Investing in Alternative Energy

Hydrogen & Batteries

February 1, 2022

David Toms
Graphics by Cindy Kalkwarf

AGENDA

- What has changed since July?
  - Infrastructure and Investment Jobs Act providing DOE investment
  - Green-centered investments have lost interest – is this the time to get in?
    - Fed funds rate increasing, driving growth to value rotation
  - Fossil fuels are resurgent
  - COP26
  - Build Back Better ????
- Everything is going electrical
- Hydrogen as a fuel of the future: background
- Hydrogen market and investment opportunities
- Lithium batteries – technologies, opportunities

A PERSONAL NOTE

- I am 71, retired, with pensions
- Investing is a hobby: I am not a professional stock analyst
  - Do your own DD before investing
- I trade infrequently, from my IRA
- Long term, buy and hold strategy
  - Always looking for new opportunities
- My portfolio is a mixed bag
  - Green energy / climate change-oriented stocks
  - Large cap, industrials, S&P500 ETF
  - High yield REITs and BDCs - health care and data center related
- My info sources: Fidelity, Seeking Alpha, WSJ, Bloomberg, Barron's

Oh, and I am living on my boat this winter in Florida with my wife

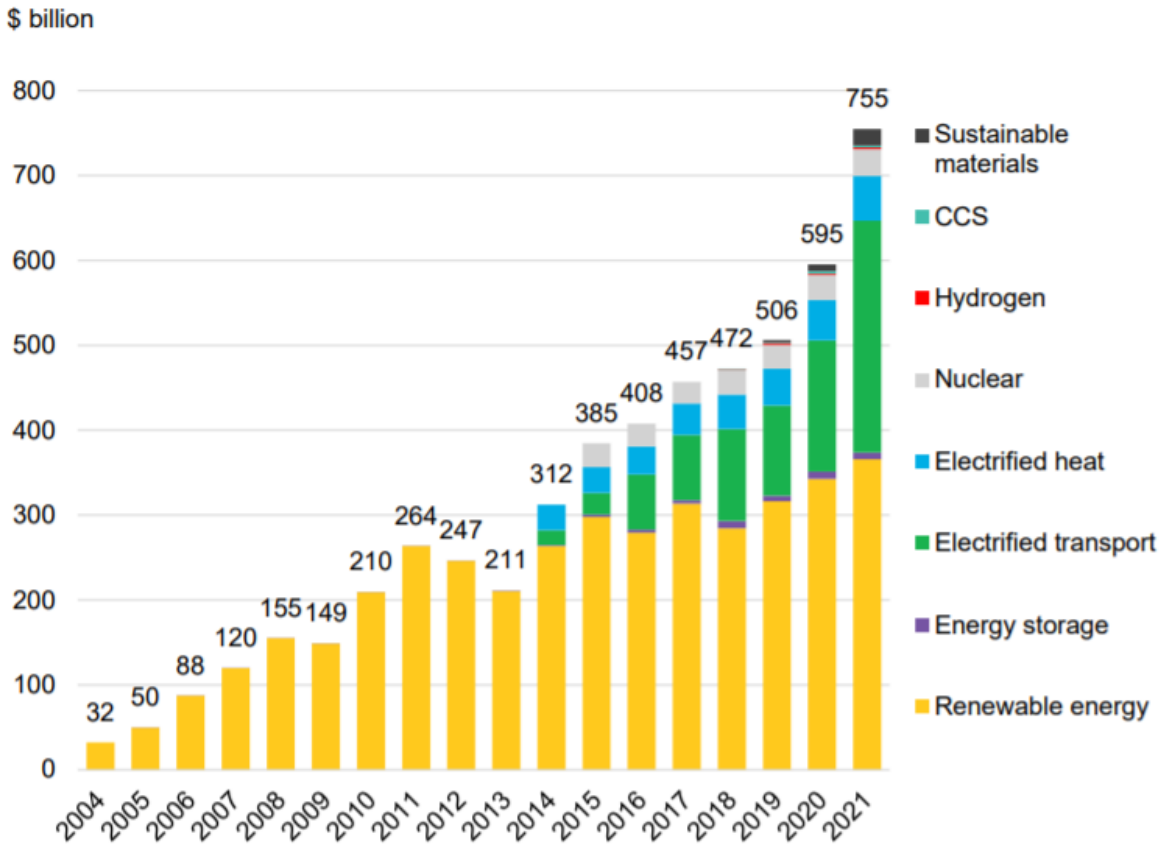
- I subscribe to Warren Buffet's philosophies:
  - "Understand the businesses you are investing in"
  - "When the market is greedy, be fearful, but when the market is fearful, be greedy."

Thesis: The world is in transition away from fossil fuels toward green energy to deal with climate change
Corollary: Everything is being electrified and decarbonized

- New Biden administration policies, Paris climate accords
- Hydrogen is emerging as a new fuel for transportation, and many other applications
  - Expected to be cheaper than gasoline by 2024
  - Technologies for H2 generation, storage, distribution, fuel cells are rapidly developing
  - EU has earmarked $550B to H2 infrastructure development
  - Many countries have developed a hydrogen strategy
- **Generating electricity is easy; storing it is hard**
- **Generating hydrogen is hard; storing it is easy**

Energy transition investment surpassed $750 billion in 2021

Global investment in energy transition by sector

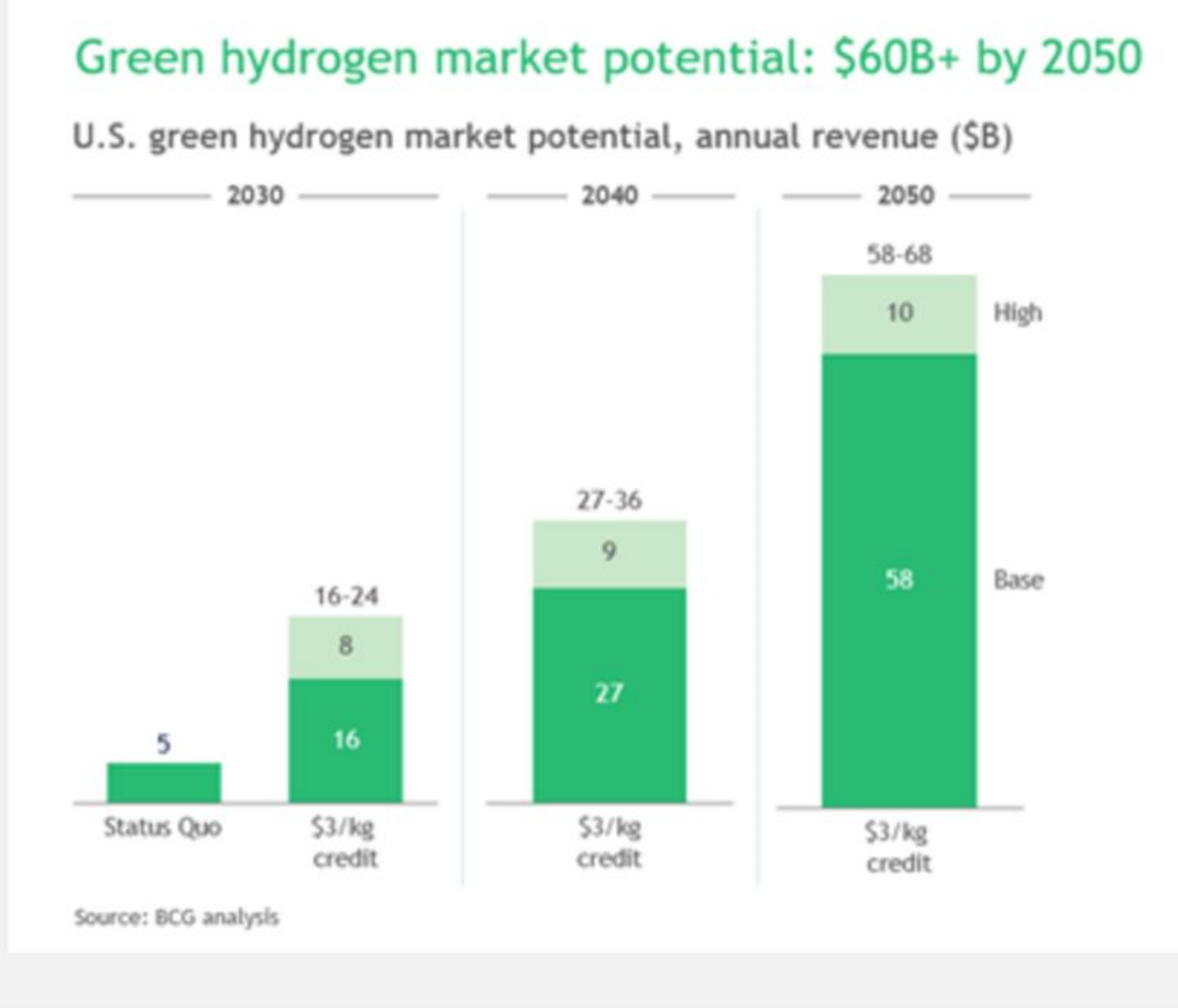


Source: BloombergNEF. Note: start-years differ by sector but all sectors are present from 2019 onwards; see Appendix for more detail.

- The world committed a record $755 billion to decarbonize the energy system in 2021, beating the previous year by 27%.
- Both renewable energy and electrified transport, the two biggest categories, rose to new records in 2021 as wind and solar installations and electric vehicle sales surged.
- Companies, governments and households invested $366 billion in new renewable energy capacity in 2021, up 6.5% on the year.
- They also spent $273 billion on electric vehicles and associated charging infrastructure, up 77%. On current trends, the EV sector should overtake renewable energy investment this year.
- The next largest sectors of spending were electrified heat at $53 billion and nuclear energy at $31 billion.
- Together, clean power and electrification (comprising renewables, nuclear, energy storage and electrified transport and heat) accounted for the vast majority of investment, at $731 billion. Hydrogen, carbon capture and storage and sustainable materials made up the rest, totaling $24 billion.
- CCS was the only sector not to see rising investment in 2021, dropping slightly to $2.3 billion.

Investment must be 6X this by 2030 in order to meet 2050 net zero goals

Green Hydrogen Market Potential



The Electrification of Everything

- US electrical generation requirements are expected to double by 2050
  - Cars, trucks
  - Heat pumps instead of oil/NG fired heaters
  - Heavy industry – steel, cement, ammonia
  - Shipping
  - Aviation
- Can the electrical grid sustain increasing demand within the next few years?
  - Probably not
  - California already directing drivers of electric cars not to charge them between 5-7 PM on hot days
- Solar (residential and utility scale), wind turbines, grid-batteries need integration

Honda Clarity Fuel Cell
2017 - 2021
Manufacturer's Website

Hyundai Nexo
2019 - 2021
Manufacturer's Website

Toyota Mirai Fuel Cell Vehicle
2017 - 2021
Manufacturer's Website

Hydrogen: Fuel of the Future

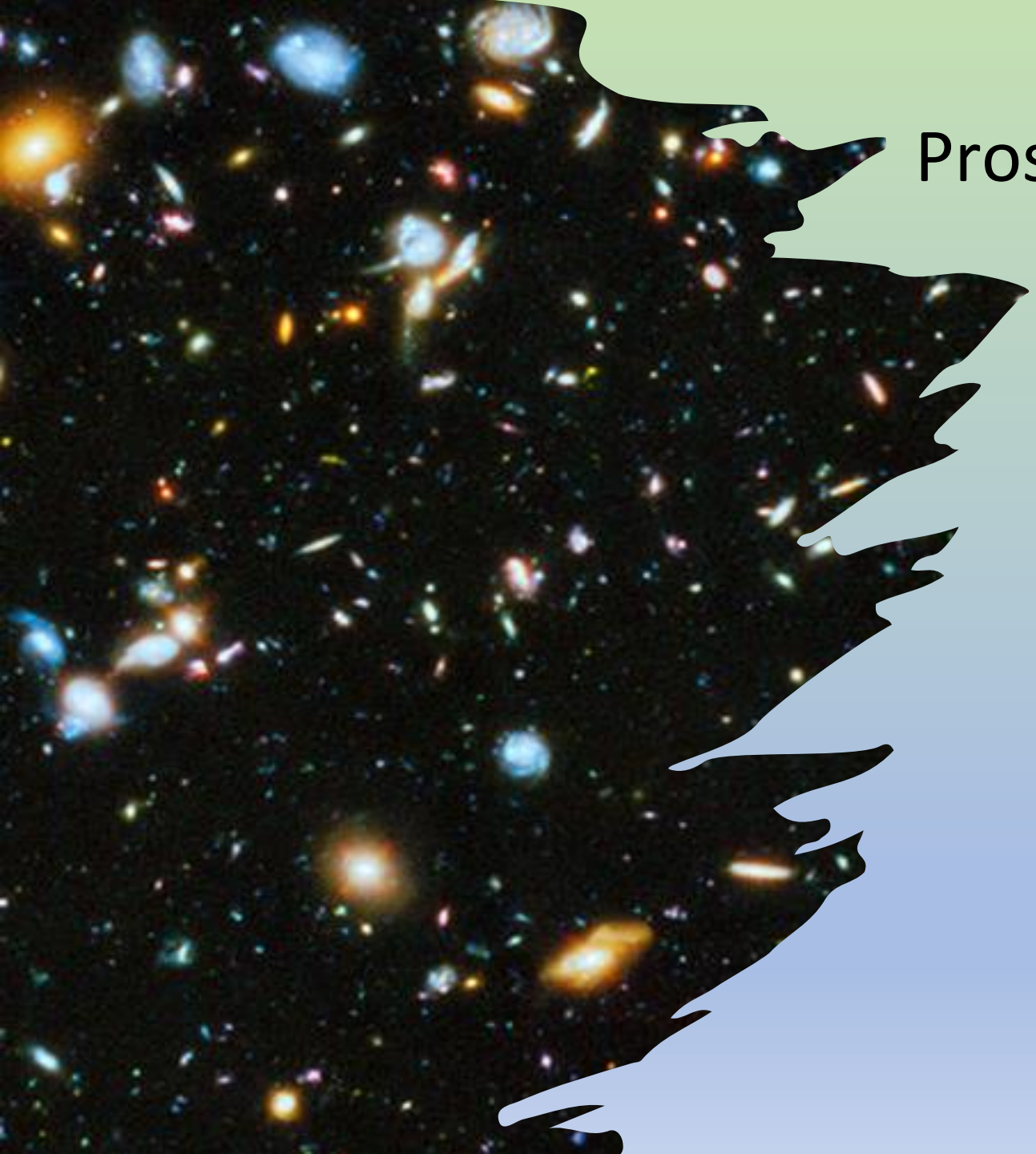
Toyota Mirai new world record: 854 miles on one tank of H2

