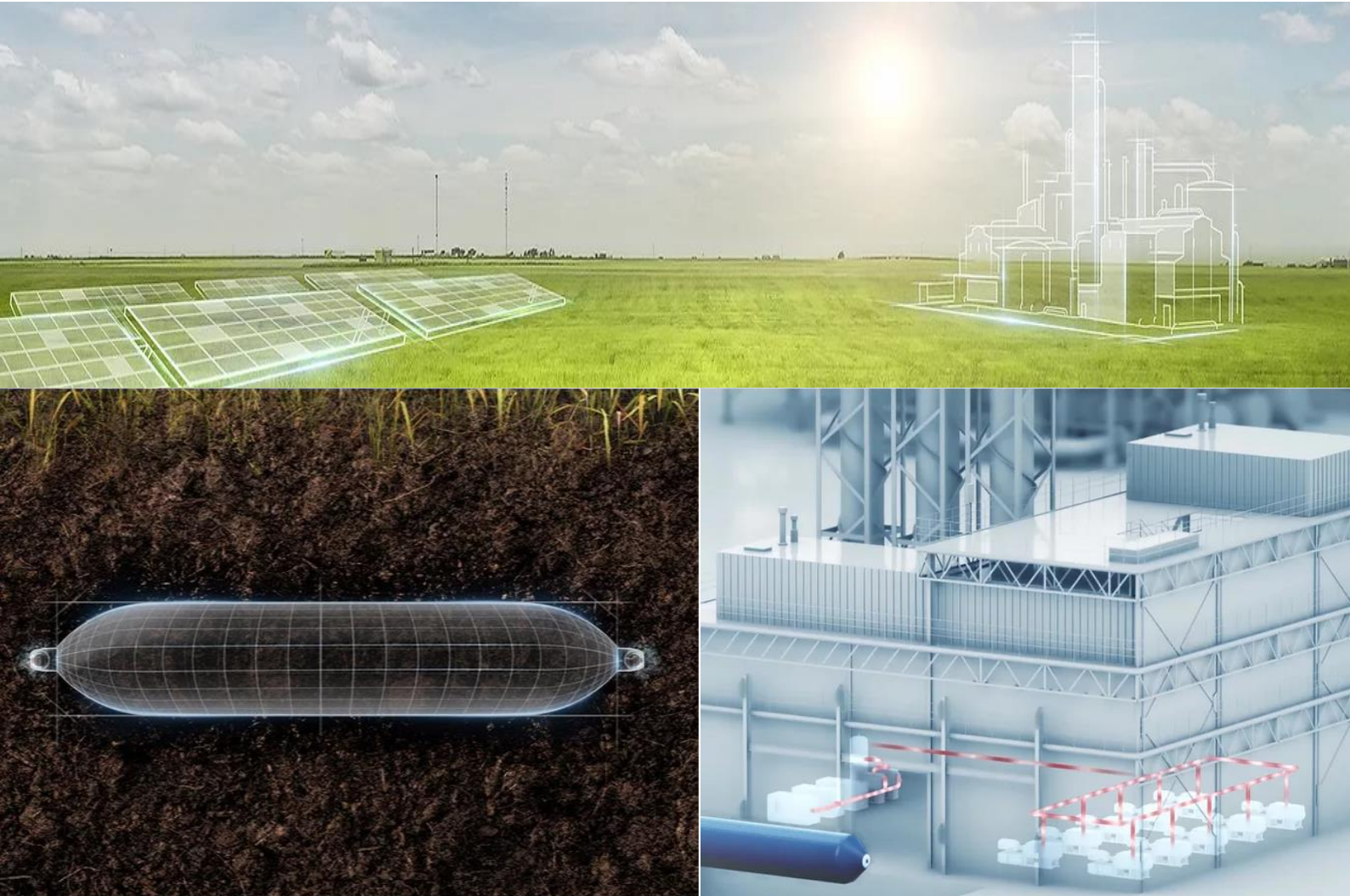


FROST & SULLIVAN

RESEARCH & CONSULTING LTD.



