Long Term Solutions

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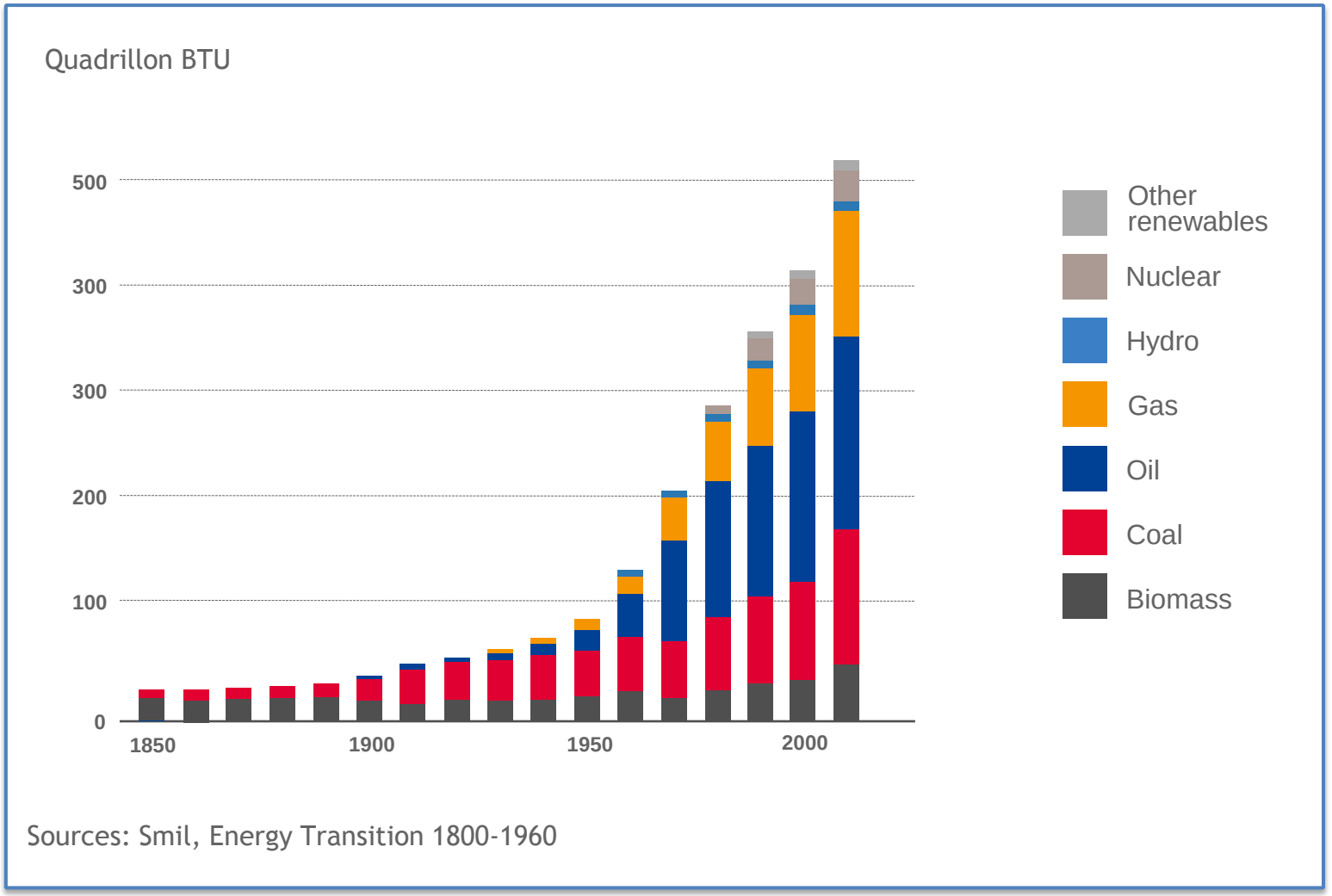
Semi-Public Workshop, May 22nd 2015

