


NACHHALTIGwirtschaften


“DG DemoNet-Concept” – Innovative Voltage Control Strategies as a Key Towards Smart Distribution Grids in Austria

Helfried Brunner




arsenal research
Ein Unternehmen der Austrian Research Centers.

Smart Grids Week Vienna08
3rd Symposium on Distributed Generation and Smart Grids
Parkhotel Schönbrunn, May 15, 2008



bmwfti FFG arsenal research ENERGIE SYSTEME der Zukunft


1



NACHHALTIGwirtschaften

Content

- **Introduction**
 - Background
 - Objective
 - Overview
 - Project Team
- **Approach**
- **Voltage control concepts**
- **Results**
- **Summary and Outlook**



bmwfti FFG arsenal research ENERGIE SYSTEME der Zukunft

2

Content

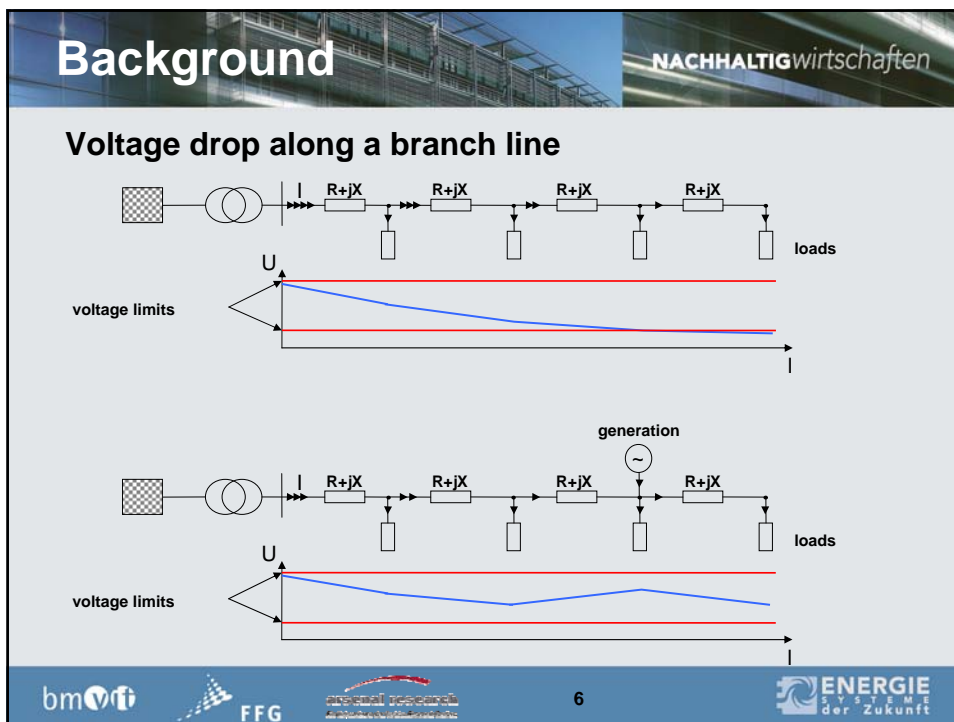
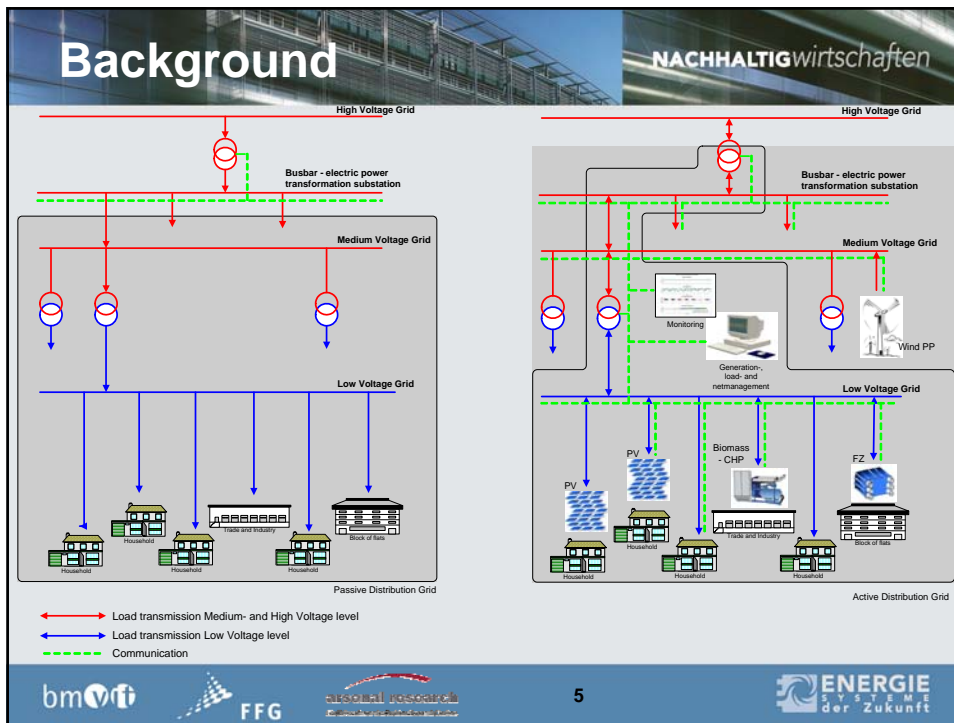
NACHHALTIGwirtschaften

