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Analysis of Natural Gas Diversion from Fertilizer Sector to Power Sector in Pakistan

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Abstract
Pakistan is facing an acute energy crisis. The crisis in natural gas sector is just a symptom of a much larger problem afflicting the country's energy sector as a whole i.e., the demand for natural gas as well as other forms of energy is fast outstripping supply. Pakistan's gas supplies can't support the ever-growing demand as they feed power plants, fertilizer companies, domestic consumers, CNG stations and other industries that rely on this fuel. As the energy crisis has worsened over the past five years, the government has consciously curtailed the supply of natural gas to fertilizer sector diverting it to power generation. The gradual reduction in the supply of gas to the fertilizer sector has been accompanied by an increase in gas prices. These two measures have adversely affected this sector and the current study evaluates the economic effects of this policy shift. With the reduction in supply and increase in the price of gas, domestic production of fertilizers has declined whereas their imports have gone up. The PEST analysis including the economic appraisal of two policy options – whether to supply natural gas for either fertilizer production or power generation - makes it quite clear that the supply of gas to the fertilizer sector has higher economic returns. However this appraisal is limited to a cost-benefit analysis and does not take into account the exogenous factors which may have a stronger impact on gas allocation policy. In the end the paper presents different policy options and concludes with a recommendation to undertake wider reforms in the energy sector aimed at increased production of natural gas, enhanced efficiencies in the transmission system and a rationalised tariff structure.
Keywords: Fertilizer sector, Economic analysis, Alternative uses of energy, PEST analysis.

1. Introduction

Pakistan is passing through the worst energy crisis. The country's energy demand has grown by 47 percent in the past decade, while its energy production has largely remained flat. .

Given the limited domestic resource capacity, Pakistan's major energy needs for power generation are met through imported fuel oil at a cost of US$ 14.5 billion per year[1]. Despite this, Pakistan is facing a huge shortfall in its energy supply. Another major source of power generation is natural gas. Pakistan is endowed with huge gas reserves. It is 27th largest producer of natural gas in the world and is already its largest consumer in South Asia. Supply of gas against demand is also dwindling. The deficit in supply of gas against demand has increased to 2,000 MMCFD[2]. Natural gas is being used by five sectors of economy_ domestic consumers, cement, transport, fertilizer and power. Natural gas is the life blood for fertilizer industry in Pakistan as it constitutes the basic raw material for production of urea. On the other hand, the share of natural gas in the overall power generation is 25.7%[3]. This means that its share in meeting the energy needs of our country is quite significant.Because of the on-going energy crisis and dwindling supply, the government is forced to re-think over its allocation of gas between power and fertilizer sector. Efficient and reliable energy supply is required for accelerating the growth of any economy. There is a strong positive relationship between sufficient energy supplies and GDP growth rate. On the other hand the positive impact of use of fertilizer on crop production and agricultural productivity is also established. Resorting to solutions like diverting gas supply from fertilizer sector to power generation hurts an important industry critical for agriculture growth. In this context, government's gas distribution policy requires an in depth cost benefit analysis of providing gas to one sector and limiting its supply to the other.

[1] Economic Survey of Pakistan FY 2013-14, Ministry of Finance, (GoP: 2015) ,195
[2] Ibid
[3] (Pakistan Energy Yearbook 2014)

1.2 Statement of the Problem

This paper aims to evaluate the impact of diverting the supply of natural gas from the fertilizer sector to power generation. . The main question this paper tries to answer is whether diversion of natural gas from fertilizer to energy sector would be a boon or a bane for Pakistan's economy. It looks at quantitative and qualitative aspects of various policy options and evaluates the costs and benefits of each option Main hypothesis is that opportunity cost of diversion of gas from fertilizer to power sector is high.

1.3 Significance and Scope of the Study

The specific objective of this research study is to map the potential impacts and costs and benefits involved in diverting the supply of natural gas from fertilizer to power sector. This research breaks new ground as it tries to quantify the economic cost and measures the effects of this policy. The study limits itself to analyzing the economic effects of this diversion and does not delve into its causes. The paper makes a few recommendations regarding price structures and sector wise allocations for preferential supply of natural gas. The study specifically focuses on the period 2010-15 as the phenomena of diversion of natural gas is prevalent in this period. However the wider scope of study is spread over the period of last three decades.

1.4 Literature Review

There is a significant dearth of literature on this particular topic especially Pakistan specific studies. The most relevant study on the subject is Pakistan Integrated Energy Model (Pak-IEM) developed by the International Resource Group & Asian Development Bank for Planning Commission of Pakistan [1]. It carried out a sector wise comparison of the economic value of natural and concluded that natural gas has a higher economic value for fertilizer production compared to power sector. Another relevant study titled "Sector Study:Fertilizer" conducted by Pakistan Credit Rating Agency has. highlighted that despite having high priority access to supply of natural gas fertilizer sector is facing up to 20% gas curtailment resulting in lower capacity utilization and the supply deficit[2]. In another study titled Impact of Rising Prices of Fertilizers on Crops Production in Pakistan." " Khan G.A(Khan- 2010) found out an inverse relationship between fertilizer prices and crop productivity by looking at data from 1990 to 2007[3]. Pakistan fertilizer Sector Review of IGI securities also suggest that since fertilizer consumption per hectare is one of the lowest in the world, nine fertilizer companies who are doing business in Pakistan were given huge incentives in successive fertilizer policies of the government[4]. A few other studies somewhat relevant indirectly to the subject have identified the causes of energy crisis. Lesnick(Lesnick 2015) has pointed out that Pakistan's inadequate and backward-looking policies have resulted in a large and expensive energy gap. The Economist (Jan 2014) highlighted that energy shortages and low investment in human capital would limit GDP growth.

At the international level similar studies have been undertaken with focus on policies of respective countries. Mahbubur Rahman has made an " Industry type based" analysis of natural gas consumption in Bangladesh in order to help policy makers to prioritize the sectors in case preferential supply and tariff restructuring become necessary5. Another study titled " Allocation and Pricing of Gas" recommended a dynamic government policy that can respond to varying requirement of natural gas by different sectors in a changing economy6. "The Economic-Wide Impact of Natural Gas Allocation in Indonesia." has also analysed the economic effects of gas allocation in Indonesia with the help of Computable General Equilibrium (CGE) model7.

