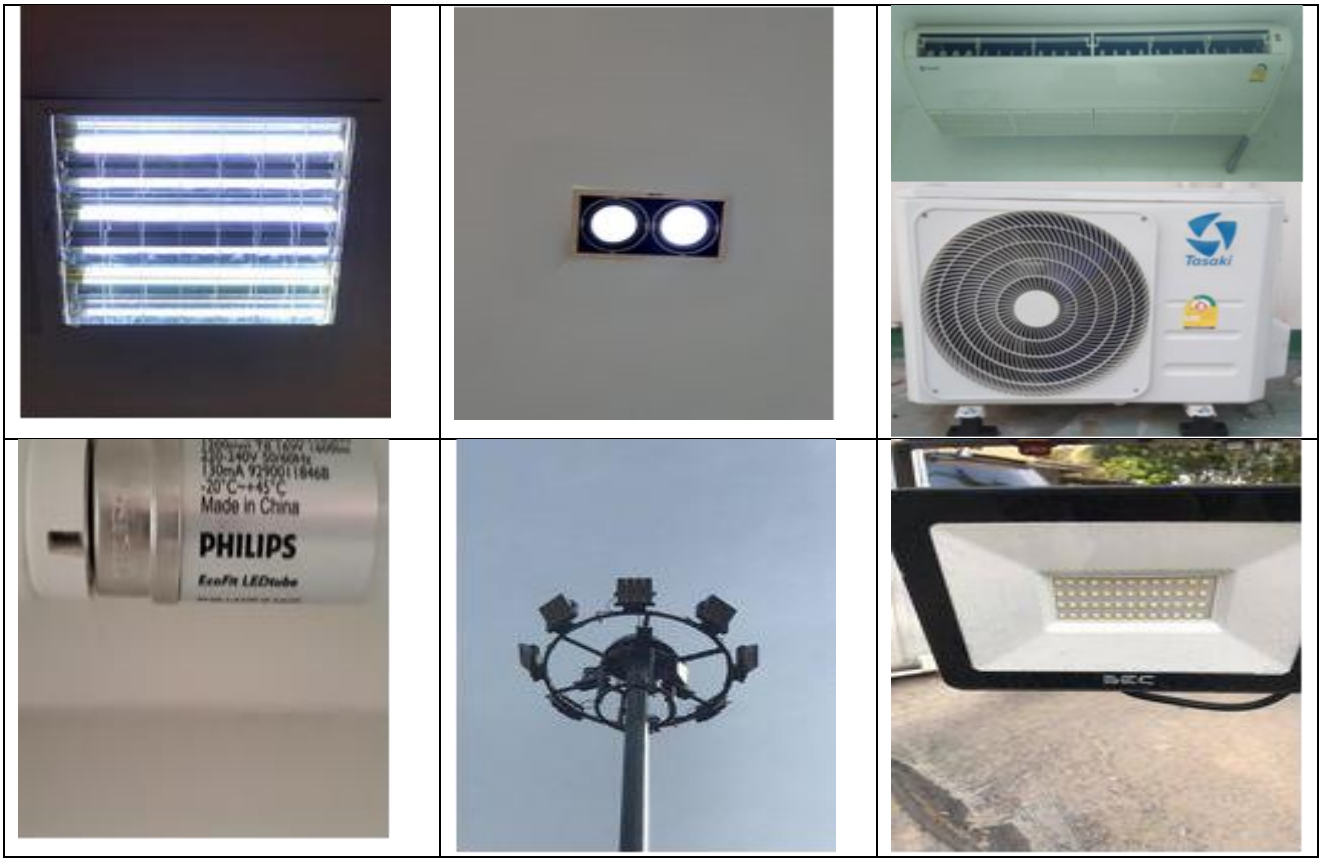
UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.1] Energy Efficient Appliances Usage



Example of Energy Efficient Appliances Usage in NPRU : (a) Fluorescent lamp with electronics ballast (b) LED Lamp 1 **(c) Air conditioners with Label No.**5 **certification (d) T**5 **LED Tube (e) LED High Mast Lights and (f) LED Spotlight**

Description:

Nakhon Pathom Rajabhat University has concerned about the use of energy-saving appliances. Energy-saving appliances, including LED lighting systems and air conditioners with Label No.5 certification, are used for all new buildings. For old buildings, conventional appliances have been replaced by energy-saving appliances such as LED lighting systems. Existing air conditioning appliances have regularly been cleaned and maintained, while the old ones have been replaced. Based on the mentioned methods, the university has already implemented energy conservation plans by replacing 26.32 % of existing appliances with new energy-efficient devices, as shown in table 1.

