RED ELÉCTRICA DE ESPAÑA

Stability FACTS + ESS for fast energy response in case of contingency

2 de febrero de 2017

Electric power storage, energy conversion and impact on the 21st century power grid. May 2017. Vancouver, Canada

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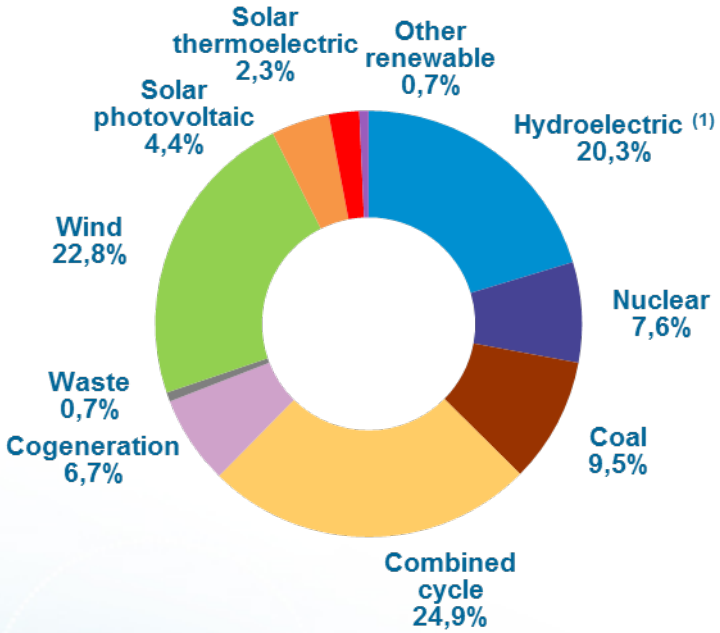
Red Eléctrica de España

- Red Eléctrica was founded on January 29th, 1985 as a result of the enactment of Law 49/1984 on the creation of a unified national power system.
- The functions assigned to the new company were:
  - Development and operation of the transmission system.
  - Coordination of the production-transmission system operation.
  - Dispatching the generation facilities at national level based on variable cost minimisation criteria.
  - Management of international interconnections.
- Red Eléctrica was the first national company in the world to specialise in high voltage power transmission and system operation.
- It was listed in the stock market in July 1999.

Functions of Red Eléctrica today

- Design, build, maintain and own the transmission grid.

- Operate the system and ensure continuity of the supply.

