

PV and Wind Produce a Record 17.5% of U.S. Electricity in April

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(Data Updates for April 2021)

U.S. PV-WIND CAPACITY April 2021 PV and Wind Capacity Additions

- April PV net capacity additions total 939 MW.
- April wind net capacity additions total 426 MW.

U.S. ELECTRICITY GENERATION April 2021 PV and Wind Electricity Generation

- PV and wind electricity production is 17.5% of total U.S. electricity generation
- Of total U.S. electricity generation, PV is 5.2% and wind is 12.3%

TRADE – U.S. PV IMPORTS/EXPORTS U.S. PV Panel Imports Decline in April

- The value of April U.S. PV panel imports is \$625 million
- Malaysia, Vietnam, and Thailand are the top suppliers of U.S. PV panel imports

WORLD PV-WIND CAPACITY 2021 World PV and Wind Forecast

- World PV forecast is 155 GW of capacity additions
- World wind forecast is 60 GW of capacity additions

PV-WIND COMPANY FINANCIAL PERFORMANCE June 2021 ETF Performance

- For June 2021, share price performance of TAN and ICLN are positive
- For June 2021, TAN outperforms QQQ, SPY and DIA

SOLAR AND WIND MARKET ANALYTICS

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other

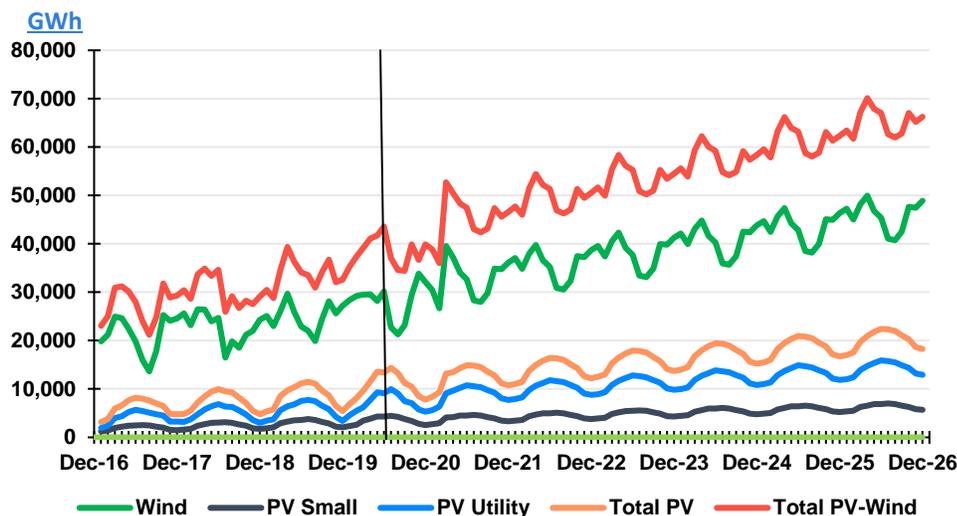
[RELEVANT ASAP REPORTS](#)

[PV-Wind Monthly Slideshow](#)

[Battery Storage Analysis](#)

[Global Warming Update](#)

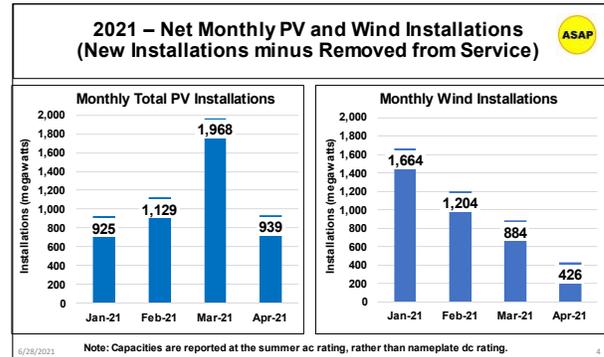
PV-Wind Electricity Generation: Actual to Apr-21; Forecast to Dec-26



