Message from the President of the International Gas Union

Dear colleagues:

Following the recent release of the 2016 IGU World LNG Report I commented how struck I was by the remarkable changes in our industry over the past year.

Global energy pricing has entered a new paradigm; while $70 (and higher) crude was the norm for many years, we are now uncertain about when to expect a rebound to historical trading ranges. Gas industry dynamics are also changing. Projects approved several years ago in a more robust pricing environment are now coming on stream. This supply abundance has affected gas hub and spot pricing levels and shifts in the wholesale price formation mechanisms are occurring.

In another development affecting the energy industry, the results of the COP21 summit in Paris provided some uncertainty yet hinted at some potentially exciting opportunities for natural gas. While the overall message of COP21 was a desire to move the world economy away from fossil fuels and toward renewables, news from Paris also highlighted a nearer term challenge, the detrimental effects of poor air quality on public health and economic development.

The global social and political groundswell illustrated by the COP21 agreements suggests that gas can be a critical part of the globe’s future energy mix. Gas has many important benefits – it’s abundant, flexible and is the perfect complement to intermittent renewables for electricity production. Gas provides clean affordable energy for industrial processes and for commercial and residential customers around the world. Natural gas also has other benefits relative to coal and oil – in terms of lower carbon emissions of course, but also in terms of particulates and other emissions that contribute to poor air quality and ensuing health concerns.

The 2015 IGU Wholesale Gas Price survey is the eighth to be undertaken in a series, which began 10 years ago. The eight surveys have confirmed the significant changes in wholesale price formation mechanisms during a period of key developments and upheaval in the global gas market.

With the aim to establish baseline survey on wholesale price formation mechanisms around the world data for over 100 countries has been collated and analysed.

The latest survey shows that gas-on-gas competition continued to increase its share in 2015 in Europe, spot LNG imports and in India’s domestic pricing. Meanwhile, oil-linked prices also increased its share marginally as the changes in Europe and LNG imports were more than offset by domestic pricing reforms in China. With the advent of US LNG exports and the current surplus of LNG more changes in pricing mechanisms may be to come over the next few years.

Enabling participants in new and established gas regions to understand natural gas pricing and wholesale gas price formation trends is important for the future success of the global gas industry. It is my hope that this publication can serve as an example of how we can all benefit when vital information is carefully gathered, analysed and shared.

Yours sincerely,

David Carroll
President of the International Gas Union
Contents

Highlights .................................................................................................................................................. 6

Introduction ............................................................................................................................................. 10

  2.1: Background .................................................................................................................................. 10
  2.2: Types Of Price Formation Mechanisms ..................................................................................... 10
  2.3: Report Layout ............................................................................................................................. 10

World Results .......................................................................................................................................... 12

  3.1: Introduction ............................................................................................................................... 12
  3.2: 2015 Survey Result ................................................................................................................... 12
      3.2.1: Domestic Production ........................................................................................................... 12
      3.2.2: Pipeline Imports ................................................................................................................ 14
      3.2.3: LNG Imports ...................................................................................................................... 15
      3.2.4: Total Imports ................................................................................................................... 16
      3.2.5: Total Consumption ........................................................................................................... 17
  3.3: World Level Comparisons 2005 To 2015 ............................................................................... 19
      3.3.1: Domestic Production ........................................................................................................... 19
      3.3.2: Pipeline Imports ................................................................................................................ 20
      3.3.3: LNG Imports ...................................................................................................................... 21
      3.3.4: Total Imports ................................................................................................................... 22
      3.3.5: Total Consumption ........................................................................................................... 23
  3.4: Analysis Of Changes In Gas-On-Gas Competition ................................................................. 27
  3.5: Thoughts On Future Price Mechanism Developments ....................................................... 28

Wholesale Price Levels .......................................................................................................................... 29

  4.1: Introduction ............................................................................................................................... 29
  4.2: 2015 Survey Result ................................................................................................................... 29
      4.2.1: Price Levels by Price Formation Mechanism .................................................................. 29
      4.2.2: Price Levels by Region and Country ................................................................................. 30
  4.3: Comparisons 2005 to 2015 .................................................................................................. 32
      4.3.1: Changes in Wholesale Prices by Price Formation Mechanisms ................................ 32
      4.3.2: Changes in Wholesale Prices by Region ........................................................................ 33
  4.4: Analysis Of Regulated Prices ................................................................................................... 34
  4.5: Thoughts On Future Price Developments ............................................................................... 36
**Highlights**

The 2015 IGU Wholesale Gas Price survey is the eighth to be undertaken in a series which began 10 years ago. The eight surveys have confirmed the significant changes in wholesale price formation mechanisms during a period of key developments and upheaval in the global gas market. The highlights of the 2015 survey are:

- Gas-on-gas competition (GOG) had the largest share of total world consumption at 45%, predominantly in North America, Europe, the Former Soviet Union and Latin America. The oil price escalation (OPE) share stood at 19%, and is predominantly Asia Pacific, Asia and Europe. The regulated categories – regulated cost of service (RCS), regulated social and political (RSP) and regulated below cost (RBC) – account in total for some 31%. RCS is mainly the Former Soviet Union, Asia and Africa, RSP mainly the Middle East, Former Soviet Union and Asia Pacific and RBC the Former Soviet Union and Africa.

- Cross border flows of gas account for some 27% of total world consumption. Pipeline imports are now over 50% GOG, with OPE under 40%, while OPE has 69% of LNG imports with GOG at 31%.

- Between 2014 and 2015, the GOG share increased by just over 2 percentage points reflecting rising gas consumption in North America and Europe, together with the continuing move away from OPE in Europe, the change in domestic pricing mechanisms in India and more spot LNG. OPE’s share increased by just under 1 percentage point, with the decline in Europe and lower share of LNG imports being more than offset by the change in the domestic pricing mechanism in China. The RCS share declined by 0.5 percentage points reflecting the changes in China, partly offset by moves to RCS in Egypt and Nigeria. RSP was down by 1.5 percentage points, principally reflecting the changes in pricing in India and Nigeria. RBC was lower by just over 0.5 percentage points, reflecting moves away in Bangladesh and partially in Egypt.
Since 2005, the GOG share has increased from 31% to 45%, at the expense of OPE which has declined from just over 24% to just under 19% in total, with the main change being in Europe where GOG increased from 15% in 2005 to 64% in 2015, with OPE declining from 78% to 30%. GOG also gained in Russia in 2009, in Latin America (Argentina especially) gradually through the period and in India in 2015 following the pricing reforms. The decline in OPE in Europe was partly offset by a move to OPE in intra-FSU trade and in 2015 in China when the pricing reforms were extended nationwide to all but the residential and fertilizer sectors.

Within the regulated sectors, RCS and RSP have gained at the expense of RBC – with key changes taking place in the Former Soviet Union, Middle East and Asia, with a more recent change in Africa (Egypt).

Overall, the regulated sectors share had fallen from 37% in 2005 to 32% in 2015, principally to GOG and, to a lesser extent, OPE. This has been one of the most significant changes recently, especially in China and India, with “market-based” pricing gaining at the expense of “regulated” pricing. Since 2009, when GOG in Russia increased at the expense of the regulated categories, there has been little significant change.

The changes in cross-border trade have been predominantly in pipeline imports with the GOG share rising from 23% to 51% between 2005 and 2015, all in Europe, at the expense of OPE. The shares in LNG imports have been more stable in recent years, although GOG rose from 13% in 2005 to 31% in 2015, but over half this increase came between 2005 and 2007 as the spot LNG market grew, and then as trading markets such as the UK began importing LNG.
Within Europe, GOG dominates in Northwest Europe¹ with a 92% share in 2015, and has the largest share at 56% in Central Europe². Elsewhere though, the GOG shares are smaller – some 32% in Mediterranean³ (principally in Italy), some 15% in Scandinavia and the Baltics⁴ and is almost non-existent in Southeast Europe⁵. OPE dominates still in Mediterranean – Spain and Turkey, and shares in Southeast Europe with the RCS category in Romania.

Asia, which is dominated by China and India, has seen significant change, initially from RSP to RCS in China in 2009 as prices were increased, and then a continuous rise in OPE, from around 25% in 2009 to 59% by 2015, as China imported pipeline gas from 2010 and the recent changes in domestic city-gate pricing. The GOG share increased sharply in 2015 to 14% as the pricing reforms in India were implemented.

In Asia Pacific, heavily LNG import dependent has seen little change with OPE around 58% or so for the whole period. There was also little change in Africa, heavily dominated by RBC in the 70% to 80% range until the change to more RCS and GOG in Egypt and Nigeria, brought the share down to just over 50% in 2015. The Middle East also has shown relative stability, apart from the major Iranian pricing changes in 2012, away from RBC to RSP, as prices were increased.

In the FSU there were early changes away from RBC to RCS in Russia, and the move to GOG in 2009 as independents competed with Gazprom in Russia, but apart from these there have been few significant changes. Latin America has experienced a gradual move to OPE and GOG (Argentina especially), with the regulated categories declining, over the period.

Wholesale price levels, in most regions, reached their peak in 2013 or 2014. This rise was across all regions apart from North America, where the dramatic increase in shale gas supply has led to sharp falls in prices – with a small rebound in 2013. The rise in prices in Europe and Asia Pacific has been well documented and studied, but prices have also risen in Asia, largely due to increases in prices in China, both as more gas was imported and regulated domestic prices increased, and in India for similar reasons.

In 2014, though, prices in Europe began to decline as the market weakened and in the FSU especially, as the rouble depreciated. This accelerated in 2015, and prices also fell back in North America and Asia Pacific on the back of weak demand, abundant supply and the impact of the sharp fall in oil prices. However, some regions did not see the 2014 and 2105 fall in prices. These were Asia, as pricing reforms and inertia increased and kept prices up in China and India, the Middle East – as regulated prices were increased in Bahrain, Oman and Iran, with other prices staying stable – and Africa – where prices have increased in Egypt, Nigeria and more recently Algeria.

¹ Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, UK
² Austria, Czech Republic, Hungary, Poland, Slovakia, Switzerland
³ Greece, Italy, Portugal, Spain, Turkey
⁴ Estonia, Finland, Latvia, Lithuania, Norway, Sweden
⁵ Bosnia, Bulgaria, Croatia, FYROM, Romania, Serbia, Slovenia
This feature of declining market prices and rising regulated prices, which has been slightly masked in the average price calculations because of currency depreciation against the dollar, looks set to continue in 2016. Prices in China and India were also estimated to be lower in 2016 Q1, as the longer adjustments to oil prices and hub prices respectively feed through in their domestic pricing mechanisms, plus in India’s case, the impact of the renegotiated Qatar LNG contract.