Four Major Uses for Hydrogen

- Traditional:
  - Fertilizers, Ammonia
- New applications:
  - Steel, Cement, Smelting
  - Power Generation and Grid Balancing
    - Gas turbines and ICE
    - Data center back up power
    - Energy storage
  - Fuel Cells for transportation and portable power generation
    - Automobiles, Trucks, Aircraft, Drones, Trains, Buses, Ships
  - Residential and Commercial Building heating and power

The Colors of Hydrogen

	Brown/Black hydrogen Made from Coal
	Grey hydrogen Produced from steam methane reforming (natural gas) Emits 10X as much CO2 as H2 95% of all current production
	Blue hydrogen Steam reforming, but sequesters the CO2 Oil companies are working hard on this
	Green hydrogen Produced via wind power, solar, nuclear, hydro Carbon-free



Pros: Why Hydrogen Makes Sense

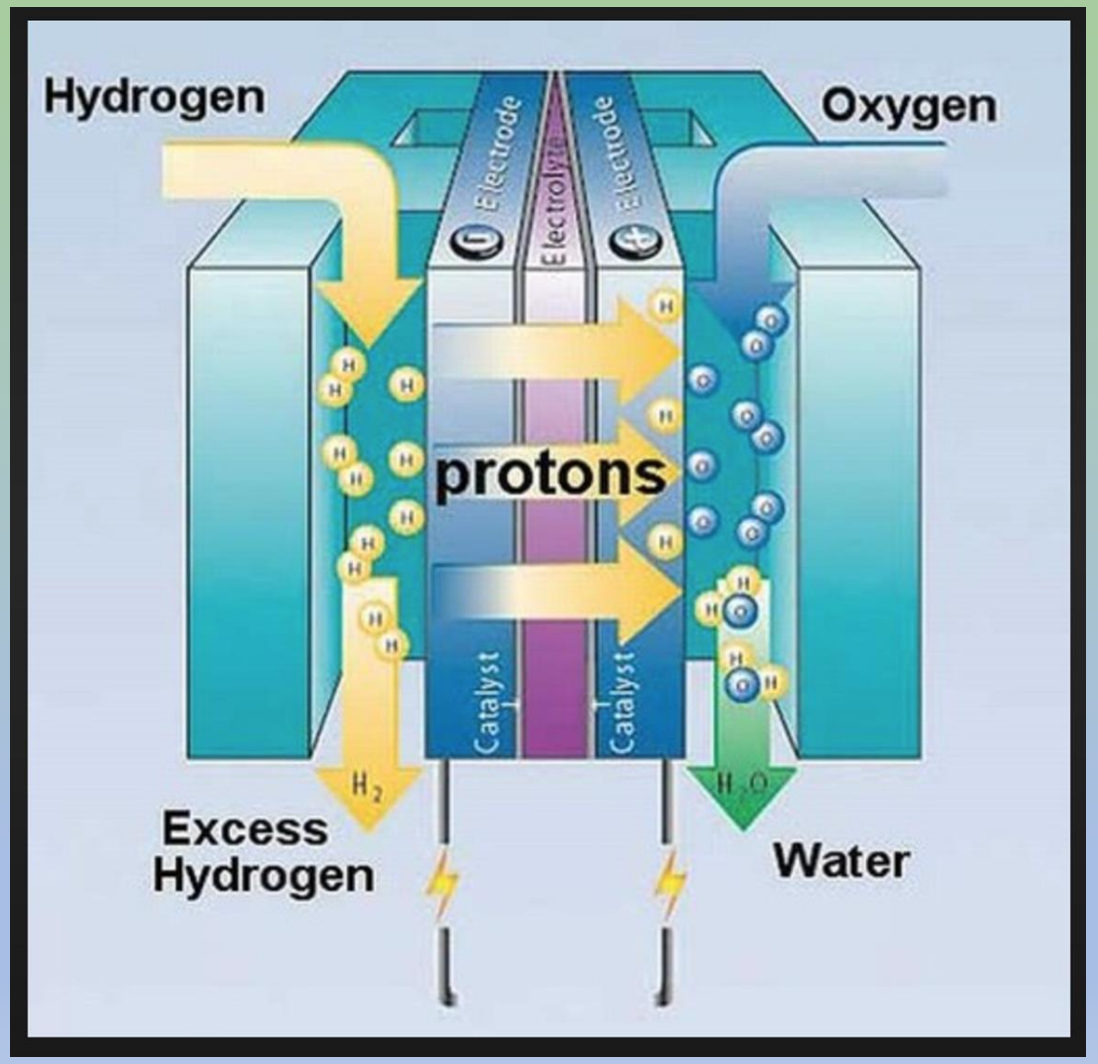
- The Universe is 99% hydrogen; the earth is 70% covered by H2O
- 1 KG of hydrogen has 130X more energy than 1 KG of Li batteries – battery energy density is poor
- 1 KG of hydrogen is roughly equivalent to 1 gallon of gasoline
- Refueling a hydrogen fuel cell vehicle takes about 5 minutes
- Hydrogen production is carbon-free when produced by wind, solar, hydro or nuclear power
  - Excess energy can be stored as hydrogen in tanks or as a liquid or as ammonia (NH3)
- Easily transported as a gas, liquid, or as ammonia
  - Pipeline distribution of hydrogen is 1/10th the cost of electricity distribution
  - Can re-use most existing pipelines
  - Can be mixed with natural gas for storage, or consumption

Cons: Why hydrogen is slow to take off

- Infrastructure does not exist to support widespread distribution
- Amazon, Walmart, Home Depot distribution centers all have H2 facilities
- H2 is costly to produce: $6 per gallon gasoline equivalent > Projected to decline to $3.00 by 2024
- Lack of public awareness; US has no plan
- Some oil companies view hydrogen as a threat
- My take: H2 transportation and power market will take off in next 3-5 years

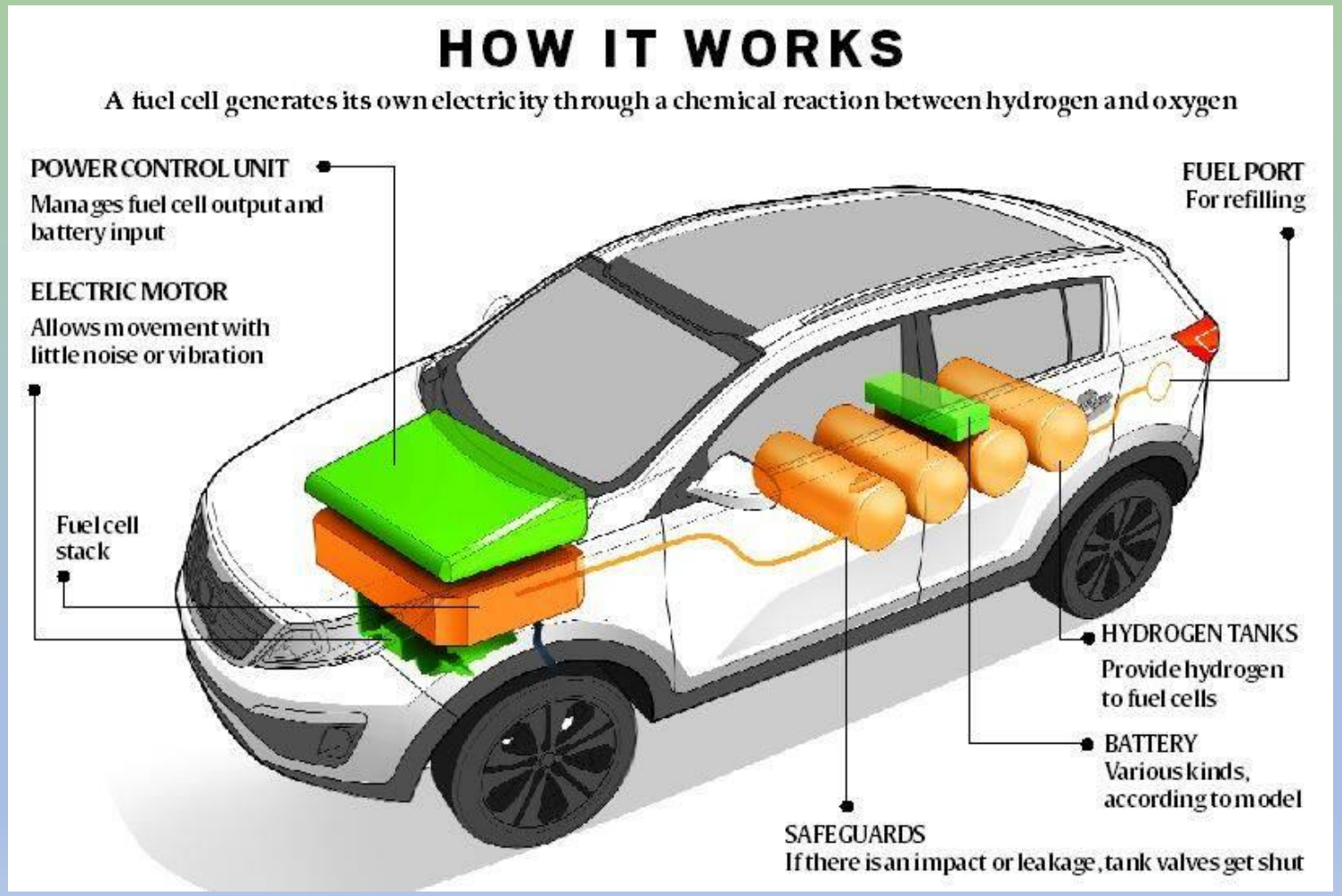
What is a Hydrogen Fuel Cell?

- Many different types
- First invented in 1838 (before oil was discovered in Pennsylvania!)
- Used by NASA in space vehicles since 1960s
- Electrolyte can be a polymer or ceramic
- **Process is reversible - reverse process is called an "Electrolyzer", which produces hydrogen**



Source: californiageo.org

Fuel Cell Vehicles are also Electric Vehicles



DIY Hydrogen Fuel Cell Car on Amazon

‹ Back to results

Roll over image to zoom in

Horizon Fuel Cell Technologies Fuel Cell Car Science Kit

Brand: Horizon Fuel Cell Technologies

4.3 out of 5 stars 16 ratings | 6 answered questions

Price: $178.82

Get 5% back ($8.94 in rewards) on the amount charged to your Amazon Prime Rewards Visa Signature Card.

- Horizon puts renewable energy technology into the hands of our future scientists
- Fuel Cell Car Science Kit uses a PEM fuel cell to combine electrolysis and power conversion
- Watch as oxygen and hydrogen gases are formed to power the car
- Combining cutting-edge science, education and fun for all!
- Includes PEM fuel cell and car, education manual and experiment guide

New (2) from $178.82

Report incorrect product information.

$14 off coupon

Leegol Electric Hobby Rock Tumbler Machine - Single Drum 3LB Rock Polisher (Single Barrel)

4.5 out of 5 stars 1,090

$62.99 prime

Sponsored

$178.82

Your selected delivery location is beyond seller's shipping coverage for this item. Please choose a different delivery location or purchase from another seller.

Amazon Hub Locker - Geoffrey - Reston 20191

In stock.

Usually ships within 3 to 4 days.

Qty: 1

Add to Cart

Buy Now

Secure transaction

Ships from M + L

Sold by M + L

Return policy: This item is returnable

Global Momentum Building for Hydrogen

- All of these countries have a hydrogen investment strategy:
  - European Union - $550B committed for infrastructure
    - Green energy plan announced just yesterday
  - China
  - Japan – Goal to build 1000 hydrogen stations by 2030
  - Australia
  - South Korea
  - Saudi Arabia
  - California - $50M per year commitment to building infrastructure
    - Goal: 1000 hydrogen filling stations by 2030
    - Goal: 1M fuel cell cars deployed by 2030

- BUT NOT THE US Government!
  - New DOE strategy due to Congress May, 2022
  - Biden Admin goals: power generation carbon-free by 2035; economy net zero by 2050.

