

63rd AMEU Convention

Global Power & Utilities Trends

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*"Clean, efficient, affordable
and reliable energy services
are indispensable for global
prosperity."*

*United Nations 'Energy for Sustainable
Future'*

Agenda

- Global power & utilities megatrends
- Energy transformation: industries' convergence and smart cities
- Global gas
- Global renewables energy
- Conclusions: energy sector change

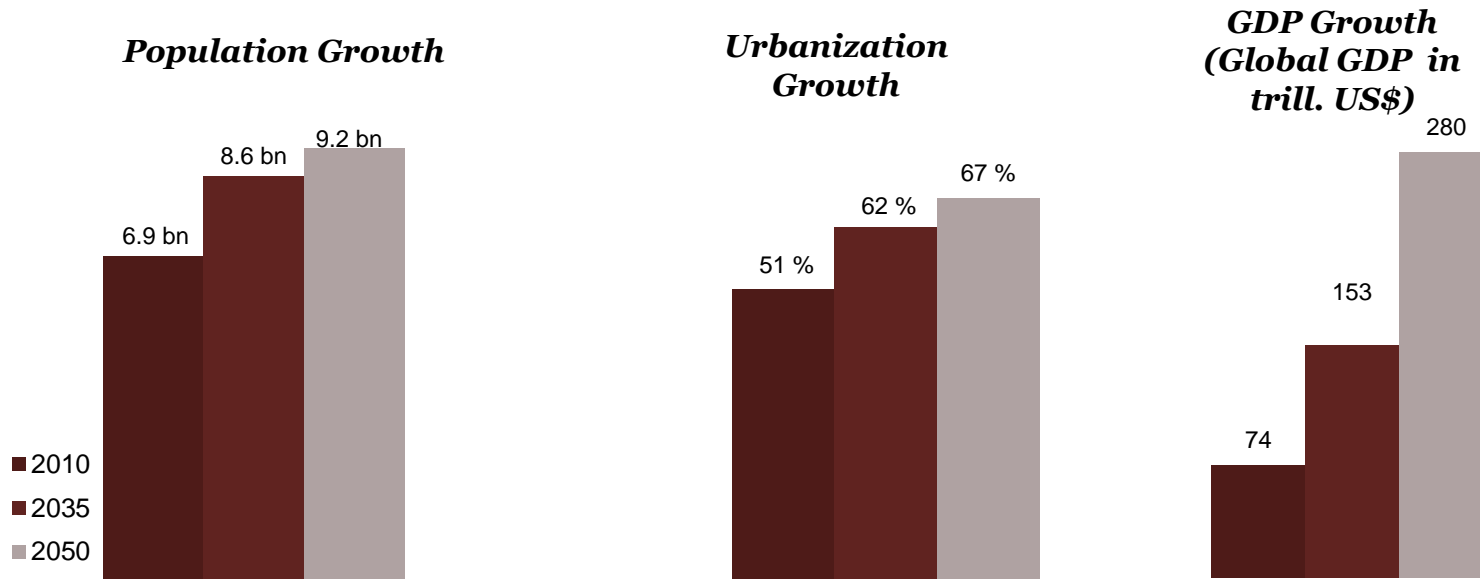
Global Power & Utilities Megatrends

Part 1

Global energy – a big picture: ExxonMobil's 2040 vision

- Global energy demand will be about 30 % higher in 2040 compared to 2010 .
- Energy demand growth will slow as economies mature, efficiency accelerates and population growth moderates.
- By 2040, electricity generation will account for more than 40% of global energy consumption.
- Demand for coal will peak and begin a gradual decline, in part because of emerging policies that will seek to curb emissions.
- Oil, gas and coal continue to be the most widely used fuels, making up about 80 % of total energy consumption in 2040.
- Natural gas will grow fast enough to overtake coal for the number-two position behind oil. Demand for natural gas will rise by more than 60 % by 2040.
- Gains in efficiency through energy-saving and technology will temper demand growth and curb emissions.
- Global energy-related CO₂ emissions will grow slowly, then level off around 2030.

Driving forces behind global energy demand



Population Growth:

- Global \emptyset 0.9% p.a.¹⁾
- 6.9 billion 2010 \rightarrow 8.3 billion 2035 \rightarrow 10 billion 2050

Urban Growth:

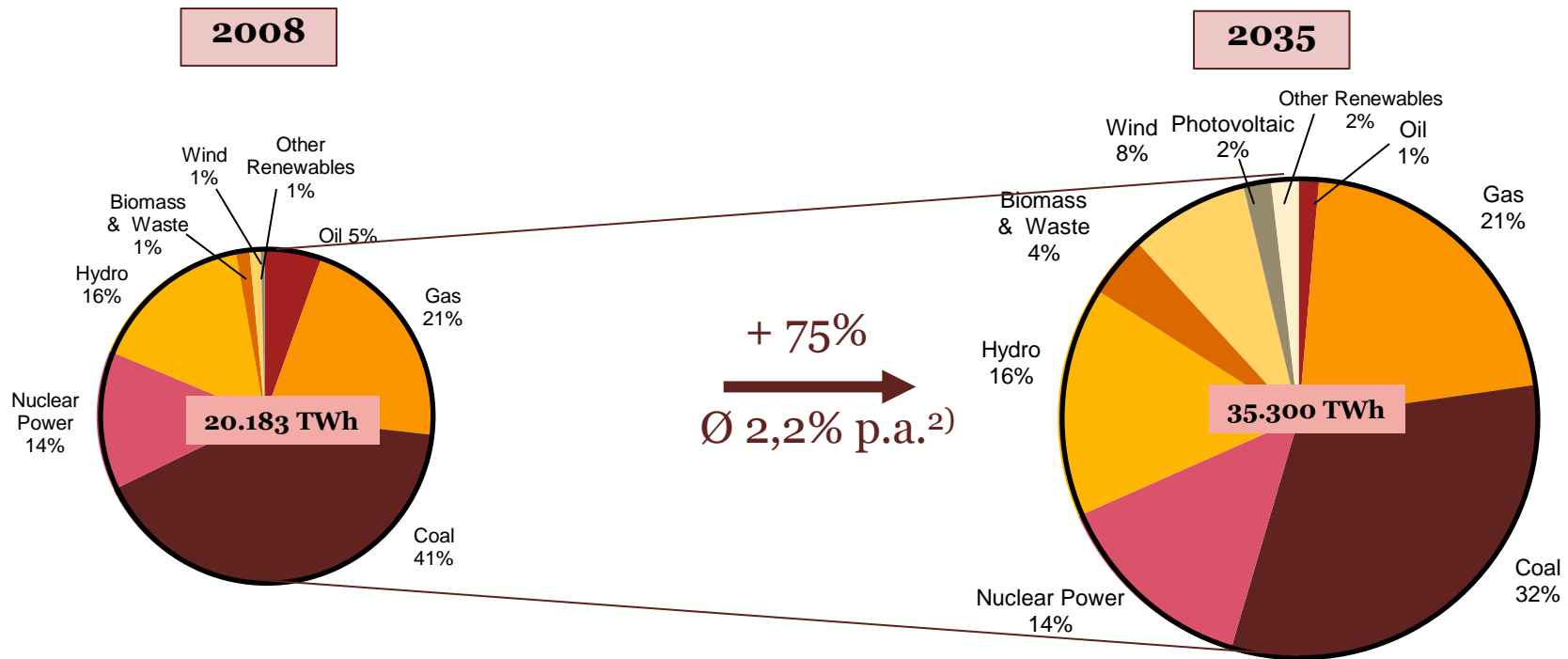
- 100% of future population growth in cities
- Since 2009 population in cities exceeds that in the countryside
- Trend to Megacities

