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12 October 2022

3:00 pm – 4:00 pm | CEST, Berlin

2:00 pm – 3:00 pm | BST, London

4:00 pm – 5:00 pm | EEST, Athens



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Certified Feed-in Management for decentralized power generation



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Welcome!

Do you have any questions? ? 

Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  

Welcome

Certified Feed-in Management for decentralized power generation

Part 1

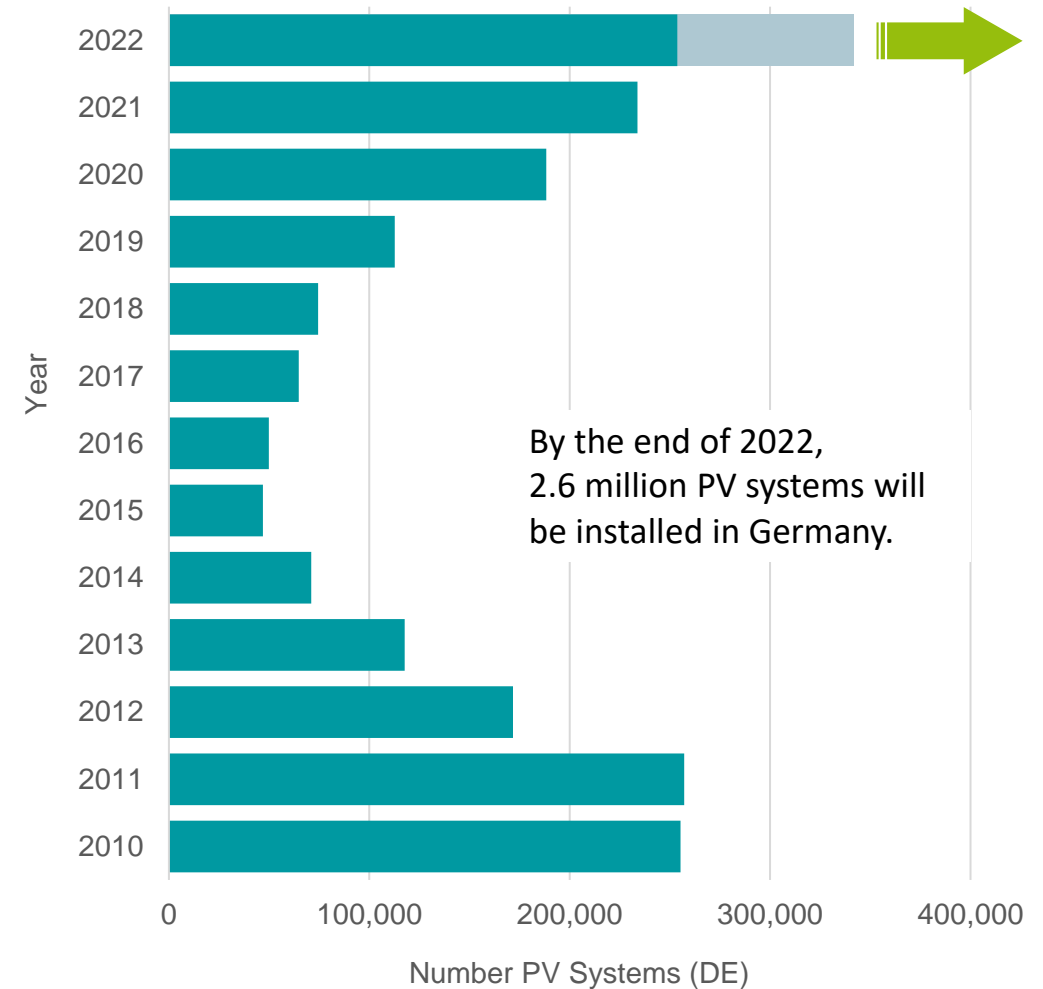
- Decentralized energy landscape and grid stability
- Network Code Requirements for Generators
- Control functionalities (according to VDE-AR-N 4110/4120)

Part 2

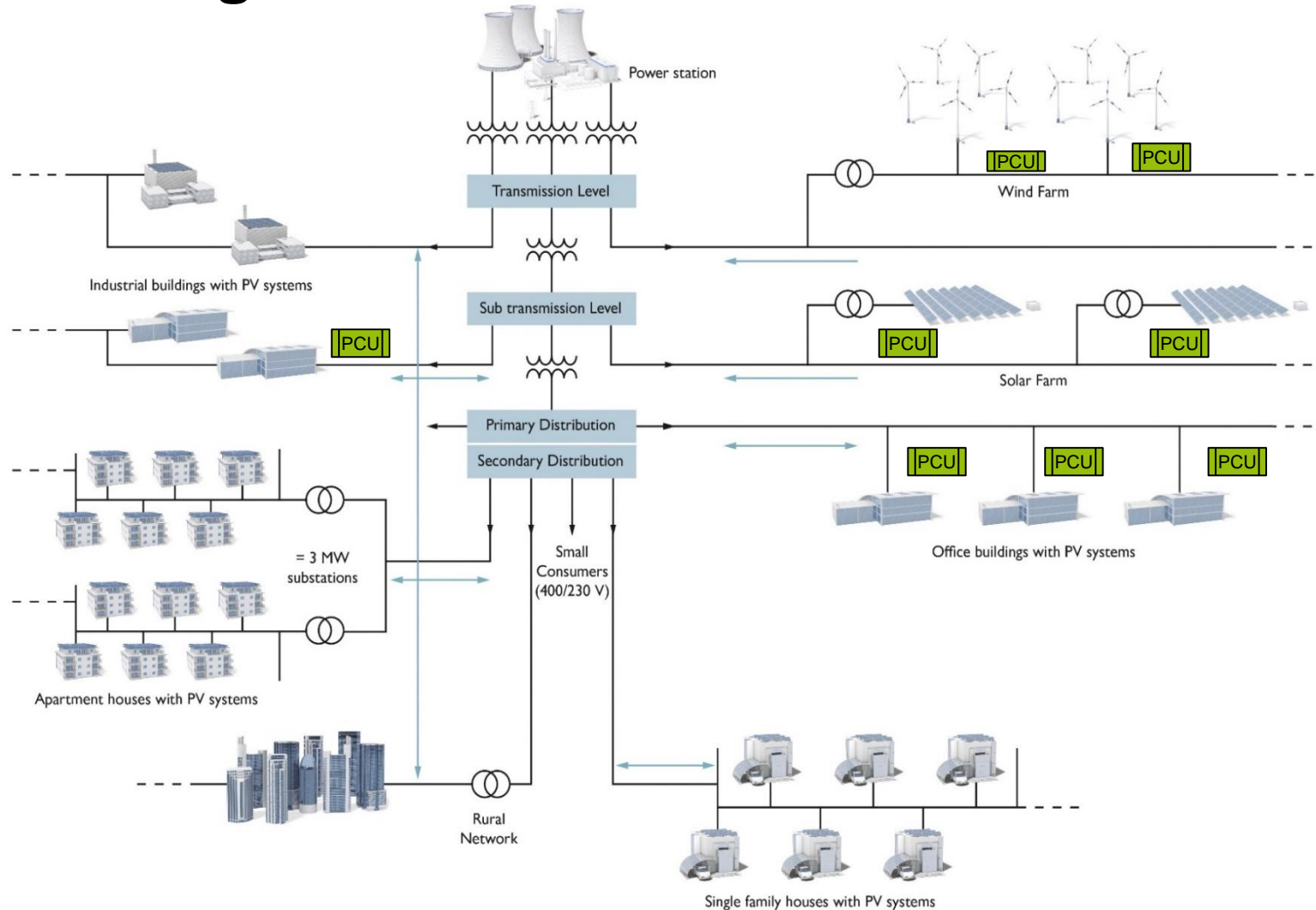
- Practical implementation and hardware requirements
- Potential additional benefits of the PCU

Transition of the electrical grid

- we are in the middle of a transformation from central power supply to decentralized energy generation
- the reasons for this have arrived in society and industry
- cost degression for renewable energy sources
- accelerated cost increase for fossil fuels
- fast growing number of small power generation plants
- the power grid must be adapted and protected
- technical solutions are available



