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Solar Energy in GCC Construction

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Solar Energy and GCC Countries

Energy needs are growing manifold, especially the GCC region where large plans toward expansion and diversification from the economies' dependence on hydrocarbons is underway since mid 2000s. Hydrocarbons have been not only supporting the economy comprising bulk of the GCC revenues, but also fed the growing needs of industrialization and urbanization when combined with the healthy population growth across the GCC. However, with the twin reasons of the hydrocarbon resources fast dwindling worldwide amid concerns about finding alternative sources of energy and the concern to build a green environment while reducing carbon emissions have driven countries across the globe to renewable energy sources, for the GCC, the most abundant one being solar energy. Though efforts have been a drop in the ocean when compared with other countries and hydrocarbons continue to dominate the primary energy source for the GCC and its construction sector, the economies are definitely relooking their strategies and aiming at increasing the shares of renewable energy in their energy mix in the future.

The following table provides a qualitative assessment of the investment of each individual GCC country on renewable sources of energy as of 2011.

Table 1: GCC Plans for Investment in Renewables and Impact Assessment on Select Indicators

Country	Current Focus Area	Investment	Private Investment participation
Bahrain	Solar, Wind, 2 Hybrid Solar cum wind plants	US\$133 million	Mainly IPP oriented
Kuwait	Solar (Nuclear plans downscaled after Japan disaster)	US\$600 million solar project	Mainly government
Oman	6 renewable energy projects - Solar, Wind, No nuclear plans for the future	US\$21 million	Mainly government with private participation
Qatar	7 Solar plants and Wind	US\$1 billion solar projects	Predominantly government with scope for private participation at a small level
Saudi Arabia	16 nuclear reactors and Solar	US\$100 billion	Government and IPP s to an extent
UAE	4 nuclear reactors, and Solar	US\$20 billion	Large avenues for private investment and IPPs

Source: VME Research (Note: The project focus is not an exhaustive list of renewable projects)