PV and Wind Capacity

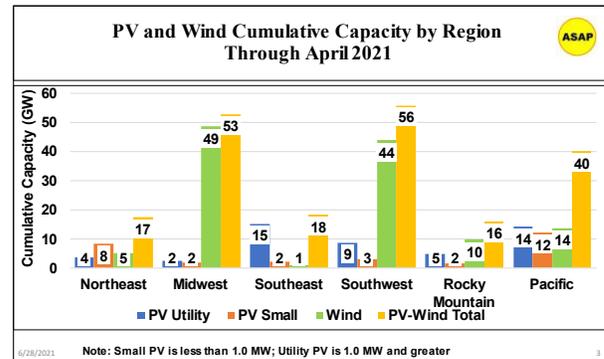
April U.S. PV capacity additions total 939 MW

With 939 MW of PV capacity additions in April 2021, the cumulative U.S. PV capacity increases to 78.8 GW. Year-to-date PV installations remain off the pace required to meet the 2021 forecast of 17.0 GW of PV growth. Through April, the year-to-date annualized pace is 14.9 GW of PV capacity additions.



The 2021 PV forecast is 17.0 GW of capacity additions

An important factor confronting the PV market is price inflation due to polysilicon production and shipping issues. In response, companies report the possibility for 2021 project slippage into 2022. The prospect for project slippage due to high PV prices is most likely to occur for large utility scale PV projects. This poises a significant headwind to meet the 17.0 GW PV capacity additions forecast for 2021.



In April, utility scale PV capacity additions totaled 526 MW, which is 56% of total PV additions. In contrast, small PV additions totaled 413 MW (44%). Going forward it is likely that the capacity additions of utility scale projects will decline for the reasons stated above.

Southeast, Southwest and Pacific regions led in April PV capacity additions

Looking ahead to 2022, the U.S. PV forecast is 22 GW. For perspective, China installed 38 GW of PV in 2020 and plans to install 60 GW/year in the 2023-2025 period. For the U.S. to become a world leader in PV technology, then at least a quadrupling of annual PV additions is in order. This task is made difficult for the U.S. due to stiff opposition from oil and gas interests. Can the U.S. national interest to address climate change triumph over oil and gas interests?

On a regional basis, the Southeast, Southwest and Pacific regions set the pace with 299 MW, 224 MW and 187 MW of PV capacity additions respectively. California led the nation with 173 MW of PV capacity additions and is followed by Arizona with 154 MW of PV capacity additions. Florida rounds out the top three states with 103 MW of PV capacity additions in April.

The 2021 PV forecast of 17.0 GW is supported by the extension of the federal PV investment tax credit. The solar investment tax credit (ITC), which was scheduled to drop from 26% to 22% in 2021, will stay at 26% for two more years. This means that solar projects in all market segments — residential, commercial, industrial, utility-scale — that begin construction in 2021 and 2022 will still be able to receive a tax credit at 26%. In 2023, all PV markets will drop to a 22% tax credit. Beginning in 2024, the solar tax credit

is ended for the residential market, while the commercial and utility markets have a permanent 10% solar tax credit. The wind industry also received a limited extension of its production tax credit.

Wind installations in April fell to 426 MW. The annual pace for wind installations is 12.5 GW, which is off the pace to meet ASAP’s 2021 wind growth forecast of 15.0 GW. April wind capacity additions are concentrated in the Southwest, Midwest and Rocky Mountain regions. The Midwest added 485 MW of new wind capacity and is followed by the Southwest with 273 MW of new wind. The leading states for wind capacity additions are Oklahoma with 199 MW, Missouri with 149 MW and Colorado with 104 MW.

April wind installations total 426 MW

PV-Wind Electricity Generation Update

April PV electricity generation is 15.2 TWh (+15% MoM) and wind electricity generation is 35.9 TWh (-9% MoM). Combined PV and wind electricity generation is 17.5% of total U.S. electricity generation in April, which is a new record. PV contributed 5.2%, and wind provided 12.3%. This is the first month on record that PV electricity generation is above the 5% mark of total U.S. electricity generation.

