



The Future Role of Gas

GECF Global Gas Outlook 2040 Insights

Presentation for the 3rd IEA-IEF-OPEC Symposium
on
Gas and Coal Market Outlooks

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Disclaimer



The Gas Exporting Countries Forum (GECF) is an international, governmental organization, established in 2001. It became a full-fledged organization in 2008 with its permanent secretariat based in Doha, Qatar.

The GECF provides the framework for exchanging experience and information among Member Countries. The GECF is a gathering of the world's leading gas producers whose objective is to increase the level of co-ordination and to strengthen collaboration among Member Countries.

In accordance with the GECF Statute, the organization aims to support the sovereign rights of its Member Countries over their natural gas resources and their abilities to develop, preserve and use such resources for the benefit of their peoples, through the exchange of experience, views, information and co-ordination in gas-related matters.

The Member Countries of the Forum are: Algeria, Bolivia, Egypt, Equatorial Guinea, Iran, Libya, Nigeria, Qatar, Russia, Trinidad and Tobago, the United Arab Emirates and Venezuela. Azerbaijan, Iraq, Kazakhstan, the Netherlands, Norway, Oman and Peru have the status of Observer Members.

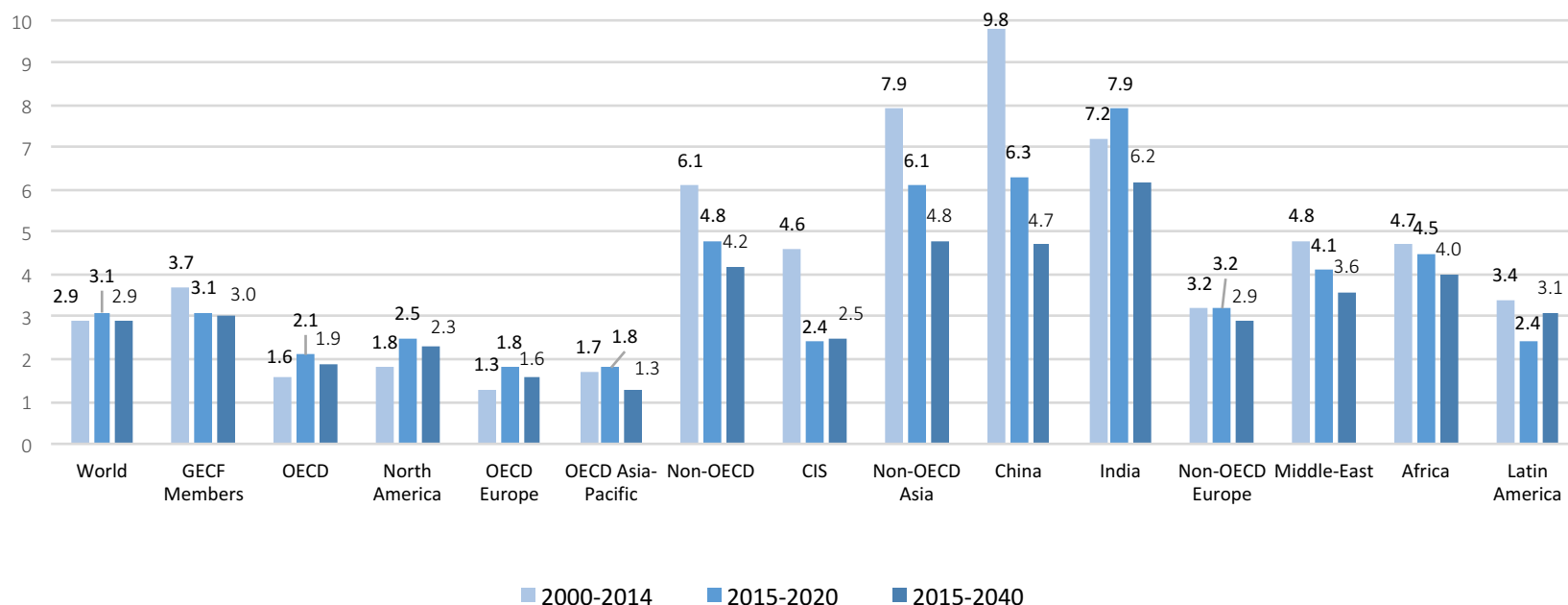
The Outlook is the result of GECF Global Gas Model (GGM) calculations. The data, forecast and analysis and any other information contained in this report are for information purposes only.

- **Introduction and scope**
- **Main outlook assumptions**
- **Global energy demand trends**
- **Gas demand outlook**
- **Main global gas supply assumptions**
- **Global gas production and trade outlook**
- **Conclusion**

Introduction and scope

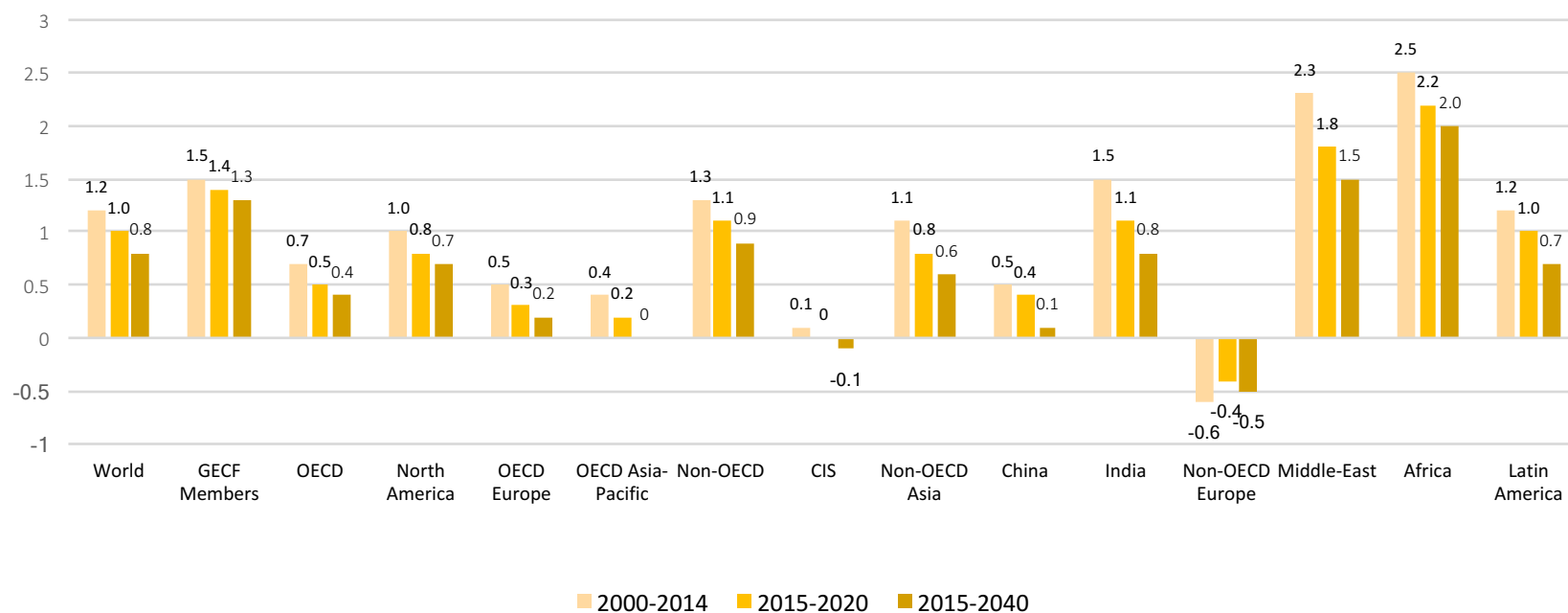
- The document offers a **neutral view on gas market evolution** by describing the developments that are most likely to occur in the medium and the long-term.
- The outcomes of the GECF reference case scenario will serve as a basis to support the formulation of a consistent long-term strategy for the Forum on which it should be aligned, which will allow progress in the agreed objectives that are included in the GECF statute and in various GECF summit declarations. Future versions of the document will explore alternative scenarios.
- The quantification of the reference case scenario is elaborated through the use of the **GECF Global Gas Model**, which is a **unique energy model developed in-house** at the GECF Secretariat. It includes several sub-models with each one focused on one segment of the gas value chain (production, pipelines, LNG, shipping, regasification, contracts and demand).
- **The originality of GECF model** is characterized by its high granularity both for demand and for supply, with the consideration of more than 100 countries for the demand and almost 100 countries for the supply representing almost 5000 production entities worldwide.
- A further important characteristic of the model is that it endogenously calculates gas demand curves and gas production profiles country by country, according to appropriate assumptions and inputs. All of the sub-models have been calibrated and **based on 2015** as the most recent year of available historical data.

