



# Open Workshop + PT User Group Meeting

Electrified Urban Bus Innovations

H4 Hotel Berlin Alexanderplatz

18th September

Ibon Cerro (JEMA; Irizar Group)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 769850.





# Innovations and solutions developed within ASSURED

Key Innovations for developed solutions are:

- Interoperable High Power Charging Systems
- Charger-Vehicle Interoperability
- Smart Tools for Fleet Level Optimization
- Vehicle Solutions Energy Management and Storage

Solutions will be tested in:

- Testing facilities (IDIADA) (WP5)
- UC3 (WP7)
- Real operation conditions (Barcelona, Osnabruck,...) (WP8)

# Innovations and solutions developed within ASSURED

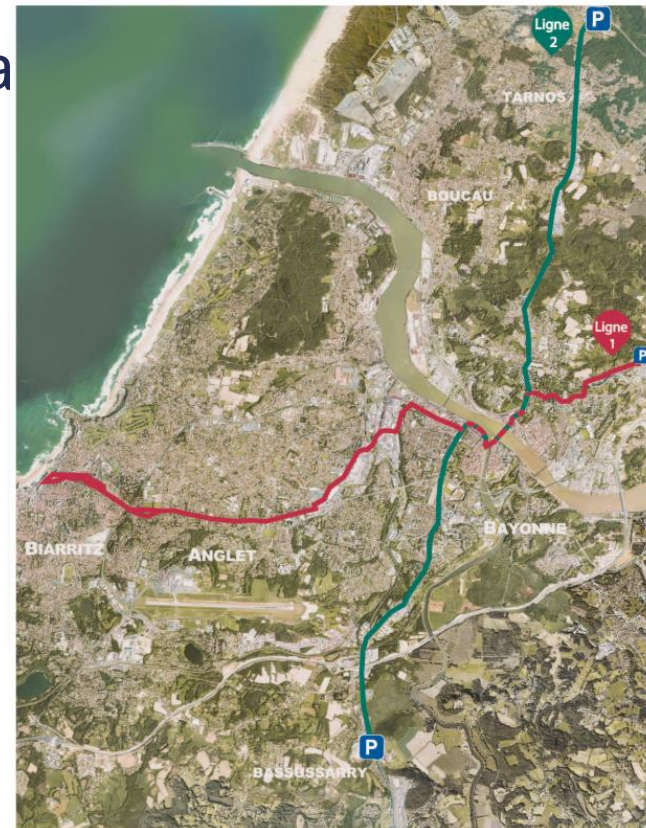
UC 3 will take place in Bayonne and Biarritz

2 x BRT lines:

- Line 1: Bayonne – Biarritz
- Line 2: Bayonne - Tarnos

7 minutes frequency

> 1.600 passengers/h/sense





# Interoperable High Power Charging Systems



Over night  
Chargers up to  
150kW



Opportunity  
Chargers up to  
600kW



Fully equipped  
Opportunity  
container up to  
600kW



# Interoperable High Power Charging Systems

IGBT based topology: V2G & G2V  
**Up to 600kW** power capability  
Voltage: 315Vac, 3Ph + N + E (+10%, -15%)  
Frequency: 50/60Hz  
DC Voltage Range: 400...850V

2000mm x 2800mm x 750mm, 1850kg,  
Operation range: - 10°C + 50°C

Without galvanic isolation, Air forced

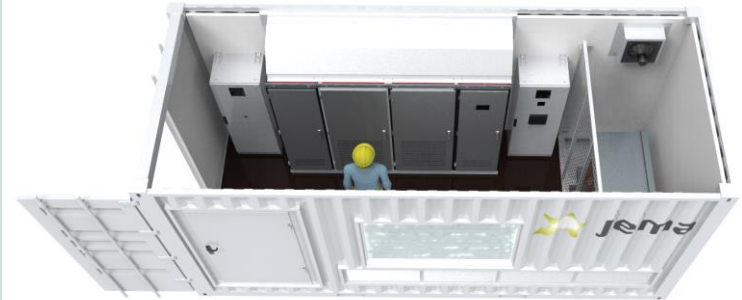
4/5 poles pantograph with vehicle

Turnkey solution for cities. Full equipped solution for the UC.

