從開放數據閱讀台灣能源 – 數據探索、模型預測和風險評估

In-depth Analysis of Open Energy Data in Taiwan – Data Exploration, Model Prediction and Risk Assessment

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buds lab
building and urban data science

Chun Fu

Ph.D student of the Building and Urban Data Science Group at NUS (National University of Singapore)

National University of Singapore
Doctor of Philosophy - PhD · Department of building
2020 年 – 2024 年

National Taiwan University
Master of Science (M.S.) · Sustainable Environment and Green Architecture · 4.18/4.30
2013 年 – 2015 年

National Taiwan University
Bachelor of Science (BS) · Bioenvironmental System Engineering · 3.81/4.30
2009 年 – 2013 年
- NTU Presidential Award (2013)
- Class Representative

Project Manager / Data Scientist
Knowledge Analysis Space Exploration (KASE, 探識空間)
2016 年 8 月 – 2020 年 1 月 · 3 年 6 個月
Taipei City, Taiwan

Analyze big data from BAS and assist in constructing the facility management systems for Taipei City government buildings.
- Uncover energy saving potential from operation data and propose energy saving strategies (predictive controls on chillers, pre-cooling strategies, and load shift) to facility managers.
- Strategies are estimated to achieve a saving rate higher than 10% in Taipei City Hall.
- Lead interns to systematize and digitalize documents of an HVAC system (including 1000+ HVAC facilities).

Constructing an intelligent building system for "Intelligent Living Space" (an exhibition space belonging to Taiwan government department)
- Integrate 500+ I/O of existing facilities and sensors through BACnet and new controller
- Exhibit state-of-the-art strategies for saving energy and improving thermal comfort
- Visualize building data into guided tour for educating 10000+ visitors per year

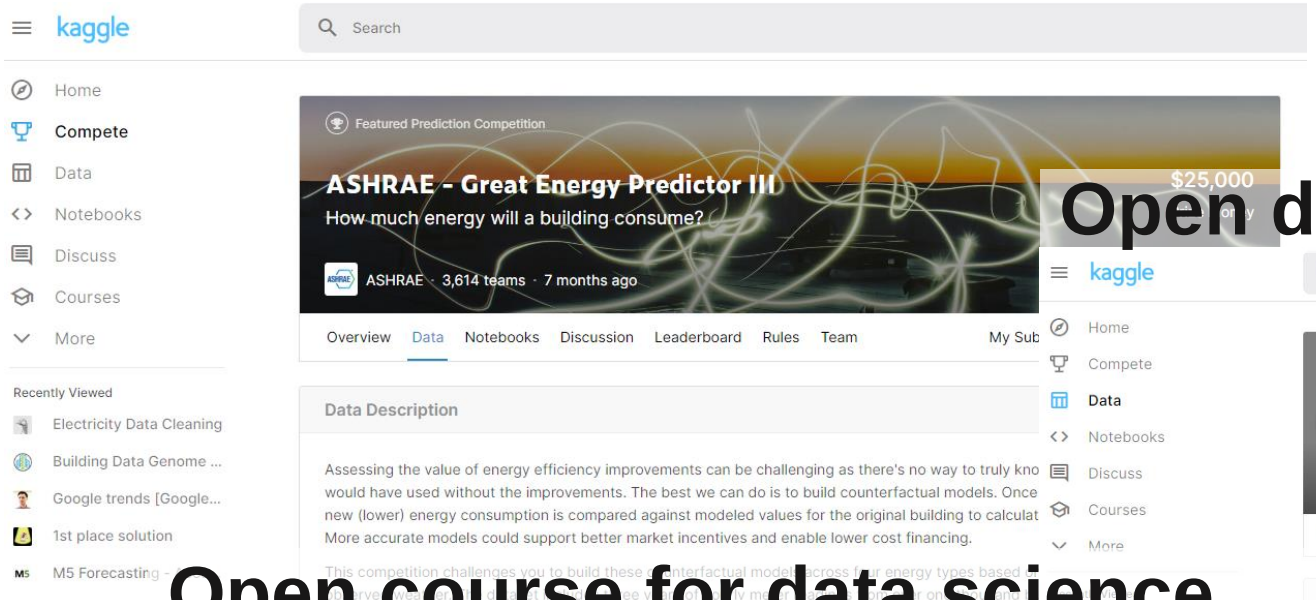
BUDSlab

buds lab

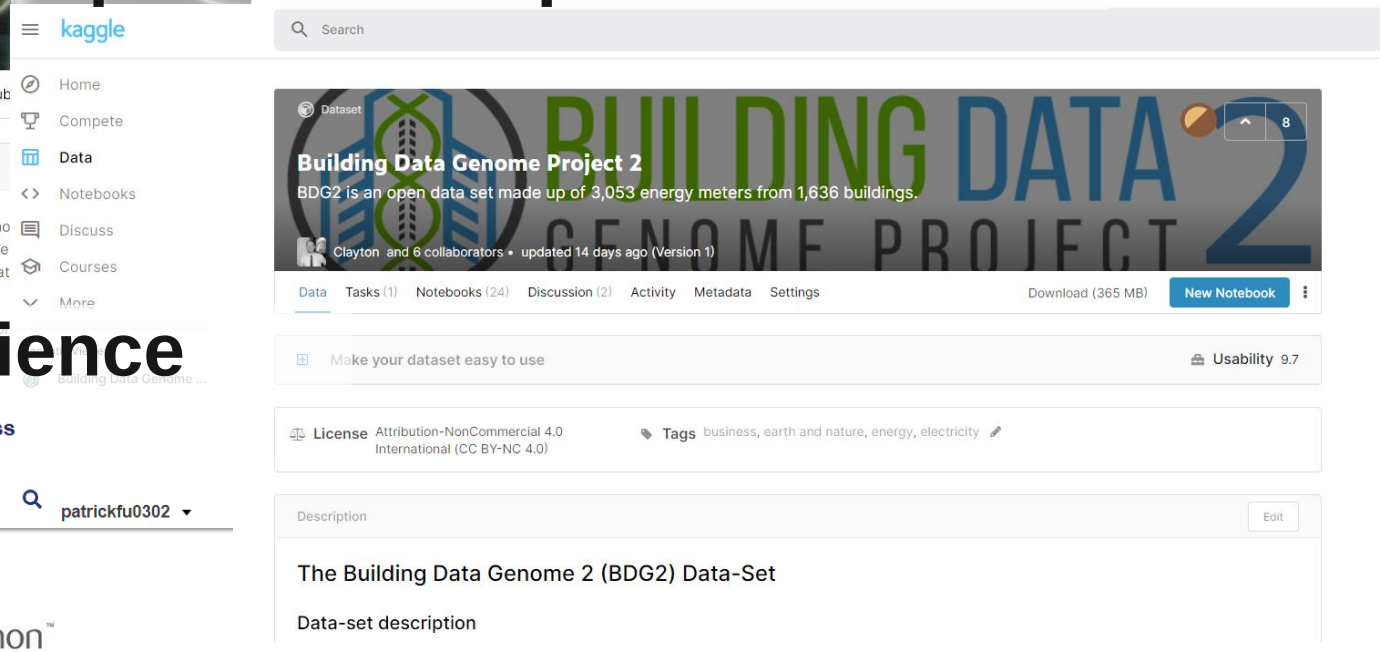
building and urban data science

BUDS Lab is a scientific research group that leverages data sources from the built and urban environments to improve the energy efficiency and conservation, comfort, safety and satisfaction of humans.

