# Investing in Alternative Energy

## Hydrogen, Batteries
## Wind, Solar

January 26, 2023

David Toms

# Agenda

Themes:  Energy transition is accelerating. Investment opportunities are emerging, some are to avoid

- Overview of the transition away from fossil fuels
- Batteries and Lithium
- Wind
- Solar
- Hydrogen

Disclaimer:  I am not a professional investor. Do your own DD before investing in any of the forthcoming ideas.

I own the following stocks:  APD, BE, CMI, PLUG

# 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

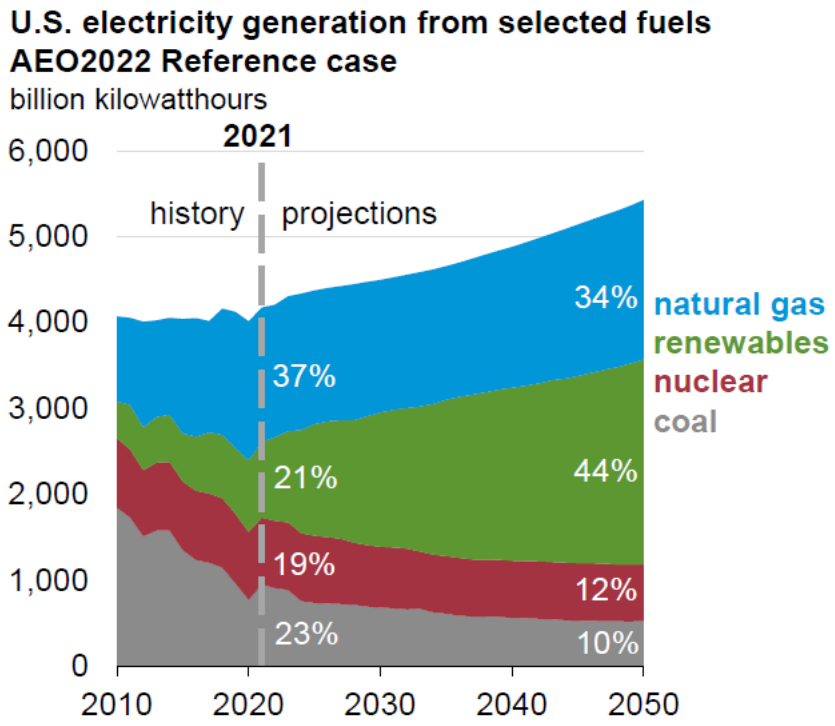
- New Biden administration climate change policies: IRA, BIL
  - Capital investments are flowing toward the USA
- Global competition in progress for clean tech
  - China dominates solar panels, batteries, electrolyzers
  - Trade war with Europe?
- Ukraine war threatens energy security in Europe
- Hydrogen 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

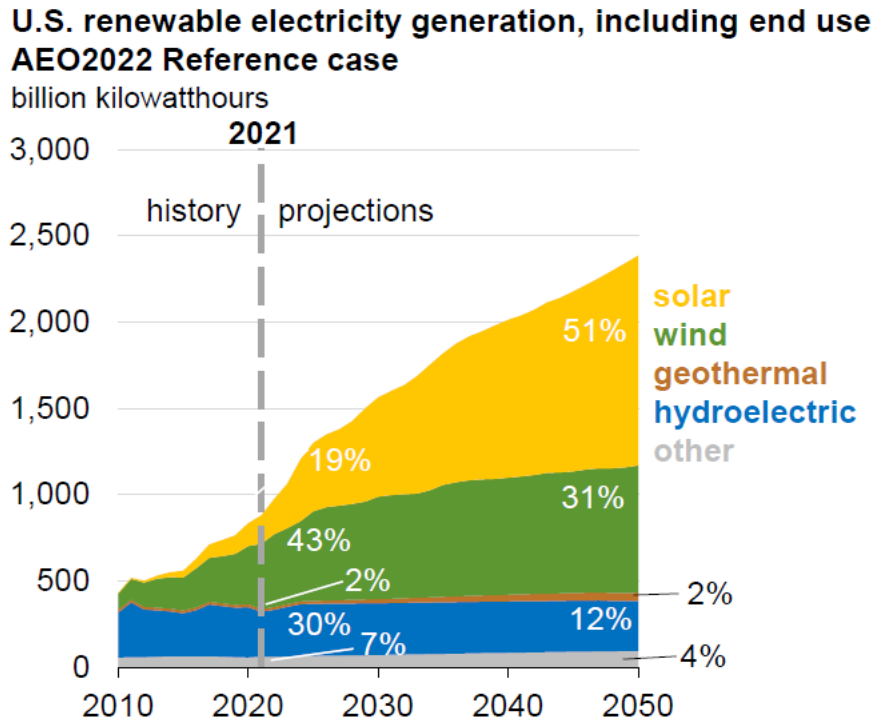
# The Electrification of Everything

- US electrical generation requirements are expected to double by 2050
  - EV cars, trucks
  - Heat pumps instead of oil/NG fired heaters
  - Heavy industry – steel, cement, ammonia
- Can the electrical grid sustain increasing demand within the next few years?
  - 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
- **Generating electricity is easy; storing it is hard**
- **Generating hydrogen is hard; storing it is easy**

# Renewable electricity is 21% today, growing to 44% by 2050

## U.S. electricity generation and shares from selected fuels and renewable sources



# Green Energy Overview

Climate change represents an existential threat to human civilization, with many nations seeking to reach zero net carbon emissions by 2050.

As the world transitions away from fossil fuels, there are opportunities for investing in clean or renewable energy sources.  And some to avoid!

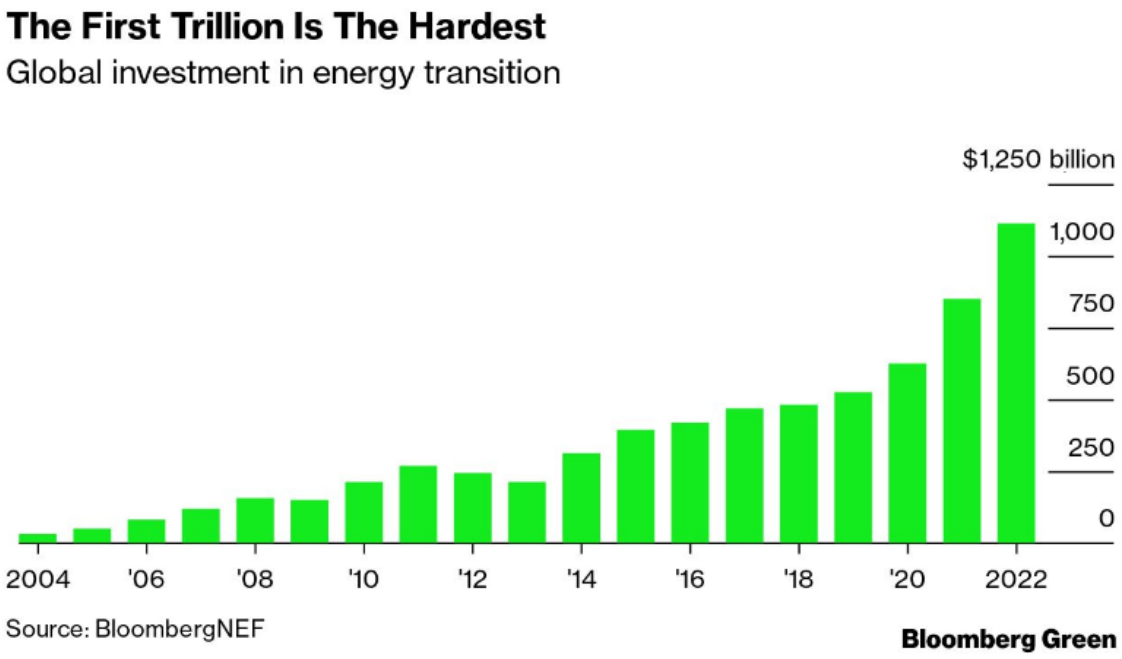
Global investment in transitional technologies reached $755 billion in 2021.

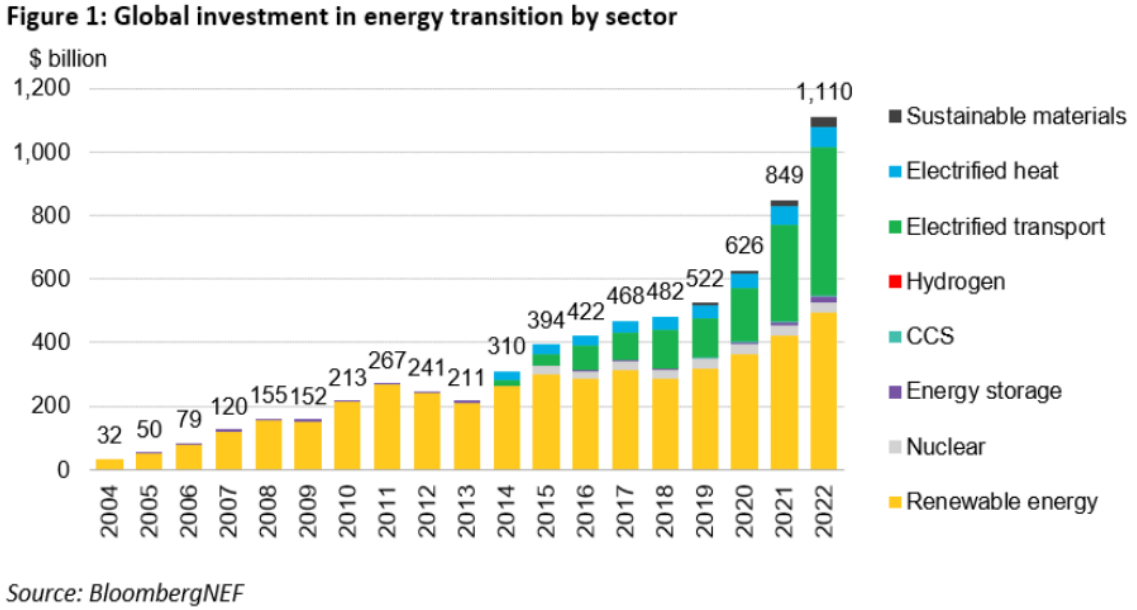
Wind, solar, batteries and hydrogen represent promising technologies in the green energy market.

Investments in renewables will need to triple in the coming years in order to reach net-zero carbon emissions by 2050.

# Green energy is accelerating

For the first time, investments in renewable energy exceed that of oil and gas.  $1.1T in 2022

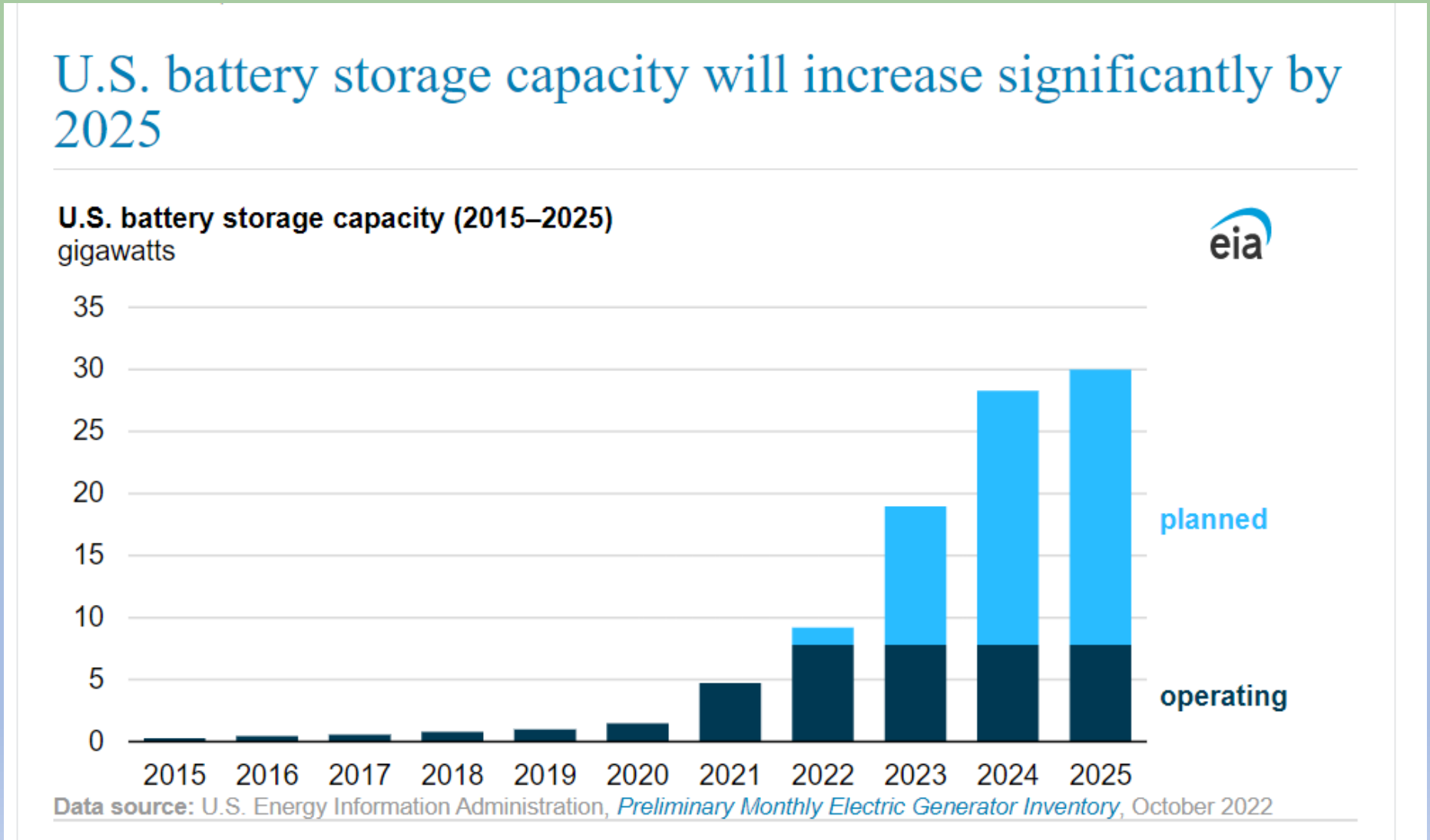


# Li-Ion Batteries

- 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 Nickel/Cobalt and toward Iron-Phosphate
  - 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

# Battery demand exploding



# Transportation in transition



1 icon represents limited long-term opportunity
2 icons represents large long-term opportunity
3 icons represents greatest long-term opportunity

| | BATTERY/ELECTRIC | HYDROGEN | SUSTAINABLE LIQUID FUELS |
|---|---|---|---|
| Light Duty Vehicles (49%)* | ●●● | — | TBD |
| Medium, Short-Haul Heavy Trucks & Buses (~14%) | ●● | ● | ● |
| Long-Haul Heavy Trucks (~7%) | ● | ●●● | ●● |
| Off-road (10%) | ●● | ● | ● |
| Rail (2%) | ●● | ●● | ●● |
| Maritime (3%) | ● | ●† | ●●● |
| Aviation (11%) | ● | ● | ●●● |
| Pipelines (4%) | ●● | TBD | TBD |
| **Additional Opportunities** | • Stationary battery use<br>• Grid support (managed EV charging) | • Heavy industries<br>• Grid support<br>• Feedstock for chemicals and fuels | • Decarbonize plastics/chemicals<br>• Bio-products |
| **RD&D Priorities** | • National battery strategy<br>• Charging infrastructure<br>• Grid integration<br>• Battery recycling | • Electrolyzer costs<br>• Fuel cell durability and cost<br>• Clean hydrogen infrastructure | • Multiple cost-effective drop-in sustainable fuels<br>• Reduce ethanol carbon intensity<br>• Bioenergy scale-up |

