

















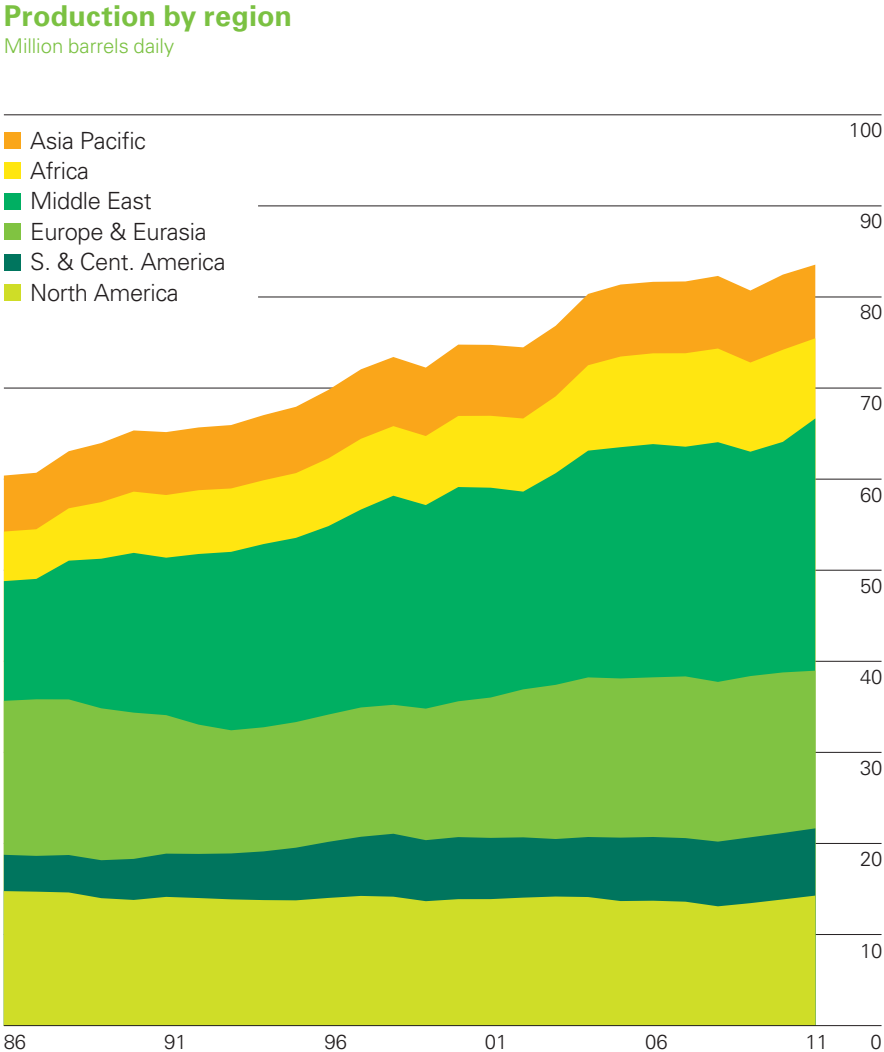








# Middle East: 30% of World Production



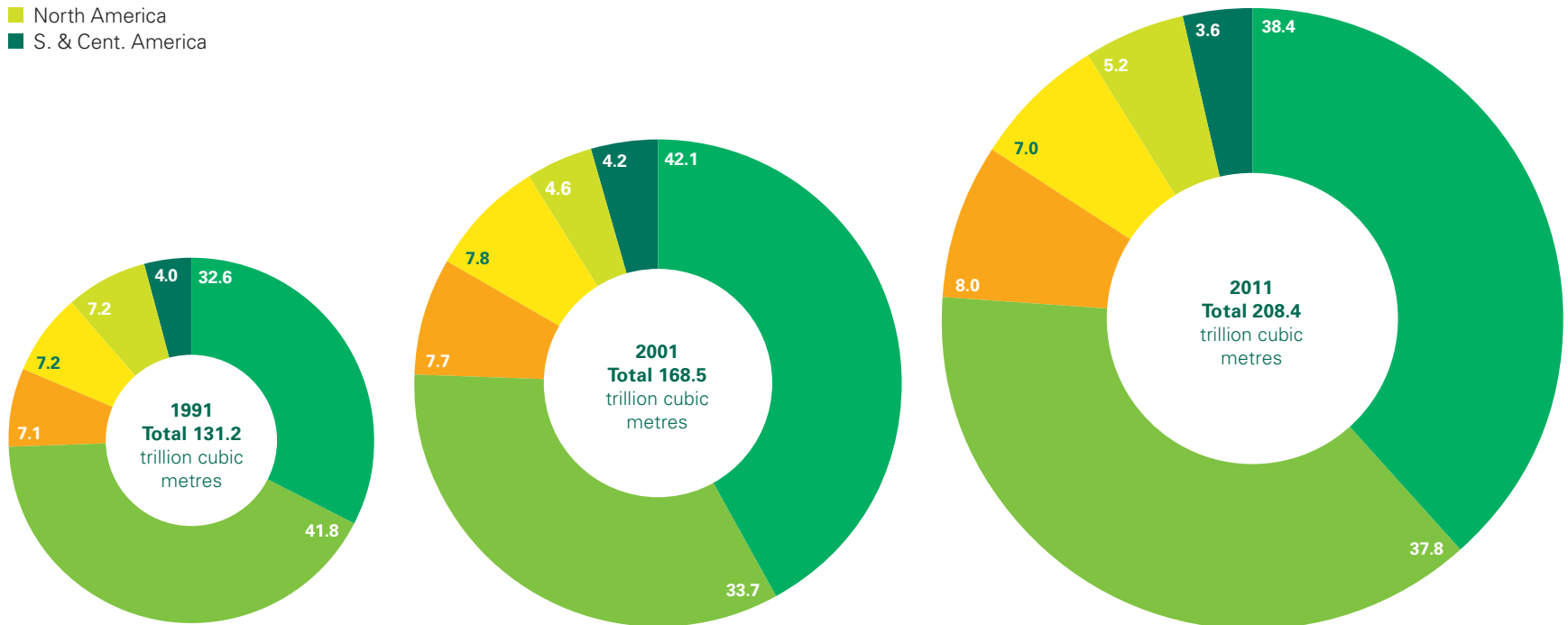
Courtesy of BP Statistical Review of World Energy June 2012. Used with permission.

