MGT 6203 Group Project Proposal Team 27

Please edit the following template to record your responses and provide details on your project plan.

TEAM INFORMATION (1 point)

Team #: 27

Team Members:

1. Kerri Robinson; krobinson78
    a. Graduated from the University of South Carolina in 2018 with a degree in Math. Then started working as a Data Analyst at Bank of America in the Quantitative Rotational Program for 2 years. After the Program I joined the Consumer Credit Card Strategies Team as a Data Analyst and have been there for 2 years. I analyze different credit card strategies to help create criteria and exclusions to meet loss expectations. Last semester in CSE 6242, my group and I created a data visualization in Tableau that showed the relationship between different podcasts based on a cosine similarity score. We took the transcripts from episodes and created keywords for each episode and then the top keywords for each show. Then calculated a similarity score based off of the number of similar keywords between shows. The interactive visualization was a network graph where users could use filters or select on a node and all similar nodes would be highlighted.
2. Andrew McAlister; amcalister7
    a. Graduated from Purdue University in 2007 with a BS in Computer & Information Technology. Worked from 2007 to 2012 for Bank of America as a Business Analyst supporting internal reporting for deals and AML/KYCS for their Corporate and Investment Bank. Since 2012, I've been working at Premier in their clinical intelligence department. I'm currently a Product Manager developing quality dashboards that help acute-care hospitals track and predict performance in several national regulatory and public ratings programs. This is my 3rd class in OMSA and first group analytics project.
3. Felipe Gastaldi; fgastaldi3
    a. Graduated from Boston College in 2018 with a BS in Marketing and Finance and a Minor in French. Worked in management consulting for Heidrick & Struggles for 1.5 years before transitioning to Nike/Converse. Currently working as a Product Solution Manager, Digital Workflow focused on creating workflows using robotic process automation and SmartSheet for the digital product creation group. Work closely with product, design, merchandising, and development to streamline and expedite the product creation process. Started in OMSA in Spring 2022 and this is my 2nd class. Previously completed ISYE 6501. Most recently built a revenue tracking visualization dashboard in Tableau for Converse that allowed the Global Merchandising function to dynamically view performance based on geography and product

offering. This dashboard enabled an 80/20 analysis that has led to cutting 80% of products from the carryover line (products that exist across multiple seasons and replace new offering).

4. Swathi M. Naik; SNAIK72
    a. I graduated from Mumbai University in 2008 with a BE in Electronics and Telecommunication Engineering. Worked for TATA Consultancy Services as an Oracle Developer in banking and Finance domain. Worked with Accenture for a French Telecommunication Project as an Oracle Developer. Worked with Concentrix as a PL/SQL and Salesforce Developer for Automotive clients. Later I worked for FORD Motor Company as a contractor as a Product Designer. Currently, I am working for the Life Sciences Company AXTRIA on Snowflake and IICS technologies. This is my second subject in the course. I enjoyed learning ISYE 6501 in the previous semester. My current company deals with analytics extensively and I am hoping to gradually move to decision sciences and analytics .
5. Changhong Guan, GT Id: cguan8
    a. BS from Harbin Institute of Technology, major in control science, focused on guided missile. MS from NCSU, major in mechanical engineering, focused on MEMS. Worked in consumer electronics market for 12 years, developed products including monitors, antennas, set-top-boxes, speakers, etc. Now I am looking for a quick career path change in data analytics. Started OMSA in Spring, finished three basic core courses and simulation, this is my 5th class along with other 4 for summer.

OBJECTIVE/PROBLEM (5 points)

Project Title:

Country Wind Energy

Background Information on chosen project topic:

Due to various reasons including changes in energy cost dynamics, advancements in new technologies, response to climate change, and geopolitical pressures, there has been a steady push for developed nations to shift from heavy reliance on fossil fuels to more alternative sources of energy. While this push is continuing and growing every day, there is still heavy reliance by European nations (as with most nations) on oil.

