

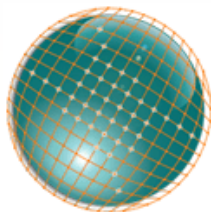
# Active Distribution Network (ADINE) Project Results

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4<sup>th</sup> International Conference on  
**Integration of  
Renewable and Distributed  
Energy Resources**  
December 6-10, 2010  
Albuquerque, NM, USA

## Conference Sponsors



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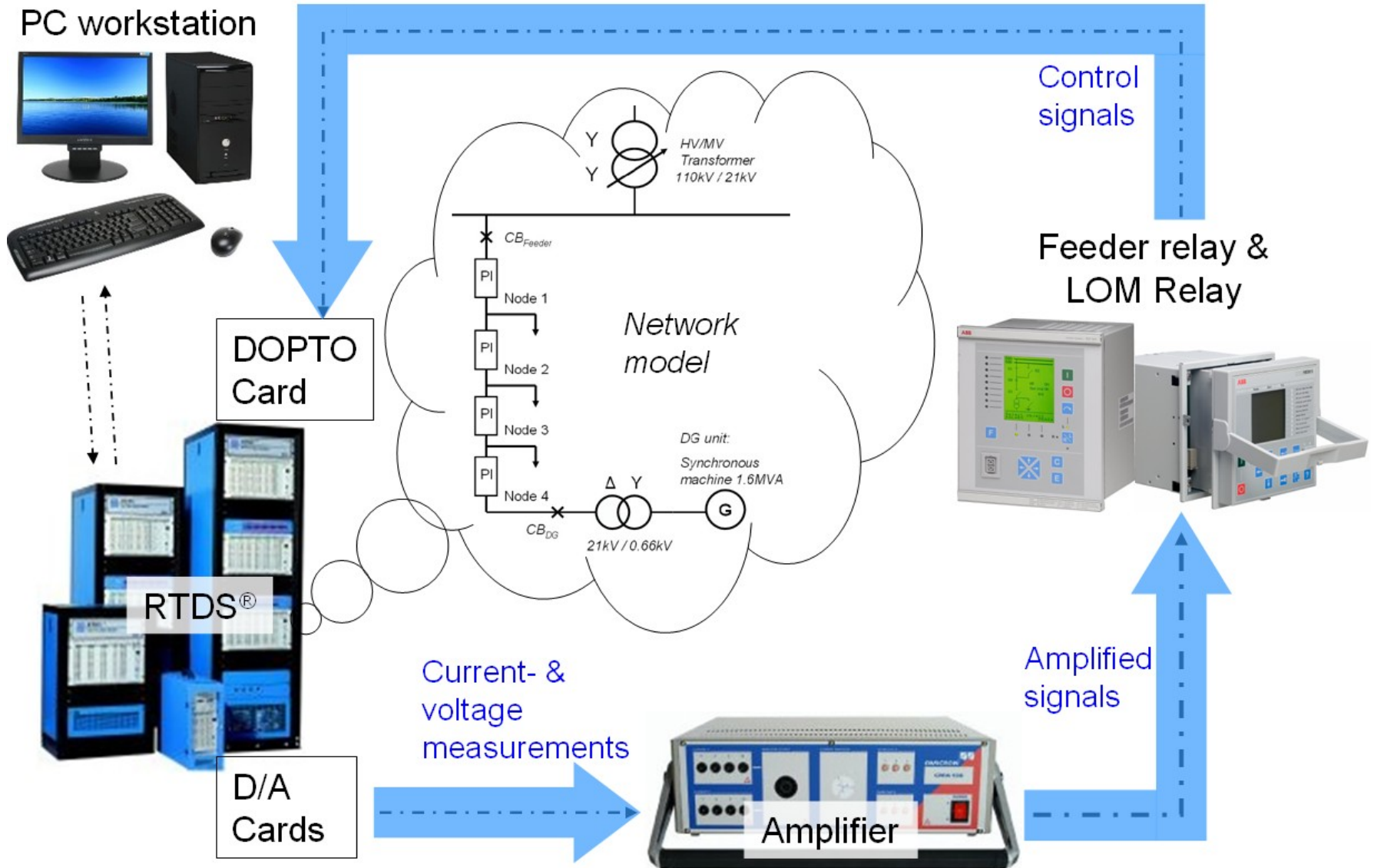


