

# An Investigation of the Future Natural Gas Prices and its effect on Turkey

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## Introduction

The shale gas revolution has changed not only the natural gas dynamics, but also others such as oil, renewables and nuclear. The road ahead is more unpredictable than it was before. This article simply cites a few observable changes in the gas market through three parts.

The first part investigates a possible change in German natural gas prices and oil indexation. Trying to extract the a possible change in Russian gas price formula for Germany, the second part investigates whether this and other developments affect Turkish gas market. The third part gives a rough projection for future Turkish natural gas supply and demand.

In the following parts, several hypothesis are tested. Foremost, we try to question whether the oil price indexation of natural gas is still valid. An hypothesis is put forward to investigate the European futures Market's foresight for the oil indexation. Later on, further points are explored such as benchmark oil price, LNG and shale gas future and the effect of "rush for gas" on demand patterns.

## Price for Natural Gas

Since natural gas market is not a liquid as the oil market, there are divergences between prices. It can depend on the continent, market, contract and even country. However, there are general rules of thumb for pricing natural gas. (Brown & Yücel, 2007) . These are

1. 10-to-1 rule : Natural gas price is one tenth of crude oil price. (developed by observation)
2. 6-to-1 rule: Based on the energy content of a barrel of WTI (5.825 million BTU)

These rules generally apply for the relation between WTI and Henry Hub prices, specifically for the US market. The time frame for such observations generally do not pass beyond 2006 when the oil price hikes started. One other important point is, if oil prices remains in the current high levels, these rules may not be applicable.

Especially, the early months of 2011 witnessed a series of discussions regarding the spread between WTI and Brent benchmarks. There are reasons for this divergence linked to pipeline and refinery issues. However a bigger problem is whether WTI and Brent is still the benchmark for pricing? The question is linked to several issues including the change in oil quality. Especially for the Asian market, this is a point for moderate anxiety.

On the European side the pricing can be divided in to three main time frames (Konoplyanik, 2011).

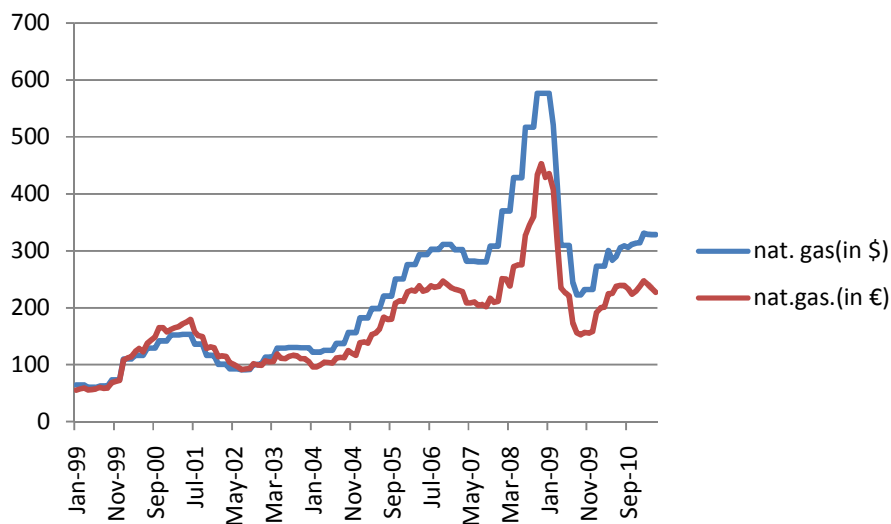
1. Pre-1960: "cost-plus" (Konoplyanik, 2011).
2. Post-1960s: Fuel oil was the main determinant of gas prices with gasoil and diesel
3. Since mid 2000s: Commoditization and spot/LNG market developments since oil prices may not be reflecting the physical costs.

