

The Golden Age of Gas

What Will it Take to Get There?

Demand Analysis

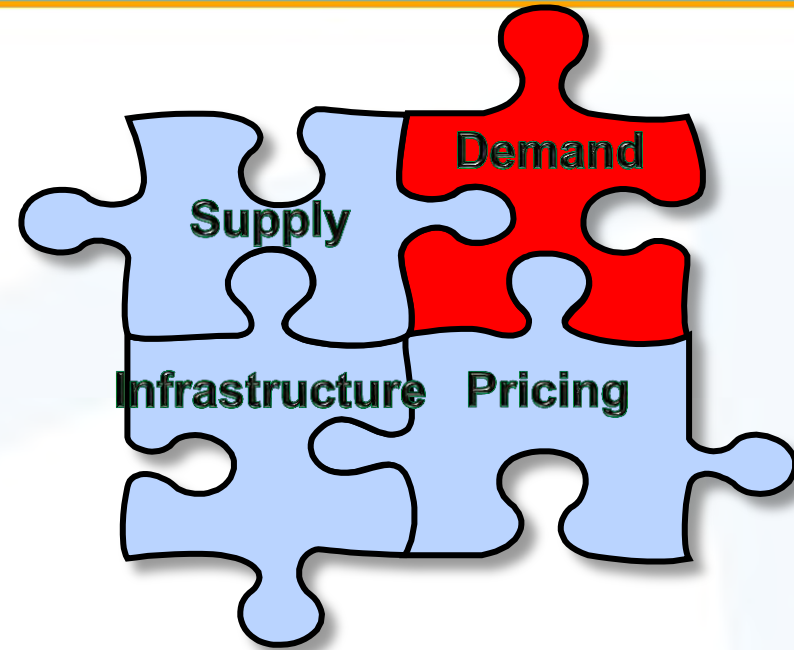
Royal Institution: 19th September, 2013

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Intro/synopsis

- A Golden Age of Gas requires;
 - Sufficient market **demand**
 - Energy security/diversity
 - Environment/climate change drivers
 - Secure market for gas/ products of gas processing (competitively priced!)
- Key questions are:
 - What will drive demand for gas
 - gas to power? transport fuels? petrochemicals?
 - For each sector what are gas's competing fuels? Is demand price sensitive?
 - Where are the key demand centres and what challenges do they face
 - Environmental issues (only briefly mentioned in this presentation due to time constraints)

