



Oil & Gas Prospects of Pakistan in the backdrop of Current Energy Scenario – Hopes for the Future, a Realistic Picture

IEP - PAPG

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TALK OUTLINE



- Global Energy Overview & Future Prediction
 - World Oil & Gas Discoveries and Production trend
 - Energy consumption and production

- Energy Resources Overview – Pakistan
 - Generalized Hydrocarbon presence and Exploratory drilling
 - Pakistan E&P – current situation
 - Energy consumption & future energy demands
 - Oil and Gas creaming curve
 - Reserves and Production graphs

- Hopes for the Future
 - Conventional resources in Pakistan
 - Unconventional resources in Pakistan

- Present & Future Scenarios in a Nut Shell...



Global Energy Overview

World Energy Overview



- We are faced with difficult challenge of sustaining the E&P growth in line with world's growing demand of Energy
- World is producing ~30 Bbo of Oil and ~105 Tcf of Gas per year
 - Demand expected to growing at ~1.2% per year
 - Only about half of produced reserves being replaced by Exploration
- Most giants/super giants are aging
- Most Production by NOCs (Saudi Arabia, Kuwait, Iran, Iraq, Libya, Mexico, Venezuela & Russia etc)
- Most petroleum provinces have attained maturity – More Effort => Little Reserves
- Most recent big discoveries in Deep water offshore, not enough to catch up
- Efforts are underway to go unconventional towards exploration & production

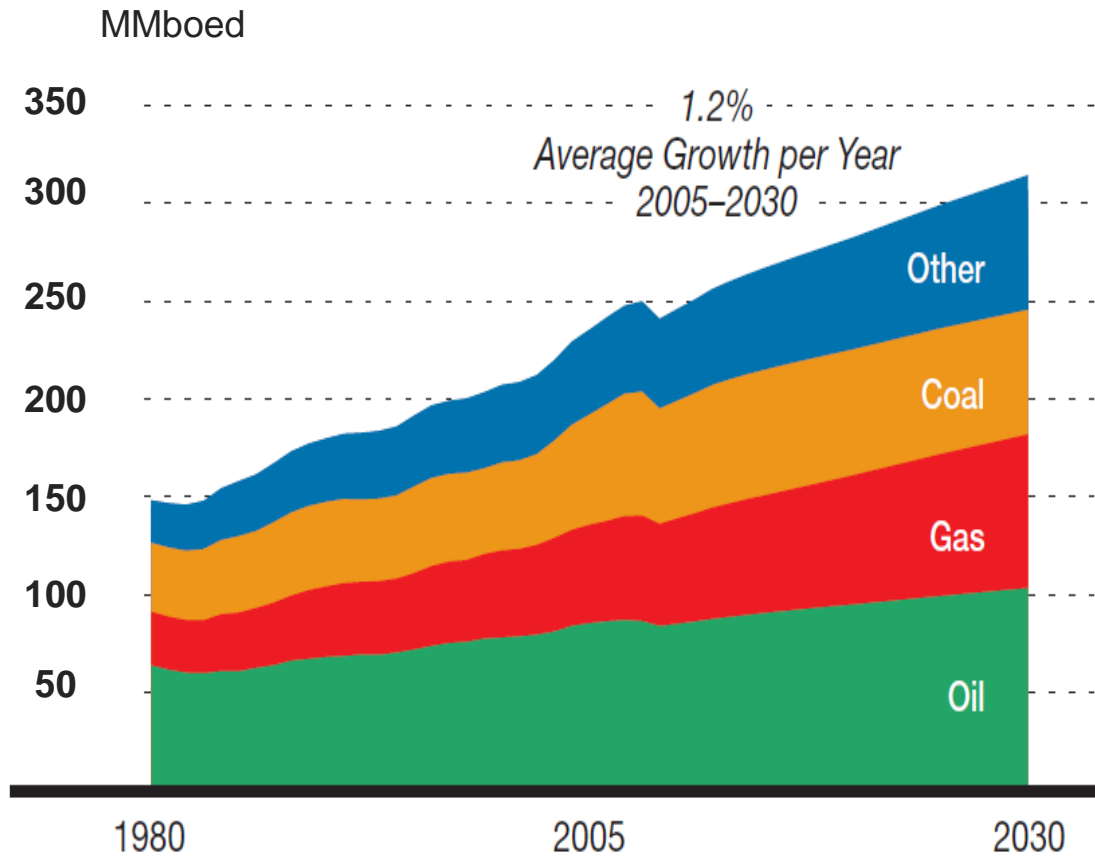
Source: Exxon Mobil Corporation – 2009 Summary Annual Report

Future Prediction by Year 2030.....



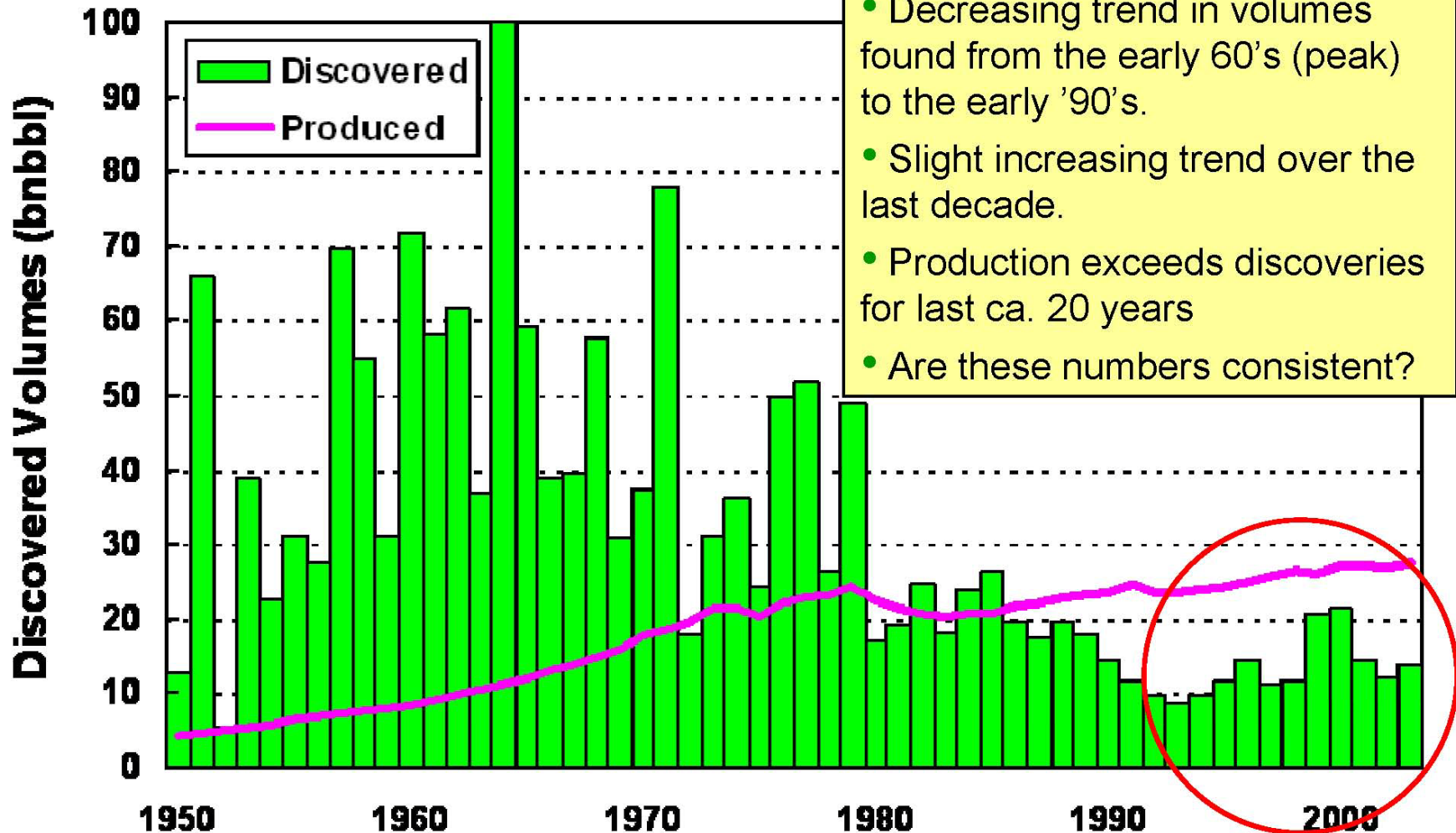
- By year 2030 total demand to be about 100 million barrels oil per day
- The global energy mix will look very similar
- Resources are adequate to support global demand growth. Access along with Technology are important in all aspects of our energy challenges
- Still considered the safest resource, viz recent nuclear disaster in Japan

Global Energy Demand



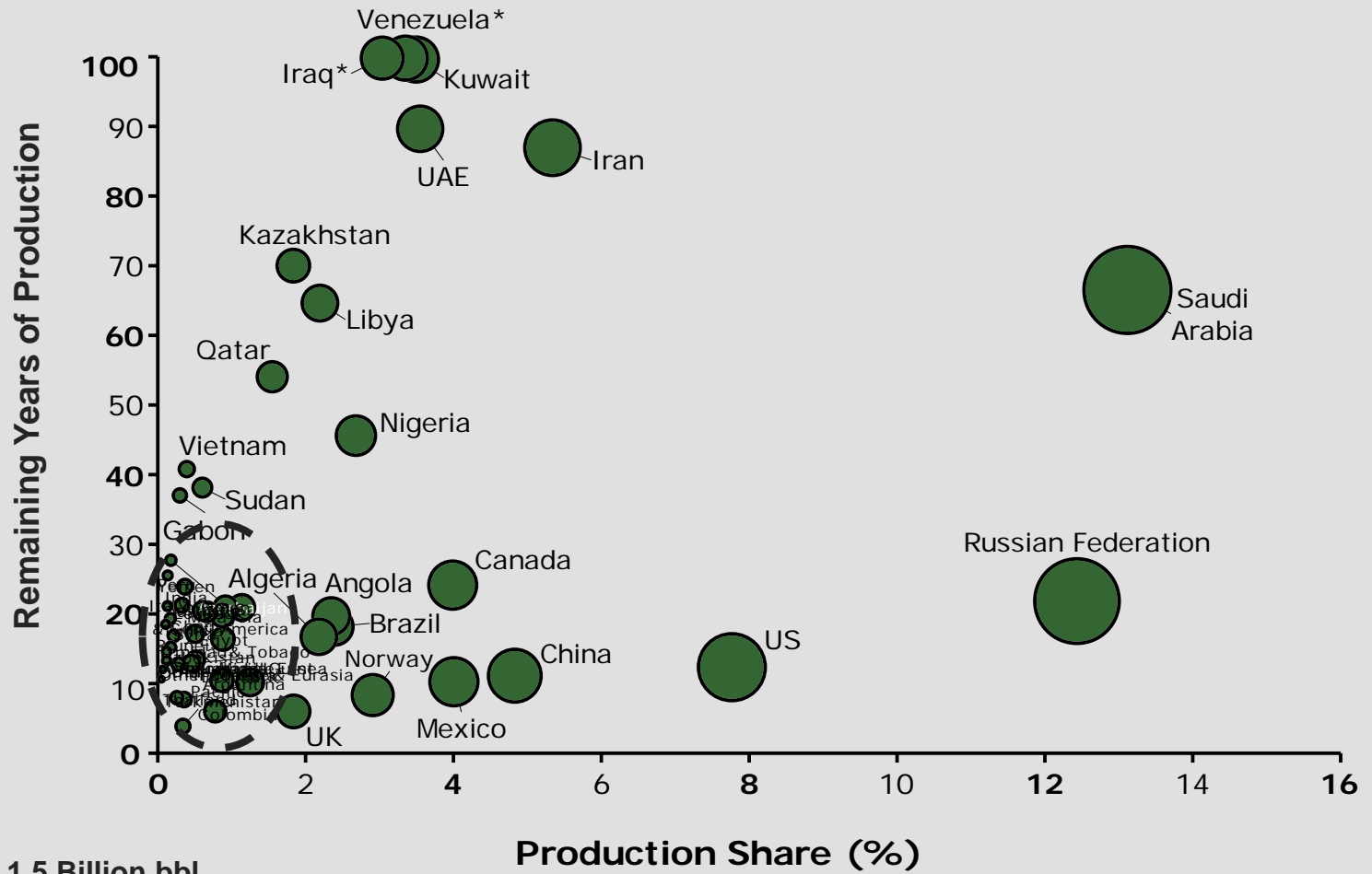
Source: Exxon Mobil Corporation – 2009 Summary Annual Report

