RENEWABLE ENERGY IN EUROPE:

POLICIES, ACHIEVEMENTS AND CHALLENGES

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NEWES, New Energy Solutions

Harvard Electricity Policy Group

Renewable Rules: Market Friend or Foe?

Chicago, October 2, 2008

POLICIES

RENEWABLE ENERGY IN CONTEXT

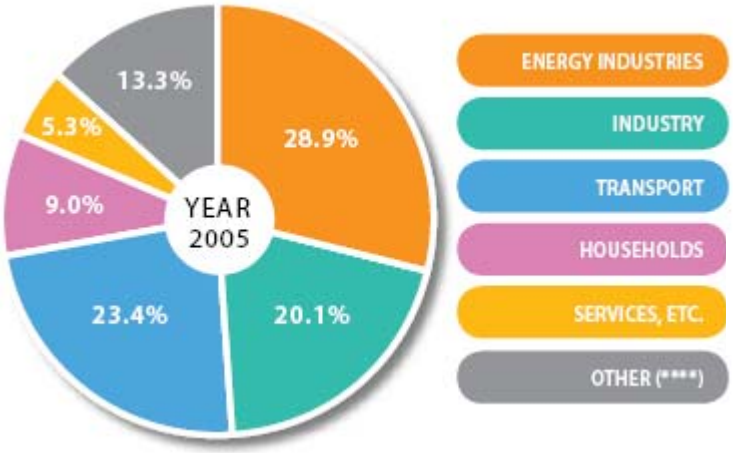
- ENERGY AND CLIMATE CHANGE POLICY
- SECURITY OF SUPPLY

EU ENERGY AND CLIMATE POLICY

"Given that energy production and use are the main sources for greenhouse gas emissions, an <u>integrated approach to climate and energy policy</u> is needed to realise this objective.

Integration should be achieved in a mutually supportive way."

European Council, March 2007



GHG Emissions(*) by Sector – EU-27
SHARES %

EU ENERGY AND TRANSPORT IN FIGURES
STATISTICAL POCKETBOOK 2007/2008

EU ENERGY IMPORT DEPENDENCY IS 50% AND GROWING...

Figure SP.5: Net imports of energy, 2004 (1)

(million tonnes of oil equivalent)

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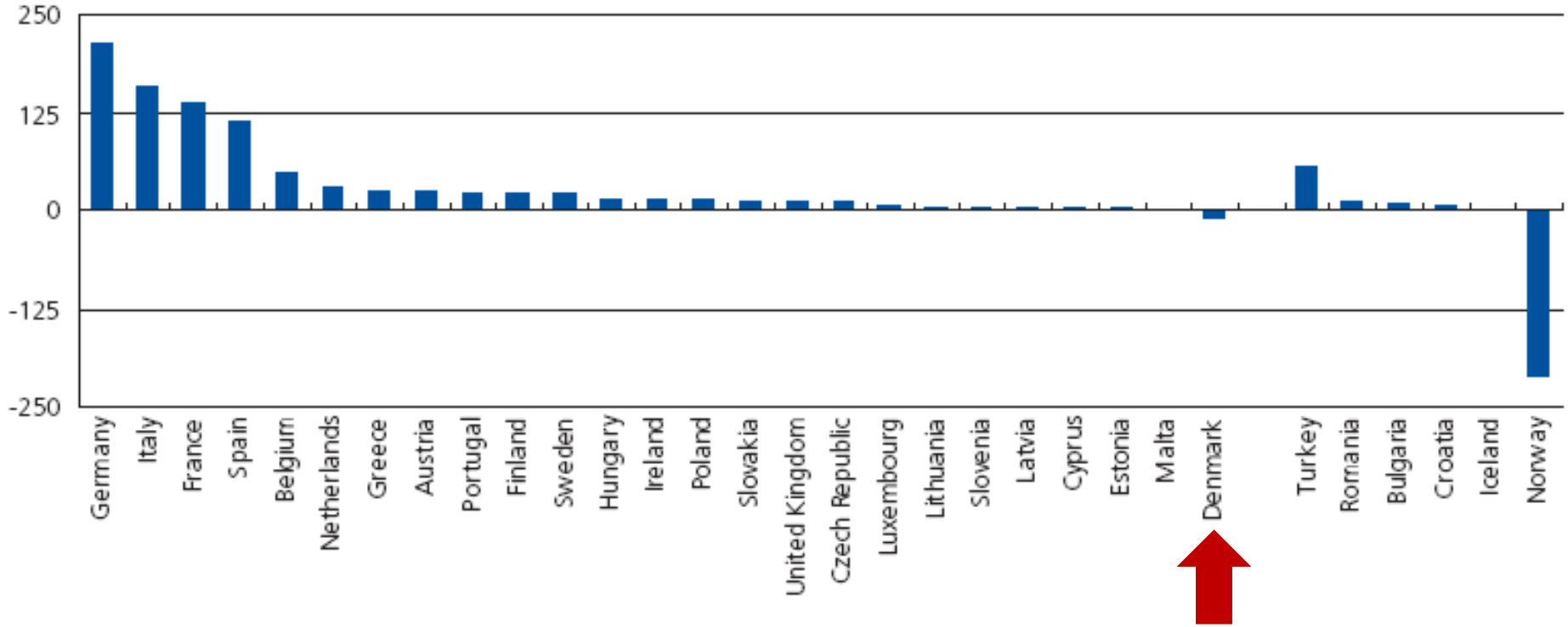


EUROPE IN FIGURES — Eurostat yearbook 2006-07

Share of Renewables to final (*)
ENERGY CONSUMPTION WITH NORMALISED HYDRO

	2000	2001	2002	2003	2004	2005
EU-27	7.6%	7.6%	7.9%	7.9%	8.1%	8.5%
EU-25	7.4%	7.4%	7.7%	7.7%	7.9%	8.3%
BE	1.2%	1.3%	1.4%	1.6%	1.8%	2.2%
BG	8.2%	8.1%	9.0%	8.8%	9.4%	9.4%
CZ	2.4%	2.7%	2.9%	4.3%	5.9%	6.1%
DK	11.7%	12.3%	13.4%	14.9%	16.1%	17.0%
DE	4.0%	4.2%	4.8%	4.6%	4.7%	5.8%
EE	16.0%	15.3%	14.9%	14.9%	19.0%	18.0%
IE	2.2%	2.3%	2.3%	2.4%	2.7%	3.1%
EL	7.4%	7.3%	7.2%	6.8%	6.8%	6.9%
ES	8.3%	8.2%	8.3%	8.6%	8.5%	8.7%
FR	10.6%	10.4%	10.3%	10.3%	10.1%	10.3%
IT	4.8%	4.9%	5.5%	4.7%	5.0%	5.2%
CY	2.6%	2.5%	2.5%	2.4%	2.6%	2.9%
LV	35.5%	34.8%	34.4%	33.6%	34.8%	34.9%
LT	16.7%	16.8%	16.8%	16.9%	15.4%	15.0%
LU	0.9%	0.8%	0.7%	0.8%	0.9%	0.9%
HU	2.8%	2.6%	4.8%	4.7%	4.4%	4.3%
MT	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NL	1.6%	1.6%	1.6%	1.8%	2.0%	2.4%
AT	25.6%	25.4%	24.7%	23.8%	22.8%	23.3%
PL	6.5%	6.9%	7.2%	7.1%	7.1%	7.2%
PT	19.6%	19.2%	19.4%	19.5%	18.3%	20.5%
RO	16.9%	14.0%	14.8%	16.3%	16.3%	17.8%
SI	16.4%	16.2%	16.7%	16.4%	16.2%	16.0%
SK	3.2%	5.7%	5.1%	5.8%	6.3%	6.7%
FI	29.0%	28.0%	28.5%	28.0%	29.2%	28.5%
SE	37.4%	37.2%	36.5%	37.3%	38.2%	39.8%
UK	0.9%	0.9%	1.0%	1.1%	1.2%	1.3%

