



"Zero Waste, Zero Emission, Rich in Bio-and Cultural-diversity"

**IPB ECO/GREEN
CAMPUS 2020**

MONITORING SYSTEM FOR GREEN CAMPUS OF IPB

Bregas Budianto and team

Bogor Agricultural University / CCROM-SEAP

Institut Pertanian Bogor
Mencari dan memberi yang terbaik

Keterangan :

1. Rektorat IPB	16. Wisma Amanitis
2. Peta Utama Kampus IPB damdaga	17. Lapangan Basket
3. Taman - taman Plaza Rektorat	18. GOR Lama
4. Cemasium (GWW)	19. Masjid Alhudaib
5. Danau Situ Burung	20. Wisma Temu Lendahuis
6. Auditorium Rektorat	21. Poliklinik IPB
7. Perpustakaan (LSI)	22. Koperasi IPB
8. Kolam Percobaan Perikanan	23. Lap. Lapangan Fak. Kehutanan
9. Rumah Polong Hewan	24. Asrama Putri
10. Lap. Fakultas Kedokteran Hewan	25. Asrama Putri
11. Lap. Kandang Percobaan Hewan	26. Mini Market
12. Rumah Sakti Hewan	27. GOR Cemasium
13. Lap. University FARM	28. Kamin Amanitis
14. Lap. Kandang Ayam	29. Unit Keamanan Kampus
15. Perumahan Dosen IPB	

www.ipb.ac.id

Informasi:
Ged. Rektorat L1.1, Kampus Darmaga Bogor 16800
Telp. : (0251) 8420638, fax. : (0251) 8622708

BACKGROUND

- 2014, **CCROM** supported with **NIES**, start to study the behavior of Bogor city energy consumption
 - > base line data for the future energy policy

- Many points of businesses, offices, houses of Bogor city and our campus their electricity consumption have been monitored

-> system provided by **Fujitsu** and **Fuji electric**

- Limitation of equipment

-> in our main campus only the central office are installed

2.3 Measuring Points in Bogor, Indonesia



Source : NIES-IPB-Fujitsu

OBJECTIVES

Increase Energy Efficiency

- Campus facilities that consume most of campus electricity need to be studied (monitored)



-> classrooms, laboratories, dormitories, workshops, freshwater processing, campus transport system, road lighting etc.



PROGRAM

- Our Rector have special interest on Energy monitoring system to study behavior of campus community in using energy toward
- CCROM try to provide similar instrumentation to expand monitoring energy consumption of IPB
 - transparent data of energy cost may change habits
 - IPB intends to improve it's energy efficiency



Beside energy (electric & fuel) monitoring system, we intends to monitor CO₂ around campus both local and mobile sampling. To provide auxiliary data for GHGs observation Lab. Of NIES in Baranangsiang

PROGRESS

- experience of developing weather station network
 - > replacing the weather sensors with electrical sensor

We use one type of CT sensor with clip mechanism with 20A/volt

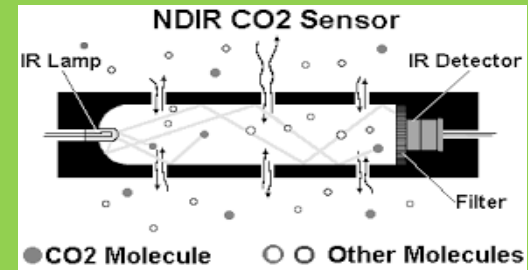
Clip mechanism simplifies the installation without disturbing AC line

we develop four channel of current sensors, dedicated for 4 loads

lighting , Air conditioning, home appliance/ office equipment,
auxiliary

Data communication to the internet utilizing modem 3G and we add feature device location without GPS , rough approximation by BTS signaling.

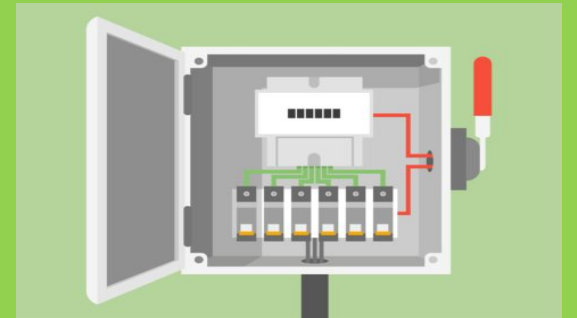
- the device ready for implementation of mobile monitoring, for instance to monitor campus transport system by electric cars and also ready for CO2 measurement by NDIR sensor.



