



Global Vision for Gas

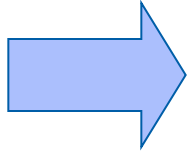
The Pathway towards a Sustainable Energy Future

Roberto D. Brandt

International Gas Union (IGU)

Lima – July 3, 2012

Table of Contents



1. What is IGU?

2. IGU's Global Vision for Gas

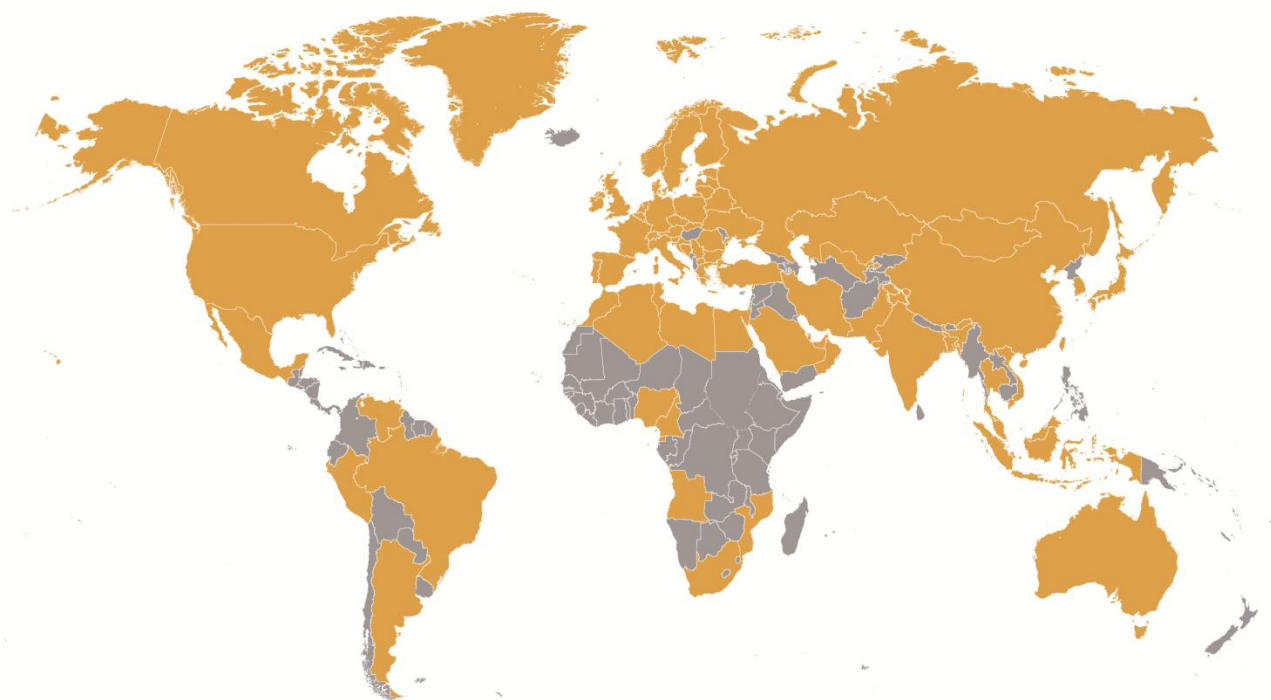
3. Unconventional Gas

IGU is **THE** Spokesman for the Gas Industry



- **Worldwide and non–profit organization established in 1931**
- **Promotes political, technical and economic progress of the gas industry**
- **Organizes World Gas Conferences every 3 years**
- **Emphasizes sound environmental performance worldwide**
- **Increased focus on strategic, policy issues and gas advocacy**
- **Cooperates with IEA, United Nations, World Bank, IEF and other international organizations**

IGU represents 95% of Global Gas Sales



■ IGU Members

- 79 Charter Members
- 38 Associate Members
- 11 Affiliated Organisations

Latin American & Caribbean Membership

- Argentina
- Brazil
- Mexico
- Peru
- Trinidad & Tobago
- Venezuela

Peru won IGU's Social Gas Award 2012

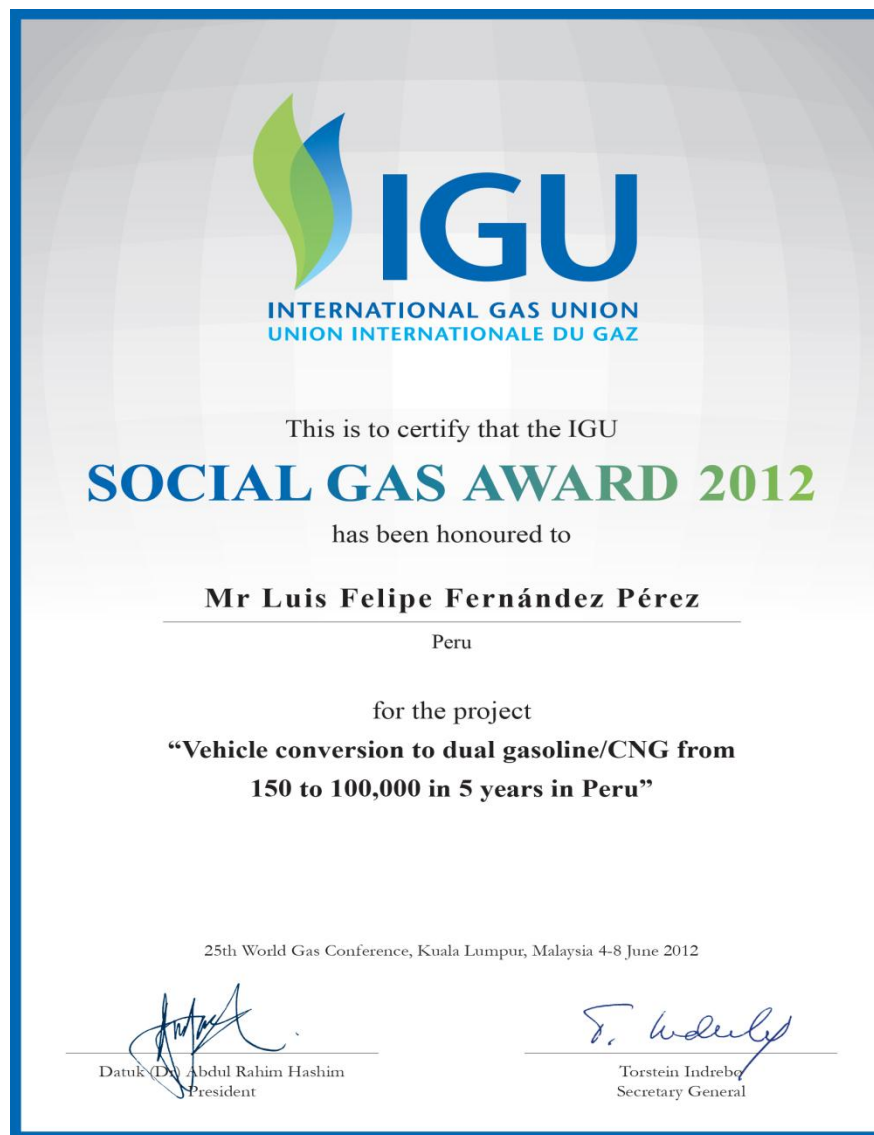
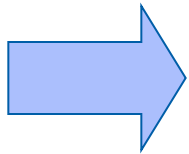


Table of Contents

1. What is IGU?



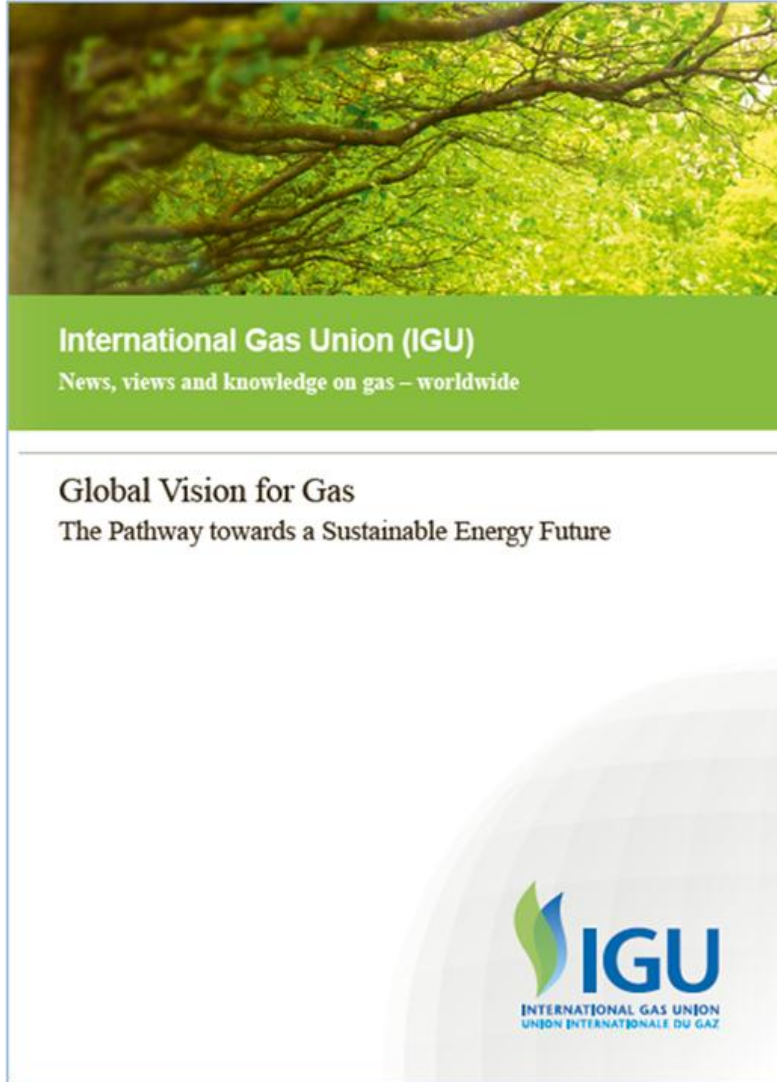
2. IGU's Global Vision for Gas

3. Unconventional Gas

IGU's Global Vision for Gas:



The Pathway towards a Sustainable Energy Future



● Published in June 2012

● Available on <http://www.igu.org>

Natural Gas: Addressing the World's Challenges

Key Global Challenges

Population Growth & Resource Availability

Economic Development & Employment

Energy Poverty & Public Health

Air Quality & Climate Change

Mobility

Affordability

Role of Natural Gas

- Newly Recognised Abundant Resource Base
 - conventional, deepwater & unconventional
- Industrial Feedstock
- Employment Creation
- Combat indoor pollution & urban smog
- Negligible SO_x, particulates
- Low levels of NO_x and CO₂
- LNG for trucks and shipping
- CNG and/or electric vehicles for cars
- CCGTs as lowest cost low carbon technology

