

September PV Installations at 1.0 GW for Fourth Consecutive Month

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U.S. PV-WIND CAPACITY October 2020 PV-Wind Capacities and Forecasts

- October PV net capacity additions total 640 MW.
- October wind net capacity additions total 322 MW.

U.S. ELECTRICITY GENERATION October 2020 PV-Wind Electricity Generation

- PV-wind electricity production is 12.7% of total electricity generation
- Of total U.S. electricity generation, PV is 3.3% and wind is 9.4%

TRADE – U.S. PV IMPORTS/EXPORTS U.S. PV Panel Imports on Record Annual Pace

- The value of October U.S. PV panel imports is \$580 million
- Malaysia, Vietnam and Thailand are the top three suppliers of U.S. panel imports

WORLD PV-WIND CAPACITY PV and Wind Growth Forecasts Revised Down

- World PV installations are expected to be 105 GW in 2020 (Pandemic Adj)
- World wind installations are expected to be 50 GW in 2020 (Pandemic Adj)

PV-WIND COMPANY FINANCIAL PERFORMANCE Stock Performance Robust

- For 2020, TAN up 234%, FAN up 61% through December 31, 2020
- For 2020, TAN and FAN are outperforming QQQ, DIA and SPY

SOLAR AND WIND MARKET ANALYTICS

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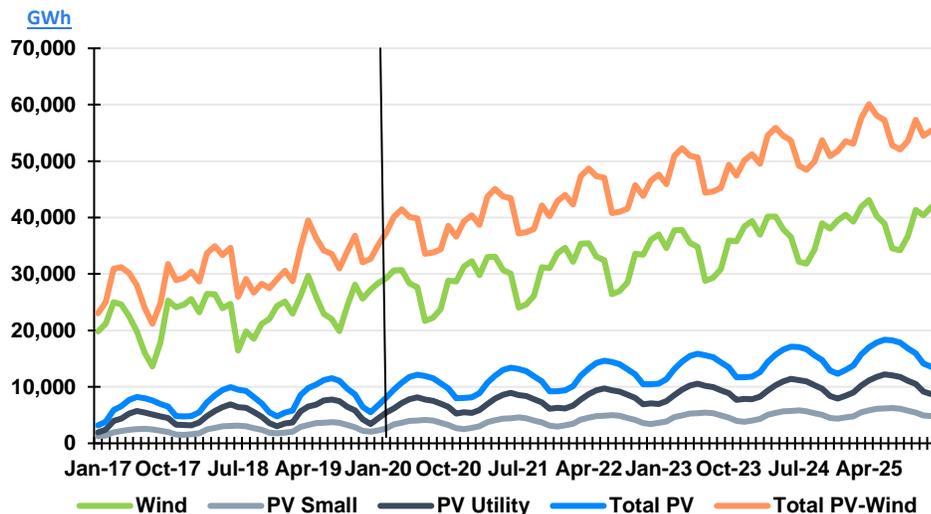
other
[RELEVANT ASAP REPORTS](#)

[PV-Wind Monthly Slideshow](#)

[Battery Storage Analysis](#)

[Global Warming Update](#)

PV-Wind Electricity Generation: Actual to Oct-20; Forecast to Dec-25



PV and Wind Capacity

October was a disappointing month for PV and wind capacity additions. PV capacity additions totaled 640 MW, which is 35% less than September. Wind capacity additions fell 59% to 322 MW. These October additions bring the cumulative U.S. PV capacity to 68.9 GW and wind capacity to 109.6 GW. The cumulative capacity of combined