Table 1 Energy efficient appliances usage on campus

Appliance	Total Number	Total number energy Efficient appliances	Percentage
LED Lamp	7,953	7,953	100 %
Fluorescent lamp with electronics ballast	24,103	24,103	100 %
Others conventional lamp	545	545	0 %
Air conditioners	852	852	100 %
Total percentage of energy efficient appliances			**98.37 %**

UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.3] Smart Building Implementation

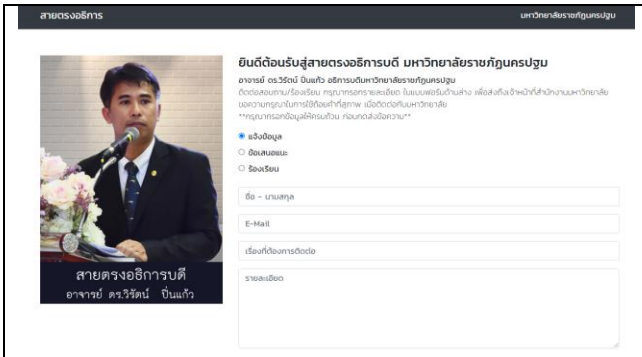
Description:

According to the definition of a smart building based on the UI Green Metric Guideline 2022, to be considered as a smart building requires more than 5 smart components. Nakhon Pathom Rajabhat University has 32 buildings with the area of 204,403.1 sq. m, which is **95.72 %** of the all building areas of the campus (213,551.1 sq. m.) that can be counted as a smart building. The first is an office of the president building which has 7 elements that meet the smart building criteria, which are B2-APP, S1-Intruder alarm, S2-Fire-fighting system, S3-CCTV system, E1-Energy Monitoring, I2-Air Quality and L1-LEDs. The second is Siri Varapunya Building which has 6 elements that meet the smart building criteria, which are B2-APP, S1-Intruder alarm, S2-Fire-fighting system, S3-CCTV system, E1-Energy Monitoring and L1-LEDs. Other buildings do not have the inspection system of temperature and air quality in the building as shown in Table 1.

Table 1 NPRU Smart Building

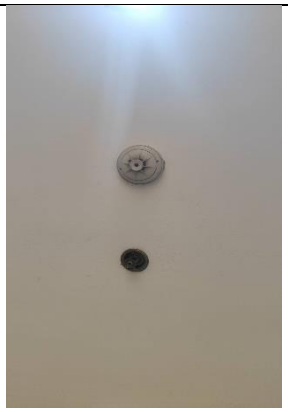
Field		Requirement		Description	Siri Varapunya	Other buildings
B	Automation	B1	BMS	Presence of Building Management System (BMS)/Building Information Modelling (BIM)/Building Automation System (BAS)/Facility Management System (FMS) **(recommended requirement)**	-	-
		B2	APP	Interactive support for users via APP or online service	B2	B2
S	Safety	S1	Intruder Alarm System	Intruder alarm system (recommended: interfaced with BMS)	S1	S1
		S2	Fire-fighting	Fire-fighting system (recommended: interfaced with BMS)	S2	S2
		S3	Video surveillance	Video surveillance system (recommended: interfaced with BMS)	S3	S3
		S4	Anti-flooding	Anti-flooding system (recommended: interfaced with BMS)	E1	-
E	Energy	E1	Monitoring	Automatic acquisition and logging system of energy consumption (recommended: interfaced with BMS)	-	-
		E2	Management	Automatic management system for energy supplies and production (recommended: interfaced with BMS)	-	-
A	Water	A1	Monitoring	Automatic acquisition and logging system of water consumption (recommended: interfaced with BMS)	-	-
		A2	Recovery	Rainwater recovery system for covering the flushing and irrigation	-	-
I	Indoor environment	I1	Thermal comfort	Monitoring (recommended: interfaced with BMS) of environmental parameters related to thermo-hygrometric comfort (e.g. air temperature, relative humidity, air velocity, etc.)	-	-
		I2	Air quality	Monitoring (recommended: interfaced with BMS)of pollutants (e.g. VOC, PM, CO_2 ...)	-	-
		I3	Real-time	Programming and management in real time according to the occupancy profile of the premises (recommended: interfaced with BMS)	-	-
		I4	Passive system	Passive cooling and/or exploitation/limitation systems for free supplies	-	-
L	Lighting	L1	LEDs	High-efficiency luminaires (LEDs)	-	
		L2	Sensors	Automatic lighting control (recommended: presence/illuminance sensors interfaced with BMS)	L1	L1
		L3	Shielding	Shielding adjustment and solar control	-	-
		L4	Natural light	Passive systems for natural light exploitation	-	-

