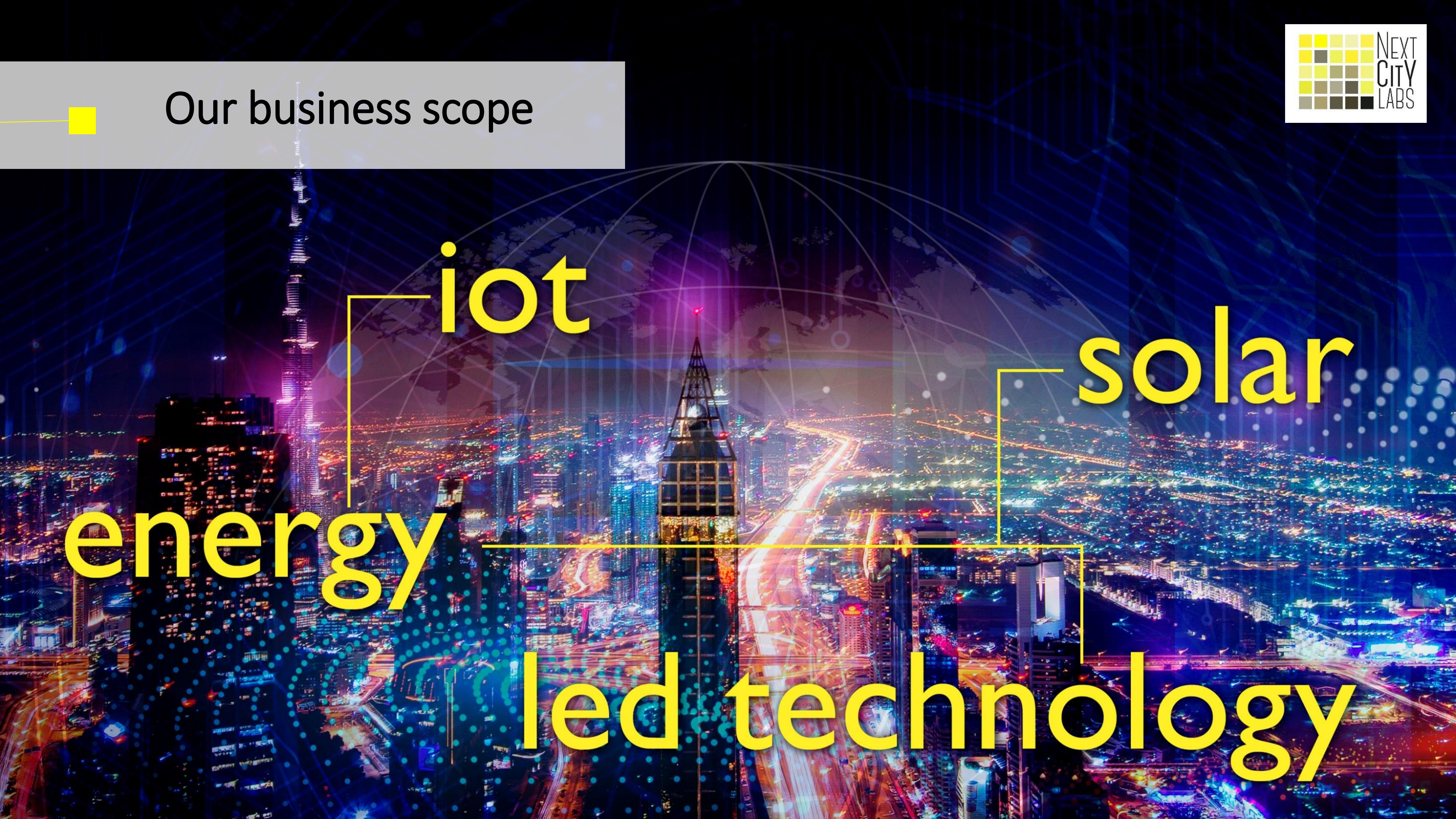

NEXT
CITY
LABS

Our business scope

NEXT CITY LABS

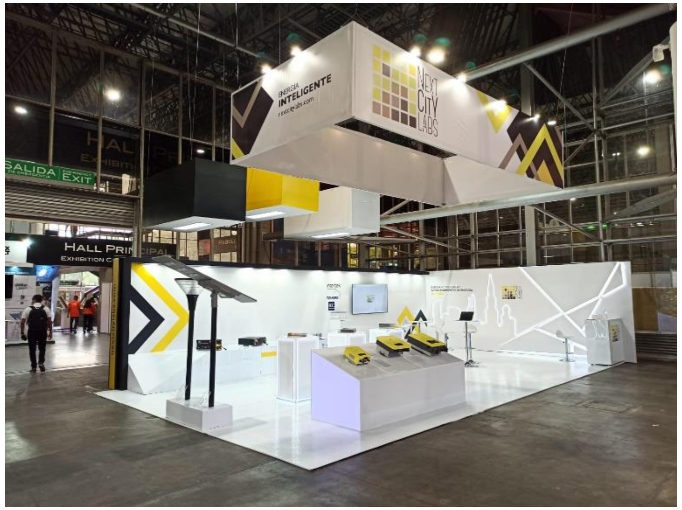


¿Where to find us?

Always in movement

Participation in the ELA2019 fair held in Mexico City

NextCity Labs sales team at ELA2018 in Mexico City



NextCity Labs silver sponsor of Exposolar – Medellín, Colombia 2021.

NextCity Labs in Expoilluminacion and Smart Cities – Medellín, Colombia 2021.

Content

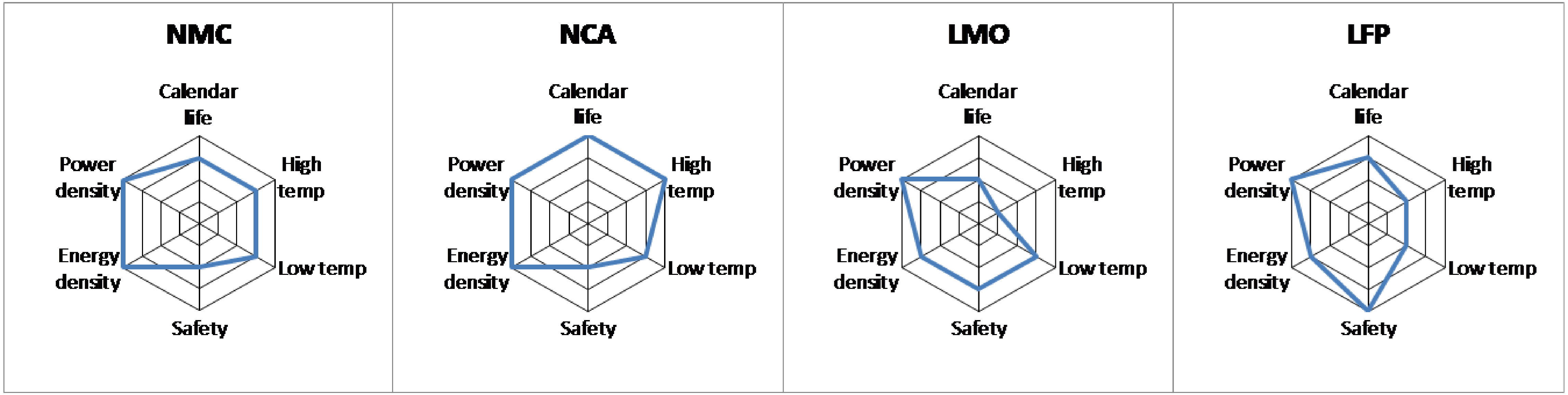
1. NextCity Labs Technology introduction.
2. Lithium iron phosphate $LiFePO_4$ technology and its advantages.
3. Product and solution portfolio for energy storage.
4. Small, medium and large-scale applications.
5. Highlight Project: Medium-Scale Energy Storage System-EES.