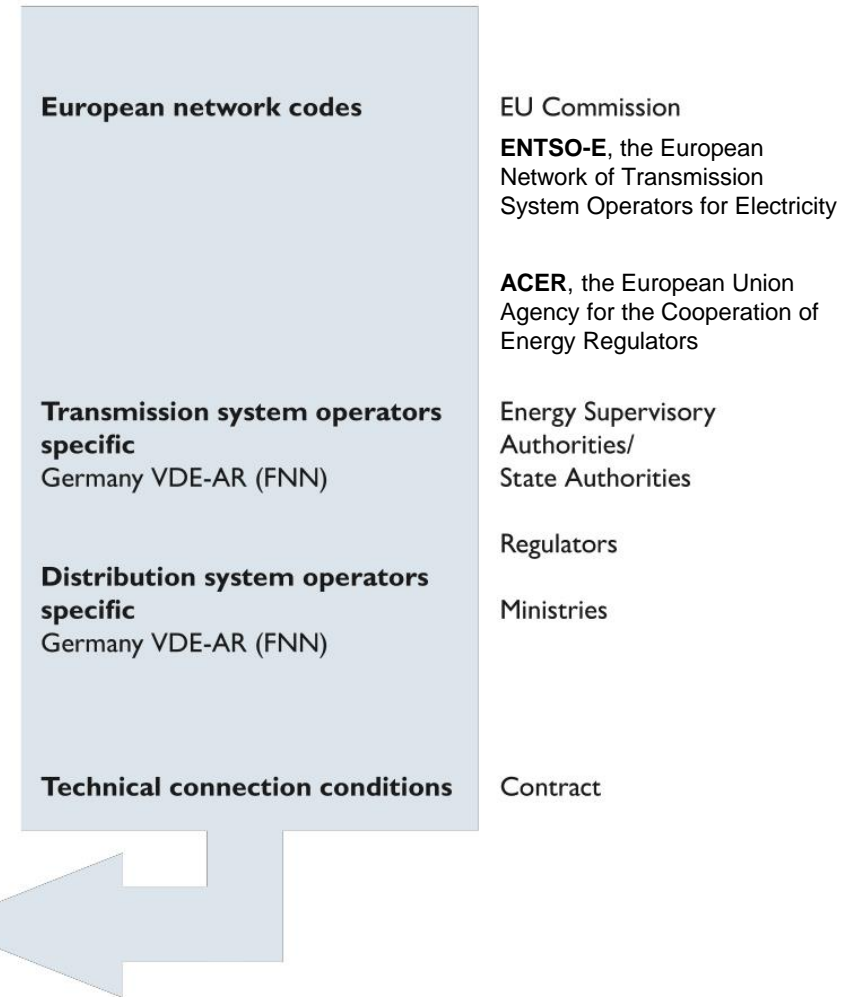
The future grid



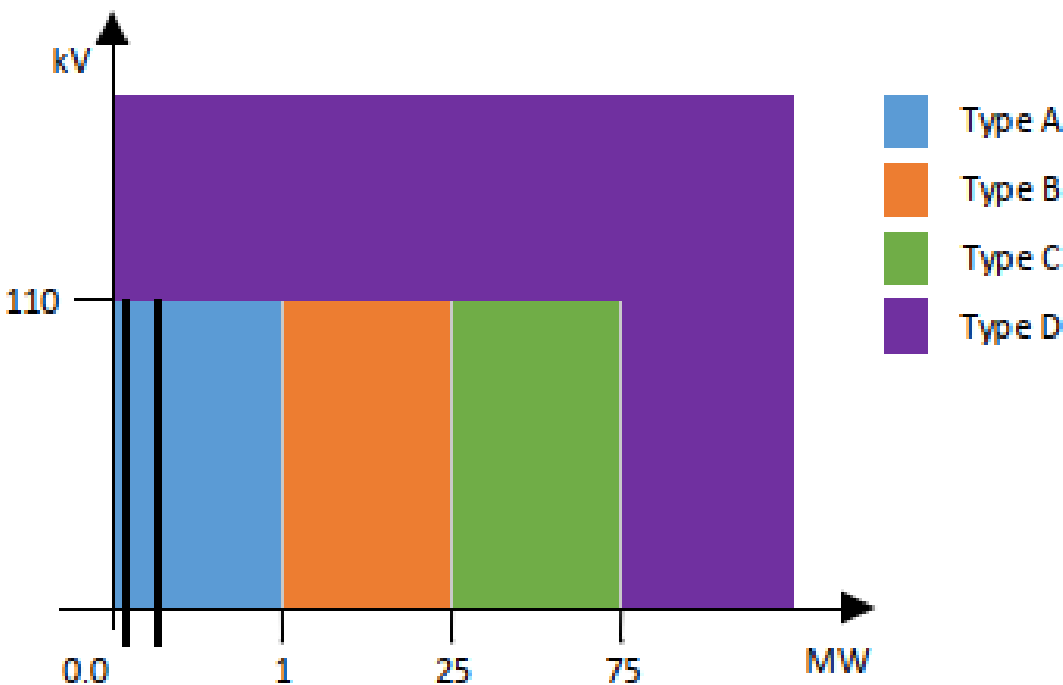
- no longer just top-down
- many more generators
- variable renewable energy
- ➔ PCU needed to balance supply and demand

NC RfG Implementation

- The European regulation is prepared by the ENTSO-E and ACER and EU Commission
- The rules and regulations were laid down in 2016 within the NC RfG
- The NC RfG regulates cross-border electricity trading and capabilities for frequency support and the provision of reactive power. The Focus is on the Power Plant Controller and on the behavior of the power plants.
- In general, the NC RfG only provides a framework, that must be specified on country level and the relevant system operators within the defined limits.
- In Europe, there are many different country-specific guidelines.



Four generator classes



DE > 135 kWp B > 250 kWp (56 kWp)

PCU required

	Requirement	Type			
		A	B	C	D
Frequency Stability	Frequency ranges	X	X	X	X
	Limited frequency sensitive mode (overfrequency), LFSM-O	X	X	X	X
	Rate of change of frequency withstand capability	X	X	X	X
	Constant output at target active power	X	X	X	X
	Maximum power reduction at underfrequency	X	X	X	X
	Automatic connection	X	X	X	X
	Remote switch on/off	X	X		
	Active power reduction		X		
	Active power controllability and control range			X	X
	Disconnection of load due to underfrequency			X	X
	Frequency restoration control			X	X
	Frequency sensitive mode			X	X

Network Code Requirements for Generators

Certification across different EU member states

- **Germany, NC RfG defined by:**
Certification according to VDE-AR-N 4110/-20 for since 2019
- **Spain, NC RfG defined by:**
Norma Técnica de Supervisión de la Conformidad de los Módulos de Generación de Electricidad según el P.O. 12.2 SENP. revisión 1.1 del 9 de julio de 2021, Spain special: Mainland / Islands
- **Poland, NC RfG defined by:**
Warunki i procedury wykorzystania certyfikatów w procesie przyłączenia modułów wytwarzania energii do sieci elektroenergetycznych, 2021
- All other member states do not have an obligation for a PPC Certificate, and the Power Plant Systems have to be certified individually.

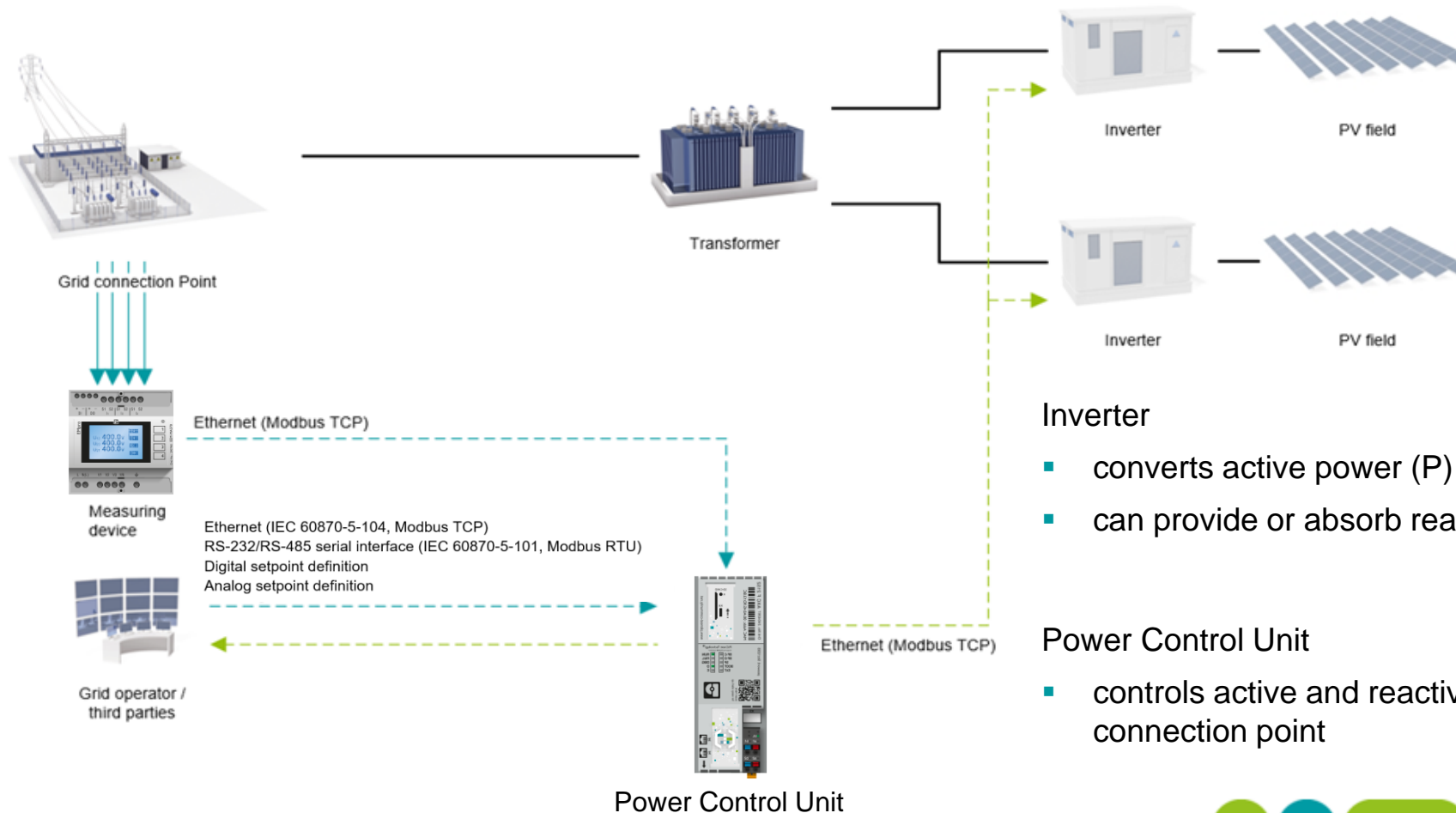
A better way to solve the confusing requirements, would be to develop international standards for testing, model validation, simulation and certification.

This standardization of the certification obligation is under discussion and is being pursued by ENTSO-E.



Control functionalities (according to VDE-AR-N 4110/4120)

View of a power generation plant



Inverter

- converts active power (P) from DC to AC
- can provide or absorb reactive power (Q)

Power Control Unit

- controls active and reactive power at the grid connection point

Control functionalities (according to VDE-AR-N 4110/4120)

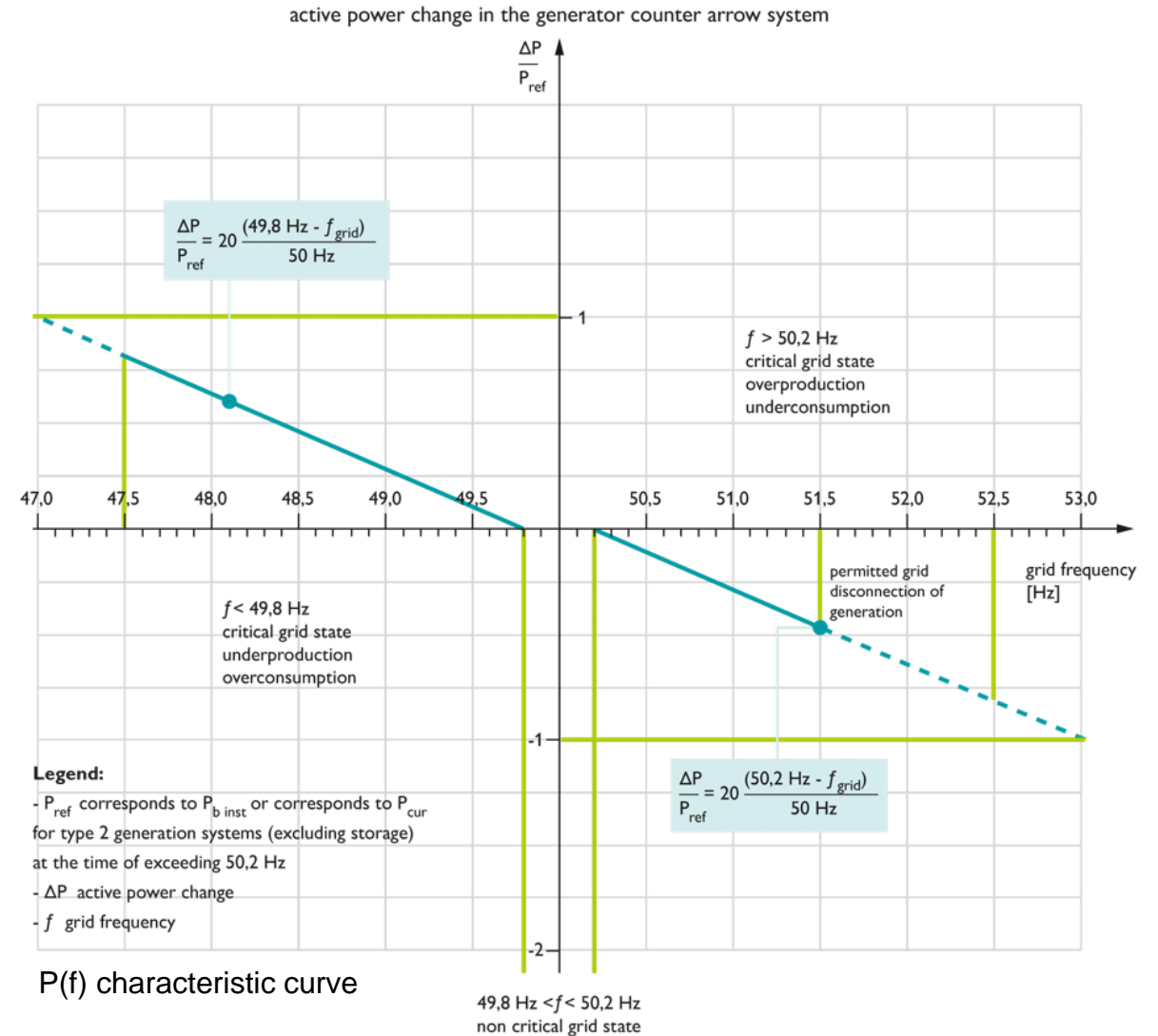
Active power control

#	Function	VDE-AR-N 4110:2018	VDE-AR-N 4120:2018
1	Active power gradients, setpoints from the grid operator for network security management and third parties (energy off-takers, self-consumption optimization, etc.)	✓	✓
2	Prioritization of external setpoint specifications by the grid operator and third parties	✓	✓
3	P(f) characteristic curve*	✓	✓

* Restriction to EZE's type 2 (PV inverters, etc.)