# ADINE project

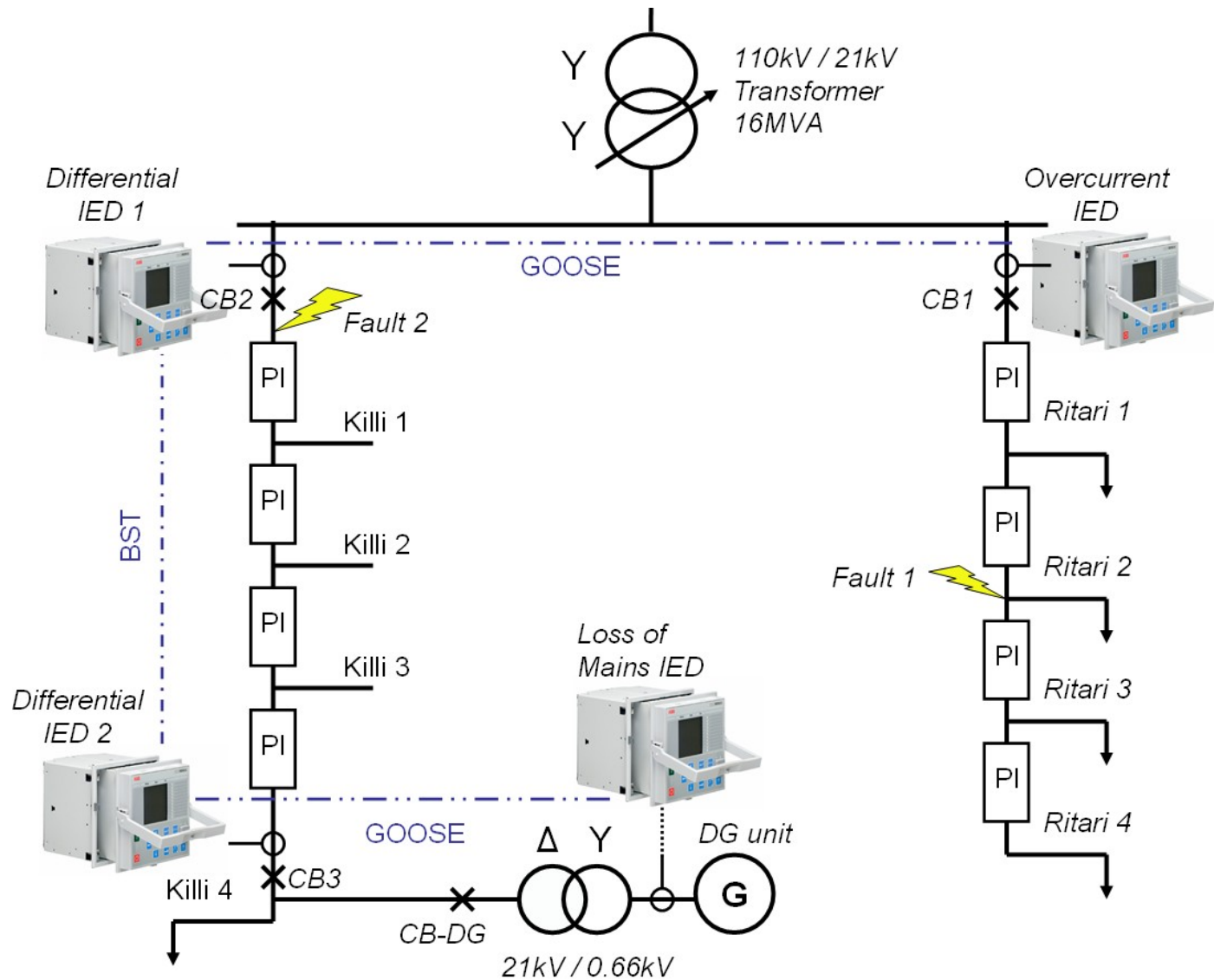
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- 3 years, 3.2 M€
- EU FP6, Specific targeted research project, STREP
- Active Network Management of distribution network including DG and other active devices
- Developed technical solutions
  - Protection relay and fault location applications (ABB, TUT)
  - Software prototype of co-ordinated protection planning (ABB, TUT)
  - Voltage control of small-scale microturbine (Compower, LU)
  - Centralized voltage control on SCADA/DMS (ABB, TUT)
  - New-generation medium voltage STATCOM (Areva T&D)

