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Let's get non-technical: An economist's take on the past, the present, and the future of the industry

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LEADERS IN IDEAS AND SOLUTIONS

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Agenda

- The market
  - The petroleum industry
  - Supply and demand
  - Prices and price elasticity of demand
  - Energy consumption and economic growth

- Market control and participants
  - OPEC
  - National Oil Companies
  - Fiscal regimes

- Producers and consumers
  - Distribution of production and consumption
  - Outlook to 2040

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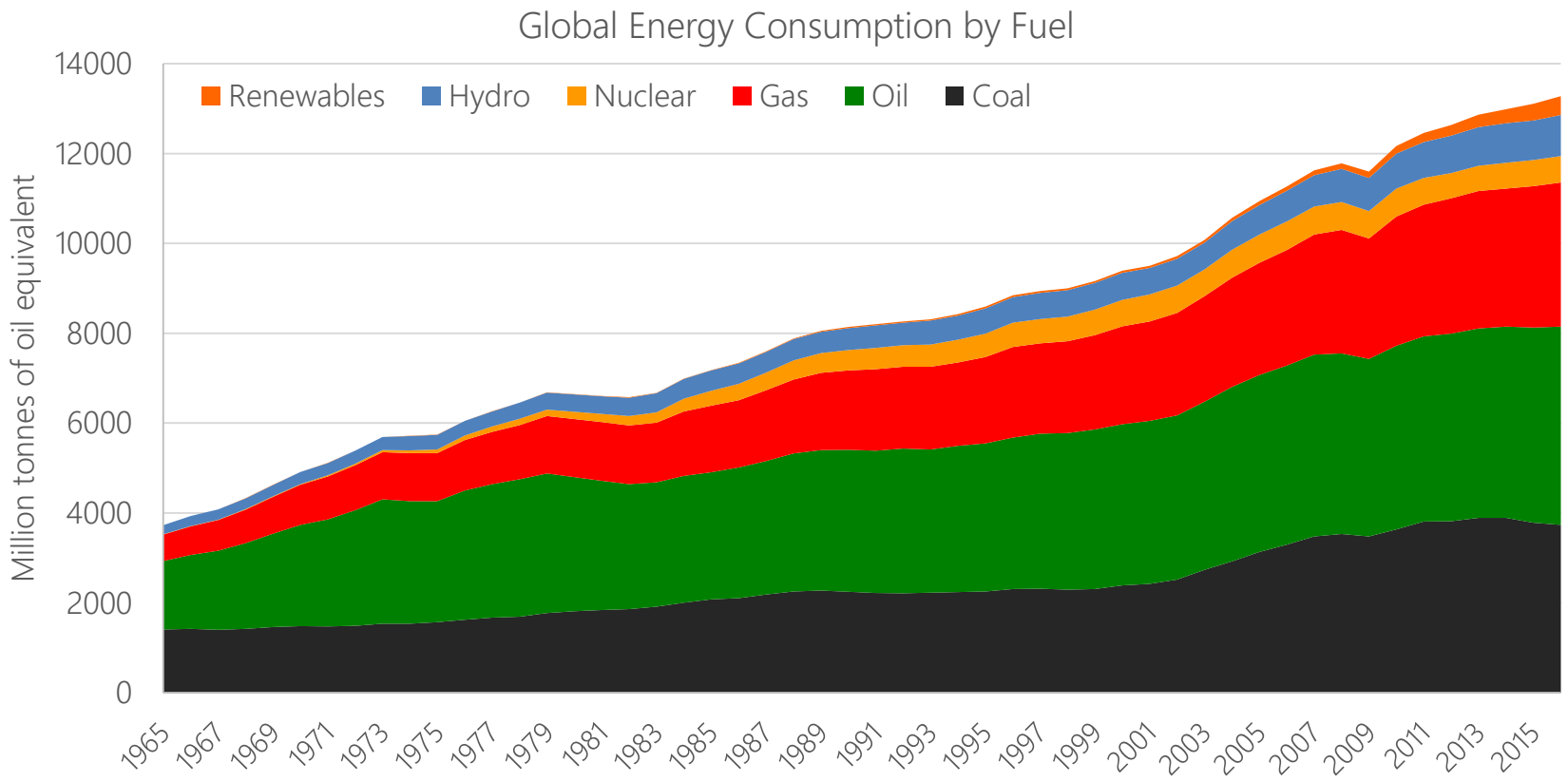
The size of the market



Source: BP Statistical Review of World Energy 2017

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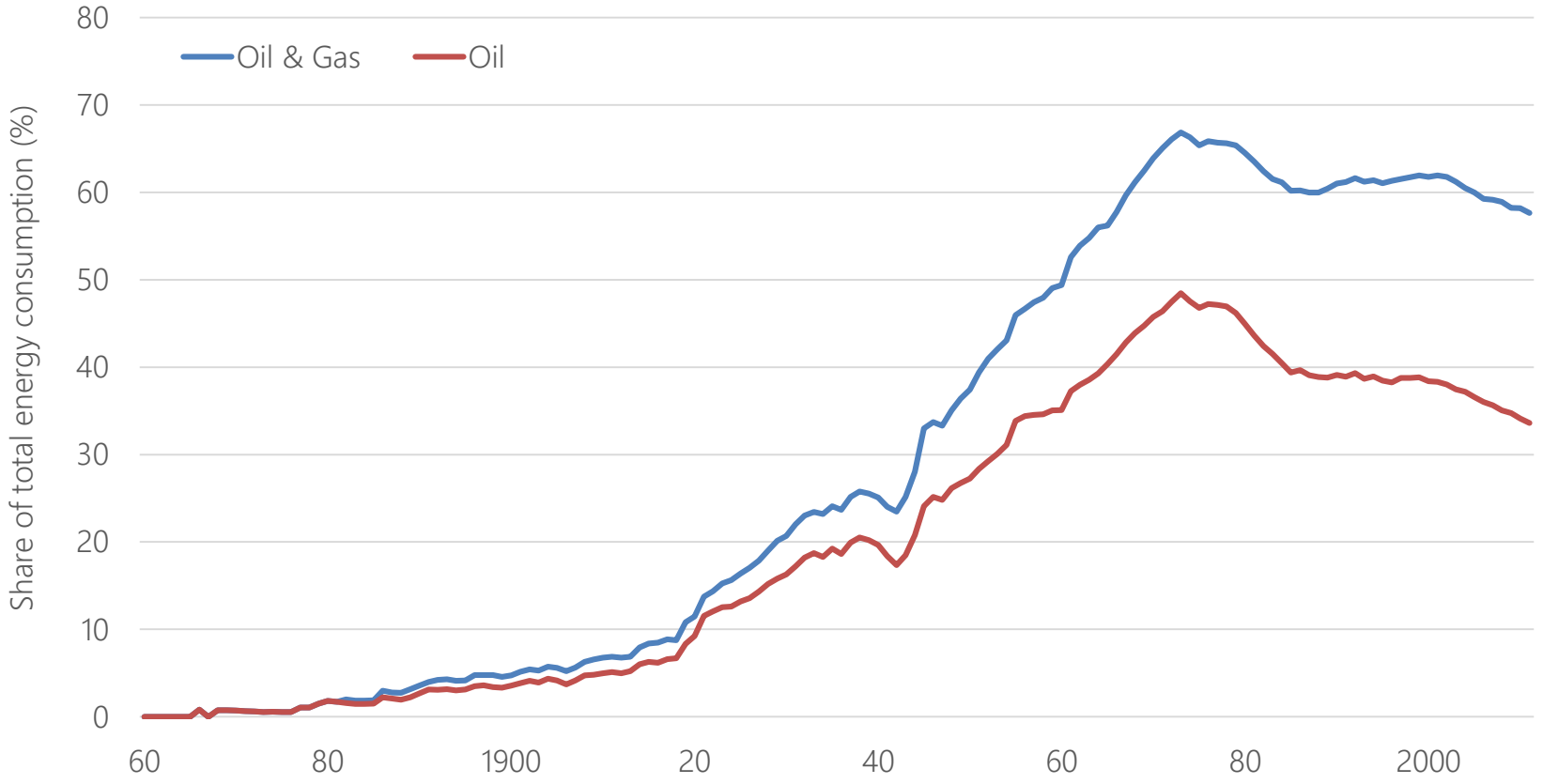
Oil and gas market share



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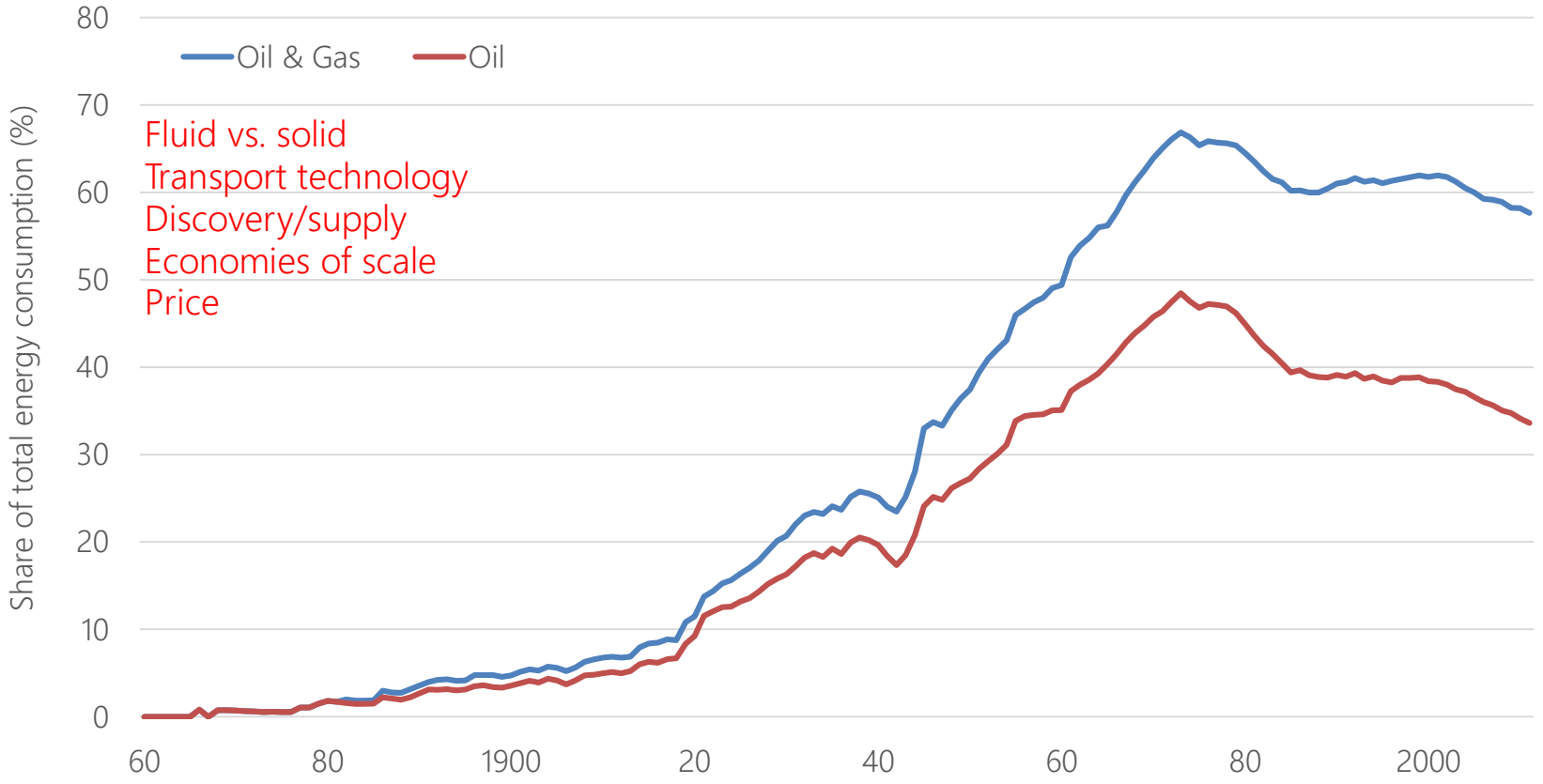

