WIND POWER PLANT

PITCH DECK

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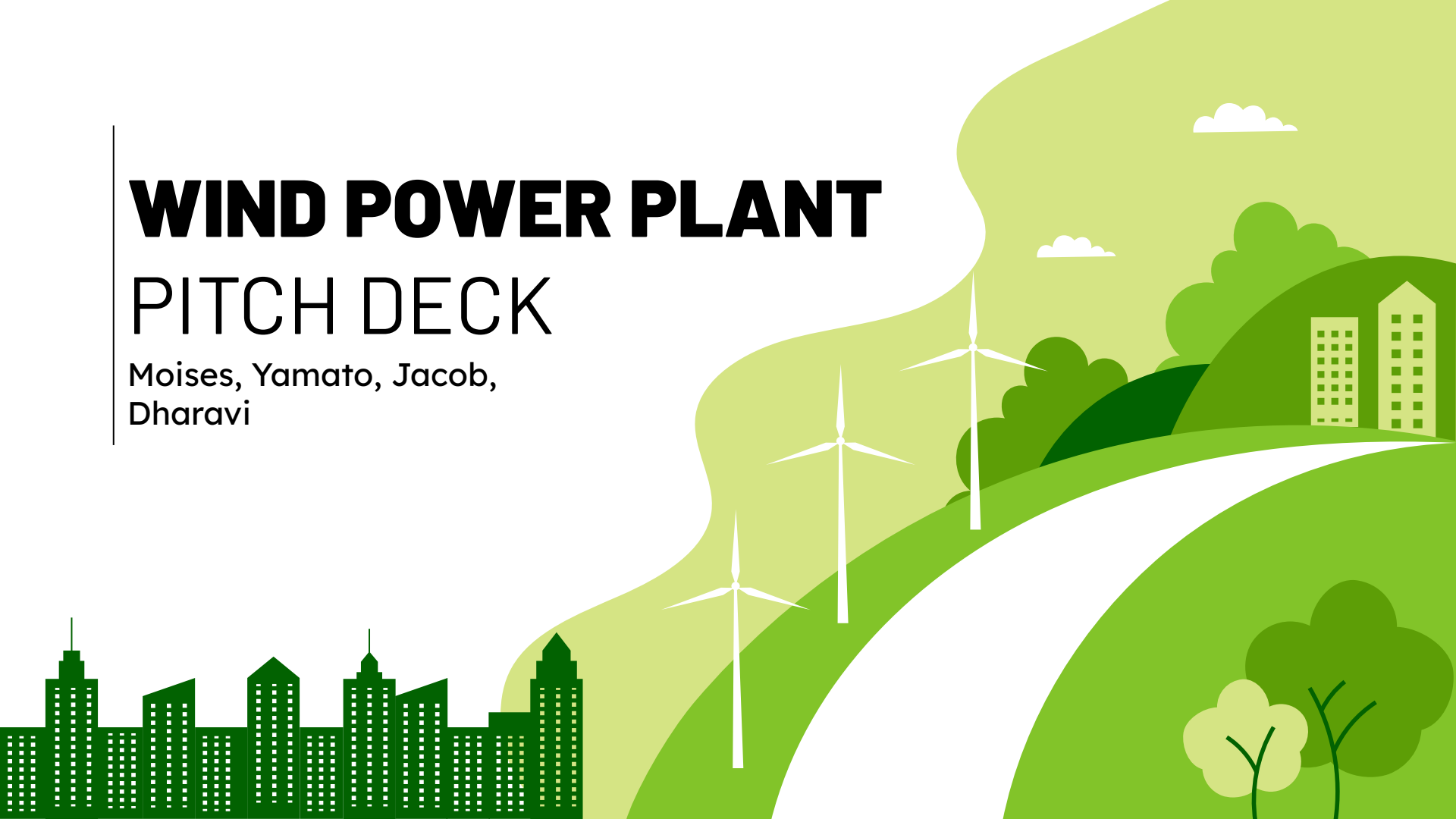
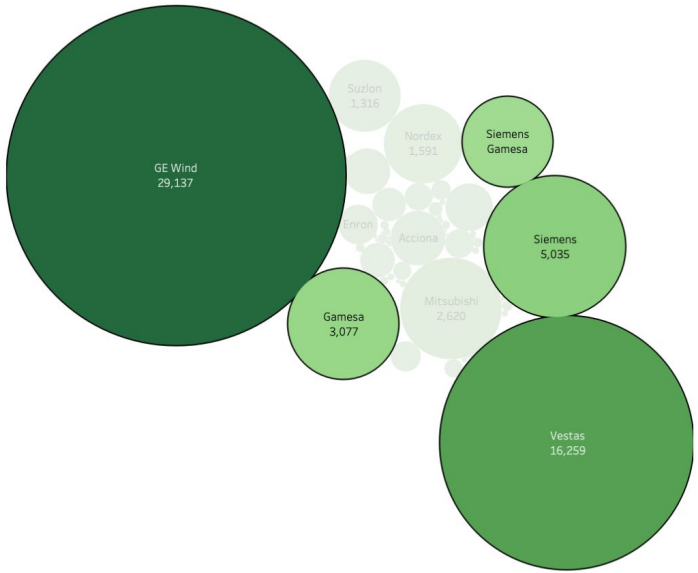
Dharavi



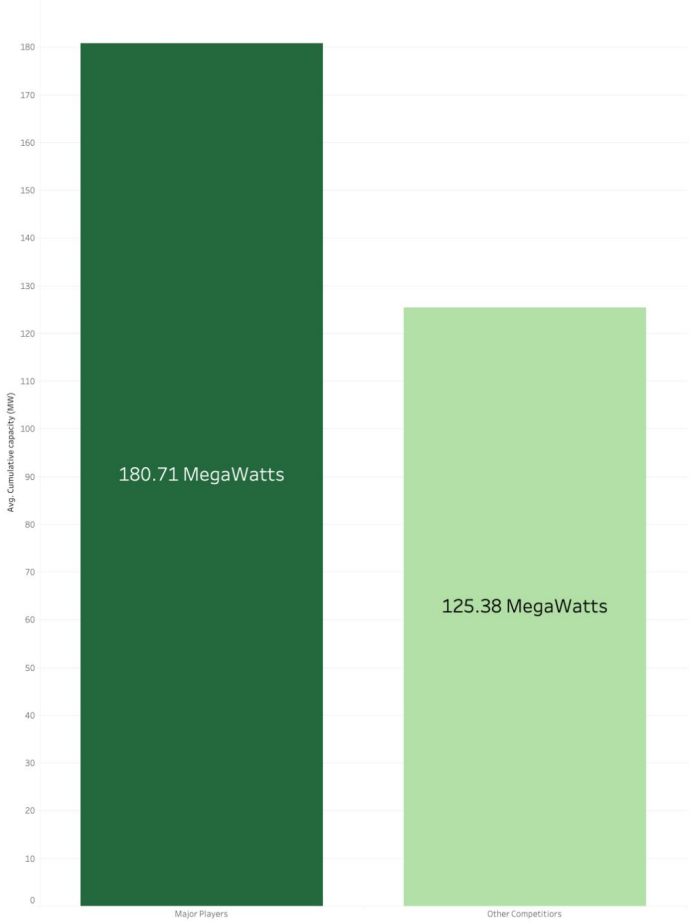
What does the wind turbine market look like?

