COMMERZBANK

Commodity Spotlight Energy

29 July 2013

Power market in Germany: electrified

The German electricity market is in a state of transition: following the liberalisation of the market at the end of the 1990s, the ambitious goals of the energy reforms ("Energiewende") are now forcing rapid changes. However, while the intensified expansion of renewable energies is driving end-consumer prices to new record levels, wholesale prices have plummeted. In this study we take a closer look at the interplay of supply and demand on electricity exchanges, and explain why a coal price recovery and a rising carbon price could slow the downward trend of electricity prices on the exchanges, at least temporarily.

Electricity stands at the heart of the energy reforms. Public debate has recently focused mainly on the rise in retail prices resulting from ever increasing levies to support renewable energies (chart 1). However, in the following article we do not seek to join the massed ranks of those who analyse and evaluate the opportunities and risks of these energy reforms. We are more interested in that part of the market which today, following the liberalisation which took place at the end of the 1990s, appears at least superficially to obey free market principles: the interplay of supply and demand on electricity exchanges. In this article we consider which factors currently determine pricing in the wholesale markets. To that end we start by examining the supply and demand structure, then go on to consider the most important price determinants and their influence on future price development.

We begin with demand, whose most conspicuous feature is the large fluctuations to which it is subject. The so-called load curve depends firstly on the time of day and secondly on the season of the year. This presents producers with great challenges, as there are only very limited possibilities for storing electricity. Demand is also cyclical: in Germany, with 46%, industry accounts for nearly half of net demand, i.e. excluding the demand of power producers. Therefore electricity demand fluctuates over the economic cycle, albeit to a proportionately smaller extent. However, electricity demand reacts little to short-term price fluctuations. In the long term, though, a lasting increase in the price of electricity leads to adaptive behaviour among both private households and industrial consumers. According to an analysis by the German Council of Economic Experts, price elasticity in industry is estimated at –0.6. This means that a 1% rise in the price of electricity leads, all else being equal, to a 0.6% fall in demand.

Commerzbank Forecasts

	Q3 13	Q4 13	Q1 14
Brent Blend	106	110	115
WTI	104	105	110
Diesel	920	1000	1050
Gasoline (95)	1010	1000	1020
Jet fuel	960	1030	1080
Natural gas	3.7	3.8	4.0
Coal (API #2)	79	85	90
EUA (€ per t)	4.0	5.0	7.0

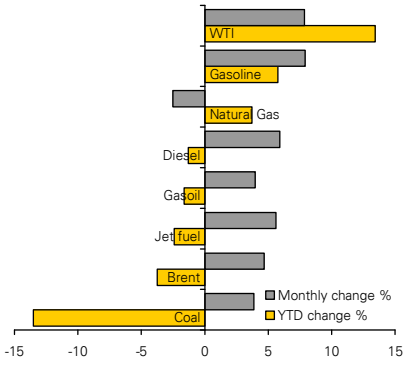
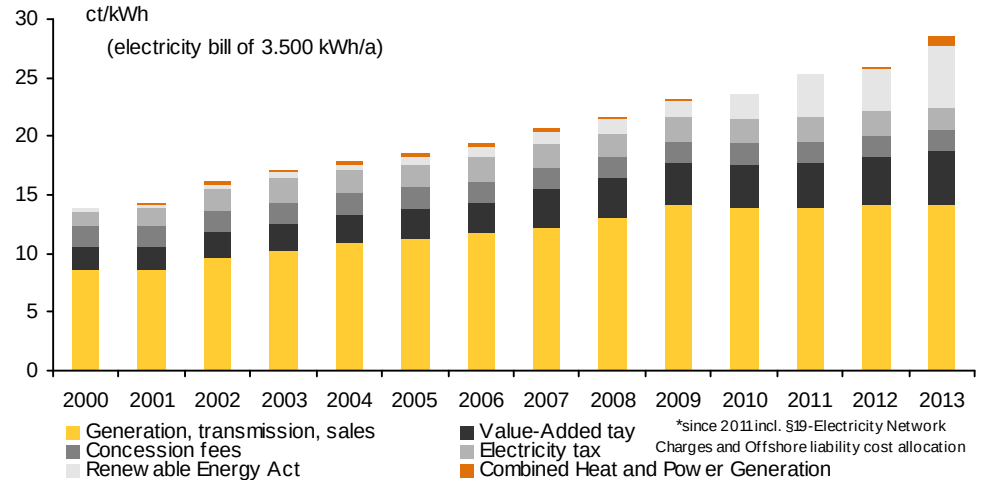


CHART 1: **Taxes and duties drive electricity prices for private households**



Source: BDEW; Bloomberg, Commerzbank Corporates & Markets

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The ambitious targets of the German federal government

In September 2010 the German federal government adopted the so-called "Energy Concept", defining the country's energy policy until 2050. The role of nuclear energy has been re-examined following the Fukushima nuclear disaster. Under the new Atomic Energy Act, nuclear energy is to be phased out altogether by 2022. Eight of the older reactors have already been taken offline. The basic idea behind the Energy Concept is to expand renewables: By 2050, 60% of final energy demand should be met by renewable energies. In particular, the following goals have been set:

	2011	2020	2050
Greenhouse gas emissons (% vs. 1990)	-26.4	-40	-80 to -95
Primary energy consumption (% vs. 2008)	-6	-20	-50
Gross electricity consumption (% vs. 2008)	-2,1	-10	-25
Final energy consumption transport sector (% vs. 2005)	-0.5	-10	-40
Electric vehicles (units)	6,600	1m	6m (2030)
Renewable energies as % of gross power consumption	20.3	at least 35	at least 80