* All emissions shares are for 2019

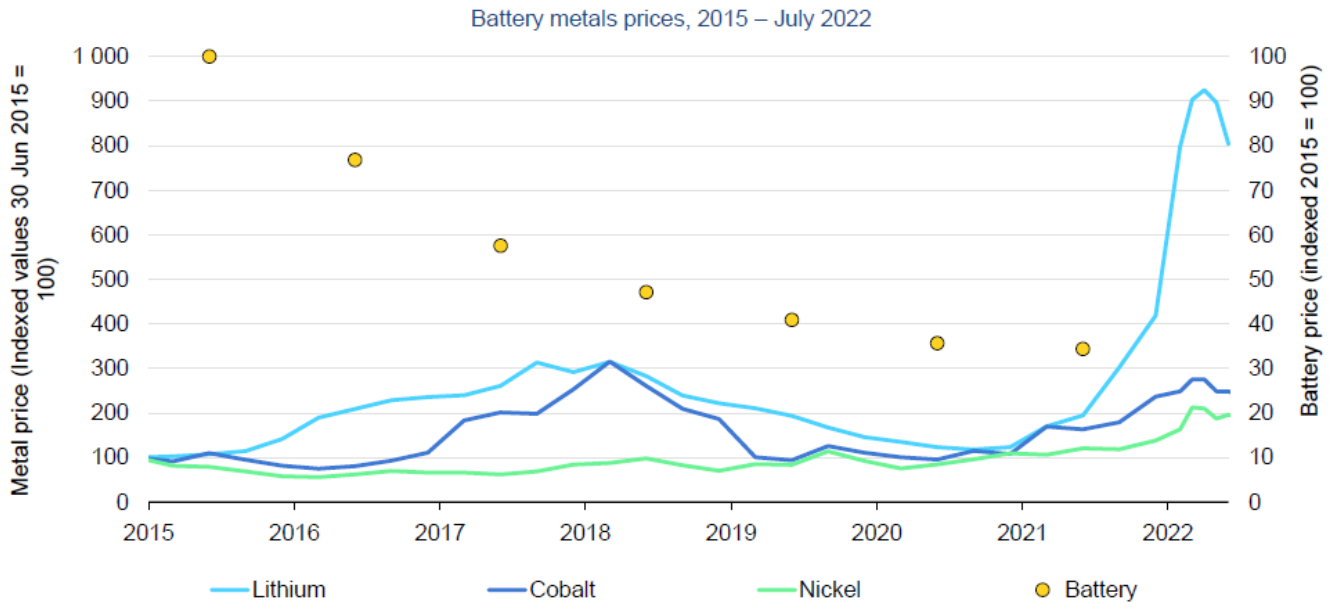
† Includes hydrogen for ammonia and methanol

*Figure 7. Summary of vehicle improvement strategies and technology solutions for different travel modes that are needed to reach a net-zero economy in 2050 (more details provided in Section 5).*

# Lithium prices have risen dramatically



**Battery metal prices increased dramatically in early 2022, posing a significant challenge to the EV industry**



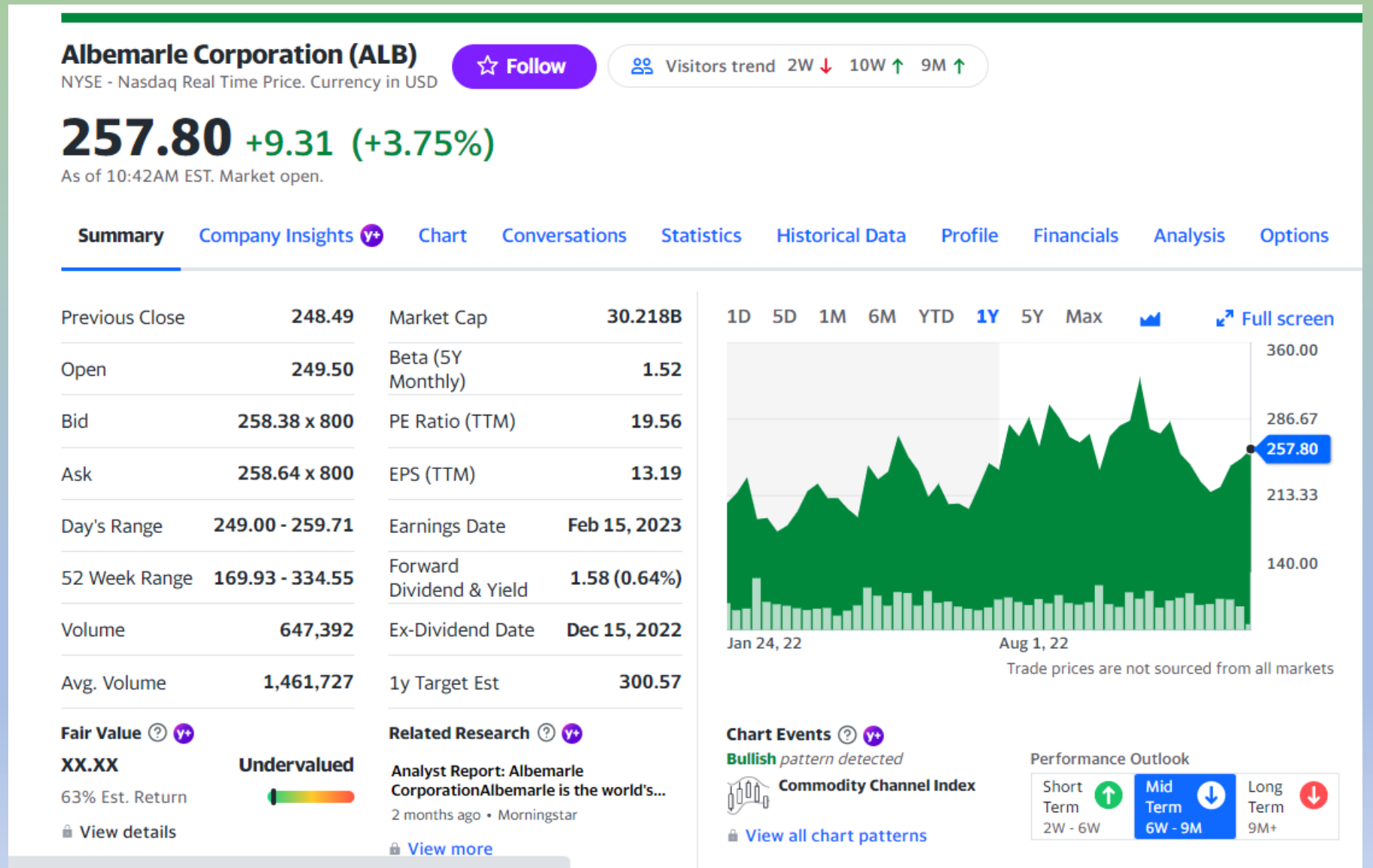



Sources: IEA analysis based on S&P Global
Notes: Lithium prices are from June 2022. Cobalt and Nickel from July 2022

# 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

# Albemarle (ALB)



**Albemarle Corporation (ALB)**
NYSE - Nasdaq Real Time Price. Currency in USD

Follow | Visitors trend 2W ↓ 10W ↑ 9M ↑

**257.80** +9.31 (+3.75%)
As of 10:42AM EST. Market open.

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

| | | | |
|---|---|---|---|
| Previous Close | 248.49 | Market Cap | 30.218B |
| Open | 249.50 | Beta (5Y Monthly) | 1.52 |
| Bid | 258.38 x 800 | PE Ratio (TTM) | 19.56 |
| Ask | 258.64 x 800 | EPS (TTM) | 13.19 |
| Day's Range | 249.00 - 259.71 | Earnings Date | Feb 15, 2023 |
| 52 Week Range | 169.93 - 334.55 | Forward Dividend & Yield | 1.58 (0.64%) |
| Volume | 647,392 | Ex-Dividend Date | Dec 15, 2022 |
| Avg. Volume | 1,461,727 | 1y Target Est | 300.57 |

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

360.00
286.67
257.80
213.33
140.00
Jan 24, 22
Aug 1, 22

Trade prices are not sourced from all markets

**Fair Value**
XX.XX — Undervalued
63% Est. Return
View details

**Related Research**
Analyst Report: Albemarle CorporationAlbemarle is the world's...
2 months ago • Morningstar
View more

**Chart Events**
Bullish *pattern detected*
Commodity Channel Index
View all chart patterns

Performance Outlook
Short Term 2W - 6W | Mid Term 6W - 9M | Long Term 9M+

# Global X Lithium and Battery Tech ETF (LIT)

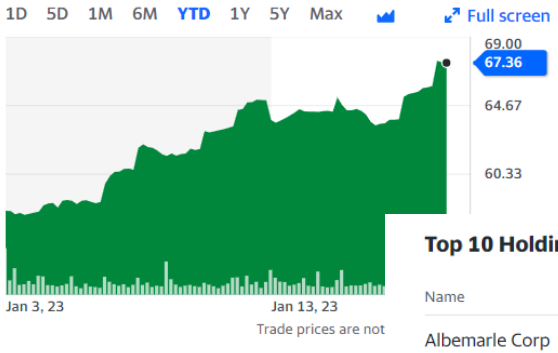
**Global X Lithium & Battery Tech ETF (LIT)**
NYSEArca - Nasdaq Real Time Price. Currency in USD

Follow | Visitors trend 2W ↑ 10W ↑ 9M ↑

**67.44** +1.62 (+2.46%)
As of 10:38AM EST. Market open.

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

| | | | |
|---|---|---|---|
| Previous Close | 65.82 | Net Assets | 3.23B |
| Open | 66.34 | NAV | 65.28 |
| Bid | 67.32 x 800 | PE Ratio (TTM) | N/A |
| Ask | 67.44 x 1800 | Yield | 0.98% |
| Day's Range | 66.31 - 67.49 | YTD Daily Total Return | 8.36% |
| 52 Week Range | 57.56 - 82.17 | Beta (5Y Monthly) | 1.23 |
| Volume | 83,100 | Expense Ratio (net) | 0.75% |
| Avg. Volume | 530,939 | Inception Date | 2010-07-22 |




**Top 10 Holdings (58.75% of Total Assets)**

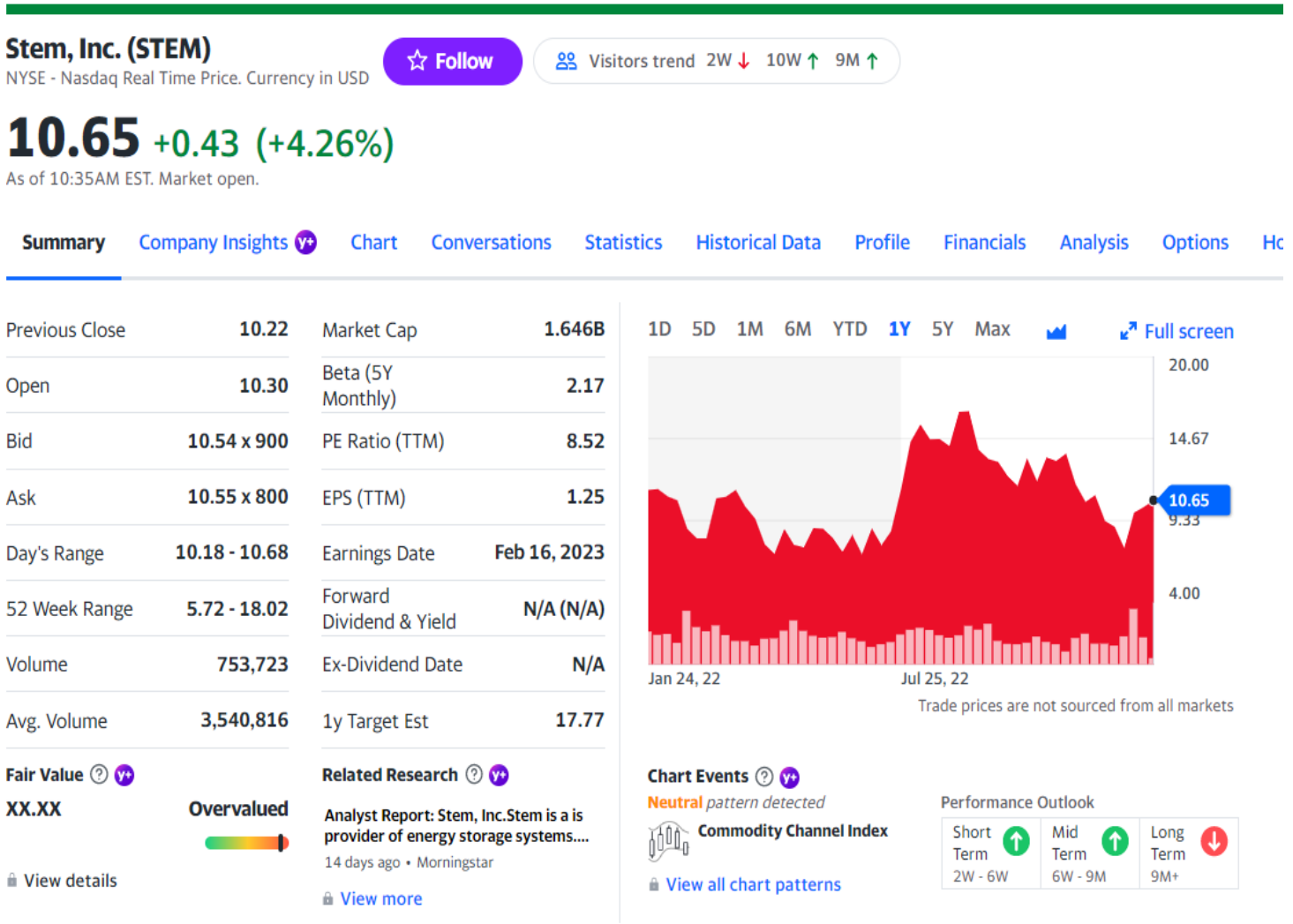
Get Quotes for Top Holdings

| Name | Symbol | % Assets |
|---|---|---|
| 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% |

