEA Countries Morocco, Paris

## 4.2.2 Existing interconnections

Morocco's grid is interconnected with Spain and Algeria. Plans include establishing new interconnections with Mauritania, Portugal and a 3rd interconnection with Spain, as illustrated in Figure 6. Power imports represent the primary source of flexibility in Morocco since they play an essential role in balancing supply and demand.

This section elaborates on these interconnections, specifically the interconnection between Morocco-Spain as the most promising for giving a viable scenario to cross-border PPAs.

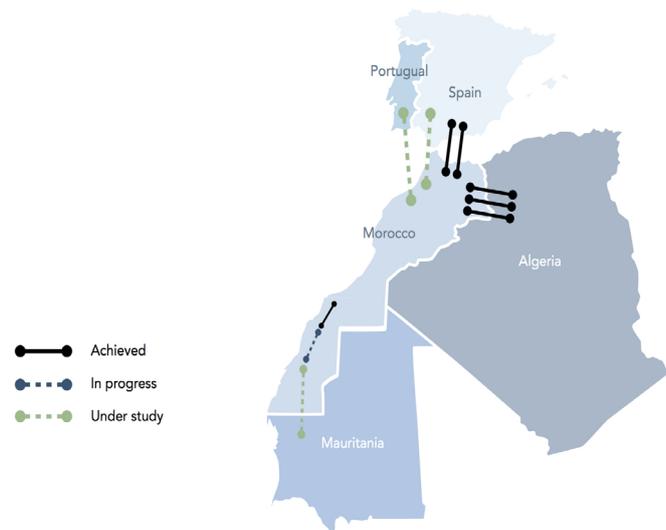


Figure 6: Moroccan power interconnectors

Morocco is interconnected to Spain through two 400 KV submarine cables with a line capacity of 1,400 MW.<sup>51</sup> Of this, the commercial capacity is 900 MW. This interconnection **is the only existing electricity link** between Europe and the southern shore of the Mediterranean. It is the gateway to Europe for RE generated in North Africa. Also, this interconnection is the building block of Morocco's power infrastructure and contributes significantly to the frequency and voltage stability of the Maghreb interconnected power system. It also offers the possibility to improve technical and economical operation of energy production and transmission systems in the two countries.

The trade of electricity is managed by ONEE in Morocco and Red Eléctrica in Spain. On the Spanish side, trade is managed on the Spanish spot market where ONEE has participated directly since 1998.<sup>52</sup> Red Eléctrica acts as Spain's sole TSO, responsible for planning, developing and managing the transmission grid, carrying out its maintenance and managing interconnectors with neighbouring countries, guaranteeing non-discriminatory Third-party access.

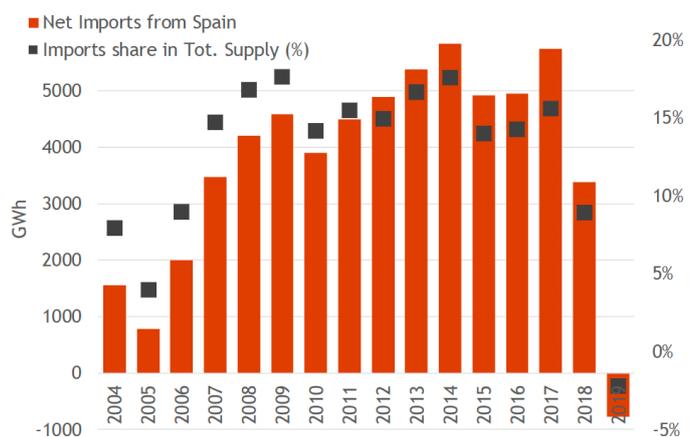


Figure 7: Electricity import Morocco 2004-2019

<sup>51</sup> The first was commissioned in 1997 and the second in 2006.

<sup>52</sup> MED-TSO, Deliverable 3.2 - Schemes for sharing systems services and RES integration. EC DEVCO - GRANT CONTRACT: ENPI/2014/347-006.

On the Moroccan side, trade is managed by ONEE as the authorized Single Buyer for the Moroccan market. As noted before, neither country has in place a capacity allocation mechanism for the interconnector.

When it comes to the volume of flows, Morocco has mostly been a net importer with volumes more than tripling between 2004 and 2017 and imports covering between 10 and 14% of electricity demand (see Figure 7)<sup>53</sup>. In 2018 and 2019, the direction of flows reversed and Morocco became, for the first time ever, a net exporter at a magnitude of around 1,2 GWh, equivalent to some 2.3% of total national generation.<sup>54</sup> The reversal of flows was driven by a mix of technical issues on the Spain-Morocco line and an increase in coal generation capacity in Morocco.<sup>55</sup> This increase in coal-generated power has been cause of some controversy, especially in the context where Spain’s own coal generation capacity has been made uncompetitive by EU carbon standards while Morocco’s electricity benefits from a free trade agreement.<sup>56</sup> This example illustrates, yet again, the importance of a well-functioning and mutually recognized Guarantees of Origin scheme which can act as an enabler of cross-border renewable electricity trade.

At any rate, it appears that there is sufficient spare capacity to accommodate additional electricity flows from cross-border corporate PPAs. This is especially the case on the interconnector Morocco-Spain which, over the last three years has on average been used for only 8% of hours available (see Figure 8).

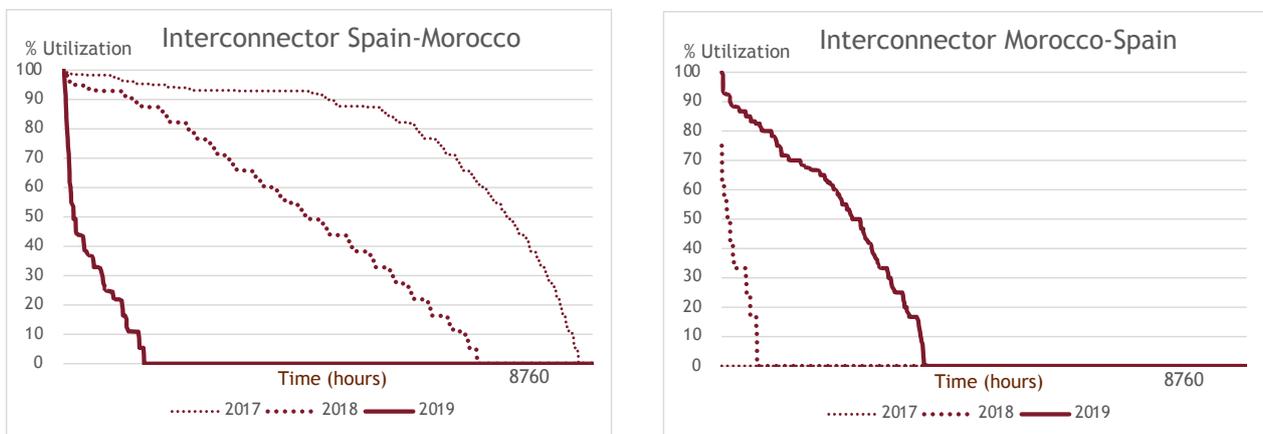


Figure 8: Spain-Morocco interconnector utilization rate <sup>57</sup>

<sup>53</sup> Key Data Report ONEE (2004-2019)

<sup>54</sup> Intended as the sum of total net imports and total National generation

<sup>55</sup> Coal production almost doubled between 2017 and 2018 from 2895 MW to 4281 MW. ONEE, 2019, Rapport D'activités 2019, Rabat

