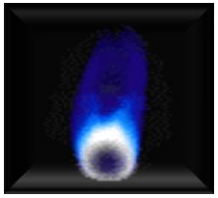

Natural Gas: The Responsible Choice

By:
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International Gas Union (IGU),
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25th January 2011
Jakarta Convention Centre | Indonesia

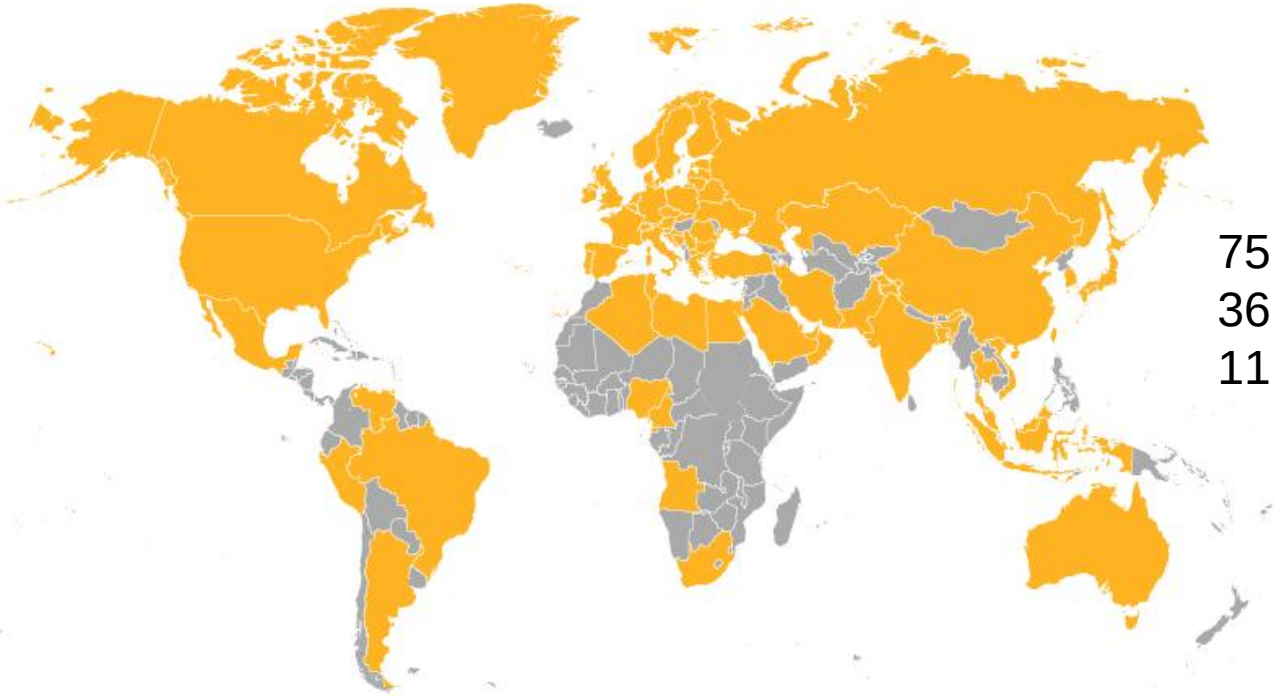
Outline

1. Introduction – Brief on IGU
2. Global Energy Scenario until 2030
3. Natural Gas: The Responsible Choice
4. Emphasis on Stakeholder's Role
5. Closing Remarks

IGU as THE spokesman for the gas industry

- Worldwide and non–profit organisation established in1931
- Promotes technical and economic progress of the gas industry
- Emphasising sound environmental performance worldwide
- Increased focus on strategic and policy issues
- Cooperation with IEA, United Nations, World Bank, IEF and others

IGU Members responsible for 95% of Global Gas Sales



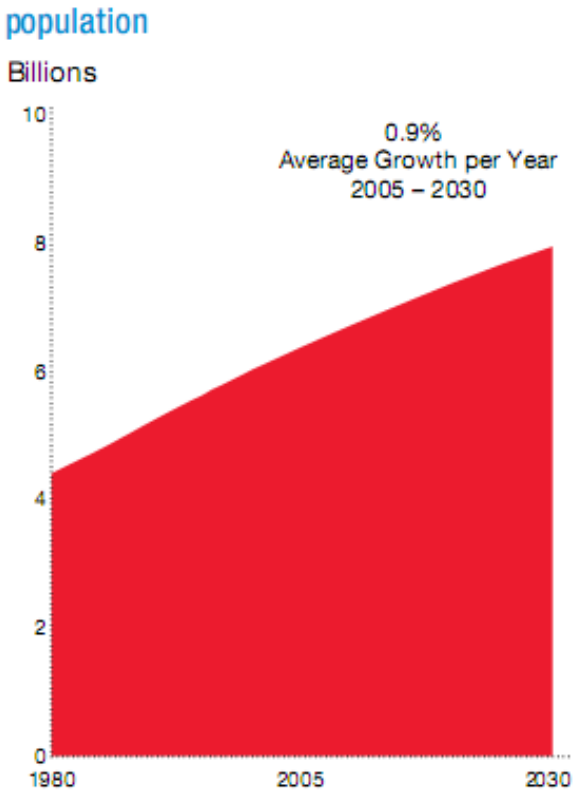
IGU Members

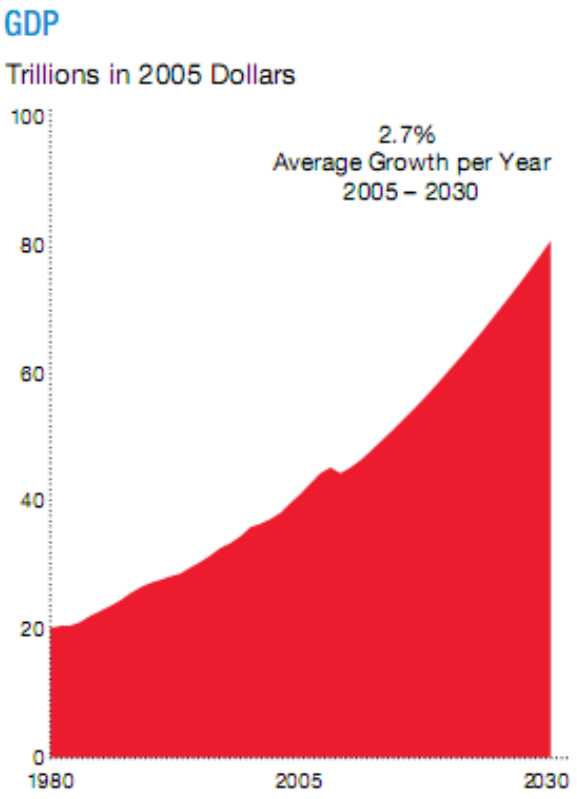
75 Charter members
36 Associate members
11 Affiliated members