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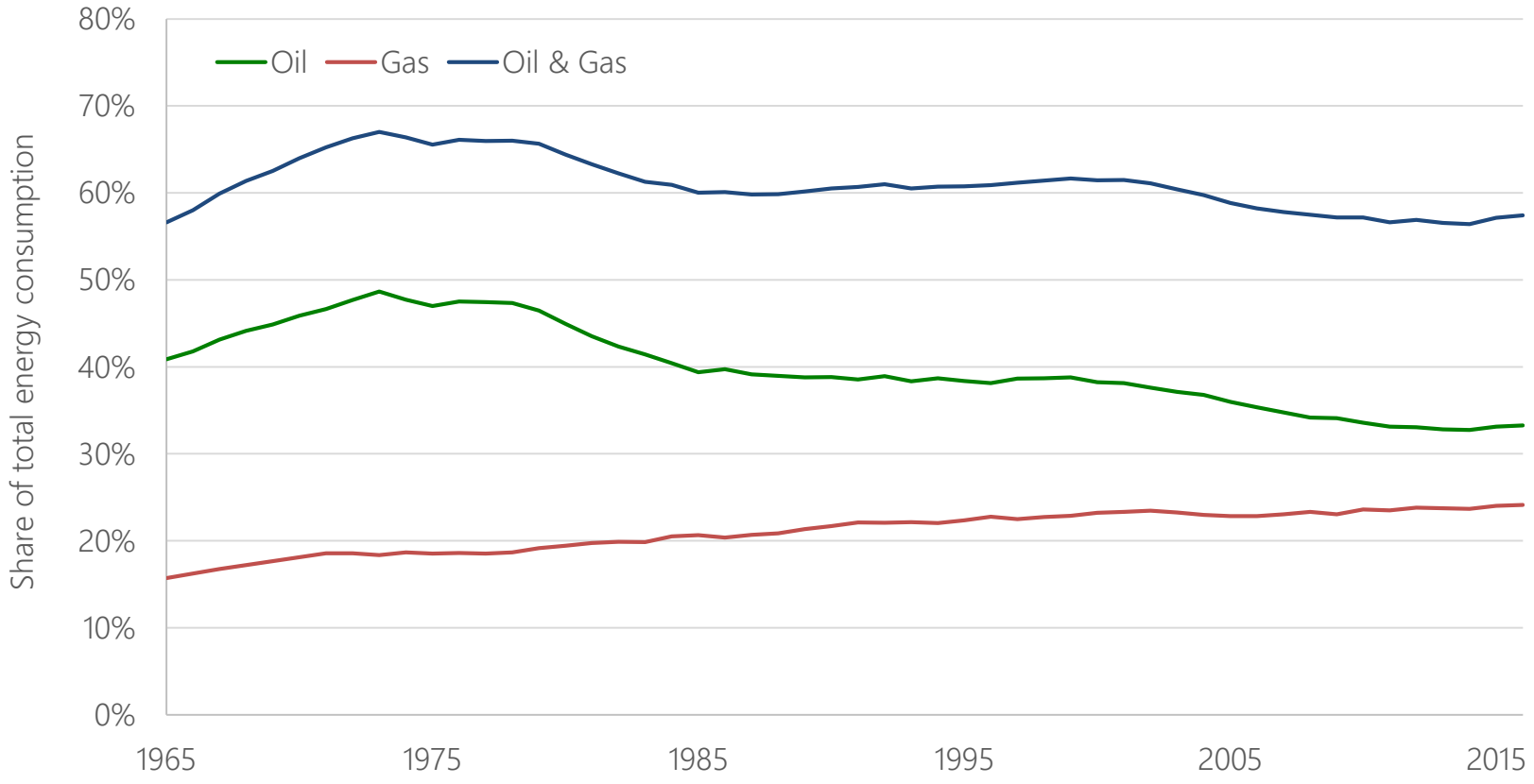

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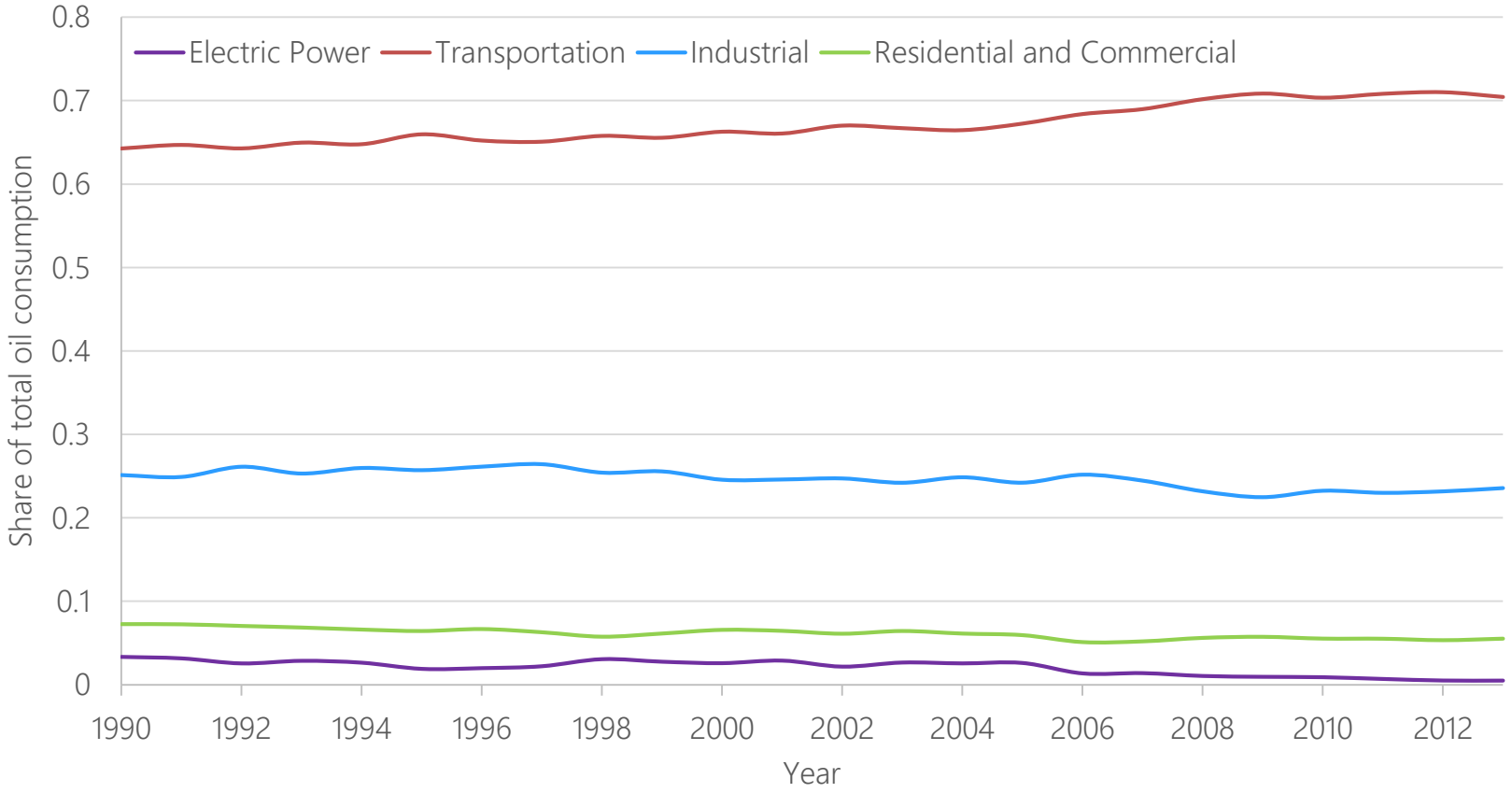
Oil consumption in the US



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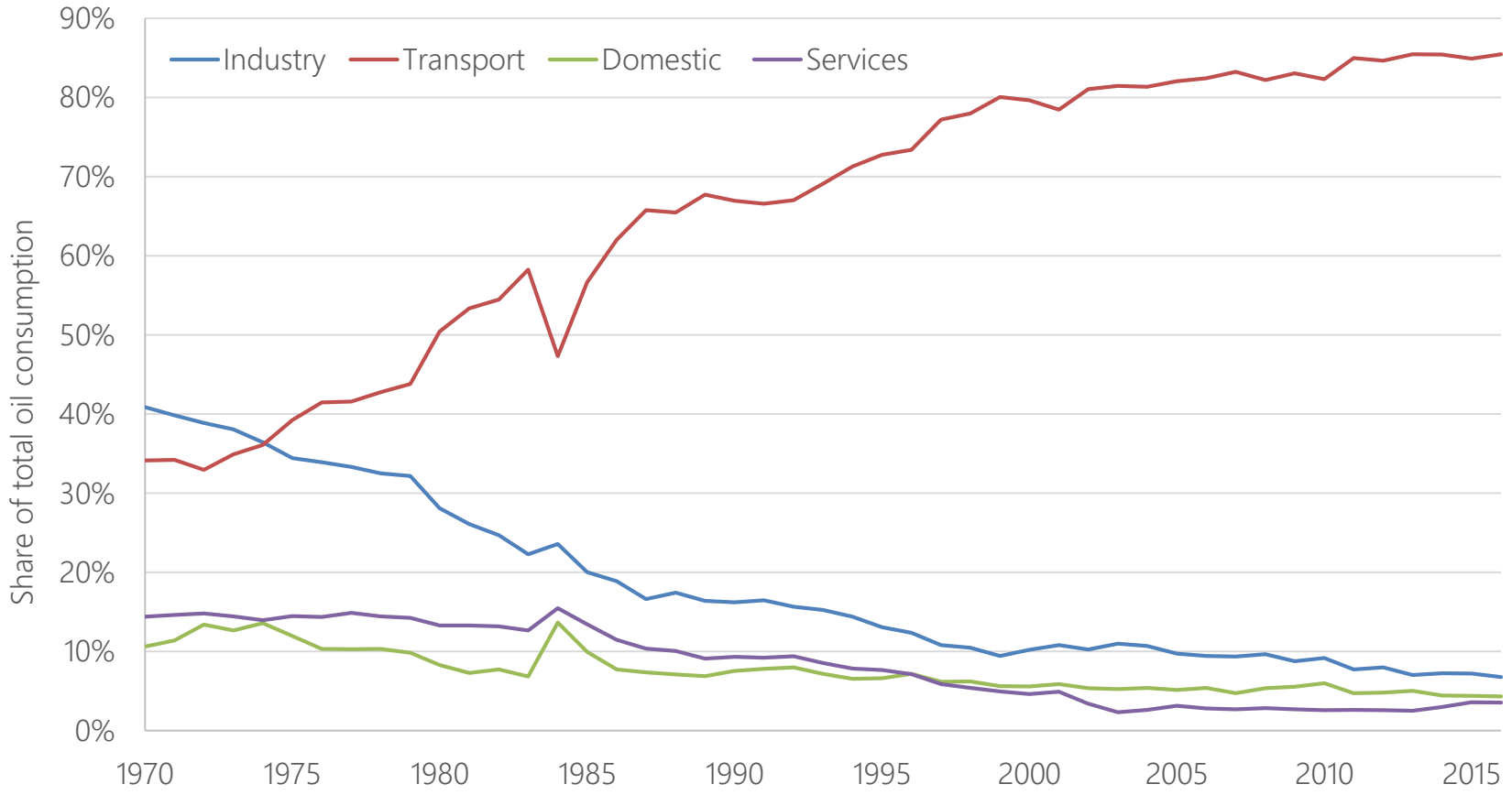
Oil consumption in the UK



Source: DUKES (Digest of UK Energy Statistics)

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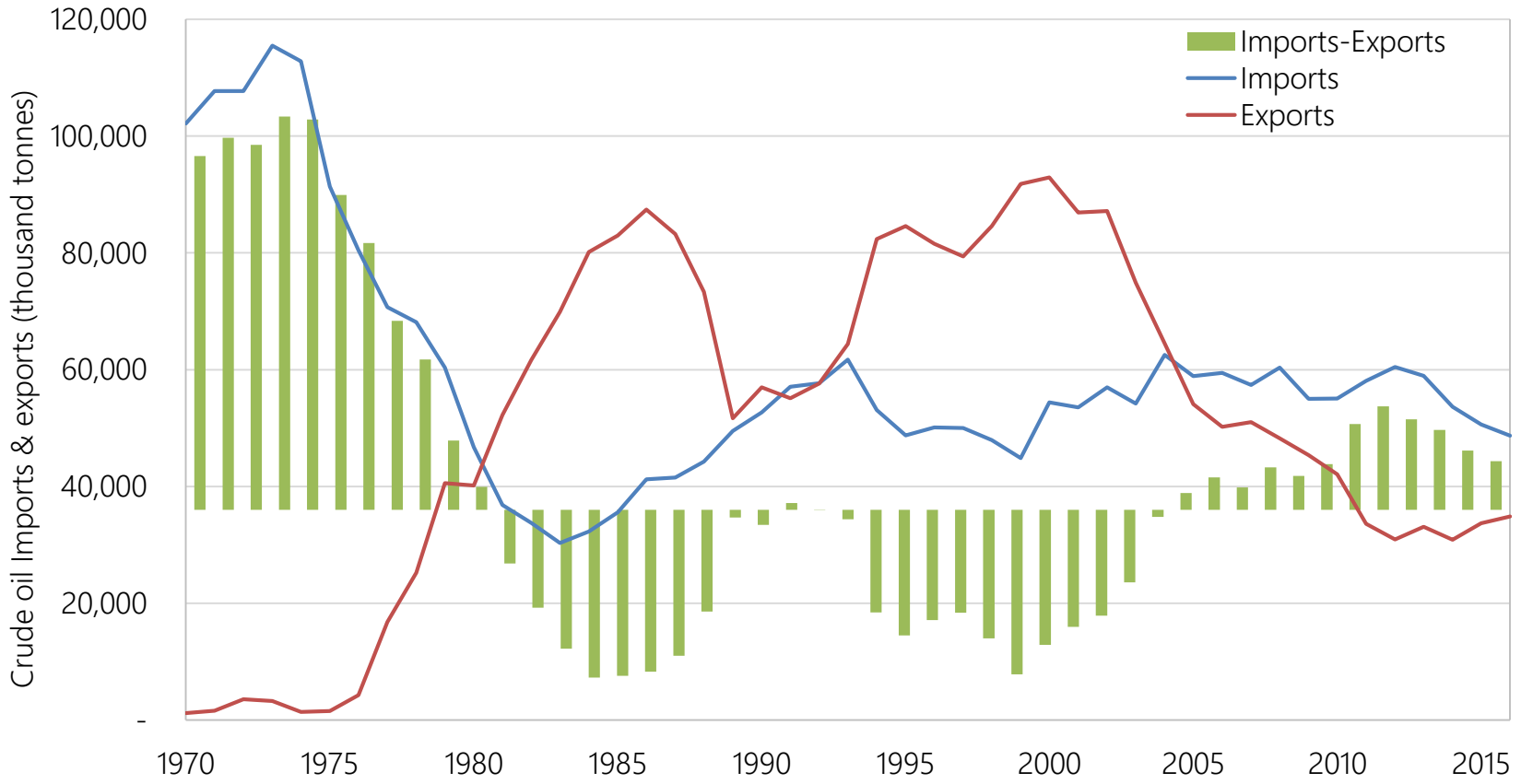
UK oil production & consumption



