



Energy storage system based on lithium batteries for signaling and station

UIC WORKSHOP on Energy Efficient Infrastructures
Paris, UIC HQ, 2 July 2018

Vincent DELCOURT
Bogdan VULTURESCU



Innovation & Recherche



Ingénierie & Projets,
Infrapole Paris-Nord



Direction Générale IdF



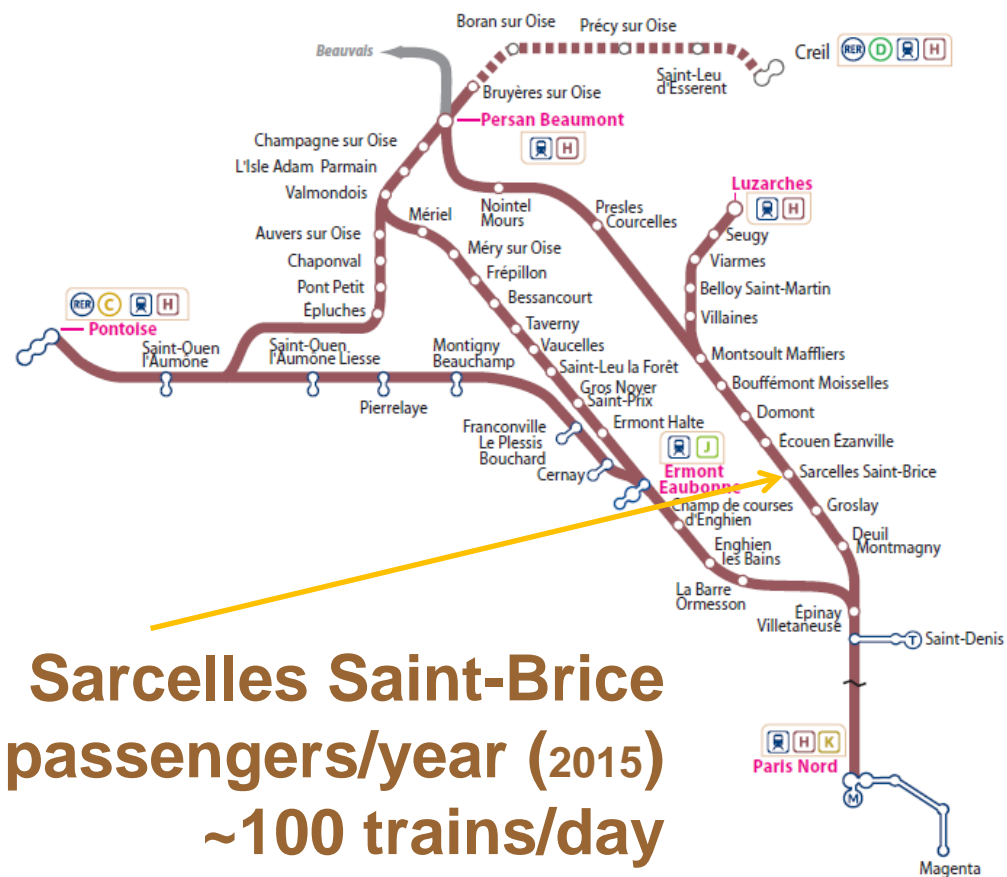
Gares & Connexions



H line commuter
@ Sarcelles Saint-Brice

02/07/2018 | UIC Workshop





Sarcelles Saint-Brice
 ~ 5 200 000 passengers/year (2015)
 ~100 trains/day



More than 3000 stations in France (~400 in IdF)

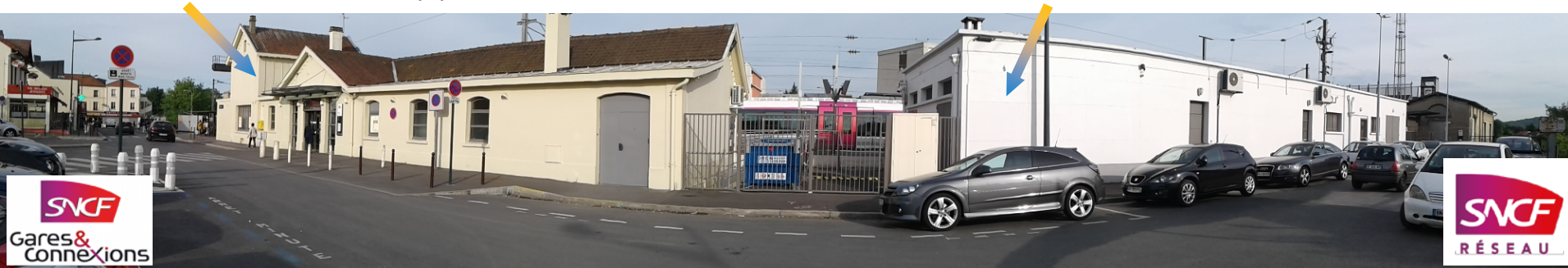
- ~130 passengers stations of national interest (a)
- ~1000 passengers stations of regional interest (b)
- ~1900 passengers stations of local interest (c)

