Global Liquids & Gas Supply Dynamics – Implications for India

Executive Summary

PFC Energy – PetroFed Seminar

30 July 2007

PFC Energy

Keynote Address

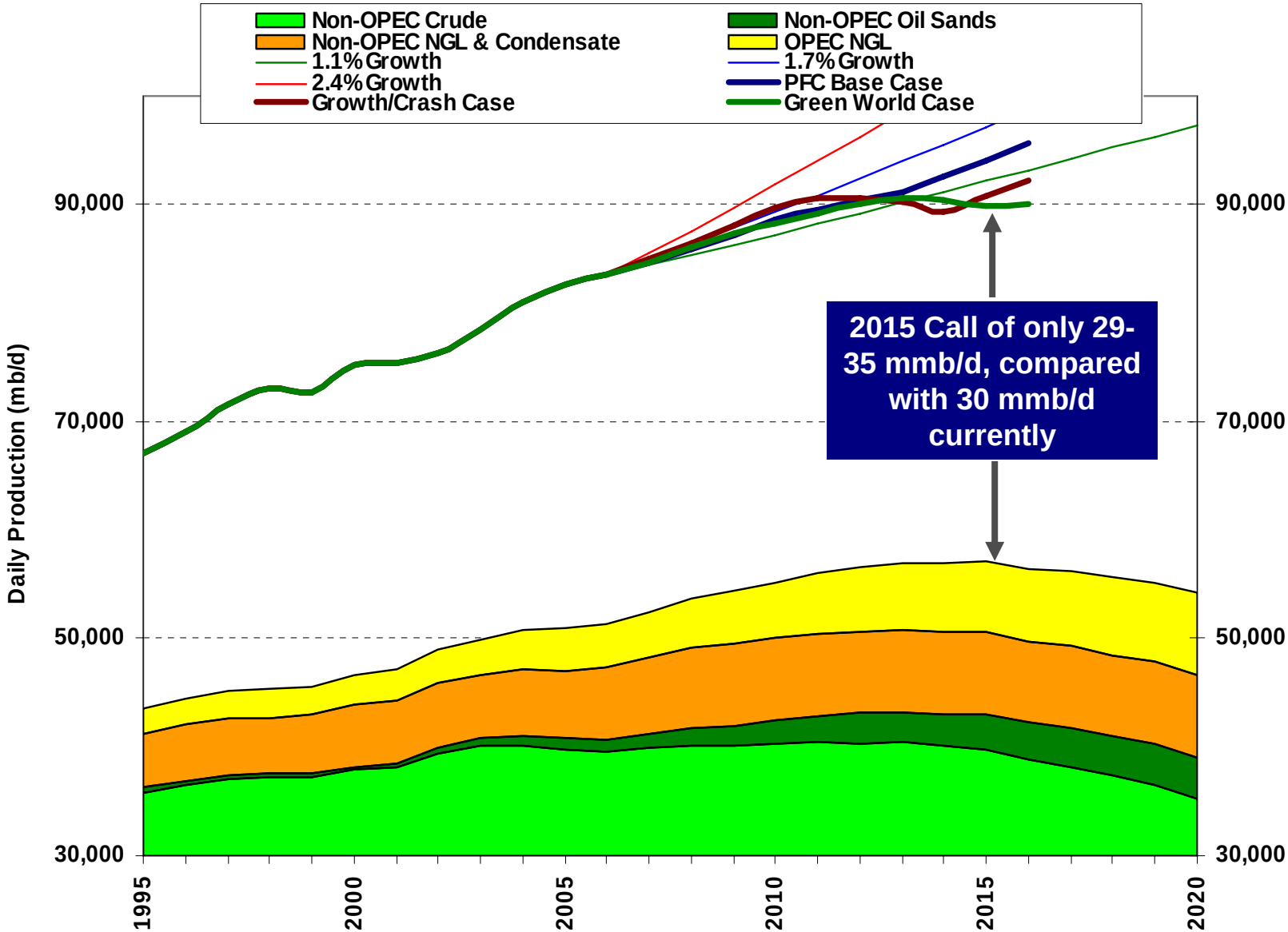
- **Price Constraints for Future Growth**
- **Call on OPEC**
- **OPEC Price Thresholds**
- **Supply/Demand Uncertainties**

What Price to Fuel Future Growth?

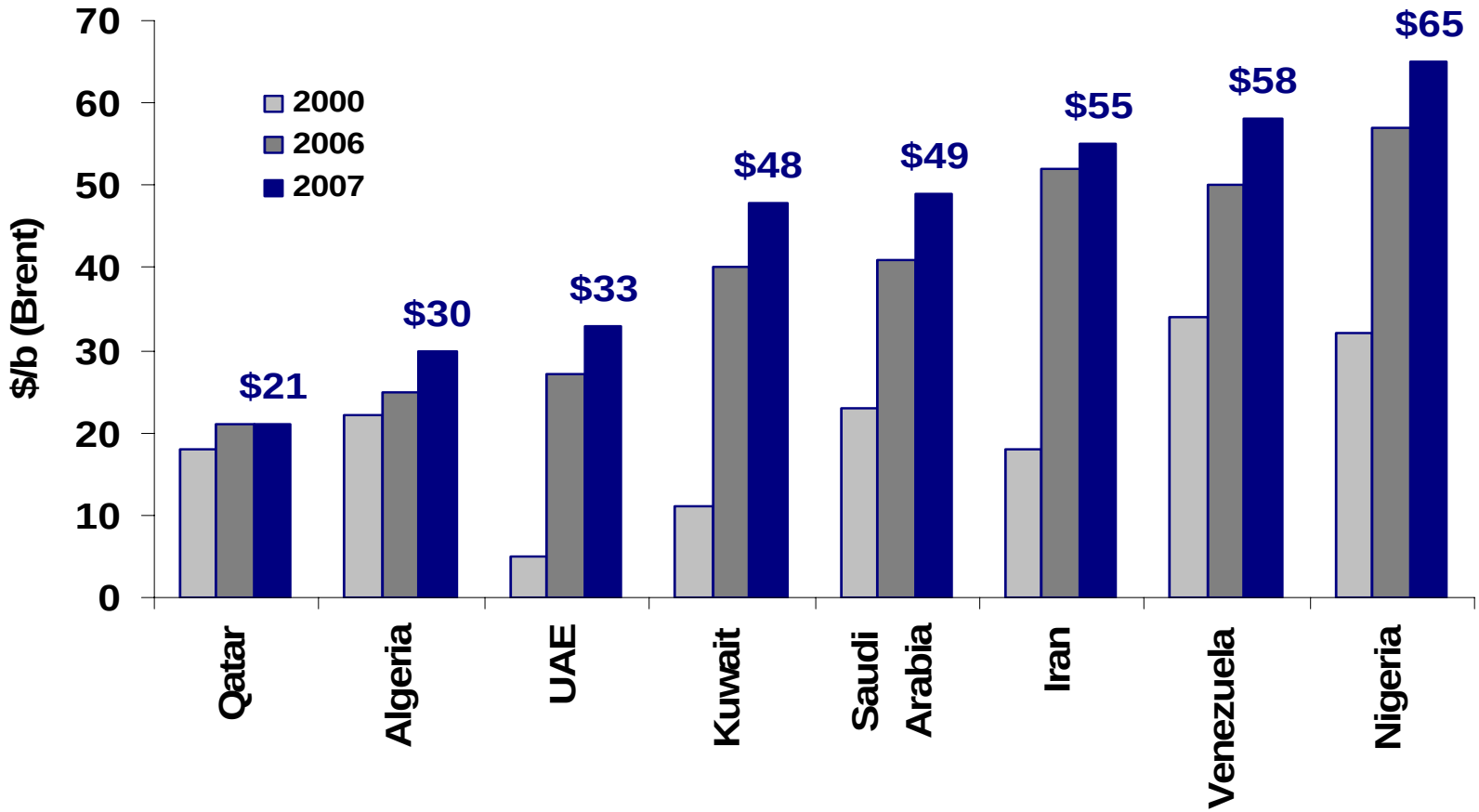
- **Currently prevailing high price environment in part reflects constraints on global oil industry to meet rising global demand**
- **But looking forward, major resource holders in OPEC face a similar uncertainty of *demand* for their output**
- **At the same time higher state financing needs increase the revenue demands placed on the oil and gas sector**

OPEC will adopt a conservative approach to brining new capacity on-line, while also defending steadily higher oil prices

The Call on OPEC?



OPEC Price Thresholds:
Minimum needed for current account balance



Spending pressures—from private consumption, populist fiscal policies, or infrastructure investment—have led to steady increases in revenue needs

OPEC has a strong *structural* incentive to defend steadily higher prices

Uncertain Demand Leads to Insecurity of Supply

- **Uncertain demand coupled with rising financing needs mandates OPEC's active market management for the rest of the decade**
  - Capacity addition investments will be approached conservatively
  - Tangible signs of stronger growth will be required for the major resource holders to change their strategy

- **However, OPEC's price goals can likely be achieved despite growing non-OPEC supplies through 2015**

- **Similarly, OPEC defense of higher prices should ensure positive price environment even for higher cost non-OPEC sources**

Global Liquids Forecast

- **Key Messages**
- **Non-OPEC**
- **OPEC**
- **India Outlook**

Key Messages

1. **In spite of high oil prices, Non-OPEC production growth has been very limited with the exception of the FSU. This trend is likely to continue through this decade.**