Generally the three producers for the European Market (Netherlands, Norway and Russia) price the natural gas in line with oil and oil product prices through a formula. These formulas may include inflation, light fuel oil, coal price, crude oil, gas price, electricity price and other elements. Generally, the formulas have two main components (Konoplyanik, 2011):

1. Heavy Fuel Oil (35%-39%)
2. Diesel and gasoil (52%-55%)

Also the natural gas markets across Europe are not even close to be liquid markets when compared to oil markets. The highest liquidity seems to be happening in UK NBP (National Balancing Point)

The other important issue is the Russian dominance in the European market. There is extensive literature on this. But the main focus of this part is the Russian pricing for German border natural gas (“Russian price”).



Graph 1. Russian Natural gas price \$ and €/1000m3

### A Possible Formula

It is very hard to cite a reference for Russian price formula. Therefore, an econometric approach is used to foresight the indexation. It is for sure that there are other elements for such formula, the below approach looks sufficient for testing purposes. The data used is extracted from IMF database. (IMF, 2011)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HEATING(-1)	24.25973	3.160895	7.674957	0
HEATING(-6)	137.5969	3.298138	41.71958	0

Table 1 – Heating oil and Russian Natural gas linkage before 2011

The data used for Table 1 covers the period from January 1999 to April 2011 on monthly basis. The closest match for the Russian price is as follows with an R-square of 0.97:

Russian natural gas(time) = 24.25\* Heating Oil (time-1) + 137.59 \* Heating Oil (time-6)

The first key assumption is the Russian price is highly correlated to Heating Oil prices of the US Market. From this point on, it is also assumed that this linkage is well known by the investors. Therefore:

- If Germany will continue to buy the same Russian gas with the same contracts and prices, the futures markets should reflect the same relationship between heating oil and natural gas.

This hypothesis may be flawed due to several issues such as marginal pricing, illiquidity of the market, exchange issues. To further support the initial hypothesis, the formula will be tested before and after the first quarter of 2011, where the discussions for oil price indexation reached its climax thanks to high oil prices. This is also the time period where oil price indexation may have changed and hence future expectations are changed.

### Testing of the Hypothesis / Step 1

There are two German gas hubs, GASPOOL (BEB) and NetConnect Germany (NCG) that is relevant to this study. The churn ratios(a measure of liquidity= traded volumes to physical deliveries) for such markets are not even close to NBP. Churn ratios for comparison are given (Kanai, 2010):

1. WTI : 1680-2240 (Feb 2010)
2. Brent (ICE): 2014 (Feb 2010)
3. NYMEX Henry Hub: 377 (in 2009)
4. NBP close to 15. (2010)

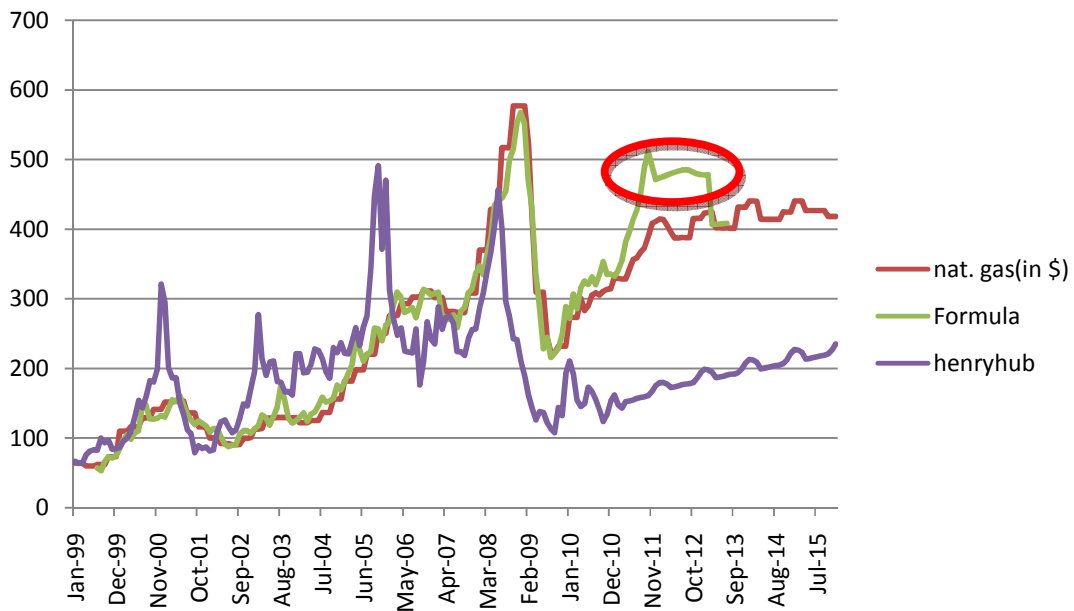
There are also several issues like while heating oil prices are in US Dollars, Gaspool and NCG is in €. So the GASPOOL prices are converted in to US dollars with 1.4 exchange rate and then scaled up for 1000m3 (Since the contracts are for 1 MWh). The data is extracted during May 2011.