<sup>56</sup> See, for example, two parliamentary questions from February and April 2019 examining this perceived case of carbon leakage: [https://www.europarl.europa.eu/doceo/document/E-8-2019-000606\\_EN.html](https://www.europarl.europa.eu/doceo/document/E-8-2019-000606_EN.html) and [https://www.europarl.europa.eu/doceo/document/E-8-2019-001764\\_EN.html](https://www.europarl.europa.eu/doceo/document/E-8-2019-001764_EN.html)

<sup>57</sup> Source: Red Eléctrica

### 4.2.3 Interconnections under consideration

In 2010, the EU launched the project “Paving the Way for the Mediterranean Solar Plan” aimed at promoting the development of renewable energy sources and the cooperation between TSOs on the two shores of the Mediterranean towards an integrated power system.<sup>58</sup> In 2015, the EU commissioned Med-TSO to conduct feasibility studies and cost-benefit analyses on cross-border interconnectors across the Mediterranean and provide technical assistance on how to promote RE integration.<sup>59</sup> For example, the latest project called TEASIMED, launched in 2020, is set to work on the implementation of the guidelines, rules and methodologies needed to enable an interconnected Mediterranean power system. Another notable project was the MAES, which laid out a view for 3rd interconnector between Morocco and Spain of 400kV based on High Voltage Alternate Current (HVAC) technology, connecting the Tarifa substation in Spain and at the Beni Harchan substation in Morocco.<sup>60</sup>

Following on from the MAES project, Spain and Morocco signed an MoU agreeing on the construction of the 3rd interconnector in February 2019. The 400-kV link should have a technical capacity of 700 MW, bringing the total commercial capacity connecting the two countries to 1,500 MW, and with an expected commissioning date by 2026. The project is estimated to require an investment of €150 million, shared 50-50 between the two countries.<sup>61</sup> The MoU also included a collaboration agreement aimed at pursuing deeper market integration of the two countries. This collaboration agreement presents opportunities to implement some of our policy recommendations which we outline in Chapter 5.

A potential interconnection between Morocco and Portugal is still under discussion between ONEE and REN, the Portuguese TSO. The new transmission line would have a capacity of 1,000 MW and a total length of around 265 km (of which approximately 220km are submarine cable).<sup>62</sup>

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<sup>58</sup> Moretti A., Pitas C., Cristofi G., Bué E., Francescato M. G., 2020, Grid Integration as a Strategy of Med-TSO in the Mediterranean Area in the Framework of Climate Change and Energy Transition, *Energies* 2020, 13 (5307), pp. 1-23

<sup>59</sup> Med-TSO has been funded for two projects by EC DG NEAR (Mediterranean Project I 2015-18, and Mediterranean Project II 2018-20), A third grant from EC DG NEAR is co-funding the new TEASIMED Project from 2020-22.

<sup>60</sup> Med-TSO, 2020, Mediterranean Master Plan of Interconnections 2020, Rome

<sup>61</sup> Source: Red Eléctrica. <https://www.ree.es/en/press-office/news/press-releases/2019/02/spain-and-morocco-agree-development-third-interconnection-between-both-Countries>

<sup>62</sup> Med-TSO, 2018, Deliverable 2.1.2 Detailed Project Description 01 - MAPT Morocco - Portugal, Rome

Summary of how Morocco meets the infrastructure Common Requirements for cross-border PPAs

Summary of the Moroccan infrastructure framework		General drawback	Barriers for cross-border PPAs
<b>Internal Grid</b>	<p>The internal grid is relatively well developed, covering the entirety of the country.</p> <p>Relevant authorities are pursuing a range of system flexibility investments in the form of interconnectors, transmission reinforcements, and storage.</p> <p>ONEE launched a 2030 roadmap for energy storage systems and reinforcement of electrical grid.</p>	<p>The grid in the south of the country is least developed.</p> <p>If RE projects are based in the south, IPP must pay reinforcement fee.</p>	<p>Successful grid integration of RES depends on the authorities' continued investments in flexibility.</p> <p>Reinforcement fees to pay hinder the attractiveness of RE market.</p>
<b>Inter-connections</b>	<p>The existing interconnector Morocco-Spain (two 400KV cables, capacity 1,400MW, of which 900MW commercial capacity). There appears to be sufficient spare capacity to accommodate additional electricity flows from Morocco to Spain.</p>	<p>There is no long-term capacity allocation mechanism on the interconnector.</p>	<p>The inability to book capacity in a transparent manner increases risk and erodes investor confidence.</p>

## **4.3 Analysis of Requirement 3: Market Framework**

### **4.3.1 Presence of a competitive and transparent electricity market**

One of the key reasons why corporate buyers choose to buy their energy via a long-term PPA rather than buying directly on the market is to maintain predictability of their energy costs and potentially lock in a price advantage relative to market levels. In turn, to assess whether a PPA price is advantageous or not, both the buyer and the seller will refer to reference prices in each respective market. Indeed, a commonly seen PPA price arrangement is one where the contract price is benchmarked to a reference market price, as a way of mitigating price risk. A variation of this arrangement is a financial PPA, in which there is no physical delivery and the PPA takes the form of a Contracts for Difference relative to a reference market price.

Spain is part of the Iberian Electricity Market MIBEL, within which the Spanish and Portuguese markets are fully coupled. Generally speaking, MIBEL is a well-functioning and highly liquid market in both its wholesale and futures segments, providing a solid reference for PPA activity. Additionally, a number of energy data providers such as BNEF or PexaPark provide information on PPA price deals.

The situation is quite different on Morocco's side, where no organized wholesale market exists and most RES deals are negotiated bilaterally with ONEE. Estimating Morocco's electricity price levels, or even gaining visibility on private deals, is therefore a challenge. This context presents an unsurmountable barrier for financial PPAs. But a possible business case still exists to implement physical PPAs, which we outline in Chapter 5.

### **4.3.2 Relative price advantage**

If we had to pick the single most important requirement for cross-border PPAs, it would be the relative price advantage. Even in a perfect political, regulatory, and infrastructure context, a cross-border PPA will be contracted only and only if the price of that PPA is equal to or lower than the price at which the off-taker can contract energy on the free market or through a PPA in their own country. This is the concept of indifference price. The end-price that an off-taker in Spain would end up paying is composed of two elements: the electricity generation cost and the cost of transmission.

#### **Electricity generation cost**

When it comes to Spain, an indication of the relevant price level can be taken from data provider BNEF, which in August 2020 reported an average Spanish PPA price with a 10

year tenure at €35.50/MWh.<sup>63</sup> An auction for solar capacity held in January 2021 yielded an average price of €24/MWh.<sup>64</sup> These refer to costs of electricity generation (plus the producer's profit margin), meaning that costs of transmission are additional.

This takes us to the question of how to estimate prices for Morocco. There are two possible avenues: results of past RES auctions or a theoretical estimation of the LCOE. Morocco introduced an auction scheme for onshore wind in 2012 for 850 MW; the results were announced four years later with world low record prices at an average of USD 25-30/MWh.<sup>65</sup> Auctions for solar plants were launched at around the same time, with Morocco opting to pursue Concentrated Solar Power technology which beyond generating power has the additional benefit of storage. Also here, the latest tender awarded in May 2019 broke the world's lowest record for that specific technology, at around €63/MWh (see Figure 9).<sup>66</sup> It is worth noting that Morocco's auctions included a local content requirement and mandatory social redistribution policies which added a price premium; it is not unreasonable to assume that without them the energy price may have been even lower.<sup>67</sup>

Another means to assess the relative market attractiveness of sourcing RE in Morocco for export to Spain can be derived in a theoretical manner via the Levelized Cost of Energy (LCOE).