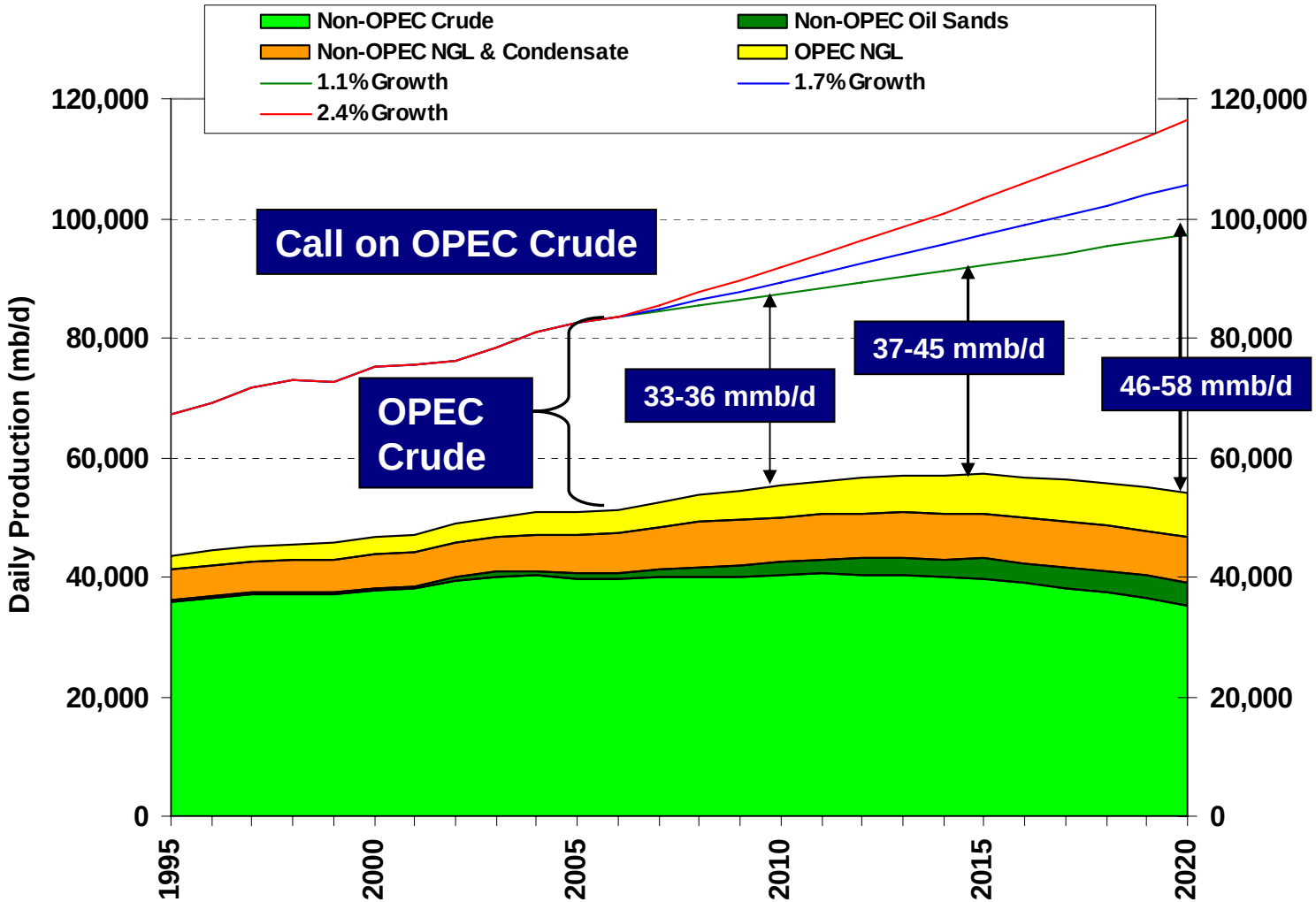
2. **Oil exploration in the last 10 years (with a few exceptions like Angola, Sudan, Mauritania, Brazil) has been much less successful than in previous decades. Since 1990 reserve replacement in non-OPEC countries of most regions has been less that 35 percent.**

3. **Every year, in every region (including OPEC), the world produces more oil than it finds. It is only logical to conclude that inevitably this will lead to dwindling supplies. *Our current view is that absent significant improvements in recovery technologies, exploration results, or a sharp increase in exploration spending, global non-OPEC liquid hydrocarbon production rate will struggle to grow beyond 2010 and may in fact start to decline.***

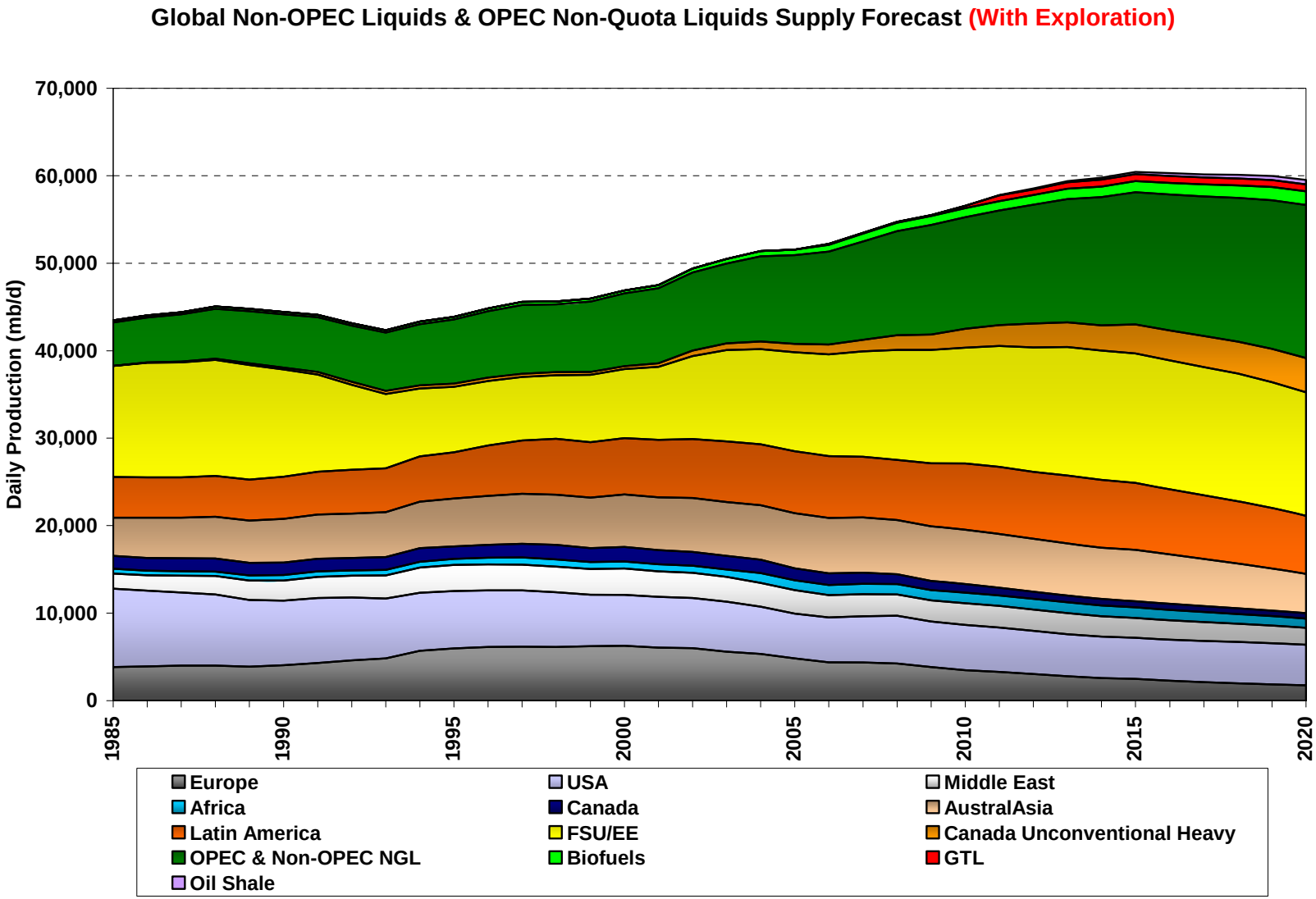
4. **Non-OPEC production growth between now and the end of this decade will rely heavily on production growth in Kazakhstan, Azerbaijan, Russia, Brazil, and several miscellaneous smaller producers. *The real unknown here is to what degree production from these countries will fill and exceed the void left by production declines in other Non – OPEC countries.***

5. **If demand continues to grow beyond 2010 and if Non-OPEC production capacity plateaus or falls, OPEC will have to make up the difference resulting in an inevitable increase in dependency on OPEC sources.**

The Dilemma - The Expected Growing Gap Between Global Demand and Global Non-OPEC Supply in the Next Decade