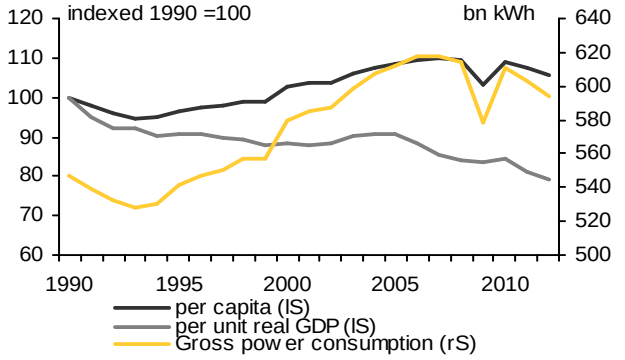
Electricity consumption increases with cyclical swings

The long term trend shows a slight increase in electricity consumption in Germany since 1990. Last year, according to AG Energiebilanzen (Working Group on Energy Balances), a federation of associations and research institutes of the power industry, gross electricity consumption (including producers' own consumption) was nearly 600bn kWh, which is 44bn kWh higher than in 1990 (chart 2). Mainly rising incomes, but also a slight increase in the population up to 2005, had the effect of increasing consumption, thereby more than offsetting the impact of improved electricity productivity (unit real GDP per electricity consumption). However, the latter has improved by an average of 1% p.a. since 1990, and efficiency has increased at more than twice that rate in the last two years.

In electricity production, renewable energies are increasingly displacing conventional fuels

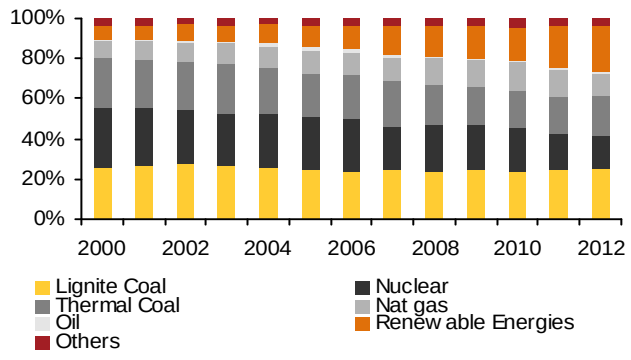
On the supply side, fossil fuels are still the mainstays of the energy sector in Germany, accounting for over half of electricity production, with nuclear energy making up another 16% (chart 3). However, renewable energies are advancing rapidly, in view of the ambitious targets of the federal government (see box). Last year they represented 22.1% of gross power production, compared with only 6.6% in the year 2000. The biggest contributor is wind power at 7.5% (2000: 1.6%). However, the importance of photovoltaics has increased rapidly: whereas in 2000 these made no significant contribution to electricity production, by last year they had already reached 4.5%. The main driver behind these developments is the German Renewable Energies Act (Erneuerbare-Energien-Gesetz, EEG) passed in 2000, which on the one hand obliges grid operators to give priority to electricity generated from renewable sources, and on the other hand guarantees plant operators a feed-in fee over 20 years. This has led to a development boom, particularly in the case of photovoltaics, because despite corrective intervention by the legislature, the gap between rates of feed-in fees and electricity generation costs has yawned ever wider. The average costs for installing a photovoltaic site halved within the five-year period up to 2011. As a result, photovoltaics accounted for nearly 40% of the installed capacity of regenerative plants last year, whilst at the same time this technology's share of total electricity generated from renewable sources was only 20%.

CHART 2: **Electricity demand on a rising long-term trend despite a falling power intensity**



Source: BMWI; Commerzbank Corporates & Markets

CHART 3: **Structure of gross power generation: renewable energies gaining ground**



Source: BDEW; Commerzbank Corporates & Markets

The EEG levy and other taxes and charges

In the last ten years, the EEG levy has risen steadily from 0.42 to 5.277 Cent/kWh in 2013. The costs of the EEG 2013 to be borne by power users amount to just over EUR 20bn. The main cost-driver is the increase in the proportion of generously subsidised photovoltaic systems. The obligations resulting from the expansion of capacity in recent years will continue to put a strain on consumers for the next two decades. Photovoltaic sites constructed up to the year 2010 alone will generate future costs of the current equivalent of about EUR 80bn.

In addition to the EEG levy, private households pay other taxes and charges such as electricity tax, the concession charge and VAT. Taxes and charges including the EEG levy account for some 50% of the price of electricity. Another 20% relates to network charges. (Source: BDEW).

Merit order effect of renewable energies depresses wholesale price…

In principle, every power technology has its own cost structure. The "merit order" indicates the utilisation sequence for power plants to cover power demand. Schematically, the price is determined on the basis of the marginal costs of the last techology used. In terms of the variable costs, nuclear power is the cheapest (conventional) technology, while the very small number of oil power stations still in use are the most expensive. Gas turbines and (pump) storage power stations are used to balance out fluctuations in load and are correspondingly designated peak load power stations. Coal-fired power plants occupy an intermediate position due to their medium level of variable costs and their mid-scale flexibility. Many renewable energies have variable costs of virtually zero. The larger the supply of renewable energies, the further the supply curve shifts to the right (chart 4). In other words, in hours when a high volume of renewable energy is fed in, power plants with lower variable costs set the price, resulting in a lower price for the same traded volume ("merit order effect"). The producer surplus of the conventional power station operators thus falls accordingly.

