
India Unable to Compete With Record Low Solar Tariffs in Gulf Region

An Analysis of Why the Gulf Region Has the Cheapest Solar Tariffs

Executive Summary

To sustainably meet growing electricity demand, countries in the Arabian Gulf are increasingly promoting renewable energy.

The International Renewable Energy Agency estimates that by 2030, the region will boast 72.0 gigawatts (GW) of renewable capacity, mostly containing solar at 65.5GW (90%).

In the last few years, the Gulf region has seen significant investor growth in large utility-scale solar photovoltaic projects, particularly in the United Arab Emirates and Saudi Arabia.

The discovered solar tariffs in some of these projects are the lowest in the world, with record low tariffs quoted in project proposals stemming from Abu Dhabi, Qatar, Dubai and Saudi Arabia.

It is unlikely that India or indeed other countries will be able to achieve the same low tariffs recorded in the Gulf, as the economic makeup of each country plays a direct role in determining tariffs.

We expect solar tariffs to continue to decline by 5-10% over the next decade, providing the lowest cost source of energy generation everywhere in the world.

Comparing Gulf Region and Indian Solar Tariffs

Solar tariffs in the Gulf region are the lowest in the world, even lower than the tariffs being achieved in India.

To understand how the Gulf region is achieving such low tariffs, and whether those

**The Gulf region
has seen significant
investor growth.**

tariffs can be achieved in other countries, we developed a financial model as a basis for comparison.

Based on current market conditions, we arrived at a tariff of US¢1.78/kWh. When we reviewed the impact of certain parameters on tariffs, including project cost, capacity utilization factors, interest rates, return on equity and debt equity ratio, the tariff landed between US¢1.65 - 1.93/kWh.

**Solar tariffs in India
are almost double the
tariffs in the Gulf region.**

Applying this model to India, we found solar tariffs landed in the range of US¢3.46 – 3.56/kWh¹, almost double the tariffs in the Gulf region.

The key reasons why the Gulf region has lower tariffs than India include:

- lower cost of US\$ denominated, long-dated financing;
- lower expected return on equity (ROE);
- higher solar resources leading to higher capacity utilization factor (CUFs);
- no corporate taxes nor duties on equipment and power sales; and
- negligible land cost for solar projects.

Awarded tariffs in the Gulf countries and in India have zero inflation indexation over the 25-year power purchase agreement, meaning the real tariff is contractually set to decline annually, driving electricity system deflation.

¹ 1 USD has been considered equivalent to 75 Indian Rupees.

Introduction

Gulf countries are known for the possession and exploitation of high reserves of non-renewable oil and fossil (natural) gas resources.

Over the past decade, various countries in the region have been developing renewable energy resources, especially solar energy, to compensate diminishing energy reserves by replacing them with abundant clean natural resources.

While government policies have been shifting to encourage the uptake of renewable energy, capacity additions across the Gulf region remain low in comparison to non-renewable energy capacities.

A growing population and ongoing economic development has put pressure on existing energy resources and in some cases, has created a significant gap between electricity production and demand.

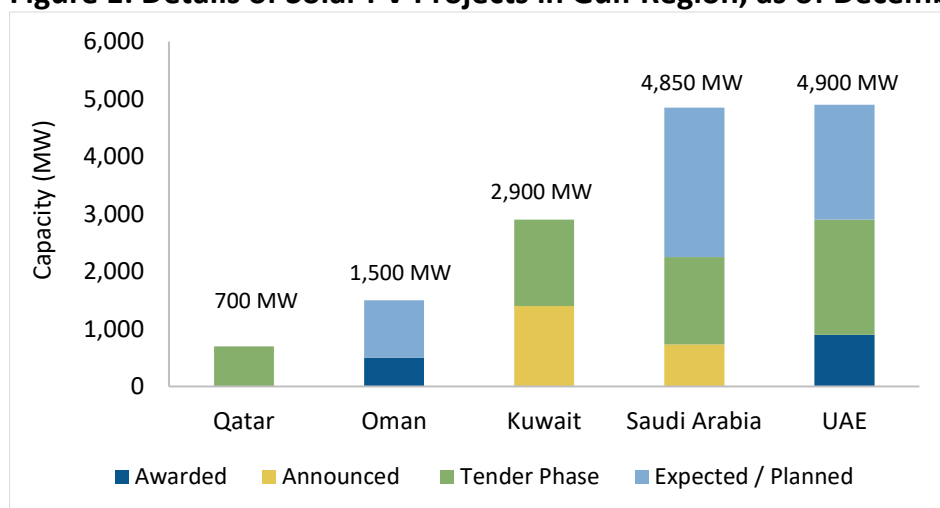
There is also growing recognition that as the world moves to address climate change, the demand for fossil fuels will clearly have to be significantly curtailed.

