



RES4MED presents

ACCELERATING THE DEVELOPMENT OF
RENEWABLES ON THE MV MARKET IN
MOROCCO

A Pöry Report to RES4MED

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RES4MED Working Group led by  **PÖYRY**



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MARKET IN MOROCCO

Contact details

Name	Email	Telephone
Antonio Nodari	antonio.nodari@poyry.com	+39 02 36 59 69 00
Riccardo Siliprandi	riccardo.siliprandi@poyry.com	+39 02 36 59 69 08

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ABBREVIATIONS

DSO	Distribution System Operator
EHV	Extreme High-Voltage
EU ETS	European Union Emissions Trading Scheme
FIT	Feed-in-tariff
GW	Gigawatt
HV	High-Voltage
ISO	Independent System Operator
LV	Low Voltage
MV	Medium Voltage
MW	Megawatt
PPA	Power Purchase Agreement
RES	Renewable Energy Sources
SO	System Operator
TSO	Transmission System Operator

1. INTRODUCTION

Morocco power sector is evolving rapidly. Due to a strong economic development, Moroccan electricity demand increased from 15.5 TWh in 2002 to 35.4 TWh in 2016 (average growth of 6.1%) and it is expected to further increase with a CAGR around 5.6% in the medium term.

In order to meet the increasing power demand, Moroccan generation mix will undergo substantial changes, with the Government's aiming to reduce the country's dependence from commodities' imports. In particular, the Moroccan Government aims at exploiting national resources and therefore the high potential of wind and solar. For this reason, the New Energy Strategy approved by the Moroccan Government has set a target of 6GW of renewable installed capacity by 2020 and plans to have a 52% share of renewables on total installed capacity by 2030.

Regulatory changes have been implemented in order to sustain the large renewable development and attract renewable private investors. Increasing private sector participation to the renewable capacity expansion plans has been considered as a preliminary condition to ensure the achievement of national renewable targets. For this reason, the Government has decided to go forward with the liberalization of its electricity market, partially opening its retail market segment.

The reform opened to private renewable producers the possibility to sell their production directly to end-users, connected to all voltage grid level, allowing the sale of the energy surplus to the grid operators. This reform was intended to attract further private investments in Morocco's renewable energy sector, offering a new route-to-market for their renewable production.

A preliminary assessment of the effective state of implementation of the opening of the retail market has shown that Morocco is facing some difficulties in kick-starting the development of renewable generation capacity on the medium voltage market segment. Such difficulties should be mostly ascribed to the persistence of some regulatory barriers, which prevent investors benefiting from the new renewable route-to-market.

RES4MED is interested in reaffirming the benefits of going on with the progressive liberalization of renewable energy sector and the opening of medium voltage market to private renewable producers in Morocco. Considering the current barriers to the liberalization path, RES4MED aims to provide high-level recommendations for short and medium term actions needed to go on with the implementation of the current market reform and speed up the efficient integration of renewable energies on the medium voltage grid.

RES4MED and Pöyry have carried out this study as basis of their suggested roadmap for the effective liberalization of the renewable energy sector in Morocco.

Section 2 of this report tries to highlight such barriers and assess how they interfere with a correct implementation of the available renewable routes-to-market.

In this Section 3 the report looks to international case studies, selected among the most successful markets in developing renewables, in order to identify the most-relevant business models adopted worldwide to widespread the development of renewable distributed generation capacities on the medium voltage market and define regulatory best-practices and useful lessons learnt.

This work will introduce Section 4, where suggestions on how improve Morocco's regulatory framework will be made based on what could be learnt from successful international case studies.

2. ASSESSMENT OF LIBERALIZATION PROCESS OF RENEWABLE ENERGY MARKET IN MOROCCO

This Section provides an overview of Morocco’s electricity legislative and regulatory frameworks, with particular attention to the power market liberalization process and the recent developments concerning the renewable sector.

The Section presents the current structure of the power market in Morocco and its main actors. Then, it focuses on the available routes-to-market for renewable energy (RES), assessing their effective implementation within the market framework.

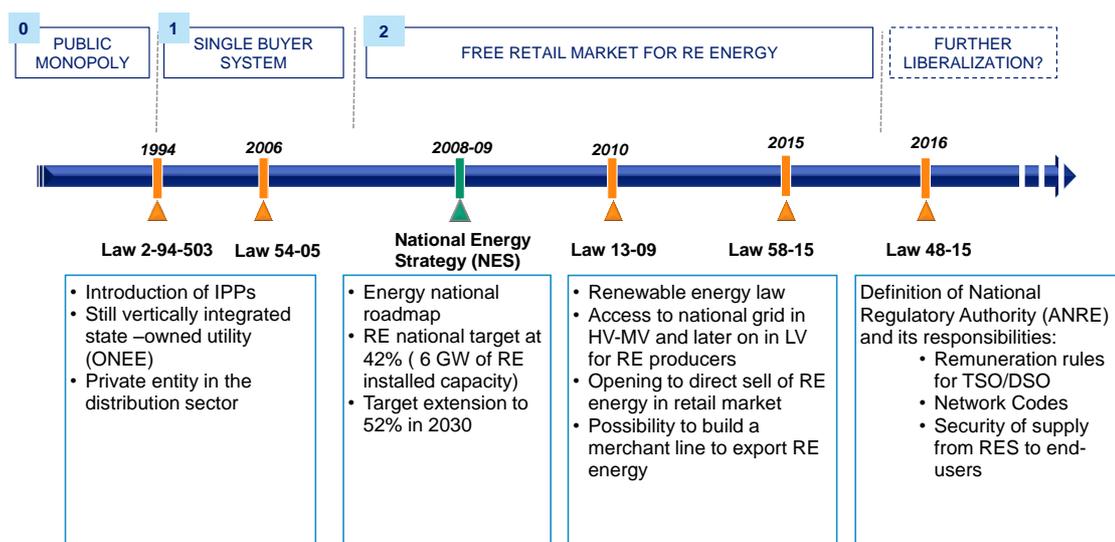
Finally, a high-level assessment of the regulatory framework concerning electrical RES is provided in order to evaluate its completion and highlights strengths and weaknesses of the available routes-to-market for renewable generators in Morocco.

2.1 The reform of the Moroccan electricity sector

The Moroccan electricity sector has been organized as a public monopoly since 1963, with the creation of the vertically integrated public utility: the *Office National de l’Energie et de l’Eau* - ONEE (former ONE). After three decades of public monopoly, in 1994 Morocco entered in a long period of energy market reform, aiming to progressively introduce competition at the different levels of the sector value chain as well as reform the sector governance framework. The reform, still undergoing, aims at establishing a new industrial organization and new market functioning in order to achieve:

- A more competitive market, and most recently
- Ambitious targets for renewable energy in 2020 and 2030.

Figure 1 - Timeline of liberalization of Morocco power sector



Source: Pöyry Management Consulting

The liberalization process was marked by two phases (see Figure 1):

■ **In Phase 1 (started in 1994) the country opened both the generation and distribution sectors to private players**

In 1994, the first pillar¹ of the Moroccan reform introduced competition in the generation sector, authorizing ONEE to enter into Power Purchase Agreements (PPAs) awarded through public tenders with private Independent Power Producers (IPPs).

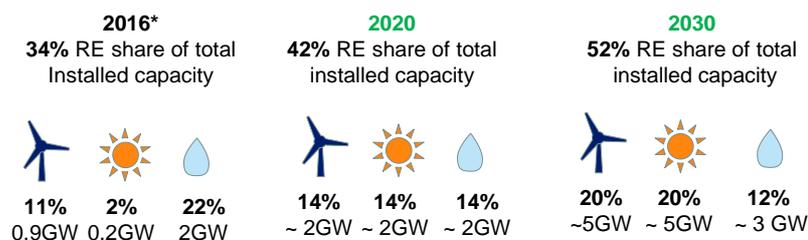
At the same time ONEE remained a vertically integrated company acting also as the authorized Single Buyer (SB) of the market. ONEE centralizes energy procurement from all the contracted generators and is the only authorized reseller to distribution companies. It is the only responsible of central system planning and dispatch, operating the national transmission network.

In 2005, the Government of Morocco (GoM) opened also the distribution sector to private investments. Distribution companies operate under concession schemes granted by the State or the local authorities², which remain the owners of the grid assets. Both public (“*Régies Multiservices*”) and private (“*Gestionnaires Délégués*”) companies are currently operating in this market.

■ **In Phase 2 (2009) the Moroccan Government introduced national renewable energy targets and a partial free retail market**

In 2009, the GoM adopted the new National Energy Strategy (NES), setting the national energy policy targets to 2020. The development of renewable energy sources (RES) is one of the core components of this policy with the target to reach a renewables share of 42% of the total installed capacity by 2020 and a share of 52% by 2030. This means reaching around 13 GW of renewable capacity (notably solar, wind and hydro) by 2030 compared to 3.2 GW at the end of 2016 (see Figure 2).

Figure 2 - Morocco RES targets



Source: Pöyry analysis on ONEE’s data and NES targets

In order to achieve the ambitious renewable target, the Moroccan Government, in 2010, adopted Law 13-09 introducing the second pillar of the electricity reform. Law 13-09 introduced a partial opening of the retail electricity market; aimed at allowing the access right to the high and medium voltage grids (the right has been extended to low voltage in 2015³) to all renewable producers that sell their energy directly to end-consumers.

¹ Law Decree- n° 2-94-503.

² Law n° 54-05.

³ Law n°58-15.

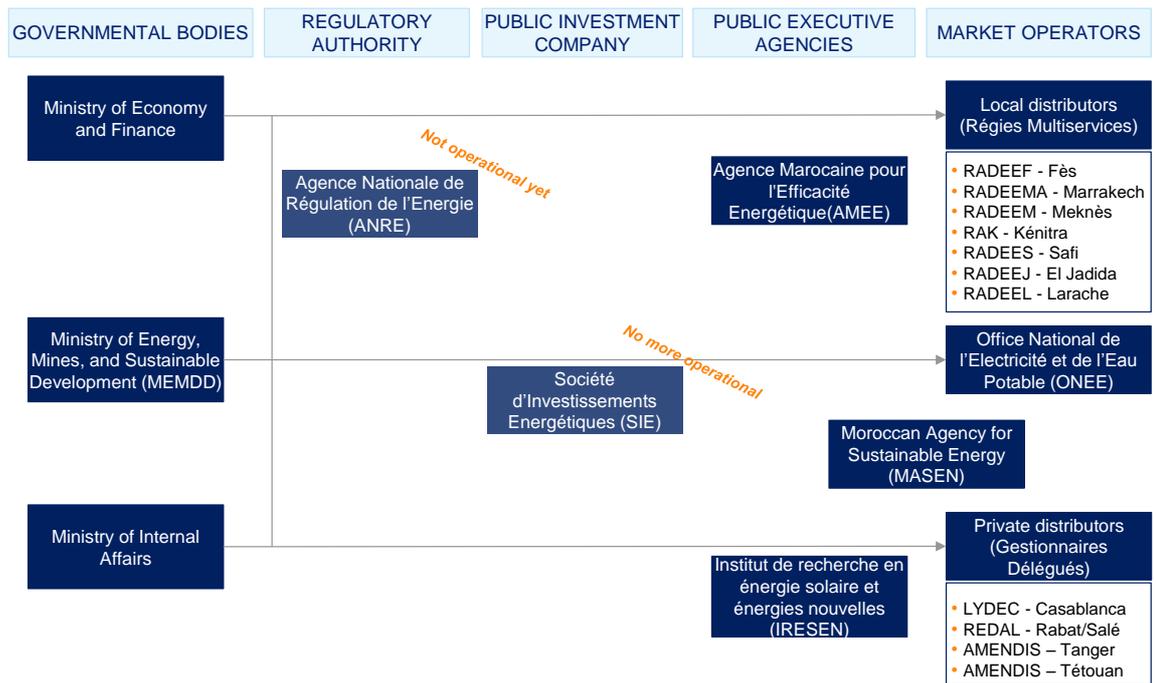
In the new retail market, consumers can bilaterally negotiate energy supply agreements with renewable producers. In this setting, security of supply to end customers is ensured by regulated suppliers⁴ (which coincide with the network operators), having the obligation to provide renewable-supplied consumers with back-up energy (“*énergie complémentaire*”) to meet their load requirements.

During the second phase, the governance of Morocco’s power sector evolved in parallel with market design. The most important evolution was the establishment of an independent regulatory authority⁵, the Agence Nationale de Régulation de l’Energie (ANRE), responsible for monitoring and supervising the implementation and the functioning of the new market model. The law gives clear responsibilities to the regulator:

- The definition of commercial and technical rules of the electricity market;
- The adoption of a grid code and grid access rules;
- Network and retail tariff methodologies.

The resulting sector governance framework and its main institutions are presented in Figure 3; details on the role and responsibilities of each bodies acting in the national electricity sector are presented in Annex A.

Figure 3 - Key players of Morocco power sector



Source: Pöyry Management Consulting

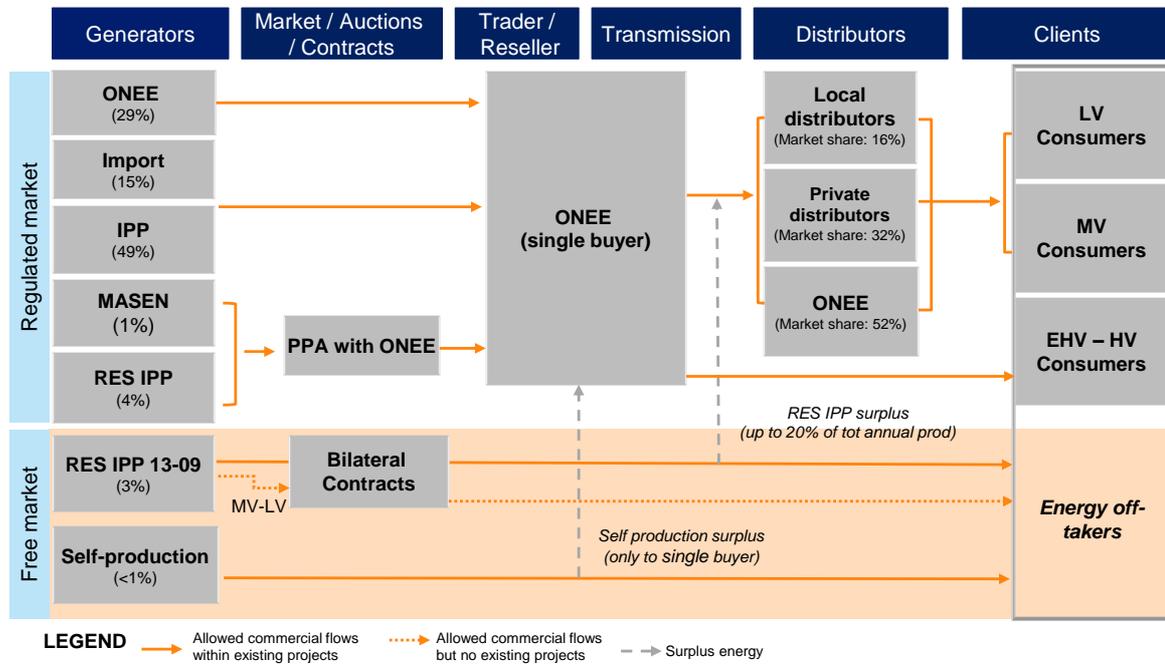
The result of the Moroccan energy reform is an hybrid market model where a regulated market, supplied by the single-buyer and distributors companies, coexists with a free

⁴ Resellers are not envisaged in the current regulatory framework.

⁵ Law n° 48-15.

retail market supplied by renewables producers and self-producers⁶ (up to date mainly fossil-fired self-producers), as shown by Figure 4.

Figure 4 - Moroccan electricity market structure



Note: Percentage values are indicative market share elaborated on 2016 ONEE data

Source: Pöry Management Consulting

2.2 Renewable energy policy and routes-to-market for RES

In early 2009, the GoM reviewed its “National Energy Strategy” (NES), setting new energy policy priorities and targets up to 2020. The NES aims at reducing the high dependence of the country from fossil fuels and energy imports through the development of renewables and the integration of national energy market in the regional context.

NES main targets are :

- Diversify the electricity generation mix through the deployment of renewables and the switch from diesel to natural gas power generation;
- Develop new renewable power generation capacity to reach at least 42% of total installed capacity by 2020; and 52% by 2030⁷;
- Increase the energy efficiency of country economy through a 15% reduction of expected final energy consumption in 2030.

⁶ Self-production was introduced by the Law n° 16-08, initially for fossil –fired self-producers and later on extended to renewables.

⁷ Law 37-16

To achieve the renewable targets set by the NES, Morocco can rely on high renewable market potential :

- Morocco is characterized by high wind potential especially along its southern coasts and in the mountainous regions in the North where wind speed can reach even 11 m/s, the maximum wind country potential is currently estimated as 6 GW;
- The country is also characterized by an outstanding solar potential due to radiation index among the highest in the world and more than 3,000 sunny hours per year.