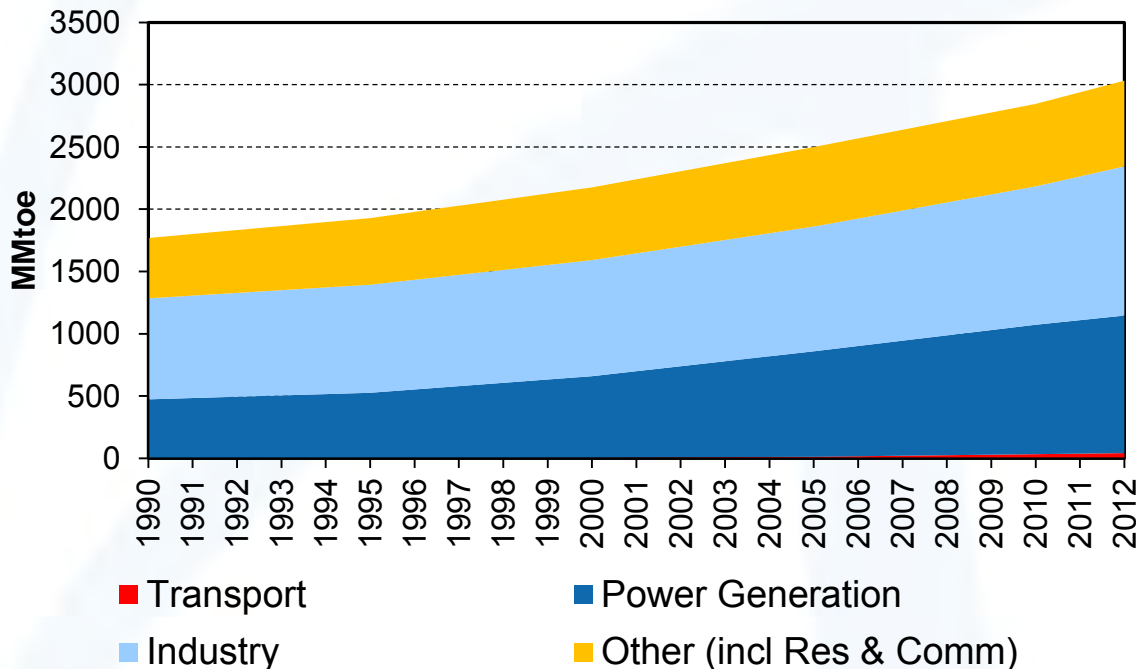


DRIVERS OF GAS DEMAND



Drivers of Natural Gas Demand

- Major areas of historical growth are industry and power generation (in terms of volumes of gas)
- But transport has highest AAGR but is still a small volume market



	AAGR, 1990-2012
Transport	16%
Power Generation	4%
Industry	2%
Res/Commercial & Other	2%

- Economic growth is single largest influence on demand – economic growth drives primary energy demand but how much of that is, or can be, met by gas?