500 SES* substations

- ~250 backup by Genset**
- ~30 Genset less than 30years

Sarcelles Saint-Brice station (b)

SES Substation & Technical local



- No second power supply for (b) & (c) stations,
- No energy storage in case of power blackout for elevators, smoke extraction, ...,
- Without lightning in station or platform, trains don't have to stop in station, for the passengers safety.

* SES Substation: *installation that provides power to railway signaling (signals, switching motors, relays, etc.).*

** Genset:

- Only one usage (*signaling backup*)
- Barely used (*ex : 300h in 50years*)
- Aging → costly maintenance, noisy, pollutant.

Solution: a multifunction energy storage

SIGALi project implemented an multifunction energy storage system based on lithium batteries for backup, in case of a power outage, and for the energy management of the “Sarcelles St Brice” station.



Genset for signaling backup (January 2017)



Lithium battery energy storage (Juin 2018)



NEW

Redundant backup of
the signaling

1



Goals



Rescue vital consumers of
the station

NEW

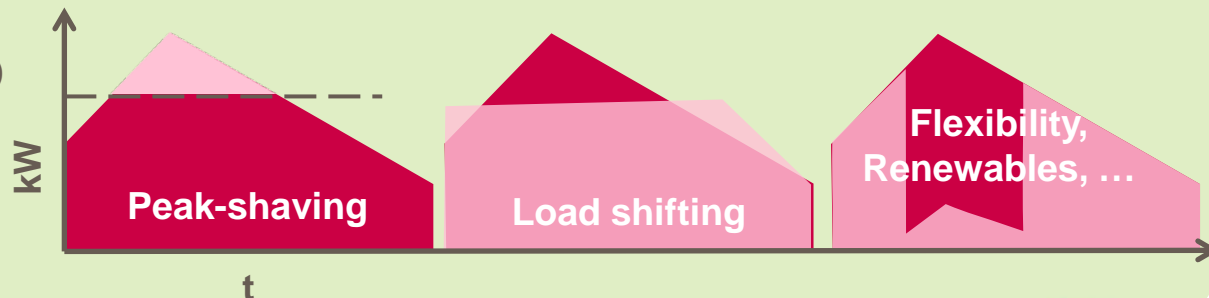
2



NEW

Energy management means new business !