In order to kick-start the development of renewable capacities, and fully benefit from its potential, the regulatory framework introduces three main routes-to-market for RES in Morocco, covering both large installations and distributed generation:

- **A TSO Procurement scheme;**
- **A Self-Production model;**
- **A Retail Direct-Sales model**

A brief description of the functioning of each model is provided here below.

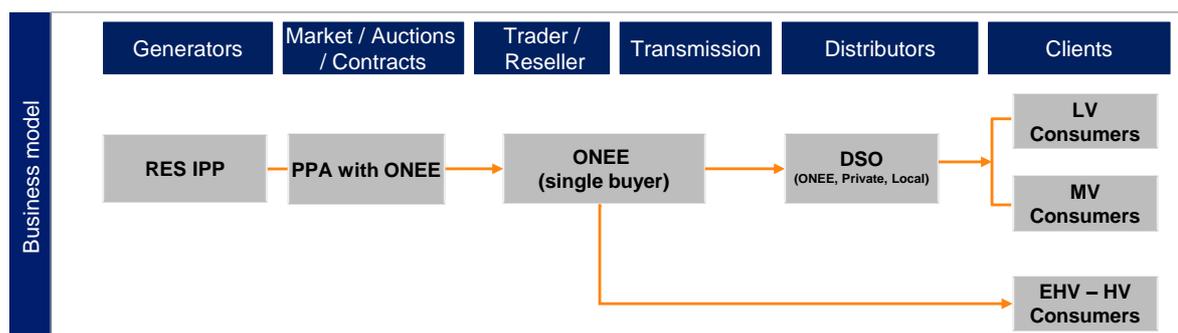
TSO procurement scheme⁸

The first instrument launched in Morocco to deploy renewables is the implementation of a “TSO procurement” model through public auction programs.

This model, as shown in Figure 5, allows the development of utility scale RE installations⁹ by IPPs through public auctions procedures. MASEN (Moroccan Agency for Sustainable Energy) supervises to the development of RE tenders (with the exception of large hydro) and is responsible for auction design and organization in cooperation with ONEE.

ONEE is the only authorized off-taker of the renewable energy produced under this scheme.

Figure 5 - TSO procurement model scheme



Source: Pöyry Management Consulting

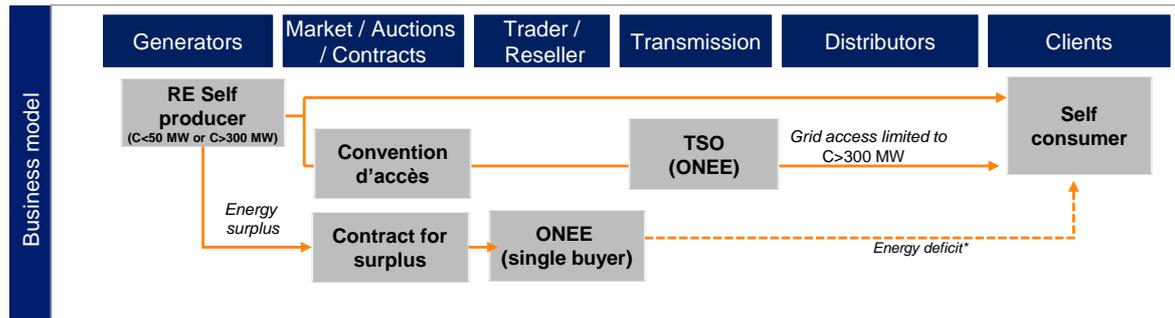
⁸ Law n° 2-94-503.

⁹ Utility-scale renewable energy projects are typically defined as those with a capacity equal or above 10 MW.

Self-production¹⁰

Morocco regulation entitles any public, private or physical person to produce its own electricity within a capacity cap of 50 MW¹¹. The energy surplus can be sold exclusively to ONEE, under commercial terms and conditions (i.e. price of the energy surplus) bilaterally negotiated between the self-producer and the system operator (Figure 6).

Figure 6 - Self-production model scheme



Source: Pöyry Management Consulting

Retail direct sales¹²

Law 13-09 introduced private off-site PPAs, entitling renewable producers to sell their production directly to end-users through the use of EHV, HV, MV grids by the payment of a network-use charge (Figure 7). Such agreements are notoriously known as wheeling services. This right was extended to final customers connected to LV grid¹³ in 2015.

Commercial terms of energy supply are bilaterally negotiated between RE producers and customers. RE producers are also allowed to sell at a regulated tariff the energy surplus to the TSO or to distributors, with a cap of 20% of their annual production. In order to ensure security of supply to end customers having concluded a PPA with a RE producer, the relevant network operator has the obligation to supply the difference between the renewable production profile and the consumption profile of the customer.

To guarantee a smooth but effective integration of renewables, especially under this scheme, notably on the MV grid, the Government set a progressive target for renewable integration to all distributors¹⁴. Distributors are required to issue yearly renewable integration plans (“*enveloppes*”) covering a ten year period (“*trajectoire*”). The amount of

¹⁰ Law n° 16-08.

¹¹ According to the law n° 54-14 the self-production was extended to plants with size above 300 MW. Self-producers are entitled to produce their own energy, obtaining access to the grid and to the wheeling service.

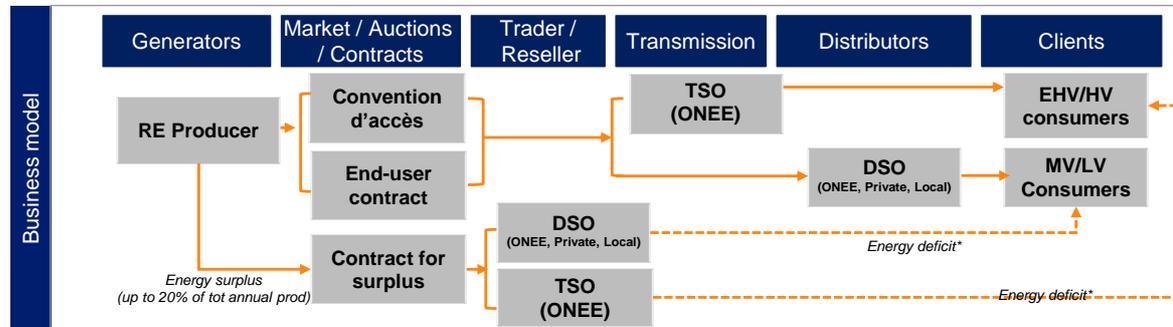
¹² Law n° 13-09, Law n° 58-15 and Decree Law n° 2-15-772.

¹³ Law n° 58-15.

¹⁴ Decree Law n° 2-15-772.

RE to integrate for each DSO has to be calculated as a fraction (between 5 and 10%) of yearly consumption of their end consumers and it is progressive¹⁵.

Figure 7 - Retail direct sales model scheme



Source: Pöyry Management Consulting

2.3 Status of RES deployment in Morocco

As of today, Morocco has been successful in implementing its “TSO-procurement” model, whose capacities counted for around 70% of total generated renewable energy in 2016:

- **Wind projects** have been deployed since 2006, reaching approximately 0.9 GW in 2016. However, recently awarded projects are experiencing important delays in obtaining the connection authorizations (i.e. 850 MW wind farm IPP-project of Enel Green Power and Nareva awarded in 2016) and uncertainties remain on their effective ability to go on-line before 2020;
- **Solar projects** have been mainly concentrated in the area of Noor Ouarzazate, which will account for around 580 MW between CSP and PV. Only 180 MW are already on-line, and it is highly unlikely that Morocco will be able to reach the 2000 MW target for solar expected in the NES.

On the other hand, the implementation of the other renewables routes-to-market has encountered some difficulties (Figure 8) which have undermined the effective development of renewable energies and their integration in the Morocco’s electricity system (Figure 9).

¹⁵ For the first year, the amount of renewable energy to integrate has to be calculated on the demand of captive consumers connected on MV with demand equal or above 2 MW; this demand cap will be yearly reduced and will totally disappear after 5 years.

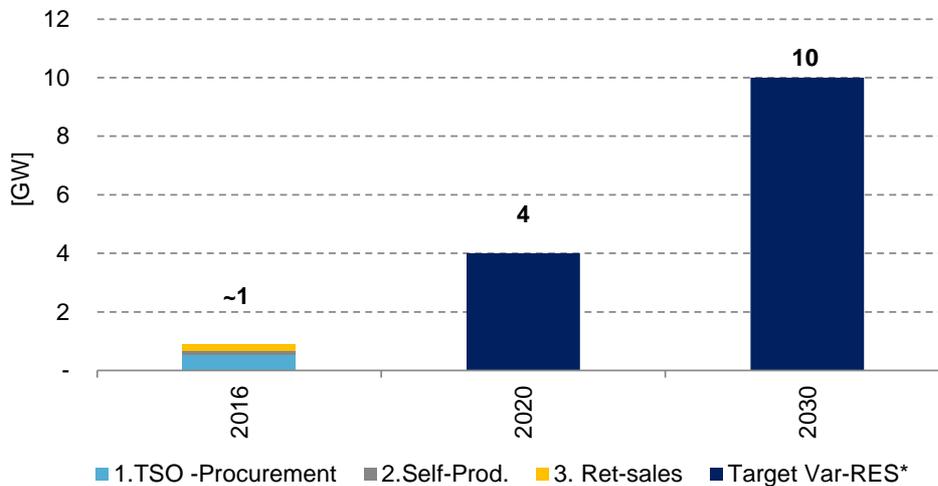
Figure 8 - Tracking of renewable projects in Morocco

	ALLOWED MODELS			EXISTING PROJ.			NOTES
	HV*	MV	LV	HV*	MV	LV	
TSO Procurement	✓	✗	✗	✓	✗	✗	<ul style="list-style-type: none"> First RE implemented scheme: more than 69% of total** RE generated energy sold to ONEE via 20 years PPA A wind farm (0.3 GW) at Tarfaya was realized by Nareva, in JV with Engie (TAREC), to sell RE energy exclusively to ONEE on HV grid.
Self Production (SP)	✓	✓	✓	✓	✗	✓	<ul style="list-style-type: none"> Third RE scheme: (4% of total RE energy) Industrial customers (Lafarge, Holcim) developed a wind-farm (10 MW) selling their surplus (up to 50% of total capacity) to ONEE Few PV installed by households especially in rural/remote areas but not relevant
Retail Direct Sales (RET-SALES)	✓	✓	✓	✓	✗	✗	<ul style="list-style-type: none"> Second relevant RE scheme (27% of total RE energy): only three projects in operation. A wind farm realized under Law 13/09 by Nareva and connected to transmission network to sell energy to industrial customers Energy wheeled by ONEE through national grid

* RE on HV is out-of-scope
 ** Total RE energy excluding hydro (exclusively owned by ONEE)

Source: Pöry Management Consulting

Figure 9 - Variable RES Integration versus national targets* (GW)



* Target RES does not include hydro

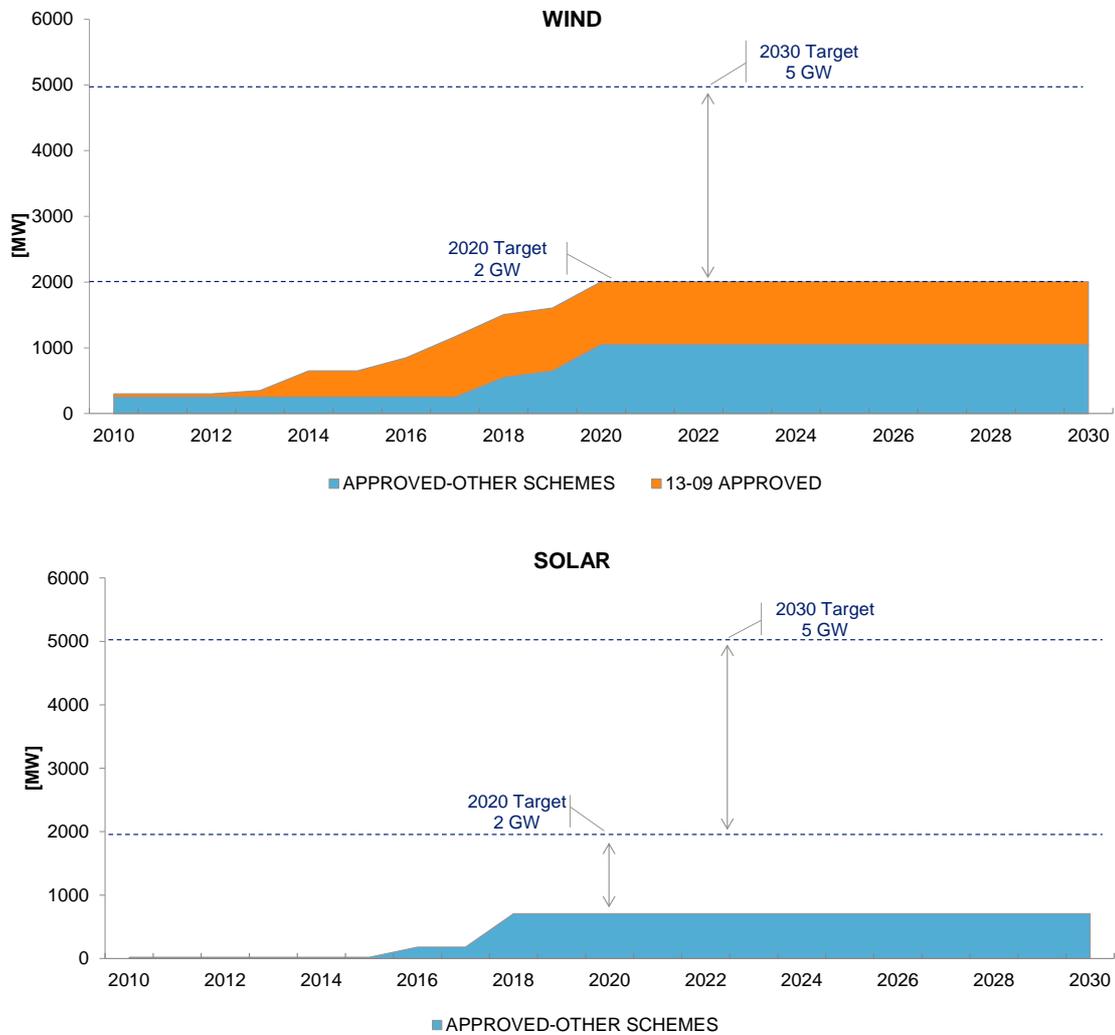
Source: Pöry Management Consulting on MASEN data

Behind projects being developed under the “TSO-procurement” model, it has to be noticed that some wind projects are being developed also under the “Retail direct sales”(RET-sales) model, although only on the HV network.

If concretely developed, all those new capacities should allow Morocco to reach its RE target for 2020 concerning wind energy, as shown by Figure 10 in the meanwhile, any

solar projects is currently under development under the “RET-sales” scheme, undermining the possibility of Morocco to reach its solar target by 2020.

Figure 10 - Wind and Solar project development and National Targets (MW)



Source: Pöry Management Consulting on MASEN data

Although it is necessary, the implementation of dedicated routes-to-market for renewable energy is not sufficient to ensure alone the effective development of large amounts of new renewable capacities. As highlighted in Figure 8, Morocco is today facing some difficulties in developing renewable projects on its MV grid, where any project has been already implemented, thus despite the opening of this market segment to private renewable generators by Law 13-09.

2.4 Assessment of the main barriers for an efficient development of renewables

The difficulties encountered by renewable investors in benefiting from the commercialization models currently implemented in Morocco could be mainly ascribed to regulatory barriers.

As showed, Morocco's primary legislation has been deeply reviewed during the last years. The GoM has started this process adopting new laws to redesign electricity market. The reforms aimed to foster the development of renewables into national power sector and their integration in the market, in accordance with the national energy policy targets.

Nevertheless, regulatory adjustments have not followed and secondary laws and executive regulations have still not be fully adopted. Those are fundamental pieces for a correct functioning of the electricity market, necessary to adapt it to specificities and technicalities of renewables, notably variable technologies as solar and wind.

The GoM has effectively reformed its legislative framework to facilitate renewable integration. Nevertheless, such reforms have not been completely implemented or translated in new regulation in-force.

Table 1 gives an overview of the renewable legislative and regulatory frameworks in Morocco. As it may notice, the framework addresses all the most relevant aspects for an efficient development of RES, from the reform of power sector governance to the introduction of new dispositions concerning the main aspects affecting renewables assets, as for permitting, grid access and management as also network tariffs and incentives.