Interoperable according to ISO15118, DIN70121

CE mark, EMC 61000-6-2, 61000-6-4, IEC 61851, IEC 61000

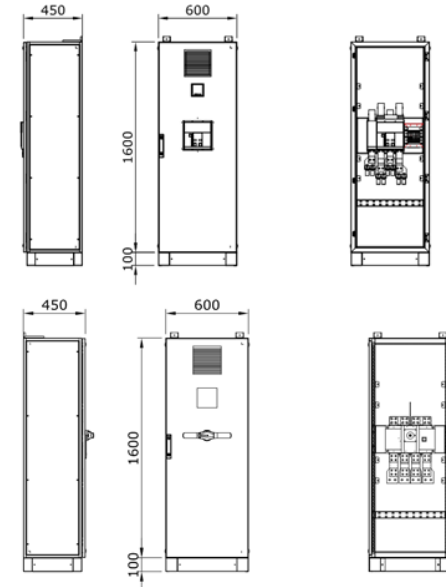
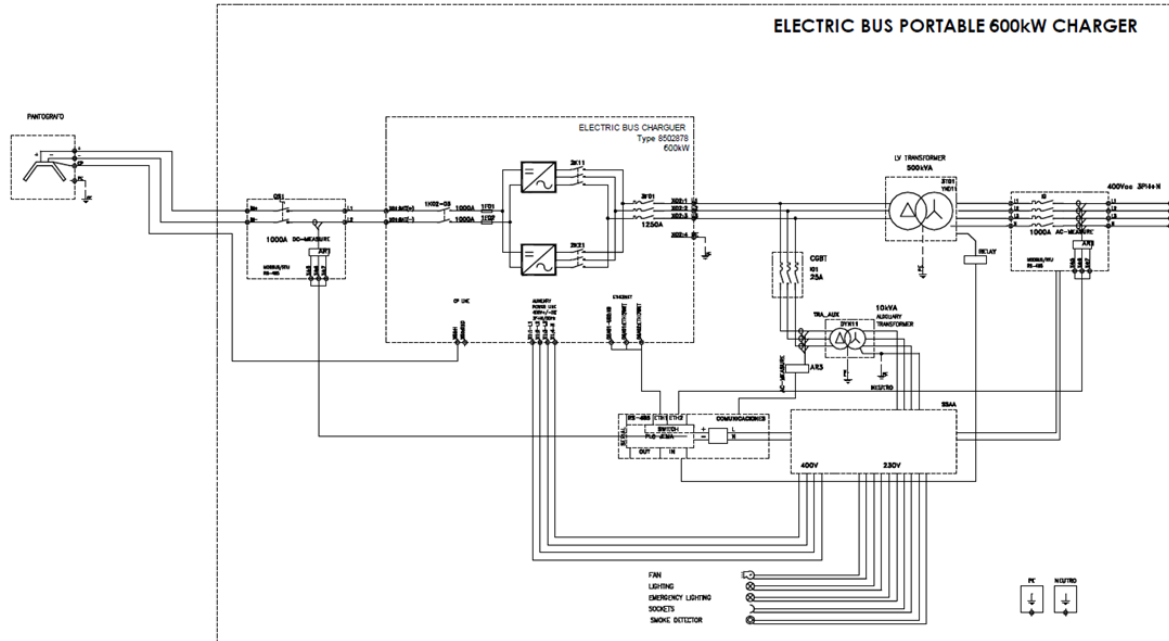
**Allows fleet management.**



# Interoperable High Power Charging Systems

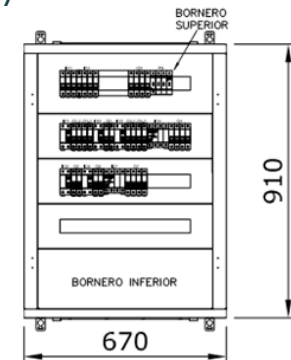
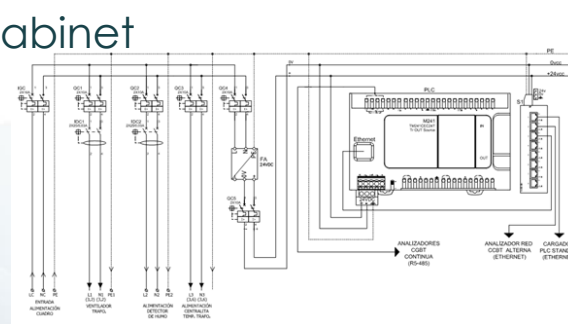
Single Line Diagram

