Creation of a simplified agent-based energy model for building

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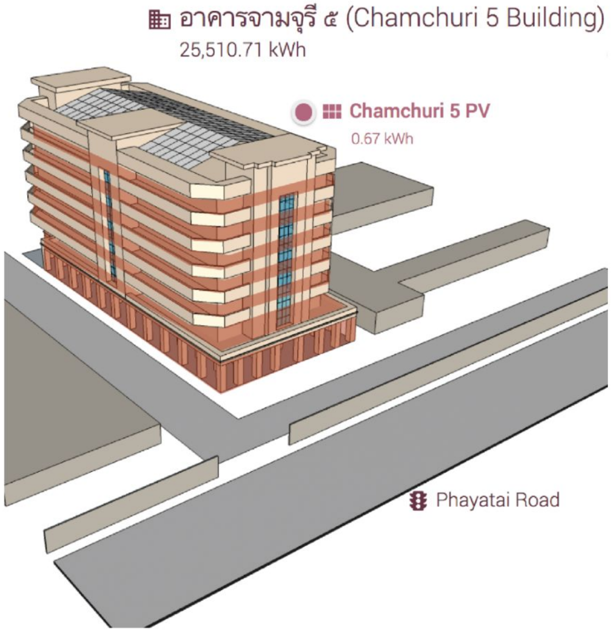
The data

The data that i used contains : power consumption (kW) of individual AC units, lighting and plug loads in each zone, on each floor of the building, together with corresponding indoor temperature (deg C), humidity (%) and illuminance (lux) in each zone.
For my study, i only used the 6th Floor data.
Available at : https://sgrudata.github.io



Chamchuri 5 is a seven-story academic office building located at Chulalongkorn University. The building has the area of around 11,700 square meters (126,000 sqft). A typical building peak load is around 700kW.

The building is equipped with **CU-BEMS** --the building energy management system, developed at Chulalongkorn University. Since mid-2018, CU-BEMS has been used to measure power consumption of building loads by type, as well as indoor temperature, humidity and ambient light condition in each zone of the building.

This site archives historical data collected by **CU-BEMS** for this particular building.

- **Data intervals:** one-minute
- **Data format:** csv
- **Data duration:** July 1, 2018 - December 31, 2019

Available data for download are: power consumption (kW) of AC, lighting, plug load, indoor temperature (deg C), humidity (%) and illuminance (lux).

Challenges to adapt the dataset to the environment

- the dataset that i found don’t contain all the information taking account by the environment, i limited the environment control to cooling storage and electrical storage.

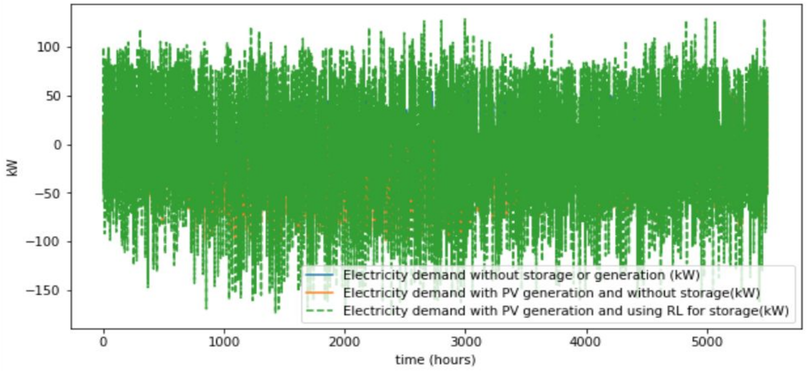
- The states returned by CityLearn at each step were also limited to:
  - MONTH
  - DAY
  - HOUR
  - TEMPERATURE INSIDE THE BUILDING
  - HUMIDITY INSIDE THE BUILDING
  - ELECTRICAL STORAGE SOC
  - COOLING STORAGE SOC
  - NET ELECTRICITY CONSUMPTION.

- I used Deep Q Learning to develop the agent, since the actions are in a continuous interval, the DQN contains 2 networks : the policy network (to predict the actions) and Q-value network : which predicts the Q-values for each state-action input.

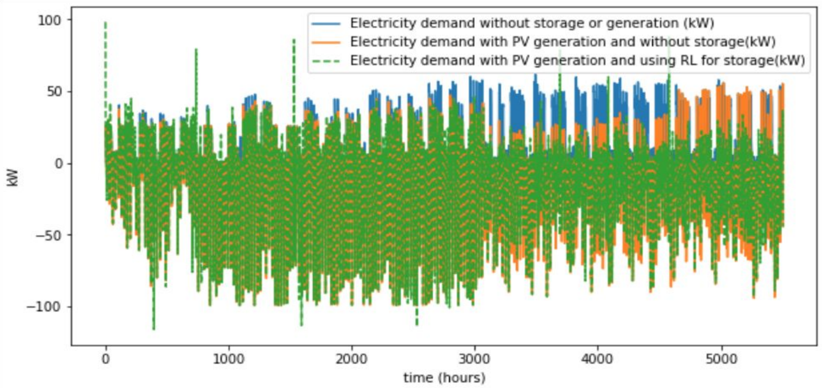
Results

- To evaluate the model, i used the metrics proposed by CityLearn and I plot the electricity demand that should be flatten to equilibrate the energy consumption and stockage.
- For this study, I compared two agents :
  - A baseline agent that take random actions.
  - The DQN Agent.

Baseline agent



DQN agent



Results - metrics

	ramping	1-load_factor	average daily peak	peak demand	net electricity consumption	total	coordination score
Baseline	6.019	0.827	3.744	2.538	2.759	3.177	3.282
DQN 1st episode	1.288	0.946	1.30	1.940	1.019	1.300	1.371
DQN 5th episode	1.044	0.924	1.023	1.930	0.875	1.159	1.230

Going further : it would be interesting to gather data of several buildings, pre-process the data with more precision and create a multi-agent system that controls all of them.