

# ADINE – EU DEMONSTRATION PROJECT OF ACTIVE DISTRIBUTION NETWORK

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## Distributed Generation – DG

- Increased DG penetration is expected
  - New products
  - New connection standards
- Advantages
  - Many use renewable energy sources
  - May relieve network
  - Island operation may reduce interruption time
- Challenges
  - Network operation and DG interact
  - Exploit communication for control
  - New view on DG needed – DG offers new possibilities



# Active network a solution

## Passive network until now

- Flexibility comes from network capacity
- Network itself may handle all probable loading conditions
- Investments are in lines, cables, transformers and switchgear

## Active network

- Flexibility comes from use of controllable resources
- Investments are in controllability and information and telecommunication technologies
- Require integration of DG units instead of "fit & forget"
- Synergy effects from co-operation of individual controllable resources

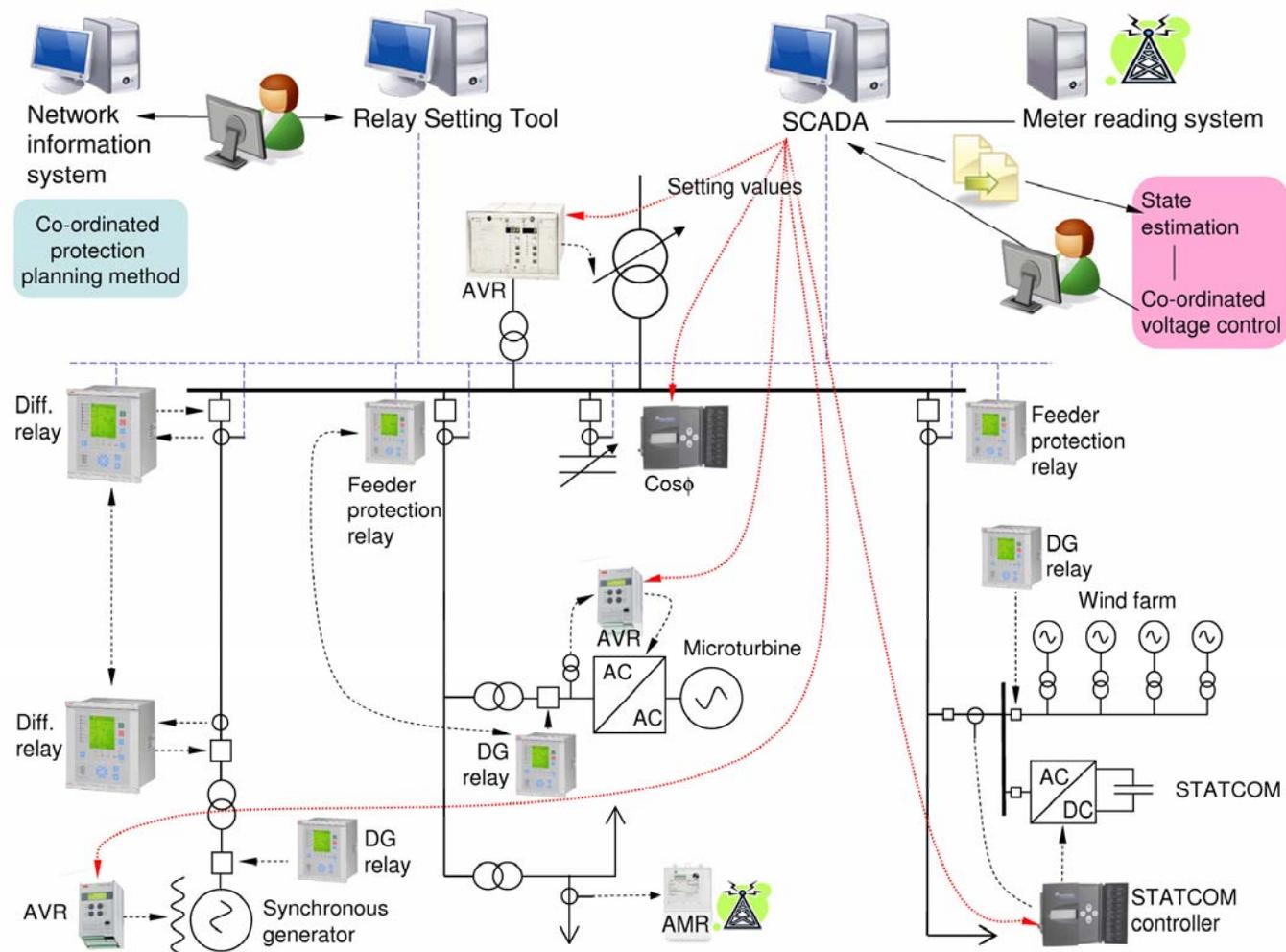
## Goals of Active Network Management – ANM