Natural gas is very well-suited to meet these challenges

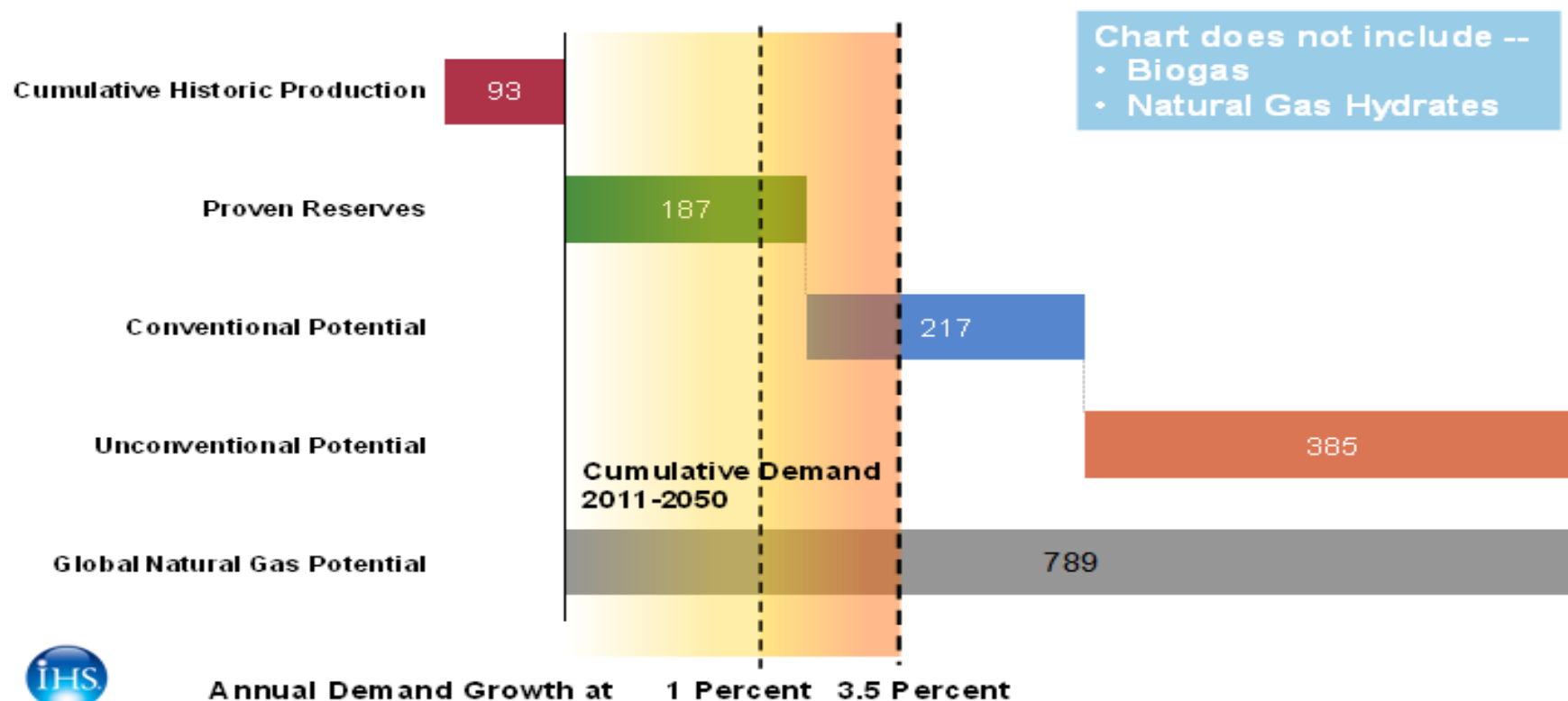
- **Availability: Abundant & growing resource base**
- **Affordability and strong cost competitiveness**
- **Acceptability: Low carbon option**
- **Efficiency, especially for power generation**
- **Reliability & adaptability: Proven technologies**



Natural Gas: Resource Availability

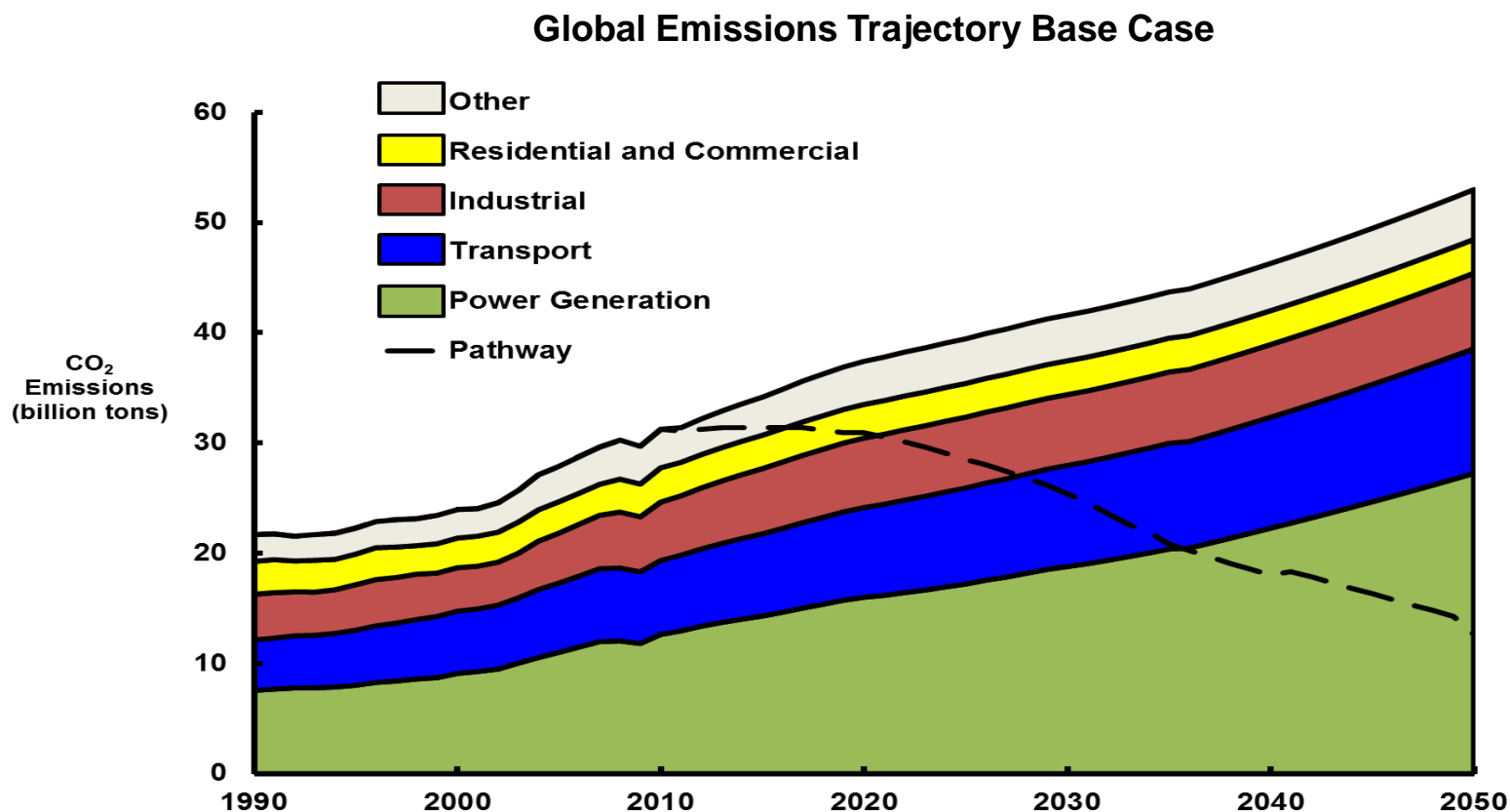
What is the Global Availability of Natural Gas? Global Natural Gas Recoverable Resources vs Demand

(Trillion Cubic Meters)