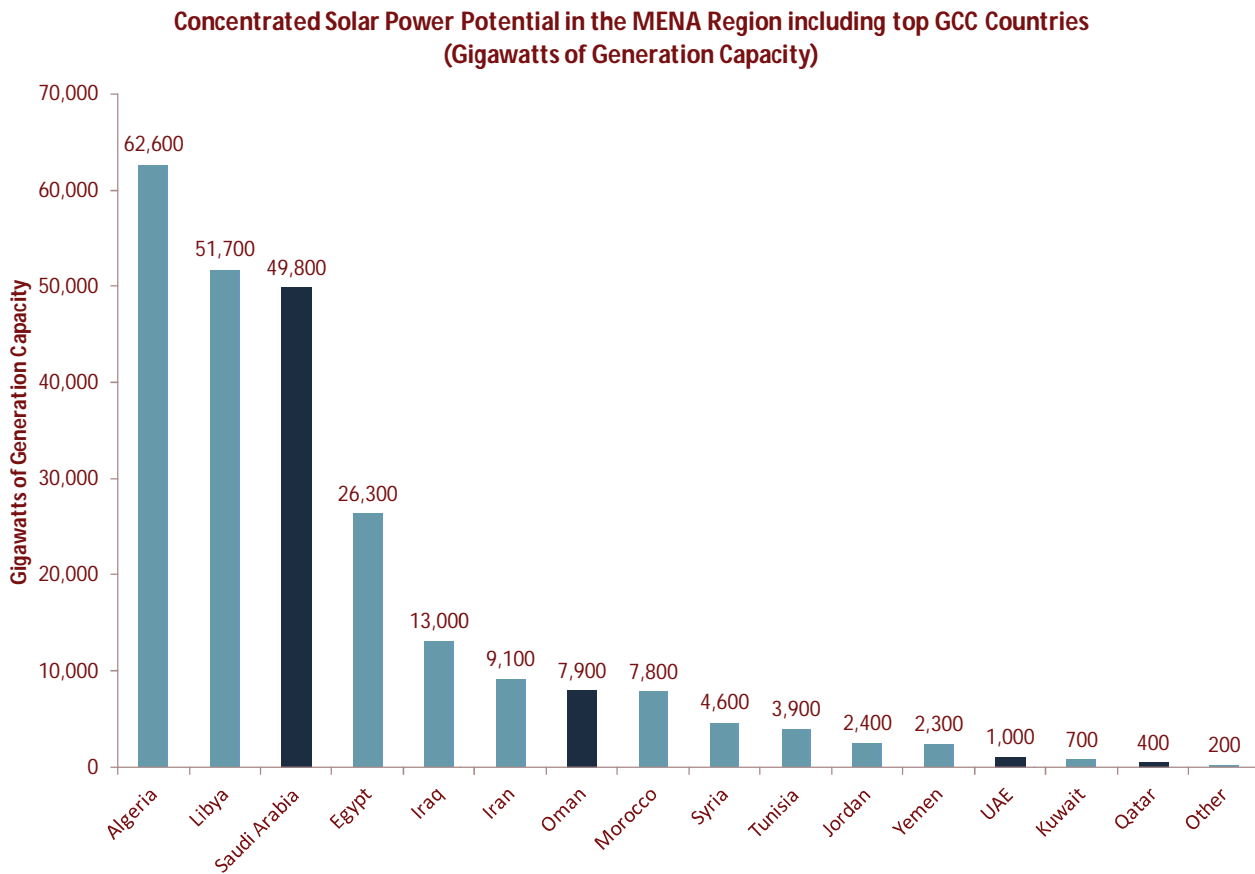
For countries such as UAE, Saudi Arabia and Qatar, the surging domestic demands for energy have necessitated the change in energy mix and from the above table it is clear that most GCC countries have given a high priority to solar energy on their agenda. For smaller countries such as Oman and Bahrain the investment in solar energy is likely to help meet gaps in energy demand and supply. Kuwait with its not so clear policy on incorporating nuclear energy into their energy mix owing to the stance taken by the government after the Japan nuclear disaster is also likely to explore the benefits of greater use of solar energy in its energy mix. .

As the development of renewable energy and its policy framework is as yet at a nascent stage across the GCC countries except for UAE, regional alliances are likely to be a far off goal and significant individual steps to develop these areas are likely to be the agenda for the next two decades in order to optimize this source as a significant source of energy for the GCC countries.

GCC Solar Energy Potential

Generation of Solar power is primarily from two sources, Concentrated Solar Power (CSP) or solar power generated by concentrating solar energy through the use of mirrors and lenses within plants that are utility-scale generators and Photovoltaic Solar Power (PVSP) that involves directly converting solar power into electricity using semiconductors and often done on a smaller scale than CSP. Both have immense potential in the GCC region and can be widely used if tapped commercially in a sustained manner though CSP technology scores in terms of commercial scale and cost. The following figure depicts the potential of CSP across GCC countries.

Figure 1: Concentrated Solar Power Capacity in the MENA region including GCC Countries (Giga Watts of Generation Capacity)



Source: "Concentrating Solar Power for the Mediterranean Region" (MED-CSP), German Aerospace Agency (DLR), 2005

As the economies move toward solar energy to conserve energy, the construction industries lead the trend in a quest to achieve sustainable building practices and conserve energy while reducing costs. The following chapter looks at the GCC construction industry and the trends across the industry in successfully harnessing solar power for maximum economic and environmental impact.



GCC Construction Industry and Solar Energy

GCC Construction Industry Overview

Not only has the GCC construction industry emerged as one of the most attractive investment destinations amid the global economic slowdown, but its maturity has enabled establishment of standards across the global construction industry with pioneering technologies across sustainable construction methods. The vast expansion and diversification programmes supported by huge spending from the government keeps the industry thriving and at the leading edge of industrial developments. Investments across infrastructure, social housing, energy, and hospitality sectors have not only helped the industry weather the worst effects of the global economic slowdown, but also helped it avert a spread of social unrest such as the Arab Spring from affecting growth in this industry.