# Middle East: Over Half of Proved Reserves

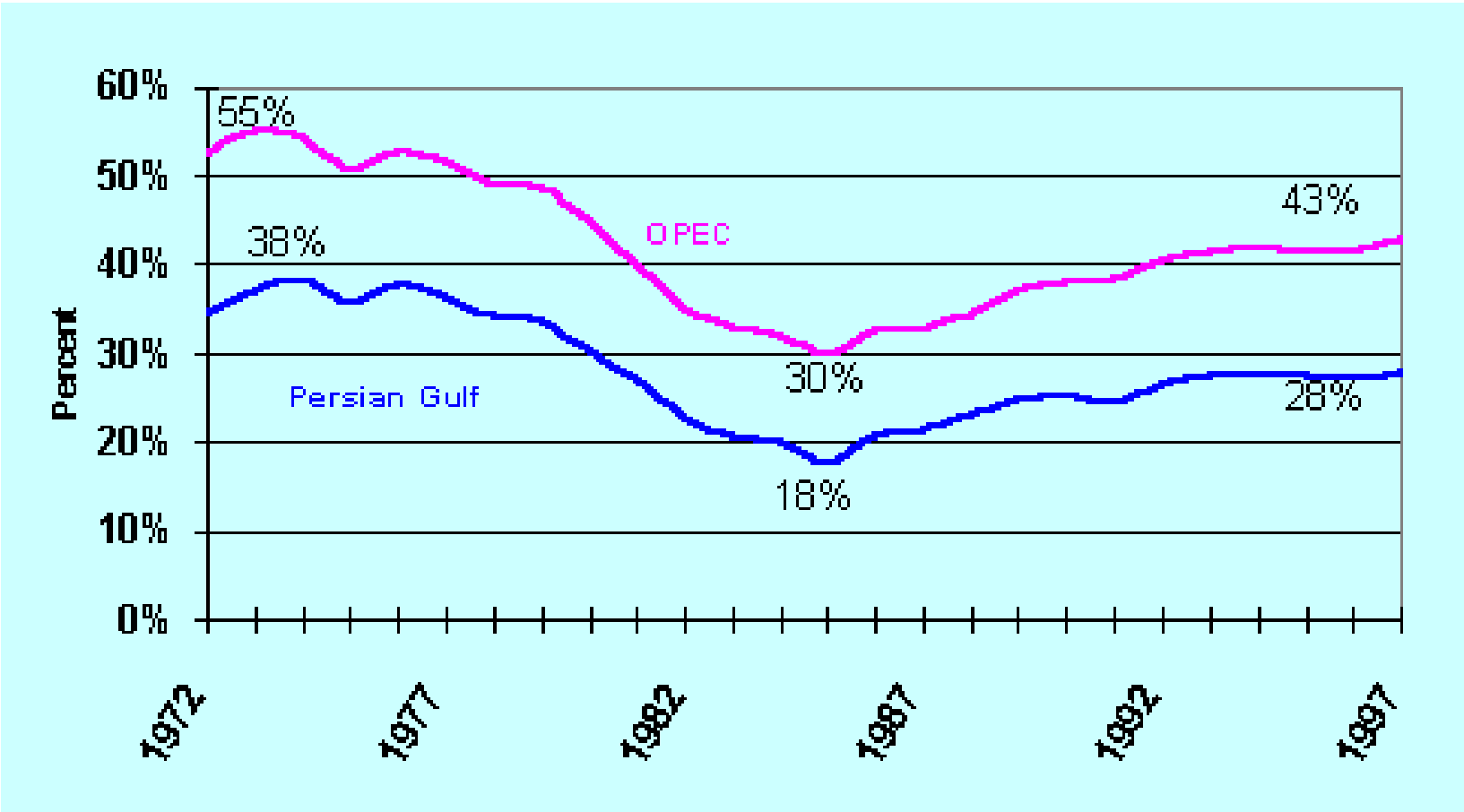
## Distribution of proved reserves in 1991, 2001 and 2011