Economic Growth:

Global \emptyset 3.2% p.a.¹⁾, China 5.7%, India 6.4%, Middle East 3.9%

21st Century - the era of electricity?

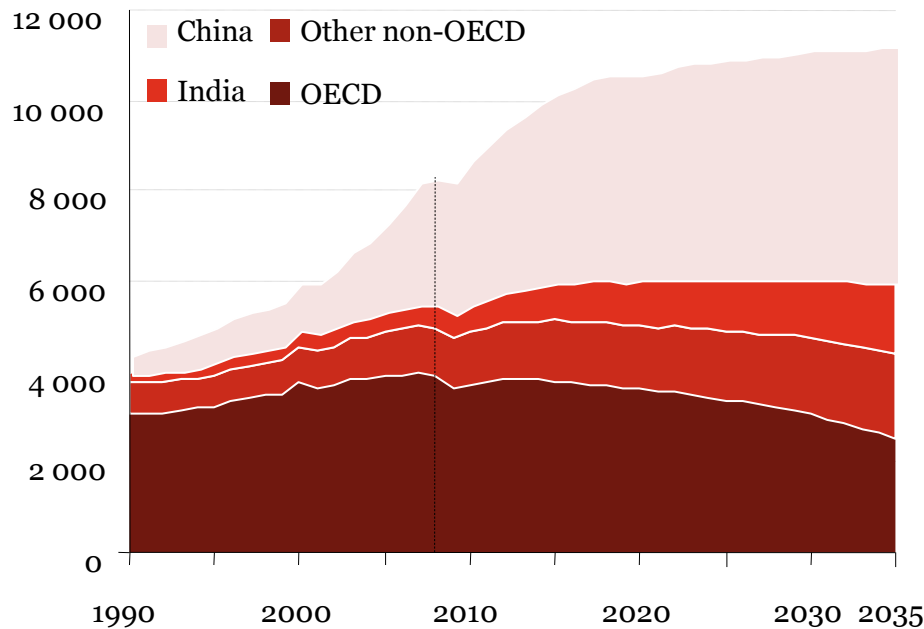
Global electricity generation and fuel mix



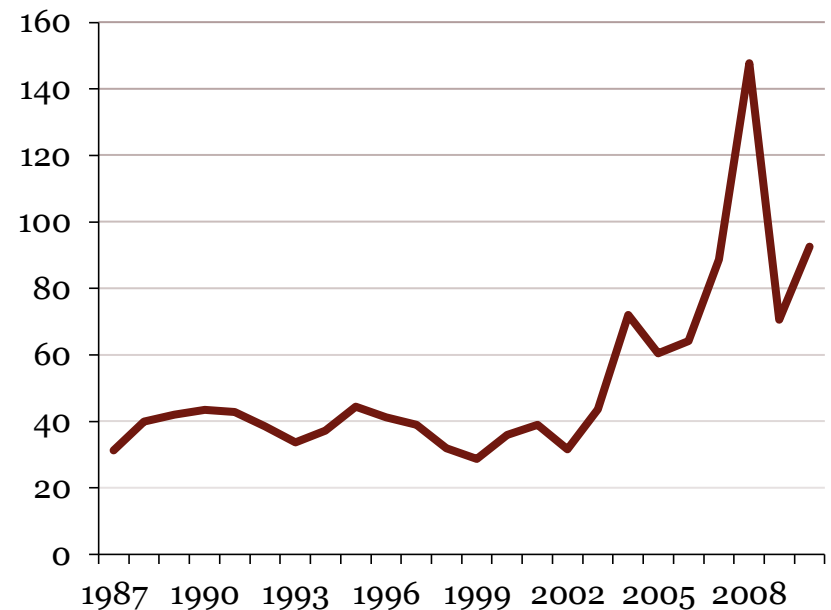
Significant transition towards low carbon technologies
Non-hydro renewables share increases from 3% to 16%
Coal-fired generation dominates

Coal: drop in coal-fired generation in OECD offset by big increase in China

Incremental primary energy demand to 2035 (TWh)



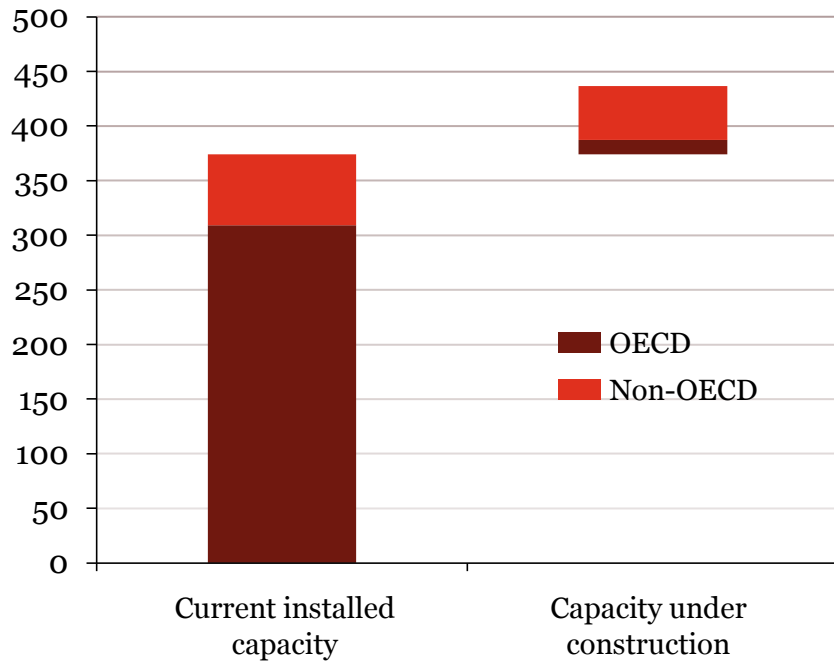
Nominal coal prices Northwest Europe (US\$ per tonne)



