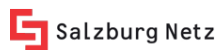


Project DG DemoNet-Concept Experiences of 3 Austrian Distribution Network Operators (DNO)

Smart Grids-Week Vienna
13.-16.05.2008 Parkhotel Schönbrunn, Vienna

A. Abart (Energie AG Netz), R. Nenning (VKW-Netz AG)

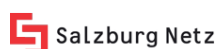


Experiences of the DNO



To manage the new challenge, we do research activities to look for alternative solutions.

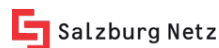
Foto: Members of the DG-Demonet-Research-Group in Bregenz 2007



Motivation to participate



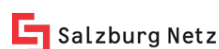
- DNOs are aware of DG as an upcoming issue
- To be well prepared for future requirements DNOs are interested in economic integration techniques.
- DNOs and some of their employees personally feel responsible to take part in the research process for more ecologic global energy supply.



Energy systems



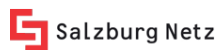
- As the grid-systems role is transmission it is one of the key components of energy supply systems
- Technical and economical efficiency are basic requirements
- Quality levels have to be guaranteed to avoid any handicap to economy



DNOs role in research project



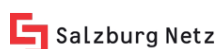
- To bring the DNOs everyday experience to the scientists
- To provide real case data – which also means setting up interfaces
- Evaluation of practicability of new approaches in respect to legal conditions, customers interests and successful business plans



DNOs Efforts



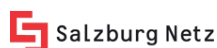
- Preparation or even measurement of data and setting up interfaces
- Clearing in case of scientific evidences in contradiction to long term DNO-experiences
- Discussions of conclusions
- Communication in the own company and to customers as well as to other DNOs
- Employees have additional workload



DNOs benefit



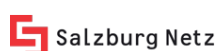
- DNOs have the chance to develop a scientific background for everyday business
- DNOs real case data are analysed scientifically in a way only a research project allows, and scientists know how to do
- DNOs participating in research programs are well prepared and ready to start the implementation of new technologies in planning and operating the grid.



Future Outlook



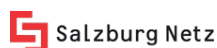
- There are still many questions
- There are many answers to evaluate e.g. by demonstration projects
- Economic & ecologic analysis of the whole energy systems have to be done.
- Many research projects are funded.
- To ensure that participation in research projects is not too much additional workload for the employees DNOs need a long term continuous research activity to employ additional engineers.



3 DNOs made experiences by participating in DG DemoNet-Concept



- Salzburg Netz, VKW-Netz and Energie AG -Netz
- Key-issue:
Increased Integration of DG units without cost intensive expansion of lines.
- Key-results:
New methods for better use of the voltage band reserve by special regulation of voltage. These are useful for increasing decentralised generation as well as for increasing loads.



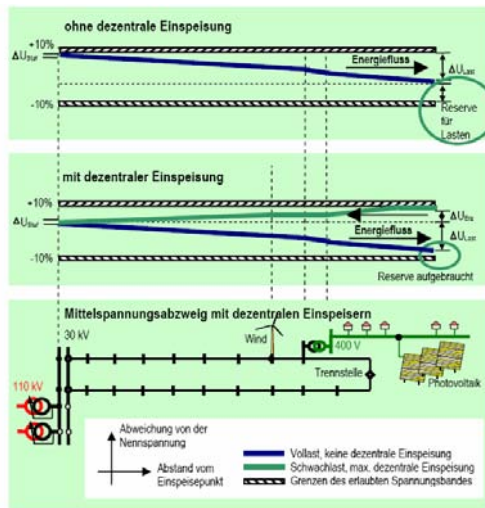
DG DemoNet-Concept: Voltage Regulation



Spannungsanhebung durch verteilte Erzeuger

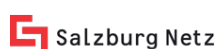
Das Netz muss so ausgelegt sein, dass die Spannung überall im Netz innerhalb der durch die EN 50160 gegebenen Grenzen liegt. Oben ist die Situation ohne dezentrale Einspeisung dargestellt. Die blaue Linie zeigt den Spannungsabfall entlang der Leitung durch die Verbraucher.

Die mittlere Grafik zeigt den Spannungsverlauf entlang der Leitung zu den kritischen Zeitpunkten bei voller Erzeugung mit geringstem Bedarf (grüne Linie) und bei voller Last ohne Erzeugung (blaue Linie). Die verfügbare Spannungsbandsreserve wird durch die Erzeugung beansprucht. Auf dieser Betrachtungsweise aufbauend, wird derzeit die Netzplanung und die Anschlussbeurteilung durchgeführt.