GLOBAL X

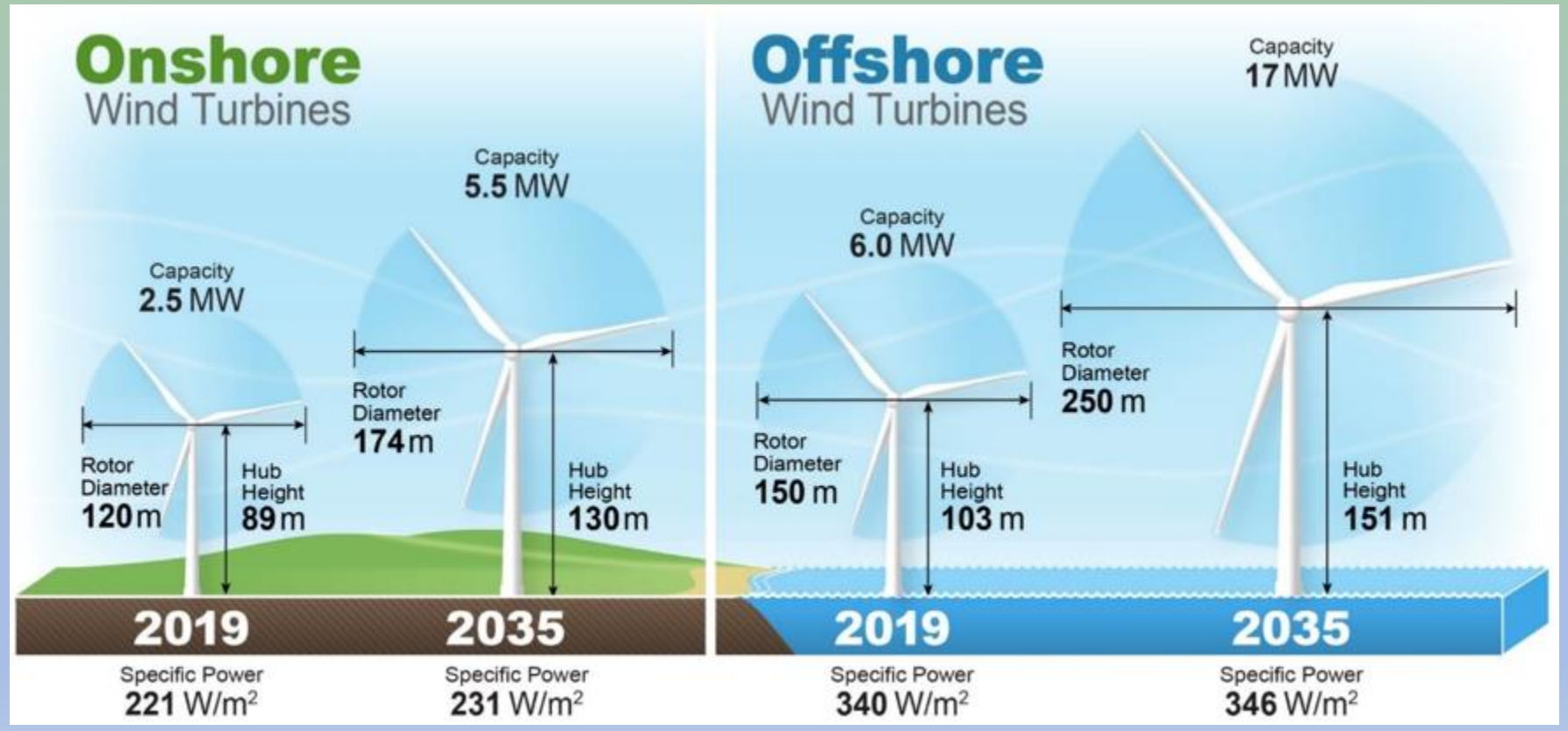
# STEM Inc. (STEM)

- AI-based computer software for managing commercial battery and grid operations
- Morgan Stanley upgraded STEM to Strong Buy



# Wind Energy Market

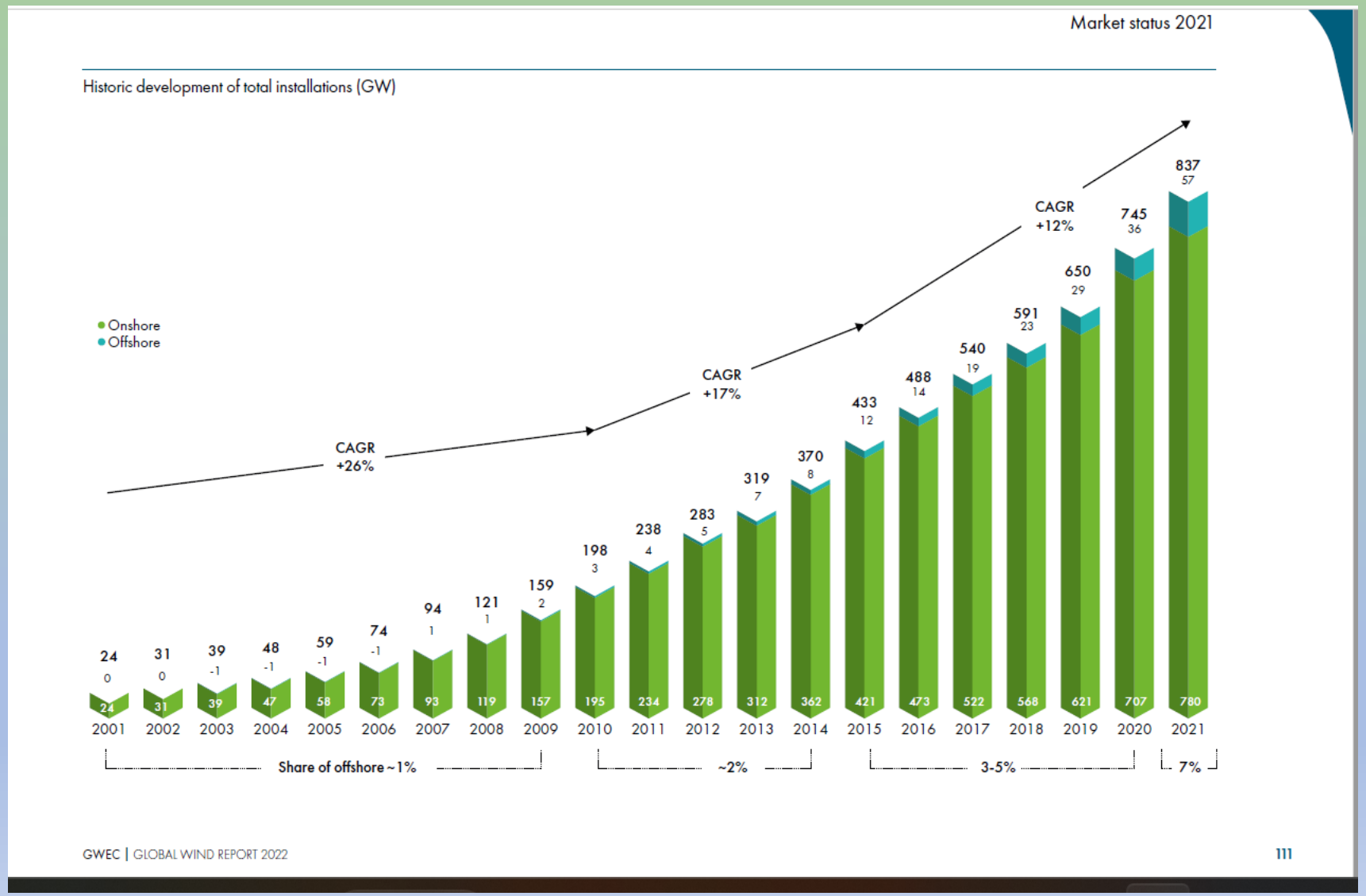
The global wind energy market was valued at $62.1 billion in 2019, and is projected to reach $127.2 billion by 2027, growing at a CAGR of 9.3% from 2020 to 2027.




Source: Nature.com; April 15, 2021

Source: Researchandmarkets.com; June 2021

# Wind Installations: Growing 12% CAGR



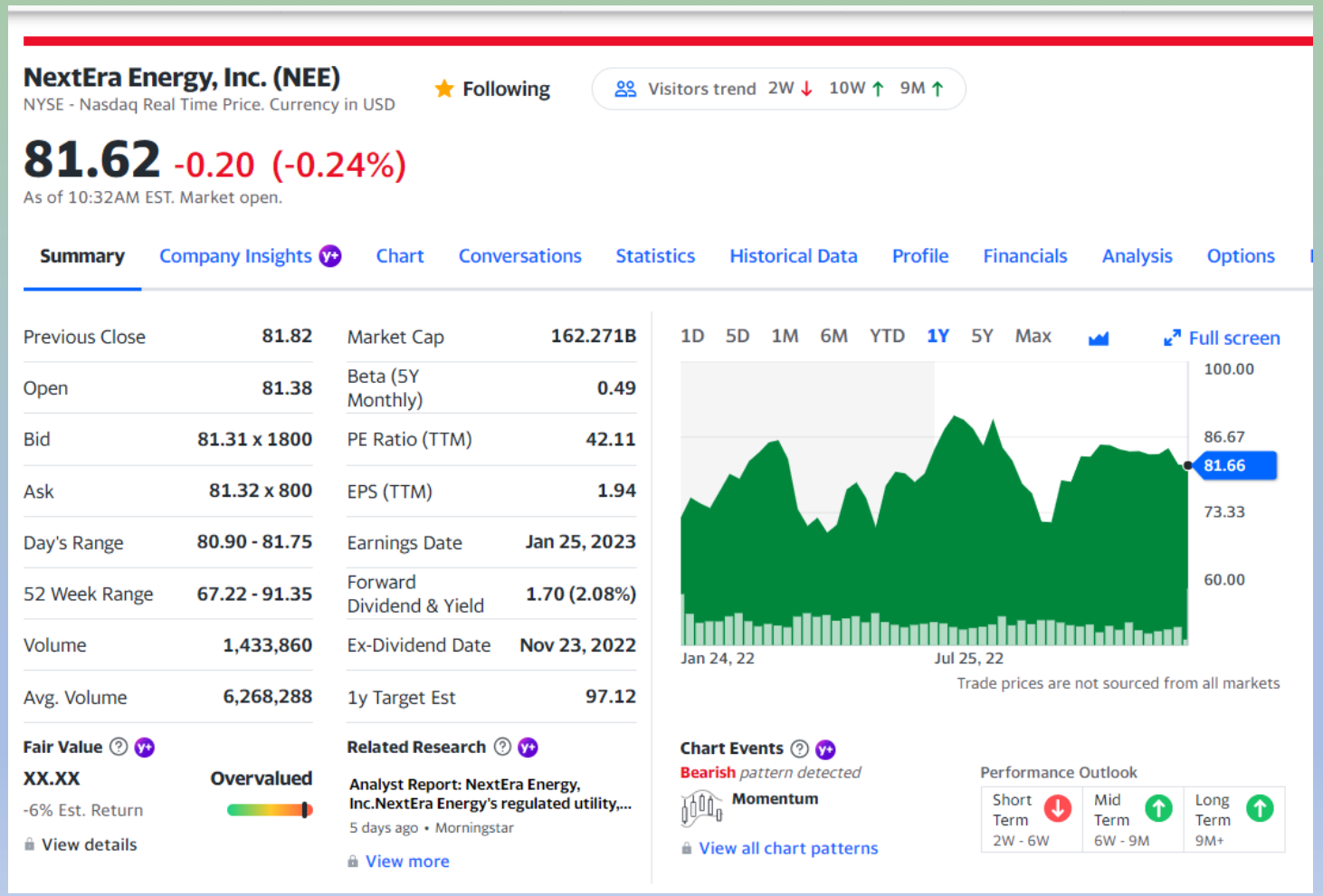
# Wind Energy Ideas

## Most Prominent Companies

- American Electric Power Company
- Exelon Corporation (EXC)
- General Electric Company
- NextEra Energy, Inc.
- TPI Composites
- Vestas Wind Systems
- SIEMENS
- Oersted

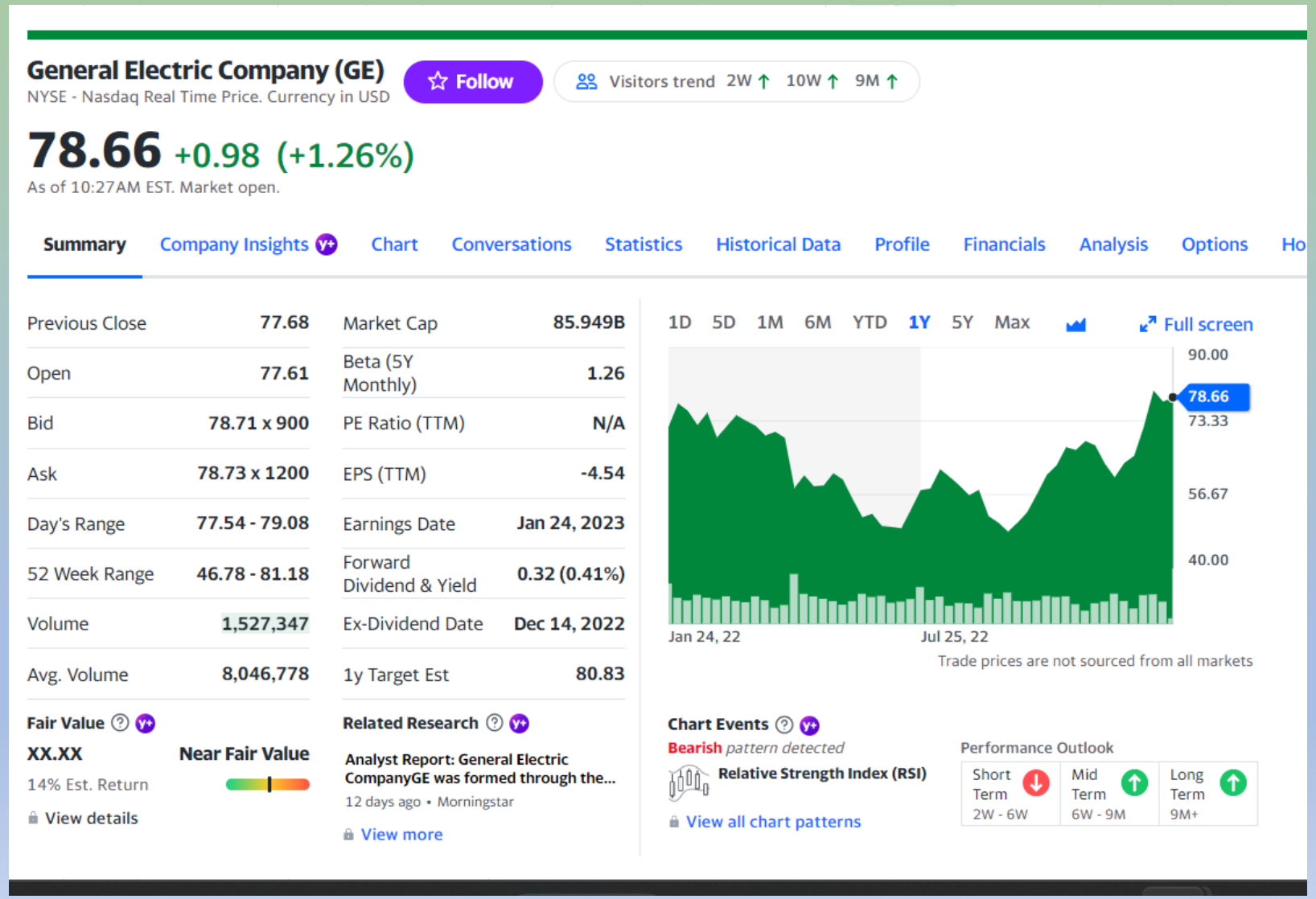
- Aegis Wind
- Ainscough Wind Energy Services
- Areva Wind
- Aris Wind
- Berkshire Hathaway Energy
- Broadwind Energy
- **China Ming Yang Wind Power Group**
- Clipper Windpower
- Dewind
- Envision Energy
- Mapna
- Ameren Corporation
- Avangrid, Inc.
- ENERCON GMBH
- Xcel Energy

# 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
- Pushed hard for hydrogen production tax credits

# General Electric (GE)



# General Electric (GE)

- GE is heavily invested in green energy products
  - Renewable business is losing money
- Wind generators
  - Largest wind generators in the world (almost)
  - $15B revenue in 2020
- Power generation – gas turbines
  - Experiments in hydrogen / natural gas mixing
- Jet engines
  - Experiments in hydrogen fuel and fuel cells[t]
- GE will break up into three companies during 2023-24
  - GE Healthcare done – 2023
  - Energy – GE Vernova in 2024
  - GE Aerospace (residual)

# Wind turbine failures

GE, Vestas, Oersted, Siemens all having problems

This 784-foot-tall wind turbine in Haltern, Germany, collapsed in 2021. *Photographer: TF-Images/Getty Images*