In the graphic below, historical data from IMF database is merged with the data from ICE. (ICE). "Formula" is the formula given in Table 1.

The graph shows that the formula which is derived from the historical relation does not extend in to the future. Actually, using the formula to calculate future natural gas prices from future heating oil prices produces quite diverging data points. The reasons for such divergence can be:

1. The share of Russian gas in German market
2. The illiquidity of the European Gas Market
3. The investors' position due to very high oil prices
4. The structure of the GASPOOL and NCG (German market)

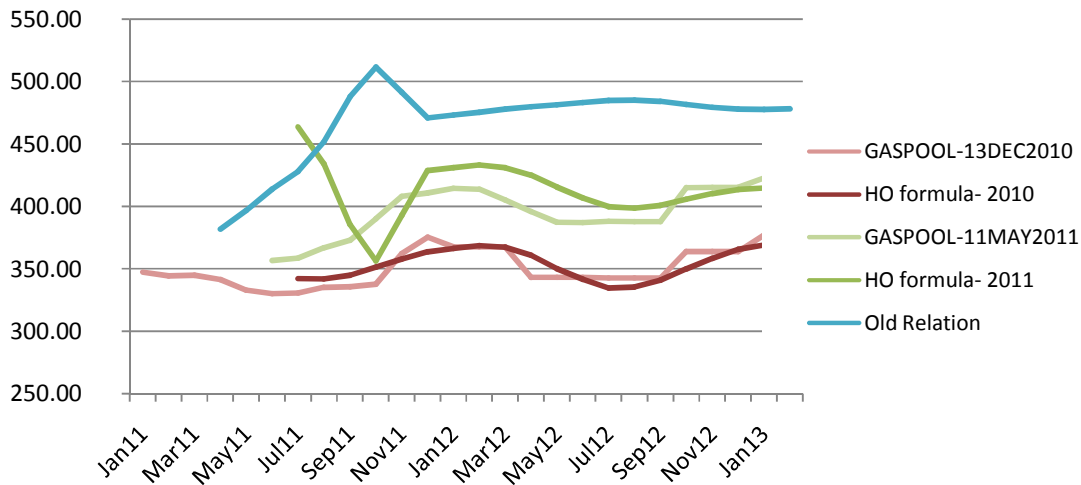
Therefore it is very hard to conclude by merely making this examination.



Graph 2- The heating oil and German natural gas prices are not matching.

### Testing of the Hypothesis / Step 2

In the second part, two data series are investigated, the first set is the GASPOOL and Heating Oil future prices at the end of 13 December 2010 (“2010 data”). The second set is the same data extracted for the date 11 May 2011 (“2011 data”).



Graph 3- The examination of two data sets.

The above graph shows that the original relations are no longer retained (the line at the top versus green and red ones). However, to avoid any mistakes, a new relation has been derived for the 2010 data.