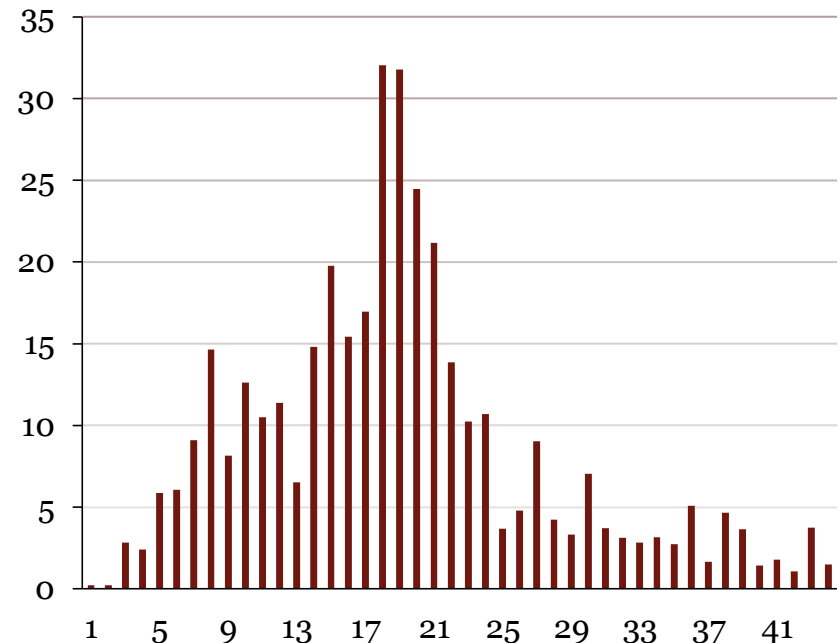
China is driving a large increase in coal-fired electricity production, whilst prices seem to be rising. At current consumption levels there is approximately 118 years of proven reserves left

Nuclear: substantial growth in non-OECD countries

Current installed capacity and capacity under construction 2011 (GW)



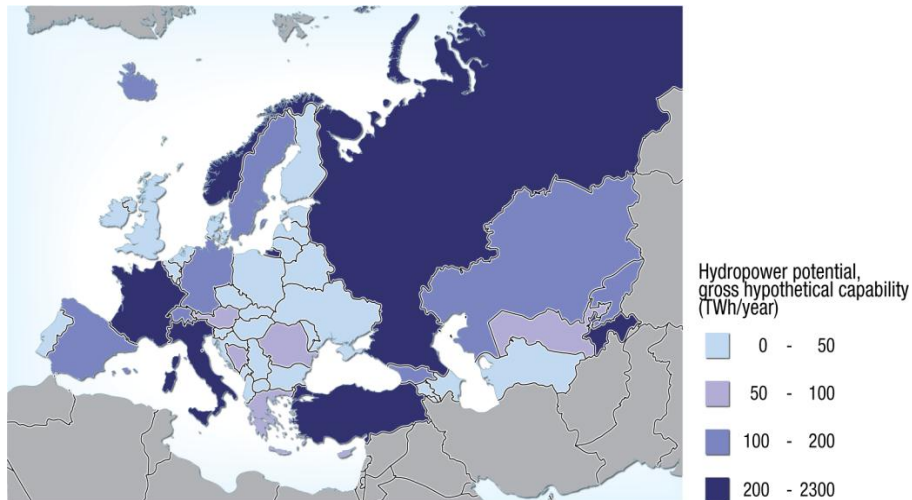
Installed nuclear capacity by age (years, GW)



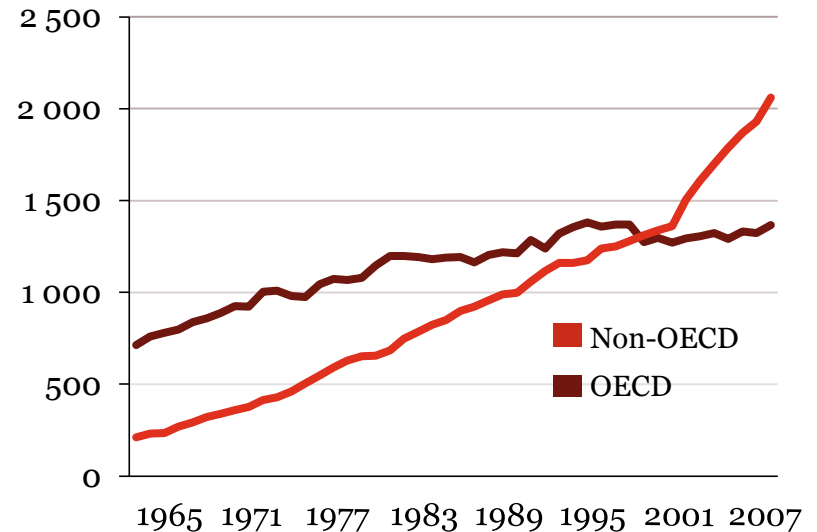
Most nuclear power is based in the OECD but the stock is ageing. Unclear what the role of nuclear will be in Europe with phasing out in Germany and Switzerland, and a “no” referendum in Italy. But some countries are continuing (France, UK, Netherlands).

