



MENAREC5

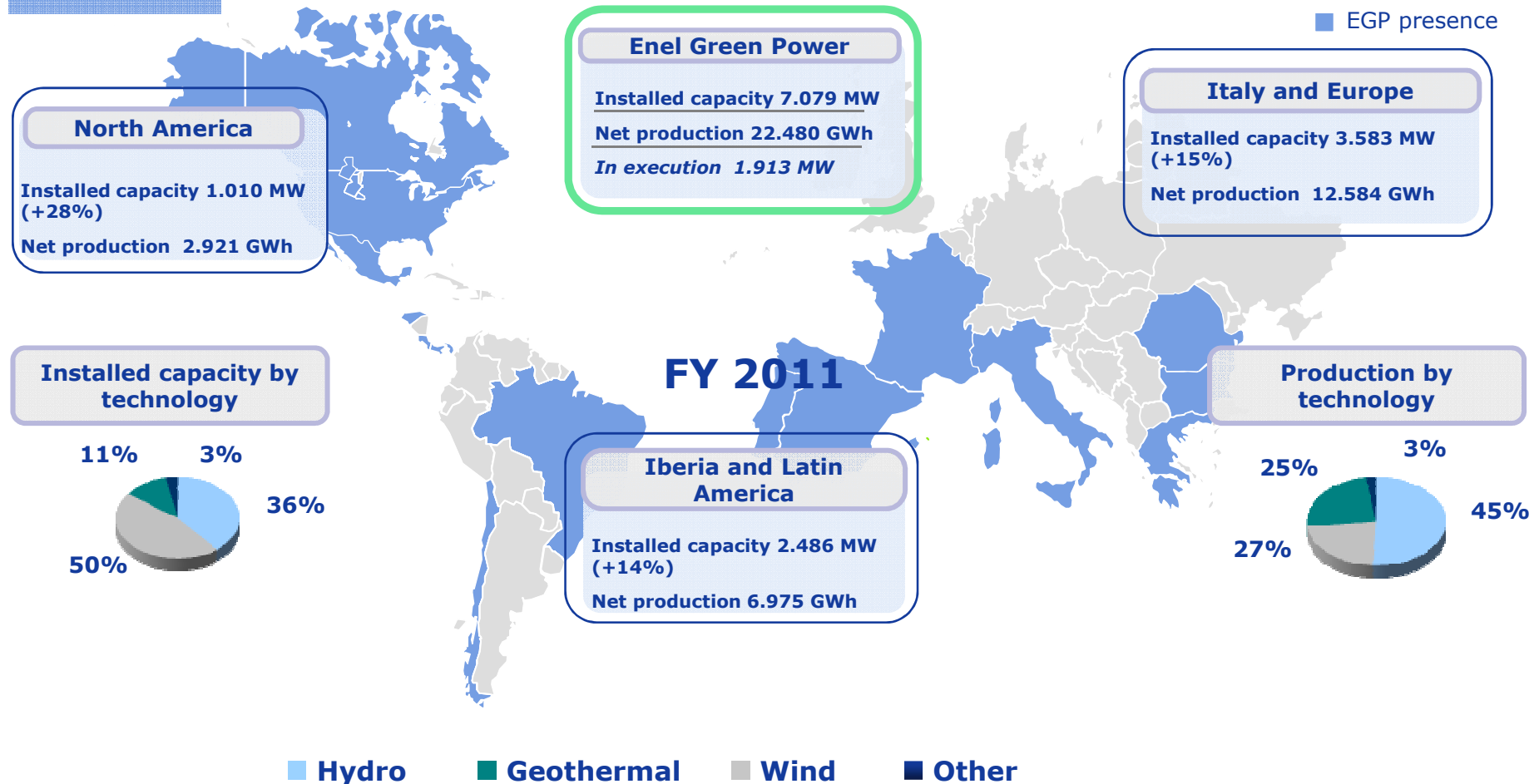
Prospect and Challenges for a Regional EU-MENA Grid and Market Integration

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Head of Business Development New Countries, Enel Green Power*

