

# Energy

# Infrastructure Assets

# Current State and Future Outlook

Harvard Energy Journal Club

October 4<sup>th</sup>, 2016

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**EXHIBIT 1.1** Types of Infrastructure

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Transportation	Communication	Energy and Utilities	Social Infrastructure
Roads	Telephone systems	Electricity distribution and generation	Universities
Bridges	Cell towers	Gas storage and distribution	Schools
Tunnels	Cable networks	Water supply	Hospitals
Airports	WiFi	Wasterwater treatment	Sports stadiums
Rail systems	Satellite	Renewable energy	Community facilities
Seaports	Television		Public housing
Shipping	Radio		Prisons
Cargo	Other systems		Corrections centers
Logistical centers			
Urban mass transit			

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# Infrastructure is Integral

## Building Blocks of Competitiveness Founded on Infrastructure

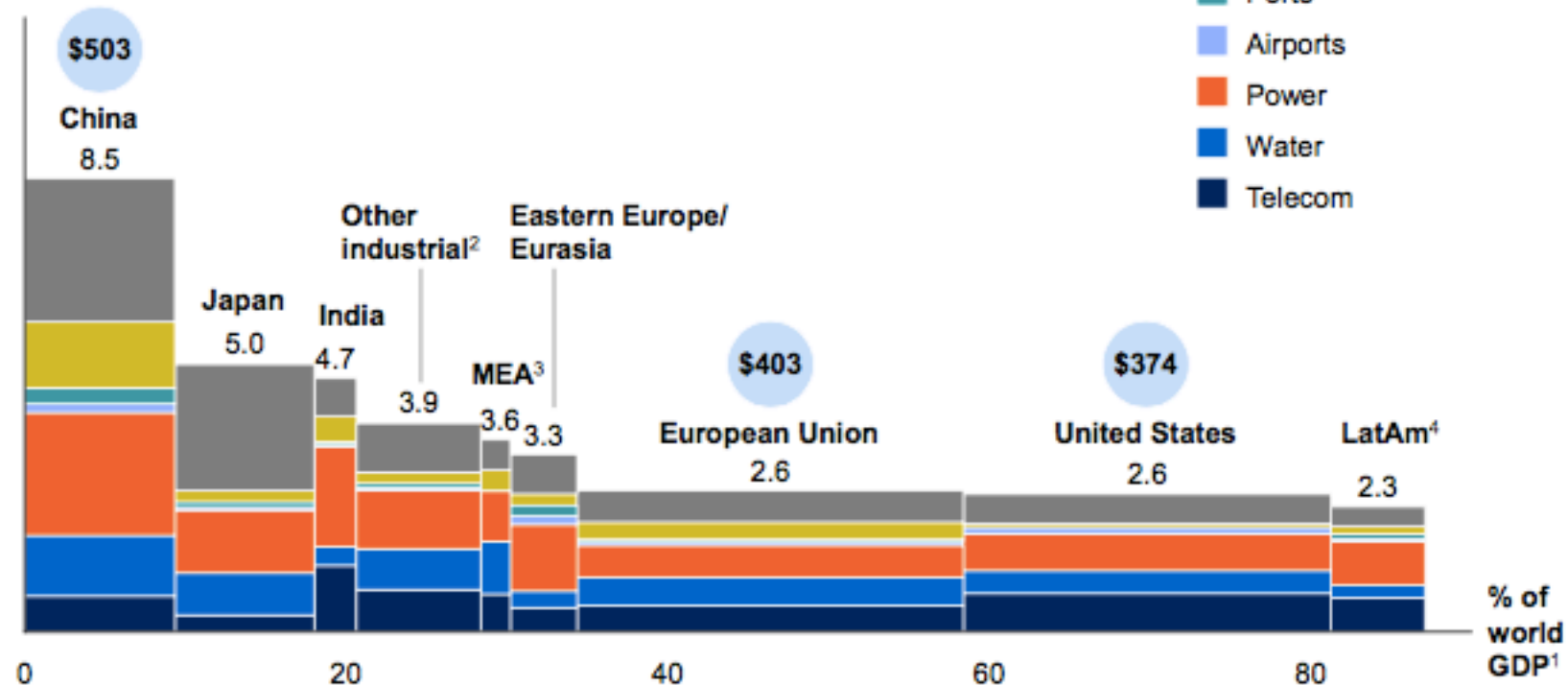
- Global Economy Dependent on Modern Logistics
- Industry Linkages Create Economic Clusters
- Metropolitan Economies are Drivers of GDP

Infrastructure has a long timeline – Dictates our carbon footprint

## Exhibit 2

# China has overtaken the United States and the European Union to become the world's largest investor in infrastructure

Amount spent on infrastructure, 1992–2011  
Weighted average % of GDP



1 Percentage of 2010 world GDP generated by the 86 countries in our analysis.

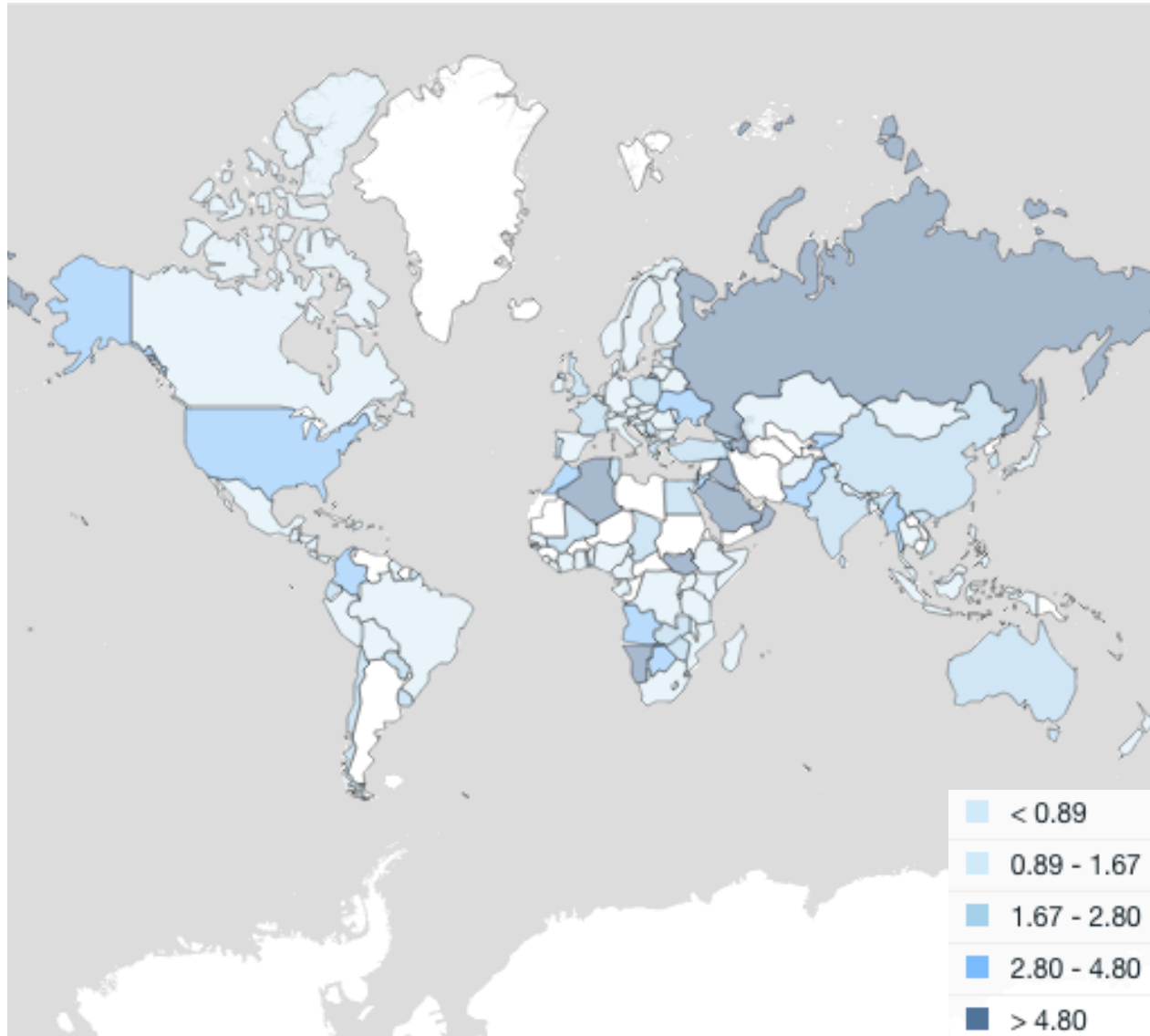
2 Australia, Canada, Croatia, Iceland, Lichtenstein, New Zealand, Norway, Singapore, South Korea, Switzerland, Taiwan (Chinese Taipei), and the United Arab Emirates.