Traditionally, Russia has been the primary supplier of oil to its European neighbors. In response to the Russian invasion of Ukraine in 2022, nations in the EU have systemically imposed economic sanctions on Russia and as a result are facing a reality of being cut off from the Russian oil supply. While short-term arrangements with alternative suppliers are in the works, it's clear this global trade shift will add increased pressure on the adoption of alternative energy.

Some European nations like Germany and France have had more advanced developments in the search for alternative energy sources and have largely mapped out their future progressions. However, there are still countries in a less-advanced state of alternative energy adoption. It will be critical for energy suppliers to project where those countries are headed and capitalize on these growth opportunities while the added pressures are in place for adoption of their technologies.

Problem Statement (clear and concise statement explaining purpose of your analysis and investigation):

Analyzing historical alternative energy trends with the most advanced European countries, how can we project future alternative energy adoption for less-sophisticated European nations and how key energy companies might financially benefit from their adoption?

State your Primary Research Question (RQ):

Focusing on a European nation that is less advanced at adopting alternative energy, like Poland, how could their future increased adoption due to new market pressures financially impact the top wind energy companies in the European market?

Add some possible Supporting Research Questions (2-4 RQs that support problem statement):

1. What does Poland's future wind adoption rate look like?
2. Can we leverage historical wind adoption rates from a more advanced European nation like Germany to project adoption for a country like Poland?
3. Does climate data support a similar adoption rate for Poland as it does for Germany?
4. With projected revenues increasing for our key wind energy providers, what sort of impact will that have on projected stock prices?

Business Justification: (Why is this problem interesting to solve from a business viewpoint? Try to quantify the financial, marketing or operational aspects and implications of this problem, as if you were running a company, non-profit organization, city or government that is encountering this problem.)

Large energy companies are some of the most heavily analyzed publicly traded companies. Models are routinely built to project future energy growth forecasts along with any outside factors that could alter those forecasts like climate data or changes in public policy. What is less likely to be included in most models is sudden and large shifts in policy due to less predictable events like pandemics or wars.

Russia's invasion of Ukraine and the resulting geopolitical reactions have caused a massive shift in the economics of the energy markets on top of the changes already being felt by the COVID-19 pandemic. These shifts can provide massive opportunities for changes in energy policy and for new market dynamics to benefit key market players that are positioned for growth.

This analysis will allow us to predict one potential shift in this market and the resulting opportunities key companies will have to take advantage of it. The result will be data that those companies could use to set their corporate strategy or for outside investors to predict those moves in hopes of investing before that growth occurs.

DATASET/PLAN FOR DATA (4 points)

1. Energy data: from Our world in data,

https://github.com/owid/energy-data

https://ourworldindata.org/energy-key-charts

Data is on energy consumption (primary energy, per capita, and growth rates), energy mix, electricity mix and other relevant metrics. The key variables we are interested in are, "year" "country" "wind_electricity" "gdp" "population". Our analysis will be filtered on results for Germany and Poland.

Screenshot:

```
> data_germany_wind
     year country wind_electricity          gdp population
6163 1986 Germany            0.001 1.916181e+12   77806136
6164 1987 Germany            0.002 1.945056e+12   78015744
6165 1988 Germany            0.008 2.009990e+12   78307520
6166 1989 Germany            0.026 2.075675e+12   78660304
6167 1990 Germany            0.070 2.015548e+12   79053984
6168 1991 Germany            0.220 2.140549e+12   79490832
6169 1992 Germany            0.290 2.206446e+12   79963168
6170 1993 Germany            0.670 2.210102e+12   80428552
6171 1994 Germany            1.430 2.290161e+12   80832928
6172 1995 Germany            1.710 2.356397e+12   81138656
```

2. Wind turbine market share,

https://www.statista.com/statistics/272813/market-share-of-the-leading-wind-turbine-manufacturers-worldwide/

Pie chart of companies' market share in wind turbines business.

3. Vestas and Gamesa financial reports,

https://www.vestas.com/en/investor/reports-and-presentations/vestas-reporting

https://www.siemensgamesa.com/en-int/investors-and-shareholders/financial-information/annual-reports

Here the key variables we are mainly focusing on are revenue and mw Sold.