# AUGWIND

## Augwind – Update Report

19.09.2021



Stock Exchange  
**TASE**



Symbol  
**AUGN**



Sector  
**Technology**



Sub-sector  
**Cleantech**



Stock price target  
**NIS 83.2**



Closing price  
**NIS 47.0**



Market cap  
**NIS 945.0 Mn**



No. of shares  
**20.0 Mn**



Average Daily  
Trading Volume  
**1,632 stocks**



Stock Performance  
(Since Jan. 2021)  
**-55.0%**

Signed agreement with Rapac Energy; Follow-up order from ISCAR; Formulation of a long-term strategic plan; Actions to promote global expansion in the US; Delay in company revenues; Price target is updated to NIS 83.2

**Augwind is an Israeli company that develops and markets an energy-storage solution (AirBattery) and an energy-efficient solution (AirSmart), based on compressed air. The company's vision is to become a global technology provider in these fields.**

### Main events of the company in 2021:

- Augwind will provide ITEEO Ltd., a subsidiary of Rapac Energy Group, with a hybrid system, the first of its kind in the world, which enables energy storage and the supply of compressed air at a discounted price to factories.
- Receipt of a follow-up order from ISCAR for the AirSmart product for approx. NIS 1.6 million.
- Completion of the installation of a pilot facility for the AirBattery system at Kibbutz Yahel. The testing and commissioning phase leading up to the full operation of the pilot facility is expected to be completed during Q4 2021.
- External validation of the technology, feasibility, and performances of the AirBattery system, as part of a comprehensive review conducted by the engineering consulting firm Fichtner GmbH. Earlier this year Augwind announced that it had reached an efficiency of about 80% (with the expectation to exceed 90% in the future).
- Updating the company's business plan – formulating a long-term plan for the realization of Augwind's global business development.
- Augwind announced it will begin the public offering process on the U.S. Stock Exchange.

**We see a growing demand for energy efficiency and energy storage solutions, alongside a trend of moving to local energy storage.** Frost & Sullivan prepared research where it estimates potential scenarios for storage energy growth. In a conservative scenario, a total of 63.1 GW would be installed between 2020 and 2025, compared with a forecast of 79.3 GW if the COVID-19 outbreak had not occurred. CAGRs are 32.8%. In our opinion, increased investment in energy storage is an international phenomenon, and countries including China, the US, Germany, and Israel all have detailed plans to increase their energy storage portfolios.

The company did not meet its revenue projections in Q1 2021. However, the company is making efforts to expand its operations in the U.S., along with formulating a long-term strategic plan. In light of this, we are updating the target price to NIS 83.2. Our estimates are based on the rate of project sales. On the next page, we present the main events in the first half and the past months of 2021.



**Augwind**  
19.09.2021**Augwind recently announced the following in the previous period:**

- Augwind will collaborate with Rapac Energy and ITEEO to install and market energy storage systems based on the AirBattery product. Rapac Energy owns 5 private power plants with a combined volume of approx. 960 MW in Israel, Augwind's technology will enable Rapac to attain significant energy storage capabilities and energy efficiency. In our view, this complication is expected to have a significant impact on Augwind's revenues in Israel. In addition, proof of concept in the local market can serve the company in its efforts to penetrate global markets.
- The company announced the receipt of another order for the AirSmart product from ISCAR in the amount of NIS 1.6 million for the purpose of energy efficiency at the ISCAR plant in Tefen. This order follows the successful installation of this product in ISCAR (in the amount of NIS 2.5 million) which was carried out at the end of 2020. We consider this follow-up order to be a significant expression of confidence in the AirSmart product capabilities.
- Completion of the construction of a pilot facility of the AirBattery system, with a storage capacity of approx. 1,000 kWh at Kibbutz Yahel. The company estimates that the testing and commissioning phase leading up to the full operation of the pilot facility is expected to be completed during Q4 2021.
- Successful completion of an engineering and techno-economic programming test of the AirBattery system, as part of activities leading up to global strategic cooperation. The test was performed by Fichtner GmbH, an engineering consulting firm. The report's findings confirm Augwind's internal analysis results in terms of system efficiency and highlights the system's lifespan and significant environmental advantages of the raw materials over lithium-ion batteries. The report also notes the prospect of a possible drop in lithium battery prices in the coming years as the most significant economic risk factor for AirBattery.
- On May 20, 2021, the company announced that it formulated a long-term comprehensive strategic plan to realize its business development worldwide. In this work, among other things, the company examined the existing working assumptions and the potential market size for the company's areas of activity.
- The company will begin the public offering process on the U.S. Stock Exchange, whether through an IPO or through a connection to an existing platform (such as SPAC), in addition to listing its shares on the Israel Stock Exchange. This step is important for promoting presence and transparency towards the American market, which is a significant target market for the company's products. This step will give the company access to additional sources of capital and debt to finance its operations.