For Spain, the 2019 LCOE was reported at \$0.056/kWh for solar PV and \$0.051 kWh for wind.<sup>68</sup> Information on Morocco's LCOE is not readily available; we therefore created our own estimate based on a set of customized parameters (see Annex 1 for details). A modelling of six geographic areas with a high solar and wind potential yielded an estimated LCOE of €0.044/kWh for solar PV and €0.032/kWh for wind, considerably lower than data available for Spain.<sup>69</sup>

The conclusions on the energy generation cost, based on both a comparison of recent auctions and of a theoretical LCOE calculation, is that Morocco may well have the ability to generate electricity at a comparatively lower price than Spain. The determining factors are solar irradiation / wind speed factors, in which Morocco may have a slight comparative advantage (see Figure 10), and the cost of capital, where on the contrary the comparative advantage is likely to lie with Spain.

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<sup>63</sup> Price of 31/08/2020, Price of 31/08/2020, PEXAPARK, 2020, PPA Price Report Spain, Switzerland

<sup>64</sup> Source: <https://www.py-tech.org/solar-wins-big-in-spains-renewables-auction-with-more-than-2gw-awarded/>

<sup>65</sup> IEA, Morocco Renewable Power Tenders (MASEN)

<sup>66</sup> 0.68 dirham/kWh. Source: <https://www.solarpaces.org/morocco-breaks-new-record-with-800-mw-midelt-1-csp-pv-at-7-cents/> and <https://news.masdar.ae/en/news/2019/05/23/10/46/noor-midelt-phase-1-hybrid-solar-power-plant>

<sup>67</sup> More specifically, an obligation was introduced on local manufacturing of wind turbine blades and on the setting up of a local training centre. Source: RES4Africa Foundation, Auction study, 2018

<sup>68</sup> Data retrieved from Global LCOE and Auction values [available at <https://www.irena.org/Statistics/View-Data-by-Topic/Costs/Global-LCOE-and-Auction-values>]

<sup>69</sup> More specifically, the results were 0.0491 €/kWh for the Meknes area, 0.0439 €/kWh for the Figuig area, and 0.0398 €/kWh for the desert near Tazenakht. While, the LCOE for wind is equal to 0.0399 €/kWh in the Safi area, 0.0319 €/kWh in the Tan Tan coast, and 0.0245 €/kWh in the Laayoune area. See Annex 2 for more detail.

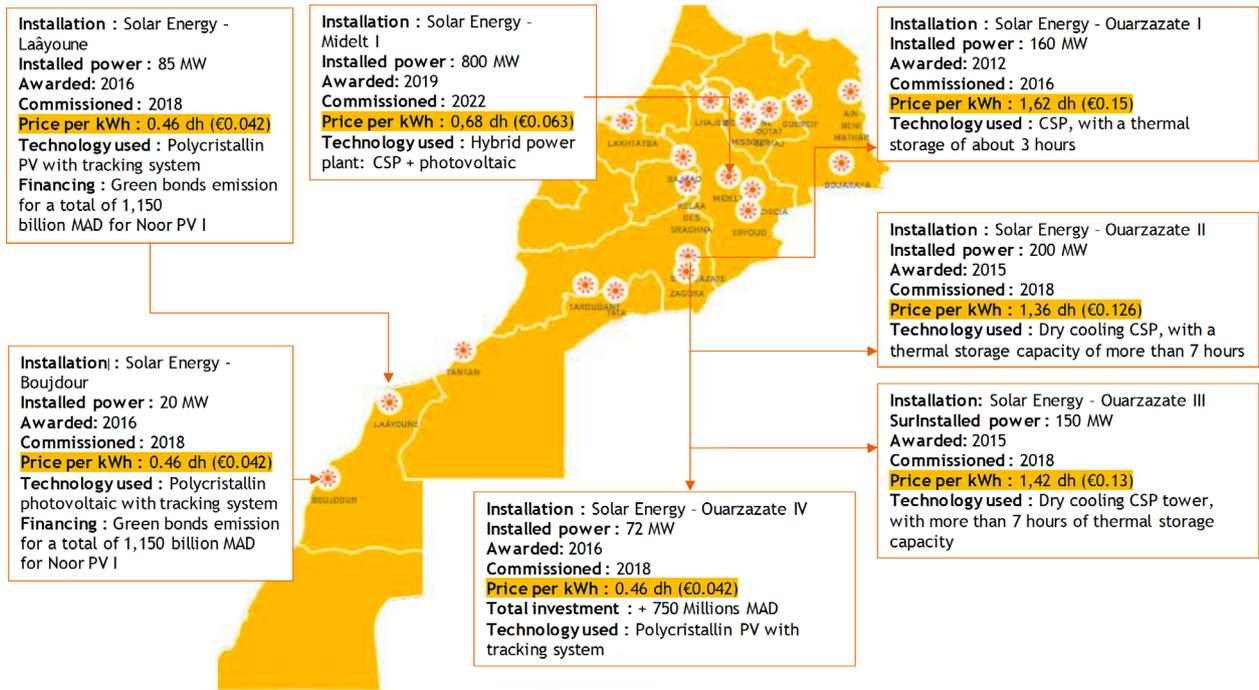


Figure 9: Information on Moroccan tenders by MASEN

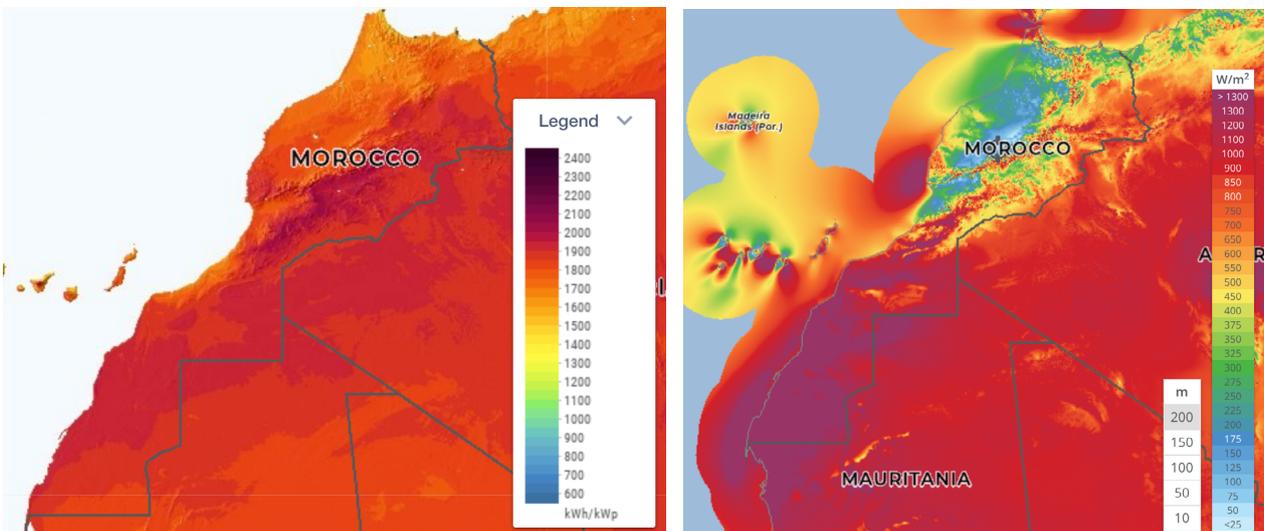


Figure 10: Solar and wind potential map of Spain and Morocco<sup>70</sup>

<sup>70</sup> Source: Global wind and solar Atlas

## Cost of transmission

In addition to electricity generation costs, the Spanish off-taker deciding whether to buy energy via a cross-border PPA with a generator in Morocco will need to consider the cost of transmitting that energy to their point of consumption. Generally speaking, longer distances and especially the need to cross highly congested grid segments are likely to translate to a higher transmission price.