Table 1 - Assessment of regulatory framework of renewable sector

	Developed	Not Developed yet	Stage
Institutional framework	<ul style="list-style-type: none"> Developed framework with several institutions dedicated to the promotions of renewables: National Energy Regulator (ANRE) establishment with responsibilities and duties Foreseen unbundling of ONEE (creation of separated TSO) 	<ul style="list-style-type: none"> ANRE not operational yet Unbundling of ONEE not completed 	
Target	<ul style="list-style-type: none"> National RE capacity targets defined in the NES: to 42% by 2020 and to 52% by 2030 Renewable portfolio standards (RPS) for DSOs: introduced in terms of RE integration obligation from 5% to 10% of the yearly distributors MV sales 	<ul style="list-style-type: none"> No coordination between distributors obligations and national targets RE obligations on LV not defined yet 	
Land access and permitting¹	<ul style="list-style-type: none"> Geographical limitation: Installation of PV and wind ≥2 MW must be only in defined priority development zones Permitting process for RE electric projects regulated in detail: <ul style="list-style-type: none"> Free market for C <20 KW Declaration process for C >20 KW and < 2MW Two-steps authorization process for C >2MW Possibility for RE producer to build a merchant line to export RE energy, subject to a concession regime 	<ul style="list-style-type: none"> Build-up of merchant line on public land not allowed for RE sales on domestic market 	
Grid access²	<ul style="list-style-type: none"> Access right guaranteed to RES both on transmission and distribution network from VHV to LV Conditions for connection to the grid not regulated but bilaterally negotiated with the grid operator (TSO/DSO) for EHV, HV and MV 	<ul style="list-style-type: none"> No grid access rules to LV grid defined yet No public network code / connection rules (CdC) 	
Grid management³	<ul style="list-style-type: none"> RES dispatching priority guaranteed only on MV Curtailment rate negotiated bilaterally on HV/MV DSOs grid losses procurement open to RE up to 7% of the yearly distributed energy 	<ul style="list-style-type: none"> RE dispatching priority not extended on HV & LV No transparent and no-discriminatory connection rules No public network code / connection rules (CdC) No balancing and ancillary services markets 	
Network tariff and energy prices⁴	<ul style="list-style-type: none"> Temporary general network tariff defined by law Price of the RE energy surplus/deficit acquired by/from TSO/DSO bilaterally negotiated 	<ul style="list-style-type: none"> No transparent methodologies for network tariffs, missing from the ANRE No regulation on price of the RE energy surplus/deficit, missing from the ANRE 	
RE support mechanism⁵	<ul style="list-style-type: none"> DSO obligations for RE energy integration 	<ul style="list-style-type: none"> No financial incentive or direct subsidy to RE generation and consumption No sanctions and penalties defined for DSO 	

LEGEND Not developed Initial Intermediate Advanced Completed

¹ Law n°13-09 set permitting procedures for renewables installations

² Law n°13-09 set grid access rights on EHV, HV, MV grids for renewable producers. Law n°58-15 open grid access right on LV grid for renewable producers. Decree Law n°2-15-772 defined grid access rules on MV

³ Law n°48-15 defines roles and responsibilities of TSO, DSOs and Regulators concerning also grid management rules definition and approval procedures. Decree Law n°2-15-772 set priority dispatch for RE connected to MV grid and rules for DSO ancillary services.

⁴ Ministerial order n° 2451-14 set end-users energy tariffs. Law n°48-15 defines network tariffs methodology principles and approval process

⁵ Decree Law n°2-15-772 set renewable integration obligation for DSOs

Source: Pöry Management Consulting analysis on main Law and regulation of Morocco's power sector

The delays accumulated by the Moroccan renewable policy, included the slow deployment of renewables on medium voltage grid, are the result of two combined factors:

- **An incomplete regulatory framework** due (also) to the absence of a fully operative Regulator, as the ANRE has still not been effectively created. As a consequence of the above, important aspects for the deployment of renewables are still missing:
 - the tariff of the surplus energy which sets the price of the renewable energy injected into the grid and sold to distributors;
 - commercial terms and prices for the back-up energy which sets the conditions between distributor-supplier and the renewables supplied-consumers;
 - the grid code which is the basis for setting transparent rules on transmission and distribution grids management;
 - network remuneration methodology and tariffs which are necessary for reducing any regulatory risk on the profitability of renewables investors¹⁶.

As a consequence, new renewable producers have to negotiate with distributors about relevant operational aspects of renewable plants such as grid access, wheeling service tariffs and curtailment rules.

- **Distributors-suppliers have no incentive to integrate renewables.** The absence of unbundling between distributors and suppliers implies that incumbent operators have no incentive to facilitate the access of RES producers to their grids as:
 - the access of other renewable producers reduces the market share of current incumbents;
 - distributors will need to perform significant new investments to ensure the adequacy and reliability of the grid in order to accommodate higher renewables, but no clear remuneration scheme is currently defined by the Regulator in order to stimulate such investments;
 - this effect is further exacerbated by the high level of uncertainty on the future of distribution concessions.

In order to cope with this issue, the Government has defined an obligation on distributors to integrate renewables according to a 10-year plan. Unfortunately:

- such obligations are not clear in terms of targets and the information on integration plans is not accessible to potential investors and
- the institutions have not prospected any penalty for non-compliant distributors.

As a consequence, distributors might slow the renewables deployment on their grid thanks also to a weak and incomplete regulatory framework. In Table 2 the main criticalities of Morocco's regulatory framework are assessed and classified in order to reflect investors' view of their direct impact on the efficient development of renewables in the country.

¹⁶ Up to date no direct or indirect incentives are envisaged for renewable producer and renewable supplied end-users (only a net-metering scheme is currently envisaged).

Table 2 - Main barriers to an efficient development of renewables

		Market barriers	Criticality
Governance & Policy	RE framework	<ul style="list-style-type: none"> ANRE not operational yet Uncertain framework of the distribution licenses 	
	RE target	<ul style="list-style-type: none"> No clear RE obligations terms on distribution grids Integration plans (<i>trajectoires</i>) still missing 	
Operational	Grid Access	<ul style="list-style-type: none"> Absence of transparent technical rules and methodology for grid access Connection conditions bilaterally negotiated 	
	Grid management	<ul style="list-style-type: none"> Absence of a public grid code No public information on the grid status Discriminatory curtailment of RE installation defined by bilaterally negotiation 	
	Network & energy tariff	<ul style="list-style-type: none"> Missing public methodologies for network and retail tariffs (competence of ANRE) 	
	Business models	<ul style="list-style-type: none"> No clear possibility for virtual RE sales on other MV grids limiting market sizing DSO procurement model limited to ONEE Absence of any direct (FIT, FIP) and indirect (RE end-user discounts) financial support 	

Source: Pöyry Management Consulting

Those criticalities directly affect the available routes-to-market for RES and could explain the difficulties encountered by renewable investors in implementing the available market models, particularly on MV and LV grids where, as already said, projects are not relevant so far and their weaknesses and criticalities largely overwhelm their strengths as of today (Table 3).

Table 3 - S&W analysis of the routes to market for renewable energy

	STRENGTHS	WEAKNESSES
TSO procurement	<ul style="list-style-type: none"> Main regulatory framework in place Centralized tenders for RES capacity Competition for the market Commercial conditions defined by PPA with public company Procurement system managed by the single buyer 	<ul style="list-style-type: none"> RES development limited by national auction program Network access conditions bilaterally negotiated ("Convention d'accès") Unclear dispatching rules
Self production	<ul style="list-style-type: none"> Main regulatory framework in place Grid access allowed to EHV/HV Possibility to sell energy surplus to TSO Possibility to buy energy deficit (énergie complémentaire) from ONEE 	<ul style="list-style-type: none"> Network access limited to EHV/HV and restricted to power plants with capacity > 300 MW Network access conditions bilaterally negotiated ("Convention d'accès") Energy surplus selling limited to ONEE Energy surplus/deficit price and conditions bilaterally negotiated
Retail direct sales	<ul style="list-style-type: none"> Competition in the market Network access rules defined for MV Possibility to sell energy surplus to TSO and DSO (up to 20% of yearly production) Obligation for TSO and DSO to supply RES customers to meet load requirements ("énergie complémentaire") 	<ul style="list-style-type: none"> Regulatory framework incomplete (network access rules for LV, network tariffs, RE integration plans on MV) Network access conditions bilaterally negotiated "Surplus energy" and "Back-up energy" selling price and conditions not defined

Source: Pöyry Management Consulting

3. INTERNATIONAL CASE STUDIES ON LIBERALIZATION PATHS FOR RES ENERGY DEVELOPMENT ON THE MV MARKET

The difficulties Morocco is facing in kick-starting the development of renewable generation capacity on MV market segment, despite the implementation of a noteworthy reform of the retail market, shall be ascribed mainly to the persistent regulatory barriers that investors face. Section 2 of this report highlights such barriers and assesses how they interfere with a correct implementation of the available routes-to-market for renewable energy in Morocco.

This Section 3 looks to international case studies, selected among the most successful international markets in developing renewables, in order to:

- Identify the most-relevant business models adopted worldwide to widespread the development of renewables capacities on the MV market;
- Define regulatory best-practices and useful lessons learnt.

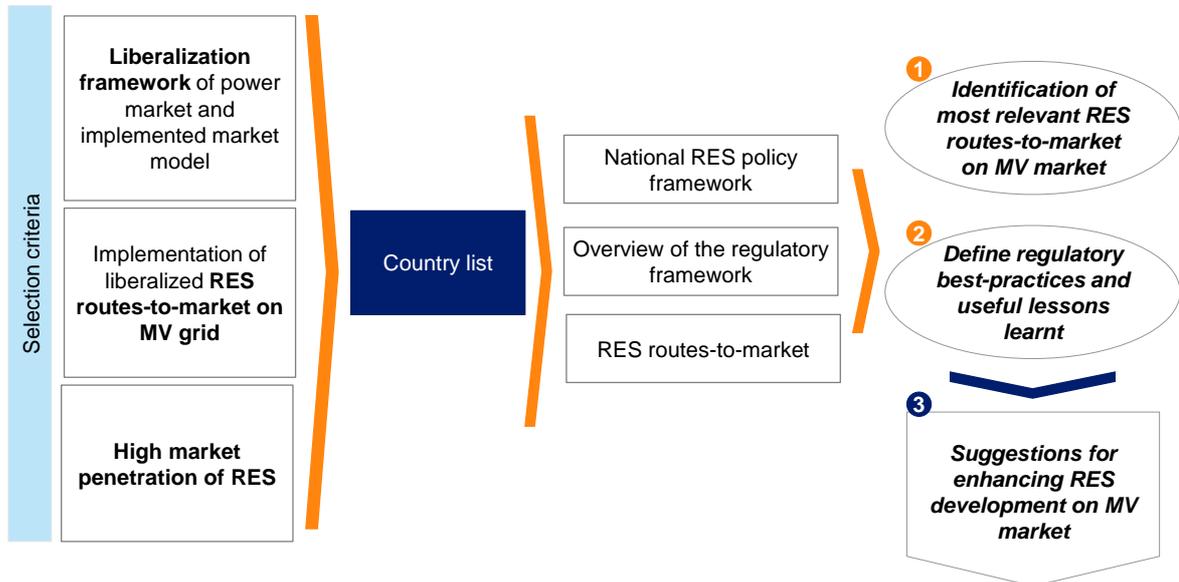
This work will introduce Section 4 where suggestions on how improve Morocco's regulatory framework will be formulated based on success-stories and lessons learnt from the international benchmark.

3.1 Benchmarking rationale

Figure 11 shows the rationale behind the selection of international case studies:

- International case studies should reflect the different power market design models implemented worldwide;
- Dedicated routes-to-market for renewables on the medium voltage market should have been adopted and successfully implemented;
- Electricity systems of each country have to be characterized by a high penetration of variable renewable generation technologies.

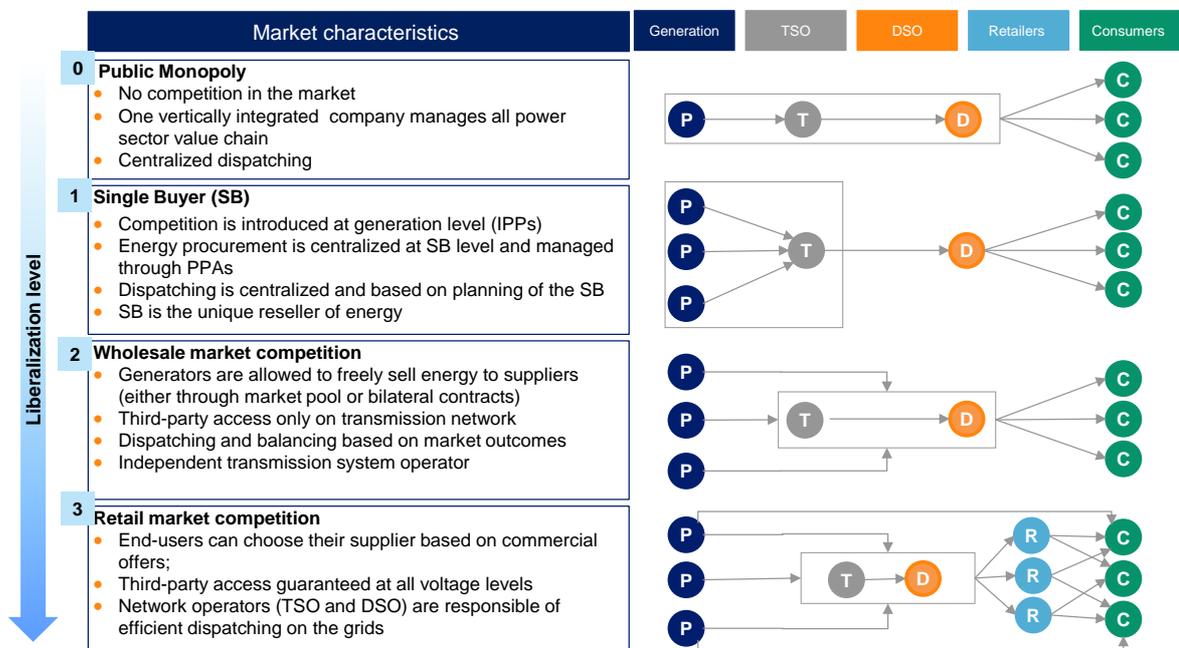
Figure 11 - Pöyry benchmarking approach



Source: Pöyry Management Consulting

Power market structures are traditionally defined with regards to the degree of internal competition (Figure 12).

Figure 12 - Taxonomy of existing power market models



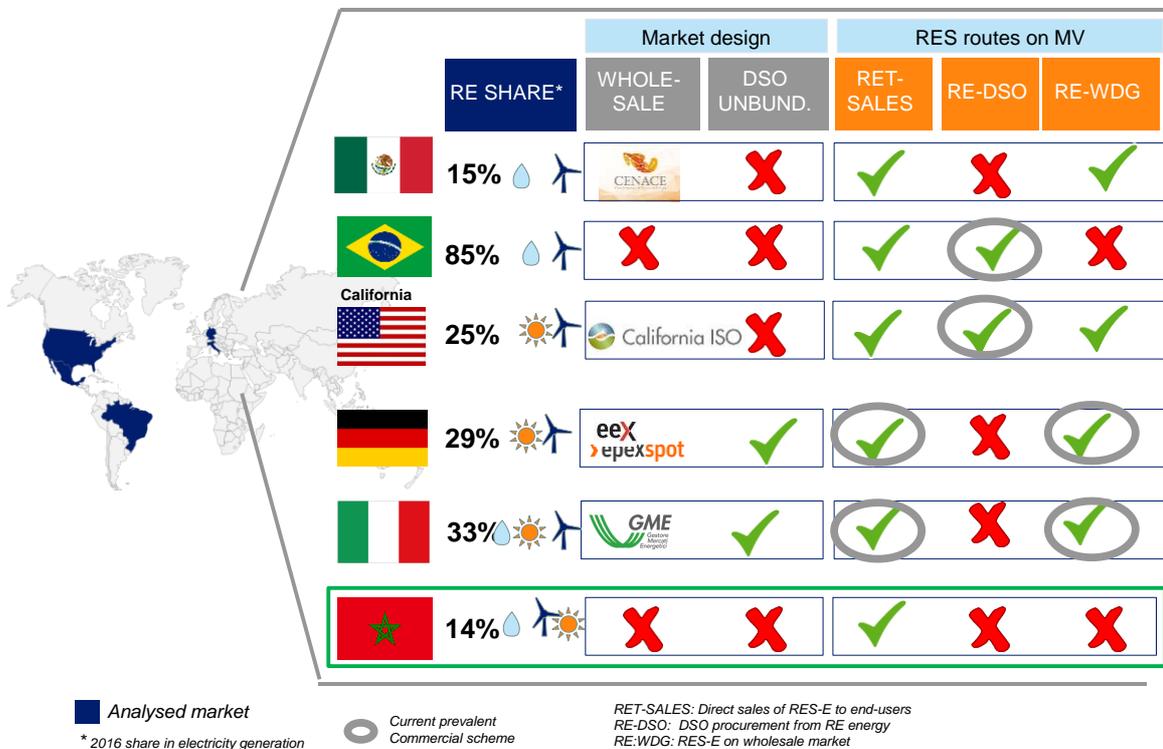
Source: Pöyry Management Consulting

- **Public monopolies** are characterized by the presence of vertically integrated public utilities managing all activities above the entire sector value-chain;
- **Single-Buyer models** allow competition at the generation level, with the introduction of IPPs, and are characterized by a centralized wholesale energy procurement process managed by the single buyer entity (normally the TSO);
- **Wholesale markets** open to generators the possibility to freely sell energy to suppliers, either through a market pool or bilateral contracts; finally
- **Free Retail markets** open competition at retail level authorizing end-users to choose their preferred energy suppliers on the basis of their respective commercial offers.

