Middle East Energy Dubai

Stable Grids for Clean Energy – Growing FACTS Demand in the GCC

Whitepaper by

Power Technology Research
Research | Analysis | Consulting

Introduction

Introduction

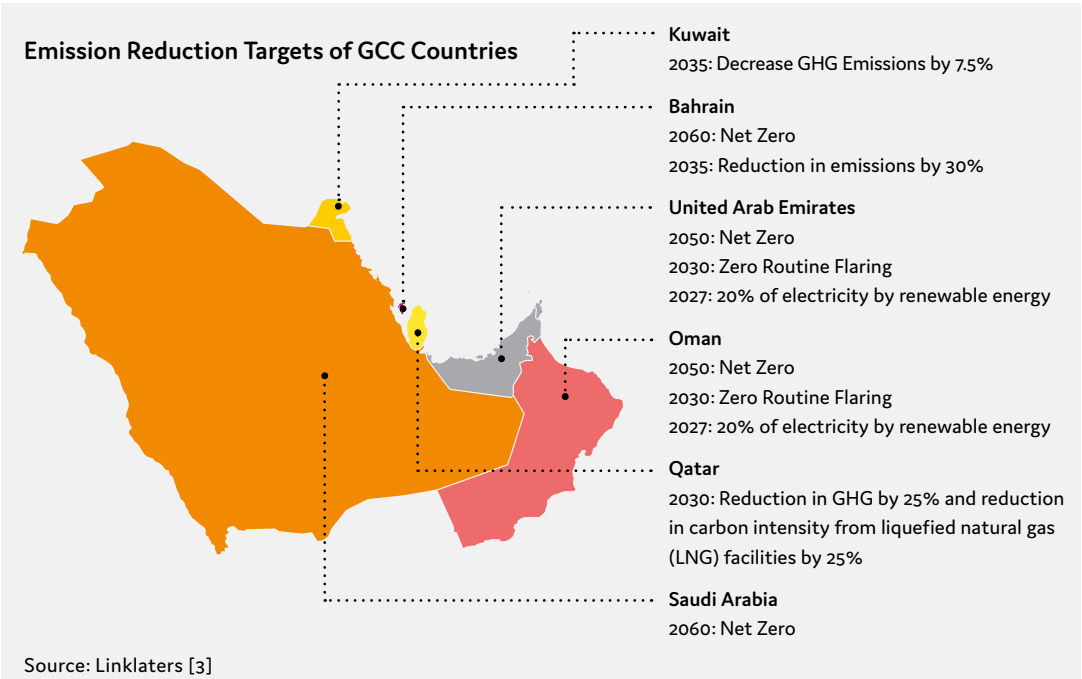
The roll out of renewables across the globe aimed at displacing fossil fuels from the energy mix has gained a lot of traction recently as more and more countries are defining their carbon neutrality goals. Q4 of 2021 in this regard was quite eventful as UN Climate Change Conference (COP26) was held at Glasgow in November 2021. During the conference, the participating countries discussed and agreed upon several initiatives which are expected to enable global transition to a greener future. For instance, a significant outcome of COP26 included countries not only reaffirming their pledge towards reduction of emissions but provision of financial support as well to cap average rise in global temperature to 1.5 degrees [1]

Nearly all the advanced and major economies across the globe have already set their clean energy goals including the countries in Middle East, specifically GCC region. Middle Eastern countries are major producers and exporters of oil and gas in the world and major share of their energy and electricity demand is served by the fossil fuels.

According to IRENA's "Renewable Energy Market Analysis: GCC 2019" report [2], by the first half of the last decade (2010-2020), countries in the region were already evaluating renewable energy as a potential replacement to conventional energy sources. However, the scenario changed drastically in the second half of last decade as the price of PV hit record low due to the consecutive auction rounds in 2016 and 2017 [2].

With current targets set by the gulf countries and effective planning, a reduction of 22% emissions in power sector by 2030 is achievable [2]. UAE became the first country in the middle eastern region to have pledged net zero emissions by 2050 followed by a commitment to reduce carbon emissions by 23.5% by 2030. Similarly, Saudi Arabia plans to get to net zero by 2060. However, Saudi Aramco has committed to net zero carbon emissions 10 years earlier than the national target. Qatar is planning to reduce greenhouse gas emissions by 25% followed by reduction of carbon intensity from LNG installations by 25% by 2030 according to its National Climate Action Plan. Whereas Oman and Bahrain plan to achieve net zero carbon emissions by 2050 and 2060, respectively. [3]

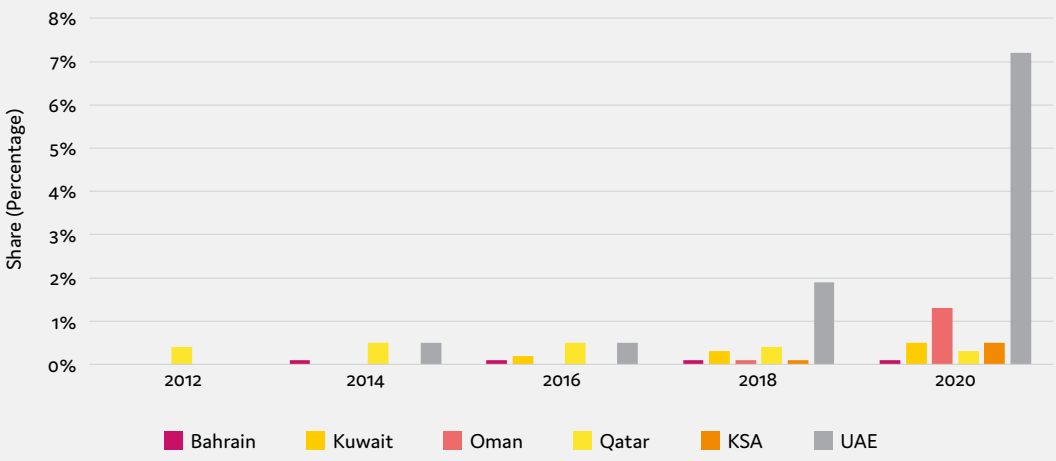
Figure 1: Emission Reduction Targets of GCC Countries.