U.S. combined PV and wind capacity is 178 GW

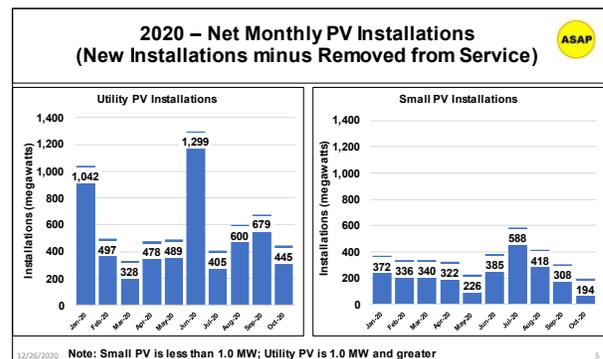
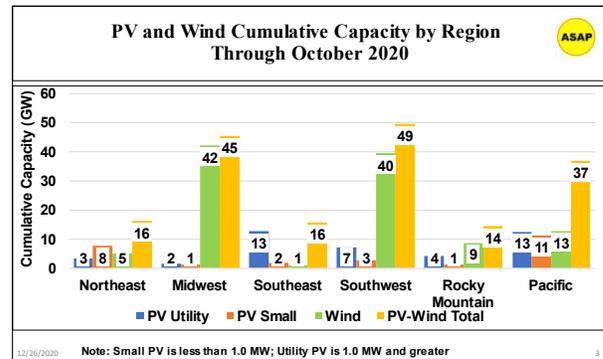
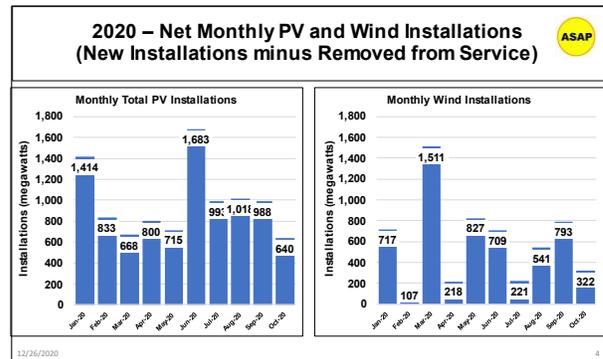
PV and wind increases to 178.1 GW. The Pacific region is the PV leader with 24 GW and is followed by the Southeast with 15 GW. The sun rich Southwest region lags with cumulative installed PV capacity of only 10 GW. Not surprisingly, wind capacity is concentrated in the wind rich Midwest with 42 GW and Southwest with 40 GW.

October PV installations totaled 640 MW, which breaks a four-month string of 1.0 GW per month PV additions. October wind installations were off as well and totaled 322 MW. The combined total of October PV and wind installations is 962 MW. For perspective, this monthly total is only 32% of the 3.0 GW average monthly forecast for combined PV and wind installations. The Midwest, Southwest and Pacific regions with abundant wind and solar resources account for 74% of U.S. PV and wind capacity.

October PV installations are 640 MW and wind installations are 322 MW

Year-to-date (YTD) PV capacity additions are 9.75 GW. This implies an annualized PV installation rate of 11.7 GW, which is behind pace to reach ASAP's revised 2020 forecast of 12.2 GW. The breakdown of October PV installations is: utility PV 445 MW (70% of new PV); and small PV 194 MW (30% of new PV). YTD utility PV is 6.3 GW and is on pace for 7.5 GW for the full year. This is behind pace to meet the 7.8 GW annual forecast for utility PV. YTD small PV is 3.5 GW and is on pace for 4.2 GW year end, which is behind the small PV annual forecast of 4.4 GW.

Year-to-date PV and wind additions are behind pace to meet the 12.2 GW PV forecast and the 10.0 GW wind forecast



October PV installations were distributed across the country

The Midwest and Rocky Mountain regions lead new wind capacity

On a regional basis in October, the Rocky Mountain and Southeast regions led the nation in PV installations. The Northeast had over a 100 MW of new PV capacity evenly split between utility and small PV, but the Northeast additions are offset by a 170 MW reduction (adjustment) to Massachusetts small PV capacity. Utah led the nation in new utility PV with 172 MW and California set the pace for new small PV with 123 MW.

YTD wind installations are 6.0 GW with a meek 322 MW of new capacity in October. The Rocky Mountain (170 MW) and Midwest (152 MW) regions accounted for 100% of wind capacity additions in October. Only two states added new wind capacity, Colorado with 172 MW and Iowa with 152 MW. The annualized pace for 2020 wind installations is 7.2 GW, which is off the pace needed to reach the revised 2020 forecast of 10.0 GW of new wind capacity.

A review of the EIA power plant inventory indicates over 500 MW of utility PV projects are complete but not in service. There is another 3.5 GW of PV projects that are over 50% complete. This information supports the 12.2 GW annual PV forecast. For wind projects, there are 1.0 GW of projects that are complete but not in service and another 8.6 GW of wind projects that are over 50% complete. Therefore, the 10.0 GW annual forecast for new wind capacity is within reach, contingent on commissioning schedules.