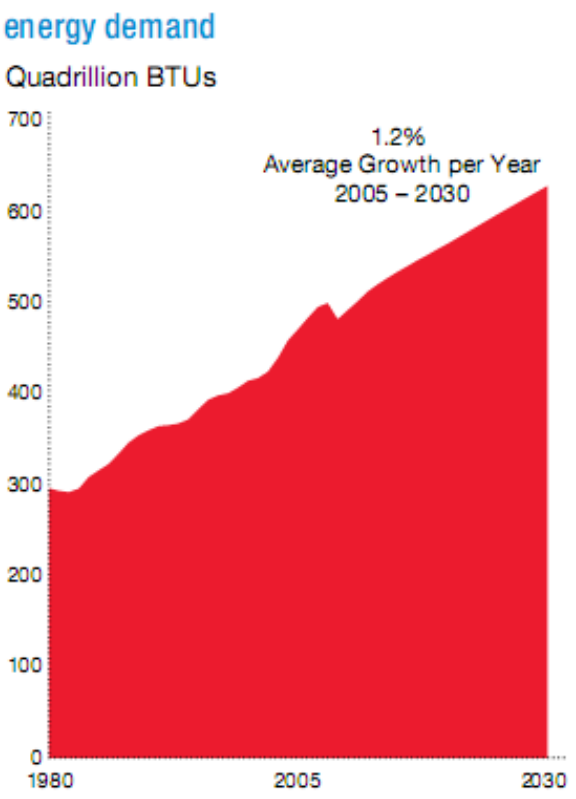
As of October 2010

IGU Organisation Chart for the 2009 – 2012 Malaysian Triennium

World demand for energy is increasing







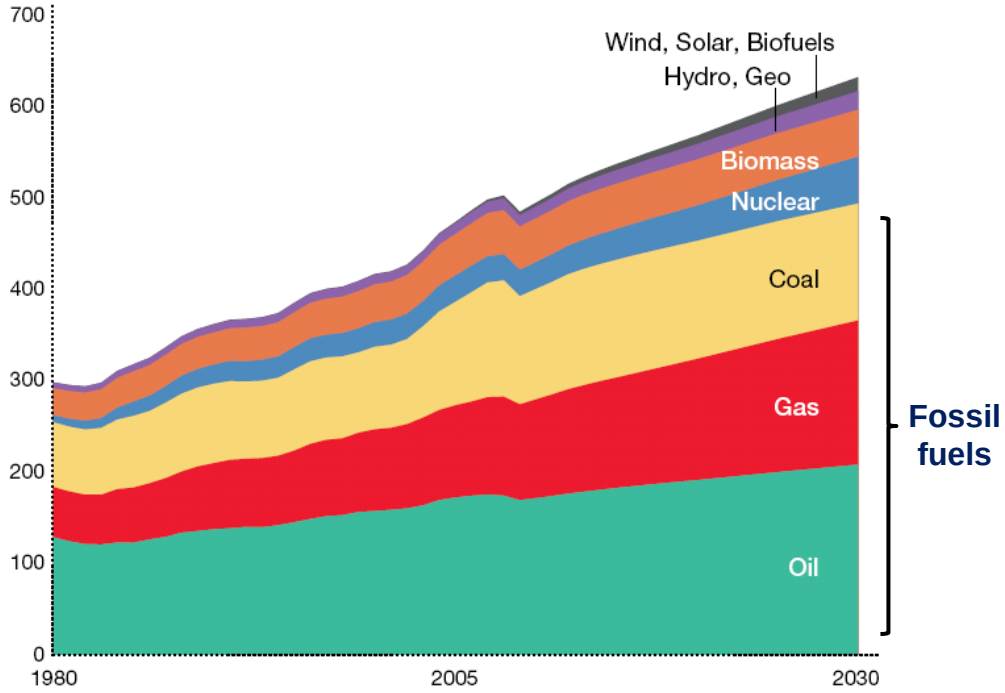
- population growth, economic expansion, urbanisation and individual's prosperity