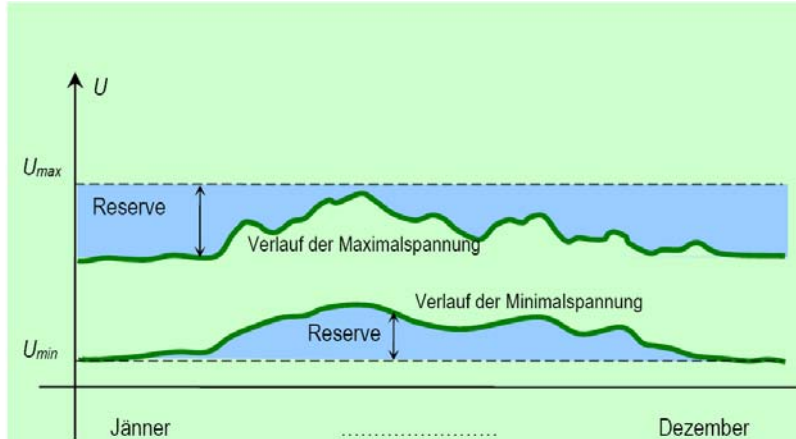


Quelle:
Leitfaden für den Weg zum aktiven Verteilnetz

Berichte aus Energie und Umweltforschung 134a/2008 bm vit



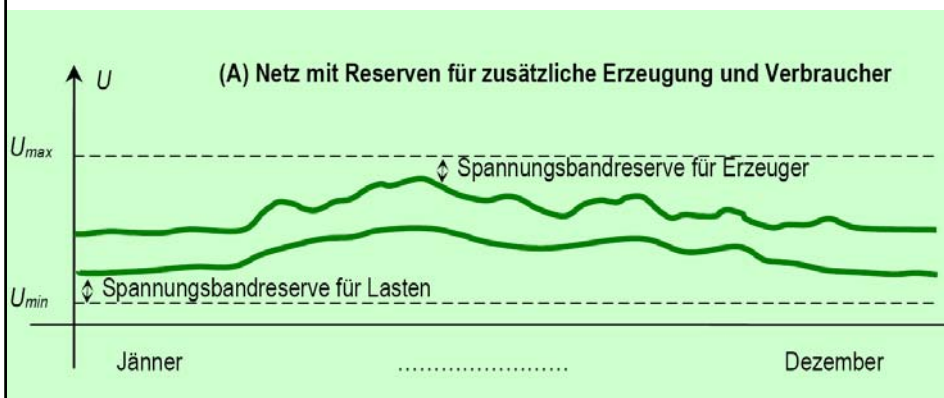
Reserves in voltage band



Quelle: Leitfaden für den Weg zum aktiven Verteilnetz
Berichte aus Energie und Umweltforschung 134a/2008 bm vit

Voltage band in medium voltage (10...30 kV) grids over a year

enough reserve!

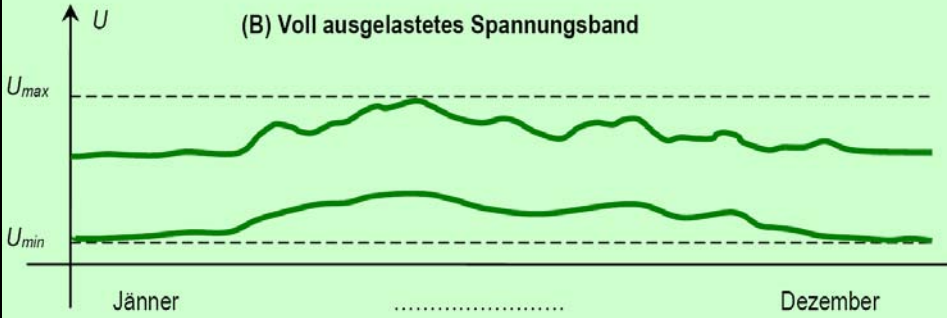


Quelle: Leitfaden für den Weg zum aktiven Verteilnetz
Berichte aus Energie und Umweltforschung 134a/2008 bm vit

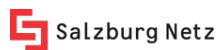
Voltage band in medium voltage (10...30 kV) grids over a year



no reserve! – need to enforce grid!