**In coming years, the company must demonstrate its ability to market and sell to markets outside of Israel more extensively. Specifically, the company must demonstrate market penetration capabilities primarily with AirBattery whose revenue is significant in our valuation when sales begin in 2021.**

## Executive Summary

Ten years ago, the lion's share of our electricity came from non-renewable energy sources such as coal, while renewable energy sources, such as solar and wind energy, accounted for a negligible 1-2% of electricity in most developed energy ecosystems. Carbon emissions from electricity generation were predicted to rise for decades to come, but surprisingly, between 2010 and 2020, coal-based energy significantly decreased, while natural gas and solar power began significantly increased.

The changes of the past decade will likely be dwarfed by those we expect to see in the coming decade. Because renewable energy sources depend are inherently intermittent, such as daylight and wind currents, they require supporting solutions to provide a consistent, stable flow of energy. The exponential adoption of renewables is propelling many countries to implement supporting solutions, such as energy storage and electricity grid management systems, as enablers of renewable energy adoption.

At August 25, 2020, at the US Energy Storage Association's (ESA) annual conference, the US Department of Energy (DOE) deputy secretary Mark Menezes stated that energy storage is "the next great chapter in a story of American energy innovation."<sup>1</sup> He further mentioned that the DOE is investing heavily in storage R&D in order to provide energy flexibility and reliability. Furthermore, the US Office of Electricity (OE) explicitly mentions energy storage as one of its four main priorities<sup>2</sup> and details its goal to "work with other DOE Offices to investigate and integrate new technologies for advancing megawatt scale storage with added resiliency and control capabilities."

Increased investment in energy storage is an international phenomenon, and countries including China, Korea, the US, Germany, France, Italy, the UK, Australia, Japan, India and Israel all have detailed plans to increase their energy storage portfolios. The ESA recently extended its vision to a goal of 100 GW of new energy storage installed by 2030<sup>3</sup>, and Israel's Ministry of Energy has outlined a tenfold increase in storage capacity over the same period.

Renewable energy sources are fuelling the need for energy storage capacity, and stored energy brings with it a whole slew of advantages that can be effectively utilized by a variety of factories and production facilities. For example, the use of compressed air energy storage technology (CAES) allows for substantially reduced energy costs by storing electricity when it is cheap and allowing factory machinery to utilize that energy during peak load times.

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<sup>1</sup> <https://essentialenergyeveryday.com/energy-storage-will-fundamentally-change-the-energy-landscape/>

<sup>2</sup> <https://www.energy.gov/oe/mission/oe-priorities>

<sup>3</sup> [https://energystorage.org/wp/wp-content/uploads/2019/06/esa\\_vision\\_2025\\_final.pdf](https://energystorage.org/wp/wp-content/uploads/2019/06/esa_vision_2025_final.pdf)



Augwind is a CAES technology provider that has developed solutions to support both renewable energy storage infrastructure and production facilities. They enable the deployment of large scale and grid-scale CAES to store energy for later use using compressed air. Their technology is primed for adoption as it is cost effective, highly scalable, completely green, and can easily be incorporated into existing facilities. Their solution for energy storage is called the AirBattery and their solution for production facilities is called AirSmart.

Strategically, Augwind is a technology provider and not an execution company. This allows it to utilize its advantages in a fast and scalable manner. In addition, this model will enable the company to operate a relatively flexible and lean operation.