Percentage

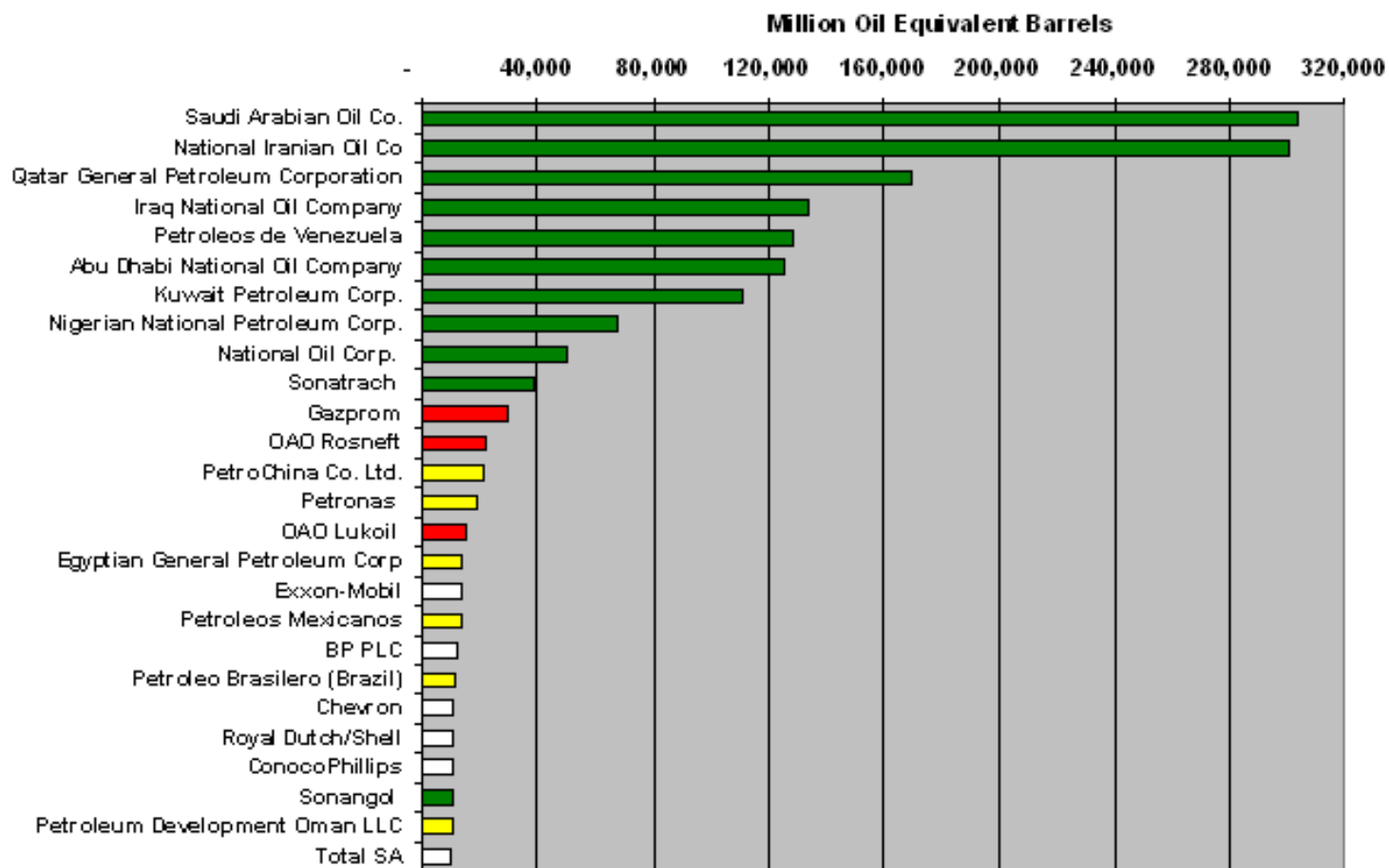
- Middle East
- Europe & Eurasia
- Asia Pacific
- Africa
- North America
- S. & Cent. America



# OPEC's Share of World Output Has Varied



# The Big Oil/Gas Companies are National



Companies ranked in order of 2007 worldwide oil equivalent oil/gas reserves as reported in "OGJ 200/100", *Oil & Gas Journal*, September 15, 2008.

# Basic Market Facts: Coal

- Reserves, production concentrated in a few leading nations in several regions
- Mainly moved by rail and ship; high weight-to-value ratio limits trade
- Markets tend to be mainly national; US has abundant supplies, relatively low prices, regional differences
- Long-term contracts dominate; spot and (since 2001) futures markets less important
- **Huge** recent increase in Chinese use of coal



# Production, Reserves Fairly Concentrated

|               | <u>2010, Pct. of World</u> |          |
|---------------|----------------------------|----------|
|               | Output                     | Reserves |
| China         | 48.3                       | 13.3     |
| United States | 14.8                       | 27.6     |
| Australia     | 6.3                        | 8.9      |
| India         | 5.8                        | 7.0      |
| Russia        | 4.0                        | 18.2     |
| Total         | 79.2                       | 75.0     |
|               |                            |          |

# Coal Exports: 15% of Production

| Leading Exporters, 2010 |       |
|-------------------------|-------|
| Country                 | Share |
| Australia               | 27.1  |
| Indonesia               | 26.1  |
| Russia                  | 10.1  |
| U.S.                    | 6.9   |

| Leading Importers, 2010 |       |
|-------------------------|-------|
| Country                 | Share |
| Japan                   | 17.5  |
| China                   | 16.6  |
| S. Korea                | 10.7  |
| India                   | 8.6   |

# Prices Differ; Not a Global Market

| US dollars per tonne | Northwest Europe market price | US Central Appalachian coal spot price index | Japan coking coal import cif price | Japan steam coal import cif price |
|----------------------|-------------------------------|--|------------------------------------|-----------------------------------|
| 1990                 | 43.48                         | 31.59  | 60.54                              | 50.81                             |
| 1991                 | 42.80                         | 29.01  | 60.45                              | 50.30                             |
| 1992                 | 38.53                         | 28.53  | 57.82                              | 48.45                             |
| 1993                 | 33.68                         | 29.85  | 55.26                              | 45.71                             |
| 1994                 | 37.18                         | 31.72  | 51.77                              | 43.66                             |
| 1995                 | 44.50                         | 27.01  | 54.47                              | 47.58                             |
| 1996                 | 41.25                         | 29.86  | 56.68                              | 49.54                             |
| 1997                 | 38.92                         | 29.76  | 55.51                              | 45.53                             |
| 1998                 | 32.00                         | 31.00  | 50.76                              | 40.51                             |
| 1999                 | 28.79                         | 31.29  | 42.83                              | 35.74                             |
| 2000                 | 35.99                         | 29.90  | 39.69                              | 34.58                             |
| 2001                 | 39.03                         | 50.15  | 41.33                              | 37.96                             |
| 2002                 | 31.65                         | 33.20  | 42.01                              | 36.90                             |
| 2003                 | 43.60                         | 38.52  | 41.57                              | 34.74                             |
| 2004                 | 72.08                         | 64.90  | 60.96                              | 51.34                             |
| 2005                 | 60.54                         | 70.12  | 89.33                              | 62.91                             |
| 2006                 | 64.11                         | 62.96  | 93.46                              | 63.04                             |
| 2007                 | 88.79                         | 51.16  | 88.24                              | 69.86                             |
| 2008                 | 147.67                        | 118.79                                       | 179.03                             | 122.81                            |
| 2009                 | 70.66                         | 68.08  | 167.82                             | 110.11                            |
| 2010                 | 92.50                         | 71.63  | 158.95                             | 105.19                            |

\*Source: McCloskey Coal Information Service. Prices for 1990-2000 are the average of the monthly market, 2001-2010 the average of weekly prices.