Source: Linklaters [3]

The region cannot achieve these carbon neutrality targets without a significant adoption of renewable energy. So far, the share of renewables in the whole energy mix has been low, ranging from <1% in most GCC markets to 7% in UAE, though it has increased over the years.

Figure 2: Share of Renewables in GCC's Generation Capacity



Source: IRENA [4]

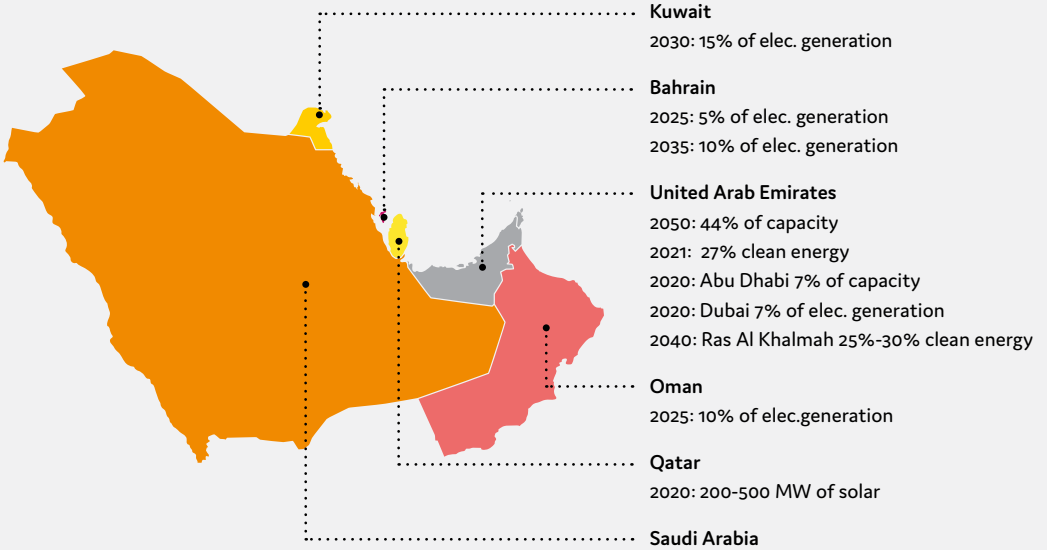
While the oil and gas sectors continue to contribute significantly to the region's GDP, the GCC's economic policy is increasingly focusing on diversification. This effort for diversification is also reflected in the renewable energy targets set by the countries in the coming years, in addition to steep reductions in the fossil-fuel based electricity subsidies in the last decade e.g., -11% in Saudi Arabia and -25% in UAE. These two elements, combined with the overall efforts by the regional leadership to reduce emissions via changing energy mix, will result in the high adoption of renewables moving forward. [2]

Increasing Adoption of Renewable Energy in GCC

The share if renewable energy in the generation mix of the region is set to improve in the coming years with countries setting ambitious targets of changing the generation capacity mix to cleaner sources. UAE and Saudi Arabia are leading the region with a target of 44% and 30% clean energy in the generation mix by 2050 and 2030, respectively. Solar power is the preferred renewable technology due to the high solar power potential in the region, with high number of PV projects in the pipeline followed by CSP and then wind energy projects. Figure 3 highlights the individual renewable energy targets set by GCC countries: planning to reduce greenhouse gas emissions by 25% followed by reduction of carbon intensity from LNG installations by 25% by 2030 according to its National Climate Action Plan. Whereas Oman and Bahrain plan to achieve net zero carbon emissions by 2050 and 2060, respectively. [3]

Figure 3: Renewable Energy Targets of the GCC Countries

Emission Reduction Targets of GCC Countries



Kuwait
2030: 15% of elec. generation

Bahrain
2025: 5% of elec. generation
2035: 10% of elec. generation

United Arab Emirates
2050: 44% of capacity
2021: 27% clean energy
2020: Abu Dhabi 7% of capacity
2020: Dubai 7% of elec. generation
2040: Ras Al Khalmah 25%-30% clean energy

Oman
2025: 10% of elec.generation

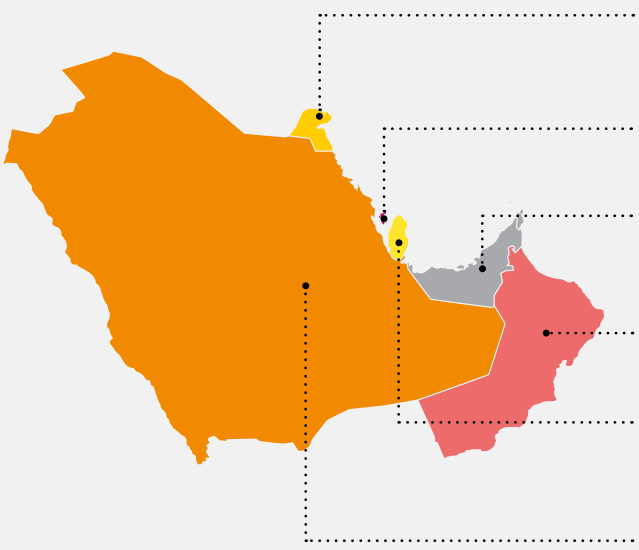
Qatar
2020: 200-500 MW of solar

Saudi Arabia
2020: 3.45GW
2023: 9.5GW by 2023 (10% of cap)
2030: 30% of generation from renewables and others (mainly nuclear)

Source: IRENA Renewable Energy Market Analysis: GCC 2019 [2]

Figure 4: Energy Efficiency Targets of the GCC Countries.