Annex I – National overall targets for the share of energy from renewable sources in final consumption of energy in 2020

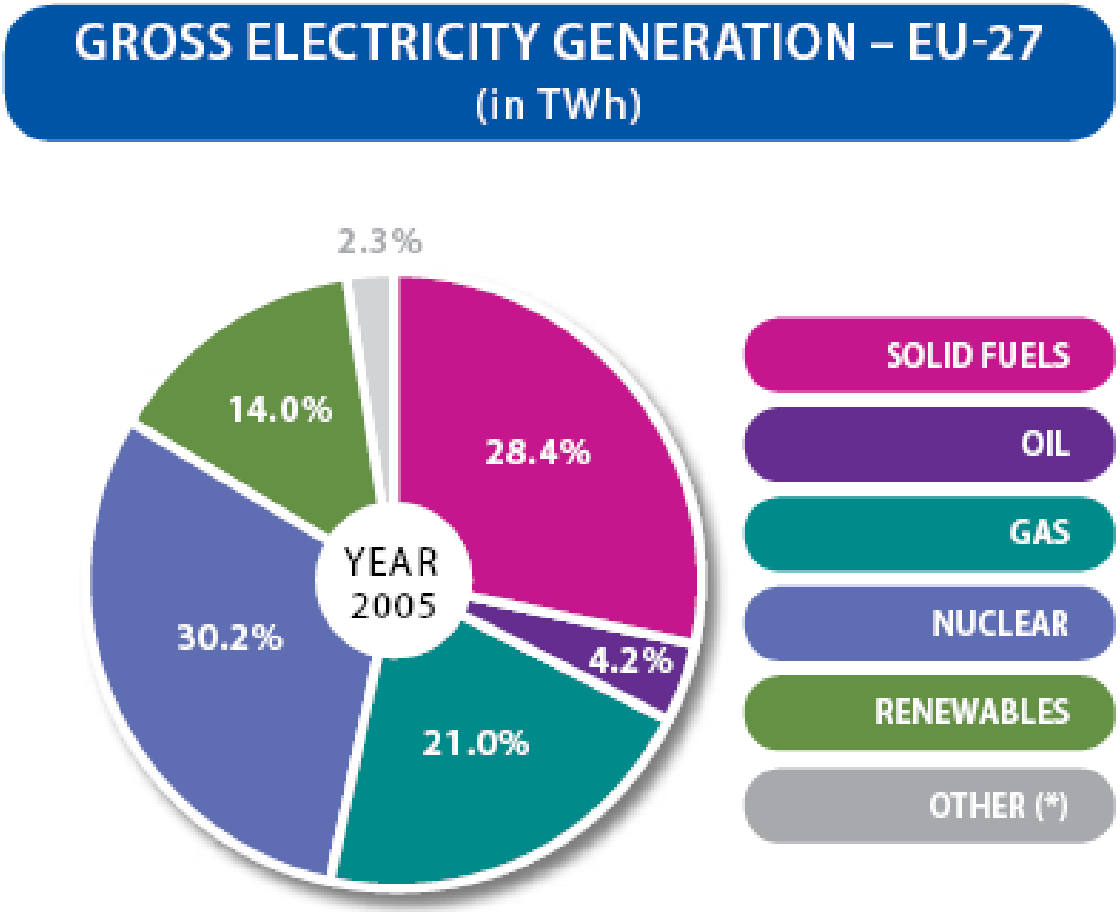
8.5 %
2005

20 %
2020

A. National overall targets

	Share of energy from renewable sources in final consumption of energy, 2005 (S_{2005})	Target for share of energy from renewable sources in final consumption of energy, 2020 (S_{2020})
Belgium	2.2%	13%
Bulgaria	9.4%	16%
The Czech Republic	6.1%	13%
Denmark	17.0%	30%
Germany	5.8%	18%
Estonia	18.0%	25%
Ireland	3.1%	16%
Greece	6.9%	18%
Spain	8.7%	20%
France	10.3%	23%
Italy	5.2%	17%
Cyprus	2.9%	13%
Latvia	34.9%	42%
Lithuania	15.0%	23%
Luxembourg	0.9%	11%
Hungary	4.3%	13%
Malta	0.0%	10%
The Netherlands	2.4%	14%
Austria	23.3%	34%
Poland	7.2%	15%
Portugal	20.5%	31%
Romania	17.8%	24%
Slovenia	16.0%	25%
The Slovak Republic	6.7%	14%
Finland	28.5%	38%
Sweden	39.8%	49%
United Kingdom	1.3%	15%