**We view Augwind as a great opportunity for investors seeking to invest in clean-tech and specifically within one of the most growing elements in clean-tech – energy storage.**

## Company Overview

Augwind Ltd. (TLV: AUGN), hereafter "the Company" and/or "Augwind," is a publicly-traded Israeli company with the vision of becoming a leading and cutting-edge global technology provider in the energy storage and energy efficiency domains. The Company is revolutionizing energy storage by providing technology for storing compressed air underground. The company's revenue for 2017, 2018, and 2019 respectively was 693K NIS, 3.14M NIS, and 6.89M NIS. The company operates out of its HQ in Yakum, Israel.

In recent years there has been a significant increase in the volume of energy production from wind, solar, and water sources to replace pollutant sources such as coal, petroleum, and gas. The shortfall of this approach is that renewable energy sources are unstable and do not allow continuous power supply throughout the day. For example, we are unable to utilize the sun at noon to power factories at hours when there is no sun out. The solution to this problem is highly efficient and cost effective energy storage. The energy storage market for renewable energy sources is projected to grow exponentially. It is also expected that in the next few years, regulators will begin to require energy storage solutions for renewable energy sources.

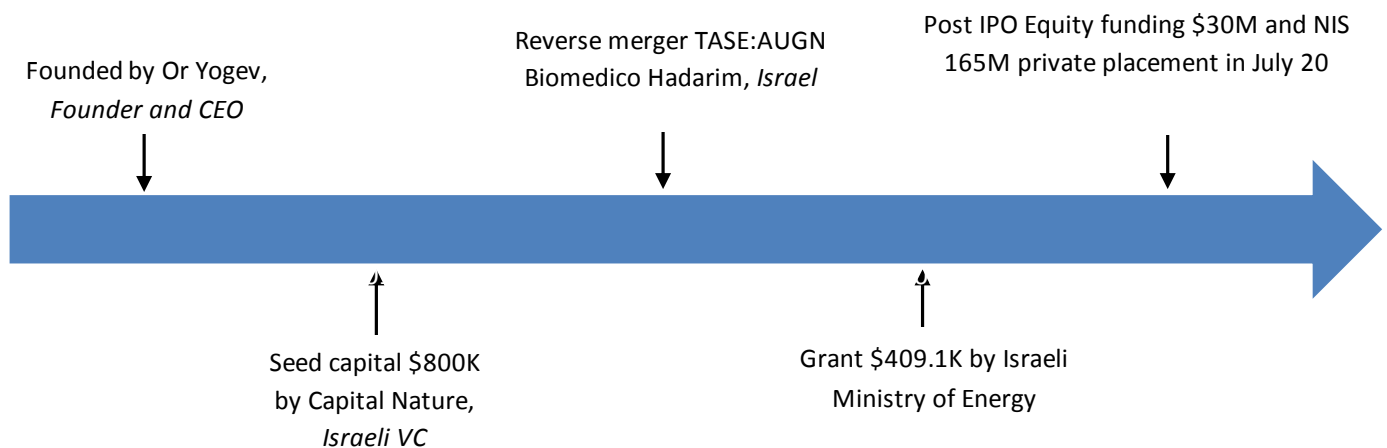
Today, almost every factory uses compressed air to power its machines, but compressed air systems are one of the most inefficient systems in the industry, and constitute 15% of overall factory energy consumption on the average (up to 20%; source: US Department of Energy).

Augwind's two flagship technology solutions solve both the energy efficiency and energy storage problems above. Their commercially available solution, AirSmart, stores energy and powers machinery that operates on compressed air. It allows for up to 45% savings in electricity consumption (source: Augwind) while reducing operating costs. The company states that this compressed air can be specifically designed to meet different factory air consumption patterns, meaning it can first stabilize the production profile of the factory's compressors array to a stable state, optimizing significantly their electricity consumption compared to a non-stable state. Secondly, by adding a large vessel of compressed air, energy can be stored in the form of compressed air while it is cheap, and used during peak demand times. The company has designed and installed its patented compressed-air storage units for large industrial plants all across Israel, including tier-1 factories from the dairy, food, and plastic industries such as: Strauss, Tnuva, Nesher Cement, Israel Aeronautics Industry (IAI), Shalam Packaging and more.