3 Excludes unusually high port and rail data for Nigeria; including these data brings the total weighted average to 5.7%.

4 Revised upward from an estimate of 1.8% published earlier based on data provided courtesy of Dr. Armando Castelar.

SOURCE: IHS Global Insight; GWI; IEA; ITF; McKinsey Global Institute analysis

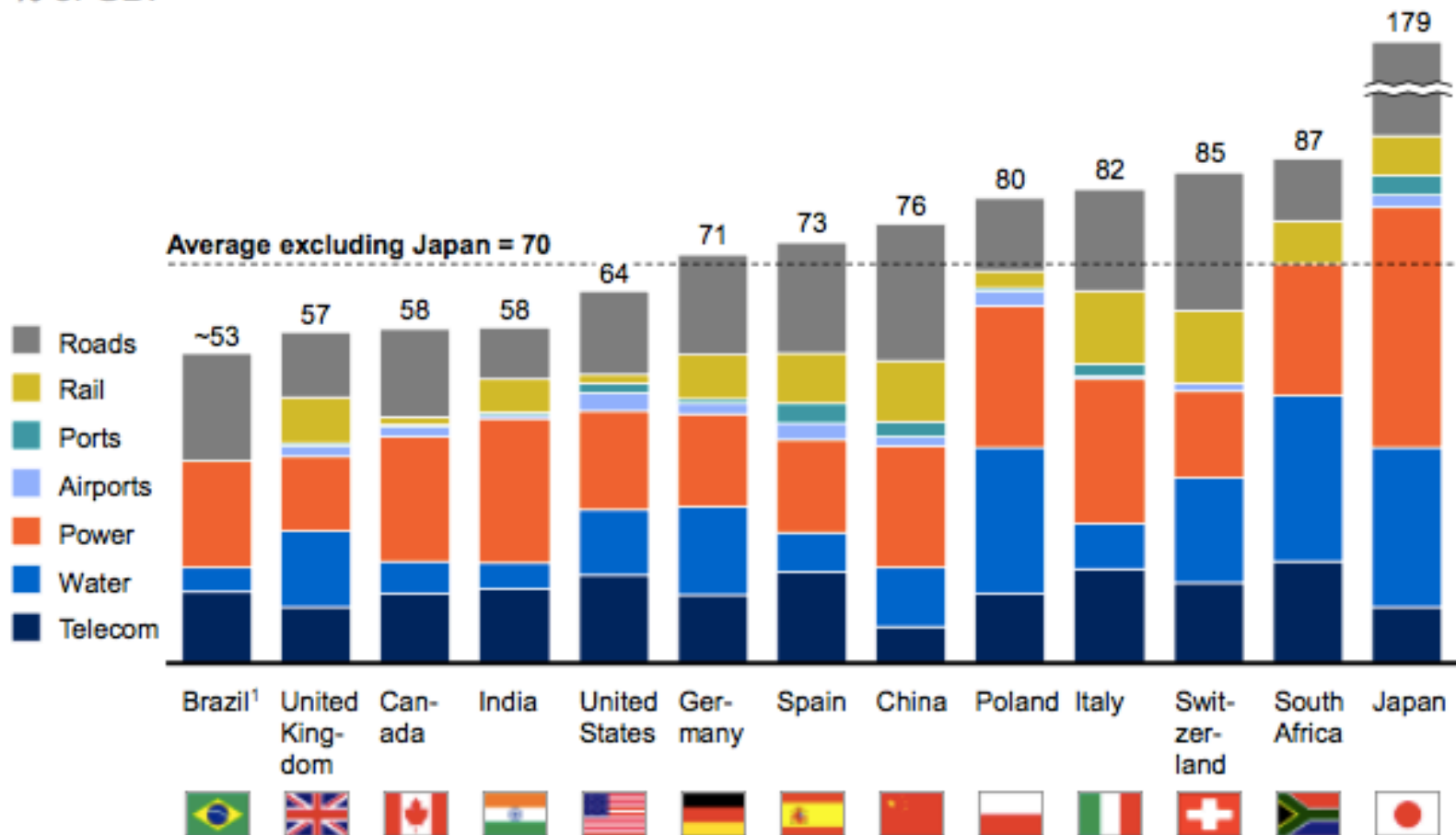
# Military Expenditure (% GDP)



## Exhibit 3

### Global infrastructure stock averages around 70 percent of GDP

Total infrastructure stock  
% of GDP

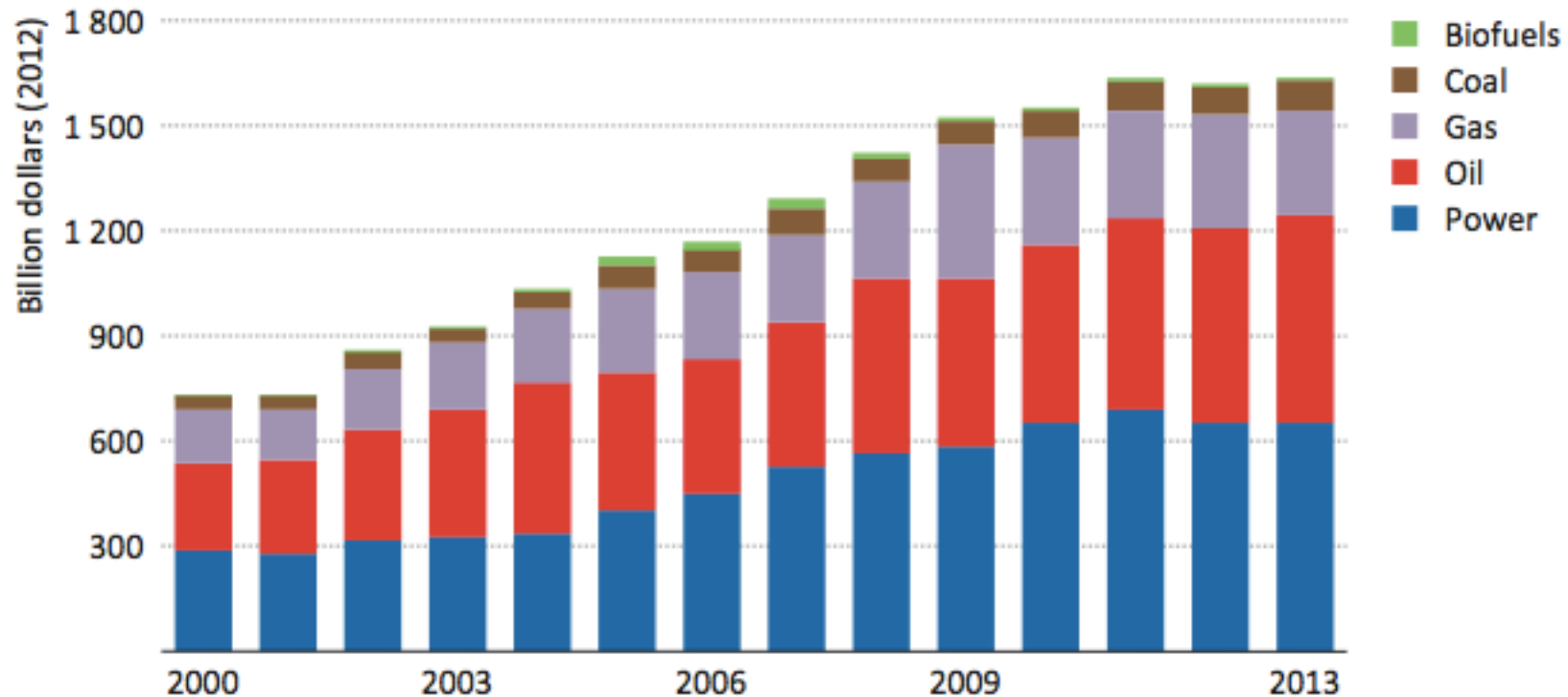


1 For Brazil, road data contains all of transport. Brazil stock revised significantly upward to 46–54% from an earlier published version based on longer time series showing 2-3x higher investment rates in the 1970s and 1980s compared to the 1990s and 2000s. The estimate shown is based on data provided courtesy of Dr. Armando Castelar.

