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Internship's period: 13.04.2019 – 28.06.2019

Report of my internship at ISEP (Institute for Sustainable Energy Policies)

Introduction

This internship at ISEP was my first work experience in the field of renewable energy. It is an experience I had hoped to have for many years. In addition, I am a fan of Japan for its culture, its food, its landscapes and so many other reasons. These reasons, coupled with Japan's particular situation in relation to energy and nuclear power, led me to ISEP.
At ISEP, I was able to work on various and more interesting subjects, both as a team and individually. These different tasks required different skills, which made this internship a complete apprenticeship. Indeed, I have learned a lot about national policies and measures for the energy transition and for the recycling of solar panels. I also developed my technical knowledge by studying technologies allowing the recycling of solar panels and by analyzing different energy charts (including that of ISEP). I also developed my programming skills on Python.

Main Tasks

National and Local Governmental Policies for the Energy Transition

The main tasks performed at ISEP are related to policies and governments at different scales. Hence, I have done research on city scale strategies but also on national strategies.
The first task assigned to me after doing some research on Japanese energy policies was to study the French national strategy to reach targets set after the Paris Agreements. I have studied the social, scientific and economic measures taken to reach the target of carbon neutrality by 2050. In 2 months, I was able to deepen this research and to see how different the situation and the government involvement are in Japan and France. I have had the opportunity to present a short summary of this research to students at University of Sophia.
In parallel with this research, other tasks were assigned to me such as research on local government energy plan. Yamashita-san being in charge of the development of the energy plan of Takarazuka city, we have been asked to study the cases of similar foreign cities in terms of size and potential. We regularly met few times with the other interns and Yamashita-san to share our findings and our ideas.

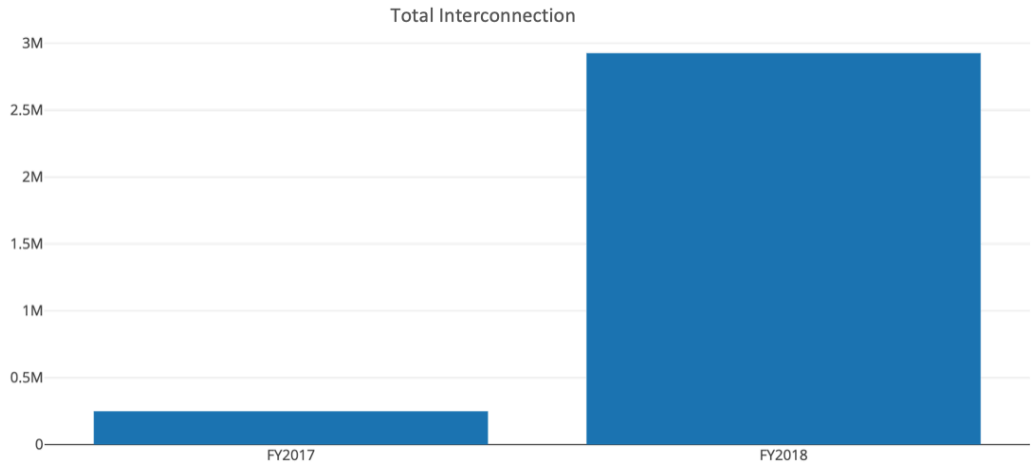
Personal Research

I was also asked to choose a topic that interested me and to research it. I have therefore decided to focus on the PV Panel waste management since it combines political and technical aspects. In addition, toxic wastes produced from solar industry are drastically higher than toxic wastes produced from nuclear industry for the same amount of energy. Therefore, recycling these modules is a great challenge before achieving sustainable energy in the long term. This is a very complex topic and it was really interesting to see the differences in regulations and technologies between EU and Japan.