1. In a report published in Allied Market Research, the global wind energy market size was valued at $62.1 billion in 2019, and is projected to reach $127.2 billion by 2027.
2. According to a report published by the International Energy Agency, In 2021, wind electricity generation increased by a record of 273 TWh. This was an increase of 17% and was also an increase of more than half the growth from 2020. This the highest growth among all renewable power technologies.
3. In terms of growth in the global market, China accounted for slightly less than 70% of wind generation growth in 2021. This was followed by the United States at 14% and Brazil at 7%.
4. Wind turbines can be onshore and offshore. They can also be horizontal axis wind turbines (HAWT) like a pinwheel or vertical axis wind turbines (VAWT) like a spinning cylinder. Among those types there can be many different ways they can be constructed based on location and size. One example of such is that water depth requiring the use of floating turbines.

Who Are the Major Players of Wind Turbines



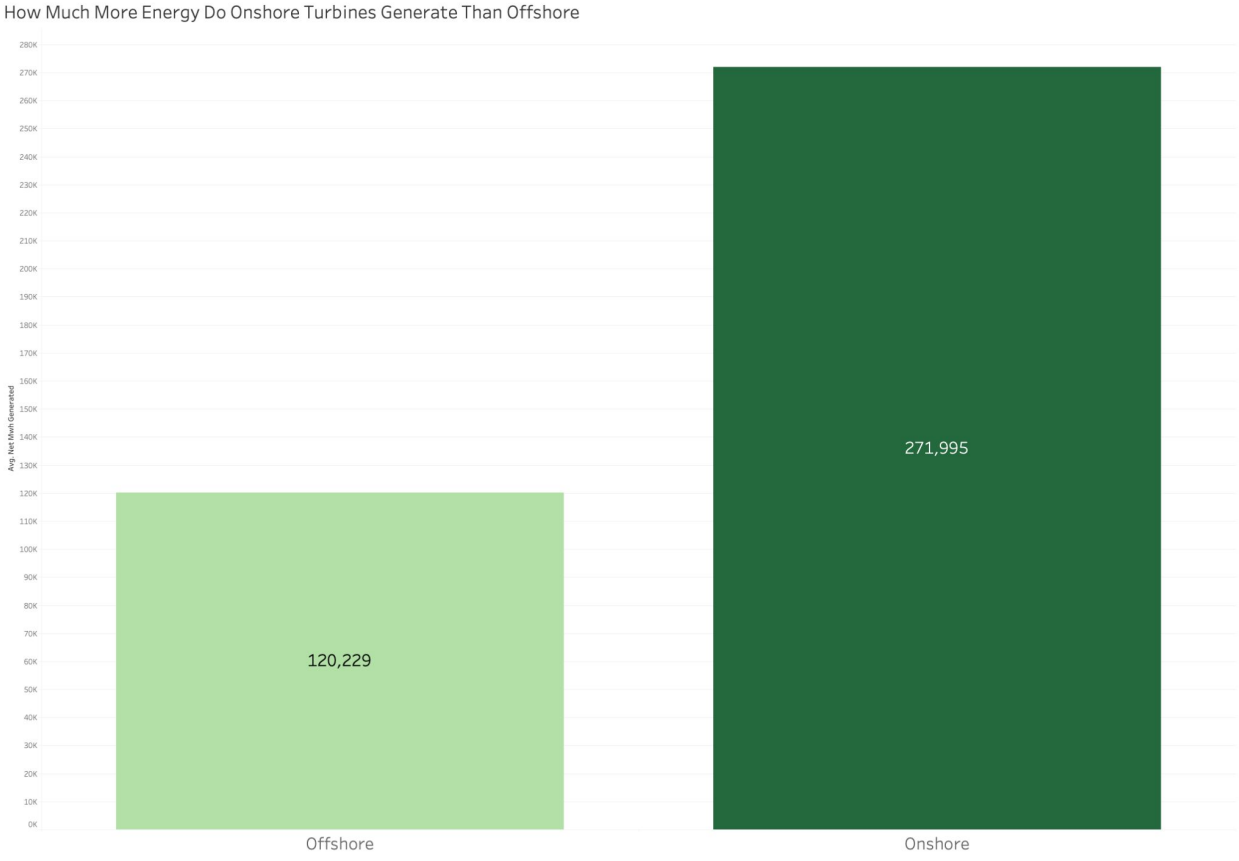
What Is The Average Capacity of The Main Players Turbines?



Onshore vs Offshore wind turbines

Onshore wind farms are usually on pieces of land that are comparatively inexpensive to build and maintain but onshore wind speeds are not as predictable and steady as offshore.

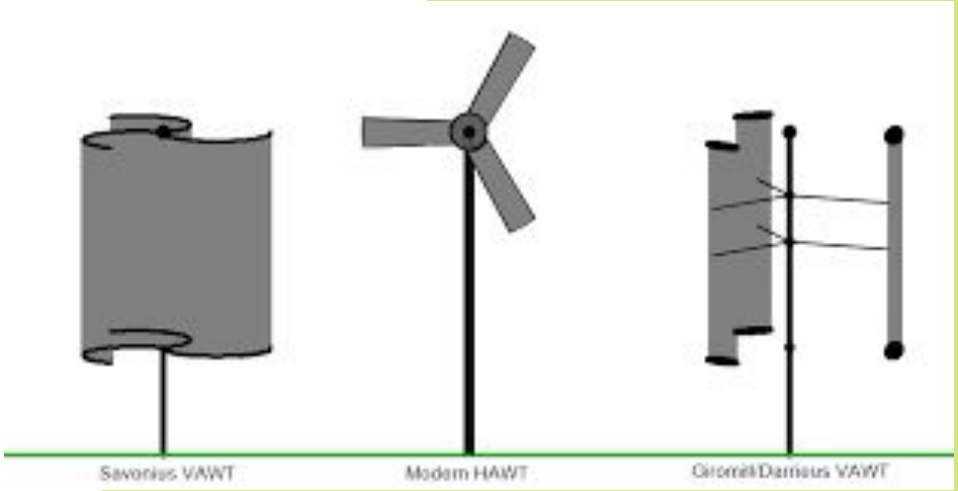
Offshore turbines can generate more electricity than onshore turbines as they tend to be in areas with higher and more stable wind speeds but offshore turbines are more expensive to install and maintain.



