IEA DSM Task XVII
Integration of DSM, DG, RES and ES
AUSTRIA

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Task XVII Workshop on Integration of DSM, DG, RES and ES

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Facts and Figures

Control-area managers:		3
Balance-group coordinators (settlement agencies):		2
Registered balance groups:		60
Distribution-system operators:		133
Nationwide electricity suppliers:	approx.	10
Consumers:	approx.	4 million
Annual demand:	approx.	60 TWh
Installed generating capacity:	approx.	18,000 MW
Peak load:	approx.	9,000 MW

(2005)

Energy situation

- Renewable energy sources in Austria and the EU

2005	Austria*	EU-27**
Gross domestic consumption	1,440 PJ	68,500 PJ
whereof renewables	21.4%	6.6%
Electricity consumption	69 TWh	3,310 TWh
whereof renewables	59%	14%

*Sources: Statistics Austria and E-Control
**Source: Eurostat

Electrical Energy demand

- Electricity balance

	in petajoules	in TWh
Electricity[2]		
Domestic electricity consumption[3]	236	65.6
Net electricity imports	11	3.1
Hydro[4]	129	35.7
Thermal	93	25,9
whereof biomass and biogas	4	1.2
Wind	5	1.3

[1] After conversion and conversion losses
[2] Data from E-Control
[3] Excl. pumped storage
[4] Energy capability factor in 2005: 0.98

[June 2007 | Sources: Statistics Austria and E-Control]

Power Plants in Austria

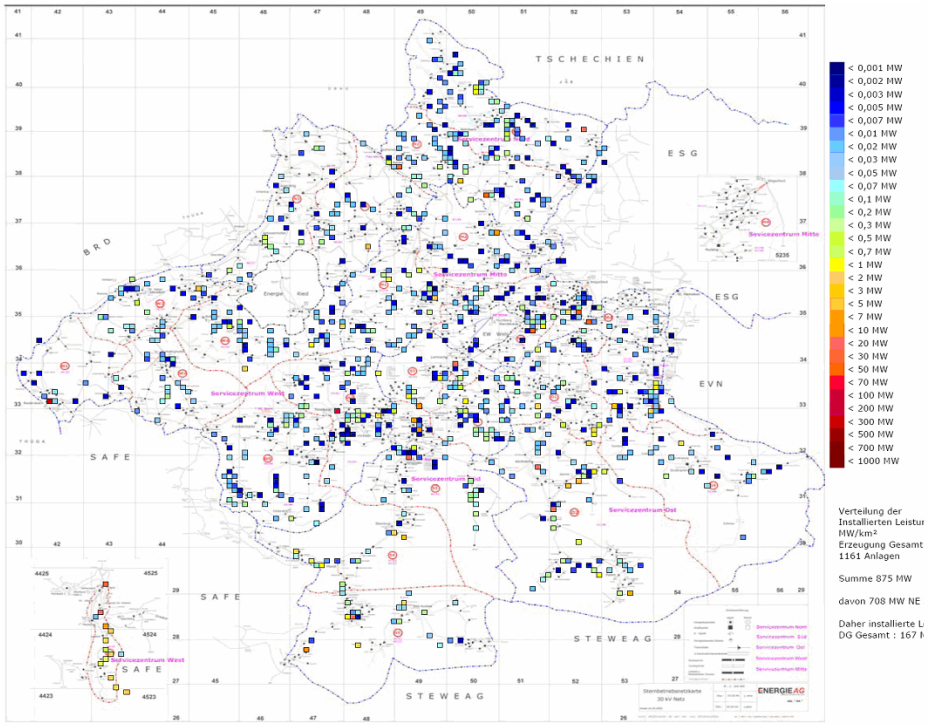
- Present aggregated capacity (2007)

maximum capacity class		maximum capacity in MW						
from ... MW	incl. ... MW	run-of-river plant	pumped hydro	hydro	caloric plant	renewable	others	sum
	1,0	115	6	121	8	8	-	136
1,0	2,5	222	17	239	98	57	-	394
2,5	5,0	192	22	214	146	62	-	421
5,0	10,0	203	104	307	163	143	-	614
< 10 MW		732	149	881	414	271		1.565
10	20	498	180	678	234	422	-	1.334
20	30	469	296	765	310		-	
30	40	177	204	381	329	276	-	
40	50	485	189	674			-	5.342
50	80	496	415	910	1.069	-	-	
80	100	264	364	628		-	-	
100	200	706	815	1.521	1.106	-	-	2.626
200	300	1.027	1.515	2.542	1.349	-	-	3.891
300		328	2.327	2.655	1.447	-	-	4.102
> 10 MW		4.449	6.305	10.754	5.844	699		17.296
collected plants		5.181	6.454	11.634	6.258	969	-	18.861
stat. Difference (1)				218	87	16	k.A.	321
sum		5.181	6.454	11.853	6.344	985	k.A.	19.182

(1) Estimation for plants with a maximum capacity < 1 MW, for which the plant type could not be classified clearly.

