IGU 2006

NGV Business: Opportunities for the Natural Gas Industry

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President International Gas Union

11th Annual European NGV Conference
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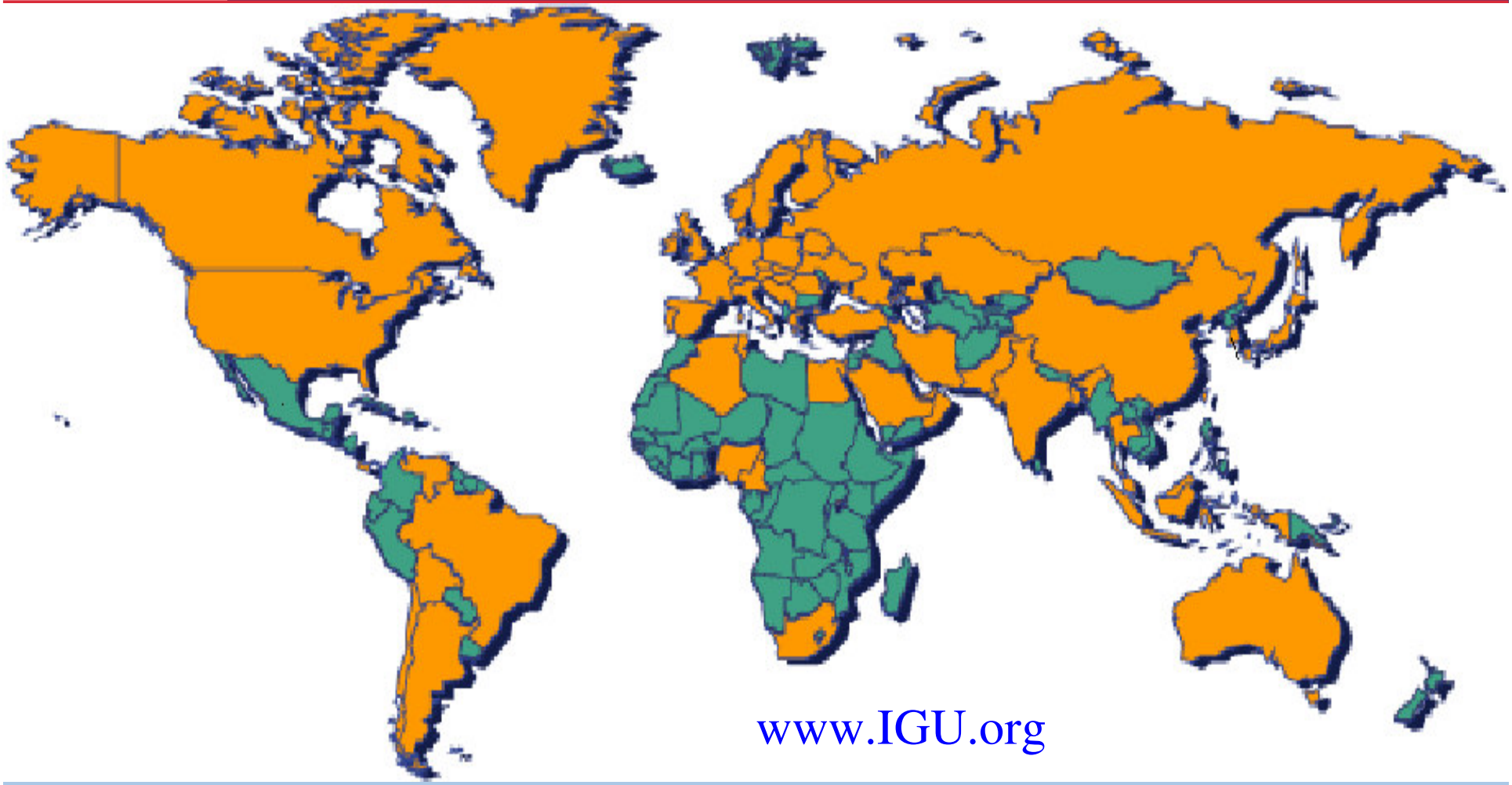
INTERNATIONAL GAS UNION
Covers >95 % of World Gas Sales
'Spokesman' of the Gas Industry



Non Members

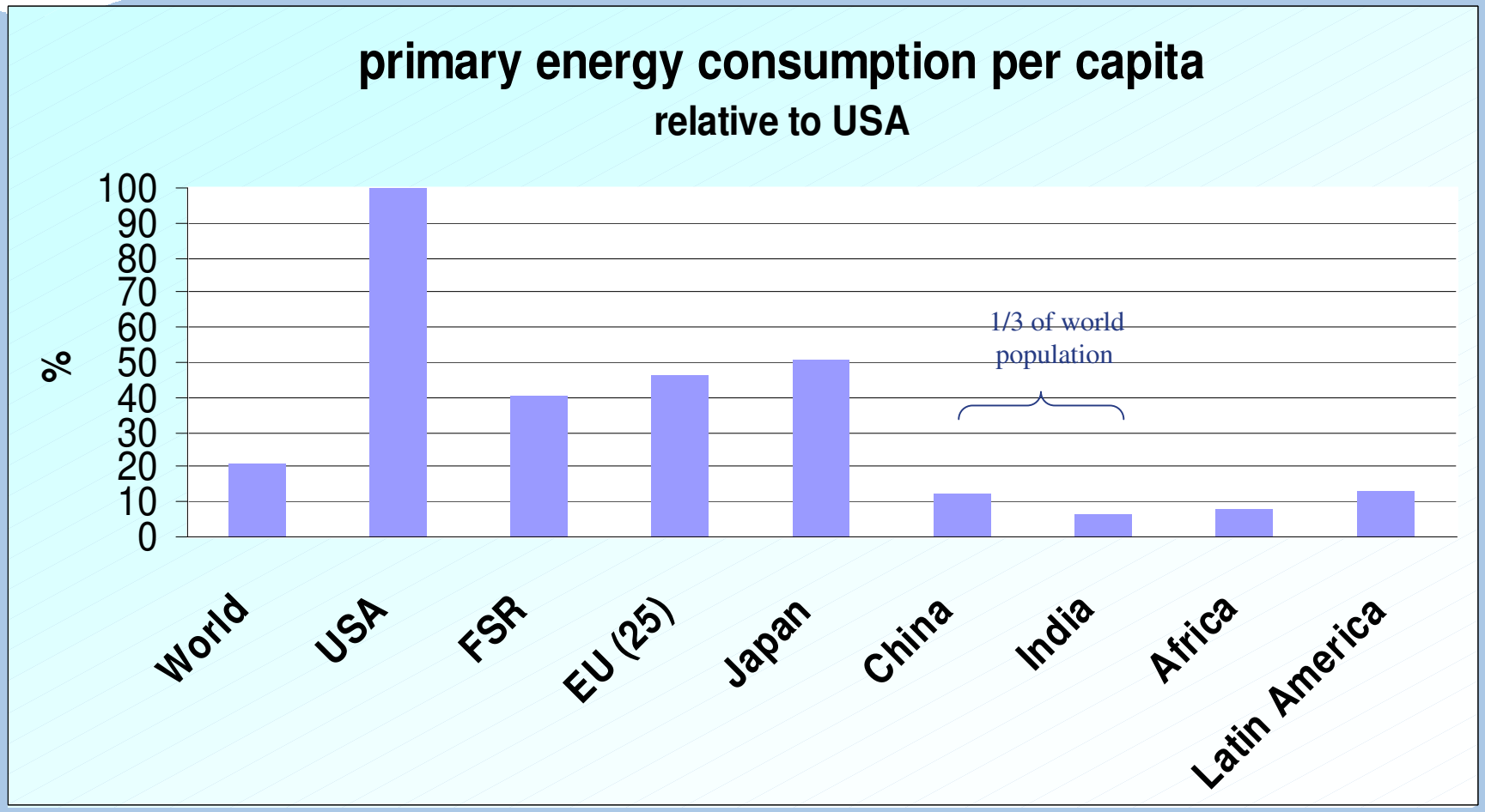
Membership from 66 countries and 20 Associated Members

IGU's objectives

- Gas as the fuel of choice preceding a sustainable energy system
  (Bridging fuel)
- Promotion of the gas industry as a responsible corporate citizen
- Promotion of technology, industry and customer focus

Not That Long Ago The Natural Gas Industry Started to Serve Its Customers: it's not a NGV, may be a NGB ?

