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INTERNATIONAL CONFERENCE ON RENEWABLE ENERGY / REGIONAL SEMINAR ON:
«Enabling Policies to Promote Financing Renewable Energy Investments»
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Economic And Social Commission For Western Asia



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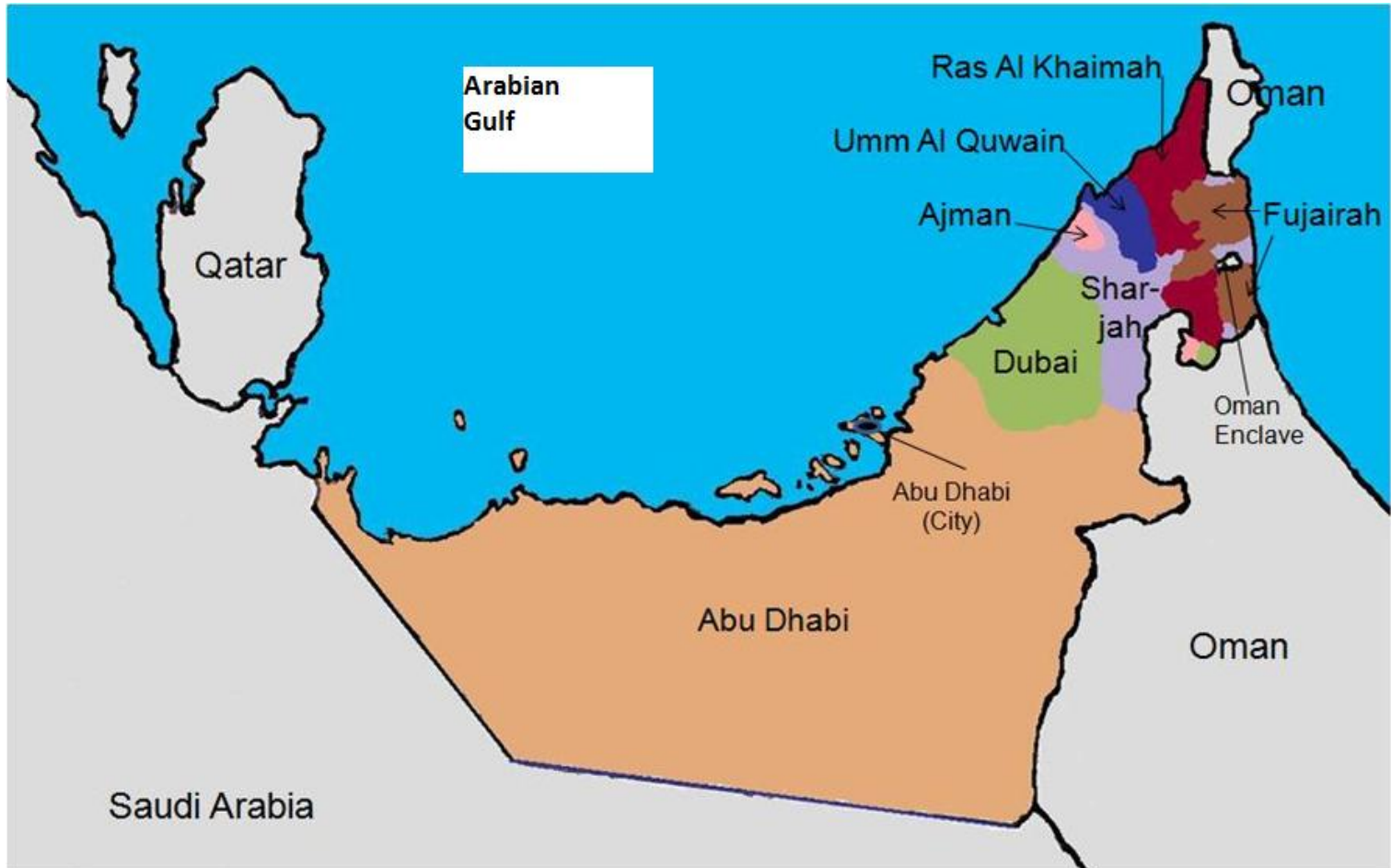
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Renewable Energy Policies Case Study For The United Arab Emirates

