Investment
Opportunities in
Alternative Energy

Hydrogen, Wind, Solar

July 15, 2021
David Toms
Graphics by Cindy Kalkwarf



AGENDA

- Hydrogen as a fuel of the future: background
- Hydrogen market and investment opportunities
- Wind energy market and investment opportunities
- Solar energy market and investment opportunities



A PERSONAL NOTE

- I am 70, 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
 - REITs, mostly health care-related
 - BDCs, mostly data centers
- My info sources: Fidelity, Seeking Alpha, WSJ, Bloomberg
- I have investments in the following stocks: PLUG, BE, QCLN, APD, HYSR
- I subscribe to Warren Buffet's philosophy: "Understand the businesses you are investing in"

Thesis: The world is in transition away from fossil fuels toward green energy to deal with climate change

- New Biden administration policies, Paris climate accords
- Electricity generation by wind and solar is now cheaper than by oil, or natural gas
- 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



Renewable Energy Costs Decreasing

- Cost declines continued for solar and wind power in 2020, despite pandemic
- Costs for electricity from utility-scale solar PV fell 85% from 2010 - 2020
- Renewable power generation costs fell sharply over the past decade, driven by:
 - steadily improving technologies
 - economies of scale
 - competitive supply chains
 - improving developer experience



Source: International Renewable Energy Agency, 2020 report

Hydrogen: Fuel of the Future



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











Four Major Uses for Hydrogen

• Traditional:

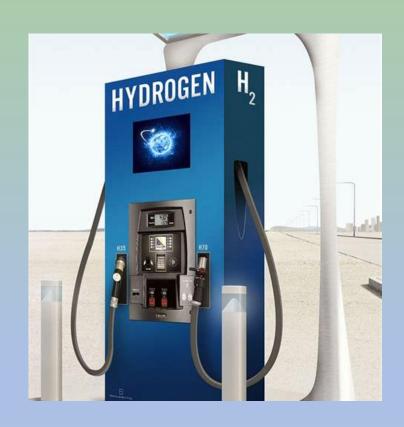
- Industrial Feedstock Industrial heat source
- Smelting, Steel, Ammonia, Cement

New applications:

- Power Generation and Grid Balancing
 - Gas turbines
 - 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

Pros - Why Hydrogen Makes Sense

- The Universe is 99% hydrogen; the earth is 70% covered by H2O
- 1 KG of hydrogen is equivalent to 1 gallon of gasoline
- 1 KG of hydrogen has 130X more energy than 1 KG of Li batteries
- Refueling a fuel cell vehicle takes about 5 minutes
- Hydrogen production is carbon-free when produced by wind, solar
 - Excess energy can be stored as hydrogen in tanks
- 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

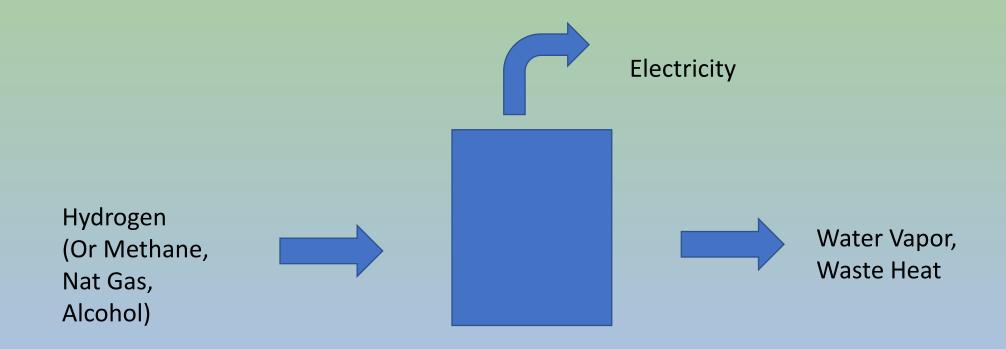


Cons – Why hydrogen is slow to take off

- Infrastructure does not exist or support widespread distribution
- Does not occur naturally by itself: must be separated
- H2 is costly to produce: \$6 per gallon gasoline equivalent > Projected to decline to \$3.50 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