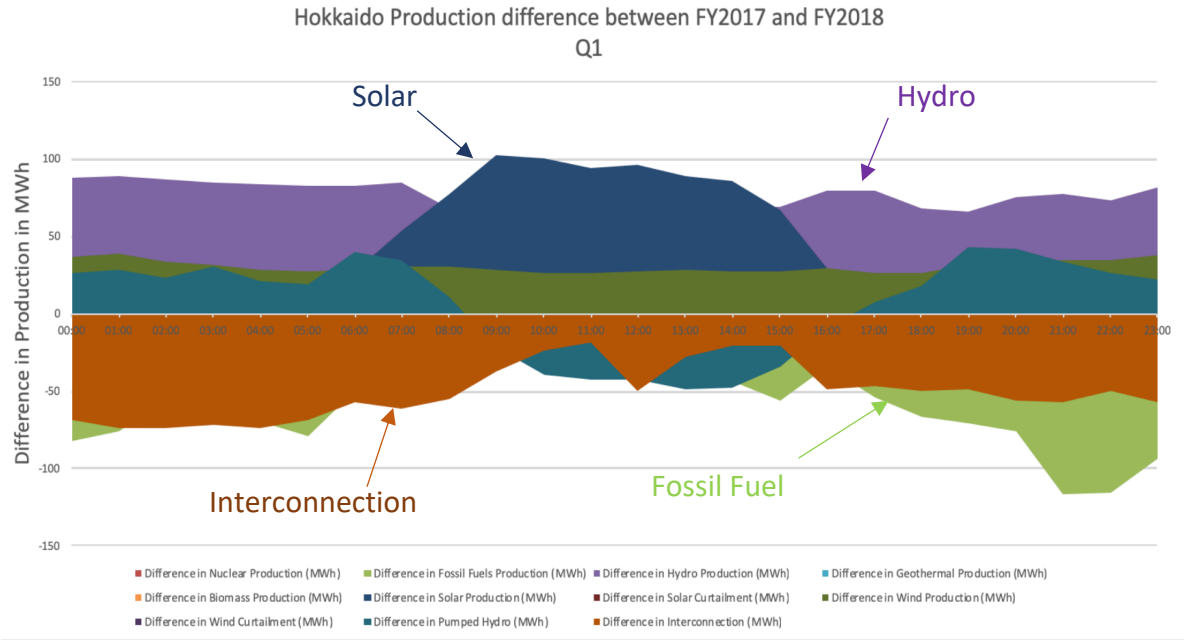
Data Analysis

With Heath, we had the task of studying the difference in energy production and consumption in each Japanese region and nationwide between FY2017 and FY2018. In order to analyze these production and consumption data, I have used the functions present in Python.
I wrote programs to calculate the average difference of production or consumption per hour of the day for each quarter of the FY and export them in Excel Files. Then, the programs plot the graphs from these Excel files. The sources of energy production are specified. This enables to determine the involvement of each region in the energy transition by looking at the evolution of the share in renewable energy production in the energy mix.
Some figures were impressive such as:

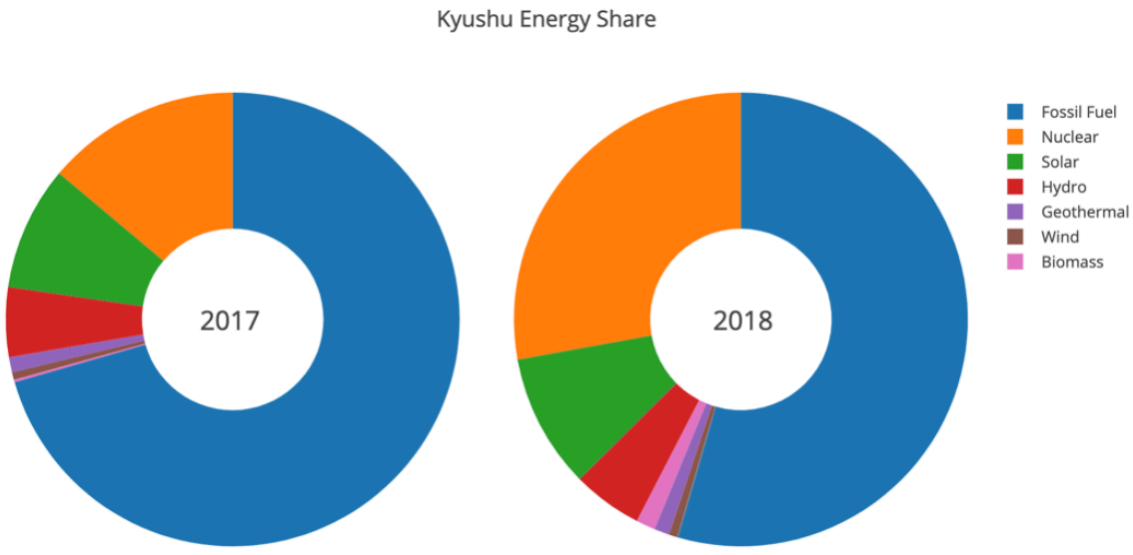
- In Chubu, the energy demand has slightly increased while the production has decreased. This results in a multiplication of imports by a factor of 10 in one year.



