

NATIONAL FORUM FOR DEMAND SIDE OPERABILITY

**Workshop organized by
RED ELECTRICA
and IEA**



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Large Power Users Responsiveness to DSM

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Large Power Users Responsiveness to DSM

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- **PRAXAIR at-a-glance**
- **Is an effective demand side response possible?**
- **Different customers' attitudes**
- **Need for adequate economic signaling**



Praxair at-a-Glance

- **One of the 3 largest industrial gases companies in the world. The largest in North and South America**
- **World's largest supplier of carbon dioxide**
- **Operations in 40 countries**
- **27,000 employees worldwide**
- **About 3,000 active patents**
- **More than 800.000 customers worldwide**
- **Sales in 2004 \$6,5 billion**



Products and delivery options

- > **Packaged Gases (cylinders)**
 - industrial, medical and specialty gases

- > **Bulk Liquid Gases (trucks)**
 - oxygen, nitrogen, argon, carbon dioxide, hydrogen, helium

- > **On-Site Plants**
 - Cryogenic: oxygen, nitrogen, argon
 - Non-cryogenic: membrane nitrogen, VPSA oxygen
 - Process gases: hydrogen, helium, carbon dioxide

- > **Pipeline Distribution**
 - oxygen, nitrogen, hydrogen, carbon monoxide, air

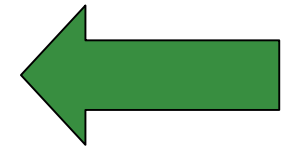




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Is a demand side response possible?

Of course it is!

- **Responsiveness depends basically on economic return**
- **Short term elasticity is not the same for every industrial process. Price signals are perceived differently**
- **To be prepared to keep under control load, consumers should adapt their supply chains to ensure that a change in production will not affect deliveries to customers**
 - **This involves capital expenditure for: additional production capacity, back up systems and extra inventories**
 - **It also requires operational expertise and sophisticated control systems to run the plants quickly and safely in changing modes**



26 27 28 29 30

Potencia Consumo

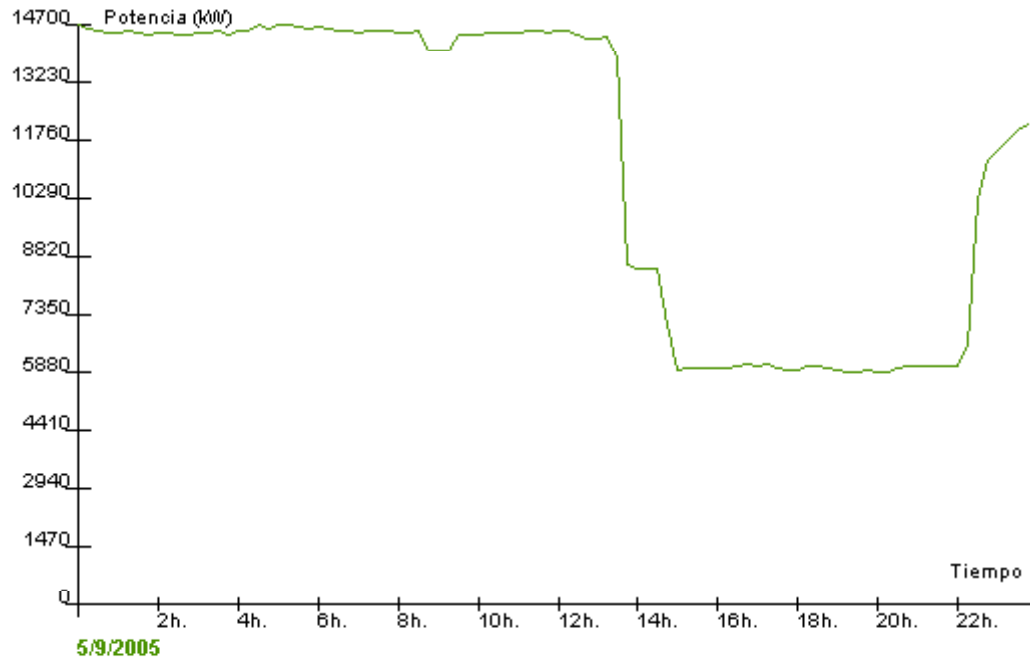
Semanal Diario

Activa Reactiva

Buscar >

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Mínimo	5888	5/9/2005	19:15
Medio	11323		

Imprimir Gráfico



Example 1

15 MW Air Separation Unit

**Free choice
changeover to
avoid peak price**

Reduction step: 60%
Low time: 7 hours
Ramping down: 10 min
Ramping up: 20 min



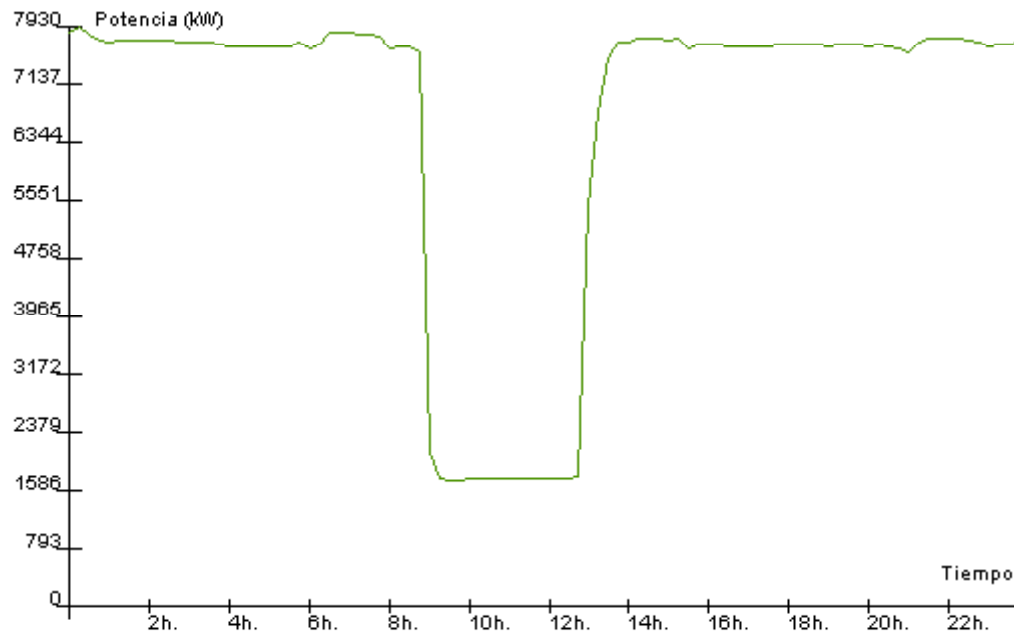
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Potencia Consumo
 Semanal Diario
 Activa Reactiva
[Buscar >](#)

