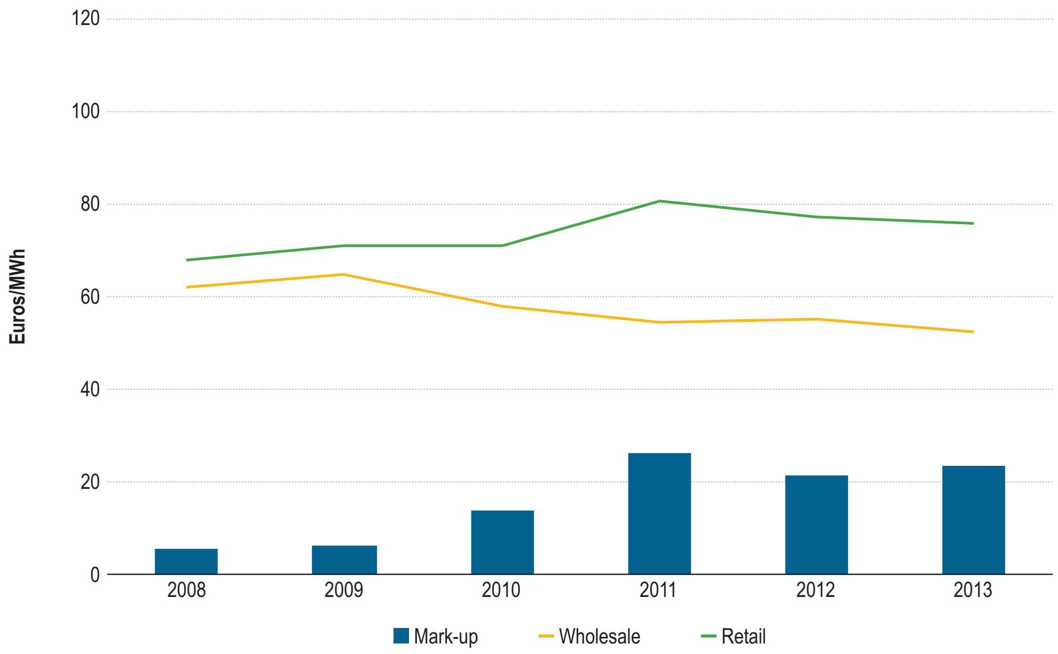
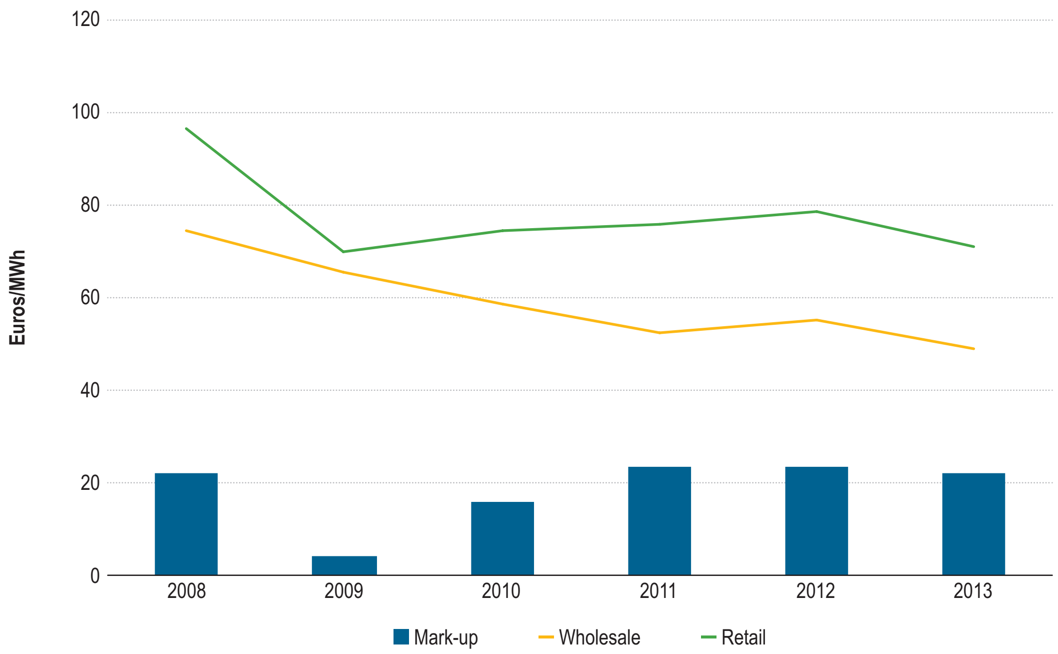
Annex 2: The relationship between the wholesale and energy component of retail electricity prices by country

Figure A 3: The relationship between the wholesale and energy components of retail prices – euros/MWh