- **Introduction**
 - Background
 - Objective
 - Overview
 - Project Team
- **Approach**
- **Voltage control concepts**
- **Results**
- **Summary and Outlook**

The Project

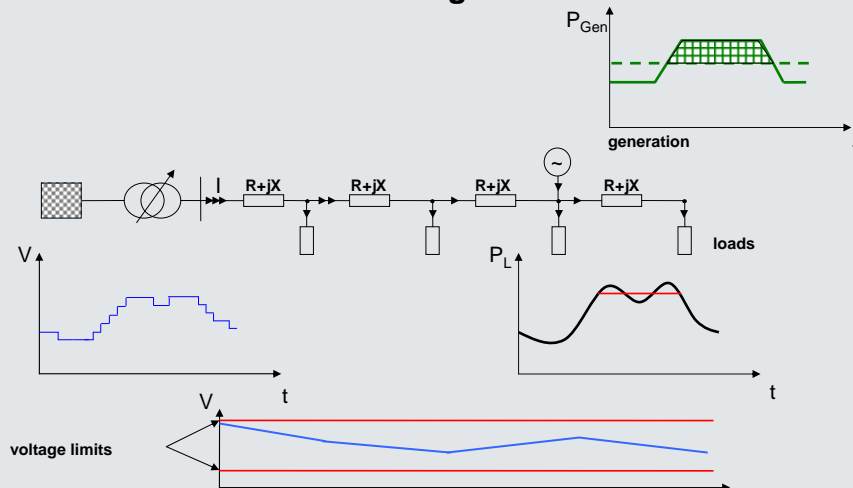
NACHHALTIGwirtschaften





Background

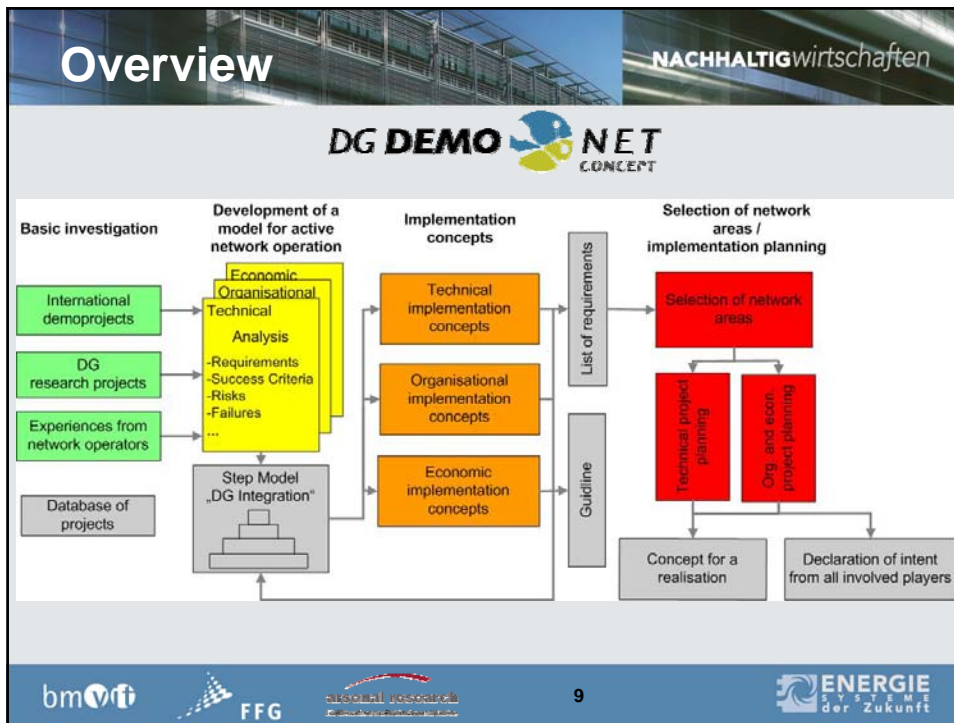
Possible contributions to voltage control