- Ensure safe network operation in networks with DG
- Increase network reliability in networks with DG
- Maximize the use of the existing networks with bottlenecks caused by voltage issues
- Maintain the required level of power quality despite non-predictable power production or consumption

## Objective of ADINE

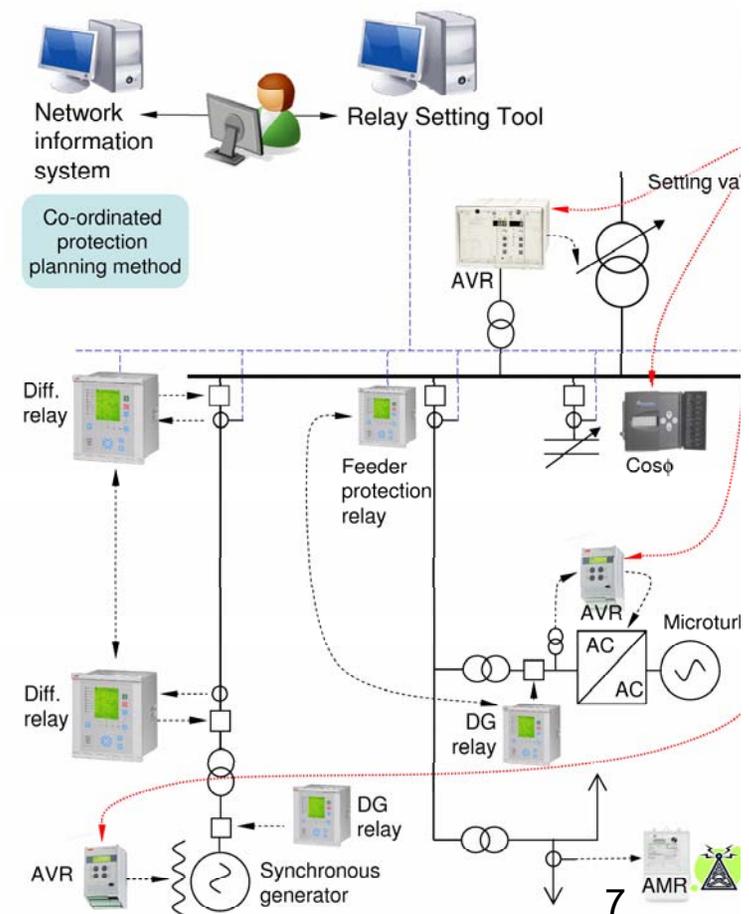
- To develop, demonstrate and validate ANM
  - distribution network including DG and other active devices
  - to enable an easy connection of DG units
- Develop a set of technical solutions
- Demonstrate in real-life environment
- Validate combination of solutions through simulations