Marrakech, May 16th 2012

A global leader

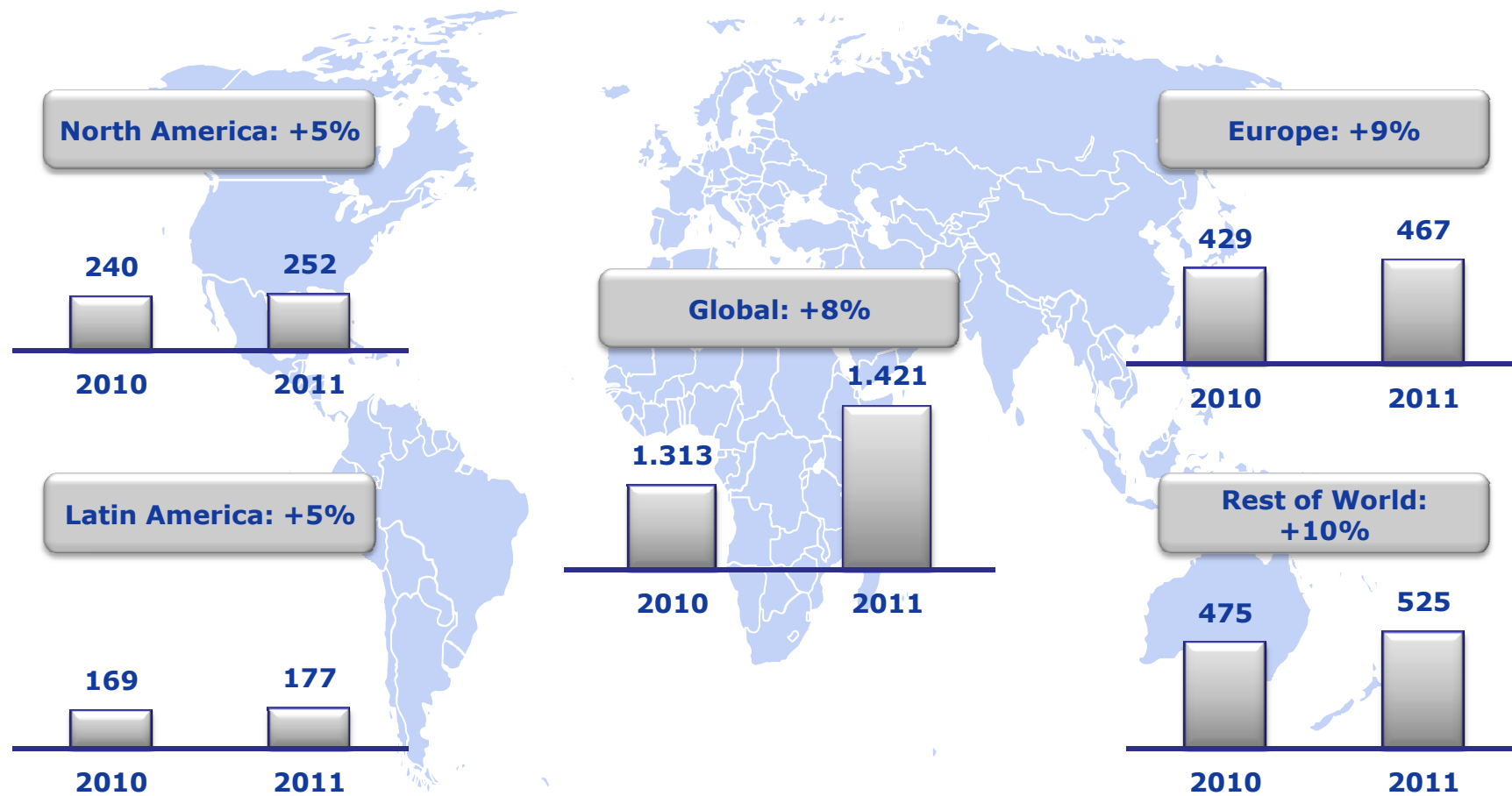
EGP global footprint – 2011



**Unrivalled footprint in 16 countries
across all main renewable technologies**

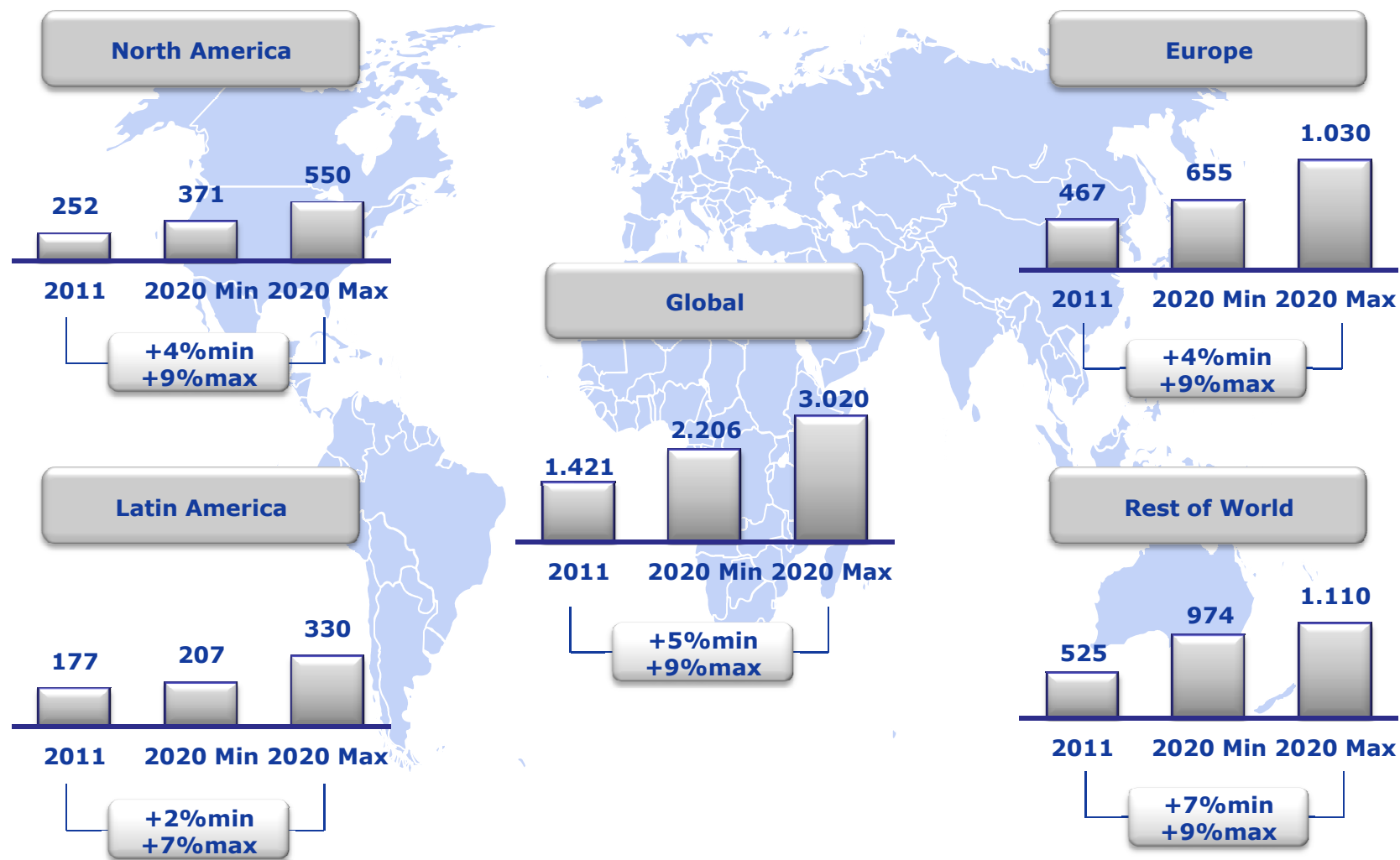


Global growth in renewables: 2011 (GW)¹



1. 2011 preliminary figures. Sources: EPIA, GWEC, EWEA, SEIA, EER (2011), WEO 2011, BNEF

Global growth in renewables: future evolution (GW)¹



1. 2011 preliminary figures. Sources: EPIA, GWEC, EWEA, SEIA, EER (2011), WEO 2011, BNEF

Renewable energy investments: a growing industry

Expected worldwide growth

By technology								By geography						
Technology	Installed base	Installed base	Delta capacity		Expected Growth CAGR 2011-20		Investments	Area	Installed base	Installed base	2020 Min	2020 Max	Expected Growth CAGR '11-'20	
	2010 (GW)	2011 (GW)	'10-11 (GW)	%	Min	Max	2011 (€bn)		2010 (GW)	2011 (GW)	(GW)	(GW)	Min	Max
Hydro	~1,005	~1,037	+32	2%	2%	2%	~65	North America	240	252 +5%	371	550	4%	9%
Wind	~197	~240	+43	22%	10%	14%	~57	Europe	429	467 +9%	655	1,030	4%	9%
Biomass	~60	~64	+4	7%	6%	25%	~15	Latin America	169	167 +5%	207	330	2%	7%
Solar	~40	~69	+28	69%	13%	25%	~105	Africa	27	28 +6%	53	110	7%	16%
Geothermal	~11	~12	+0.4	4%	6%	11%	~2	Asia	449	494 +11%	921	1,000	7%	8%
TOTAL	~1,313	~1,421	+108	8.2%	5.0%	8.7%	~€244bn	TOTAL	~1,313	~1,421	~2,206	3,020	5.0%	8.7%