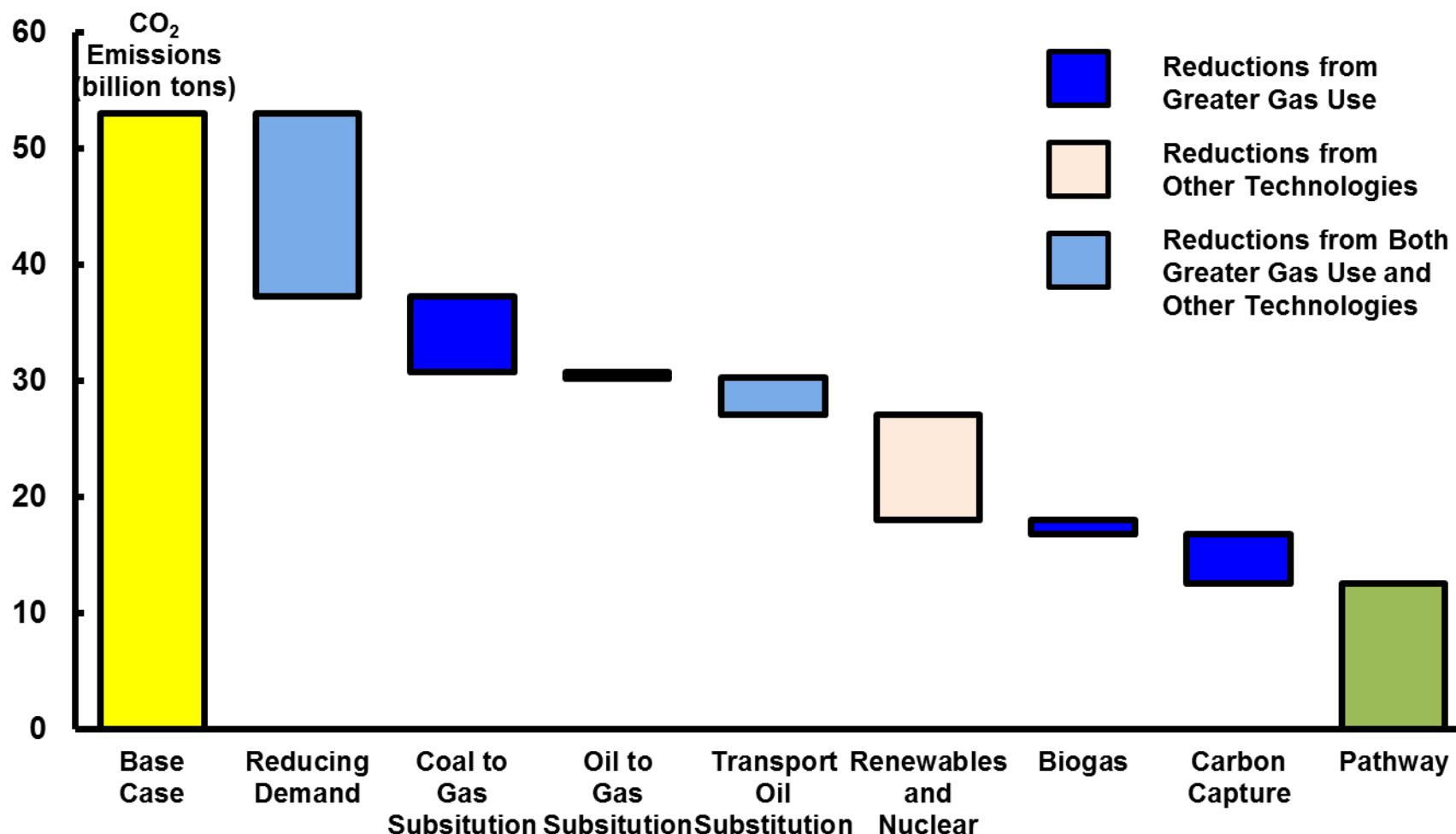


Pathway towards a Sustainable Future

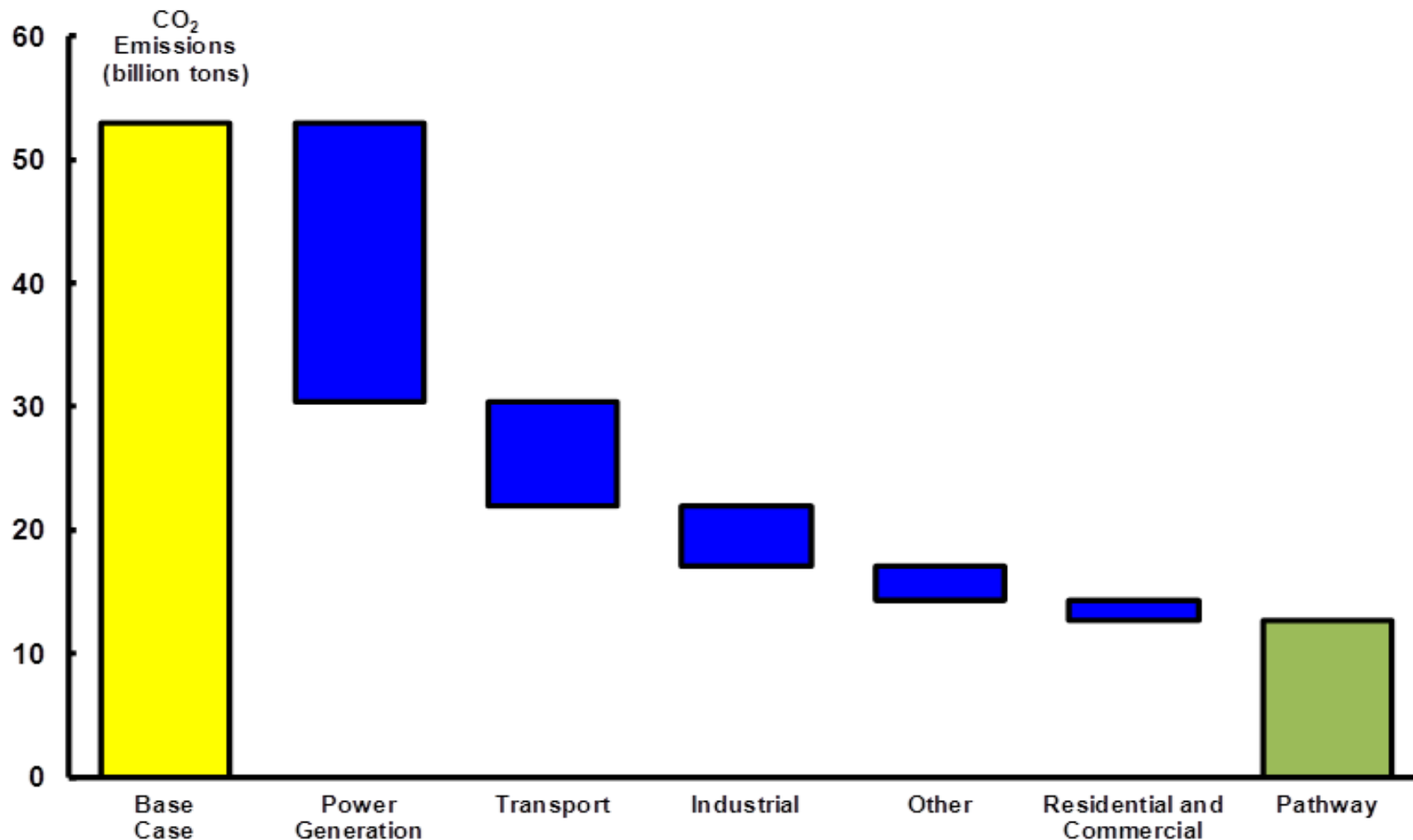
The task to meet future global energy needs whilst at the same time addressing air quality and climate change concerns is challenging.



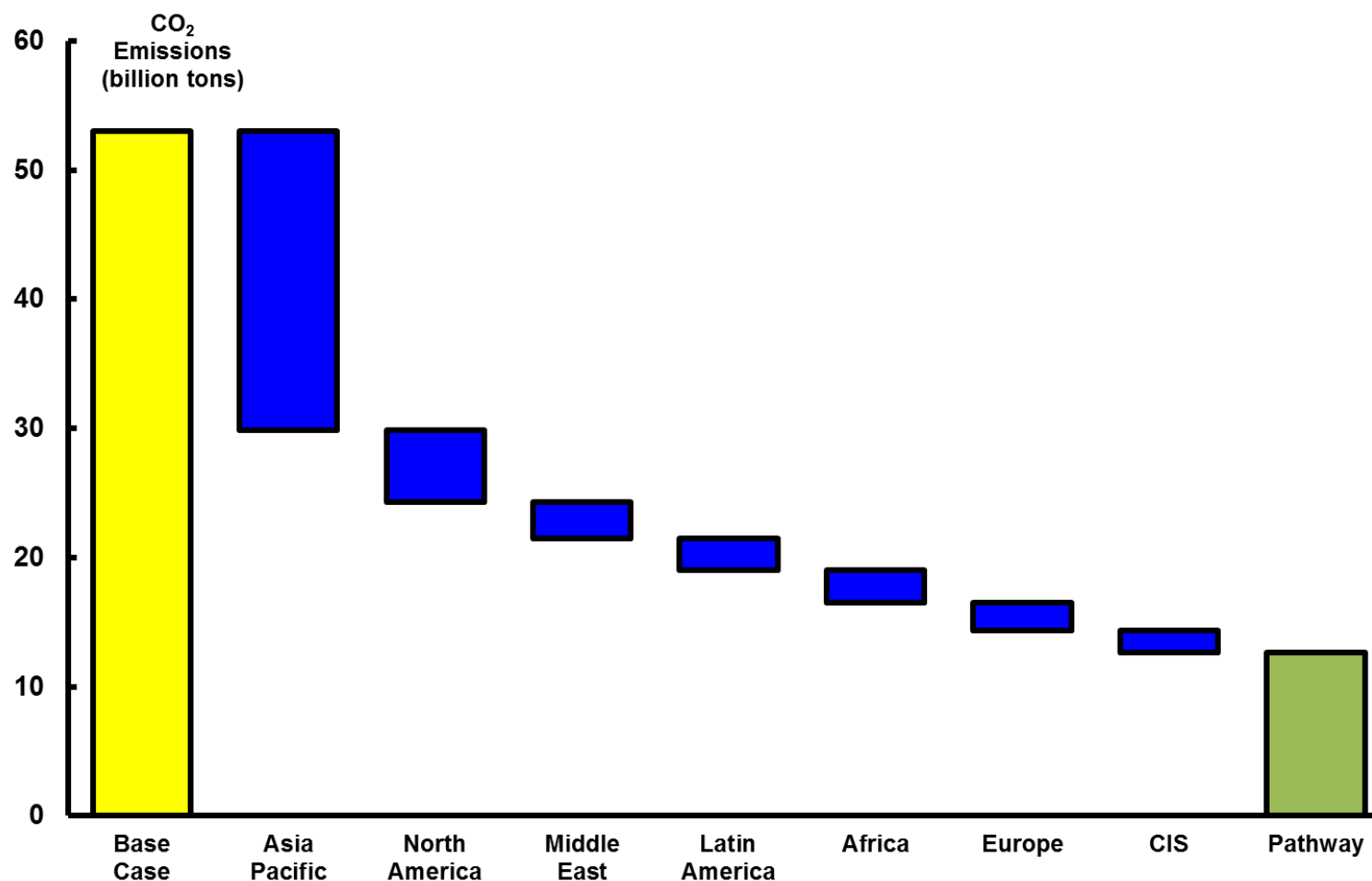
IGU's Pathway Trajectory: Global Emissions Reductions, by Abatement Method



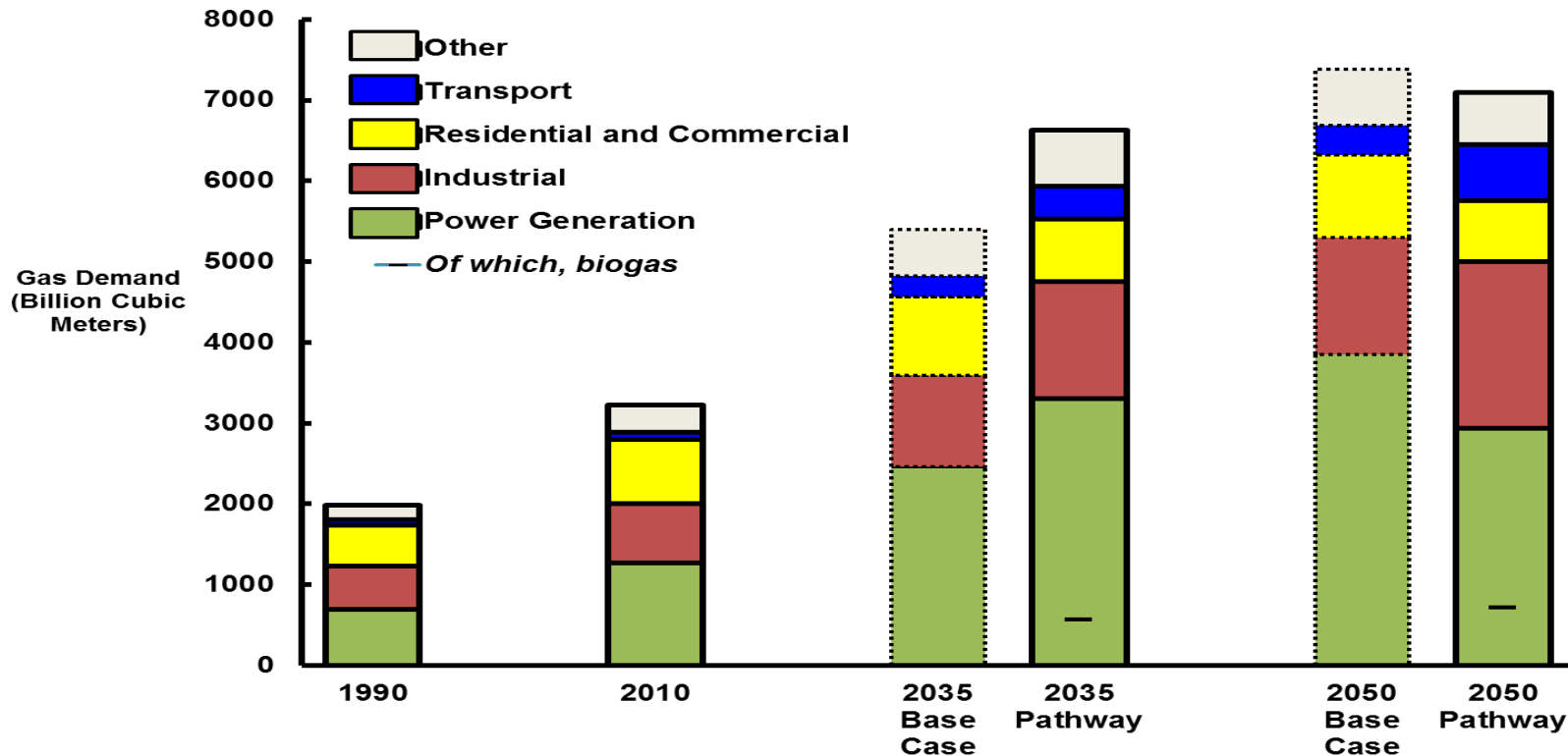
IGU's Pathway Trajectory: Global Emissions Reductions, by Consumer Sector