In the case of transmission from Morocco, congestion does not appear to be a major problem at the moment as the interconnector in the direction from Morocco to Spain has sufficient spare capacity. But the high number of grid fees to be paid, and above all the lack of transparency and predictability of those fees, is a major barrier that risks eroding the competitive advantage of Morocco's energy exports. Box 4 below illustrates the fees that currently would be part of a cross-border PPA.

### Grid fees to be paid for transmission of energy from the generator in Morocco to the off-taker in Spain

**Balancing fees**, to be paid by the generator. Formalised under draft Law 40.19. All operators on the national electricity grid will contribute to the stability of the grid by paying a balancing fee determined by ANRE upon a proposal from the operator(s) of the concerned electrical grid(s). In absence of an operational ANRE and pending implementation of draft Law 40.09, this fee is bilaterally negotiated between IPPs and ONEE. This factor limits transparency and thus prevents the economic evaluation of cross-border PPAs.

**Reinforcement fee**, to be paid by the generator. Although Law 13.09 do not refer to a reinforcement fee as it is bilaterally negotiated with ONEE, operators may have to pay it. Power producers, when evaluating a power plant project, must ask for a technical opinion from ONEE on the capacity of the power grid to accommodate the energy the plant will produce. If the grid requires reinforcement, ONEE develops a study assessing the total needed investment.

This investment will be paid (through a reinforcement fee) by the power producer evaluating the project and eventually by other future producers installing new capacity in the area. The reinforcement fee discourages investors from making new projects where the national grid is not particularly developed. The lack of transparency limits a precise evaluation of the economic feasibility of new plants. To be paid by the generator.

**Grid upgrade costs**, to be paid by the generator. Where the transmission capacity is insufficient, producers can build a new merchant line under a concession agreement to be concluded with ONEE and that includes **grid upgrade costs** (Art.28 of Law 13.09).

**Export fee from Morocco**, to be paid by the generator. Fees for export of energy are regulated by Law 13.09 (Articles 27 to 30). Private producers must pay an export fee to the State to transfer power from Morocco to Spain through the interconnections in place. The annual fee is proportional to the volumes, rates and terms and at the State request can either be paid in cash or in kind or in part kind and in part cash (Art. 29).

**Transmission fee**, to be paid by the off-taker. Introduced under Law 13.09, is to be bilaterally negotiated between the two parties. In lack of transparency, potential investors are unable to evaluate this operating cost component clearly.

**Interconnection fee**, to be paid by the off-taker. Draft Law 40.19 introduced the interconnector capacity fee, and the level of that fee is to be determined by implementing legislations (to be issued by ANRE the regulator). To date, this legislation has not been introduced. Consequently, the cost of exporting is unknown, and thus increasing the uncertainty on the economic aspect of a cross-border PPA with Morocco.

*Box 4: Overview of grid fees applicable to energy export from Morocco via a cross-border PPA*

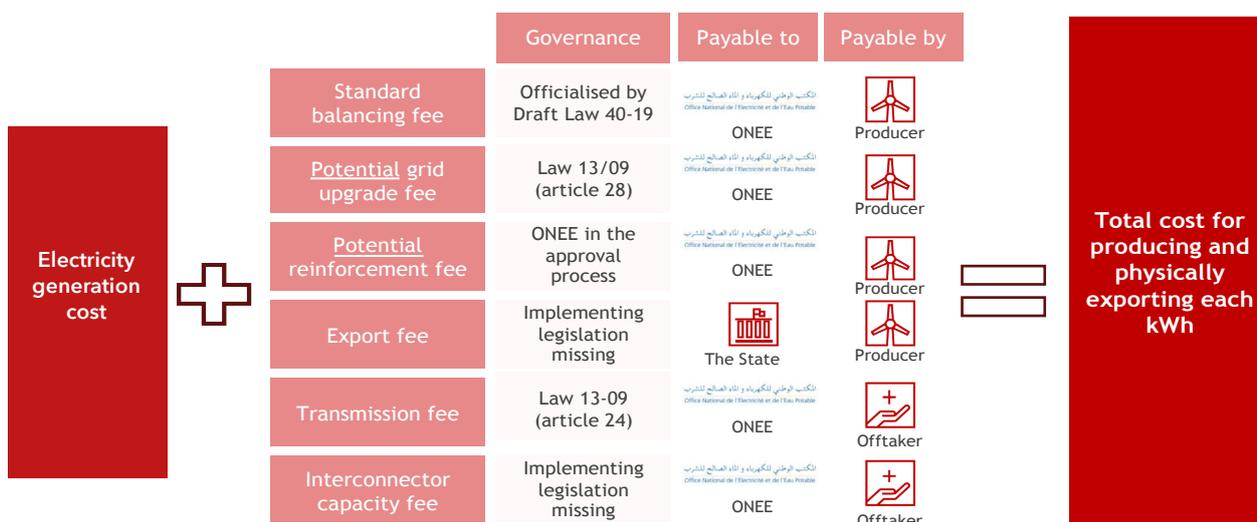


Figure 11: Costs components included in economic assessment

Summary of how Morocco meets the market Common Requirements for cross-border PPAs

	Summary of the as-is market framework	General drawback	Barriers for cb PPAs
<b>Electricity Market</b>	<p>No organised wholesale power market.</p> <p>ONEE is single buyer for most volumes (around 80% in 2019).</p> <p>Remaining volumes are traded/self-consumed in the market.</p>	<p>Low liquidity.</p> <p>Lack of a transparent and reliable reference price.</p>	<p>Inability to assess the relative price advantage of a PPA relative to market price.</p>
<b>Relative price advantage</b>	<p>In terms of electricity generation costs, Morocco may indeed have a relative price advantage compared to Spain (based on past auctions and LCOE estimates).</p> <p>But transmission costs may be quite high and risk eroding that relative price advantage. Without transparency on the level of fees, this cannot be established with clarity.</p>	<p>Fees are bilaterally negotiated with grid operator, so there is no guarantee of level playing field.</p> <p>A large share of implementing regulation for existing laws has not been published.</p>	<p>The lack of transparency prevents a clear and reliable economic evaluation, and increases investment risk.</p>

## 5. POLICY RECOMMENDATIONS

Morocco and the four EU members of the SET Roadmap (Spain, Portugal, France, Germany) have a clearly stated commitment to deepening their trade in sustainably generated electricity. They committed to do so via green corporate cross-border PPAs, which is a frontier and rather rare practice even between highly integrated EU markets. The intent of this study is to provide Morocco's policy makers with a set of concrete policy recommendations for how to deliver on that strategic commitment, without losing sight of the specificities of Morocco's context.

Our policy recommendations are based on a gap assessment relative to minimum common requirements, with a view of implementing a pilot project based on a specific business model that appears most feasibly within reach. Below we first explain that business model, and then lay out recommendations for policies and actions needed to make that business model feasible.

### 5.1 Business model for cross-border PPAs between Morocco and Spain

The overall conclusions of the analysis of Morocco's political, regulatory, infrastructure and market framework suggest that a **reasonable basis for cross-border trade exists, though there are major gaps in certain areas**. Those gaps are substantial enough to practically exclude the possibility of applying a financial cross-border PPA model in Morocco, for reasons including:

- Absence of a transparent, liquid and well-function wholesale market in Morocco which would serve to provide reference prices and the needed liquidity.
- Incompatibility of financial PPAs with certain EU cooperation mechanisms, including joint projects and the Union Renewable Finance Mechanism (which can provide advantages).
- Incompatibility of financial PPAs with a mutual recognition of Guarantees of Origin (in case that recognition occurs in the future).
- Nonetheless a physical (sleeved) cross-border PPA model could feasibly be implemented if a set of policy actions is pursued. Figure 12 illustrates the business model.