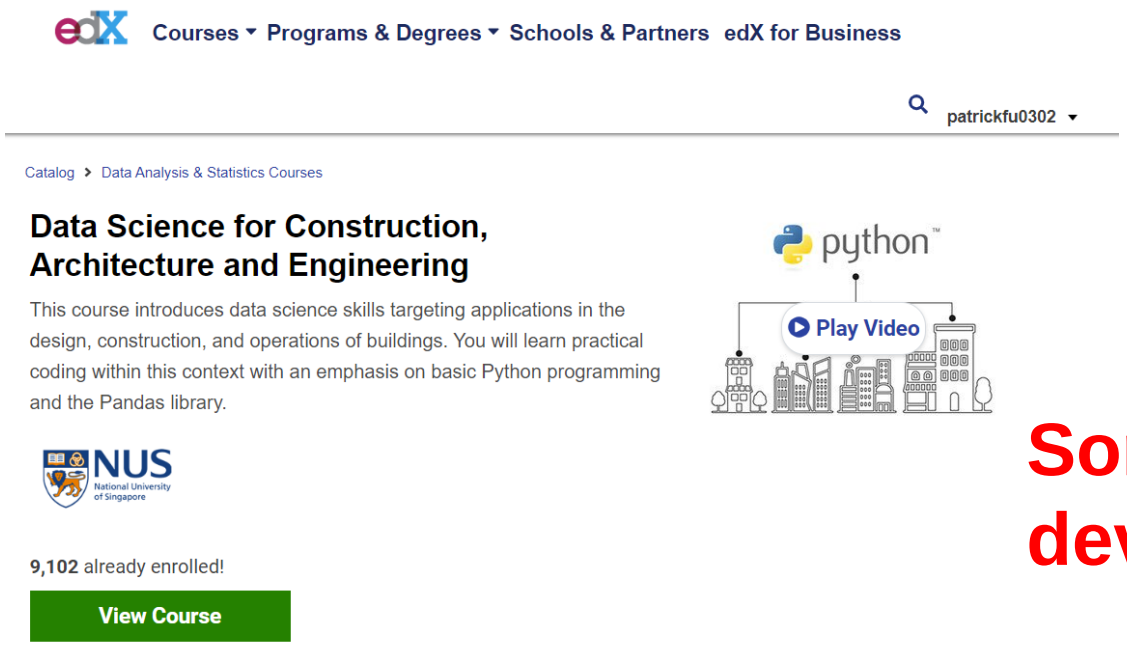
Kaggle competition



Open data for power meters

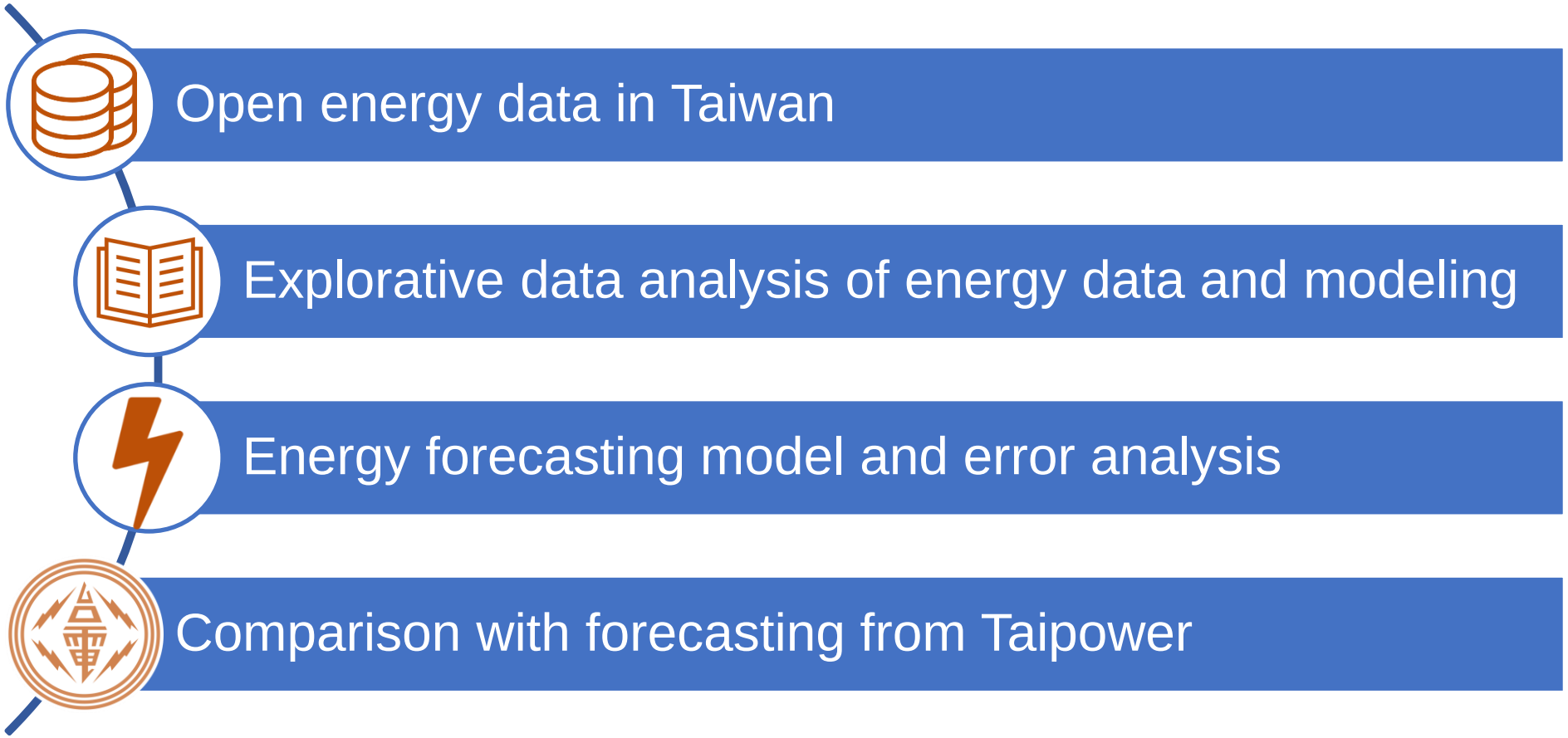


Open course for data science



Some interesting projects devoted to the community!

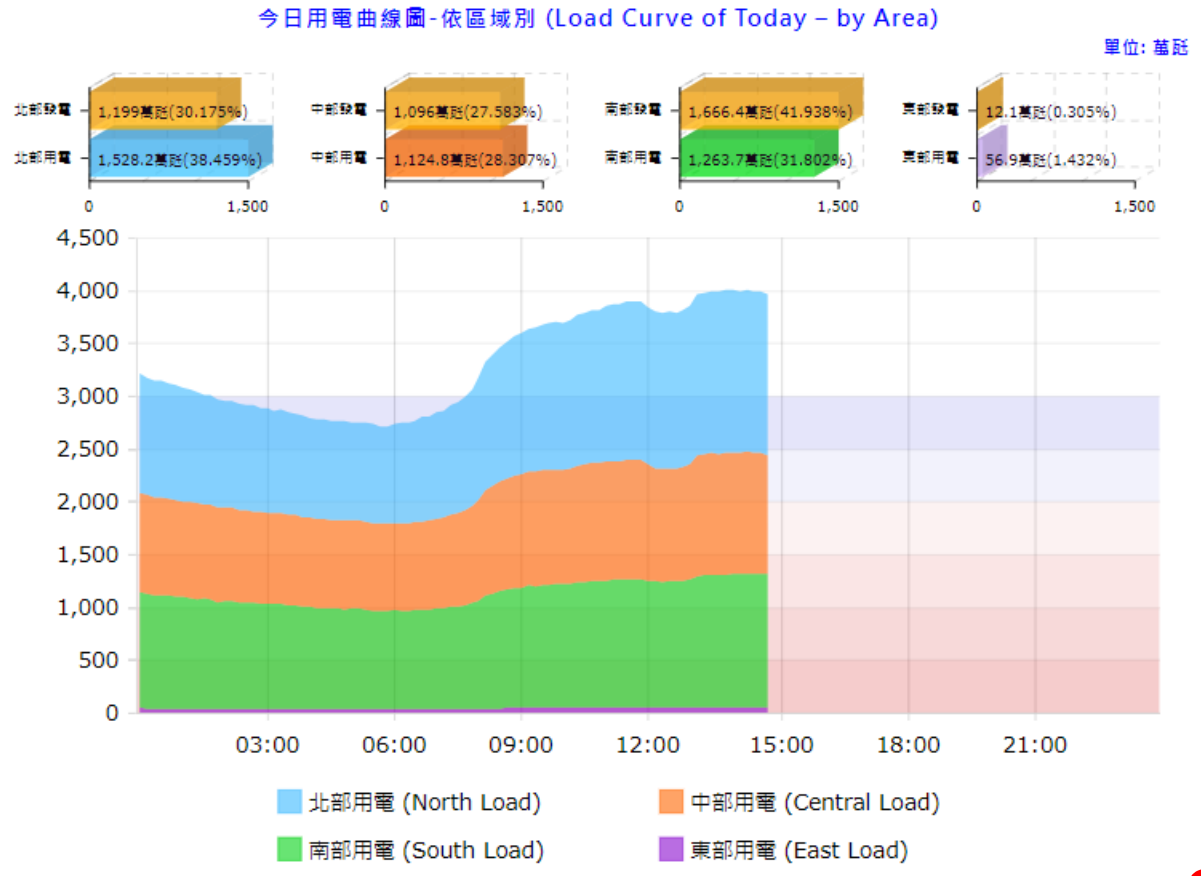
Agenda


Open energy data in Taiwan
Explorative data analysis of energy data and modeling
Energy forecasting model and error analysis
Comparison with forecasting from Taipower

Energy data

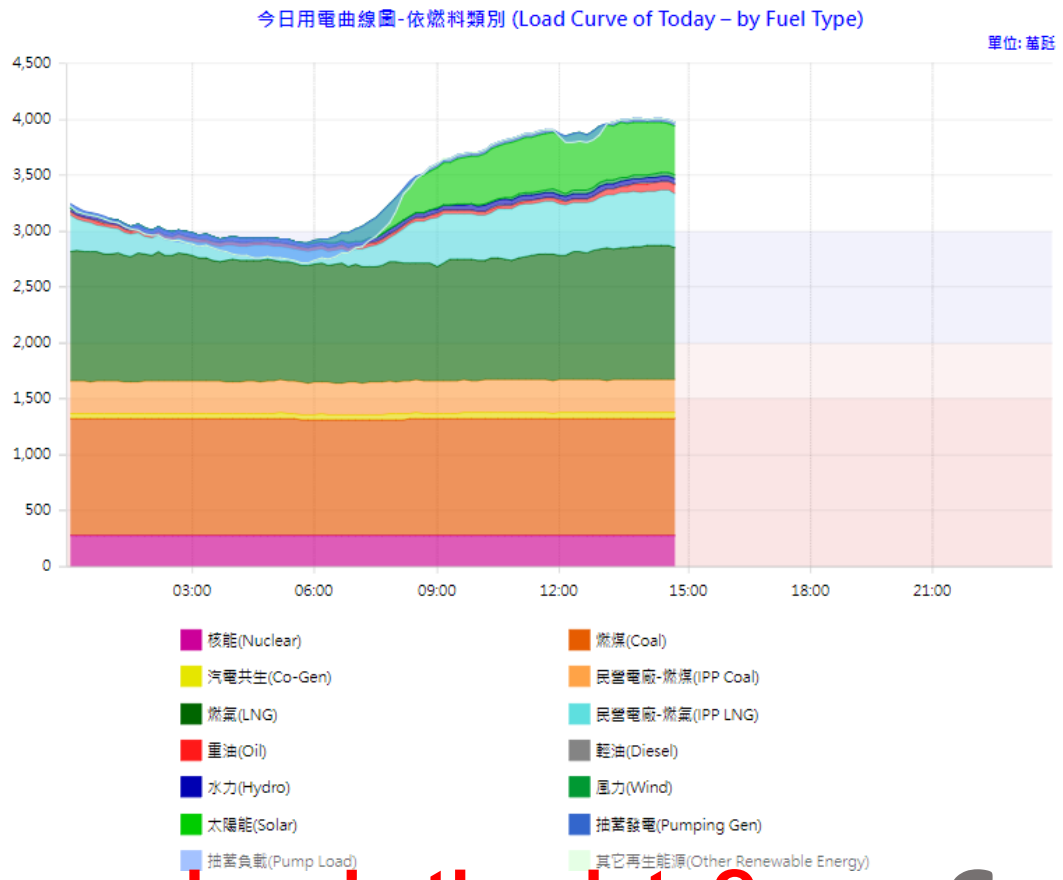
今日用電曲線(區域別)