- Project Overview
- Justification
- Technical Solution
- Implementation

2. Lithium Iron-Phosphate - Advantages

This a secondary battery (rechargeable) derived from Li-ion technology, which implements a cathode based on a phosphate of lithium-iron: $LiFePO_4$. This mixture helps to improve the chemical stability resulting in an increased safety and long shelf life.

2. Lithium Iron-Phosphate - Advantages



Source: IEEE 1679 1-2017.

NMC: Nickel, manganese, cobalt.

NCA: Nickel, cobalt, aluminium.

LMO: Lithium metal-oxide.

LFP: Lithium iron-phosphate.

2. Lithium Iron-Phosphate - Advantages

- Life cycle > 6,000 cycles (DoD 80%).
- Lastest Battery Management System BMS generation.
- Compatibility with top brands.
- Extense experience and technical support.
- Specialized in $LiFePO_4$.
- Lower usage of heavy metals (Cobalt, Manganese, Nickel).

2. Lithium Iron-Phosphate - Advantages

- Cycle life > 6,000 cycles
- Memory
- High-resistance to temperature variations
- Autonomy to the end
- Safety
- Sustainable
- Constant discharge voltage
- High quality cells
- Warranty

info@nextcitylabs.com

2. Lithium Iron-Phosphate - Advantages

Sonnenschein – OPzV – EXIDE vs. NCL-LFP

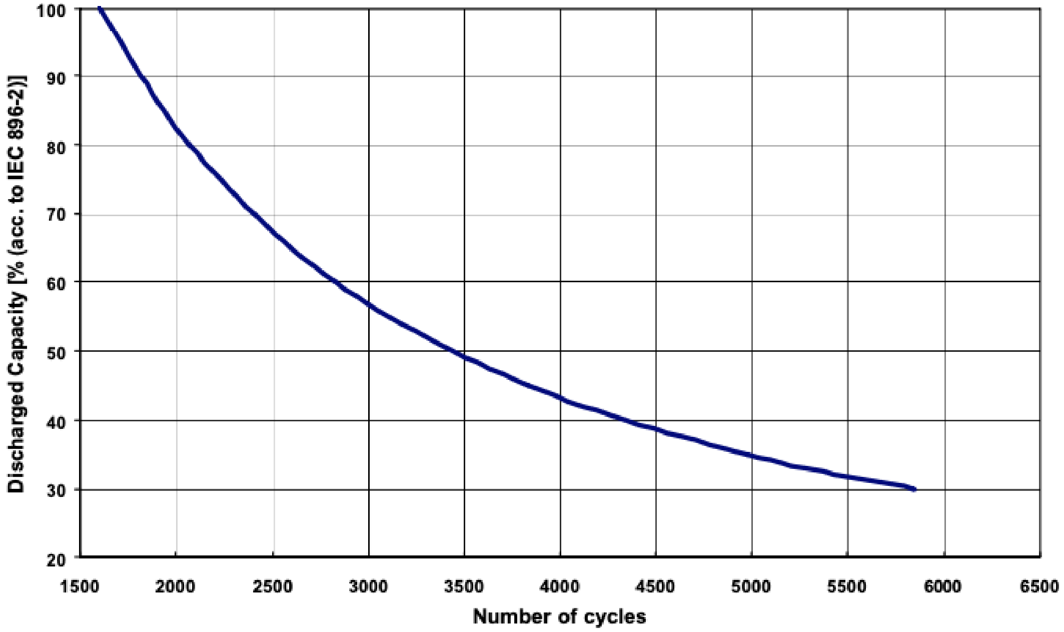
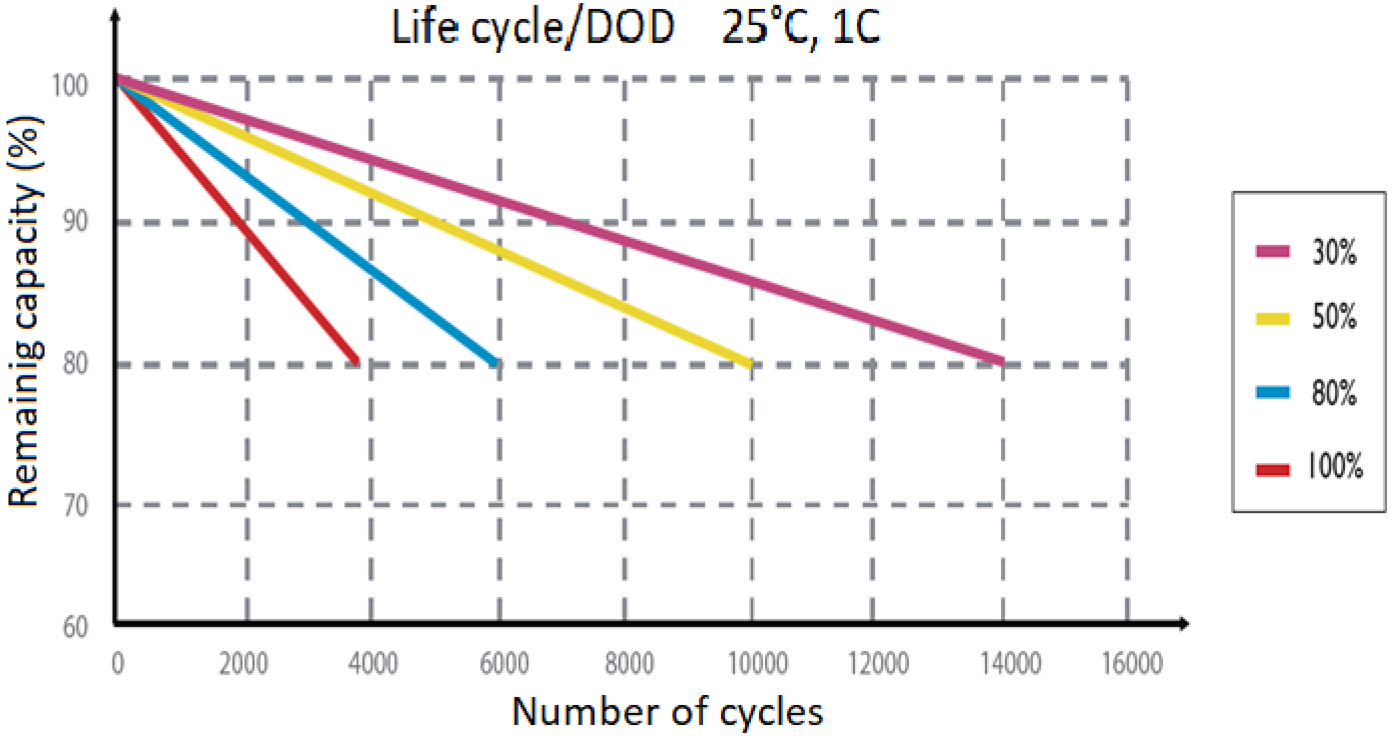


Fig. 16: A 600 SOLAR, Number of Cycles vs. Depth of Discharge (DOD)



DoD 30% - 6,000 cycles.

DoD 80% - 6,000 cycles.