Energy Efficiency Targets of the GCC Countries



Kuwait
2020: ↑ 5% generation efficiency
2030: ↑ 15% generation efficiency

Bahrain
2025: ↓ 6% elec. consumption

United Arab Emirates
2050: ↓ 40% elec. consumption
2030: Dubai: ↓ 30% elec. consumption

Oman
2030: ↓ 2% emission

Qatar
2022: ↓ 8% per - capita elec. consumption
2022: ↓ 15% per - capita water consumption

Saudi Arabia
2021: ↓ 8% in elec. consumption
2021: ↓ 14% in peak demand

Source: IRENA Renewable Energy Market Analysis: GCC 2019 [2]

UAE

In 2017, UAE unveiled 'Energy Strategy 2050' which aims to increase the contribution of clean energy in the energy mix of the country from 25% to 50% by 2050 followed by reduction in carbon emissions from electricity generation by 70% in turn saving AED 700 billion by 2050. However, the UAE government plans to invest AED 600 billion by 2050 in order to meet the increasing demand for energy and incorporation of clean energy sources in the energy mix of the country. UAE's 'Energy Strategy 2050' targets an energy mix in the future which includes renewables, nuclear and natural gas to meet country's not only economic requirements but also the environmental goals as well: 44% renewables, 38% gas, 12% coal and 6% nuclear power generation. [5]

Kingdom of Saudi Arabia

Saudi Arabia has reaffirmed half a decade old commitment to provide power to 50% of the country with renewable energy sources as per recently announced 'green initiative'. Under National Renewable Energy Program (NREP) Saudi Arabia has started developing large scale renewable energy projects aimed at meeting ambitious renewable energy goals. Large scale projects have already been implemented including ACWA Power, a power generation and water desalination company, linking the 300-megawatt (MW) Sakaka solar power plant to the electric grid (the country's first utility-scale renewable energy facility) in November 2019 and the 400-MW Dumat Al Jandal wind farm, Saudi Arabia's first commercial wind project, going online in August 2021. In April 2021, the kingdom has also inked PPAs for seven solar projects with a total capacity of 3GW expected to be completed in coming years. [6] [7]

Oman

Under National Energy Strategy, Oman has set a target of generating 30% of electricity from renewable sources by 2030. It plans to increase electricity generation capacity of the country through renewable independent power projects (IPPs) including a wind farm in Dhofar, two solar IPPs in Manah and eleven solar diesel hybrid facilities followed by the 'Sahim' initiative under which small scale solar panels on residential and commercial buildings will be installed. Oman Power and Water Procurement Company (OPWP), the sole power purchaser in the Sultanate, has set a target of procuring 3.05 GW of renewable based capacity which is in line with the set target by the government of Oman of 10% share of renewables in the energy mix by 2025. [8]

Kuwait

Kuwait today is completely dependent on fossil fuels for generation of energy and water desalination. As per Ministry of Electricity and Water, the demand for energy will triple by 2030 [9] and enough fossil fuel resources will not be available to maintain country's current economic and social growth. Hence, the country has plans to diversify its energy mix and has set a target to increase share of renewables to 15% till 2030. [10]

Qatar

Qatar primarily relies on natural gas reserves for electricity generation in the country. However, under National Vision it plans to diversity energy sector and achieve 20% non-gas energy by 2030 through investments in the solar PV. Following these goals, Qatar is developing first large scale (800 MWp) solar plant near Doha which will sell electricity to Qatar General Electricity and Water Corporation- Kahramaa under a 25-year PPA. [5]

Bahrain

Bahrain's Vision 2030 provides an outline for measures aimed at protecting the natural environment, reducing the carbon emissions along with the promotion of sustainable energy. National Renewable Energy Action Plan has set a target of 5% renewables in the mix for 2025 followed by 10% target for 2035. Under the action plan Bahrain will require to produce 280 MW of electricity from renewables by 2025 and 710 MW of electricity by 2035. [5]

Adoption of Renewable Energy and the Role of FACTS

With the incorporation of intermittent renewable energy resources in the grid, and the shutdown of conventional generators, issues like voltage stability and loss of inertia arise. To address these issues Flexible AC Transmission Systems (FACTS) including SVCs, STATCOMS, Series Compensation and Synchronous Condensers are being commissioned globally.

STATCOM devices are being installed to provide voltage stability and synchronous condensers to provide inertia and short circuit strength to the system when it gets unstable due to renewables. Further, as challenges arise with the growing demand of electricity and changing energy mix causing bottlenecks in transmission infrastructure, series capacitors are deployed which are one of the oldest FACTS technologies.

Here are three examples of FACTS installations around the world where the utilities commissioned FACTS devices to increase grid stability in view of decreasing rotational generation and increasing renewables in the mix:

Minnesota Power

In 2005, 95% of the utility's power came from coal power plants, however, currently around 50% of the power comes from clean energy sources. Minnesota Power is left with only two coal units as it depends on wind energy (870 MW), hydro (>370 MW) and solar energy (11 MWp). The utility has plans to decarbonize its grid and has set a target to achieve 100% carbon free energy by 2050. [11]

In order to stabilize the electric grid following the incorporation of renewables as coal fired generation was reduced, North Shore Switching Station has been commissioned which hosts STATCOM, which manages the surges and dips that grid encounters due to intermittent renewable generation while allowing for efficient utilization of assets.