The Gulf region is looking to develop record low cost renewable energy as part of its economic transition and diversification to address both this key risk and opportunity for the region.

To meet the growing demand for sustainable electricity, and to reduce fossil fuel use domestically in order to free up more oil and liquefied natural gas (LNG) capacity for export, the countries in the region are increasingly promoting renewable energy.

Presently, some 15GW of PV-based solar projects are under different stages of development/planning. A country-wise break-up of capacity is presented in the graph below.

Figure 1: Details of Solar PV Projects in Gulf Region, as of December 2019

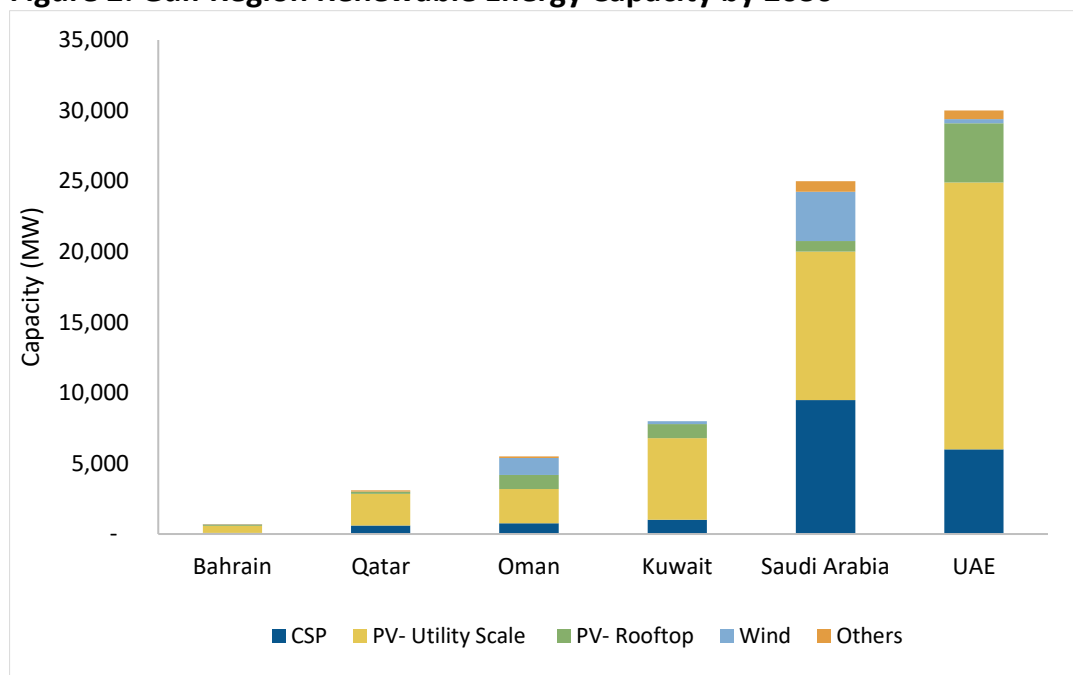


Source: MESIA Annual Solar Outlook Report, 2020, JMK Research.

By 2030, based on renewable energy targets set by each country in the Gulf region, IRENA estimates that 72GW of renewable capacity is planned, out of which 65.5GW (almost 90%) would be from solar.²

The break-up of each country's planned installed capacity is presented below.

Figure 2: Gulf Region Renewable Energy Capacity by 2030



Source: IRENA.

Gulf countries are shifting to renewables because:

- The region is endowed with considerable renewable energy potential (especially solar energy). Solar PV technology has strong potential for deployment in the region, with Saudi Arabia and UAE leading the way.
- Renewable energy is now the most cost competitive form of power generation in the region, replacing traditional energy sources to meet fast-growing domestic energy demand.
- Renewables are the most practical and readily available climate solution to reducing greenhouse gas emissions. With the rapid development of renewable energy technologies, 136 million tonnes of CO₂ emissions can likely be removed from the Gulf region by 2030.³
- Water scarcity is an acute challenge in the Gulf region. As per the World Resources Institute, four out of six countries in the region are within the top

² IRENA. [Renewable Energy Market Analysis: GCC 2019](#). January 2019.