Energy demand (by area)



今日用電曲線(能源別)

Energy supply (by fuel type)



So… where's the data?

Energy data

今日用電曲線(區域別)

今日用電曲線(能源別)

Yay!!!! We have APIs from open data platform!

Energy data

邦****王 於 2019-12-10 16:35 回應

查詢2017年之資料

這個資料中只有2018到2019的每日資料，是否可以提供2017甚至更以前的資料以供專題使用呢?謝謝

W****g 於 2022-06-07 13:16 回應

歷年資料也應該作為開放資料

本資料集僅提供上一年度至上個月，應將過去資料以年度為單位進行資料公開。過去的資料不應該還要民眾寫信和台電申請才可以取得，非屬政府開放資料精神。歷史資料也應作為公開資料，而非就這樣消失在開放資料集中。

2****料 於 2015-11-27 18:27 回應

可否提供每小時資料

請提供每小時資料，會更有意義

b****1 於 2021-05-22 22:13 回應

台灣一年以上歷史用電資料

你好！我是在英國的博士後研究員，之前建之過模型來分析英國在2030/2050不同能源比例和使用下，對電力系統的影響。最近想要用台灣的資料來作類似的分析，所以想要有過去一年以上台灣的發電資料。

我已經寄信給薛小姐以及工研院懂能源團隊，但目前還沒有得到回覆。

另外，我想建議這裡可以提供CSV檔下載，如果要讓更多人更容量使用資料，應該要讓資料取得更方便 不是嗎?

英國有許多資料都可以直接下載，讓數多人取得並使用資料，有興趣可以參考看看...

蔡****臻 於 2017-02-23 14:00 回應

可否提供2015年日資料

可否提供2015年的過去電力日資料的csv檔？謝謝

Tons of complaints...

- **No historical data**
- **No finer granularity (only daily values)**

Energy data

紫豹在哪裡 github:
https://github.com/aga3134/AirPollution

But someone scrapes energy data and provides API for us!

- **Energy demand data**
- **Energy supply data**
- **Weather data**

4. 取得北中南東部用電量

http://purbao.lass-net.org/powerLoad?date=2017/5/28

date改成你想取得資料的日期(日期前面不要補0)

資料為json格式:

_id: 用電時間

north: 北部用電量(單位: 萬瓩)

central: 中部用電量(單位: 萬瓩)

south: 南部用電量(單位: 萬瓩)

east: 東部用電量(單位: 萬瓩)

5. 取得各發電類型的發電量

http://purbao.lass-net.org/powerRatio?date=2017/5/28

date改成你想取得資料的日期(日期前面不要補0)

資料為json格式:

_id: 發電時間

pumpGen: 抽蓄發電(單位: 萬瓩)

solar: 太陽能(單位: 萬瓩)

wind: 風力(單位: 萬瓩)

hydro: 水力(單位: 萬瓩)

diesel: 輕油(單位: 萬瓩)

7. 取得氣象資料

http://purbao.lass-net.org/weatherData?date=2017/5/28

date改成你想取得資料的日期(日期前面不要補0)

資料為json格式:

p: 壓力(單位: 百帕)

h: 溼度，(單位: 百分率)

t: 溫度，(單位: 攝氏)

wSpeed: 風速(單位: 公尺/秒)

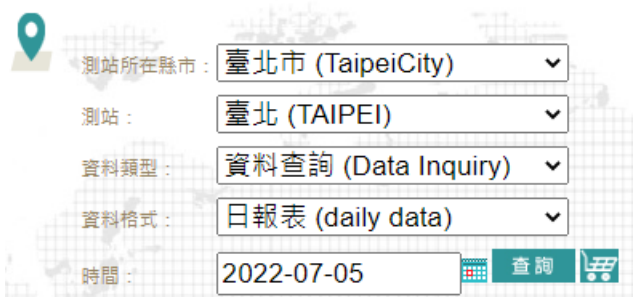
wDir: 風向(單位: 度，0度北風，45度東北風)

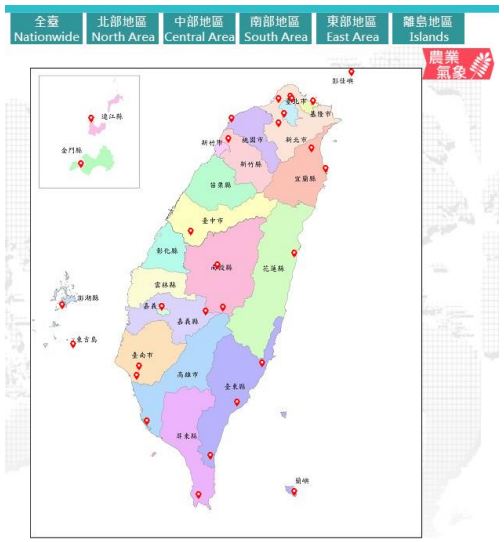
height: 測站海拔高度(單位: 公尺)

siteID: 測站ID

Weather data

氣象局 觀測資料查詢平台:
http://e-service.cwb.gov.tw/HistoryDataQuery/index.jsp





日報表 (daily data) 測站:466920_臺北 466920_臺北 觀測時間:2022-07-05 CSV下載 資料定義請詳見

	Press		temperature	dew point	RH	WD/WS				Precp		Sun Shine		visibility	UVI	Cloud
觀測時間 (hour)	測站氣壓 (hPa)	海平面氣壓 (hPa)	氣溫 (℃)	露點溫度 (℃)	相對濕度 (%)	風速 (m/s)	風向 (360degree)	最大陣風 (m/s)	最大陣風風向 (360degree)	降水量 (mm)	降水時數 (h)	日照時數 (h)	全天空日射量 (MJ/m²)	能見度 (km)	紫外線指數	總雲量 (0~10)
ObsTime	StnPres	SeaPres	Temperature	Td dew point	RH	WS	WD	WSGust	WDGust	Precp	PrecpHour	SunShine	GloblRad	Visb	UVI	Cloud Amount
01	1002.7	1006.2	26.3	25.3	94	0.9	130	2.9	160	0.0	0.0	...	0.00	...	0	...
02	1002.0	1005.5	26.2	25.3	95	0.2	0	2.3	180	0.0	0.0	...	0.00	...	0	...
03	1002.4	1005.9	26.1	24.5	91	1.1	180	2.8	160	0.0	0.0	...	0.00	...	0	...
04	1002.8	1006.3	25.6	24.6	94	1.1	100	2.2	210	0.0	0.0	...	0.00	...	0	...
05	1003.1	1006.6	26.0	24.1	89	1.5	160	4.3	160	0.0	0.0	...	0.01	...	0	...
06	1002.9	1006.4	26.2	23.9	87	1.1	220	2.3	160	0.0	0.0	0.4	0.17	...	0	...
07	1003.0	1006.5	27.1	23.8	82	1.0	140	3.2	160	0.0	0.0	1.0	0.76	...	1	...
08	1003.1	1006.5	28.8	24.2	76	1.0	80	2.7	90	0.0	0.0	1.0	1.53	60.0	2	2.0
09	1003.3	1006.7	31.1	24.8	69	1.3	120	3.1	100	0.0	0.0	1.0	2.28	60.0	5	3.0
10	1003.2	1006.6	32.4	24.2	62	1.6	90	5.0	120	0.0	0.0	0.8	2.53	...	8	...
11	1002.9	1006.3	33.7	23.7	56	2.0	90	4.9	80	0.0	0.0	1.0	3.27	40.0	11	6.0
12	1002.4	1005.8	32.9	24.7	62	2.0	10	5.4	40	0.0	0.0	0.2	1.63	...	7	...
13	1002.7	1006.2	27.7	26.1	91	1.2	270	7.2	310	23.5	0.6	0.0	0.20	...	1	...
14	1002.9	1006.4	26.5	25.1	92	1.4	240	8.1	170	17.5	1.0	0.0	0.22	10.0	1	8.0
15	1003.4	1006.9	26.6	25.4	93	0.6	150	5.5	310	0.5	0.7	0.0	0.31	...	2	...
16	1003.6	1007.1	26.4	25.2	93	1.7	210	3.0	200	2.0	1.0	0.0	0.18	...	1	...
17	1003.2	1006.7	26.4	25.2	93	0.8	190	3.7	220	2.5	0.8	0.0	0.24	13.0	0	10.0
18	1002.5	1006.0	26.7	24.9	90	0.7	160	2.6	130	0.0	0.0	0.4	0.42	...	0	...
19	1003.1	1006.6	26.8	25.8	94	1.2	140	2.3	120	0.0	0.0	0.4	0.14	...	0	...
20	1003.4	1006.9	26.7	25.5	93	1.1	170	3.2	120	0.0	0.0	...	0.00	...	0	...
21	1003.6	1007.1	26.7	25.3	92	1.8	140	3.0	130	0.0	0.0	...	0.00	...	0	...
22	1004.0	1007.5	26.4	25.5	95	0.2	0	2.2	120	0.0	0.0	...	0.00	...	0	...
23	1003.7	1007.2	26.2	25.2	94	1.3	220	3.2	210	0.0	0.0	...	0.00	...	0	...
24	1003.0	1006.5	26.1	25.1	94	1.0	220	2.4	210	0.0	0.0	...	0.00	...	0	...