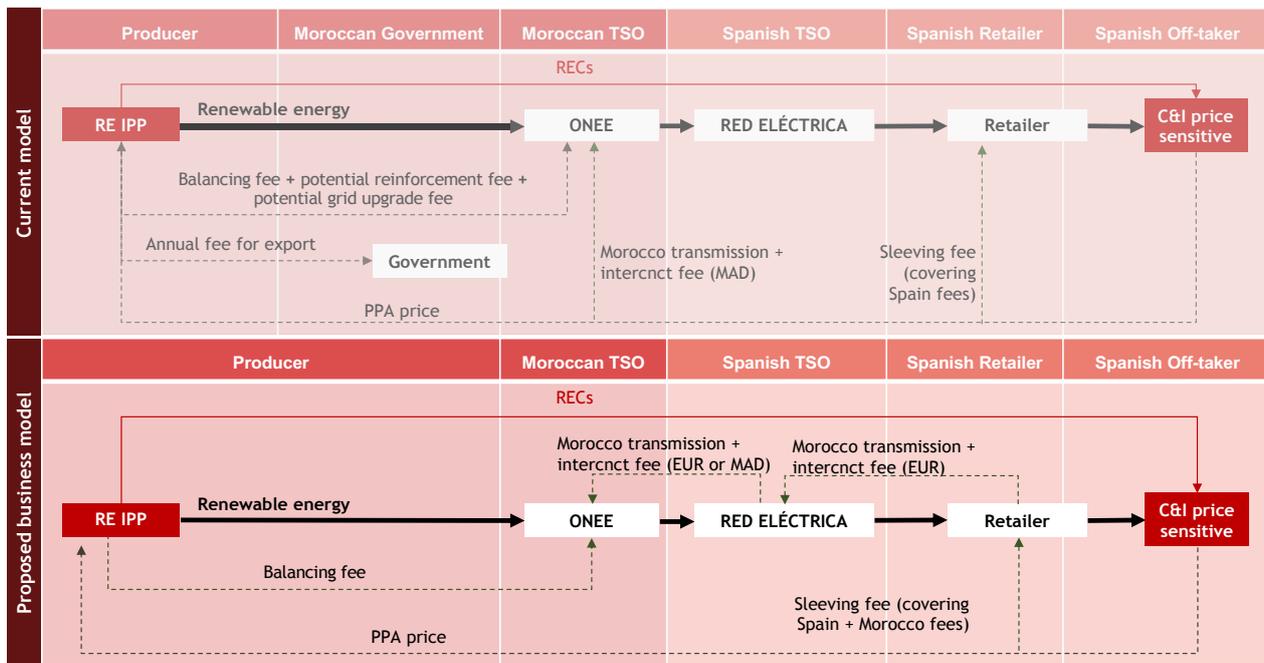


Figure 12: A physical (sleeved) cross-border PPA model between Morocco and Spain

Within this model, the long-term exchange of RE takes place between a RE IPP in Morocco as a seller and a corporate buyer in Spain. In the current context where Guarantees of Origin are not mutually recognized, corporate buyers interested in fostering their green credentials are unlikely to pursue cross-border PPA with Morocco. Therefore, price-sensitive corporates are more likely target buyers.

Given their price sensitivity, this model is applicable **only if the PPA price is competitive with the end-user's market price**. Even in a perfect political, regulatory, and infrastructure context, a PPA will only be signed at a price level where the off-taker is indifferent between the cross-border PPA and the second-best option. We saw earlier that **in terms of electricity generation costs, Morocco may well have a relative price advantage** compared to a generator in Spain. Yet the full costs of a PPA are also driven by a set of fees on which currently there is little visibility as they are negotiated bilaterally with ONEE (and are indexed to electricity prices over the lifetime of an asset), and the information available suggests the **fees are very high**. They include balancing fees, reinforcement fees especially if the power flows are south oriented, upgrade and transit fees. The export fees to be paid to the state are yet to be specified in implementing regulations and has never been applied, as ONEE is currently the only exporter. Investors report that the fee level is currently so high that it can almost double the cost of electricity. This de facto erodes Morocco's relative price advantage.

The lack of visibility on fees also hampers the commercial arrangement of the sleeving fee. In a standard corporate cross-border PPA, a utility acts as an intermediary between the buyer and the seller to manage their physical exchange of energy (and of renewable energy certificates, if applicable), against a proportionate compensation by the buyer. In our business model, the Spanish retailer providing sleeving services needs to have full visibility and predictability of relevant fees, including a means to protect against currency risk in the case of fees payable to Moroccan counterparts.

## 5.2 Recommendations for making the proposed business case applicable

The premise of our recommendations is that comparative advantage is the *condicio sine qua non* of any cross-border PPA. For that reason, priority must be given to introducing transparency on all relevant fees in order to guarantee a level playing field where rules are the same for all and offer potential investors a minimum basis on which they can estimate the competitiveness of a PPA price. Besides transparency, the fees should be set at a level that sufficiently reflects costs on the operator without eroding the relative price advantage of Morocco's power.

The business model outlined above can be feasibly applied in trade between Morocco and Spain under condition that a series of barriers are removed. In the section that follows we lay out a set of policy recommendations grouped into four categories: political, regulatory, infrastructure, and market.

### Political commitment

Within the Sustainable Energy Trade Roadmap, Morocco and four EU countries charted a path to regulatory and political cooperation in pursuing cross-border electricity trade via green corporate PPAs. The high-level political agreements signed in 2016 has been followed by a series of preparatory studies and a follow-up Joint Declaration. Yet there has been a slowdown in the past few years, which is problematic for two reasons. First, because it leaves unresolved a series of issues and prolongs the period where barriers persist. Second, because a lack of visibility of public commitment risks introducing uncertainty among the investment community. We recommend five specific actions:

- 1. Reinvigorate the pace of cooperation on the Sustainable Energy Trade Roadmap by signing the Memorandum of Understanding.** The Memorandum of Understanding could serve to provide concrete implementation actions on both sides of the Mediterranean, including on:
  - Broad commitment, with adequate deadlines, to remove regulatory and other barriers to cross border trade
  - Establishment of a transparent interconnector capacity allocation mechanism between Morocco and Spain
  - Mutual recognition of Guarantees of Origin
  - Specific initiatives for Morocco to benefit from existing EU RES cooperation mechanisms, notably joint projects and the Union Renewable Financing Mechanism.
- 2. Commit to implementing a pilot green corporate cross-border PPA project between Morocco and Spain.** A pilot project can serve policy makers to identify what are the practical barriers to CB PPAs. It can also serve to increase investor confidence and attract additional interest in this kind of trade.

- 3. Pursue topics of cross-border PPAs in other ongoing high-level initiatives**, such as the 3rd Morocco-Spain interconnector and the Deep and Comprehensive Free Trade Agreement (DCFTA). More specifically:
  - Negotiations on the 3rd Morocco-Spain interconnector should extend beyond infrastructure considerations to cover the topic of competitive allocation mechanisms, mutual recognition of GOs, potential tapping into EU RES cooperation mechanisms, the possibility for the 3rd Spain-Morocco interconnector to be recognized as a Project of Common Interest under the EU's Connecting Europe Facility, etc.
  - The DCFTA negotiations were officially launched in March 2013 but the process came to a practical standstill only a year later. Relaunching negotiations on the Agreement, and notably on its dedicated chapter on Trade-related Energy matters, can provide mutually beneficial cooperation on regulatory harmonization, including via Technical Assistance from the EU to Morocco. The Agreement can also provide an additional avenue within which to negotiate a mutual recognition of Guarantees of Origin.
  