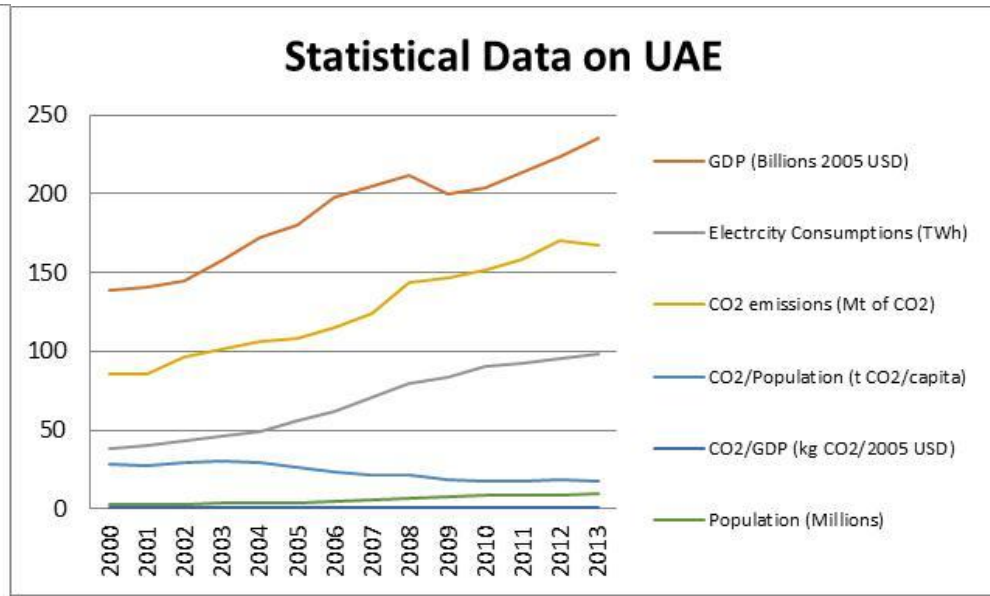
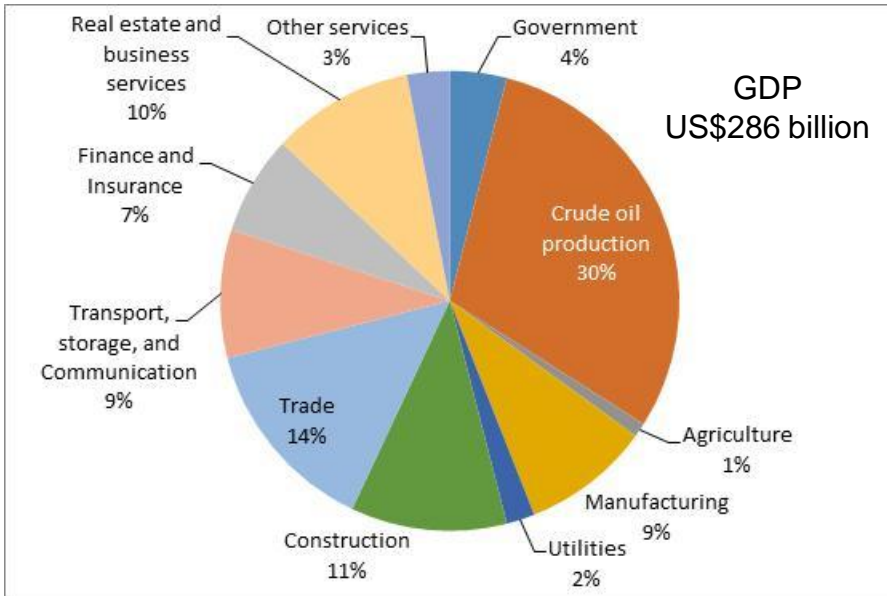
Toufic MEZHER
ESCWA Consultant