DG in Austria

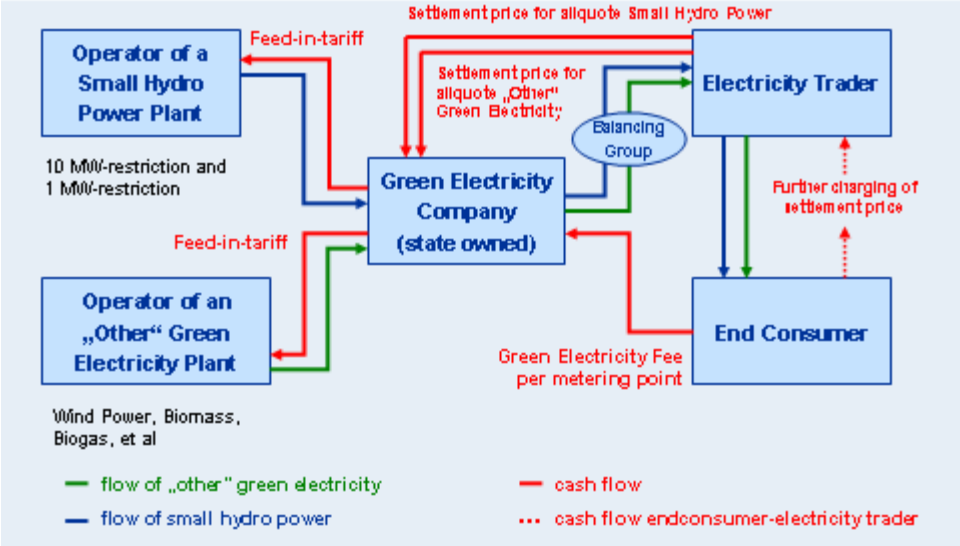
Upper Austria (Energie AG) / Lower Austria (EVN)



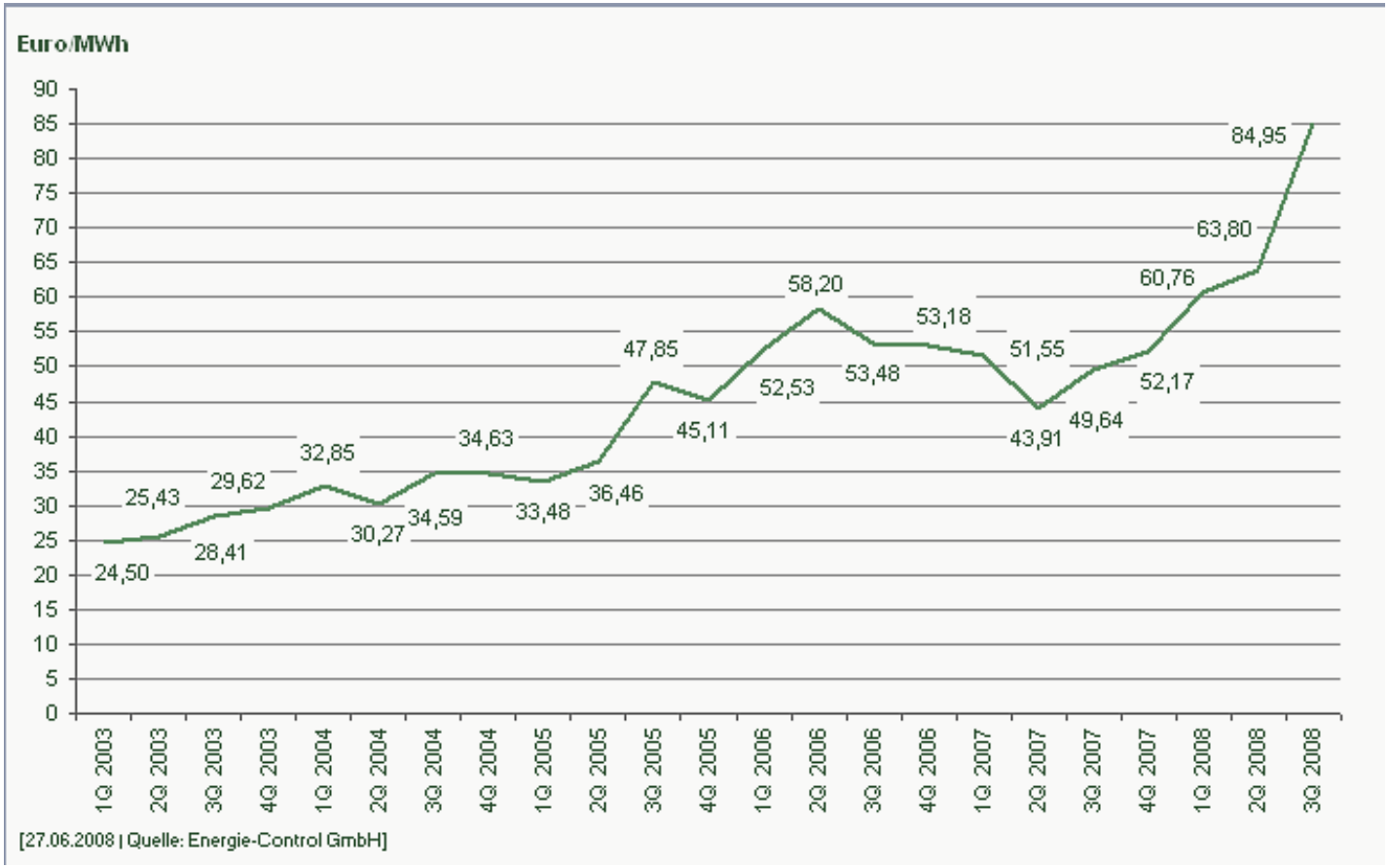
Upper Austria: 167 MW DG (875 MW total)