Screenshot:

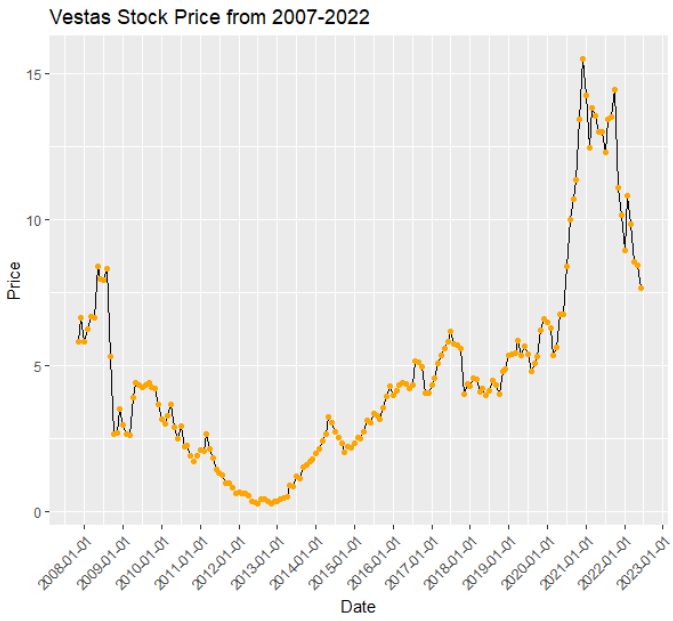
```
> data
   Year Company Revenue  P.L mW.Sold
1    NA            mEUR mEUR      MW
2  2007  Vestas    3828  104    4974
3  2008  Vestas    5904  470    6160
4  2009  Vestas    5979  125    6131
5  2010  Vestas    6920  156    4057
6  2011  Vestas    5836 -166    5054
7  2012  Vestas    7216 -963    6171
8  2013  Vestas    6084  -82    4513
9  2014  Vestas    6910  392    6125
10 2015  Vestas    8423  685    7948
11 2016  Vestas   10237  965    9957
12 2017  Vestas    9953  894   11237
13 2018  Vestas   10134  683   10676
14 2019  Vestas   12147  700   12618
15 2020  Vestas   14819  771   17055
16 2021  Vestas   15587  176   17845
17 2007  Gamesa    3247  220    3289
18 2008  Gamesa    3834  320    3684
19 2009  Gamesa    3229  115    3145
20 2010  Gamesa    2764   50    2405
```

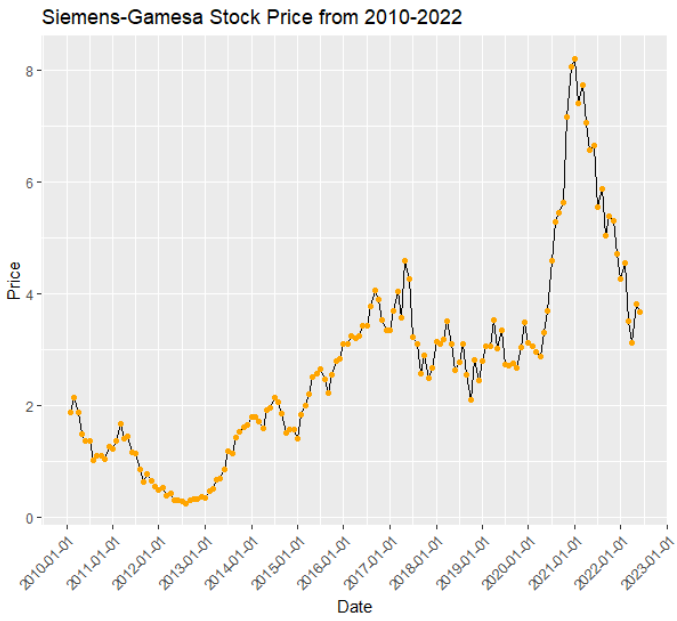
4. Vestas and Gamesa stock price, from yahoo finance,

https://finance.yahoo.com/quote/GCTAY/history?p=GCTAY

https://finance.yahoo.com/quote/VWDRY/history?p=VWDRY

Stock price of two tickers. We are only interested in “date” and “Adj.Close” price.