ElectraNet

South Australia is rapidly transitioning to renewable energy generation, causing issues in the grid. As per Australian Energy Market Operator (AEMO) two synchronous condensers were installed by South Australian transmission operator ElectraNet, followed by installation of two more synchronous condensers at Robertstown.

According to ElectraNet, synchronous condensers turned out to be the lowest cost option among others, and hence, were installed to provide strength to the system and resolve issues related to the loss of inertia to ensure maintenance of system frequency despite growing share of renewables in the electricity grid. [12]

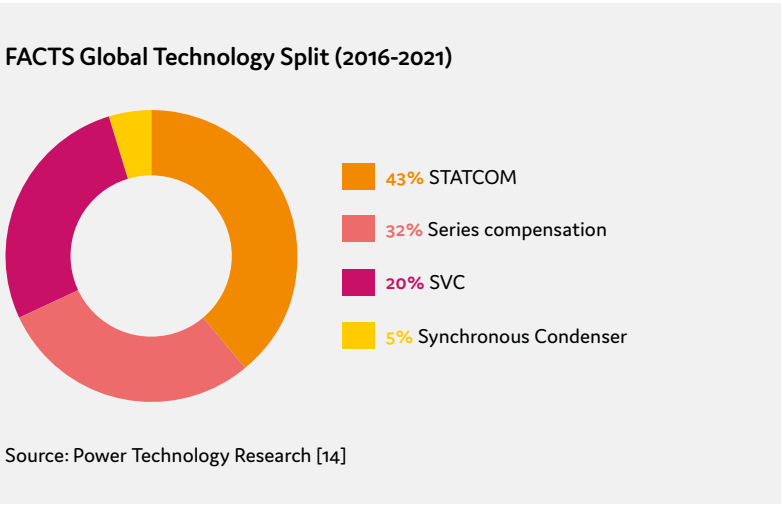
Southwest Sweden

Following months of test operation, a STATCOM plant has been commissioned which will provide reactive power to the transmission network and regulate voltage. This is essential for operational reliability of electricity to southwestern Sweden following the shutdown of two nuclear power blocks in Ringhals in 2019 and 2020. [13]

Global FACTS Market Landscape

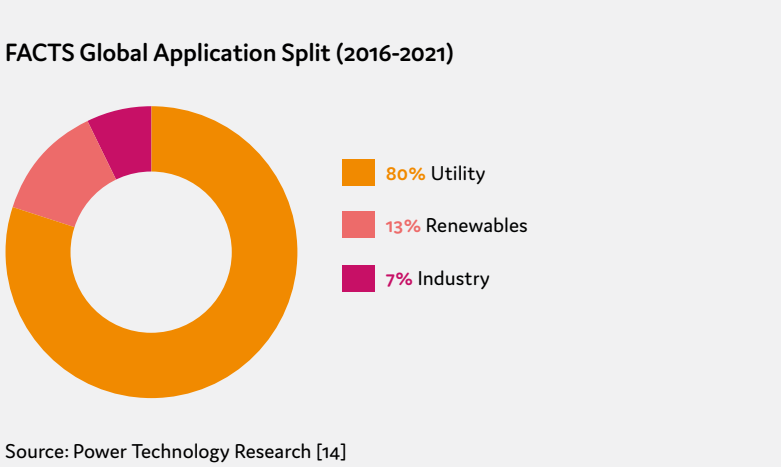
Around the world, more and more FACTS devices are being installed to stabilize electricity grids. In 2021 15.2 GVAr of SVCs & STATCOMs were commissioned around the world. From 2016-2021, 43% (by capacity) of the installed FACTS devices were STATCOMs while 32% were Series Compensation followed by SVCs and Synchronous Condensers accounting for 20% and 5% of the installations during that period, respectively. From an end-application perspective, 80% of these FACTS devices commissioned between 2016-2021 were installed by the utilities while 13% were installed with the renewables. Only, 7% of the FACTS installed were in the industry. [14]

Figure 5: FACTS global technology split (2016-2021)



Source: Power Technology Research [14]

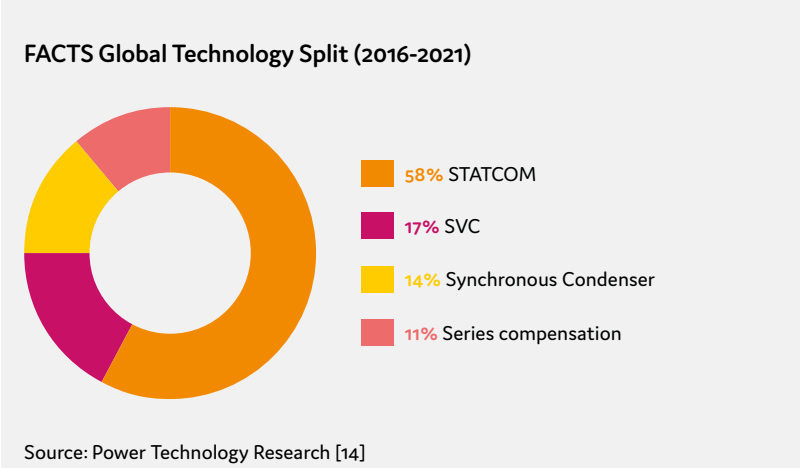
Figure 6: FACTS global application split (2016-2021)