However, the industry did face turbulent times after a rapid and zealous growth phase between 2007 and 2009. The boom ended equally rapidly as profligate spending and unchecked building construction combined with the adverse impact of the global economic slowdown shrinking credit availability brought these markets to a crawl by end of 2009 and a huge number of projects were either shelved or put on hold across the major construction markets of the GCC. Among the GCC markets, the largest and the fastest growing one, namely the UAE, also took the largest battering amid the slowdown, while Bahrain and Kuwait too were affected adversely by the Arab Spring and social and political unrests across these states, while Saudi and Qatar too witnessed moderation in spite of heavy government backing and strong economic fundamentals.

Apart from Bahrain and Kuwait, the Arab Spring that affected other economies of the Gulf, proved to be a mixed blessing in terms of reversing investment and tourist flows to the GCC as it began to be perceived as a safe haven for investors amid the slowdown as it made a strong rebound.

The inherent resilience combined with sustained demand from a growing and fast urbanizing population helped the economies recover gradually though 2010 and 2011 and the construction industries across the region revived erstwhile projects shelved or put on hold and gradually resumed fresh projects. Building projects worth over US\$ 57.8 billion were awarded to contractors in 2011 across all the building sectors



including residential, commercial, hospitality and retail and is likely to reach US\$ 65.5 billion in 2012. These strong growth signals have also prompted analysts to revise growth estimates for the GCC region upward, citing fundamentals such as its strong and consistent economic growth, political stability amidst unrest in its neighbourhood, strong oil prices boosting their revenues, clear-cut government plans and vast spending to fuel the growth across its non-oil sectors, for the revision.

The following is the list of top building projects across the GCC as of September 2012:

Table 2: Top 30 Building Construction Projects across the GCC (US\$ Million), September 2012

Project Name	Country	Client	Consultant	Contractor	Value (US\$ Million)	Status
Barwa Al Khor Project - Urjuan	Qatar	Barwa Real Estate Company	KEO International Consultants; Qatar	-	9,600	Design
Amphibious 1000	Qatar	Seaquest Marine Technology Plc	Giancarlo Zema Design Group	-	500	Concept Stage
Viva Bahriya	Qatar	United Development Company (UDC)	SRSS Associates	& Various Contractors	2,000	Construction
Lusail Phase II - Fox Hills	Qatar	Qatari Real Estate Investment Company (QDREIC)	Diar -	-	3,800	Design
Energy City Project - Phase 1	Qatar	Energy City	PFC Energy	-	3,000	Design
New Doha International Airport	Qatar	NDIA Steering Committee	-	Various Contractors	10,000	Construction
Muscat International Airport Expansion - Phase 1	Oman	Ministry of Transport & Communications	COWI & Partners; Larsen Architects	& TAV Construction; Turkey; Consolidated Contractors International Company (CCC); Oman	4,000	Construction



Project Name	Country	Client	Consultant	Contractor	Value (US\$ Million)	Status
New Terminal at Salalah International Airport	Oman	Ministry of Transport & Communications	COWI & Partners; Larsen Architects	Galfar Engineering & Contracting; Oman; Larsen & Toubro; Oman	760	Construction
Eco - Resort at Ras al-Hadd	Oman	Ministry of Tourism; Oman; Qatari Diar Real Estate Investment Company (QDREIC)	Dar Al Handasah; Oman; Spillis Candela DMJM	-	300	Design
Mutrah Redevelopment	Oman	Muscat Municipality; Haya Water (OWSC)	-	-	500	Concept Stage
Sohar Free Zone	Oman	Sohar International Development Company	Mott MacDonald; Oman	Premier International Project	2,000	Construction
Al Khairan Residential City Project	Kuwait	Public Authority for Housing Welfare (PAHW)	Gulf Consult; Atkins; Kuwait	Not Appointed	27,000	Design
Jaber Ahmed Sabah Hospital	Kuwait	Ministry of Health; Kuwait; Ministry of Public Works (MPW); Kuwait	Gulf Consult; Langdon Wilson; Kuwait	Kuwait Arab Contractors	1,057	Construction
Kuwait Cancer Control Center Expansion	Kuwait	Ministry of Health; Kuwait	Pan Arab Consulting Engineers (PACE)	Alghanim International General Trading & Contracting; Kuwait	597	Construction