³ Ibid.

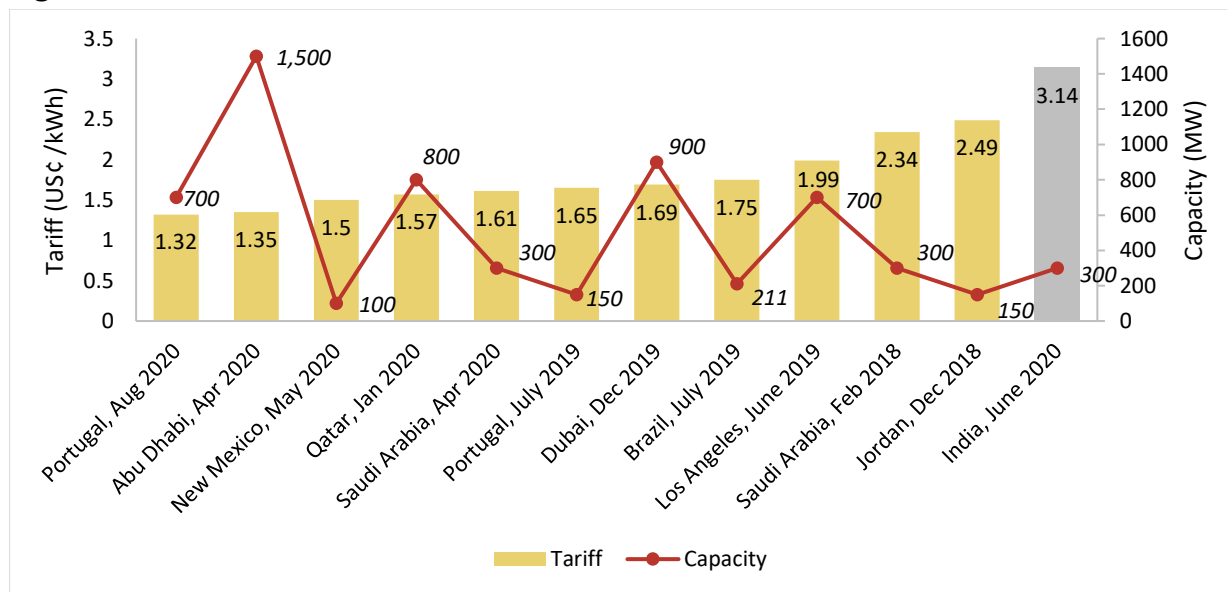
ten water-stressed countries in the world. Water demand in the region is expected to increase five-fold by 2050.⁴ With increases in renewable energy capacity and a reduction in fossil fuel-based generation, estimated water consumption is likely to be reduced by 12% in the power sector.

- The power generation curve of solar power plants meets the growing demand from summer air conditioning and other electrical appliances, with solar peaks catering to demand peaks during the daytime.
- Renewable energy installations can facilitate an increase in employment opportunities. As per IRENA estimates⁵, by 2030, renewable energy can generate around 2 million jobs in the region, with solar energy accounting for almost 89% of those jobs.

Tariff Trends

In the last few years, the Gulf region has achieved lowest tariffs in the range of US¢1.35-1.80/kWh, On 24 August 2020, another low record is been set in Portugal with tariff discovery of US¢1.32/kWh in the recent bid of 700MW solar energy auction. While India’s tariffs, whilst some of the lowest in the world, are in the range of US¢3.14-3.56/kWh

Figure 3: Lowest Solar Tariff Trends Across the World vs. India



Source: JMK Research.

The discovered solar tariffs of some of these projects are the lowest in the world with most priced below the cost of fossil fuel generation, despite the abundance of low cost fossil fuel resources in the region.

⁴ IRENA. *Five Reasons Why Countries in the Gulf are Turning to Renewables*. October 2019.

⁵ IRENA. *Renewable Energy Market Analysis: GCC 2019*. January 2019.

Indeed, tariffs in the Gulf countries are almost half the rate of already low Indian solar tariffs. (A detailed analysis of this difference is discussed later in the report.)

In the last 8 – 10 months, solar tariffs for large scale-utility projects in the Gulf region have been in the range of US¢1.35 –1.70/kWh.