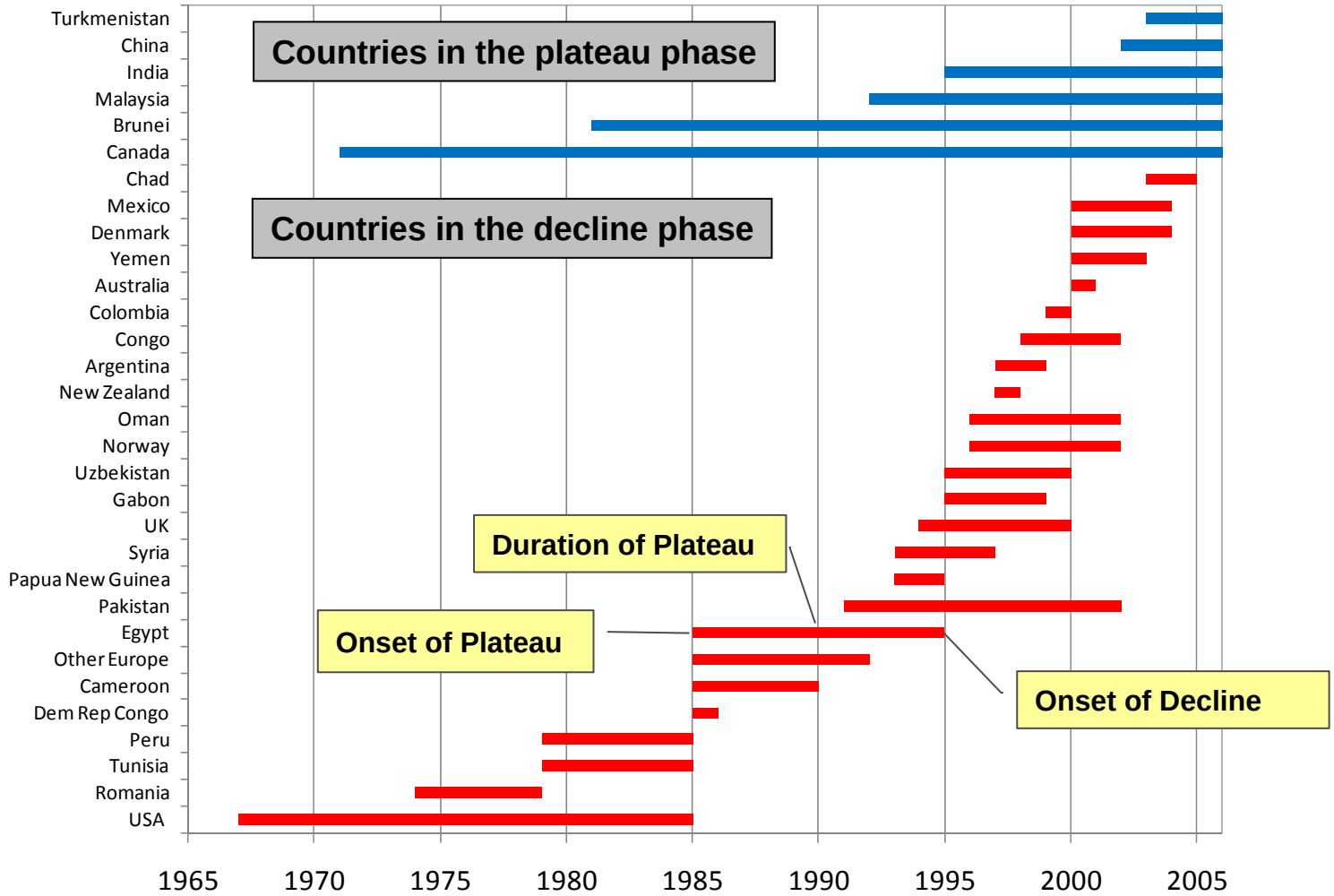


Global Non-OPEC & OPEC Non-Quota Total Liquids Forecast with Exploration



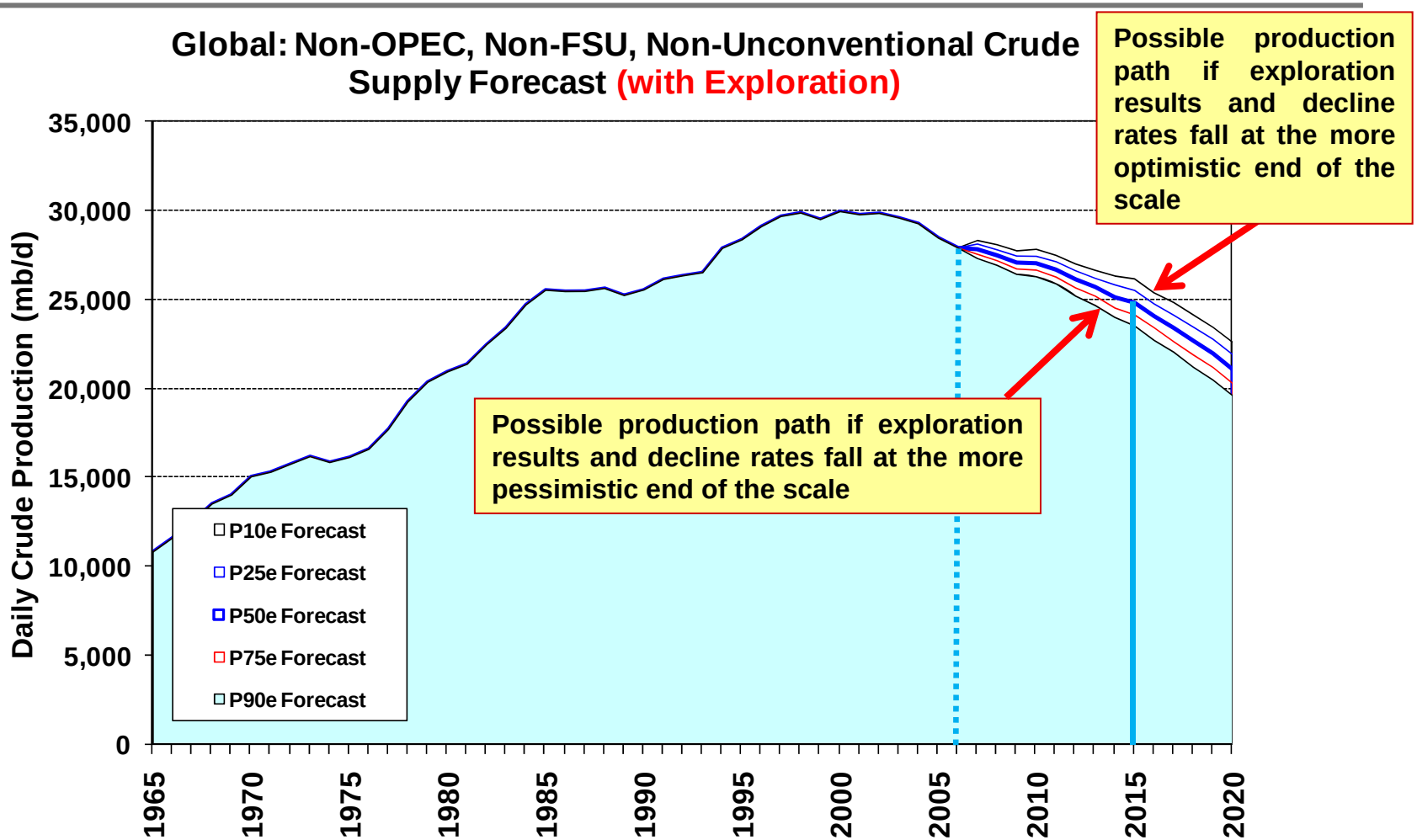
A combined forecast of Non-OPEC liquids and OPEC non-quota liquids suggests that production will grow to just around 60 million barrels per day by 2015.

Non-OPEC Countries in Decline or in Plateau



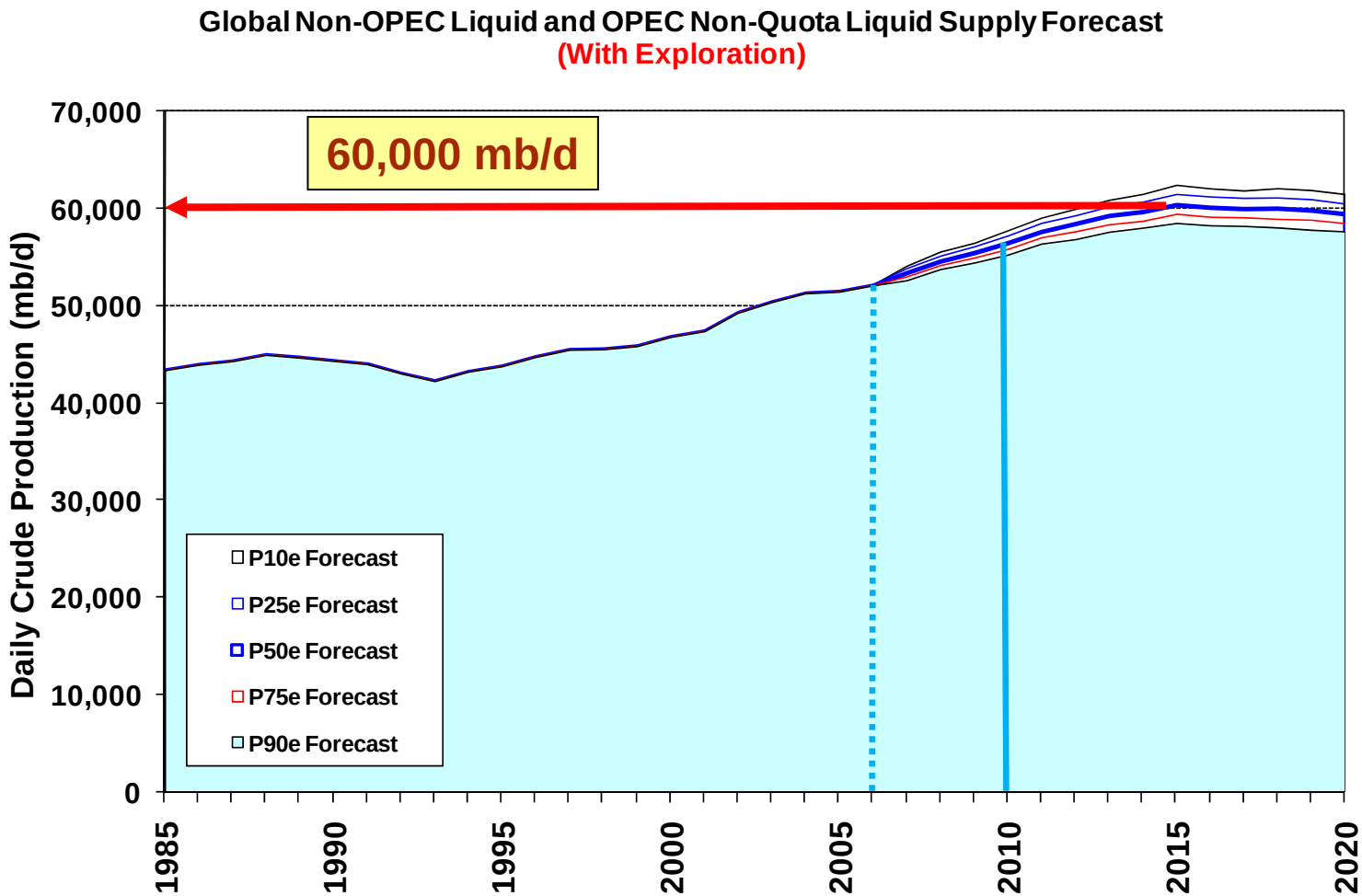
The above bars show the onset and duration of documented production peaks or plateaus – *tracking country life cycle shows an acceleration of the number of countries passing from peak to decline*

Non-OPEC Crude Oil Forecast with Exploration (excluding NGLs, FSU, and Uncon. Heavy Oil)



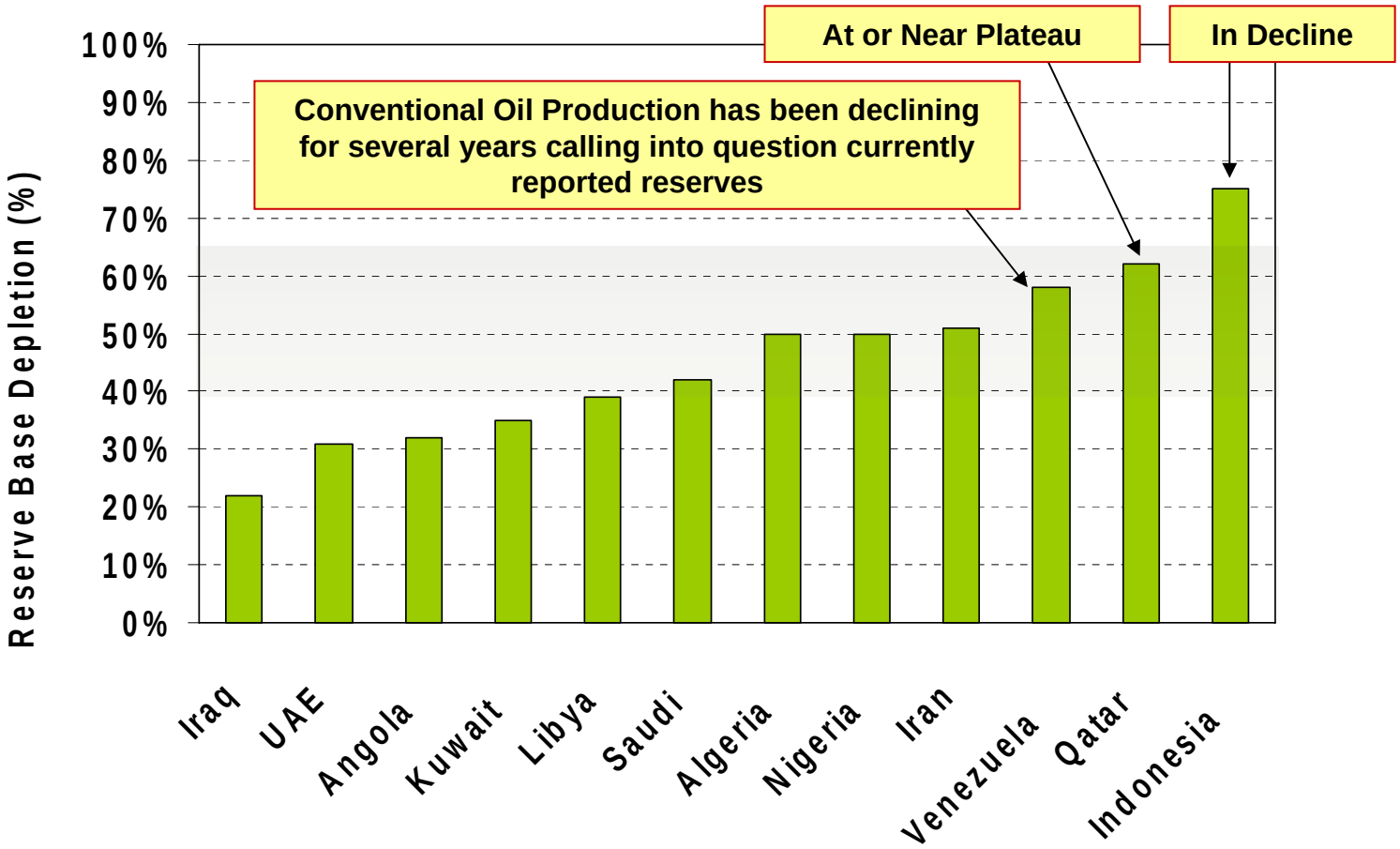
PFC Energy's models suggest that production has declined but reserve addition from exploration will keep production level above 25,000 million barrels per day until the middle of the next decade.