ACHIEVEMENTS

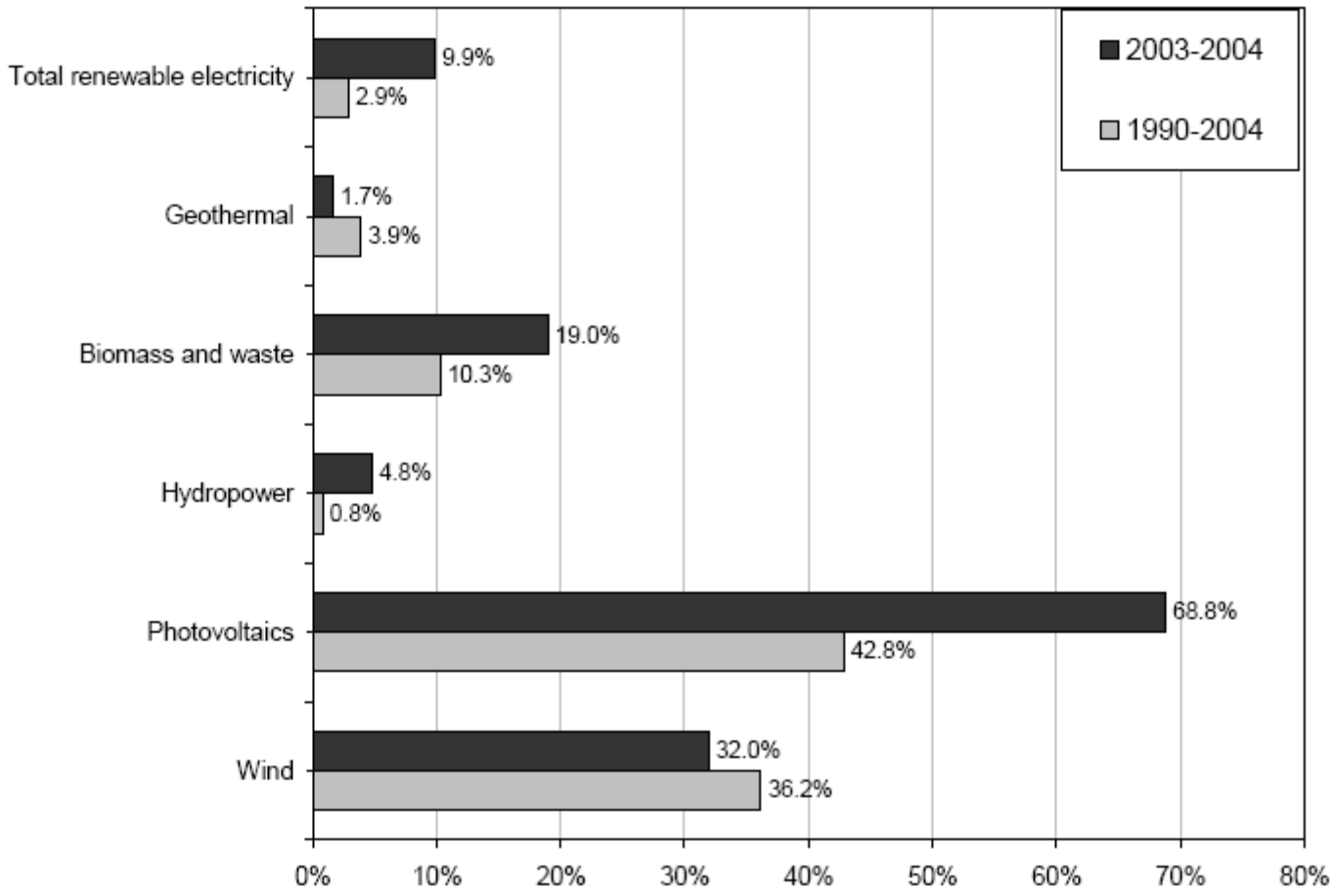


EU ENERGY AND TRANSPORT IN FIGURES
STATISTICAL POCKETBOOK 2007/2008

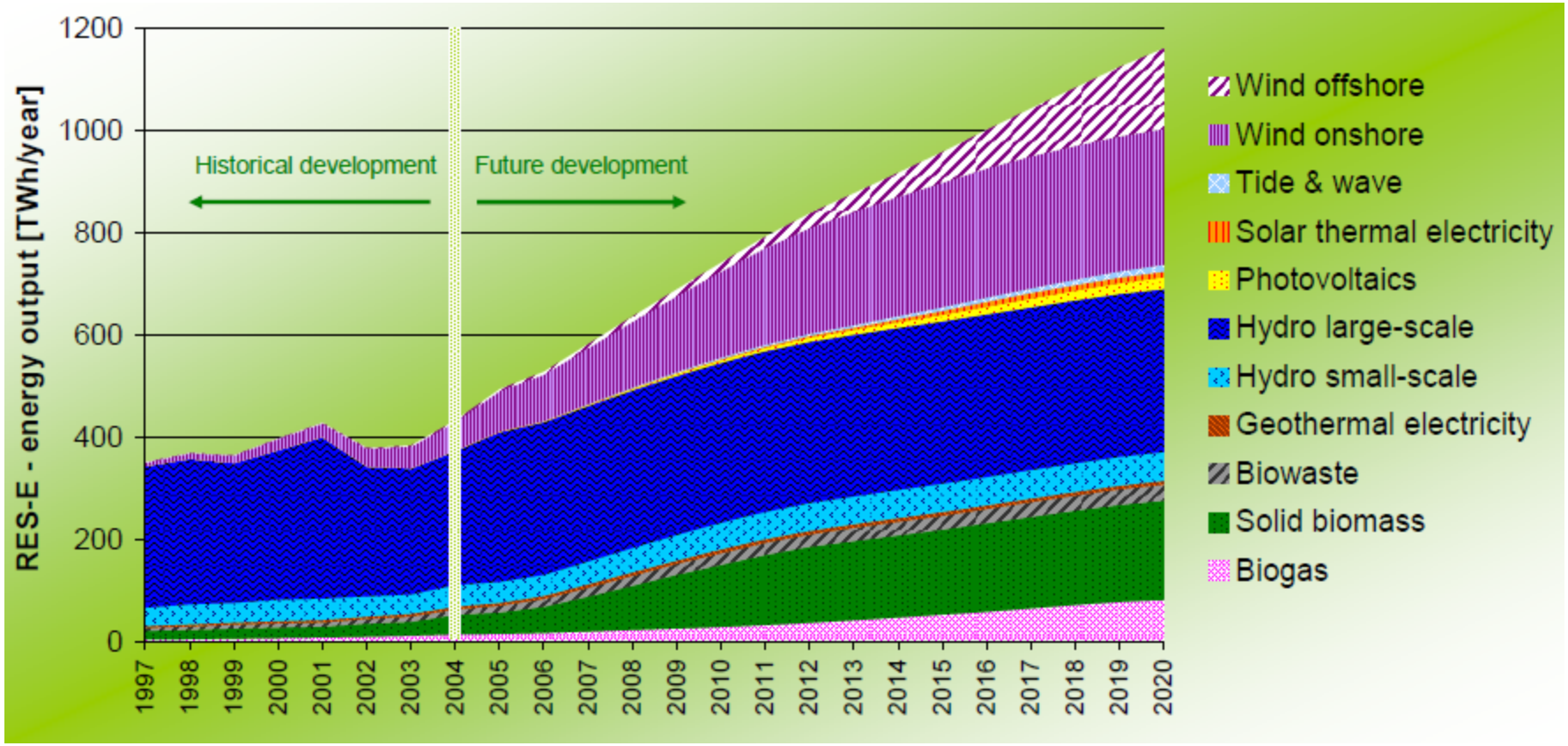
Gross Electricity Generation
FROM RENEWABLES, 2005 (in GWh)