LECTURAS

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Mínimo	1736	27/7/2005	09:30
Medio	6683		

Imprimir Gráfico



27/7/2005

Example 2
8 MW Air Separation Unit

**Free choice
 changeover to
 avoid peak price**

Reduction step: 80%
Low time: 4 hours
Ramping down: 3 min
Ramping up: 20 min

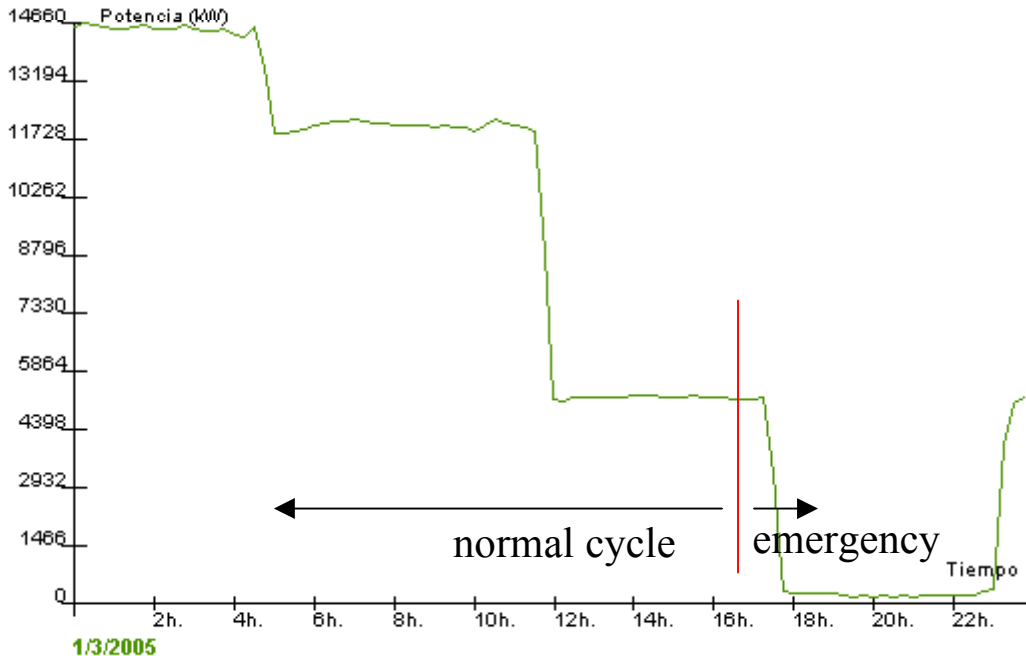


14 15 16 17 18 19 20
 21 22 23 24 25 26 27
 28 29 30 31

Potencia Consumo
 Semanal Diario
 Activa Reactiva

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Mínimo	172	1/3/2005	19:30
Medio	7926		

Imprimir Gráfico



Example 3
15 MW Air Separation Unit

Shutdown to comply with a curtailment signal from System Operator

Reduction:	95%
Low time:	3 hours
Ramping down:	3 min
Ramping up:	20 min

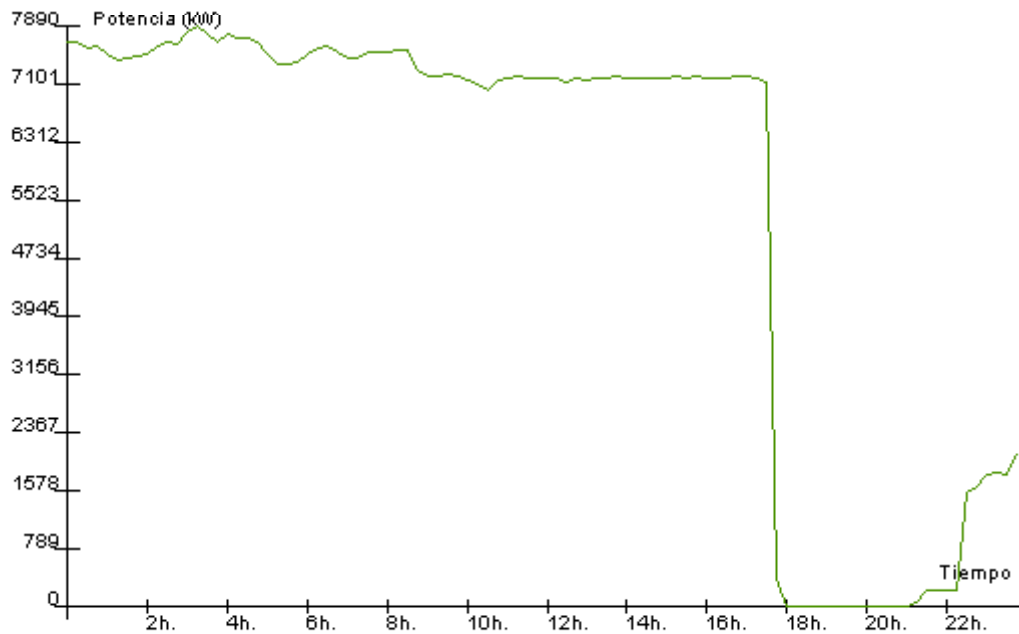


14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Potencia Consumo
 Semanal Diario
 Activa Reactiva
Buscar >