Hydro: large potential in wider Europe, but growth is in non-OECD countries

Hydro potential in Europe



Hydro electricity production OECD vs. Non-OECD (TWh)

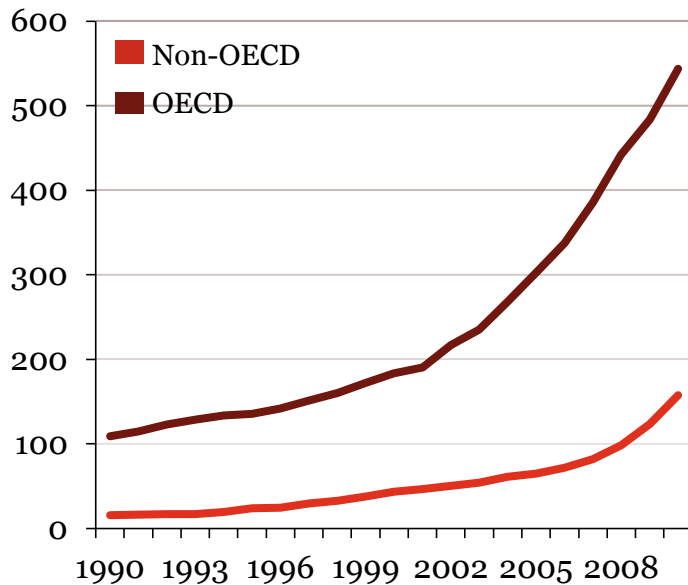


Hydro looks to have stabilised since 1995 in OECD, but growth has been staggering in non-OECD countries over last 20 years

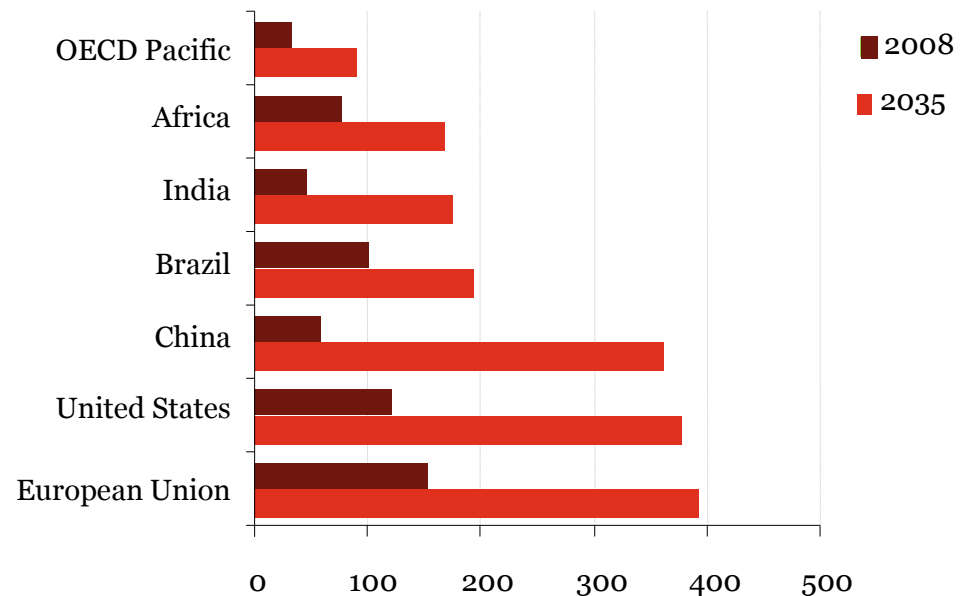
In the IEA Blue Scenario hydro production could double by 2050 (6000TWh)

Renewables: growth is likely to continue and accelerate even further

Renewable electricity production OECD vs. Non-OECD (TWh)

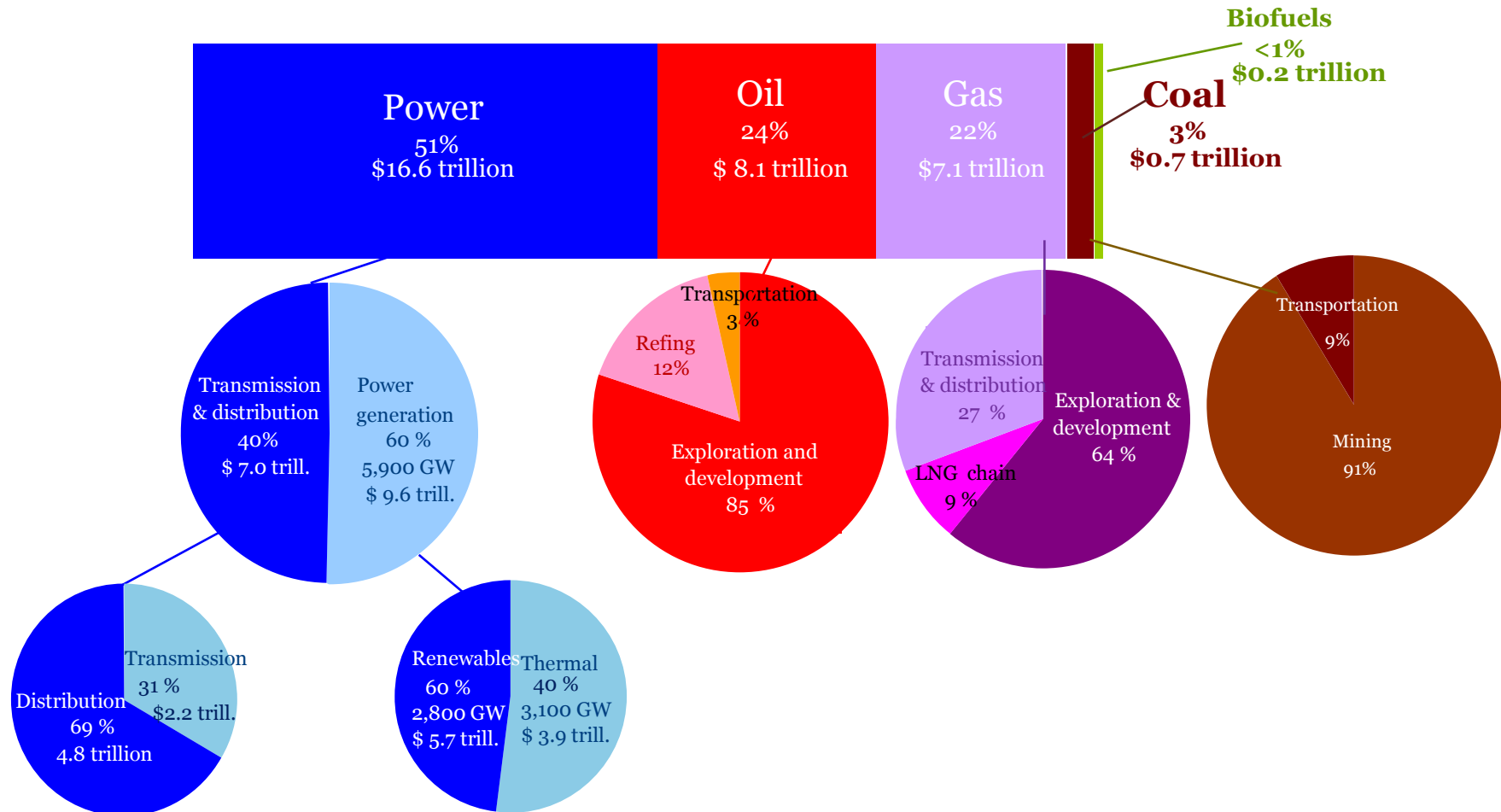


Renewable production in 2008 and 2035 (Mtoe)

