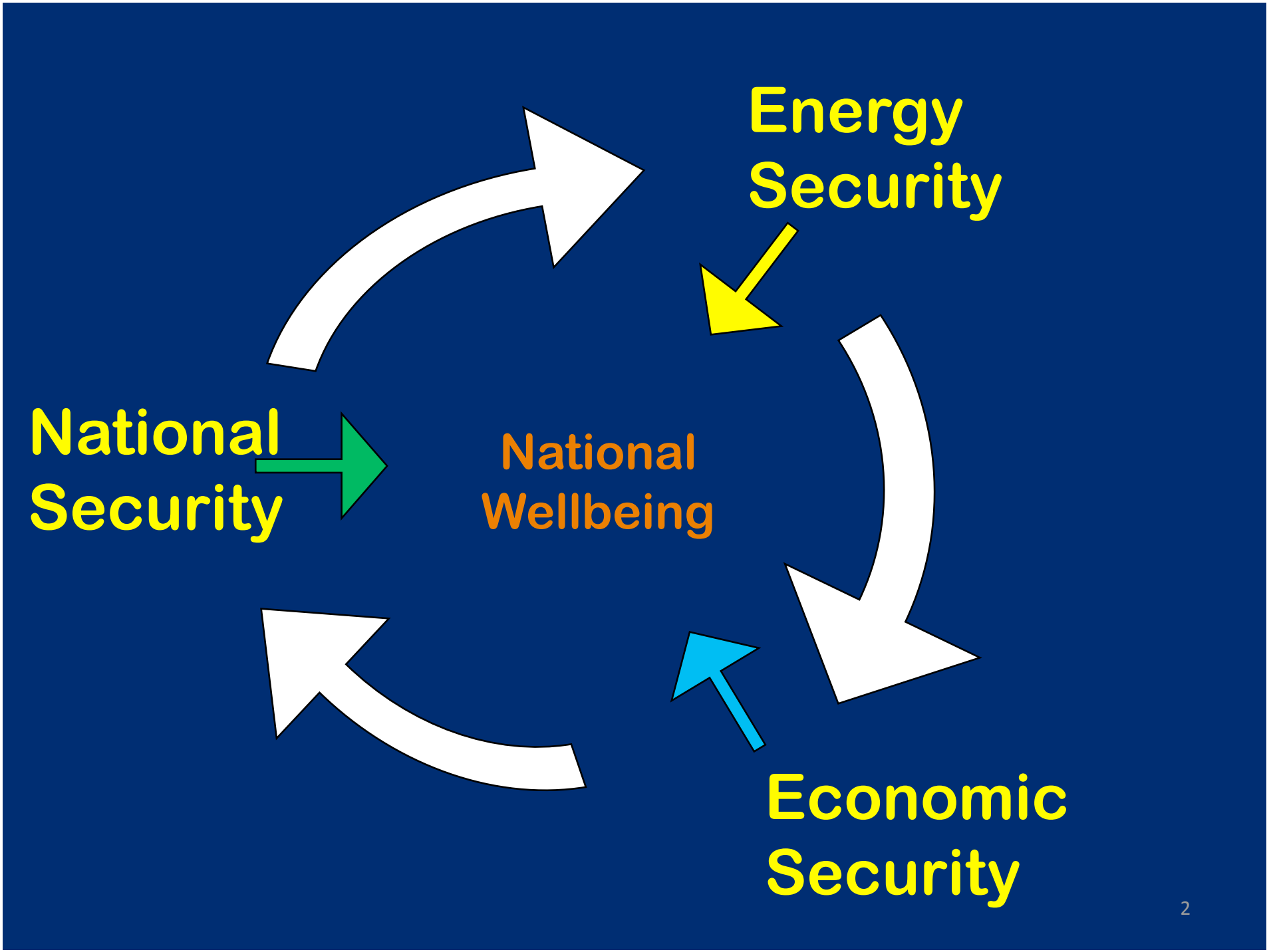
THE NATIONAL QUEST FOR ENERGY AND ITS MANAGEMENT

Asim Majid Khan

Chief Instructor NIM, Lahore

18.03.11


Energy Security
National Security
National Wellbeing
Economic Security

SUGGESTED SCOPE OF THE DISCUSSION

- Apparent aspects of energy crisis
- Deeper perspective of energy crisis
- Causes of growing energy crisis
- Future outlook
  - Demand-supply projection
  - Resource gap, if any, how to bridge it?
- Paradigm change in energy management

APPARENT ASPECTS OF A BREWING CRISIS

- Shortage of electricity
- Spike in power tariff
- Shortage in natural gas
- Increase in natural gas tariff
- Impact on economy and employment
- Lack of national strategy and vision and effective management

Pakistan

- Pakistan, despite the enormous potential of its energy resources, remains energy deficient and has to rely heavily on imports to satisfy hardly its needs.

- Moreover a very large part of the rural areas does not have the electrification facilities because they are either too remote and or too expensive to connect to the national grid.

ROOTS OF PAKISTAN'S ENERGY CRISIS

i. **Lack of Integrated Energy Planning** & Demand Forecasting and absence of central & focused entity responsible for the Energy Sector

ii. **Imbalanced Energy Mix** with heavy reliance on gas (47.5%) and Oil (30.5%) (72% imported)

iii. **Non-utilization of vast indigenous resources** of Thar Coal and Hydel potential

i. **Lack of effective project structuring**, planning and implementation of indentified and viable projects

ii. **Inadequate Primary Energy Sources** or access to, or local availability / development

CONTD

- As a consequence the energy shortages have snowballed with major supply chain and infrastructure gaps, namely;

  i. **The Electric Power Sector;** has been in static non-growth mode from 2003-2008, and the peak supply-demand gap has grown to about 3,500 - 4,000 MW from about 1,000 MW in 2006

II. **In the Gas Sector;** the demand - supply gap that emerged in 2007 has grown to about 800 MMcfd in 2009 due to stalled import projects (Mashal, IPI, PGP) and local fields not developed / put in production for 5 years (500 MMcfd)

i. **Inadequate Energy Infrastructure;** supply to end customers both for electric power as well as fuel oil for Power Plants has been constrained

ii. **Short Supply of Gas/Oil to Power Plants;** the crisis has been aggravated due to gas supply shortfall and reduced oil supply due to non-payment to OMCs

PAKISTAN's ENERGY CHALLENGES

1. Low Energy Consumption Per Capita: Low Generation of Wealth
2. High Energy Intensity: Low Efficiency of Converting Energy into wealth/GDP
3. Dependence on Imported Oil: Low Exports Resulting in Balance of Payment Issues
4. Oil-based Power Generation: High Cost Electricity Affecting Export Competitiveness

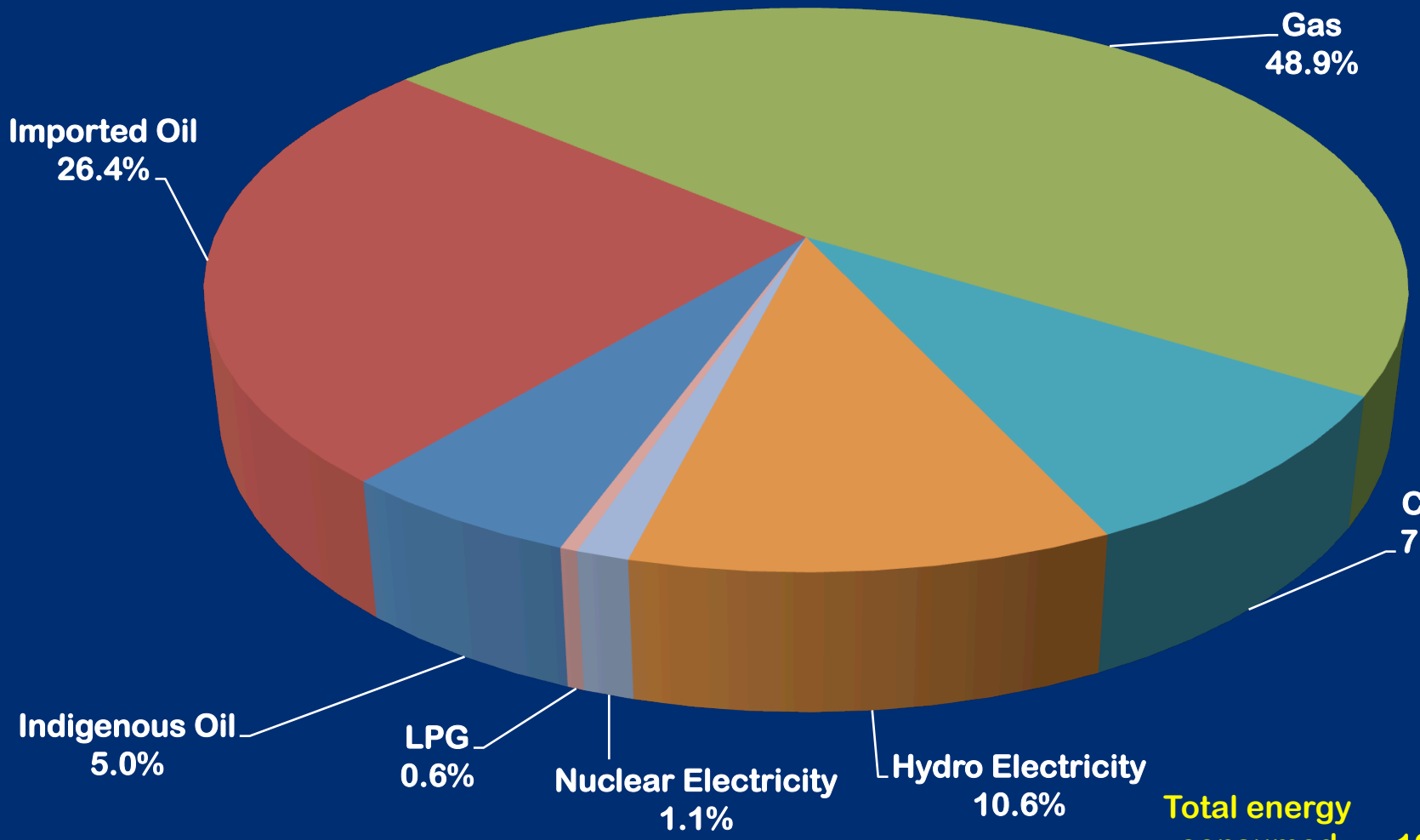
Continue

5. Increasing Gap between Demand and Supply Affecting Energy Security and Inhibiting Economic Growth

6. High transformation, transmission, distribution losses and energy thefts

7. Lack of: Vision, Coherent Policy, Integrated Strategy and Efficient Management

PAKISTAN PRIMARY ENERGY MIX 2009-10
(63.043 mtoe = 1,261000 boed)



Total energy consumed	~ 100 mtoe
Traditional energy	~ 37 mtoe
Commercial energy	~ 63 mtoe

PAKISTAN'S PRIMARY ENERGY MIX

- Pakistan's Primary Energy Mix is essentially imbalanced even on a worldwide comparative basis, with dependence on gas at 47.5%, oil at 30.5% (72% imported)

- The 2005 Energy Plan, projected a continuing dependence of about 48% on Natural Gas in the 2030 scenario, based on mega imports thru Transnational Pipelines (6.5 bcfd) and LNG (1.5 bcfd)

- With the continuing delay in the planned TNPs and LNG import projects (Mashal, PGP, Engro etc) the primary energy gap is increasing at an alarming rate

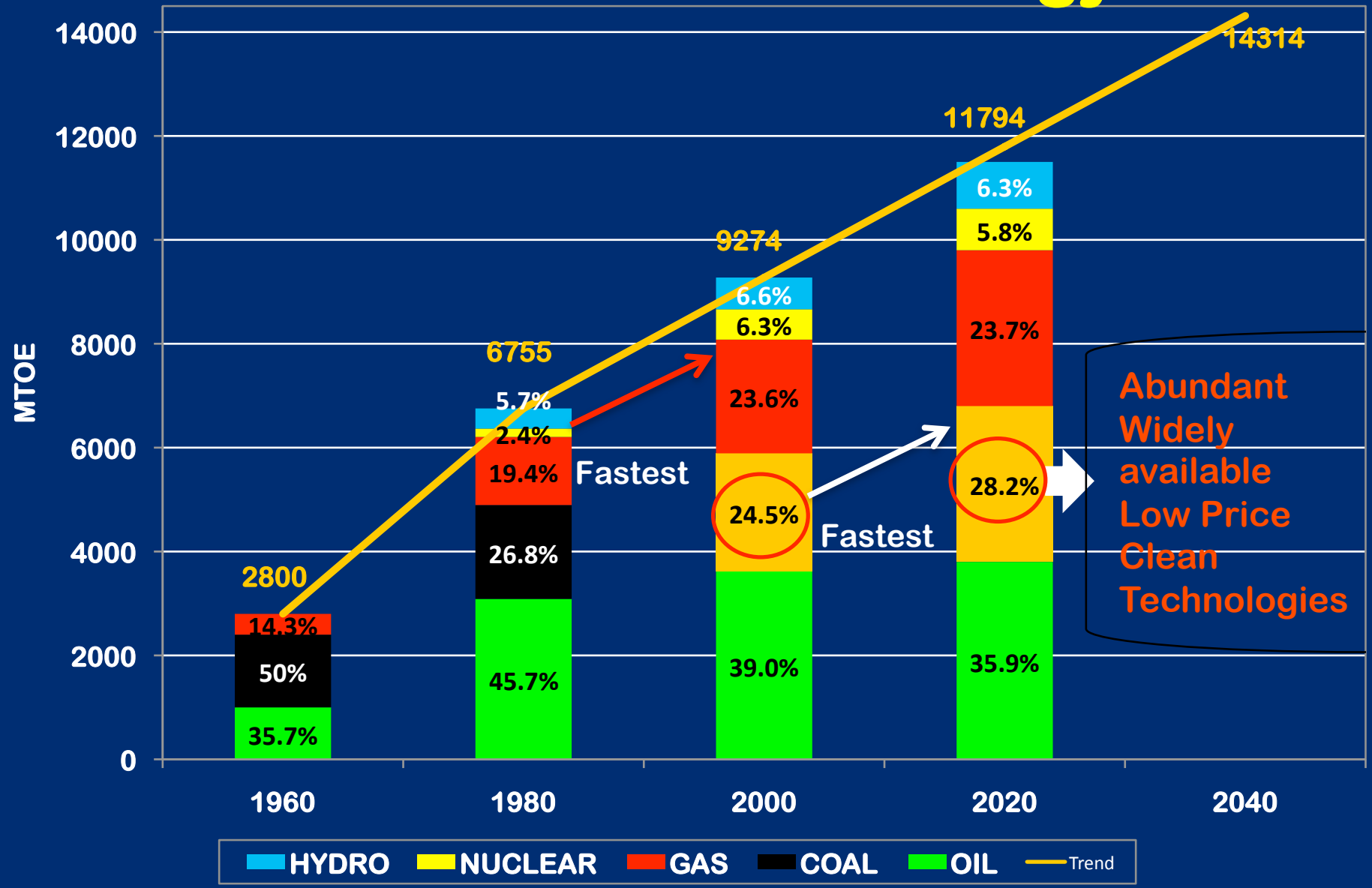
- By 2015 the natural gas supply-demand gap after LNG imports of 1.0 bcfd (if implemented) will increase to 1.7 bcfd, and is unlikely to be covered as IPI cannot be completed in this time frame

- **There is clearly an essential need to plan a revised Primary Energy Mix** along with a revised electricity generation plan by source in the 2010 – 2030 scenario
- With rising cost of crude oil from $ 60 in 2005 to $ 147 in 2008, Pakistan's oil based thermal generation (32%) became unsustainable and has resulted in a massive Energy Sector debt ($ 3.6 billion)

- Coal utilization is about 9% in the Energy Mix, and only 0.1% for Power Generation vs. 72% in China, 56% in India and more than 50% in the USA
- New power generation has remained static for about **7** years
- A more rational and Sustainable Energy Mix must be planned for the 2010-2030 scenario.

- Significant increase in hydel power generation and optimum use of coal thru gasification and clean coal technologies
- As a strategic priority Nuclear Electric Energy has to be increased to about **5%** and Renewable to about **3%** in the 2030 scenario

World Commercial Energy Mix



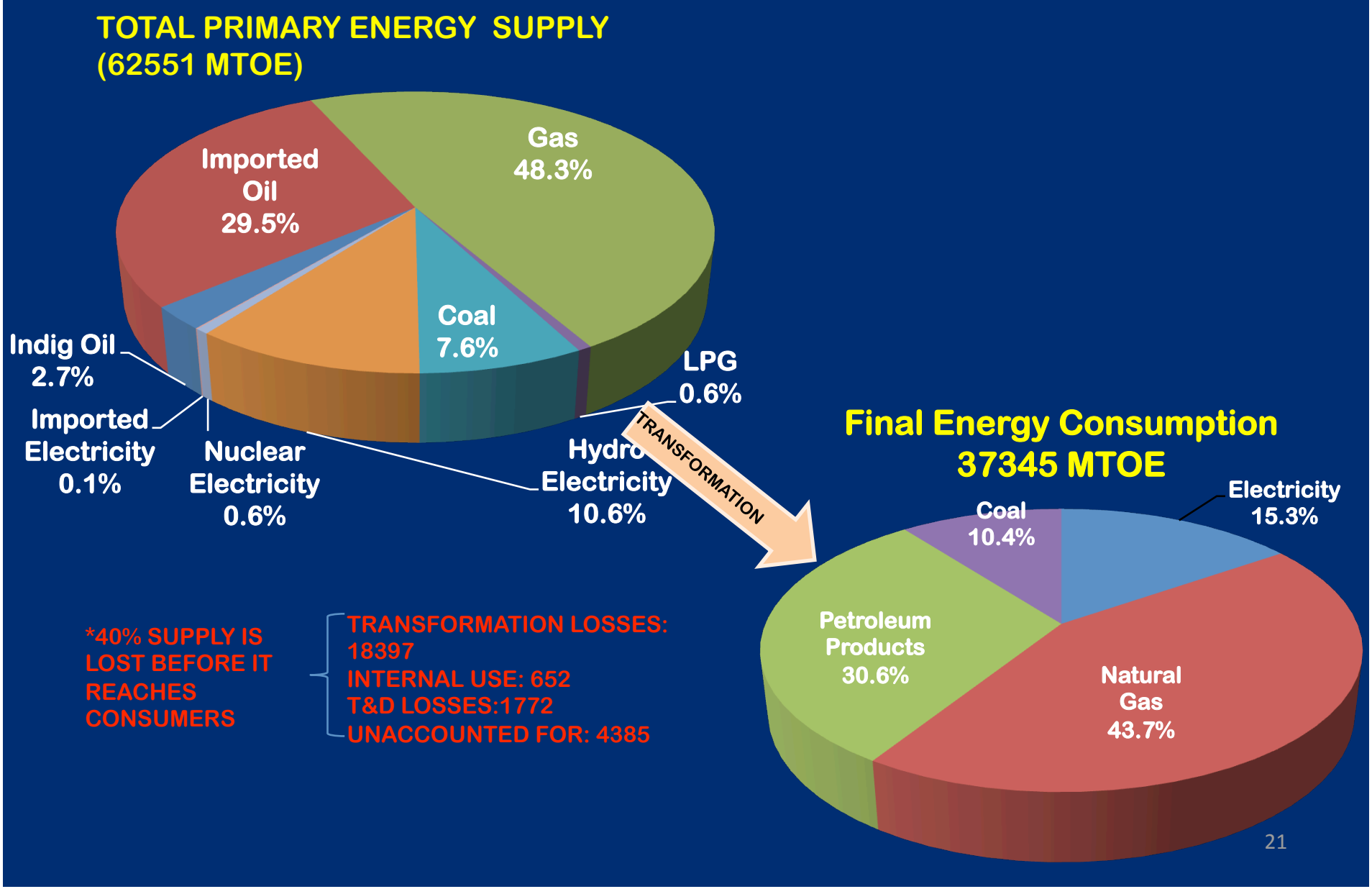
PAKISTAN ENERGY POTENTIAL & RESOURCES (June 30, 2010)

	Potential	Resource
OIL (billion barrels)	?*	0.965
GAS (trillion cubic feet)	?*	55.0
COAL (billion tons)	185	9
HYDRO (mega watt)	45,000**	6600

* USGS: 250 million barrels oil and 18 tcf gas remain to be discovered in Indus Basin onshore and offshore (Excluding frontier areas of Sulaiman Fold Belt & Balochistan Basin)