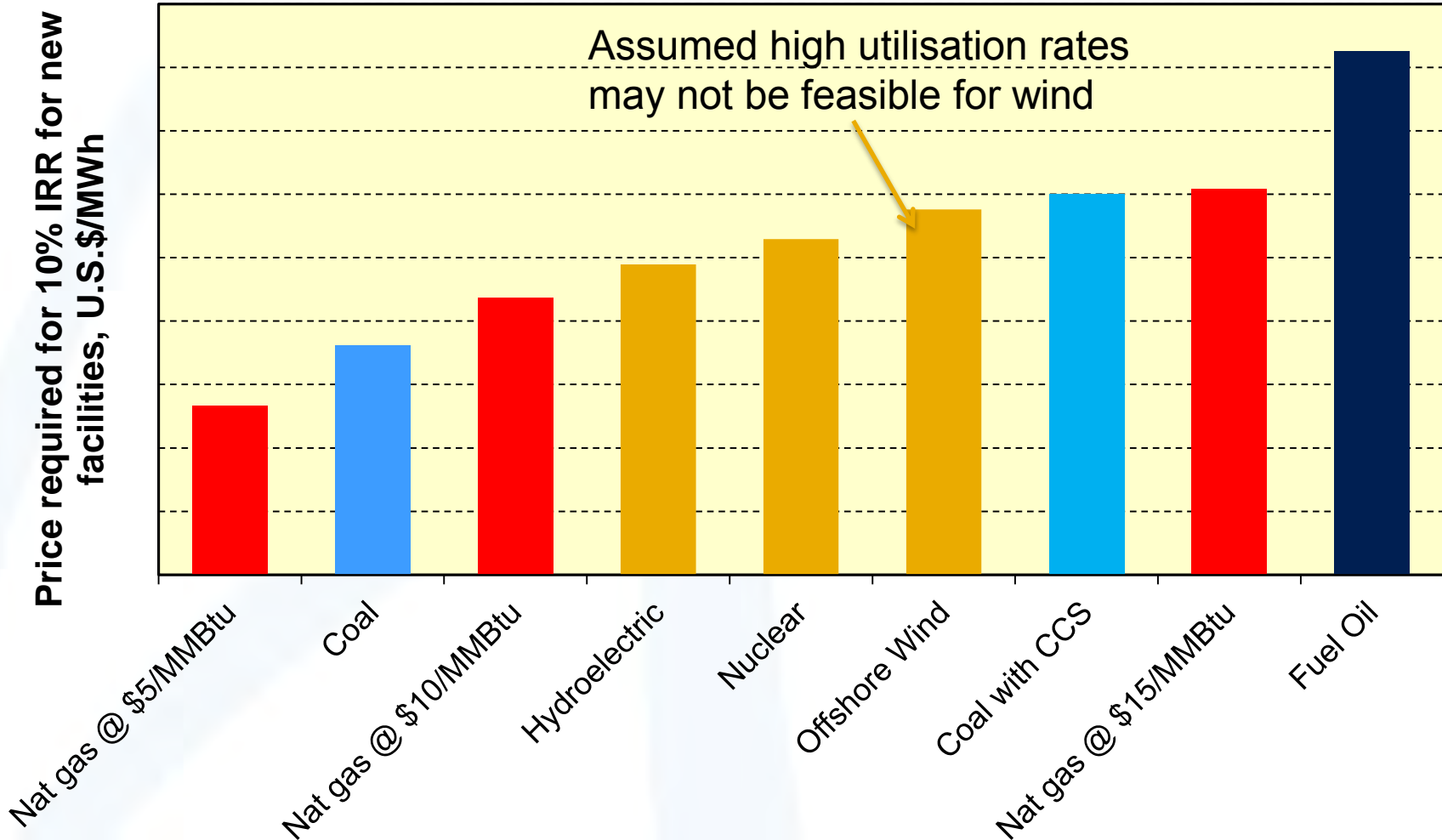
Source: BP

Drivers of Gas Demand – Power Generation

- Clean burning, cost effective, good for variable demand, quick construction times for CCGT/OCGTs
 - “dash for gas” seen in many countries
- But competition from coal (especially if gas prices are high) and renewables (if mandated/supported)
- Limited ability for switching fuel in existing plants – but cost competitiveness of gas will influence new build choices and prioritisation of existing generators



Estimated Electricity Generation Costs



Source: GCA Analysis

Power Generation – It's not just the cost of generation that determines fuel choice!



- NIMBYism and safety concerns (which can be based on accurate data or supposition) of general public may have a strong influence on power generation choices

Drivers of Demand – Industrial (including Petrochemicals)

- Natural gas used in variety of industries competing against heavy fuel oil, distillate and electricity in many applications
- Also used as petrochemical feedstock