3



Travellers safety, in station or on platforms



Test a new maintenance free battery technology



Issues

Improve the energy efficiency in stations



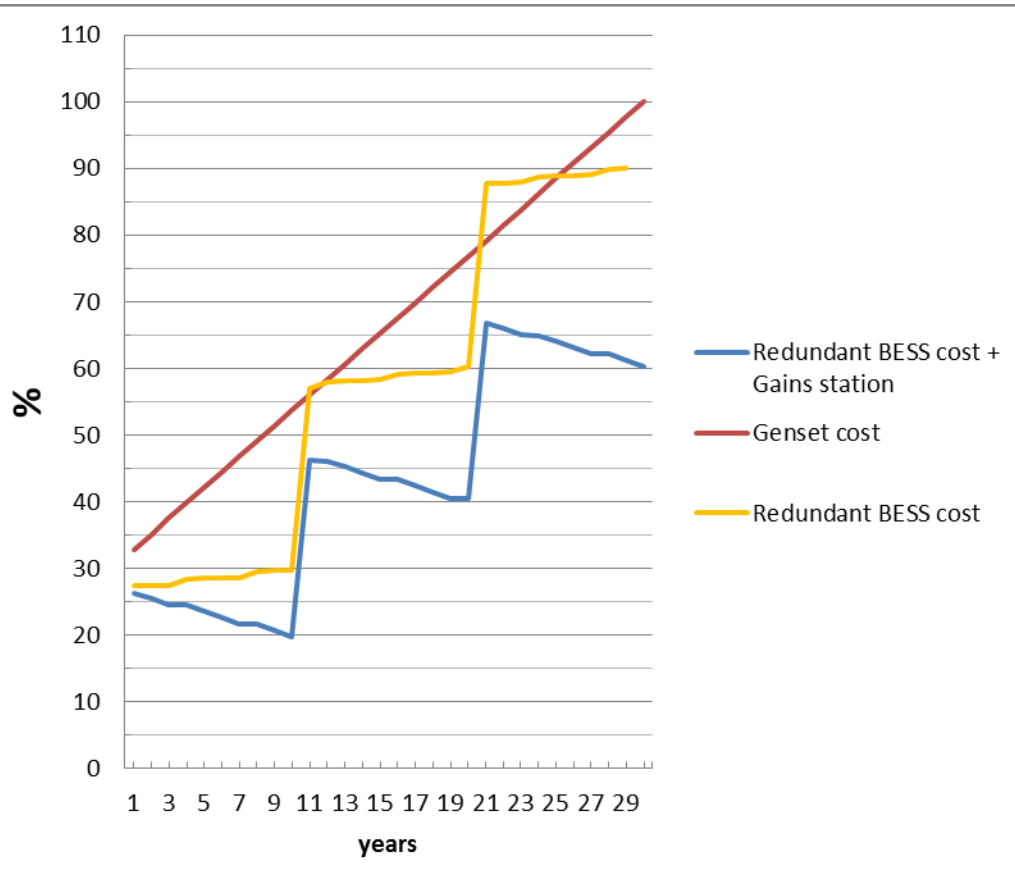