1. Country Brief

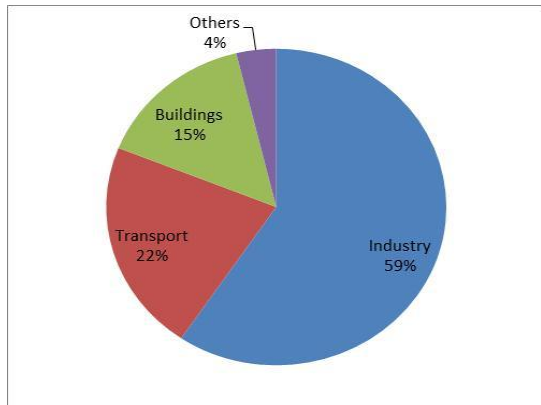
United Arab Emirates



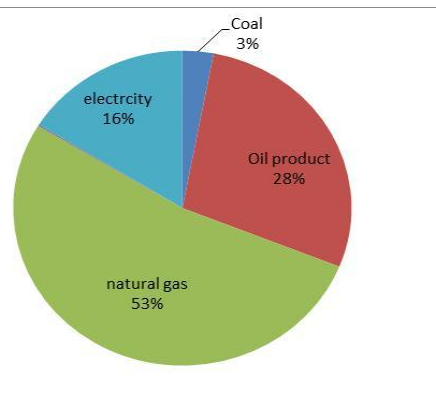
1. Country Brief (Cont.)



UAE Economic Profile in 2010 (Source MOE, 2012)



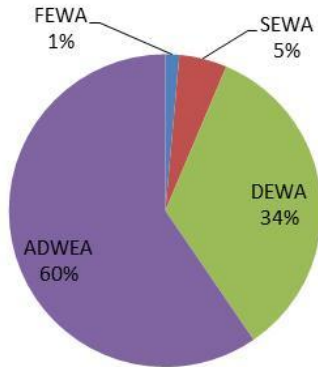
Economic and Energy Data of UAE (Source IEA)



Total final energy consumption (48833 ktoe) by sector and fuel inputs in 2013. (Source IEA)

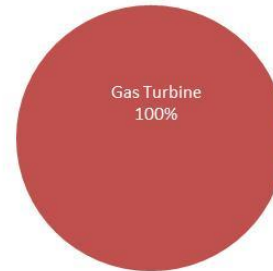
2. Energy sector characteristics

Total Electricity Generated in 2014

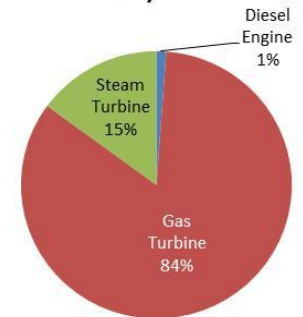


Share of total energy generated (116,528 GWH) by each utility in 2014

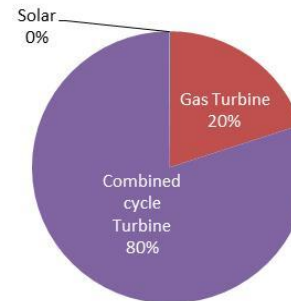
Total Installed Capacity in FEWA 733 MW



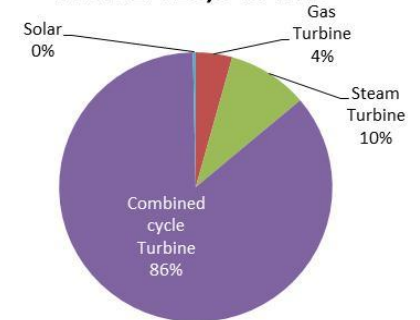
Total Installed Capacity in SEWA 2,894 MW



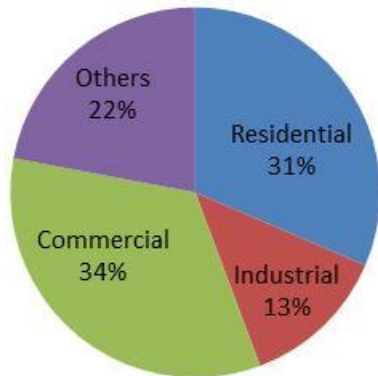
Total Installed Capacity in DEWA 9,656 MW