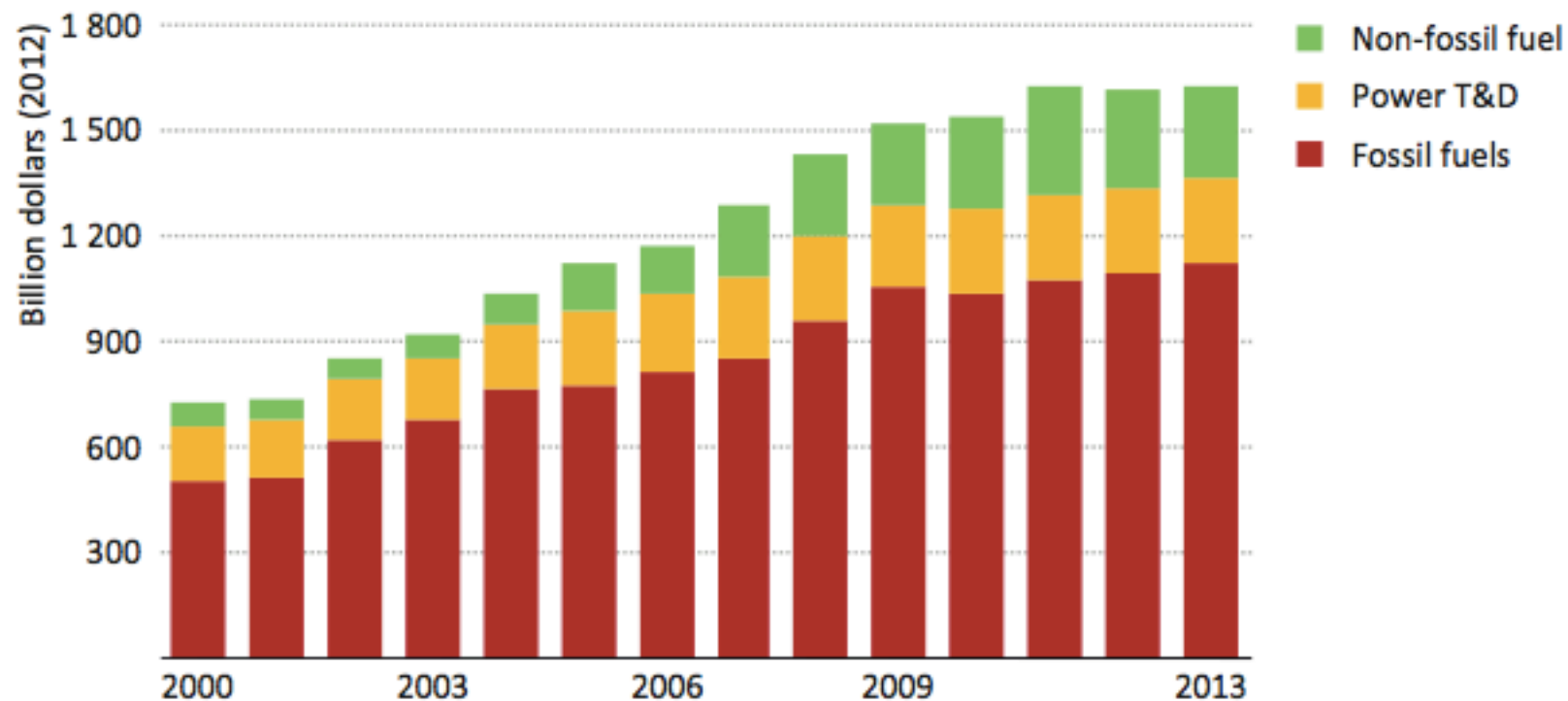
SOURCE: ITF; GWI; IHS Global Insight; various national statistics; McKinsey Global Institute analysis

# Historical Trends

**Figure 1.1** ▶ Investment in global energy supply



**Figure 1.2** ▸ Investment in global energy supply by fossil fuel, non-fossil fuel and power T&D

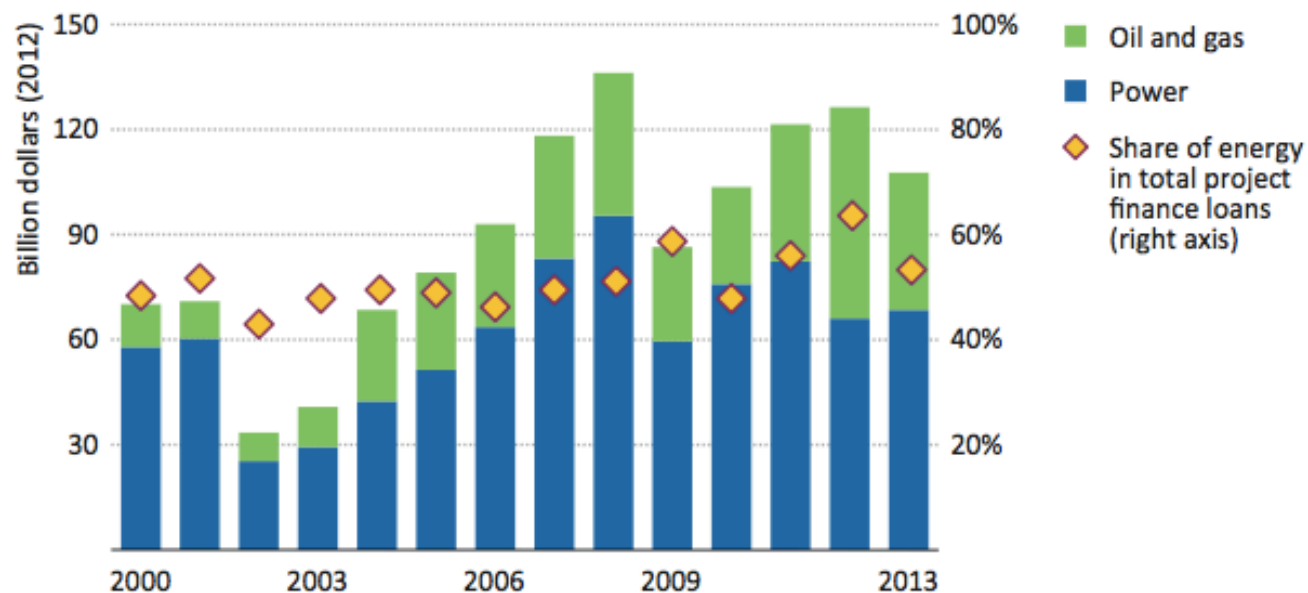


Notes: Non-fossil fuel includes all renewable technologies, nuclear and biofuels. Power T&D is transmission and distribution for the power sector: this cannot be assigned to either fossil-fuel or non-fossil fuel use.

# Financing Infrastructure

- Sources:
  - Self-financing
  - Banks
  - Capital Markets
- Constraints:
  - Public Spending Pressure
  - Long-term Investment
  - Regulation of Markets

**Figure 1.11** ▶ Value of global project finance loans in oil, gas and power



Source: Project Finance International "League Tables" 2000-2013.

# Future Projections

- Many Assumptions at Play
  - Growth in Demand
  - Policies Enforced/Emission Targets
  - Costs of Technologies
  - Project Timelines
- New Policy Scenario – Demand and supply projections to reflect policies implemented and announced commitments as of 2014

# Financing the Future

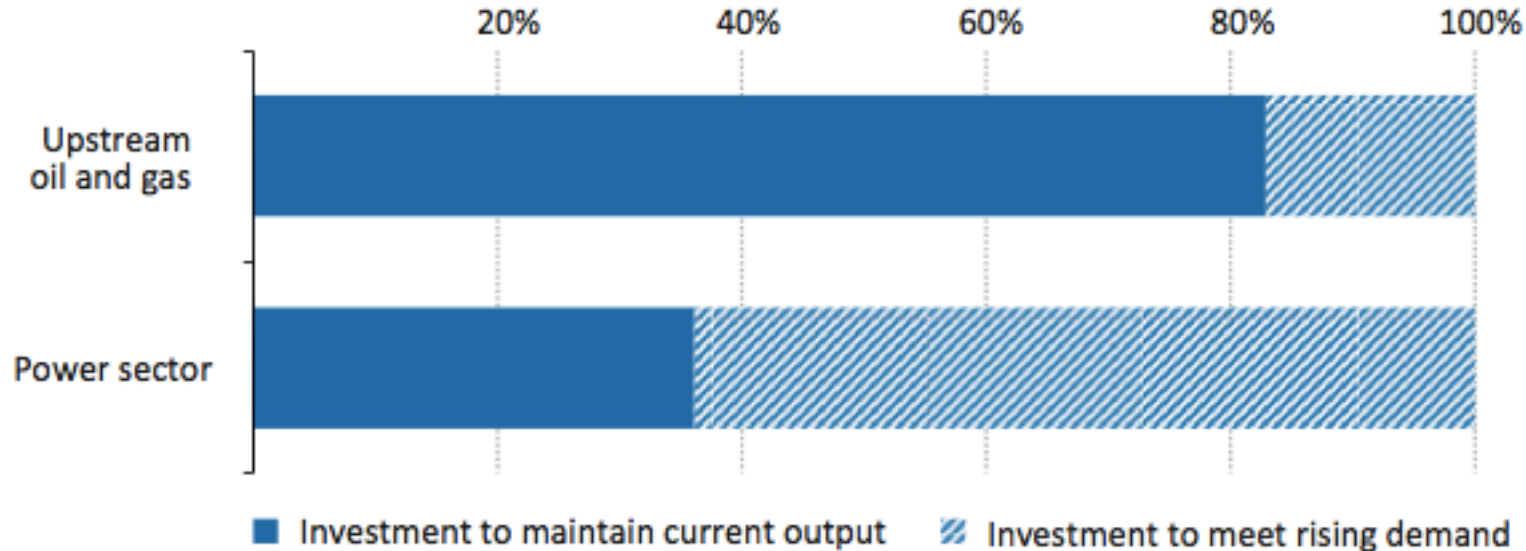
Low-carbon energy investments must provide attractive risk-adjusted return