AC & DC Protections Cabinets



Auxiliary Services Cabinet

Communications Cabinet





# Interoperable High Power Charging Systems





# Interoperable High Power Charging Systems

- ✓ Modular charger (N x 50kW) (2x50kW in the picture)
- ✓ Smart central unit features without extra cabinet (features incorporated in charger)
- ✓ Interoperable with vehicle (ISO 15118, DIN70121)
- ✓ OCPP 1.5 and OCPP 1.6 available for communications with operator
- ✓ Electrical features:
  - Input voltage: 400Vac, 3Ph+N+E (+10%, -15%)
  - Input frequency: 50/60Hz
  - Output power 100kW
  - Output DC Voltage Range: 480...850V
  - 1850mm x 800mm x 800mm, 900kg, IP54
  - Operation range: - 20°C + 50°C
  - IGBT based topology: V2G & G2V
  - Galvanic isolation, efficiency 96%, Air forced
  - Minimum harmonic distortion assured by design.

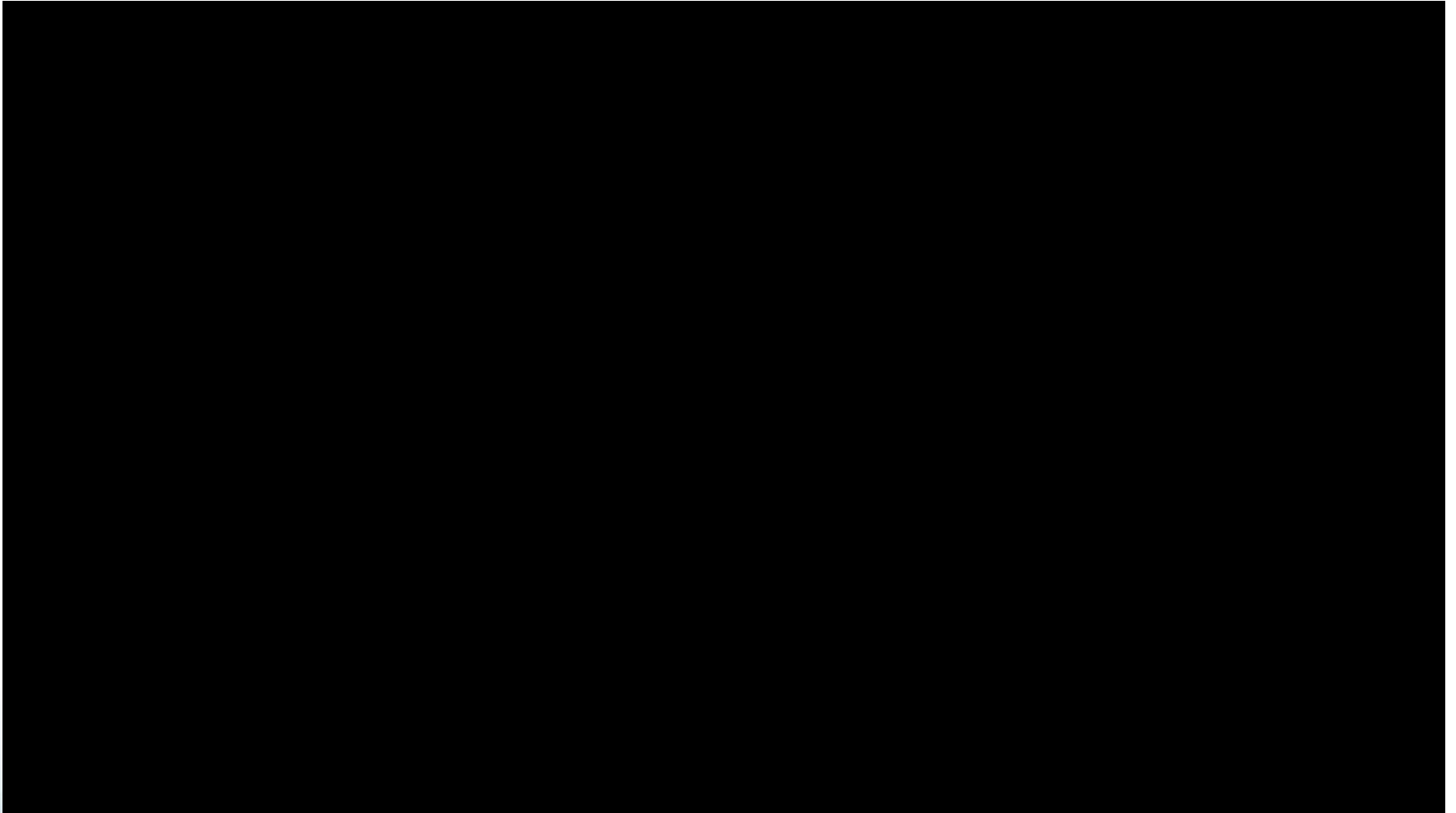


**Over night  
Chargers up to  
150kW**





# Charger-Vehicle Interoperability



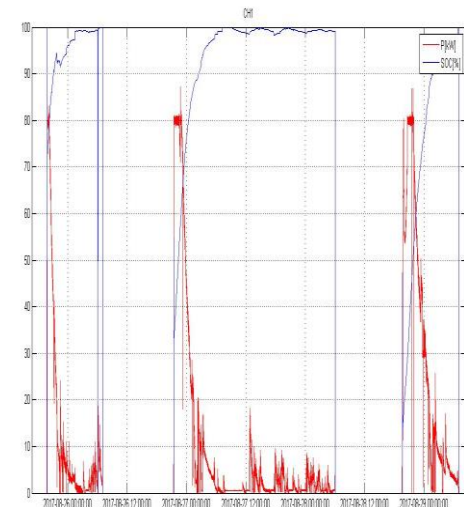


# Smart Tools for Fleet Level Optimization

- **Manage the loading process for each bus** separately of the fleet, according to operator's requirements
- **Minimizes the contracted power from the grid**, distributing the accessible power between vehicles connected to the charger, making sure contracted power is the minimum that fits to the operation and that this value is not exceeded
- It gives the possibility to charge the vehicles with a minimum power when the price of electricity is higher and allowing to charge at maximum power when the price of electricity is lower. Obviously this option extends the loading time, so it is applicable only if you have enough time.
- **Minimizes the reactive power** of the installation
- **Storage data** for offline analysis
- **Remote real time monitoring** of charging process (web access)
- **Send** emails with the most important **alarms automatically**
- Provides an analysis of the data, **making automatically a report** with the most important data of the **weekly** charging processes.

