Energy Sector Assessment:

1. Over the past five years, Pakistan has been relying on imported crude oil, petroleum products and coal for nearly one third of its energy requirements. Crude oil, fuel oil, high speed diesel and coal account for bulk of the energy imports. A steady increase in international energy prices has resulted in a very significant balance of payment deficit for the country. Import bill for energy products has nearly doubled in the 2007-2012 period reaching over US$ 15.3 billion in FY2012 corresponding to 32% of total imports. The supply of cheap indigenous natural gas that met nearly half of the country's demand for commercial energy leveled at around 3.5 Bscfd[1] pushing imports of substitute liquid fuels and coal to meet the growing demand. High cost of imported fuels and limited supply of natural gas have contributed to low economic growth and an increase in cost of living for the common man. Curtailment of compressed natural gas (CNG) for transport sector due to shortage of natural gas has resulted in public unrest. Courts[2] have kept intervening in the management, pricing and supply of energy products, making it difficult for government and utilities to manage the crises. Rising prices of fuel oil and limited supply of natural gas have forced the utilities to curtail power generation as government was unable to pass the high cost of fuel oil and substitute fuels for power generation to electricity consumers already suffering from power shortages.
2. According to the Economic Survey of Pakistan 2012, power outages alone accounted for a drop of nearly 2% in annual Gross Domestic Product (GDP) growth rate. Over the 2008-2012 period, average annual GDP growth was recorded at 3.2% which was half of the historical long term average of about 6.5% per annum and was lower than that required for sustainable increase in employment and income and reduction in poverty.

1. Energy Sector Performance

3. Corresponding to an increase in price of crude oil from US$ 68 to 109 per barrel, the energy import bill of Pakistan increased from US$9.4 billion4 in 2009 to US$15.3 billion in 2012. Rising energy prices impacted the demand for primary energy which grew at only 0.7% per annum over the same period increasing from 62.5 million5 tonnes oil equivalent (TOE) in FY2009 to 64.7 million TOE in 2012. Higher energy prices and a deteriorating security situation were considered to be major reasons for a slowdown in economic growth. While oil and gas supplies increased marginally, the coal supplies declined by over 7%6 per annum mainly due to a fall in construction activities that reduced the demand from the cement industry and brick kilns where bulk of the coal is utilized. Demand for LPG also decreased by 6.4% per annum in response to price increases.

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[1] Billion standard cubic feet per day.
[2] Supreme Court Suomoto notice of LNG import projects in March 2013. Islamabad High Court order to open CNG stations for 3 days in a week in December 2013.
[4] Pakistan Economic Survey, 2012
[5] Pakistan Energy Year Book, 2012
[6] Pakistan Energy Year Book, 2012