 - Methane for methanol/fertilizers (no easy alternative feedstocks)
 - Ethane as feedstock for crackers producing ethylene, propylene (alternative = naphtha or LPG crackers)
- Due to lack of alternatives and/or highly priced alternatives industrial gas demand has a high tolerance to high prices – but it is price sensitive



Drivers of Demand – Transport Fuels

- Still a small volume consumer – but with strong growth rates
 - 10 – 20 million vehicles around the world that use CNG and LPG (approx 1 billion total cars)
 - LNG as bunker fuel and HGV transport
 - GTL (no new supply/filling infrastructure required)

Natural Gas: The Fastest Growing Transportation Fuel In The U.S.

Shell, TravelCenters of America Develop LNG Fueling Network

04/15/2013

Shell and TravelCenters of America LLC (TA) have finalized an agreement to develop a U.S. nationwide network of liquefied natural gas (LNG) fueling centers for heavy-duty r

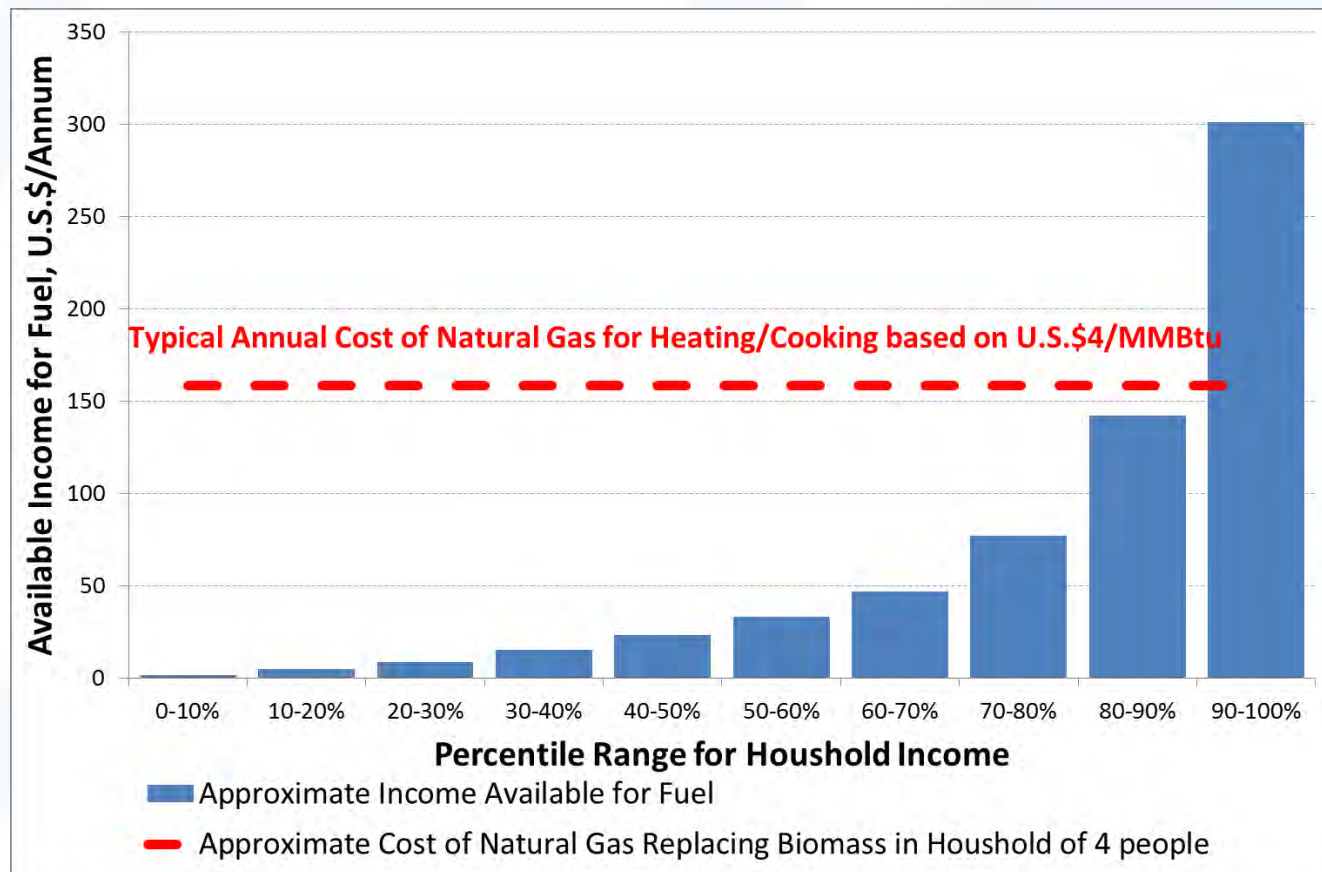
LNG Emerging as "Prime Fuel for Ferries"

