Notes on energy and environmental markets at 31 03 2016

Overview of Italy and bordering countries

May 2016

a2a Trading

Summary – Q1 2016 – Power and environmental markets

- In Q1 2016 there was a **-1.5% decrease in Italian electricity demand** (2.3% seasonally adjusted).
- **Hydroelectric production decreased by -17.6%** (to levels well below the historical average), due to a strong reduction in rainfalls at the end of 2015 and at the beginning of the year.
- **Thermoelectric production increased by 2.5%,** mainly due to the reduction in hydro production.
- Slump in PUN prices (-12.2. €/MWh y-o-y) due to the fall in gas prices and to the weak demand. The fall was particularly strong in February and March (with April at even lower prices), touching a new historical minimum every month.
- CSS are at their highest level since 2013, thanks to the slump in gas prices, relatively stronger than the decrease in power prices. On the contrary, the decrease in power prices compared to the coal prices has led to a fall in CDS.
- The **correlation between PSV and PUN is steady** (CCGTs are still marginal plants in the Italian market), while the correlation between PUN and Brent is low (and declining) due to fewer gas supplies linked to oil formulas.
- **Temperatures** in Q1 2016 in Italy were **higher than in Q1 2015 and, even more, than the 10YR average,** especially in February**. Very low levels of precipitations** in Q1 2016 compared both to 2015 and to the 10Y average.
- Starting in December 2015 **EUA prices** registered a steep fall from above 8.5 €/ton to 4.7 €/ton in mid February. Prices kept a steady path at around 5 €/ton until the end of March, when they started to increase up to around 7 €/ton at the end of April. Since then, a new downward trend began, bringing prices below 6 €/ton.

Summary – Q1 2016 – Gas markets

- **Gas demand marked a -0.4% decrease in Q1 2016** (year-on-year basis), with an increase in thermoelectric consumption and a reduction in domestic consumption due lo mild temperatures.
- + 102% increase in Algerian gas imports during Q1-16 (year-on-year basis); higher imports through Tarvisio as well, compensated by the reduction in imports through Passo Gries.
- Strong gas price decline in Q1-16 vs. Q1-15 on the PSV (-9.4 €/MWh); reduction in spreads with the Austrian VTP, TTF and Peg Nord.
- **Recovering in the PSV-Brent correlation** (fewer gas supplies linked to oil formulas but more competition with spot gas prices due to the oil price crash, LNG prices still linked to oil formulas).
- **Growing correlation between coal and Brent oil.**

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Italian Electricity Supply– breakdown by sources

Fall in hydroelectric production

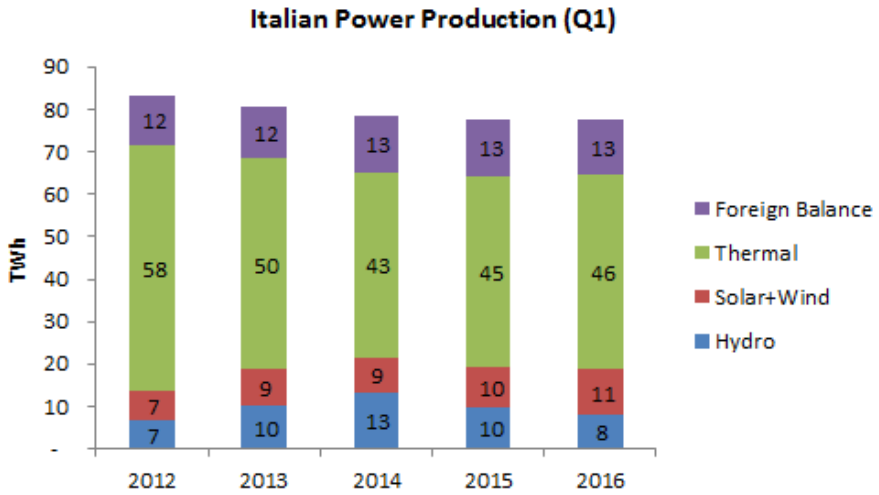
GWh	Q1 2016	Q1 2015	Var. % 2015/2014
Net Production			
Hydroelectric	7.907	9.592	-17,6%
Thermal	46.175	45.058	2,5%
Geothermal	1.489	1.438	3,5%
Wind	5.772	5.195	11,1%
Solar	3.966	4.473	-11,3%
Total net production	65.309	65.756	-0,7%
Import	14.459	14.636	-1,2%
Export	1.530	1.137	34,6%
Foreign balance	12.929	13.499	-4,2%
Pump storage	606	450	34,7%
Demand	77.632	78.805	-1,5%