World's Oil Discovery / Production Trend



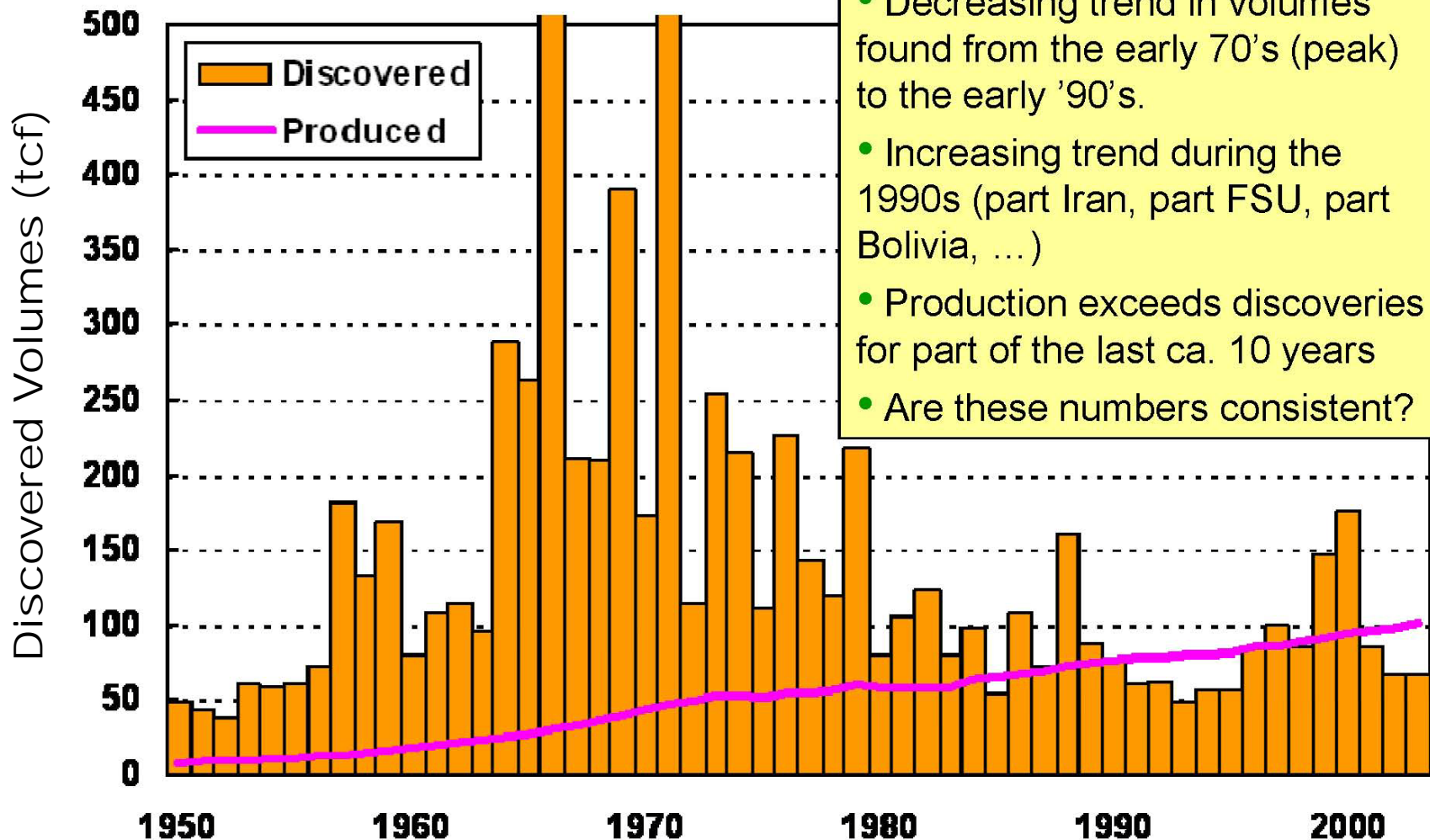
Data based on those of IHS Energy

World Oil R/P Vs Production Share (1 of 2)



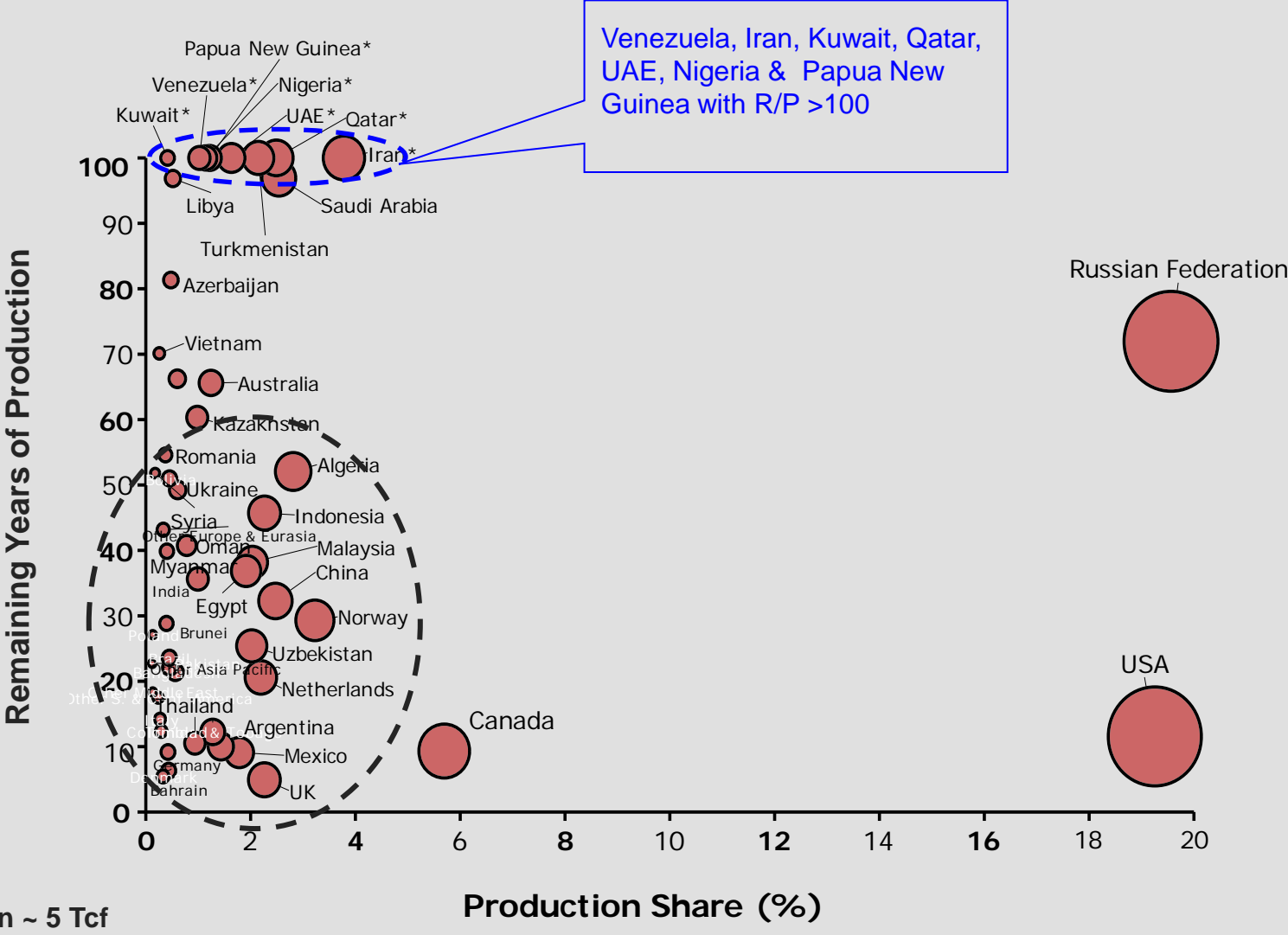
* Iraq & Venezuela R/P >100

World's Gas Discovery / Production Trend

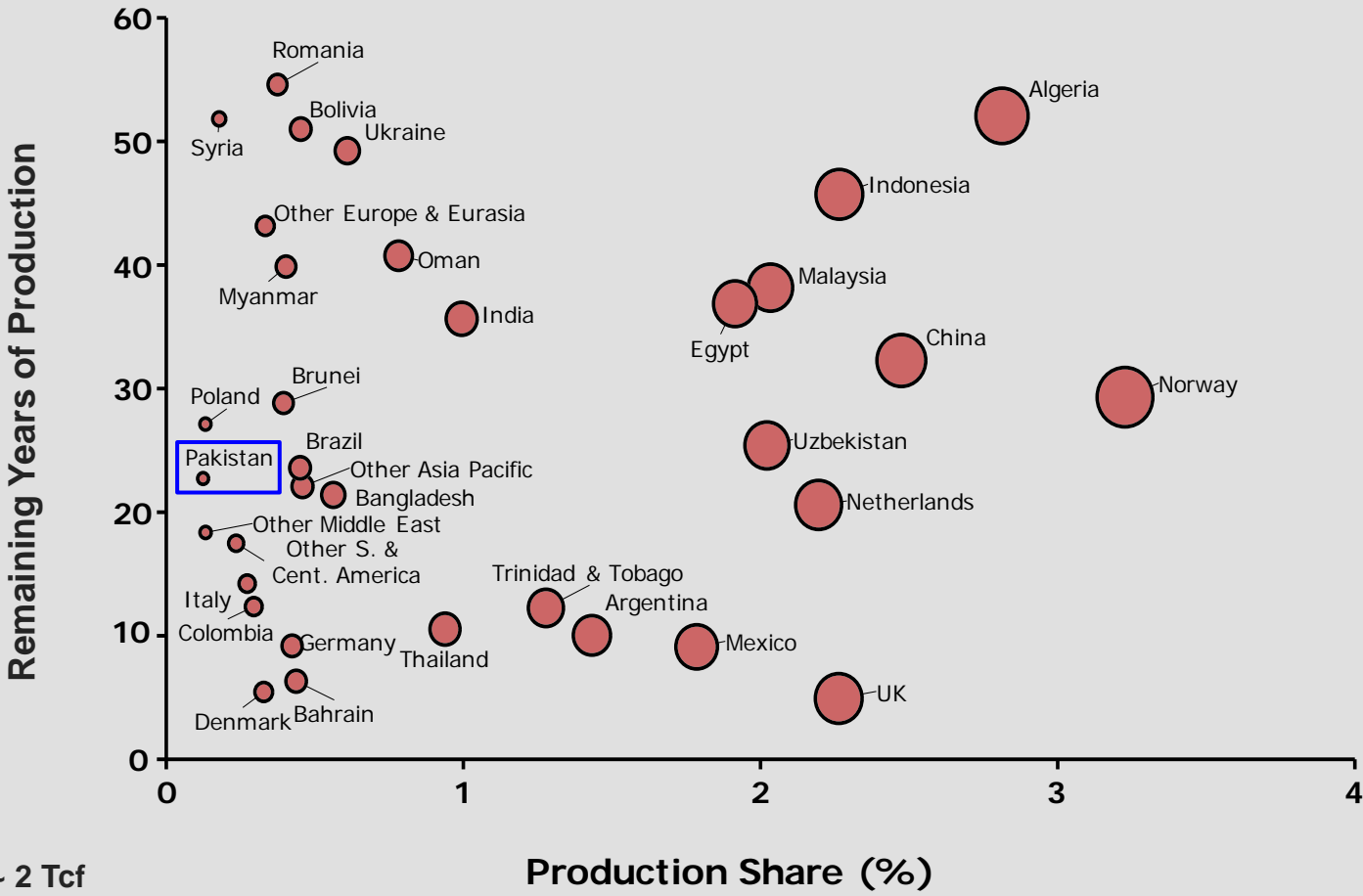


Data based on those of IHS Energy

World Gas R/P Vs Production Share (1 of 2)



World Gas R/P Vs Production Share (2 of 2)

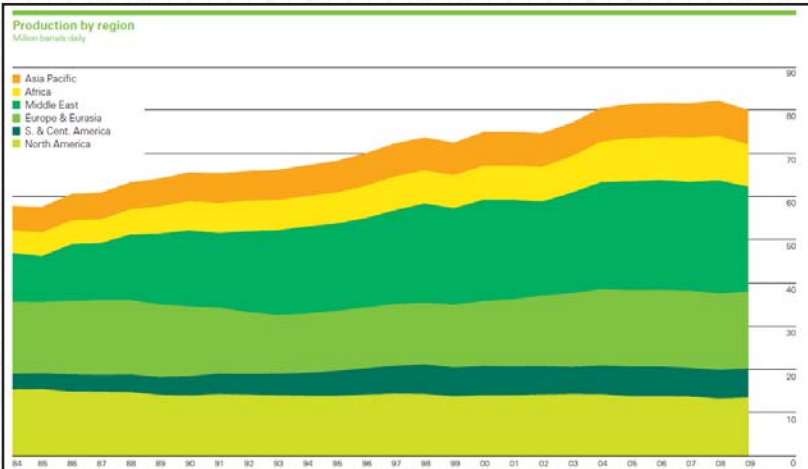




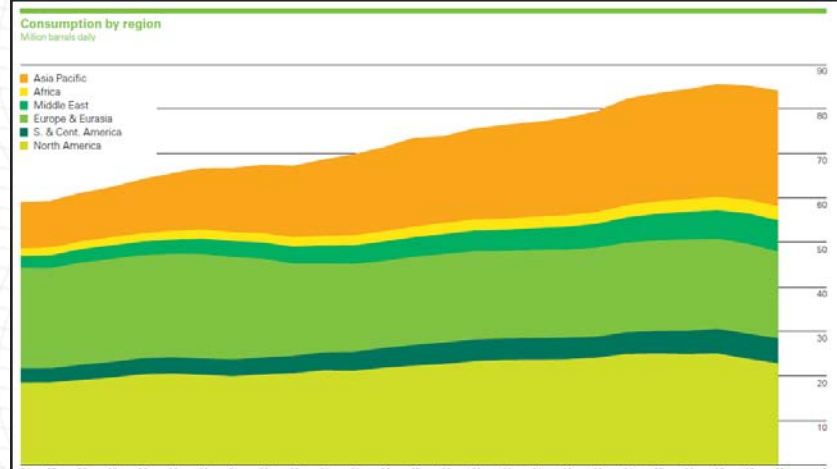
Production and Consumption of Oil

Production 3820.5 mto

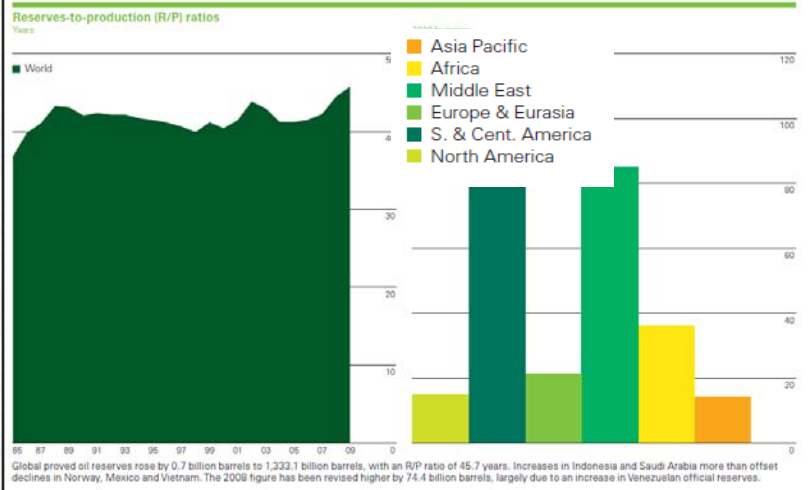
Consumption 3882.1 mto



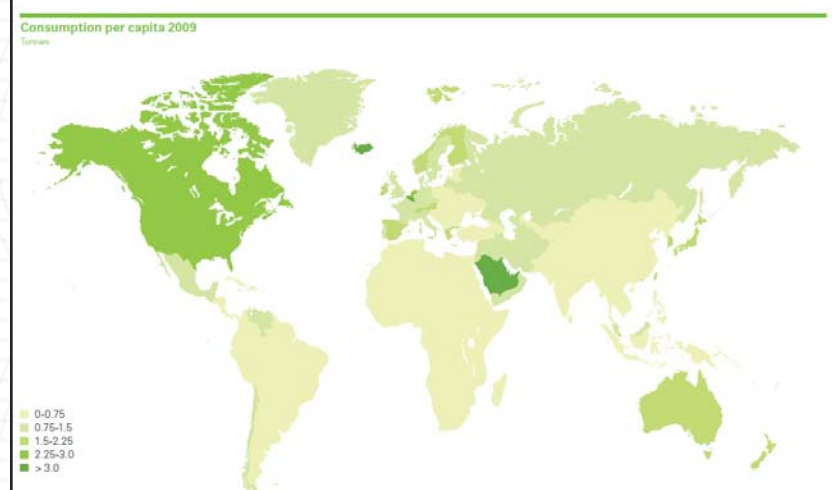
World oil production fell by 2 million b/d in 2009, the largest decline since 1982. OPEC production fell by 2.5 million b/d; Saudi Arabian output fell by 1.1 million b/d, the world's largest volumetric decline. Production outside OPEC rose by 450,000b/d, led by an increase of 460,000b/d in the US, the largest increase in the world and the strongest US growth since 1970.