The US Invests in Hydrogen in the 2021 Infrastructure Investment and Jobs Act (IIJA)

Bipartisan Infrastructure Law - Hydrogen Highlights

- **Covers $9.5B** for clean hydrogen:
  - $8B for at least four regional clean hydrogen hubs
  - $1B for electrolysis research, development and demonstration
  - $500M for clean hydrogen technology manufacturing and recycling R&D

President Biden Signs the Bipartisan Infrastructure Bill on November 15, 2021.
Photo Credit: Kenny Holston/Getty Images

- **Aligns with Hydrogen Shot priorities by directing work to reduce the cost of clean hydrogen to $2 per kilogram by 2026**
- **Requires developing a National Hydrogen Strategy and Roadmap**

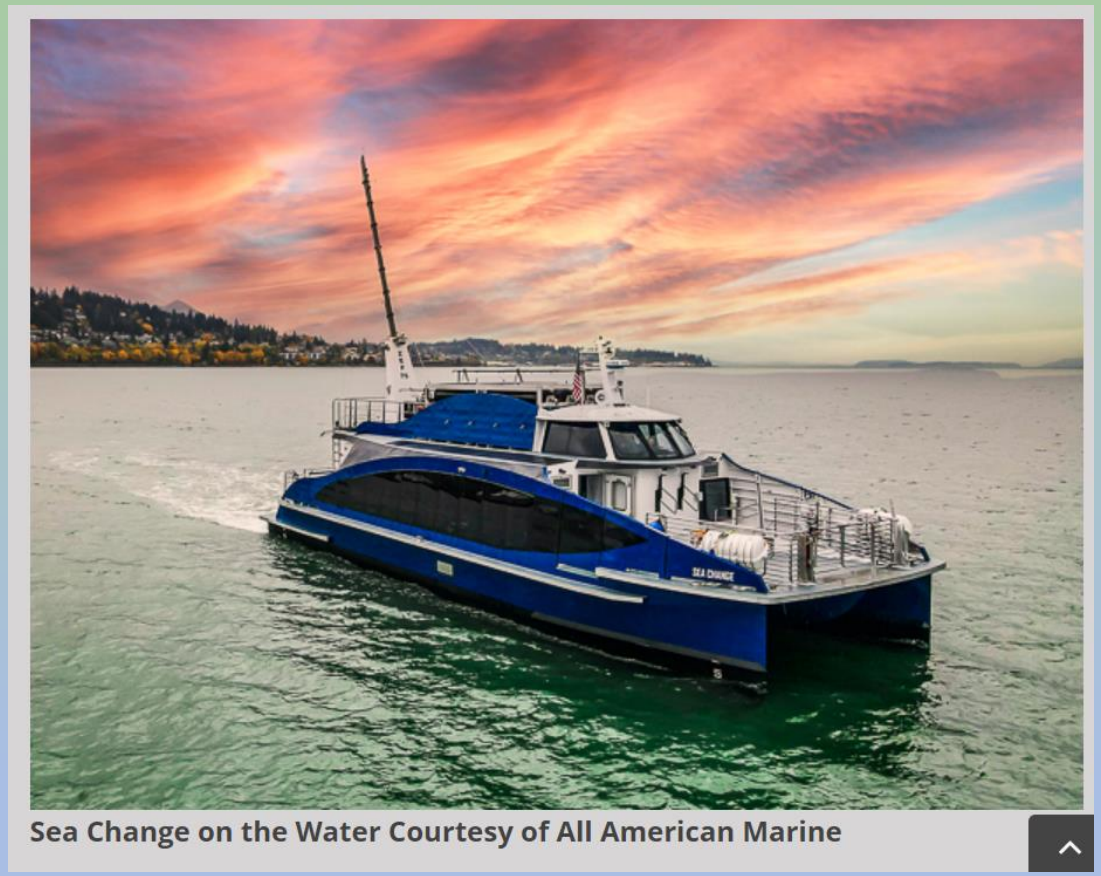
6

- Passed Nov 15, 2021
- Appropriates $550 billion for new infrastructure investments
- Creates new Office of Clean Energy Demonstrations under DOE
- For the first time, U.S. law will define “clean hydrogen”

Source: US Dept of Energy

California Hydrogen Filling Stations (63)

Hydrogen-Powered Ferry, “Sea Change”



Sea Change on the Water Courtesy of All American Marine

- https://www.cbsnews.com/news/hydrogen-powered-ferry-to-debut-in-san-francisco/

SunLine Bus Transit, Palm Desert, CA

An all-hydrogen bus fleet – no emissions, no carbon

Operational since 2012

AIRBUS developing hydrogen aircraft

AIRBUS | Who we are | What we do | Innovation | Sustainability | Safety | Products & Services

Hydrogen propulsion to power future aircraft

All three ZEROe concepts are hybrid-hydrogen aircraft. They are powered by hydrogen combustion through modified gas turbine engines. Liquid hydrogen is used as fuel for combustion with oxygen.

In addition, hydrogen fuel cells create electrical power that complements the gas turbine, resulting in a highly efficient hybrid-electric propulsion system. All of these technologies are complementary, and the benefits are additive.

ZEROe concept aircraft

Turbofan

Two hybrid-hydrogen turbofan engines provide thrust. The liquid hydrogen storage and distribution system is located behind the rear pressure bulkhead.

Turboprop

Two hybrid-hydrogen turboprop engines, which drive eight-bladed propellers, provide thrust. The liquid hydrogen storage and distribution system is located behind the rear pressure bulkhead.

Blended-Wing Body (BWB)

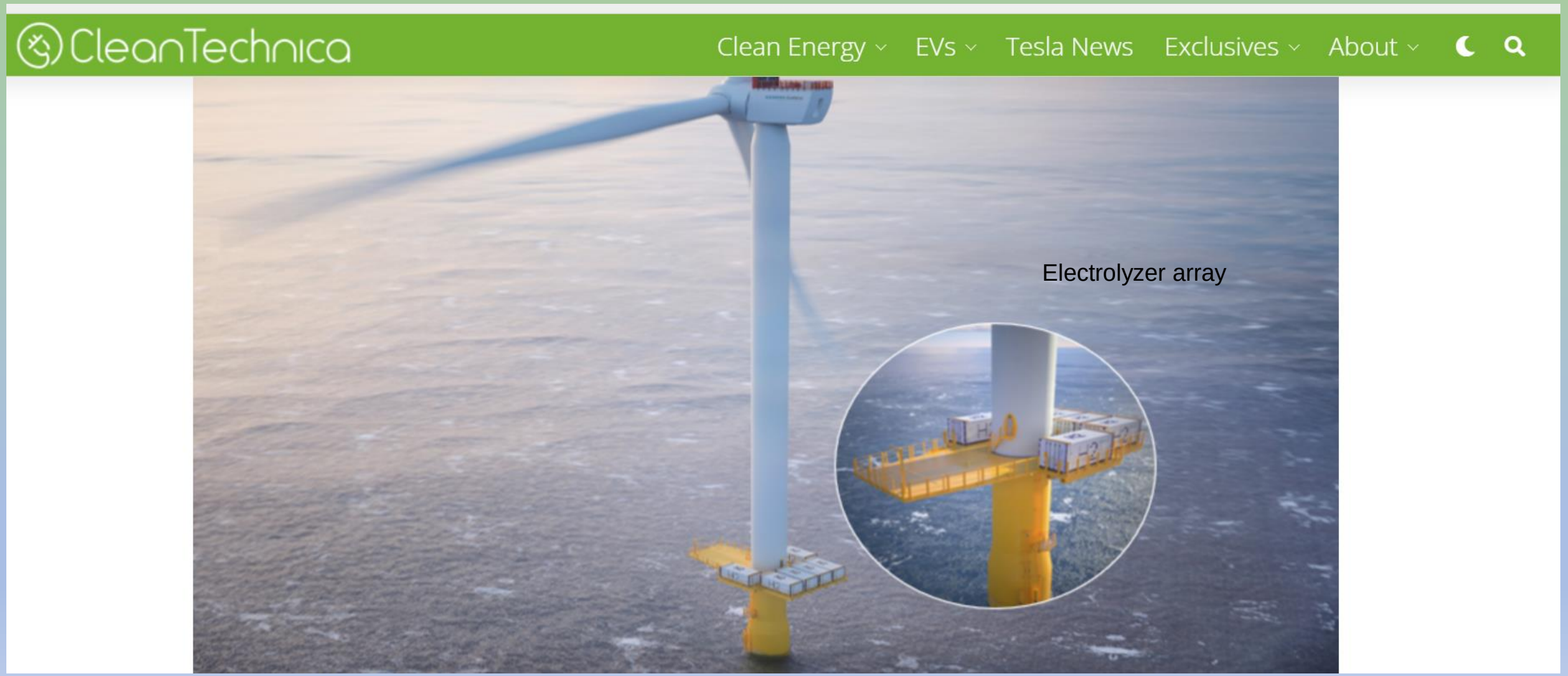
The exceptionally wide interior opens up multiple options for hydrogen storage and distribution. Here, the liquid

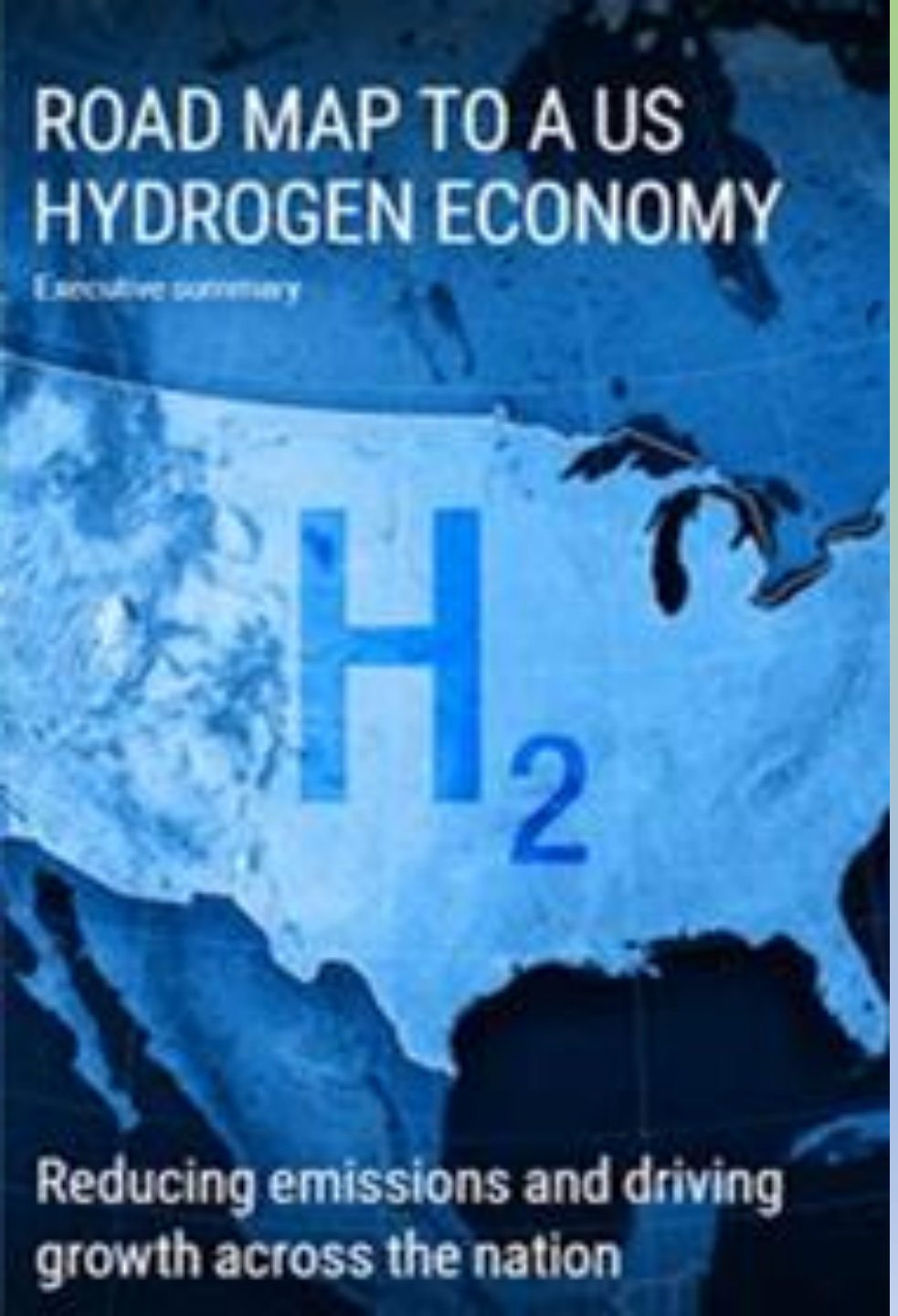
Generating hydrogen from common trash

Source: WAYS2H

- WAYS2H and SGH2 are developing reactors to convert common garbage into hydrogen
- Lancaster, CA, project under construction
- 3800 tons / year @ $2/kg expected production
- Future H2 production sites may be at garbage dumps

Excess wind energy stored via hydrogen





2020 Study contributors (20):

Air Products*Cummins*Shell*Chevron*Mercedes Benz*Hyundai*Plug Power*Air Liquide*Toyota*Others

Projected Growth 2020 to 2030

- FCEV's: 2,500 to 1.2M
- Material Handling: 25,000 to 300,000
- H2 Filling stations: 63 to 4,300
- Annual investment: $1B to $8B
- Jobs: 50K to 500K

My View of Fuel Cell Vehicles

Hydrogen works best in heavy-load, long-range vehicles

Depot-constrained vehicles will come out before autos:

- Buses
- Trains
- Aircraft
- Material handling and ground support equipment
- Delivery trucks
- Garbage trucks
- Post Office vehicles