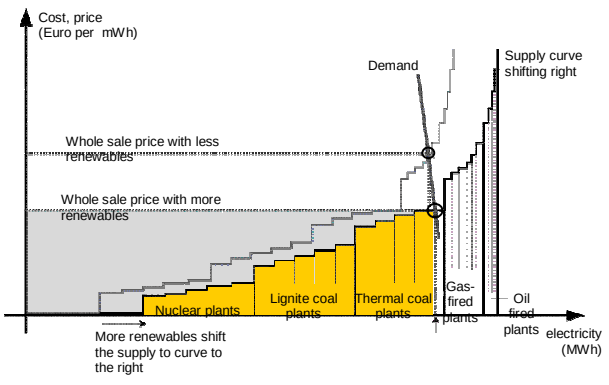
..and increases the EEG levy

The low prices also lead to a reduction in marketing revenue from renewable energies or respectively the differential between agreed payments and actual prices widens. Roughly speaking, this difference is covered by the EEG levy, which has to be paid by most end users as a surcharge on the electricity price. This surcharge has risen sharply in recent years (see box). The divergence between the end user price and the wholesale price is thus increasing steadily.

Short-term prices much more volatile than long-term equivalents

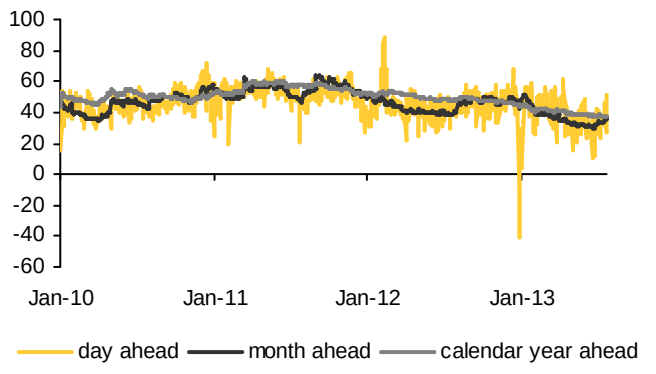
We will not discuss the associated problems in any greater detail here since our main interest is wholesale prices. Even if a large proportion of power sales is transacted independent of exchanges, the prices on the exchanges are the reference prices. Electricity is mainly traded outside exchanges in over-the-counter trading. Because they are more transparent or better data is available for them, we concentrate on the standardised products on the Leipzig energy exchange EEX. As with OTC trading, a distinction is made here between spot markets and forward markets as well as baseload (1-24 hours) and peak/off-peak load. The reference price for German power trading is the Phelix Future (Physical Electricity Future). Short-term prices are much more volatile than long-term prices due to fluctuating demand and weather-dependent renewable energies (chart 5). From time to time, prices are even negative if the network is at risk of overloading and power plants have to be withdrawn from the market.

CHART 4: **Merit-order-effect of renewable energies depresses power price**



Source: SolarenergieFörderverein, Commerzbank Corporates & Markets

CHART 5: **Power prices on EEX: the shorter-term, the more volatile (Baseload, Euro per mWh)**



Source: EEX, Bloomberg, Commerzbank Corporates & Markets

German power prices under pressure despite closure of nuclear power plants

We have therefore considered the forward contract for the next calendar year which is less susceptible to fluctuation. Chart 6 shows that the German electricity price has been under severe pressure for more than two years. At around EUR 38 per Mwh for next calendar year, electricity is cheaper than for eight years. The price decline in the last two years is particularly striking against the background of the decommissioning of eight nuclear power stations. For, using the merit order schematic once again: a smaller supply of nuclear power represents a shift to the left on the supply curve, which should theoretically lead to a higher price. However, this effect has obviously been more than offset: on the one hand, the proportion of renewable energies in this period has increased. In addition, as a result of the oversupply in the market, coal power plants thus continued to set prices as medium load generators. Moreover, due to the steep decline in coal prices and a decline in carbon prices on the European emission trading, their power production costs have fallen sharply. Lower marginal costs lead in turn to lower prices.

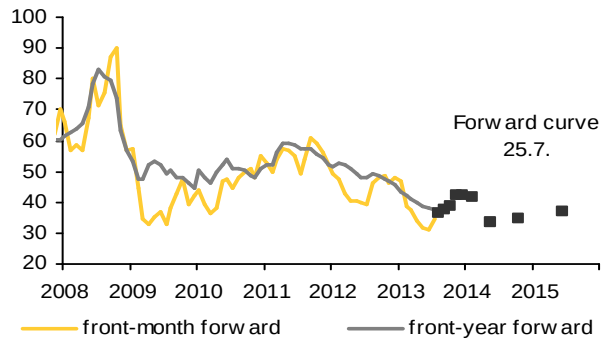
Empirical estimate confirms major importance of coal prices for the electricity price

The strong influence of coal prices is confirmed in a simple regression analysis. For the changes in the electricity price last year can be easily explained by the change in the coal future, with the front-month future delayed by one month (chart 7). A negative constant could detract from the price-reducing structural effect of an increasing supply of renewable energies. Based on this empirical analysis, the carbon price (still) surprisingly does not help to provide an explanation in any statistical significant way, which could be due to the effect being absorbed by the parallel decline in the price of coal. In fact, the carbon price does in fact have a significant impact on power generation costs. For even in a more modern coal-fired power plant, for every kilowatt hour of electricity produced, almost 750 gr of CO_2 is also emitted. This means that an increase of EUR 1 per ton in the price of carbon leads to an increase of 75 Euro cents in the production cost of one megawatt hour. Correspondingly the sharp fall in carbon prices has lowered the production cost of a coal plant.

