TotalEnergies

Energy Landscape

Understanding the energy fundamentals for a successful transition

In partnership with

Capgemini

and

Colette Lewiner

Our sustainable energy challenge

1

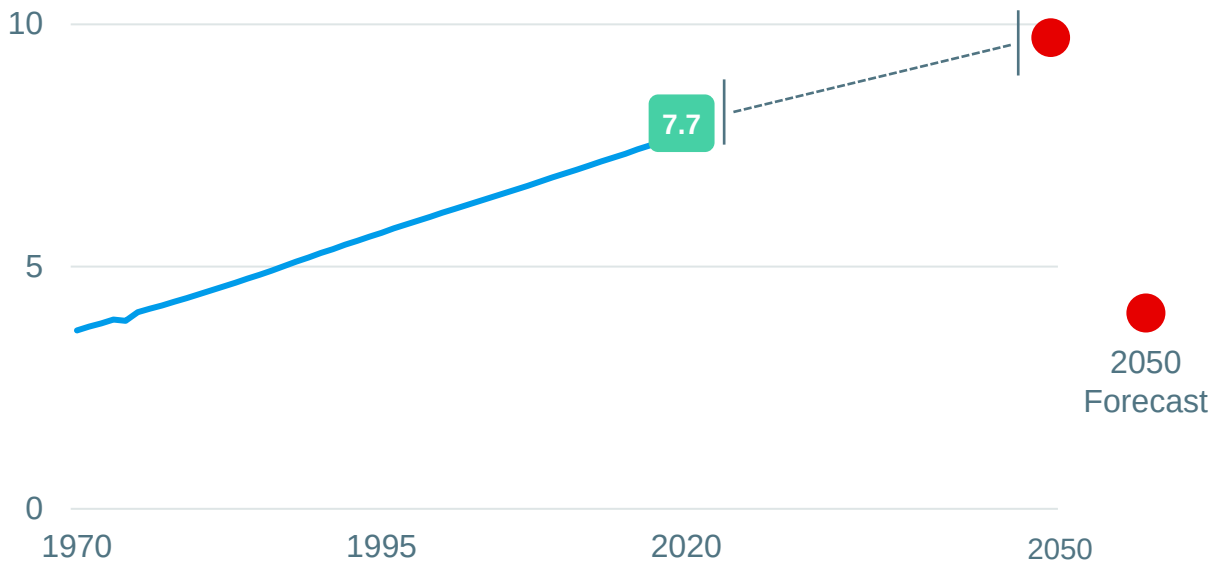
Ensuring a reliable, affordable, accessible energy supply for a growing world population

2

Protecting the planet and its inhabitants from the adverse effect of greenhouse gas emissions and their impact on climate change

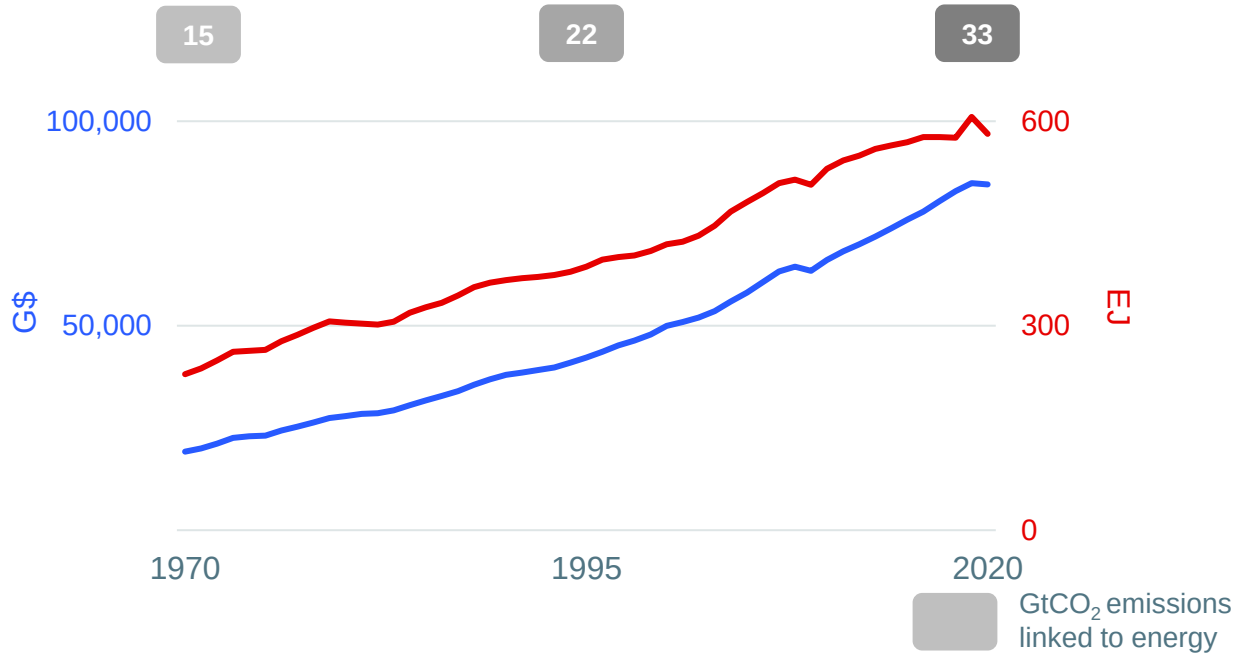
Energy must be reinvented

World population evolution and forecast (billions of people)



- The world population is expected to reach ~ 10 billion in 2050

World GDP (G$) and primary energy demand (EJ)