- 4. Pursue a systemic energy policy view which recognizes potential synergies between hydrogen and cross-border electricity trade.** Recently the topic of green hydrogen has captured the attention of many, and for good reason: Morocco has plenty of RES capacity which can be used to produce hydrogen, and the EU is a willing buyer. But hydrogen need not come at the expense of other initiatives; a systemic view of the energy system needs to pursue the many synergies between hydrogen and cross-border energy trade. Enabling cross-border trade via PPAs will serve to provide an additional degree of system flexibility, which can benefit the system overall.
  
- 5. Continue to promote RES development and the PPA market in Morocco more broadly.** Export of green electricity via cross-border PPAs can certainly provide mutual benefits for both Morocco and European countries, but Morocco has still a long way to go in terms of greening its own domestic consumption. Promoting PPAs, especially for energy-intensive consumers, is being increasingly pursued in Europe and can be a fruitful route also for Morocco's RES development. Spain has a relatively well developed PPA market with a series of dedicated incentive schemes in place, which can be a starting point of knowledge transfer and lessons learned.
  
- 6. Strengthen the domestic Renewable Energy Certificates market by stimulating demand.** Even if mutual recognition of EU's and Morocco's RECs is ensured, the fact remains that Morocco's REC market is embryonic at best. The country's RE and sustainability sector more broadly could draw substantial benefits from a deeper development of the RECs market, including by promoting green choice, increasing consumer consciousness and promoting social acceptance of RES. To stimulate demand, the policy maker should undertake two types of action:
  - Information and promotion - to increase awareness among industry and society about the multiple benefits of RECs

- A closer scrutiny of the costs of issuance of RECs - issuing bodies typically charge an administration price for issuing RECs, and attention needs to be paid to the level of charge in order to prevent a potential excessive burden on the generator.

## Regulatory requirements

The bulk of the policymaker's effort will need to be focused on regulatory requirements, where 3 areas of action are needed. Namely:

- a. Internal functioning of Morocco's electricity market, where a series of reform and transparency measures are pending full implementation. Here, undertaking our recommended policy measures can be beneficial to enable green corporate cross-border PPAs, and also for removing barriers to RES development more broadly.
- b. Active incentivization of cross-border PPAs, in view of reducing investment risks and improving the relative advantage of Moroccan electricity in Spain.
- c. Greater regulatory and grid code harmonization between Morocco and Spain.

Concerning the **internal functioning of Morocco's electricity market**, a starting point must be an effective implementation of rules already in place. Morocco already has a series of relatively well-designed laws. Their implementation is of utmost importance. Areas of priority include:

### 1. Introduce full transparency, visibility and predictability of all relevant grid fees.

Fees concerning grid connection, balancing and transmission are all currently subject to private negotiations between the government and the RE-IPP. Fees for interconnection are unknown as no private operator exports energy. This is problematic for many reasons. First, the lack of transparency and predictability on these fees makes it difficult to ascertain whether a level playing field exists in which rules are the same for everyone. Second, the need to engage in bilateral negotiation comes at a transaction cost for the IPP which can act as a de-facto barrier. To introduce transparency of fees, Morocco's policy makers need to prepare a set of implementing regulations governing the level of fees. and subsequently entrust a relevant body with their implementation and management.

### 2. Ensure that ANRE is entrusted with the full capacity needed to manage grid fees.

The mandate of ANRE includes setting tariffs, maintaining transparency of the market, ensuring a correct market functioning and handing disputes, all of which requires a substantial administrative and technical capacity. Following its inaugural meeting in October 2020, ANRE needs to accelerate its start-up process and ensure it has the capacity (and political backing) needed to fully take on its duties.

The need for **incentivization of cross-border PPAs** emerges from a recognition that the relative price advantage is the single most important factor determining whether or not a cross-border PPA will get concluded, and that the current risk environment in

Morocco may erode the relative price advantage of Morocco's electricity generation costs. If Moroccan policy makers are committed to pursuing cross-border PPAs, they should consider implementing the following incentive policies:

- 1. Scrap the export fee.** A fee on exports is distortionary as it places an undue burden on the IPP located in Morocco. Removing it will add a competitive advantage to Moroccan electricity on the Spanish market, and thus improve the economic case for PPAs. This fee has never been fully implemented and has never been applied, as ONEE has been the only exporter. Therefore, its scrapping will not have major consequences on public finances.
- 2. Scrap the potential reinforcement and grid upgrade fees.** The costs of grid reinforcement and upgrade should already be reflected in the transmission fee, and charging an additional fee would in some sense amount to a form of double charge. Additionally the fact that these fees are only placed on projects in the south of the country is distortionary, as it amounts to a de facto disincentive to develop RES potential in an area with otherwise immense untapped potential. Scrapping these two fees can provide a further boost to the competitiveness of the PPA price and reduce investment uncertainty. This needs to be done in a way that does not compromise the financial stability of ONEE.
- 3. Revisit the level of other grid fees.** Investors report that grid fees are currently excessively high, to the extent that they render export of Morocco's electricity uncompetitive. Fees need to be set at a level that reflects the grid upgrade costs, without placing an undue burden on the IPP.

On the area of **greater regulatory and grid code harmonization** between Morocco and Spain, measures are needed to foster the broader benefits of greater market integration. There is no need to fully harmonize national regulation; a starting point can be a harmonization of approaches concerning essential shared components of cross-border PPAs. Two areas of priority include:

- 1. Introduce a harmonized, transparent and competitive capacity allocation mechanism for the existing interconnector between Morocco and Spain.** Such a mechanism would increase visibility and predictability of fees and procedures concerning long-term export, therefore increasing investor confidence. A standardized allocation mechanism may also reduce administrative transaction costs, and therefore improve competitiveness of traded energy in the market of destination. The implementation of such a mechanism is done at a local level, but a political impetus is indispensable - including, for example, via the SET Roadmap or as part of the ongoing negotiations on the 3rd Morocco-Spain interconnector. The setting and management of fees on the part of Morocco should be put under the mandate of ANRE, as part of the overall management of the grid value chain.

- 2. Create a standard methodology for calculating interconnection charges across both sides of the Gibraltar.** Similarly to the capacity allocation mechanism, transparency on the methodology of calculating fees can improve investor confidence and promote a range of other benefits related to closer market harmonization (e.g. use the interconnector to trade ancillary services). Spain already has experience in regional cooperation on methodology setting, notably through trilateral cooperation with Portugal and France.
- 3. Ensure mutual recognition of Guarantees of Origin.** Sustainability is becoming a growing concern for corporates, and the desire to foster their green credentials is likely to be an important motivator for corporates in Spain to pursue green cross-border PPAs with Morocco. The contrary is also true: absent the possibility to prove that the energy they purchase is green would remove large part of the economic rationale for pursuing cross-border PPAs. Mutual recognition of GOs can therefore provide a boost for cross-border PPAs, and should be pursued with no delay. The added benefit is that once recognized at the EU level, the theoretical possibility exists for Morocco to pursue electricity trade with the Union more broadly.