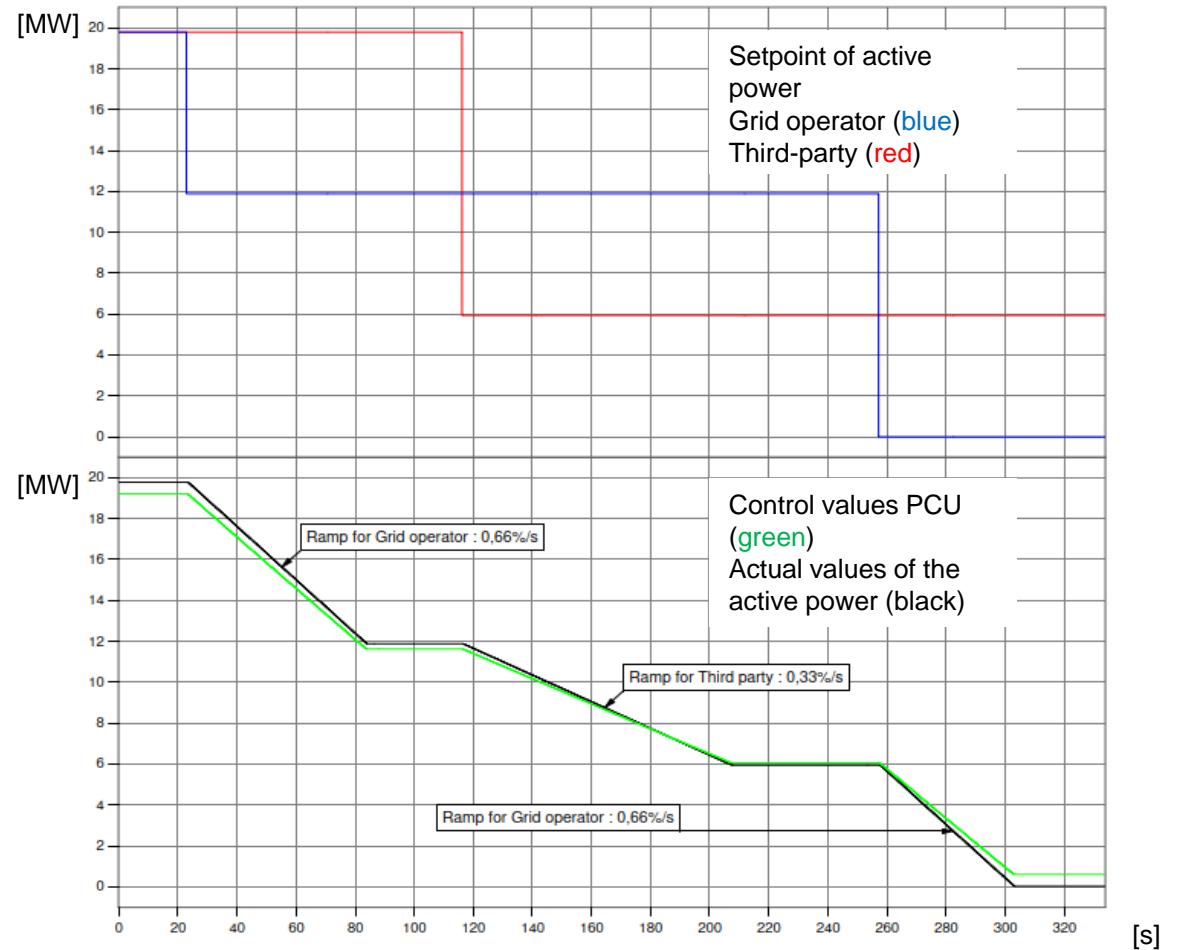
Active power control

- P(f) characteristic
- Additional functions
 - Active power limitation/control
- **Fallback options** in case of a malfunction
 - The last valid setpoint is maintained
 - Fixed setpoint (can be parameterized)



Active power control

- Prioritization of different set values
 - Grid operator
 - Third parties
 - Ramp function for both set values



Control functionalities (according to VDE-AR-N 4110/4120)

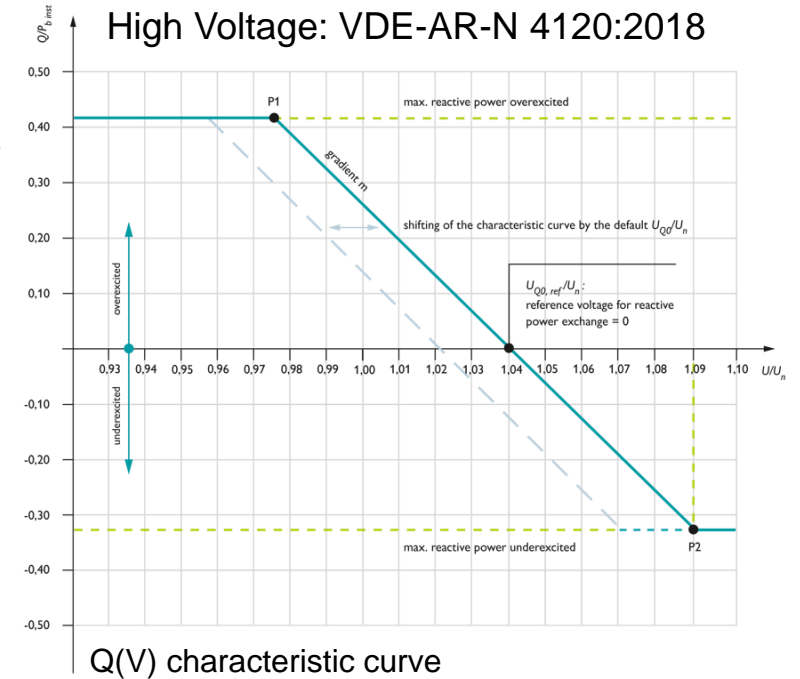
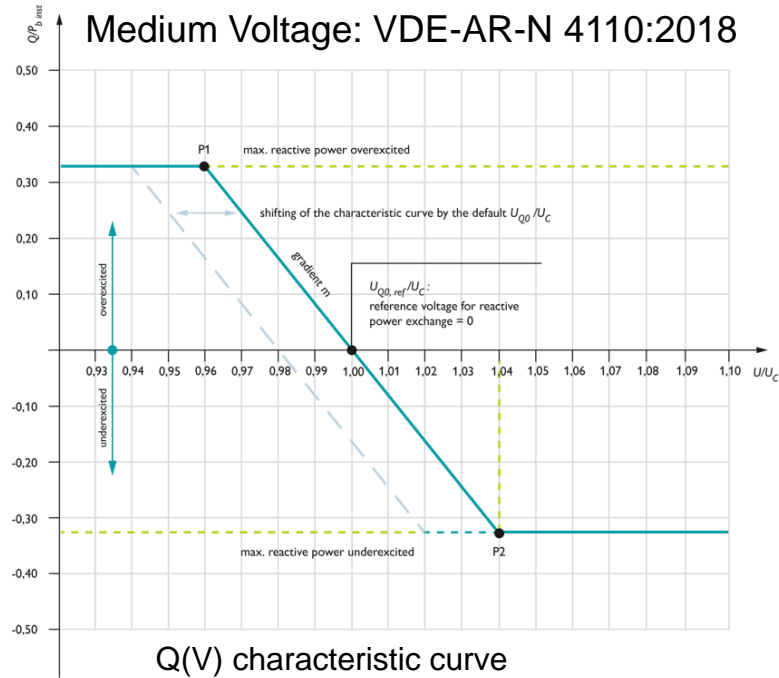
Reactive power control

#	Function	VDE-AR-N 4110:2018	VDE-AR-N 4120:2018
1	Direct Q setpoint specification with voltage limiting function	✓	✓
2	Q(V) characteristic curve	✓	✓
3	Q(P) characteristic curve	✓	<i>not required</i>
4	Cos(φ)	✓	✓
5	Switching between the individual reactive power processes	✓	✓
6	Reactive power-prioritizing driving style (reduction of the active power in favor of reactive power)	✓ *	✓ *

*not subject to certification

Reactive power control

- Q(V) characteristic
 - Hysteresis about the reference voltage
 - Adjustable reference voltage



Control functionalities (according to VDE-AR-N 4110/4120)

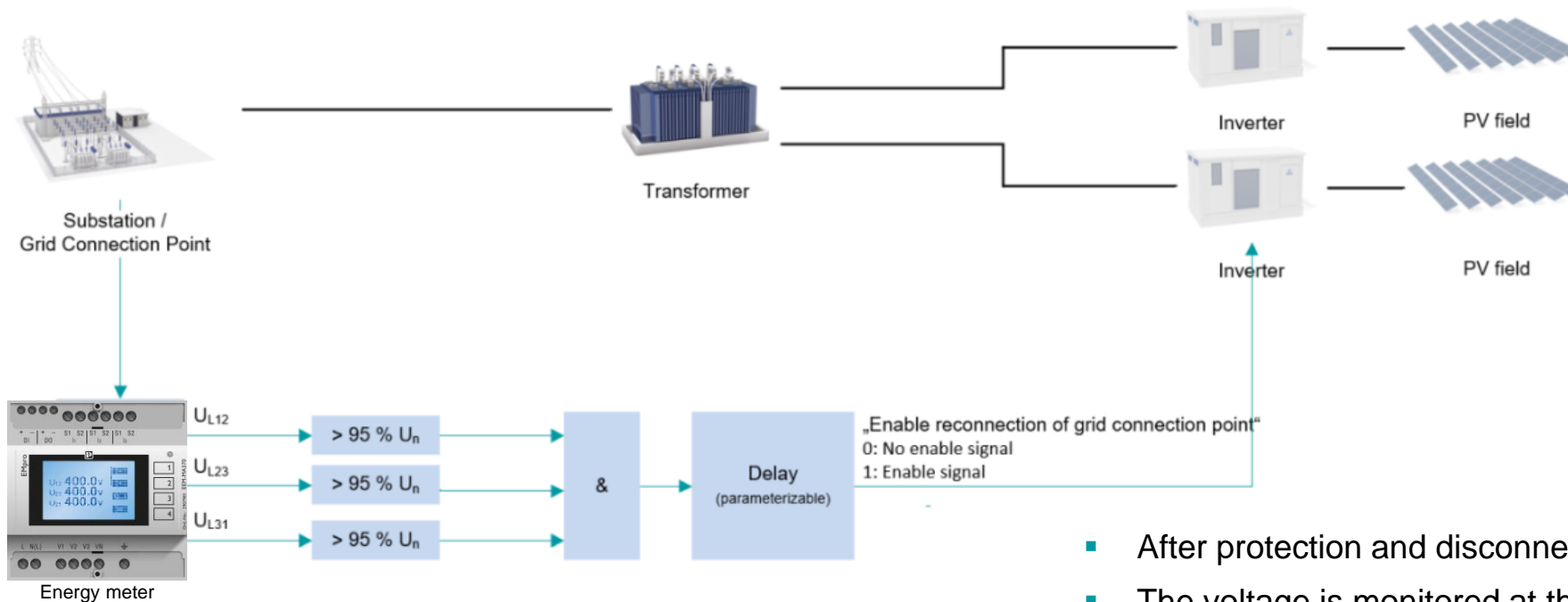
Additional functions

#	Function	VDE-AR-N 4110:2018	VDE-AR-N 4120:2018
1	Controller bridging (bypass mode)	✓ *	✓ *
2	Signal "Release reconnection from Grid Connection Point (voltage criterion)	not required	✓

* not subject to certification

Control functionalities (according to VDE-AR-N 4110/4120)

Reconnection of the grid connection point



Since all functions of the PCU can be flexibly parameterized, we were able to meet the certification requirements for Germany, Spain and Poland.

