Energy Transition
the Challenge for the Oil & Gas Sector

Mariano Marzo
Independent External Director,
Lead Independent Director and
Chairman of the Sustainability Committee

REPSOL

The six axes of Repsol's Sustainability Model

CLIMATE CHANGE
Be a part of the solution of climate change

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 posible impact

INNOVATION AND TECHONOLOGY

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

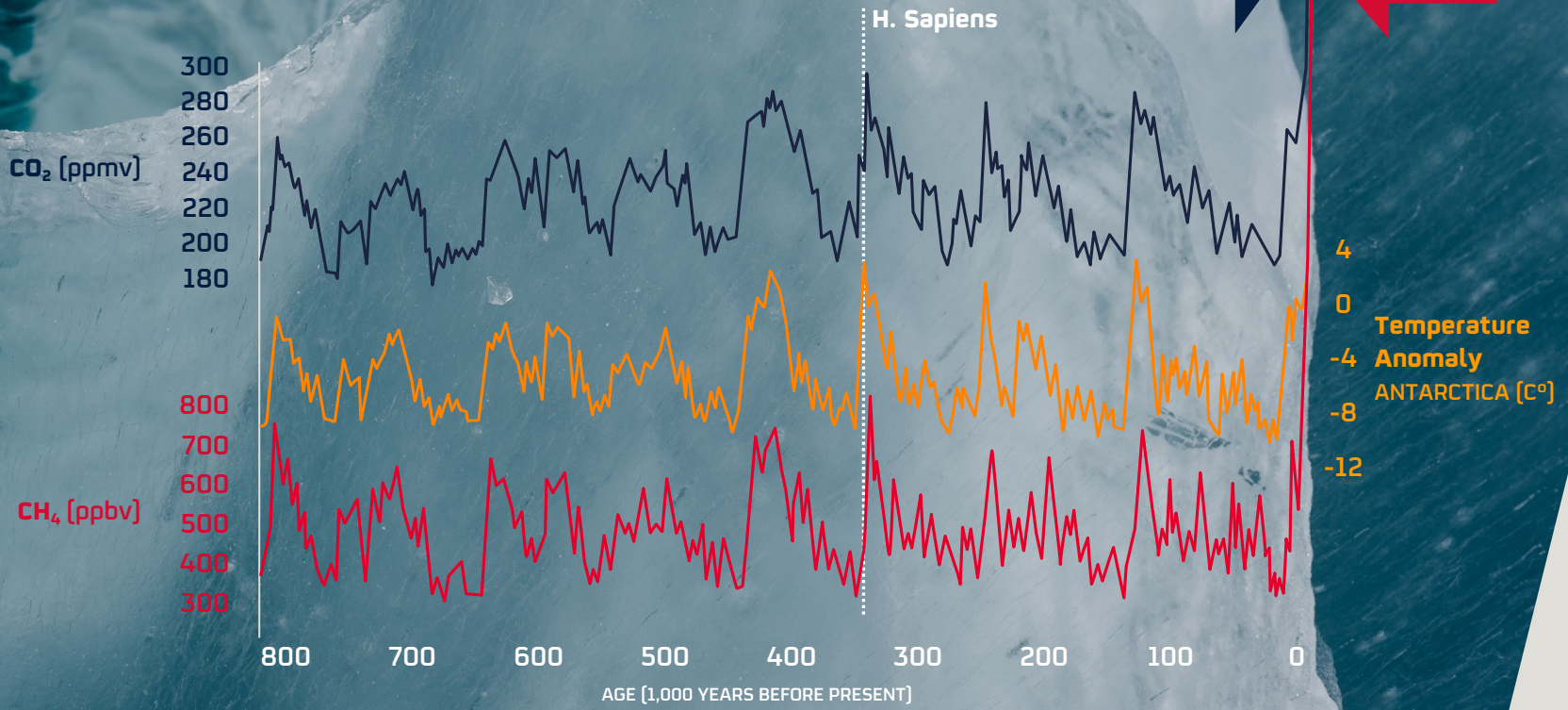
“Tiny bubbles tell it all”

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

390 ppm
Carbon Dioxide (2010)