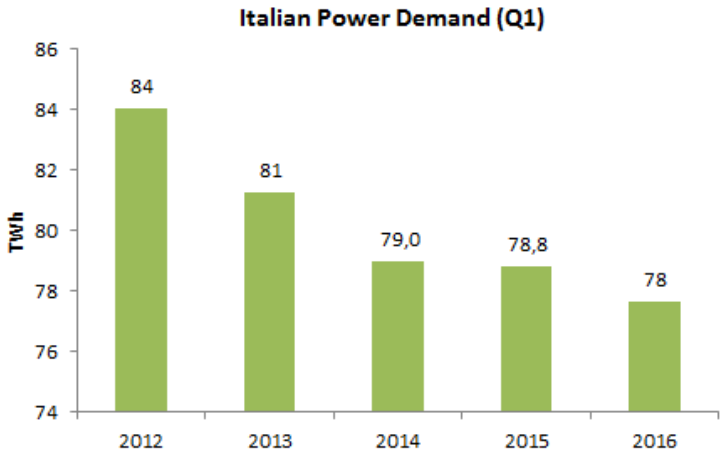
- In Q1 2015 there was a -1.5% decrease in electricity demand.
- **Hydroelectric production decreased by -17.6%,** due to a strong reduction in rainfalls at the end of 2015 and at the beginning of the year. A decrease in solar production was recorded too, while there was an increase in wind production (+11.1%).
- **Thermoelectric production increased by 2.5%,** mainly due to the reduction in hydro production.
- Decrease in the import-export balance (-4.2%)

Source: Terna - Monthly Report on the Electricity System.

Italian Electricity Supply and Demand – historical trends

-1.5% decrease in demand (-2.3% seasonally adjusted)





- New rise in thermal production, after a long decline ended last year.
- Steady increase in new renewables during the last years: in 2016 the increase in wind production was balanced by the decrease in solar production.
- Hydro production at a very low level, well below the 10-year average (10.3 TWh), especially in January and February.

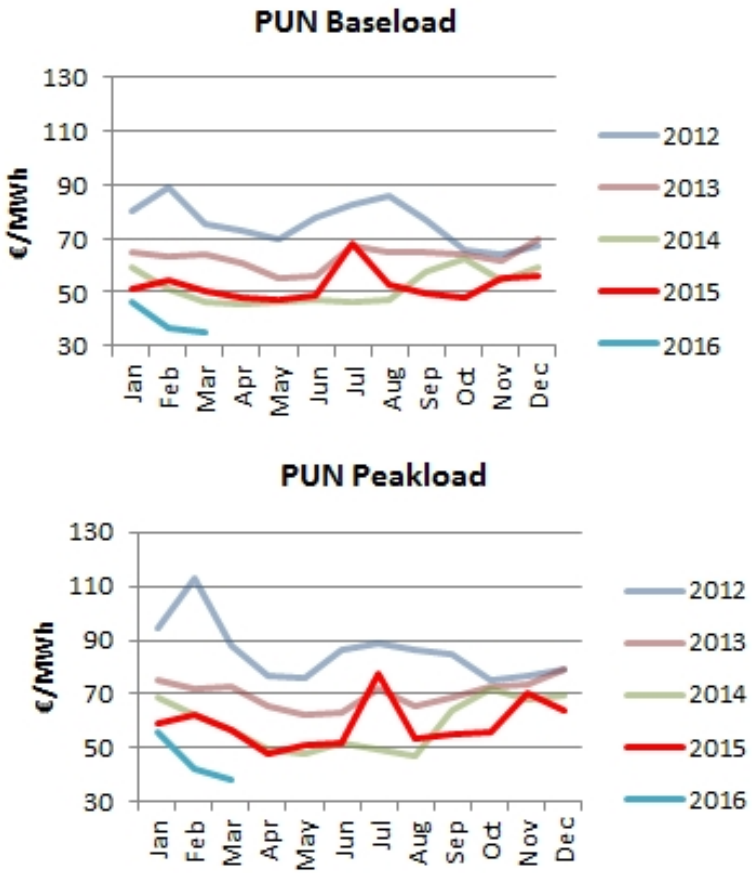
- -1.5% year-on-year decrease (-2.3% seasonally adjusted) in the Italian power demand - despite the economic recovery and the increase in 2015 – due to energy efficiency and to the mild climate.

Source: Terna - Monthly Report on the Electricity System

Italian Electricity Spot Prices

Strong PUN decrease

€/MWh		PUN BL	PUN PL	PL - BL
2015	Q1	51,8	59,0	7,3
	Q2	47,9	50,3	2,3
	Q3	56,7	62,3	5,6
	Q4	52,8	63,4	10,6
	CAL15	**52,3**	**58,8**	**6,5**
2016	Q1	39,6	45,2	5,6
2016 vs 2015 Q1		-12,2	-13,8	-1,7



- Q1 registered a slump in PUN prices, due to the fall in gas prices and to the weak demand. The fall was particularly strong in February and March (with April at even lower prices), touching a new historical minimum every month.
- Peakload prices decreased more than baseload prices, bringing down the BL-PL spread.

