# *Analysis of the effects of liberalization on the Turkish energy market*

November 2011

pwc

# *Introduction*

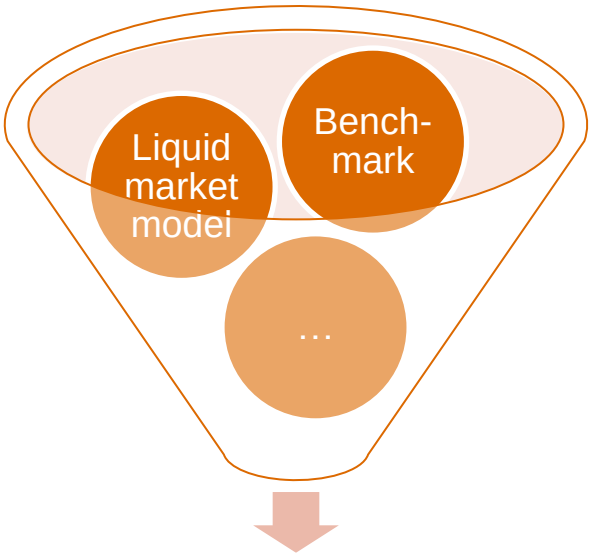
The Turkish government assertively endorsed the dual goals of privatizations and liberalization and has already initiated various efforts in this regard, i.e. privatization of state-owned companies. As these efforts are still ongoing, the Turkish energy sector is currently in transition towards liberalization.

Strategic targets for Turkey are to create a market based framework for the Turkish energy market to secure further  local and foreign investment, to increase the security of supply of energy as well as to increase competition for the benefit of the customers and reducing the costs along all steps of the value chain.

What is hitherto missing is a comprehensive and far-reaching amending of the Turkish legal and regulatory framework as a basis for the inception of a liquid wholesale market as a market-based framework to invest in the Turkish energy market.

The desired final qualitative outcomes of these amendments are well understood and rarely disputed. But quantitatively a large degree of uncertainty prevails regarding the repercussions of these necessary amendments in terms of economic gains for the entire Turkish economy in general, and the energy sector in particular.

# *Quantification of the effects of liberalization*
## Our approach




**Quantitative analysis of key indicators**

The main objective is to provide a quantitative analysis of selected key indicators through a change of the Turkish energy market to a fully liberalized market with prices determined by supply and demand.

The quantitative analysis will address approximated effects on selected key indicators of a market-based framework by describing changes of this indicators under predefined, free-market assumptions and comparison to liberalizations in other countries in the past.

However, this analysis can be only a rough estimation and not a detailed calculation of these effects.

# *Summary Report*
## Our Approach

Our analysis is performed in two steps:

1. Estimate the effects of liberalization toward a market-based framework on industry specific fundamentals
2. Estimate the effects of specified key economic indicators on relevant macroeconomic indicators which display the change in overall welfare for the Turkish economy

For such an analysis the scope of work is limited to power and natural gas and is based on:

- Assumptions of IMF World Economic Outlook and of EMRA
- Germany, Netherland and UK as benchmark for the liberalizations effects
- One scenario for effects to the Turkish energy market and to the Turkish economy
- A macroeconomic model for Turkey

# *Estimate the effects of liberalization on industry specific fundamentals*

*1*

# *How to achieve an energy hub?*
## Elements of a transparent market framework

### Preconditions

- Sufficient market size and number of market participants
- Sufficient diversity of players active on the natural gas import and power generation side
- Contractual standardization (force majeure, credit, scheduling, termination etc.)
- Price transparency and sufficient market depth both for spot and forward products
- Controlled transaction environment for standard products (i.e. rule book for exchange)
- Established physical delivery mechanism

### Effects

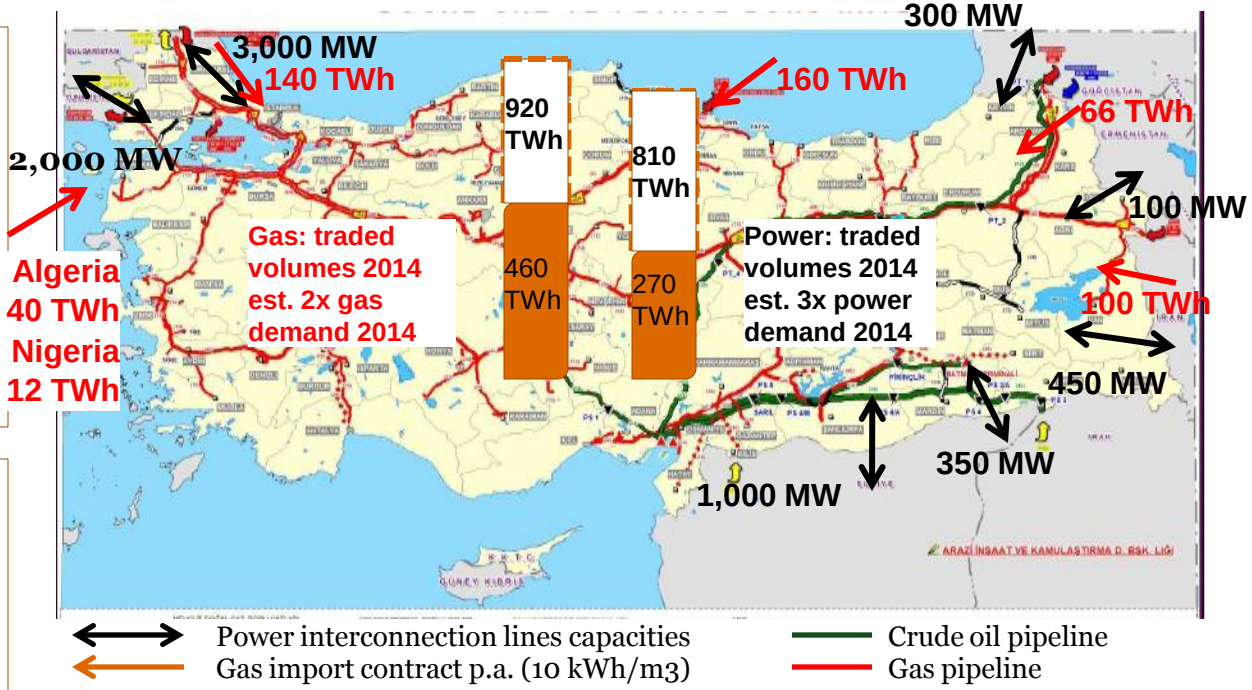
- Market transparency for new entrants both on production and retail side
- Price signals generated by the market not by the state
- Potential to manage risks from asset ownership (e.g. power plants, LTC)
- Additional source of income for the state and investments from the private sector
- Both industrial and households end users profit from efficiency gains
- Increased competition on the retail side puts a check on retail prices
- Long-term contracts needed for security of supply can be optimized on traded markets

# *Infrastructure key to traded market development*
## Turkey's potential role as a future energy hub

**Gas infrastructure:**
Investments to the regional gas network infrastructure (67 provinces) amounted to TLR 9.3 bn by 2010. Investment of BOTAŞ into the national transmission network amounted to $ 1.4 billion between 2002 to 2010. Planned investment not published by BOTAS.