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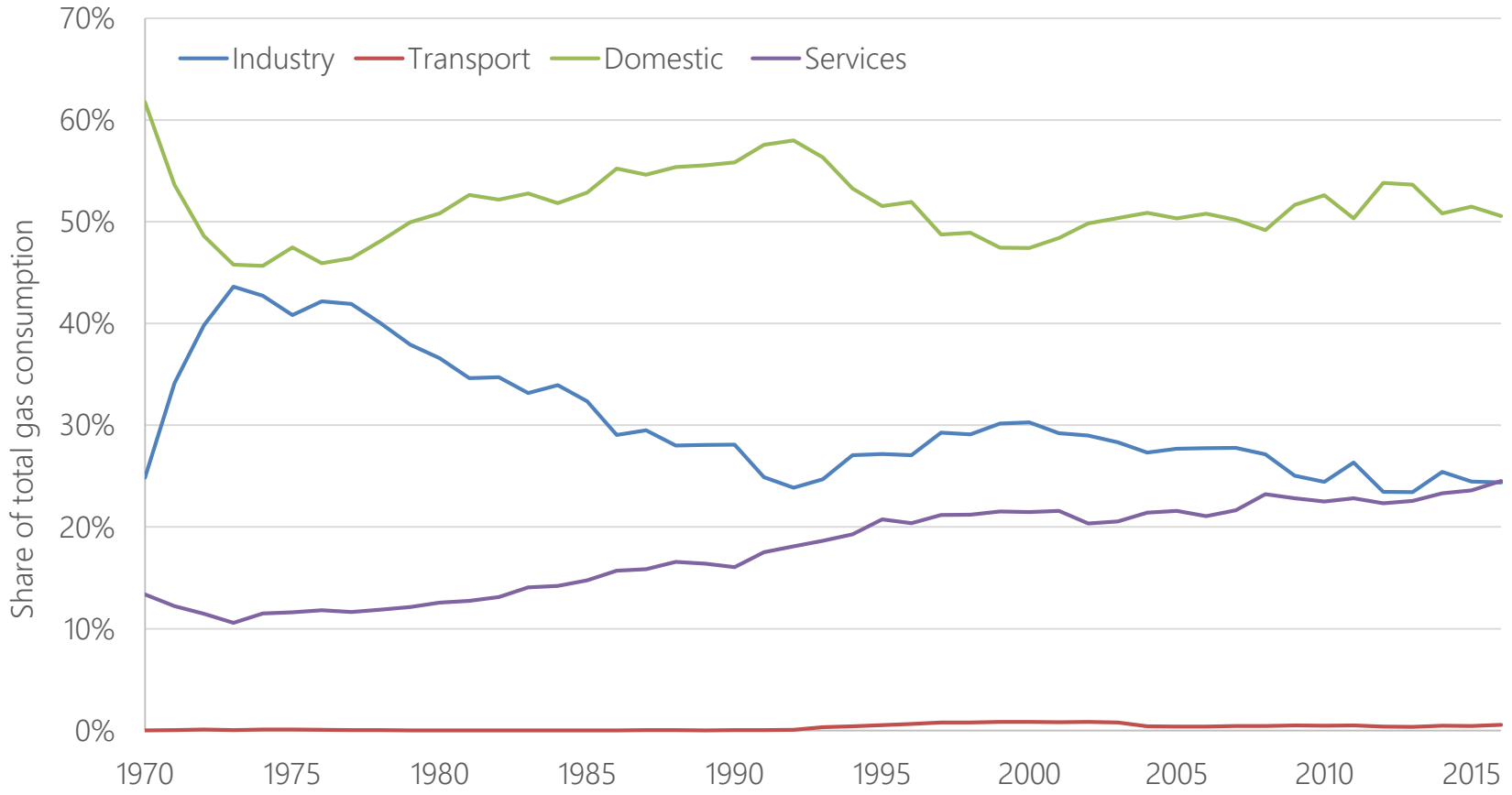
Gas consumption in the UK



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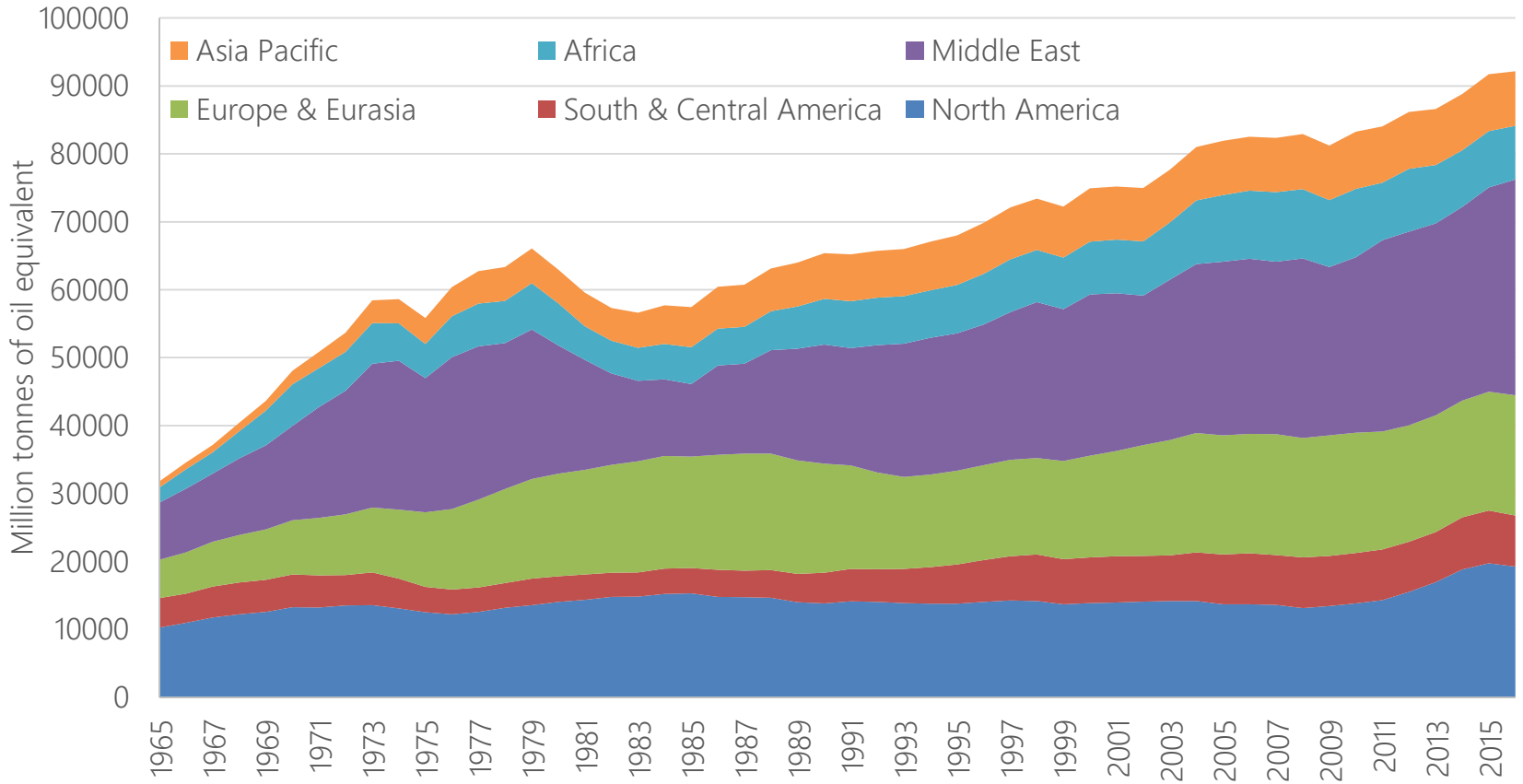
Oil production by region



Source: BP Statistical Review of World Energy 2017

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Size of the industry

Value of petroleum production and trade in 2012		
Crude oil production	86.15	million barrels per day
Price of oil	111.67	$ per barrel
Global production value per day	9.62	billion $
Global production value per year	3.51	trillion $
Natural gas production	324.6	bcf per day
Price of natural gas	10	$/tcf
Global production value per day	3.25	billion $
Global production value per year	1.18	trillion $
Crude oil trade	55.31	million barrels per day
Price of oil	111.67	$ per barrel
Total value traded per day	6.18	billion $
Total value traded per year	2.25	trillion $
LNG trade	327.9	bcm
Price of natural gas	10	$/tcf
Total value traded per year	115.80	$ bn

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Size of the industry – $3.51 trillion?

» 3,510,000,000,000 = $\mathbf{3.51 \times 10^{12}}$

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> 3.51 million seconds = 41 days ago

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> 3.51 billion seconds = 111 years ago

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Size of the industry – $3.51 trillion?

» 3,510,000,000,000 = $\mathbf{3.51 \times 10^{12}}$

» Time: If we count backwards,

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> 3.51 billion seconds = 111 years ago

> 3.51 trillion seconds = 110,000 B.C.

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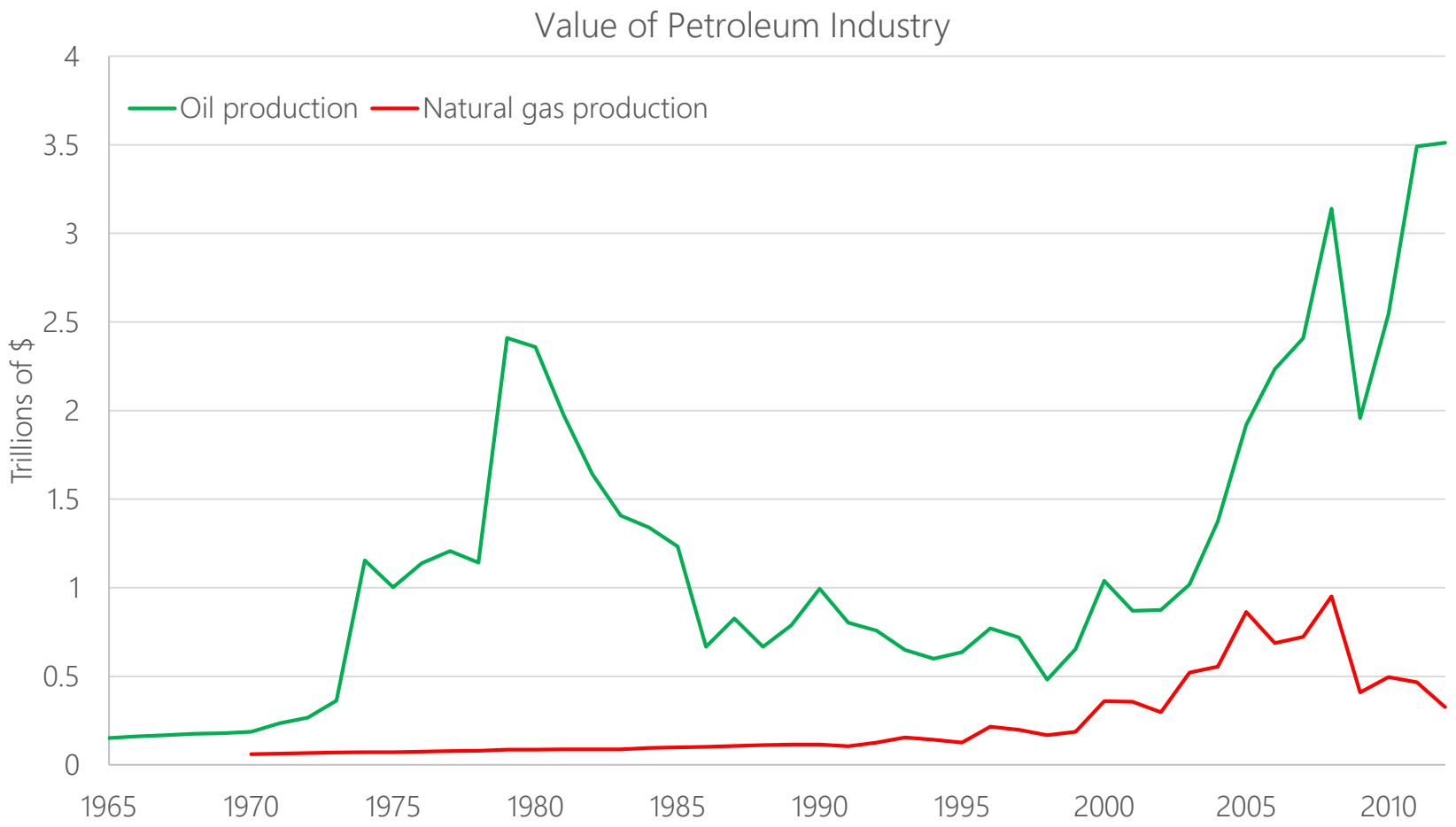
Size of the industry – history