IGU's Pathway Trajectory: Global Emissions Reductions, by Region

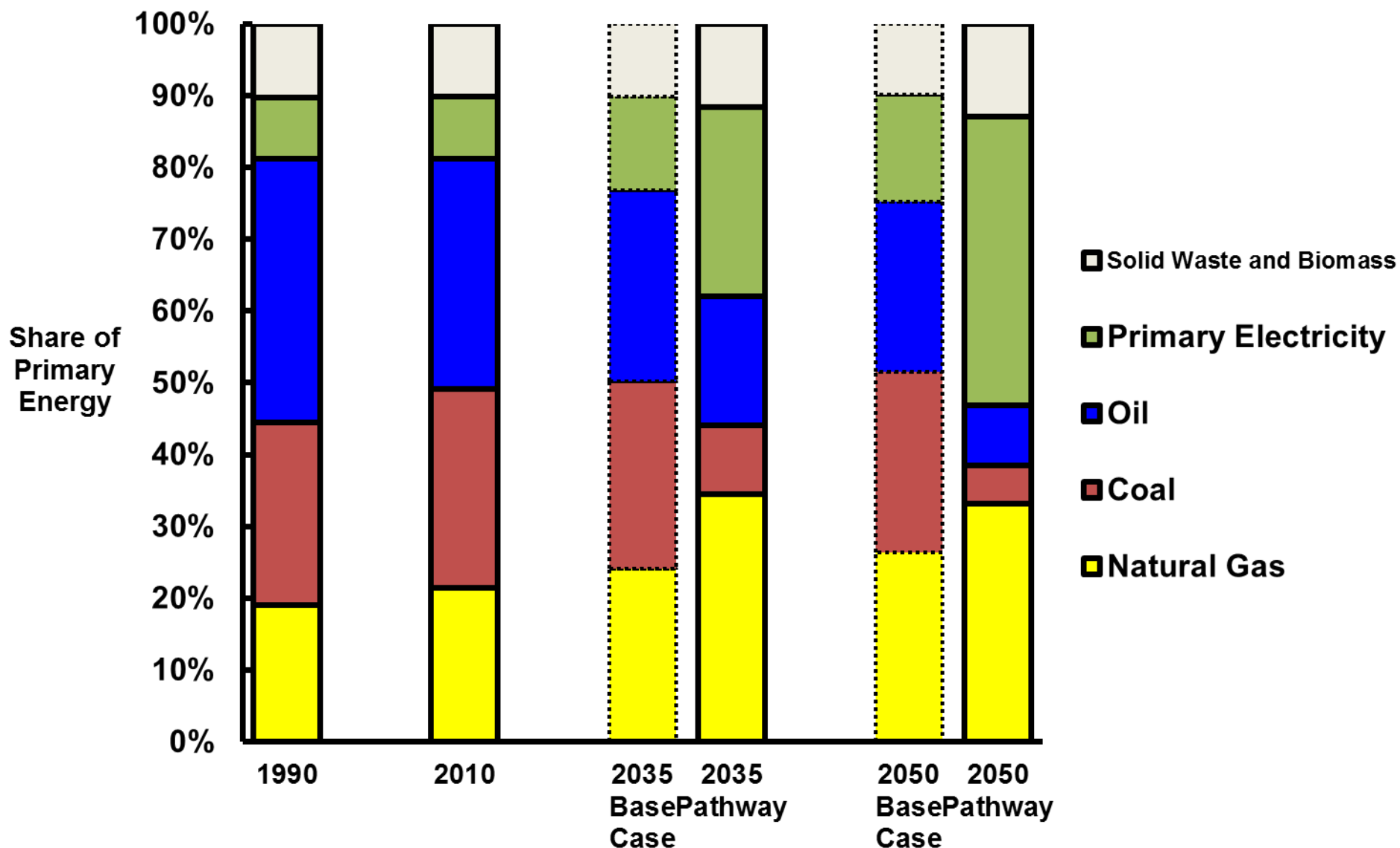


IGU's Pathway Trajectory: Implications for Gas Demand, by Consumer Sector

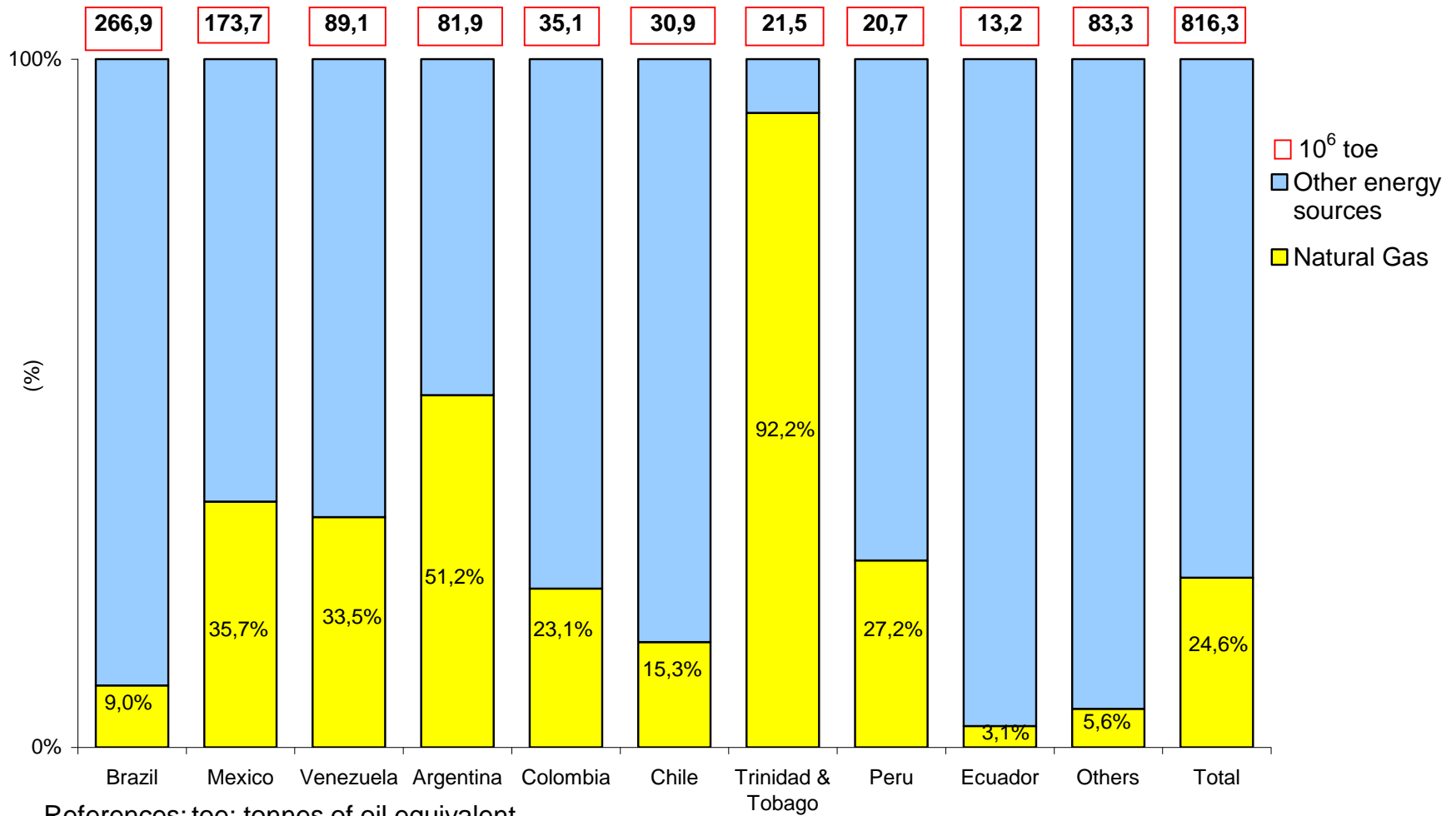


As today, power generation will be the largest consumer sector by 2050

IGU's Pathway Trajectory: Implications for Gas Market Share of Primary Energy



Latin America & Caribbean: Gas Market Share of Primary Energy, by Country - 2011



Significant regional differences in energy market sizes and gas penetration by country.

Source: R. Brandt, based on BP Statistical Review of World Energy 2012.

Policy will be particularly important in the areas where the greatest reductions in emissions are projected

- Demand reduction & energy efficiency
- Coal to gas substitution
- Carbon capture



Latin America & Caribbean: Main Challenges for the Growth of the Natural Gas Industry

Regions / Countries

Major Challenges

A. Integrated domestic markets

- Argentina
- Brazil
- Chile
- Colombia

- Competition against other energy sources
- Acceptability of market economics and long-term pricing policies
- Marketing of associated gas
- Infrastructure expansion
- Diversity of national energy policies / Regional integration

B. Emerging markets

- Brazil
- Peru
- Uruguay
- Venezuela

- Internal market development

C. Predominantly exporters

- Bolivia
- Trinidad & Tobago

- Ability to attract investment
- Ability to retain external market share

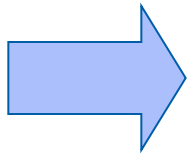
IGU's Global Vision for Gas: Conclusions

- ➡ The 'Global Vision for Gas' lays out a clear pathway towards a **sustainable energy future**.
- ➡ There is a strong need for a **portfolio approach** in energy, combining:
 - Reductions in energy use
 - Enhanced energy efficiency
 - Expanded use of zero carbon technologies
 - Greater resort to clean-burning natural gas
- ➡ Policymakers need to recognize the critical role that natural gas has to play alongside other low carbon options, and facilitate the appropriate **policy enablers** as befits each region, based on its particular circumstances.