Source: Power Technology Research [14]

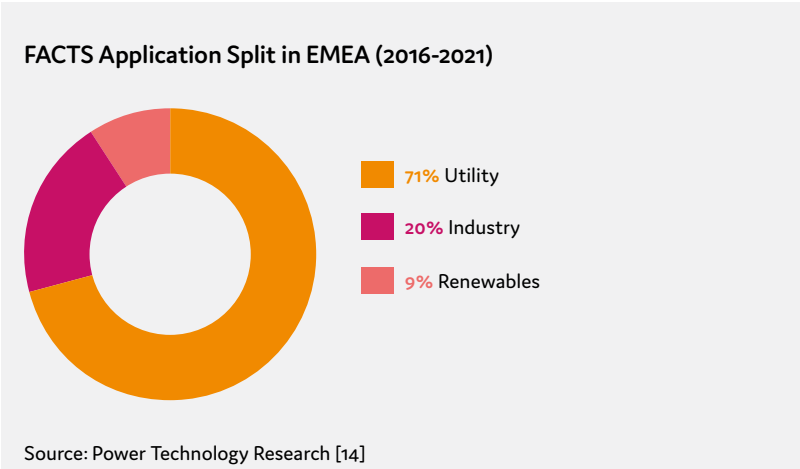
However, in the EMEA, between 2016-2021, more than half of the FACTS installed were STATCOMs (58%) followed by SVCs which accounted for 17% while Synchronous Condensers and Series Compensation were only 14% and 11% respectively. Application wise, in EMEA, majority of the FACTS devices were installed in the utility making 71% of the market by capacity, 20% were installed with renewables while only 9% were installed in the industry between 2016-2021. [14]

Figure 7: FACTS technology split in EMEA (2016-2021)



Source: Power Technology Research [14]

Figure 8: FACTS application split in EMEA (2016-2021)



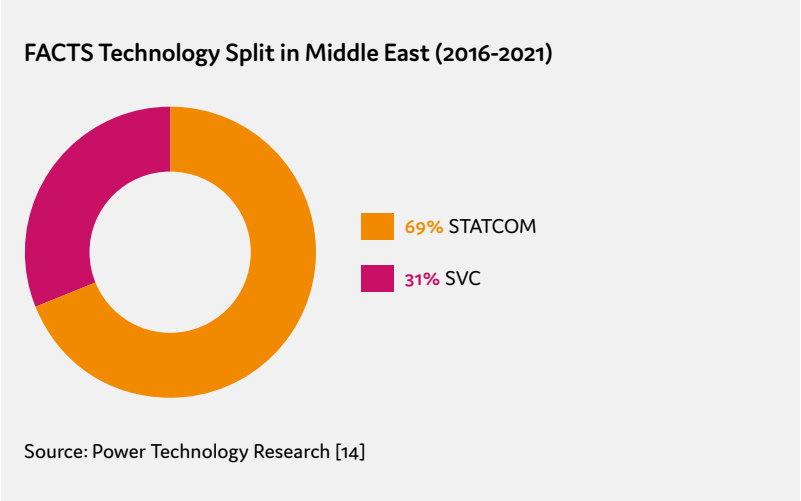
Source: Power Technology Research [14]

FACTS Market in the GCC (and Middle East)

Looking closely at the GCC region, FACTS market has not been very active in the past other than Saudi Arabia, where majority of the FACTS devices are installed and has remained a major demand centre for SVCs in the region. The reason behind relatively smaller market size today is mainly the fact that majority of electricity in the region is generated from fossil fuel fired rotational power plants. However, this is expected to change in the coming years as the percentage of renewables in the energy mix increases significantly.

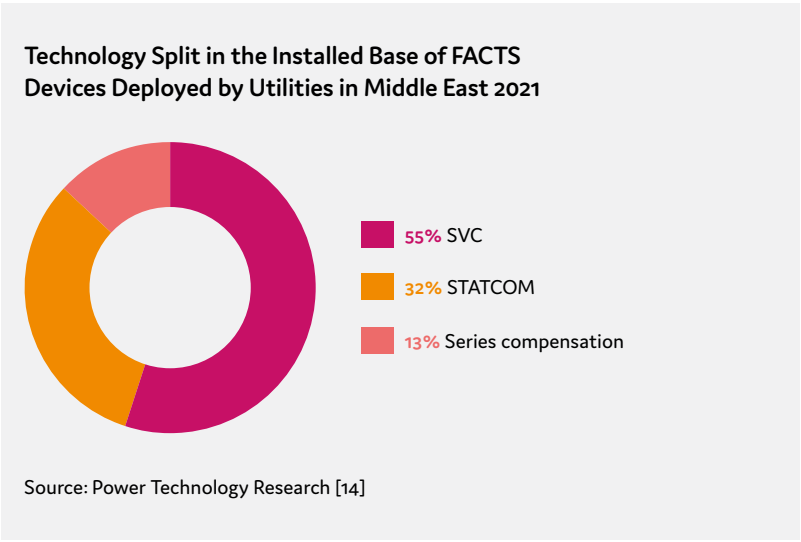
Between 2016-2021, a significant majority of the FACTS devices installed in the GCC region were STATCOMs accounting for 69% followed by SVC which accounted for the remaining 31% of the total FACTS. However, if we look at the installed base of the whole middle east region, majority of projects installed for voltage stability by utilities in the past were SVCs at 55% followed by STATCOMs at 32% and series compensation 13%. From an application perspective, 79% of these devices were installed in the utility sector, 17% were installed in the industry while only 4% were installed with renewables. [14]