Global Non-OPEC Liquid & OPEC Non-Quota Liquid Supply Forecast with Exploration



A combined forecast of Non-OPEC crude, Non-OPEC NGLs, and OPEC Non-Quota NGLs suggests that, with exploration success, production will reach 60 million barrels per day with declines beginning towards the end of the next decade.

Historical Production and Depletion Levels (OPEC)



OPEC as a whole is depleting but some countries are depleting faster than others

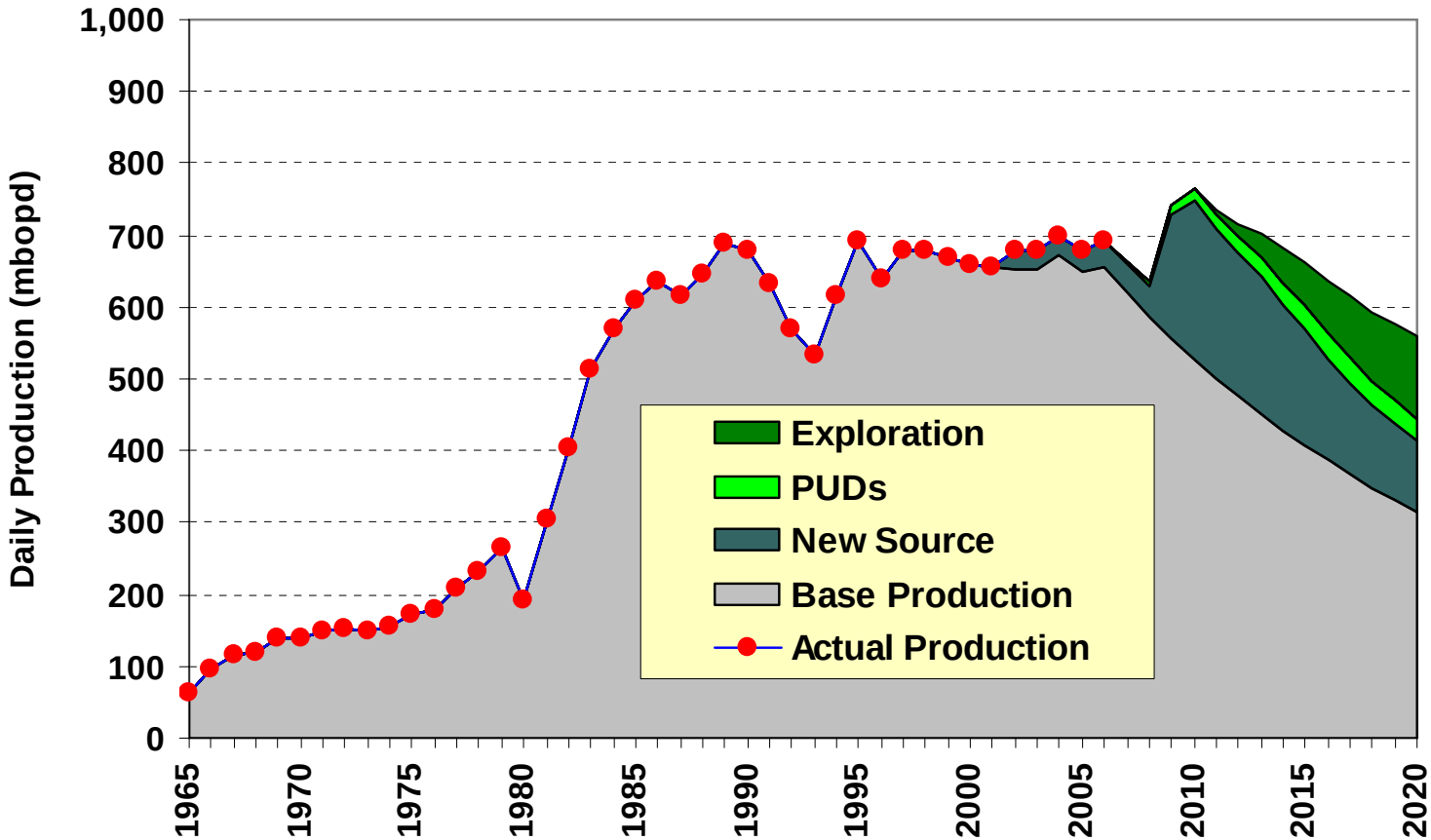
India Oil Supply Forecast

- **Key Messages**
- **Production Forecast**
- **Future Potential**

Indian Key Messages

- **Overall, production from India has been stagnant for the past five years – has not crossed the 700 mbopd mark.**
- **India's production levels are expected to be near peak according to this model. The recently discovered Mangala complex of fields will likely add enough incremental production beginning in 2009, to extend the production plateau of the last 20 years into the early part of the next decade.**
- **A comparison of discovered and produced volumes suggests that India has been running a negative balance (producing more reserves than new reserve additions from exploration) for nearly 20 years.**
- **India's production has been relatively flat for a decade. However, depletion levels have reached approximately 60% which is typically beyond the upper limit of reserve depletion that can be reached before production declines set in.**
- **The producing base has begun to decline significantly. Based on the reported reserves in the inventory of undeveloped discoveries, it is difficult to see a scenario where new production from new source developments will be able to keep up with the underlying base decline.**

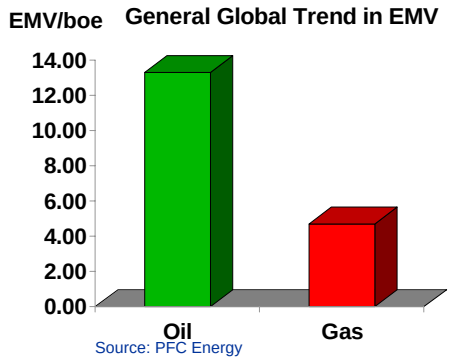
Indian Crude Oil Production



- **Production from India has been stagnant for the past five years**

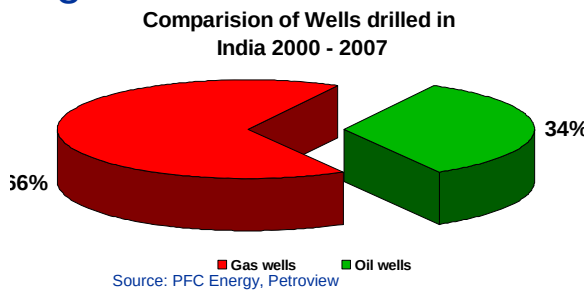
Indian Crude Oil Story: How to Overcome the Perception of Limited Oil Potential?

- **India's crude oil demand remains strong – over 70% of current consumption is met with imports…**
- **Even in terms of value, oil biased portfolios are significantly higher than gas heavy portfolios**



Source: PFC Energy

- **.. But domestic exploration focus on oil is relatively lacking**
  - Analysis of recent drilling trends indicates 66% were gas wells



Source: PFC Energy, Petroview

- **The Big Question:-**
- **Which factors will revive exploration focus on oil in India**

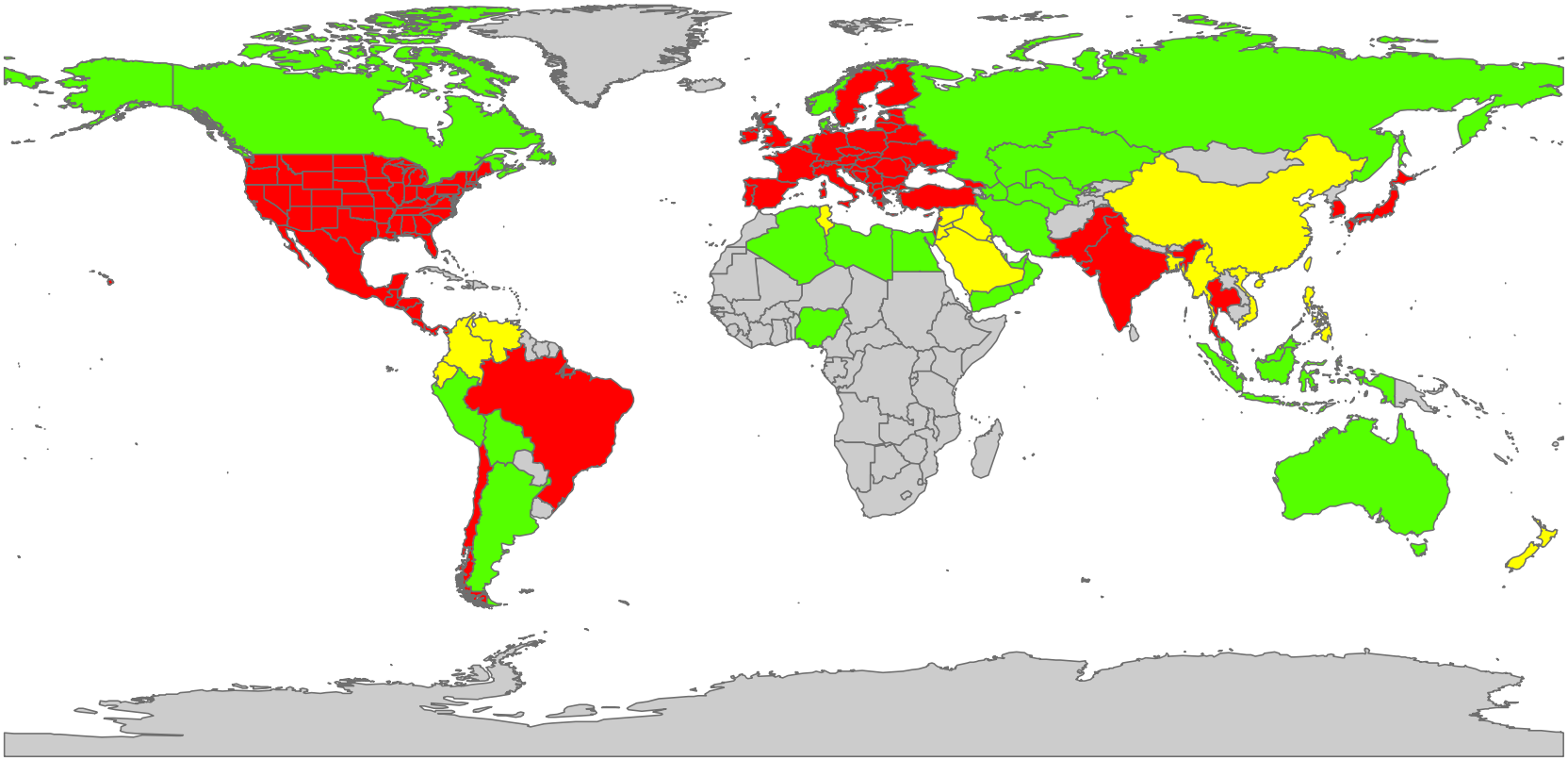
Global Gas Forecast

- **Changing Global Gas Markets: 2006, 2010, 2015, 2020**
- **Regional Forecasts**

Regional Key Messages

- **South America:** Growing Demand in Brazil, Argentina, and Columbia will create a short-term need for gas imports, which Venezuela will be unable to supply and therefore Bolivian gas reserves become extremely important.
- **Europe & FSU:** Imports from LNG and Russia will continue to grow, thereby increasing the strategic importance of access to Russian reserves and the continued development of African LNG sources (Nigeria and Angola).
- **Asia:** Economic growth will continue to fuel the demand for natural gas and increase the need for Australian and Indonesian LNG imports, and even possibly create the need for an import pipeline from Russia.
- **North America:** The United States will continue to require LNG imports to supply a portion of domestic demand needs, but proximal gas sources in the Gulf of Mexico, Alaska, and the Rocky Mountains will be able to supply a growing portion of the demand.