# Solar Market Overview

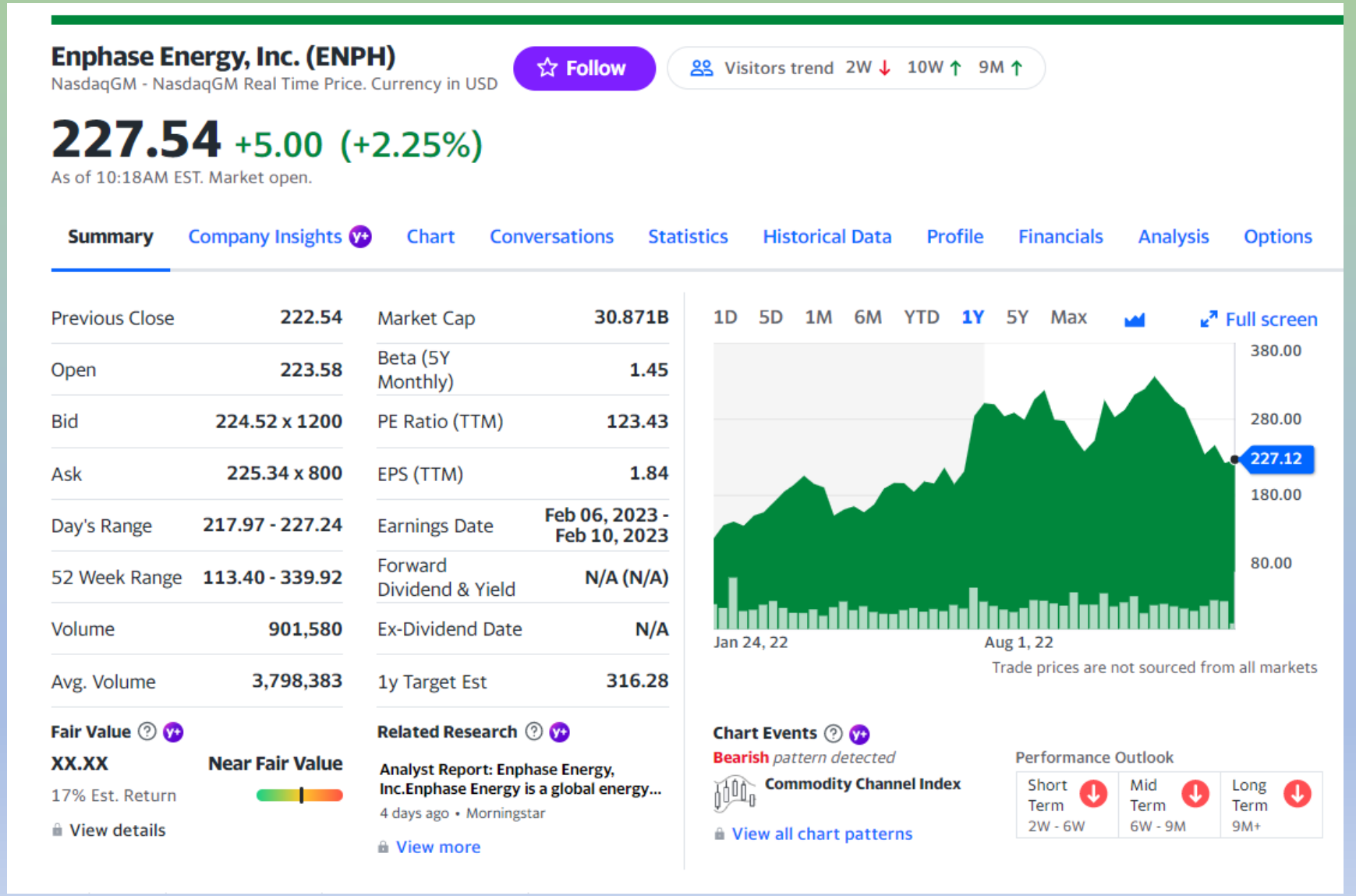
- Solar power sector is forecast to account for 52% of power capacity growth globally between 2022 and 2032
- 26% CAGR growth 2022-2030
- Solar Technology is advancing
  - Improvements to solar modules, solar cells, tracking and mounting systems, and software could yield additional cost declines
  - Solar cell efficiency is up from 16%, approaching 26%
- Next generation solar modules are emerging
- Costs are decreasing via scale
- Biden Admin IRA bill is a huge tailwind
- Biggest problem:  Site permitting slowing down installs

- Source:  Seeking Alpha

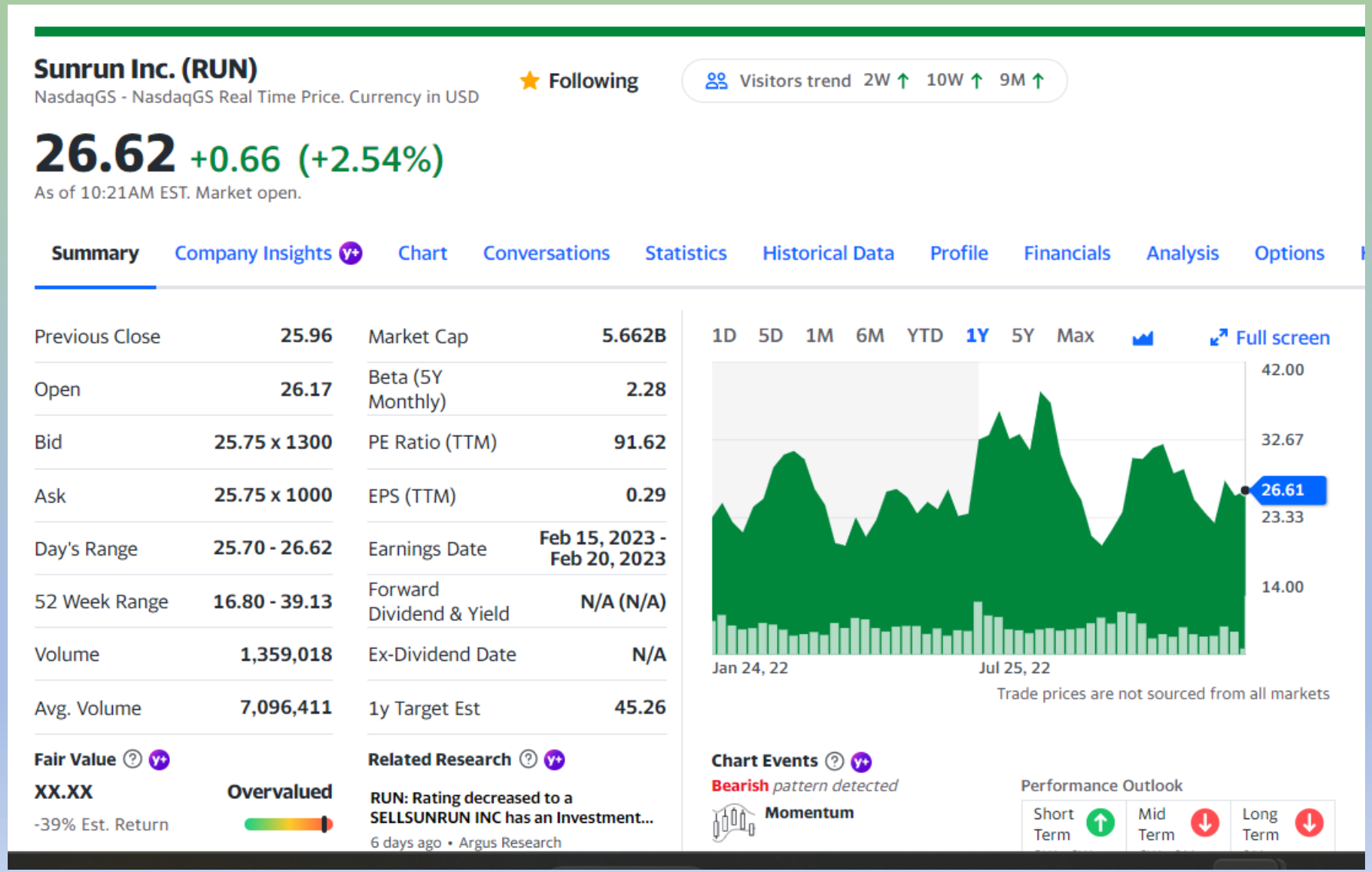
# Solar Tax Credits and Incentives from IRA

- Homeowners:  30% tax credit for new installs 2022-2032
- Businesses:  30% tax credit or 2.6 cents per Kwh depending on location (IRS rules TBD)
- Manufacturers:  Best guess approx 30% tax credits depending on what components are manufactured
- IRA has created large demand increases, now a shortage of panels
- Chinese tariffs on 8 companies
  - 27% tariff normally
  - 254% for tariff cheaters (4 Chinese companies)

# Enphase (ENPH)



# SUNRUN (RUN)



**Sunrun Inc. (RUN)**
NasdaqGS - NasdaqGS Real Time Price. Currency in USD

Following | Visitors trend 2W ↑ 10W ↑ 9M ↑

**26.62** +0.66 (+2.54%)
As of 10:21AM EST. Market open.

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

| | | | |
|---|---|---|---|
| Previous Close | 25.96 | Market Cap | 5.662B |
| Open | 26.17 | Beta (5Y Monthly) | 2.28 |
| Bid | 25.75 x 1300 | PE Ratio (TTM) | 91.62 |
| Ask | 25.75 x 1000 | EPS (TTM) | 0.29 |
| Day's Range | 25.70 - 26.62 | Earnings Date | Feb 15, 2023 - Feb 20, 2023 |
| 52 Week Range | 16.80 - 39.13 | Forward Dividend & Yield | N/A (N/A) |
| Volume | 1,359,018 | Ex-Dividend Date | N/A |
| Avg. Volume | 7,096,411 | 1y Target Est | 45.26 |

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



Trade prices are not sourced from all markets

**Fair Value**
XX.XX — Overvalued
-39% Est. Return

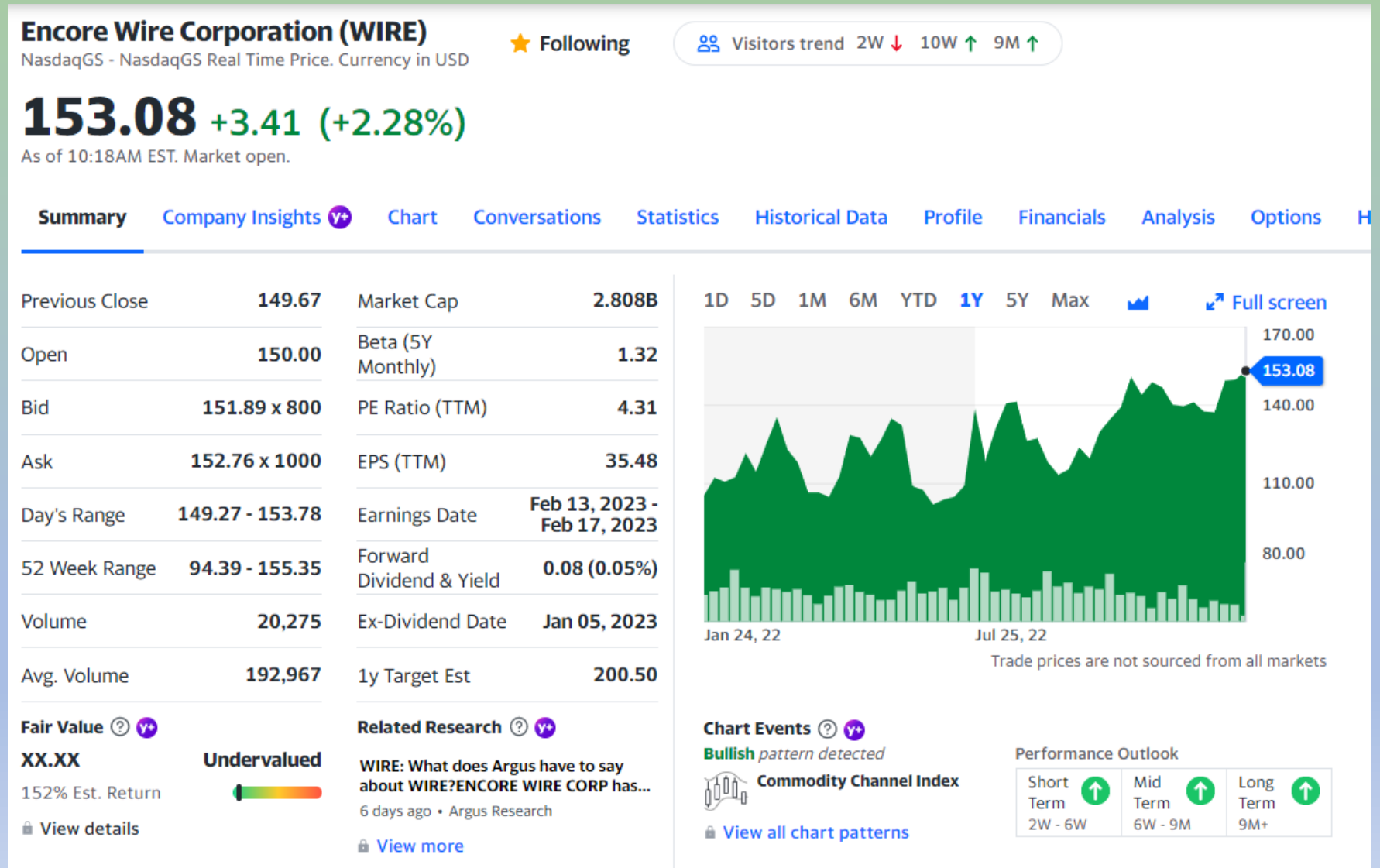
**Related Research**
RUN: Rating decreased to a SELLSUNRUN INC has an Investment...
6 days ago • Argus Research