Policies, driving forces, Markets

- Green Electricity Act (Amendment 2008)
- Clearing Agency for Green Electricity (OeMAG)

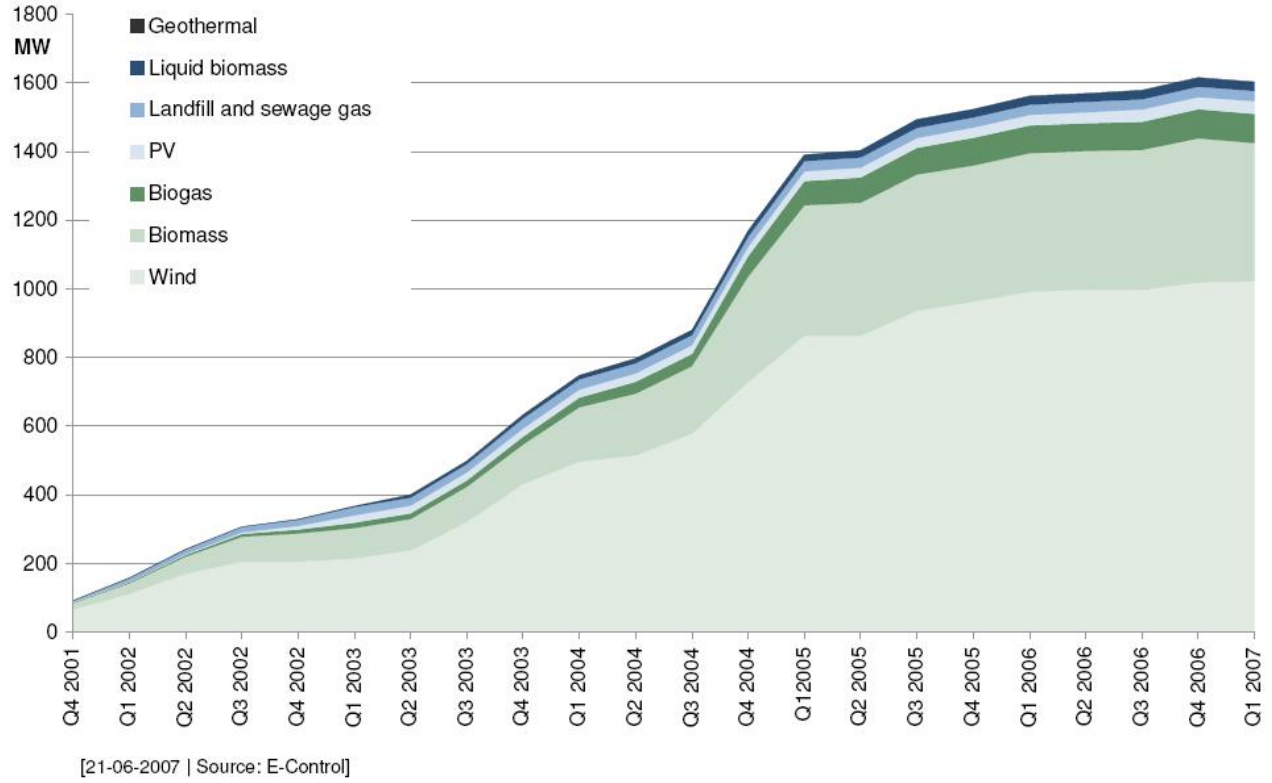


Electricity market price
Development 2003 - 2008



Status and targets for DG, RES, DR/DSM

Evolution of accredited renewable generating capacity, 2002-2007



[21-06-2007 | Source: E-Control]

Status and targets for DG, RES, DR/DSM

Supported renewable electricity output, 2002-2008 (est.)