Mutualize means and functions between the 3 EPIC



Projet Planning



Economical equation

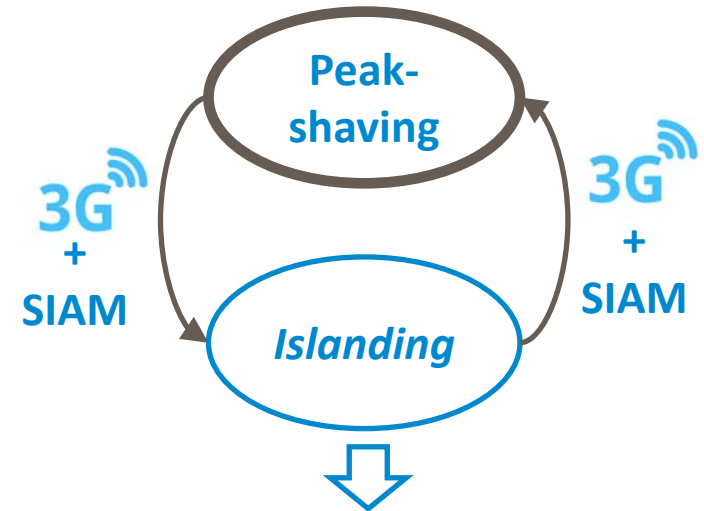
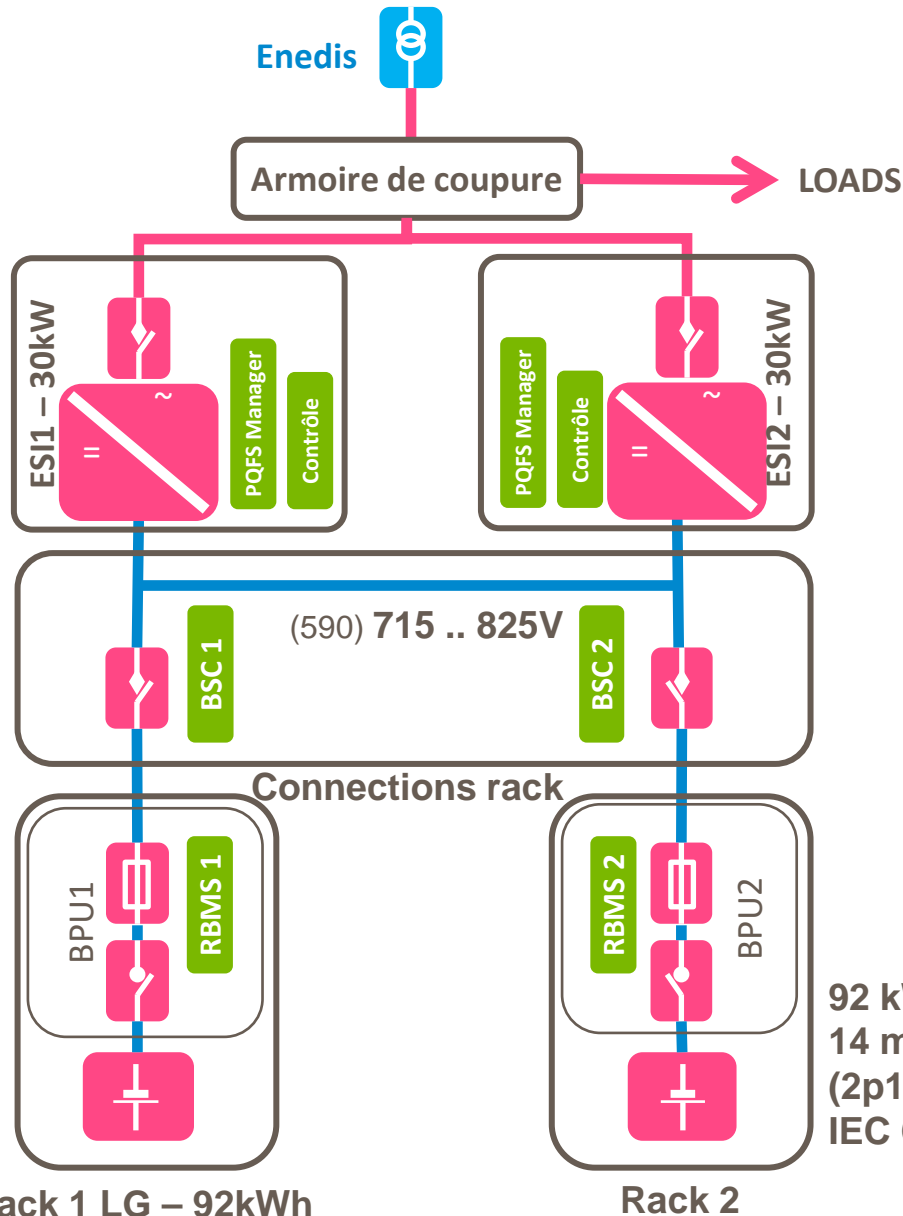