HAWTs vs VAWTs

HAWT turbines generate a higher yield of electricity, they are more efficient in energy generation, however they must be built to rotate because they can only spin from wind blowing in a certain direction.

VAWT turbines can take wind from 360 degrees and can be more easily scaled to size so they can be placed in urban settings or on hilltops. However, they are not as efficient at higher wind speeds, they do not generate as much electricity as HAWTs.



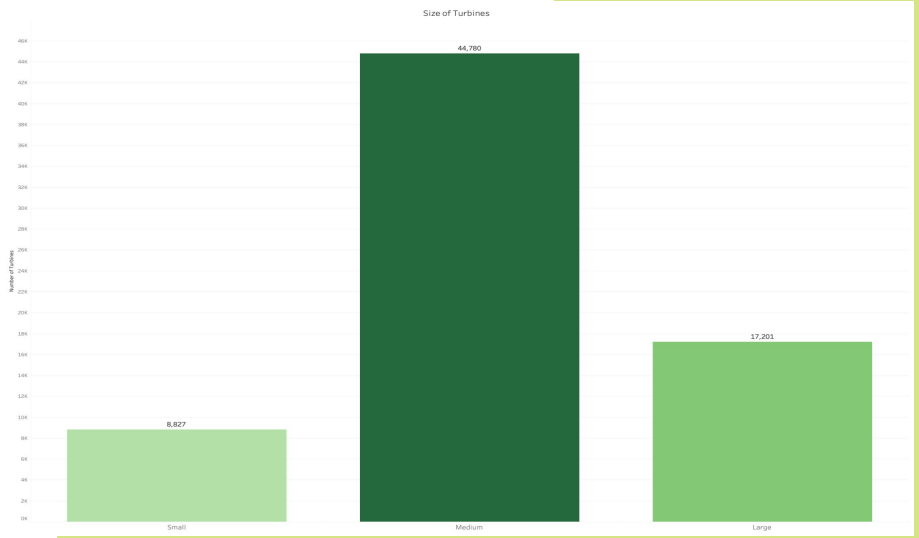
Size of Turbines

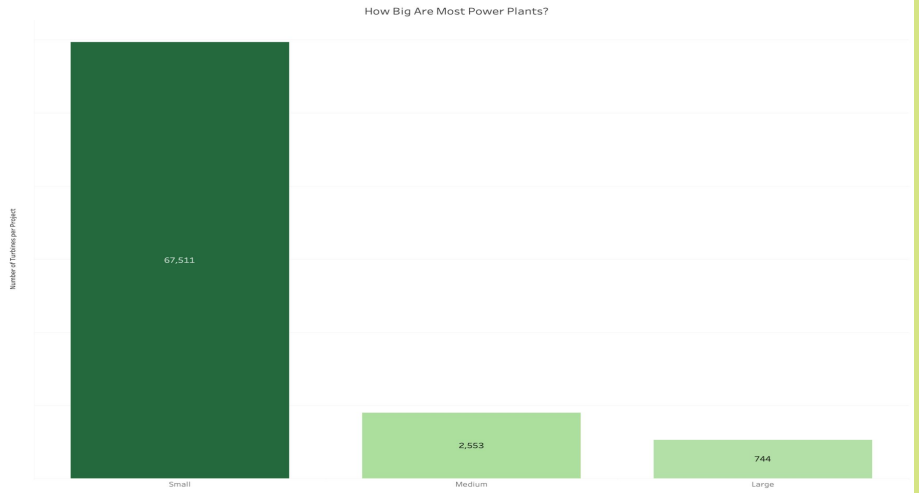
How large are they?

- *The commercial-scale turbines:* placed on 100-meter towers, high as 160 meters (525 feet)
- *Smaller home- or farm-sized turbines:* placed on 30- to nearly 50-meter towers, up to 15 meters (50 feet) high.
- Wind turbine hub heights have significantly increased.

How large are the power plants?

- According to the researchers at the National Renewable Energy Laboratory in the United States, the direct land use for wind turbines comes in at three-quarters of an acre per megawatt of rated capacity. **A 2-megawatt wind turbine would require 1.5 acres of land.**





Wind Power

Wind turbine electricity can be transmitted over long distances through high voltage transmission lines.

The loss in power during transmission is typically around 3% per 1000 miles, according to the U.S. Department of Energy.

The maximum distance it can travel and still be useful depends on factors such as:

- the strength of the wind resource
- the efficiency of the transmission system
- the availability of transmission infrastructure.

Where Are the Wind Turbines Located?

Environmental Issues Pt.1

Land Use: The amount of land needed to put up a wind turbine depends on many things, like the size of the project and where it's located. Wind farms on land take up less space than those in the ocean because the turbines and blades are smaller. While the turbines themselves don't take up much space, they need enough room between them, especially in large wind farms.

Local Wildlife: Wind turbines have the potential to harm wildlife both directly through collisions and indirectly due to factors such as noise pollution, habitat loss, and lower rates of survival and reproduction. Most impacted wildlife are birds and bats.

Manufacturing & Transportation: Wind turbines require significant amounts of raw materials and energy to manufacture, and their transportation to the installation site can generate greenhouse gas emissions. However, the emissions associated with wind turbines are generally much lower than those associated with traditional fossil fuels.

Environmental Issues Pt.2

Airplane Obstructions*:* Wind turbines can be dangerous for planes, especially in areas with low visibility or near airports. To make turbines safer, they have lights and markers to help pilots see them. Wind farms are usually not allowed near plane paths, and they need permission from aviation authorities to be built.