World oil consumption fell by 1.2 million b/d, a second consecutive decline and, like oil production, the largest decline since 1982. OECD consumption fell by 2 million b/d, a fourth consecutive annual decline. Consumption outside the OECD increased by 650,000b/d. Consumption declined in North America, South and Central America and Europe and Eurasia, outweighing modest increases in the Middle East, Africa and Asia-Pacific regions.



Global proved oil reserves rose by 0.7 billion barrels to 1,333.1 billion barrels, with an R/P ratio of 45.7 years. Increases in Indonesia and Saudi Arabia more than offset declines in Norway, Mexico and Vietnam. The 2009 figure has been revised higher by 74.4 billion barrels, largely due to an increase in Venezuelan official reserves.

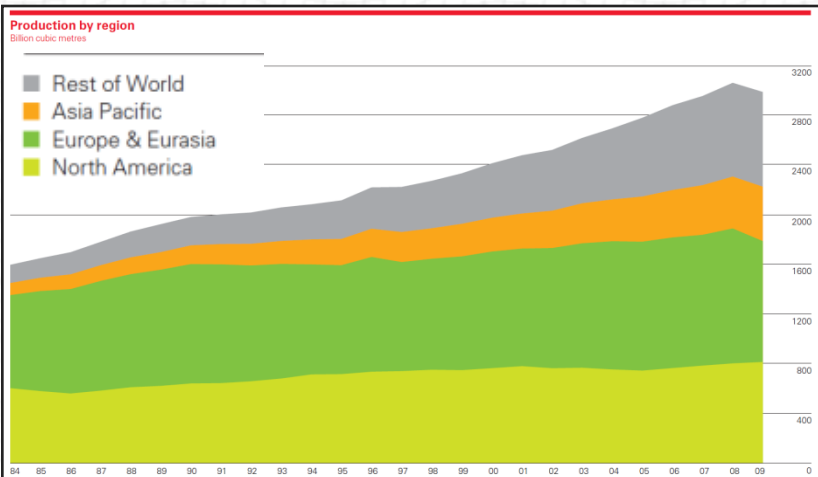


Production and Consumption of Gas

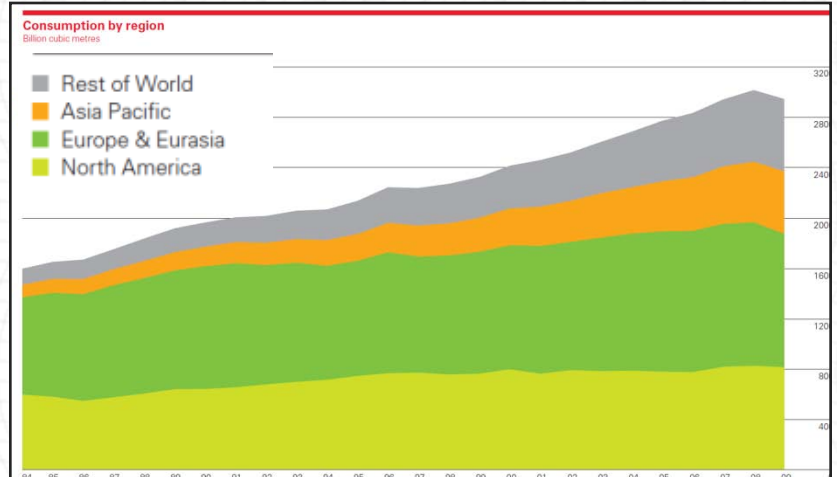


Production 2696 mtoe

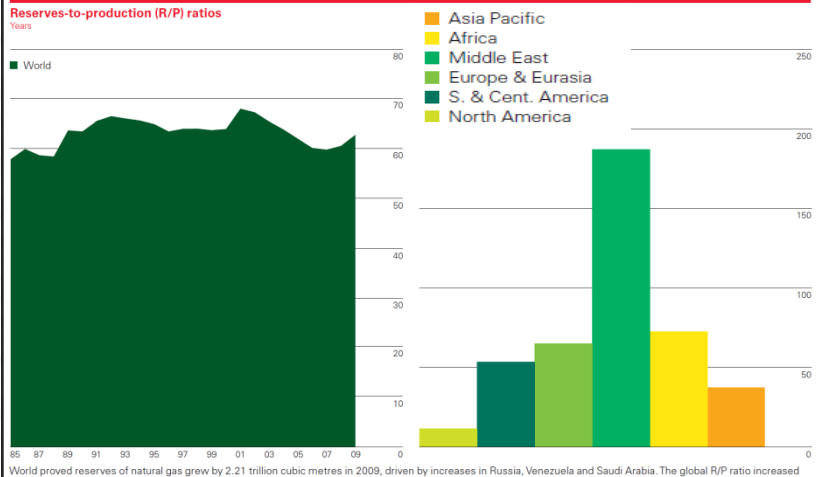
Consumption 2653.1 mtoe



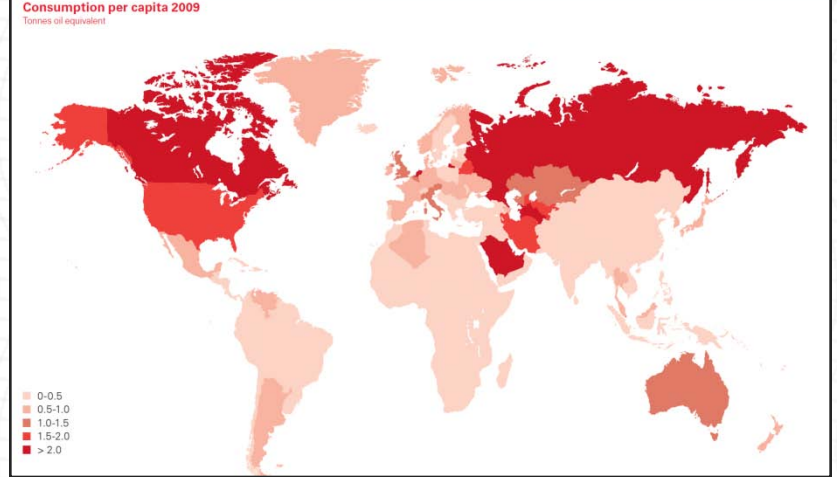
Global natural gas production fell by 2.1% in 2009, the first decline on record. Production fell sharply in Russia (-74.2bcm) and Turkmenistan (-29.7bcm), in each case the largest decline on record. The US recorded the largest increase in the world for the third consecutive year.



World natural gas consumption fell by 2.1%, the most rapid decline on record and the sharpest decline among major fuels. Russia experienced the world's largest decline, with consumption falling by 26.3bcm. Consumption growth was below average in every region.



World proved reserves of natural gas grew by 2.21 trillion cubic metres in 2009, driven by increases in Russia, Venezuela and Saudi Arabia. The global R/P ratio increased to 63.4 years.

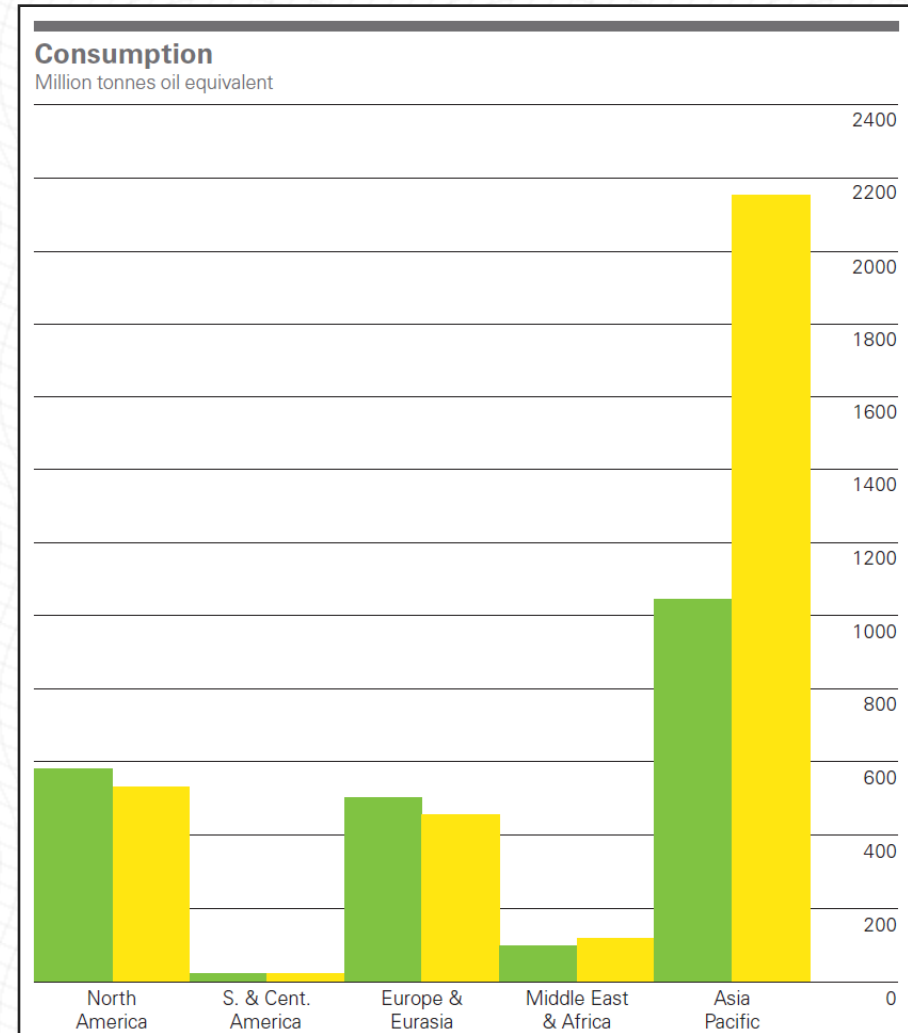
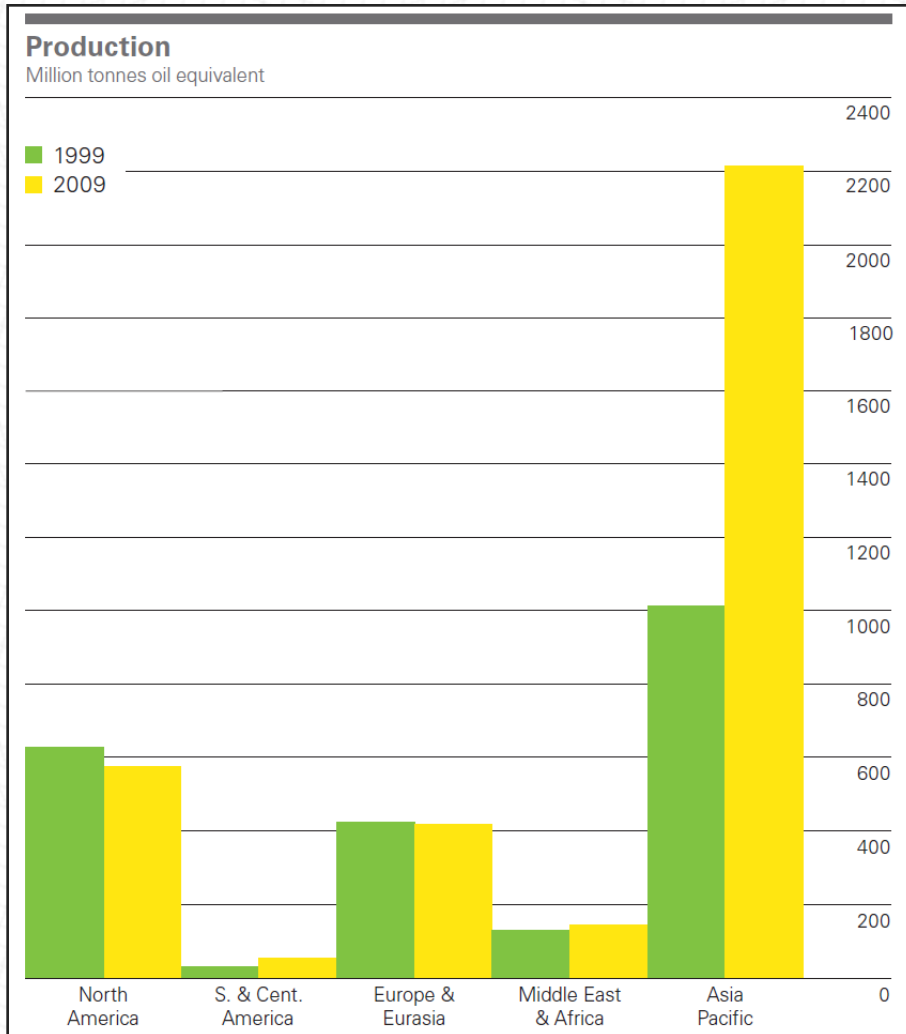




