



**AUGWIND**

THE SOLUTION TO ENERGY STORAGE IS RIGHT UNDER OUR FEET

# **AUGWIND ENERGY – UNDERGROUND COMPRESSED AIR *ENERGY* STORAGE**

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## Company At a Glance

The Company operates through its fully owned subsidiary, AugWind Ltd .

Augwind Ltd is an Israeli based technology company founded in 2012 by Or Yogev Ph.D





## Going Underground

**Augwind** Ltd. has developed state of the art underground compressed air storage units that store large amounts of compressed air at high pressure.

**In existing installations, **Augwind's** solution has been shown to save up to 50% of power consumption to the air delivery system.**

**Augwind** has designed and installed their patented compressed air storage units for large industrial plants all across Israel, including top tier-1 factories from the dairy-food, aviation, plastic industries and more.



## Main Applications



### ENERGY SAVING

Augwind's units are actively saving energy in factories all across Israel.

By allowing the compressors to work more efficiently, Augwind's units can reduce electricity consumption to the compressed air delivery system by up to 50%.



### CLEANER COMPRESSED AIR

Augwind's units provide the equipment with better quality compressed air than any other system can.

By storing large amount of compressed air, the quality air equipment provides the driest and cleanest compressed air possible.



### OPERATIONAL SAVINGS

Increase redundancy and Eliminates the need to purchase compressed air equipment, even when growing, by preventing the need to operate some compressors and reduce maintenance costs by reducing equipment's running hours.



### PRODUCTION CONTINUITY/ EMERGENCY RESERVOIR

In case of a power outage or any other malfunction in the air compression system, Augwind's units can act as an emergency compressed air reservoir, supplying the system with compressed air until the compressors are brought back online.



### PEAK SHAVING

Augwind's units can be utilized to replace the compressors entirely during peak consumption times to reduce fines and evade higher electricity consumption costs.



Our Product



Installation Photos



Yotvata



Elidan



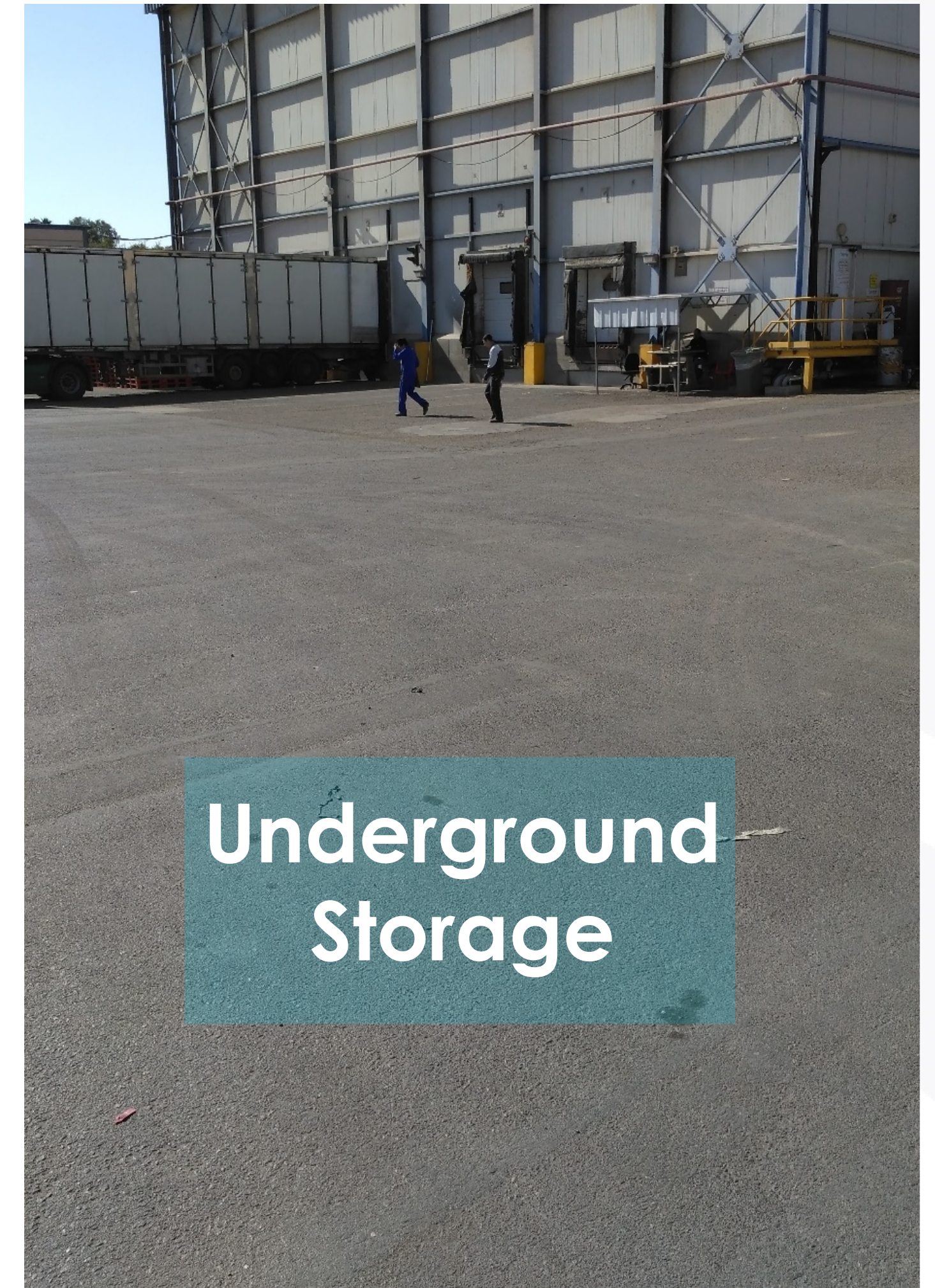
Nilit



25%-50%  
Energy Savings



## Dairy Plant – Zero Footprint





## Case Studies

### Israeli Aircraft Industries Aviation



- ✓ Central compressed air station, that provides air to 5 different plants
- ✓ 5 tanks installed at different locations

**Electricity saved annually:  
1,187,000 kWh (22%)**

### Yotvata Dairy Farm (Owned by Strauss) Dairy Products



- ✓ Cooling down the water-steam-disinfected milk tanks with injecting compressed air
- ✓ The milk is pressed through the pipes with compressed air
- ✓ 2 installed tanks with each 50 m<sup>3</sup>

**Electricity saved annually:  
520,000 kWh (25 %)**

### Shalam Packaging Ltd. Plastic



- ✓ Turning up plastic packages for products as dairy or paint
- ✓ 3 installed tanks with each 50 m<sup>3</sup>

**Electricity saved annually:  
1,192,000 kWh (35 %)**



## Among Our Clients



**Tnuva**



**NILIT®**

**SIEMENS**



Shalam Packaging Ltd.