4. Pakistan's principal energy supplies consist of gas, oil, coal, hydro and nuclear electricity, and liquefied petroleum gas (LPG). The energy mix of the country remained consistent over the years where natural gas had been meeting almost half of country energy needs. Crude oil and petroleum products contributed to nearly 32% whereas coal and non-thermal electricity generation shared 17% and 12% respectively in the total energy supplies. 39% of the total energy was consumed by industrial sector followed by transport sector that accounted for 31% consumption. Domestic sector consumed around 22% while share of commercial was 4%, and shares of agricultural and others were 2% each.
5. The remaining recoverable reserves of crude oil in Pakistan are estimated at 342 million barrels (46 million TOE) equivalent to 14 years of production at the current rate of production. The remaining recoverable gas reserves of the country are 21.8 TCF (495 million TOE) at 950 Btu/Scf[7] which is equivalent to 15 years of production at the current rate of production. In the absence of major new discoveries, Pakistan's reliance on imported energy will continue to increase.
6. Petroleum products accounted for 29% of the energy consumption in the country. Transport sector was the highest consumer of petroleum products with almost 50% share mainly consisting of motor gasoline and high speed diesel. Power sector accounted for 41% of the demand for petroleum products, mainly consisting of fuel oil and high speed diesel.
7. Indigenously produced natural gas has been the preferred fuel for all consumers due to its low price, ease in use, and environment friendliness. For the past decade, natural gas has met the bulk of country's needs contributing to 44% of the final energy consumption. While Pakistan has the largest pipeline network in South Asia, only 20% population of the country has access to natural gas. In the absence of significant new discoveries, the supplies have leveled off and shortfalls have increased to crisis levels in the winter season. Gas allocation policies of the government have been based primarily on socio-political rather than economic considerations. Over the 2009-2012 period, the share of residential sector has increased from 18.3% to 22.3% while that of transport sector (CNG) has increased from 7.6% to 10%, mainly at the expense of power and industrial sectors. Share of power sector has reduced from 28.7% to 24.7% and that of industrial sector has dropped from 28% to 25.3%, clearly showing a shift of natural gas supply to less productive sectors of economy. There is a clear need for rationalization of gas prices to divert the scarce indigenous resource to segments of the economy where it can add value.
8. Despite the cost advantage, demand for coal is limited to cement and brick industries. Annual coal consumption has been around 4 million TOEs of which cement sector accounts for 60% and brick kilns for about 30% of the demand. Coal has a share of 10% in the final energy consumption of the country. Nearly 65% of the consumption is met through imports. Coal presently being mined has generally high sulfur and ash content, produced from smaller reserves where extraction methods are primitive preventing large scale production. Pakistan has a total of 150 MW installed power generation capacity based on lignite at Lakhra in Sindh. This plant operates at only about 25% capacity due to technical difficulties. Pakistan has large lignite reserves estimated at 175 billion tons at Thar in Sindh. Major constraints in development of this resource include high moisture content of the coal and a soft over burden, and limited infrastructure to support large

[7] British Thermal Unit per Standard Cubic Feet

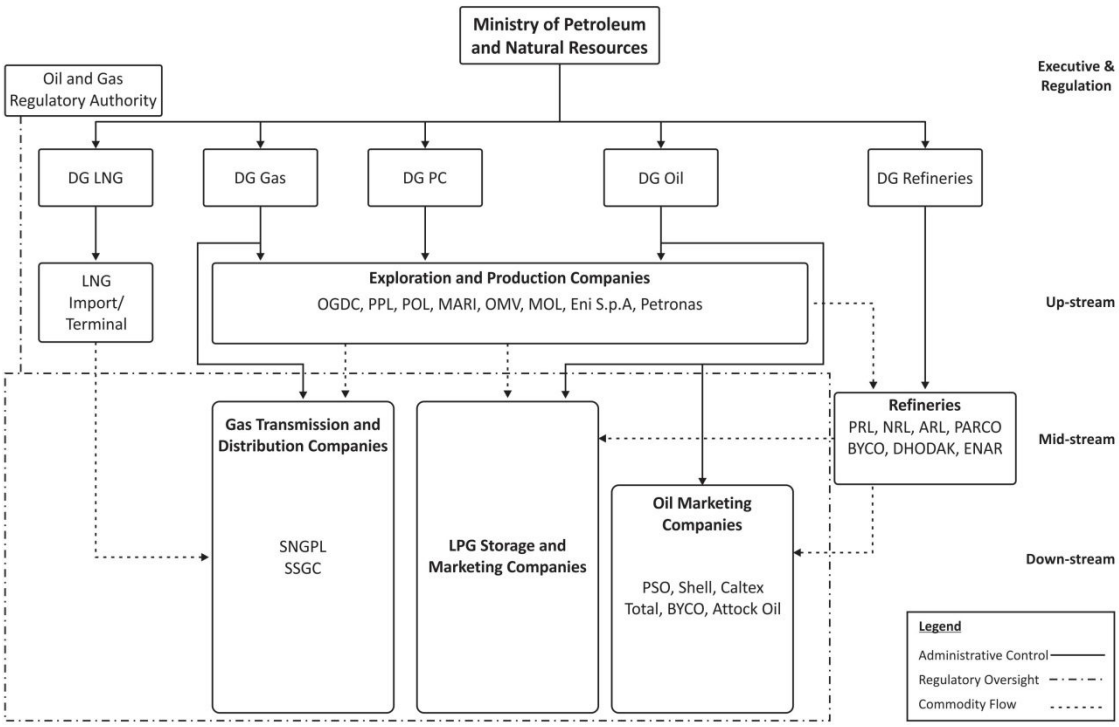
scale mining and power generation. Government has formed the Thar Coal and Energy Board (TCEB) to facilitate coal mining and coal fired power generation. Prime Minister performed ground-breaking of the US 1.6 billion dollar Thar Coal Mining and Power Project of Sindh Engro Coal Mining Company (SECMC) in January, 2014. A mine mouth capacity of 650 MW is expected to go on-line in 2017. Meanwhile, with support from ADB the state owned Jamshoro Power Company is installing a 2x600 MW coal fired generation plant in Sindh based on blend of imported and local coal. Government of Punjab has also announced 6,000 MW of coal fired power generation capacity based on imported coal at various locations. Government is also seriously considering converting the existing fuel oil fired steam units to coal firing to reduce the cost of power generated in the country. However, limited capacity in railways to transport imported coal from the ports in the south to the power plants in the north and poor condition of the road infrastructure are likely to limit the power generation capacity that can be installed on coal.

