European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out

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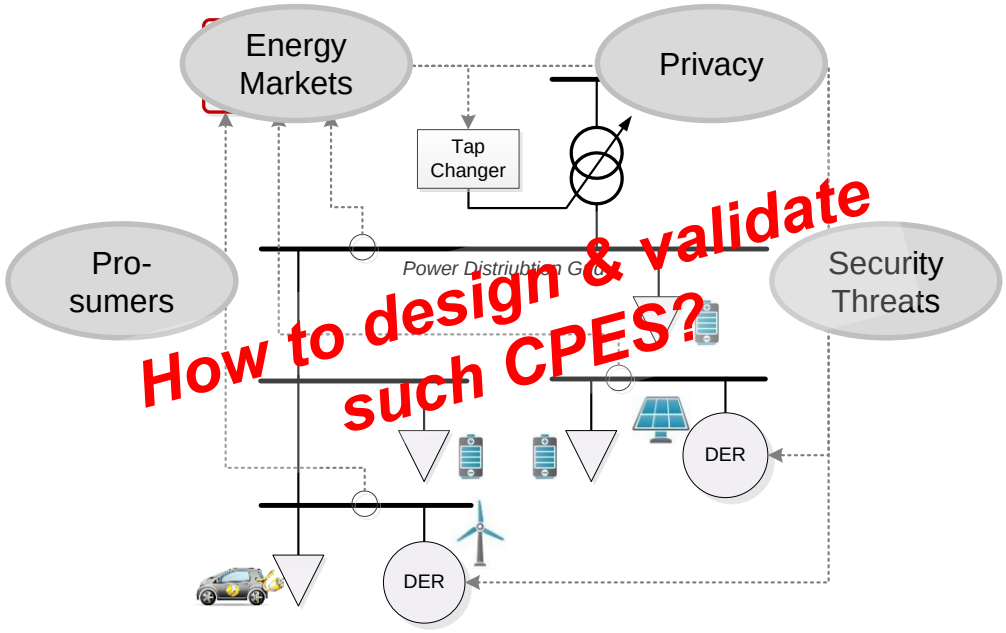
Motivation and Research Questions

- Planning and operation of the energy infrastructure becomes more complex
  - Large-scale integration of renewable sources (PV, wind, etc.)
  - Controllable loads (batteries, electric vehicles, heat pumps, etc.)
- Trends and future directions
  - Digitalisation of power grids
  - Deeper involvement of consumers and market interaction
  - Linking electricity, gas, and heat grids for higher flexibility and resilience