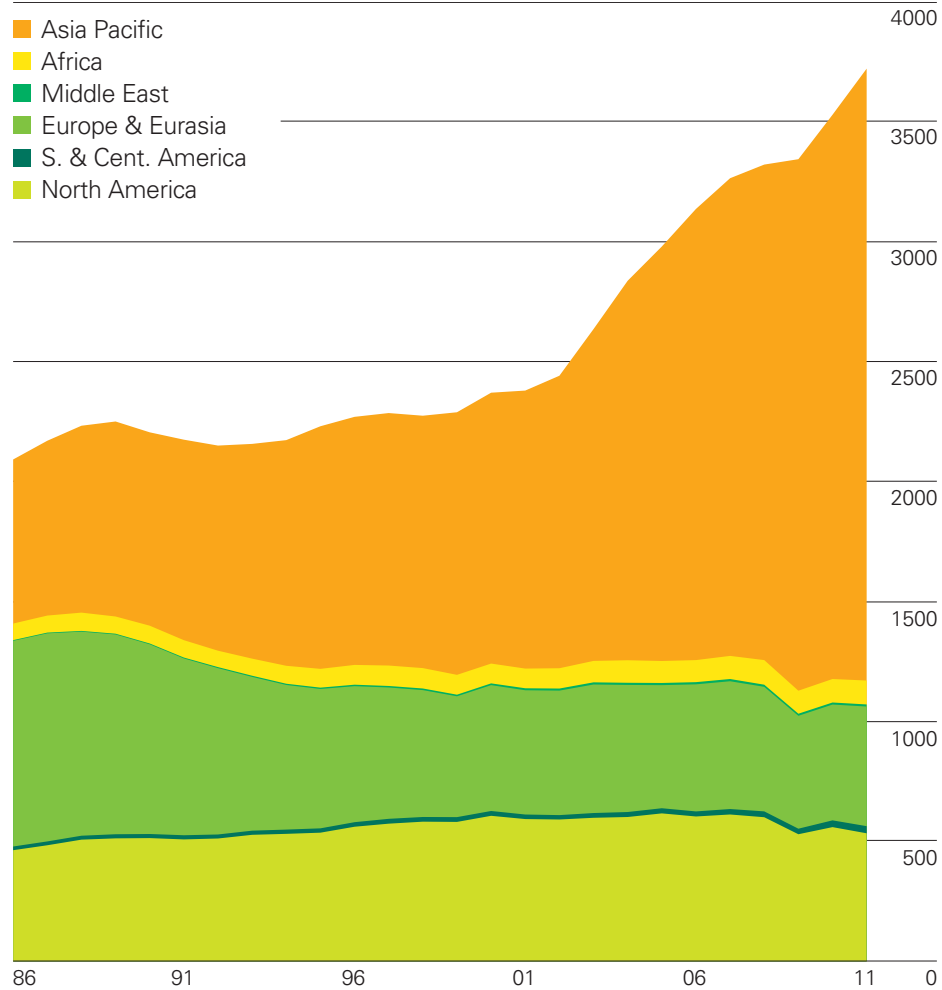
\*\*Source: Platts. Prices are for CAPP 12,500Btu, 1.2 SO<sub>2</sub> coal, fob. Prices for 1990-2000 are by coal price publication date, 2001-2010 by coal price assessment date.

Note: CAPP = Central Appalachian; cif = cost + insurance + freight (average prices); fob = free on board.

# Large Increase in Chinese Coal Use

## Consumption by region

Million tonnes oil equivalent



Courtesy of BP Statistical Review of World Energy June 2012. Used with permission.

# US: Production Concentrated, Usage Less So

## Leading States' % Shares of Total US 2007 Coal

|               | <u>Production</u> |              | <u>Consumption*</u> |
|---------------|-------------------|--------------|---------------------|
| Wyoming       | 39.6              | Texas        | 9.8                 |
| West Virginia | 13.4              | Ohio         | 6.6                 |
| Kentucky      | 10.1              | Indiana      | 5.8                 |
| Pennsylvania  | 5.7               | Illinois     | 5.4                 |
| Montana       | 3.8               | Pennsylvania | 5.3                 |
| Total         | 72.5              | Total        | 33.0                |

\*For electric power only, 93.3% of total consumption

# Basic Market Facts: Uranium

- Market for uranium is global; economically recoverable reserves fairly dispersed:
- Low prices caused mine closures through the mid-90s
- Subsequent tripling of prices then through 2010 induced new mining activity
- No organized market; Long-term contracts dominate; short-term volatility on (thin) spot market

Known Recoverable Resources\* of Uranium 2007

|              | tonnes U  | percentage of world |
|--------------|-----------|---------------------|
| Australia    | 1,243,000 | 23%                 |
| Kazakhstan   | 817,000   | 15%                 |
| Russia       | 546,000   | 10%                 |
| South Africa | 435,000   | 8%                  |
| Canada       | 423,000   | 8%                  |
| USA          | 342,000   | 6%                  |
| Brazil       | 278,000   | 5%                  |
| Namibia      | 275,000   | 5%                  |
| Niger        | 274,000   | 5%                  |
| Ukraine      | 200,000   | 4%                  |
| Jordan       | 112,000   | 2%                  |
| Uzbekistan   | 111,000   | 2%                  |
| India        | 73,000    | 1%                  |
| China        | 68,000    | 1%                  |
| Mongolia     | 62,000    | 1%                  |
| other        | 210,000   | 4%                  |
| World total  | 5,469,000 |                     |

Courtesy of World Nuclear Association. Used with permission.