# Hardware in loop testing

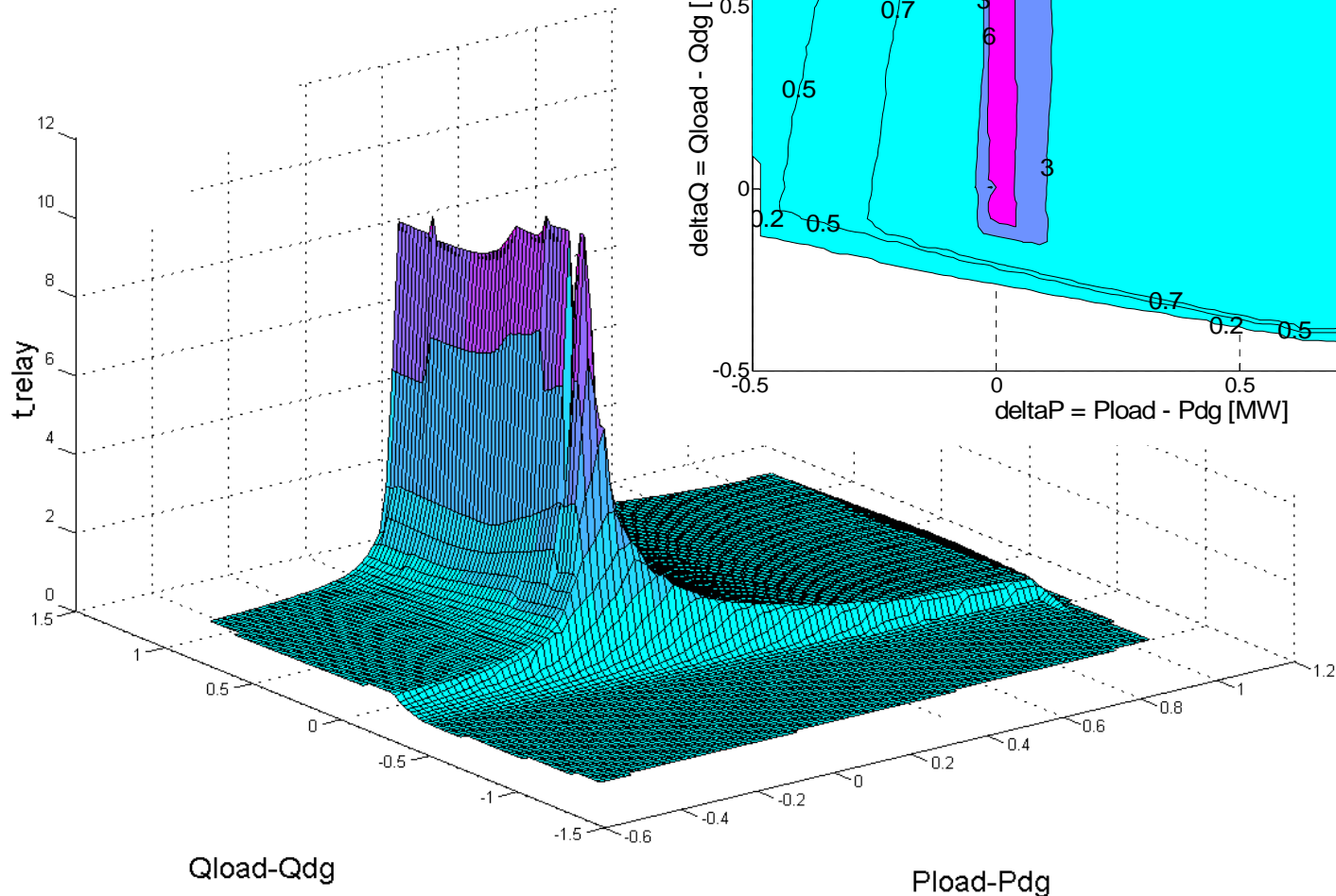


# Communication based Loss-of-Mains protection



# Non-detection zone of Loss-of-Mains

Frequency and voltage functions

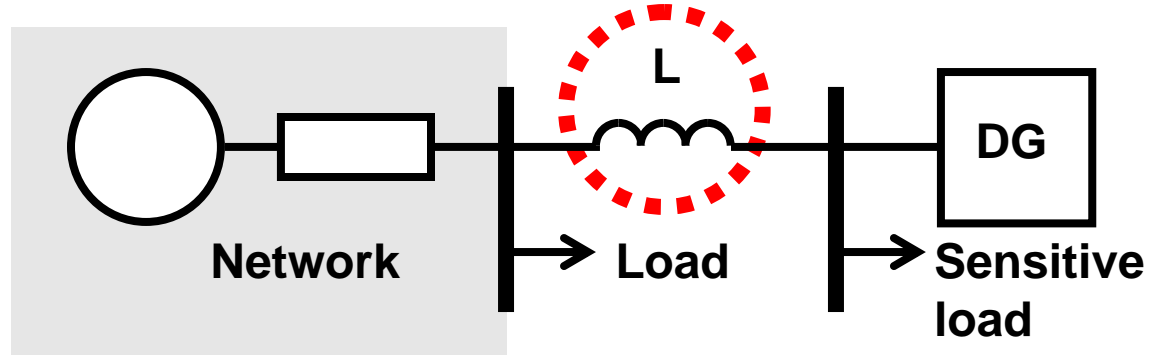


# Voltage control at low voltage network

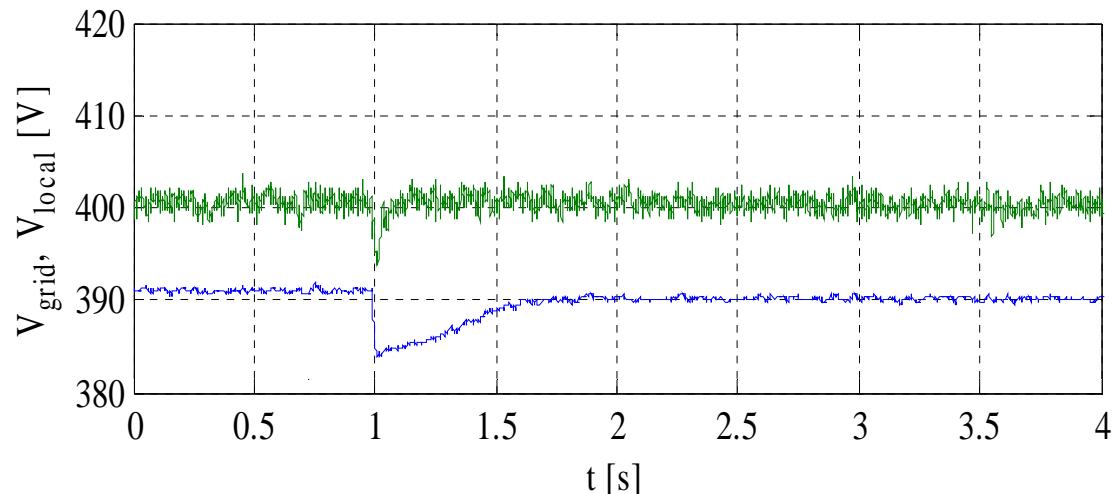