Real GDP growth assumptions (MER - %)



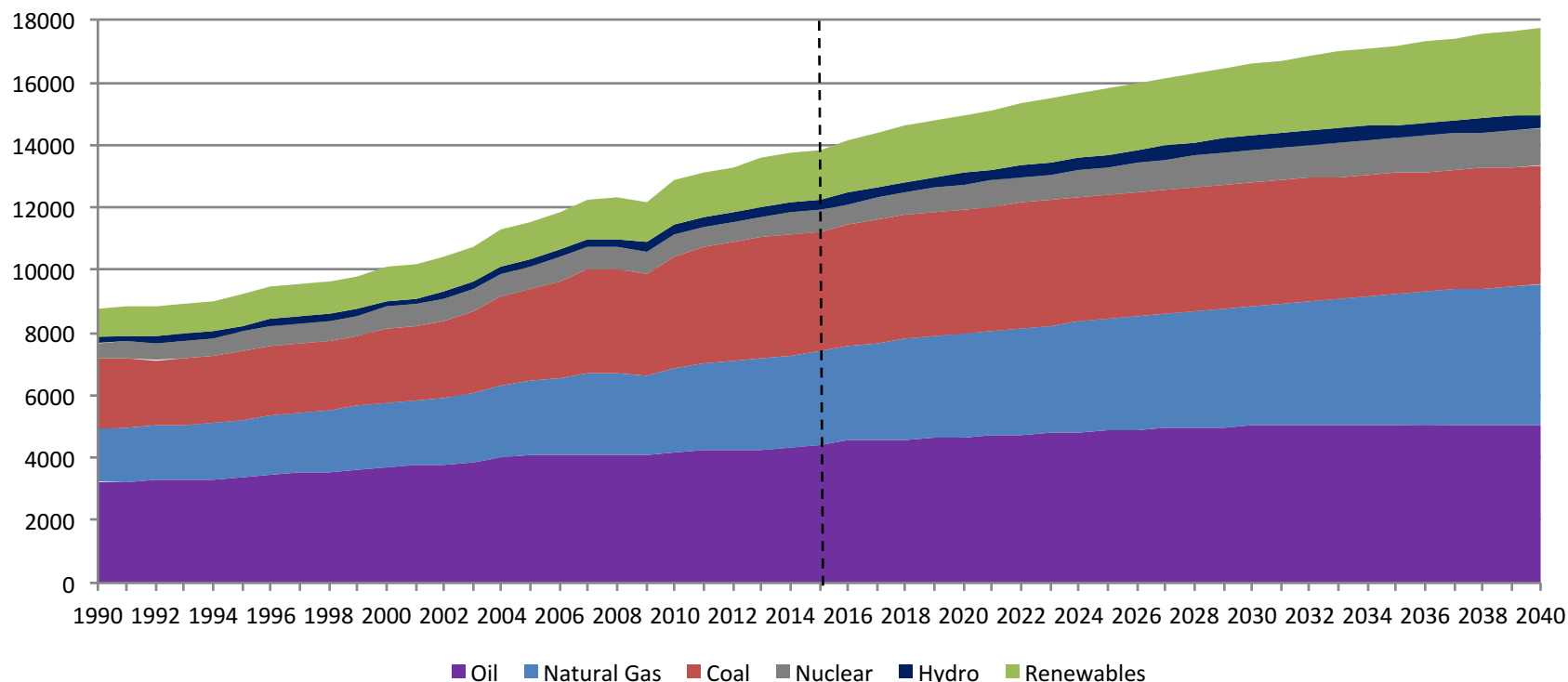
- The 2.9% average annual growth rate in the outlook period is almost equal to the historical average rate from 2000.
- In the short term, while growth in some advanced economies is gradually picking up, growth in the emerging economies shows signs of wavering.
- Key contributing factors are the impact of low commodity prices, tighter financing conditions, and the rebalancing measures in China; these result in weak investment and slower trade growth worldwide, in a setting of increased geopolitical tensions.

Average annual growth rate of population by major region (%)



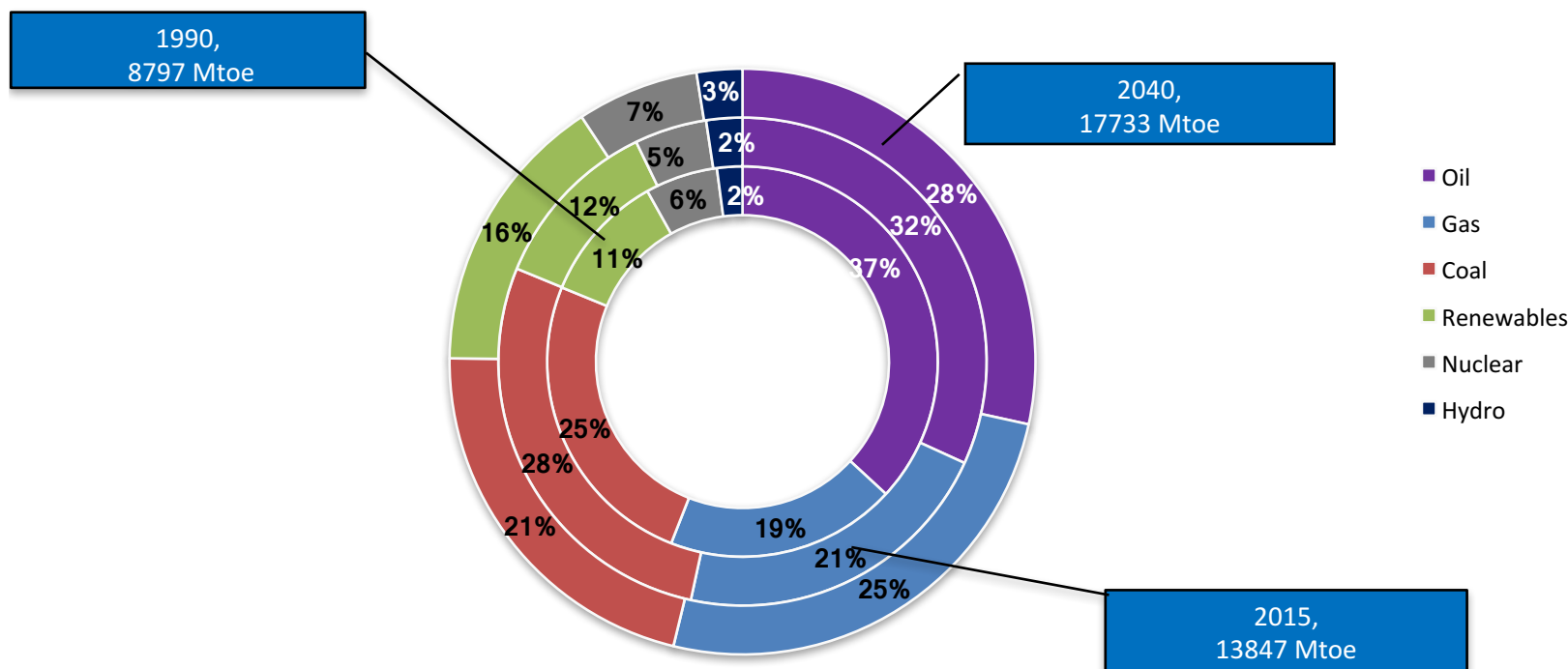
- Global population rising from 7.3 billion in 2015 to 8.9 billion in 2040. Population growth slows over the projection period, in line with the trends of the last three decades: from 1.0% per year in 2015-2020 to 0.7 % per year from 2020 to 2040.
- A remarkable transformation in the non-OECD Asian societies, from largely rural (over 70% in 1990) to increasingly urban (44% urban population in 2015 and forecast to be 56% by 2040).

World energy demand by fuel (Mtoe)



- World primary energy consumption is projected to grow by 1% per annum between 2015 and 2040, climbing from 13.8 Gtoe to 17.7 Gtoe.
- Natural gas will be the largest contributor to the increase in total primary consumption, with a share of almost 40%, followed by non-hydro renewables, which account for almost 30% of additional primary energy demand over the projection period.

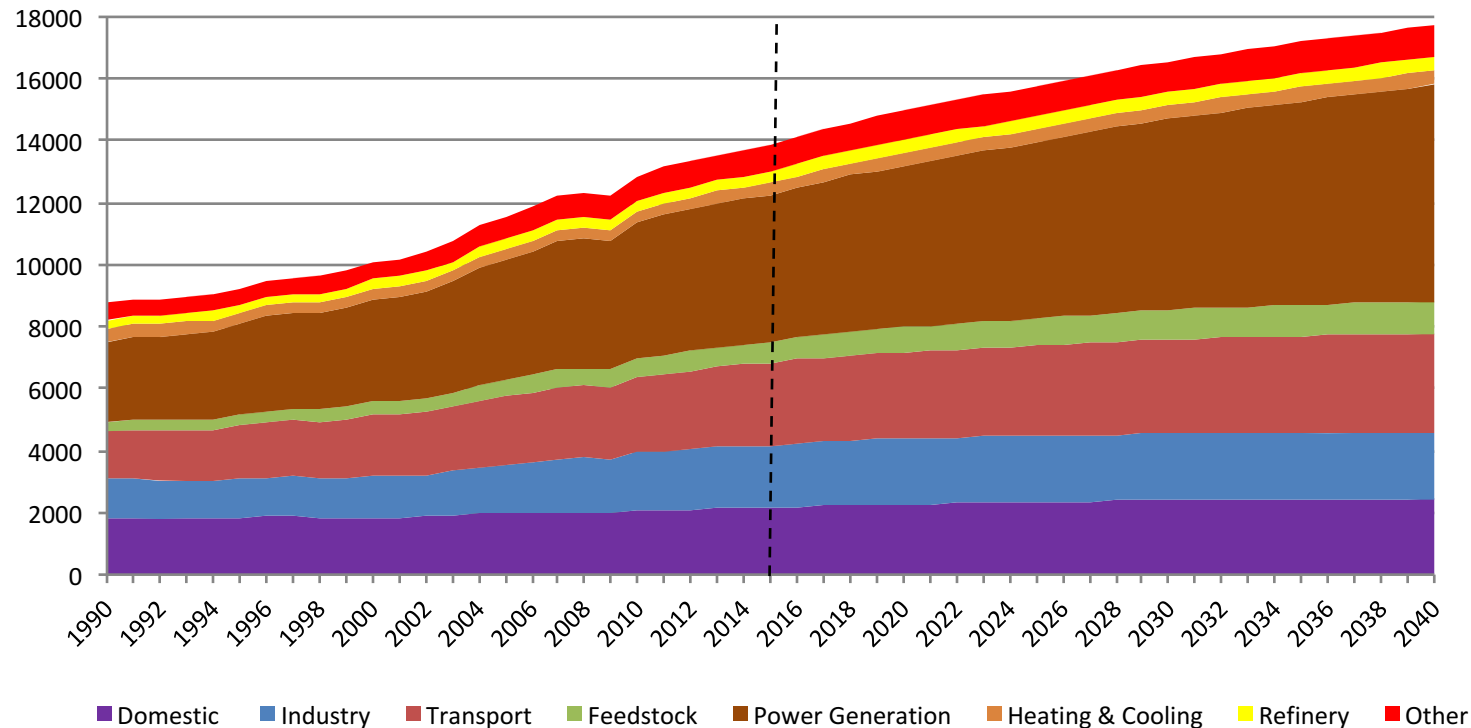
World energy mix (%)



