

With the support of the PV Market Alliance

The PV Market Alliance



# APVIA Q3 2019 Market Report



# Introduction

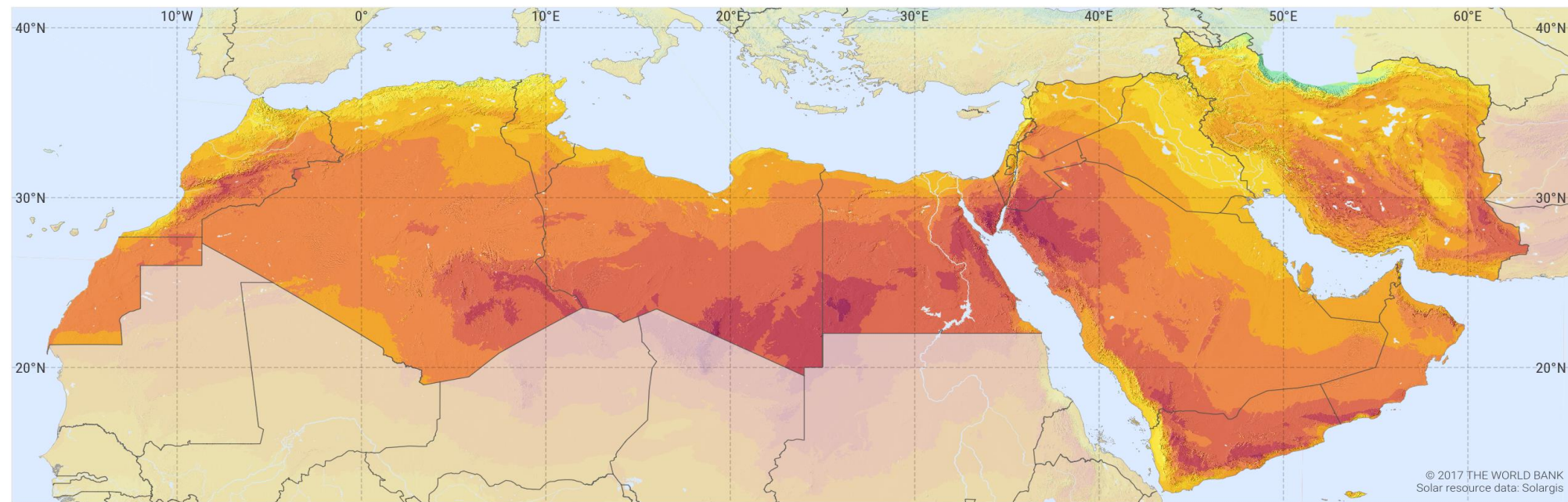


- Launched in 2017, this 11<sup>th</sup> edition of APVIA’s quarterly PV market report focus on the “The Role of PV and Storage across the Middle East Region”
- This report has been prepared with information provided by the PV Market Alliance, Asia Europe Clean Energy (Solar) Advisory Co. Ltd. (AECEA) and especially the “Apricum Cleantech Advisory Group”
- All information collected are valid at the time of publication. The data published do not engage the responsibility of APVIA or AECEA and should be considered with all due caution and are for informational purposes only

# Middle East / North-Africa - Solar Resource Maps

SOLAR RESOURCE MAP

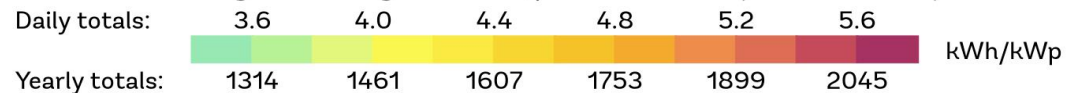
## PHOTOVOLTAIC POWER POTENTIAL MIDDLE EAST AND NORTH AFRICA



© 2017 THE WORLD BANK  
Solar resource data: Solargis

500 km

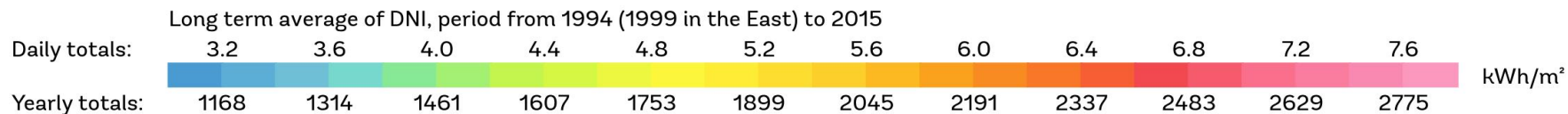
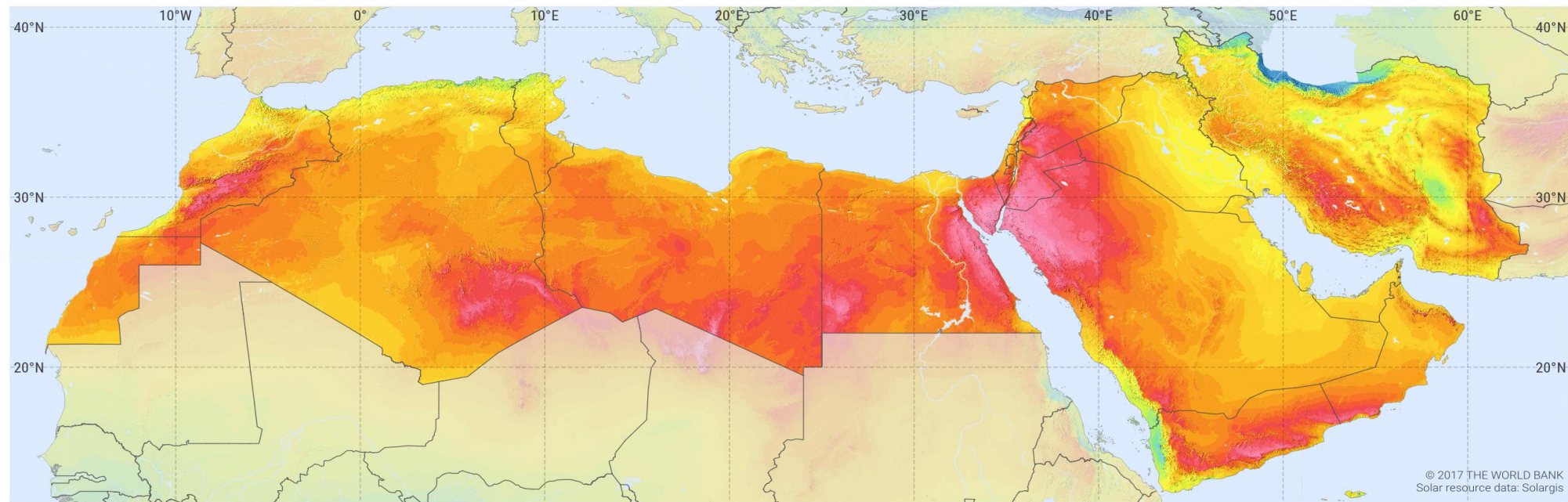
Long term average of PVOUT, period from 1994 (1999 in the East) to 2015



# Middle East / North-Africa - Solar Resource Maps

SOLAR RESOURCE MAP

## DIRECT NORMAL IRRADIATION MIDDLE EAST AND NORTH AFRICA

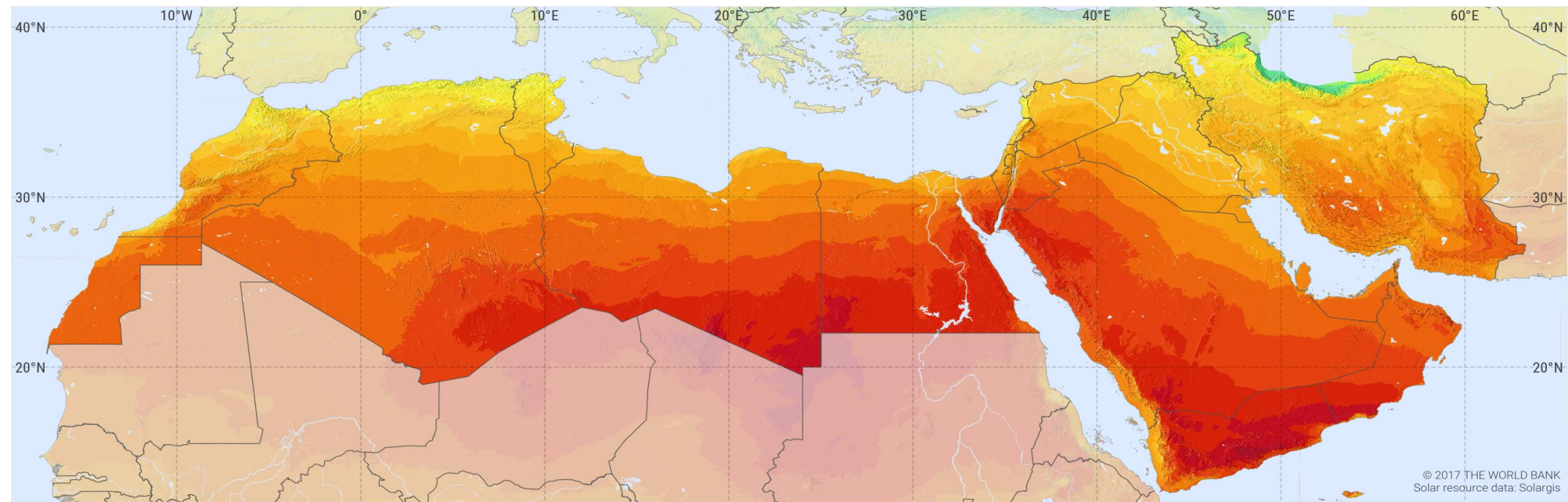


This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

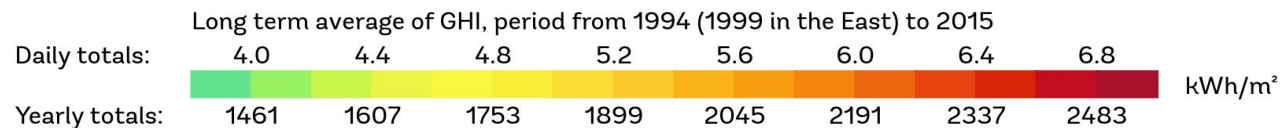
# Middle East / North-Africa - Solar Resource Maps