Production and Consumption of Coal

Production 3408.6 mtoe

Consumption 3278.3 mtoe



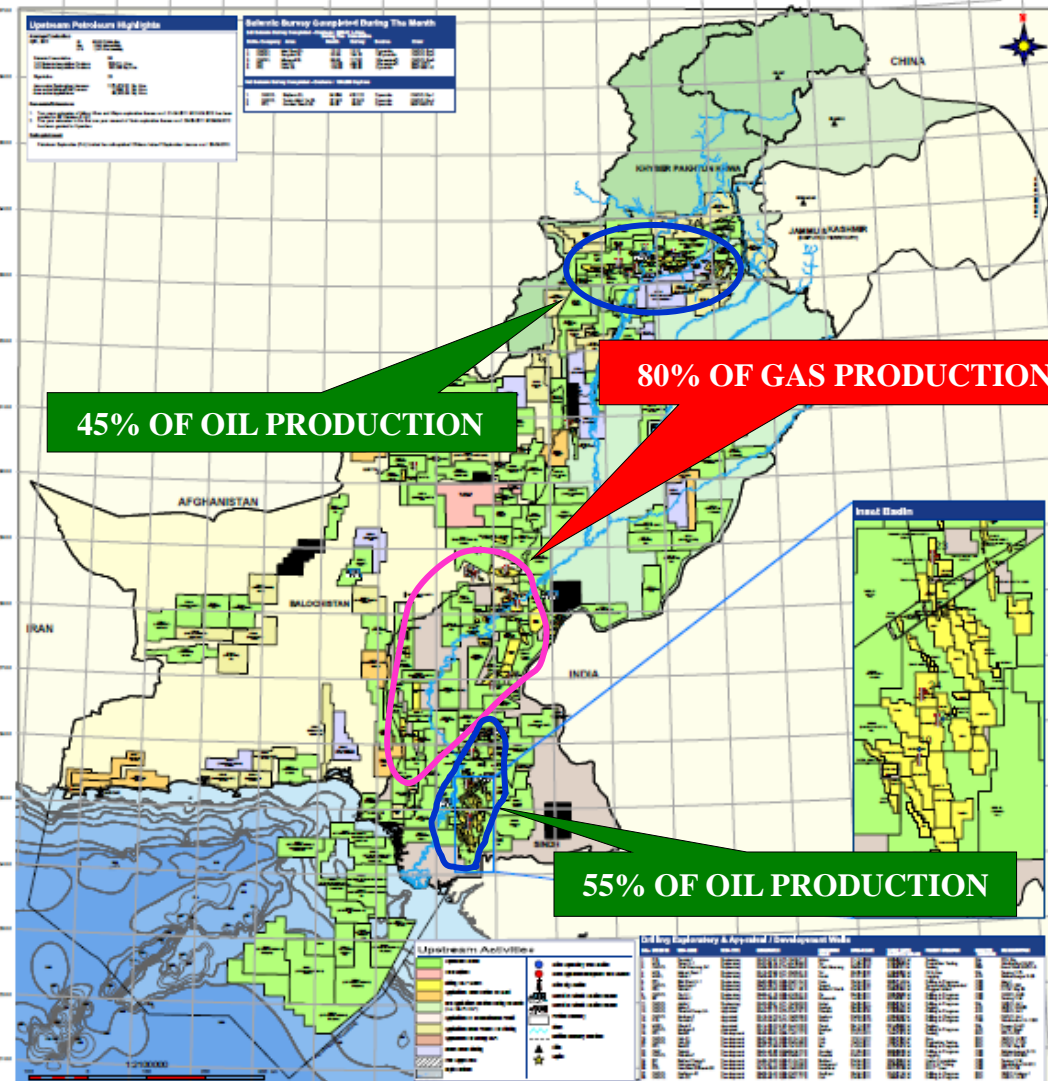


Energy Resources Overview - Pakistan

Current Exploration Activities (May, 2011)



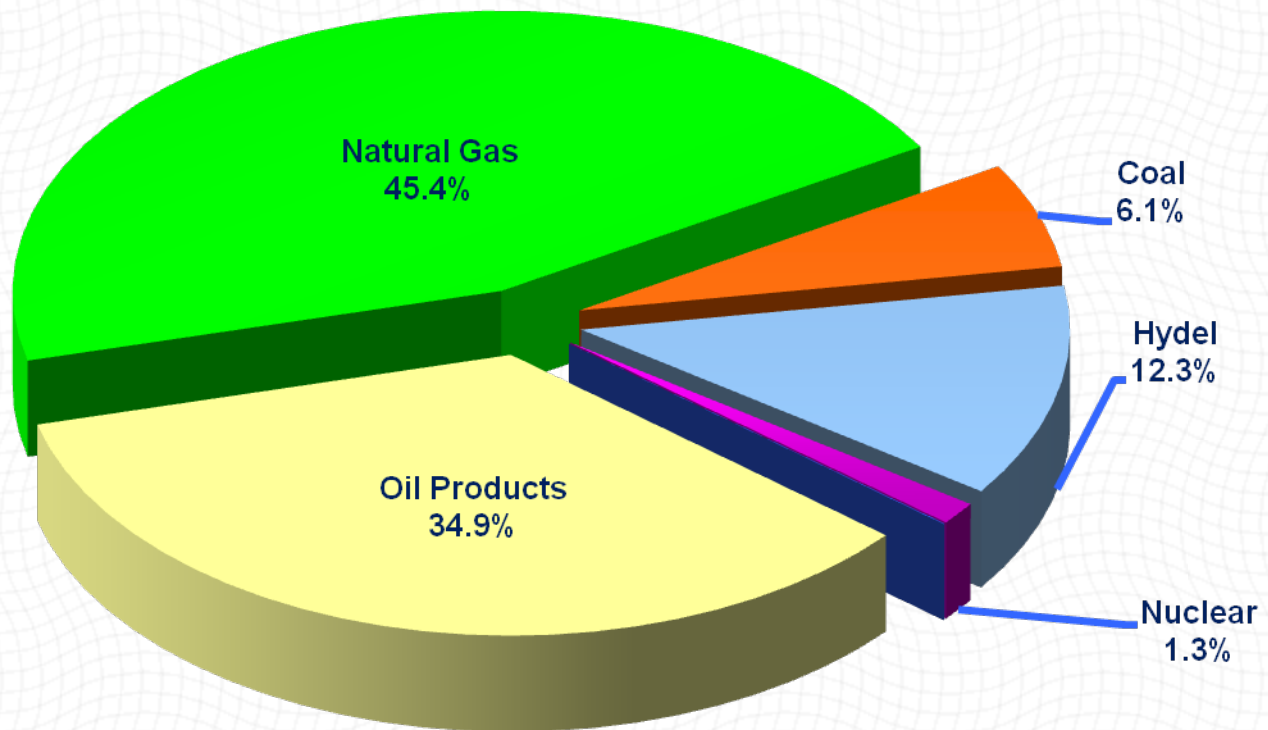
- Area under Exploration: 278,475 sq km (134 ELs)
- Area under Exploration Application: 72,398 sq km (36 ELs)
- Average Production:
 - Oil: 65,333 bbl/d
 - Gas: 3,893 MMcf/d
- Active Exploration Companies:
 - Operator: 28 (Foreign: 17 & Local: 11)
 - Non Operator: 30 (Foreign: 24 & Local: 6)
- Active Seismic Crews: 8
- Active Rigs: 25



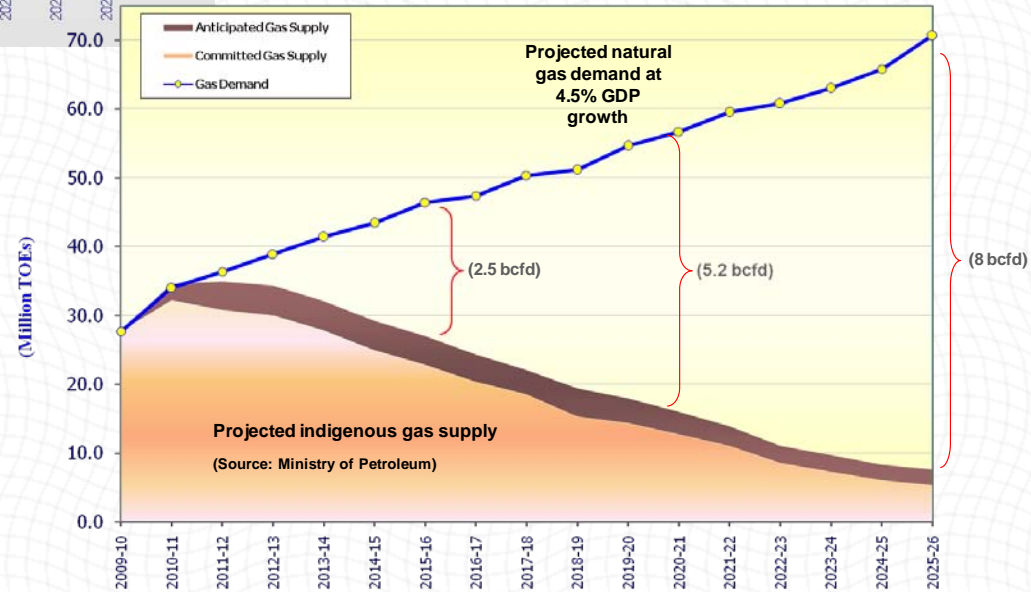
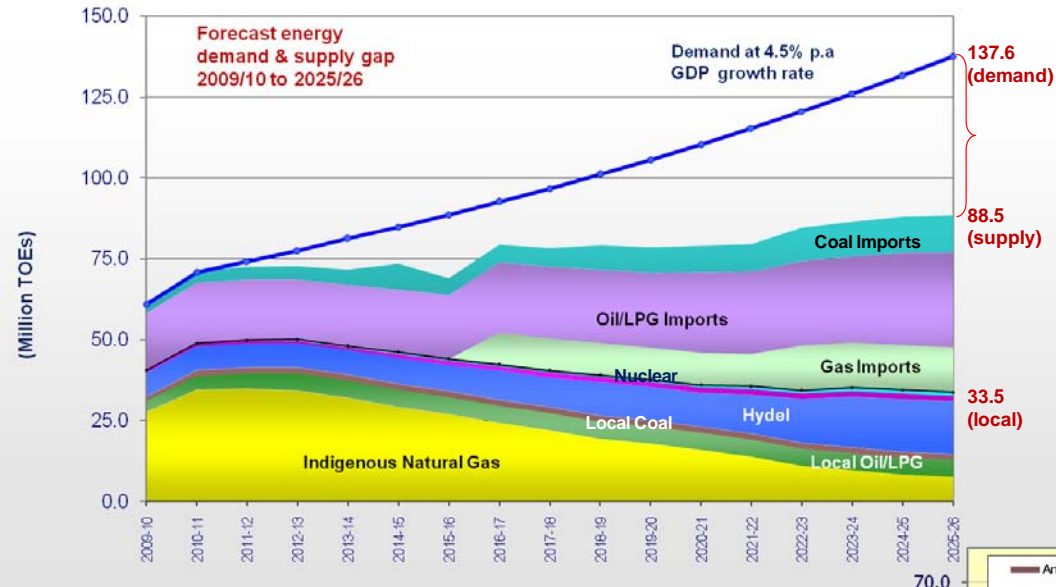
Indigenous natural gas currently supplies almost 50% of Pakistan's energy needs ...



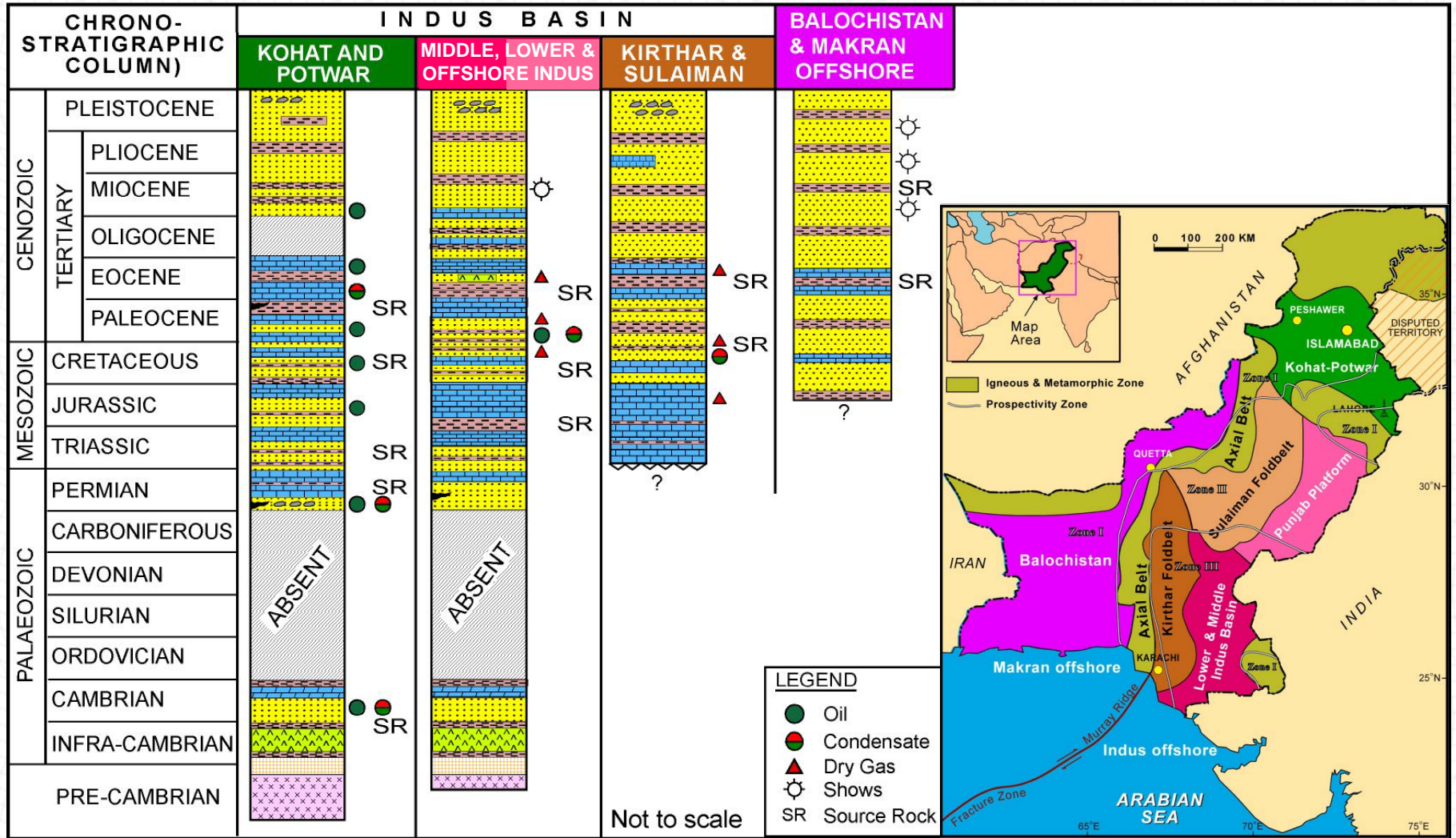
Pakistan's Primary Energy Consumption
2009-10 (61 million TOEs)