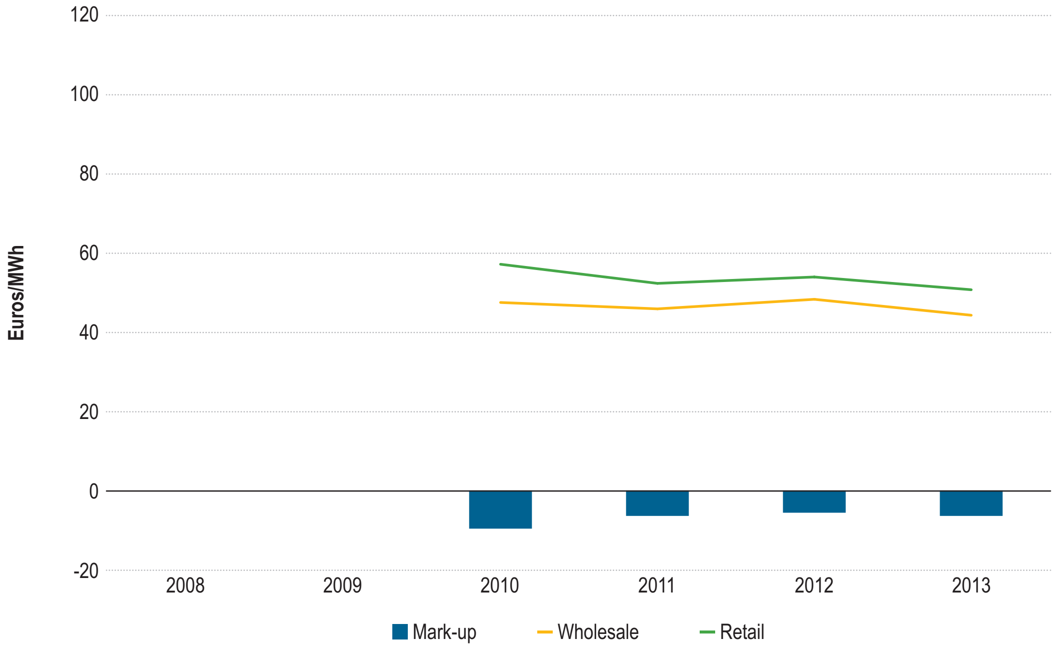
Austria



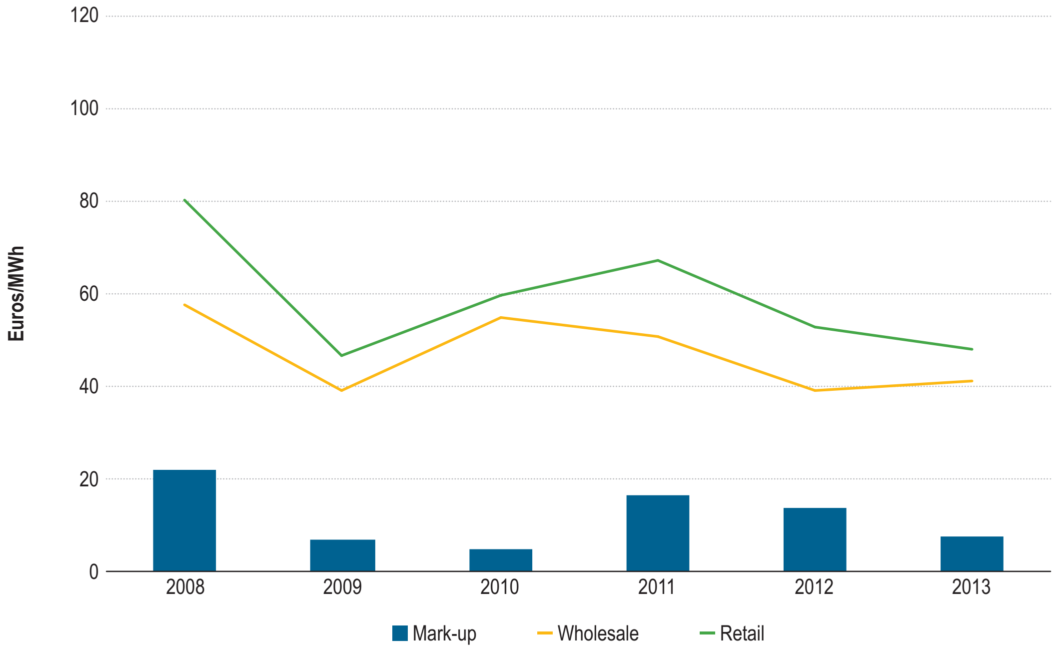
Belgium



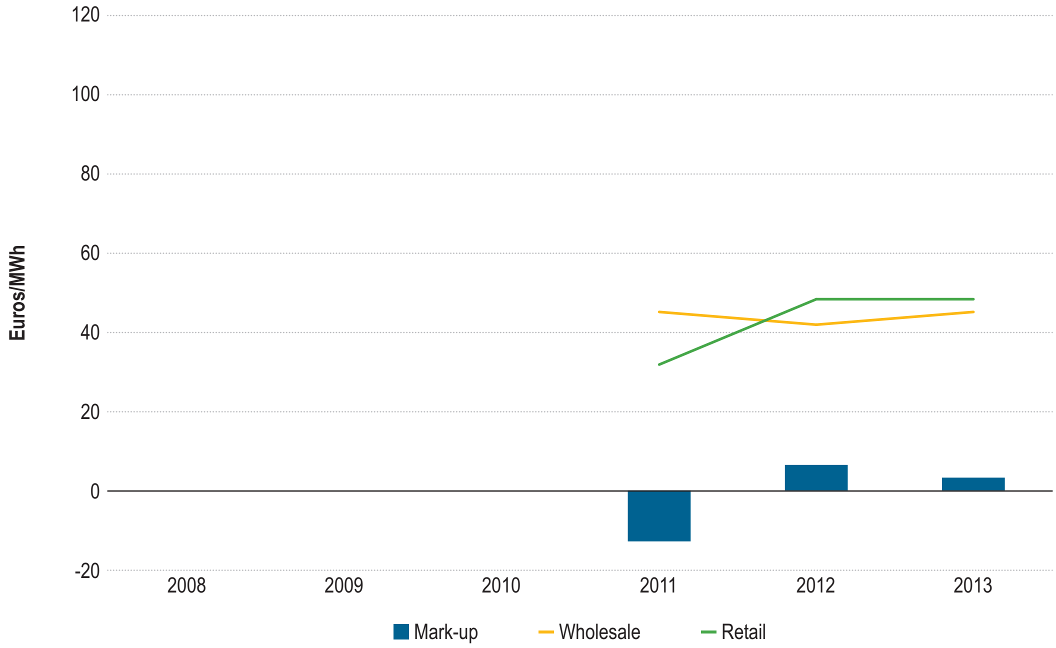
Czech Republic



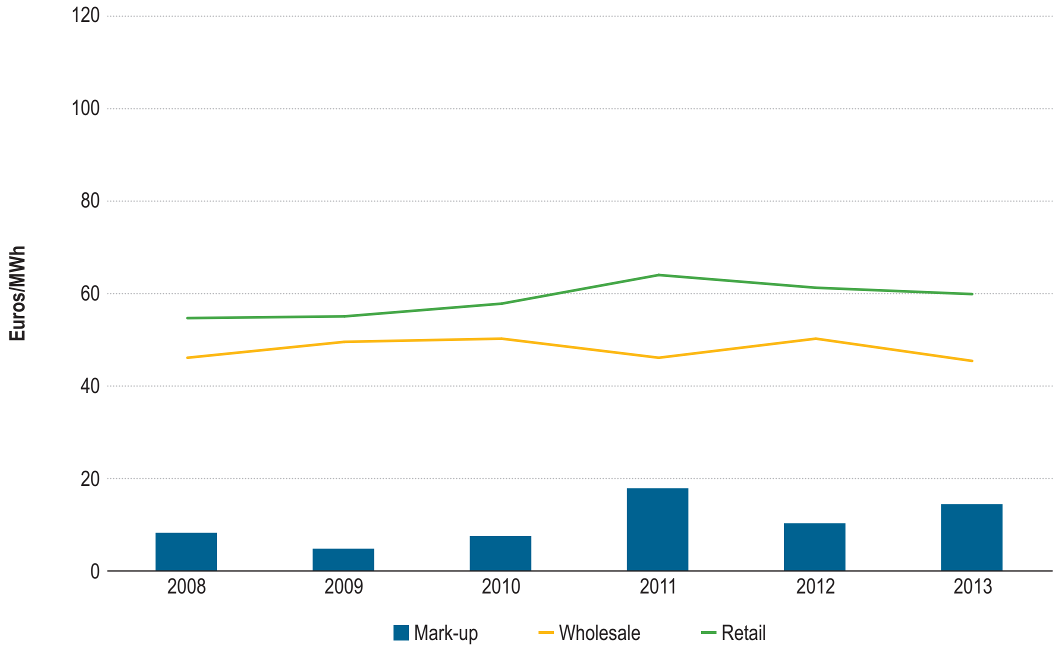
Denmark



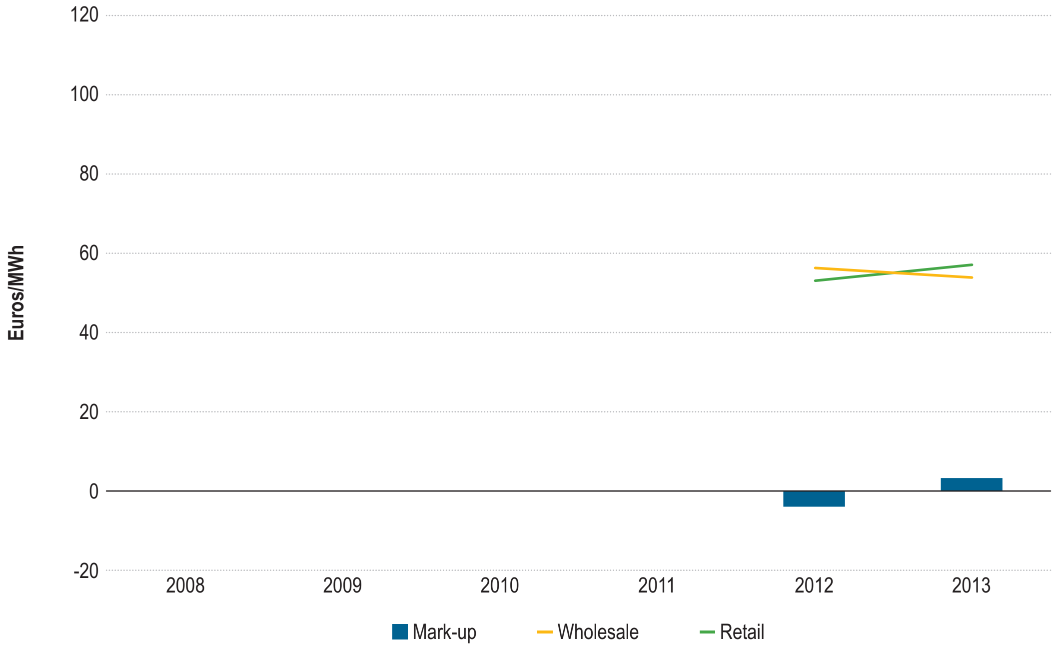
Estonia



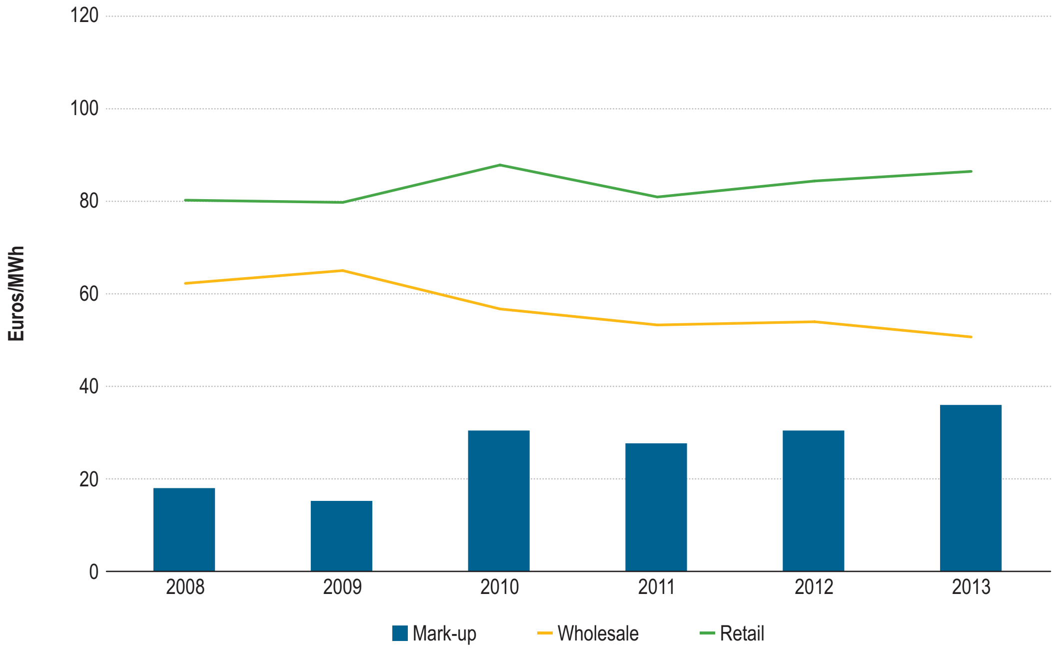
Finland



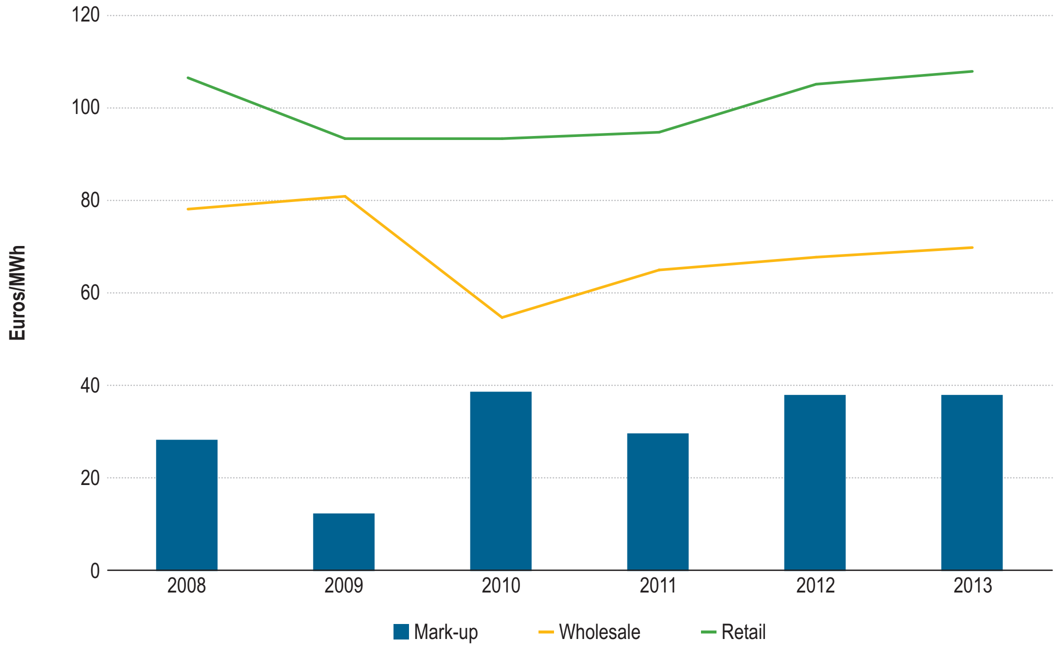
France



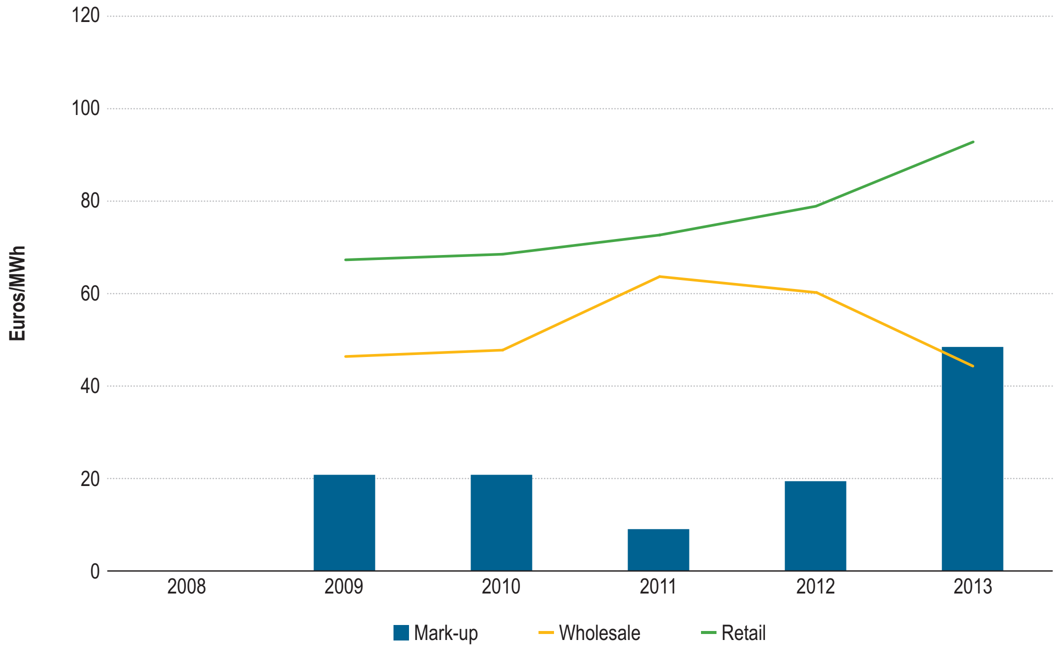
Germany



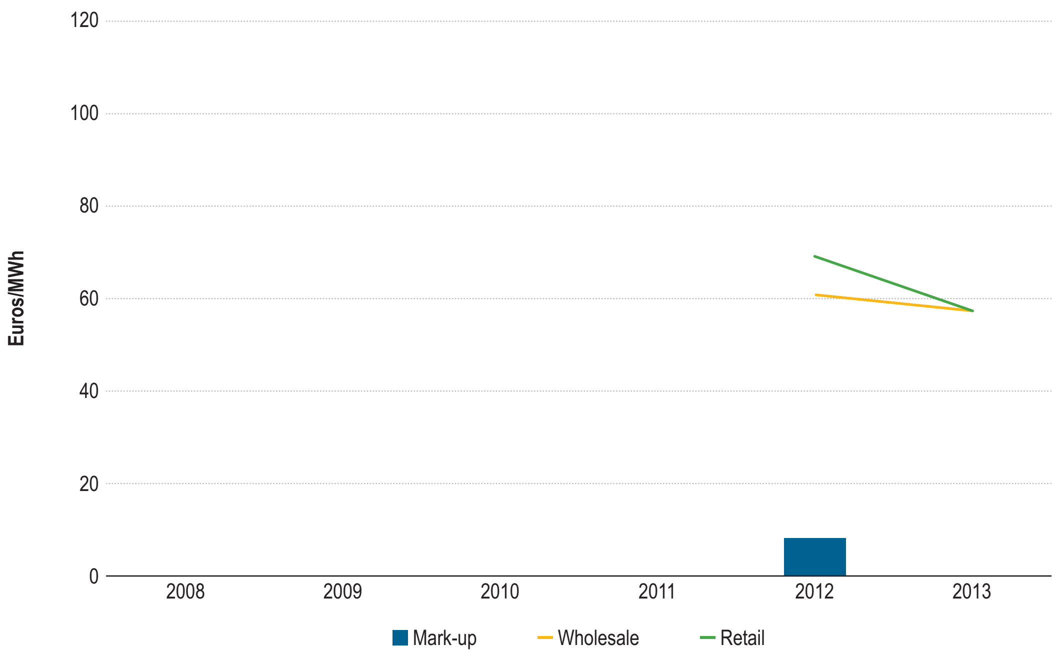
Great Britain



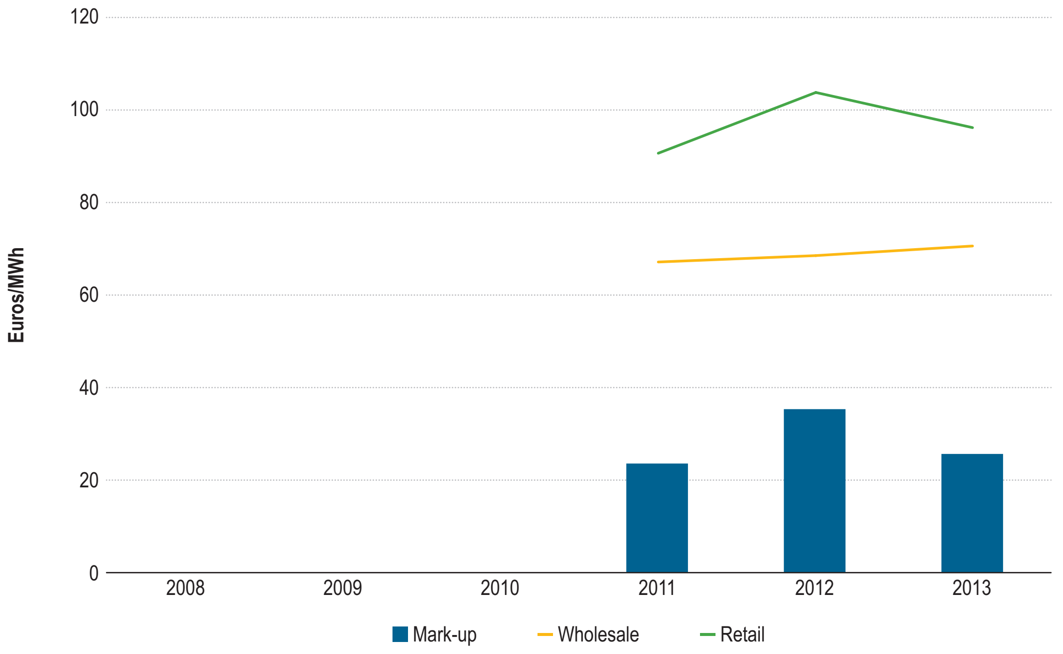
Greece



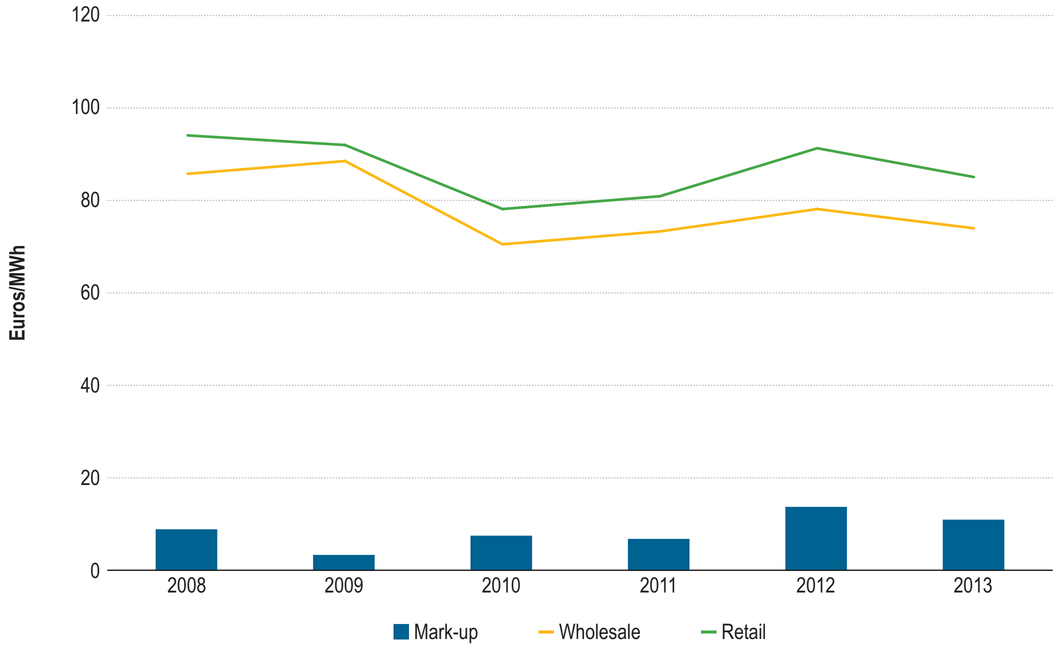
Hungary



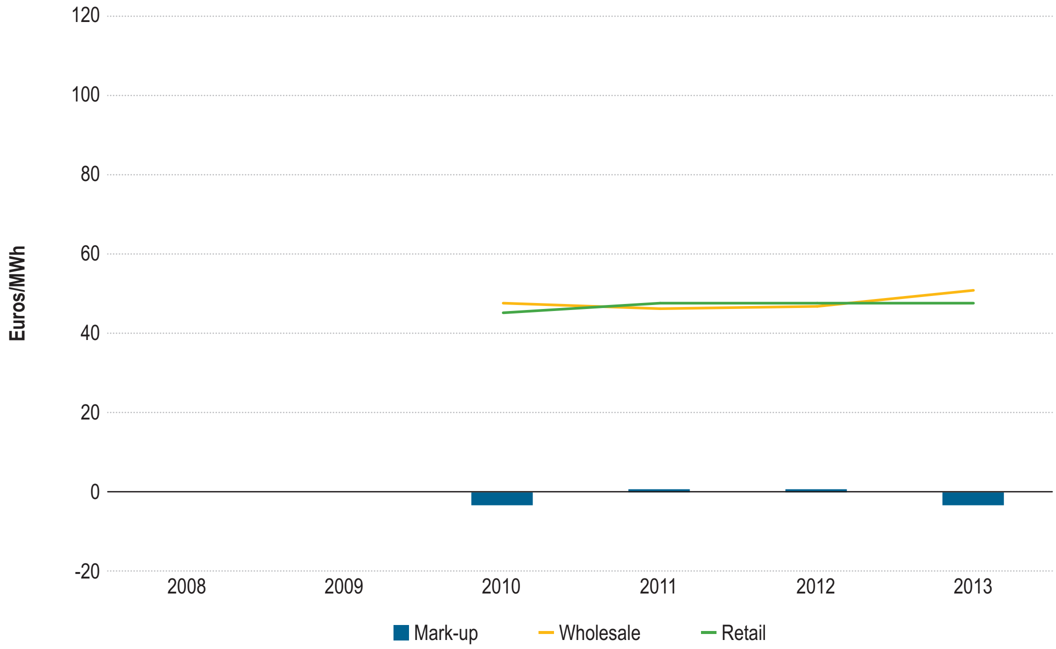
Ireland



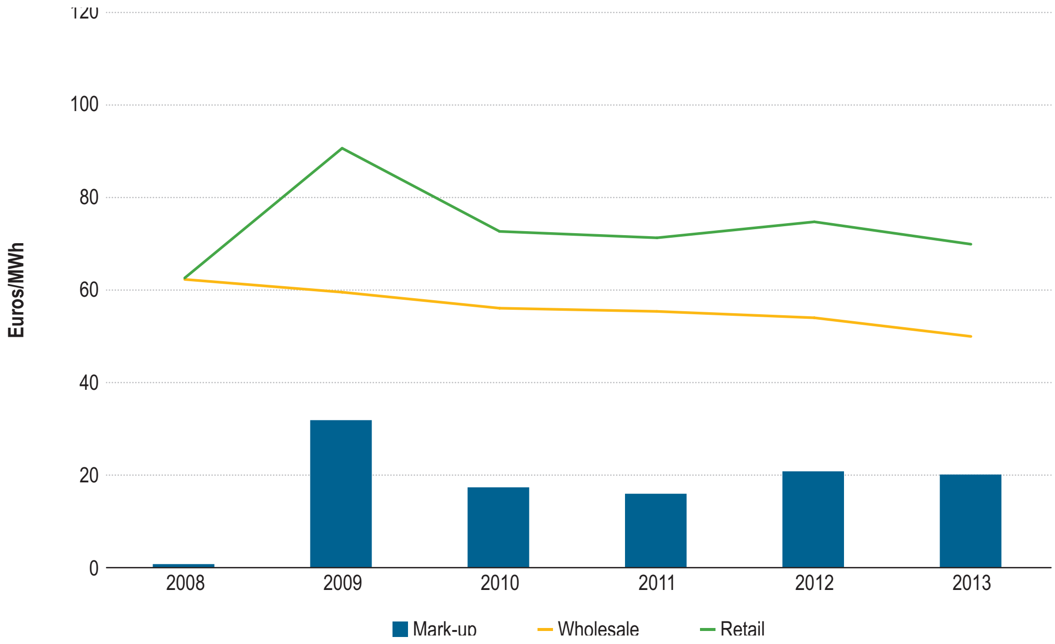
Italy



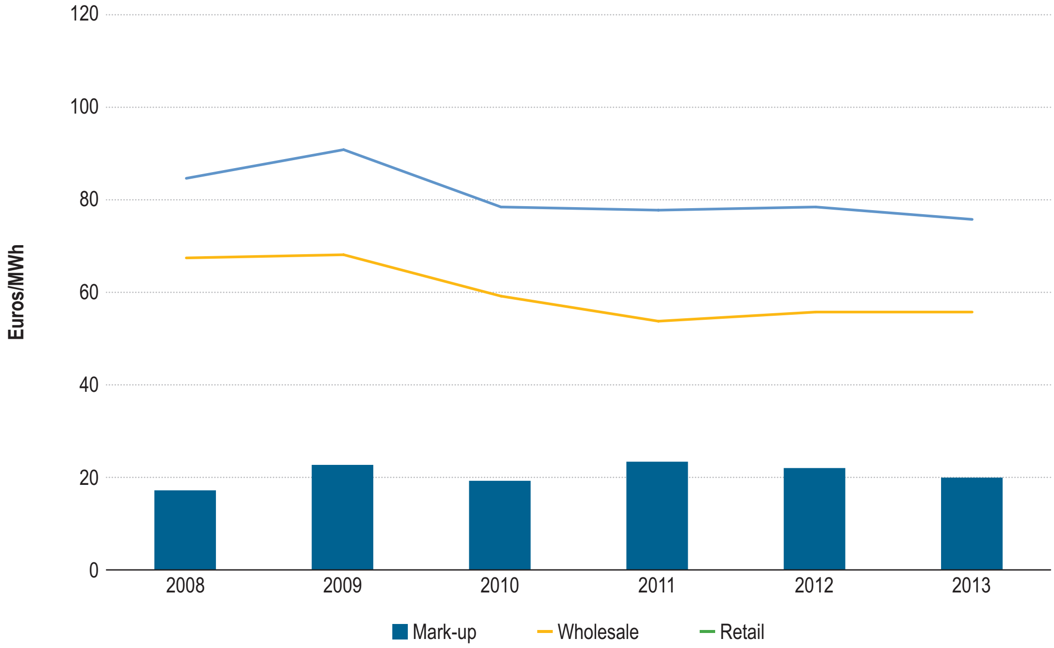
Lithuania



Luxembourg