Example of Smart building implementation
Office of the president



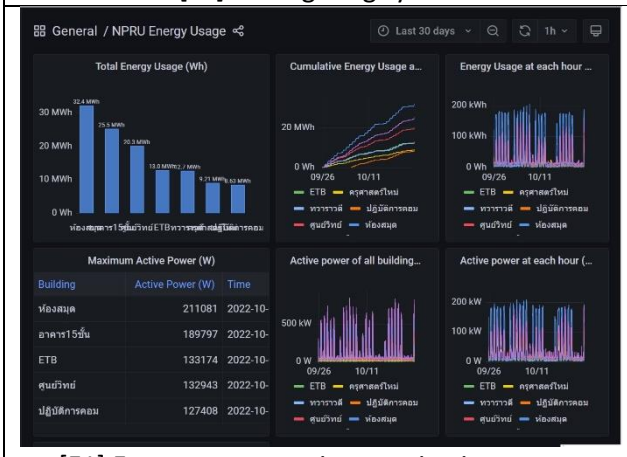
[B2] Interactive support for users via online service.(http://res.npru.ac.th/president_hotline/)

[S1]-Intruder alarm and [S3] CCTV system.



[S2] Fire-fighting system.

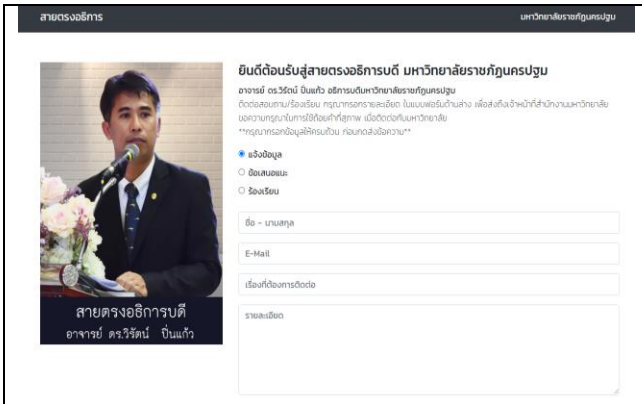
[I2] Air Quality Monitoring system.



[E1] Energy consumption monitoring system.

[L1] LEDs.

Siri Varapunya Building



[B2] Interactive support for users via online service. (http://res.npru.ac.th/president_hotline/)

[S1]-Intruder alarm of Siri Varapunya building.

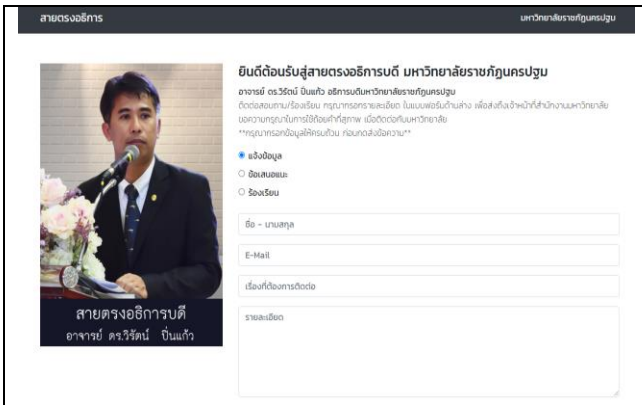
[S2] Fire-fighting system.

[S3] CCTV system.

[E**1**] Energy consumption monitoring system.

[L1] LEDs.

Engineering and Technology building



[B2] Interactive support for users via online service. (http://res.npru.ac.th/president_hotline/)

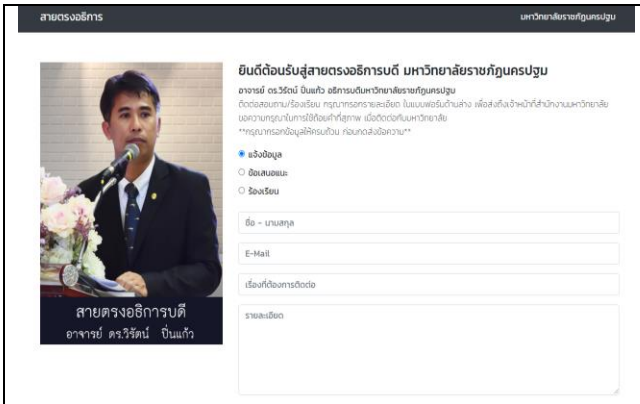
[S1]-Intruder alarm of Siri Varapunya building.

[S2] Fire-fighting system.

[S3] CCTV system.

[L1] LEDs.