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Medio	5583		

Imprimir Gráfico



1/3/2005

Example 4

8 MW Air Separation Unit

Shutdown to comply with a curtailment signal from System Operator

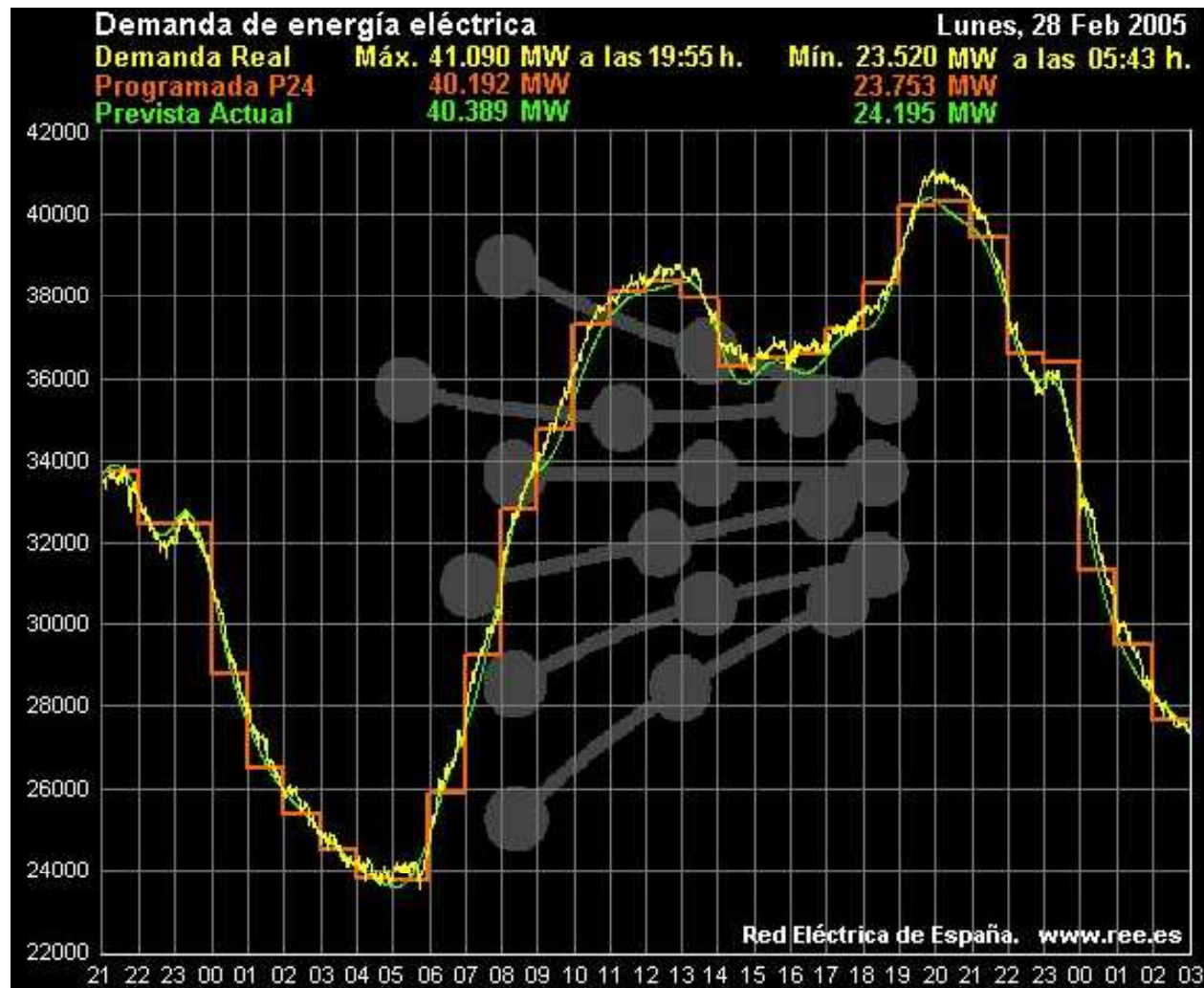
Reduction:	100%
Low time:	3 hours
Ramping down:	3 min
Ramping up:	60 min



Is it effective ?