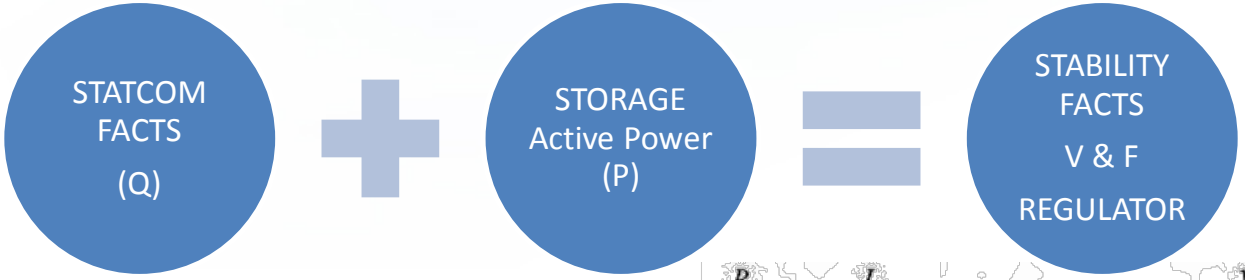


Installed capacity on the Spanish Peninsula (12/2016): **100,088 MW**

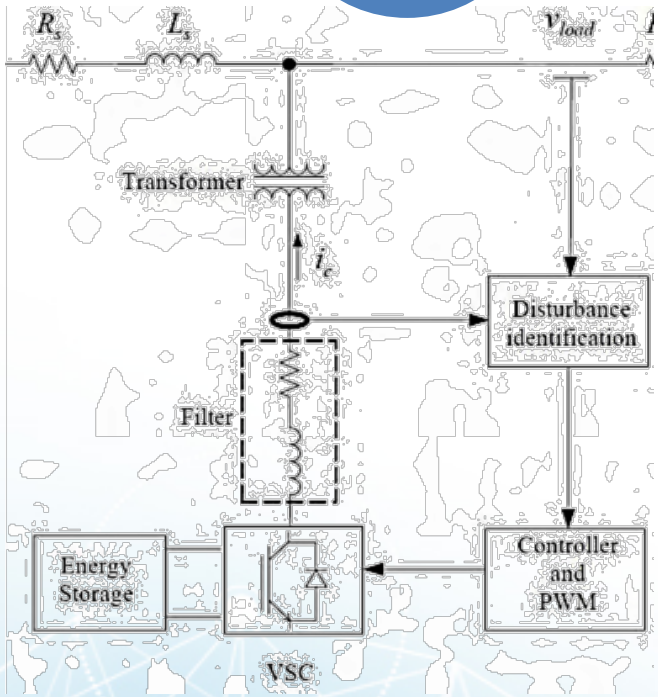
(1) Includes pure pumped storage installed capacity.

AMCOS- Stability FACTS for small isolated systems

Global Solution

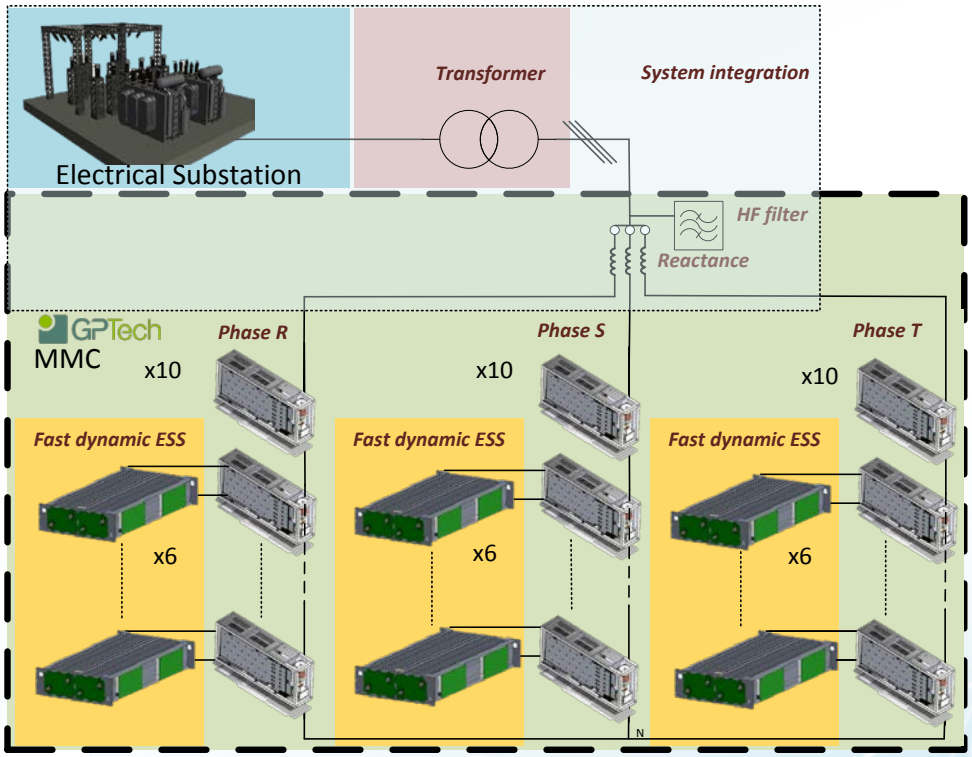


- Applications:
  - Voltage control
  - Power factor compensation
  - Increase of power transfer
  - Imbalances compensation
  - Damping of power oscillations
  - Voltage flicker correction



AMCOS- Stability FACTS project

- The project is partially supported by CDTI with FEDER Funds within the Innterconecta Programme.
- It is jointly developed by GPTech, Cobra and Red Eléctrica.