Thursday September 12, 2013

- Opportunities for fleet vehicles that refuel at a central station e.g. public transport
- Competing with liquid fuels means high prices can be tolerated – but requires infrastructure to support a switch from liquid fuels to gas
 - Cost of conversion needs to be covered – consumer won't want to pay!!

Drivers of Demand – Residential and Commercial

- Competition from a wide variety of fuels – LPG, kerosene, electricity, biomass (residential)
- In developing countries encouraging the switch from biomass to commercial fuels will be key as often it is simply not affordable

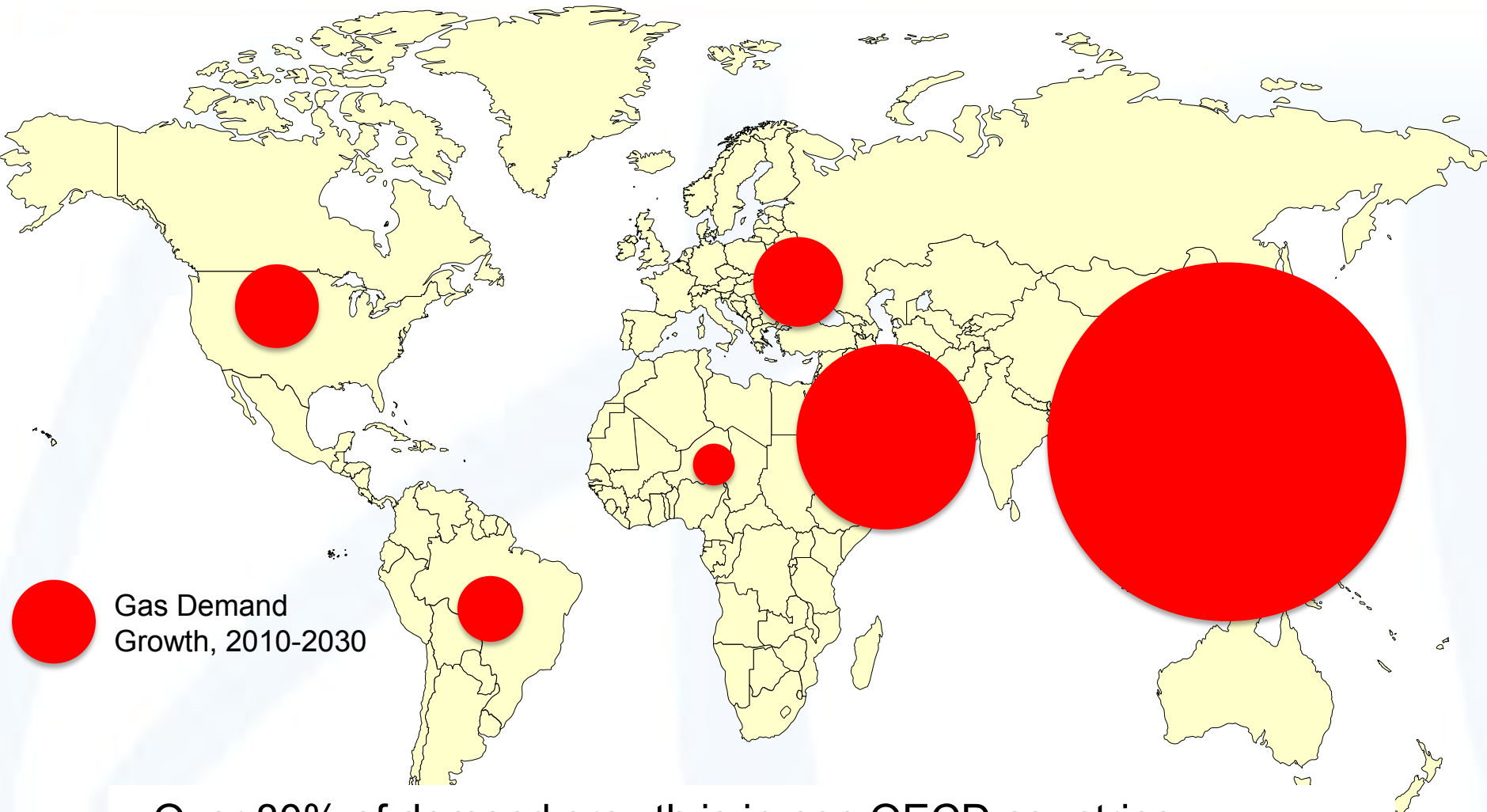


Source: GCA Analysis

FUTURE PROJECTIONS



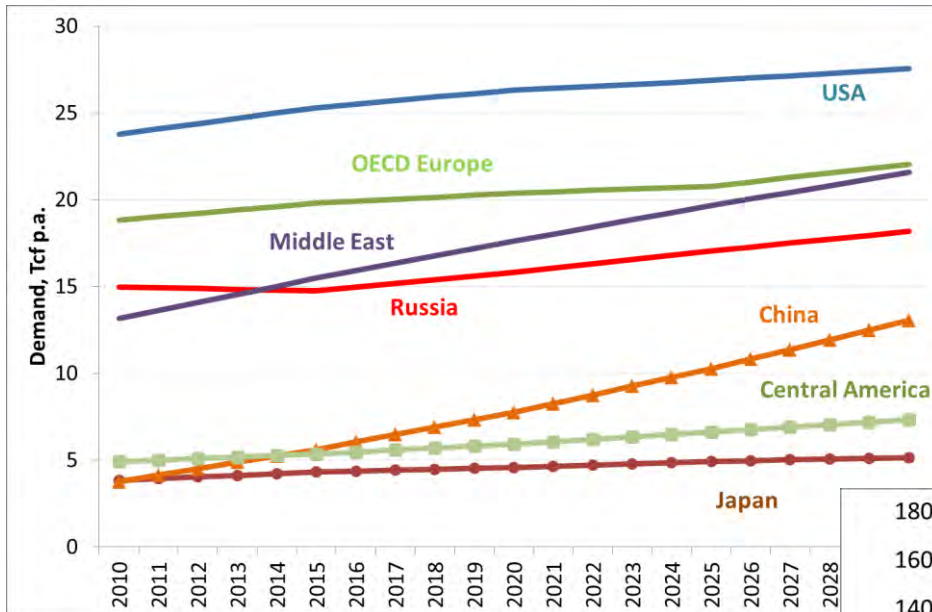
Gas Demand Growth by Region



- Over 80% of demand growth is in non OECD countries

Source: BP

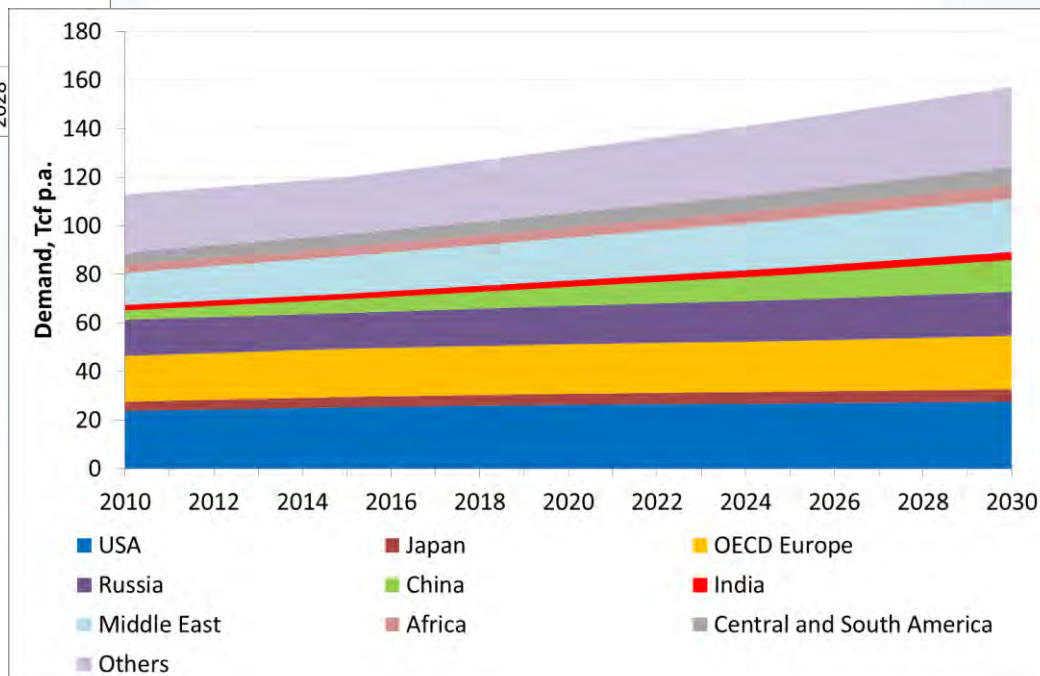
Gas Demand by Region



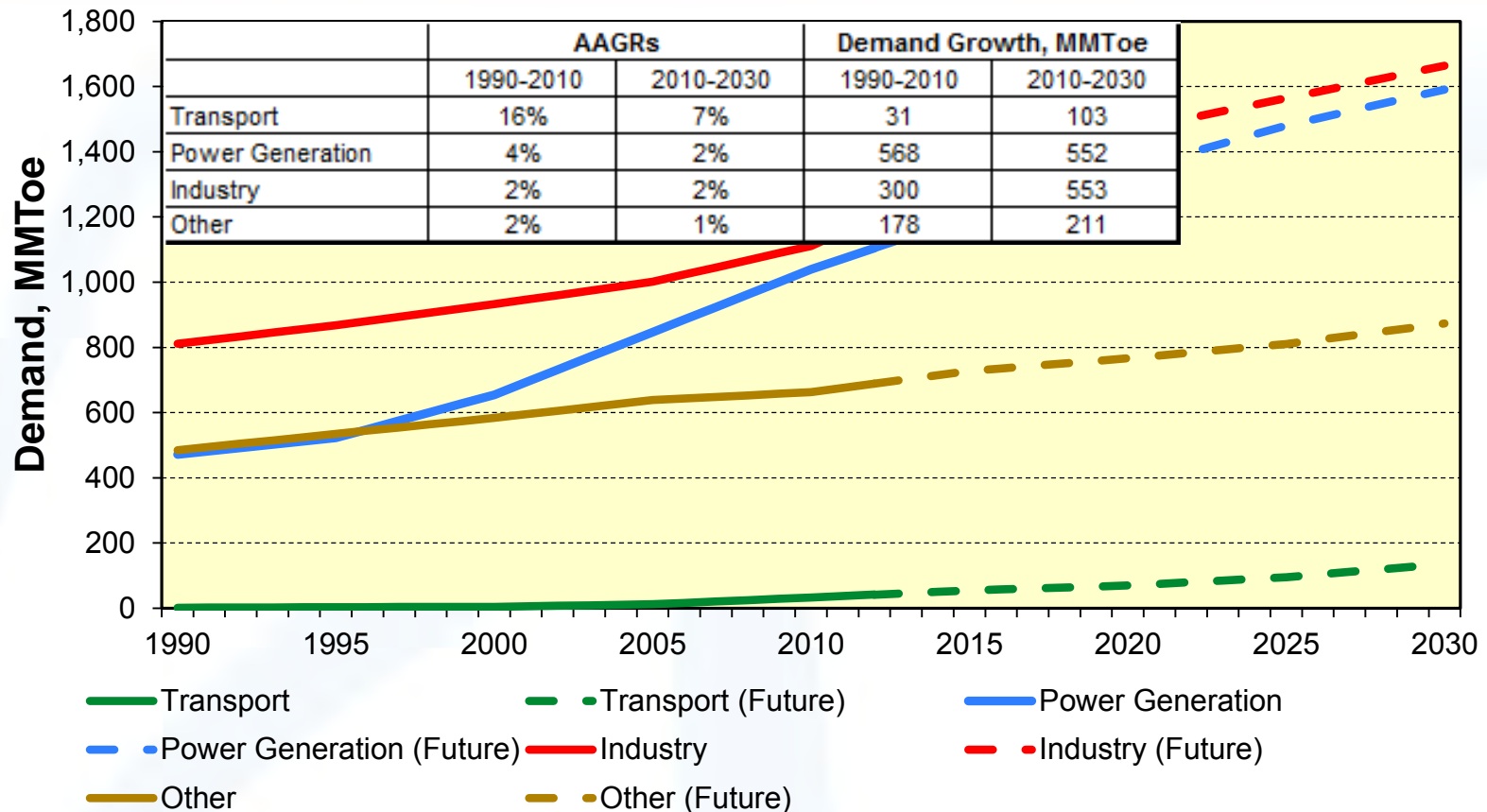
- Muted growth in developed markets but stronger in developing markets
- 80% of growth in non-OECD