**Power infrastructure:**
Electricity grid owners are planning to invest up to TLR 9.1 bln in private electricity distribution networks over the next five years. Testing period with ENTSO-E with Greece and Bulgaria ongoing. No synchronized parallel connection with Eastern neighbouring countries.

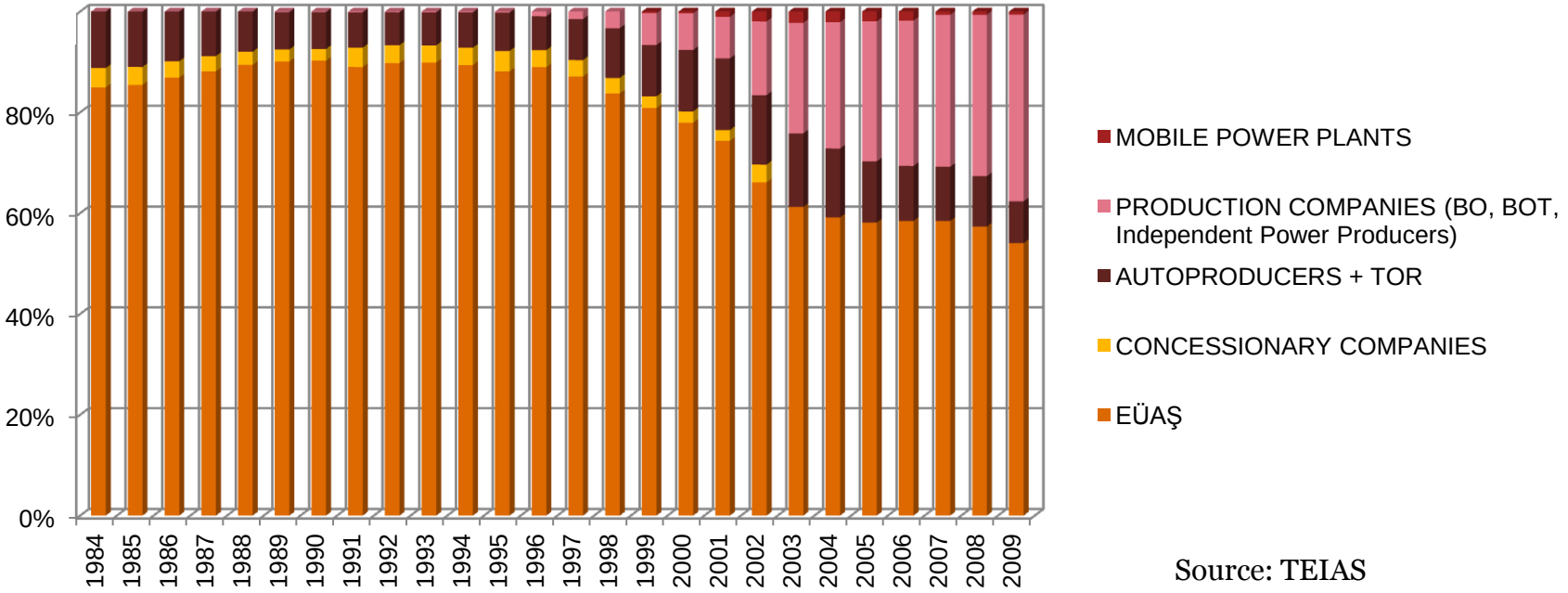
Source: BOTAS, EMRA, IEA, TSOs




Cross-border activities for power have to meet international interconnection conditions. For gas adequate cross-border infrastructure in place (additional transit through Nabucco with investment decision outstanding).

# *Privatization has come to a stand-still*

## Development of state ownership in generation capacities




Source: TEIAS

54% of state ownership in total installed capacity in 2009. There is high uncertainty about the future privatization process. Plant ownership and operation is partly privatized but specifically gas fuel supply remains in the hands of state-owned companies.

# *Revision of long-term contract structure intended*

## Overview on activities of public administration

**Electricity Sale Agreemenets („ESA“)**

- ESAs, which are consistent with the market liberalization objectives are envisaged for a certain period of time
- Tenor, base price and escalation issues of ESAs are currently being addressed

**Fuel Supply**

- **Natural Gas**
  - Natural gas supply agreements with BOTAŞ, which are consistent with ESAs, are envisaged
- **Lignite / Coal**
  - Preparatory work is ongoing to structure the right model to ensure long term coal supply to the plants with optimum quality and sufficient quantity
- **Water**
  - Preparatory work ongoing for signing water usage agreements with DSİ
  - Privatization process for the mini hydro´s provides a useful framework for water usage rights and improved step-in rights

**Transaction Structure**

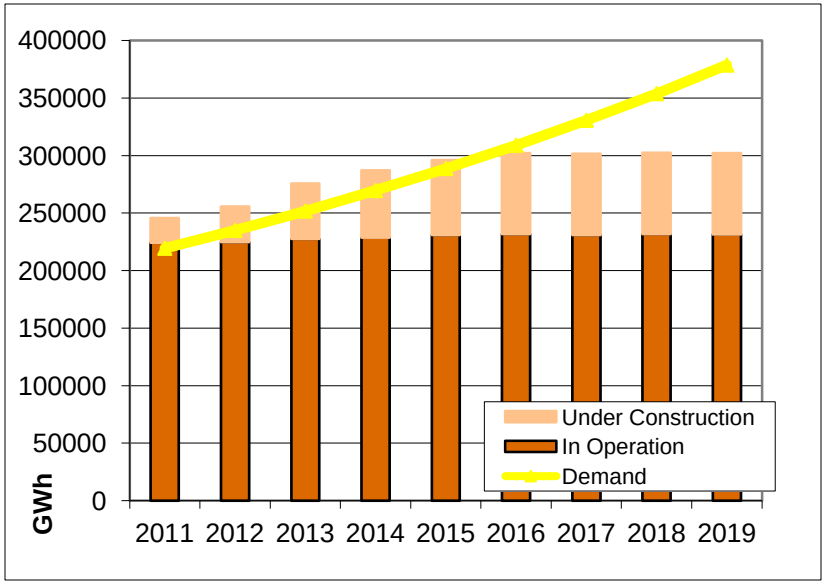
- Share sale of Portfolio Companies to be incorporated
- Portfolio Companies will have Operating Rights for HPPs and ownership of the Thermal assets

