

Cooperation with the University of Ljubljana in the Field of Distributed Generation

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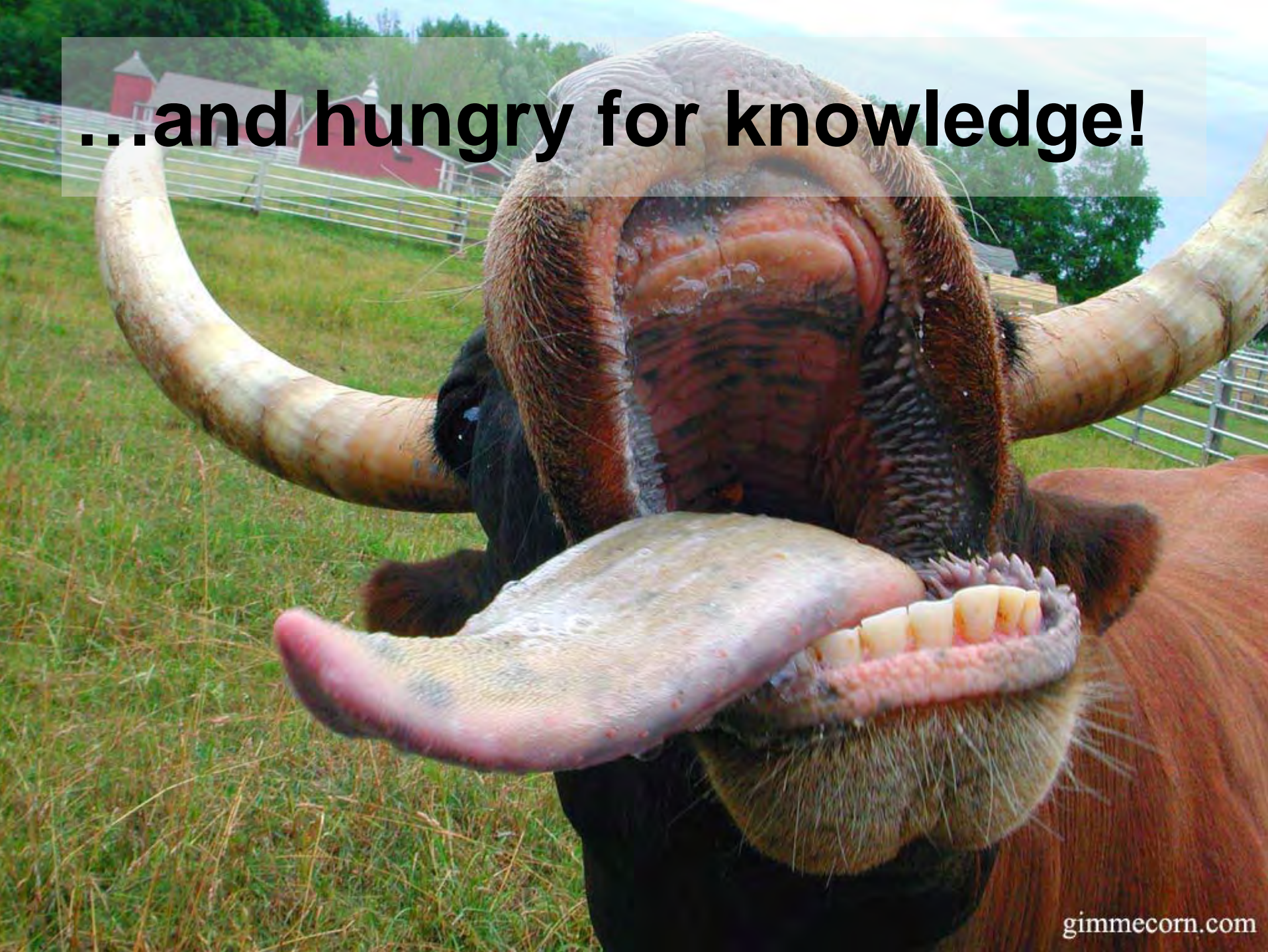
Univerza v Ljubljani
Fakulteta *za elektrotehniko*



Engineers are always curious...



...and hungry for knowledge!



We know that being on the same team is crucial...



...to put daring ideas into practice!



Cooperation benefits us all!



Cooperation was established between

Univerza v Ljubljani
Fakulteta za elektrotehniko




arsenal research
Ein Unternehmen der Austrian Research Centers



RENEWABLE ENERGY



...water...