In general, with regard to measuring the impact of gas allocation policy on the overall economic condition of a country, available analyses and studies are not sufficient.

2. Research Methodology

This paper uses qualitative as well as quantitative research methods. It contributes to providing a scientific basis

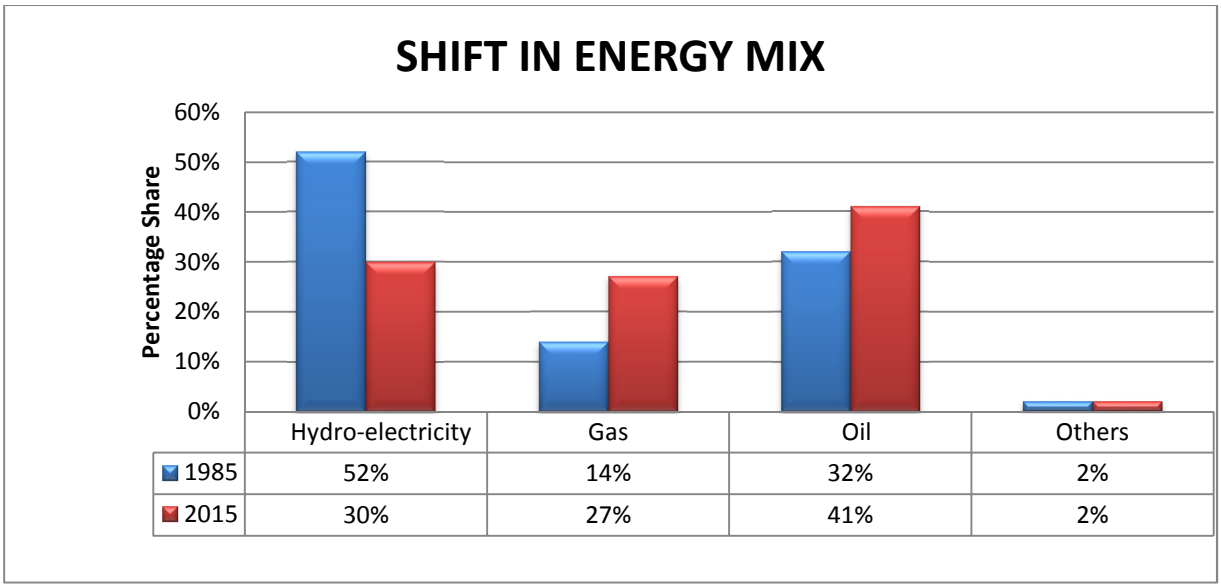
[1] Group, International Resource. *Evaluation of Value of Natural Gas in Various Sectors.* Planning Commission of Pakistan, 2011.
[2] *Sector Study_ Fertilizer* . The Pakistan Credit Rating Agency Limited, 2011
[3] Hafiz Ghufran Ali Khan, Arif Ahmad and Dr Awais e Siraj. "Impact of Rising Prices of Fertilizers on Crops Production in Pakistan." (Global Journal of Management and Business Research, P a g e |54 Vol. 10 Issue 9) December 2010.
[4]
[5] Mahbubur Rahman, Lutfar Rahman and Mohammad Tamim. "Analysis of Natural Gas Consumption by the Industrial Sector of Bangladesh"." (Journal of Chemical Engineering, IEB) 2012.
[6] Gas, Standing Committee on Petroleum and Natural. *Allocation and Pricing of Gas.* Ministry of Petroleum & Natural Gas, India, 2013.
[7] Hartono, Aldi Hutagalunga and Djoni. "The Economic-Wide Impact of Natural Gas Allocation in Indonesia." Fifth Annual Conference on Competition and Regulation In Network Industries, 2012.

of allocating natural gas to either power or fertilizer sector. While the quantitative analysis is based on data collected from various sources, the qualitative part of the paper has benefitted from the views of the all stakeholders. Secondary data is collected from HDIP, OGRA and Ministry of Petroleum and Natural Resources.

3. Situation Analysis

3.1. Shift in Energy Mix

Pakistan's energy consumption has increased to 39.8 million TOE in 2014 compared to 17.0 million TOE in 1991 with annual compound growth rate of 3.6 percent1. This increase in power consumption is coupled with a shift in the ratio of various sources used in power generation. This gradual shift in energy mix2 is highlighted as under:



Graph 1. Shift in Energy Mix

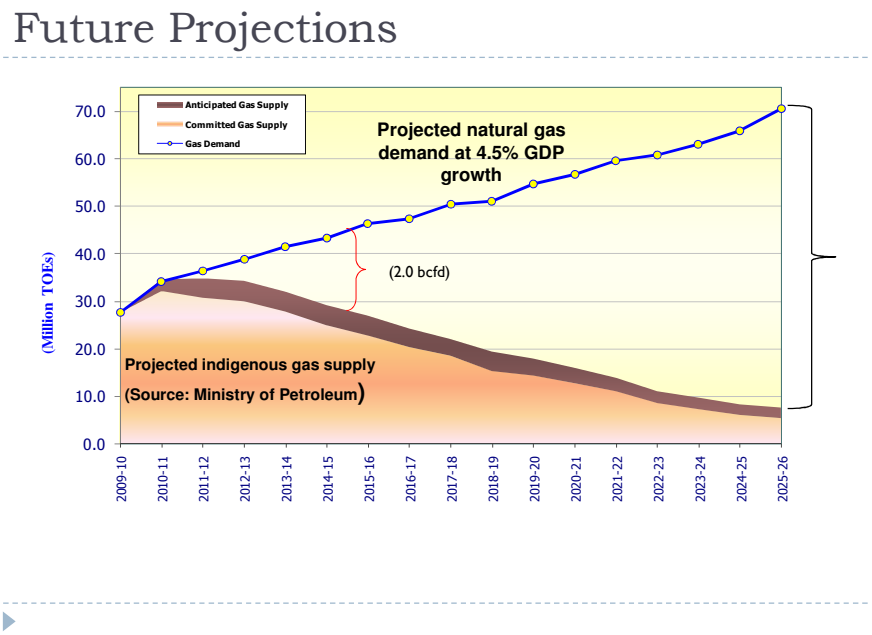
Source: Arshad H. Abbassi, Petroleum & Mineral Resources of Pakistan: Prospects and Challenges Energy Crisis, 2015