Month-on-month, PV electricity generation increased, while wind electricity generation declined as shown in the graphs. MoM, PV generation increased 15.2%, and wind generation declined 9.2%. MoM combined PV and wind electricity generation declined 3.1%

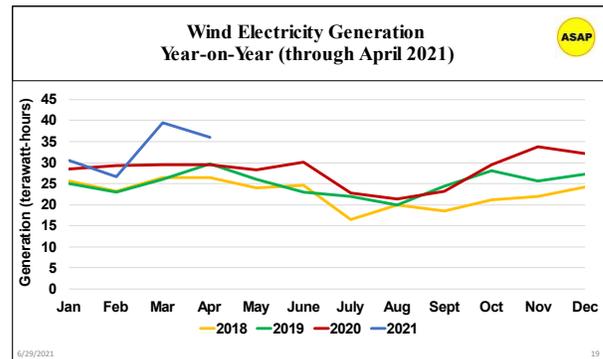
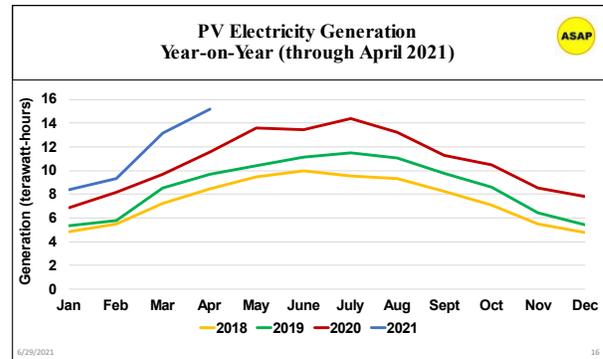
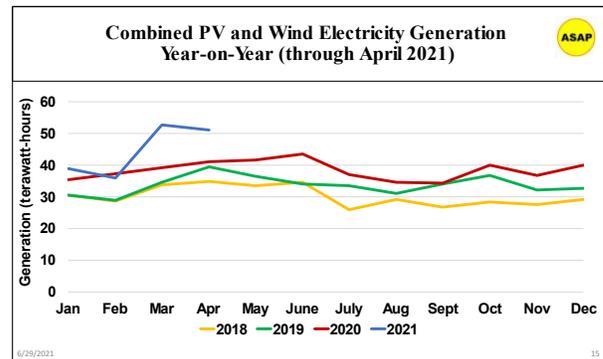
Year-on-year, April-20 to April-21, PV generation has increased 30.5%, and wind generation has increased 21.6%. YoY, combined PV and wind electricity generation has increased 24.1%.

In April, the Pacific region led the nation in PV electricity generation with 5.5 TWh and is followed by the Southeast region with 3.5 TWh and the Southwest region with 2.2 TWh. California is the leading state with 5.1 TWh of PV electricity generation, which is 34% of total U.S. PV electricity

April combined PV and wind electricity generation is 17.5% of total U.S. electricity generation

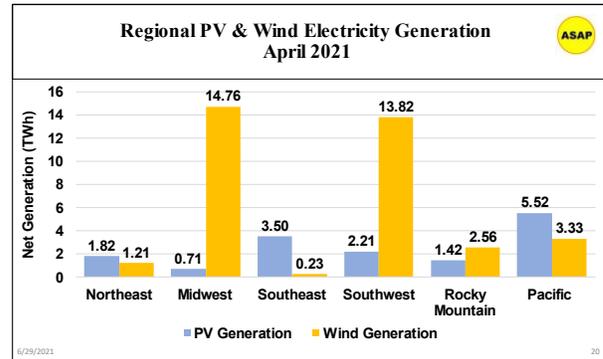
Year-on-year, PV electricity generation increased 30.5%

The Pacific region leads the nation in PV electricity generation



production in April. Texas is second with 1.1 TWh. Filling out the top five are North Carolina with 1.1 TWh, Florida with 1.0 TWh, and Arizona with 0.84 TWh.

Wind electricity generation in April is greatest in the Midwest and Southwest regions, which combined produced 80% of total U.S. wind electricity. The Midwest leads with 14.8 TWh of electricity generation and is followed by the Southwest with 13.8 TWh. The Pacific region is a distant third with 3.3 TWh of electricity generation. Texas is the nation’s leader with 9.4 TWh of wind electricity generation and is followed by Iowa with 3.7 TWh, Oklahoma with 3.3 TWh, and Kansas with 2.5 TWh.