Source: Gestore Mercato Elettrico (GME)

Italian Electricity Spot Prices: marginal technology on MGP

CCGTs as the main marginal technology

MARGINAL TECHNOLOGY

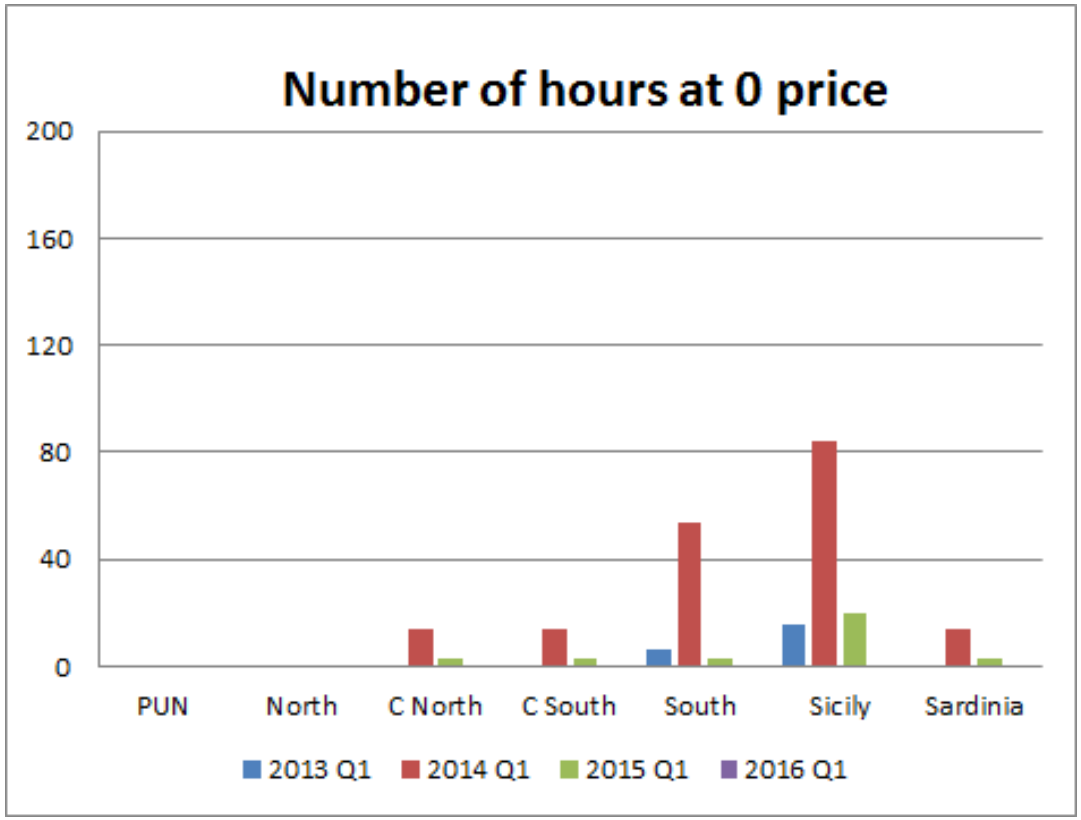
	Coal, Dual Fuel Coal	CCGT	Renewables	Run-of-river hydro	Storage hydro	Pumped storage hydro	Market Coupling	Oil + gas turbines + Others	Import
Jan 2016	10%	47%	5%	7%	6%	4%	11%	5%	5%
Feb 2016	13%	48%	5%	8%	6%	5%	4%	6%	5%
Mar 2016	15%	44%	3%	9%	6%	7%	4%	6%	3%
Jan 2015	15%	49%	1%	6%	6%	2%	0%	4%	17%
Feb 2015	10%	54%	1%	6%	4%	2%	2%	4%	16%
Mar 2015	20%	45%	3%	6%	3%	2%	14%	2%	5%
Apr 2015	21%	42%	3%	8%	5%	1%	12%	4%	4%
May 2015	27%	43%	4%	9%	5%	3%	3%	5%	1%
Jun 2015	25%	46%	2%	8%	8%	4%	4%	2%	2%
Jul 2015	9%	61%	2%	7%	8%	2%	7%	4%	1%
Aug 2015	7%	61%	2%	11%	6%	3%	5%	3%	2%
Sep 2015	14%	56%	2%	6%	3%	1%	14%	3%	1%
Oct 2015	15%	39%	2%	5%	4%	1%	29%	4%	2%
Nov 2015	15%	46%	2%	8%	6%	2%	12%	6%	3%
Dec 2015	15%	50%	3%	7%	5%	1%	6%	7%	7%

- CCGTs are still the main marginal technology, but in reduction compared to last year, while an increase in the hydro and renewables marginal hours was recorded. The decrease in the marginal hours for import/market coupling from February may be due to the decrease in foreign prices.

Source: MPF (on GME data).