Project Name	Country	Client	Consultant	Contractor	Value (US\$ Million)	Status
Boubyan Island Development	Kuwait	Ministry of Public Works (MPW); Kuwait; Mega Projects Agency (MPA)	Hellmuth Obata Kassabaum (HOK); Gulf Consult; Mouchel; Kuwait	Hyundai Engineering & Construction Company /Mohammed Abdulmohsin Al Kharafi & Sons	6,640	Construction
North Bahrain New Town Project - Main File	Bahrain	Ministry of Works & Housing; Bahrain	-	-	4,500	Design
Janayen Al Hamala Housing Development	Bahrain	Al Salam Bank	Manara Developments Company	Abdulla H. Al Mutawa Sons Group (AMSG); Saudi	1,325	Construction
20,000 Low-cost Housing Project in Bahrain - Phase 1	Bahrain	Ministry of Housing; Bahrain; Naseej BSC	-	Chase Perdana Sdn. Bhd.	550	Construction
Kingdom Riyadh Land - Main File	Saudi Arabia	Kingdom Holding Company	Omrana & Associates (O&A); Saudi Arabia	-	7,000	Design
King Abdullah Economic City (KAEC)	Saudi Arabia	Emaar Economic City; Saudi	-	Various Contractors	51,953	Construction
Riyadh East Sub Center - Main File	Saudi Arabia	Hamed & Ahmed Mohammed Al Mozainy Real Estate Co.	-	-	8,000	Tender for Construction Contract



Project Name	Country	Client	Consultant	Contractor	Value (US\$ Million)	Status
Makkah Gate Cultural Oasis	Saudi Arabia	Al Balad Al Ameen Company for Urban Development; Makkah Municipality; Sumou Real Estate Company; Makkah Gate Company	-	-	10,000	Design
South Obhur Project - Main File	Saudi Arabia	Rayadah Investment Company	Sulaiman Al Khorashi Office	-	15,000	Design
King Faisal University in Al Ihsa - Staff Accommodation - Phase 2	Saudi Arabia	King Faisal University	Arch-Centre for Architecture & Engineering Consultant; Saudi	Al Arrab Contracting Company	7,012	Construction
Masdar City in Abu Dhabi	UAE	Masdar (Abu Dhabi Future Energy Company)	Flack & Kurtz Consulting Engineers; Ascon; Dhabi; Transsolar; WSP Group; Abu Dhabi	Al Ahmadiyah Contracting; Dubai; Hip Hing Construction - Hong Kong	22,000	Construction
Nebras Aviation City	UAE	Strata	-	-	10,000	Concept Stage
Ghantoot Green City - Main File	UAE	International Capital Trading LLC	KEO International Consultants; Abu Dhabi	-	10,000	Design
Danet Abu Dhabi	UAE	Al Oudra Real Estate	Architectural & Engineering Consultants; Abu Dhabi (AEC); RSP (Raglan Squire and Partners) Architects	Various Contractors	9,260	Construction



Project Name	Country	Client	Consultant	Contractor	Value (US\$ Million)	Status
Al Ghadeer at Saih As Sidirah	UAE	Sorouh Real Estate	Sun Engineering (South Korea)	Jin Construction General Contracting	5,400	Construction
Khor Dubai	UAE	Dubai Culture and Arts Authority	Kling Consult; Dubai	-	1,907	Design