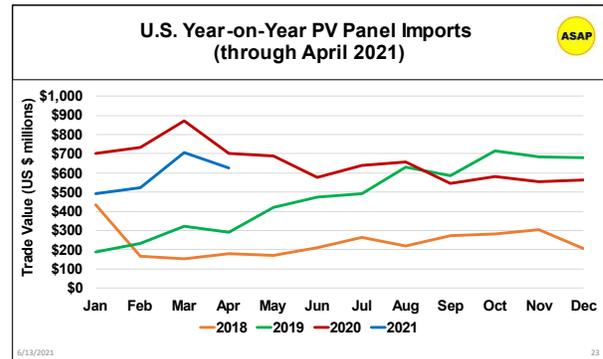
Year-on-year, wind electricity generation increased 21.6%

Year-on-year, April-20 to April-21, wind electricity generation increased 6.4 TWh (+21.6%). YoY, Midwest wind electricity generation increased 3.0 TWh (+25.4%), and Southwest wind electricity generation increased 2.4 TWh (+21.9%).

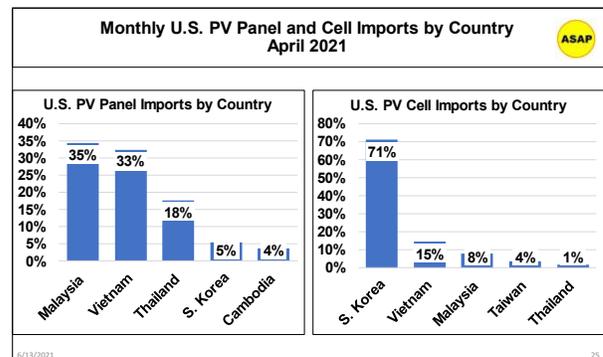
Obviously, seasonality combined with variations in weather patterns have significant impacts on month-on-month and year-on-year changes in PV and wind electricity generation.

PV Trade

In April, the value U.S. PV panel imports declined month-on-month 11.4% to \$625 million. With the year-to-date value of U.S. PV panel imports standing at \$2.34 billion, the annual trajectory for U.S. PV panel imports is \$7.0 billion. PV trade is facing headwinds caused by increasing PV prices due to polysilicon shortages, high transportation costs and unfavorable foreign exchange fluctuations.



The value of April 2021 U.S. PV panel imports is \$625 million



Malaysia, Vietnam and Thailand are the top three sources of U.S. PV panel imports in April 2021

A leading polysilicon manufacturer reports an average selling price of \$11.90/kg for high-purity polysilicon in the first quarter of 2021, which is approximately 10% higher than the fourth quarter of 2020. For the second quarter of 2021, the average selling price is expected

South Korea dominates the U.S. PV cell import market in April

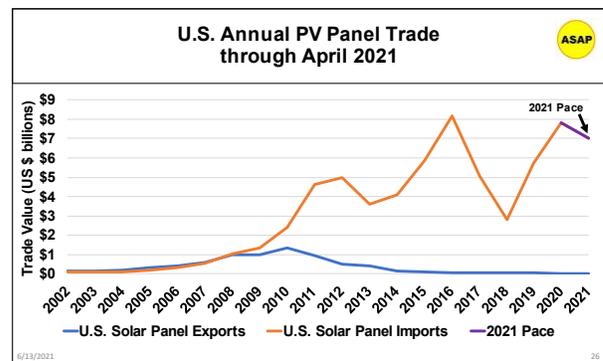
to be in the range of \$19-\$20/kg since the market price of high-purity polysilicon is hit \$25/kg in May and ended the month of June at \$28.50/kg (China spot price).

Supply in the upstream polysilicon market is expected to remain tight until the middle of 2022 due to strong market demand for mono-silicon PV driven by global carbon neutrality commitments by all major economies. Manufacturers are increasing PV panel prices to offset the increased costs, and one major manufacturer reported double-digit price increases in first quarter of 2021. While underlying demand for solar energy remains strong driven by ambitious public and private sector targets, there is an observed increasing price elasticity of demand, which holds the prospect that certain utility scale projects may be delayed going forward into 2022.

Malaysia returns to the lead for U.S. PV panel imports with a 35% market share. Vietnam’s share of the U.S. PV panel import market fell to a 33% share in April. Thailand rounds out the top three with an 18% share. In total, these three countries account for 85% of April U.S. PV panel imports. Year-to-date, Malaysia and Vietnam are tied at 34% market share, while Thailand follows with a 16% market share. For full year 2021, Malaysia, Vietnam and Thailand are expected to be the source of more than 80% of U.S. PV panel imports.

Turning attention to U.S. imports of PV cells, the total value of April U.S. PV cell imports declined 20% month-on-month to \$46 million. South Korea dominates U.S. supply of imported PV cells with a 71% April share and a 58% YTD share. The forecast for the value of PV cell imports in 2021 is \$840 million, which averages \$70 million per month.