2010 Data – 13 Dec 2010					2011 Data – 11 May 2011				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
HEATING2010(-1)	343.2185	46.92511	7.314175	0.0000	HEATING2011(-1)	108.5332	35.33375	3.071658	0.0066
HEATING2010(-6)	-204.2124	47.27277	-4.319873	0.0004	HEATING2011(-6)	26.10849	35.40374	0.737450	0.4704
R-squared	0.699231	Mean dependent var	354.1025		R-squared	0.247944	Mean dependent var	398.3436	
Adjusted R-squared	0.682522	S.D. dependent var	15.67720		Adjusted R-squared	0.206164	S.D. dependent var	18.90023	

Table 2 – The relation of German future natural gas prices to heating oil prices

What has been observed so far is a relaxation of relationship between heating oil and natural gas prices. This is not a concrete proof of the change of contract formulas, since there may be numerous reasons especially when it comes to future prices.

However, there is a sense that as the price of oil and heating oil has reached record highs, future gas price expectations have slid towards spot prices. One should also remember that, the future prices extracted are for the hubs. Nevertheless, even as we can observe some kind of old relations in the 2010 data, this relation diminishes in the 2011 data.

## Results so Far

As the physical oil price increases, it will be hard to sustain the old relationship of oil indexation. However as the volatility stemming from LNG glut, shale gas developments or future developments, some kind of security is required by the producers. It is hard to say that this relationship is dead or will die. But there are signs of divergence from this relationship, yet not big enough. The key point is not the formula or the formation of point but the road ahead for more liquid natural gas markets.

The other issue is the benchmark issue. The spread between WTI and Brent has fueled these discussions. (Sanlı) Whatever the reason is there is a certain part of market looking for new benchmarks, especially the Asian market.

There can be other options to peg the price to other elements such as coal as Ukrainian Prime Minister Azarov claims: "It goes of a Europe-style approach, when the gas price is pegged to the cost of an energy source which can be a substitute for gas. And which resource can be used instead of gas in Ukraine? Coal, for instance. We have plenty of coal. So, why not set coal as a benchmark in this formula?". (Ukrainian News Agency, 2011)

## New Developments Around Turkey

Instead of discussing the well known suppliers and options for Turkey, in this part we will try to examine the possible new comers to Turkish gas supply chain. These can be:

1. Possibility of Iraqi gas
2. Explorations in the Black Sea
3. Shale gas possibilities
4. Israeli gas

Iraq is one of the question marks and possible sources for gas for both Europe and Turkey. Regularly, Iraqi leaders are underlying the fact that Iraq is desiring to export its gas. Turkey on the other hand wants to increase the infrastructure between the two countries to make that happen (Today Magazine - Iraq, 2011).

The other possibility is the explorations in the Black Sea. TPAO has been persistently exploring for oil and gas reserves in the Black Sea. General Director for TPAO, Mehmet Uysal, claims by 2023 Turkey can be energy independent (Zaman Newspaper, 2007). This is a wish yet to be fulfilled. However, these development efforts are expected to yield with some results.

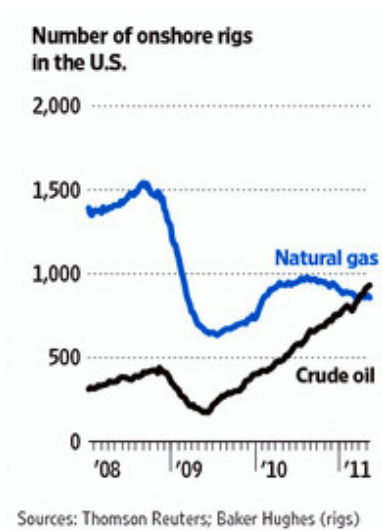
The shale gas possibilities, if the environmental regulations pave the way, are game changers for both Europe and the world. There are hostilities against such developments, whether it is the gasification of the power market and replacement of renewables or methane leaks or playing to the hands of anti-nuclear campaigners. According to EIA report, Turkey has some 424 bcm of shale gas resources for development. Although this is a rough estimate, by using the thumb rule of 60 (production to reserves ratio for gas), one can simply state that this means 7 bcm of natural gas supply per year. However, the extent of the study and the way shale gas production works may avoid such short cuts (U.S. Energy Information Administration, 2011).