March 1st 2005

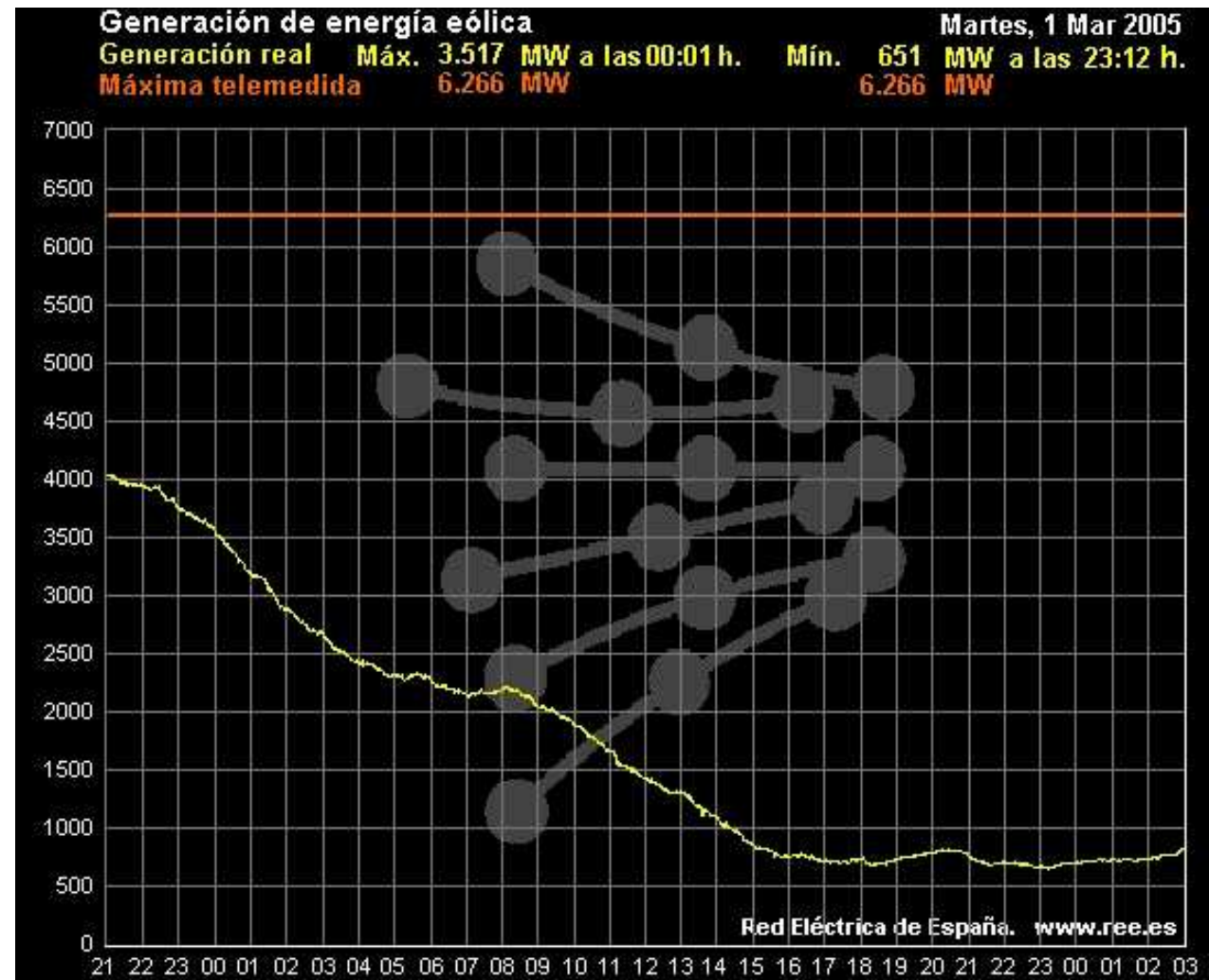
- The system faced a winter peak (the day before peak load reached 41.090 MW) short of natural gas supply to CCGTs
- Unplanned outages of thermal units were slightly above normal





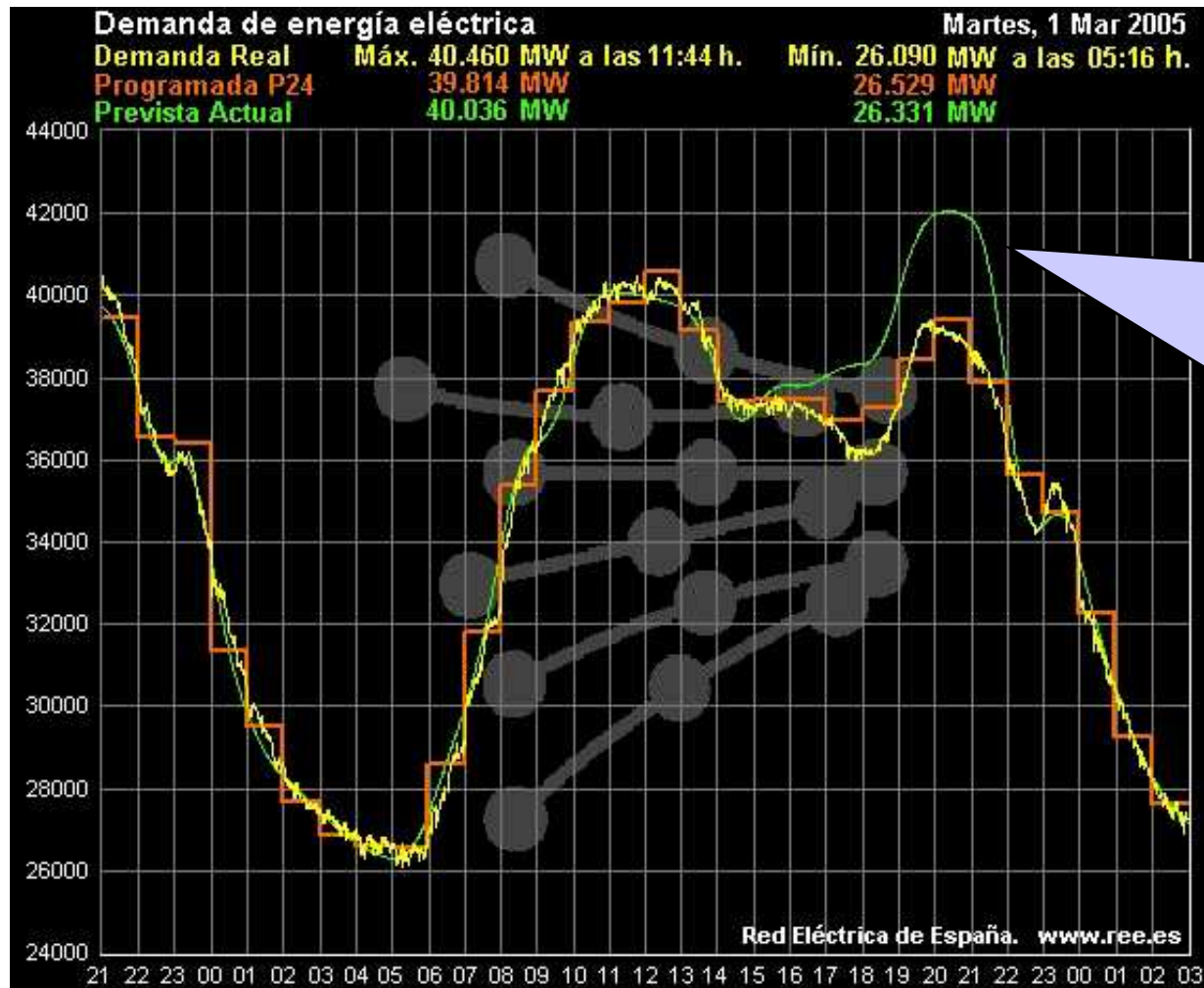
Is it effective ?