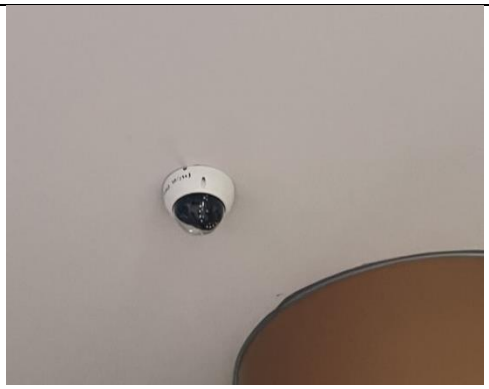
Humanities and Social Sciences Building



[B2] Interactive support for users via online service. (http://res.npru.ac.th/president_hotline/)

[S1]-Intruder alarm of Humanities and Social Sciences Building

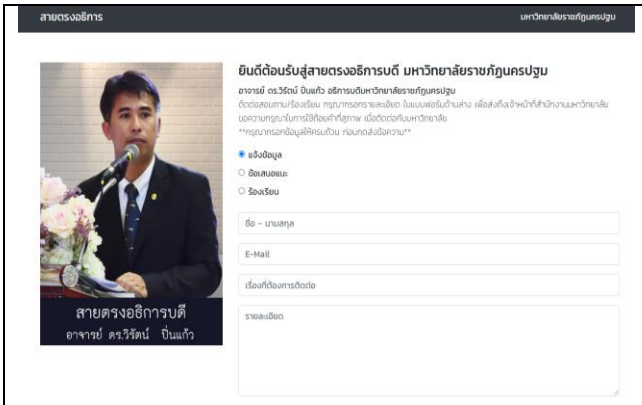
[S2] Fire-fighting system



[S3] CCTV system.

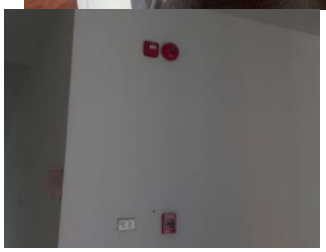
[L1] LEDs.

Education Building



[B2] Interactive support for users via online service.

(http://res.npru.ac.th/president_hotline/)



[S2] Fire-fighting system

[S3] CCTV system.

[E1] Energy consumption monitoring system.

[L1] LEDs.

Language Institute Building

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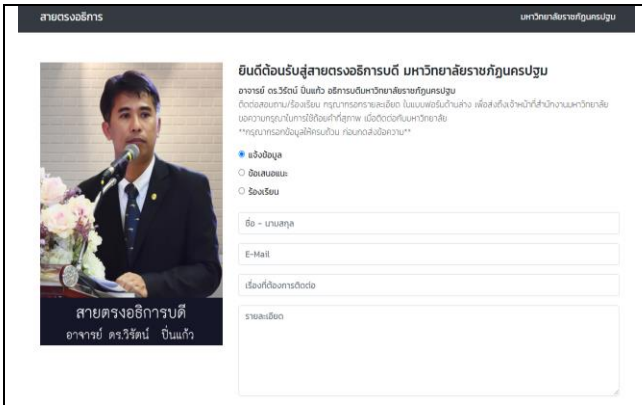

[B2] Interactive support for users via online service. (http://res.npru.ac.th/president_hotline/)
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[S2] Fire-fighting system
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<td>

[L1] LEDs.
</td>
<td>

[E1] Energy consumption monitoring system.
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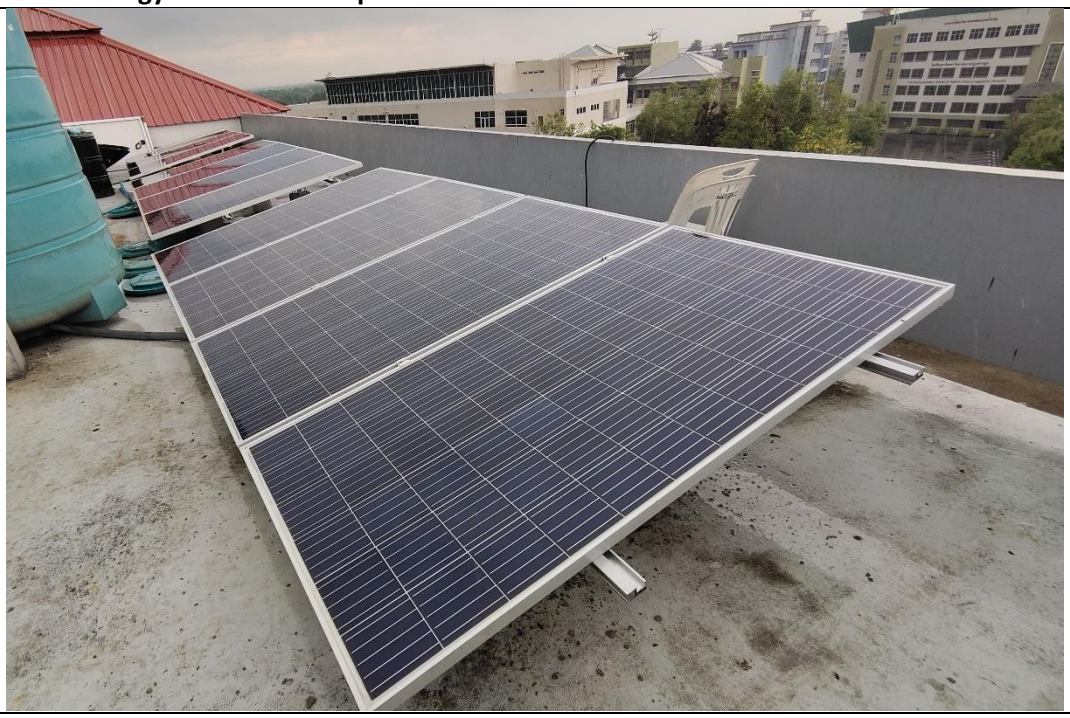
UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.5] Renewable Energy Sources in Campus