Figure 9: FACTS technology split in middle east (2016-2021)



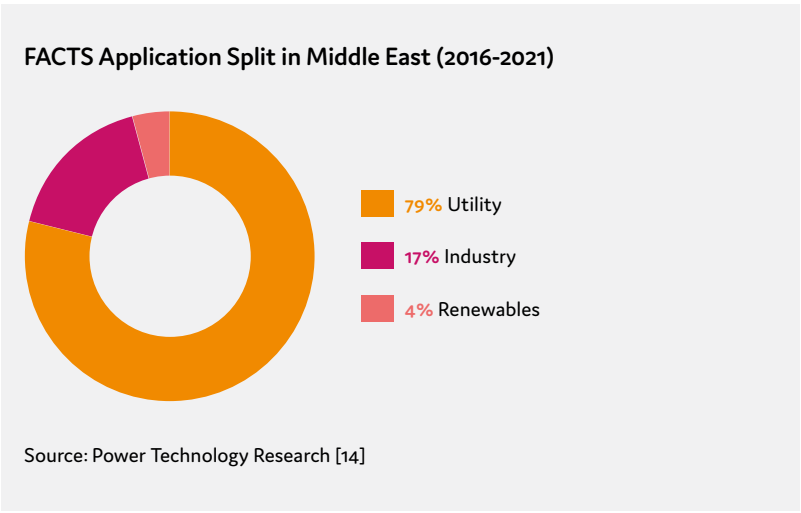
Source: Power Technology Research [14]

Figure 10: Technology split in the installed base of FACTS devices deployed by utilities in middle east. 2021



Source: Power Technology Research [14]

Figure 11: FACTS application split in middle east (2016-2021)

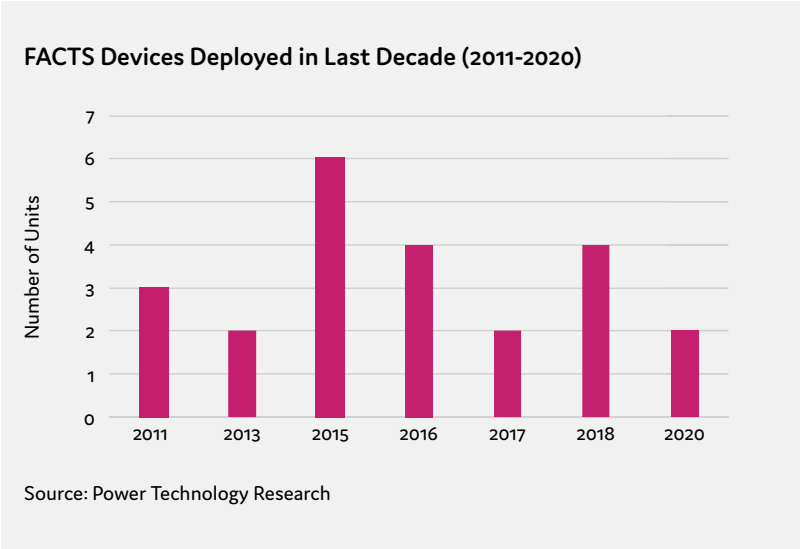


Source: Power Technology Research [14]

Recent Market Activity in the Region

Between 2011-2021, a total of 23 FACTS projects were commissioned in GCC, most of them in the utility segment, with Saudi Electricity Company (SEC) commissioning fourteen of these projects while Dubai Electricity and Water Authority (DEWA) commissioned two of these projects. Yearly distribution of these projects is represented in Figure.10, which highlights the fluctuations in the market over the years.

Figure 12: FACTS devices deployed by utilities during in middle east during last decade (2011-2020)



Source: Power Technology Research

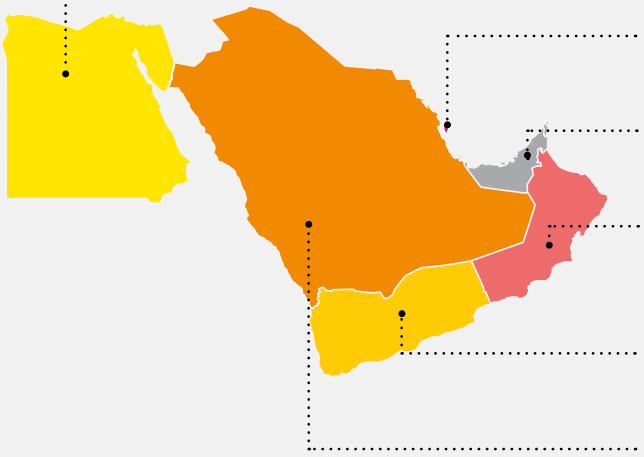
From a project award angle, in 2011, only three projects were awarded (all SVC) in the region which included two projects by Dubai Electricity and Water Authority and one project by Saudi Electric Company. In 2012, only one project (SVC) was awarded in the region by Saudi Electric Company. In 2013, 4 projects were awarded in the region by Saudi Electric Company that employed SVC technology.

Five projects were awarded in 2014 which was followed by a gap year. It included four projects by Saudi Electric Company (3 STATCOM and 1 SVC project) while only one project (SVC) by Public Electric Company of Yemen. On the other hand, 1 STATCOM project was awarded in 2016 followed by another STATCOM project in 2020 by Saudi Electric Company with no projects awarded in 2017-2019.

However, last year in 2021, 13 projects were awarded in the region which included 10 STATCOM projects, most of which were awarded by Saudi Electric Company and Electric and Water Authority of Bahrain, 2 series compensation projects by Oman Electricity Transmission Company and 1 SVC project by Abu Dhabi Transmission and Despatch Company in UAE. It is significant to note that in the initial years of the last decade majority of projects that were installed in the region were SVC while the trend has shifted heavily towards STATCOM use more recently in the region.