...wind...



...sun...



...and biomass...



...in the field of Distributed Generation

- What is Distributed Generation (DG)?

The DG are small-scale power generation units that generate electricity from many small energy sources, characteristic for local environment

(water, wind, sun, biomass, etc....)

- Typical range: < 10MW (>100MW)

DISTRIBUTED GENERATION



ADVANCED TURBINES



WIND



FUEL CELLS



PHOTOVOLTAICS



MICROTURBINES



Why is DG important...

- Advantages
 - Low maintenance
 - Low pollution
 - High efficiency
 - Automated operation
 - Small in size (environmental issues)
- Problem
 - High investment costs

What are the benefits?

- Power system
 - DGs provide incremental capacity of available power
 - Reduce the cost of transmission and distribution system upgrades
- Consumer
 - Lower energy costs
 - Higher service reliability
 - High power quality
 - Increased energy efficiency
 - Energy independence

Challenges...

- Network integration (reinforcement needed)
- Insufficient control schemes (common methods are out of date)
- Power quality
- Reliability issues (stochastic operation)

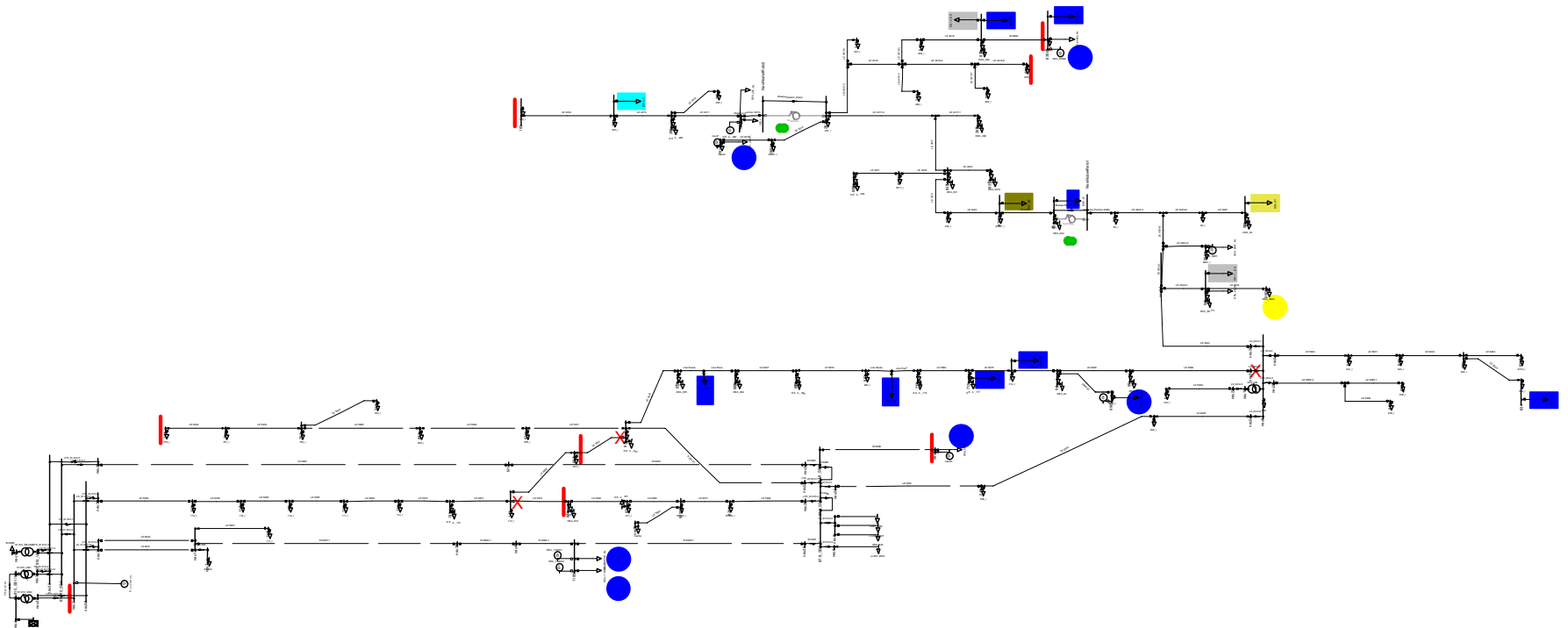
Goals of our work...

