

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

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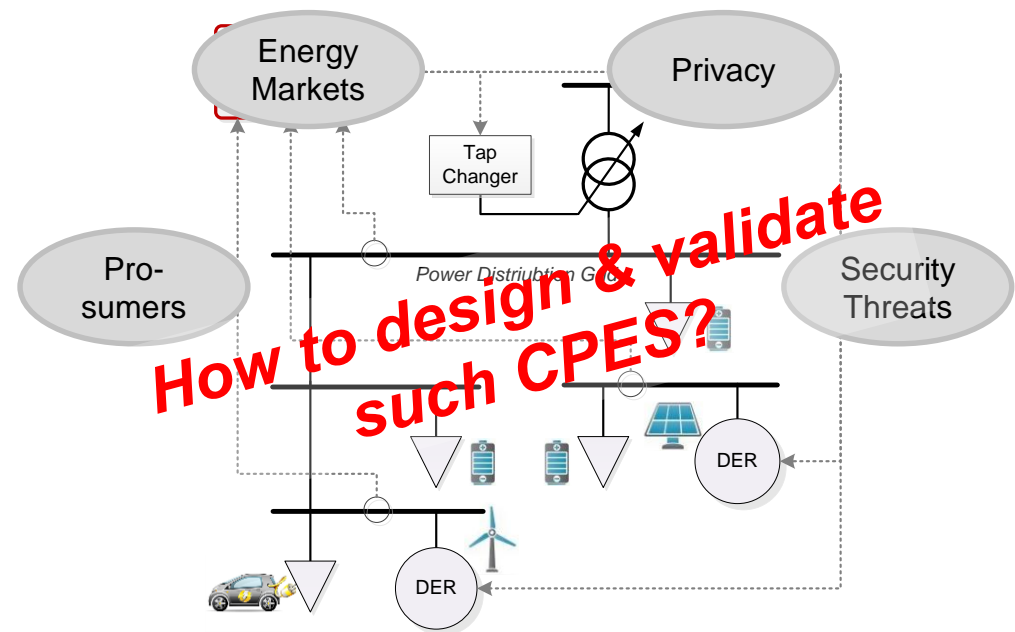
**IRED 2018**

International Conference on Integration of  
Renewable and Distributed Energy Resources



# Motivation and Research Questions

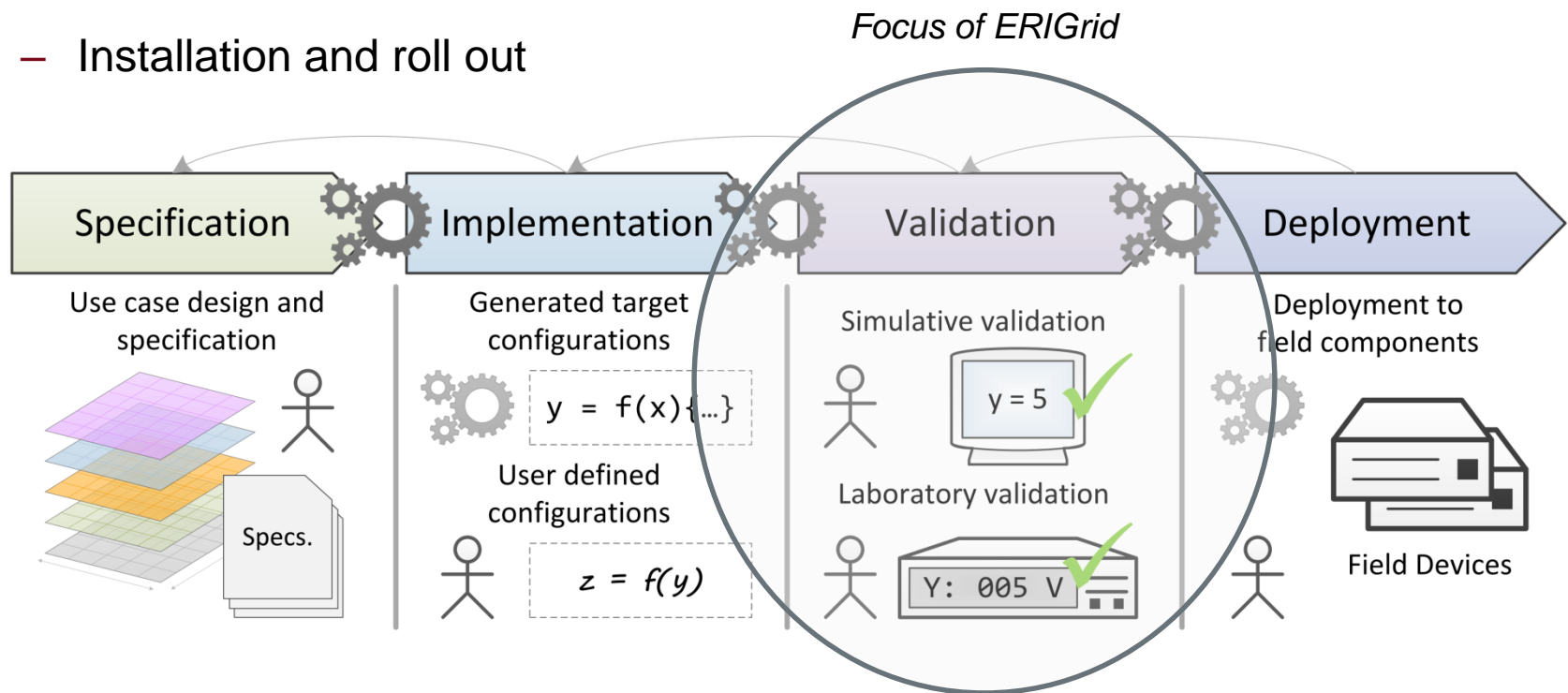
- Planning and operation of the energy infrastructure becomes more complex
  - Large-scale integration of renewable sources (PV, wind, etc.)
  - Controllable loads (batteries, electric vehicles, heat pumps, etc.)
- Trends and future directions
  - Digitalisation of power grids
  - Deeper involvement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



