Enerdata intelligence + consulting

December 2025

Ten years after the Paris agreement: what's done, what's due?

Assessing the progress in 10 years and looking ahead to 2050

Powered by our EnerFuture scenarios derived from the POLES-Enerdata model

Since 1991, we have proven a renowned expertise in energy-climate scenario modelling services

- **Independent energy research & consulting company since 1991**
- Expert in analysis and **forecasting of global energy & climate issues**
- **In-house** and globally recognized **sectoral databases** and **forecasting models**

Enerdata intelligence + consulting

65+
committed Consultants and Experts

- **Headquartered in the Grenoble (French Alps) research cluster**; a subsidiary in **Singapore**
- **Global reach**: Clients and projects in Europe, Asia, Americas, Middle East, Africa
- **Connected** with **leading public institutions, financial and corporate actors, academia and NGO actors**

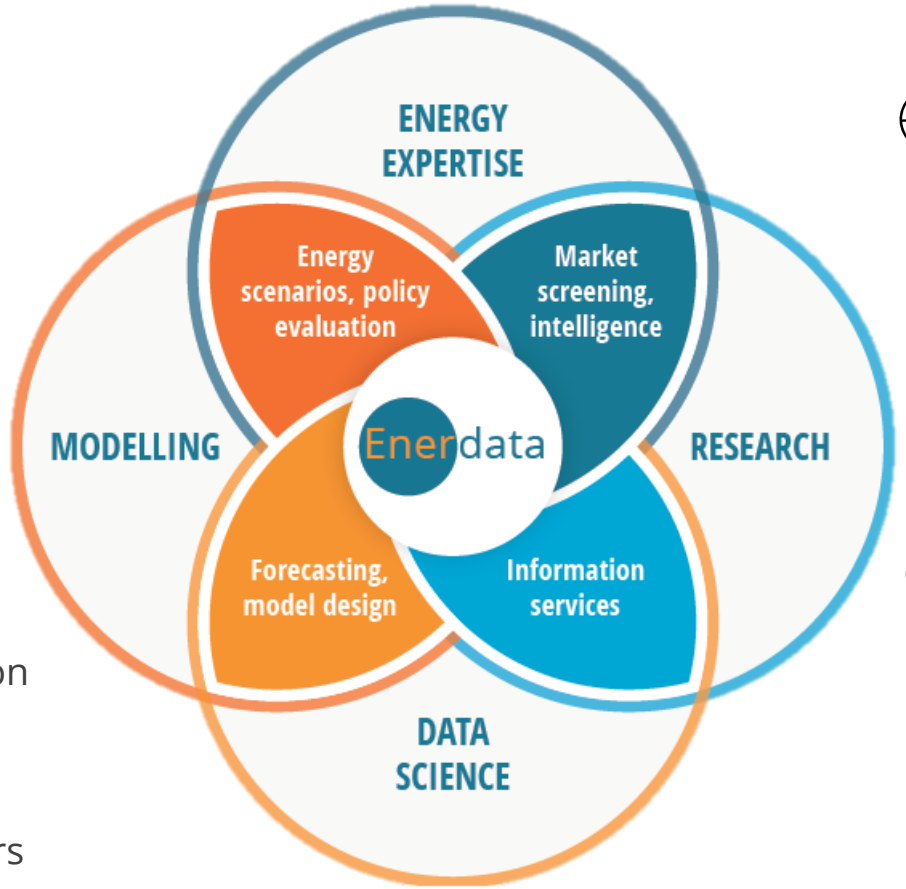
Our services – Combining fields of expertise from research, data science to modelling

Modelling

- Creation of E-C scenarios, climate alignment trajectories
- Identification of alignment pathways by sector and by country

Expert in energy / climate

- Knowledge of market drivers
- Expertise covering all energy transition pillars: mix decarbonisation, energy efficiency, sufficiency, and flexibility (assets and markets)
- Deep coverage: all energies, all sectors and 150+ countries



Market intelligence

- Market Research
- Business intelligence
- Energy market watch
- Tracking of E-C policies worldwide

Data science

- Gathering, consolidating and analysing energy data
- Market forecasts: supply, demand and prices

Agenda of the webinar

1. Introduction
2. Looking back: the World is not on track…
3. … but real progress was still made
4. Looking forward: what now?
5. Takeaways and Q&A session

Aurélien PEFFEN
Head of Prospective & Scenarios

Joseph BON-MARDION
Project Manager

1 Introduction

Methodological approach,
Scenario definition

Enerdata

Scenario construction

Starting from today, we explore different pathways to 2050 relying on varying assumptions but a common framework

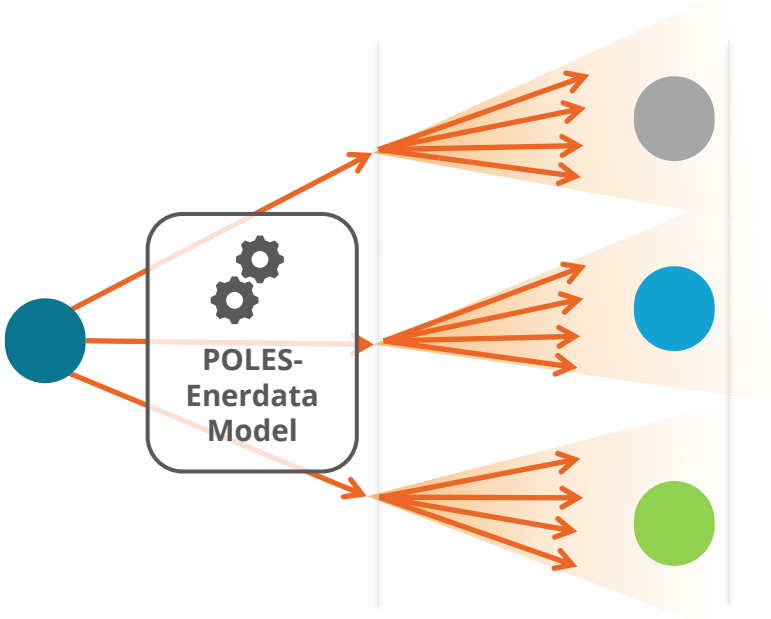
Today

Energy demand
Activity, technological description

Energy supply
Technologies

Energy prices
Several markets

GHG emissions



2050

Demand
Global & regional dynamics, fuel mix, efficiency…

Supply & Prices
Availability,
self-sufficiency, trade, bills…

Sustainability
GHG emissions…

- Use macroeconomic assumptions:
  - population (UN),
  - GDP growth (IMF, CEPII, OECD)

- Apply alternative assumptions for key drivers:
  - climate and energy policies,
  - available technological options, etc.