Standards: IEC 60896-2, IEC 60896-21 e IEC 61427

2. Lithium Iron-Phosphate - Advantages

A600 SOLAR

- Life expectancy: 12 to 15 years at standard test conditions STC (20° C).
- Aprox. 6,000 cycles Aprox. 30% DoD.
- Charge and discharge current shouldn’t exceed 35% of nominal current.
- Tend to lose the half of life cycle when exposed to temperatures 10° C above STC (20º C).
- Self discharge curve with greater downhill.

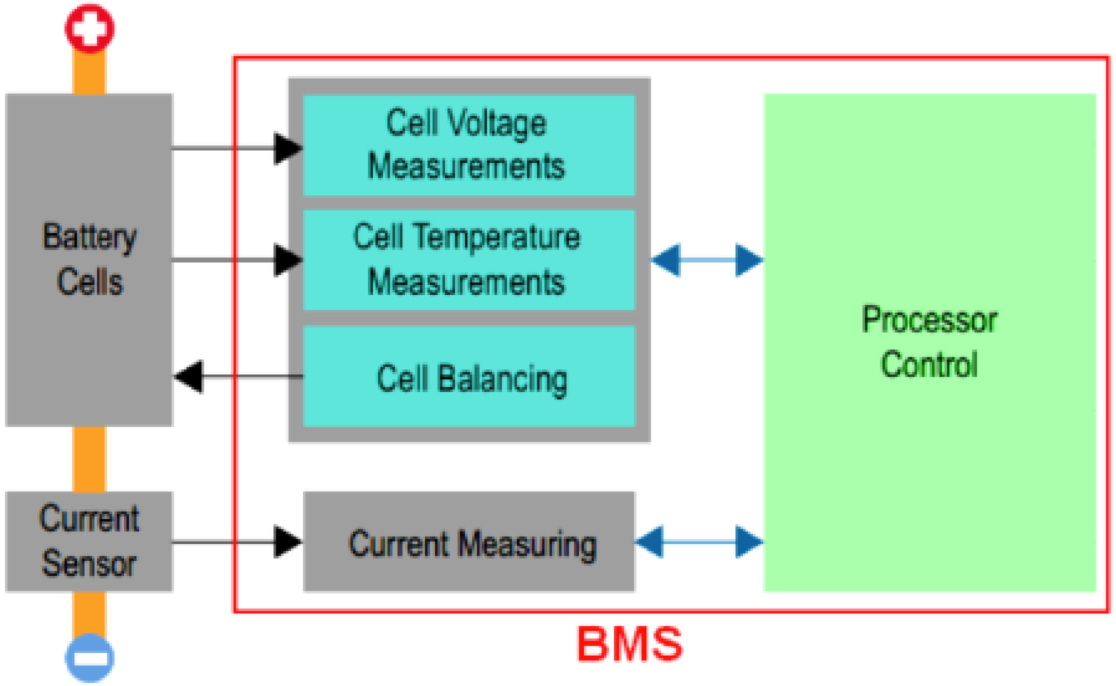
2. Lithium Iron-Phosphate - Advantages

BMS: Monitoring and protection functions.

- Cell voltage
- Cell temperature
- Battery voltage
- Battery temperature
- Battery operation
- System voltage
- System temperature
- System operation
- SOC State of Charge (SOC)
- SOH State of Health (SOH)
- Charge/discharge Control
- Prevention and fault detection
- Fault protection

2. Lithium Iron-Phosphate - Advantages

BMS (Battery Management System)



BMS monitors, balances y protects batteries during charge and discharge (operacion).

MONITORING AND CONTROL

- SOC (State of Charge).
- Keep a balanced system, under parameters of voltage, temperature and current flow.

CHARGE AND DISCHARGE

- Keep voltages within normal limits.
- Keep a balanced system, under parameters of voltage, temperature and current flow.

CELL BALANCING

- Voltage level in cells.

2. Lithium Iron-Phosphate - Advantages

IEC 62619:2017

- External short circuit test at cell level
- Cell level impact test
- Cell level drop test
- Cell level thermal abuse test
- Cell level overload test
- Cell level forced discharge test
- Internal short circuit test at cell level

IEC 62619
Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications

3. Products and Solutions

$LiFePO_4$ BATTERIES

3. Products and Solutions

$LiFePO_4$ BATTERIES

Voltage ranges: **12.8**, **25.6** and **51.2** Vdc.

12Ah | 60Ah
20Ah | 80Ah
30Ah | 100Ah
40Ah | 150Ah
50Ah | 200Ah

25.6V

100Ah | 150Ah
120Ah | 200Ah

51.2V

32Ah | 80Ah
50Ah | 100Ah
150Ah

3. Products and Solutions

LiFePO4 BATTERIES

Nominal Voltage	12.8V	25.6V	51.2V
Internal resistance	≤20mΩ	≤20mΩ	≤30mΩ
Max. Charge Current	= Nominal Capacity		
Recommended Charge Current	=50% Max. Charge Current		
Max. Discharge Current	= Nominal Capacity		
Recommended Discharge Current	=50% Max. Charge Current		
Range Voltage	12-14.2V	24-28.4V	48-56.8V
Discharge Voltage	<12V	<24V	<48V
Work temperature	-20° C to 60°C discharge / 0°C to 45°C charge	-20°C to 60°C discharge / 0°C to 45°C charge	-10°C to 50°C
Cycle life	>2,500 Cycles / >5,000 Cycles	>6,000 cycles	>6,000 cycles

3. Products and Solutions

Energy Storage Systems (ESS): SERIE MESR

3. Products and Solutions

Energy Storage Systems – ESS: SERIE MESR

System Parameters										
	Cell 100Ah				Cell 210Ah					
Technology	Lithium iron phosphate (LiFePO4)				Lithium iron phosphate (LiFePO4)					
Cell	100Ah 3.2V				210Ah 3.2V					
Module	51.2V 100Ah				51.2V 210Ah					
Rack	512V 100Ah	768V 100Ah	512V 100Ah	768V 100Ah	512V 210Ah	768V 210Ah	512V 210Ah	768V 210Ah	512V 210Ah	768V 210Ah
Modules per rack	10	15	10	15	10	15	10	15	10	15
Energy per rack	51.2kWh	76.8kWh	51.2kWh	76.8kWh	107.52kWh	161.28kWh	107.52kWh	161.28kWh	107.52kWh	161.28kWh
System	8 racks	8 racks	20 racks	20 racks	8 racks	8 racks	20 racks	20 racks	40 racks	40 racks
Energy	0.41MWh	0.615 MWh	1.024 MWh	1.536 MWh	0.86MWh	1.29 MWh	2.15MWh	3.36MWh	4.3MWh	6.45MWh
Nominal Voltage	512V	768V	512V	768V	512V	768V	512V	768V	512V	768V
Voltage Range	375-547V	562-820V	375-547V	562-820V	375-547V	562-820V	375-547V	562-820V	375-547V	562-820V
Altitude	3000m (scalable)				3000m (scalable)					
Life Span	>6000 cycles (@80%DOD)				>6000 cycles (@80%DOD)					
Other equipment	DCP/FPS				DCP/FPS					
Dimensions	10ft container	10ft container	20ft container	20ft container	10ft container	10ft container	20ft container	20ft container	40ft container	40ft container
Weight	3.1Tn	4.6Tn	7.7Tn	11.56Tn	5.5Tn	8.2Tn	13.65Tn	20.5Tn	28Tn	41Tn*