2. Institutional Structure

9. **Figure 1** shows Institutional structure of oil and gas sector, executive, regulator, and the upstream, midstream and downstream operating entities. Ministry of Petroleum and Natural Resources (MP&NR) provides the policy framework and administrative oversight for the operations of the upstream oil and gas, oil refining, as well as mid and downstream functions carried out by gas transmission and distribution companies, oil marketing companies and LPG storage and marketing companies. Technical functions of the MP&NR are managed by Director Generals of petroleum concession, gas refineries, oil, and liquefied natural gas.
10. All exploration activities, licences and concession agreements are handled by the Directorate General of Petroleum Concessions (DGPC). About 15 foreign and local E&P companies are currently operating in Pakistan. The Director General of gas in the MP&NR oversees the gas transmission and distribution sectors. Sui Northern Gas Pipelines Company (SNGPL) operates transmission and distribution networks in Khyber Pakhtunkhwa, Punjab and AJK while Sui Southern Gas Company (SSGCL) has operations in Sindh and Balochistan. The federal government has majority shareholding in the two companies which are listed on the stock exchanges. In addition to the pipeline quality main transmission network, there is an independent medium-BTU gas network—such as the pipelines connected to the Mari, Sara, Suri, Uch, and Kandhkot fields—supplying gas directly to fertilizer and power plants.
11. Oil and Gas Regulatory Authority (OGRA) was set up under the Oil and Gas Regulatory Authority Ordinance in 2002 to foster competition, increase private investment and ownership in the midstream and downstream petroleum industry, protect the public interest while respecting individual rights and provide effective and efficient regulations. OGRA has a primary role in issuing operating licences to utilities and companies in the energy sector. However, it has a limited role in determining prices of petroleum products which are determined under formulas approved by the government. In gas sector, however, OGRA determines the prescribed prices for SNGPL and SSGC on the basis of their revenue requirements and the subsequent consumer prices after accounting for prescribed prices and gas development surcharge.
12. The OGRA Ordinance 2002 empowered OGRA to determine the third-party access rules on the basis of guidelines provided by the GoP. Thus far, however, no contracts for capacity off-take

have been entered into between the gas transmission and distribution (T&D) companies and the producers or large consumers under this new open access regime accept for transportation of gas between the two gas utilities.

