

Economic and Social Development in MENA from Renewable Energy

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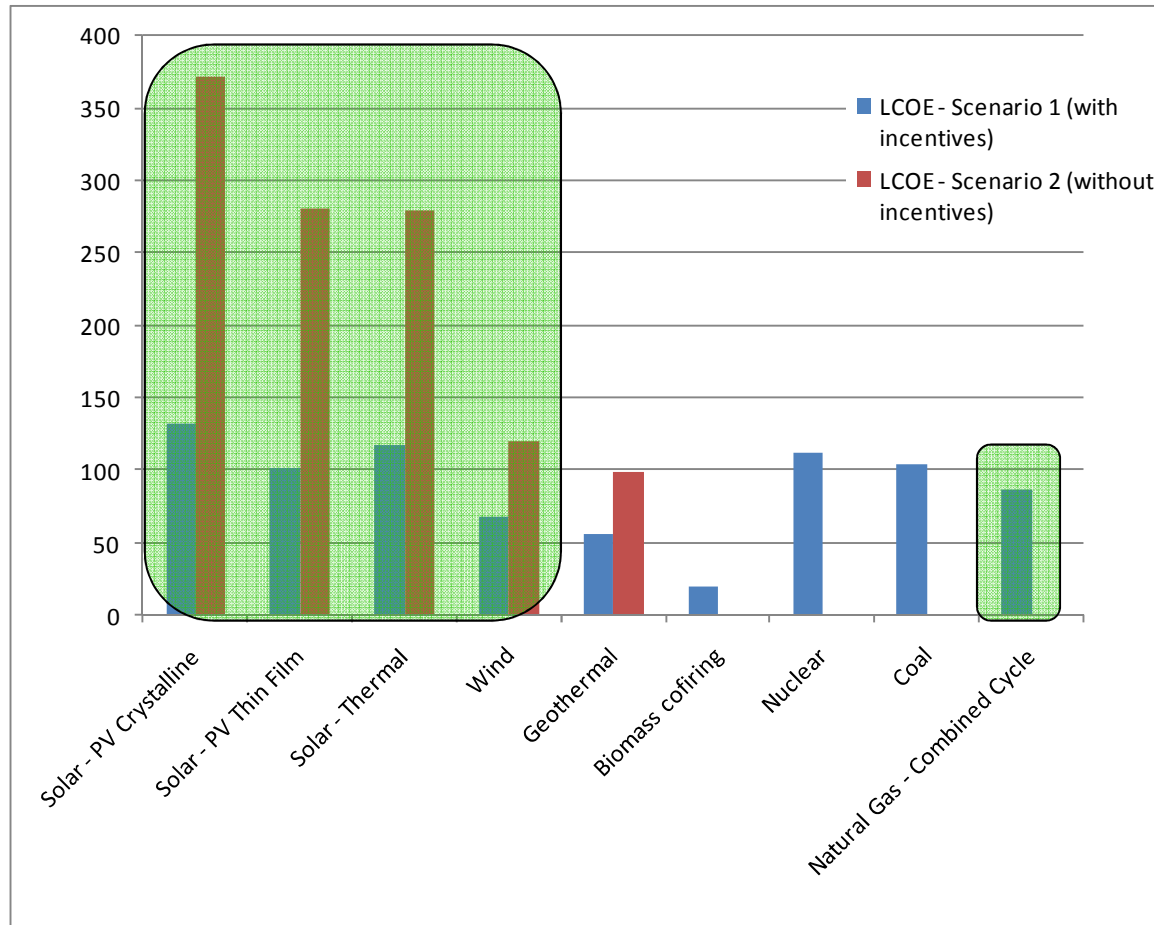


AGENDA

- Drivers for Clean Technology
- Regional Initiatives
- Solar Energy in the Middle East