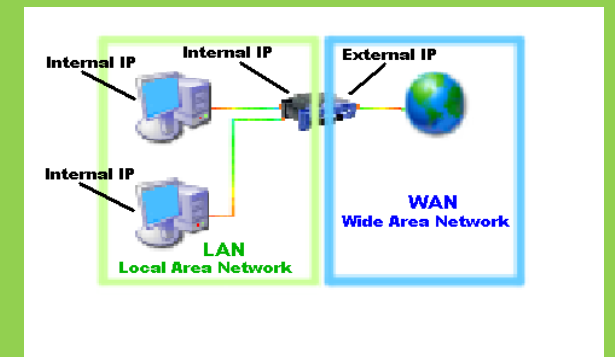
SPECIFICATION

- outdoor equipment electromagnetic interference is low. Possible problems of cellular data communication when operating inside electrical panel box within building.

anticipated by sending data as frequent as possible



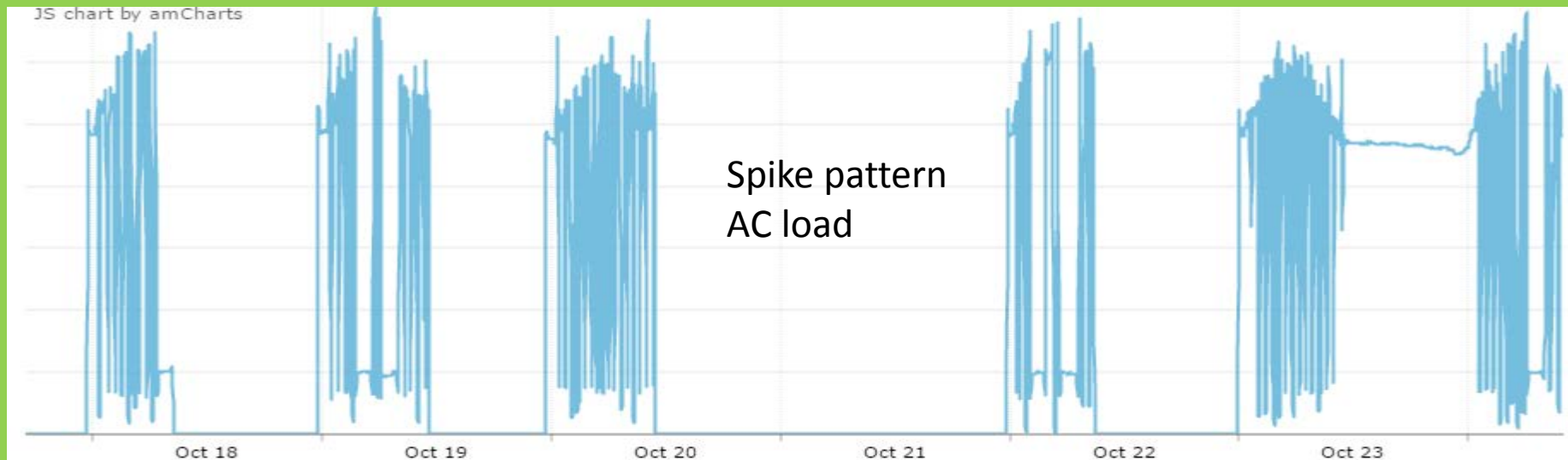
- Fujitsu system is prepared for LAN environment have advantage of large integration for building complex. we develop without LAN connectivity, each node work for WAN connectivity by Cellular data network



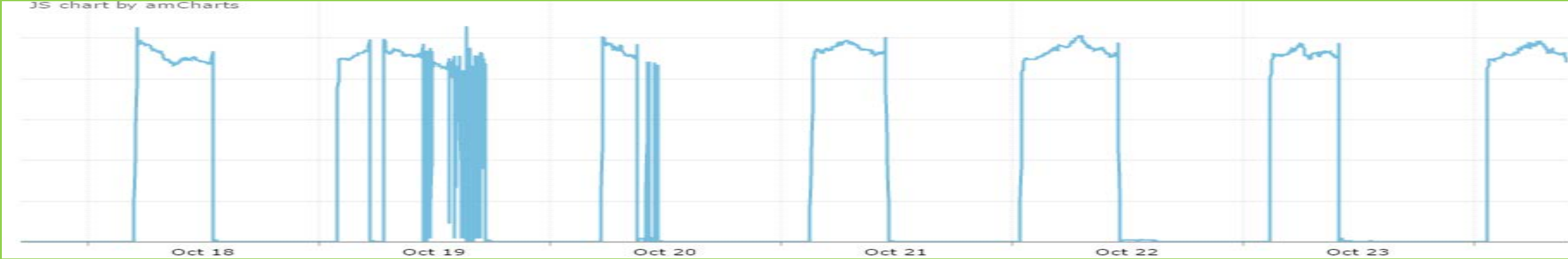
- **add cost** of data communication of every nodes but **easier installation**, no need network parameter setting. We will use **LoRa** communication next