Energy Consumption In Perspective

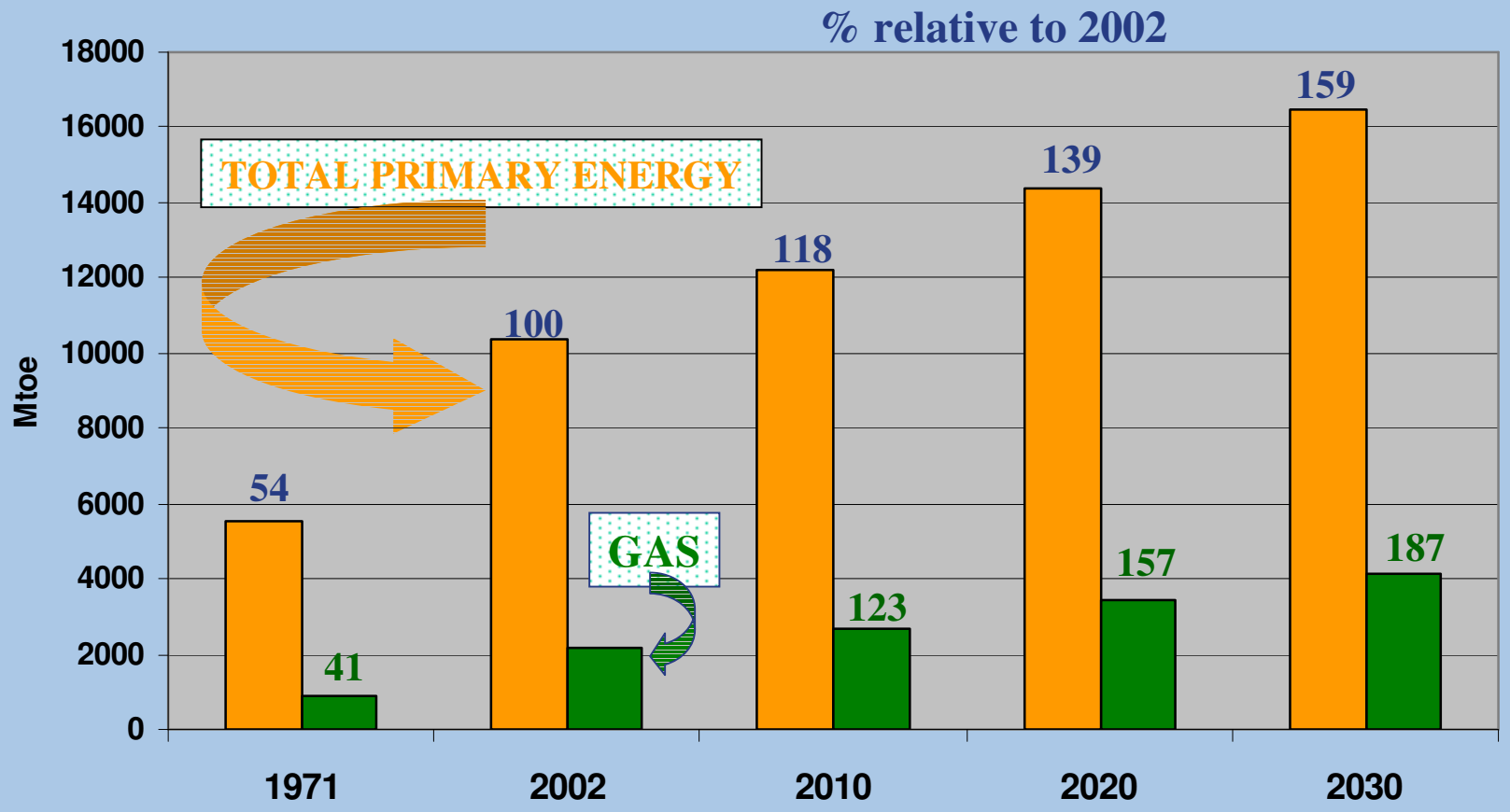


IEA data year 2002

Energy Demand Will Increase

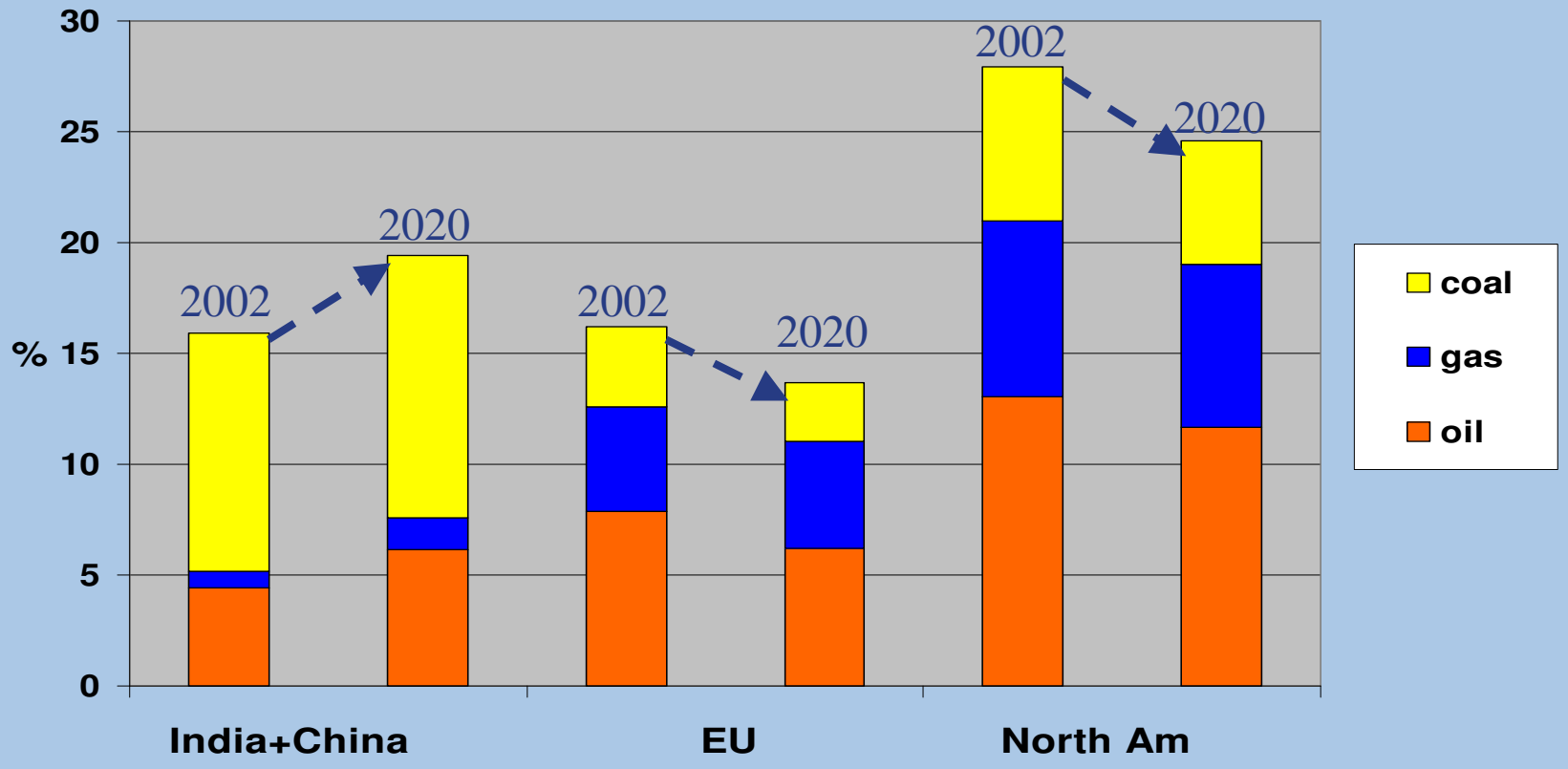
- Population grows (~1%/yr)
- More people seek access to modern energy and electricity
  - Still 2.5 bln people rely on traditional biomass for cooking and heating
  - Still 1.6 bln people without electricity
- Economy and life style develop towards 'western' production and consumption standards
- Even in highly developed countries more power applications like air conditioning