- Biogas-fired gasturbine with high-speed generator
- Preliminary ratings 15 kW heat + 5 kW electricity
- Single-phase power electronic converter
- Installed in Kristianstad, Sweden

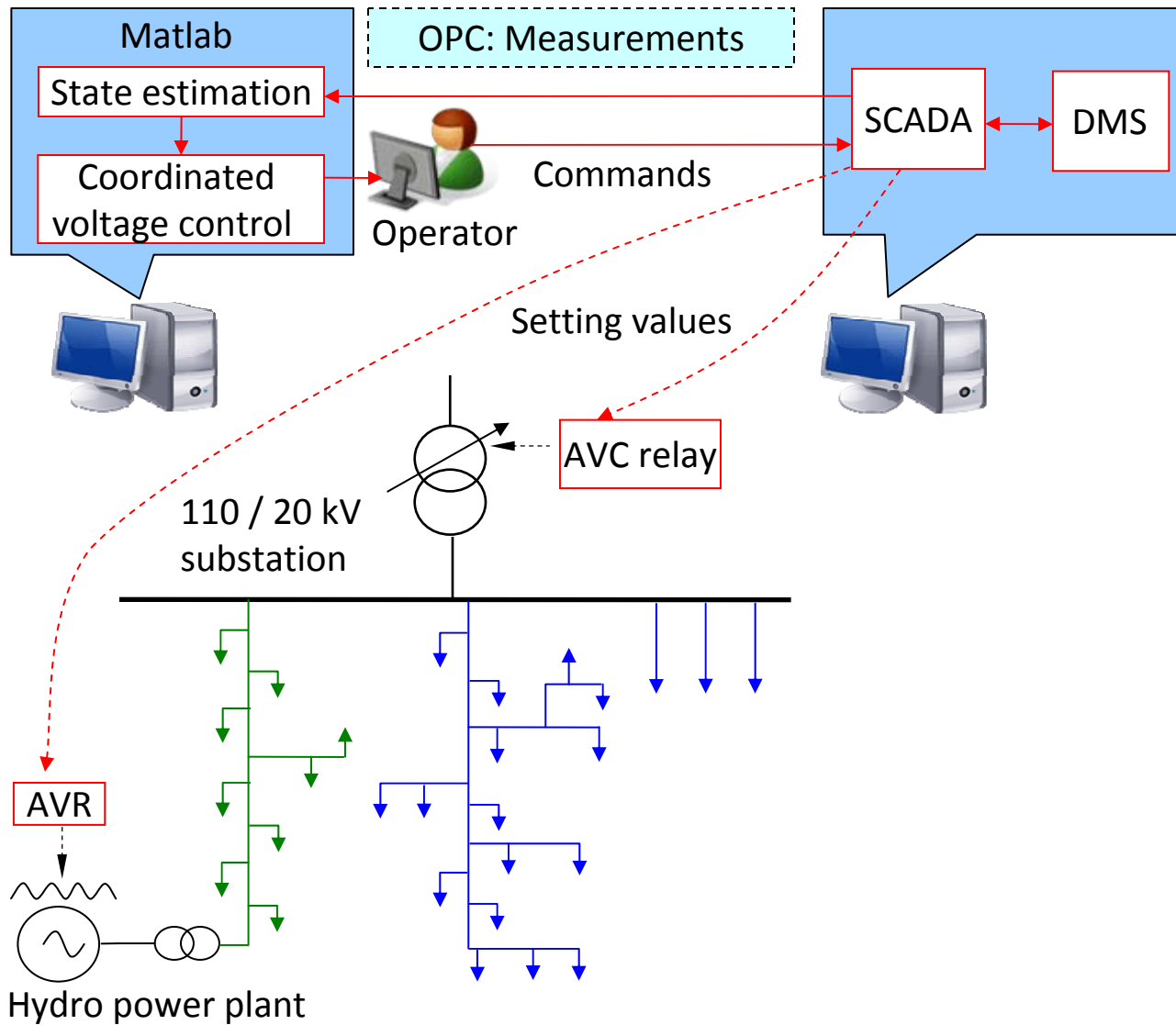
Decoupling DG from strong resistive network