The value of 2021 U.S. PV panel and cell exports are minimal



In terms of exports, the value of U.S. PV panels exports in April is a meager \$1.0 million. Year-to-date, the value of U.S. PV panel exports is \$4.0 million, and the annual pace is \$12.1 million. For full year 2021, the value of U.S. PV panel exports is expected to be \$25.0 million, which is 16.7% lower than the \$30.0 million value of U.S. PV panel exports in 2020. In essence, the U.S. PV panel export market is minimal.

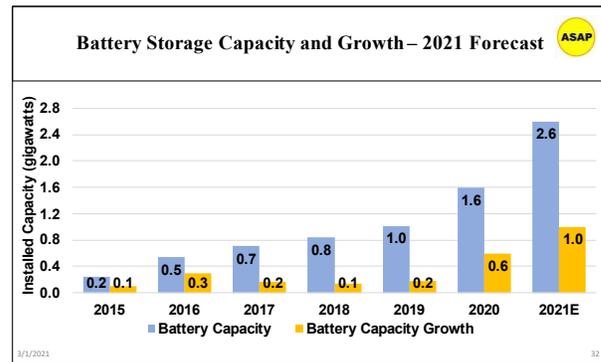
The value of April U.S. PV cell exports increases to \$2.1 million, which is a 6% month-on-month increase. YTD the value of U.S. PV cell exports is \$8.1 million and is on an annual pace of \$24.2 million. The 2021 forecast for U.S. PV cell exports is \$23 million.

China is dominant in the PV industry space. China’s upstream poly-silicon manufacturing base supplies over 70% of the world’s PV grade poly-silicon demand. With announced expansion plans by Chinese firms, China is likely to supply 90% of the poly-silicon demand in 2025. Both Europe and the U.S. are exploring ways to compete with China in the PV market. A bill introduced in the U.S. Congress is the Solar Energy Manufacturing for America Act, which aims to accelerate domestic manufacturing by offering tax credits at all stages of the solar supply chain. The fully refundable tax credit would allow companies to front-load capital expenditure and rapidly scale production domestically for components and materials, including photovoltaic cells and modules.

Utility Battery Storage

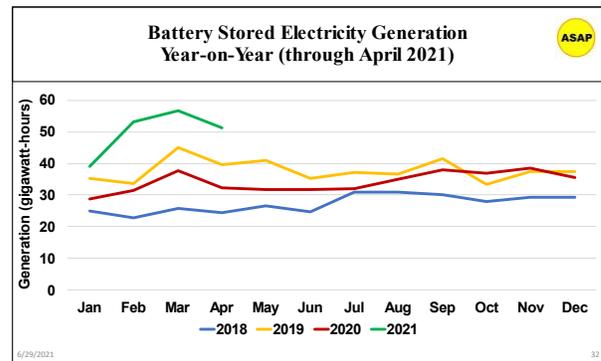
Battery storage capacity additions totaled 153 MW in April, which increased cumulative battery storage capacity to 1.8 GW. In lieu of battery media fanfare, the 156 MW of year-to-date utility battery installations to date are rather disappointing. The annualized pace is 554 MW, which is somewhat off the forecast pace of 600 MW.

U.S. cumulative battery storage capacity for April is 1.8 GW



The 2021 forecast for battery storage capacity additions is 600 MW, which will bring cumulative battery storage capacity to 2.2 GW. ASAP expects annual battery capacity additions to exceed 5.0 GW in 2025. From company battery installation announcements, four hours of battery storage potential is becoming the norm.

The reported April average monthly battery utilization factor is 4.0%, which implies battery electricity generation of 51.1 GWh. Year-on-year, April-20 to April-21, battery electricity generation has increased 50%. Battery electricity capacity and supply will continue to increase at an exponential rate with a significant scale-up in annual battery capacity additions going forward.



