Energy Review

Issue : 18
Date: 07.05.2007

http://turkishweekly.net/energy

Inside

Letter From the Editor

Dear Readers,

Our 18th issue is available for now. Energy Review has attracted quite a bit of attention since its first edition. Now we have a big email list of day by day growing subscribers. Not only we have a large number of subscribers, but a geographically distributed quality readers.

Energy Review is not only investigating Turkey, we have also plans to find more regional experts from Central Asia and Caucasus. As you are aware our Chief Editor Rovshan Ibrahimov is an important expert from Azerbaijan.

Again in this issue, Haluk Direskeneli, our most popular writer has written an intformative article.

Metin Gezen has written a comment about the Turkish public's priorities, in terms of energy supply: Dependence on Russian Gas or Peak Oil?.

Also Burcu Demir also contributed with a brief comment about competition between Greece and Turkey.

Until next week,

My Best Regards.

Editor

Energy Review is a Uluslararasi Stratejik Arastirmalar Kurumu/International Strategic Research Organization publication and prepared by the USAK Energy Desk.

www.turkishweekly.net/energy

energyreview@turkishweekly.net

ISRO House,
Suslu sok. No:2
Mebusevleri, Tandogan, Ankara, Turkey
Tel: +90 312 212 28 86 - 87
Fax : +90 312 212 25 84

Energy Review

Issue : 18
Date: 07.05.2007

http://turkishweekly.net/energy

Condition Assessment for Increasing Boiler Output and Boiler Life Extension in Turkish Utility Power Plant Applications

Haluk Direskeneli
Energy Analyst
HalukDireskeneli@tr.net

This article is prepared for the public use in order to explain the importance of Condition Assessment for Increasing Boiler Output and Boiler Life Extension in utility applications. This article is joint output with my colleagues during my employment in a JV company with a reputable North American utility boiler supplier organization.

Increasing the availability, efficiency and reliability of power plant capacity through its plant life extension is the most economical method for meeting the incremental energy demand.

Servicing the existing EUAS (Electricity Generation Public Company of Turkey) Utility plants are not feasible in the short run, since EUAS traditionally prefers to use their own resources or alternatively they work together with original boiler supplier(s).

After "Privatization" would be implemented in future, the new owners will certainly ask experienced service companies to make the necessary upgrading of existing utility units. This paper presents the necessary approach for assessing the boiler remaining life and its role in plant life extension.

Meeting the demand for electric energy can be achieved by improving the availability, efficiency and reliability of the existing boiler capacity through life extension. Improved plant performance can provide power for as little as 10% of the cost of new plant capacity, when measured on a cost per installed KW basis. It is also possible to reduce plant emissions while making modifications to improve plant performance.

The Condition Assessment begins by defining the operating objective for the plant;

- How many more years of service are required from this plant?
- Will the plant be base loaded or used for cycling duty?
- What capacity will be required of the plant, and at what levels of availability and reliability?
- What are the allowable limits for emissions from the plant during its expected life?

With the operating objectives of the plant defined, it is necessary to assess the current condition of the unit and determine if meeting the objectives is feasible. Non-destructive methods exist for evaluating boiler condition and for estimating remaining useful life and time-to-failure.

With current condition and remaining life estimates in hand, it must be determined if the objective is feasible for these units. In some cases, evaluation may indicate that the unit can no longer be repaired or altered, but more often it is found that with repair and alteration, the boiler can continue to operate in an efficient, reliable, environmentally acceptable manner.

Given the objectives of operation, alternative cases for improving unit performance and reducing emissions can be considered. Each case will have perceptible capital and operating costs for economical evaluation. Case-by-case requirements will dictate the necessary criteria for selecting the optimum course of action.

Project Plan

A plan should be developed for evaluating the plant and determining its viability for extended operation. It should define the critical decision points and include a clear statement of the future needs for the plant. The condition of the Power Plant can be assessed without knowing the future plant needs. However, the scope of upgrades considered, including component replacements, will be directly affected by the projected plant requirements.

Condition Assessment of Fossil Fuel-Fired Boilers

Fossil Fuel Fired Boilers operating at higher temperature and pressure are subject to aging and finite life of major components due to creep, fatigue and interactive creep- fatigue. Coal firing accelerates the normal wear and degradation of heating surfaces due to erosion and corrosion. In addition, boilers can experience degradation from sources that are not fuel related such as inadequate water chemistry controls, effects of cycling operation, or corrosion of surfaces during extended lay-up of the boiler.

The problems associated with creep and creep-fatigue are most likely on boilers that have been in operation for 20-years or more. Typically it is these plants that implement life extension programs and install upgrades to reduce emissions. Although the condition assessment program must consider the entire boiler, the emphasis is to evaluate those components with a cost of replacement, which has major economic impact on the life extension project.

Phased Approach

We would recommend three-phase approach to condition assessment. That would describe the steps followed for a typical project done in the USA. The three phases are defined around the plant inspection outage as follows,

Phase-I. Pre-Outage Planning

- Evaluate maintenance and operations history
- Determine the critical Components for the unit
- Establish outage inspection / test plan

Phase-II. Outage

- Implement inspection/test plan
- Perform root cause analysis, as required to ensure all needed data be obtained during outage. Install instrumentation to support on-line testing if required by the Phase-I plan, or for root cause analysis.