- Results in contrasted pathways

Scenario definition

Three energy-climate scenarios to explore possible futures of global energy systems

EnerBase

Continuation of existing policies and trends

Temperature increase around 3°C

EnerBlue

Achievement of new NDCs submitted up to end of 2024

Temperature increase in the 2-2.5°C range

EnerGreen

Ambitious GHG emissions budget in line with the Paris Agreement

Temperature increase well below 2°C

- EnerFuture is relying on the recognised **POLES-Enerdata model**, an energy-economy-environment model of the global energy system,
- 66 countries and regions, with global coverage and annual step until 2050,
- with dedicating modelling of the individual end-use sectors, energy supply, prices and GHG emissions

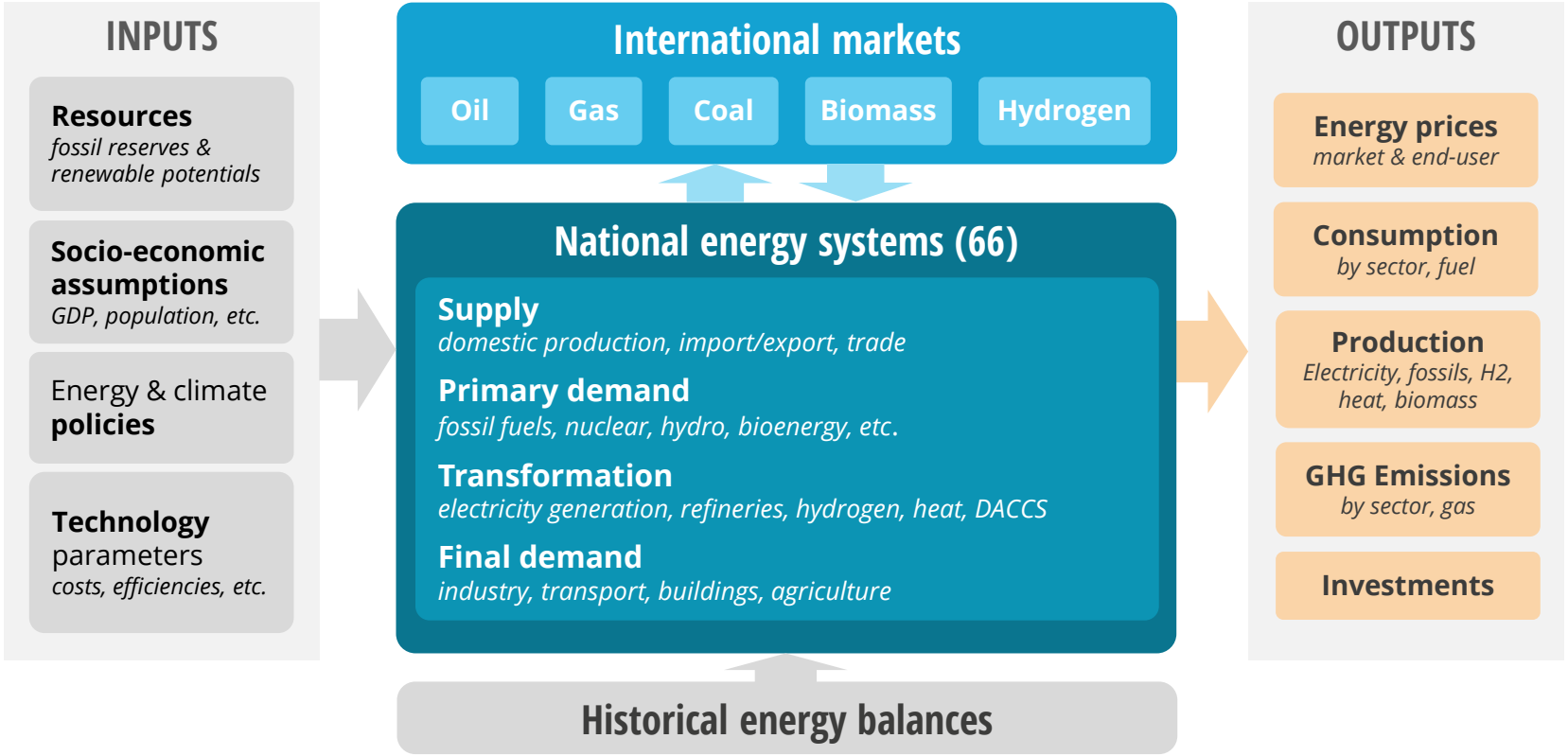
POLES
PROSPECTIVE OUTLOOK ON LONG-TERM ENERGY SYSTEMS

Note: The POLES model has been initially developed by the GAEL (Grenoble Applied Economics Lab) at the University of Grenoble Alpes

The POLES-Enerdata model

The EnerFuture scenarios are produced using our POLES-Enerdata global energy model

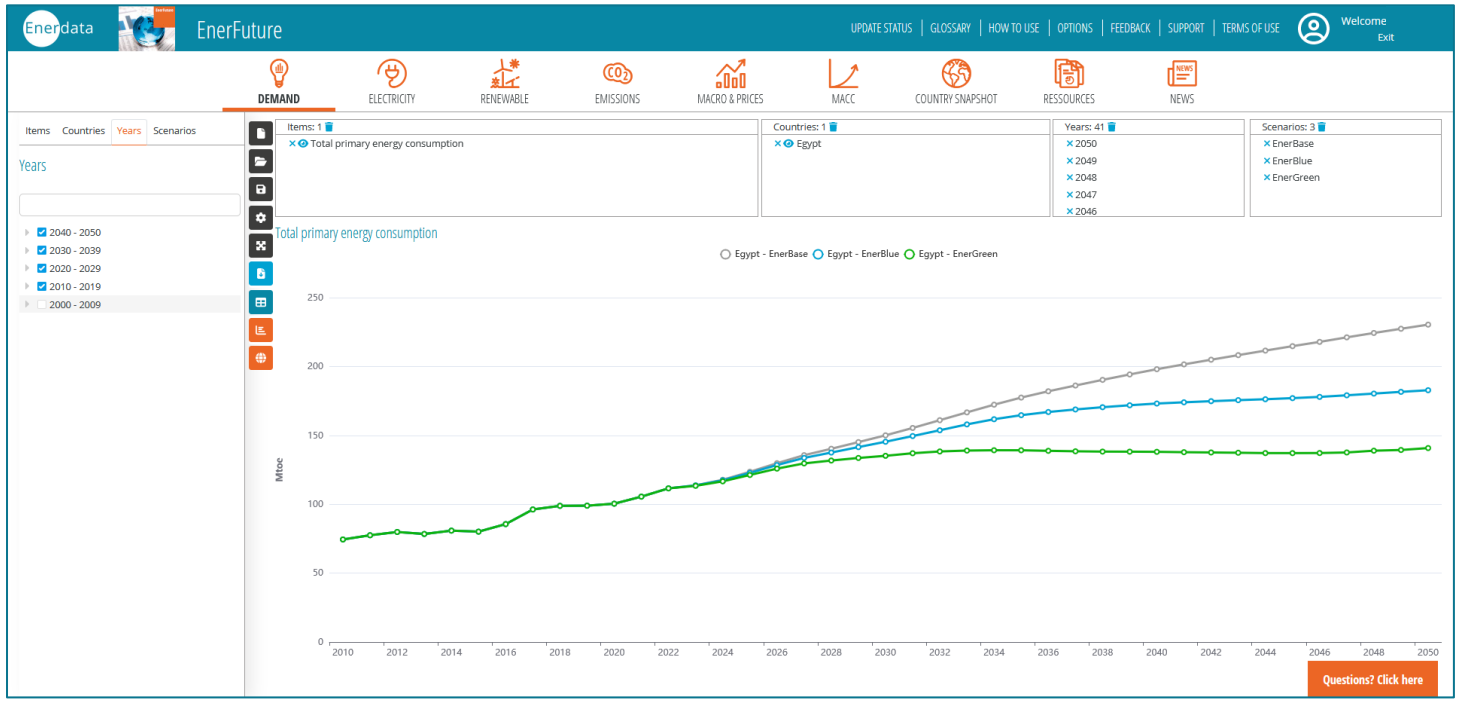
- POLES-Enerdata: Prospective Outlook on Long-term Energy Systems;
- Owned, maintained and operated by Enerdata



EnerFuture interface

Benefit from instantaneous access to POLES-Enerdata model outputs

- **Annual projections to 2050 for 55 countries/aggregates**
  - 3 Enerdata scenarios: **EnerBase**, **EnerBlue**, **EnerGreen**
  - Demand, prices and emissions forecasts for all energies at sector level
  - Power generation forecasts by fuel (both capacities and production)



- Insightful indicators and country-level dashboards
- Intuitive online interface for visualisation, table & graph generation and data queries
- Yearly update to include latest historical statistics and developments in the energy sector
- Option: Marginal Abatement Cost Curves for CO_2 by sector and industrial branches
- Option: **deep dive on energy demand** with end-use level results and indicators