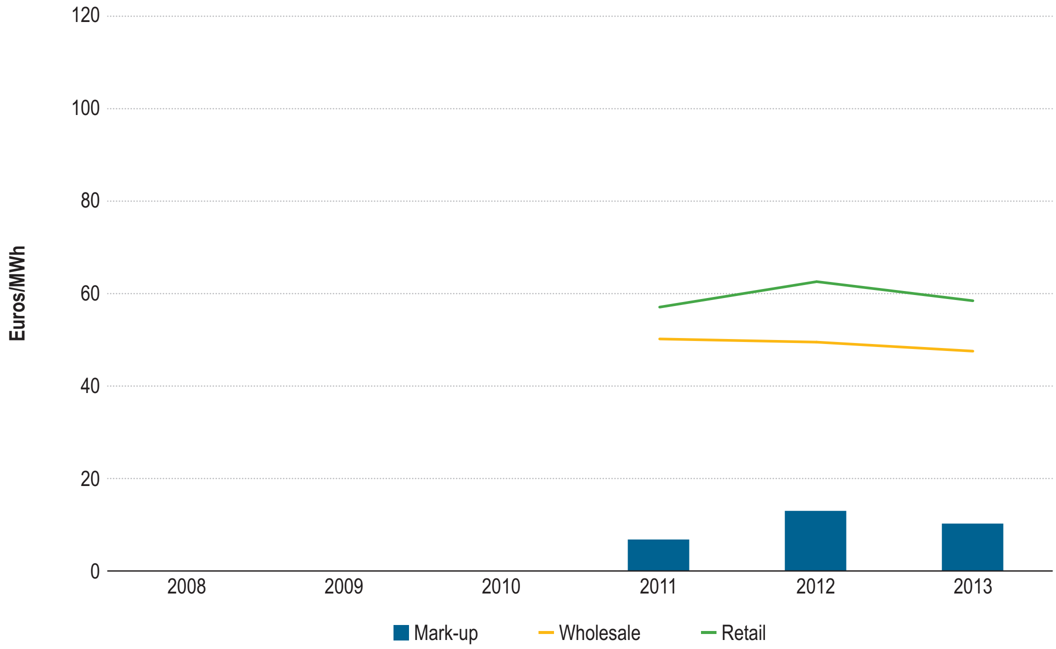


Netherlands

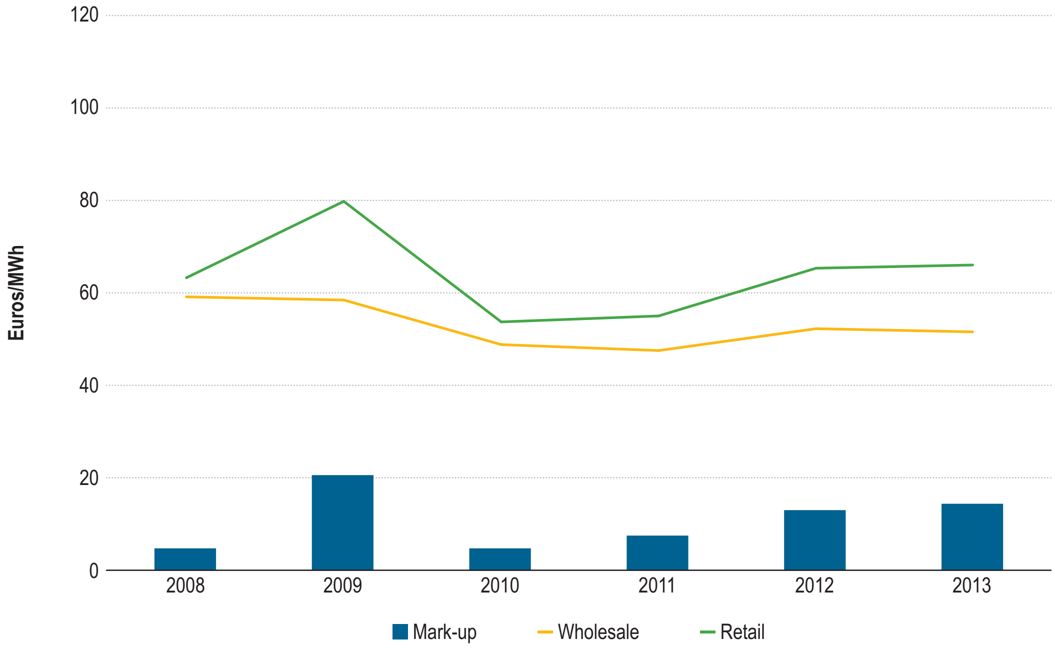


Norway

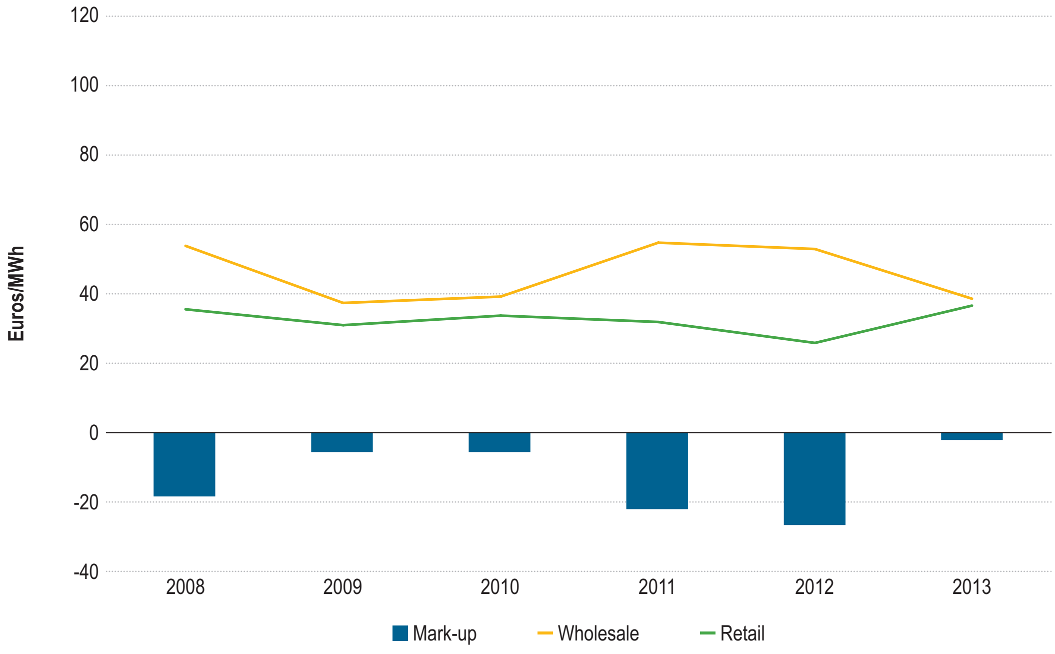
Poland



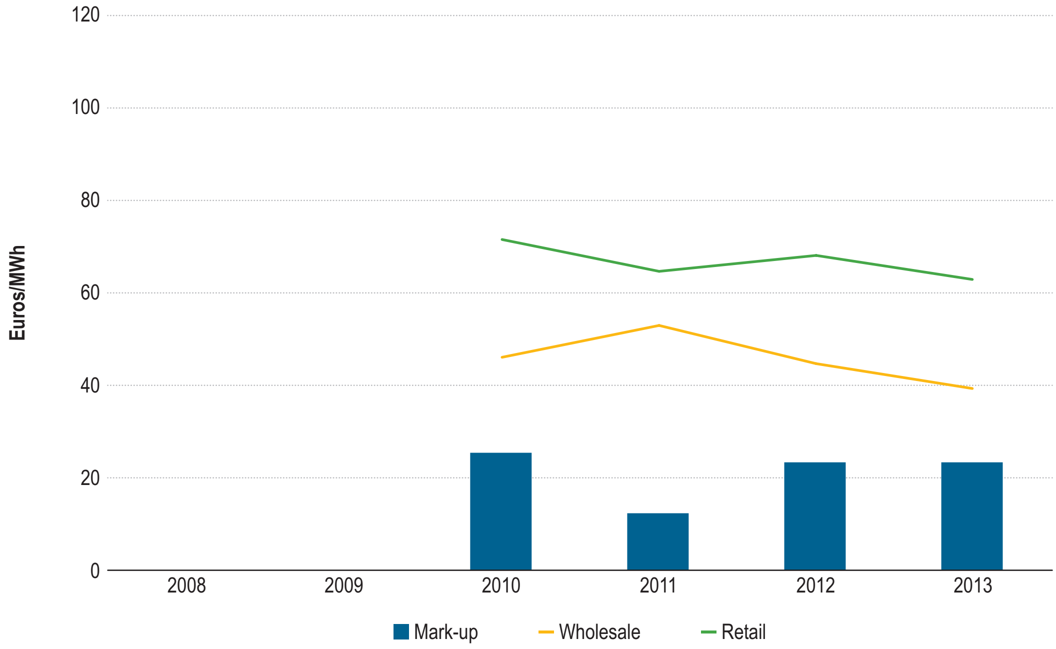
Portugal



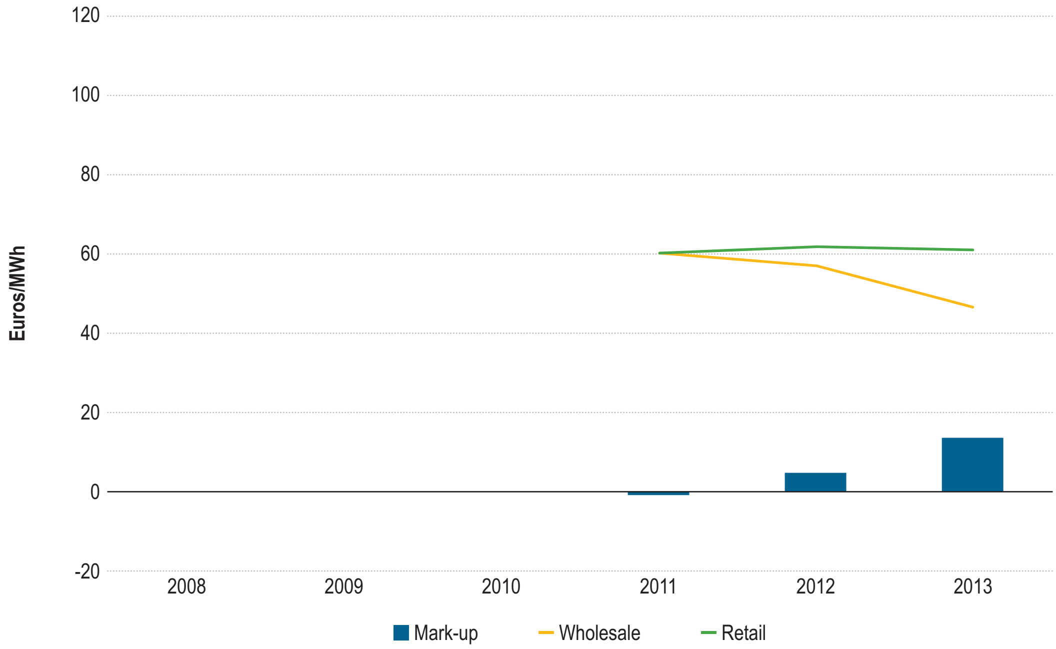
Romania



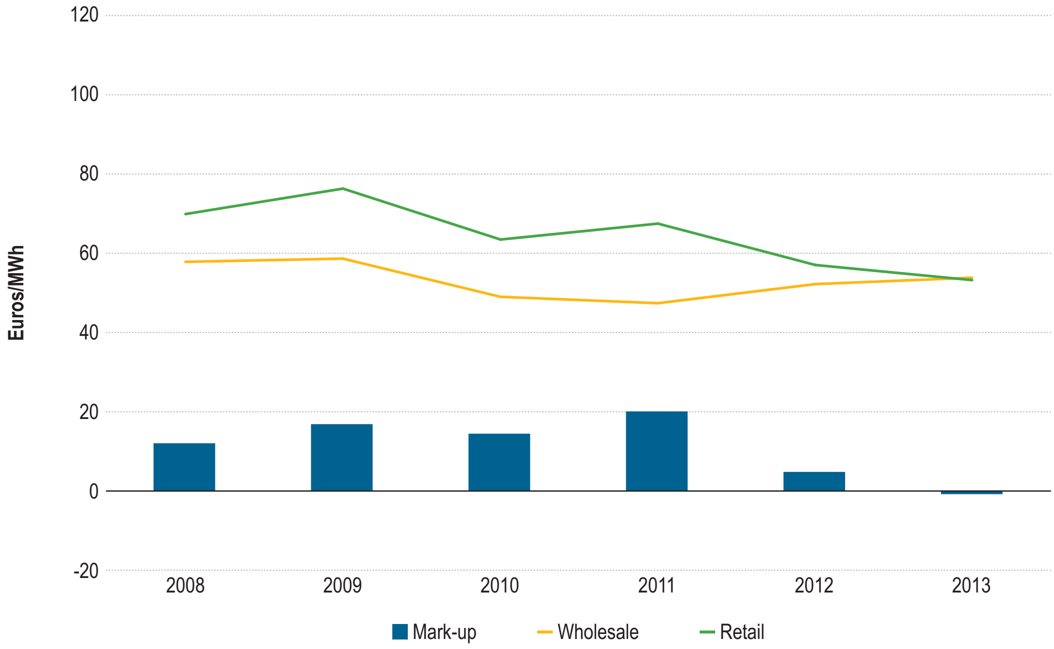
Slovakia



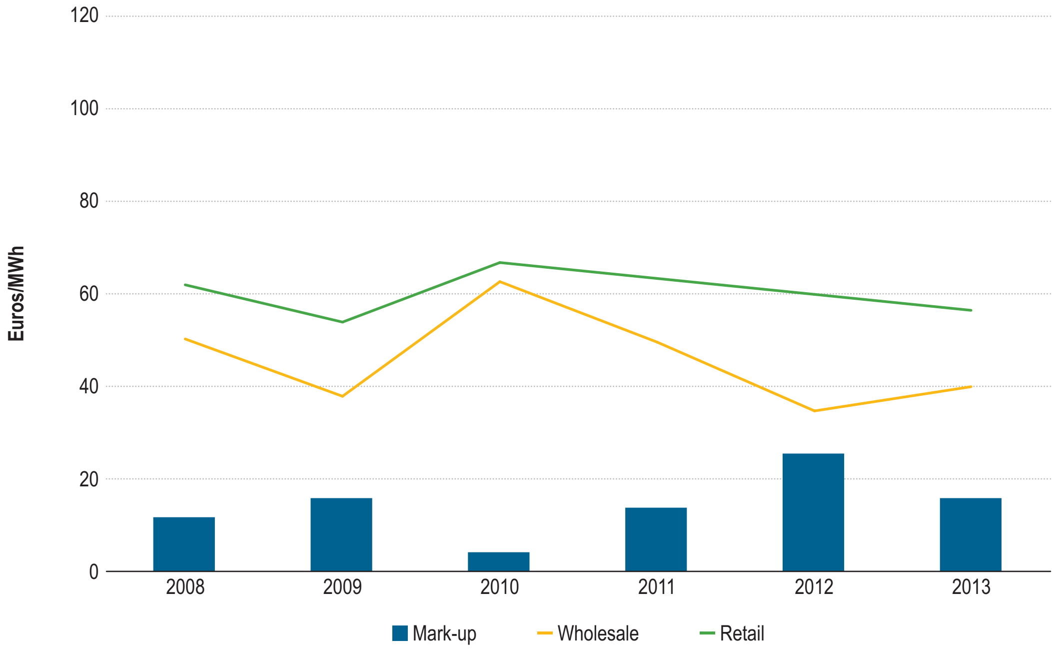
Slovenia



Spain



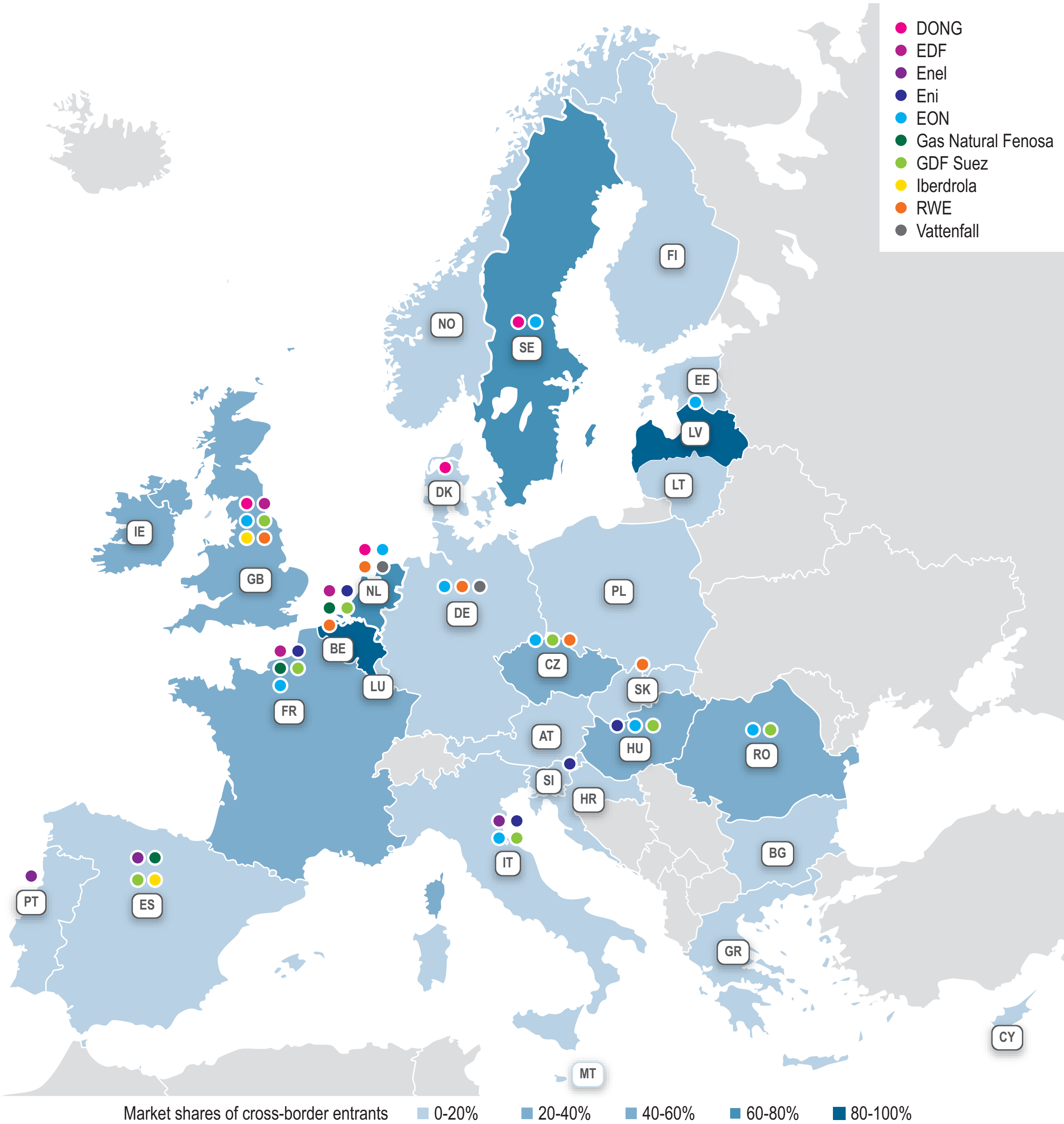
Sweden



Source: NRAs and European power exchanges data (2014) and ACER calculations

Annex 3: Presence of major gas suppliers in Europe

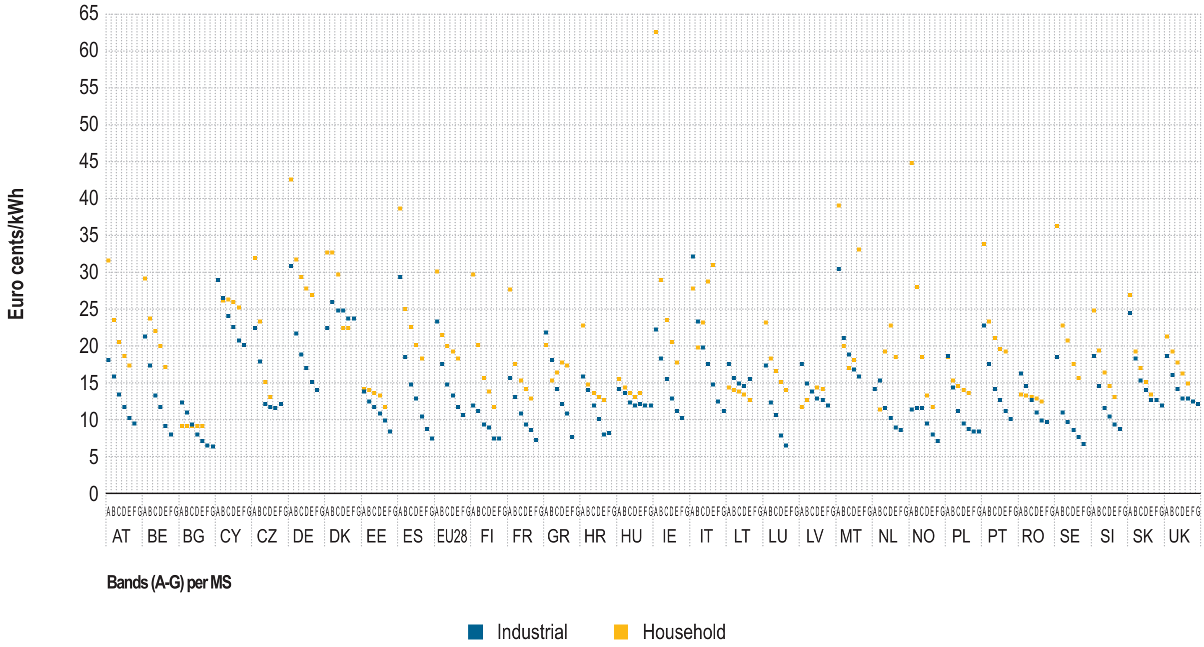
Figure A 4: Presence of major gas suppliers in Europe and market shares of cross-border entrants – 2013



Source: ACER analysis based on Datamonitor's data

Annex 4: Electricity and gas household and industrial consumer price levels per MS

Figure A 5: Electricity household and industrial consumer price levels per MS per band (euro cents/kWh)



Source: ACER, based on Eurostat (21/7/2014)

Notes: Dutch electricity prices for household consumer band DA are not applicable, as a special annual refund per connection would result in unrealistic national prices for this band. For large industrial end-users (band IF), prices are not applicable for Malta and Luxembourg, and not available for Ireland (confidential). Prices for Band IG are not available for a few countries, as the price data for this band are declared on a voluntary basis. Source: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/FR/nrg_price_esms.htm.