Phase-III Post Outage Testing and Engineering Analysis

- Final remaining life analysis
- Operational testing and analysis, if required
- Repair/ replace recommendations with associated cost

For a feasibility analysis, it is common to limit the project to a Phase-I assessment, which is essentially a study that considers only plant historical data, including;

- Unit operating hours
- Unit mode of operation, ie. cycling vs. base load
- Cycling characteristics- frequency, ramp rates, hot, warm or cold,
- Past failure history including failure analysis reports
- Maintenance history
- Replacement/ Upgrade history
- Materials of Construction
- Actual steam operating temperatures
- Specific characteristics of the boiler design

Key Boiler Components

For a typical electric utility power boiler, some of the components can be expected to fail, and require replacement after as little as 20 years of operation.

Component Replacement Schedule
For a typical High temperature/ High Pressure Utility Boiler

Typical Life In Years	Component Replaced	Cause for Replacement
20	Miscellaneous Tubing	Corrosion, erosion, overheating
	Attemperator	Fatigue
25	Superheater (SH)	Creep
	SH Outlet header	Creep- Fatigue
	Burners and Throats	Overheating – Corrosion
30	Reheater	Corrosion
35	Primary Economizer	Corrosion
40	Lower Furnace	Overheating- Corrosion

Note: Actual component life is highly variable depending on the specific design, operation, maintenance and fuel.

High Temperature Headers

High temperature headers, including the superheater outlet headers, operate at 900F (482C) or greater, and with stresses which make them susceptible to creep, the time dependent phenomenon of increasing material strain with constant stress. Creep interacts with thermal fatigue to accelerate the onset of damage.

Three factors influence creep- fatigue in the high temperature headers of the superheaters

- Combustion
- Steam Flow
- Boiler Load

Burner inputs can vary causing uneven heat input across the boiler. Air distribution can vary, and boiler slagging and fouling can occur, leading to unbalance flow of gases through the superheater and convection passes. The net effect is variations in heat input to the superheater and reheater, and variations in tube outlet leg temperatures entering the outlet headers.

Large differences can occur at individual tube bore locations. These outlet temperatures can occur at individual tube bore locations and these outlet temperatures are greater than the surrounding header temperature and cause localized thermal stress.

Changes in boiler load can increase these differences. Also, decreases in boiler load often result in a reversal of individual thermal stresses at the bore holes locations. When decreasing boiler load, the superheater tube outlet temperature can be less than the surrounding header. This reversal of thermal stresses results in fatigue, which when combined with creep, can initiate cracks in the header along the bore hole penetrations. Load cycling thereby increases the potential for header ligament cracking.

In addition to the effects of creep and creep- fatigue on the header, other potential damage, which should be investigated, includes external cracking due to the stresses from header expansion and piping loads. Header expansion is more likely to cause damage on cycling units where it produces fatigue cracks at header support attachments, torque plates, and other branch connection welds.

Since the superheater outlet header experiences greater temperature and thermal expansion than the furnace roof enclosure, on/off cycling can also result in tube stub-to-header weld cracking. These fatigue cracks are found on the tube side of the weld and are most likely to occur on tubes near the ends of the header. Steam piping flexibility problems can transmit excessive loads to the outlet nozzle of the header and result in externally initiated cracks at the outlet nozzle weld.

If present, longitudinal seam welds in high temperature headers are of concern because of the potential for sub-surface weld flaws, which can promote crack growth due to creep. Finally, a problem seen on some outlet headers is related to the thermal shock and is associated with cycling. In plants where more than one boiler or header are tied to a common blowdown tank, it has been found that condensate can sometimes back up through drain lines and enter a hot header during startup. The resulting thermal shock can damage the header in areas immediately adjacent to the drain connection.

Condition assessment of high temperature headers should include a combination of “Non-Destructive Examination (NDE)” techniques targeted at the welds where cracks are most likely to develop. All major welds on the header including outlet nozzle, torque plates, support lugs, support plates, and circumferential girth welds should be examined non-destructively.

The welds at miscellaneous connections and branch lines such as drains, thermal wells, radiograph plugs, and hand hole caps should also be examined. The internal header should be inspected in locations near the drain lines if the boiler arrangement allows the possible back-flow of condensate. Any seam weld should be examined by surface NDE methods such as magnetic particle or liquid dye penetrant testing, as well as a volumetric examination using electronic test methods. The heat affected header material adjacent to welds can be examined for creep damage by metallographic replication or, if necessary, by sample removal and testing.

We would recommend internal examination of at least one header tube bore hole to look for ligament cracking. If gone undetected, the first indication of severe ligament cracking may be steam leaks at the tube stub-to-header welds, at which time immediate replacement may be the only option. Borehole examinations should include removal of oxide scale that could hide damage. A special test can be done by oxide removal followed by fluorescent dye penetrant inspection for maximum sensivity. The damage most likely to require header replacement is ligament cracking. Its early detection is given the utmost priority. In most instances, other cracks are repairable.

High Temperature Tubing

The superheater and the reheater superheater may each have tubes with finite life due to the effects of metal creep. The creep life of superheater tubes is reduced by higher tube metal operating temperatures and/or higher stresses. Erosion and/or corrosion associated with coal ash attacks the outside diameter of the tube causing wall thinning and increasing tube stress. Excessive moisture or condensate in sootblowing steam can also erode tube wall material. Depending upon the arrangement of the surface, excessive stresses associated with thermal expansion and mechanical loading can occur.

Lower grade alloys, such as ASME SA-213 T11 and SA-213 T22, containing 1-1/4 Chromium and 2-1/4 Chromium respectively, operating at high temperature will experience oxidation of internal surfaces. The internal iron oxide (Fe_3O_4) continues to grow in thickness and has an insulating effect on the tube. This time/ temperature dependent oxide growth and resulting temperature increase in tube metal further reduces the creep life.