# Global Market, Production Fairly Concentrated

- EIA: 92% of uranium delivered in 2010 was imported:
  - 44% from Australia and Canada
  - 33% from Kazakhstan, Russia, & Uzbekistan
- Production of  $U_3O_8$  is more concentrated than reserves:

| Country       | Share       |
|---------------|-------------|
| Kazakhstan    | 33.2        |
| Canada        | 18.2        |
| Australia     | 11.0        |
| Namibia       | 8.4         |
| Niger         | 7.8         |
| Russia        | 6.6         |
| Uzbekistan    | 4.5         |
| U.S.A.        | 3.1         |
| <b>Total:</b> | <b>92.8</b> |

# Basic Market Facts: Natural Gas

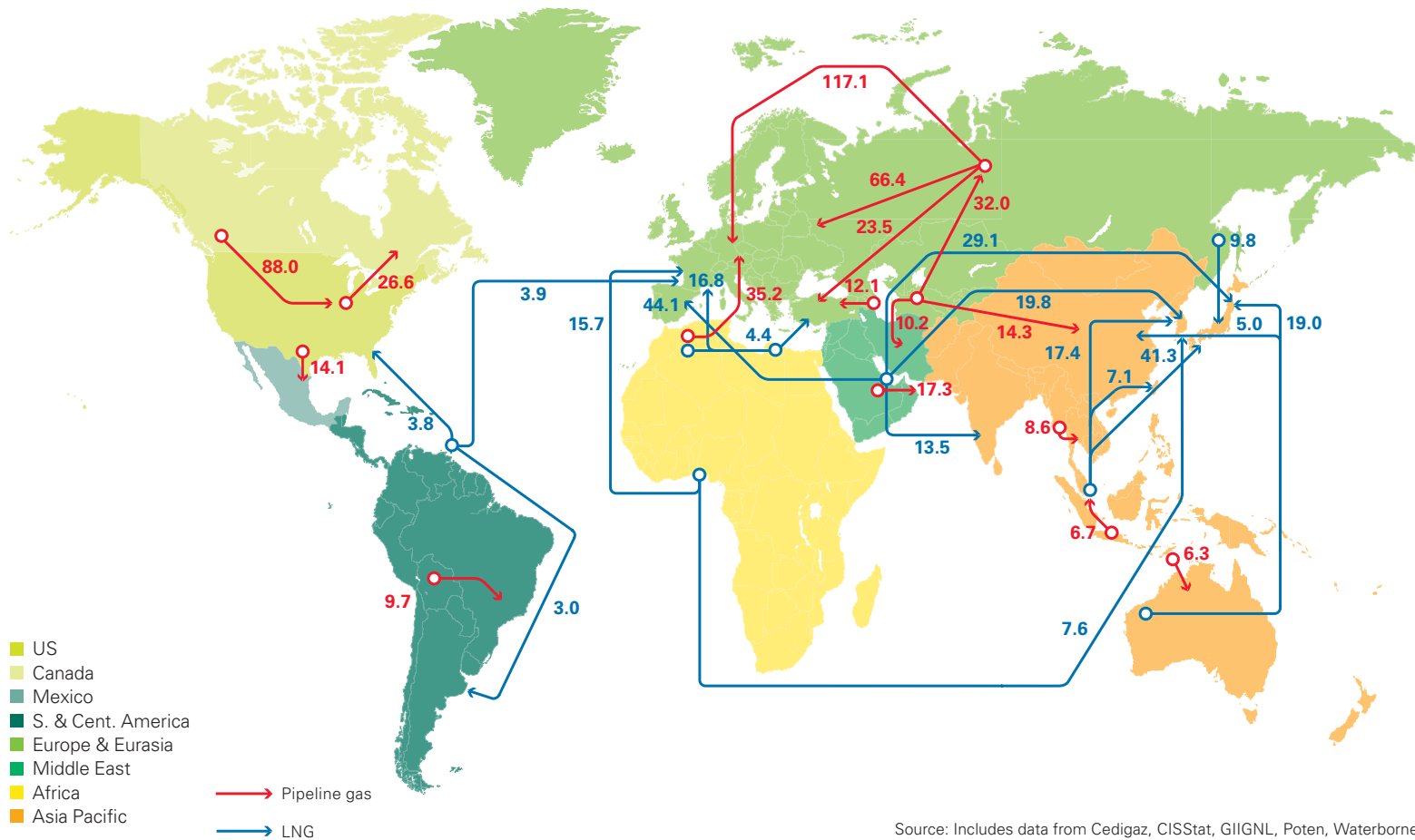
- “Natural” distinguishes from gas manufactured from coal, in US since 1816 (Baltimore)
- Gas can be moved by pipeline, but must be liquified (expensive) to go by ship (LNG); market is not global
- US supplies: 84% domestic, 12% Canadian
- US prices < EU (Russian gas), << Asia (LNG).
- Gas tends to occur with oil; historically gas reserves also concentrated in unstable regions, **BUT**
- **Next class: recent advances in hydraulic fracturing (fracking) make shale gas cheap; lots in the US**
  - If exploited, serious market & CO<sub>2</sub> impacts,
  - but also serious environmental issues.