As showed in Section 2, Morocco power market is currently organized as a Single-Buyer model, where ONEE act as the TSO and the only authorized energy off-taker at the wholesale-level. Any unbundling reform has been implemented, at this stage, and distribution service remains bound with energy selling to end-users. In the meanwhile, the Law 13-09 opened to renewable generators the possibility to sell their energy directly to the final consumers on all voltage grid levels, introducing a new decentralized route-to-market for renewable energy in Morocco (RET-Sales model). This will let to the creation of a competitive retail market for RES, pushing Morocco’s power market design towards a decentralized hybrid market model

The selection of countries to benchmark has been performed taking into account such peculiarities of Moroccan power market, selecting the most similar energy markets with high share of renewables in the energy mix, as showed in Figure 13.

Figure 13 - Country selection



Source: Pöyry analysis on IEA, TSO and Energy Ministry data

3.2 Renewables routes-to-market on distribution grid

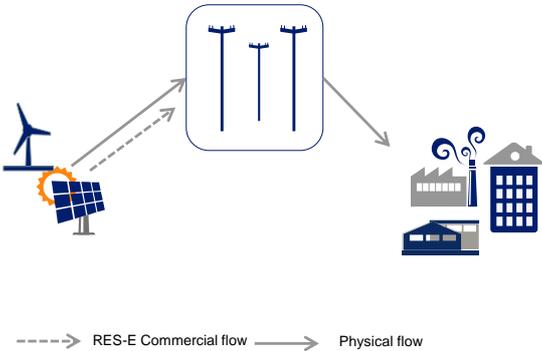
As a first level of the analysis, this section investigates the routes-to-market implemented to sell renewable energy on MV grid in the selected countries, as it appears from Figure 13. Three main models could be appreciate, briefly described here below:

- **Sales to the distributor (RE-DSO):** This scheme (Figure 14) is aimed at the direct procurement of distributor-suppliers from RES, typically under PPAs and/or market based reverse auctions (RAM).

It is commonly associated with green-energy procurement obligations (e.g. Renewable Portfolio Standards, RPS).

This scheme has required, in most of the markets, relevant investments of distributors in the grid adequacy in order to accommodate increasing share of variable renewables, and the adoption of balancing responsibilities for DSOs to ensure system reliability. The main advantage is that renewable generators will not threaten retailers market share since they sell energy to the distributors and not directly to end-consumers.

Figure 14 - Sales to distributor (RE-DSO)

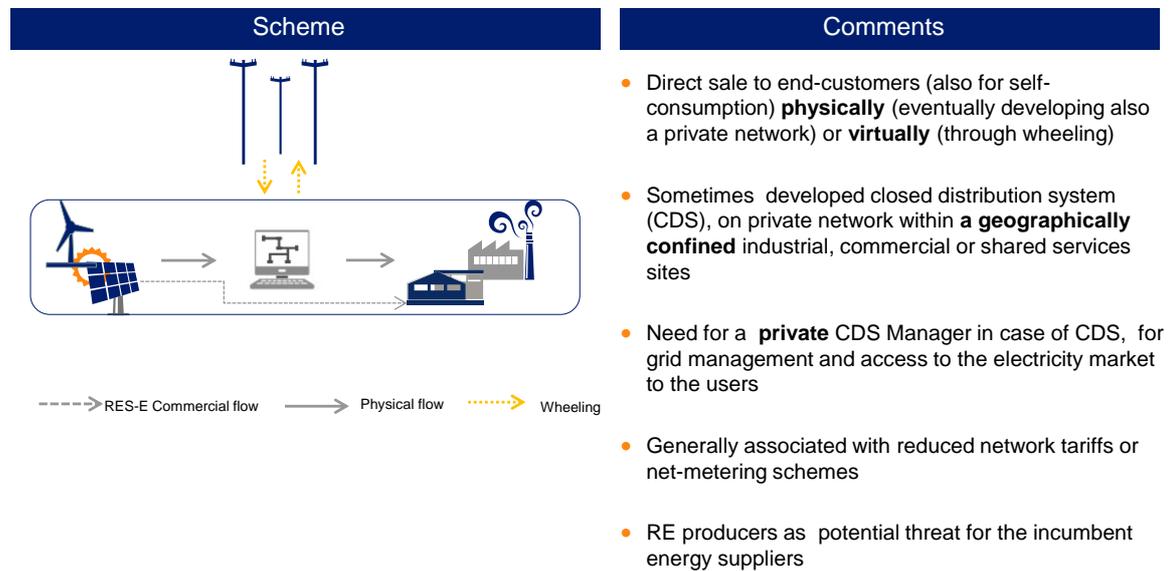
Scheme	Comments
 <p>---> RES-E Commercial flow —> Physical flow</p>	<ul style="list-style-type: none"> • Direct DSO procurement from RES (typically under PPA and/or market based reverse auctions, RAM) • Scheme typically associated with green-energy procurement obligations (Renewable Portfolio Standards, RPS) • Green-energy potentially sold to all end-users (included the LV residential users) • Smart-grid and advanced metering infrastructure • Typically requires balancing responsibilities of DSO for higher RE integration • No threats from RES to DSO/retailer market share

Source: Pöyry Management Consulting

- **Retail direct sales (RET-SALES):** RES producers sell energy directly to end-customers (Figure 15). Sometimes such renewable business model collapses in self-consumption and closed distribution systems (CDS), private network within a geographically confined industrial, commercial or shared services sites .

Generally such scheme is associated with reduced network tariffs or net-metering schemes. In this model, RES producers are a threat for the existing distributor-suppliers since they erode their market share in the retail market.

Figure 15 - Retail direct sales (RET-SALES)

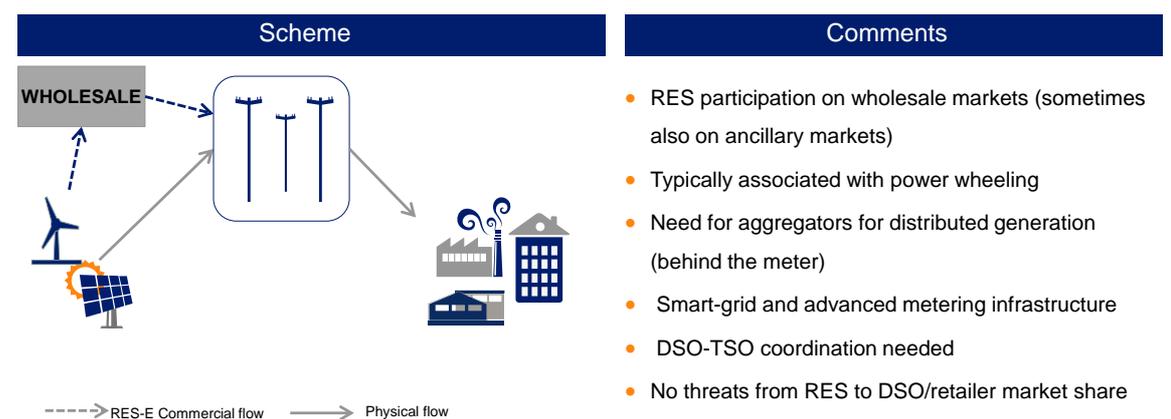


Source: Pöyry Management Consulting

- **Wholesale distributed generation (RE-WDG):** Under this regime RES generators sell their production directly on the wholesale markets, sometimes providing also ancillary services, without any limitation (Figure 16).

Typically small plants can participate to wholesale market through aggregator service provider. Such solution might need a strong DSO-TSO coordination for balancing and dispatching the grid.

Figure 16 - Wholesale distributed generation (RE-WDG)



Source: Pöyry Management Consulting

3.3 RES regulatory framework overview

A correct and successful implementation of those models requires to adapt power sector regulatory frameworks to the peculiarities of renewables. The following section presents the main results of the assessments of power market frameworks for each selected countries of the benchmark.

Based on current legislation and regulation in force, the most relevant regulatory aspects for renewables development in each selected country has been assessed, as for:

- General market framework;
- National renewable targets;
- Permitting process;
- Grid access and grid management rules and dispositions;
- Existing direct or indirect support schemes for RES; as well as
- Power and network tariffs rules.

This section reports the main results of the analysis, documenting also that a wide range of mechanisms can be used to accommodate high penetration of variable renewable resources. The detailed analysis of every national power market is presented in **Error! Reference source not found., Error! Reference source not found., Error! Reference source not found., Error! Reference source not found. and Error! Reference source not found..**

Mexico

Mexico has recently developed one of the most ambitious and comprehensive electricity reform since the 1990s, seeking to establish a new industrial organization for the power sector. The Law of the Electric Industry (Ley de la Industria Eléctrica, LIE), which was adopted by decree in August 2014, established a new power market structure, abolishing the vertically integrated monopoly and opening wholesale and retail markets to private investments.

The Energy Reform resulted in the introduction of a hybrid power market design for Mexico, with the creation of a new wholesale electricity market (MEM). In the new market, generation dispatch is managed by the National Centre for Energy Control (CENACE), a newly created ISO responsible, also, for the operation of the national transmission grid. The Federal Energy Commission (CFE), the state-owned vertically integrated utility, has been divided into separate subsidiaries in order to unbundle its generation, transmission, distribution and retail activities.

Renewables development has been at core of the reform process of Mexico's electricity sector, which introduced auctions to contract energy, capacity and clean energy certificates (CELS), providing that a growing proportion of generation should be procured from clean energy sources.

Mexico has great wind, solar and geothermal potentials: there are numerous areas of high wind speeds capable of supporting large generation capacities and the country has among the highest solar irradiation in the world with levels ranging between 4.4kWh/m² and 6.3 kWh/m².

In terms of installed capacity RES represent around 25% of the total installed capacity at the end of 2016 with 19GW with respect to a total installed capacity of 74GW. Hydro counts for 13GW and the rest is mainly wind, geothermal and bioenergy. Renewable accounts for 15% of the total electricity generation with around 49GWh.

Mexico has adopted a technology neutral approach to renewable development with mid-term targets for the development of clean energy sources (including nuclear). The country attempts to reach a 35% target of power generation from clean sources by 2024, as mandated by the 2008 Renewable Energy Development and Financing for Energy Transition law. The strategy promotes energy efficiency (both in energy consumption and production) and the efficient use of electricity to reduce greenhouse gas emissions.

The Special Program for the use of Renewable Energies (“Programa Especial para el Aprovechamiento de las Energías Renovables”), elaborated by the Federal Ministry of Energy (SENER) establishes objectives and goals for clean energies development and for the reduction of fossil-based power generation:

- Increase installed capacity of clean energies to 34.6% by 2018;
- Increase installed capacity of renewables to 32.8% by 2018;
- Limit fossil fuel based generation to 65% by 2024, 50% by 2030 and 50% by 2050 (objectives defined in the General Climate Change Law);

Achieving those targets will result in the installation of around: 13GW hydro, 9GW of wind, 1GW of geothermal, 0.8GW bioenergy and 0.6GW of solar PV by 2018.

The new market provides for two main routes-to-market for RES generators to deliver and allocate their generation:

- **Wholesale distributed generation (RE-WDG)** opens to renewable generators the possibility to directly sell their production on the MEM short-term markets. All generators, electricity traders, large load customers and small load customers can directly participate to the MEM (day-ahead and retail markets) to purchase electricity or exercise such choice via qualified retail service providers, authorized by the law to buy electricity from the wholesale market and sell electricity to “qualified customers”. Direct MEM participation requires an authorization from the national regulator (CRE) and a connection agreement from CENACE. Qualified user status, which authorizes to freely procure the energy they need, was initially reserved for customers with aggregate demand of at least 3 MW then reduced to 1 MW, in 2016.
- **Retail direct sales (RET-sales)** allows RES generators to sold their energy through private PPAs. The energy off-takers can be any market participant, including qualified user, suppliers, aggregators. The PPA commits the RES generator to deliver a pre-defined amount of energy to the off-taker. The payment terms can range from a wide variety of agreements(fixed price plus inflation, discount over the market price, linked to a market reference price) and lengths. some of the most common ones are:

The current legislative framework provides also two different support scheme, mostly dedicated to support the development of renewable generation capacity:

- **A Clean energy certificate market (CELS)** has been implemented in order to support the achievement of the renewable goals set by the General Climate Change Law. SENER created clean energy consumption requirements for “qualified

suppliers” and large customers as a portion of their total energy consumption. The current requirements are as follows:

- 5% of renewable energy by 2018;
- 7.4% by 2020;
- 10.9% by 2021; and
- 13.9% by 2022.

Qualified suppliers and large customers are required to comply by purchasing the CELs from the market and sanctions are set for non-compliance. RES generators receive one CEL for each MWh of clean energy produced by wind, solar (in any form), tidal, geothermal, biomass, hydro, nuclear, waste to energy, carbon capture and efficient cogeneration power plants. Subjects under obligation can procure the CELs from the Clean Energy Certificate and Compliance Management System.

- **A Long-term auction scheme** for energy, capacity and CELs has also been implemented to facilitate investments in new generation capacity, notably wind and solar¹⁷. These auctions offer 15-year contracts for energy and capacity, and 20-year contracts for CELs. Auctions are held once a year, with CENACE reserving the right to convene additional auctions and the CRE establishing ceiling prices for energy, capacity and CELs. If CFE was the only authorized off-taker for the first phase of long-term auctions, all market players will be allowed to participate to the next auction rounds with a new clearing house, the Compensation Chamber (CC), administering contracts between RES generators and energy off-takers. The CC will act as a market pool, serving as a wholesale intermediary between RES generators and off-takers.

Table 4: Mexico - RES Regulatory Framework assessment

Market Framework	Target	Permitting
<ul style="list-style-type: none"> • The Energy Reform abolished the vertically integrated monopoly of power sector, precedent managed by the Federal Electricity Commission (CFE) • The reform introduces a competitive wholesale power market open to large consumers and traders • New unbundling provision have been introduced, requiring CFE to separate in different independent entities its generation, transmission (CENACE), distribution and supplies activities • Qualified supplier are entitled to commercialize energy to qualified users (with a n estimated demand >2MW for 2016, >1MW from 2017) • Long-term auction for the procurement of electricity, clean energy certificates (CECs), and capacity for new clean energy have been adopted 	<ul style="list-style-type: none"> • The Energy Transition Law (Ley de Transición Energética, LTE) abandoned clean energy goals for the long term (2035–2050) replacing them with following mid-term goals: <ul style="list-style-type: none"> –25% by 2018 –30% by 2021 –35% by 2024 • The 	<ul style="list-style-type: none"> • Generation plants with capacity ≥ 0.5 MW or plants of any size represented in the wholesale market require a permit • The Regulator, CRE, is empowered to grant generation permits • If the producer is also a qualified supplier it needs an authorization by CENACE
Grid Access	Grid Management	Support scheme
<ul style="list-style-type: none"> • CENACE (not CFE) performs the interconnection evaluation of power plants to the transmission and distribution network • The interconnection evaluation is performed on non-discriminatory basis (whenever feasible) but bilaterally negotiated • Interconnections must be executed under a timeframe set by CENACE 	<ul style="list-style-type: none"> • No dispatching priority • Specific procedures and platform (i.e. the National Inventory of Clean Energy, the National Atlas of Potential Zones for Clean Energy development) to improve transparency on grid and to monitor RES deployment • RES participation on wholesale and ancillary markets allowed with minimum 5 MW and 20 GWh of demand 	<ul style="list-style-type: none"> • Long-term auction for clean energy awarding 15y contracts for energy and capacity, 20y for CEC • Obligation on suppliers (CECs) tradable in the market or bilaterally negotiated • Fiscal incentive (fast depreciation -100% in one year) • Net Metering (< 500KW) • Soft loans for RES
Network and energy tariff		
<ul style="list-style-type: none"> • Network tariffs should be regulated by the National Regulator (CRE) but still missing • Wheeling and commercial conditions for RES network users bilaterally negotiated with CENACE (separate transmission and distribution company) • Energy surplus from RES could be sold to a qualified supplier (under bilateral agreements) or in the wholesale market 		

¹⁷ The auction mechanism provides that awarded projects must enter into commercial operation three years after the awarding, favoring those technologies (as wind and PV solar capacities), which have short construction periods

Source: Pöyry Management Consulting analysis on main power sector Law and Regulations

California

California is the highest RE-committed State of the U.S. and among the first States in the world to having adopted binding targets for the reduction of green-house gas (GHG) emissions at national levels, already in 2005. Thanks to this strong political commitment, California has succeed in developing significant quantities of renewable capacities in its power system during the last years.