Some of the recent projects allotted in this region include:

- **In October 2019**, the tariff for a 900MW PV solar project in Dubai's Mohammed Bin Rashid Al Maktoum Solar Park was awarded at US¢1.69/kWh with a 25-year PPA by the [Dubai Electricity and Water Authority \(DEWA\)](#) to a consortium with ACWA Power owning 40% as the project operator, with DEWA holding the remaining 60%. This project will constitute the fifth phase of the total planned 5GW being installed at the Park.
- **In January 2020**, [Qatar General Electricity and Water Corporation \(Kahramaa\)](#) concluded the bidding for an 800MW solar tender. The winning bid was submitted by a consortium including Total Energy and Marubeni Corp. at a price of US¢1.56/kWh for the 25-year power purchase agreement (PPA).
- **In April 2020**, the world's record lowest price for solar electricity of US¢1.35/kWh LCOE was discovered in a 1.5GW solar tender by UAE's [Emirates Water and Electricity Company \(EWEC\)](#) for a project located in Abu Dhabi. The project was awarded to consortium led by Abu Dhabi National Energy Company (TAQA) and Masdar (a combined 60%), with partners Jinko Power and EDF energy (a combined 40% equity share). Jinko Solar is also one of the leading Chinese module suppliers and hence there is a possibility that module prices for this project will be highly competitive and less than standard market prices.
- **In April 2020**, the [Renewable Energy Project Development Office \(REPDO\)](#) of Saudi Arabia called for bids in the second round of its renewable energy program. With tenders open for 5 different projects, the lowest bid received was for the Jeddah project (300MW) at a tariff of US¢1.62/kWh, offered by the Masdar and French utility EDF consortium. A total of 1.47GW of solar tenders had been received.

Analysis of Tariffs in the Gulf Region

To understand tariff trends and how tariffs are constructed in Gulf region utility-scale solar PV projects, we developed a financial model based on feedback received from various industry experts working on solar projects in the region.

Using a sample project as the basis for our analysis, we chose a 300MWac capacity solar project located in Abu Dhabi which was allocated by the central utility, the Emirates Water and Electricity Company (EWEC) through a bidding process to an Independent Power Producer (IPP) with a fixed price PPA for 25 years.

Table 1: Assumptions for Tariff Analysis in Gulf Region

S. No	Parameter	Units	Value
1	Project Capacity (AC)	MW	300
2	DC Overloading Ratio ⁶	%	25%
3	Project Capacity (DC)	MW	375
4	Project Cost (On DC basis)	US\$ million/MW	0.42
5	DC Capacity Utilization Factor (CUF) – 1st year	%	25%
6	AC Capacity Utilization Factor (CUF) – 1st year	%	31.25%
7	Degradation Factor	%	1.5% for 1st year 0.5% for subsequent years
68	Long Term Interest Rates (US\$ denominated)	%	3.0%
9	Return on Equity (US\$ linked)	%	6.0%
10	Loan Tenor	Years	25
11	Depreciation (Straight Line Method)	%	3.6%
12	Debt/Equity Ratio		80:20
13	Corporate Tax Rate	%	Zero
14	Project Location		Abu Dhabi

Source: JMK Research.

For our analysis, bifacial modules were considered along with single axis trackers⁷ (the most prevalent type of solar projects in the Gulf region), leading to higher energy generation including raising CUFs by 3-5% to an assumed 25%. Due to water scarcity in the region, robotic module cleaning systems were also included. We considered land to be free of cost, and there are no infrastructure costs for the transmission of power. Further, in our sample project, no taxes are applicable on equipment including modules, inverters, balance of system (BOS). (Other assumptions considered for our analysis are summarised in Table 1 above.)

We determined key project costs to include modules (53%), inverters (6%), and BOS costs at 32%, including single axis trackers and robotic module cleaning systems (to significantly reduce water usage). Other project costs, including preoperative expenses, contingency costs, and costs incurred from interest during construction (IDC) constitute the balance (9%) of the total project cost. Considering all of these estimates, the per MW (DC capacity) project cost is US\$0.42 million/MW.

Based on these assumptions, we arrived at a tariff of US¢1.78/kWh, which is in the range of prevalent tariffs in the Gulf region as observed in some of the recent bids.

⁶ A solar power plant rarely produces nameplate capacity power as solar modules operate at their maximum efficiency only during limited peak hours. It has, therefore, become routine industry practice to over-size DC module capacity to generate more power - a concept commonly known as DC overloading. For Bifacial modules, the overloading ratio generally varies between 23 - 25% for optimum generation.