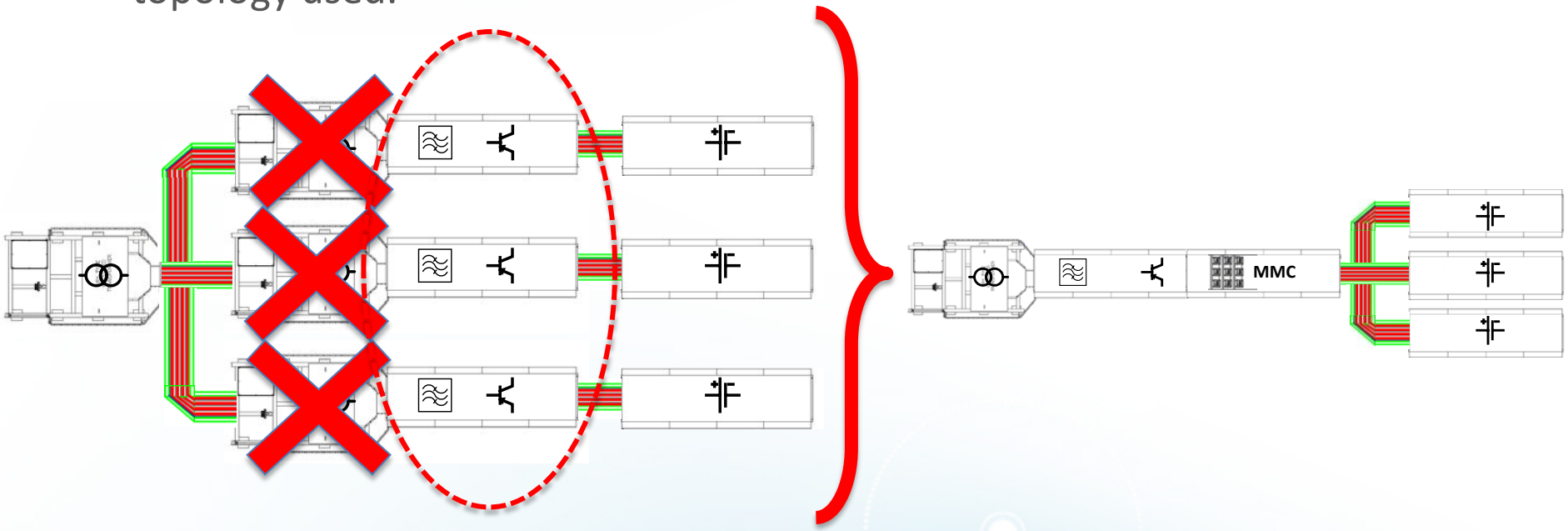
Prototype Characteristics (STATCOM + STORAGE)

- Total Apparent Power: 25 MVA
- Fast Active Power:
  10 MW
  18,7kWh
- Voltage: 9.5kV
- Current: 1.6kA

AMCOS- Key advantages.

Storage Systems directly attached to the modular power converter

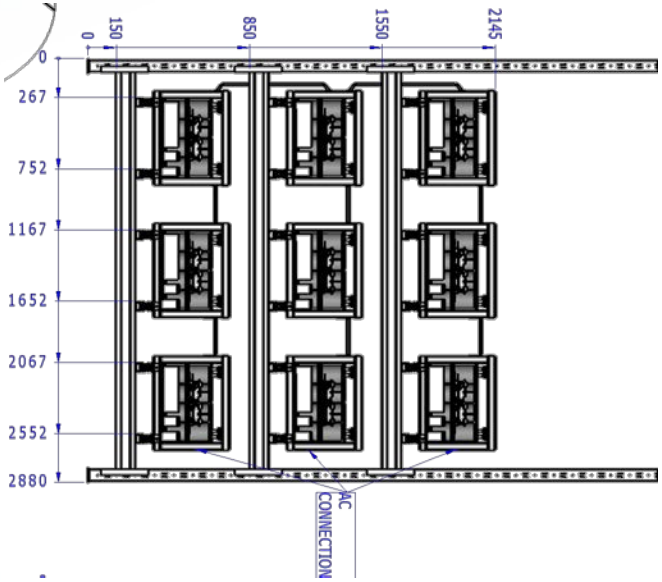
- The Energy Storage Systems are integrated by the power electronic elements avoiding the need of further infrastructures such as power transformers or filters, thanks to the Multilevel Modular Converter topology used.