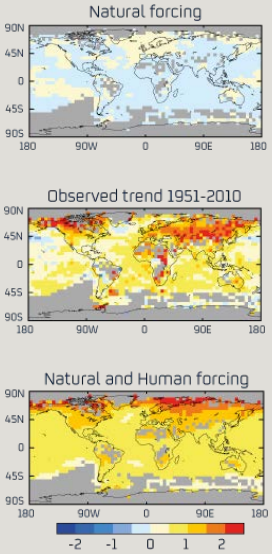
1,800 ppb
Methane (2010)



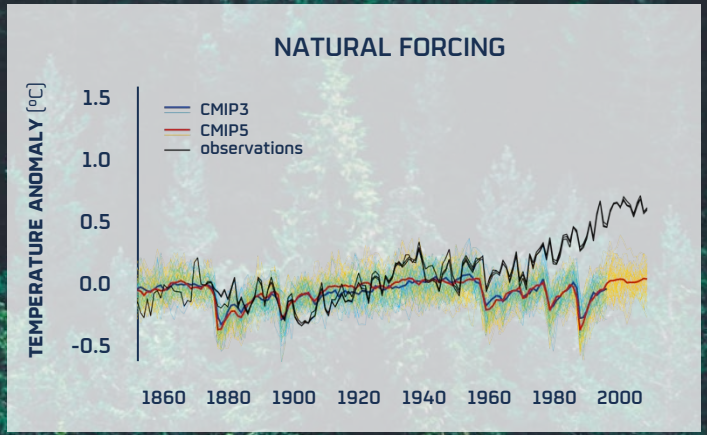
Adapted from: Loulergue L., et al. Orbittal and millennial-scale features of atmospheric CH4 over the past 800,000 years, NATURE, 2008.
Lüthi D., et al. High-resolution carbon dioxide concentration record 650,000-800,000 years before present, NATURE, 2008.

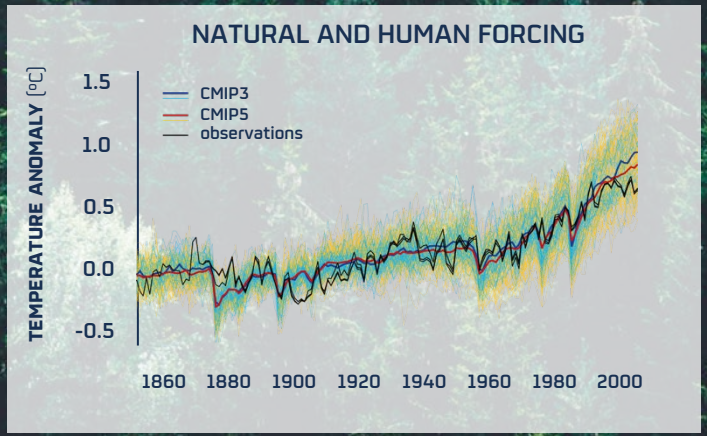
Climate change

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



https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter10_FINAL.pdf





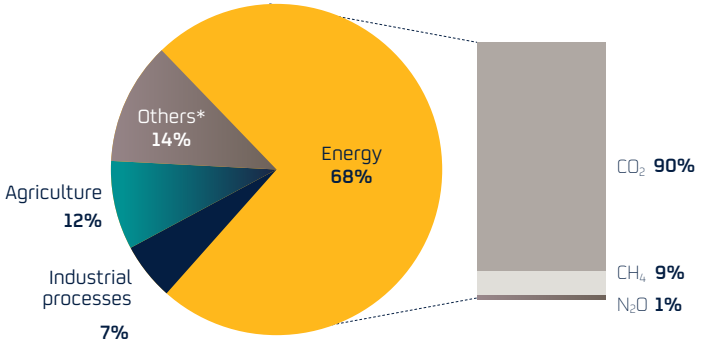
The ‘good news’ is we do not depend on uncontrollable external factors (astronomical and/or geodynamic)