Global Energy Demand
Forecast IEA WEO 2004

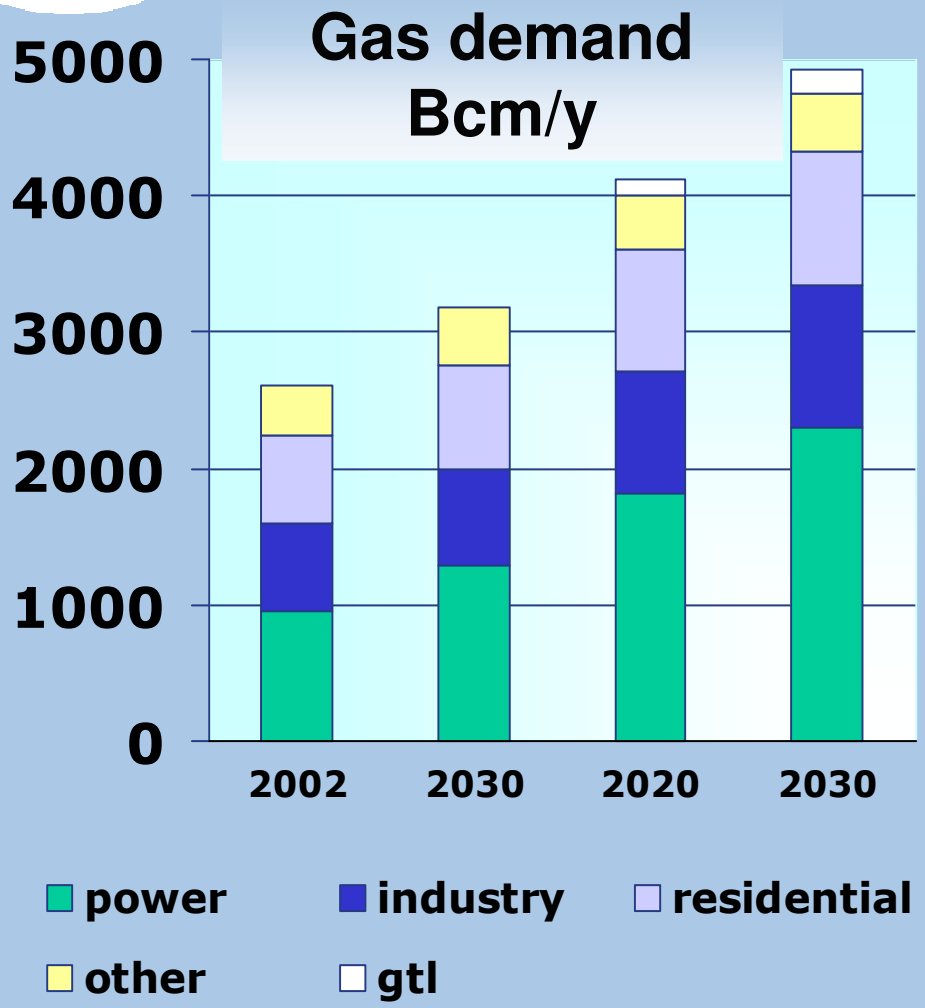


Emerging Markets Put Their Mark On Hydrocarbons Demand

% of Global Hydrocarbons Demand for each region
& Market Share oil/gas/coal per Region

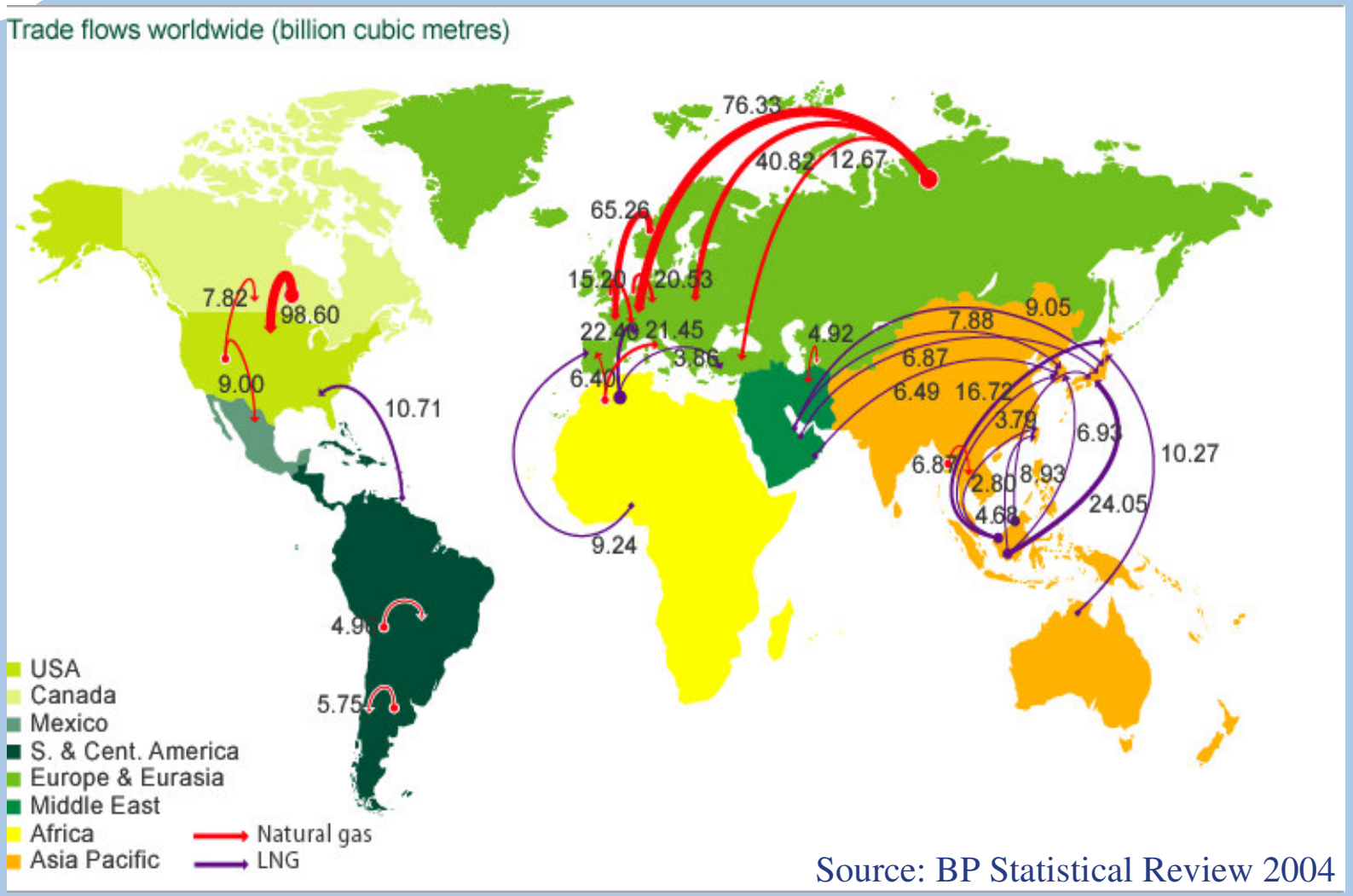


Gas demand forecast per market sector



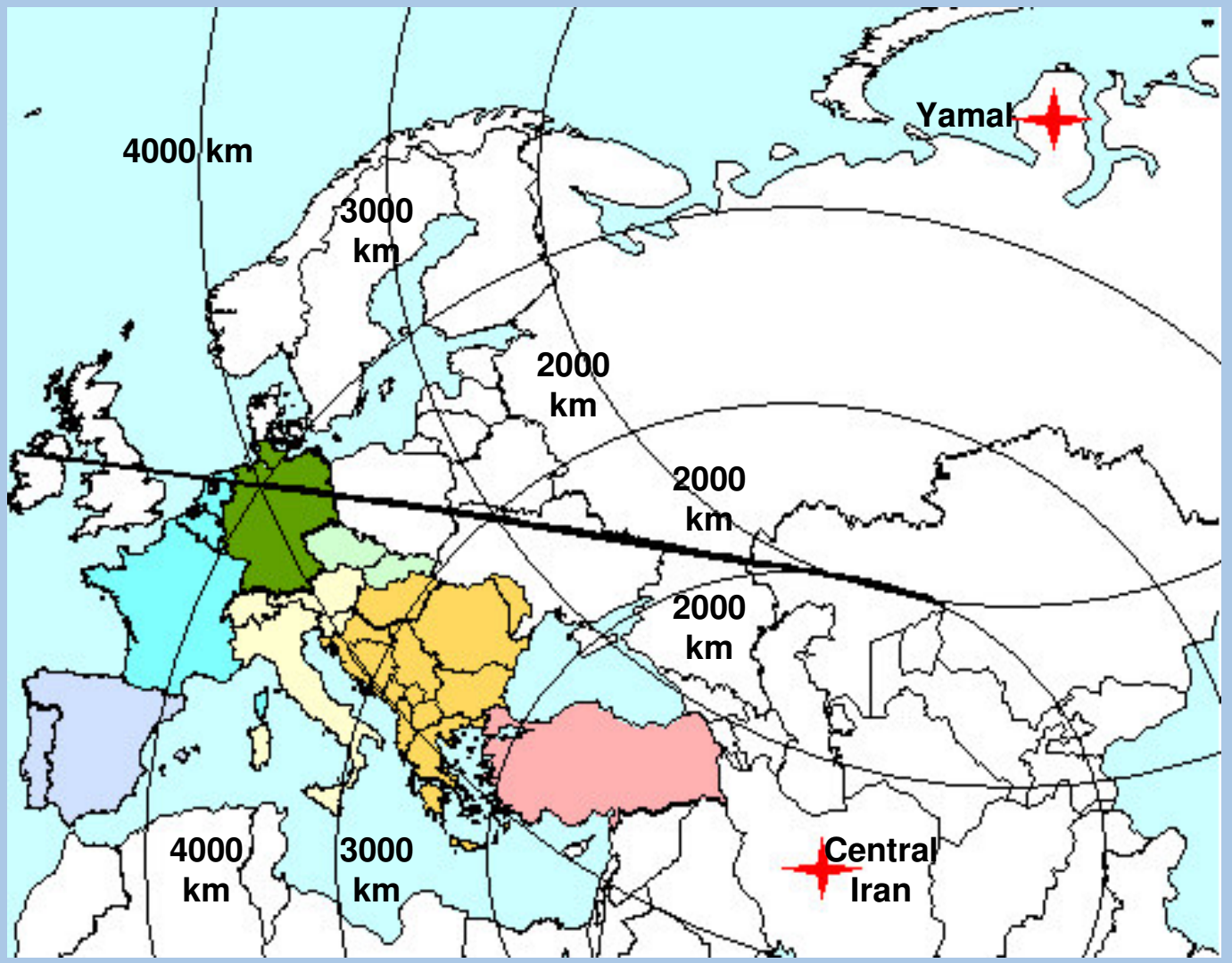
- Power is expected to lead the increase in gas demand: from 36% in 2002 to 47% share of gasmarket in 2030
- High gasprice could shift generators' choice for new powerplants to (clean)coal, nuclear

Major natural gas trade movements



Source: BP Statistical Review 2004

How to diversify further in Europe ?!