Source(s): ExxonMobil 2009, OECD/IEA 2010

World will still depend on fossil fuels in decades to come

by energy type

Quadrillion BTUs



CAGR of Fuel Consumption 2010-2030

Liquids	1.3%
Natural Gas	2.0%
Coal	2.1%
Nuclear	1.7%
Other	3.0%

% of natural gas from total energy mix 1990-2030

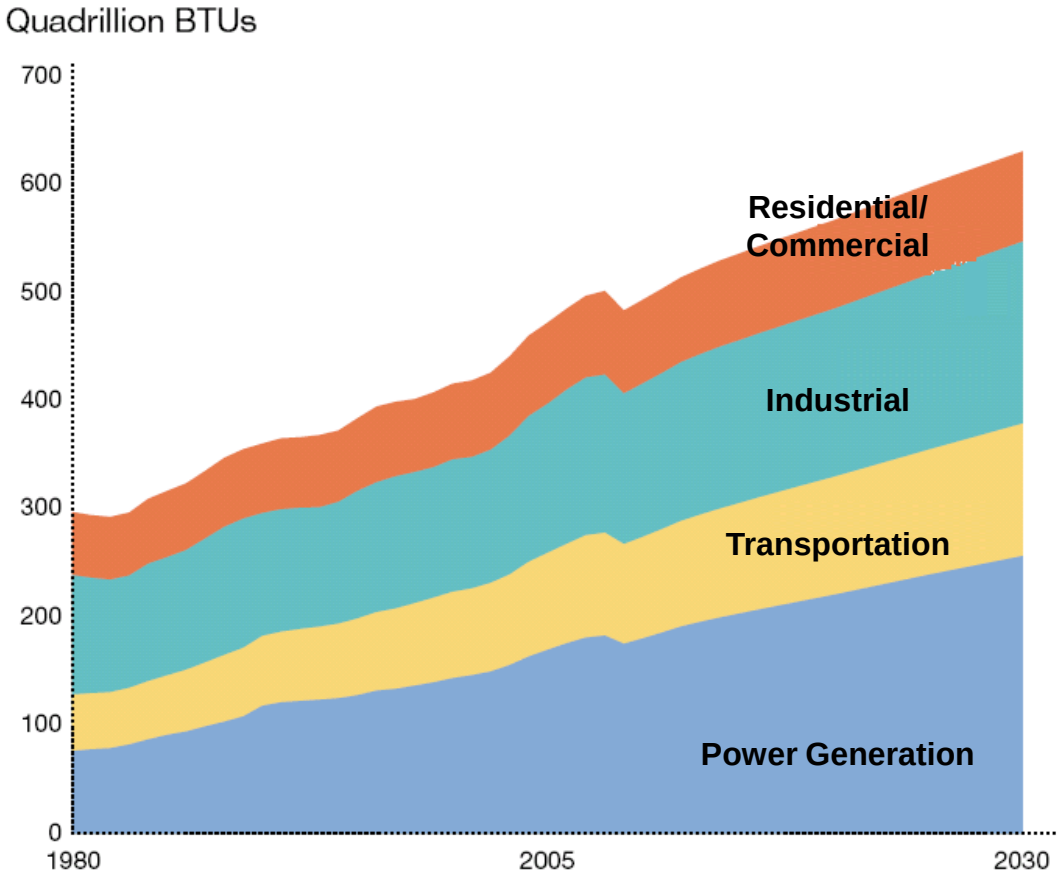
1990	22%
2005	23%
2010	23%
2030	24%

- renewables are growing rapidly but expensive
- coal is abundant and cheap but environmentally unacceptable
- vehicles still depend on petroleum products

Source(s): ExxonMobil 2009, EIA/IEO 2009, PETRONAS 2009, IEA 2010, IEF 2010, IGU 2010

Gas demand will increase correspondingly

by sector



Sector	CAGR
1) Power Generation	1.7% p.a.
2) Industrial	1.5% p.a.
3) Transportation	1.2% p.a.
4) Residential / Commercial	0.8% p.a.

- power generation & industrial demand

*CAGR = Cumulative Average Growth Rate

Source(s): ExxonMobil 2009, EIA/IEO 2009, PETRONAS 2009

But world faces twin challenges…

- growing demand for energy
- need to address environmental issues & climate change

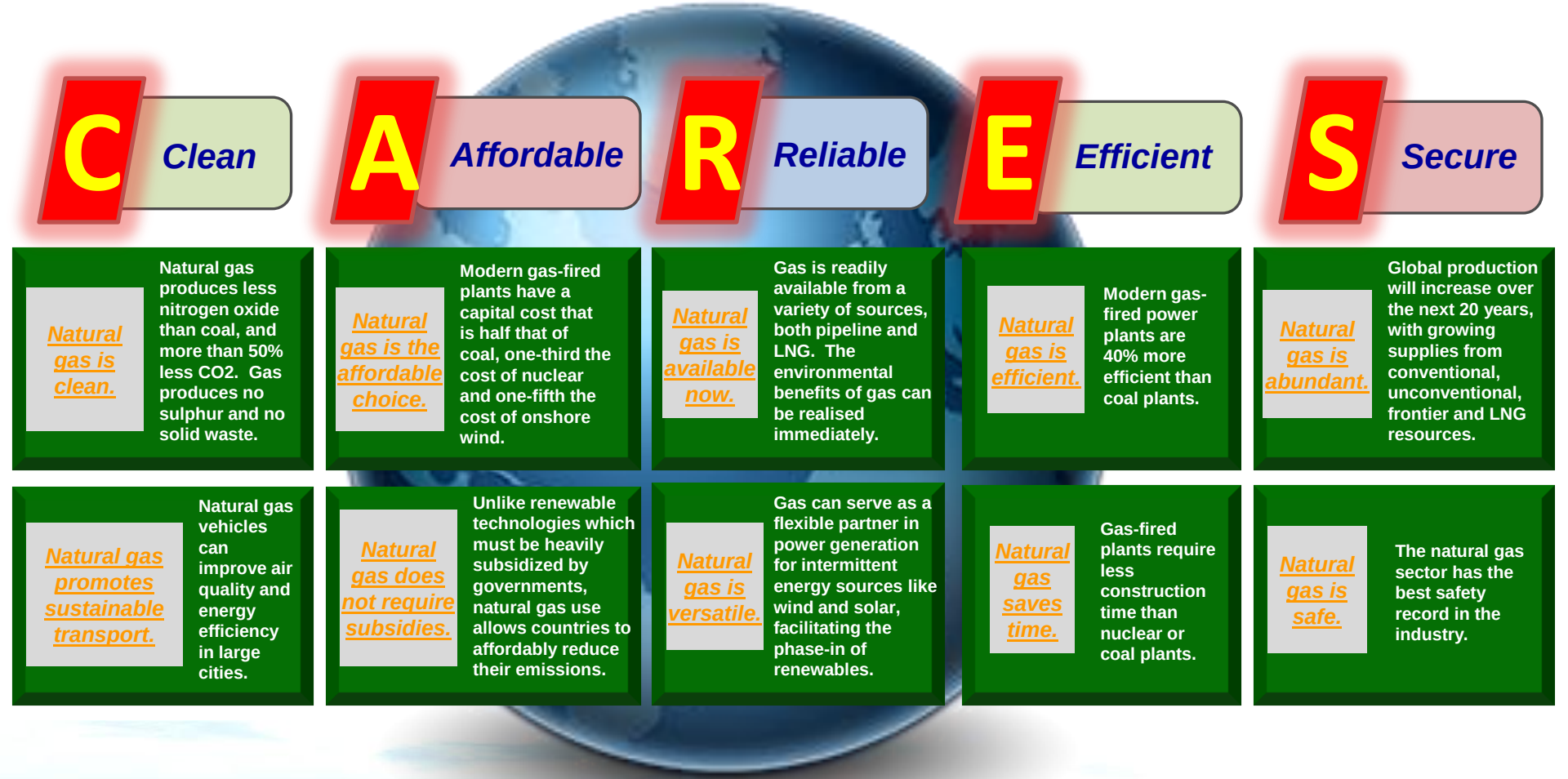
No silver bullet solution – need multifaceted approach

- short, medium & long term approach
- long term renewables
  – need game changing innovation
- short to medium term and in the future – natural gas

Why natural gas ?

- CARES & 3 As

Natural gas CARES for the world



C Clean

Natural gas is clean.

Natural gas produces less nitrogen oxide than coal, and more than 50% less CO2. Gas produces no sulphur and no solid waste.

Natural gas promotes sustainable transport.

Natural gas vehicles can improve air quality and energy efficiency in large cities.

A Affordable

Natural gas is the affordable choice.