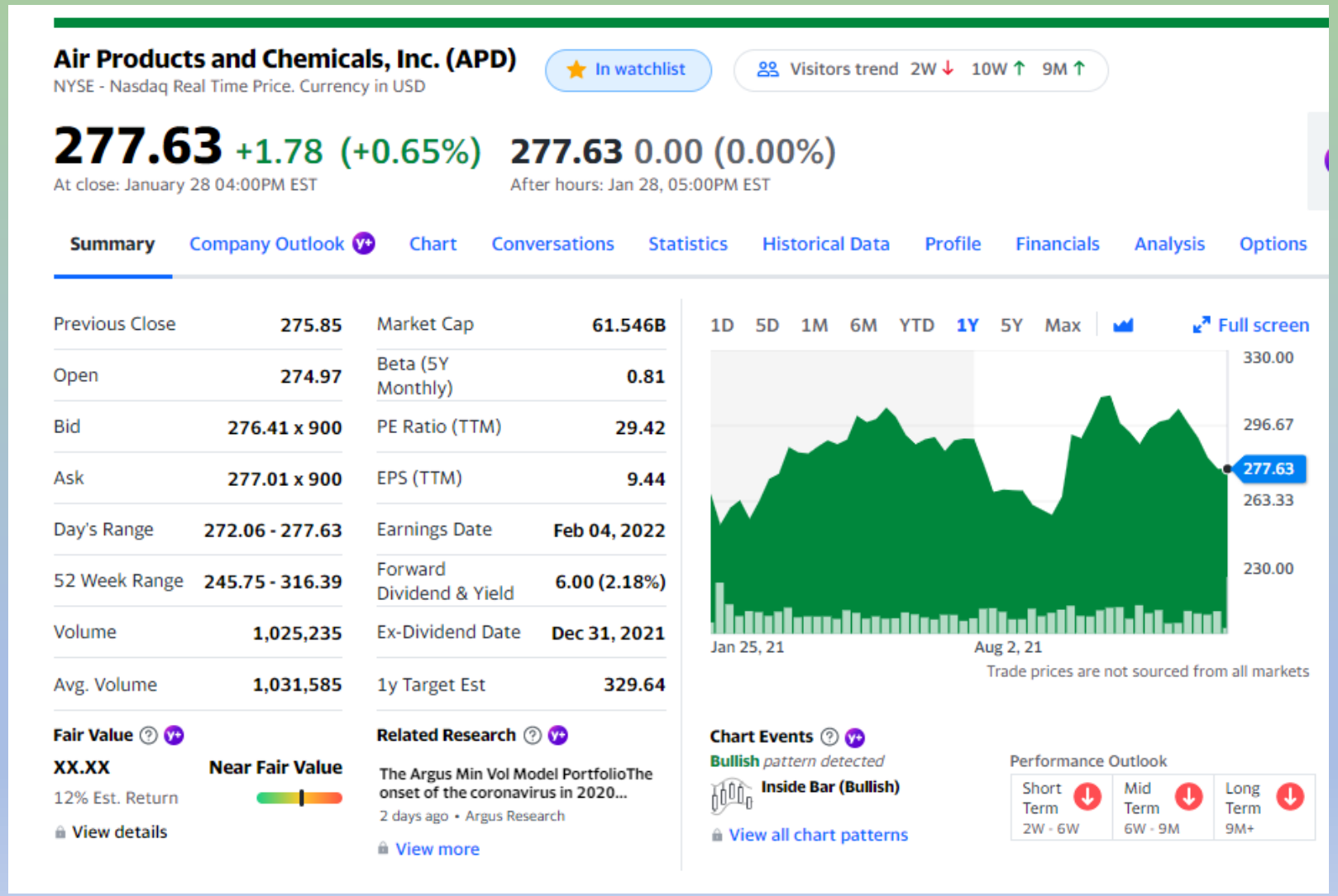
TATA MOTORS

Investment Opportunities: Top Hydrogen Stocks

- Established industrial firms, **average risk**
  - Air Products, Cummins, Shell, BP, Air Liquide, GE
- Vehicle manufacturers, **average risk**
  - Toyota – serious technology lead
  - Hyundai, Honda, GM, Ford, VW, BMW, many others
  - "EV" also applies to fuel cell vehicles
- Emerging companies, moderate to **high risk** (none are profitable yet)
  - Plug Power, Bloom Energy, Fuel Cell Energy, Ballard Power
- Pure **Speculation**
  - HYSR, NKLA, ZEV…many others

Additional reading: https://www.bloomberg.com/graphics/2020-opinion-hydrogen-green-energy-revolution-challenges-risks-advantages/

Air Products (APD)



Air Products and Chemicals, Inc. (APD)
NYSE - Nasdaq Real Time Price. Currency in USD

In watchlist | Visitors trend 2W ↓ 10W ↑ 9M ↑

277.63 +1.78 (+0.65%)
At close: January 28 04:00PM EST

277.63 0.00 (0.00%)
After hours: Jan 28, 05:00PM EST

Summary | Company Outlook | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options

Previous Close	275.85	Market Cap	61.546B
Open	274.97	Beta (5Y Monthly)	0.81
Bid	276.41 x 900	PE Ratio (TTM)	29.42
Ask	277.01 x 900	EPS (TTM)	9.44
Day's Range	272.06 - 277.63	Earnings Date	Feb 04, 2022
52 Week Range	245.75 - 316.39	Forward Dividend & Yield	6.00 (2.18%)
Volume	1,025,235	Ex-Dividend Date	Dec 31, 2021
Avg. Volume	1,031,585	1y Target Est	329.64

1D 5D 1M 6M YTD 1Y 5Y Max | Full screen

330.00
296.67
277.63
263.33
230.00

Jan 25, 21 — Aug 2, 21

Trade prices are not sourced from all markets

Fair Value
XX.XX — Near Fair Value
12% Est. Return
View details

Related Research
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2 days ago • Argus Research
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Chart Events
Bullish *pattern detected*
Inside Bar (Bullish)
View all chart patterns

Performance Outlook

Short Term	Mid Term	Long Term
2W - 6W	6W - 9M	9M+

Air Products, cont’d

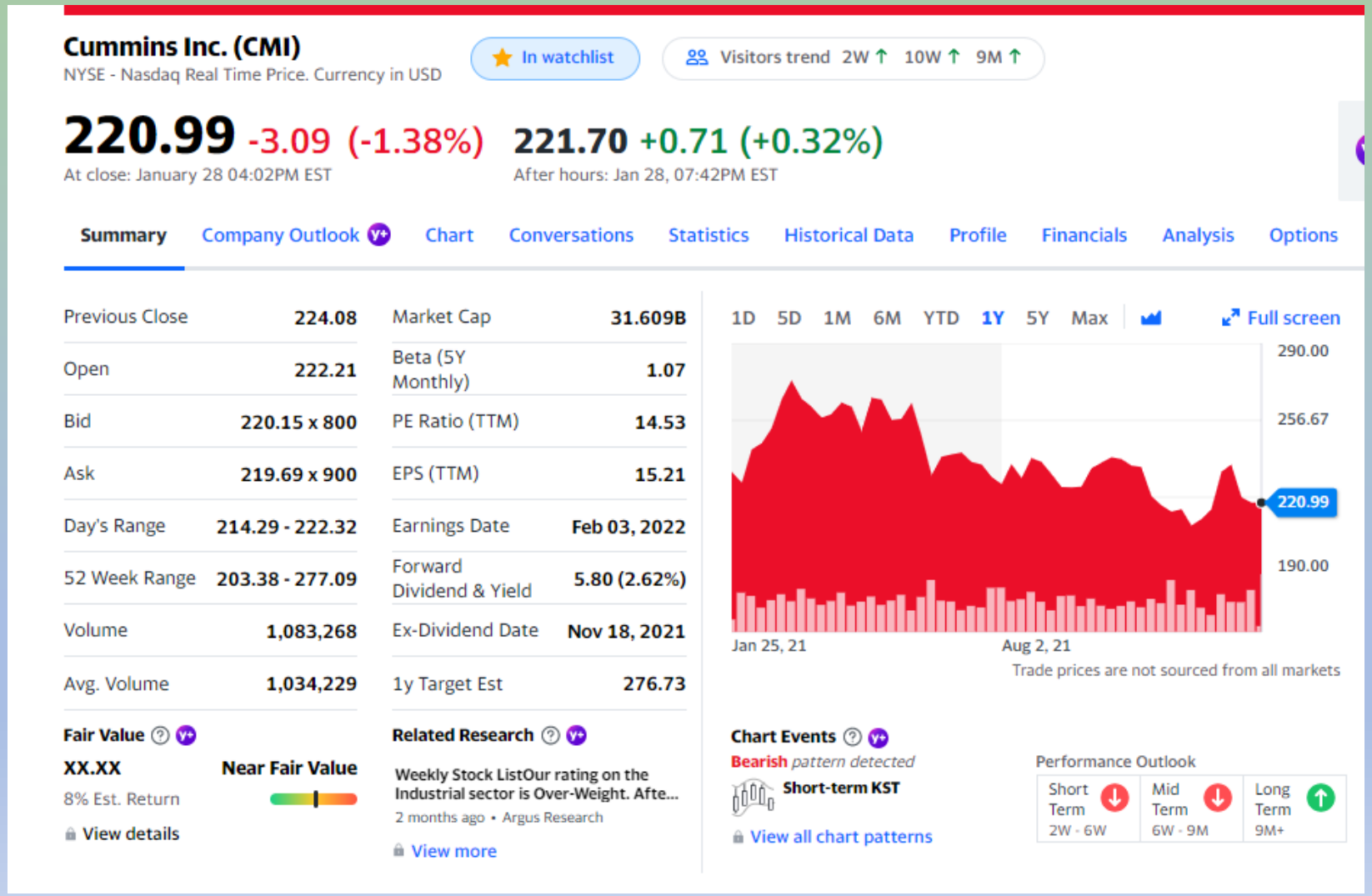
FEATURED NEWS

One of the Largest Green Hydrogen Projects in the World: thyssenkrupp Signs Contract to Install Over 2GW Electrolysis Plant for Air Products in NEOM

Air Products has awarded thyssenkrupp Uhde Chlorine Engineers a contract to supply a more than two-gigawatt (2 GW) electrolysis plant for one of the world’s largest green hydrogen projects at NEOM in Saudi Arabia.

Read More

Cummins (CMI)



Cummins Inc. (CMI)
NYSE - Nasdaq Real Time Price. Currency in USD

In watchlist | Visitors trend 2W ↑ 10W ↑ 9M ↑

220.99 -3.09 (-1.38%)
At close: January 28 04:02PM EST

221.70 +0.71 (+0.32%)
After hours: Jan 28, 07:42PM EST

Summary | Company Outlook | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options

Previous Close	224.08	Market Cap	31.609B
Open	222.21	Beta (5Y Monthly)	1.07
Bid	220.15 x 800	PE Ratio (TTM)	14.53
Ask	219.69 x 900	EPS (TTM)	15.21
Day's Range	214.29 - 222.32	Earnings Date	Feb 03, 2022
52 Week Range	203.38 - 277.09	Forward Dividend & Yield	5.80 (2.62%)
Volume	1,083,268	Ex-Dividend Date	Nov 18, 2021
Avg. Volume	1,034,229	1y Target Est	276.73

1D 5D 1M 6M YTD 1Y 5Y Max | Full screen

290.00
256.67
220.99
190.00
Jan 25, 21
Aug 2, 21

Trade prices are not sourced from all markets

Fair Value
XX.XX — Near Fair Value
8% Est. Return
View details

Related Research
Weekly Stock ListOur rating on the Industrial sector is Over-Weight. Afte...
2 months ago • Argus Research
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Chart Events
Bearish *pattern detected*
Short-term KST
View all chart patterns

Performance Outlook

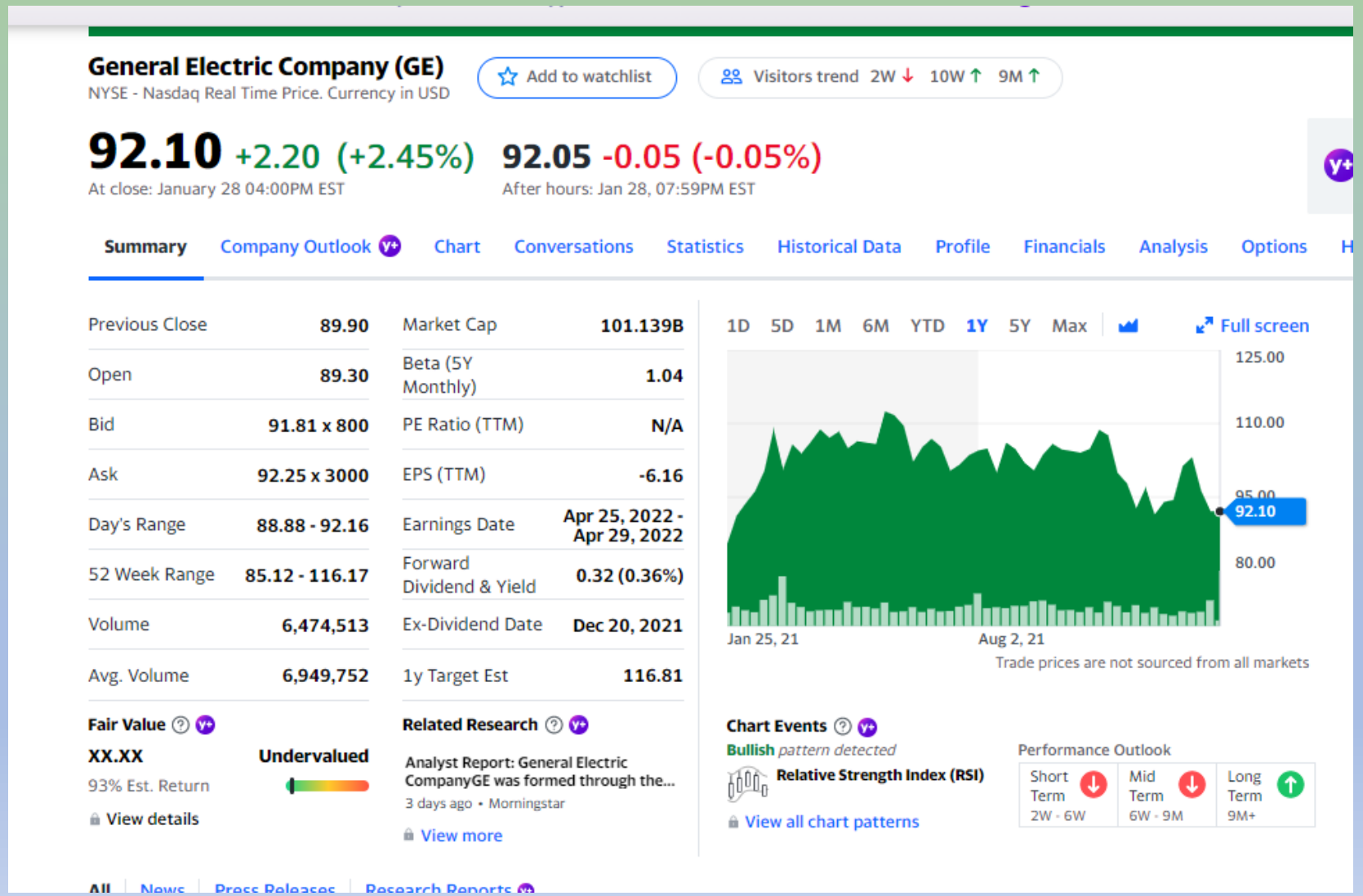
Short Term	Mid Term	Long Term
2W - 6W	6W - 9M	9M+

Cummins (CMI)

Source: Nov 2020 Investor Brief

- Cummins expects $400M revenue from electrolyzers and fuel cells in 2024
- “Cummins is combining its powertrain expertise and its fuel cell and hydrogen technologies to power a variety of applications, including transit buses, semi-trucks, delivery trucks, refuse trucks and passenger trains”
- “Today, Cummins has more than 2,000 fuel cell installations across a variety of on-and off-highway applications as well as more than 500 electrolyzer installations.”