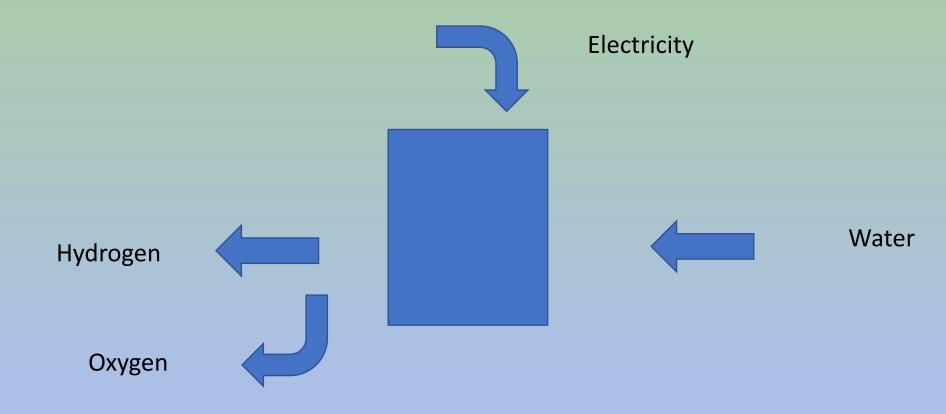


So, what is a Fuel Cell? Basically, like a battery



- First invented in 1838 (before oil was discovered in PA!)
- Used by NASA in space vehicles

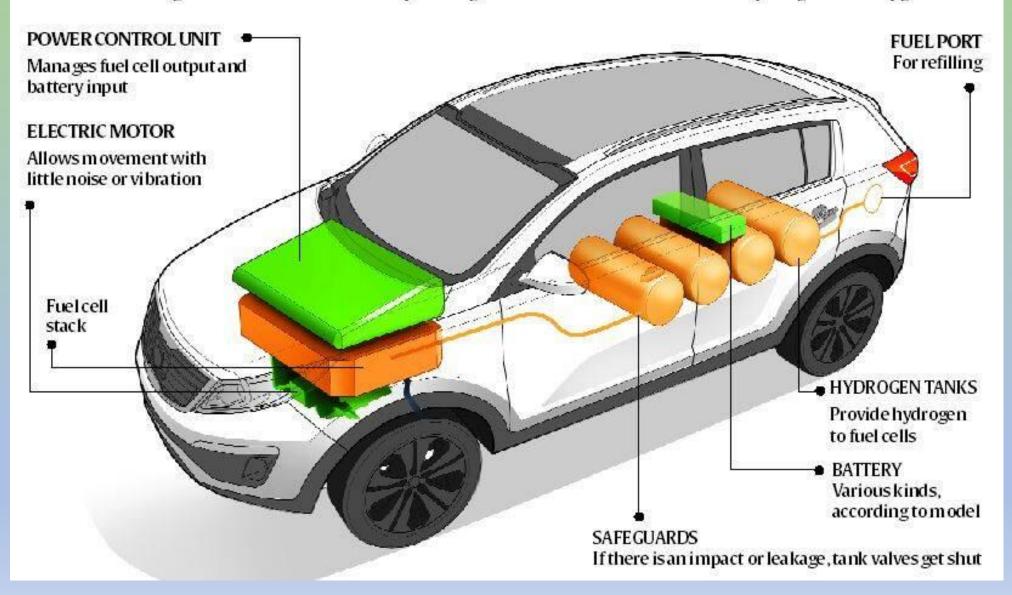
And the Process is Reversible: an electrolyzer produces hydrogen via electrolysis



Fuel cell / electrolyzer technology has advanced markedly in the past 5 years: Costs, efficiency, durability, reliability all significantly improved

HOW IT WORKS

A fuel cell generates its own electricity through a chemical reaction between hydrogen and oxygen



DIY Hydrogen Fuel Cell Car on Amazon



Horizon Fuel Cell Technologies Fuel Cell Car Science Kit

Brand: Horizon Fuel Cell Technologies

★★★★☆ Y 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.



Sponsored



Global Momentum Building for Hydrogen

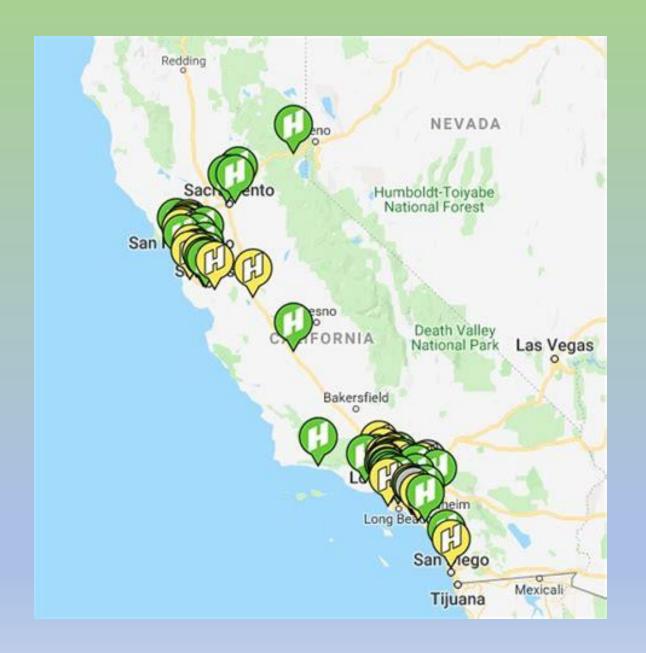
- All of these countries have a hydrogen investment strategy:
 - European Union \$550B committed for infrastructure
 - China
 - Japan Goal to build 1000 hydrogen stations by 2030
 - Australia
 - South Korea
 - Saudi Arabia
 - California \$50M per year commitment to building infrastructure
 - Goal: 1000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