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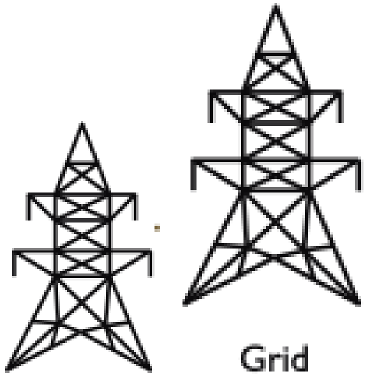
4. Applications

Photovoltaic Power Plant



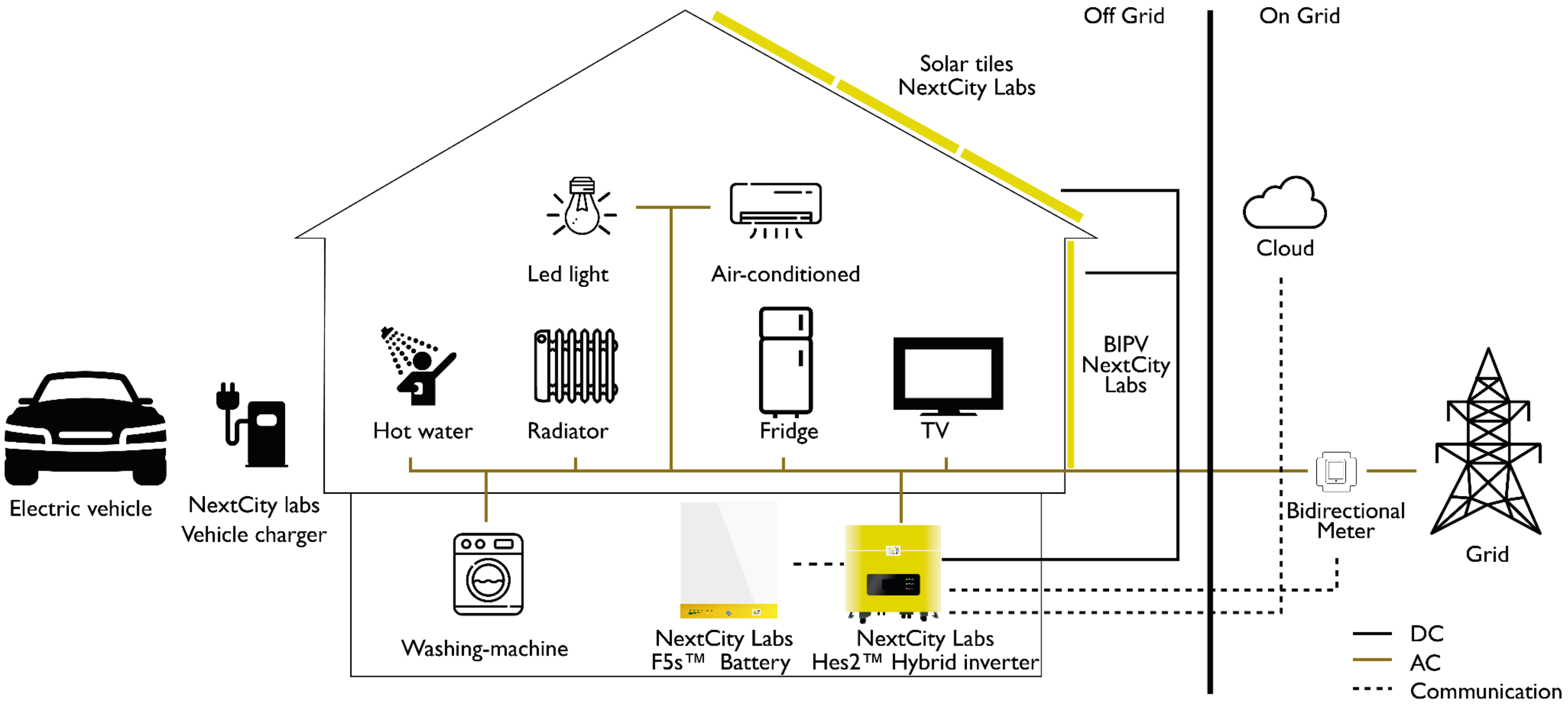
Grid

Off-Grid
- Rural electrification
- Competitive costs
- Improve reliability

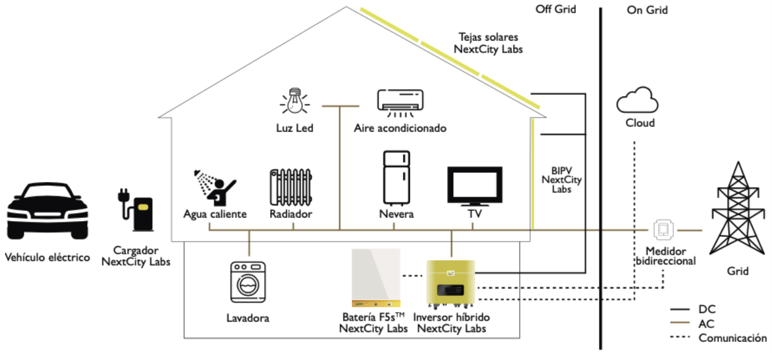
On-Grid
- Hybrid systems
- Competitive costs
- Improve quality