SOLAR RESOURCE MAP

## GLOBAL HORIZONTAL IRRADIATION MIDDLE EAST AND NORTH AFRICA

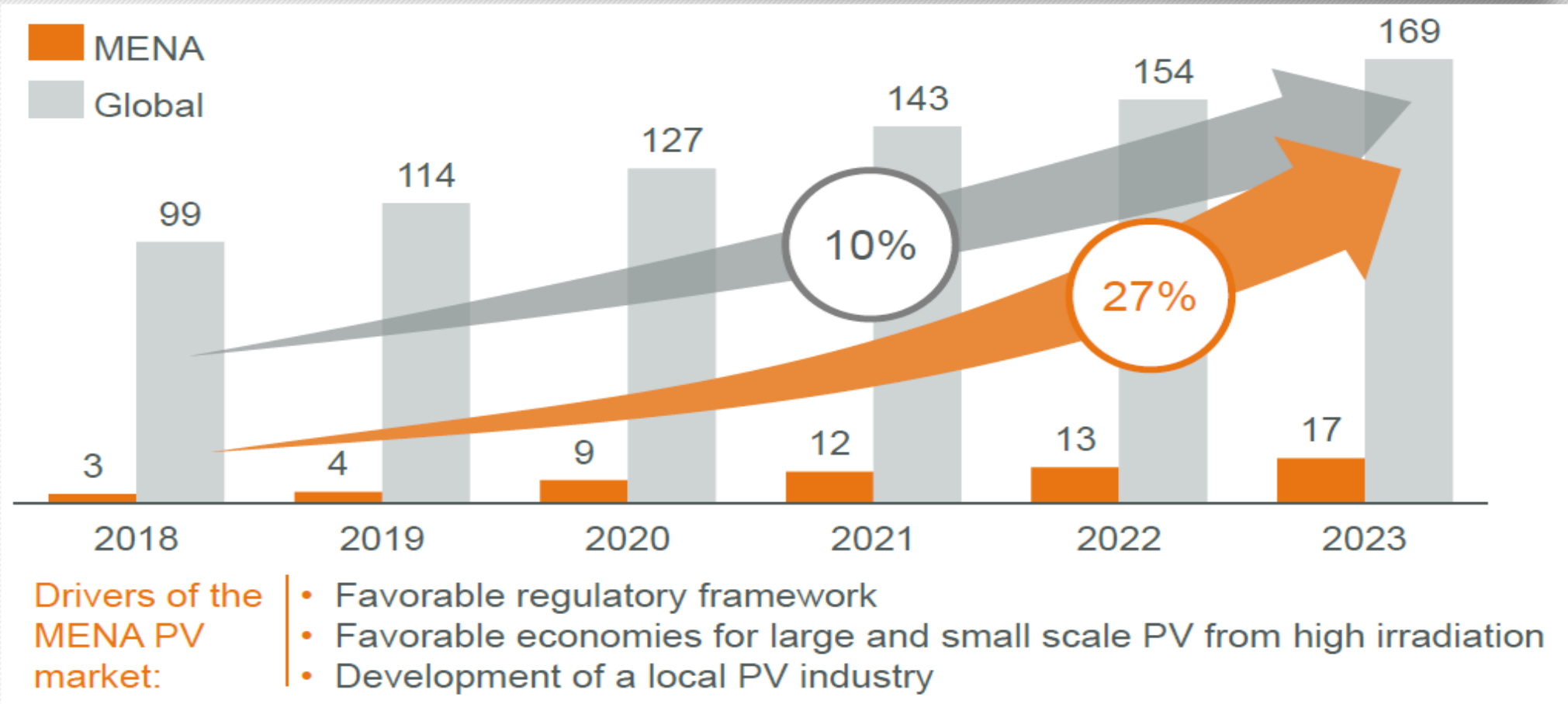


© 2017 THE WORLD BANK  
Solar resource data: Solargis



This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

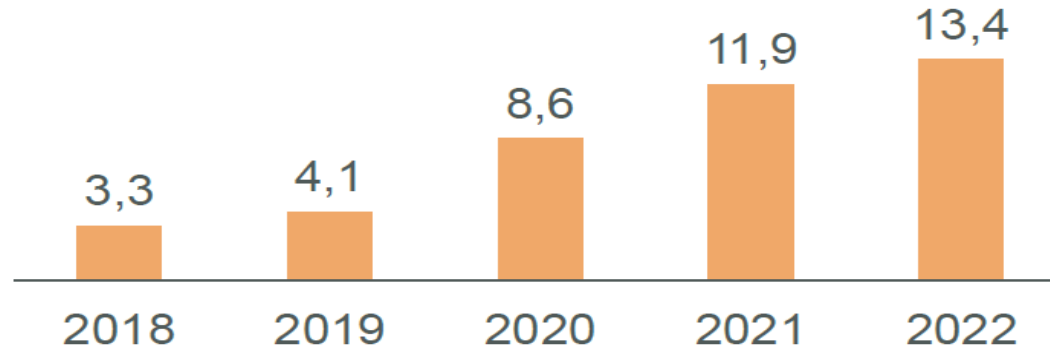
# MENA - Strong Market Growth Anticipated



# MENA - Prospects for Solar and Wind



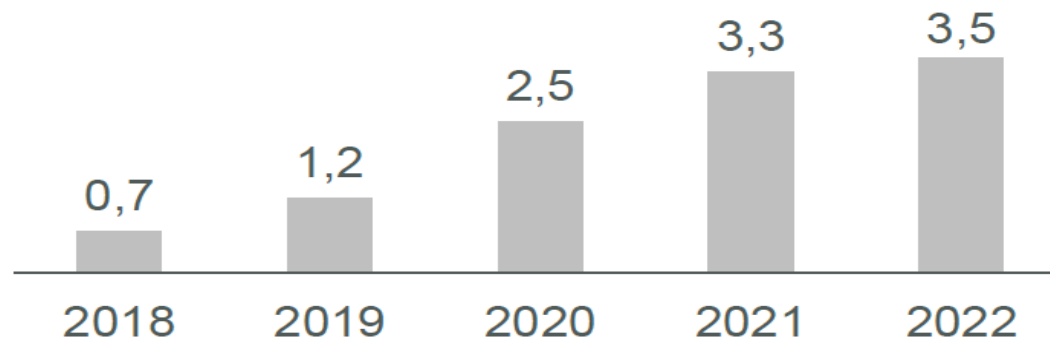
MENA solar PV annual demand [GW]



Total (2018–  
2022):  
**41.3 GW**

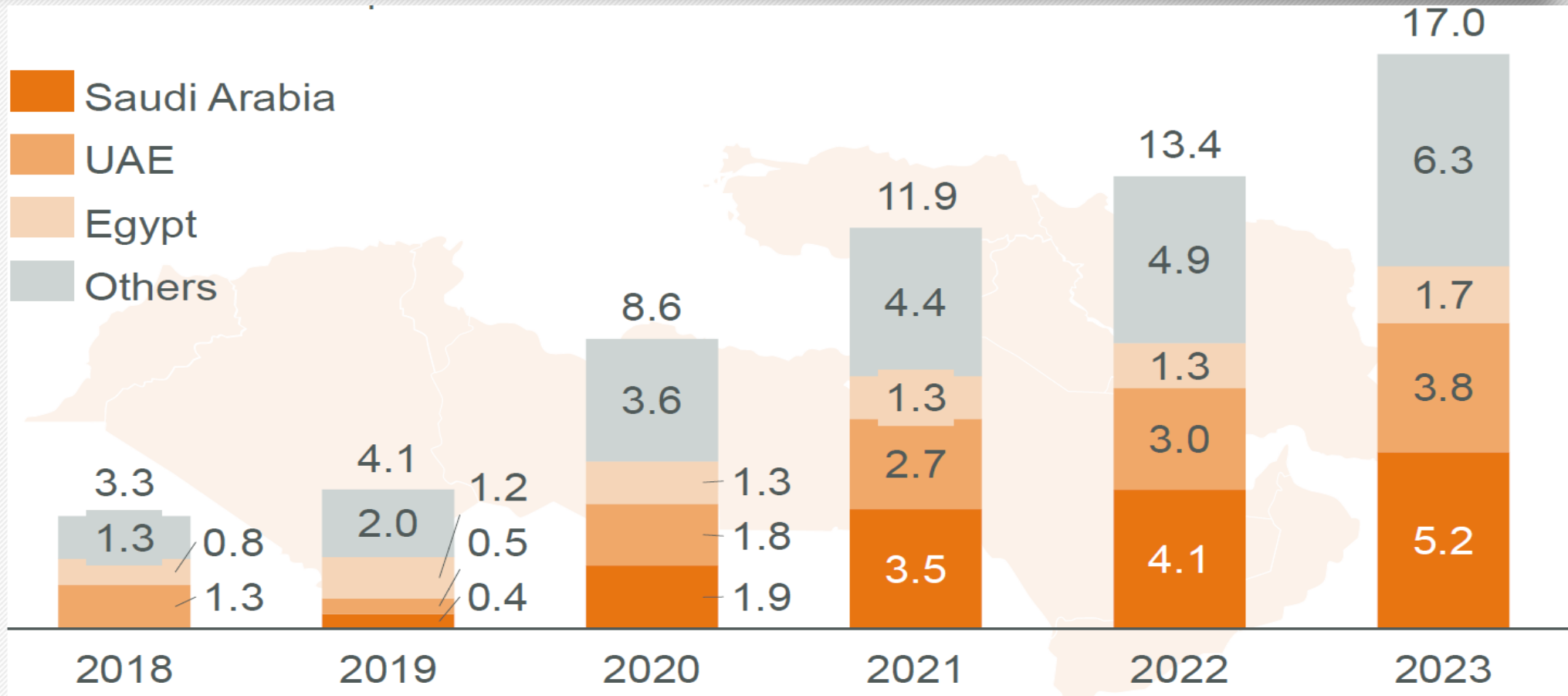


MENA wind annual demand [GW]



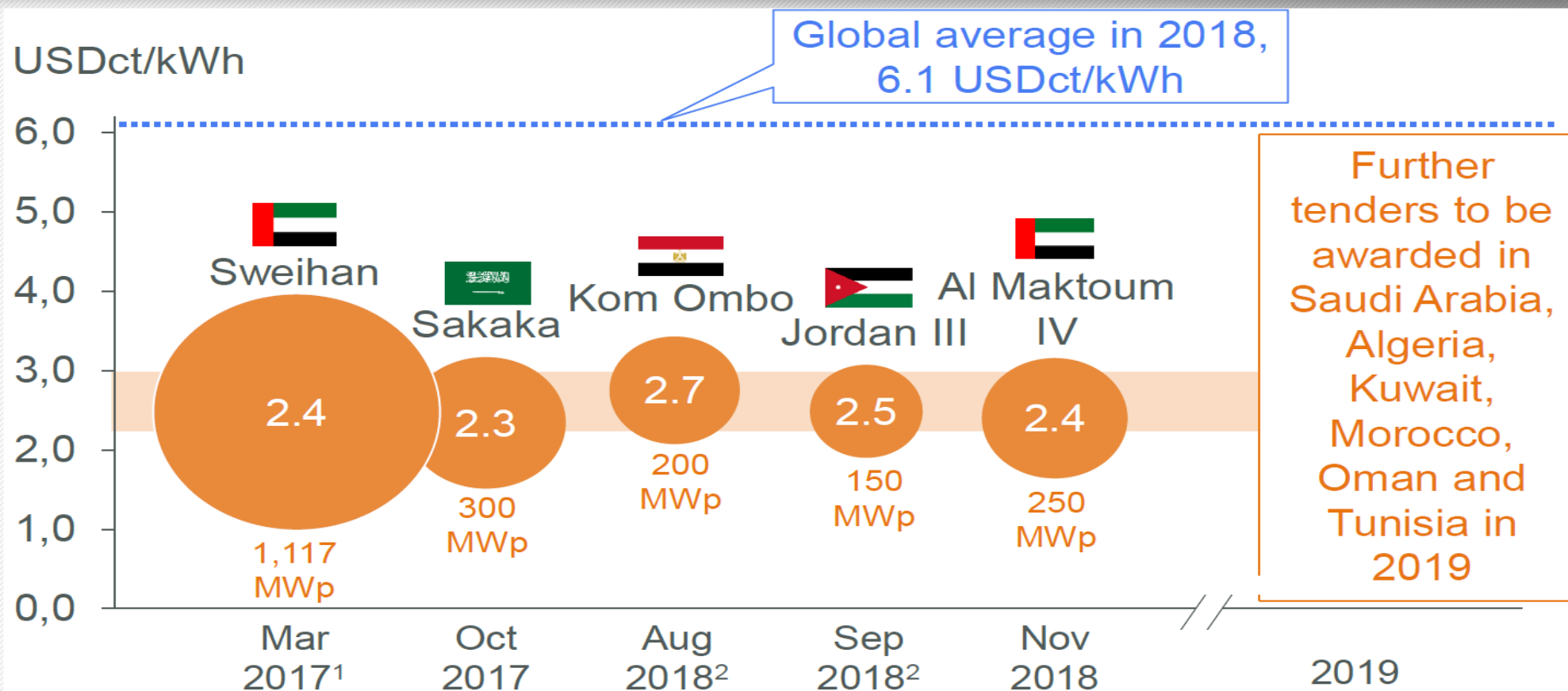
Total (2018–  
2022):  
**11.2 GW**

# MENA - Key markets will make up a share of >60% in 2023





# MENA - Recent tenders have attracted record-low bids



Source: IEA, Apricum analysis; 1) Date of PPA signature shown; 2) Lowest submitted bid price

# Saudi Arabia - Vision 2030 sets renewable energy targets



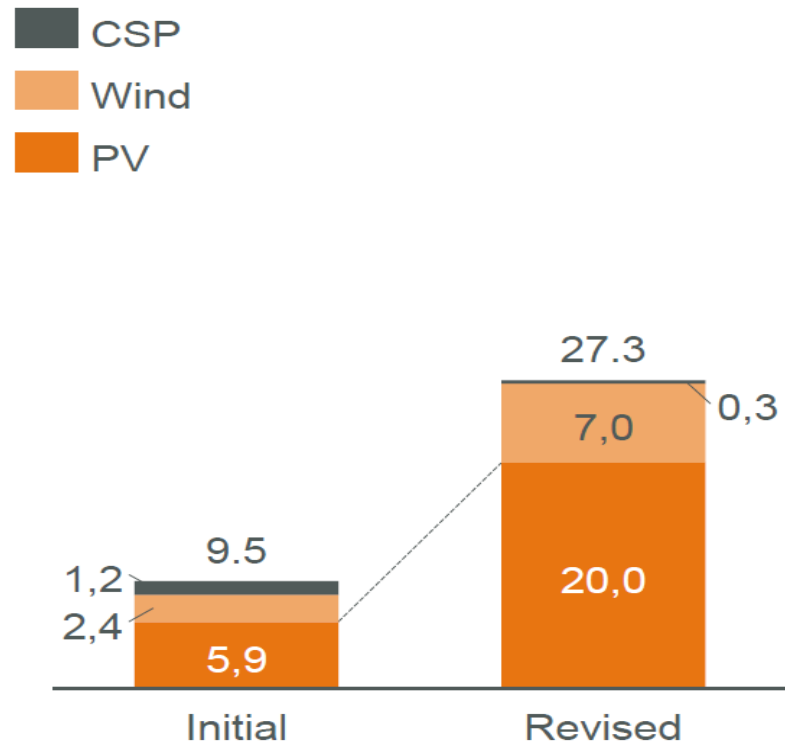
- 1 Meet the growing demand for electricity
- 2 Reduce fossil fuel consumption in electricity generation
- 3 Contribute to peak load demand
- 4 Reduce air pollution and improve public health
- 5 Maximize local content to spur local employment
- 6 Fair and transparent bidding process
- 7 Attract foreign and local private investment and participation in Saudi Arabia



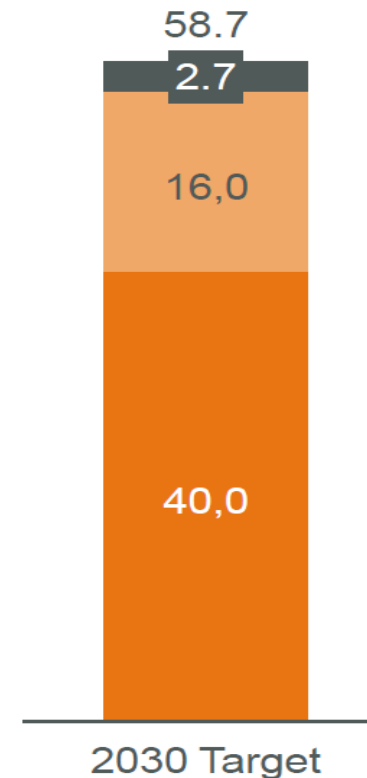
Goal is to develop a more diverse and sustainable economy through improved education and privatization of government services.