- After protection and disconnection of the power plant
- The voltage is monitored at the Grid Connection Point
- PCU sends a release Signal to the PGU, when voltage exceeds the adjustable Limits

Certified Feed-in Management for decentralized power generation

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Part 2

- Practical implementation and hardware requirements
- Potential additional benefits of the PCU

Power Control references

Europe:
1.1GW implemented in 2021 by Phoenix Contact

Amareleja | Portugal



208 MWp

6 PV parks

from 9,5 to 60 MW

Investor: Wirtgen Invest
EPC: Conecon GmbH
Web portal: QOS-Energie
Inverters : SMA

Phoenix Contact Scope:

2158 x SCB's

80 x Datalogger

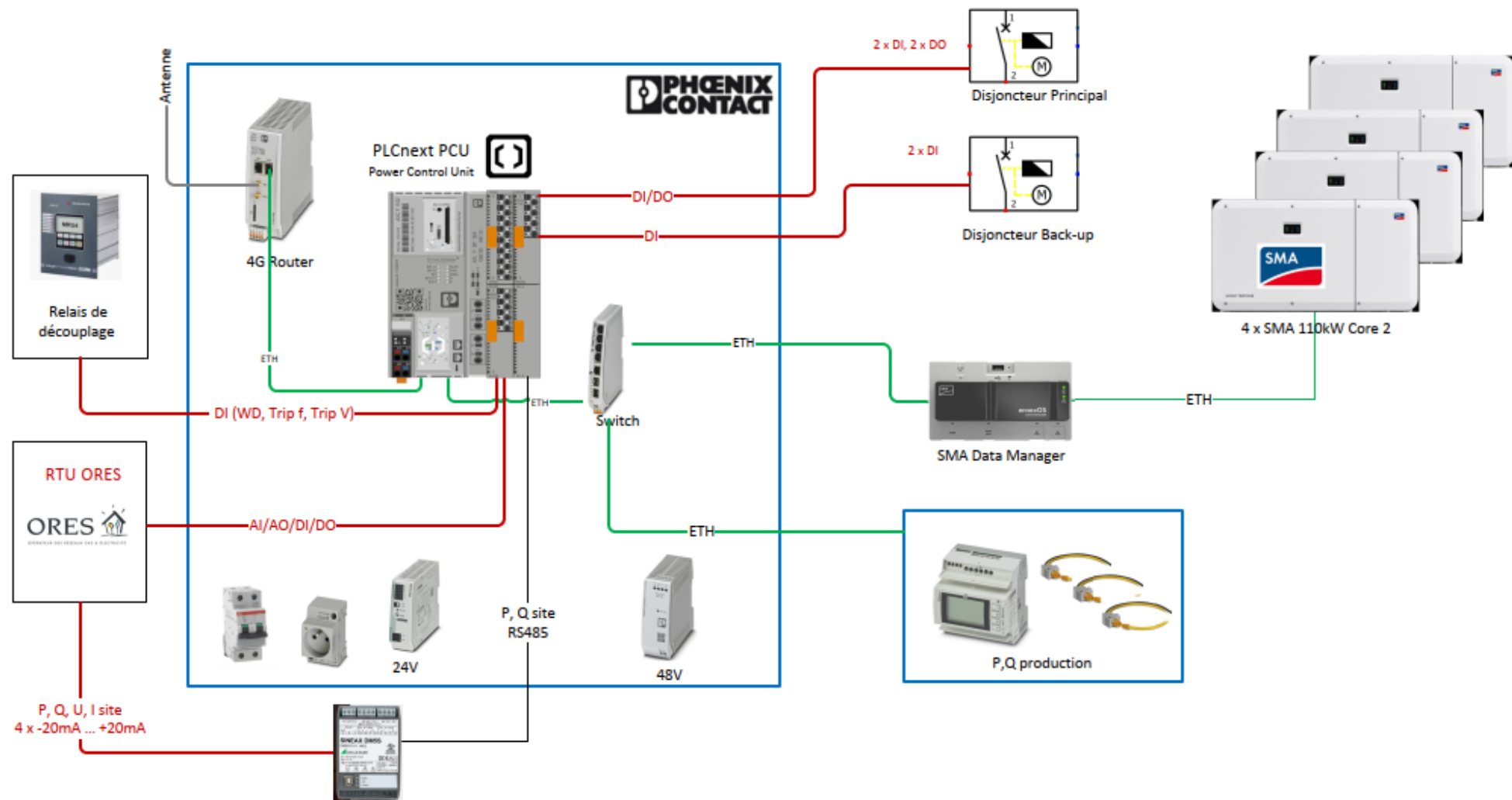
25 x Weather stations

6 x Power Control Units

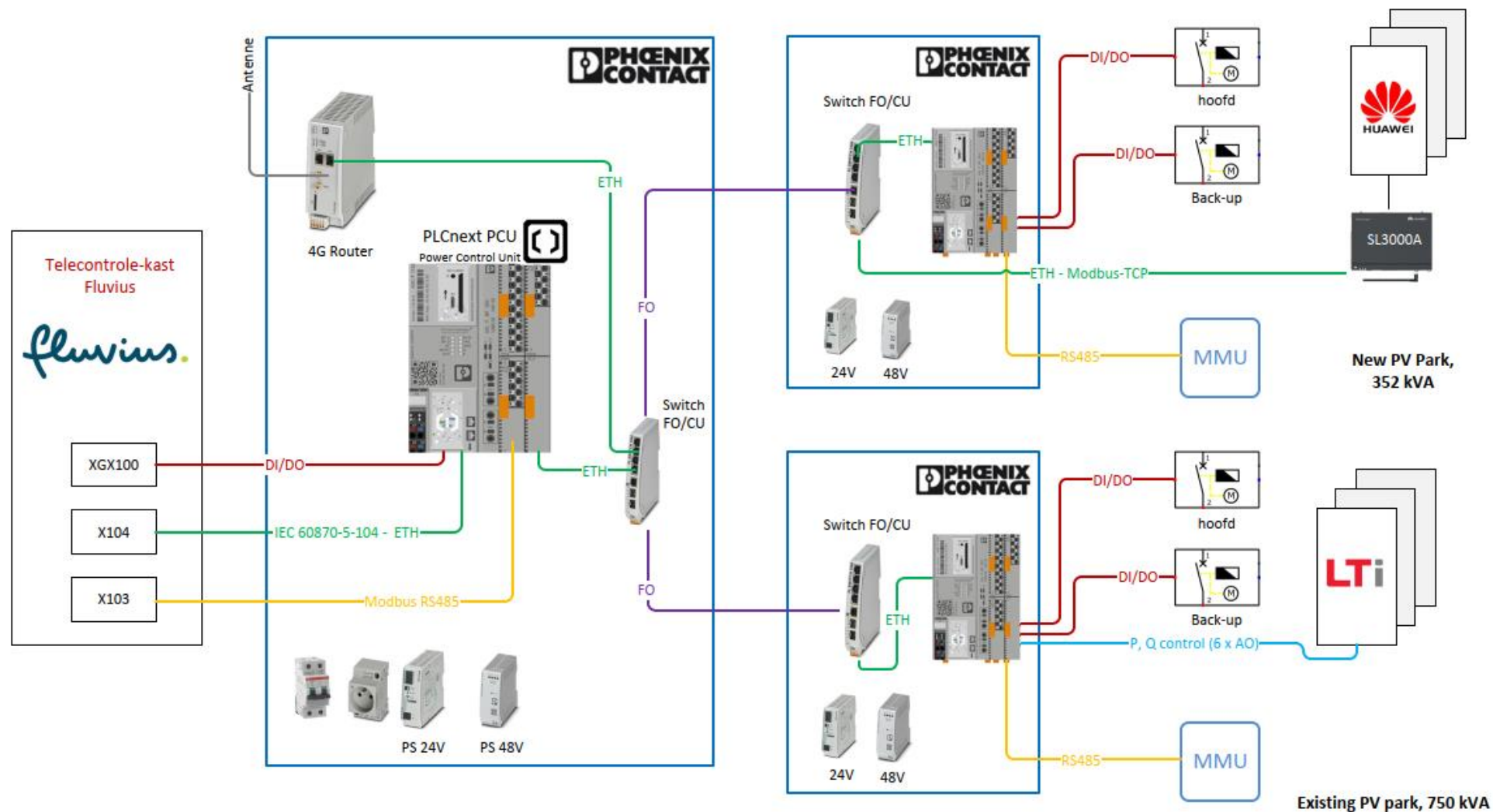
1. Arlon | Belgium | 250 kVA



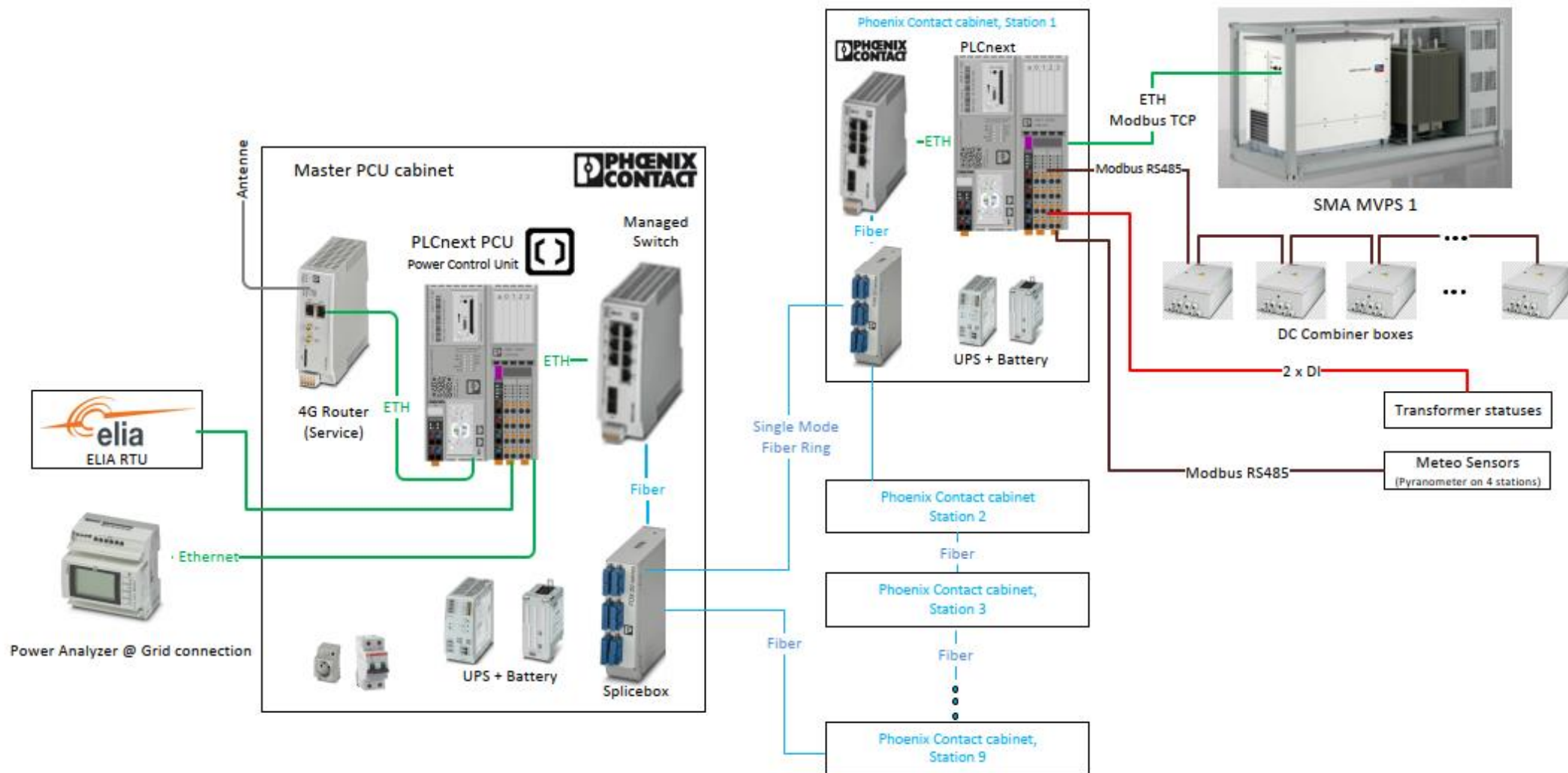
2. Jambes | Belgium | 440 kW



3. Belorta | Belgium | 1100 kVA

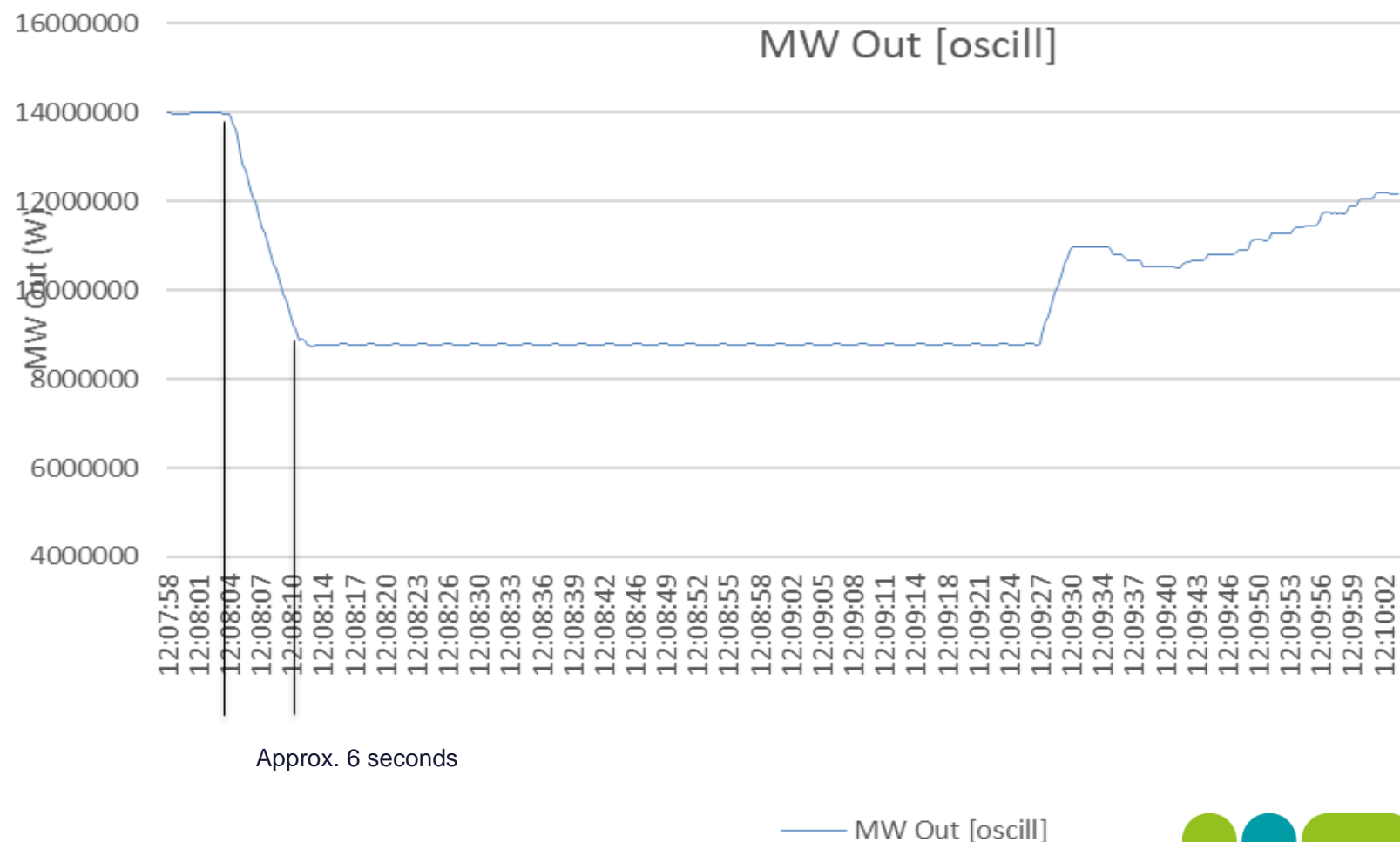


Utility scale ground mount | 40 MVA Site



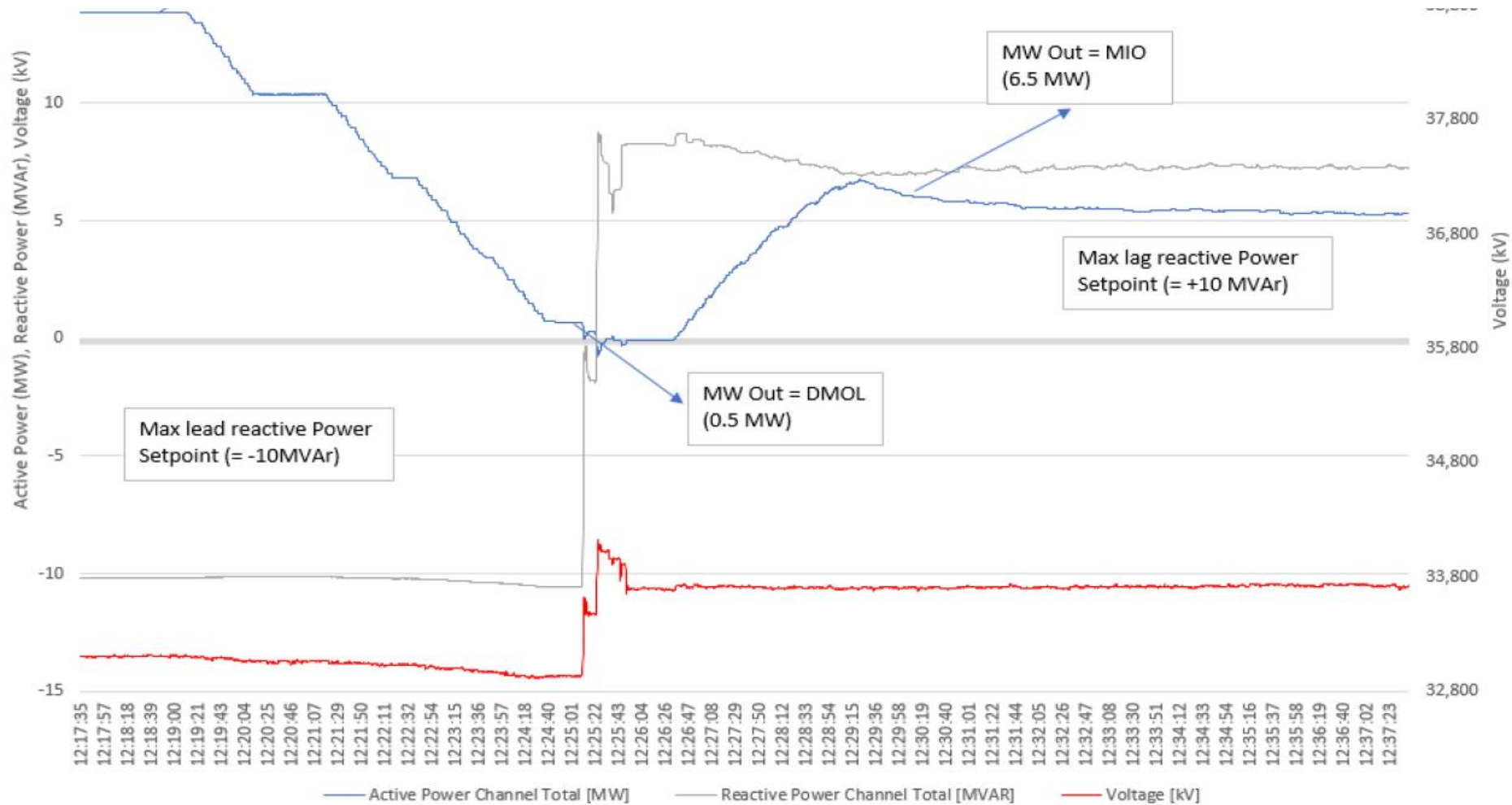
Commissioning of PV site - measured values