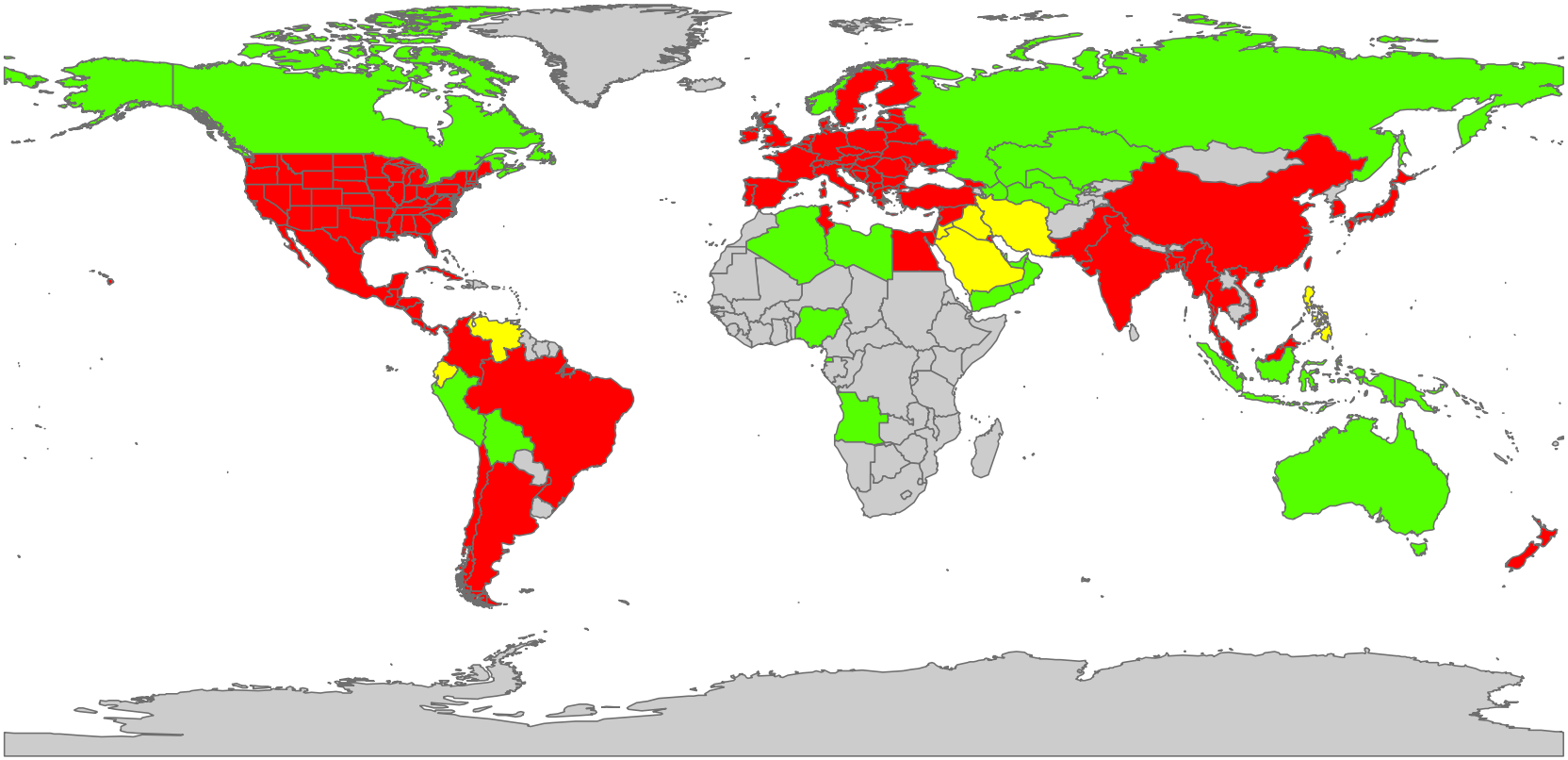
Global Status of Natural Gas: 2006



- **Highlights:**
  - Shah Deniz comes onstream and makes Azerbaijan into a net gas exporter
  - Europe finds another North African supplier from the Libyan Greenstream pipeline
  - Difficulties with Russian gas to Europe and delays in Sakhalin raise security of supply concerns

Key: 60 = Import 25 = Export 17 = Self Sufficient = No Market

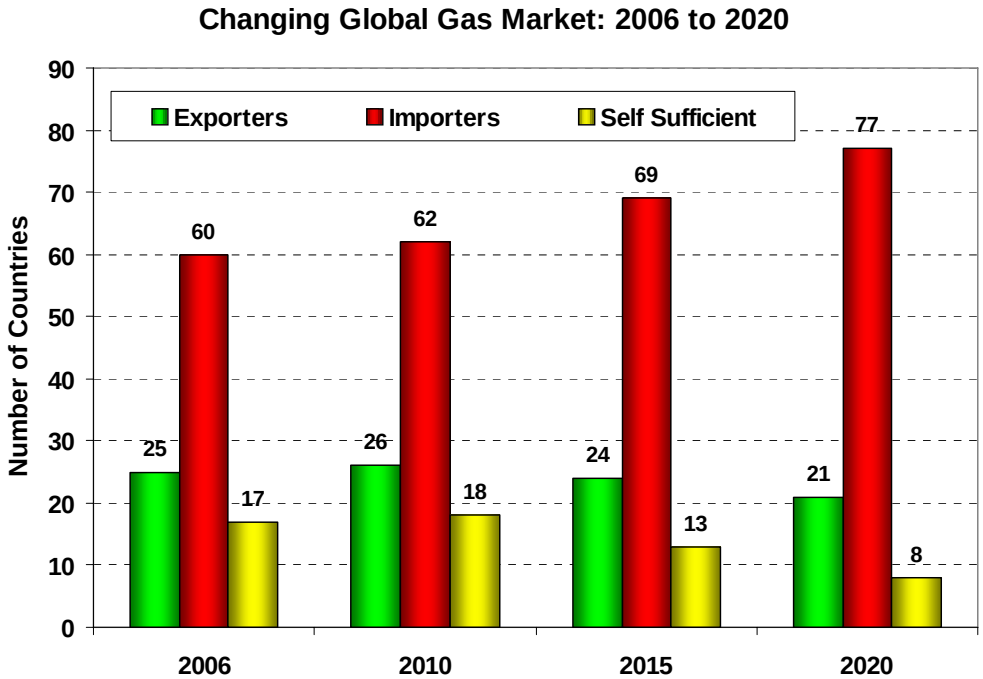
Global Status of Natural Gas: 2020



- **Highlights:**
  - Latin America:
    - » Trinidad & Tobago and Venezuela transition from exporters to self sufficient countries
    - » Columbia transitions from self sufficient to a gas importer
  - North Africa & Middle East:
    - » Egypt, Bahrain, and Kuwait become gas importers
    - » Iran can no longer export gas and becomes self sufficient
  - Asia & SE Asia:
    - » China, Malaysia, and Vietnam become importing countries

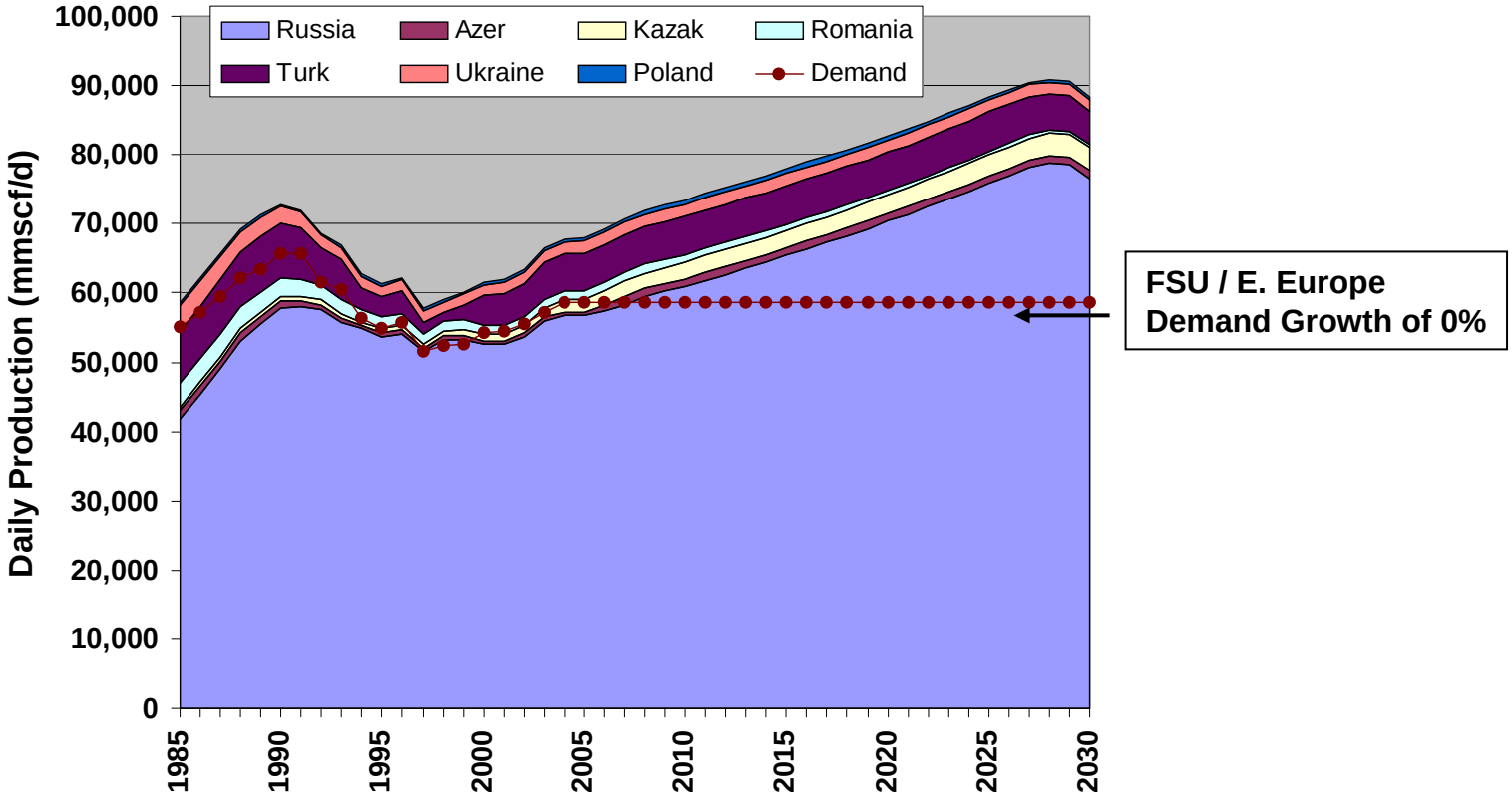
Key: 77 = Import | 21 = Export | 8 = Self Sufficient | = No Market