However… no API for the dataset

Weather data

5-star recommended downloader for saving weather data in Taiwan!

Taiwan Weather Data Downloader:
https://github.com/JackyWeng526/Taiwan_Weather_Data

Taiwan Weather Data Downloader

Download Taiwan local weather data for advanced analysis and application.

Instal packages and libraries

Install python libraries with requirements.txt in src folder.

```
pip install -r requirements.txt
```

Weather Station Information

You can reach the information table of CWB stations on CWB e-service.

Or you can also extract the table as following:

```
webpage = "https://e-service.cwb.gov.tw/wdps/obs/state.htm"
read_html = pd.read_html(webpage)
html_table = read_html[0]
html_df = html_table.loc[:, ["站號", "站名", "海拔高度(m)", "城市", "經度", "緯度", "地址"]]
display(html_df)
```

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display(html_df)
```

Get the station number and the station name you need.

	站號	站名	海拔高度(m)	城市	經度	緯度	地址
0	466850	五分山雷達站	756.0	新北市	121.781205	25.071182	瑞芳區靜安路四段1巷1號
1	466880	板橋	9.7	新北市	121.442017	24.997647	板橋區大觀路二段265巷62號
2	466900	淡水	19.0	新北市	121.448906	25.164889	淡水區中正東路42巷6號
3	466910	鞍部	837.6	臺北市	121.529731	25.182586	北投區陽明山竹子湖路111號
4	466920	臺北	5.3	臺北市	121.514853	25.037658	中正區公園路64號

Calendar data

政府行政機關辦公日曆表:

https://data.ntpc.gov.tw/api/datasets/308DCD75-6434-45BC-A95F-584DA4FED251/csv/file

	A	B	C	D	
1	date	name	isHoliday	holidayCategory	description
2	2013/1/1	中華民國開國紀念日	是	放假之紀念日及節日	全國各機關學校放假一日。
3	2013/1/5		是	星期六、星期日	
4	2013/1/6		是	星期六、星期日	
5	2013/1/12		是	星期六、星期日	
6	2013/1/13		是	星期六、星期日	
7	2013/1/19		是	星期六、星期日	
8	2013/1/20		是	星期六、星期日	
9	2013/1/26		是	星期六、星期日	
10	2013/1/27		是	星期六、星期日	
11	2013/2/2		是	星期六、星期日	
12	2013/2/3		是	星期六、星期日	
13	2013/2/9	農曆除夕	是	放假之紀念日及節日	全國各機關學校放假一日，適逢星
14	2013/2/10	春節	是	放假之紀念日及節日	全國各機關學校於二月十日至二月
15	2013/2/11	春節	是	放假之紀念日及節日	全國各機關學校於二月十日至二月
16	2013/2/12	春節	是	放假之紀念日及節日	全國各機關學校於二月十日至二月
17	2013/2/13		是	補假	
18	2013/2/14		是	補假	
19	2013/2/15		是	調整放假日	二月十五日全國各機關學校調整假
20	2013/2/16		是	星期六、星期日	
21	2013/2/17		是	星期六、星期日	
22	2013/2/23		否	補行上班日	
23	2013/2/24		是	星期日	
24	2013/2/28	和平紀念日	是	放假之紀念日及節日	全國各機關學校放假一日。
25	2013/3/2		是	星期六、星期日	
26	2013/3/3		是	星期六、星期日	
27	2013/3/8	婦女節	否	紀念日及節日	本日照常上班。
1186	2022/12/3		是	星期六、星期日	
1187	2022/12/4		是	星期六、星期日	
1188	2022/12/10		是	星期六、星期日	
1189	2022/12/11		是	星期六、星期日	
1190	2022/12/17		是	星期六、星期日	