אלידן פלסטיקה בע"מ  
יחידת נקבוקים פלסטיים מודיעים





## Potential Market – Energy Eff + Peak Shaving

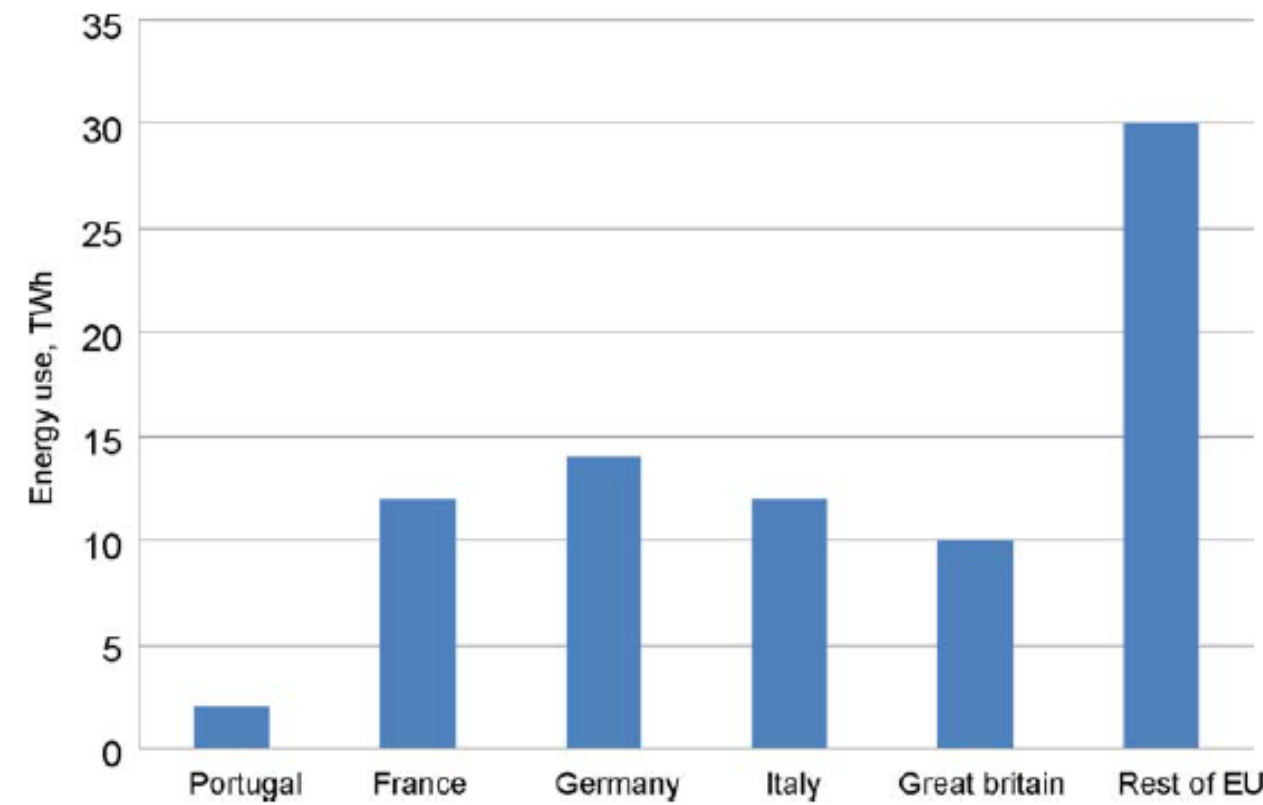


Fig. 2. Compressed-air energy use in 15 EU countries [13].

Radgen P. Efficiency through compressed air energy audits. Energy Audit Conference, www.audit06.fi; 2006.

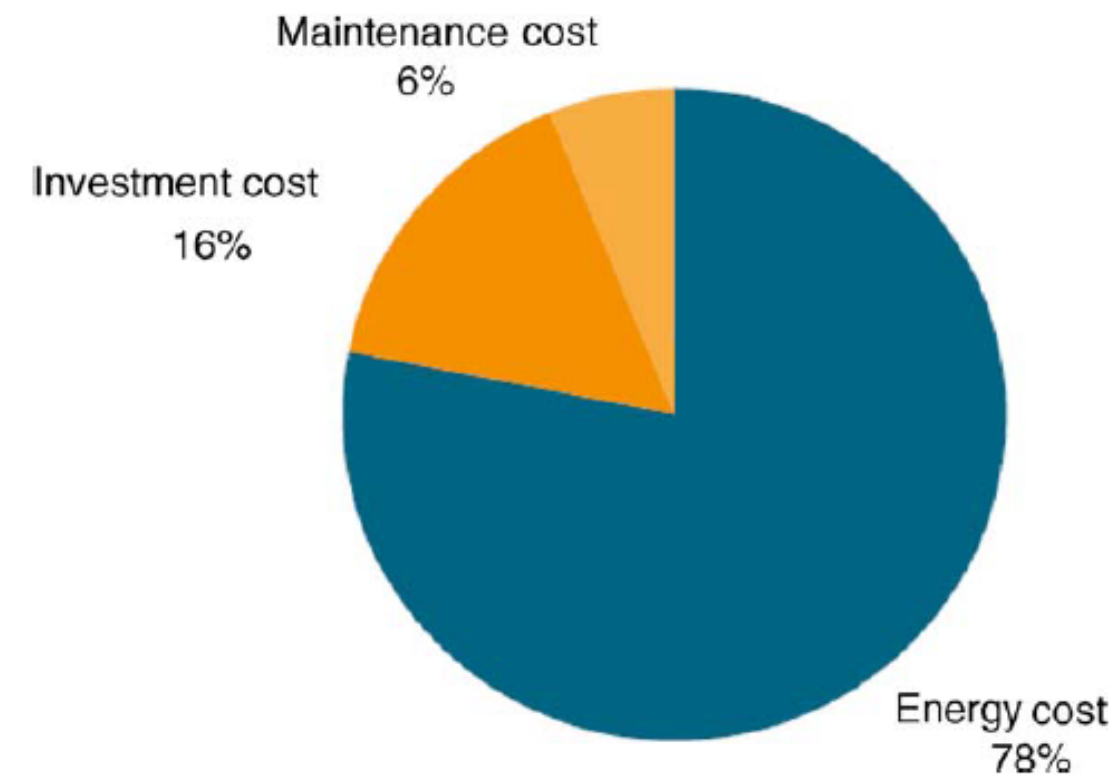


Fig. 3. Life cycle costs of compressed-air energy use [13].