- To cope with the problems given (development and application of novel solutions)
- The focus is on the development of high-performance algorithms with large range of application (compatibility - one fits them all)
- Approach
 - Construction of a simulation model of an existing distribution network with a number of DG units installed
 - Simulation of DG operation and identification of voltage associated problems (location, magnitude)
 - Development of the intelligent control schemes and their application (DigSilent – Power system simulator, Matlab)

Test network



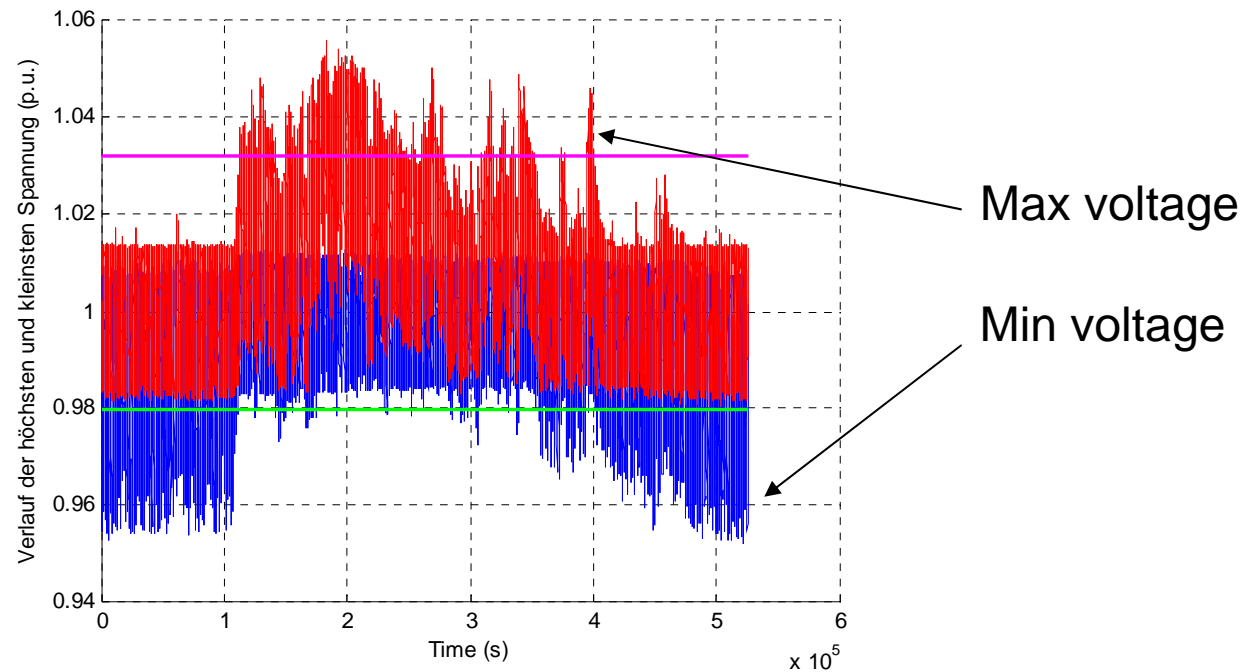
- Vorarlberg VKW distribution network
- DG installations (>20)
- Load and power injection profiles (1 year)