1191	2022/12/18		是	星期六、星期日	
1192	2022/12/24		是	星期六、星期日	
1193	2022/12/25		是	星期六、星期日	
1194	2022/12/31		是	星期六、星期日	

Very straightforward!
Without any issues :)

Forecasting data
- Demand and weather forecasting

Power Supply and Demand Forecast for the Next Seven Days (updated: 07/20/2022)

	07/21 (Thu.)	07/22 (Fri.)	07/23 (Sat.)	07/24 (Sun.)	07/25 (Mon.)	07/26 (Tue.)	07/27 (Wed.)
Net Peaking Capability(MW)	44420	44460	42280	38690	44080	44510	44450
Peak Load (MW)	40300	40300	34900	34300	39900	40300	40300
Operating Reserve(MW)	4120	4160	7380	4390	4180	4210	4150
Percent Operating Reserve (%)	10.22%	10.33%	21.14%	12.78%	10.47%	10.44%	10.30%
Light of Percent Operating Reserve							

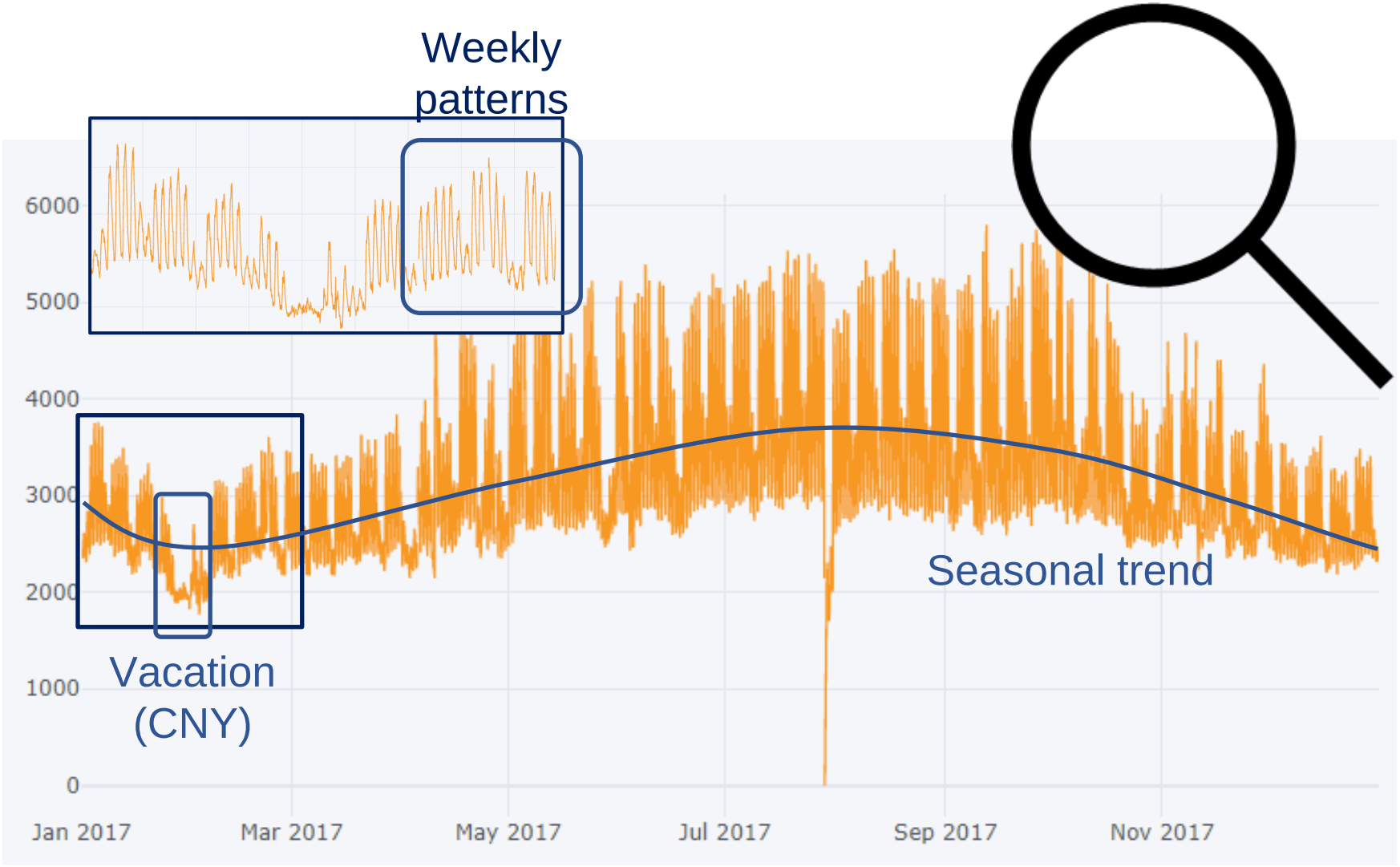
≥10%: Supply Adequate
10%~6%: Supply Tight
≤6%: Emergency Stage 1
≤900MW: Emergency Stage 2
≤500MW: Emergency Stage 3

Unfortunately, no historical data for forecasting : (
So, I collected them by setting task scheduler for over one year

Demo time
- Download datasets

Let’s get the data done before modeling!

Energy modeling 101

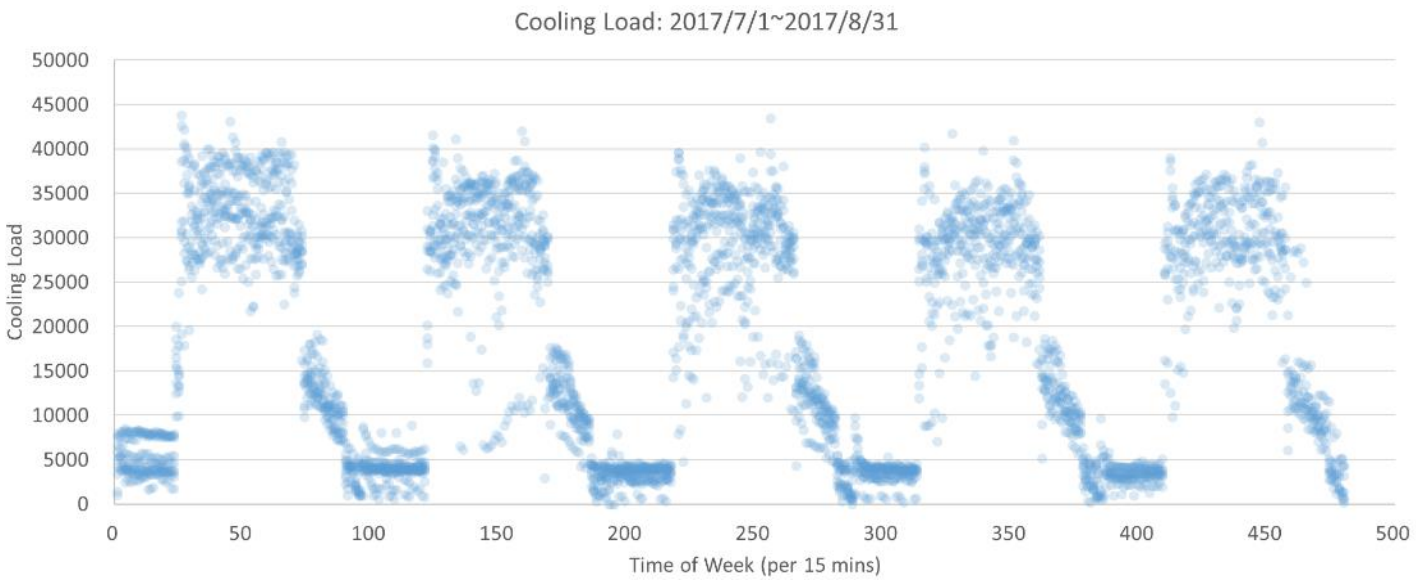


One of the most famous building energy models:

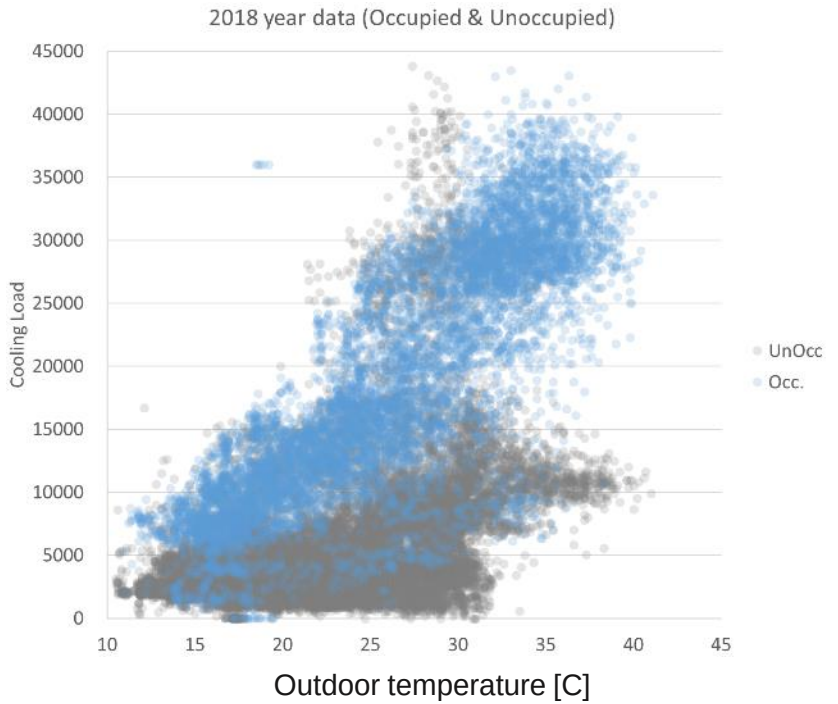
“LBNL Regression Model (TOWT model)”

→Main factors: (1)**TOW** (Time of Week)
(2)**Outdoor Temperature**
(3)**Occupied mode**

Weekly pattern (TOW)



Temp.-dependence (Occ. / UnOcc.)



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→Main factors: (1)**TOW** (Time of Week)
(2)**Outdoor Temperature**
(3)**Occupied mode**

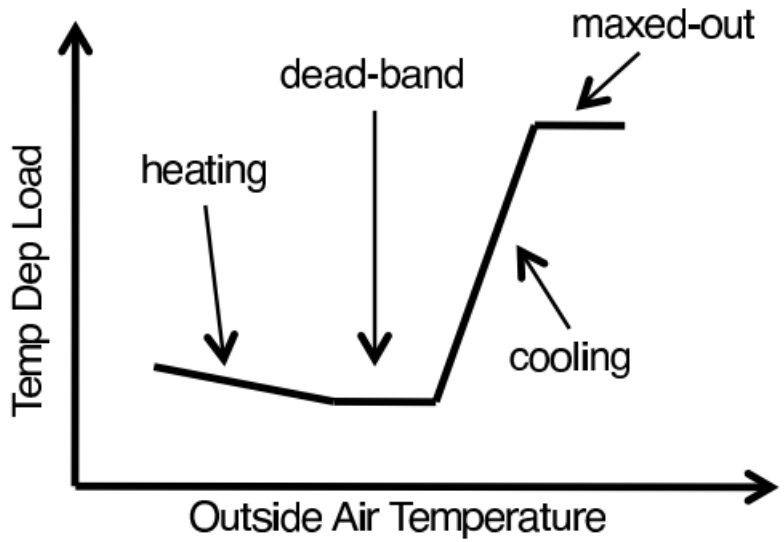
For occupied periods the building load is calculated by:

$$L_0(t_i, T(t_i) = \alpha_i + \sum_{j=1}^{6} \beta_j T_{c,j}(t_i)$$

Prediction of unoccupied mode occurs using a single temperature parameter, βu. Unoccupied load is calculated by:

$$L_0(t_i, T(t_i) = \alpha_i + \beta_u T_{c,j}(t_i)$$

* Most facilities are expected to be operating at or near the dead-band at night



Mathieu, J. L., Price, P. N., Kiliccote, S., & Piette, M. A. (2011). Quantifying changes in building electricity use, with application to demand response. *IEEE Transactions on Smart Grid*, *2*(3), 507-518.

Physical model: Thermal Network

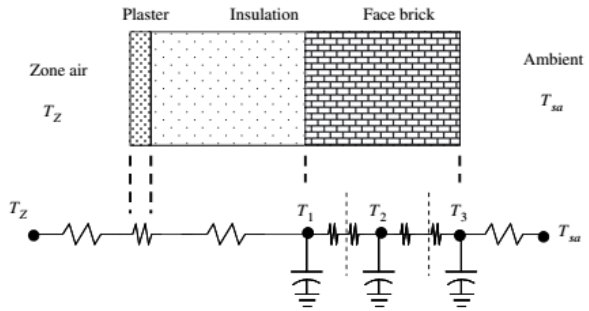
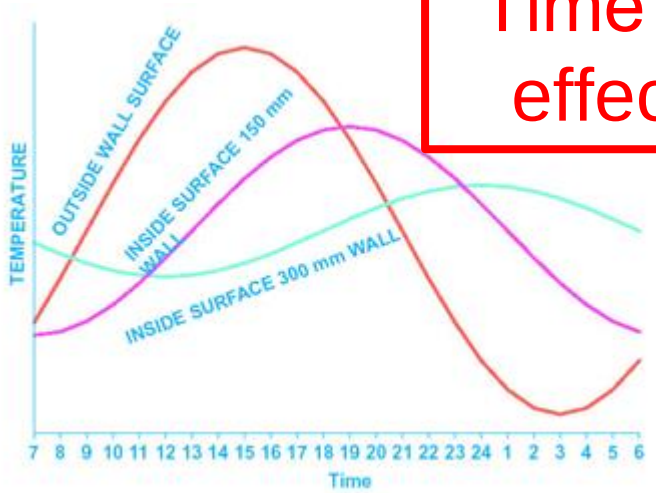


Figure 9.5 Thermal network representation of a building wall