More changes in pricing mechanisms in 2016 may also be foreseen, with recent contract renegotiations in Germany and France maybe leading to further GOG gains. In addition, while the start-up of LNG exports from the USA looks likely to add to the GOG share, these volumes are not that large in 2016, but changes to shorter duration contracts and fewer destination clauses may also lead to LNG pricing changes.
Introduction

2.1: Background

The 2015 IGU Wholesale Gas Price survey is the eighth to be undertaken in a series which began 10 years ago, at the start of the 2006 to 2009 triennium culminating in the World Gas Conference in Buenos Aires. Prior to the 2015 survey, previous surveys were undertaken for the years 2005, 2007, 2009, 2010, 2012, 2013 and 2014. The eight surveys have confirmed the significant changes in wholesale price formation mechanisms during a period of key developments and upheaval in the global gas market. In the 2015 survey responses were received for over 70 out of 110 countries, but these responses covered over 95% of total world consumption. Data on the remaining countries, where responses were not received, was researched by Nexant.

2.2: Types Of Price Formation Mechanisms

In preparation for the initial 2005 survey, a series of discussions were held at the PGCB meetings, in 2006 and early 2007, on the definition of different types of price formation. It was decided to use for categorisation purposes the wholesale pricing mechanisms described in Box 1.

2.3: Report Layout

Section 3 of the report covers the results at the World level of the 2015 survey for the different categories – domestic production, pipeline imports, LNG imports, total imports and total consumption. A comparison of the results across all eight surveys, at the World level, is then analysed to identify key trends, concluding with an analysis of changes in the GOG category.

Section 4 of the report covers wholesale price levels including a discussion and analysis of the results of the 2015 survey, by region, price formation mechanism and country, and then comparisons over all eight surveys.

Section 5 of the report looks at the individual regions (IGU definitions) results for the 2015 survey, comparisons across all eight surveys for the price formation mechanisms and wholesale price levels.

Appendix A describes the survey methodology, including the data collection method, the IGU regional definitions, the definitions of the price formation mechanisms and the analytical framework.

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6 The Wholesale Gas Pricing Group began life as Sub Group 2 of PGCB and was chaired in the period leading up to the 2009 World Gas Conference by Runar Tjersland of Statoil and since 2009 by Mike Fulwood of Nexant. It is now part of the IGU’s Strategy Committee and has been re-titled as the Gas Pricing Group.
### Box 1: Types Of Price Formation Mechanisms

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil Price Escalation (OPE)</strong></td>
<td>The price is linked, usually through a base price and an escalation clause, to competing fuels, typically crude oil, gas oil and/or fuel oil. In some cases coal prices can be used as can electricity prices.</td>
</tr>
<tr>
<td><strong>Gas-on-Gas Competition (GOG)</strong></td>
<td>The price is determined by the interplay of supply and demand – gas-on-gas competition – and is traded over a variety of different periods (daily, monthly, annually or other periods). Trading takes place at physical hubs (e.g. Henry Hub) or notional hubs (e.g. NBP in the UK). There are likely to be developed futures markets (NYMEX or ICE). Not all gas is bought and sold on a short term fixed price basis and there will be longer term contracts but these will use gas price indices to determine the monthly price, for example, rather than competing fuel indices. Also included in this category is spot LNG, any pricing which is linked to hub or spot prices and also bilateral agreements in markets where there are multiple buyers and sellers.</td>
</tr>
<tr>
<td><strong>Bilateral Monopoly (BIM)</strong></td>
<td>The price is determined by bilateral discussions and agreements between a large seller and a large buyer, with the price being fixed for a period of time – typically one year. There may be a written contract in place but often the arrangement is at the Government or state-owned company level. Typically there would be a single dominant buyer or seller on at least one side of the transaction, to distinguish this category from GOG, where there would be multiple buyers and sellers trading bilaterally.</td>
</tr>
<tr>
<td><strong>Netback from Final Product (NET)</strong></td>
<td>The price received by the gas supplier is a function of the price received by the buyer for the final product the buyer produces. This may occur where the gas is used as a feedstock in chemical plants, such as ammonia or methanol, and is the major variable cost in producing the product.</td>
</tr>
<tr>
<td><strong>Regulation: Cost of Service (RCS)</strong></td>
<td>The price is determined, or approved, formally by a regulatory authority, or possibly a Ministry, but the level is set to cover the “cost of service”, including the recovery of investment and a reasonable rate of return.</td>
</tr>
<tr>
<td><strong>Regulation: Social and Political (RSP)</strong></td>
<td>The price is set, on an irregular basis, probably by a Ministry, on a political/social basis, in response to the need to cover increasing costs, or possibly as a revenue raising exercise – a hybrid between RCS and RBC.</td>
</tr>
<tr>
<td><strong>Regulation: Below Cost (RBC)</strong></td>
<td>The price is knowingly set below the average cost of producing and transporting the gas often as a form of state subsidy to the population.</td>
</tr>
<tr>
<td><strong>No Price (NP)</strong></td>
<td>The gas produced is either provided free to the population and industry, possibly as a feedstock for chemical and fertilizer plants, or in refinery processes and enhanced oil recovery. The gas produced maybe associated with oil and/or liquids and treated as a by-product.</td>
</tr>
<tr>
<td><strong>Not Known (NK)</strong></td>
<td>No data or evidence.</td>
</tr>
</tbody>
</table>

Wholesale Gas Price Survey 2016 Edition
World Results

3.1: Introduction

This section covers the full results and analysis at the World level for wholesale price formation mechanisms and comprises four parts:

• Results for the 2015 survey at the World level for the different categories – domestic production, pipeline imports, LNG imports, total imports and total consumption;
• Comparisons and analysis of the results of the surveys from 2005 to 2015;
• An analysis of changes in the gas-on-gas competition (GOG) category; and
• Some thoughts on future price mechanism developments.

The results for previous surveys may, in some cases, appear slightly different from what has been published in previous reports. This reflects mostly revisions to IEA data on consumption, production, imports and exports but can also reflect retrospective changes to price formation classification when survey respondents have a better appreciation of the classification definitions as they reflect upon the results from the surveys overall.

3.2: 2015 Survey Results

3.2.1: Domestic Production

Domestic production in 2015 accounted for some 73% of total world consumption – around 2,590 bcm.

![Figure 3.1: World Price Formation 2015 – Domestic Production](image-url)
The percentage shares of the mechanisms for each region are shown in Figure 3.2 below.

GOG has the largest share in domestic production at 45%, totalling some 1,160 bcm, with North America accounting for 849 bcm – almost three quarters of the total. The next largest share is in the Former Soviet Union, where the sales of gas in Russia to the large eligible customers by either Gazprom or the independent producers is classified as GOG (see the section on Former Soviet Union in the regional analysis for further discussion), accounting for some 154 bcm. The balance is in Europe at 74 bcm – principally the Netherlands and UK, Asia Pacific at 29 bcm – Australia and New Zealand, Asia at 28 bcm – all India, and Latin America at 20 bcm – mainly Argentina and Colombia.

OPE has a relatively small share in domestic production at 7%, totalling some 193 bcm, with 109 bcm in Asia – China and Pakistan mainly, 50 bcm in Asia Pacific – mainly Thailand, with some in Australia, Philippines and Malaysia, 25 bcm in Latin America – Brazil and Colombia, 4 bcm in Europe – small amounts in a few countries, and 4 bcm in Africa, mainly Tunisia.

The regulated categories – RCS, RSP and RBC – in total account for 43% of domestic production, with RCS principally in the Former Soviet Union and Asia, RSP principally in the Middle East, Former Soviet Union, Asia Pacific and Latin America and RBC in the Former Soviet Union, Africa, Latin America and the Middle East. A more detailed breakdown of the regulated categories is contained in the regional analysis sections.

![Figure 3.2: Regional Price Formation 2015 – Domestic Production](image-url)
3.2.2: Pipeline Imports

Pipeline imports in 2015 accounted for some 18% of total world consumption – around 637 bcm\(^7\).

Pipeline imports are split between just three categories – OPE, GOG and BIM\(^8\). The regional breakdown is shown in figure 3.4 below.

GOG is over half of all pipeline import, totalling some 329 bcm, with Europe at 224 bcm and North America the rest. Most of the European gas importing countries, have some element of GOG pipeline imports with the top four countries being Germany, Italy, France and UK.

OPE is under 40% of all pipeline imports, totalling some 244 bcm, mostly in Europe with some 114 bcm – Turkey, Italy, Spain and Germany being the main contributors. Asia accounts for some 38 bcm – China, the Former Soviet Union for some 34 bcm – principally Ukraine and Russia, with 25 bcm in Asia Pacific – Thailand, Singapore and Malaysia, and 19 bcm in Latin America – mainly Brazil and Argentina. There are also small quantities in other regions, apart from North America, including countries such as Iran and Tunisia.

BIM has the balance of 10%, totalling some 63 bcm. This is mainly in the Former Soviet Union and the Middle East with just two routes – Russia to Belarus and Qatar to the UAE – comprising most of it, but also includes Russia to Turkey (part of the Botas gas release) in Europe.

\(^7\) This figure represents the total effective net pipeline imports for all countries. Many countries will produce gas and import by pipeline and LNG and also export by pipeline from the “pool” of all sources of supply. Gross pipeline imports in total in 2015 were almost 730 bcm so effectively 93 bcm was “re-exported” by pipeline.

\(^8\) There is a small amount of RCS in Africa reflecting the regulated transportation tariff element of pipeline gas from Nigeria to Ghana. The BIM category also includes a small element of transportation tariffs, principally Bolivia to Brazil.
3.2.3: LNG Imports

LNG imports in 2015 accounted for some 9% of total world consumption – around 330 bcm\(^9\).

LNG imports are split 69% OPE and 31% GOG. The regional breakdown is shown in Figure 3.6 below.

OPE at some 227 bcm is mostly Asia Pacific – Japan, Korea and Taiwan, followed by Asia – China and India – and Europe – mainly Spain, Turkey, France and Italy.

\(^9\)As for pipeline imports, the figure represents total effective net LNG imports for all countries. Gross LNG imports (net of re-exported LNG) was some 335 bcm in 2015, with around 5 bcm being regasified and re-exported as pipeline gas.
GOG totals some 103 bcm and can be divided into imports into North America and countries such as the UK, Belgium and Netherlands, where the domestic market pricing mechanism is GOG, and all other countries which are importing spot and short term priced LNG cargoes, which is almost every other LNG importing country – Japan and Korea taking the largest shares – but also includes Argentina and Brazil.