** Economically viable 30,000 MW

ENERGY USAGE AND SUPPLY AT A GLANCE

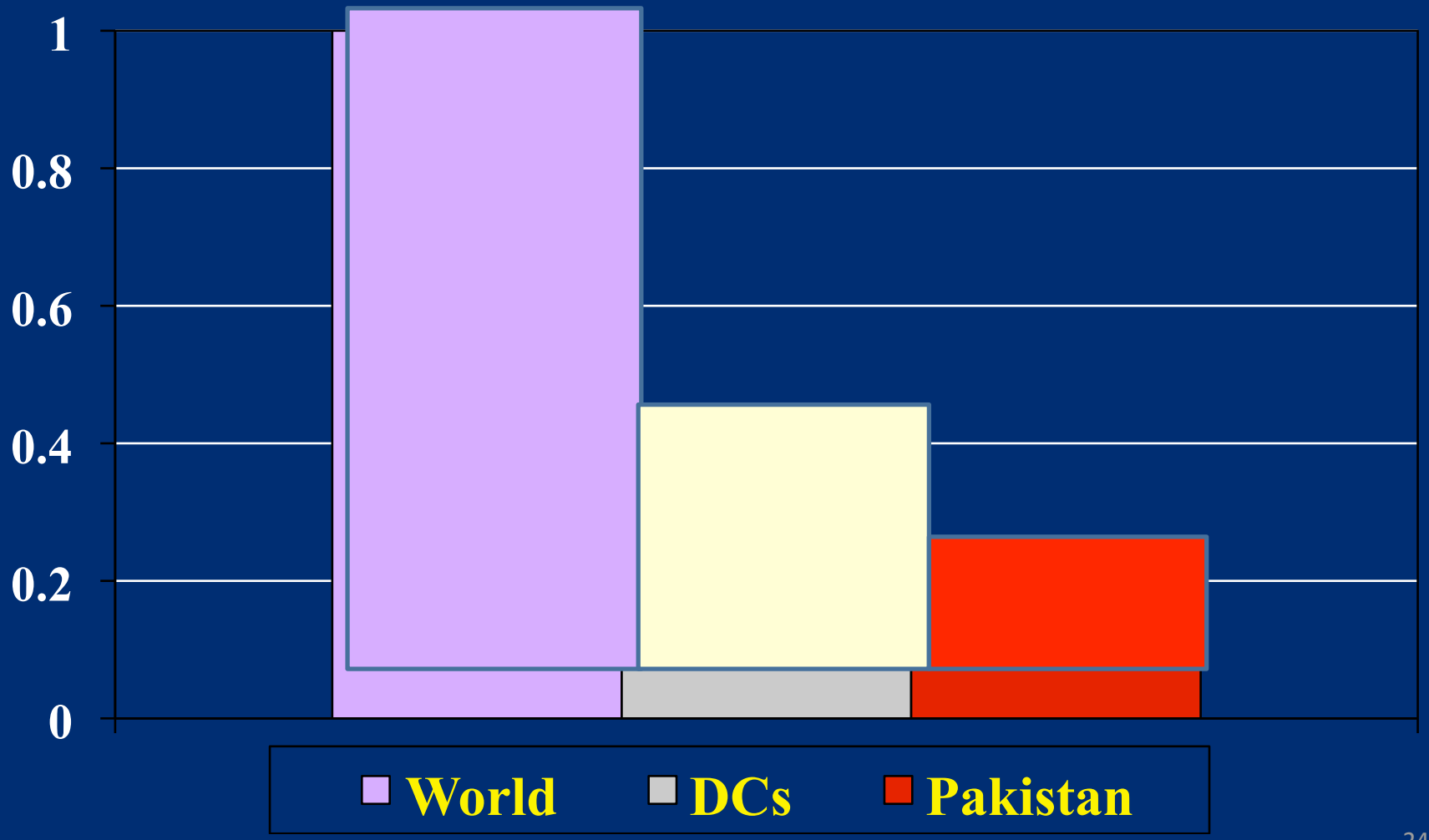


ENERGY SUPPLY & GDP GROWTH CORRELATION IN PAKISTAN

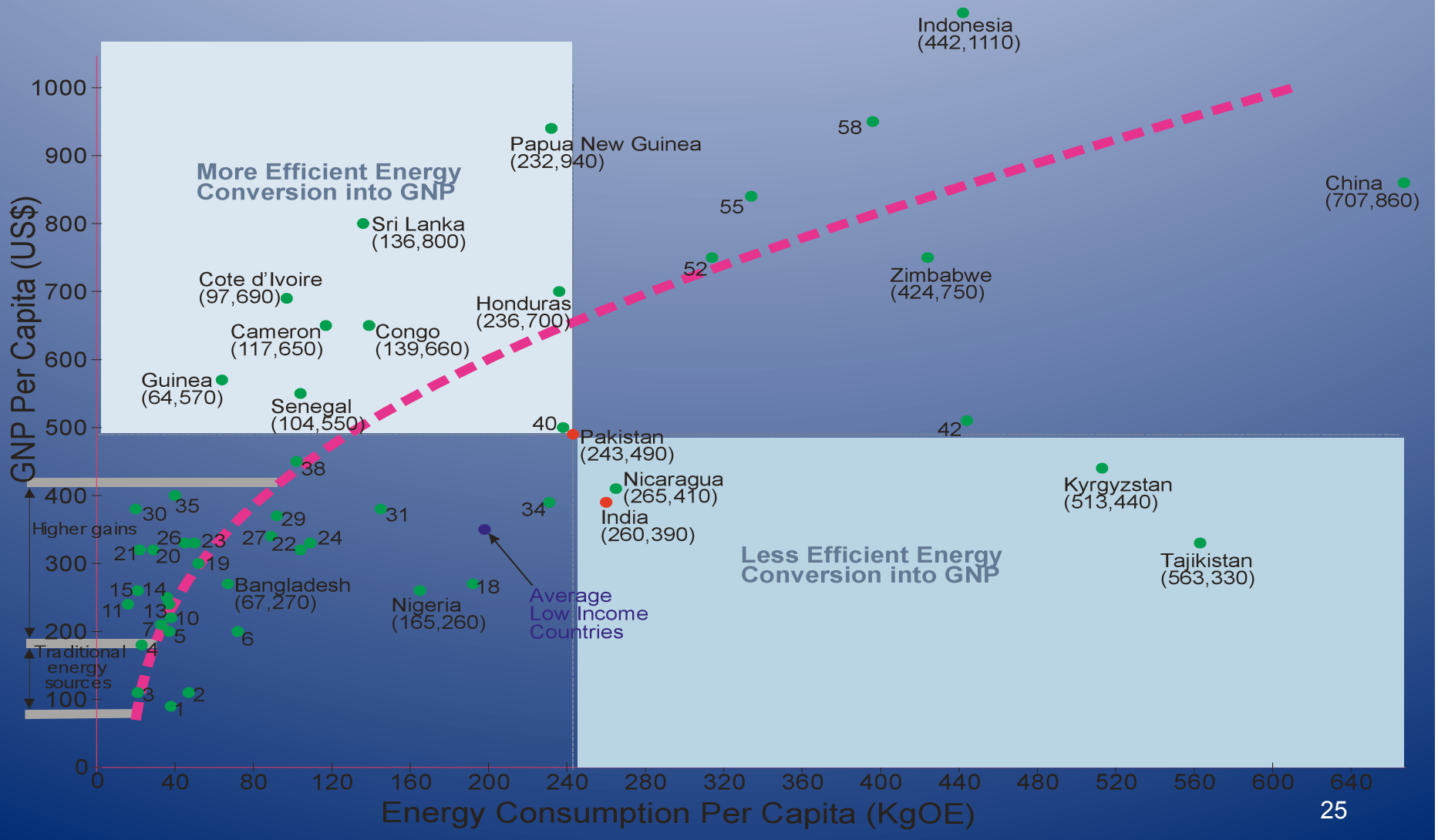
*SBP Dec 2009 Report

Energy Security Fundamentals

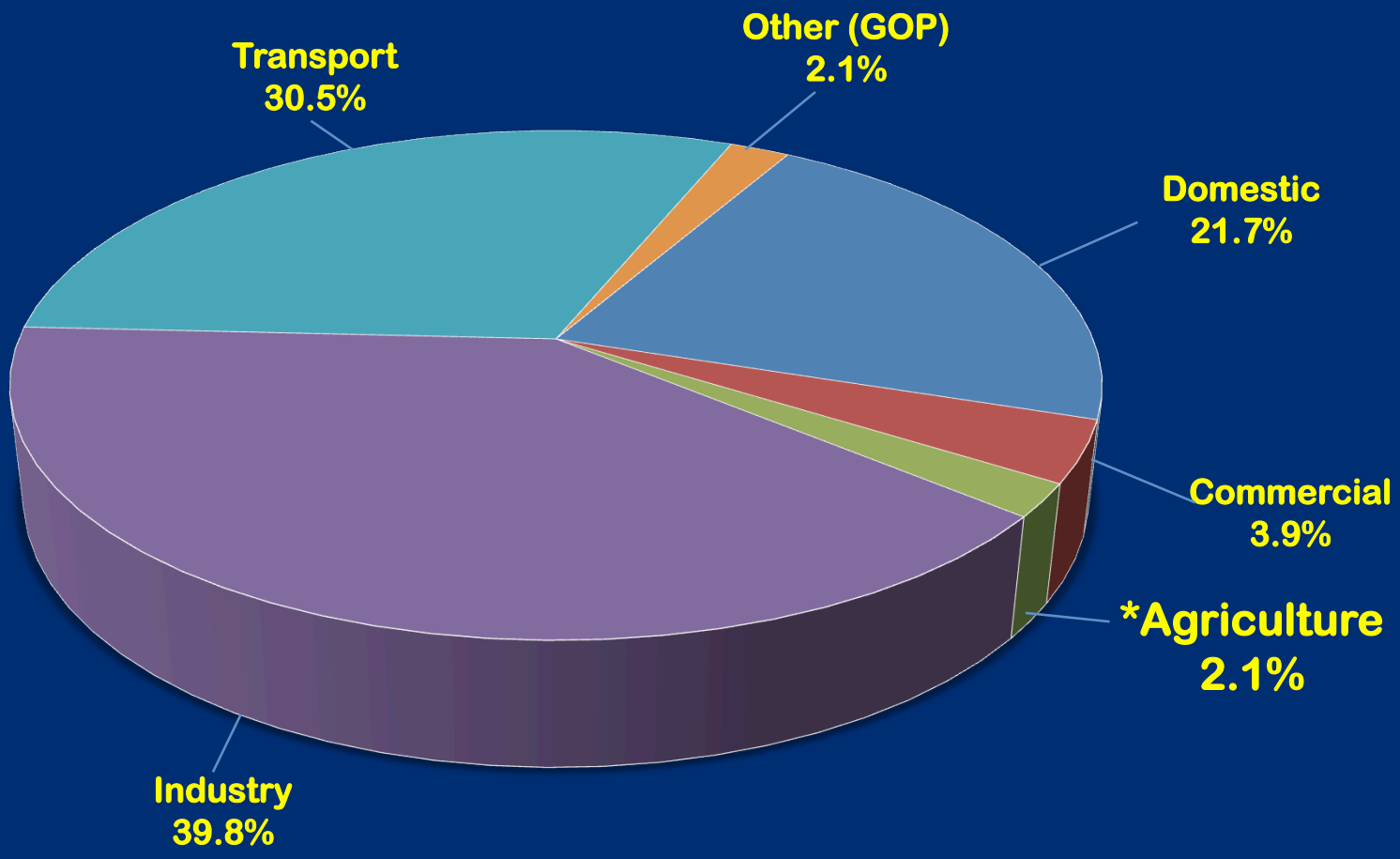
RELATIVE ENERGY CONSUMPTION/CAPITA



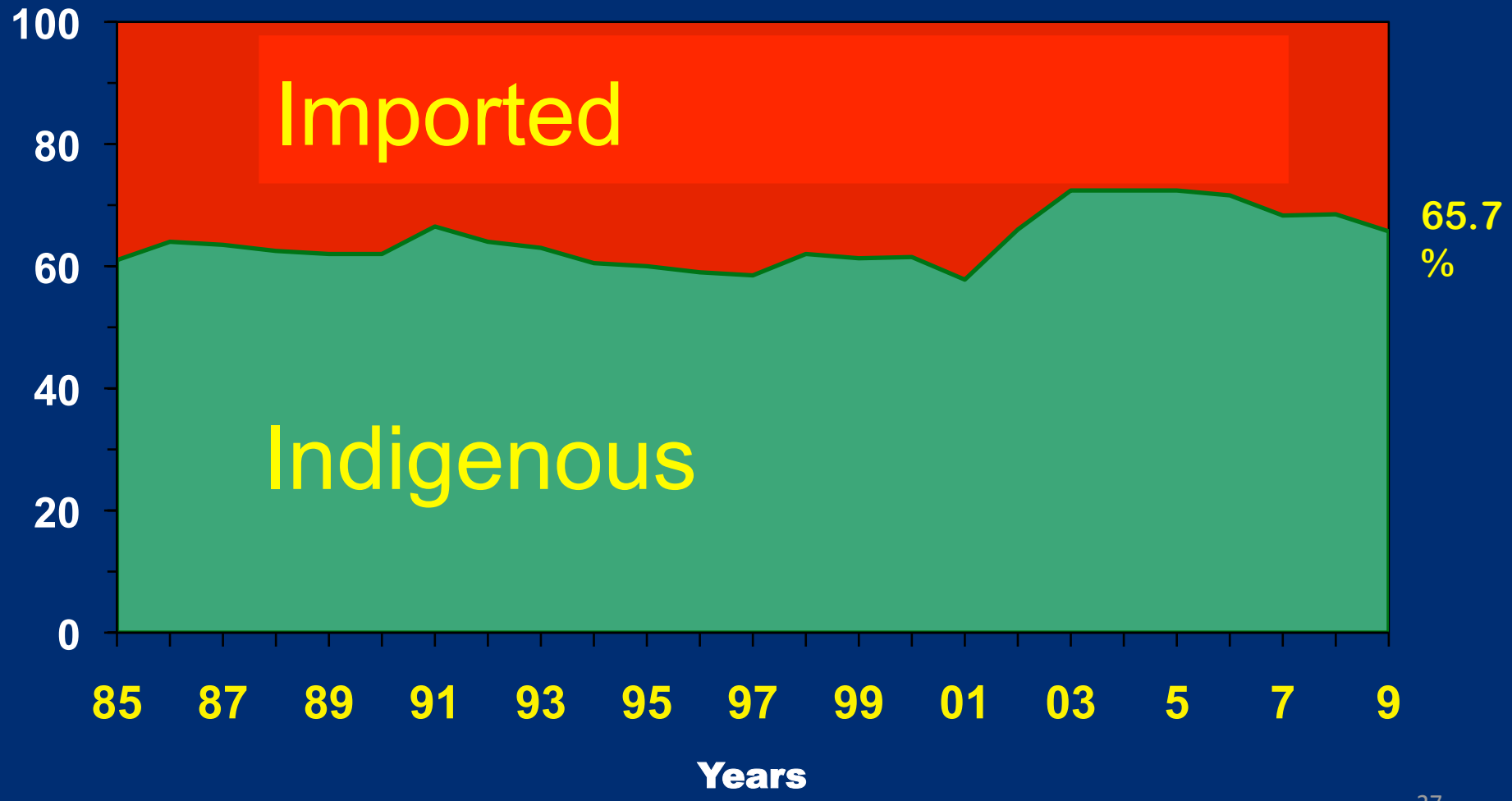
Energy Consumption and Economic Development Low Income Countries (up to $1000/capita) -2008



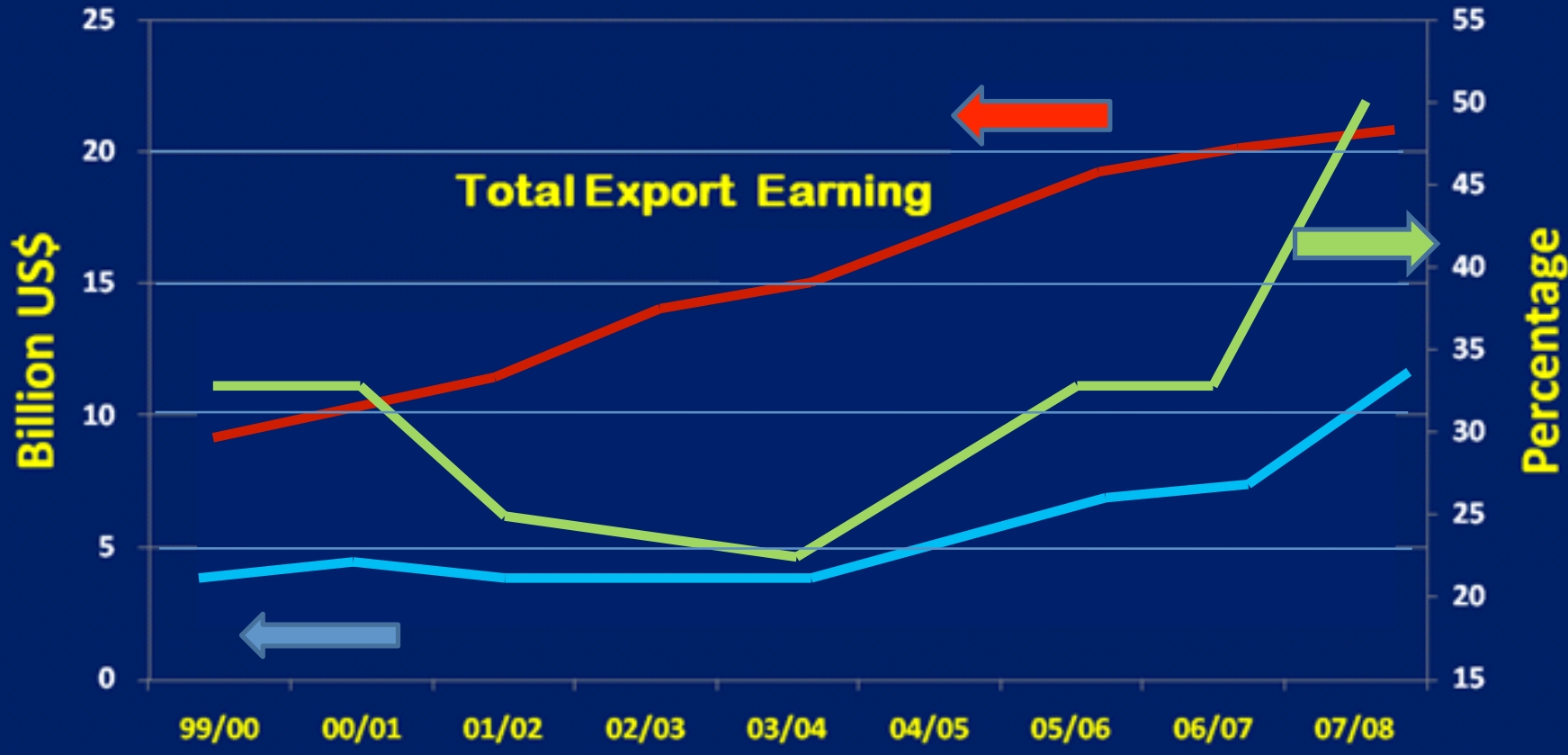
CONSUMPTION BY SECTORS 2008-2009 (37345 MTOE)



ENERGY INDEPENDENCE RATE (%)



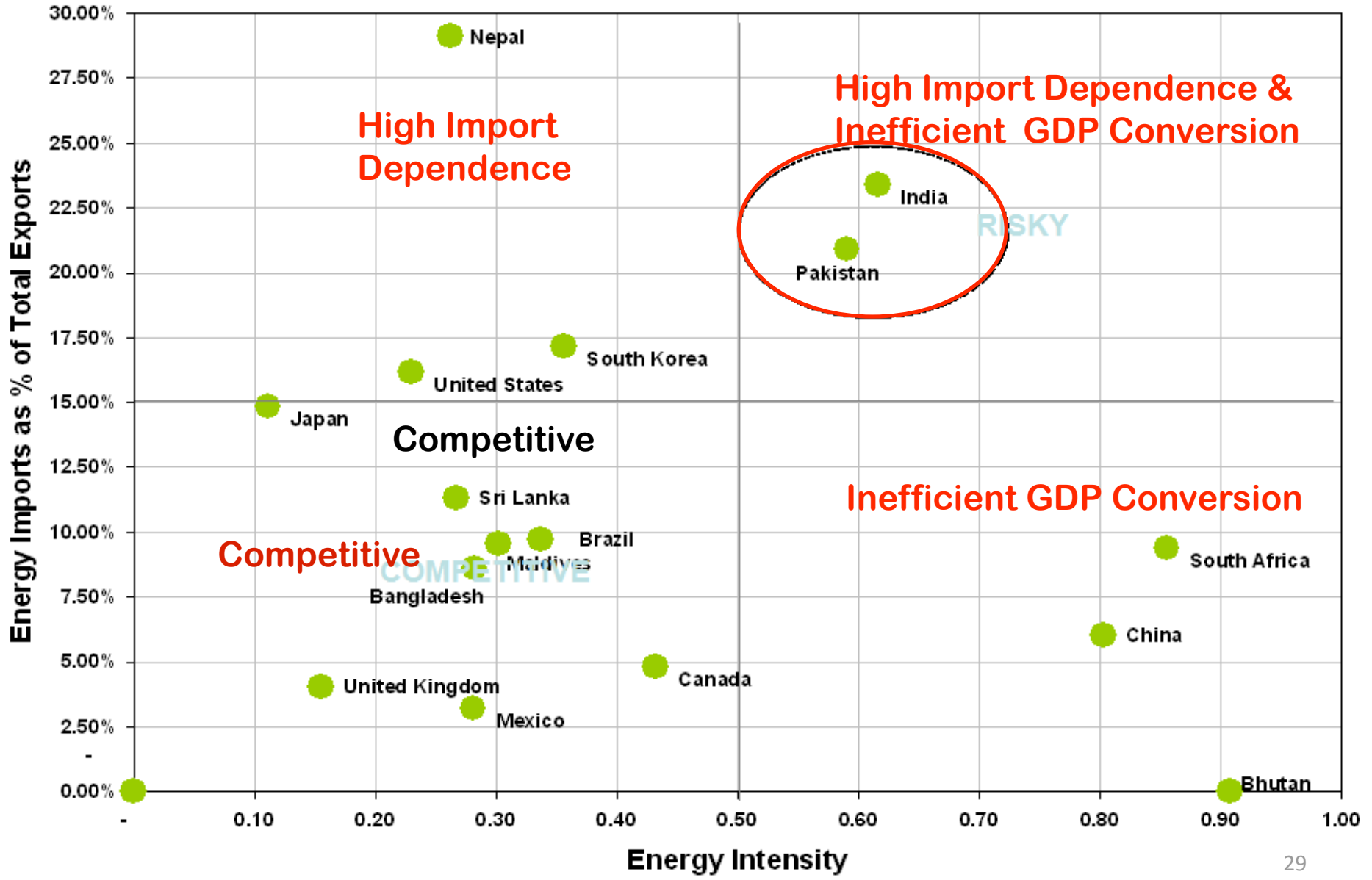
Cost/Dependence on Imported Oil



Left Vertical Axis
- Total Export Earnings (Billion US$) (Export of Goods & Non-Factor Services)
- Net Oil Import Bill (Billion US$)

Right Vertical Axis
- Oil Imports as % of Total Exports

Energy Security Matrix



ENERGY SECURITY IMPERATIVE

- Pakistan is an energy deficit country: it has to rely on substantial imports to sustain required level of economic growth to develop infrastructure, increase industrial capacity, raise GDP, eradicate poverty and improve quality of life
- Energy security implies higher exports to sustain greater energy imports

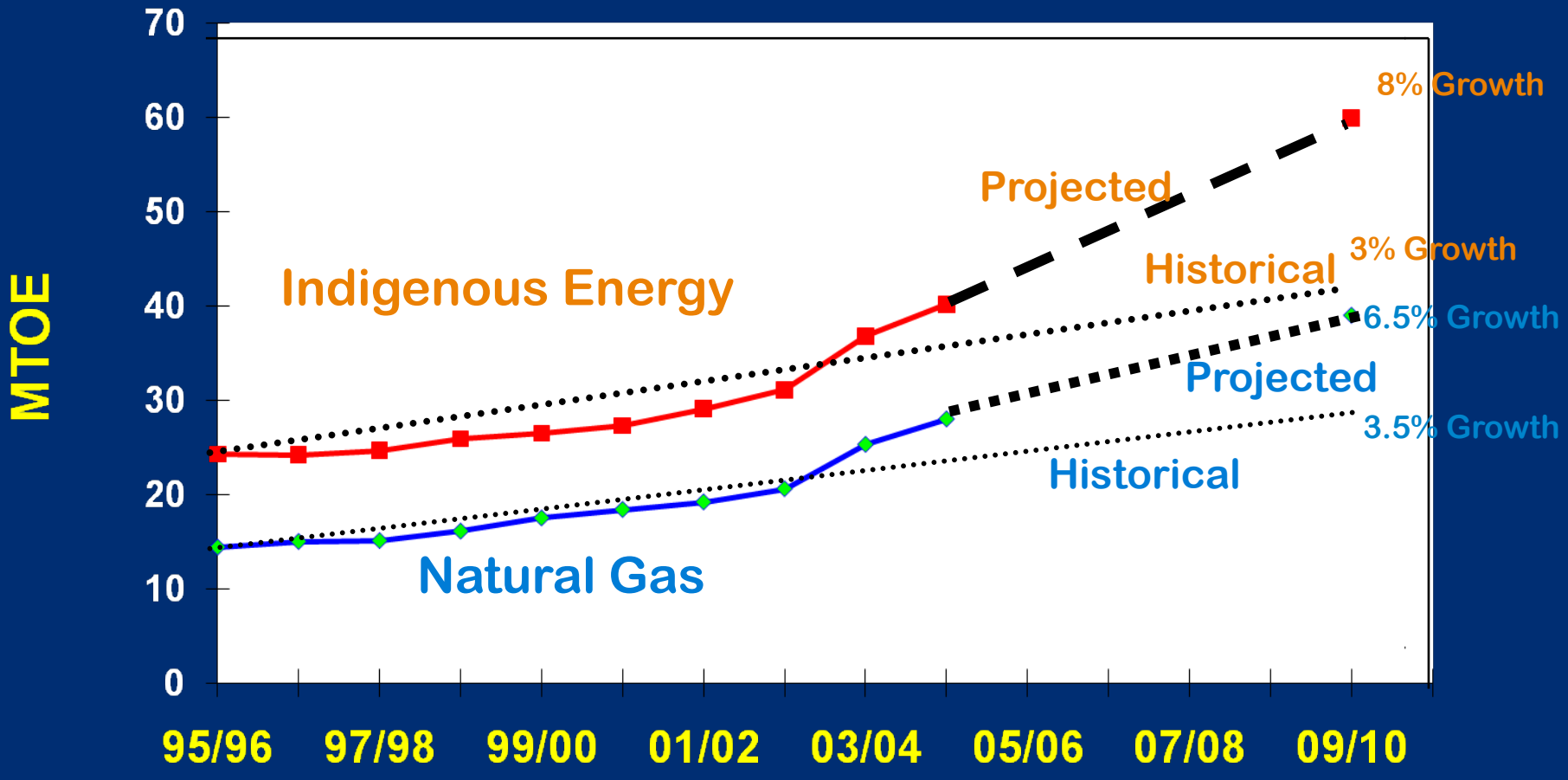
EMERGING CHALLENGE/ OPPORTUNITY

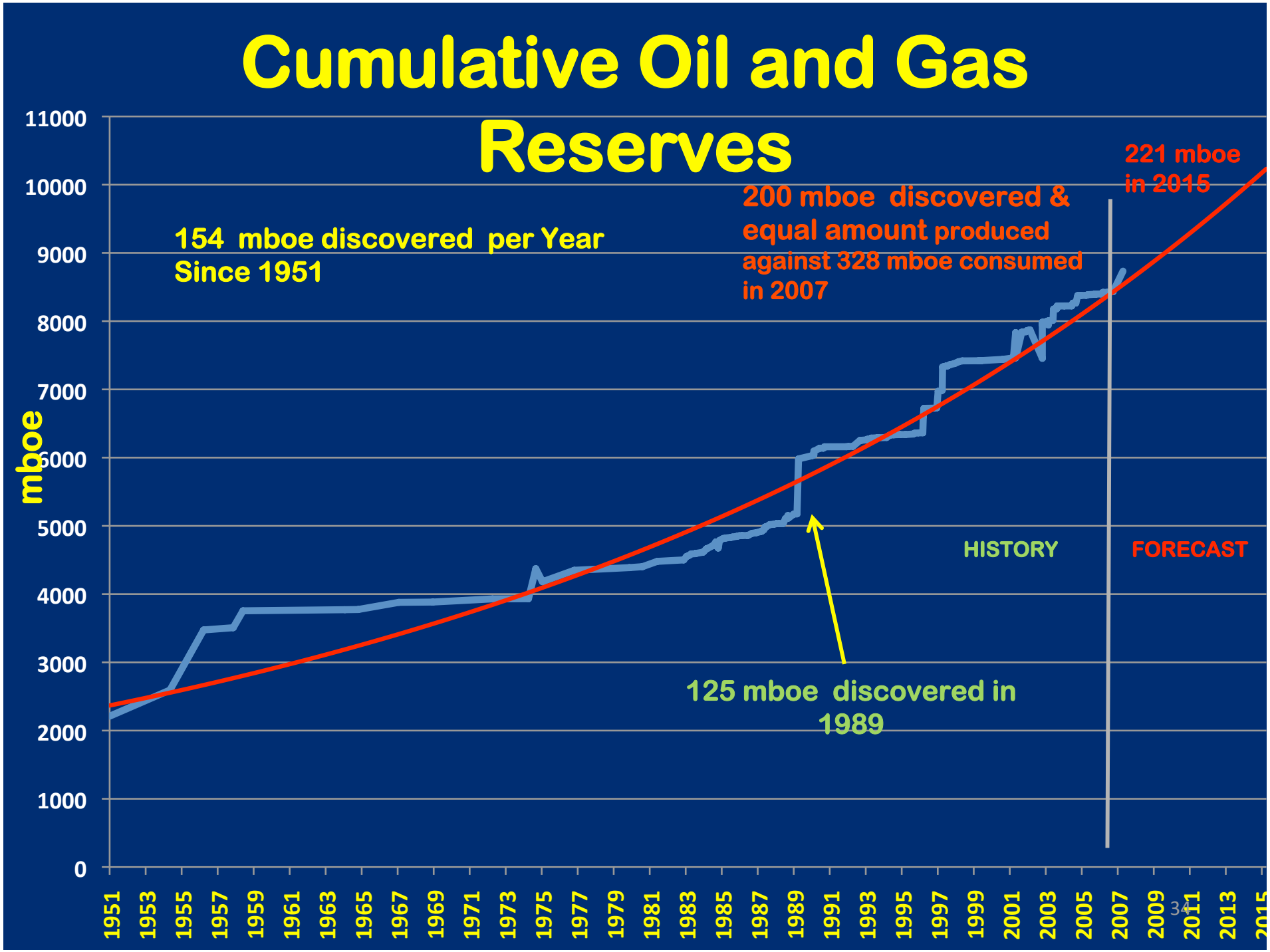
Shortfall in indigenous energy presents an opportunity of importing optimum mix of fuels for minimizing cost and maximizing end-use efficiency: natural gas, LNG, LPG, coal, oil and hydroelectricity instead of oil alone as at present.