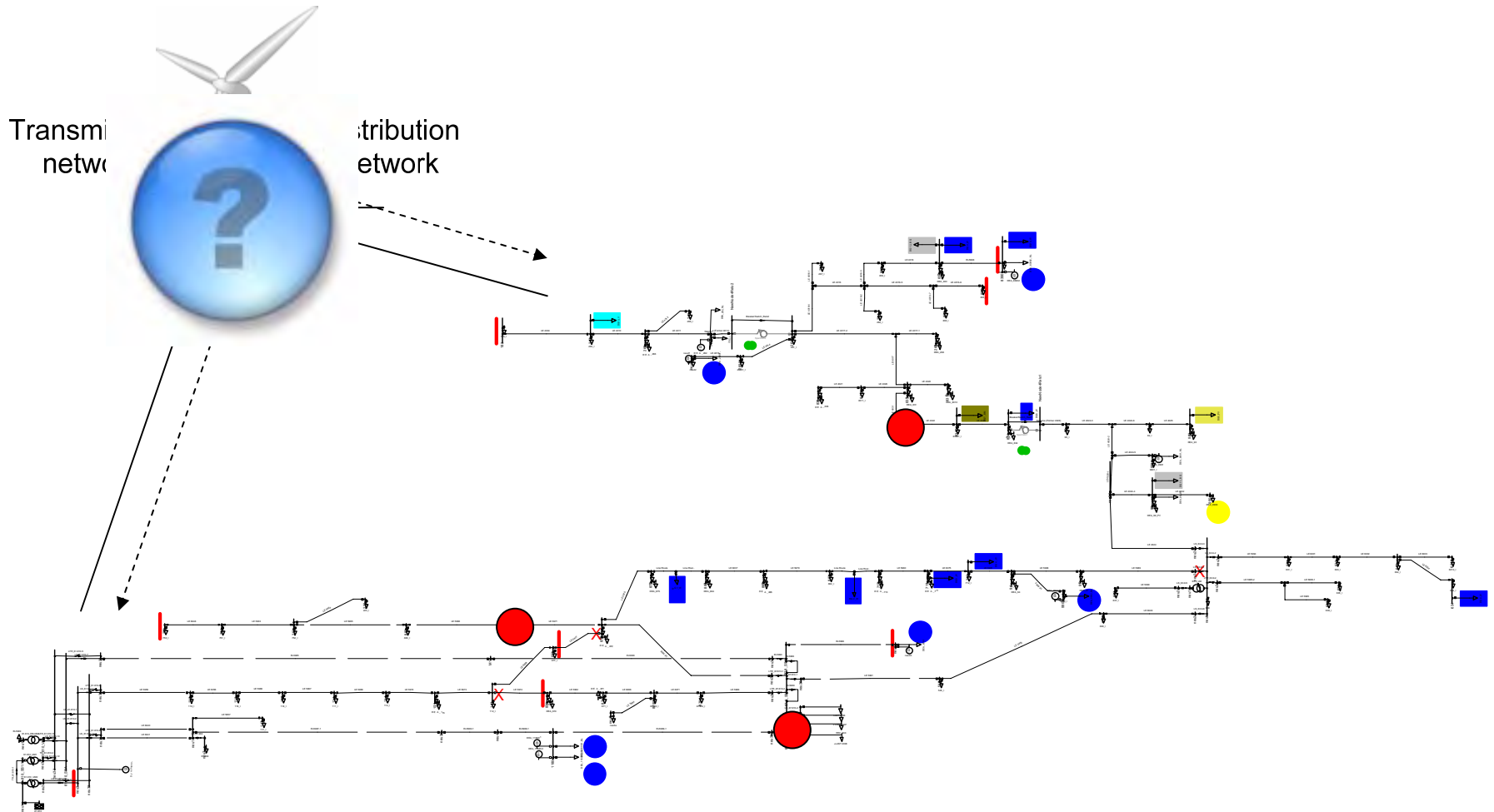
Identification of problems...



- Problem: voltage deviation
- Focus: the nodes with the minimum and maximum voltage



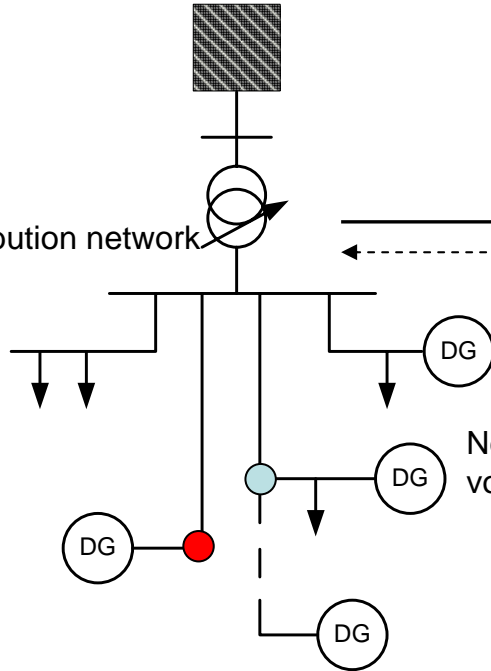
Control schemes...



The concept...