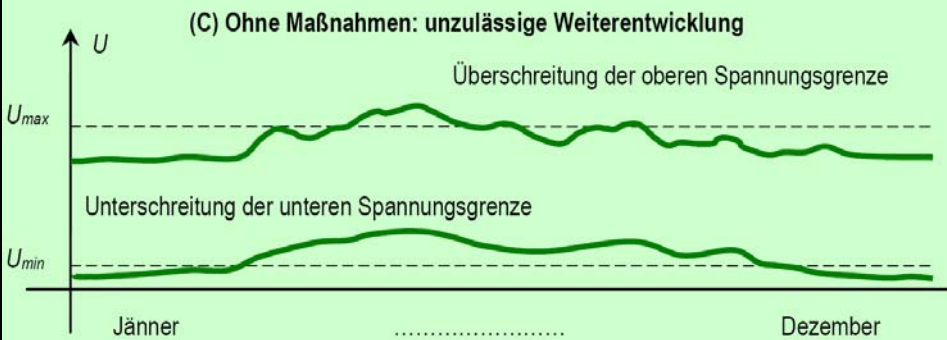
Quelle: Leitfaden für den Weg zum aktiven Verteilnetz
Berichte aus Energie und Umweltforschung 134a/2008 bm vit



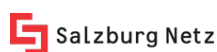
Voltage band in medium voltage (10...30 kV) grids over a year



no reserve...voltage out of band! – urgent need to enforce grid!

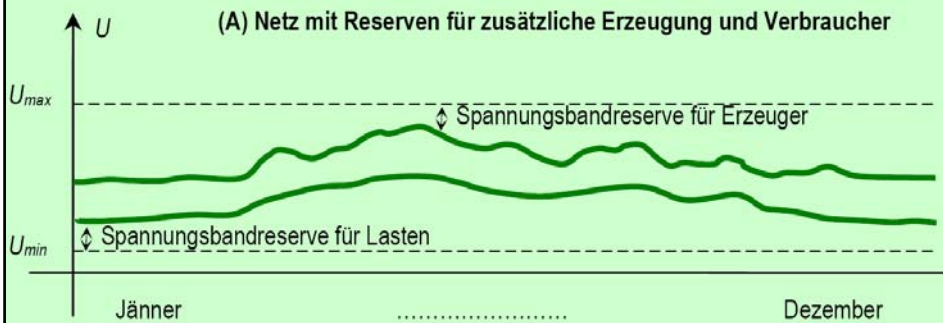


Quelle: Leitfaden für den Weg zum aktiven Verteilnetz
Berichte aus Energie und Umweltforschung 134a/2008 bm vit



Voltage band in medium voltage (10...30 kV) grids over a year

enough reserve after reinforcement of grid by additional Lines!



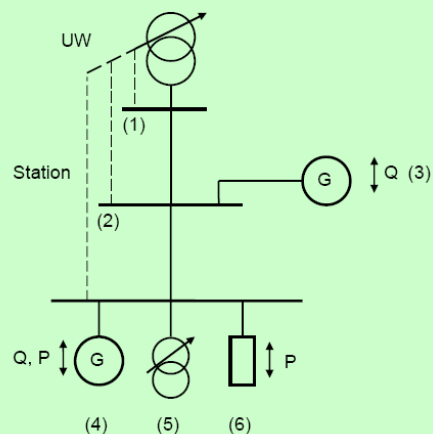
Quelle: Leitfaden für den Weg zum aktiven Verteilnetz
Berichte aus Energie und Umweltforschung 134a/2008 bm vit

Optimizing voltage regulation

Spannungshaltung

In der Zeichnung rechts ist der im Rahmen des Projektes „DG DemoNetz-Konzept“ erarbeitete Maßnahmenkatalog als Prinzipschaltbild dargestellt. Die Darstellung folgt dem Prinzip „vom Groben (oben) ins Feine (unten)“.