*Cyber-Physical Energy System (CPES)*

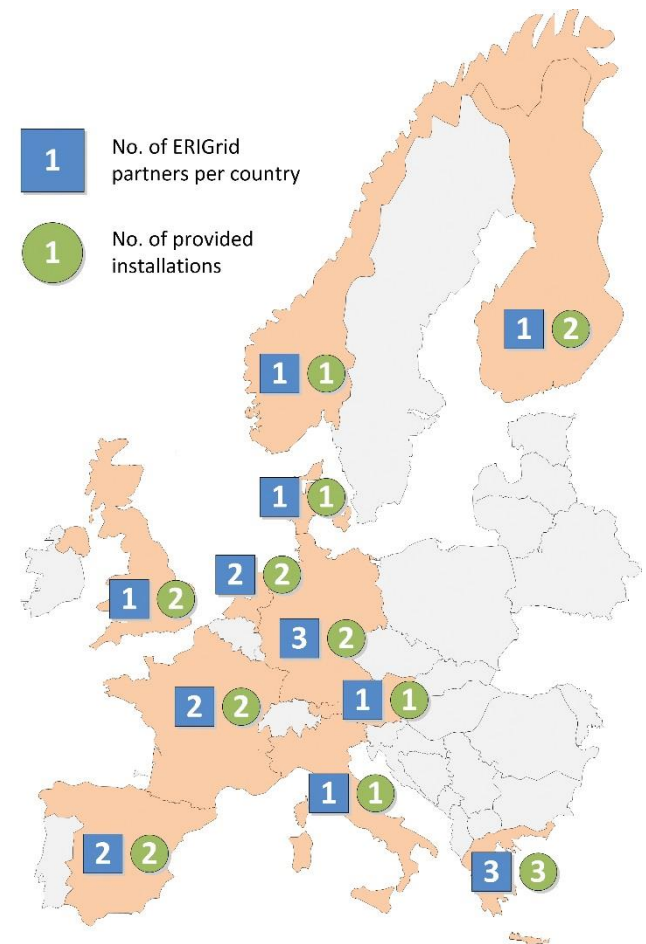
# Motivation and Research Questions

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



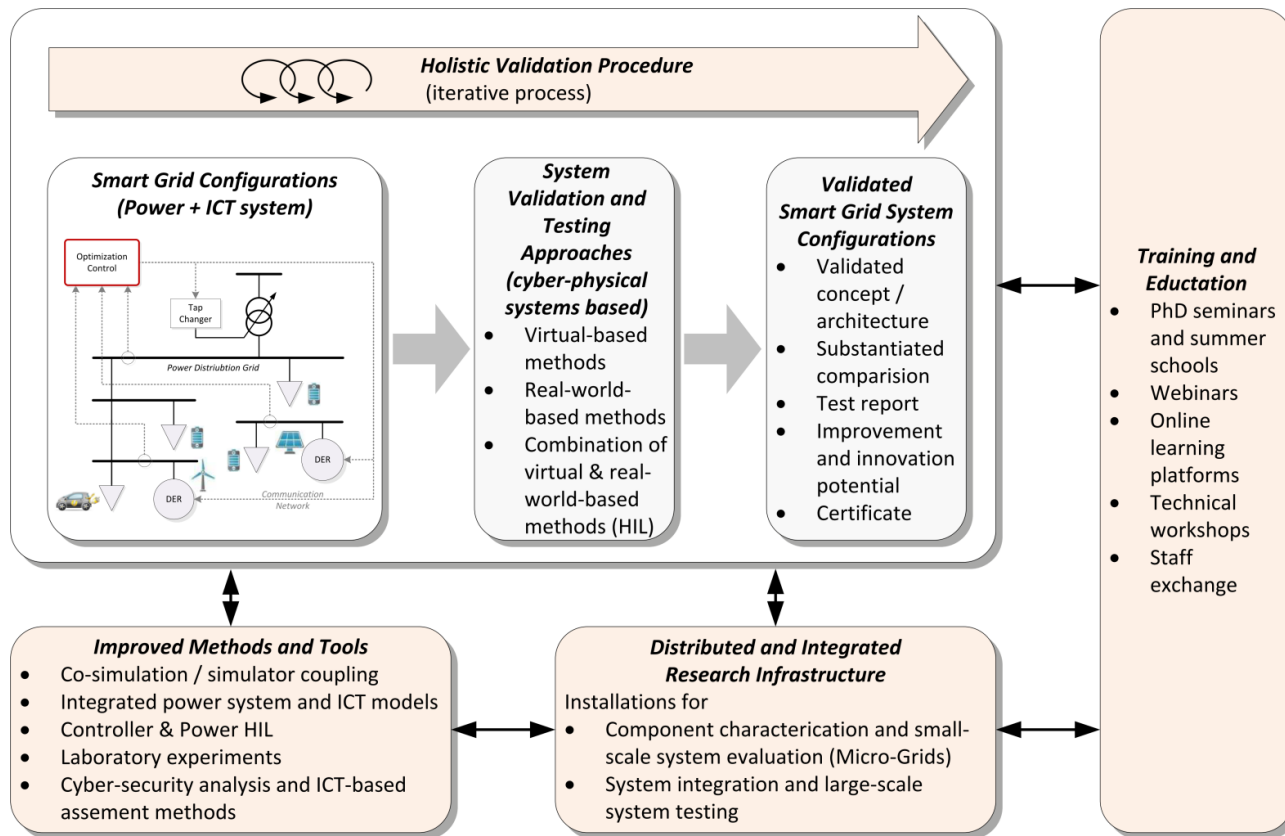
# Integrated Research Infrastructure for System-Level Testing

- 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)