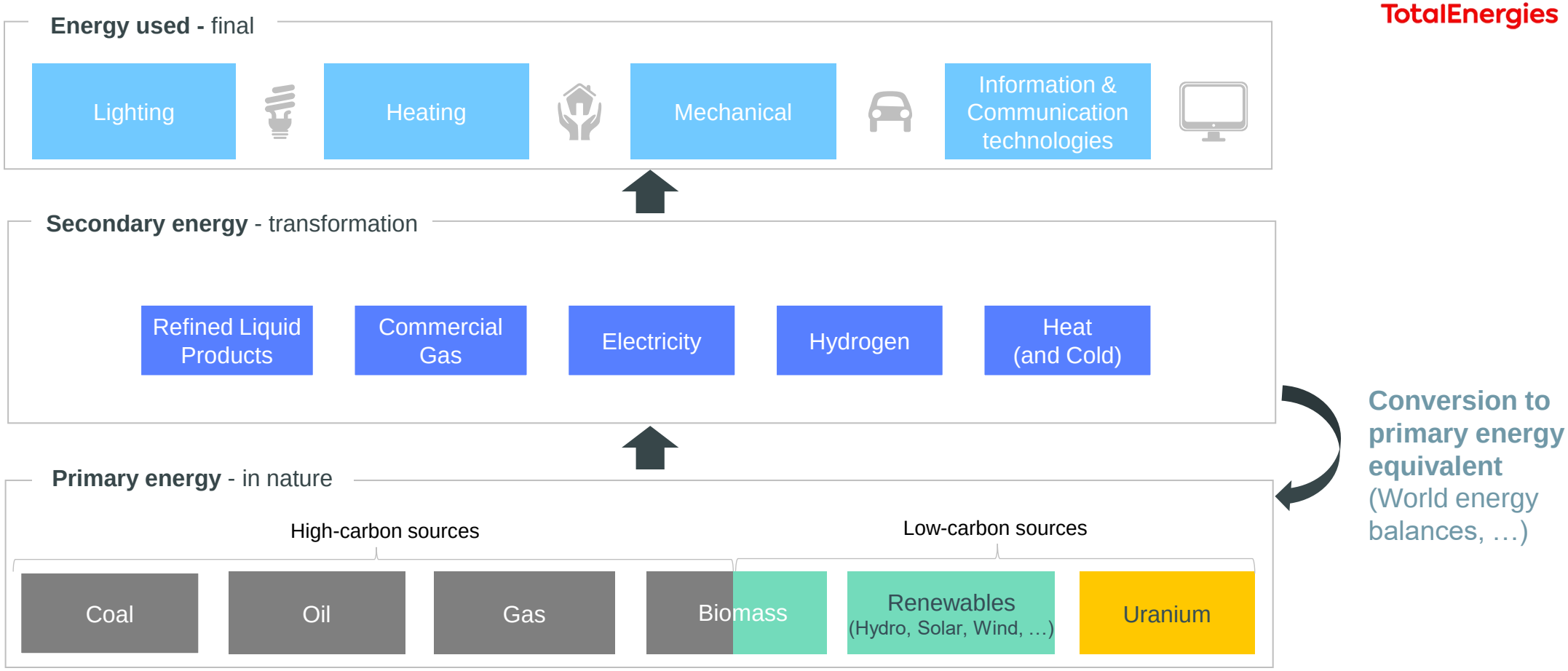


- GDP and primary energy demand have increased in line with population
- And energy CO_2 linked emissions have also gone up

Our societies must reconcile population growth and prosperity with massive reduction in CO2 emissions

Sources: IEA World Energy Balance 2021, World Bank, United Nations

Where does the energy supply come from?



Conversion to primary energy equivalent (World energy balances, …)

80% of the world's energy supply relies on GHG* emitting fossil fuel resources

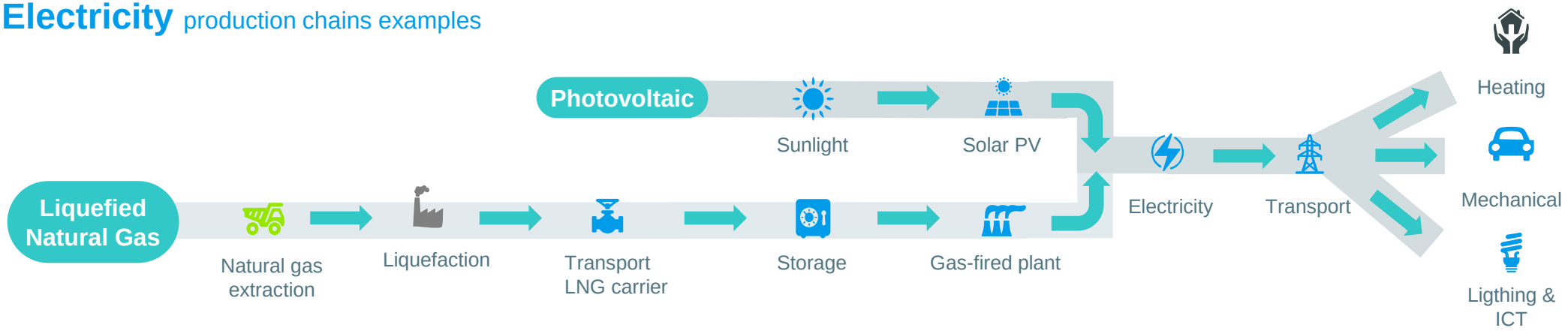
This dependance is not sustainable: increasing the share of other energy sources is key

*GHG : Greenhouse gases

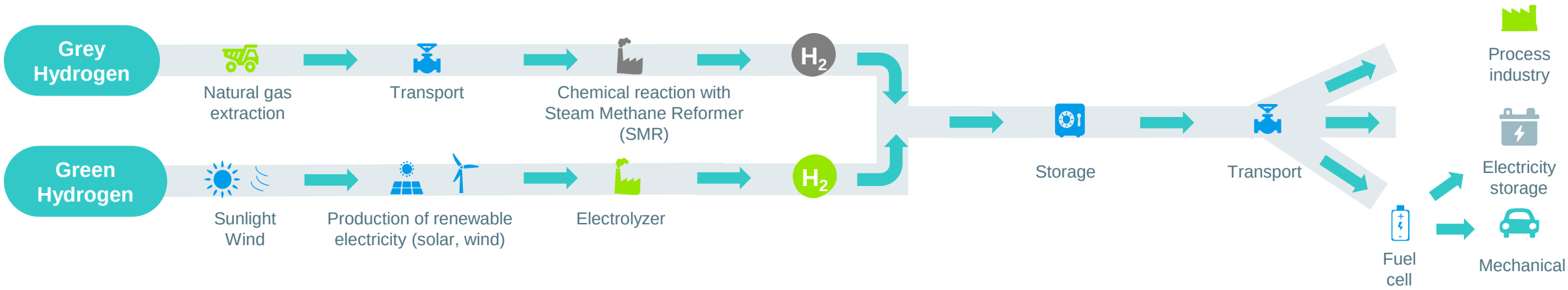
Source: Capgemini Analysis

The energy chains

Electricity production chains examples



Hydrogen production chains examples



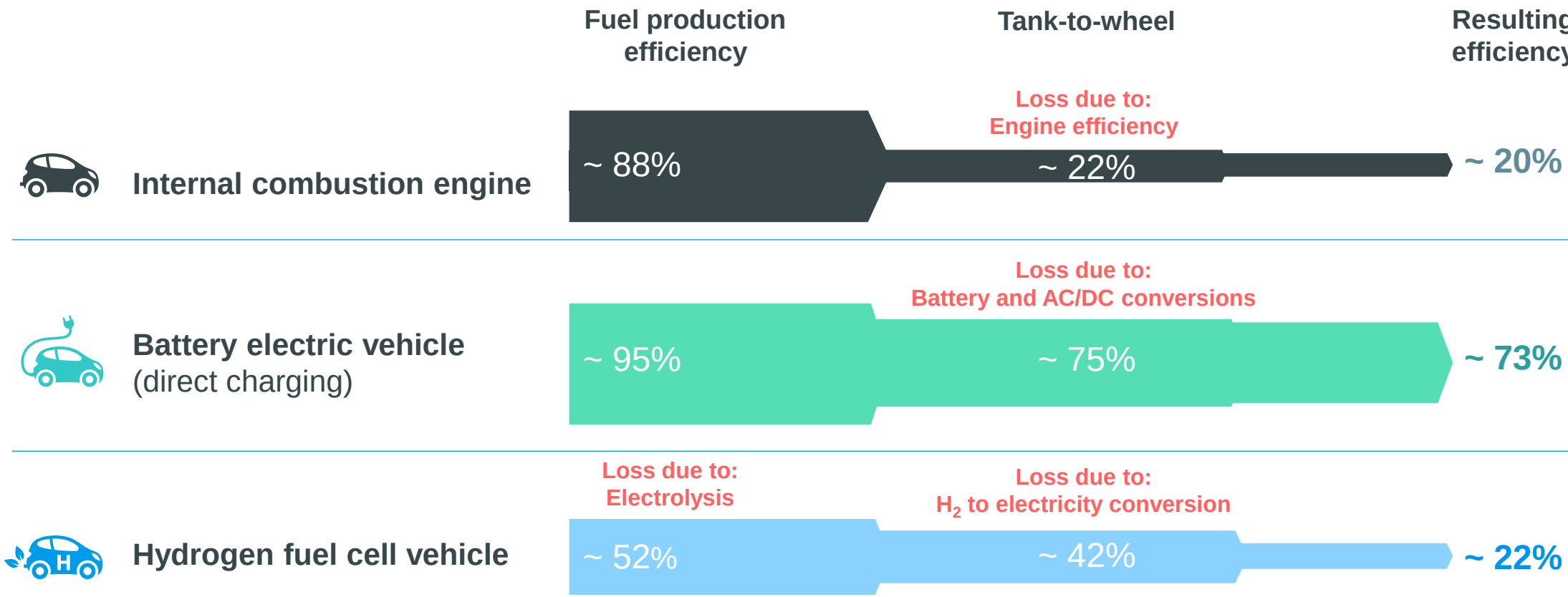
For a similar end-use, the number of transformation steps is variable