3.2.4: Total Imports

Total imports in 2015 accounted for some 27% of total world consumption – around 966 bcm. Total imports are the sum of pipeline and LNG imports and comprise the three categories of OPE (49%), GOG (45%) and BIM (6%).
The table below shows the regional and category breakdown in volume terms.

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OPE</td>
</tr>
<tr>
<td>North America</td>
<td>0.0</td>
</tr>
<tr>
<td>Europe</td>
<td>141.8</td>
</tr>
<tr>
<td>Asia</td>
<td>71.3</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>181.6</td>
</tr>
<tr>
<td>Latin America</td>
<td>23.1</td>
</tr>
<tr>
<td>FSU</td>
<td>34.4</td>
</tr>
<tr>
<td>Africa</td>
<td>5.1</td>
</tr>
<tr>
<td>Middle East</td>
<td>13.2</td>
</tr>
<tr>
<td>Total</td>
<td>470.6</td>
</tr>
</tbody>
</table>

**Table 3.1: World Price Formation 2015 – Total Imports**

### 3.2.5: Total Consumption

Total consumption in 2015 was around 3,555 bcm.

GOG has the largest share at 45%, totalling around 1,590 bcm, dominated by North America at 963 bcm, followed by Europe at some 315 bcm and the Former Soviet Union at 154 bcm. In all GOG can now be found in some 51 countries, in one form or another, and in all regions.

The OPE share at 19%, totals around 663 bcm and is predominantly Asia Pacific (231 bcm), Asia (180 bcm) and Europe (146 bcm). OPE is widespread being found in some 60 countries, including virtually every country in Europe, and in all regions except North America.
The regulated categories – RCS, RSP and RBC – account in total for some 31%, around 1,106 bcm:

- RCS totals some 374 bcm and is in 19 countries, mainly the Former Soviet Union (Russia) and Asia (China), followed by Africa (Egypt and Nigeria);
- RSP totals some 528 bcm and is in 23 countries, with the Middle East dominating – Iran, Saudi Arabia, UAE and Oman – followed by the Former Soviet Union – Russia – and Asia Pacific – Indonesia and Malaysia, with some in Latin America – mainly Argentina;
- RBC totals some 204 bcm and is in 12 countries, mainly the Former Soviet Union – Kazakhstan, Turkmenistan and Uzbekistan, Africa – Egypt and Algeria – and Latin America – Venezuela.

The BIM share at 4% totals some 145 bcm and is in 25 countries, predominantly Middle East – Qatar, UAE and Israel, Former Soviet Union – Belarus, Asia Pacific – Indonesia, Europe – Turkey, and Latin America – Trinidad.

The NET share at less than 1% totals some 22 bcm in just 3 countries – Egypt, Trinidad and Norway.

The NP share at 1% totals some 29 bcm in 10 countries, largely Norway, Mexico, Turkmenistan, Kuwait, and Brunei, where it is used in the energy industry in refining processes or enhanced oil recovery.

The table below shows the regional and category breakdown for total world consumption and figure 3.9 the regional breakdown in percentage terms.

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OPE</td>
</tr>
<tr>
<td>North America</td>
<td>0.0</td>
</tr>
<tr>
<td>Europe</td>
<td>146.2</td>
</tr>
<tr>
<td>Asia</td>
<td>180.4</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>231.2</td>
</tr>
<tr>
<td>Latin America</td>
<td>48.6</td>
</tr>
<tr>
<td>FSU</td>
<td>34.4</td>
</tr>
<tr>
<td>Africa</td>
<td>9.3</td>
</tr>
<tr>
<td>Middle East</td>
<td>13.2</td>
</tr>
<tr>
<td>Total</td>
<td>663.2</td>
</tr>
</tbody>
</table>

Table 3.2 World Price Formation 2015 – Total Consumption
3.3: World Level Comparisons 2005 To 2015

3.3.1: Domestic Production

The main changes in price formation over the eight surveys have been the general rise in GOG from 35% in 2005 to 45% in 2015. The share rose again in 2015, after a slight fall in 2014, as the GOG share rose again in Europe and FSU but also reflected a significant rise in Asia as India fully adopted a new domestic pricing formula, largely linked to international hub prices. The OPE category is not particularly large in terms of domestic production, but rose significantly in 2015 as China extended its pricing mechanism, linking city-gate prices to competing fuels for all sectors other than residential and fertilizers. This resulted in a move away from RCS which was partly offset by moves to RCS in Egypt and Nigeria as prices were raised to more economic levels in some sectors.

Over the period as a whole, GOG has gained share from the three regulated categories which in 2005 totalled some 52% compared to 43% in 2015. A large part of this occurred in 2009 and 2010 when the GOG category increased in Russia at the expense of the regulated categories, as the market began to open up to independents more, and there was more effective competition between the independents and Gazprom for power sector and industrial customers. This was followed by the changes in India noted above in 2015. There has also been an increase in GOG in Latin America as well, principally in 2009.
Within the regulated categories, there have been two main changes, in 2009 when Russia changed from RBC to RCS as prices were finally increased above the cost of production and transportation, and in 2012 when Iran increased prices sharply to move from RBC to RSP. RSP increased again in 2014 as prices to the population in Russia switched away from RCS.

3.3.2: Pipeline Imports

The main changes in the eight surveys from 2005 to 2015 are the continued rise in GOG from 23% in 2005 to 52% in 2015, which has been at the expense of the OPE category. However, the decline in OPE has been partly offset by a switch from BIM to OPE in intra-FSU trade in 2009, and more recently the imports of pipeline gas from Turkmenistan to China.

The rise in GOG at the expense of OPE has been entirely in the European market as the Northwest Europe countries began switching to GOG and more recently the Central Europe countries and, in 2014, Italy. In respect of pipeline imports into Europe GOG in 2015 has a 65% share compared to 33% for OPE. This is in marked contrast to 2005 when it was 91% OPE and only 7% GOG.
3.3.3: LNG Imports

The main changes in the eight surveys from 2005 to 2015 are a rise in GOG from just over 13% in 2005 to 32% in 2012, which was largely at the expense of the OPE category, before it fell back in 2013 to 26% and in 2014 to 25%. However, in 2015 there was a recovery back to a 31% share.

There was a significant increase in GOG between 2005 and 2007, which was principally due to a rise in spot LNG imports in Asia and Asia Pacific and a smaller rise in North American imports. Since 2007, there have been offsetting changes with North American LNG imports – which are all GOG – declining, European imports, principally to the UK increasing in 2009 and 2010 and relatively stability in Asia and Asia Pacific spot LNG imports. In 2012, as Europe’s LNG imports declined, these were more than offset in the GOG category by rising spot LNG imports in Asia and Asia Pacific. The decline in 2013 reflected the fall in the share of spot LNG imports and a decline in LNG imports into the UK, the USA and Canada. The further small decline in 2014 was principally due to lower spot LNG cargoes in Asia and Asia Pacific, with correspondingly higher OPE under long term contracts. The rebound in 2015 was largely due to more spot LNG cargoes in all markets but especially Japan and the new markets, as the fall in spot LNG prices preceded the decline in oil-linked contract prices.

The BIM category in 2005 and 2007 was the Qatar to India LNG contract which subsequently switched to OPE.
3.3.4: Total Imports

Total imports are the sum of pipeline imports and LNG imports and have only comprised three categories – OPE, GOG and BIM – in all eight surveys from 2005 to 2015\(^{10}\). As well as the figure the table below shows the volume breakdown. OPE declined from 63% in 2005 to 58% in 2007 as GOG rose from just over 20% to 28% and then in 2009, OPE gained share rising to 66% as BIM fell from 14% to 6%, with GOG rising to 29%. Since then OPE has lost share by around 14 percentage points and GOG gained a similar share, in large part due to pipeline imports in Europe.

\(^{10}\) Apart from the very small RCS on the Nigeria to Ghana pipeline
Since 2010 there have been very small quantities of RCS reflecting the regulated transportation tariff element of pipeline gas from Nigeria to Ghana. The BIM category also includes a small element of transportation tariffs, principally Bolivia to Brazil.
The changes between each survey can be summarised as follows:

- Between 2005 and 2007, GOG increased its share by some 2 percentage points and OPE decreased by 2 percentage points reflecting faster growth in consumption in North America than most other regions, a switch from OPE to GOG in Europe, and to a lesser extent in Asia Pacific and Asia, and a very small move from regulated pricing to GOG in Russia and Latin America. RSP also increased its share by half a percentage point reflecting more rapid growth in consumption in the RSP countries;

- Between 2007 and 2009, GOG increased its share by a further 4 percentage points, at a time when total world consumption showed little change, mainly because of the change in Russia from RBC to GOG but also because of the continuing switch from OPE to GOG in Europe. OPE actually gained 1 percentage point with the loss in share in Europe being more than offset by a switch from BIM, which lost 2 percentage points overall, to OPE in intra-FSU trade. The other major change was the decline of 14 percentage points in RBC and a similar gain in RCS, mainly in Russia, but RCS also gained at the expenses of RSP, which lost almost 2 percentage points, as China’s domestic production changed categories as prices increased as a consequence of regulatory change;

- Between 2009 and 2010, GOG increased its share by another 3 percentage points, with the continuing switch from OPE to GOG in Europe and further move in Russia away from RCS to GOG. OPE declined by only half a percentage point with losses in share in Europe being partly offset by gains in shares in Asia, as China began importing pipeline gas and more LNG under contract, and Asia Pacific on the back of rapid growth in demand in Korea, Taiwan and Thailand;

- Between 2010 and 2012, GOG increased its share by just under half a percentage point, rising to just under 40.5%, with the continuing increase in share in Europe away from OPE, and more spot LNG imports in Asia and Asia Pacific, being partly offset by a decline in share in Russia. OPE declined by almost 3 percentage points, based on the switch to GOG in Europe (and BIM in Turkey, as a contract changed) coupled with declining European demand, only partly offset by a rising share in pipeline imports in China. RCS increased its share by 1.5 percentage points, principally in Russia but also as demand grew sharply in China. RSP increased its share by almost 5 percentage points, principally due to the change in pricing in Iran and rising demand in Saudi Arabia. RBC declined by a similar amount, reflecting the Iran pricing change.

- Between 2012 and 2013, GOG increased its share by over 2 percentage points, gaining from OPE as pricing mechanisms continued to switch in Europe, and from RCS in Russia as the independent producers recovered market share. OPE declined by another 1 percentage point reflecting the changes in Europe, partly offset by a small gain in the LNG import segment with spot LNG trade declining, and in China with the new pricing regime in two provinces. RCS declined by 0.5 percentage points, largely reflecting the change in Russia towards GOG and in China to OPE. The BIM category regained almost half a percentage point in share reflecting domestic production growth in Qatar.