Some data, showing different AC thermostat setting

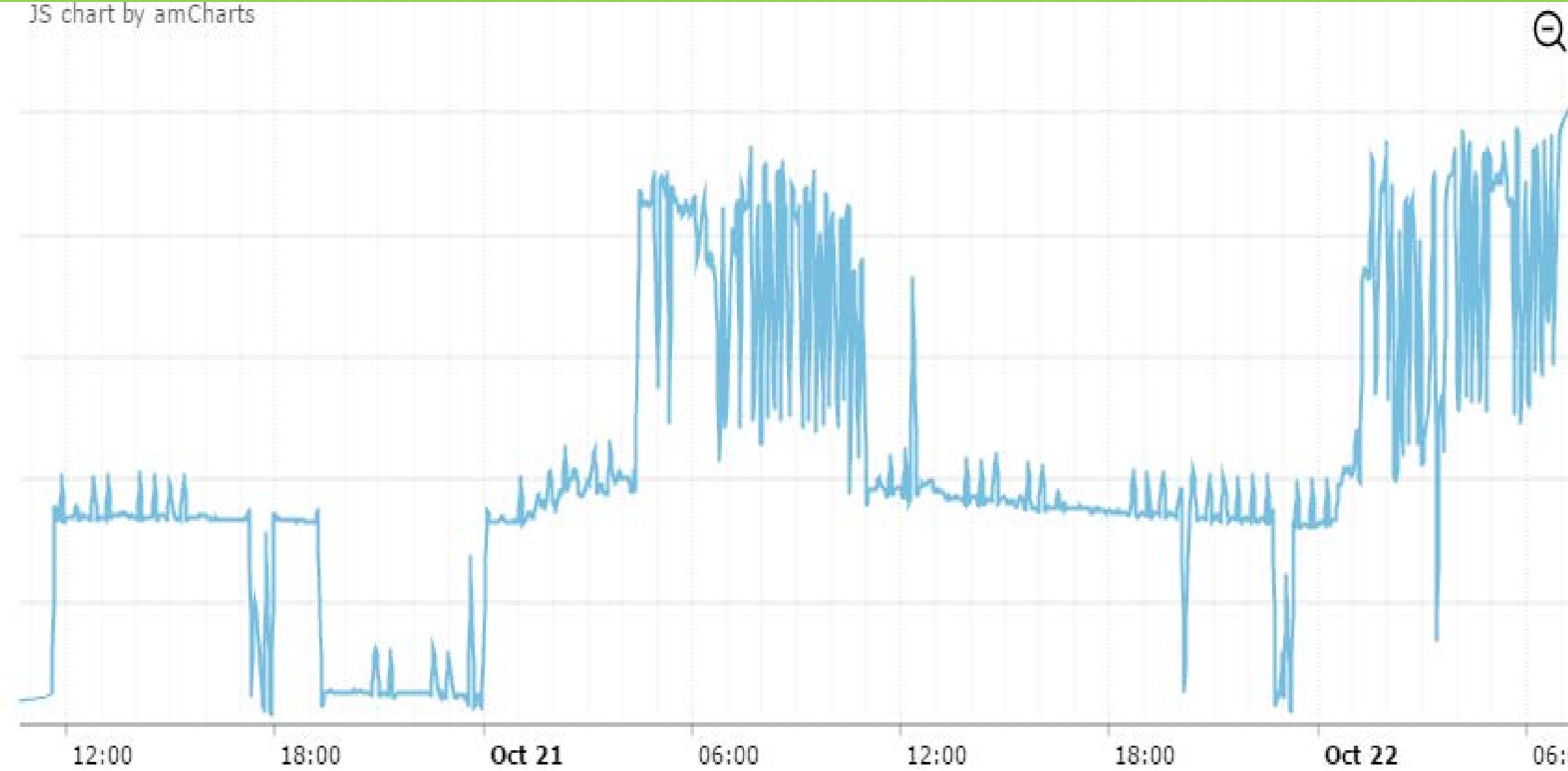
20 21 weekend



Some data of showing different pattern



Example of hourly data (mix AC & lighting load)