Total Installed Capacity in ADWEA 15,546 MW



Generation Technology for the installed Capacity for each utility in 2014

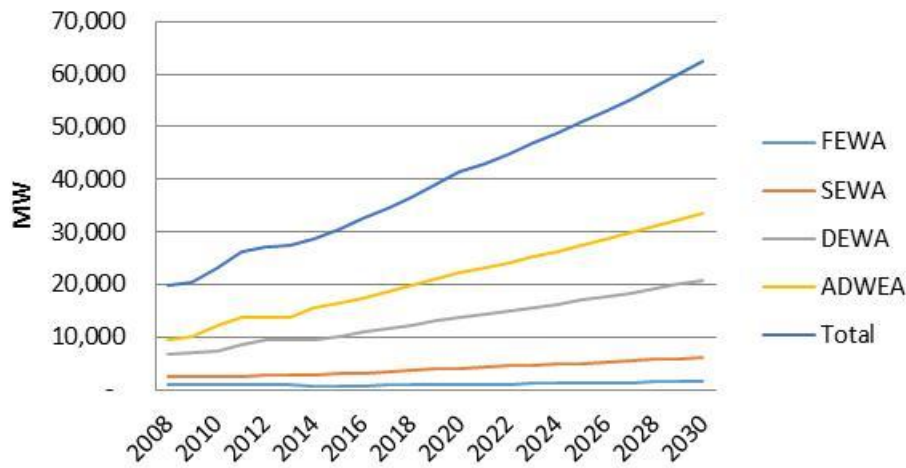


Share of Electricity Consumption by Sector in 2014

(Source MOE, 2012)

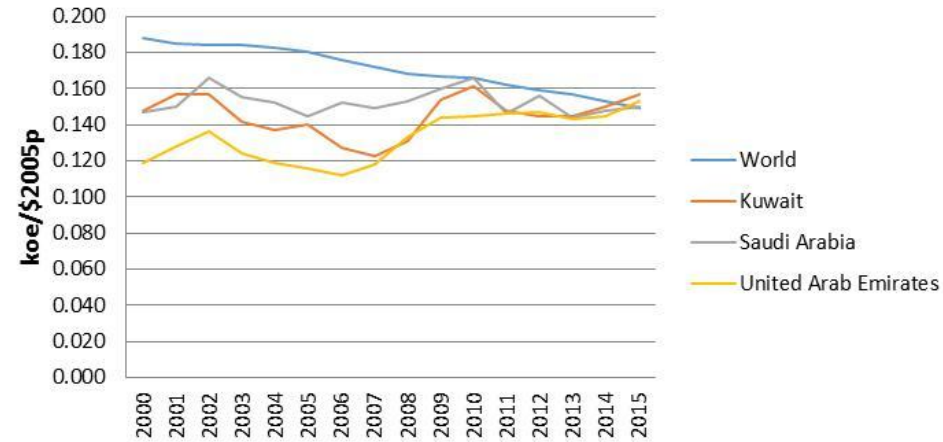
2. Energy sector characteristics (Cont.)

