Energy Transition
the Challenge for
the Oil & Gas Sector

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The six axes of Repsol’s Sustainability Model

**ETHICS AND TRANSPARENCY**
Act responsibly and with integrity wherever the company is present.

**PEOPLE**
Commit to people and promote their development and social environment.

**SAFE OPERATION**
Ensure the safety of our employees, contractors, partners and the local community.

**ENVIRONMENT**
Consume the resources needed to generate energy more efficiently and with the least possible impact.

**CLIMATE CHANGE**
Be a part of the solution of climate change.

**INNOVATION AND TECHNOLOGY**
Foster innovation and incorporate new technology to improve and grow.
Repsol supports the United Nations Agenda 2030 and its **Sustainable Development Goals (SDGs)**, taking them as a reference to define sustainability priorities.

Repsol has prioritized seven SDGs to which the company can contribute most, highlighting two of them: SDG 7, **Affordable and clean energy**, and SDG 13, **Climate action**.
Climate change

A scientific consensus that cannot be ignored

“Tiny bubbles tell it all”

Since the industrial revolution, particularly since the mid-twentieth century, humans are forcing global warming at a rate exceeding that of other previous natural climatic cycles.
800,000 year ice core record

H. Sapiens

Adapted from: Loulergue L., et al. Orbital and millennial-scale features of atmospheric CH4 over the past 800,000 years, NATURE, 2008.
Lüthi D., et al. High-resolution carbon dioxide concentration record 650,000–800,000 years before present, NATURE, 2008.
Climate change

One of the world's main challenges in the 21st century

https://www.ipcc.ch/site/assets/uploads/2018/02/WGIAR5_Chapter10_FINAL.pdf
We have to find a way to regulate the thermostat.
Energy (through all its value chain) under the spotlight

Estimated shares of global anthropogenic GHG, 2014

- Energy 68%
- Agriculture 12%
- Industrial processes 7%
- Others* 14%

(*) Others include large-scale biomass burning, post-burn decay, peat decay, indirect N₂O emissions from non-agricultural emissions of NOₓ and NH₃, Waste, and Solvent Use.

World CO₂ emissions from fuel combustion by sector, 2015

- CO₂ 90%
- CH₄ 9%
- N₂O 1%

- Energy 42%
- Industry 17%
- Residential 11%
- Services 8%
- Other* 4%

Transport 24%

The graph also shows allocation of electricity and heat to end-use sectors. (*) Other includes agriculture/forestry, fishing, energy industries other than electricity and heat generation, and other emissions not specified elsewhere.

CO₂ emissions from fuel combustion statistics 2017, Highlights, IEA 2017
Since 1950, thanks to hydrocarbons, the world energy consumption has multiplied by five...

GDP has multiplied by a factor close to seven...

world's population by more than two...

and CO₂ emissions by more than four (more than ten since 1900)

[*] https://webstore.iea.org/key-world-energy-statistics-2018
The first step in solving a problem is to formulate it properly

Kaya Identity

\[
\text{CO}_2^{\uparrow} = (P \times \frac{\text{GDP}}{P}) \times \left( \frac{\text{E}}{\text{GDP}} \times \frac{\text{CO}_2}{\text{E}} \right) - \text{CO}_2^{\downarrow}
\]

- \( \text{CO}_2^{\uparrow} \) = global CO\(_2\) emissions from human sources
- \( P \) = global population
- \( \text{GDP} / P \) = world Gross Domestic Product per capita
- \( \text{E} / \text{GDP} \) = global energy intensity of the GDP
- \( \text{CO}_2 / \text{E} \) = carbon footprint or carbon intensity of the global energy mix
- \( \text{CO}_2^{\downarrow} \) = CO\(_2\) removed by natural or induced means (CCUS)
Change in global energy related CO₂ emissions and avoided emissions 2017-2018

Socioeconomic factors are the main drivers of world’s increasing emissions
Why a new energy transition?

What does e. t. really means?