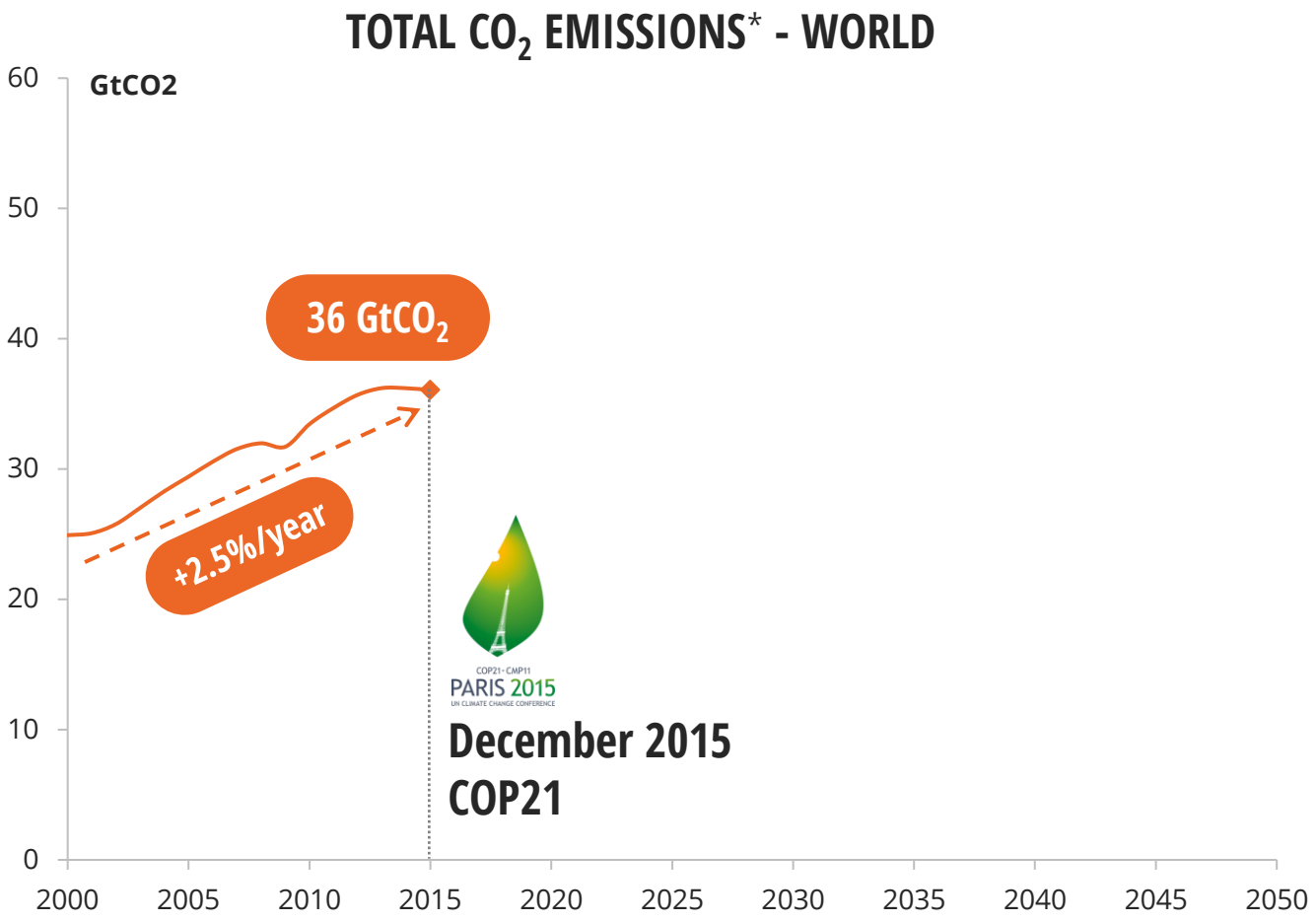
2 Looking back: the World is not on track...

We did not live up to the Paris Agreement

Enerdata

Ten years ago, COP21 was starting

After long decades of rapid growth in global emissions, the whole world was in Paris to accelerate climate action



CO_2 emissions excl. AFOLU
Source: EnerFuture, Enerdata

- **A COP aimed at reversing the trend**
  - Global CO_2 emissions (excl AFOLU) reached 36 $GtCO_2$ in 2015, up from 25 $GtCO_2$ in 2000
  - This corresponds to a +2.5%/y average growth

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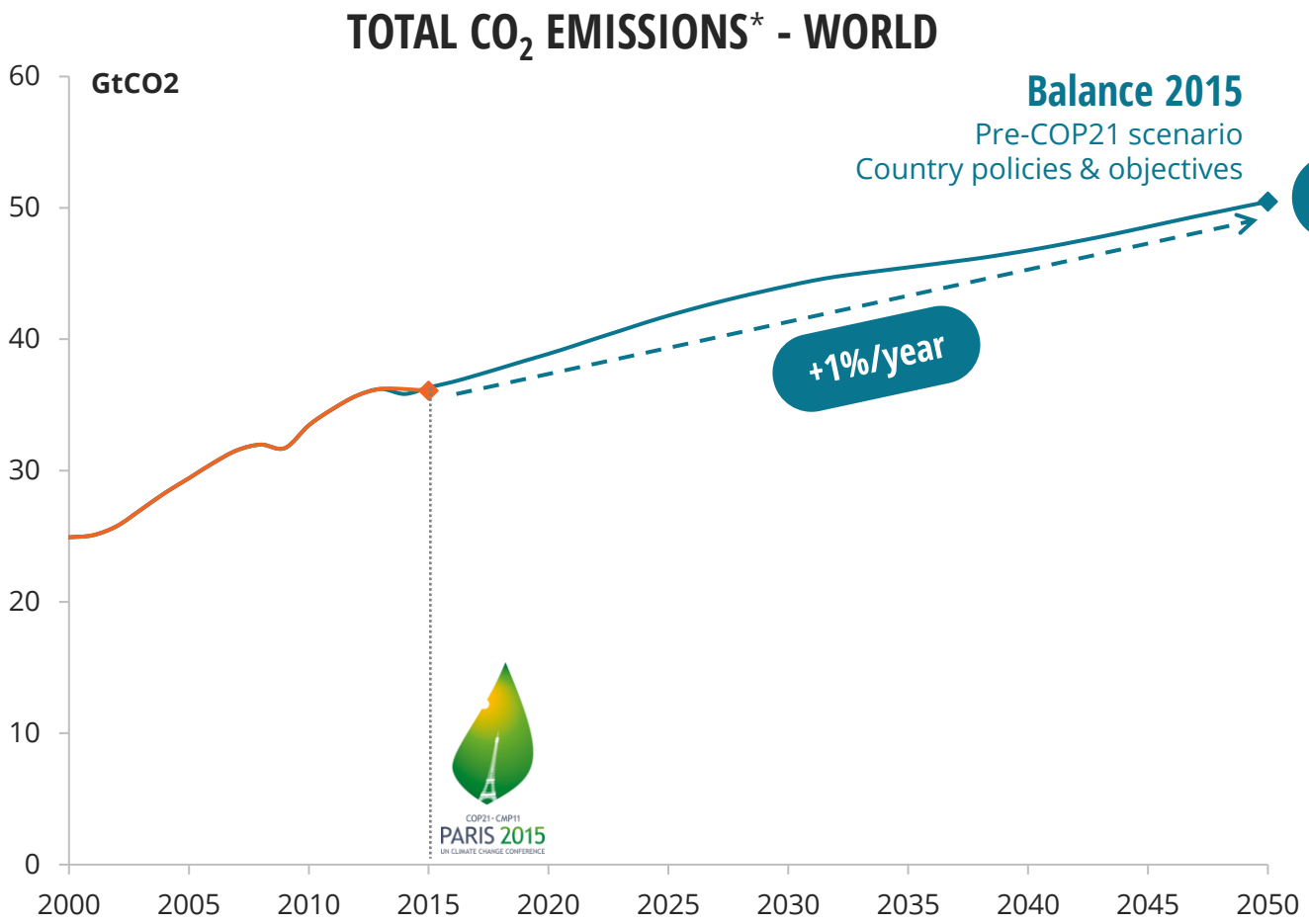