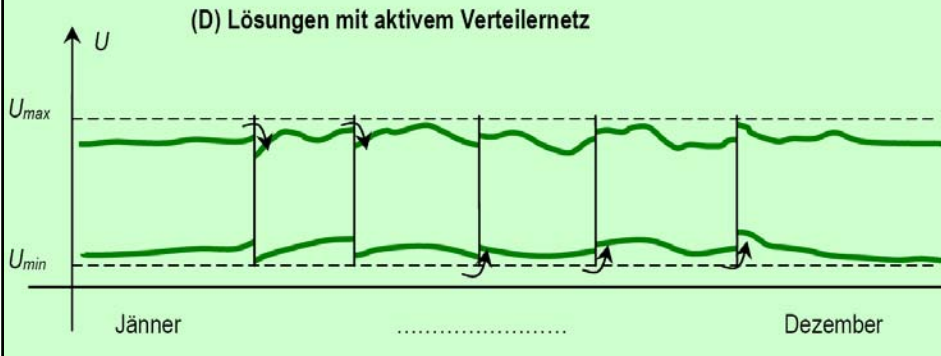
- (1) Regelung durch Stufentrafo aufgrund der Spannung an der Sammelschiene des Umspannwerkes
- (2) Regelung durch Stufentrafo aufgrund von Messwerten von kritischen Knoten im Netzabschnitt
- (3) Lokale Spannungsregelung an kritischen Knoten durch Blindleistungsregelung an Erzeugeranlagen
- (4) Lokale Spannungsregelung an kritischen Knoten durch Wirkleistungsregelung an Erzeugeranlagen
- (5) Nachregelung durch stellbare Trafos (MS/MS, MS/NS)
- (6) Lokale Spannungsregelung an kritischen Knoten durch Lastmanagement.



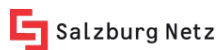
Voltage band in medium voltage (10...30 kV) grids over a year

DG DEMO 

enough reserve after implementing a voltage regulation system!



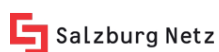
Quelle: Leitfaden für den Weg zum aktiven Verteilernetz
Berichte aus Energie und Umweltforschung 134a/2008 bm vit





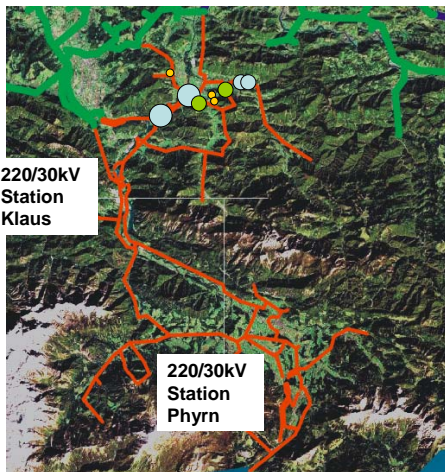


DG-Demonet Concept AREA
Energie AG-Netz



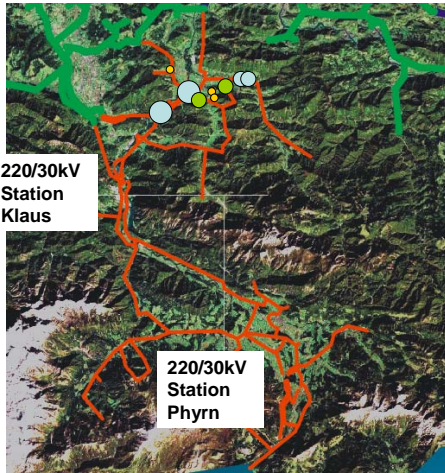


- 439.600 Customers
6,8 GWh/a
- 42 Stations
110/220 kV / 10...30 kV
- 4 110 kV-switching stations
- 8500 30/0.4 kV Substations
- Almost 9000 km lines (110 kV & 30 kV) about 20% cables
- Almost 21.000 km lines (LV) about 60% cables



DG DemoNet Area

- AREA: 709 km²
- residents: 18.300
- Population density: 26 / km²

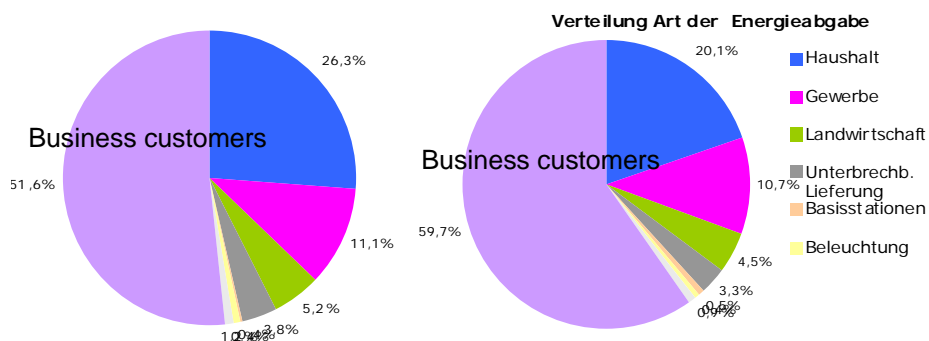


Branch with increased DG units

- AREA: 191,4 km²
- residents: 3700
- Population density: 19 / km²
- 70% wood and 20% agriculture