Italian Electricity Market: zonal hours at zero price

No 0-price hour

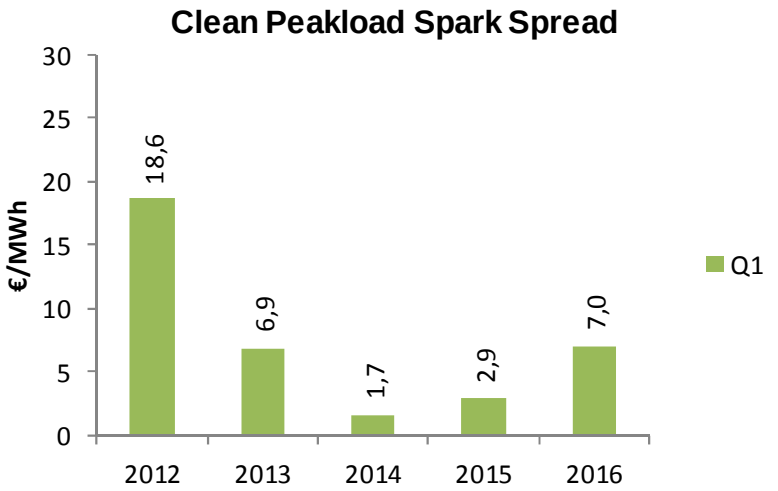


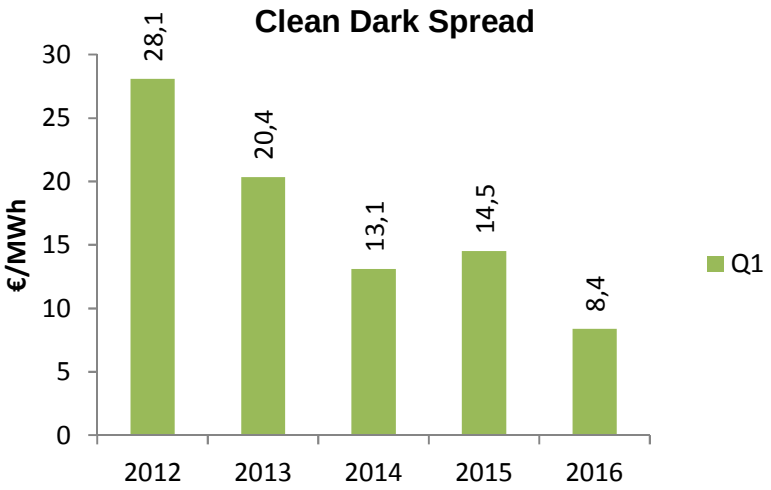
- After the 2014 peak in the number of 0-price hours, the number decreased.
- No 0-price hour was registered in Q1 2016, despite the slump in prices.

Italian Electricity Clean Spark and Dark Spreads (CSS and CDS)

Improvement in CSS due to low gas prices

GWh		clean baseload spark spread - 51% efficiency	clean peakload spark spread - 51% efficiency	clean dark spread - 35% efficiency
2015	Q1	-4,4	2,9	14,5
	Q2	-5,6	-3,2	10,5
	Q3	4,0	9,6	19,9
	Q4	3,5	14,1	17,0
	CAL	**-0,6**	**5,9**	**15,5**
2016	Q1	1,4	7,0	8,4
2015 vs 2014		**5,7**	**4,2**	**-6,1**





- CSS are at their highest level since 2013, thanks to the slump in gas prices, relatively stronger than the decrease in power prices.
- On the contrary, the decrease in power prices compared to the coal prices has led to a fall in CDS.

Clean Spark Spread: PUN (BL/PL) – gas PSV cost (eff. 51%) – EUA cost – CV cost (up to 2014)- variable transport costs
Clean Dark Spread PUN BL –coal cost (API2 + spread MED + variable transport costs - eff. 35%) – EUA cost – CV cost (up to 2014)

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Italian Gas Supply - breakdown by sources

Increase in Russian and Algerian flows, decrease in domestic production

mcm	Q1 2016	Q1 2015	Δ% 2016/2015
Import			
Mazara del Vallo (Algeria)	3.273	1.619	102,2%
Gela (Libia)	1.249	1.764	-29,2%
Tarvisio (Austria)	7.391	6.700	10,3%
Gorizia (Slovenia)	-	1	-
Passo Gries (Svizzera)	1.601	2.802	-42,9%
Total Pipeline	13.515	12.885	4,9%
Rovigo (Cavarziere)	1.471	1.512	-2,7%
Panigaglia	2	2	-
Livorno (OLT)	-	3	-
Total LNG	1.473	1.517	-2,9%
Total Import	14.988	14.402	4,1%
Domestic Production	1.499	1.583	-5,3%
Delta Stock	7.086	7.662	-7,5%
Demand	23.564	23.647	-0,4%

- -0.4% in gas demand during Q1-16 (year-on-year basis)
- +102% in Algerian gas imports during Q1-16 (year-on-year basis)
- Higher imports through Tarvisio as well, compensated by the reduction in imports through Passo Gries