Example of 3.96 kW Solar Roof Top (Engineering and Technology Building)

Description:

On the rooftop of ETB building, a small solar PV system is installed for supplying power to lighting and charger systems in the electrical laboratory room (ETB 406). The total capacity of the solar PV system is 3.96 kW. The solar PV system has been operating 5.23 [1] hours per day and 240 days per year. The solar panels have 0.7 [2] energy yield derating factor (EF). The production of electric power is 3.96 x 5.23 x 240 x 0.7 = 3,479.41 kWh/year

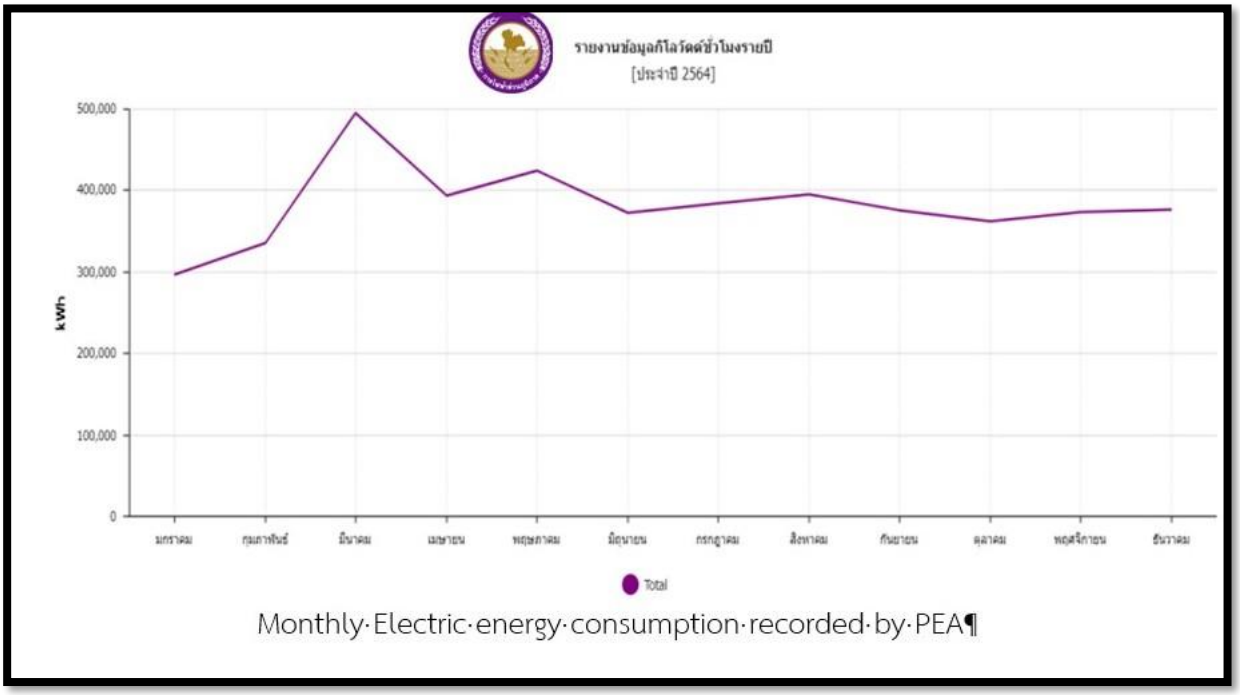
[1] See NASA Langley Research Center Atmospheric Science Data Center (2011)
[2] The energy yield derating factor is calculated from an energy loss occurring in the system, such as tilt angle installation, the location, inverter wiring, dust and so on, which typically equals 0.7 (based on www.greenzone-thailand.com).

UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.6] Electricity Usage per Year (in Kilowatt hour)



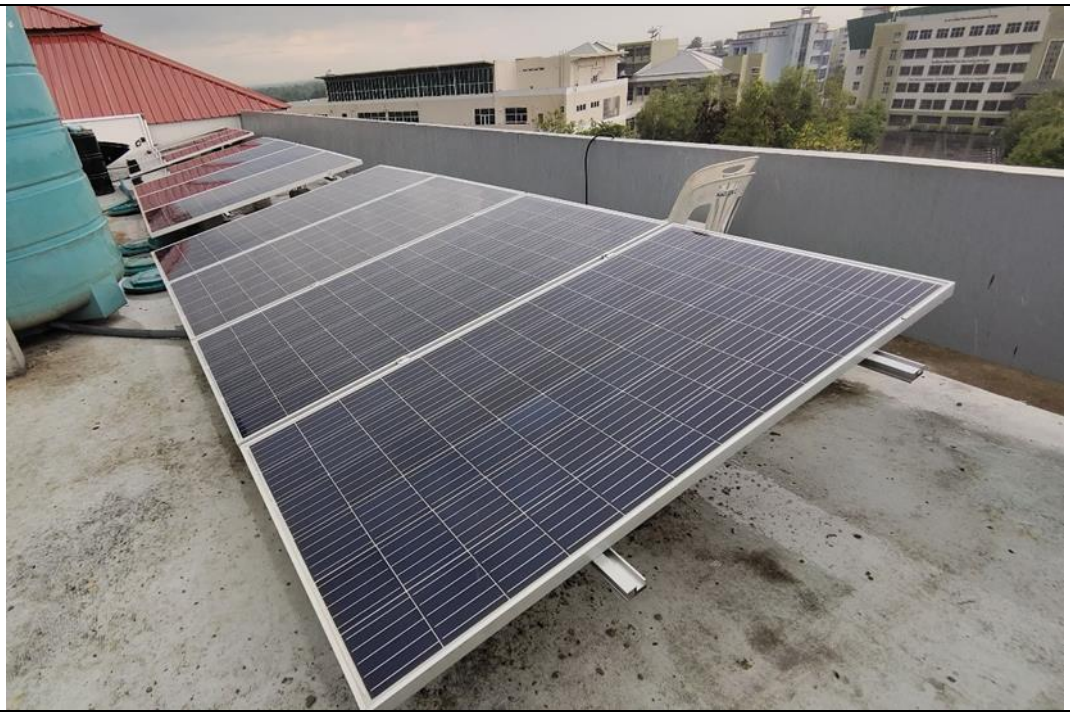
Description:
In 2021, Nakhon Pathom Rajabhat University used electricity for 4,585,959.44 kWh.

UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.8] The ratio of renewable energy production divided by total energy usage per year (EC.5)



Example of 3.96 kW Solar Roof Top (Engineering and Technology Building).

Description:

In 2021, onsite renewable energy produced 3,479.41 kWh, while electricity consumption was 4,585,959.44 kWh. Based on the total energy consumption on campus, **the proportion of renewable energy production per energy consumption was 0.07 %**, as shown in Table 1.

Table 1 The amount of renewable energy production in 2021

Detail	Unit	In 2021
Electric energy usage	kWh/y	4,585,959.44
Electric energy production		
Solar PV from ETB building	kWh/y	3,479.41
Electric energy production per energy consumption		**0.07 %**

UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.10] Greenhouse gas emission reduction program

	
1. PV Solar Rooftop	2. NPRU EV shuttle bus utilizes two electric vehicles replacing four-wheeled diesel cars)

Description:

From the summary table of the greenhouse gas reduction measures of Nakhon Pathom Rajabhat University in 2021, there are all kinds of direct and indirect greenhouse gas emission reduction projects (Scope 1 and 2).

2021 greenhouse gas reduction measures include
1. The electrical power produced by PV Solar rooftop = 3,479.41 kWh/year. The amount of greenhouse gas is reduced to 3,479.41 x 0.561[1] = 1,951.95 kgCO2 = 1.952 TonCO2/year.
2. The NPRU EV shuttle bus uses 2 electric vehicles replacing four-wheeled diesel cars, using average diesel gas amount of **7 liters/day** and average fuel consumption of 8 km/litre. This reduces 7 x 240 x 2.7080/1000 = 4.549 TCO2/year.
Table 1 Greenhouse gases emission reduction in 2020.