Condition assessment of the superheater tubes is possible because of the development of NDE methods, such as “Non-destructive Oxide Thickness Inspection System”, that allow measurement of the internal oxide layer as well as the tube wall thickness. Oxide growth correlated to historical metal temperature. Using the tube’s thermal history, along with the calculated stress due to wall loss, it is possible to predict remaining life for the tube even though no failures may yet have occurred. In addition to this inspection, condition assessment of the superheater includes visual inspection, ultrasonic thickness (UT) testing, and tube sample analysis. UT testing is performed, especially on coal-fired units, to quantify general superheater tube wall loss. Testing is targeted at the location of the hottest tubes in the outlet banks of the superheater and reheater.

Cycling- Other Condition Assessment Considerations

Cycling operation, particularly on/off cycling, has become common place in North American Utilities. The condition assessment program is necessarily directed at the major components that have the greatest economical impact and which are subject to finite life due to their operating temperature and stresses. Cycling operation can lead to component damage, which is not a consequence of creep, but it is the result of thermal shock and fatigue. Two components of concern are the economizer inlet header and the spray attemperator or desuperheater.

Severe economiser inlet header damage has been experienced on drum type utility power boilers that are daily on/off cycled. The problem is unit specific and it is most likely to occur where the economiser inlet header is located within the convection gas pass of the boiler. Boilers held in overnight stand-by without firing would experience pressure decay and a lowering of drum level. Concurrently during this idle period, the stack effect of the hot boiler and in-leakage of air cause the economiser to heat up. The economiser may reach saturation temperature since there is no flow into the unit during this period. As relatively cold water is introduced into the hot economiser header, it produces a thermal shock within the header. The magnitude of the thermal shock and the frequency impact how much damage the header experiences. This damage will occur in the header boreholes and tubes closest to the feedwater inlet. Condition assessment simply involves the removal of a tube segment or hand hole fitting to allow internal visual inspection with a fiber optics probe or video probe system.

The attemperator, normally located in the piping between the primary and secondary superheater, is also subject to damage associated with thermal fatigue and thermal shock. Steam exiting the primary superheater passing through the attemperator can be in excess of 900F (482C). When relatively cold feedwater 300F (149C) is sprayed into the steam for tempering, the components of the attemperator assembly are subjected to large thermal stresses which, over time, lead to failures. The attemperator is inspected by removing the spray head assembly and performing internal inspections with fiber optic or video probes.

Remaining Life Analysis

Once the Phase-II testing has been accomplished and data complied, the damage must be evaluated and decision should be made whether to repair, replace or reinspect. These decisions are based upon the component's useful remaining life or end-of-life. End-of-life may be the point at which damage has accumulated to where failures occur, or when the cost of inspection and repair exceed replacement cost.

End-of-life may also be the point where the risk of failure is unacceptable due to the hazard to plant personnel. It is important that guidance be given on the acceptable remaining life when preparing the project plan.

The method of quantifying remaining life varies depending upon the component. For high temperature tubing such as the superheater and reheater tubing, creep rupture data is used to estimate a time to failure. For low temperature tubing, remaining life is determined by calculation of wall loss rate. This is used to predict when a tube will be at minimum acceptable tube wall thickness. For thick walled components such as superheater outlet headers and steam piping that operate at high temperature susceptible to creep and fatigue, remaining useful life is a function of crack initiation and creep crack growth.

The basis of calculating remaining life of superheater tubing is ASTM creep rupture data and Robinson's Rule of life fractions. If operating conditions were constant for the tube material throughout its life then remaining life calculation would be a simple task.

Creep rupture data is published with stress as a function of Larsen- Miller Parameter (LMP) where

$$LMP = T \times (20 + \log \text{time}) \times 10^{-3}$$

T = constant temperature of material, in Celsius

time = time at temperature T, in hours

For a specific material, if the stress (an easily calculated value for tubing) is known then the LMP can be found from ASTM curves. With an estimated tube metal temperature, the LMP can be used to calculate a tube life. The difficulty of this method is the fact that tube conditions are not constant. Internal oxides which grow on the tube ID have an insulating effect and cause increased tube metal temperature over time. At the same time, tube wall loss from erosion or corrosion results in increased tube stress over time.

Calculation of tube life must allow for these changing operating conditions. Robinson's Rule says that a tube's life will be expended when the sum of its life fractions equals unity,

$$(t/t_f)_1 + (t/t_f)_2 + \ldots\ldots + (t/t_f)_n = 1$$

where t and t_f are actual hours of operation and predicted total hours of life, respectively, at each set of unique stress and temperature conditions defined by subscripts 1 through n. PC programs are developed to address the changing operating conditions for tube life.

Life prediction for thick wall components is more complex and utilises time dependent fracture mechanics (TDFM). In the past, software programs were developed to allow prediction of crack growth under the influence of creep. The basic expression for crack growth as a function of crack tip driving force for creep, C_t, is:

$$\frac{da}{dt} = bC_t^{\,m}$$

Where a is a crack depth, t is time, and both b and m are material constants.

Through continuing work as sponsored by EPRI, a software program was developed which was called the "Boiler Life Evaluation and Simulation System" (BLESS). The BLESS program has two unique features that are improvements over the previous programs.

The program incorporates algorithms that allow for the calculation of crack initiation in addition to crack growth and the program automatically calculates the stress in complex geometry such as header ligament locations.

Upgrade Feasibility

After determining the current condition and remaining life of key boiler components and obtaining cost estimates of any major components needing replacement, the feasibility of the operating objective should be reviewed,

- Can this unit economically meet the requirements of the objective?
- How costly will required repairs and modifications be?