Source: Ventures Onsite MENA Projects Database www.venturesonsite.com

GCC Construction, Green Building and Solar Energy Initiatives by Country

As the construction industry resumed its growth trajectory, renewable energy and sustainable construction have been brought back into focus with solar energy, the most abundant resource in the region, being tapped across construction projects not only for the benefit of its cost and energy savings but also to achieve the high standards of sustainable construction set by the Construction industry in the GCC. Green building codes specify a number of requirements to improve the design or performance criteria for both existing buildings and for new constructions with the aim to improve overall building performance while reducing their environmental impact and cost over their life cycle and each requirement is assigned a credit or given a rating that helps the construction achieve the required green building certifications that vary from region to region such as the Pearl Rating System and LEED or USABC ratings that widely encourage solar energy usage across the GCC construction industry.

Bahrain continues to be the least energy efficient in terms of GCC building construction though studies have showed huge savings for Building-Integrated Photovoltaics (BIPV) in construction designs and that the high insulation rates in Bahrain are highly conducive to the introduction of solar thermal devices such as water heating devices as also PV panels to be installed on the roofs or structure of buildings, also allowing for nearly 30 percent of electricity to be generated from BIPV alone. However, aside from the Bahrain Trade Center (BTC) which too is not anywhere close to international standards of renewable energy compliance standards, has been one of the few constructions that have embraced solar energy and other renewable energy standards in construction.



Kuwait too with the largest solar irradiation levels across the GCC offers vast potential for adoption of both PV and CSP technologies. Studies have shown that installation of BIPV in residential homes can provide an average surplus of 25000 kilowatt hour per year of electricity generated after meeting their individual electricity needs and achieve cost savings of at least 25 percent in energy usage of households. Though Kuwait was one of the first to embrace and adopt solar energy in its construction with the Kuwait English School becoming the first building in the Middle East to harness solar energy using BIPV panels in 1984 itself. Though enthusiastic projects such as solar cooling for the Ministry of Kuwait Building, PV systems for agricultural green houses, a solar desalination system and a 100 KW solar thermal power station did emerge in the eighties, interest in solar energy in Kuwait construction petered out citing technical and economic viability issues and it was only in 2006 that Kuwait's First Gold LEED rated building the Sabah Al Ahmed Financial Center again adopted significant solar energy usage in its building design. However, BIPV has caught on in a big way with the government encouraging projects such as two buildings of the Ministry of Electricity and Water and a new airport terminal to incorporate solar panels and BIPV technology.

Oman too has a high potential for harnessing solar energy across construction though the available area is limited by the small size of the country. In fact, Petroleum Development Oman (PDO), Oman's main oil company is actively pursuing technologies to adopt solar steam generation techniques from CSP in its Enhanced Oil Recovery (EOR) projects. Oman has encouraged proposals for individual solar pilot projects, mostly on a Build Operate and Own basis, which have plans of being implemented to reduce its dependence on gas as a feedstock. Foreign participation too has actively been garnered such as the US\$ 2 billion PV solar power project that includes production of the silicon, solar panels and aluminium frames for the project that would produce 120 MW solar panels a year financed by German venture capitalists including training cum transition phase for the local workforce. A 200 MW solar plant and a 400 MW PV station are also commissioned to be ready by 2013 and 2016 respectively, further boosting the solar energy applications across Oman.