ENERGY SUPPLY-DEMAND GAP SUMMARY (IN %)

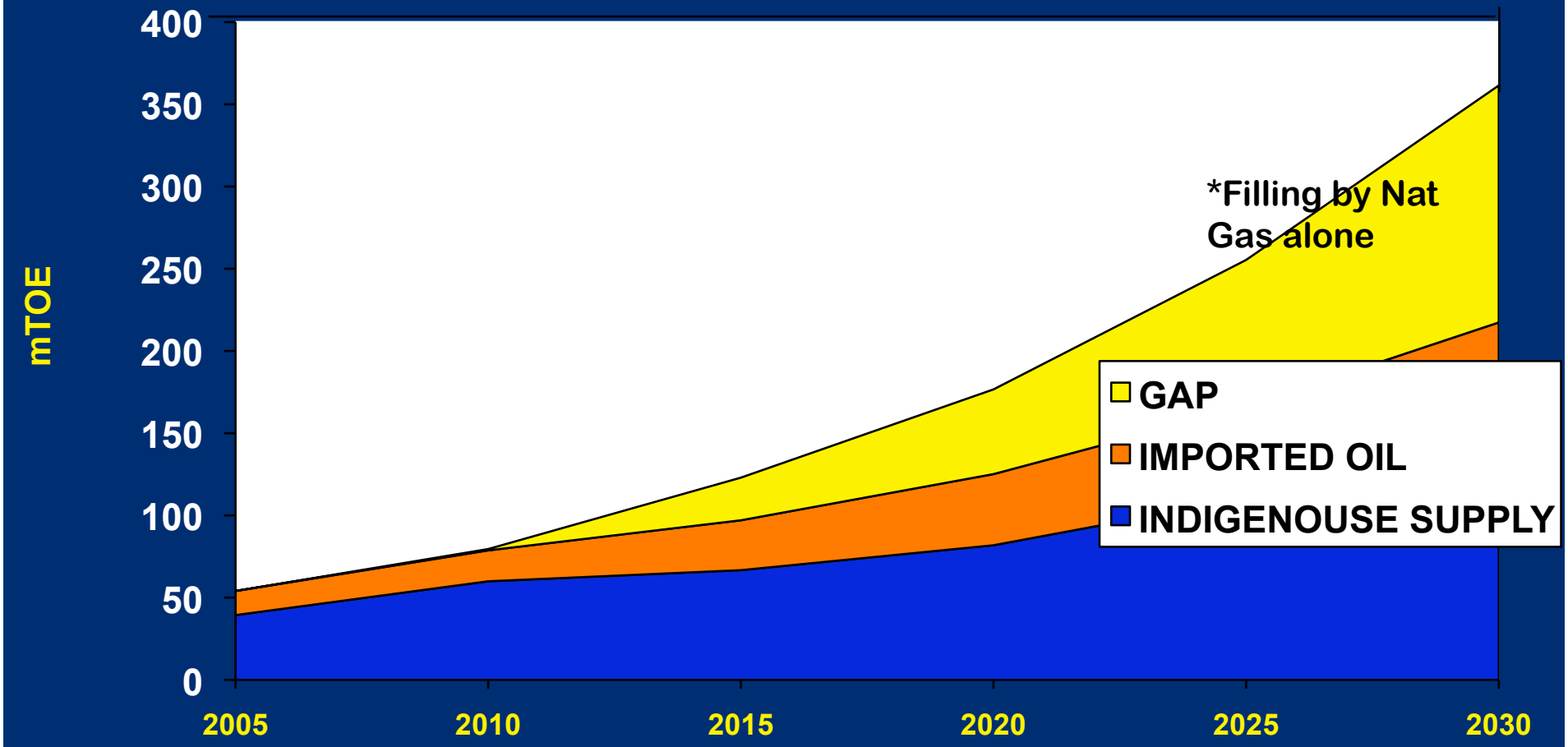
Year	2005	2010	2015	2020	2025	2030
INDIGENOUS SUPPLY	39.4	59.9	66.7	81.8	110.4	153.7
IMPORTED OIL	14.6	18.8	30.3	43.3	55.7	63.5
IMPORTED COAL	1.0	2.0	2.0	2.0	2.0	2.0
GRAND TOTAL	54.0	80.7	99.0	127.1	168.2	219.3
DEMAND	53.8	79.5	123.0	176.6	255.4	361.5
GAP	0.0	0.8	25.9	51.5	89.2	144.1

Indigenous Energy Growth Targets

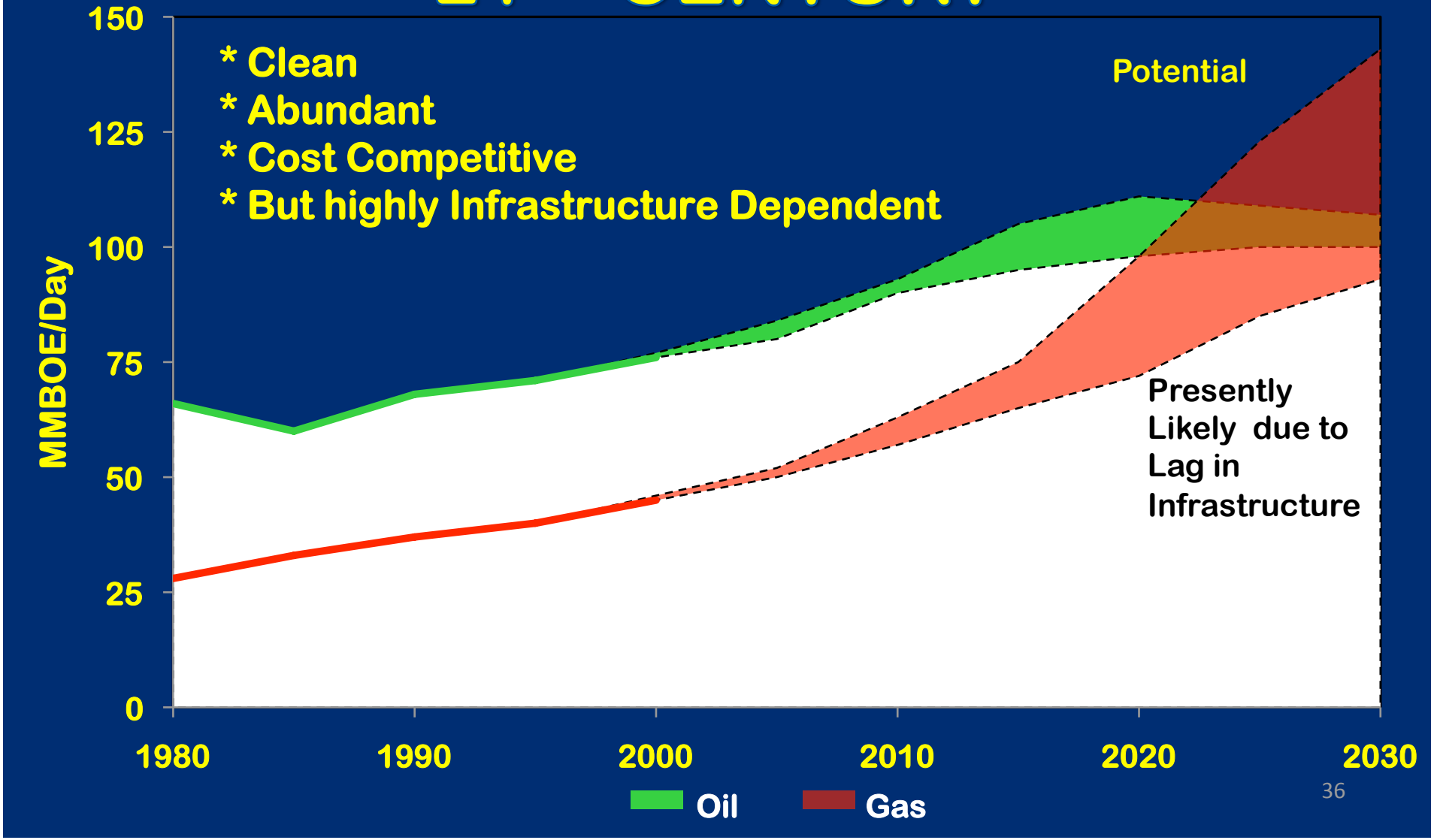



Cumulative Oil and Gas Reserves
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mboe
154 mboe discovered per Year
Since 1951
200 mboe discovered &
equal amount produced
against 328 mboe consumed
in 2007
221 mboe
in 2015
HISTORY
FORECAST
125 mboe discovered in
1989
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015

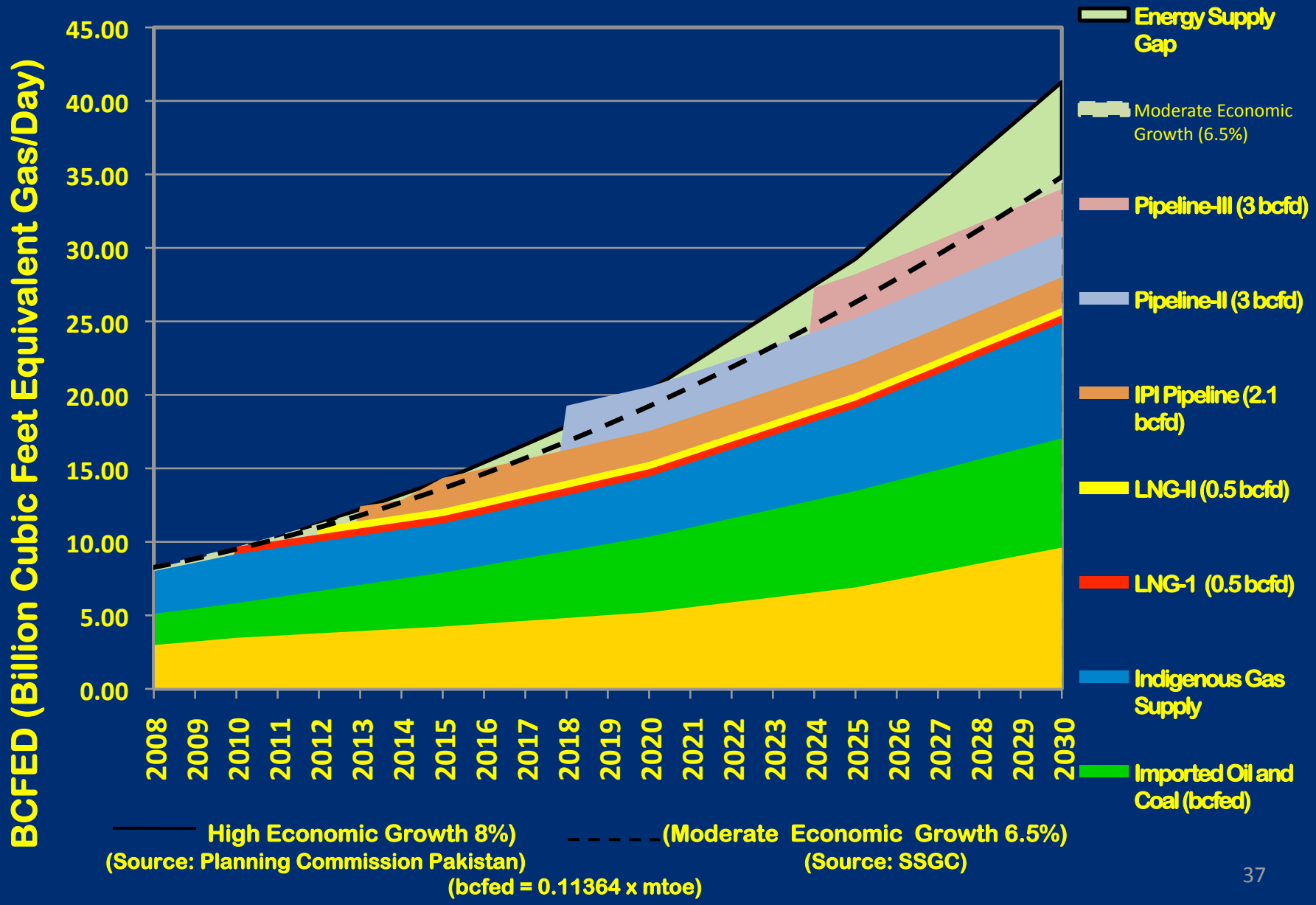
ENERGY SUPPLY-DEMAND GAP



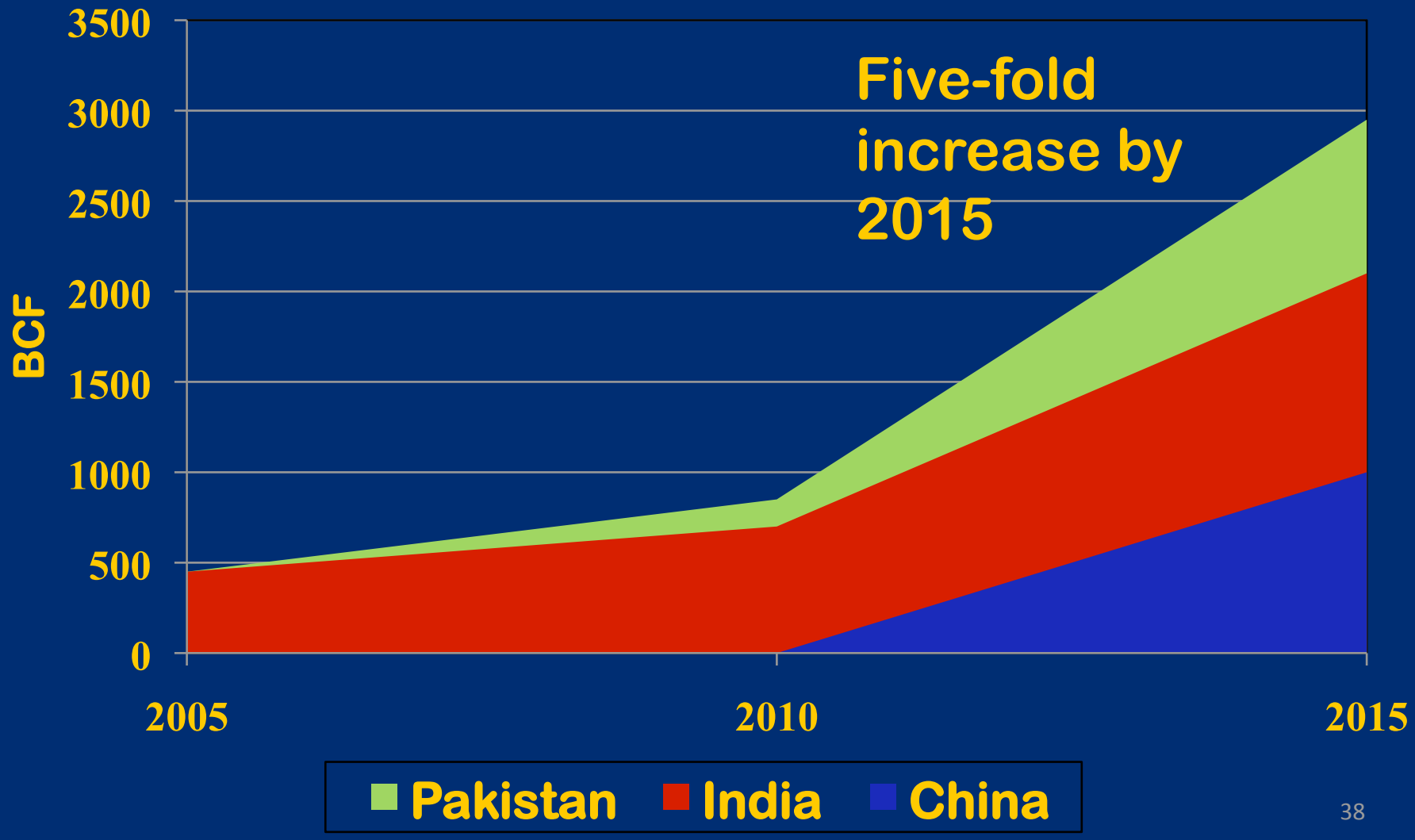
NATURAL GAS A FUEL OF 21ST CENTURY

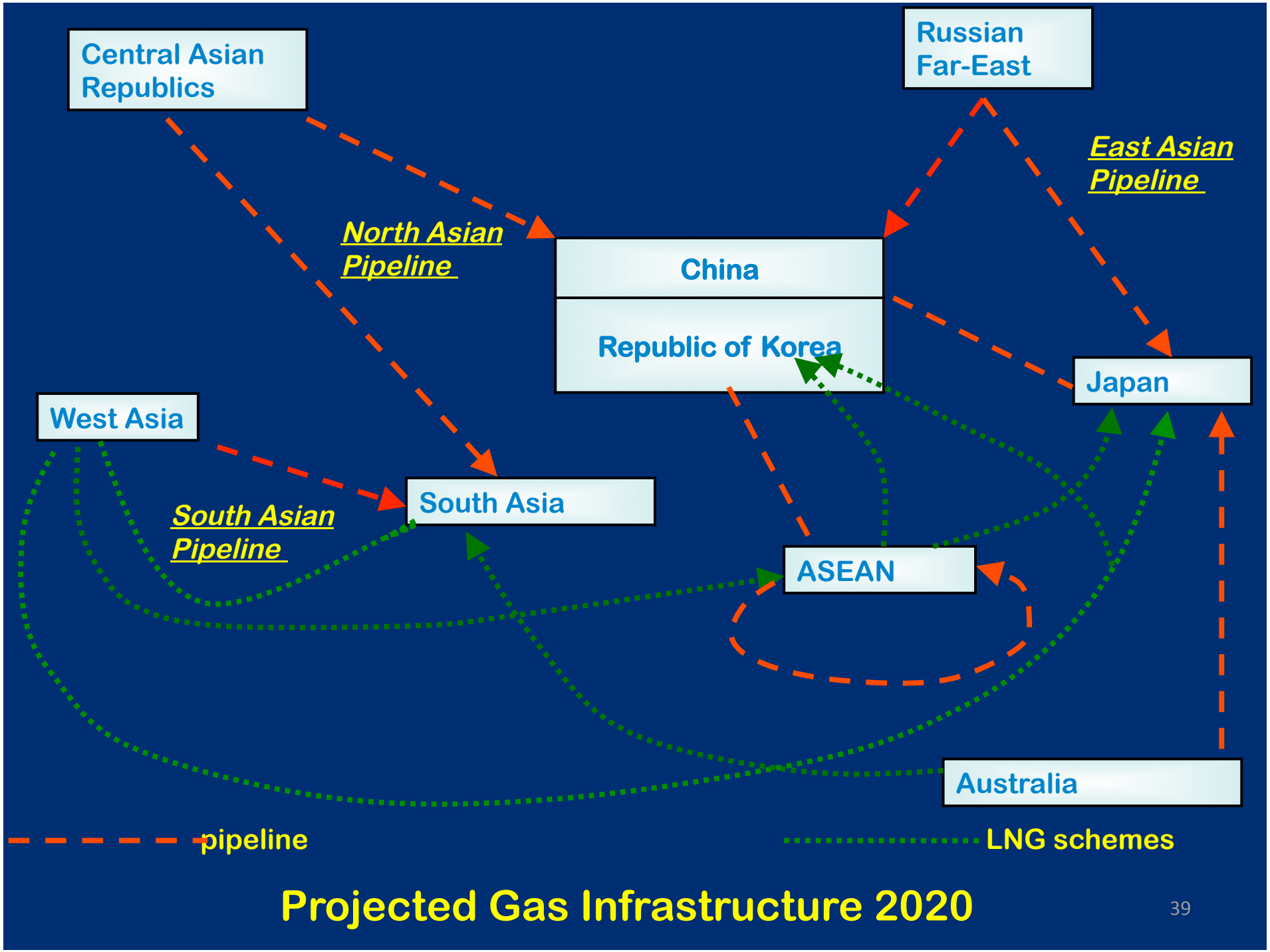


ENERGY DEMAND-SUPPLY FORECAST



REGIONAL DEMAND FOR GAS IMPORTS



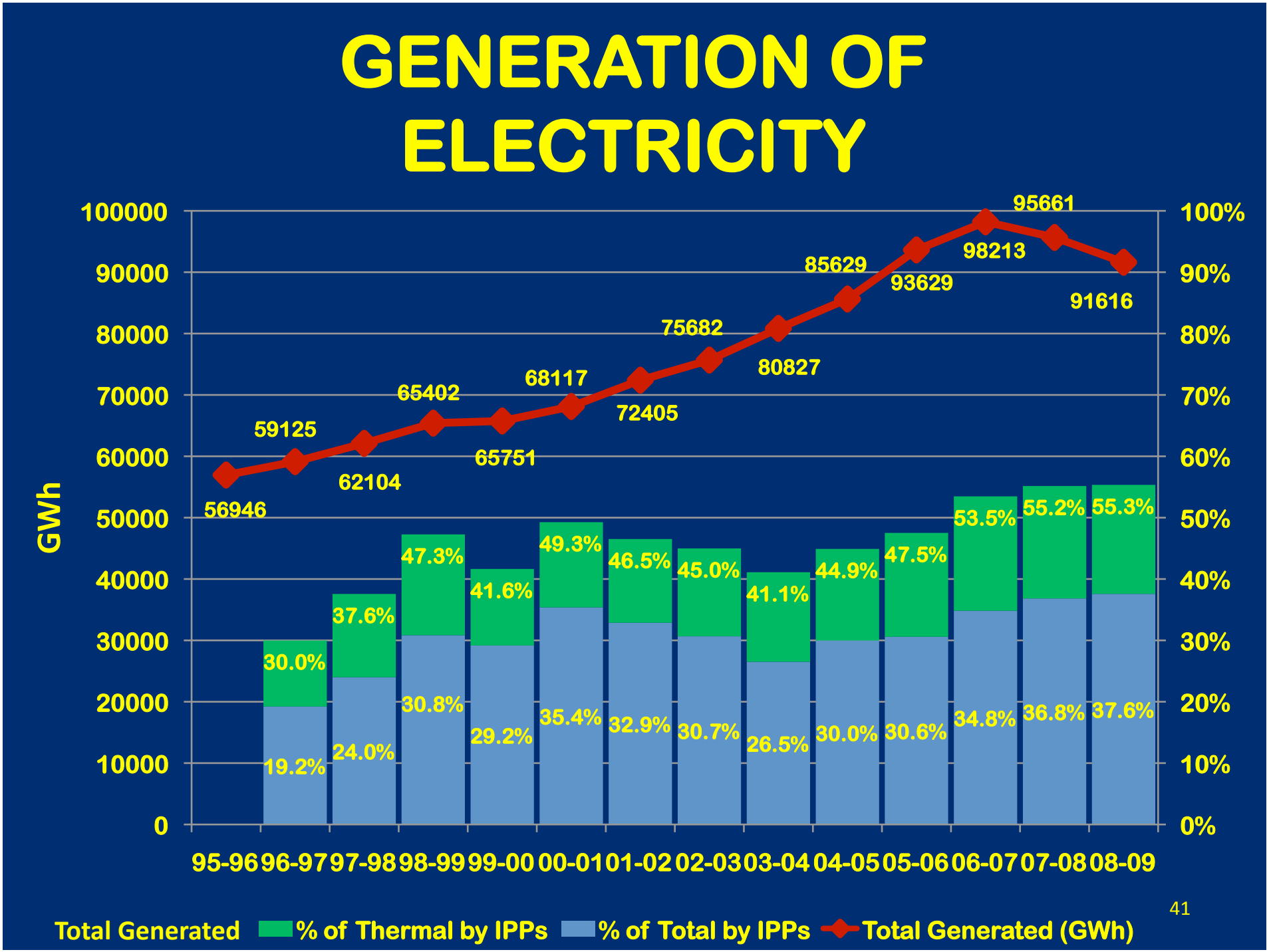


Projected Gas Infrastructure 2020

CIVIL NUCLEAR POWER IMPERATIVE

- Pakistan critically needs access to modern and economy of scales civil nuclear power technology to close its projected energy gap

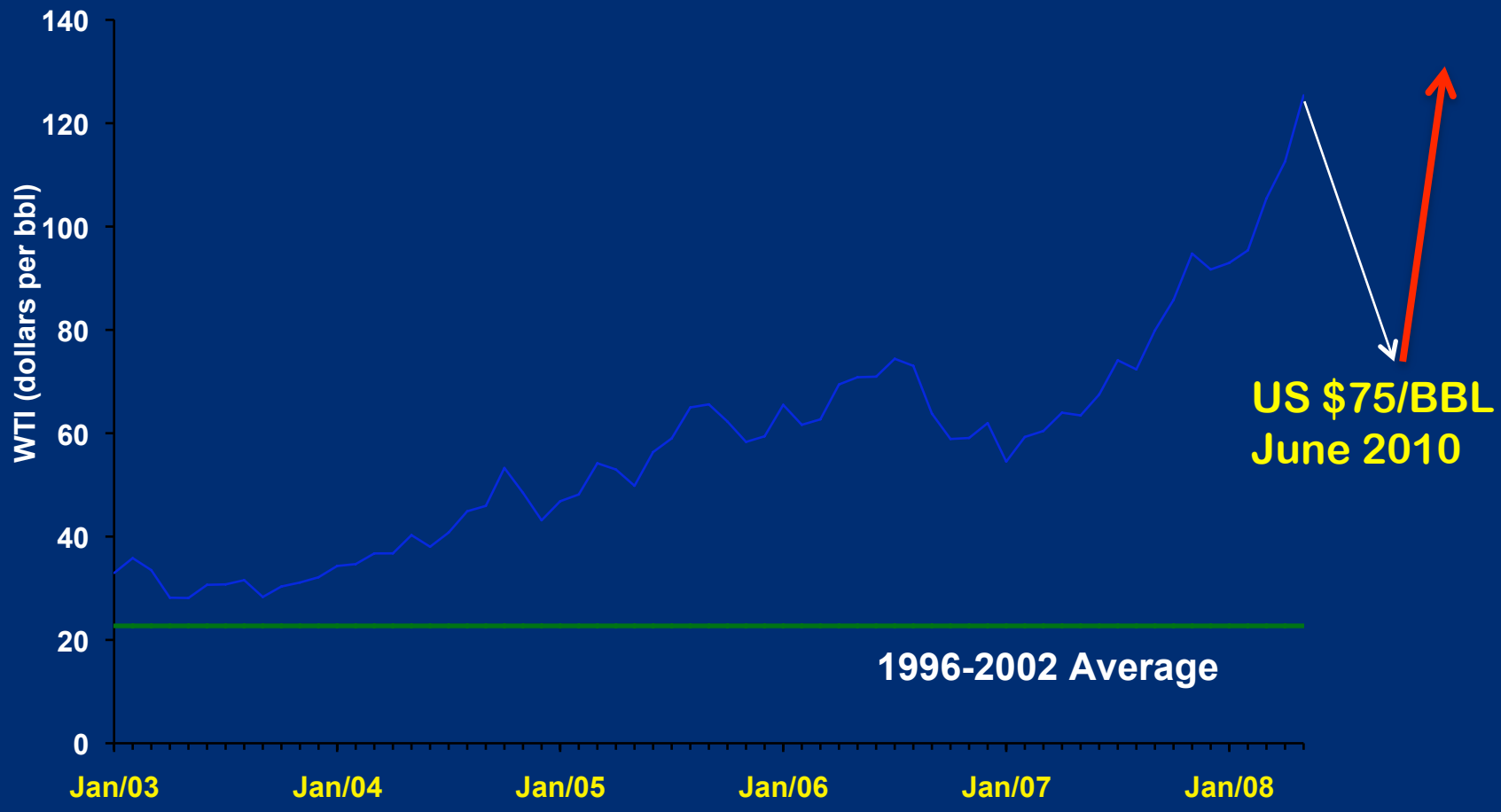
GENERATION OF ELECTRICITY



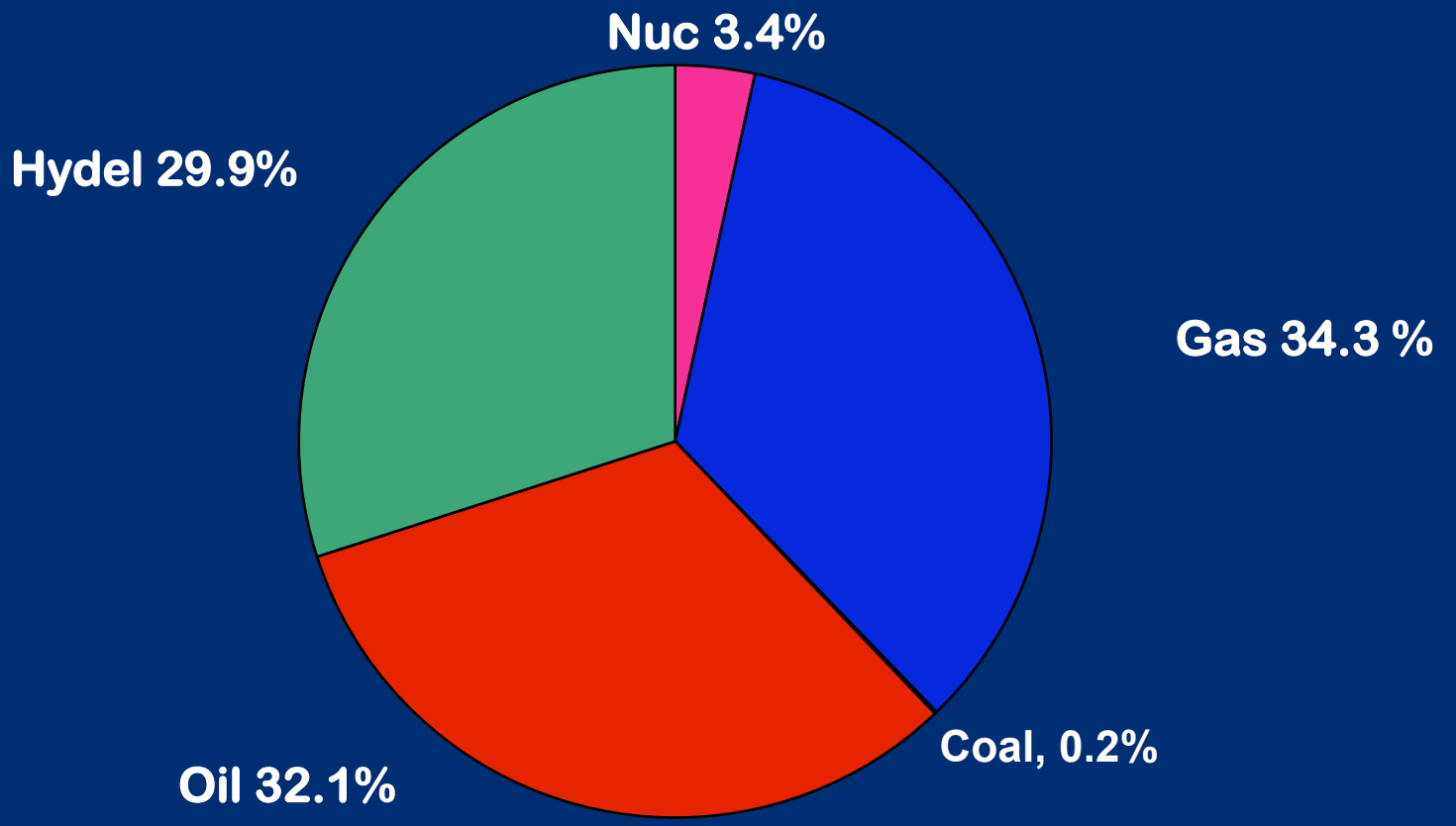
PER CAPITA CONSUMPTION 2008-09

PAKISTAN	450 UNITS
INDIA (2006-457)	612 UNITS
WORLD AVG.	2,516 UNITS
MALAYSIA	3,166 UNITS

Oil Price Increase (300% since Jan 2003)