# Saudi Arabia - Natl.PV target 40 GW by 2030

5-year target – 2023



12-year target – 2030



Source: REPDO (2019)

# Saudi Arabia - Visibility on how to reach these renewable energy targets

Track	Development approach	Allocated projects	Objectives
Tendered by REPDO	<ul style="list-style-type: none"> <li>Competitive tender</li> <li>Increasing local content requirements</li> </ul>	30%	<ul style="list-style-type: none"> <li>Attract private investments</li> <li>Promote market innovation</li> <li>Enable price discovery</li> </ul>
Direct placement by PIF (Public Investment Fund)	<ul style="list-style-type: none"> <li>Negotiate deals with international partner for project development</li> <li>Captive offtake from large scale manufacturing</li> </ul>	70%	<ul style="list-style-type: none"> <li>Fast-track localization</li> <li>Target exports of RE equipment</li> <li>Develop Giga-scale projects</li> </ul>

Local content at the top of the agenda.

# Saudi Arabia - Vision 2030 features renewable energy



27.3 GW by 2023  
renewable energy  
target

Large PV market  
envisioned  
(>1 GW p.a.)

Fuel market  
liberalization and  
subsidy removal

Increasing cost  
competitiveness  
of PV locally

Localized  
manufacturing  
and job creation

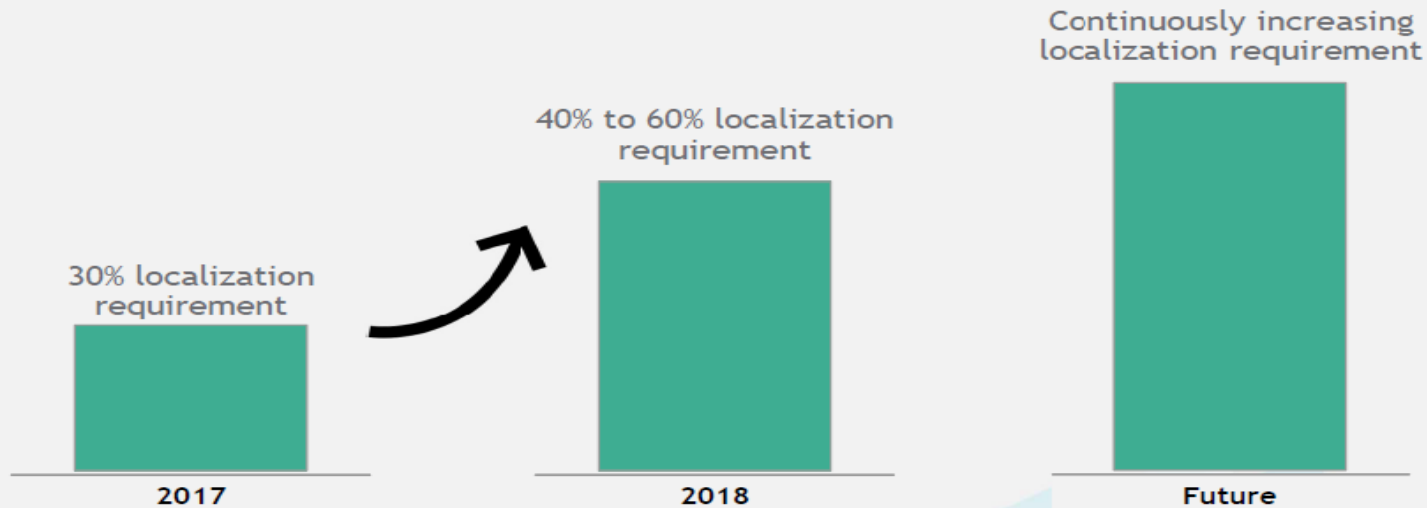
Local content  
regulation

# Saudi Arabia - Local Content Policy



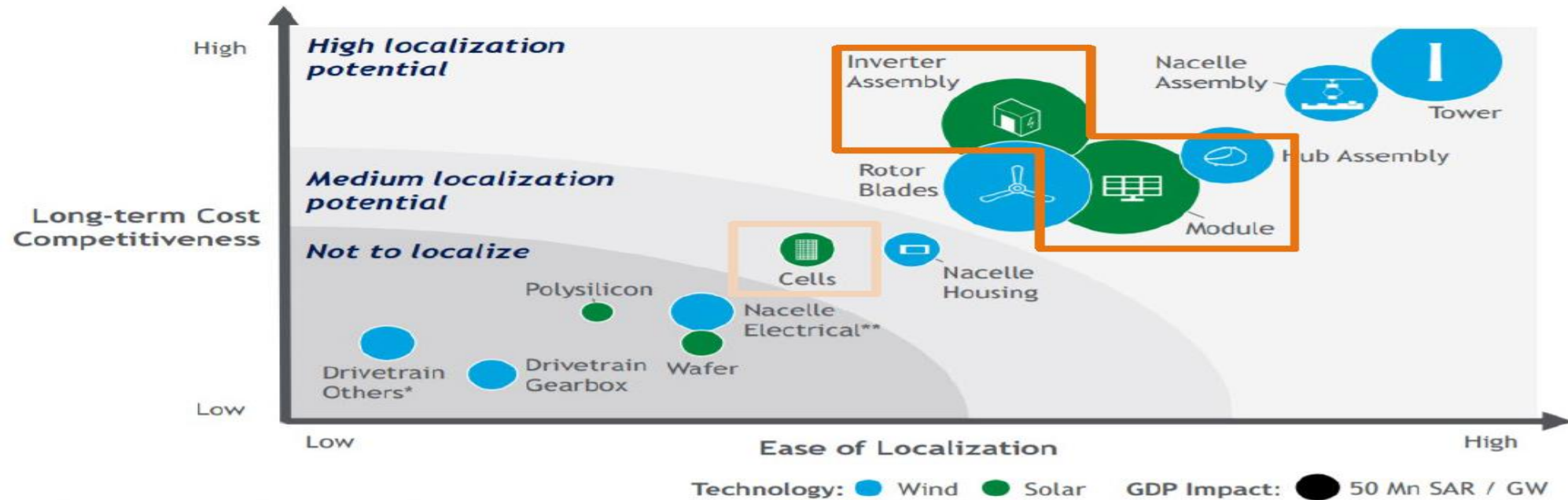
In addition, KSA set 30% localization requirement in 2017, aimed to increase to over 50% going forward

## Localization requirement targets



# Saudi Arabia - Local Content Policy (2)

An assessment of renewable energy components identifies 4 wind and 2 solar segments with high localization potential



Notes: \*) Rotor Bearings, Break System, and Main Shaft; \*\*) Power Converter, Transformers, and Fiber-optic Cables

# Saudi Arabia - Local REPDO's first PV tender has a 30% local content requirement, measured by NREP Saudization Compliance Metric

$$\text{NREP Saudization Compliance Metric (\%)} = \frac{\text{Localized Value}}{\text{Total project CAPEX}} \times 100$$

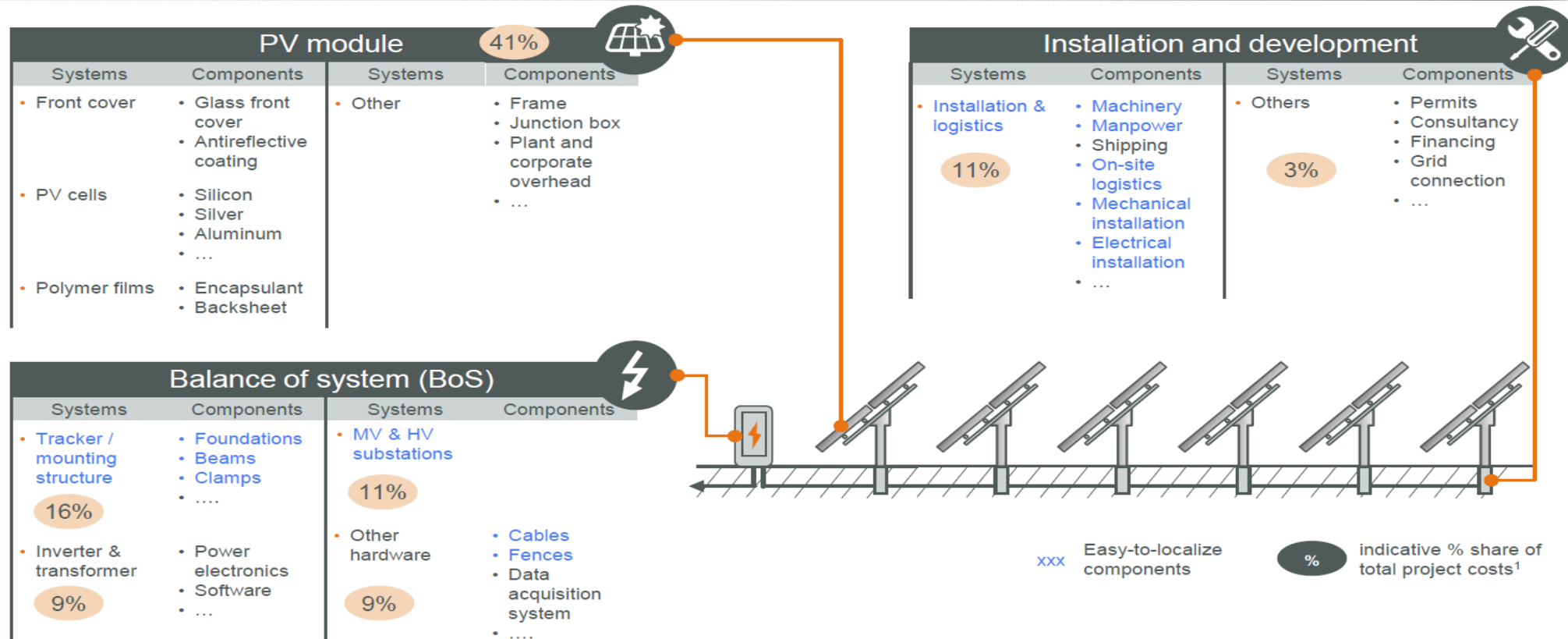
Targets and penalties for first tender round (Sakaka project):

- >30% local CAPEX: No penalty
- 20–30% local CAPEX: **Penalty of USD 1M** for each percentage point below 30%
- <20% local CAPEX: REPDO reserves right to exclude bidder

High penalty to deter non-compliance provides a great opportunity for Chinese players to capture the value in the market.