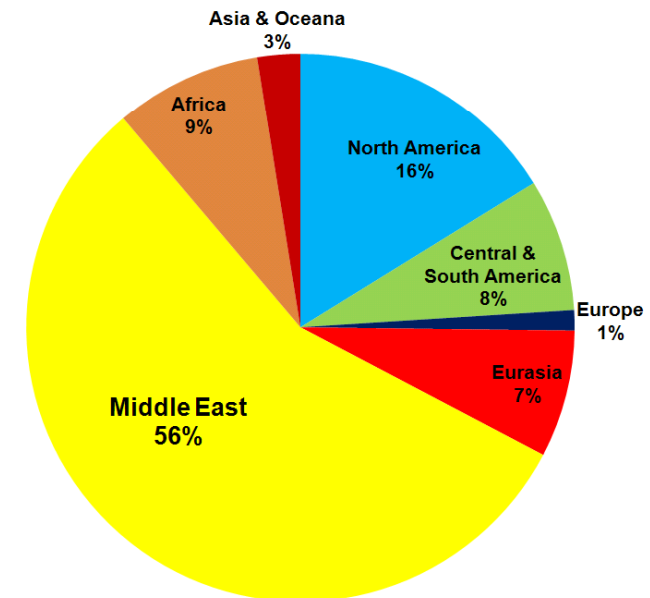


WHY RENEWABLE ENERGY?



Source: Levelised Cost of Energy Analysis v2.0, Lazard 2008

World Oil Reserves by Region



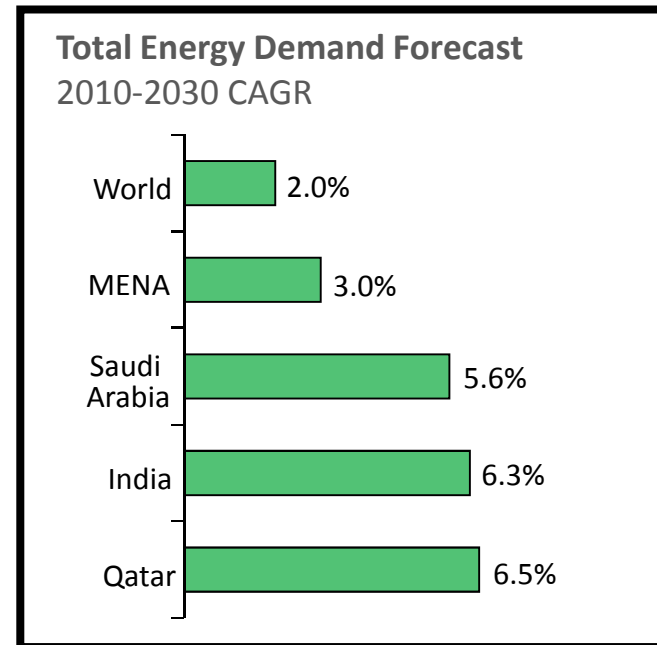
Data source: US Energy Information Administration from Oil and Gas Journal (2007)
Oil includes crude oil and condensate

The cost of electricity produced by non fossil fuel is significantly greater than that produced by burning fossil fuels



WATER & ELECTRICITY DEMAND IN MIDDLE EAST

	2008	2015	Growth
Electricity demand	672 TWh	1,010 TWh	50%
Water consumption	277 km ³ per year	390 km ³ per year	40%
Population	199 million	230 million	15%



- MENA's energy consumption in the recent years has grown faster than that of any other region in the world, due to expansion of energy-intensive industries and population growth.
- Saudi Arabia is using 15% of its oil output currently for producing electricity and for desalinization, and in 10 years, it will have to be using 20%.