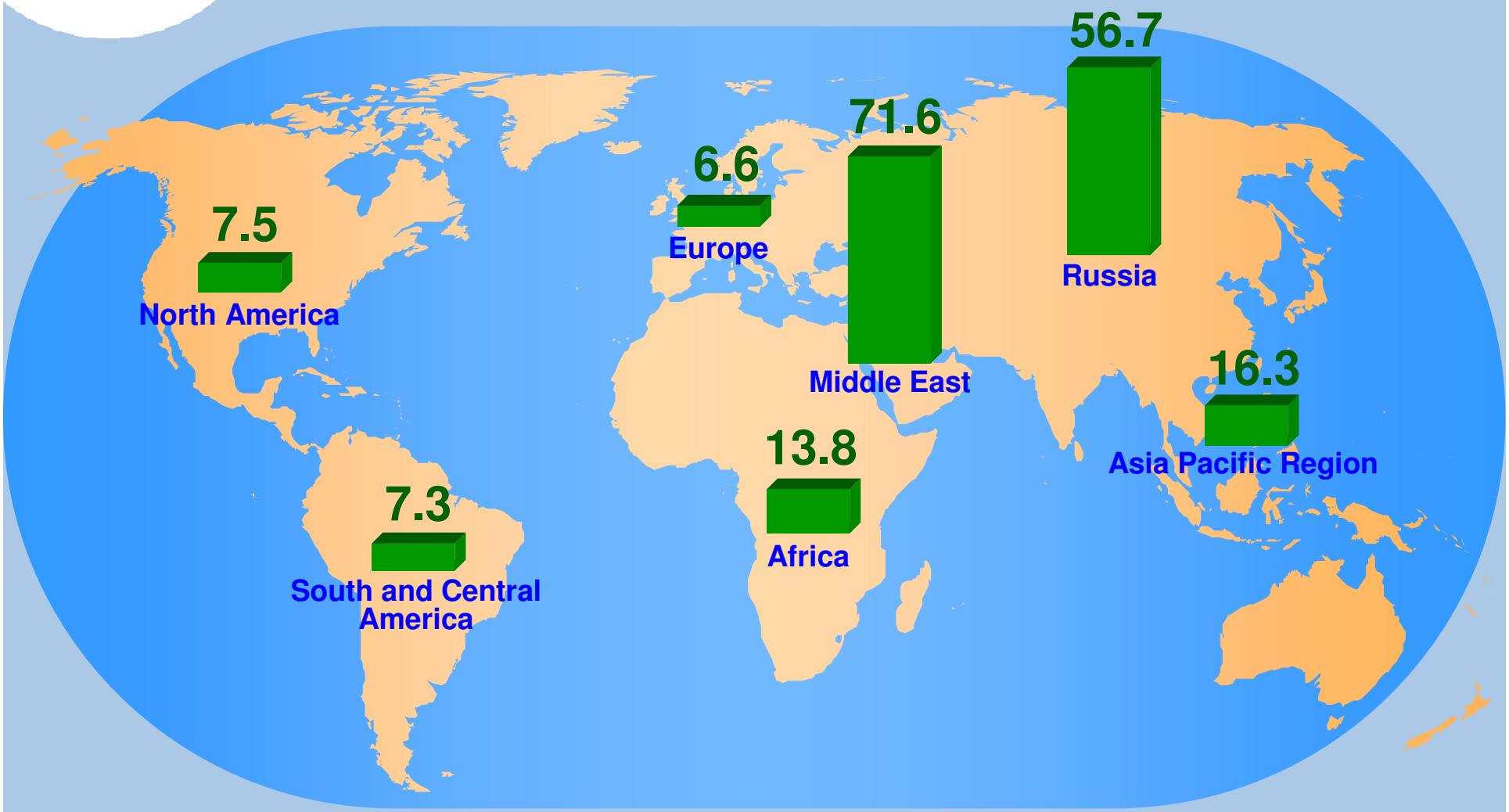
Transport by pipeline: some figures

- **Pipelines**

  Long distances to cover

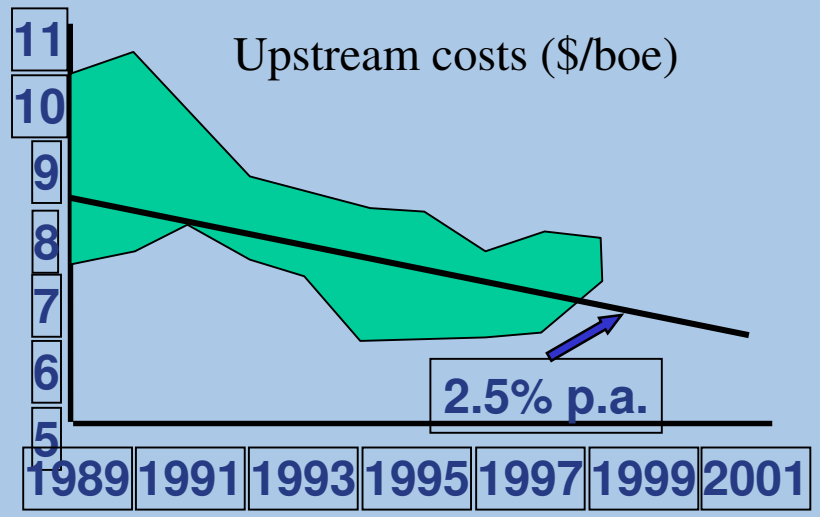
  - **Iran-India 2775 km, investment > $4b**
  - **Alaska-Chicago >5000 km**
  - **Russian gas fields-W.EU up to 4000 km**

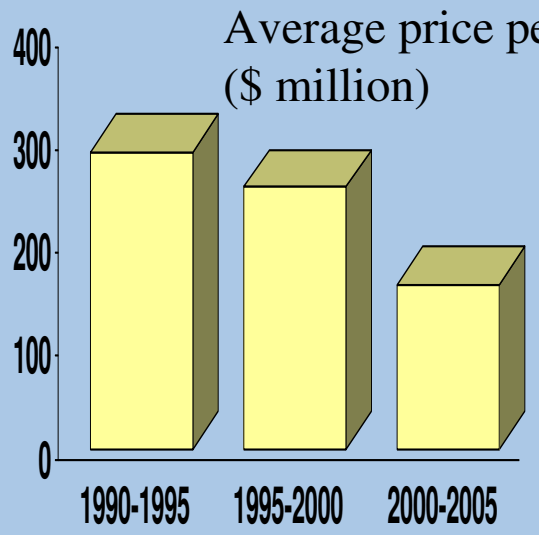
Proven world gas reserves
180 trillion cm
R/P ratio ~60 years