Figure 13: Timeline of FACTS projects in the middle east from 2011-2021

Emission Reduction Targets of GCC Countries



Egypt
2021: 1 STATCOM project awarded by Egyptian Electricity Transmission Company (EETC)

Bahrain
2021: 3 STATCOM projects awarded by Electricity and Water Authority (EWA)

United Arab Emirates
2011: 2 SVC projects awarded by Dubai Electricity and Water Authority (DEWA)

Oman
2021: 2 Series Compensation projects awarded by Oman Electricity Transmission Company (OETC)

Yemen
2014: 1 SVC project awarded by Public Electricity Company (PEC)

Saudi Arabia
2011: 1 SVC project awarded by Saudi Electricity Company (SEC)
2012: 1 SVC project awarded by Saudi Electricity Company (SEC)
2013: 4 SVC projects awarded by Saudi Electricity Company (SEC)
2014: 4 (3 STATCOM & 1 SVC) projects awarded by Saudi Electricity Company (SEC)
2016: 1 STATCOM project awarded by Saudi Electricity Company (SEC)
2020: 1 STATCOM project awarded by Saudi Electricity Company (SEC)
2021: 5 STATCOM projects awarded by Saudi Electricity Company (SEC)

Source: Power Technology Research [14]

Looking Ahead

FACTS are and will remain key enablers in transition towards renewable energy and making the grid resilient against the instability caused by the intermittent generation. As the share of renewable generation increases in the energy mix, installed base of FACTS devices in the middle east will not only increase but also spread geographically from being concentrated in Saudi Arabia alone to other parts of the region as evident from the large number of projects awarded in 2021. This demand could further increase as the region is full of strategic ports which might be implementing shore-to-ship power solutions, leading to grid expansions next to ports incl. medium voltage FACTS devices.

Within FACTS, STATCOMS and Synchronous Condensers will be the two most desirable technologies of grid operators and renewable developers. This is because STATCOMS offer faster response within a smaller footprint as compared to SVCs and the price parity is not so big anymore. Synchronous Condensers, though an older "phased out" technology, has been brough back to life, since it is the most effective solution to ensure system inertia as the share of conventional rotational generation decreases in the system.

As the demand for reactive power compensation increases, in addition to FACTS devices, alternative solutions will also come into play. One of the important elements to consider would be energy storage projects, especially the utility scale and hybrid installations, which would be able to act as a replacement of FACTS devices, especially for the renewable applications. With already committed projects of integrated storage with solar [7] and the emergence of hydrogen as a potentially important source of intermittent energy storage, the overall mix of reactive power compensation systems could become very dynamic in the region.

References

[1] United Nations Climate Change, "GLASGOW CLIMATE CHANGE CONFERENCE – OCTOBER-NOVEMBER 2021," [Online]. Available: https://unfccc.int/conference/glasgow-climate-change-conference-october-november-2021 [Accessed 15 Feb 2022].

[2] IRENA, "Renewable Energy Market Analysis: GCC 2019," IRENA, Abu Dhabi, 2019.

[3] G. Hutchinson and D. Sriram, "The Middle East: COP26 and the journey to net zero," Linklaters, 20 December 2021. [Online]. Available: https://sustainablefutures.linklaters.com/post/102hes8/the-middle-east-cop26-and-the-journey-to-net-zero [Accessed 15 Feb 2022].

[4] IRENA, "IRENA Renewable Energy Stats 2021," IRENA, 2021. [Online]. Available: https://public.tableau.com/views/IRENARETimeSeries/Charts?:embed=y&:showVizHome=no&publish=yes&:toolbar=no

[5] US International Trade Administration, "Energy Resource Guide - 2021 Edition," US International Trade Administration, 2021. [Online]. Available: https://www.trade.gov/energy-resource-guide-united-arab-emirates-renewable-energy [Accessed 15 Feb 2022].

[6] US Energy Information Administration, "Saudi Arabia Analysis," EIA, 2 Deccember 2021. [Online]. Available: https://www.eia.gov/international/analysis/country/SAU [Accessed 15 Feb 2022].

[7] Arab Petroleum Investments Corporation, "MENA Energy Investment Outlook 2021-2025," Arab Petroleum Investments Corporation, Dammam, 2021.

[8] "Oman Sustainability Week," 2021. [Online]. Available: https://www.omansustainabilityweek.com/LatestUpdate2021.aspx?LatestUpdate=pressRe3 [Accessed 15 Feb 2021].

[9] Kuwait Institute for Scientific Research, "Harnessing renewable energy to fuel Kuwait's growth," Kuwait Institute for Scientific Research, [Online]. Available: https://www.kisr.edu.kw/en/program/19/ [Accessed 15 Feb 2022].

[10] IRENA Renewables Policies Database, "Kuwait Renewable Energy Target," IEA, 7 September 2016. [Online]. Available: https://www.iea.org/policies/6106-kuwait-renewable-energy-target?country=Kuwait [Accessed 15 Feb 2022].