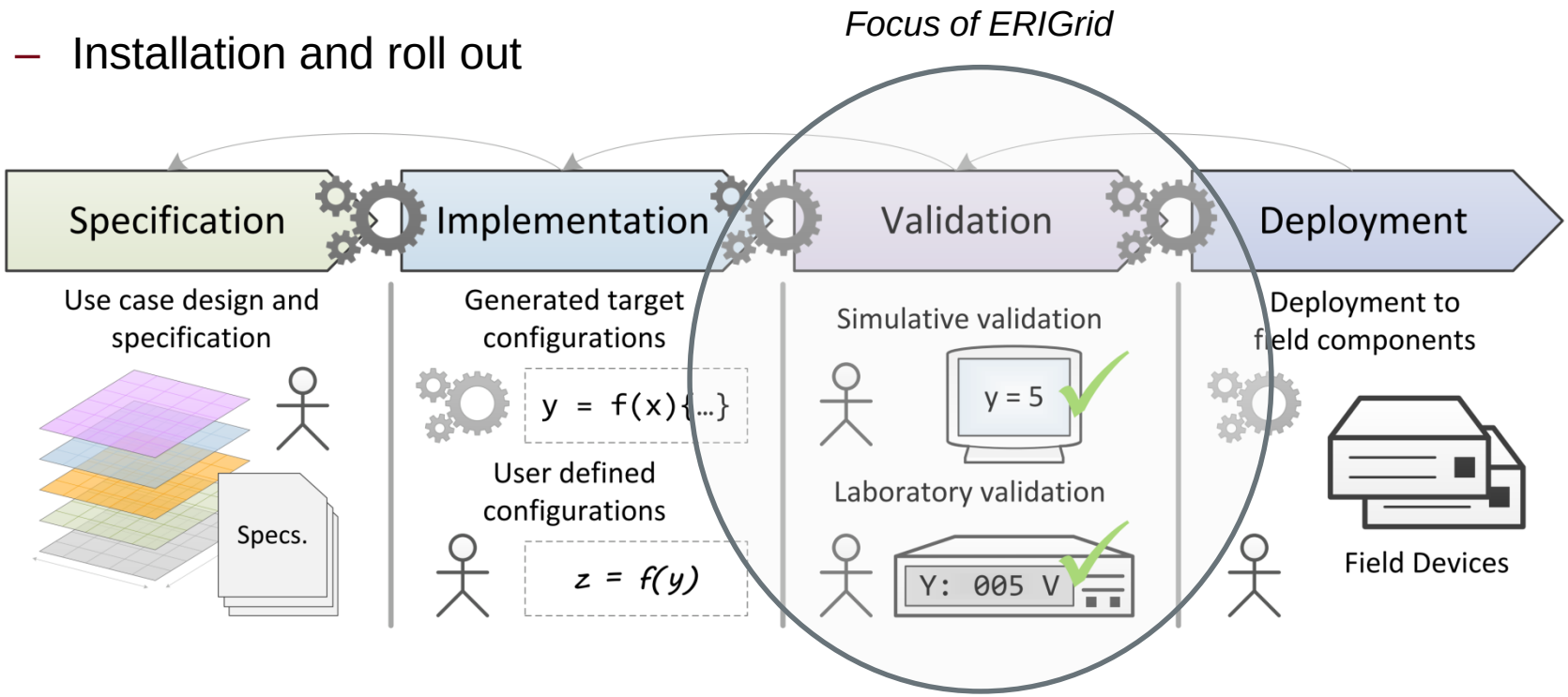


Cyber-Physical Energy System (CPES)

EU H2020 Programme GA No. 654113

Motivation and Research Questions

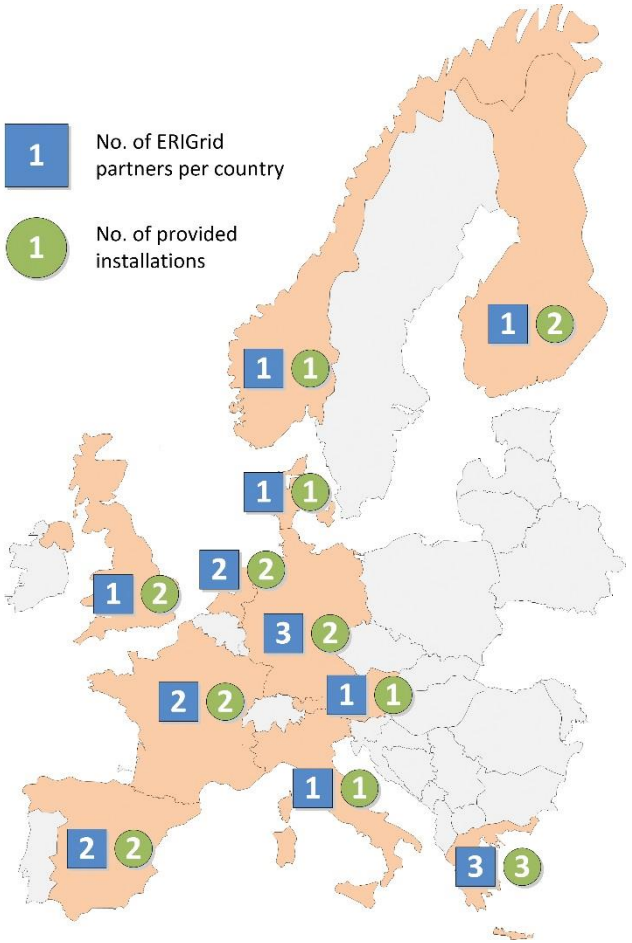
- Vision: *"Providing support from design to implementation & installation"*
  - Integrated system design
  - Validation and testing
  - Installation and roll out