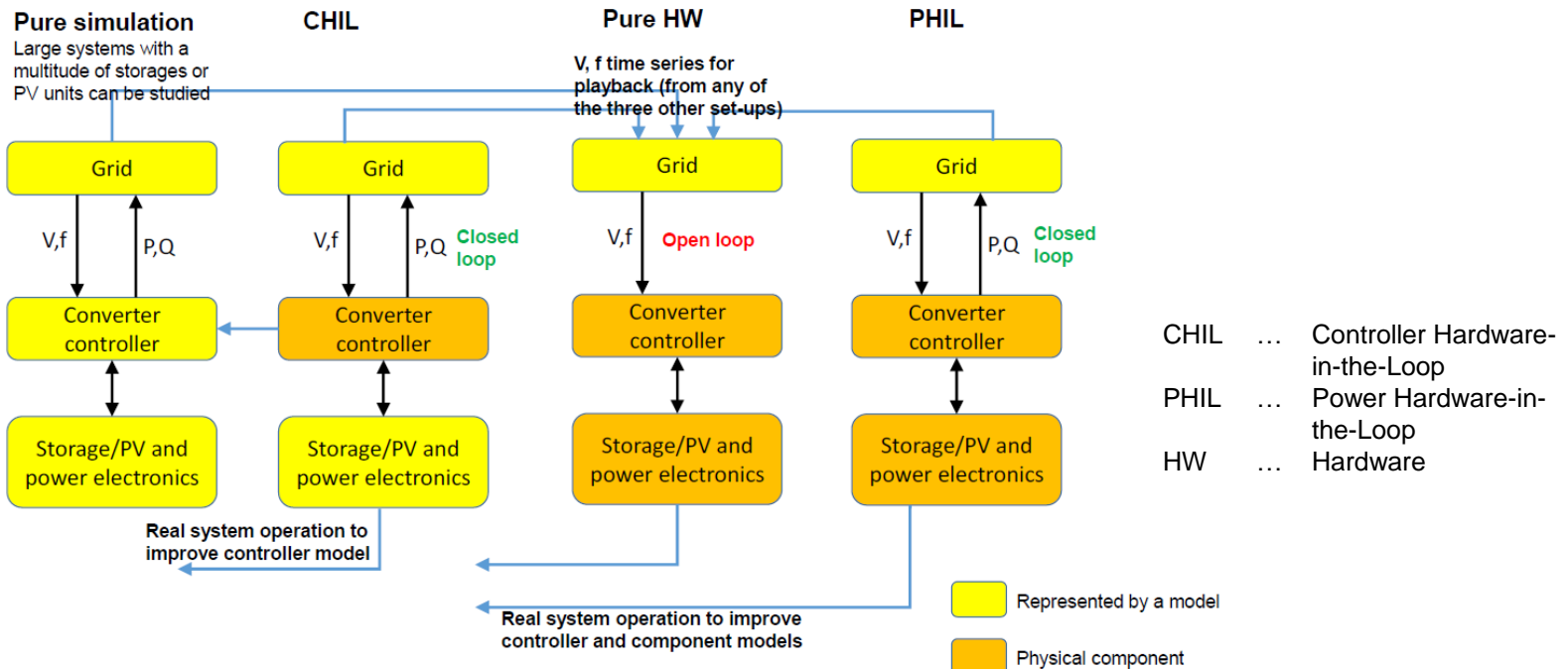
# Integrated Research Infrastructure for System-Level Testing

- Overview and approach