## Barriers

- Policy Uncertainty
- High Up-Front Costs
- Dispersed/Diverse Nature

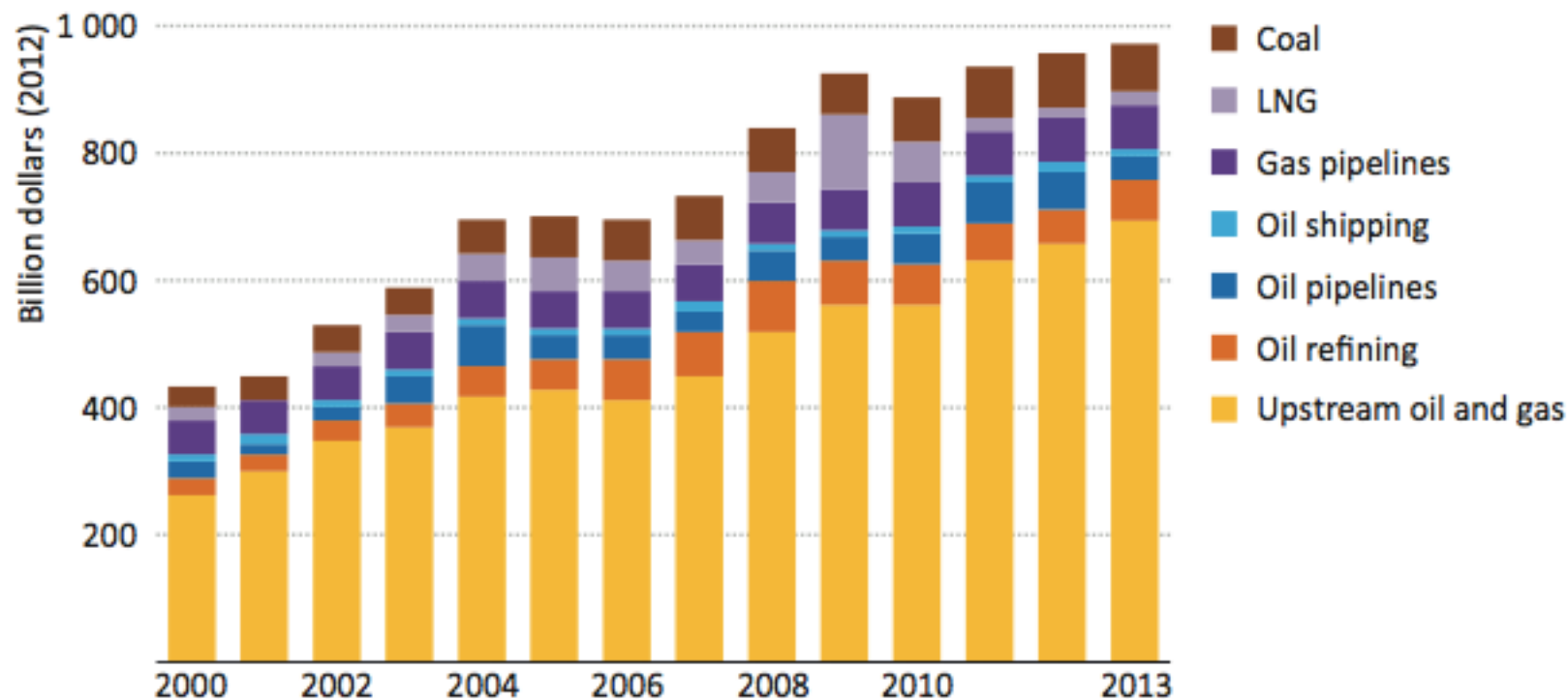
# Financing the Future

**Figure 1.5** ▶ Share of investment required to keep global output at current levels versus total investment required in the New Policies Scenario, 2014-2035