PV-Wind Electricity Generation Update

Combined PV and wind electricity generation was 12.7% of total U.S. electricity generation

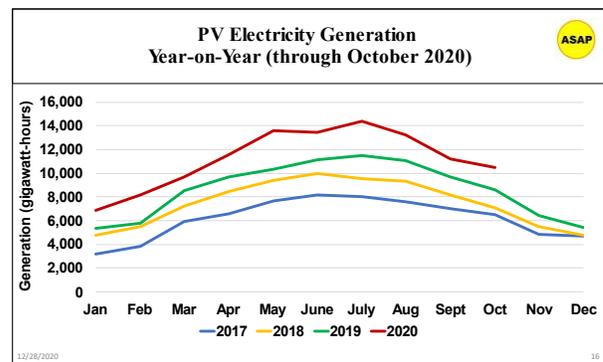
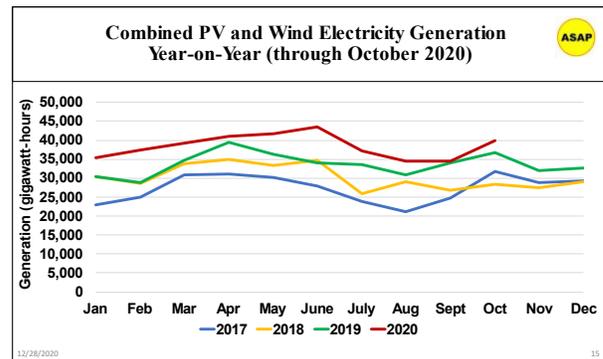
Month-on-month, PV electricity generation declined 6.9%

Month-on-month, wind electricity generation increased 26.9%

In October, PV generated 10.5 TWh of electricity, and wind produced 29.4 TWh. Combined PV and wind electricity generation totaled 39.9 TWh in October, which is 15.9% greater than September. Combined PV and wind electricity generation is 12.7% of total U.S. electricity generation with PV contributing 3.3% and wind 9.4%.

Month-on-month (MoM), PV electricity generation declined 6.9%, while wind electricity generation increased 26.9%. Both utility and small PV electricity generation declined MoM 5.6% and 9.5% respectively.

On a regional basis, the Pacific region set the pace in October with 3.9 TWh of PV electricity generation and was followed by the Southeast with 2.2 TWh and the Southwest with 1.7 TWh. Month-on-month, PV electricity generation decreased in all regions. The MoM declines in PV electricity generation in the Pacific, Southeast and Southwest regions are -7.6%, -8.3% and -1.7% respectively.

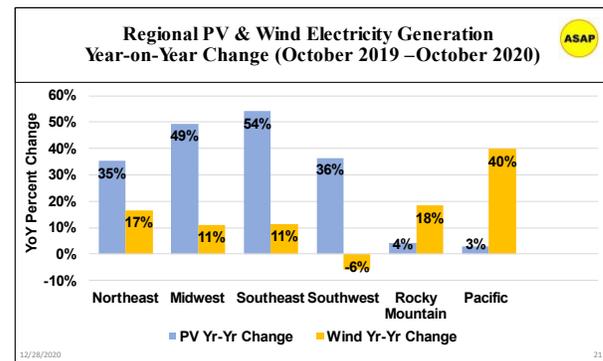
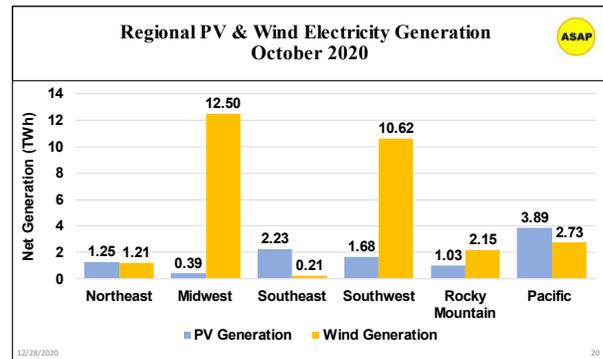
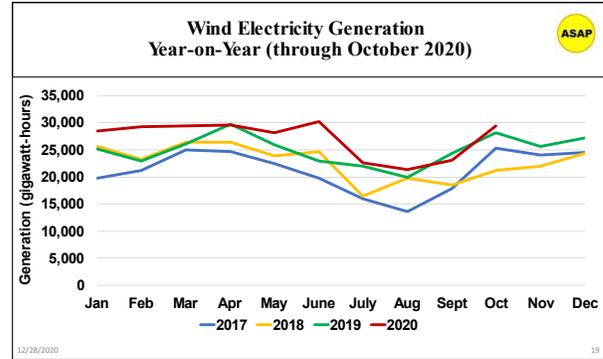


In October, wind electricity generation was greatest in the Midwest and Southwest regions, which combined produced 79% of total U.S. wind electricity. The Midwest region set the pace with 12.5 TWh of electricity generation and was followed by the Southwest region with 10.6 TWh of electricity generation.