 Biden Admin goals: power generation carbon-free by 2035; economy net zero by 2050.



California
Hydrogen
Filling Stations
(63)



SunLine Bus Transit, Palm Desert, CA

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





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:

Depot-constrained vehicles will come out before autos:

Buses

Trains

Aircraft

Material handling and ground support equipment

Delivery trucks

Garbage Trucks,

Post Office vehicles





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

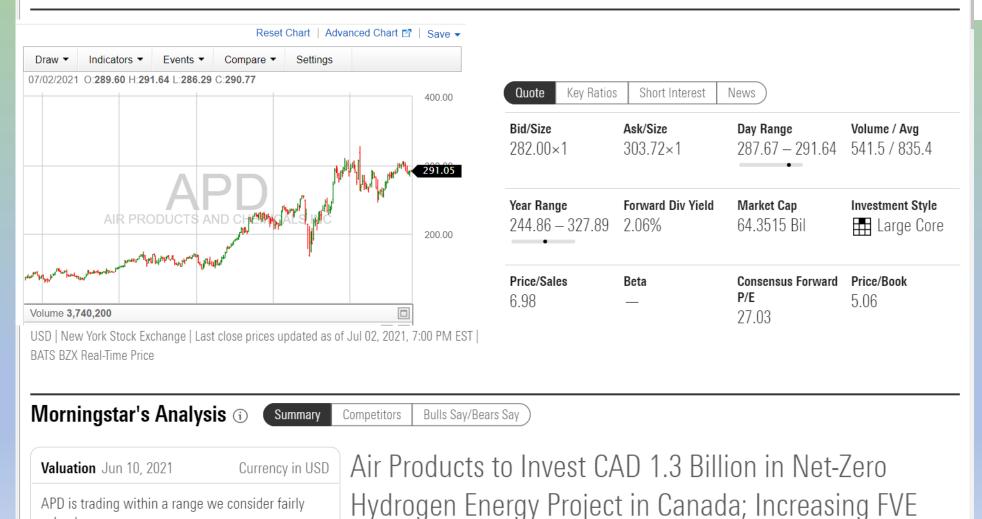
Additional reading: https://www.bloomberg.com/graphics/2020-opinion-hydrogen-green-energy-revolution-challenges-risks-advantages/



Air Products (APD)

valued.





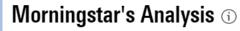
Cummins (CMI)

Cummins Inc CMI ★★★ Jul 12, 2021



USD | New York Stock Exchange | Prices updated as of Jul 13, 2021, 9:40 AM EST | BATS BZX Real-Time Price

Quote Key Ratios	Short Interest	News	Volume / Avg 38.1 / 1.0 Mil Investment Style Mid Core		
3id/Size 244.35×2	Ask/Size 244.95×1	Day Range 243.00 — 245.44			
'ear Range 73.07 – 277.09	Forward Div Yield 2.22%	Market Cap 35.7955 Bil			
Price/Sales	Beta (5-Year) 1.07	Consensus Forward P/E 15.29	Price/Book 4.39		



valued.

Summary

Competitors

Bulls Say/Bears Say

Valuation May 05, 2021 Currency in USD

CMI is trading within a range we consider fairly

The Near Term Looks Bright for Cummins as Freight Demand Remains Hot Globally



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)





USD | New York Stock Exchange | Prices updated as of Jul 13, 2021, 9:53 AM EST | BATS BZX Real-Time Price

Morningstar's Analysis (i) Summary Competitors Bulls Say/Bears Say

Valuation May 28, 2021 Currency in USD

GE is at a 16% Discount.