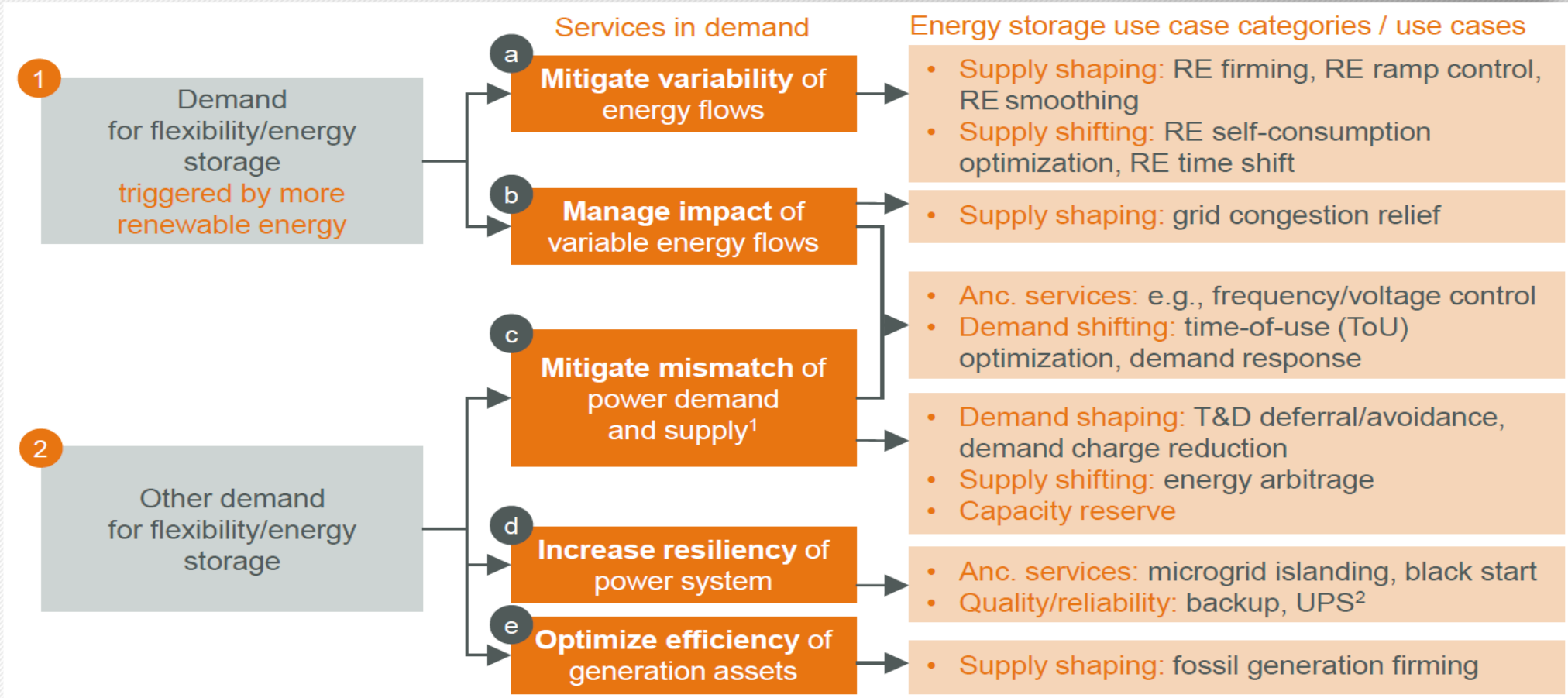


# Saudi Arabia - Local Locally produced modules will likely be key to realize local content targets in excess of 50%

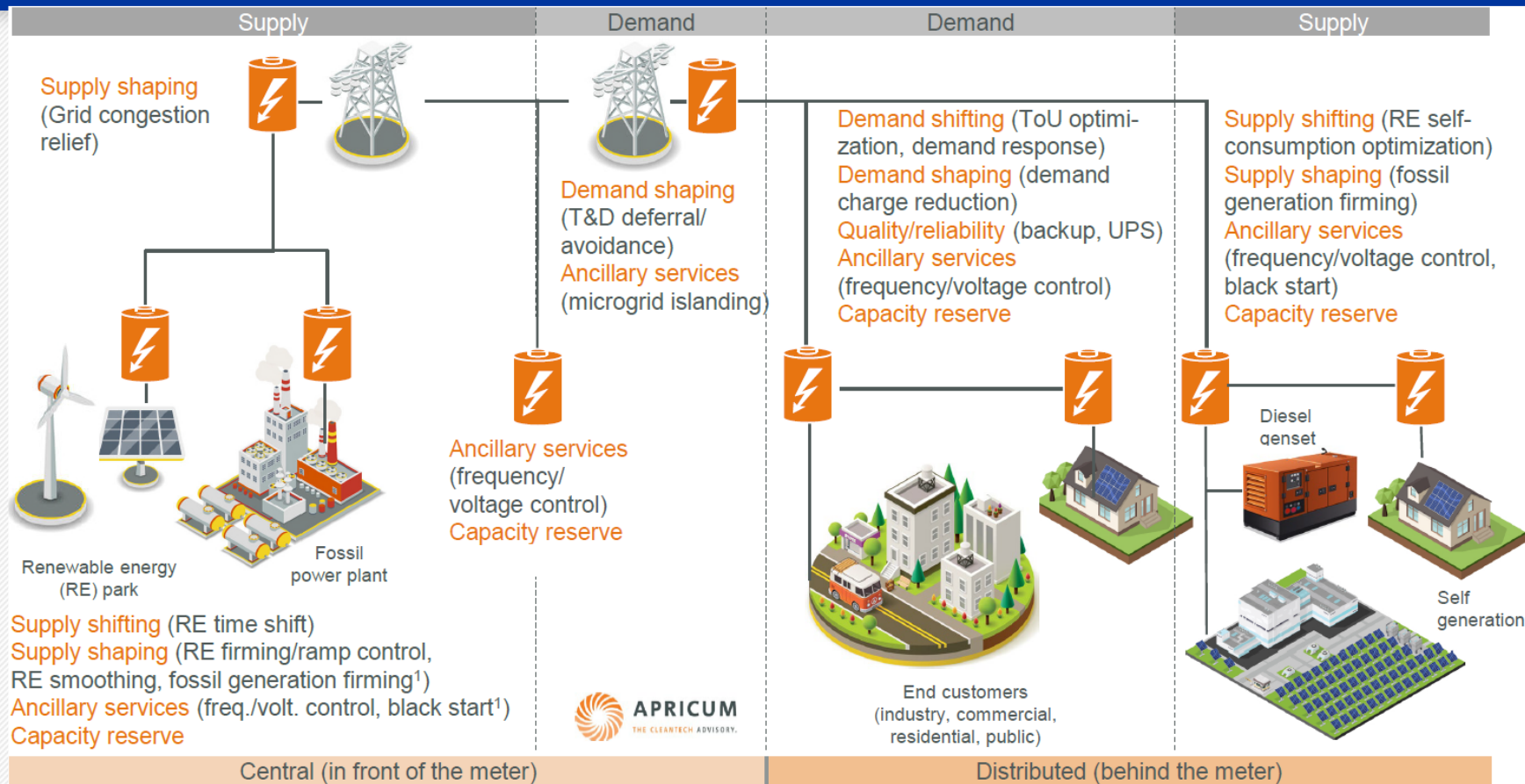


~30% of local content can be achieved with components such as mounting structures, cables, fences, manpower, etc., if substations, inverters and transformers can be procured locally, this share increases to ~50%.

# MENA - The Role of Storage



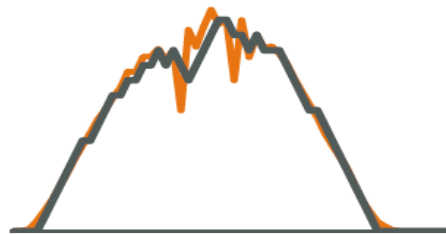
# MENA - The Role of Storage



1) Use cases co-located with fossil generation

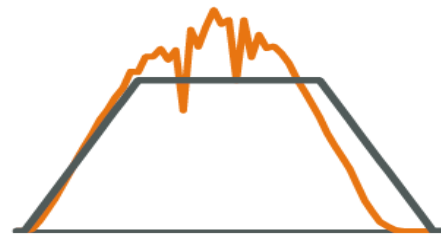
# MENA - The Role of Storage

Short-term storage up to  
a few minutes



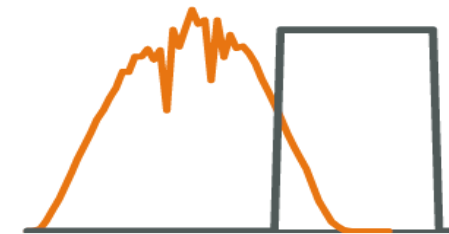
- RE ramp control
- RE smoothing
- Ancillary services

Mid-term storage up to  
1–4 hours



- RE firming
- Grid congestion relief
- RE self-consumption optimization
- ToU optimization
- Demand response