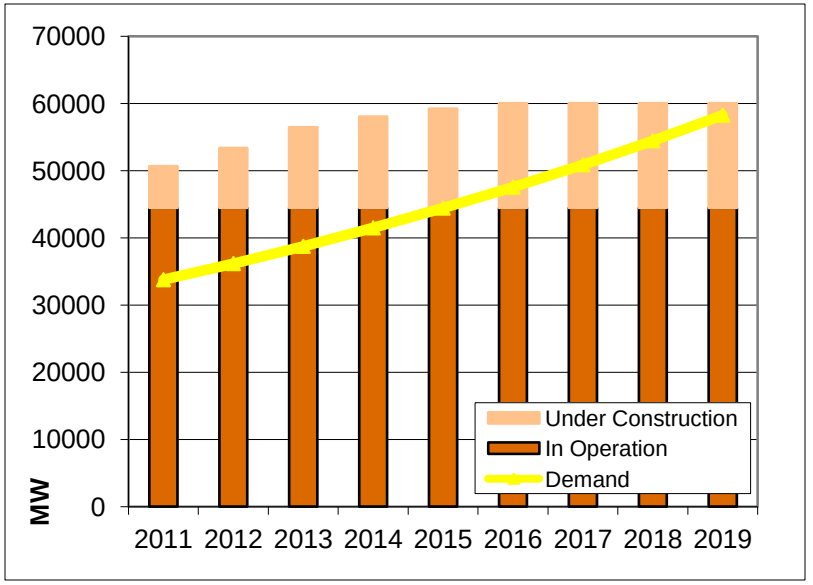
**Source:** Republic of Turkey Prime Ministry Privatization Administration (OIB) EÜAŞ Privatisation Investor Information Session, 8 March 2010

Success of the generation privatizations depend on the availability of liquid wholesale markets, fuel supply options and the transaction structure chosen for the further process. Currently state-owned power plants under EUAS hold transition period energy sale agreements with Turkish Electricity Trade and Contracting AS (TETAS) and distribution companies. These agreements are due to expire at the end of 2012.

# *Investment needs to cope with rising demand*

Power demand and generation projection (2011-2019)




Source: TEIAS, PwC calculation

Considering all projects under construction as per today, a volume gap of 164 TWh is apparent by 2019.

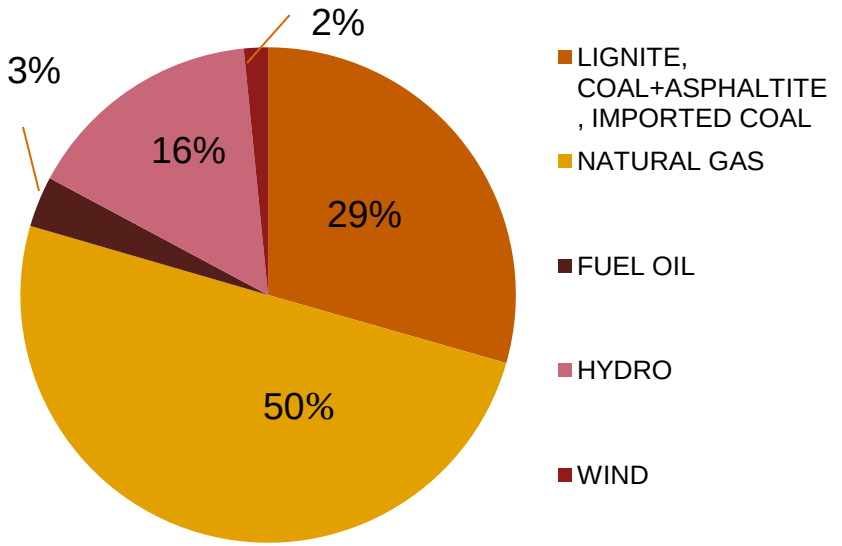
Existing plants and under-construction projects will presumably satisfy future peak demand in terms of capacity.

# *Natural gas still predominating fuel in 2019*
## Political framework vs. estimated fuel mix for 2019

Supply Security Strategy Document
(Source: ETKB)

Natural gas:
To be reduced to less than 30%
Renewables:
30% by 2023 (specific targets –
Wind: 20 000 MW by 2023
Geothermal: 600 MW by 2023)
Nuclear:
5% by 2020
Coal:
Domestic lignite and hard coal resources to be utilized by 2023 (no percentage target)
Utilize domestic and renewable resources first, no specific target for imported coal.