The longer the production chains, the greater the losses and costs. However, some longer chains emit less GHG

Source: Capgemini Analysis

The more processing steps, the greater the energy losses

Illustratives vehicle performance yields



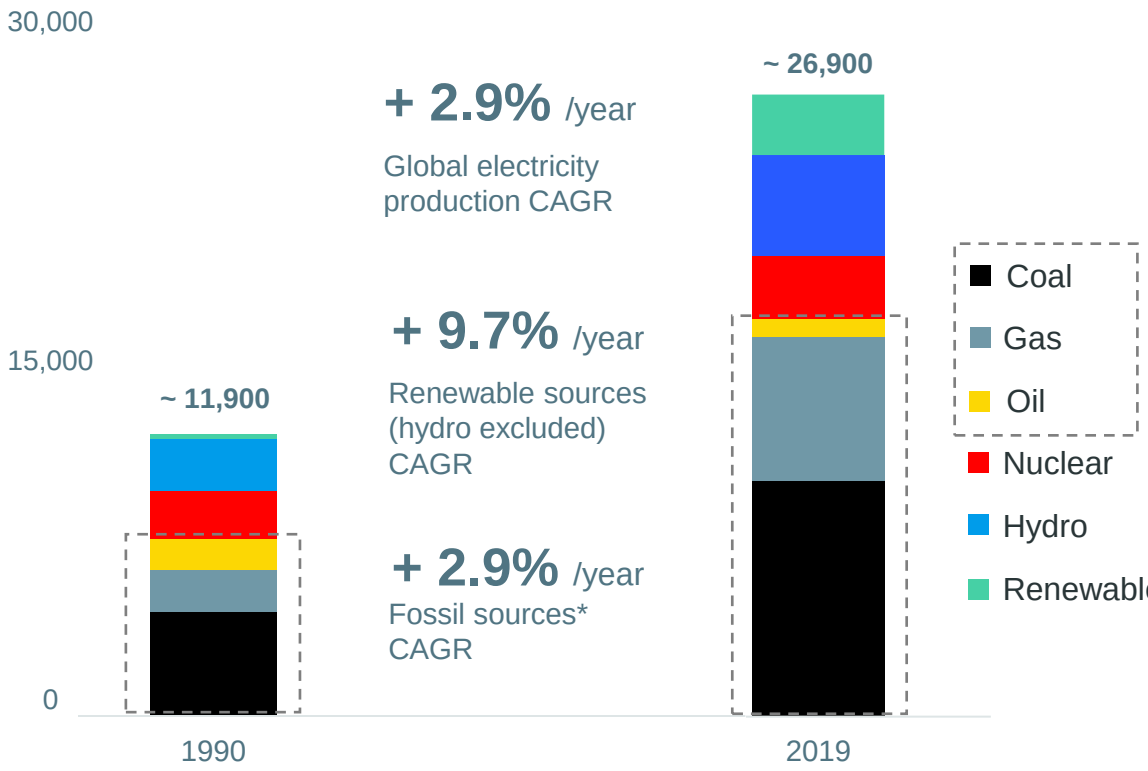
Electric vehicle is very efficient

Electrification is a major trend including transportation

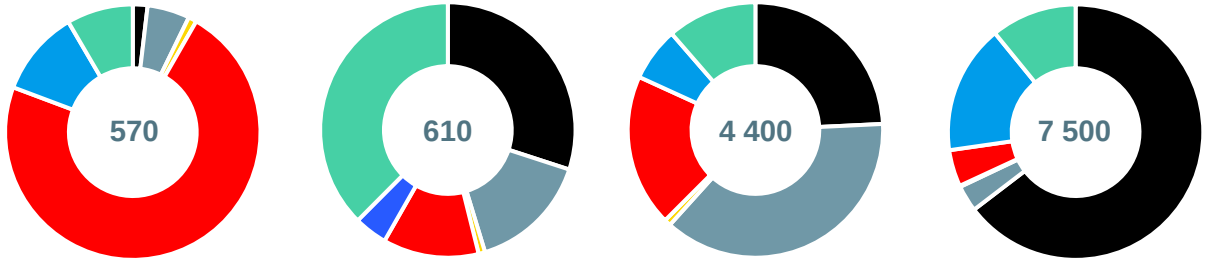
Source: UK Transport & Environment, Comparison of the Overall Energy Efficiency for Internal Combustion Engine Vehicles and Electric Vehicles - Aiman ALBATAYNEH, Mohammad N. ASSAF, Dariusz ALTERMAN, Mustafa JARADAT - 2020

Decarbonization under way : electricity the main enabler

Global electricity production mix (TWh)



Electricity production mix per country (TWh)



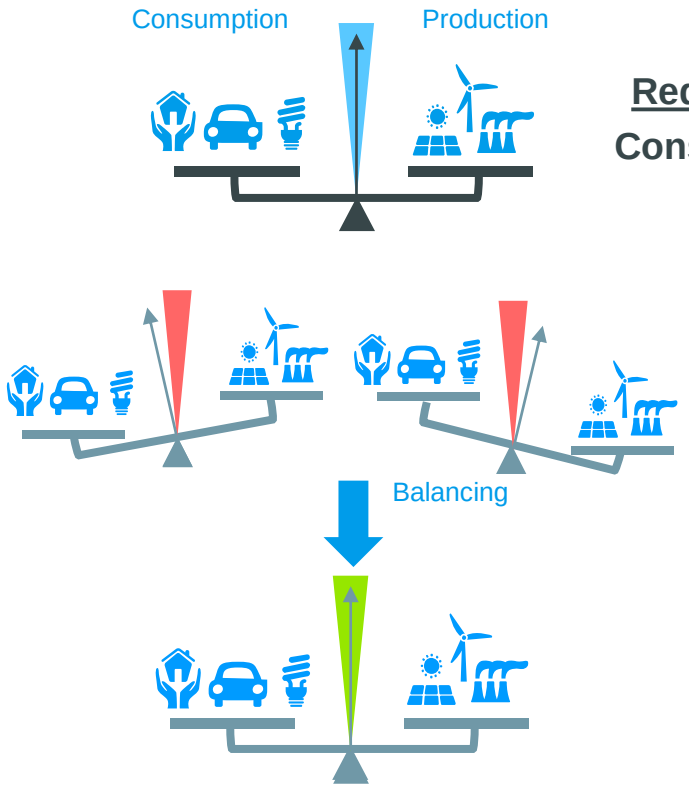
- The power mix is highly variable across countries

Low carbon electricity is at the core of numerous Net Zero carbon emissions oriented policies

*Note: *Fossil sources include Coal, Gas and Oil.*

Sources: IEA World Energy Balance 2021, World Bank United Nations, IEA, World Total Energy Supply