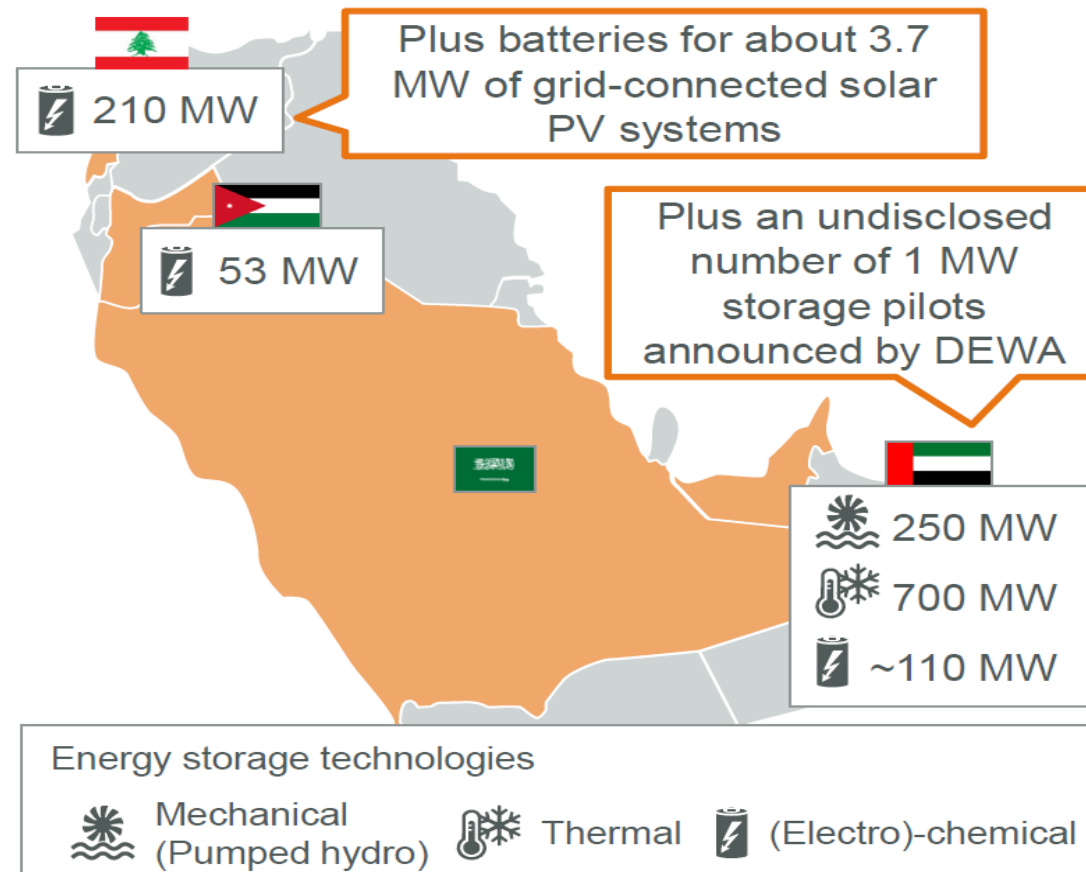
Long-term storage up  
to 5–6 hours



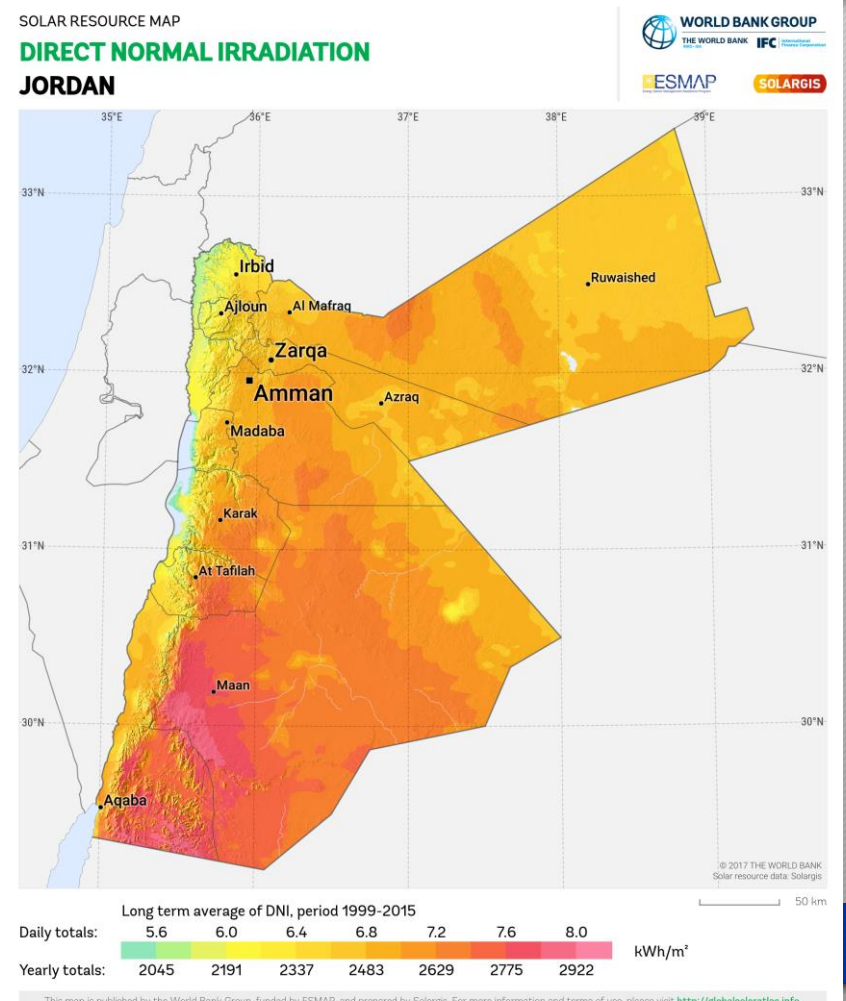
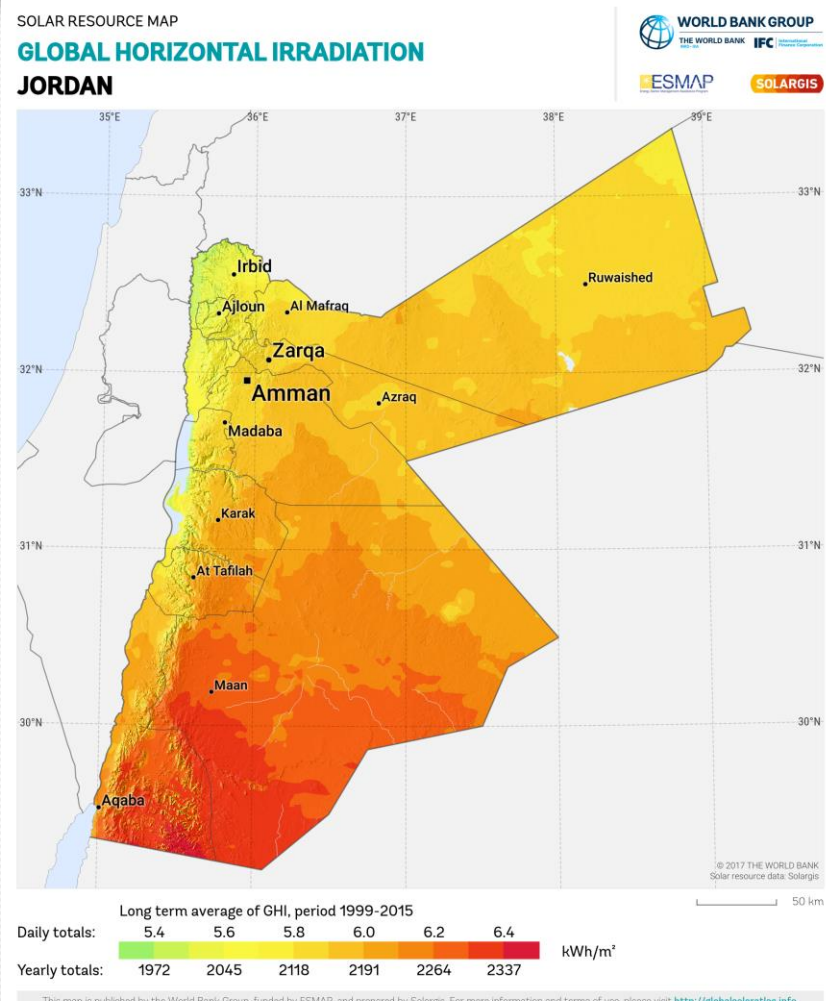
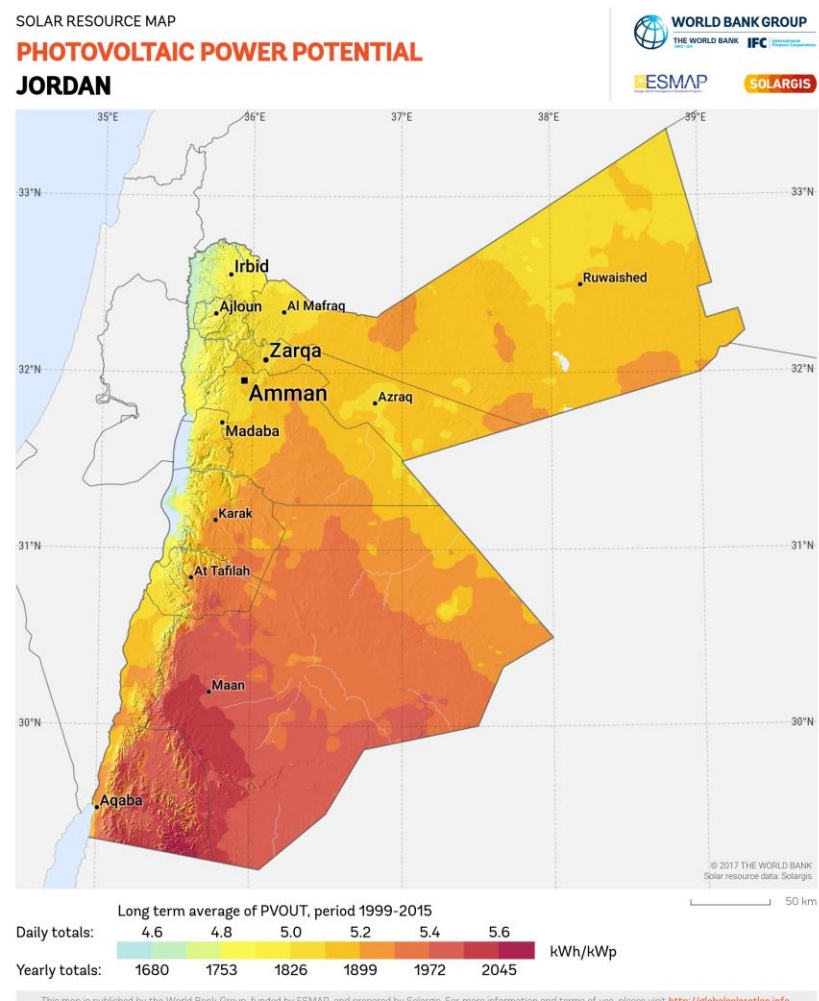
- RE time shift

# MENA - The Role of Storage

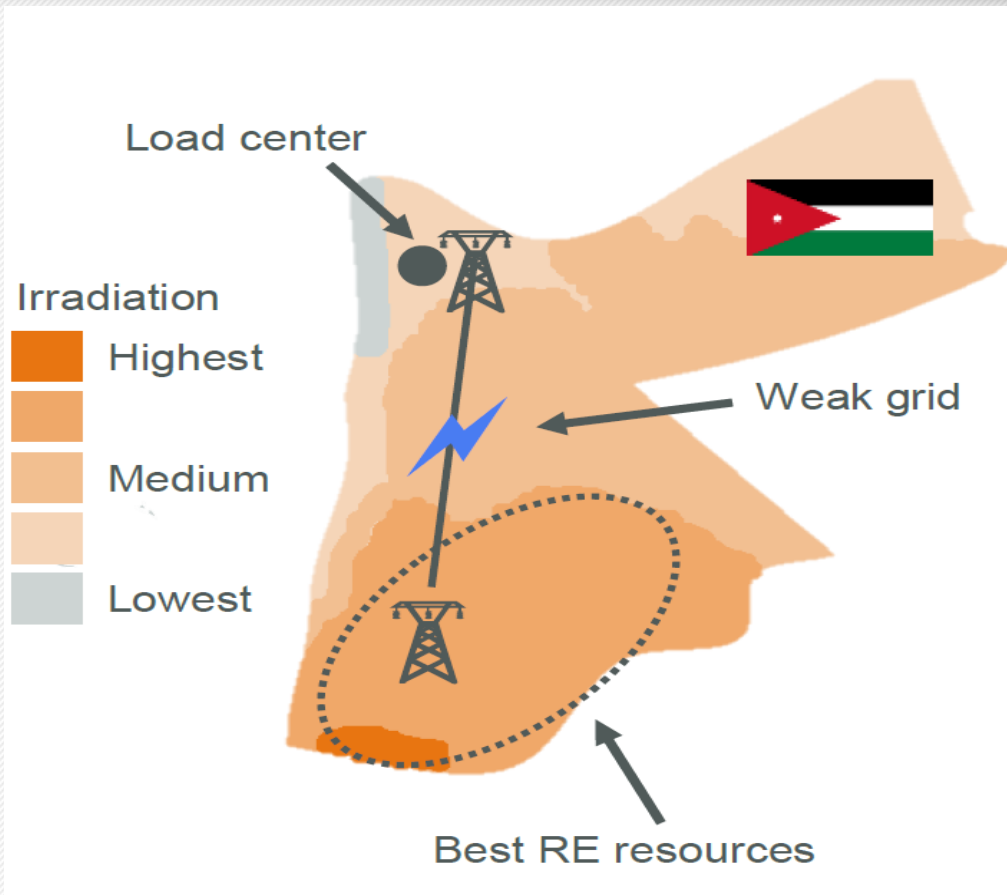
- **Lebanon:** 210 MW of storage capacity announced in tender for 3 solar PV plants in 2019
- **Jordan:** Two larger storage projects with capacities of 23 MW (operational) and 30 MW (in tender process)
- **UAE:** While pumped hydro and CSP are the dominating energy storage technologies, a large (108 MW) distributed battery project has been completed recently
- **Saudi Arabia:** No larger-scale stationary storage projects yet



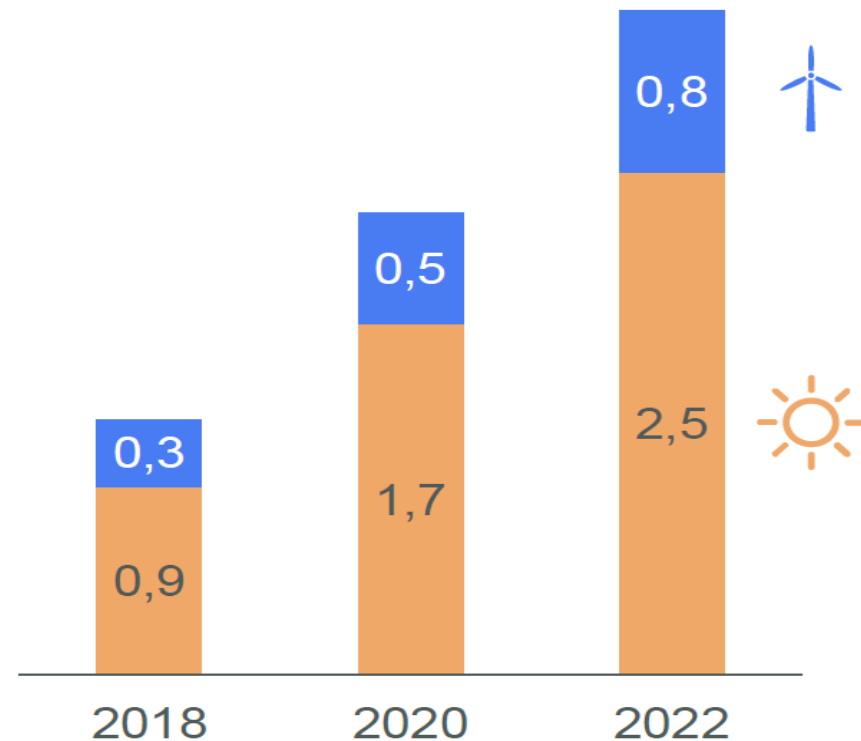
# MENA - Jordan - Solar Resource Maps



# MENA - Jordan - The Role of Storage



Cumulative RE capacity [GW]



# MENA - Jordan - The Role of Storage



- Irbid: IRFP for 30 MW/60 MWh stand-alone battery
- **Capacity Lease Agreement for 15 years** (capacity payment + variable payment)
- Ramp rate control, grid congestion relief, backup power, frequency response and others
- 23 groups prequalified, 10 bids submitted by January 20, 2019, e.g.,