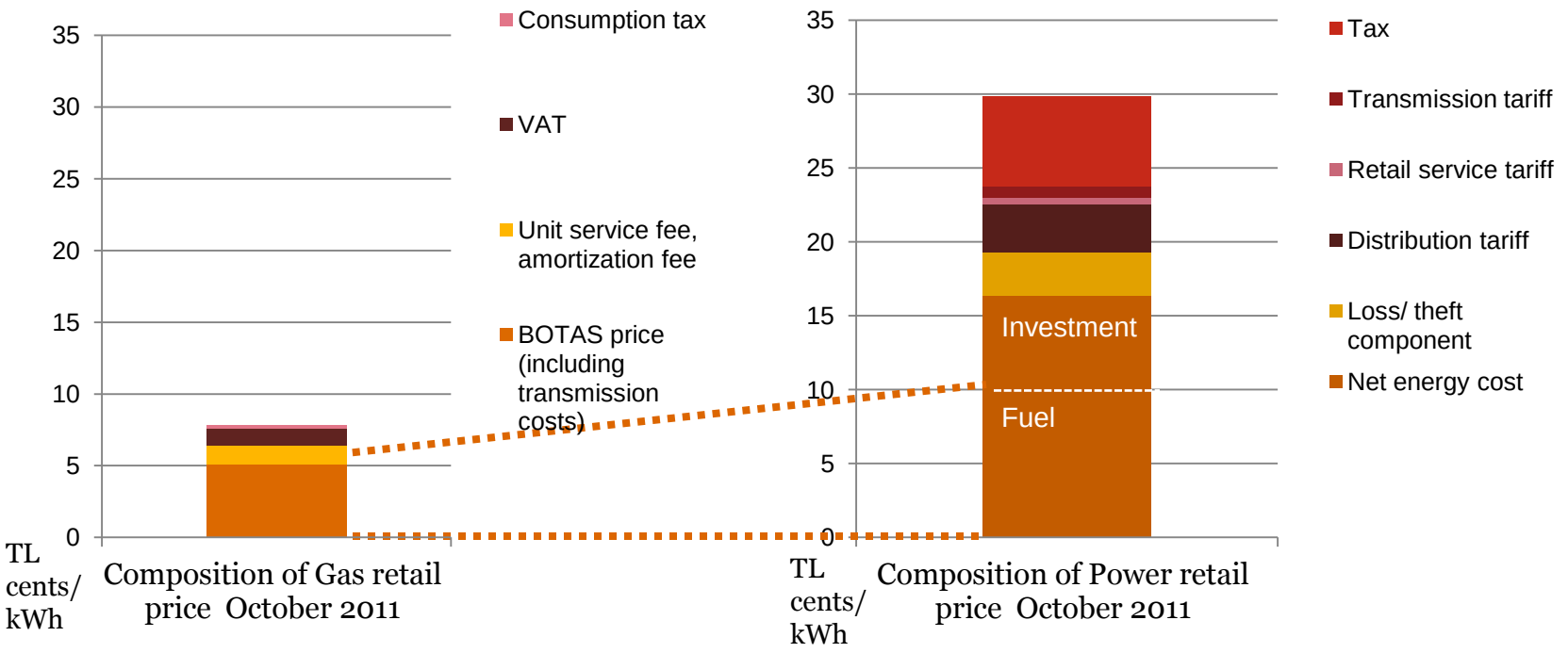
Estimated fuel mix in 2019
(Source: TEIAS, PwC calculation)




Against the expressed political will, the fuel mix for power generation remains in the medium terms dominated by natural gas. TEIAS projections from 2009 do not include nuclear power plant plans.

# *Power prices will be driven by gas prices*

## Retail prices for power and natural gas in Turkey




**Gas and power price relationship:**
Power wholesale price will in the future mainly depend on the natural gas wholesale price, as this price determines the last MWh produced for getting supply and demand in balance. This will impact the power retail prices accordingly.

# *Gas supply to Turkey dominated by ToP contracts*
## Development of contracted quantities

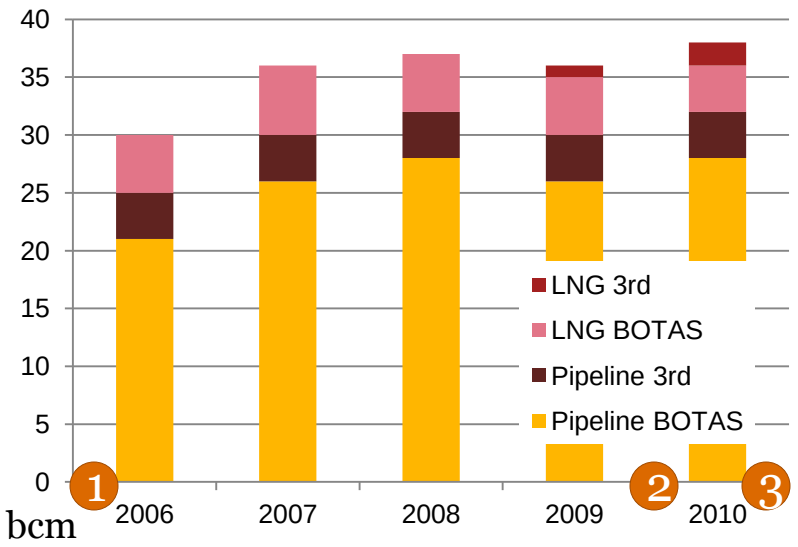
| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total contracted (bcm/ year) | % imported of total contracted (2010) |
|---|---|---|---|---|---|---|---|---|
| Russia | 17,524 | 19,316 | 22,762 | 23,159 | 19,473 | 17,526 | 30 | 58% |
| Iran | 4,248 | 5,594 | 6,054 | 4,113 | 5,252 | 7,765 | 10 | 78% |
| Azerbaijan | 0 | 0 | 1,258 | 4,58 | 4,96 | 4,521 | 6.6 | 69% |
| Algeria | 3,786 | 4,132 | 4,205 | 4,148 | 4,487 | 3,906 | 4 | 98% |
| Nigeria | 1,013 | 1,1 | 1,396 | 1,017 | 903 | 1,189 | 1.2 | 99% |
| Spot | 0 | 79 | 167 | 333 | 781 | 3,079 | N/A | N/A |
| Total imported (mcm) | 26,571 | 30,221 | 35,842 | 37,350 | 35,856 | 38,037 | | |

**ToP risk not mitigated:**
It may be assumed that payments are due if imported volume is below say 80% of contracted volume. According to Sabah newspaper from 13.06.2011, Botaş paid $704 million in 2008 and $650 million in 2009 to Iran and $1.1 billion in 2010 to Russia.

Source: Botas, PwC calculation

# *Gas supply to Turkey dominated by ToP contracts*
## Development of private import activities

Total imported gas volumes in 2006 - 2010




Strong position of national gas incumbent: In 2010 Botas holds 87% of import contracts for pipeline gas and 63% for LNG. Auctions carried have not led to a substantial diversification of bidders.

1 **First transfer of natural gas (4 bcm, 2005)**

Transfer of 4 bcm from the 8-bcm 1998 contract between Russia and Turkey (gas goes through the Western pipeline)

**Gas transfer auction (6 bcm, 2010):**

2 In July 2011 Gazprom announced that they would not be providing the required "Seller's Consent Protocol" (SCP) to bidders, because the Blue Stream contract is based on a intergovernmental protocol that specifies BOTAS as the buyer.

BOTAS still carried out the tender on September 8, but none of the three bids were considered valid due to the absence of the SCP.

3 **BOTAŞ plans (6 bcm, 2011):**

BOTAŞ decided not to extend the 6 bcm/year gas contract with Gazprom, which is delivered through the Western pipeline. Gazprom announced that they would be willing to sell this gas to private Turkish wholesale companies.