- Between 2013 and 2014, the GOG share declined marginally as the continued switch away from OPE in Europe and more rapid consumption growth in North America was offset by a decline in the share of GOG in Russia towards regulated pricing, and fewer spot LNG cargoes. OPE was down by another 1.5 percentage points reflecting the changes in Europe, partly offset by an increase in China. RCS was down by 1 percentage point largely as a result of the switch to RSP in Russia and the RSP category was up by almost 2.5 percentage points, reflecting the Russia switch but also a change in Nigeria as well, away from RBC, coupled with more rapid consumption growth in RSP countries. RBC was up marginally, with the decline in Nigeria, being more than offset by rising consumption on Kazakhstan, Turkmenistan and Uzbekistan.
• Between 2014 and 2015, the GOG share increased by just over 2 percentage points reflecting rising gas consumption in North America and Europe, together with the continuing move away from OPE in Europe, the change in pricing in India and more spot LNG, partly offset by a decline in Australia as OPE netback contracts began to be introduced. OPE’s share increased by just under 1 percentage point, with the decline in Europe and lower share of LNG imports being more than offset by the change in the domestic pricing mechanism in China. The RCS share declined by 0.5 percentage points reflecting the changes in China, partly offset by moves to RCS in Egypt and Nigeria. RSP was down by 1.5 percentage points, principally reflecting the changes in pricing in India and Nigeria. RBC was lower by just over 0.5 percentage points, reflecting moves away in Bangladesh and partially in Egypt.

Overall over the 2005 to 2015 period, OPE has declined by 5.5 percentage points, GOG has risen by 14 percentage points, BIM has declined by 1.5 percentage points, RCS has risen by 9.5 percentage points, RSP risen by 2.5 percentage points and RBC declined by 19 percentage points.

<table>
<thead>
<tr>
<th>Year</th>
<th>OPE</th>
<th>GOG</th>
<th>BIM</th>
<th>NET</th>
<th>RCS</th>
<th>RSP</th>
<th>RBC</th>
<th>NP</th>
<th>TOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>694.3</td>
<td>883.3</td>
<td>116.4</td>
<td>16.7</td>
<td>24.8</td>
<td>322.8</td>
<td>718.0</td>
<td>22.9</td>
<td>2849.1</td>
</tr>
<tr>
<td>2007</td>
<td>677.9</td>
<td>1011.8</td>
<td>158.1</td>
<td>19.5</td>
<td>24.0</td>
<td>364.5</td>
<td>766.5</td>
<td>26.2</td>
<td>3048.6</td>
</tr>
<tr>
<td>2009</td>
<td>707.2</td>
<td>1135.5</td>
<td>93.9</td>
<td>19.4</td>
<td>432.7</td>
<td>309.1</td>
<td>334.7</td>
<td>26.3</td>
<td>3058.5</td>
</tr>
<tr>
<td>2010</td>
<td>756.5</td>
<td>1332.1</td>
<td>102.4</td>
<td>22.8</td>
<td>394.3</td>
<td>300.7</td>
<td>379.9</td>
<td>28.1</td>
<td>3316.8</td>
</tr>
<tr>
<td>2012</td>
<td>695.5</td>
<td>1393.3</td>
<td>124.2</td>
<td>24.2</td>
<td>462.6</td>
<td>484.3</td>
<td>225.3</td>
<td>27.1</td>
<td>3437.0</td>
</tr>
<tr>
<td>2013</td>
<td>678.8</td>
<td>1513.0</td>
<td>143.2</td>
<td>20.6</td>
<td>425.4</td>
<td>495.5</td>
<td>217.8</td>
<td>27.2</td>
<td>3521.4</td>
</tr>
<tr>
<td>2014</td>
<td>627.0</td>
<td>1492.8</td>
<td>141.7</td>
<td>22.2</td>
<td>390.0</td>
<td>576.6</td>
<td>225.8</td>
<td>30.0</td>
<td>3506.2</td>
</tr>
<tr>
<td>2015</td>
<td>663.2</td>
<td>1589.8</td>
<td>145.2</td>
<td>21.5</td>
<td>374.3</td>
<td>528.4</td>
<td>203.7</td>
<td>28.7</td>
<td>3554.8</td>
</tr>
<tr>
<td>2005</td>
<td>24.4%</td>
<td>31.0%</td>
<td>5.8%</td>
<td>0.6%</td>
<td>0.9%</td>
<td>11.3%</td>
<td>25.2%</td>
<td>0.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2007</td>
<td>22.2%</td>
<td>33.2%</td>
<td>5.2%</td>
<td>0.6%</td>
<td>0.8%</td>
<td>12.0%</td>
<td>25.1%</td>
<td>0.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2009</td>
<td>23.1%</td>
<td>37.1%</td>
<td>3.1%</td>
<td>0.6%</td>
<td>14.1%</td>
<td>10.1%</td>
<td>10.9%</td>
<td>0.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2010</td>
<td>22.8%</td>
<td>40.2%</td>
<td>3.1%</td>
<td>0.7%</td>
<td>11.9%</td>
<td>9.1%</td>
<td>11.5%</td>
<td>0.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2012</td>
<td>20.2%</td>
<td>40.6%</td>
<td>3.6%</td>
<td>0.7%</td>
<td>13.5%</td>
<td>14.1%</td>
<td>6.6%</td>
<td>0.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2013</td>
<td>19.3%</td>
<td>43.0%</td>
<td>4.1%</td>
<td>0.6%</td>
<td>12.1%</td>
<td>14.1%</td>
<td>6.2%</td>
<td>0.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2014</td>
<td>17.9%</td>
<td>42.6%</td>
<td>4.0%</td>
<td>0.6%</td>
<td>11.1%</td>
<td>16.4%</td>
<td>6.4%</td>
<td>0.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2015</td>
<td>18.7%</td>
<td>44.7%</td>
<td>4.1%</td>
<td>0.6%</td>
<td>10.5%</td>
<td>14.9%</td>
<td>5.7%</td>
<td>0.8%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 3.4: World Price Formation 2005 to 2015 – Total Consumption
The major overall changes, in the 2005 to 2015 period, have been the continuous move away from OPE to GOG in Europe, and also in Asia Pacific as spot LNG imports have risen, from RBC to RCS, RSP and GOG in Russia, from RSP to RCS and OPE in China and from RBC to RSP in Iran and from RBC to RCS in Egypt and Nigeria. GOG and OPE have also recently benefitted from pricing reforms in India and China respectively.

While there have been a number of significant changes over the period of the surveys between the 8 categories, as described above, the changes have been almost wholly within larger groupings of categories, until very recently. The categories of OPE, GOG, BIM and NET can be broadly described as “market” pricing, while the categories of RCS, RSP, RBC and NP can be broadly described as “regulated” pricing. The figure above compares the changes in the “market” and “regulated” categories over the eight surveys.

The total of “market” pricing rose from 61.5% in 2005 to 68% in 2015, mirrored by a decline in “regulated” pricing, from 38.5% in 2005 to 32% in 2015. Changes in percentages between surveys can arise because of actual changes in price formation mechanism or because of more rapid growth in consumption in countries with a specific type of price formation mechanism. Since 2005 consumption in countries with “regulated” pricing has generally grown faster than consumption in countries with “market” pricing, so the switch to “market” pricing is effectively understated. The switch to “market” pricing is down to the following:

- The move away from regulated pricing in the Russian market to GOG as the independent producers began to compete with each other and Gazprom to sell gas to the power sector and large industrials – this was partly reversed in 2014 with more “regulated” pricing;
- A similar move in Argentina, to GOG, as the eligible market opened up, and more recently in Nigeria;
- The recent changes, since 2013, in China where there was initially a move to OPE in 2 provinces away from RCS which in 2014 became nationwide for incremental production over 2012 levels and then in 2015 for all sectors except residential and fertilizers; and
- The pricing reforms in India, which began in late 2014, moving pricing away from RSP to GOG.
3.4: Analysis Of Changes In Gas-On-Gas Competition

The rise in GOG from 31% of total world consumption in 2005 to 45% in 2015 and in which regions, has been discussed in some detail above. It has been noted earlier that GOG is not one homogeneous category and can be considered to comprise the following types of pricing mechanisms:

- **Trading** – what is generally thought of as GOG where the price is determined by the interplay of supply and demand and is traded over a variety of different periods (daily, monthly, annually or other periods). Trading takes place at physical hubs (e.g. Henry Hub) or notional hubs (e.g. NBP in the UK). This will also include longer term contracts where the price is linked to hub prices in markets where there is hub trading.

- **Bilateral** – there is no trading market or hub but there are multiple buyers and sellers – distinguishing this from BIM – providing the competitive element. This is largely in Australia, Russia and Argentina.

- **Spot LNG** – simply spot LNG cargoes into markets where there are no trading hubs, but the price of the cargoes reflects the current supply-demand situation.

The figure below breaks down the GOG percentages over the seven surveys into these 3 categories.

![Figure 3.16: Changes in GOG 2005 to 2015](image)

**Figure 3.16: Changes in GOG 2005 to 2015**

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12 In order to emphasise the changes the vertical axis starts at 25%
The Trading category is by far the largest – dominated by North America and increasingly Europe – and has increased from 29.8% of total world consumption in 2005 to 36.7% in 2015 – a rise of almost 7 percentage points. The Bilateral category has risen from 0.9% to 5.9% - a rise of 5 percentage points, while the Spot LNG category has risen from 0.2% to 2.2% - a rise of 2 percentage points. The total rise in GOG between 2005 and 2015 has been 13.8 percentage points.

Just over one third of the rise in GOG has come from the Bilateral category and is largely in Russia together with much smaller changes, in volume terms, in Argentina and, latterly, Nigeria. The rise in the Trading category is almost entirely due to changes in the European market, both in terms of increased trading volumes and contract renegotiations, although at the end of 2014 indexation to hub prices in India, away from RSP for domestic production, also increased the Trading category. The changes in the Spot LNG category have been variable over time reaching a peak of 2.2% in 2012 before falling back in 2013 and 2014 as the number of spot LNG cargoes declined, and rebounding in 2015 as spot LNG cargoes recovered.  

3.5: Thoughts On Future Price Mechanism Developments

It has not been the remit of this survey to look forward and try and project changes in the wholesale price formation mechanisms, but with 10 years’ experience, some thoughts on recent developments in gas pricing around the world and the lessons learned may be in order.