**Chart Events**
Bearish *pattern detected*
Momentum

Performance Outlook
Short Term ↑ | Mid Term ↓ | Long Term ↓

# Encore Wire Corp. (WIRE)

## Electrical cable and components wholesale distributor





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

# Hydrogen demand explodes

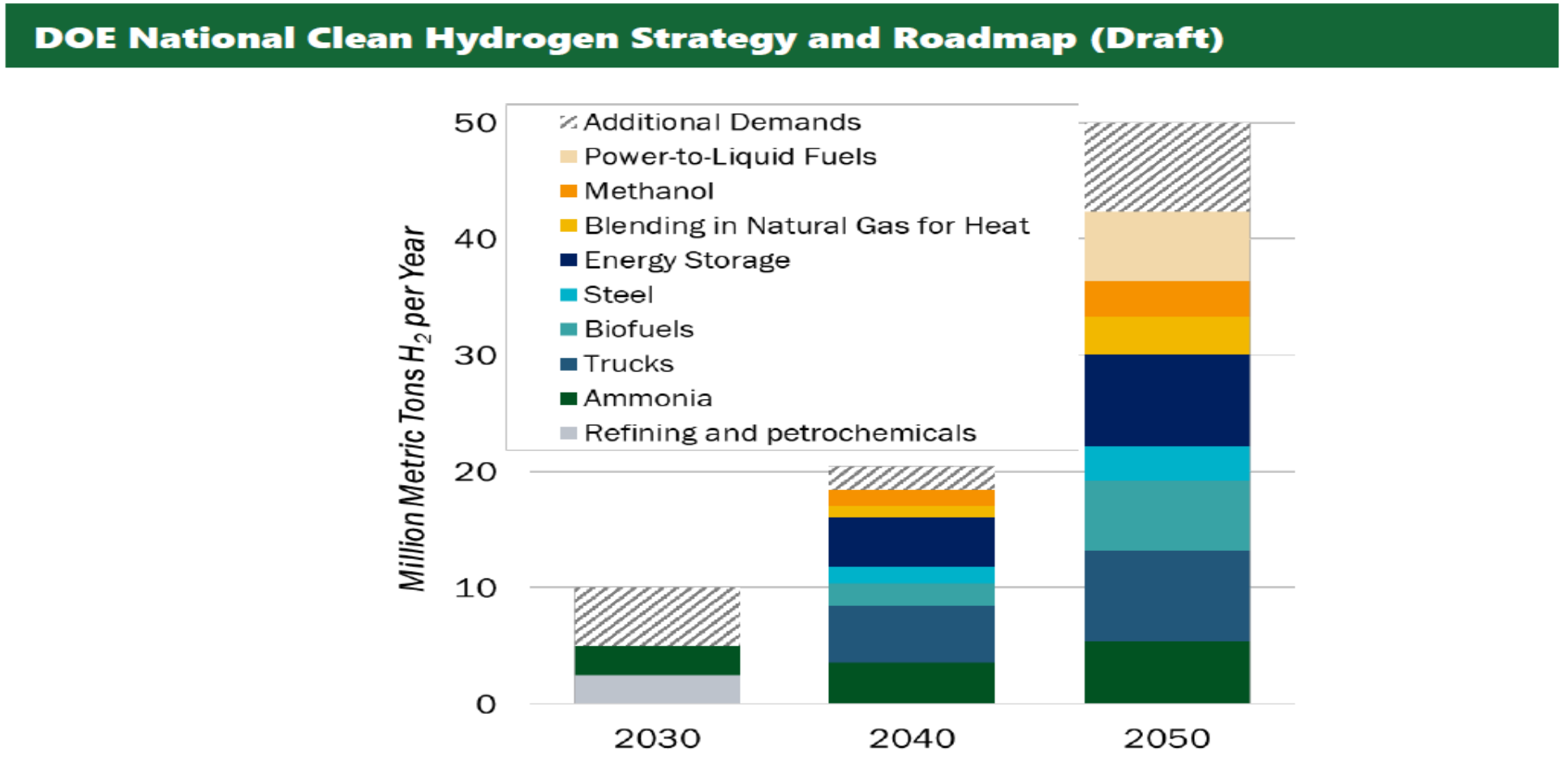



*Figure 12: Deployments of clean hydrogen to decarbonize industry, transportation, and the power grid can enable 10 MMT/year of demand by 2030, ~20 MMT/year of demand by 2040, and ~50 MMT in 2050*

# New US Gov't investments in hydrogen

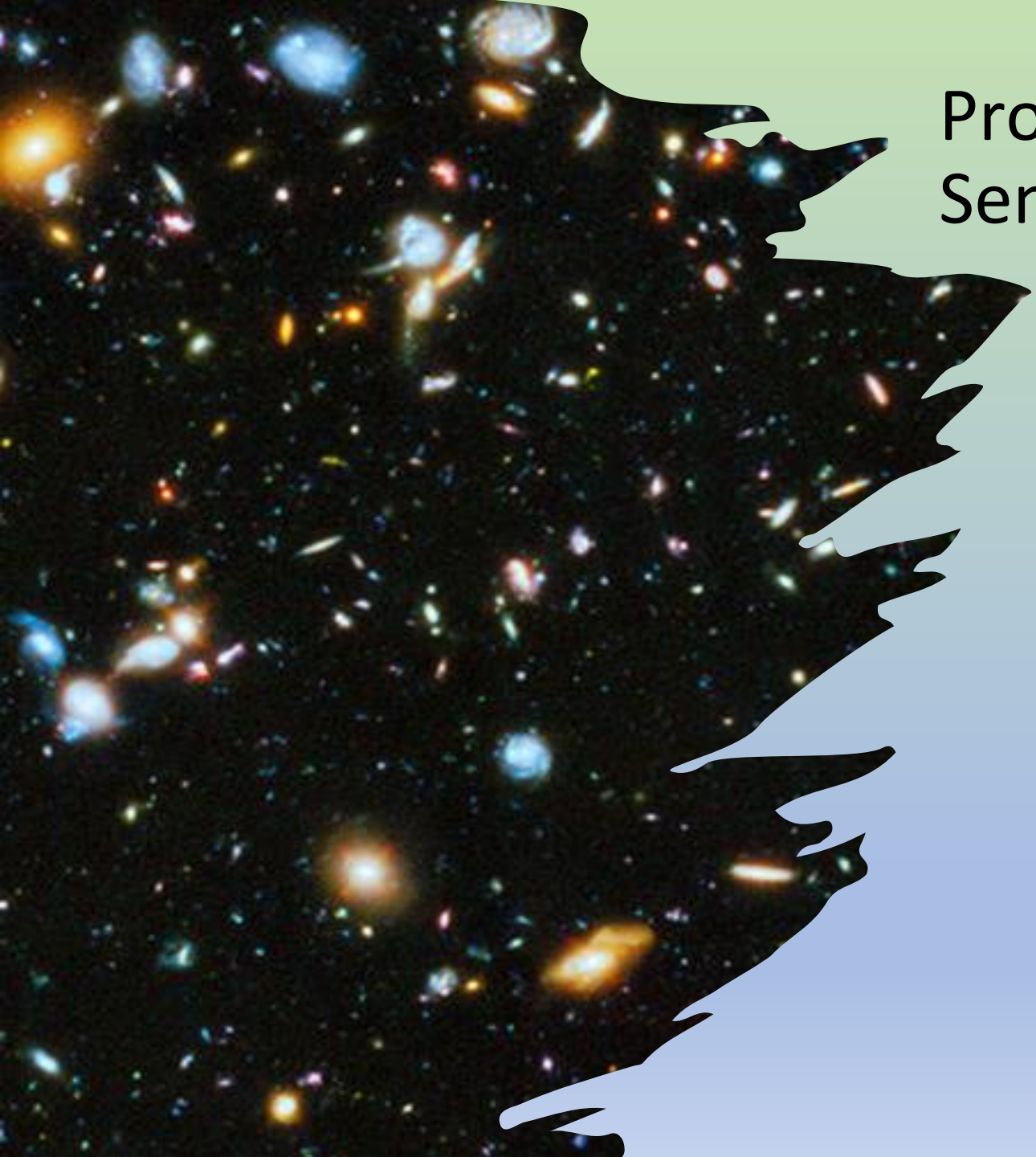
## Goal: Reduce hydrogen production costs to $1 per KG by 2030 from $5+ today

- Infrastructure Law Nov 21:
  - $8B for Regional Clean Hydrogen Hubs
  - $1B for electrolysis R&D, demonstrations, cost reduction
  - $500M for other clean hydrogen supply chains
  - Develop the US National Hydrogen Roadmap and standards
- Inflation Reduction Act Aug '22: (uncapped!)
  - $3 per KG production tax credit
  - Grants and loans for FCEV manufacturing, both autos and heavy trucks
  - Tax credits for manufacturing hydrogen production equipment
- Similar tax credits and incentives for wind and solar

- **Prime motivation: Prevent China from dominating the clean energy market**

# Colors of Hydrogen

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



# 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
- 1 KG of hydrogen is roughly equivalent to 1 gallon of gasoline
- Refueling a 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 is $1/10^{th}$ the cost of electricity distribution
  - Can re-use most existing pipelines
  - Can be mixed with natural gas for storage, or consumption

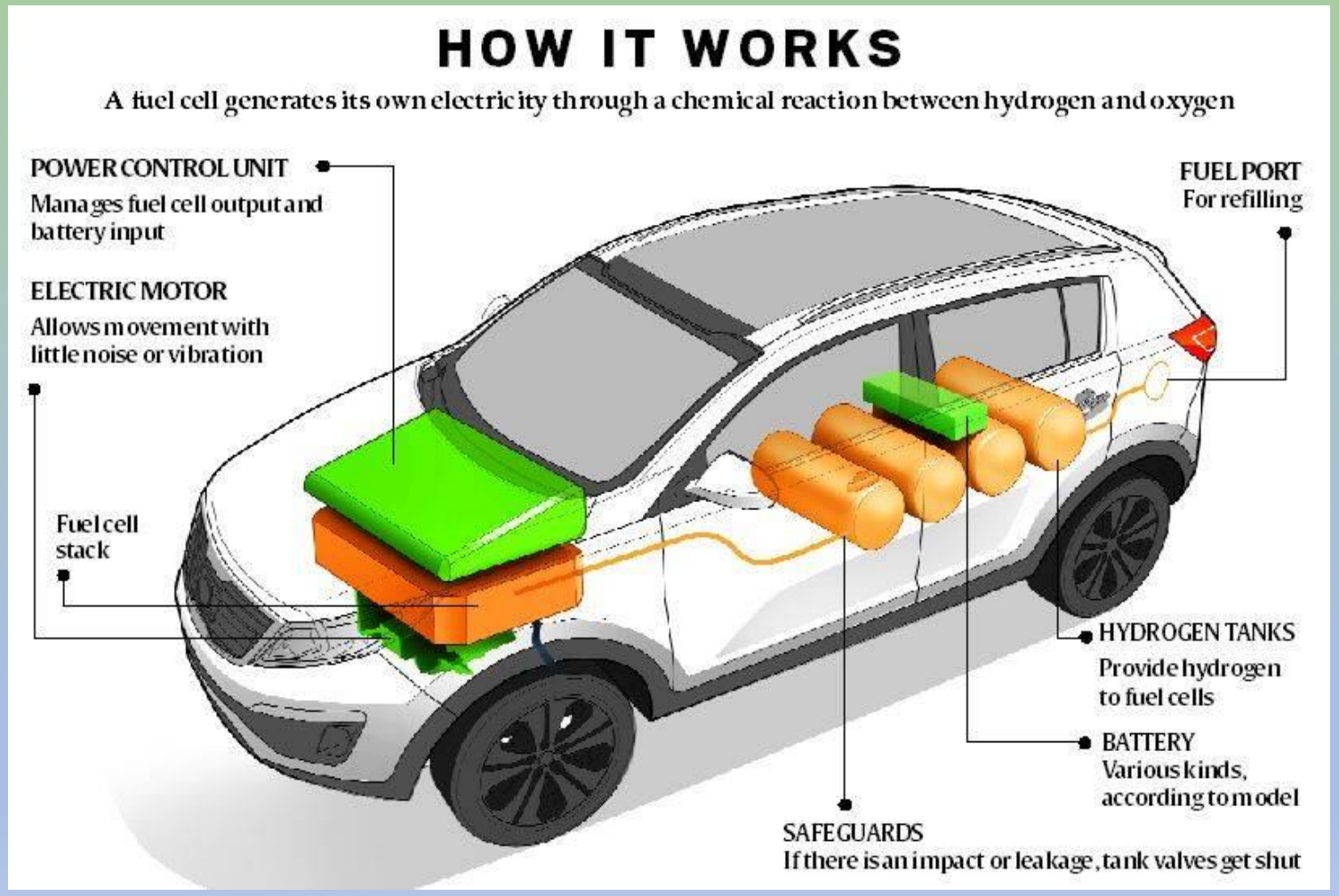
# Cons – Why hydrogen is slow to take off

- Infrastructure does not exist to support widespread distribution
- Amazon, Walmart, Home Depot distribution centers all have H2 facilities
- H2 is costly to produce:  $5 per gallon gasoline equivalent > Projected to decline to $3.00 by 2024
- Lack of public awareness
- Some oil companies view hydrogen as a threat
- My take: H2 transportation and power market will take off in next 3-5 years

# Global Momentum Building for Hydrogen

- All of these countries have a hydrogen investment strategy:
  - European Union
    - $550B committed for infrastructure
  - 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