- How elastic is demand at high gas prices in emerging economies?
- China quotes GDP energy intensities double those of developed regions - massive scope for efficiency improvement driven by price sensitivity

Source: BP



Projected Natural Gas Demand Growth by Sector



- Major areas of growth are industry and power generation (in terms of volumes of gas)
- But transport has highest AAGR

Source: BP

Demand Growth by Sector

- Industrial
 - Middle East has very cheap gas – if prices rise then demand may be more muted
 - Cheap gas in N America could mean less petchems in Asia more in North America?
 - But what if US gas prices rise?
- Power
 - Growth is in OECD nations – will these invest in lower emissions generation
 - Will coal still be king in some nations?
- Transport
 - Where will investment in infrastructure come from?
- Residential and Commercial
 - Demand in developing countries – is it affordable?



VS



result : ??

Gas vs Coal - Environmental Issues

	CO ₂ emissions, MMt CO ₂	Energy Consumed, MMToe	Tonne CO ₂ per Toe
Coal	13,042	3,628.2	3.59
Gas	6,173	2,864.1	2.16

Source: BP

- Increasingly there is an environmental cost of coal burning versus gas – carbon credits etc
- However, how will security of supply stack up against environmental concerns? European coal consumption increasing even though the region largely signed up to Kyoto and put in place an Emission Trading Scheme
 - The irony is that the United States, which did not sign the Kyoto Protocol will see GHG emissions reduced through cheap gas

Key Markets: India

- Rapidly growing demand and infrastructure to support demand – pipelines, LNG
- Limited options for low cost non-LNG gas supply to blend gas pricing
 - Existing developments have government mandated gas prices below typical import costs
- So what about price elasticity – will demand still be robust at higher gas prices e.g.
 - Demand for natural gas is price sensitive, but only 30% of IEA's forecast expected from sectors with low price elasticity
 - Industrial consumers and niche affluent communities may be able to afford to pay import prices