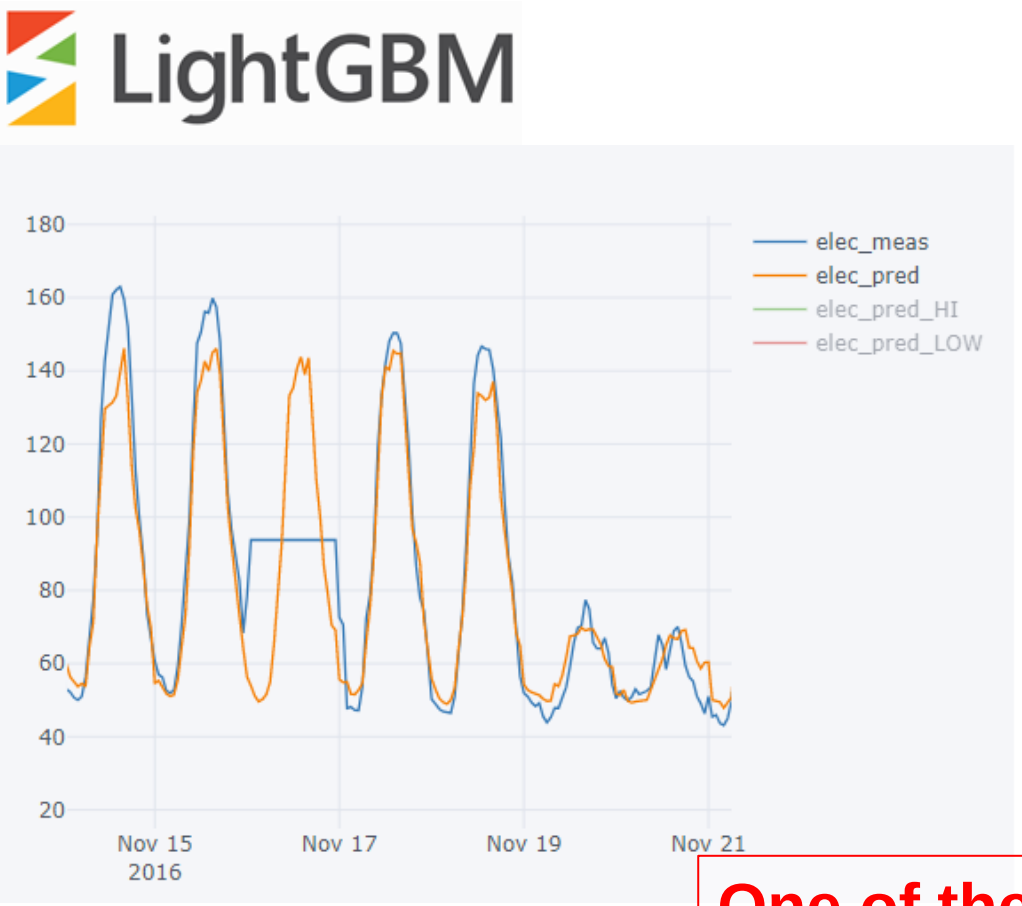
"Time lag" effect !

Outdoor temperature [C]

Consider "time lag" effect from thermal model

Outdoor temperature
v.s. Indoor temperature

Machine learning: LightGBM

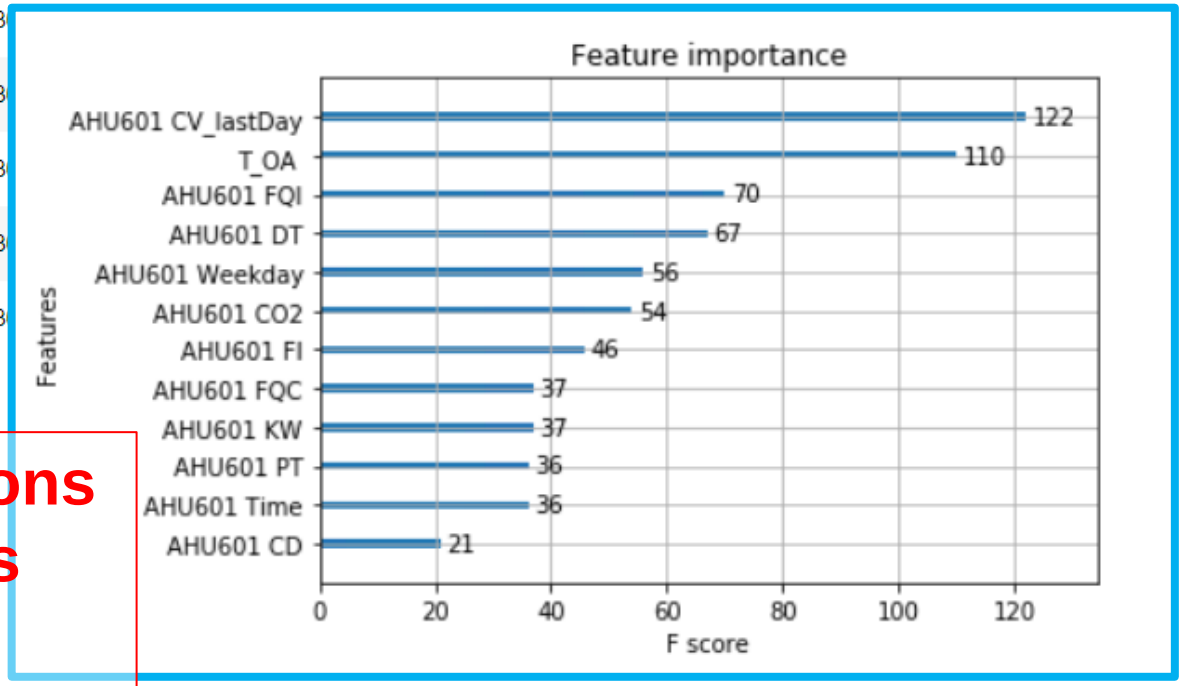


Category	Features	Type
Temporal	Hour of day	categorical
Temporal	Day of week	continuous
Weather	Outdoor air temp.	continuous
Weather	Pressure	continuous
Weather	Cloud cover	continuous
IoT	Variables from AHU	continuous
IoT	Variables from VAV	continuous
IoT	Variables from sensors	continuous
Meta	Equipment id	categorical
Meta	Space type	categorical
Meta	Capacity / Power	continuous
Lag feat.	24 hour lag for target value	continuous
Lag feat.	7 days lag for target value	continuous

One of the most popular regression / classification model for tabular data!

Machine learning: LightGBM

AHU	AHU601											T_OA	AHU601
item	CD	CO2	CV	DT	FI	FQC	FQI	KW	PT	Time	Weekday		CV_lastDay
Datetime													
2018-05-21 00:00:00	20.0	418.833333	14.143333	21.946667	12392.070000	36.293333	36.903333	6.391667	99.580000	0.000000	0	27.286667	14.655000
2018-05-21 00:15:00	20.0	418.070000	13.700000	21.770000	12497.940000	36.490000	3						
2018-05-21 00:30:00	20.0	418.070000	13.533333	21.770000	12440.593333	36.490000	3						
2018-05-21 00:45:00	20.0	418.070000	14.100000	21.770000	12403.292500	36.490000	3						
2018-05-21 01:00:00	20.0	414.653333	14.143333	21.770000	12561.698333	36.490000	3						
2018-05-21 01:15:00	20.0	409.280000	14.235000	21.770000	12438.217500	36.490000	3						



1. Better adapt to various distributions and incorporate additional variables

2. Balanced performance between efficiency and accuracy

Why LightGBM?

Great Energy Predictor III

- Biggest building energy prediction competition in recent decades
  - 2380 power meters worldwide
  - Three-years duration with hourly resolution
- Over 3000 teams from 94 countries
- Modern ML techniques have been tested and evaluated

kaggle

ASHRAE Energy Calculations
ASHRAE Technical Committee 4.7

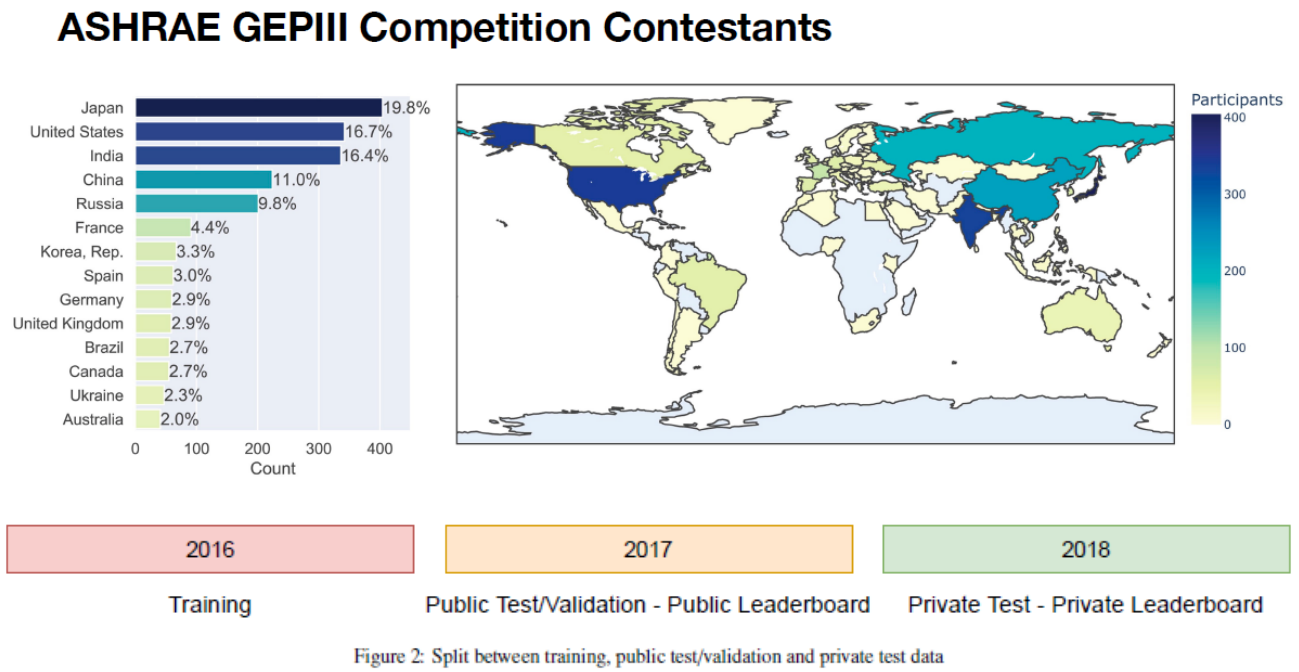


Figure 2: Split between training, public test/validation and private test data

Why LightGBM?

Great Energy Predictor III

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Rank	Team Name	Score	Pre-process	Feature Strategy	Features	Modeling Strategy	Post-Process