Another very important game changer is the Israel's Leviathan basin. The development of such basin is considered as an "export project" (Udasin, 2011). However the Israel's strategy is more towards Cyprus-Greece and possibly Europe than proximity. The offshore field is around 200 km away from Vasilikos, Cyprus. Whatever the development strategy is to be, it will have important consequences for the regional gas prices.

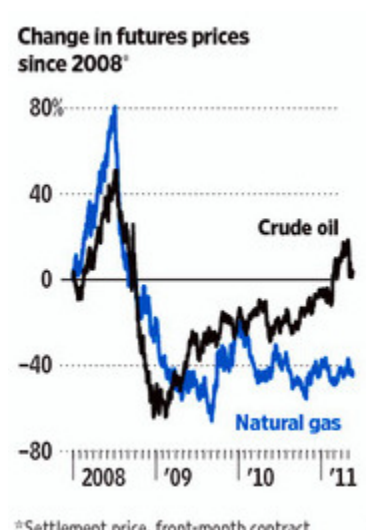
These whole new variables in the regional equation stirs up certain questions like

- What is the break even price for such projects?
- Export possibilities of the new comers combined with shale gas developments and the rigidity of long term contracts of current suppliers is a whole new game field.
- Will there be a need for Nabucco?
- Do the expectations on future gas glut deter current suppliers from investment?

A demonstration of price-investment interaction is already happening in the US Market (Gilbert, 2011).

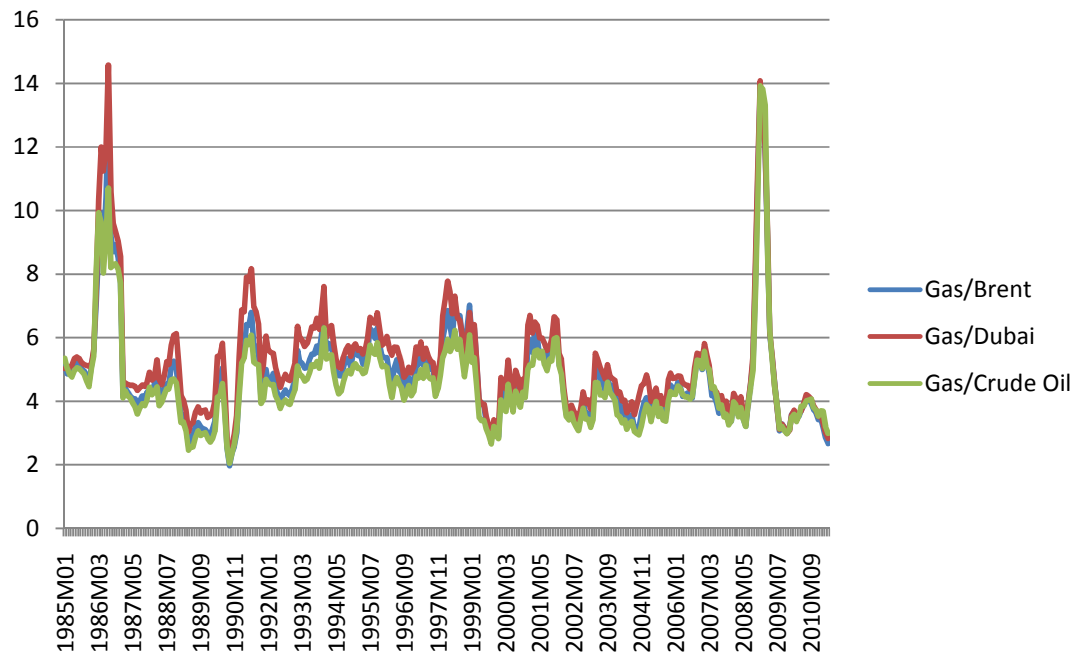


Graph 4 – Number of onshore rigs in the US



Graph 5 – Changes in future prices since 2008

The above graphs from The Wall Street Journal (Gilbert, 2011) clearly shows that as the oil prices increase and gas prices stagnate, investment shifts towards the more profitable resource. This is also another indication of oil-gas linkage, since the same rigs are used for both oil and gas.