P-control test results

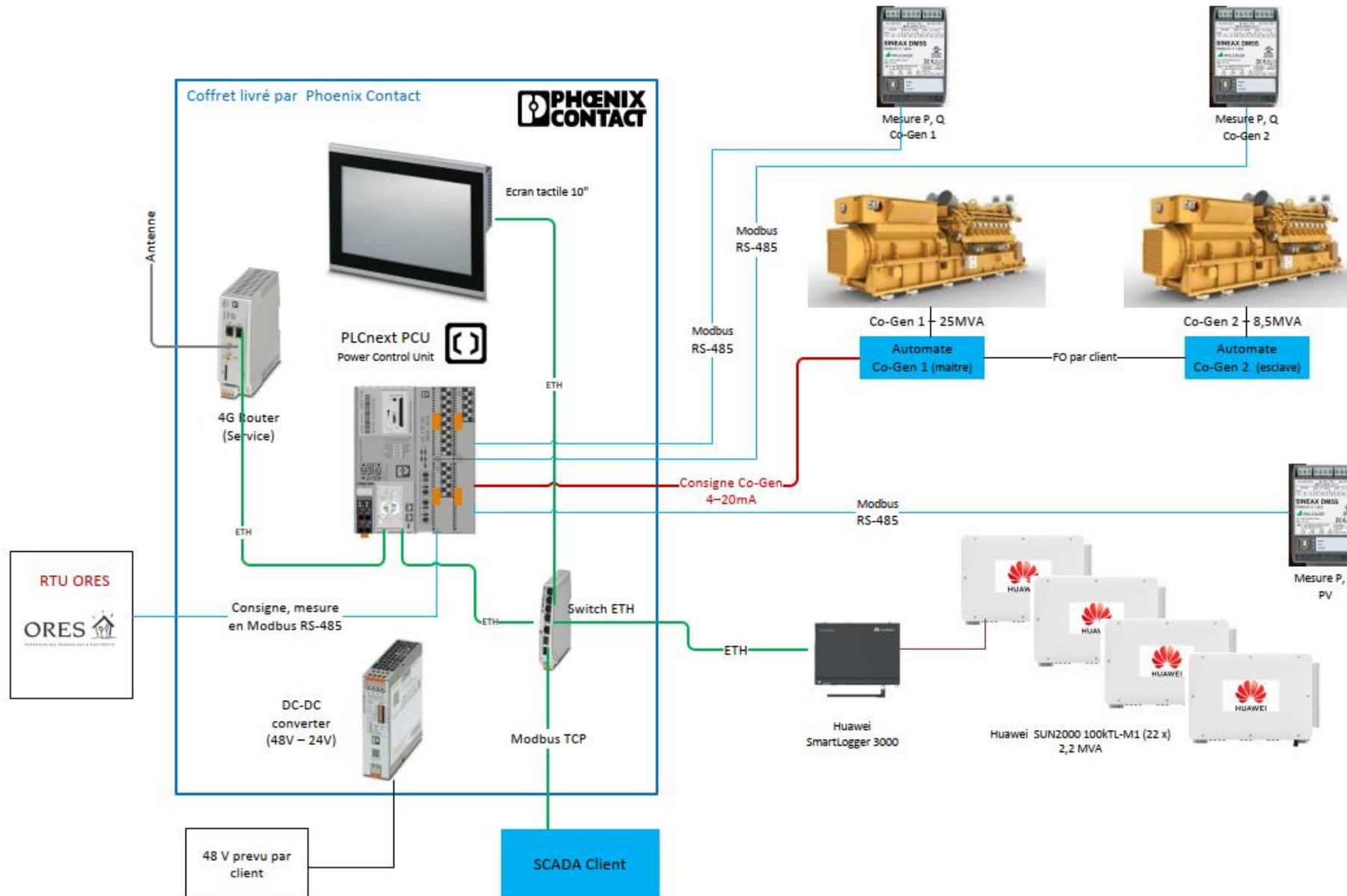


Commissioning of PV site - measured values

Q-control test results



5. Co-Gen project | Belgium | 33,5 MVA + 2.2 MVA



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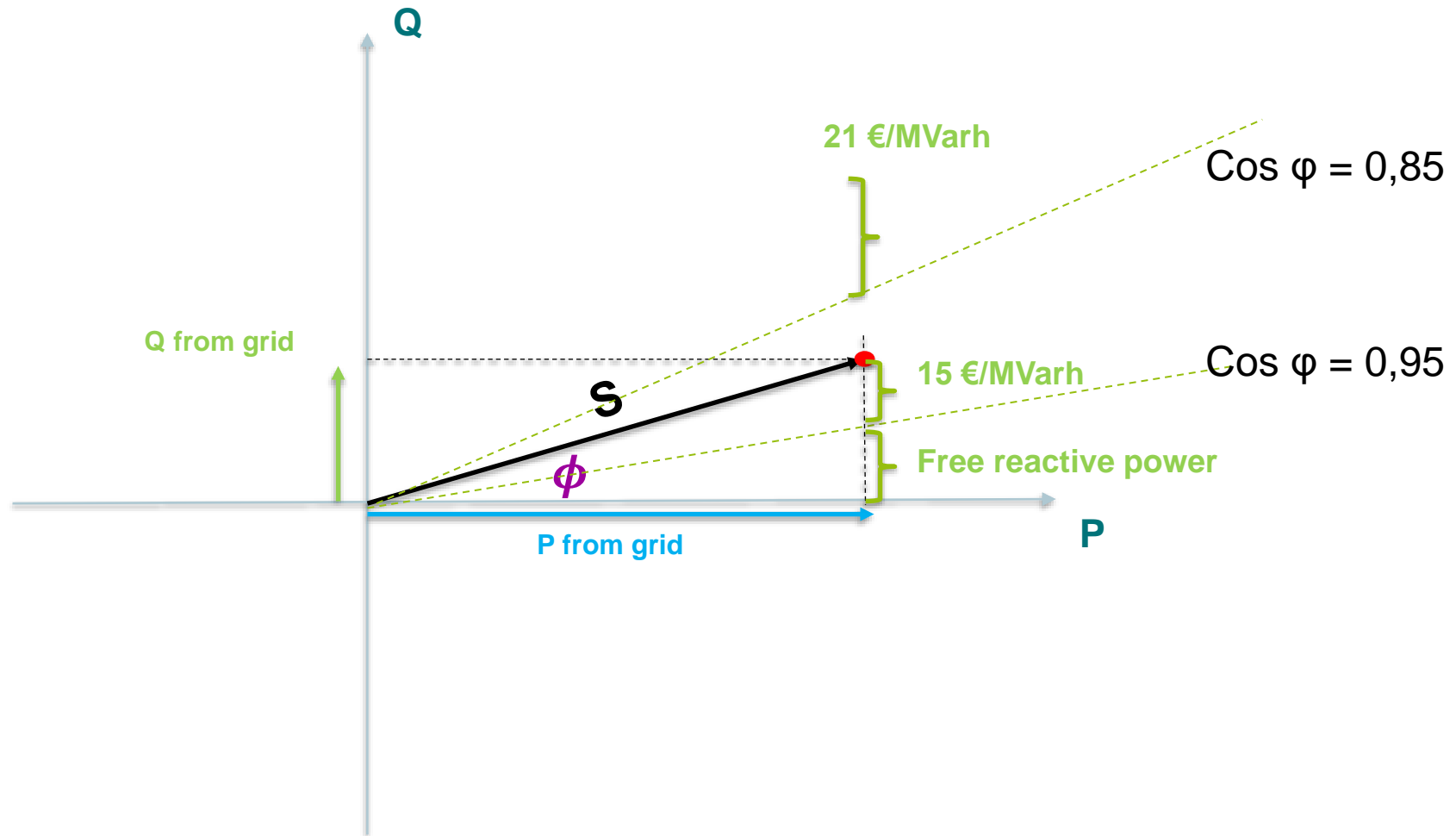
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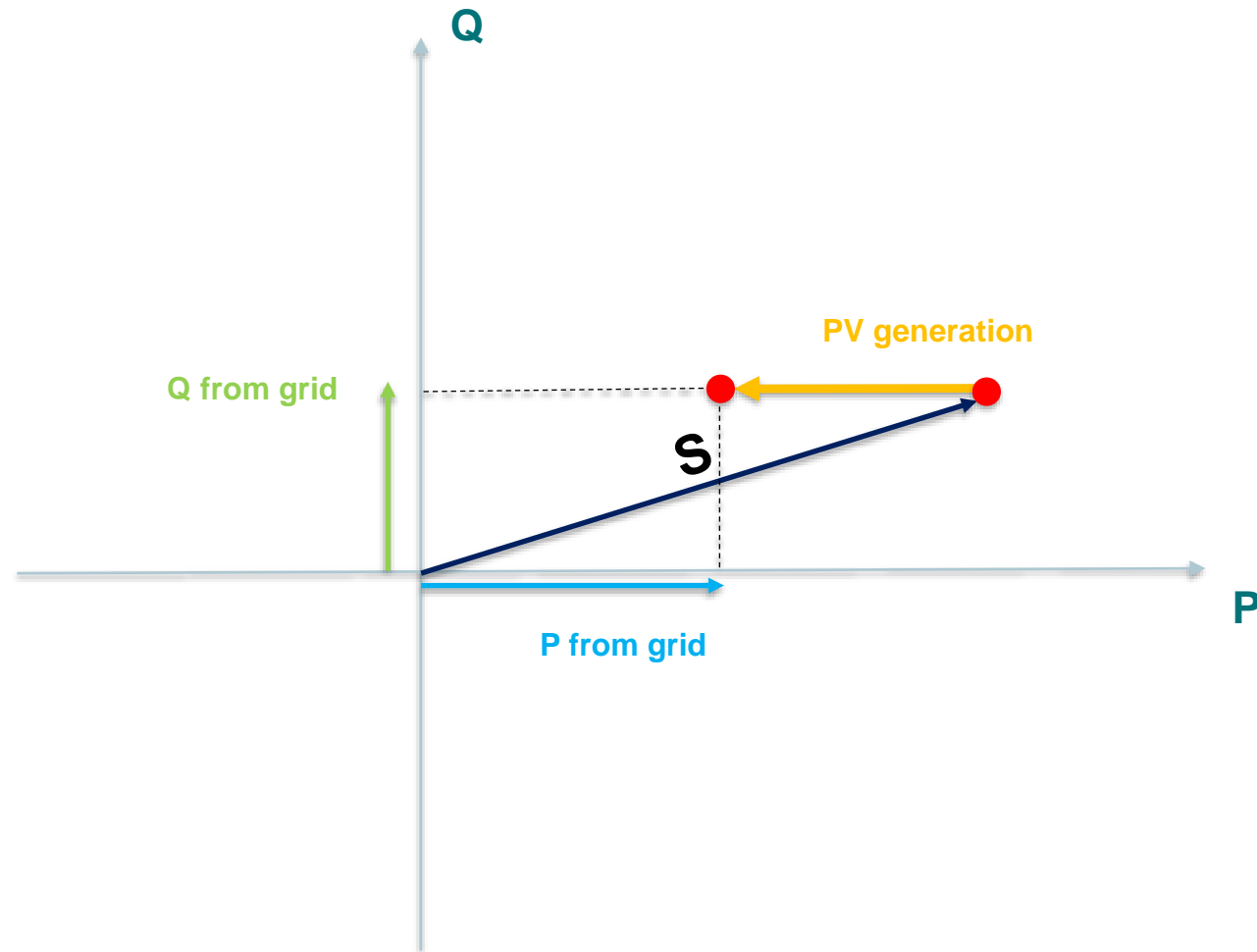
Part 2

- Practical implementation and hardware requirements
- Potential additional benefits of the PCU