TABLE 1-1: Compressed Air System Use by Industry Group

SIC	Industry Group	Compressed Air System GWh/Year	Total Motor System GWh/Year	Comp. Air as % of Motor System Use	Comp. Air as % of Total Electric Use
28	Chemicals and Allied Products	39,960	144,362	27.7%	20.1%
33	Primary Metal Industries	12,609	87,935	14.3%	8.3%
29	Petroleum and Coal Products	7,930	51,938	15.3%	15.9%
37	Transportation Equipment	5,519	29,549	18.7%	14.0%
30	Rubber and Miscellaneous Plastics Products	4,767	36,610	13.0%	10.9%
26	Paper and Allied Products	4,533	99,594	4.6%	3.7%
36	Electronic and Other Electric Equipment	3,008	13,243	22.7%	9.1%
20	Food and Kindred Products	2,898	37,797	7.7%	4.5%
22	Textile Mill Products	2,392	16,750	14.3%	7.2%
24	Lumber and Wood Products	1,901	22,946	8.3%	8.7%
34	Fabricated Metal Products	1,777	7,296	24.4%	5.2%
35	Industrial Machinery and Equipment	1,172	7,378	15.9%	3.6%
38	Instruments and Related Products	721	6,487	11.1%	4.9%
32	Stone, Clay, and Glass Products	566	2,231	25.4%	1.6%
25	Furniture and Fixtures	460	3,694	12.5%	6.9%
27	Printing and Publishing	437	5,961	7.3%	2.5%
23	Apparel and Other Textile Products	398	1,168	34.1%	5.1%
31	Leather and Leather Products	1	491	0.3%	0.2%
20-39	Overall Manufacturing	91,050	575,428	15.8%	10.0%

Assessment of the market for Compressed air efficiency services - Office of Energy efficiency and Renewable energy U.S department of energy

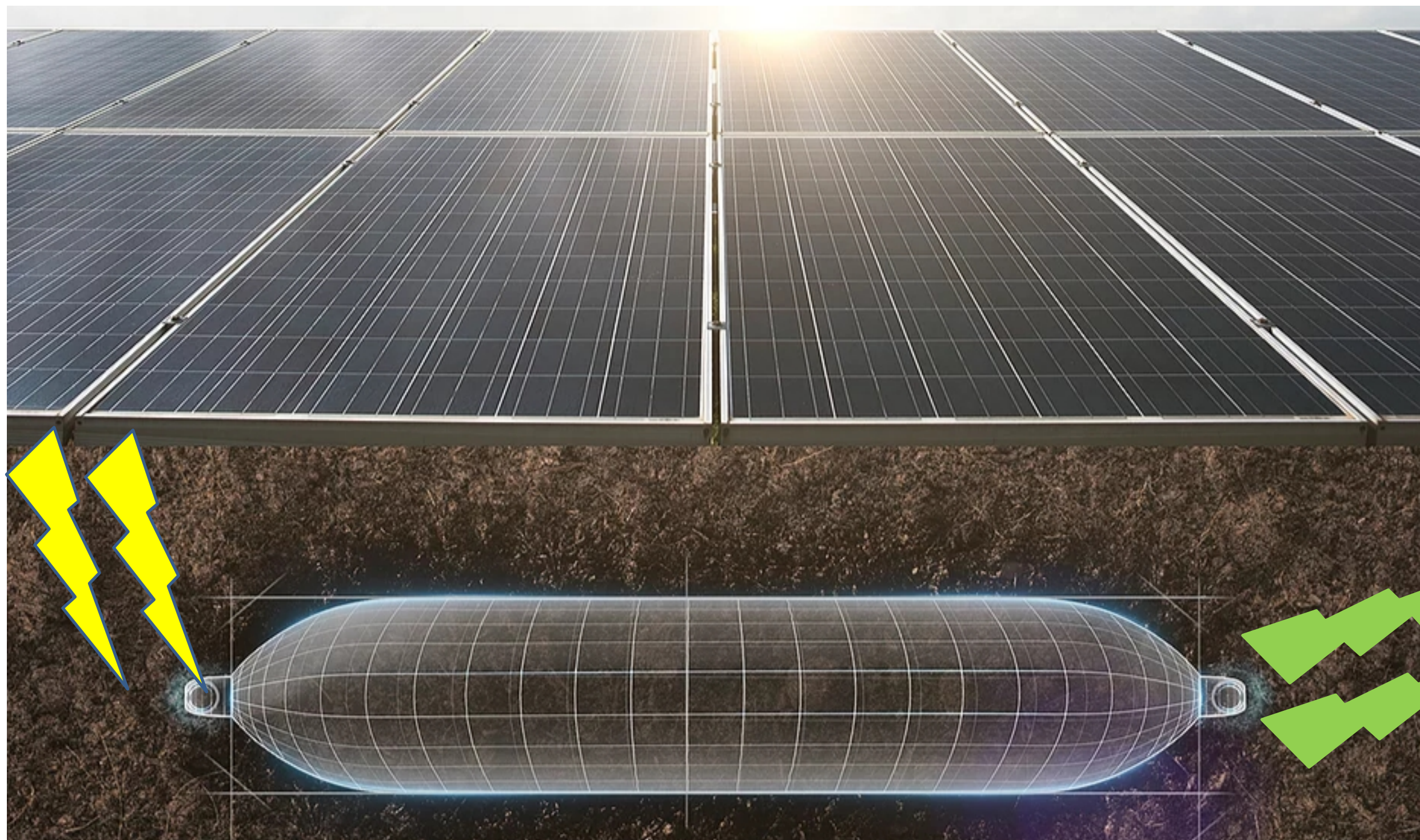
	\$/Month per enrolled KW	\$/KWh curtailed	Extra
	8-9		
	18-25	1	
	3.25	6	\$50/Kwh during first 2 events

- **Eu+US Market Spend 17B\$ annually for compressed air systems Power consumption 172TWhr**
- **EF - for 4 years ROI and 25% energy savings potential market is 17B\$**
- **PS -  $(172TWhr/8760) \times 5\$ \times 36months$  (3 years ROI)=3.53B\$**