Table of Contents

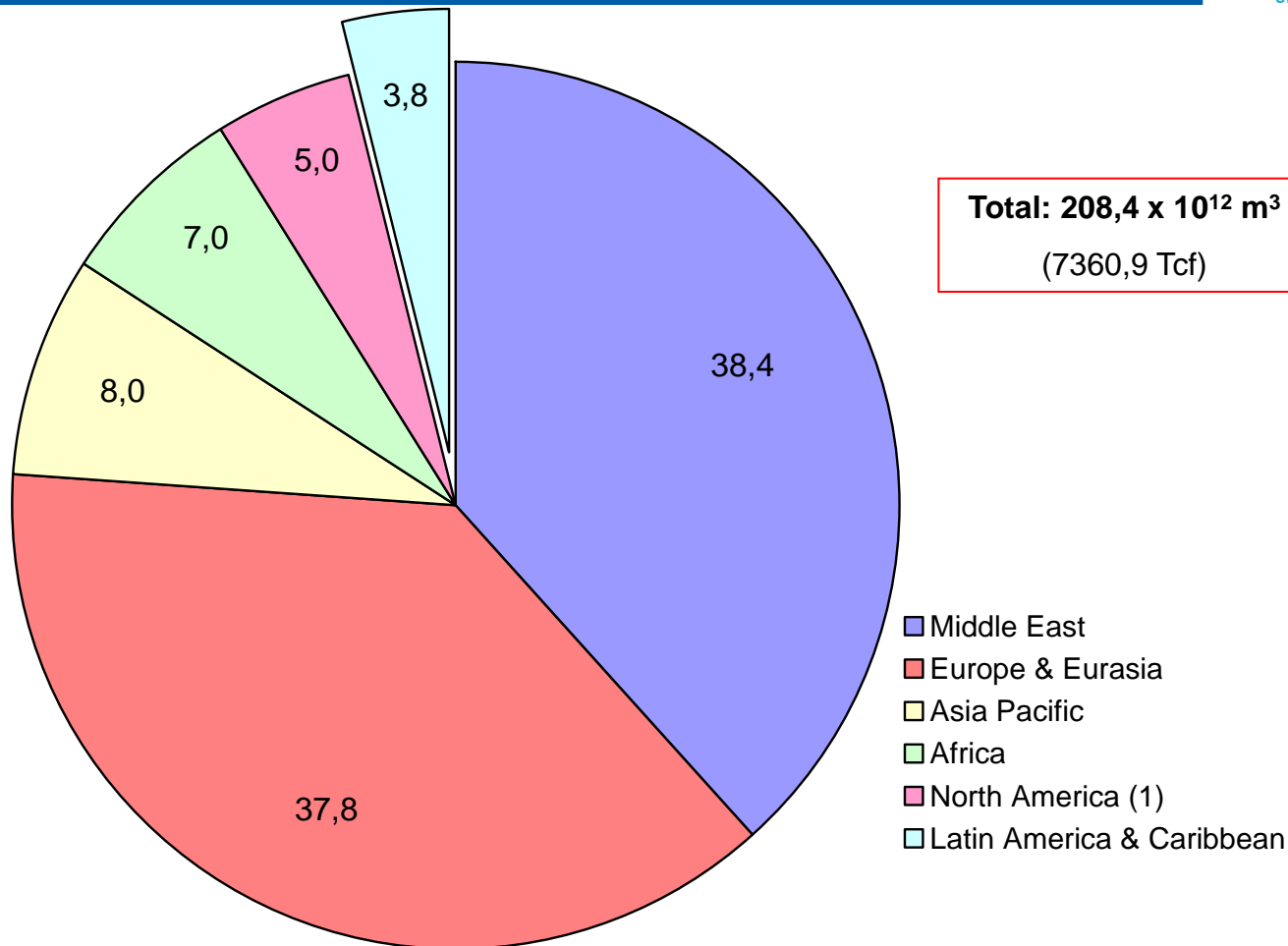
1. What is IGU?

2. IGU's Global Vision for Gas



3. Unconventional Gas

Proved World Natural Gas Reserves, by Region - 2011 (%)

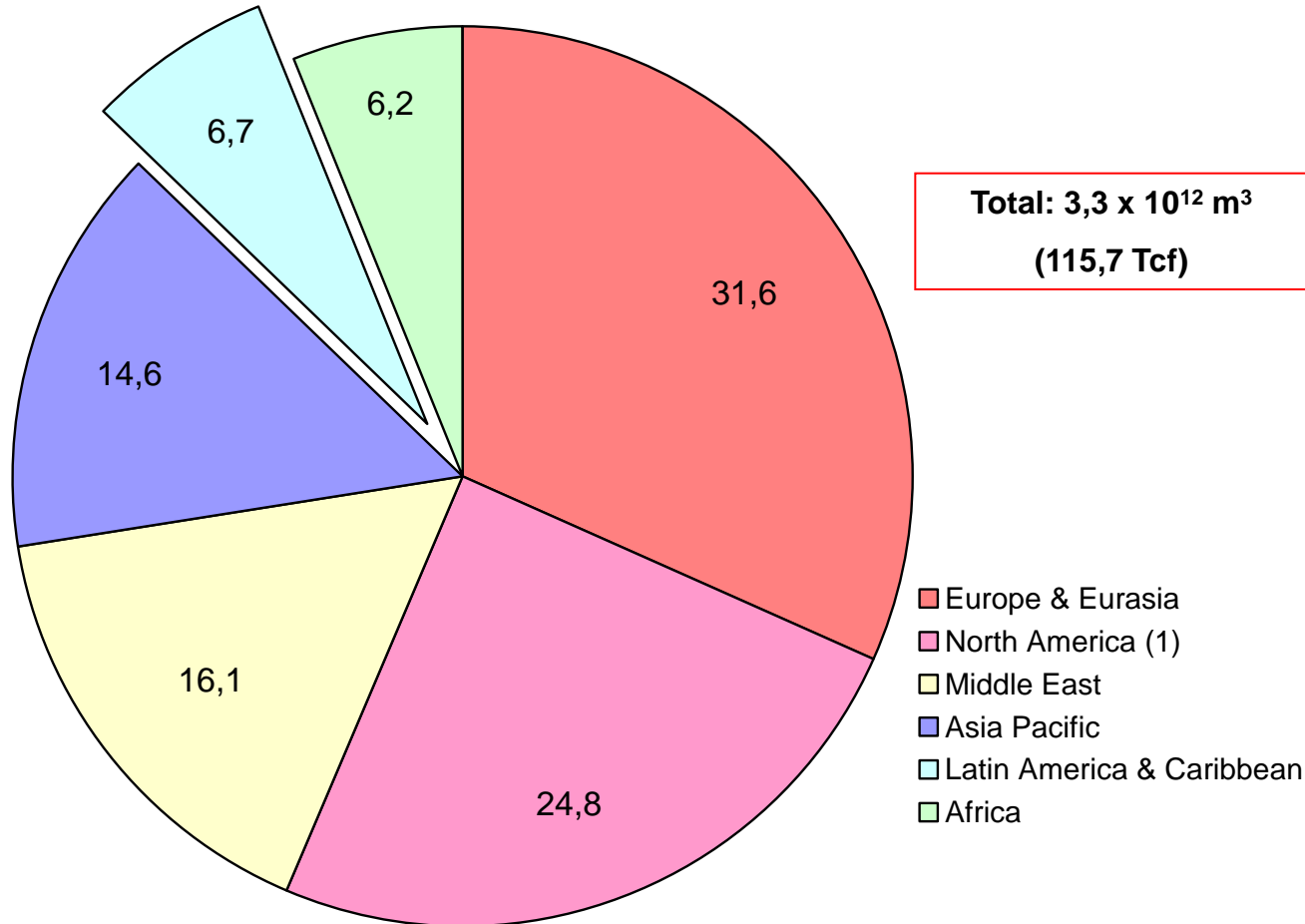


References: ⁽¹⁾ Excludes Mexico (included in Latin America & Caribbean).

Reserves life index (RLI) of 63 years, with 49% concentrated in Russia, Iran and Qatar.

Source: R. Brandt, based on BP Statistical Review of World Energy 2012.

World Natural Gas Production, by Region - 2011 (%)

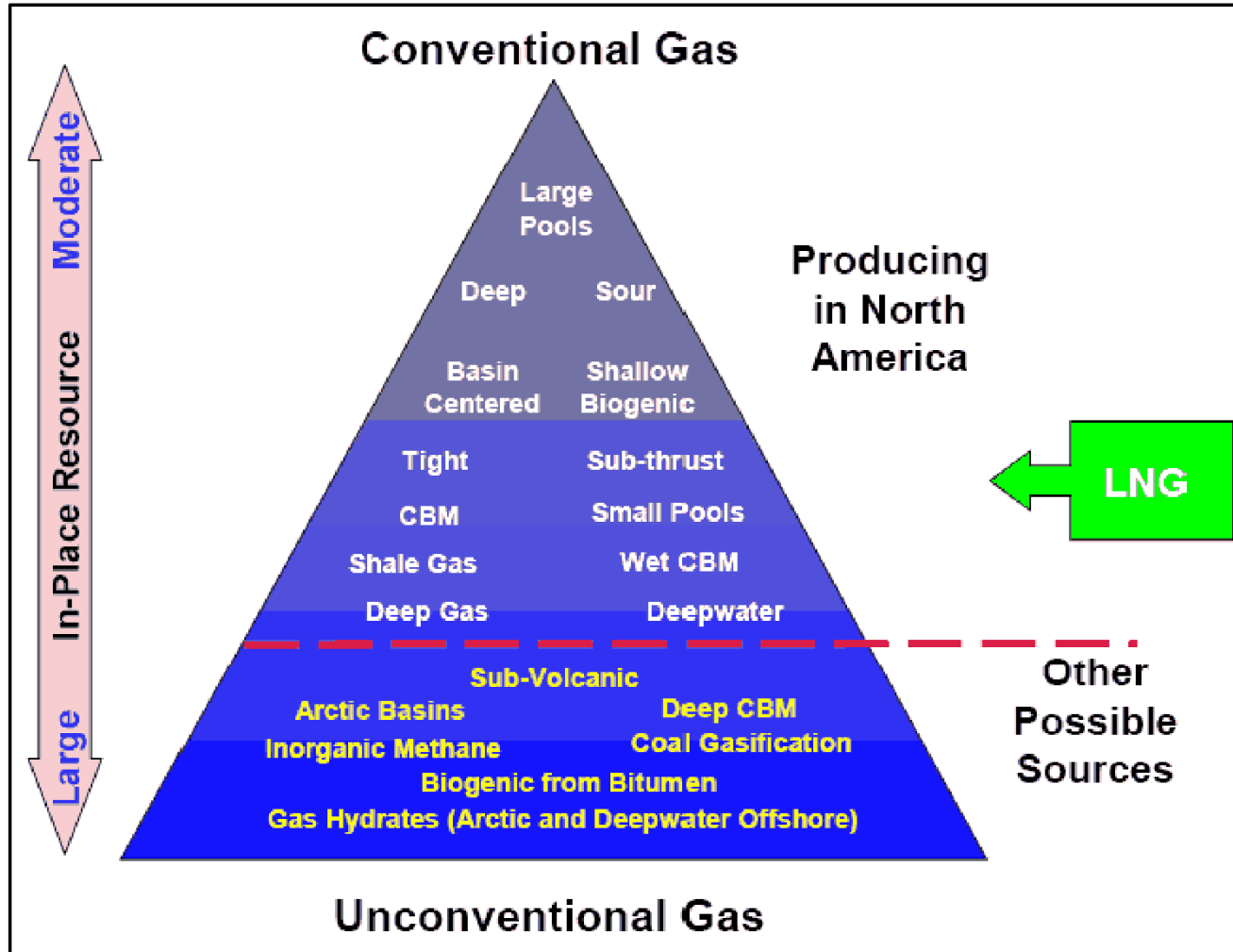


References: ⁽¹⁾ Excludes Mexico (included in Latin America & Caribbean).