In rare instances, the cost of modifications may exceed the cost of building new capacity. In these cases, the owner must determine if another objective can be met by the unit or if it should simply be retired.

More often the plant can successfully modified to meet the requirements at a fraction of the cost of a new capacity. A series of options which meet the project objective need to be developed, with an estimate for each of the associated capital costs, operating costs, and payback on investment. Selection criteria will vary from one operation to another. But generally speaking, the alternative which maximises the return on investment will be chosen course of action.

Capacity Increase and Emissions Reduction

Because of the investment of capital in a life extension program, it is common to look for capacity increases as part of the upgrades to the plant. Once it is determined that life extension and upgrade is feasible, it is necessary to evaluate the options available for increasing capacity. Since plants designed and built 20 or more years ago, were not required to meet current environmental emissions limits, any upgrades must also consider control of emissions to meet current and future regulations. In general, determination of the best method for control or reduction of emissions involves evaluation of combustion process alternatives (front end) as well as options for flue gas cleanup (back end control) and Flue Gas Desulphurisation (FGD). Options for capacity increases can be logically evaluated with the combustion options.

Capacity Increase

Increases in boiler capacity may not be feasible. However, if the output of the unit has declined due to lost efficiency and unavailability, the capacity improvement should result from equipment upgrades and refurbishment, and the improved availability. Because the maximum capacity of the boiler is a function of many parameters, increases to boiler output have to be made considering each parameter. The design parameters which affect capacity can be grouped into the categories of combustion and circulation.

Combustion parameters for fossil fuels such as coal include fuel characteristics- heating value, moisture content, grindability, ash content, ash characteristics (fouling and slagging properties) and volatile matter content. The fuel will directly affect fuel handling equipment capacity, burner capacity and fan requirements. In unit design, the combustion process is taken into account when establishing furnace volume, burner-input limits including burner spacing or heat release rate in the burner zone, and spacing of radiant and convective heating surfaces. These geometric limits for the heating surfaces are influenced most directly by the fouling and slagging properties of the coal ash.

The circulation parameters are linked to the boiler's fluid and steam side capacity limitations. Circulation parameters include drum internal capacity, riser and supply tube flow limits, wall tube versus heat input requirements, and convection pass flow and pressure drop limits.

Emission Control

Whenever power plants are upgraded or modified, emission control options must be considered. Control Technologies must be added to bring the plant into compliance with local regulations. Air pollution control legislation has been adopted by most industrialised nations and continues to become more widespread. The focus of these regulations has been on power plants that emit pollutants as a result of the combustion process. The pollutants of particular interest are sulfur dioxide ($SO2$), nitrogen oxides (NOx), carbon dioxide ($CO2$), and particulate and air toxins. Emissions of these pollutants are regulated in any of four ways:

- Emission standards
- Percent removal requirements
- Fuel restrictions
- Technology requirements

Retrofit technologies have been developed for a broad range of emission control measures. This allows power plant operators to consider the advantages and disadvantages of more than one option for a particular emission control problem.

A fabric filter or electrostatic precipitator (ESP) is typically used for particulate control. The combustion process is modified to control NOx by replacing the old burners with low Nox burners. Sometimes it becomes necessary to supplement the control of NOx by placing additional equipment after the combustion process. Selective Catalytic reduction (SCR) and Selective Non-catalytic reduction (SNCR) systems have been used for post combustion Nox removal. For SO2 reduction, there are three basic options

- Switching fuels to a lower Sulphur coal
- Installing a fluidised bed combustor
- Installing post combustion process systems

Each has advantages and disadvantages.

Upgrades

Many boilers have been upgraded to increase capacity from original design. Evaluation requires a complete engineering analysis, which examines all of the relevant combustion and circulation parameters. Because of conservatism of some older designs, it is often possible to extend the boiler limits.

In general many combinations of component changes may be possible to address capacity increases while lowering emissions. Considerations must also be given to unique operating parameters such as cycling and its affect on key components. The design engineer working with the plant owner must economically evaluate the options and determine the best option for specific objective of the plant.

Upgrading of coal fired boilers will require the greatest capital expenditure since more systems have to be addressed including fuel handling equipment, fuel preparation equipment, and ash handling equipment. Among the systems that can be enhanced through unit upgrade are.

- Use of the latest burner technology for NOx control
- Upgraded coal pulveriser designs which provide for capacity increases and improved pulverised coal fineness
- Modernised control systems for tighter regulation of boiler operation for greater efficiency and better emission control
- Advanced boiler circuits such as spiral furnace geometry or internally ribbed tubing to enhance circulation,
- Improved monitoring and cleaning equipment,
- Addition of Flue Gas Desulphurisation.
- Upgraded materials in the superheater for high temperature headers along with enhanced header designs that address tube flexibility and cycling service needs
- Redesigned heating surfaces to address absorption and internal circulation as well as gas side velocities.

Summary and Conclusion

There are many possibilities to consider when upgrading and extending the life of older fossil fuel firing power boiler capacity. Key to success of an upgrade project is a clear understanding and statement of the long-term requirements of the plant.

The first critical step in the project is assessment of the remaining useful life of the boiler and key plant systems. Once it is confirmed that continued operation of existing plant system is feasible, and then the options for upgrading the plant to meet objectives can proceed.

The best combination of modifications for reducing emissions while increasing capacity requires evaluation of alternatives for both combustion and post combustion emission control.

In future we should also consider application of CO_2 capture and sequestration capabilities, adding more capacity of electrostatic dust filters (E/P) and FGD systems to protect Mother Nature as well as to avoid global warming.

Experience has proven that in most cases extending the life of an existing plant is a viable and economical option to meet growing demand for power.