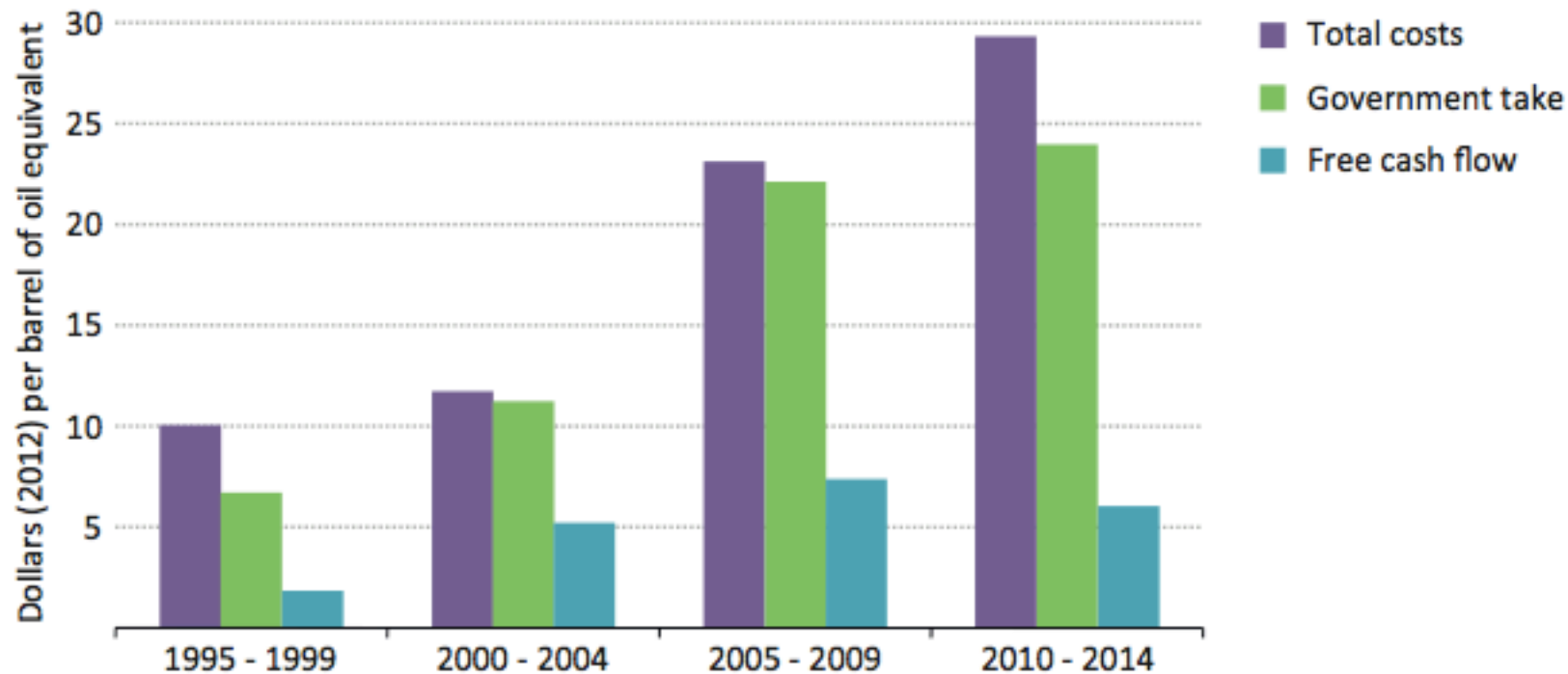
# Historical Trends – Fossil Fuels

**Figure 2.1** ▷ Global investment in fossil fuel supply



# Financing – Oil and Gas

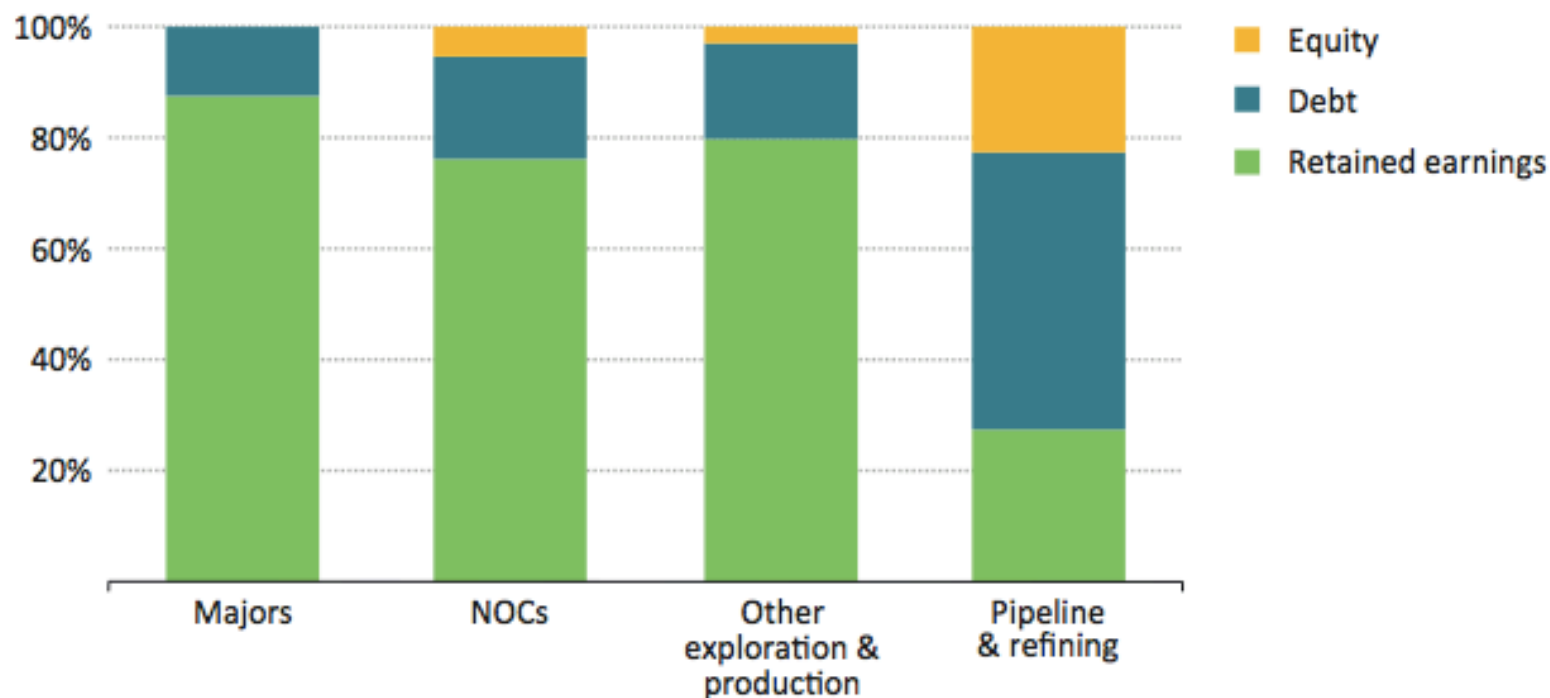
**Figure 2.2** ▶ Aggregate split of oil revenue for private upstream companies between total costs, government take and free cash flow



Sources: IEA analysis; Rystad Energy AS.

# Financing – Oil and Gas

**Figure 2.3** ▶ Indicative sources of financing for capital expenditure for different types of listed oil and gas companies, 2002-2012

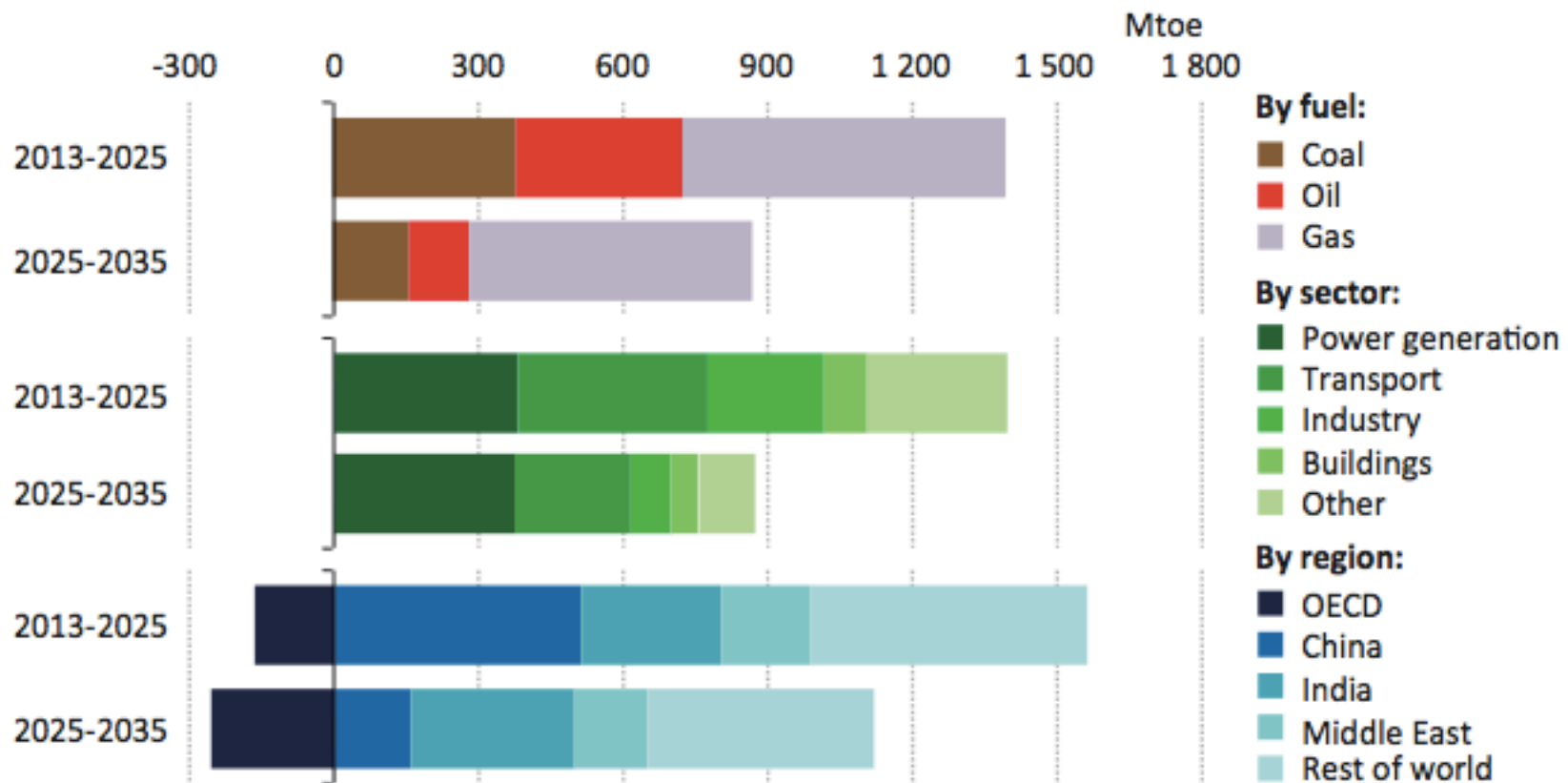


Notes: This is calculated looking at total change in debt and equity financing for the top 50 listed oil and gas companies as a percentage of capital expenditure, used to proxy the share of external financing. The seven Majors are BP, Chevron, ExxonMobil, Shell, Total, ConocoPhillips and Eni.

Sources: IEA analysis and 2° Investing Initiative, based on data from Bloomberg Professional service.