## Infrastructure requirements

Our analysis pointed out the deteriorating quality of Morocco's internal grid, and a satisfactory level of spare capacity on the Morocco-Spain interconnector. To avoid infrastructure bottlenecks, we recommend the following two actions:

- 1. Prepare credible and implementable long-term grid investment plans.** ANRE needs to be the owner of this activity and the investment plans need to become an authoritative and reliable basis for future grid fees. Investors need to be given the certainty that their potential RES projects will be granted all the needed grid authorizations without undue financial burdens.
- 2. Increase investments in flexibility solutions for the domestic grid, with the view to integrate ever growing share of variable RES in the power mix.** Morocco's grids face a double challenge of growing energy demand and a growing share of renewables in the power mix. To keep the grid stable and flexible, a high degree of investment over the next decade is of critical importance. Relevant solutions come in a multitude of forms include interconnectors, general grid reinforcements, storage, incentives for demand response etc. Even small signs of grid bottlenecks must be prevented as they can reduce investor confidence and erode Morocco's economic growth trajectory more broadly.
- 3. Accelerate works on the 3rd Morocco-Spain interconnector, with a view to capitalize on its systemic benefits.** A 3rd interconnector is not only needed for cross-border PPAs; it can provide a multitude of system benefits including as a flexibility source (which is much-needed on either sides of the Gibraltar). Morocco's policy makers should explore possibilities to benefit from EU mechanisms such as Projects of Common Interest or joint projects, with a view to accelerate works and scope out investor interest.

- 4. Consider interconnection capacity constraints between Spain and other EU SET countries.** Our business model is focused on cross-border PPAs between Morocco and Spain, although the intention of the SET roadmap is to foster this kind of trade also between Morocco and Portugal, France and Germany. The high congestion on the France-Spain interconnector could be a bottleneck to furthering this kind of trade, and needs to be examined more closely.

## Market requirements

We've outlined earlier a picture where market requirements, notably the presence of a transparent electricity market and a clear relative price advantage, are not adequately met in Morocco. We recommend three actions that improve the relative price advantage and reduce investor risk by increasing transparency and reducing transaction costs. Namely:

- 1. Strive to introduce a degree of transparency on the electricity price level.** Building a transparent, liquid and well-functioning wholesale market will take years, but a starting point can be the introduction of transparency on contracted prices for government negotiated PPAs. They will serve to give investors a basic reference point to estimate the relative competitiveness of their PPA.
- 2. Create a framework agreement between ONEE and Red Eléctrica governing the payment of Moroccan transmission and interconnection fees, to simplify procedures and reduce currency risk.** In our proposed business model, fees for transmission and interconnection within the Moroccan market are payable by the Spanish offtaker to ONEE. The offtaker would typically conclude a sleeving agreement with a Spanish retailer, who takes on the duties of paying to ONEE. The potential complexity of this payment exchange, and potential currency risks in case the fee is payable in Moroccan Dirham, may translate to high transaction costs which in turn erode the relative advantage of the PPA price. A possible solution could be found in a framework agreement between ONEE and Red Eléctrica, where the Spanish retailer is allowed to pay the entirety of the fees to the Spanish TSO, in Euro, and the Spanish TSO subsequently arranges for a transfer to ONEE. A solution needs to be found to avoid undue exposure of Red Eléctrica (or ONEE) to foreign exchange risk.
- 3. Create a standard contract for physical cross-border PPAs, to reduce transaction costs and improve bankability.** Cross-border physical (sleeved) PPA agreements tend to be complex legal documents which need to account for a high number of risk factors which may emerge over the entire duration of a contract, including market risks of the two markets concerned. The transaction costs of drafting such agreements is not negligible. The Moroccan policy maker should consider tasking a specific working group, composed of adequate legal experts and industry stakeholders, with the creation of a standard contract applicable to a specific cross-border PPA model and governing a range of factors including project risk, currency risk, sleeving arrangements etc.

## Recommended policy actions needed to make the proposed business model feasible



### Political

- Reinvigorate the pace of cooperation on the Sustainable Energy Trade Roadmap by signing the Memorandum of Understanding.
- Commit to implementing a pilot green corporate cross-border PPA project between Morocco and Spain.
- Pursue topics of cross-border PPAs in other ongoing high-level initiatives.
- Pursue a systemic energy policy view cognizant of potential synergies between hydrogen and cross-border electricity trade.
- Continue to promote RES development and the PPA market in Morocco more broadly.
- Strengthen the domestic Renewable Energy Certificates market by stimulating demand.



### Regulatory

#### Area 1: internal functioning of Morocco's electricity market

- Introduce full transparency, visibility and predictability of all relevant grid fees.
- Ensure that ANRE has the administrative and capacity and political backing needed to manage grid fees and guarantee a level playing field.

#### Area 2: incentivization of cross-border PPAs

- Scrap the export fee.
- Scrap the potential reinforcement and grid upgrade fees.
- Revisit the level of other grid fees.

#### Area 3: greater regulatory and grid code harmonization between Morocco and Spain

- Introduce a harmonized, transparent and competitive capacity allocation mechanism for the existing interconnector between Morocco and Spain.
- Create a standard methodology for calculating interconnection charges across both sides of the Gibraltar.
- Ensure mutual recognition of Guarantees of Origin.



### Infrastructure

- Prepare credible and implementable long-term grid investment plans.
- Increase investments in flexibility solutions for the domestic grid, with the view to integrate ever growing share of variable RES in the power mix.
- Accelerate works on the 3rd Morocco-Spain interconnector, with a view to capitalize on its systemic benefits.
- Consider interconnection capacity constraints between Spain and other EU SET countries.



### Market

- Strive to introduce a degree of transparency on the electricity price level.
- Create a framework agreement between ONEE and RED Eléctrica governing the payment of Moroccan transmission and interconnection fees, to simplify procedures and reduce currency risk.
- Create a standard contract for physical cross-border PPAs, to reduce transaction costs and improve bankability.

# Annex 1: Estimating Morocco's Levelized Cost of Electricity

Assuming realistic parameters for 2020, the LCOE considers the initial investment (I), the maintenance and operations expenditures (M), the fuel expenditures (equal to zero for RES plants)(F), the Carbon tax (zero for RES plant)(C), the sum of all electricity generated (E), the discount rate of the project represented by the WACC (r), and the useful life of the system (n). In general, the resulting LCOE values for Morocco appear globally competitive, reflecting its considerable RE potential.

## LCOE for wind farms in Morocco

WACC <sup>71</sup>	6.50%
Capex (€/kW) <sup>72</sup>	1315
Lead time to COD (years)	2
Expected lifetime (years)	25
Annual O&M (€) <sup>73</sup>	2% of Total Investment
Annual degradation factor <sup>74</sup>	1.6%

Investment cost depend on the technology and the site of installation. It involves the value of technology, which is currently between 500 and 740 €/kW,<sup>75</sup> and its transport, installation, and connection to the grid (which is highly variable from project to project). Isolated installation sites as well as long distances from the technology manufacturer significantly increase the project's initial investment and thus the LCOE. Also, the costs for grid connection (included in the excel model within the Capex assumed value) are difficult to estimate in Morocco since they are bilaterally negotiated between the producers and grid operators.

We assumed three different wind capacity factors for our three case studies based on the Global Wind Atlas:

- 40%, the average value found on the coast near the city of Safi;
- 50%, the average value found on the coast near Tan Tan;
- 65%, the average value found on the Laayoune area.
- The LCOE results equal to 0.0399 €/kWh in the Safi area, 0.0319 €/kWh in the Tan Tan coast, and 0.0245 €/kWh in the Laayoune area as illustrated in the graphs below.

## LCOE for solar farms in Morocco

WACC	6.50%
Capex (€/kW) <sup>76</sup>	888 €/kW
Lead time to COD (years)	2
Expected lifetime (years)	30
Annual O&M (€) <sup>77</sup>	12712 €/MWp/y
Annual degradation factor <sup>78</sup>	0.75%

The three-area considered for the calculation of utility-scale PV projects are:

- The desert near Meknes, in the north of the country, where solar PV potential is around 1700 kWh/kWp;<sup>79</sup>
- The desert close to Figuig, in the eastern region, in which the average solar PV potential is 1900 kWh/kWp;
- The desert near Tazenakht (Ouarzazate province), where a substantial solar potential is present: 2100 kWh/kWp.
- Similar to the LCOE results for the wind farm projects, a sensitivity analysis is shown by varying the assumed parameters from -20% to +20%.