Figure A 5 shows electricity 2013 price levels (euro cents/kWh) per household and industrial consumer band. The price for electricity per kWh varies according to total annual electricity consumption. These consumption levels are categorised in 'bands' for both the household and industrial sector.

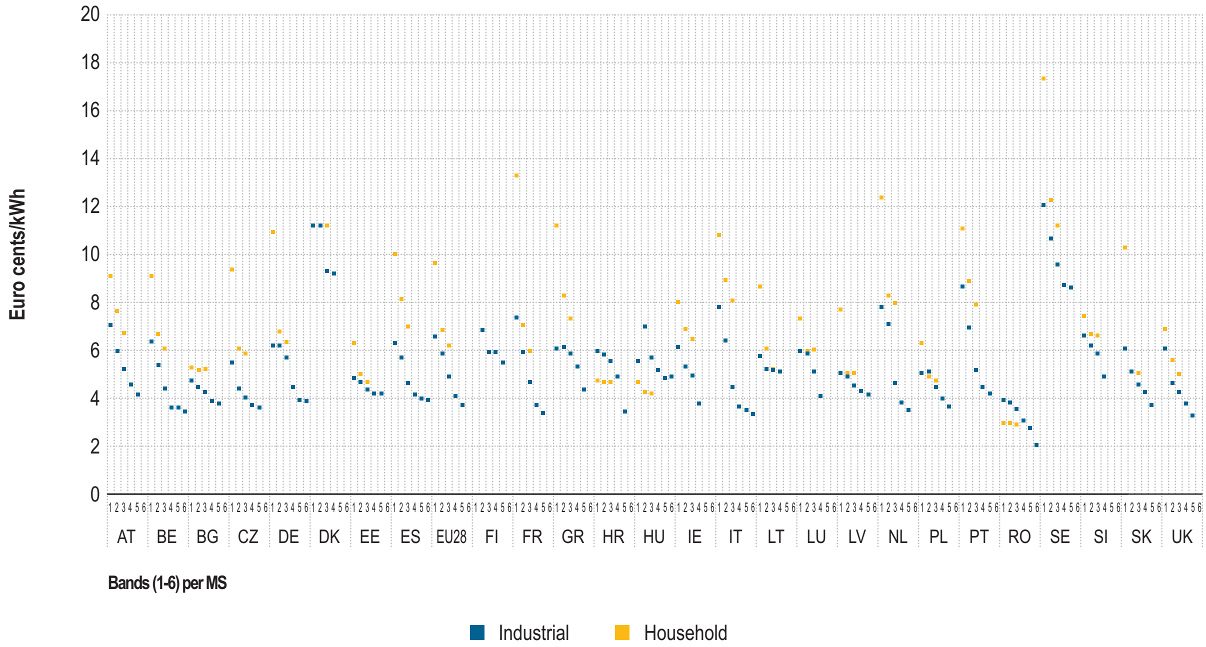
The household sector has five bands, ranging from DA to DE: DA: consumption < 1,000 kWh;

- DB: 1,000 kWh < consumption < 2,500 kWh;
- DC: 2,500 kWh < consumption < 5,000 kWh;
- DD: 5,000 kWh < consumption < 15,000 kWh;
- DE: consumption > 15,000 kWh.

The industrial sector has seven bands, ranging from IA to IG:

- IA: Consumption < 20 MWh;
- IB: 20 MWh < consumption < 500 MWh;
- IC: 500 MWh < consumption < 2,000 MWh;
- ID: 2,000 MWh < consumption < 20,000 MWh;
- IE: 20,000 MWh < consumption < 70,000 MWh;
- IF: 70,000 MWh < consumption < 150,000 MWh;
- IG: consumption > 150,000 MWh.

Figure A 6: Gas household and industrial consumer price levels per MS per band (euro cents/kWh)



Source: ACER, based on Eurostat (21/7/2014)

Notes: Due to the limited size of the natural gas markets in Finland (households), Cyprus, and Malta, data for these countries are not available or only partially available. Prices for large industrial end-users (band I5) are not applicable for Luxembourg, and confidential for Ireland and Slovenia. Prices for Band I6 (annual consumption above 4,000,000 GJ are not available for a few countries, as the price data for this band are declared on a voluntary basis.

Figure A 6 shows gas 2013 price levels (euro cents/kWh) per household and industrial consumer band. The price of gas per kWh varies according to the total amount of gas consumed per year. These consumption levels are categorised in 'bands' for both the household and industrial sector.

The household sector has three bands, ranging from D1 to D3:

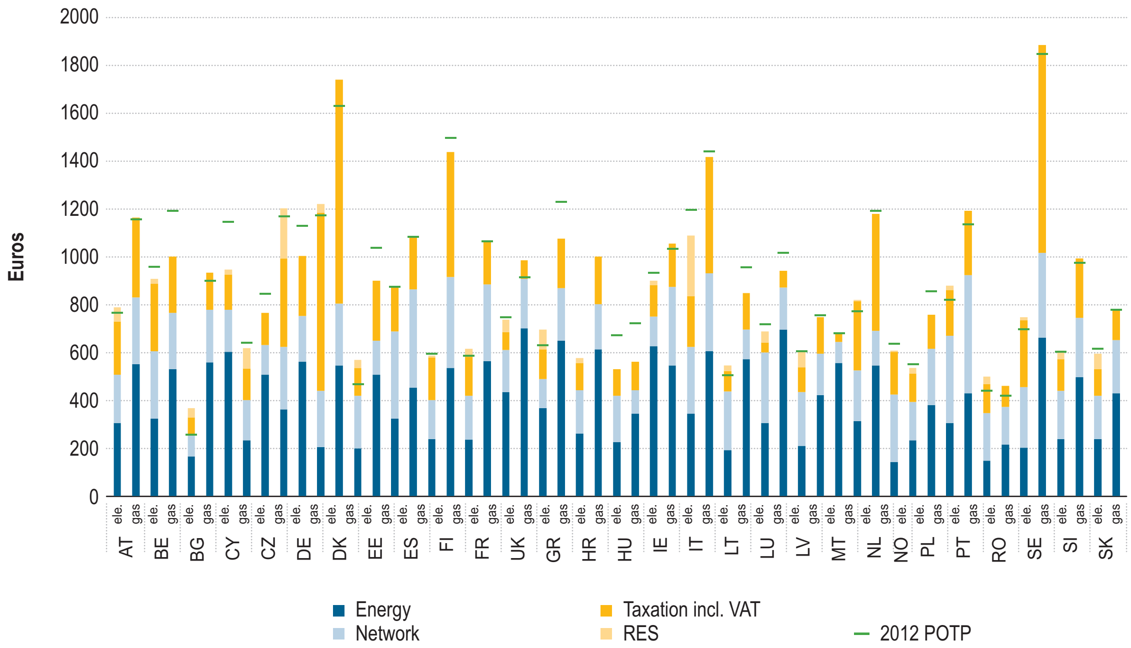
- D1: consumption < 20 GJ;
- D2: 20 GJ < consumption < 200 GJ;
- D3: consumption > 200 GJ.

Six bands are used for gas consumption in the industrial sector, ranging from I1 to I6:

- I1: consumption < 1,000 GJ;
- I2: 1,000 GJ < consumption < 10,000 GJ;
- I3: 10,000 GJ < consumption < 100,000 GJ;
- I4: 100,000 GJ < consumption < 1,000,000 GJ;
- I5: 1,000,000 GJ < consumption < 4,000,000 GJ;
- I6: consumption > 4,000,000 GJ.

Annex 5: Electricity and gas household price break-down

Figure A 7: 2013 POTP electricity and gas break-down and comparison with the 2012 price – incumbents' standard offers for households in capital cities – November– December 2013 (%)



Source: ACER Retail Database and information from NRAs (2013)

Annex 6: RES charges for industrial and household consumers

Table A 3: RES Charges for Industrial and Household consumers, EU-28. (Charges per Eurostat band (euros/MWh) unless a different categorisation applies).

MS/ Band	Industrial consumers in general are obliged to pay RES charges	Categories compatible with Eurostat bands	IA (<20 MWh)	IB (20 – 500 MWh)	IC (500–2,000 MWh)	ID (2,000–20,000 MWh)	IE (20,000–70,000 MWh)	IF (70,000–150,000 MWh)	IG (>150,000 MWh)	Additional information	RES Charges for household consumers (Based on ACER Retail Database)
AT	YES	Yes	not yet available	not yet available	not yet available	13.597 EUR per MWh	not yet available	not yet available	not yet available		14.77 euros/MWh
BE	YES	Yes for RES paid through the network.	2.35 euros/MWh	2.35 euros/MWh	2.35 euros/MWh	2.35 euros/MWh	2.35 euros/MWh	2.35 euros/MWh	2.35 euros/MWh	Industrial consumers pay a RES charge through the transmission network charges, depending on the region in which they are located: Flanders: 2.8699 euros/MWh, Brussels: 2.3528 euros/MWh, Walloon region: 16.1687 euros/MWh. The cost of RES-obligations imposed on suppliers is included in the energy component. For large industrial consumers no average euros/MWh can be given, since this is part of the negotiated energy price in the supply contract.	5.5 euros/MWh
BG	YES		9.6 euros/MWh	9.6 euros/MWh	9.6 euros/MWh	9.6 euros/MWh	9.6 euros/MWh	9.6 euros/MWh	9.6 euros/MWh		9.6 euros/MWh
CY	YES		5.0 euros/MWh	5.0 euros/MWh	5.0 euros/MWh	5.0 euros/MWh	5.0 euros/MWh	5.0 euros/MWh	5.0 euros/MWh		5.0 euros/MWh
CZ	YES	Yes	21.18 euros/MWh	21.18 euros/MWh	21.18 euros/MWh	21.18 euros/MWh	21.18 euros/MWh	21.18 euros/MWh	21.18 euros/MWh		21.32 euros/MWh
EE	YES	Yes	8.7 euros/MWh	8.7 euros/MWh	8.7 euros/MWh	8.7 euros/MWh	8.7 euros/MWh	8.7 euros/MWh	8.7 euros/MWh	Expected to fall to 0.77 euros/MWh in 2014.	8.7 euros/MWh
FI	YES		0.925 euros/MWh	0.925 euros/MWh	0.925 euros/MWh	0.925 euros/MWh	0.925 euros/MWh	0.925 euros/MWh	0.925 euros/MWh		20 euros/MWh
FR	YES It depends on the company's consumption.		Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	All industrial consumers are obliged to pay a CSPE charge, which includes RES charges. CSPE is capped at 569,418 euros. CSPE should not exceed 0.5% of the added value for industrials consuming more than 7,000 MWh.	7.94 euros/MWh
GR	YES		1.79 euros/MWh (HV) and 8.87 euros/MWh (MV)	1.79 euros/MWh (HV) and 8.87 euros/MWh (MV)	1.79 euros/MWh (HV) and 8.87 euros/MWh (MV)	1.79 euros/MWh (HV) and 8.87 euros/MWh (MV)	1.79 euros/MWh (HV) and 8.87 euros/MWh (MV)	1.79 euros/MWh (HV) and 8.87 euros/MWh (MV)	1.79 euros/MWh (HV) and 8.87 euros/MWh (MV)	An annual cap of 991,000 euros applies per consumption site. In 2013, only 2 large industrial sites are actually estimated to have reached this cap.	20.8 euros/MWh
HR	YES	Yes	4.58 euros/MWh	4.58 euros/MWh	4.58 euros/MWh	4.58 euros/MWh	4.58 euros/MWh	4.58 euros/MWh	4.58 euros/MWh	Customers that have the obligation to acquire a permit for greenhouse gas emissions (regulated by other legislation) are obliged to pay 0.005 HRK/kWh (0.65 Euro/MWh). This is irrespective of consumption, but depends on the type of activity.	4.65 Euro/MWh
HU	YES	Yes	0.127 euros/MWh	0.127 euros/MWh	0.127 euros/MWh	0.127 euros/MWh	0.127 euros/MWh	0.127 euros/MWh	0.127 euros/MWh	RES is charged to customers not entitled to universal supply (connection capacity exceeding 3 x 63 amperes).	0 Euro/MWh