Global Statistics



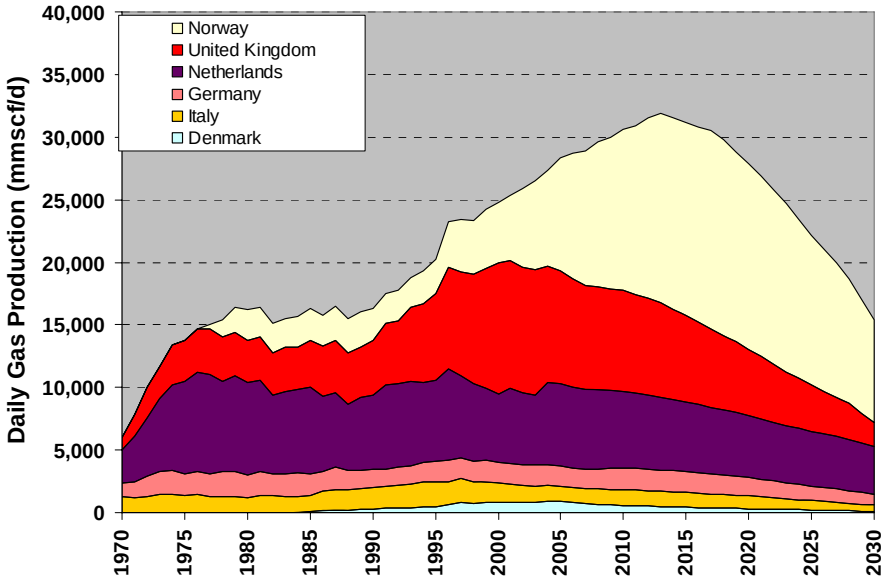
- **Global trends:**
  - **Importing Countries increase from 60 in 2006 to 77 in 2020**
  - **Exporting Countries decrease from 25 in 2006 to 21 in 2020**
  - **Self Sufficient Countries decrease from 17 in 2006 to 8 in 2020**
- **Countries that have historically relied on natural gas imports for power generation or industrial projects will only see their demand volumes increase dramatically from 2006 to 2020.**

FSU - E. Europe Regional Gas Production Forecast



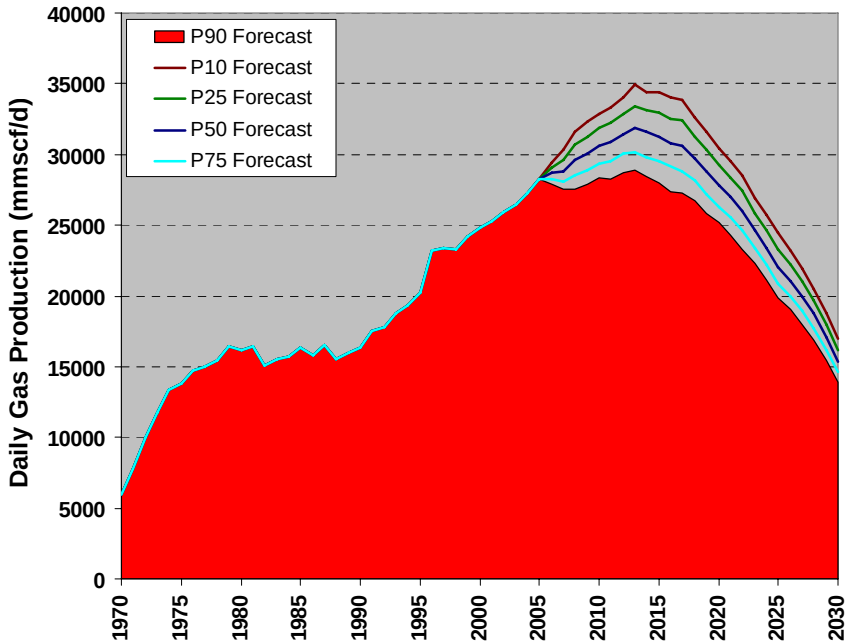
- **If production from each individual country model in FSU-EE is stacked it would appear that a peak could extend beyond 2025.**
- **If we assume that current and planned exports from FSU / E. Europe are met, it is logical to assume that the regional consumption (using a historical average of approximately 0%) could also be met beyond 2027.**

Western Europe Regional Gas Production Forecast

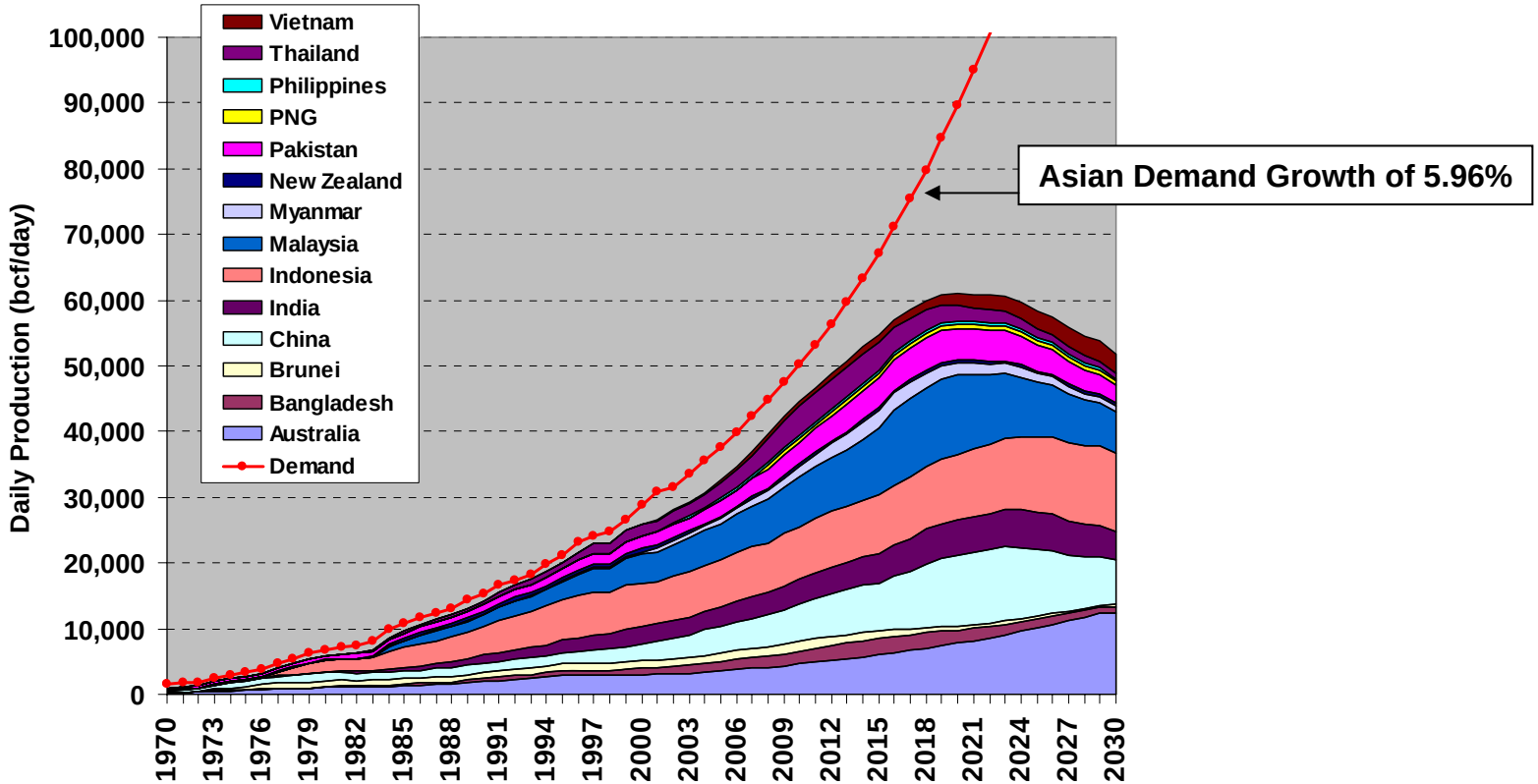


A forward looking production forecast was built with an analysis of base production decline, new projects, proven undeveloped discoveries, and the assumption that reserve additions through exploration will continue over the next two decades at a rate comparable to what was realized during the post 1990 period.

This analysis indicates that production growth could be maintained through the middle part of the next decade with a peak of over 30 bcf/day. In order to maintain a growth trajectory there would need to be a significant improvement in the addition of new gas reserve volumes through exploration.