Supported renewable electricity output [in GWh]							
Energy sources	*2002*	*2003*	*2004*	*2005*	*2006*	*2007e (Nov. 2006)*	*2008e (Aug. 2007)*
Wind	203	366	924	1,328	1,738	2,077	2,100
Solid biomass	95	99	313	553	1,086	2,003	2,000
Biogas	20	42	102	220	358	522	500
Liquid biomass	3	2	18	33	54	120	90
PV	3	11	12	13	13	13	14
Other supported renewable electricity	88	78	76	65	55 [1]	88 [1]	51 [1]
Total "other" renewable electricity	**412**	**598**	**1,445**	**2,212**	**3,304**	**4,823**	**4,755**
Small hydro (supported)	4,243	3,386	3,995	3,561	1,806 [1]	2,000 [1]	1,600 [1]
Total supported renewable electricity	**4,655**	**3,984**	**5,440**	**5,773**	**5,110**	**6,823**	**6,355**

[1] A considerable proportion of the small hydro (and landfill and sewage gas) capacity has been withdrawn from the support system because of higher price realisations on the free market

[29-08-2007 | Sources: E-Control and OeMAG]

Projects on Integration of DER / Smart Grids

- DG DemoNet
- Virtual Green Power Plant
- Smart Meter Field Test (3 DNO)
- SimTech Laboratory
- Austria Technology Platform Smart Grids
- PV-Store – PV Systems and VRB Battery

Projects on Integration of DSM with DG/RES/ES

- **Studies on Potentials**
  - end customers: refrigerators, boilers
  - wind integration and load management
  - supermarkets (electrical cooling and heating potential)
  - potentials and barriers for power DSM in Austria
- **Research Projects**
  - Simulation: Virtual power plant and DSM
    → next phase implementation: Virtual Green Power Plant
  - ICT / Information and Communication – IRON Concept
    → next phase implementation

Wind and DSM
Potentials

Requirements for balancing 2015:

Austria: total 2GW / share 4% → 19,4% max, 9% avg

Germany: total 30GW / share 18% → 15% max, 8% avg

Potentials:

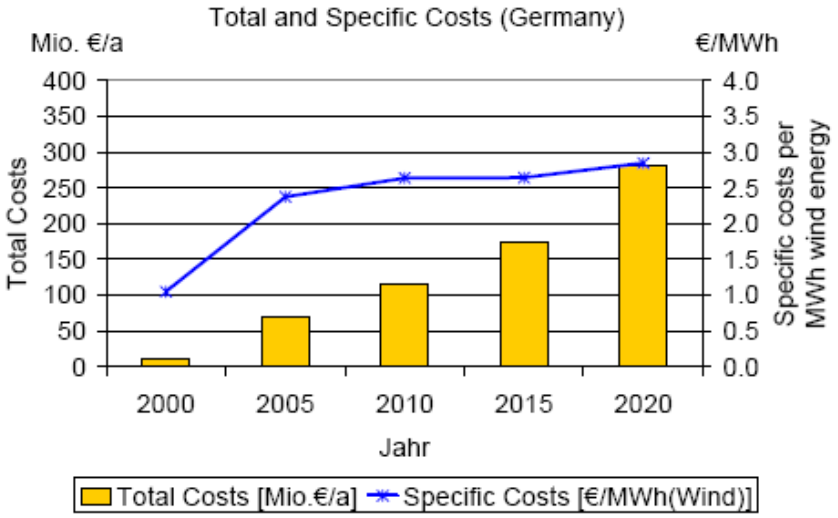
Sector	Appliance	Category – Austria		Category – Germany	
		Storage	Flexible	Storage	Flexible
Residential	refrigeration	2.2 TWh		16 TWh	
	washing		0.7 TWh		4 TWh
	drying		0.3 TWh		5 TWh
	dishwashing		0.7 TWh		4 TWh
Tertiary	refrigeration	1 TWh		12 TWh	
	ventilation		2 TWh		11.4 TWh
Industry	refrigeration	2.3 TWh		20 TWh	
	ventilation		2.1 TWh		20 TWh
	processes			4 TWh	32 TWh