ELECTRICITY GENERATION 2007-08
Total: 95,860 GWh



Oil Generation
USA: 2.8%
India: 1.0%

*
40% of Total Oil is Consumed in Power Generation

EXISTING GENERATING CAPACITY (Oct, 2010)

Types of Generation	Nameplate / Installed Capacity (MW)	Derated / Dependable Capacity (MW)	Availability (MW)	
			Summer	Winter
WAPDA Hydro	6444	6444	6250	2300*
GENCOs	4829	3580	2780	3222*
IPPS (incl Nuclear)	7911	7695	5750	6900**
Rental	62	60	60	60
Total	**19246**	**17779**	**14840**	**12482**

*Hydro Availabity based on last 5 years average

** Excludes 10% Forced Outages for GENCOs & 6.0% for IPPs & Rental

OVERALL PERFORMANCE

ITEM	FY2003	FY2004	FY2005	FY2006	FY2007	FY 2008	FY 2009 ACHIEVEMENT Jul08-Mar09
GENERATION (MkWh) (%age Change)	64,038	69,091 (7.9%)	73,521 (6.4%)	82,225 (11.8%)	87,837 (6.8%)	86,141 (-1.9%)	61,318 (-5.0%)
PEAK DEMAND* (MW) (%age Change)	11044	11598 (5.0%)	12595 (8.6%)	13847 (9.9%)	15838 (14.4%)	17398 (9.8%)	17852 (11.2%)
LOSSES (%age) (%age Change)	24.4%	23.9% (-0.5%)	22.9% (-1.0%)	22.4% (-0.5%)	21.5% (-0.9%)	21.3% (-0.2%)	19.8 (-0.5%)
REVENUE (Rs. in billion) (%age Change)	200	220 (10.0%)	231 (5.0%)	257 (11.3%)	281 (9.3%)	307 (9.2%)	253.2 (14.7%)
CUSTOMERS (in million) (%age Change)	13.3	14 (5.3%)	14.9 (6.4%)	15.9 (6.7%)	17.0 (6.9%)	18 (5.9%)	18.5 (4.6%)
VILLAGES ELECTRIFIED (yearly addition)	73,829 (2246)	81,022 (7193)	90,489 (9467)	103,253 (12764)	117,499 (14246)	127,940 (10441)	133,506 (5566)

*Computed Peak Demand including load shedding and export to Karachi

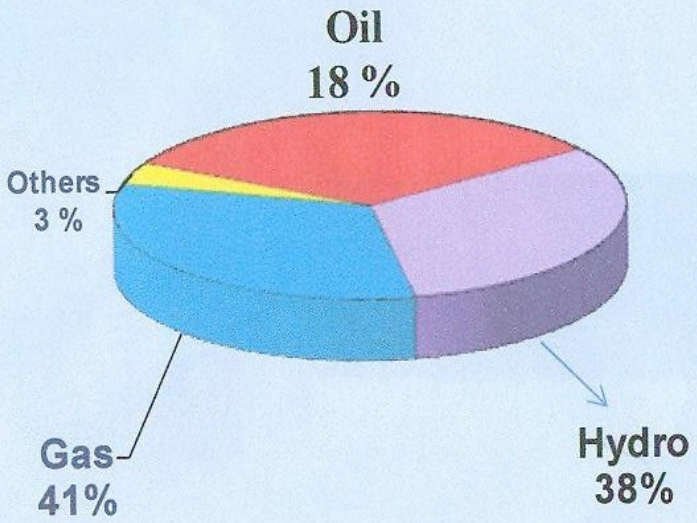
Demand & Supply Position (2002 – 2008)

(All Figures in MW)

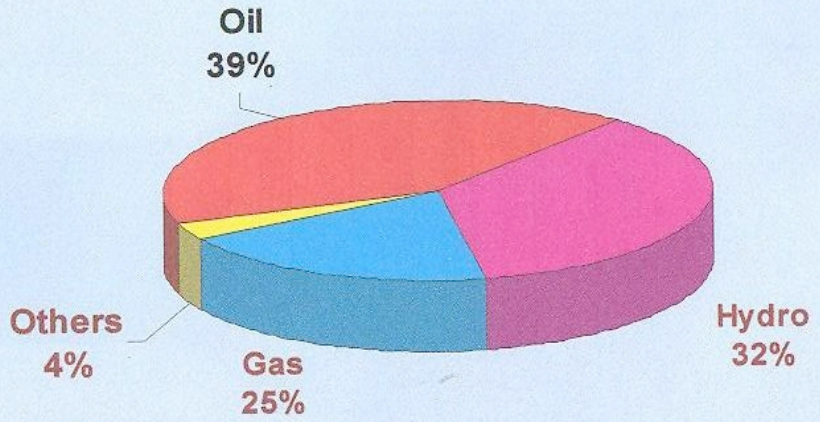
Year	Computed Peak Demand *	Corresponding Supply	Surplus/ Shortfall
2001	10459	10894	435
2002	11044	10958	-86
2003	11598	11834	236
2004	12595	12792	197
2005	13847	12600	-1247
2006	15838	13292	-2546
2007	17398	12442	-4956
2008	17852	13637	-4215

ELECTRICITY GENERATION BY FUEL (excluding KESC) (2006-2007) & (2009-2010)

Jul 06 - Jun 07



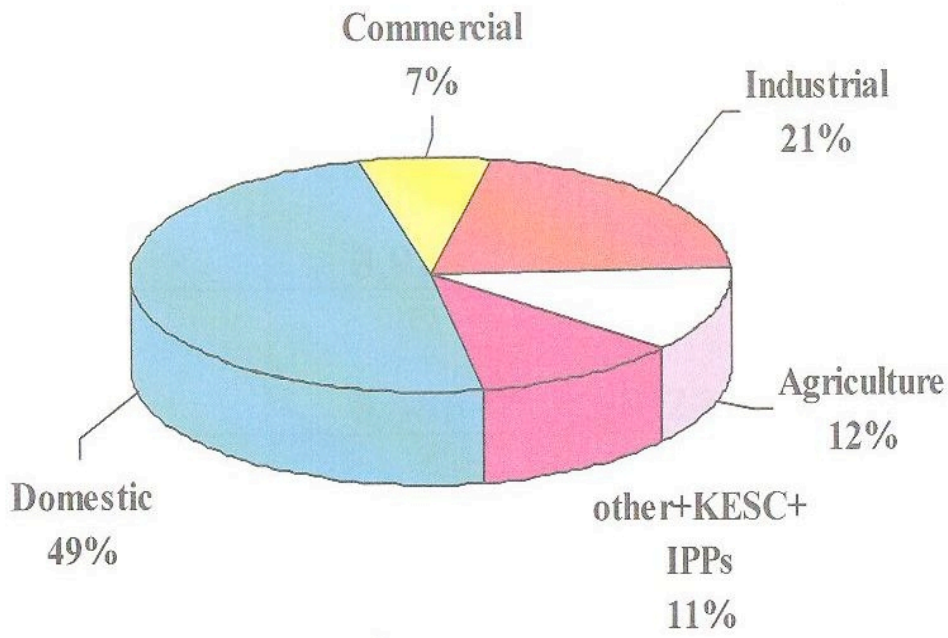
Jul 09 – June 10



Source: Central Power Purchasing Agency

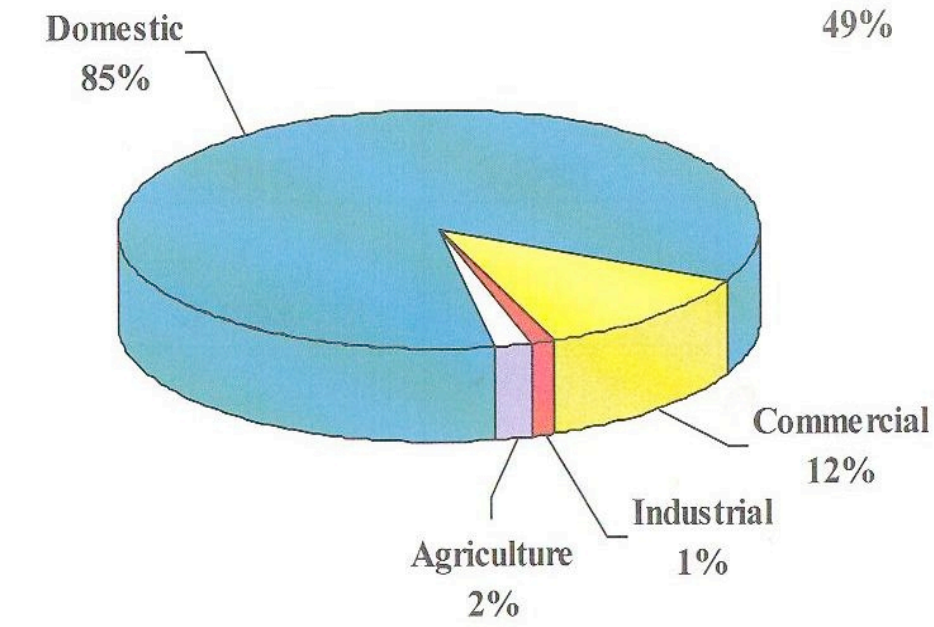
CONSUMPTION PATTERN

Jul – Aug 2010

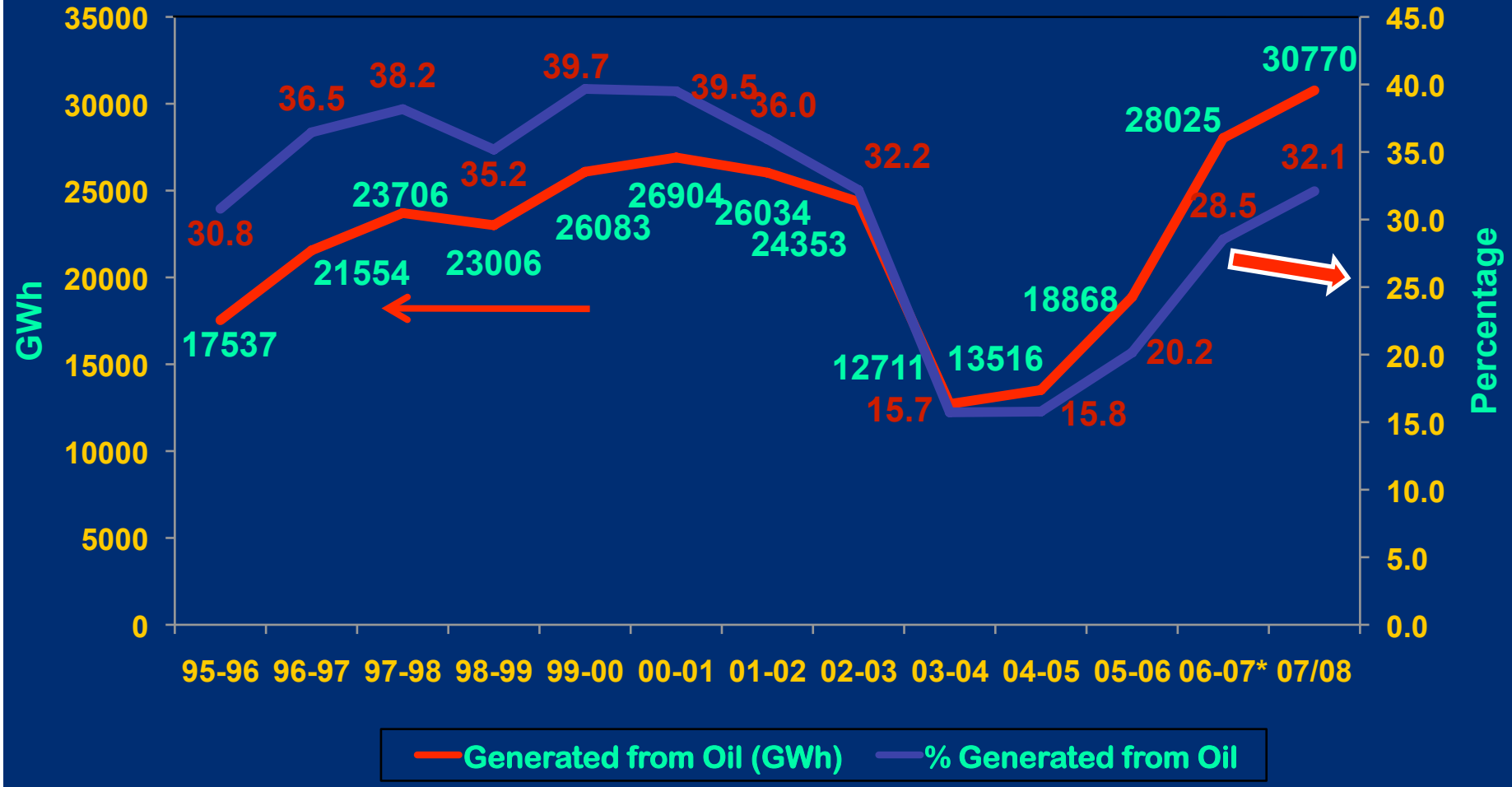


CUSTOMERS PATTERN

Jul – Aug 2010



OIL FUELLED ELECTRICITY GENERATION IN PAKISTAN

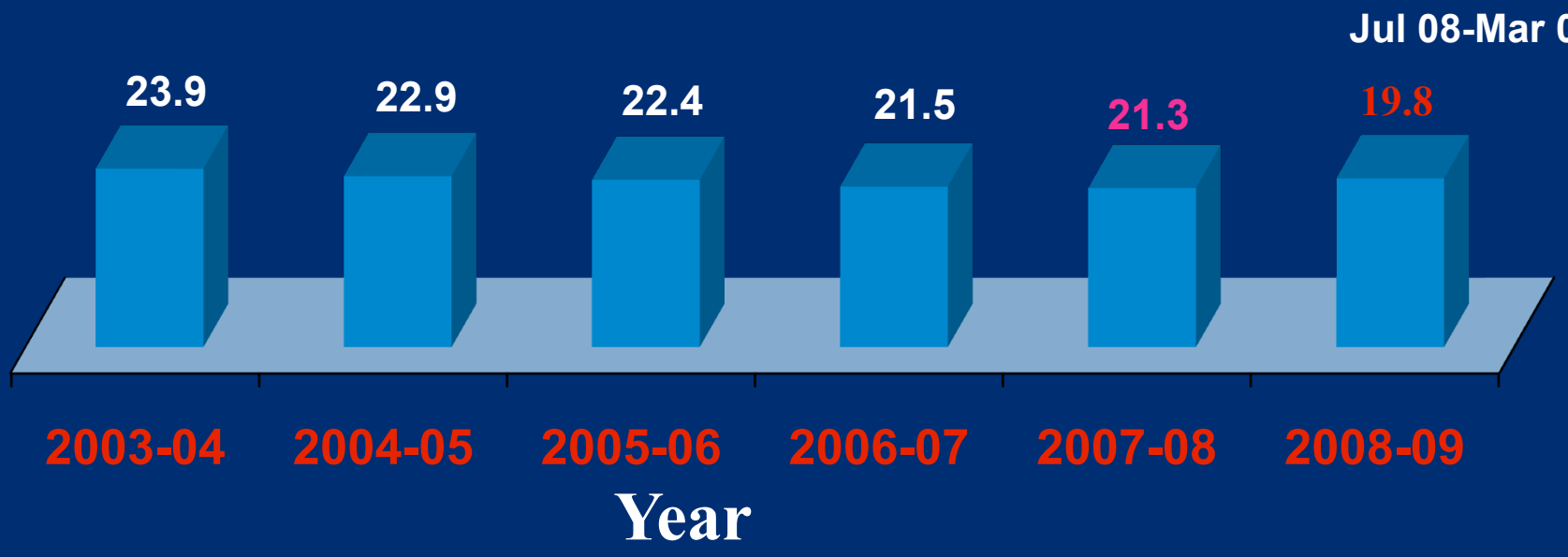


*40% of Total Oil is Consumed in Power Generation

OVERVIEW OF PERFORMANCE

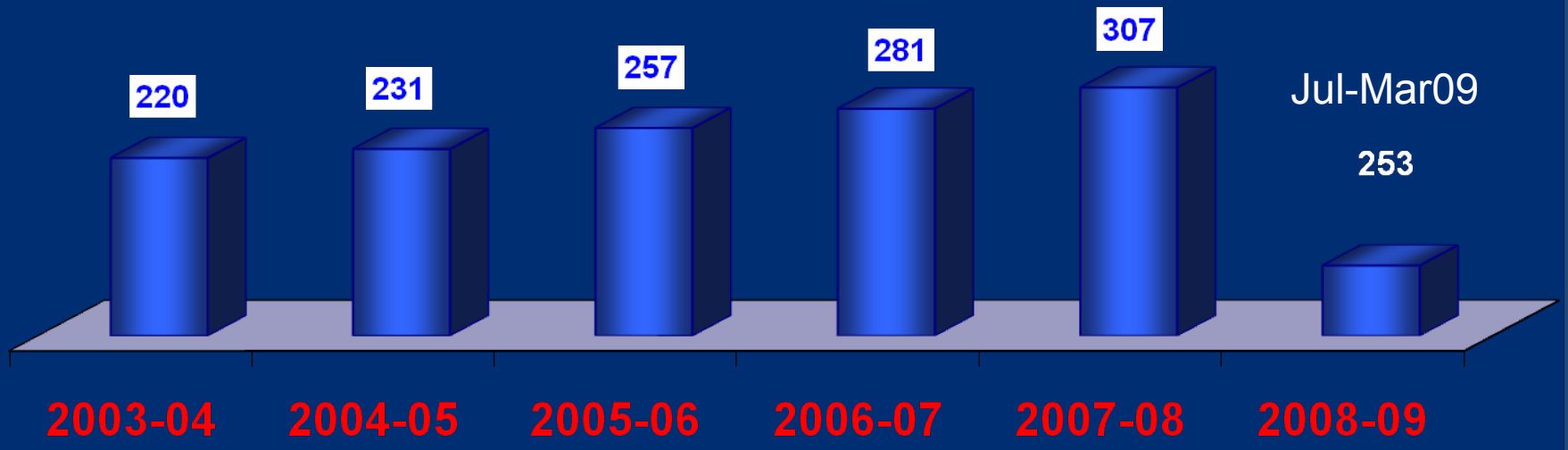
Transmission & Distribution Losses

(% age)

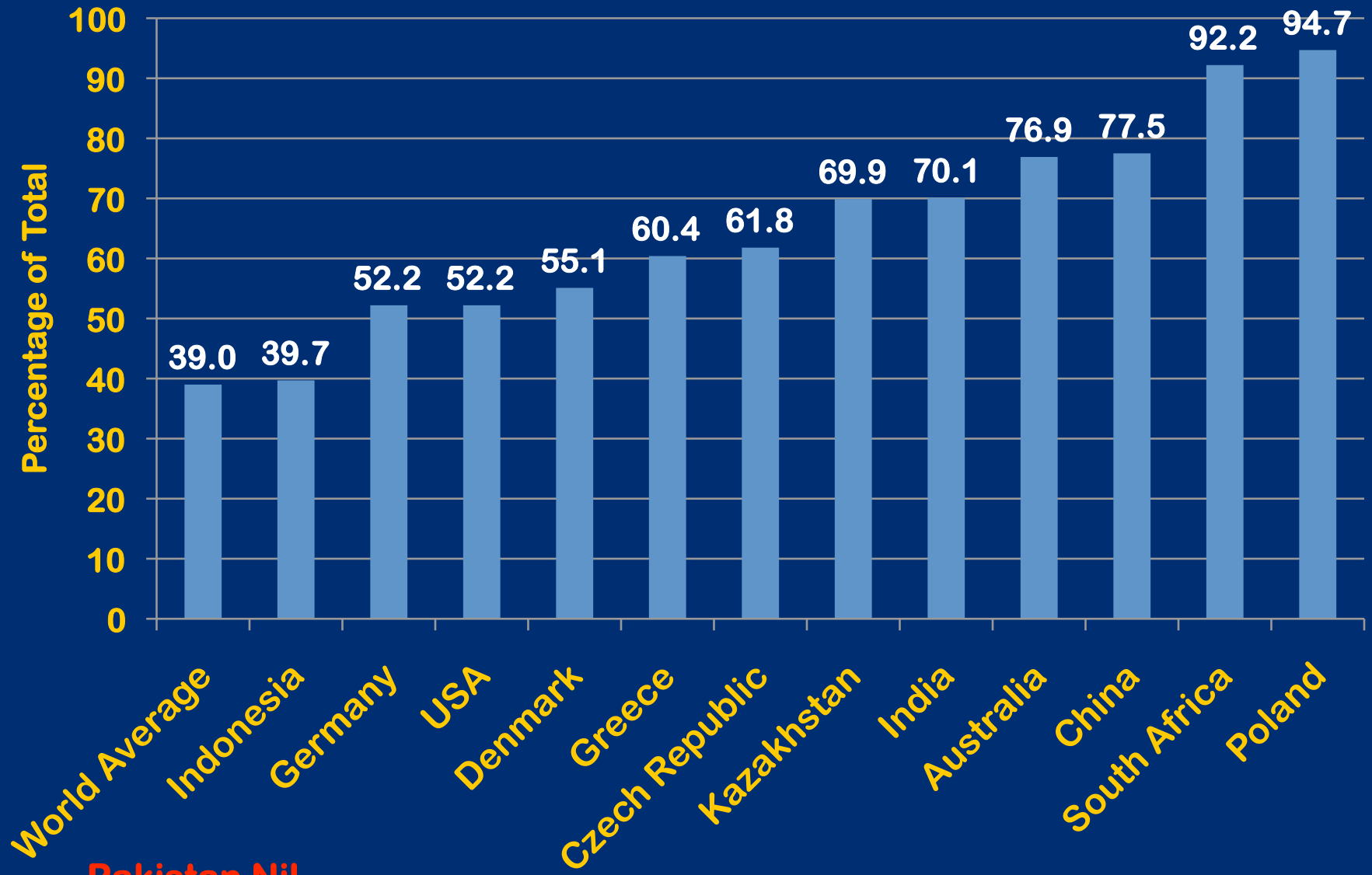


OVERVIEW OF PERFORMANCE

Revenue
(Rs. Billion)



COAL FUELED ELECTRICITY* GENERATION



Pakistan Nil

*Cheaper than oil and even gas

REVIEWING THE WATER SITUATION

1.	Total System Inflows (Average Post Tarbela period)(1976-77 to 2008-09)	=	138.92 MAF
2.	Total Canal withdrawals (Average Post Tarbela period)(1976-77 to 2008-09)	=	104.23 MAF
3.	Live Storage available for System Inflows in Tarbela	=	11.58 MAF
	Mangla and Chashma	8.3% of total system inflows	
4.	Reduction in Live Storage due to Siltation	=	4.18 MAF (27%)

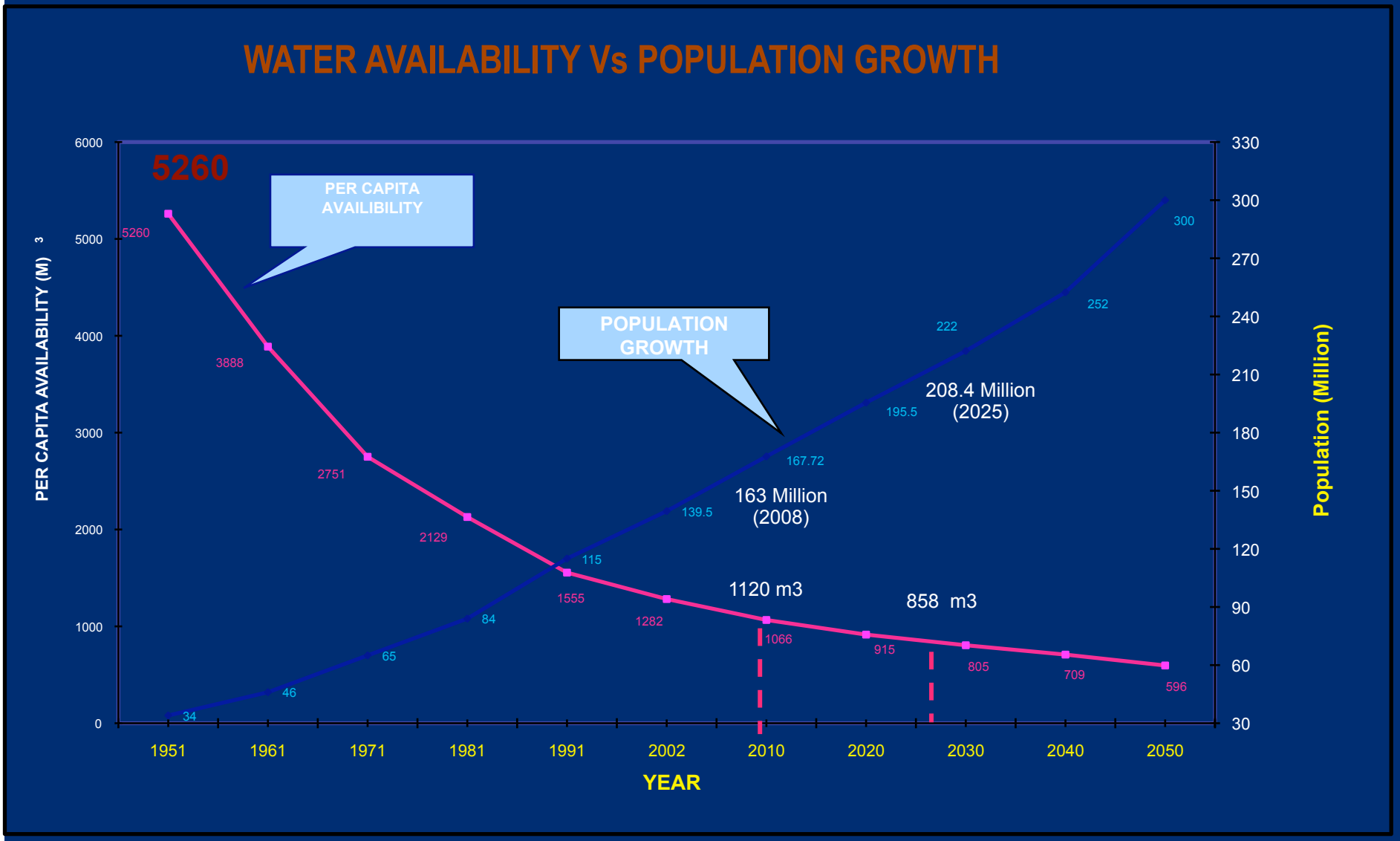
Cont .....