“Genset cost” means mainly maintenance cost.

“Gain station” means gains from peak-shaving (subscription reduction) or consumption cut-off (flexibility).

Very difficult to value the station backup despite the latest events in Montparnasse & Aix stations, ...

Technical description

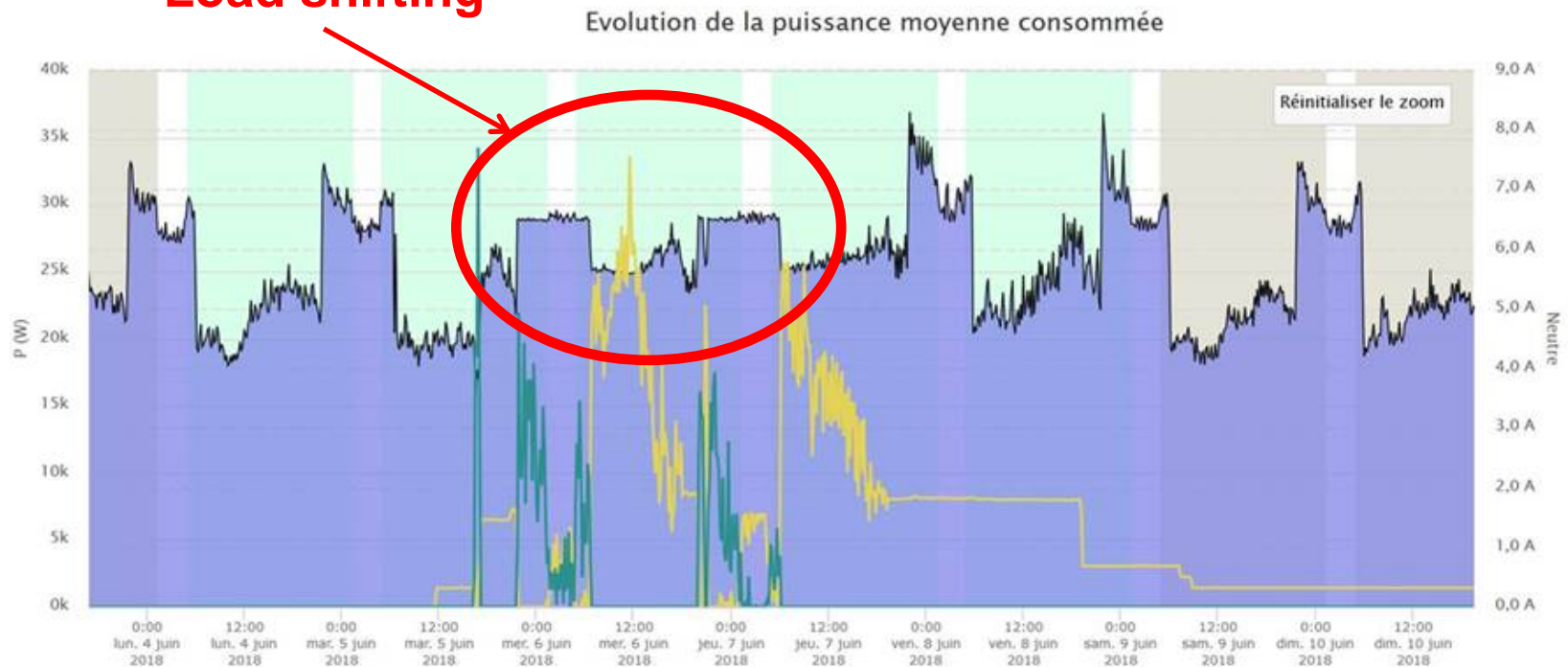


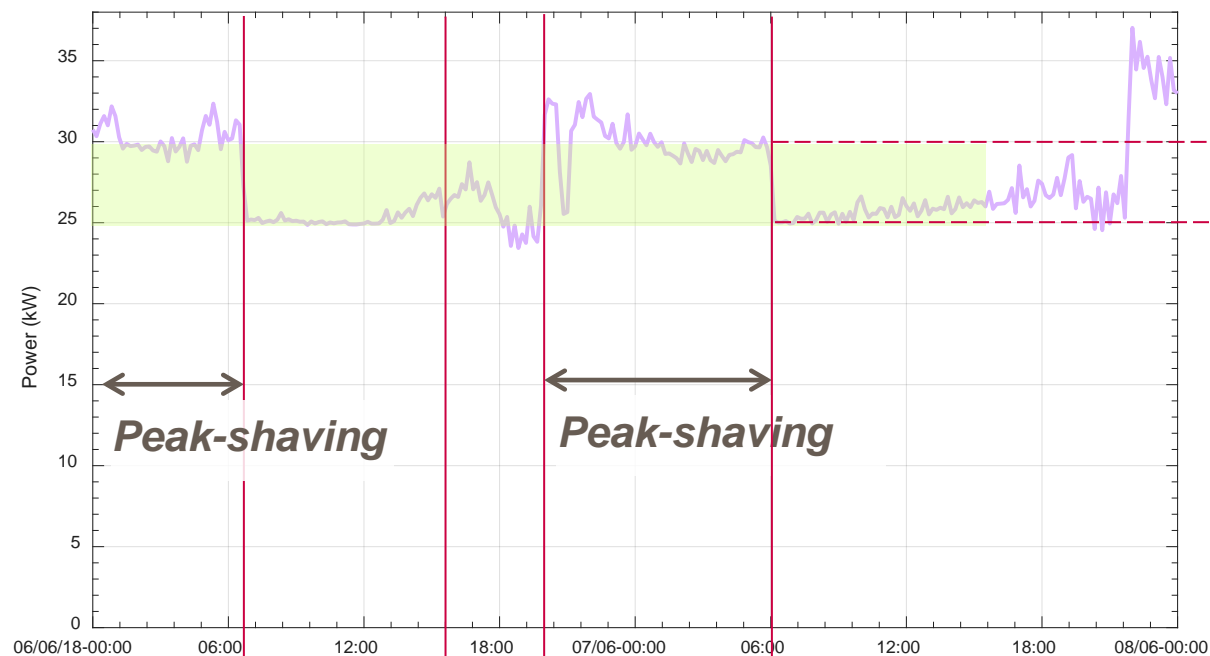
1. **Immediate dumped loads** : CAB rack (doors holders, turnstiles, metallic shutters),
2. **Temporarily backup** : rack TD Platform (elevators, sewage pumps, lightning, audio & video system), rack TD Station energy (Information system, passenger building, ...),
3. **Backup loads** : Signaling, HVAC.