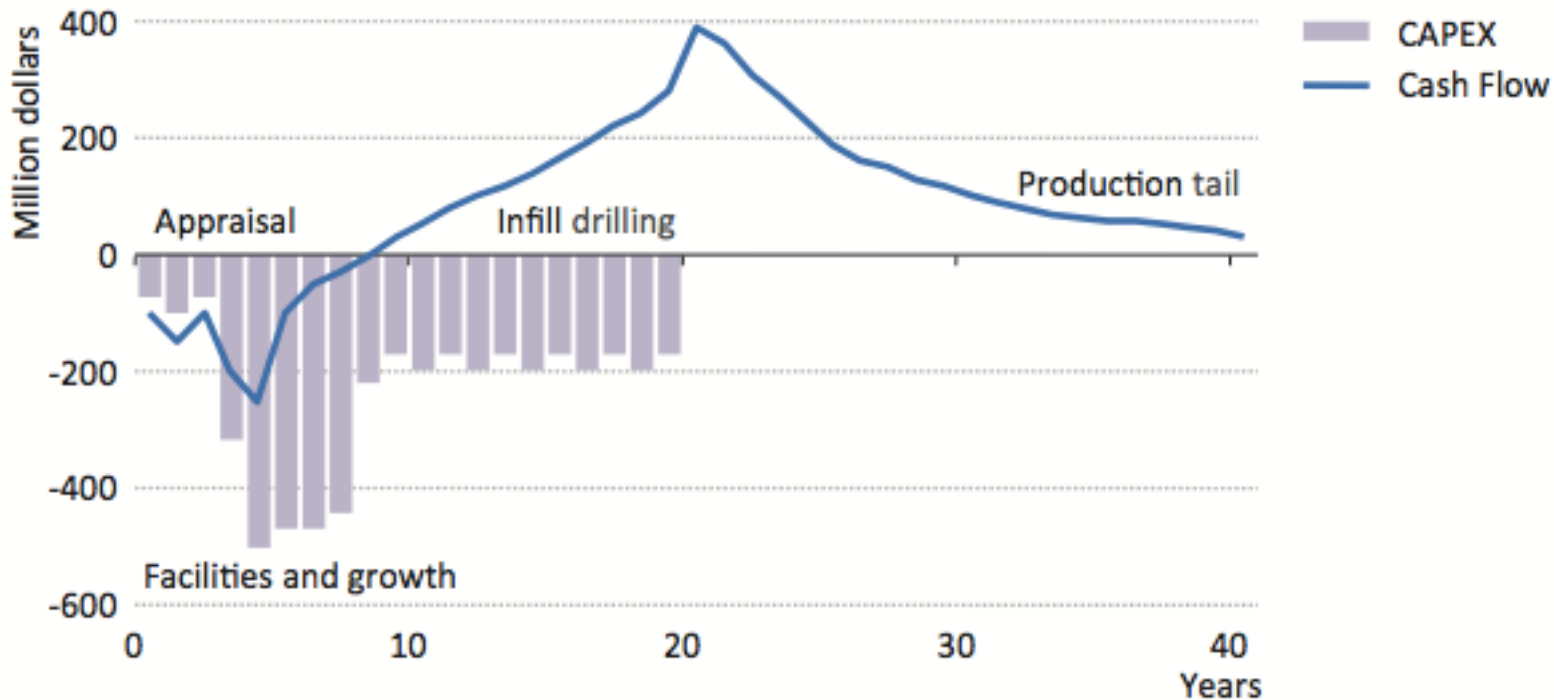
# Future Trends – Fossil Fuels

**Figure 2.5** ▶ Growth in world fossil fuel demand in the New Policies Scenario



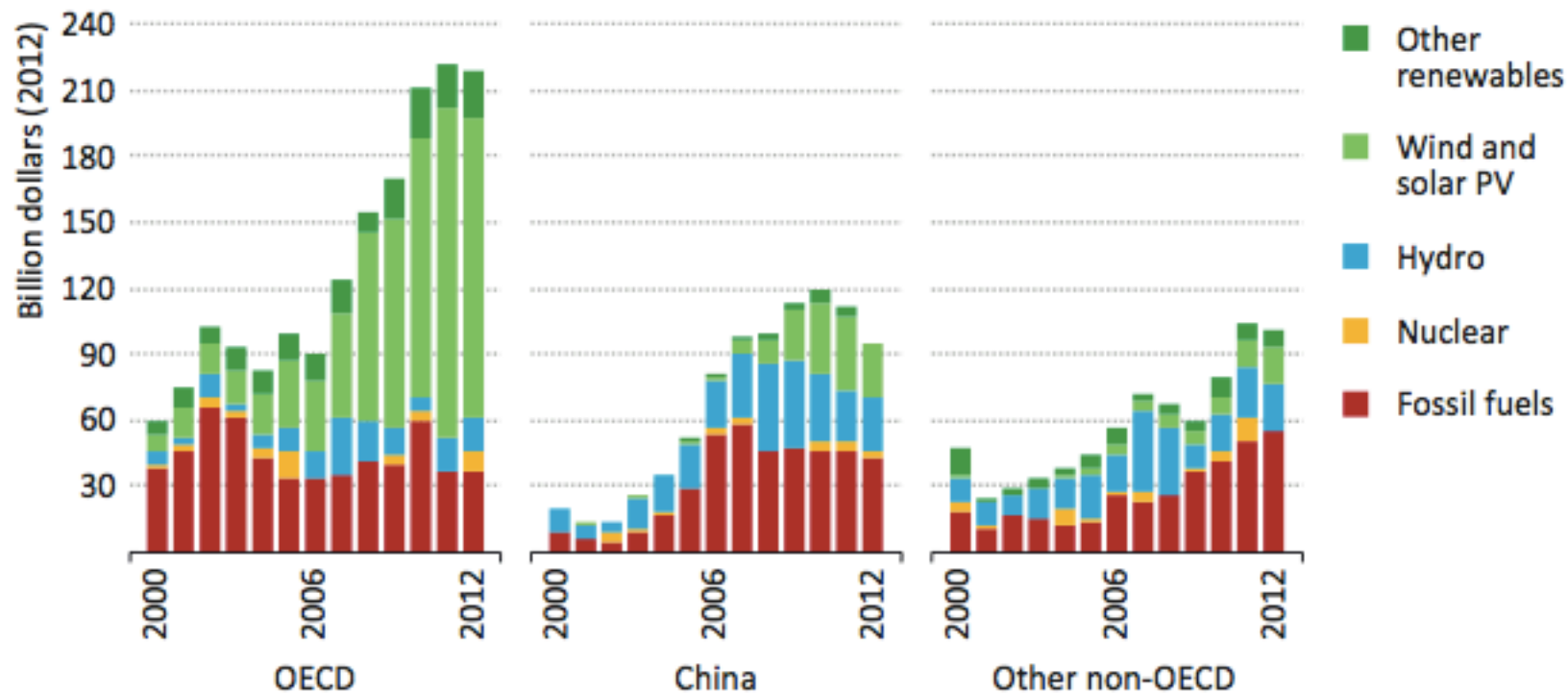
# Future Financing – Fossil Fuels

**Figure 2.19** ▸ Illustrative capital expenditure and cash flow for a large shale gas / tight oil investment



# Historical Trends – Power Sector

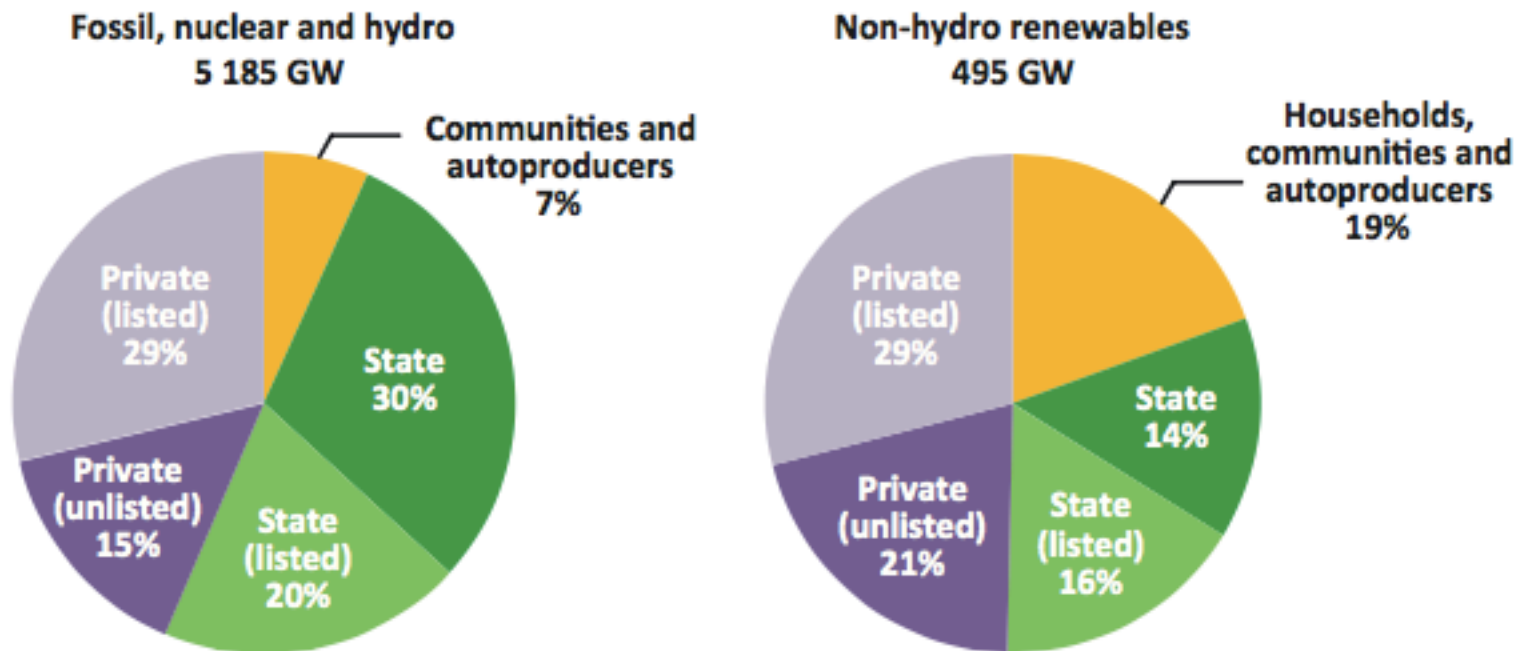
**Figure 3.1** ▶ Investment in power plants by type and region, 2000-2012