EU H2020 Programme GA No. 654113

Integrated Research Infrastructure for System-Level Testing

- H2020 INFRAIA-1-2014/2015 call
  - Integrating and opening existing national and regional research infrastructures of European interest
- Funding instrument
  - Research and Innovation Actions (RIA)
  - Integrating Activity (IA)
- 18 Partners from 11 European Countries
- Provision of 19 first class smart grid labs to external users via Trans-national Access (TA)
- 10 Mio Euro Funding from the EC (~1000 Person Month)



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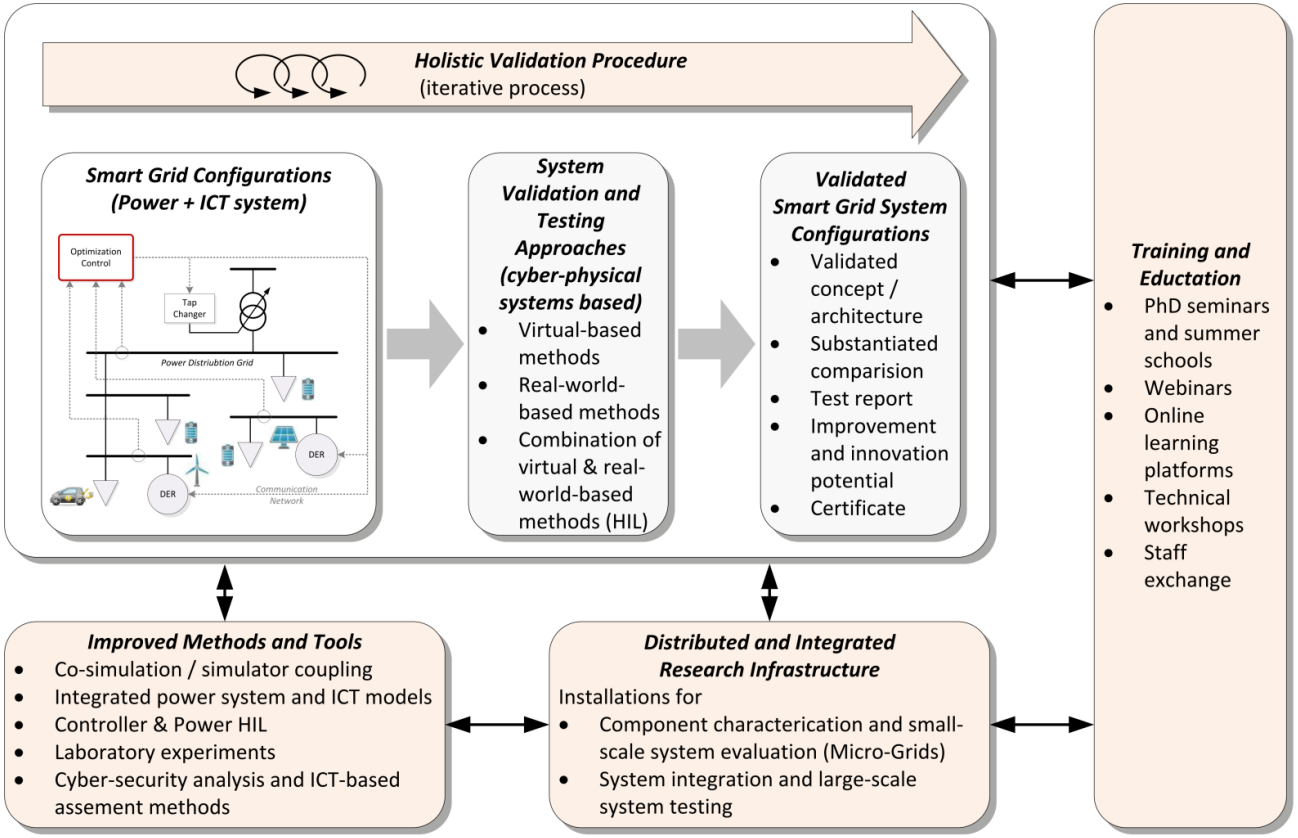
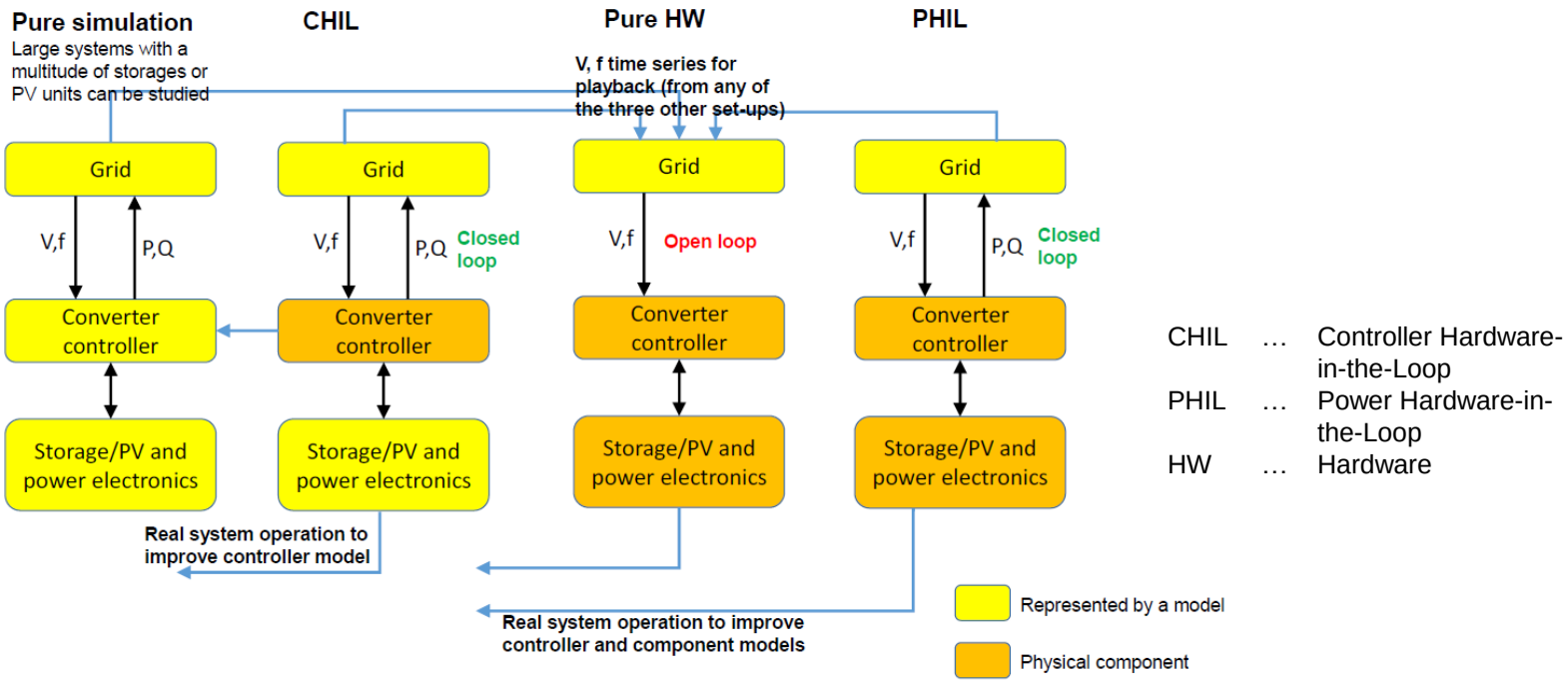
Integrated Research Infrastructure for System-Level Testing

- Overview and approach



ERIGrid Validation Approaches for Testing Smart Inverters

- Comparison and validation of different ERIGrid testing methods and tools
  - Implementation of the same test case with 4 approaches (testing chain)
  - Use case is a P-f and Q-V droop control of battery or PV inverters