USA represents 20% of the world's total, with 60% of its production coming from unconventional gas. The latter has considerably impacted international Liquefied Natural Gas (LNG) trade and flows.





Source: R. Brandt, based on BP Statistical Review of World Energy 2012.

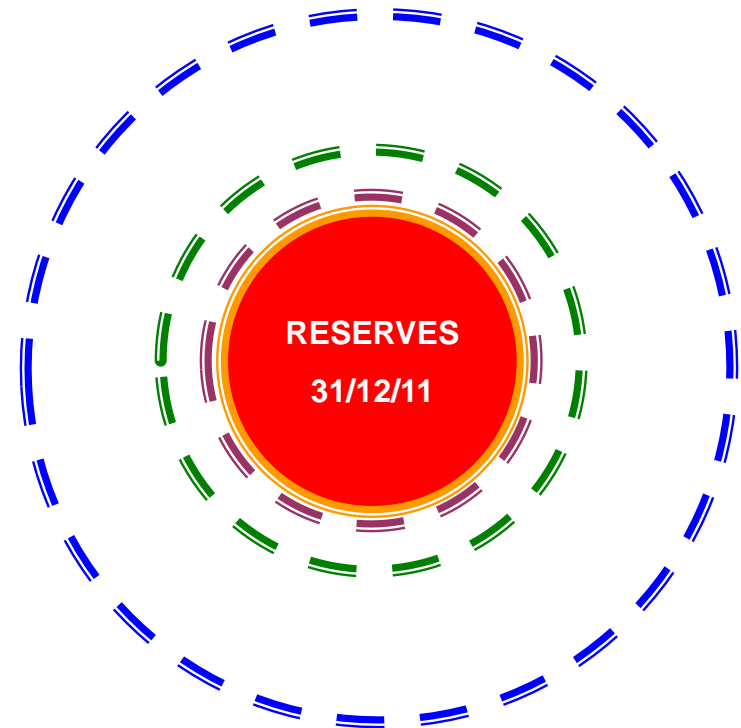
Classification and Potential of Existing Gas Resources



Most advanced unconventional gas technologies: Shale gas, Coal-bed methane (CBM) and Tight-sands.

Comparison of Unconventional Gas Resources vs. “Conventional” Gas Reserves

		10^{12} m^3	Tcf	Order of magnitude
	"Conventional" Natural Gas	208,4	7360,9	1,0
	Tight-sand gas	209,7	7405,6	1,0
	Coal-bed methane / CBM	256,1	9044,2	1,2
	Shale gas	456,3	16114,2	2,2
	Gas hydrates / Under study	2500	88287,5	12,0



Estimated resources of Shale gas, CBM and Tight-sands more than quadruple the 2011 gas reserves.

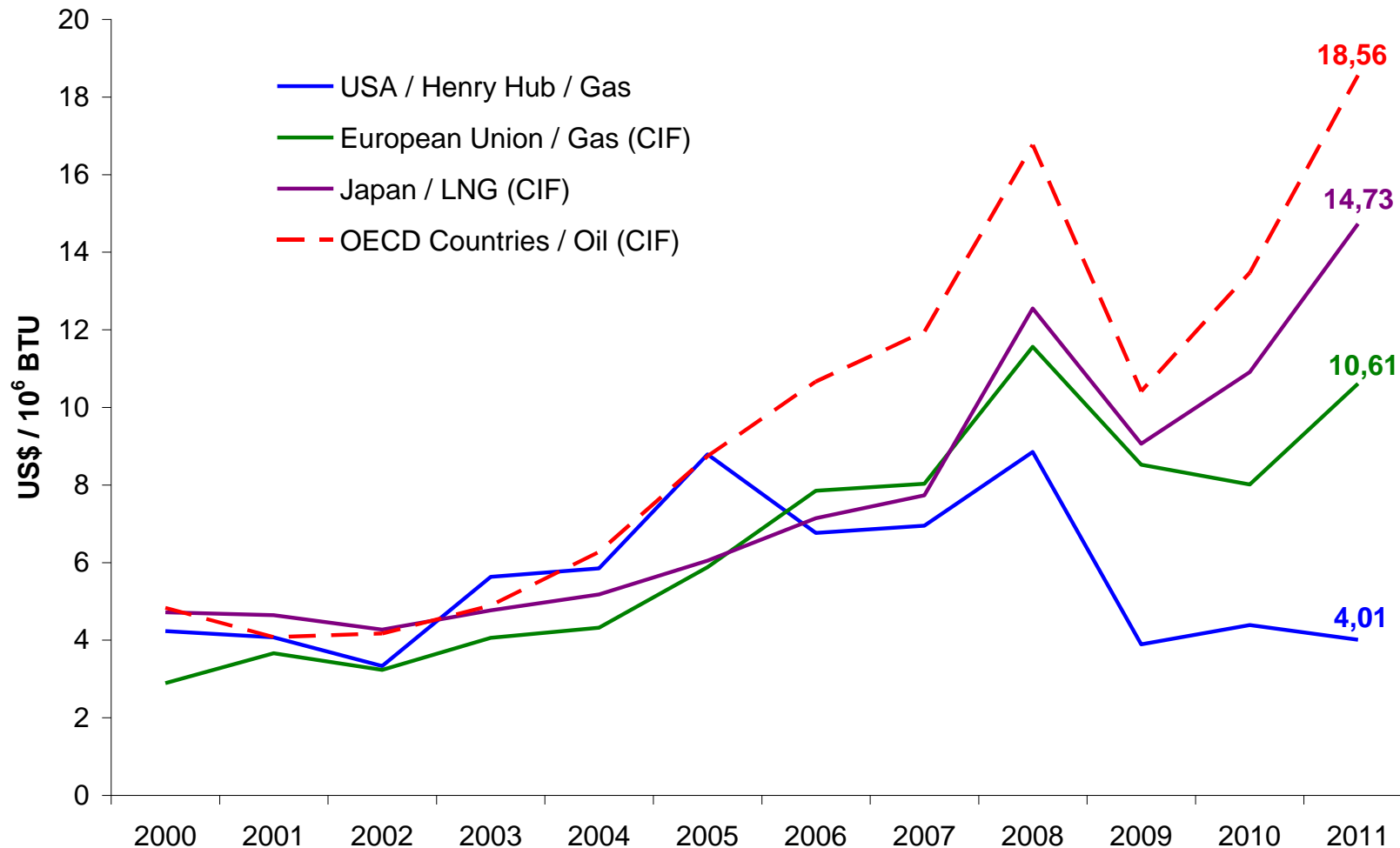
Technically Recoverable Shale Gas Resources - 2011

REGION / COUNTRY	Tcf
North America	
USA	862
Canada	388
Europe	
Poland	187
France	180
Norway	83
Asia	
China	1275
India	63
Pakistan	51
Australia	396
Africa	
South Africa	485
Libya	290
Algeria	231

REGION / COUNTRY	Tcf
Latin America	
Argentina	774
Mexico	681
Brazil	226
Chile	64
Paraguay	62
Bolivia	48
Uruguay	21
Colombia	19
Venezuela	11

China, USA, Argentina, Mexico and South Africa “rank” among the first 5 of the 32 countries covered by the survey. Moving from Shale gas “resources” to “reserves” will be a major challenge.

Comparison of Gas vs. Oil Prices in Developed Markets - 2000/2011 (US\$/10⁶ BTU)

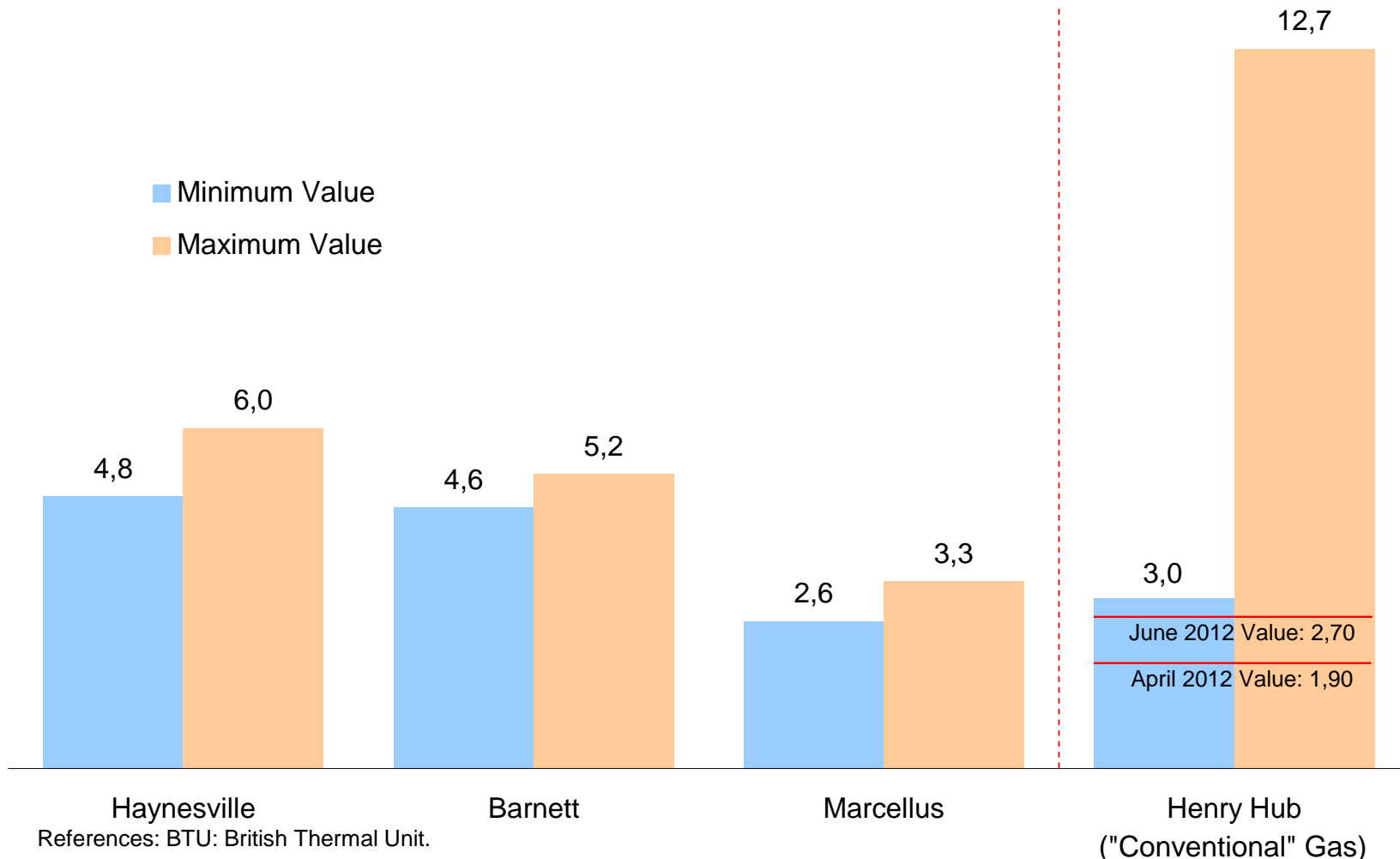


2,70 in
June 2012

Reference: BTU: British Thermal Unit.