Expected recovery in coal and carbon prices should support power prices

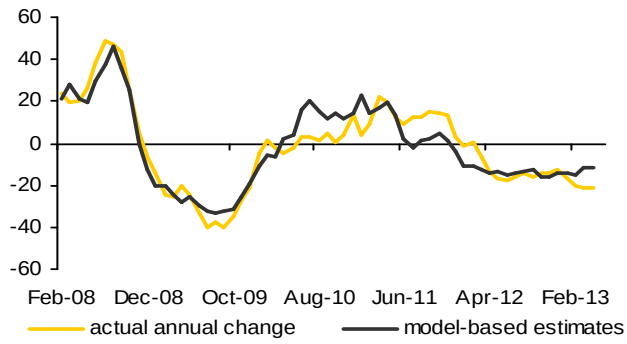
However, what will the future trend in power prices look like? At the moment the forward curve is showing power prices moving sideways more or less the next two years (chart 6). We are slightly more optimistic and expect a small recovery. The main reason for our optimism is the expected recovery in coal prices, which we believe are likely to have bottomed out. On the one hand, some coal producers are already operating unprofitably and are therefore likely to scale back their supply, and on the other hand China is likely to buy more coal abroad as a result of low world market prices. Additonally, China might implement higher import standards which could support the market of higher quality coal. India's import demand could also increase further, with South Africa, as a swing producer between the Atlantic and Pacfic markets, likely to increasingly supply the latter. Since greater use is also being made of coal in the USA as a result of higher gas prices, the coal price should tend to increase, especially as the economy in the Euro area should also recover somewhat. An increase in carbon prices should give additional support to power prices if the trialogue shows signs of reaching agreement on backloading, i.e. the temporary holding back of 900 million emission certificates. However, the fact that power prices are likely to increase only moderately, is attributable to the simultaneous further advance of the expansion of renewable energies. The associated costs will lead to an increase in the EEG levy, whereas the wholesale price will be negatively affected.

CHART 6: **Power price under pressure in the whole sale market... (Euro je mWh)**



Source: Bloomberg, EEX, Commerzbank Corporates & Markets

CHART 7: **Trend in power prices nicely explained by (delayed) coal prices**



Source: Commerzbank Corporates & Markets

At a glance

TABLE 1: **Our Forecasts**

		Forecasts								Yearly Average		
	26-Jul	1Q13	2Q13	3Q13	4Q13	1Q14	2Q14	3Q14	4Q14	2012	2013	2014
Brent Blend ($/bbl)	107.2	113	103	106	110	115	118	115	115	112	108	116
WTI ($/bbl)	104.7	94	94	104	105	110	115	112	112	94	99	112
Diesel ($/t)	932	970	890	920	1000	1050	1050	1020	1060	979	950	1040
Gasoline (95 ARA) ($/t)	1005	1030	960	1010	1000	1020	1060	1060	1030	1032	1000	1040
Jet Fuel ($/t)	980	1040	930	960	1030	1080	1090	1060	1090	1027	990	1080
Natural Gas HH ($/mmBtu)	3.56	3.5	4.0	3.7	3.8	4.0	3.5	4.0	4.5	2.8	3.8	4.0
Coal (API #2) ($/t)	77.9	86	80	79	85	90	92	95	95	93	83	93
EUA (€ /ton)	4.3	5.0	4.0	4.0	5.0	7.0	7.0	7.0	7.0	7.4	4.5	7.0

Source: Commerzbank Corporates & Markets, Bloomberg

TABLE 2: **Inventories, supply and refinery activity**

	19-Jul	Net change			% change		Comment
		1 month	1 year	vs. 5 -year-Ø	year	vs. 5 -year-Ø	
US inventories (mm barrels)							
Crude oil	364.2	-29.9	-15.9	16.6	-4.2	4.8	US crude oil inventories posted biggest 1-month decline in more than 30 years. Cushing stocks at 8-month low. US natural gas inventories well below last year
of which: Cushing	44.0	-4.6	-2.5	9.7	-5.3	28.2	
Gasoline	222.7	1.0	12.7	8.2	6.0	3.8	
Distillates	126.5	4.8	1.2	-21.1	1.0	-14.3	
Natural gas (bn cubic feet))	2786	348	-403	-75	-12.6	-1.2	
ARA inventories ('000 tons)							
Gas oil	1961	-111	-377	-401	-16.1	-17.0	Gasoil stocks in Western Europe well below the seasonal usual level
Gasoline	676	-112	-52	-85	-7.1	-11.1	
US oil supply (mm bpd)							
Imports	8.0	-0.4	-1.6	-2.1	-16.6	-20.7	US reduced oil imports markedly
Production	7.6	0.4	1.2	2.1	18.7	37.4	US oil production at 22½-year high
US refinery activity (mm bpd)							
Utilisation (%)	92.3	3.0	-0.7	3.6			Very high utilisation rate
Processing	16.0	0.5	0.2	0.8	1.5	4.9	Crude oil processing at 8-year high

Source: Commerzbank Corporates & Markets, Bloomberg, US Energy Information Administration

TABLE 3: **Historic prices of energy commodities**

Energy	Latest	% change				1Q11	2Q11	3Q11	4Q11	1Q12	2Q12	3Q12	4Q12
		1 Week	1 Month	ytd	year ago								
Brent Blend ($/bbl)	107.2	-1.1	4.7	-3.7	0.5	106	117	112	109	118	109	109	110
WTI ($/bbl)	104.7	-2.6	7.9	13.4	15.6	95	102	90	94	103	93	92	88
Diesel ($/t)	932	-1.2	5.9	-1.3	-0.3	911	982	967	975	1011	943	978	984
Gasoline (95 ARA) ($/t)	1005	-3.3	7.9	5.8	3.5	913	1059	1016	931	1055	1033	1059	982
Jet Fuel ($/t)	980	-0.6	5.6	-2.4	-0.3	973	1057	1021	1011	1062	996	1026	1025
Natural Gas HH ($/mmBtu)	3.56	-5.5	-2.5	3.7	15.5	4.2	4.4	4.1	3.5	2.5	2.4	2.9	3.5
Coal (API #2) ($/t)	77.9	4.3	3.9	-13.5	-14.2	122	125	124	114	101	91	91	89
EUA (€/t)	4.3	3.3	-2.0	-35.1	-41.6	15.1	16.1	12.1	9.0	7.7	6.9	7.6	7.3