AMCOS- From lab to real application

Lab Test Bench Characteristics

- STATCOM 7,5 MVA
- Multilevel modular Techn.
- H bridge
- Separate control per module
- 1100 V. and 1500 A. per cell
- ACrms Voltage: 2.9kV.
- 3 Supercap. Storage Modules

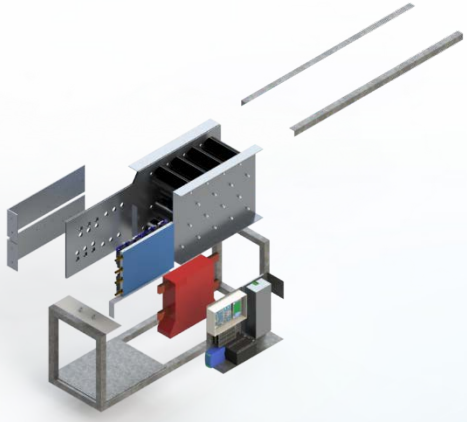


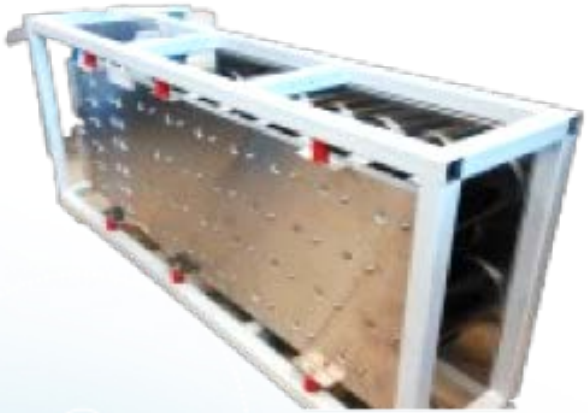
AMCOS (as a previous phase) and STABILITY FACTS are able to control active and reactive power in High Voltage applications, taking it even one step further with the inclusion of modular fast dynamic energy storage systems (ESS)