- Contract renegotiations in Europe appear to be continuing – see recent announcements by EON and Engie – suggesting that GOG will increase its market share, at least in Northwest and Central Europe. However, what are the prospects for changes in mechanisms in the rest of Europe, particularly Southeast Europe and Spain, Portugal, Turkey and Greece?

- Changes in the LNG market have principally been confined to whether more or less LNG has gone to the “Trading” markets and any changes in “Spot LNG” volumes. The surveys have not reported any significant change, as yet, in the pricing of medium and long term contracts. However, with the start of LNG exports from the US, based on Henry Hub pricing, seemingly shorter duration contracts and attempts to develop pricing references and hubs Asia, might this change?

- Are the recent moves away from regulated pricing, especially in India and China, sustainable? The India pricing formula does not reflect market conditions in the local market and is already being criticised as resulting in prices which are too low for producers. In China, the “linking” of city-gate prices to competing oil products and LPG prices, suffers from regulatory inertia in changing the prices, with the result that the falls in oil prices are not being fully reflected in the city-gate prices. In addition, not all sectors are included in the formula approach. Will the reforms in India and China be sustainable or might there be a reversion to more regulation?

- While there have been some moves away from “regulated” to “market” pricing, there have also been significant changes within the “regulated” categories. This has principally been away from the lower-priced RBC towards higher-priced categories and, as is discussed in the next section, a trend of increasing prices to improve economics and reduce subsidies. Can we expect this trend to continue?

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13 The definition of Spot LNG in this survey is not the same as the GIIGNL definition of spot and short term contracts. In this survey, spot LNG excludes the short term contracts element i.e. contracts over one year but less than four years, of the GIIGNL reports. In addition, since LNG imported by the trading markets of North America and Northwest Europe, is classified in the “Trading” category, there may be significant volumes, of what might be regarded as spot, not included in the “Spot LNG” category.
Wholesale Price Levels

4.1: Introduction

This section covers the full results and analysis on wholesale price levels at the overall World level and comprises four parts:

• The results for the 2015 survey;
• Comparisons across the eight surveys;
• An analysis of changes in “regulated” prices; and
• Some thoughts on future developments.

There is further additional analysis on wholesale price levels in the next section on Regional results.

In considering wholesale price levels across regions, countries or price formation mechanisms, it should be noted that the wholesale price can cover different points in the gas chain – wellhead price, border price, hub price, city-gate price – so the comparison of price levels is not always “like for like”. Comparisons, therefore, should be treated with utmost caution and taken only as a broad indication.

4.2: 2015 Survey Results

4.2.1: Price Levels by Price Formation Mechanism

The figure below shows a snapshot of wholesale prices for 2015 by price formation mechanism.

![Figure 4.1: Wholesale Prices in 2015 by Price Formation Mechanism](image)

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14 It should be noted that on an individual country basis no break down has been made of the price level for different price formation mechanisms within the country, so the same price level is applied to all mechanisms. This simplifying assumption is not considered to have any material influence on the conclusions.
The highest prices, by some margin, are in the OPE category, which, at $8.04 per MMBTU, are more than double the $3.74 for the GOG category, which is only slightly above the RCS category. The price level in the GOG category is heavily influenced by the relatively low prices in 2015 in North America.

In the regulated categories, it can be seen that the prices in the RCS category are higher than those in RSP and, in turn, RBC – which were the lowest at $1.29 per MMBTU in 2015.

4.2.2: Price Levels by Region and Country

The figure below shows a snapshot of wholesale prices for 2015 by IGU region.

![Figure 4.2: Wholesale Prices in 2015 by Region](image)

Wholesale prices can obviously vary significantly from year to year, but both Asia and Asia Pacific had average prices over $8.00. OPE is the primary pricing mechanism in both regions. Prices in Europe, which has the next largely share of OPE have fallen behind prices in Asia. Prices in North America, fell sharply in 2015 to levels which are well below the average for Latin America and even below Africa prices! Prices have fallen back sharply in the Former Soviet Union, in $ terms, reflecting the continued currency weakness, especially for the rouble. Middle East average prices remain the lowest.

These conclusions are further reinforced when wholesale prices are viewed at the country level. The figure below includes all countries with consumption greater than 7 bcm in 2015.
The highest wholesale prices in 2015 were again found in the largely LNG dependent countries in Asia Pacific – South Korea, Japan and Taiwan – plus Singapore and Thailand, but these were joined by China, with domestic prices – now largely OPE – not fully reflecting declining oil prices until November. These were followed by some Central European countries plus Turkey. Prices in India were also around $8.00 reflecting the pricing reforms and the high price of the Qatar LNG contract before it was renegotiated. In Northwest Europe countries, where GOG dominates, prices are somewhat lower than the rest of Europe, but still a lot higher than in the USA, Canada and Mexico, where prices are even below those in Egypt, Nigeria and Bangladesh. Prices in Russia have fallen well below other countries, which, in previous years, they had been above, as a consequence of the large rouble depreciation. At the bottom of the chart are generally countries where wholesale prices were subject to some form of regulation and often below the cost of production and transportation – Turkmenistan, Algeria and Venezuela.
4.3: Comparisons 2005 To 2015

4.3.1: Changes in Wholesale Prices by Price Formation Mechanisms

The figure below compares changes in wholesale price levels across the eight surveys by price formation mechanisms.

In 2005 the highest prices by price formation mechanism were for GOG at $8.14 per MMBTU, but these declined between 2005 and 2009, before levelling off at around $4.50, followed by small rise to the $5.20 range in 2013 and 2014 and a sharp decline in 2015 to $3.74. These changes were largely due to pricing changes in North America, but most countries with significant GOG saw prices fall in 2015. In contrast OPE prices rose significantly from $5.50 per MMBTU in 2005 to over $10.00 in 2012, as oil prices increased, remaining at that level through 2014, before declining to around $8.00 in 2015, following the oil price fall. There were also general increases in prices over time in the regulated price categories as well, through to 2014, although in 2015 this trend was reversed, principally due to sharp dollar declines in the FSU as currencies depreciated. The rise in prices in the BIM category reflected largely the loss of low priced intra-FSU trade to the OPE category as prices were raised in line with oil prices.
4.3.2: Changes in Wholesale Prices by Region

The figure below compares changes in wholesale price levels across the eight surveys by region.

At the world level, on average, wholesale prices have risen between 2005 and 2013 from around $4.47 per MMBTU to $5.61. This rise was across all regions apart from North America, where the dramatic increase in shale gas supply has led to sharp falls in prices – with a small rebound in 2013. The rise in prices in Europe and Asia Pacific has been well documented and studied, but prices have also risen in Asia, largely due to increases in prices in China, both as more gas was imported and regulated domestic prices increased, and in India for similar reasons.

In 2014, though, prices in Europe began to decline as the market weakened and in the FSU especially, as the rouble depreciated. This accelerated in 2015, and prices also fell back in North America and Asia Pacific on the back of weak demand, abundant supply and the impact of the sharp fall in oil prices. However, some regions did not see the 2014 and 2015 fall in prices. These were Asia, as pricing reforms and inertia increased and kept prices up in China and India, the Middle East – as regulated prices were increased in Bahrain, Oman and Iran, with other prices staying stable – and Africa – where prices have increased in Egypt, Nigeria and more recently Algeria. There is more discussion on regulated prices below.
4.4: Analysis Of Regulated Prices

Figure 4.4 showed that prices in the 3 regulated categories – RCS, RSP and RBC – had been rising consistently from 2005 to 2013, in the case of RSP and 2014, in the case of RCS and RBC. The main countries – in terms of consumption levels – these categories cover are shown by region and allocated to each category.

<table>
<thead>
<tr>
<th>Region</th>
<th>RCS</th>
<th>RSP</th>
<th>RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSU</td>
<td>Russia</td>
<td>Russia</td>
<td>Kazakhstan, Turkmenistan, Uzbekistan</td>
</tr>
<tr>
<td>Africa</td>
<td>Egypt</td>
<td>Nigeria</td>
<td>Algeria, Egypt</td>
</tr>
<tr>
<td>Middle East</td>
<td></td>
<td></td>
<td>Bahrain, Iran, Oman, Saudi, Arabia, UAE</td>
</tr>
<tr>
<td>Asia</td>
<td>China</td>
<td>Bangladesh</td>
<td></td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>Vietnam</td>
<td>Indonesia, Malaysia</td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td></td>
<td>Argentina, Venezuela</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1: Key Countries with Regulated Pricing

All these countries have been consistent members of the regulated group since 2005, although there has been movement between categories, notably from RBC to RSP and/or RCS. Only India, of the countries with significant consumption levels, has completely left the regulated category and that was only in 2015.

The figures below show the price changes for these countries since 2005.

Figure 4.6: FSU Regulated Prices 2005 to 2015
Figure 4.7: Middle East Regulated Prices 2005 to 2015

Figure 4.8: Asia and Asia Pacific Regulated Prices 2005 to 2015

Figure 4.9: Africa and Latin America Regulated Prices 2005 to 2015
The prices are the average prices for each country so will include an element of non-regulated prices especially where imports by pipeline and LNG are involved.

For the Middle East and Asia and Asia Pacific, prices have generally continued to increase through the period and including 2015 apart from a small decline in China in 2015. In Africa and Latin America, the pattern is similar apart from a decline in Argentina in 2015, reflecting in part lower import prices and the peso depreciation and in Venezuela throughout as the bolivar prices were held down and the currency depreciated. Only in the FSU, since 2013 have prices come down significantly in dollar terms and this reflects a constant, or even rising, local currency price and large currency depreciation, especially for the rouble.

The general conclusion, therefore, would be that regulated prices have largely continued to increase over the period of the surveys since 2005 and the recent declines in the last two years, for the regulated categories, as recorded in figure 4.4, which analysed price levels by price formation mechanism, were a result of currency depreciation against the dollar, as opposed to any actual reduction in local currency prices. In fact, in most countries, outside the FSU, even dollar prices continued to increase.