General Electric (GE)



General Electric Company (GE)
NYSE - Nasdaq Real Time Price. Currency in USD

Add to watchlist | Visitors trend 2W ↓ 10W ↑ 9M ↑

92.10 +2.20 (+2.45%)
At close: January 28 04:00PM EST

92.05 -0.05 (-0.05%)
After hours: Jan 28, 07:59PM EST

Summary | Company Outlook | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | H

Previous Close	89.90	Market Cap	101.139B
Open	89.30	Beta (5Y Monthly)	1.04
Bid	91.81 x 800	PE Ratio (TTM)	N/A
Ask	92.25 x 3000	EPS (TTM)	-6.16
Day's Range	88.88 - 92.16	Earnings Date	Apr 25, 2022 - Apr 29, 2022
52 Week Range	85.12 - 116.17	Forward Dividend & Yield	0.32 (0.36%)
Volume	6,474,513	Ex-Dividend Date	Dec 20, 2021
Avg. Volume	6,949,752	1y Target Est	116.81

1D 5D 1M 6M YTD 1Y 5Y Max | Full screen

125.00
110.00
95.00
92.10
80.00
Jan 25, 21
Aug 2, 21

Trade prices are not sourced from all markets

Fair Value
XX.XX Undervalued
93% Est. Return
View details

Related Research
Analyst Report: General Electric CompanyGE was formed through the...
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Chart Events
Bullish *pattern detected*
Relative Strength Index (RSI)
View all chart patterns

Performance Outlook

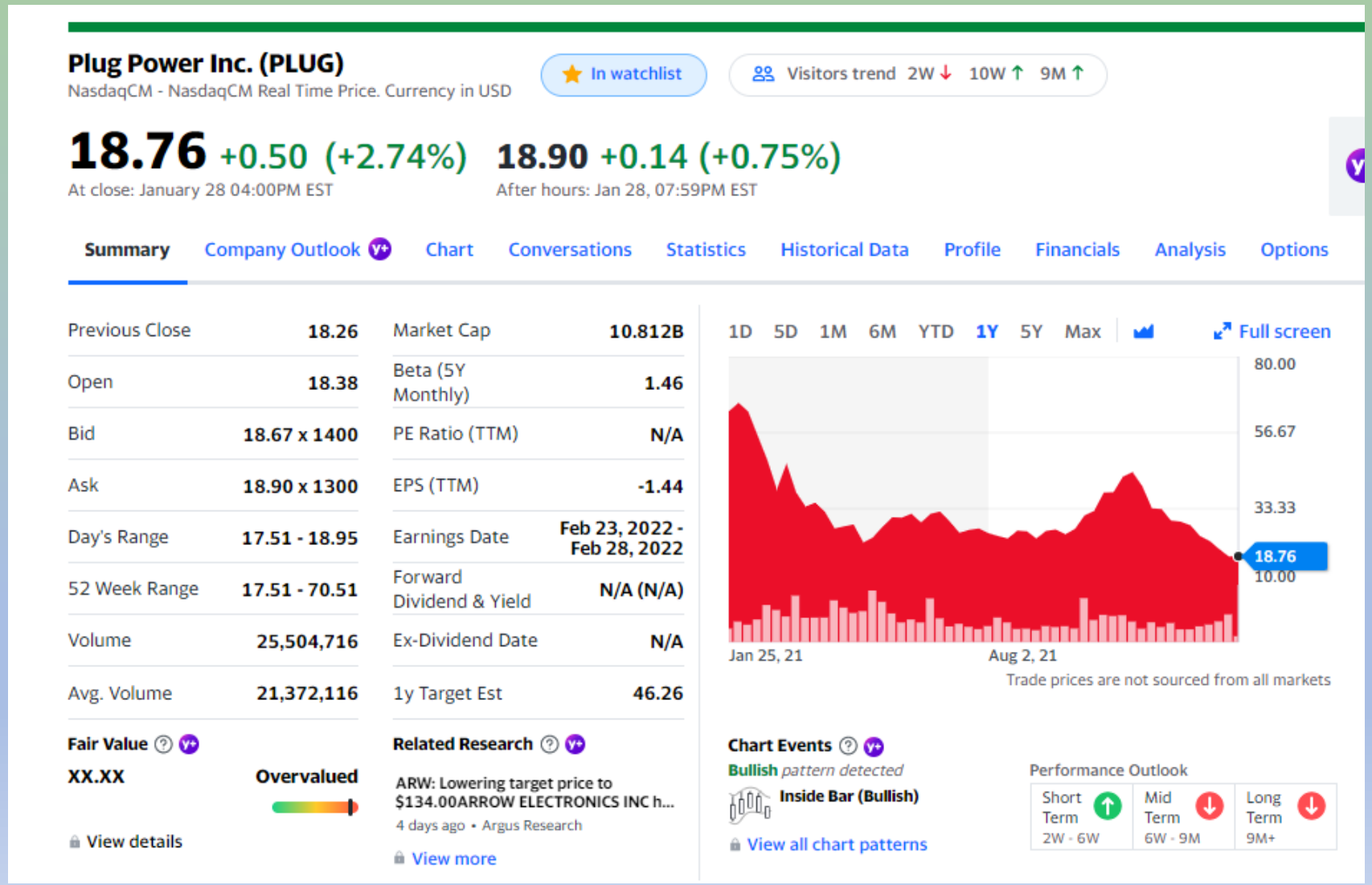
Short Term	Mid Term	Long Term
2W - 6W	6W - 9M	9M+

All | News | Press Releases | Research Reports

General Electric (GE)

- GE is heavily invested in green energy products
- Wind generators
  - Largest wind generators in the world
  - $15B revenue in 2020
- Power generation – gas turbines
  - Experiments in hydrogen / natural gas mixing
- Jet engines
  - Experiments in hydrogen fuel and fuel cells
- 1 for 8 reverse split executed on July 31st
- GE will break up into three companies during 2023-24
  - Healthcare
  - Aviation
  - Energy

Plug Power (PLUG)



Plug Power Inc. (PLUG)
NasdaqCM - NasdaqCM Real Time Price. Currency in USD

In watchlist | Visitors trend 2W ↓ 10W ↑ 9M ↑

18.76 +0.50 (+2.74%)
At close: January 28 04:00PM EST

18.90 +0.14 (+0.75%)
After hours: Jan 28, 07:59PM EST

Summary | Company Outlook | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options

Previous Close	18.26	Market Cap	10.812B
Open	18.38	Beta (5Y Monthly)	1.46
Bid	18.67 x 1400	PE Ratio (TTM)	N/A
Ask	18.90 x 1300	EPS (TTM)	-1.44
Day's Range	17.51 - 18.95	Earnings Date	Feb 23, 2022 - Feb 28, 2022
52 Week Range	17.51 - 70.51	Forward Dividend & Yield	N/A (N/A)
Volume	25,504,716	Ex-Dividend Date	N/A
Avg. Volume	21,372,116	1y Target Est	46.26

1D 5D 1M 6M YTD 1Y 5Y Max | Full screen

80.00
56.67
33.33
18.76
10.00

Jan 25, 21 — Aug 2, 21

Trade prices are not sourced from all markets

Fair Value
XX.XX — Overvalued
View details

Related Research
ARW: Lowering target price to $134.00ARROW ELECTRONICS INC h...
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Chart Events
Bullish *pattern detected*
Inside Bar (Bullish)
View all chart patterns

Performance Outlook

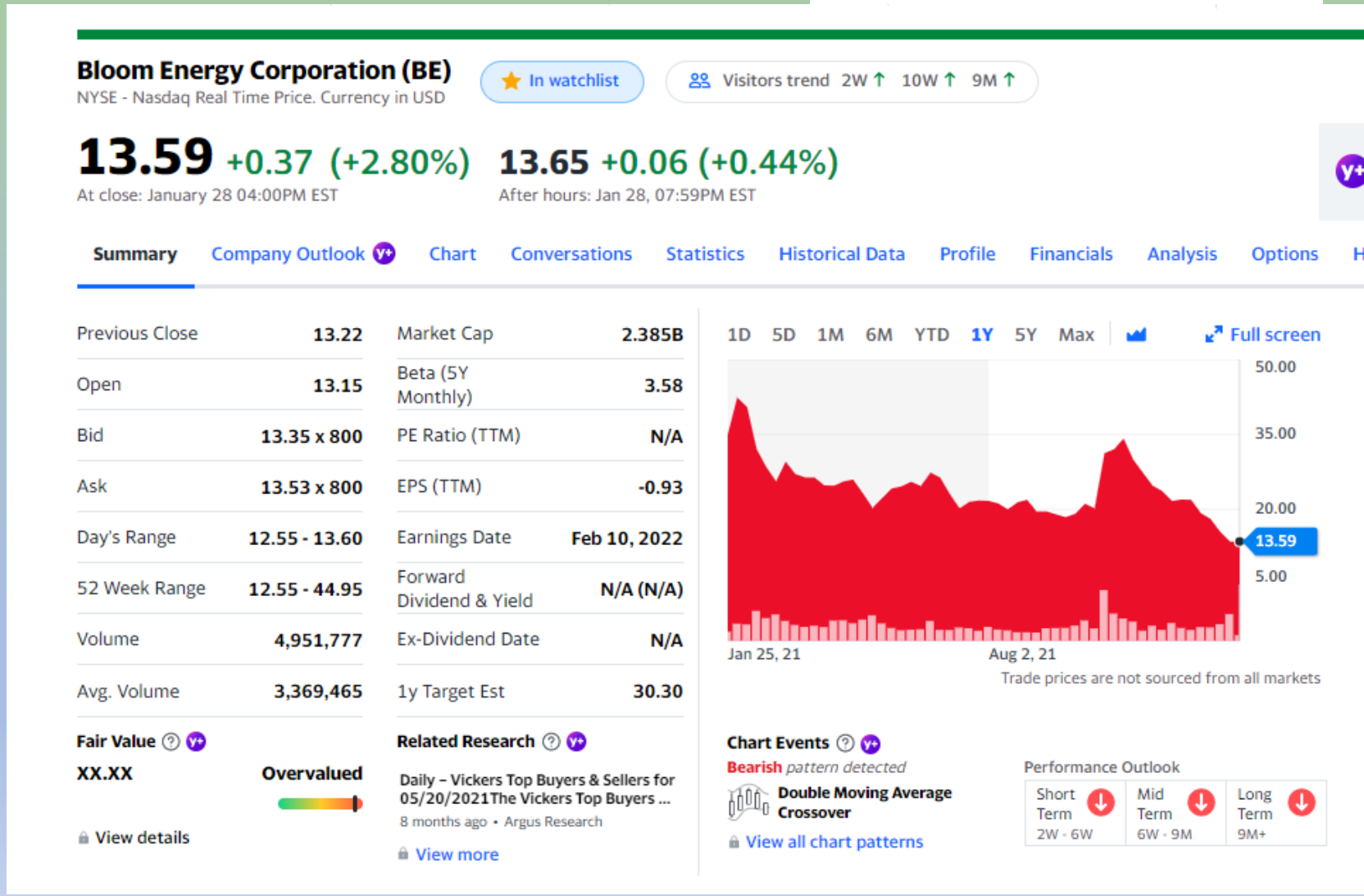
Short Term	Mid Term	Long Term
2W - 6W	6W - 9M	9M+

PLUG is volatile, but future is bright

- Vertically integrated product line: Provide fuel, fuel cells, electrolyzers, service
- Significant technology / product lead; 20 years' experience
  - Transitioning from R&D to full scale production - crossing the chasm
  - Large stock of IP, patents
- Large, committed customers: AMZN, WMT, HD, GM, BAE, Renault
- JVs with Renault, SK, GM, BAE, others pending
- Large, deployed product base: 40,000+ fuel cell units
- Largest consumer/provider of hydrogen in the world
- Employee count: Grew from 600 to 2,000, from 2020 to 2021
- Heavy institutional interest: >1,000 large investors
  - BlackRock: 50M shares
- Holding $4.5B cash
- Biggest criticisms: unprofitable, management competence

Bloom Energy (BE)

- Fuel cells for large or stationary applications
  - Grid balancing
  - Data center back up power
  - Hospital, retail back up power
  - Ships



Bloom Energy Corporation (BE)
NYSE - Nasdaq Real Time Price. Currency in USD

In watchlist | Visitors trend 2W ↑ 10W ↑ 9M ↑

13.59 +0.37 (+2.80%)
At close: January 28 04:00PM EST

13.65 +0.06 (+0.44%)
After hours: Jan 28, 07:59PM EST

Summary | Company Outlook | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options

Previous Close	13.22	Market Cap	2.385B
Open	13.15	Beta (5Y Monthly)	3.58
Bid	13.35 x 800	PE Ratio (TTM)	N/A
Ask	13.53 x 800	EPS (TTM)	-0.93
Day's Range	12.55 - 13.60	Earnings Date	Feb 10, 2022
52 Week Range	12.55 - 44.95	Forward Dividend & Yield	N/A (N/A)
Volume	4,951,777	Ex-Dividend Date	N/A
Avg. Volume	3,369,465	1y Target Est	30.30

1D 5D 1M 6M YTD 1Y 5Y Max | Full screen

50.00
35.00
20.00
13.59
5.00

Jan 25, 21 — Aug 2, 21

Trade prices are not sourced from all markets

Fair Value
XX.XX — Overvalued
View details

Related Research
Daily – Vickers Top Buyers & Sellers for 05/20/2021The Vickers Top Buyers ...
8 months ago • Argus Research
View more

Chart Events
Bearish *pattern detected*
Double Moving Average Crossover
View all chart patterns