Figure 1: Institutional Structure of Petroleum Sector



3. Petroleum Infrastructure

13. Six refineries in the country have an annual crude handling capacity of 14 million tonnes have operated at around 70% capacity in recent years due to energy sector circular debt. Nearly 13 oil marketing companies are operating in the country through 29 main storage depots and over 7,000 retail outlets for the sale of petroleum products. Country has sufficient oil storage and transportation infrastructure to meet the market demand. LPG is produced by all refineries, and a number of oil and gas production and processing companies. Over 80 licensed marketing companies operate in the mid and downstream LPG market with a network of 5,000 plus distributors in the country.

4. Upstream Oil and Gas Policies

14. Due to deteriorating law and order situation and low wellhead gas prices, only 79 exploratory wells[8] were drilled over the four year between 2009 and 2012 period at an average of 20 wells per year against the average 30 wells per year in the preceding four years, clearing indicating dwindling interest of the E&P companies.

[8] Energy Year Book 2012

15. Under the Petroleum Exploration & Production Policy 2012, the Government enhanced the well head pricing terms for natural gas producers. The gas price stayed indexed to the C&F price of a basket of Arabian/Iranian crude oils import in Pakistan. The maximum producer price for gas in Zone III9 was raised from US$4.38MMBtu offered in 2009 to US$6/MMBtu in 2012. The Government has received a positive response as 50 offers have been received in recent bidding for 58 blocks offered for exploration and production rights. However, the response from foreign companies remained subdued despite attractive gas prices mainly due to law and order situation in the country.
16. A policy for exploration and production of 'tight gas' was announced in May 2011. The well head price of tight gas was primarily pegged to the price of conventional gas offered under the 2009 policy. However, as an incentive a 40% premium was allowed over the respective zonal price under 2009Policy. In order to fast track development and production of tight gas, an additional 10% premium was also offered for volumes that are brought into production within two years of announcement of the Tight Gas Policy. The maximum producer price for pipe line quality specification gas from tight gas reserves in Zone III works out to US$6.57/MMBtu for fields coming on line within two years and US$6.13/MMBtu for later developments. So far one gas field with an estimated production of 10 Mmscfd has been developed and supplying gas in to the national gas network. With increase in well head price for conventional gas in 2012, there is also a need for increasing incentives for tight gas to attract investment.
17. Government is also working with United States Agency for International Development (USAID) to develop a policy for development of shale gas reserves in the country. The shale gas policy is expected to be finalized and approved within two years. Under the 18th Constitutional Amendment, provinces have been awarded greater authority in the approval process of oil and gas sector affairs. Consequent to the Amendment, petroleum rules, 2013 have been modified to disburse the royalty share of the provinces directly and instantly to the provinces instead of channelizing them through federal government, a major step in removing their long standing grievance.

5. Product Pricing Policies and Mechanisms

18. Petroleum product prices in Pakistan are market based and linked to fluctuations in petroleum product prices in the international market. However, except for fuel oil and HSD, other petroleum product prices are determined by OGRA based on a fixed formula agreed between the government and marketing companies.
19. Refineries are allowed to fix their ex-factory prices on the basis of import parity prices (IPP) under a revenue protection regime. OGRA was mandated by a federal cabinet decision in March 2006 to fix the prices in accordance with the government's prescribed formula. In 2011, the Government deregulated the prices of motor fuels and jet fuels. As a result refineries and oil Marketing Companies (OMCs) fix prices of these products. The OMCs are allowed to charge a distribution

[9] Pakistan is divided into three onshore and one offshore Zones for the purposes of petroleum licensing under the Policy, Zone I-West Balochistan, Pashin and Potowar Basins; Zone II- Kirthar, East Balochistan, Punjab platform and Suleman Basins; Zone III-Lower Indus basin

margin of 3.5% and a dealer's commission of 4% to protect their returns. Government, at times, controls the prices of these products for consumers through adjustment in the petroleum development levy charged in the final prices to consumers.