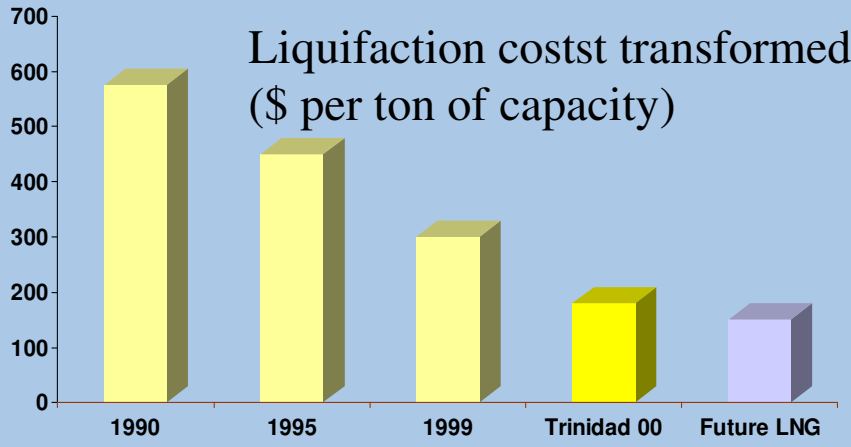


Data: IEA WEO 2004 / Cedigaz/BP

Costs in the LNG chain

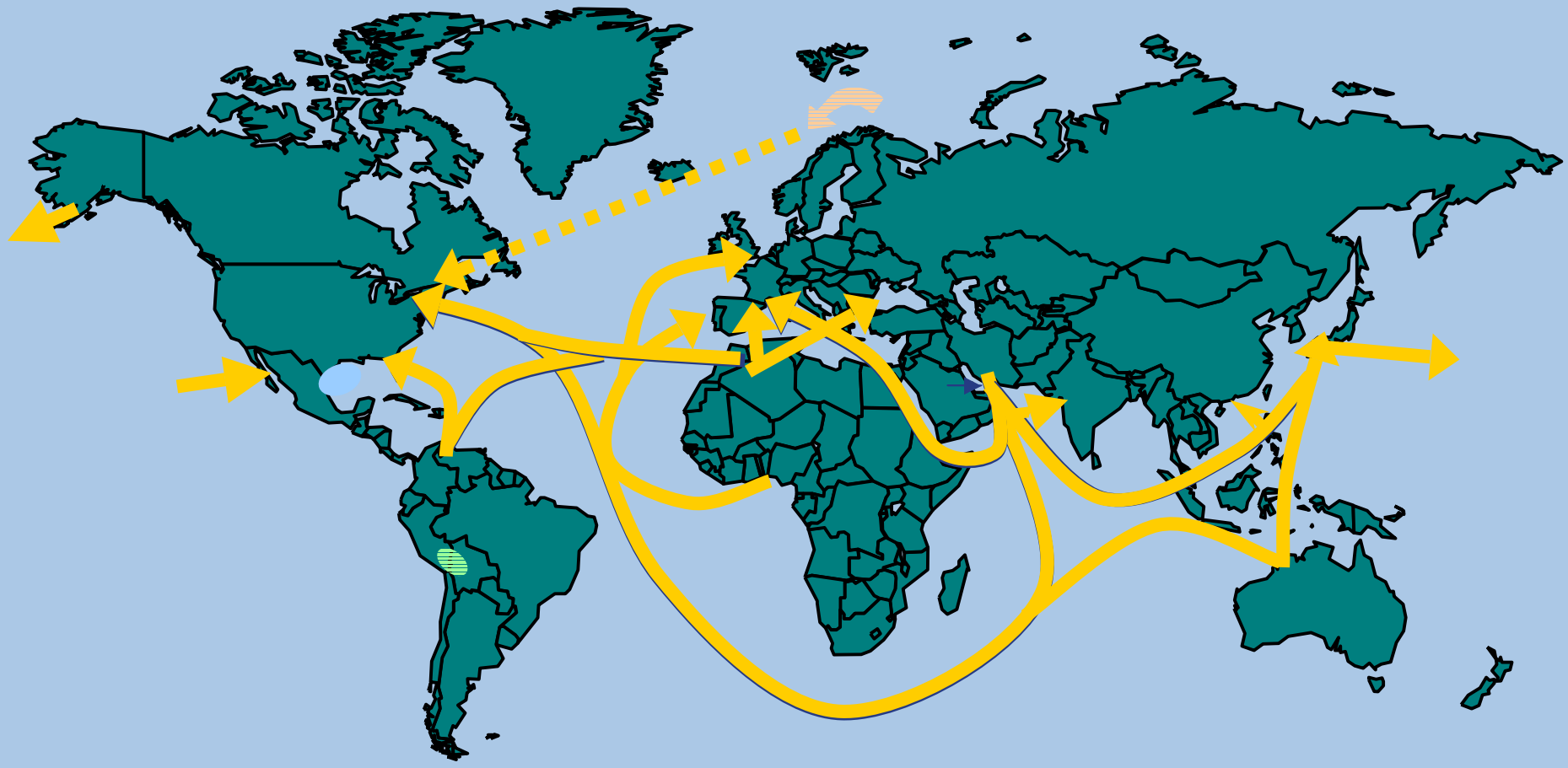






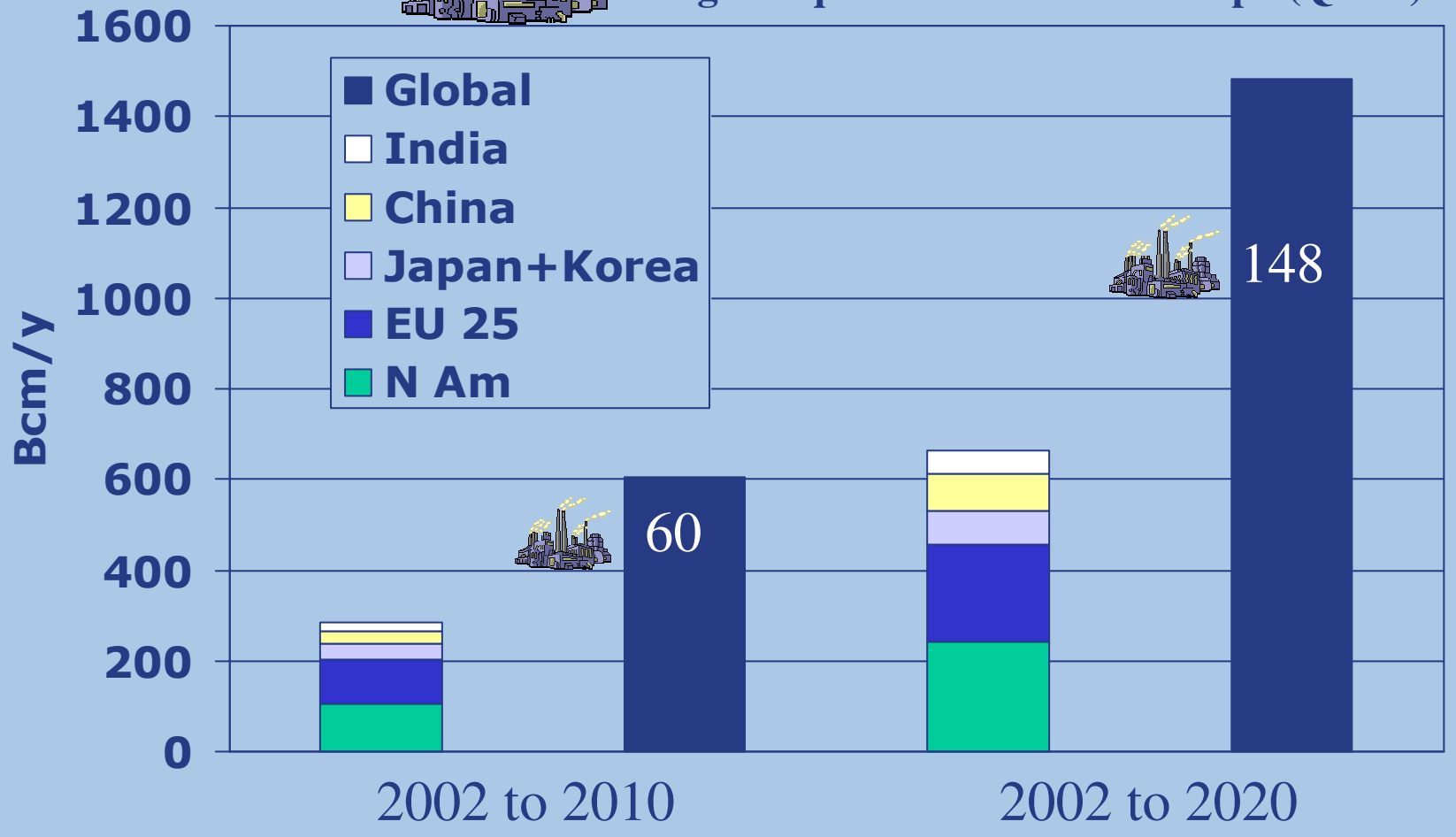
From a presentation by BP
(february 2003)