Gas is preferred over other types of fuel in nearly all sectors of the economy because of its price and cleanliness in use. Although the share of natural gas in country's energy mix has increased over the years, its production has been stagnant at the 4,000 Million Cubic Feet per Day (MMCFD). According to an estimate Pakistan still has recoverable gas reserves of 23.64 trillion cubic feet (TCF)3. This trend has reflected itself in the form of continuously increasing gap between supply and demand of gas. This gap is expected to widen in future as depicted below:

[1] Economic Survey of Pakistan, 2015

[2] Arshad H. Abbassi, Petroleum & Mineral Resources of Pakistan: Prospects and Challenges Energy Crisis, 2015

[3] Pakistan Energy Year Book 2014, Hydrocarbon Development Institute of Pakistan, (Islamabad: Official printers, May 2015), 60



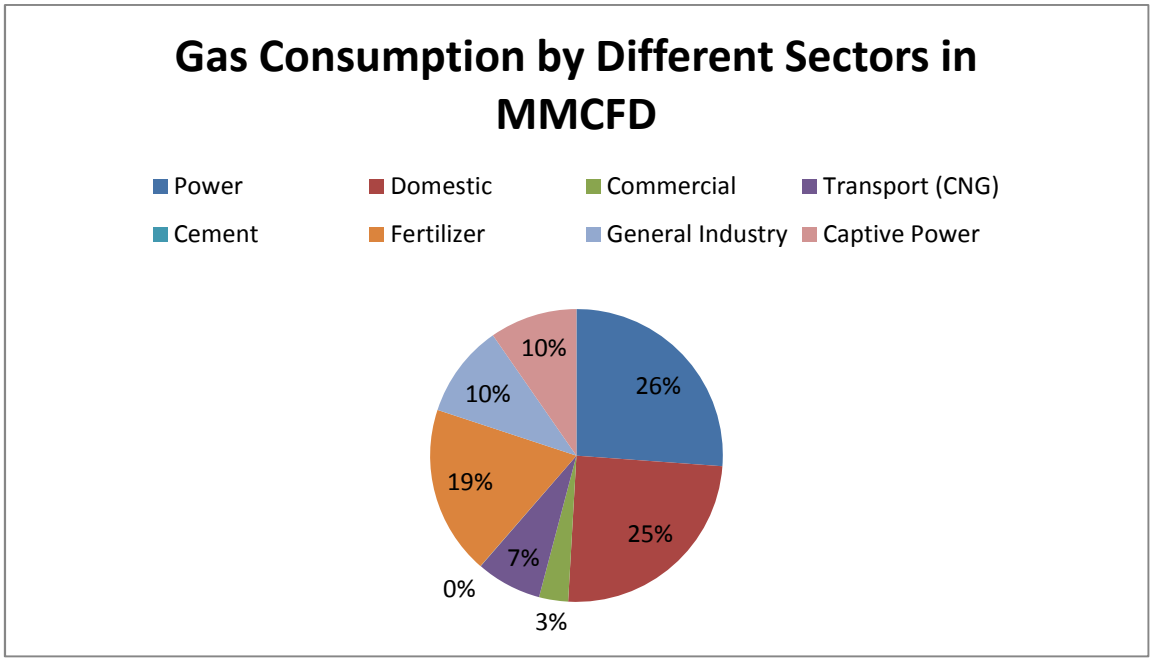
Graph 2. Future Projections of Natural Gas Demand and Supply
Source: HDIP Energy Year Book

In the backdrop of shift in energy mix and increasing demand of natural gas there arises a compelling case to reconsider the current natural gas pricing and allocation policies.

3.2 Shift in Prioritization - Resource Allocation & Distribution

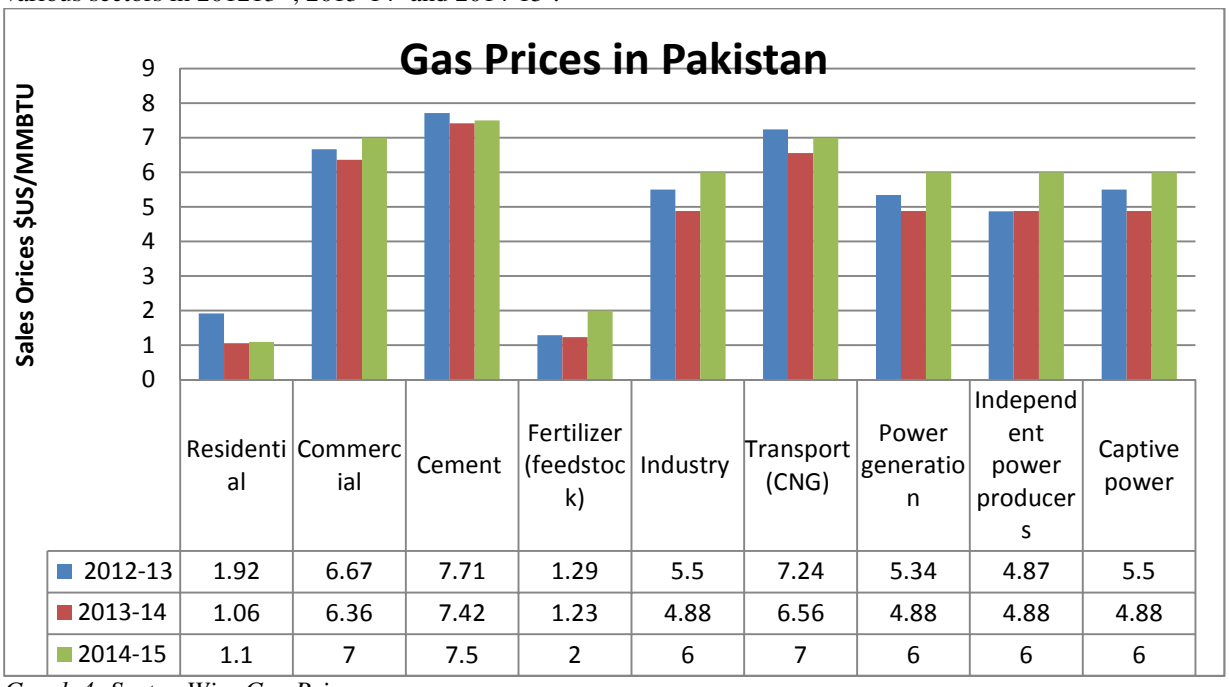
According to the CIA World Fact Book, Pakistan's gas production and consumption in 2014 stood at 1,493,508 MCF[1] and 1.220493 MCF[2] respectively. The gap between supply and demand is being managed by gas rationing between various sectors. The government prioritizes the supply of gas in the following order. Domestic consumers get first priority followed by commercial users, power sector, large-scale general industry, fertilizer companies, cement and finally CNG sector. Sector-wise gas allocation and consumption percentages are given (Pakistan 2015)[3] below,:

[1] Ibid
[2] Ibid
[3] Government of Pakistan, Ministry Of Petroleum and Natural Resources, Monitoring and Evaluation Unit Pakistan Petroleum Sector Quarterly Report of 10th April, 2015



Graph 3. Sector Wise Gas Consumption
Source: Economic Survey of Pakistan

Above table shows that the power sector is already consuming the highest quantity of the available natural gas (28%) followed by domestic consumers. Gas allocation is also implemented through differential pricing of gas provided to various sectors. Following is an overview of the prices at which gas is provided to various sectors in 201213[1] , 2013-14[2] and 2014-15[3].



	Residential	Commercial	Cement	Fertilizer (feedstock)	Industry	Transport (CNG)	Power generation	Independent power producers	Captive power
2012-13	1.92	6.67	7.71	1.29	5.5	7.24	5.34	4.87	5.5
2013-14	1.06	6.36	7.42	1.23	4.88	6.56	4.88	4.88	4.88
2014-15	1.1	7	7.5	2	6	7	6	6	6

Graph 4: Sector-Wise Gas Prices
Source: For 2012-13, The World Bank, Project Appraisal Document for Natural Gas Efficiency Project. For 2013-14 HDIP, Pakistan Energy Year Book. For 2014-15 Ministry of Petroleum And Natural Resources, first Monitoring and Evaluation Report dated 10th April 2015

1 Project Appraisal Document for Natural Gas Efficiency Project, The World Bank, p.33
2 Pakistan Energy Yearbook. HDIP, 2014, 78
3 *Ministry of Petroleum And Natural Resources,*
first Monitoring and Evaluation Report dated 10th April 2015

3.4 Supply and Pricing of Gas to Fertilizer Sector

Fertilizer sector gets 19% share of natural gas through two sources i.e. dedicated field supply and system supply. Dedicated field i.e. Mari gas field supplies gas only to fertilizer industry as its gas is of inferior quality containing more phosphoric content which is on one hand not suitable for general industry and on the other more suited to fertilizer industry. System supplies gas for commercial as well as domestic consumers. Detail of the way the above quoted two forms of supplies are distributed is explained as under:

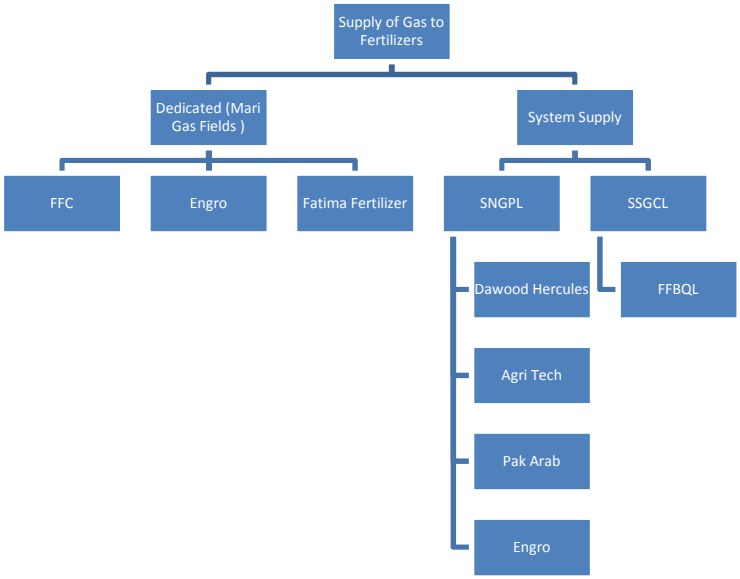
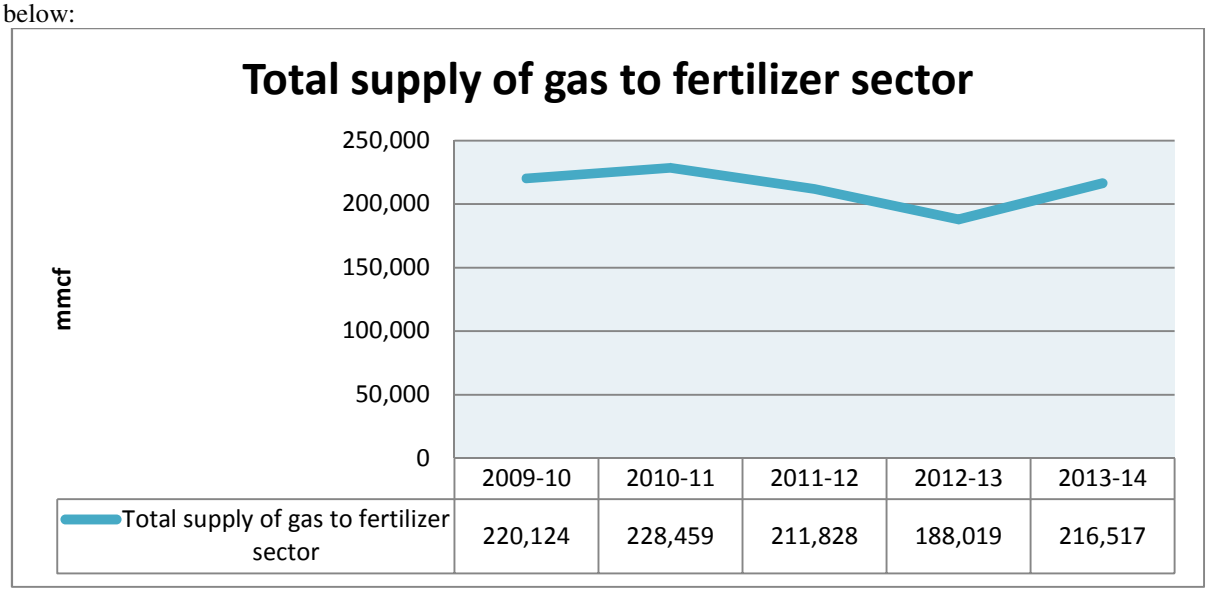