Activities	**Greenhouse gas in 2021**	
	TonCO_2 reduction a year	**%**
PV Solar rooftop	1.952	-
NPRU EV shuttle bus utilizes two electric vehicles replacing four-wheeled diesel cars	4.549	-
Total greenhouse gas emissions reduction in 2021	6.501	-

Emission Factor

[1]Electricity 1 MWh = 0.561 TonCO_2
[2]Gas/Diesel fuel emission = 2.7080 kgCO_2/litre

Option 2 : UI Green metric calculation criteria

CO2 (electricity) = (4,585,959.44 kWh /1000) x 0.84 = 3,852.21 metric ton
CO2 (cars) = (257 x 2 x 2 x 240/100) x 0.02= 49.34 metric ton
CO2 (total) = 3,901.55 metric ton In 2020, 25,098 people made CO_2 footprint per person as 0.229 metric ton/person.

In 2021, the population of 17,729 people made a CO2 footprint per person of 0.220 metric tons per person.

* The NPRU EV shuttle bus is a zero-emission vehicle using electricity. Its CO2 footprint has already been counted in electricity.

* The motorcycle does not allow to enter into the university area because of the existence of motorcycle parking area. Therefore, Its CO2 footprint is zero.

UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.11] Please Provide The Total Carbon Footprint (CO_2 emission in the last 12 months, in metric tons)

The Total Carbon Footprint (CO_2 emission in the last 12 months, in metric tons)
CO2 (electricity) = (4,585,959.44 kWh /1000) x 0.84 = 3,852.21 metric ton **CO2 (cars) = (257 x 2 x 2 x 240/100) x 0.02= 49.34 metric ton** **CO2 (total) = 3,901.55 metric ton**

Description:

In 2021, the population of 17,729 people made a CO2 footprint per person of 0.220 metric tons per person.

* The NPRU EV shuttle bus is a zero-emission vehicle using electricity. Its CO2 footprint has already been counted in electricity.

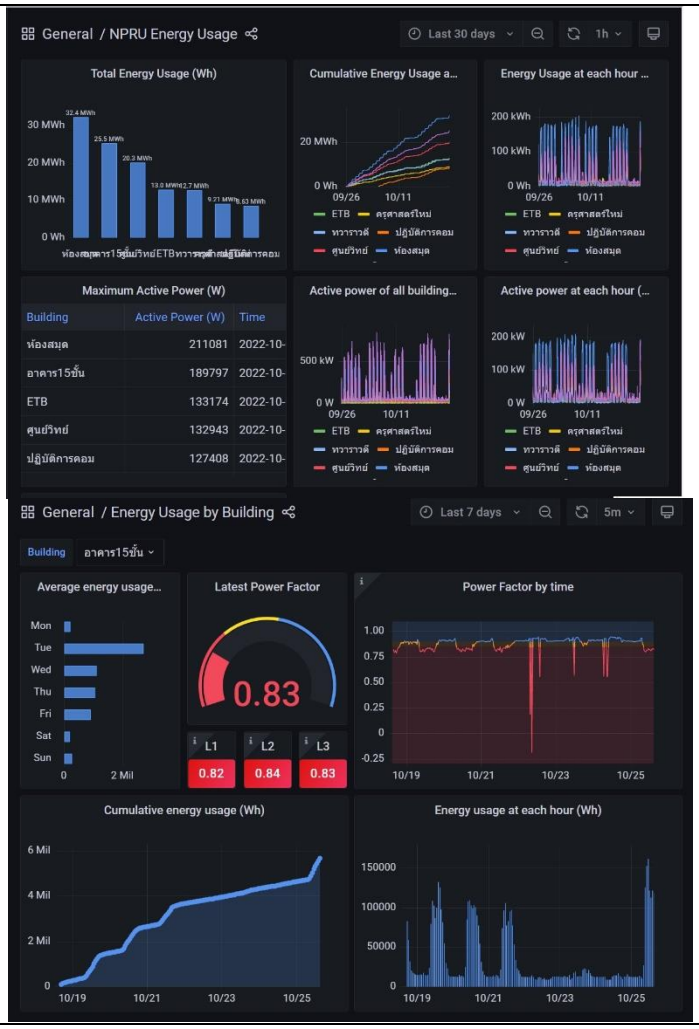
CO2 (total) = 3,901.55 metric ton (From UI Green metric calculation criteria)