[11] F. Jossi, "Enabling the energy transition - Minnesota Power's solution to optimize grid stability," Siemens Energy, 6 August 2021. [Online]. Available: https://www.siemens-energy.com/global/en/news/magazine/2021/minnesota-powers-solution-to-optimize-grid-stability.html

[12] ElectraNet, "Strengthening South Australia's power system," ElectraNet, 2021. [Online]. Available: https://www.electranet.com.au/what-we-do/projects/power-system-strength/

[13] Svenska Kraftnät, "STATCOM-anläggningen i Stenkullen är i drift och bidrar med reaktiv effekt till sydvästra Sverige," Svenska Kraftnät, 13 September 2021. [Online]. Available: https://www.svk.se/press-och-nyheter/nyheter/allmanna-nyheter/2021/statcom-anlaggningen-i-stenkullen-ar-i-drift-och-bidrar-med-reaktiv-effekt-till-sydvastra-sverige/

[14] Power Technology Research, "Flexible AC Transmission Systems Market Analysis," Power Technology Research, 12 November 2021. [Online]. Available: https://powertechresearch.com/services/grid/facts-market-research/

Disclaimer

For further information and permissions, contact us at:

Power Technology Research Inc.

Pinenut Ct., Sunnyvale, CA 94087

inquiry@powertechresearch.com

+1-408-622-0456 (USA)

+49 (0)89 12250950 (Germany)

Specialized Power Grid and Energy Transition Research

Transformers
(Dist., Power)

Substation Automation
(Dist. vs Cent.)

EV Charging Infrastructure
(Public, Private, Passenger/Comm.)

Switchgear
(HV, MV)

DC Power Grid
(Shore to Ship, MVDC)

Storage Value Chain Monitor
(Utility Scale, C&I)

Flexible AC Trans. Systems
(SVCs, STATCOMs)

Smart Meters
(Power Quality, AMI)

Comm. & Off-Highway Vehicles
(BEVs, PHEVs, ICEs)

HVDC Market Analysis
(VSC, LCC, Cables)

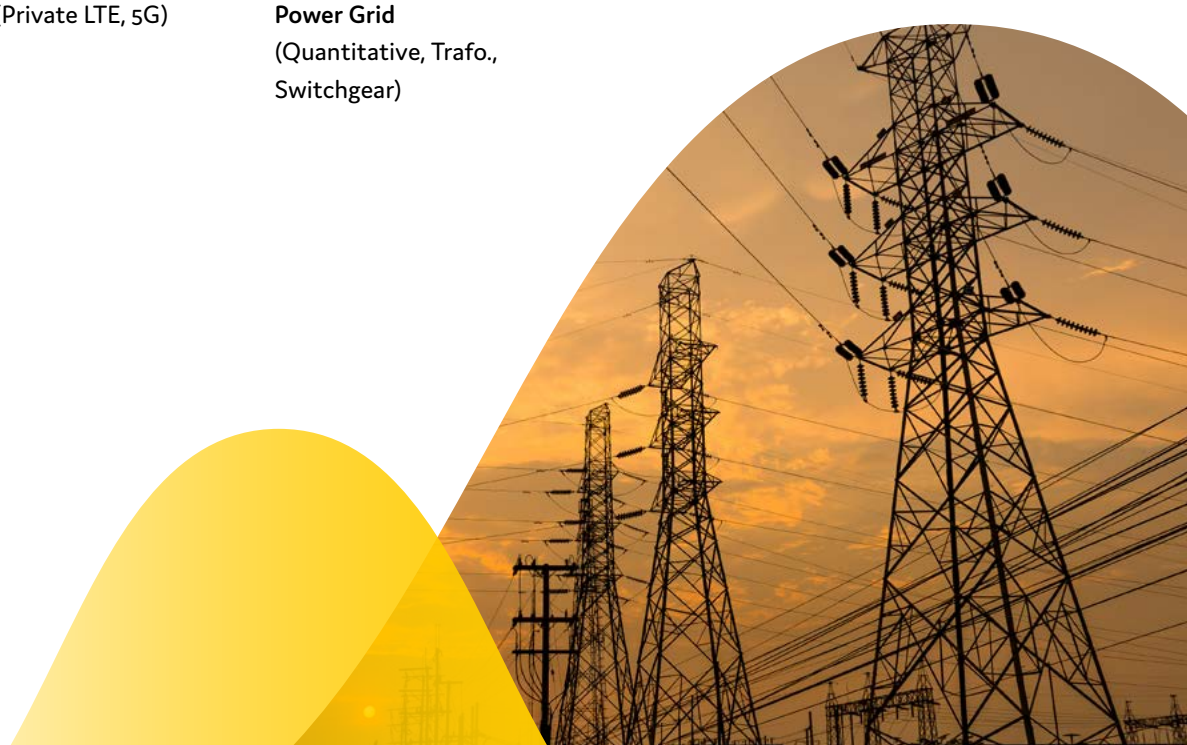
Power Factor Correction
(Active, Passive)

Hydrogen in Power Sector
(Tech., Demand, Value Chain)

Synchronous Condensers
(4-Pole, 6-Pole,...)

Grid Communication
(Private LTE, 5G)

Impact of EVs on Power Grid
(Quantitative, Trafo., Switchgear)



Market Sizing & Forecasting

- Historical Data
- Segmenta-tion
- Forecast
- Project Specific

Competitive Analysis

- Market Shares
- SWOT Analysis
- Bench-marking
- Cost Breakdown

Market Accessibility

- Business Practices
- Regulatory Landscape
- Product & Market Trends
- Sales Channel Analysis

Power Technology Research's specialized market research coverage on Power Grid Equipment and Energy Transition Infrastructure provides clients a strategic advantage by enabling proactive decision-making supported by highly reliable data. Having worked for various blue-chip Fortune-500, FTSE-100, DAX-30 and NIKKEI-225 clients, Power Technology Research can assist you in identifying, valuing, and bench-marking opportunities in a multitude of topics within the power gird and energy transition space.