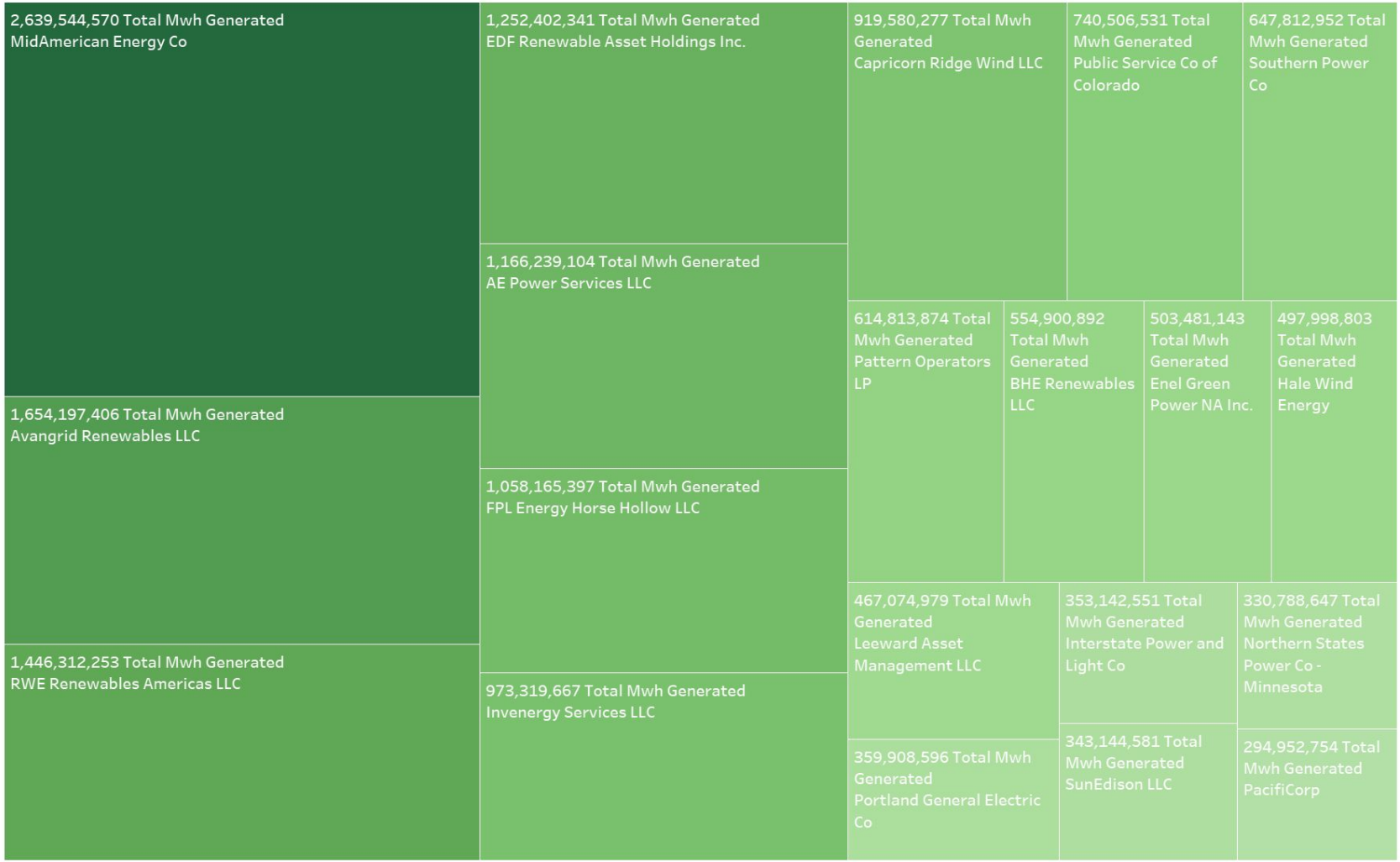
Sound & Visual Impact: The wind turbines can make a significant amount of noise, which can be a disturbance for nearby residents and wildlife. Proper planning and setback distances can help mitigate noise impacts. People are concerned with the visual appeal of the wind turbines and how they can alter the appearance of landscapes.

Operators in the Wind Turbine Industry

Top 5 Wind Turbine Operators in the Industry:

- **MidAmerican Energy Co**: Iowa-based company owned by Berkshire Hathaway Energy that operates a large portfolio of wi turbines across several states.
- **Avangrid Renewables LLC:** Owned by Spanish energy company Iberdrola, it operates wind turbines across the US and has one of the largest renewable energy portfolios in the country.
- **RWE Renewables Americas LLC:** The US subsidiary of German energy company RWE, it operates both onshore and offshore wind farms in the US, with a growing portfolio in several states.
- **EDF Renewable Asset Holdings Inc.:** The renewable energy subsidiary of French electric utility company EDF, it has a large portfolio of wind farms and other renewable energy projects across the US.
- **AE Power Services LLC**: Based in Colorado, it offers a range of services related to wind turbine construction, operation, and maintenance, including engineering, procurement, and construction management.