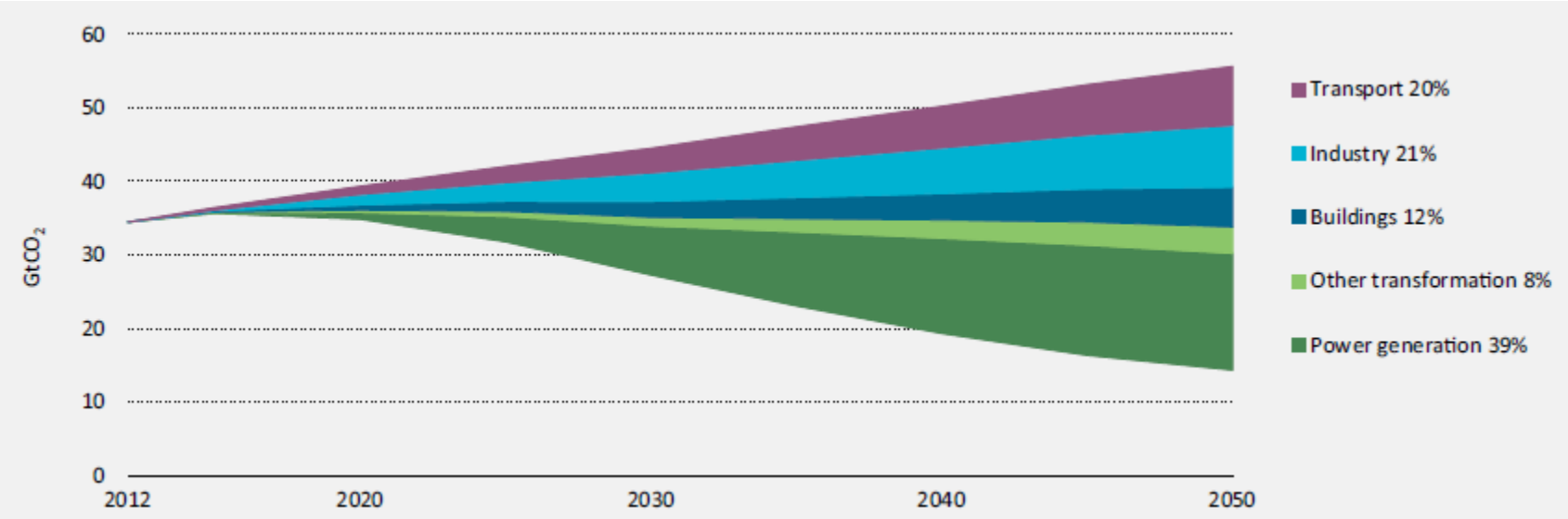
OIL AND GAS CLIMATE INITIATIVE

An energy transition is on the way



Sources: Smil, Energy Transition 1800-1960

More energy will be needed with less emissions



Source: IEA 2015

Long Term Solutions workstream

Objectives:

- Share company visions of the long-term energy mix
- Identify breakthrough technologies or other disruptive factors such as behavioral change, regulatory developments, implementation of digital solutions
- Initiate a constructive dialogue with relevant stakeholders

…in order to facilitate enough energy availability at acceptable cost to allow development in all countries and to achieve a zero net emission during this century.

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Working to different time horizons

A wide range of activities with solutions coming into reality across three broad time horizons:

Strategic core activities

- Efficiency (saving)
- Gas (switching and management)
- Mitigation (CCS, CCuS)