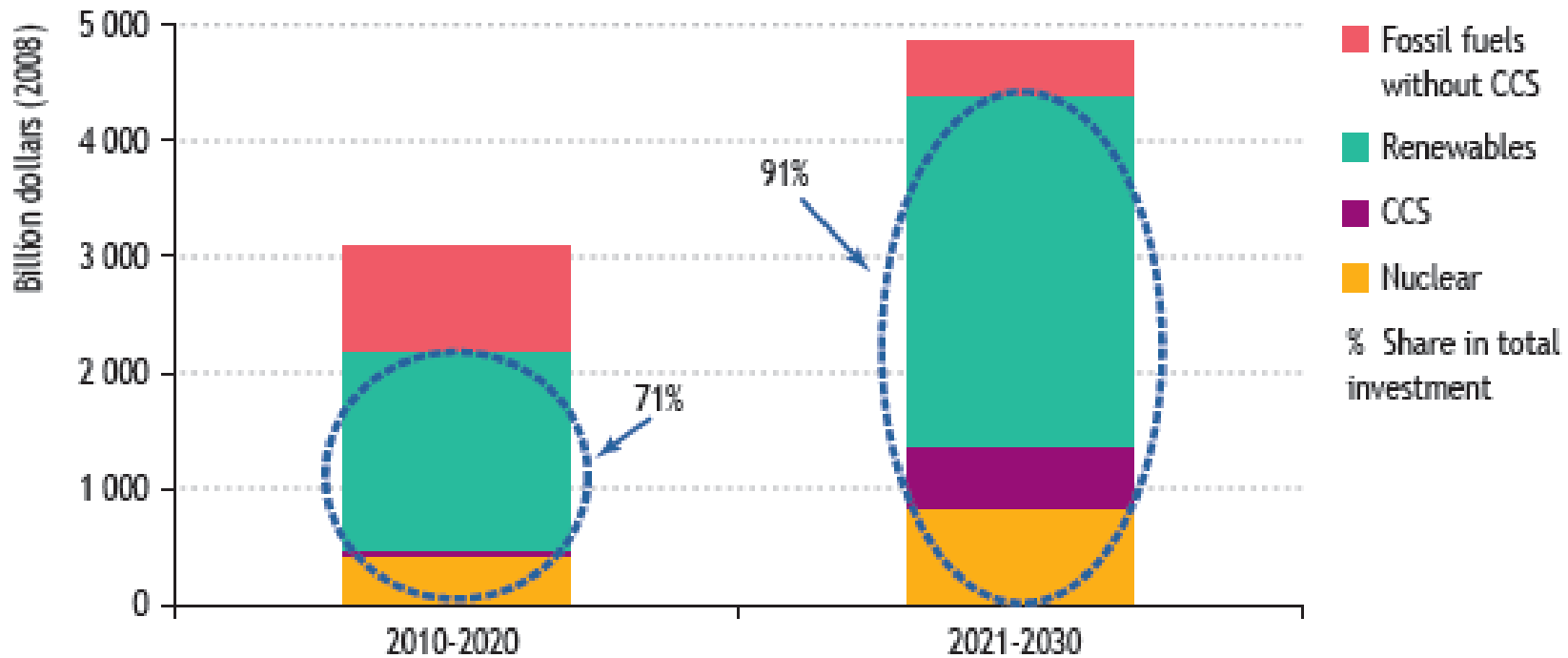


Renewable energy is growing rapidly across the world. The consumption of modern renewable energy will triple between 2008 and 2035. China, US and the EU are likely to lead in installed capacity and production

Global investment needs for the energy sector: \$32.8 trillion investment by 2035



High investments needed in power generation



8.000 bn US\$ total investments 2010 – 2030.
The biggest part in renewables, nuclear and CCS
at the expense of fossil fuels without CCS.

Energy Transformation: Industries Convergence and Smart Cities

Part 2

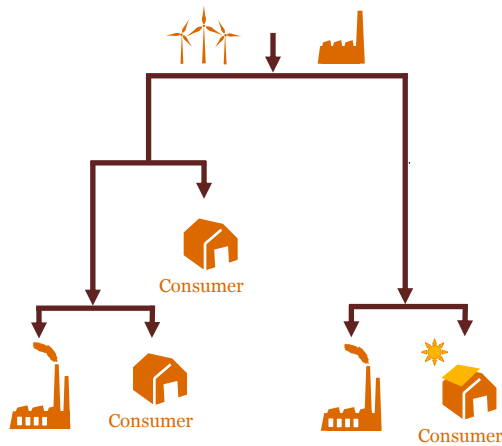
New revolution - energy transformation

- The ability to tap **shale gas** and other **unconventional gas sources**.
- Continued/new access to **oil sands, arctic reserves, and deep water reserves**.
- The ability to **transport and store resources** (LNG, electricity, power to gas, batteries, etc.).
- The expansion of **new fuel sources** – biofuels and renewables.
- The expansion of **smart energy** – smart grid, smart metering, smart homes, smart cities.
- **Nanotechnology applications** for lighting, transportation, renewable energy and storage.
- Increased **globalisation** of national (state-owned) energy companies and **decentralisation** of energy generation.