Sapiens’ ingenuity has caused the problem, now it has to fix it

We have to find a way to regulate the thermostat

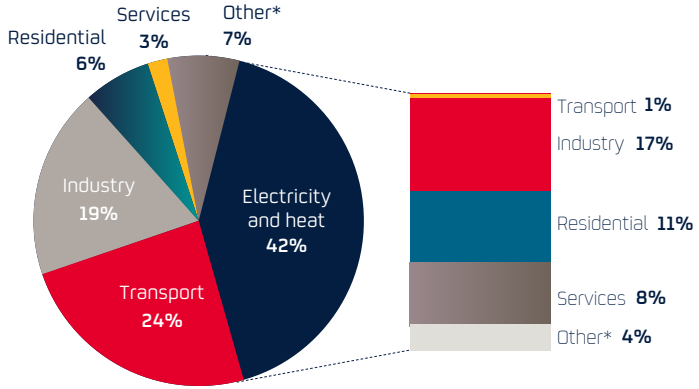
Energy (through all its value chain) under the spotlight

Estimated shares of global anthropogenic GHG, 2014



[*] Others include large-scale biomass burning, post-burn decay, peat decay, indirect N_2O emissions from non-agricultural emissions of NO_x and NH_3, Waste, and Solvent Use.

World CO_2 emissions from fuel combustion by sector, 2015

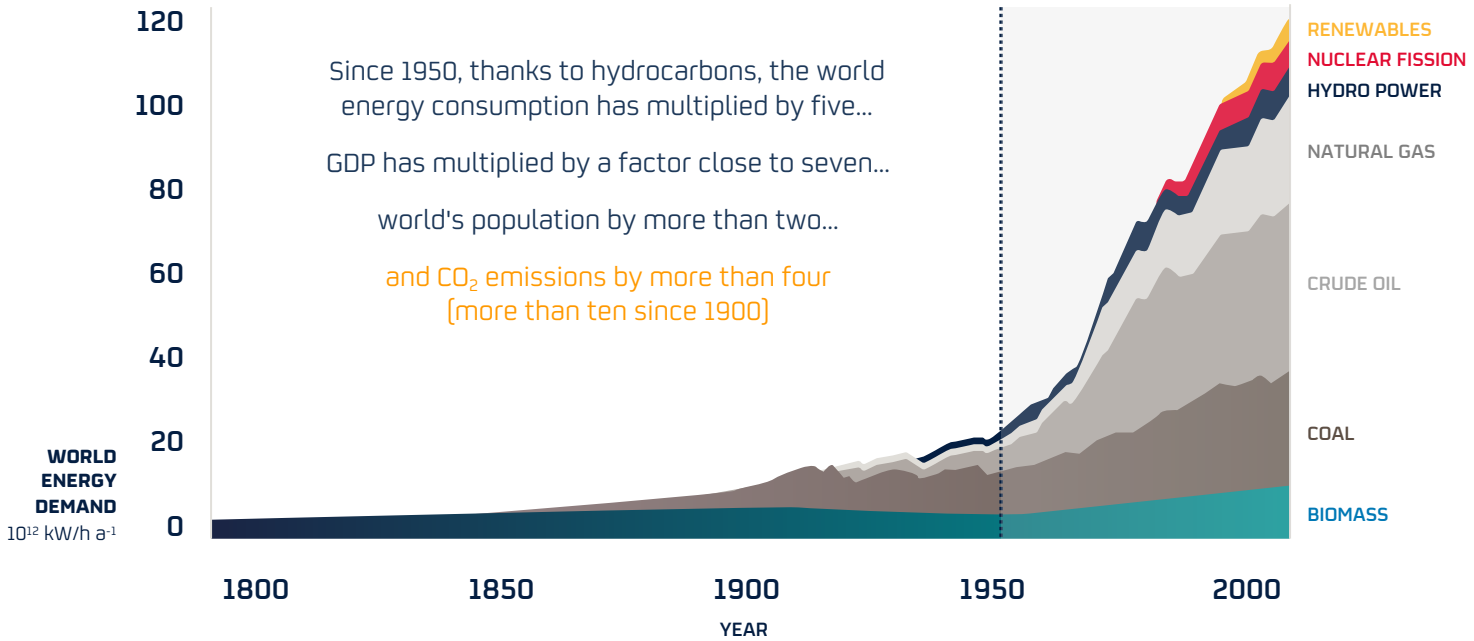


The graph also shows allocation of electricity and heat to end-use sectors.
[*] Other includes agriculture/forestry, fishing, energy industris other than electricity and heat generation, and other emissions not specified elsewhere.