Evaluation of promising technology

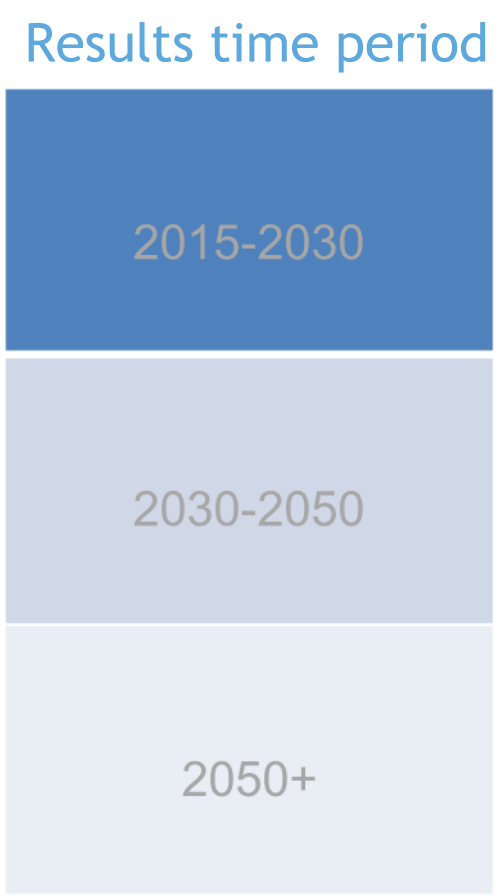
Full development of low carbon technologies

- Renewables, biofuels, CCS

Technological and behavioural disruptive factors

Breakthrough low carbon technologies and business models

- R&D proprietary programmes
- Engaging with universities and institutes
- Venturing with start-up companies



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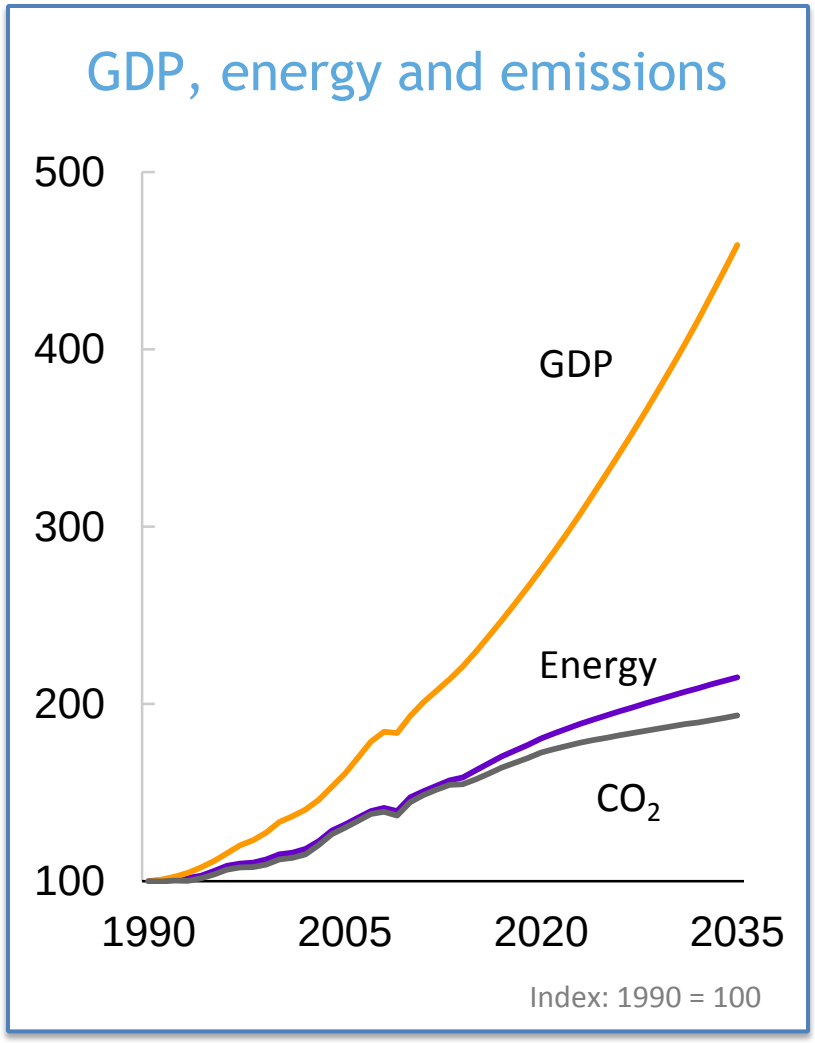
Energy efficiency restrains growth of emissions



Source: BP Energy Outlook; specific figures vary according to OGCI companies, but global overall views are in the same order of magnitude