- Except coal, all other types of energy show growth over the outlook period. Gas is the fastest growing fossil fuel, with a 1.6% average growth rate per annum, and gains the most market share among all energy types except the non-hydro renewables. Indeed, under the *Outlook*, the gas share of global energy demand increases from 21% in 2015 to over 25% in 2040

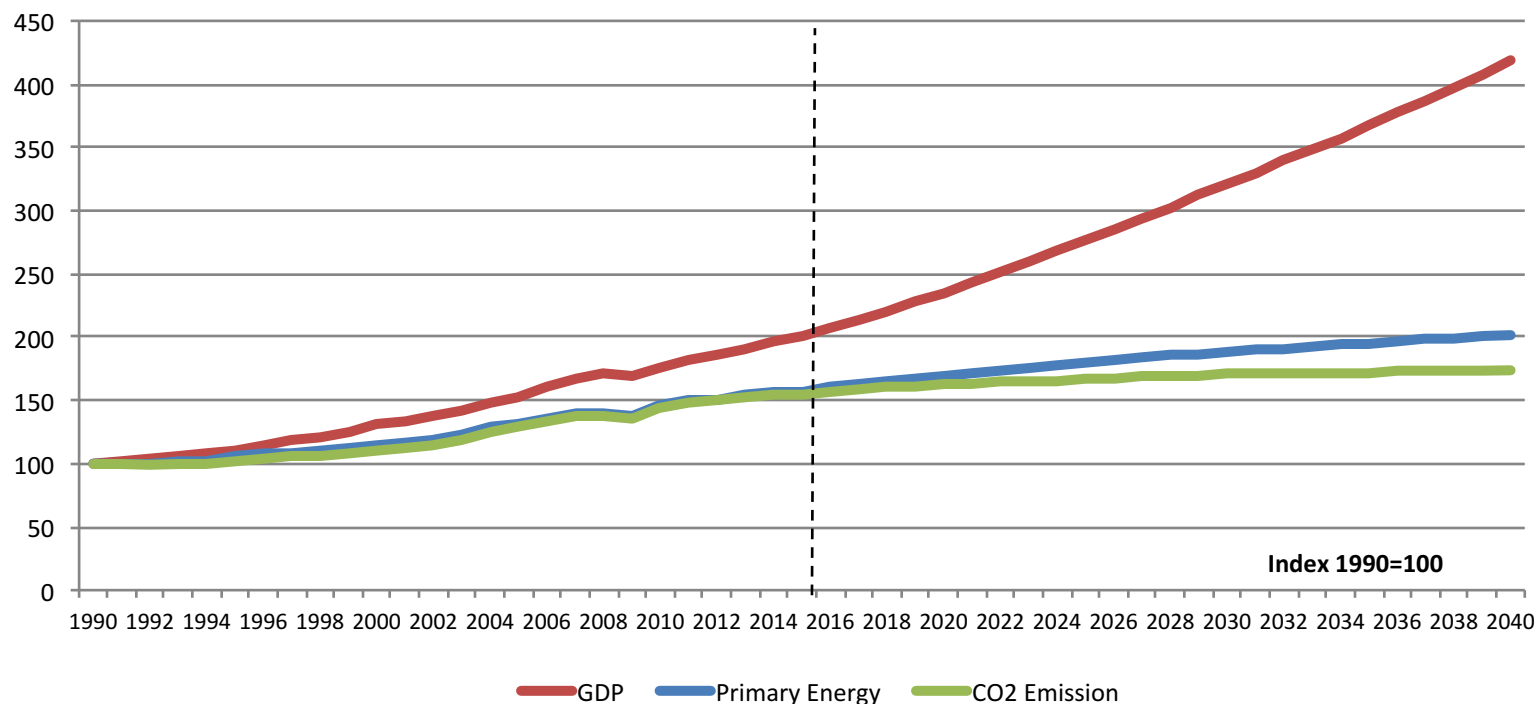
* Note: due to rounding, numbers may not add up precisely to the totals provided and percentages may not precisely reflect the absolute figures.

World primary energy demand by sector (Mtoe)



- Over the outlook period, fuel input into power generation grows at 1.6% per annum and remains the main driver of global energy demand. The share of this sector's demand in total energy consumption rises from 34% in 2015 to 40% by 2040. More than half of world's additional energy needs are presumed to be needed for use in power generation.

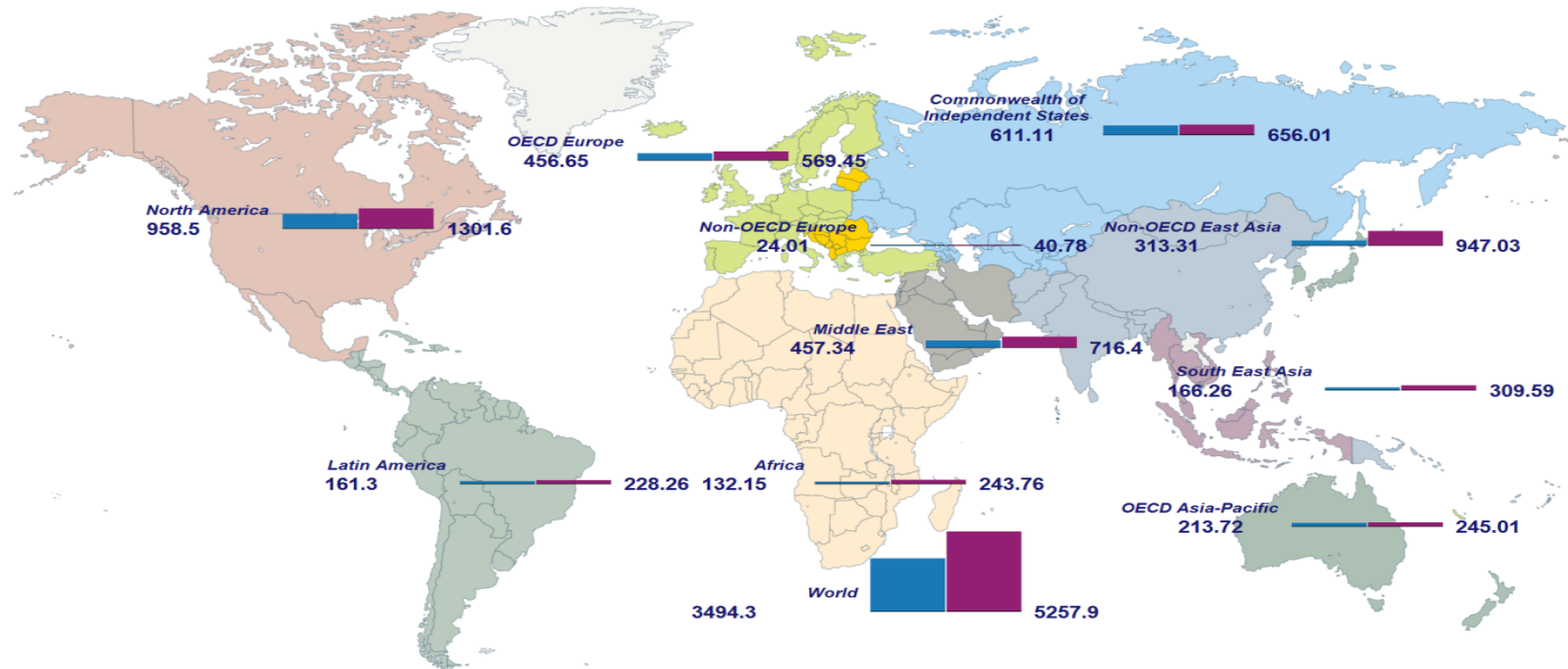
Global CO₂ emissions, GDP, and energy consumption



- Globally, implementing better energy efficiency measures and shifting the economic structure of the developing countries from high energy-intensity sectors to the low energy-intensity service sector is expected to result in lower global energy intensity per capita and per GDP, and therefore GDP and energy consumption are set to decouple over the outlook period. Furthermore, increasing the penetration of clean fuels, including gas and renewables in countries fuel mix, will also widen the gap between carbon dioxide emissions and total primary consumption