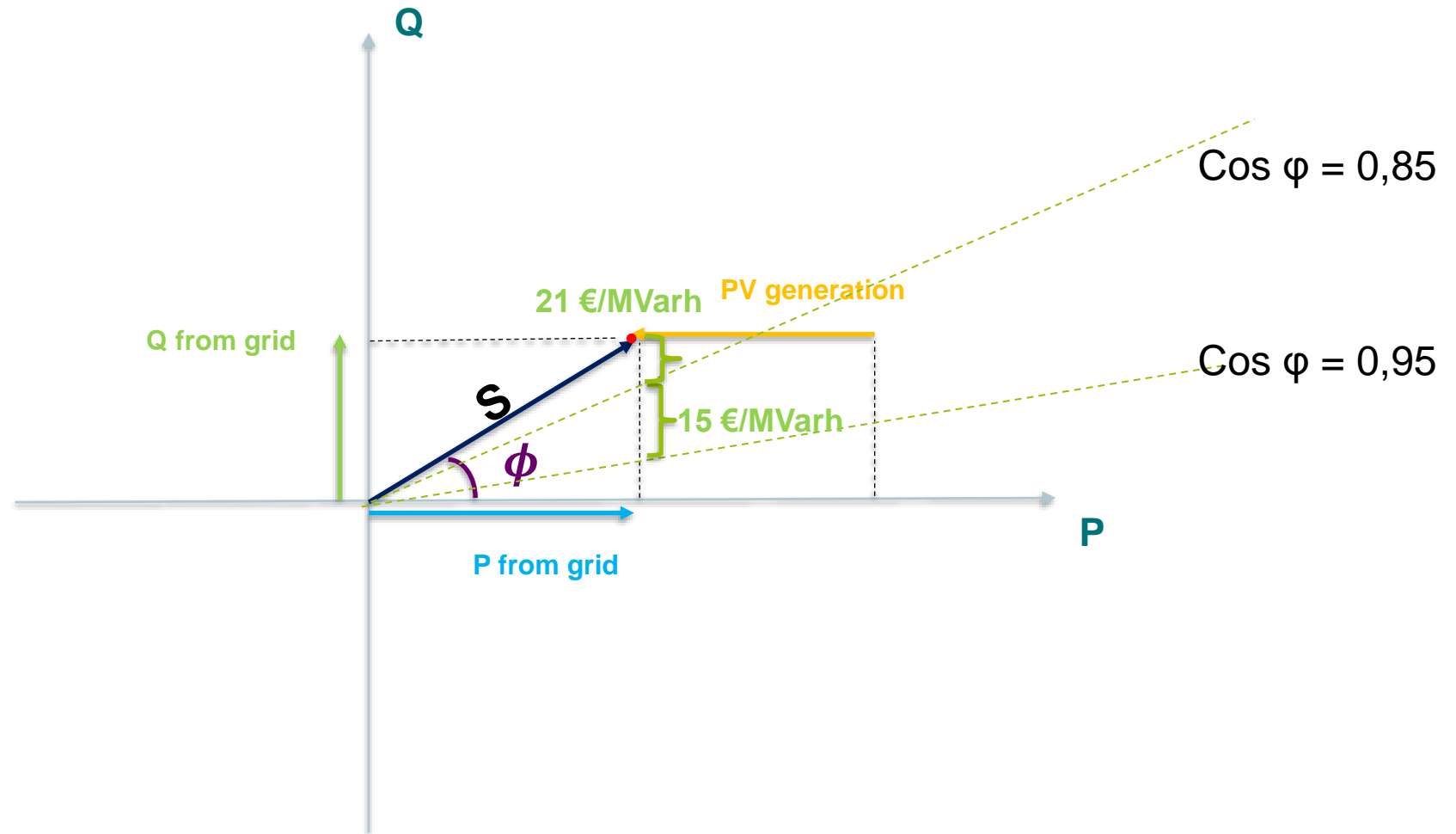
No PV



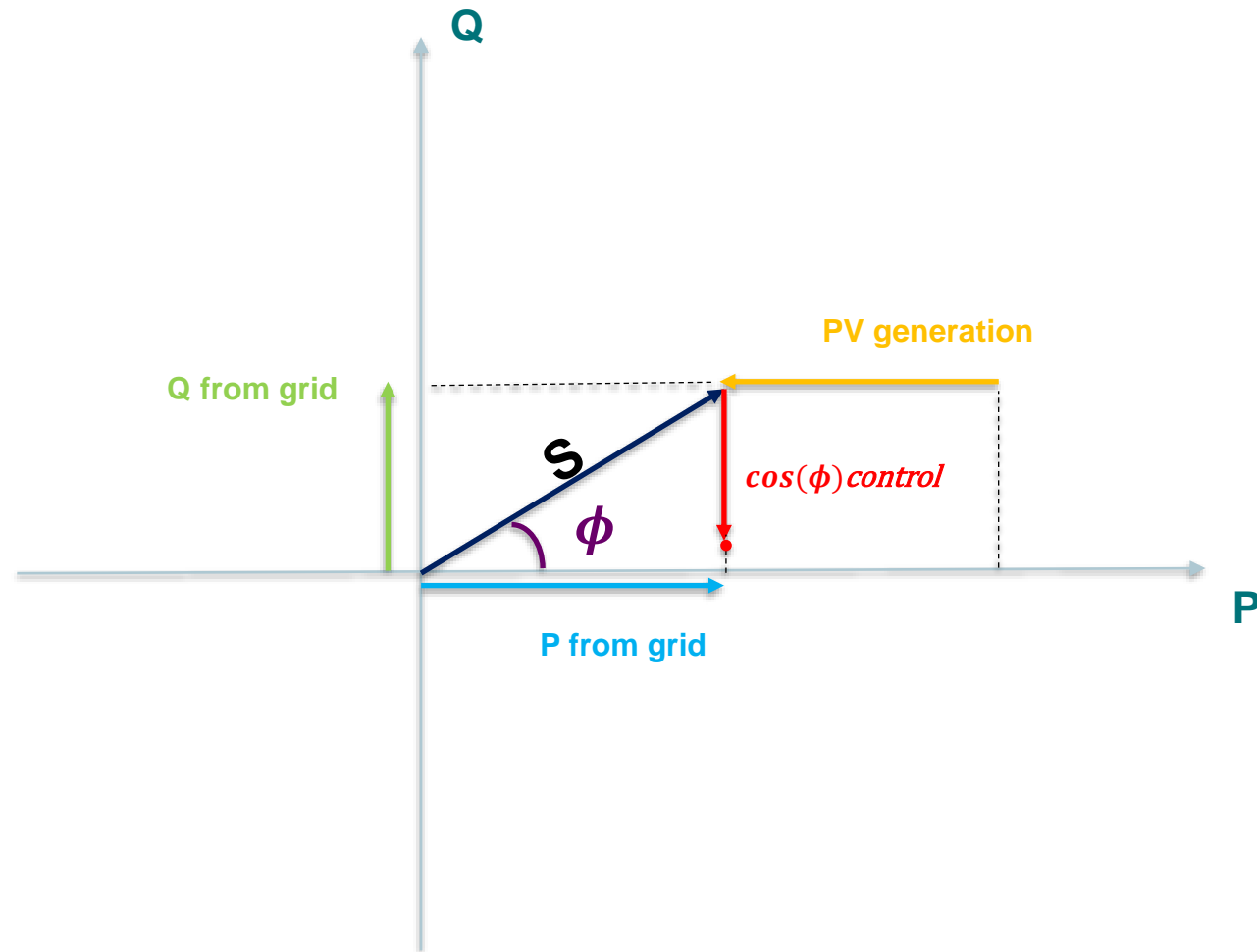
With PV



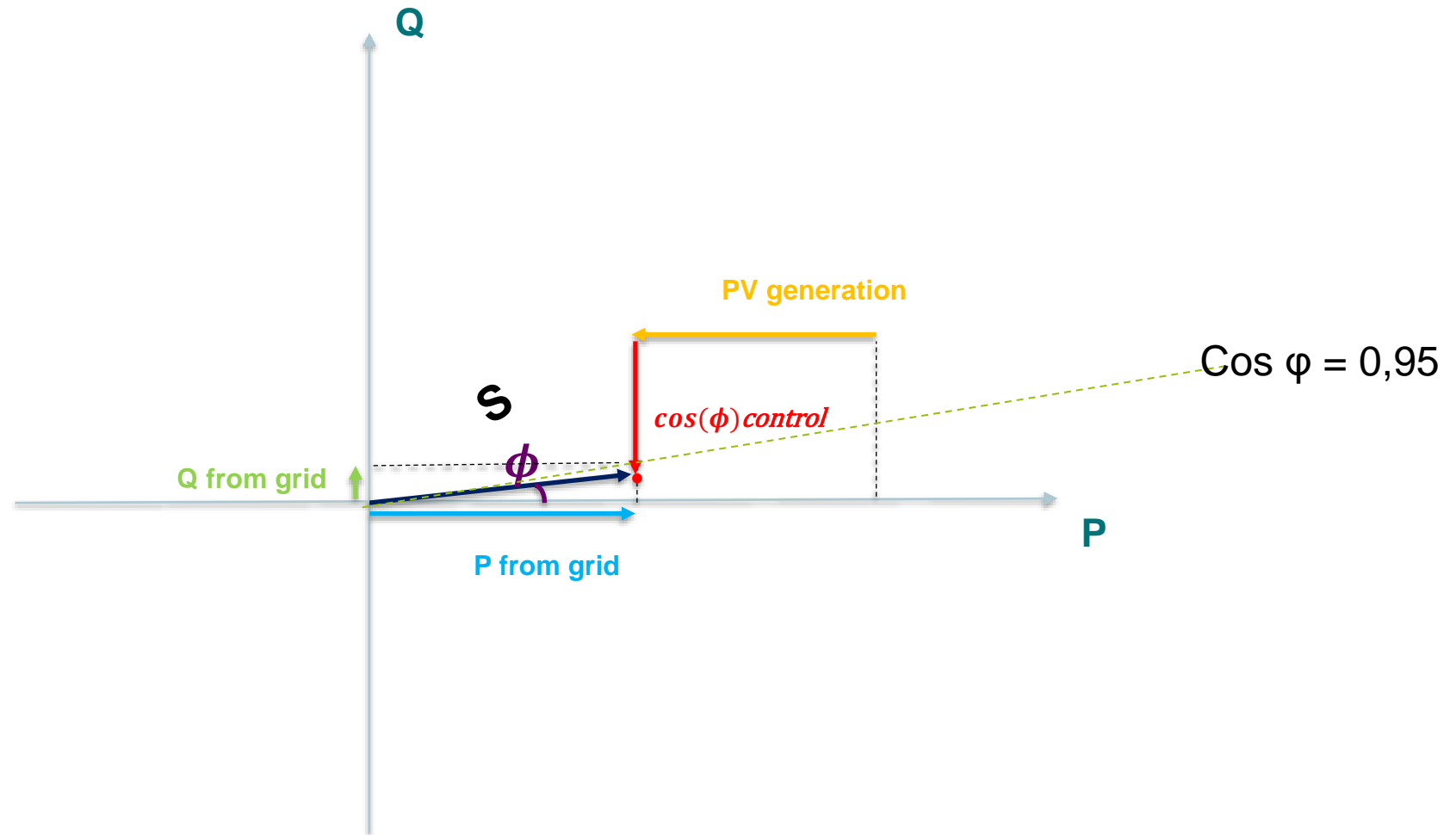
With PV



With PV and PCU



With PV and PCU



Electricity marktes

For Elia, Energy traders are BRPs.