Transmission network

Distribution network

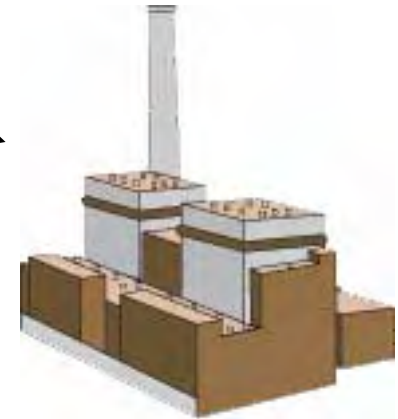


Network voltages

Intelligent control



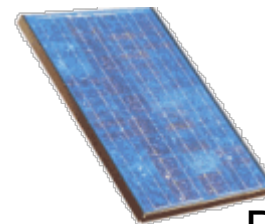
Wind unit



Biomass unit



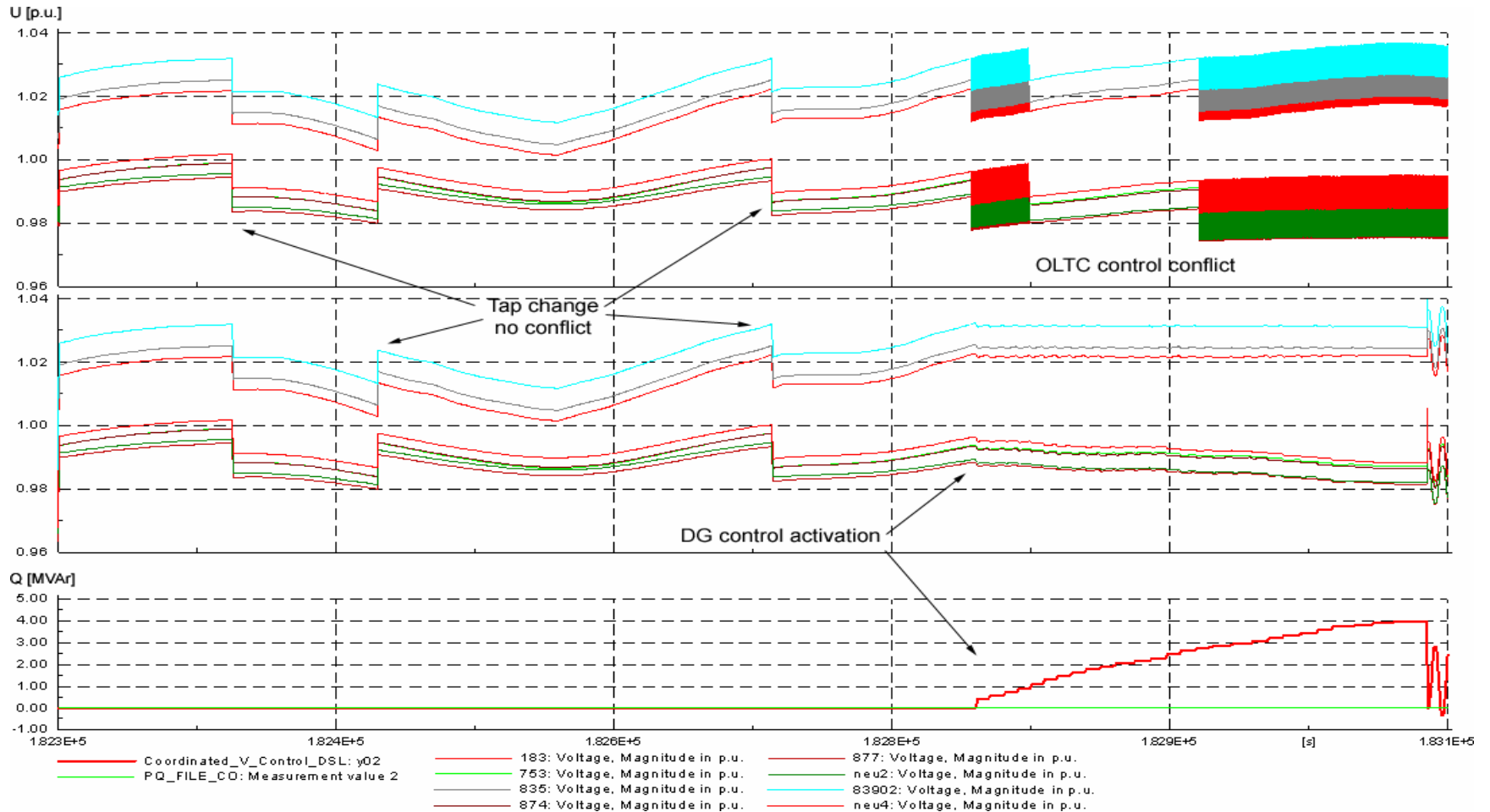
Small-hydro unit



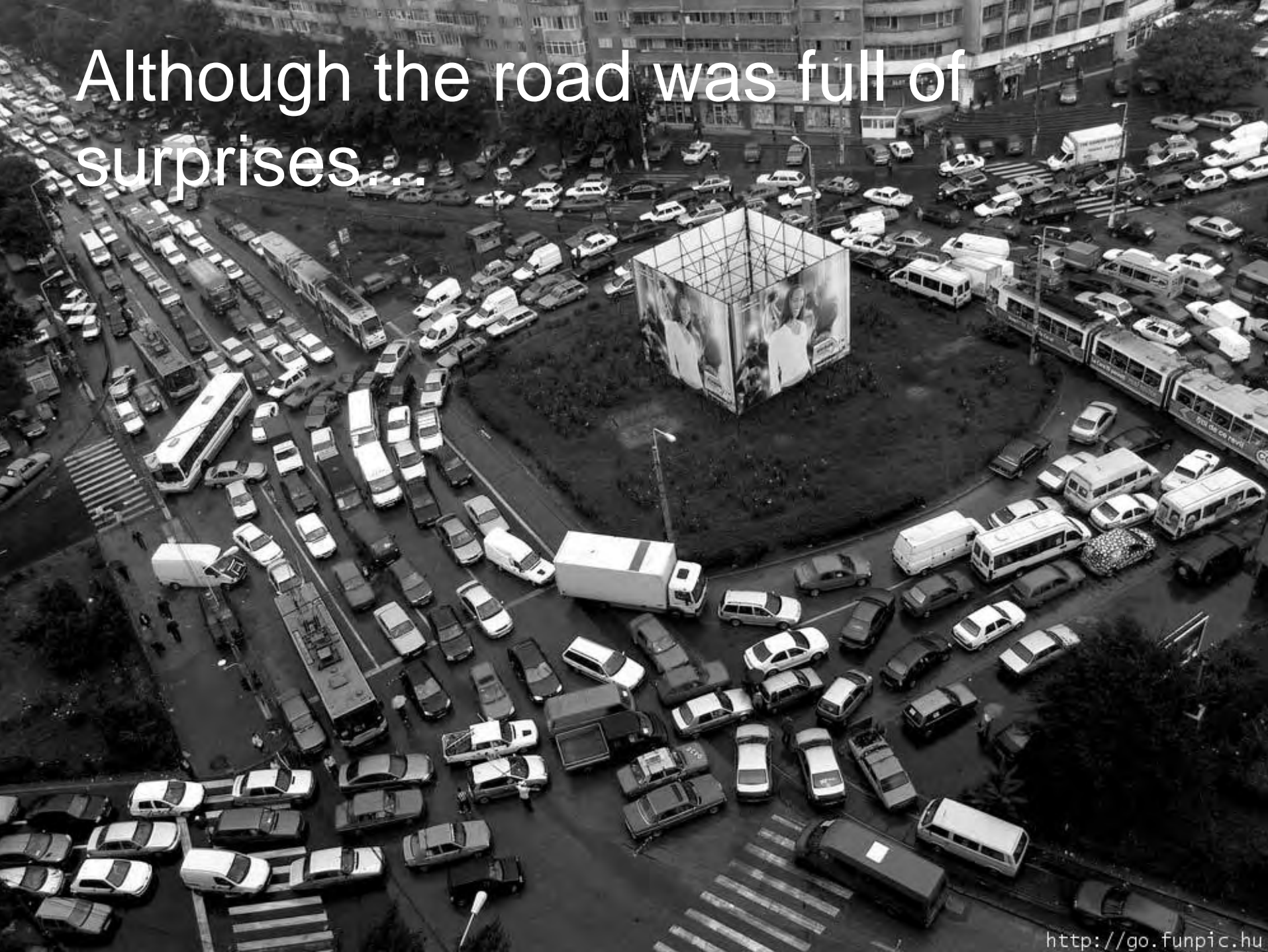
Photovoltaic unit



Study case



Although the road was full of surprises...



...and different views were
discussed...