Their solution under development, the AirBattery (commercially available by mid-2021), stores electrical power generated by any source (Renewable and non-renewable) and dispatch it on-demand also by form of electrical power. The AirBattery solution has obvious advantages over current energy storage solutions, such as batteries since it has no degradation, unlimited cycles and it is 100% green technology utilizing air and water.

## Strategy and Business Model

Augwind was founded by Dr. Or Yogev in 2012. In 2019, the company performed a reverse merger with the public company 'Biomedico Hadarim' on the Tel Aviv Stock Exchange. Biomedico Hadarim was later renamed Augwind Energy.



Compressed air is required for many applications in the industrial sector, and operating electrical costs for a single compressor are often exorbitant, running into thousands of dollars annually. Usually the demand

for compressed air is not constant, but periodic, and compressed air is produced accordingly. Thus the load on the air compressors can vary, leading to wasted energy. This challenge of waste can be mitigated by using a large energy storage tank that can act as a buffer and stabilise the system thereby reducing energy waste. The compressed air energy storage solution developed by Augwind is at least 80% more cost-effective than the current alternative. This solution has resulted in 45% reductions in energy costs at industrial plants where it is currently installed, thereby recovering the cost of investment in just 2-3 years.

Due to these factors the company's AirSmart solution targets industries with two characteristics: 1) those that incur high electricity prices and 2) those with large players, such as plastics, foods, metals, etc. Today the company is targeting large industrial parks in the US, Germany, and Israel. In March, Augwind's AirSmart met the standard demands of the National Sanitation Foundation (NSF) and were officially approved by the NSF.

Upon commercial availability in 2021, the company's AirBattery solution will target renewable energy producers and plants, from small-scale, private producers to large-scale producers.

In terms of its business model, Augwind acts as a technology provider and will operate internationally via sales and execution contractors (EPC) that license the company's technology. For each installation, Augwind designs customized plans for the size and placement of its units to best meet the demands of its clients. Afterward, project management and installation is carried out by the EPCs.

The Company delivers its products both in a CAPEX package and in an OPEX savings distribution model. The OPEX model allows both the client and Augwind to share the savings generated via their technology. Additional revenue is produced through annual maintenance of the company's solution.

With significant support from the Chief Scientist of Israel and the European Union, Augwind has taken major steps to patent and develop their technologies. Augwind has 10 approved patents and 5 pending patents, all in the energy domain.

## Products and Technology

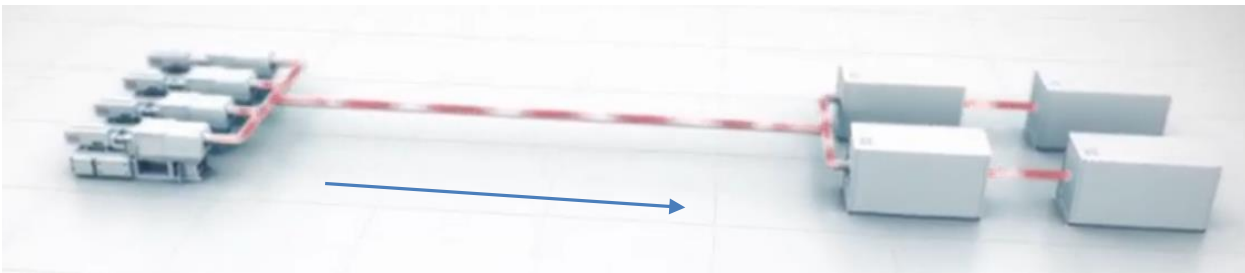
Industries require a large amount of compressed air to keep their machinery running. With a variety of applications from plastic manufacturing to chemical refinement, compressors supply machines with the air pressure they need to work. However, air consumption varies between machines and across tasks, thus limiting the efficiency of standardized compressed air systems. Augwind's patented compressed air storage

units are installed underground. By mediating between the compressor and the machinery, Augwind's units can reduce compressors' power consumption costs by up to 45%.