Graph 6 – Parity of Russian Natural Gas border price(in \$/1000m3) in Germany wrt several benchmarks

Another important point is the parity between natural gas prices and oil prices. In the US case this can be 10 or 20 or 30, but historically Russian natural gas prices settle around 4 to 6 (ignoring the oil price spikes). The spikes are an indication of oil price crashes.

To project future developments in the Turkish market, all these developments must be considered. So far, a quantitative prediction can be far more unreliable than a human prediction due to complexity of interactions.

Instead, the boundaries for future price movements are tried to be listed:

1. Upper bound
  - a. Old natural gas formula without spot price indexation(Russian natural gas prices in yearly average)
  - b. LNG prices in the peak demand periods with fast Asian growth
2. Lower bound
  - a. Cost of shale gas development
  - b. LNG prices during the off peak season

Therefore, the forecast for prices are more unpredictable than previously seen.

## What are the prospects for Turkey

The developments briefly examined means that World's -and hence Turkey's, hunger for natural gas may not end any time soon. The real issue is on the supply side. How will these price changes affect Turkey's supply diversification.

The main developments expected in the Turkish gas market are as follows:

1. Electricity demand including seasonal effects
2. Privatization of BOTAS Contracts
3. Global LNG developments
4. Shale developments

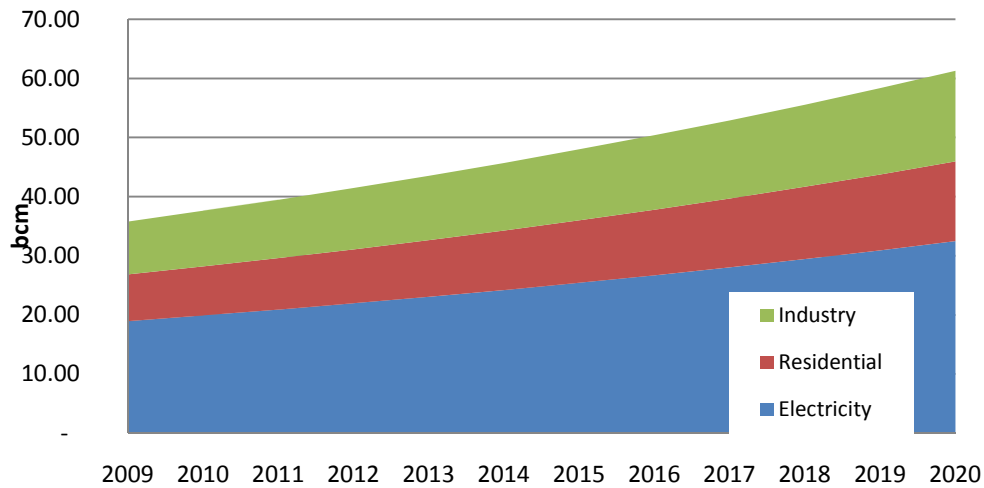
Both shale and LNG developments can be very important since, as a developing country Turkey needs to develop new opportunities. For example, the natural gas prices are the main determinants of the electricity prices in Turkey. The oil indexed prices cause an unintended support mechanism for renewable especially wind. Despite governments efforts for Feed-in-Tariff(FIT), the natural gas prices paves the way for profitable wind energy development without any requirement for FIT. This is what one may call "unintended effects across sectors".