5.	Escapages below Kotri (33 years) (1976 to 2009)	=	31.5 MAF
6.	Escapages below Kotri (Last 10 years Avg.) (2000 to 2009)	=	10.2 MAF
7.	System Losses of the Indus Basin	=	15% to 20%
8.	Water Shortage during Rabi 2009-2010	=	32%

PAKISTAN'S HYDROPOWER POTENTIAL (RIVERWISE SUMMARY)

Sr.	River/ Tributary	Power (MW)
1.	Indus River and Tributaries	43786
2.	Jhelum River (Kunar, Neelum, Poonch, etc.)	6891
3.	Swat River & Tributaries	2371
4.	Chitral River & Tributaries	2282
5.	Schemes < 50 MW on Tributaries	1055
6.	Schemes < 50 MW on Canals	408
Grand Total		56793

WHERE DOES PAKISTAN STAND IN WATER AVAILABILITY vis-a-vis POPULATION



As per global criteria, 1000 m^3 per capita is the threshold value

PAKISTAN'S NEED FOR LARGE DAMS

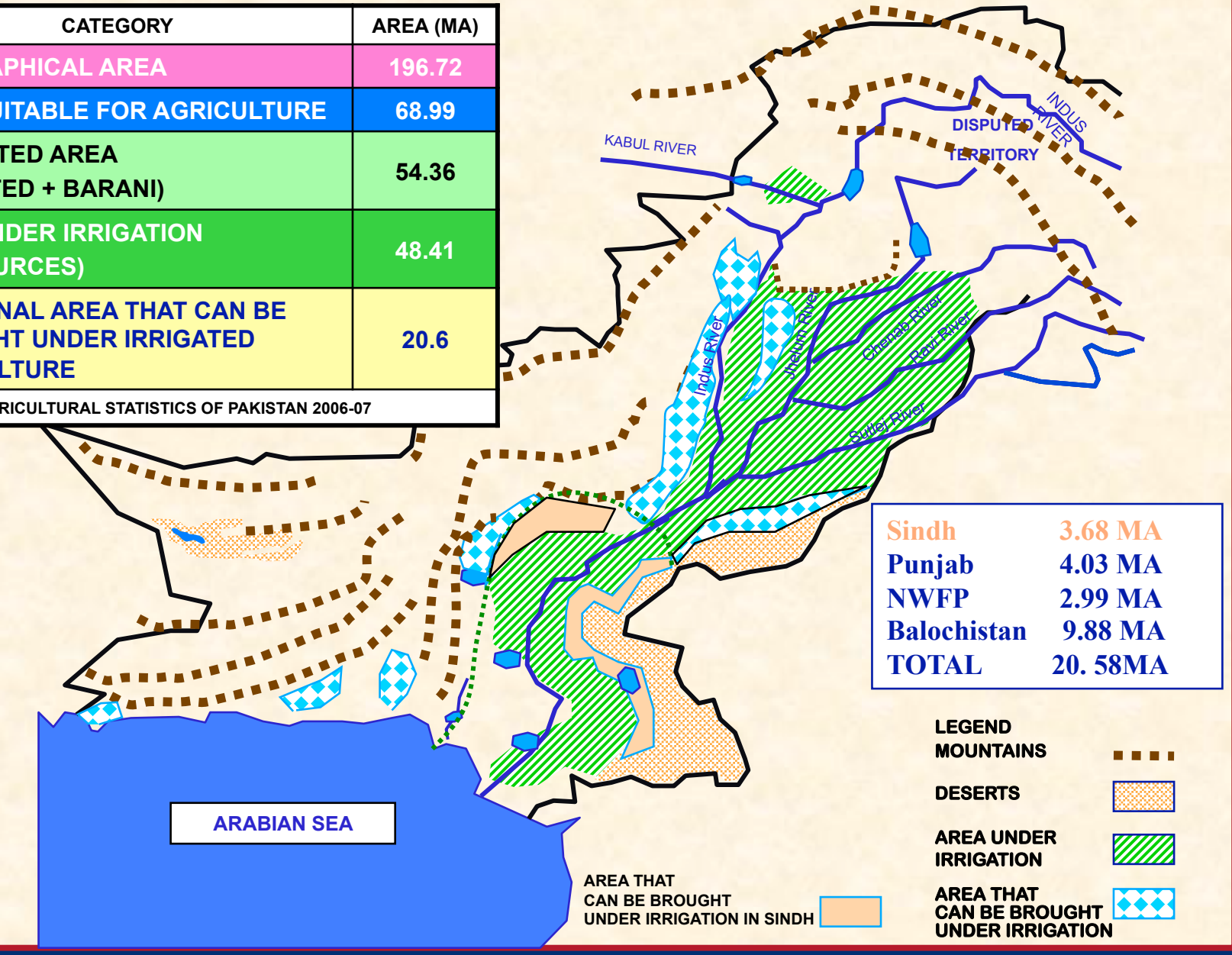
- WATER SCARCE COUNTRY AS PER GLOBAL CRITERIA – 1000 m^3/Capita
- RAPIDLY INCREASING POPULATION – 173 Million (2008); 208 Million (2025)
- DEPLETING ON-LINE STORAGES – 28% Silted
- CHEAP HYDROPOWER (Rs. 1.07 per unit / Thermal Rs. 8.55 per unit)
- LARGE ESCAPAGES OF UNCONTROLLED FLOOD TO SEA – average 32 MAF

- EFFECTIVE RIVER REGULATION AND INTEGRATION OF EXISTING IRRIGATION SYSTEM
- NON-PERENNIAL CANALS WOULD BECOME PERENNIAL CANALS
- IMPROVEMENT OF DOMESTIC WATER SUPPLIES

LAND USE IN PAKISTAN

CATEGORY	AREA (MA)
GEOGRAPHICAL AREA	196.72
AREA SUITABLE FOR AGRICULTURE	68.99
CULTIVATED AREA (IRRIGATED + BARANI)	54.36
AREA UNDER IRRIGATION (ALL SOURCES)	48.41
ADDITIONAL AREA THAT CAN BE BROUGHT UNDER IRRIGATED AGRICULTURE	20.6

SOURCE: AGRICULTURAL STATISTICS OF PAKISTAN 2006-07



AVERAGE ANNUAL FLOW AND STORAGE CAPACITY OF DAMS OF SOME MAJOR RIVER BASINS

Sr. #	River Basin	Average Annual flow (MAF)	No. of Dams	Storage Capacity (MAF)	% age Storage
1	Colorado	12	3	59.62	497
2	Nile	47	1	132	281
3	Sutlej Bias India (Total)	32 750	5 4,636	11.32 245	35 33
4	Yellow River	345	7	68.95	20
5	Columbia	179	3	34	19
6	Indus & others Rivers*	145	3	18.37	13
7	World	20,000	-	8,000	40

* Including seepage and evaporation

RESERVOIR SEDIMENTATION (MAF)

RESERVOIR	GROSS STORAGE CAPACITY		GROSS STORAGE LOSS		
	ORIGINAL	YEAR 2008	YEAR 2008	YEAR 2012	YEAR 2025
TARBELA	11.62 (1974)	8.07 (69%)	3.55 (31%)	3.97 (34%)	5.33 (46%)
MANGLA	5.88 (1967)	4.67 (79%)	1.21 (21%)	1.32 (23%)	1.71 (34%)
CHASHMA	0.87 (1971)	0.50 (57%)	0.37 (43%)	0.41 (48%)	0.54 (63%)
TOTAL	18.37	13.24 (72%)	5.13 (28%)	5.71 (31%)	7.58 (41%)

MAJOR DAMS (200 FT. OR HIGHER) UNDER CONSTRUCTION IN 2006 IN SOME COUNTRIES

Country	No. of Dams
CHINA	95
TURKEY	51
INDIA	10
IRAN	48
JAPAN	40
PAKISTAN	2

Source: The International Journal on Hydropower & Dams 2006

MAJOR WAPDA PROJECTS UNDER EXECUTION
STORAGE DAMS

S #	Name of Project	PC-I Cost (Rs. in Million)	Storage (MAF)		Irrigated Area (Acres)	Hydropower (MW)	Physical Progress/ Completion
			Live	Gross			
1.	MANGLA DAM RAISING	62553 (101384)	Additional 2.88	-	-	644 GWh Additional	82.5% (June 2009)
2.	GOMAL ZAM DAM	12829	0.892	1.14	163,086	17.4	31.8 % (Oct 2010)
3.	MIRANI DAM	5811	0.152	0.302	33,200	-	Completed
4.	SABAKZAI DAM	1577	0.015	0.033	6,875	-	Completed
5.	SATPARA DAM	4397	0.051	0.093	15,536	15.8	79.1% (Sep 2009)
6.	Kurram Tangi Dam	17205	0.90	1.20	362,380 (Addl. 84,300)	83.4	Survey works started in North Waziristan Agency & Bannu area
	Total	104,372	4.890	2.768	580,577	116.6 MW & 644 GWh	

*Available Storage in Mangla, Tarbela, Chashma 13.24 MAF 2008

MAJOR PROJECTS UNDER IMPLEMENTATION

HYDROPOWER PROJECTS				
Sr #	Name of Project	PC-I Cost (Rs. Billion)	Hydropower (MW)	Status/Completion
1.	ALLAI KHWAR – Battagram, NWFP	8.578	121	34% (October 2011)
2.	KHAN KHWAR Besham, NWFP	5.363	72	60% (February 2010)
3.	DUBER KHWAR Kohistan, NWFP	9.754	130	55% (October 2010)
4.	JINNAH HYDROPOWER, Jinnah Barrage	7.680	96	66.1% (Feb 2010)
5	NEELUM JHELUM Neelum, AJK	130	969	• Contractor mobilized. Offices/ Roads under construction. (2016)
6	KURRAM TANGI Kurram, NWFP	19	83.4	• Survey works started in North Waziristan Agency & Bannu area
	Total	180.375	1471.4	

HYDROPOWER PROJECTS UNDER STUDIES BY WAPDA

Sr. No	Project	River	Location	Installed Capacity (MW)	Status / Study Completion	Approx Project Construction Cost (US$)
1	Diamer -Basha	Indus	Chilas / Kohistan	4500	Ready for construction.	11.3 billion
2	Golen Gol	Golen Gol -Mastuj	Chitral -Mastuj	106	Ready for construction.	130 million
3	Palas Valley	Chor Nullah	Pattan	621	Under study. March 2009	700 million
4	Spat Gah	Spat Gah	Pattan	610	Under study. March 2009	700 million
5	Kohala	Jhelum	Kohala	1100	Under study. Aug 2009	2.16 billion
6	Dasu	Indus	Dasu	4000	Under study. Oct 2009	
7	Bunji	Indus	Gilgit	5400	Under study. April 2010	6.5 billion
8	Phandar	Ghizar	Gilgit	80	Under study Dec 2010	6 billion
9	Basho	Basho	Skardu	28	Under study. Dec 2010	65 million
10	Keyal Khwar	Keyal Khwar	Pattan	122	Under study. Dec 2010	30 million
11	Lawi	Shishi	Darosh -Chitral	70	Under study. Dec 2011	160 million
12	Harpo	Harpo Lungma	Skardu	33	Under Study. Dec 2011	40 million
13	Thakot HPP	Indus	Thakot	2800	Under Study. Dec 2012	5 billion
14	Pattan	Indus	Pattan	2800	Under Study. Dec 2012	
15	Yulbo	Indus	Skardu	3000	Under Study. Dec 2016	6 billion
16.	Shyok	Shyok	Skardu	600	Under study.	1 billion
TOTAL				25270		44.9 billion

LIST OF HYDROPOWER PROJECTS WHICH CAN BE UNDERTAKEN FOR IMPLEMENTATION DURING NEXT FIVE YEARS

Sr. No.	Project	River	Location	Capacity (MW)	Likely Project Initiation
1.	Diamer Basha Dam	Indus	NA	4500	2009
2.	Kohala	Jhelum	AJK	1100	2010
3.	Dasu	Indus	NWFP	4000	2011
4.	Bunji	Indus	NA	5400	2011
5.	Munda	Swat	FATA/ NWFP	740	2011
6.	Patan	Indus	Punjab	3000	2013
7.	Others (Matiltan, Palas Valley etc.)		NWFP/ NA/AJK	1500	2011-2013
	Total			~ 20,000	

OIL GENERATION COST TREND

YEAR	FUEL COST/UNIT (Rs)	CAPACITY COST*/UNIT (Rs)	TOTAL (Rs)
1995	0.64	2.17	2.81
2000			6.55
2010	11.04	3.70	14.74

capacity payment @ $ 19,000/MW, Plant factor 60 %,furnace oli @ Rs. 2.9/kg in 1995 and Rs. 49/Kg in 2010

Distribution Losses W.R.T. Units Sent Out to Each Company
(132 KV & Below System)

Companies	2008-09			% age Losses 2008-09	Collection Inc.(2008-09) Dec.
	Units (M.kwh)				
	Received	Billed	Lost		
LESCO	15116.99	13167.62	1949.37	12.9	96%
GEPCO	6672.07	5956.52	715.55	10.7	95%
FESCO	9047.08	8089.18	957.9	10.6	97%
IESCO	8047.42	7200.81	846.61	10.5	97%
MEPCO	11146.69	9050.5	2096.19	18.8	96%
PESCO+TESCO	11684.82	7559.82	4125	35.3	87%
HESCO	7858.53	5128.24	2730.29	34.7	68%
QESCO	5144.88	4109.51	1035.37	20.1	80%
TOTAL DISCOs	74718.48	60262.2	14456.28	19.3	89%
KESC. Exp	5014.39	5014.39	0		29%
IPPs	9.93	9.93	0		
G.TOTAL	79742.8	65286.52	14456.28	18.1	

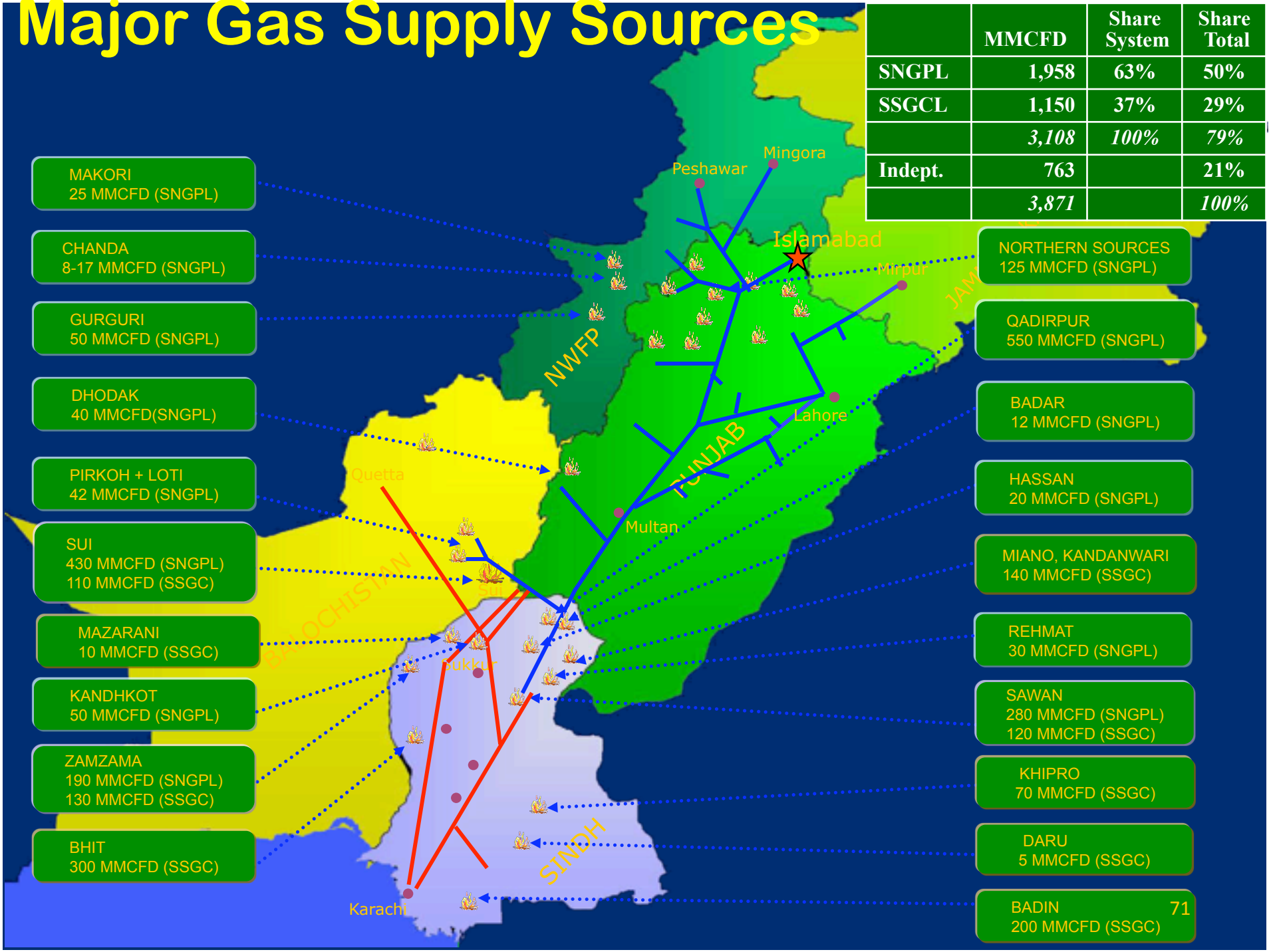
* + TRNSMISSION 3.0 %

21.3 %

Natural Gas

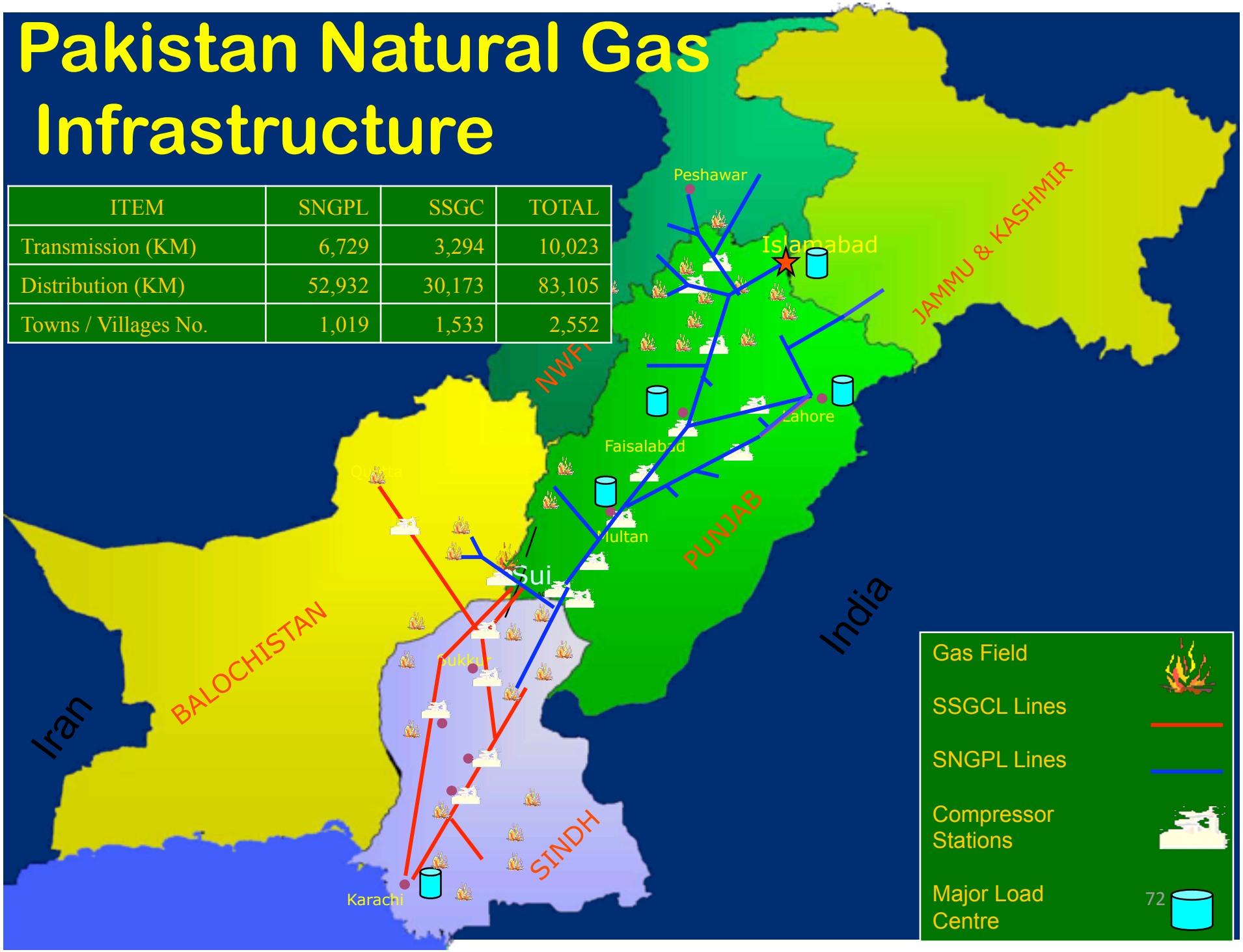
Major Gas Supply Sources

	MMCFD	Share System	Share Total
SNGPL	1,958	63%	50%
SSGCL	1,150	37%	29%
	3,108	*100%*	*79%*
Indept.	763		21%
	3,871		*100%*

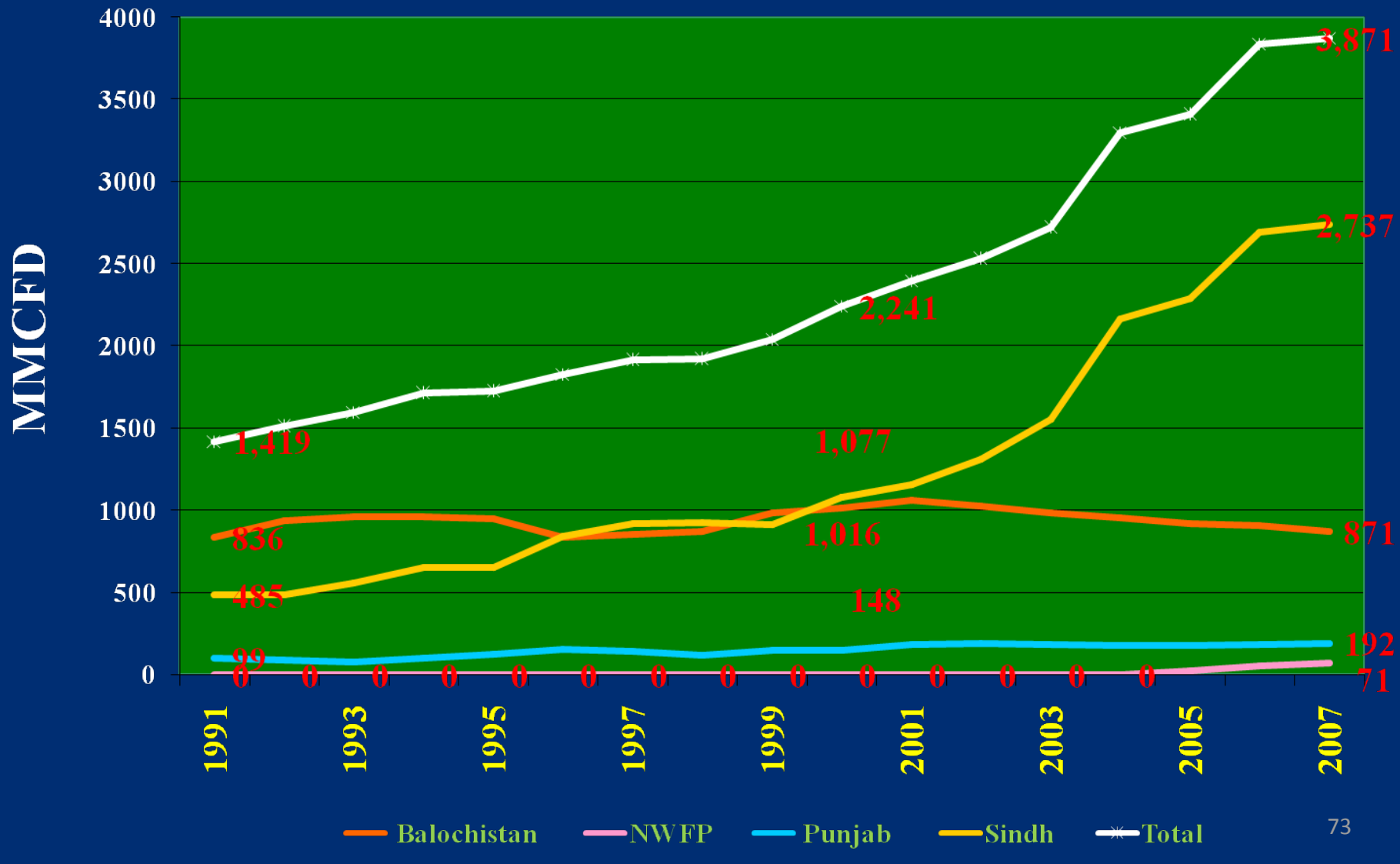


Pakistan Natural Gas Infrastructure

ITEM	SNGPL	SSGC	TOTAL
Transmission (KM)	6,729	3,294	10,023
Distribution (KM)	52,932	30,173	83,105
Towns / Villages No.	1,019	1,533	2,552