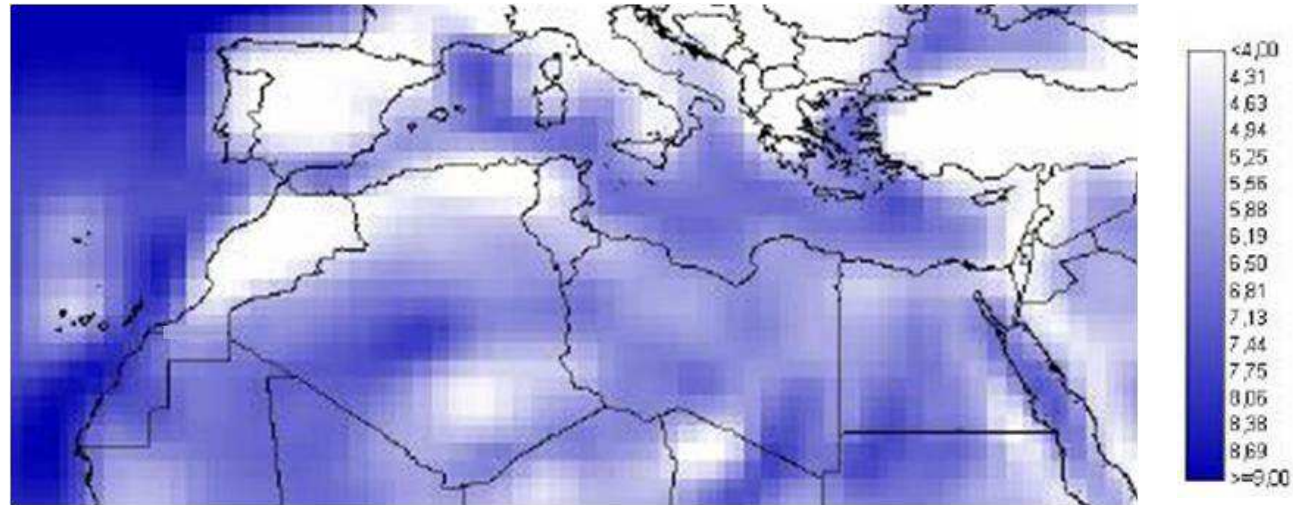
- All renewable technologies and regions confirm their strong potential
- Investments in distributed generation accounted for 25% of the total
- During 2011, total R&D investments amounted to €20bn (€10bn from corporate and €10bn from government)

Source: EPIA, GWEC, EER (2011); WEO 2011 New Policies scenario (2020 min); industry reports/McKinsey (2020 max); BNEF, EGP estimates
 Note: All 2011 figures are preliminary estimates. Investments estimated based on BNEF figures and assuming an fx of 1.3 €/\$. Hydro investments estimated assuming 16GW of new installations and 2.0€/MW capex.

Outstanding RES potential in MENA Region

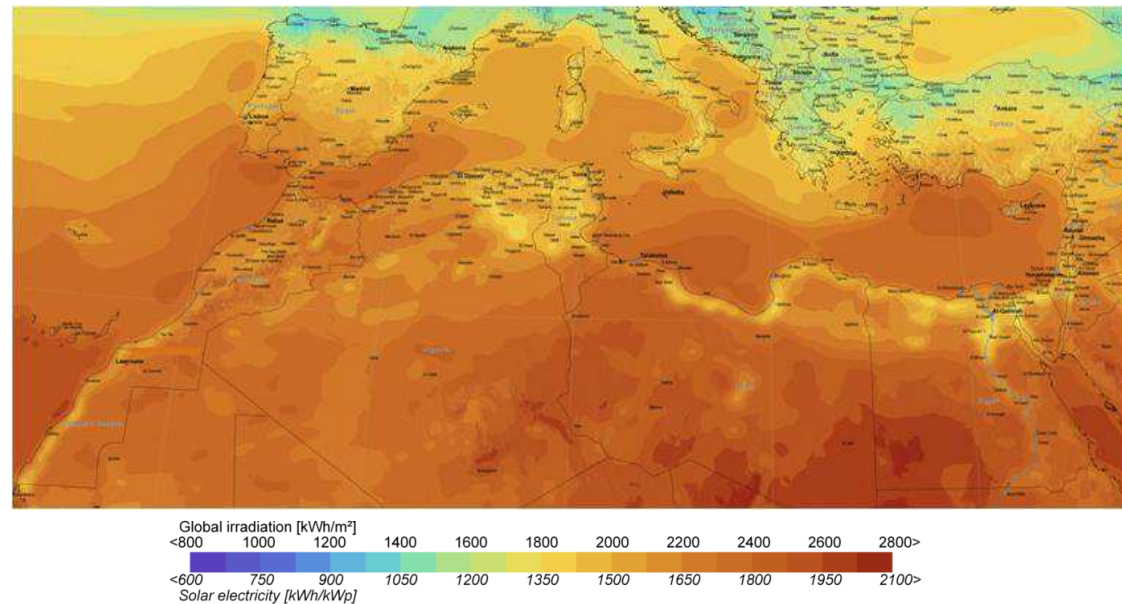
Wind

Annual average wind speed at 80m above ground level in m/s.