Results indicate that LCOE is of 0.0491 €/kWh for the Meknes area, 0.0439 €/kWh for the Figuig area, and 0.0398 €/kWh for the desert near Tazenakht.

<sup>71</sup> The reference 6.50% was deduced following consultations with PwC and Enel P&C. The team intentionally chose the higher end of the estimate; some sources suggested the WACC may be below 5%.

<sup>72</sup> IRENA, 2019, Renewable Power Generation, Abu Dhabi. The value represents the global weighted average. It was provided in 2019 USD/kW and it was converted considering the average exchange rate of 2019 (1 Eur = 1.12 USD)

<sup>73</sup> Wind Measurement International, Operation and Maintenance Costs for Wind Turbines ([www-2o0a.windmeasurementinternational.com/wind-turbines/om-turbines.php](http://www-2o0a.windmeasurementinternational.com/wind-turbines/om-turbines.php))

<sup>74</sup> Staffell Lain & Green Richard, 2014, How does wind farm performance decline with age, Renewable Energy, 66, pp. 775-786

<sup>75</sup> IRENA, 2019, Renewable Power Generation Costs, Abu Dhabi. The value represents the global weighted average. It was provided in 2019 USD/kW and it was converted considering the average exchange rate of 2019 (1 Eur = 1.12 USD)

<sup>76</sup> IRENA, 2020, Renewable Power Generation Costs, Paris. The value represents the global weighted average. It was provided in 2019 USD/kW and it was converted considering the average exchange rate of 2019 (1 Eur = 1.12 USD)

<sup>77</sup> Urrejola, Elías (2018). Re: 80 MW Solar PV plant O&M cost. The value provided in 2018 USD/MWp/y and converted considering the 2018 avg FX rate (€1 = \$1.18)

<sup>78</sup> Fu R., Feldman D., Margolis R., Woodhouse M., and Kristen A., 2017, U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017, National Renewable Energy Laboratory

<sup>79</sup> Global Solar Atlas, <https://globalsolaratlas.info/map?c=32.310349,-3.419495,8&s=32.790738,-2.492523&m=site&pv=ground,180,35,1000>

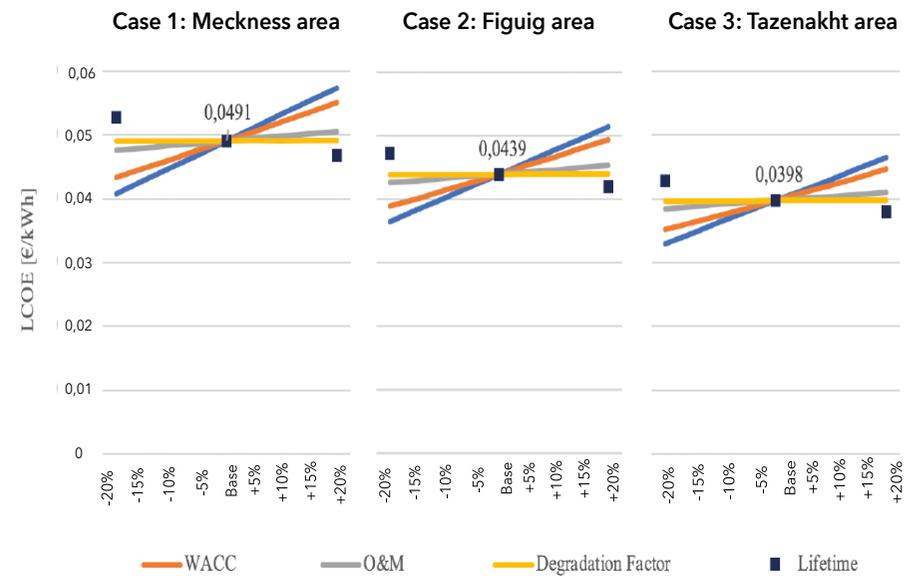
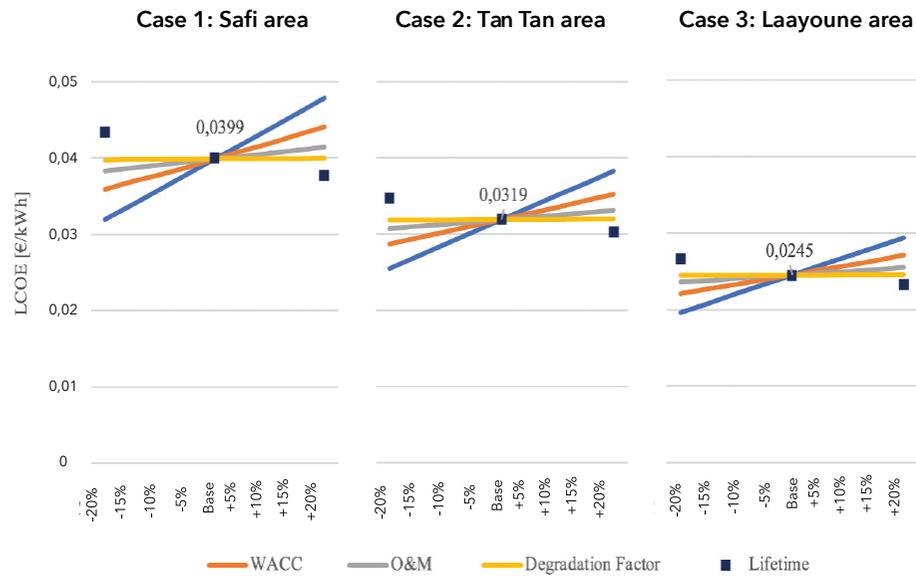


Figure 13: Sensitivity analysis for some cases of wind projects in Morocco

Figure 14: Sensitivity analysis for some cases of solar projects in Morocco

Moreover, below are the LCOE values estimated for nine different wind farms already in place in Morocco.<sup>80</sup> The weighted average LCOE of these nine plants is equal to 0.0301 €/kWh.

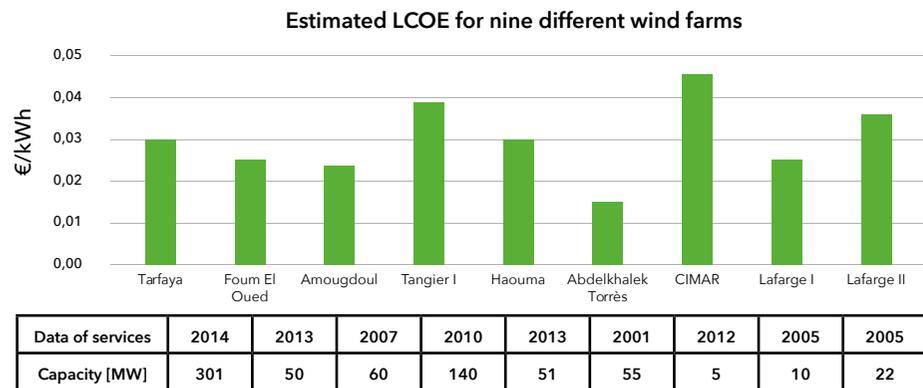


Figure 15: Estimation of LCOE of nine different wind farms

<sup>80</sup> Tizgui I., El Guezar F., Bouzahir H., Vargas A. N., 2018, Estimation and Analysis of Wind Electricity Production Cost in Morocco, International Journal of Energy Economics and Policy, 8(3), pp.58-66

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