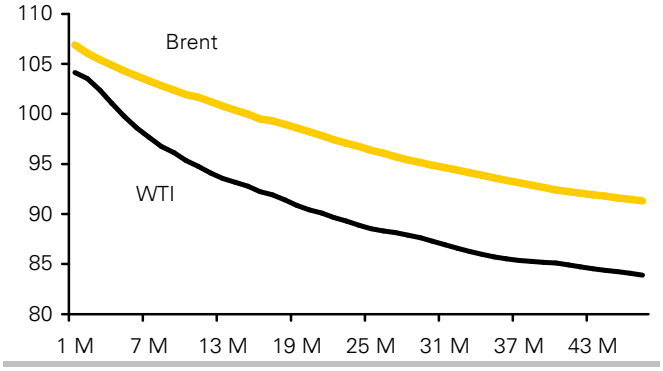
Source: Commerzbank Corporates & Markets, Bloomberg

TABLE 4: **Upcoming events**

31 July / 7/14 August	USA	US EIA oil inventory data
1/8/15 August	USA	US EIA gas inventory data
6 August / 10 September	USA	EIA Short term energy outlook
9 August / 10 September	INT	OPEC oil market report
9 August / 12 September	INT	IEA oil market report
4 December	INT	OPEC meeting in Vienna, Austria

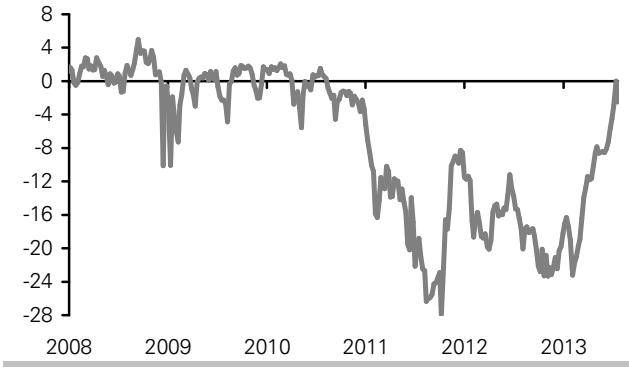
Source: EIA, IEA, OPEC, Bloomberg, Commerzbank Corporates & Markets, Bloomberg

CHART 8: **Crude Oil - Forward Curves in US$ per barrel**



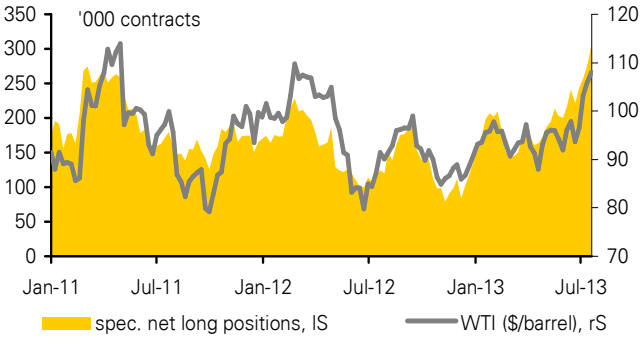
Source: Bloomberg, Commerzbank Corporates & Markets

CHART 9: **Price spread WTI and Brent Blend in US$/bbl**



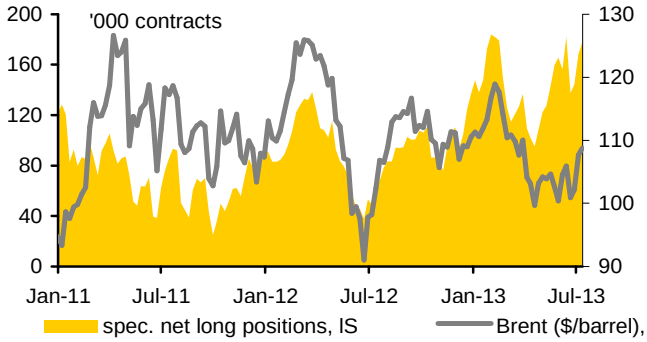
Source: Commerzbank Corporates & Markets

CHART 10: **WTI: managed money net-long positions**



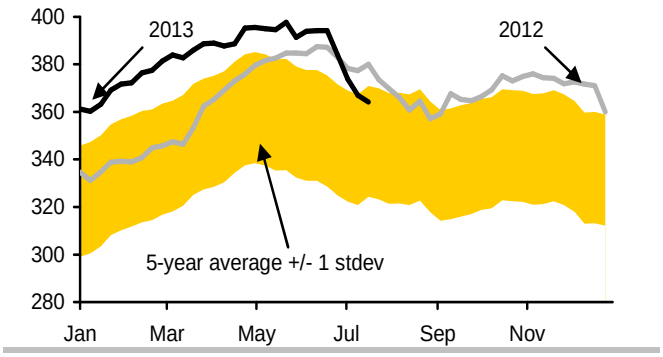
Source: CFTC, Bloomberg, Commerzbank Corporates & Markets