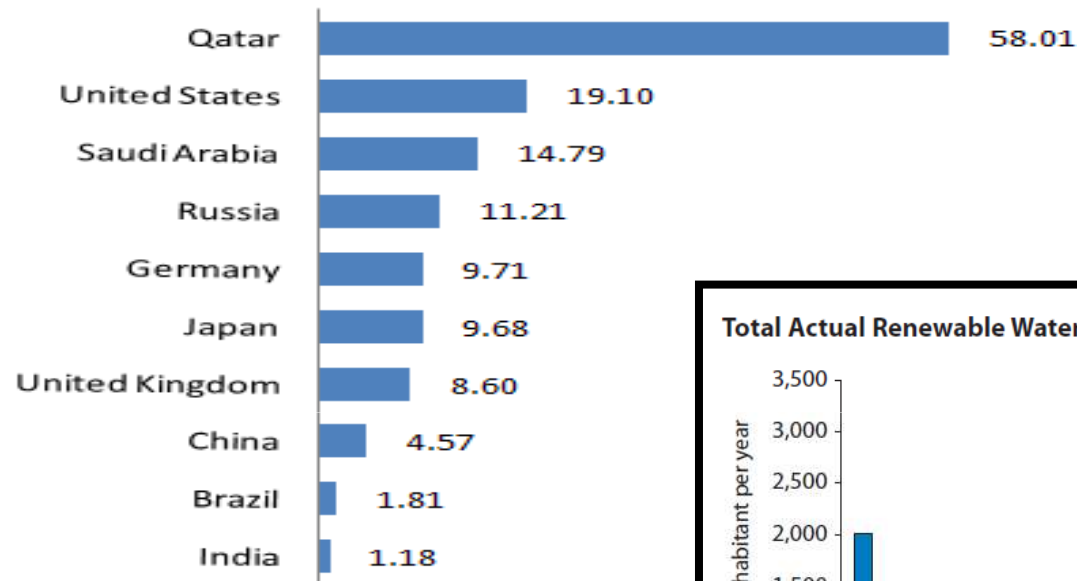
Source: MEED, IEA, AQUASTAT, UNESCO, GG Research

**Population and economic growth will drive a continued increase
in power requirements and energy efficiency in the short term**

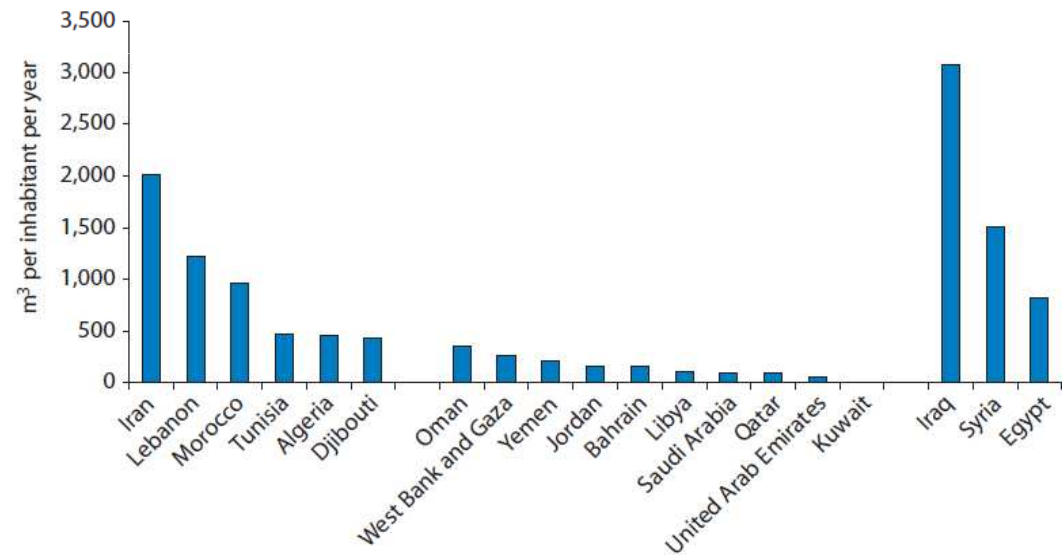


DRIVERS FOR CLEAN TECHNOLOGY

Emissions per Capita
(tonnes CO² / capita)



Total Actual Renewable Water Resources per Capita in MENA



Source: IEA, AQUASTAT

Fresh water sources in the Middle East and North Africa are scarce and water requirements are served through desalination facilities further compounding energy demands



Regional Clean Energy Initiatives

Saudi Arabia

- King Abdullah University of Science & Technology Solar Research
- Announced a 15% Renewable Energy target by 2020
- Saudi Aramco developing off-grid PV projects around the country
- Large scale solar desalination plants study and rollout
- Azmeel thin film manufacturing facility
- ACWA Power developing large scale clean energy platform internationally



Abu Dhabi

- Commitment to generate 7% from Renewables by 2020
- First large-scale PV power plant in the region (10MW)
- First utility-scale CSP power plant in the region (100MW): Shams 1 (Total /Abengoa)
- Introduction of Feed-in tariff scheme for rooftops in 2011
- MASDAR and TAQA investing heavily in clean energy technology and infrastructure globally