- In Hokkaido, the share of renewable energy in the production mix has increased by 4% to reach 26.5% over FY2018. Here is plot the difference of production per source per hour between Q1 of FY2017 and FY2018.

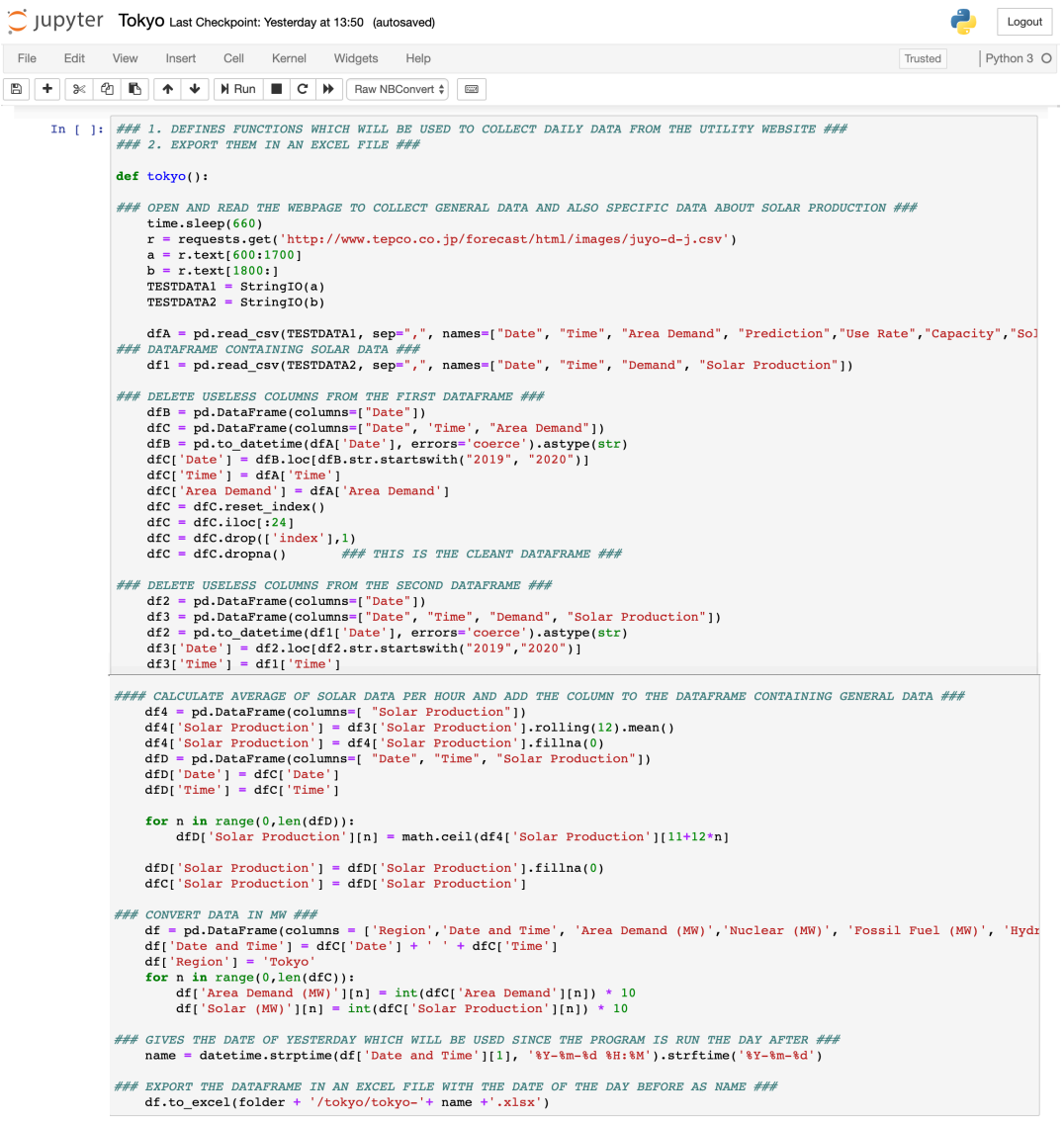


- In Kyushu, Nuclear Power Production has doubled in one year. Kyushu has started to curtail Wind and Solar energy in favor of Nuclear energy. Solar Curtailment can reach up to 30% of the Solar energy production and 22% of the Total demand at some points.