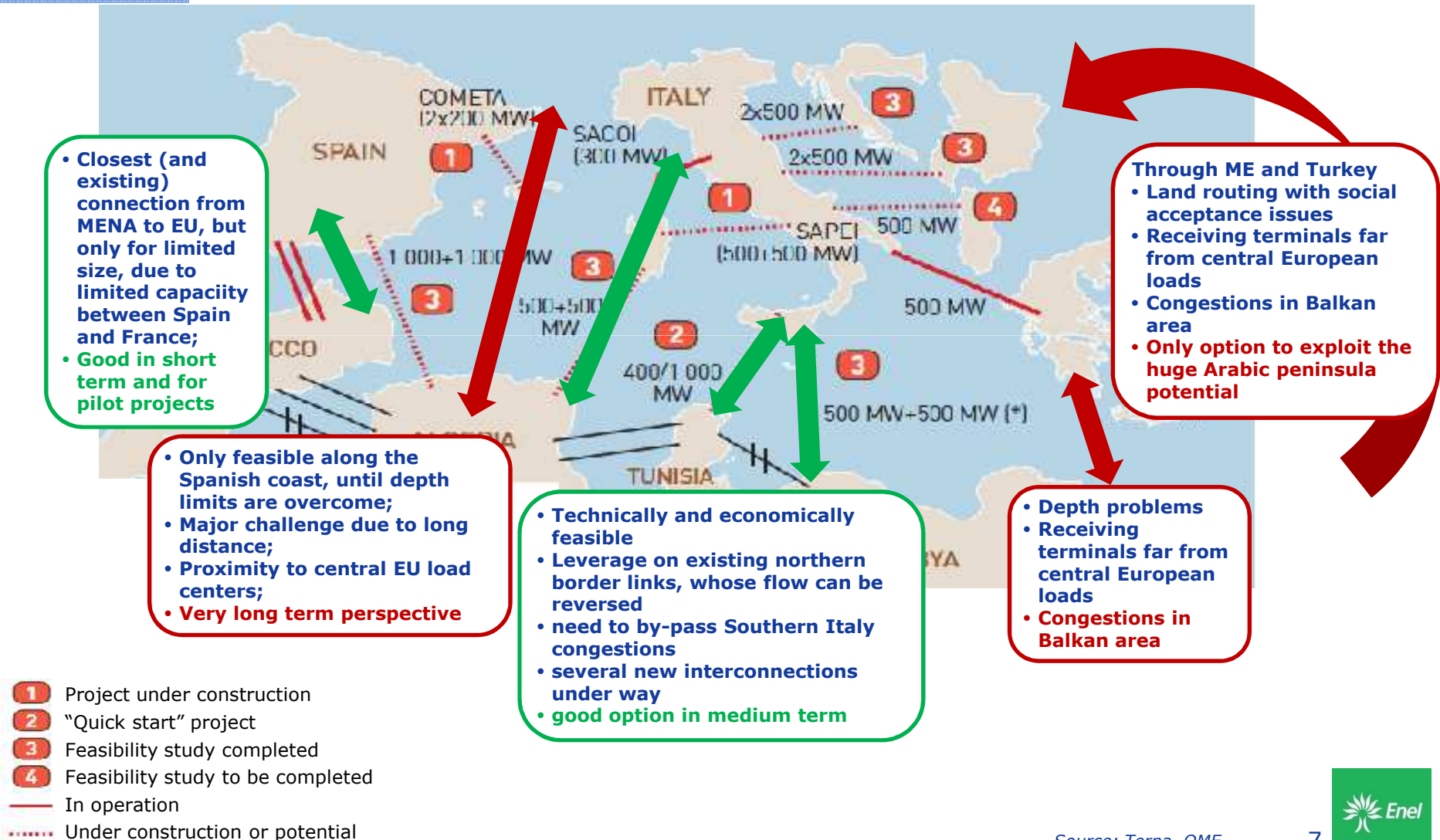
Solar

Yearly sum of global irradiation incident on optimally-inclined surface.



Source: DLR, EC-JRC

Mediterranean cross-border links



Source: Terna, OME

Main challenges for EU-MENA RES integration

Institutional and regulatory framework

Some aspects to focus on:

- ✓ Cooperation mechanisms between States
- ✓ Harmonization of incentives and ease the permitting process and all required bureaucratic procedures
- ✓ Technical assistance on market and transmission issues
- ✓ Suitable and stable Regulatory framework
- ✓ Suitable tariffs/subsidies policy in order to:
 - Cover investment and operation plants costs
 - Cover infrastructural systems costs: grid connection and system costs, power transportation locally and/or towards EU
 - Avoid competing subsidies to conventional power production
- ✓ Concrete possibility to implement **Art. 9 of Directive 2009/28/CE**
- ✓ Select the **proper technology mix according to local conditions**

Interconnections

Development of interconnections:

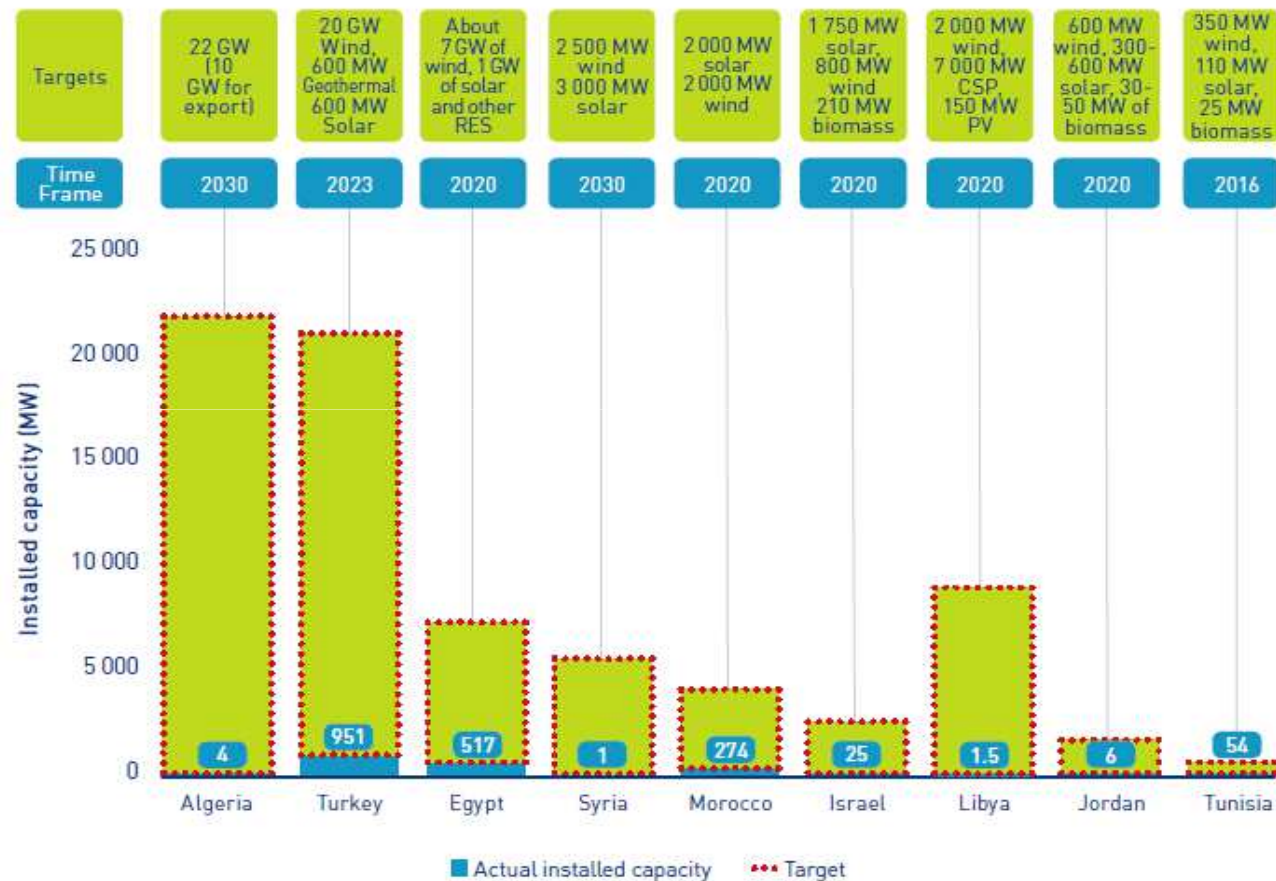
- ✓ among European Countries
- ✓ between MENA Region and EU

System flexibility

Enhancement of:

- ✓ Flexibility of the power generation mix (through an increased use of electricity from natural gas)
- ✓ Electricity storage
- ✓ Smart grids technologies and infrastructures at the distribution level
- ✓ Mobility (i.e. electric vehicles)
- ✓ Demand Side Management









RES targets in selected MENA Countries



Note: RES = Renewable Energy Sources.