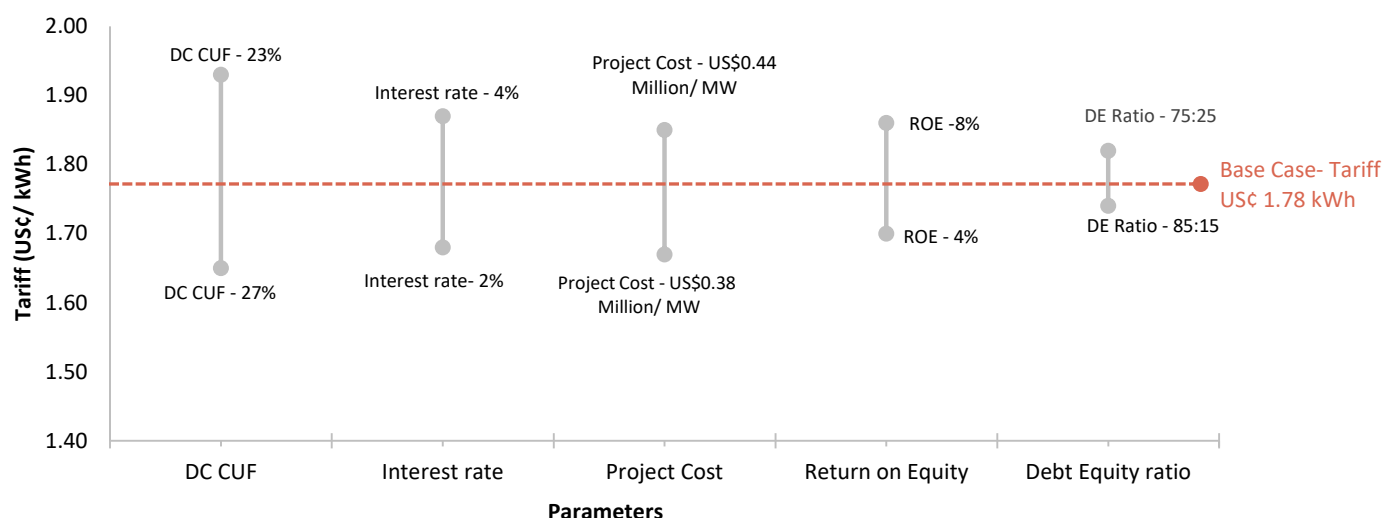
⁷ PVTech. [PPA sign-off brings progress to ultra-cheap 900MW solar project in Dubai](#). April 2020.

Risk and Sensitivity Analysis

We also performed a risk and sensitivity analysis on various fluctuating parameters including project cost, CUF, interest rates, ROE and Debt Equity Ratio (D:E) to ascertain the impact on tariffs (See Figure 4).

From this, we observed tariffs varying between US¢ 1.65 - 1.93/kWh, with CUF and interest rates having the maximum impact on tariffs.

Figure 4: Sensitivity Analysis Viz-A-Viz Tariff for Solar Projects in the Gulf Region



Source: JMK Research.

Further key findings include:

- Capacity Utilisation Factor (CUF):** Project CUF is dependent on project location, operations and maintenance (O&M) practices adopted, equipment quality, and technology. Since the Gulf region is a desert region with higher quantities of dust, robotic cleaning is necessary for plant maintenance. Any failure in O&M practice or equipment can lead to less generation. A 2% drop in CUF results in an ~8% increase in tariff, and a 2% increase in CUF results in a tariff decrease by about 7%.
- Project costs:** Modules constitute 53% of project costs in the Gulf region. In certain bids, leading global module manufacturers are participating in consortiums with government entities. Hence, there is a possibility that module prices for such projects are highly competitive and less than standard market prices. A 10% fall in project costs (US\$0.04 million/MW) leads to a 6% tariff reduction, while an increase in project cost by 5% leads to a tariff increase of 4%.