	RENEWABLES	Hydro (*)	Wind	Biomass	Solar (**)	Geothermal
EU-27	464 379	306 970	70 482	80 042	1 490	5 395
Share	100.0%	66.1%	15.2%	17.2%	0.3%	1.2%
EU-25	439 827	282 426	70 480	80 036	1 490	5 395
Share	100.0%	64.2%	16.0%	18.2%	0.3%	1.2%
BE	2 630	288	227	2 114	1	
BG	4 339	4 337	2			
CZ	3 141	2 380	22	739		
DK	10 619	23	6 614	3 982		
DE	64 662	19 581	27 229	16 570	1 282	
EE	97	22	54	21		
IE	1 873	631	1 112	130		
EL	6 406	5 017	1 266	122	1	
ES	43 964	19 553	21 219	3 114	78	
FR	58 444	52 285	963	5 181	15	
IT	49 751	36 067	2 344	5 985	31	5 324
CY	1				1	
LV	3 414	3 325	47	42		
LT	458	451		7		
LU	239	93	53	75	18	
HU	1 929	203	10	1 716		
MT						
NL	8 918	88	2 067	6 729	34	
AT	39 251	35 874	1 328	2 034	15	
PL	4 166	2 201	135	1 830		
PT	8 555	4 731	1 773	1 977	3	71
RO	20 213	20 207		6		
SI	3 575	3 461		114		
SK	4 645	4 638	7			
FI	23 564	13 784	170	9 607	3	
SE	82 045	72 808	936	8 301		
UK	17 480	4 922	2 904	9 646	8	
HR	6 347	6 333		14		
MK						
TR	39 748	39 561	59	34		94
IS	8 681	7 019		4		1 658
NO	136 681	135 796	506	379		
CH	31 234	31 226	8			

Fig. 2a: Average annual growth rates 1990-2004 and 2003-2004

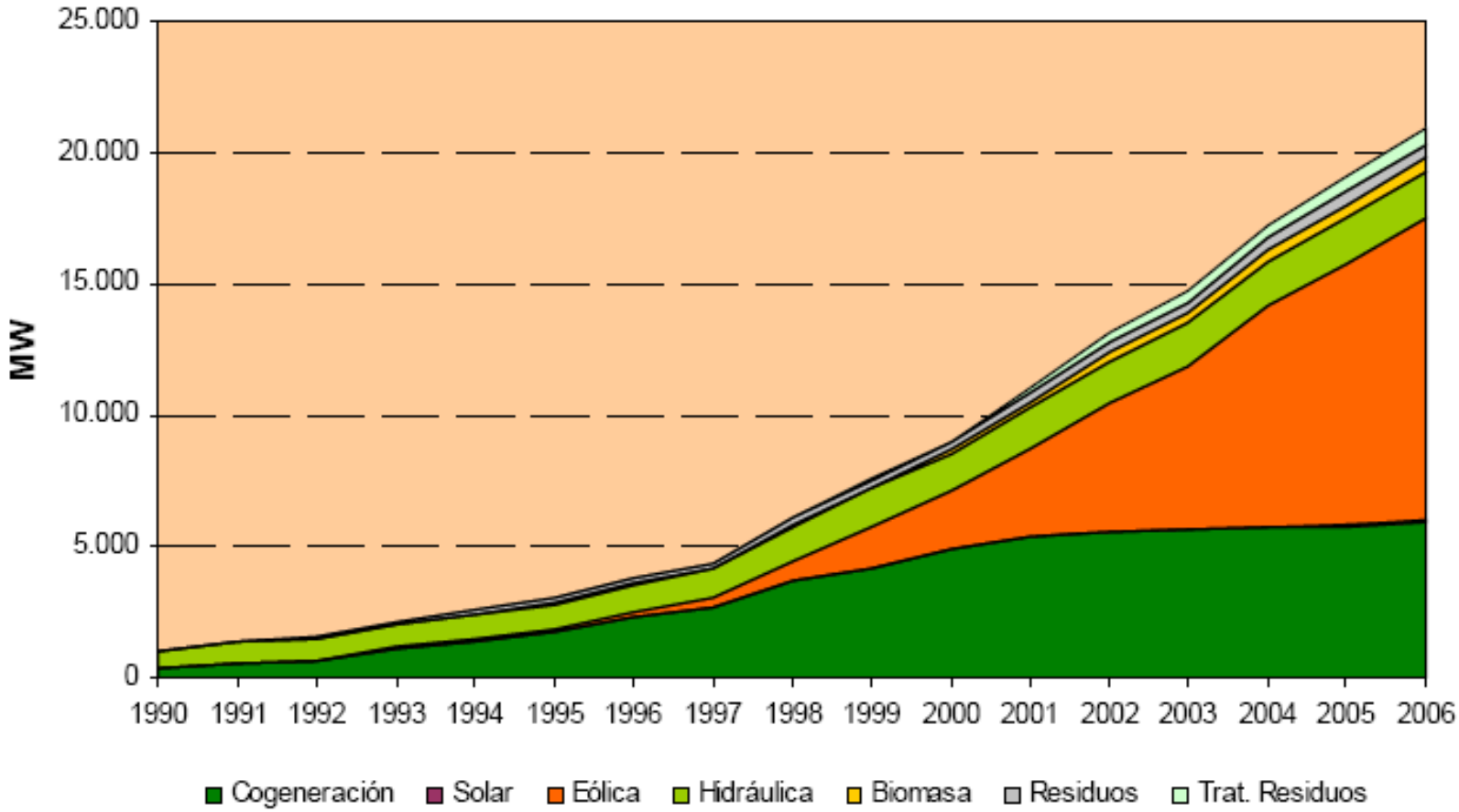


Data source: Eurostat


RES-E - energy output [TWh/year]
1200
1000
800
600
400
200
0
Historical development
Future development
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Wind offshore
Wind onshore
Tide & wave
Solar thermal electricity
Photovoltaics
Hydro large-scale
Hydro small-scale
Geothermal electricity
Biowaste
Solid biomass
Biogas

ACHIEVEMENTS DEPEND ON INCENTIVES

- ❑ FEED-IN TARIFFS
- ❑ GREEN CERTIFICATE SYSTEM
- ❑ TENDERING PROCEDURE
- ❑ TAX INCENTIVES



Source: http://www.cne.es/cne/doc/publicaciones/PA006_07.pdf

BALANCE DE ENERGIA ELECTRICA Del 1 de enero al 30 de abril			
PRODUCCIÓN ELECTRICA BRUTA DE LAS EMPRESAS PENINSULARES DE UNESA	Millones de KWh		% VAR
	2007	2008	
Hidroeléctrica	11.303	5.820	-48,5
Termoeléctrica clásica	41.879	48.255	15,2
Nuclear	20.260	20.720	2,3
PRODUCCIÓN BRUTA TOTAL	73.442	74.795	1,8
Consumos en Generación	2.771	2.797	0,9
Consumos en Bombeo	1.419	1.441	1,5
Mercado cubierto con energía producida por las empresas eléctricas	69.252	70.557	1,9
Saldo de intercambios internacionales	-645	-3.573	453,6
Energía aportada por los productores en régimen especial	19.177	23.721	23,7
DEMANDA TOTAL PENINSULAR	87.784	90.706	3,3