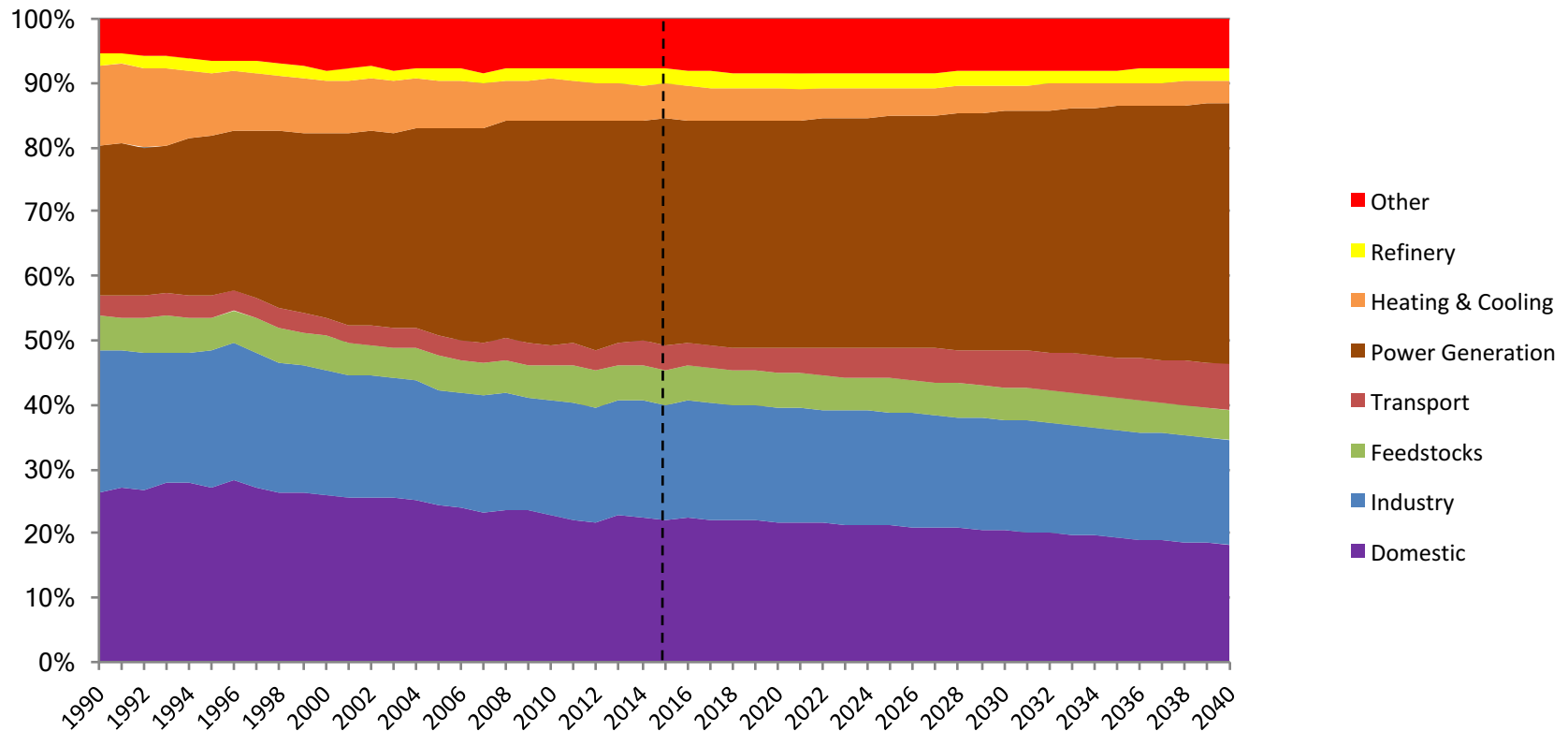
Regional breakdown of primary gas demand (2015 and 2040) in the Outlook

Primary Consumption of Natural Gas (Bcm)
2015 and 2040



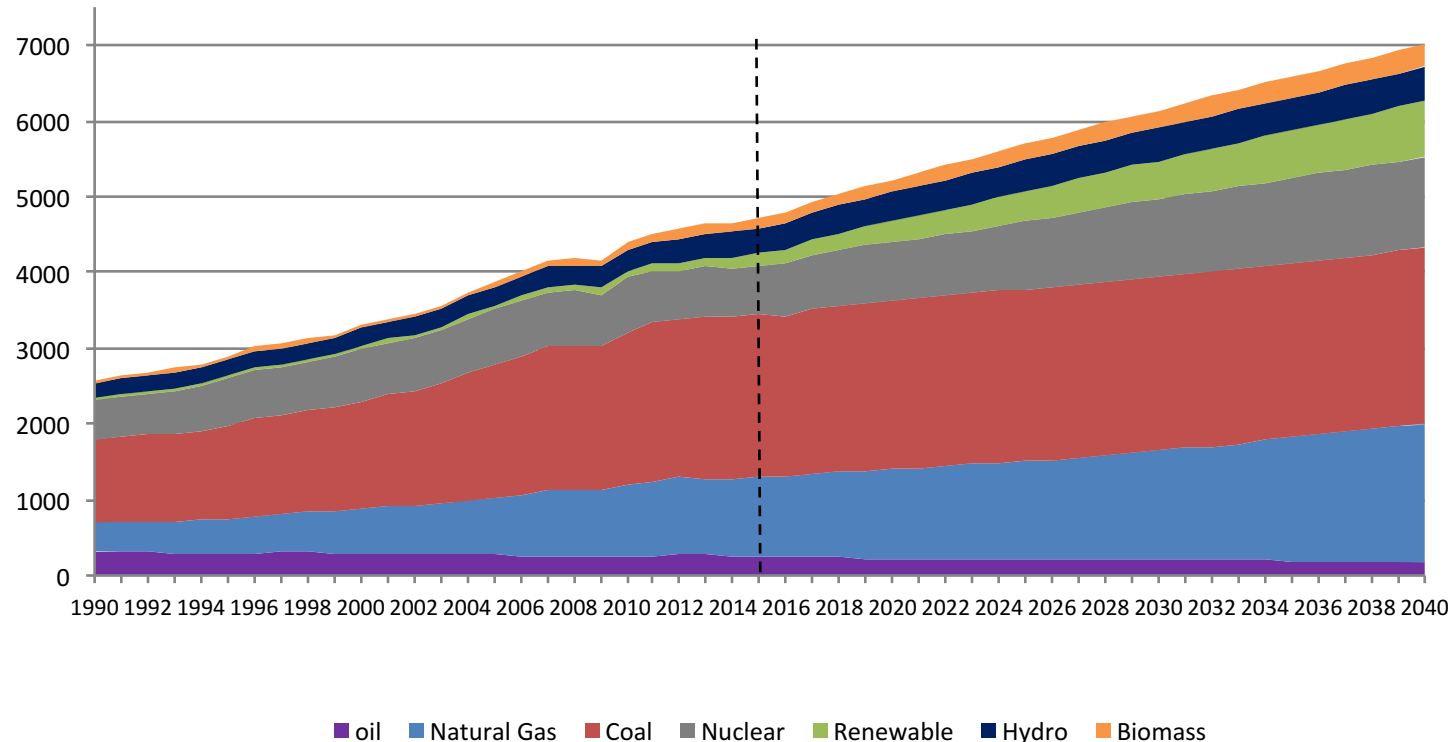
- In the OECD region, natural gas approaches oil consumption as a dominant fuel by the end of outlook period with a share of 32% in primary energy by 2040. However, in non-OECD, natural gas remain third most-consumed fuel, still behind coal and oil, and reaching a share of around 22% by 2040

Sector gas demand share from global gas consumption, 1990-2040



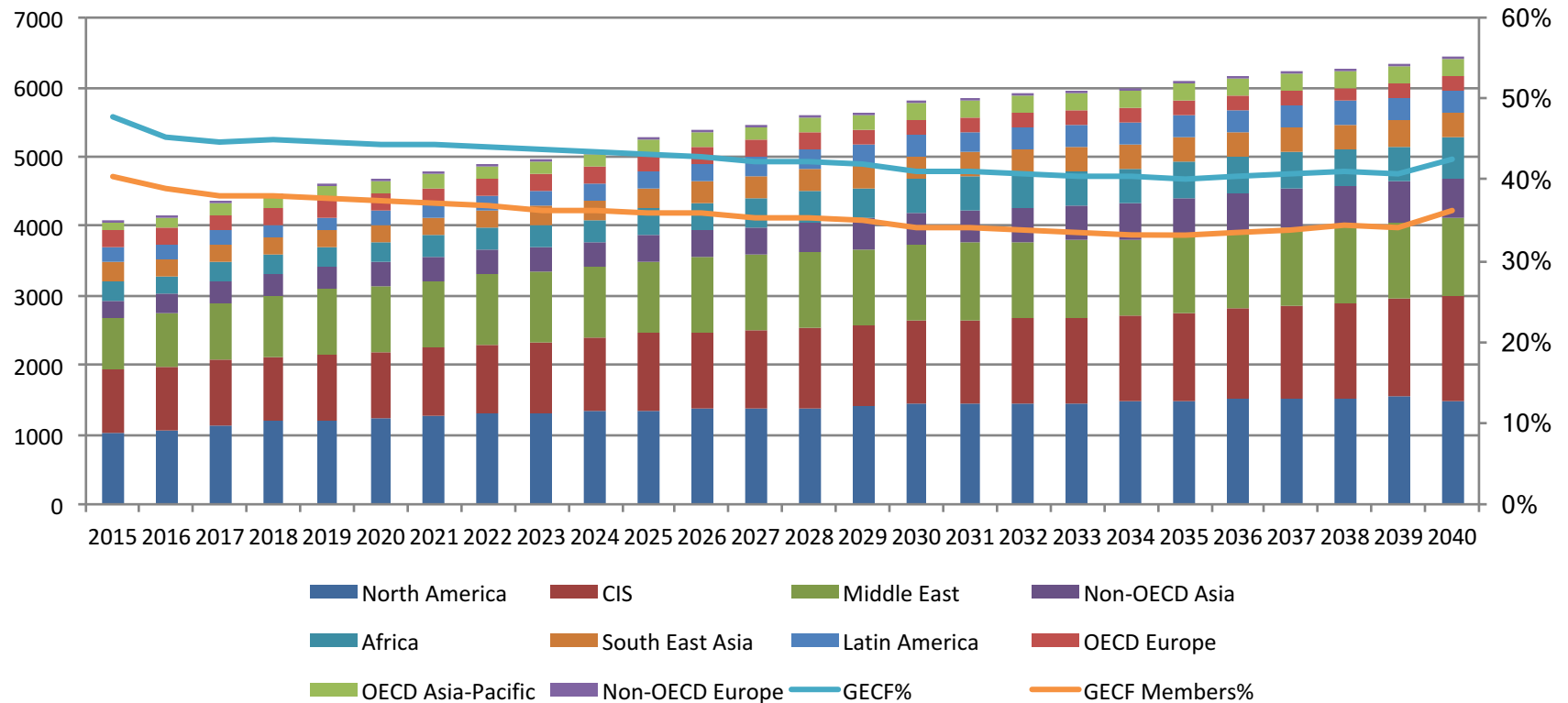
- Overall, through to 2040, the share of gas from total gas consumption in the power sector and transport is expected to increase while in industry, district and domestic sector declines and remaining flat in refinery and feedstock sectors.