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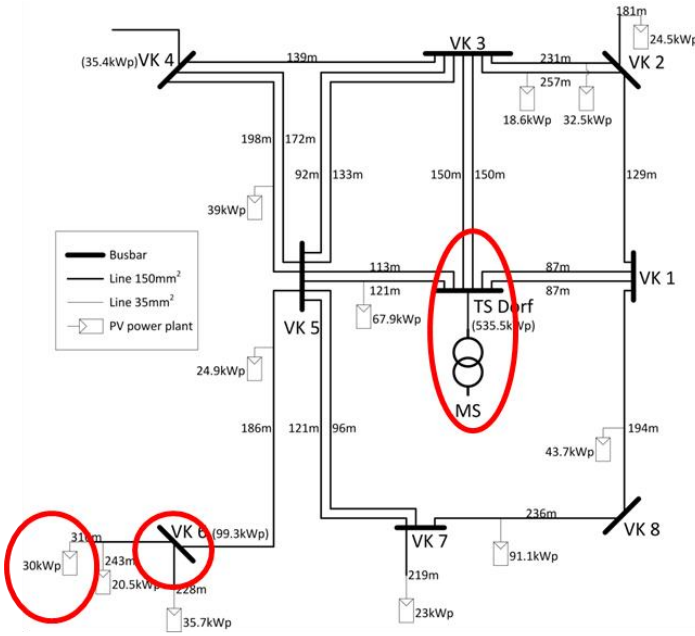
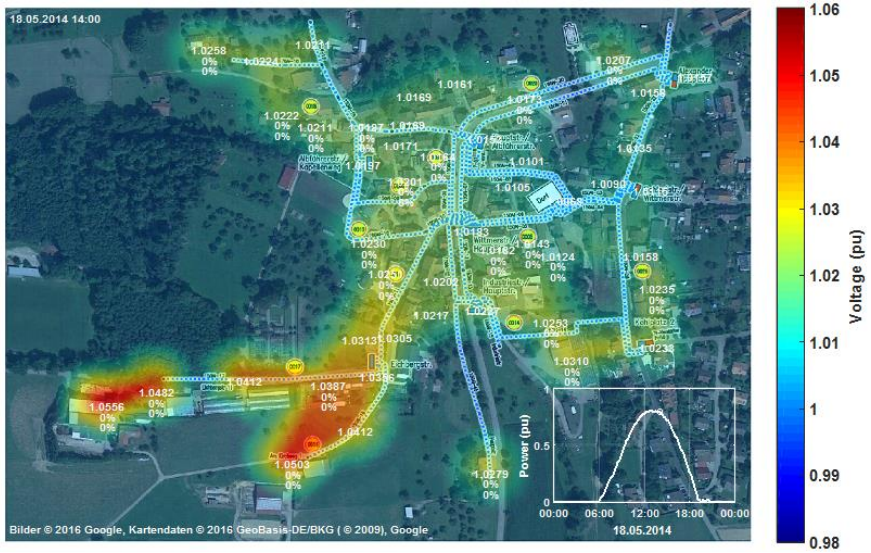
Integrated PV Inverter Testing in the TA Project “TIPI-GRID”

- Analyzing the voltage stability of PV inverters reactive power control in the lab environment by including a smart secondary substation
- Answering “Is the PV inverters Q(U) control stable all the time?”





Ref: F. Carigiet et al., «Optimisation of the Load Flow Calculation Method in order to perform Techno-Economic Assessments of Low-Voltage Distribution Grids», EUPVSEC 2017