- Total carbon emissions from energy consumption increase by 25% between 2013 and 2035 (1% p.a.)
- Energy efficiency remains the biggest lever to reduce emissions
- Only about 15% of primary energy is converted into useful heat, light and motion
- Product emissions account for 80-90% of the hydrocarbon value chain
- The scope for efficiency improvements is significant

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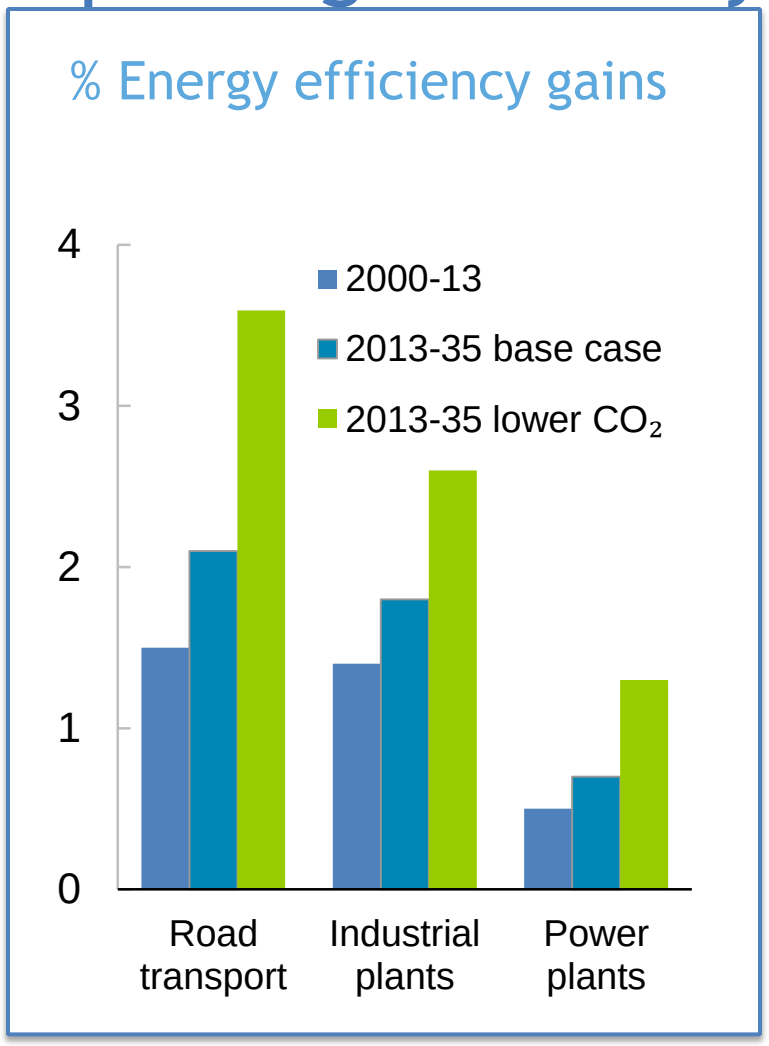
Improving efficiency in the oil and gas industry



Source: BP Energy Outlook; specific figures vary according to OGCI companies, but global overall views are in the same order of magnitude

Efficiency of operations

- Base case efficiency improvements for industrial plants, including oil, gas refining and chemicals is nearly 2% p.a.
- Up to 3% is possible from known technologies and careful production management
- Managing flaring, venting and fugitives are other substantial emissions reduction opportunities

Efficiency of products

- Fuel economy of new cars is improving at more than 2% p.a. through engine/drive train design, hybridization and fuel/lubricant efficiency
- Evolving consumer behaviour patterns – such as car pooling, vehicle autonomy and new business models (e.g. Uber, Zipcar) - could significantly impact emissions

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Switching from coal to gas offers an immediate route to lowering CO_2 today