Power sector demand by fuels (Mtoe)



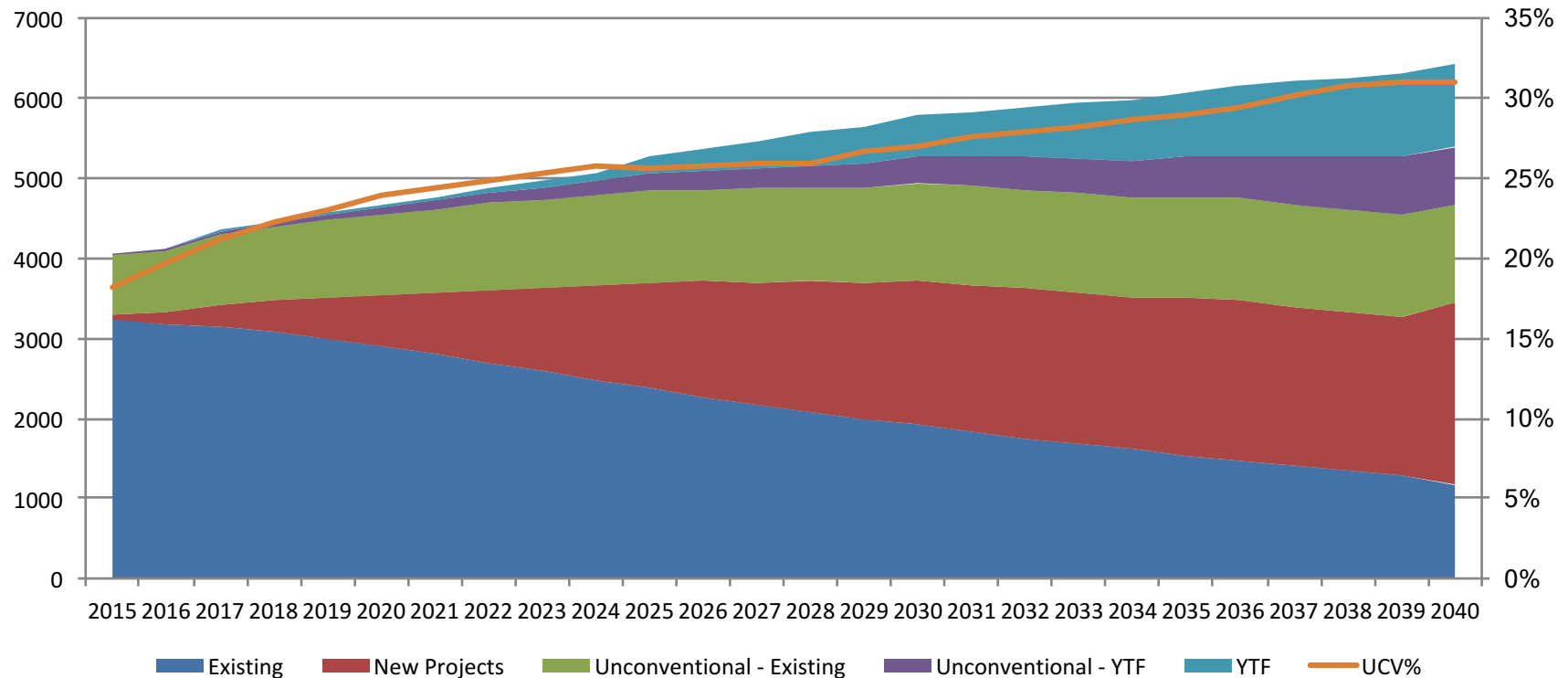
- The power sector is by far the biggest source of additional gas demand over the outlook period. In the *Outlook* gas use in the power sector is projected to grow by 2.2% per year, which is faster than global gas demand growth of 1.6%. As a result, the power sector's share of global gas demand increases from 35% in 2015 to 41% by 2040.

Natural gas production capacities by region (bcm)



- Global natural gas production capacity is expected to grow on average by 1.9% yearly
- The GECF as a whole is expected to grow its capacity by around 1.7% per year in the long-term
- GECF countries' share in global gas production capacity is expected to slide slightly to reach an average of 43% throughout 2040 compared to a little more than 45% currently.

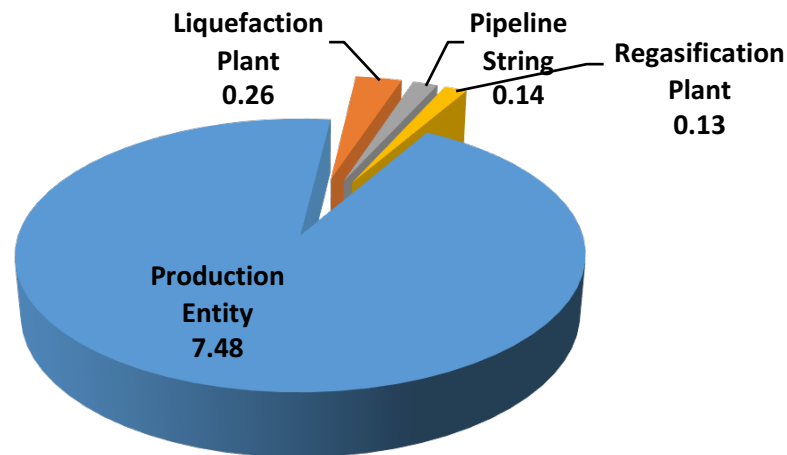
Production capacities by resource type



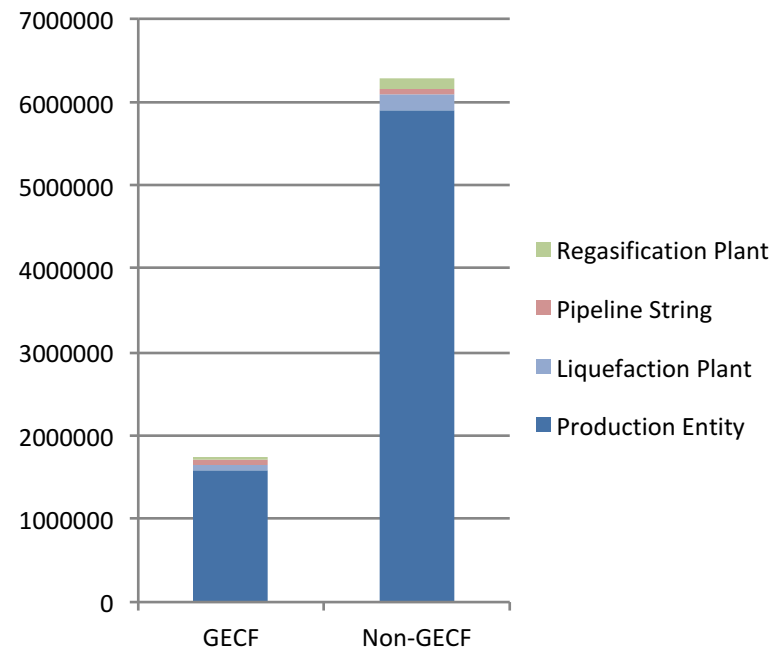
- Starting from next decade the undiscovered resources (YTF, either conventional or unconventional) will play an important role in meeting demand and are assumed to reach more than 30% of the world total capacity by 2040. From currently close to 18%, the capacity of the Unconventionals (reserves and resources included) is assumed to reach 30% of the global production capacity starting from 2035. However, we expect that the unconventional production capacity in some key regions to hit a plateau by the end of the outlook time period.

Investment costs by segment of the gas supply chain

Investment costs by segment of the gas supply chain (2015 Trillion USD)