The Californian power market is a centralized system, with a pool with real-time balancing markets managed by the California Independent System Operator (ISO), CAISO. Generation is a fully liberalized activity, while transmission and distribution are regulated sectors. The electricity retail service is only partially liberalized with only a portion of non-residential users, defined as the “direct access end-users”, having the possibility to purchase energy from retailers (Electricity Service Providers) other than regulated local distributors.

The wholesale power market, in day-ahead and real-time timeframes, are directly managed by CAISO, which is the responsible, as system operator, for providing the most economical energy dispatch. CAISO directly operates the transmission grid, being responsible to ensure free access to the grid to all market participants and plan the development of the transmission grids under the Federal Regulator (FERC) rules and guidance.

In terms of renewable development policy framework, the State of California highlighted its ambition in tackling climate change in June 2005, adopting its first climate legislation which defined the basis of National GHG targets¹⁸ for the coming years:

- To reduce GHG emissions to 2000 emission levels by 2010;
- To reduce GHG emissions to 1990 emission levels by 2020;
- To reduce GHG emissions by 40% from 1990 levels¹⁹ (adopted in 2016) by 2030;
- To reduce GHG emissions by 80% from 1990 levels by 2050.

As a consequence, California set ambitious goals for renewable energy in 2011, implementing the Renewables Portfolio Standard (RPS) program²⁰ as part of its wider political engagement against climate change. The RPS puts a regulatory mandate to electricity suppliers to procure a growing portion of their energy from renewable energy sources in order to sustain their development into the market. Since 2011, the RPS targets have been regularly reviewed by the Californian Senate:

- In 2011 the RPS target established that 20% of sold electricity shall be generated from eligible renewable sources by 2013, and 33% by 2020, requiring to each utility to procure a balanced portfolio of renewable products;

¹⁸ Executive order #s-3-05

¹⁹ Senate Bill 32 extended the GHG emissions limit set in AB32

²⁰ Senate Bill SBX1-2

- In 2015, the RPS target has been increased to 50% by 2030²¹, with the requirement for large utilities to produce Integrated Resource Plans outlining how these goals will be met.

The RPS has succeeded in its intent of sustaining renewable energy deployment into California power system. Its effectiveness is demonstrated by the growth of renewable installed capacity in the State. As of today, California has the highest level of RES capacity of any States of the US:

- 5.6GW of installed wind capacity at the end of 2016;
- 8.6GW of solar PV (considering only plant above 1MW) and an estimated other 5.4GW of distributed solar capacity at the end of 2016²².

The California Public Utilities Commission (CPUC) monitors the progress of the investor-owned utilities (IOUs) in meeting their RPS targets, while the California Energy Commission (CEC) monitors the renewable procurement of Public-owned utilities (POUs). Their reports show that the Californian utilities are well ahead of their interim targets and on track to exceed the 2020 target.

To ensure the success of the RPS policy and the achievement of its targets, the CPUC has implemented several routes-to-market for renewable energy in order to simplify the procurement of renewable energy from the utilities:

- **Distributor sales (RE-DSO)** scheme has been originally designed as a feed-in-tariff program with a simplified procurement process allowing small renewable generators (with capacity lower than 1.5MW) to sell directly their energy to local utilities through a simplified standard contract for 10,15 or 20 years. Starting from 2010, a renewable auction mechanism (RAM) was implemented, opening to the possibility for the utilities to directly procure the renewable energy they need by competitive tender in order to comply with RPS obligations.
- **Retail direct sale (RET-sales)** scheme for renewable producers is allowed only if the generator is an eligible Electric Service Provider (ESP) and limited to the “direct access end-users”.
- **Wholesale distributed generation (RE-WDG)** scheme opens also to the aggregation of distributed renewable generation (from aggregation of 0.5 MW or greater) to enable them to sell energy and ancillary services in the wholesale market, but today remains rarely adopted.

The high level of RES penetration results, on one side, from the implementation of well-developed financial RES support schemes and, on the other side, from a suite of technology-specific policy measures custom-tailored to national specific needs. California has implemented several standard guidelines to facilitate and quickly deploy renewable resources on the MV and LV grid, as for standardization of the permitting procedure and of the connection rules, as well as a high transparency on the grid management and status. Other indirect financial incentives, as for tax-credit and advantageous investment facilities, have also played a role in the widespread of renewable energies in California. It is undoubted, however, that multiple and diversified financial support schemes have been key in kick-starting the development of renewables:

²¹ Senate Bill 350, or the Clean Energy and Pollution Reduction Act of 2015

²² EIA, Today in Energy, 7 April 2017, <https://www.eia.gov/todayinenergy/detail.php?id=30692>.

- **RPS Feed-in-tariff (FIT)** program, implemented in 2008, was originally designed so that small renewable generators (less than 1.5MW) were able to sell their generation to the IOUs through a simplified contract structure. The IOUs have set an amount to procure per program period (two months), which is offered to eligible generators on a first-come, first-served basis. The latest program revised the limit to 3MW project size and featured a renewable market adjusting tariff (ReMat) which consists of two elements, a starting price and a market adjustment.
- **Renewable Auction Mechanism (RAM)** was firstly set, in 2010, as a regulatory obligation on IOUs to procure a total of 1299MW, with project between 3MW and 20MW, holding four auctions over a two year period. Two additional RAM auctions occurred in 2014 and 2015. After the sixth RAM auction, the rules were relaxed somewhat so IOUs could determine their own procurement targets and consider projects greater than 20MW.
- **Net Energy Metering (NEM)** is a program to encourage IOU customers to install small renewable facilities by giving credits for any excess generation that is exported to the grid. These credits are settled monthly and are worth the equivalent of the retail rate for the electricity, thus include all transmission and distribution elements. NEM customers are not exempt from certain non by-passable charges, but pay these on their net consumption rather than gross.

Table 5: USA - California assessment of RE regulatory framework

Market Framework		Target	Permitting
<ul style="list-style-type: none"> • Centralized power market (pool system) with real-time balancing markets (ancillary markets). • RES sale schemes: wholesale (for size <0.5 MW participation as aggregated), DO procurement (RAM auctions), DG retail sales • ISO is the direct counterparty on all markets (capacity, spot, real-time balancing) • Presence of distribution utilities (DO) – both private and public – and distributed energy resource providers (aggregators) • State Energy Commission (CEC) supports the RES development • Federal Energy Regulatory Commission (FERC) governs the distribution sector 		<ul style="list-style-type: none"> • RES share in energy consumption at <ul style="list-style-type: none"> - 33% by 2020 - 50% (at least) by 2030 as defined in the California Renewable Portfolio Standard, (RPS), and Clean Energy and Pollution Reduction Act) 	<ul style="list-style-type: none"> • Standard permitting procedures for large (>20 MW) and small generators (≤20 MW). Fast-track process for size ≤ 2 MW) – Rules 21 • Geographical and total capacity limitations in line with the DRP’s trajectory and CAISO integration Plan
Grid Access	Grid Management	Support scheme	Network and energy tariff
<ul style="list-style-type: none"> • Standard terms and conditions under the Service and Connection Agreements • LVRT and SCADA capability required for wind farms • Open access to real-time market – critical data (OASIS) of the utilities for RES optimization 	<ul style="list-style-type: none"> • RES subject both to ISO and DSO instructions • Units are directly controlled by ISO which has all plants technical and financial info • RES aggregation subject to ISO approval to bid into wholesale market • Two mechanisms to balance variable renewables: “must-offer” market obligations and “flexible ramping product” 	<ul style="list-style-type: none"> • Mandatory RES obligations quota on suppliers (included in the DRP) • Feed in Tariff (FiT) under fixed-term contract (typically for a period of 5-20 years) • Net metering policies and upfront cash incentives to commercial and residential DG • Self-generation incentive program (investment grants) 	<ul style="list-style-type: none"> • RES wholesale distributed energy sold at a market based tariff rate under long term PPA • Wheeling service charges regulated by the FERC and state public utilities regulator (CPUC)

DG: distributed generation
 DRP: Distribution Resource Planning provided by 3 large investor-owned utilities: PG&E, SCE and SDG&E

Source: Pöyry Management Consulting analysis on main power sector Law and Regulations

Brazil

Brazil is the largest power market in Latin America. Its power system is highly dominated by hydropower (approx. 99GW) counting for 63% of the total installed power generation capacity (162GW). This highly dependence from hydropower exposes Brazil to the risks

of droughts and shortages in the electricity supplies. That's why power generation mix diversification has always been a top priority in national energy policy.

In 2004, Brazil reformed its power market, introducing the “New Regulatory Framework” (NRF)²³. The NRF was intended to attract new private investments in the power sector by creating to distinct energy purchase environments :

- **A regulated market** (Ambiente de Commercializacao Regulada - ACR) for captive consumers served by authorized suppliers, corresponding to local distribution companies;
- **A free market** (Ambiente de Commercializacao Libre – ACL) where authorized consumers, typically those with a contracted demand, freely negotiate bilaterally contracts with energy suppliers at market prices.

The NRF introduced also strict unbundling requirements in order to prevent any discrimination in third party grid access right from the distributors. As a result, local distribution companies are interdict from developing any activity relating to power generation, transmission or energy trading.

The operations of transmission grids are ensured by tens of transmission companies, most of them operating under BOOT (build-own-operate-transfer) concession schemes. The National Electricity System Operator (ONS) is the ISO responsible of coordinating and controlling the National Interconnect System (Sistema Interligado Nacional-SIN) and controls the activities of all the transmission companies. Distribution is a regulated activity but open to private companies participation.

To achieve the goal of reinforcing competition in power generation investments, the NRF provides for the introduction of a tender based model for the contracting of energy in the regulated market. Local distribution companies are required to purchase energy by competitive public bids, managed by the regulator, in order to cover their expected demand for the five years to come.

The Government can decide about the generation technology, as well as the type of contract (energy or capacity) to be auctioned. Local distributors are the direct off-taker of the energy, signing bilaterally contracts with generators for quantities proportional to their forecasted demand. This particular procurement scheme has also been considered as the best option to foster development of renewable technologies into Brazilian power system.

Although there are no legislative targets for increasing renewable power generation, Brazil commits to achieve 45% renewables penetration in the energy mix by 2030, during COP-21 in Paris. This would mean:

- Expanding the use of RES (other than hydropower) in the total energy mix to between 28% and 33% by 2030;
- Increasing the share of RES (other than hydropower) in the power supply to at least 23% by 2030;
- Achieving 10% efficiency gains in the electricity sector by 2030.

Renewable energy development has also become a key priority of Brazil's energy security policy, as it appears from the Long Term National Energy Plan (Plano Nacional

²³ Law n° 10,847/2004 and Law n. 10,848/2004

de Energia 2050 – PNE 2050) and the Decennial Energy Expansion Plan /Plano Decenal de Expansao de Energia – PDE).

Both those long-term planning exercises look to renewable energies, and in particular to solar, wind and biomass, as a best suited solution for the diversification of the generation mix, foreseeing an important increase of those capacities in Brazilian power system. The last Decennial Energy Expansion Plan foresees the development of around 7GW of new solar capacity and approx. 12GW of new wind capacity by 2026 in its reference scenario²⁴.

To achieve those targets, the country has implemented two main routes-to-market for renewable energy, becoming one of the most attractive market for RES investors in the American continent:

- **Distributor sales (RE-DSO)** scheme allows renewables generators to sell energy to the DSOs via the auction mechanism of the regulated market. The auction design of the regulated market has progressively evolved to accommodate renewable capacity development in the auctions schemes. The ACR energy procurement model provides for auctions for existing capacity (A-1), with supply expected to begin the year after the awarding, and auctions for new capacity, “New Energy Auctions”, serving to meet the forecasted demand of regulated customers. The New Energy Auctions (A-3, A-4, A-5, A-6) are linked to commercial operations deadlines, with solar and wind capacity normally auctioned in A-3 and A-4 tenders. Awarded companies are granted with long-term PPAs, lasting 20 years for wind and solar with distributors acting as the final off-takers. In 2009, Brazil introduced “Reserve Energy Auctions”, designed as capacity auctions, to ensure grid reliability. The Electric Energy Trading Chamber (CCEE) administrates the reserve auctions and acts as the off-taker, recovering an energy reserve charge from all customers connected to the national electric grid. The auction could be technology-specific (as for wind in 2009 and 2010), as well as dedicated to alternative energy (only for renewables) or technology neutral. ANEEL determines which technology are eligible in each auction rounds.
- **Retail direct sale (RET-sales)** is foreseen by the ACL regulatory framework which allows renewable producers to sell their production in the free market directly to end-users under commercial conditions bilaterally negotiated with the counterparties. In ACL power consumers with demand of more than 3 MW, generators and power marketers can freely negotiate bilateral contracts. Customers must contract 100% of their forecasted load and are not eligible to participate to the regulated auction mechanism. To foster the development of renewables in the free market, consumers or consortia of consumers with cumulated demand equal or above 500 kW are allowed to procure renewable energy directly from the free market.

Since the beginning, Brazil has implemented several support schemes to sustain renewable development. The Program of Incentives for Alternative Electricity Sources (PROINFA)²⁵, started in 2002 and closed in 2011, set a feed-in tariff scheme for new renewable capacities, covering all technologies. PROINFA feed-in tariffs program played a prominent role in facilitating the development of renewables at the first stage, promoting around 2 GW of wind power.

²⁴ Ministério de Minas e Energia, “Plano Decenal de Expansao de Energia-2026”

²⁵ Law n° 10438/2002

Today, renewable energy technologies receive discounts on transmission and distribution tariffs: biomass, small hydro, and wind receive a 50% discount, and solar PV benefit from a 80%discount. The Brazilian Development Bank (BNDES) provides financing at advantageous conditions for renewable projects fulfilling local content requirements.

Moreover, consumers have the possibility to self-produce their own energy benefiting from the advantageous conditions offered for renewable self-production, notably from solar. A net-metering scheme²⁶ allows renewable self-producers to offset their energy surplus, fed into the grid, with the energy withdrew from local distribution companies. Regulation opens also to the possibility to install self-production system in location other than the point of consumption (wheeling service), provided that they are in the same distribution concession areas. Self-production and net-metering scheme are open to capacities inferior or equal to 5MW.

Table 6 - Brazil assessment of RE regulatory framework

Market Framework		Target	Permitting
<ul style="list-style-type: none"> Hybrid market design Centralized energy procurement for suppliers in regulated market Presence of energy traders on the free market National Regulatory Authority (ANEEL) Independent System Operator (ONS) 		<ul style="list-style-type: none"> RES-no hydro 28-33% share of tot power capacity by 2030 Reach 23% of RES share in energy final consumption 	<ul style="list-style-type: none"> ANEEL responsible of granting authorization or concession for construction and operation of RES plants Duration: 30-35 years for concession; 20-25 for authorization Requirements for applicants are based on technical, legal and financial capacity No restriction on land access
Grid Access	Grid Management	Support scheme	Network and energy tariff
<ul style="list-style-type: none"> Access to grid rules defined by network operator in the "opinion access" Third party access rule 	<ul style="list-style-type: none"> Network Code approved by ANEEL ONS responsible of centralized planning, dispatch and balancing Distribution Network rules approved by ANEEL 	<ul style="list-style-type: none"> Auctions to grant 20 y PPA with DSOs as statutory off-takers Discount on connection fees to grids Net metering scheme for DG up to 5 MW Possibility to off-set injected surplus energy from energy bill Tax exemptions on wind and PV components 	<ul style="list-style-type: none"> Network tariffs (TUST for transmission and TUSD for distribution) calculated by ANEEL Regulated end-user tariffs fixed by ANEEL

Source: Pöry Management Consulting analysis on main power sector Law and Regulations

Germany

Germany is the largest electricity market in Europe in terms of demand, generation and installed capacity. At the begin of the '00s, the country started a successful energy transition process (the "Energiewende") aimed at shifting the national power system away from fossil fuels and introducing renewables.

As a result, Germany has become a world leader in terms of RES development: the wind and solar contribution to total installed power capacity in the country, around 210GW, has grown rapidly over the last decade to reach respectively 50GW (20% of total) and 41GW

²⁶ REN n. 482/2012

(24%) at the end of 2016. The share of renewable generation has increased from 8% to 31% of net electricity generation between 2000 and 2016.

Germany power system is an unbundled and fully liberalized market, characterized by the presence of power wholesale market. The unbundling of regional vertically integrated utilities resulted in the creation of four new independent TSOs, responsible for balancing and operation of the transmission grid assets. Distribution is managed under concession contracts (up to 20 years), with around 900 DSOs of which 4 leading companies involved also in generation and retail activities.