CHART 11: **Brent: managed money net-long positions**



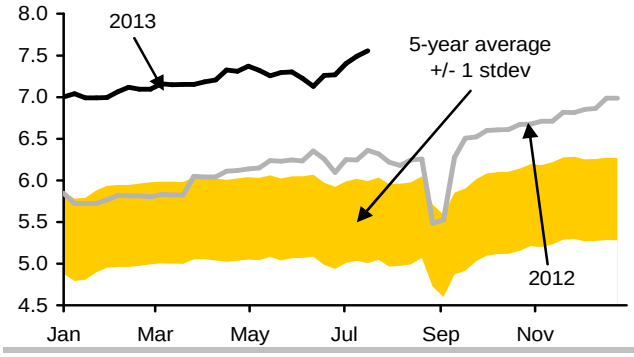
Source: ICE, Bloomberg, Commerzbank Corporates & Markets

CHART 12: **Crude oil: US inventories in mm barrel**



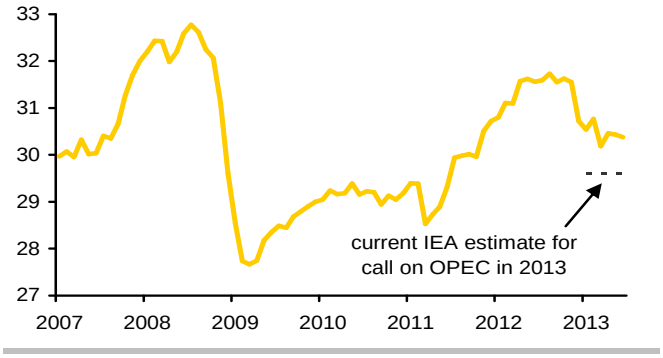
Source: EIA, Bloomberg, Commerzbank Corporates & Markets

CHART 13: **US oil production in mm bpd**



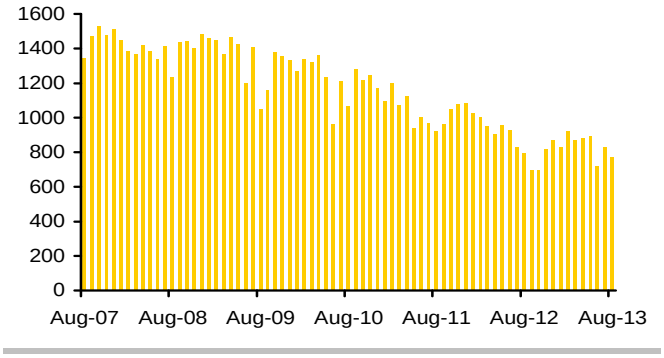
Source: EIA, Bloomberg , Commerzbank Corporates & Markets

CHART 14: **OPEC oil production in mm bpd**



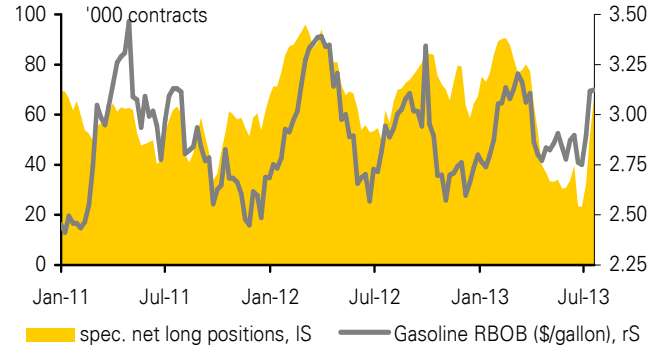
Source: Reuters, Bloomberg, IEA, Commerzbank Corporates & Markets

CHART 15: **Monthly loadings of North Sea crude oil (Brent, Forties, Oseberg and Ekofisk) in '000 bpd**



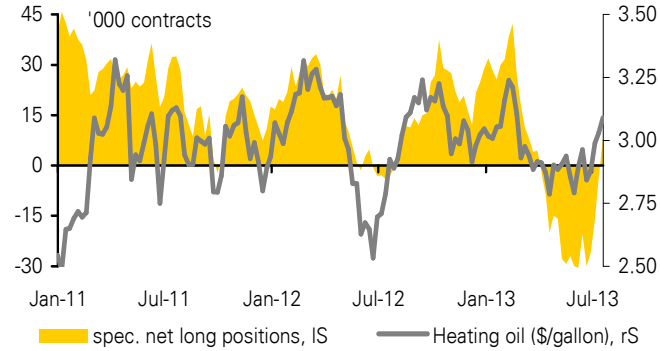
Source: Bloomberg, Commerzbank Corporates & Markets

CHART 16: **Gasoline: managed money net-long positions**



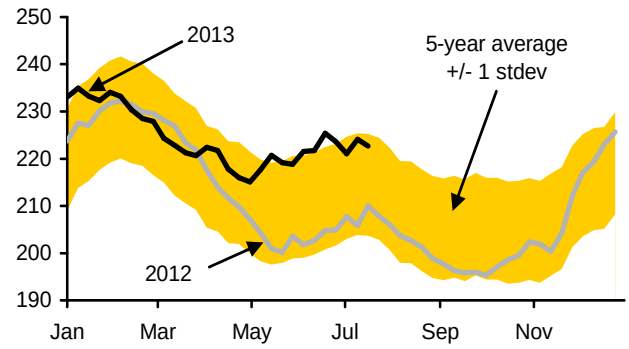
Source: CFTC, Bloomberg, Commerzbank Corporates & Markets