Source: OME

Existing on going energy initiatives in MED area

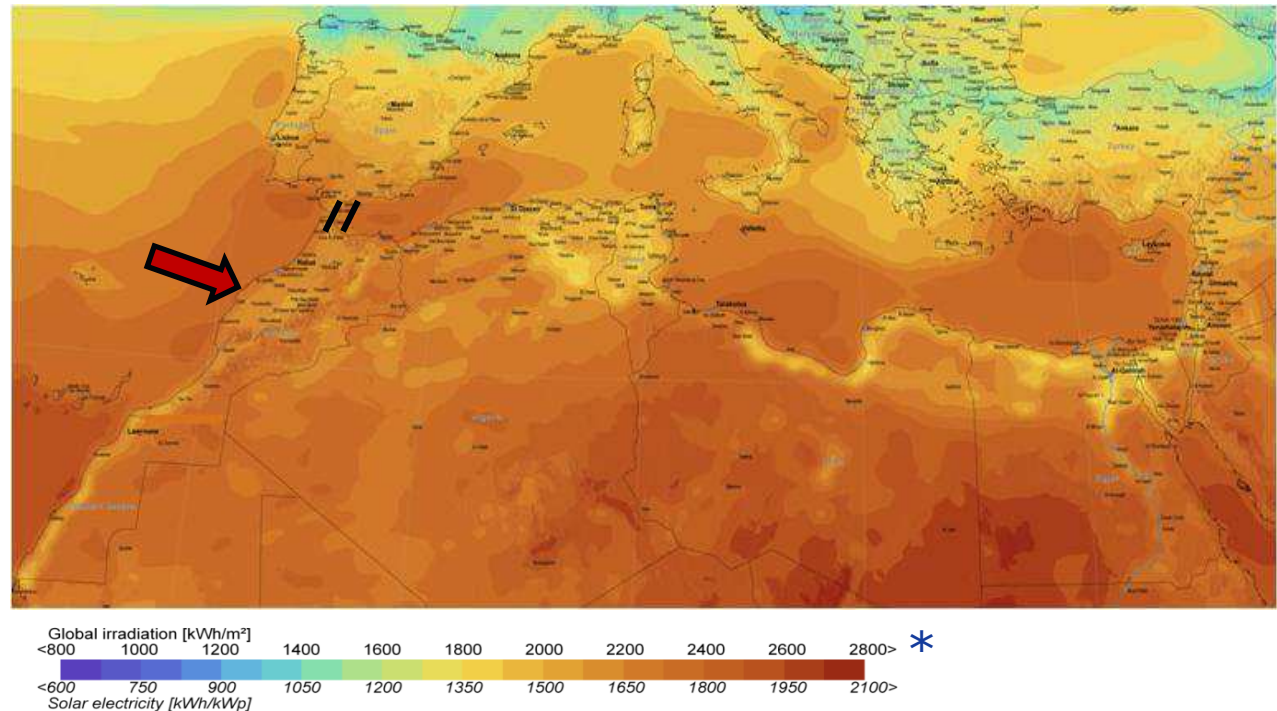
	Initiative	Type	Area of Activities	Technology focus	Year of foundation	N. of members
	RES4MED	Industrial & Institutional	Cooperation with ongoing MED initiatives	All renewable energies	2012	12
	OME	Industrial	Analysis of energy Issues	All energy, RE and efficiency	1991	33
	MedReg	Institutional	Regulatory framework, supporting scheme	Electricity and Gas	2007	24
	Mediterranean Solar Plan	Institutional	Policy, regulatory framework, supporting scheme	Renewable deployment of 20 GW at 2020	2008	43
	Desertec Industrial Initiative	Industrial consortium	Markets, transmission regulation	Transmission and interconnection grids	2009	56
	MedGrid	Industrial consortium	Regulation for grid access for RES producers	Grid network	2010	20
	PWMSP	Institutional	Paving the way to Med Solar Plan	All renewable energies	2010	5
	MedTSO	Industrial	Transmission system in the MED	TSO	2012	16

Source: RES4MED

Focus on Morocco

Countries of the Mediterranean Basin

- **Morocco** presents the **best balance in the MENA region** between **yearly irradiation**, **grid development** for local consumption and **existing interconnection capacity with European countries**
- This allows for **immediate development of distributed photovoltaic generation capacity at profitable economic conditions**



* Yearly sum of global irradiation incident on optimally-inclined surface
Source: EC-JRC

PV is reaching a grid parity at certain conditions

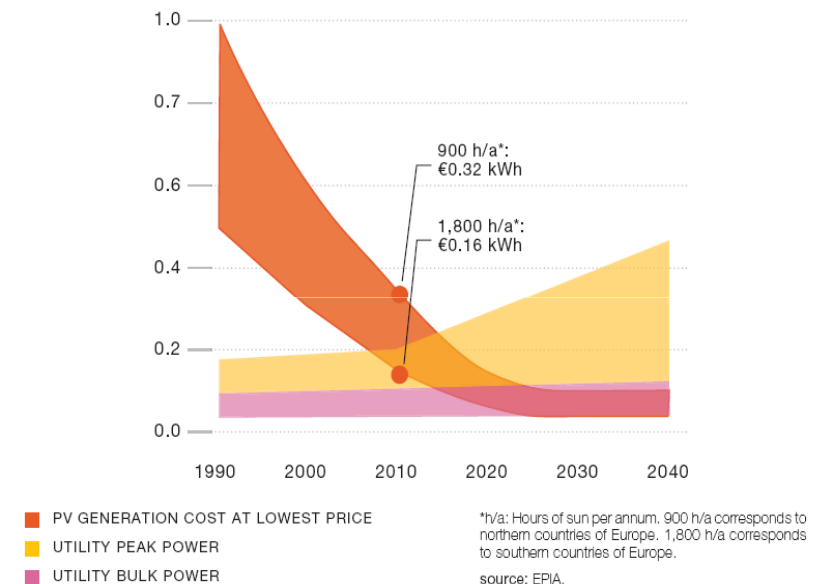
LCOE for market segments and operating hours

Large Plant (2.5 MW)	LCOE (€/MWh)	1000 EOH	1250 EOH	1500 EOH
	Capex : 1.6 €/W	220	180	150
	Capex : 1.0 €/W	150	120	100

Medium Rooftop (100 kW)	LCOE (€/MWh)	1000 EOH	1250 EOH	1500 EOH
	Capex : 1.8 €/W	185	150	125
	Capex : 1.2 €/W	130	105	90

Residential Rooftop (3 kW)	LCOE (€/MWh)	1000 EOH	1250 EOH	1500 EOH
	Capex : 2.0 €/W	215	175	145
	Capex : 1.4 €/W	160	130	110