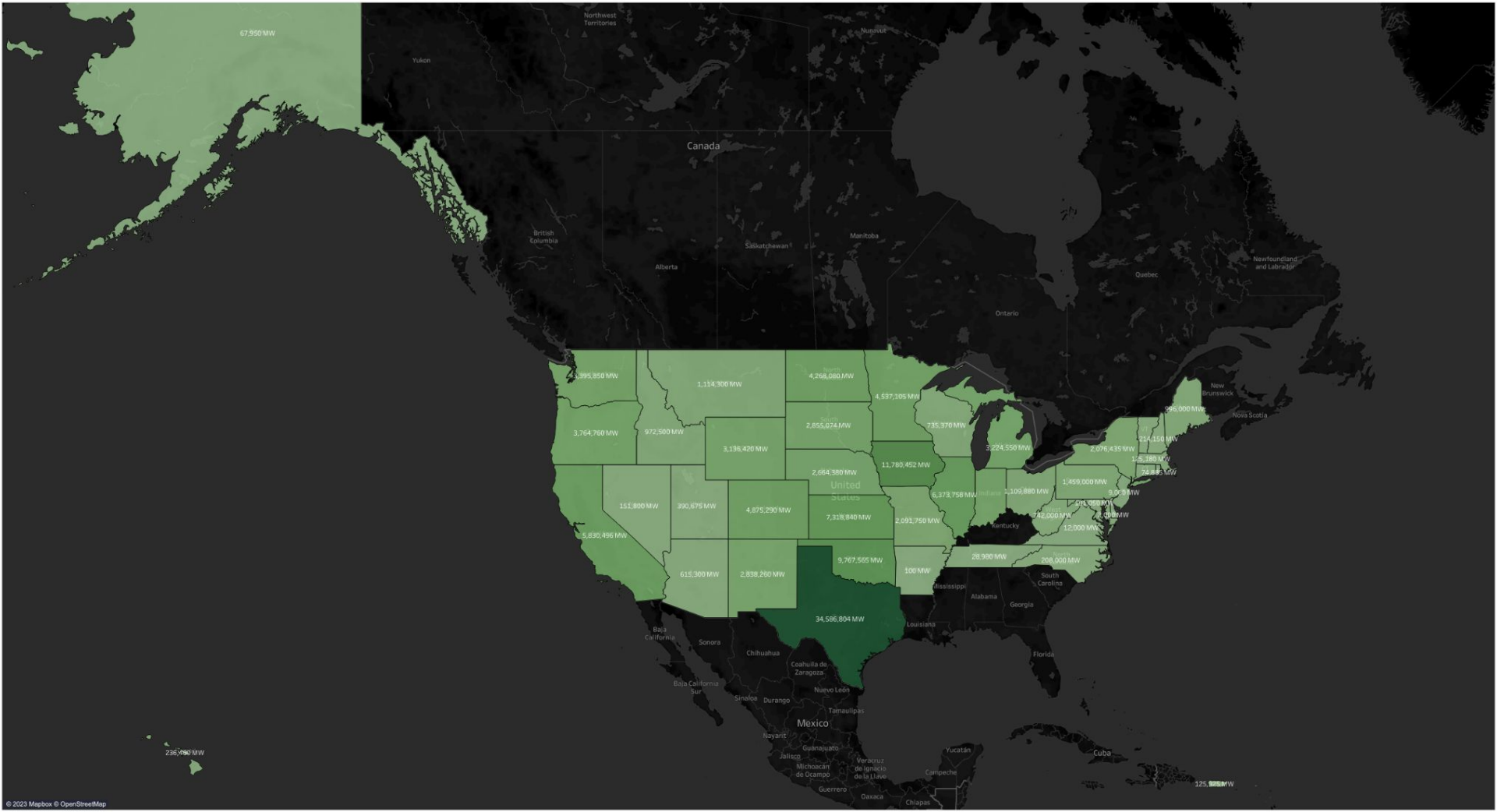
Power Generated Per Operator



Government Contracted

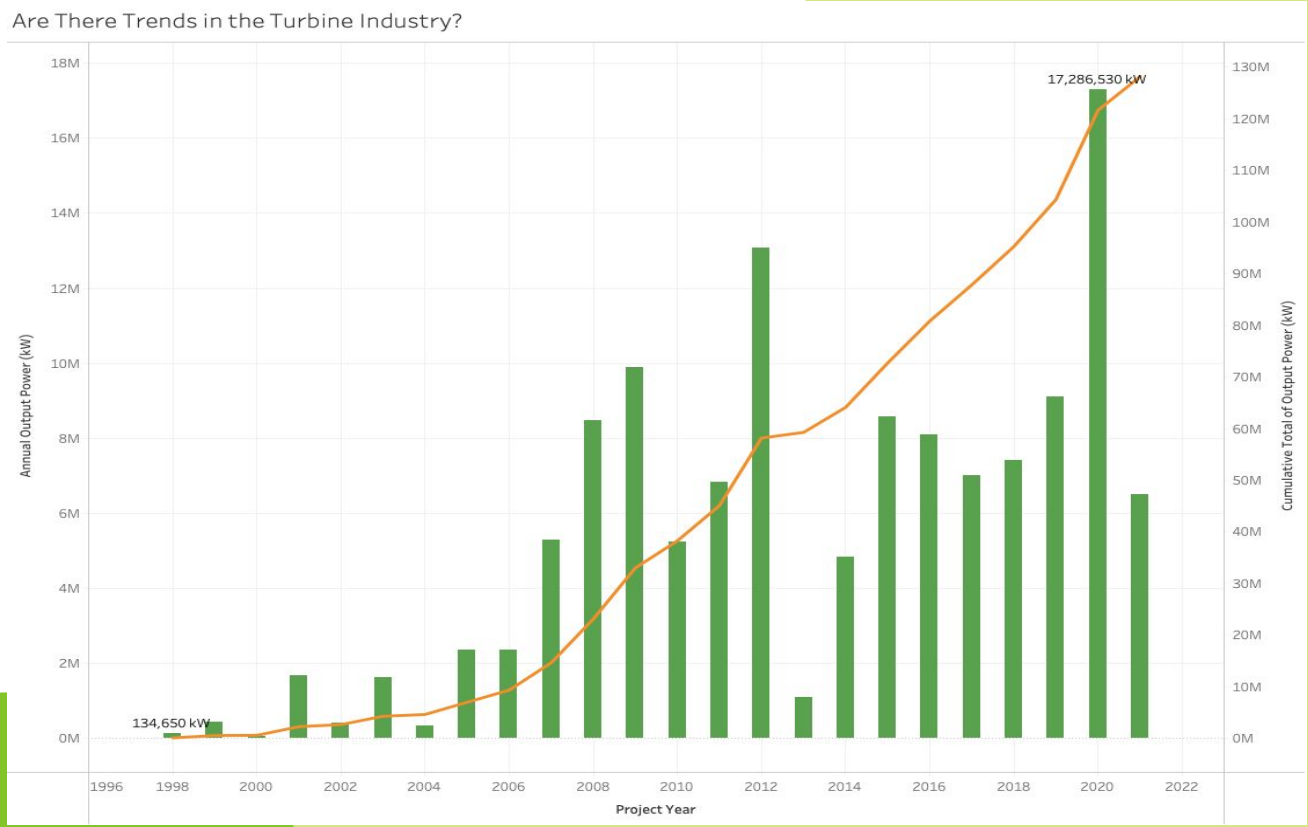
- **RWE Renewables Americas LLC:** Renewable energy company focused on wind, solar and energy storage development, operations and maintenance.
- **EDF Renewable Asset Holdings Inc.**: Renewable energy company with a portfolio of wind, solar, and energy storage projects in North America.
- **Invenergy Services LLC:** Renewable energy company specializing in the development, construction, and operation of wind, solar, and natural gas power projects.
- **Engie North America:** Energy company offering renewable energy solutions, natural gas, and electricity services to customers in the US and Canada.
- **EDF Renewable Services Inc:** Renewable energy company providing operation and maintenance services for wind and solar power projects.

What is the Output Capacity of Turbines By State?



Energy production overtime

As you can see, the energy output of the wind energy industry is growing fast over the last 10 years.



Can wind energy generation be forecast?