Sources: IEA analysis and IEA (2014a).

# Financing – Power Sector

**Figure 3.3** ▶ Ownership of global power generation assets in 2012

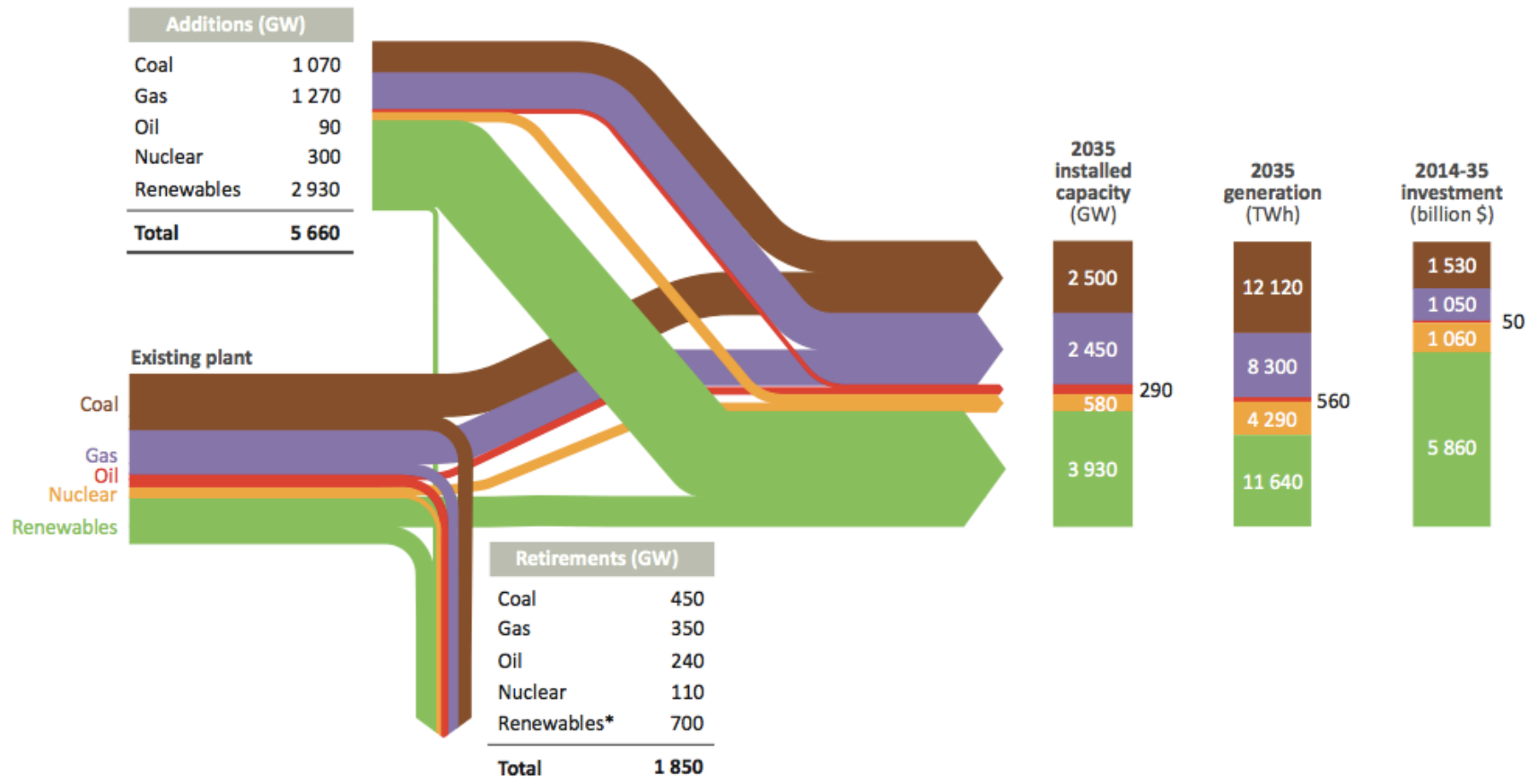


Note: Plants with mixed ownership were fully attributed to the majority owner.

Sources: IEA analysis and 2° Investing Initiative, based on Platts, Bloomberg Professional service, Bloomberg New Energy Finance and national sources.

# Future Trends – Power Sector

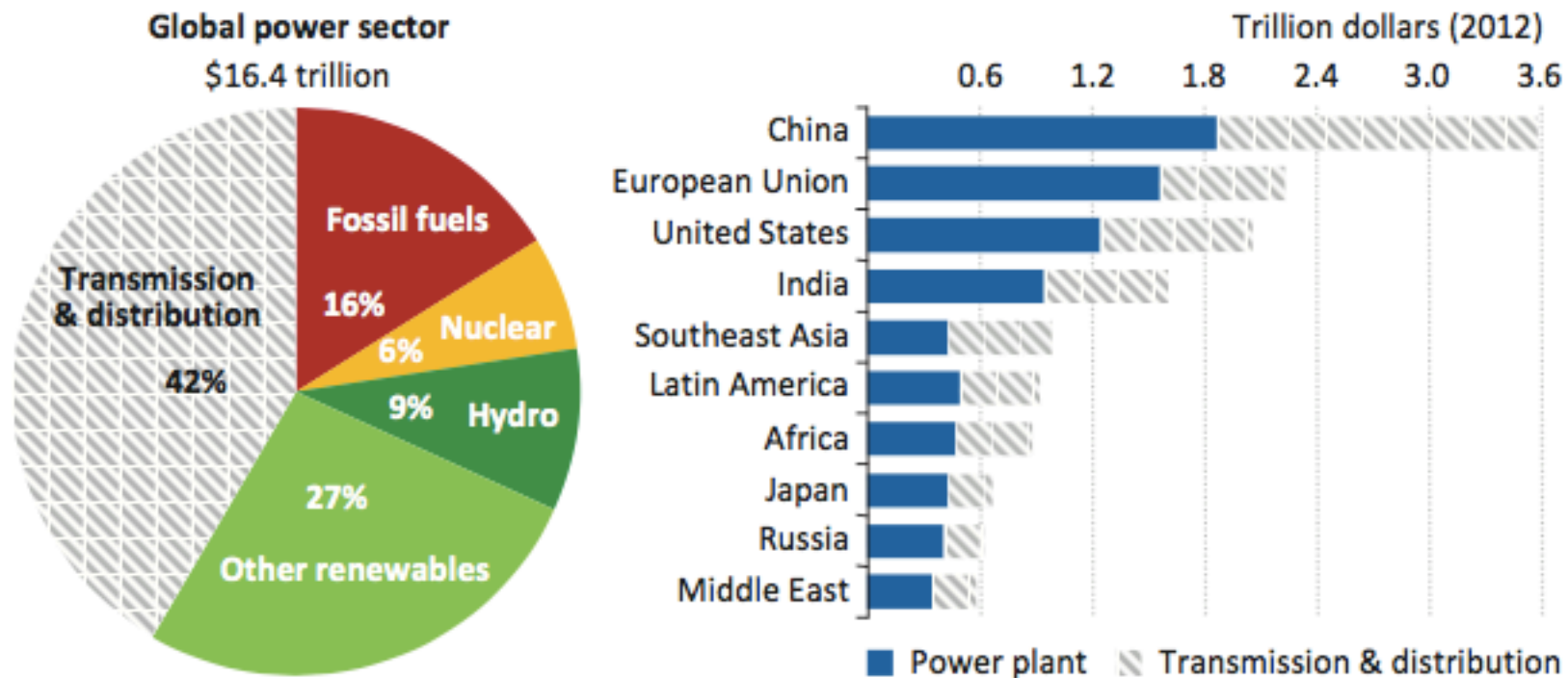
**Figure 3.5** ▶ Power generation global capacity flows and investment, 2014-2035