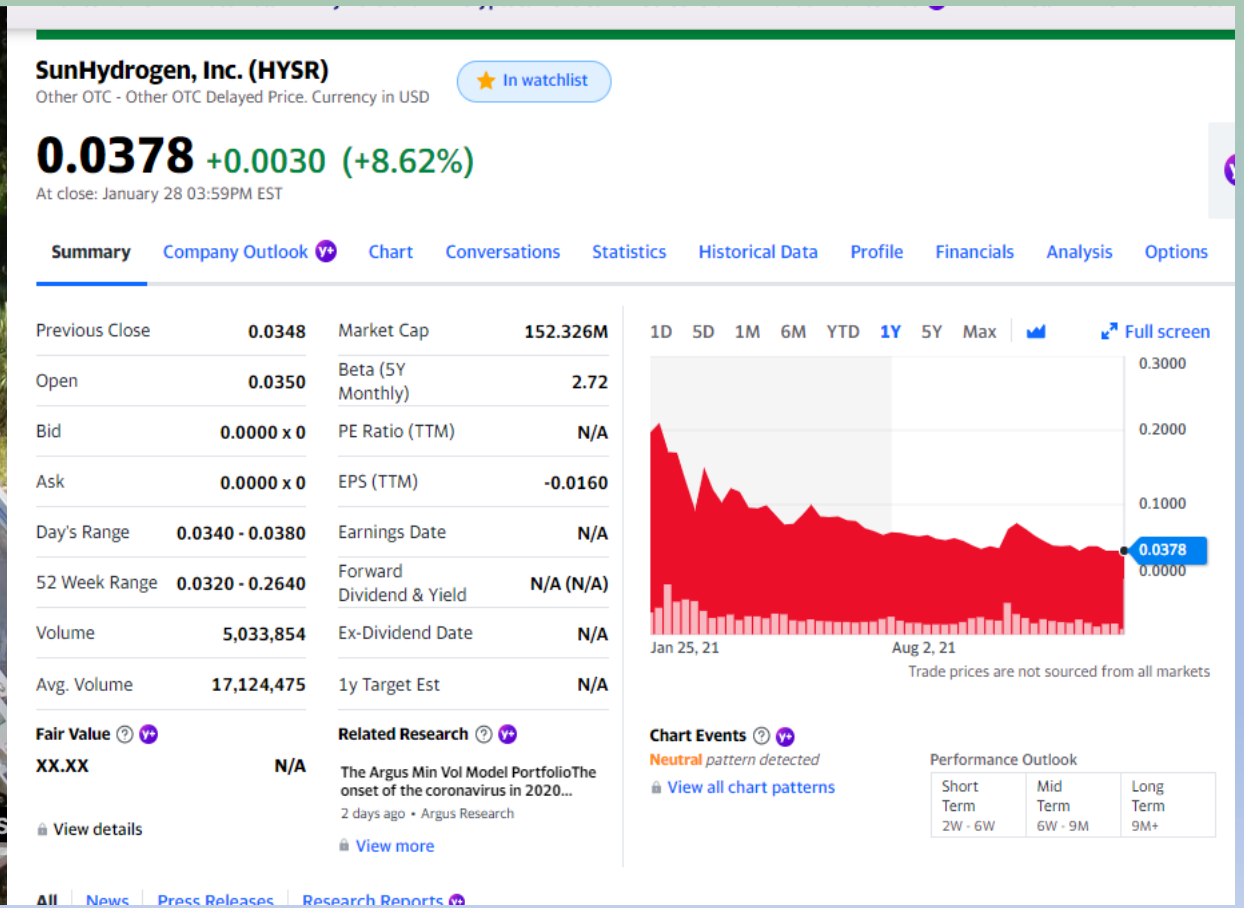
Performance Outlook

Short Term	Mid Term	Long Term
2W - 6W	6W - 9M	9M+

SunHydrogen (HYSR)

- Only for strong stomachs!

Venture-capital backing



Lithium - EV Eco System
Each one of these is a market in itself

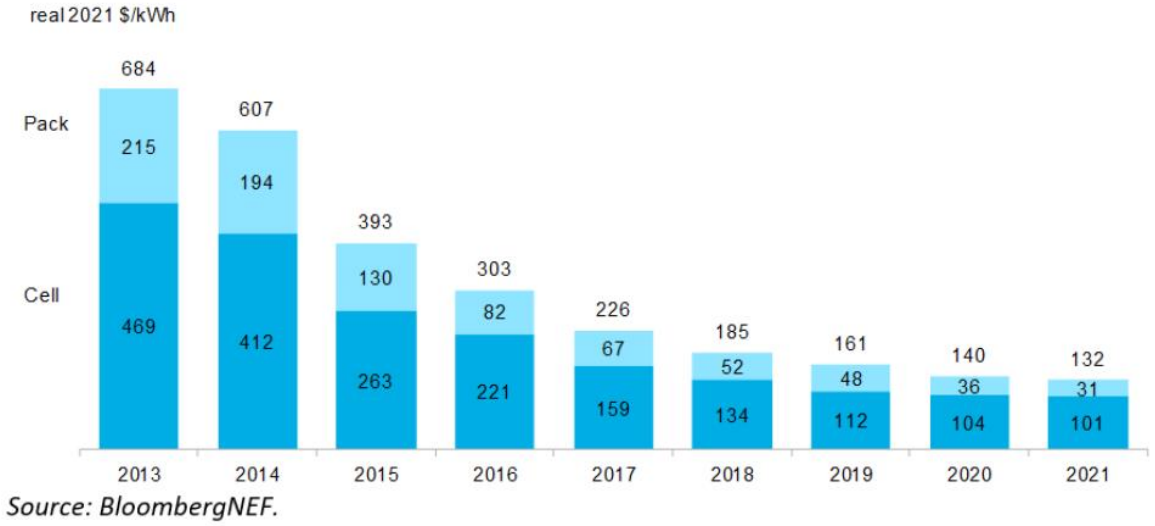
EV Charging Systems	EV Data Analytics	Electrical Grid	EV Manufacturing Sales & Service
Auto Electronics	Manufacturing Equipment	Li Battery development, manufacturing	Hydrogen Fuel Cells, Infrastructure
Self-Driving Technology	Battery mining Li, Ni, Co	Battery Recycling	Utilities/Consumer Electronics

Li-Ion Batteries

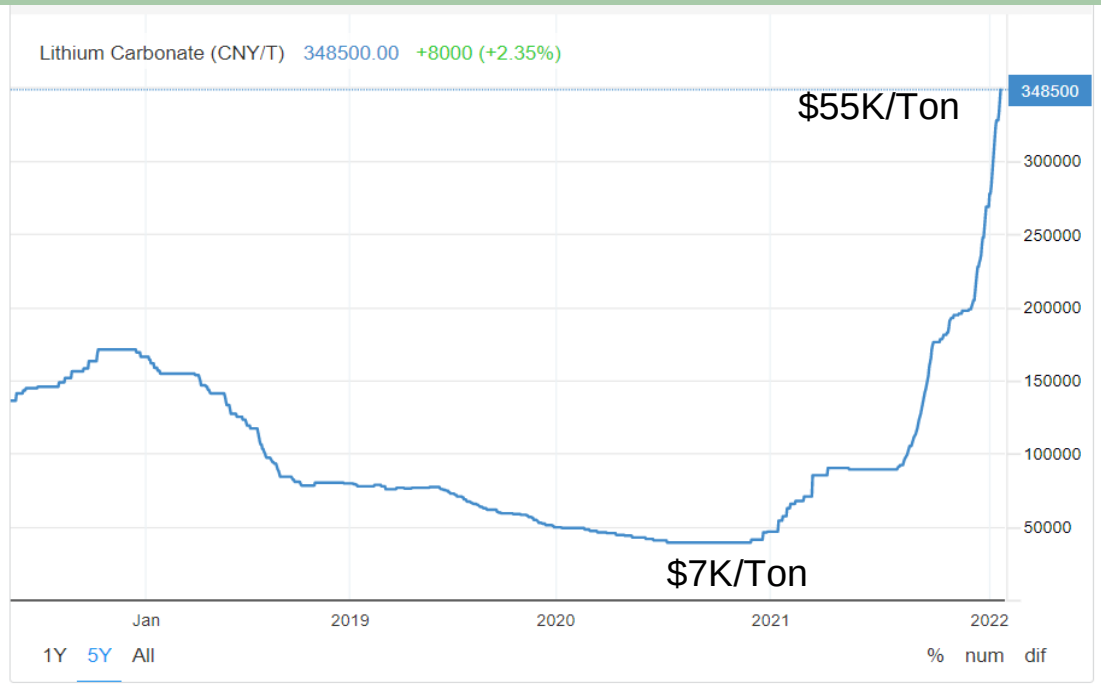
- First invented in 1980 – commonly used in EVs and electronic devices
- Typically 2.5-2.8X energy density of Lead-acid batteries
- Technology is changing rapidly
  - R&D driven by EV market demand
  - HUGE R&D efforts are focused on energy density, durability, recharging time
  - Transition away from Cobalt and toward Iron-Phospate
  - STOREDOT has announced a new Li battery technology with 2X capacity
  - QuantumScape (QS) announced 80% recharge in 10 minutes
  - Solid-state batteries now at the forefront
  - Much safer than current designs - less prone to fires

Li Battery Pack Pricing Goal: $80-100/KWh

Figure 1: Volume-weighted average pack and cell price split



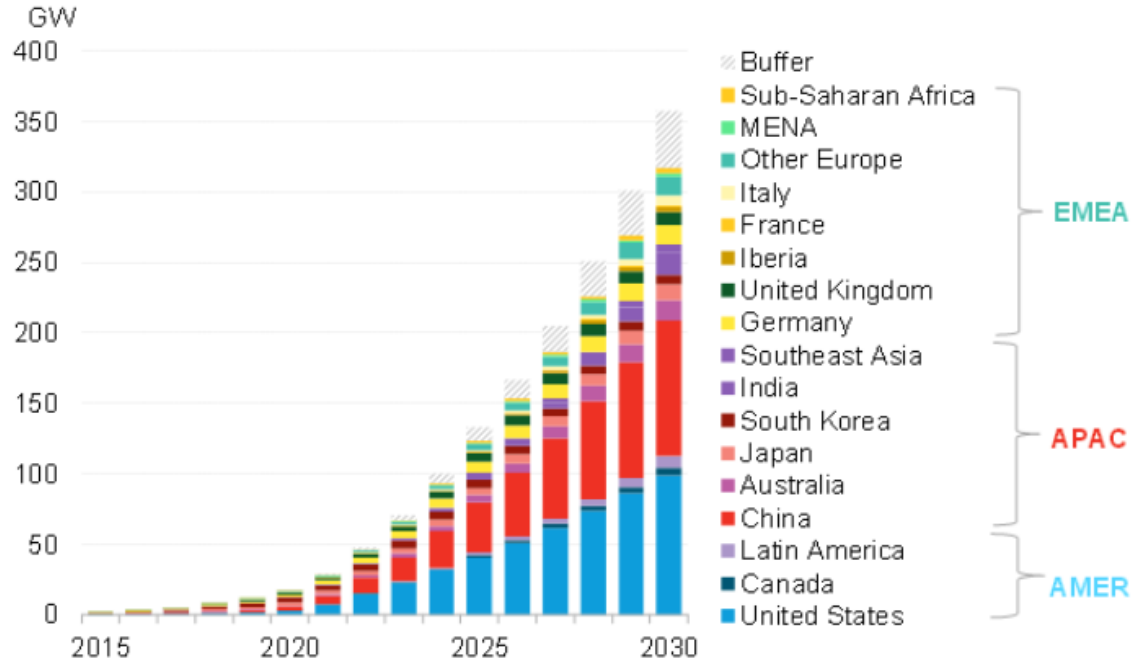
Source: BloombergNEF.



But: Raw Lithium prices are exploding

Utility-Scale Batteries:
10X capacity increase by 2030 expected

Figure 1: Global cumulative energy storage installations, 2015-30



Source: BloombergNEF. Note: MENA = Middle East & North Africa. Buffer represents markets and use-cases that we are unable to forecast due to lack of visibility.

55% of utility batteries are devoted to wind/solar intermittent energy storage

Manufacturers of Utility Scale Batteries

Panasonic Corporation

LG Chemicals

Samsung

SDI Co., Ltd

BYD Company Limited

GS Yuasa International Ltd.

SAFT

Hitachi Ltd.

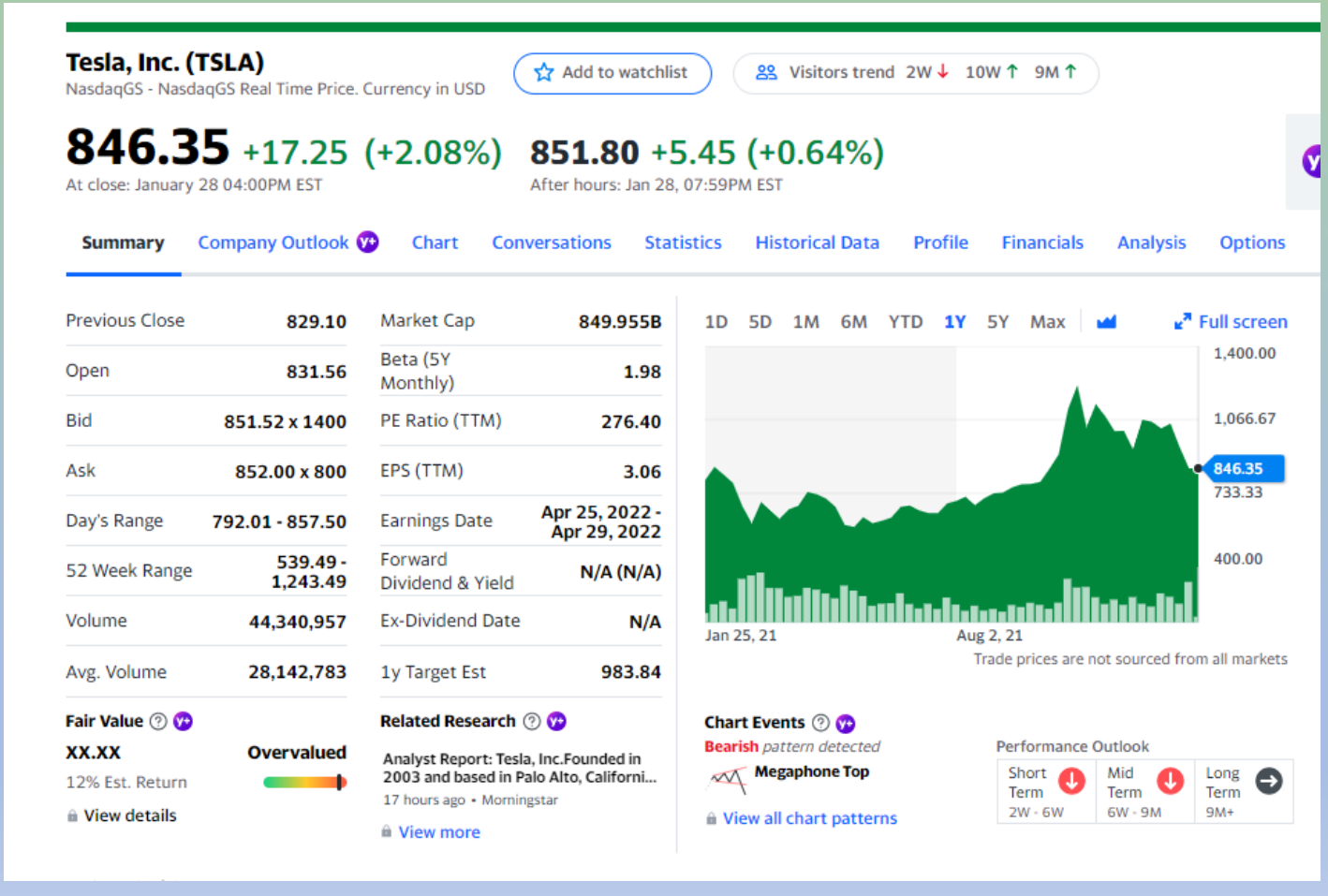
Electrovaya Inc.