Demand Response
- Back-up
- High reliability

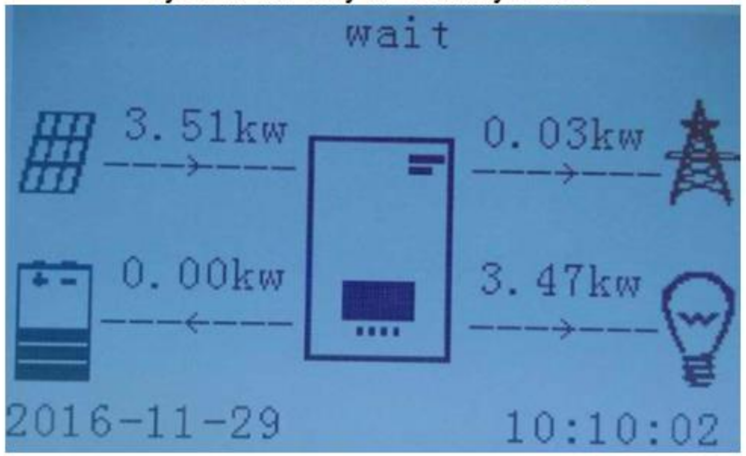
4. Applications: Small-Scale



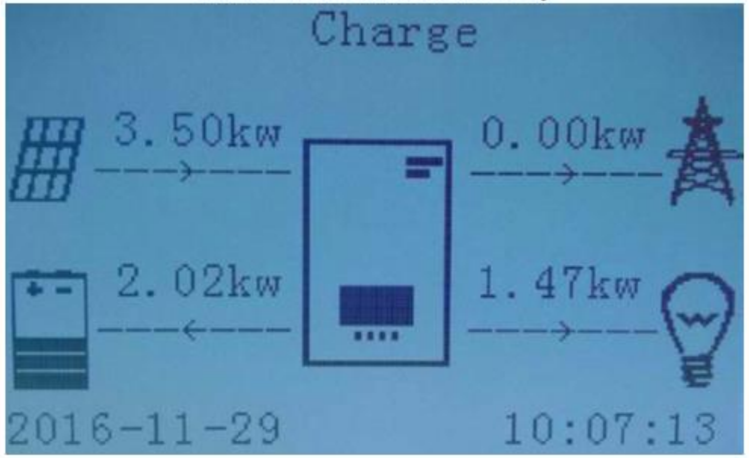
4. Applications: Small Scale



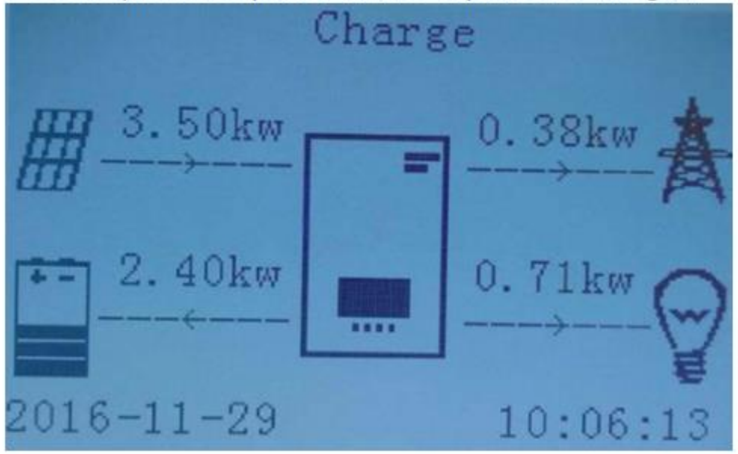
1) PV generation ~= LOAD consumption (ΔP < 100W), system will stay in Standby state.



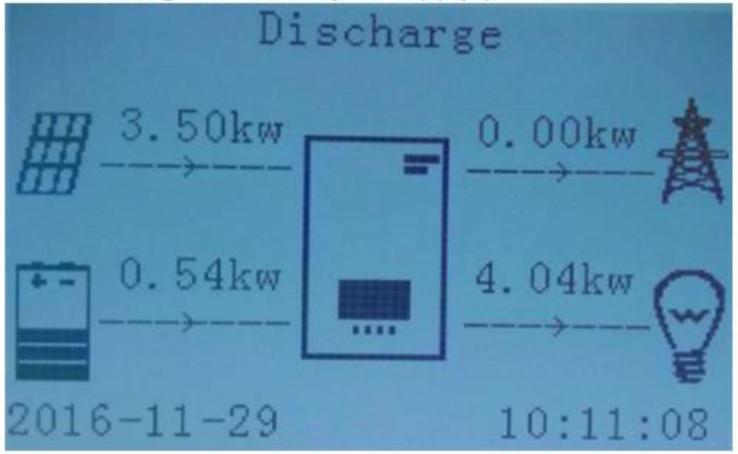
2)PV generation > LOAD consumption, the surplus power will be stored in the battery



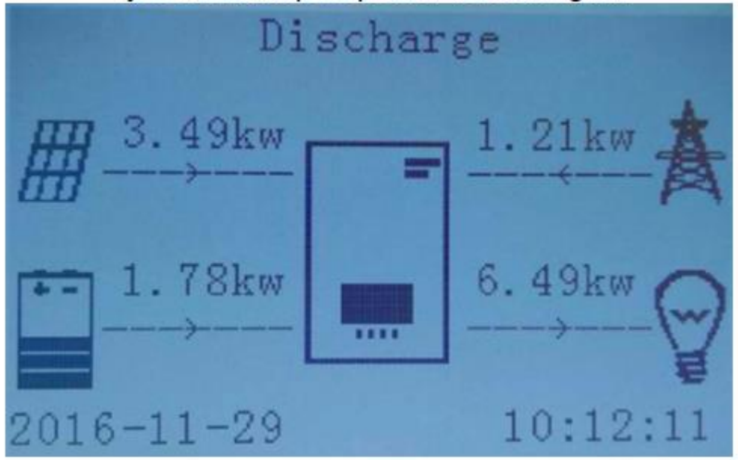
3) When the battery is full(or already at Max Charge Power), excess power will be exported to the grid.



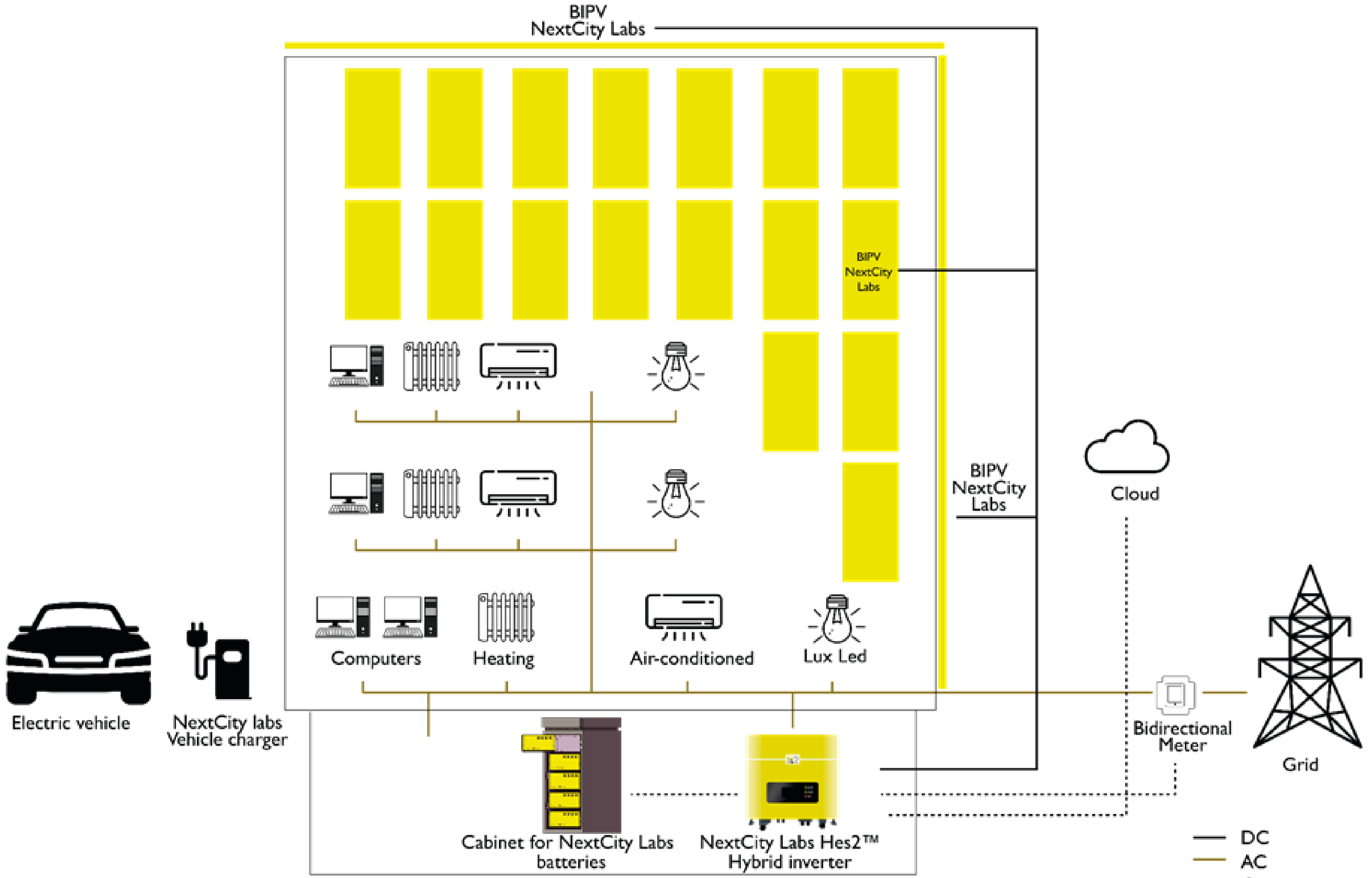
4) PV generation < LOAD consumption, system will discharge the battery to supply power to load,