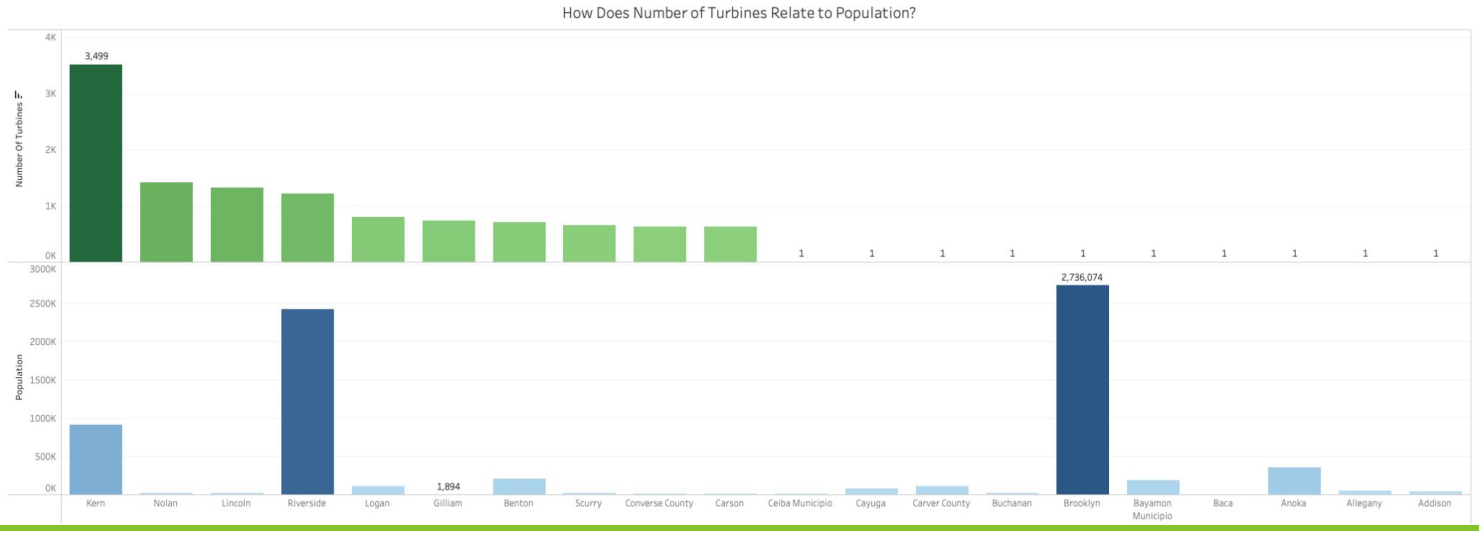
Yes it can! Since wind power requires wind, forecasting models should include weather data in what is called a numerical weather prediction (nwp) model.

Nwp models are based upon current weather and climate conditions run through computer simulations based upon mathematical models.

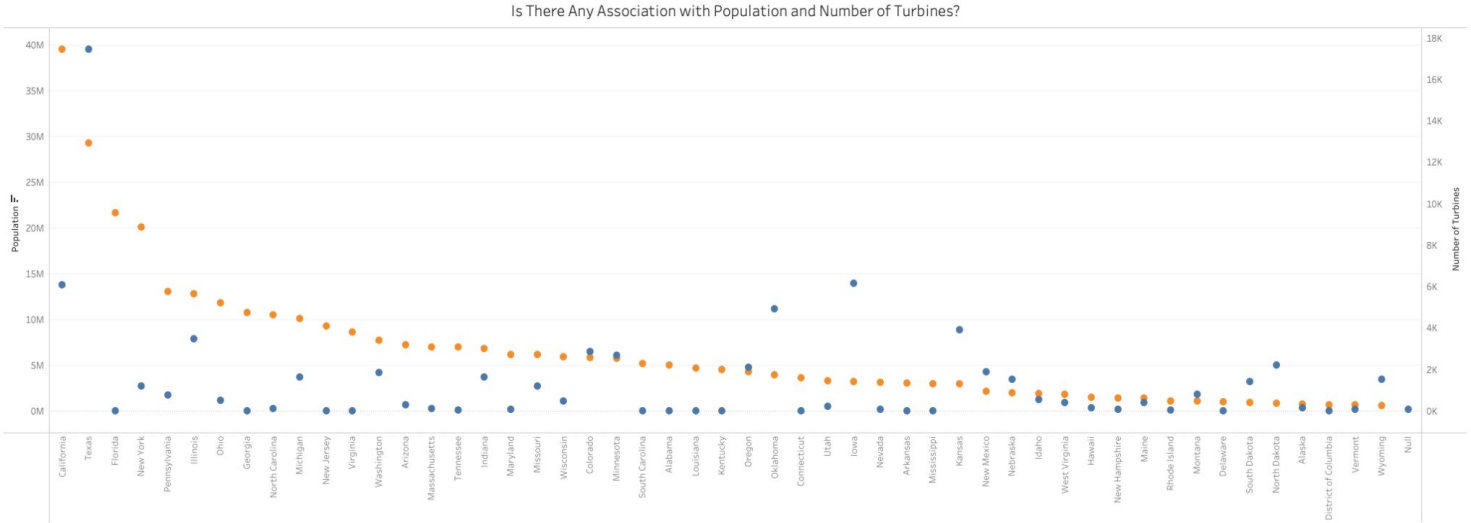
Wind power forecasting has gotten more accurate overtime and will probably continue to be improved as they are constantly tested and reviewed.

The main factors that determine power output are wind speed, air density, and blade radius. This demonstrates that location is highly important for wind turbine location as areas with more consistent and stronger wind will produce more energy.

Top 10
and bottom 10
counties
by population and
comparing
to number of turbines
in same counties