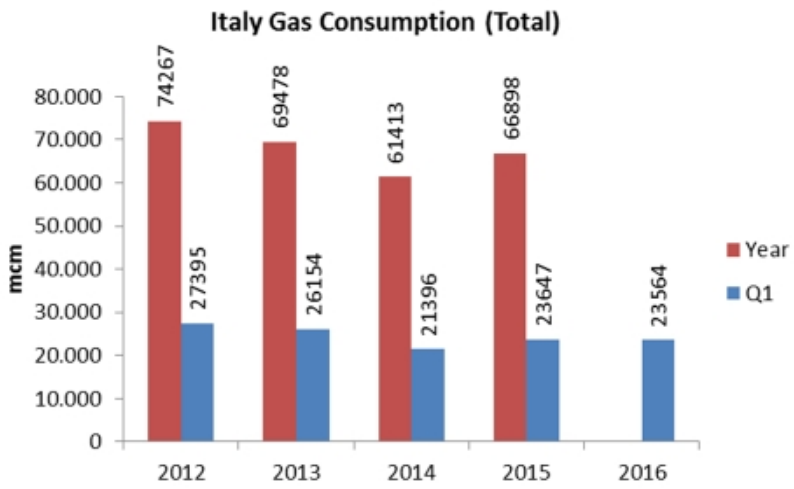
Source: Snam Rete Gas, PCS correction by Snam Rete Gas during 2016, data corrections by Snam Rete Gas

Italian Gas Consumption

Higher thermal demand, strong reduction in households consumption.

Italy: Gas consumption

mcm		Industry	Thermal	Distribution Network	Other networks	Total
2015	Q1	3.519	5.113	14.403	612	**23.647**
	Q2	3.104	4.074	4.097	326	**11.600**
	Q3	2.938	5.936	2.862	260	**11.996**
	Q4	3.225	5.525	10.404	501	**19.655**
	Year	**12.786**	**20.648**	**31.766**	**1.698**	**66.898**
2016	Q1	3.516	5.731	13.790	527	**23.564**
	Q2	-	-	-	-	**-**
	Q3	-	-	-	-	**-**
	Q4	-	-	-	-	**-**
	Year	**3.516**	**5.731**	**13.790**	**527**	**23.564**
Q1-16 vs. Q1-15		**- 3**	**618**	**- 613**	**- 85**	**- 83**



- Q1-16 shows a reduction in natural gas consumption, on a year-on-year basis
- Increased thermoelectric consumption during Q1-16 (+12% Q1-16 vs. Q1-15)
- Reduction in households consumption due to mild temperatures in Q1-16 (-4.2% Q1-16 vs. Q1-15)

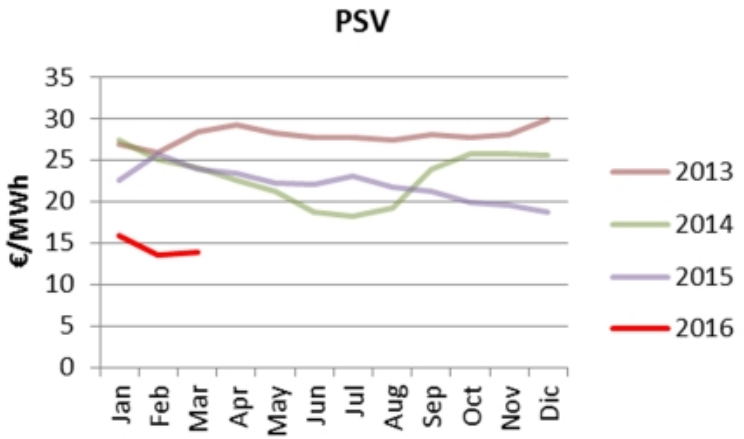
Source: Snam Rete Gas, PCS correction by Snam Rete Gas during 2016, data corrections by Snam Rete Gas

Italian Gas Spot Prices – PSV and main hubs spread

Strong contraction in PSV prices

€/MWh		PSV	PSV-TTF	PSV-VTP	PSV-PEG NORD
2013	Q1	27,1	- 1,0	0,3	- 1,8
	Q2	28,4	1,2	0,9	0,5
	Q3	27,7	1,8	0,8	1,2
	Q4	28,5	1,7	1,1	1,2
	Year	**27,9**	**0,9**	**0,8**	**0,3**
2014	Q1	25,5	1,2	0,5	1,1
	Q2	20,8	1,9	0,6	1,2
	Q3	20,5	2,4	0,8	1,7
	Q4	25,7	3,6	1,7	3,2
	Year	**23,1**	**2,3**	**0,9**	**1,8**
2015	Q1	24,1	2,8	1,7	2,2
	Q2	22,5	1,5	1,0	1,4
	Q3	22,0	2,2	1,2	2,2
	Q4	19,4	2,4	1,4	2,1
	Year	**22,0**	**2,2**	**1,3**	**2,0**
2016	Q1	14,5	1,6	1,1	1,3
	Q2	-	-	-	-
	Q3	-	-	-	-
	Q4	-	-	-	-
	Year	**-**	**-**	**-**	**-**