# Fuel Cell Vehicles are also Electric Vehicles

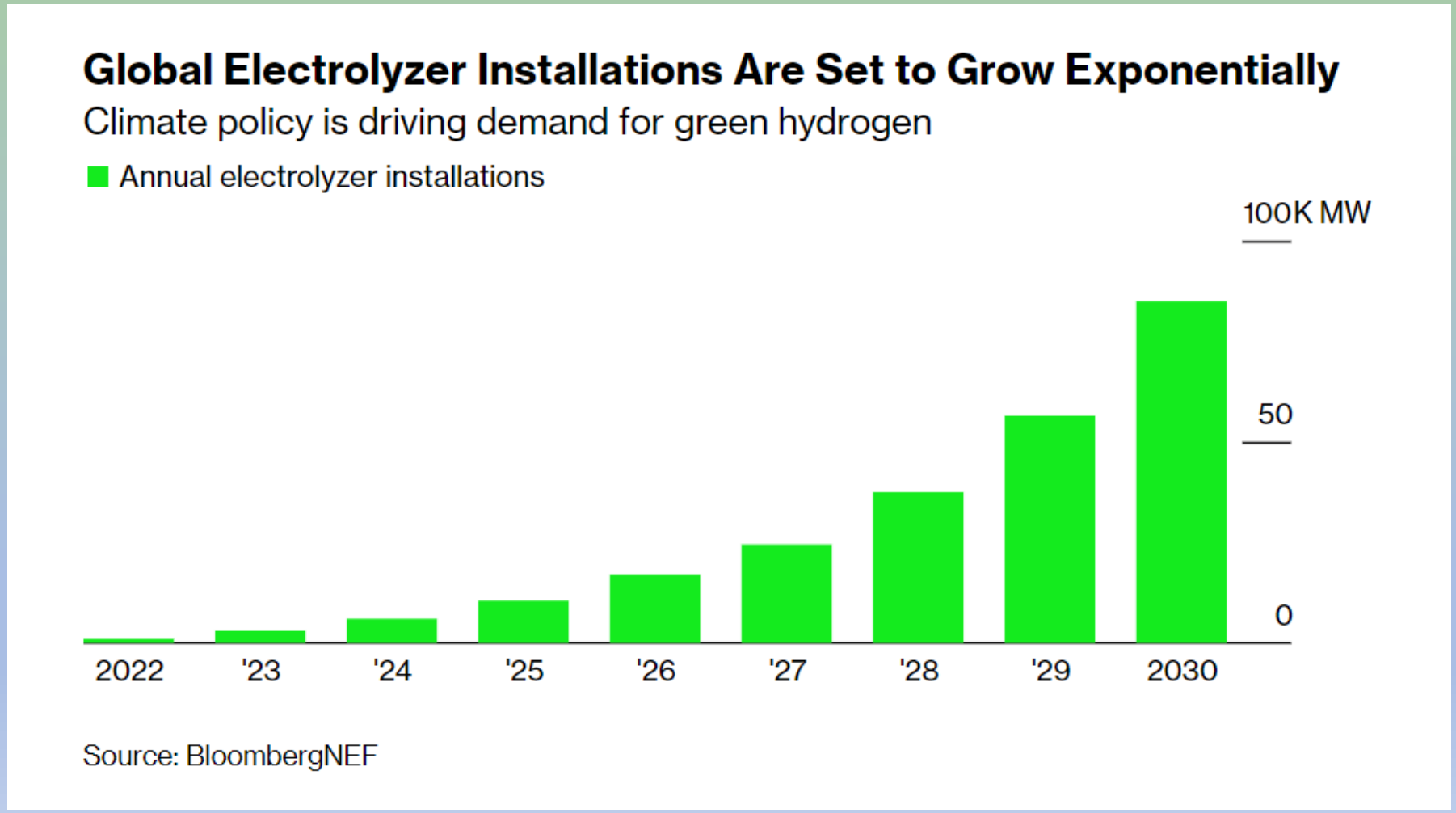


# Compare Batteries, Fuel Cells

- 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

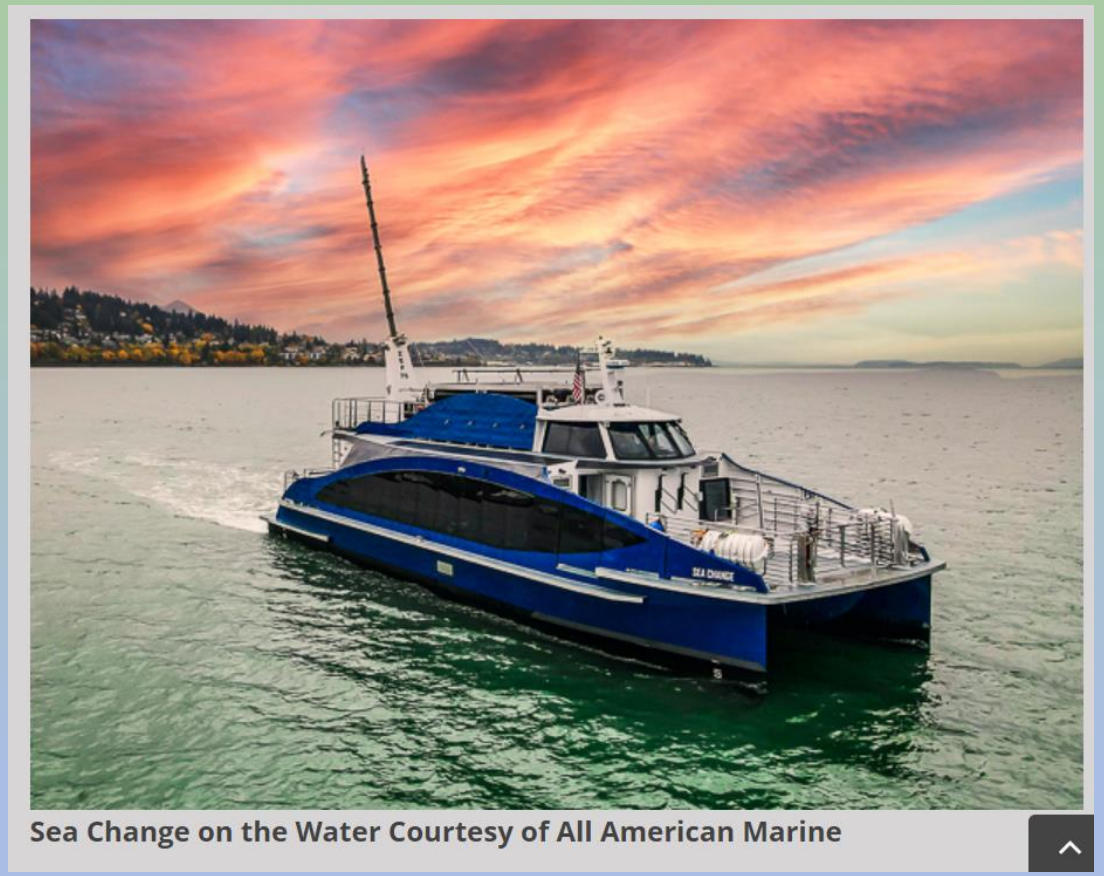
This is not a competition!  Both will win in the long term.
Batteries will always have a place, as will fuel cells

# Electrolyzer demand exploding



# 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/

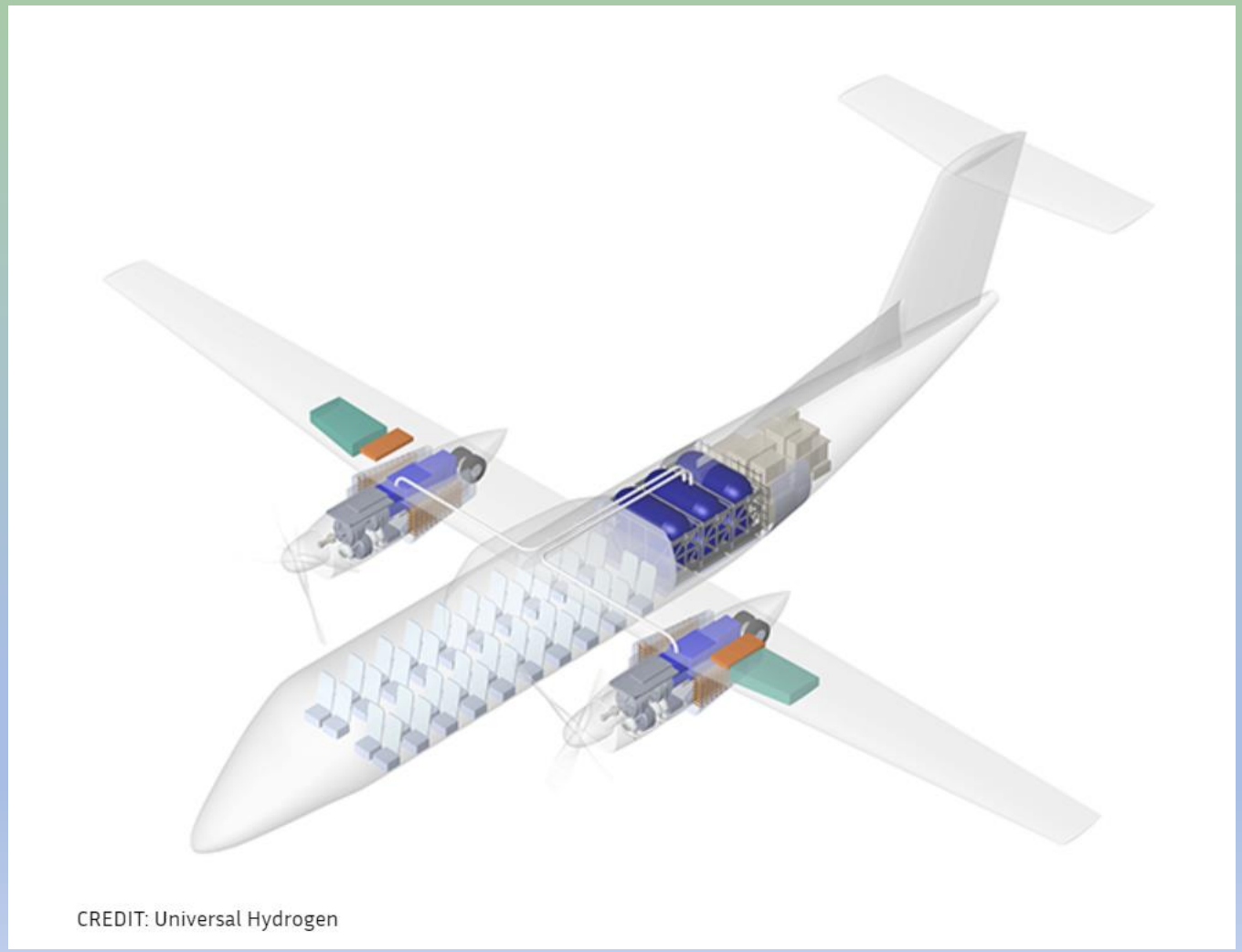
# SunLine Bus Transit, Palm Desert, CA

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

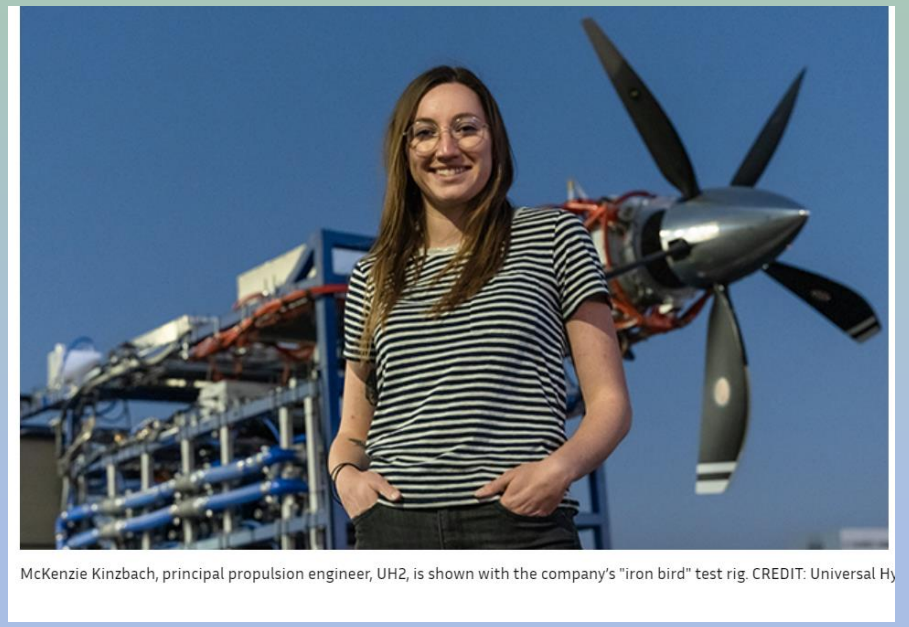
Operational since 2012

# Hydrogen-powered demo aircraft

## DeHavilland Dash-8 re-configured with H2 tanks and PLUG fuel cells



CREDIT: Universal Hydrogen



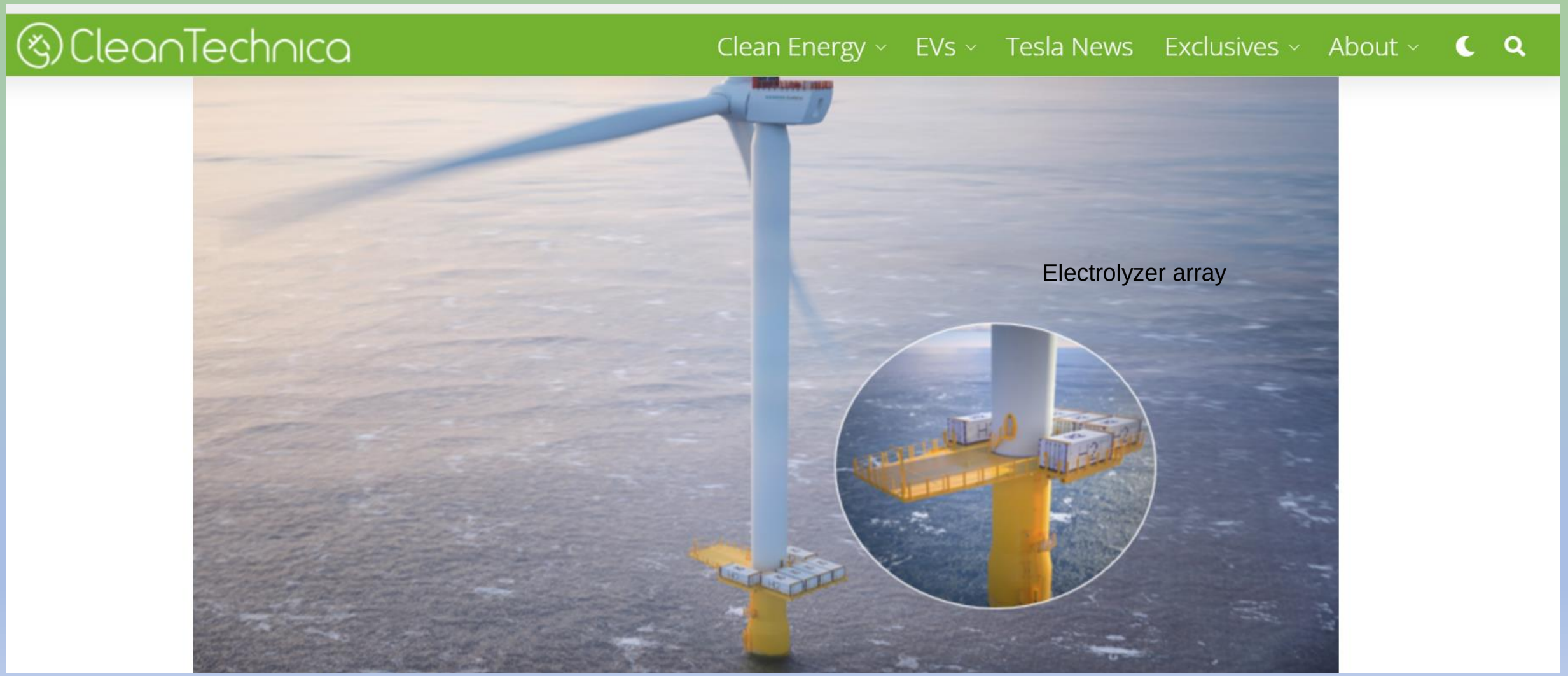
McKenzie Kinzbach, principal propulsion engineer, UH2, is shown with the company's "iron bird" test rig. CREDIT: Universal Hy

# 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



## My View of Fuel Cell Vehicles:

Depot-constrained vehicles will come out before autos:

- Long haul trucking
- Buses
- Trains
- Aircraft
- Material handling and ground support equipment
- Delivery trucks
- Garbage Trucks,
- Post Office vehicles


TATA MOTORS

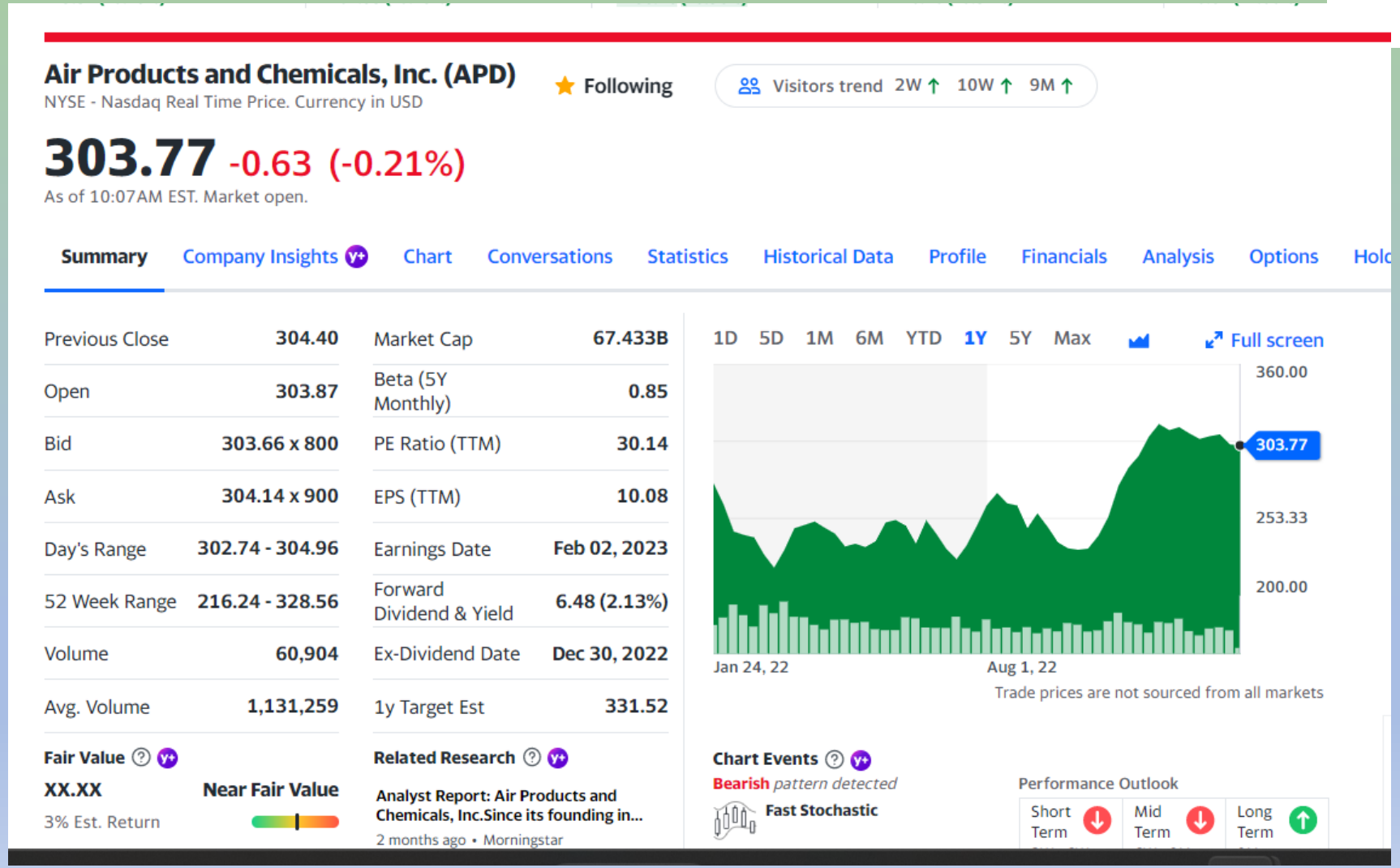
# Investment Opportunities: Top Hydrogen Stocks