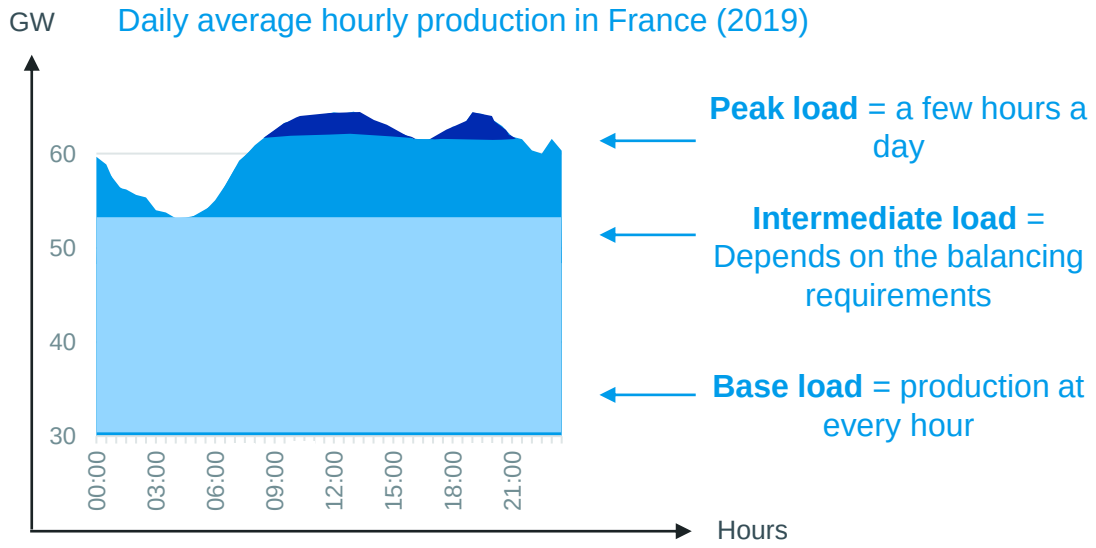
Power systems must adapt to intermittent renewables



<u>Requirement</u>: at any time
Consumption = Production

- **Unbalancing**: weather, intermittency (wind, solar, etc.), demand.
- **Balancing by:** peak load solutions, storage, etc.

Means of production and role in the electrical system



- Electrical generation is composed of multiple means of production with different roles

The massive introduction of intermittent renewable energy has a systemic impact on electric network balance

Their intermittency needs mitigation : storage, intermediate load and peak load power plants & clients demand response

Source: Capgemini Analysis

Characteristics for comparing main energy sources

	Oil	Natural gas	Intermittent renewables
Energy density (MJ / kg)	⊕⊕ Very high (41-48)	⊕ High (38-50)	⊖ Low
Availibility/Abundance*	⊕ 60 years of consumption (including shale oil)	⊕ 80 years of consumption (including shale gas)	⊕⊕ Infinite (limited by available space)
Predictibility/Reliability	⊕	⊕	⊖
Impacts on electrical networks	No	No	Yes, need for predictable energy and storage
Externalities	CO_2/CH_4 emissions	CO_2/CH_4 emissions	Rare metals resources, footprint
Corrective measures	Blending with green fuels, Carbon Capture, Use and Storage (CCUS)	Blending with green gases, Carbon Capture, Use and Storage (CCUS)	N/A
Technology maturity	⊕⊕	⊕⊕	⊕

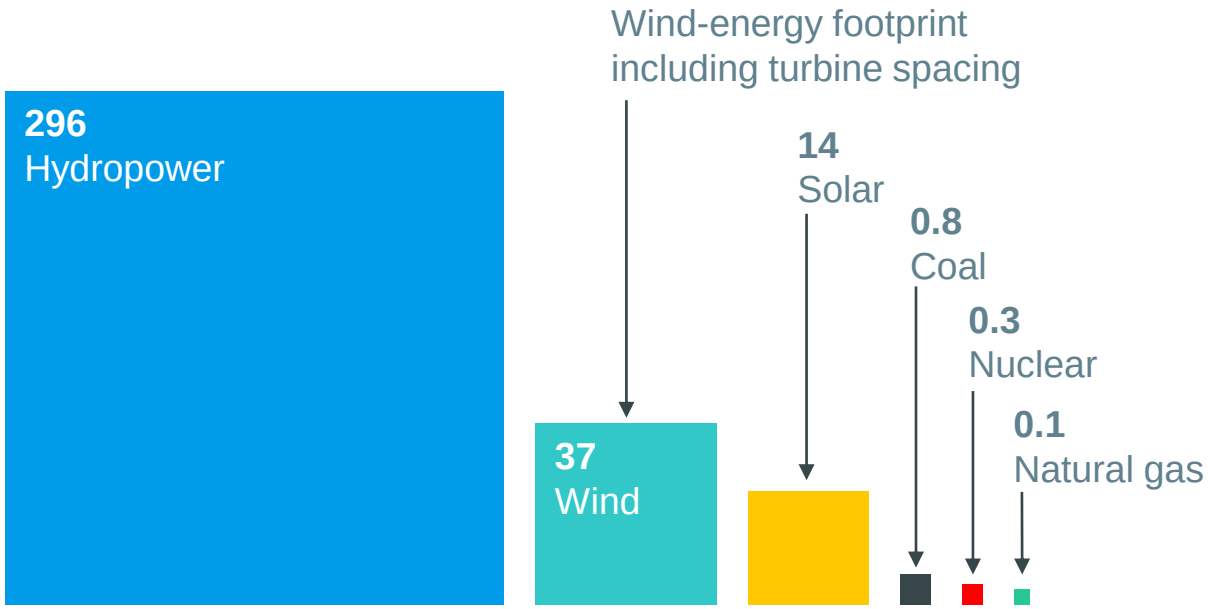
Comparisons are not straightforward. Cost most include a price for carbon or GHG and for network impact related to intermittency of renewables.

*Note: *Abundance is depending upon States sovereignty*

Source: Capgemini Analysis

The footprint is also to be considered

Land use required to power a 100W flat TV screen by energy type
(m^2)



Acceptability issues of solar & wind due to their impact on territories and landscape must be overcome

Source: van Zalk, John, Behrens, Paul, 2018, The Spatial Extent of Renewable and Non-Renewable Power Generation

Where does the energy consumption come from ? (1/2)