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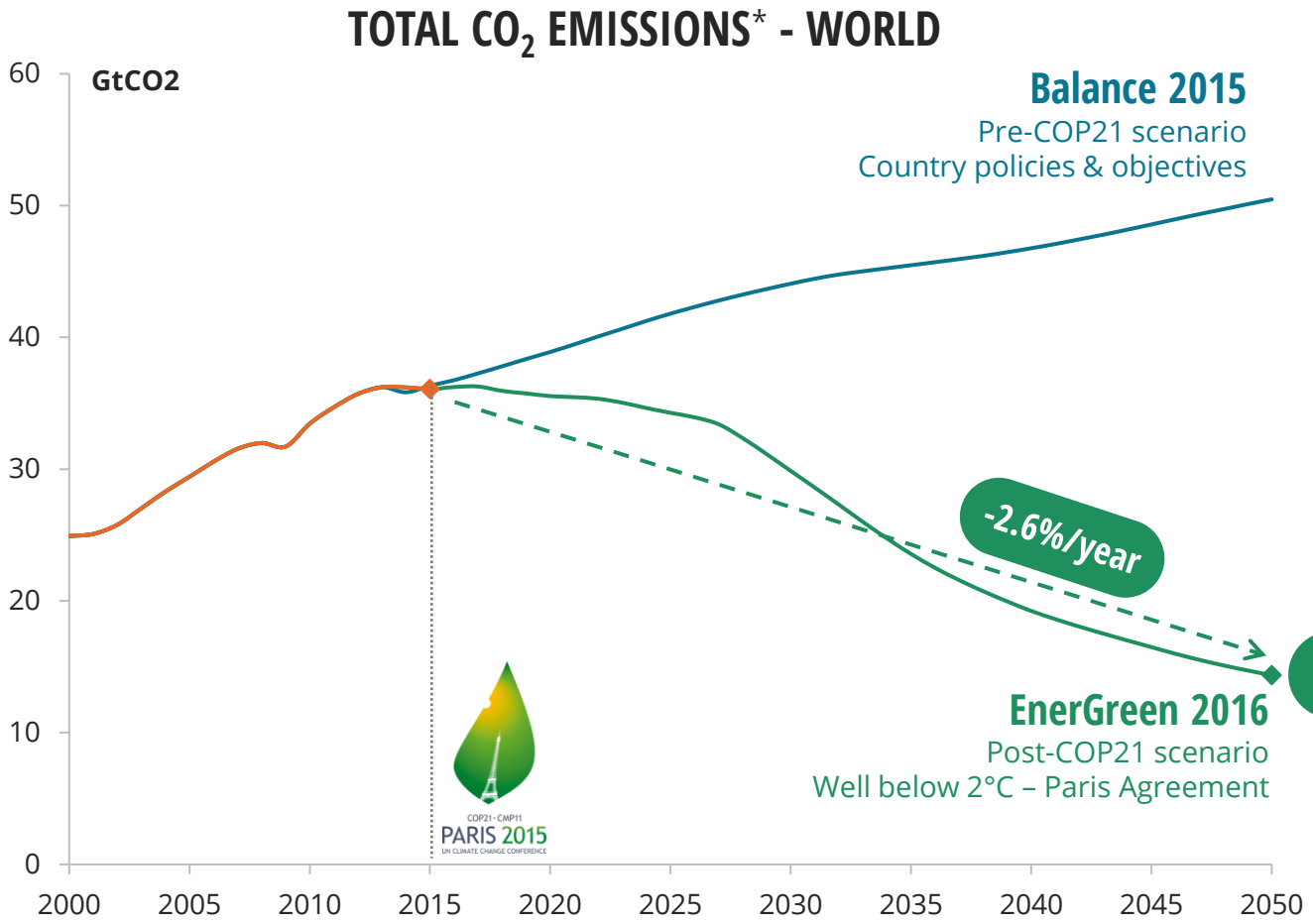
  - This corresponds to a +2.5%/y average growth
- **Insufficient country policies & objectives**
  - Going into COP21, existing country pledges led to a steady increase in global emissions
  - Our Balance scenario 2015 showed a growth of about 1%/year in average

COP21: A New Hope

On December 12th 2015, after an extra day, COP21 leads to the historic Paris Agreement



CO_2 emissions excl. AFOLU

Source: EnerFuture, Enerdata

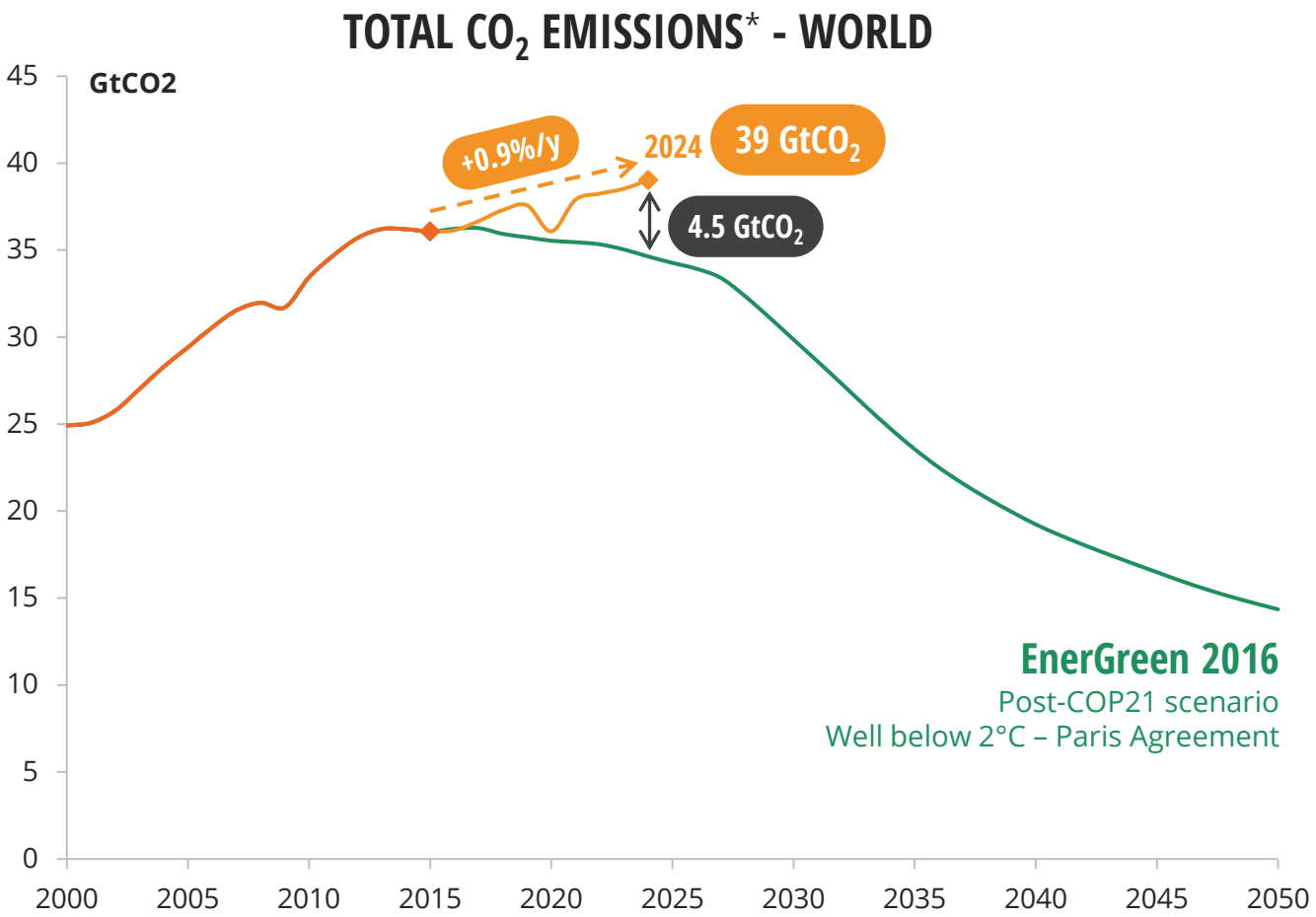
- **The Paris Agreement, a historic turning point**
  - International treaty with 195 parties
  - Covering mitigation, adaptation and finance
  - Goal of limiting global temperature increase to « Well below 2°C » by 2100 compared to pre-industrial levels