The April average battery utilization factor is 4.0%

Obviously, variability in PV and wind electricity production requires electricity storage to convert PV and wind into a dependable supply of on-demand electricity. At present, the U.S. has approximately 800 GW of fossil fuel power plants, which implies the need for hundreds of GW of storage if PV and wind electricity is to replace fossil fuel power plants. At present, the large-scale storage options are pumped hydro, batteries, hydrogen, molten salt for thermal solar, underground compressed air energy storage. Currently, pumped hydro is the largest storage technology with over 22 GW of installed capacity. Due to siting constraints, it is expected that pumped hydro storage capacity will remain in the 22 GW neighborhood going forward. On the other hand, battery storage is gaining traction for PV storage.

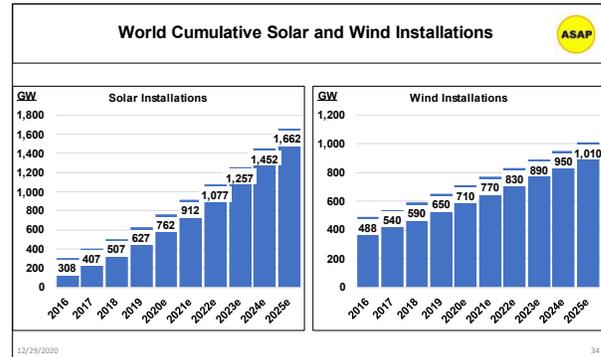
There are several green hydrogen projects on the drawing board with hydrogen produced from water using PV, wind, and hydro electricity. Green hydrogen is being discussed as a fuel for fuel-cell heavy transport trucks. Molten salt storage for solar concentrating plants and compressed air energy storage are basically being ignored. There is a permitted compressed air energy storage project in Texas using salt storage that is slated to begin construction in 2022.

World PV and Wind

The world PV forecast for 2021 is 155 GW

The five-year forecast for global annual PV and wind capacity additions is 350 GW in 2026

ASAP’s 2021 forecast for global PV capacity additions is 155 GW, which is 10.7% greater than 2020 PV additions. The global wind forecast for capacity additions is 60 GW, which is 35% lower than the reported 2020 wind additions. Wind installations are generally much larger in terms of capacity and require more regulatory hurdles than PV installations, therefore the record 2020 wind installation rate is not expected to be replicated in 2021. However, global annual wind installations are likely to approach 100 GW in 2025.



Year-end 2020, the global cumulative PV capacity is approximately 766 GW. World PV installations are expected to approach 250 GW in 2026. ASAP expects the global cumulative PV capacity to more than double by year-end 2025 to over 1,700 GW. For this to occur, the global annual growth rate needs to be a robust 17%. The PV growth forecast is consistent with growth over the past five years. For example, in 2020 the cumulative world PV installations is 766 GW, which is more than double the 308 GW of cumulative PV capacity in 2016.

European PV installations are expected to rebound in 2021 to pre-2018 levels. Europe is expected to install 12.0 GW of new PV. Germany leads the way and is expected to install 6.4 GW of PV in 2021.

China is the world leader in PV manufacturing and annual installations. The 2021 forecast for China PV capacity additions is 55 GW. By 2025, China’s annual PV installation rate is expected exceed 60 GW, which is 50% greater than the average 2017-2020 level.

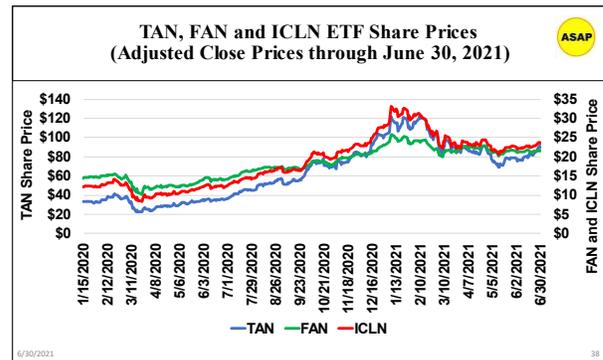
The U.S. is the second largest installer of PV systems and is expected to increase the annual installation rate to 25 GW by 2025, which is a 10% annual increase. Based on China’s performance, a U.S. commitment to increase annual PV installations 60 GW by 2030 appears to be a reasonable goal. In addition, ASAP’s 2030 forecast calls for wind installations of 30 GW and PV/wind storage capacity additions of 10 GW.

To meet the international goal of limiting the increase in average global temperature to below 2.0 degrees Celsius, climate change analysts state that the world needs to install at least 400 GW/annum of zero emissions energy systems over the next twenty years. To achieve this goal will require the U.S. to approach 100 GW of annual PV and wind installations as soon as possible.