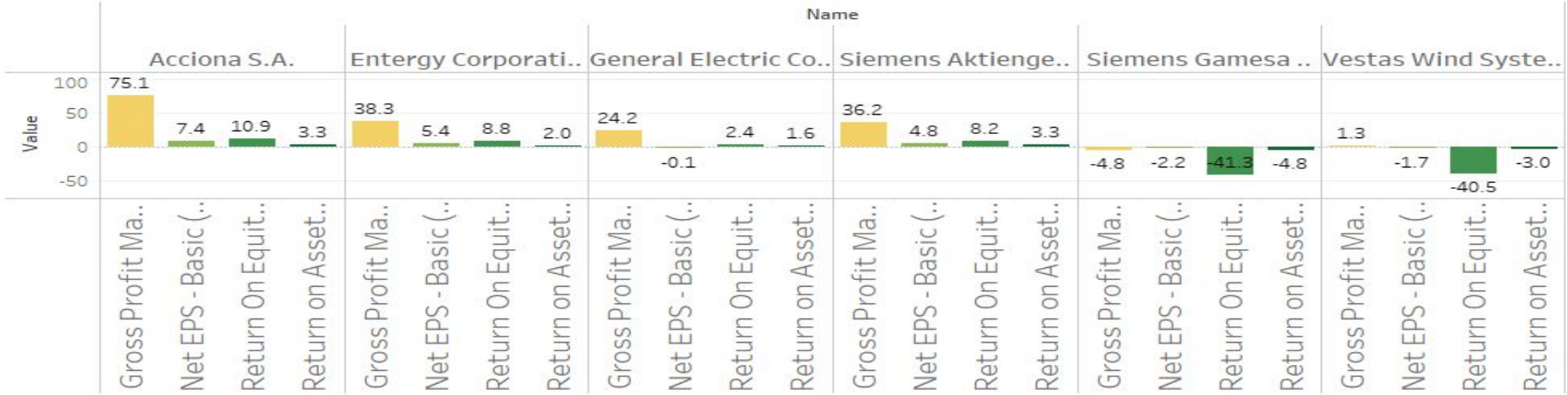
Overall comparison of
state population and
number of turbines



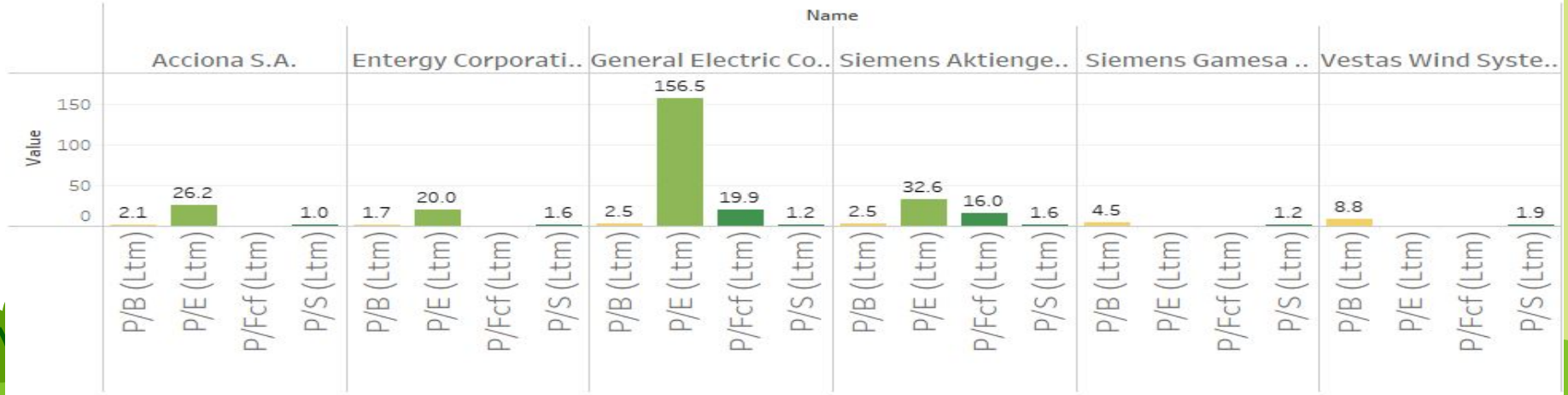
Wind Turbine Market

- Dynamics of Wind Turbine Market in the US
    - Growing Demand for renewable energy
    - Government Incentives and regulations
    - Advancements in Wind Turbine Technology
    - Competitive Market