We are confident that technology and experience are available for the Turkish Entrepreneurs for better and feasible operation of the existing power plants.

Your comments are always welcome

Haluk Direskeneli- Energy Analyst
ODTU ME'1973, Ankara MMO 6606
HalukDireskeneli@tr.net

Peak Oil or Dependence on Russian Gas – Which is more important for Turkish Public?

Metin Gezen, USAK Energy Review
metingezen@gmail.com

When a terrorist attack happens, for days we talk about terrorism, why this happened? An attack does not only distract attention to itself but also increase the inflow of people interested in this subject to the academic discussion. More students tend to work on this subject. But which one will save more lives? Finding a solution to terrorism or wearing a safety belt?

Both problems will save lives, that is obvious. On the one hand lots of academicians, intelligence officers, security experts work men hours to avoid a possible terror attack that will kill many. On the other hand, not very brainy but creative ad-campaigns and regulations will save lots of lives.

When the discussion comes to Turkey, traffic accidents is a big subject. The people name it "Traffic terror". So many people dies in everyday accidents. You can just turn on a Turkish TV news and see common scenes of high speed crashes and junked cars. But the importance of this discussion for Turkey, may not have the effect in a European or American public discussion.

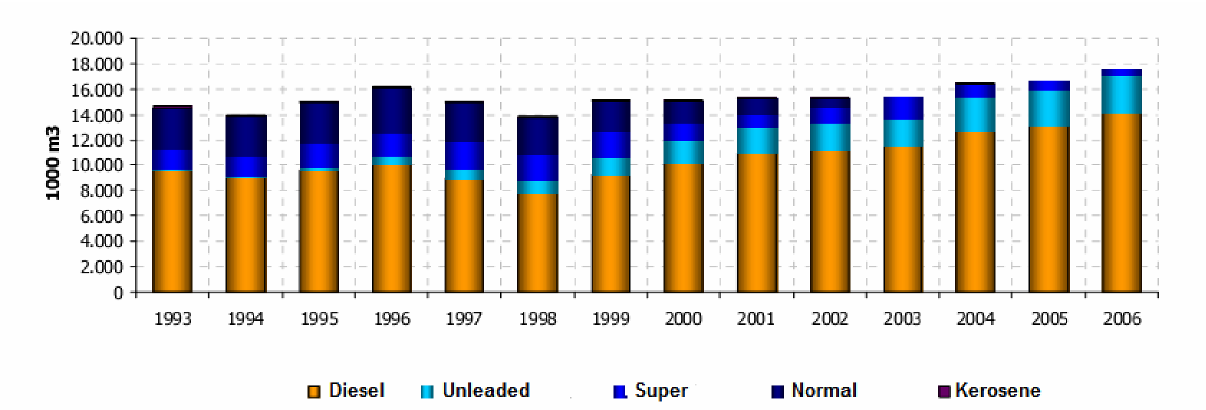
The same can be said for peak oil. Peak oil is a hot subject, but hardly any Turkish energy discussion involves it. It is more about market, sales, new investments, doomed scenarios regarding the energy dependency to regional countries. But in America, peak oil is much more debated than Turkey.

There may be several reasons for that including the long history of oil, developments and intellectual accumulation over the years with experience in the US. But one of the most important factors is the increase in oil prices increases the outrage and panic with respect to the life style of today.

As an example, Turkish roads have much smaller, European/Japanese style, an increasingly diesel powered engine cars. SUVs? What are they?

According to February statistics by Turkstat, 14.5% of the whole registered cars is Renault, 8.5% is Toyota, 8.3% Volkswagen and then comes and American brand Ford with 8.1%.

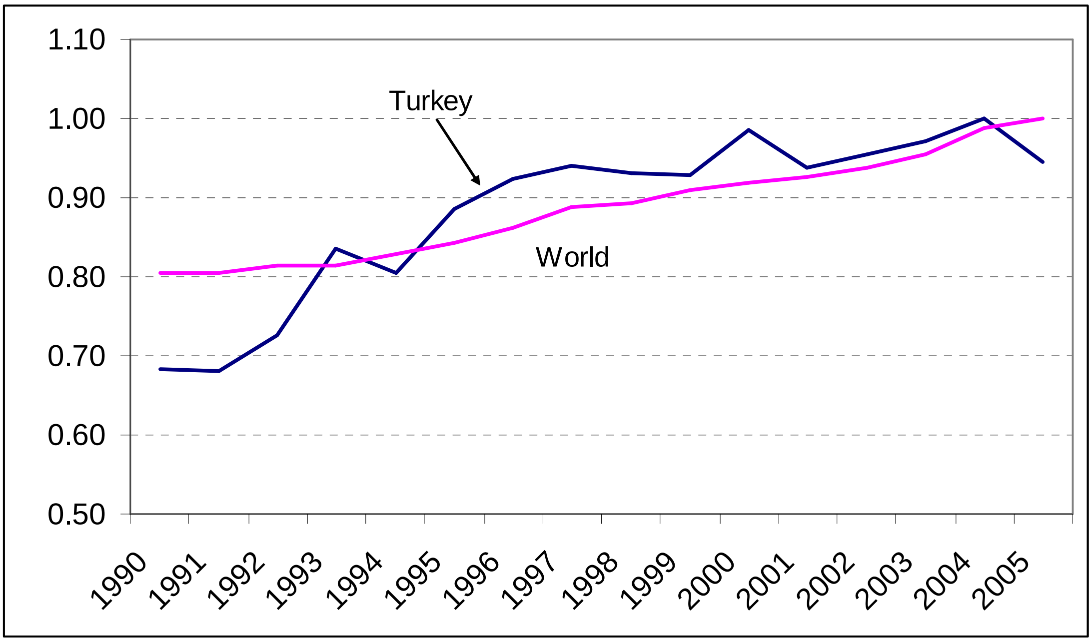
And how about the prices? The prices are nearly three times of the US prices. And the GDP of Turkey is far lower than US. In the previous weeks, we have shown that the Turkish Diesel is around 256 dollars (US) a barrel and this price is increasing due to strengthening Turkish lira against US dollars.