Rather than providing the machinery with compressed air directly, the compressors supply Augwind's storage units. Augwind's system mediates between the compressors and the machines by intelligently and efficiently storing and supplying compressed air. With Augwind's units, the compressors only refill the storage tank when necessary, keeping the minimum number of compressors operating at any given moment. Augwind's units provide a smoother, more controlled stream of air pressure to precisely meet each machine's demands. Augwind's specialized, flexible compressed air storage units are designed to harness the geo-mechanical power of the earth itself to contain the immense pressure that comes with storing large amounts of compressed air, at a fraction of the cost and with no visible footprint.

In the US and most of Europe, electricity costs are higher during peak consumption times. Factories often face large fines for operating during peak hours. With Augwind's system, storage units can be filled or charged with compressed air during off-peak hours, or at low air consumption times. The stored compressed air can then be utilized when costs are high, eliminating the need for operating the compressors during peak hours.

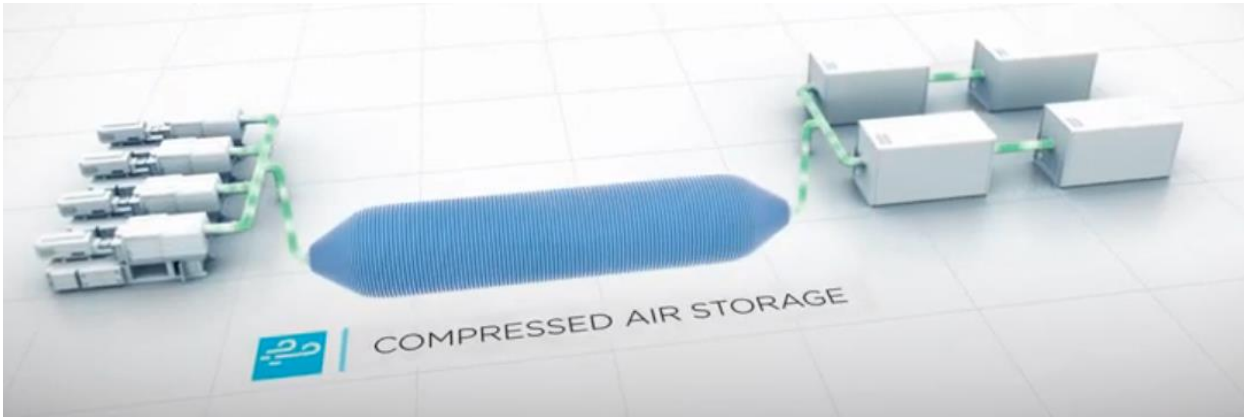
#### **How compressed air is utilized today:**



Air compressors directly supply machines on demand using minimum storage units in between, mainly in order to protect the compressors from frequent shutdown. This is a highly inefficient and costly methodology.

#### **How compressed air is utilized with Augwind's system:**





The Company leverages its unique AirX technology that stores large amount of compressed air at up to 40 atmospheres of pressure. This technological platform has several applications. **Their commercially available solution, AirSmart, stores energy for small time periods and powers pneumatic equipment that operates using compressed air. The airSmart can be attribute as a buffered system that enable the compressors to operates much more efficiently. Alternatively , the AirBattery solution provide means to store electrical power by converting it to compressed air, store it for long time periods inside AirX tanks and then converting it back to electrical power when required.**

1) **AirSmart:** a commercially available energy efficiency solution for air compressors, combining underground energy storage along with a unique monitoring system, supported by a dedicated simulator.

Augwind's patented AirSmart solution allows for the storage of a vast quantity of compressed air, specifically designed to meet factory air consumption patterns. This reduces the inherent inefficiencies of compressed air systems and improves both economic and ecological outcomes.

Augwind's solution has saved up to 45% of power consumption to the air delivery system for current clients. In addition Augwind's solution managed to save air consumption by enabling more efficient use to compressed air by the air consumers

Augwind's units have managed to save millions of dollars of wasted energy by improving the efficiency of compressed air systems in addition to providing significant operational benefits, including pressure stabilization, improved air quality, and emergency backup compressed air storage.

