

ENERGY STORAGE POTENTIAL OF THE MIDDLE EAST



The global energy storage market is growing rapidly, with a current value of more than \$100 billion per year



UAE Energy Plan 2050 aims to achieve 44% of all energy needs from renewable sources, with 75% from clean energy for Dubai



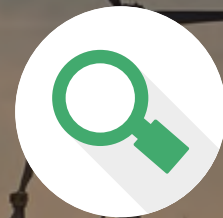
The UAE plans to invest \$163 billion in renewable projects to achieve its 2050 targets



A further \$100 billion is currently being invested across the GCC



The costs of clean energy storage are dropping rapidly: lithium-ion batteries, the large-scale energy storage solution, have declined in cost by about 60 per cent between 2007 and 2014



GCC member nations are creating new R&D facilities to develop new and improved energy storage solutions in partnership with leading international technology providers

REGIONAL ENERGY STORAGE PROJECTS

MASDAR CITY'S NEW ENERGY STORAGE TECHNOLOGY (NEST)

- ➔ NEST is a revolutionary thermal battery, using a concrete mix (\$80 per tonne) to store energy instead of molten salt (\$500-\$1000 per tonne), cutting operational costs by 50-75%
- ➔ Energy storage makes up 20% of the costs involved in CSP. NEST technology could cut these costs in half
- ➔ Current international targets aim to bring the average price of Concentrated Solar Power (CSP) down from US\$0.20 per kilowatt hour (kWh) to \$0.06
- ➔ In the UAE, this price of 6 cents would achieve grid parity, i.e.: CSP would be as cheap as natural gas

DEWA MOHAMMAD BIN RASHID AL MAKTOUM SOLAR PARK

- ➔ DEWA's solar park is the largest single-site renewable energy project in the world, capable of producing 1000MW of clean energy by 2020 and 5000MW by 2030
- ➔ The park will produce electricity at a record-breaking price of less than 3 cents per kWh
- ➔ The project uses CSP and the first 200MW project will be operational by April 2021. DEWA will generate 1,000MW using this technology by 2030
- ➔ CSP's thermal heat energy can be stored easily for 8-12 hours daily, allowing the plant to feed energy to the grid after sunset, on demand. Photovoltaic (PV) has far lower capital costs, but it can only generate electricity when the sun is shining
- ➔ The park includes an R&D Centre to develop the next generation of clean energy storage solutions including TES and lithium ion battery improvements

INTERNATIONAL ENERGY STORAGE PROJECTS

MOROCCO: NOOR CSP POWER PLANT

- ➔ Imported fossil fuels provide approximately 97% of Morocco's energy needs, making it heavily dependent on other countries and vulnerable to changing global energy prices
- ➔ Noor I started operations in February 2016, providing 160MW of CSP
- ➔ Once fully completed, Noor will cost \$2.45 billion and generate 580 MW, enough power for almost 2 million people
- ➔ Noor I utilises molten salt energy storage capacity for 3 hours. Noor 2 and 3 plants will open in 2017 and 2018 and will store energy for up to eight hours

AUSTRALIA: SPENCER GULF PUMPED HYDROELECTRIC STORAGE PLANT

- ➔ The plant will produce approximately 100MW of electricity with six-to-eight hours of storage, making it the largest of its type in the world
- ➔ Due for completion by 2020, construction will commence in mid-2017 after feasibility work from Energy Australia and its partners
- ➔ Water is pumped from a lower reservoir to a higher one for storage when energy is cheap. When prices rise, the water is run down again and put through a turbine to generate electricity
- ➔ This process is entirely repeatable and uses seawater. This is a key benefit for ME nations considering pumped hydroelectric storage

MIDDLE EAST'S CHALLENGES FOR ENERGY STORAGE

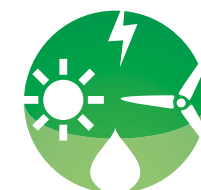
- ➔ **Investment:** Despite falling prices of technology, components, etc, the energy storage market is still in its infancy, leading to high capital expenditure (CAPEX) costs for implementing new technologies and processes
- ➔ **Rapidly evolving solutions market:** Energy storage solutions are quickly growing in number with new subcategories frequently emerging. Researching, understanding and choosing the right solution appropriate for the given conditions takes time and diligence
- ➔ **Early adoptive market:** While high CAPEX costs are a challenge, early adoption will bring long-term benefits as ME countries can grow domestic energy storage capacity and expertise, ultimately exporting both in the future
- ➔ **Proprietary technologies slow adoption:** Early stage energy storage technologies and services are usually proprietary and customised engineering solutions. Deployments may include features not supported in other countries. Adopting solutions from other nations will require greater effort and cooperation

REQUIRED SOLUTIONS

- ➔ **Increased R&D cooperation between governments and private entities:** Joint-venture efforts such as Masdar and Norwegian EnergyNest will aid smoother and faster technology development
- ➔ **Bespoke investment vehicles:** Energy storage represents a key element of increasing national clean energy yields while ensuring reliable power grid operations. As such, targeted investment from ME governments and companies will be required
- ➔ **Standardisation of energy storage technologies:** Modular energy storage architecture will lead to easier adoption and integration

WANT TO LEARN MORE?

Join leading experts from DEWA, Masdar, Saudi Aramco, Saudi Electricity and more, at the Middle East Energy Storage Forum (24-25 May 2017, Dusit Thani Hotel, Dubai, UAE), to learn about the best technology and solutions for planning, initialising and implementing large-scale energy storage solutions successfully.



**Middle East
Energy Storage
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