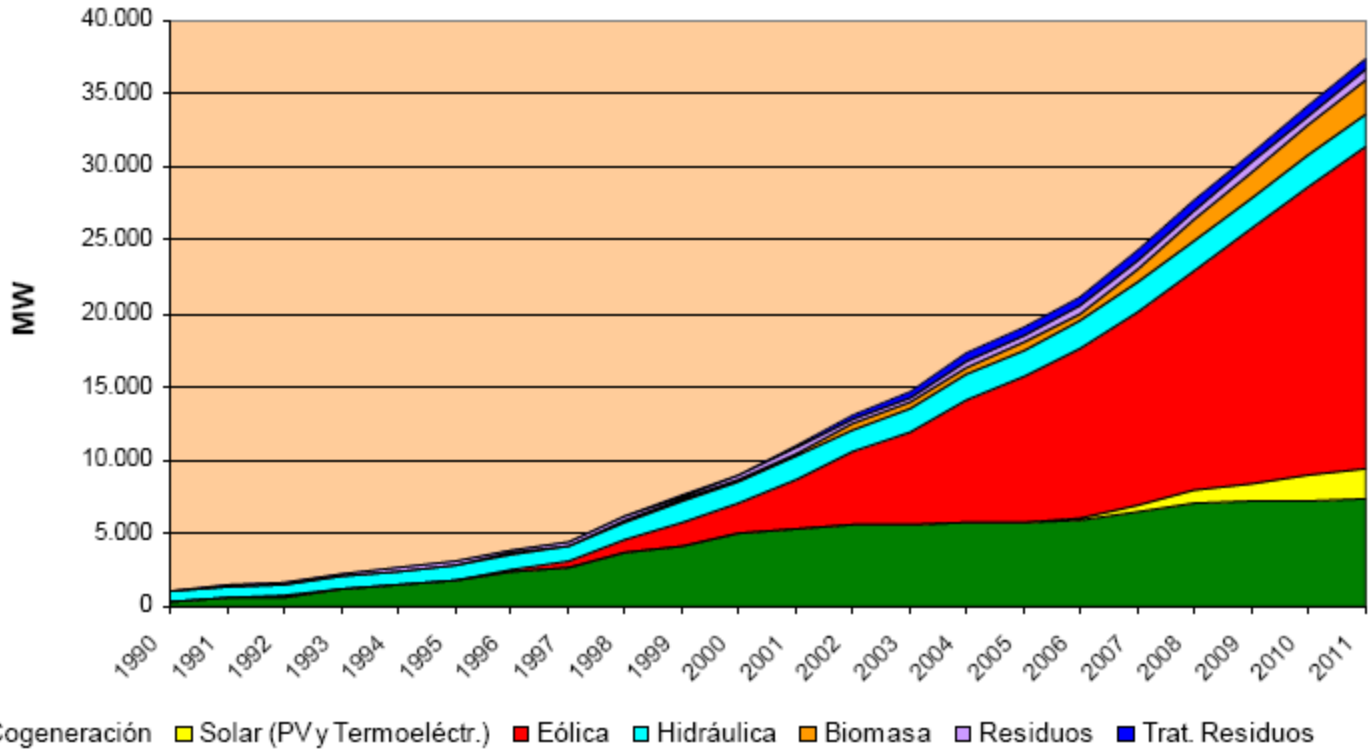
26 %

Source: http://www.unesa.es/

Cobertura para la punta máxima	2005 27 enero, 19-20 h		2006 30 enero, 19-20 h	
	MW	%	MW	%
Nuclear	7.374	17	7.588	18,0
Térmica clásica	13.014	30	12.646	30,0
CCTG	7.374	17	10.538	25,0
Hidráulica	5.639	13	4.215	10,0
Régimen especial	8.676	20	7.166	17,0
Int. Internacionales	1.301	3	0	0
TOTAL	**43.378**	**100**	**42.153**	**100**

Figura 2.2.32. Cobertura de la demanda de potencia media horaria para la punta máxima. Fuente: Informe REE. Año 2006.

Source: http://www.cne.es/cne/doc/publicaciones/PA006_07.pdf



Potencia Instalada (MW)	2007	2008	2009	2010	2011
Cogeneración	6.432	7.000	7.123	7.247	7.370
Solar (PV y Termoeléctri-ca)	409	900	1.300	1.650	2.000
Eólica	13.288	14.980	17.320	19.660	22.000
Hidráulica	2.000	2.000	2.080	2.160	2.240
Biomasa y biogás	898	1.520	1.827	2.093	2.360
Residuos	600	600	610	660	710
Tratamiento de Residuos	625	650	675	700	700
Total	**24.252**	**27.650**	**30.935**	**34.170**	**37.380**

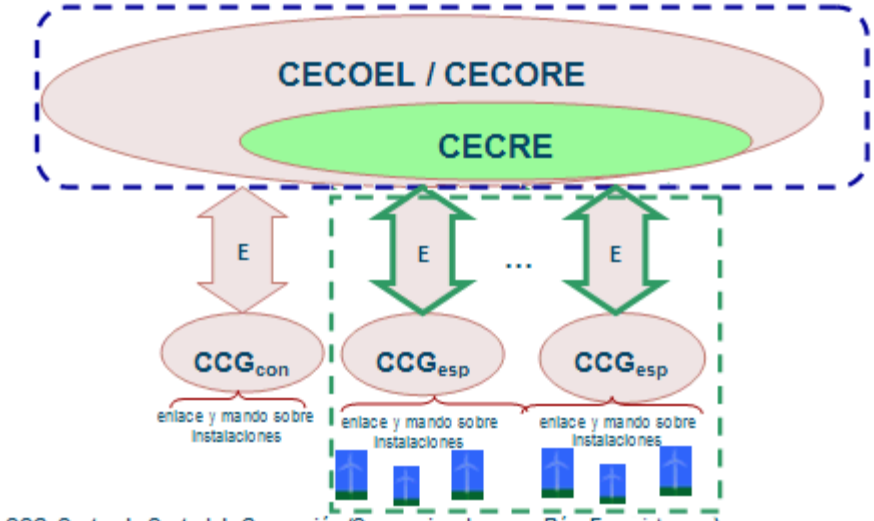
Figura 4.2.9. Previsiones de evolución de potencia del régimen especial en la Península por tecnologías. Fuente: CNE, Documento de Planificación y Plan de Energías Renovables.