4.5: Thoughts On Future Price Developments

The wholesale price levels and changes discussed above all focus on annual averages and can, therefore, mask on-going price developments. In terms of market prices, whether spot and hub prices or contract prices linked to oil, there have been further declines from the average 2015 prices. The table below considers the key market prices and changes since 2014.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>4.35</td>
<td>2.60</td>
<td>2.00</td>
<td>-40.2%</td>
<td>-23.1%</td>
<td>-54.0%</td>
</tr>
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<td>UK</td>
<td>8.71</td>
<td>6.80</td>
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<td>-45.4%</td>
</tr>
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<td>15.98</td>
<td>10.36</td>
<td>7.50</td>
<td>-35.1%</td>
<td>-27.6%</td>
<td>-53.1%</td>
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<td>China</td>
<td>10.56</td>
<td>9.67</td>
<td>7.54</td>
<td>-8.4%</td>
<td>-22.1%</td>
<td>-28.6%</td>
</tr>
<tr>
<td>India</td>
<td>6.80</td>
<td>7.94</td>
<td>5.50</td>
<td>16.8%</td>
<td>-30.8%</td>
<td>-19.11%</td>
</tr>
</tbody>
</table>

Table 4.2: Changes in Market Prices 2014 To Date

The decline in prices in USA, UK and Japan reflected the general market decline. The large fall in the USA in part reflected the relatively high prices in 2014 as a result of the cold Q1. The fall in Japan was larger than European spot prices, since the latter were already declining from April 2014, while the Japan contract prices did not begin to fall significantly until Q1 of 2015 as the lag effect of falling oil prices began to feed through. Prices in China declined only marginally in 2015 as the adjustment to the city-gate prices, formally linked to oil product prices and LPG were delayed, plus the delivered prices of pipeline gas from Turkmenistan to the key east coast markets, contain significant fixed transit and transportation elements. In India, prices actually rose reflecting a full year of the new hub-linked pricing formula for domestic production and the price of the Qatar LNG contract remaining high because of the long lags – since renegotiated from the start of 2016.
The 2016 Q1 prices have fallen even further from the average 2015 levels and China and India are catching up in the declines as the inertia in their pricing systems begin to eventually reflect market prices for spot gas and oil, plus in India the price under the renegotiated Qatar LNG contract feeds through. If the 2016 Q1 price levels were maintained we might expect to see, therefore, the average OPE prices of just over $8.00 and the GOG prices of $3.74 fall by another 25% to 30% to maybe $6.00 and under $3.20 respectively.

However, it looks as though it will be a different story in the world of regulated prices. As these are set in local currencies, for the most part, any changes against the dollar exchange rate will impact the reported dollar prices. Outside any exchange rate changes, all the pressure on regulated prices is upwards. Saudi Arabia has already increased its gas price from $0.75 per MMBtu to $1.25 effective January 1 2016 and Algeria announced higher prices in a regulation published on December 29 2015. Egypt’s prices may rise further as the higher prices being offered on the development of new fields is reflected in wholesale and end-user prices\textsuperscript{15}. Nigeria’s regulated prices are likely to rise further as the transportation charge element of the gas price to power is increased. Oman is set to continue increasing prices at 3 per cent per annum. Bahrain is planning to increase its price from $2.50 per MMBtu by $0.25 each year until the price reaches $4.00. Indonesia and Malaysia have been steadily increasing domestic wholesale prices as their requirements to import LNG begin to increase and this trend seems likely to continue. Finally, the new government in Argentina has announced increase in gas prices in pesos, although how much of this shows up in dollar prices will depend on exchange rate movements.

Overall for 2016, therefore, is appears, based on current trends, that we will be looking at falling market-based prices and rising regulated prices, subject to any dramatic exchange rate changes.

\textsuperscript{15} The government also announced in late 2015 that it would increase the prices paid to ENI for new discoveries to $4-5.88/MMBtu from $2.65/MMBtu previously as a way to boost domestic gas production, notably from the recent gas discovery (Zohr).
Regional Level Results

5.1: Introduction

This section covers the regional level results for the eight IGU regions and for each region the results of the 2015 survey are discussed, followed by a comparison of the results of the eight surveys undertaken from 2005 to 2015. Finally there is some analysis of wholesale price levels in different regions.

The results for previous surveys may, in some cases, appear slightly different from what has been published in previous reports. This reflects mostly revisions to IEA data on consumption, production, imports and exports but can also reflect retrospective changes to price formation classification when survey respondents have a better appreciation of the classification definitions as they reflect upon the results from the surveys overall.

5.2: North America

5.2.1: North America 2015 Survey Results

North America consumption in 2015 was some 27% of total world consumption – around 968 bcm.

GOG clearly dominates the North American market with fully liquid trading markets in the USA and Canada and the wholesale price in Mexico being referenced to prices in the USA. The small amount of NP is in Mexico where Pemex uses the gas in refinery process and for enhanced oil recovery.
5.2.2 North America Comparison 2005 to 2015

Price formation mechanisms have not changed at all, in effect, in North America over the seven surveys. Apart from the small amount – around 1% - of NP which, as noted earlier, is gas used by Pemex in refinery processes and enhanced oil recovery, North America was all GOG in 2005 and has remained so ever since. In fact if the surveys had gone back even further, it is likely that the USA at least would have been GOG since the early 1990s.

![Figure 5.2: North America Price Formation 2005 to 2015](image)

5.3: Europe

5.3.1: Europe 2015 Survey Results

European consumption in 2015 was some 14% of total world consumption – around 492 bcm.

![Figure 5.3: Europe Price Formation 2015](image)
GOG remains the largest share in Europe, standing at 64%, totalling around 315 bcm. Some 73 bcm is domestic production, mainly Netherlands and UK, with some 224 bcm being pipeline imports, predominantly all the northwest European countries plus Italy in the Mediterranean area, but also increasingly the central European countries of Poland, Czech Republic, Slovakia, Austria and Hungary. LNG imports account for some 19 bcm, over half of which are into the UK, with the remaining quantities being largely spot cargoes into the more traditional LNG importing countries.

OPE is now down to 30%, totalling around 146 bcm, and is predominantly pipeline imports (114 bcm) into almost every European country, apart from the UK, Netherlands, Denmark, Croatia, Sweden and Ireland, followed by LNG imports (28 bcm) into Spain, France, Italy, Turkey, Portugal and Greece, with domestic production (4 bcm) in a variety of countries.

BIM is some 8 bcm and is almost all pipeline imports into Turkey.

RCS accounts for some 11 bcm and is domestic production in Romania, while RSP also accounts for some 8 bcm and is also domestic production in Poland, Hungary and Croatia.

5.3.2: Europe Comparison 2005 to 2015

Europe is one of the regions where the most significant changes in price formation mechanisms have taken place. There has been a broadly continuous move from OPE to GOG since 2005, with GOG’s share increasing from 15% in 2005 – when OPE was 78% – to 64% in 2015 – when OPE had declined to 30%. The other largely regulated categories – domestic production in Poland, Hungary and Romania – remained at similar levels.

The changes have reflected a number of factors over the years; initially a decline in the volume of gas imported under the traditional oil indexed contracts, being replaced by imports of spot gas and increasing volumes traded at hubs, followed by the ending of contracts or the renegotiation of the terms to include a proportion of hub/spot price indexation in the pricing terms, or even a move to 100% hub price indexation, and in some cases, a reduction in the take-or-pay levels. The renegotiations have also seen the introduction of hybrid pricing formulas where oil indexation is partly maintained but within a price corridor set by hub prices. The trend towards GOG and away from OPE, was reinforced by the continued decline in domestic production in the UK in the old legacy contracts, which were in the OPE category, to be replaced by pipeline and LNG imports, all at GOG.
The change in price formation mechanisms in Europe was not universal across the region. The figures below summarise the changes in the key sub-regions.

Northwest Europe\(^\text{16}\) has seen the most dramatic change in price formation mechanisms, with a complete reversal in the ratio of OPE to GOG from 72% OPE and 27% GOG in 2005 to 8% OPE and 92% GOG in 2015, as a result of increased hub trading and contract renegotiations, as noted above.

\(^{16}\) Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, UK
Central Europe\textsuperscript{17} has also, more recently, seen significant changes. Apart from the 15% or so of RSP, in Hungary and Poland, OPE has declined from 85% in 2005 to 29% in 2015, while GOG has increased from almost zero in 2005 to 56% in 2015, principally reflecting increased imports of spot gas, often from Germany, and contract renegotiations.

There has been much less change in other areas of Europe such as the Mediterranean\textsuperscript{18}, where OPE has only declined from 100% in 2005 to around 63% in 2015 and GOG rising from nothing to around 32%. This initially reflected spot LNG imports in the sub-region and some spot pipeline imports into Italy, as well as changes in the pricing of domestic production in Italy. However, in 2014 this was further enhanced by the renegotiation of the main Russian contract into Italy. The small BIM starting in 2012 is part of pipeline import contract into Turkey.

\textsuperscript{17} Austria, Czech Republic, Hungary, Poland, Slovakia, Switzerland

\textsuperscript{18} Greece, Italy, Portugal, Spain, Turkey
In Southeast Europe\textsuperscript{19} a very small amount of GOG is shown for 2014 and 2015 in Croatia but in no other country. There is a large element of RCS in Romania, with the lower level of OPE in 2009 and 2010 a consequence of lower demand for imports in Romania and the rise in 2012 reflecting a switch from BIM in Bulgaria, where until 2010 there was payment in kind for transit (BIM) which then became a cash payment with the gas being purchased under the same OPE terms as the other imported gas. OPE fell back again in 2013 and 2014 as imports declined in Romania, before the trend was reversed in 2015.

\textsuperscript{19} Bosnia, Bulgaria, Croatia, FYROM, Romania, Serbia, Slovenia
In Scandinavia and Baltics\textsuperscript{20}, GOG has gained ground in recent years in Sweden, Norway and more recently in LNG imports into Lithuania and stood at 15\% in 2015, all at the expense of OPE, but this still has the largest share at 48\%. The early switch in 2009 from BIM to OPE was in the contiguous Baltic States. NET and NP are in Norway.

5.4: Asia

5.4.1: Asia 2015 Survey Results

Asian consumption in 2015 was some 9\% of total world consumption – around 305 bcm.

\textsuperscript{20} Estonia, Finland, Latvia, Lithuania, Norway, Sweden
OPE at 59% totals some 180 bcm and is principally domestic production, pipeline and LNG imports in China, LNG imports together with a small amount of domestic production in India, and domestic production in Pakistan where the regulator sets gas wellhead prices but linked to the oil price.

GOG at 14%, some 42 bcm, is mainly domestic production in India as the new pricing formula was introduced and spot LNG imports into India, China and Pakistan.

RCS accounts for some 26%, totalling around 79 bcm of domestic production, mostly in China with around 20 bcm in Bangladesh.

The small amount of BIM at 1% - 3.5 bcm – is in Bangladesh.