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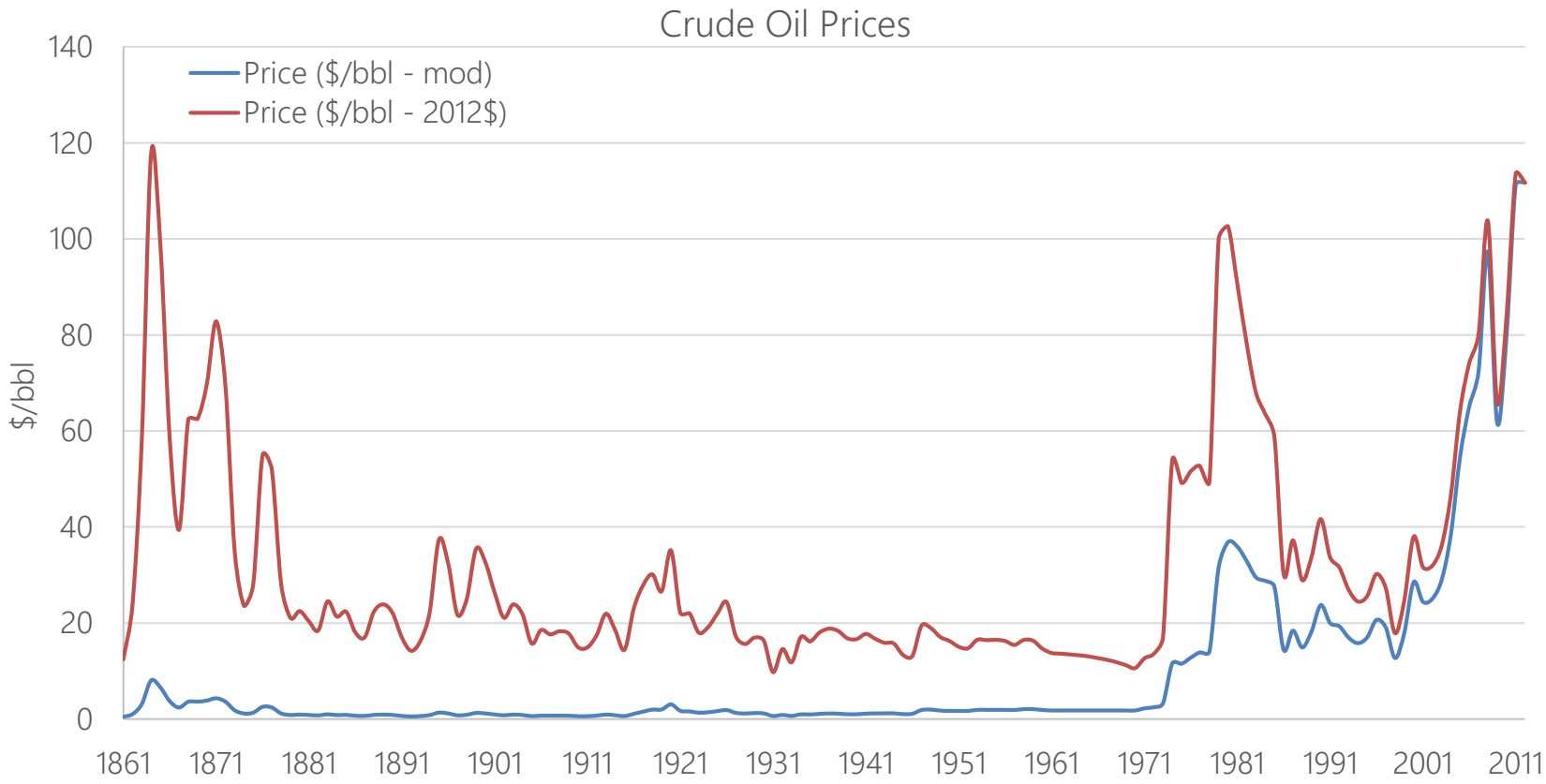
Oil prices



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Price dynamics – supply and demand

- The parrot problem
- Supply – the amount that a producer would make available to the market at different prices
- Demand – the amount that a consumer would require from the market at different prices
- Both are functions of price
- Shift along the curve vs. shift of the curve

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Energy and economic development

Country	Population (in millions)	Energy Consumption (toe per capita)
United States	311.59	7.03
Saudi Arabia	27.76	6.74
Norway	4.95	5.68
Russian Federation	142.96	5.11
Netherlands	16.69	4.64
France	65.37	3.87
Germany	81.80	3.81
Japan	127.82	3.61
United Kingdom	62.75	3.00
Italy	60.72	2.76
Venezuela, RB	29.50	2.38
Portugal	10.56	2.19
China	1344.13	2.03
Mexico	119.36	1.56
Nigeria	164.19	0.72
India	1221.16	0.61
Bangladesh	152.86	0.20
Eritrea	5.93	0.13

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Energy and economic development

Country	Population (in millions)	Energy Consumption (toe per capita)	Real GDP per capita ($2005)
United States	311.59	7.03	44439.41
Saudi Arabia	27.76	6.74	26505.78
Norway	4.95	5.68	46733.36
Russian Federation	142.96	5.11	14731.03
Netherlands	16.69	4.64	37063.46
France	65.37	3.87	29963.22
Germany	81.80	3.81	34619.99
Japan	127.82	3.61	30764.24
United Kingdom	62.75	3.00	32877.54
Italy	60.72	2.76	27080.65
Venezuela, RB	29.50	2.38	11173.01
Portugal	10.56	2.19	21670.98
China	1344.13	2.03	7417.89
Mexico	119.36	1.56	12747.31
Nigeria	164.19	0.72	2254.13
India	1221.16	0.61	3277.01
Bangladesh	152.86	0.20	1544.80
Eritrea	5.93	0.13	471.26

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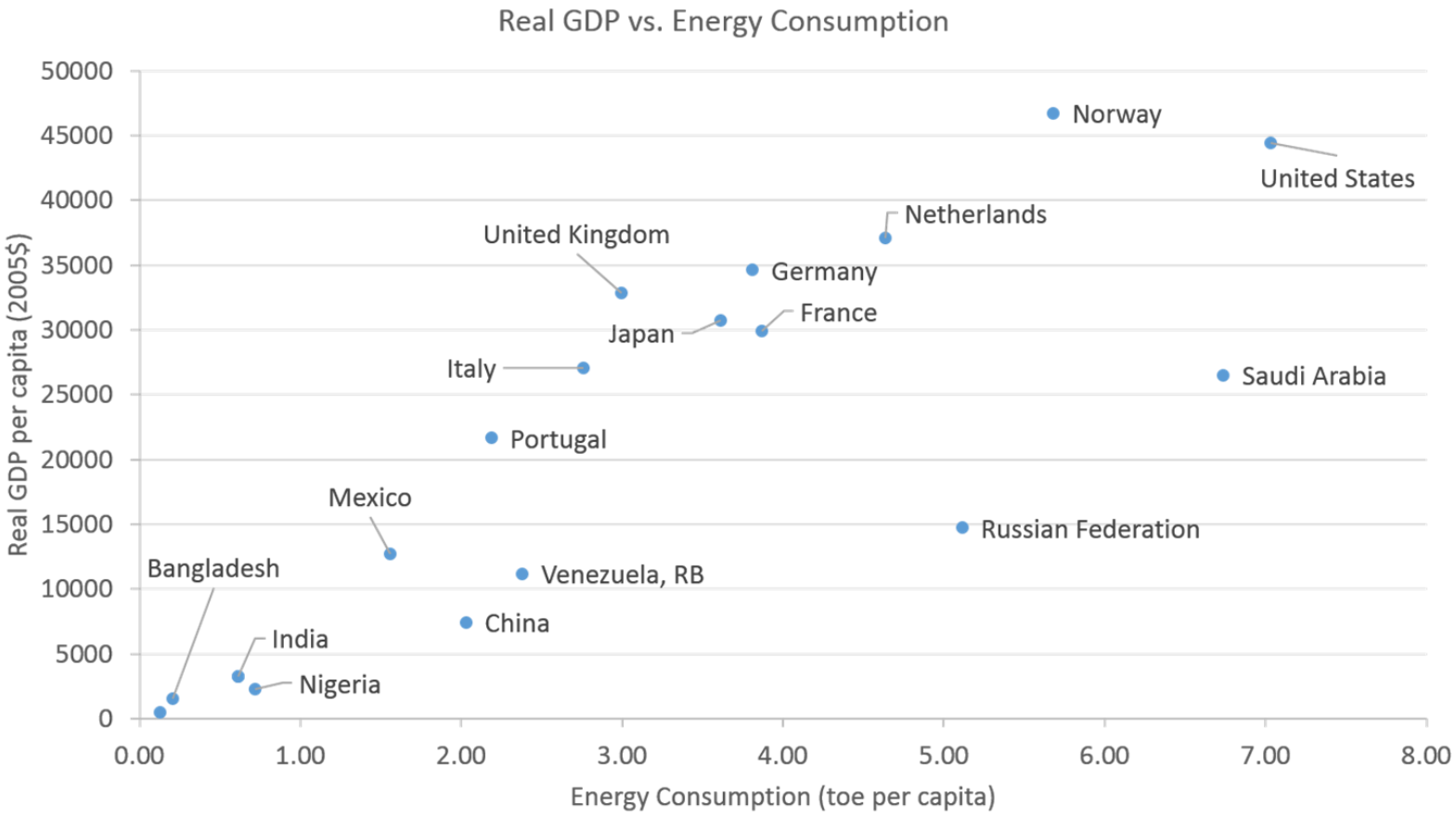
Energy and economic development



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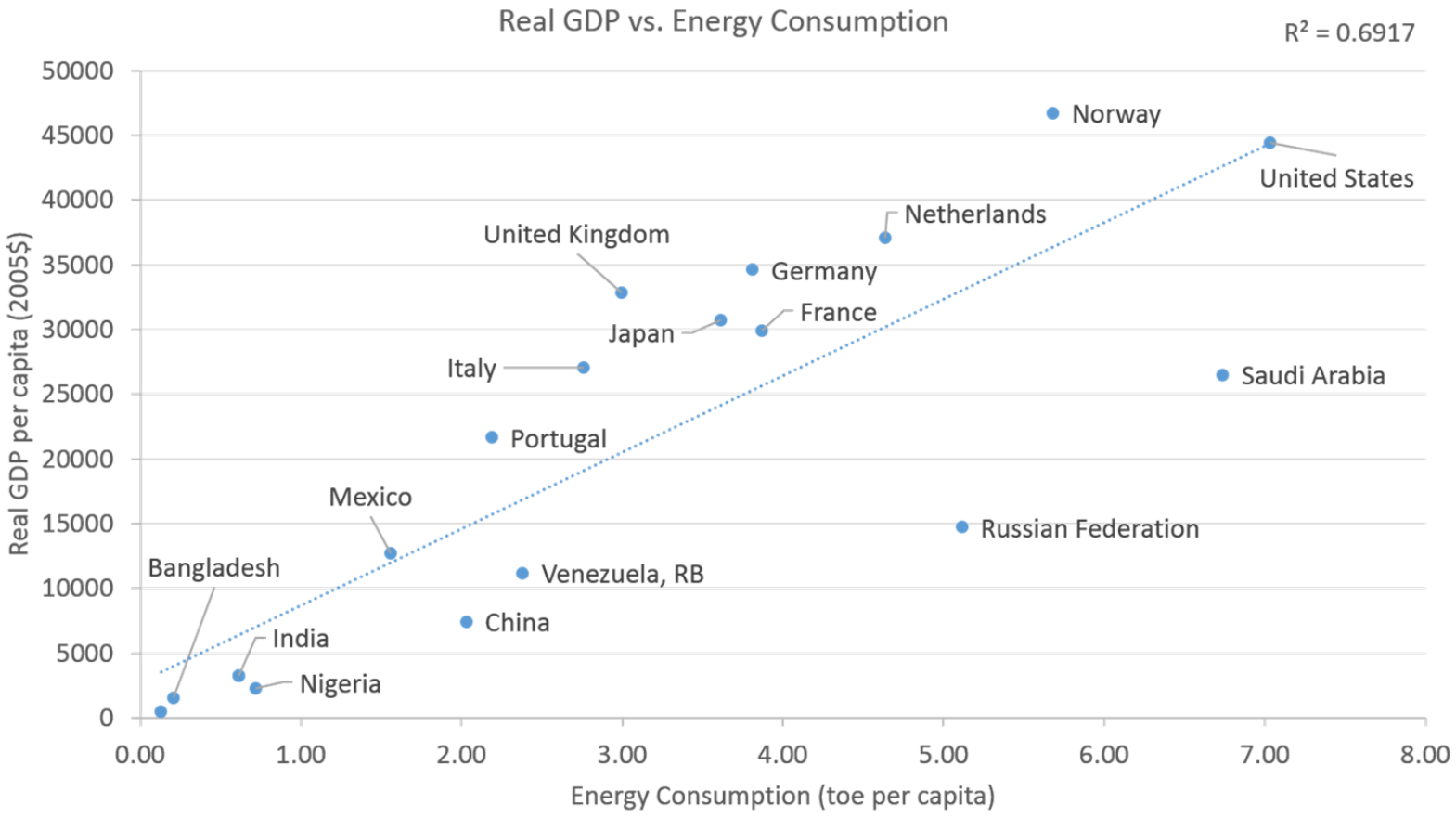