Energía vertida (GWh)	2007	2008	2009	2010	2011
Cogeneración	17.366	18.900	19.233	19.566	19.899
Solar	429	1.080	1.950	2.476	3.000
Eólica	26.576	30.709	37.065	42.072	47.080
Hidráulica	4.399	4.400	4.992	5.184	5.376
Biomasa y biogás	2.695	4.560	7.307	8.373	9.440
Residuos	2.461	2.460	2.745	3.300	3.550
Tratamiento de Residuos	3.624	3.769	4.049	4.199	4.199
Total	**57.550**	**65.878**	**77.340**	**85.170**	**92.544**

Figura 4.2.10. Previsiones de evolución de ventas de energía del régimen especial en la Península por tecnologías. Fuente: CNE, Documento de Planificación y Plan de Energías Renovables.

Source: http://www.cne.es/cne/doc/publicaciones/PA006_07.pdf

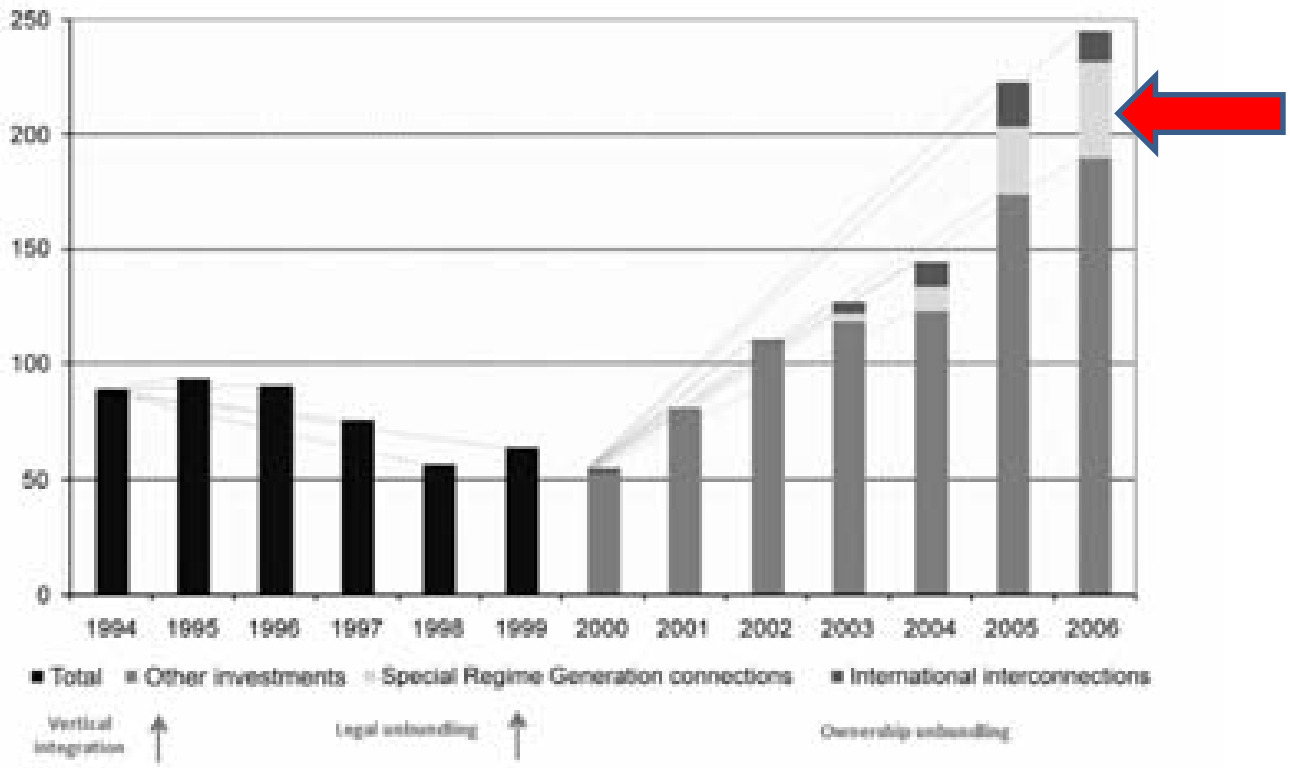
SYSTEM CONTROL



CCG: Centro de Control de Generación (Convencional –con- o Rég. Especial –esp-)
E: Enlace (Iccp)

Source: http://www.ree.es/operacion/regimen_especial.asp

GRID INVESTMENT



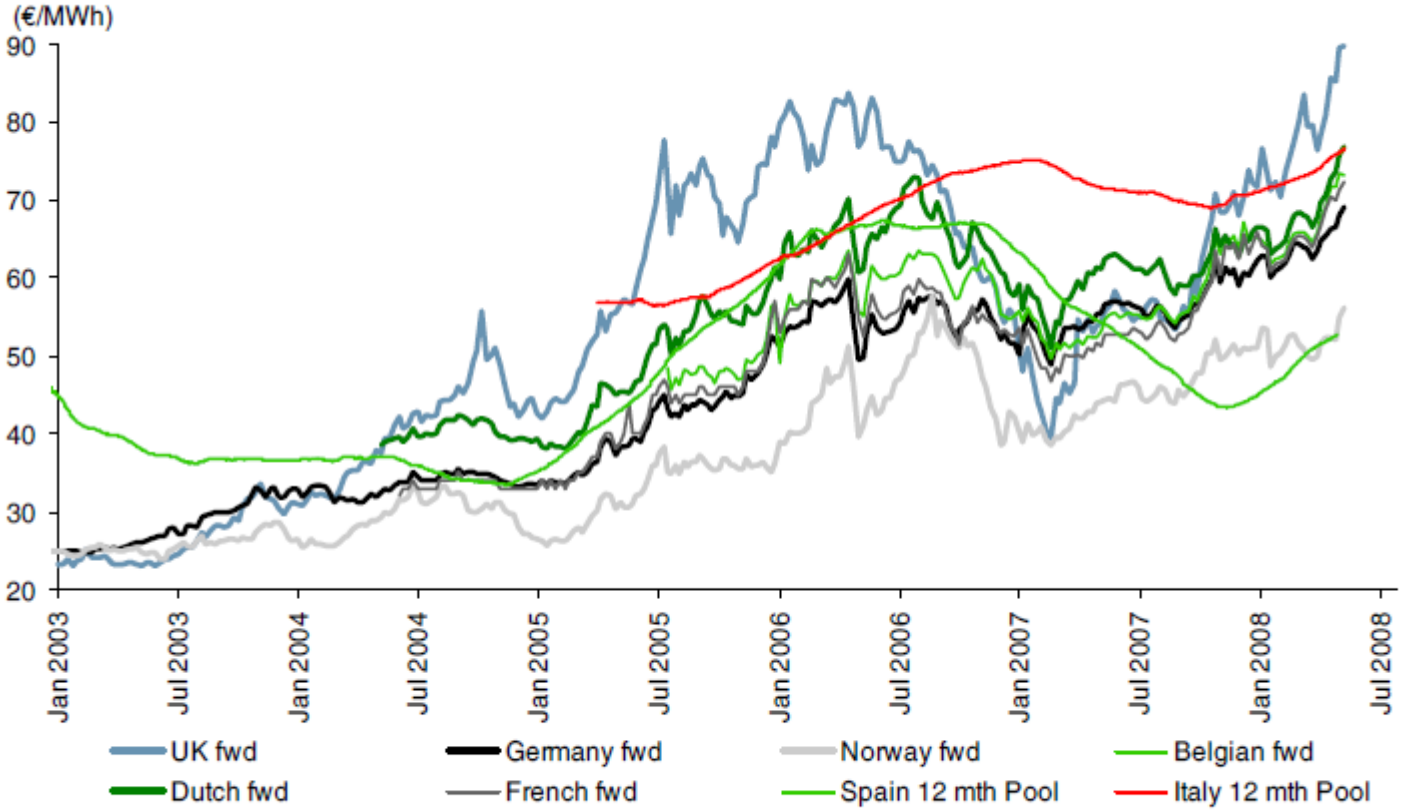
Source: http://www.erse.pt/NR/rdonlyres/789EA4BB-B104-42C9-A248-6332D9883136/0/livro_ERSE_final.pdf