Project Power Capacity for UAE



Projected Power capacity for UAE

Energy Intensity

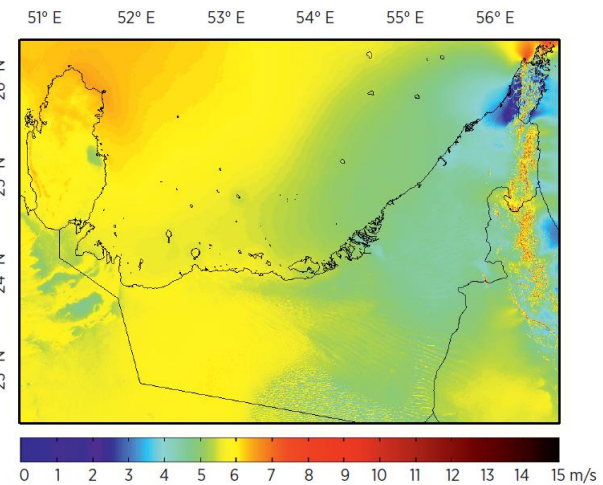
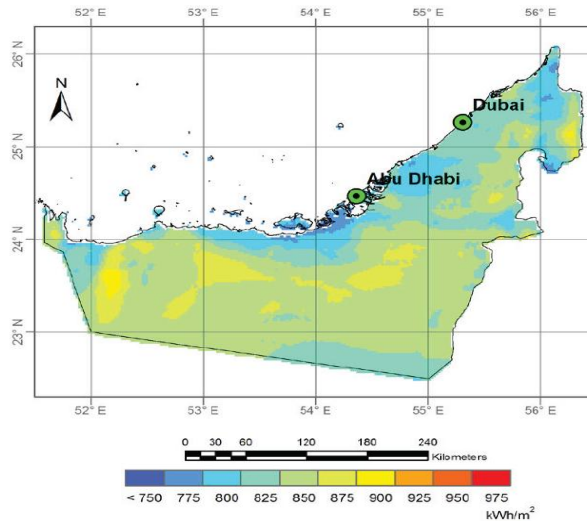
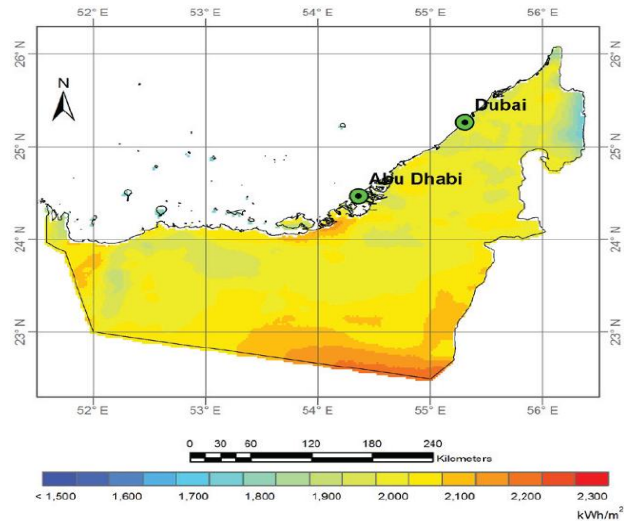


UAE energy intensity (Source: Enerdata)

3. Renewable Energy Potential

Direct Normal Irradiation (DNI) (2010)

Global Horizontal Irradiation (GHI) (2010)



DNI and GHI for UAE in 2010
Source: ReCREMA, The UAE Solar Atlas.

Average wind Speed Map at 100 in UAE
Source: IRENA (2015), REmap 2030, UAE

3. Renewable Energy Potential (Cont.)

Existing, Announced and Future Solar projects in UAE

		Capacity (MW)
Existing RE Power Plants	Dubai Solar PV Plant, Mohammed bin Rashid Al Maktoum 1	13
	Abu Dhabi Masdar City PV Plant	10
	Abu Dhabi Shams 1 CSP Plant	100
Announced RE Power Plants	Dubai Solar PV Plant by 2020, Mohammed bin Rashid Al Maktoum 2	200
	Dubai Solar PV Plant by 2020, Mohammed bin Rashid Al Maktoum 3	800
	Abu Dhabi Solar PV power Plants by 2020, Nour 1 in Sweihan	350
Future RE Plants	Dubai is planning to add 4000 MW of Solar PV and Maybe CSP by 2030.	4000
	Abu Dhabi is planning to add solar PV plants by 2020, Nour 2	540
Future RE Rooftop	Abu Dhabi is planning to add solar PV rooftop by 2020	500

Projected total installed capacity of Solar Projects

	Total Installed Capacity		
	2016	2020	2030
Solar PV power plants and rooftop	23 MW	2500 MW	6500 MW
Solar CSP Power Plant	100 MW	100 MW	100 MW
Total	110 MW	2600 MW	6600 MW

Projected Total Waste to Energy Projects

	2020	Total Electricity Generated (KWh)
Abu Dhabi , TAQA	100 MW	700,800,000
Dubai, Al Warsan	60 MW	420,480,000
Sharjah, bee'ah	35 MW	245,280,000
Total	195 MW	1,366,560,000

4. Current and prior Policy status

Power Generation Announced Targets

	2020	2021	2030	2050
UAE		24 % of Clean Energy of the total energy mix		
Abu Dhabi	7% Renewables (Solar), 19% Nuclear (5.6 GW)			
Dubai	7% Renewables		25% Renewables (Solar), 7% Nuclear, 7% Clean Coal, 61% gas	75 % of energy needs will be clean sources

