# Sprint 22 Mar 2023

| **User Story** | **Status** | **Assignee** | **Notes** |
| --- | --- | --- | --- |
| Justification for Wind Energy | **Launched** | Janisse | Compare Hydro vs Wind Energy  Build business case for wind energy  To confirm with the team what charts / data is required |
| EDA and then do visualizations | **Launched** | Daniel  Avan  Nicholas  Ning | Interesting insights that contribute to the arguments:   * Wind energy is good * This is the company we should invest in   Create copies of powerpoint from Janisse’s template |
| Dashboard | **Not started** | Nicholas | Not done. Not required |
| Rehearse for Presentation | **Launched** | All |  |
| Slide deck | **Launched** | All |  |

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# Sprint 21 Mar 2023

| **User Story** | **Status** | **Assignee** | **Notes** |
| --- | --- | --- | --- |
| Data Cleaning | **Launched** | Daniel  Avan  Nicholas  Ning | Decided on 860, 923 and main wind turbine data file  860: Capacity, Number of Turbines  923: Consumption, Net Generated  WT: Turbine capacity, Turbine specs  Across all 3 files only 1137 plants remain out of 1279 plants initially. |
| Justification for Wind Energy | **In progress** | Janisse | Compare Hydro vs Wind Energy  Build business case for wind energy  To confirm with the team what charts / data is required |
| EDA and then do visualizations | **In progress** | Daniel  Avan  Nicholas  Ning | Interesting insights that contribute to the arguments:   * Wind energy is good * This is the company we should invest in   Create copies of powerpoint from Janisse’s template |
| Modeling (Forecasting) | **Launched** | Daniel | To analyze and optimize  To create growth rate for picked companies |
| Modeling (Clustering) | **Launched** | Nicholas | To confirm with Kishan approach - Done  To include Ning’s Analysis |
| Time Series Analysis | **Launched** | Ning | To come up with time series feature  Analyse for insights |
| Pick a few companies and then do ROI Calculations / Market Research | **Launched** | Avan | What is IPP vs Electric Utility |
| Dashboard | **Not started** |  |  |
| Rehearse for Presentation | **Not started** |  | To be done on Wednesday |
| Slide deck | **Not started** |  | To be done on Wednesday |

* Try to pick big companies
* Manufacturer or Operator investment?
* Financial analysis can we impute based on listed companies because our recommendations might be smaller companies
* Potential AM is Green, Market size (TAM)

# Sprint 20 Mar 2023

| **User Story** | **Status** | **Assignee** | **Notes** |
| --- | --- | --- | --- |
| Justification for Wind Energy | **In progress** | Janisse | Compare Hydro vs Wind Energy  Build business case for wind energy |
| EDA | **In progress** | Daniel  Avan  Nicholas  Ning | Avan - aggregate the dataset under ‘Plant Name’, we need generation, capacity, consumption and turbine specs if possible - Done  Nicholas - Clustering Model  Daniel - Data pipeline for ARIMA  Ning - EDA and data decay analysis |
| Modeling (Forecasting) | **Launched** | Daniel | Basic forecasting model done. To analyze |
| Modeling (Clustering) | **Launched** | Nicholas | Built skeleton for clustering algorithm |
| Visualizations | **Not started** |  | To be done on Tuesday |
| ROI Calculation | **Not started** |  | To be done on Tuesday |
| Rehearse for Presentation | **Not started** |  | To be done on Wednesday |
| Slide deck | **Not started** |  | To be done on Wednesday |

# Sprint 16 Mar 2023

| **User Story** | **Status** | **Assignee** | **Notes** |
| --- | --- | --- | --- |
| Users need clean data to do analysis for the wind market for the main sheet | **Launched** | Avan | Multiple EIA ID - why? |
| We need to rename columns for us to easily understand columns to make the EDA process easier for the main sheet | **Launched** | Avan | Done |
| We need to link the energy market to wind data to get analysis on ROI | **Launched** | Daniel | EIA\_ID and Plant ID can be used to match both datasets  We can try and impute missing 4000 EIA\_ID so that we can match energy generation and consumption to turbine specs |
| We need to understand how to collaborate on the same shared folder/files | **Launched** | Nicholas | Agreed to use Github to store project documents  No branches  Will monitor and switch to other methods if its not working out |
| We need to get the latest updated data based on 2023 or other data sources OR just decide to use data from 2022 | **Launched** | Nicholas | Included updated and new potential data sources and explanation in [Data sources](#_8fjwn8hrr652) and also in Github |
| Research of Wind Source vs other Energy Sources | **Launched** | Janisse | Renewable sources (especially wind) has been increasing  Possible technological advancement for Wind |
| Qualitative Research of the Wind Market | **Launched** | Ning | Slides for review - general negative outlook |

**Meeting Notes**

* Missing EIA\_ID data - Daniel to work on it
* Wind Curtailment issue / Cost and value comparison - will it completely stop our project and research? -> Nicholas to do worst case scenarios to see the wind generation vs sales
* What to do about hybrid plants? Create a new feature called hybrid or not
* Renewable certificates - impact on project?
* How many companies should they invest in?
* Find sales by plant?