March 1st 2005
... as the wind
stopped blowing





Yes, it is!



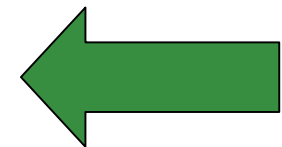
- Curtailment to industrial customers was key to restore national operational reserve
- Approximately 2.000 MW were obtained country-wide through interruptible contracts



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Different customers' attitudes

- Elasticity to price signals vary significantly from one customer to another. A diverse perception of how supply and lack-of-supply costs impact ordinary activities result in very different attitudes in the face of DSM economic signals. As a first approach:
 - Companies that are (more or less) able to transfer an increase in production costs to their sales prices, would manage DSM simply as an opportunity for obtaining higher economic efficiencies. The share of power in variable costs defines the strength of actions
 - Discontinuity of power supply in certain industrial processes result in exorbitant production costs, and those companies will refrain from adopting initiatives for DSM
- However competition changes dramatically the outlook. Companies exposed to open markets are forced to explore any measure to remain competitive. Although power may not be among main supplies, and on-off cycles always result in increasing complexity to the operations, DSM may be in those cases indispensable



Different customers' attitudes

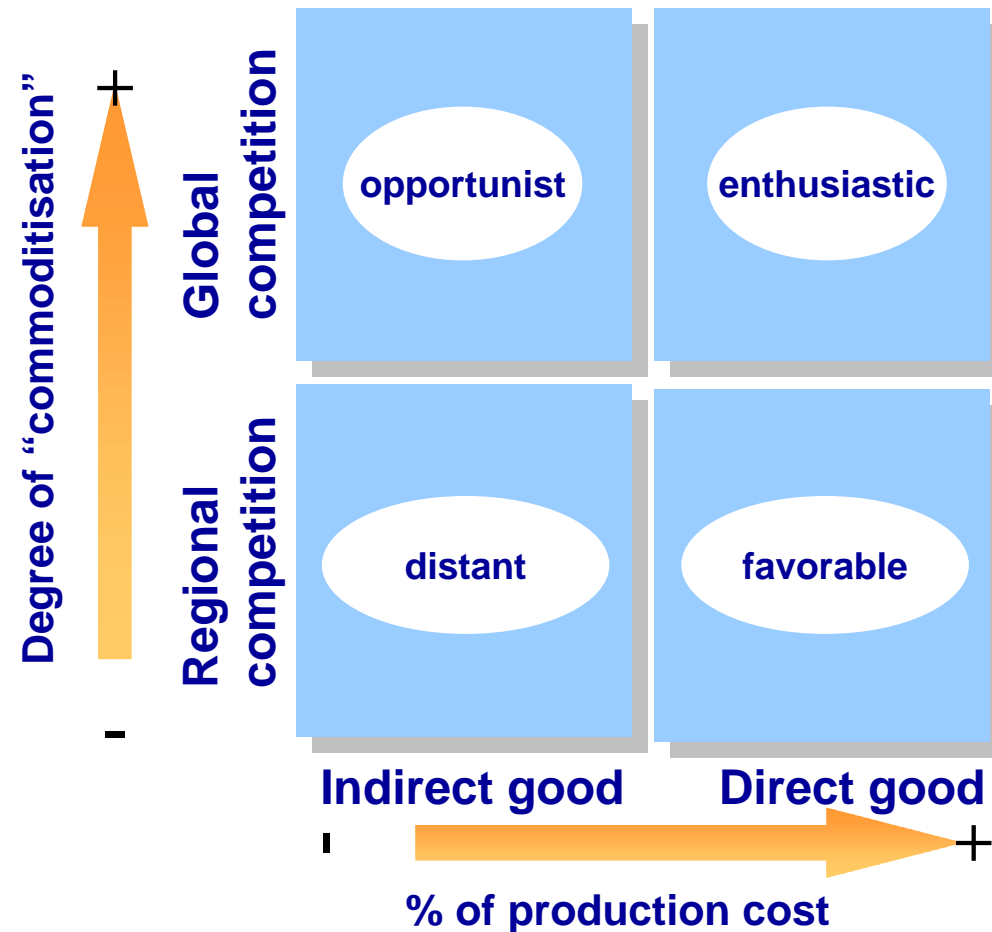
- In conclusion, a user's propensity to participate on DSM may be predicted from the significance of power sourcing to the following attributes
 - **The role of electricity as a production input**

Is electricity used as a “direct good”? i.e. is it mixed in specific quantities in final products? or is it used as an “indirect good”?, i.e. is it combined in the production but it can not be identified as a part of each produced unit?
 - **The degree of competition in their markets**