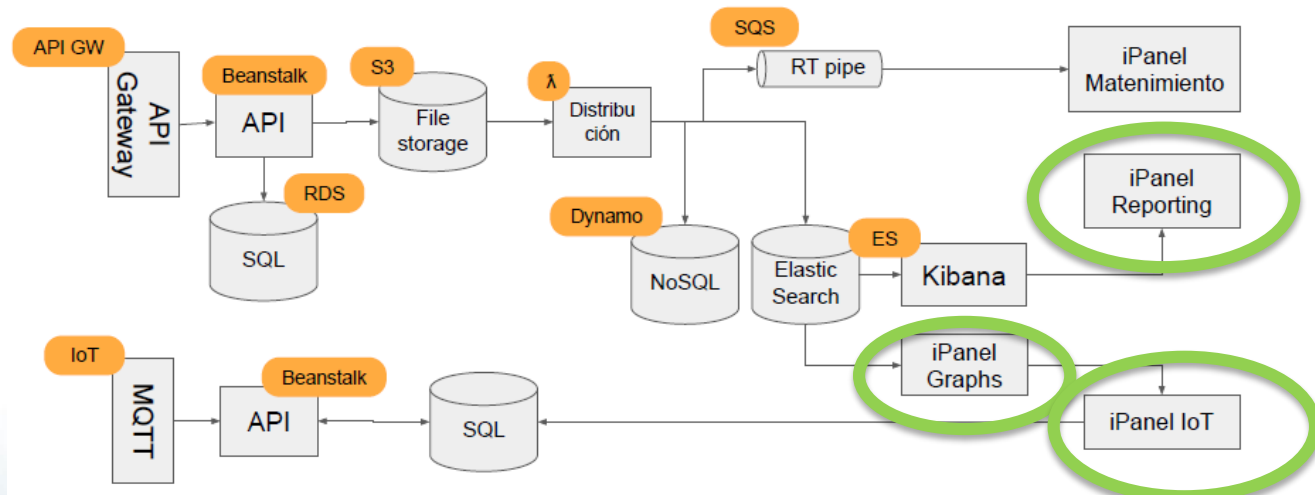
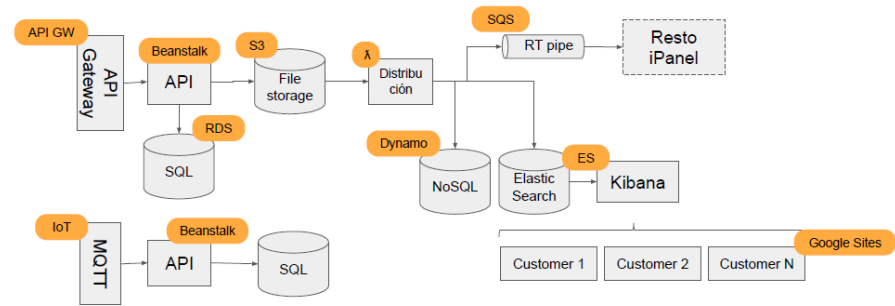
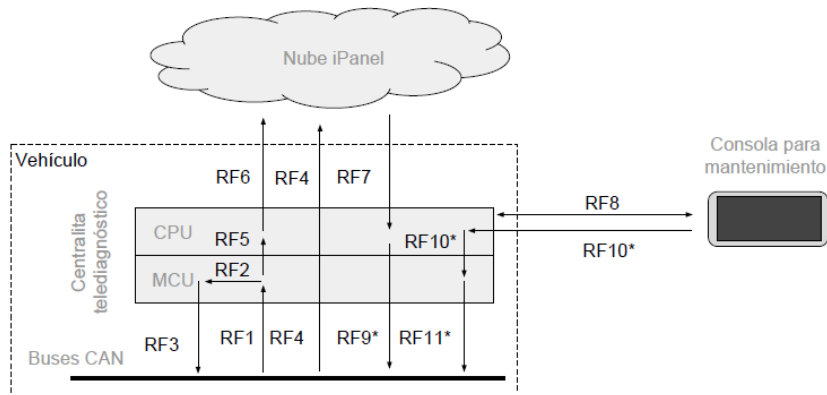
Features are included in the chargers

No extra hardware is needed





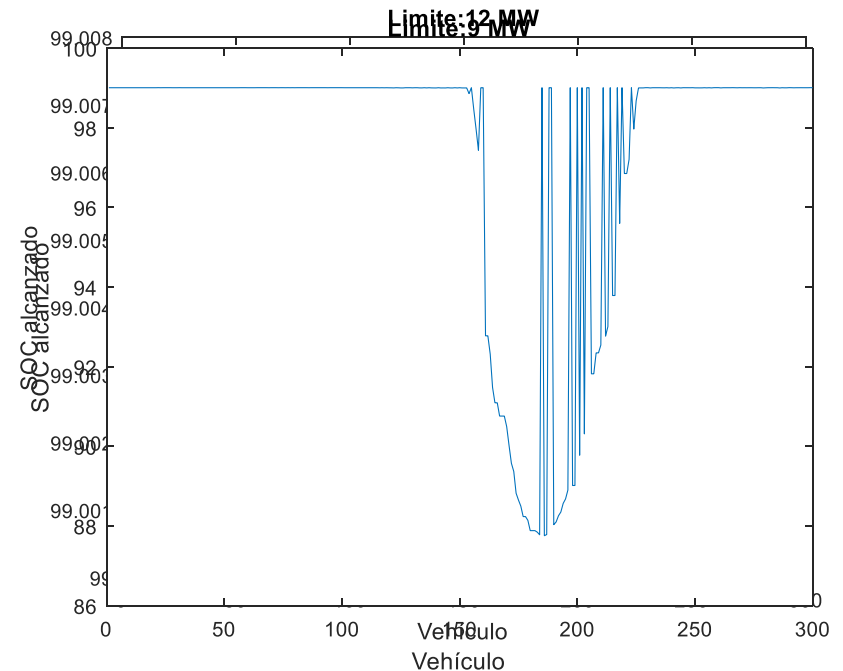
# Smart Tools for Fleet Level Optimization