Modern gas-fired plants have a capital cost that is half that of coal, one-third the cost of nuclear and one-fifth the cost of onshore wind.

Natural gas does not require subsidies.

Unlike renewable technologies which must be heavily subsidized by governments, natural gas use allows countries to affordably reduce their emissions.

R Reliable

Natural gas is available now.

Gas is readily available from a variety of sources, both pipeline and LNG. The environmental benefits of gas can be realised immediately.

Natural gas is versatile.

Gas can serve as a flexible partner in power generation for intermittent energy sources like wind and solar, facilitating the phase-in of renewables.

E Efficient

Natural gas is efficient.

Modern gas-fired power plants are 40% more efficient than coal plants.

Natural gas saves time.

Gas-fired plants require less construction time than nuclear or coal plants.

S Secure

Natural gas is abundant.

Global production will increase over the next 20 years, with growing supplies from conventional, unconventional, frontier and LNG resources.

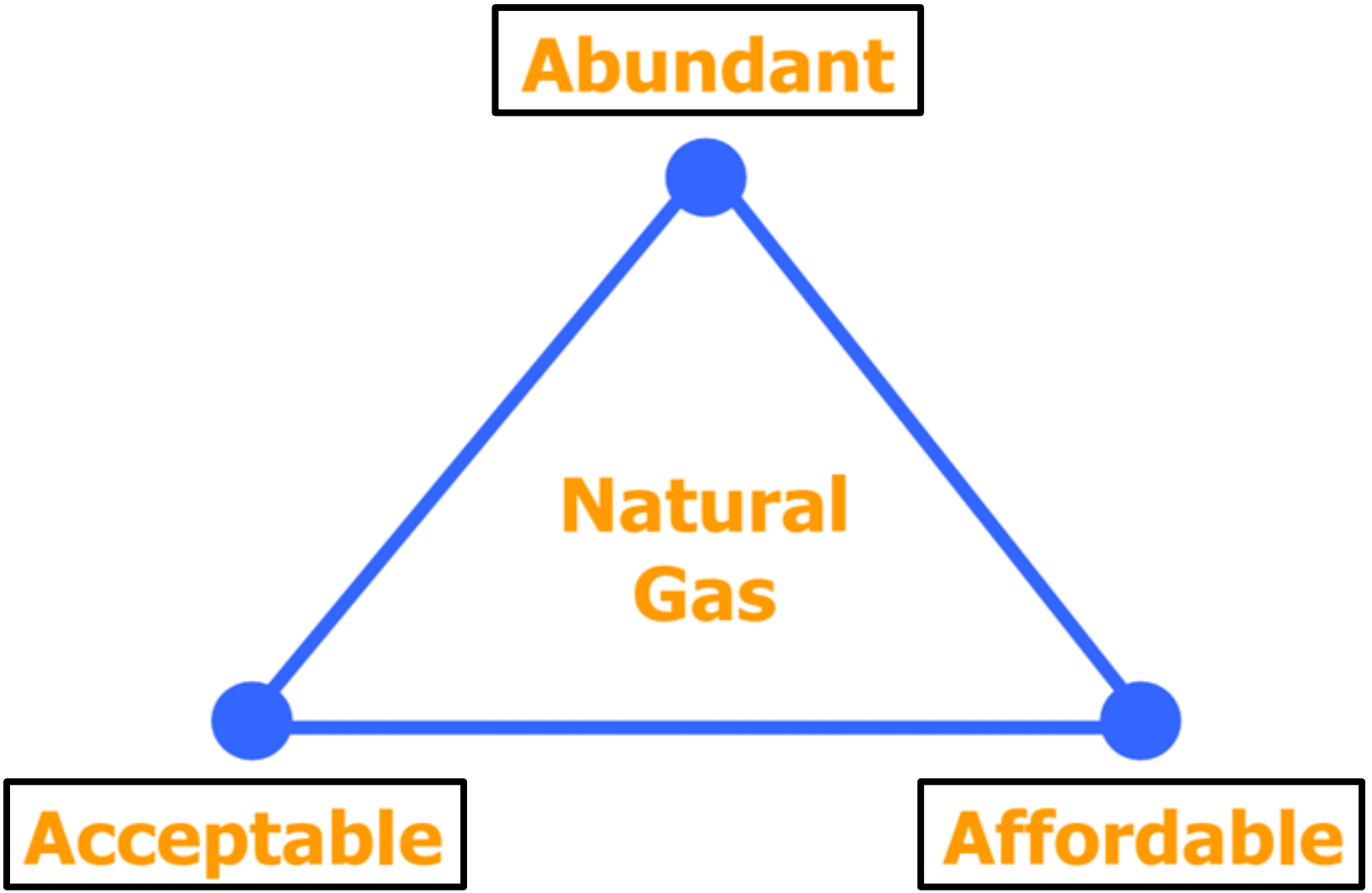
Natural gas is safe.

The natural gas sector has the best safety record in the industry.

- Natural gas is a clean, affordable, reliable, efficient, and secure energy source.
- Natural gas is the responsible choice for achieving a sustainable energy future.

Source(s): IGU 2010, PFC Energy 2010

What is 3 As?



Also need involvement of stakeholders

- **governments** – encourage, legislate, incentivise
- **regulators** – encourage, legislate, incentivise
- **industry** – innovate, conserve
- **consumers** – conserve
- **researchers** – innovate

What can government in particular do?

- encourage investments in all parts of the value chain
- encourage use of clean burning fuels
  – legislate, incentivise
- encourage R&D for game changing technology
- multifaceted approach to solutions
  – don't pick winners/losers
- encourage & grow demand for gas
- encourage efficiency & conservation of energy

What can industry in particular do?