Friday

Sat

Sun



Frequent sampling, some data transmission fail

JS chart by amCharts

Lighting & office appliance

18:00

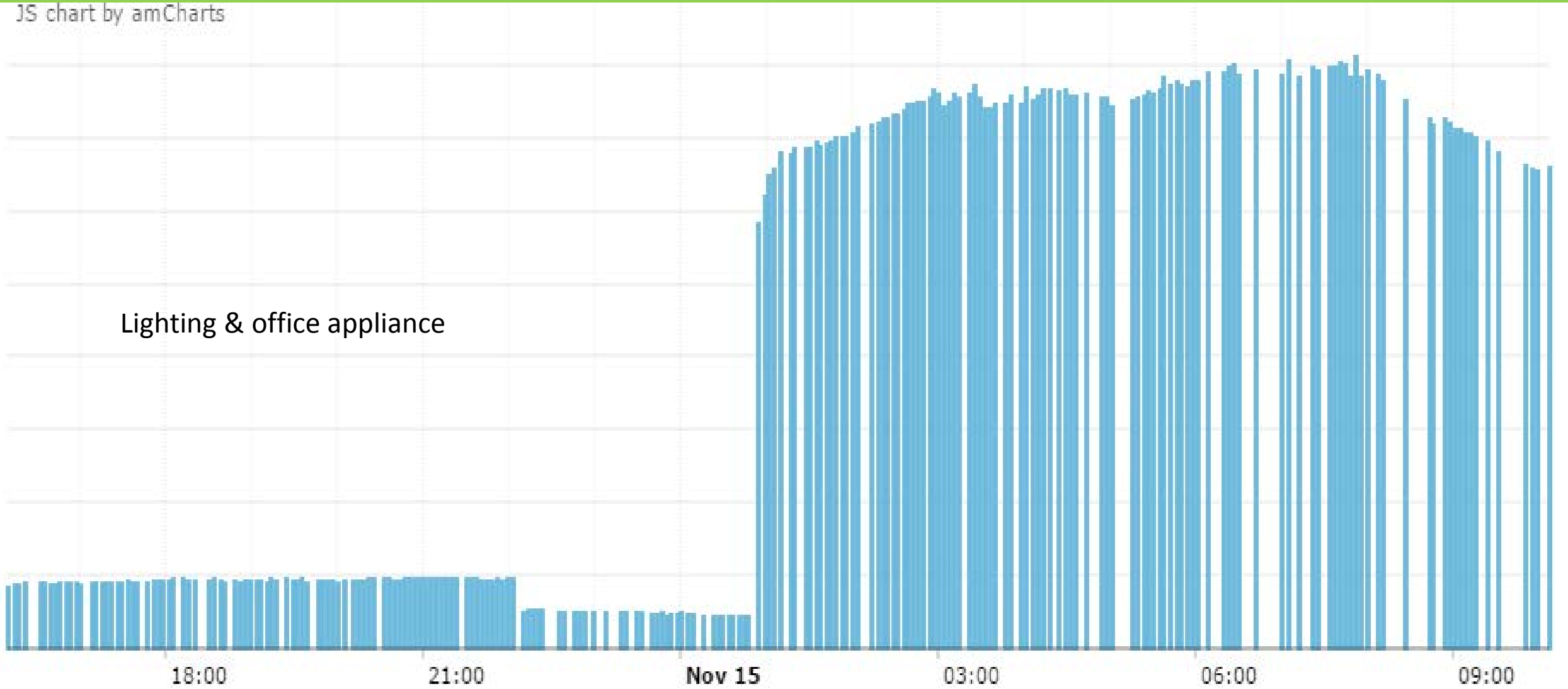
21:00

Nov 15

03:00

06:00

09:00



INSTALLATION PROBLEM

- Its hard to get dedicated Electrical lines for specific purposes (contact breaker in panel box unstructured)



- CT sensor size, hard for closed spacing lines



Terima Kasih - Thank You

bregasbudianto@gmail.com

"Zero Waste, Zero Emission, Rich in Bio-and Cultural-diversity"

<http://greencampus.ipb.ac.id/>