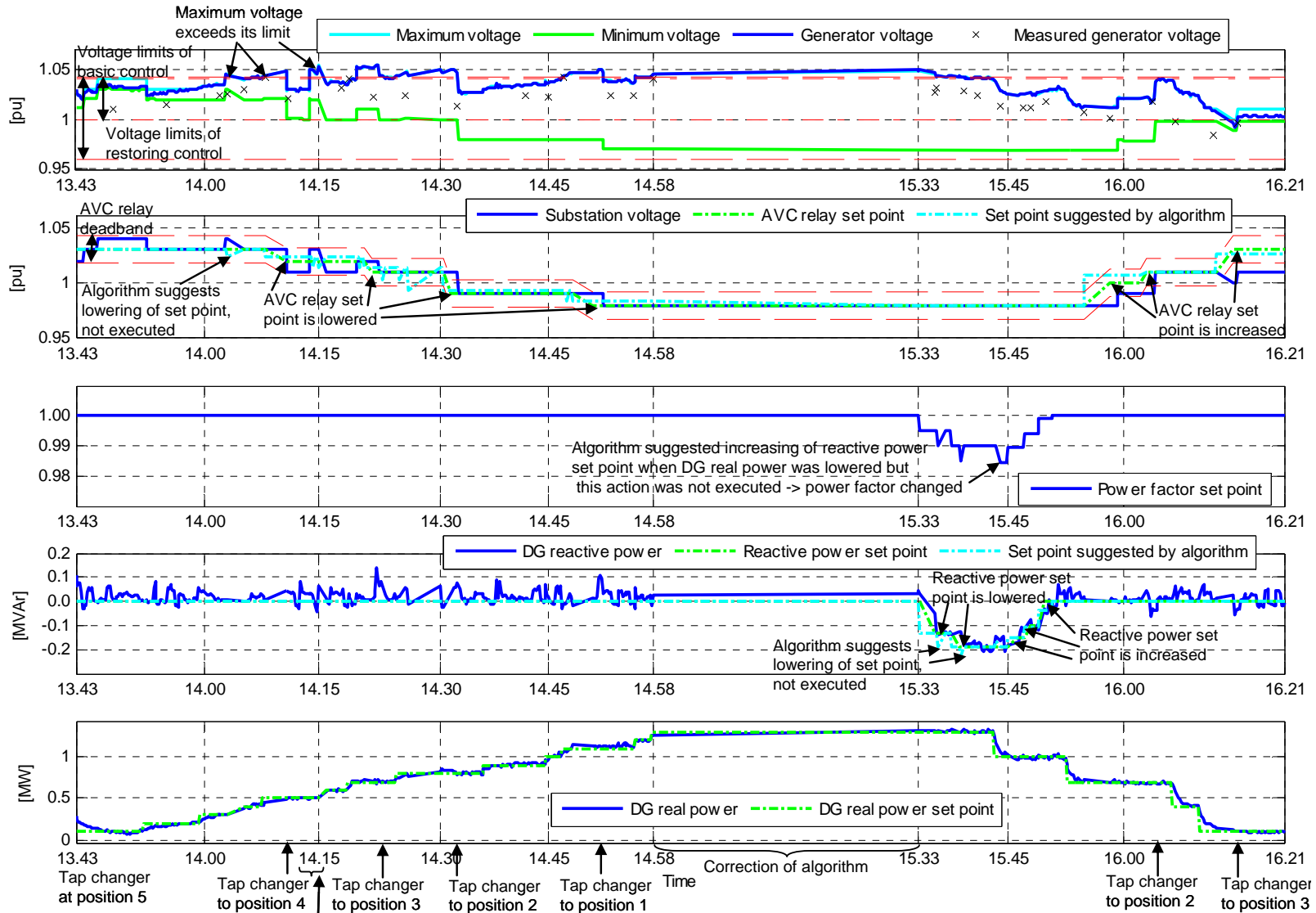
10 kVA power electronic converter (LU):  
Starting of 2 kW single phase motor