Source: Petder.org.tr

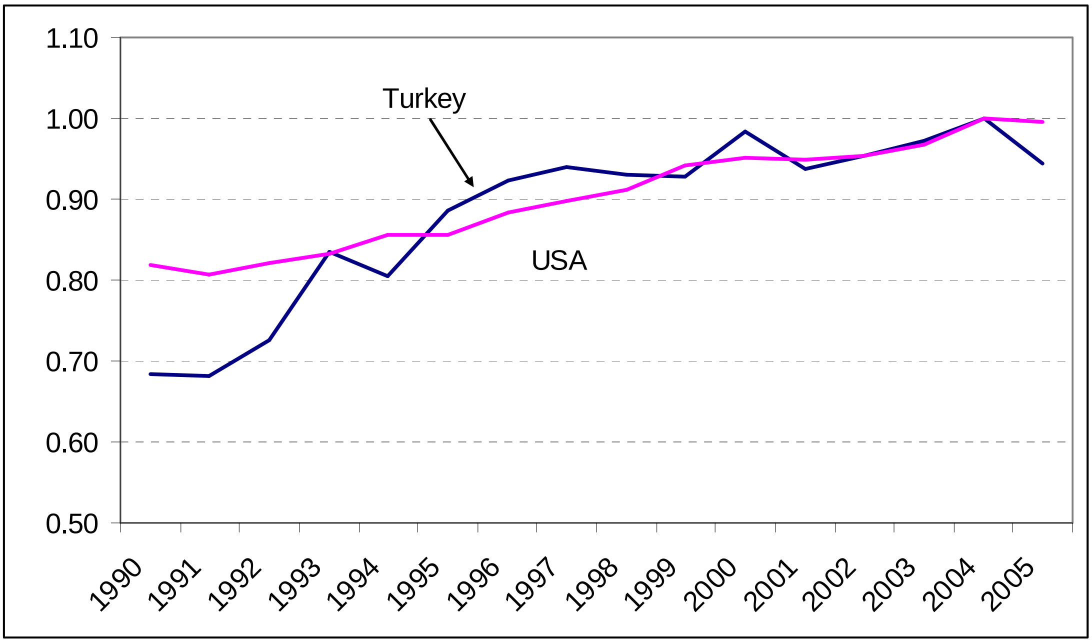
The results of this can be easily seen in the graphs. In Turkey the consumption of what is petroleum products for transportation sees a plateu. But this may be misleading because most of the cars in Turkey also uses LPG. And this has not been mentioned in this graph. Most of the cars inserted with LPG modules are generally gasoline/benzine using cars.

So there is a need to investigate the trend in Turkish oil consumption and world's oil consumption and probably this will be more helpful. From the graph one can easily spot the plateu in Turkish oil consumption.



Source: BP Statistical Review 2006 (1.00 corresponds to 688,000 b/d for Turkey and 82.5 million b/d for World)

What we see from the graph is a sudden increase in Turkish oil consumption between 1991-1993 and 1995-1996 but afterwards the growth in oil consumption stagnates. But the world consumption increases with near linearity. One should also note that except for the crises years Turkey has grown roughly twice when compared with the world.



Source: BP Statistical Review 2006 (1.00 corresponds to 688,000 b/d for Turkey and 20.7 million b/d for US)

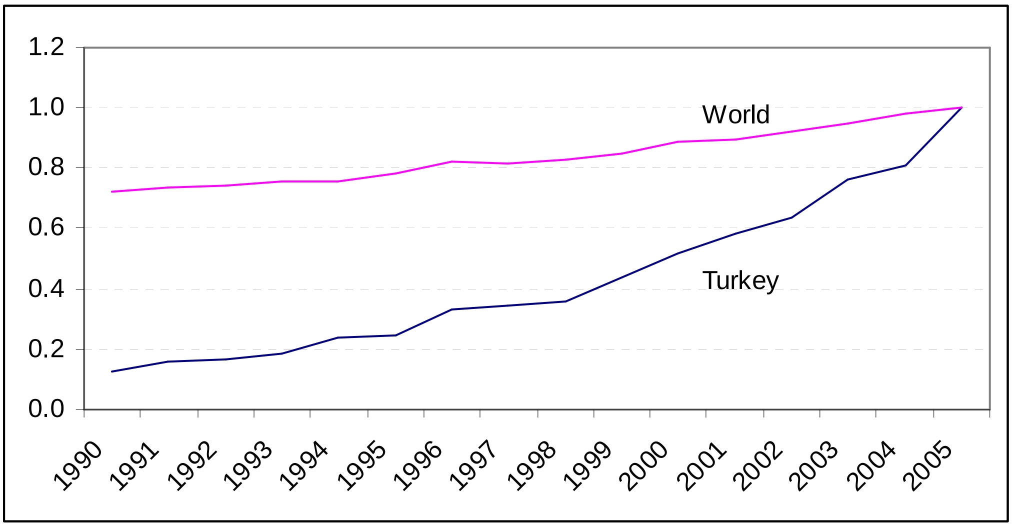
Also when compared with the US, Turkish hunger for oil has grown less than that of US between 1996-2005. Even it can be concluded that Turkey has seen a more dramatic decrease in 2005 than US.

