Power Industry 2022 Trends & Predictions

By John Benson

January 2022

1. Introduction

My colleagues at Energy Central asked me to participate in the title predictions. After considering this, I offered to review three areas where I post frequently, and consider myself qualified. These areas are:

- U.S. growth in electric vehicle (EV) deployments in 2022 and later years
- U.S. transition from fossil-fueled generation to utility-scale photovoltaic (PV) and battery energy storage systems (BESS), from 2022 through 2024
- Deployment of the first large-scale offshore wind projects in 2022 and 2023

I track all of the above subjects on a regular basis, so I will follow this process:

- I will start with trends from 2021 posts
- I will look at other factors that could accelerate or decelerate growth
- Project growth for the next few years in the above markets.

2. Growth in EV Deployments in 2022

There are now over a million EVs registered in the U.S. Also the expansion of the number of EV, especially in California, are beginning to make an impact on electric utility usage patterns. Below are the registrations of EVs per state for the 12 states with the most EVs as of mid-2021.[1]

1.	California	425,300
2.	Florida	58,160
3.	Texas	52,190
4.	Washington	50,520
5.	New York	32,590
6.	New Jersey	30,420
7.	Arizona	28,770
8.	Illinois	26,000
9.	Colorado	24,670
10.	Georgia	23,530
11.	Oregon	22,850
12.	Massachusetts	21,010

[1] Scooter Doll, Electrek, "Current EV registrations in the US: How does your state stack up?" Aug 24, 2021, https://electrek.co/2021/08/24/current-ev-registrations-in-the-us-how-does-your-state-stack-up/

It should be clear that California will need to deal with the EV-driven change in load-patterns before any others. As we will see from other sections in this post, there are many other changes in consumption that we are dealing with at the same time, so at least we have practice.

2.1. Sales by Manufacturer and Model

Regular readers know that I cover Tesla much more than any other EV manufacturer. However, note that I'm not a fan of Tesla nor Elon Musk. In fact I will not buy a Tesla anytime soon because (1) they are too expensive (and my wife and I are too thrifty), and (2) they are too weird (wife would refuse to drive them). However, if you look at the numbers below, Tesla is clearly driving EV Sales forward in the U.S.

Here are the top 12 best-selling electric vehicles in 2021 in the US through October:[2]

1. Tesla Model Y, 132,000 units sold, base price: $41,190
2. Tesla Model 3, 94,900 units sold, base price: $38,690

Tot Models Y & 3: 226,900 units sold

3. Chevrolet Bolt EV and EUV, 24,803 units sold, Base price: $37,495
4. Ford Mustang Mach-E, 18,855 units sold, base price: $43,995
5. Volkswagen ID.4, 12,279 units sold, base price: $41,190
6. Nissan Leaf, 10,074 units sold, base price: $27,400
7. Audi e-tron and e-tron Sportback , 7793 units sold, base price: $66,995
8. Hyundai Kona Electric, 7656 units sold, base price $34,000
9. Porsche Taycan, 7228 units sold, base price: $81,250
10. Tesla Model S, 5400 units sold, base price: $81,190
11. Tesla Model X, 3000 units sold, base price: $91,190

Total, all Teslas: 235,300

12. Hyundai Ioniq Electric, 1595 units sold, base price: $34,250

Total units sold for all above EVs: 325,583

So Teslas made up about 72% of all U.S. EV Sales. I expect this ratio to increase slightly into the start of 2022, but in mid-2022 through the end of the year, I expect Tesla's percentage to actually increase much more for the following reasons:

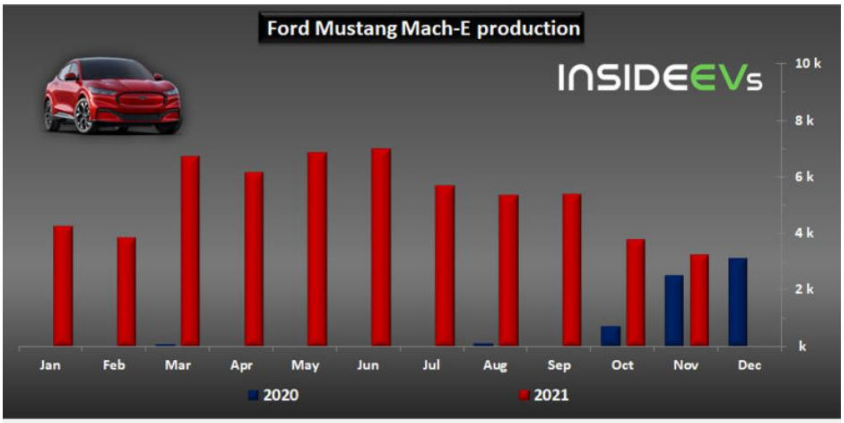
- Gigafactory Austin will start to seriously ramp production in mid-2022.
- The mothership factory (Fremont) will start to increase production slightly in 2022.
- Tesla's battery supply crunch should loosen up as the Giga-Austin battery line starts ramping up 4680 battery production in mid-2022. Giga 1 (Reno) is already ramping 4680 production.

[2] Annie White, Car and Driver, "12 Best-Selling Electric Vehicles of 2021 (So Far)," Oct 29, 2021, https://www.caranddriver.com/features/g36278968/best-selling-evs-of-2021/

Events that should impact production among other manufacturers include

Ford:

Mustang Mach E: See the chart below from the site linked in the Reference here.[3]



Ford is clearly suffering supply chain issues. It peaked out at about 6,800 per month in June, and production has been seriously declining since then.

F150 Lightning: The text below is from the reputable EV source referenced below:

Let's recall that the company has increased its production target from 40,000 to 80,000 a year in 2024. But in 2023, it might be less (some say 55,000), while in 2022 it probably will be very limited (like 15,000). We can only guess that Ford will not be able to produce more than 20,000 F-150 Lightning next year.[4]

I differ. I would guess that Ford will continue to have EV supply chain issues well into 2022, and I would be surprised if they produced more than 10,000 Lightnings in 2022.

One other comment, Tesla seemed to get ahead of these issues in 2021. They have been dealing with them since 2012, and have many sources for all EV components.

GM:

GM has really amazing ambitions, but many are skeptical:

GM's only EV for sale is the Chevy Bolt, which appeared in the U.S. market in 2017. It has won several awards, such as Motor Trend's 2017 Car of the Year. And yet GM has sold only 24,803 Bolts this year through September, according to Inside EVs, and that is "already more than any previous year..."[5]

---

[3] Mark Kane, Inside EVs, "US: Ford Sold Over 3,000 Mustang Mach-E In November 2021," Dec 2, 2021 https://insideevs.com/news/552101/us-ford-mache-sales-november2021/

[4] Mark Kane, Inside EVs, "Ford F-150 Lightning Orders Delayed Until December," Oct 23, 2021, https://insideevs.com/news/542640/ford-f150-lightning-ordering-postponed/

[5] Merrill Matthews, The Hill, "Can GM increase electric vehicle production 2800 percent in four years," Dec 7, 2021, https://www.msn.com/en-us/news/politics/can-gm-increase-electric-vehicle-production-2800-percent-in-four-years/ar-AARzvK4?ocid=BingNewsSearch

General Motors (GM) has committed to spending $35 billion to bring 30 new fully electric vehicles (EVs) to its market worldwide by the end of 2025 - just four years from now.

And the company says that two-thirds of those models will be available in the United States. About 40 percent of GM's U.S. production will consist of battery-powered vehicles, including crossovers, SUVs and trucks.

According to Auto Industry Portal Marklines, GM sold 1,766,219 passenger cars, light-duty trucks and SUVs in the United States from January through September of this year…

Forty percent of roughly 1.76 million new vehicles sold would be about 706,000 - the number of EVs GM would need to produce to hit its 2025 U.S. target for the same time period.

I'm not a big fan of GM, but I do believe that Mary Barra has done a good job as CEO. However she has deep roots in the automotive industry and in GM, and this does not suit her well to execute the type of transformation being described above. Only a crazy genius that is also a very flexible thinker can pull off an evolution like this (and he's been there, done that, and is not available).