Electricity flows will become more complex and require innovation

2012

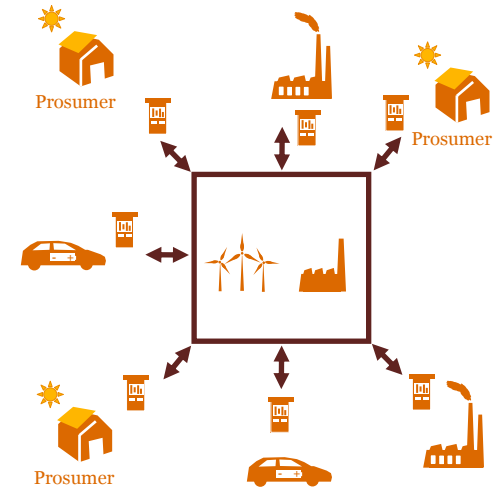
Energy supply



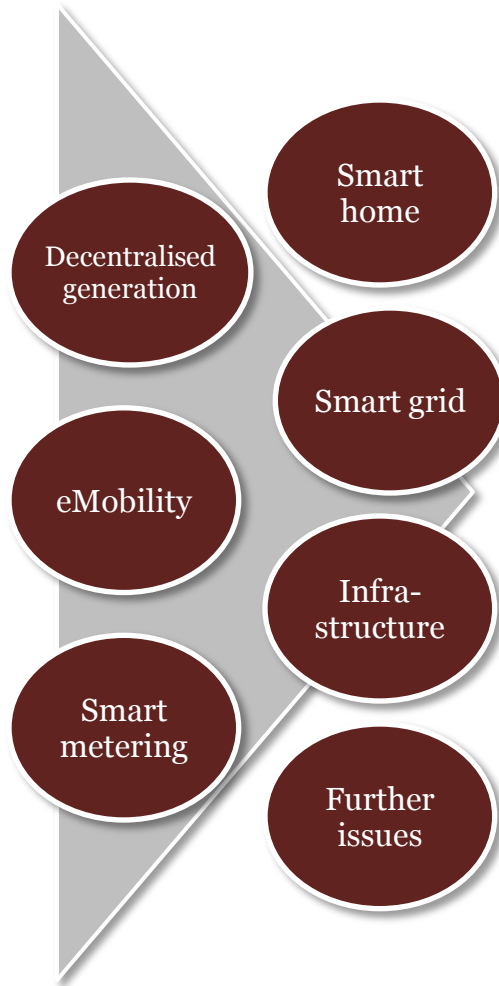
Unidirectional – non intelligent linking

2020

Smart Energy



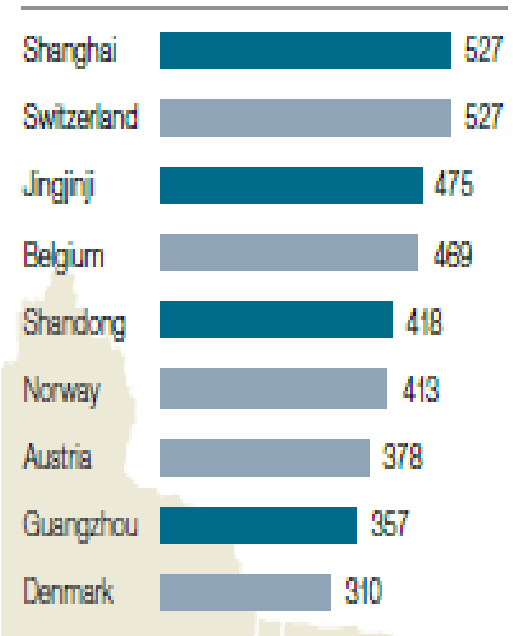
Bidirectional – intelligent linking



Smart cities

- Since 2009 more people live in cities than in rural areas.
- By 2050 2/3 or 6 bn people will live in urban areas.
- Development of Megacities rapidly increasing, but the main potential is with the mid-team cities in emerging markets.
- Over the next 15 years, just 440 emerging market cities will generate nearly half of global GDP growth and 40 percent of global consumption growth.
- A clustering approach can help companies target consumers more effectively in Chinese cities, some of which are economically larger than entire European countries.

2010 GDP for urban clusters in China vs selected countries, \$ billion



Source: "Winning the \$30 trillion decathlon in emerging markets", McKinsey

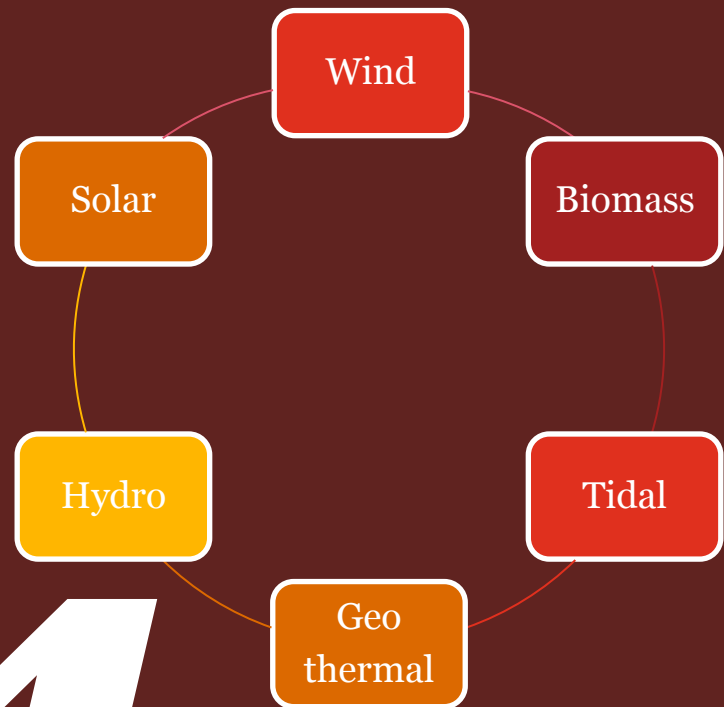
Global Gas

Part 3

A golden age for gas?