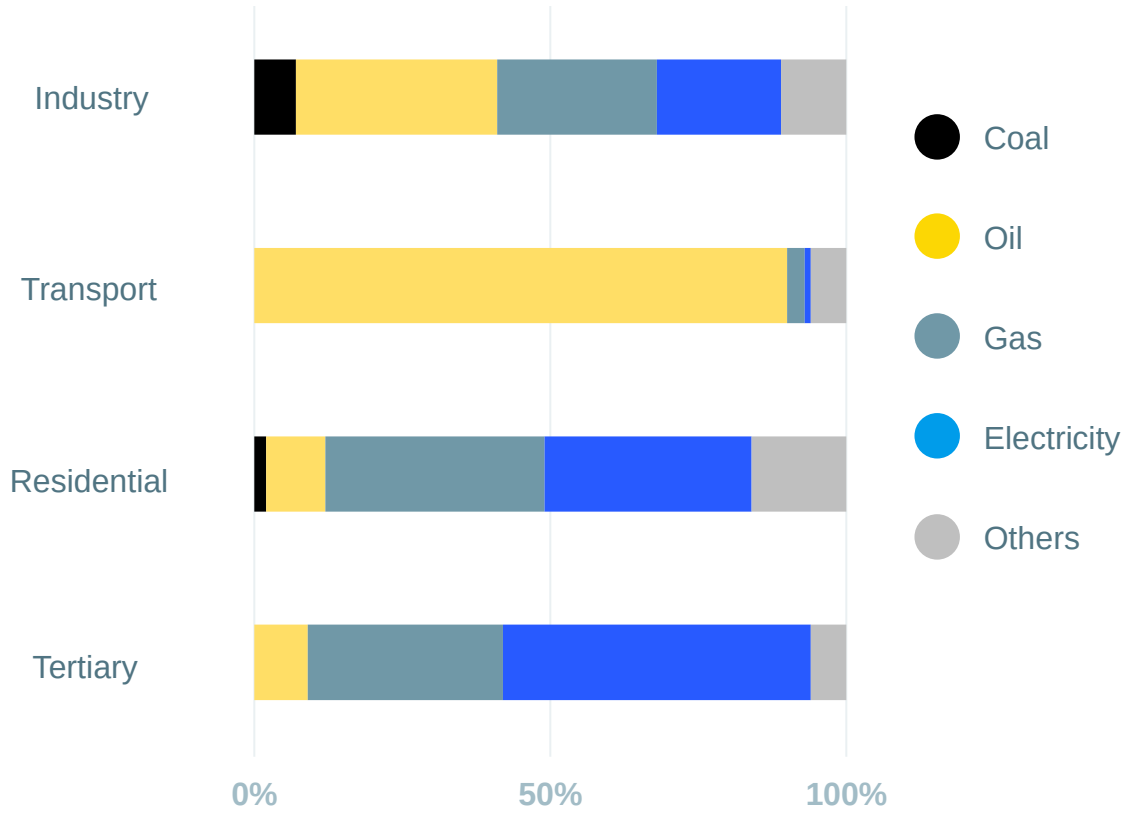
Energy is central to human life

- **Lighting**
- **Heating**
- **Mechanical**
- **ICT**

→

- Heat, Light, Cook
- Transform, Produce
- Mobility
- Communicate

Final energy consumption mix, OECD 2018



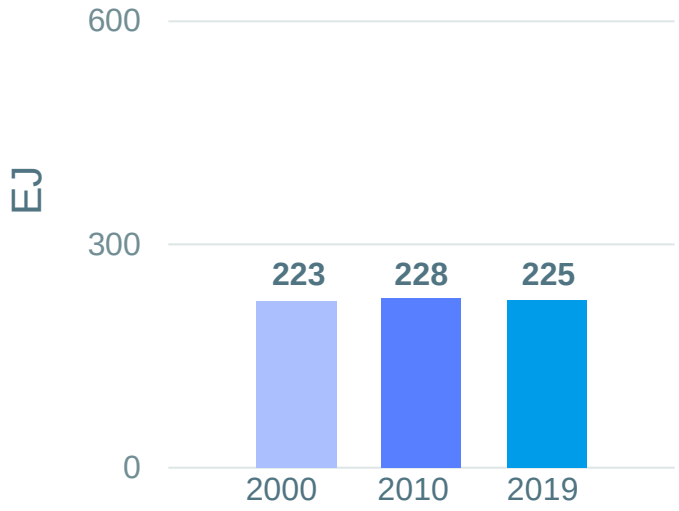
When enough energy is available its consumption mix varies according to end use

Source: IEA World Energy Balances 2020

Where does the energy demand come from ? (2/2)

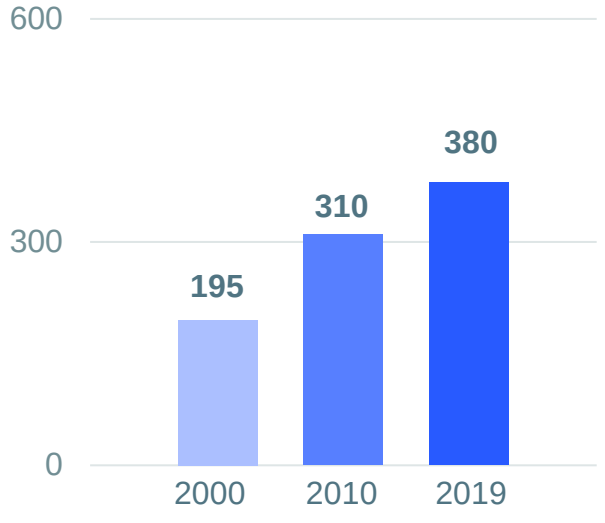
Developed countries (OECD)

+ 0%/year
(2000-2019)



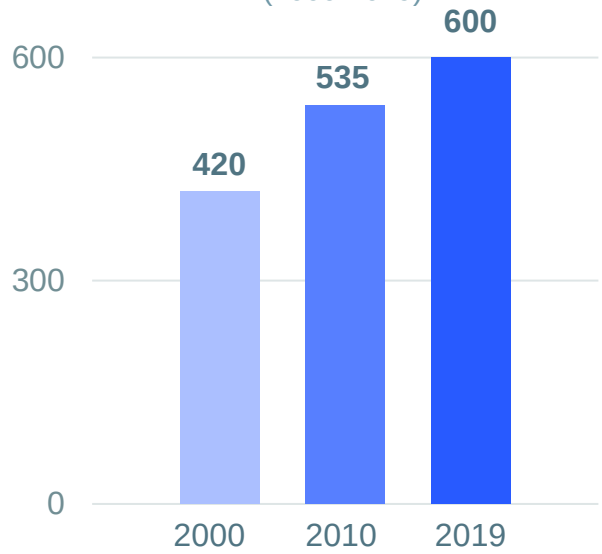
Developing countries (non-OECD)

+ 3.4%/year
(2000-2019)



Global

+ 1.8%/year
(2000-2019)



- Energy demand increases at a different pace according to the region
- Developed countries are the main consumers of energy. However, their consumption is decreasing while developing countries consumption is increasing

For many countries, access to energy is paramount for their development:

Nearly 1 billion people do not have access to electricity today

Source: IEA World Energy Balances 2020

People are not equal towards energy

22
World average primary energy consumption per capita in 2019 (MWh/capita)

Energy consumption per Capita in 2019
MWh/Capita

United States **78**

Saudi Arabia **73**

France **42**

China **28**

India **8**

Kenya **6**

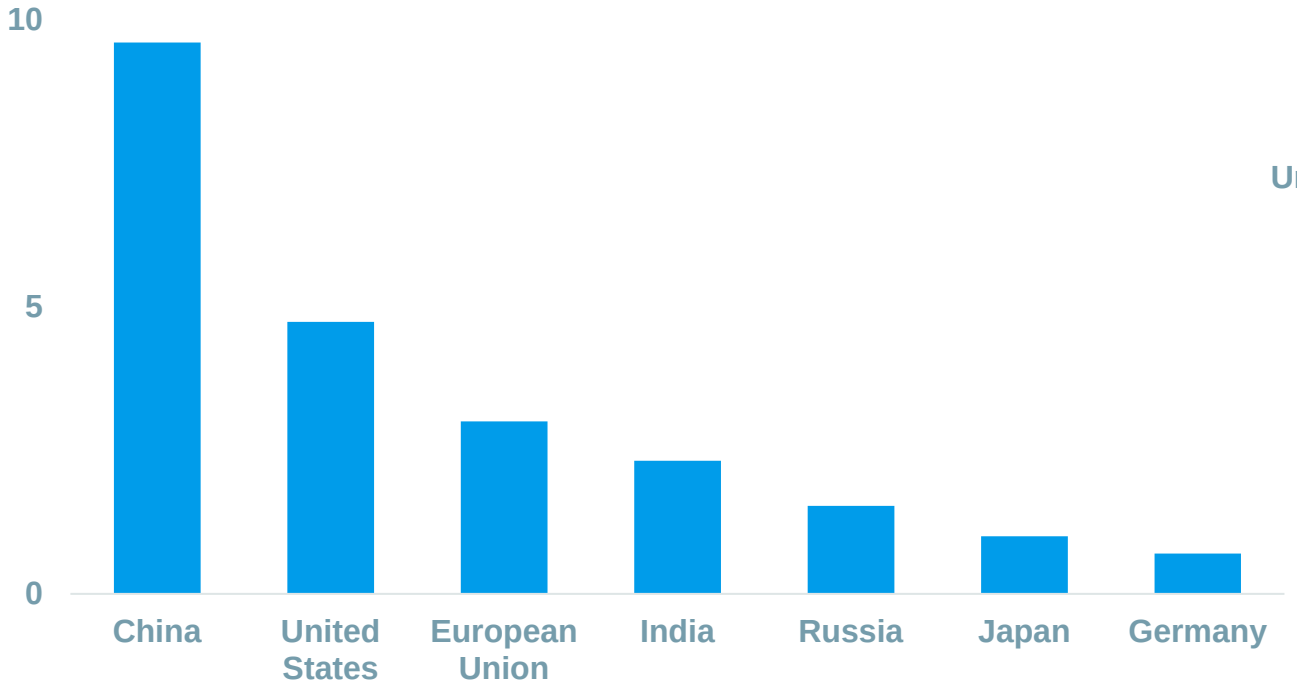
Energy consumption per capita reflects both accessibility to energy sources and living standards

Necessity of a just and inclusive energy transition

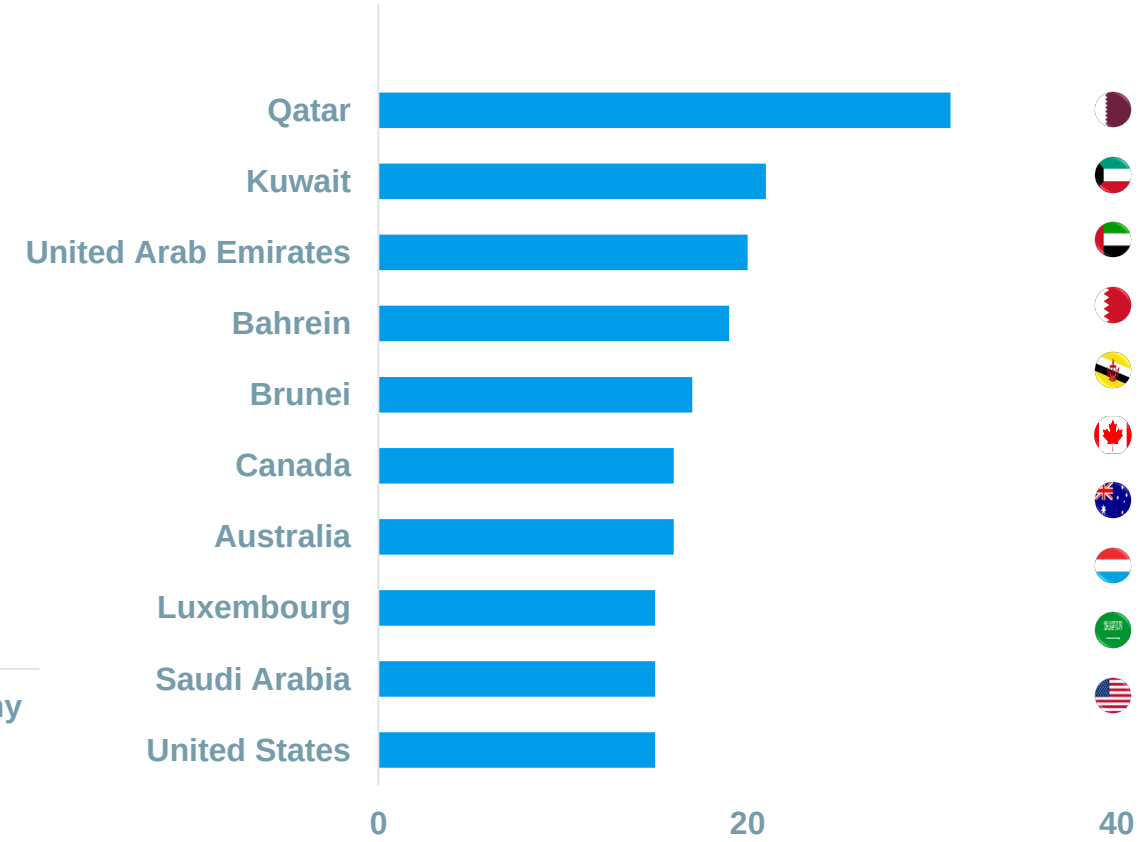
Source: IEA (2021), Key World Energy Statistics 2021

Not all countries are equal regarding CO_2 emissions

Largest global CO_2 emitters (2019)
($GtCO_2$)



Largest CO_2 emissions per capita (2019)
(tCO_2/Capita)

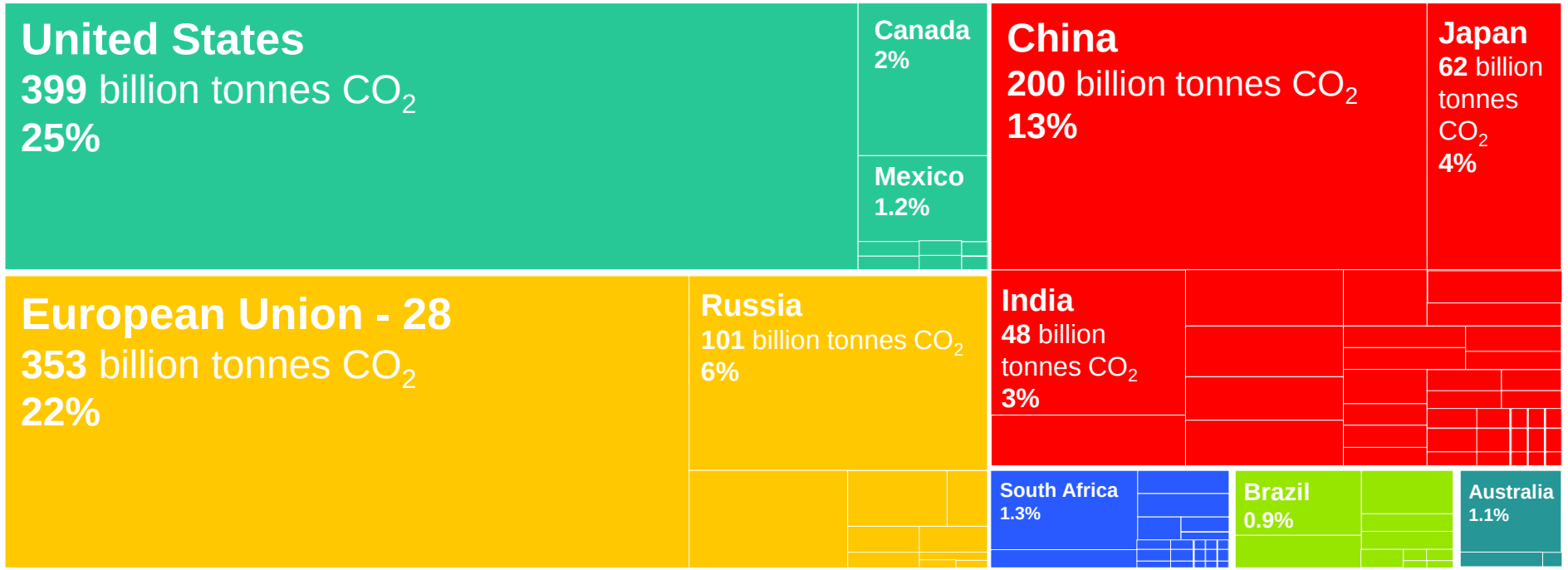


Since 2006, China has become the largest emitter of CO_2 ahead of the United States