In considering non-U.S. based multinational auto manufacturers, I do not see any capable of executing a major transition to EVs, so I'm forecasting for the next two or three years, EV growth will come largely from Tesla. I'm repeating their production growth for the last few years below, and that should be a good minimum rate for the next few years. Note that these are global delivery numbers, but the growth rate should be indicative for both global and U.S. growth rates going forward.

- 2018, 244,920
- 2019, 367,200 (up 50% year over year)
- 2020, 499,550 (up 36% year over year during the first year of the pandemic)
- 2021, 936,000 (up 87% year over year)

2.2. Chargers

The main question is will the lack of chargers slow EV Growth. I believe I can give this a quick "no." See the earlier part of this section about how "EV Growth" is really "Tesla Growth." Tesla has its own fleet of "Superchargers", and these do not seem over capacity, in fact they are starting to open them up (very slowly) to non-Tesla EVs in Europe (however there are no known plans to do this in their main market, the U.S.).

In the many tests of EVs that I've read in the media, it seems that all of the reviewers rave about how easy it was to use Superchargers vs. other chargers.

…Finding a Supercharger is remarkably easy to accomplish. Not only does Tesla keep a map of every single Supercharger location on its website, you can use both the Tesla app and the in-car navigation system to track down your nearest Supercharger locations.[6]

[6] Tom Pritchard, Tom's Guide, "Tesla has an ambitious new plan to triple the number of Superchargers," Oct 21, 2021, https://www.tomsguide.com/news/tesla-has-an-ambitious-new-plan-to-triple-the-number-of-superchargers

In fact, if you find yourself out on an extended road trip, Tesla's navigation system will automatically take charging into account. That means the car will send you to a Supercharger along the way to your destination, to ensure that you have enough power to comfortably get there.

Tesla also keeps tabs on what amenities are available by each Supercharger (like restrooms and Wi-Fi), how many charging bays there are, and what the opening hours are. The app and in-car systems can also see whether Supercharger bays are available or not, so you don't arrive to find them all in use.

Tesla's Superchargers are very simple to use. All you do is park next to a machine, plug in, and wait for the cable to lock in place. The Supercharger will then begin delivering power, and the logo next to your charging port will turn green.

Because each car is already linked to an account with the Tesla app, there's absolutely nothing else that needs to be done. Other public charging networks often rely on drivers confirming their charge in a separate smartphone app.

You'll be able to see the progress of your recharge session on the car's central display. It shows you how fast you're recharging, how many miles of range have been added, how many miles you have in the battery, and how much this charging session has cost so far. This information is also visible in the Tesla app, should you have to leave your car unattended.

2.3. Medium to Heavy EVs

I'm going to send you to two recent posts for these. Although these EVs are trickling out of various manufacturers' factories, electric buses are moving into their markets much quicker than trucks and the latter are really not moving much at all.

2021 Electric Truck & Bus Update, Part 1, Trucks: This post is on the progress to date of the medium-to-heavy truck and markets.

https://energycentral.com/c/ec/2021-electric-truck-bus-update-part-1-trucks

2021 Electric Truck & Bus Update, Part 2, Buses: Section 2 of this report will describe all major manufacturers of buses, their offerings and any new developments by those firms. Section 3 will describe how fleet managers can evaluate and remedy the overload risk described above.