Power sector legislation in Germany is governed by a number of acts and ordinances which are subject to constant modifications. The main legislative texts are:

- **The German Energy Industry Act (EnWG)** defines the power market structure, transposing European energy law packages, and set the rules for the unbundling of vertically integrated utilities and grid operators. The requirements of the EnWG are further specified in various ordinances, including:
 - The Incentive Regulation Ordinance (Anreizregulierungsverordnung) providing for a revenue-cap regulation regarding the operation of the grid;
 - The Reserve Power Plant Ordinance (Reservekraftwerksverordnung);
 - The Electricity Grid Access Ordinance (Stromnetzzugangsverordnung) regulating access to the grid;
 - the Electricity Grid Charges Ordinance (Stromnetzentgeltverordnung) regulating wheeling fees.
- **The Renewable Energy Sources Act (EEG)** is the core of the German policy for supporting various renewable electricity sources and defines the National Targets for the contribution of electrical renewables to gross consumption of electricity. The targets up to 2050 are defined as follows:
 - Between 40% and 45% of RES share of electricity consumption by 2025;
 - Between 55% and 60% of RES share of electricity consumption by 2035;
 - Around 80% of RES share of electricity consumption by 2050.

The first version of EEG took effect in 2000 and has been amended several times since then (2012, 2014 and 2017) in order to adapt legislation to undesirable market developments and to optimize the available routes-to-markets and support mechanisms for renewable generators.

The EEG 2017, which applies to RES plants commissioned after 31st December 2016 while plants commissioned before have been grandfathered their existing tariff and route to market options, provides four separate routes-to-market by which renewable generators can sell their electricity:

- **“Direct Marketing – claiming a Market Premium” (RE-WDG)** allows renewables generators to sell their electricity directly on a power exchange or through a third party via a PPA and claim the so-called market premium from the grid operator. The 2017 EEG stated that the market premium for most technologies has to be determined by public competitive tender. Since the tender only applies for projects of a certain size, there are still new projects entitled of a classical market premium, being calculated as the difference between a fixed feed-in and the monthly market value of the electricity traded on the wholesale market.

- **Other Direct Marketing (RET-sales)** allows eligible renewable generators to benefit from avoided grid charges instead of receiving EEG payments. In order to receive the exemption from system charges, the electricity consumer needs to be in a relative proximity, on the same network or on a lower network level, to the renewable generator. The calculation of the avoided grid charge is conducted on a case by case basis by the network operator. The basis for the calculation is the avoided electrical energy (kWh) and power (kW). Renewable generators are still able to sell their electricity directly on a power exchange or through a third party, or either to end-users, but only receive the corresponding market value for their output. Also, renewable generators opting for this route to market are required to take on balancing risk.

RES producers operating under EEG 2017 are allowed to switch between the commercialization models (if eligible) on the first calendar day of each month. Operators may also apportion the electricity generated in their installations between the marketing methods. In the event that multiple routes to market are used, the operator of the renewable plant is required to notify the network operator of the chosen apportion and be able to demonstrate compliance with this percentage at all times. As of today, the 'Other Direct Marketing' option is rarely used: in November 2017 around 177MW were marketed via the 'Other Direct Marketing' route compared to 67,428MW using the Direct Marketing scheme²⁷.

Despite a more market-oriented approach for RES routes-to-market implemented by the last revisions of the EEG (2014 and 2017), the development of renewable electricity generation continues to be promoted by a system of strong financial support guaranteed through a well and diversified financial mechanisms:

- The Market Premium (Contract for Difference model);
- The Feed-in-tariff system for small plants with a capacity of up to 100 kW as well as an "exceptional feed-in-tariffs" scheme (Ausfallvergütung), opened to all RES plants regardless of the size, allowing to access to the feed-in-tariffs with a 20% discount for a period no longer than 3 consecutive months and no more than 6 months within a calendar year;
- Investment supports, consisting in low-interest loans and financing packages offered by the German National Development Bank, KfW.

Finally, Germany's secondary legislation of power sector defines clear non-financial supports for renewable energies, as for dispatching and connection priority.

²⁷ 'Informationen zur Direktvermarktung nach §21b Abs. 1 EEG 2017'. 50 Hertz, Amprion, Tennet, TransnetBW, November 2017.

Table 7 - Germany assessment of RE regulatory framework

Market Framework		Target	Permitting
<ul style="list-style-type: none"> Decentralized power market RES sale schemes: wholesale, DG retail sales 4 TSOs responsible for balancing Several (900) DSO : 4 leading companies* involved also in generation and retail. Concession contracts up to 20 years Liberalized Retail market: consumers choose market offers Presence of retailers and services companies (ESCO) Regulators: Federal Network Agency (BNetzA) and Federal Cartel Office (for ensuring market competition) 		<ul style="list-style-type: none"> RES share in energy consumption at <ul style="list-style-type: none"> 40-45% by 2025 44-60% by 2035 according to Renewable Energy Sources Act revisions (Energiewende , EEG) 	<ul style="list-style-type: none"> All plants require public licensing procedures, with the type of license differing depending on technologies (specific permit procedure for on-shore wind farms under Federal Emission Act and off-shore wind farms from German Maritime Agency) No geographical limitation but RES capacity cap (deployment corridors) for qualified RES
Grid Access	Grid Management	Support scheme	Network and energy tariff
<ul style="list-style-type: none"> Guaranteed TPA to the whole grid (from EHV to LV) Connection priority No differences on connection rules for RES and conventional plants (Negotiated TPA contracts). RES connection costs borne by end-customers of the distribution territory 	<ul style="list-style-type: none"> Dispatching and connection priority Single unit and demand-supply aggregation participation to wholesale and ancillary markets 	<ul style="list-style-type: none"> FiT (small plants, <100 KW) and CfD Indirect support for self-consumption (exemption from network charges and electricity tax) Compensation payment for curtailment Dedicated finance programs from state owned credit bank 	<ul style="list-style-type: none"> Regulated criteria for the calculation of transmission fees, Energy sold at fixed FIT for 20 years from the commissioning (pre 2016) with yearly/monthly digression rate

* 4 leading DSOs (EnBW, E.ON, RWE and Vattenfall) manages 40% of total energy sales

Source: Pöyry Management Consulting analysis on main power sector Law and Regulations

Italy

The Italian power system is an unbundled liberalised system, where generation, transmission, distribution and retail are separated activities.

The electricity market is organized as a virtual pool where producers sell their generation and retailers purchase electricity for resale to end-users. The market is a voluntary (or net) wholesale market, where the market operator (Gestore del Mercato Elettrico, GME) coordinates a central dispatch process for all transactions in the market.

Trades can be executed through the Italian Power Exchange (IPEX) or through bilateral contracts for direct supply of electricity from generators to customers. All transactions need to be registered by the central market operator, the GME.

The Market participants (i.e. Operatori del Mercato) are those entities entitled for trading the electricity (both through the pool or bilateral contracts), registering the injection or withdrawal schedules, and for the payment of system costs. They can take actions as owners of generation capacity or demand, or on behalf of other generators/retailers, which delegate these activities to them.

Responsibility for the physical execution of market orders – generation, consumption and balancing services – remains on each single market entity, which is defined as ‘Utente del Dispacciamento’ (UdD), or user of dispatching services.

Italy committed to challenging targets in terms of renewable development, in line with the European Union Climate and Energy targets. Renewable penetration has rapidly grown

over recent years thanks to generous incentives and favourable geographical position of the country, reaching a relevant market share, 34% of electricity demand in 2016.

The main legislative and regulatory elements which form the renewable policy framework in Italy are:

- The EU Renewable Energy Targets for 2020, included in the National Renewable Energy Action Plan²⁸ setting a renewable penetration target of 17% on total energy consumption by 2020;
- The EU 2030 Targets, approved by the European Council on 2014, promoting a 27% renewable penetration target by 2030, which however have not been translated yet into specific targets for each Member State; and
- The new National Energy Strategy (SEN), taking into account the guidelines of the Paris Agreement²⁹, defining energy policy orientations to 2050 and setting the following renewable penetration targets:
 - Electricity sector: 55% in 2030;
 - Heating and cooling sector: 30% in 2030;
 - Transport sector: 21% in 2030.

The growth of renewable installed capacity, with regards to the electricity sector, has been historically supported by a well-developed, and highly advantageous, scheme of incentives :

- Premium tariffs for solar PV;
- FiT schemes for small renewable generators;
- Tradable clean energy certificates markets for medium and large renewable producers with an obligation on thermal generators to procure a certain amount of CECs.

Such schemes have been successful in ramping up renewable development, notably small-scale distributed generation, allowing Italy to overwhelm its RE 2020 target with approx.17.5% RE penetration on gross final energy demand in 2017 against a 17% target by 2020.

Today, Italy has implemented a more market oriented approach, defining four main routes-to-market for RES generators. Renewable generators can sell the energy they produce either directly or through a third party:

- **“Ritiro Dedicato” (Single-buyer model)** is a centralized simplified off-take agreement between the producer and a last resort operator, the GSE. This mechanism was introduced through Resolution AEEG 280/07 and allows the GSE to withdraw the electricity produced by eligible operators and resell it in the Italian Power Exchanges (IPEX). In such way, the GSE effectively acts as an intermediary

²⁸ National Renewable Energy Action Plans are official country specific documents in which each country has defined a path to reach 2020 targets.

²⁹ The Agreement, signed during the Paris Conference in December 2015, was opened for signature for one year on 22 April 2016. It entered into force on 4th November 2016 after that 55 countries (accounting for at least 55% of global emissions) have deposited their instruments of ratification. USA ratified the Agreement on 4th September 2016, but have then announced the intention to withdraw.

between renewable generators and the market facilitating the realization of electricity revenues;

- **Bilateral sales (RET- sales)**, are off-take agreements (PPAs) with a private counterparty directly or not directly connected to the grid. Under a PPA, the off-taker agrees to buy electricity from the RES producer at a price negotiated by the parties. Through the PPA contract the RES producer gives also mandate to the off-taker to become the dispatch user of the plant;
- **Direct participation in the wholesale electricity market (RE-WDG)**, either in the spot market or in the forward market. Renewable generators can realise the value of their electricity production by trading onto the Italian Power Exchange (IPEX) provided they meet the required criteria. This route to market is generally used by larger market players that are familiar with trading procedures and have already in place their own trading units. Among the different options, this is the one that involves the highest transaction costs (and risks)
- **“Scambio sul posto”** is a net metering scheme available to renewable micro-generators, with capacity between 20 to 200 kW, whose production is generally used for ‘on-site’ consumption. The principle of the “Scambio sul Posto” is based on the balance of the energy fed in and consumed: the plant operator pays the supplier for the electricity consumed, while GSE gives credit for the electricity fed in. This method can lead to a surplus on behalf of the plant operator, with the balance calculated once a year. More specifically, the owner of such plants will receive a compensation equal to the difference between the value of electricity exported to the grid (e.g. for PV installations the energy fed in during daytime) and the value of the electricity consumed in a different period. This credit will be available for an unlimited period of time.

While the direct participation to wholesale market entails specific trading competencies, all the other routes-to-market represent simplified solutions, particularly adapted to medium and small scale renewable plants, where the producer cedes electricity to a third party in charge of selling such electricity in the market.

As already said, Italy has been particularly successful in efficiently accommodating large quantities of renewable generation capacities to the national power system at all voltage levels. This has been possible thanks to the efforts in adopting and implementing several standard guidelines to facilitate and quickly deploy renewable resources. The main characteristic are:

- Standardization of the permitting procedure and of the connection rules;
- Standardization of the grid access procedure and commercial conditions;
- Diversified support schemes (per technology and size).

Table 8 - Italy assessment of RE regulatory framework

Market Framework		Target	Permitting
<ul style="list-style-type: none"> Hybrid system: pool system in conjunction with decentralized Central dispatch managed by Terna (ISO) Presence of wholesale and ancillary markets managed by GME (Energy Market Manager) 5 distribution companies with unbundling requirement for sales Finalization of the retail liberalization market on-going GSE is the state-owned company to support RES deployment RES sales to power exchange market, to GSE (ritiro dedicato, < 100 KW) or bilateral end – customers contracts National Energy Authority, AEEGSI responsible for the approval of remuneration network tariff, grid code and access rules 		<ul style="list-style-type: none"> RES share in energy consumption at <ul style="list-style-type: none"> - 40 % by 2025 - 55 % by 2030 according to the new National Energy Plan (SEN 2017) 	<ul style="list-style-type: none"> RES plants are authorised through the single authorisation regime (Autorizzazione Unica) granted by the relevant region or province Simplified procedure for small generators (< 60 KW wind, < 20 KW PV)
Grid Access	Grid Management	Support scheme	Network and energy tariff
<ul style="list-style-type: none"> Guaranteed third party access to the whole grid (from EHV to LV) and defined by TICA approved by AEEGSI RES connection priority RES Connection regime differs from conventional plants (Semi-deep regime) 	<ul style="list-style-type: none"> RES participation to ancillary markets Dispatching priority RES curtailment from Terna foreseen in case of congestion 	<ul style="list-style-type: none"> FIT (CIP6, Conto Energia) and CfDs modified in 2016 Income tax credits Production obligation from RES and Green Certificates Economic net metering (Scambio sul posto, SPP) Curtailment remuneration only for large wind plants 	<ul style="list-style-type: none"> Low Voltage (LV) and Medium Voltage (MV) RES connection charges defined on a conventional basis

Semi-deep regime : generators and system operators share costs
 Deep regime: generators pays connection costs as conventional producers

Source: Pöyry Management Consulting analysis on main power sector Law and Regulations

3.4 Gap analysis

The RES regulatory frameworks of the benchmarked countries shows a variety of regulatory dispositions implemented to sustain RES development. Comparing such mechanisms with the current regulation of Morocco helps to define the main areas of intervention that Morocco should target to better accommodate RES on the MV grid:

- Grid access rules;
- Grid management dispositions;
- Support schemes for renewables.

Table 9 - Gap analysis of Morocco RES liberalization framework

GRID ACCESS	STANDARD ACCESS	✗ Negotiated terms with the system operator	✓ Negotiated with CFE but ensured by CENACE	✗ Negotiated terms but grid code available	✓ Terms and conditions for all producers (in grid code)	✓ Terms and conditions for all producers (in grid code)	✓ Specific terms and conditions for RES (i.e. TICA, REDIGI)
	CONNECTION PRIORITY	✗ N.A.	✗ N.A.	✗ Negotiated terms of connection but grid code	✗ Standard terms and condition for all producers	✓ Connection priority but negotiated conditions	✓ Guaranteed by DSOs
GRID MANAGEMENT	DISPATCHING PRIORITY	✓ Defined but no transparent grid management	✗ N.A.	✗ No clear priority rules	✗ Economic dispatch	✓ Recently under discussion	✓ For the same offer price
	CURTAILMENT TRANSPARENCY	✗ No clear rules	✗ No clear rules	✗ No clear rules	✓ Open access to real time market data (OASIS)	✓ Real-time data on grid status	✓ Real time data on grid status
	CURTAILMENT CAP	✓ Negotiated on annual basis	✗ N.A.	✗ N.A.	✗ N.A.	✗ N.A.	✗ N.A.
	CURTAILMENT COMPENSATION	✗ N.A.	✗ N.A.	✗ N.A.	✓ Negative price allowed	✓ If lost revenues are >1%/y full compensation	✓ Programmable plants compensated at zonal price
	RES AGGREGATION	✗ N.A.	✓ Only demand aggregation	✗ N.A.	✓ Allowed for plants <0.5 MW into wholesale market	✓ Demand and Supply aggregation	✗ No participation to the market (up to date)
	RE DSO OBLIGATIONS	✓ Foreseen but not implemented	✗ Obligation only on generation	✓ Procurement obligations through auctions	✓ Obligation on utilities	✗ N.A.	✗ Obligation on generation
SUPPORT SCHEMES	GREEN CERTIFICATES	✗ N.A.	✓ CELS negotiated bilaterally or on the market	✗ N.A.	✓ Renewable energy credits	✗ N.A.	✓ CV negotiated bilaterally or on the market
	FIP	✗ N.A.	✗ N.A.	✗ N.A.	✗ N.A.	✓ Including CfD	✓ Including CfD
	FIT	✗ N.A.	✗ N.A.	✓ FIT programme achieved in 2004	✓ Small generators < 3 MW	✓ Levied tax	✓ Levied tax
	TAX CREDITS and INCENTIVES	✓ Import tax reduction	✓ Fast Depreciation	✓ Financial incentives by BNDES	✓ Upfront cash incentives	✓ Dedicated financing from nat. bank	✓ Fiscal deduction on PV for renovation
	NET METERING	✓ Also for self-producer on MV	✓ Only on LV (< 500 KW)	✓ For DG up to 5 MW	✓ For residential and commercial distributed generation	✗ N.A.	✓ Economic net metering
	OTHERs	✓ N.A.	✓ Soft Loan	✓ Discount on connection fees	✓ SP incentive programmes	✓ Discount on connection fees	✓ Discount on connection fees

3.5 Best-practices and lesson learnt

International case studies document that a wide range of mechanisms and instruments can be used to accommodate high penetration of variable renewable resources:

- In **Mexico**, the integration of renewables was ensured by the introduction of a clear and stable market framework with clear rules about market functioning and operators participation, ensuring long-term visibility to private investors. The ISO, CENACE, is in charge of the technical evaluation of all new applicants and acts as the guarantor of third-party access rights to the national grid for all market participants, although the connection agreement remains bilaterally negotiated with the vertically integrated company, CFE.
- In **Brazil**, high renewables deployment has been achieved through two key instruments: a well-designed auction mechanism for supplier procurement and an efficient net-metering scheme. Discount on transmission and distribution charges for renewable energy are also key in sustaining RES development.
- In **California**, the strong development of renewable distributed generation has been mainly achieved thanks to the RPS regulatory obligations. The RPS defines the obligation for all energy suppliers (including utilities and service providers) to procure a portion of their demand from eligible renewable resources. The utilities might prove compliance through Renewable Energy Credits, purchasing them from others or investing in their own renewable power generation assets.
- In **Germany and Italy**, the renewables deployment has been granted mainly through well and diversified financial mechanisms (i.e. FiT, FiP) and through clear non-financial supports (i.e. dispatching and connection priority). Moreover standard and specific procedures for grid access (i.e. REDIGI and TICA in Italy) have avoided any discriminatory rejection or delay in the connection.