Source: R. Brandt, based on BP Statistical Review of World Energy 2012.

USA: Break-even Prices for Unconventional Gas 2008/11 (US\$/10⁶ BTU)



Significant differences in "break-even" prices of unconventional gas reservoirs. Henry Hub volatility!

Source: R. Brandt, based on Smith International, BP Statistical Review of World Energy 2012 and US Energy Information Administration.



Global Vision for Gas

The Pathway towards a Sustainable Energy Future

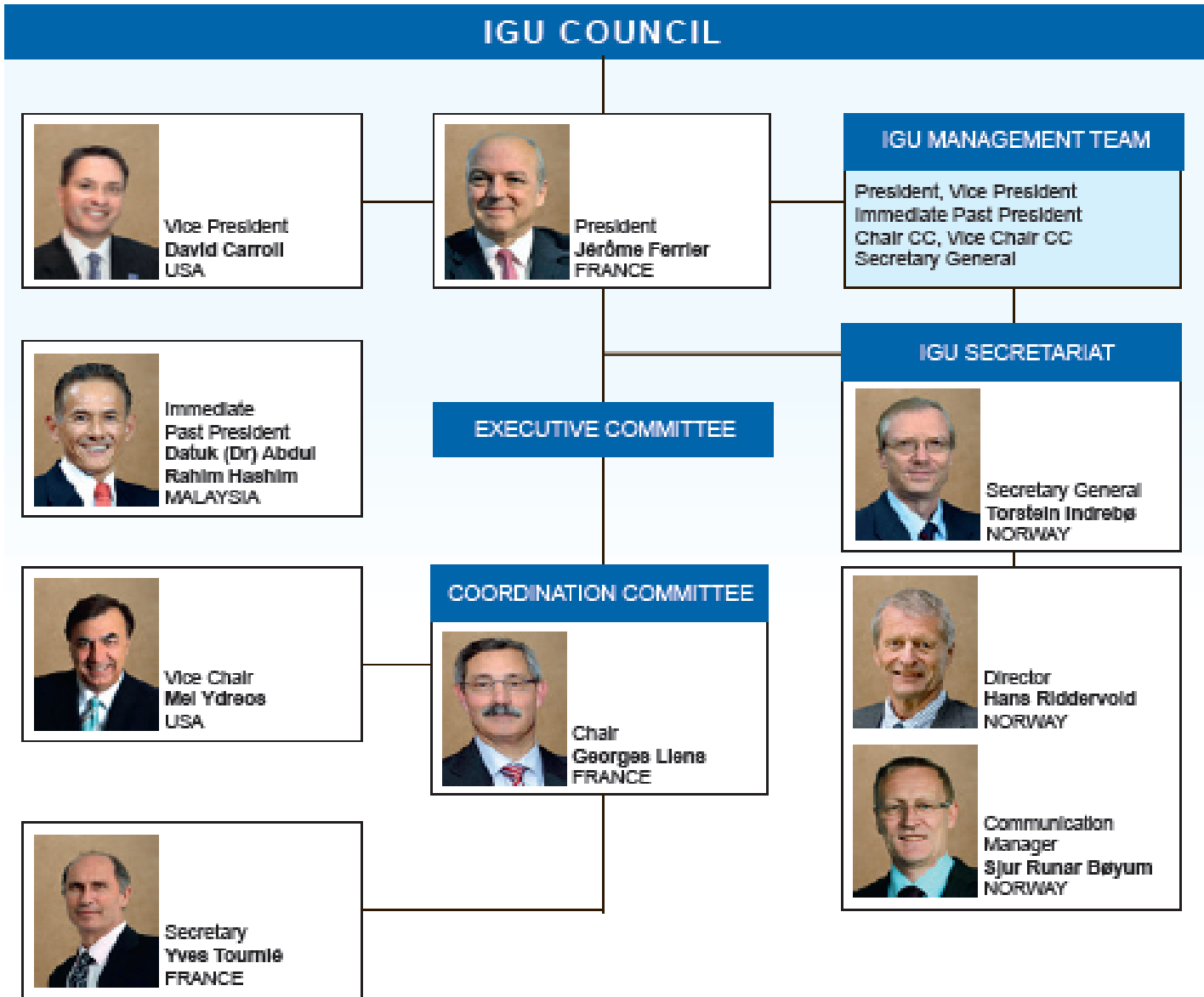
Backup Slides

Roberto D. Brandt

International Gas Union (IGU)

Lima – July 3, 2012

France heads the IGU in the 2012-2015 Triennium



Theme

“ Growing together towards a friendly planet ”

- Natural Gas is a destination fuel necessary for Sustainable Development
- Natural Gas must be available everywhere (new emerging countries), and its role will grow in Asia and South America
- Continuity and building on the last presidencies actions is key

Strategic Guidelines

“ Growing together towards a friendly planet ”

- Advocating for the development of natural gas as a destination fuel necessary for Sustainable Development
- Promoting an accurate combination with renewable energies and electricity
- Improving availability of natural gas in new areas and in developing countries
- Attracting and retaining Human Resources for the Future

Strategic Vision

"Growing together towards a friendly planet"



Latin America & Caribbean: IGU Charter Members



- **Argentina**
 - Instituto Argentino del Petróleo y del Gas (IAPG)
- **Brazil**
 - ABEGAS - Associação Brasileira das Empresas Distribuidoras de Gás Canalizado
- **Mexico**
 - Asociación Mexicana de Gas Natural, A.C.
- **Peru**
 - PERUPETRO S.A.
- **Trinidad and Tobago**
 - The National Gas Company of Trinidad and Tobago Limited
- **Venezuela**
 - Petróleos de Venezuela S.A. (PDVSA)

Latin America: IGU Associate Members

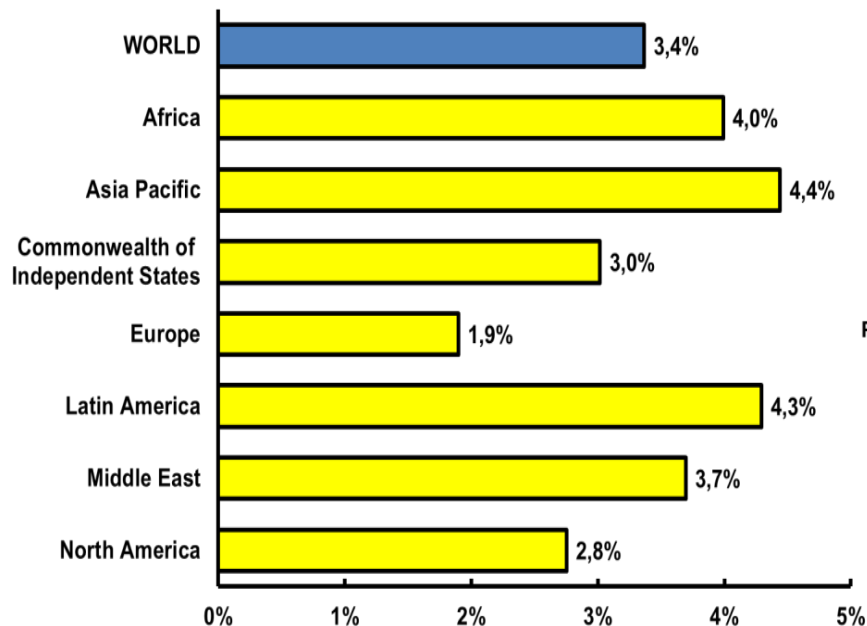


- **Instituto Brasileiro de Petróleo, Gás e Biocombustíveis**
- **Petróleo Brasileiro S.A. – Petrobras**
- **TBG - Transportadora Brasileira Gasoduto Bolivia-Brazil S/A**

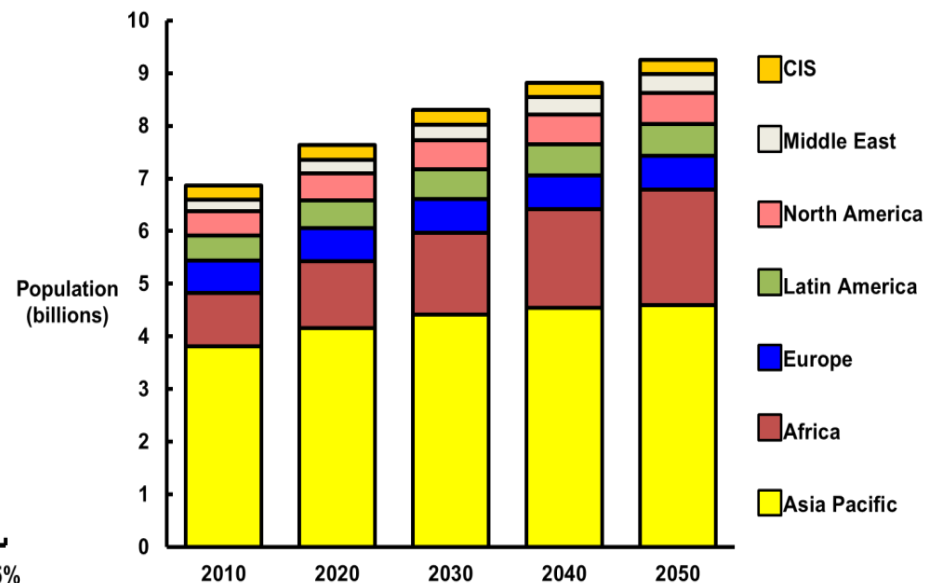
Global Gas Vision: Base Case Outlook

The model builds up energy demand both ‘bottom-up’ by key industrial sector, and on a regional basis

Outlook for Real GDP Growth by Region,
2010–50



Outlook for Population by Region



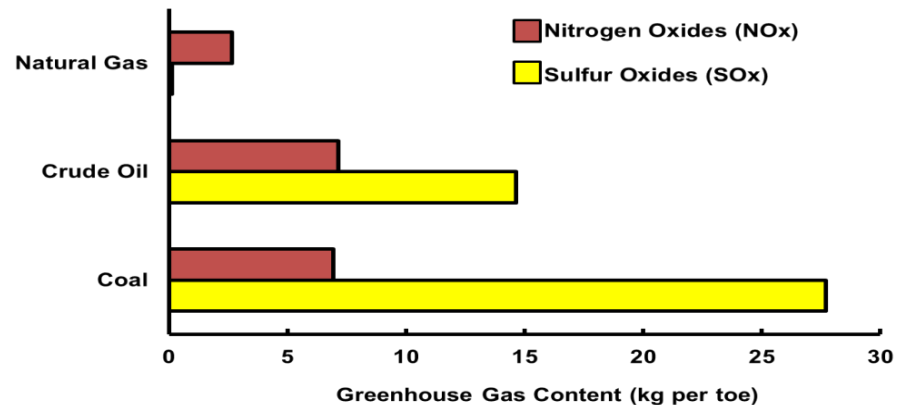
Global Gas Vision: Air Quality and Climate Change