20. In the upstream gas sector, the price of gas for producers is determined by OGRA on the basis of their respective pricing formulas. The government fixes consumer gas prices and maintains them at a uniform level within the same category throughout the country. Gas tariffs for consumers are set on the basis of average cost of gas in the country, regulated transmission and distribution (T&D) expenditure and return on assets for the two state owned gas companies. The companies demanded an unaccounted for gas (UFG) of 7% in determination of their revenue requirements but OGRA has allowed them UFG allowance of only 4.5% to increase the operational efficiency of the companies. The consumers in gas sector as a whole do not get any subsidy from government, but large residential, industrial and commercial consumers cross subsidize small and medium residential consumers. Government earns gas development surcharge to the tune of Rs. 30 billion[10] from power and fertilizer producers that draw gas from medium btu gas fields.
21. Energy sector companies generally earn good financial returns due to various types of protections and regulated returns allowed to these companies.

6. Problems and Opportunities

22. The MP&NR lacks professional expertise and skills to coordinate the development of policies within the sector and to manage the sector entities for optimal development and efficient operations. Owing to low salaries, public sector entities fail to retain qualified professionals staff in the long term.
23. OGRA's role in determination of the prices of petroleum products is very limited as it is only empowered to notify prices on defined formulas. OGRA lacks the mandate to enforce competition which will be critical in a deregulated environment.
24. In 2005 government formed a gas allocation policy to manage the shortages. However, with increasing shortages and political pressure of certain consumption sectors, the gas companies have not been able to follow the policy. Government tried to ration gas supply to CNG stations for transport sector but courts intervened and directed the gas utilities to supply gas to CNG station for a minimum 3 days in a week in the northern market of the country. Court directives have seriously impeded government's ability to manage the system in shortages resulting in reduction in supply for the high priority residential and industrial customers.
25. The continuing law and order and security situation in the country continues to hinder exploratory activities in certain areas of Baluchistan and Khyber Pakhtunkhwa provinces. In order to increase domestic production of natural gas, the government needs to open up the inaccessible areas restoring law and order in these regions.
26. Post the 18th Constitutional Amendment, provinces have acquired greater role in approval of upstream gas sector development plans. However, provinces have limited technical and management capabilities to handle these new areas that results in significant delays in approvals

[10] Ministry of Finance: Explanatory Memorandum on Federal Receipts, 2013-14, (http://www.finance.gov.pk/budget/exp_memorandum_2013_14.pdf)

of key decisions and agreements. Provinces need to establish institutional capacity to deal with petroleum concession functions within their own setup to expedite the process. Once established, these institutions would need capacity building and close liaison with DG PC in MP&NR for effective coordination and expedition of the approval processes.

27. Low wellhead gas prices and a developed transmission and distribution system has enabled the government to maintain consumer gas prices significantly below the alternatives making gas the preferred fuel for all consumers. The gas consumption is generally inefficient in most of the residential, commercial and industrial applications and consumers exert their socio-political pressure to receive gas allocations. Although gas sectors does not take any direct subsidies from government, the residential and fertilizer sectors receive cross subsidies from industrial, commercial and power customers. In order to release pressure on gas demand and promote consumptive efficiency of this precious resource, government must move towards economic pricing of gas based on the prices alternatives and rationalize gas prices to eliminate cross subsidies.
28. Unaccounted for gas (UFG) in the national gas network has reached around 11% which is eroding major portions of the returns of the gas utilities. The UFG levels have increased mainly due significant drop in gas sales to bulk consumers since 2003-04 owing to expansion of transmission network on 'socio-political considerations', resulting in higher leakages in retail system. The MP&NR and gas utilities are also seeking to fix the cost of gas for gas losses at the level of 2004-05 on the premise that such losses were outside the control of the gas companies even though gas rates for consumers increased by almost 70 per cent since then. However, OGRA has set a bench mark of 4.5% for both the utilities and the cost of gas losses at current price of gas. This, however, is seriously going to impact the financial viability of the gas utilities and not only impede their ability to invest in the system but is also resulting in raising the circular debt in the gas sector. OGRA needs to carryout detailed audits of UFG in the utilities periodically to identify the reasons and associated magnitude of UFG and set bench marks in line with best international practices and ensure compliance thereafter.
29. Pakistan has been actively pursuing opportunities to supplement its indigenous supply of natural gas with imported natural gas. The Turkmenistan-Afghanistan-Pakistan-Iran (TAPI) pipeline project and the Iran-Pakistan (IP) pipeline project are two major initiatives for which basic technical studies have been completed and framework agreements covering contractual and commercial terms have been developed. Both the projects are complex in nature given the regional setting, and face considerable challenges in realization. Financing arrangements and implementation timelines for these projects have yet to be finalized. Delays are attributable mainly to political issues in case of the IP project, and political as well as security constraints in case of TAPI project.
30. Recognizing the challenges in import of natural gas by pipelines, the government turned its attention to LNG imports around 2006 when Pakistan's first LNG policy was introduced. The 2006 policy emphasized private sector LNG import projects to be undertaken on purely commercial grounds without the GoP's physical or financial support. LNG Policy 2011 was introduced with minor changes in the policy of 2006 giving further incentives to the private sector short of the government's off take and payment guarantee. In absence of government guarantees, the