Source: Botas, EPDK 2010 Natural Gas Market Report, PwC calculation

# *Effects of key indicators on the overall welfare for the Turkish economy*

# 2

# *Correct assessment of liberalization impact*
## Macroeconomic Modeling Approaches

**No structural effects on the economy**

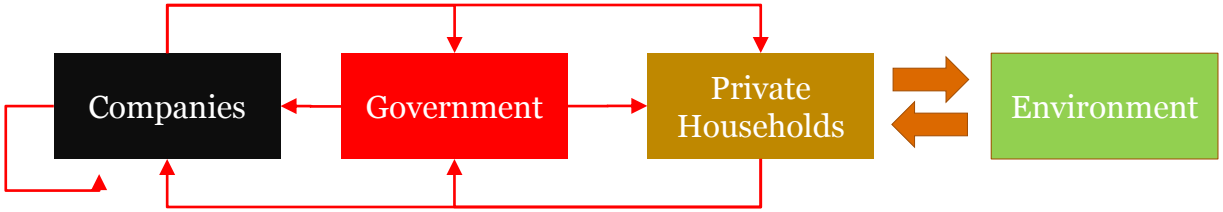
**Structural effects on the economy**

**Dynamic structural effects over time**

| | Advantages | Disadvantages |
|---|---|---|
| **Input-Output model** | - Reliable, national accounts data can be utilized.<br>- Relatively detailed sectoral resolution.<br>- Low data requirements.<br>- Transparent and easy to adopt scenarios | - Price and quantity are duals.<br>- Price is assumed to homogeneous across purchasing sectors. |
| **CGE model** | - Price and quantity are jointly derived.<br>- Conforms better with neoclassical economic theory. | - Price elasticity data are scarce and less reliable.<br>- Does not specify temporal dimensions.<br>- High data requirement. |
| **System dynamics model** | - Capable of describing non-linear, multiple feedback loops over time.<br>- Flexible to use. | - High data requirement.<br>- Realistic socio-economic model requires labor-intensive modeling efforts. |

**Choice of model approach:**
Since the energy market liberalization will have significant impact on the countries' economic interrelations we applied Computable-General-Equilibrium (CGE) type modeling and used the multiregional Global Trade Analysis Project (GTAP).

# *Effects of the energy sector on the economy*
## Choices made in GTAP-CGE model for quantification




- CGE models are useful whenever it is necessary to analyze the **effects of changes in one part of the economy** upon the rest (e.g. an increase in energy price due to liberalization ). CGE models recognize that there are many markets within the economies and that they interact in complex ways.
- The demand for any good depends on the prices of all other goods and on income. Income, in turn, depends on wages, profits, and rents, which depend on technology, factor supplies and production, the last of which, in its turn, depends on sales (i.e. demand). Prices depend on wages and profits and vice versa.

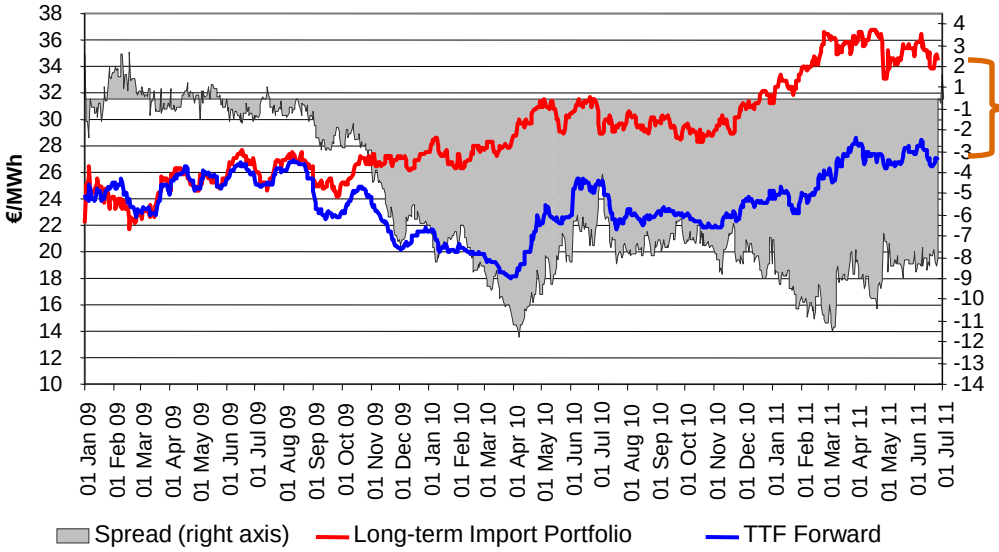
**Interrelations of economic regions:**
- Definition of sector aggregation (10 sectors including energy)
- Definition of regional aggregation (12 regions including Turkey)

**Choice of shocks to the economy:**
- To Energy sector on prices and quantities
- To Energy sector on construction of power generation capacities

# *Potential effect of liberalization on prices*

## North-West-Europe: Price erosion via traded markets

Gas Year 2012/13 – Long-term Import Portfolio vs. TTF (Dutch gas hub)




**20-30% price gap**

**NWE gas markets drivers:**

- Transparent market framework for hubs
- Additional supplies via LNG
- Gas release auctions
- New market players
- Push from national regulators

Source: Sample contract portfolios, PwC calculations

**Price assumption for model input:**
Similar factors for price decrease and decoupling from long-term prices as in NW Europe would apply to Turkish gas market in case a consistent market framework would be adopted. A 20% decrease of natural gas costs for the economy was assumed.