5.4.2: Asia Comparison 2005 to 2015

The changes in price formation mechanisms in Asia have been dominated by China and India. Firstly, there has been an increase in OPE from around 35% to 59% over the eight surveys, largely at the expense of the regulated categories and BIM. The move from BIM to OPE reflected the change in the pricing of the Qatar LNG contract to India between 2007 and 2009, while the more recent rise in 2010 and 2012 was due to the start of pipeline imports into China from Turkmenistan, which are oil indexed under the contract. The change from RSP to RCS in China as the regulator increased prices to economic levels. Finally, there was the further change in domestic production pricing, initially in two provinces in China, before extending nationwide to all sectors except residential and fertilizer, again increasing OPE. The rise in GOG in 2015 to some 14% reflected the pricing reform in India, linking domestic prices to a basket of market hub prices. GOG already includes spot LNG in India, China and now Pakistan.

The changes in RSP – down from 48% in 2005 to almost zero in 2015 was almost all due to the change in price formation in China as regulated prices were increased to economic levels, and the more recent change in India. Initially, RCS was the beneficiary, rising to 43% by 2012, but this has since declined with the pricing changes in China, partly offset by the move to more RCS in Bangladesh. The decline in RBC, from 11% in 2005 to zero in 2015, largely reflected changes in pricing in Bangladesh in 2009 and 2015 to RCS via RSP.
5.5: Asia Pacific

5.5.1: Asia Pacific 2015 Survey Results

Asia Pacific consumption in 2015 was some 11% of total world consumption – around 400 bcm.

![Figure 5.12: Asia Pacific Price Formation 2015](image)

OPE at 58% totals some 231 bcm, with LNG imports – in Japan, Korea and Taiwan – accounting for 157 bcm. Pipeline imports are some 25 bcm into Singapore, Thailand and Malaysia, while domestic production is 50 bcm – almost all Thailand with small amounts in Australia and the Philippines.

GOG at 17% totals some 69 bcm, of which 39 bcm is spot LNG imports mainly in Japan, Korea and Taiwan, while the balance is domestic production in Australia and New Zealand.

BIM at 5% totals some 18 bcm, comprising part of domestic production in Indonesia and domestic production in Japan.

RSP at 16% totals some 66 bcm and is domestic production in Malaysia and Indonesia, while RCS at 3% or some 12 bcm, is mostly domestic production in Vietnam. NP at 1% or 4 bcm is domestic production in Brunei and PNG consumed in the energy industry.
5.5.2: Asia Pacific Comparison 2005 to 2015

There have been only minor changes in price formation mechanisms in Asia Pacific since 2005. GOG has risen from 11% to 17%, with OPE declining marginally and RSP down from 23% to 17%. Changes have not been consistent over time, but the rise in GOG has largely been the rise in spot LNG imports, mostly in Japan plus a smaller rise in Korea, with the variability reflecting the requirements for spot LNG. Spot LNG increased in 2015 but this was offset by new contracts in Australia which are linked to the LNG netback price, based on oil prices, so that the OPE and GOG percentages in 2014 and 2015 were largely the same. The fall in the RSP share reflects the relatively sluggish growth in consumption in Indonesia and particularly Malaysia.
5.6: Latin America

5.6.1: Latin America 2014 Survey Results

Latin America consumption in 2015 was some 5% of total world consumption – around 172 bcm.

OPE at 28% totals some 49 bcm, mainly domestic production in Brazil and Colombia, pipeline imports into Brazil, Argentina and Venezuela and a proportion of LNG imports into Chile and Argentina.

GOG at 20% totals some 34 bcm, over half of which is domestic production in Argentina, Colombia, Chile and Peru. The balance is LNG imports into Brazil, Argentina, Chile, Puerto Rico and Dominican Republic.

BIM at 4% totals some 6 bcm and is almost all domestic production to the power sector in Trinidad, plus the transportation element of the imports into Brazil from Bolivia. NET at 10% totals some 17 bcm and is the balance of domestic production in Trinidad used as a feedstock in petrochemicals.

RSP at 18% totals some 31 bcm and comprises domestic production in Argentina, Peru, Ecuador and Bolivia. RBC at 13% totals some 23 bcm and is domestic production in Venezuela, while RCS at 6% totals some 10 bcm and is domestic production in Argentina, Brazil and Colombia. NP at less than 1% or 1 bcm is Cuban domestic production.
5.6.2: Latin America Comparison 2005 to 2015

The changes in price formation mechanisms in Latin America have seen a rise in GOG from 4% to 20%, a decline in RSP from 52% to 18% and a rise in RBC from 0% to 13% - the latter all in Venezuela. The rise in GOG in part is due to rising spot LNG imports in Argentina, Brazil and Chile, and a switch away from RSP to GOG in Argentina, and to a lesser extent from RCS to GOG in Colombia. In Argentina, this reflected producers and marketing entities, being allowed to sell gas at unregulated prices to large eligible customers, such as power plants.

![Figure 5.15: Latin America Price Formation 2005 to 2015](image)

5.7: Former Soviet Union

5.7.1: Former Soviet Union 2015 Survey Results

Former Soviet Union consumption in 2015 was some 18% of total world consumption – around 643 bcm.

![Figure 5.16: Former Soviet Union Price Formation 2015](image)
RCS at 37% is the largest share, totalling some 237 bcm and is almost all the major proportion of domestic production in Russia together with most of the domestic production in Azerbaijan. RBC at 17% or 106 bcm is domestic production in Kazakhstan, Turkmenistan, Uzbekistan and a small amount in Azerbaijan, while RSP at 11% or 73 bcm is a proportion of Russia domestic production (sold to the population) and Ukraine domestic production.

GOG at 24% totals some 154 bcm and is all domestic production to the eligible large customer market in Russia.

OPE at 5% or 34 bcm is all pipeline imports into Ukraine and Russia, while BIM at 5% or 32 bcm represents other pipeline imports in the FSU region, principally from Russia to Belarus, but also Armenia, Georgia, Kazakhstan, Kyrgyzstan, Moldova and Tajikistan.

NP at 1% or 7 bcm is part of domestic production in Turkmenistan.

5.7.2: Former Soviet Union Comparison 2005 to 2015

The Former Soviet Union is another region, like Europe, where there have been significant changes in price formation mechanisms, largely based around Russia. From having domestic production completely in the RBC category in 2005, there was a switch to GOG as the independent producers began to compete with each other and Gazprom to sell gas to the power sector and large industrials, and the rising Gazprom regulated prices saw a switch from RBC to RCS, although in 2014 the regulated pricing to the population saw a move from RCS to RSP, maintained in 2015. The other change was in intra-FSU trade where pricing switched from BIM to OPE, particularly in the Russia to Ukraine trade.

![Figure 5.17: Former Soviet Union Price Formation 2005 to 2015](image)
5.8: Africa

5.8.1: Africa 2015 Survey Results

African consumption in 2015 was some 3% of total world consumption – around 120 bcm.

RBC at 53% or some 63 bcm, has the largest share and is domestic production in Egypt, Algeria and Libya.

RCS at 22% or some 26 bcm is domestic production in Egypt, Nigeria and South Africa plus part of pipeline imports from Nigeria to Ghana, Benin and Togo.

RSP at 2% or some 3 bcm is domestic production in Equatorial Guinea, Gabon, Morocco and Tanzania.

OPE at 8% or some 9 bcm comprises part of the pipeline imports into Tunisia and Morocco from Algeria, from Nigeria to Ghana, Benin and Togo, as well as domestic production in Tunisia and part of Ivory Coast and Tanzania.

GOG at 7% or some 8 bcm is part of domestic production in Nigeria (sales to the non-power sector) and spot LNG imports into Egypt.

BIM at 5% or some 6 bcm is pipeline imports into South Africa from Mozambique and the balance of domestic production in Ivory Coast, plus domestic production in Cameroon.

NET at 3% or some 4 bcm is domestic production in Egypt in fertilizer plants.

NP at less than 1% is Angola.
5.8.2: Africa Comparison 2005 to 2015

There was very little change in price formation mechanisms in Africa between 2005 and 2014, apart from the switch to RSP from RBC in 2012 in Nigeria, with some GOG as non-power markets were freed up. However in 2015, Nigerian domestic production moved again from RSP to RCS as prices to power plants were increased, and also in Egypt there was a similar partial move away from RBC to RCS in some sectors, plus the start-up of spot LNG imports. The region remains dominated, however, by RBC, with gas prices largely subsidised.

5.9: Middle East
5.9.1: Middle East 2015 Survey Results

Middle East consumption in 2015 was some 13% of total world consumption – around 453 bcm.
RSP at 77% or 347 bcm dominates the region and is domestic production in Iran, Saudi Arabia and the UAE with smaller amounts in Oman, Bahrain and Kuwait.

RBC at 3% or 13 bcm is domestic production in Iraq and Syria.

BIM at 15% or 69 bcm is partly pipeline imports from Qatar to UAE and Oman and domestic production in Qatar and Israel.

OPE at 3% or 13 bcm is largely pipeline imports into Iran from Turkmenistan, plus some LNG imports into UAE, Jordan and Kuwait. There are also very small quantities of GOG as spot LNG imports into Jordan, Kuwait, UAE and Israel.

NP at 1% or 6 bcm is largely gas used in enhanced oil recovery and refineries in Kuwait and Yemen.

5.9.2: Middle East Comparison 2005 to 2015

The changes in price formation mechanisms in the Middle East have almost totally taken place between 2010 and 2012, when prices were increased significantly in Iran, moving from the RBC category to the RSP category. The other change was in small quantities of OPE and GOG as LNG began to be imported into Kuwait, UAE and, in 2015, into Jordan. The rise in BIM in 2013 reflected the rapid consumption growth in Qatar.
5.10: Regional Wholesale Price Levels

The previous section considered the history of regulated prices since 2005, predominantly in the FSU, Middle East, Africa and Latin America and for some countries in Asia and Asia Pacific. This concluded that, if the effects of the depreciation of currencies against the US dollar in the last 2 to 3 years are excluded, then regulated prices have been rising, as many countries look to reduce subsidies and in many cases begin to introduce more market based pricing – Nigeria being a good example of both these trends.

This leaves the more market based markets and those with significant cross-border trade in North America, Europe, parts of Asia Pacific and Asia, and a few countries in other regions. Figure 4.2 showed wholesale prices by region for 2015. The regions, however, can have a wide variety of prices within the region, even somewhere like Europe where consumption is mostly gas traded across borders. The weighted average European price in 2015 was $7.23 per MMBtu, while the simple unweighted average of all the countries was $8.10.