**ACWA POWER**  
**TESLA**

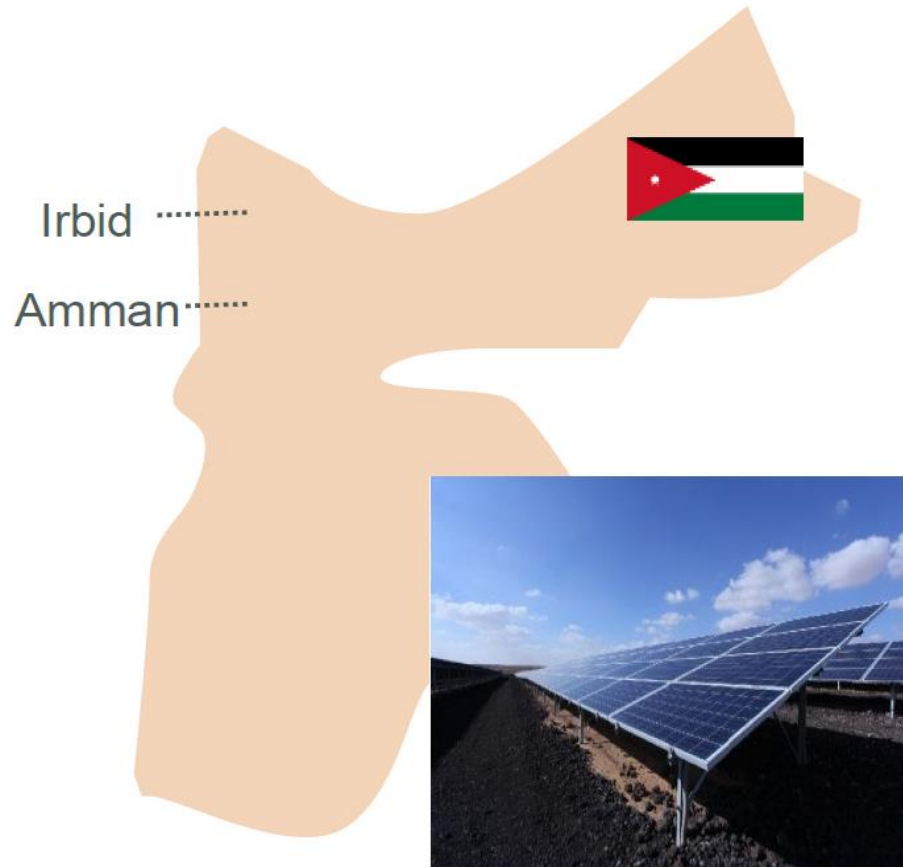
**Jinko** Solar  
WÄRTSILÄ

**NEOEN**  
**TESLA**

Source: MEMR

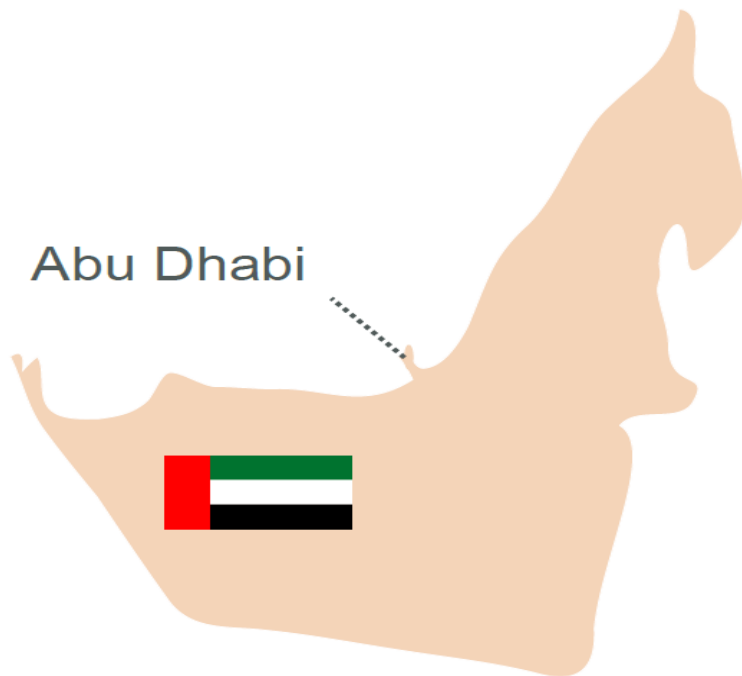


# MENA - Jordan - The Role of Storage

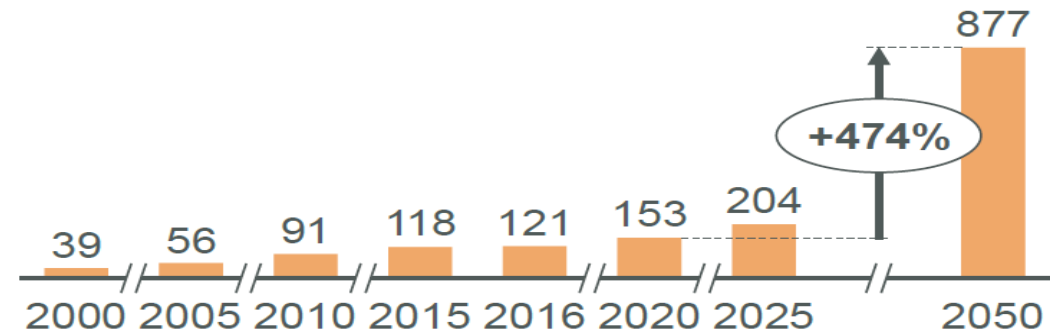


- Also in Irbid: COD for 23 MW/12.3 MWh Li-ion battery next to 23 MW PV plant in February 2019
- PV manufacturer and EPC Philadelphia Solar signed **PPA for 20 years** with Irbid District Electricity Company
- RE smoothing, RE firming

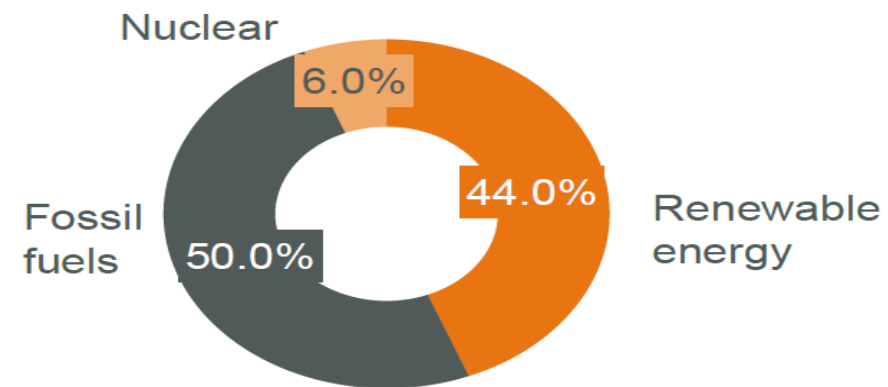
# MENA - United Arab Emirates - The Role of Storage



UAE electricity consumption [TWh]



UAE energy mix target for 2050



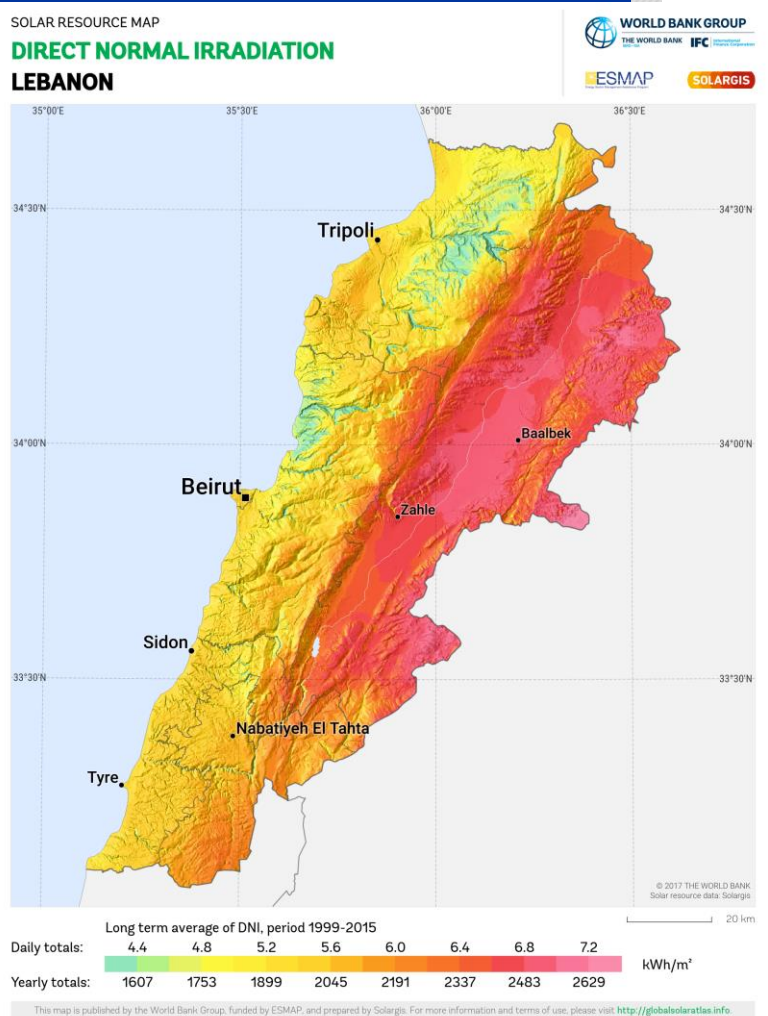
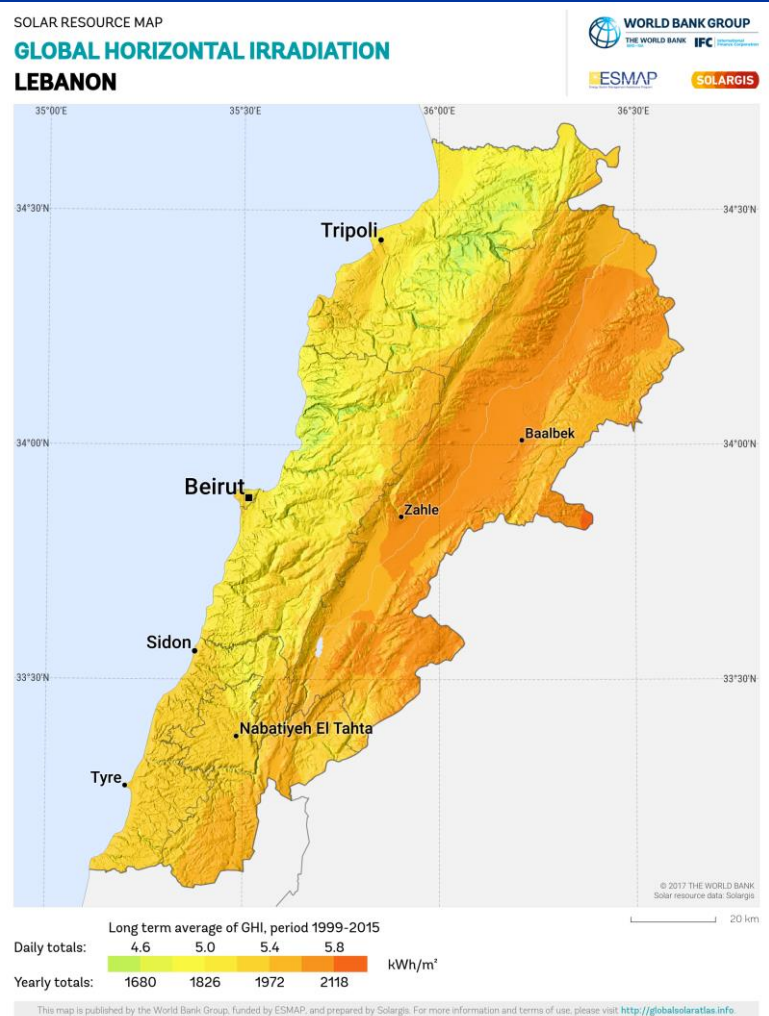
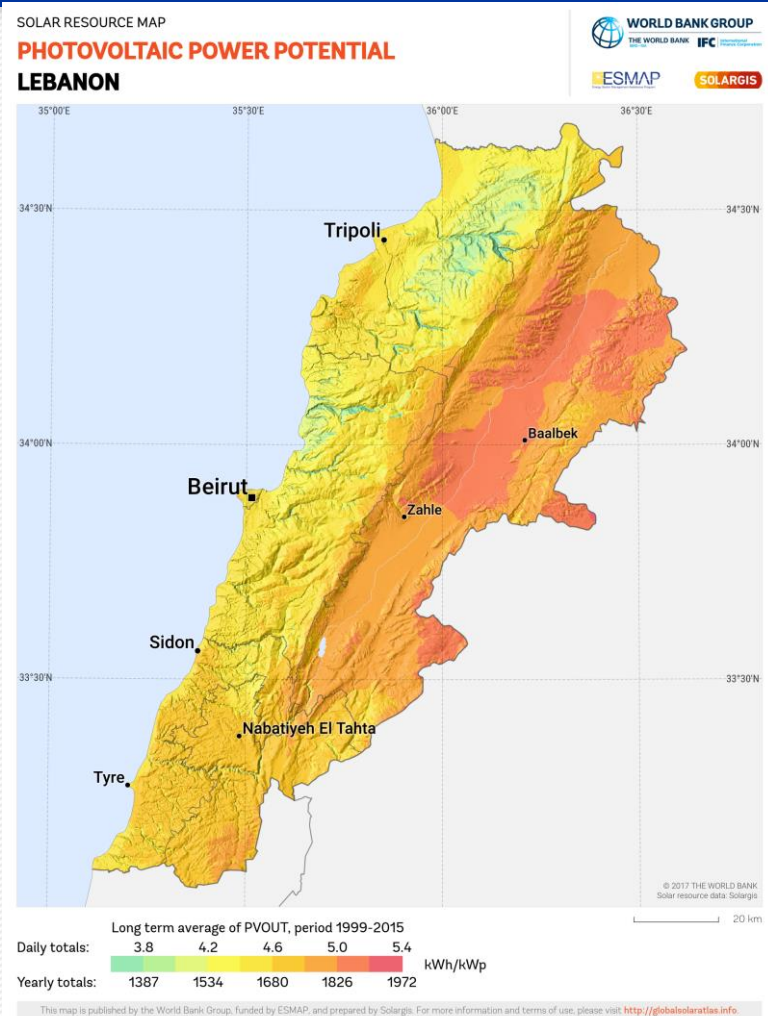
# MENA - United Arab Emirates - The Role of Storage