- **Interest rates:** Prevalent interest rates vary from country to country and lie within the range of 3% - 6% in the Gulf region. We have assumed 3% per annum for a US\$-indexed borrowing cost, given the state-owned enterprise-backed PPA leverages the sovereign country rating. An increase or decrease of 1% in interest rates leads to approximately a 5% increase/decrease in the price of tariffs.
- **Return on equity (ROE):** ROE also plays a major role in tariffs. The expected ROE in the Gulf region is low due to 25-year PPA's, and sovereign risk means projects are more akin to a long term cashflow annuity of an infrastructure project rather than a listed corporate equity type ROE. A 2% change in the base ROE changes the tariff by about 4%.
- **Debt equity ratio (D:E):** In the Gulf region, governments are heavily promoting renewable energy projects. Also, most of these countries have historically strong economies with surplus funds, leading to high leveraging of the D:E ratio. A 5% change in debt equity ratios leads to approximately a 2% change in tariffs.

Comparison of Solar Tariffs: Gulf Region vs India

In this section, we compare the lowest solar tariffs in the Gulf region with the Indian market.

For the Indian market, we considered two scenarios:

1. One project which has bifacial modules with mono Passivated Emitter and Rear Cell (PERC) technology with single axis trackers.
2. A second project, which is more prevalent in this region, is a project with mono PERC modules with fixed tilt.

The following table shows the assumptions for the two different projects.

Table 2: Assumptions for Analysing Tariffs in The Gulf Region and India

S. No	Parameter	Gulf region	India (Case 1)	India (Case 2)
1	Project Type	Bifacial Modules with Single Axis Tracker	Bifacial Modules with Single Axis Tracker	Mono PERC module with fixed tilt
2	Overloading ratio	25%	25%	40%
3	Project Cost (MW DC), US\$m/ MW	0.42	0.46	0.38
4	DC CUF – 1st year	25%	22.5% ⁸	19.5%
5	AC Capacity Utilization Factor (CUF) – 1st year	31.25%	28.12%	27.3%
6	Degradation Factor	1.5% for 1st year	1.5% for 1st year	1.5% for 1st year
		0.5% for subsequent years	0.5% for subsequent years	0.6% for subsequent years
7	Cost of Financing	3.0%	9.5% ⁹	9.5%
8	Loan currency	US\$	Indian Rupee	Indian Rupee
9	Loan Tenor	25	18	18
10	Return on Equity	6.00%	13.00%	13.00%
11	Useful Life of Asset (years)	25	25	25
12	Depreciation (Straight Line Method)	3.6%	5.83% for initial 12 years 1.84% for balance 13 years	5.83% for initial 12 years 1.84% for balance 13 years
13	Debt/Equity Ratio	80:20	75:25	75:25
14	Corporate Tax Rate	Zero	15% ¹⁰	15%
	Tariffs Discovered (USc/ kWh)	1.78	3.56	3.46

Source: JMK Research.

Note: 1 USD is considered equivalent to 75 Indian Rupees.

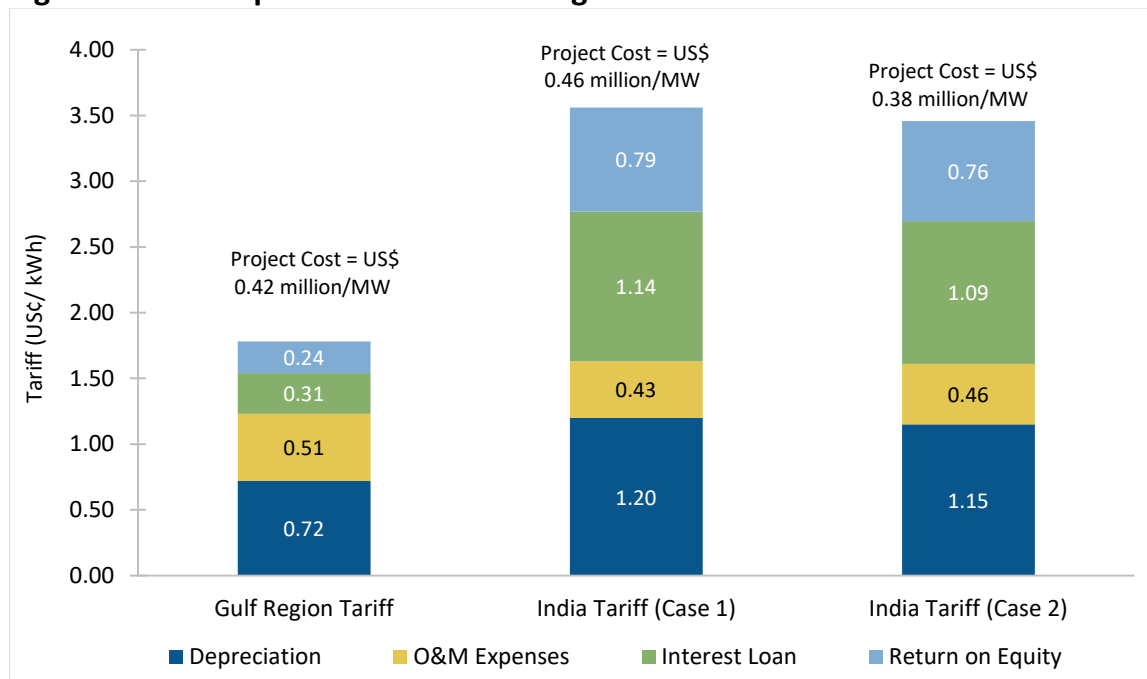
In the following chart, we show the break-up of tariff components in the Gulf region and India for the various scenarios considered. As can be seen, solar tariffs in India are almost double the tariffs in the Gulf region.