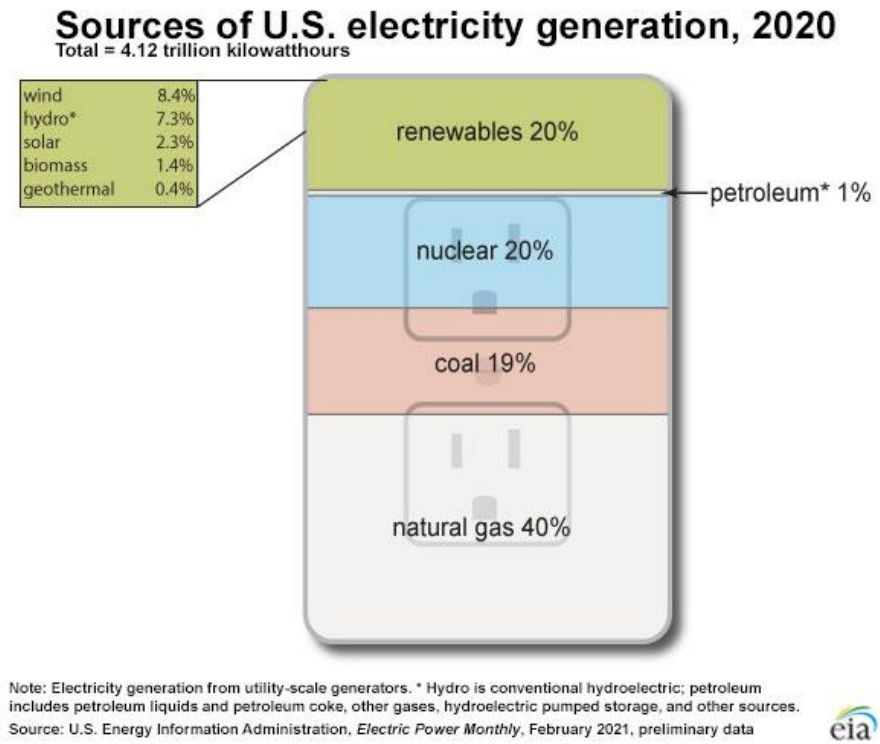
https://energycentral.com/c/ec/2021-electric-truck-bus-update-part-2-buses

3. U.S. Transition to GHG-Free Generation

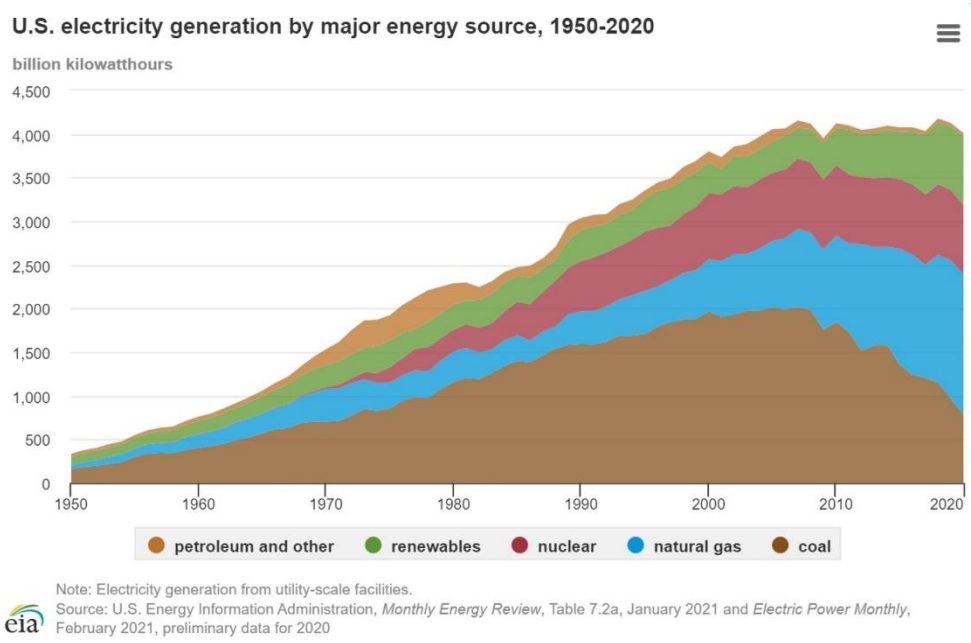
Here we will look at recent trends in Electric Utility Generation. The charts below are from the web page referenced here.[7]

First we will look at the sources of generation in the U.S. in 2020:

[7] U.S. DOE Energy Information Administration, "Electricity in the United States," https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php