- **In 2016, our very first « Paris Agreement-compatible » scenario: EnerGreen**
  - EnerGreen 2016 is a scenario of substantial decrease of emissions by 2050
  - The first 10-15years of projections see a moderate decrease, before the trend accelerates, envisioning a realistic trajectory

Enerdata

Ten years after, a bleak picture

Failing to start reducing our emissions, the Paris Agreement goal has become a distant dream



CO_2 emissions excl. AFOLU
Source: EnerFuture, Enerdata

- **Emissions have kept increasing since 2015**
  - In 2024, they reached 39 $GtCO_2$, i.e. an increase of almost 1%/year in average (despite COVID)
  - This is about 4.5 $GtCO_2$ higher than what the EnerGreen 2016 scenario envisioned

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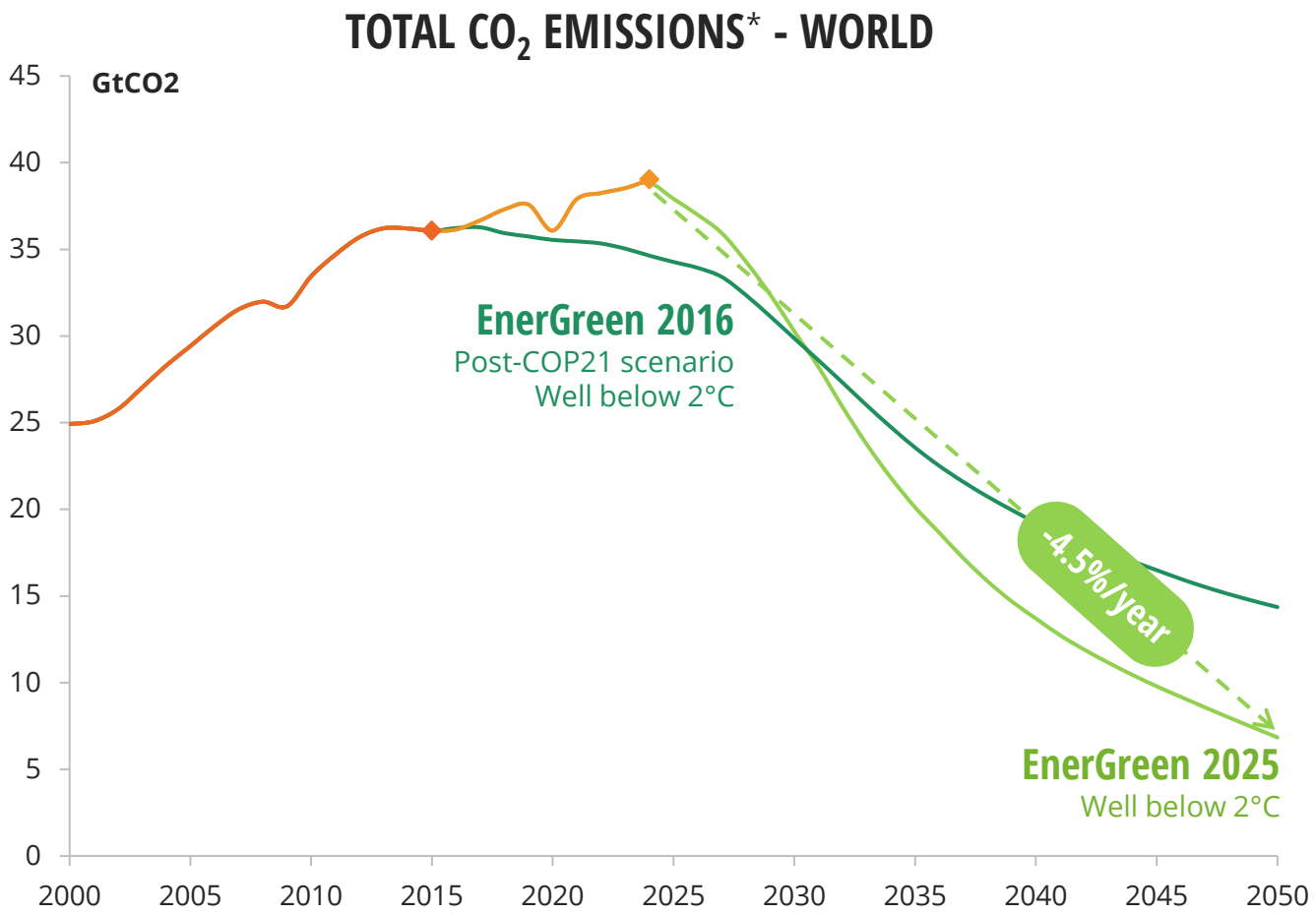

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  - This is about 4.5 $GtCO_2$ higher than what the EnerGreen 2016 scenario envisioned
- **The « Well below 2°C » goal is becoming increasingly difficult to reach**
  - Our latest EnerGreen scenario (2025) shows a required 4.5%/y decrease in emissions by 2050
  - The steep curve means that very strong, and immediate efforts would be necessary
  - Begging the question: is the Paris Agreement goal still realistic, and hence still relevant?

What could a « well below 2°C » world look like in 2050?