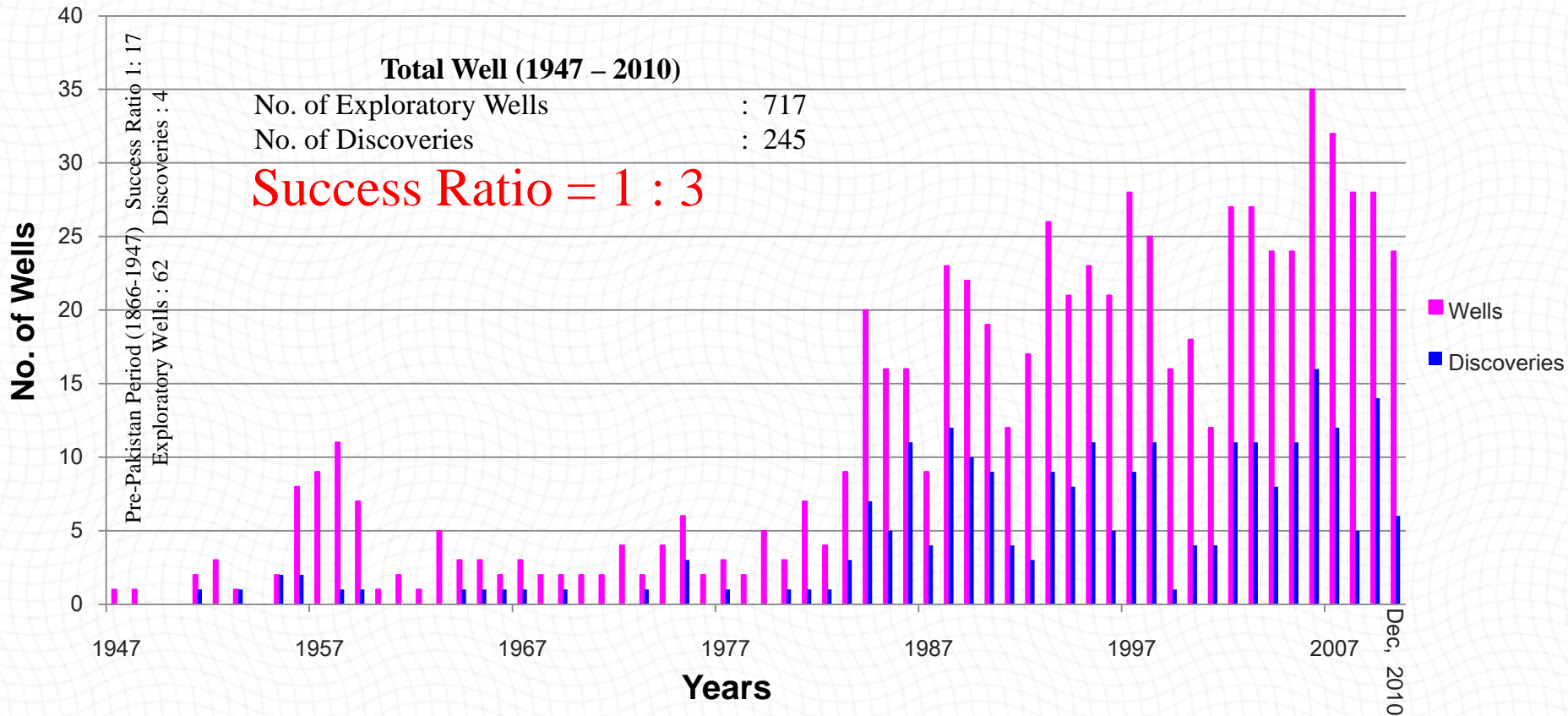
Pakistan - Future Energy Demand Supply Deficit



Generalized Basin-wise Hydrocarbon Presence



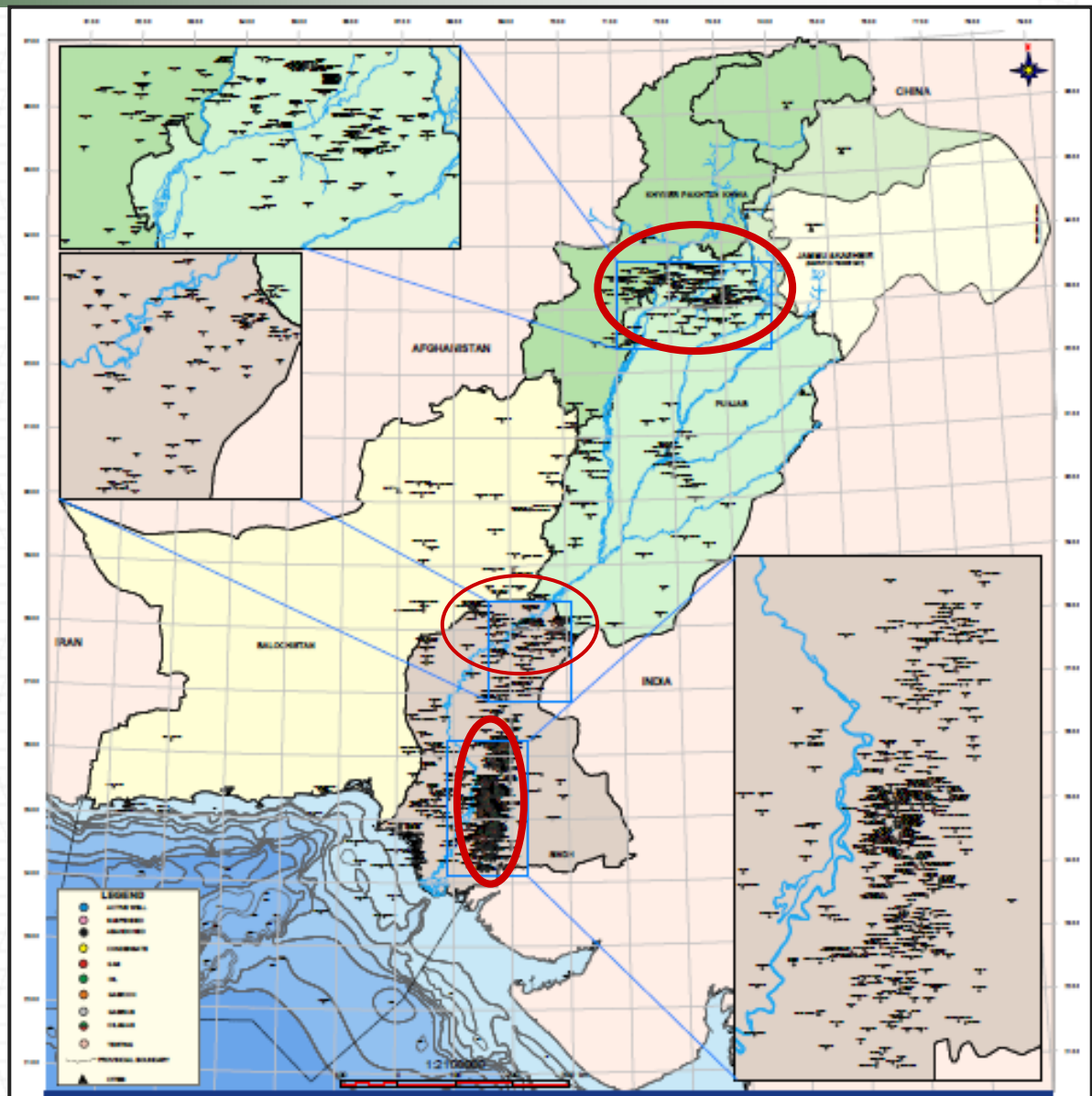
Pakistan – Exploratory Wells Vs Discoveries (1947 – 2010)



Pakistan Exploratory Wells Density Dec, 2010

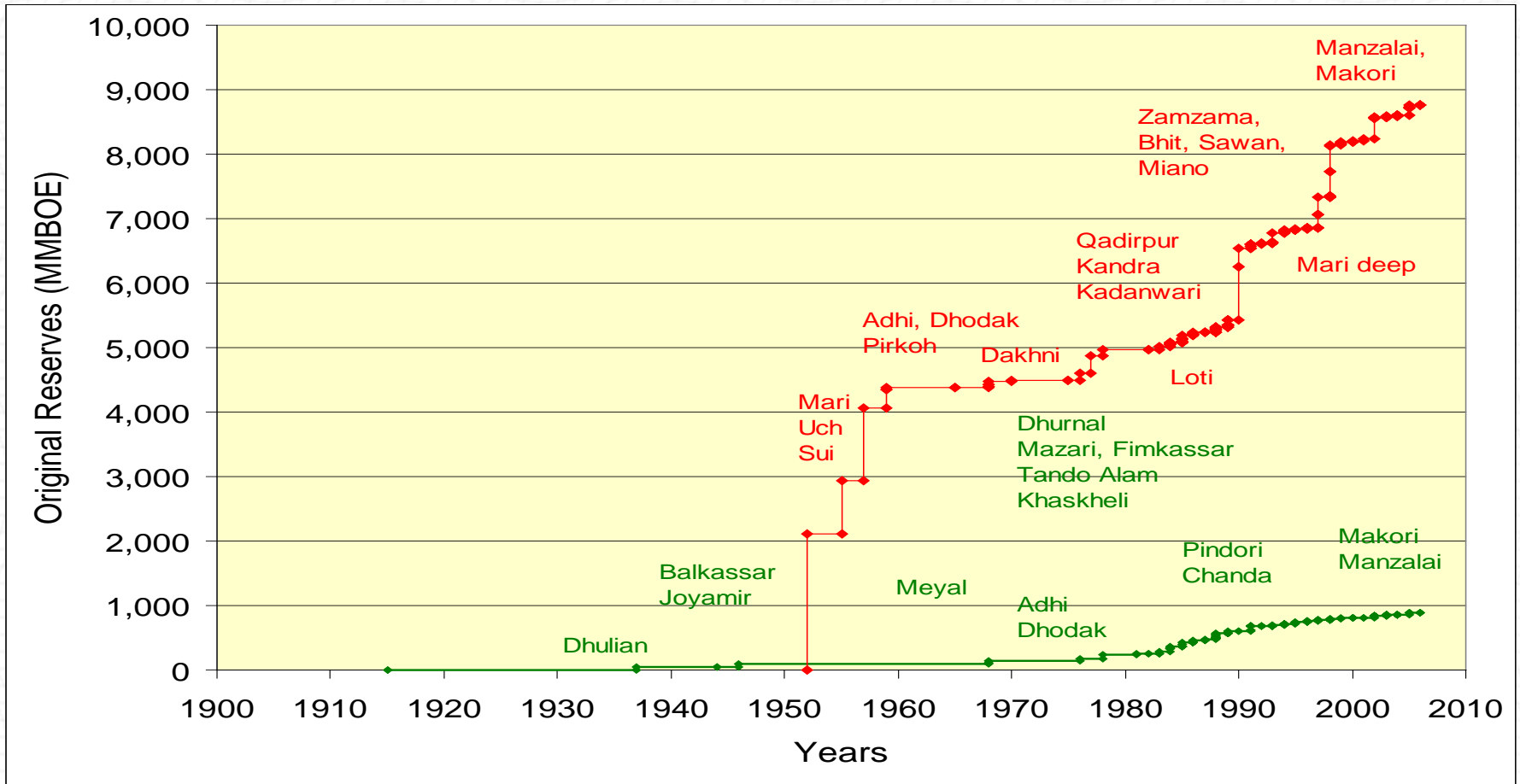


- Total Exploratory Wells:
717 (1947 to Dec, 2010)
- Kohat-Potwar Basin in the North
- Middle Indus Basin
- Lower Indus Basin in South (Density increased exponentially after Khaskeli discovery in 1981)