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Market control

- Standard Oil
- Red Line Agreement
- Achnacarry
- OPEC

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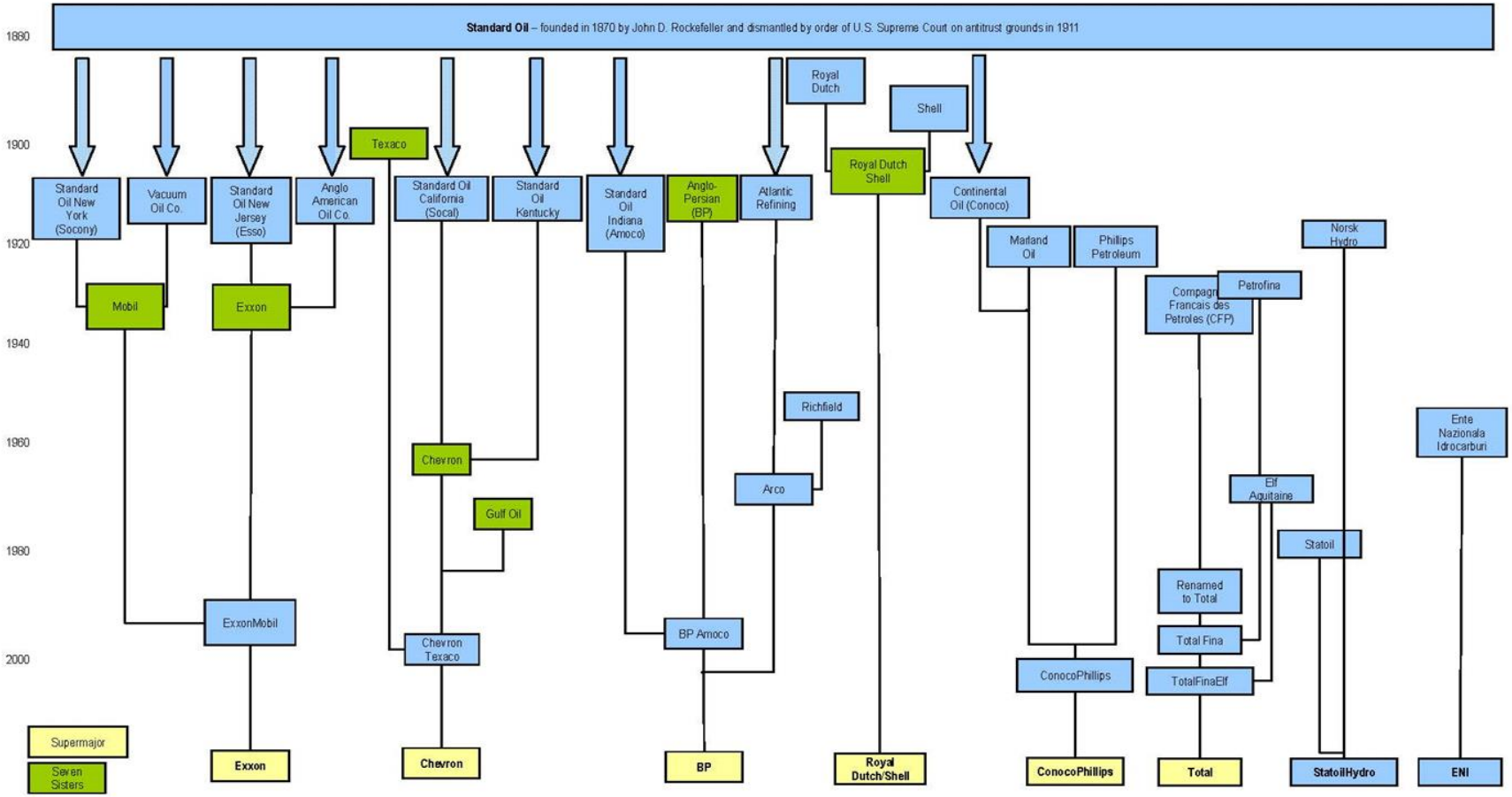
Standard Oil



Source: Deutsche Bank

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OPEC

- Objectives:
  - Restore price
  - Consultation on pricing issues
  - Mechanism for production control
  - Solidarity

- Founding members: Saudi Arabia, Iraq, Iran, Venezuela

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OPEC oil embargo of 1973/74

- In 1973, price of oil per barrel was about $17 (in 2012$).
- By 1974, a barrel was $52
- Indirect implications for domestic and global economies

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Security of supply

- Oil crisis of 1973/74 led to uncertainty about supply
- IEA formed by members of OECD in 1974
  - Members required to maintain stocks as protection against disruptions
- US SPR ≈ 664 million barrels as of 6 May 2018
  - 258.9 million barrels of sweet and 405.4 million barrels of sour
  - An investment of approximately $46.5 billion

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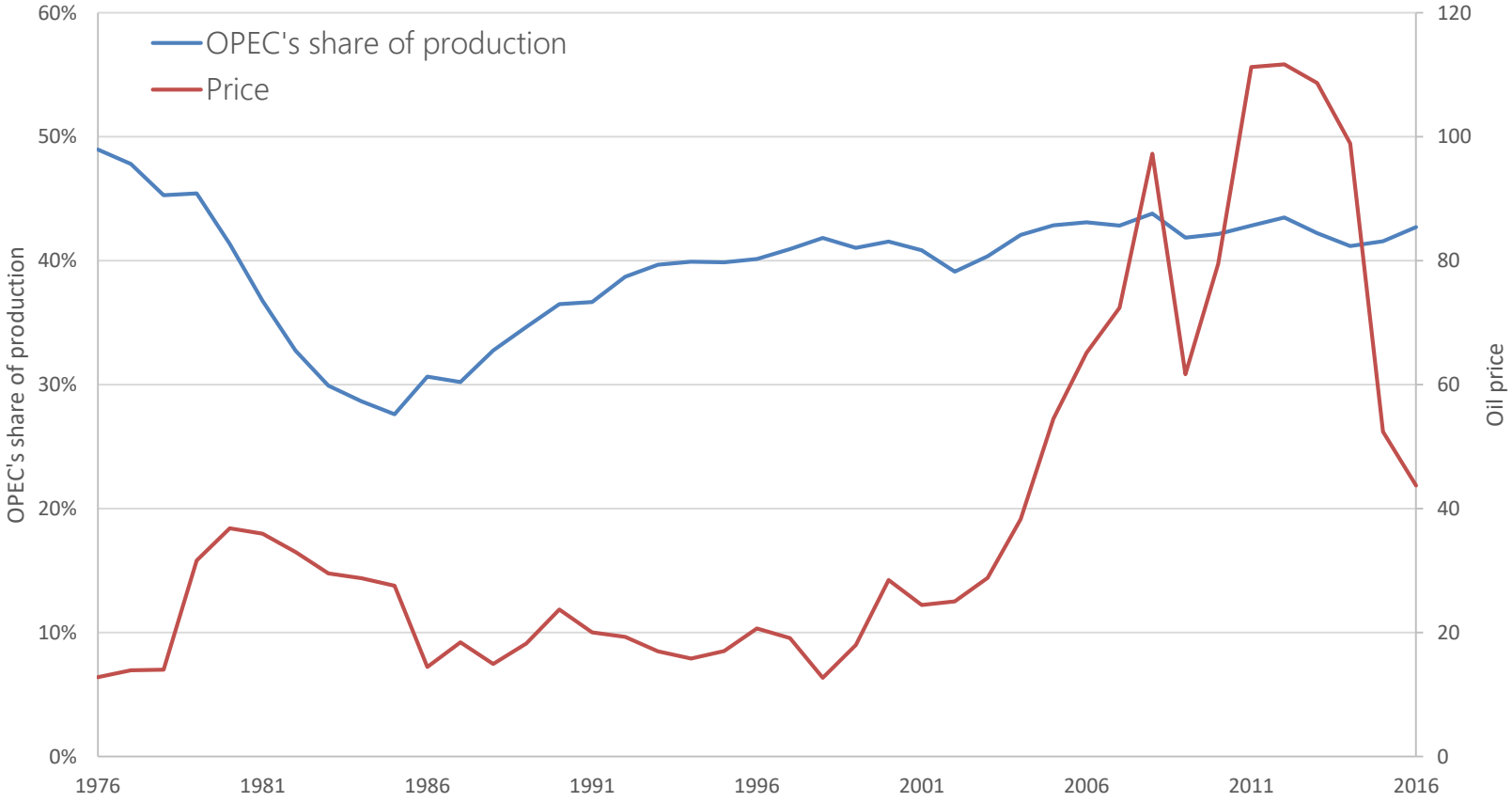
Security of supply



Economic incentives and behaviour

- Price elasticity of demand
  - Sensitivity/responsiveness of demand to a change in price

$$\varepsilon = \frac{\%\Delta Q}{\%\Delta P}$$

  - $|\varepsilon| > 1$ → elastic demand
  - $|\varepsilon| < 1$ → inelastic demand
  - $|\varepsilon| = 1$ → unit elastic demand

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Price elasticity of demand and revenue

- If demand is price *inelastic*, an increase in price leads to an increase in revenue

- If demand is price *elastic*, a fall in price leads to an increase in revenue

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National interest

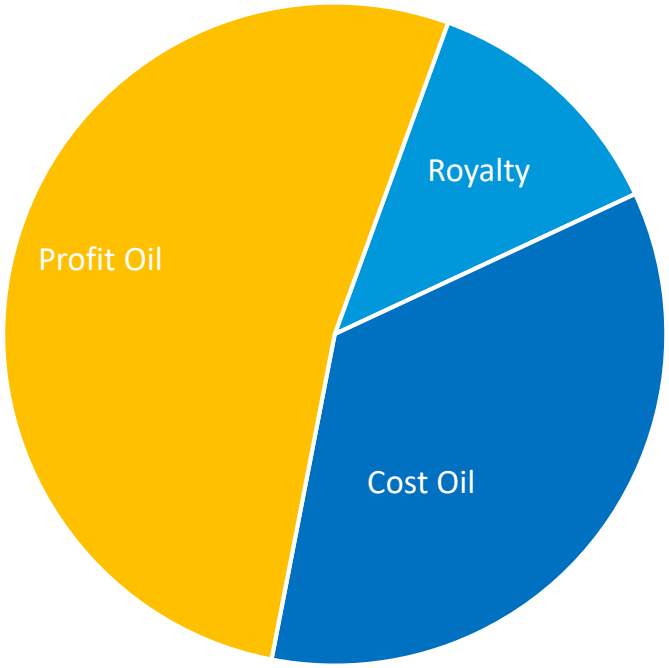
- Formation of National Oil Companies (NOCs)
- World Bank: In 2010, NOCs accounted for 75% of global oil production and 90% of proven reserves

Year	Country	Company
1914	United Kingdom	BP
1922	Argentina	YPF
1924	France	CFP
1926	Italy	Agip
1938	Mexico	Pemex
1951	Iran	NIOC
1953	Brazil	Petrobras
1956	India	ONGC
1960	Kuwait	KNPC
1962	Saudi Arabia	Petromin
1965	Algeria	Sonatrach
1967	Iraq	INOC
1970	Libya	LNOC
1971	Indonesia	Pertamina
1971	Nigeria	NNOC
1972	Norway	Statoil
1974	Qatar	QGPC
1974	Malaysia	Petronas
1975	Venezuela, RB	PDVSA
1975	Vietnam	Petrovietnam
1975	Canada	Petro-Canada
1975	United Kingdom	BNOC
1976	Angola	Sonangol
2002	Equatorial Guinea	GEPetrol
2006	Chad	SHT