EnerGreen 2050 snapshot

EFFICIENCY & SUFFICIENCY

-15% Final energy demand vs. 2023

- **12%** Efficiency gains
- **3%** Sufficiency gains

ELECTRIFICATION

x2.3 Electricity share vs 2023

- **70%** Electric cars in the fleet
- **44%** Heat pumps in space heating

CLEAN ENERGY SUPPLY

÷5 Fossil fuel consumption vs 2023

- **95%** CO_2-free electricity
- **76%** H_2 from electrolysis

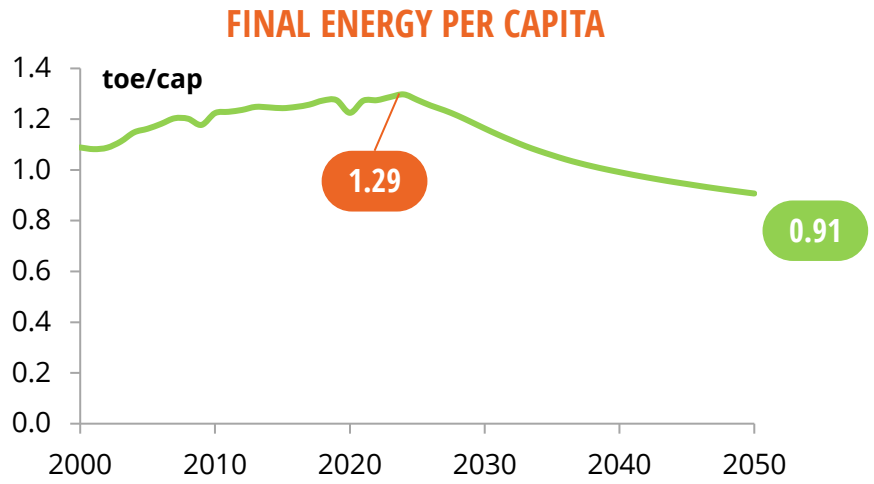
Deep dive into EnerGreen 2025

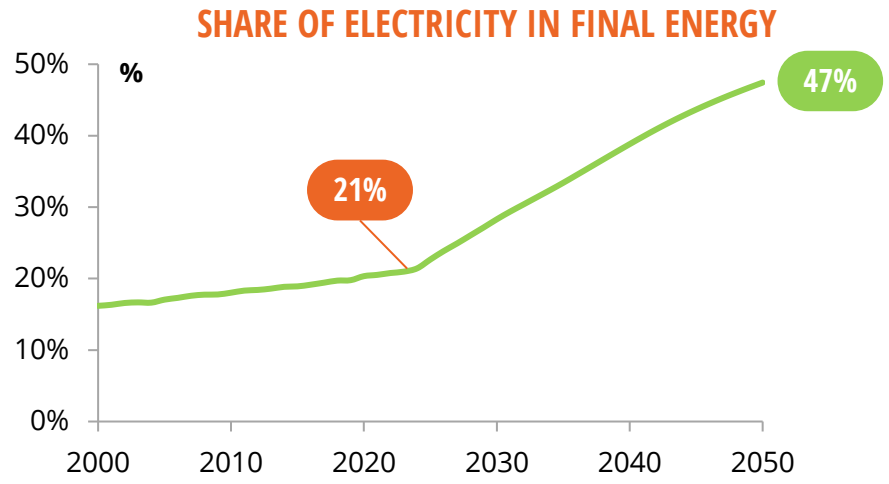
What would it concretely take to stay on track with the Paris Agreement goals?

Scope: WORLD

- **Energy consumption:**
  - After a continuous slight increase, average energy demand per capita should immediately start decrease, reaching -30% by 2050

- **Electrification:**
  - After gaining 5 points since 2000, the share of electricity in the final demand should surge by over 25 points over the next 25 years





Deep dive into EnerGreen 2025

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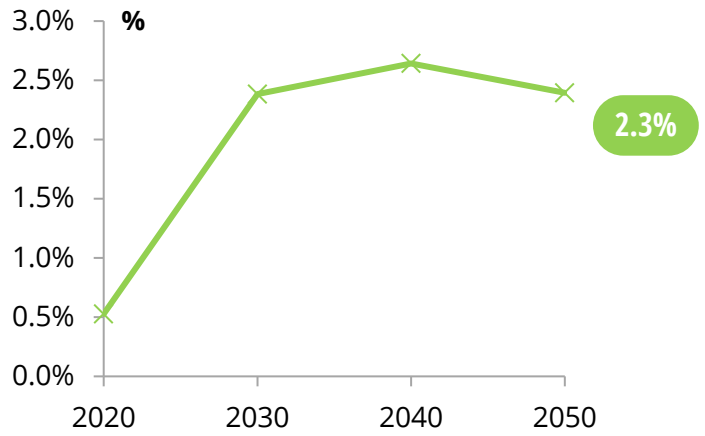
Scope: WORLD

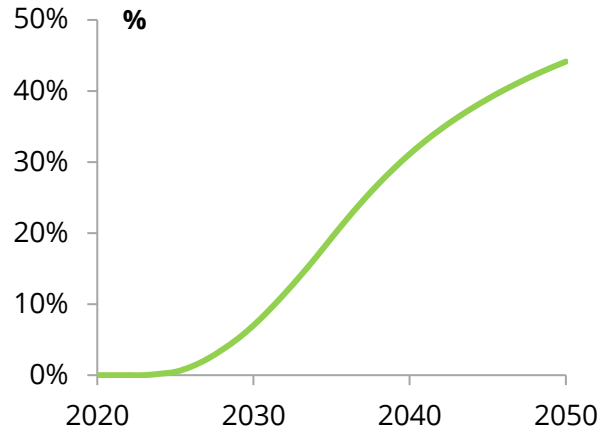
- **Residential sector**
  - **Energy efficient renovation** rate to quickly reach over 2% and remain there by 2050
  - **Heat pumps** to dominate sales of space heating equipment, and reach almost half of useful energy provided

- **Passenger transport sector**
  - **Electric Vehicles** to become the number one option for cars (70% of the fleet in 2050)
  - Behavioural changes required to **reduce passsenger traffic** by almost 15% compared to a baseline