Note: Over the projection period, a small portion of the renewables additions is retired following the lifetime assumption for wind and solar PV of 20-25 years

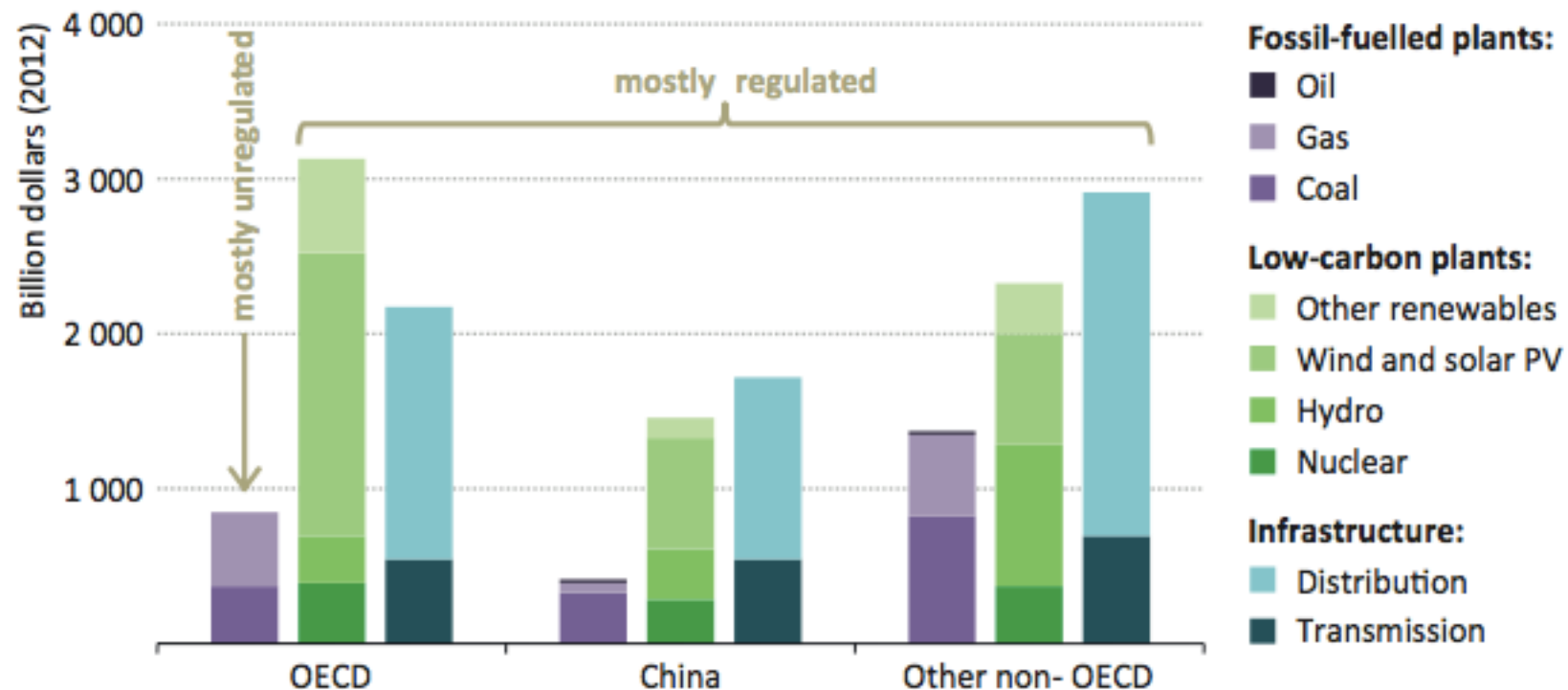
# Future Financing – Power Sector

**Figure 3.7** ▶ Cumulative global power sector investment by type and selected region in the New Policies Scenario, 2014-2035



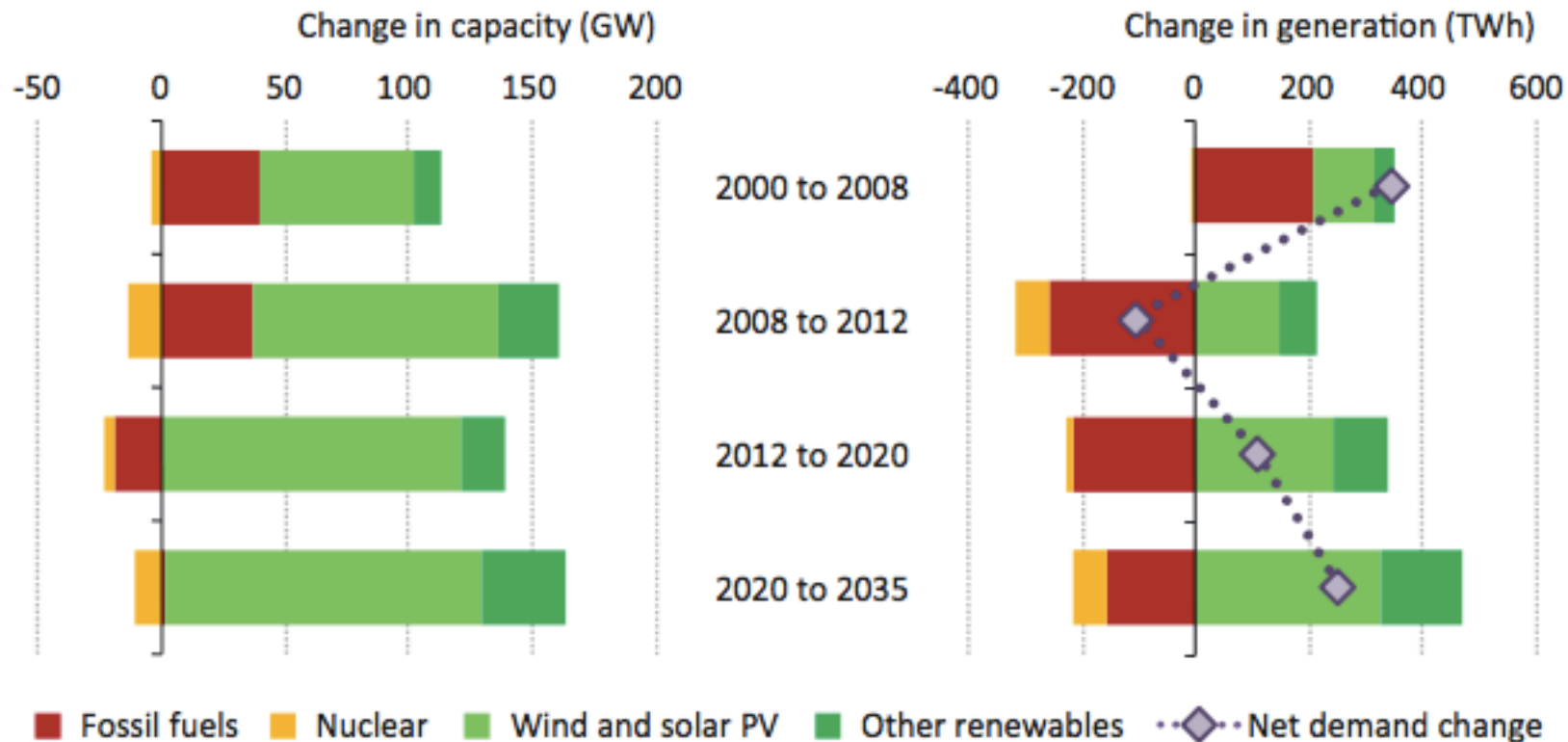
# Future Financing – Power Sector

**Figure 3.11** ▶ Power sector investment by market type and region, 2014-2035



# Future Financing – Power Sector

**Figure 3.13** ▶ Net capacity additions and net incremental demand and generation by type in the European Union, 2000-2035



# Policy Mechanisms

- Feed-In Tariffs
- Quota Obligations
  - Renewable Portfolio Standards
  - Certificate Systems
- Tariff Tendering
- Capital Grant
- Fiscal Measures

# Social Dimensions

- Who gets energy?
- Who gets profits?
  - Monopolies
  - Directionality of Transport
- Avoidance of environmental responsibility?

Seek to design systems that provide access to wide range of users