Fiscal regimes

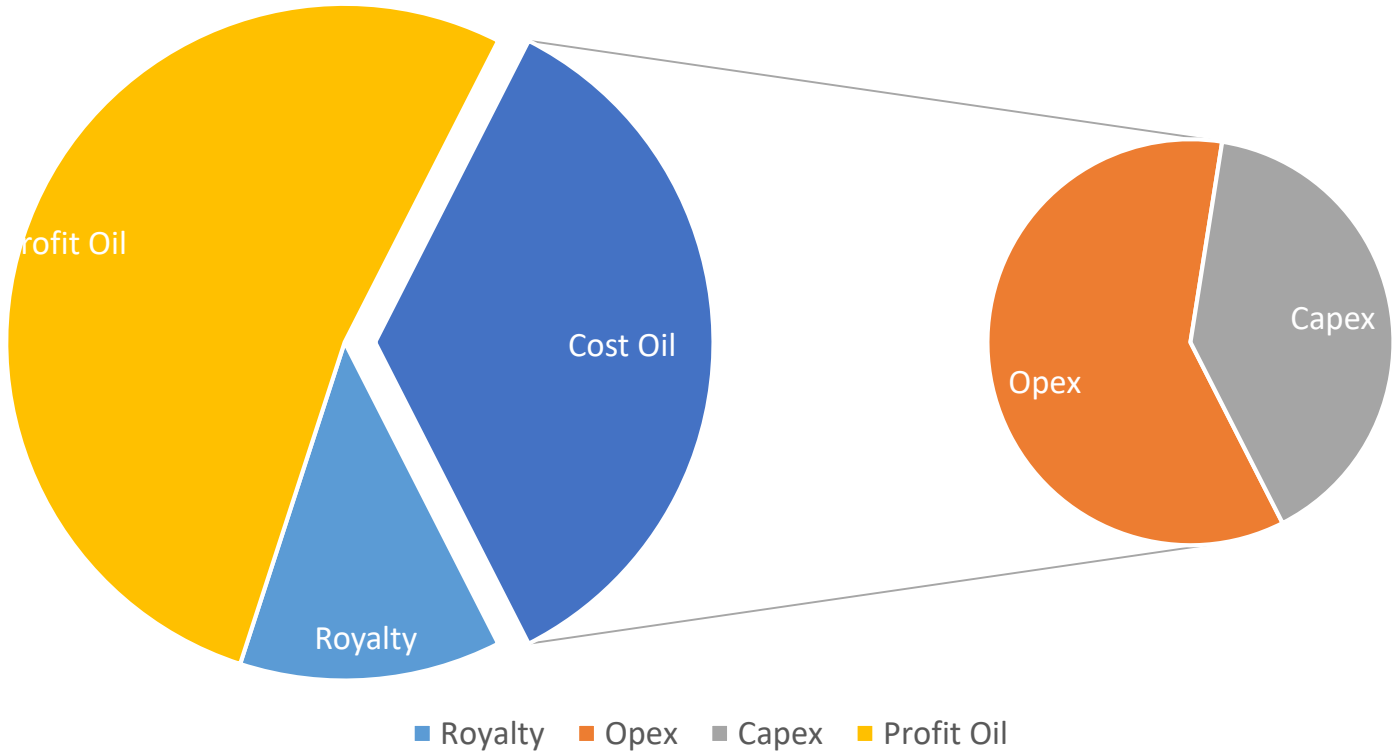
- Who owns the reserves?
  - Royalty/tax systems
  - Contractual systems
    - PSA/PSC
    - Service agreements

Production sharing agreements

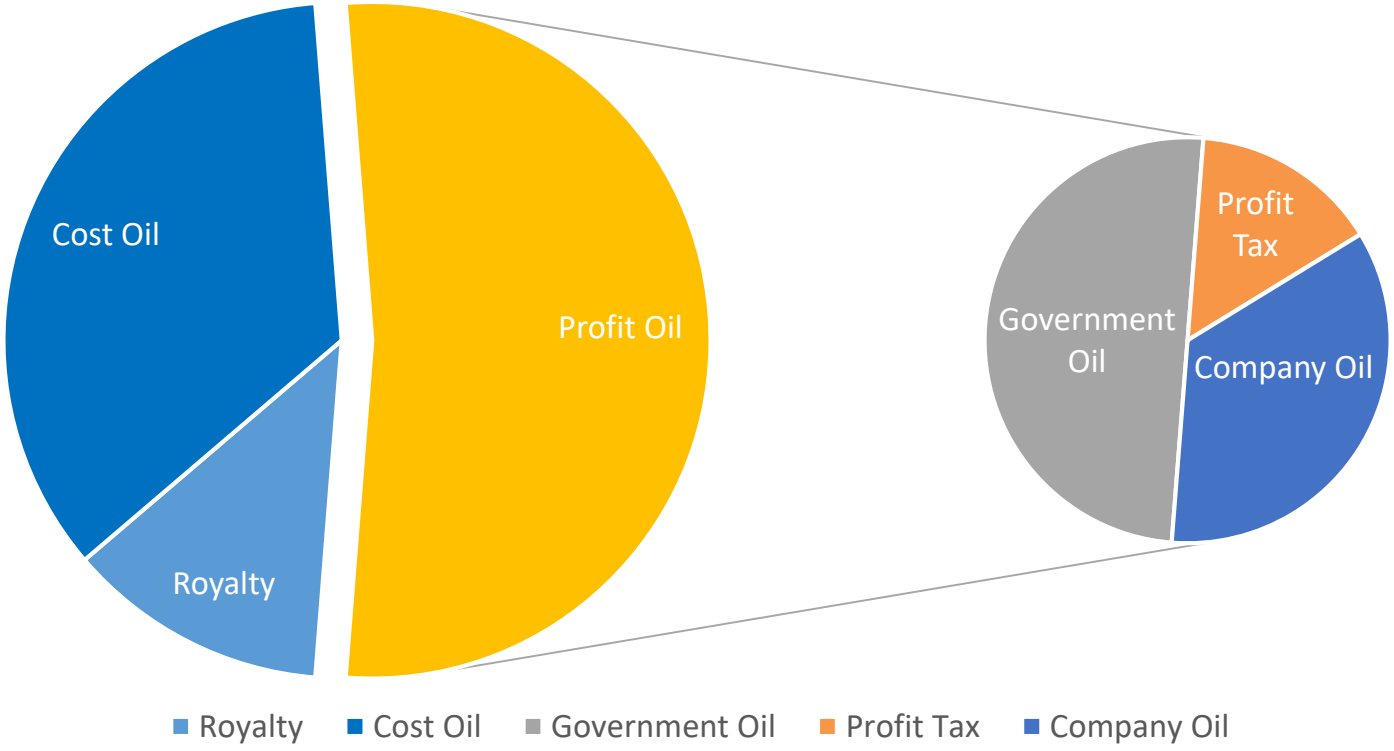


Royalty Cost Oil Profit Oil

Production sharing agreements



Production sharing agreements



Fiscal regimes

- No equity participation, no reserves on books
- Services include:
  - Seismic
  - Exploration and appraisal drilling
  - Wellhead services
  - Rig construction
  - Field development
- Fee based on activity
- Also risk service agreements

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Distribution of production & consumption in 2016

Source: BP Statistical Review of World Energy 2017

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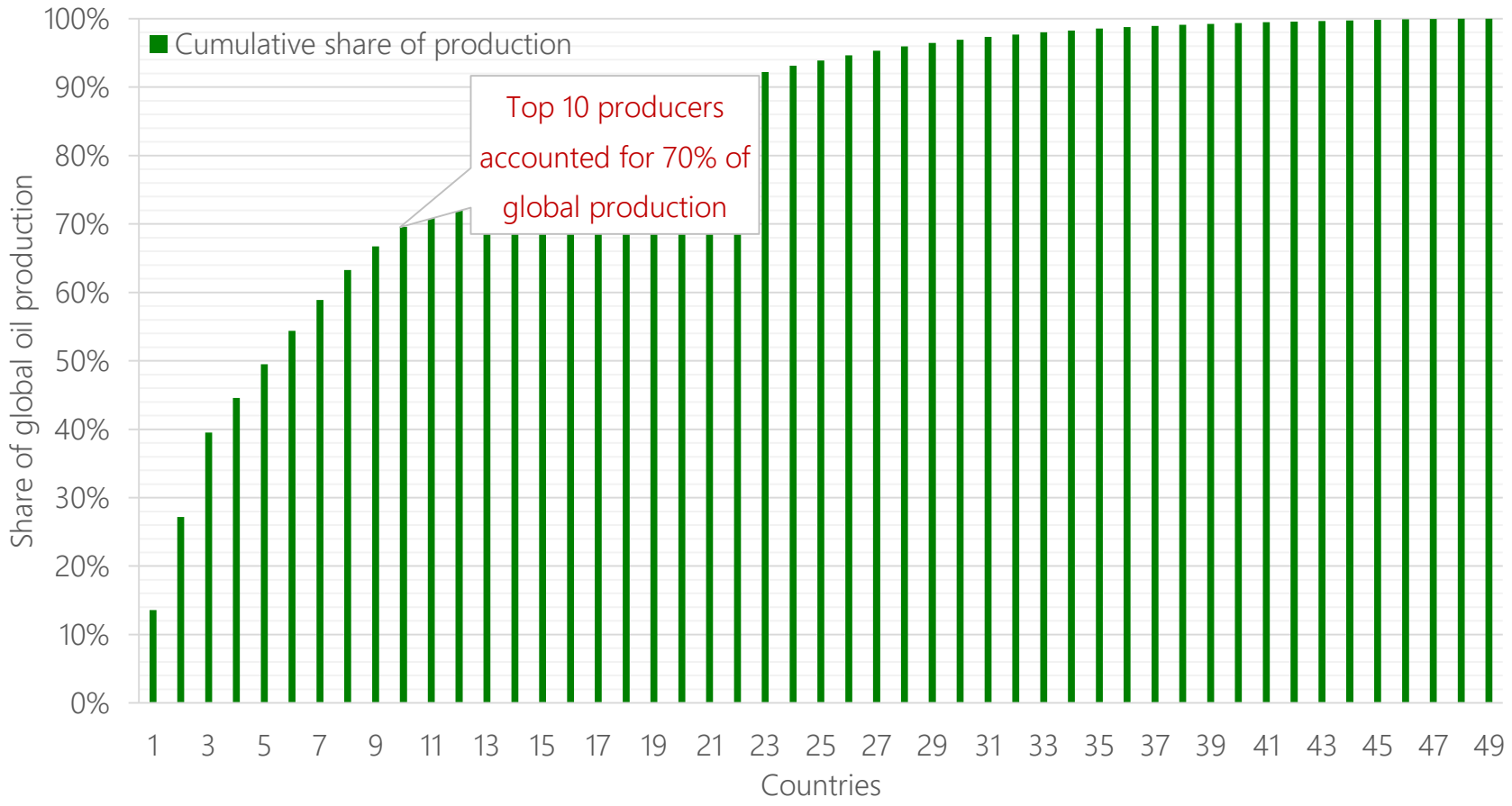