Data Description (describe each of your data sources, include screenshots of a few rows of data):

Listed above/under each data source.

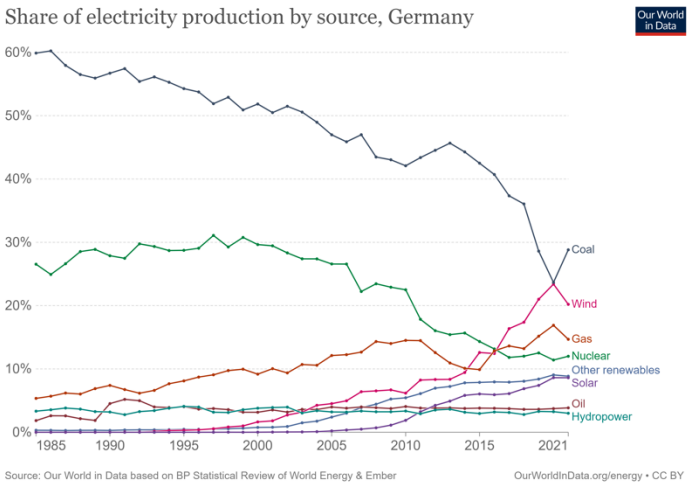
Key Variables: (which ones will be considered independent and dependent? Are you going to create new variables? What variables do you hypothesize beforehand to be most important?)

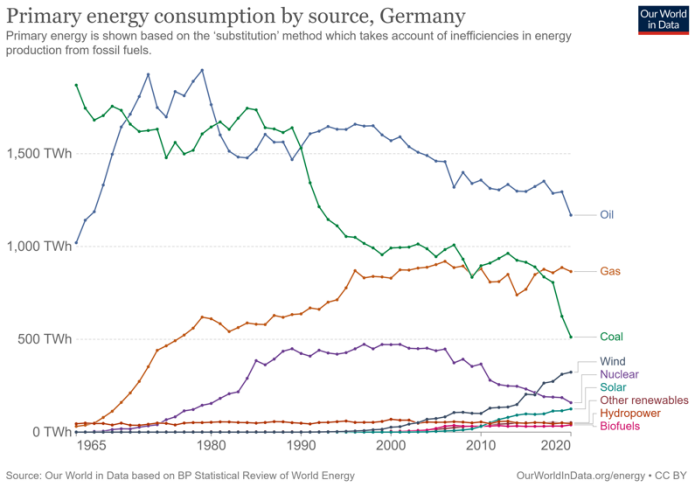
Our key dependent variable will be projected stock price for a company that can successfully capitalize on the opportunity to move into/capture a new market like Poland. Some of our key independent variables include historical wind energy adoption rates, projected growth rate, population size, historical energy consumption, price of oil, time of peace/war, and estimate of maximum wind energy production, historical company performance, country GDP, and year.

APPROACH/METHODOLOGY (8 points)

Planned Approach (In paragraph(s), describe the approach you will take and what are the models you will try to use? Mention any data transformations that would need to happen. How do you plan to compare your models? How do you plan to train and optimize your model hyper-parameters?))