9	MPWARE	1.241	RO, I	H, CS	-	LGBM(7), CB(4), LM(1), NN(4)	EM
13	Tim Yee	1.243	RO, I	CS	-	LGBM(3)	EM
20	[ods.ai] PowerRangers	1.244	RO, I	-	-	LGBM(15), NN(5)	EM
25	Georgi Pamukov	1.245	RO, I	H	-	LGBM, NN, LR	EM
46	Fernando Wittmann	1.248	-	-	-	LGBM(9)	EM
52	Pavel Gusev	1.25	-	-	-	LGBM(4)	EM
77	CR7	1.256	RO, I	H, CS	50	LGBM(10), CB(1)	EM
173	Electrium Z	1.267	RO, I	H, CS	-	LGBM, CB, XG, RF, NN	EM
367	patrick0302	1.28	RO, I	H, CS	40	LGBM(7)	EM
497	Hiroyuki Namba	1.286	RO	-	18	LGBM(32)	EM
1545	KottayamKings	1.31	RO	H	14	LGBM (1)	-
1678	Taegwan Kim	1.32	-	H	14	LGBM (1)	-
1703	Vishwanath R Kulkarni	1.326	RO, I	CS	25	LGBM (1)	-
1710	Georgios Chatzis	1.327	RO	-	17	LGBM (1)	-
1727	UniTartu_ML	1.332	RO, I	CS	27	LGBM (1)	-
1866	Sergei Tsimbalist	1.369	RO, I	-	18	LGBM (1)	-
1920	Hitesh Somani	1.378	RO, I	-	24	LGBM (1)	-
2058	Clement_ut	1.385	RO, I	CS	27	LGBM (1)	-
2066	Atharva Patel	1.386	RO	H	24	LGBM (1)	-

LightGBM dominates among all ML models!

→Let's use LightGBM model as the prediction model today!

Demo time
- Energy modeling

Let’s dive into energy data and modeling!

(Train: 2017-2020, test: 2021-2022)

Energy issues in Taiwan

自由財經- 自由時報

夜尖峰用電恐又爆 台電東拼西補祭3招

...〔記者林菁樺 / 台北報導〕電力真的吃緊！台電盼民眾節約用電，台電興達回歸、麥寮協助後，白天電力系統比昨天約增加100萬瓩，關鍵的 ...

5 小時前

科技新報

電力備轉容量率只剩6.73% 供電吃緊，台電將個別通知大用戶 ...

今（18）日氣候預報與昨日相同，均可能出現38 度以上極端高溫，冷氣需求大增，加上景氣升溫帶動用電增加，台電預估尖峰負載高出昨日實績值 ...

5 小時前

聯合新聞網

513大停電餘悸猶存台電又出包？興達電廠今中午又跳機

依台電網站資料，興達電廠一機組目前顯示故障。台電表示，興達電廠是今天中午12點54分發生跳機，正在查明原因，目前沒有造成停電等影響， ...

1 天前

聯合新聞網

又停電又染疫！台電板橋營業處傳員工確診 約20人隔離

台電各營業處目前正常受理民眾申辦業務，都有落實戴口罩、量體溫、實聯制、消毒等疫情指揮中心要求的相關防疫措施。 疫情快報.。【今日疫情 ...

1 小時前

新頭殼Newtalk

Yahoo奇摩新聞

夏季用電尖峰不斷電？台電給答案

至於面臨即將來到的夏季尖峰用電，楊偉甫則稱會先做好準備，在夏天之前會把所有調度能量放到最大。 台電董事長楊偉甫透過影片提到，供電 ...

23 小時前

經濟日報- 聯合新聞網

停課民生用電增 台電急調度民營機組力拚不限電

同時透過需量反應等措施，預計可減少105萬瓩用電需求。 經濟部長王美花昨天也表示，太陽光電能解決白天尖峰負載，真正挑戰會落在夜間尖峰用 ...

6 小時前

自由財經- 自由時報

夜尖峰用電恐又爆 台電東拼西補祭3招

台電盼民眾節約用電，台電興達回歸、麥寮協助後，白天電力系統比昨天約 ... 加上景氣升溫，以致用電增加，台電預估尖峰負載略升為3750萬瓩。

1 天前

中時新聞網

救援投手又上場！下午用電達尖峰 台電抽蓄水力發電再啟動

根據台電資料顯示，18日用電尖峰出現在下午1點40分，尖峰用電量3728萬瓩，略低於17日用電量，最後實際備轉容量率為8.30%，亮出供電 ...

1 天前

2.5% of energy growth rate in Taiwan

能源局4月份更新的統計資料顯示，2021年我國總用電量高達2830億度，漲幅4.3%，是近10年來最高。 2021年用電量與經濟成長率雙雙破紀錄，用電漲幅還遠超最新的年均用電成長率估值2.5%。 能源局官員表示，每一年的用電成長狀況都不同，去年經濟大幅成長是用電需求提升的主因，也讓漲幅較難精準掌握。 2022年5月10日

https://e-info.org.tw › node

連兩年用電破紀錄能源局統計：2021年工業用電史上新高

Energy forecasting from Taipower