Abu Dhabi



- Deployed across 10 locations in Abu Dhabi, 15 systems in total (“**virtual battery**”), CISC<sup>1</sup> located in Mussafah, operated by TSO
- **108 MW / 648 MWh in total** (12 x 4MW, 3 x 20 MW)
- Sodium sulfur batteries, provided by NGK Insulators
- Load shifting, frequency response, thermal generation investment deferral and others

# MENA - Lebanon - Solar Resource Maps



# MENA - Lebanon - The Role of Storage

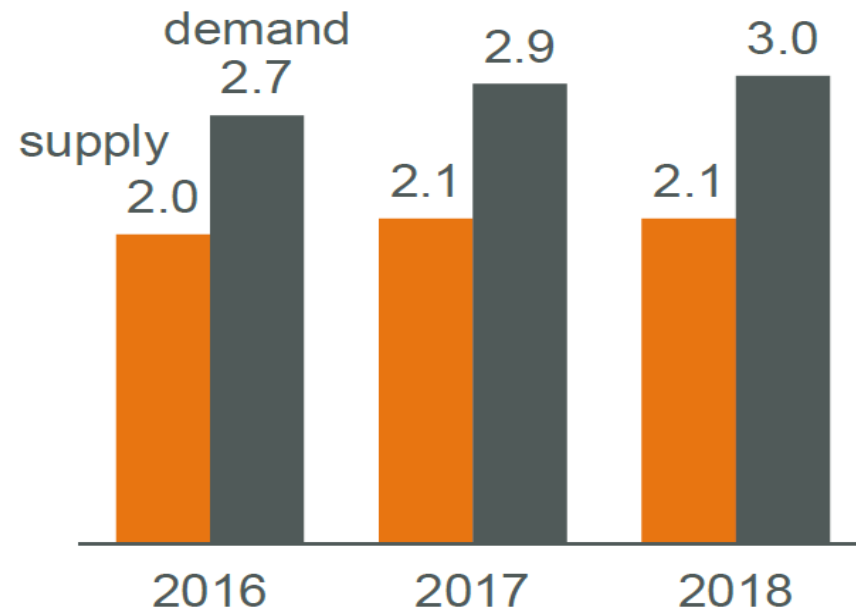
## Key challenges of Lebanese electricity sector:

- Old power plants (majority 25–45 years), inadequate fuel and high T&D losses leading to **supply shortage** of in total ~1 GW
- Highly subsidized state-owned utility EDL

## Effects on electricity supply:

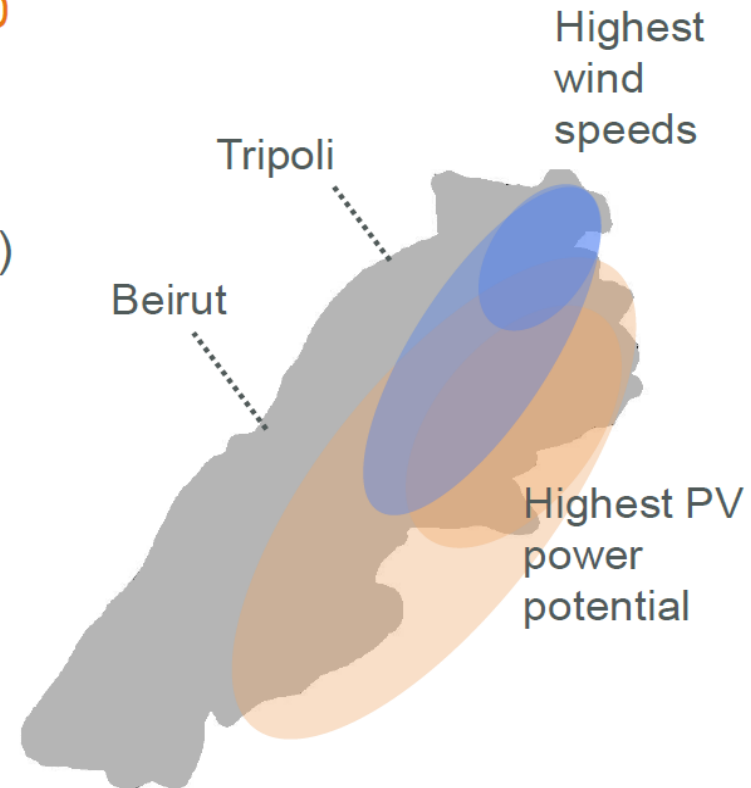
- High dependency on **electricity import**
- Substantial share of private generation via **diesel gensets** <500 kVA, typically running ~3–6 hr per day

## Lebanon power generation & demand [GW]







# MENA - Lebanon - The Role of Storage

- Overall, Lebanon aims to source 12% of its electricity and heat from renewables by 2020, and 30% by 2030
- In 2017, decentralized solar PV capacity of 35 MW installed, target 100 MWp by 2020
- Wind PPAs for 180 MW signed in 2018 (COD 2020)
- Shortlisted bidders for 12 solar farms with a total capacity of 180 MW announced in March 2019
- Large scale tenders announced: 3 x 100 MW solar PV, each with **at least 70 MWh of storage capacity**
- Further potential for energy storage from **distributed fossil generation firming**



# MENA - Saudi Arabia - The Role of Storage

	Nationwide deployment program		Other potential sources	
Source	REPDO program	SoftBank/PIF plan	NEOM City	Corporates
	 وزارة الطاقة والصناعة والثروة المعدنية المملكة العربية السعودية	 صندوق الاستثمارات العامة Public Investment Fund	 نيوم NEOM	 نادك nadec ارامكو السعودية Saudi Aramco other corporates
Description	Tendering of RE projects under IPP framework to realize 9.5 GW Vision 2030 deployment target	Tendering of EPC contracts for solar energy projects developed by PIF/SoftBank JV	100% local renewable energy supply, further details on procurement program to be published (see next slides)	Procurement of renewable energy by different corporate entities, e.g., via PPAs (see next slides)
Apricum assessment	Program expected to proceed as planned, with sizeable future tenders, though with some delay to original timeline	Project realization expected to occur in parallel to REPDO program under aligned, long-term vision	RE projects with exclusive focus on NEOM power supply, expected to be integrated in RE procurement by REPDO or PIF	RE procurement by individual corporations, independently of formal RE programs, likely at small scale given limited economic viability