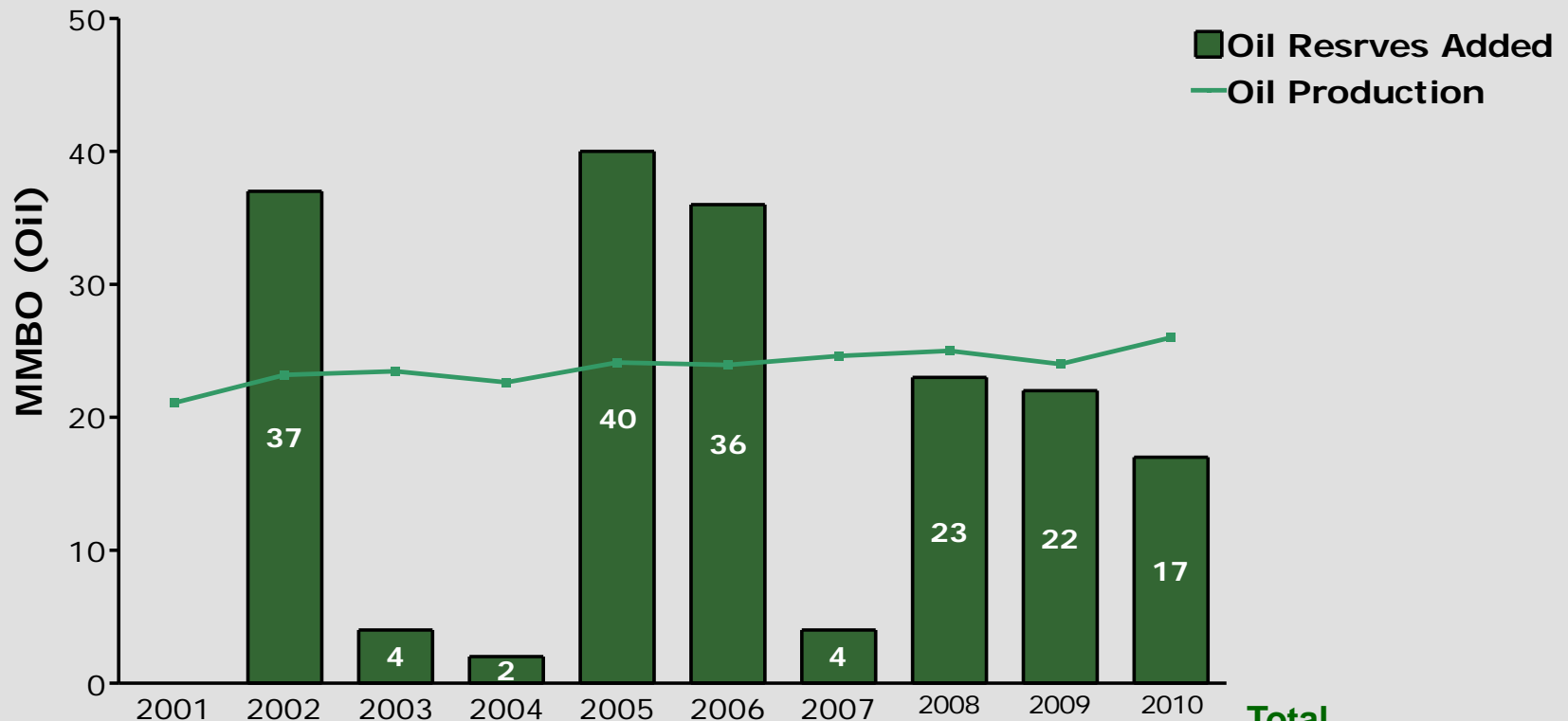
Oil & Gas Creaming Curve of Pakistan

Number of Discoveries increases while the size decreases with time.....



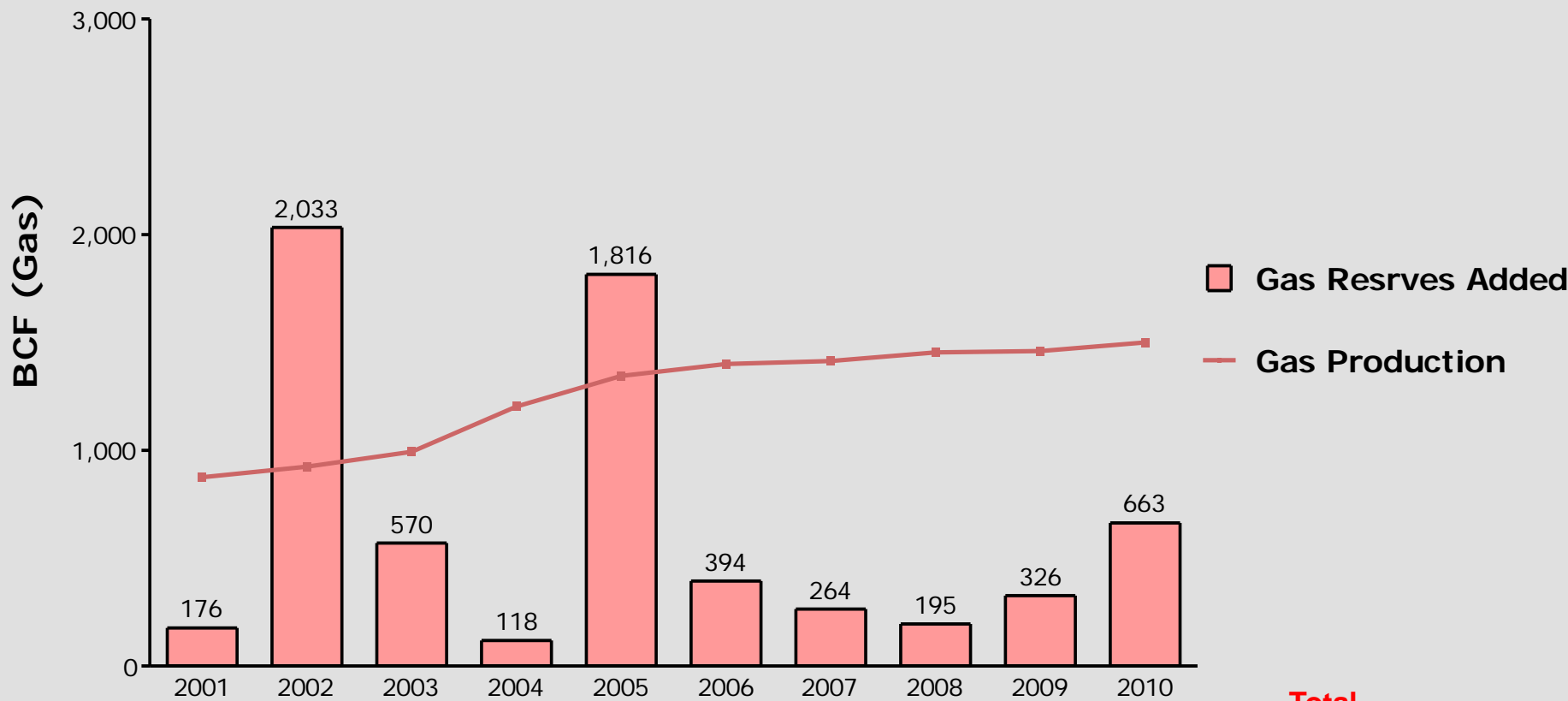
— Oil
— Gas

.....During last 10 years Pakistan has replaced 78% of its oil reserves... thanks to Manzalai, Mela & Nashpa



Oil Reserves Added (MMBO)	0	37	4	2	40	36	4	23	22	17	Total
Oil Production (MMBO)	21	23	23	23	24	24	25	25	24	26	238

.....During last 10 years Pakistan has replaced 52% of its gas reserves...



Gas Reserves Added (BCF)

176 2,033 570 118 1,816 394 264 195 326 663

Gas Production (BCF)

875 924 993 1,203 1,345 1,400 1,414 1,454 1,460 1,500

Total

6,555

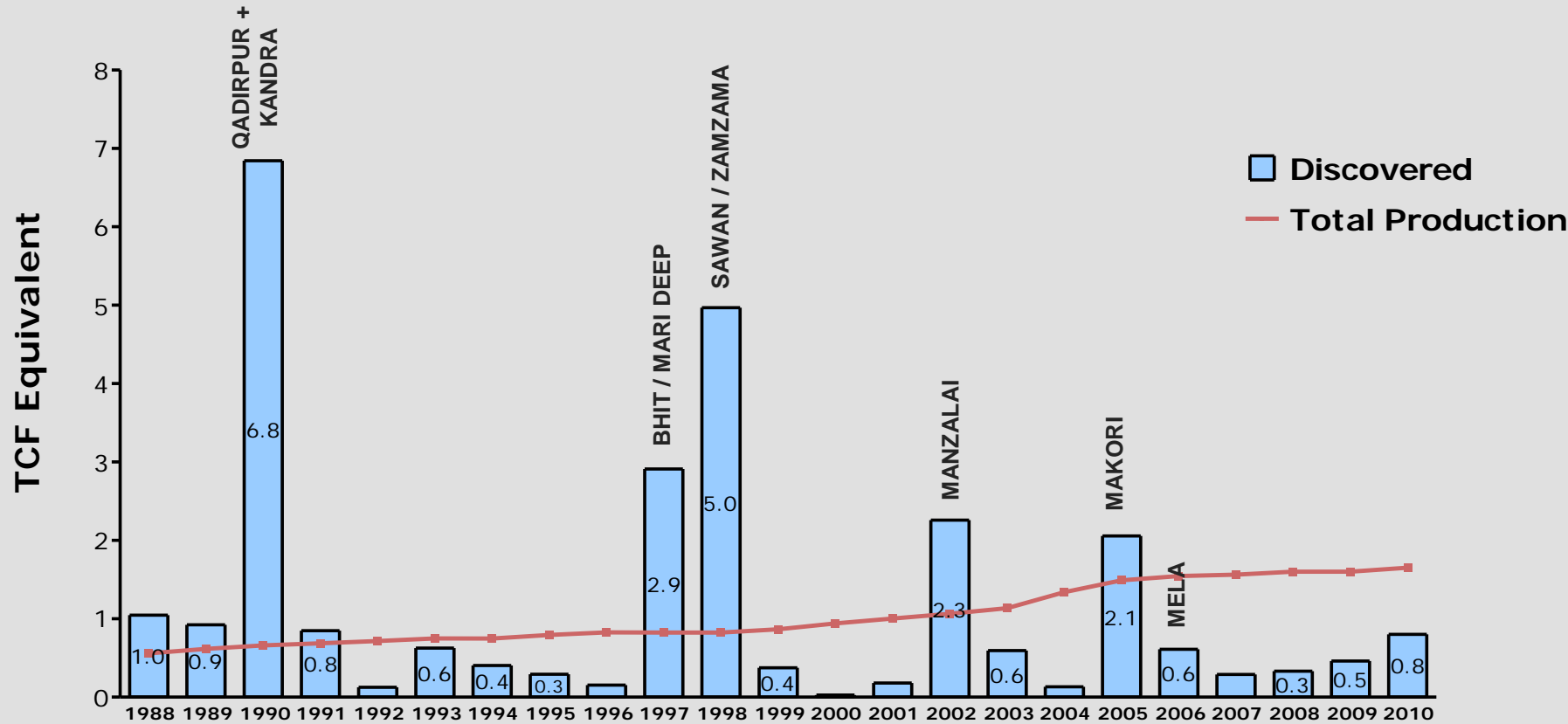
12,568

Size of discoveries decreasing while production is increasing

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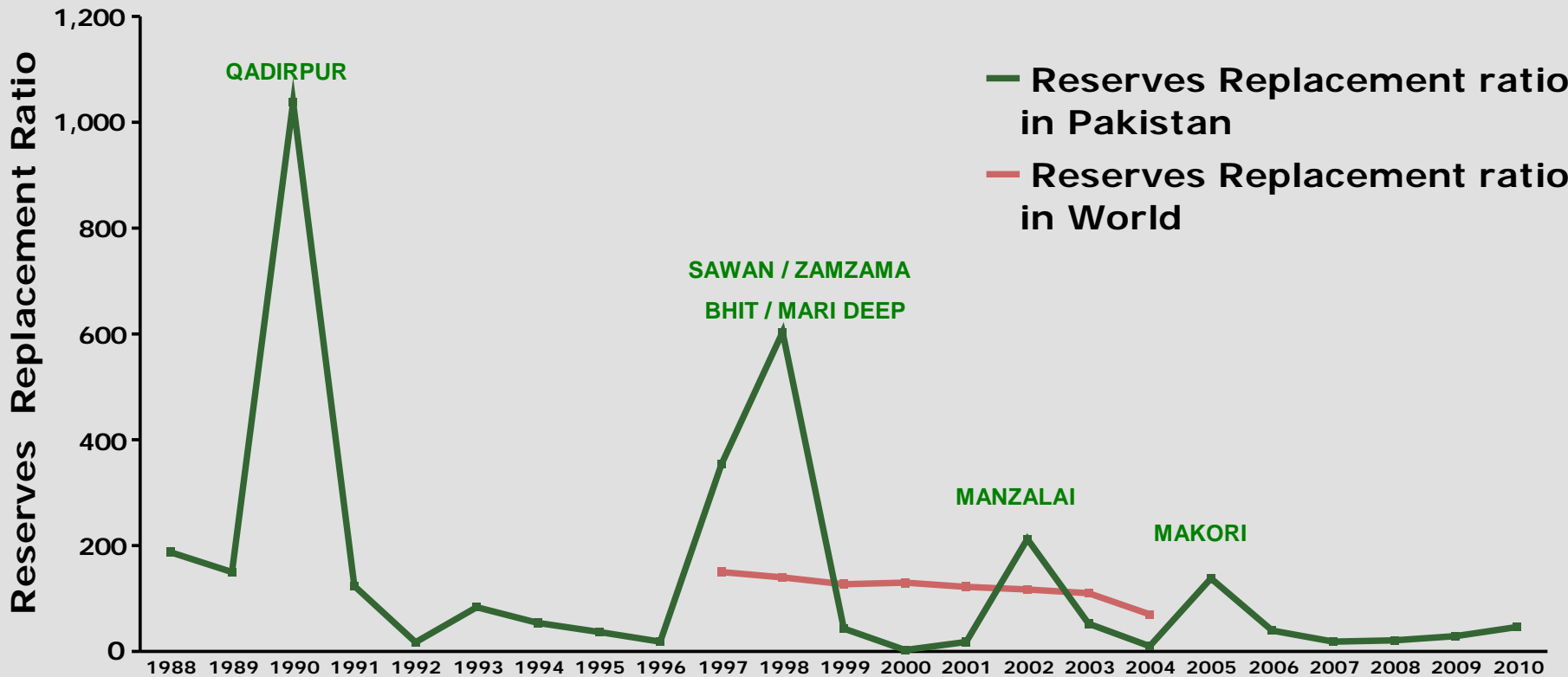
Pakistan's Oil/Gas Discoveries / Production Trend



Reserves are Sinking with time



Pakistan Vs World



The efforts of oil companies to replenish reserves through traditional exploration have been increasingly unfruitful

Pakistan E&P – Current Situation



- Increasing gap between country's produced and discovered reserves
- Decreasing size of new discoveries
- Limited availability of the seismic & drilling services
- Increasing uncertainties and risks in exploration process
- Limited availability of experienced exploration human resource
- Most of the low to medium risk areas are already held leaving only high risk/high cost frontier areas
- Limited potential for large discoveries in currently accessible onshore areas of Pakistan
- Decreasing expected return (reserve addition) against increasing exploration risk



Hopes for the Future

Why go for Unconventional Reservoirs.....