Year-on-year, PV electricity generation increased 18.9%, and wind electricity generation increased 6.9%

Month-on-month October wind electricity generation increased in the Midwest region by 2.2 TWh (+21.5%) and in the Southwest region by 2.6 TWh (+32.4%). It should be noted that all other regions reported MoM increases in wind electricity generation.

Year-on-year (October-19 to October-20), PV electricity generation increased 1.8 TWh (+18.9%), while wind electricity generation increased 1.9 TWh (+6.9%). Regional year-on-year change in PV electricity generation was positive for all regions. In contrast, regional YoY change in wind electricity generation was positive for all regions except the Southwest, which is likely due to variability.

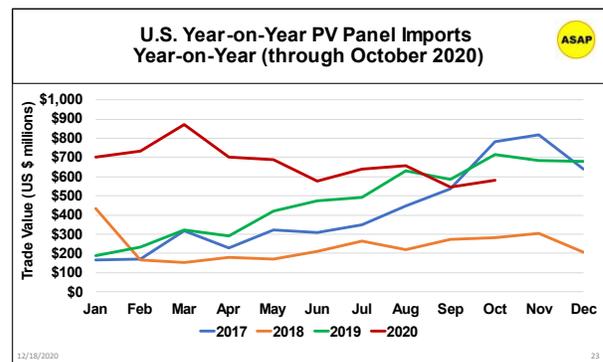


PV Trade

2020 U.S. PV panel imports fall below record pace

Malaysia, Vietnam and Thailand are the top three sources of U.S. PV panel imports in 2020

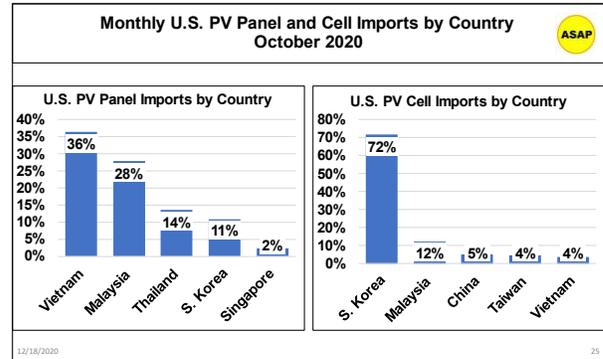
The value of October U.S. PV panel imports increased 6.6% month-on-month to \$580 million, as shown in the graph. The year-to-date (Jan.-Oct.) total value of U.S. PV panel imports is \$6.7 billion. On an annual basis, the U.S. is on pace to import \$8.04 billion worth of PV panels, which is slightly below the record \$8.1 billion value of imported panels in 2016.



Vietnam was the source of 36% of U.S. PV panel imports in October, while Malaysia held a 28% share. Year-to-date, Malaysia holds a 31% share and Vietnam a 29% share.

Turning attention to U.S. imports of PV cells, the total value of October U.S. PV cell imports increased 90% month-on-month to \$49 million. South Korea dominated supply with a 72% share in October and a YTD 64% share. The value of PV cell imports is expected to average approximately \$30 million per month through the end of 2020.

In terms of exports, the value of U.S. PV panels exports in October was \$4.2 million. Year-to-date, the value of U.S. PV panel exports is \$28.8 million. The annualized pace of U.S. PV panel exports is \$32.1 million, which is lower than the \$35.6 million value of U.S. PV panel exports in 2019. The value of U.S. PV panel exports has declined steadily over the past decade.

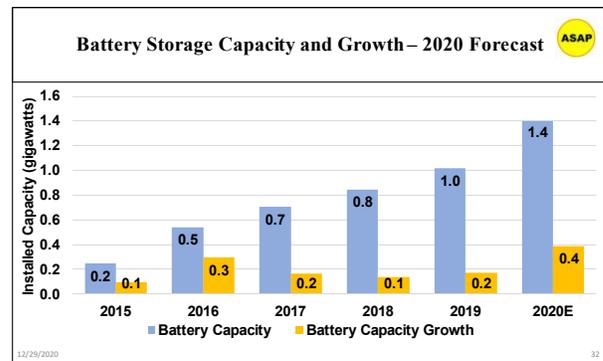


The value of U.S. PV cell exports in October was \$1.4 million, which is 34% lower than September PV cell exports. YTD the value of U.S. PV cell exports is \$18.9 million, and the annual pace is \$22.6 million. In 2019, the value of U.S. PV cell exports was \$31.5 million.