Power Supply and Demand Forecast for the Next Seven Days (updated: 07/20/2022)

	07/21 (Thu.)	07/22 (Fri.)	07/23 (Sat.)	07/24 (Sun.)	07/25 (Mon.)	07/26 (Tue.)	07/27 (Wed.)
Net Peaking Capability(MW)	44420	44460	42280	38690	44080	44510	44450
Peak Load (MW)	40300	40300	34900	34300	39900	40300	40300
Operating Reserve(MW)	4120	4160	7380	4390	4180	4210	4150
Percent Operating Reserve (%)	10.22%	10.33%	21.14%	12.78%	10.47%	10.44%	10.30%
Light of Percent Operating Reserve							

≥10%: Supply Adequate

10%~6%: Supply Tight

≤6%: Emergency Stage 1

≤900MW: Emergency Stage 2

≤500MW: Emergency Stage 3

The Taiwan Power Company is a state-owned electric power industry providing electricity to Taiwan

Energy forecasting from Taipower

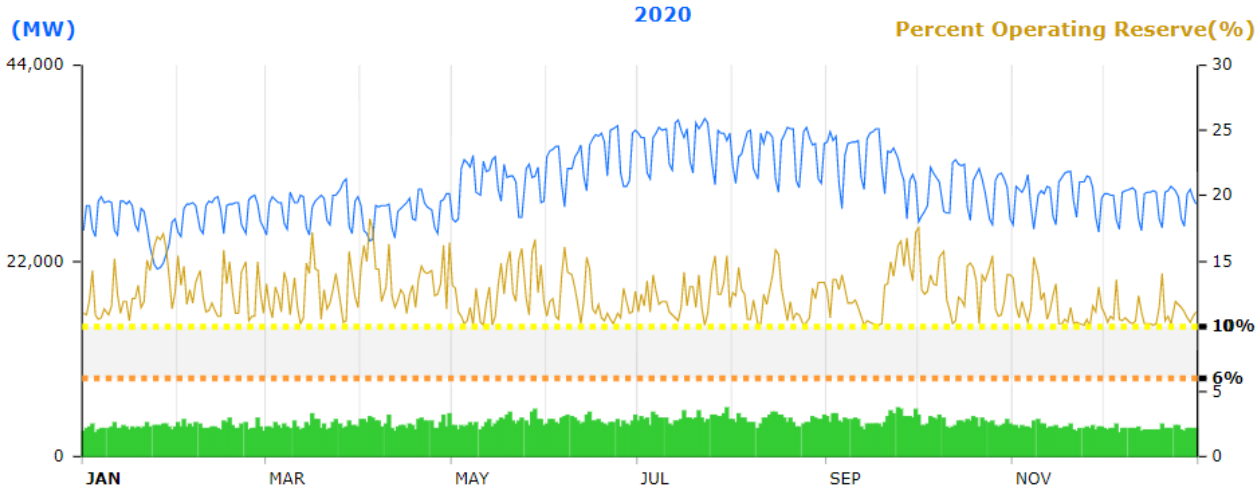
Could we make better energy forecasting than Taipower company?

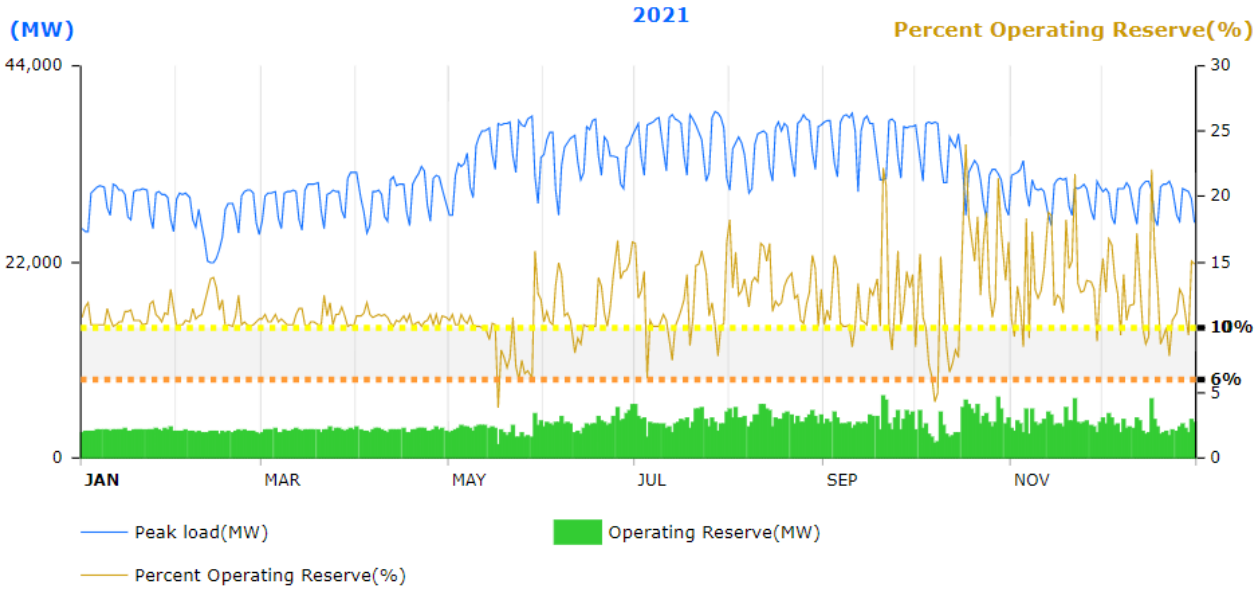
The Taiwan Power Company is a state-owned electric power industry providing electricity to Taiwan

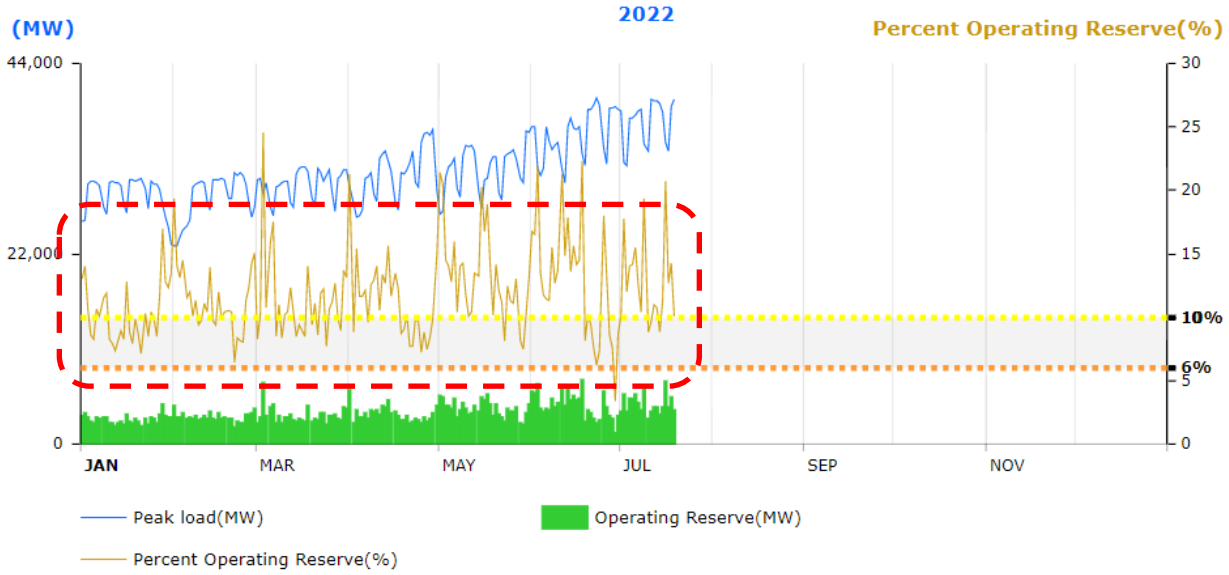
Operating Reserve (備轉容量)

•Taiwan Power Company provides the percentage of estimated peak operating reserve on a daily basis
• The estimated operating reserve percentage is published by 7AM every day, and will be updated when needed. The net peaking capability includes the power generated during the trial run and testing.

Operating Reserve (備轉容量)

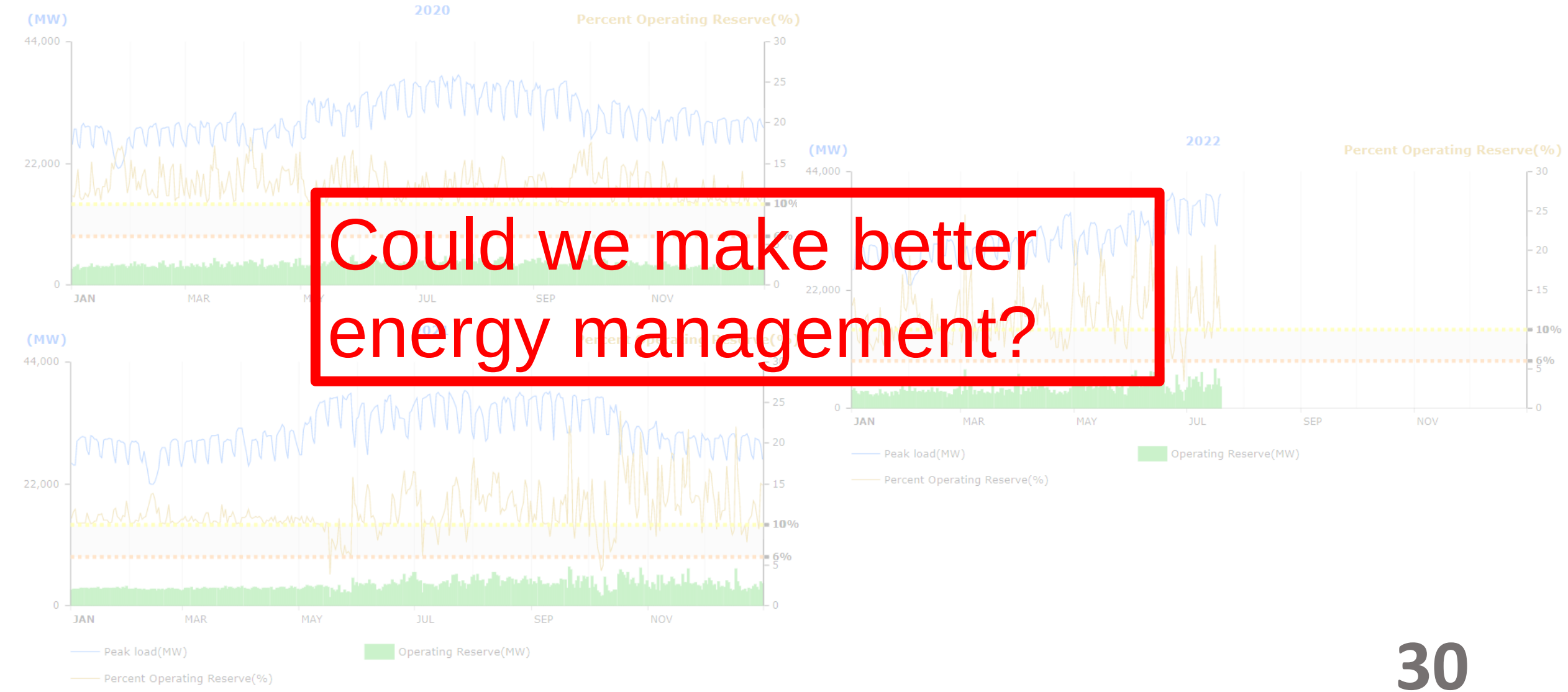






The setting of operating reserve seems more unstable in recent years… …

Operating Reserve (備轉容量)



Could we make better energy management?

Demo time
- Energy forecasting

Compare it with Taipower’s prediction!

Summary

- Open datasets
  - Various and rich open datasets in Taiwan
  - Official and unofficial data sources
- Energy modeling
  - LightGBM: good balance between performance and tuning effort
  - Good performance: R^2 between forecast and measurement > 0.95
  - Even slightly better than forecasting from Taipower company!
- Better strategies for energy management in Taiwan?
  - Taipower company has good enough forecasting
  - Mystery of setting operating reserve…

Do you have further application or idea based on the open data?

Thanks for your attention!

Chun Fu

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Github:
https://github.com/PatrickFu0302/pycon2022_taiwan_energy