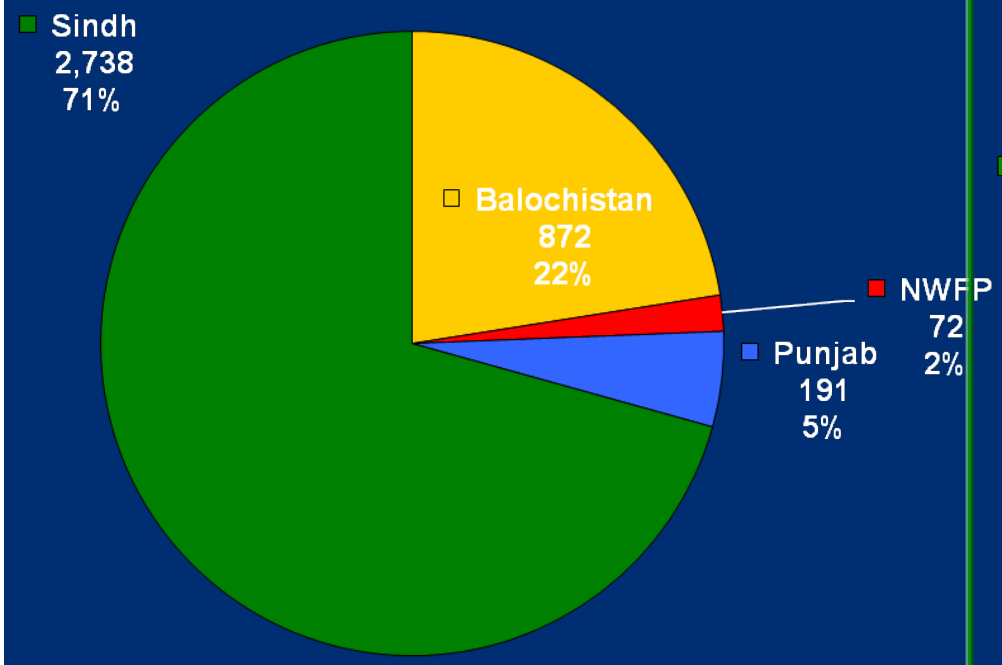


Provincial Share in Historical Gas Production



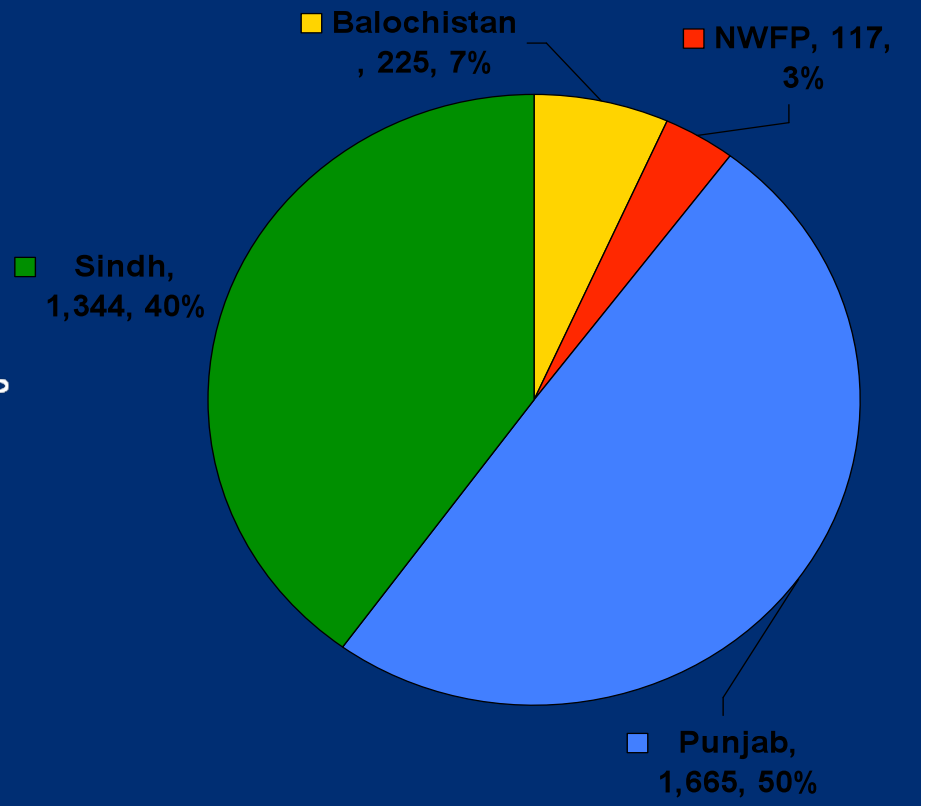
Provincial share 2006-07

Production



Total Gas Production : 1.414 TCF
(3,871 MMCFD)

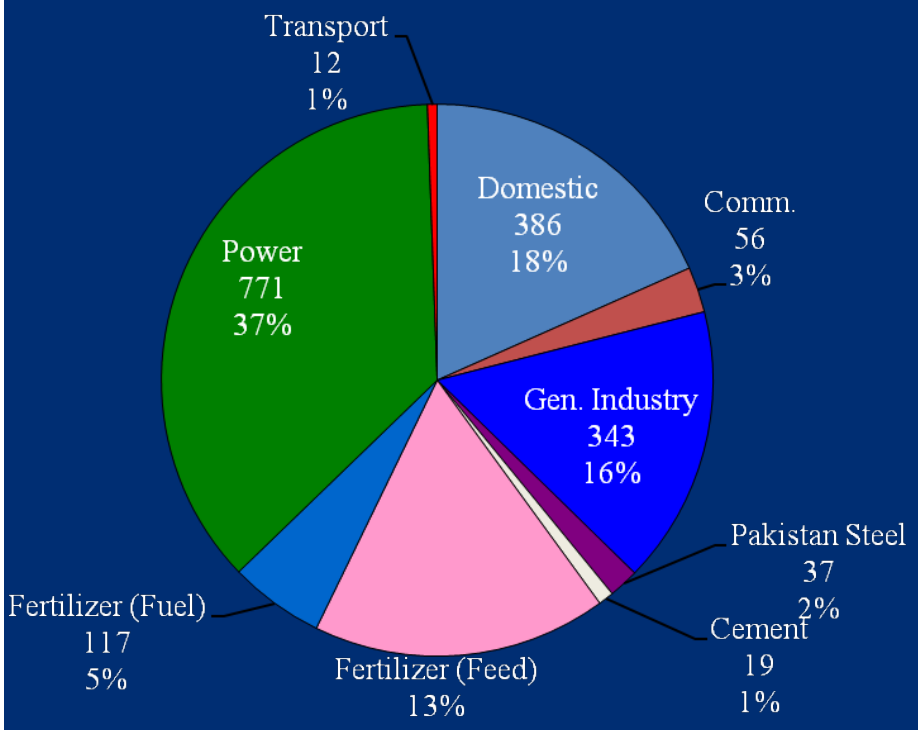
Consumption



Total Gas Consumption : 1.223 TCF
(3,351 MMCFD)

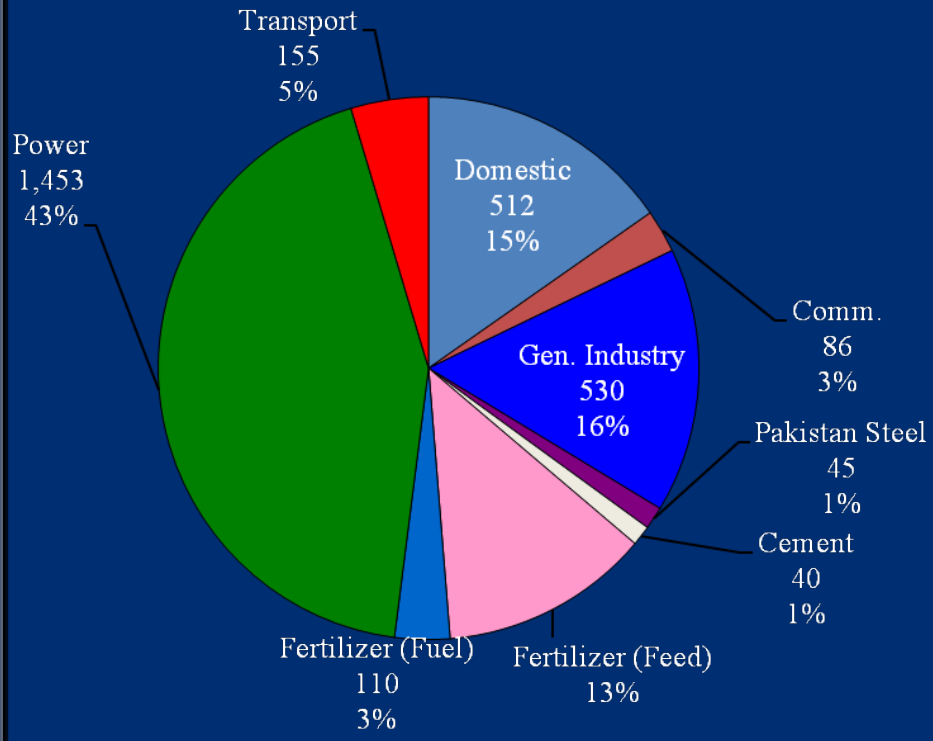
Sector-wise Gas Consumption (59% growth in 5 years)

2001-02



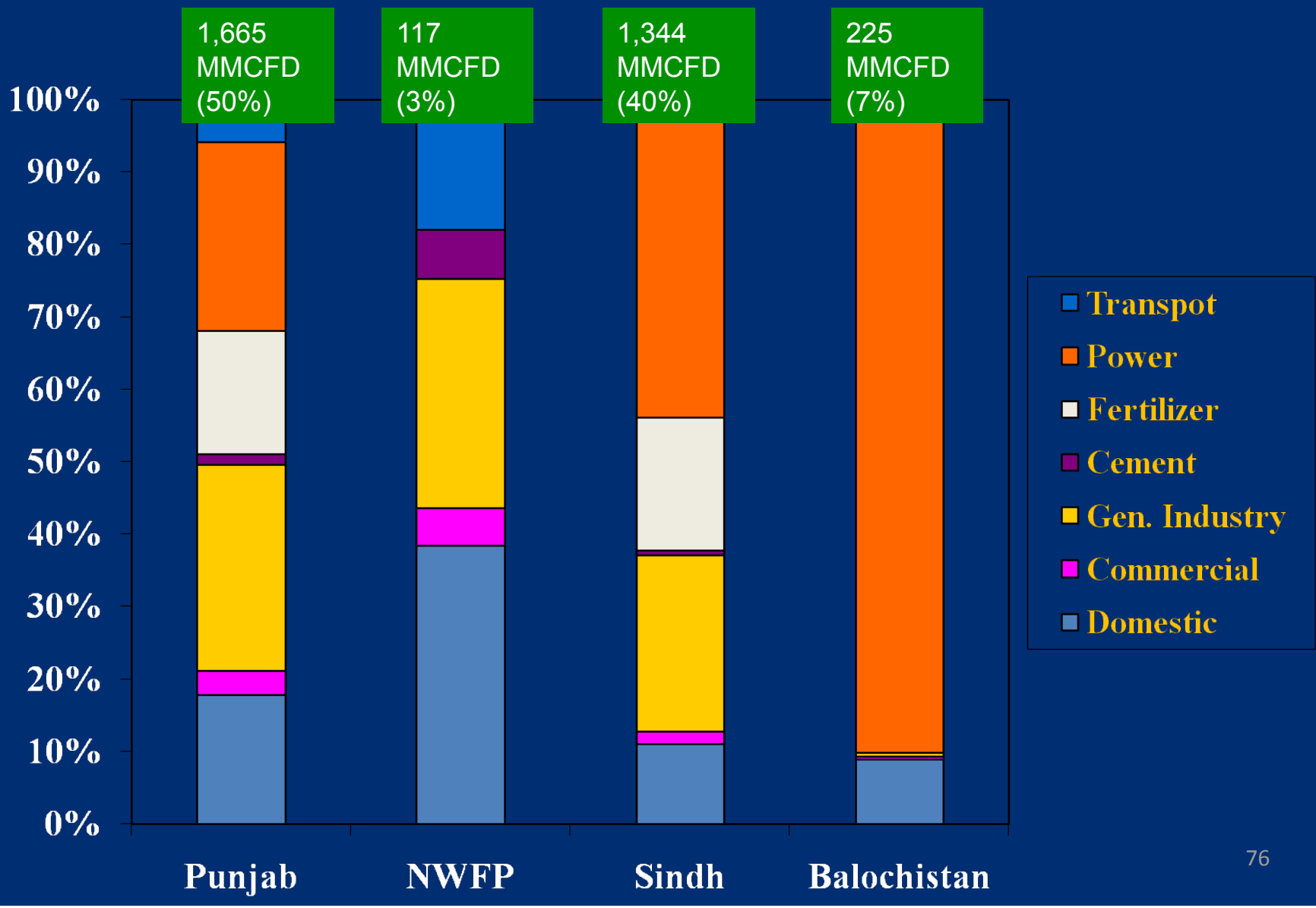
Total Gas Consumption: 0.768 TCF (2,014 MMCFD)

2006-07



Total Gas Consumption: 1.223 TCF (3,351 MMCFD)

Province-wise Consumption Pattern 2006-07



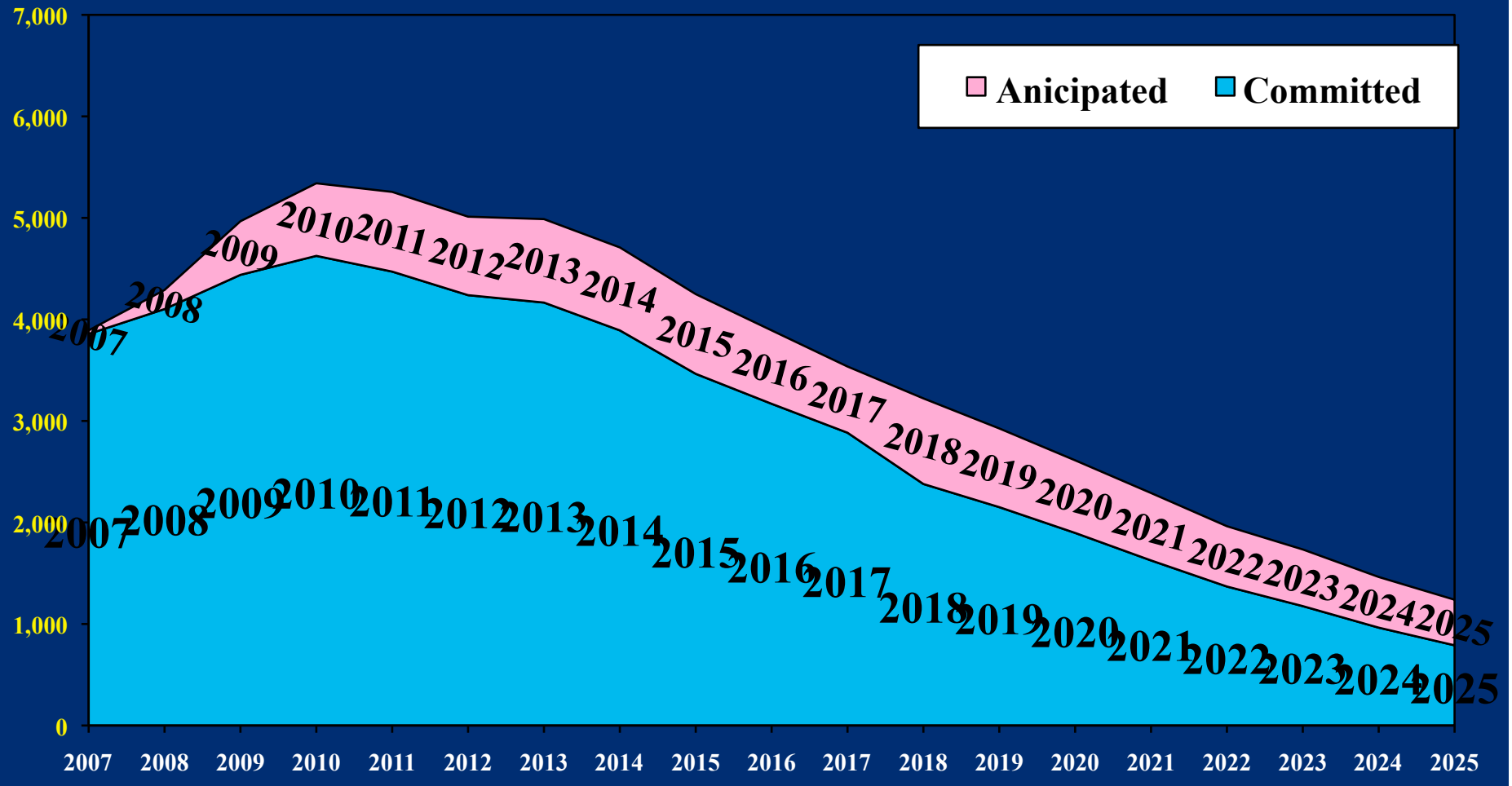
Gas Sector Development

	30.06.2001	30.09.2007	%age increase
No. of Towns/Villages	1,414	2,552	80%
Transmission (km)	7,444	10,023	35%
Distribution (km)	56,208	83,105	48%
Gas Sales (MMCFD)	1,411	3,351	137%
No. of Customers			
Industrial	4,434	7,756	75%
Commercial	46,113	67,649	47%
Domestic	3,401,783	4,889,922	44%

	Punjab	NWFP	Sindh	Balochistan	Pakistan
Domestic consumers	2,597,017	352,691	1,770,221	169,993	4,889,922
&age of population benefiting	19%	11%	27%	14%	20%

Projected Gas Supply (Without Imports)

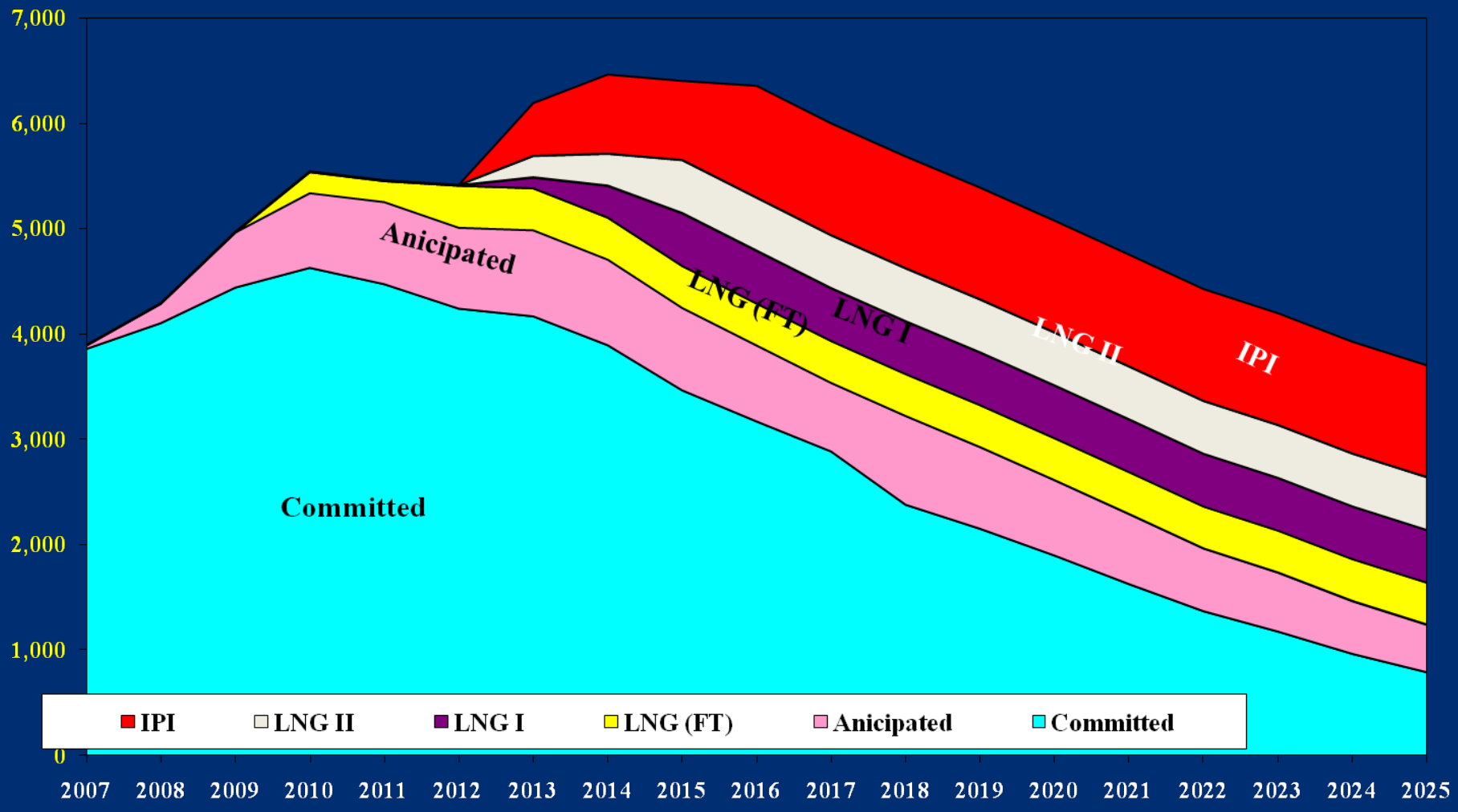
MMcfd



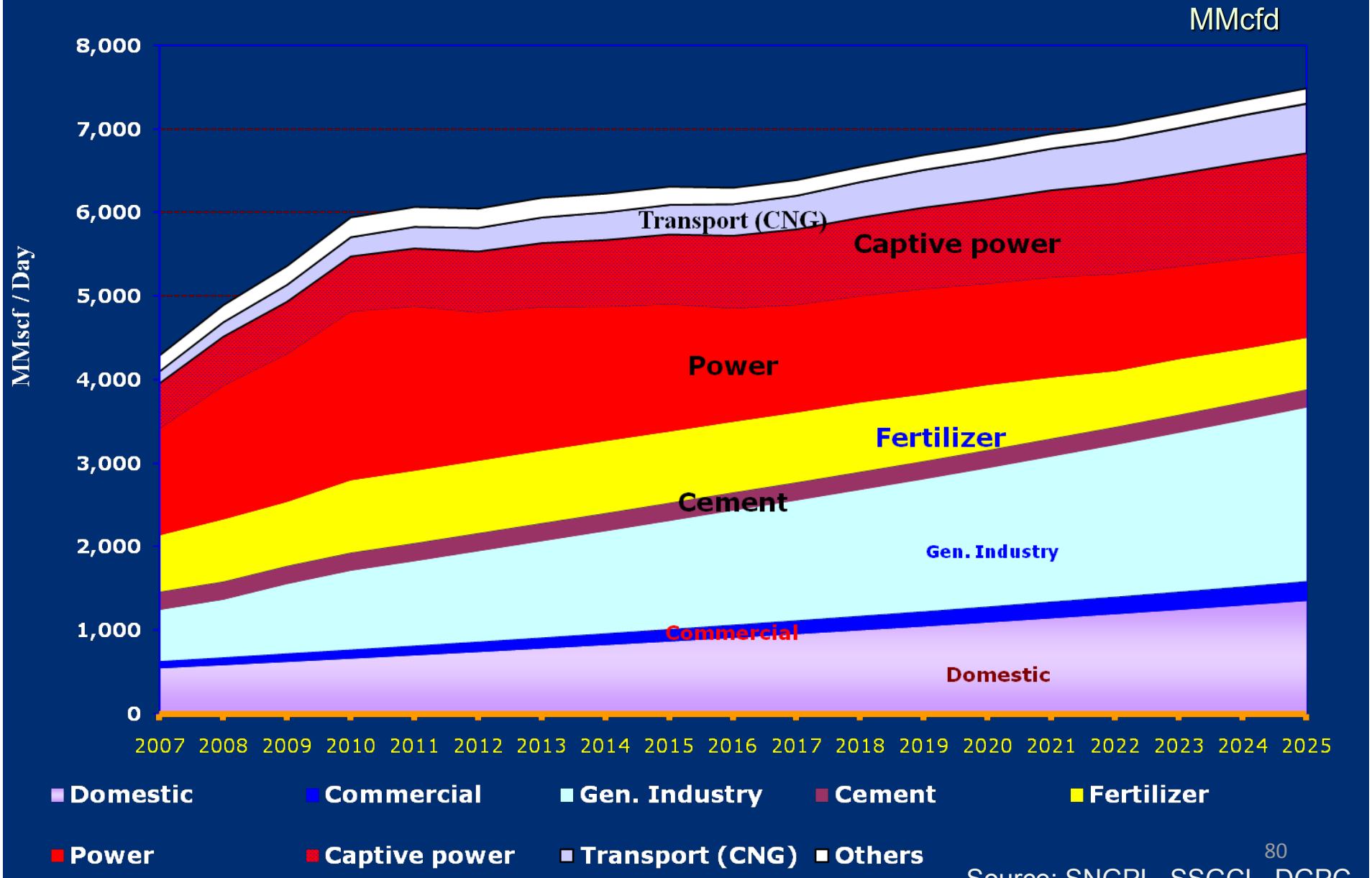
Source: DGPC

Projected Gas Supply (With Imports)