DEVELOPMENT OF UTILITY PRICES AND PV GENERATION COSTS
€/kWh



Source: EPIA, EGP estimates

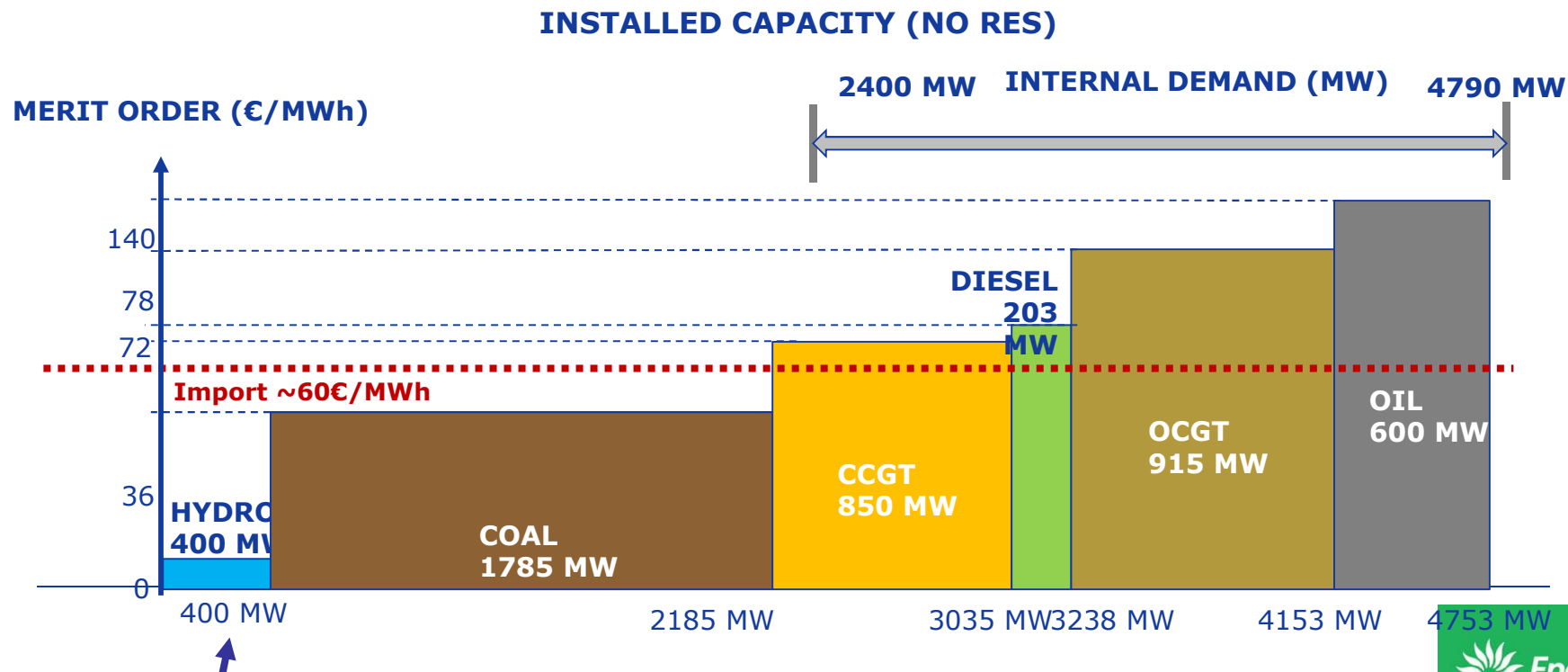
Note: For the LCOE calculation the following assumptions were used: 7% WACC, 35% tax rate for large plant, 30k€/MW annual opex for residential and large plant and 20k€/MW for medium rooftop installations, 25 years of life, no terminal value and 0.05% annual decay of productivity.

For residential installations a WACC decreased for 1% leads to a LCOE decrease of ~10€/MWh

Morocco Electricity Market

Merit Order

A significant demand growth together with a high marginal cost of production (old fuel oil), and in many occasion with negative reserve margin, creates the urgent need to increase the generation capacity. Simultaneously Morocco is seeking to increase its energy independence from the Algerian gas and the electricity imports from Spain

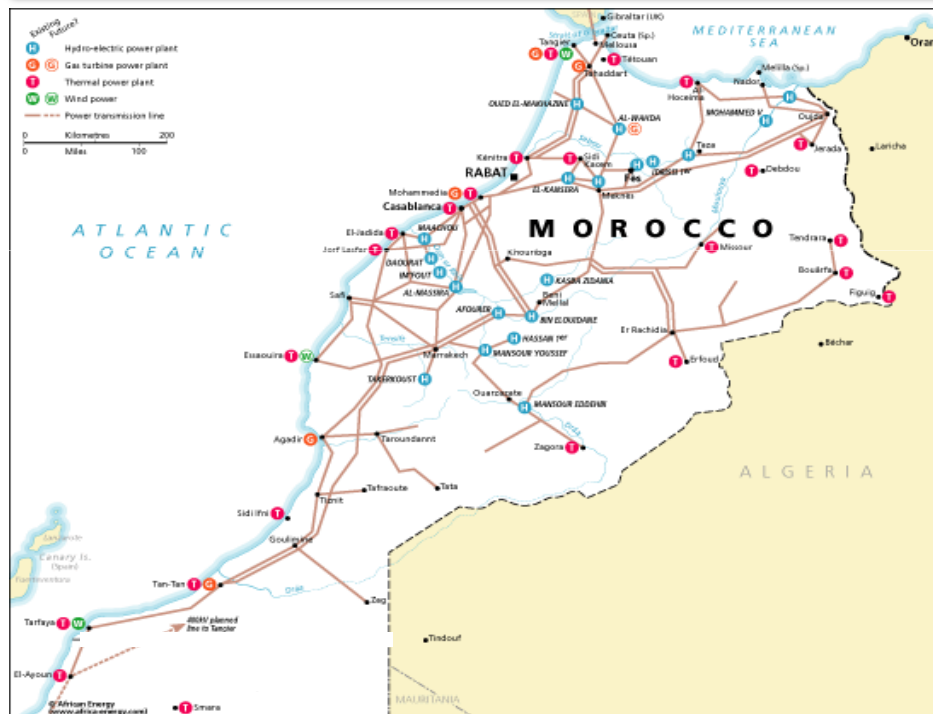


Morocco Electricity Market

Electricity Market Infrastructure

The Moroccan Grid is already suitable to manage the not programmable renewable resources as defined in the National Plan for Renewable

Morocco Grid Map & Interconnection



Morocco is interconnected with*:

- **Algeria** (400 MW)
- **Spain** (900 MW import 600 MW export underwater)

Source: GENI - Global Energy Network Institute, Enerdata

* Morocco is interconnected with Spain since 1998. in May 2006 the second part of the electricity interconnection was commissioned (further 700 MW). The interconnection with Algeria should be increased as well from 400 MW to 1700 MW