# The full picture



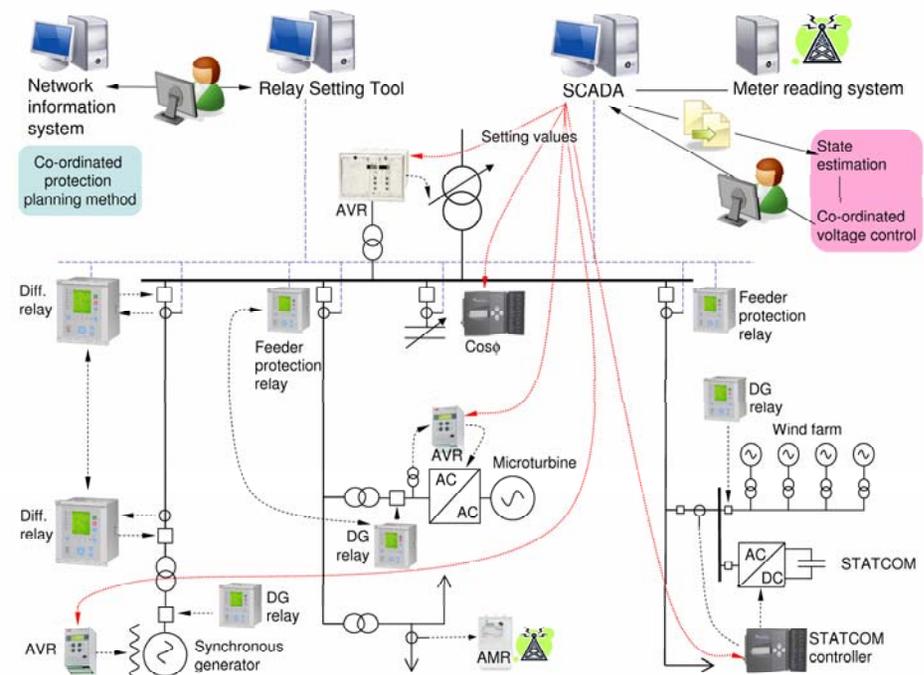
# Protection of distribution networks with DG

- Protection is a critical issue for DG integration
- Non-directional over-current relays not sufficient
  - Communication based relays a solution
- Fault location disturbed by DG
  - New method taking DG influence into account
- Manual protection planning needs to be minimized
  - Co-ordinated planning in Network Information System



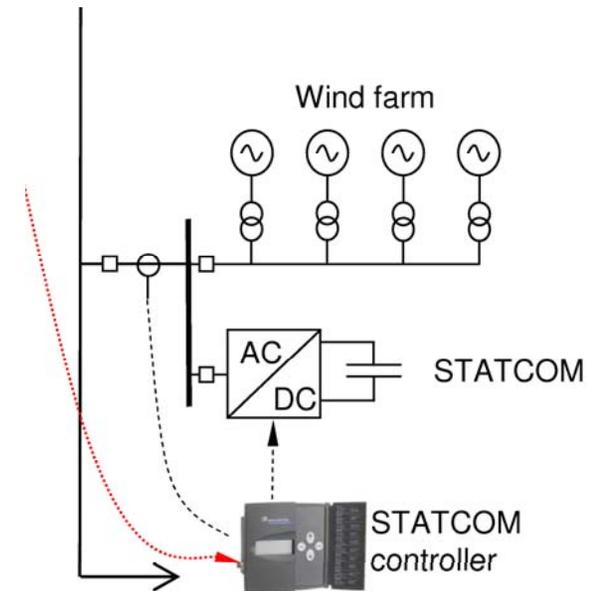
# Voltage control of networks with DG

- DG affects voltage regulation by violating basic assumptions
- Local control of DG units
  - Control of reactive output
- Centralised voltage control
  - Co-ordinate all devices
  - SCADA/DMS software
  - Manage network losses, reactive compensation