Q1-16 vs. Q1-15	**- 9,6**	**- 1,2**	**- 0,6**	**- 0,9**

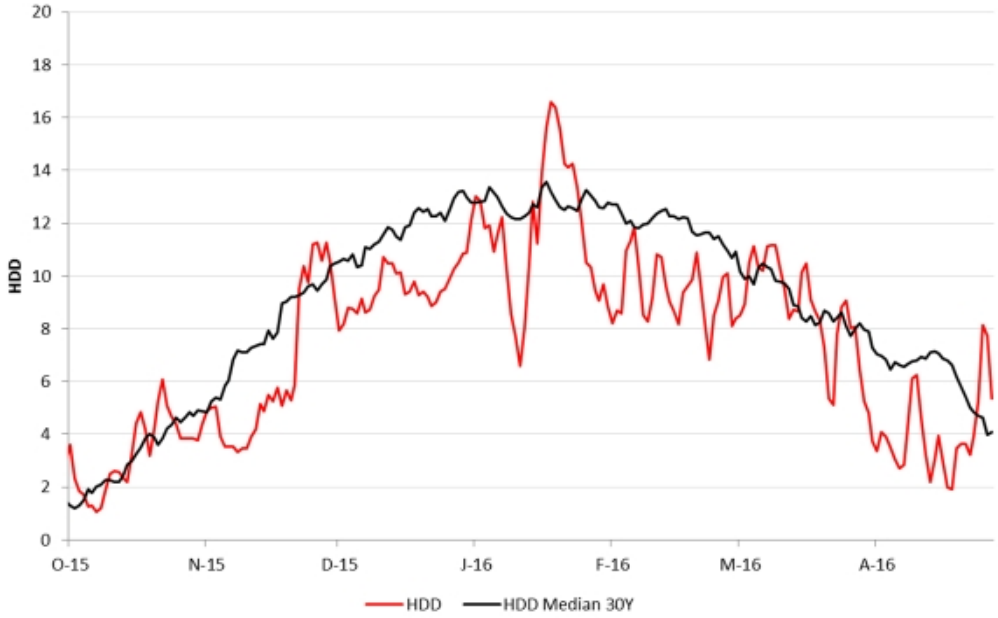


- Strong gas price decline in Q1-16 vs. Q1-15 on the PSV (-40%).
- Reduction in spreads with the Austrian VTP, TTF and Peg Nord (Q1-16 vs. Q1-15).

Source: ICE-Endex, CEGH, Powernext

Italian Heating Degree Days – Q1 2016

	30Y Median HDD	Heating Degree Days 2015-2016	Δ	Heating Degree Days 2014-2015	Δ yoy (Win-15 vs. Win-14)
Oct	98	102	4	75	26
Nov	238	190	-48	149	41
Dic	366	297	-69	302	-5
Gen	395	364	-31	344	20
Feb	345	272	-73	322	-50
Mar	277	265	-12	263	2
Winter	1719	1489	-230	1454	35



- **Lower Heating Degree Days vs. Median Degree Days during Q1-16 and Winter-15**
- Higher Heating Degree Days on a year-on-year basis (Winter-15 vs. Winter-14)

Source: Bloomberg – Heating Degree Day calculation method: HDD = Y – AVG, Y = 18 ºC, HDD = Mean, if HDD<0 then HDD=0.

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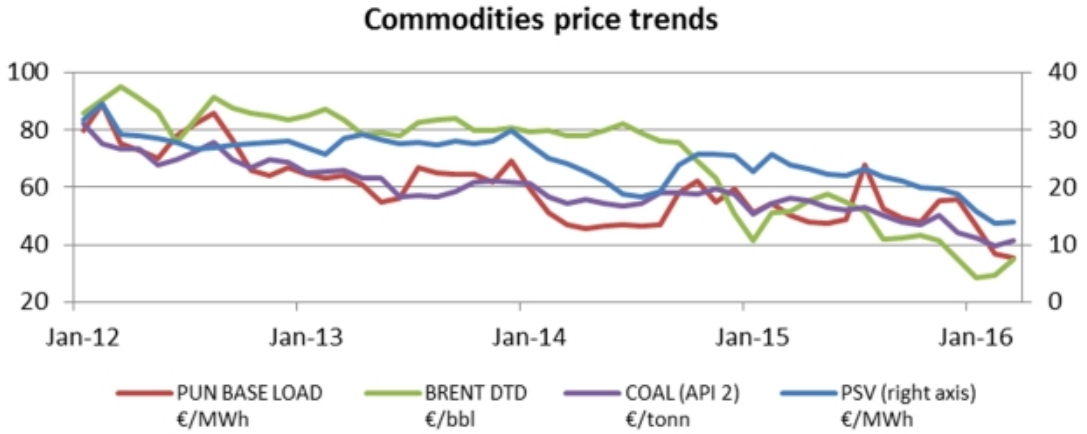
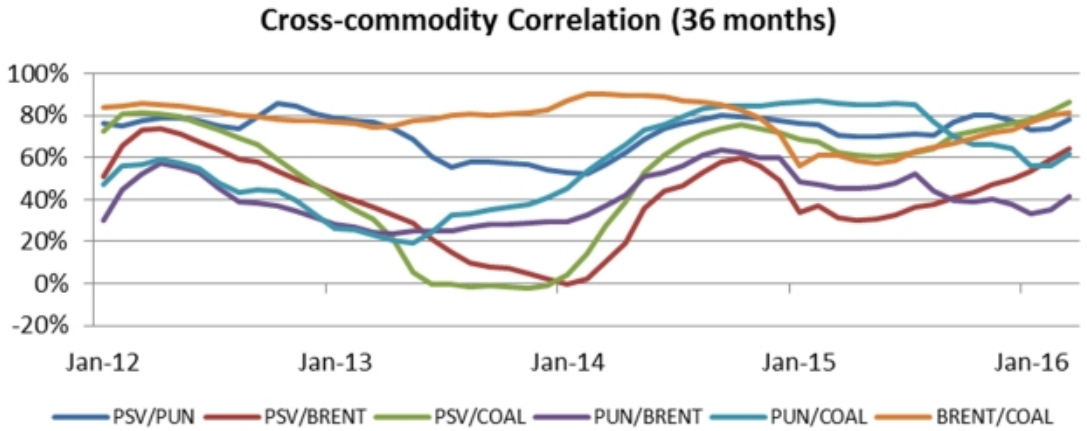
Correlation among commodities