- investment in R&D for more efficient use of energy
- implement energy conservation

Expectations

- good dialogue between all stakeholders (government, industry, environmentalist, consumers, regulators, etc)
  - to grow demand
  - to address issues
  - to advocate for gas
- emphasise role of each stakeholder
- actions to be taken by each stakeholder
- can do more if we have a united voice with more concerted & robust effort

IGU Message on Natural Gas

- It is abundant, affordable and acceptable
- Clean, efficient, versatile and environmental friendly fuel
- Continue to play a substantial role in global energy demand
- Basis for sustainable economic growth

Natural gas
– major part of the long term energy solution

The 25th World Gas Conference (25th WGC)




KUALA LUMPUR 2012 WORLD GAS CONFERENCE

"GAS : SUSTAINING FUTURE GLOBAL GROWTH"

Kuala Lumpur Convention Centre

4 to 8 June, 2012

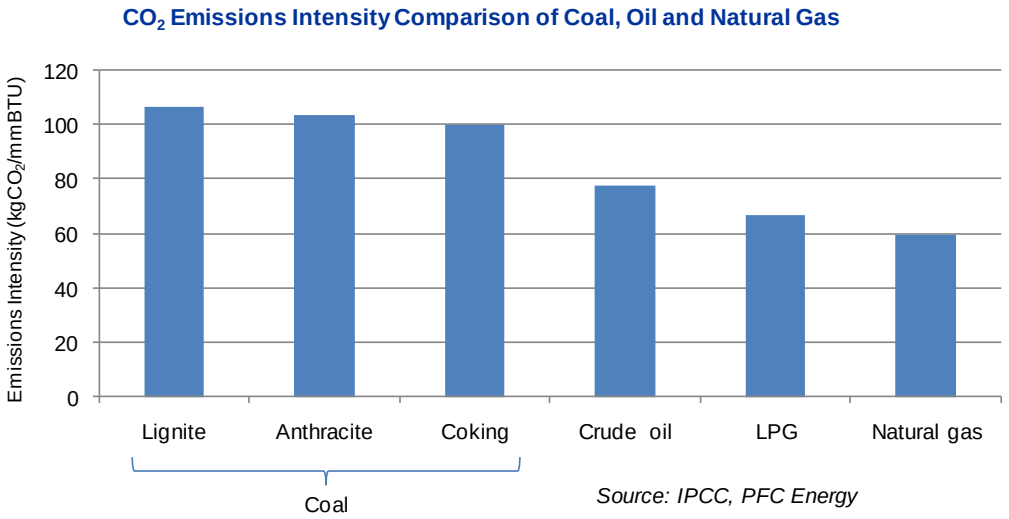
www.wgc2012.com/,www.igu.org/

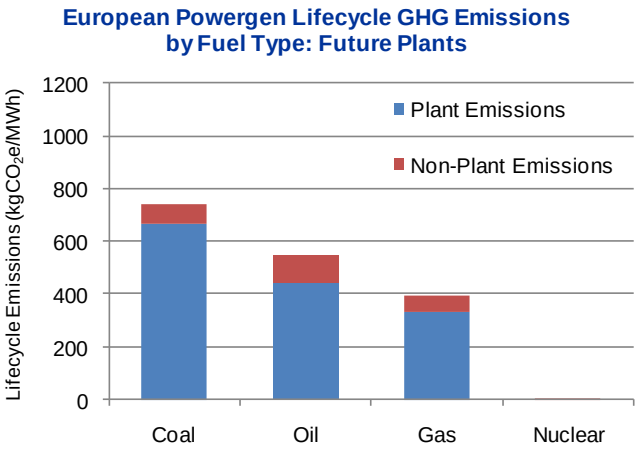
THANK YOU FOR YOUR KIND ATTENTION !

REFERENCE SLIDES

Natural gas is clean

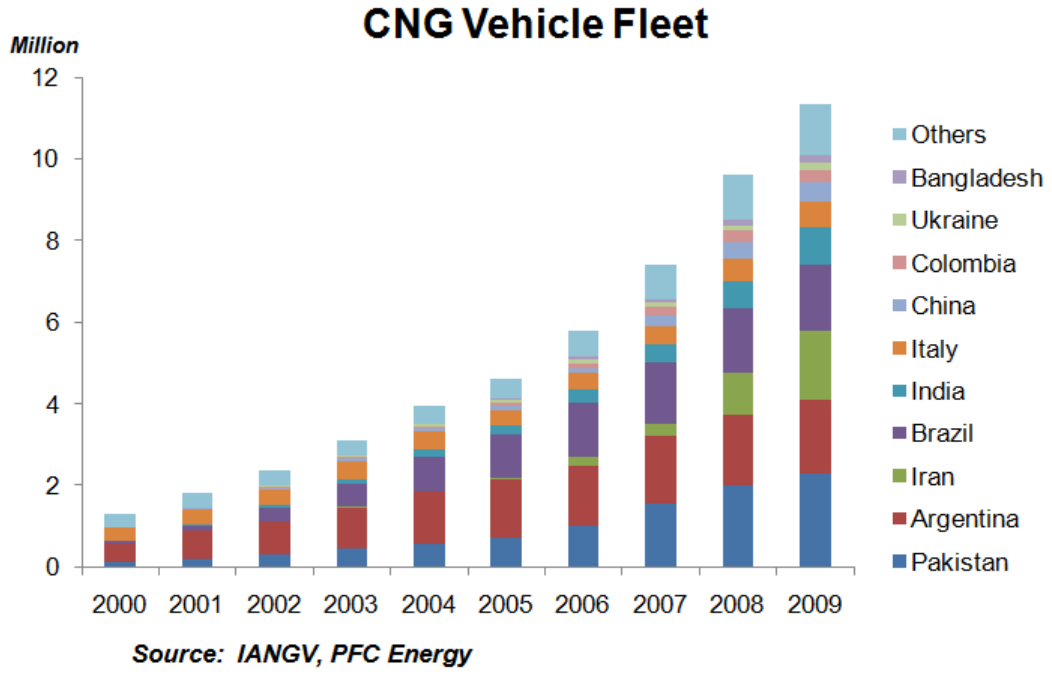
- **Natural gas produces lower emissions than any other fossil fuel.**
  - Natural gas combustion produces an average of 60 $kgCO_2$/MMBtu, while burning coal produces 92-102 $kgCO_2$/MMBtu.
- **Gas-fired power generation produces far lower emissions.**
  - The most advanced combined cycle gas turbine (CCGT) power plants can produce less than 350 $kgCO_2$ per MWh—half the amount produced by the most efficient coal-fired power plants.