# *Potential effect of liberalization on investments*
## Estimated investment need for plants and network

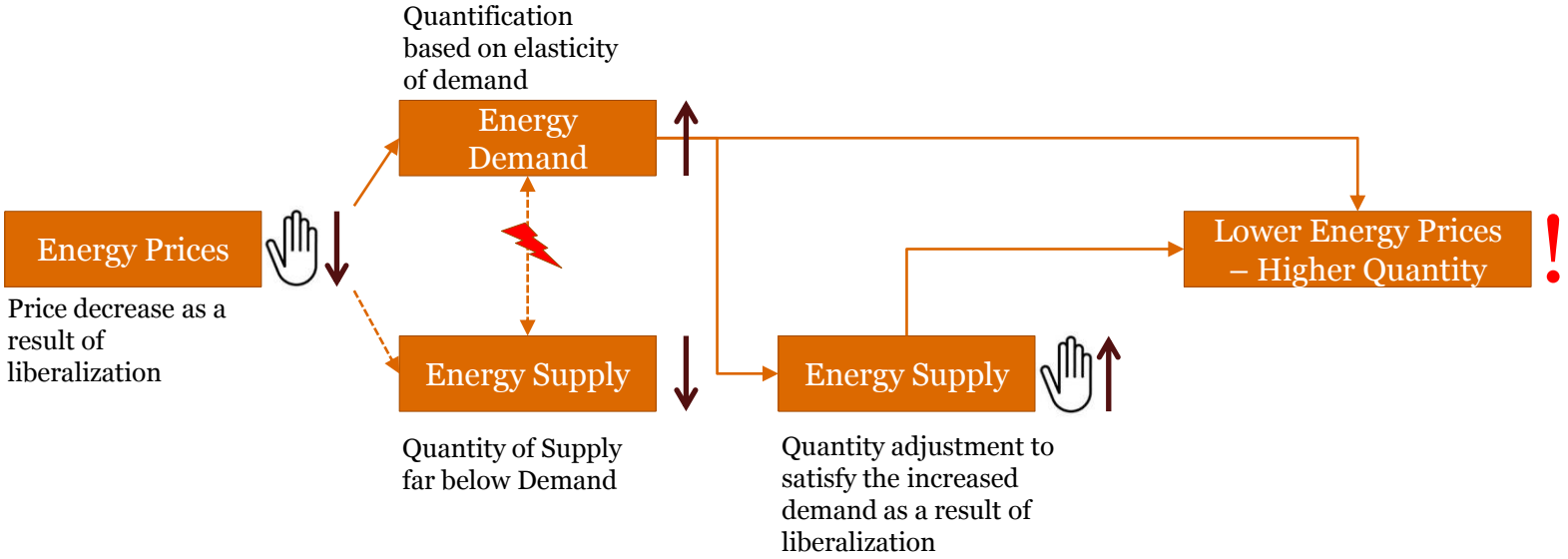
| Fuel type | Sharein energy mix in 2019 | Total gap in GWh | Gap in GWh based on the energy mix | Gap recalculated into GW | Gap recalculated into ths TL | Gap recalculated into ths USD |
|---|---|---|---|---|---|---|
| LIGNITE, COAL+ASPHALTITE, IMPORTED COAL | 29% | 164,086 | 47,585 | 2.081 | 2,601,664 | 1,480,742 |
| NATURAL GAS | 50% | | 82,043 | 2.887 | 2,887,316 | 1,643,321 |
| FUEL OIL | 3% | | 4,923 | 0.275 | 275,024 | 156,530 |
| HYDRO | 16% | | 26,254 | 3.179 | 5,086,119 | 2,894,775 |
| WIND | 2% | | 3,282 | 0.305 | 609,779 | 347,057 |
| **Total** | **100%** | | **164,086** | **8.727** | **11,459,901** | **6,522,425** |

Source: PwC calculation

**Investment assumption for model input:**
Calculated generation investment figure of 11.5 bn TL until 2019 was modelled (1) as part of overall investment figure in conjunction with potential price decrease. (2) as an isolated effect independent of a price decrease. Investments for transit and cross-border capacity were not separately available and could not be used as model input.

# *Consistency of results*

## Equilibrium of price and quantity assumptions




**Modelled relationship between price and quantity assumptions:**
In model theory a decrease in energy prices would result in a decrease in supply. Since it is assumed that liberalization also affects the production capacities, supply will meet increased demand in a new equilibrium with lower prices and higher quantities, both for natural gas and power. It is assumed that the Turkish economy will adjust its structures to an initial shock (liberalization) in a period of approx. 5 years after the direct changes within the energy sector take place.

# *Increase of Gross Domestic Product by 2.6%*
## Results of shocks (1)

Our modelling indicates that the anticipated gas price decrease of 20% due to liberalization will **increase the Turkish GDP in 2019 by 2.6%** as compared to a scenario without liberalization. This corresponds to an absolute increase of GDP **by approx. 42 Bill.TL**. Accumulated **additional investment until 2019** compared to a scenario without liberalization will amount to **approx. 26 Bill.TL**

| GDP Source | GDP Expenditures |
|---|---|
| (1) 3.2% increase in income of private households and companies;<br>(2) 1.9% increase in government income;<br>(3) 0.1% increase in depreciations. | (1) 2.8% increase in consumption of private households;<br>(2) 4.5% increase in investments;<br>(3) 3.0% increase in government expenditures;<br>(4) 0.2% exports decrease and 2.2% imports increase. |

Especially the Capital Good Commodity Sector (+ 4.3%), the Heavy Manufacturing Sector (+ 4.2%) and the Construction Sector (+ 4.1%) increase Gross Value Added.

# *Significant employment effects*
## Results of shocks (2)

Significant **employment effects** for the non-energy sectors and in parallel a negative employment effect on the energy sector are visible from model output [in %]:

| | Elec-tricity | Gas Distr | Extrac-tion | Con-struct. | Machi-nery | Light Mnfc | Heavy Mnfc | Agri-culture | Trans Com. | Oth Serv. | CGDS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Labour | -14.7 | -8.9 | 1.0 | 5.3 | 2.2 | 3.0 | 6.8 | 1.3 | 4.41 | 3.7 | 5.4 |

The negative employment effect on the energy sector is due to a strong increase in sectoral labour productivity following the international technology transfer which is assumed to take place after liberalization. Overall estimated effect is a **3.1% increase in skilled employment** and a **3.4% increase in unskilled employment**.

In contrast to the overall positive employment effects in the non-energy sectors there is no significant **wage level effect** on the economy as a whole due to the liberalization scenario. This is mainly due to ongoing substitution between labour and capital on the one hand and the high unemployment rate in Turkey on the other hand.

# *Significant trade effects*
## Results of shocks (3)

Factors leading to increase in **imports (+2.2%)**:

- higher demand for investment goods
- increased demand for intermediate goods and services in all sectors of the economy
- rising demand from private households due to higher available income

Factors leading to decrease in **exports (-0.2%)** :

- export of electricity more than doubles
- energy-intensive heavy manufacturing sector profits from energy price decrease
- exports from all other sectors decrease because of higher demand in the domestic market (increased investments, increased spending of private households and increased production)
- increased prices for goods and services which cannot be compensated by lower prices for energy inputs

# *Energy price effects are dominating*
## Results of shocks (4)

**Using an assumed price decrease for natural gas of 10 %** as input leads to a 1.4% higher GDP than in a scenario without a price decrease. Labour effects for this scenario: a 1.7% increase in skilled employment and a 1.9% increase in unskilled employment. Imports and exports change by +1.2 and -0.1 % respectively.

The **isolated effect of the anticipated investment in generation capacity** from 2016 to 2019 in a liberalization scenario is small compared to the effect of the price decrease: GDP will only be approx.0.1% higher than in a scenario without such investment.