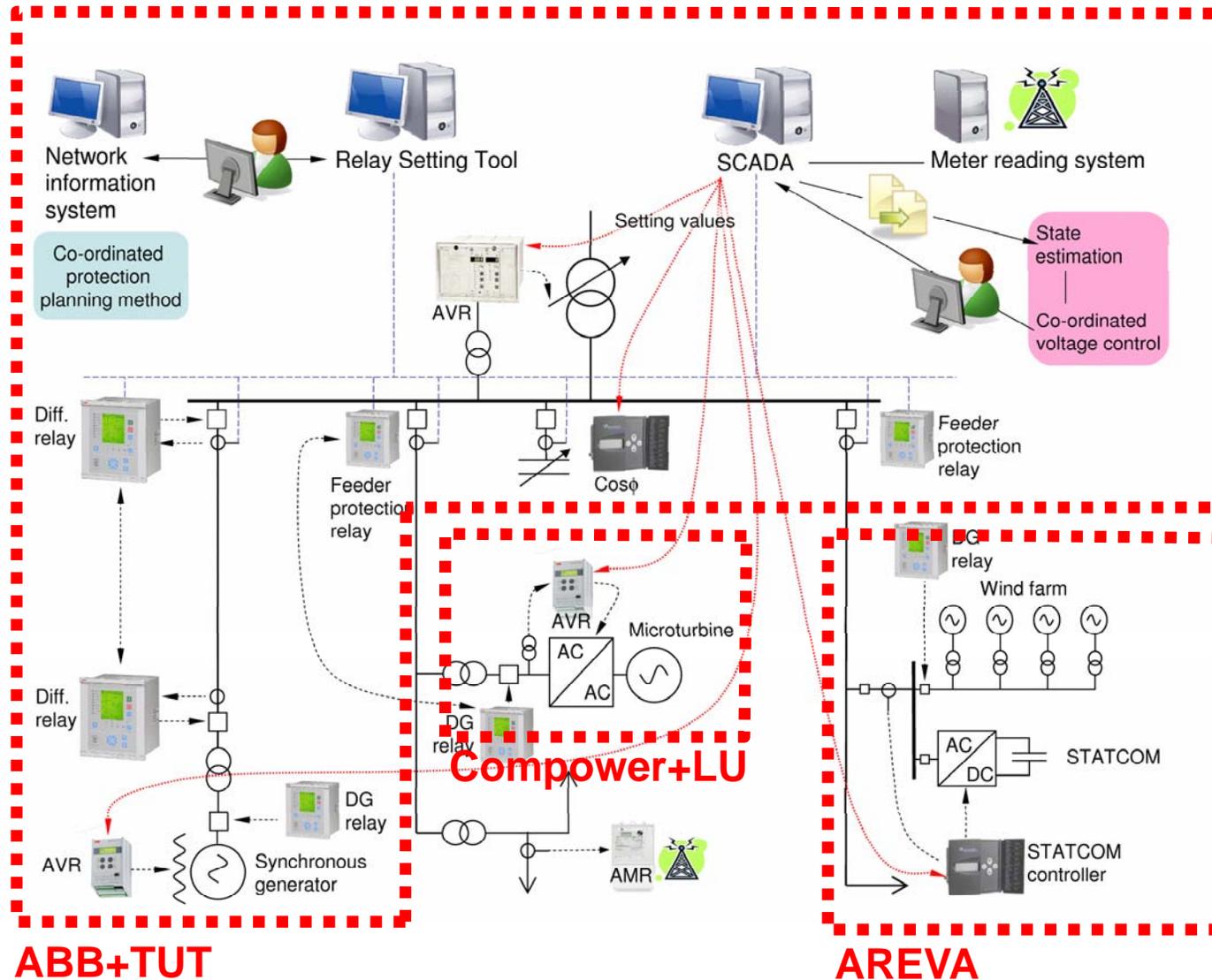
# New generation medium voltage STATCOM

- DG affects power quality
- STATCOM can act in many time-scales
  - Filtering harmonics, eliminating flicker
  - Voltage dip mitigation
  - Reactive power compensation
  - Voltage regulation