Natural gas promotes sustainable transport

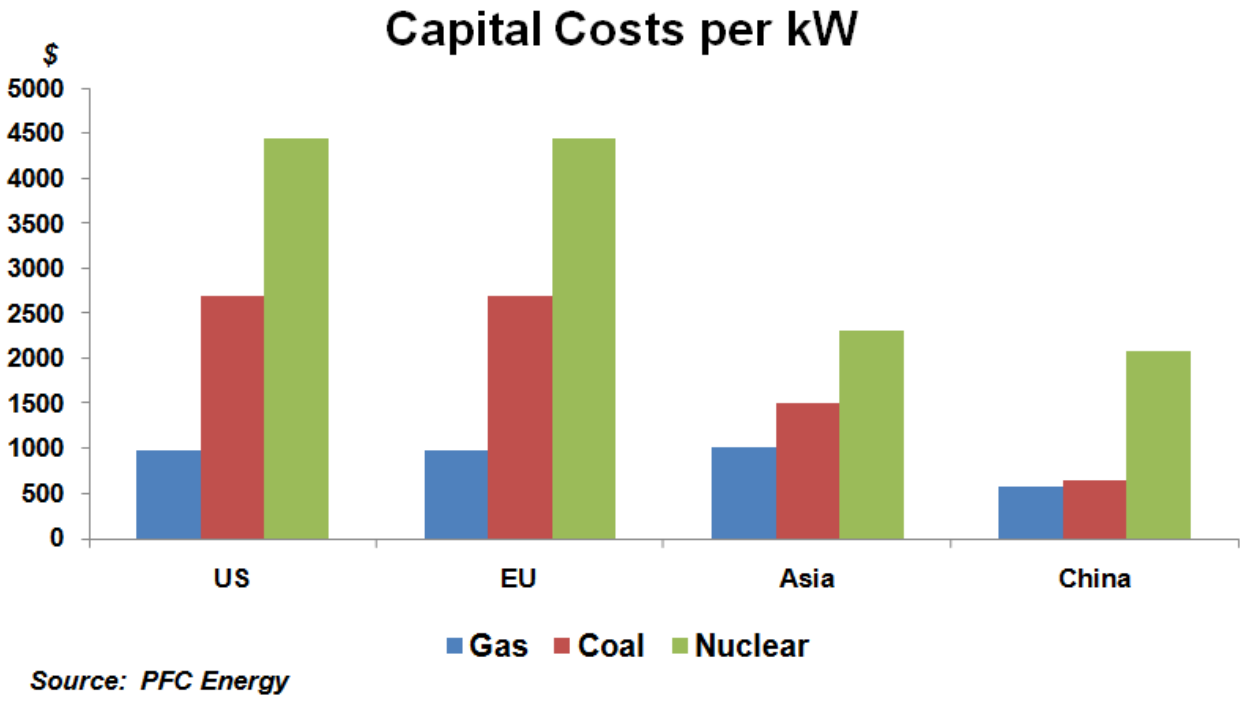
- Natural gas vehicles can promote air quality. Delhi's switch to compressed natural gas (CNG) vehicles for public transport helped to reduce carbon monoxide and particulate levels.
- Over the past decade, the number of natural gas vehicles worldwide has grown from 1.3 million to 11.4 million, and the number of countries using CNG in transportation has doubled.
- Although the vast majority of CNG vehicles are passenger cars, CNG could play a larger role in long-haul trucking and transportation in the future.



Source: IANGV, PFC Energy

Natural gas is the affordable choice

- The capital costs for gas-fired power plants in the United States and Europe are far lower than the costs per kW for coal and nuclear.
- Even in China, the capital costs for gas-fired power generation are competitive with coal.



Source: PFC Energy

On a per kW basis, natural gas is very competitive relative to other fuels.

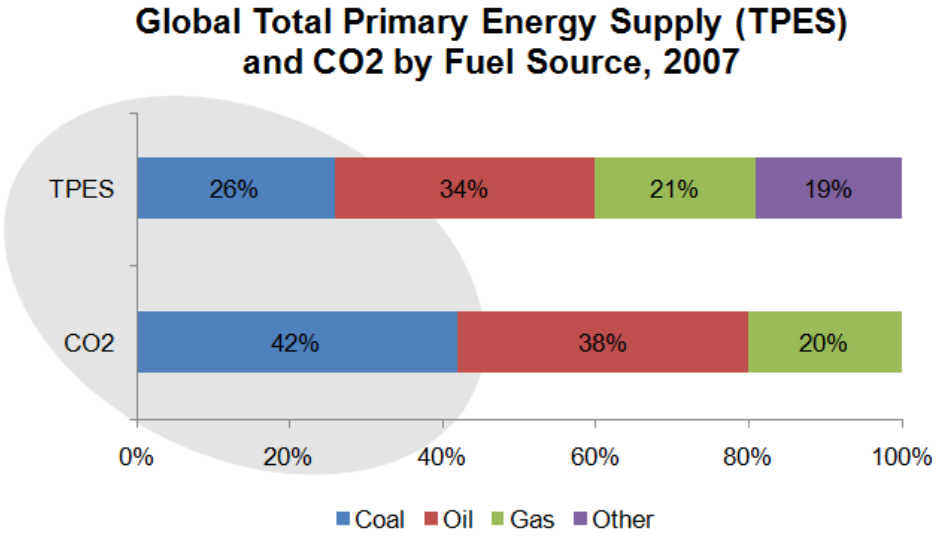
Natural gas does not require subsidies

- **Unlike heavily subsidized renewable technologies, natural gas use allows countries to affordably reduce their carbon emissions.**
- **Government subsidies and direct spending accounted for about one-third of the $145 billion invested in clean energy projects worldwide in 2009.[1]**
- **In the United States, for example, subsidies provided for energy include:**
  - Renewable Energy Production Tax Credit
  - Nuclear Energy Production Tax Credit
  - Energy Investment Tax Credit
  - Loan Guarantees
  - Clean Coal Technologies Investment Tax Credit
  - Local and State Incentives

Natural gas, unlike most renewable technologies, does not require government subsidies to remain competitive—allowing countries to achieve emissions targets while avoiding market distortions.

Natural gas is available now

- In contrast to renewable technologies that in some cases will require decades of research and innovation, the environmental benefits of gas can be realized today.
- Using gas to displace coal in power generation offers an immediate opportunity to reduce emissions. In the United States, coal accounts for 80% of CO_2 emissions from the power sector and 33% of all US CO_2 emissions—and doubling the utilization rates at existing gas-fired plants could displace enough coal to reduce coal-related emissions by 20%.[1]