# Gas Trade: 31% of Use (69% via pipelines)

## Major trade movements 2011

Trade flows worldwide (billion cubic metres)

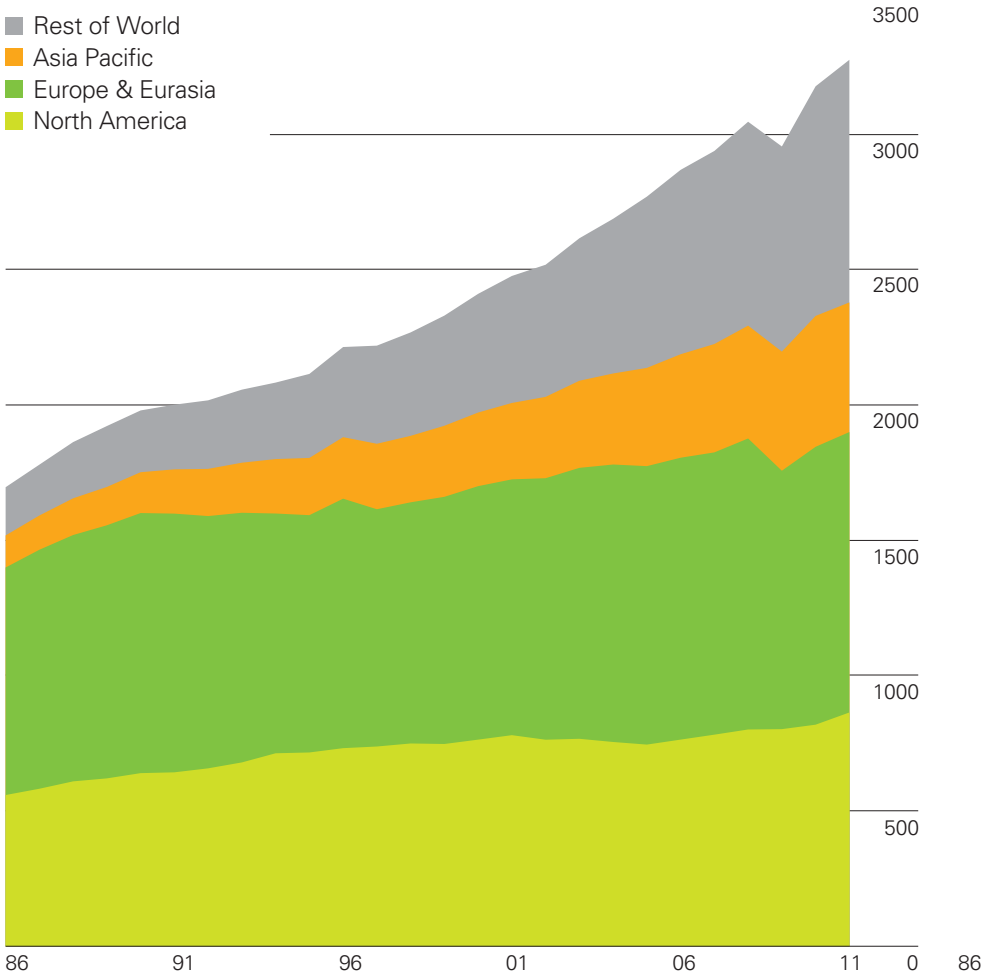


Source: Includes data from Cedigaz, CISStat, GIIGNL, Poten, Waterborne.

# Output: Russia 15%, Middle East 14%

## Production by region

Billion cubic metres



Courtesy of BP Statistical Review of World Energy June 2012. Used with permission.

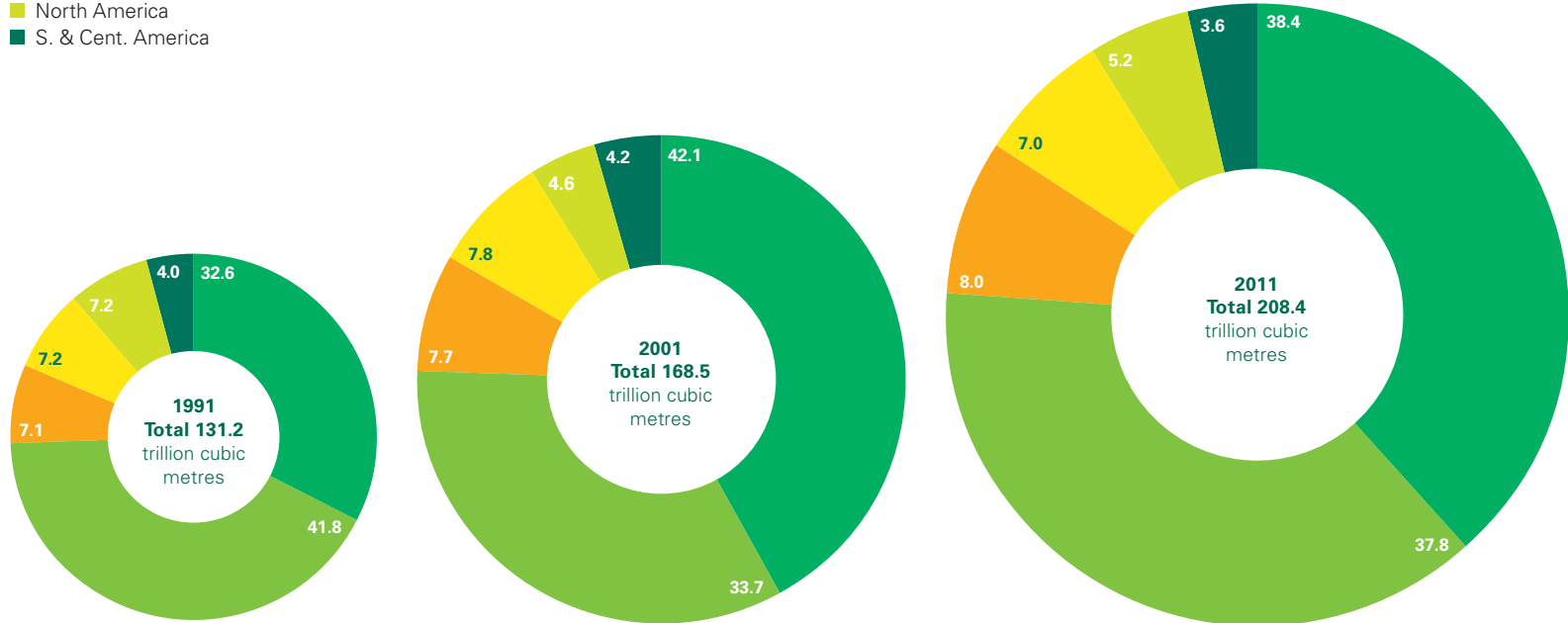
# Proved Reserves: Russia 24%, Middle East 40%, US 5%