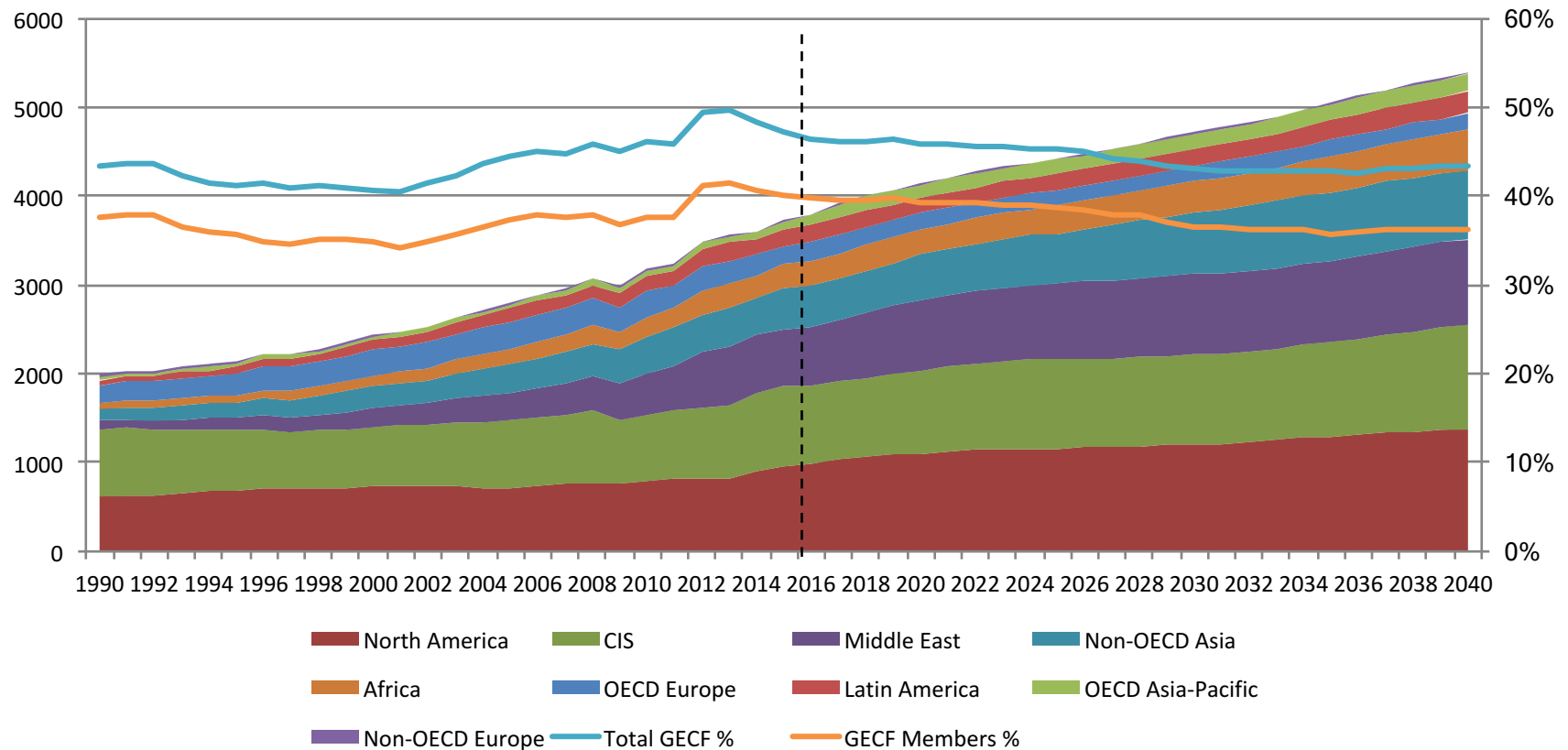


Cumulative investment 2015-2040 (thousands 2015 USD)



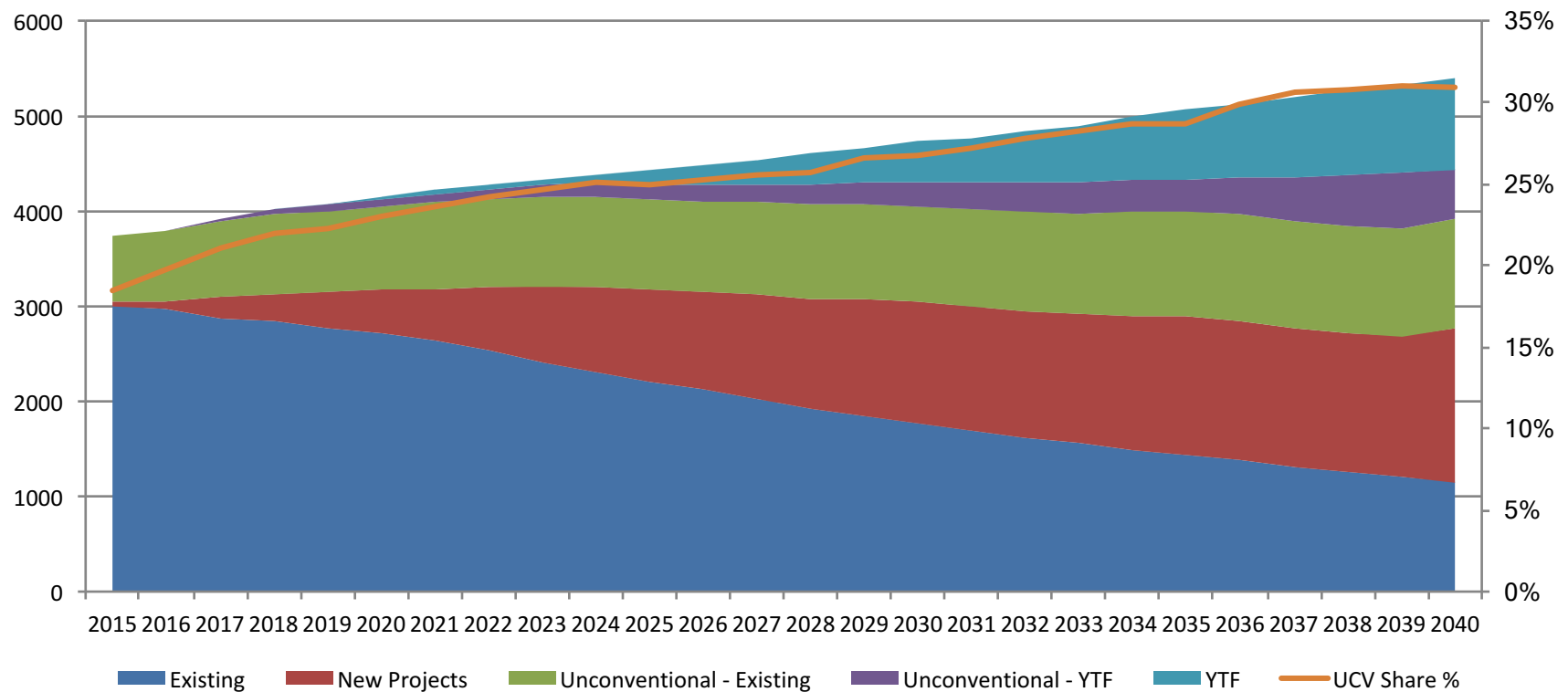
- Total cumulative investment in the upstream and gas transportation system is estimated at USD 8.0 trillion for the period 2015 to 2040 (real 2015 US dollars).
- The upstream part should account for the biggest part of this, with more than 90% or almost USD 7.5 trillion, and other segments in liquefaction, regasification and pipeline projects representing the remaining 7-8%.

Global gas production by region (bcm)



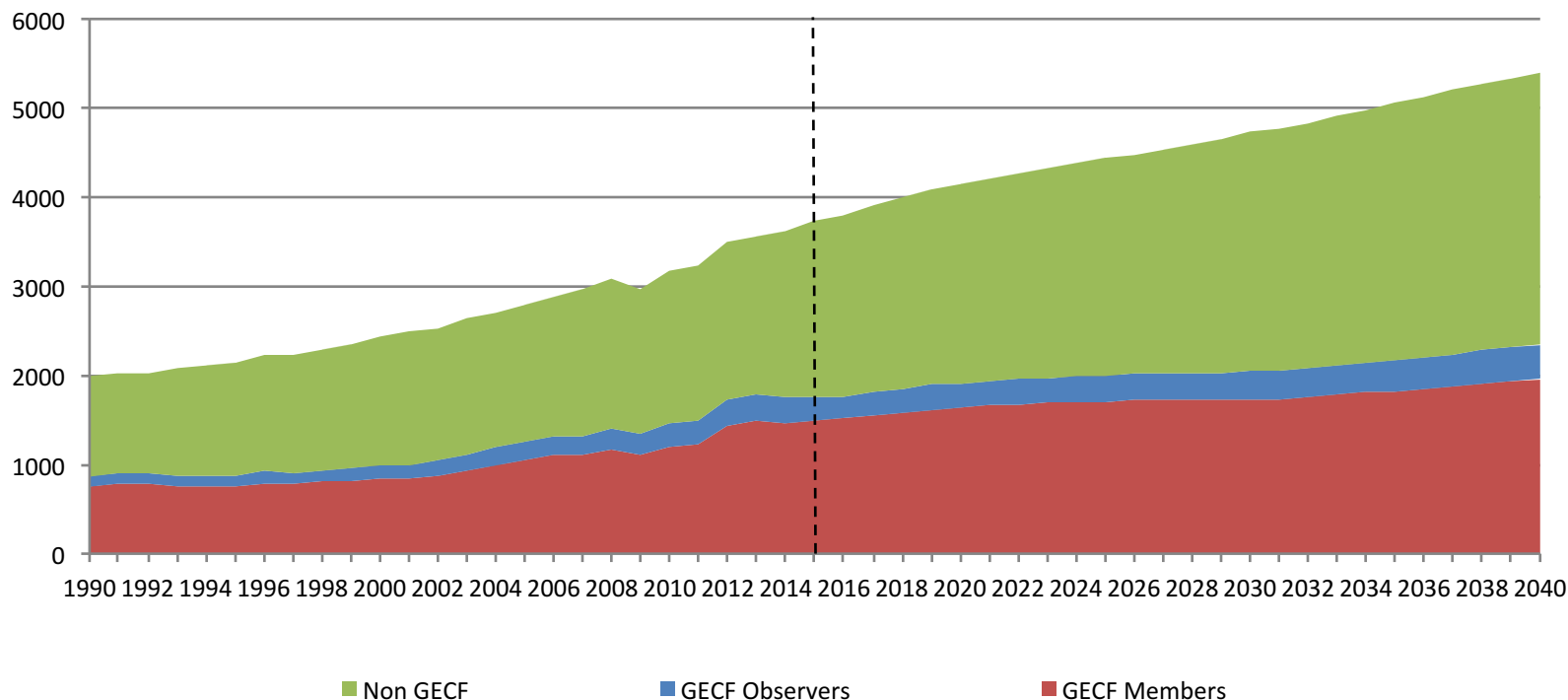
- In the coming twenty-five years, the average global production growth rate from 2015 to 2040 is expected to be at around 1.6% (2.1% average annual growth by 2020). Thus, global gas production is expected to almost double compared with 1990, or increase by almost 50% above today's gas output, increasing to around 5,400 bcm by 2040.