International LNG trade: connecting markets



Incremental Global Gas Demand from 2002 to 2010, 2020

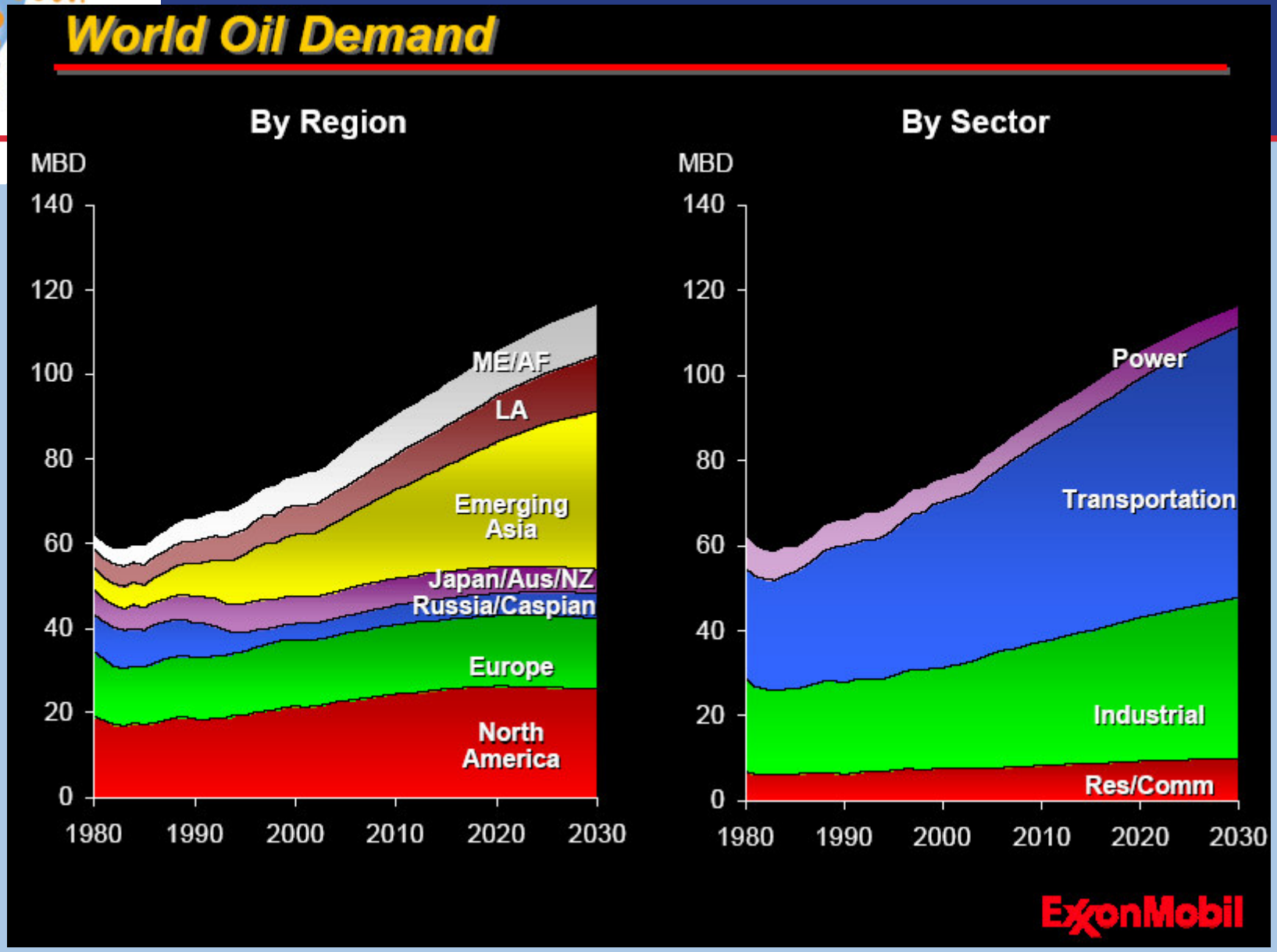
largest liquefaction train: 7.8 mtpa (Qatar)



So for Many Decades to Come…

- Enough natural gas, oil, coal, but
- Regions of demand are NOT the regions with reserves, so
- A lot of long distance transportation and transit,
- Through many countries or narrow sea straits
- And production areas are more and more difficult and costly

World Oil Demand



Some statistics (approximate)

- 700 mln cars in the world
  - annual production capacity of cars 60 mln
  - in highest developed economies 0,5 car per capita
- 4 mln NGV's
  - 1,3 mln in Argentina, 0,9 mln in Brazil
  - 475.000 in Pakistan
  - 220.000 in India including 120.000 three-wheelers
  - 400.000+ in Italy
  - 97.000 in China (half of this buses)
  - 350 in The Netherlands (also 8 NG-boats)
  - *Large NGV countries employ 1 refuelling station per 1000 cars*
  - *Annually 10 bcm is consumed by NGV's*

Why should we promote CNG ?

Public interest:

- **Environmental reasons**
  - **Less polutants emitted**
  - **Less engine noise**
- **Diversification of automotive fuels (EU: 10% gas in 2020)**

Advantages for the gas industry:

- **New market**
- **Better use of gas infrastructure**
- **Image (promotion for natural gas in general)**

Chicken and egg?

- No refuelling stations - no long distance travel by NGV
- No NGV's – no investments in refuelling stations

- So: start with local traffic: urban buses, municipal fleet – 1 refuelling station will apply
- Build up NGV market from these kernels to regional/national/EU-wide level
- Important for public confidnece in future of NGV's: guarantees from government for taxes on cars and duties on fuel

Chicken and egg? Serve a 'German' ommelette!

- In EU, Germany most visibly advocates NGV's:
  - guaranteed reduced duty on natural gas as an automotive fuel until 2020
  - expansion of refuelling stations network with 10 to 15 /month (1200 in 2007)
  - subsidies from local gas companies (even €1500 to 2500, sometimes as free fuel)

Blue Corridor

Blue Corridor

- 10.500 trucks and buses
- Conversion from diesel to CNG, LNG, dual fuel
- Goals: reduction of emissions (health threatening particulates), fuel diversification
- State of art: final report to UN's economic commission for Europe; project not executed yet

US-Canadian trucks on LNG

- "Clean Air corridor": Westport's HDPI Natural Gas Engines mounted into 5 Volvo trucks for transport Ontario – Michigan
- 500 miles range Project just started
- 4-year of good experience with 13 waste trucks in San Francisco, same technology
- Technology: small amount of diesel to provide ignition, bulk fuel is LNG

Situation in a few EU countries

Italy : already a mature market, but developing further

- State promotion of alternative energies since first oil crisis
- present number of fuelling stations : 471
- present number of NGV's: 434'000

Germany : in active development

- State support : fuel tax reduction until 31.12.2020
- Active promotion by the gas industry
- Present number of CNG stations: 565 objective 2007: 1'400
- Present number of NGV's: 27'000 objective 2007: 500'000

France : in active development

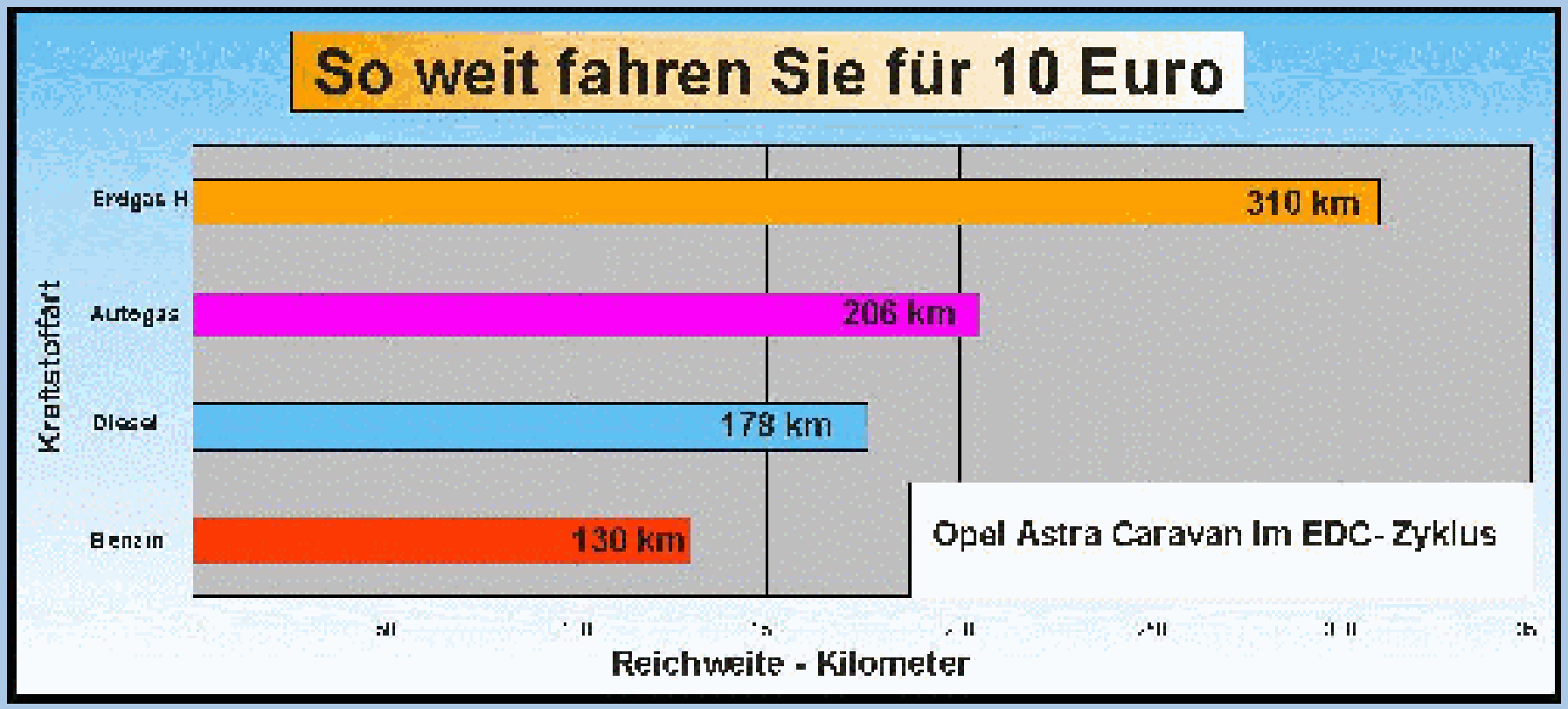
- Concentration on public transport and large fleets
- 7200 cars and 1400 buses
- New program: individual CNG fuelling stations at home