**Qi Xiang on Monday**

* Can we do other energy (e.g Solar)?
* Investing in manufacturer (turbine specs) or operator (plant efficiency) or both?
* What is the budget?

**Direction**

* Clustering k means

3 groups

1. High efficiency low ROI (battery recommend this one)
   1. **Company A: $100k**
   2. **Company B: $200k**
   3. Company C: $300k
2. High ROI low efficiency (renewable cert recommend this one)
3. Medium efficiency medium ROI (balanced approach)

# Data sources

## MACRO-Numbers

Generation by Resource Type Annual

<https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_1_01>

Generation by Resource Type (only renewables) Annual

<https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_1_01_a>

Capacity by Resource Type

<https://www.eia.gov/electricity/annual/html/epa_04_03.html>

**Nameplate generation capacity** – Determined by the manufacturer of the generator

**Net summer generation capacity** – Determined by performance tests during peak demand between June 1 – September 30

**Net winter generation capacity** – Determined by performance tests during peak demand between December 1 – February 28.

**Capacity is not the same as electricity generation**

Power plants have a capacity to produce a certain amount of power during a given time, but if they are taken offline (i.e. for maintenance or refueling) then they are not actually generating power. Nuclear power plants had a 8% share of the total U.S. generation capacity in 2021 but actually produced 19% of the country’s electricity due to its high capacity factor.

New features -> plant efficiency = generation/capacity(t\_cap or p\_cap?)

New feature -> return on investment = electricity consumed/generation

New feature -> Variance (KIV)

Sales by Sector (mW) Annual

<https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_01>

Sales by Sector ($) Annual

<https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_02>

**-> We can get CAGR of energy market from this**

**-> Total generation =/= Total sales, some of the generated energy is just lost because they must produce based on forecasts and in real time**

**-> Providers sell to 10 main distributors in the US**

**-> There are 4 sectors to sell to (Residential, Commercial, Industrial, Transportation)**

## micro-numbers

EIA 923 (Yearly release)

<https://www.eia.gov/electricity/data/eia923/>

* 1989 to 2022 data available
* Breakdown of generation by Plant Id and Month
* Breakdown of consumption by Plant Id and Month

**Overall picture**

1. Should we invest in wind energy? → most likely a ‘yes’ → justify
   1. Energy sources
   2. Wind energy market CAGR
2. Which turbine manufacturing company - t\_manu
3. What type of project
   1. Location - t\_state, t\_county, t\_fips, xlong, ylat
   2. Project size - p\_tnum, p\_cap
   3. Power capacity - t\_cap
   4. Size of turbines - t\_hh, t\_rd, t\_rsa, t\_ttlh (most probably will be linked to power capacity)
4. Costs
   1. How long it takes to construct -
   2. Retrofitting requirements and costs - retrofit, retrofit\_year
5. ~~Benefits? ROI?~~
6. Do we need a model? What to optimize?
   1. Clustering? To moneyball the wind companies

**Main Questions to Answer**

| User Story | Category | Assignee | Status |
| --- | --- | --- | --- |
| Powerpoint deck for the client. You can pick a slide template from https://slidesgo.com/ and download it |  |  | Not started |
| Are there any trends in the wind turbine industry over time? | Wind turbine market in general |  | Not started |
| As a potential investor, I want a recommendation on which wind turbine operators in the US market I should approach to invest in | Wind turbine operators in the US market |  | Not started |
| As an investor, I want to better understand any environmental issues with building wind turbines. | About wind turbines |  | Not started |
| As an investor, I want to better understand wind turbines so that I can make an informed decision on where to invest. | About wind turbines |  | Not started |
| As an investor, I want to know the dynamics of the Wind Turbine market in the US, so I can work out whether to invest in it | Wind turbine market in the US |  | Not started |
| As an Investor, I want to know who operates the wind turbines in the USA, and also whether they operate other types of power plants, so I can assess potential takeover targets. | Wind turbine operators in the US market |  | Not started |
| As an investor, I want to know who owns which plants (and their turbines) across the USA, so I can assess the footprint of turbine owners in the USA. | Wind turbine operators in the US market |  | Not started |
| As an investor, I want to see the locations and output power (capacity) of wind turbines across the USA. | Wind turbine operators in the US market |  | Not started |
| As an investor, I want to understand the global energy market and what part wind turbines play within it. | Global energy market |  | Not started |
| As an investor, I want to understand the locations that the wind turbines are in, and how that matches with population data. | Wind turbine market in the US |  | Not started |
| As an investor, I want to understand whether wind power capacity can be forecast, to maximise the amount of wind power that can be generated, and minimise the amount of electricity that is wasted to produce wind power. | About wind turbines |  | Not started |
| Average wind speeds overlaid on a map of all wind turbines in the US, to show potential opportunities | Wind turbine market in general |  | Not started |
| How transferable is wind power that is generated? How far can it travel and still be useful? | About wind turbines |  | Not started |
| What is the future of wind turbines?  Use machine learning to predict the future. | Wind turbine market in general |  | Not started |
| What is the total capacity per equipment manufacturer (OEM) of wind turbines? | About wind turbines |  | Not started |
| Who are the main players in the original equipment manufacturer (OEM) market for wind turbines in the USA? How good are their turbines? | Wind turbine market in the US |  | Not started |