MS/ Band	Industrial consumers in general are obliged to pay RES charges	Categories compatible with Eurostat bands	IA (<20 MWh)	IB (20 – 500 MWh)	IC (500–2,000 MWh)	ID (2,000–20,000 MWh)	IE (20,000–70,000 MWh)	IF (70,000–150,000 MWh)	IG (>150,000 MWh)	Additional information	RES Charges for household consumers (Based on ACER Retail Database)
IE	YES. It depends on maximum import capacity.		Small commercial customers: maximum import capacity <30kVA: 129.83 euros	Medium and large customers: maximum import capacity => 30kVA: 18.47 euros/kVa							4.39 euros/MWh
IT	YES		74.6 euros/MWh	53.2 euros/MWh	45.6 euros/MWh	44.6 euros/MWh	40.3 euros/MWh	30.0 euros/MWh	17.0 euros/MWh		63.22 euros/MWh
LT	YES	Yes	5.585 euros/ MWh	5.585 euros/ MWh	5.585 euros/ MWh	5.585 euros/ MWh	5.585 euros/ MWh	5.585 euros/ MWh	5.585 euros/ MWh		5.75 euros/MWh
LU	YES	No. Different categories	11.4 euros/MWh Category A (=< 25 MWh/year)	3.8 euros/ MWh. Category B > 25 MWh / year (unless they apply for Category C)			0.75 euros/ MWh. Category C: =>20,000 MWh or connected to 65 kV grid or being classified as a large consumer				11.4 euros/MWh
NL	YES	No. Different categories	1st Cat: <10 MWh: 1.10 euros/MWh	2nd Cat: 10 MWh- 50 MWh: 1.40 euros/ MWh	3rd Cat: 50 MWh- 10,000 MWh: 0.4 euros/ MWh	4th Cat: >10,000 MWh: 0.017 euros/MWh				RES charges are expected to increase as follows: 1st Category: 2.3 euros in 2014, 3.6 euros in 2015 and 5.6 euros/ MWh in 2016; 2nd Cat: 2.7 euros in 2014, 4.6 euros in 2015 and 7.0 euros/ MWh in 2016; 3rd Cat: 7.0 euros in 2014, 1.2 euros in 2015, 1.9 euros/MWh in 2016; 4th Cat: 0.034 euros in 2014, 0.055 euros in 2015 and 0.084 euros/ MWh in 2016.	1.1 euros/MWh
PT	It depends on the voltage level.		VHV – 0.00 euros/MWh, HV – 0.00 euros/MWh, MV – 0.02 euros/ MWh	VHV – 0.00 euros/MWh, HV – 0.00 euros/MWh, MV – 0.02 euros/ MWh	VHV – 0.00 euros/MWh, HV – 0.00 euros/MWh, MV – 0.02 euros/ MWh	VHV – 0.00 euros/MWh, HV – 0.00 euros/ MWh MV – 0.02 euros/MWh	VHV – 0.00 euros/MWh, HV – 0.00 euros/MWh, MV – 0.02 euros/ MWh	VHV – 0.00 euros/MWh, HV – 0.00 euros/MWh, MV – 0.02 euros/ MWh	VHV – 0.00 euros/MWh, HV – 0.00 euros/MWh, MV – 0.02 euros/ MWh		4.65 euros/MWh
RO	YES		8.1 euros/MWh	8.3 euros/MWh	8.44 euros/MWh	7.7 euros/MWh	8.3 euros/MWh	7.4 euros/MWh	-		7.62 euros/MWh
SI	YES. It depends on contracted power, voltage level, category of supply and the purpose of the electricity usage.		Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	The price ranges from 9.713 euros/kW/year to 48.726 euros/ kW/year.	8.83 euros/MWh
SK	YES	Yes	16.04 euros/ MWh	16.04 euros/ MWh	16.04 euros/ MWh	16.04 euros/ MWh	16.04 euros/ MWh	16.04 euros/ MWh	16.04 euros/ MWh	The RES charge is a component of the “TPS charge” (Tariff for Operation of the System)	16.02 euros/MWh

MS/ Band	Industrial consumers in general are obliged to pay RES charges	Categories compatible with Eurostat bands	IA (<20 MWh)	IB (20 – 500 MWh)	IC (500–2,000 MWh)	ID (2,000–20,000 MWh)	IE (20,000–70,000 MWh)	IF (70,000–150,000 MWh)	IG (>150,000 MWh)	Additional information	RES Charges for household consumers (Based on ACER Retail Database)
DE	YES with exemptions, depending on an individual company's consumption.		52.77 euros/MWh	52.77 euros/MWh	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	All companies pay 52.77 euros/MWh up to their 1,000 MWh consumed. Thereafter the RES charge depends on a) exemptions with regard to the type of industry in which a company is involved (manufacturing, railway; electricity costs at least 14 per cent of gross value etc.) if approved by BAFA. Depending on the exemption level, RES charges for MWh consumed in addition to the first 1,000 MWh are calculated.	52.77 euros/MWh
DK	YES with exemptions. Estimated at 8.5% of the final price.	No.	–	–	–	–	–	–	–	RES charges depend on the consumption of the company in question. Based on the hourly Nord Pool Spot prices, the RES charge is estimated at 8.5% of the final price for industrial electricity consumers.	8.71 euros/MWh
NO	YES with exemptions		1.42 euros/MWh	1.42 euros/MWh	1.42 euros/MWh	1.42 euros/MWh	1.42 euros/MWh	1.42 euros/MWh	1.42 euros/MWh	Exemptions relate to the type of electricity consumption among other factors.	1.48 euros/MWh
PL	YES with exemptions		Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Industrial end-users who use more than 100,000 MWh of electricity annually, are obliged to buy green certificates for 13% (in 2014, in 2013 – 12%) of all energy they sell to end-users: - up to 20% of the energy they use for their own production if the cost of energy is greater than 12% of the value of their production; - up to 60% of the energy they use for their own production if the cost of energy amounts to 7 to 12% of the value of their production; - up to 80% of the energy they use for their own production if the cost of energy amounts to 3 to 7% of the value of their production. As of September 2013, some big industrial end-users who are entitled to exemptions can fulfil the RES support obligation by themselves at a reduced amount were obliged to buy energy from the seller encumbered with green certificates.	6.13 euros/MWh
SE	YES with exemptions for energy intensive industries.		3.01 euros/MWh	3.01 euros/MWh	3.01 euros/MWh	3.01 euros/MWh	3.01 euros/MWh	3.01 euros/MWh	3.01 euros/MWh	Exemptions exist for electricity intensive industries.	3.06 euros/MWh
UK	YES with exemptions		Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	Cannot say	RES charges for industrial consumers are comprised of Renewable Obligation Certificates (ROCs) (10.6 euros/MWh), the Climate Change Levy (CCL) (6.39 euros/MWh) and the Levy Exemption Certificates (LECs)"(depending on the certificates and their price on the market), the Feed-in-Tariffs (FITs) (in total 522.76 million euros are estimated to be paid by all industrial consumers)) and the Price Carbon Floor (PCF) (included in the direct fuel cost and therefore already reflected in the wholesale cost).	12.83 euros/MWh

Source: ACER Retail Database and information from NRAs (2013)

Annex 7: List of price comparison websites from which offers were obtained

Table A 4: Price comparison websites for the offer data analysis

Country	Electricity	Gas
AT	http://www.e-control.at/haushalts-tarifkalkulator	http://www.e-control.at/haushalts-tarifkalkulator
BE	http://www.brusim.be/	http://www.brusim.be/
BE	Information from NRA	Information from NRA
HR	https://kompare.hr/	Supplier's site: http://www.gpz-opskrba.hr/
CZ	http://kalkulator.eru.cz/	http://www.cenyenergie.cz
CY	Information from NRA	n.a.
DK	http://www.elpristavlen.dk/	http://gasprisguiden.dk
EE	https://minuelekter.ee/calc	Supplier's site: http://www.gaas.ee
FI	http://www.sahkonhinta.fi/	http://www.gasum.fi/Yksityisille/Kodin-lammitys/hinnastot/
FR	www.energie-info.fr	www.energie-info.fr
DE	www.verivox.de	www.verivox.de
GR	NRA	http://www.aerioattikis.gr/default.aspx?pid=34&la=1&artid=135
HU	Information from NRA and other offers from 3 suppliers	http://www.vasarlocsapat.hu
IE	http://www.bonkers.ie/compare-gas-electricity-prices/electricity/	http://www.bonkers.ie/compare-gas-electricity-prices/gas
IT	http://trovaofferte.autorita.energia.it/	http://trovaofferte.autorita.energia.it/
LV	Information from NRA	Information from NRA
LT	Information from NRA	Information from NRA
LU	http://www.ilr.public.lu/stroumagas/comparaison_des_prix/index.html	http://www.ilr.public.lu/gaz/fournisseurs/
MT	Information from NRA	n.a.
NL	http://www.energieleveranciers.nl/energie-vergelijken	http://www.easyswitch.nl/energie
NI	http://www.consumercouncil.org.uk/energy/price-comparison-/	n.a.
NO	http://www.konkurransetilsynet.no/en/Electricity-prices/Check-power-prices/	n.a.
PL	http://ure.gov.pl/ftp/ure-kalkulator/ure/formularz_kalkulator_html.php	Information from NRA
PT	http://www.erse.pt / Simulador de Preços de Energia Elétrica	http://www.erse.pt / Simulador de Preços des Gas Natural
RO	Information from NRA	Information from NRA
SK	http://www.urso.gov.sk:8088/CISRES/Agenda.nsf/KalkulackaElektrinaNewWeb	http://www.urso.gov.sk:8088/CISRES/Agenda.nsf/KalkulackaPlynNewWeb
SI	http://www.agen-rs.si/primerjalnik/index.php?/kalkulatorelektrika/kalkulator/action/IzbiraOdjemalca/redirected/1/	http://www.agen-rs.si/primerjalnik/index.php?/kalkulatorplin/kalkulator/action/korak2/redirected/1/
ES	http://comparadorofertasenergia.cnmc.es/comparador/	http://comparadorofertasenergia.cnmc.es/comparador/
SE	http://www.ei.se/elpriskollen/	Individual suppliers' offers
UK	http://www.ukpower.co.uk/	http://www.ukpower.co.uk/

Source: ACER, November–December 2013

Annex 8: Survey of estimates of values of DSF

Table A 5: Survey of estimates of values of implicit DSF in electricity (euros/kW/yr)

Source	Scope	Metric	Benefit	Origin of benefit	Comment
EC COM(2014) 356, *Benchmarking smart metering deployment in the EU-27 with a focus on electricity*	EU	billion euros NPV	23 billion NPV	Net smart metering benefits projected in CBA studies, including administrative savings, net of metering and operating costs	Total projected by CEPA from study result of euros 86 per metering point. Many MSs appear to have been unambitious in relation to the uptake of DSF methods.
		euros/kW/year of peak demand	3/kW/yr	Gross energy savings (only), arising from assorted smart metering programs varying by MS. Includes demand reduction due to greater awareness of consumption, and other measures mostly likely to focus on implicit DSF.	Amount projected by CEPA from study result of average 3% energy saving. This 3% is likely to apply to the newly metered customers, not the whole market. This level is consistent with greater awareness of usage and simple ToU tariffs.
		% peak load shift	1% to 10%		
A Faruqui, D Harris and R Hledik (2009), *Unlocking the euros53 Billion Savings from Smart Meters in the EU,* The Brattle Group	EU	euros/kW/year of peak demand	2 to 12/kW/yr	Gross energy and network benefits from smart metering, mostly implicit DSF, excluding administrative benefits and smart metering costs	In the low cases, a net loss is made after costs of metering and admin benefits. Achieving the high case is contingent upon high level of consumer engagement.
Bradley P., M. Leach and J. Torriti (2013) *A Review of the Costs and Benefits of Demand Response for Electricity in the UK*	UK	euros/kW/year of peak demand	6/kW/year	Gross energy benefits from smart metering schemes, mostly implicit DSF, excluding administrative benefits and smart metering cost. Also includes resistive loss savings and environmental savings from CO_2 abatement.	GB is the most optimistic of the EU MSs in relation to the overall financial benefits of smart metering, albeit that energy reduction projections in the UK from smart metering are less than the 3% average in MSs' CBAs.

Source: Literature survey undertaken on behalf of ACER (2014)

Table A 6: Survey of estimates of values of explicit DSF in electricity – (euros/kW/yr)

Source	Scope	Metric	Benefit	Origin of benefit	Comment
Capgemini (2008), Demand Response: a decisive breakthrough for Europe	EU-15	euros/kW/yr of peak demand	up to 60/kW/yr	Net benefits of DSF, from all kinds of schemes, explicit and implicit, to 2020	Inconsistent with the results of other studies.
Source: Booz & Company (2013), Benefits of an Integrated European Energy Market	EU (approx.)	euros/kW/yr of peak demand	6 to 10/kW/yr	Net benefits of DSR to balance supply and demand to 2030, taking into account a fully integrated market with optimal interconnection	Much greater savings potential if full market integration and optimal interconnection levels are delayed
EWI (2012), Flexibility options in European electricity markets in high RES-E scenarios	EU (approx.)	% of peak demand in 2050	10%	Potential size of explicit DSR resource by 2050, employed to balance supply and demand in a future high wind low carbon future	The 10% is intended to be an achievable level based on a potential level of 18%. Can be compared with the 10% demand resources already available in some parts of the USA.
H Gils (2014), Assessment of the theoretical demand response potential in Europe, Energy 67 (2014) 1-18	Europe (broader than EU)	% of peak demand	14%	Potential size of the explicit DSR resource	Total potential size, without regard for a trajectory of achievability as in EWI (2012)
dena (2010), Grid Study II – Integration of Renewable Energy Sources in the German Power Supply System from 2015 – 2020 with an Outlook to 2025	Germany	euros/kW/yr of peak demand	6/kW/yr	Net system benefit of explicit DSR to balance supply and demand, mainly from avoiding capital costs of flexible plant and T&D, and reducing wind curtailment	Amount projected by CEPA from euros500m/year total in study. Study assesses appropriate amounts of DSR against other sources of flexibility, capped by available amount.
S Feuerriegel and D Neumann (2014), Measuring the financial impact of demand response for electricity retailers, Energy Policy 65, 359–368	Germany	euros/kW/yr of peak demand	12/kW/yr	Some net benefits of explicit DSR to balance supply and demand	Implausible quantity of DSR resource by comparison with other studies, and only partial estimate of benefits