# *Conclusion*
## Timeline of macro-economic changes due to liberalization

To quantify the macroeconomic effects for Turkey, CGE model calculations were made taking two anticipated effects of liberalization on the Turkish Energy sector as input. The significant positive GDP impact of plus 2.6% in 2019 (or in absolute figures approx. 42 Bill.TL) is due to liberalization of the Turkish energy markets and the expected reduction of gas cost to the economy. In comparison to that the impact of effected further investment in new generation capacity on the GDP remains modest.

It is assumed that the Turkish economy will adjust its structures to an initial shock (liberalization) in a period of approx. 5 years after the direct changes within the energy sector take place. Afterwards the economy will remain on a higher GDP level in comparison to a scenario without liberalization.

Finally the following should be emphasized once more: the above mentioned benefits were estimated on the basis that privatization (access to energy related assets such as long-term gas supply contracts and ownership in power generation capacity) and liberalization – including the inception of a liquid energy exchange for gas and for power – proceed, leading to the establishment of a transparent market-based framework in Turkey.

# *Annex 1: Project description*

# *Project description*

In order to 'build their case' supporting a rapid liberalization of the energy industry, the Turkish Energy Traders Association (ETD) requires estimations on micro-and macroeconomic impacts on the private and public energy industry across the value chain and the Turkish economy.

For that reason, ETD has asked PwC to deliver a two-page summary report to address quantitative effects of a complete liberalization of the energy sector toward a market-based framework, excluding transmission. Such a complete liberalization assumes:

- Complete privatization across the value chain (excluding transmission)
- 100% market opening rate and full choice for retail customers
- Establishment of an independent energy exchange and a functioning OTC market to determine a market- based price for energy
- Full integration with the European ENTSO-E grid.

Energy comprises electricity and gas. Assumptions to be considered are the IMF World Economic Outlook regarding the macroeconomic development of the Turkish economy and assumptions made by Turkish authorities regarding the development of the energy markets. Moreover, the analysis takes into account the overall objective of the government and the energy industry to achieve a secure & affordable energy supply and a high degree of security of investment respectively.

# *Summary Report*

## Step 1: Define success indicators of a liquid wholesales market as a market-based framework for investment

We will execute a more quantitative analysis of key fundamentals of three existing liberalized, liquid Energy Markets (GER, NL, UK) and compare them with the current market in Turkey.

Based on this analysis we will provide estimated changes to the following key fundamentals based on a predetermined market-based scenario for the energy sector, which is agreed with ETD:

- Market structure and participants
- Price and trading volumes
- Need of generation supply capacity
- Investments in infrastructure and generation capacities
- Government's revenues

# *Summary Report*

## Step 2: Assess macroeconomic impact of defined success indicators for the entirety of the Turkish economy

The results from step 1, which are quantitative effects on identified energy fundamentals, are incorporated as inputs in a macroeconomic model for Turkey.

The macroeconomic model provides as output the impact on the following key economic indicators:

- Gross Domestic Product (GDP)
- Skilled and unskilled labor (employment)
- Current Account Balance

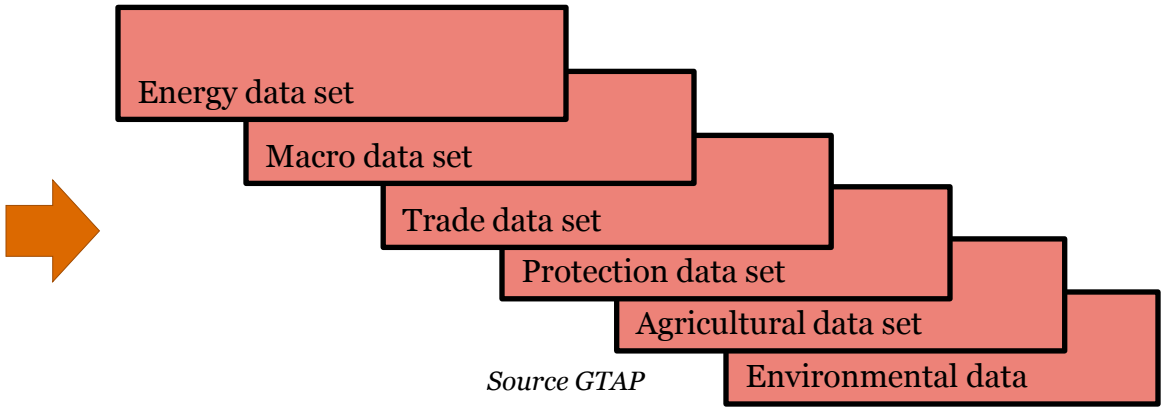
# *Annex 2: Model description*

# *Choice of the model: the GTAP model, Version 7.1*

To ensure the quality, predictability and reliability of our work we will base our analysis on one of the most well-known CGE models – the multiregional GTAP model.

- GTAP - The Global Trade Analysis Project is a global network of researchers and policy makers conducting quantitative analysis of international policy issues. GTAP is coordinated by the Center for Global Trade Analysis in Purdue University's Department of Agricultural Economics.
- PwC is a member of the GTAP network, we are a licensee the GTAP´s data and models which we used for a wide range of applications and projects. The main advantages of the use of GTAP input can be differentiated between the comprehensive fully developed GTAP dataset and the existing CGE models which built on this data. The following summarizes the data input to the GTAP CGE models.

GTAP 7.1
(published in 2010)
(112 Regions, 57 sectors)