Figure 17 - International best-practices

	<ul style="list-style-type: none"> • Clear and stable market framework with clear rules and long term stability measures, developed in few years • An independent state-controlled company and system operator, on charge to control the technical evaluation of the new access applicants (although the connection is bilaterally negotiated with the vertically integrated company, CFE)
	<p>Two key instruments:</p> <ul style="list-style-type: none"> • Well-designed auction mechanism for DSO/supplier procurement • Efficient net-metering scheme
<p>California</p> 	<ul style="list-style-type: none"> • The most affordable market for distributed generation, uses a noteworthy policy tool to integrate medium and small renewable plants: the Renewable Portfolio Standard. • The utilities might prove compliance through Renewable Energy Credits, purchasing them from others or investing in their own renewable power generation assets.
	<ul style="list-style-type: none"> • Standard and specific procedures for grid access (i.e. REDIGI and TICA in Italy) have avoided any discriminatory rejection or delay in the connection • Well and diversified financial mechanisms (i.e. FiT, FiP) and through clear non-financial supports (i.e. dispatching and connection priority)

Source: Pöyry Management Consulting

Looking at both emerging and mature power markets similar to Morocco³⁰, a significant deployment of renewables on distribution grids has in many cases been achieved through direct sales to **distributor-suppliers (RE-DSO)**. Under such scheme, all energy suppliers must procure from eligible renewable resources to meet the policy goals as portion of their retail sales (California³¹) or as a target directly imposed by the Government (Brazil). In some cases, the obligations have been envisaged through a well-designed auction mechanism (Brazil) or by entitling the suppliers to invest in their own power generation assets (California).

Nevertheless Morocco has opted for a different route to market for renewables on distribution grids, adopting a **Retail direct sales (RET-SALES)** scheme. Such approach has been successfully developed in some countries thanks to³²:

- **A clear and stable regulatory framework:** clear rules and long term stability measures are necessary to ensure investors attractiveness. Mexico is a good example of fast and stable regulatory framework arranged also to accommodate renewables.
- **Firm grid access rights for renewables:** in Europe this has been achieved by the definition of standard and specific procedures for grid access that have avoided any discriminatory rejection or delay in connection. In other markets (e.g. Mexico) it has been achieved through the creation of a specific entity (identified with the system operator in Mexico) in charge of controlling the technical evaluation of the new applicants (although the connection is bilaterally negotiated with the distributor-supplier).
- **Well and diversified support schemes:** all the international case studies showed that **direct and indirect financial mechanisms** (i.e. FiT, CfD, upfront cash incentives) and **advantageous dispatching rules** (i.e. dispatching priority, rules for curtailment) are both key in kick-starting RES development.
- **Efficient network tariffs definition:** in many countries it is envisaged a direct discount on the network charges (e.g. Italy, Germany), as well as advantageous prices for the energy sold to the grid by self-producers (e.g. Brazil³³).

³⁰ I.e. countries characterized by the absence of wholesale market and/or distribution services separated from retail.

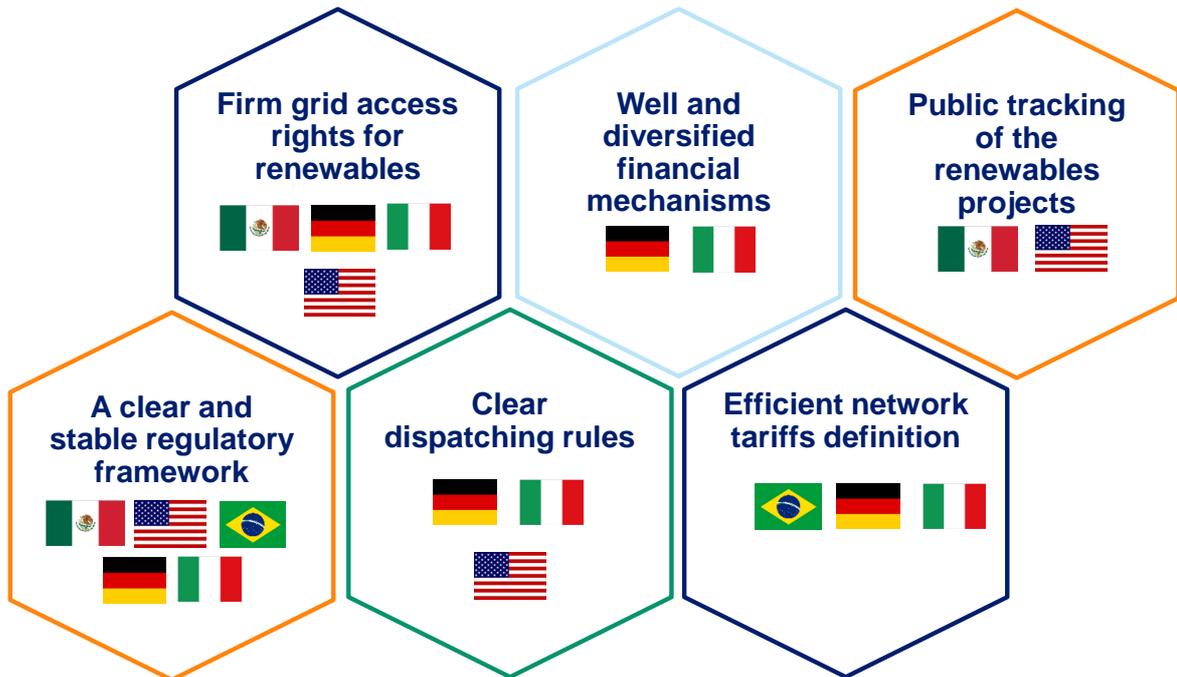
³¹ All energy suppliers (including utilities, service providers) must procure, as portion of their electricity retail sales, from eligible renewable resources to meet the policy goals. The utilities might prove compliance through Renewable Energy Credits, purchasing them from others or investing in their own renewable power generation assets.

³² A summary of the main regulatory framework and support schemes worldwide implemented for renewables is depicted in Table 2.

³³ The successful development of distributed generation in Brazil must be attributed to: (i) a discount on network tariffs for end-consumers supplied by renewable energy; (ii) a net-metering scheme allowing consumers, with an installed RE generation capacity between 75kW and 5 MW, to offset the surplus energy fed into the grid from their electricity demand. The credits received by such consumers for the surplus injected could be valorised at an advantageous rate, as for solar energy. Moreover, regulation allows participating consumers to distribute energy credits among multiple electric service accounts on the same distribution grid.

- Public tracking of the renewables projects:** a public register is usually available to track and monitor the progress of the renewable projects in the country/region: in California the Energy Commission every year tracks and publishes the RPS-eligible generation operational and non-operational with permits, by county and by technology³⁴; in Mexico CCER monitors every year the progress by the National Inventory of Clean Energies.

Figure 18 - Lessons learnt from international best-practices



Source: Pöyry Management Consulting

³⁴ http://www.energy.ca.gov/renewables/tracking_progress_

4. A ROAD MAP TO ACHIEVE A HIGHER RES PENETRATION ON MV MARKET

Morocco has set ambitious renewable targets, aiming to increasing the sustainability and the security of its power sector. To achieve such targets, Morocco has entered in a long reform process of national power industry organization, resulted in the creation of a free competitive market for renewable energy, that has to co-exist with the centralized single-buyer market managed by ONEE. Having started with the high-voltage market segment, Law 13-09 has opened the retail market also for end-users connected to the MV and LV grids, opening to bilateral agreements between renewable generators and end-users for the direct reselling of RE by a wheeling agreement with the grid operators.

Section 2 of the report shows that Morocco is today having some difficulties in efficiently implement such new routes-to-market for renewables, especially with regards to the MV and LV market segments where any relevant renewable project has been already implemented.

The case studies of Section 3 reveals that a wide range of mechanisms can be used to successfully accommodate high quantities of variable renewable resources into national power systems. The case studies reveal there is no one-size-fits-all approach since, each approach is strictly affected by the policies, market designs and system operations of each specific country.

This final Section of the Report suggests possible forward for Morocco in order to free its enormous renewable potential and allow renewable private investors reinforcing their contribution to the transformation of national power sector.

4.1 Possible scenarios of Moroccan market design evolution

Looking at the case studies related to both emerging and mature power markets, a significant deployment of renewables on distribution grids has in many cases been achieved through direct sales to distributor-suppliers (**RE-DSO**). Under such scheme, all energy suppliers must procure from eligible renewable resources to meet the policy goals as portion of their retail sales (California³⁵) or as a target directly imposed by the Government (Brazil). In some cases, the obligations have been envisaged through a well-designed auction mechanism (Brazil) or by entitling the suppliers to invest in their own power generation assets (California).

A clear “RE-DSO” model is not fully implemented by the Morocco’s regulation and DSOs are still obliged by current regulation to procure from the single-buyer the energy needed to satisfy the consumption of their clients. Nevertheless, recent regulatory reforms have marginally modified the electricity procurement process for DSOs, opening to the possibility for DSOs to buy the energy surplus of renewable generators having a bilateral contract with a private off-taker connected to the grid (Law 13-09) as well as to procure

³⁵ All energy suppliers (including utilities, service providers) must procure, as portion of their electricity retail sales, from eligible renewable resources to meet the policy goals. The utilities might prove compliance through Renewable Energy Credits, purchasing them from others or investing in their own renewable power generation assets.

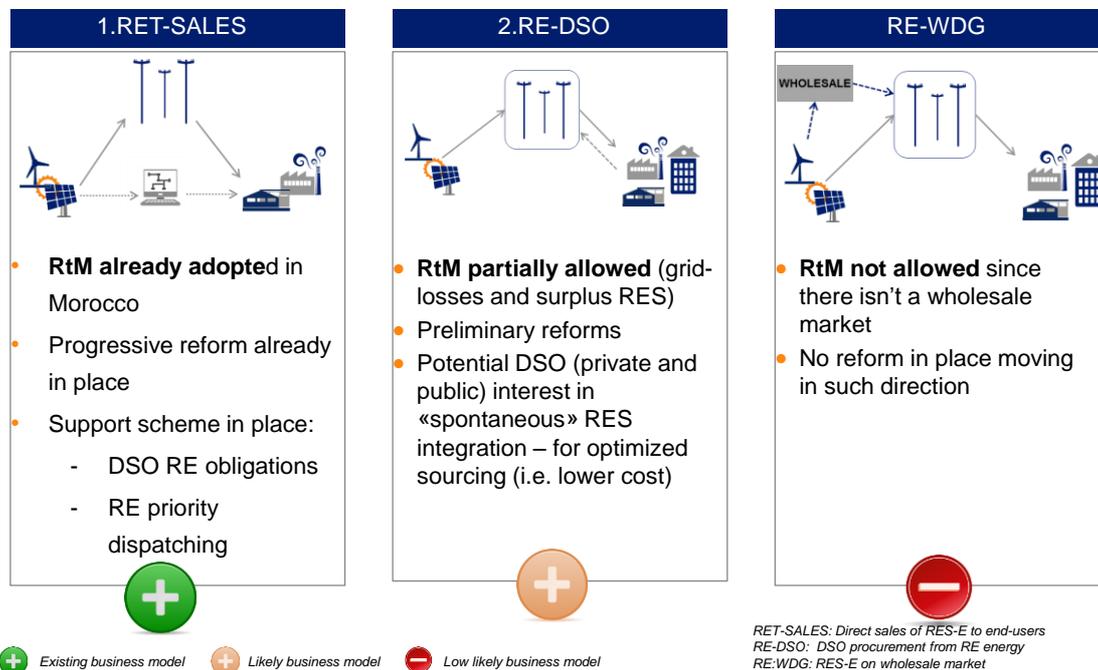
directly from renewable generators up to 7% of their balancing energy needs (Law 2-15-772).

The wholesale distributed generation model (**RE-WDG**) is adopted in the most mature power markets, as for Germany and Italy where renewable generators have the opportunity to sell their energy directly into the wholesale market, receiving additional financial support if the average market price is not considered sufficient to cover the investment costs of the plants (as for FiP and CfD support schemes). The Mexico case shows, however, that a wholesale market could be introduced and successfully implemented in relative short time.

Morocco’s current discussion around power market reform doesn’t consider the implementation of a power wholesale market and there is no evidence of any interest expressed by the GoM in going on this direction. That’s why the implementation of this route-to-market for renewable generators doesn’t seem very likely, at least in the short-medium terms.

Morocco has opted for developing competition directly on the retail market for renewable energy implementing a **Retail direct sales (RET-SALES)** scheme for renewables on distribution grids. The development of this model is supported by an obligation put on DSOs/retailers to integrate a certain amount of renewable energy, expressed as a portion of their energy selling (GWh) to captive consumers connected to the MV grid.

Figure 19 - Scenarios for possible evolutions of renewables routes-to-market



Source: Pöyry Management Consulting

The case studies reveal there is no one-size-fits-all approach in order to kick-start the deployment of large quantities of distributed renewables on the MV grid by private investors. RES routes-to-market are strictly affected by the policies, market designs and system operations adopted by each specific country.

Each RES routes-to-market presents its own strengths and weaknesses; it may open to new opportunities, as well as jeopardise the efficient development of the power system. The Table 10 here below summarizes those aspects for both the “RET-sales” and the “RES-DSO” models with regards to their further development within the Morocco national power system.

Table 10 - SWOT analysis of “RET-sales” and "RE-DSO" models with regards to Morocco power system

RET-SALES	
<p>Strength</p> <ul style="list-style-type: none"> Moroccan reforms aligned to adopt direct marketing Many energy markets have adopted such model to deploy high RES in a short time 	<p>Weakness</p> <ul style="list-style-type: none"> Needed financial support or higher DSO obligations to stimulate RES energy purchases by end-users Uncertainty of the timeframe of the distribution reform could slow down the RES integration Best framework foresees the distribution unbundling, in absence of DSO incentives, but no reform in place
<p>Opportunities</p> <ul style="list-style-type: none"> Ambitious RES targets, especially on PV, could be supported by medium scale projects developed within such business model (as happened in Germany and US) Increasing competition in retail market with potential direct benefits on end-customers 	<p>Threats</p> <ul style="list-style-type: none"> No efficient coordination between national and local initiatives and uncontrolled DG could create stranded assets Involvement of distributors company in generation could close the door to new RES investors
RE-DSO	
<p>Strength</p> <ul style="list-style-type: none"> Prevalent BM adopted in the most compatible market (Brazil) Distribution unbundling not necessary for high RES penetration 	<p>Weakness</p> <ul style="list-style-type: none"> Absence of relevant reform of DSO procurement model No direct effects on customer bills, since the end-customers will remain regulated Additional reform required to overcome the single buyer model ONEE unbundling necessarily to be finalized to separate dispatching services from energy sales
<p>Opportunities</p> <ul style="list-style-type: none"> RE private investors with no-reputation in the retail market could enter easier in the market than the previous scheme Medium scale projects (RE private investors) more advantaged than small scale (self-consumer, small investors) 	<p>Threats</p> <ul style="list-style-type: none"> ONEE (Producer) could oppose such change since could furtherly reduce its generation share and/or margins Supply-aggregation scheme: if allowed small scale projects could be a threat for big investors

Source: Pöyry Management Consulting

The SWOT analysis shows that the RET-SALES scheme and the RE-DSO scheme are both well-suited to scale-up the development of renewables on Morocco medium voltage grids and attract private renewable investors.

Nevertheless, a full implementation of the RE-DSO scheme – today strictly limited to certain exceptions, as already said- will require deep legislative reforms with the involvement of all national energy stakeholders, from ONEE to DSOs and market operators:

- The single-buyer model has to be abolished in order to open to the possibility for the DSOs to freely procure the energy they need from RES-IPP;
- New disposition about the energy procurement process of DSOs (i.e. competitive auctions managed directly by each DSOs) must be adopted and implemented in order to overcome the existing model managed by the single buyer;
- The unbundling of ONEE TSO/Producer-Retailer must be finalized in order to separate dispatching services from the commercial energy sales.