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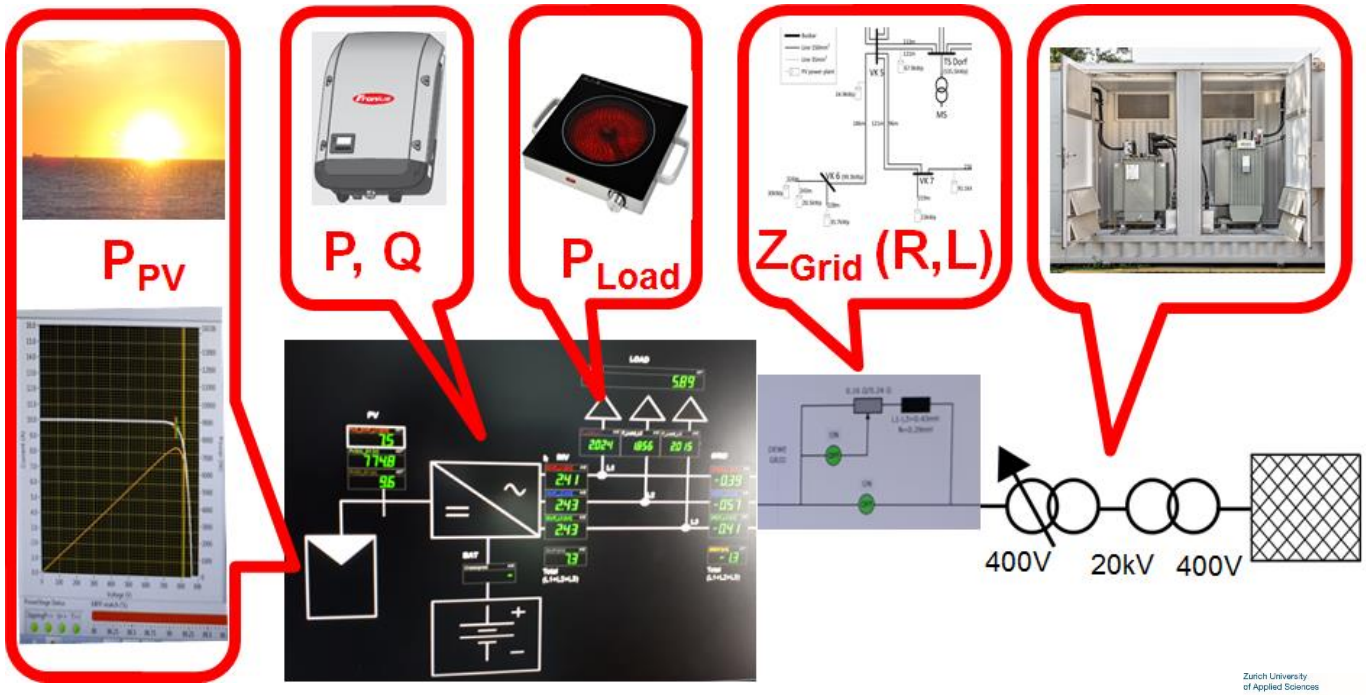
Integrated PV Inverter Testing in the TA Project “TIPI-GRID”

- AIT SmartEST laboratory test setup (incl. grid emulation)



Integrated PV Inverter Testing in the TA Project “TIPI-GRID”

- No stability issues for Time Constants (TC) between 1s and 5s observed
- Time constants well below 5s reduce over-voltage occurrence dramatically observed during transient compensation of Q(U) inverter control
- Instability in combination with active components as the Voltage Regulation Distribution Transformer (VRDT) was not observed for regular settings due to delay time and much faster TC of Q(U)
- VRDT an Q(U) stability issues could arise if the installer mixed-up the sign of the static parameter settings of the inverter during the installation process
- Paying attention at different definitions of the adjustable Q(V) time constant in different grid codes (PT1, 1Tau, 3 Tau, Ramp Rates)

Open Issues and Questions for Discussion

- To which extent is local and remote control necessary?
- How can inverter parameterization errors been detected?
- Requirements for the ICT/automation system?
- What are the needs and requirements for a suitable research infrastructure?
- What kind of testing and validation procedures are necessary (system-level)?

Free Access to European Smart Grid Labs
Apply Now!

ERIGrid calls for free transnational access:

1st call: 15 September - 15 December, 2016
2nd call: 15 March - 15 June, 2017
3rd call: 15 August - 15 November, 2017
4th call: 15 February - 15 May, 2018
5th call: 15 August - 15 November, 2018
6th call: 15 February - 15 May, 2019

erigrid.eu/transnational-access

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