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\text{CO}_2^{\uparrow} = \left( \frac{\text{GDP}}{\text{P}} \right) \times \left( \frac{\text{E}}{\text{GDP}} \times \frac{\text{CO}_2}{\text{E}} \right) - \text{CO}_2^{\downarrow}
\]

Demographic trends: more people & more urbanites
- 7,241 million (2016) vs 9,144 million (2040)
- Urban areas 56% - 64% (80% in EU, US, Brazil, Russia, Japan)

Economic trends: more middle class, more purchasing power
- Global GDP to double from 2016 to 2040
- The middle class will grow by about 80% by 2030, surpassing 5 billion people; most of the growth comes from non-OECD countries

Energy transition - COP21, Paris 2015-12-2
1 Decoupling economic and demographic growth from CO₂-GHG emissions
2 Moving towards a low-energy intensity, decarbonized economy
Emphasis on: efficiency + decarbonization + CCUS
In order to go beyond the Paris ambition of “well below 2°C” and not surpass 1.5°C by 2100, reduction path should reach net-zero emissions and even negative emissions in the second half of the century, by removing CO₂ from the atmosphere.
CCUS – enabled low emission pathways and technologies
Medium – Long Term Levers (well below 2°C)

<table>
<thead>
<tr>
<th>CCUS-enabled Low Emission Pathways</th>
<th>Negative Emission Technologies (NET) and natural climate solutions (NCS)</th>
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<tbody>
<tr>
<td>• Natural Gas + CCUS as a stable supply of low carbon electricity</td>
<td>• NET’s required for net zero emissions in the 2nd half of the century</td>
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<tr>
<td>• No alternatives to CCUS to decarbonize industries as steel, cement</td>
<td>• CCS-based solutions: Bioenergy (BECCS), Direct air capture (DACCS)</td>
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<td>• CCS enables NET pathways</td>
<td>• e-fuels (CO₂ + renewable H₂ to yield liquid fuels)</td>
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<td>• NCS’s (i.e. reforestation) as natural sinks of CO₂</td>
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Carbon pricing systems
Framework for effective policies

Quantitative economic models show that effective policies to address global challenges as climate change are those based on the following principles:

- Measures are introduced as soon as possible
- Universal participation
- Marginal cost (of reducing emissions) equal for all
- Increasing stringency over time

The energy transition enjoys wide social acceptance and government support. It’s here to stay, although perhaps it will not be as easy or fast as would be desirable. A road full of uncertainties but also with opportunities.

Newsweek, 6-13 September 2004
Energy transition and the O&G industry

1/ Decarbonization
Human-forced global warming is supported by solid scientific evidence, so this phenomenon is a key factor for the future of the O&G industry.

2/ Social license to operate
Increasing awareness and social commitment to the UN-SDGs and to address global warming. Greater prominence of ESG investors.

3/ Regulatory pressure
Paris Agreement
Decisions on energy policy (e.g. EU countries)

4/ Divestment & stranded assets risks

5/ Other
Technological advances.
New competitors, “New consumers”

A powerful current... paddling against it is not an option.
1/ Growing global demand despite efficiency gains
The big question is how to get to net-zero emissions while meeting the energy needs of billions more people

2/ Towards the most diversified and low-carbon primary energy mix in history
O&G still some 50% of the global primary energy mix by 2040: IEA, WEO 2018, SDS

3/ Spectacular growth of renewables

4/ Electrification

5/ Key role of natural gas

6/ Non-imminent peak in oil demand
How to keep performing while transforming?
Some thoughts...

Oil and gas will still play a key role in the next two decades, although we can foresee an intense and rapid electrification of the global energy system, driven by renewable sources and backed by natural gas.

Therefore it seems appropriate for the O&G industry to proceed to diversify its energy portfolio, while consolidating its current privileged position in the oil and gas business in the new context imposed by the energy transition.

This consolidation involves:

- Efficiency gains throughout all the value chain
- Prominence of natural gas
- Continued reduction of emissions (CO₂ & CH₄) in all the business facets
- Reserve management matched to the pace of the energy transition
Diversification involves:

- Transformation into multi-energy companies, capable of generating and marketing any form of energy, particularly low-carbon electricity
- Deployment of a range of new businesses, with special attention to those aimed at improving efficiency and reducing the carbon intensity of the mix

In parallel, it is imperative to promote:

- Implementation of new technologies (digitalization, AI, ...)
- Effective policies of recruitment and retention of talent
- Innovative R&D (with a particular emphasis on circular economy-CCUS)
- New business initiatives

How to keep performing while transforming?

Some thoughts...

All this while reinforcing cooperation (governments, organizations, economic sectors, other industries, social stakeholders...) in order to join efforts to advance in the fulfilment of the United Nations Sustainable Development Goals
‘At Repsol, we share society’s concern about the effects that human action causes on the climate and we work every day to be part of the solution’

Towards a low-emissions future. Repsol Climate Roadmap