*Source GTAP*

# *PwC adjustments to the model*

## Definition of regional aggregation - Model sectors

| No. | Code | Description | Comprising |
|---|---|---|---|
| 1 | Turkey | Turkey | Turkey |
| 2 | NexttoTurk | Countries next to Turkey | Greece; Bulgaria; Armenia; Georgia; Islamic Republic of Iran |
| 3 | Germany | Germany | Germany |
| 4 | USA | USA | United States of America |
| 5 | GBR | United Kingdom | United Kingdom |
| 6 | Italy | Italy | Italy |
| 7 | Russia | Russia | Russian Federation |
| 8 | France | France | France |
| 9 | RestEurope | Rest of Europe | Austria; Belgium; Cyprus; Czech Republic; Denmark; Estonia; Finland; Hungary; Ireland; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Slovakia; Slovenia; Spain; Sweden; Switzerland; Norway; Rest of EFTA; Albania; Belarus; Croatia; Romania; Ukraine; Rest of Eastern Europe; Rest of Europe |
| 10 | MENASCA | MENA and Central East Asia | Kazakhstan; Kyrgyzstan; Rest of Former Soviet Union; Azerbaijan; Rest of Western Asia; Egypt; Morocco; Tunisia; Rest of North Africa |
| 11 | RestAmerica | Americas without USA | Canada; Mexico; Rest of North America; Argentina; Bolivia; Brazil; Chile; Colombia; Ecuador; Paraguay; Peru; Uruguay; Venezuela; Rest of South America; Costa Rica; Guatemala; Nicaragua; Panama; Rest of Central America; Caribbean |
| 12 | ROW | Rest of World | Australia; New Zealand; Rest of Oceania; China; Hong Kong; Japan; Korea; Taiwan; Rest of East Asia; Cambodia; Indonesia; Lao People's Democratic Republic; Malaysia; Philippines; Singapore; Thailand; Viet Nam; Rest of Southeast Asia; Bangladesh; India; Pakistan; Sri Lanka; Rest of South Asia; Nigeria; Senegal; Rest of Western Africa; Central Africa; South Central Africa; Ethiopia; Madagascar; Malawi; Mauritius; Mozambique; Tanzania; Uganda; Zambia; Zimbabwe; Rest of Eastern Africa; Botswana; South Africa; Rest of South African Customs |

# *PwC adjustments to the model*
## Definition of sector aggregation - Model Regions

| No. | Code | Description | Comprising |
|---|---|---|---|
| 1 | Electricity | Manufacture, distribution ELY | Electricity |
| 2 | Gas _Distr | Gas manufacture, distribution | Gas manufacture, distribution |
| 3 | Extraction | Mining and Extraction | Forestry; Fishing; Coal; Oil; Gas; Minerals nec; Water |
| 4 | Construction | Construction | Construction |
| 5 | Machinery | Machinery and Equipment | Machinery and equipment nec |
| 6 | LightMnfc | Light Manufacturing | Vegetable oils and fats; Dairy products; Sugar; Food products nec; Beverages and tobacco products; Textiles; Wearing apparel; Leather products; Wood products; Paper products, publishing; Metal products; Motor vehicles and parts; Transport equipment nec; Manufactures nec |
| 7 | HeavyMnfc | Heavy Manufacturing | Petroleum, coal products; Chemical,rubber,plastic prods; Mineral products nec; Ferrous metals; Metals nec; Electronic equipment |
| 8 | Agriculture | Grains and Crops | Paddy rice; Wheat; Cereal grains nec; Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Crops nec; Cattle,sheep,goats,horses; Animal products nec; Raw milk; Wool, silk-worm cocoons; Meat: cattle,sheep,goats,horse; Meat products nec; Processed rice |
| 9 | TransComm | Transport and Communication | Trade; Transport nec; Sea transport; Air transport; Communication |
| 10 | OthServices | Other Services | Financial services nec; Insurance; Business services nec; Recreation and other services; PubAdmin/Defence/Health/Educat; Dwellings |

# *Annex 3: Sources*

# *List of sources (1)*


2010-2019 Electricity Energy 10-Year Generation Capacity Projection Report, Turkish Electricity Transmission Co (TEIAS), October 2010

Electricity Market Report 2010, Energy Market Regulatory Agency (EMRA)

Natural Gas Market Report 2010, EMRA

Energy Market Regulatory Agency (EMRA) web-site: http://www.epdk.gov.tr

Turkish Electricity Distribution Co (TEDAŞ) web-site: http://www.tedas.gov.tr

Turkish Electricity Transmission Co (TEIAŞ) web-site: http://www.teias.gov.tr

TEIAŞ Market Financial Settlement Center (PMUM) web-site: http://dgpys.teias.gov.tr/dgpys/

Turkish Electricity Trading and Contracting Co (TETAŞ) web-site: http://www.tetas.gov.tr

Petroleum Pipeline Corporation (BOTAŞ) web-site: http://www.botas.gov.tr

Istanbul Gas Distribution Co (IGDAŞ) web-site: http://www.igdas.com.tr

Republic of Turkey Prime Ministry Privatization Administration (OIB) EÜAŞ Privatisation Investor Information Session Presentation, 8 March 2010

Energy Market and Supply Security Strategy Document, 21 May 2009

Commerzbank web-site: http://www.commerzbank.de

EEX web-site: http://www.eex.com

# *List of sources (2)*


GTAP web-site: http://www.gtap.org

ICIS Herren Power report from 15 September 2011 and 22 June 2011

Natural gas information 2010 & OECD/IEA, 2010

BMI (Business Monitor International) web-site: http:// www.businessmonitor.com

PwC Turkish Energy Deals reports

Egegaz web-site: http:// www.egegaz.com.tr

Turkish Electricity Generation Co (EUAŞ) web-site: http://www.euas.gov.tr

Erdogdu, Erkan (2007) – Electricity Demand Analysis Using Cointegration and ARIMA Modelling: A case study of Turkey

# *List of abbreviations*

| | |
|---|---|
| **TEİAŞ** | Turkish Electricity Transmission Company |
| **TETAŞ** | Turkish Electricity Trading Company |
| **EÜAŞ** | Electricity Generation Company (State owned) |
| **ETKB** | Ministry of Energy and Natural Resources |
| **EİGM** | General Directorate of Energy Affairs |
| **ÇEAŞ** | Former Private Company (Transferred to EÜAŞ) |
| **KEPEZ** | Former Private Company (Transferred to EÜAŞ) |
| **MYTM** | National Load Dispatching Center |
| **TEDAŞ** | Turkish Electricity Distribution Company |
| **EPDK** | Energy Market Regulatory Authority |
| **EPK** | Electricity Market Law N0:4628 |
| **DSİ** | State Hydraulic Works |
| **ADÜAŞ** | Private Generation Company |
| **DTP** | State Planning Organization |
| **GDP** | Gross Domestic Product |
| **WASP** | Wien Automatic System Planning<br>(Planning Model to use for Electricity Generation Expansion Planning) |
| **MAED** | Model for Analysis of Energy Demand |
| **BOT** | Built-Operate-Transfer |
| **BOO** | Built-Operate-Own |
| **TOR** | Transfer of Operational Right |

# *Disclaimer*

The main objective of this document is to provide a quantitative analysis of selected key indicators through a change of the Turkish energy market to a fully liberalized market with prices determined by supply and demand. The quantitative analysis addresses approximated effects on selected key indicators of a market-based framework by describing changes of this indicators (in percent) under predefined, free-market assumptions and comparison to liberalizations in other countries in the past. However, this analysis can be only a rough estimation and not a detailed calculation of these effects.

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