Elia.be Elia Group EGI 50Hertz Elia Jobs

EN Jobs News Publications


elia
Elia Group

Company Investors Sustainability Safety Innovation

Electricity Market and System

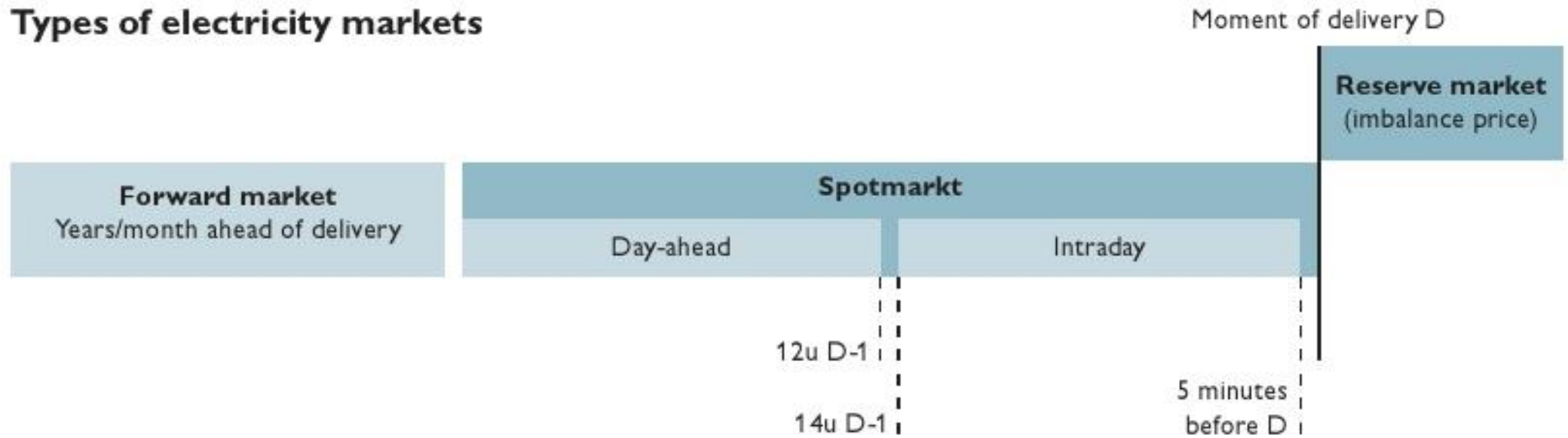
The role of the BRP

To help maintain the balance on the grid between generation and consumption, Elia has Balance Responsible Parties (BRP) at every access point.



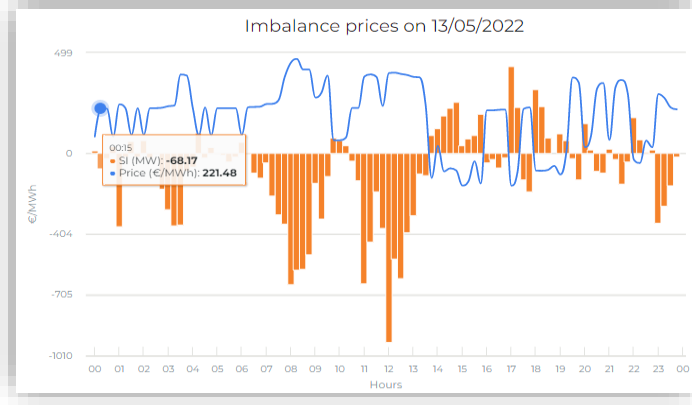
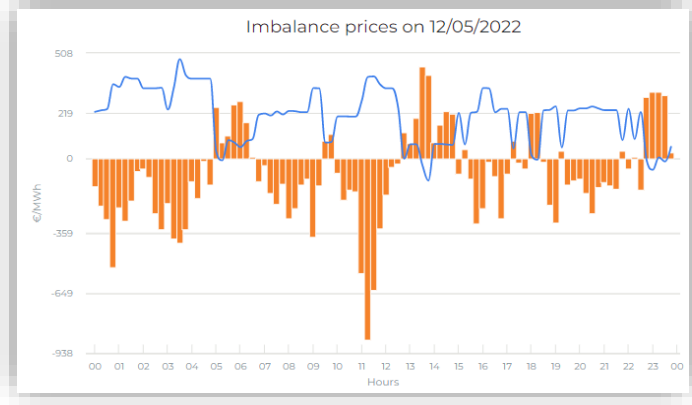
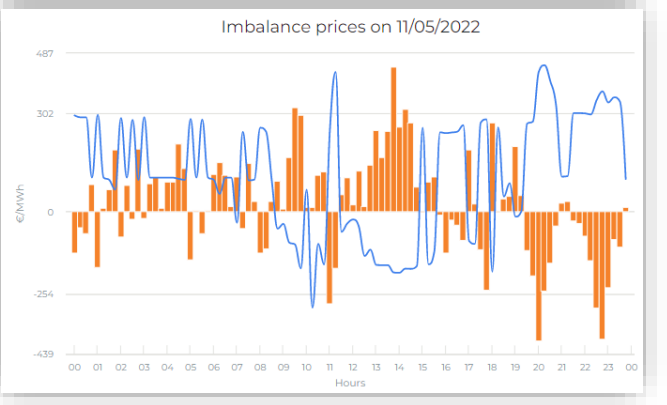
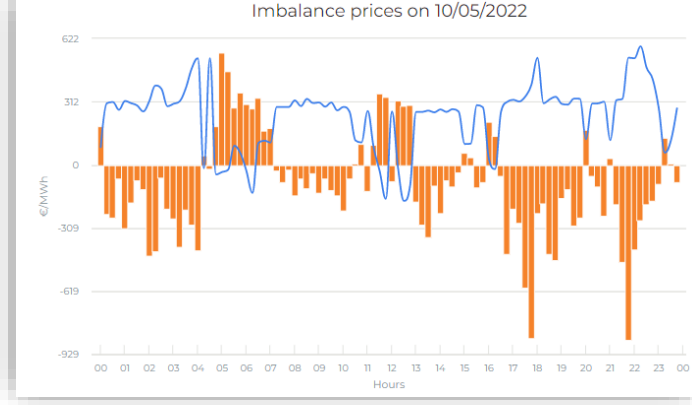
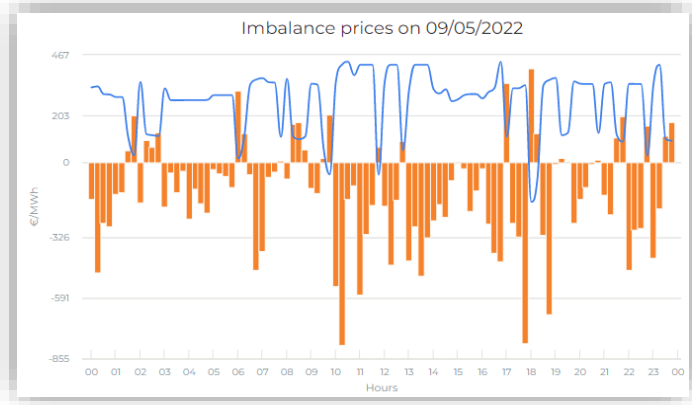
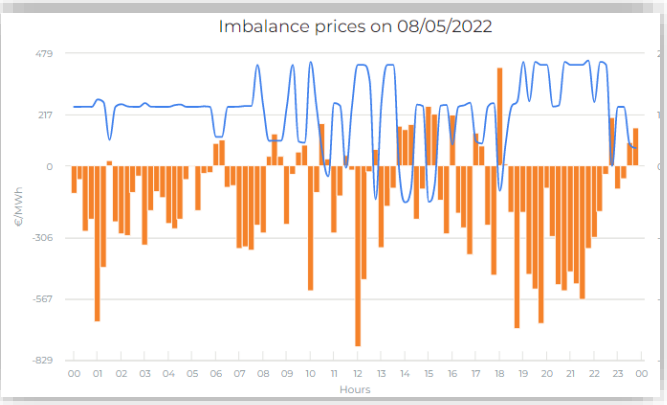
Electricity marketes

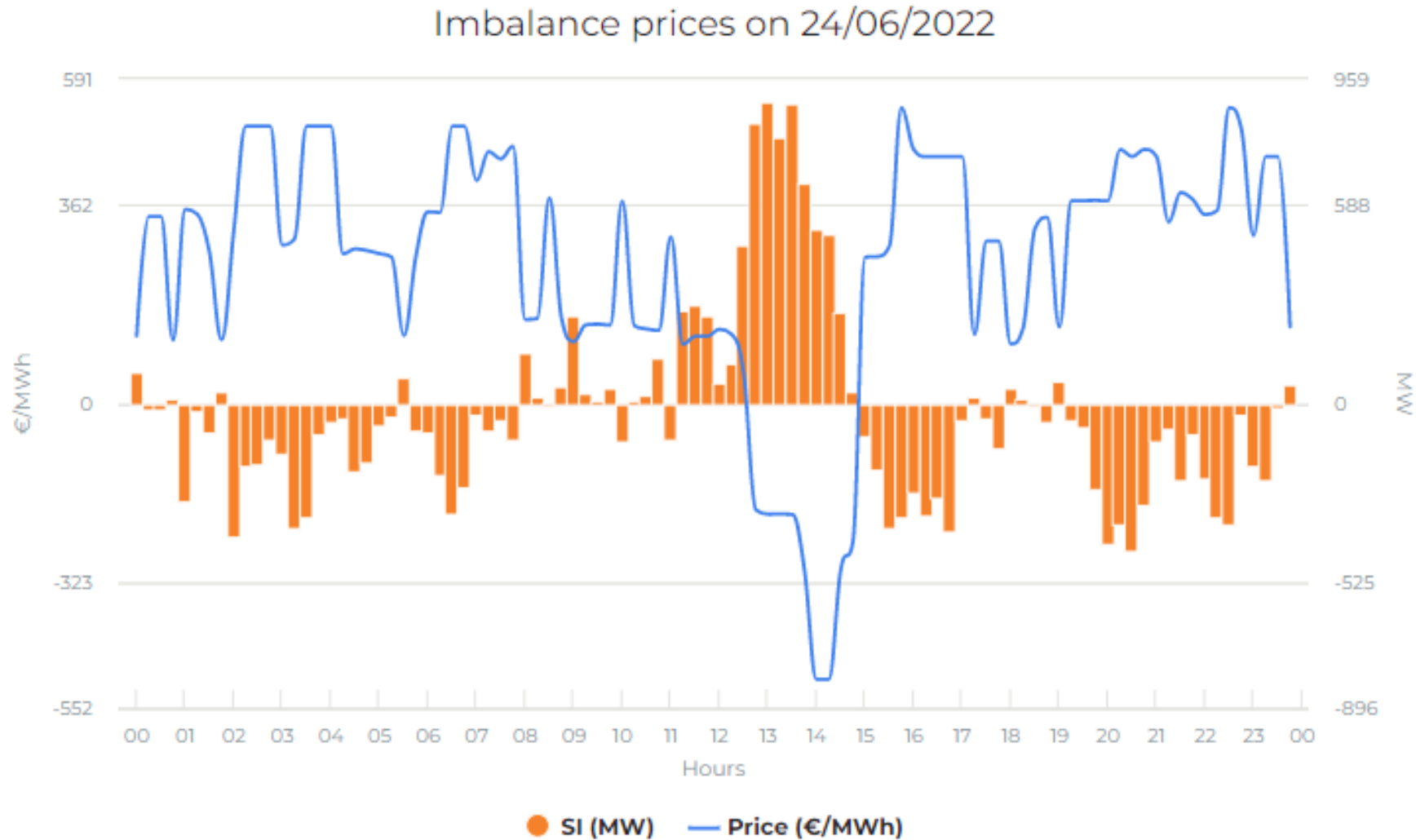
Types of electricity markets



Imbalance prices

2022: daily negative pricemoments





Contact Details

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Thank very much for
your attention!

Empowering the All Electric Society



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Q&A



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Pairing batteries with rooftop solar

by Ryan Kennedy



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Wednesday, 19 October 2022

2:00 pm – 3:00 pm EDT, New York City

8:00 pm – 9:00 pm CEST, Berlin

Thursday, 20 October 2022

4:00 pm – 5:00 pm AEST, Sydney

8:00 am – 9:00 am CEST, Berlin

Many more to come!

**How to diversify
and grow lead
generation
without
additional ad
spend**

**Tailoring
mounting
systems for
the Asia-
Pacific**

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