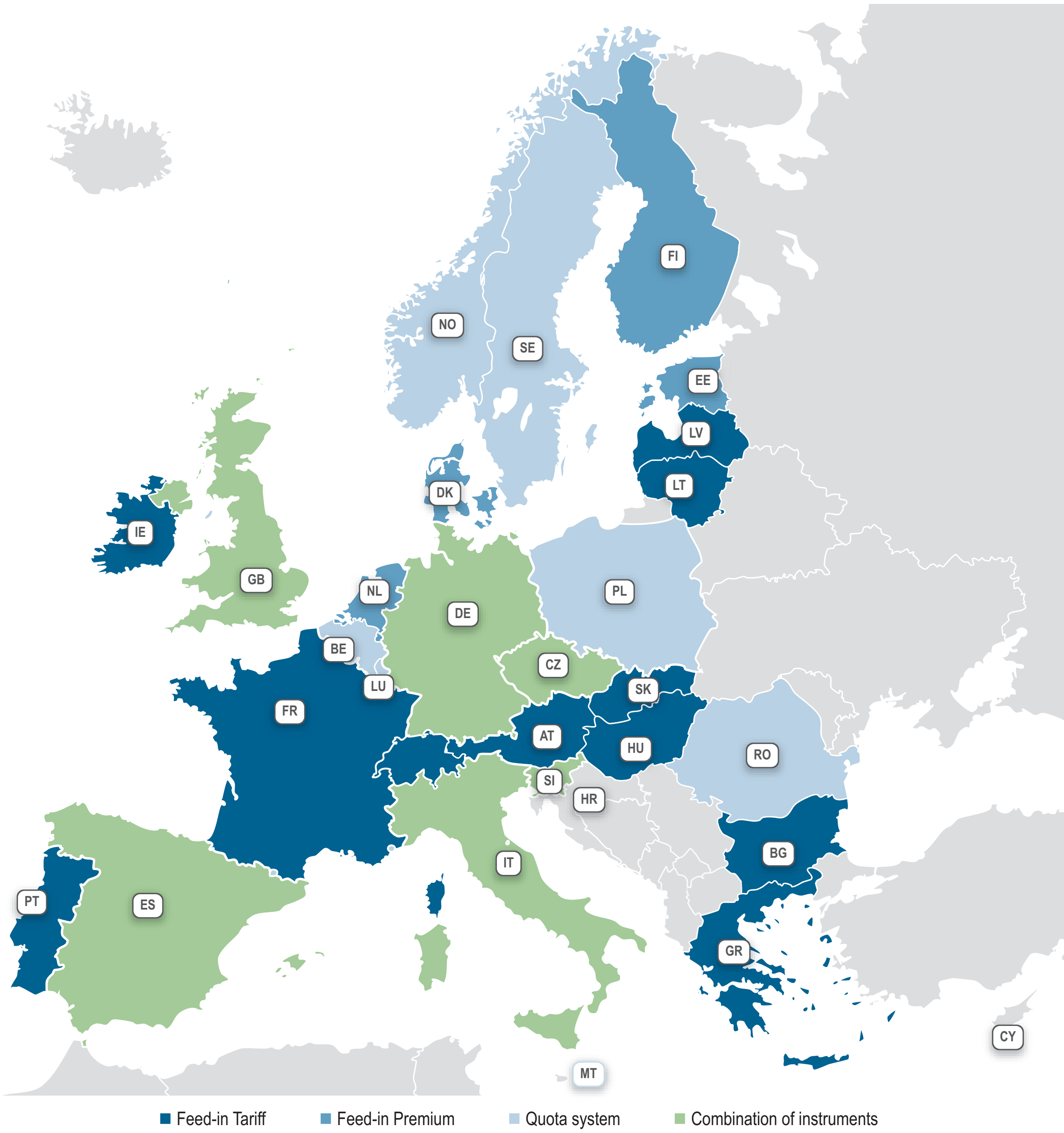
Source	Scope	Metric	Benefit	Origin of benefit	Comment
Bradley P., M. Leach and J. Torriti (2013) A Review of the Costs and Benefits of Demand Response for Electricity in the UK	UK	euros/kW/yr of peak demand	0.5 to 19/kW/yr	Net benefits of explicit DSR to balance supply and demand, and reduce or eliminate involuntary curtailments	The value in balancing supply and demand mostly arises as wind power grows from its present level, which GB currently has sufficient flexibility to cope with. No estimate was made of what proportion of customer involuntary curtailments DSR could practically avoid.
Imperial College London (2012), Understanding the Balancing Challenge, Study for Department of Energy and Climate Change	UK	euros/kW/yr of peak demand	1 to 92/kW/yr	Net benefits of explicit DSR to balance supply and demand in the context of high intermittency in generation and decarbonisation of energy usage	Makes clear that if other flexibility technologies are thoroughly used, the value of DSR can be low, though also dependent upon other factors. DSR becomes exceedingly valuable for balancing if those other sources of flexibility are restrained, or in particular demand conditions.
US Department of Energy (2006): Benefits of demand response in electricity markets and recommendations for achieving them	USA (various zones)	euros/kW/yr of peak demand (gross)	0.5 to 6.4/kW/yr	Net benefits of explicit DSR to balance supply and demand, as found collated from seven studies of prospects for DSR	
		euros/kW/yr of peak demand (normalised)	0.7 to 1.5/kW/yr		The normalised amount compares the above on the basis of a 10% take-up of DSR, and corrects for some other study differences
Brattle Group (2007), Quantifying Demand Response Benefits In PJM	PJM (part), USA	euros/kW/yr of peak demand	1.2 to 2.4/kW/yr	Net benefits of explicit DSR delivering a 3% reduction in peak demand	In practice the DSR resource available to some US markets is up to 10% of their peak demand

Source: Literature survey undertaken on behalf of ACER (2014)

Note: During the proofing period of this report, DG-ENER published KEMA, Imperial College and NERA (2014), Integration of Renewable Energy in Europe. It reports the result of modelling two scenarios (low and high) for the increased use of explicit DSF, to estimate the potential savings in the costs of additional transmission capacity needed in the EU by 2030 for renewables integration. This resulted in an estimate of around euros10 billion to euros15 billion per year (euros20/kW/yr to euros30/kW/yr). The model result is shown only in graphical form at Fig 129 of that report, hence the approximate nature of the figures reported here.

Annex 9: Overview of primary national RES support regimes in Europe

Figure A 8: Overview of primary national RES support schemes

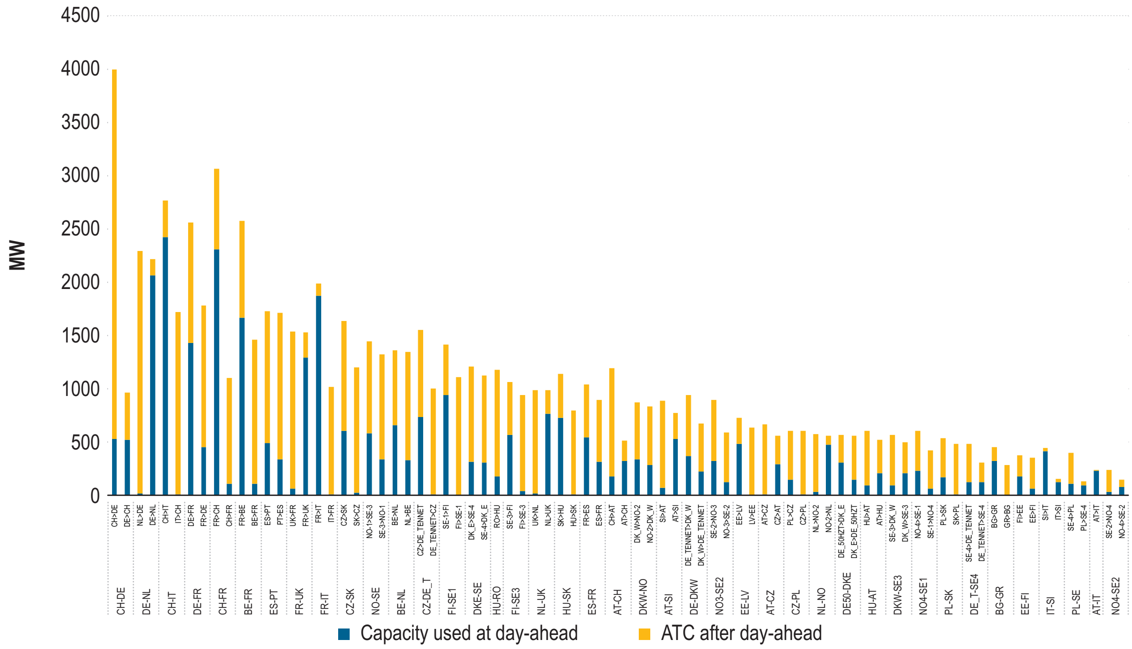


Source: RES Legal (2014), available on: http://www.res-legal.eu

Note: The map shows the main support instrument in each member state based on three general categories and a combination of these three. Tax incentives, loans and other forms of support measures are not included in the map.

Annex 10: Average available transfer capacity after day-ahead gate closure per border

Figure A 9: Average available transfer capacity after day-ahead gate closure per border – 2013 (MW)



Source: ENTSO-E, data provided by NRAs through the ERI, Vulcanus (2014) and ACER calculations

Annex 11: Methodological note on the calculation of the potential for imbalance netting, exchange of balancing energy and benefits that can be achieved from the integration of balancing energy markets

This annex explains the scope and methodology used in Section 3.3.1 to calculate the potential for imbalance netting, exchange of balancing energy and benefits per border that can be achieved from the integration of balancing energy markets.

The methodology does not intend to provide a precise estimate of the social welfare gains that could be achieved by integrating balancing markets. Instead, it is intended to provide a rough estimate (at least an order of magnitude) of the potential efficiency gains per border.

The benefits can be seen either from the perspective of the TSOs (if they can procure balancing energy at a lower price) or from the perspective of the BRPs (if they incur lower costs for their imbalances, being those costs equal to the volumes of their imbalances multiplied by the corresponding imbalance price). Both approaches should yield similar results, provided the imbalance prices reflect the prices of the balancing energy necessary to keep the system in balance, as explained below.

The imbalance settlement can (typically) be done either through a one-price or two-price system as summarised in Table A 7.

Table A 7: Imbalance settlement through typical one-price and two-price systems

		Imbalance settlement through a typical one-price system	
		System Imbalance	
		Short	Long
BRP Imbalance	Short	+BPu	+BPd
	Long	-BPu	-BPd

		Imbalance settlement through a typical two-price system	
		System Imbalance	
		Short	Long
BRP Imbalance	Short	-BPu	+ PDA (or linked to PDA)
	Long	-PDA (or linked to PDA)	-BPd

Source: ACER based on Impact Assessment on European Electricity Balancing Market (Contract EC DG ENER/B2/524/2011), Final Report (2013)

Notes: BPu= price of upward energy regulation, BPd= price of downward energy regulation, PDA=Day-ahead Power Exchange price.

In either the one-price or two-price mechanisms, when a system is short of energy, the imbalance price for ‘short’ BRPs can be considered a good proxy for the price at which TSOs procure upward balancing energy. Similarly, when a system is ‘long’, the imbalance price for ‘long’ BRPs can be understood as a proxy for the downward balancing energy. If TSOs were allowed to procure balancing energy in any of the adjacent markets, they could save money by, first, applying imbalance netting and, second, procuring the remaining need for balancing energy at the cheapest possible price. Those savings would then be transferred to

BRPs. Therefore, the potential savings can also be calculated by considering that BRPs are charged the lowest imbalance price across adjacent markets. This was the approach taken for this analysis. As explained in Section 3.3.1, due to the diverging national imbalance settlement mechanisms, the results of the calculations provide an indication of both the potential for further harmonisation of imbalance settlement pricing and the potential for the exchange of balancing energy.

The calculations were made with a two-step approach. First, the potential for imbalance netting subject to cross-border capacity calculations was computed. Second, based on the remaining system imbalances and the resulting cross-border capacity after the imbalance netting, the potential for further exchange for balancing energy (and its associated efficiency gains) is calculated.

To apply the above outlined methodology, a number of assumptions were made:

- The estimates assumed the deepest possible integration of balancing markets, i.e. the sharing of a full CMO list and includes the imbalance netting and the exchange of balancing energy from all types of balancing reserves.

- The analysis considered only those gains that could be achieved by netting imbalances or by exchanging balancing energy. Savings obtained from the exchange of balancing reserves have not been considered due to the limited data available and to the fact that the incurred costs to procure balancing reserves are often recovered aside from the imbalance settlement mechanism. This aspect, if neglected, may lead to an underestimate of the potential efficiency gains compared to a situation where balancing reserves are also exchanged.

- The estimates assumed 'all else being equal' and do not, in particular, consider the impact on the behaviour (their bids and offers) of market participants in organised markets following the application of imbalance netting and exchange of balancing energy. In addition, they do not take account of market resilience, i.e. the impact on prices of altering the volumes exchanged. This could be estimated precisely only by applying aggregated curves of supply and demand in each market and for all the exchangeable balancing products. This effect, if neglected, may lead to an overestimate of the potential savings.

- The estimates do not take account of the effect of simultaneity, i.e. when system imbalances are netted with an adjacent system (or balancing energy is exchanged) for a given ISP, the same process should not be simultaneously applied with a third neighbouring system. In reality, this would need an optimisation process to identify where imbalance nettings (or exchanges of balancing energy) are more valuable.

- The analysis does not take account of the various energy products from different types of reserves and their different weight across MSs in the respective imbalance prices. This would require having access to and processing million data points corresponding to all the different balancing energy products of all the imbalance areas that are relevant for the analysis.

- The analysis makes use of the net system imbalances. It is assumed that all out-of-balance BRPs deviate from their schedule in the same direction as the system. This would imply that the imbalance price for being short or long can be considered to be respectively the upward or downward balancing energy price. This is consistent with the assumption proposed above that the savings obtained by TSOs equal the savings observed by BRPs.

- Calculations were made at the ISP level. When a border connects imbalance areas with two different ISPs, data was aggregated at the level of the largest ISP. For example, if the ISP in area A is 1 hour and in area B is 30 minutes, the energy volumes (balancing energy or imbalances) in imbalance area B are added for the first and second half-hour and similarly, volume-weighted averages were applied area B for the imbalance prices.

- Imbalance netting and the exchange of balancing energy are subject to the available cross-border capacity in the economic direction after the intraday timeframe. Hourly values of available cross-border capacity after the intraday timeframe were used.

- Imbalance netting is applied in real time by acting on actual surplus or shortage, while the calculations made use of the total system imbalance in an ISP. This alters the results on the potential for imbalance netting (which is underestimated) and the potential for the exchange of balancing energy, because the imbalances within the ISP are not taken into account.

The above methodology described above made use of the following data items: (i) Amount of activated balancing energy (MWh) per ISP, all types of reserves; (ii) System net imbalance volumes (MWh); (iii) Imbalance prices per ISP (euros/MWh); and (iv) Available cross-border capacity after intraday, hourly values (MW).