Source: EIA

Key Markets - Balancing Exports and Domestic Market Needs

Egypt Importing Gas for First Time as Exports Disappear

By Eduard Gismatullin - Dec 11, 2012 6:01 PM GMT

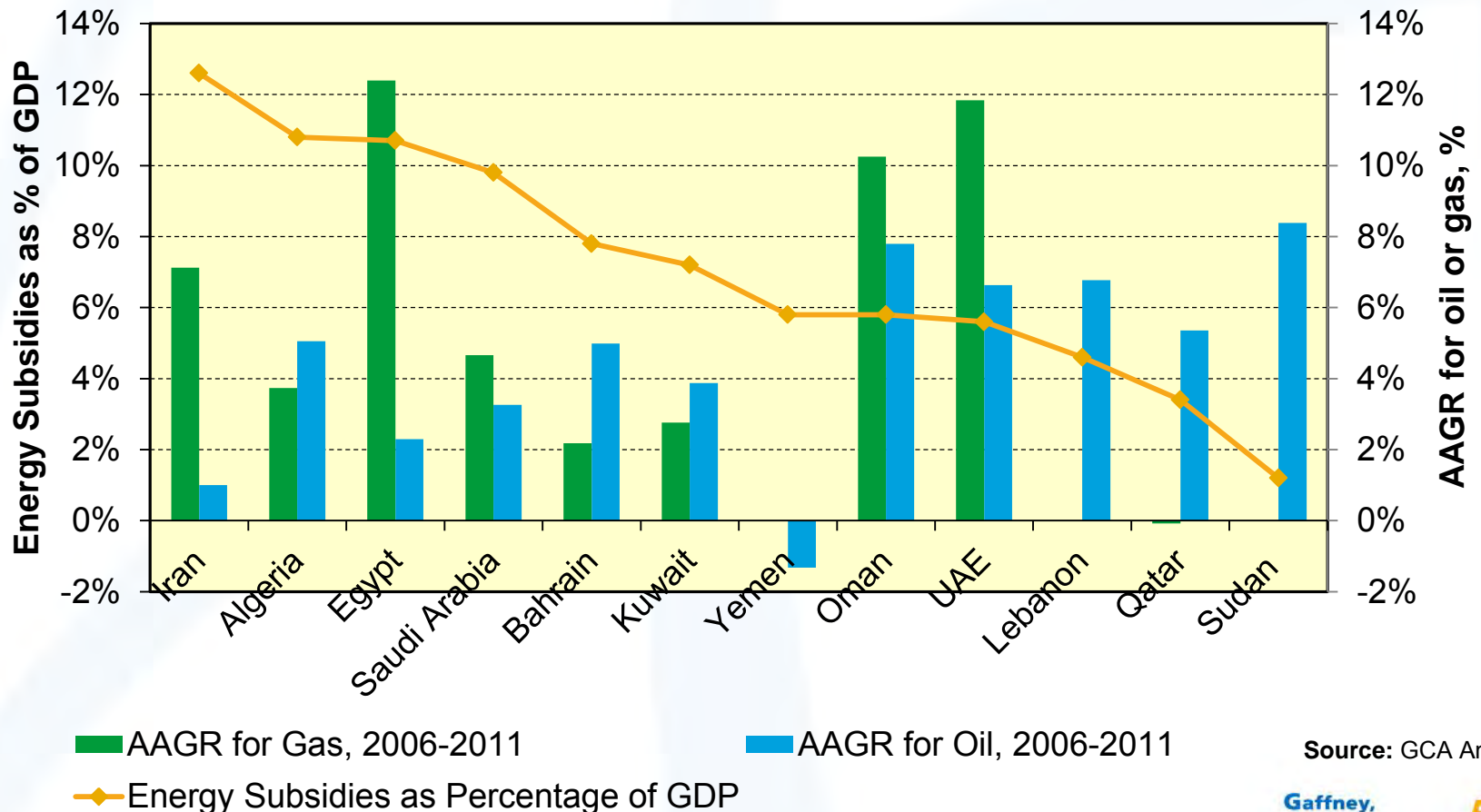
Indonesia to allocate 46 mil mt LNG to domestic market over 2013-2025

Jakarta (Platts)--7Feb2013/521 am EST/1021 GMT

- Many gas rich countries, and current exporters are facing (or will soon face) increasing pressure to supply their own markets and divert gas away from exports e.g. Egypt, Indonesia, Algeria, Nigeria
- Situation is exacerbated by subsidies – underpinning high growth rates
 - Political difficulties in removing subsidies

Subsidies and AAGRs for Selected Countries

- Subsidies: expensive for governments, fuels high growth rates, promote energy inefficiency but difficult to remove!!!



Source: GCA Analysis

CONCLUSIONS



Conclusions

- Plentiful demand predominantly in non OECD region
 - Gas is already dominant in many OECD countries but majority of future growth seen in non-OECD. OECD will typically pay for clean energy – will non OECD?
- So what does a golden age of gas require;
 - Recognition of environmental benefits of gas
 - Realistic pricing
 - Infrastructure
- Threats include step changes in clean coal costs and renewables in power sector

**"Energy forecasting is easy.
It's getting it right that's
difficult"**