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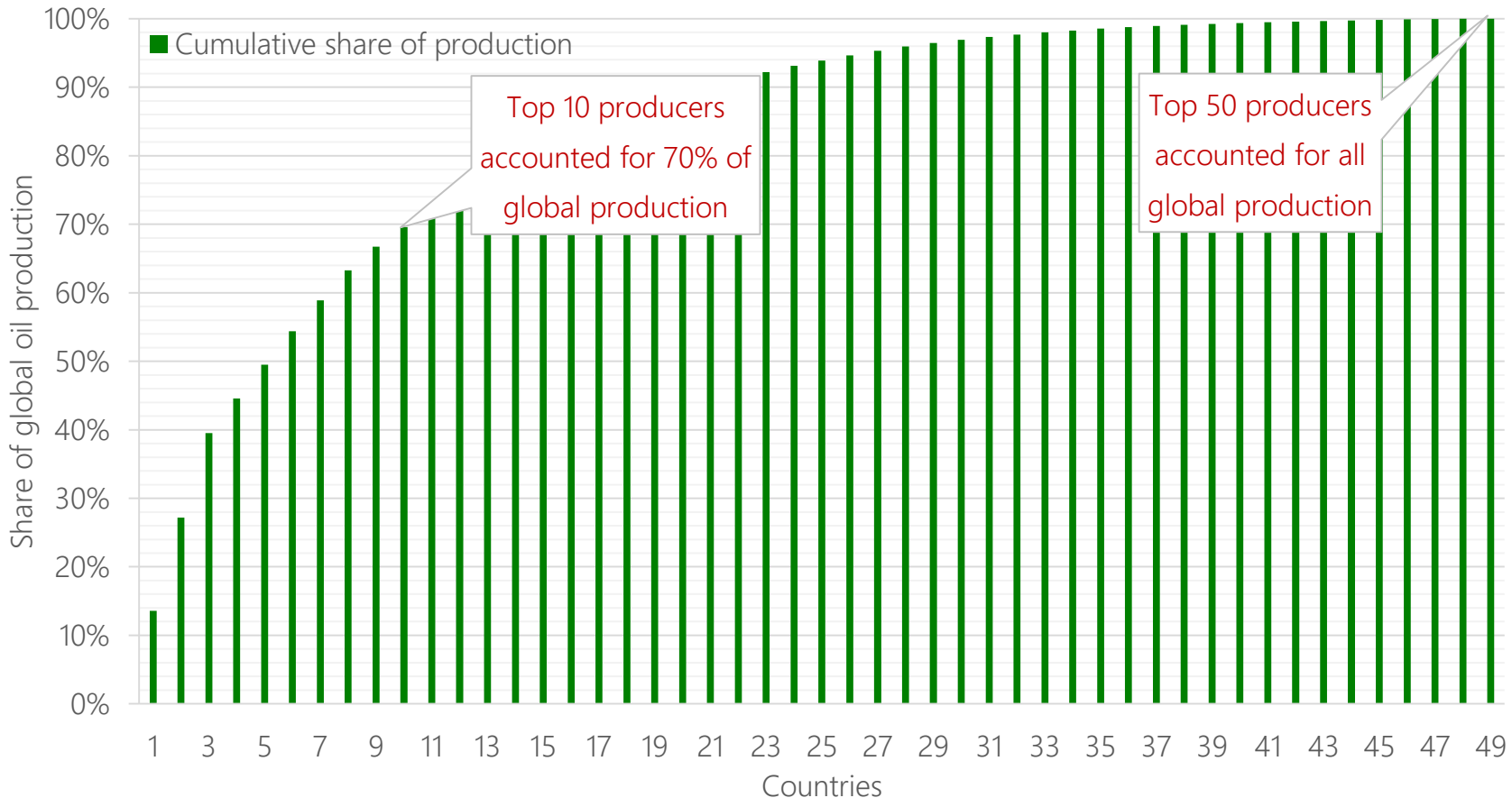

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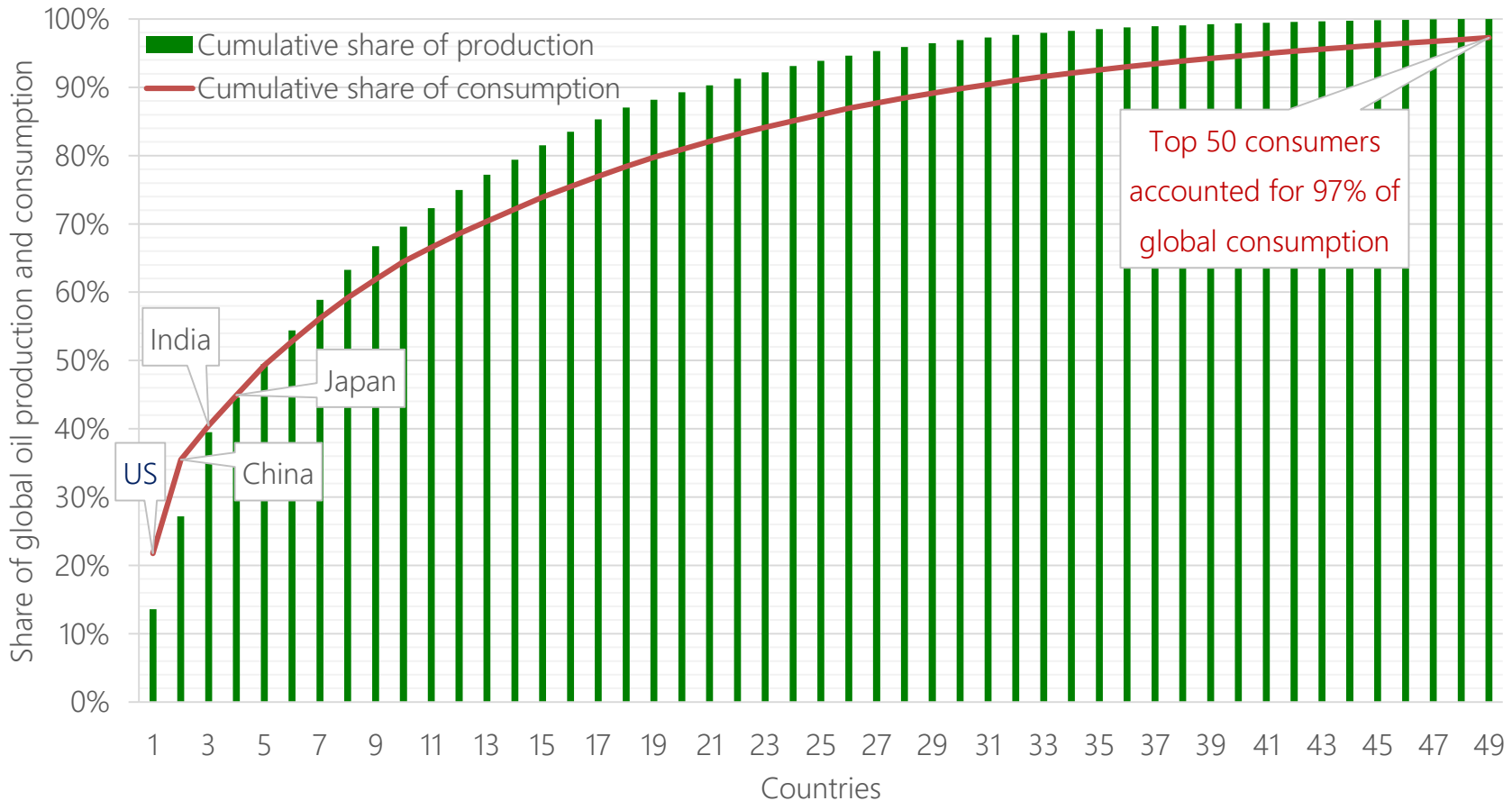

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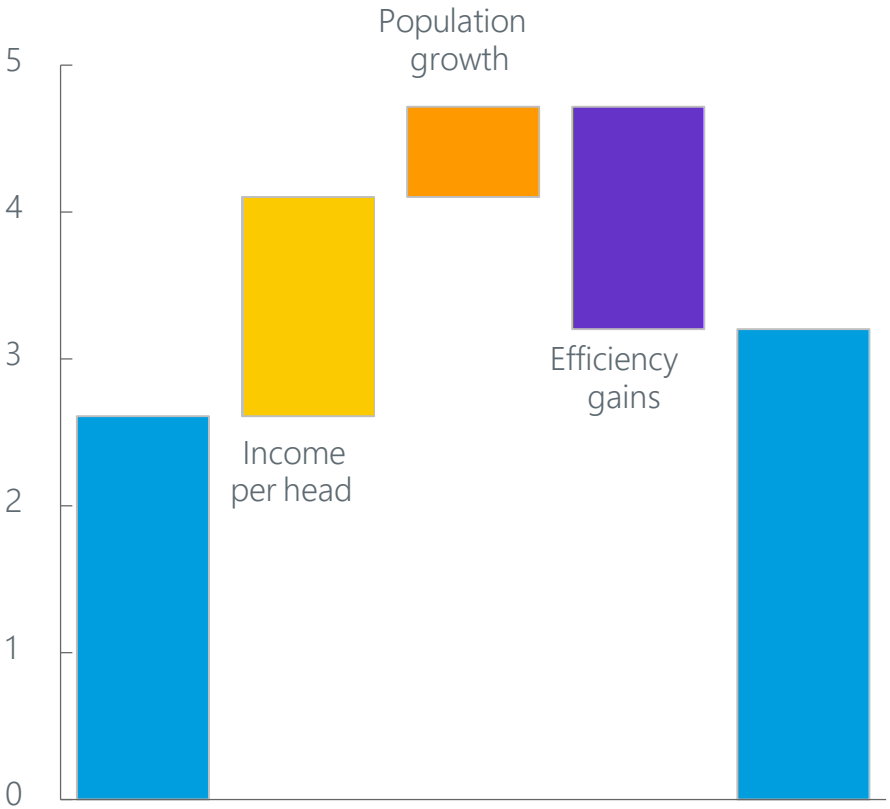
Outlook to 2040: the role of transport

Contribution to transport energy consumption growth

Billion toe



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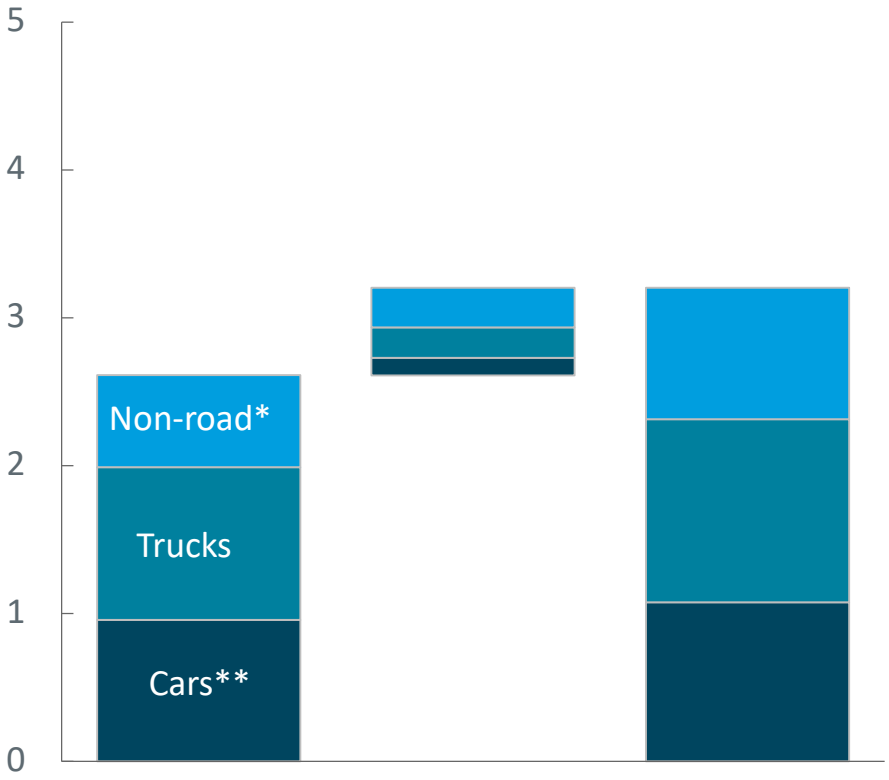
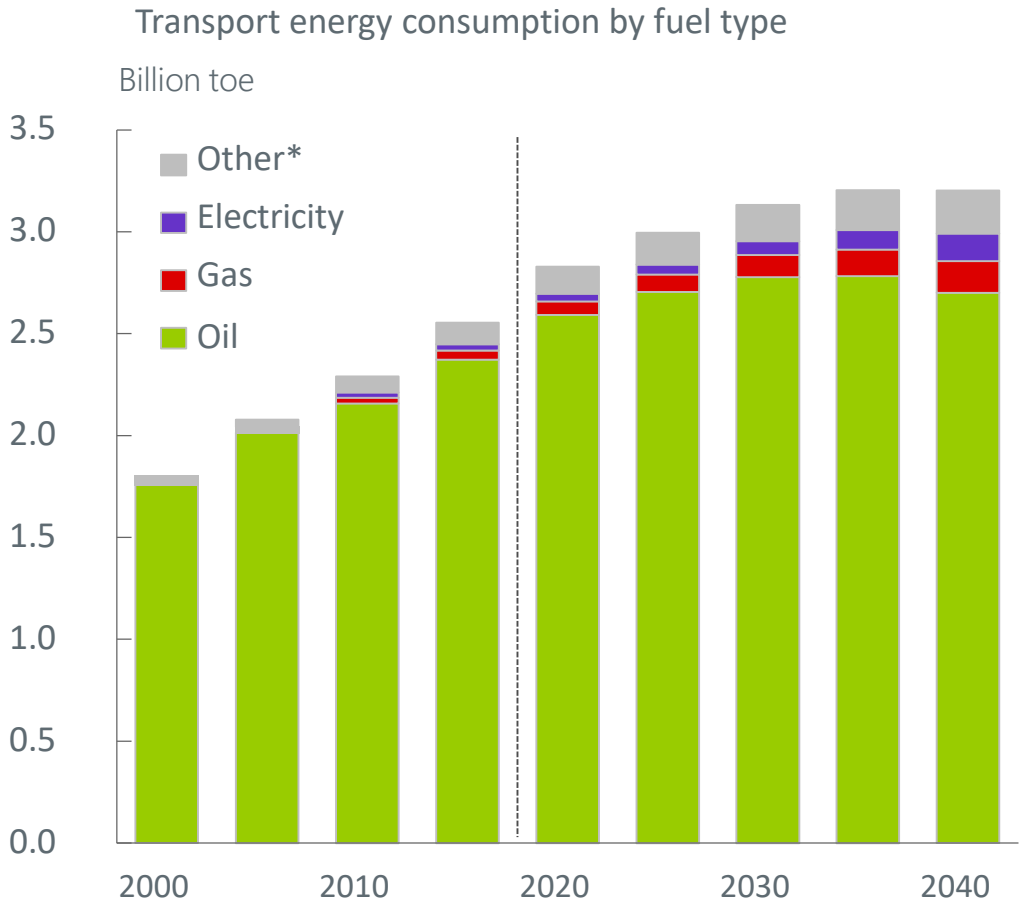