In minimum load conditions, the **maximum wind generation** that is possible to inject in the Moroccan system is sufficient to cover the Moroccan Grid Plan and the external investment. In fact the power production can be up to nearly 2000 MW

Without pumping system		With pumping system	
Wind generation	PV solargeneration	Wind generation	PV solargeneration
1840	819	1840	1260

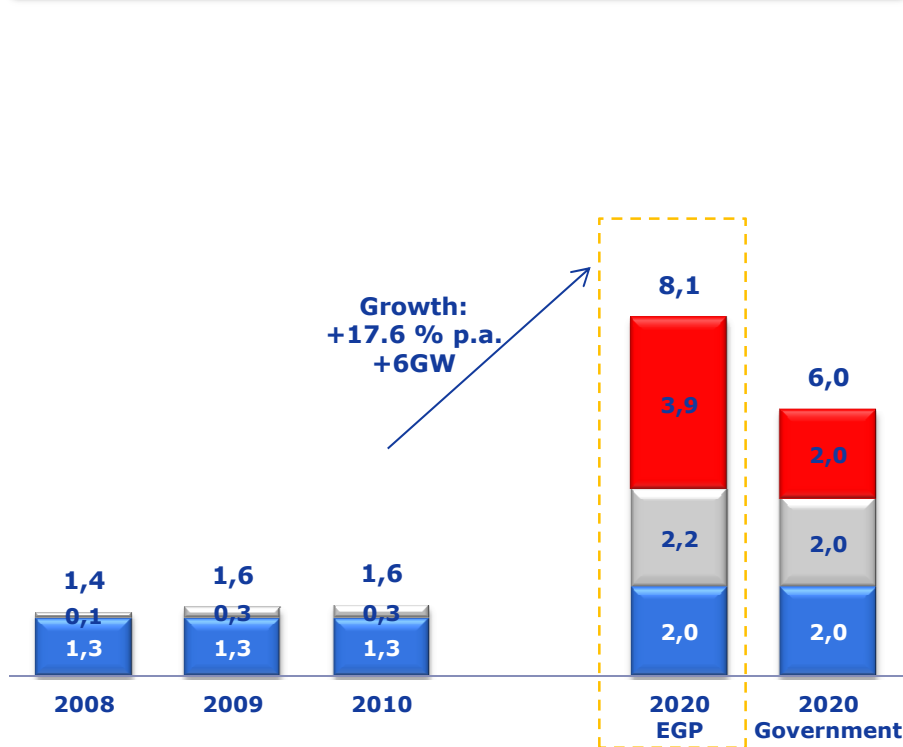


Morocco Electricity Market

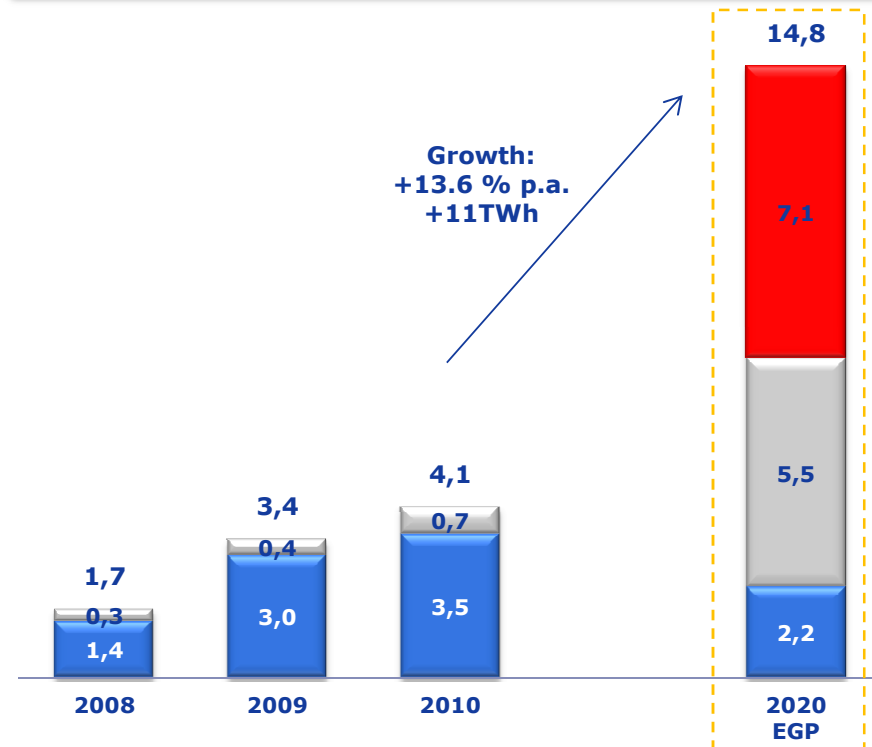
Renewables - Market Overview



Renewables - Installed Capacity 2008-2020 (GW)



Renewables - Production 2008-2020 (TWh)



As for the Government Target:

- **MASEN Solar Plan** foresees 2 GW of solar capacity in 2020
- In addition to the 1 GW of wind capacity in operation and under development, ONE is planning further 1 GW under its integrated wind program.

Source: Enerdata, OME, EPIA, CSP Today, MEED, MASEN, ONE, EGP estimates

Note: For the calculation of the 2020 production, the following load factors are assumed: Hydro 1.100 EOH, Wind 2.500 EOH, PV 1.500 EOH, CSP 3.400 EOH. Hydro figures exclude Pump (0.5 GW installed and 0.2 GWh production in 2010)