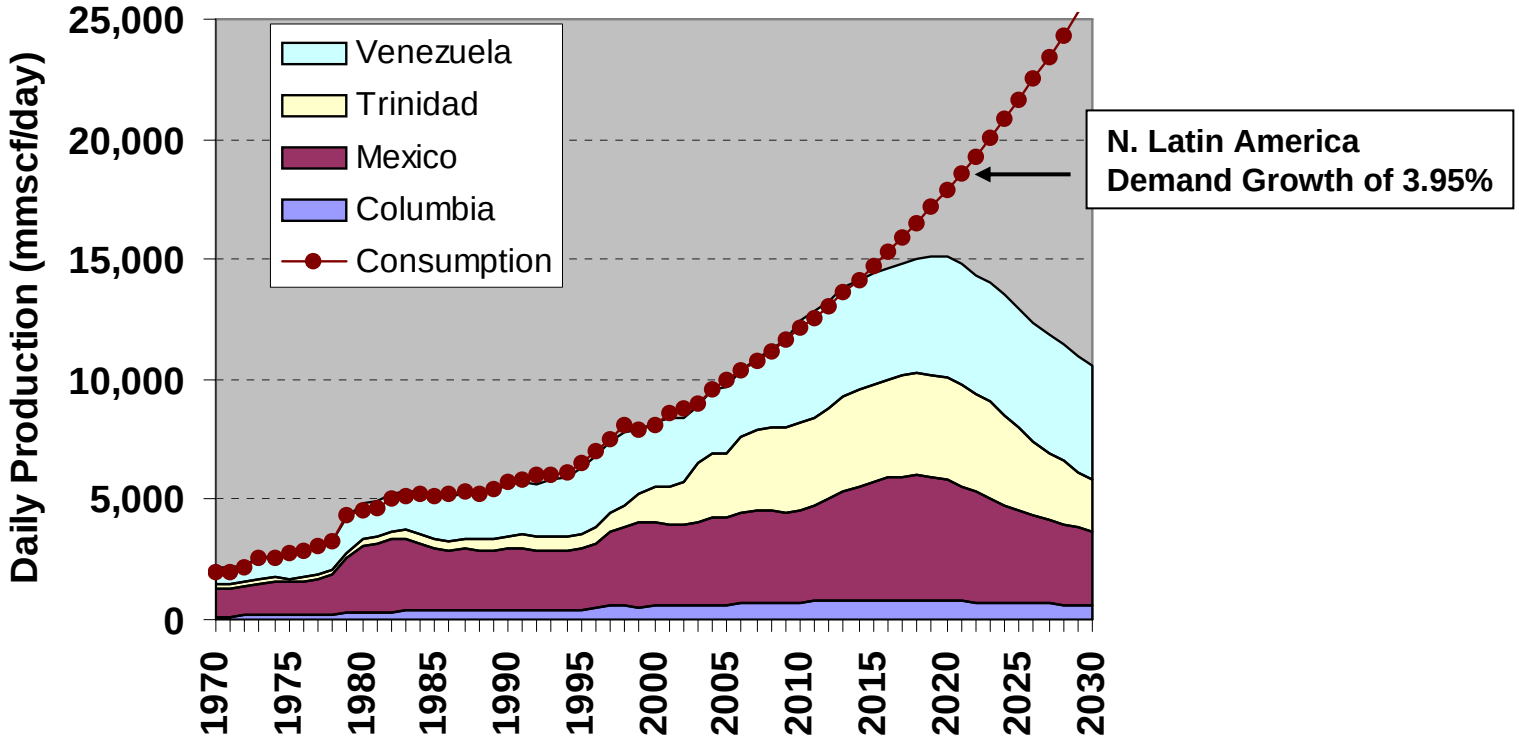


Austral – Asia Regional Gas Production Forecast



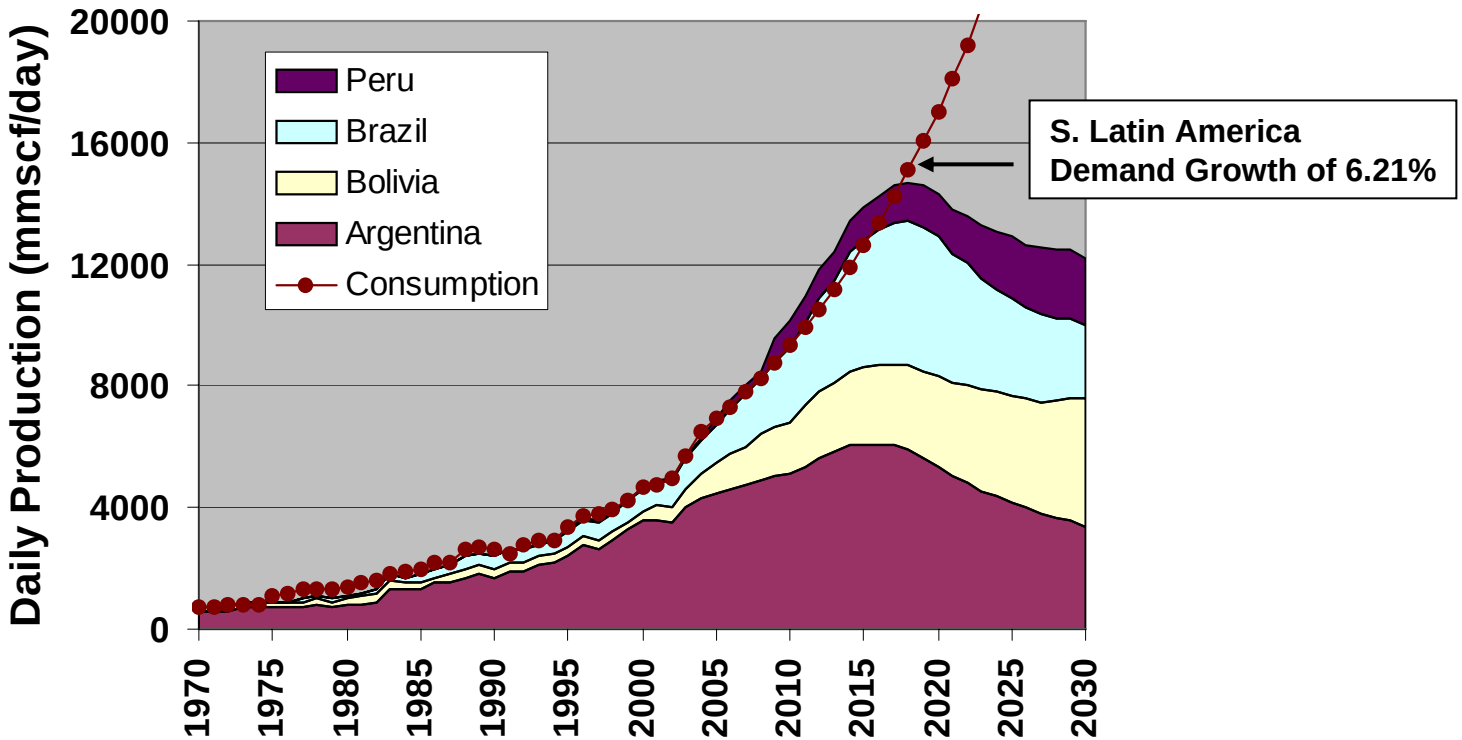
- **If production from each individual country model in Asia is stacked, it would appear that a peak would be reached toward the end of the next decade.**
- **If we assume that current imports/exports into Austral-Asia are held at current levels, it is logical to assume that the regional consumption growth (using a historical average of approximately 6%) could be met by shifting future volumes from countries like Australia, Indonesia, and Malaysia into other consuming countries without production (Japan, Taiwan, etc.).**

N. Latin America Regional Gas Production Forecast



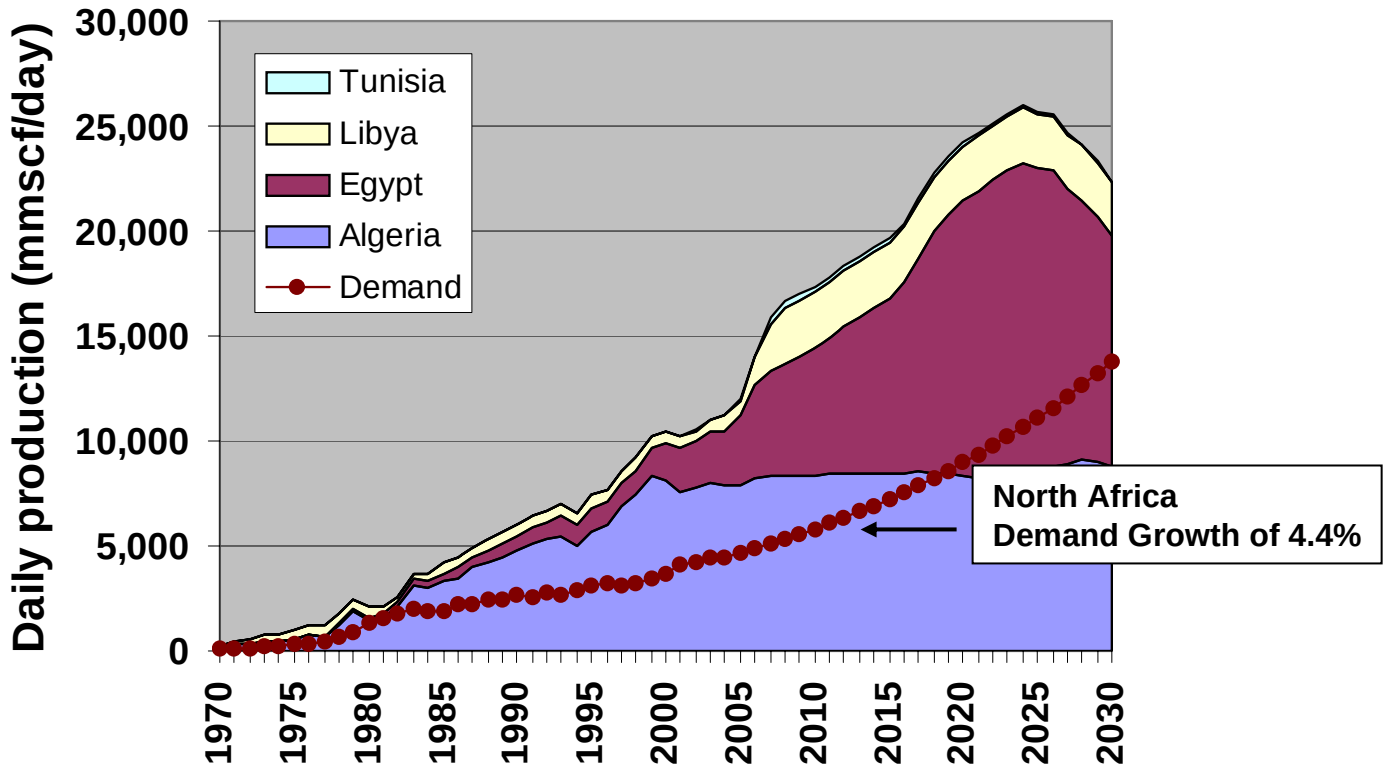
- **If production from each individual country model in NLA is stacked it would appear that a peak would be reached toward the end of the next decade.**
- **If we assume that current imports/exports into Northern Latin America are held at current levels, it is logical to assume that the regional consumption growth (using a historical average of approximately 4%) could be met by shifting future volumes from countries like Venezuela, Mexico, Trinidad, and Columbia into other consuming countries without production (Ecuador).**

S. Latin America Regional Gas Production Forecast



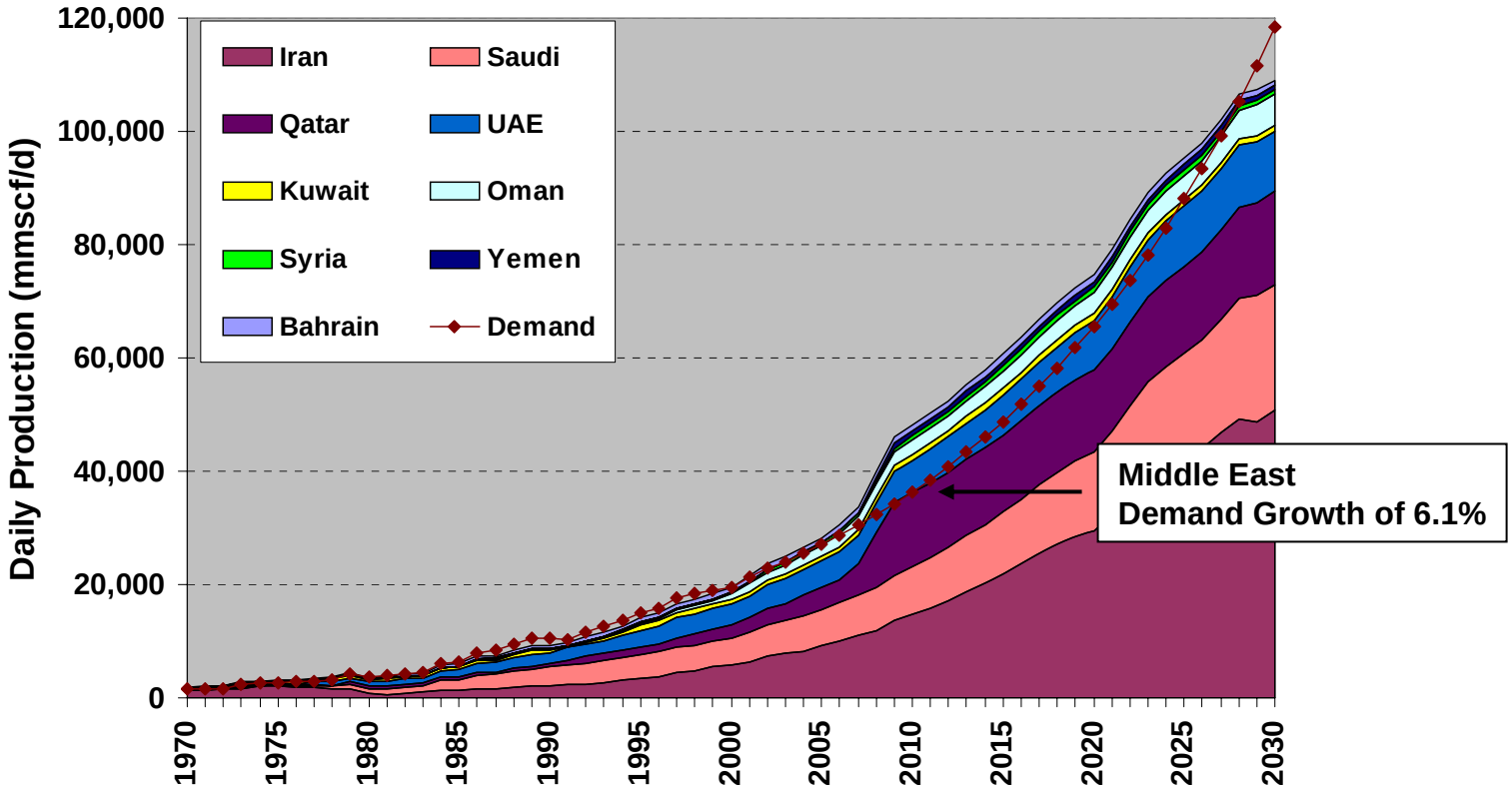
- **If production from each individual country model in SLA is stacked it would appear that a peak would be reached toward the end of the next decade.**
- **If we assume that current imports/exports into SLA are held at current levels, it is logical to assume that the regional consumption growth (using a historical average of approximately 6%) could be met by shifting future volumes from countries like Argentina, Bolivia, Brazil, and Peru into other consuming countries without production (Chile).**