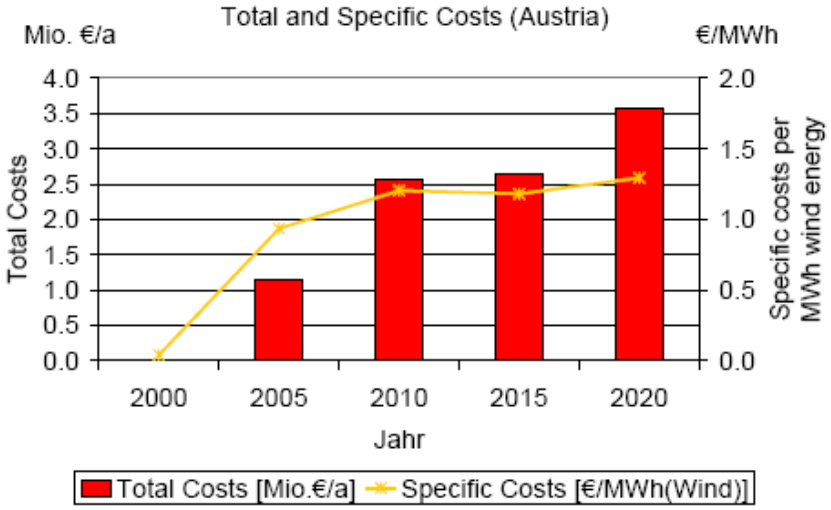
Source: ISI database, [11]

Wind and DSM

additional balancing power / costs

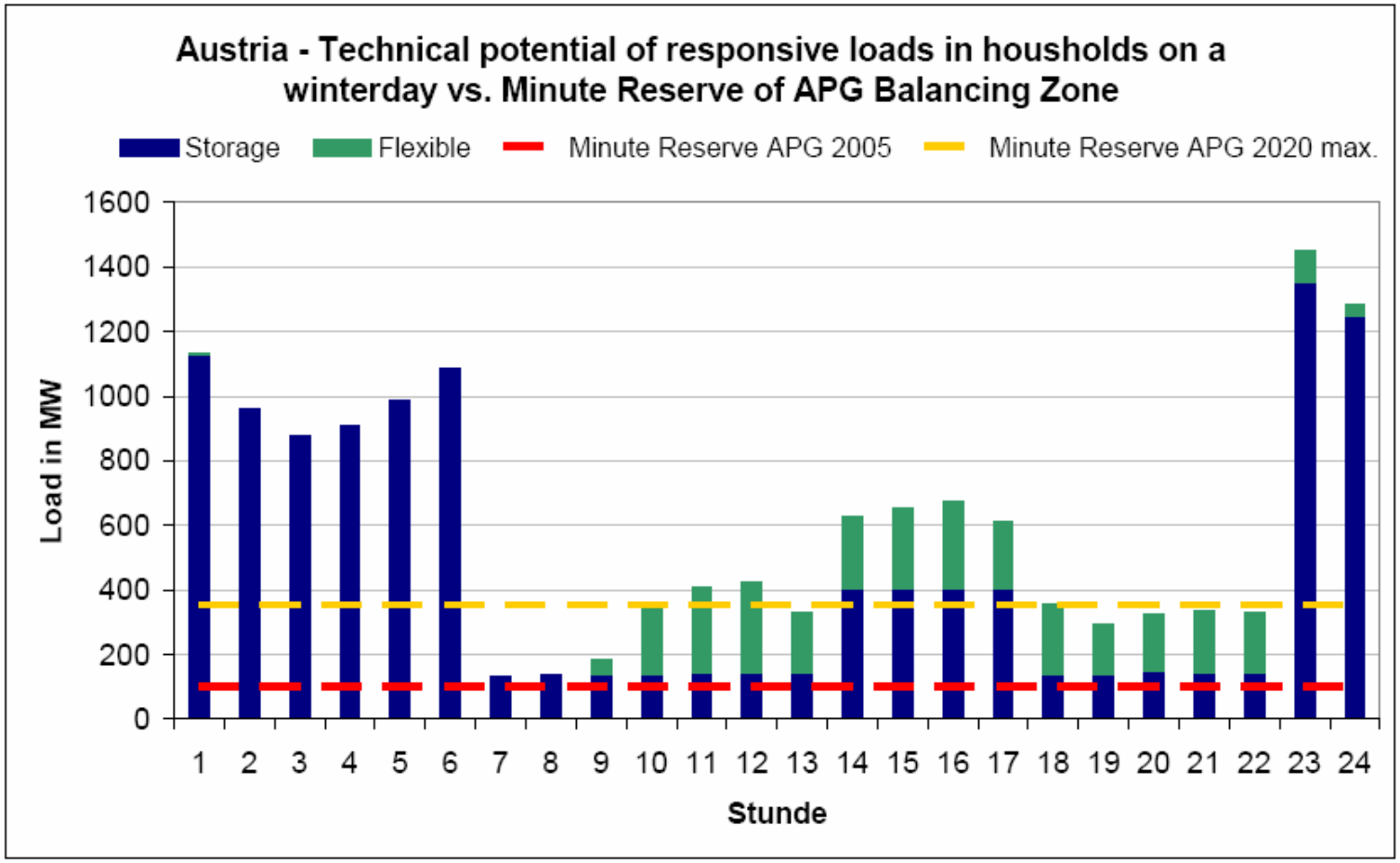
Country	Year	Additional minute reserve	Capacity installed
Austria	2005	90 MW	650 MW
	2020	250 MW	1.500 MW
Germany	2005	1.500 MW	17.000 MW
	2020	6.000 MW	36.000 MW





