Transforming Water Scarcity into Abundance for Saudi Arabia

Water Scarcity: a major challenge for Saudi Arabia

Saudi Arabia has a huge annual consumption of fresh water, reaching 30 billion cubic meters per year, while the total amount of surface water produced each year is only about 2 billion cubic meters. The fresh water gap is increasing with population growth and rising living standards. In order to cope with the shortage of fresh water resources, Saudi Arabia has taken various measures to ensure the supply of fresh water, one of the main means of which is seawater desalination technology.

However, the process of seawater desalination consumes a significant amount of electricity. In some coastal desert areas suitable for building seawater desalination plants, the utility grid has not yet been connected to, and relying on fossil fuels for seawater desalination will result in high costs. This white paper explores how the ATESS energy storage technology empowers seawater desalination plants in a cost-effective and sustainable way.

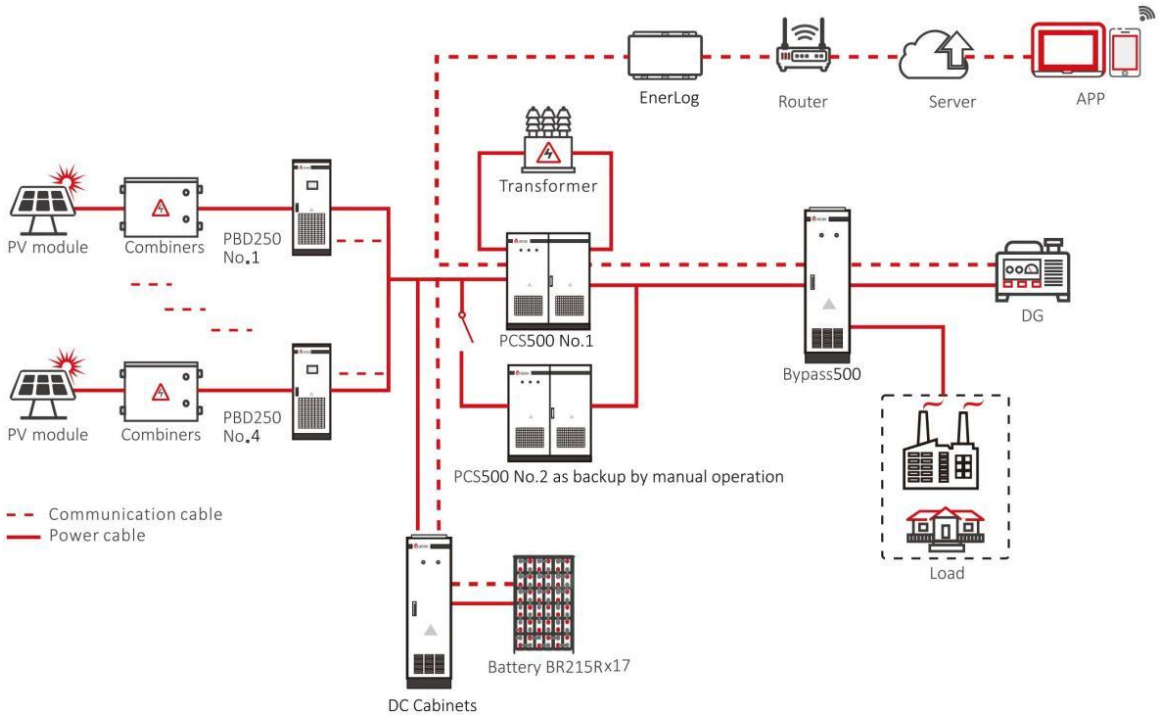
Containerized energy storage system in the desert

This seawater desalination plant is located in a desert region with no access to the public power grid, necessitating an off-grid power solution to ensure a continuous supply of fresh water to urban areas. Designed for 24/7 operation, the plant’s system handles a peak load of 380 kW and is integrated with a 950 kWp PV system. The site is equipped with two ATESS 40 FT containers that house the system's core components, including two ATESS PCS500 bi-directional battery inverters (totaling 1 MW) and seventeen ATESS BR215R Battery Racks, creating a 3.66 MW lithium battery storage system. The system follows a load-priority logic to ensure that power is directed primarily to operational loads.