North Africa Regional Gas Production Forecast



- **If production from each individual country model in North Africa is stacked it would appear that a peak would be reached toward s 2025.**
- **If we assume that current and planned exports from North Africa are met, it is logical to assume that the regional consumption growth (using a historical average of approximately 4.4%) could also be met until 2025.**

Middle East Regional Gas Production Forecast



- **If production from each individual country model in the Middle East is stacked it would appear that a peak would be reached well beyond 2030.**
- **If we assume that current and planned exports from the Middle East are met, it is logical to assume that the regional consumption growth (using a historical average of approximately 6.1%) could be met until 2030.**

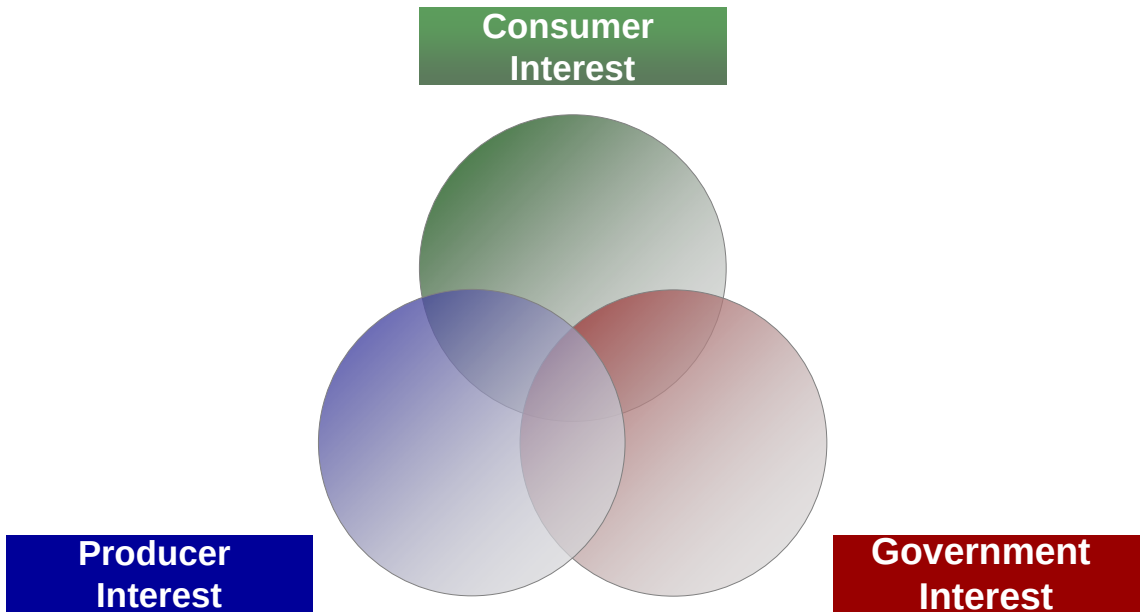
India Gas Supply Forecast

- **Key Messages**
- **Production Forecast**
- **Future Potential**

Indian Key Messages

- **New Supply (Firm and Non-Firm) will meet needs of a Supply-constrained market**
- **Without Exploration Potential, Supply could peak at between 5-6 bcf/d (52-62 bcm/year) around 2010**
- **With Exploration Potential, Supply could peak between 6-12 bcf/d (52-124 bcm/year) around 2020-2025**
- **The natural gas market has to resolve competing interests**
- **Indian gas is a growth story**

Natural Gas Market Dynamics:
Resolving conflicting interests



Consumer Interest:

- *Keep prices at historic lows*
- *Reduce import duties on LNG*
- *Reduce marketing costs for bulk consumers*

Producer Interest:

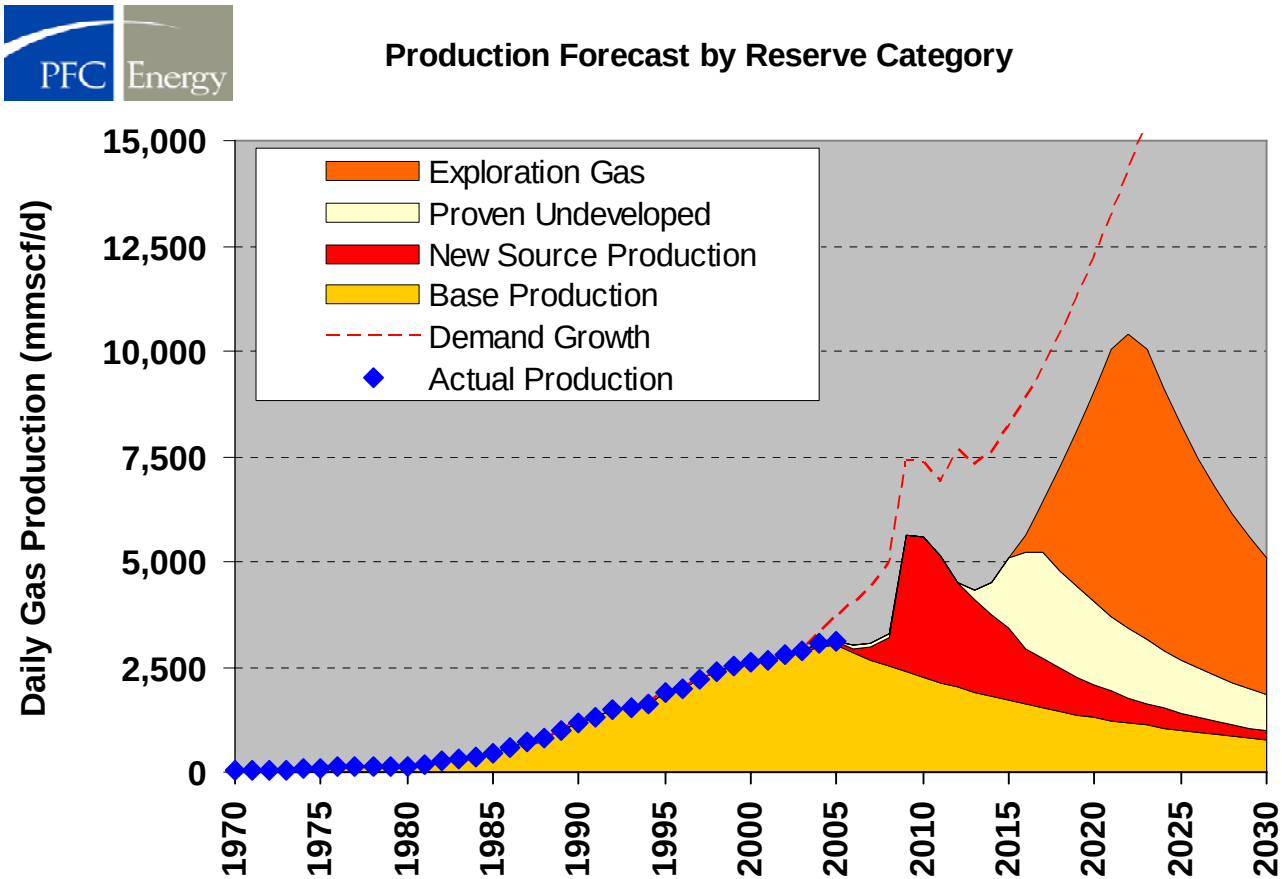
- *Prices should reflect excess demand*
- *Prices should sync up with costs*

Government Interest:

- *Maximize share of profit gas*
- *Caters to vote banks especially in election years*
- *Reduce fiscal deficit by reducing subsidies*

The System has to Resolve Competing Interests and Reform is a Protracted process

India Gas Production Forecast



- **New Supply (Firm and Non-Firm) will meet needs of a Supply-constrained market**

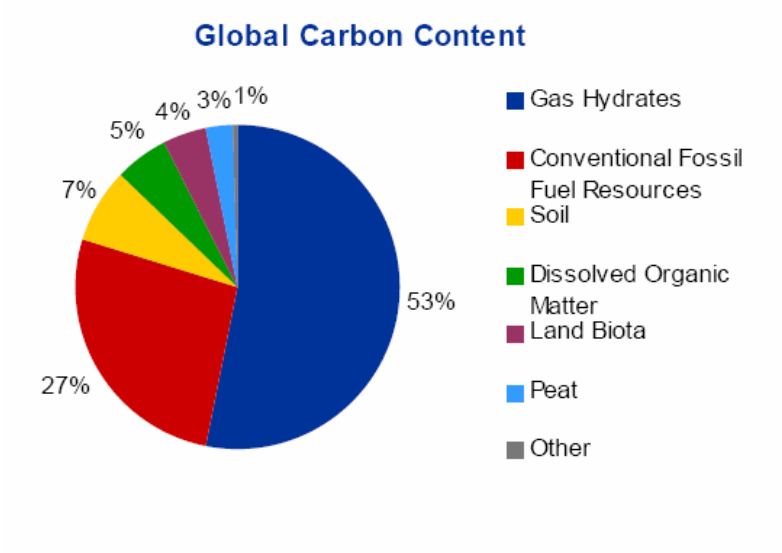
Indian Gas Story is a…. GROWTH story ..

- **..of SUPPLY**
- **Main Challenge in Supply:** ***Attract enough technology and companies to develop known gas reserves***
- **..of DEMAND**
- **Main Challenge in Demand:** ***Will ability to pay match up with market value***

- **There are BIG UNKNOWNS**
- **Will P10 Reserve volumes materialize?**

  Range from 50 Tcf – 450 Tcf

- **The Potential of Gas Hydrates:** ***Could technology and focus on this be sufficient to ensure Material supply in Long-term?***



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