⁸ With the installation of bifacial modules, single axis tracker and robotic cleaning systems, energy generation increases by almost 18 – 20%.

⁹ Interest rates have been reduced by 1.5 – 2% in recent months in India due to lower RBI repo rates.

¹⁰ Economic Times. [New power generation companies to be taxed at 15%](#). 1 February 2020.

Figure 5: Break-up of Tariffs for Gulf Region and India



Source: JMK Research.

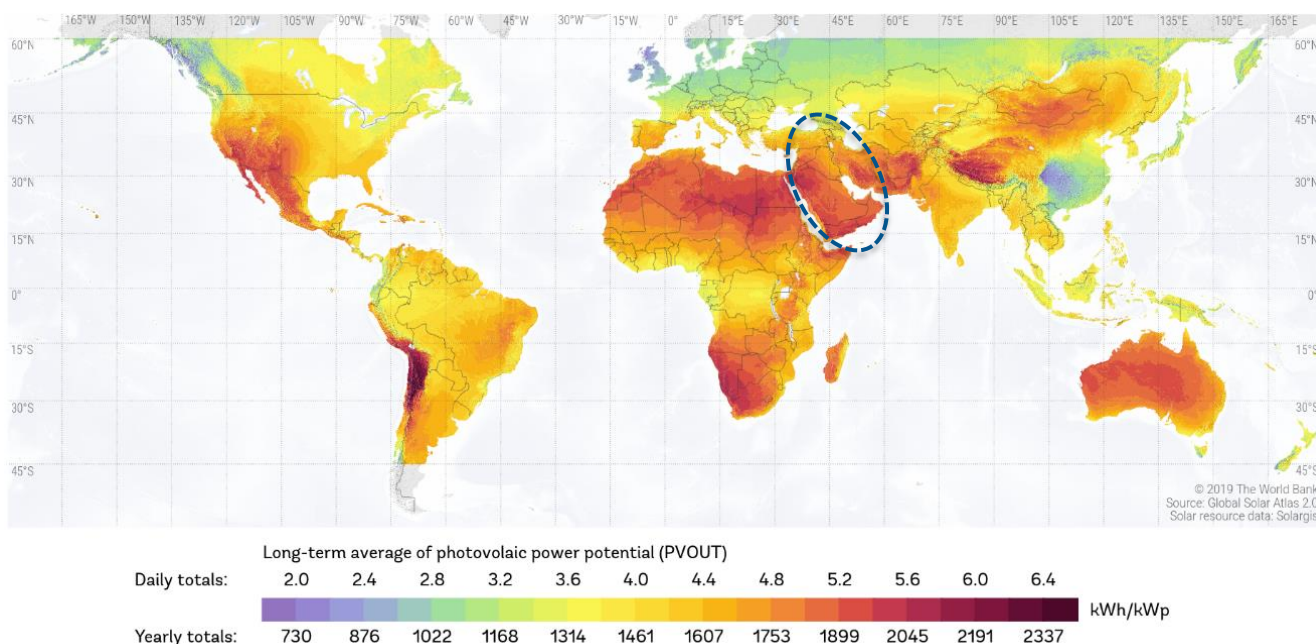
Note: 1 USD is considered equivalent to 75 Indian Rupees.

* Case 1- Project with bifacial mono PERC modules with single axis trackers; Case 2- Project with mono PERC modules with fixed tilt.