Source: IEA World Energy Outlook 2020
Note: emissions on the graph are expressed in CO2, not CO2eq (unit for GHG emissions)

Largest historical CO_2 emitters worldwide

Cumulative CO_2 emissions over the period from 1971 to 2017



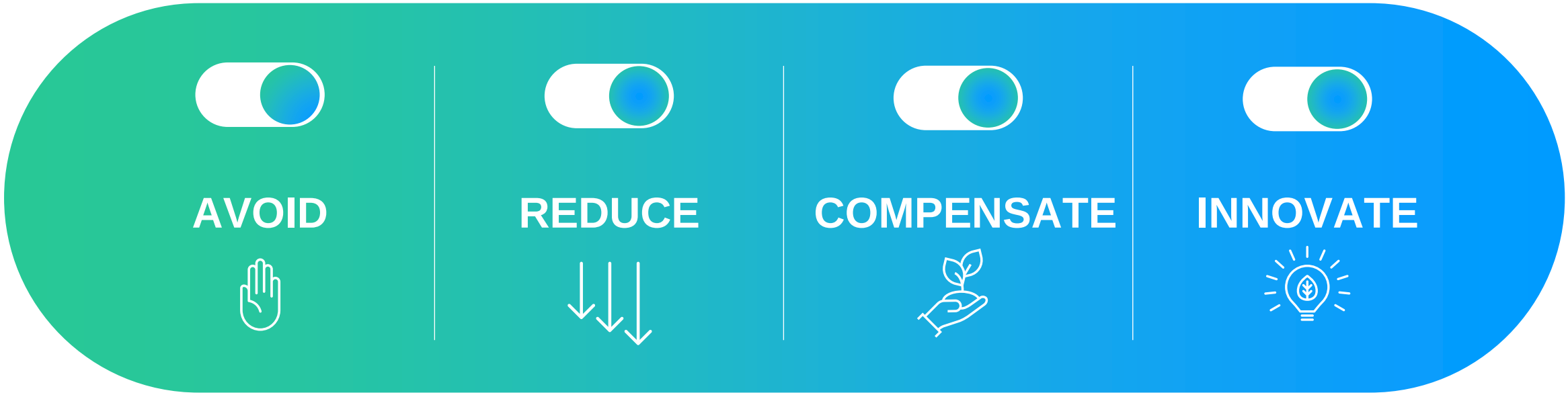
x%: global cumulative emissions

Developed countries have thrived without any constraints in GHG emissions

Developing and emerging countries will need help to grow without following the same path

Source: Who has contributed most to global CO_2 emissions?, Our World in Data, Hannah Ritchie, 2019
Note: emissions on the graph are expressed in CO2, not CO2eq (unit for GHG emissions)

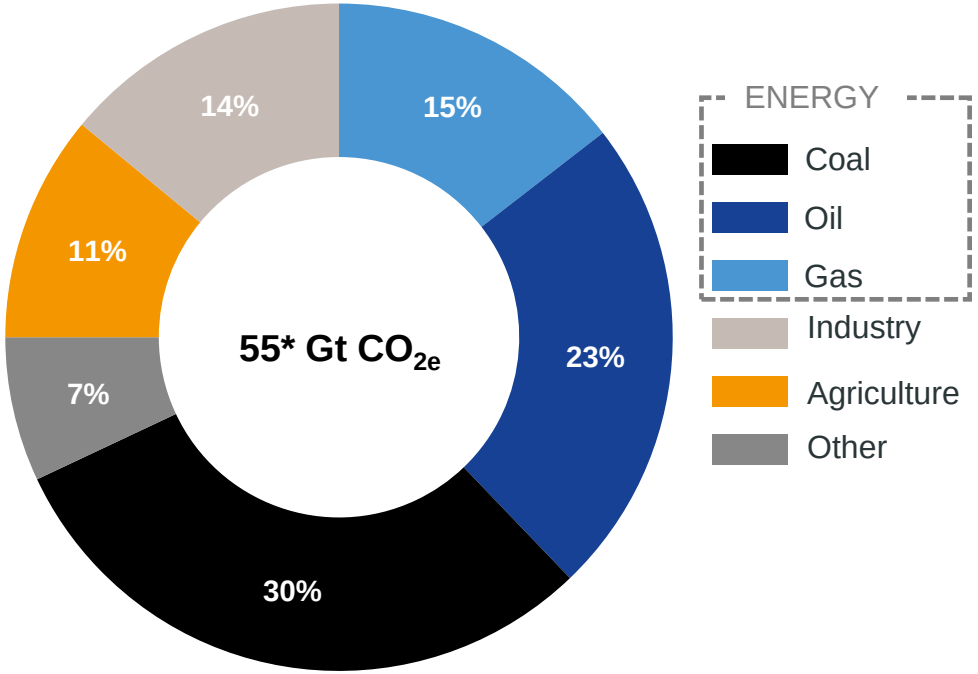
Decarbonization levers



Appendix

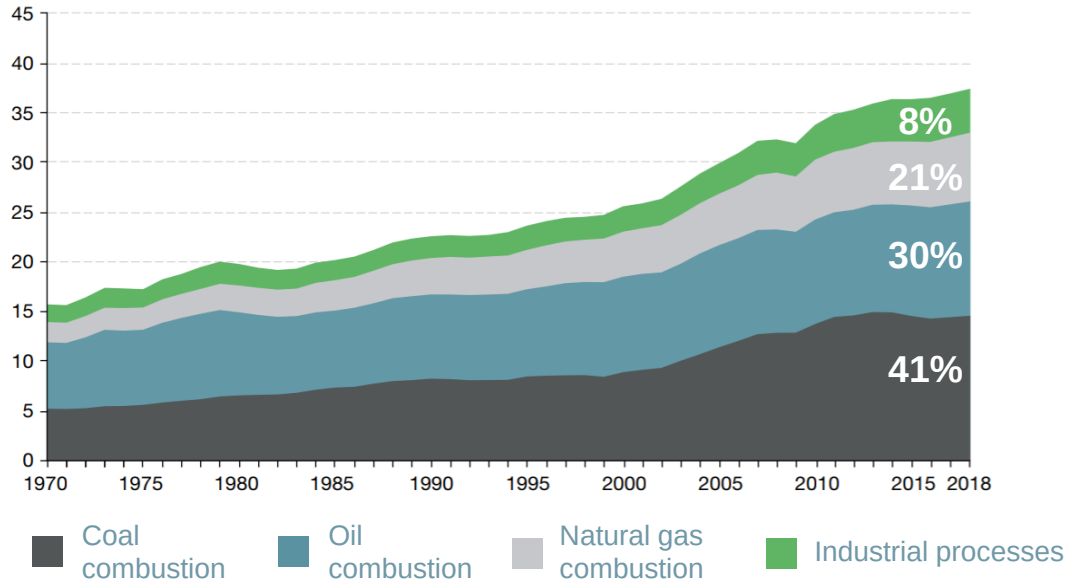
Fossil fuels are the main contributors to GHG emissions

Global GHG emissions in 2018 by sector in CO_2eq



Energy usages contributes up to 68% of GHG emissions*

CO_2 emissions by source in the world (in Gt CO_2)**



The combustion of fossil fuels generates CO_2 emissions

The energy transition aims at radically changing the global energy mix in order to limit the GHG emissions