## This picture will change...

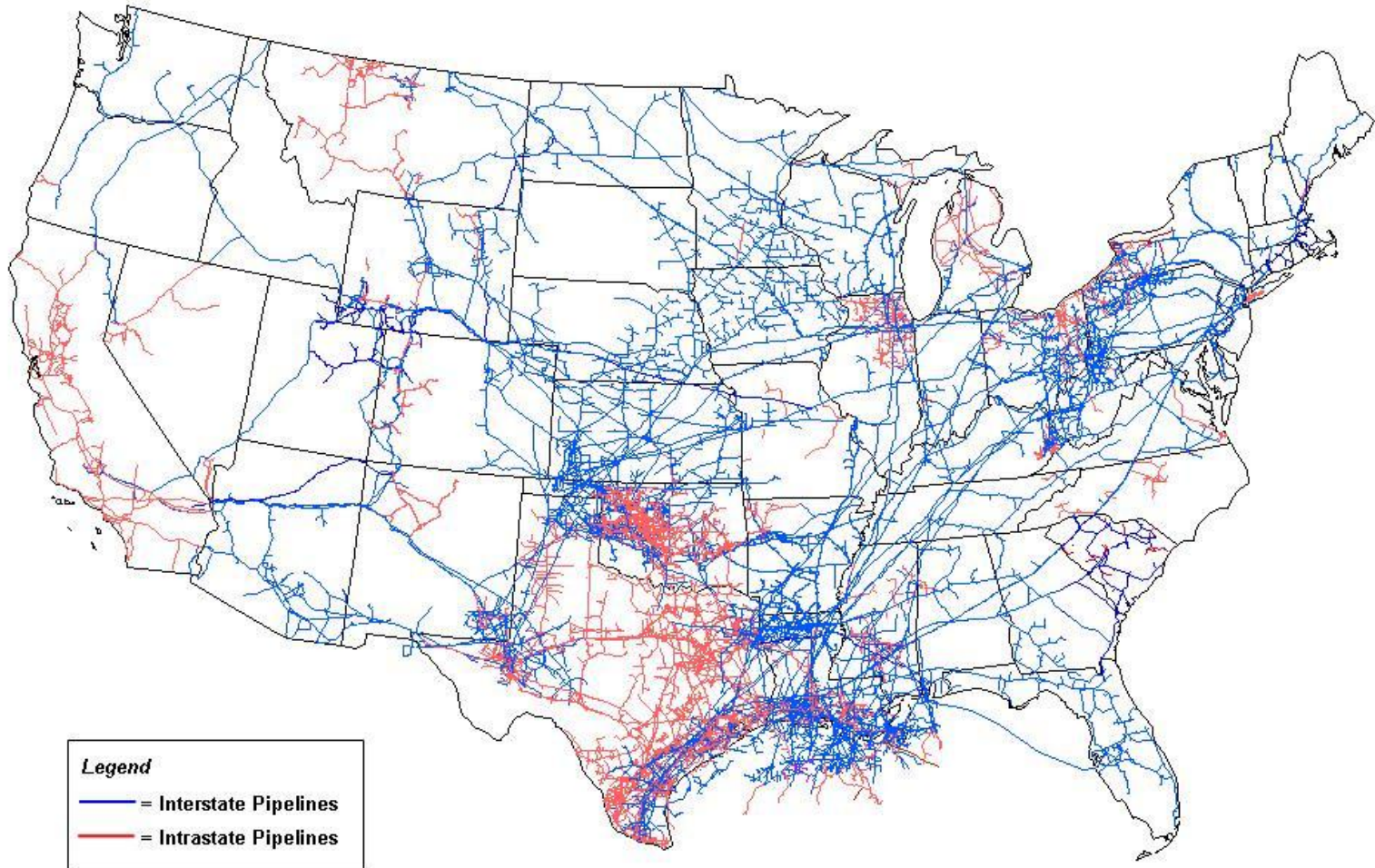
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# The US Natural Gas Pipeline Network