CHART 17: **Heating oil: non-commercials' net-long positions**



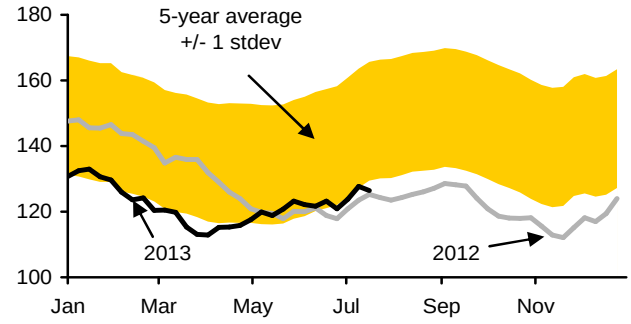
Source: CFTC, Bloomberg, Commerzbank Corporates & Markets

CHART 18: **Gasoline: US inventories in mm barrel**



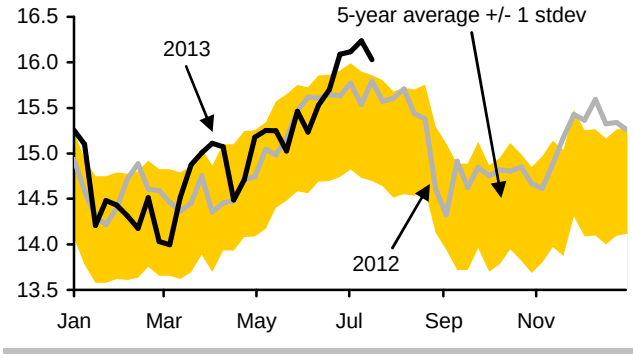
Source: EIA, Bloomberg, Commerzbank Corporates & Markets

CHART 19: **Distillates: US inventories in mm barrel**



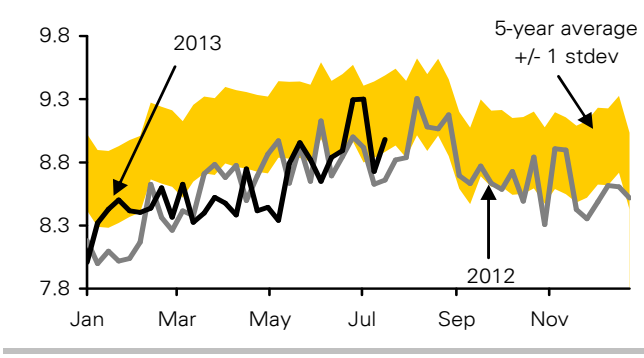
Source: EIA, Bloomberg , Commerzbank Corporates & Markets

CHART 20: **US crude oil processing in mm bpd**



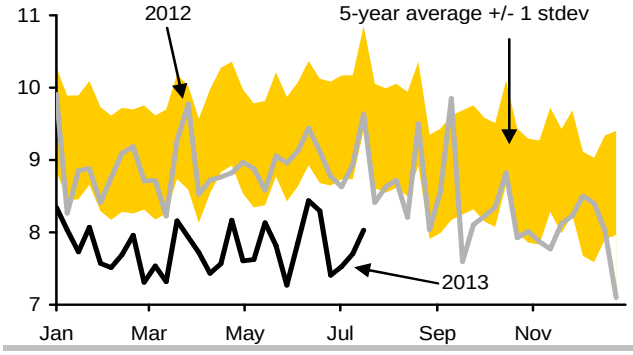
Source: EIA, Bloomberg, Commerzbank Corporates & Markets

CHART 21: **US gasoline demand in mm bpd**



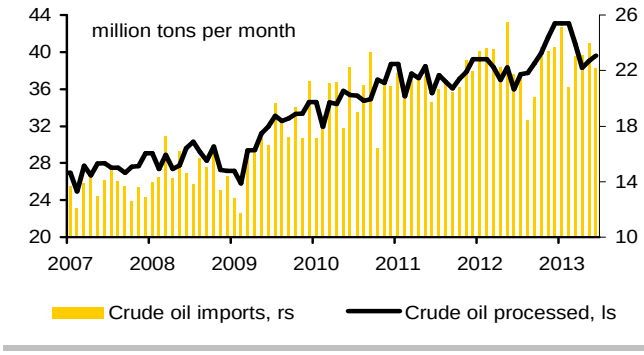
Source: EIA, Bloomberg, Commerzbank Corporates & Markets

CHART 22: **US crude oil imports in mm bpd**



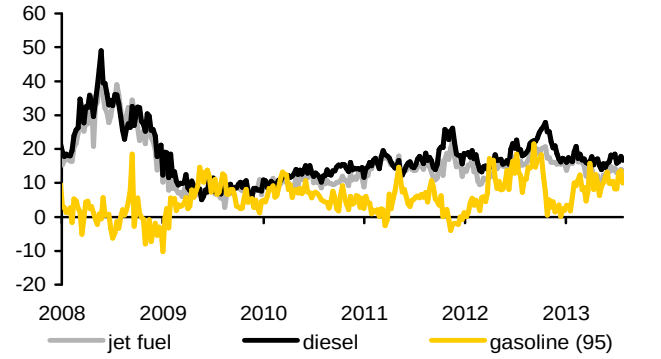
Source: EIA, Bloomberg, Commerzbank Corporates & Markets

CHART 23: **China: crude oil processed and imports**



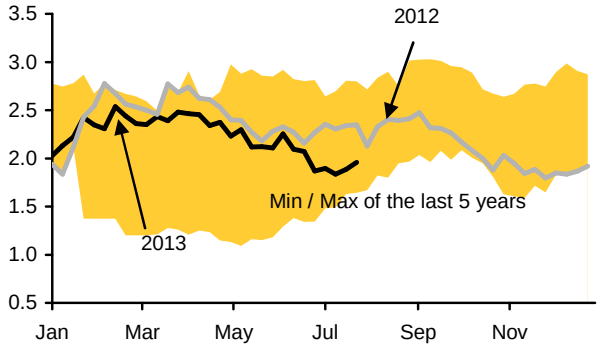
Source: China NBS, Chinese Customs, Commerzbank Corporates & Markets