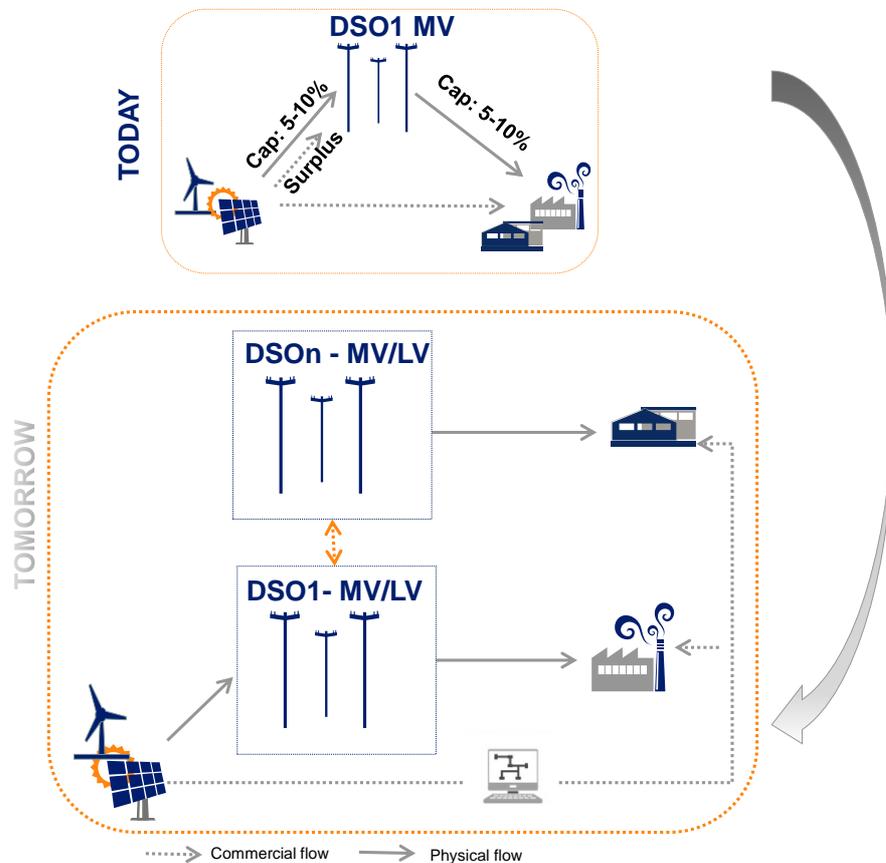
Despite its advantages, implementing a reform process of this amplitude is not an easy task and it will certainly face difficulties and resistances from different sides. Full commitment from policy-makers is, by the way, required to implement any reform of Morocco's primary legislation. Such options today appear as highly unlikely, considering that the GoM has recently reformed the governance and market structure to introduce competition over the retail market.

As a result, a fully implementation of the RET-SALES scheme, as well as its further development, seems to be the best option to foster renewable development into MV market actually available in the current Morocco power market structure. Primary legislation has already be fully adopted and the GoM has reiterated its commitment in fostering competition in the retail market by encouraging private renewable investors entering this market.

Moreover, such scheme could be easily broaden (Figure 20) introducing small reforms to the current secondary legislation in order to:

- **Eliminate the cap on the authorized renewable energy surplus selling to DSOs;**
- **Implement a virtual sales model on MV allowing virtual exchanges of renewable energy among DSOs;**
- **Extend the RET-SALES scheme to LV market segment.**

Figure 20 - Possible evolution of the RET-SALES scheme



Source: Pöyry Management Consulting

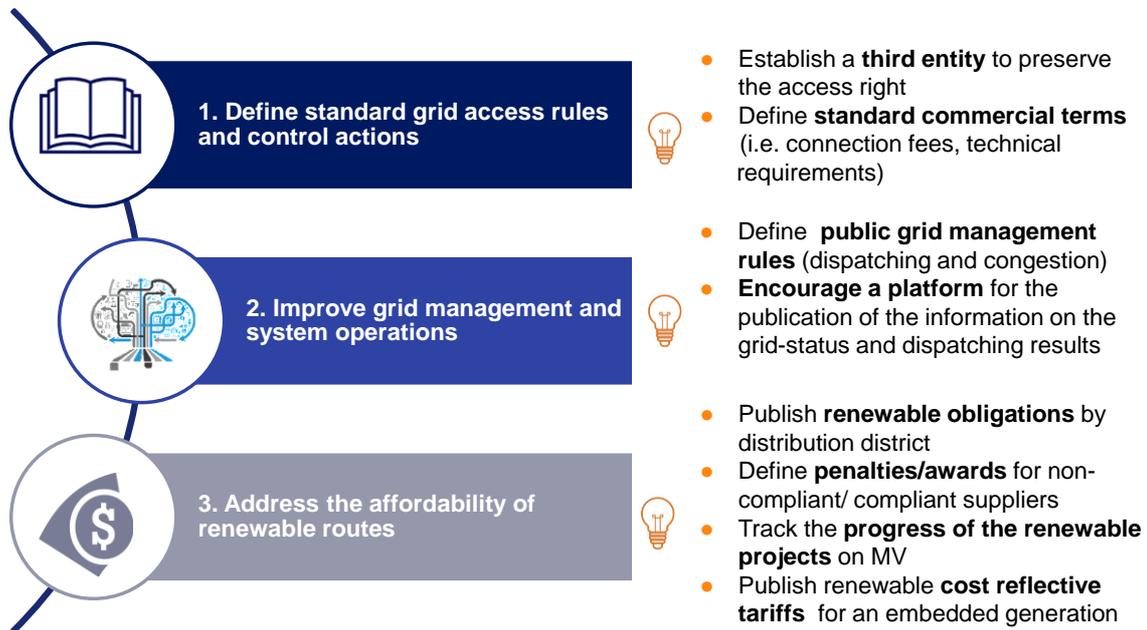
4.2 Three areas of intervention to accommodate higher RES on the medium voltage market

As a first step towards a correct and efficient implementation of the RET-SALES model, Morocco has to overcome the regulatory barriers which are preventing investors in developing renewable projects on the MV grid under this scheme.

For each of the main areas of intervention, the following sections describe in detail the rationale, best practices, diversity of approaches as revealed through the case studies, and challenges and actions to implement such best practices. This could be seen as an indicative road-map (Figure 21) that Moroccan public institutions could implement in order to accelerate the country transitions from low to high RE penetration:

1. **Defining standard grid access rules and control actions**
2. **Improving grid management and system operations**
3. **Addressing affordability**

Figure 21 - Our Vision to encourage the deployment of RES on MV market



Source: Pöry Management Consulting

1. Define standard grid access rules and control actions

Rationale

High variable RE penetration requires the definition of standard terms and technical conditions for the connection of new users to the grid.

Technical rules for the connection are a critical element for all power producers, especially in the energy markets characterized by dominant market players.

In Morocco the technical parameters for the connection are not published, nor grid codes and *cahier de charges* are available. Also connection fees and commercial terms are not public since they are currently negotiated between the applicant and the system operators (DSOs or ONEE) which are also suppliers.

Finally the absence of any control from a third party (i.e. Regulator or other entity) leaves renewables exposed potentially obstructive actions of current suppliers (ONEE or other distributors).

Lessons Learnt

It is quite common to publicly define the technical parameters that new applicants must fulfil to be connected. Most of the times, the definition of technical parameters and standard commercial terms involves the Regulator which controls and approves the proposals of the network operators (e.g. in the USA, Germany and Italy). Conditions can be defined in the grid code or in other specific documents submitted by network operators and approved by Regulator.

Nevertheless Mexico has shown that it is possible to protect the access rights of new applicants even when access conditions are negotiated with the dominant player (CFE) which owns the transmission and distribution assets. CENACE, state-controlled company and system operator, is in charge of managing the national grid and to control the technical evaluation of the new applicants in order to preserve the access right of new resources.

Actions

Establish a third entity to preserve the access right. The institution must be designed to enable access to the grid (both on transmission and distribution). As happened in Mexico, it could be identified with the independent system operator, which is actually prospected in the current Moroccan regulation³⁶.

Such proposal would require:

- The finalization of the unbundling process of ONEE; and
- Strong cooperation of such entity with the distributors.

Define standard commercial terms: connection fees should be regulated in order to guarantee equal conditions to the applicants.

2. Improve grid management and system operations

Rationale

Renewable integration in Morocco requires changes in system operations in order to ensure a safe and reliable dispatching and congestion management. Currently ONEE is responsible for the dispatching, but it does not provide the network users with clear dispatching and congestion rules, nor for renewable energy.

The dispatching priority of renewable energy is envisaged in the current framework, but congestion management rules are not transparently defined and no public rules exist.

Renewable generation could be curtailed without any information about the grid status. Moreover, the curtailment is currently negotiated on an annual basis between the system operator and the producer.

Furthermore, Moroccan legislation does not envisage any compensation for the curtailed production.

Lessons Learnt

In the best RE committed countries, standard dispatching and curtailment terms are essential for achieving high variable renewable integration.

In Italy, Germany, USA and Mexico the system operator provides the network users with the information of dispatching results and real-time³⁷ data on the grid status which helps

³⁶ The creation of a separated company from ONEE responsible for the national grid management is envisaged in the Law n°48-15, art. 53.

³⁷ Mexico actually provide only daily information on the grid status

the users and the supervisor of the energy market (system operator and/or Regulator) in the verification of the right functioning of the electricity system.

In addition to that, in the same countries the renewable producers are mostly re-paid for curtailed production. Storage systems are also envisaged as flexible sources particularly relevant in case of curtailment and congestions.

Actions

Define public grid management rules especially for dispatching and congestion: based on that, the network users and the Regulator can verify easier any discriminatory curtailment of the system operator.

Encourage a platform for the publication of the information on the grid-status and dispatching results: a website/platform available for network users favours the supervision of the market and the fulfilment of the dispatching priority. Such action reduce the market risk for renewable producers.

3. Address the affordability of renewable routes-to-market

Rationale

Morocco has not developed yet any relevant renewable project on MV grid due also to the weak affordability of the current renewable energy route-to-market.

Currently Morocco has supported the sales of renewable energy (retail direct sales) with only two instruments: green energy obligation on distributor/supplier (not clearly defined) and net-metering.

The first instrument might be weak considering that if the distributor does not fulfil the obligation and/or integrate renewable plants, no sanction (nor control actions) are in place.

The second instrument, the net-metering, has a complex implementation: the surplus energy is capped at 20% and the price of the energy sold is bilaterally negotiated with the system operator.

Lessons Learnt

In all case studies, the integration of the renewable was highly supported both with financial and non-financial schemes.

Net-metering is also an extensive policy tool in most analysed countries. The efficient design of such mechanism has favoured the development of small-medium renewable plants. Usually the energy in exceed can be sold to the system operator or into the market without any limitation on the quantity injected. In many cases this support is combined with discount on network charges (i.e. in Italy on general charges) or with a competitive price for the electricity injected to the grid (i.e. Brazil).

Actions

Publish renewable integration targets by distribution district: clear integrations target might better address the future investment decisions.

Publish renewable cost reflective tariffs for an embedded generation: wheeling prices and network tariffs assessed on real costs of the distribution service is the basis for renewables profitability.

Define penalties/rewards for non-compliant/compliant distributor-suppliers: the introduction of financial rewards or penalties could stimulate a faster integration of renewable generation.

Track the progress of the renewable projects on MV: the creation of an open-access database could help both institutions and market players in the identification of slowest districts, furthermore in addressing the authority investigations.

Estimate grid reliability and required investments for grid adequacy and reliability to accommodate renewable on MV: up to date no estimation on the grid adequacy and reliability costs (i.e. storages or other flexibility sources) are provided. It might be useful to assess or not any financial support for renewables in Morocco, currently absent.

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ANNEX A

A.1 Morocco Electricity Market Institutions and players

The current institutional framework of Morocco power sector is a direct result of the progressive liberalization of the energy sector. The GoM progressively modified the institutional framework in order to efficiently take up the challenges of such process.

The result has been the establishment of new institutions and a clarification on role and responsibilities of each bodies acting in the national electricity sector.

The Ministry of Mines, Energy, Water and Environment

The MEMDD is the main policy entity in the energy sector, defining the national energy policy and supervising to its correct implementation. The Ministry is also responsible for :

- The implementation of the necessary measures to ensure the security of energy supplies, spread the energy access to the all population and protect the energy infrastructures;
- The surveillance on the organization and operation of energy markets in the context of their liberalization and regional integration;
- The supervision of public enterprises and institutions under its jurisdiction, including the ONEE.

Ministry of Internal Affairs and Ministry of Economy and Finance

The Ministry of Internal Affairs has the responsibility to control the activity of local private distributors (“Gestionnaires Délégués”) and electric distribution service concessions.

The Ministry of Economy and Finance has the responsibility to control the activity of local distributors (“Régies Multiservices”) and has also the financial control of ONEE.

Agence Nationale de Régulation de l’Energie (ANRE)

The most important evolution has been the establishment of an independent regulatory authority³⁸, ANRE, responsible to monitor and to supervise the implementation and the functioning of the electricity market model.

The ANRE is responsible of the correct functioning of electricity market and is dedicated to set main technical and economic regulation of the electricity sector in order to ensure an effective and fair competition in Morocco electricity market.

The law gives clear responsibilities to the regulator especially about: the definition of commercial and technical rules of the electricity market, the adoption of a grid code and grid access rules, network and retail tariff methodologies.

Despite its importance for the correct functioning of the electricity market, the ANRE remains not operational yet.

³⁸ Law 48-15

Moroccan Agency for Sustainable Energy (MASEN)

Moroccan Agency for Sustainable Energy – State-owned limited company, it was founded with the aim of contributing to the development of the national solar industry³⁹. Now it is responsible for the implementation of objectives for all renewables energy technologies and has also acquired the property of all national renewable assets (excepting hydro pumped storage)⁴⁰.

ONEE

ONEE is the public vertically integrated utility, which replaced the ONE after the company reorganization in 2011⁴¹. The ONEE is a public law company answering directly to the MEMDD.

Most important market operator, ONEE owns and operates an important share of generation. It is also responsible to procure energy from IPPs, being allowed to give concessions and to sign PPAs with private electricity producers to satisfy the national electricity demand.

It acts as the single buyer of power system and is the only responsible for system planning and central dispatch of Morocco power system.

It operates and develops the transmission network and serves final consumers connected to both the transmission network and the distribution grids directly managed.

Régies Multiservices

Local municipal utilities for the distribution of electricity and water can be owned by a single municipality or by neighbouring communes. They own and manage electricity distribution grids at local level and are responsible to provide electricity to the customers connected to their grids.

Gestionnaires Délégués

Private entities, which operate under concession agreements granted by the state or local authorities⁴², have obtained the right to deliver water and electricity services to end consumers in specific urban areas, such Casablanca and Rabat. They are also responsible of expansion and maintenance of electricity distribution in order to ensure the quality of the public services in their areas.

³⁹ Law n° 57-09

⁴⁰ Law n° 38-16 art.2

⁴¹ Law n° 40-09

⁴² Law n° 54-05

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Approved by:	Antonio Nodari	June 2018

ABOUT RES4MED&AFRICA

(Renewable Energy Solutions for the Mediterranean & Africa)

Who we are: RES4MED&Africa promotes the deployment of large-scale and decentralized renewable energy and energy efficiency in Southern-Mediterranean and Sub-Saharan African countries to meet local energy needs. Since its inception in 2012, the association gathers the perspectives and expertise of a member network from across the sustainable energy value chain.

Our work: RES4MED&Africa functions as a platform for members and partners of emerging markets to foster dialogue and partnerships, share knowledge and build capacity to advance sustainable energy investments in Southern-Mediterranean and Sub-Saharan African countries.

Our mission: RES4MED&Africa aims to create an enabling environment for renewable energy and energy efficiency investments in emerging markets through on 3 work streams:

- Acting as a connecting **platform for dialogue & strategic partnerships** between members and partners to exchange perspectives and foster cooperation;
- Providing **technical support & market intelligence** through dedicated studies and recommendations based on members' know-how to advance sustainable energy markets;
- Leading **capacity building & training efforts** based on members' expertise to enable skills and knowledge transfer that supports long-term sustainable energy market creation;

At the end of 2015, RES4MED members decided to expand the geographic focus to Sub-Saharan Africa in light of the huge potentials and growth opportunities for Africa's renewable energy sector.

Members: RES4MED&Africa gathers a network of 38 members from across the sustainable energy value chain including industries, agencies, utilities, manufacturers, financing institutions, consultancies, legal and technical services providers, research institutes, and academia.

Partners: RES4MED&Africa works with local, regional and international partners, agencies and organizations to pursue its mission and promote renewable energy and energy efficiency deployment in the region of focus.

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RES4MED
Via Ticino, 14
00198 Rome
Italy
Tel: +39068552236
Fax: +390685832954
E-mail
info@res4med.org



Pöyry Management Consulting (Italia) S.r.l.
Viale Francesco Restelli, 3/1
I-20124 Milano
Italy

Tel: +39 02 3659 6900
www.poyry.it