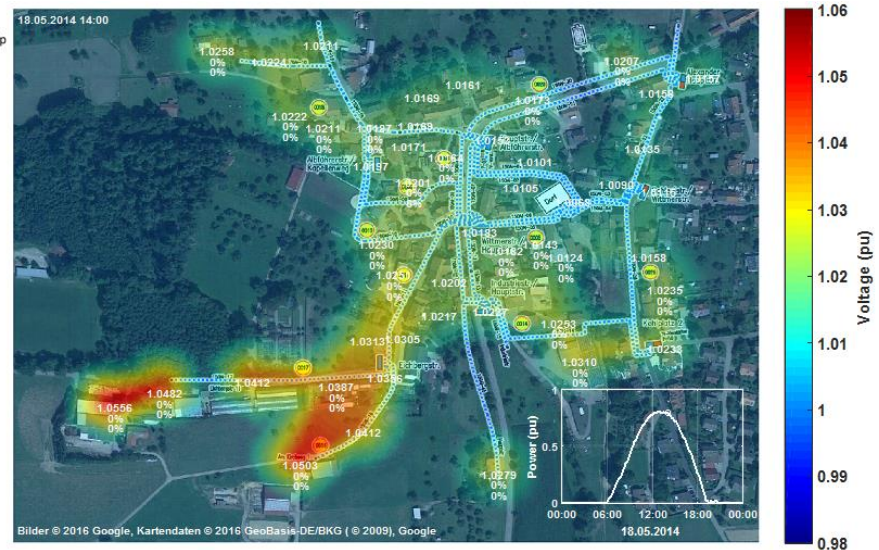
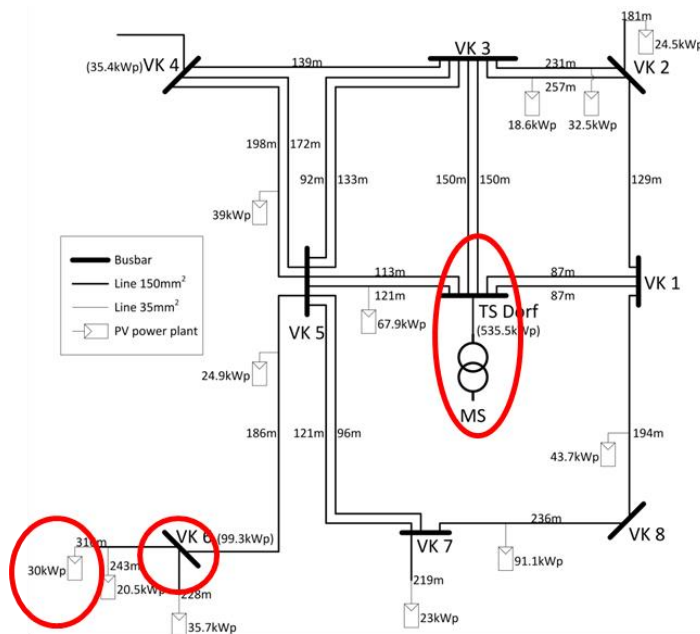
# ERIGrid Validation Approaches for Testing Smart Inverters