Figure 1: supply of gas to fertilizer companies
Source: Ministry of Petroleum, Monitoring and Evaluation Unit

The reduction in supply of gas to fertilizer industry is only for those plants which are on system supply. Gas supplies to three plants on exclusively on SNGPL system have been virtually suspended for more than 4years operating these plants at mere 10% capacity. The total quantity of gas supplied to fertilizer industry has reduced from 228,459 MMCF in 2010-11 to 216,517 in 2013-14[1]. There has been a gradual reduction in the supply of gas to the fertilizer sector over the past five years accompanied by an increase in prices at which gas is made available to it. The gradual curtailment in total gas supplied to fertilizer industry is depicted in graph below:



Graph: yearly trend of supply of gas to fertilizer sector
Source: HDIP Pakistan Energy Yearbook

The above line graph depicts that from 2010-11 to 2012-13 there has been a trend of gradual decline in supply of gas to fertilizer industry. The trend again went up from 2012-13 onwards. The government is also discouraging the consumption of natural gas by the fertilizer sector by making it more expensive. Increase in

[1] (HDIP 2015)

prices over the past few years at which gas is made available to fertilizer sector is shown in the table below:

	2010	2011	2012	2013	2014
Price at which gas was supplied to fertilizer sector(Rs./MBTU)	36.77	102.01	116.27	129	123.41

Table 1. Fluctuations in Price of Gas to Fertilizer Sector

but enhancement in prices was accompanied by imposition of GIDC.

It is clear from Graph 4 that gas a the supply to the fertilizer sector has been at much lower rates compared to the power sector. However another point to be understood here is that enhancement in prices is being accompanied by imposition of GIDC on various sectors at different rates.

In the case of fertilizer industry it is almost 300% of price so the actual rise in prices of gas to fertilizer was sharper than what is obvious. The government has imposed GIDC. GIDC for fertilizers (feedstock) is Rs.300, for captive power is Rs.200 and for power generation it is Rs. 100. Therefore, despite similar pattern in terms of pricing, the increase in gas price has been much steeper for the fertilizer sector than for others.

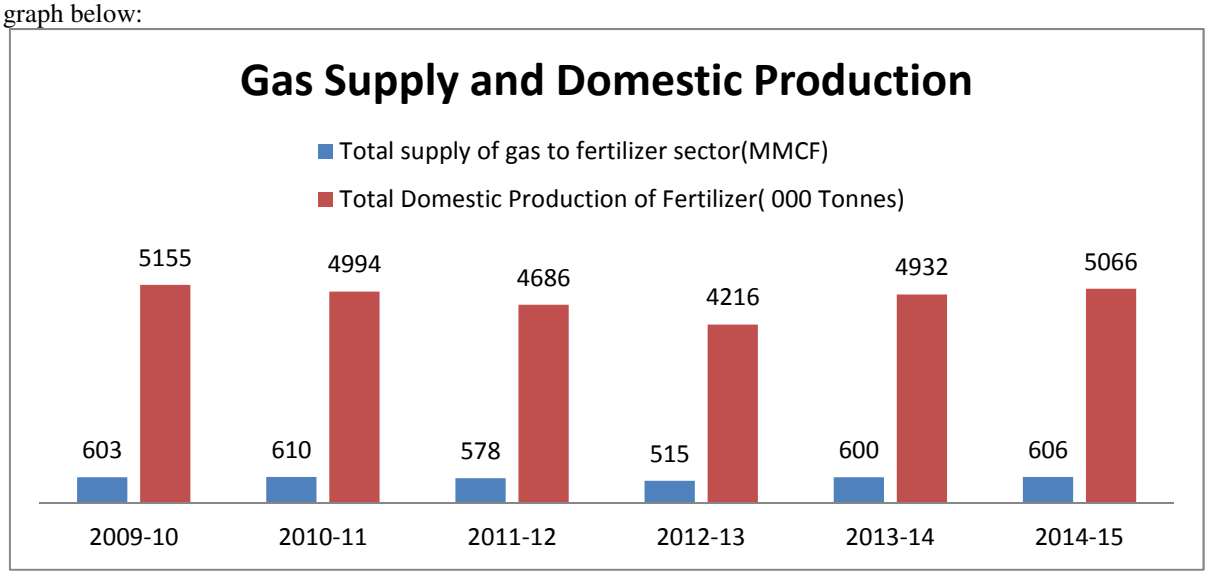
3.5. Fertilizer Production and Imports

The fertilizer industry has been facing high supply risk in recent times. The situation is a direct consequence of government's policy of curtailment of gas to fertilizer plants. The situation is unlikely to improve in the short run until the government finds new sources of supply[1]. The interaction between supply of gas, fertilizer production, expenditure on fertilizer import and the cost of imported urea can be understood with the help of the following table compiled by this researcher after data collection from various sources:

Fertilizer production and imports						
	2009-10	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Total supply of gas to fertilizer sector(000 tonnes)MMCF	603	610	578	515	600	606
Total Domestic Production of Fertilizer(000 tonnes)	5155	4994	4686	4216	4932	5066
Total Import of Fertilizer	1525	635	1647	761	1155	650
Total Subsidy Cost on Urea Import (US m$)	19.4	9.2	50.5	12.7	11	4.1

Table 2: comparison of domestic production and import of fertilizer
Source: Ministry of Petroleum and Natural Resources, Monitoring and Evaluation Unit

The above table is helpful in discerning three trends. Firstly it shows that there is a direct relationship between the quantity of gas supplied to the fertilizer sector and fertilizer production. With the exception of 2010-11, a reduction in gas supply has led to a reduction in the domestic production of fertilizer. This is shown in graph below:



Graph 4. Gas Supply and Domestic Production

[1] Sector Study- Fertilizer 2011

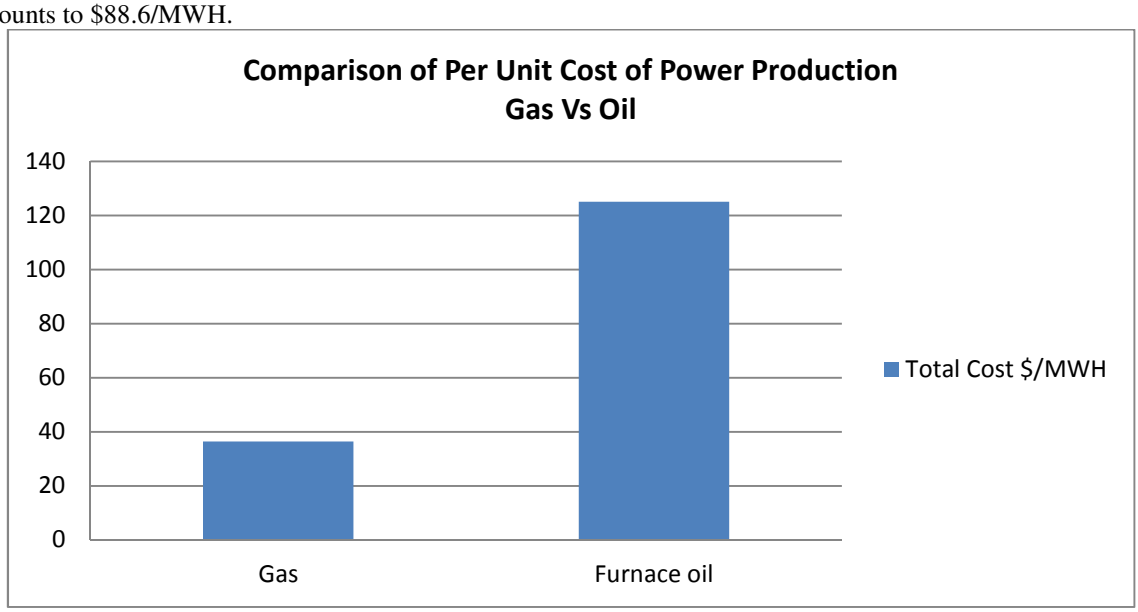
Source: Ministry of Petroleum and Natural Resources, Monitoring and Evaluation Unit

Secondly table 2 also shows that there is an inverse relationship between the quantity of gas supplied to the fertilizer sector and the import bill on account of fertilizer imports. Due to reduced gas supply, domestic fertilizer plants in the country had to import around 5 million ton of fertilizer during the last five years. It is worth noting that the fertilizer sector is working below its annual installed capacity of 6.9 million ton as it could only produce an average output of 5 million ton annually during the last five years. The difference in supply and demand is being filled by imports. Thirdly table 2 also shows that there is an inverse relationship between supply of gas and total subsidy cost on urea import. Lesser the gas more the government has to pay in the form of subsidy on imported urea. Urea is imported at international prices by TCP and marketed by NFML at subsidized rates. In the last four years government has imported 6.3 million tons of urea at an average cost of US$ 410 per ton CFR amounting to US$ 2.58 billion. In the same period government also spent $106,9 million on subsidy.

3.6 Electricity Generation

Having established that reduced supply of gas to fertilizer sector leads to an increase in government spending in the form of import bill and subsidy and we will now explore the impact of reduced supply of gas to the power sector. Supply of natural gas to power generation has reduced substantially in the last decade. In 2005 43.5% [1]percent of the available natural gas was allocated to power generation but the share has declined to or 25.7% percent in 2014[2]. This has led to a significant reduction in the production of electricity. A explained above, the price of natural gas supplied to the power like all other sectors has gone up quite significantly thereby increasing the cost of electricity generation manifold.

Using oil for power generation costs much more than using natural gas. A plant which produces electricity using natural gas requires six units (MMBTU) of gas to produce 1 MWH of electricity. The cost of 1 MMBTU of gas is $1.9 which means cost of production of 1 MWH is $12 (1.9 * 6). If we add $25/MWH ownership cost to it, we can calculate that a gas power plant costs $36.4 for generating each MWH of electricity. Compared to this, a plant which generates electricity from oil requires 0.24 units (Tonne) of oil to produce 1 MWH of electricity. 1 tonne of oil costs $420 which means cost of production of 1 MWH is $100 (0.24 *420). If we add $25/MWH ownership cost to it, we can calculate that a furnace oil power plant costs $125 for generating each MWH of electricity. The savings from using domestic natural gas rather than imported heavy fuel oil amounts to $88.6/MWH.



Graph 6. Comparison of Cost Of Production

Source: Shahzad Iqbal, Executive Director (Gas) Oil & Gas Regulatory Authority, Pakistan

Due to reduction in the supply of gas to the power sector 1409 GWH less power was generated using natural gas in 2013-14 as compared to 2009-10[3]. In the same year, electricity generated using furnace oil was 3805 GWH more compared to 2009-10[4]. In other words, Pakistan moved from relatively low cost of electricity

[1] Pakistan Energy Year Book 2014, Hydrocarbon Development Institute of Pakistan, (Islamabad: Official printers, May 2015), 76
[2] Pakistan Energy Year Book 2012, Hydrocarbon Development Institute of Pakistan, (Islamabad: Official printers, 2013), 69
[3] (HDIP 2015), Table 5.3, 88
[4] Ibid

generation (Rs.5-6 per unit from gas) to high cost electricity generation (Rs.16-17/ unit from furnace oil) in the last ten years. Higher cost of generation has forced the government to increase the price of electricity by more than 100 percent.