MMcfd

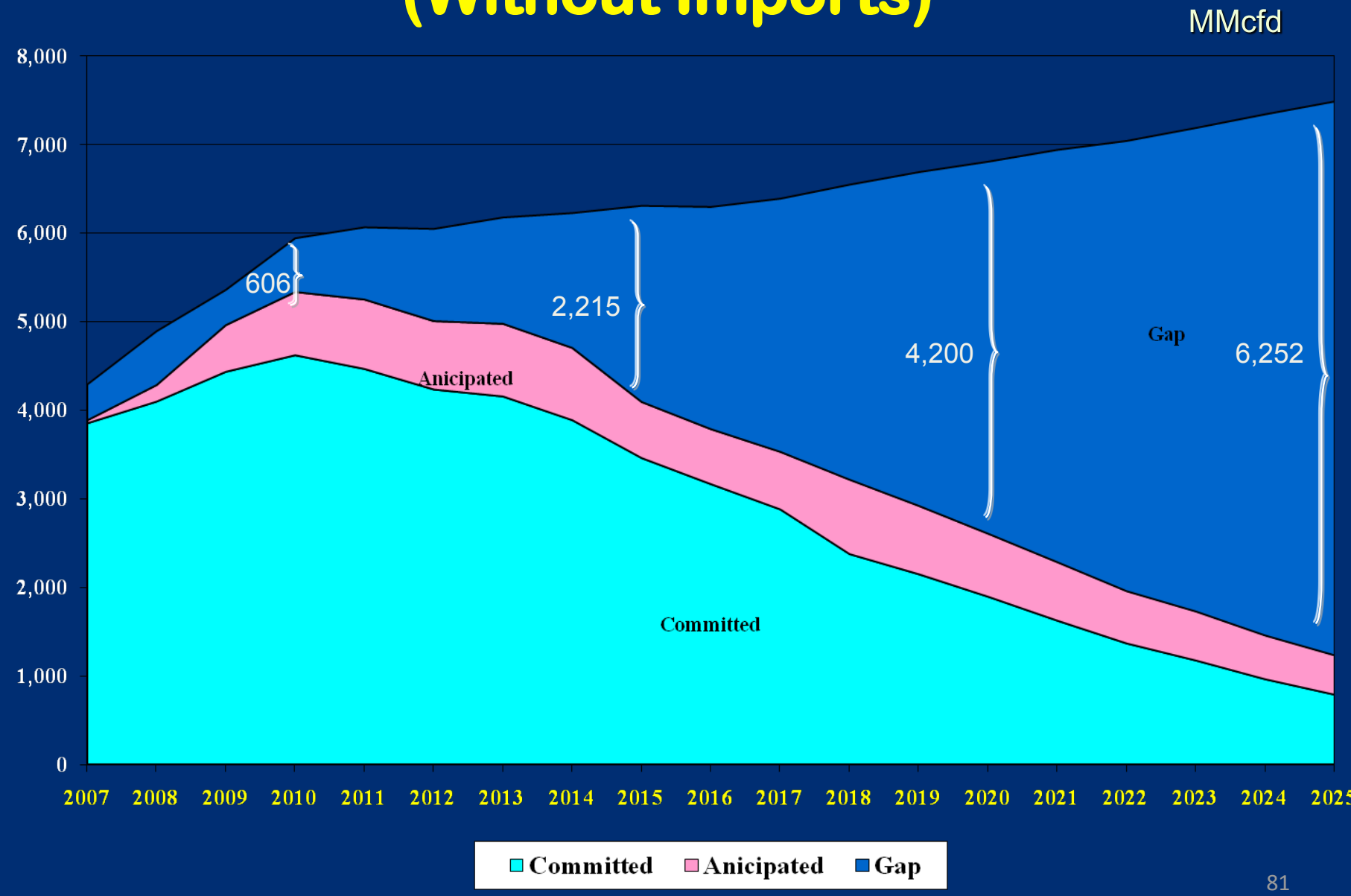


Projected Gas Demand

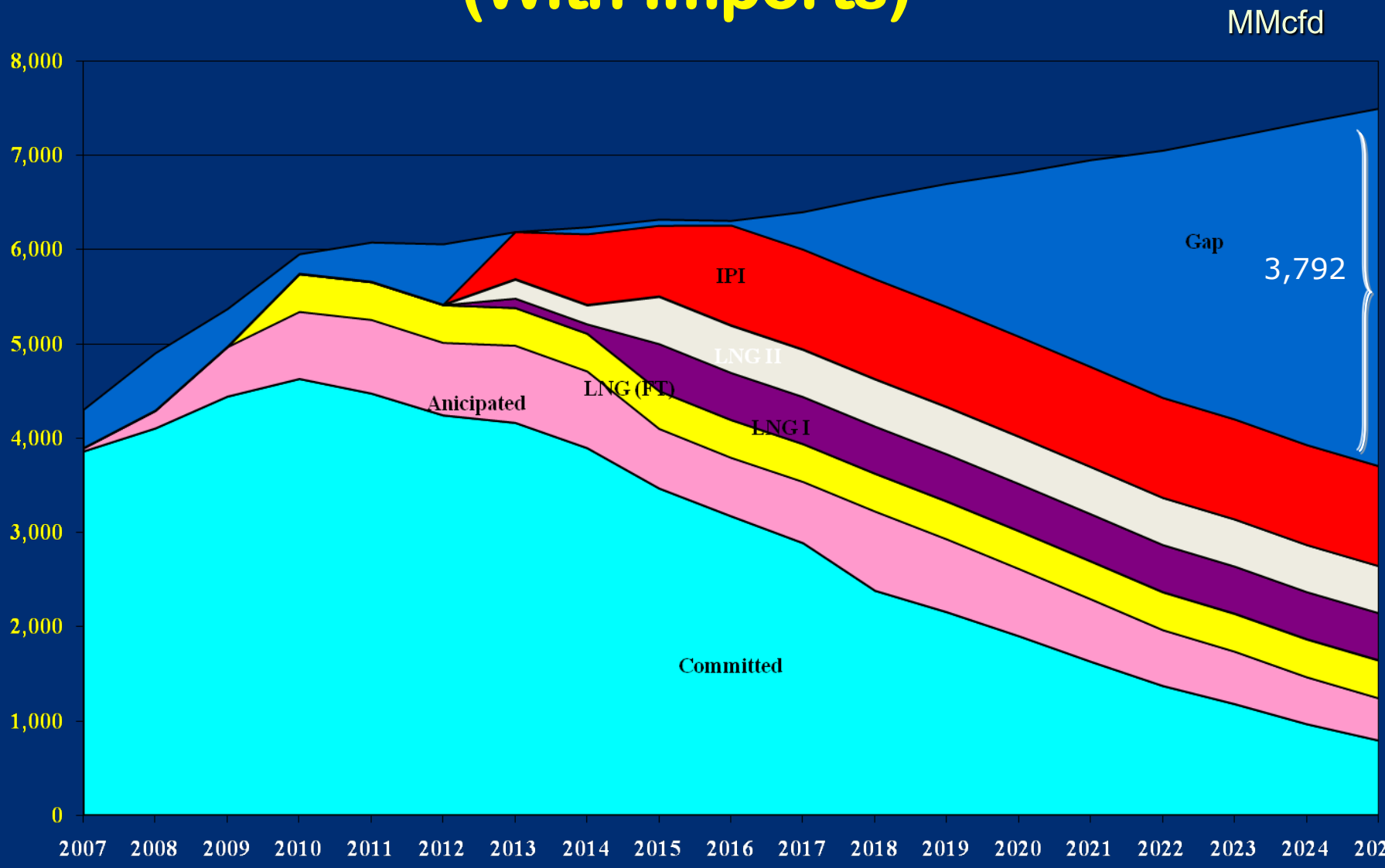


Source: SNGPL, SSGCL, DGPC

Projected Gas Supply-Demand Balance (Without Imports)



Projected Gas Supply-Demand Balance (With Imports)



CNG Sector Overview

- Compressed natural gas (CNG) being promoted for economic and environmental benefits
- 1,834 CNG stations serving over 1.55 million vehicles; Pakistan 2nd largest in world, and largest in Asia.
- CNG kits and dispensers are being manufactured locally
- Cabinet approved replacing diesel buses with CNG buses in 8 cities leading to new investment.
- CNG Policy is under finalization.

PEAK SEASON GAS SHORTFALL 2008-2009 WINTER

Maximum Gas Production : 4000 mmscfd

Maximum Gas Supply: 3500 mmscfd

Committed Normal Demand from Already Connected Consumers : 3500 mmscfd

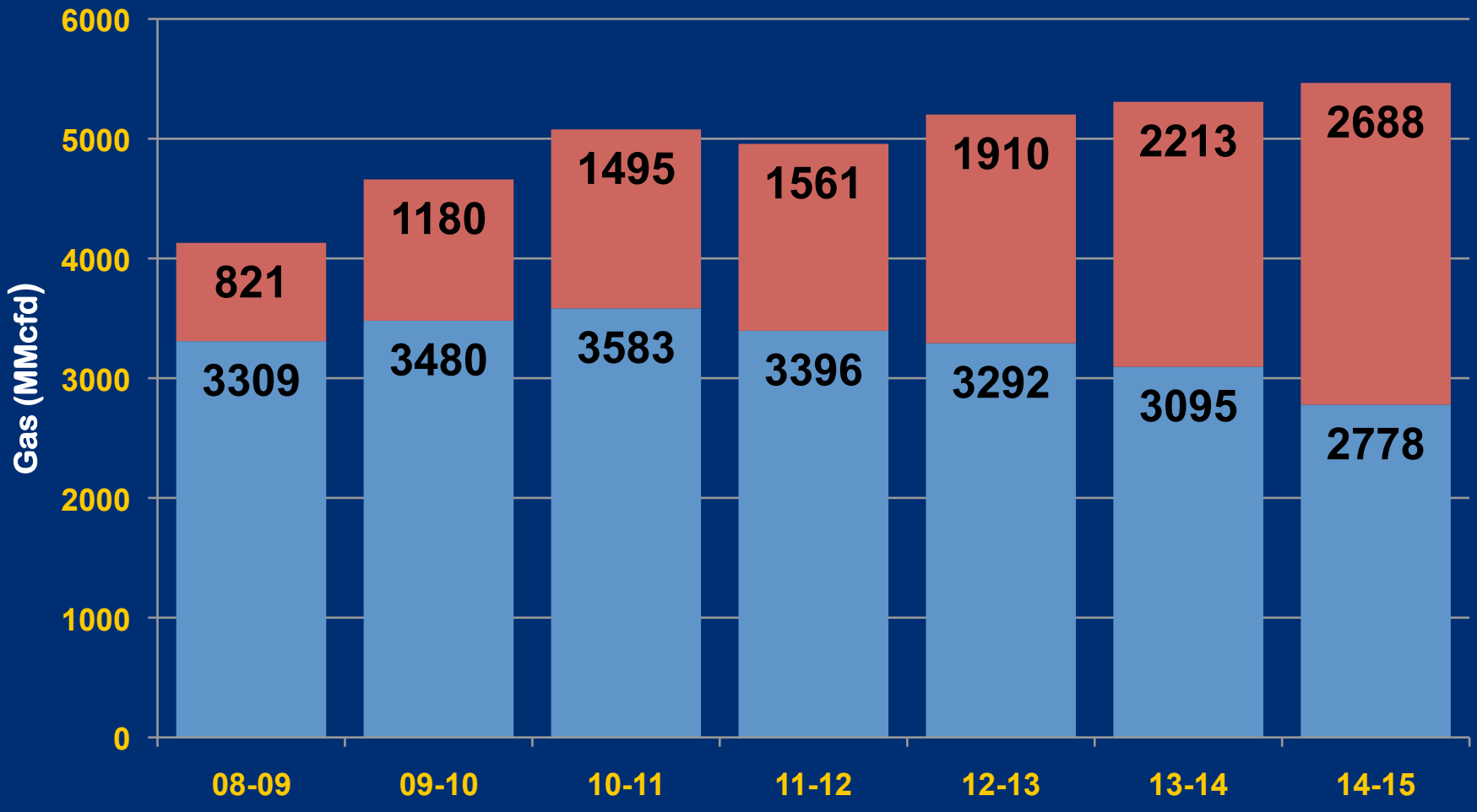
Normal Domestic Demand: 560 mmscfd

Winter Domestic Demand: 1600 -1800 mmscfd

Winter Demand from Existing Consumers: 4540-4740 mmscfd

Winter Gas Shortfall : 1040-1240 mmscfd

CONSTRAINED GAS DEMAND & SUPPLY FORECAST (SNGPL & SSGCL)*



* Excluding Power & Fertilizer

THAR COAL UTILIZATION

- Worlds Single largest contiguous Coal field extending over 10,000 Sq KMs
- Reserves of 175 – 200 billions tons exceed oil equivalent reserves of Saudi Arabia, Iraq, Iran, with a value of several trillion US$
- Phased development can lead to 400 – 600 mt /year coal mining in 20 years

- All of Pakistan's energy requirements (Electric, Power, Gas, Diesel) can be met in 2020 – 2030 scenario
- The most recent ADB report (May 2007) states "**Thar lignite once mined, is a useable fuel or carbon resource**" and "**Coal to liquids-CTL is considered a serious utilization option**"
- In addition to Electric Power, SNG, Chemicals, Fertilizer, etc can be produced for self consumption and surplus can be exported

- Contribution to GDP in plants, products, services, employment, etc, would be in the range of $200b-$300b which exceeds Pakistan's current GDP of $ 170 b

RECOMMENDATIONS: WAY FORWARD

Conclusion:
BRIDGING THE ENERGY GAP

- About 79% of energy is based on oil and gas. There is a critical shortfall of indigenous oil. About 83% of oil consumed in Pakistan is imported @ about 325,000 barrels per day

- Over 600,000 barrels oil equivalent per day is obtained from indigenous natural gas

- Energy security requires enhancement of indigenous oil and gas reserves and production. This would need stability and improved security, which is closely linked with ongoing war on terror.
- There is a crucial need to have access to civil nuclear power as given to India. This may be linked with war on terror.
- Crucial need to accelerate exploitation of Thar coal reserves

- Critical need to accelerate construction of dams/hydro-electricity projects including mega dams that will also provide critically needed water storage.
- Earliest access to economically priced imported gas is crucial.
- Bringing into use economically viable alternative sources of energy.
- Efficient transformation, control of losses and conservation.

CONSERVATION MEASURES

1) Increase efficiency of transformation/ conversion
2) Economize internal consumption
3) Control transmission/distribution losses
4) Prevent energy theft
5) Regulate efficiency of household appliances

7) Introduce weather efficient codes for building designs and materials to reduce requirement of energy for heating and cooling
8) Incubate energy smart offices
9) Build in renewable energy as a back-up for peak- load/emergency use in offices/buildings
10) Promote campaign for conservative use of energy

STRUCTURAL CHALLENGES

- Development of water storages at standstill since 1976
- Currently Storage capacity only 8.31% of total surface water
- Currently Hydropower, only 11.4% of identified potential
- More than 20 million acres culturable land available for development

The Way to a New Tomorrow

- Three approaches to the solution
  - **Increase supply** (Scientists/Technicians/ Managers)
  - **Reduce demand** (Economists / Policy makers)
  - **Alternative sources**

  (Scientists and Economists)
- Efforts are required
- in all three arenas

Sorry – There are limits to Supply

- Geological, technical and economic constraints limit supply growth
- With advanced technology, we are aware of most of the new discoveries which will be made
- Increases in **the ratio** of ***recovered*** oil to.

Oil-in-Place are also limited; optimistic predictions (of such increases) should be viewed skeptically

Possibility of production improvements from exploration and extraction are useful but limited

Increase in supply will only **postpone**, but not *alleviate* **the problem**

Formulating a Strategy

- Renewables, Renewables, RENEWABLES!!! They will help us answer all the questions about the future of energy
- Localized applications – Solar and Biomass
- Large scale applications – Wind, Hydro, Solar

- Policy is currently focused on use of renewables where conventional power supply does not reach, or is impractical. We need to start pushing for renewables to replace other power sources
- Wind Energy is the most promising – Non-polluting, great potential, economically feasible

Formulating a Strategy

- Research and Development money may be spent on studying, researching and evaluating various new possibilities, such as methane hydrates and hydrogen fuel cells, to determine their potential, but
- Given that Pakistan is a developing country with limited resources, and many needs for investment,

- we must be very conservative when making decisions about large *operational* investments in such new technologies
- Pakistan should channel operational investments towards more proven, but under-exploited, energy resources such as wind energy, and proven techniques of improved oil recovery from existing wells

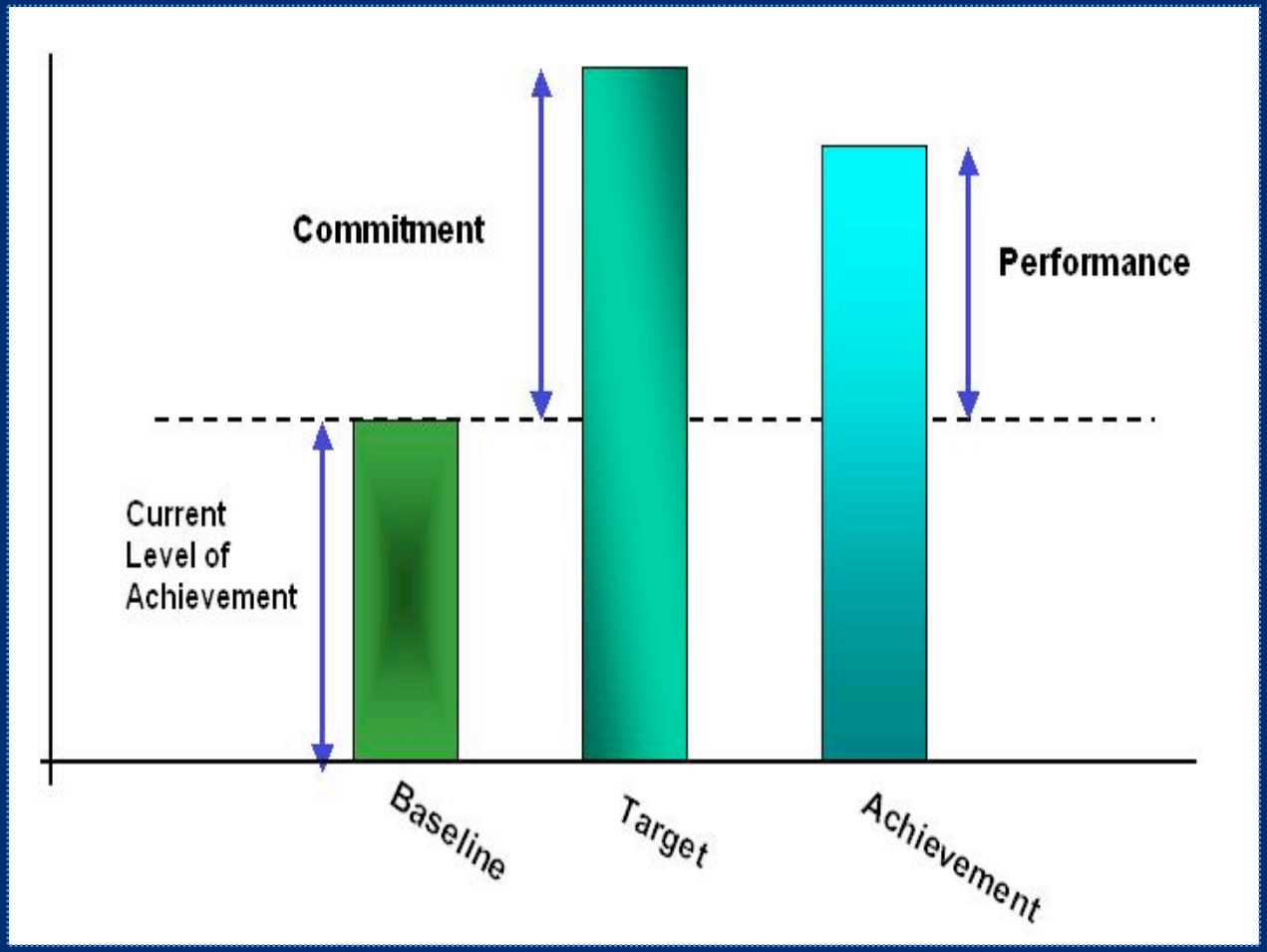
A Smooth Transition?

- The transition to the next generation of energy includes
  - -- Political recognition, at the highest level, of the importance of this transition
  - – Accumulation of (our own) reserves of extractable oil through technological innovation
  - – Time-targeted set up of plants for alternative and renewable energy

- Time-targeted and sector-wise reduction in our petroleum consumption and CO2 generation (which leads to Global Warming)
- Anticipation of geo-political and economic changes that will occur in the world as related to energy issues
- Identification of specific sectors where reforms need to be implemented

- Prudent decision making regarding investment in research and development in newer energy sources (e.g. methane hydrates)
- Implementation of effective and transparent politico-economic policies to encourage the setting up – and profitable survival -- of renewable power plants, such as wind farms, micro-hydel power plants,

Indicators


Commitment
Performance
Current
Level of
Achievement
Baseline
Target
Achievement

Key Phases

Strategic Planning

- Formulating **SMART results**
- Setting targets
- Selecting indicators

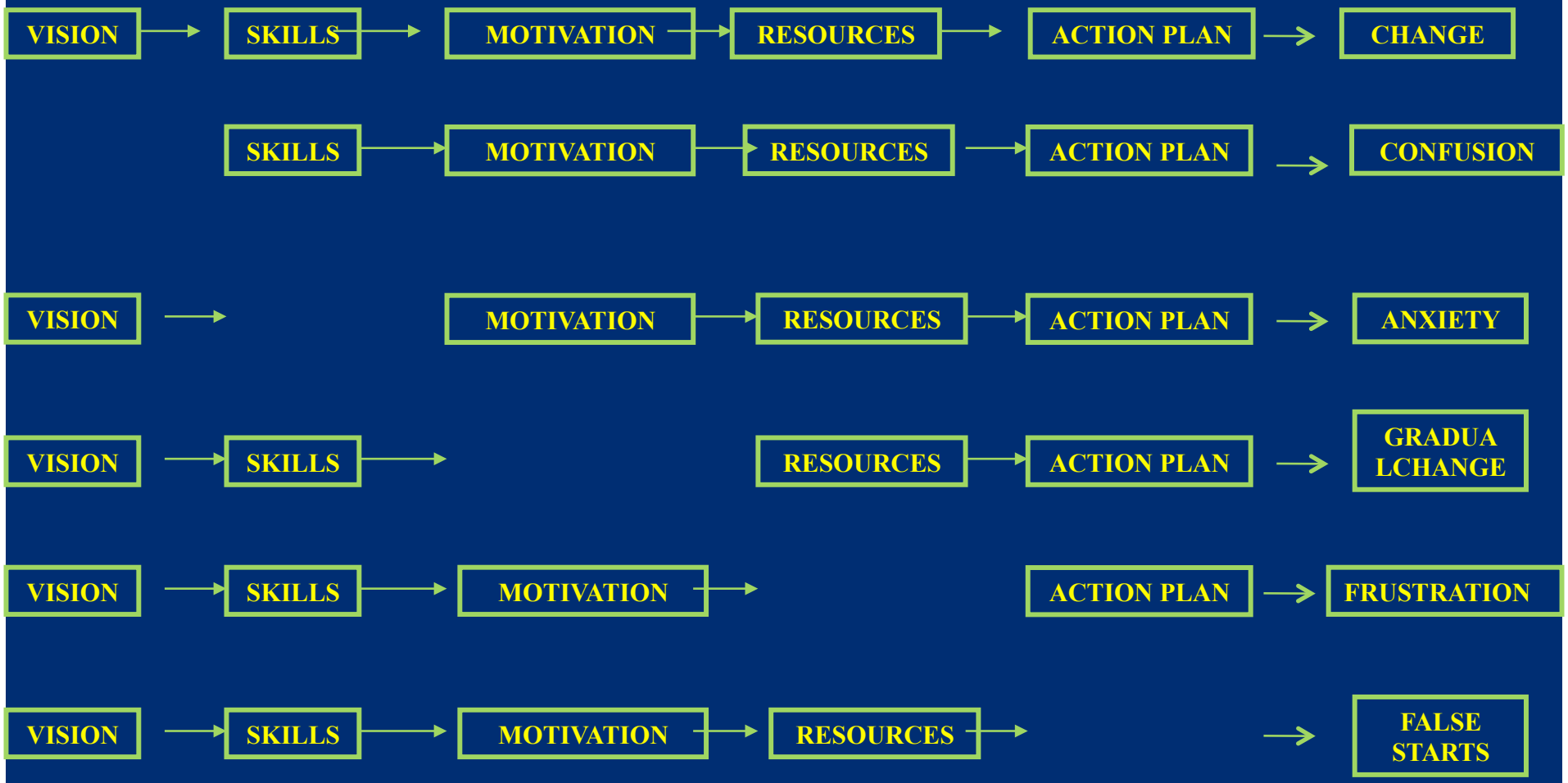
Performance Measurement

- **Monitoring performance** data
- Reviewing & reporting performance

Performance Management

- **Evaluation** and Lessons
- Using performance information for managing

IN A NUTSHELL...



Renewable & Non-conventional Energy Resources Of Pakistan

Coal

Wind

Solar

Tidal

Wastes

Geo-Thermal


COAL RESOURCE

Resources of Coal in Pakistan

- Pakistan is very enriched with this source of energy.
- Pakistan is at no: 1 position in Asia for Coal.
- Largest area of coal in Pakistan is at Thar Parkar district of Sindh province.
- The total area of Thar coal is about 9,000 sq.km.

The total coal reserve are 175.506 Billion metric tons.

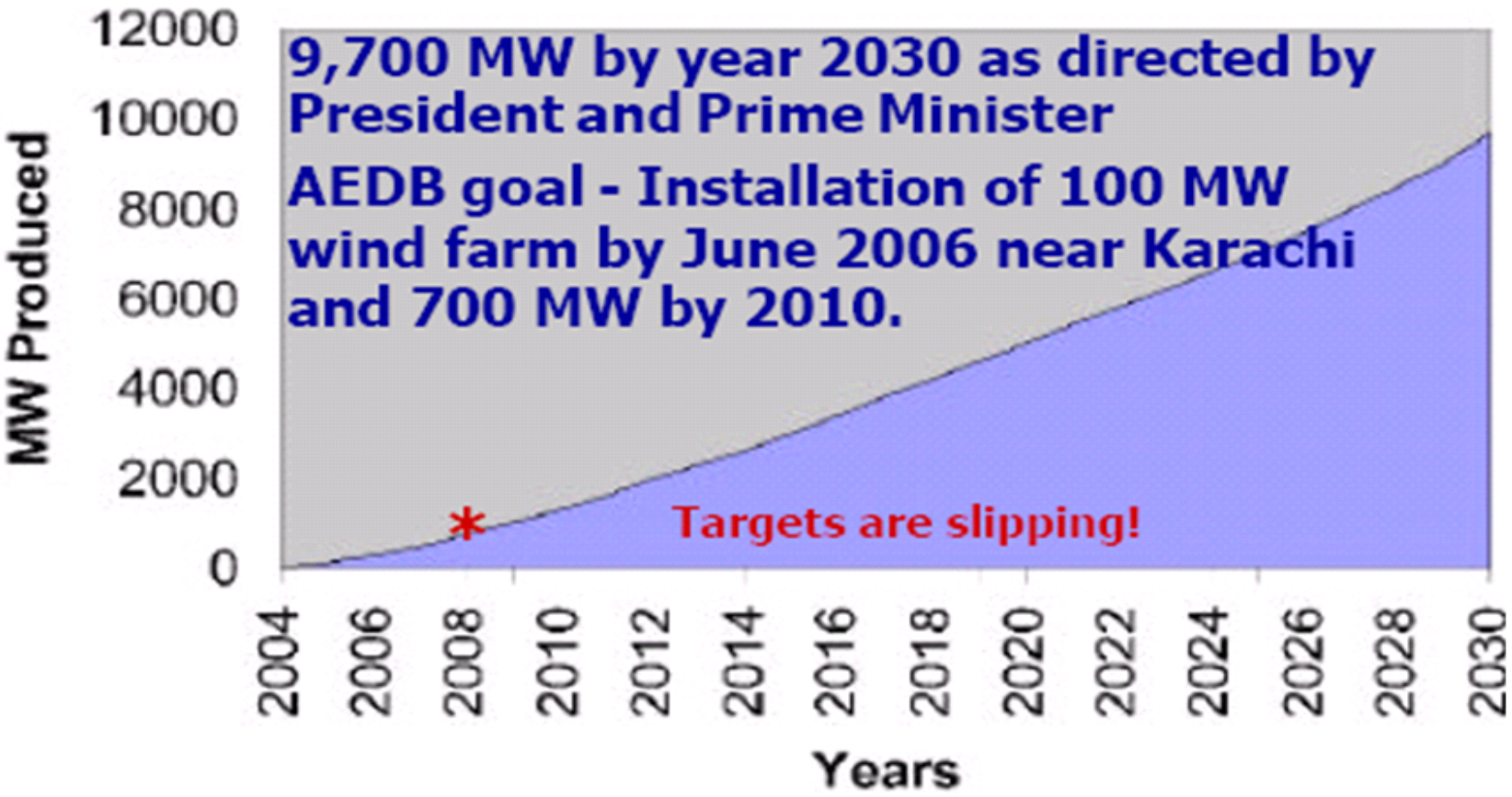
WIND ENERGY

Resource of Wind Energy in Pakistan

- Harnessing wind power to produce electricity on a commercial scale has become the fastest growing energy technology.
- Pakistan has 1046 km long coastline in south, which could be utilized for the installation of wind farms.
- Average wind speed more than 7 m/s in Gharo Wind Corridor.