CHALLENGES

- ❑ PRICE / TARIFF INCREASES
- ❑ MARKET LIQUIDITY
- ❑ DEMAND RESPONSE
- ❑ INCENTIVES FOR NETWORK OPERATORS

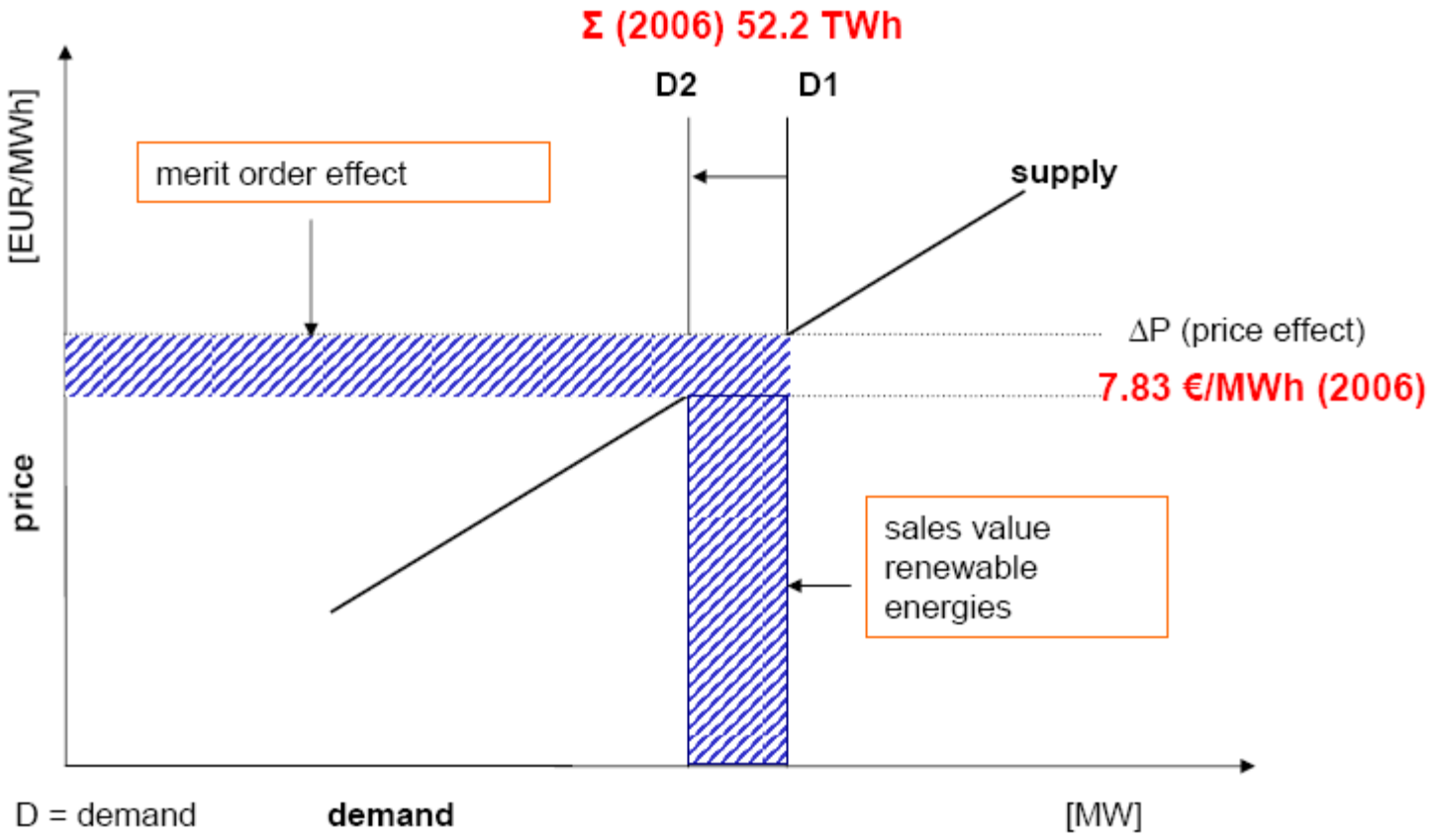
SINCE THE 1st OF JULY 2007 ALL ELECTRICITY AND GAS CONSUMERS ARE FREE TO CHOSE SUPPLIER FROM ANY MEMBER STATE

European electricity prices (12 month forward contracts or 12 months historic Pool price averages)