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Electricity demand	672 TWh	1,010 TWh	50%
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Oman

- Tender for a major solar power plant (up to 250 MW) with plans for further roll-out

Kuwait

- Plans to generate 5% of electricity demand from renewables by 2020
- Working to develop a 250MW combined gas and solar power plant



Bahrain

- Goal to begin utilizing solar and wind power for electricity in the next few years

**GCC countries are taking major steps towards developing clean technology to meet rising power demand
Saudi and Abu Dhabi companies investing in clean energy infrastructure globally**



TEST FACILITIES & PILOT PROJECTS

Evaluating PV and solar thermal products, both commercial and emerging, under Middle East climate conditions

Starting point for relationships with technology developers and manufacturers

Data supports investment cases for solar projects in the region



Test facilities and pilot projects are crucial in understanding and commercializing solar technologies in the unique GCC climate



ATTRACTIVENESS OF SOLAR IN MENA

Good match for energy usage profile

- High sunlight climates see peak energy requirement in middle of the day matching solar energy production

Scalable

- PV plants scalable from 1MW to 100MW

Limited supporting infrastructure required

- No fuel re-supply and limited maintenance requirements
- Highly attractive in underdeveloped areas
- Straight forward connection to grids

Predictable production

- Energy production only dependent on solar irradiation
- Data is available with annual solar variance < 5%
- Storage possible for CSP