CHART 24: **Price spread products to Brent in $ per barrel**



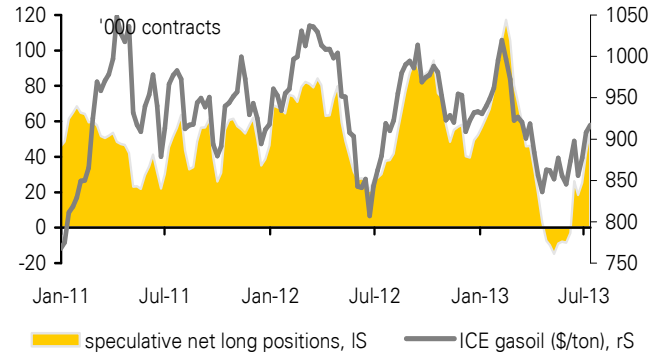
Source: Commerzbank Corporates & Markets

CHART 25: **ARA Gasoil inventories in million tons**



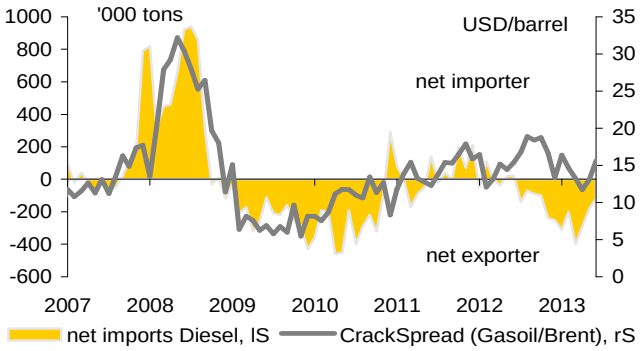
Source: PJK International, Bloomberg, Commerzbank Corporates & Markets

CHART 26: **Gasoil: managed money net-long positions**



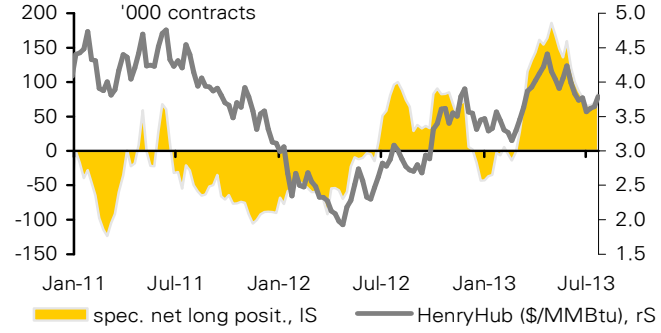
Source: ICE, Bloomberg, Commerzbank Corporates & Markets

CHART 27: **China: Diesel imports and gasoil crackspread**



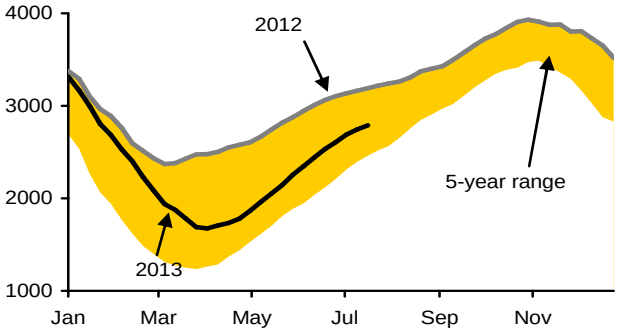
Source: Chinese Customs, Commerzbank Corporates & Markets

CHART 28: **Nat. gas: non-commercials net-long positions (Futures and swaps)**



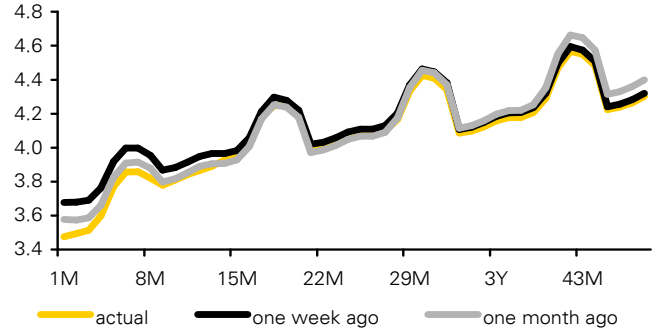
Source: CFTC, Bloomberg, Commerzbank Corporates & Markets

CHART 29: **Natural gas: US storage in bn cubic feet**



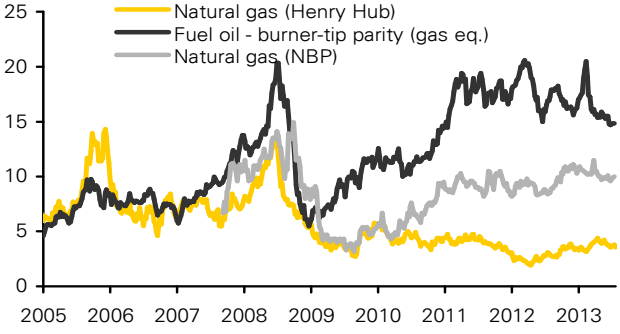
Source: EIA, Bloomberg, Commerzbank Corporates & Markets

CHART 30: **Natural gas – forward curve (Henry Hub) in USD per mmBtu**



Source: Bloomberg, Commerzbank Corporates & Markets

CHART 31: **Burner-tip parity (natgas vs. fuel oil no.6) in USD per mmBtu**



Source: Bloomberg, Commerzbank Corporates & Markets

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