"Future energy resources of the World, particularly gas, will be found in what we consider today to be unconventional reservoirs. These are not, in fact, undiscovered resources, since their occurrences are fairly well-known. However, we do not have adequate geologic data to evaluate the contribution such reservoirs will make to the World's energy endowment in the future."

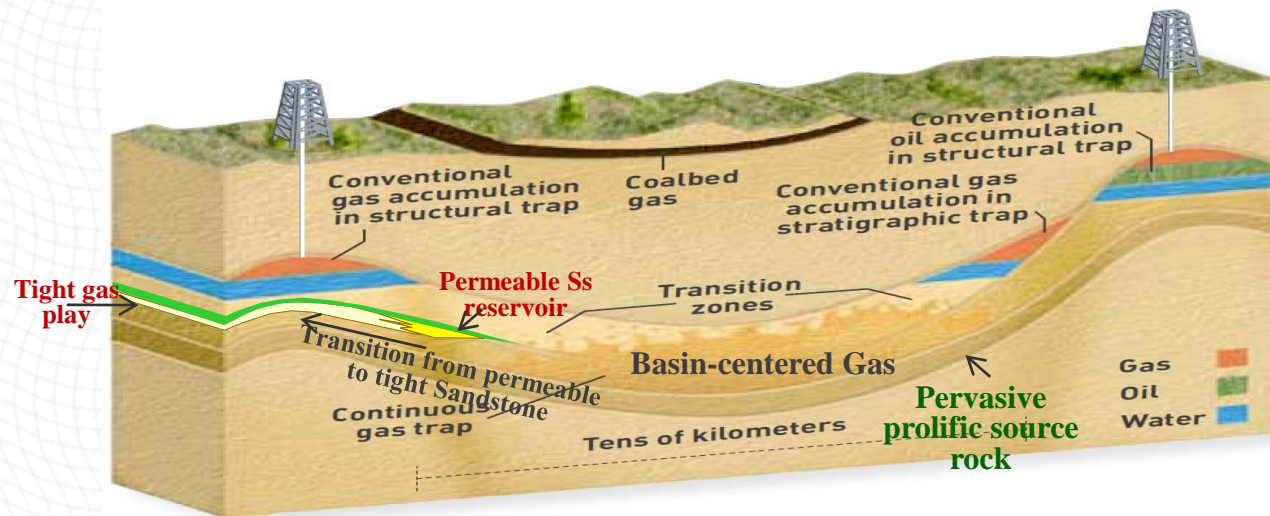
(USGS)



Unconventional Hydrocarbon Resources

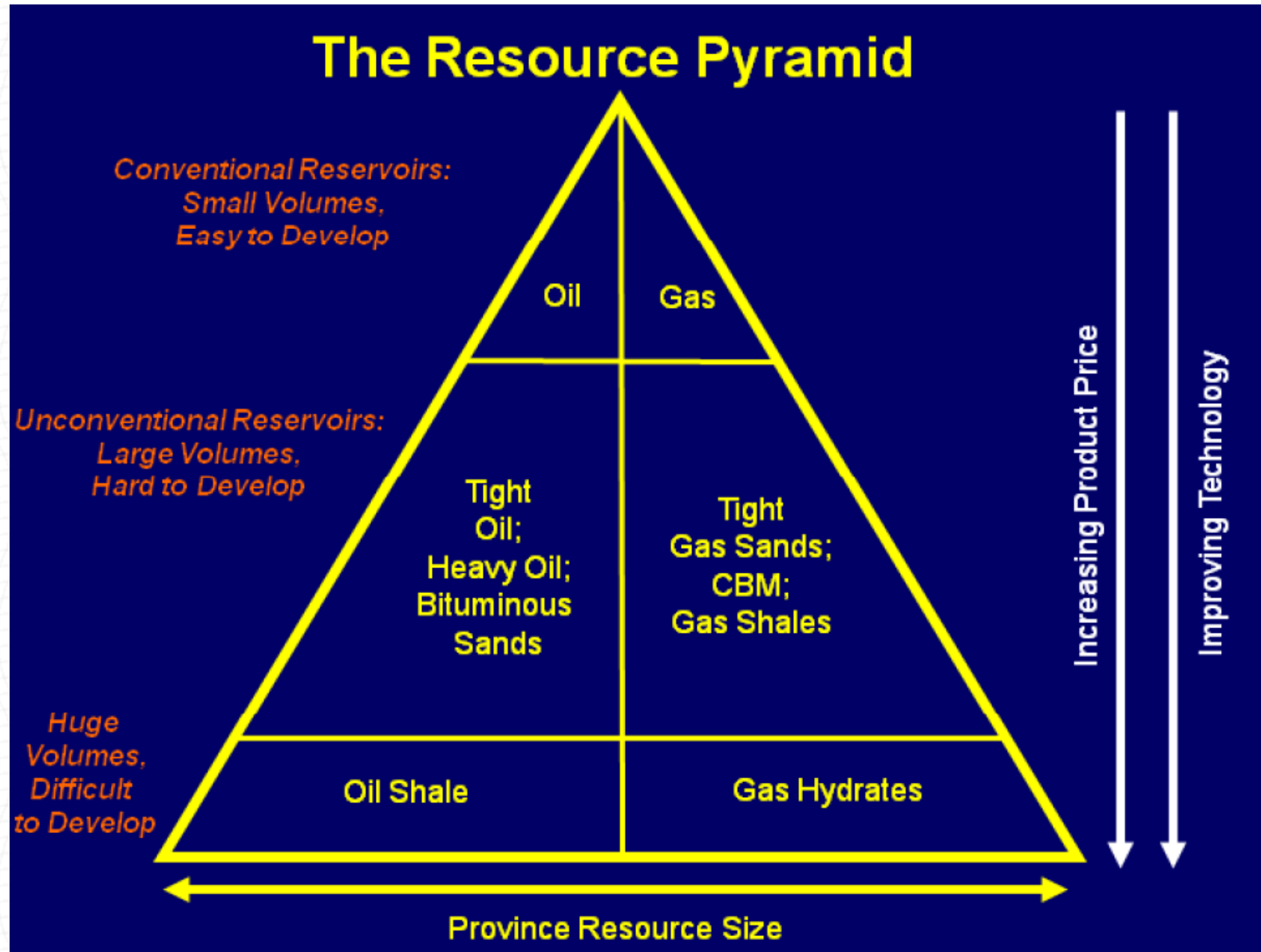
- Unconventional resources are
 - Difficult to develop with available technology
 - Expensive to produce

- Unconventional hydrocarbon resources include
 - Tight Gas (TG) Sand Reservoirs (in situ permeability of less than 0.1 mD and porosity about 10%)
 - Shale gas
 - Coal bed Methane
 - Deep gas
 - Methane hydrates
 - Tar sands and Oil shales



Region	Coalbed Methane (Tcf)	Shale Gas (Tcf)	Tight Sand Gas (Tcf)	Total (Tcf)
World	9,051	16,112	7,406	32,560

Resource Triangle



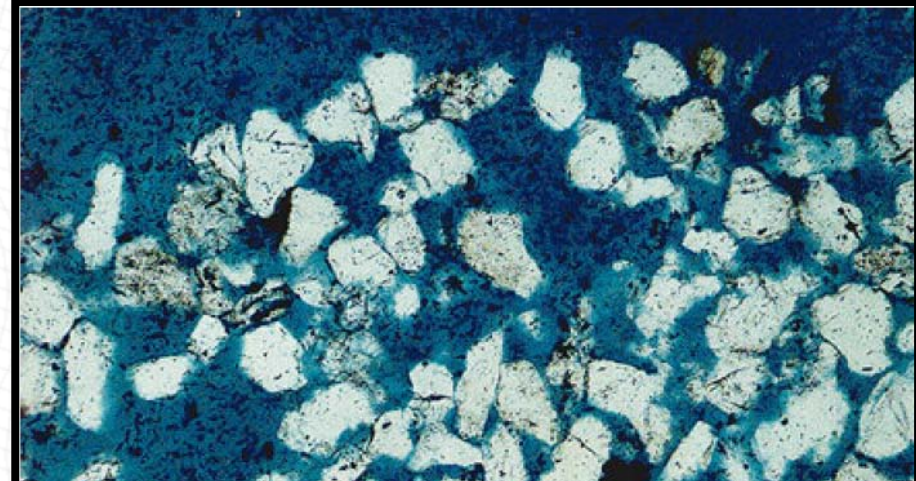
Tight Gas Reservoir



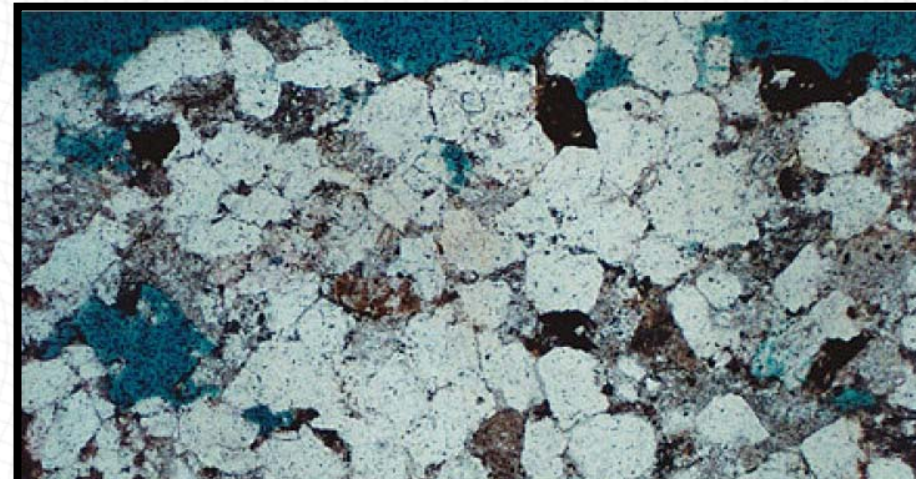
- ❑ Gas bearing sandstones and carbonates having in-situ permeability to gas of less than 1 mD
- ❑ Many 'ultra tight' gas reservoirs may have in-situ permeability down to 0.001 mD
- ❑ Typically, un-stimulated gas flow rates in a well less than 1 mmscfd

USA: ~ 300 Tcf (Recoverable reserves)

Pakistan: ~ 34 Tcf (Estimated recoverable resource)



Conventional sandstone reservoir

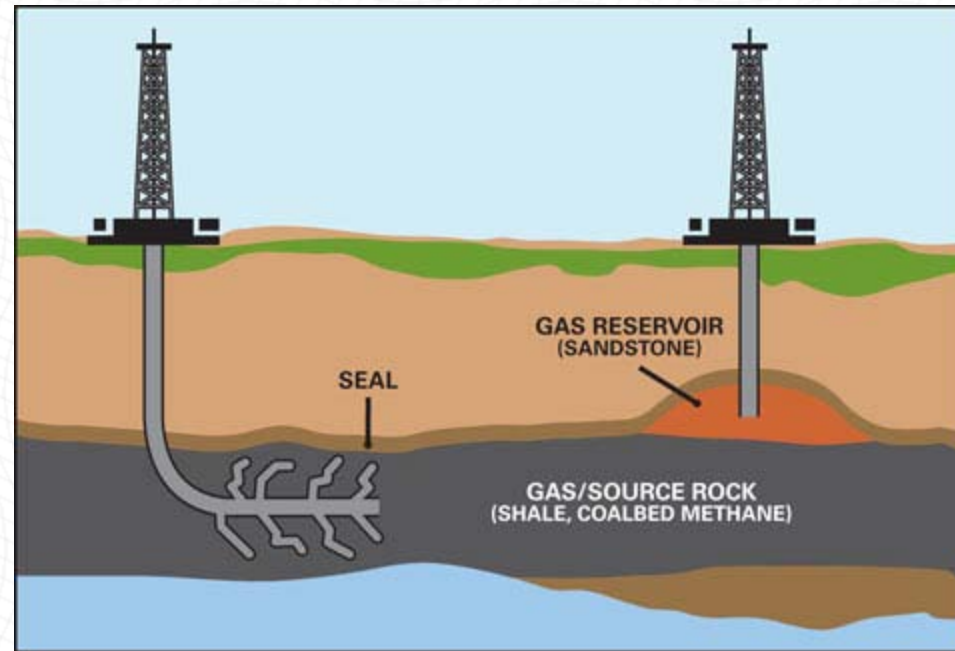


Tight gas sandstone

Shale Gas



- Natural gas produced from shale
- Shale gas areas often known as resource plays - not the exploration plays
- Shale permeability restricted utilization of a rich resource in the past
- Horizontal drilling and Hydraulic fracturing resulted shale gas boom in recent years
- Shale gas expected to account for major gas supply in USA



USA: ~ 742 Tcf (Recoverable reserves)

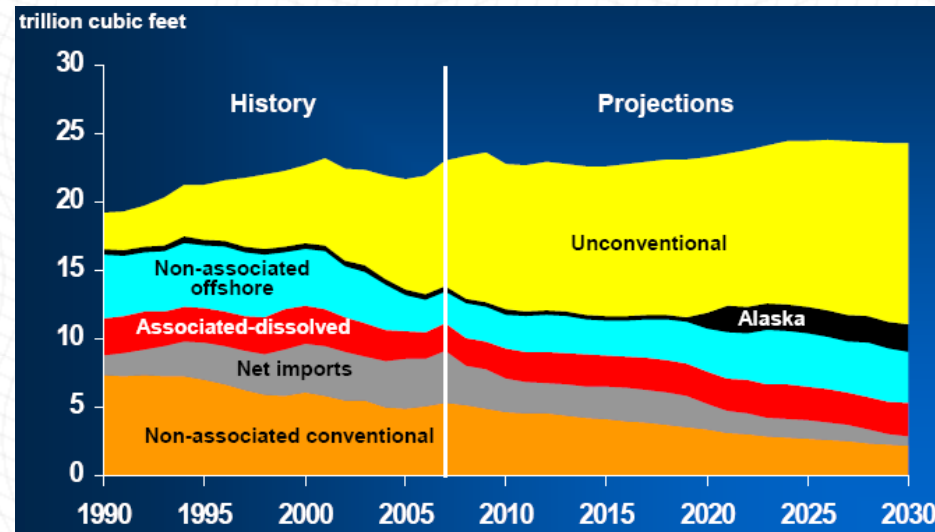
Pakistan: Prognosticated Reserves 65 Tcf