Template for Evidence(s)
UI GreenMetric Questionnaire

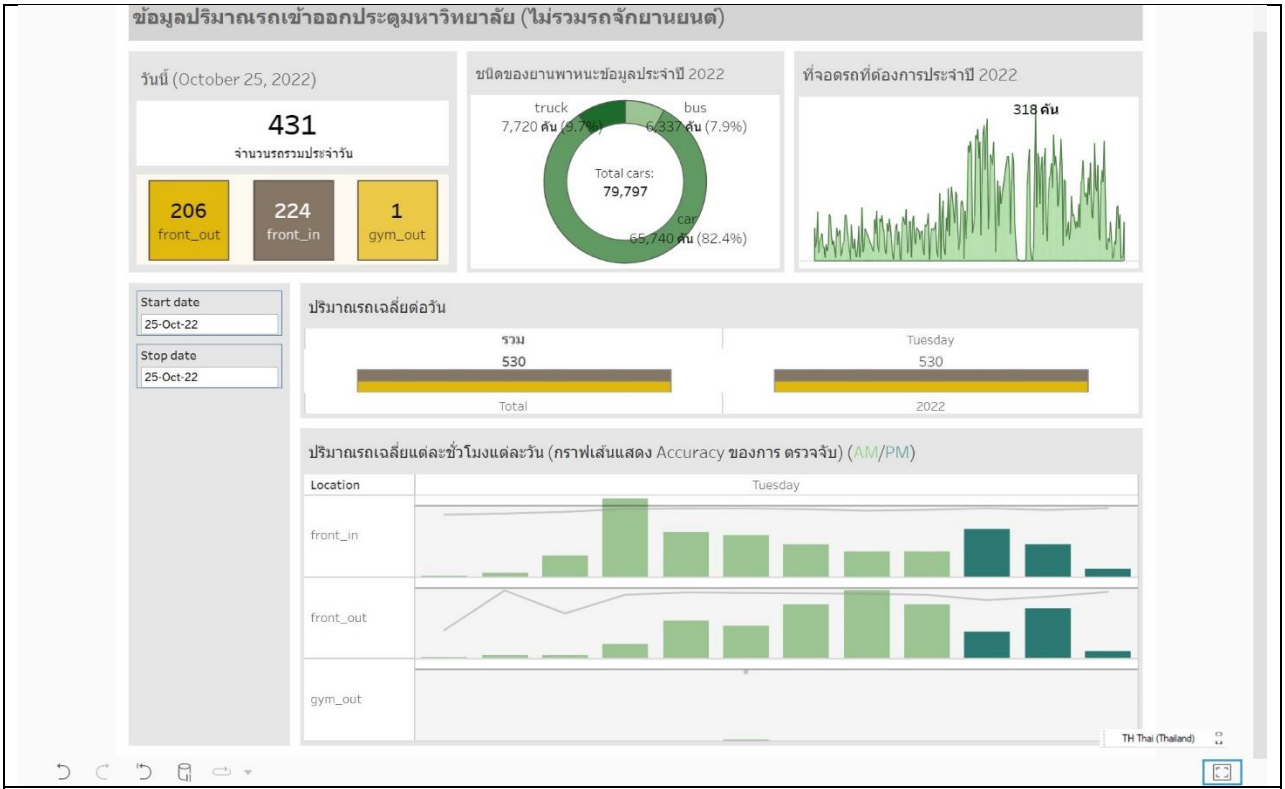
University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : www.npru.ac.th

[2] Energy and Climate Change (EC)

[2.13] Number of innovative program(s) in energy and climate change



1. Energy Usage Monitoring System.



2. Vehicle Counting System.

Description:

1. Energy usage monitoring system is used for monitoring the energy consumption of each building in NPRU. Data from the system will be used for planning the policy of energy management to reduce the energy consumption as much as possible.

2. Vehicle counting system is used for monitoring the number of vehicle such as buses, cars and trucks entering in NPRU. Data from the system will be used for planning the policy of greenhouse emission reduction and improving the NPRU transportation service

Template for Evidence(s)
UI GreenMetric Questionnaire

University : Nakhon Pathom Rajabhat University
Country : Thailand
Web Address : ww.npru.ac.th

[2] Energy and Climate Change (EC)

[2.14] Impactful university program(s) on climate chang

No	Programs	Scope (international/regional/national)	Total Participants	Photo	URL	Description
1	Research and Development of Biomass Gas Station as an Alternative Fuel Source for Household and Community Enterprise in the Country's Rural Society	Surrounding communities	People in the area.	 	https://tnrr.nriis.go.th/#/services/research/detail/63038462	This research project aims to develop efficient small biomass gasification station for community application and transfer technology to community.

No	Programs	Scope (international/regional/national)	Total Participants	Photo	URL	Description
2	Research and Propagation of Hybrid PV Cells Power Generation Technology to Deep Underground Water Suction for Non-Toxic Vegetable Production : The Case Study of Huai Phra Organic Vegetable Community Enterprises Huai Phra, Don Tum, Nakhon Pathom	Surrounding communities	5 Teachers and 20 people in the area.	 	https://dric.nrct.go.th/Search/ShowFulltext/2/307869	This research project aims to study and transfer technology of hybrid PV cells power generation to community in case of Huai Phra Organic Vegetable Community Enterprises Huai Phra, Don Tum, Nakhon Pathom.

Additional information: https://tnrr.nriis.go.th/#/services/research/detail/63038462

https://dric.nrct.go.th/Search/ShowFulltext/2/307869