- Gas is set to play a key role in meeting the world's energy needs
 - *demand rises by 44%, led by China & Middle East*
- Unconventional gas accounts for 35% of the increase in global supply to 2035, with new non-US producers emerging
- Gas glut will peak soon, but may dissipate only very slowly
- The glut will keep pressure on gas exporters to move away from oil-price indexation, notably in Europe
- Lower prices could lead to stronger demand for gas, backing out renewables & coal in power generation

Global Renewable Energy



Part 4

Renewables – a big picture

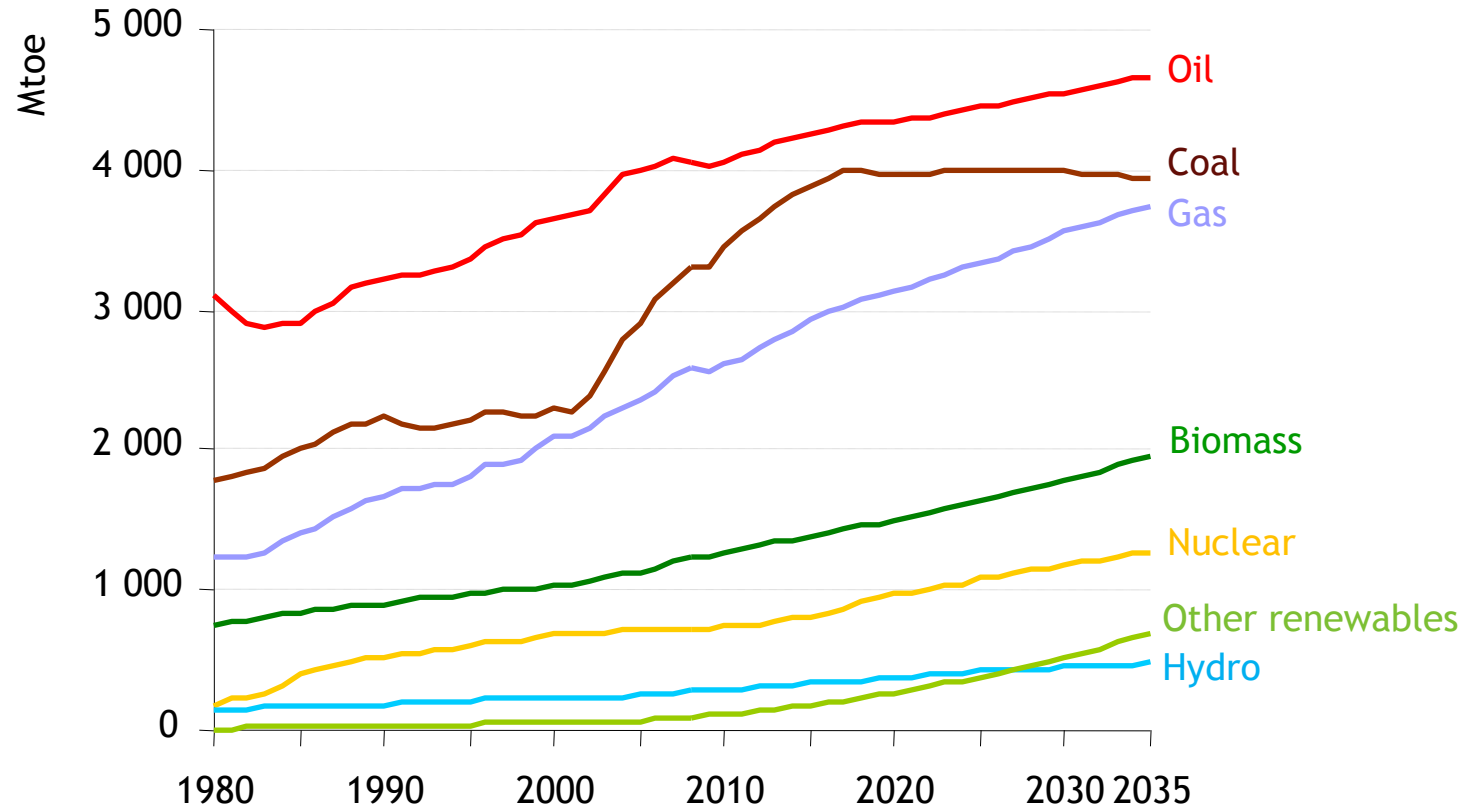
- Renewable energy is growing at double-digit rates - in 2011 US\$120 billion was spent to install renewable electricity generation worldwide

...but still only comprises about 16% of global energy production.

- The main challenge with renewable energy is producing it at a cost that is comparable to other energy sources.
- Economies of scale have yet to be achieved, but with the global investment in renewables (because they are environmentally more attractive), continued progress is expected.
- By 2030, it is expected that 20-30% of the global energy supply will come from renewables.

Fossil fuels remain dominant, even with high growth in renewables

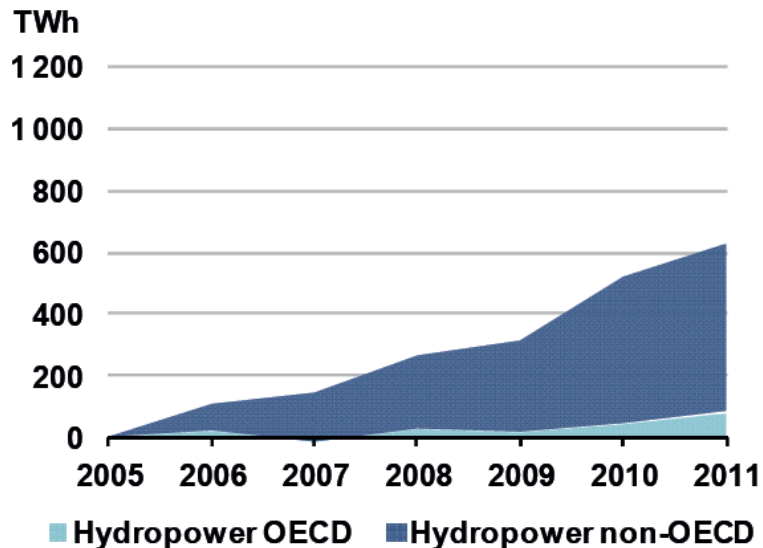
World primary energy demand by fuel in the New Policies Scenario



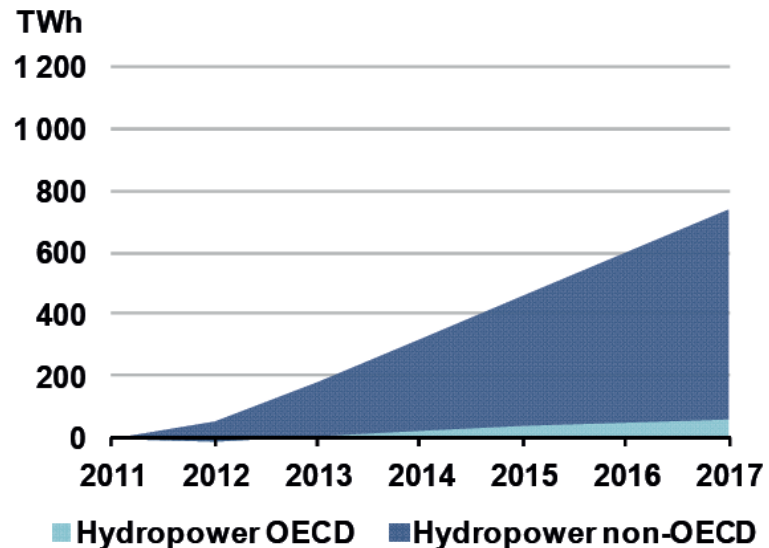
Renewables – hydro remains a main source

- Hydropower production has grown by 630 TWh since 2005, and in 2011 it accounted for 80% of total renewable generation.
- Renewable energy technologies outside of hydropower continue to grow at a faster rate. Of these, wind power (onshore and offshore) should make the largest contribution to global renewable electricity generation in 2017, at 16.7%.