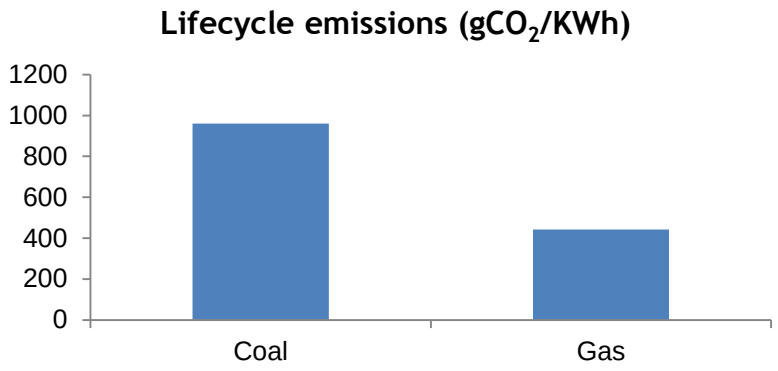
Natural gas is the lowest-carbon fossil fuel:

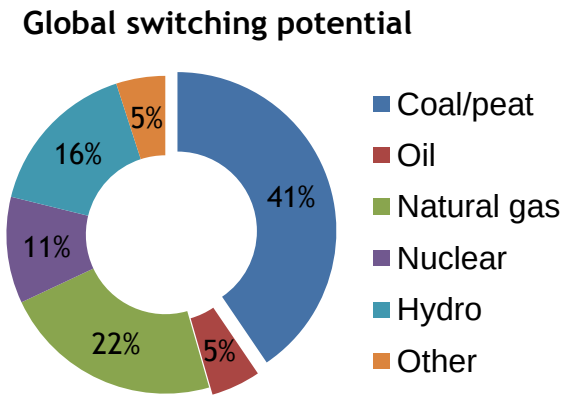
- Affordable – one of the cheapest sources of energy
- Abundant – 230+ years production at current rates
- Available – existing infrastructure and flexible energy storage technology

1% switch from coal to gas would equal:

- 11% increase in renewables power generation
- 6% increase in nuclear generation

Natural gas life-cycle emissions are less than half those of coal





Sources: WEO 2014, BP Energy Outlook 2035, BG Group

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Renewables and natural gas work together

Natural has a proven track record of working with renewables:

- Most flexible source of generation in many countries
- Significant CO_2 savings compared to coal "spinning reserve"

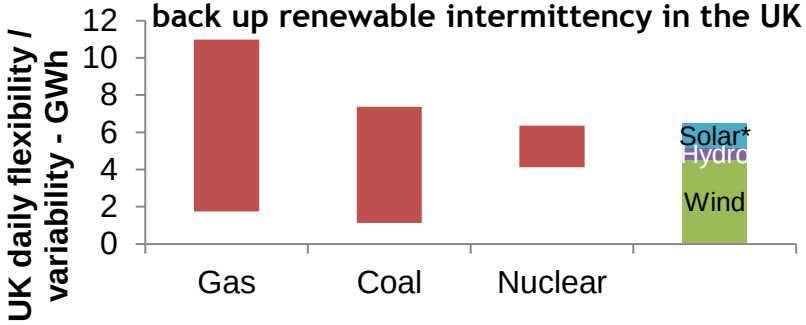
Ticks all the boxes - a natural fix with intermittent renewables:

- Fuel security – reliable source of supply
- System adequacy – ample capacity
- System security – high flexible resource

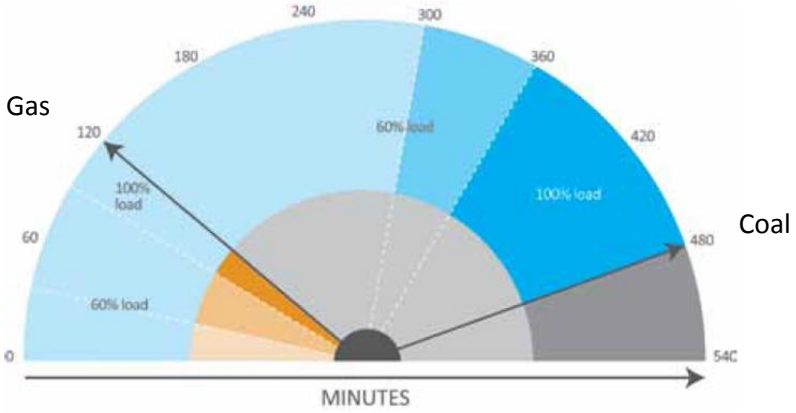
Zero regrets option

- Fast build times
- Enhanced grid resilience
- Lower capital spend mitigates "gas lock in"
- Minimal local environmental footprint – 7x smaller than comparable coal plants
- Existing transmission infrastructure