Global gas production by field type (bcm)



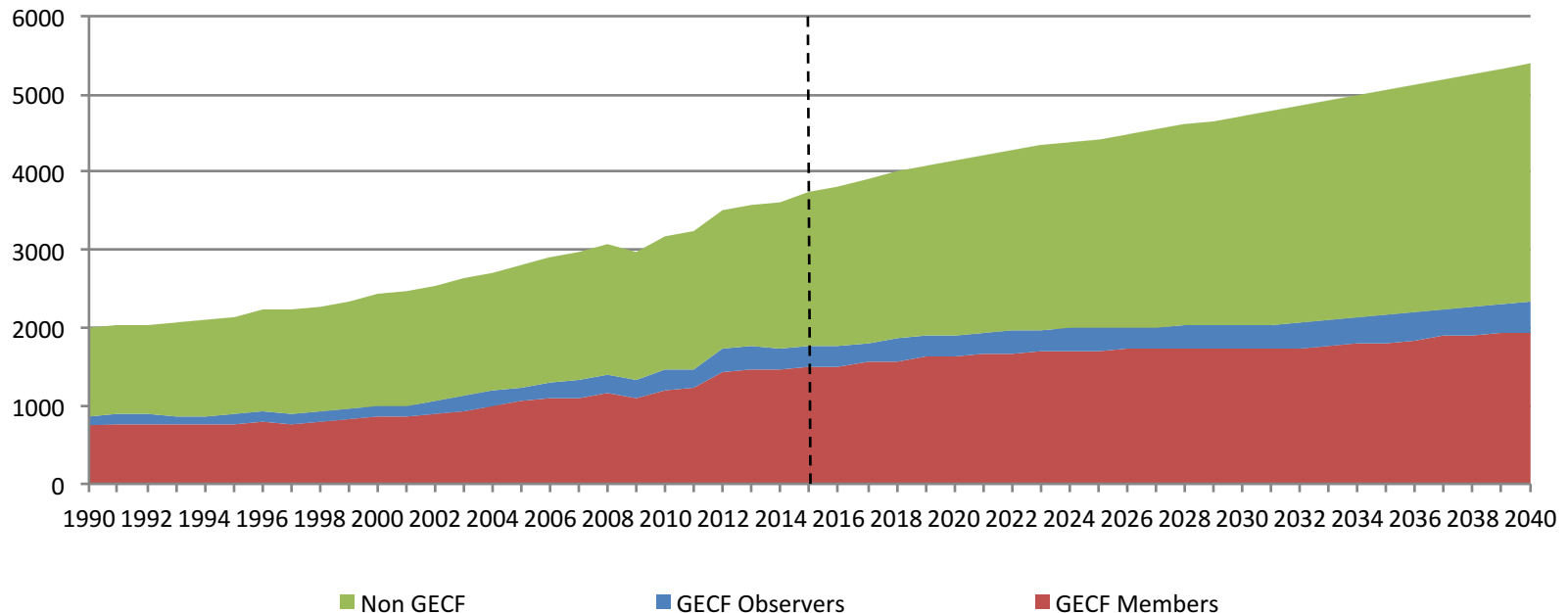
- The share of unconventional gas is expected almost to double from currently around 15% to almost 30% by 2040.

Global gas production by GECF and non-GECF countries (bcm)



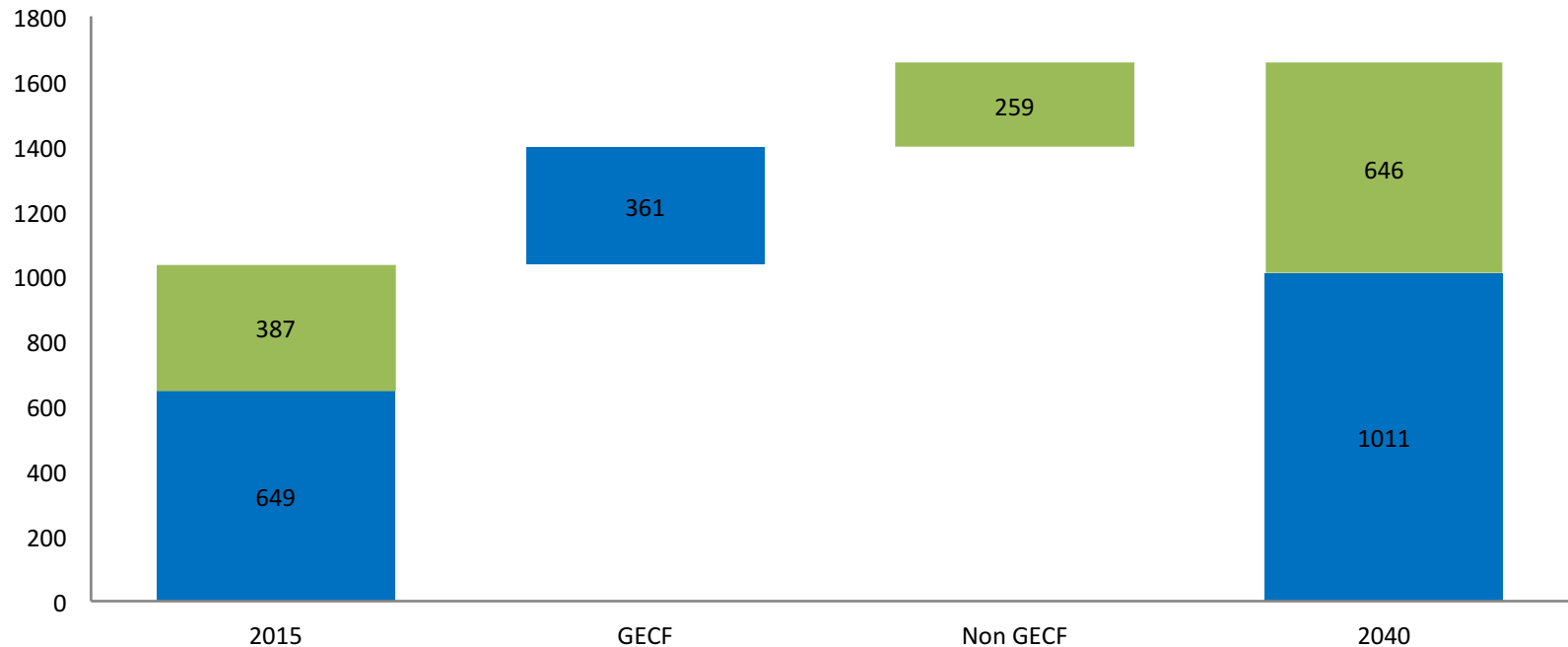
- GECF Members' gas output is expected to rise to around 1,630 bcm in 2020 (39% of the world total), to over 1,700 bcm (37%) in 2030, and to almost 2,000 bcm (39%) in 2040
- The share of the GECF member countries in global marketed gas production is expected to remain relatively stable at an average of 38% during the outlook period, while the historical average starting from 1990 was about 37%.

Global gas demand composition (bcm)



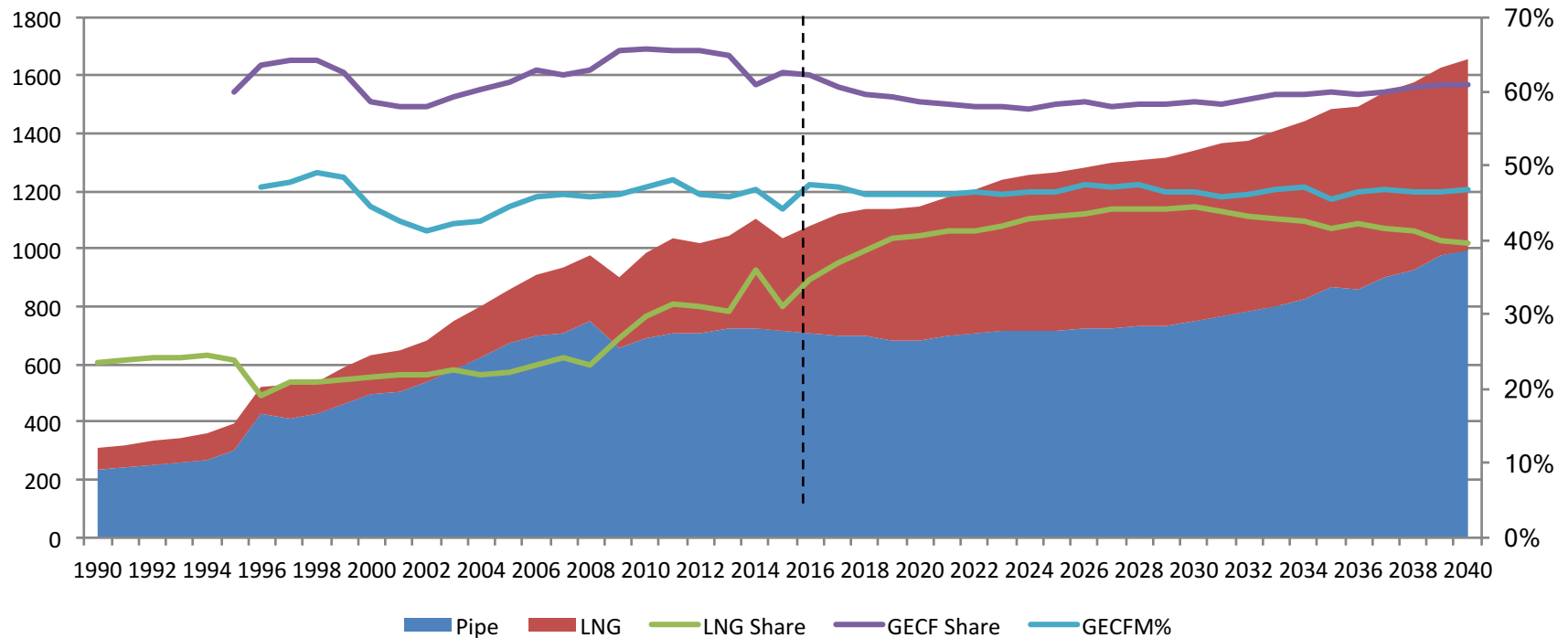
- It is estimated that currently global gas trade represents around 30% of all global gas marketed production. This share is expected to remain at that level by 2040, although the global gas trade is expected to expand in absolute levels by 60%.
- Regionally and at country level the situation is somehow different, as the needs and the conditions of each region differ from the other, both regarding possibilities of domestic supply and also prospects of gas demand.