Some of the reasons for lower tariffs in the Gulf region vis-a-vis India are:

- **Lower project cost:** Project costs in the Gulf region are lower compared to those in India, leading to lower tariffs. Lower project costs can be attributed to the following factors:
 - Negligible land cost
 - No infrastructure costs for power transmission
 - No corporate taxes nor duties payable on the purchase of equipment for constructing solar projects
 - Lower Interest During Construction (IDC) for the project.
- **Higher CUF:** The Gulf region is endowed with the highest solar resources in the world, as highlighted in the map below which shows global solar radiation. The Gulf region's higher solar resources, ranging from 2,100 – 2500 kW/m² leads to higher CUFs (~2.5% higher than India). This prompts higher generation and thereby lower tariffs. Further, with the installation of a single axis tracker, bifacial modules and robotic module cleaning systems, the generation is higher than most projects in India.

Figure 6: World Solar Resource Map



Source: SolarGIS.

- **Depreciation:** Depreciation costs in the Gulf region are almost half those in India (refer Figure 5) as the Gulf region has lower capital costs.
- **Operations and maintenance (O&M) expenses:** O&M expenses are higher in the Gulf region due to higher labour costs.
- **Lower interest rates and longer principal repayment tenor:** As can be seen from the above tariff break-up, the major difference between tariffs in the Gulf region and India is interest rates. The prevalent interest rates for solar projects in the Gulf region (3 - 6%) are almost one third of the interest rates in India (9 - 11%) leading to lower tariffs. Also, the Gulf region's repayment period for long term debts can be prolonged to 25 years (aligned to the useful life of the plant and the contract term of the PPA), which leads to higher leveraged cash flows for equity owners and better returns.
- **Higher debt-to-equity ratio (D:E):** The typical D:E ratio in the Gulf region is 80:20 (and can be as high as 85:15) whereas in India, the D:E ratio is 70:30. The higher D:E ratio leads to lower tariffs (as interest rates are always lower than expected ROE).
- **Return on Equity (ROE):** ROE also plays a major role in tariff price setting. The expected ROE is governed by the prevalent interest rates in a country and the currency denomination of the tariff (US\$ vs Indian rupee), and also reflects inflation rates and sovereign risk rating differentials. The expected ROE in the Gulf region is around 6 - 8% pa whereas the expected ROE for Indian projects is in the range of 12 - 15%.

Conclusion

Recent solar tariffs in Abu Dhabi, Dubai, Saudi Arabia and Qatar have set global record low benchmarks.

Despite having higher labour costs, solar project costs are lower in the Gulf region than in India.

The Gulf region can achieve tariffs in the range of US¢1.65 – 1.80/kWh mainly due to lower costs in financing and the ability to garner higher generation. Other factors, such as technological advancements in modules, weather trackers and robotic cleaning systems (leading to less soiling losses) have been installed, and lower engineering, procurement, and construction (EPC) costs also have an impact.

The Gulf region has lower or negligible taxes applicable on equipment costs and long-term income tax holidays on the sale of power. Also, project developers have to pay negligible land prices for solar projects and evacuation infrastructure is provided by the central utility.

Further, IPPs in the Gulf region can bid for larger scale capacities at a single project location, leading to economies of scale that drives down both capital expenditure and operational expenses, again resulting in lower tariffs. Moreover, there appears to be fierce competition to win trophy projects in the region, with bidders quoting extremely low solar tariffs which has led to very aggressive bidding in recent times, resulting in headline record low rates.

With the fast-paced growth of the Gulf region's solar market and its high future growth prospects, some foreign IPPs have been very risk tolerant in their bidding for one-off trophy solar projects in order to gain prominence and the advantageous position of 'learning by doing' in this upcoming market. As government owned entities have the majority stake (mostly around 60%) in these projects, the virtually sovereign-backed credit risk is lower, leading to the availability of low-cost financing at negligible interest rates. Also, government-owned organisations who have invested in these projects have very low expectations of ROE invested.

The circumstances leading to lower solar tariffs in the Gulf region cannot be replicated in the Indian market as most of the factors, like low interest rates, zero taxes and lower ROE expectations, are fundamentally driven by the way economics functions across different countries in the region, and hence cannot be changed. For instance, if India imposed import duties on solar modules, the required Indian solar tariff would widen further.

We note the ongoing technological development of solar combined with ever larger factories driving economies of scale means solar tariffs will continue to see 5-10% annual declines over the coming decade, driving ever-stronger competitiveness against incumbent fossil fuel alternatives.

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