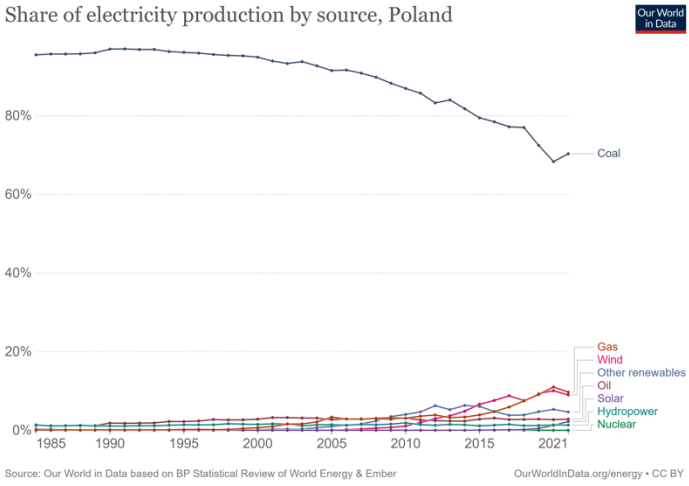
1. **Pre Russian-Ukraine conflict**
    1.1. Germany Case

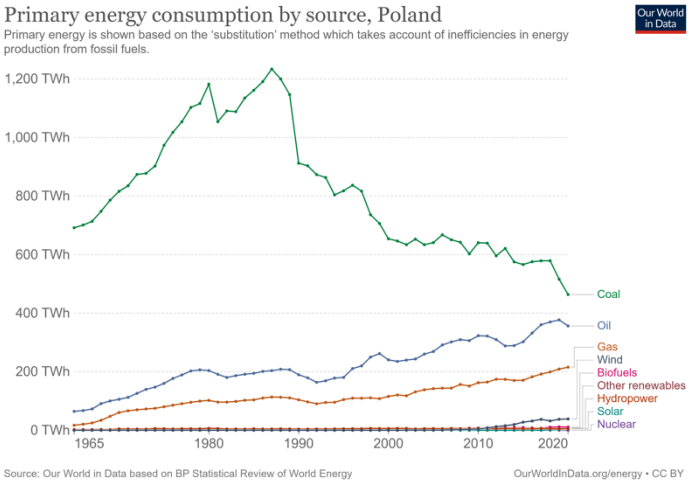




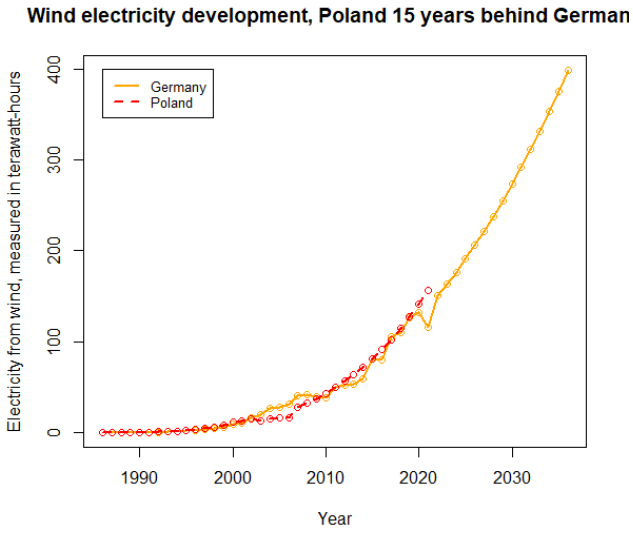
We'll begin our analysis by reviewing the state of renewable energy growth in Germany. Observe from the chart above, wind is the fastest growing renewable energy source in Germany, in both volume and percentage. We'll use a simple linear regression (SLR) model with electricity from wind as the dependent variable and year as the independent variable to find lambda for BoxCox transformation. Germany Lambda = 0.34. We'll apply a BoxCox transformation on the dependent variable (wind_electricity), and re-train the SLR model and analyze SLR model assumptions. As shown in Fig1 and Fig 2, after BoxCox transformation, the dependent variable presents good linear relationship with year, and residual assumptions hold. We end up with a prediction for the next 15 years for Germany as shown in Fig 3.