private sector has struggled to find room for viable investments in view of high capital requirements, commercial risks, and previously untested business models where private importers could sell to bulk customers through regulated tolling fees for import terminals and wheeling charges for transmission lines. Government own attempts to import LNG through state owned companies have not been successful mainly due to limited capacity to manage a complex procurement under government rules, and a few major initiatives were bogged down in litigation. LNG developers have shied away from supplying imported LNG to IPPs in view of the circular debt issue and the commercial and regulatory challenges posed by the fuel and power purchase agreements under which the IPPs operate. Supplying gas to the private industry has also not been possible due to the commercial arrangements such as opening of letter of credits to manage payments. The efforts of private sector and the government notwithstanding, the future of LNG imports remains completely uncertain at present for these reasons.

31. The practice of illegal decanting of LPG, cross refilling and charging of the excessive prices of LPG during the winter season continues despite presence of enforcement rules by OGRA. OGRA needs to build monitoring capacity and effective enforcement mechanism to stop these practices.
32. Major deposits of lignite are located in the Thar Desert in south eastern Sindh. Long term plans[11] for power generation from Thar lignite prepared by the National Transmission and Despatch Company (NTDC) show capacity additions of the order of 30,000 MW over the next twenty year period. However, in view of the pace of current development, the plan appears extremely ambitious. The government of Sindh has issued a number of licenses for development of open pit mines in Thar and has advertised for leasing of additional mining blocks. Detailed technical, economic and environmental studies for mining, however, have been completed by two of the licensees, who are now aiming to achieve financial close within a year to be able to achieve full production by about 2018. Typical development plans are based on an initial mine size of about 3 million tonnes per annum, expanding to 6 million tonnes to support mine mouth power plant capacity of 1,200 MW at each mine. Development of basic infrastructure in Thar such as roads, water supply, and transmission lines to support large scale mining and power generation, and availability of financing for the combined mine and power plant projects remains a major challenge for these projects.
33. However, in order to expedite the development of Thar, regulatory framework for integrated coal mining and power pricing needs to be developed. At the same time, the institutional capacity of TCEB needs to be expeditiously built to for creating the enabling environment for private sector participation. Government should also consider setting up of a one window operation such as that provided in 2002 Power Policy to facilitate coal mining and power generation. There should be a clear demarcation of the jurisdictions of the federal and provincial policies for development of integrated mine mouth power generation.
34. Punjab government has announced to build 6,000 MW of power generation capacity on imported coal in the medium term timeframe. While coal transportation for large quantity of coal to the mid and upcountry will be a major logistical challenge, the imported coal may displace market for Thar lignite, thereby resulting in delay in the development of the indigenous coal resource.