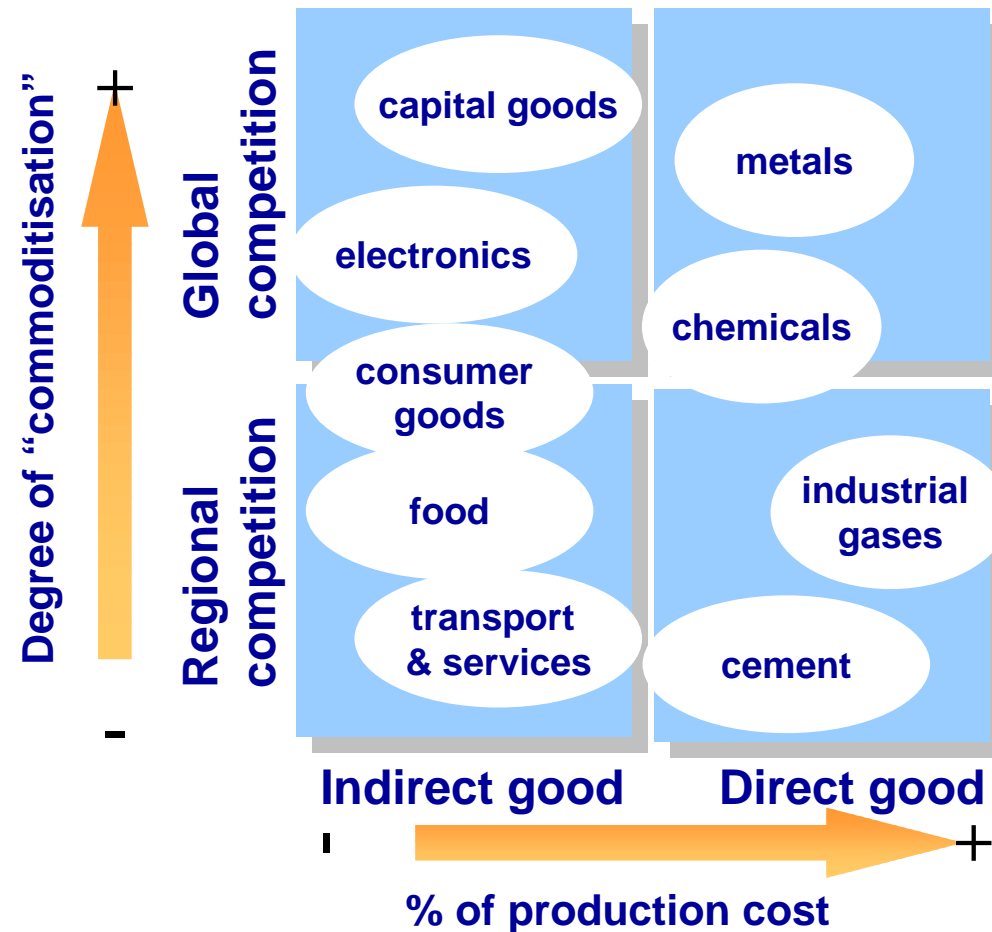
To what extent is user able to pass higher electricity costs to its customers? For products sold globally, the user is often unable to pass on local cost increases.



Different customers' attitudes on DSM



Example of industries

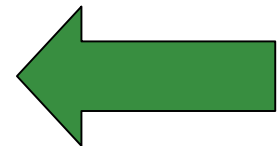




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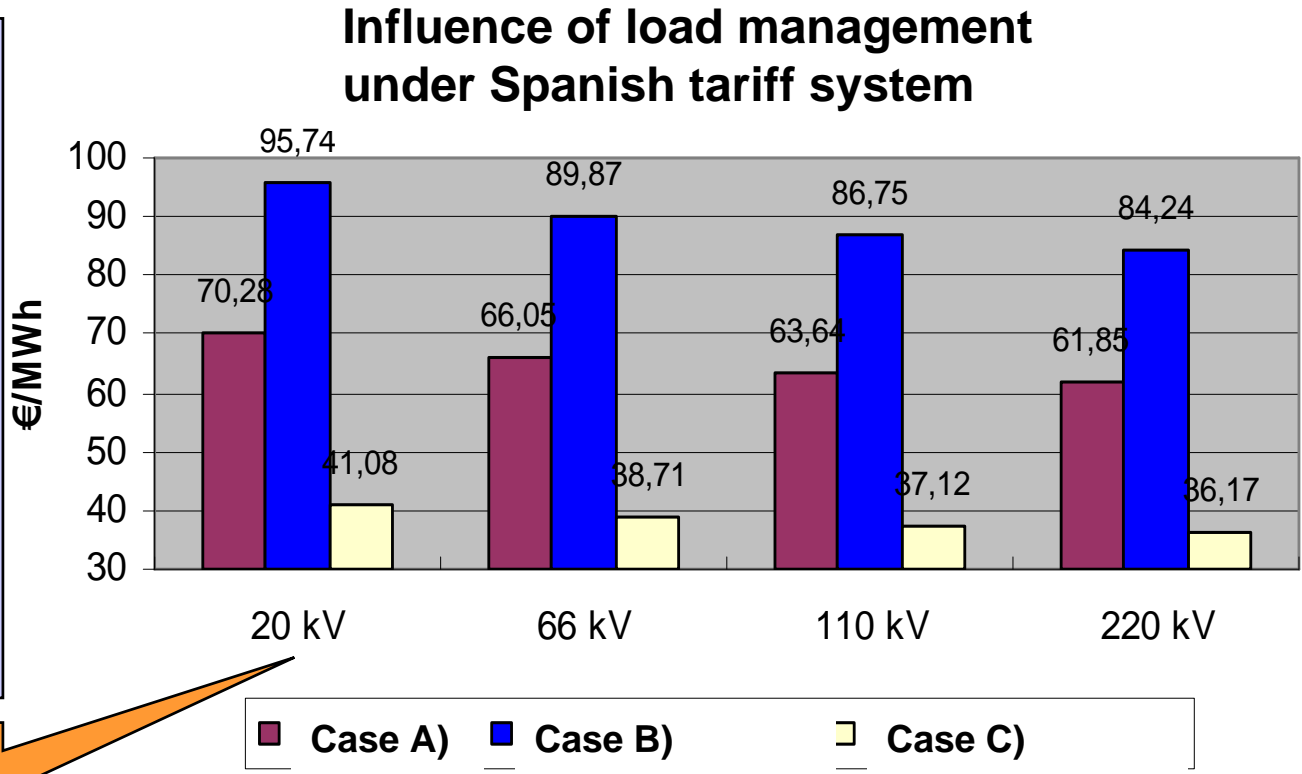


Need for proper economic signaling

In Spain tariff system offers today strong signals to DSM

Tariff prices applicable to normal HV industrial customer (tariff HV 3.x):

- Assumption: 6.000 h/y
- Case A) is a flat usage
- Case B) off-peak consumption is reduced by a half
- Case C) total peak consumption is shifted to off-peak hours