Looking at New Opportunities

EGP New Countries activities in the Mediterranean Area

Key

 Enel Group presence

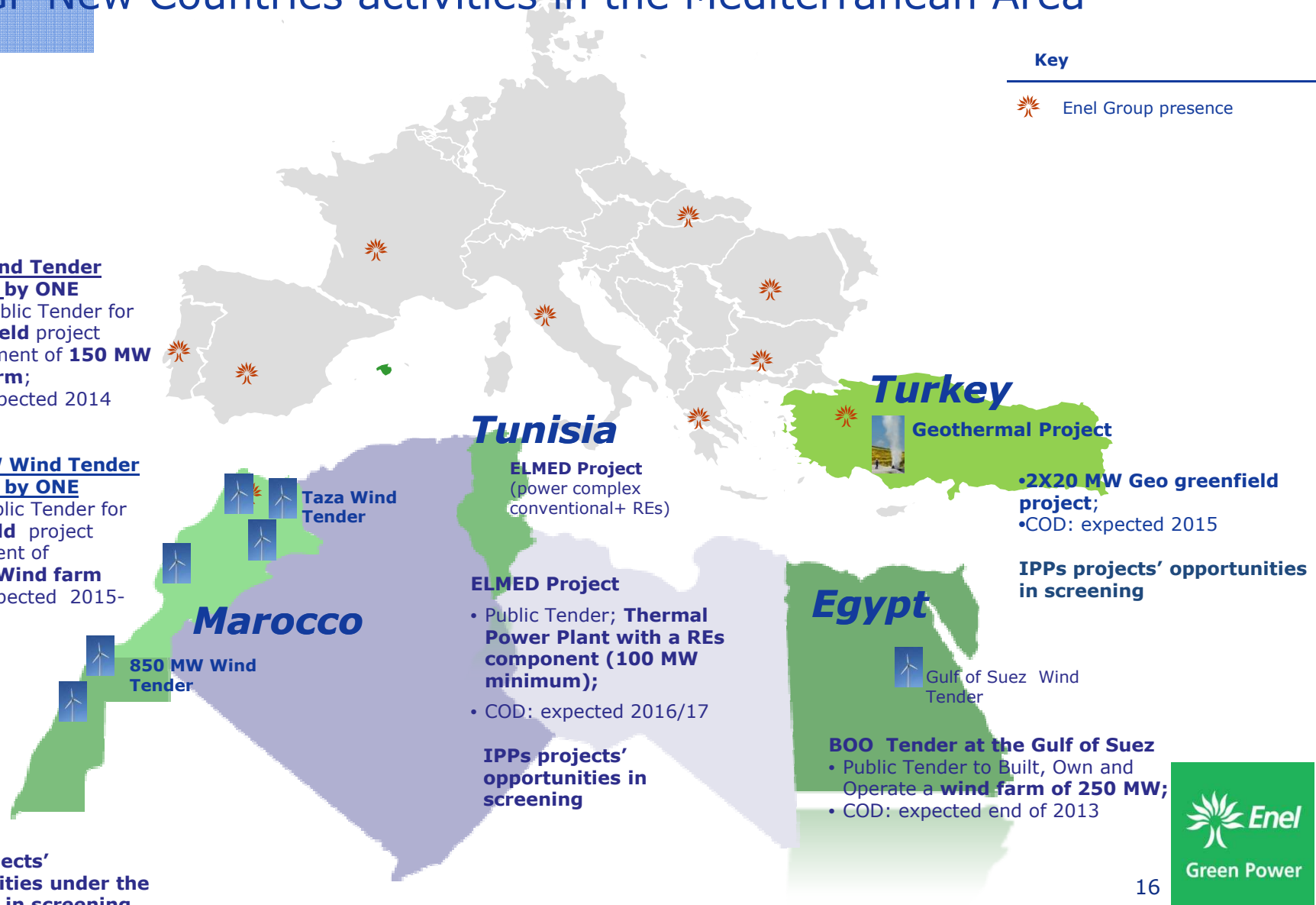
➤ Taza wind Tender launched by ONE

- BOOT Public Tender for **green field** project development of **150 MW wind farm**;
- COD: expected 2014

➤ 850 MW Wind Tender launched by ONE

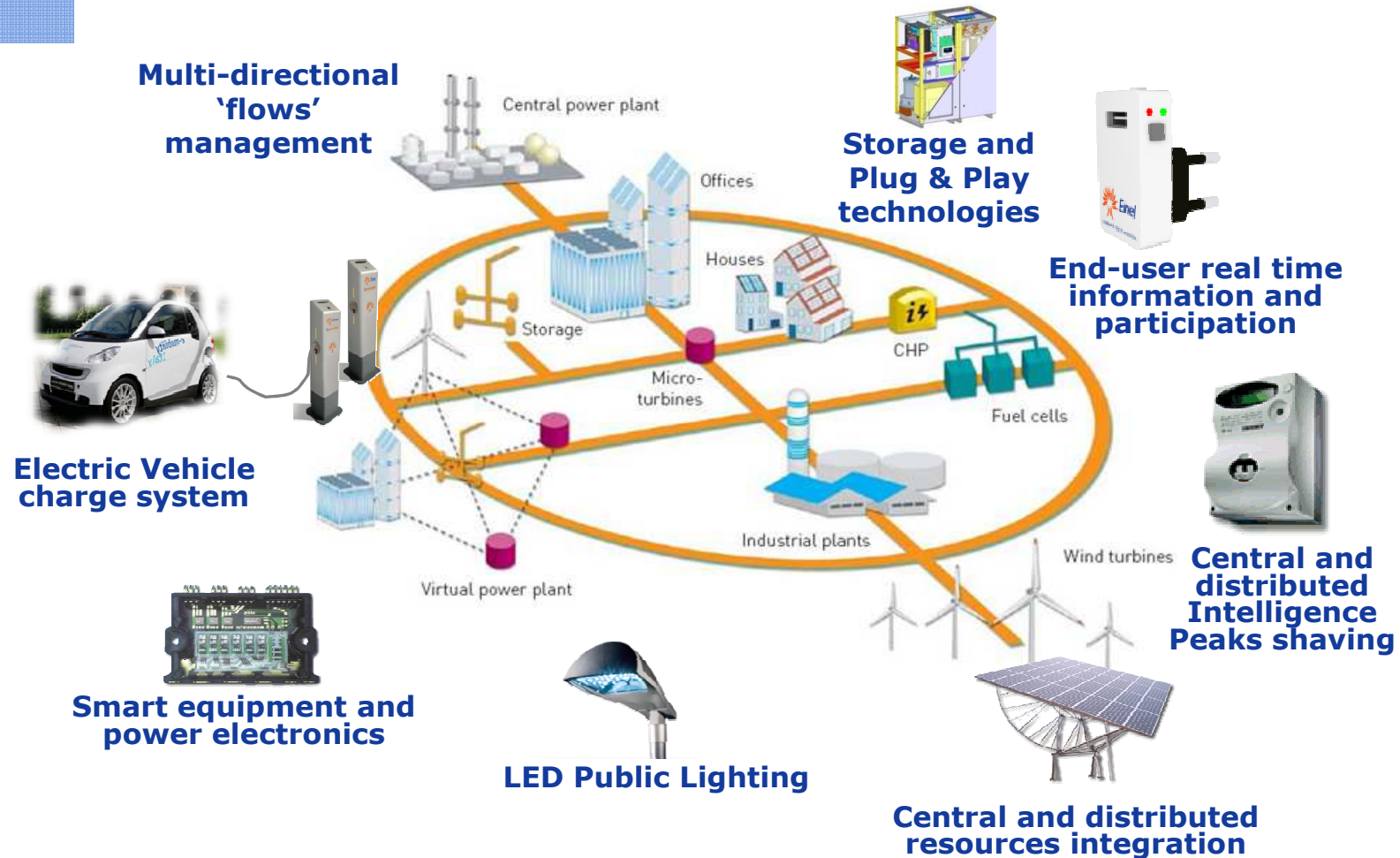
- BOOT Public Tender for **green field** project development of **850 MW Wind farm**
- COD: expected 2015-2019

IPPs projects' opportunities under the New Law in screening



Enel Smart Grids

Vision: Building a smart Energy future



Network interacts intelligently with all connected parties in order to efficiently deliver sustainable, economic and secure electricity supply

THANK YOU!

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