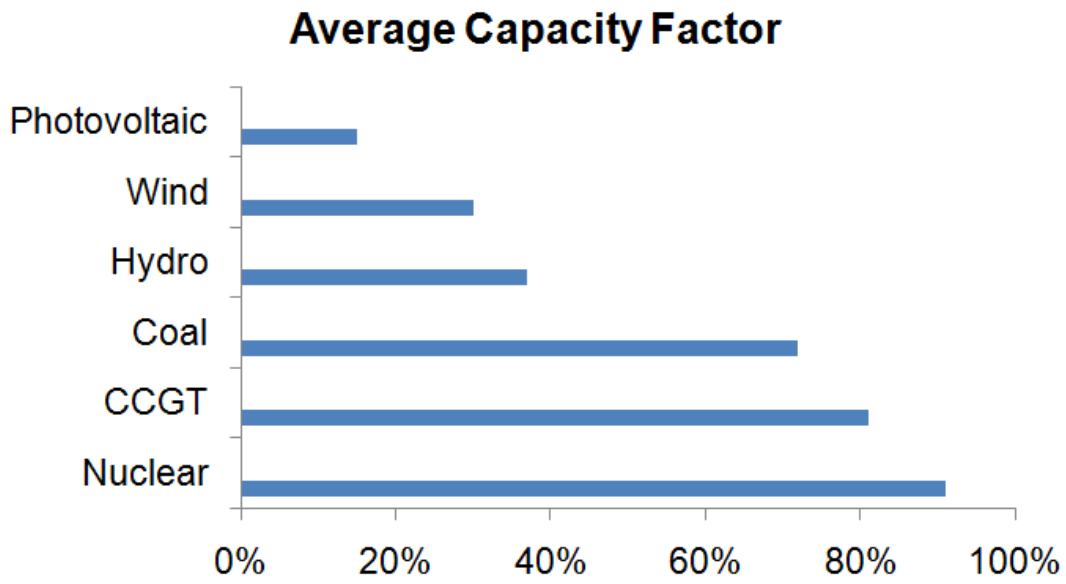


The Intergovernmental Panel on Climate Change (IPCC) has noted that as the fossil fuel with the lowest CO_2 intensity, natural gas offers an immediate opportunity to reduce emissions.

1. *Source: US Congressional Research Service*

Natural gas is versatile

- Gas can serve as a flexible partner in power generation for intermittent technologies like solar and wind, facilitating the phase-in of renewables.
- Wind power, for example, typically has a very low capacity factor—in most cases between 20% and 40%—meaning that those energy sources are effectively idle for 60% to 80% of the time.
- Because gas is a load-following resource—gas turbines can be adjusted upward and downward fairly rapidly according to load changes—gas is essential to complement the growth in variable energy sources.



Renewable Energy Research Laboratory, University of Massachusetts, and US DOE

Natural gas is efficient

- **Modern gas-fired power plants are 40% more efficient than coal-fired plants. Combined cycle gas turbine (CCGT) plants can achieve thermal efficiency rates of 55-60%, compared with thermal efficiency of 42% for coal and 33% for nuclear.**
- **CCGT plants—producing both electricity and heat—have boosted overall plant efficiencies considerably, reducing GHG emissions per unit of energy generated.**
- **Natural gas transmission, distribution and consumer use have become more efficient—and sound energy policies can lead to further improvements. In a 2008 survey of natural gas utilities in 33 US states with energy efficiency programs, reported energy savings averaged 9% for residential users and 7% for all users.[1]**

Sample Gas Turbine Performance			
First operation year of prototype machine	*1981*	*1992*	*2002*
Gas Turbine Power Output (MW)	144	278	334
Gas Turbine Efficiency (% Lower Heating Value, or LHV)	34.8	38.7	39.5
Combined Cycle Efficiency (%LHV)	51.4	59.0	59.3

Source: Mitsubishi Heavy Industries Review, Dec. 2007

1. *American Gas Association, 2008*

Natural gas saves time

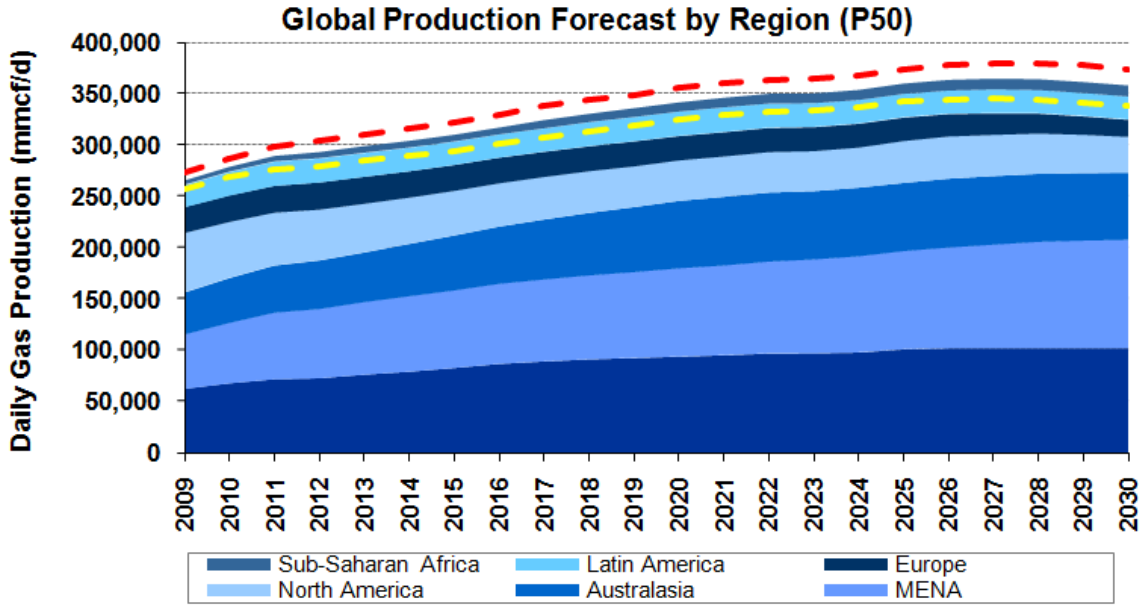
- Gas-fired power plants require less construction time than either coal-fired plants or nuclear facilities.
- A typical gas-fired power plant can take only two years to construct—less than half the lead time required to build a coal-fired plant, and less than one-third the time required to construct a nuclear plant.
- This shorter construction time makes it easier for firms to make efficient investment decisions.
- Nuclear plants in particular have been subject to extreme cost overruns and larger-than-expected decommissioning costs. The lengthy construction time (often more than six years) and the volatile regulatory climate for nuclear are serious disincentives for potential investors.

Natural gas-fired plants have a clear advantage over coal and nuclear with regard to construction time.