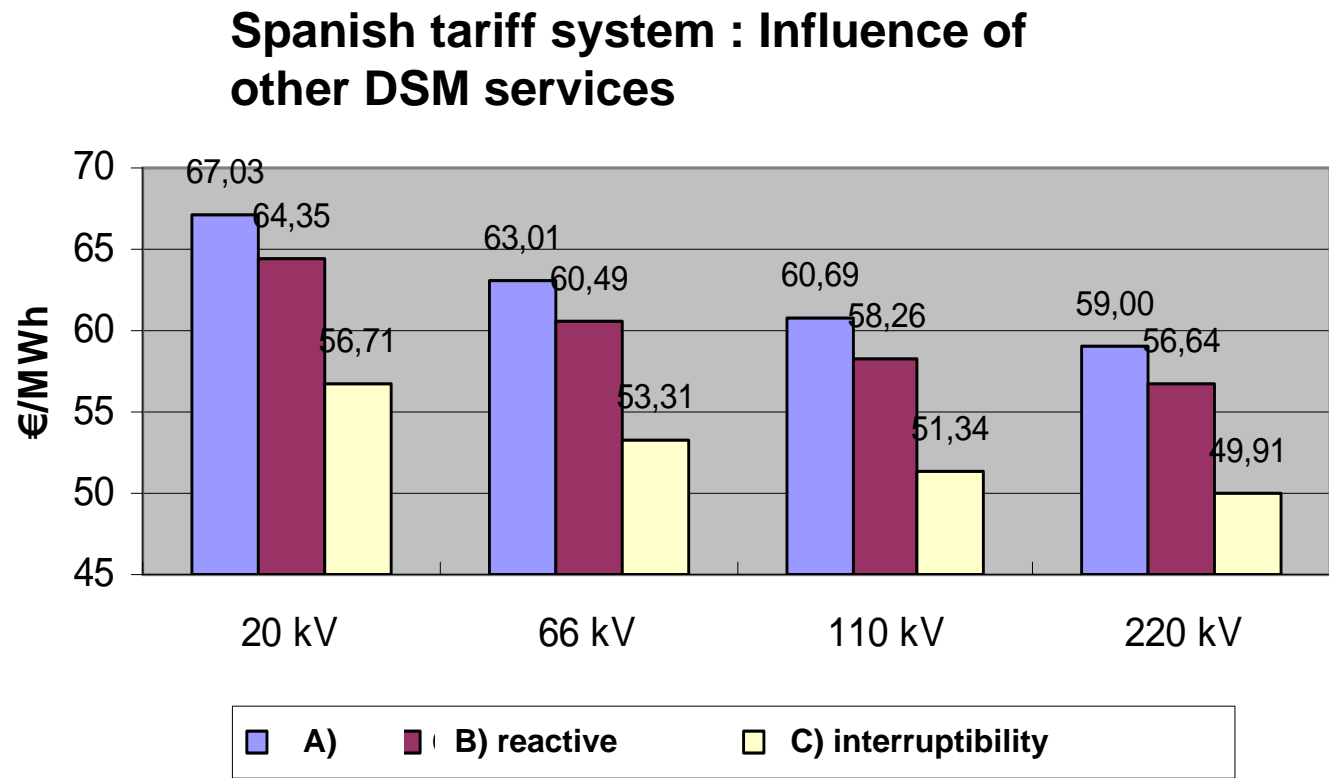
Price ratio of Peak portion to off-Peak's is higher than 2



Need for proper economic signaling

Tariffs also promotes power system operability ...

- Tariff prices applicable to normal HV industrial customer (tariff HV 3.x):
- Assumption: 7.000 h/y
 - Case A) normal rate, flat usage
 - Case B) full reactive compensation
 - Case C) Case B) + interruptibility up to a 50% of the load





Need for proper economic signaling

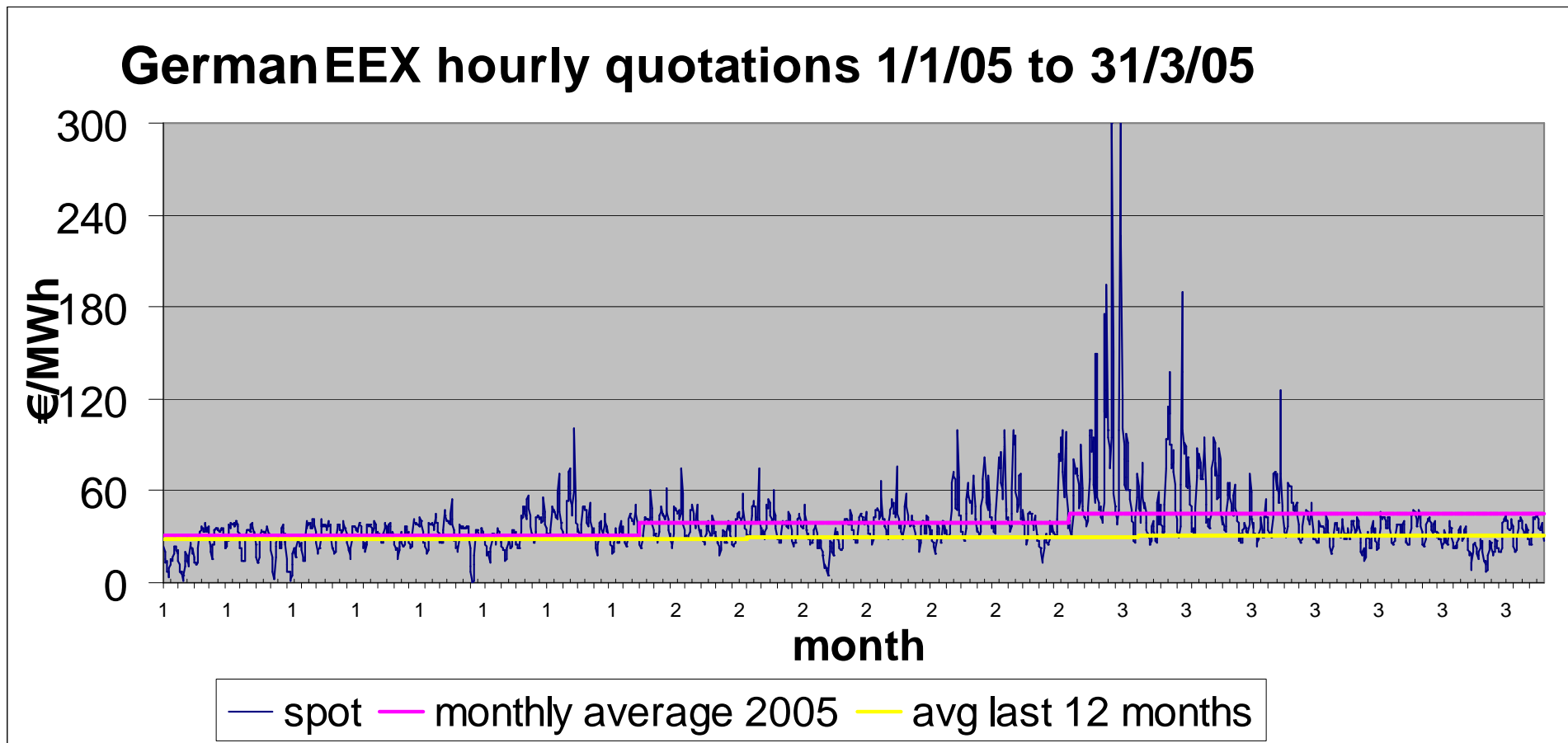
But DSM incentive design becomes tougher under a market environment ...