Austria : starting

- State support : fuel tax reduction until 31.12.2020
- 400 vehicles and 24 CNG stations

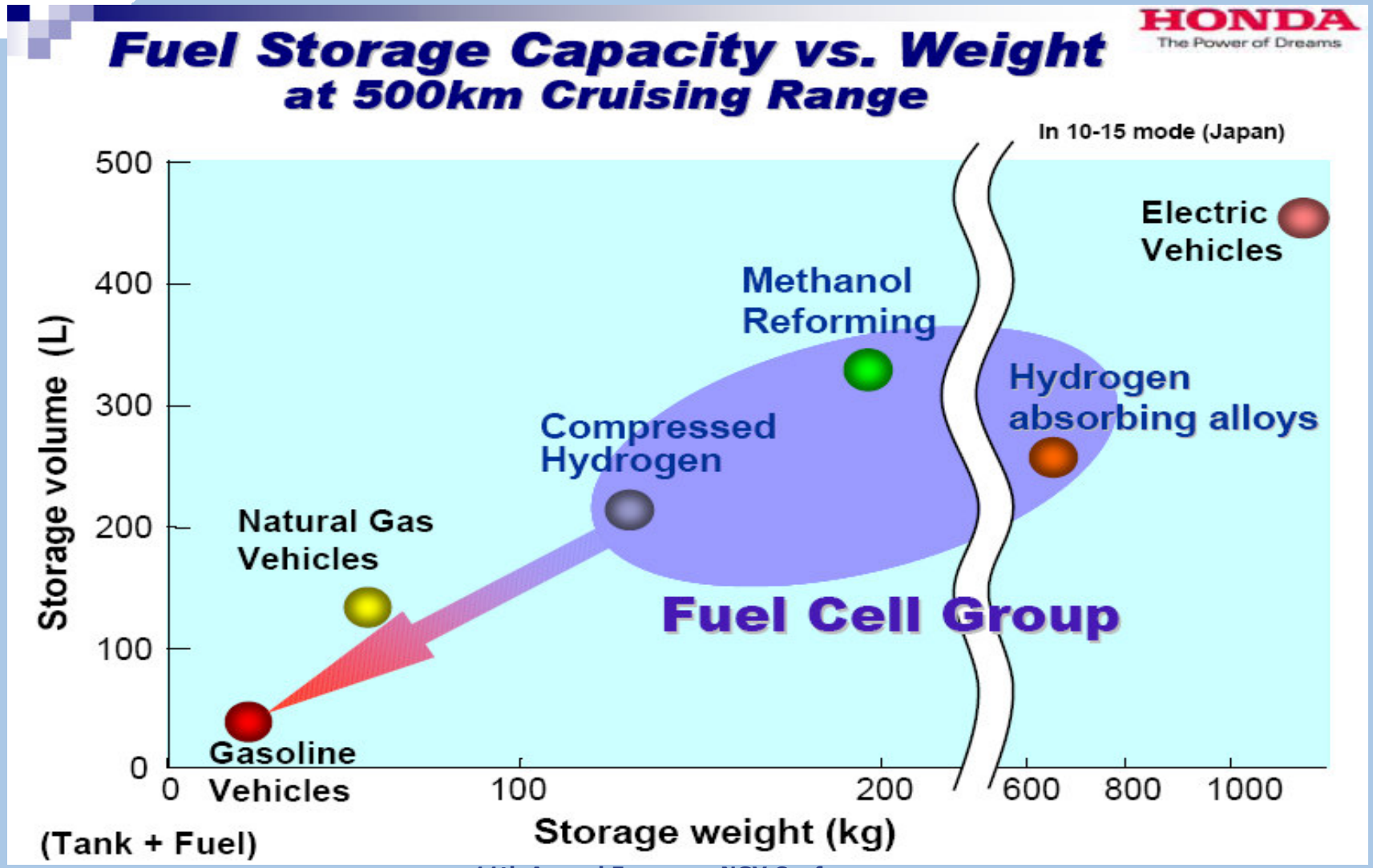
Source: GAZNAT

How far can you get with € 10

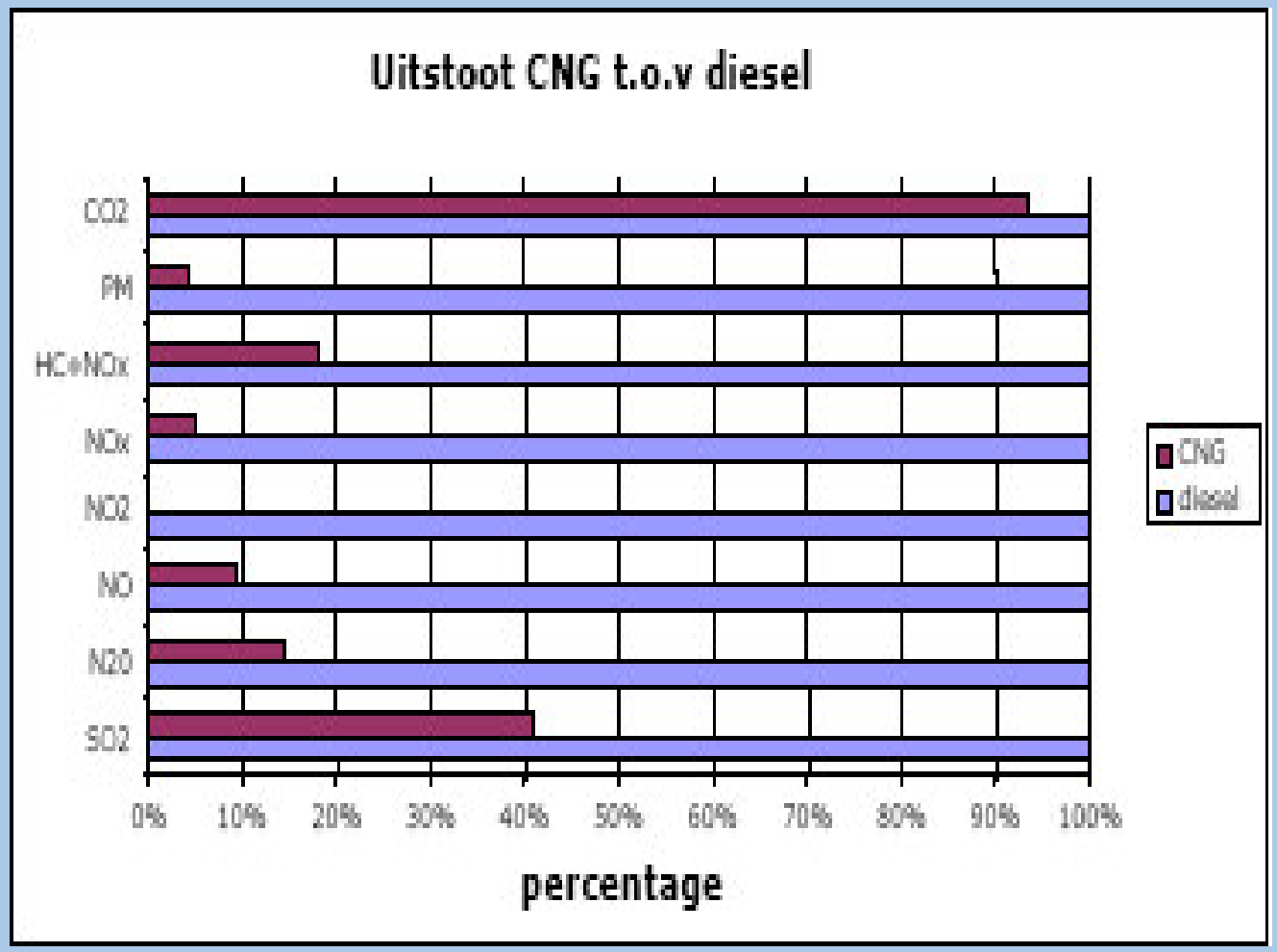


Source: Energie Waldeck-Frankenberg GmbH

Storing gas in your vehicle takes up volume and payload capacity

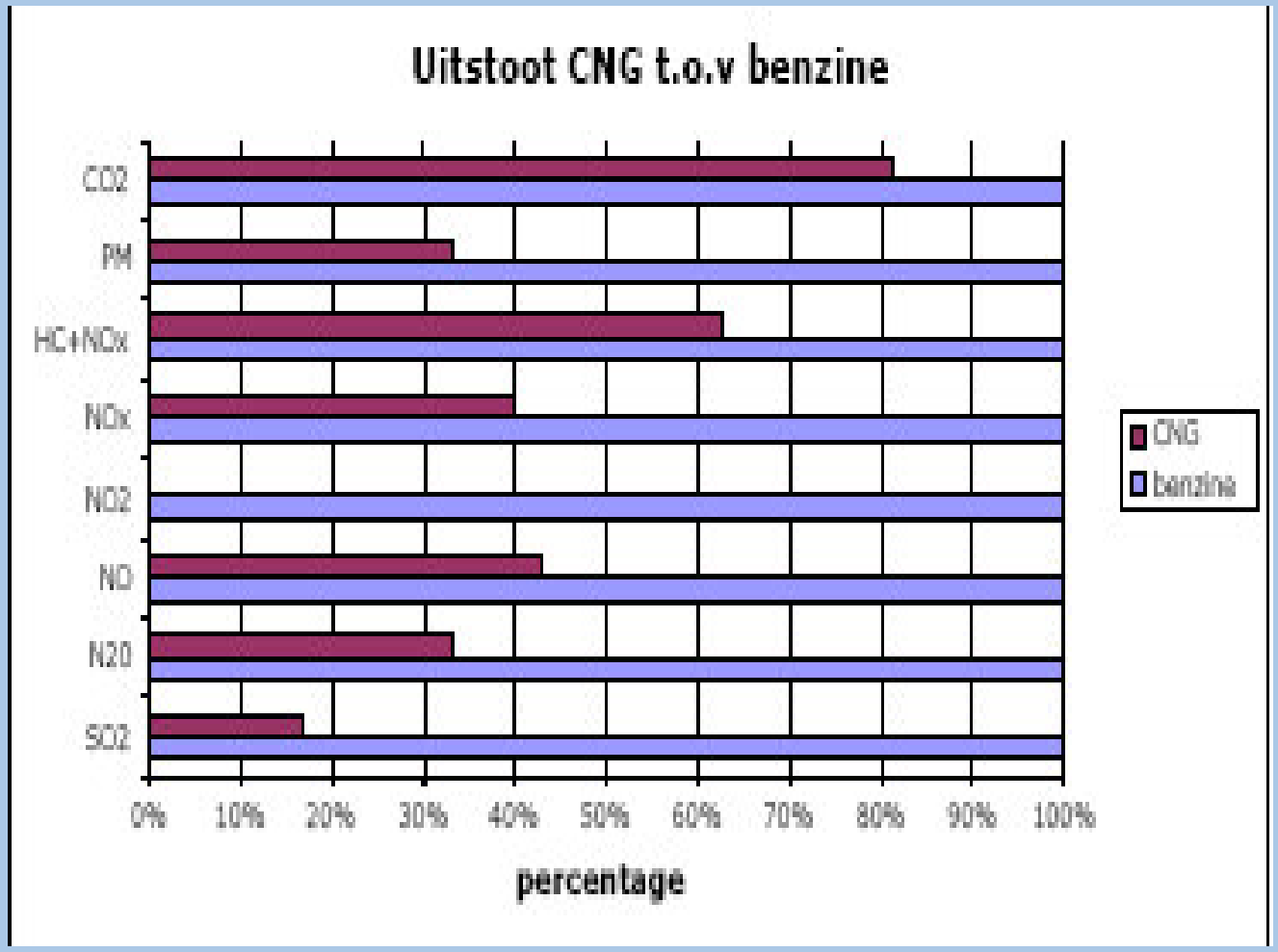


How clean is CNG versus diesel



Source: TNO report 03.OR.VM.1PHE, 24 dec. 2003

And how clean versus gasoline

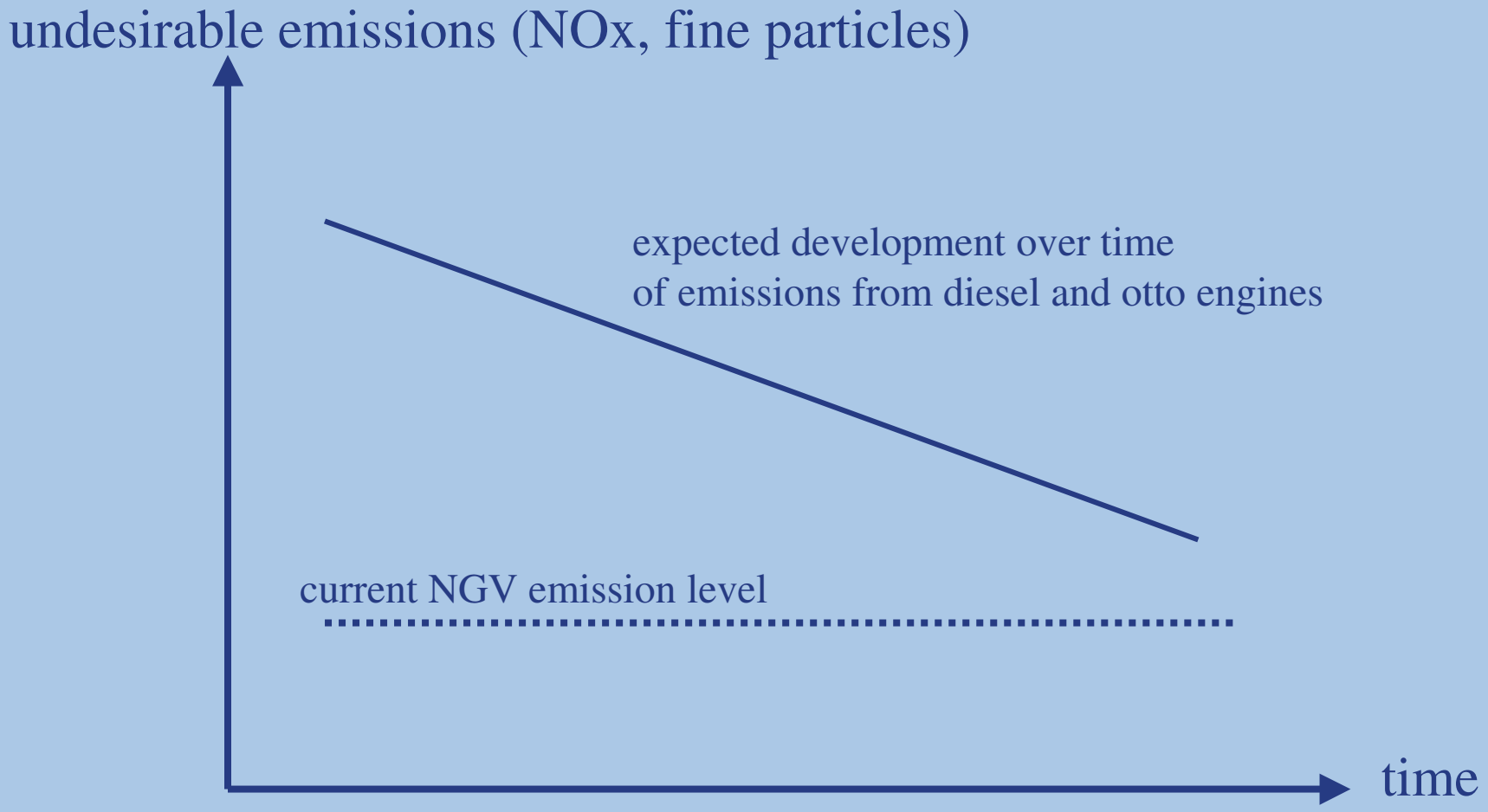


Source: TNO report 03.OR.VM.1PHE, 24 dec. 2003

Competition for clean tailpipes

- **New combustion technology: Toyota's Clean Power Diesel claims to beat EU 4 by 92% for particles and 56% for NOx**
- **Particle filters (soot filters) are subsidised by governments (NL €600) and are already standard in new top class diesel passenger cars**
- **Treatment of exhaust gases reduces NOx and particles from heavy diesel trucks, for instance Mercedes Blue Tec complies with Euro 4 to 5 norm**

Policy makers dilemma



Experience with Gas-on-the-Road can pave ways

- For green gas (bio gas) in vehicles
  - same technology as natural gas
- For fuel cells to replace internal combustion engines
  - same storage technology but different engine
- For hydrogen
  - fuel cell but different storage technology (very high pressure or metal hydride)

Natural Gas Bus in Zigong

Natural Gas Bus in Zigong