The last decade was a demonstration period for PV, and it has exceeded expectations in terms of cost (\$1.00/W installed) and performance (20% efficiency). In many regions of the world new PV capacity is cost competitive with new coal capacity. Storage remains an obstacle to achieving zero carbon emissions electricity generation with PV and wind electricity generation.

PV and Wind Industry Financial Performance

Each month ASAP reports the share price performance of solar (TAN), wind (FAN), and renewable energy (ICLN) ETF index funds as a proxy financial indicator of the PV and wind industry. In addition, ASAP summarizes quarterly reports of twenty-two relatively pure play solar and wind companies.



Share prices of the PV, wind and renewable energy ETFs peaked in January 2021, and a correction continues through May.

PV and clean energy ETFs gained share price value in June

For the first month since January, share prices of the PV (TAN) and clean energy (ICLN) ETFs are positive with monthly gains of 13.0% and 2.9% respectively. In contrast the wind ETF (FAN) continued to decline with a 1.0% loss in June share price. The share price bottom should be near with strong demand for renewable energy indicated over the next couple of years. Global demand for PV and wind installations is growing at a healthy rate, which should translate into share prices increases for solar and wind companies going forward.

The following summarizes the first quarter 2021 financial reports of twenty-two solar and wind industry companies. Mixed play energy conglomerates are excluded from the summary of quarterly financial reports. The survey includes six PV panel manufacturers, three wind manufacturers, two polysilicon manufacturers, four balance-of-system manufacturers (three inverter companies and one tracker company), and seven PV and wind producers (system operation and maintenance companies). The market capitalization of the twenty companies ranges from \$610 million to \$58 billion.

First quarter 2021 financial reports indicate that the PV and wind industry is on sound financial footing

First, we look at net income reports for the first quarter of 2021. Of the twenty-two companies surveyed 50% reported positive net income. The first quarter net income reports are in line with the fourth quarter 2020 net income reports. GAPP net income is the ultimate bottom line since it is directly related to earnings per share and return on equity. While most positive returns on equity were less than 1.0%, three companies reported healthy 5.3%, 3.7% and 1.4% returns on equity for the first quarter. Trailing twelve-month earnings per share reports are positive for 59% of the companies surveyed.

Analysis indicates that net income in the first quarter 2021 is tied to company market capitalization. The correlation between company market capitalization and company net income is 0.74. In other words, the greater the market capitalization, the greater the likelihood of positive net income. The affect of market capitalization on positive/negative net income is likely explained by the realization of production economies-of-scale and firm maturity in terms asset amortization for those firms with large market capitalization.

Secondly, we examine company share price changes. Of the companies surveyed, 68% experienced share price declines from the last day of the fourth quarter 2020 to the last day of the first quarter 2021. Share prices peaked in late January and then declined in February and March. PV and wind industry cost inflation is likely affecting investor sentiments leading to the share price declines.

While second quarter financial reports are not yet available, end of second quarter share prices are available. Analysis indicates that the PV and wind industry companies are still experiencing quarterly share price declines. Only six of the twenty-two companies (27%) surveyed have positive share price changes from the last day of the first quarter through the last day of the second quarter.

Companies report that cost inflation is being driven by higher raw material and transportation costs, and unfavorable foreign exchange fluctuations. For instance, the price of polysilicon has tripled over the past twelve months. For the PV industry, demand remains strong driven by ambitious public and private sector targets, but there is increasing price elasticity of demand due to PV panel price increases, which increases the prospect for delay of some utility scale PV projects. The impact of project delays on firm revenue streams are likely creating a drag on investor sentiments.

Company first quarter revenues are mostly on target with guidance. Overall, company cash balances for the first quarter appear adequate. Also, debt/equity ratios are mostly in line with expectations. In essence, the PV and wind industry is poised for future growth.

ASAP Methodology

ASAP benchmarks U.S. historical electricity generation and capacity to the Energy Information Administration (EIA) of the U.S. Department of Energy. The EIA reports all generating capacity in terms of AC capacity, rather than DC rated capacity. ASAP benchmarks historical U.S. trade to U.S. Census Bureau trade data. Global data sources include the International Energy Agency (IEA), European Wind and Solar Industry Associations, China's NEA, and company reports. All forecasts are ASAP generated.