Automation of Data Collection to improve the Energy Chart

At the beginning of my internship, I have been asked to study the French energy charts and to determine some interesting features they have that ISEP does not have. Hence, ISEP could aspire to them in order to improve its energy chart. The French energy chart is updated every hour while ISEP updates its data monthly.
In order to improve the energy chart, I have been asked to write a program able to collect data from utility websites hourly and then to export them into excel files. These excel files will then be hourly uploaded in the energy chart in order to directly display the current data. There will be one file per day per region. At the end of the week, my program combines these files into one per region to have a file containing weekly data per region. At the end of the month, the program combines every file containing daily data into one with monthly data. The files containing daily data are deleted afterwards since they are heavies and they become unnecessary. I have also written a code which sums the files per region into one to have the nationwide data.
Here is the function enabling the data collection from the TEPCO website and the export of these data in an Excel File.

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### 1. DEFINES FUNCTIONS WHICH WILL BE USED TO COLLECT DAILY DATA FROM THE UTILITY WEBSITE ###
### 2. EXPORT THEM IN AN EXCEL FILE ###

def tokyo():

### OPEN AND READ THE WEBPAGE TO COLLECT GENERAL DATA AND ALSO SPECIFIC DATA ABOUT SOLAR PRODUCTION ###
    time.sleep(660)
    r = requests.get('http://www.tepco.co.jp/forecast/html/images/juyo-d-j.csv')
    a = r.text[600:1700]
    b = r.text[1800:]
    TESTDATA1 = StringIO(a)
    TESTDATA2 = StringIO(b)

    dfA = pd.read_csv(TESTDATA1, sep=",", names=["Date", "Time", "Area Demand", "Prediction","Use Rate","Capacity","Sol
### DATAFRAME CONTAINING SOLAR DATA ###
    df1 = pd.read_csv(TESTDATA2, sep=",", names=["Date", "Time", "Demand", "Solar Production"])

### DELETE USELESS COLUMNS FROM THE FIRST DATAFRAME ###
    dfB = pd.DataFrame(columns=["Date"])
    dfC = pd.DataFrame(columns=["Date", 'Time', "Area Demand"])
    dfB = pd.to_datetime(dfA['Date'], errors='coerce').astype(str)
    dfC['Date'] = dfB.loc[dfB.str.startswith("2019", "2020")]
    dfC['Time'] = dfA['Time']
    dfC['Area Demand'] = dfA['Area Demand']
    dfC = dfC.reset_index()
    dfC = dfC.iloc[:24]
    dfC = dfC.drop(['index'],1)
    dfC = dfC.dropna()       ### THIS IS THE CLEANT DATAFRAME ###

### DELETE USELESS COLUMNS FROM THE SECOND DATAFRAME ###
    df2 = pd.DataFrame(columns=["Date"])
    df3 = pd.DataFrame(columns=["Date", "Time", "Demand", "Solar Production"])
    df2 = pd.to_datetime(df1['Date'], errors='coerce').astype(str)
    df3['Date'] = df2.loc[df2.str.startswith("2019","2020")]
    df3['Time'] = df1['Time']

#### CALCULATE AVERAGE OF SOLAR DATA PER HOUR AND ADD THE COLUMN TO THE DATAFRAME CONTAINING GENERAL DATA ###
    df4 = pd.DataFrame(columns=[ "Solar Production"])
    df4['Solar Production'] = df3['Solar Production'].rolling(12).mean()
    df4['Solar Production'] = df4['Solar Production'].fillna(0)
    dfD = pd.DataFrame(columns=[ "Date", "Time", "Solar Production"])
    dfD['Date'] = dfC['Date']
    dfD['Time'] = dfC['Time']

    for n in range(0,len(dfD)):
        dfD['Solar Production'][n] = math.ceil(df4['Solar Production'][11+12*n]

    dfD['Solar Production'] = dfD['Solar Production'].fillna(0)
    dfC['Solar Production'] = dfD['Solar Production']