Demand Reduction Targets

Abu Dhabi	Enactment in 2010 of Estidama, mandatory building and landscape sustainability regulations to cut energy and water consumptions by one third and pricing reforms
Dubai	Establishment of 30 % demand reduction target by 2030 through a mix of pricing reforms, performance codes, and efficient investments (building regulations, building retrofits, district cooling, standards and labels for appliances and equipment, outdoor lighting, and change of tariffs rates)

Institutions and regulatory bodies involved in policy making and planning in UAE energy sector

	Institutions	Regulatory Bodies
UAE	Ministry of Energy	Electricity is regulated by Emirate-level institutions in Abu Dhabi, Dubai and Sharjah. The remaining are covered by Federal Electricity and Water Authority (FEWA)
Abu Dhabi	Abu Dhabi Water and Electricity Authority (ADWEA), Abu Dhabi Energy Authority (2016)	Abu Dhabi Regulation & Supervision Bureau (RSB); Abu Dhabi Water and Electricity Authority (ADWEA)
Dubai	Dubai Water and Electricity Authority (DEWA) and Dubai Supreme Council of Energy (DSCE)	Dubai Regulation & Supervision Bureau (RSB); Dubai Electricity and Water Authority (DEWA)

4. Current and prior Policy status (Cont.)

		Dubai			Abu Dhabi		
Stakeholders	Role in the value chain	DEWA 13 MW	DEWA 200 MW	DEWA 800 MW	Masdar 10 MW	SHAMS 1 100 MW	Nour 1 350 MW
Equipment Provider	Manufacturing, Assembly, and Distribution	First Solar and ABB	First Solar	BYD, JA Solar, Canadian Solar, Jinko Solar and Trina Solar	First Solar and Suntech	Abengoa Solar, First Solar, Schott Solar, and Flabeg	Jinko Solar
Developer and/or EPC	Project planning, Construction, Operation and maintenance	First Solar	ACWA Power and TSK	Masdar, GranSolar, Fotowation Renewable Ventures	Enviromena Power Systems, Masdar	Total, Masdar, Teyma, Abengoa Solar	Marubeni-Jinko Solar
Utility	Support functions: Decision making, System planning, Grid connection	DEWA and DSCE	DEWA and DSCE	DEWA and DSCE	Masdar, ADWEC	Masdar, ADWEC	ADWEC
Financier(s)	Support functions: Financial Services	DEWA	First Gulf Bank, Samba, BCB	Local and Foreign banks	Masdar	NBAD, FfW, BNP Pribas, Societe General, SMBC, MUFG	Local and Foreign banks
Financial Model		EPC	IPP and PPA	IPP and PPA	Net metering	IPP and PPA	IPP and PPA
Announced LCOE (US Cents/KWh)			5.85	2.99			2.42
Announced RE targets		5% by 2030 in 2011 and updated to 25% by 2030 in 2016			2009 7% by 2020		
Year		Commissioned in 2013	Auctioned and awarded in 2015	Auctioned and awarded in 2016	Commissioned in 2010	Commissioned in 2013	Auctioned and unofficial announcement in 2016

5. Economic, Environmental and Policy Analysis

Critical Milestones in UAE since 2008 influencing RE Policy:

1. The Creation of the Masdar Initiatives in 2006.
2. World Future Energy Summit (WFES) in Abu Dhabi since 2008. WFES became part of the annual Abu Dhabi Sustainability Week (ADSW)
3. The establishment of ZFEP was announced in 2008.
4. Abu Dhabi became the home and headquarters for the International Renewable Energy Agency (IRENA) in 2009. Today it is located in Masdar City.
5. Building the first sustainable city in the world in 2010, Masdar City.
6. Commissioning several RE power plants in the country including the 10 MW solar PV in Masdar City, the 100 MW solar CSP plant in the Western region of Abu Dhabi, and the 13 MW solar PV plant in Dubai.
7. On July 26, 2016, the fully powered solar PV aircraft, Solar Impulse 2, made its final destination Abu Dhabi after an epic journey around the world which started in March of 2015.
8. UAE will be hosting the 2020 World Expo in Dubai. This event is critical and gives a new momentum for the RE sector where sustainable development is highly emphasized.