Source: BP Energy Outlook 2018

Outlook to 2040: the role of transport



Source: BP Energy Outlook 2018

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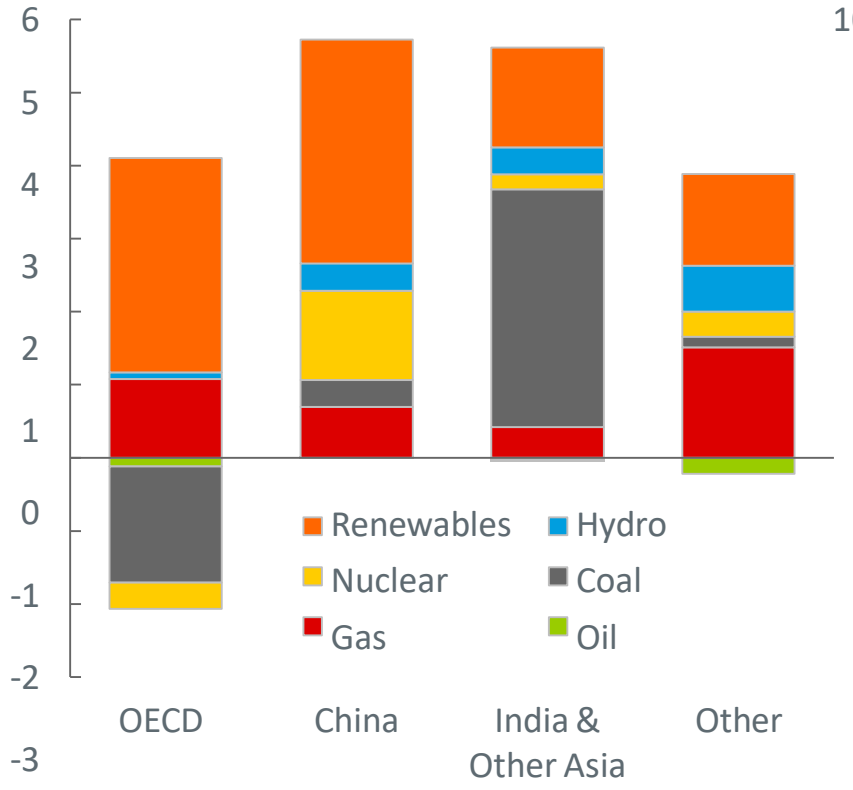
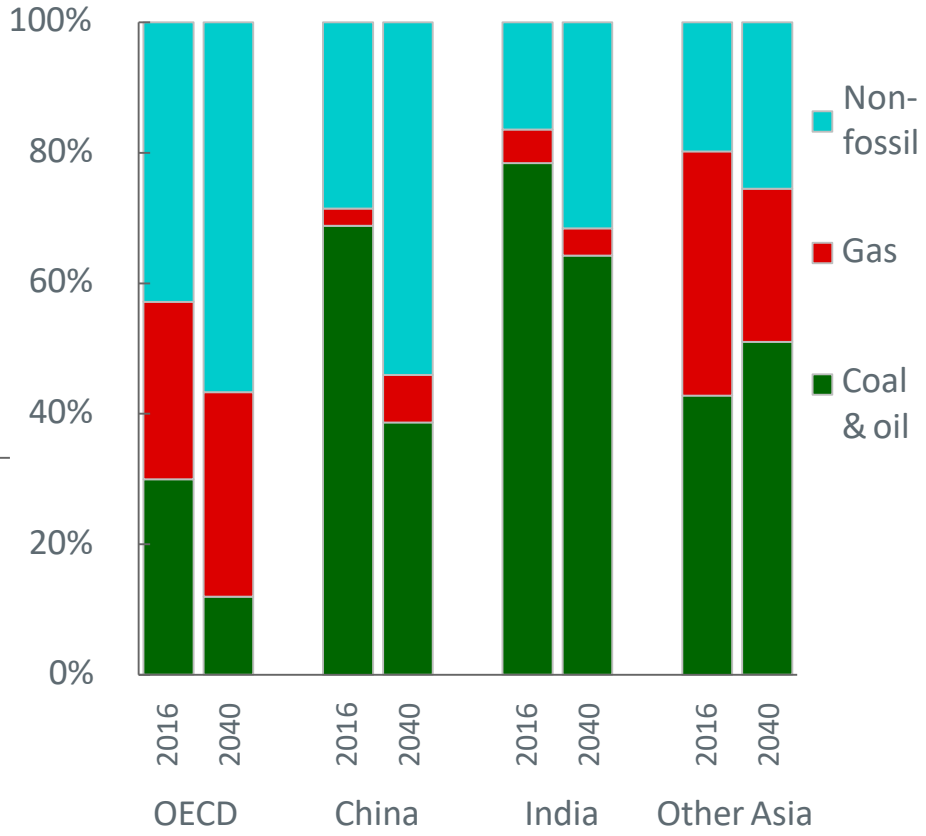
Outlook to 2040: power generation

Growth of power generation, 2016-2040

Thousand TWh



Shares of power generation, 2016 and 2040



Source: BP Energy Outlook 2018

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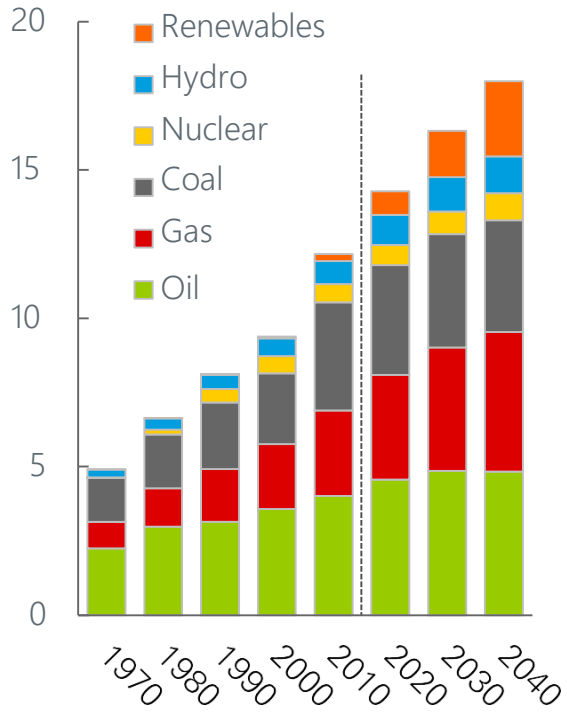
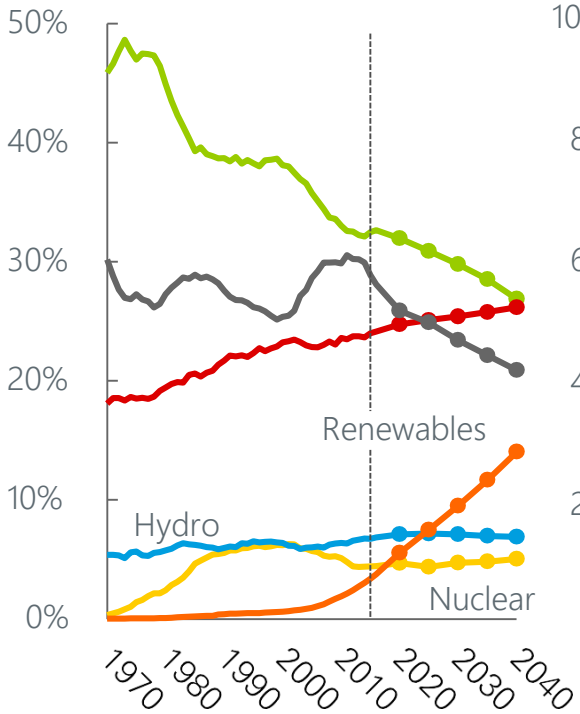
Outlook to 2040: consumption by fuel

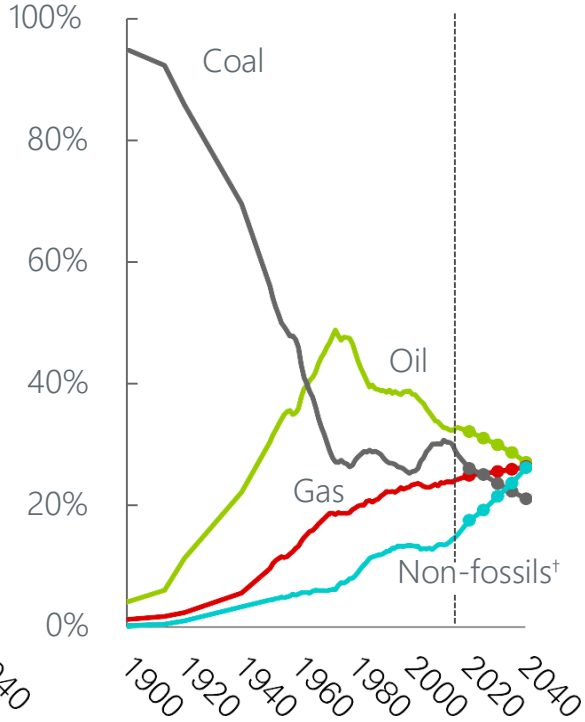
Primary energy consumption by fuel

Billion toe



Shares of primary energy





Source: BP Energy Outlook 2018

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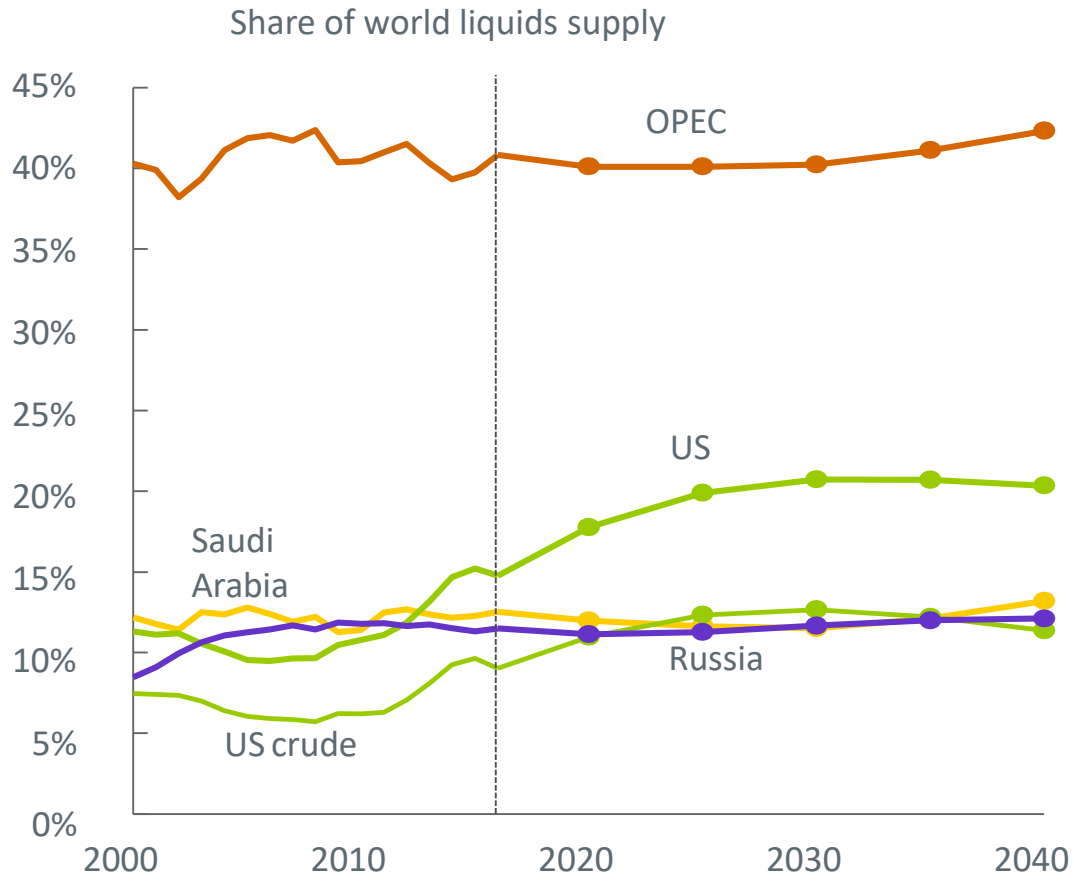
Outlook to 2040: supply of liquid fuels



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