AMCOS- From lab to real application

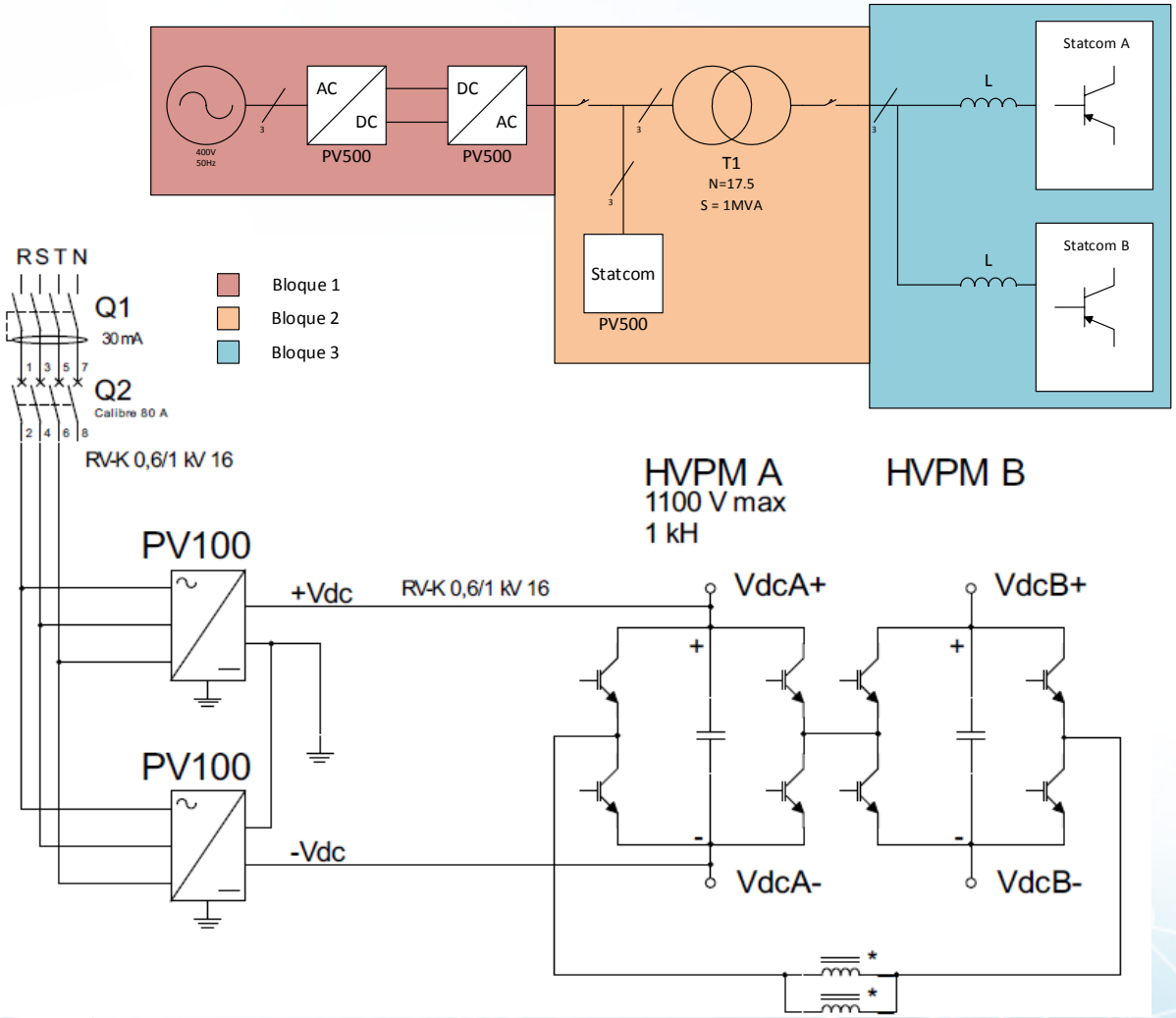
Modular Technology

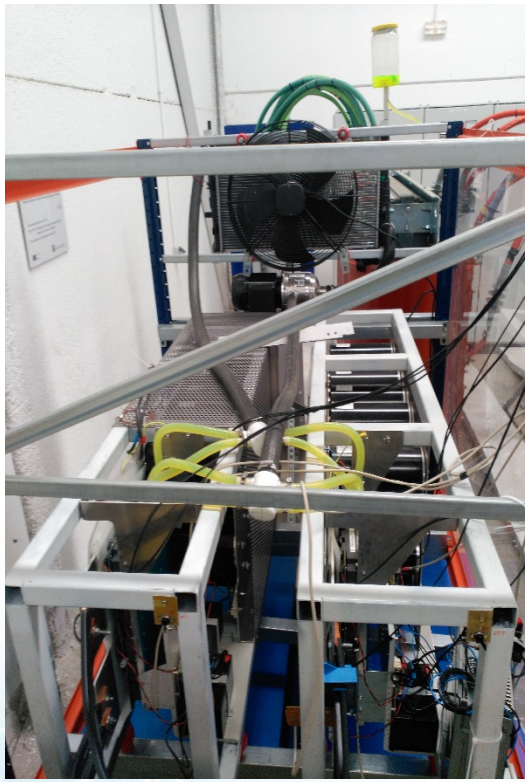
General characteristics of the power module	
DC nominal Voltage	900 V - 1000 V - 1100 V
Nominal Current	1700 A - 1600 A - 1500 A
Switching frequency	1 kHz
Frequency	50 Hz
Capacity	17,6 mF
Size (prototype)	630 x 330 x 1500 mm