Of course the data's reliability should be checked. There is a major factor that may be affecting the reliability of the domestic oil consumption in Turkey and that is oil smuggling from Iran. The contrast between Iran's cheap, subsidiesed oil and Turkey's expensive and highly taxed oil turns the smuggling into an highly profitable financial activity. Neverthless Turkish authorities have launched new measures to control this activities through regulatory authority.

So, it will not be wrong to say that, Turkey's high growth has not increased the oil consumption. There are different factors including taxes, prices and consumer expectancy for long term high prices for mobility sector in overall.

Is this an answer to why peak oil is not much debated in Turkey? Is this because, Turks are already practising peak oil measures? So what are the alternatives?

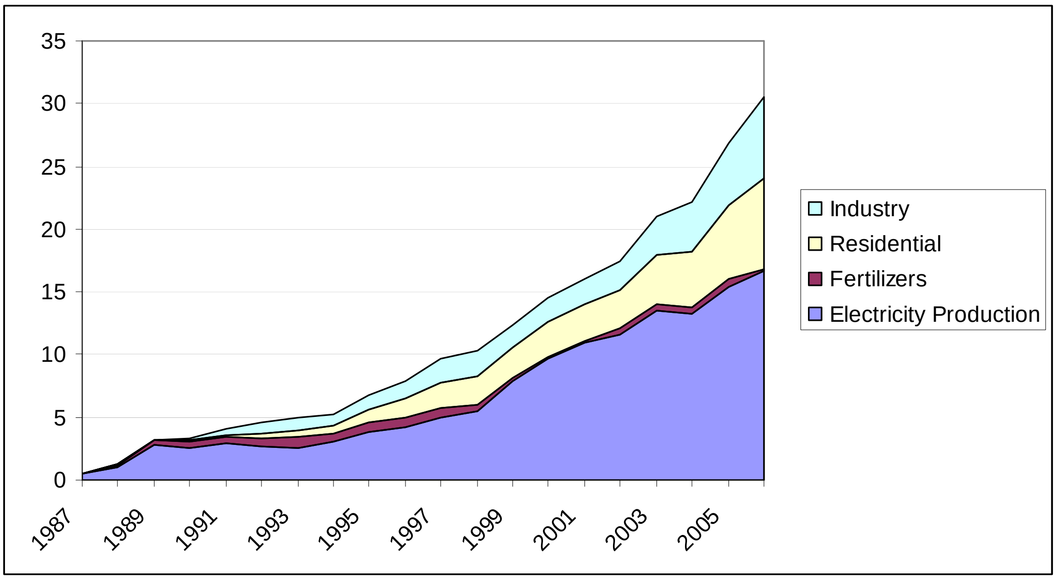
The answers to this questions is not easy. On important thing is the decrease in oil consumption growth does not necessarily diminished the energy imports. Turkey's pitfall and preference in energy discussions lie here. Turkey's problem is natural gas not oil. And most of the active discussion and strategy is based on natural gas which will not likely to peak soon.



Source: BP Statistical Review 2006 (1.00 corresponds to 27.4 bcm for Turkey and 2750 bcm for World)

Due to long term take-or-pay aggrements, the relatively modest consumption for natural gas between 1990-1996 takes off the 27.4 bcm by 2005. And this number is approximately 30 bcm by the end of 2006.

The breakdown of this consumption reveals a dominant usage for power generation. While in the world we see a modest increase in gas usage a near stagnation and a small decrease in US consumption, we see a surge in demand in Turkey.



Source: Botas.gov.tr

Turkey may not be oil addicted, but Turkey is well on the way to be a gas-addicted country. And due to market liberalisation, it is feared that this addiction to continue. The most feared is not the addiction by itself but addiction to a single largest supplier: Russia.

Therefore, it is not a big suprise to see anyone discussing about peak oil in Turkey, but rather talking about using domestic resources to produce electricity and reduce the dependency to Russian gas. Turks do not have big inefficient cars. And there are lots of incentives to use less oil, mainly because of high taxes on cars and oil. But the normative energy discussion in Turkey is the future about gas and electricity. Like safety belts and terrorism, the price increase in oil may have threaten American's belief in abundance of oil, but for Turks the belief in low oil prices has ended up in 1996.

metingezen@gmail.com

Energy Review

Issue : 18
Date: 07.05.2007

http://turkishweekly.net/energy

The Competiton Between Two Transit Countries: Turkey & Greece

Burcu Demir, USAK
burcu.demir@hotmail.com

The control over energy supplies is a significant discussion of international relations.The reason is that it has always been an issue of worry for governments. Energy consumer countries have created new policies in order to have impact on regions which are rich in natural resources such as Middle East or Central Asia. But it is necessary to point out the fact that there is another related topic of energy; transportation. Because is that the geographical situation of some regions is problematic. The landlocked countries can not export their crude petroleum and natural gas without pipelines. So, the significance of transit countries becomes more considerable from the perspective of global powers.