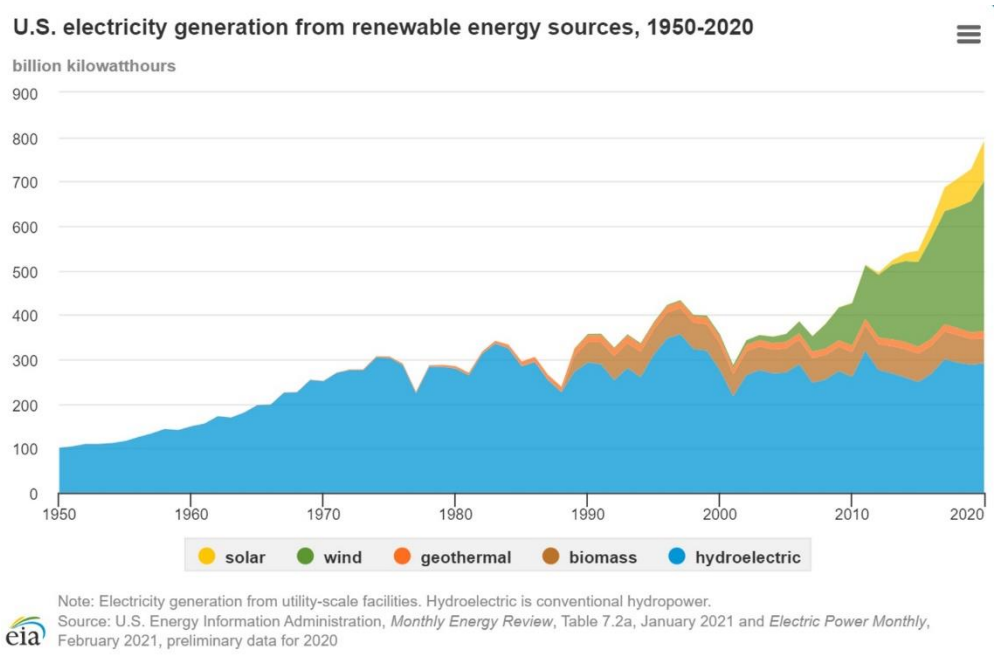


Note that renewables have now passed coal, and are tied with nuclear, but if you look at long-term trends:



Note that coal is crashing and not burning, natural gas is still expanding (and displacing coal). Nuclear is holding steady, and renewables are definitely expanding.

The following chart are the details on renewables.



Most of renewable's expansion is coming from wind, but solar (photovoltaic or PV) is starting to take off.

3.1. 2021 PV and BESS Projects

In 2021, I have closely tracked two types of renewable projects: large utility-scale photovoltaic (PV) and large utility-scale battery energy storage systems (BESS). In 2021, I only tracked projects, or associated project-groups with an output greater than 100 MW. This measurement is the minimum size of a PV project, a BESS project, or, for projects that contained both PV and BESS, the size of either PV or BESS.

I posted three papers or series of papers on U.S. PV / BESS projects in 2021. These are described and linked below.

2021 Photovoltaic & BESS Projects: It has been over a year since I posted the last paper similar to this one. This paper looks at large photovoltaic, photovoltaic plus storage and storage projects. This paper is limited to projects in the U.S. that are at least 100 MW and that are either recently completed, under construction or planned to be complete by 2024. Projects are sorted by state.

https://energycentral.com/c/cp/2021-photovoltaic-bess-projects

Photovoltaic & Storage for Fall 2021: This ended up being a three-part post, and the last two parts were mainly on projects. These are linked below.

https://energycentral.com/c/cp/photovoltaic-storage-fall-2021-part-2-us-and-states

https://energycentral.com/c/cp/photovoltaic-storage-fall-2021-part-3-states-megafactory

Photovoltaic & Storage, Late 2021: This was a two-part post, and part 2 covered projects. Like the other PV+BESS Posts in 2021, this was sorted by states. I did increase the minimum power output for these projects to 150 MW for either PV or BESS.

https://energycentral.com/c/cp/photovoltaic-storage-late-2021-%E2%80%93-part-2

Below is the summary of these projects, sorted by state (with U.S totals), and announced completion dates for future projects. I loaded the projects from the above three papers into an Excel database, and there are over 100 projects.