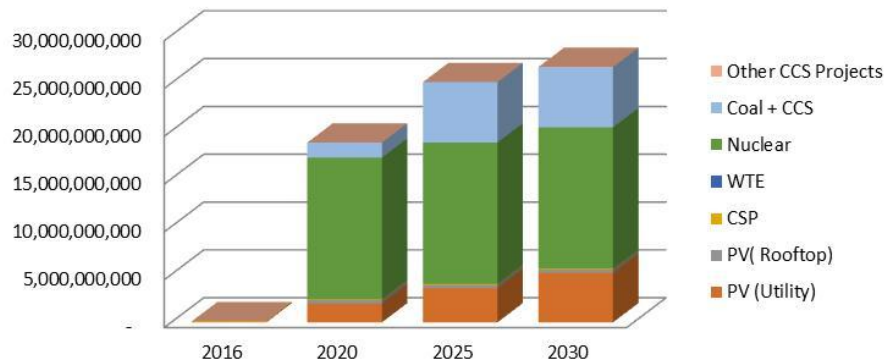
5. Economic, Environmental and Policy Analysis (Cont.)

Economic Impacts of Policy Measures:

1. Diversification of the Economy
2. Many National Companies were established in partnership with international firms
3. Establishment of two solar associations in UAE: MESIA and ESIA
4. Masdar City
 1. Home of top high tech companies in RE and Energy Sector
 2. Incubator for startup companies in Energy Sector
 3. Masdar Institute of Science and Technology (MIT partner) is considered to be top R&D institution regionally in the field of RE
5. PPA-IPP Model encouraged the involvement of the private sector including financial institutions both national and international
6. Many jobs (direct and indirect) are being created
7. Masdar Company becoming an international brand and investments in RE projects all over the world.

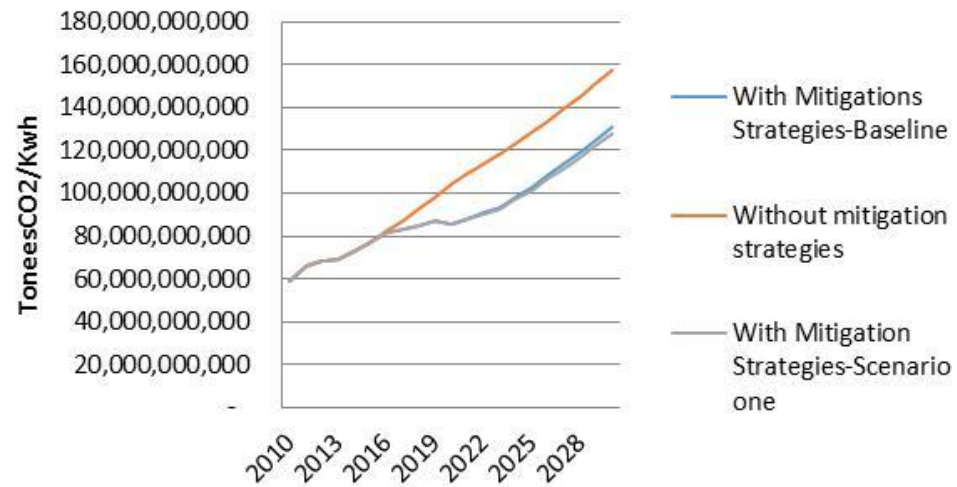
5. Economic, Environmental and Policy Analysis (Cont.)

CO2 Emissions Reductions (tons of CO2/KWh)



Potential CO2 emission reduction from clean energy deployment

CO2 Emission Trend in UAE



CO2 emission trends in UAE before and after adopting mitigation strategies

6. Policy Design Considerations

Main Drivers for RE Policy in UAE are Government of Abu Dhabi and Dubai.

1. Abu Dhabi (Oil producer)

- Abu Dhabi 2030 vision & Economic and Population growth
- Increase internal energy demand especially for electricity and water production
- Net gas importer in 2007 and changing global oil and gas markets (shale)
- Abundance of solar resources

2. Dubai (non oil producer)

- Dubai Plan 2021 and Integrated Energy Strategy 2030 (Sustainable energy sources)
- Economic and Population growth
- Increase internal energy demand especially for electricity and water production
- Need to purchase its fuel needs from open markets
- Abundance of solar resources

2. UAE

- COP21 and Intended National Determined Contribution.
- The UAE will pursue a portfolio of actions, including an increase of clean energy to 24% of the total energy mix by 2021.