- Estimated wind potential more than 50,000 MW
- In the same geographical environment as we have in Pakistan, India has set up the first of its ten 55 KW plants at Gujarat in1986.

Wind Power Development Goal



There is a single project is started in Gharo who's capacity is 50MW and unfortunately it generates only 2MW

SOLAR ENERGY

Resource of Solar Energy in Pakistan

- Pakistan has a very good overall solar-energy potential.
- The average daily insulation rate amounts to approximately 5.3 kWh/m2.
- South-western province of Baluchistan offers excellent conditions for harnessing solar energy.
- Sun shines between 8 and 8.5 hours daily, or approximately 3,000 hours per annum.
- Practically Solar Power Potential is approx: 10,000 MW throughout the country.

HYDEL RESOURCE

Resource of Hydel in Pakistan

- Hydropower source of energy is very well known in Pakistan.
- The hydro potential was estimated at about 50,000 MW. Out of which about 4,800 MW has been developed over the past 50 years through mega-hydel plants.

- The canal system has a huge hydropower potential at numerous sites/locations.
- Potential in micro-hydropower (MHP) up to 100 kW, is roughly estimated to be 300 MW


WASTES RESOURCE

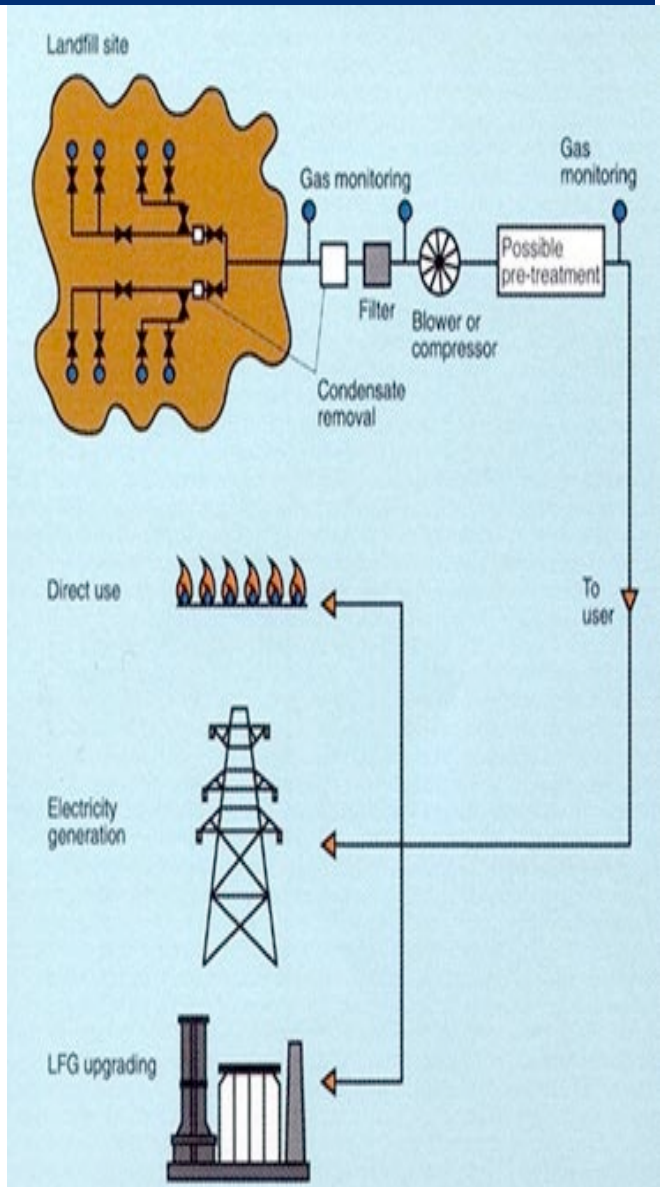
Resource of Wastes in Pakistan

- City Wastes

➢Every day, we produce a lot of waste - in our homes, offices and factories, farms and hospitals, and so on.

➢It is estimated that the urban areas of Pakistan generate over 55,000 tones of solid wastes daily.

➢UK produces 28 million tones of household waste every year. This could be used to generate 1700MW of energy, Currently, UK recovers 11% of this, around 190MW, enough for 300,000 households.



Chicken Litter

- Chicken litter is one of those wastes produced from the farms and animal processing operations.
- 15 tones/year chicken litter is scrapped out from a shade of 3000 chicken-birds in a poultry farm.

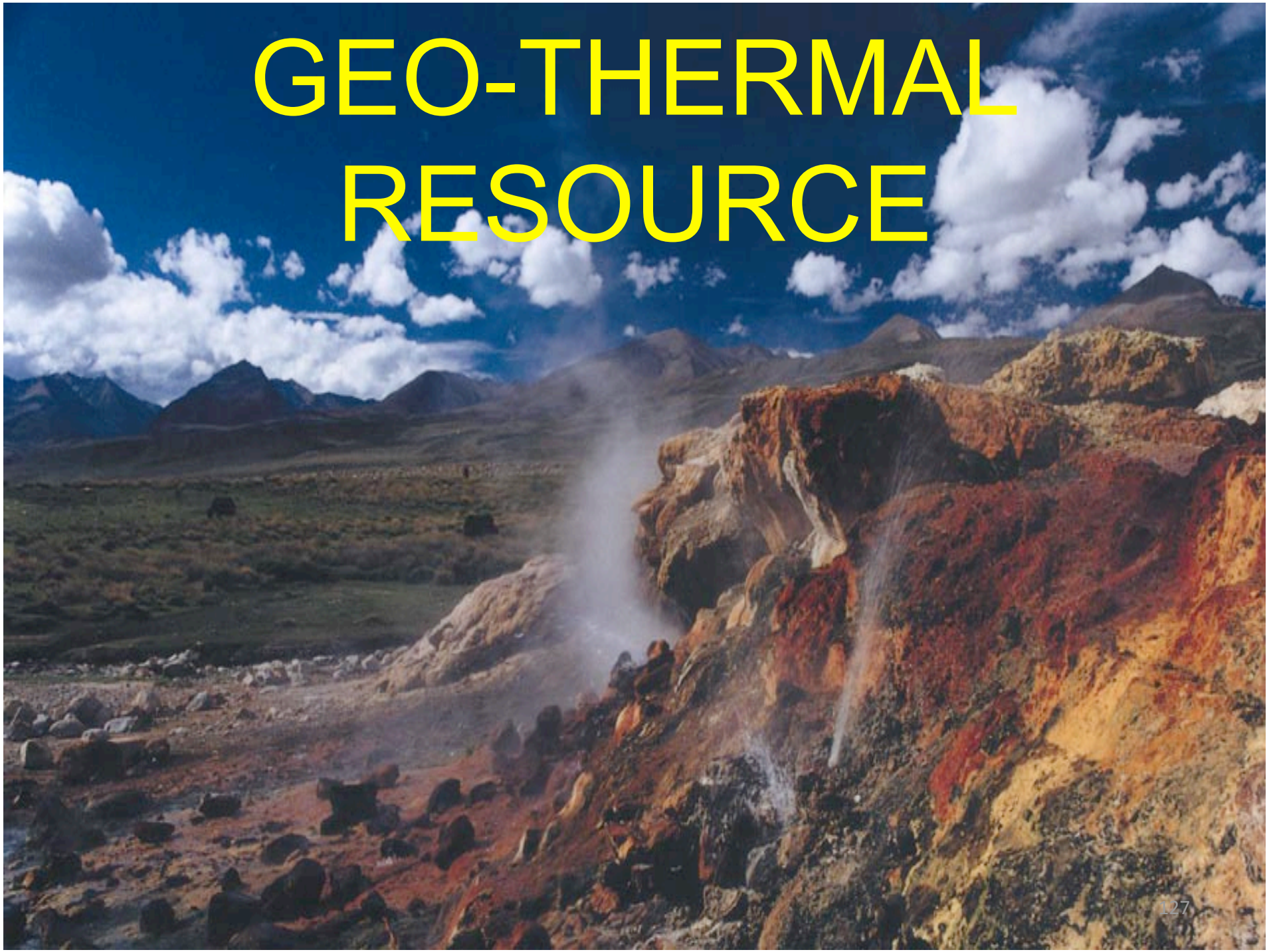
- Therefore, more than 5,00,000 tones/ year chicken litter is expected to be produced in and around Karachi region.
- In Britain, chicken litter waste from local chicken farms of about 4,00,000 tones/year.
- This can produce 38.5 MW of electricity.

Animal Slurry

- Pakistan is an agriculture country. About 70% of the population resides in rural areas.
- Who meet 95% of their domestic fuel needs by burning bio-fuels.
- As per livestock census 2000, there are 46.69 million of animals (buffaloes, cows, bullocks) in Pakistan.

- On the average, the daily dung dropping of a medium size animal is estimated at 15 kg per-day. This would yield a total of 700 million kg dung per day.
- Thus, 35 million M3 biogas per day can be produced through the bio- machination

GEO-THERMAL RESOURCE



Resource of Geo-Thermal in Pakistan

- Geothermal energy is the energy derived from the heat of the earth's core.
- It is clean, abundant, and reliable. If properly developed, it can offer a renewable and sustainable energy source.
- In Tibet, more than 600 surface indications of geothermal energy resources have been

- discovered with an estimated potential of 8,00,000 kilowatts.
- “Hot dry rock" Geo-Thermal energy in Kharan-Panjgur tectonic depression in western part of Pakistan.

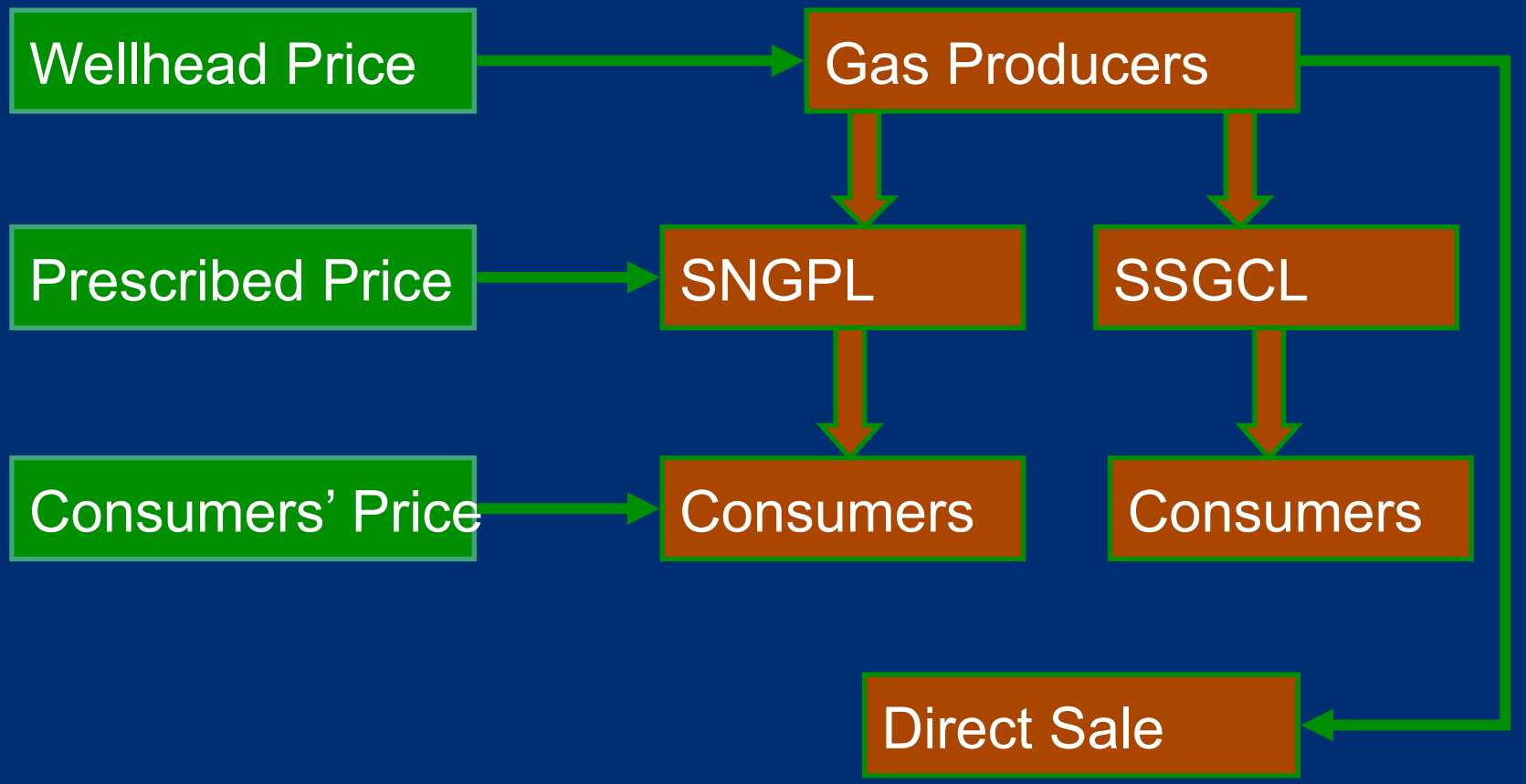
Composition of Consumers' Gas Prices

- Wellhead price:
  - It is paid to the producers in accordance with the Petroleum Concession Agreements (PCAs) and applicable policy at the wellhead.
- Prescribed price:
  - It is determined by OGRA after taking into account the following elements

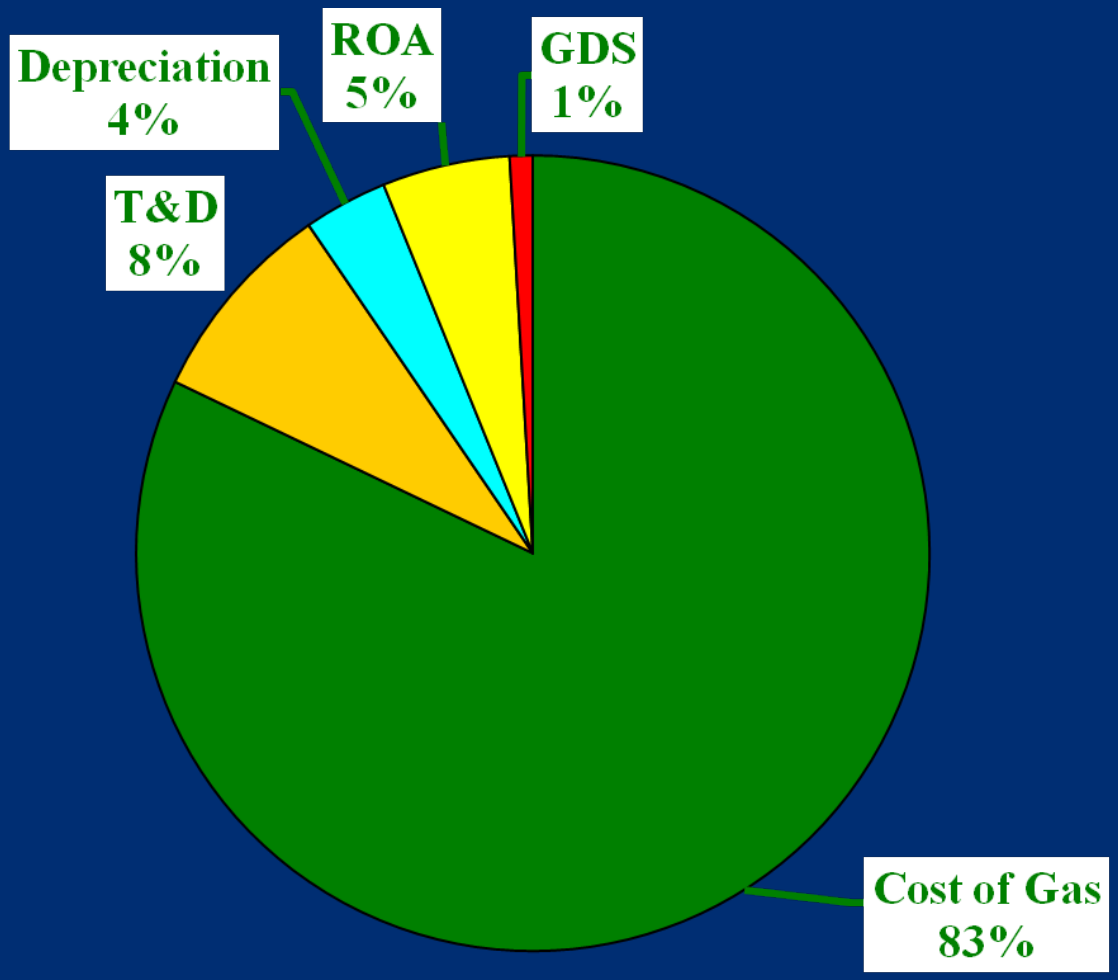
- Average well head gas price
- Excise duty at well head
- Operating and maintenance costs
- Depreciation
- Return on assets (ROA) (17.5% SNGPL, 17% SSGCL)

- Selling (Consumers') Price:
  - It is sum of prescribed price and Gas Development Surcharge

Consumer Gas Pricing Mechanism



Breakup of Current Consumers' Prices

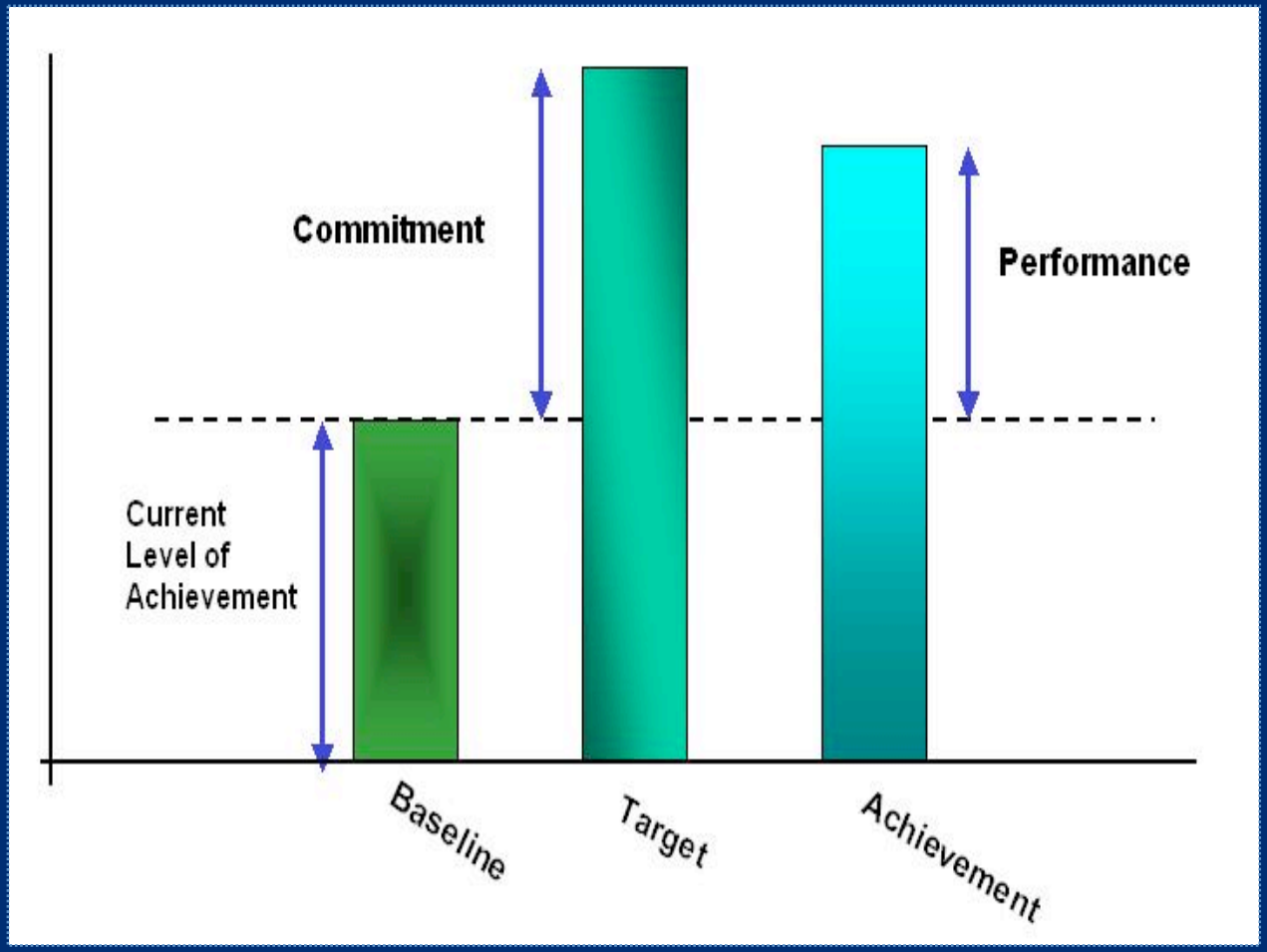


Current weighted average consumer price is Rs 217.10 per MMBtu

Natural Gas Allocation and Management Policy 2005

CATEGORY OF CONSUMERS	PRIORITY ORDER
Domestic and Commercial Sectors	First
I. Fertilizer Sector; and II. Industrial Sector (to the extent of process gas)	Second
Independent Power Plants as well as WAPDA and KESC's Power Plants with firm gas supply commitments under GSAs	Third
I. General Industrial Sector II. CNG Sector III. Captive Power (for export-oriented textile units)	Fourth
I. WAPDA and KESC's Power Plants (other than those included in Third Priority Order) II. Captive Power Sector (other than that for export-oriented textile units)	Fifth
Cement Sector	Sixth

Indicators


Commitment
Performance
Current
Level of
Achievement
Baseline
Target
Achievement

Key Phases

Strategic Planning

- Formulating **SMART results**
- Setting targets
- Selecting indicators

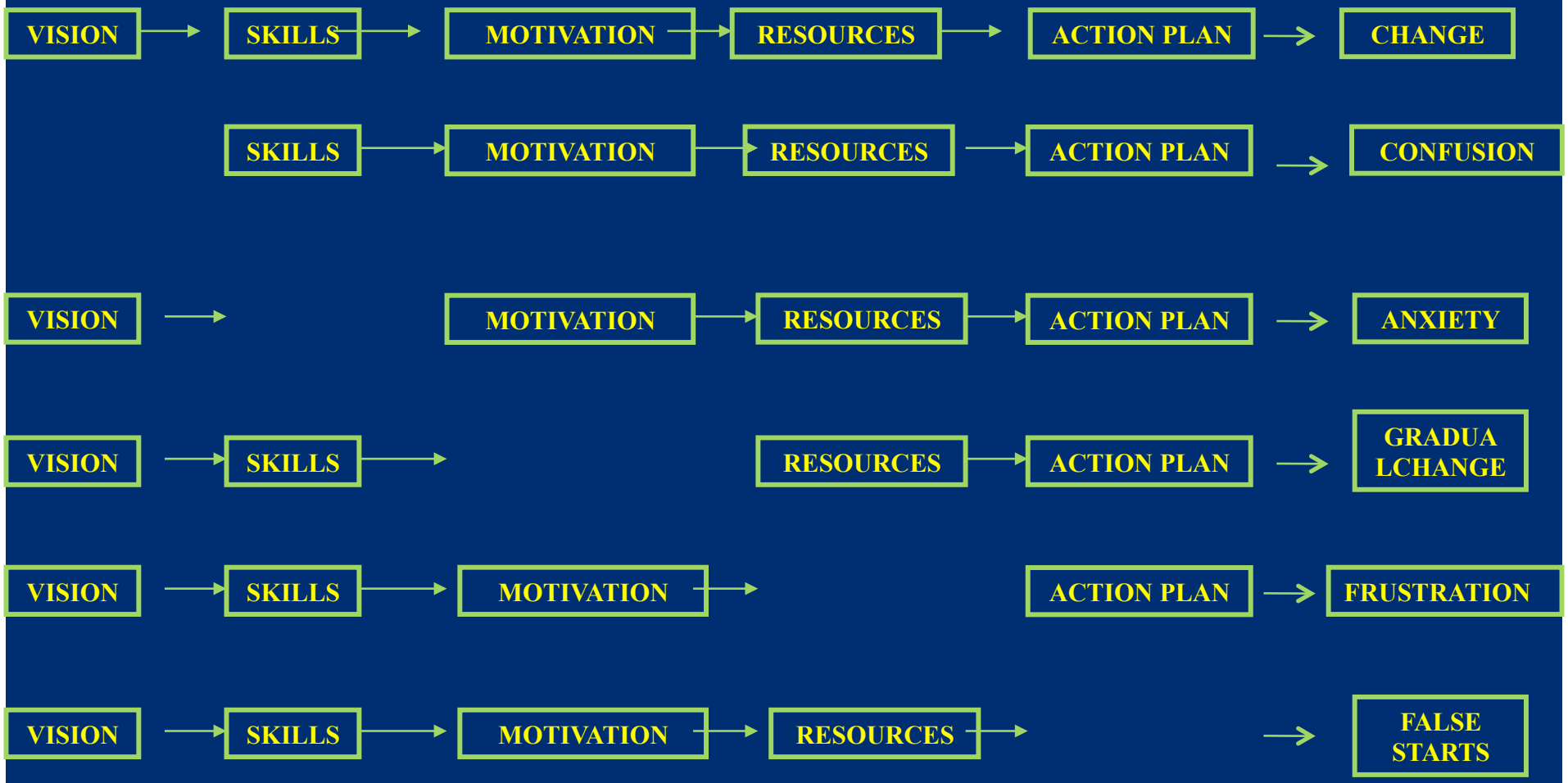
Performance Measurement

- **Monitoring performance** data
- Reviewing & reporting performance

Performance Management

- **Evaluation** and Lessons
- Using performance information for managing

IN A NUTSHELL…



SOURCES

- Various Govt. Publications including official documents Ministry of Petroleum
- Annual Reports of Sui Southern and Sui Northern
- Talks by Tariq Hameed, Chairman WAPDA at SMC and MCMC
- Talks by Dr Gul Faraz, Ex Secretary Petroleum

THANKS