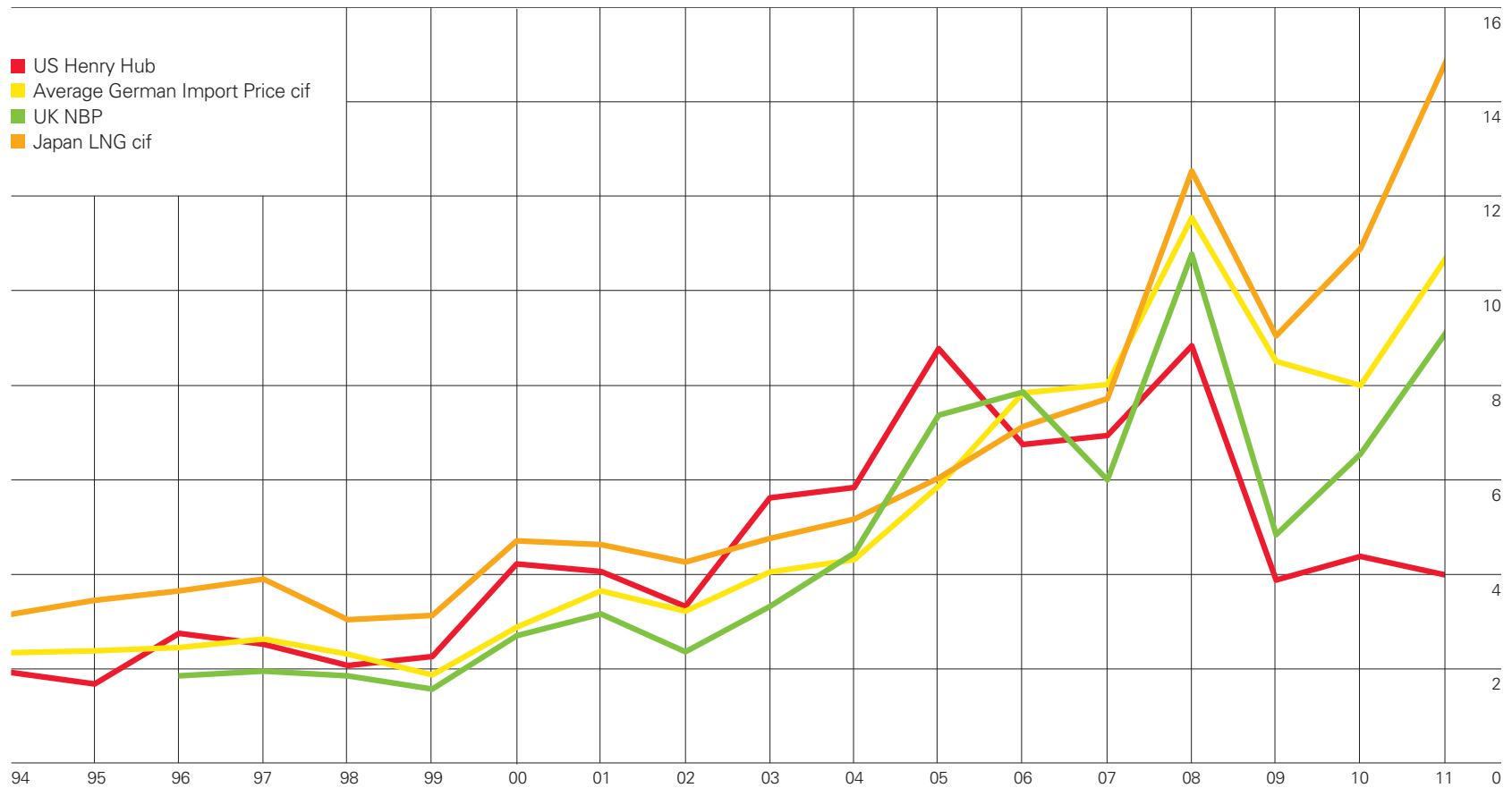
Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

The “Henry Hub” is in south-central Louisiana; a junction of 13 pipelines; the pricing point for futures contracts.

# Three Regional Markets, For Now...?

## Prices

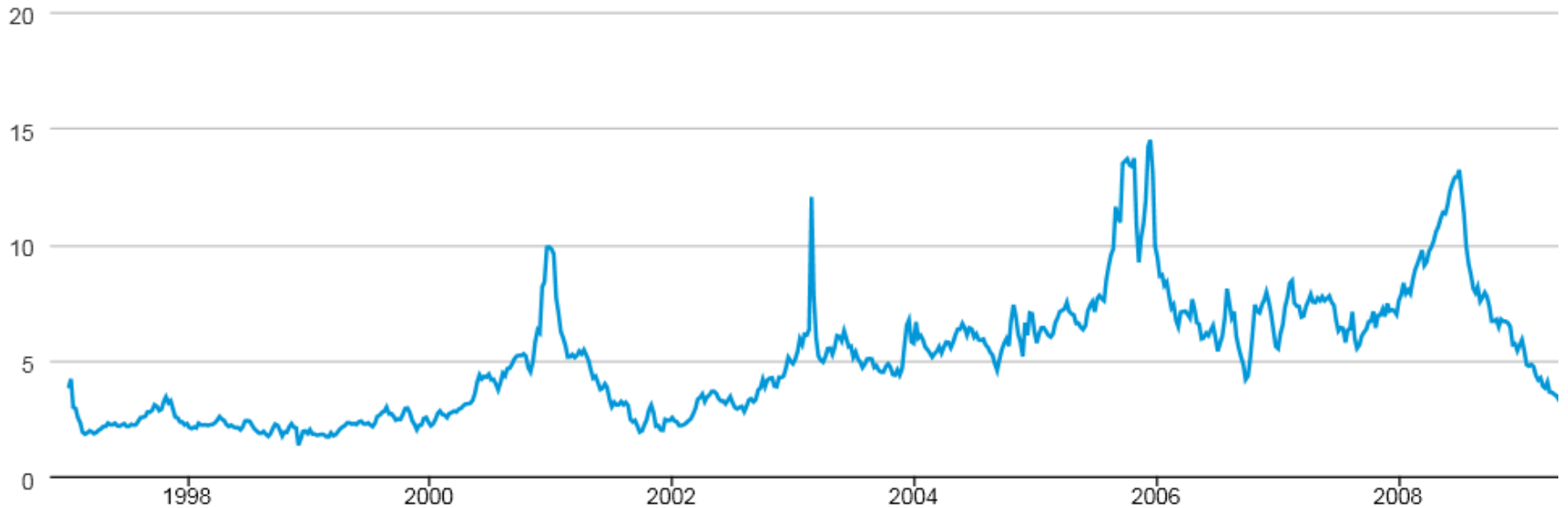
\$/Mmbtu



# US Prices Historically Volatile

## Henry Hub Gulf Coast Natural Gas Spot Price

Dollars/Mil. BTUs



Source: EIA. Weekly averages shown; most recent years omitted.

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