Scenario 1: Political Analysis. Shutting Down Domestic Production of Fertilizer

As a political policy option fertilizer units can be closed down to in order for government to divert natural gas to power generation. As domestic production stops, fertilizer needs can be met by imports. Benefits of this option include availability of more gas for generating electricity which can help mitigate the energy crisis. On the downside, closure of the fertilizer industry would mean unemployment for thousands of people who are associated with this sector and divestment of billions of rupees as capital assets comprising real estate, plant and machinery and infrastructure become redundant. Investors can demand compensation for financial losses as a result of a shift in government policy and handling the resultant lawsuits and dispute settlement can become a costly and treacherous exercise. Such forced closure of an entire industry would send wrong signals to investors. Government would also lose billions of rupees that it currently collects as revenue through levying different taxes on the fertilizer industry. Moreover, indigeneous production of such an important commodity which has direct bearing on agriculture production is important because of two reason. First, the precarious nature of international political relations call for economic independence. Secondly, the fluctuations in international oil prices can reshape international price structures of fertilizers. in case imported fertilizer becomes too expensive, our exclusive reliance on imports of urea would become a threat a stable economy.

*Scenario II. Economic Evaluation of Natural Gas Use**

From the above analysis it is clear that Pakistan is in a difficult situation as the cost of reduced supply of gas to both sectors is quite high making it very difficult to prefer one sector over the other. An economic appraisal of natural gas use can possibly provide an answer. The following section attempts to compare the costs of using gas for fertilizer or power sector. First cost of producing fertilizer domestically and cost of importing fertilizer shall be compared. Then cost of using gas in power generation shall be compared with cost of using fuel oil in power generation. Finally comparison of savings shall be made.

In a fertilizer plant, 100 MMCFD of gas can yield 1.43 MT/yr of fertilizer with 75% of the gas being feedstock and 25% being fuel for the process. The total value of fertilizers in the domestic market (price to the farmer) is Rs. 22.3 billion per year. The alternative is the imported fertilizer priced at Rs 37,200 ($430) per ton including transport and distribution costs, with the total cost of Rs. 51.7 billion. The savings from domestic fertilizer production versus imports thus amount to Rs. 28.3 billion[1] per year.

In a 220 MW thermal power plant, 100 MMCFD of gas generates 11.1 GWH of electricity, which has a fuel cost of Rs.6.2 billion based on natural gas priced at Rs 700[2] per million BTU. A 220 MW thermal power plant requires 0.22 million tons of heavy fuel oil to generate the same amount of electricity. At Rs 32887[3] per ton, the fuel oil plant has a fuel cost of Rs.7.28billion. The savings from using domestic natural gas for power generation rather than imported heavy fuel oil thus amount to Rs.0.9 billion.

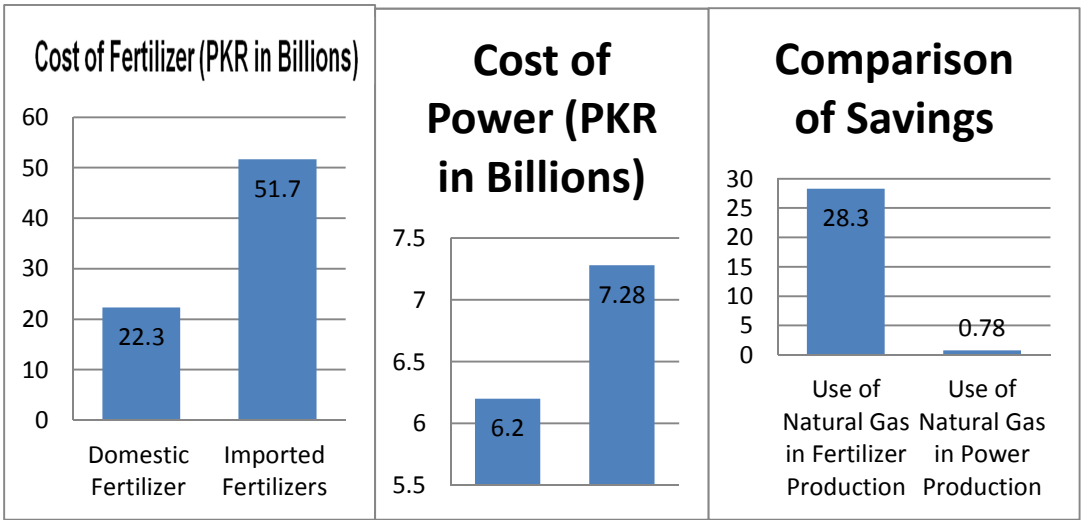
Therefore it is quite clear that, other things being equal, natural gas has a higher economic value for fertilizer production compared to power generation.

*. The Economic Evaluation is based on the work of Haigler Bailey done in 2011 which showed that using natural gas for fertilizer has a higher savings relative to using it for power generation. This report has updated the analysis insofar as the prices of gas and oil are concerned using the prevalent prices as of December 2015.

[1] International Resource Group. *Evaluation of Value of Natural Gas in Various Sectors.* Planning Commission of Pakistan, 2011

[2] OGRA website accessed on December 15, 2015

[3] Ministry of Petroleum Website accessed on December 15, 2015



Graph 7. Comparison of Economic Value of Gas

The comparison shows that using 100 MMCFD of natural gas for fertilizer production saves Rs. 28.3 billion compared to importing fertilizers, while using the same amount of gas for power generation saves Rs.0.78 billion compared to using imported heavy fuel oil. Thus using natural gas for producing fertilizer has higher savings relative to using it for power generation by a margin of Rs.27.52.