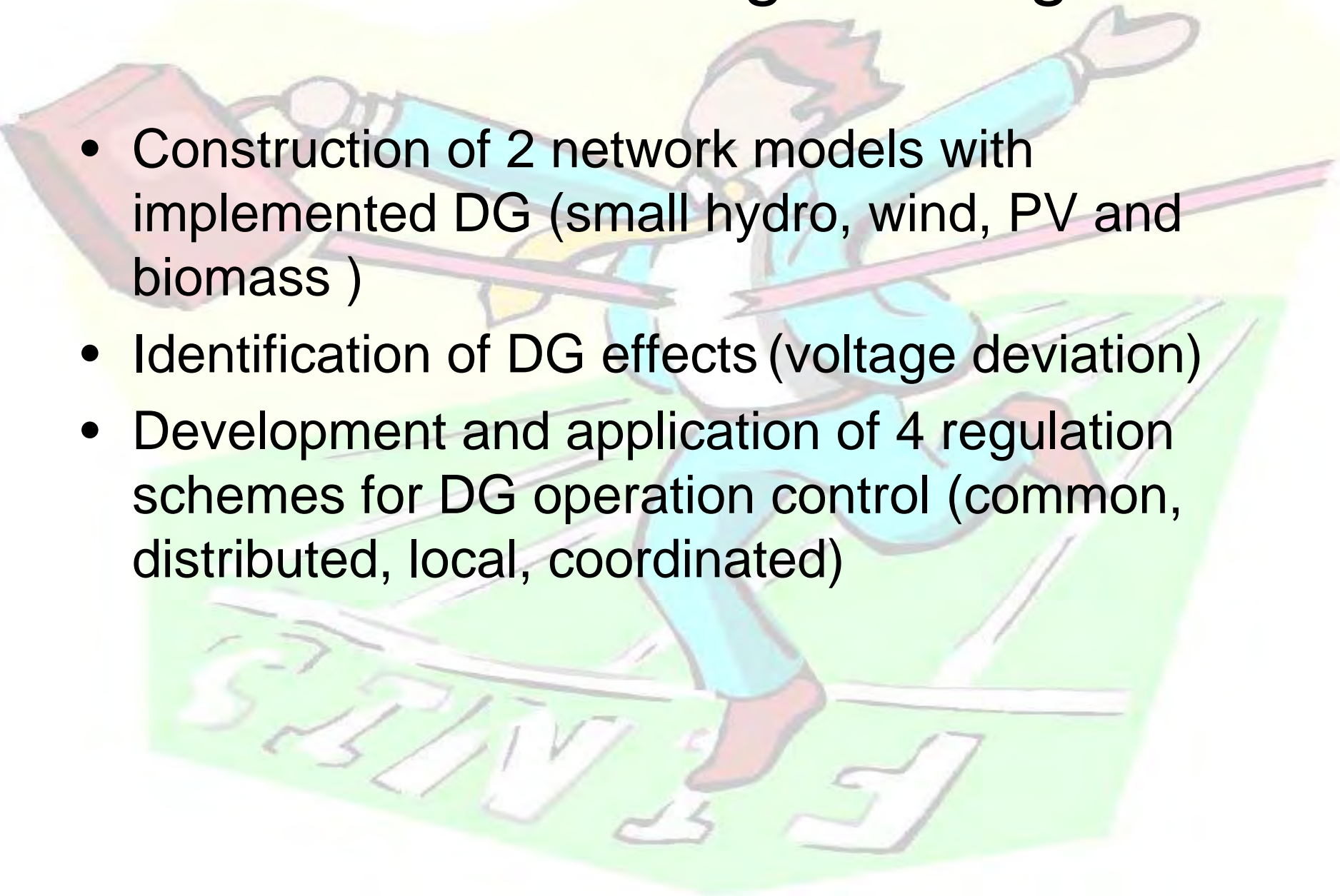


...we've stayed focused...



...and achieved the goals targeted

- Construction of 2 network models with implemented DG (small hydro, wind, PV and biomass)
- Identification of DG effects (voltage deviation)
- Development and application of 4 regulation schemes for DG operation control (common, distributed, local, coordinated)



Conclusion...

- Cooperation was/is successful
- Knowledge transfer
- Common ground for future work and cooperation
- Establishment of new friendships...

....and since everything proved to be a success...



...we made our “superiors”
...well, happy!

Questions?