The same unintended effects will be the builder of both shale gas developments and attracting other suppliers to Turkish market. If the oil price indexation of Turkish gas prices remains the same, the profit margins for new comers will be higher in the Turkish market than European market (and no transit fees!).

Therefore, here is a business as usual projection for Turkey.



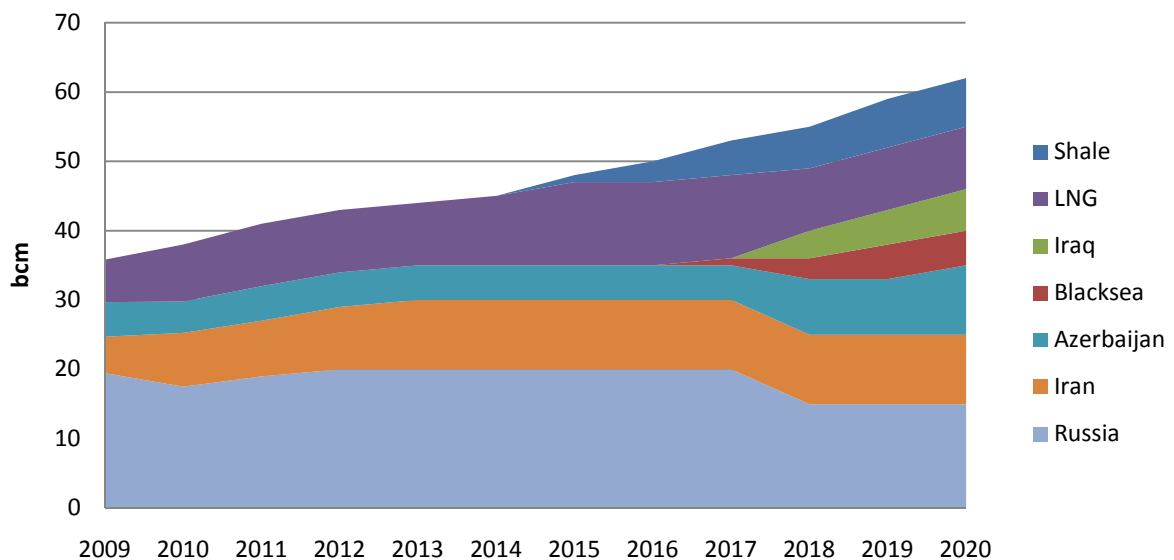
## Turkey - Natural Gas Demand



Graph 7 – Turkish Natural gas demand by sectors

In this scenario, a very conservative estimate of 5% annual growth rate is assumed in line with governments' plans to increase the share of renewable in electricity generation. As the total demand increases around 5%, the ratios of subsectors remain the same as in 2009 and 2010. (2011 can be different since the rainy season means less natural gas used for electricity generation)

## Turkey - Natural Gas Supply 2010-2020



Graph 8 – Turkish Natural Gas Supply projection to 2020

## Conclusions

In this article, following summary and projections are derived:

- European market is becoming more liquid, hence oil-price indexation is diverging from its historical relationship.
- The more liquid the market, the harder for the current producers to control the price
- However, a security of demand is needed for producers to invest in production capacities.
- In Europe, new mechanisms are more linked to hub prices.
- The more Turkish gas prices are linked to oil indexation of the pre-2011, the more opportunities for the private sector to invest in other alternatives.
- Shale gas can be very profitable in Turkey.
- Azeri and Iraqi gas may be delayed till 2018.
- Electricity is still the key driver for natural gas demand both in Europe and Turkey.

Since the new developments, it has become much more difficult to make projections. Transition to more liquid natural gas markets are bringing lots of uncertainties for the supply side and price. However, with the current supply and price structure, there is very little entry barrier for the Turkish market for new supply options. Therefore the rigidity of the past can be a center of attraction for new opportunities. But Turkey should not limit itself to the stated topics and should consider a place for a regional commodity market based in Istanbul to price natural gas exports.

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