DG Demonet Area Facts

Data for the station KLAUS and the branch with increasing DG
 3,82... 9,52 MW 1,34...5,47 MW

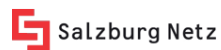
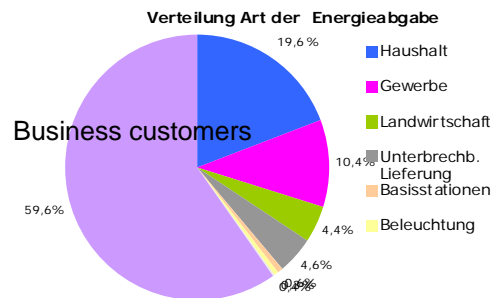


DG Demonet Area Facts



Data for the station PHYRN

1,55...9,03 MW



DG DemoNet Area Facts



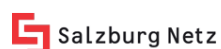
Data for the branch with increasing DG

Electric Power and Energy in the DG DemoNet area today:

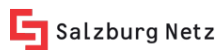
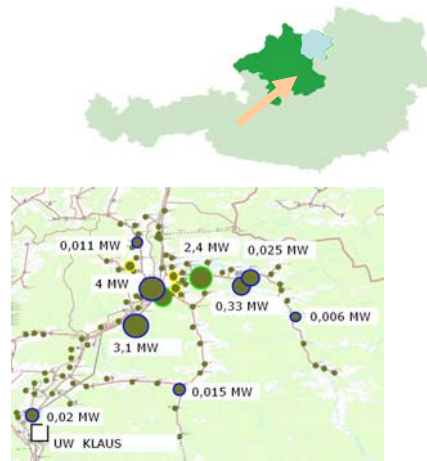
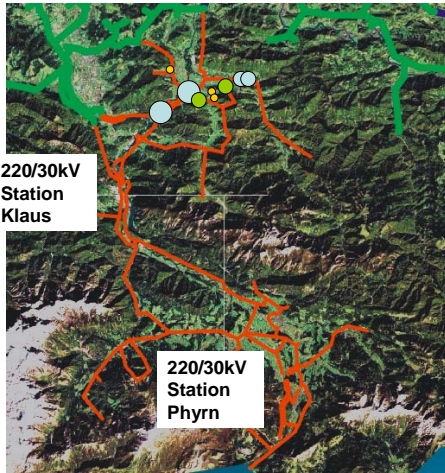
- 5,5 MW 15-min AVG peak load 10,3 MW installed DG-Power
- 32,8 GWh loads 37,6 GWh generation

Electric Power and Energy in the DG DemoNet future scenario:

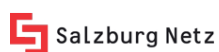
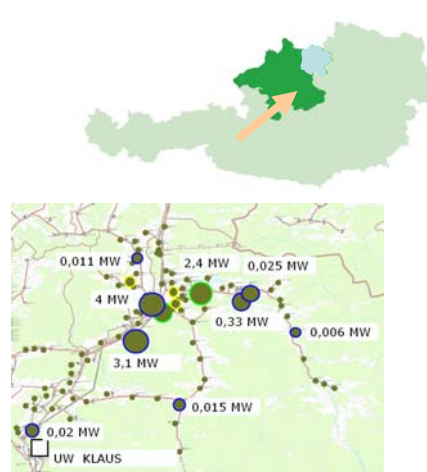
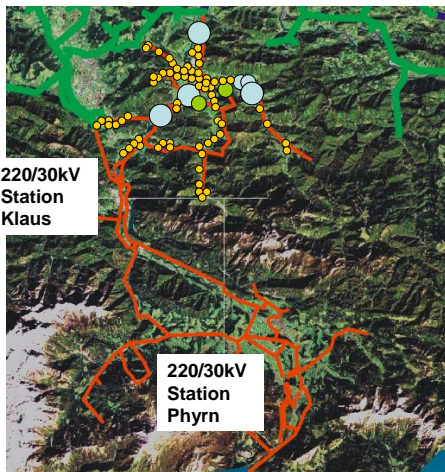
- 7,5 MW 15-min AVG peak load 26,5 MW installed DG-Power
- 44,3 GWh loads 88,75 GWh generation
 - PV: ca. 900 plants 3,5 MW installed power
1000 equivalent hours of full load :3,15 GWh/a
 - Biogas- und Biomass plants :10 2,5 MW installed power
8000 equivalent hours of full load : 20 GWh
 - Hydropowerplant:6 MW, 28 GWh/a