ATESS' Power Conversion System (PCS) is the captain of the whole system, who commands other crew members like PBD250, bypass and battery to dispatch energy seamlessly. To mitigate the risks associated with power outages and equipment failures, an additional PCS500 unit has been installed. This redundancy ensures that if one PCS unit fails, the backup can seamlessly take over, minimizing downtime and

protecting the operational integrity of the desalination plant.

The desert's extreme heat and sandstorms pose durability challenges for energy storage. To combat these, ATESS' EnerMatrix container solution features IP54-rated equipment compartments and IP65-rated battery compartments, protecting against dust and sand ingress. For stability in high temperatures and day-night fluctuations, it includes intelligent temperature and humidity control, along with an exhaust system. Insulated with a custom rock wool layer (thermal conductivity <0.04 W/m·K), the design provides thermal and frost protection, maintaining a stable internal temperature. These features ensure reliable, long-lasting performance in harsh desert conditions, safeguarding critical equipment from environmental stresses.



System Diagram

System Configuration		
Item	**Description**	**Quantity**
ATESS Batt-Master Cabinet9R-1C	DC Cabinet	3
ATESS Slave Battery Rack BR215R	Battery Rack	17
ATESS ESS-BM-51.2-280R-A	Battery Module	119
ATESS ESS-BM-51.2-280R-B	Battery Module	136
ATESS PV-CB8M	PV Combiner	20
ATESS PBD250	Solar Charger Controller	4
ATESS PCS500	Battery Inverter	2
Isolation Transformer 500	Transformer	1
ATESS Bypass500	Bypass Cabinet	1
ATESS EnerLog	Data Logger	1
40FT HC Container	Container	2

System Configuration

How the system works

The seawater desalination plant will operate in Off-Grid mode, and switch to Diesel Generator (DG) modes when neither solar or battery is sufficient:

Off-Grid Mode: The system will primarily rely on PV and battery storage to supply the necessary load.

DG Mode:
Generator connection (dry contact control)
In off-grid mode, when the battery voltage is approaching the voltage limit, PCS will close a relay output to start the generator. The generator power will be used to supply load and charge the battery. When the battery is fully charged, PCS will send a signal to shut down the generator. (When the battery is equipped with BMS, the generator on-off-depends on SOC control)

2 sets of ATESS PCS500 battery inverters and other components installed for the Saudi Arabia Project

Socio-economic benefits

The integration of ATESS' innovative solutions enables a shift towards a more sustainable model in the below aspects:

1. Increase energy utilization: Saudi Arabia boasts ample sunshine resources, and harnessing solar energy as an alternative to conventional fossil fuels has significantly enhanced energy efficiency.

2. Reduce energy cost: The installation of energy storage systems will largely reduce the energy expenditure for the seawater desalination plants.

3. Reduce carbon footprint: The shift towards renewable energy sources reduces the carbon emission of the desalination plant by approximately 890 tons annually,

supporting Saudi Arabia's vision for sustainable development and environmental preservation.

Conclusion

The seawater desalination project in Saudi Arabia represents a significant step towards sustainable water management in the region. By integrating ATESS' advanced solar energy solutions, the project not only addresses the critical issue of water scarcity but also aligns with global trends towards renewable energy and environmental sustainability.

ATESS is proud to be at the forefront of this water treatment revolution, contributing to a sustainable future for Saudi Arabia and setting a precedent for similar projects worldwide. The innovative approach taken in this project underscores ATESS' commitment to leading the way in the renewable energy sector and enhancing the quality of life in arid regions through sustainable solutions.