Objective

„Project planning of models for an integration of a high as possible share of distributed generation with perpetuation of power quality and high macroeconomic profit

Option: Increase of reliability of supply – ability of intended islanding“



The Team

NACHHALTIGwirtschaften

- **arsenal research**
 - project leader
 - technical issues
- **Distribution Network Operators:**
 - Energie AG OÖ Netz
 - Salzburg Netz AG
 - VKW Netz AG
- **Institut für Computer Technologie – TU WIEN:**
 - Information and Communication Technologies
- **Energy Economics Group – TU WIEN:**
 - economic issues

arsenal research
Forschungsinstitut für Energieeffizienz

ENERGIE AG Netz

Salzburg Netz

Netz
VKW-Netz AG

ICT
TECHNISCHE UNIVERSITÄT WIEN
WIEN
VIENNA UNIVERSITY OF TECHNOLOGY

Energy economics group

bmwviti FFG arsenal research ENERGIE SYSTEME der Zukunft

10

Content

NACHHALTIGwirtschaften

- **Introduction**
 - Background
 - Objective
 - Overview
 - Project Team
- **Approach**
- **Voltage control concepts**
- **Results**
- **Summary and Outlook**

Approach

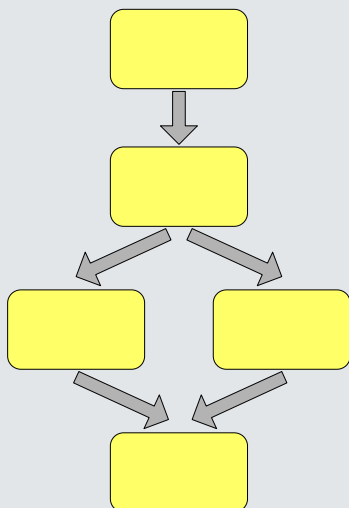
NACHHALTIGwirtschaften

- Basic research
- Data collation (network, generators, loads, potentials)
- Implementation of the Data in DigSILENT PowerFactory
- Development of voltage control concepts and integrations into the simulation environment
- Technical simulations (incl. the integration of additional DG units)
- Economic investigations
- Planning of the implementation
- Finally it was a process with a (high) number of iterations

Content

- Introduction
 - Background
 - Objective
 - Overview
 - Project Team
- Approach
- **Voltage control concepts**
- Results
- Summary and Outlook

Voltage Control Concepts



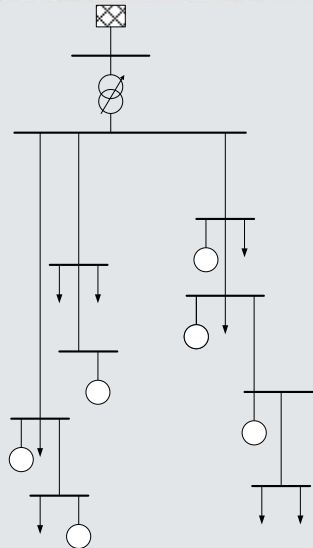
Step	OLTC	DG unit	load	VR
Current Practice	fixed set-point	-	-	-
"Decoupling" of Voltage Control	fixed set-point	-	-	✓
Local Voltage Control	fixed set-point	✓	✓	✓
Distributed Voltage Control	variable set-point	-	-	✓
Coordinated Voltage Control	variable set-point	✓	✓	✓

Voltage Control Concepts

NACHHALTIGwirtschaften

Current Practice

- Passive network operation
- network planning so that voltage stays within the limits
- The OLTC is operated to control the substation busbar at a constant voltage
- In case of voltage problems mainly network reinforcement
- Used as reference scenario