Unconventional Gas Production (USA)

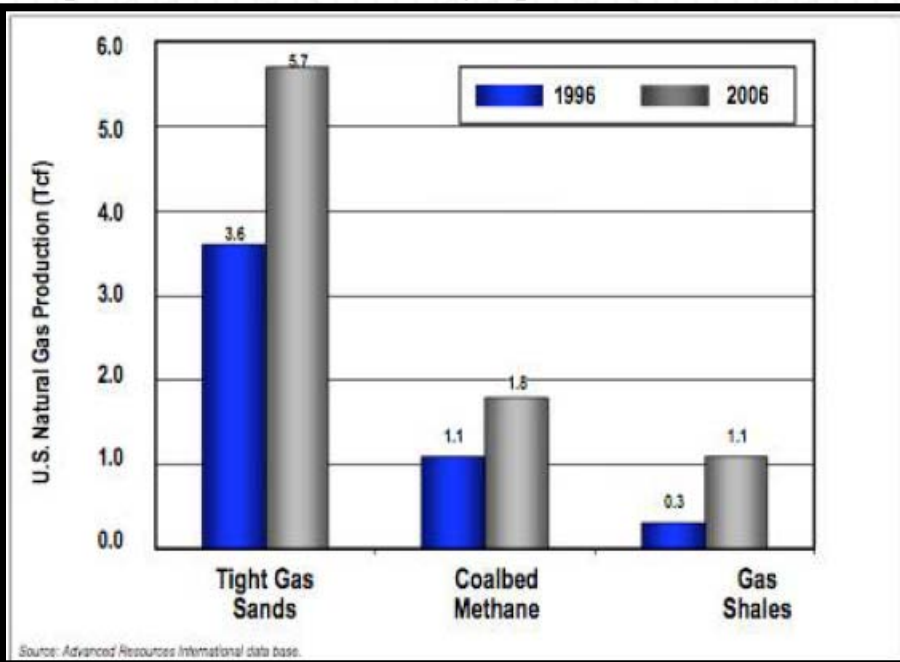


- Projection shows Unconventional Reservoirs will be the dominant resource for Future

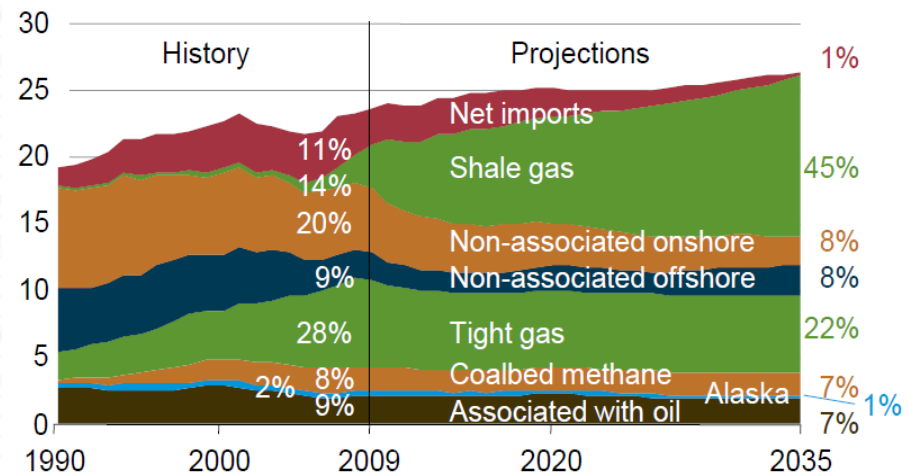
US Total Gas Production



Comparison of unconventional gas production in 1996 and 2006



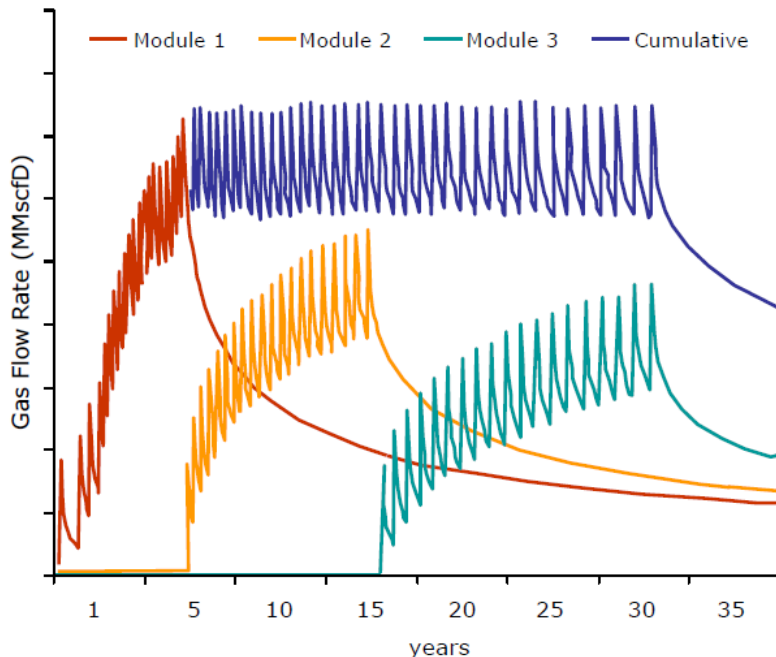
U.S. dry gas production (trillion cubic feet per year)



Conventional vs Modular Approach

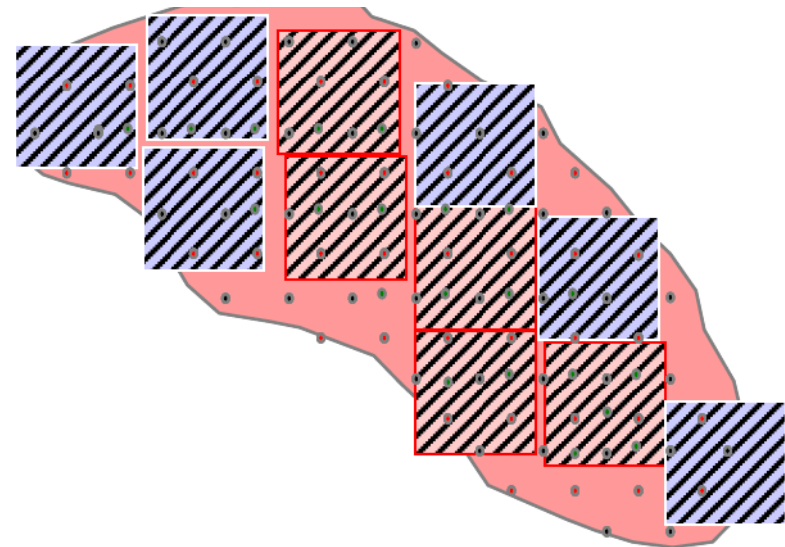
Conventional:

- Field Coverage
- Increasing intensity
- Central Facilities



Modular:

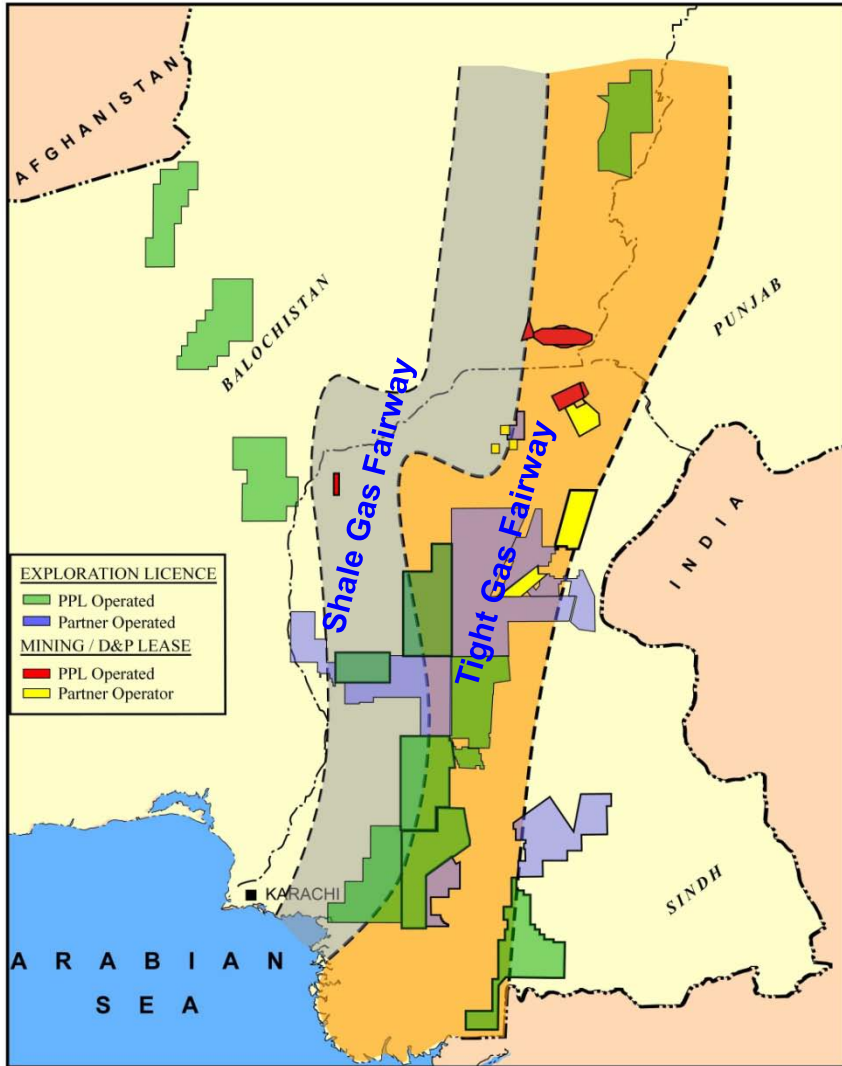
- Always intense
- Increasing coverage
- Adaptive facilities
- Adopting to technology evolution



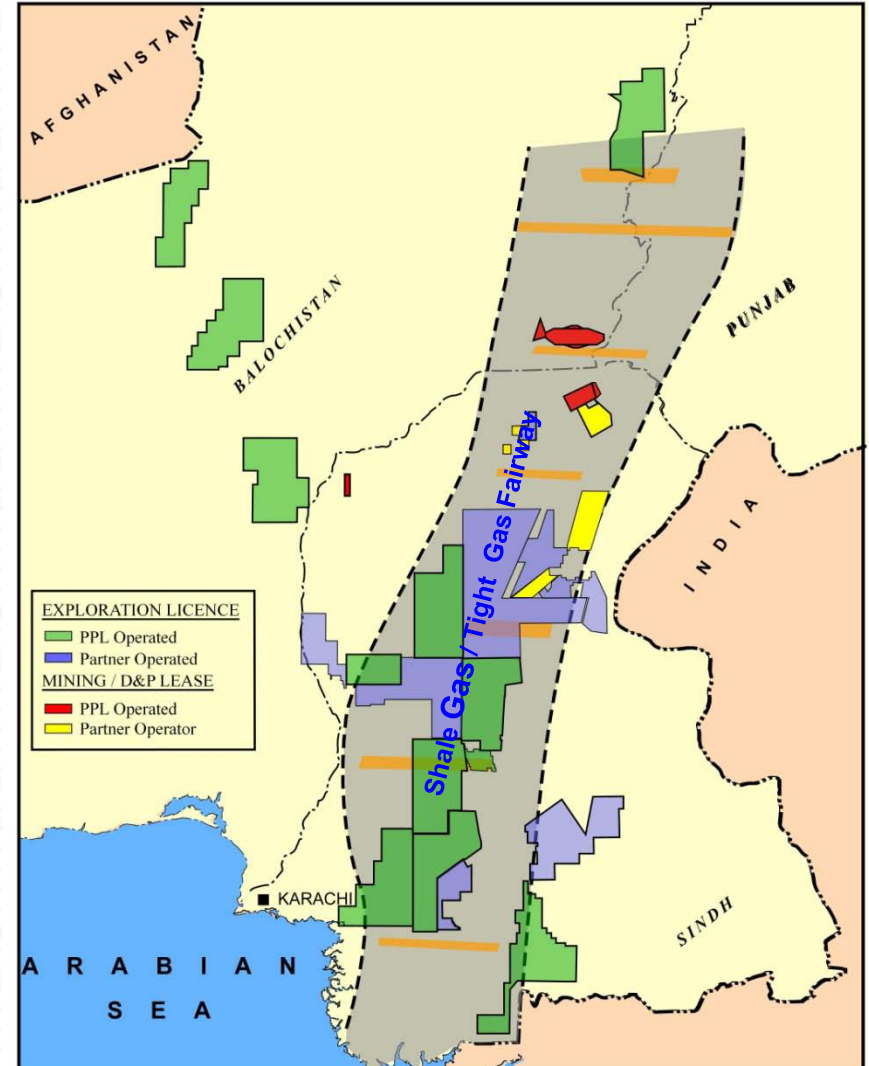
Tight / Shale Gas Fairways & PPL Blocks



Shale Gas & Tight Gas Fairway Map (Lower Goru)



Shale Gas / Tight Gas Fairway Map (Sembar)



Present & Future Scenarios in a Nut Shell...



- ❑ Several studies suggest that only a small percentage of the huge hydrocarbon volumes that have been generated, reaches the Conventional Reservoirs
- ❑ Conventional reservoir size and chance of success of finding these is decreasing
- ❑ 2011 Policy for Conventional reservoirs will be announced soon
- ❑ Significant hydrocarbon volume is present in Unconventional Reservoirs - Tight Gas and Shale Gas– V. Preliminary Assessment: ~ 100 Tcf. Tight Gas Policy 2011 announced while Shale Gas Policy under preparation
- ❑ Significant volume of Tight Gas is present in Middle Indus Basin
- ❑ Hydrocarbon Production from Unconventional Reservoirs will eventually take over,
- ❑ Three pronged approach required: i) Incentivize E&P Sector (Early Cost Recovery, optimum gas price etc; ii) Promote Service Sector; and iii) Gain Buyers' confidence
- ❑ Main Drivers : "Technology" and "Gas Price"



**Thanks
&
Questions?**