Sources: GHG Emissions from fuel combustion IEA report and UNEP emissions Gap report 2019
CO_2 : Ministry of Ecological Transition - Key figures for climate 2021 - France, Europe and Global
*Note: * GHG emissions are expressed in CO_2eq, a unit created by the IPCC to aggregate emissions from all GHG (CO_2, CH_4, N_2O, …)*
*** excluding Land Use and Land Use Change and Forestry*

Avoid

Avoiding unnecessary energy consumption through energy efficiency and responsible behavior

Increase energy performance in all sectors through proactive policies

Impact of a speed reduction from 130 to 110 km/h on highways:

- A 15% reduction in fuel consumption
- A fuel bill reduced by 7% on average
- A reduction of CO^2 emissions around 20%
- For a 100 km journey, a 8 minute longer journey time

Source: Capgemini Analysis

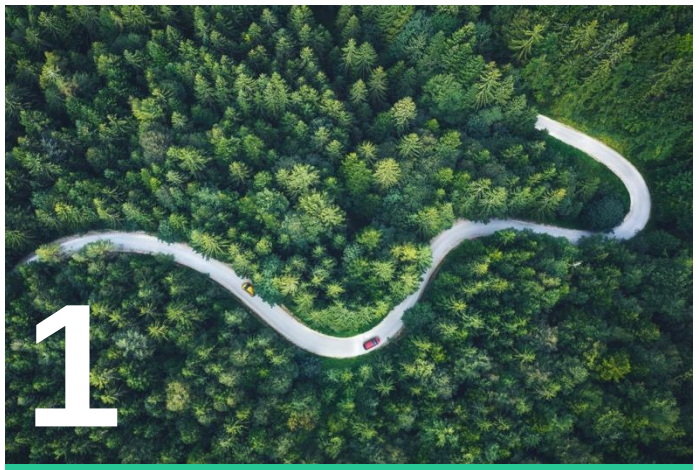
Reduce: Decarbonization of the energy value chain

Changing the energy mix
Shift to minimum or no carbon energy

Decarbonize uses:
For instance: promote the electrification of transportation and the use of biogas and bioliquids

Source: Capgemini Analysis

Compensate emissions



Preserve natural carbon sinks (forests, peat, oceans...) **and develop artificial carbon sinks** (CCUS)

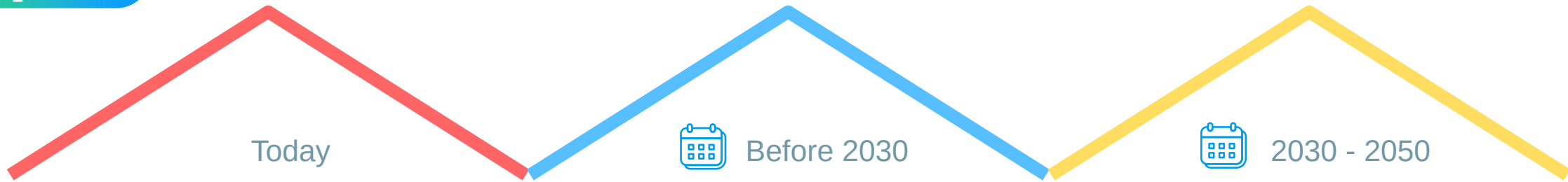
Support actors in other sectors/countries to offset their own emissions that cannot be avoided

Robust auditing and certification for carbon offsetting

Source: Capgemini Analysis

Innovate

Overview of low-carbon energy technologies and their technological maturity



Mature and established technologies

- Hydraulic, Solar PV & thermal, Wind, Nuclear, Geothermal
- Heat (networks, pumps, recovery)

Technologies in development and emerging on the market

- Small Modular Reactors (nuclear)
- Autonomous Electric Vehicles
- Clean hydrogen
- CCUS

Technologies in R&D

- Zero waste batteries
- Synthetic fuel or gas
- Direct Air Capture
- Nuclear fusion
- Superconductivity

Working on fundamental research, technology maturity, industrial scale up and business model viability (including costs) is essential

Note: The concept of "TRL" (Technology Readiness Level) is used to evaluate the level of maturity of a technology

Source: Capgemini Analysis

We all have a role to play

Government

Carbon price, carbon neutrality policy and investments, regulation, mandates, subsidies and multilateral action

Citizens

Adapting behaviour and becoming informed, seek for holistic based information

Companies

Reducing Direct and indirect GHG, upstream/downstream value chain actions, innovation scale up

Innovators & Scientists

Progressing on fundamental research and applications. Providing insights and concrete solutions

Financial sector

Supporting the transition, Deploying ESG strategies

NGOs

Raising awareness and informing stakeholders

Source: Capgemini Analysis

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Financial information by business segment is reported in accordance with the internal reporting system and shows internal segment information that is used to manage and measure the performance of TotalEnergies. In addition to IFRS measures, certain alternative performance indicators are presented, such as performance indicators excluding the adjustment items described below (adjusted operating income, adjusted net operating income, adjusted net income), return on equity (ROE), return on average capital employed (ROACE), gearing ratio, operating cash flow before working capital changes, the shareholder rate of return. These indicators are meant to facilitate the analysis of the financial performance of TotalEnergies and the comparison of income between periods. They allow investors to track the measures used internally to manage and measure the performance of TotalEnergies.

These adjustment items include:

(i) Special items

Due to their unusual nature or particular significance, certain transactions qualified as "special items" are excluded from the business segment figures. In general, special items relate to transactions that are significant, infrequent or unusual. However, in certain instances, transactions such as restructuring costs or asset disposals, which are not considered to be representative of the normal course of business, may be qualified as special items although they may have occurred within prior years or are likely to occur again within the coming years.

(ii) Inventory valuation effect

The adjusted results of the Refining & Chemicals and Marketing & Services segments are presented according to the replacement cost method. This method is used to assess the segments' performance and facilitate the comparability of the segments' performance with those of its competitors.

In the replacement cost method, which approximates the LIFO (Last-In, First-Out) method, the variation of inventory values in the statement of income is, depending on the nature of the inventory, determined using either the month-end price differentials between one period and another or the average prices of the period rather than the historical value. The inventory valuation effect is the difference between the results according to the FIFO (First-In, First-Out) and the replacement cost.

(iii) Effect of changes in fair value

The effect of changes in fair value presented as an adjustment item reflects, for some transactions, differences between internal measures of performance used by TotalEnergies' management and the accounting for these transactions under IFRS.

IFRS requires that trading inventories be recorded at their fair value using period-end spot prices. In order to best reflect the management of economic exposure through derivative transactions, internal indicators used to measure performance include valuations of trading inventories based on forward prices.

TotalEnergies, in its trading activities, enters into storage contracts, whose future effects are recorded at fair value in TotalEnergies' internal economic performance. IFRS precludes recognition of this fair value effect.

Furthermore, TotalEnergies enters into derivative instruments to risk manage certain operational contracts or assets. Under IFRS, these derivatives are recorded at fair value while the underlying operational transactions are recorded as they occur. Internal indicators defer the fair value on derivatives to match with the transaction occurrence.

The adjusted results (adjusted operating income, adjusted net operating income, adjusted net income) are defined as replacement cost results, adjusted for special items, excluding the effect of changes in fair value.

Euro amounts presented for the fully adjusted-diluted earnings per share represent dollar amounts converted at the average euro-dollar (€-$) exchange rate for the applicable period and are not the result of financial statements prepared in euros.

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