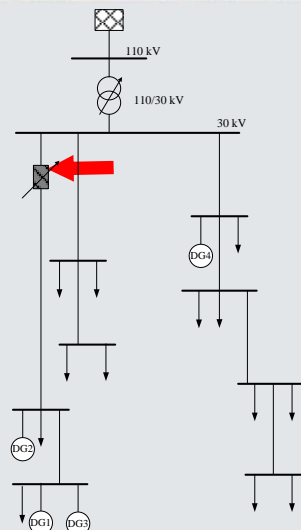


Voltage Control Concepts

NACHHALTIGwirtschaften

„Decoupling“ Solution

- Feeder dominated by load or generation
- Decoupling of voltage control by voltage regulator
- Solution in case of local voltage problems
- Offline calculation before implementation is required

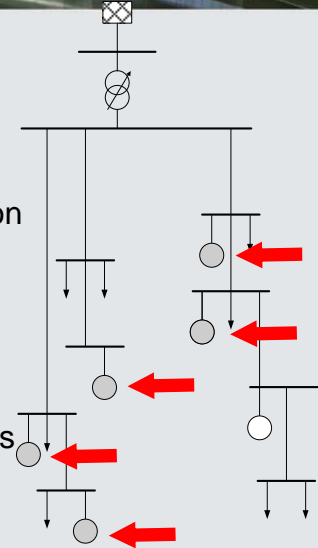


Voltage Control Concepts

NACHHALTIGwirtschaften

Local Voltage Control

- The OLTC is operated to control the substation busbar at a constant voltage
- Local voltage control at selected generation units with reactive and active power management
- Under current framework reactive power management is preferred
- Selection of the units by offline calculations
- The same approach is possible for loads just as well

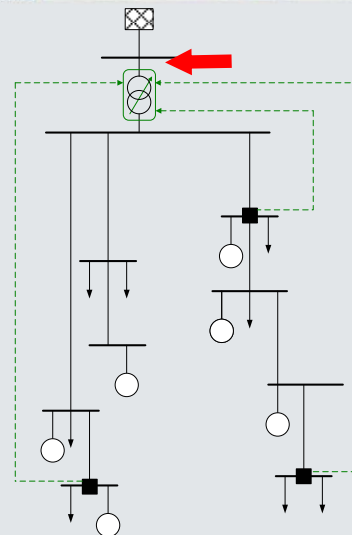


Voltage Control Concepts

NACHHALTIGwirtschaften

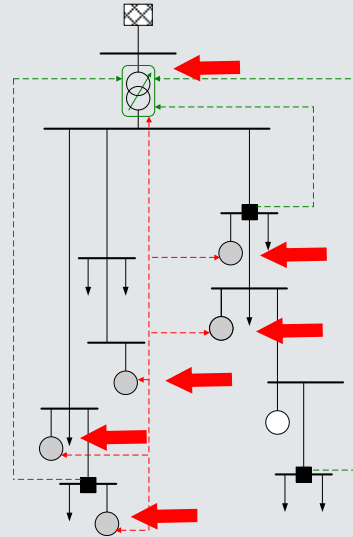
Distributed Voltage Control

- OLTC is operated based on measurement data of monitored network nodes
- In case of voltage problems tap change occurs
- Measurement nodes selected by offline analyses
- Efficiency strongly depends on network topology
- Information and communication technology is required (green)



Coordinated Voltage Control

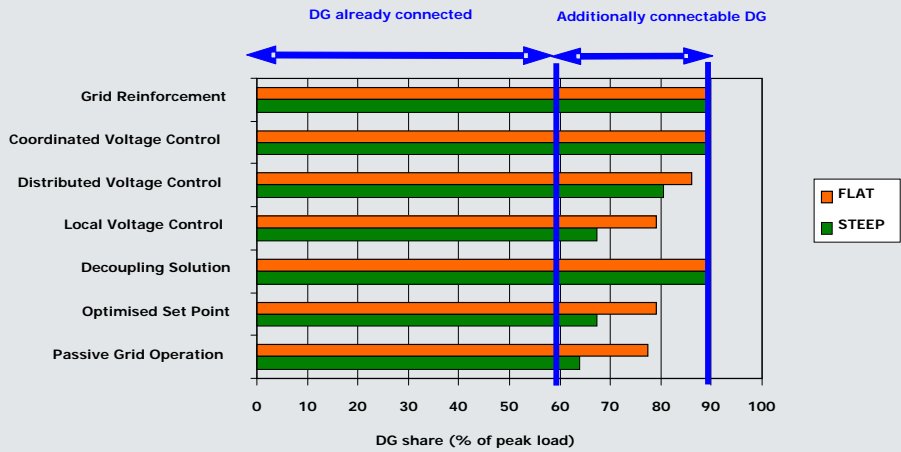
- Combination of local and distributed voltage control
- Offline selection of monitoring nodes
- Hierarchical list is used for coordination of the participation of OLTC, DG units or loads (algorithm implemented in substation)
- Bidirectional data flow is required (from measurement point – green, to the controlled units - red)