Qatar, like all the countries in the region has a high potential in terms of irradiation levels to exploit both CSP and PV solar technologies. However, the costs continue to be high when compared to traditional technologies such as gas turbines which use resources that the country has abundant supply of. However, this has not deterred Qatar from introducing solar energy as an alternative and a green construction technique across its various projects, pioneering technologies such as the artificial cloud that has solar panels to absorb the sun's radiation and convert it to energy utilized to cool its stadiums while protecting



the players from the harsh rays of the sun while a match was in progress. It also has a dedicated Qatar Solar Technology (QSTec) manufacturing facility to commercially produce solar technologies for PV cells and solar modules. It is expected with constant innovation and technological development the costs of adopting solar energy would gradually come down. Plans to generate power using solar technology also have been included in the national strategy though they are still at the nascent stage. The World Cup 2022 has however, provided ample opportunities to test commercially a number of solar technologies for air conditioning and cooling of stadiums, convention centres and venues for the event. The Qatar Green Building Council (QGBC) too has ratings and credits for adopting renewable solar energy that have set a benchmark for construction projects across the globe.

Saudi Arabia, the largest amongst the GCC states has a very high potential for the use of CSP technology, added to its long coasts that also provide a greater coastal CSP potential for producing power and water desalination plants using solar power. Saudi Arabia has invested heavily in research and development programmes for development of solar technologies to meet its surging demand for power and water in recent years that is expected to be extremely difficult for hydrocarbon fuels to meet without reducing exportable surplus if it continues at its current pace. A number of private institutions have also been roped in to lead these research projects with the aim of producing commercially viable and low cost technology using its most abundant resource namely solar power. Projects in collaboration with international players for power generation using solar panels are another popular trend in Saudi Arabia, researched to meet climatic and geographical stipulations and allowing for expansion to large commercialisation at later stages. Availability of capital, low energy prices, and large demand potential make Saudi Arabia an attractive market for both CSP and upstream PV manufacturing activities such as the manufacturing of silicon ingots and wafers to help feed the region's solar technology market. Though targets for incorporating solar energy in the energy mix and investment is in place the efforts for deployment in commercially viable projects across Saudi Arabia have been scattered and insignificant so far.

The United Arab Emirates (UAE), by virtue of its thriving construction industry has also the largest Co2emissions across the region, adding to its common regional need to diversify from hydrocarbon dependence is also the need to use renewable energy to reduce its carbon footprint. The potential of UAE for harnessing solar energy is huge with its large irradiation levels as it is also located along the region's solar belt. Similar to Saudi Arabia, studies for potential of CSP technology have been found more financially and technologically viable than PV technology and through establishment of its first carbon neutral city

MASDAR where a number of state of the art renewable energy technologies have been deployed including solar power. Solar cooling is another area that has been given significant attention in the UAE, with technical collaborations with international private institutions to explore technologies such as solar assisted cooling. A number of solar projects on small and large scales have been designed and implemented across Abu Dhabi and Dubai and are planned across Ras al Khaimah and Fujairah. Together they account for nearly 68 percent of the GCC's installed solar capacity at 115 MW as of 2012, though in absolute terms it is but a fraction of UAE's fossil fuel based electricity generation capacity of nearly 25 GW.

Moreover, with its large and growing construction market, potential for BIPV systems is also large across the UAE. However, apart from MASDAR city and the Pacific Control Systems (PCS) headquarters in Dubai, efforts to harness solar technologies in building designs have been limited. The PCS headquarters which is a USGBC LEED certified platinum rated green building has adopted solar technologies for lighting as well as solar thermal air conditioning. MASDAR city, initially designed as a mixed use development incorporating residential units, office and R & D facilities, currently only houses MASDAR Institute of Science and Technology (MIST) and its student residences, where all buildings have rooftop solar panels that meet more than 30 percent of their electricity needs and 75 percent of their water heating needs, the remaining met by a solar photovoltaic plant of 10 MW capacity that is also connected to the Abu Dhabi grid

The green building codes including ESTIDAMA and Pearl Ratings of Abu Dhabi and Dubai have not imposed green building stipulations on developers yet unlike Qatar and other economies which require compliance by a stipulated period and combined with the highly subsidized electricity and water charges across the Emirate solar powered technologies have not caught on with no pressing need to do so.