ABB Ltd

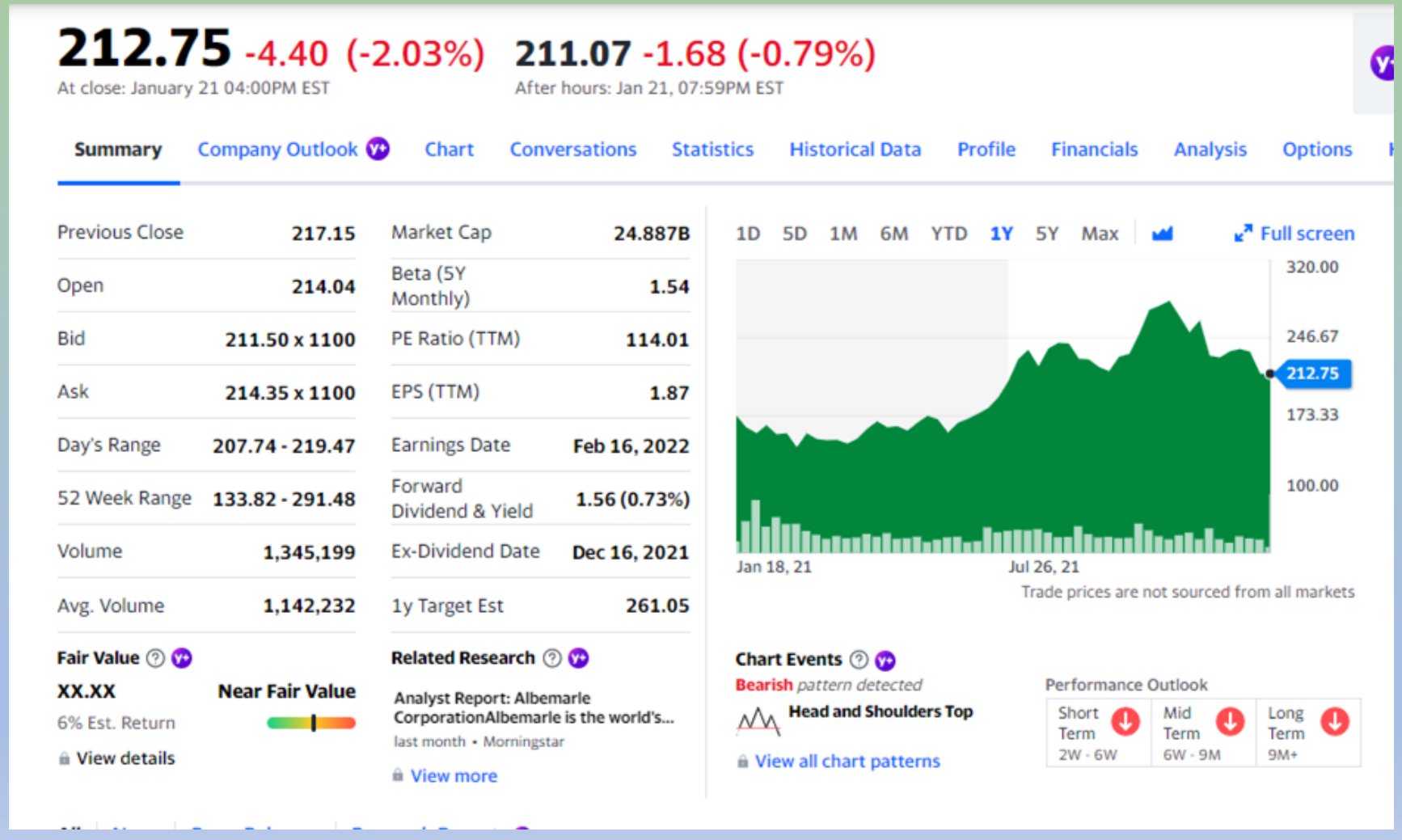
Tesla Energy Operations Inc.

TESLA (TSLA)

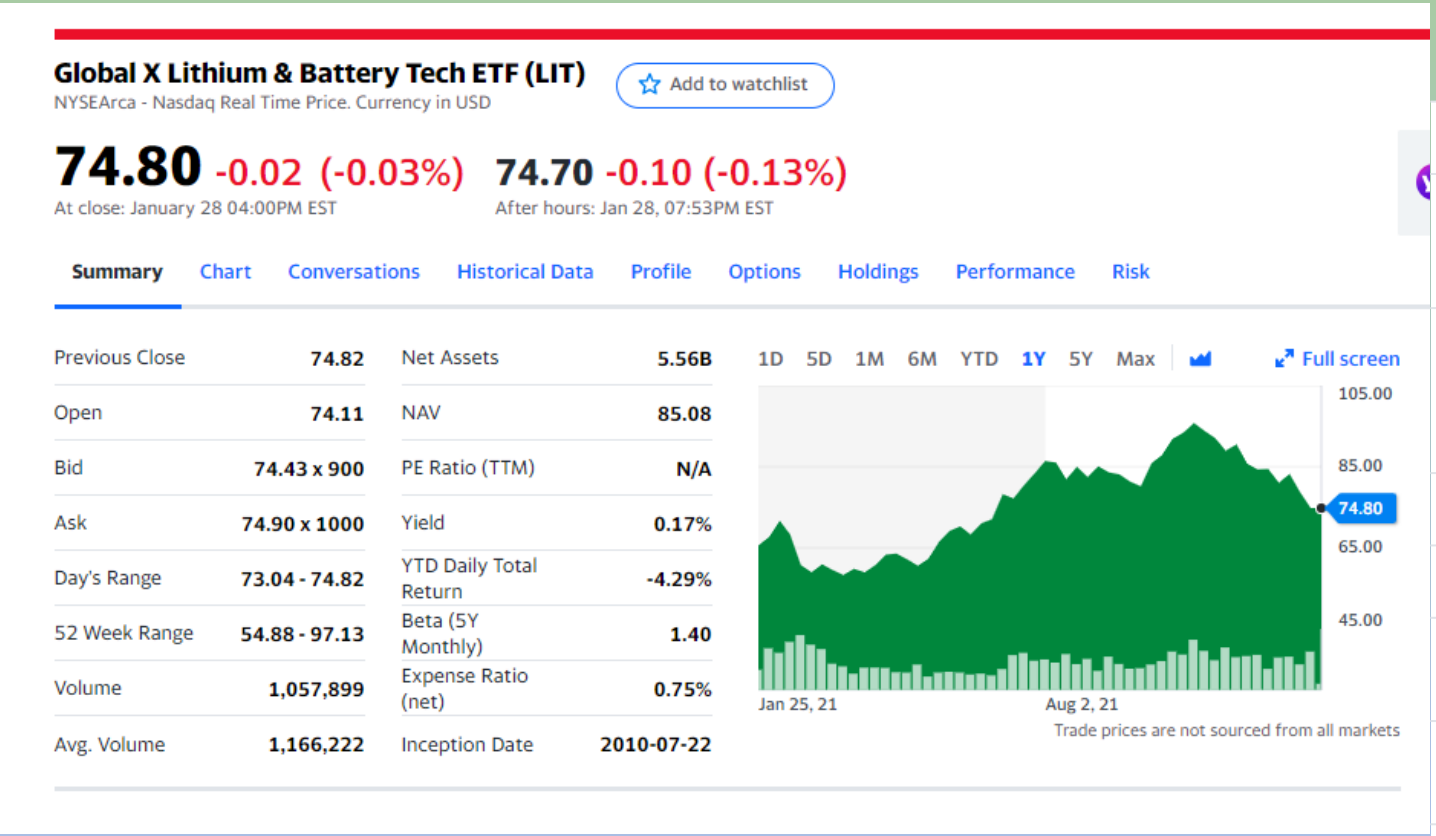
- Tesla's battery business is 6% of revenue, and losing money
- Tesla also depends heavily on Panasonic for car batteries
- Q4 profit and revenue beat expectations
- Stock price lost 12%



Albemarle (ALB)



Global X Lithium and Battery Tech ETF (LIT)



Global X Lithium & Battery Tech ETF (LIT)
NYSEArca - Nasdaq Real Time Price. Currency in USD

Add to watchlist

74.80 -0.02 (-0.03%) At close: January 28 04:00PM EST

74.70 -0.10 (-0.13%) After hours: Jan 28, 07:53PM EST

Summary | Chart | Conversations | Historical Data | Profile | Options | Holdings | Performance | Risk

Previous Close	74.82	Net Assets	5.56B
Open	74.11	NAV	85.08
Bid	74.43 x 900	PE Ratio (TTM)	N/A
Ask	74.90 x 1000	Yield	0.17%
Day's Range	73.04 - 74.82	YTD Daily Total Return	-4.29%
52 Week Range	54.88 - 97.13	Beta (5Y Monthly)	1.40
Volume	1,057,899	Expense Ratio (net)	0.75%
Avg. Volume	1,166,222	Inception Date	2010-07-22

1D 5D 1M 6M YTD 1Y 5Y Max Full screen

Trade prices are not sourced from all markets

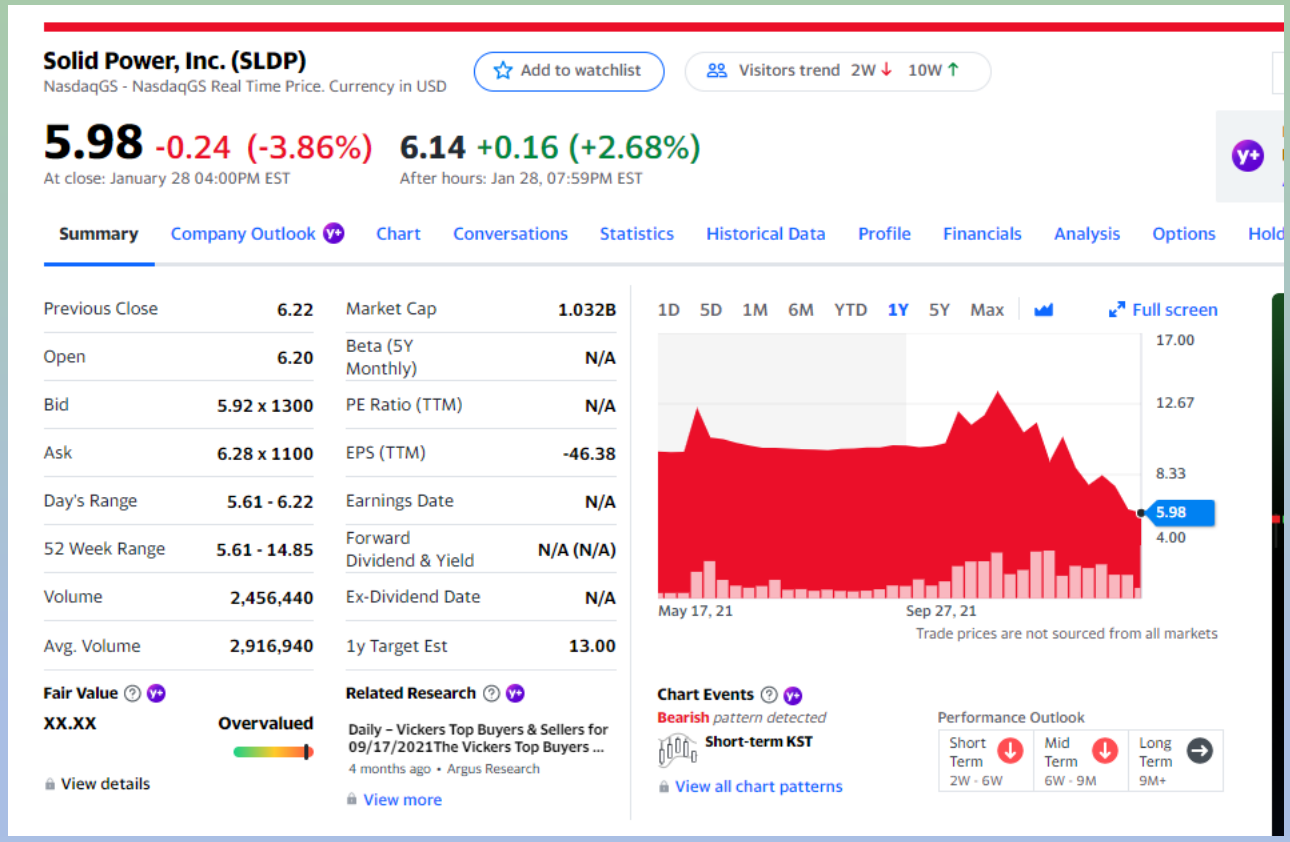
GLOBAL X

Holdings:

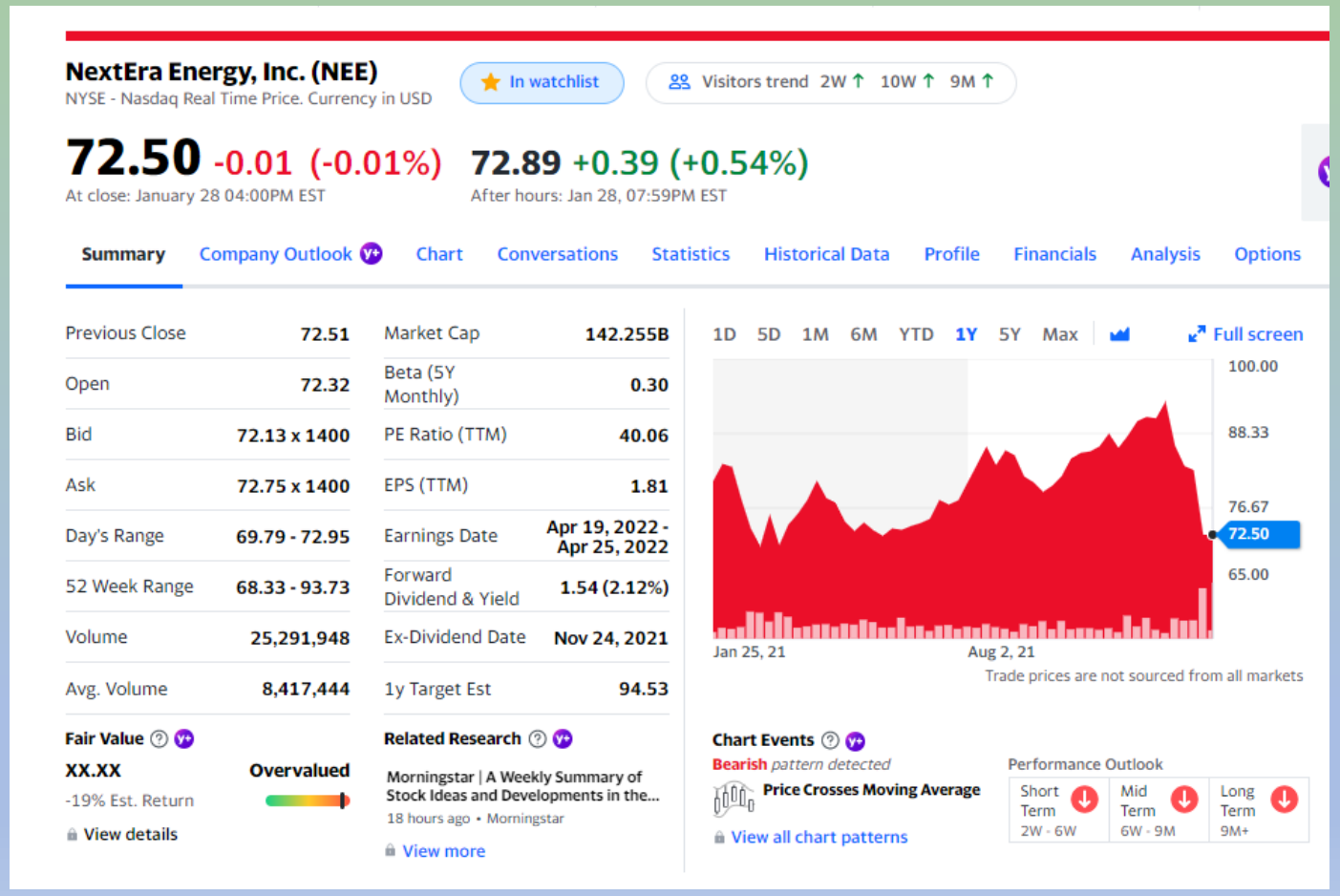
Albemarle Corp	ALB	12.00%
Yunnan Energy New Material Co Ltd A	002812	6.67%
Contemporary Amperex Technology Co Ltd Class A	300750	6.41%
EVE Energy Co Ltd	300014	5.81%
BYD Co Ltd Class H	01211	5.23%
NAURA Technology Group Co Ltd	002371	5.11%
Ganfeng Lithium Co Ltd	002460	5.10%
Wuxi Lead Intelligent Equipment Co Ltd A	300450	4.46%
Mineral Resources Ltd	MIN.AX	4.02%
Samsung SDI Co Ltd	006400.KS	3.94%

Solid Power (SLDP)

- Solid State battery developer
- Emerged recently via SPAC
- Backed by Ford and BMW
- Licensing model
- OEM contracts expected



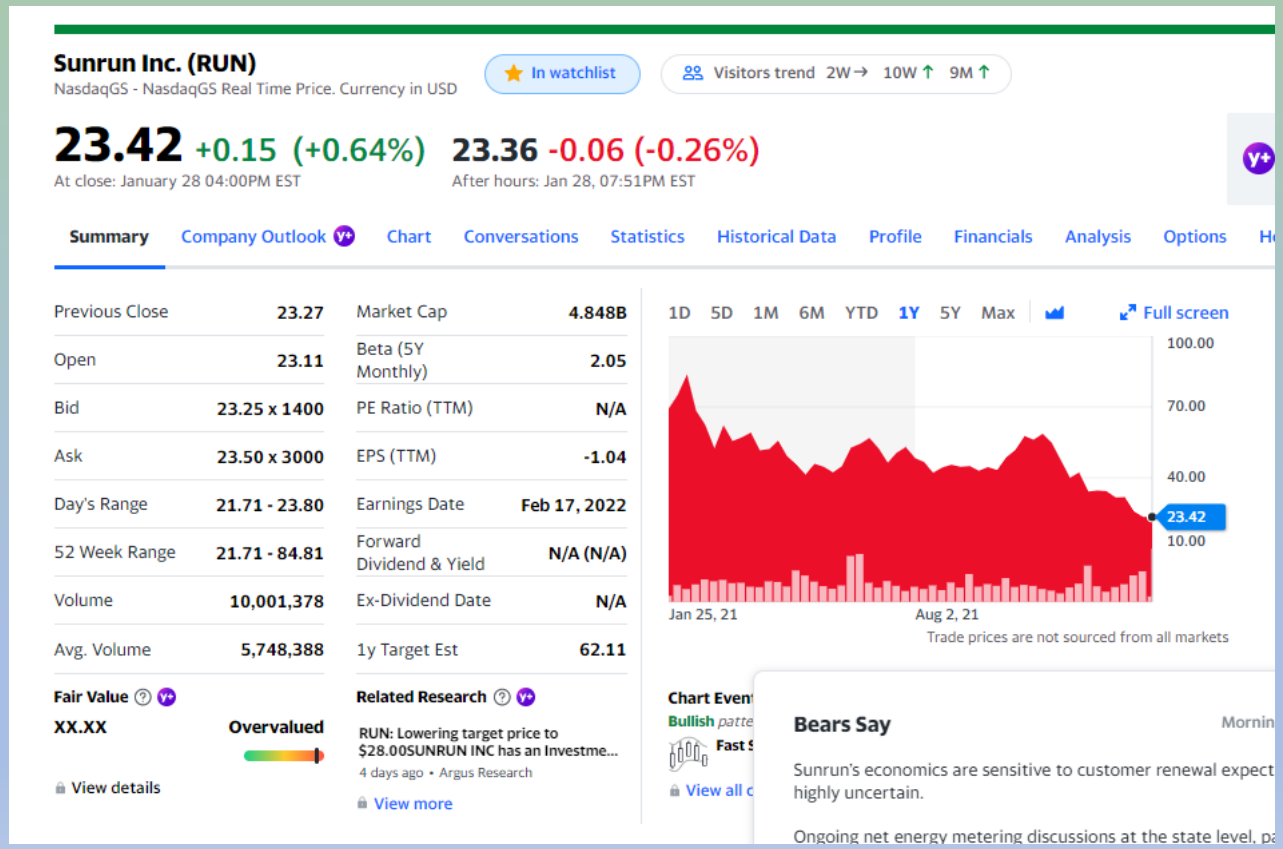
NextEra Energy (NEE)



- Largest utility by market cap
- 60% of power generation from renewable sources
- Experimenting with electrolyzers and fuel cells
- Pairing grid batteries to wind and solar power generation
- Pushing for hydrogen production tax credits

SUNRUN (RUN)

Provider of residential solar panels and batteries



Compare Batteries & Fuel Cells

Li Ion Batteries

- Low energy density
- Long charging times
- Temperature sensitive
- Durable
- Commonly used Li
- Dependent on Li, Cobalt, Nickel supplies, prices
- Recycling is expensive

Fuel Cells

- High energy density
- Short fueling times
- Temperature insensitive
- Sensitive to impurities
- Use some exotic materials
- Dependent on Platinum prices
- Reversible
- Infrastructure not available

This is not a competition! Both will win in the long term.
Batteries will always have a place, as will fuel cells

Top Alternative Energy ETFs

- QCLN
  - My favorite: holdings are diversified, relatively low priced
- TAN
- PBW
- ICLN

QCLN Top 10 Holdings

(FIRST TRUST NASDAQ CLEAN EDGE GREEN ENERGY)

Name	Symbol	% Assets	Market
Tesla Inc	TSLA	8.84%	EV
NIO Inc ADR	NIO	7.51%	EV
Albemarle Corp	ALB	6.50%	Chemcals
Enphase Energy Inc	ENPH	6.15%	Solar
Plug Power Inc	PLUG	4.72%	Hydrogen
ON Semiconductor Corp	ON	4.49%	Semi
SolarEdge Technologies Inc	SEDG	4.08%	Solar
Universal Display Corp	OLED	3.81%	OLED
Brookfield Renewable Partners LP	BEP.UN	3.79%	Utility
Cree Inc	CREE	3.75%	LED

Blackrock ESG ETFs (Environmental, Social, Governmental)

ESGU	**iShares ESG Aware MSCI USA ETF**	15.02	42.49	20.09	-	-	18.95	Jun 30, 2021	Dec 01, 2016	18,806M	+ Quick view
ESGE	**iShares ESG Aware MSCI EM ETF**	7.82	42.20	12.55	13.56	-	14.39	Jun 30, 2021	Jun 28, 2016	7,901M	+ Quick view
ESGD	**iShares ESG Aware MSCI EAFE ETF**	9.00	33.17	9.04	10.75	-	11.61	Jun 30, 2021	Jun 28, 2016	6,031M	+ Quick view
SUSL	**iShares ESG MSCI USA Leaders ETF**	16.41	40.84	-	-	-	23.66	Jun 30, 2021	May 07, 2019	3,657M	+ Quick view
SUSA	**iShares MSCI USA ESG Select ETF**	16.52	44.48	21.03	18.89	14.42	10.20	Jun 30, 2021	Jan 24, 2005	3,345M	+ Quick view
EAGG	**iShares ESG Aware U.S. Aggregate Bond ETF**	-1.65	-0.44	-	-	-	6.18	Jun 30, 2021	Oct 18, 2018	1,333M	+ Quick view

Summary

- Climate change demands that we reduce dependence on fossil fuels
- Everything is being electrified and decarbonized
- Hydrogen, Solar, Wind, Batteries will be part of the solution
- Fossil fuels will not disappear, but will be seriously diminished
- It's early to invest in green energy
  - What is your investing horizon?
  - What level of risk are you comfortable with?
- Please due your own DD prior to making any investments

Warren Buffet: "The stock market is a mechanism for transferring money from the impatient to the patient."

Suggested Reading / Sources

ENERGY.GOV

Investopedia

FuelCellsWorks

Green Car Congress

THE WALL STREET JOURNAL.

International Energy Agency

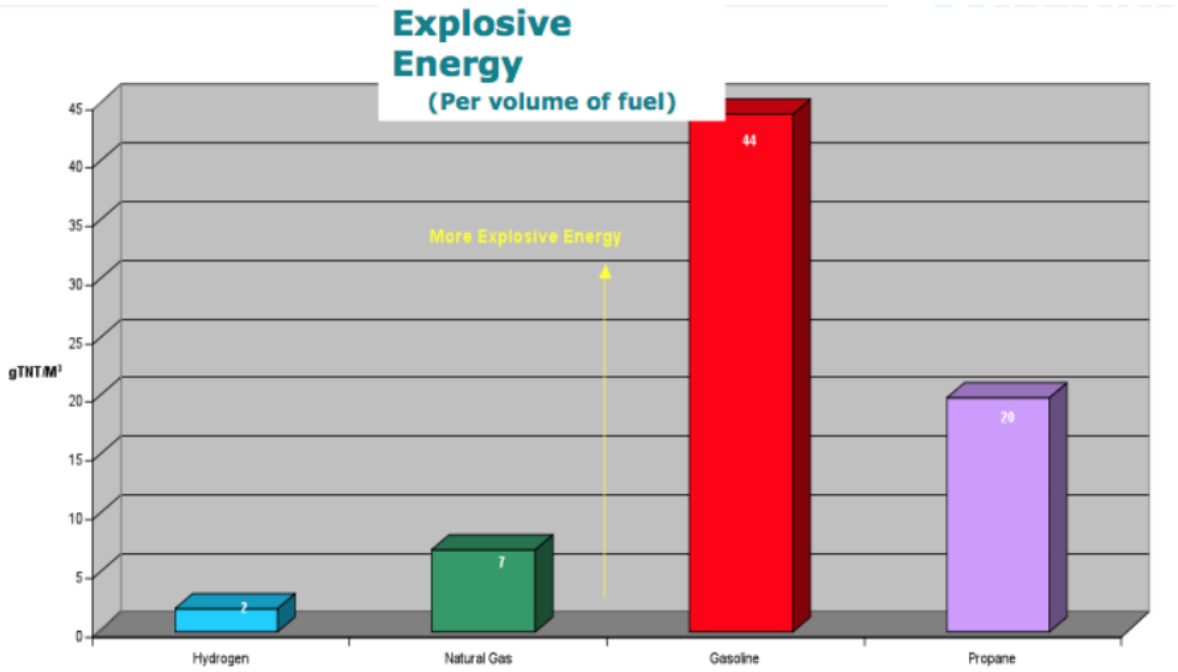
facebook

BloombergNEF

Backup material

- Ferry Video?

Hydrogen is safer than many fuels



The worst-case explosion scenario for each fuel. Hydrogen gas does not have a lot of "bang-power" volume-wise compared to other common fuels.

- Flammable mixtures of hydrogen have relatively low energy density compared to other fuels.

Source: Ballard Power