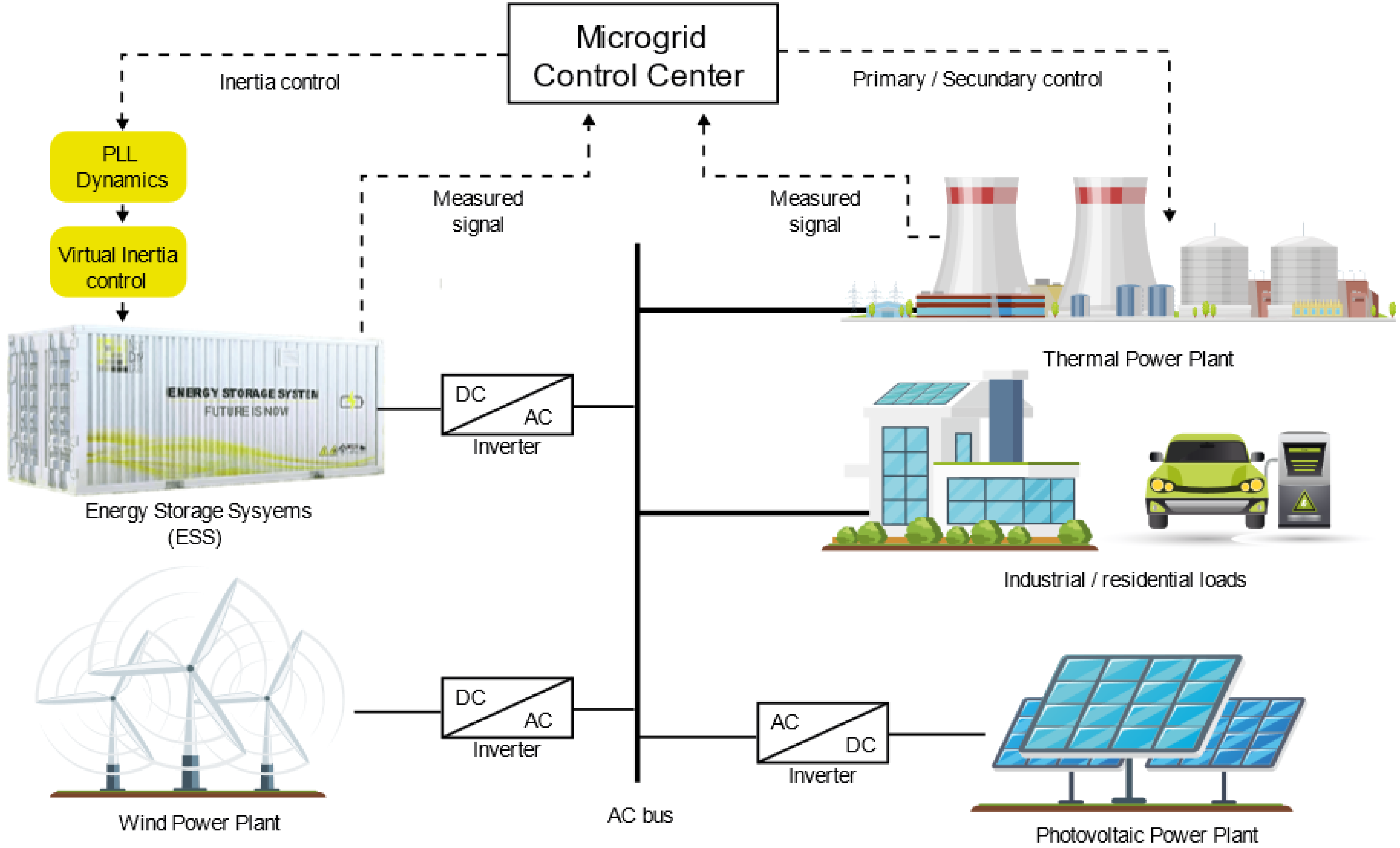
5) If PV generation + Battery < LOAD consumption, system will import power from the grid.



4. Applications: Medium-Scale



4. Applications: Large-Scale



5. Highlight Project: Medium-Scale ESS

Project Overview

This project is oriented to supply the electricity required for a Printer Plant and also offering a high level of reliability because traditional connection to EPS increases CAPEX and OPEX.

The load has an energy consumption of 250 kWh/day (on average). Their pick load is close to 100 kVA and it’s fed by a three phase circuit 120/227 Vac – 60Hz.

It was pruposed a system composed by 106 kWp of Photovoltaic Generation, 120 kVA of power in Inverters and an Energy Storage System of 491.5 kWh (0.49 MWh). Last experiences determine the technical viability for this engineering solution.

Some tax incentives apply to this type of projects in Colombia. They took advantage of those savings.

5. Highlight Project: Medium-Scale ESS

Justification

Within and industrial area placed in the surroundings of Bogotá D.C. (Colombia), there is a Customer (Printing Plant) that produces several products such as: books, magazines, newspapers, and so on.

During the phase of construction of its facility the Owners weren't sure about the access point to connect this plant to electrical power system EPS (public grid). Once the facility has been built and put into operation, it provitionaly was connected to a circuit provided for Grid Operator Company (GOC).

Then, this GOC denied to this Customer the possibility to be connected from a close substation or circuit. In constrast, they gave a connection point acces so far from the plant and also determine the construction for their own substation. They claimed the electrical node was full loaded.

This new project substantialy increased the CAPEX to get ready their operation phase. It was the situation that encouraged Owners to chose for an Off-Grid application.

5. Highlight Project: Medium-Scale ESS

Technical Solution

EES 491.5 kWh (0.49 MWh)

Location: Bogotá D.C., Colombia.

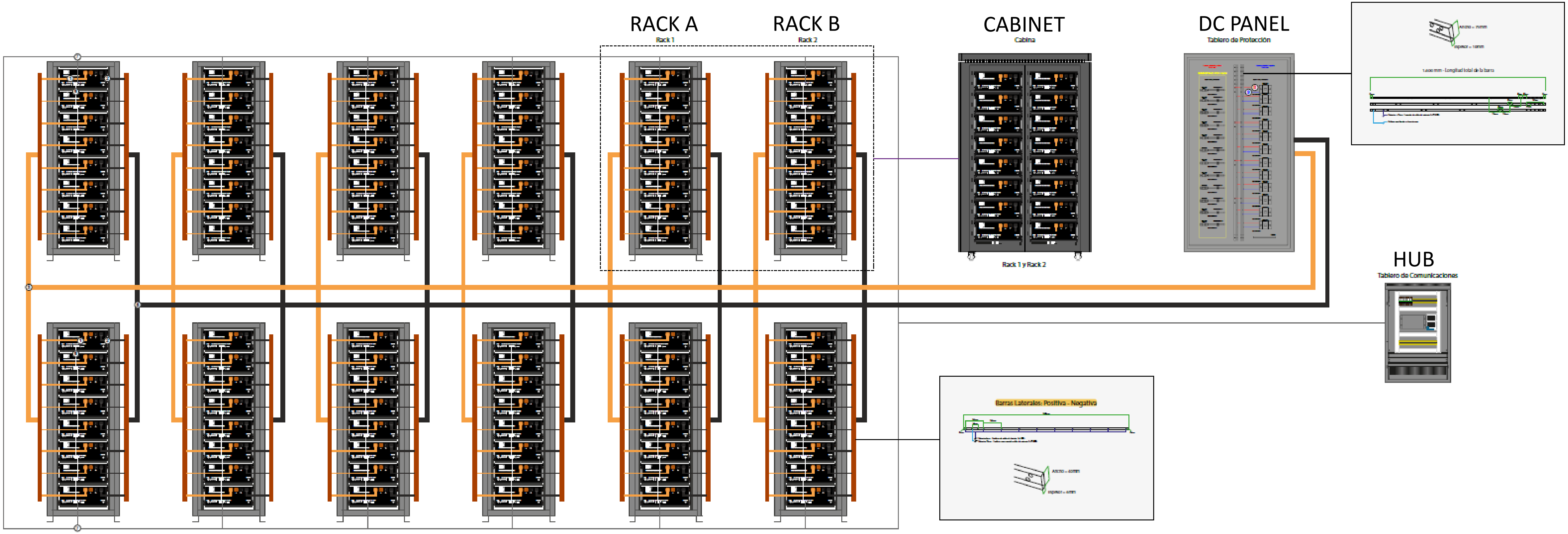
Technical description: 96 batteries NCL-LFPO-48100 (51,2Vdc/100Ah), cabinets, communication HUB y power wires and electrical protections.