AMCOS- From lab to real application



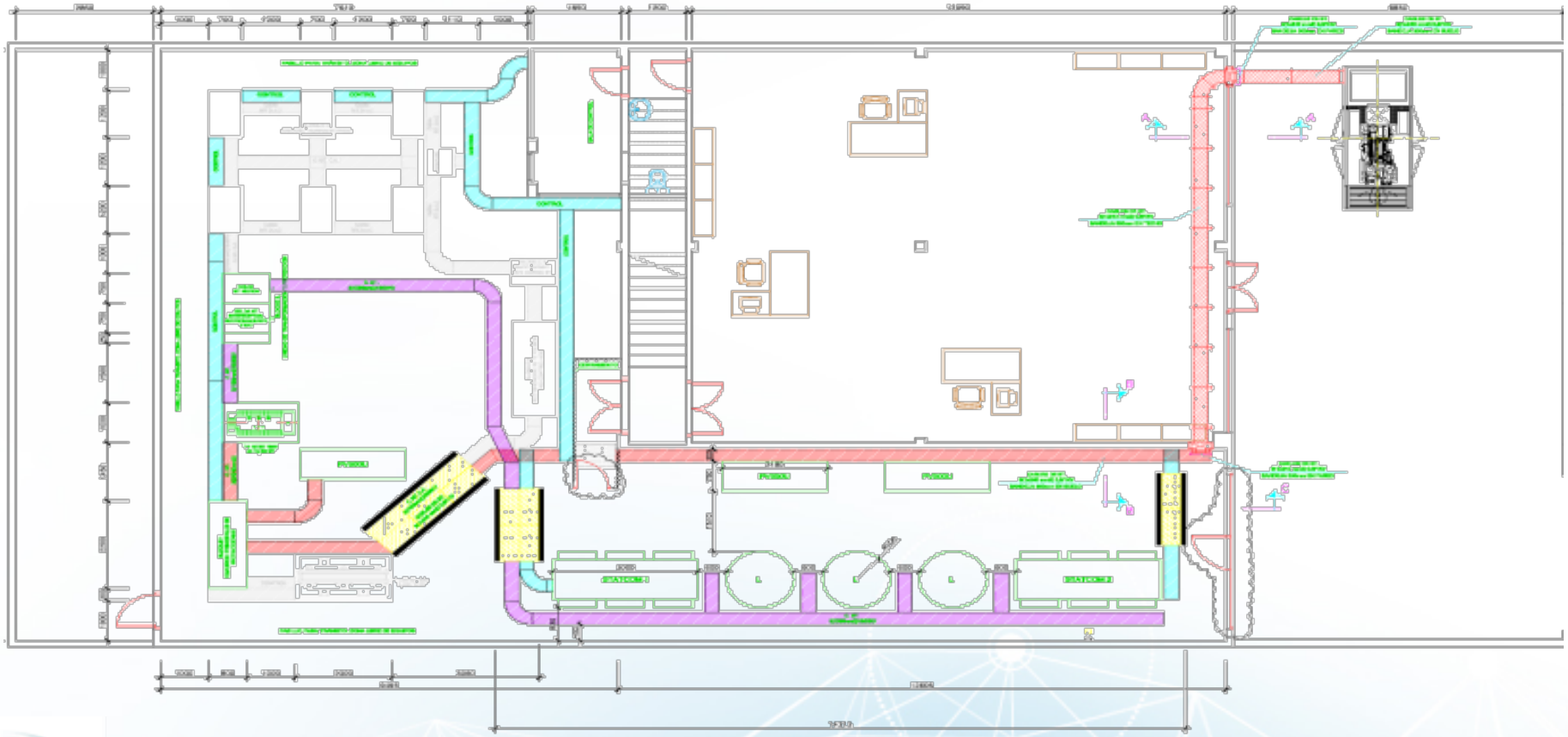


AMCOS- From lab to real application

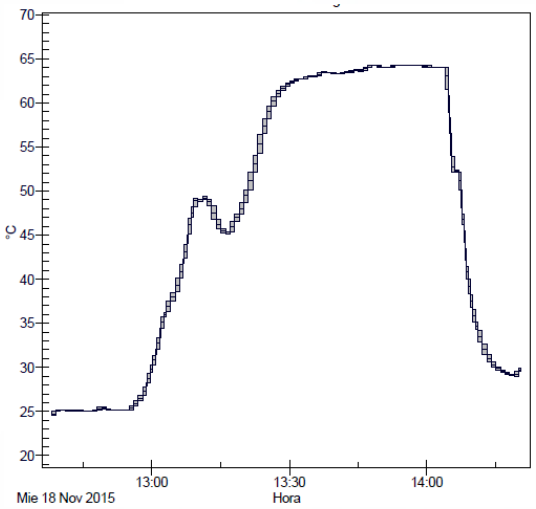
Lab testing

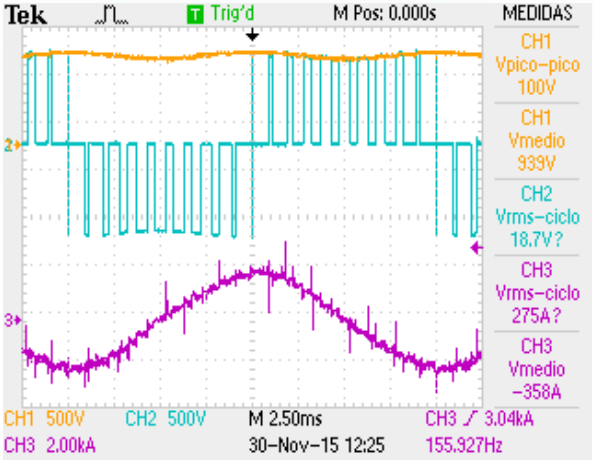
AMCOS

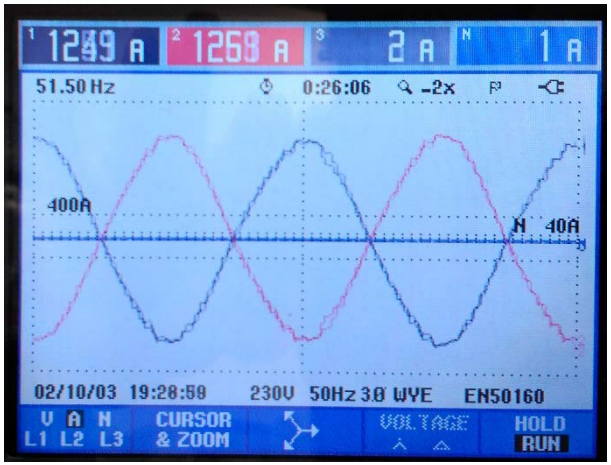
STABILITY
ELECTRICAL NETWORK COMPENSATOR WITH HYBRID ESS
FACTS

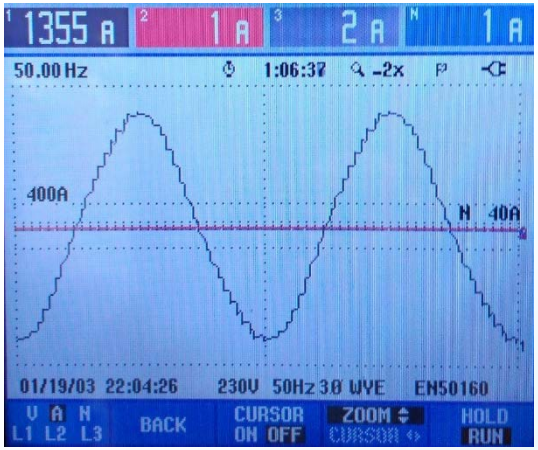


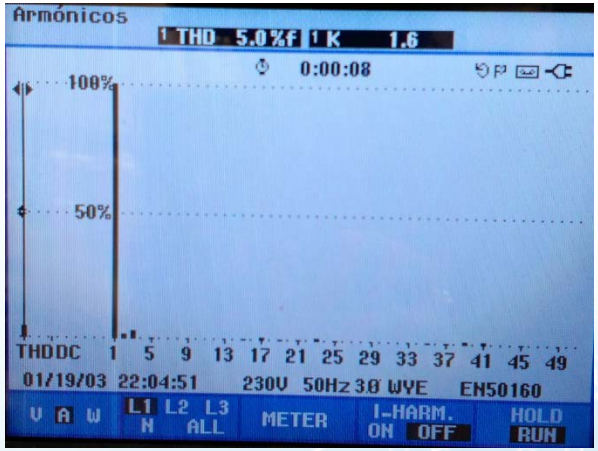
AMCOS- From lab to real application

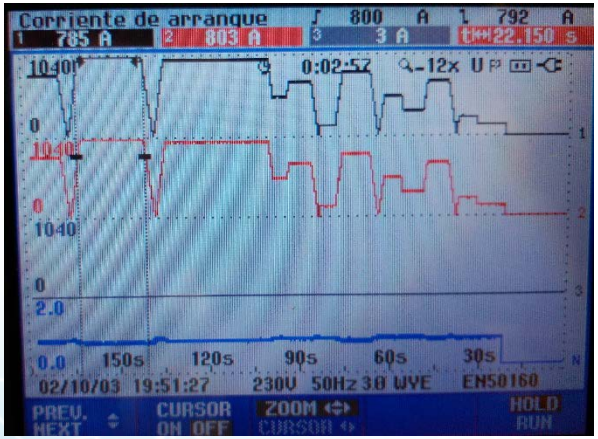












AMCOS- Next steps

Competitive advantages

- Hybrid ESS Supercapacitor + LiBattery, including fast dynamic response and high capacity storage system, modular attached to HV MMC modules
- Innovative and cost-effective control methods

Applications

- Contingency reduction in case of generation losses
- Congestion relief
- Renewable power plant integration as traditional power plant
- Increase PR of traditional power plants

	Speed of response	Repeated operation posible	Steps	"Inductive" control	Inertia (active power)	Cost CAPEX/OPEX
Stability FACTS	Fast	Continuous	Continuous	Yes	Possible, modular and adaptative	Low

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Thank you for your attention

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