- **First, because end-user's power price is split into many items and no co-ordination is assured between the parts**
 - > wholesale energy
 - > use-of-the-grid (transmission and distribution grids)
 - > ancillary services (balancing, metering, ...)
 - > up-lifts (fixed system charges, environmental support, ...)
 - > taxes (CO₂, levies, ...)
- **Second, because economic signals from wholesale market are erratic and difficult to predict**
 - > generators are not natural counterparts in DSM: They gain from price surges
 - > demand is not a factor in balancing markets. As a result imbalances increase volatility of short term prices
 - > forward trading reduces the value of load management in the long term and discourages short term demand elasticity



Need for proper economic signaling

Wholesale markets fluctuate in a small range unless imbalances occur. Price “spikes” do not take place necessarily during yearly peak





Need for proper economic signaling

German wholesale prices per hour and type of day in 2005

German EEX day-ahead market from 1.1.2005 to 30.09.2005

- Peak-hours definition:
Labor days from 8 to 20h
- Off-peak hours definition:
Labor days 0-8h & 20-24h
weekends 0 to 24 h
- Average base load: 41,31 €/MWh
- Average peak hours: 54,40 €/MWh
- Average off-peak h : 34,04 €/MWh
- Average ratio peak/off-peak: 1,60

Because energy represents about 2/3 of final price and the rest of the parts are unaffected by modulation, average ratio peak/ off-peak falls to **1,40**

2005 hour	day of the week						
	1	2	3	4	5	6	7
1	28,52	31,76	32,96	33,61	33,22	35,45	28,78
2	26,01	30,04	30,72	31,22	30,40	32,08	24,57
3	24,39	27,70	28,72	28,76	28,32	30,34	22,46
4	23,35	26,20	27,15	26,52	26,59	28,10	21,36
5	24,09	26,73	27,81	26,95	27,37	27,49	20,45
6	27,73	30,76	31,68	30,11	31,52	26,41	19,99
7	35,81	36,64	37,61	35,97	37,15	24,83	15,37
8	48,78	49,36	49,56	50,64	49,52	29,85	17,65
9	52,81	58,04	54,32	51,90	58,77	35,98	23,77
10	55,37	59,12	56,48	54,79	57,66	41,53	29,01
11	59,44	60,54	61,60	56,82	61,18	44,16	33,03
12	71,29	70,19	66,49	63,33	62,51	45,92	36,82
13	61,46	59,83	59,61	54,93	55,03	43,56	35,56
14	61,48	58,03	60,47	54,52	50,52	40,22	31,73
15	54,59	56,89	55,83	52,31	47,99	37,31	28,71
16	51,02	50,64	51,77	50,57	45,97	35,38	26,97
17	47,87	48,38	48,59	48,03	44,08	34,43	26,90
18	48,27	47,51	48,25	48,29	44,81	36,92	30,63
19	50,56	50,20	53,07	56,98	46,81	40,07	35,24
20	49,35	47,54	49,79	54,54	45,02	39,99	37,17
21	48,32	47,49	48,09	51,27	45,31	39,03	36,97
22	44,00	43,46	44,15	44,08	41,71	36,57	36,09
23	41,51	41,02	41,31	42,10	40,90	37,40	37,92
24	34,62	34,54	35,07	35,57	35,56	31,52	32,08
base	44,61	45,53	45,88	45,16	43,66	35,61	28,72



Need for proper economic signaling

Summary of obstacles found in deregulated markets for DSM initiatives

- **Generators do not promote DSM actions: They do not face the risk of lack of supply and they benefit from price surges due to demand inelasticity**
- **TSO are responsible for system security but they are not always authorized to contract DSM services**
- **Bilateral forward trading drives wholesale markets to reflect more imbalances than real demand patterns**
- **Explicit discounts to customers for participating in DSM are no longer being proposed. Customers must make capital expenditures associated to DSM at their own risk**
- **Access tariffs contain heavy fixed-fee that dilute users' efforts**
- **Grid charges ignore DSM contribution to transmission system**



Friends and Enemies of DSM

FRIENDS

- **Visibility for investments, through long term DSM contracts**
- **Grid charges and uplifts: Fees proportional to actual kWh with strong peak/off-peak differentiation. Bonus to reflect contribution to system security and for making dispatch of renewable energy easier**
- **Taxation: Ramsey principles applied to active DSM users. Asymmetric taxation of peak/off-peak periods**

ENEMIES

- **Pure short term reward upon request**
- **Grid charges and uplifts: capacity fees and/or flat kWh pricing. No advantage for high off-peak usage. Neglect of avoided transmission's investments. Disregard of positive contribution to support environmental policies**
- **Taxation: Flat or uniform burdens ignoring DSM users' elasticity to price**

PRAXAIR

Making Our Planet More Productive



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