- Established industrial firms, **average risk**
  - Air Products, Cummins, Shell, BP, Linde, Air Liquide
- 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, **high risk** (none are profitable yet)
  - Plug Power, Bloom Energy, Fuel Cell Energy, Ballard Power
- Pure **Speculation**
  - HYSR, NKLA, ZEV…many others
- Hydrogen-centered ETFs:  HDRO, HJEN, HYDR

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

# Air Products (APD)

AIR PRODUCTS
APD



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

Following | Visitors trend 2W ↑ 10W ↑ 9M ↑

**303.77** -0.63 (-0.21%)
As of 10:07AM EST. Market open.

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

| | | | |
|---|---|---|---|
| Previous Close | 304.40 | Market Cap | 67.433B |
| Open | 303.87 | Beta (5Y Monthly) | 0.85 |
| Bid | 303.66 x 800 | PE Ratio (TTM) | 30.14 |
| Ask | 304.14 x 900 | EPS (TTM) | 10.08 |
| Day's Range | 302.74 - 304.96 | Earnings Date | Feb 02, 2023 |
| 52 Week Range | 216.24 - 328.56 | Forward Dividend & Yield | 6.48 (2.13%) |
| Volume | 60,904 | Ex-Dividend Date | Dec 30, 2022 |
| Avg. Volume | 1,131,259 | 1y Target Est | 331.52 |

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

360.00
303.77
253.33
200.00
Jan 24, 22
Aug 1, 22
Trade prices are not sourced from all markets

**Fair Value**
XX.XX Near Fair Value
3% Est. Return

**Related Research**
Analyst Report: Air Products and Chemicals, Inc.Since its founding in...
2 months ago • Morningstar

**Chart Events**
Bearish *pattern detected*
Fast Stochastic

Performance Outlook
Short Term | Mid Term | Long Term

# Air Products, cont’d

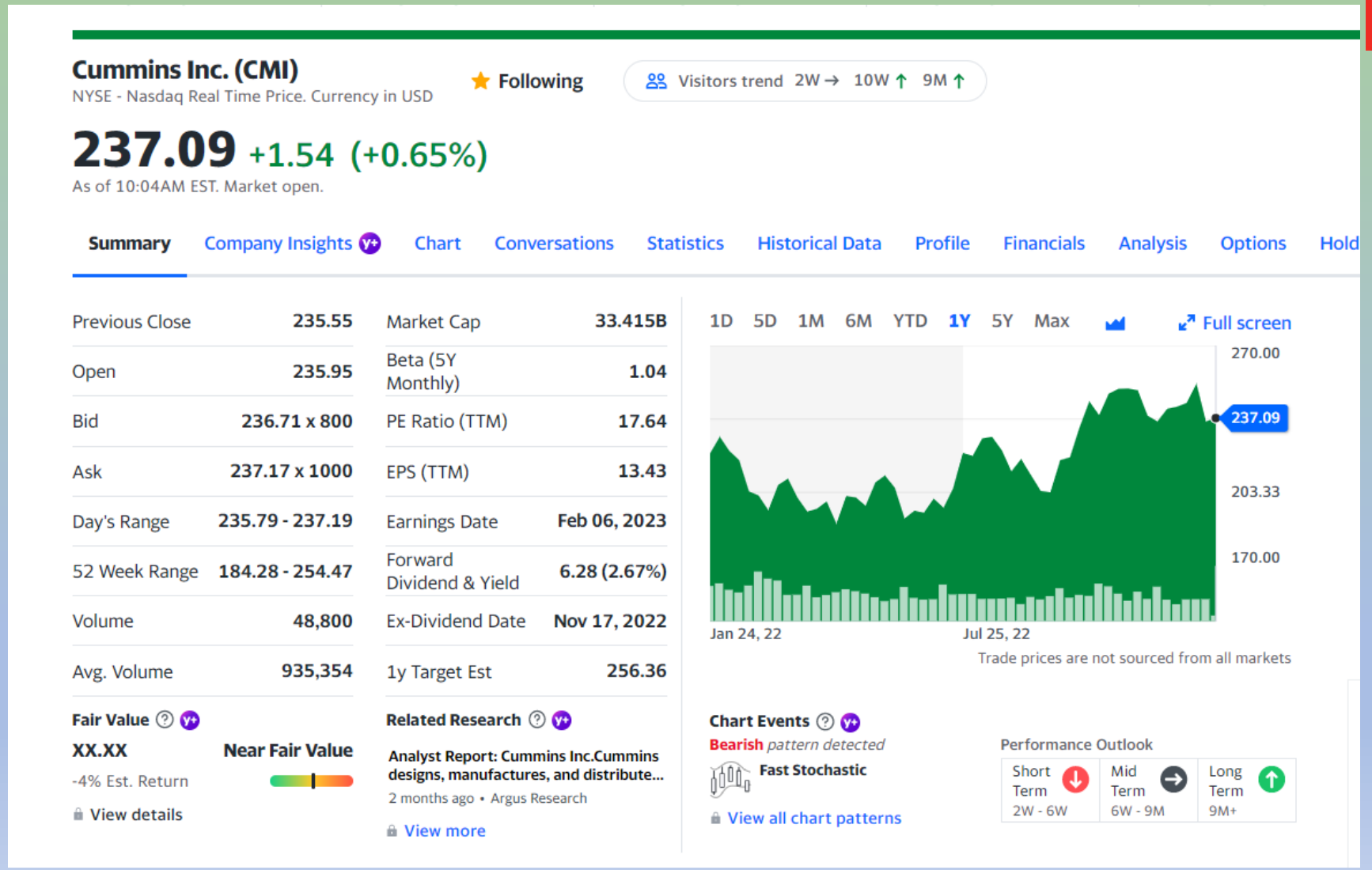

FEATURED NEWS

## 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)

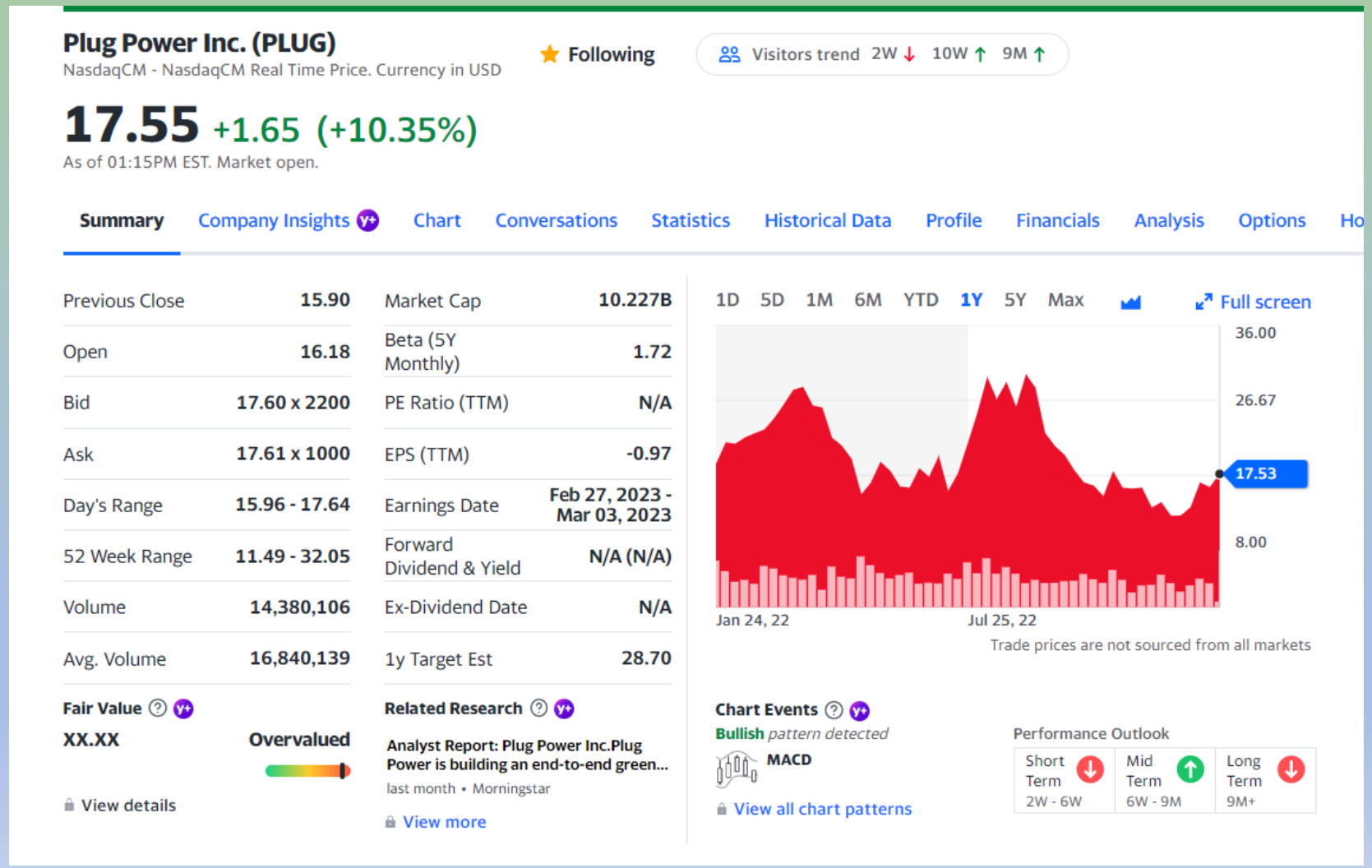

Cummins Inc. (CMI)
NYSE - Nasdaq Real Time Price. Currency in USD
Following
Visitors trend 2W → 10W ↑ 9M ↑
237.09 +1.54 (+0.65%)
As of 10:04AM EST. Market open.
Summary
Company Insights
Chart
Conversations
Statistics
Historical Data
Profile
Financials
Analysis
Options
Hold
Previous Close 235.55
Open 235.95
Bid 236.71 x 800
Ask 237.17 x 1000
Day's Range 235.79 - 237.19
52 Week Range 184.28 - 254.47
Volume 48,800
Avg. Volume 935,354
Market Cap 33.415B
Beta (5Y Monthly) 1.04
PE Ratio (TTM) 17.64
EPS (TTM) 13.43
Earnings Date Feb 06, 2023
Forward Dividend & Yield 6.28 (2.67%)
Ex-Dividend Date Nov 17, 2022
1y Target Est 256.36
Fair Value
XX.XX
Near Fair Value
-4% Est. Return
View details
Related Research
Analyst Report: Cummins Inc.Cummins designs, manufactures, and distribute...
2 months ago • Argus Research
View more
1D 5D 1M 6M YTD 1Y 5Y Max
Full screen
270.00
237.09
203.33
170.00
Jan 24, 22
Jul 25, 22
Trade prices are not sourced from all markets
Chart Events
Bearish pattern detected
Fast Stochastic
View all chart patterns
Performance Outlook
Short Term 2W - 6W
Mid Term 6W - 9M
Long Term 9M+

# Cummins (CMI)

- 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”
- “Cummins has more than 2,000 fuel cell installations ……as well as more than 500 electrolyzer installations.”
- Now demonstrating a “fuel-agnostic” internal combustion engine
  - Diesel, natural gas, biogas or hydrogen

Source: Cummins’ website

# Plug Power (PLUG)

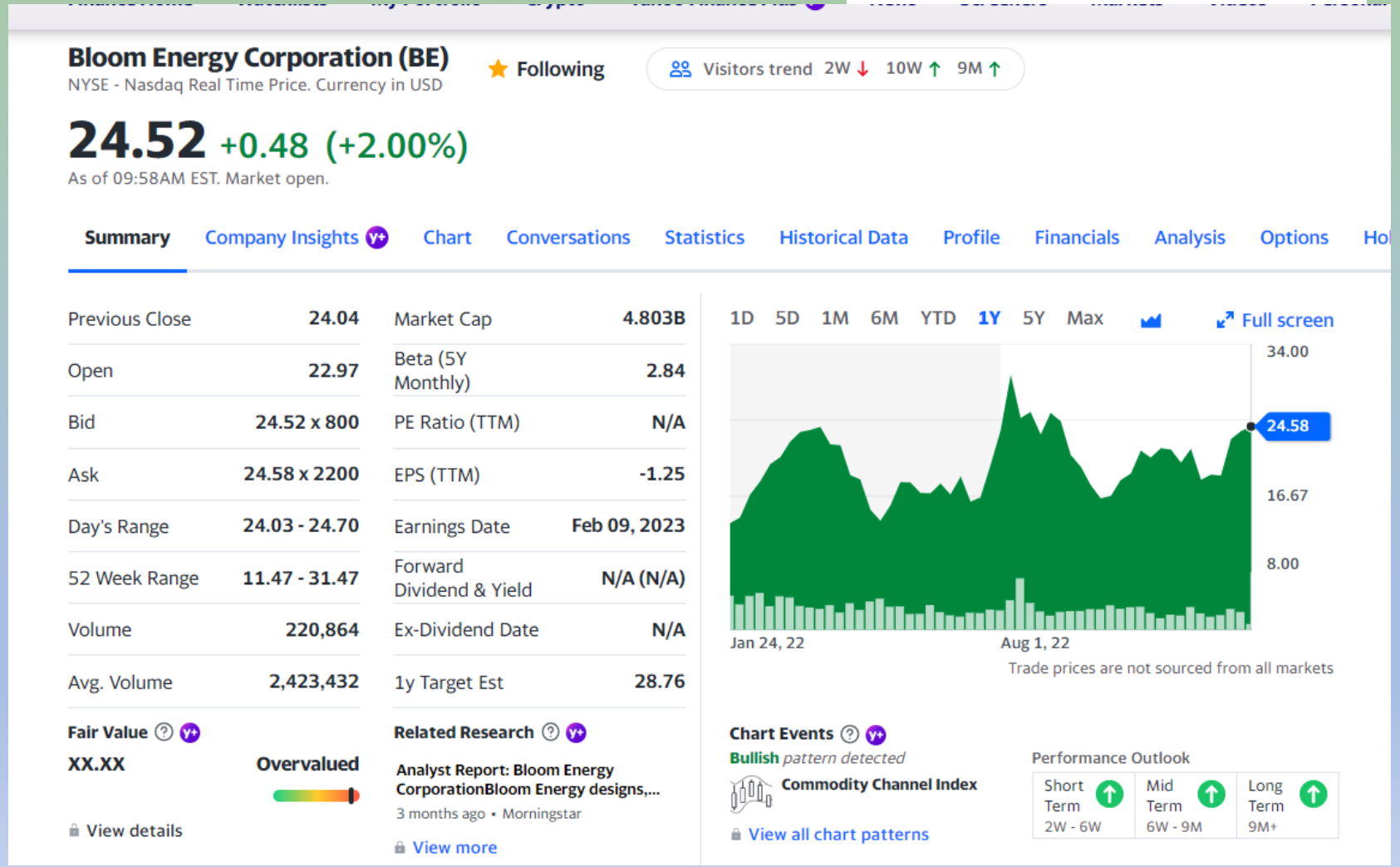


# PLUG is volatile, but future is bright

- 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, BAE, Renault
- JVs with Renault, SK, GM, BAE, others pending
- Large, deployed product base: 50,000+ fuel cell units
- Largest consumer/provider of hydrogen in the world
- Employee count: Growing from 600 to 2,500 in 2023
- Heavy institutional interest: >1,000 large investors
  - BlackRock: 56M shares; Vanguard: 51M shares
- Holding $2.7B cash – strong balance sheet
- 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