[11] National Power Plan System Expansion Plan 2011-2030, SNC Lavalin International, 2011

7. Energy Sector Reforms

a. Implementation Status of the Recommendations of the FODP[12] Report

35. FODP report made several recommendations for energy sector reforms for improvement in the operations and to stimulate and sustain optimal growth in the energy sector.

Strengthening Energy Sector Governance and Regulation

36. FODP report recommended a number of reforms in the management of energy sector that included: appointment of senior energy advisor for crisis management; setting up a joint parliamentary committee on energy; and setting up Ministry of Energy by merging Ministry of Water and Power and Ministry of Petroleum and Natural Resources. The main objectives of these reforms were to harmonize decision making in the energy sector, rationalize pricing and allocation of resources on economic basis and economic optimal planning of energy supplies in the country. However, government apparently has not moved on with the recommendations and no concrete step has been taken to implement the reforms.
37. The boards of directors of the most of energy companies are dominated by members from public sector with minority members taken up from private sector. MP&NR exercise administrative control through the public sector members and the entities are retrained from making independent decisions. The appointment of members from private sectors has also not worked out well and led to corrupt practices in the past in the absence of checks and balances and lack of stakes of the directors in the affairs of the company. The recent cases of certain board member in the board of gas utilities are the evident examples.

One Energy Regulator by Merging NEPRA and OGRA

38. In the absence of a unified ministry of energy, the possibility of merging electricity and oil and gas regulators appears remote. Owing to certain lobbies in the power and energy sector, the merge the two regulators is not imminent in the near term.

Other Gas Sector Reforms

39. The Gas (Theft Control and Recovery) Ordinance 2014 was promulgated to provide for prosecution of cases of gas theft and other offenses relating to gas and to provide a procedure for recovery of amounts due. This would be a key step in curbing the gas theft and reduce UFG of the two gas companies.
40. In order to establish a competitive gas market and enhance business efficiency through transmission open access in gas sector, the proposal of forming a national gas transmission company by separating the transmission and distribution functions including the pricing regimes of the gas utilities was approved by the Economic Coordination Committee of Cabinet (ECC) in March 2013. However, no concrete steps have been taken by the government towards establishment of an independent transmission company since then. Due to vested right of the two companies in gas distribution, the progress on development of a vibrant open access market in the gas sector appears to be slow.