Wind and DSM

potential of responsive load



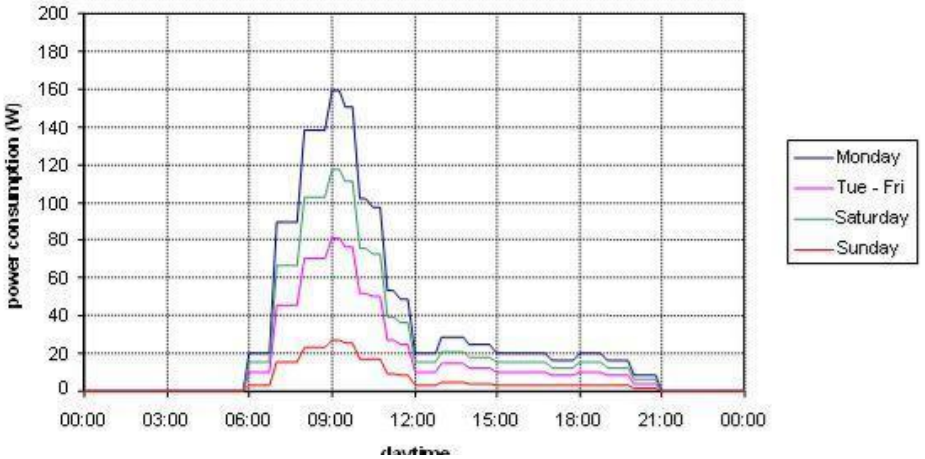
Wind and DSM
Conclusions

- Most critical are the **accuracy of the forecast** and **forecast window** determined by the the spot-market.
- Responsibility for balancing power:
  - TSO → costs are socialized
  - Treated like other generation and is program responsible
    → PRP bearing the costs of imbalances (Spain, Netherlands?)
- DR Potentials in Austria (and Germany) high enough to cope with future requirements

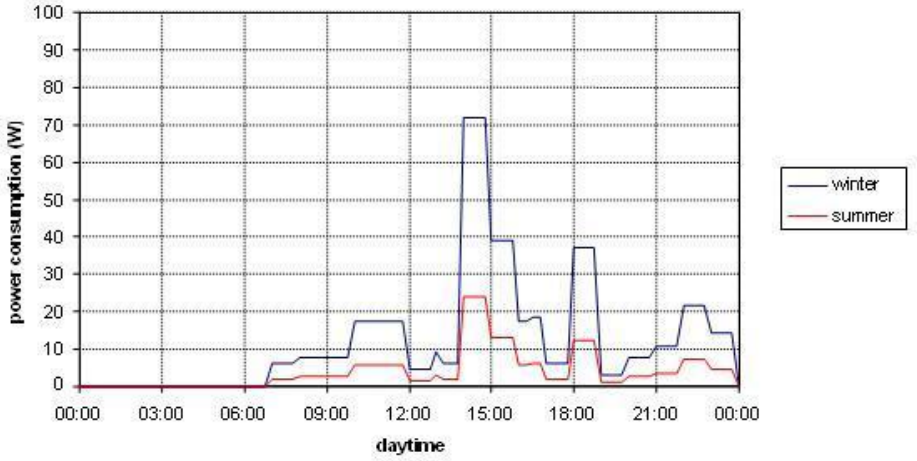
Balancing of Fluctuating Regenerative Gen. by DSM