Utility Battery Storage

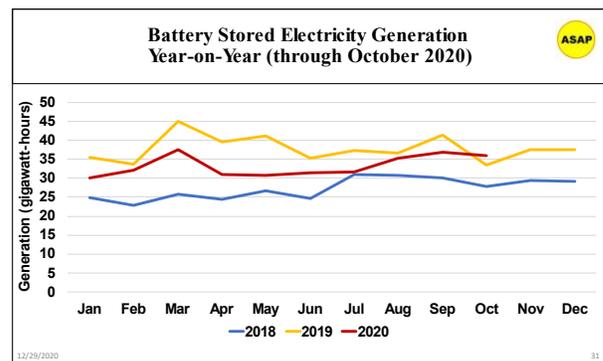
Cumulative U.S. battery storage capacity is 1.35 GW in October

There were zero battery storage capacity additions reported in October. Hence, U.S. cumulative battery storage capacity remains at 1.35 GW. YTD battery capacity additions are 343 MW, which is closing in on the 2020 forecast of 387 MW. The annualized pace of new battery storage capacity is 411 MW. The EIA power plant inventory reports 12.0 MW of battery storage projects that are complete but not in service. In addition, the reported battery storage projects that are greater than 50% complete total 329 MW.



The 2020 average battery utilization factor is 4.1%

The reported October average monthly battery utilization factor is 3.7%, which implies a battery electricity supply of 35.9 GWh in October. For January through



October, battery electricity supply is averaging 33.2 GWh/month with an average utilization factor of 4.1%. Battery electricity capacity and supply will continue to increase with a significant scale-up in annual battery capacity additions going forward.

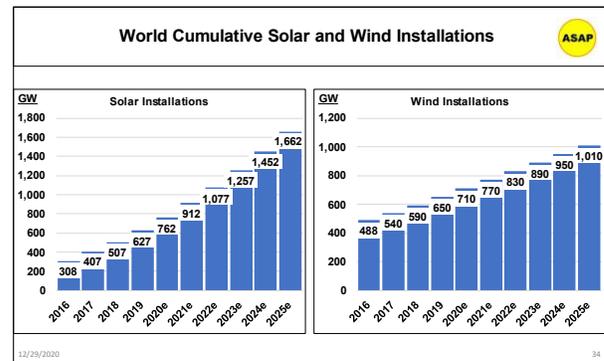
Obviously, variability in PV and wind electricity production requires electricity storage to convert PV and wind into a dependable supply of on-demand electricity. At present, the U.S. has approximately 800 GW of fossil fuel power plants, which implies the need for hundreds of GW of storage if PV and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

The fossil fuel power plant balance is an important metric for climate change forecasts. In 2020, the U.S. is adding approximately 7.5 GW of new natural gas power plant capacity with 8.1 GW of coal power plant retirements and 2.0 GW of natural gas power plant retirements. The net fossil fuel power plant balance for 2020 is a negative 2.6 GW. In essence, coal power plants are being retired and replaced with new natural gas power plants. The 2020 fossil fuel power plant balances should decrease utility power plant carbon dioxide emissions, net pandemic effects.

World PV and Wind

World PV installations doubling every 5 years

The trajectory of global cumulative PV installations is a doubling in cumulative capacity every five years. In 2020, the cumulative world PV installations will surpass 700 GW, which is more than double the 308 GW of cumulative capacity in 2016. The global COVID-19 pandemic is having an impact on global PV installations in 2020, which may



result in a decrease by as much as 25%. ASAP’s original 2020 forecast was 135 GW of global PV installations, but a 25% reduction decreases the total to 100 GW of new capacity. Even at this reduced rate, global PV capacity will surpass 700 GW in 2020.

Looking ahead to 2025, global cumulative PV installations are expected to more than double to over 1,600 GW at a 9.2% annualized growth rate. It follows that the global annual installation rate is expected to approach 200 GW in 2025.