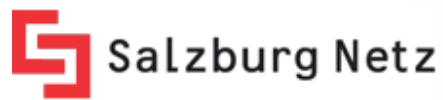


Experience of DNO

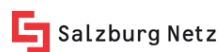


Experience of DNO



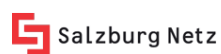


DG DemoNet-Concept AREA Salzburg Netz

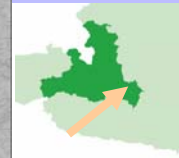
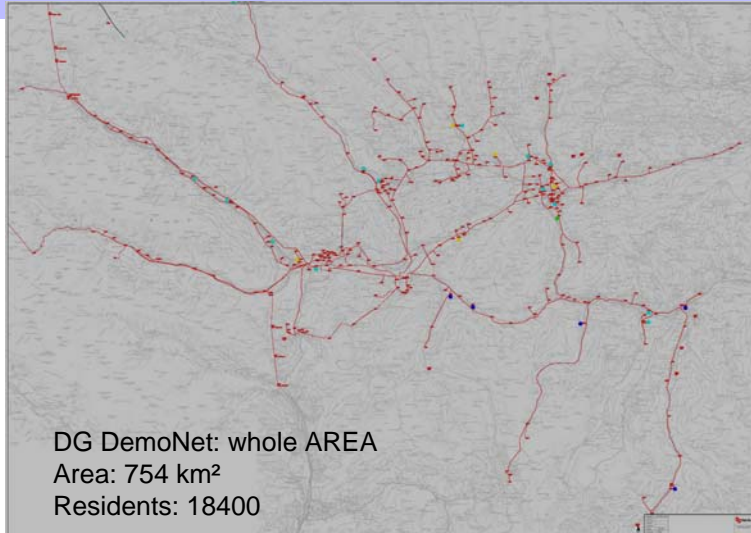
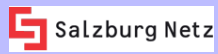


Experience of DNO

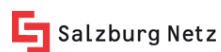
Stromnetz	2006
Netzabgabe	4.015,38 GWh
Anzahl der Kundenanlagen	375.141
Leitungs-km	
110 kV	571 km
30 und 10 kV	4.112 km
davon Fremd	47 km
0,4 kV	10.576 km
davon Fremd	2.449 km
Gesamt	15.259 km
davon Fremd	2.493 km
Umspannwerke (110 kV/Mittelspg.)	24
Umspannstationen (30 kV/10 kV)	47
Trafostationen (Mittel-/Niederspg.)	5.044
davon Fremd	330



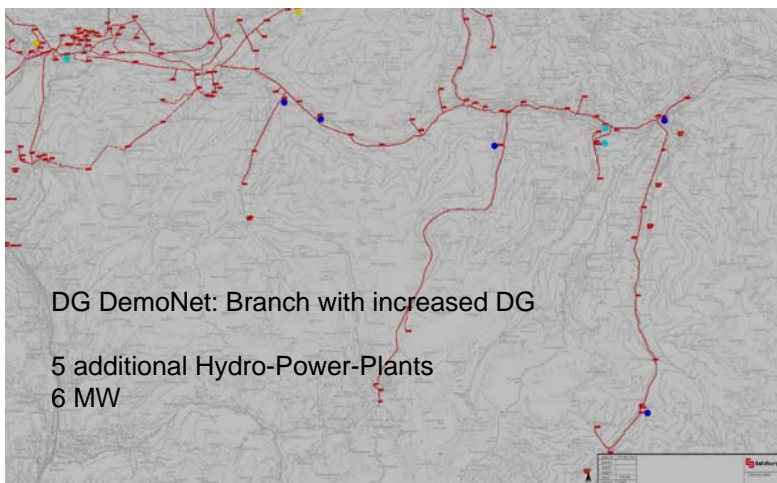
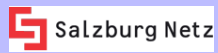
Experience of DNO