Historically declining Brent oil effect on the Italian energy market

	PSV-PUN	PSV-BRENT	PSV-COAL	PUN-BRENT	PUN-COAL	BRENT-COAL
MAX	86%	74%	87%	63%	87%	90%
MIN	52%	0%	-2%	23%	19%	56%
AVG. 12-15	72%	40%	52%	41%	57%	77%

- **Steady correlation between PSV and PUN** (CCGTs still marginal plants in the Italian market)
- **Low correlation between PUN and Brent oil** (fewer gas supplies linked to oil formulas)
- **Recovering in the PSV-Brent correlation** (fewer gas supplies linked to oil formulas but more competition with spot gas prices due to the oil price crash, LNG prices still linked to oil formulas)
- **Growing correlation between coal and Brent oil**





Source: GME, Thomson Reuters, Bloomberg

Italian temperatures, precipitations and wind

High temperatures and low precipitations in Q1-16

	Temperature	Precipitations	Wind	Temp. 16 vs. 15	Prec. 16 vs. 15	Wind 16 vs. 15	Temp. 16 vs. 10-YR Avg.	Prec. 16 vs. 10-YR Avg.	Wind 16 vs. 10-YR Avg.
Q1 10-YR Average	7,7	184,6	6,7						
Q1 2015	8,0	162,8	7,1						
Q1 2016	8,4	115,3	6,7	5%	-29%	-6%	9%	-38%	0%

- **Temperatures in Q1 2016 in Italy were higher than in Q1 2015 and, even more, than the 10YR average, especially in February.**
- According to independent analyses by NASA and the National Oceanic and Atmospheric Administration (NOAA), the combined average temperature over global land and ocean surfaces for each month of Q1 2016 was well above the 20th century average (for the same month); February and March had the highest temperatures for the month in the 1880–2016 record.
- **Very low levels of precipitations in Q1 2016 compared both to 2015 and to the 10Y average.**
- **Wind at historical levels.**

Source: Bloomberg. Temperatures are the average temperature (usually of the high and low) that was observed between 7am and 7pm local. Precipitations include rainfall and the liquid equivalent of snow and sleet (measurement: Integer in 100th millimeters). Wind Speed is the average sustained winds which does not include wind gust

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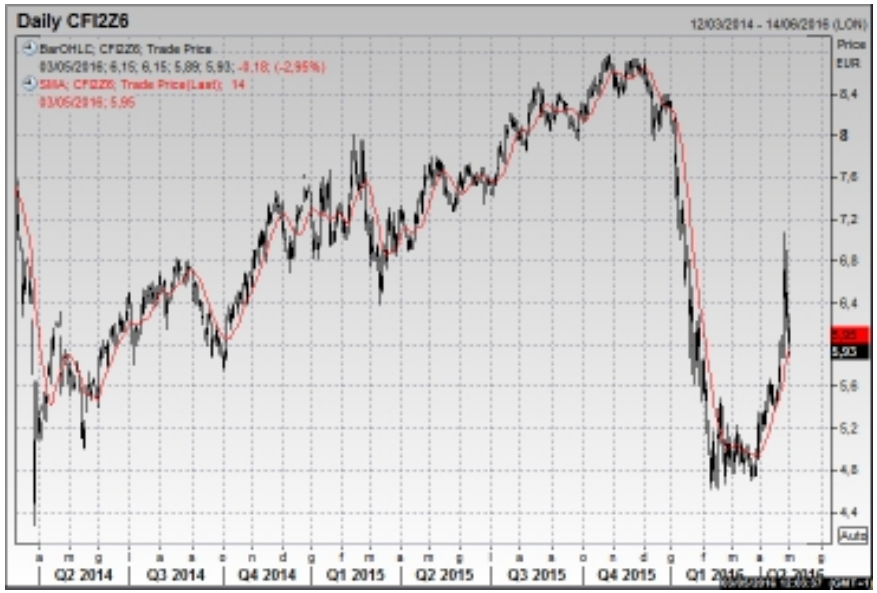
EUA Market