Demand characteristics

- washing machines



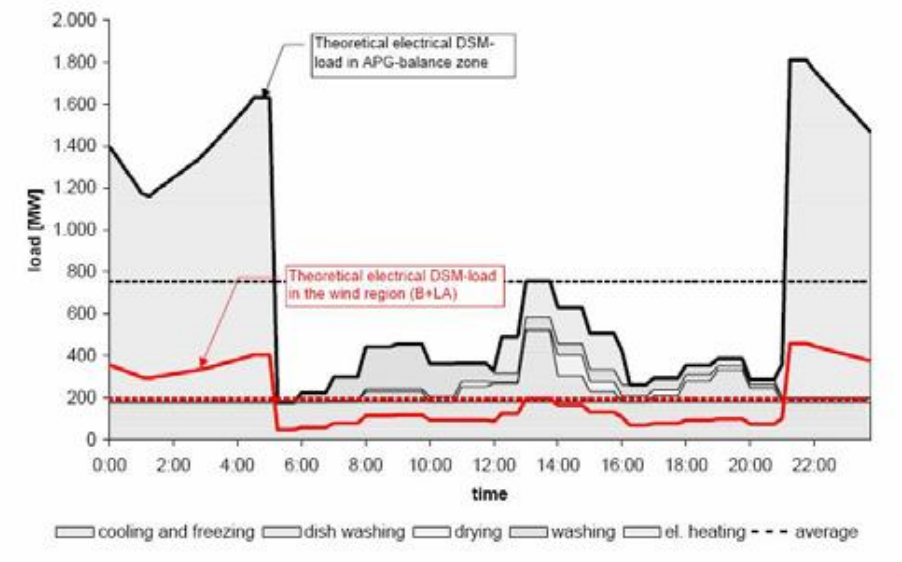
- dryers



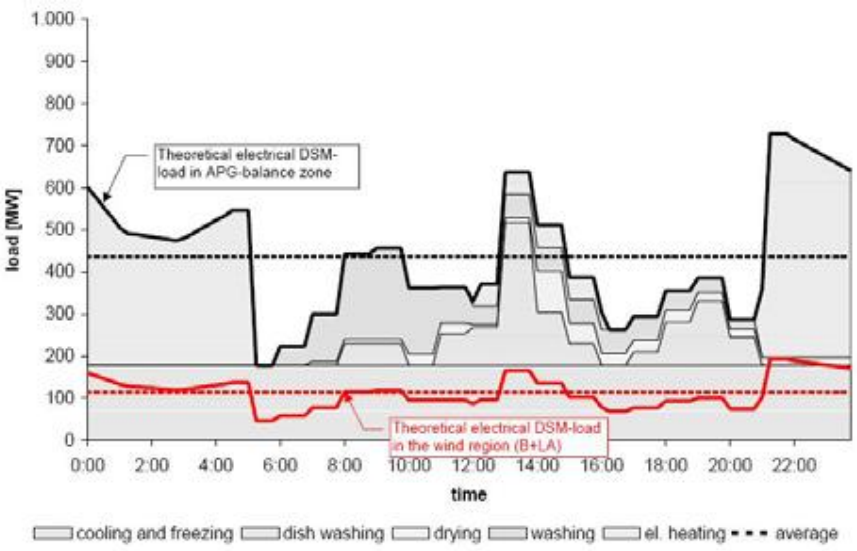
Balancing of Fluctuating Regenerative Generation

Theoretical DSM-Potential in Austria (1)

- winter day



- summer day



Balancing of Fluctuating Regenerative Generation

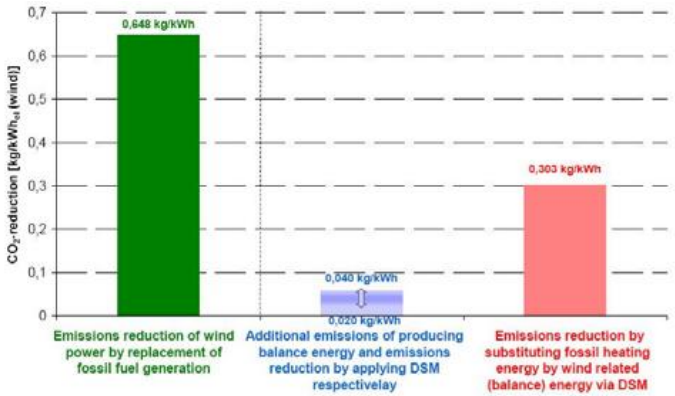
Theoretical DSM-Potential in Austria (2)