Natural gas is the only fuel that can solely back up renewable intermittency in the UK



Natural gas plants take just 90 minutes to reach 100% load whilst coal takes 4 times as long



Source: WEO 2014, BP Energy Outlook 2035, BG Group Eurogas

*Includes biomass

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CCS and CCUS Proposition

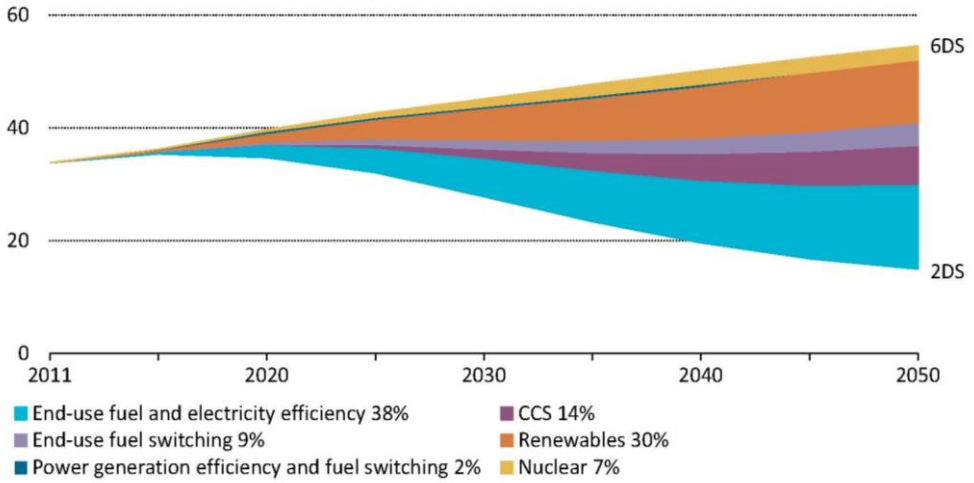
CCS, including CCUS for enhanced oil recovery of hydrocarbons, is vital to our energy future

- CCS can enable more energy with less emissions
- In a 2°scenario, CO_2 captured is in excess of 6500 Mt in 2050

Industry has strong know-how in capture, transportation and storage. There are 13 large scale projects in operation with a further 9 under construction. Enablers are needed to advance CCS and CCUS to ensure application and commerciality.

CCS and CCUS enablers

- Cost reduction through deployment
- Policy until commerciality
- Collaboration on projects
- Improved public acceptance
- Improved storage assessments



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Importance of research and new ideas

- Investing in R&D, engaging with universities and institutes, and supporting start-ups are critical to optimizing current operations, but also to prepare for medium and long term futures

- $bns collectively invested in research per year, with an average of 20-25 % in low carbon technologies and energy efficiency

- Globally, OGCI companies support over 50 start-ups with focus on energy efficiency, renewables, forest-agriculture, CCS, biotechnology and energy storage

- OGCI companies are also investing in a broad range of renewable technologies linked with solar, biotech, geothermal and wind.

Opening discussion

- Our industry has an important role to play, alongside other actors: notably governments and consumers
- OGCI companies have the will to address the need to supply enough energy at an acceptable cost while coping with climate reality
- Overall OGCI companies are investing in a wide range of lower-carbon technologies. Strong efforts are dedicated to R&D and support to new ventures.
- A structured, constructive and transparent dialogue with main stakeholders is key to success

Are we on the right path ?
Are we efficient ?
Do we sufficiently balance medium and long term ?
How to improve ?