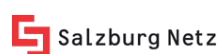
DG DemoNet: whole AREA
Area: 754 km²
Residents: 18400



Experience of DNO

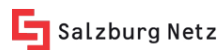


DG DemoNet: Branch with increased DG
5 additional Hydro-Power-Plants
6 MW

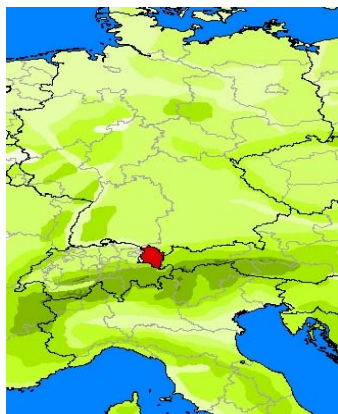




DG-Demonet Concept AREA VKW-Netz

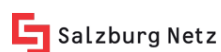


Experiences of the DNO



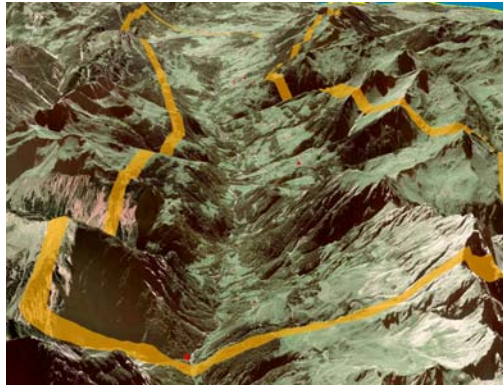
The VKW-Netz AG – Center in Bregenz
(DNO of the most western region of Austria)

Electricity-Supply of 360.000 inhabitants, 184.000 clients, 1.500 DG-Inst.





Country Vorarlberg
366.000 inhabitants



The DG-Demonet-Region „Biosphärenpark
Großes Walsertal“ – alpine region
17 villages - 26.000 inhabitants

DG-Demonet-data	Number	Generation [MW]	Load [MW]	Transformer-stations 30kV
Photovoltaik	116	1,42	50	150
Hydro Power < 10 MW	18	11,87		
Hydro Power > 10MW	1	19,30		
Gas (different types)	4	0,49		
Total	139	33,08		

Situation Großes Walsertal

- No more DG installation is possible
- Main problem ist voltage increase (30kV)
- 2 actual hydropower-projects (2*400kW)
- Other additional DG-projects probable
- Expensive investments upcoming
30kV underground cables 500mm² ALU

Experiences – lessons learned (internal effects 1):

- More work for the planning engineers
- A lot of additional necessary data:
load- and generation profiles (1 year)
- More precise network-models for the simulations (control-circuits)
- But: Simulation results promise additional 10MW Hydropower possible in the DG-Demonet Großes Walsertal by using a new voltage control system
- Another unexpected effect: about 10% more load is possible
- Substitution of cables by control systems are possible and cheaper within ranges in certain situations (high DG-penetration)

Experiences – lessons learned (internal effects 2):

There are also fears of the local operation-units and remaining technical problems to be solved

- The substitution of overhead-lines by underground-cables may be stopped (is not intended generally)
- The network operation may become too complicated
- The failure of the central voltage control unit (CVCU) in the central HV/MV-Substation (110/30kV)
- The failure of local metering-points in the network-area
- Strategies in the case of over- or undervoltage-information to the CVCU by the system

Experiences – lessons learned (external effects):

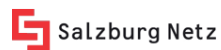
The efforts to solve the new challenges of DG lead to a better image of the DNO seen by:

- + Operators of DG-Installations (lower costs of DG-connection, but also higher costs for better control systems and data-connections)
- + Politics (Ministry for infrastructures), following EU-directives
- + Regulators (ECG)
- + NGO's (environment organisations, Austrian hydro-power-organisation)
- + The own management – CEO's support the research:
Part of our concern-strategy-papers: "DG and their intelligent control in context with load and networks become more important"

Intentions of the DNO



VKW-Netz AG: We want to lead the new voltage control strategy to reality...



Thank you for
your attention!