3.1.1. Regional & State Forecasts

The one thing I've noted for individual states or regions, is that some states are market leaders, and have continually deployed large PV and BESS projects (California, Texas and Nevada to a lesser extent). Then there are states in one region that appear to be recently taking off and are rapidly deploying projects in a burst of activity (Indiana and Ohio in the eastern Midwest). Other states are just deploying anywhere from zero to a few large PV projects. Most states / regions seem to start with PV-only and then later start backfilling with PV+storage or storage-only projects.

The categories below list the states with large utility-scale PV or BESS deployments as described in the first paragraph in subsection 3.1. Note that there will be developments that are missed by the current survey in later years (2023 and 2024), and projects in the later years that fail.

Market Leaders:

California, deployments per year, 2021: 1,073 MW of PV, 175 MW of BESS

2022: 1,953 MW of PV, 537 MW of BESS

2023: 1,000 MW of PV, 980 MW of BESS

2024: None

Comment: Developers in California have been on the ground developing large projects for about five years, and thus probably only require about a year to develop all but the largest projects. Also, there are still many off-takers that are eager to sign PPAs. Thus it isn't totally surprising that there are no project completions shown after 2023. Also note that more BESS are deployed in later years.

Texas, deployments per year, 2021: 812 MW of PV

2022: 1,125 MW of PV, 80 MW of BESS

2023: 2,301 MW of PV

2024: 200 MW of PV

Nevada: deployments per year, 2021: 1,451 MW of PV, 100 MW BESS

2022: None

2023: MW 732 PV, 200 MW BESS

2024: 350 MW PV, 280 MW BESS

Eastern Midwest Bursts:

Indiana, deployments per year, 2021: None

2022: 1,250 MW PV, 135 MW BESS

2023: 1,675 MW PV

2024: 610 MW PV, 180 MW BESS

Ohio, deployments per year, 2021: None

2022: None

2023: 2,649 MW PV, 50 MW BESS
2024: None

Significant deployments (more than 2 projects/state):

Arizona. Deployments per year, 2021: 100 MW PV, 30 MW BESS
2023: 660 MW PV, 560 MW BESS

Michigan, deployments per year, 2022: 200 MW PV
2023: 525 MW PV

South Carolina, deployments per year, 2023: 425 MW PV

Wisconsin, deployments per year, 2022: 250 MW PV
2024: 465 MW PV

Small Deployments (one or two projects per state, not sorted by year):

Alabama: 226 MW PV

Colorado: 550 MW PV, 2 projects

Florida: 409 MW BESS

Georgia: 287 MW PV

Hawaii: 185 MW BESS

Iowa: 200 MW PV. 75 MW BESS

Illinois: 560 MW PV, 2 projects

Kentucky: 388 MW PV, 2 projects

Louisiana: 695 MW PV, 2 projects

Minnesota: 460 MW PV

Missouri: 200 MW PV

Mississippi: 100 MW PV

New Mexico: 600 MW PV, 300 MW BESS, 2 projects

New York: 716 MW PV, 2 projects

Oklahoma: 250 MW PV, 200 MW BESS

Oregon: 100 MW PV

Pennsylvania: 127 MW PV

General Projection:

There are several factors that lead me to believe that the overall growth of both utility-scale PV and BESS will continue over the next few years.

- Market leaders: Strong trend of increasing growth in the next few years, considering the likely growth profile and deployment expertise of California and Texas. Nevada has a much smaller population, and thus it will not contribute significantly going forward.
- Burst States: These bursts will be short-lived, but then these developers will move to other states further north, west and south.
- Significant deployment states: These may be at a start of burst growth. Note that South Carolina is too far south to have strong offshore wind potential (like the states further north). Also note that Arizona has been deploying PV for several years, and is supported (in a number of ways) by their proximity to California.
- Small deployment states: There are 17 of these, and each has the potential for growth.

3.1.2. U.S. Growth Forecasts

The following are the results of a completion-year sort on the 2021 database:

2021: 4,766 MW of PV and 714 MW of BESS

2022: 6,090 MW of PV and 1,237 MW of BESS

2023: 12,199 MW of PV and 1,690 MW of BESS

2024: 2,735 MW of PV and 355 MW of BESS

Some added information: The average project in the U.S. will require one and a half to two years from initial firm commitment to completion. Thus considering that we are at the end of 2021 as I'm writing this, most projects that are starting now will finish in 2023. However, these may not appear on our radar for six months, thus change "2023" to "2022 or 2023." Thus the above strength of 2023 suggests that the market for this segment is strongly growing.