GE's Comeback Is in Full Swing: The Stock Is One of Our Top Picks in the Industrial Sector

General Electric (GE)

(egg)

- GE is heavily invested in green energy products
- Wind generators
 - Largest wind generators in the world
 - \$15B revenue in 2021
- Power generation gas turbines
 - Experiments in hydrogen / natural gas mixing
- Jet engines
 - Experiments in hydrogen fuel and fuel cells

Plug Power (PLUG)





PLUG is volatile, but has staying power



- Vertically integrated product line: Provide fuel, fuel cells, electrolyzers, service
- Significant technology / product lead; 20 years' experience
 - Transitioning from R&D to rate production
 - Large stock of IP, patents
- Large, committed customers: AMZN, WMT, HD, GM, Microsoft?
- JVs with Renault, SK, GM, BAE, others pending
- Large, deployed product base: 40,000+ fuel cell units
- Largest consumer 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: 60M shares
- Holding \$4.5B cash
- Biggest criticisms: unprofitable, accounting issues, management competence

Bloom Energy (BE)

Bloomenergy

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



SunHydrogen (HYSR)

Only for strong stomachs!



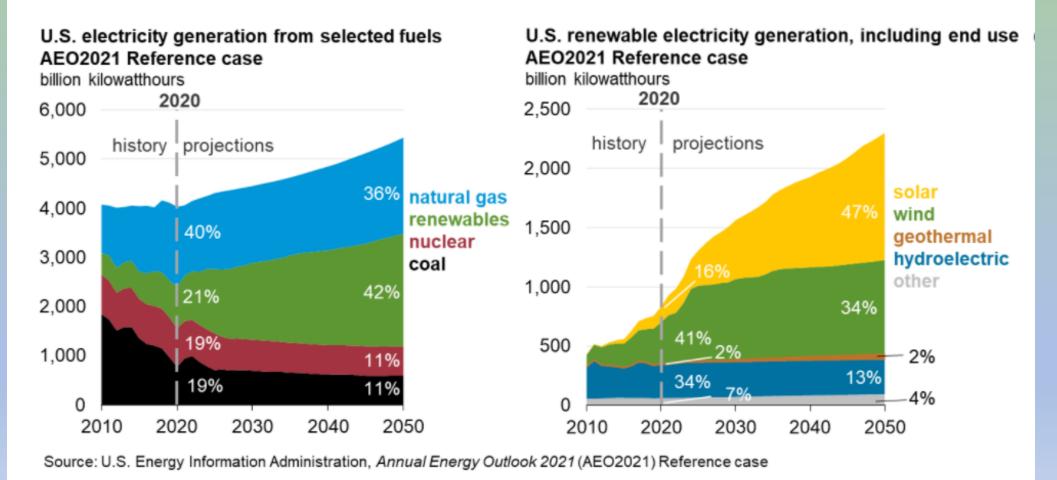
SunHydrogen

Venture-capital backing

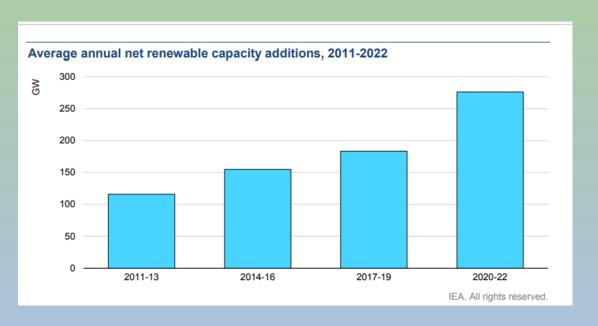


Renewable electricity generation increases more rapidly than overall electricity demand through 2050

SUSTAINED LOW NATURAL GAS PRICES DO NOT RESULT IN SIGNIFICANT INCREASES IN THE SHARE OF NATURAL GAS GENERATION IN THE REFERENCE CASE



Global trends accelerating



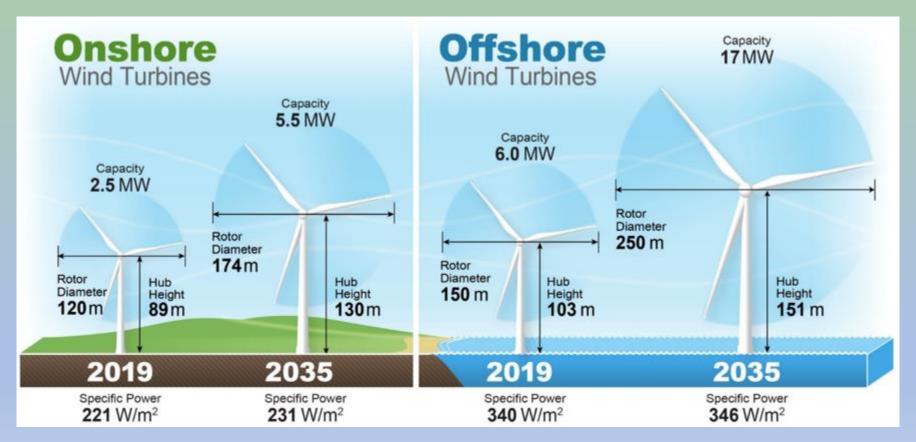
July 1, 2021 Announcement:
U.S. Interior Secretary Joins Governor
Northam, Senator Kaine to Announce New
Actions to Advance Offshore Wind in
Virginia