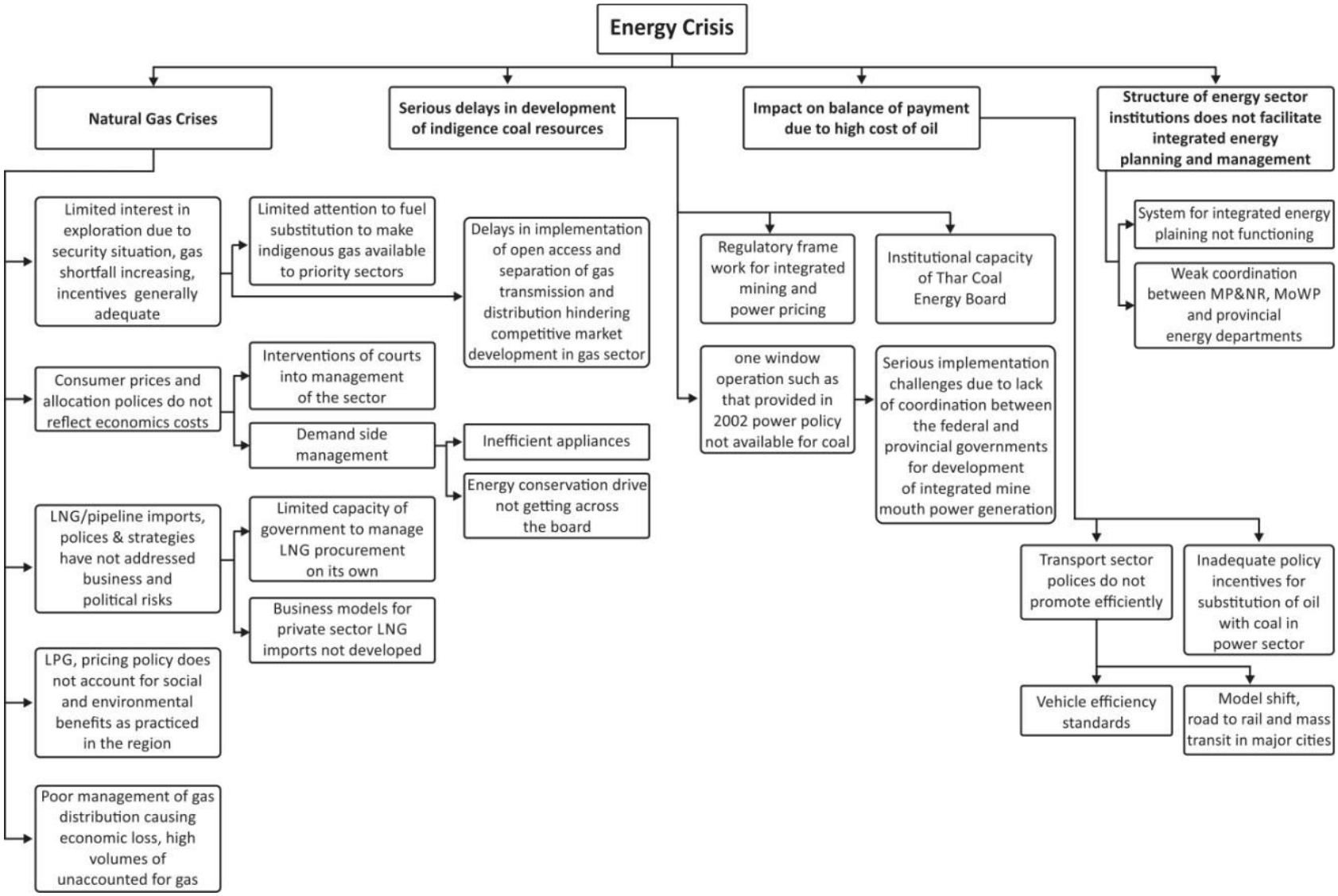
[12] Friends of Democratic Pakistan: Integrated Energy Sector Recovery Report and Plan, December 2010.

41. Under the new energy policies, the price of wellhead gas has been increased by 30-40% for various production zones. These prices should attract investment in the upstream sector provided the law and order situation improves and companies are freely allowed to operate in all areas of the country. In mid and downstream, the margins made by energy companies are sufficient to fund their investment requirements and infrastructure development is expected to match market growth in a sustainable manner.

b. Way Forward

The management and technical capacity of the Ministry of Petroleum and Natural Resources and coordination between federal and provincial institutions need to be improved to formulate and execute policies that address business and political risks for the participation of private sector in main stream development of energy resources. With oil prices soaring high, there is a need to institute gas allocation policies based on economic costs, rather than the currently applied socio-political considerations, to increase consumption efficiencies and promote energy conservation in the country. Government should focus on removing all barriers for development of Thar coal to increase the share of indigenous resources to enhance energy security of the country.

Problem Tree for Energy Sector: Oil, Gas and Coal



Sector Results Framework (Pakistan Energy Sector, 2009-13)

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contributions	**Indicators with Targets and Baselines**	**Outputs with ADB Contributions**	**Indicators with Incremental Targets**	**Planned and Ongoing ADB Interventions**	**Main Outputs Expected from ADB Interventions**
Reliable and affordable energy services through the development of indigenous energy resources (coal and gas) and strengthening		Increased efficiency, both technical and financial, of the natural gas and petroleum sector	Completion of at least one LNG project of 400 MMScfd capacity Establish integrated energy resource Planning Capacity Building of MoWP, TECB, and provincial energy departments		**Pipeline Projects** Capacity building of MP&NR, and OGRA to develop capabilities in integrated energy planning **On-going Projects** Integrated Energy Modeling for Long-term Resource Planning