6. Policy Design Considerations (Cont.)

The implications for promoting RE policies in UAE are very beneficial and they include:

1. CO2 emission reduction.
2. Saving fossil fuel which can be used for export for income generation purpose.
3. Building a new RE sector which will have direct and indirect impact on the economy and society.
4. Companies like Masdar are becoming important regional and global players in the RE sector.
5. UAE taking leading role in International Climate Change agreements.
6. Build the knowledge and expertise in RE sector in both public and private sectors.
7. Becoming the hub for the major RE players throughout the value chain of the RE sector.
8. Hosting the biggest international annual meeting, Abu Dhabi Sustainability Week.
9. Currently there are 14 projects registered as CDM program since 2009. Currently certified emission reductions (CERs) were issued for an equivalent of 617,974 t CO₂ to the registered projects in UAE which include all the existing solar power plants.

7. Barriers/Challenges facing implementation of RE projects and Lessons Learned

Economics and financial challenges

1. Economic crisis in 2008
1. The drop in oil prices and no income taxes.
2. High upfront cost and long payback period for RE projects.
3. Additional cleaning cost for PV modules and CSP mirrors due to dust and humidity.
4. Power sector subsidies for fossil fuel.
5. The true cost for utilities is not just the PPA; additional costs include: addition grid connection, managing the smart grid for RE intermittencies, and operating and maintaining fossil fuel backup plants.

Market challenges

1. Lack of wholesale competitive market in UAE
2. RE sector in UAE is mostly controlled by foreign companies through the business value chain of the industry.
3. Commercial and bankruptcy laws

7. Barriers/Challenges facing implementation of RE projects and Lessons Learned (Cont.)

Political, institutional / governance, regulatory and administrative challenges

1. No CO2 emission reduction targets set.
2. No income taxes in UAE.
3. 80% of population in UAE are expats and no incentives for RE integration.
4. Other 5 emirates besides Dubai and AD lack RE policies and institutions.
5. Limited Federal and Stakeholders involvement in decisions.
6. There are no economic, social, and environmental studies on current impact of fossil fuel.

Cultural, behavioral and educational challenges

1. Lack of awareness regarding:
 - The benefits of RE
 - Educational programs climate change challenges.
2. Subsidies encourage wastes.

Technical/technological challenges

1. Intermittencies and high cost of storage.
2. Additional cost on utilities including backup plants.
3. Need for accurate measures for DNI and GHI.
4. The performance of existing solar power plants is not shared in public.

8. Conclusions and Recommendations

Positive signs:

- UAE has rebuilt its momentum in RE.
- UAE can meet its RE targets(e.g., new BM PPA and IPP)
- The LCOE for solar PV is as low as 2.42 US Cents/KWh
- Strong and well built infrastructure.
- Abu Dhabi and Dubai have the right institutions

Ways forward:

- Build smart grid systems and encourage the adoption of RETs in off grid uses
- More collaboration and coordination is needed between all stakeholders
- The federal government should play more active role in RE and leverage knowledge between all emirates.
- Dubai net metering model should be implemented throughout the country
- Eliminating or reducing subsidies in both supply and demand
- Unify utility bills for both expats and nationals
- More assurances from utilities to guarantee buying the power offtake

8. Conclusions and Recommendations (Cont.)

Ways forward (Cont.):

- RE and clean energy targets should be complemented with CO2 emission reduction targets.
- The true cost of solar PV to utilities should be reflected in consumers' bill.
- Allowing active wholesale market encourages RE adoption.
- Commercial and bankruptcy, and immigration and residency laws should be re-evaluated to encourage more entrepreneurial risk taken start-ups and investments.
- More research and development funding is needed for capacity building.
- More accurate DNI and GHI measures are needed, at least and over a 10-year period.
- Wind power potentials should be more explored.
- The government of UAE can take advantage of its RE policies to build up the industry throughout the business value chain by imposing local procurement. This will increase the know-how and job opportunities in the country.
- RE policies should address the potential of RE applications in desalination.
- Need to share current experiences and lessons learned between all stakeholder to improve the RE policy decisions and technical solutions.

THANK YOU

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