The benefits of the AirSmart solution include:

- **Energy Savings:** electricity consumption is reduced by allowing compressors to work more efficiently

- **Cleaner Compressed Air:** equipment is supplied with cleaner and dryer more stable and more precise air supply
- **Compressor Longevity:** compressors work more efficiently, thereby extending their lifespan
- **Production Continuity:** in case of a power outage Augwind's compressors can supply machinery with energy until compressors are brought back online
- **Peak Shaving:** Augwind's AirShaver system which consist of high pressure large volumes AirX tanks are filled with high pressure air off peak times. During high peak times air is released from the AirShaver system hence curtailing peak power consumption. This peak shave operation save electrical cost due to high peak power consumption times.
- **Quick Implementation:** installation takes several weeks at the most, depending to the size of the system
- **No footprint:** the system is installed underground and does not take up expensive real-estate
- **Environmentally friendly:** the carbon footprint is reduced
- **NSF compliant:** the technology is National Sanitation Foundation (NSF) compliant

#### Major AirSmart customers include:



2) **AirBattery:** In recent years, there has been a significant increase in the volume of energy production from wind, solar, and water sources to replace pollutant sources such as coal, petroleum, and gas. The problem is that renewable energy sources are characteristically unstable, and do not provide a continuous power supply throughout the day and across the seasons. You cannot use the midday sun to turn on the lights at night-time. The solution is energy storage. It is expected that in the next few years, regulators will require energy storage solutions for renewable energy sources. This market is projected to increase

exponentially. Augwind's AirBattery solution is completely green and targets a high cost benefit of over 80% energy round trip efficiency.

AirBattery is a modular energy storage solution in advanced development stages intended for medium-sized solar and wind energy installations. Augwind has developed innovative underground compressed air storage units that store large amounts of compressed air at high pressure. The most significant challenge renewable power generation deployment is dispatching it using energy storage . Today, a significant amount of electricity is either curtailed or not utilized, solely because it is easier to utilize it directly during peak hours than to store it for later use.

This solution is intended for the energy storage market, and in particular, for the electrical utility sector. The development of this system is based on Augwind's existing compressed air storage system, combined with a unique technology for converting the energy stored in compressed air back into electricity at high efficiency.

Augwind's energy storage system is designed for medium-sized and large scales, and will effectively compete existing energy storage systems in the market, given its low costs, high efficiency, unlimited cycles and zero degradation. When completed successfully, the system will serve as an alternative to batteries and other means of energy storage that are currently on the market but suffers drastically from many drawbacks. When completed, this solution will provide optimal storage volume for solar farms, wind farms and power grid, at much lower prices, with little need for maintenance and minimal environmental impacts.

Integrating renewable energy sources with efficient storage systems will increase their reliability and reduce dependence on fossil pollutant power plants.

**The benefits of the AirBattery solution include:**

- **High conversion rate:** over 80% energy efficiency
- **Cost effective:** the solution aims to be highly cost competitive
- **Endless charging cycles:** the system has more than 40-year lifespan, during which it can be charged repeatedly with no limits
- **High capacity:** the system contains high pressure by utilizing the earth's geo-mechanical forces
- **No footprint:** the system is installed underground and does not take up expensive real-estate
- **Environmentally friendly:** the carbon footprint is reduced
- **Expandable and modular:** the technology can be scaled for increased capacity

- **Green and cutting-edge:** the first 100% green energy storage solution (uses only water and compressed air)

### **AirBattery Pilot**

In order to prove the feasibility of the AirBattery, Augwind set up a pilot in Kibbutz Yahel, along with the PV and wind energy infrastructure company Doral. Augwind received a grant of 1.5M NIS from the Israeli Ministry of Energy, based on an estimated total cost of 3M NIS. The pilot is expected to be completed in the coming months and will demonstrate the ability of the AirBattery to store 1000 kilowatt hours at 250KW power rating. Upon this successful PoC, the AirBattery will be commercially available in 2021.

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