CAES – Leveraging existing air storage technology

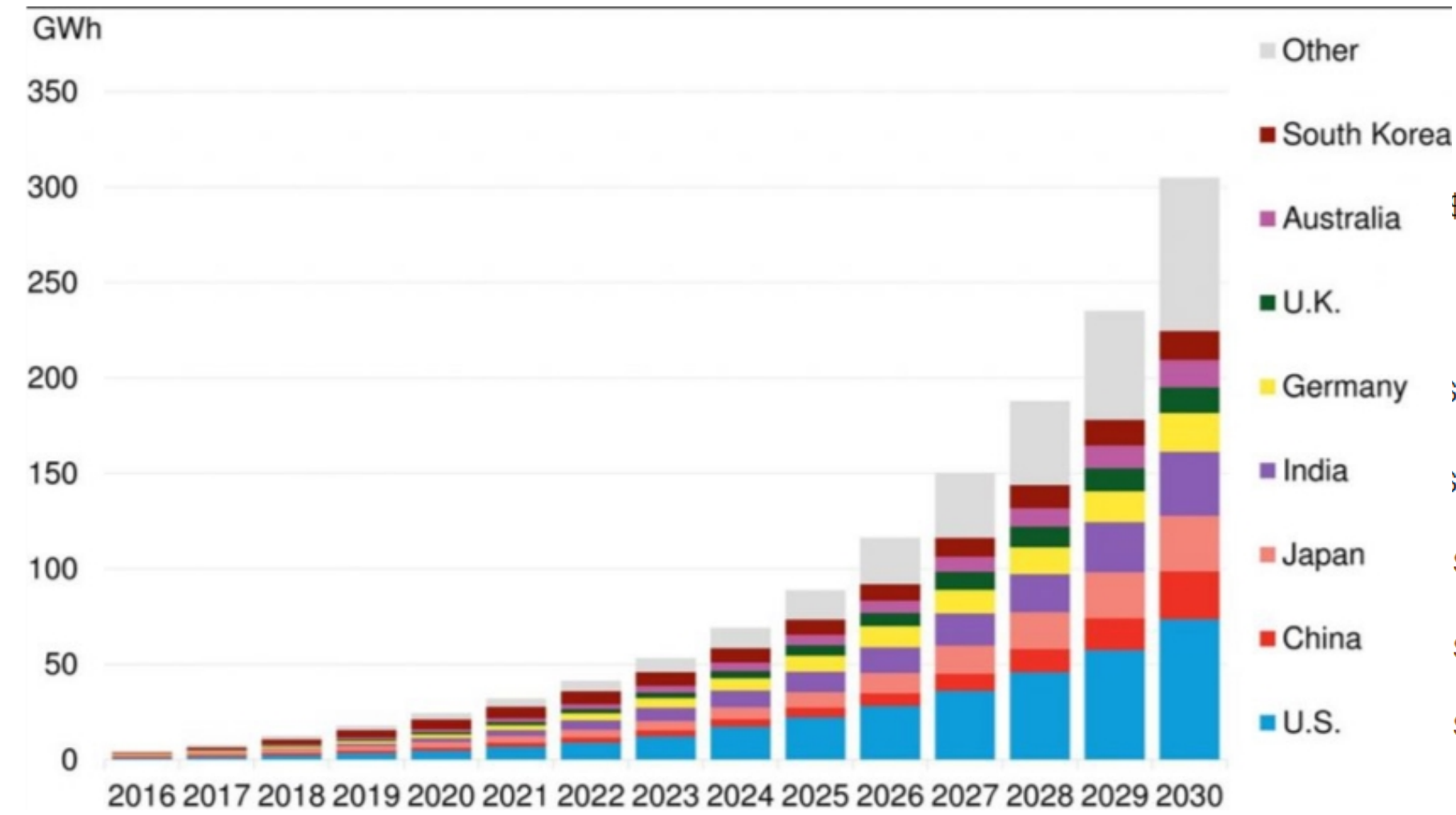
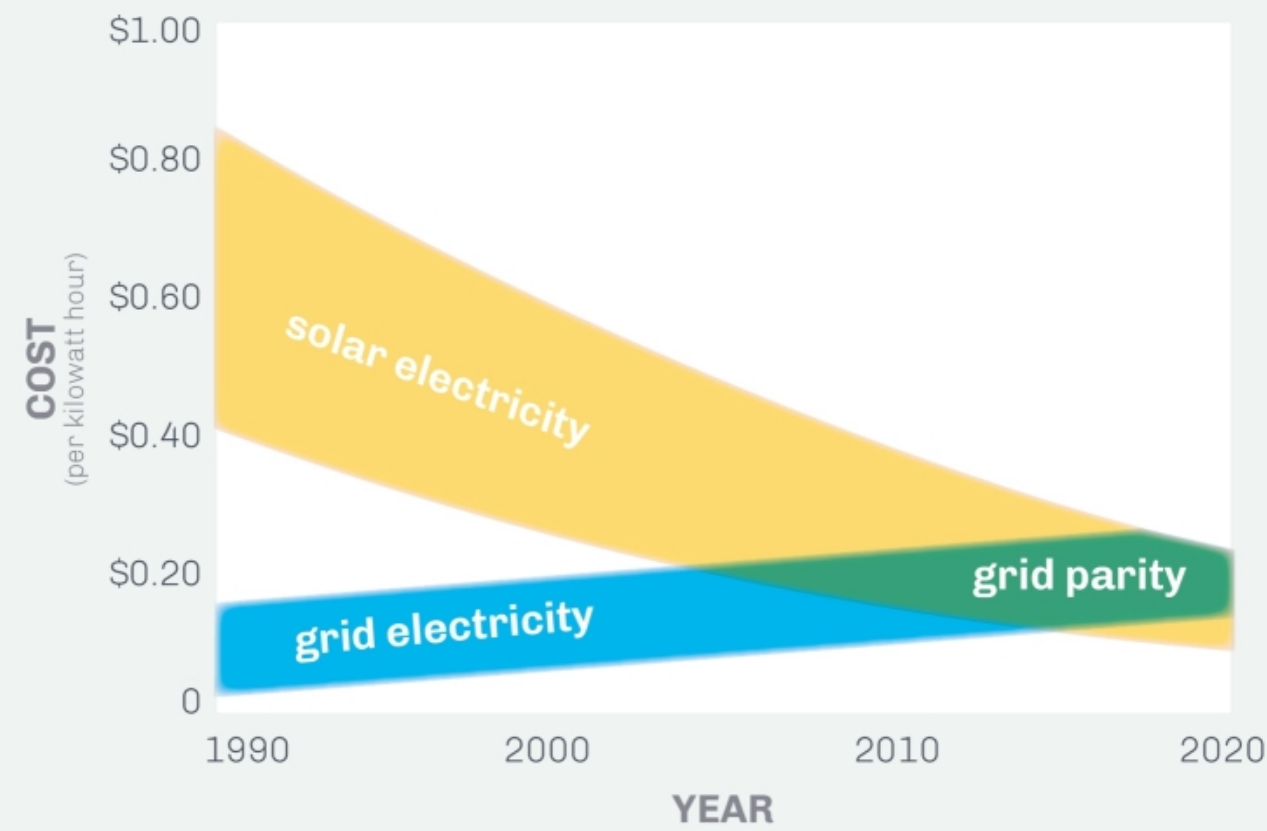
**GREEN**, Economic, High Efficient **ENERGY** Storage -> **CAES**