CO_2 emissions from fuel combustion statistics 2017, HighlightS, IEA 2017

Living in the age of hydrocarbons

2017: Oil, natural gas and coal, 81% TWPES (IEA, WEO 2018)



(*) https://webstore.iea.org/key-world-energy-statistics-2018

The first step in solving a problem is to formulate it properly

Kaya Identity

$$CO_2\uparrow = \left[P \times \frac{GDP}{P} \times \frac{E}{GDP} \times \frac{CO_2}{E} \right] - CO_{2\downarrow}$$

$CO_2\uparrow$ = global CO_2 emissions from human sources

P = global population

GDP / P = world Gross Domestic Product per capita

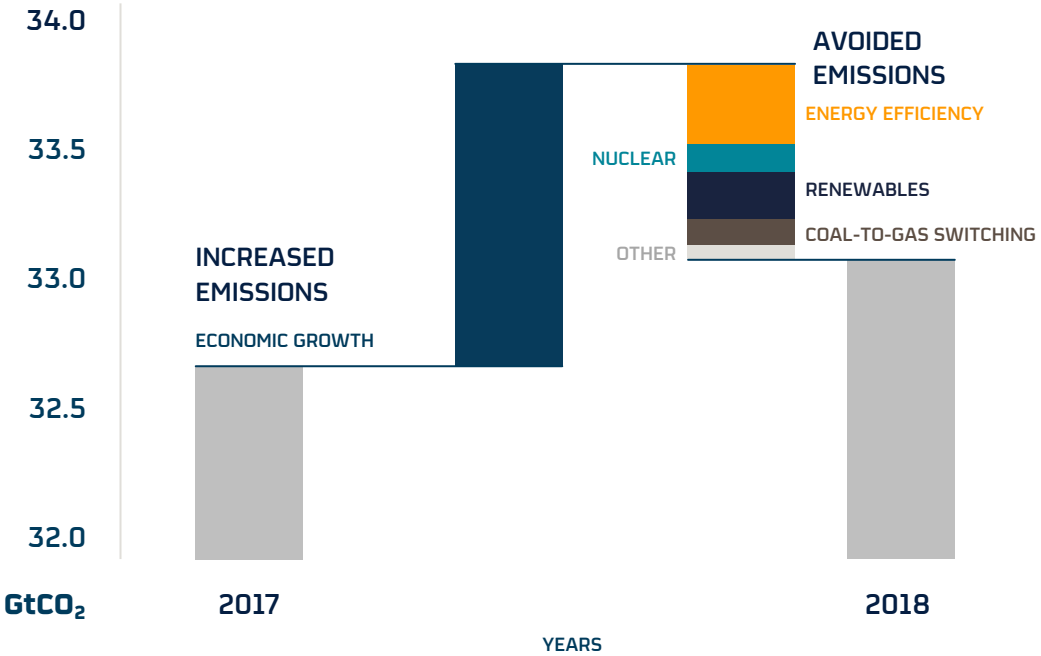
E / GDP = global energy intensity of the GDP

CO_2 / E = carbon footprint or carbon intensity of the global energy mix

$CO_2\downarrow$ = CO_2 removed by natural or induced means (CCUS)

Change in global energy related CO_2 emissions and avoided emissions 2017-2018

Global Energy & CO_2 Status Report (IEA, March 2019)



Socioeconomic factors are the main drivers of world's increasing emissions

Why a new energy transition?

What does e. t. really means?

$$CO_2\uparrow = \left[P \times \frac{GDP}{P} \times \frac{E}{GDP} \times \frac{CO_2}{E} \right] - CO_{2\downarrow}$$