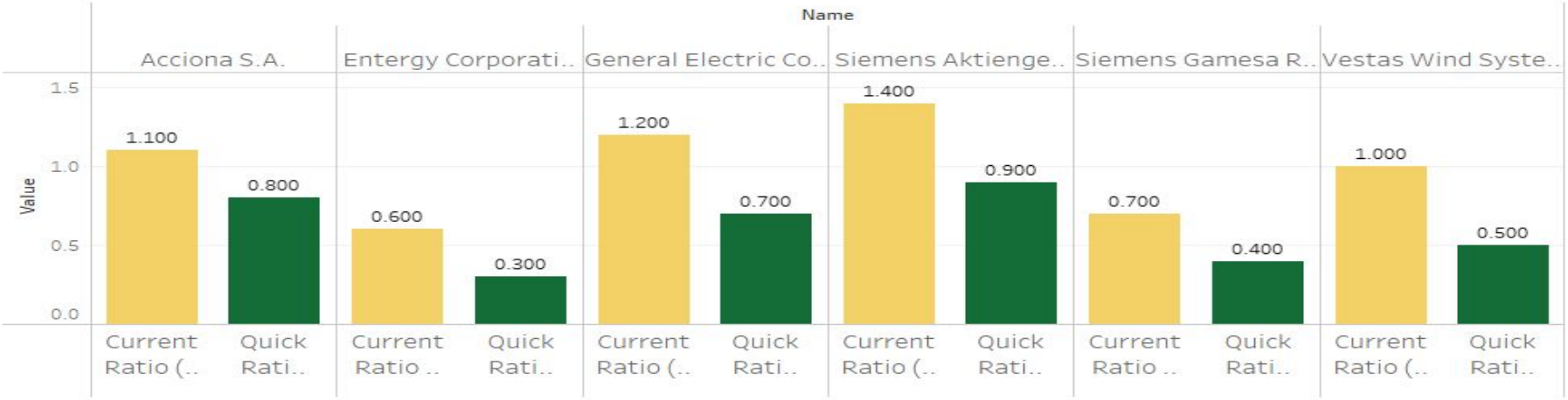
Profitbility Metrics



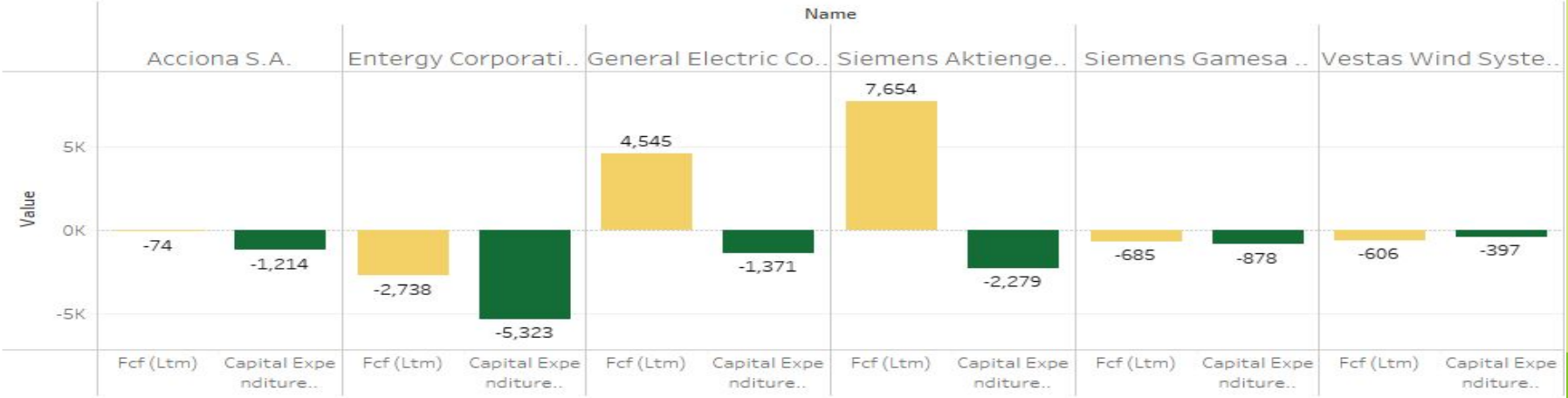
Valuation Metrics



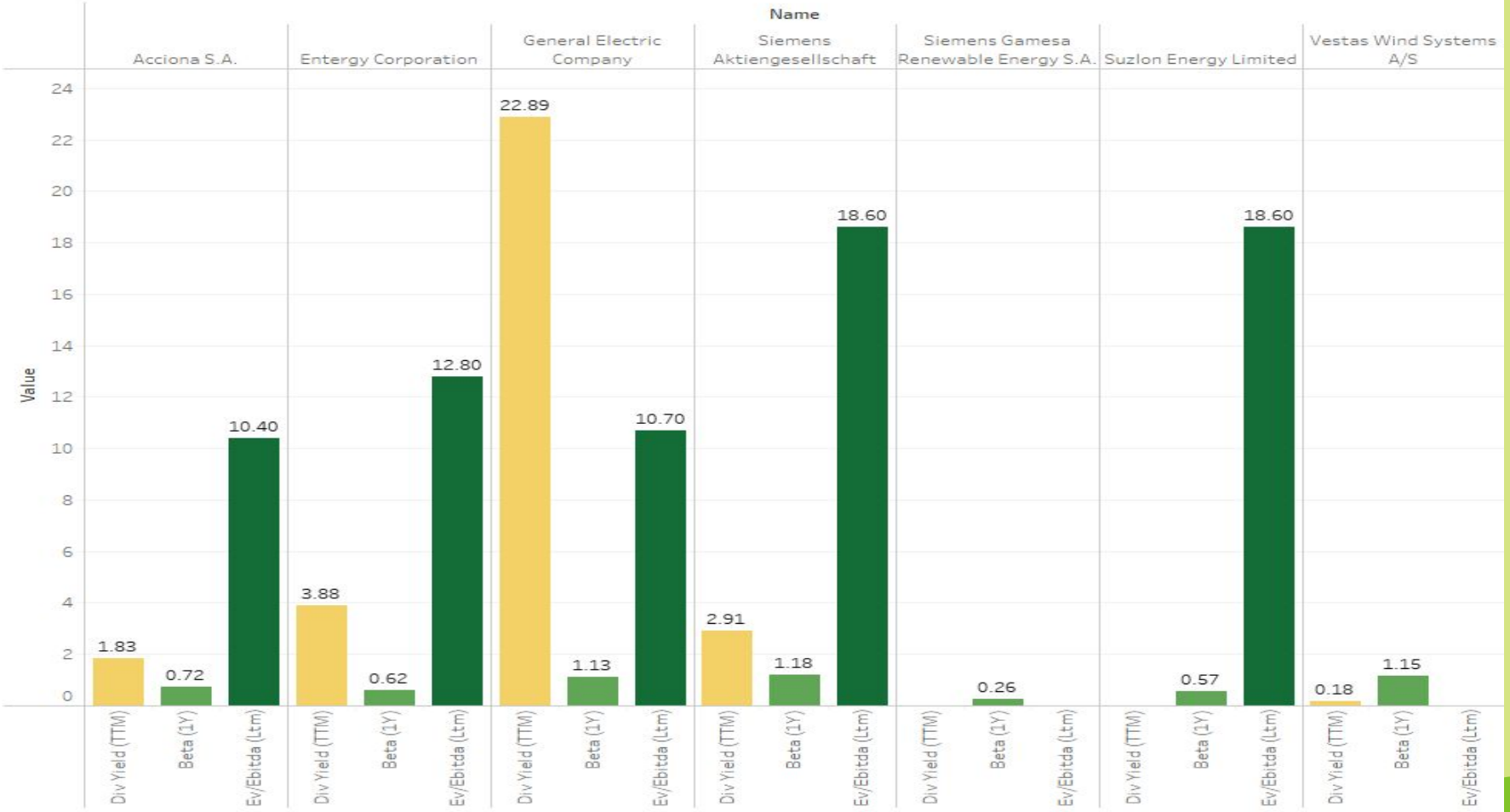
Financial Health Metrics



Cash Flow Metrics



Other Metrics



Recommendation:

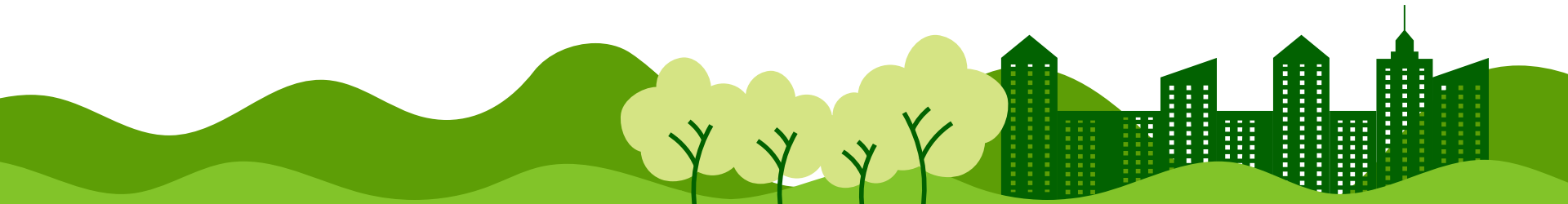
- Which wind turbines operators in the US should they invest in?
  - Government Contracted Operators
  - Manufacturers such as GE, Siemens, and Acciona

Thank You

Any Questions?

Resources:

- https://www.census.gov/



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