Sources: Reuters, Dresdner Kleinwort Equity Research estimates

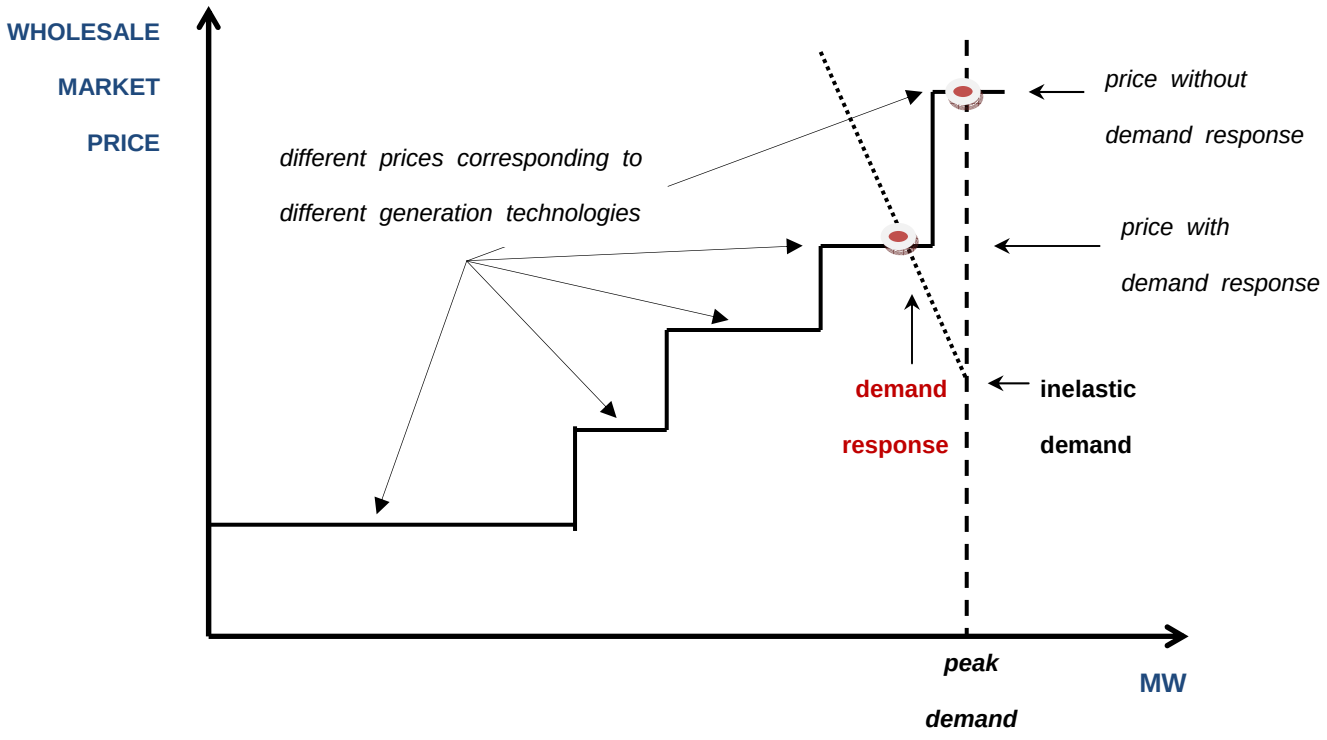
Merit-Order Effect of Power Supply through EEG



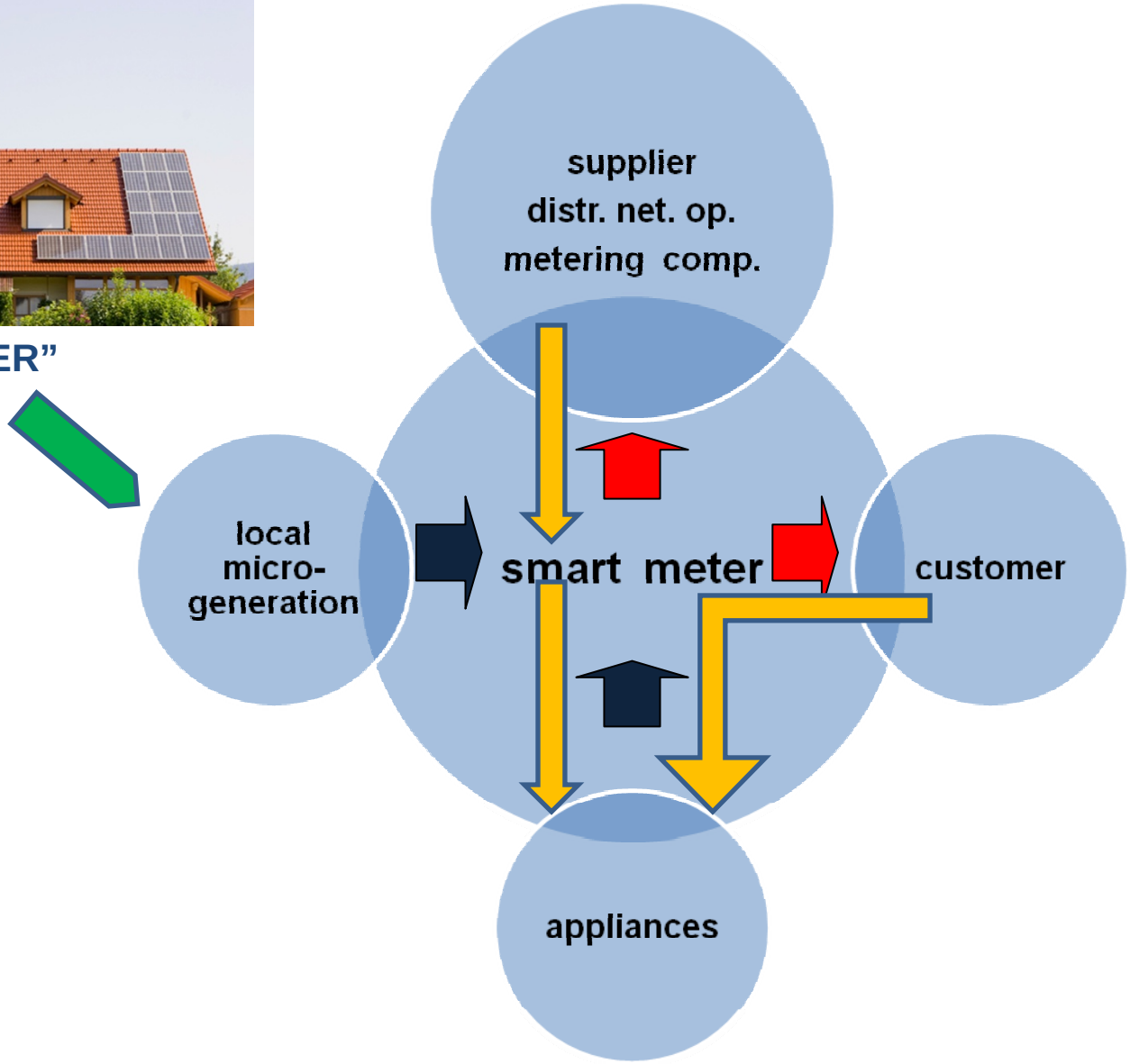
Total volume merit-order effect (2006): € 4.98 billions

Source: http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/eusew_slides_langniss.pdf

DEMAND PARTICIPATION IMPROVES MARKET EFFICIENCY



“PROSUMER”



SMART METER - THE CORNERSTONE OF SMART ELECTRICITY GRIDS

NETWORK OPERATORS HAVE DELAYED INTRODUCTION OF NEW TECHNOLOGIES

THE COST-EFFECTIVE ACHIEVEMENT OF EU RENEWABLES (AND EFFICIENCY) GOALS REQUIRES "NEW REGULATION" PROVIDING THE RIGHT INCENTIVES FOR

- ❑ **NETWORK DEVELOPMENT**
- ❑ **SYSTEM OPERATION**
- ❑ **DEMAND RESPONSE**