Annex 12: Estimated loss of social welfare due to loop flows and unscheduled transit flows in the CEE, CSE and CWE regions and the flows statistics 2011–2013

Table A 8: Estimated loss of social welfare due to loop flows and unscheduled transit flows – (million euros, MW, GWh)

Welfare loss (million euros)	year	direction	CH>AT	CH>DE	CH>FR	CH>IT	AT>SI	FR>BE	FR>DE	FR>IT	IT>AT	IT>SI	BE>NL	DE>NL	DE>PL	DE>CZ	DE>AT	AT>CZ	AT>HU	PL>CZ	PL>SK	CZ>SK	SK>HU	Total	Grand Total	"% of LF(UTF) in UF"
LFs	2011	indicated	0,003	0,001	1,167	22,349	-1,068	-2,714	30,271	-36,315	-0,024	0,000	-6,773	3,000	12,497	-1,387	0,000	0,075	1,571	24,112	5,198	0,344	11,351	63,660		
		opposite	3,175	30,133	0,000	-0,031	1,607	0,036	0,000	0,266	8,287	3,466	1,496	0,017	-1,009	2,664	0,000	3,390	0,307	-0,126	-0,142	0,000	-0,964	52,573	116,233	36,2%
	2012	indicated	-0,025	0,294	6,352	24,994	1,013	-0,269	4,082	-14,850	-0,003	0,000	-0,822	25,576	18,219	-3,504	0,000	0,005	0,734	21,432	2,626	2,485	24,914	113,253		
		opposite	25,619	5,976	0,010	0,079	1,185	-1,517	-0,052	3,980	4,376	17,929	1,705	0,004	-0,001	2,283	0,000	1,956	0,545	-0,052	0,014	0,000	-0,438	63,600	176,853	39,0%
	2013	indicated	-0,056	0,617	2,170	6,703	1,264	-3,979	11,947	-11,177	-0,027	0,012	-6,948	58,870	17,674	-1,858	0,000	0,025	0,118	21,305	4,186	1,892	10,894	113,632		
		opposite	14,287	11,036	0,052	0,063	1,677	0,538	0,000	0,322	4,875	8,807	4,887	0,000	-0,726	3,192	0,000	3,157	1,114	-1,418	0,049	0,000	0,008	51,923	165,555	35,6%
UTFs	2011	indicated	0,025	0,002	8,524	1,834	1,959	3,024	7,438	54,978	0,088	0,000	14,009	0,350	2,720	5,927	0,000	0,168	0,039	-0,048	5,847	-0,181	1,878	108,581		
		opposite	21,418	57,499	0,000	0,069	-0,031	-0,016	0,000	0,308	-6,099	10,499	-0,737	0,053	1,316	-1,169	0,000	9,889	0,662	0,164	0,361	0,000	2,069	96,255	204,835	63,8%
	2012	indicated	0,112	-0,115	12,519	43,798	-0,077	0,420	1,307	29,745	0,017	0,000	1,282	23,983	9,856	9,797	0,000	0,003	-0,387	5,221	6,025	-1,007	3,235	145,735		
		opposite	28,471	88,933	0,068	0,082	0,724	4,950	0,061	-0,374	-2,002	-3,323	0,081	0,037	0,003	-1,182	0,000	11,845	1,259	0,077	0,002	0,000	0,763	130,476	276,211	61,0%
	2013	indicated	0,129	-0,172	14,695	24,155	0,058	5,515	3,859	22,526	0,070	0,050	11,270	45,451	8,134	10,786	0,000	0,061	0,984	2,830	3,018	-0,170	4,559	157,808		
		opposite	28,213	69,707	0,136	0,065	0,597	-0,239	0,000	1,218	-1,659	25,631	-0,430	0,000	0,962	-1,688	0,000	14,869	0,596	2,481	1,543	0,000	0,002	142,004	299,813	64,4%
Ufs	2011	indicated	0,028	0,003	9,691	24,182	0,891	0,310	37,708	18,664	0,064	0,000	7,237	3,350	15,217	4,540	0,000	0,243	1,610	24,063	11,046	0,163	13,229	172,240		
		opposite	24,594	87,632	0,000	0,038	1,575	0,020	0,000	0,574	2,188	13,964	0,759	0,070	0,307	1,495	0,000	13,279	0,968	0,039	0,220	0,000	1,105	148,828	321,068	
	2012	indicated	0,087	0,179	18,871	68,792	0,936	0,151	5,389	14,895	0,014	0,000	0,461	49,559	28,075	6,292	0,000	0,008	0,347	26,654	8,652	1,478	28,150	258,988		
		opposite	54,090	94,909	0,077	0,162	1,908	3,433	0,009	3,607	2,374	14,606	1,786	0,041	0,001	1,101	0,000	13,801	1,804	0,025	0,016	0,000	0,325	194,076	453,064	
	2013	indicated	0,073	0,445	16,865	30,857	1,322	1,537	15,807	11,349	0,043	0,061	4,322	104,321	25,797	8,928	0,000	0,086	1,102	24,134	7,204	1,722	15,453	271,428		
		opposite	42,500	80,742	0,188	0,128	2,274	0,299	0,000	1,540	3,216	34,438	4,458	0,000	0,236	1,503	0,000	18,006	1,713	1,063	1,592	0,000	0,011	193,908	465,336	

Flows (MW)	year	CH>AT	CH>DE	CH>FR	CH>IT	AT>SI	FR>BE	FR>DE	FR>IT	IT>AT	IT>SI	BE>NL	DE>NL	DE>PL	DE>CZ	DE>AT	AT>CZ	AT>HU	PL>CZ	PL>SK	CZ>SK	SK>HU
Average LFs	2011	-107	-454	250	312	-237	-454	1.155	-444	-89	-30	-448	449	731	-266	-296	-184	-3	633	93	186	229
	2012	-132	-610	629	102	-349	-511	1.308	-204	-306	250	-503	426	562	-282	-126	-134	-39	516	49	94	116
	2013	-267	35	140	93	-124	-629	968	-174	-50	-31	-614	595	676	-248	-227	-177	-101	568	100	139	175
Average UTFs	2011	-320	-1.017	1.453	-115	41	356	882	211	138	-54	351	-351	90	475	-350	-525	-39	-16	110	-68	-193
	2012	-322	-1.039	1.133	224	-113	-115	1.320	-69	77	74	-121	117	317	611	-746	-695	-175	94	223	8	-21
	2013	-293	-921	1.089	133	-47	-119	1.358	-170	108	-148	-124	123	127	775	-577	-727	27	48	97	94	45
Average SCHs	2011	-160	-83	-2.897	2.679	423	660	269	1.836	-170	-454	381	629	-284	-1.068	1.385	-429	149	235	142	732	891
	2012	-267	-58	-2.005	2.422	752	1.362	-993	1.720	-175	-422	280	1.726	-309	-981	1.994	-326	456	170	136	926	958
	2013	-243	-22	-1.906	2.313	331	1.476	-1.119	1.753	-227	-412	351	2.045	-241	-1.322	1.789	-286	116	149	152	584	726

Flows (GWh)	year	direction	CH>AT	CH>DE	CH>FR	CH>IT	AT>SI	FR>BE	FR>DE	FR>IT	IT>AT	IT>SI	BE>NL	DE>NL	DE>PL	DE>CZ	DE>AT	AT>CZ	AT>HU	PL>CZ	PL>SK	CZ>SK	SK>HU	Total	Grand Total	"% of LF(UTF) in UF"
Total LFs	2011	indicated	223	166	2.468	2.978	68	80	10.116	89	185	876	78	4.009	6.404	169	492	172	427	5.548	1.013	1.733	2.058	39.353		
		opposite	1.165	4.146	275	245	2.144	4.061	0	3.982	964	1.141	4.005	79	0	2.500	3.083	1.786	452	0	199	102	51	30.378	69.730	45,1%
	2012	indicated	94	1.355	1.814	2.160	319	42	9.570	216	252	665	37	5.668	5.802	106	1.086	237	321	5.467	805	1.838	2.086	39.939		
		opposite	2.881	1.304	421	728	1.438	5.854	0	2.629	517	1.340	5.756	44	1	2.595	2.280	1.529	689	0	458	162	88	30.712	70.651	44,6%
	2013	indicated	87	1.524	1.731	1.651	352	26	8.492	486	118	1.142	21	5.245	5.924	466	757	393	112	4.983	1.019	1.436	1.645	37.609		
		opposite	2.426	1.222	502	836	1.440	5.535	9	2.013	557	1.416	5.398	30	6	2.636	2.744	1.941	998	6	141	215	110	30.181	67.790	41,7%
Total UTFs	2011	indicated	90	36	12.729	1.188	1.141	3.445	7.832	2.907	1.283	986	3.395	319	1.741	4.264	1.839	93	868	707	1.254	689	321	47.128		
		opposite	2.892	8.943	0	2.194	784	326	110	1.056	77	1.455	319	3.398	954	106	4.905	4.688	1.210	848	290	1.288	2.015	37.857	84.985	54,9%
	2012	indicated	117	30	10.142	2.630	313	1.333	11.673	1.434	791	1.398	1.297	2.337	2.933	5.401	474	6	274	1.148	1.975	893	627	47.227		
		opposite	2.948	9.159	193	667	1.305	2.343	79	2.036	115	747	2.356	1.310	147	37	7.022	6.106	1.814	326	21	821	813	40.365	87.591	55,4%
	2013	indicated	177	67	9.708	2.189	1.086	1.831	11.990	1.232	1.007	720	1.814	2.894	2.164	6.818	1.830	94	944	1.175	1.233	1.349	999	51.320		
		opposite	2.739	8.135	171	1.020	1.497	2.875	97	2.719	63	2.020	2.898	1.813	1.053	26	6.881	6.466	706	756	388	523	607	43.454	94.774	58,3%
Total SCHs	2011	indicated	331	3.600	2	23.465	4.082	6.636	7.356	16.080	0	4	5.475	8.006	106	78	13.325	54	2.414	2.145	1.271	6.555	7.813	108.797		
		opposite	1.735	4.329	25.373	2	378	854	5.004	2	1.490	3.982	2.135	2.494	2.593	9.430	1.195	3.814	1.113	86	23	144	13	66.188	174.985	
	2012	indicated	313	3.647	310	21.276	6.641	13.079	2.378	15.150	1	10	5.036	15.730	12	139	17.656	122	4.168	1.511	1.200	8.145	8.419	124.943		
		opposite	2.658	4.154	17.919	5	32	1.118	11.102	40	1.534	3.719	2.577	572	2.722	8.756	141	2.988	165	17	5	13	2	60.237	185.180	
	2013	indicated	698	4.451	187	20.302	3.571	13.842	2.737	15.384	4	23	5.885	18.010	128	54	17.345	86	1.875	1.365	1.412	5.317	6.404	119.080		
		opposite	2.824	4.646	16.883	39	675	917	12.540	28	1.996	3.634	2.806	94	2.242	11.632	1.671	2.591	862	57	84	199	41	66.460	185.540	

Source: ENTSO-E, Vulcanus, EMOS (2014) and ACER calculations

Notes: Data for 2013 are not available because PTDFs are not available. The German-Czech border uses aggregated value for both of its interconnectors, which partially offset one another in volumes of UFs; thus the presented result cannot be meaningfully interpreted.

Annex 13: List of Abbreviations

Acronym	Definition
AC	Alternating current
ACER	Agency for the Cooperation of Energy Regulators
ADR	Alternative dispute resolution
ATC	Available transmission capacity
BEUC	Bureau Européen des Unions de Consommateurs
CACM	Capacity allocation and congestion management (electricity)
CAGR	Compound annual growth rate
CAM	Capacity allocation management (gas)
CBA	Cost-benefit analysis
CBCA	Cross-border cost allocation
CEE	Central-East Europe (electricity region)
CEER	Council of European Energy Regulators
CEGH	Central European Gas Hub (Austrian gas hub)
CGM	Common grid model
CHP	Combined heat and power
CMP	Congestion management procedures (gas)
CRM	Capacity remuneration mechanism
CSE	Central-South Europe (electricity region)
CWE	Central-West Europe (electricity region)
DA	Day-ahead
DC	Direct current
DSF	Demand-Side Flexibility
DSO	Distribution system operator
DSR	Demand-side response
E/E	Entry/exit
EC	European Commission
EEX	European Energy Exchange
EMIB	Energy Market Issues for Biomethane Projects
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
ERGEG	European Regulators' Group for Electricity and Gas
ERI	Electricity Regional Initiative
ETS	Emission Trading System
EU	European Union
FAPDs	Flows against price differentials
FCFS	First come, first served
FG	Framework guidelines

Acronym	Definition
FUI	France-UK-Ireland (electricity region)
GDP	Gross domestic product
GTM	Gas Target Model
HH	Henry Hub (US)
HVDC	High-voltage direct current
IEA	International Energy Agency
IEM	Internal Energy Market
IP	Interconnection point
LDZ	Local distribution zone
LNG	Liquefied natural gas
LTCs	Long-term contracts
mcm	Million cubic metres
MMR	Market Monitoring Report
MS	Member State
NBP	National Balancing Point (the British gas hub)
NC	Network code
NCG	Net Connect Germany (one of Germany's gas hubs)
NRA	National regulatory authority
NTC	Net transfer capacity
OTC	Over-the-counter
P2P	Point-to-point
PCI	Project of common interest
PCR	Price Coupling Region
PEG	Point d'Echange de Gaz (the name of France's gas hubs; Nord, Sud and TIGF)
POTP	Post-tax total price
PRISMA	Platform for European gas capacity booking
PSV	Punto di Scambio Virtuale (the Italian gas hub)
PTDF	Power transfer distribution factor
PTP	Pre-tax total price
REMIT	Regulation on wholesale energy market integrity and transparency
RES	Renewable energy sources
RES-E	Electricity from renewable energy sources
RPI	Retail price index
SEE	South-East Europe (electricity region)
Sm3	Standard cubic metres
SME	Small and medium-sized enterprise

Acronym	Definition
SO	System operator
SOB	Shared order book
SoLR	Supplier of last resort
ST	Short-term
SWE	South-West Europe (electricity region)
TEN-E	Trans-European Energy Networks
TEN-T	Trans-European Transport Networks
TPA	Third-party access
TSO	Transmission system operator
TTF	Title Transfer Facility (the Dutch gas hub)
UIOLI	Use It or Lose It
UNC	Uniform network code
VAT	Value added tax
VTP	Virtual trading point
ZEE	Zeebrugge-Beach (the Belgian physical interconnection point)
ZTP	Zeebrugge Trading Point (the new Belgian gas hub)

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