Natural gas is a clean-burning and low carbon fuel

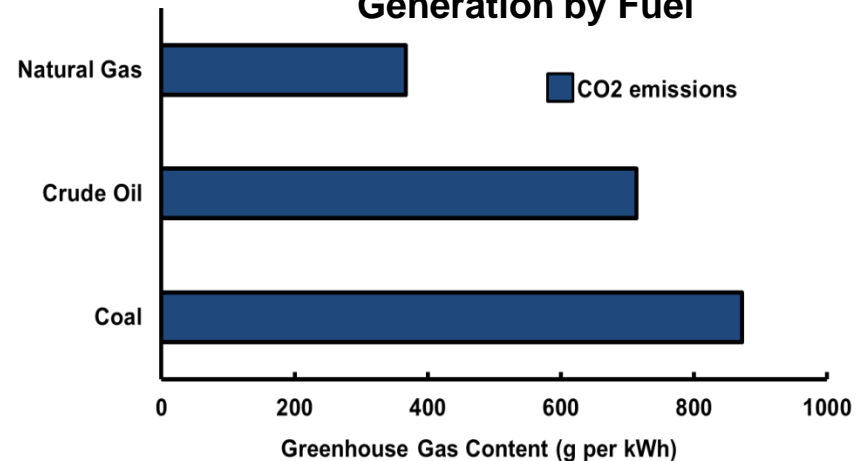
The emissions of NO_x from natural gas are typically 63 percent less than from oil and at least 60 percent less than for coal. The emissions of SO_x from natural gas are almost negligible, and so are particulates

In terms of carbon dioxide, natural gas typically has 40 percent less carbon content than coal, and 25 percent less carbon content than oil

NO_x and SO_x Content by Fuel



Carbon Dioxide Emitted During Electricity Generation by Fuel

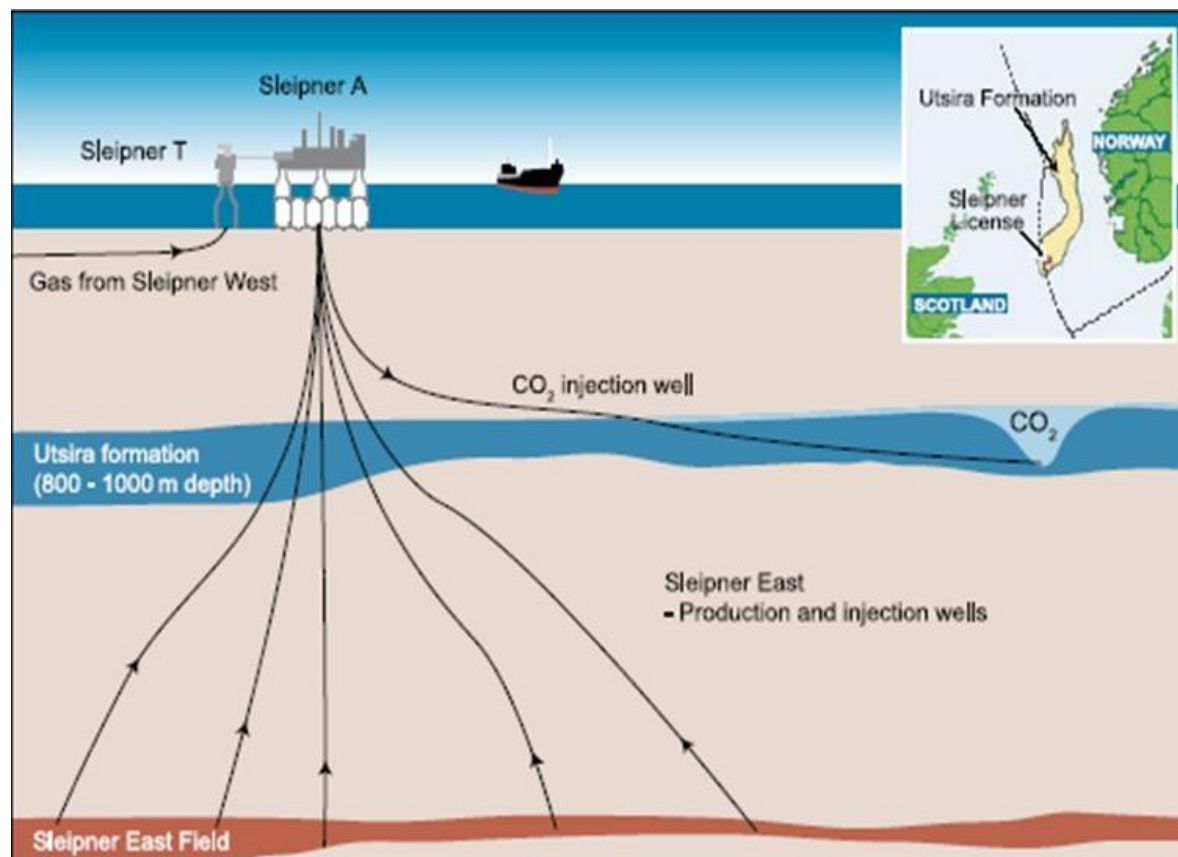


Global Gas Vision: Carbon Capture

To achieve even further reductions in emissions, it will be necessary either to rely exclusively on non-fossil fuel options, or to deploy carbon capture technologies widely in addition to the non-fossil fuel options.

Natural gas CCS is likely to have two significant cost advantages over coal CCS

- The Capex (investment) cost for gas will be lower.
- The cost of CO₂ transportation and storage (T&S) will be lower.



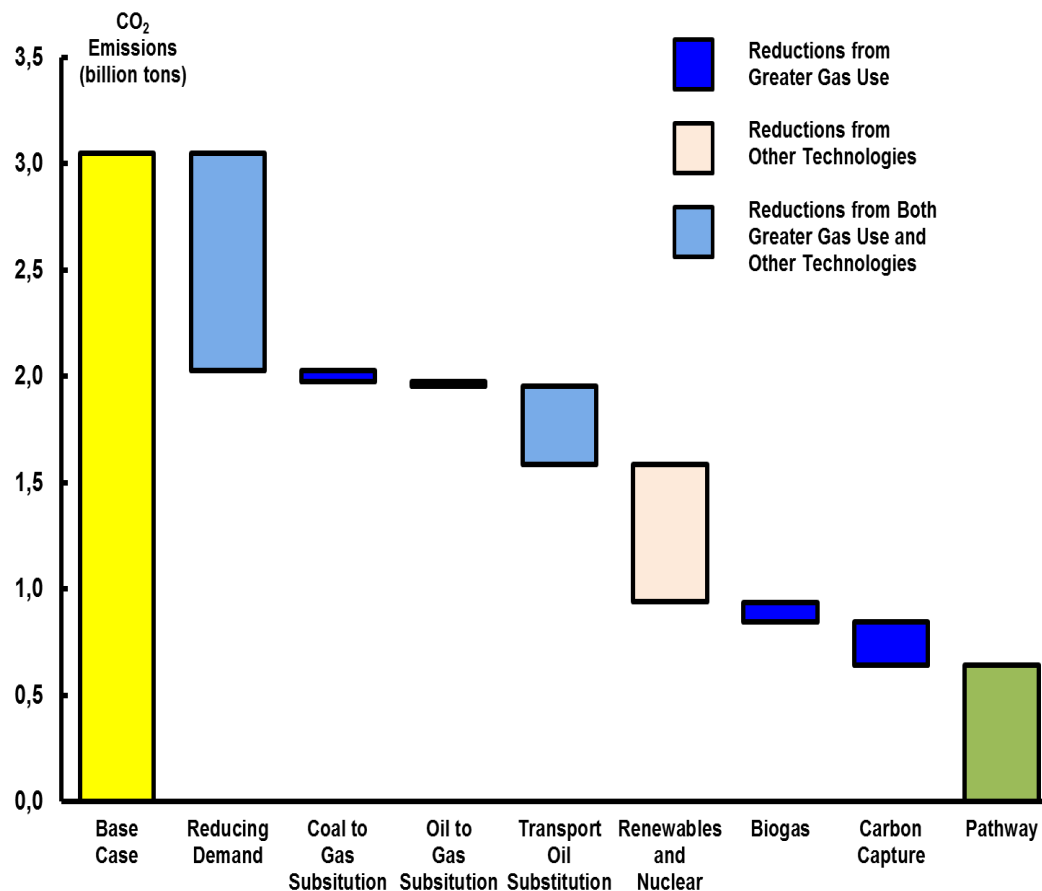
The 'Global Vision for Gas' lays out a clear pathway towards a sustainable energy future

- Improved air quality and public health
- Affordable energy
- Available resources
- Sharply reduced greenhouse gas emissions



Carbon emissions are expected to grow significantly in Latin America

Emissions Reductions by Abatement Method—Latin America



Oil is dominant

The substitution of oil, largely in the transport sector, is a key part of bringing emissions down

Global Gas Vision: Economic Impact

- Gas prices remain broadly at today's levels in 2050.
- The lowest cost form of new base load power generation today is generally gas-fired CCGTs in the OECD
- The gas industry is a major generator of employment across the globe



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.

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.

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.

E

Efficient

Natural gas is efficient.

Modern gas-fired power plants are 40% more efficient than 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 promotes sustainable transport.

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

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.

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.

Natural gas saves time.

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

Natural gas is safe.

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

- In the pathway to a sustainable energy future, natural gas is more than a bridge, it is a destination fuel!

Unconventional Gas Resources, by Region

	Shale gas		Coal-bed methane / CBM		Tight-sand gas	
	10 ¹² m ³	Tcf	10 ¹² m ³	Tcf	10 ¹² m ³	Tcf
North America	108,8	3842,3	85,4	3015,9	38,8	1370,2
Former Soviet Union	17,8	628,6	112,0	3955,3	25,5	900,5
Central Asia and China	99,9	3528,0	34,4	1214,8	10,0	353,2
Asia Pacific (OECD)	65,5	2313,1	13,3	469,7	20,0	706,3
Latin America & Caribbean	59,9	2115,4	1,1	38,8	36,6	1292,5
Middle East and North Africa	72,2	2549,7	0,0	0,0	23,3	822,8
Sub-Saharan Africa	7,8	275,5	1,1	38,8	22,2	784,0
Western Europe	14,4	508,5	4,4	155,4	10,0	353,2
Asia Pacific (Other)	8,9	314,3	0,0	0,0	15,5	547,4
Central and Eastern Europe	1,1	38,8	3,3	116,5	2,2	77,7
South Asia	0,0	0,0	1,1	38,8	5,6	197,8
Total	456,3	16114,2	256,1	9044,2	209,7	7405,6