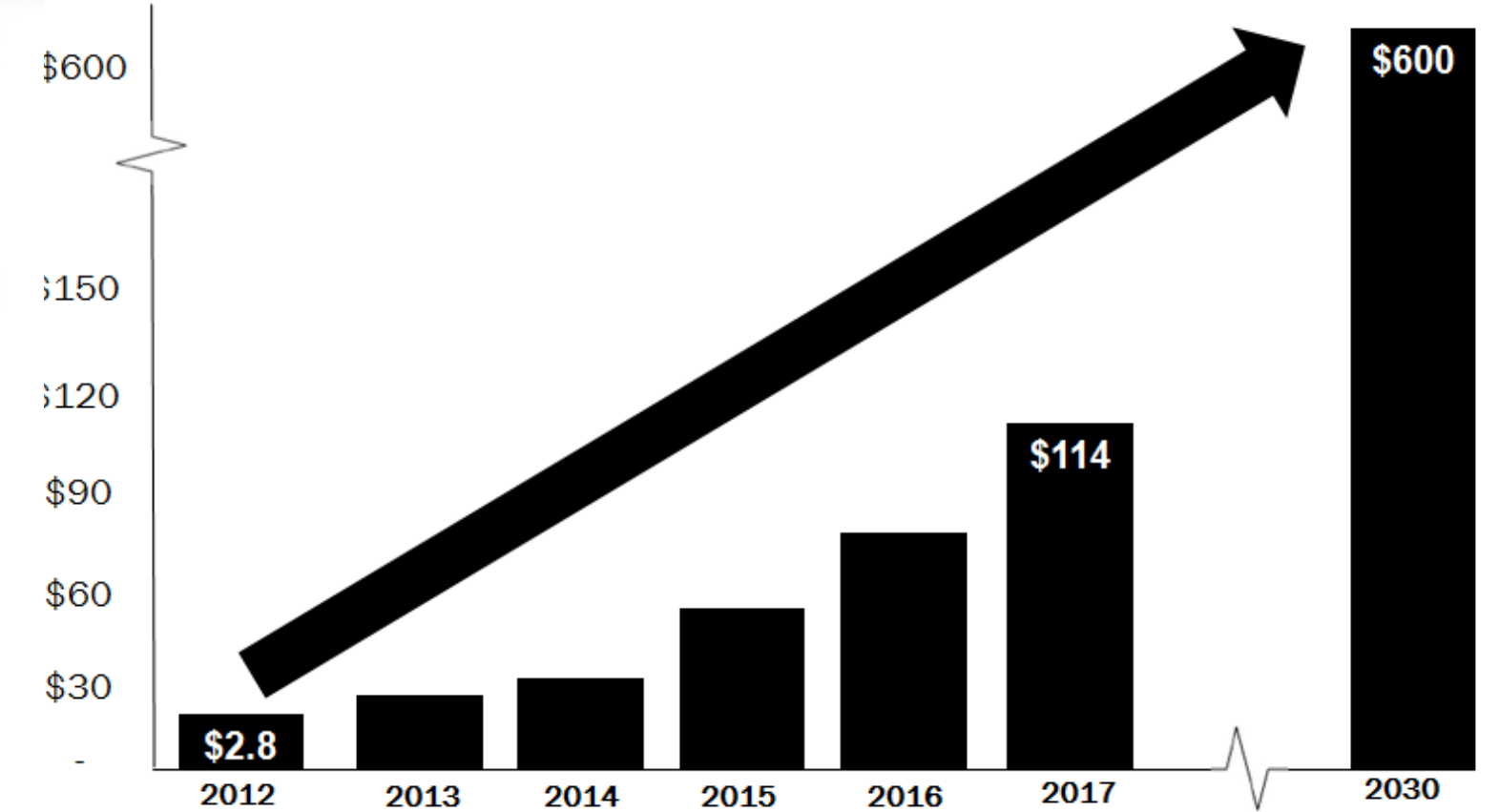
## Potential Market – Energy Storage

Solar Grid Parity Explained



**\$600 Billion by 2030**

Market Potential of Energy Storage Industry





## Energy Storage - Batteries



*“When it comes to batteries, people should not have to choose between their safety and access to power, much less store clean, renewable energy in toxic and hazardous batteries utilizing minerals that abuse human rights.”*

*“For the safety and true sustainability of both the planet and its inhabitants, the energy storage industry must say no to toxic and abusive raw materials, such as cobalt, and insist on storage solutions that are conflict and hazard free.”*

- ✓ Require significant natural resources
- ✓ High Degradation
- ✓ Non-Renewable
- ✓ Costly
- ✓ Pollution