Global gas trade GECF/non-GECF (bcm)



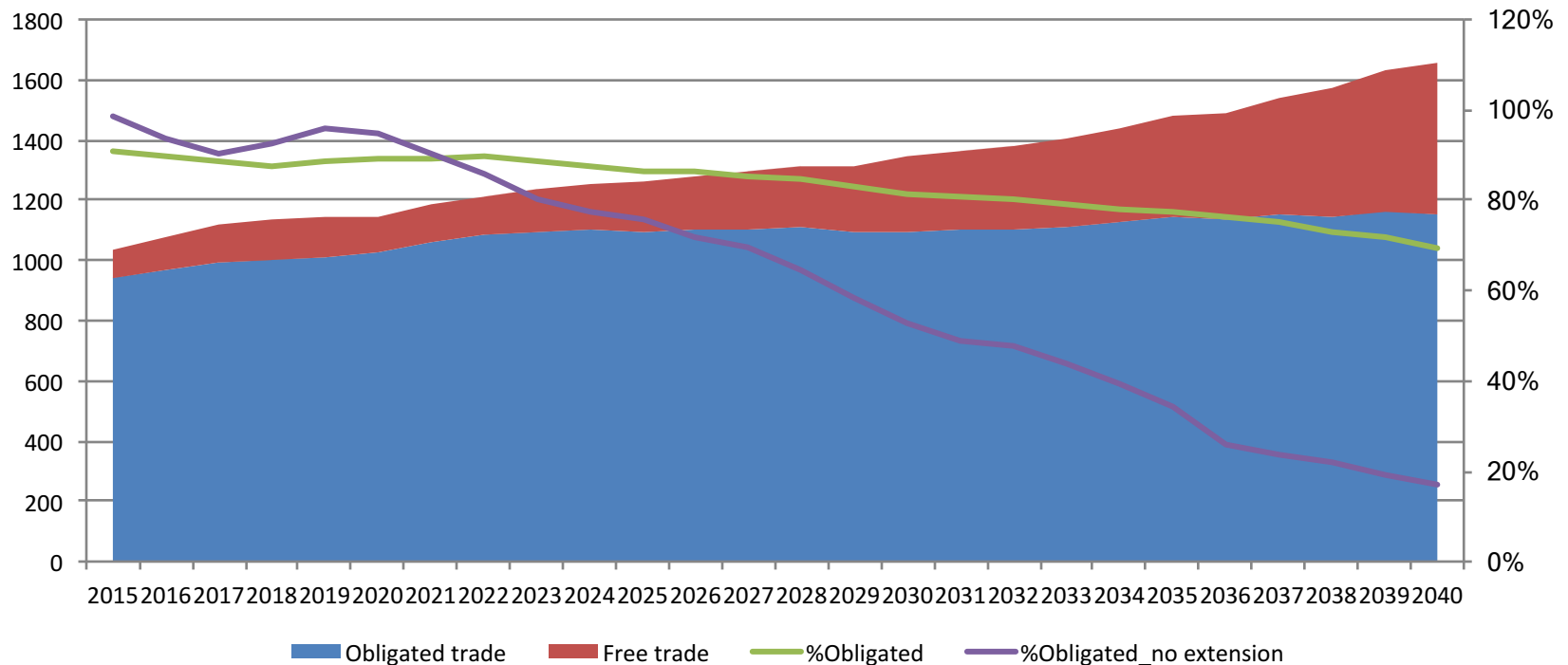
- The volume of the global gas trade is expected to increase, from 2015 levels, by 60% by 2040 reaching a level of 1,650 bcm, growing by almost 2.1% annually on average.
- GECF members averaged a market share of 46% in the last twenty years in global gas trade; we expect this share to remain in this range by 2040

Global gas trade by LNG and pipe (bcm)



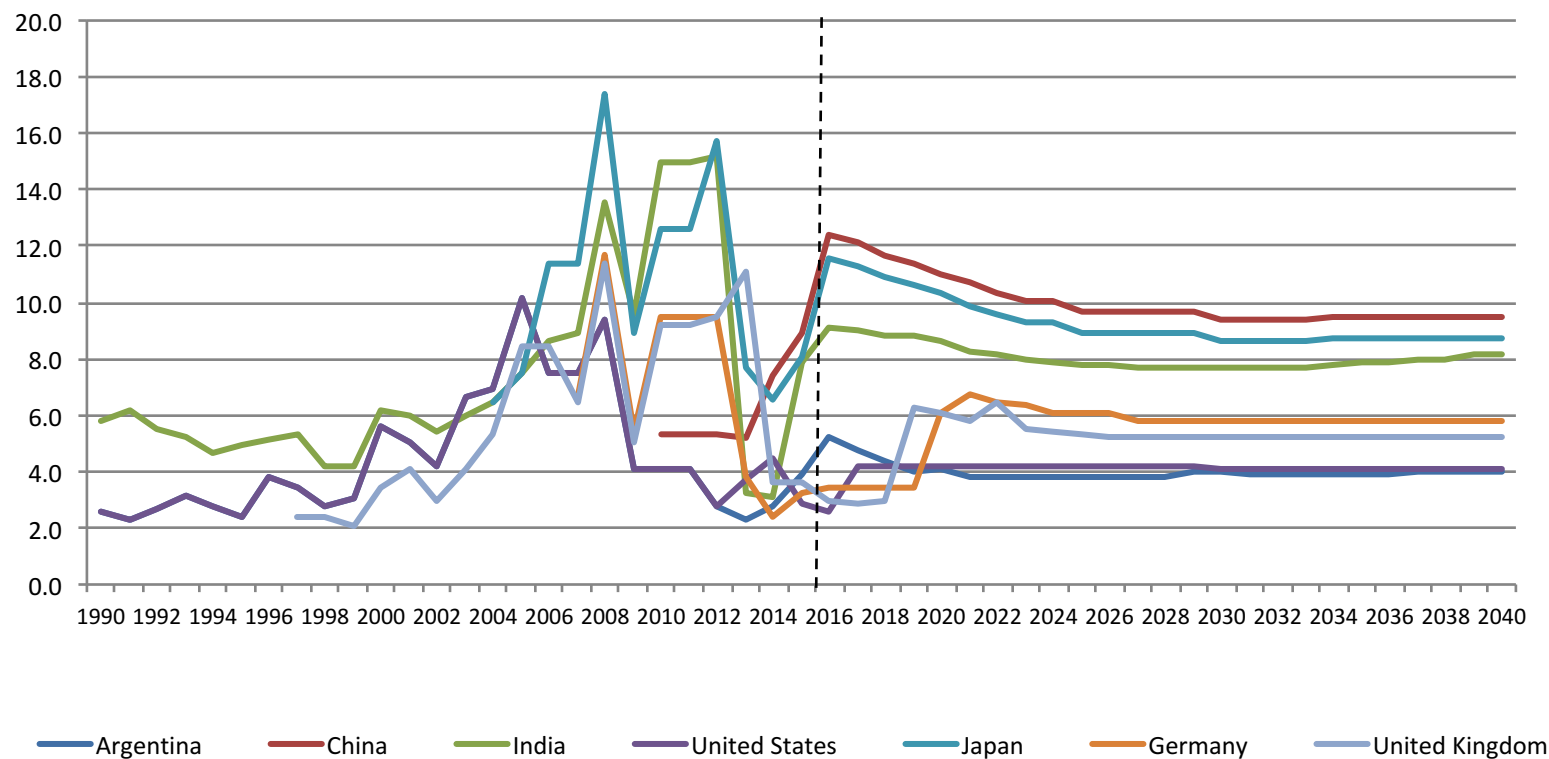
- A little more than 1,000 bcm of gas was traded globally in 2015, of which almost 300 bcm was LNG (30%) and the remaining.
- By the mid-2020s international gas trade is expected to exceed 1,250 bcm, with potentially 43% associated with LNG. After that, LNG trade slows and stabilizes in the 40-45% range, because of the parallel growth in piped gas by 2030, especially from CIS to Non-OECD Asia. On an annual average basis, LNG trade will grow by 2.8%.

Contracted trade vs. spot trade (bcm)



- The unconstrained international gas trade that can be contracted either through spot or potentially other long-term deals, will grow significantly at about 6% per year. From around 12% share of total gas trade, it will represent roughly 30% by the end of the outlook period in 2040.

Marginal costs of gas delivered in some regional markets (Real USD Per MMBtu)



- There are some extreme peak supplies (the 'needle peak') that cause sharp increases in the marginal cost of supply in some key importing regions
- In some Asian markets (Japan, China) the marginal costs vary from USD 7.50 to 12.00/MMBtu, while India receives slightly lower price levels.

- Gas demand and supply remain coordinated during the Outlook period, even though some short periods of disequilibrium might occur, and long-term contracts act as the tool to manage the volume and price risk.
- The gas industry in all countries will require significant investments in order to deliver new gas to domestic and to export markets. The Outlook emphasizes the importance of maintaining contractual relationships between the buyers and sellers in international gas trade that will support the needed investment. Sellers and buyers will require that the risks in both volume and price can and will be effectively managed.
- The work shows that GECF members are in a position to maintain, throughout the period to 2040, the share in international trade that is implied by the least-cost solutions of our modelling and forecasting exercise.
- The role of natural gas in the battle with greenhouse gas emissions gains momentum especially after the ratification of the COP21 agreement.
- The GECF Secretariat will continue to support GECF members both in dialogue in the international community and with analytical support such as that contained in this edition of GECF Global Gas Outlook to 2040.