# Co-ordinated voltage control



# Co-ordinated voltage control



# STATCOM

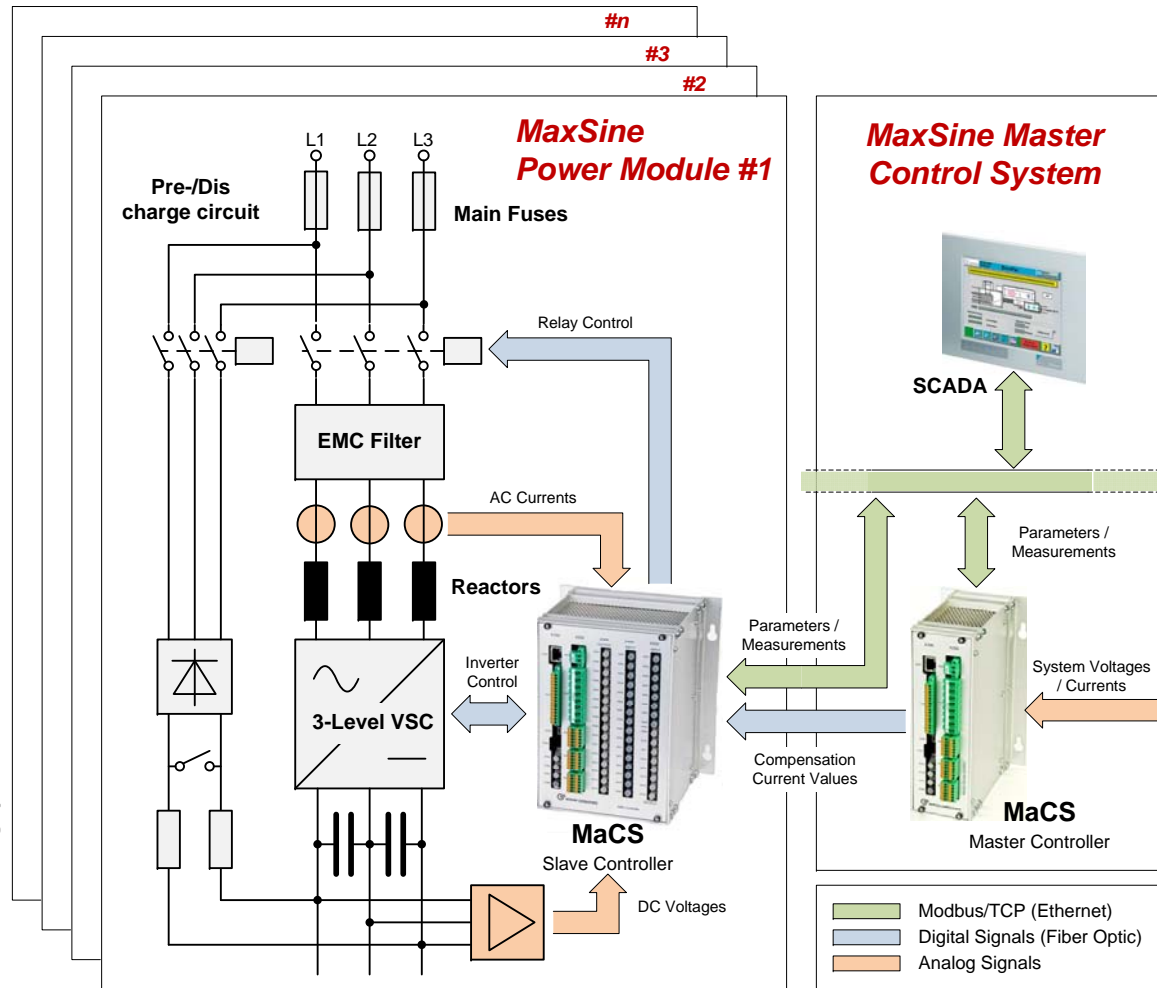
Unit size is 2 MVA and 2 kV

Parallel connection to achieve required rating

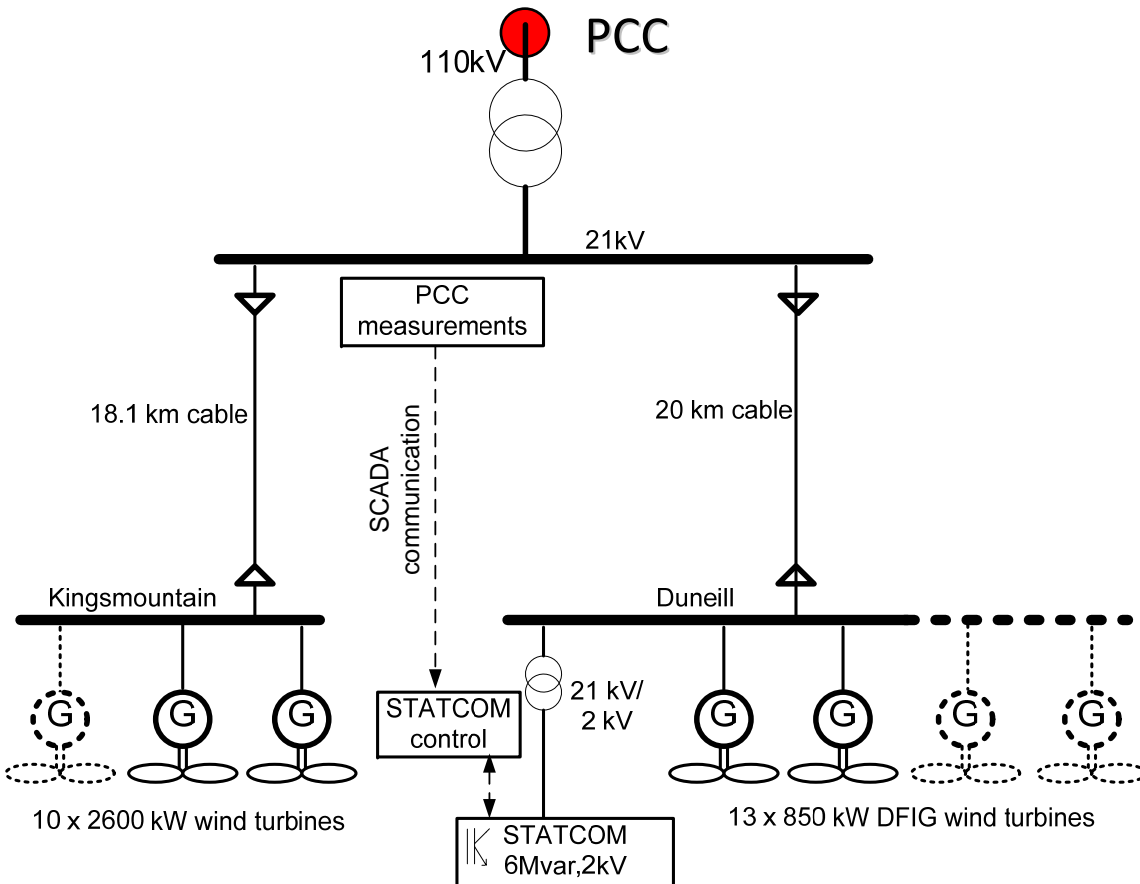
STATCOM compensation algorithms implemented:

- Continuous and dynamic voltage control
- Power Factor Correction
- Active harmonics cancellation
- Flicker mitigation
- Unsymmetrical load balancing