## Lithium Ion – Battery Cost/Efficiency

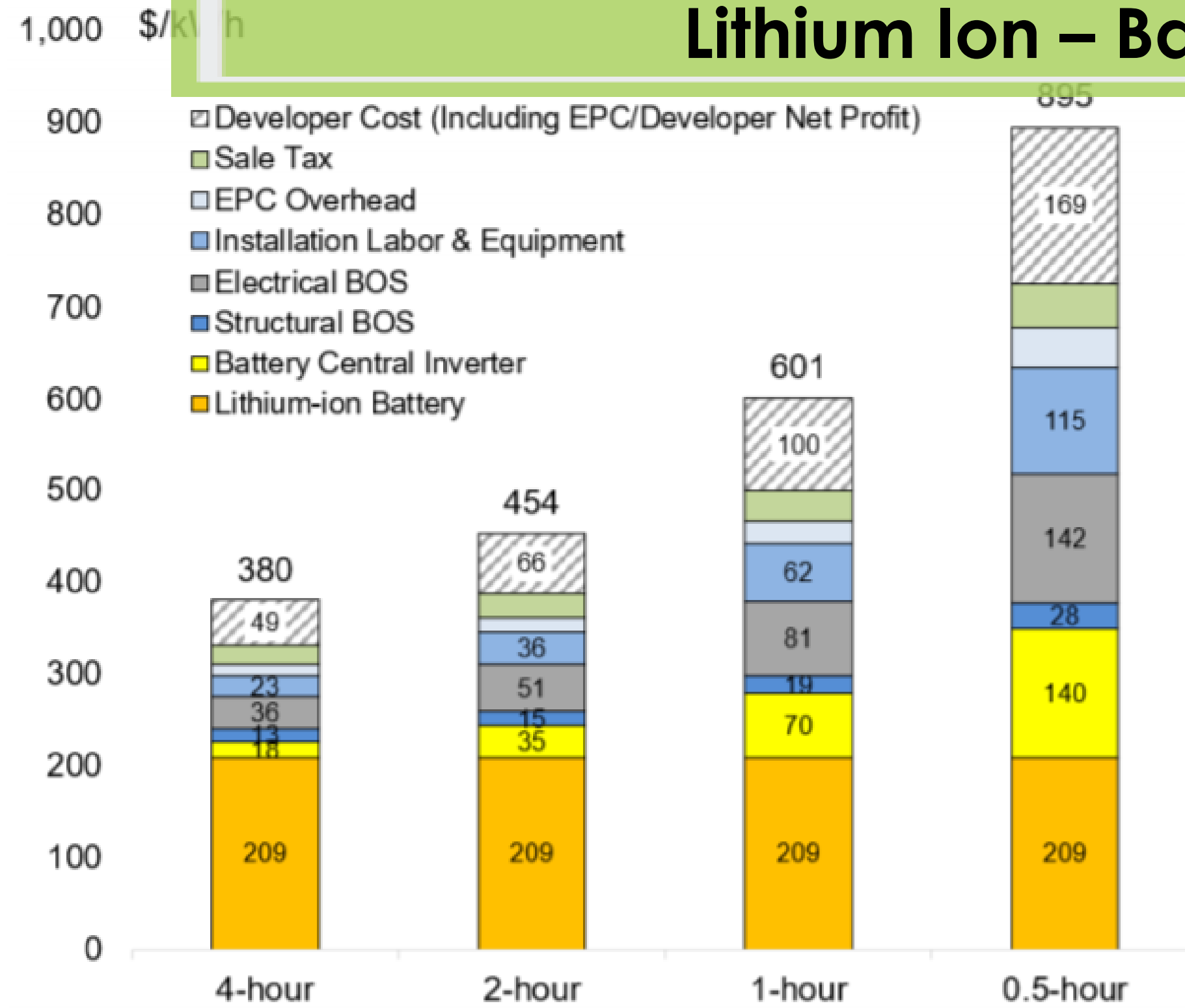


Figure ES-1. 2018 U.S. utility-scale lithium-ion standalone storage costs for durations of 0.5–4 hours (60 MW<sub>DC</sub>)

- Overall storage Li-ion battery > 2x cost of the battery itself
- High power → high overhead cost
- 'Cell' cost reduction will have miniscule effect on overall cost for high power system

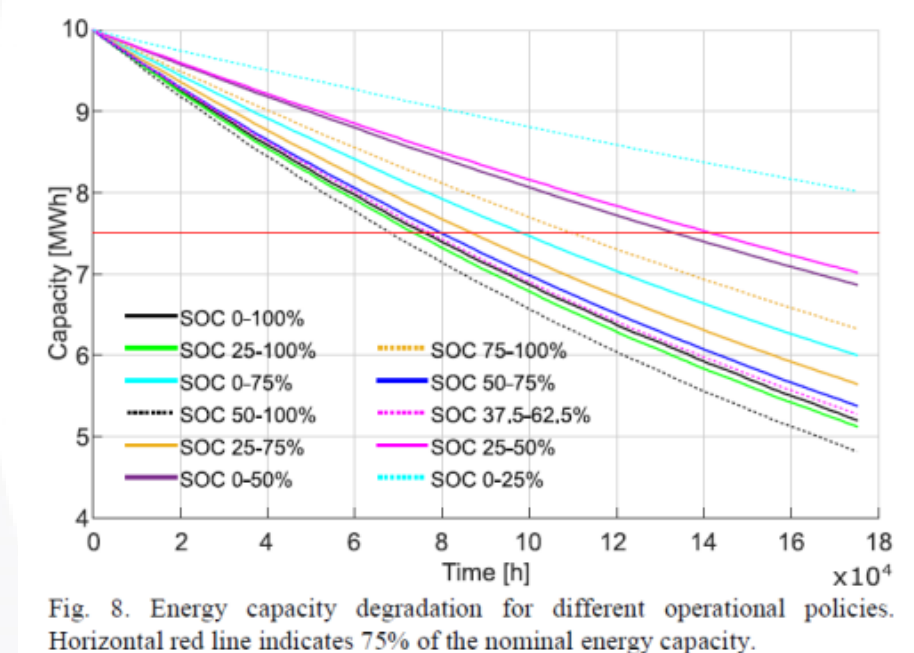
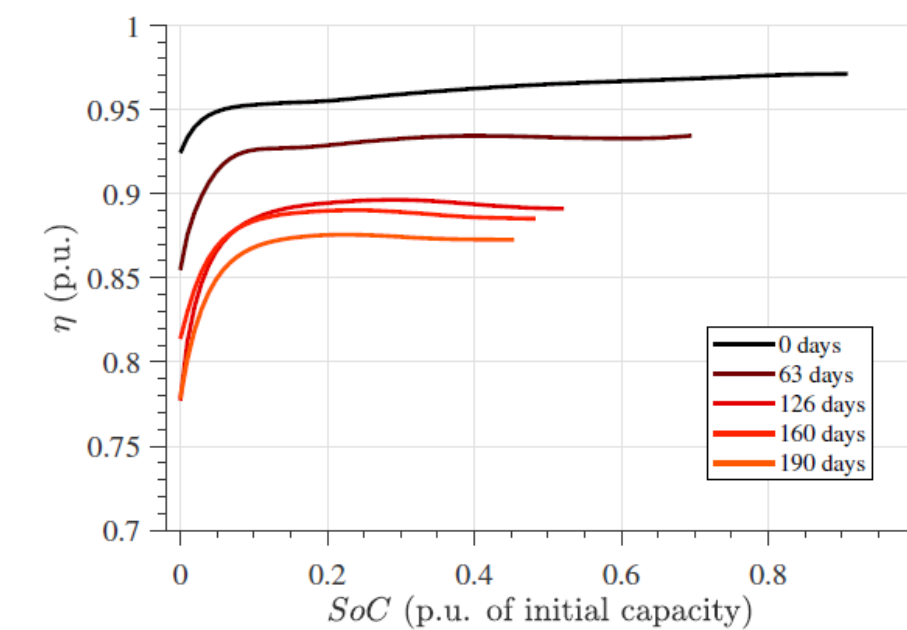
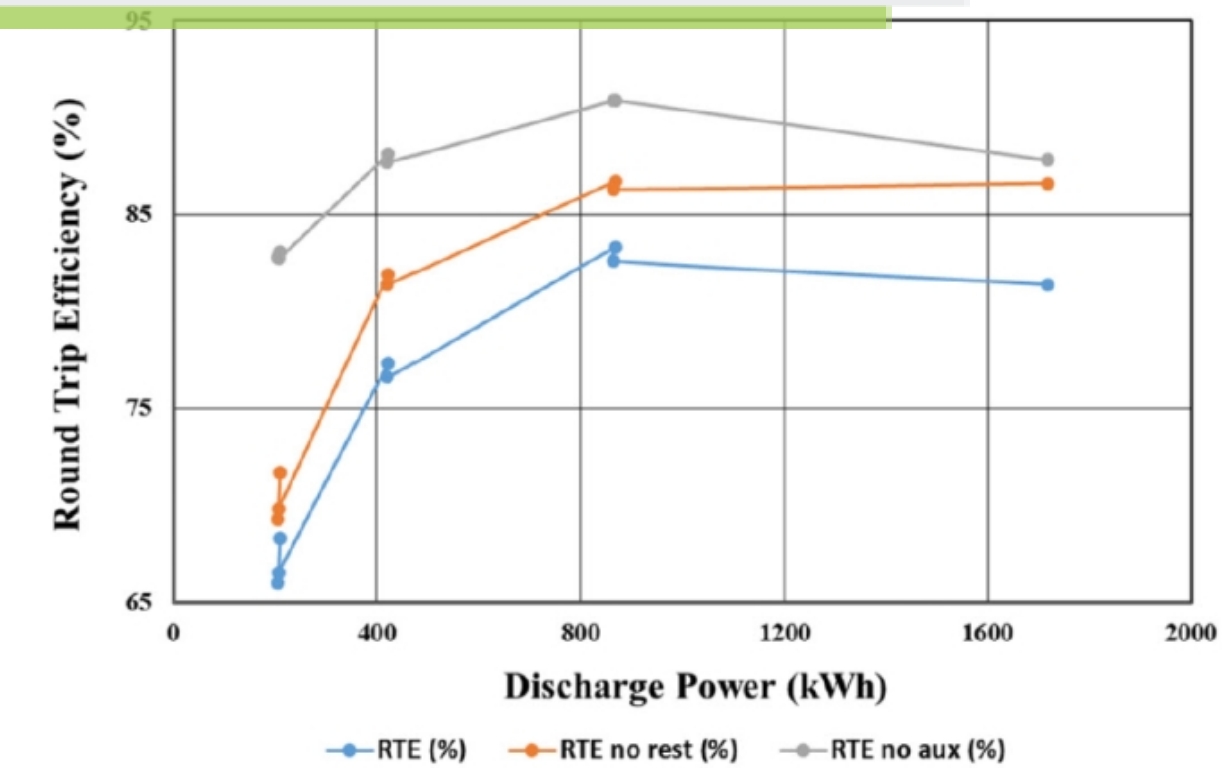