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

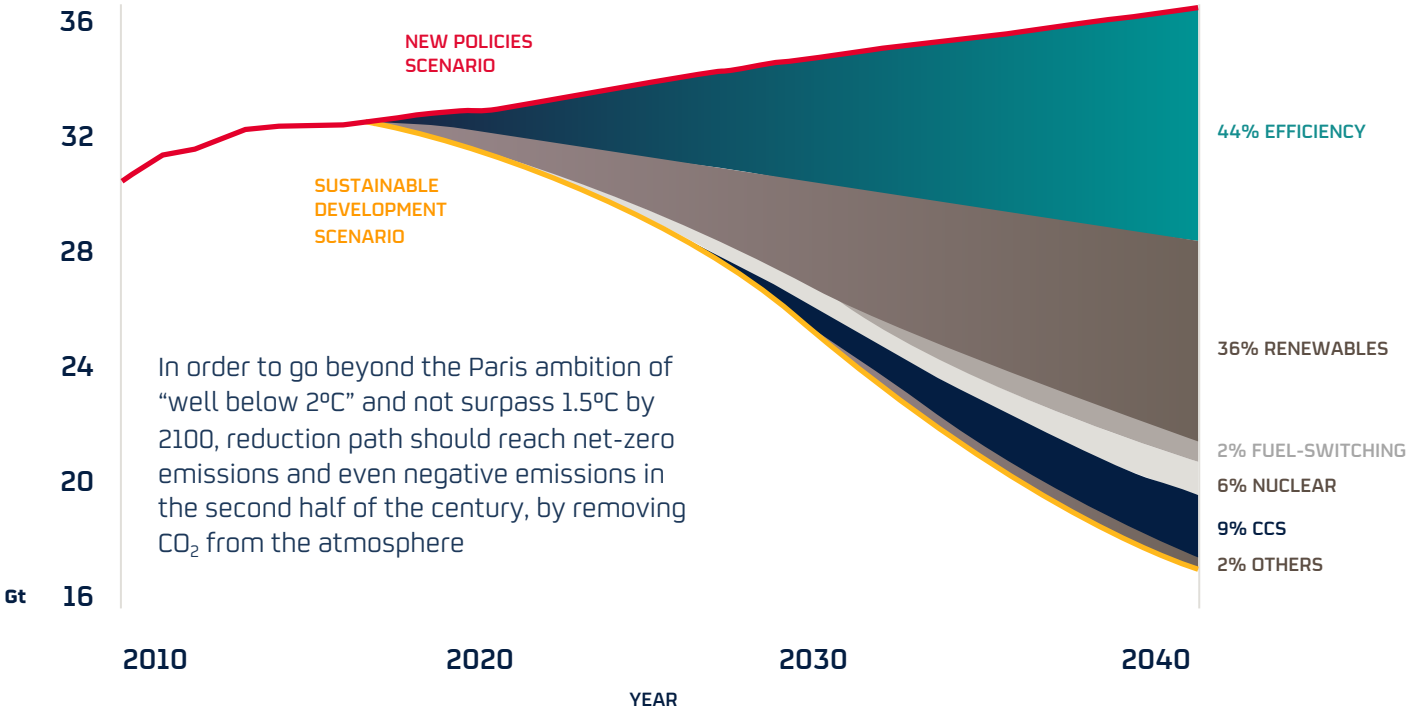
1 Decoupling economic and demographic growth from CO_2-GHG emissions

2 Moving towards a low-energy intensity, decarbonized economy

Emphasis on: efficiency + decarbonization + CCUS

Global CO_2 emissions reductions by scenario

(IEA, WEO 2017)



Energy efficiency and renewables account for 80% of the cumulative CO_2 emissions savings in the Sustainable Development Scenario

CCUS –enabled low emission pathways and technologies

Medium – Long Term Levers (well below 2ºC)

CCUS-enabled Low Emission Pathways

- Natural Gas + CCUS as a stable supply of low carbon electricity
- No alternatives to CCUS to decarbonize industries as steel, cement
- CCS enables NET pathways

Negative Emission Technologies (NET) and natural climate solutions (NCS)

- NET's required for net zero emissions in the 2nd half of the century
- CCS-based solutions: Bioenergy (BECCS), Direct air capture (DACCS)
- e-fuels (CO_2 + renewable H_2 to yield liquid fuels)
- NCS's (i.e. reforestation) as natural sinks of CO_2

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

(From 2018 Economy Nobel Prize W. Nordhaus,
"Climate change: the ultimate challenge for economics", Feb.2019)

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

Some global trends relevant to the future of the O&G industry

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 (CO_2 & CH_4) in all the business facets
- Reserve management matched to the pace of the energy transition

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

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

Towards a low-emissions future. Repsol Climate Roadmap
https://www.repsol.com/imagenes/global/en/repsol-climate-roadmap_tcm14-155816.PDF

REPSOL