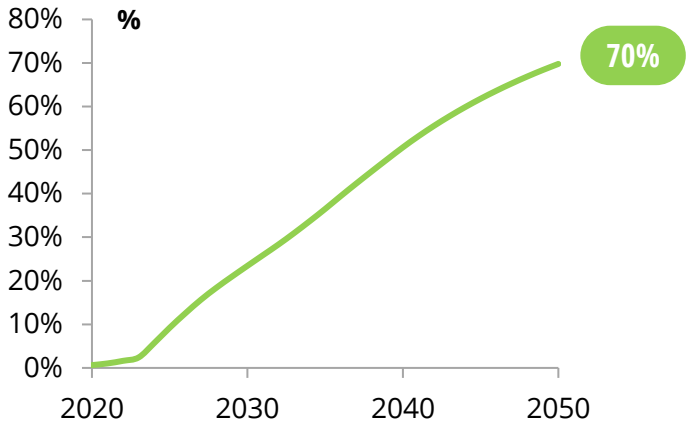
RENOVATION RATE



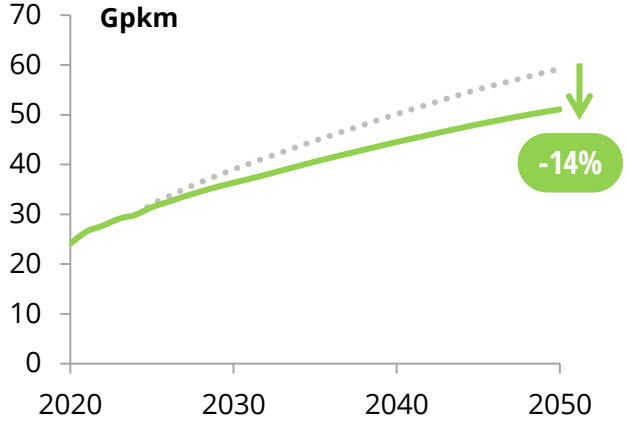
SHARE OF HEAT PUMPS IN SPACE HEATING



SHARE OF EVs IN PASSENGER CAR FLEET



PASSENGER CAR TRAFFIC



Deep dive into EnerGreen 2025

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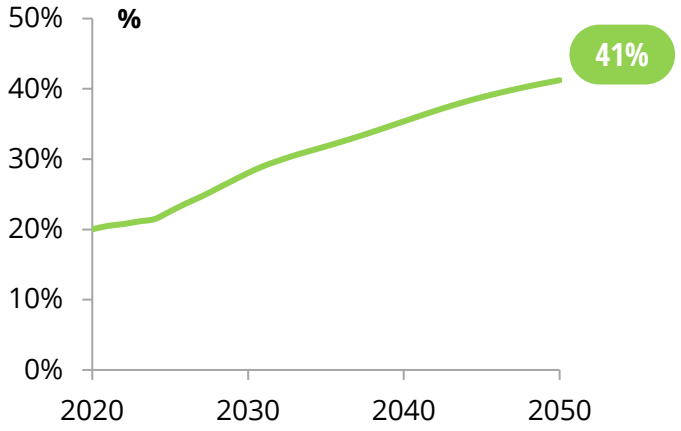
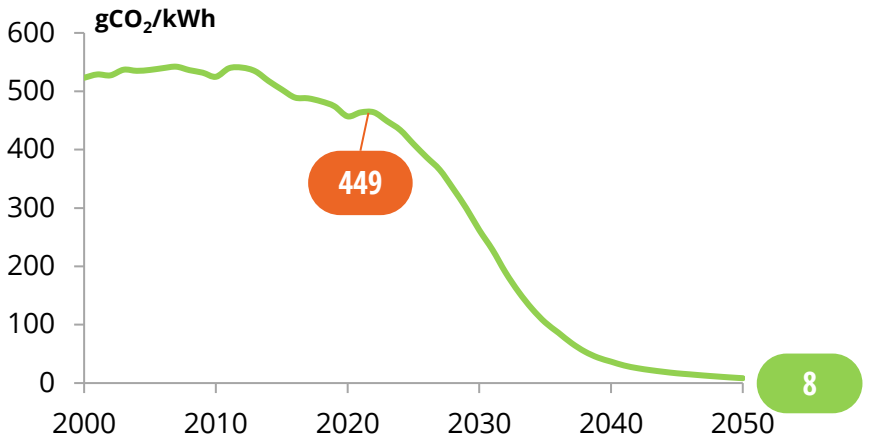
Scope: WORLD

- **Industry:**
  - Profound structural changes necessary, e.g. with electrification of processes and development of CCS (notably for process emissions)
- **Electricity generation:**
  - Drastic decrease of emissions required for power gen, among the easier-to-abate sectors.
  - A key prerequisite to decarbonise demand through eletrification
- **Carbon capture:**
  - Even with immediate and strong action to mitigate emissions, significant volumes of CCS will need to be developed by 2050

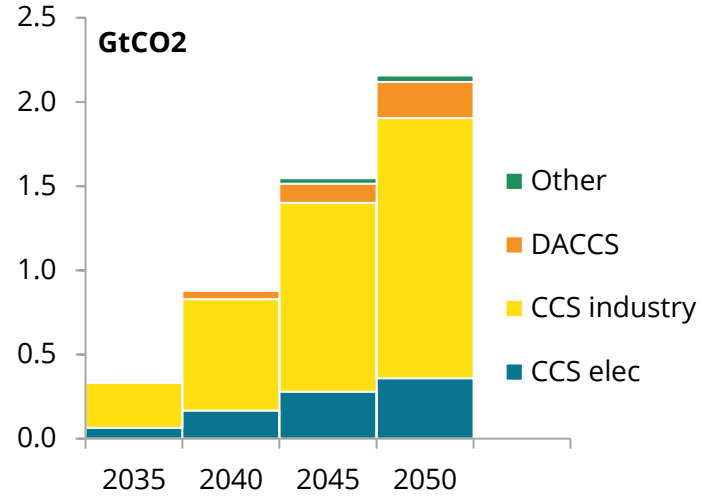
SHARE OF ELECTRICITY IN INDUSTRY



CO_2 INTENSITY OF ELECTRICITY GENERATION



TOTAL GLOBAL CAPTURED CO_2



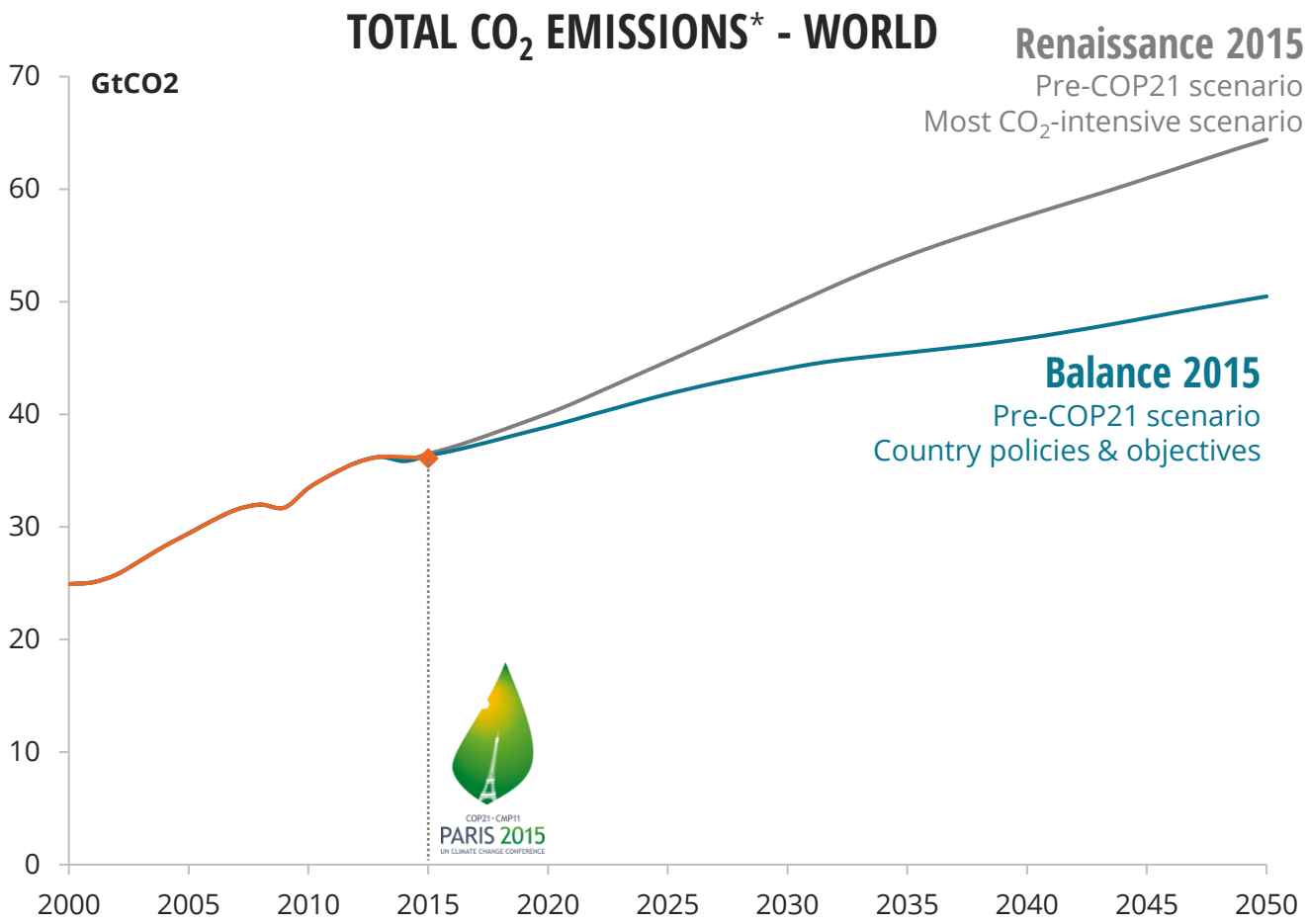
3 … but real progress was still made

We have started to flatten the curve

Enerdata

Before COP21, carbon-intensive perspectives

Back in early 2015, CO_2 emissions outlooks were strongly increasing with no slow down in sight



CO_2 emissions excl. AFOLU
Source: EnerFuture, Enerdata

- **Enerdata's pre-COP21 scenarios envisioned a steady increase in emissions:**
  - **Balance:** central scenario accounting for country policies & pledges
    - **50 $GtCO_2$** in 2050, i.e. **+1%/year** over 2015-2050
  - **Renaissance**: most CO_2-heavy scenario, with a lack of climate commitments and a renewed push for fossil fuels
    - **64 $GtCO_2$** in 2050, i.e. **+1.5%/year** over 2015-2050