# Smart Tools for Fleet Level Optimization


- **Fleet simulation tools** develop in order to work together with customers **for the best solution** (number and type of chargers, power needed) for their operation (number of busses, time schedule, type of busses, ...)

Simulation number	Power needed	Time at max power	Fleet charged ?
1	24MW	-	Yes
2	21MW	0:10	Yes
3	18MW	1:07	Yes
4	15MW	2:00	Yes
5	12MW	4:50	Yes
6	9MW	6:15	No
7	10MW	6:05	Yes



# Vehicle Solutions Energy Management & Storage

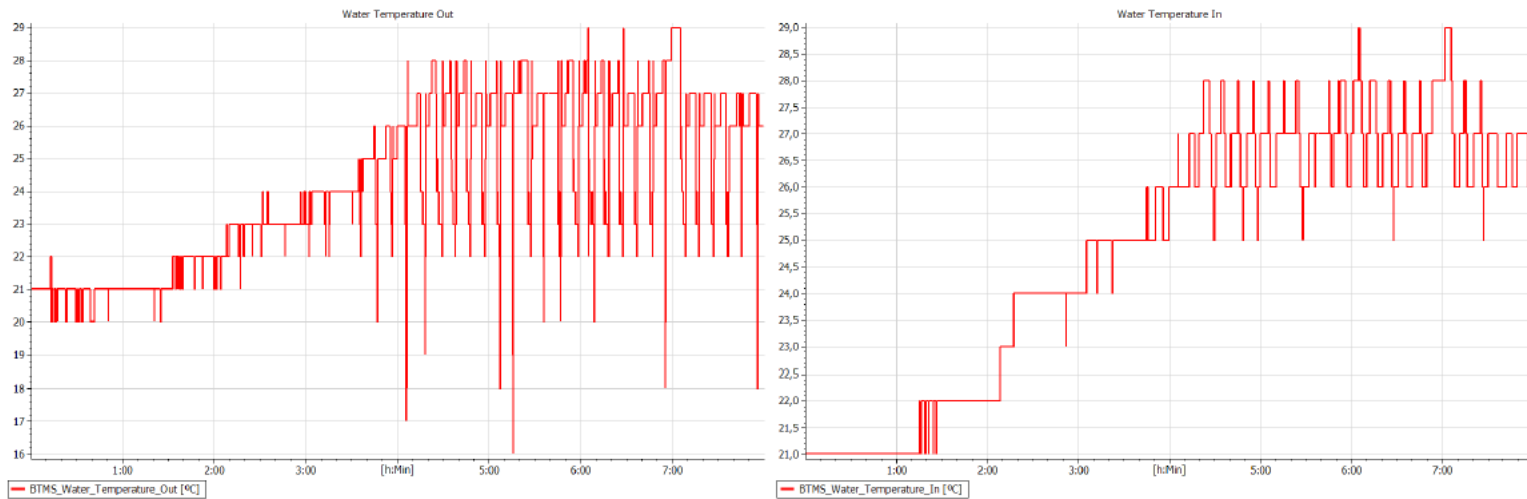
New **B**attery **M**anagement **T**emperature **S**ystem (BMTS)

- System develop specifically for eBus by  hispacold
- New **E**lectric **C**ontrol **U**nit (ECU)
- Modifications on existing cooling system
- Mechanical adaptation in the bus is required
- External components involved in the behaviour of the system need to be updated (for example, storage ECU)



# Vehicle Solutions Energy Management & Storage

Data coming from the first BTMS test in a DEMO bus in San Sebastian



Non continuous water temperature. Keep on...