1.2. Poland Case





Next, we'll do a similar analysis with Poland. Observe in that chart above that wind energy is still at an early stage in terms of the percentage of total energy source, but it is the fastest growing renewable energy source in Poland as well. We'll follow the same SLR model procedure as with Germany, and we find Poland Lambda = 0.26. After the same BoxCox transformation, we have an SLR model for Poland as shown in Fig 4. Fig 5., and our residual assumptions hold. As before, we predict the next 15 years for Poland as shown in Fig 6. If we plot Electricity generation from wind, measured in terawatt-hours, vs year on Germany and Poland, and move Poland year ahead 15 years, both countries follow similar parabolic trajectories and Poland's wind electricity adoption rate is slightly faster.



2. Post conflict triggers faster adoption

Now we move to next phase of our analysis. Our assumption is that after the Russian-Ukrainian conflict, European countries are going to accelerate pace in adopting renewable energy. We'll use China as a control group for comparison, since China has been setting record for building infrastructures and adopting renewable energy for years. With SLR, China's Lambda = 0.06. We assume three business scenarios going forward, based on the BoxCox Lambda:

	Lower Bound Rate	Projection Rate	Upper Bound Rate
Germany	0.34	(0.34+0.06)/2=0.2	0.06
Poland	0.26	(0.26+0.06)/2=0.16	0.06
China	0.06	0.06	0.06

Keep in mind that available wind energy ("floating wind") is capped due to country size. Electricity from wind will reach a ceiling and plateau the growth curve. If our projection hits the ceiling, we will further optimize the models (logistic regression) based on "floating wind" from each country.

3. **Two companies in wind turbines business: Vestas and Gamesa**

Once we complete our analysis on what a post-conflict acceleration in wind adoption might look like we want to view the potential impact on two major players in European wind energy; Siemens-Gamesa – Ticker: GCTAY (OTCMKTS), and Vestas – Ticker: VWDRY (OTCMKTS). For this analysis we'll utilize their annual financial data. We'll then project the Germany and Poland markets as a % of the two companies' total business, using a linear regression model. We'll then convert that to Siemens-Gamesa' and Vestas' wind turbine business growth over the next 15 years.

4. **Conclusion**

We'll finish our analysis with investment recommendations based on projected company revenue growth %.

Anticipated Conclusions/Hypothesis (what results do you expect, how will you approach lead you to determining the final conclusion of your analysis) Note: At the end of the project, you do not have to be correct or have acceptable accuracy, the purpose is to walk us through an analysis that gives the reader insight into the conclusion regarding your objective/problem statement

Our hypothesis is wind turbine market sector will experience accelerated exponential growth in next few years. We will provide expected return with confidence intervals for the two companies we researched.

What business decisions will be impacted by the results of your analysis? What could be some benefits?

Our goal in this analysis is to predict long-term revenue potential for a firm that captures a large share of the emerging wind-energy market in a specific country, then use that to provide a stock price target. By successfully proving the first-mover advantage associated with capturing a previously coal-dependent market like Poland, our analysis could lead a firm such as Vestas Wind Systems A/S or Siemens AG to shift focus and target the Polish market.

With demand for renewable energy consistently increasing over the years, and events like the Ukraine-Russia conflict accelerating adoption and the desire to shift away from fossil fuels, moving into markets that were previously dependent on traditional energy sources could drive significant revenues. In addition, successful implementation in one country could position Vestas or Siemens for significant growth across other emerging markets as wind-energy becomes a more readily available and cost-effective alternative. In short, by becoming the key player in Poland, Vestas or Siemens would create a lucrative foothold in Europe which could result in long-term revenue growth across emerging wind-energy markets.

Benefits associated include increased revenue, heightened brand recognition, customer loyalty, ability to capture large corporate/government contracts, price definition, and prime real-estate. Additionally, Vestas or Siemens would have the power to define the market and how it operates in Poland.

PROJECT TIMELINE/PLANNING (2 points)

Project Timeline/Mention key dates you hope to achieve certain milestones by:

We expect this project to take roughly one month to one and a half months to complete. Below is our timeline of events/milestones we will reach in order to have the project completed in time.