Global hydropower historical cumulative additions (2005-11)



Global hydropower forecast cumulative additions (2011-17)



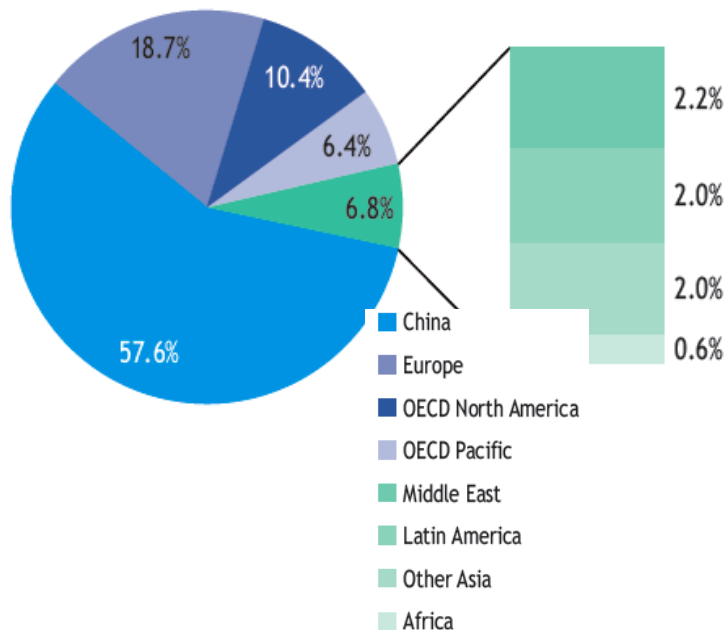
Renewables – Investment outlook

- The cost and availability of financing will act as a key variable to renewable electricity investment over the medium term.
- In 2011, global new investment in renewable electricity generation increased to USD 250 billion, a rise of 19% from USD 210 billion in 2010.
- We see a fall-off in global new investment during the first quarter of 2012 - looking ahead, increased macroeconomic risk and tighter bank capital requirements amid uncertainty about policy support in some areas could constrain funds from traditional sources
- An assumption of easing economic conditions combined with the emergence of new sources and structures of renewable financing should sustain overall investment over the forecast period.
- However, the attractiveness of new investment will depend on the evolution of policy and technology risk going forward.
- In those countries with more uncertain policy supports, the cost of capital tends to remain relatively high, undermining project economics.
- Moreover, investors still perceive some renewable technologies as risky, particularly offshore wind and CSP.

Solar energy - concentrated solar power (CSP)

Solar Hot Water/Heating

- Total solar heat capacity by region, 2008
- Worldwide capacity 2010 \approx 185 GWth



Concentrating Solar Thermal Power (CSP)

- Worldwide capacity 2010 \approx 1,095 MW
- Spain is the global CSP lead 632 MW in operation.
- Interest is also notable in North Africa and the Middle East
- Several CSP projects are under construction in India
- China has indicated intentions to install CSP plants

Conclusion

Part 5

In a nutshell: what is driving the energy sector change

- ***Supply***

- Oil, gas and coal currently supply around 87% of the world's energy needs and the shift away from these sources is slow. Their combined share of energy supply is expected to drop to 75% by 2035
- Current proven oil and gas reserves continue to grow, but the growth rate is slowing

- ***Demand***

- Global energy demand is forecast to grow by 30-40% between 2010 and 2030, driven largely by economic growth in Asia-Pacific
- Energy-efficient buildings, industrial processes and transportation could reduce the world's projected energy needs in 2050 by one third, according to the IEA

- ***Shale Gas and Renewables***

- Shale gas is increasingly becoming an important source of future gas supply
- Alternative energy sources are currently being developed, but hydro and wind are still forecast to comprise 75% of renewable energy supply by 2035
- The move to alternative energy sources is likely to drive energy prices up overall, until technological advances can reduce the cost of producing wind, solar, etc

- ***Nuclear***

- Nuclear energy experienced rapid growth between 1970 and 1990, largely in Western countries; however, growth has slowed since 1990 and put on hold in few countries post-Fukushima
- It is anticipated that 75% of future growth in nuclear energy will be driven by Asia -Pacific

In a nutshell: CEO's agenda

The CEO agenda

1

Shaping the future

- Economic rebalancing
- Industry structure
- Capital investment strategies
- Regulation
- Social policy
- Investor expectations
- Community engagement

2

Rethinking the strategy

- New stakeholder objectives
- Long-term planning
- Alignment to global trends
- Determining risk appetite
- Redefining performance targets
- Portfolio rebalancing
- Relative competitive advantage

3

Reinventing the organisation

Governance

- Board composition and qualifications
- Executive remuneration
- Regulatory compliance
- Risk management
- Financial reporting and controls

Target operating model

- Legal and physical structure
- Tax and capital efficiency
- Allowable cost structure
- Technology
- Partnership structure
- People and resources

Competitive advantage

- 'Seeing the future'
- 'War for talent'
- 'Constant reinvention'
- 'Product innovation'
- 'Strategic agility'
- 'Operational alignment'

Conclusions

- Advancements in the energy industry reach out far beyond the power and utility sectors.
- These advancements will also change the operations and focus of power and utilities companies.
- Companies will look to markets that favor the newer technologies, providing tax incentives or investment opportunities that allow them to develop these ideas more quickly.
- Most of technological advancements will require significant investments in infrastructure.
- Many of these energy advancements will require partnering with companies in other sectors.
- These ventures will require strategic planning and careful financial planning to minimize costs and potential interruptions.