Fig. 8. Energy capacity degradation for different operational policies. Horizontal red line indicates 75% of the nominal energy capacity.

- Li-ion battery storage has 80-85% round trip efficiency
- Rapid degradation



## CAES

Advantages	Disadvantages
Free Air Availability	Low efficiency
No Hazards	High Cost for compressed air storage
Reliability (no degradation)	
High Density	
No Footprint	
Modularity/Scalability	

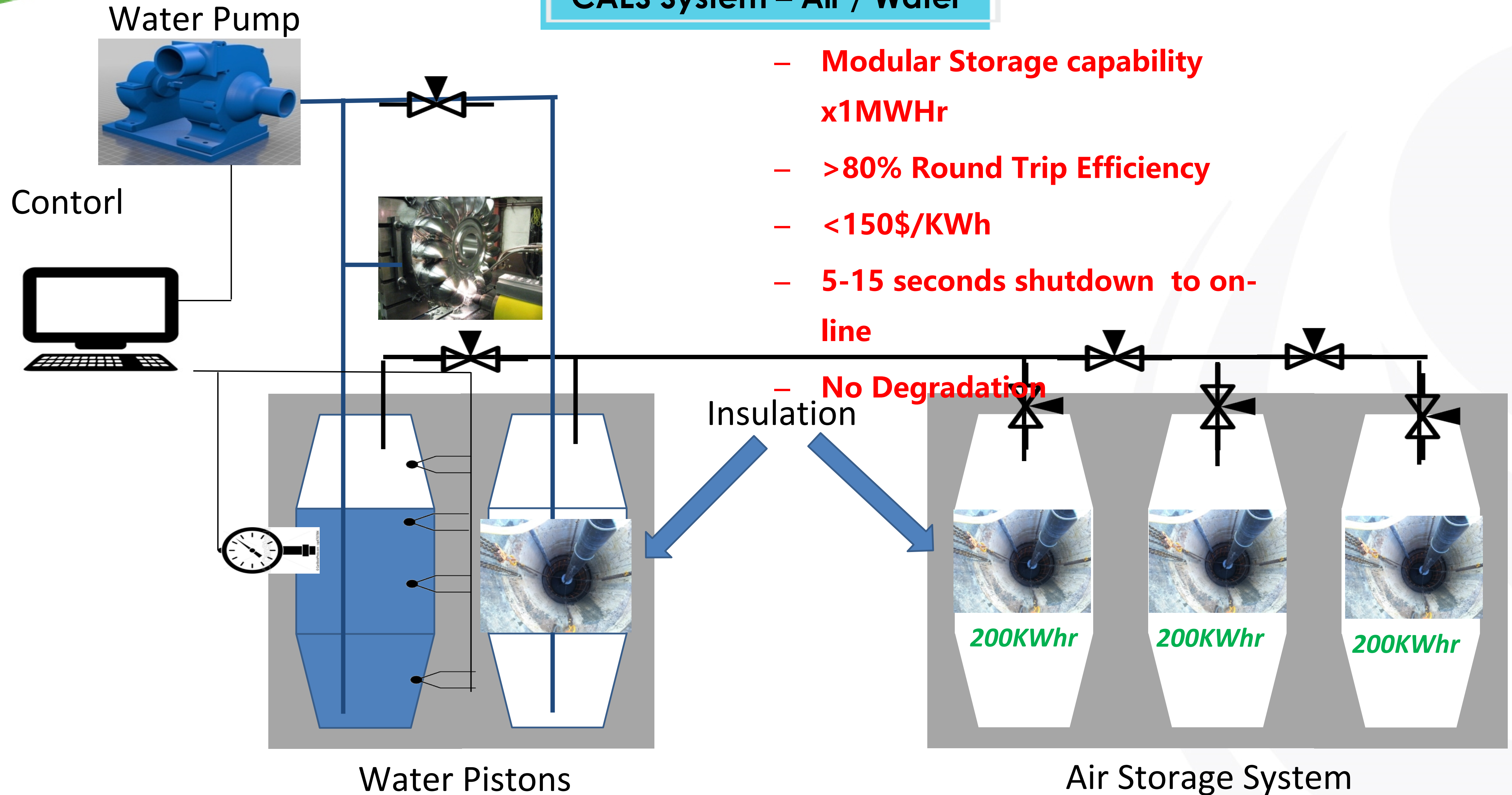


## Energy Storage – Augwind's main vision

- ✓ Developing the most cost/efficient energy storage technology for mid-
- ✓ Large scale application
- ✓ Unlike batteries, our technology is **100% GREEN** utilizing air/water only
- ✓ Infinite lifetime/cycles
- ✓ Modular solution
- ✓ Zero footprint
- ✓ **Becoming the largest energy storage company in the world**