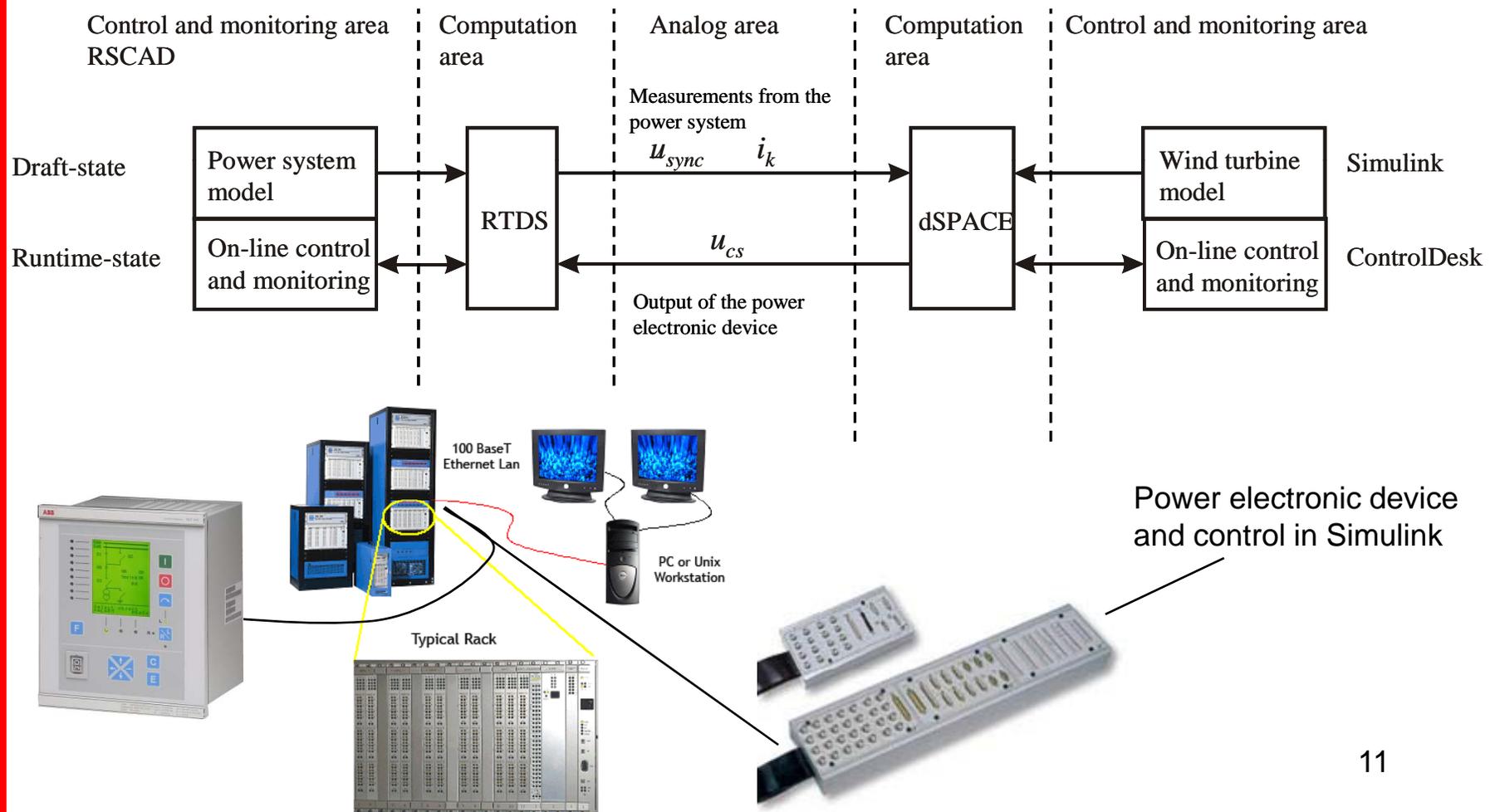


# Test sites

- Simulations and measurements of individual solutions



# Real-time simulations in RTDS/dSPACE



## Summary of ADINE project

- Active Network Management method
- Technical solutions
  - Protection
  - Voltage control
  - Power quality
- Individual assessment of technical solutions
  - Simulations
  - Field tests
- Interaction simulations
  - Real-time environment with dSPACE and RTDS
- Final report by end of 2010