There is an abundance of natural gas in this part of Sichuan. All of the local buses in Zigong use natural gas to fuel. The bags of rubber on the top of the bus contain the gas. The sheer weight of the bag forces the gas into the engine. From time to time the buses stop at a station to get a fresh supply of gas. Certain parts of China have natural gas but China doesn't have much in the way of pipelines to distribute the gas to other parts of China.

Challenges to be met for a rapid NGV introduction:

A short list:

- **Realise well positioned refuelling stations,**
- **Communicate the advantages of NGV's to the autorities and the public,**
- **Make a long term deal with the authorities about taxing policies etc. regarding NGV's**
- **Win the hearts of the car buyers,**

And a growing marketshare will be the result!

Natural Gas Bus in L.A.

Los Angeles Metropolitan Transportation Authority's CNG-fueled "Metro Liner" buses are powered by the low-emissions Cummins Westport 320-hp L-Gas Plus engine.

H2 fuel cell generator "the Core"

Design by 'intelligent energy', UK
1 kW electricity power unit for all kind of appplications

The Core as 'engine' for ENV (emission neutral vehicle)

Launched March 2005, for urban use
1 kW fuel cell, motor 6 kW peak with batteries
Range 160 km, top speed 80 kph, completely silent!

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Thank you, for your attention

See you in Amsterdam!

23rd World Gas Conference and Exhibition

June 5 – 9 2006