Following | Visitors trend 2W ↓ 10W ↑ 9M ↑

**24.52** +0.48 (+2.00%)
As of 09:58AM EST. Market open.

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

| | | | |
|---|---|---|---|
| Previous Close | 24.04 | Market Cap | 4.803B |
| Open | 22.97 | Beta (5Y Monthly) | 2.84 |
| Bid | 24.52 x 800 | PE Ratio (TTM) | N/A |
| Ask | 24.58 x 2200 | EPS (TTM) | -1.25 |
| Day's Range | 24.03 - 24.70 | Earnings Date | Feb 09, 2023 |
| 52 Week Range | 11.47 - 31.47 | Forward Dividend & Yield | N/A (N/A) |
| Volume | 220,864 | Ex-Dividend Date | N/A |
| Avg. Volume | 2,423,432 | 1y Target Est | 28.76 |

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



Trade prices are not sourced from all markets

**Fair Value**
XX.XX — Overvalued
View details

**Related Research**
Analyst Report: Bloom Energy CorporationBloom Energy designs,...
3 months ago • Morningstar
View more

**Chart Events**
Bullish *pattern detected*
Commodity Channel Index
View all chart patterns

Performance Outlook

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

# ETF: HDRO

**Defiance Next Gen H2 ETF (HDRO)** ★ Following | Visitors trend 2W↑ 10W↑ 9M↑

NYSEArca - Nasdaq Real Time Price. Currency in USD

**10.73** +0.11 (+1.04%)

As of 09:43AM EST. Market open.

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

| | | | |
|---|---|---|---|
| Previous Close | 10.62 | Net Assets | 37.91M |
| Open | 10.66 | NAV | 10.50 |
| Bid | 10.67 x 1100 | PE Ratio (TTM) | N/A |
| Ask | 10.73 x 1000 | Yield | 0.00% |
| Day's Range | 10.70 - 10.73 | YTD Daily Total Return | 9.60% |
| 52 Week Range | 8.07 - 18.09 | Beta (5Y Monthly) | 0.00 |
| Volume | 5,216 | Expense Ratio (net) | 0.30% |
| Avg. Volume | 20,483 | Inception Date | 2021-03-09 |


**Top 10 Holdings (60.77% of Total Assets)**

Get Quotes for Top Holdings

| Name | Symbol | % Assets |
|---|---|---|
| Plug Power Inc | PLUG | 11.78% |
| Bloom Energy Corp Class A | BE | 7.71% |
| Ballard Power Systems Inc | BLDP.TO | 5.84% |
| NEL ASA | NEL | 5.65% |
| FuelCell Energy Inc | FCEL | 5.49% |
| PowerCell Sweden AB | PCELL | 5.46% |
| Doosan Fuel Cell Ordinary Shares | 336260.KS | 4.99% |
| SFC Energy AG | F3C.DE | 4.95% |
| Ceres Power Holdings PLC | CWR.L | 4.69% |
| ILJIN Hysolus Co Ltd | 271940.KS | 4.21% |

# 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 Index Fund (QCLN)**

NasdaqGM - NasdaqGM Real Time Price. Currency in USD

Follow | Visitors trend 2W ↑ 10W ↑ 9M ↑

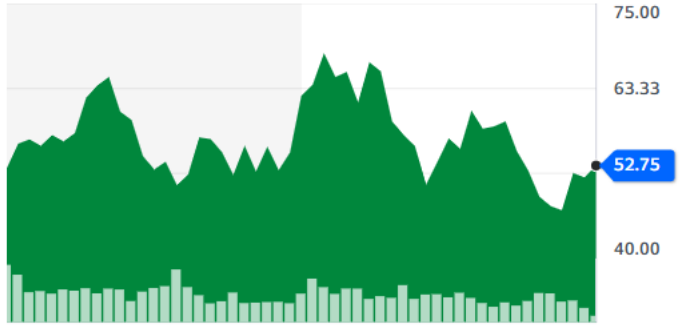
**52.75** +1.62 (+3.17%)

As of 10:14AM EST. Market open.

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

| | | | |
|---|---|---|---|
| Previous Close | 51.13 | Net Assets | 1.57B |
| Open | 51.50 | NAV | 51.17 |
| Bid | 52.39 x 1200 | PE Ratio (TTM) | N/A |
| Ask | 52.57 x 900 | Yield | 0.33% |
| Day's Range | 51.33 - 52.80 | YTD Daily Total Return | 5.40% |
| 52 Week Range | 44.25 - 68.94 | Beta (5Y Monthly) | 1.63 |
| Volume | 29,891 | Expense Ratio (net) | 0.58% |
| Avg. Volume | 205,860 | Inception Date | 2007-02-08 |

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




Trade prices are not sourced from all markets

**Top 10 Holdings (56.07% of Total Assets)**

| Name | | |
|---|---|---|
| NIO Inc ADR | | |
| Tesla Inc | | |
| Enphase Energy Inc | | |
| Albemarle Corp | | |
| Plug Power Inc | PLUG | 5.83% |
| XPeng Inc ADR | XPEV | 4.94% |
| SolarEdge Technologies Inc | SEDG | 3.83% |
| Sunrun Inc | RUN | 3.56% |
| Cree Inc | CREE | 3.50% |
| ON Semiconductor Corp | ON | 3.42% |

# 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 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

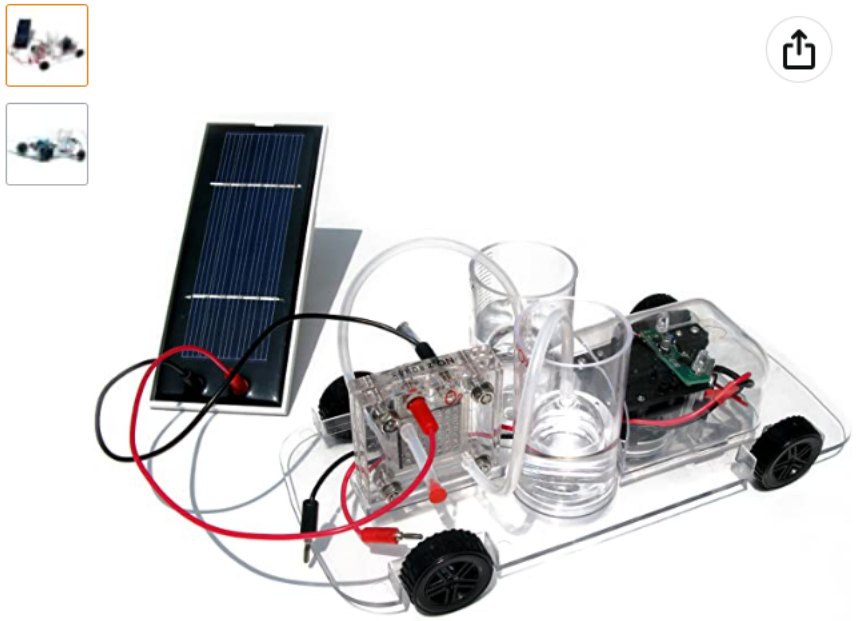
# Backup material

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

# Research pointers

- https://www.forbes.com/advisor/investing/best-lithium-stocks/
- https://www.forbes.com/advisor/investing/best-solar-power-stocks/

# DIY Hydrogen Fuel Cell Car on Amazon



Roll over image to zoom in

## Horizon Fuel Cell Technologies Fuel Cell Car Science Kit

Brand: Horizon Fuel Cell Technologies

4.4 out of 5 stars 16 ratings | 6 answered questions

-7% $162.02

Was: $175.00

**Get 5% back ($8.10 in rewards)** on the amount charged to your Amazon Prime Rewards Visa Signature Card.
Not eligible for Amazon Prime. Available with free Prime shipping from other sellers on Amazon.

### Enhance your purchase

**Payment plans**

2 options from $27.00/mo (6 mo) with 0% APR

**One-time payment**
$162.02

$162.02

$3.99 delivery **February 1 - 16**. Details

Deliver to David - North Beach 20714

Only 13 left in stock - order soon.

Qty: 1

Add to Cart

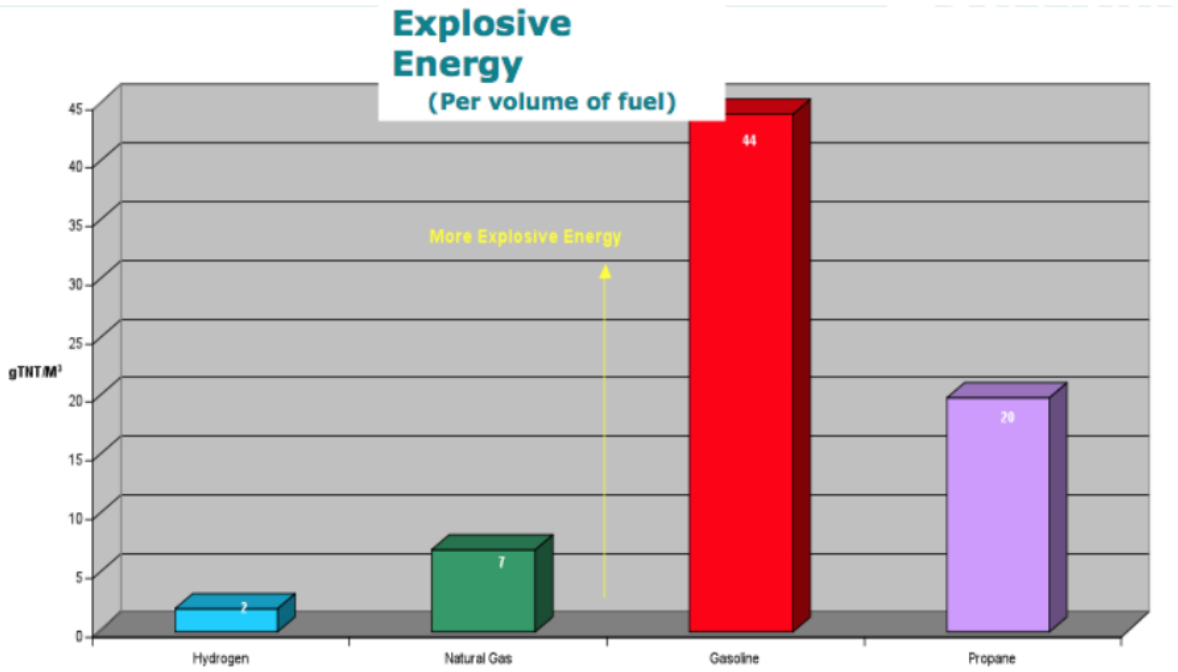
Buy Now

Secure transaction

Ships from RAREWAVES-IMPORTS
Sold by RAREWAVES-IMPORTS

Return policy: Eligible for

# Hydrogen is safer than many fuels



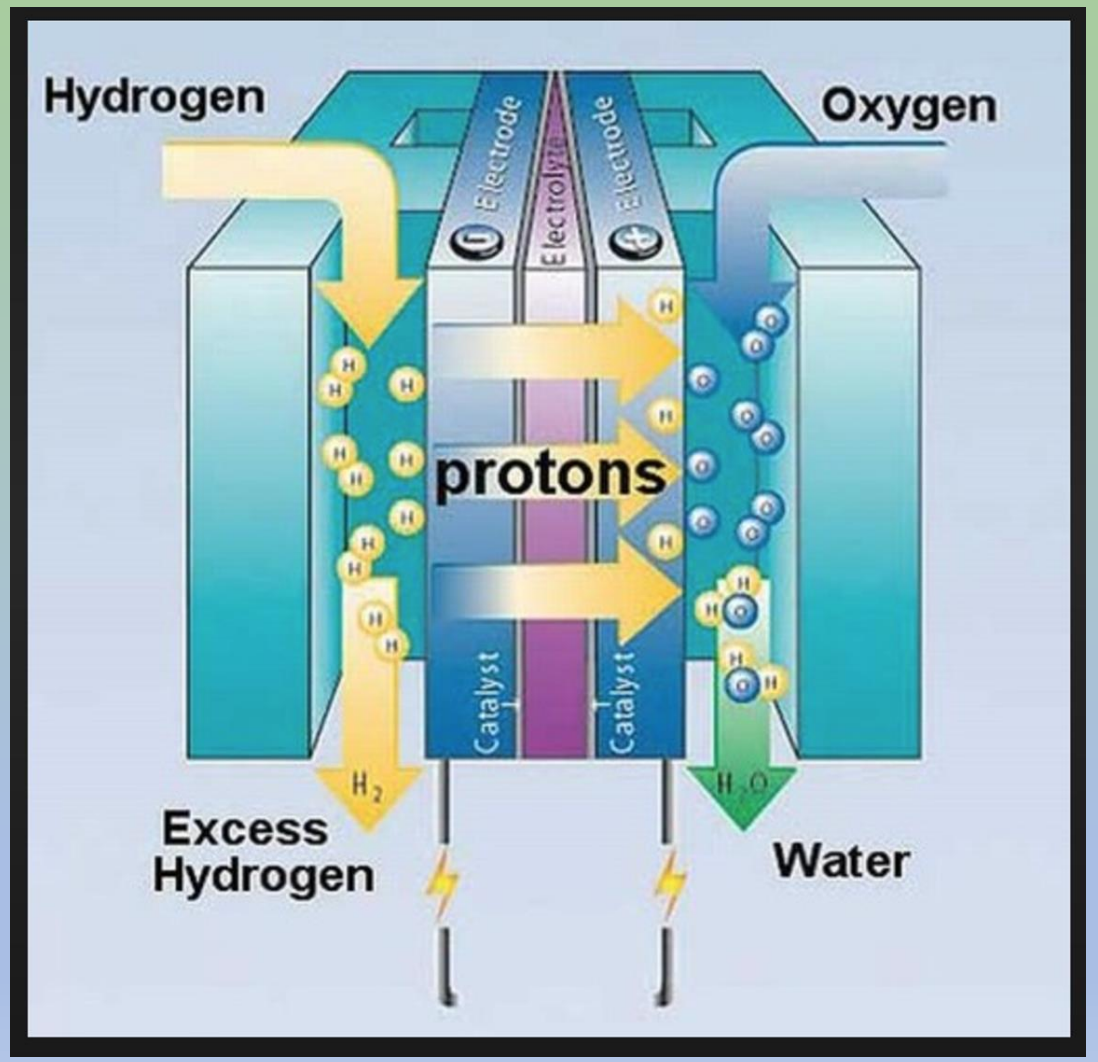

**The worst-case explosion scenario for each fuel. Hydrogen gas does not have a lot of "bang-power" volume-wise compared to other common fuels.**

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

Source: Ballard Power

# What is a Hydrogen Fuel Cell?

- Several 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