# MENA - Saudi Arabia - The Role of Storage



Solar street lights



Off-grid / On-grid  
telco towers



Off-grid  
construction sites



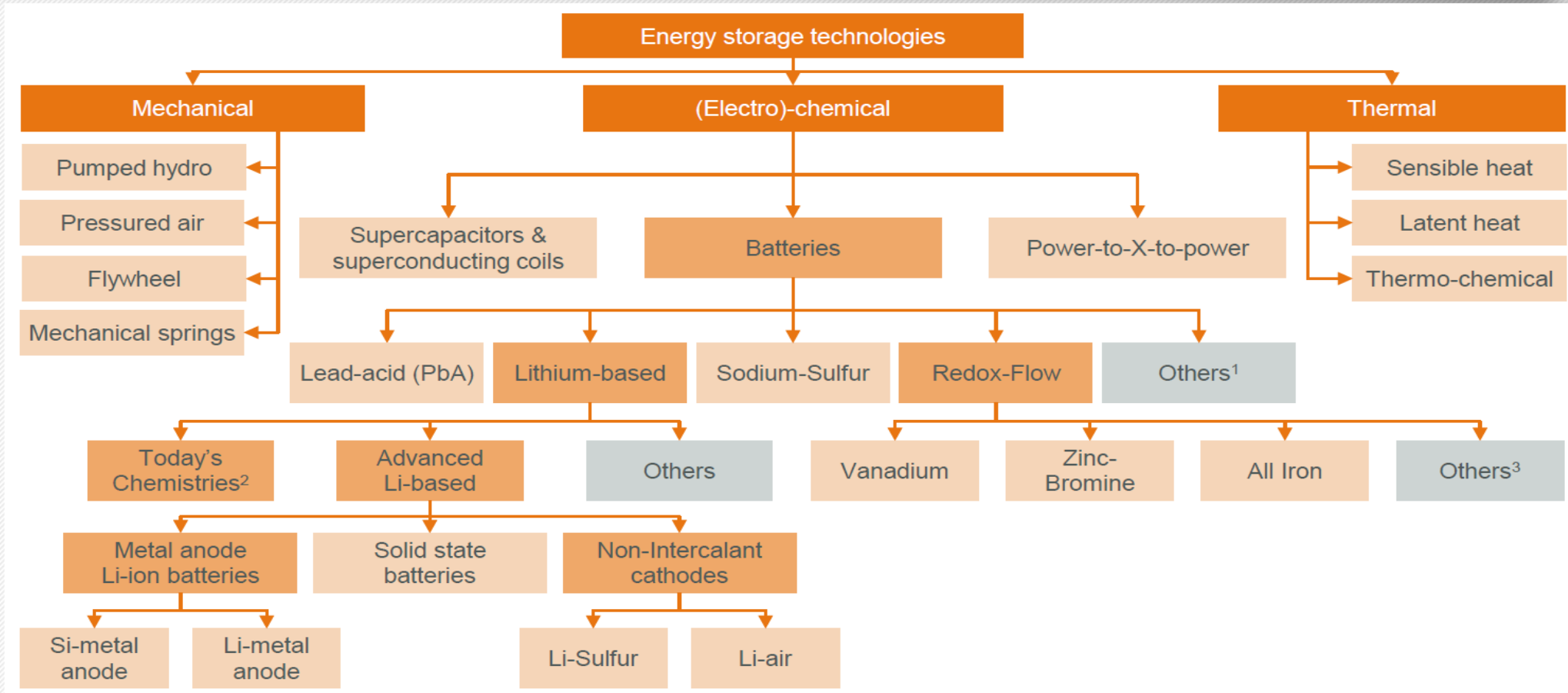
Off-grid irrigation



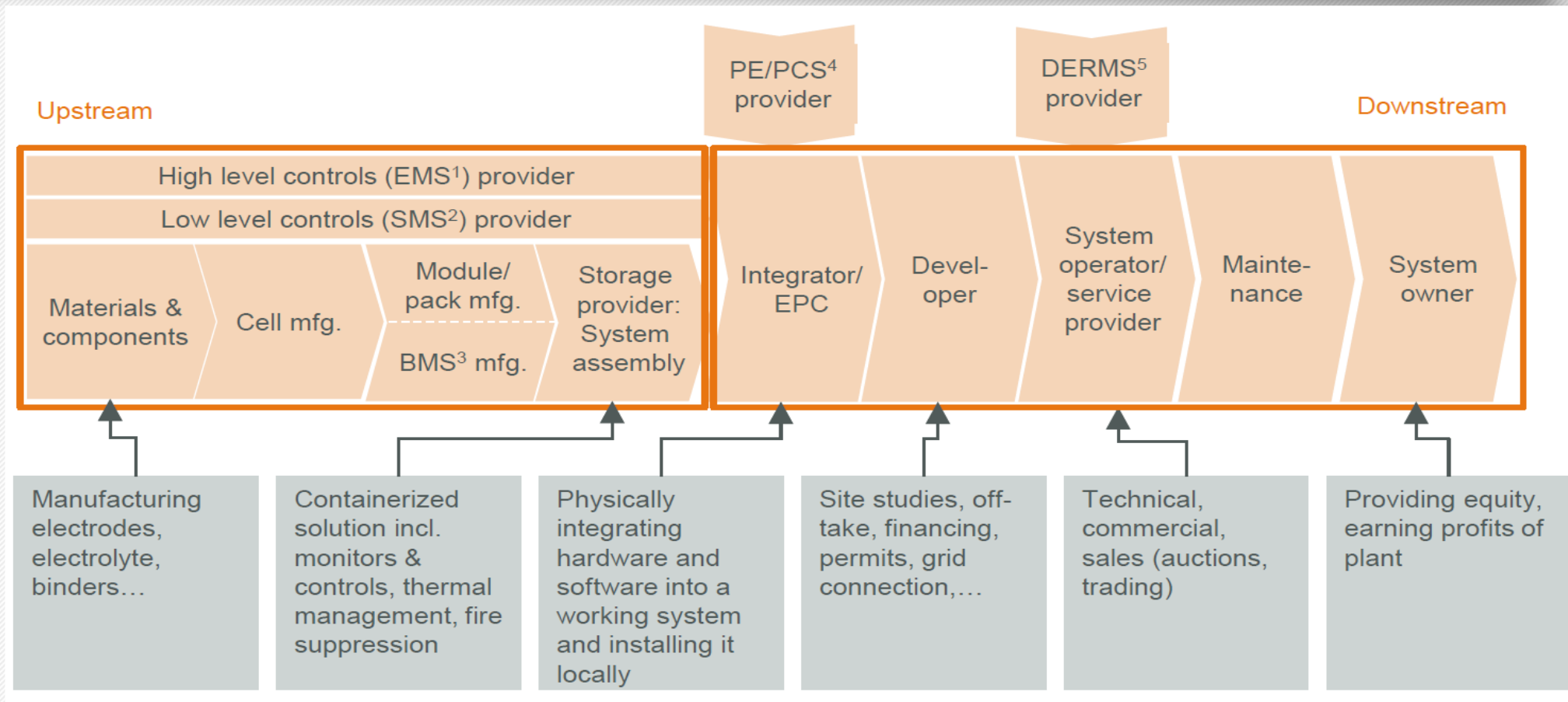
Short-term opportunities exist in KSA to test partnerships and build track record in preparation for expected energy storage boom from large scale renewable energy projects



# MENA - Overview Storage Technologies



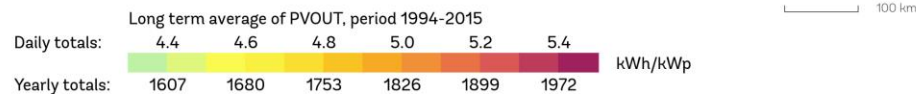
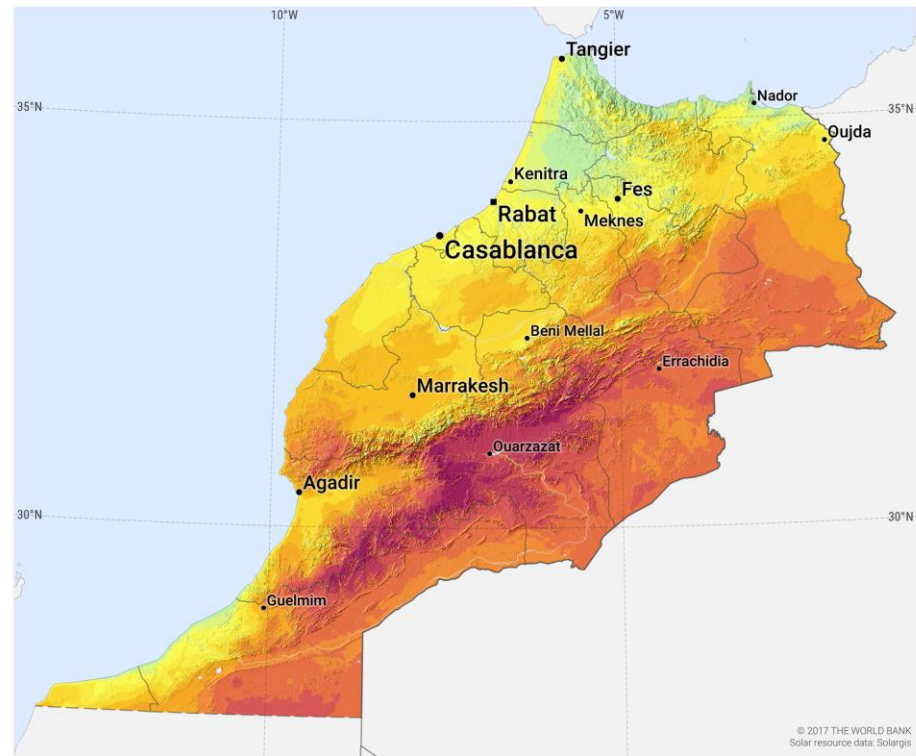
# MENA - Overview Storage Technologies



# MENA - Morocco - Solar Resource Maps

SOLAR RESOURCE MAP

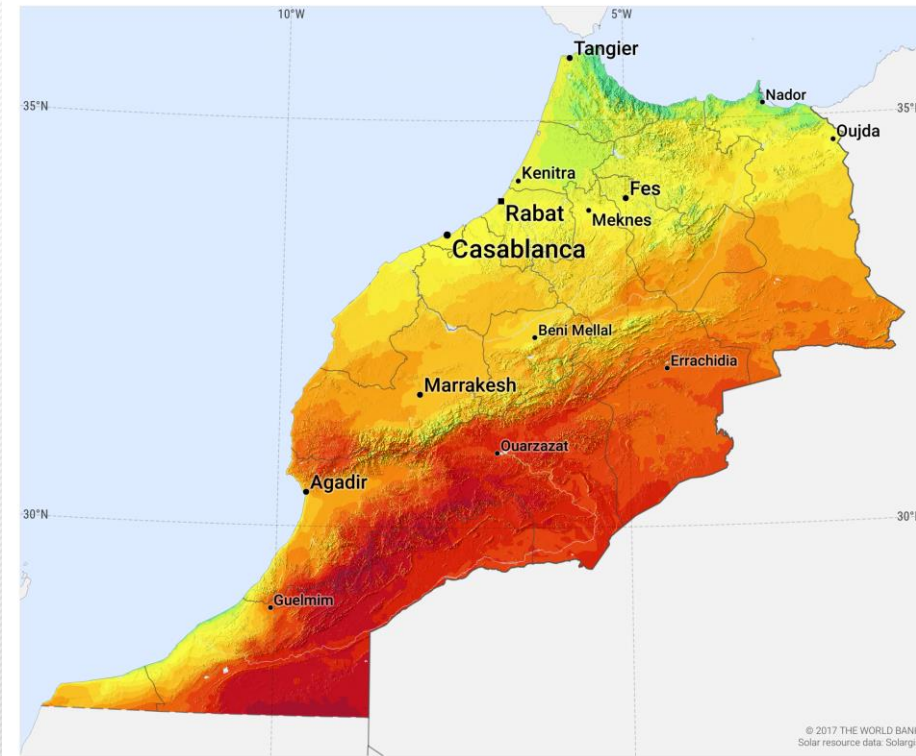
## PHOTOVOLTAIC POWER POTENTIAL MOROCCO



This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit: <http://globalsolaratlas.info>.

SOLAR RESOURCE MAP

## GLOBAL HORIZONTAL IRRADIATION MOROCCO



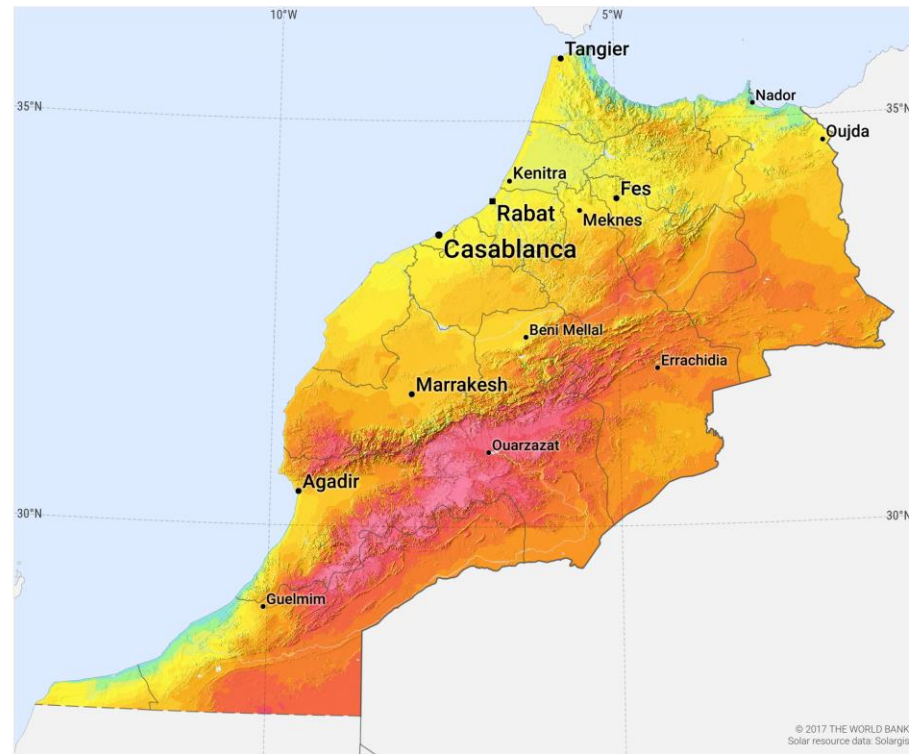
This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit: <http://globalsolaratlas.info>.

# MENA - Morocco - Solar Resource Maps

SOLAR RESOURCE MAP

**DIRECT NORMAL IRRADIATION**

**MOROCCO**



Long term average of DNI, period 1994-2015

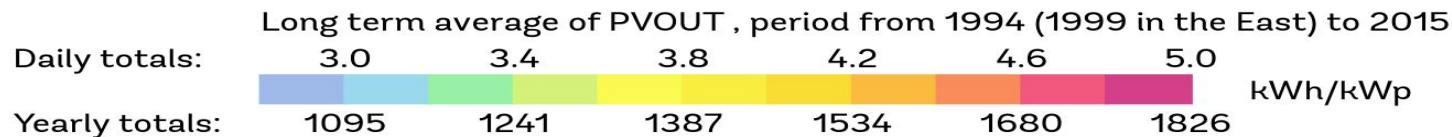


This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

# MENA - Turkey - Solar Resource Maps

SOLAR RESOURCE MAP

## PHOTOVOLTAIC POWER POTENTIAL TURKEY



© 2017 THE WORLD BANK  
Solar resource data: Solargis

200 km

This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

# MENA - Turkey - Solar Resource Maps

SOLAR RESOURCE MAP

## GLOBAL HORIZONTAL IRRADIATION TURKEY



Long term average of GHI , period from 1994 (1999 in the East) to 2015



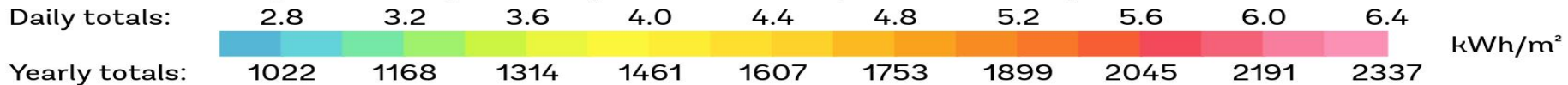
# MENA - Turkey - Solar Resource Maps

SOLAR RESOURCE MAP

## DIRECT NORMAL IRRADIATION TURKEY



Long term average of DNI , period from 1994 (1999 in the East) to 2015



This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

# Apricum Cleantech Advisory Group

<https://www.apricum-group.com>

Contact : [info@apricum-group.com](mailto:info@apricum-group.com)



- We are a globally active transaction advisory and strategy consulting firm dedicated to the cleantech industry. Established in 2008, we serve our clients as their independent advisor to help them succeed in the fields of solar & wind, water, waste, energy storage, green mobility and digital energy. We offer a wide range of growth-oriented services to investors and companies both public and private, including mergers and acquisition, fund raising, project finance, strategy development, business model design and technology roadmaps.
- Our team of more than 40 senior experts combines profound market and technology expertise.
- We've completed over 200 cross-border consulting and transaction projects with the highest levels of client satisfaction.
- We are headquartered in Berlin and serve clients around the world. We have representatives in the UK, Turkey, Saudi Arabia, UAE, India, China, South Korea, Japan, Thailand, the Philippines, Vietnam, Indonesia and the USA. Through our widespread global presence, we offer valuable local market insights and access to potential business partners.



# Courtesy



- Market data have been collected and analysed by members of the PV Market Alliance.
- Special thanks to Apricum Cleantech Advisory Group
- More information: [Frank.Haugwitz@aecea.com.de](mailto:Frank.Haugwitz@aecea.com.de)
- [info@pvmarketalliance.com](mailto:info@pvmarketalliance.com) // [www.pvmarketalliance.com](http://www.pvmarketalliance.com)

## The PV Market Alliance