Scenario III: Social Analysis. Additional Supply of Gas to Fertilizer Sector

Keeping in view the significance of fertilizers for the agriculture sector, this policy option supports supply of more gas to the fertilizer plants. Benefits of this option include continuous supply of fertilizers to farmers. Contribution of balanced use of fertilizers towards increased yield of crops is well established, more so in a country like Pakistan where almost hundred percent soils in Pakistan are deficient in nitrogen; 80-90 percent are deficient in phosphorus and 30 percent in potassium[1] (It is estimated that with a 10% reduction in the use of fertilizers, there is a 25-30% curtailment in crop yield[2]. If applied inversely, this means a 10% increase in fertilizer production through increased supply of gas can lead to 25-30% improvement in crop yield. these figures establish the importance of fertilizer sector for agriculture sector specifically and for economy generally Fertilizer sector uses almost 20% of gas supplied to it as fuel stock[3], it can be asked to utilize it as a feedstock[4]. On the flip side, this policy option would result into reduced supply of natural gas to power generation.

Scenario III b: Additional Supply of Gas to the Power Sector

This scenario envisages increasing the supply of natural gas to power plants by diverting it from the fertilizer industry. The increased supply will be used to increase power generation which will have a multiplier effects on all sectors of the economy. The correlation between increased power supply and economic output has been established by Haigler Bailey in their study titled" Integrated Energy Model" in which they regressed total GDP against power consumption. The results showed that regression coefficient has value of 72.51 which is highly significant[5]. High coefficient value implies that power consumption generates high value-addition in the economy. Pakistan's main export sector i.e. textile is suffering heavy losses due to power shortage and gas diversion from fertilizer sector to power generation will yield considerable economic benefits for textile sector alone.

Scenario IV: Technological Analysis. Allow Fertilizer Sector to Import LNG

This scenario builds a case for government to allow the fertilizer plants to directly import LNG from the international market. Since the domestic gas is cheaper than international price of RLNG, the fertilizer plants may be supplied RLNG at local gas price applicable for fertilizer plants inclusive of GIDC by utilizing the subsidy budget available for importing Urea. Given that RLNG price is $ 9/MMBTU total amount required to subsidize the RLNG works out to be Rs 16.13 billion per annum. Whereas, savings in subsidy for the import of equivalent volume of urea would be around Rs 9.51 billion per annum and the fertilizer manufacturers may be asked to contribute Rs6.62 billion per annum in taxes upon resumption on uninterrupted supply of RLNG. The tax revenue being underwritten can be apportioned among the fertilizer plants on the basis of RLNG MMBTU being allocated to them for production of fertilizers.

[1] Econonic Survey of pakistan, 2015
[2] Ibid
[3] Raw material used for energy input.
[4] Raw material (input) fed into a process for conversion into something different (output). e.g. gas for production of fertilizer. http://www.businessdictionary.com/definition/feed-stock.html#ixzz3vMne7JKK
[5]

4. Conclusion

After weighing pros and cons of various policy options it is evident that the issue of giving preferential supply of natural gas to one sector or the other is quite complex. The complexity only highlights the need to undertake wide-ranging reforms in the energy sector in general and natural gas sub-sector in particular. The economic analysis of this paper shows that it is better value for money if natural gas is supplied to the fertilizer sector than to divert it to the power sector. Therefore in the short term the government should continue to supply gas to the fertilizer sector. Government should supplement this policy by stopping other wasteful uses of natural gas such as its use as a fuel (CNG) for the transport sector. Based on a more comprehensive analysis government can reconsider its allocation policy. Moreover, fertilizer plants should be allowed to import LNG from the international market. Another short term measure that the government can take is to promote a more efficient use of natural gas by power plants by gradually stopping the supply less efficient power plants and divert it to more efficient ones. In the medium term, a broader analysis in needed to account for other important variables such as the extent of subsidies, preferential treatment, low contribution of the agriculture sector to country's tax collection. There should be a policy of gradual reduction in subsidy to fertilizer sector, instead it should be substituted by giving direct subsidy to the farmer. In the long run there is a need to undertake wide-ranging reforms in the energy sector. Pakistan's limited supplies are running out. Country's two largest gas fields are expected to run dry by 2022. These should focus on oil and gas exploration, improvements in the transmission system, power generation from hydel and coal so that there is more gas is freed up for other uses. More importantly, the government needs to do away with the culture of untargeted price subsidies and preferential treatment and should implement tariff rationalization, By curtailing natural gas for the productive end-uses, the economy incurs a loss, as the direct and multiplier benefits of productive activities are foregone.

5. Recommendations

Short term:

- Government should gradually undo diverting natural gas from fertilizer to power sector.
- Government should stop supplying gas to the CNG sector.
- Government should allow fertilizer companies to import their own LNG from international market from their own sources. To help increase the affordability of fertilizer produced from expensive LNG, government may consider charging GST @ lower rates on fertilizer produced by using imported LNG. Furthermore, no duties (GIDC) be imposed on imported LNG to be utilized by fertilizer plants.
- Government may also consider providing LNG to fertilizer plants on landed cost but the plants should be bound to provide fertilizer to farmer at internationally competitive prices.
- If government exercises option of importing fertilizer, it can consider giving exclusive import permits to fertilizer plants in order to compensate for their losses for not manufacturing the fertilizers.
- Natural gas should only be supplied to more efficient power plans and government should stop supplying natural gas to inefficient power plants which should only be allowed to use oil for generating electricity.

Medium term:

- To enable the production of cheap urea fertilizer, the government provides an "indirect subsidy" in the form of a low gas price to fertilizer plants. However, this indirect gas subsidy should be substituted with a direct subsidy on urea that is produced—a policy already in place for imported fertilizer. There should be a policy of gradual reduction in subsidy to fertilizer sector. If the government wants to support farmer, it should consider giving direct subsidy to the farmer instead of subsidizing gas for fertilizer manufacturers. The elimination of a subsidy on natural gas to the fertilizer industry would, among other benefits, end discriminatory complaints by other industries against the fertilizer industry

Long Term:

- More exploration and investments are needed in gas sector. Government should try to draw international companies into gas exploration and development of other fields by offering better terms and competitive prices. Government should also encourage investment to improve the efficiency of gas transmission system. The completion of projects such as TAPI and Pak-Iran gas pipeline would also help fill the shortage.