“Ride through support” for grid failures



# Duneill wind farm demonstration



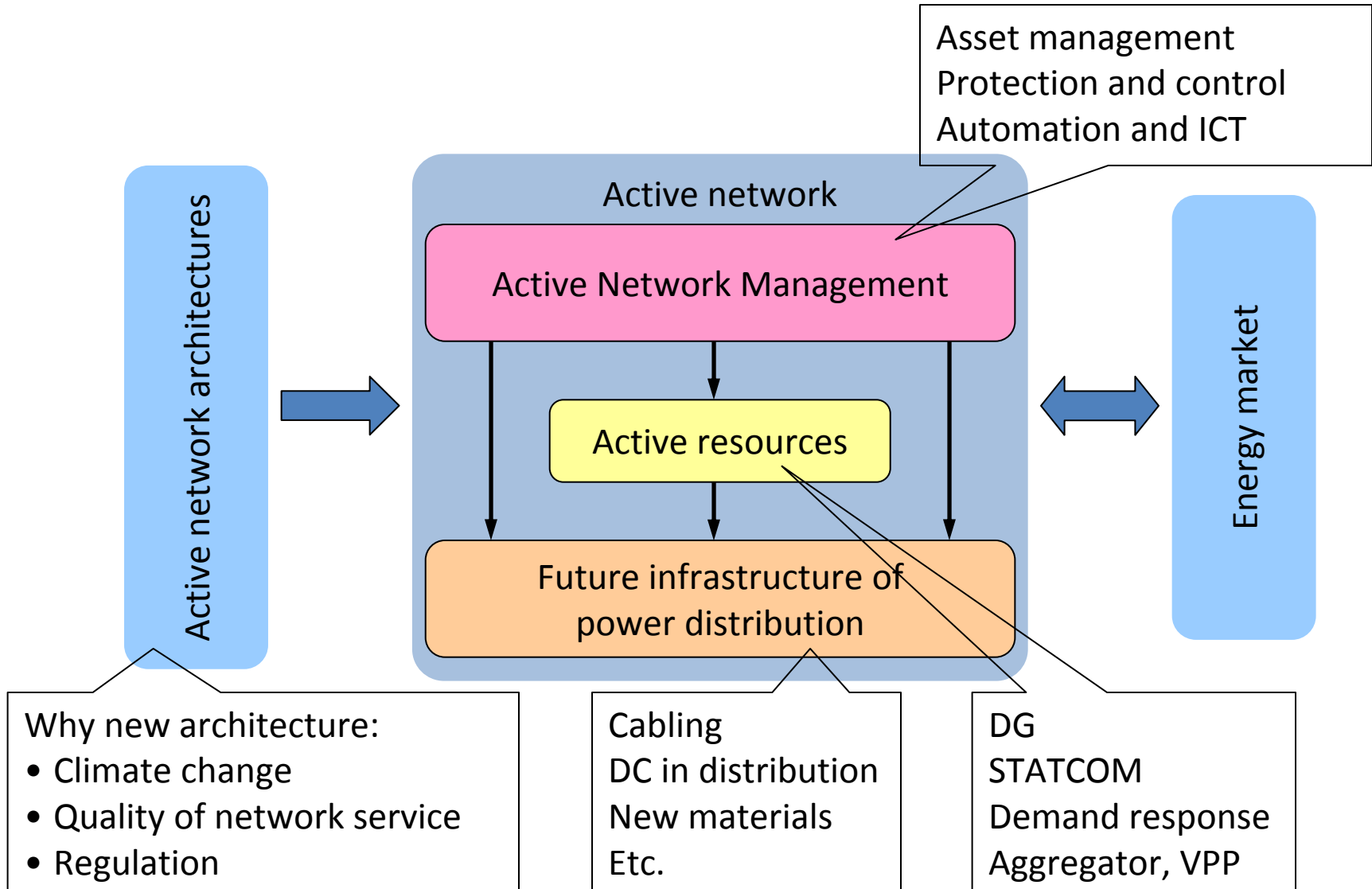
Control modes:

1. Constant reactive power
2. Reactive power control at PCC
3. Power factor control at PCC
4. Voltage control at PCC

In addition STATCOM support electricity network in fault situations (Fault ride through)

A grid code compliance study has shown that the windfarm is not fully compliant with the EirGrid Grid Code  
→ 6Mvar STATCOM required

# Active Network





# Conclusions

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- Active network management is feasible today
  - Several active network solutions have been developed and demonstrated
  - Existing equipment and automation systems are utilized in these demonstrations → evolution instead of revolution
- Further development needed
  - Utilization of existing information and communication technologies
  - New solutions and systems for combined management of electricity networks and markets
- Hardware in loop simulations
  - Extension of product development between prototype and field tests
  - Versatile tests compared to field tests



ADINE is a project co-funded by the European Commission



Thank you!



[www.adine.fi](http://www.adine.fi)

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