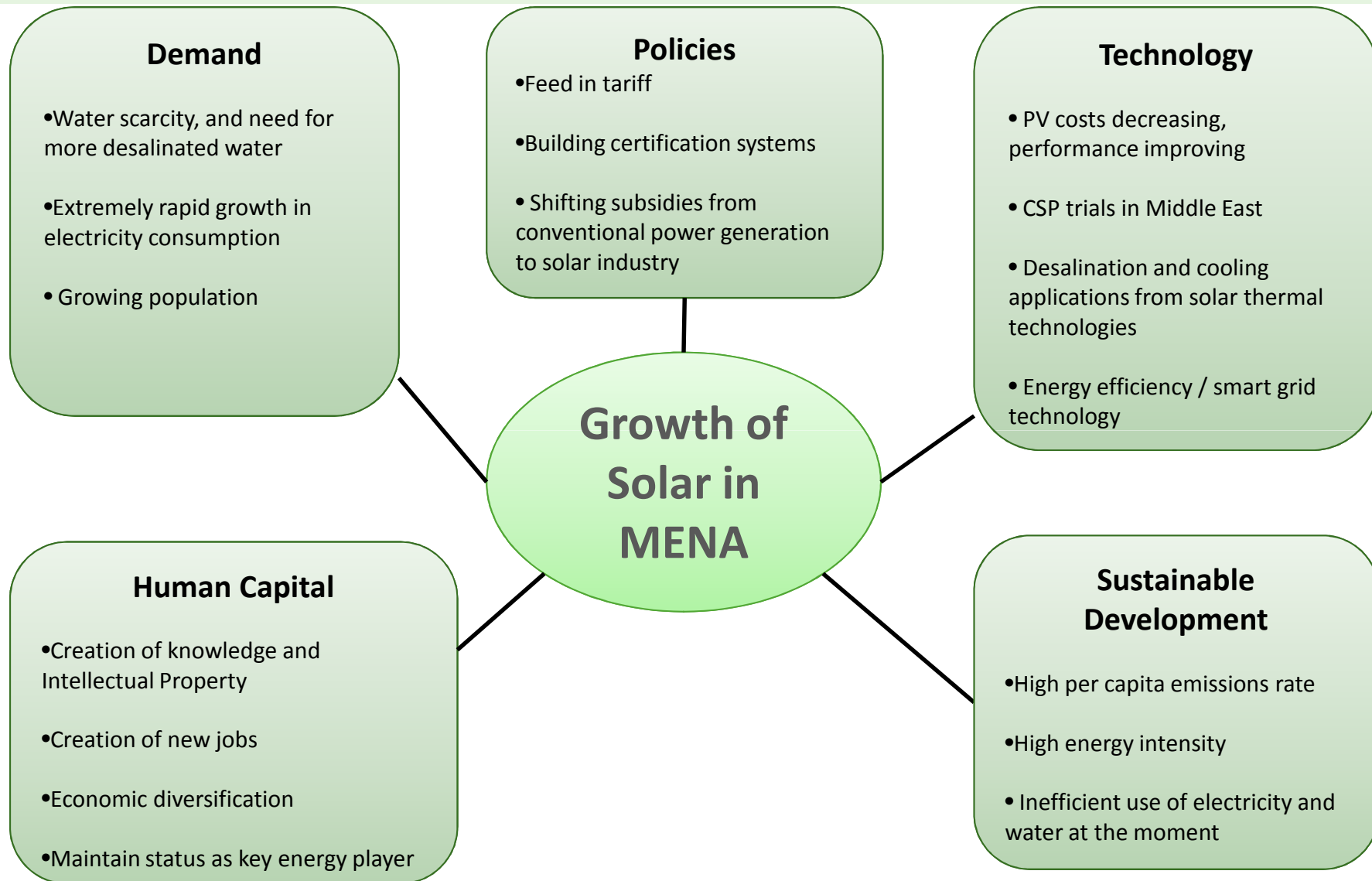
Economic Diversification

- Solar Energy introduces a new industry which can lead to job creation and private sector opportunities
- Large scale solar power assets provide attractive strategic investment opportunities

Solar Energy is attractive to MENA from a power generation and overall economic standpoint



SOLAR IN MENA



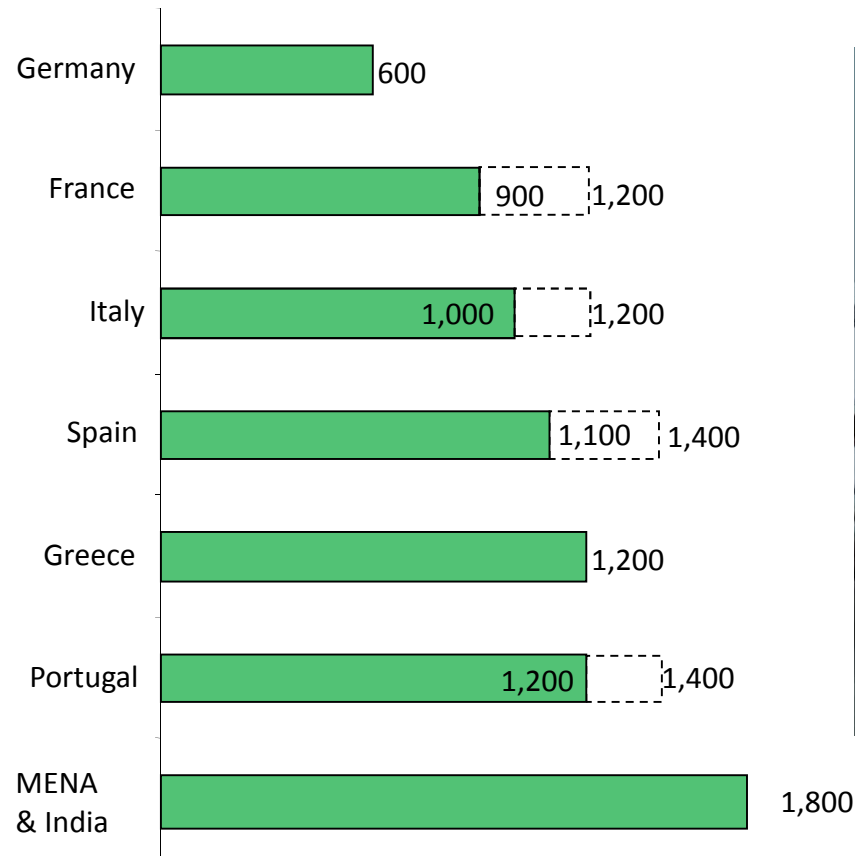
Solar is due to grow in MENA due to several economic, and social factors



SOLAR ENERGY POTENTIAL

Sunlight hours

p.a.



Source: GreenGulf Estimates

Solar tariffs are a function of annual sunlight hours. MENA has significantly more sunlight per year than solar energy producing countries such as Germany, Spain and Italy

Thank you



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