6/14/22 - Have Topic and Datasets Done and Listed in Teams – All members contributed evenly

6/17/22 - Have Proposal Draft Completed for Team to Review – All members contributed evenly

6/21/22 - Have Proposal and Datasets Submitted Before Due Date – All members contributed evenly

6/22/22 - Have Dataset in Datasource and All Members Set Up – All members contributed evenly

6/24/22 - Cleaning of Data Finished

6/24/22 - Find 2 or 3 Research Papers for Progress Report Video

6/30/22 - Have Progress Report Video and Draft Completed for Team to Review

7/5/22 - Have Progress Report and Video with Slide Submitted Before Due Date

7/8/22 - Have Analysis/Coding Done

7/13/22 - Have Visualizations Done

7/15/22 - Have Final Drafts Completed for Team to Review

7/19/22 - Have Final Presentation Submitted Before Due Date

7/23/22 - Have Final Report, Slides, Data and Code Submitted Before Due Date

We will have weekly team meetings, meeting once or twice per week to go over target dates, divide up work and share independent progress reports with the team. We will either stick to schedule or be ahead of

schedule and keep each other accountable. We will also assist team members when needed to meet target dates.

Appendix (any preliminary figures or charts that you would like to include):

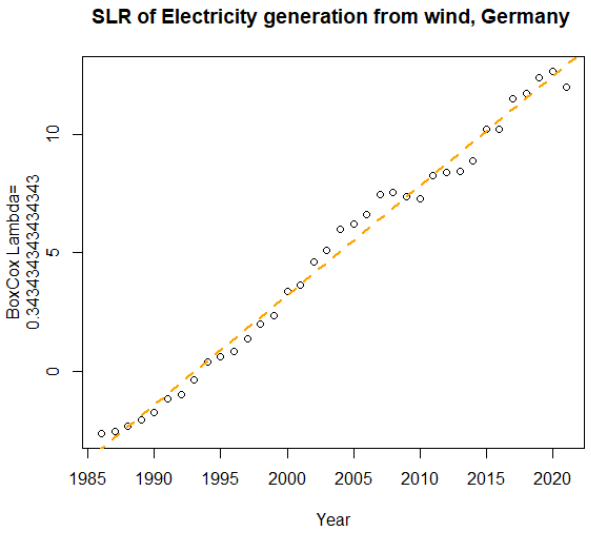


Fig 1. Germany SLR model

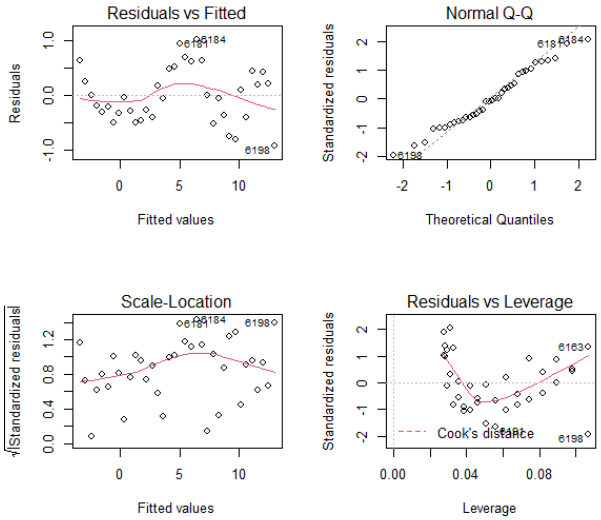


Fig 2. Germany SLR model assumptions plot

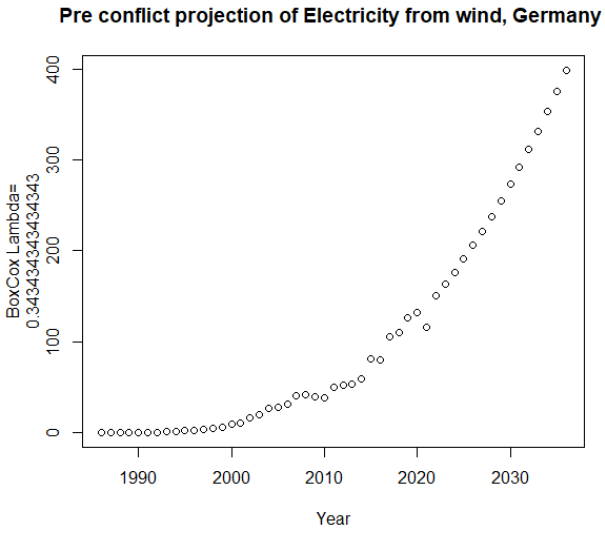


Fig 3. Germany wind electricity generation projection

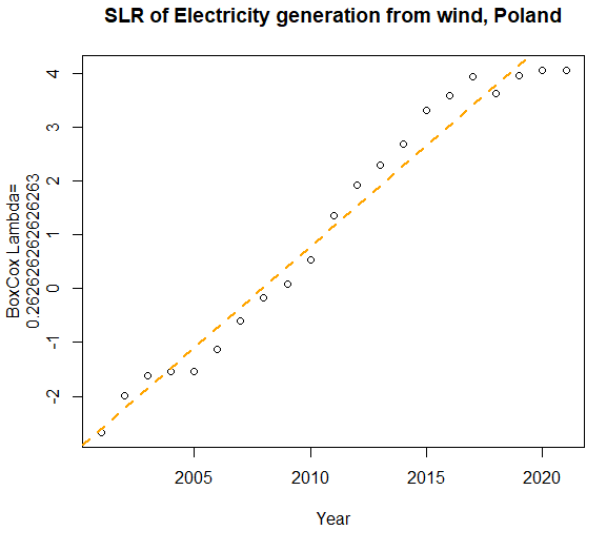


Fig 4. Poland SLR model

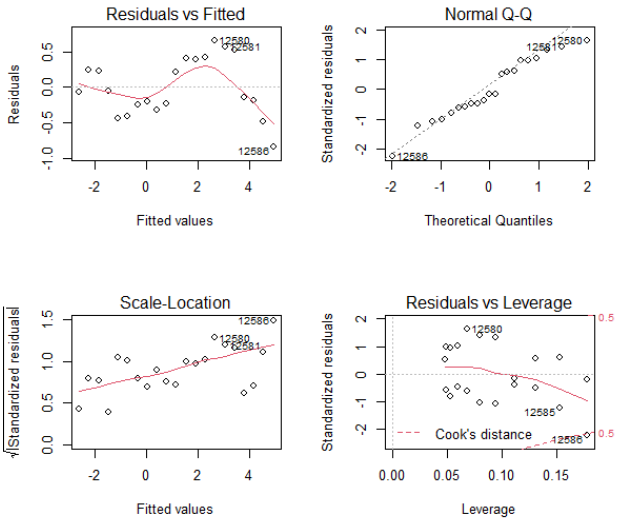


Fig 5. Poland SLR model assumptions plot

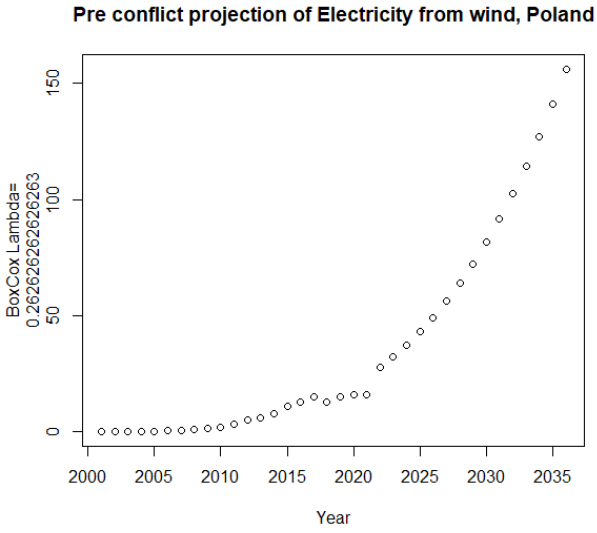


Fig 6. Poland wind electricity generation projection