Almost all countries in Europe import gas either by pipeline or LNG, so are all exposed to cross-border trade. Norway’s domestic market is effectively largely isolated from the rest of Europe and Romania’s price is almost all the regulated price. Excluding those countries wholesale prices ranged from just under $12.00 per MMBtu to just over $6.00. Of the countries where the pricing mechanism is equal to or more than 50% OPE, 12 out of 15 have prices above the simple average for Europe, while out of the remaining 15 countries (excluding Norway and Romania) where OPE is less than 50% only 3 have prices above the simple average for Europe (Croatia, Sweden and Slovakia).

![Figure 5.22: European Wholesale Prices in 2015](image-url)
Africa and Latin America also have a few countries which are import dependent and these include Tunisia, Morocco, Ghana, Benin and Togo in Africa and Brazil, Chile, Dominican Republic and Puerto Rico in Latin America.

Prices in these countries are significantly above their regional weighted averages and much closer to the European average which is a reasonable proxy for prices under international trade whether OPE or GOG mechanisms.

Finally in the Asia Pacific region, the heavily import dependent countries again have prices higher than the average price while those countries which are isolated from international trade have prices below the average for the region.

Prices in Asia are dominated by China and India and these have been discussed elsewhere. Then average wholesale prices in these countries are also a mixture of market based and regulated prices.
Appendix

Survey Methodology

The idea for a survey of wholesale gas price formation mechanisms arose at the beginning of the triennium leading to the 2009 World Gas Conference. The Strategy, Economics and Regulation Programme Committee (PGCB) had set up a new sub-group to consider gas pricing, with a key remit to carry out a comprehensive analysis of gas price formation mechanisms. The sub-group decided to carry out a survey of current pricing mechanisms around the world, not only for gas traded internationally, but also for gas produced and consumed within countries. IGU members were surveyed and provided the data and the survey responses were collated and analysed by Nexant. The 2009 World Gas Conference in Buenos Aires presented the results of the surveys for the years 2005 and 2007. Two further surveys for the years 2009 and 2010 were undertaken and presented at the 2012 World Gas Conference in Kuala Lumpur. Three surveys were undertaken and presented at the 2015 World Gas Conference in Paris, covering the years 2012, 2013 and 2014. This survey for 2015 is the eighth overall and the first in the triennium for the 2018 World Gas Conference to be held in Washington DC. In the 2015 survey responses were received for some 70% of the 110 countries researched. Data on the remaining countries, where responses were not received, was researched by Nexant. However, where responses were received this covered 95% of total world consumption.

A.1: Data Collection

The focus of the gas pricing sub-group, and the surveys, was very much on wholesale prices, which can cover a wide range. In fully liberalised traded markets, such as the USA and the UK, the wholesale price would typically be a hub price (e.g. Henry Hub or the NBP). In many other countries, where gas is imported, it could typically be a border price. The more difficult cases are countries where all gas consumed is supplied from domestic production, with no international trade (either imports or exports) and the concept of a wholesale price is not recognised. In such cases the wholesale price could be approximated by wellhead prices or city-gate prices. Generally the wholesale price is likely to be determined somewhere between the entry to the main high pressure transmission system and the exit points to local distribution companies or very large end users.

The initial data collection was done on a country basis. The data were then collated to a regional level using the standard IGU regions shown in the figure below. Most of the regions are defined along the usual geographic lines, although the IGU includes Mexico in North America, and divides Asia into a region including the Indian sub-continent plus China, called Asia, and another region including the rest of Asia plus Australasia which is called Asia Pacific.

In terms of the allocation between different price formation mechanisms in any country, the general rule is that the wholesale price at the “point of first sale” in the country should be considered. For example, if gas enters a country under an oil-indexed contract and is then re-traded at a hub it is still considered to be in the oil price escalation (OPE) category.
Data for each country were collected in a standard format. As an example, a data collection form for the UK is shown in the figure below. Individual country gas demand may be supplied from a combination of three sources – domestic production, pipeline imports and LNG imports (storage is ignored for the purpose of this analysis). For each of these three sources data was collected separately on what percentage of the wholesale price for that category is determined by each mechanism. In some countries, one single mechanism was found to cover all transactions and that mechanism, therefore, was allocated 100%. In many cases, however, several mechanisms were found to be operating, in which cases estimates were made of the percentages for each price mechanism. The only constraint is that the total for each source of gas – domestic production, pipeline imports and LNG imports – must add up to 100%.

Information was also collected on wholesale price levels. This covered the annual average price and the highest monthly average price and lowest monthly average price. All prices were converted to $ per MMBTU. A comments section was included to identify and acknowledge the source of the information and any other useful information.

All data in the IGU study on gas volumes for consumption, production, imports and exports is taken from the IEA database, supplemented where necessary by any specific country and/or regional knowledge. It should be noted that 2015 volume data is still preliminary and may be adjusted once the final estimates are published later this year by the IEA. In addition previous years may also be revised. These revisions may lead to small changes in the percentages for each price category when country data is aggregated at both the regional and world level.
<table>
<thead>
<tr>
<th>Country</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>Europe</td>
</tr>
<tr>
<td>Volumes</td>
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<td>2015 BCM</td>
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<td>Consumption</td>
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<td>Production</td>
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</tr>
<tr>
<td>Imports</td>
<td>Pipeline</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
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</tr>
<tr>
<td>Oil Price Escalation</td>
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</tr>
<tr>
<td>Gas-on-Gas Competition</td>
<td>96.5%</td>
</tr>
<tr>
<td>Bilateral Monopoly</td>
<td></td>
</tr>
<tr>
<td>Netback from Final Product</td>
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</tr>
<tr>
<td>Regulation: Cost of Service</td>
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<tr>
<td>Regulation: Social and Political</td>
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<tr>
<td>Regulation: Below Cost</td>
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<tr>
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<tr>
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<td></td>
</tr>
<tr>
<td>Total</td>
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</tr>
<tr>
<td>Estimated 2015 Wholesale Price Range ($/MMBTU)</td>
<td>Average</td>
</tr>
<tr>
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<td>$6.80</td>
</tr>
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</table>

*Figure A.2: Data Collection Form*
A.2: Types Of Price Formation Mechanisms

In preparation for the initial 2005 survey, a series of discussions were held at the PGCB meetings on the definition of different types of price formation. It was decided to use for categorisation purposes the wholesale pricing mechanisms described in Box 1.

**Box 1: Types Of Price Formation Mechanisms**

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Price Escalation (OPE)</td>
<td>The price is linked, usually through a base price and an escalation clause, to competing fuels, typically crude oil, gas oil and/or fuel oil. In some cases coal prices can be used as can electricity prices.</td>
</tr>
<tr>
<td>Gas-on-Gas Competition (GOG)</td>
<td>The price is determined by the interplay of supply and demand – gas-on-gas competition – and is traded over a variety of different periods (daily, monthly, annually or other periods). Trading takes place at physical hubs (e.g. Henry Hub) or notional hubs (e.g. NBP in the UK). There are likely to be developed futures markets (NYMEX or ICE). Not all gas is bought and sold on a short term fixed price basis and there will be longer term contracts but these will use gas price indices to determine the monthly price, for example, rather than competing fuel indices. Also included in this category is spot LNG, any pricing which is linked to hub or spot prices and also bilateral agreements in markets where there are multiple buyers and sellers.</td>
</tr>
<tr>
<td>Bilateral Monopoly (BIM)</td>
<td>The price is determined by bilateral discussions and agreements between a large seller and a large buyer, with the price being fixed for a period of time – typically one year. There may be a written contract in place but often the arrangement is at the Government or state-owned company level. Typically there would be a single dominant buyer or seller on at least one side of the transaction, to distinguish this category from GOG, where there would be multiple buyers and sellers trading bilaterally.</td>
</tr>
<tr>
<td>Netback from Final Product (NET)</td>
<td>The price received by the gas supplier is a function of the price received by the buyer for the final product the buyer produces. This may occur where the gas is used as a feedstock in chemical plants, such as ammonia or methanol, and is the major variable cost in producing the product.</td>
</tr>
<tr>
<td>Regulation: Cost of Service (RCS)</td>
<td>The price is determined, or approved, formally by a regulatory authority, or possibly a Ministry, but the level is set to cover the &quot;cost of service&quot;, including the recovery of investment and a reasonable rate of return.</td>
</tr>
<tr>
<td>Regulation: Social and Political (RSP)</td>
<td>The price is set, on an irregular basis, probably by a Ministry, on a political/social basis, in response to the need to cover increasing costs, or possibly as a revenue raising exercise – a hybrid between RCS and RBC.</td>
</tr>
<tr>
<td>Regulation: Below Cost (RBC)</td>
<td>The price is knowingly set below the average cost of producing and transporting the gas often as a form of state subsidy to the population.</td>
</tr>
<tr>
<td>No Price (NP)</td>
<td>The gas produced is either provided free to the population and industry, possibly as a feedstock for chemical and fertilizer plants, or in refinery processes and enhanced oil recovery. The gas produced maybe associated with oil and/or liquids and treated as a by-product.</td>
</tr>
<tr>
<td>Not Known (NK)</td>
<td>No data or evidence.</td>
</tr>
</tbody>
</table>

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22 The Wholesale Gas Pricing Group is Sub Group 2 of PGCB and was chaired in the period leading up to the 2009 World Gas Conference by Runar Tjersland of Statoil and since 2009 by Mike Fulwood of Nexant. It is now part of the IGU's Strategy Committee and has been re-titled as the Gas Pricing Group.
A.3: Analysing The Results

In looking at the different price formation mechanisms, the results have generally been analysed from the perspective of the consuming country. Within each country gas consumption can come from one of three sources, ignoring withdrawals from (and injections into) storage – domestic production, imported by pipeline and imported by LNG. In many instances, as will be shown below, domestic production, which is not exported, is priced differently from gas available for export and also from imported gas whether by pipeline or LNG. Information was collected for these three categories separately for each country and, in addition, pipeline and LNG imports were aggregated to give total imports and adding total imports to domestic production gives total consumption. For each country, therefore, price formation could be considered in 5 different categories:

- Domestic production (consumed within the country, i.e. not exported)
- Pipeline imports
- LNG imports
- Total imports (pipeline plus LNG)
- Total consumption (domestic production plus total imports)

Each country was then considered to be part of one of the IGU regions, as described above, and the 5 categories reviewed for each region. Finally the IGU regions were aggregated to give the results for the World as a whole.

As well as collecting information on price formation mechanisms by country, information was also collected on wholesale price levels in each country. Comparisons of wholesale price levels, however, need to be treated with caution. As noted above, the wholesale price can cover different points in the gas chain – wellhead price, border price, hub price, city-gate price – so the comparison of price levels is not always a like for like comparison.