Other features:

- Nominal Voltage: 51.2 Vdc
- Total ampacity: 9,600 Ah
- Cycle life: 6,000 cycles 80% DoD. 15-20 years.
- Layout: 6 cabinets (16 batteries per cabinet), and a main panel with HUB and protections.
- Operative temperature: 0 - 45° C.

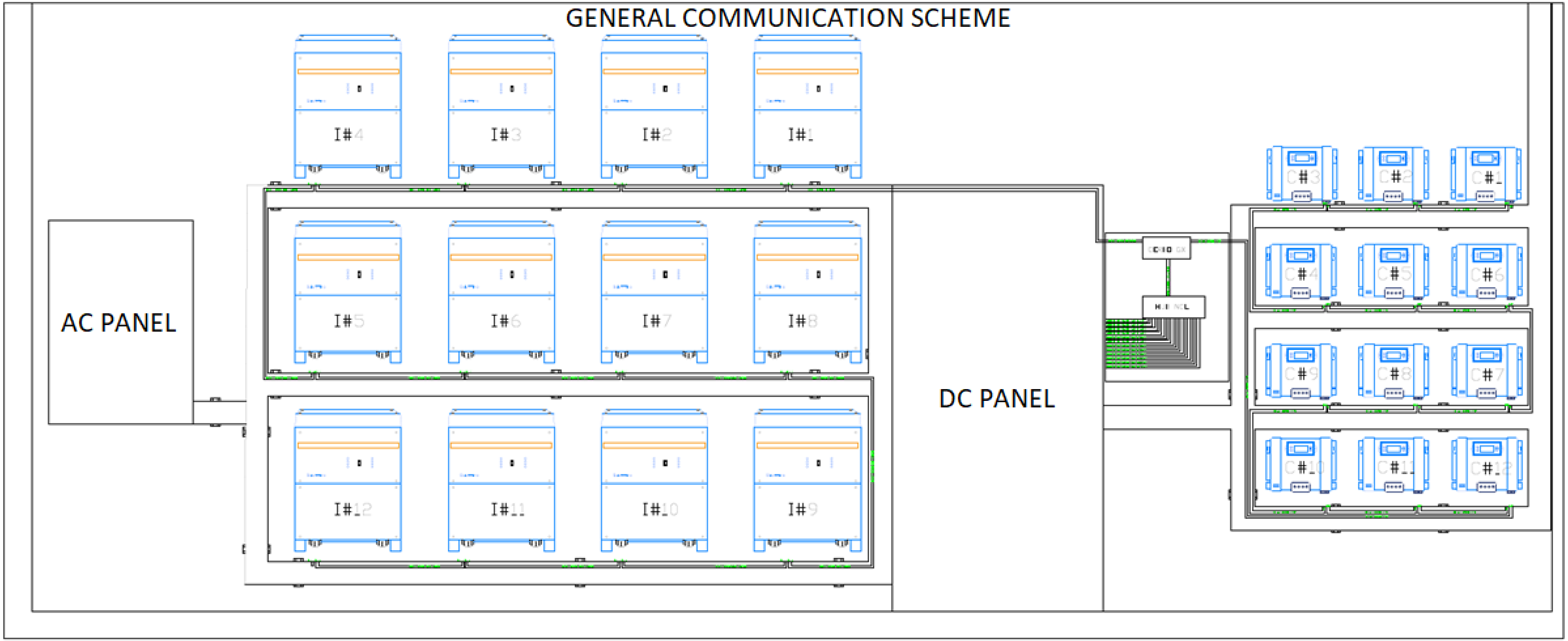
5. **Highlight Project:** Medium-Scale ESS