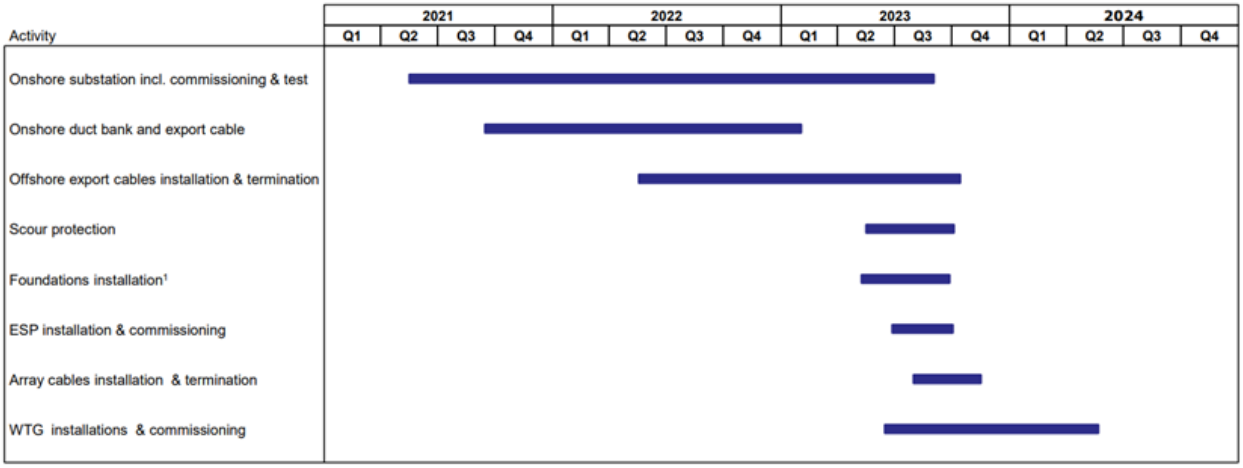
Considering the results for the states and regions, I would expect this growth to continue at least through 2025.

3.2. Windpower

Although the onshore wind projects continue to be deployed at only a slightly slower rate than PV+ BESS Projects, these are still substantial (see above "U.S. electricity generation from renewable energy..." chart) However, since we are discussing future forecasts, most future growth will come from offshore windpower projects. The first of the utility-scale offshore wind project will be Vineyard Wind 1.

The following is the construction schedule for Vineyard Wind 1 (updated in June, 2021):

Draft High-level Construction Plan



ESP - Electrical service platform: The offshore substations located in the Wind Development Area, which contain transformers and other electrical gear.

WTG – Wind Turbine Generator: Vineyard Wind 1 will consist of an array of 62 wind turbines, spaced 1 nautical mile apart on an east-west and north south orientation. The turbines are General Electric Haliade-X turbines, each capable of generating 13 megawatts of electricity.

I believe this schedule is realistic at this point, and I believe first power will be in late 2023, and completion in mid-2024

Both the Orsted / Eversource Revolution Wind and South Fork projects, both in Rhode Island waters, were scheduled to be completed in 2023. US Wind's MarWin project in Maryland was also scheduled to be completed in 2023. I don't find these dates credible, and believe first power will be in early 2024, and completion in late 2024 or 2025. I found an article linked at the end of this paragraph that confirmed that Revelation Wind is not expected to be commissioned until 2025.[8]

I count five major projects that are scheduled to be completed on the East Coast in 2024. I would bet on 2025 or later for most of these.

See the post linked below and other posts linked therein for more information on these and other projects.

https://energycentral.com/c/cp/fall-2021-offshore-wind-update

Also note that offshore projects tend to be much larger (on average) than onshore projects, and have a much higher availability and capacity per turbine.

[8] Carmen, Power Technology, "Revolution Wind Farm, US," Dec 3, 2021, https://www.power-technology.com/marketdata/revolution-wind-farm-us/