Collapse in EUA prices since the end of 2015



Sector	2015	2014	Change (Mt)	Change (%)
Power and heat	1014.3	1018.7	-4.4	-0.4%
Cement, lime and glass	179.5	181.4	-1.8	-1.0%
Metals	188.8	193.3	-4.5	-2.3%
Oil and gas	186.3	182.2	4.1	2.3%
Pulp and paper	31.6	32.0	-0.3	-1.0%
Other	203.9	206.0	-2.1	-1.0%
Subtotal Industry	***792.0***	***794.8***	***-2.8***	***-0.4%***
Total excluding aviation	**1806.3**	**1813.5**	**-7.3**	**-0.4%**
Aviation	56.9	54.9	2	3.6%
Total EU ETS (incl. aviation)	**1863.2**	**1868.4**	**-5.2**	**-0.2%**

- Starting in December 2015, once the sentiment connected to regulatory and political events (COP 21) was over, prices registered a steep fall from above 8.5 €/ton to 4.7 €/ton in mid February. Prices kept a steady path at around 5 €/ton until the end of March, when they started to increase to around 7 €/ton at the end of April. Since then, a new downward trend began, bringing prices below 6 €/ton.

- On the 1st of April, the EU Commission published the 2015 verified emissions (see table above), which were roughly at the same level as in 2014 (down 0.4%, after a long decline since 2011). Power sector emissions decreased 0.4%, despite a slight increase in electricity output, due to more renewables and more gas, and less use of coal for power. Overall industry emissions fell 0.4 percent. (despite a 2.3% increase for refineries).

- Overall, the oversupply, due to weak demand, still persists and weighs on the prices.

Source: Reuters.

BACKUP

Glossary (1)

- **Baseload:** A Baseload Day consists of all hours from 00:00 to 23:59 Central European Time of each calendar day
- **CDS** (Clean Dark Spread): It represents the margin an hypothetical coal plant with 35% efficiency can obtain on energy markets by selling one unit of electricity, given fuel and environmental costs. Throughout our analysis CDS are computed as follows

CDS = PUN BL –coal cost (API2 + spread MED + variable transport costs - eff. 35%) – EUA cost – CV cost (up to 2014)

- **China DES:** it is the Argus' price assessment for Chinese landed LNG cargoes delivered in the ports of Guangdong, Fujian, Shanghai, Jiangsu, Dalian, Zhejiang, Tangshan, Zhuhai, Tianjin
- **CSS** (Clean Spark Spread): It represents the margin that an hypothetical CCGT power plant with 51% efficiency can obtain on energy markets by selling one unit of electricity, given fuel and environmental costs. Throughout our analysis CSS are computed as follows:

CSS = PUN (BL/PL) – gas PSV cost (eff. 51%) – EUA cost – CV cost (up to 2014)- variable transport costs

- **EUA** (European Union Allowances): A tradable and bankable unit under the EU ETS. Each allowance equals 1 tonne of CO_2.
- **Heating degrees days:** it is a proxy of the average Italian temperature during the winter season. It is related to gas consumption for heating. It is calculated as follows:

HDD = Y – AVG, Y = 18 ºC, HDD = Mean, if HDD<0 then HDD=0

Glossary (2)

•**Henry Hub**: It is the main US gas hub, located in Erath, Louisiana. It serves as the official delivery location for futures contracts on the NYMEX

•**Marginal Technology:** electricity generating technology that sets the selling price on the Italian day-ahead market in each hour. Data on marginal technologies are an average of zonal data taken from the marginal technology index (ITM) published by the GME.

•**Peakload:** A Peakload Day consists of all hours from 08:00 to 19:59 Central European Time of each weekday (i.e. Monday to Friday inclusive)

•**PSV** (Punto di Scambio Virtuale): virtual trading point for natural gas in Italy, as established by the relevant Network Operator and located between the entry points and the exit points of the national transportation network where shippers may exchange and sell natural gas

•**PUN** (Prezzo Unico Nazionale): average of Zonal Prices in the Day-Ahead electricity Italian Market, weighted for total purchases and net of purchases for Pumped-Storage Units and of purchases by Neighboring Countries' Zones.

• **VTP** (Virtual Trading Point): a notional point in Austria at which gas can be traded within the market area after injection and before offtake. The VTP is not a physical entry/exit point but enables grid users to transfer capacity titles from one balancing group to another within the market area (for trading) without the need to book capacity.

•**TTF** (Title Transfer Facility): it is a virtual trading point for natural gas in the Netherlands.

•**Peg Nord** (Point d'Echange du Gaz): it is one of the virtual trading locations for the sale, purchase and exchange of natural gas and LNG in France. It is one of the pricing and delivery points for Powernext natural gas futures contracts.