- Solar development will continue to break records...
 by 2022 50% higher than 2019
- Global wind capacity growing rapidly
- Europe's wind capacity growth is accelerating due to policy support

Source: IEA

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 Energy Companies

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

vextera.

Experimenting with electrolyzers and fuel cells

TPI Composites (TPIC)

• Manufacturer of wind turbine blades; 30% market share



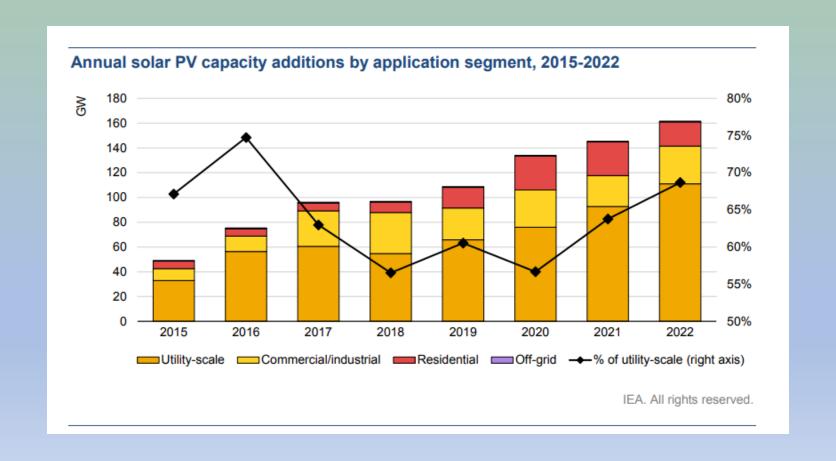
TPIC turbine blades





Solar Energy is Growing Rapidly

- Global Solar Energy Market will grow from \$52B in 2018 to \$223B by 2026, for a CAGR of 20.5%
- US Federal tax credit available: 26% in 2021-2022



Top Solar Energy Stocks

- Sunrun (RUN)
- First Solar (FSLR)
- Enphase (ENPH)
- Solar Edge (SEDG)

US tariffs preventing China from flooding the market





resident Biden's infrastructure plan would extend tax credits for solar and wind power, but opponents argue such subsidie re often driven by politics.

PHOTO: PATRICK T. FALLON/AGENCE FRANCE-PRESSE/GETTY IMAGES

Additional reading: https://www.investopedia.com/investing/top-solar-stocks/

First Solar (FSLR)

Focused on utility-scale solar projects

Factory expansion in progress Conservative management Very pricey right now



SUNRUN (RUN)

- Provider of residential solar panels and batteries
- Not profitable



Enphase Energy (ENPH)

- Primary product is the "Microinverter", which converts DC voltage from a solar panel directly into AC for the grid. 30M deployed.
- 72% market share



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	<u>TSLA</u>	8.84%	EV
NIO Inc ADR	NIO	7.51%	EV
Albemarle Corp	ALB	6.50%	Chemcals
Enphase Energy Inc	<u>ENPH</u>	6.15%	Solar
Plug Power Inc	<u>PLUG</u>	4.72%	Hydrogen
ON Semiconductor Corp	<u>ON</u>	4.49%	Semi
SolarEdge Technologies Inc	<u>SEDG</u>	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	ß	+ 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	Ø	+ 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	ß	+ Quick view
SUSL	iShares ESG MSCI USA Leaders ETF	16.41	40.84	-	-	-	23.66	Jun 30, 2021	May 07, 2019	3,657M	Ø	+ 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	Ø	+ 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

Morningstar: "ESG inflows are at record pace"; June 2021: \$29B inflow to ESG funds

Summary

 Climate change demands that we change our sources of energy and reduce dependence on fossil fuels

Hydrogen, Solar and Wind (and batteries) will be part of the future

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

- https://www.bloomberg.com/graphics/2020-opinion-hydrogen-green-energy-revolution-challenges-risks-advantages/?sref=2DkaRRGK
- Investopedia
- WSJ
- Facebook shareholder groups
- FuelCellsWorks newsletter
- GreenCarCongress.com
- International Energy Agency
- US Department of Energy