ASAP U.S. PV projection: 30 GW/year by 2030

China is the world leader in PV manufacturing and annual PV installations. China’s PV manufacturing base has a 70+% global market share. In terms of domestic installations, China has installed on average about 40 GW per annum since 2017. In March 2020, China’s NEA set a target of 30 GW of new PV installations in 2020. Combine this with the 15 GW of uncompleted 2019 projects, the total of new 2020 PV capacity is expected to be in the 35-45 GW range. By 2025, China’s annual PV installation rate is expected reach 60 GW (+50%).

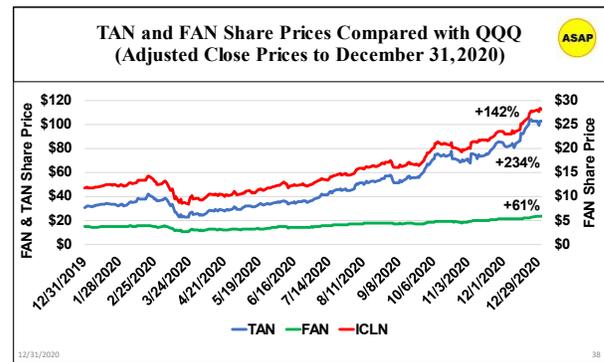
The U.S. is the second largest installer of PV systems and is expected to increase the annual installation rate to 20 GW by 2025 and to 30 GW by 2030. ASAP’s long-term deployment schedule for PV installations is 30 GW per annum by 2030. This is a doubling of the current capacity installations. Hence, a U.S. commitment to 30 GW per annum of new PV installations by 2030 appears to be a reasonable goal. ASAP’s 2030

forecast calls for wind installations of 30 GW per annum and PV/wind storage capacity additions of 10 GW per annum.

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 meet the international goal of limiting global temperature increase to below 2.0 degrees Celsius. To achieve this goal will require the U.S. to approach 100 GW of annual PV and wind installations with storage. The last decade was a demonstration period for PV, and it has met the challenges in terms of cost (\$0.90/W installed) and performance (20% efficiency). New PV capacity is becoming cost competitive with new coal capacity.

PV and Wind Industry Financial Performance

Share prices for three popular renewable energy ETFs soared in 2020. The renewable energy ETFs monitored by ASAP are TAN (solar focus), FAN (wind focus) and ICLN (clean energy focus). ASAP reports the adjusted close prices, and the share price increases from December 31, 2019 through December 31, 2020 are: TAN



+234%; FAN +61%; and ICLN +142%. These amazing returns are greater than the returns for the major market index funds, QQQ (NASDAQ), SPY (S&P) and DIA (DOW). Renewable energy stocks have responded positively to the incoming Biden administration and the expectation that the U.S. will rejoin the international Paris Climate Agreement.

ASAP surveyed the third quarter financial reports of sixteen solar and wind pure play companies. Mixed play energy conglomerates have been excluded from the survey of quarterly financial reports. The survey includes six PV and wind manufacturing companies, four balance of system (inverters-2 and trackers-2) companies and six PV system operation and maintenance companies. The market capitalization of the sixteen companies range from \$1.4 billion to \$36 billion.

Ten of the companies reported positive net income for the third quarter. Also, ten of the companies have debt/equity ratios under 30%. As expected, the PV system operation and maintenance companies have relatively high debt/equity ratios since they finance the installations that they then receive income over years of operation. Importantly, the cash positions of the sixteen companies is generally strong with thirteen companies reporting over \$100 million in cash and cash equivalents at the end of the third quarter. The strong cash-on-hand balances is a good indicator of growth potential.

Each of the three sectors surveyed (manufacturing, BOS and SystemO-M) appear to be on about equal footing in terms of profitability and free cash flows. The overall financial position of the sixteen solar and wind pure play companies appears sound and poised for growth in the coming year. On a final note, all of the surveyed companies have positive share price increases in the third quarter of 2020, as well as strong YTD increases.

For 2020, TAN up 234%, FAN up 61% and ICLN up 142%

Third quarter financial reports indicate that the PV and wind industry is financially sound

Analysis of the financial reports is complicated by third quarter acquisitions, IPOs and spinoffs. The Sunrun acquisition of Vivint was finalized with Vivint's finances integrated into Sunrun. SunPower completed the spinoff of Moxeon, a PV manufacturer, to focus on system O-M. Also, the PV tracker companies Array and Soltec had successful IPOs in October.

ASAP Methodology

ASAP benchmarks U.S. historical electricity generation and capacity to the Energy Information Administration (EIA) of the U.S. Department of Energy. 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, as well as company reports. All ASAP forecasts are ASAP generated.