Iran, Turkey and Greece are best placed for transportation because of their local jeopolitical situation but various reasons made Iran a undesirable partner for most of the western countries. As a result of this fact Turkey and Greece took the attention of governments. Although there is a collaboration for the construction of *Greece-Italy Pipeline* which is planned to transport natural gas from Caspian region to Europe via Turkey and will be more than 800 kilometers, Turkey and Greece chose to compete for most of the pipeline projects. For instance; *Baku-Tbilisi-Ceyhan Pipeline* which is opened in 2006, is the first transnational pipeline that transports crude petroleum from Azerbaycan to Turkey's port of Ceyhan without crossing Russian soil. Another project of Turkey is *Nabucco Pipeline* which is proposed to transport natural gas to Austria, via Bulgaria, Romania and Hungary. It is also considerated as a diversion from the current methods of importing natural gas solely from Russia. On the other hand; Greece signed for *Burgas*-*Alexandroupoli Pipeline* which will be used to transport Russian and Caspian oil from the Bulgarian Black Sea port of Burgas to the Greek Aegean port of Alexandroupoli. Although it will be more expensive to cross the Greek soil, the partners preferred bypassing Turkish straits and create an alternative route. The environmental concerns are also considered by the critics. Because the traffic of oil tankers in Turkish straits and Aegean Sea has a negative effect on tourism and fishing. It is estimated to be completed by the beginning of 2011. There are more competitive projects such as the AMBO pipeline from Burgas to Vlore, Pan-European Pipeline from Constanța to Trieste and Samsun Ceyhan pipeline.

It is also necessary to emphasize the main reasons of the competition. In other words; why do Turkey and Greece try to become the intersection country of energy transportation? A pipeline means occupation for citizens who have no jobs. Furthermore; it is one of the best tools to have impact on neighborhoods such as Balkans.

In that process; Turkey and Greece have some considerable properties which directly effect their actions. To give a specific example; Greece is a member of European Union and it can be defined as an advantage in the process of creating collaborations with other countries for new pipeline projects. On the other hand; Turkey's significance does not only come from pipelines, it also plays a prominent role because of Bosporus and Dardanelles.

As a conclusion; global and regional powers of the world such as USA, UK and Russian Federation prefer to diminish the importance between this two Aegean countries they insist to have the key role of energy transportation.

Burcu DEMIR (USAK)

burcu.demir@hotmail.com

Indicators

Indicative Exchange Rates Announced at 15:30 on 27/04/2007 by the Central Bank of Turkey

CURRENCY	*EXCHANGE RATES*		*EXC.RATES ON BANKNOTES*	
	Buying	*Selling*	*Buying*	*Selling*
USD/TRY 1 US Dollar	1.3479	1.3544	1.3470	1.3564
EUR/TRY 1 EURO	1.8280	1.8368	1.8267	1.8396
GBP/TRY 1 British Pound	2.6767	2.6907	2.6748	2.6947

Turkish Refinery Output Price

Product Name	YTL/TON	YTL/M3	Special Concise Tax	Dividend	Exclusive of VAT	VAT	VAT included price	Validity Date
Unleaded Petrol 95 OCTANE			**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	
İzmit	1.061,08	806,42	1.362,50	1,40	2.170,32	390,66	2.560,98	02/05/2007
İzmir	1.061,08	806,42	1.362,50	1,40	2.170,32	390,66	2.560,98	02/05/2007
Kırıkkale	1.065,13	809,50	1.362,50	1,40	2.173,40	391,21	2.564,61	02/05/2007
Batman	1.093,49	831,05	1.362,50	1,40	2.194,95	395,09	2.590,04	02/05/2007
Jet Fuel			**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	
İzmit	951,90	761,52	0,00	1,40	762,92	137,33	900,25	03/05/2007
İzmir	951,90	761,52	0,00	1,40	762,92	137,33	900,25	03/05/2007
Kırıkkale	964,27	771,42	0,00	1,40	772,82	139,11	911,93	03/05/2007
Kerosene			**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	
İzmit	951,90	761,52	760,50	1,40	1.523,42	274,22	1.797,64	03/05/2007
İzmir	951,90	761,52	760,50	1,40	1.523,42	274,22	1.797,64	03/05/2007
Kırıkkale	972,52	778,02	760,50	1,40	1.539,92	277,19	1.817,11	03/05/2007
Batman	979,40	783,52	760,50	1,40	1.545,42	278,18	1.823,60	03/05/2007
Diesel 7000			**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	
İzmit	878,18	742,06	834,50	1,40	1.577,96	284,03	1.861,99	18/04/2007
İzmir	878,18	742,06	834,50	1,40	1.577,96	284,03	1.861,99	18/04/2007
Kırıkkale	919,29	776,80	834,50	1,40	1.612,70	290,29	1.902,99	18/04/2007
Batman	919,29	776,80	834,50	1,40	1.612,70	290,29	1.902,99	18/04/2007
Diesel 50			**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	**YTL/M3**	
İzmit	876,60	740,73	927,00	1,40	1.669,13	300,44	1.969,57	11/04/2007
İzmir	876,60	740,73	927,00	1,40	1.669,13	300,44	1.969,57	11/04/2007
Kırıkkale	918,40	776,05	927,00	1,40	1.704,45	306,80	2.011,25	11/04/2007
Fuel Oil 4			**YTL/TON**	**YTL/TON**	**YTL/TON**	**YTL/TON**	**YTL/TON**	
İzmit	591,29		476,00	1,50	1.068,79	192,38	1.261,17	01/05/2007
İzmir	591,29		476,00	1,50	1.068,79	192,38	1.261,17	01/05/2007
Fuel Oil 6			**YTL/TON**	**YTL/TON**	**YTL/TON**	**YTL/TON**	**YTL/TON**	
İzmit	464,10		204,00	1,50	669,60	120,53	790,13	01/05/2007
İzmir	464,10		204,00	1,50	669,60	120,53	790,13	01/05/2007
Kırıkkale	470,76		204,00	1,50	676,26	121,73	797,99	01/05/2007
Batman	470,76		204,00	1,50	676,26	121,73	797,99	01/05/2007

Source : www.tupras.com.tr