Natural gas is abundant

Conventional gas production to grow over next two decades

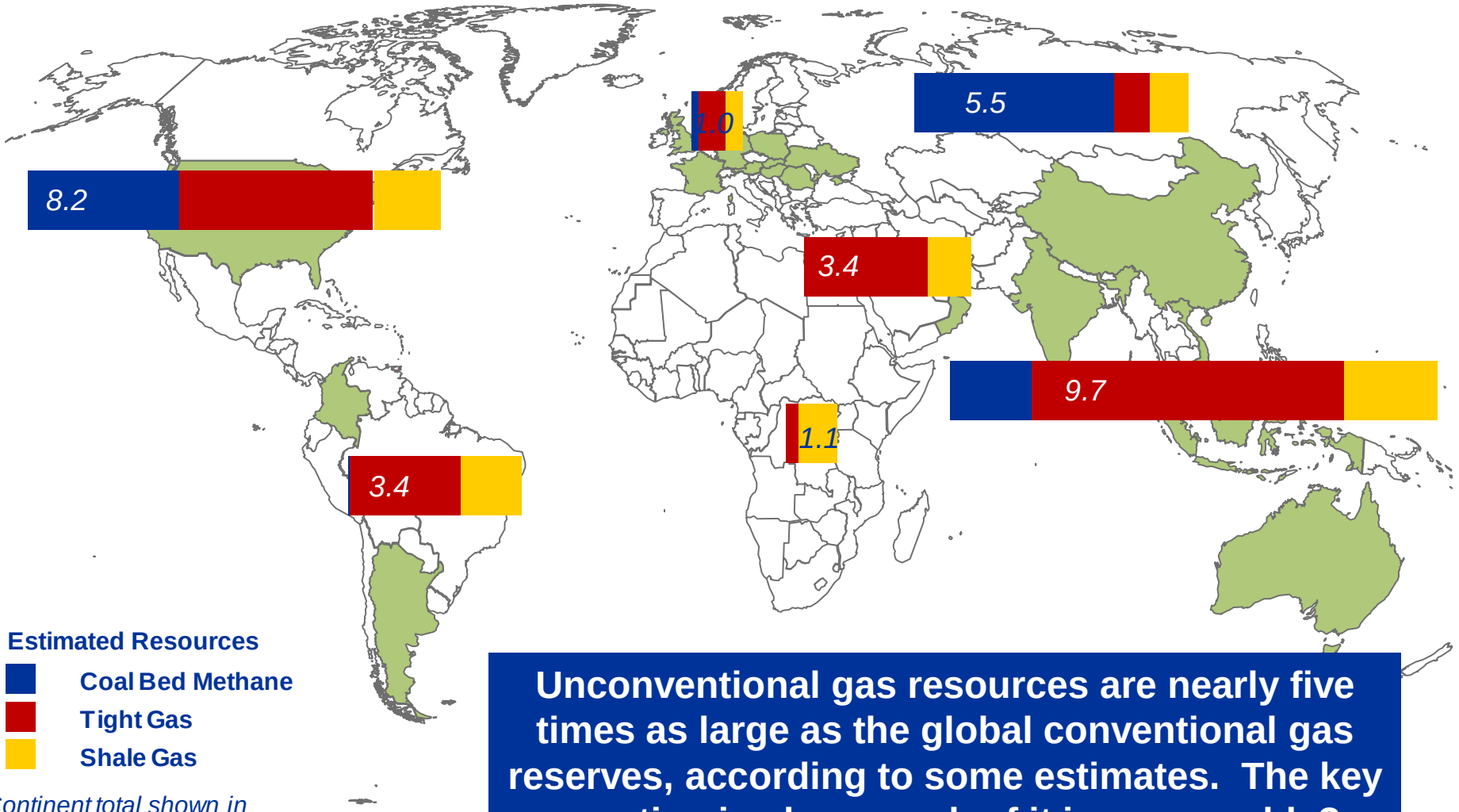
- **Global gas production will increase over the next 20 years, with growing supplies from both conventional and unconventional resources.**
- **Australasia, Russia and the Former Soviet Union and the Middle East are all expected to increase gas production over the next 15-20 years.**
- **There are many questions still to be answered about the extent of unconventional gas resources, but the potential resources are enormous.**



Source: PFC Energy, Global Gas Supply Forecast

Natural gas is abundant

Unconventional gas resources (in-place)

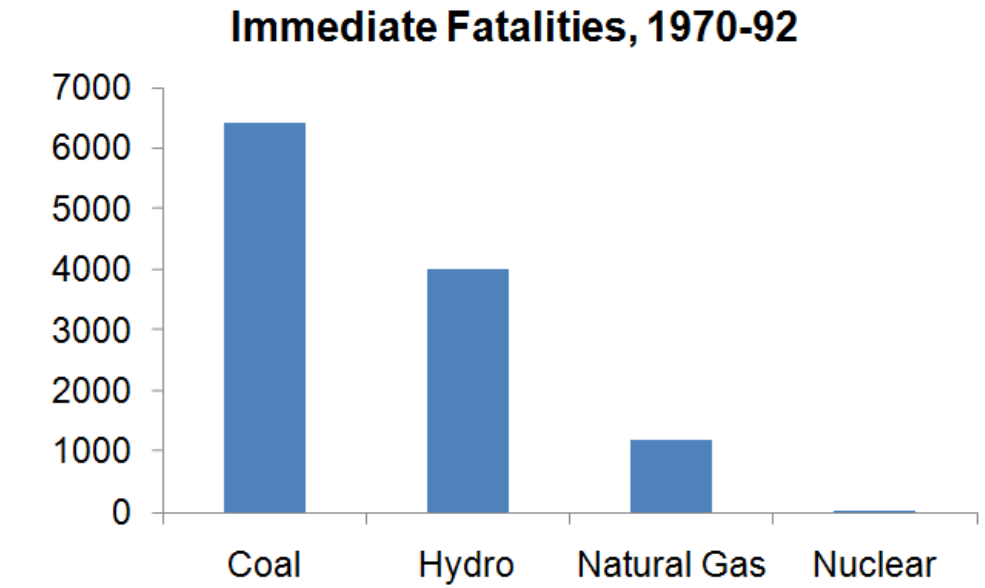


Unconventional gas resources are nearly five times as large as the global conventional gas reserves, according to some estimates. The key question is: how much of it is recoverable?

Sources: PFC Energy Global LNG Service, Rogner 1997

Natural gas is safe

- The natural gas industry has an excellent safety record, with fewer risks for severe accidents than those presented by other energy sources.
- Gas-fired power generation also excels in terms of local environmental safety. Gas-fired plants produce fewer pollutants than coal-fired plants, generating far lower levels of sulfur oxides and nitrogen oxides—primary contributors to acid rain and smog—as well as mercury.
- The favorable safety and environmental profile of gas power plants aids in the siting and permitting process.



Source: Canadian Energy Research Institute, 2008