- 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



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

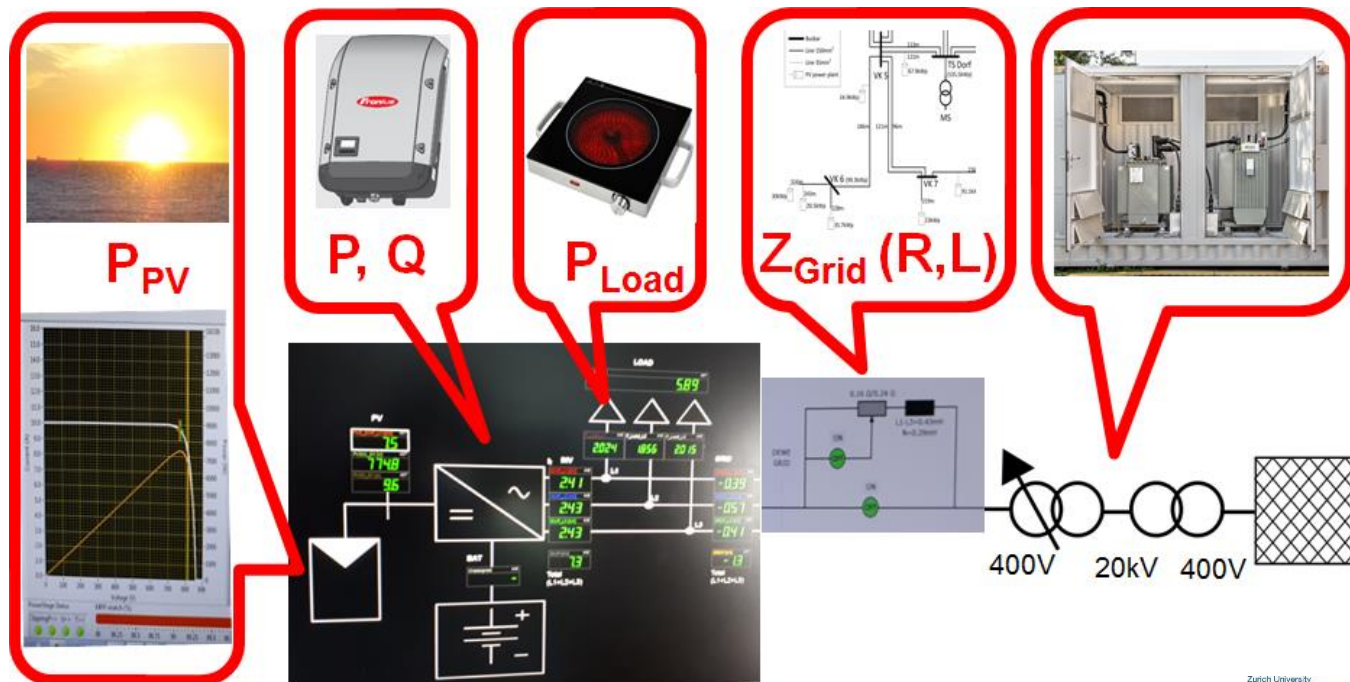
- Analyzing the voltage stability of PV inverters reactive power control in the lab environment by including a smart secondary substation
- Answering “Is the PV inverters Q(U) control stable all the time?”



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

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

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



Zurich University  
of Applied Sciences



# 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 be 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)?



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With the aim to support the development of smart grid solutions in Europe, the ERIGrid project opens its first call for transnational access. The project partners offer their infrastructure and support to the successful applicants for experimental research free of charge.

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**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**



[erigrd.eu/transnational-access](http://erigrd.eu/transnational-access)



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