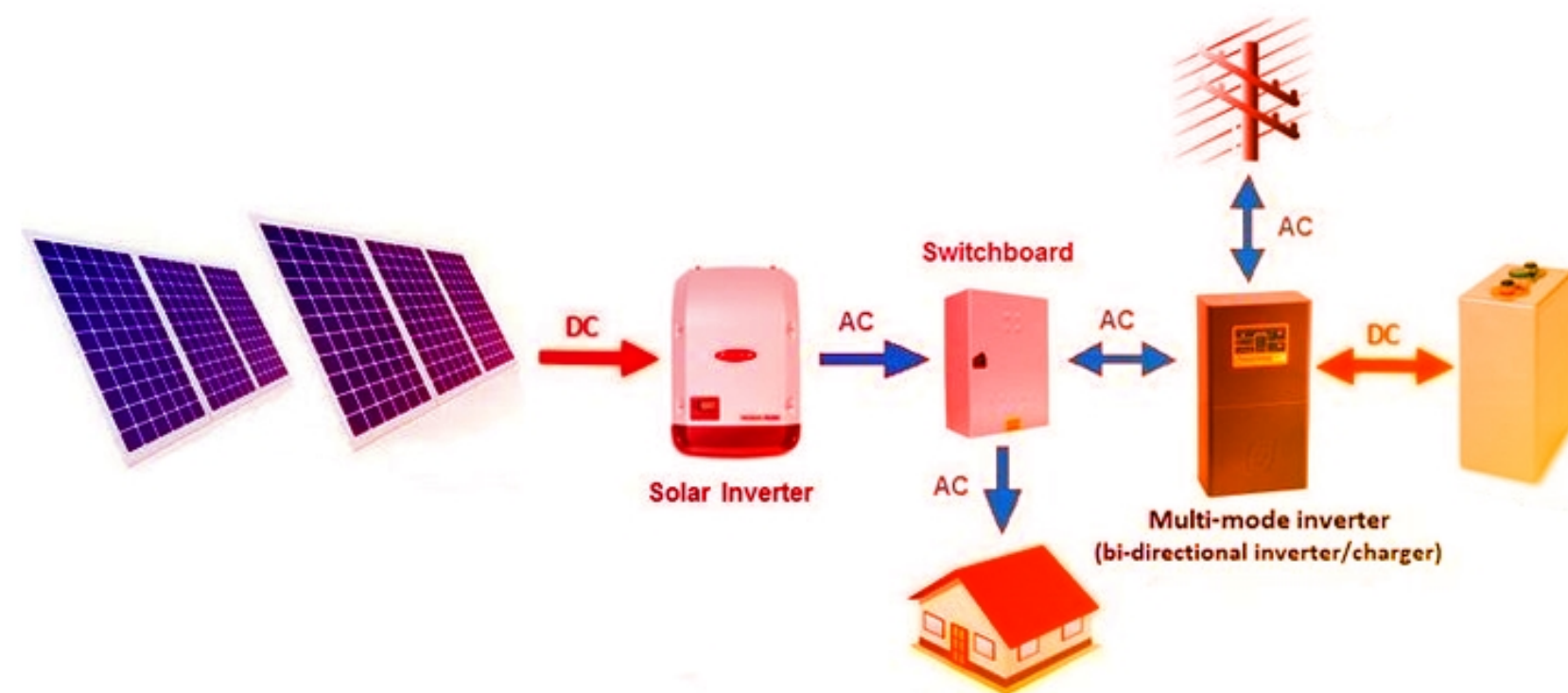


## CAES System – Air / Water

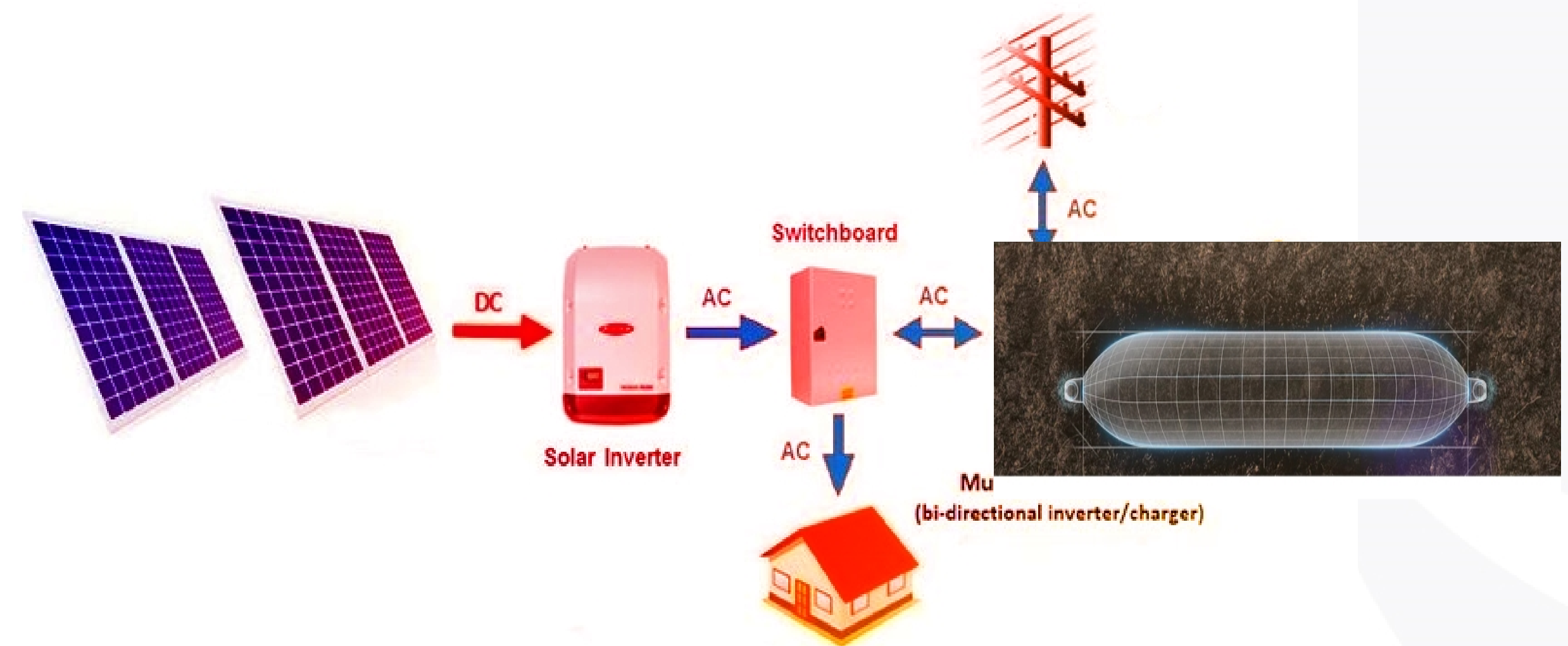




## System Configuration



***Li-ion Battery System***



***Augwind System***



## Pilot Project

# 1.5M nis Grant Ministry of Energy

**Augwind** is currently in the early stages of a pilot program for a storage system in the Negev, Israel.

If successful, the pilot will demonstrate **Augwind's** energy storage technology in a renewable energy setting.

**The program will be a cooperative effort alongside a major Israeli renewable energy company.**





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# THANK YOU!

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