92 kWh (NMC)
 14 modules EM48126P3BA
 (2p14s, 42..59V, 126Ah)
 IEC 6219:2017

Modes of operation (1/2)

Peak-shaving
Load shifting





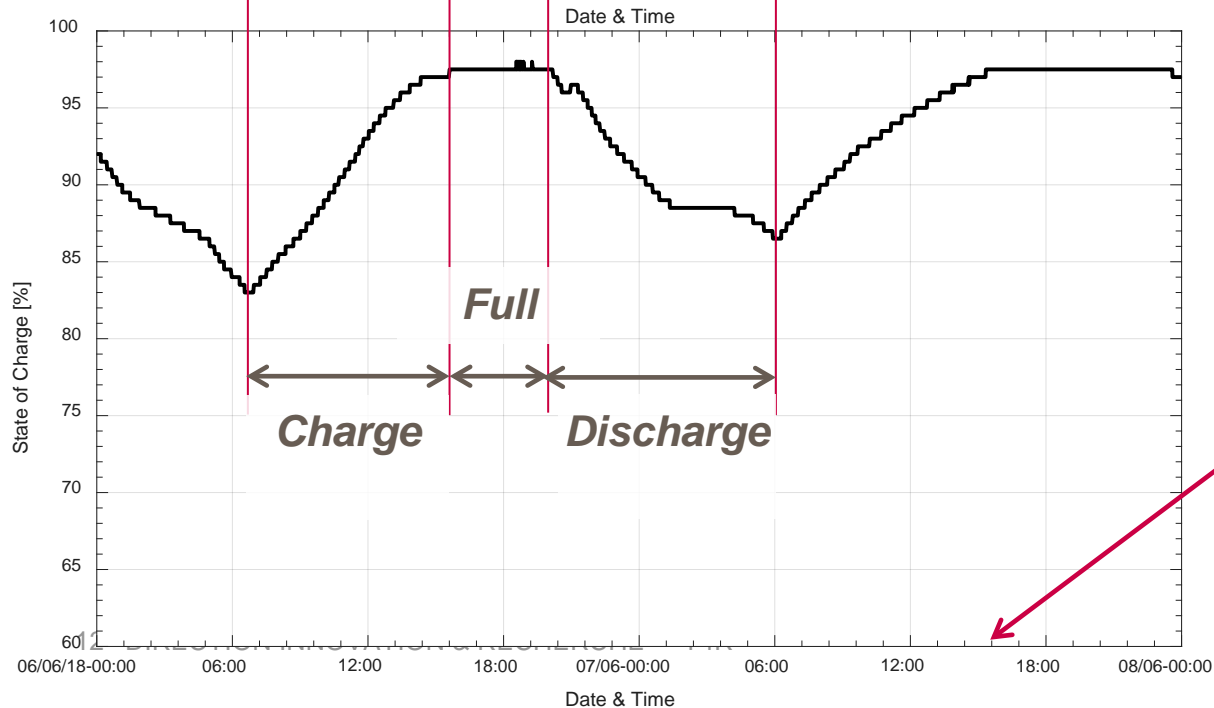
Discharge
@ $P_{load} - 30$



Standby



Charge @
 $25 - P_{Load}$



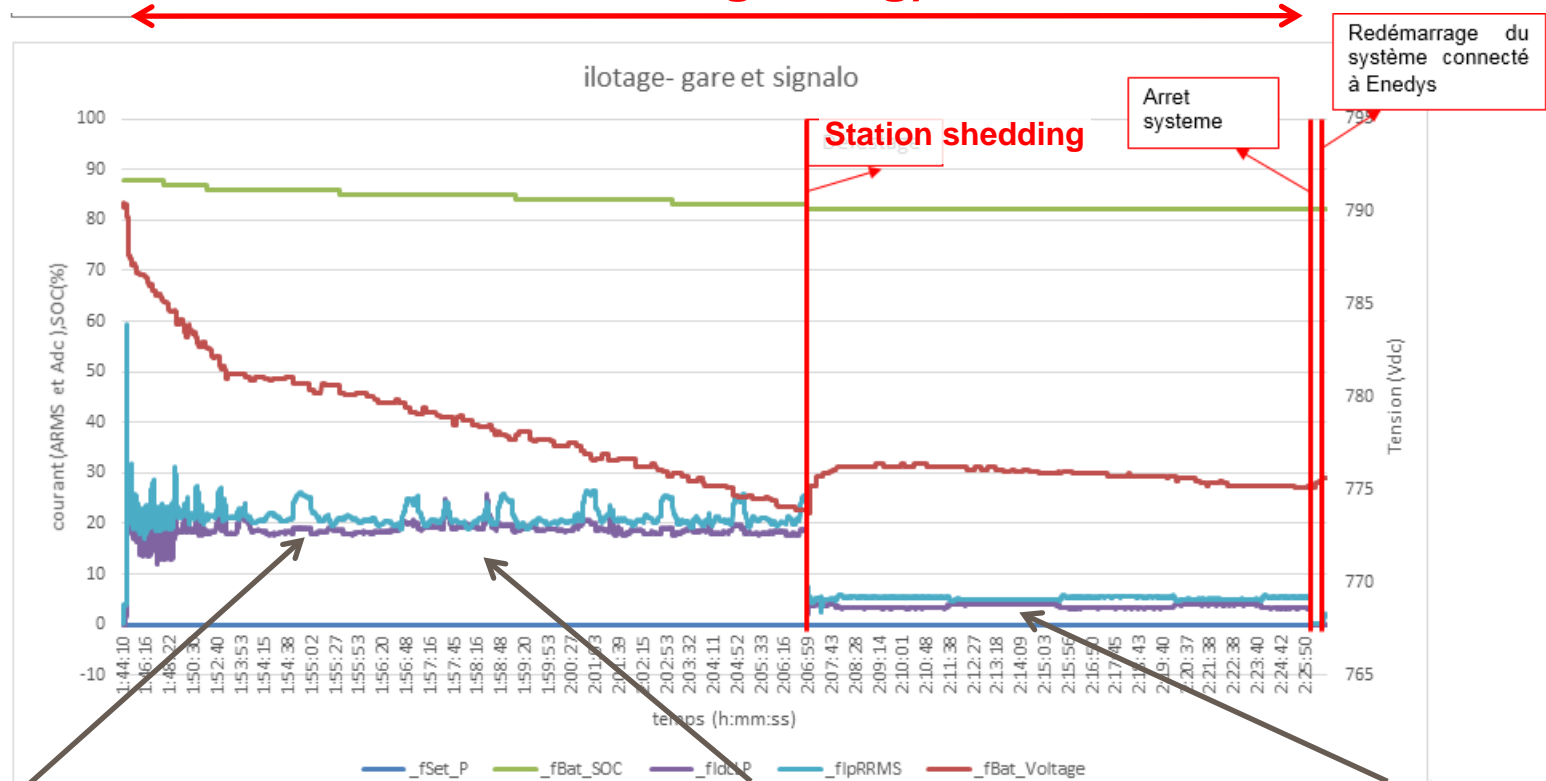
Energy stock level:

4hours only for
signaling

Modes of operation (2/2)

Islanding (backup for station & signaling)

Reconnection to DSO



Movements of the turnout systems

Signaling & station consumption

Signaling consumption

Fire risk management

LG **SRS** (Safety Reinforced Separator)
increase the mechanical & thermal
stability of **NMC** cells



Building level

- HVAC (*freecooling* ventilating)
- Concrete walls, 2h false ceiling, fireproof doors, brick filled windows.

System level

- Current control,
- Overcurrent control by inverter semiconductor's.

Battery rack level

- Fuse,
- Breaker.

Battery Management System

- Power control as a function of temperature,
- Voltage control at cell level,
- SoC & SoH estimation.

Module level

- 2 temperature sensors,
- Voltage sensor at cell level,
- Fuse,
- Breaker.

Certification
UN 38.3



Certification
62619:2017



Conclusions & Perspective

- Human factor, the most important capital,
- System integration, a complex job even for the best ... still look for a supplier with experience and an industrial product installed in many places,
- Storages of an interesting size for the railway stationary (50 - 200kWh) are in adolescence,
- *An energy storage system opens a lot of opportunities of business and new services for Network and Stations: renewables integration, energy recovery, flexibility, V2G, ...*

Merci de votre attention

Bogdan VULTURESCU, project manager

INNOVATION & RECHERCHE

TECH4RAIL team

1-3 avenue François Mitterrand, JADE building

93212 La Plaine Saint-Denis Cedex

France