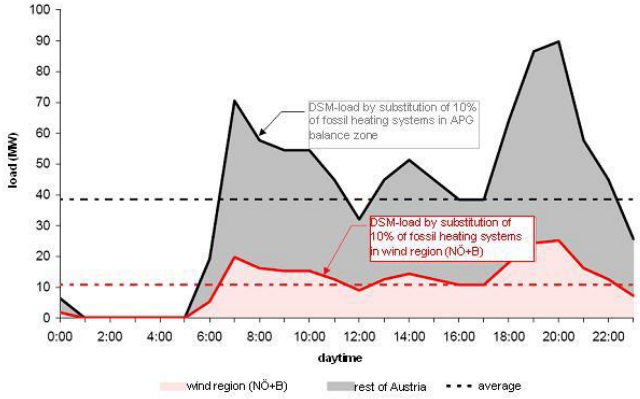
- Large **daily** and **seasonal variations** for DSM in household applications – (760 MW winter / 360 MW summer)
- Main part are **refridgerators** and **freezers** – 180 MW base load
- **Heating applications** dominate the potential – fact of fundamental seasonal variations of DSM load
- **Austrian Wind region**: avg of 200 MW on winter days and 90 MW on summer days
  - without heating: 80 MW per day.

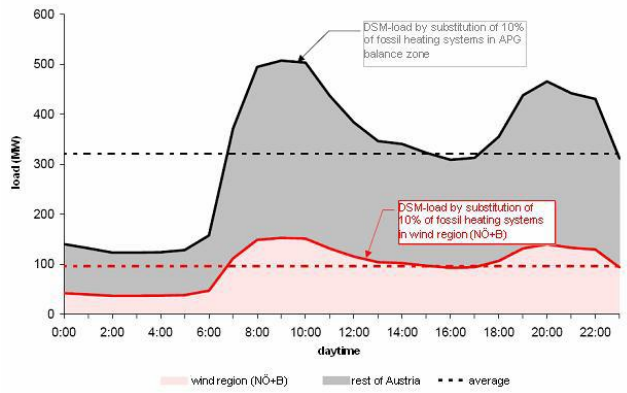
Balancing of Fluctuating Regenerative Generation

Substitution on fossil heating systems

- Fictive DSM load: substitutes 10% of heating systems (bivalent)
- CO2 saving: fluctuation can be balanced locally „Virtual oil source“



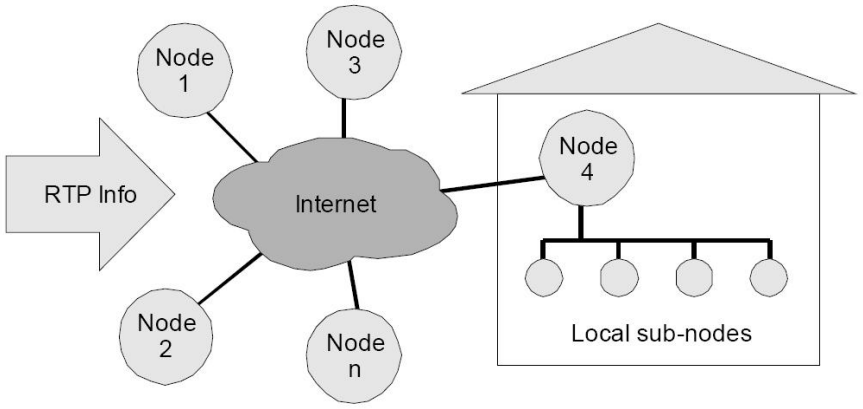




IRON - Integral Resource Optimization Network Study

Integration

- **„Intelligent“ consumers**: appliances know in advance how much energy they will consume in the future (e.g. washing machine)
- „**Virtual“ energy storages**: flexible loads or consumers which can store energy (e.g. heating / cooling devices)



IRON - Integral Resource Optimization Network Study

Market scenarios

- **Private company:** acts as an energy supplier with time-variable tariffs or prices
- (Distribution) **grid operator:** uses load shedding to actively manage the grid and to provide new services
- Embedded into national energy **economic strategies** (similar to the dedicated economic structure of the green balance zone)

Conclusions

Barriers from the DNO point of view

- Interruptable supply for heating / heat pump
  - → not a big deal for DNOs
  - → not interuptable at any time
- High/low tariffs → rent for 2nd meter too expensive

„The lack of a capacity dependent tariff including the consideration of the daytime of the demand is identified as a barrier for the efficiency enhancement of the electricity system, because there exist no tariff incentives for the demand side measurements to reduce peak demand“

Outlooks

- Infrastructure:
  - Communication Network parallel to electricity network will emerge
- Technology:
  - Feasibility and DR capable device costs
- Regulatory:
  - incentives on efficiency (peak avoiding, mitigation of fluctuations)
  - feed in tariffs vs. program responsibility (PR party)
- Economically:
  - Spot market – real time trading
  - Tariffs – demand and power dependent (instead of energy)

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