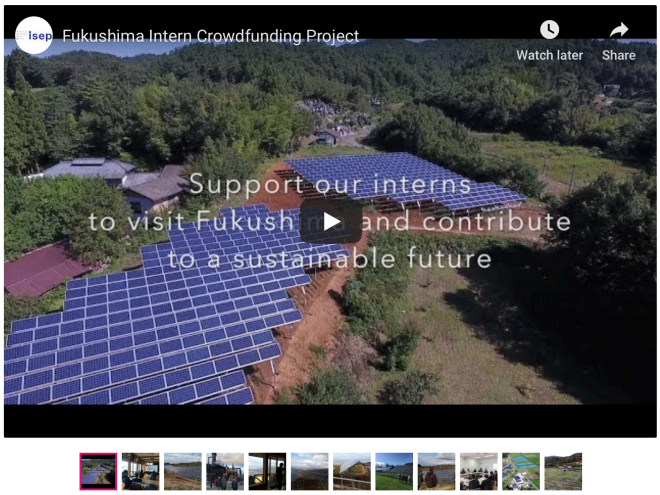
### CONVERT DATA IN MW ###
    df = pd.DataFrame(columns = ['Region','Date and Time', 'Area Demand (MW)','Nuclear (MW)', 'Fossil Fuel (MW)', 'Hydr
    df['Date and Time'] = dfC['Date'] + ' ' + dfC['Time']
    df['Region'] = 'Tokyo'
    for n in range(0,len(dfC)):
        df['Area Demand (MW)'][n] = int(dfC['Area Demand'][n]) * 10
        df['Solar (MW)'][n] = int(dfC['Solar Production'][n]) * 10

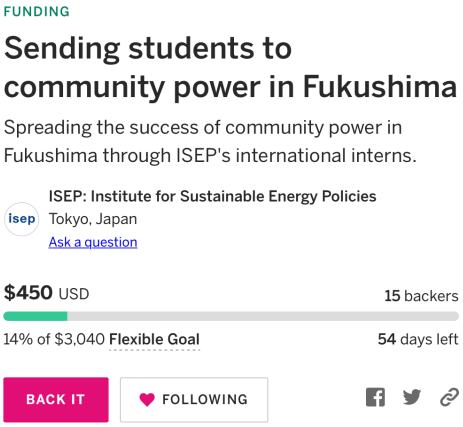
### GIVES THE DATE OF YESTERDAY WHICH WILL BE USED SINCE THE PROGRAM IS RUN THE DAY AFTER ###
    name = datetime.strptime(df['Date and Time'][1], '%Y-%m-%d %H:%M').strftime('%Y-%m-%d')

### EXPORT THE DATAFRAME IN AN EXCEL FILE WITH THE DATE OF THE DAY BEFORE AS NAME ###
    df.to_excel(folder + '/tokyo/tokyo-'+ name +'.xlsx')
```

Crowdfunding Project

With Hiroaki, Katrin and Yixin, I have worked on a crowdfunding project. This crowdfunding's goal is to send 6 interns to Fukushima to meet people involved in community power projects who worked to revitalize the area after the Fukushima accident in 2011. We have recorded a video including interviews of Iida-san, founder of ISEP, Chiba-san, founder of Iitate electric power company (Fukushima area) and Kushibuchi-san, who went to Fukushima and met these people last year. We have also written a text illustrated by pictures taken on site last year. All of this content has been released on the crowdfunding platform Indiegogo on Friday 21st of June.





Conclusion

This internship at ISEP was very formative for me. This internship helped me to choose the type of master's degree I wanted to pursue after my bachelor's degree in engineering. Thus, I plan to study environmental policies for my master's degree.
At ISEP, I learned a lot about the importance of the national or local governments' involvement in the development of renewable energy. I also acquired scientific knowledge by studying the technologies used for the recycling of photovoltaic panels or by the analysis of data of production. I have also loved working in team for the crowdfunding project.
What I will remember about this internship:

- Very good working environment: working with interns coming from different countries and with different backgrounds is definitely a good experience intellectually and humanely. I learnt a lot from them thanks to their various ideas based on their own points of interests. We also shared good moments at restaurant, izakaya or soccer.
  I also learnt a lot from the staff members and enjoyed the moments shared such as the UNO games, the craft beer parties or the party with the ISEP board members.
- Full of meetings: We have attended to various meetings thanks to ISEP, including conference hold by the foundation F20, or meetings at the DIET building. Inside ISEP,

we have had intern meetings or meetings to show our crowdfunding project or share our ideas on local community power.

- I have enjoyed living in Tokyo and more generally in Japan thanks to the kindness of Japanese people, the cultural activities and the countryside.
- I am very thankful for this experience and I hope that I will the opportunity to repeat this experience in the future. I am still available to help on the python programs for example.

Thank You for these moments!!!