Technical Solution



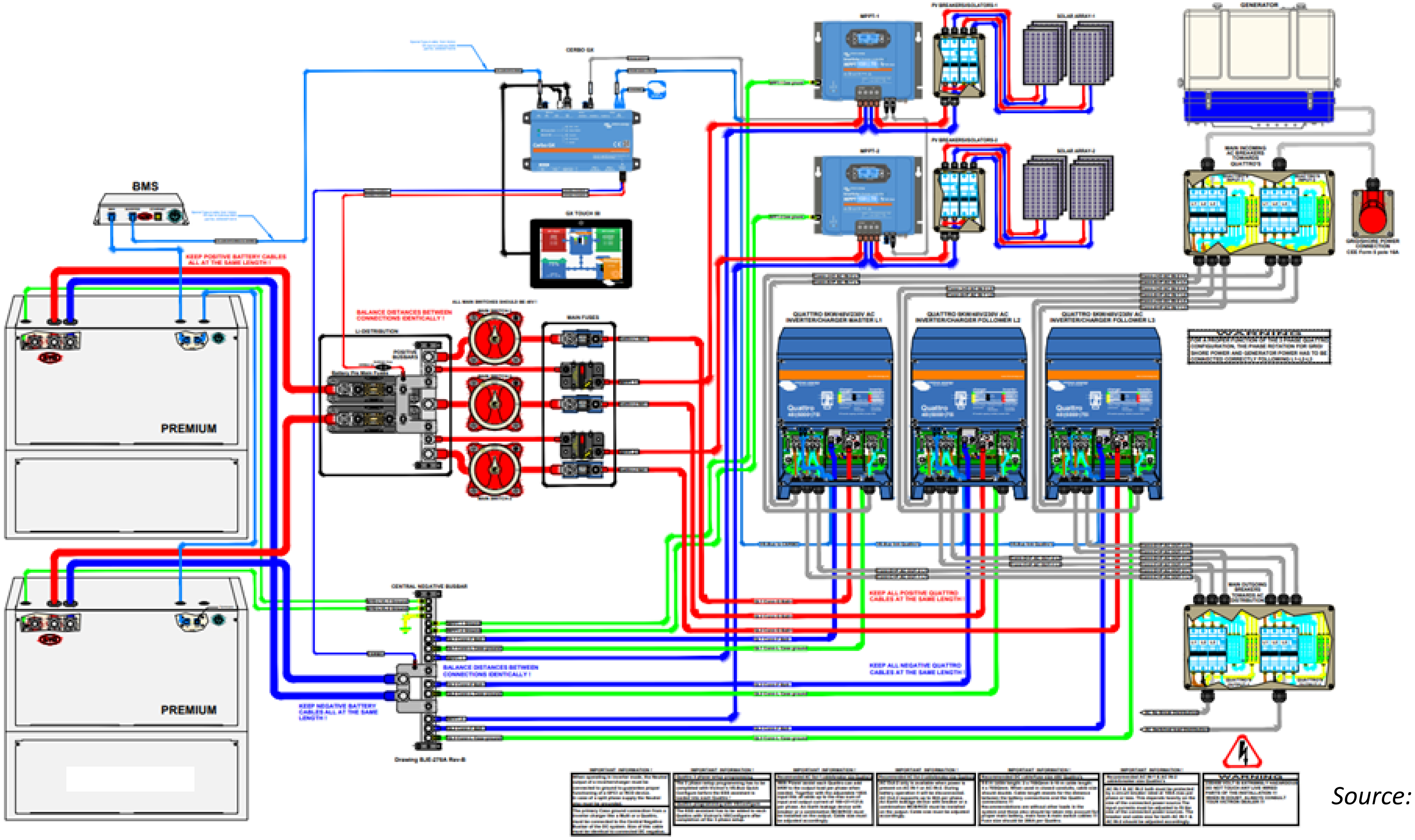
5. Highlight Project: Medium-Scale ESS

Technical Solution



5. Highlight Project: Medium-Scale ESS

Technical Solution



Source: VICTRON ENERGY

5. Highlight Project: Medium-Scale ESS

Technical Solution

Most sensitive issues

Precise communication

- Communication within batteries: Modbus RTU – Master and slaves per rack.
- Communication within Masters and HUB: CANbus. Six (6) masters must be connected to HUB.
- The HUB groups six (6) master batteries. HUB only send main parameters to controller.

Impedance balance (resistance)

- Whole batteries must be at 100% SOC before commissioning.
- Power wires for each rack must ensure the same impedance for each battery.
- Power wires between racks and main panel must be equal in length and cross section.

Cross seccion **2x2/0 AWG / pole * rack** Length **6,300 [mm]**

Electrical protection

- BMS
- Circuit breakers at battery level.
- Circuit breakers at rack level.

Fire system

NFPA 111 – NFPA 855 – Early detection

5. Highlight Project: Medium-Scale ESS

Implementation

CHARGE CONTROLLERS

INVERTER / CHARGER

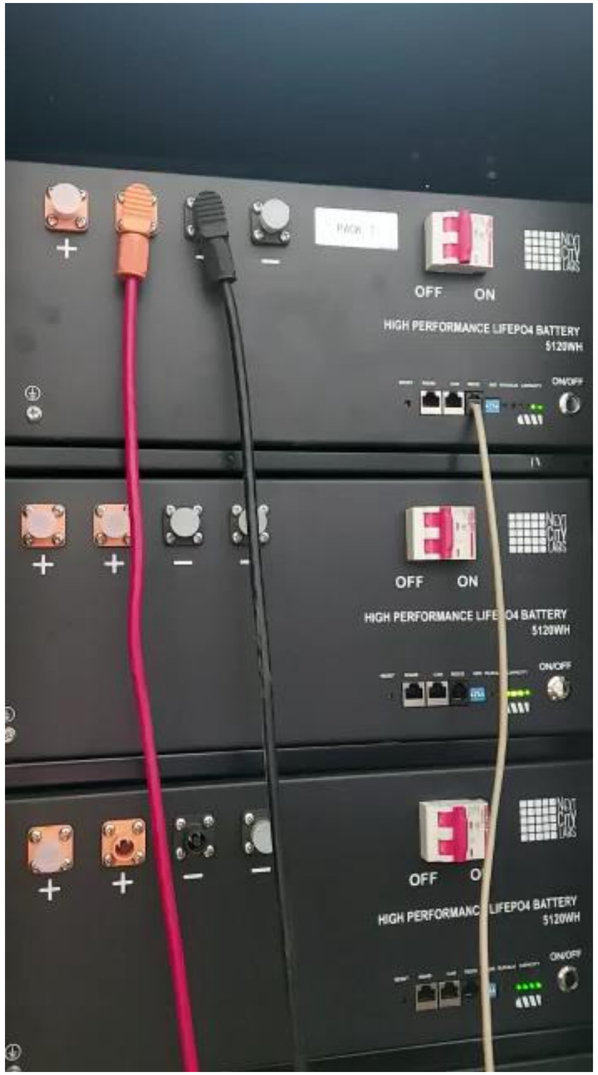
BATTERIES

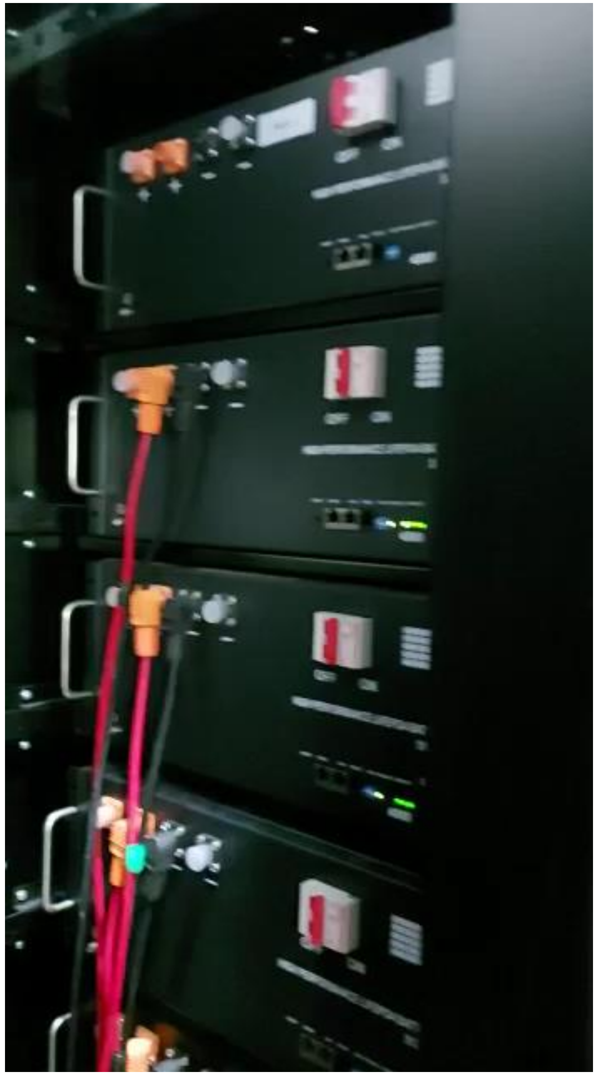
CABINETS

5. Highlight Project: Medium Scale ESS

Implementation

BMS CHECK





CHARGE PROCESS

Conclusions

The concept of “Smart Cities” relates to this Energy Storage technology ($LiFePO_4$) in the sense that the easy usage and huge technical advantages respected to predecesor technology (lead-acid) provide a tool which can support the requirements of operative challenges in Electrical Power Systems EPS.

The Grid Operator Company might have developed a “Demand Response” strategy in order to tuckle this issue associated with an overloaded electrical node. This strategy clould have involved and Energy Storage System ESS and distributed generation as well.

Communication compatibility between battery bank and power electronic devices is a sensitive subject that must be checked and monitored periodically.

The right usage of Energy Storage Systems ESS entails good engineering practices but also good safety and environmental practices.

Q&A

Personal information
Pablo Bedoya
Mobile: +57 3016889451 (Colombia)
Email: pbb@nextcitylabs.com
URL: www.nextcitylabs.com

Thank you for your attention

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Pablo Bedoya
Mobile: +57 3016889451 (Colombia)
Email: pbb@nextcitylabs.com
URL: www.nextcitylabs.com

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