- **Introduction**
 - Background
 - Objective
 - Overview
 - Project Team
- **Approach**
- **Voltage control concepts**
- **Results**
- **Summary and Outlook**

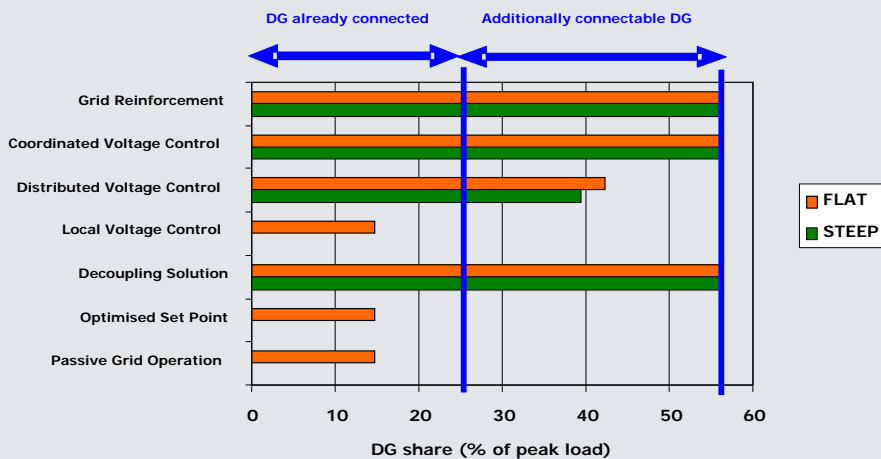
Results

Case study 1: connectable DG shares for different grid integration strategies



Results

Case study 2: connectable DG shares for different grid integration strategies



Content

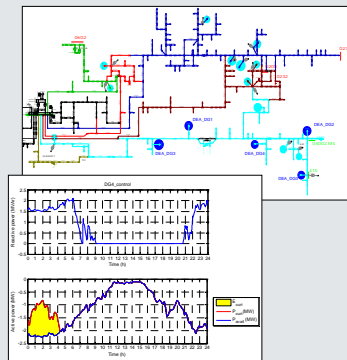
NACHHALTIGWIRTSCHAFTEN

- **Introduction**
 - Background
 - Objective
 - Overview
 - Project Team
- **Approach**
- **Voltage control concepts**
- **Results**
- **Summary and Outlook**

Summary and Outlook

NACHHALTIGWIRTSCHAFTEN

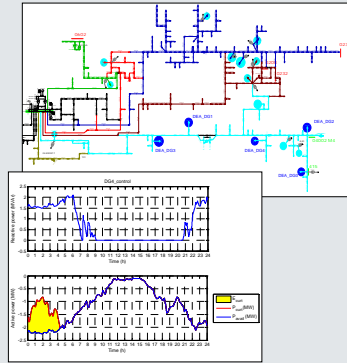
- Four voltage control concepts have been developed and validated
- In distribution networks extended reserves of the voltage band are utilised by the control strategies; assets can be used more efficiently
- The quantified potential of the control concepts is considerable; technical and economic feasibility is given



Summary and Outlook

NACHHALTIGwirtschaften

- the implementation of the results is planned in the short term by the network operators
- the guideline “Smart Grids of the Future – The Way Towards Smart Distribution Grids” is published
- some details for the implementation have to be clarified (i.e. behaviour of the control concepts in case of network reconfiguration); thus the follow up project BAVIS was launched
- New approaches for network planning are required (BAVIS)



Guideline

NACHHALTIGwirtschaften

To make our experience and approach available for similar intentions



Only available in German