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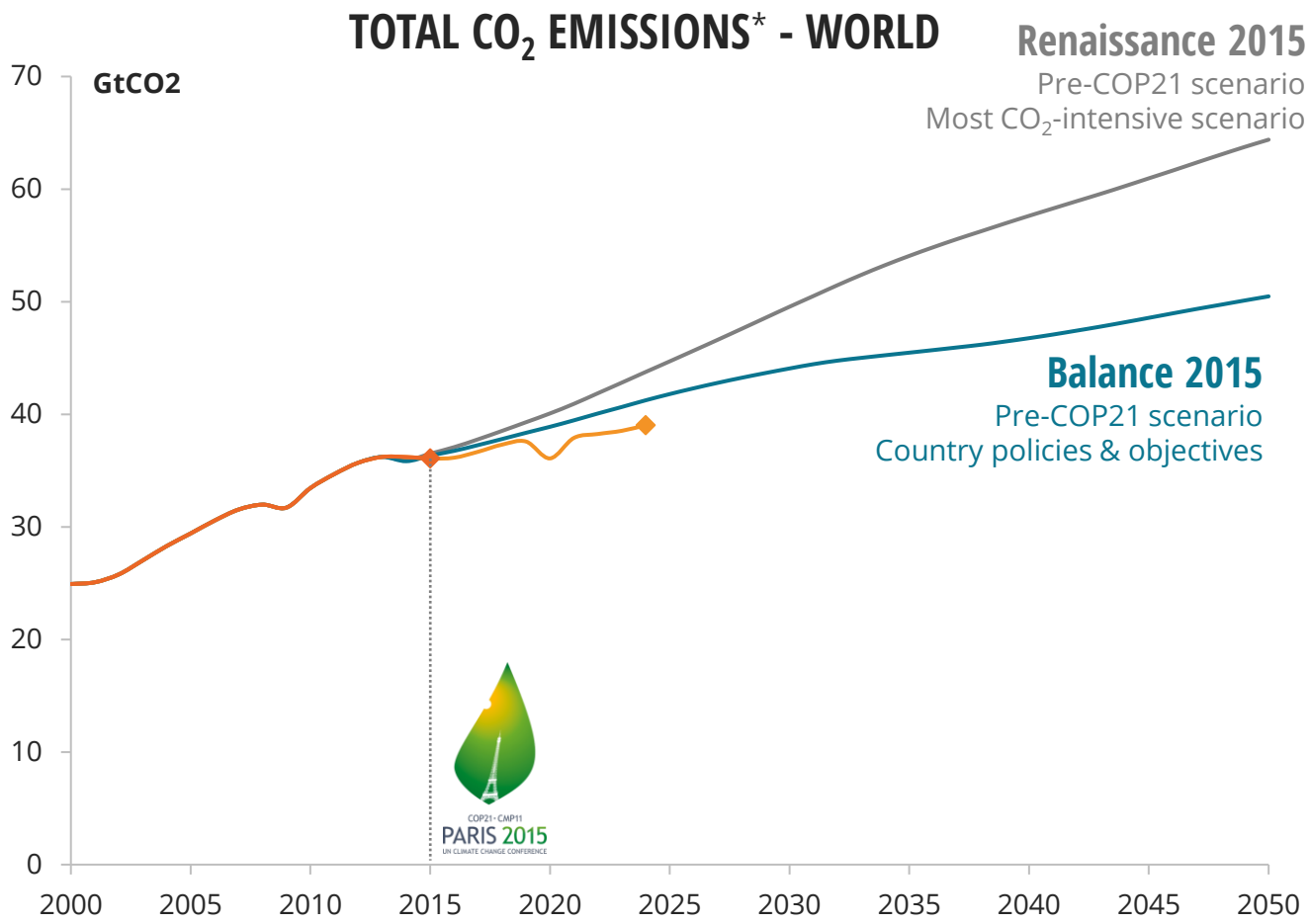

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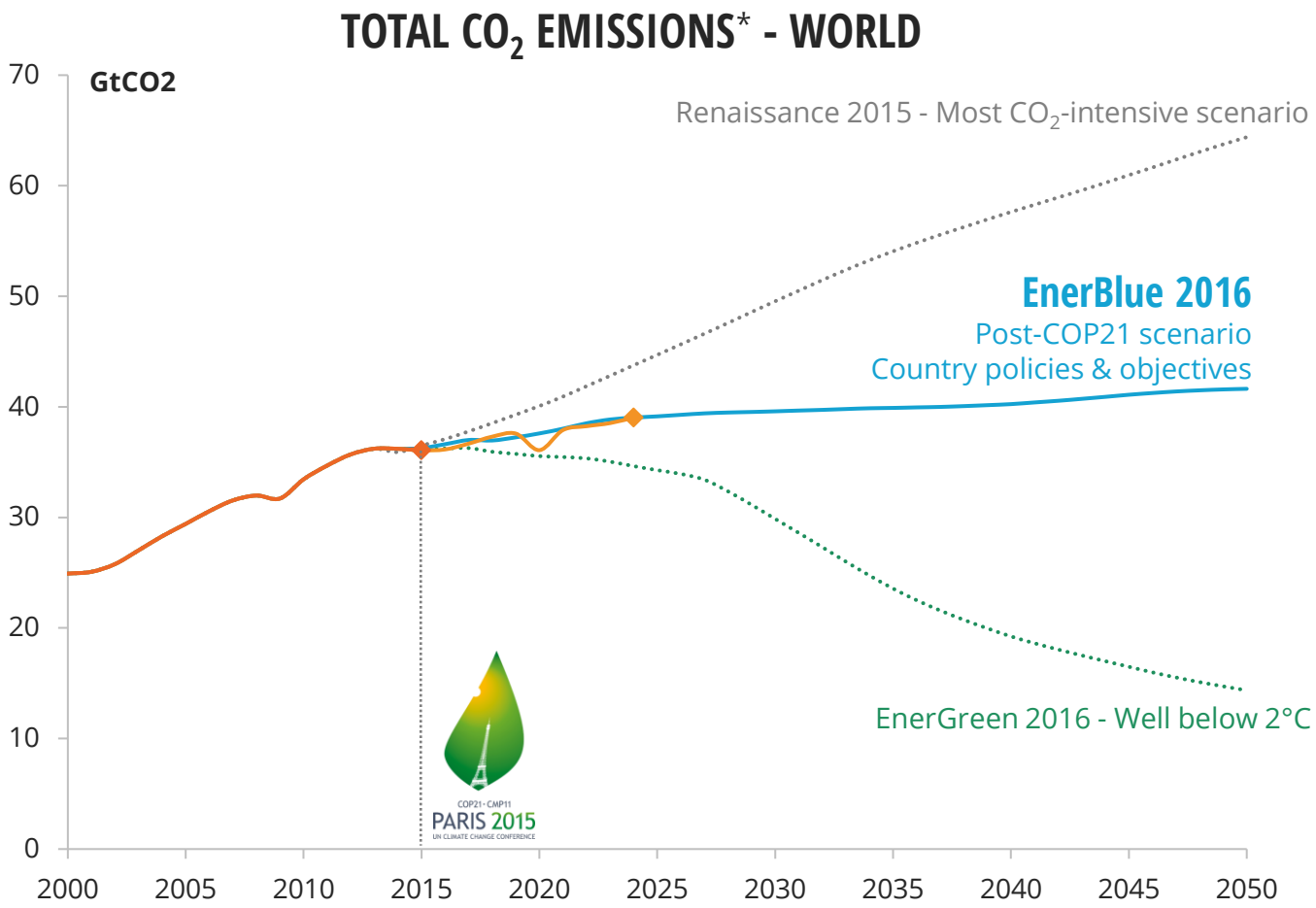
- **Current realised emissions are actually not increasing as fast:**
  - In 2024, CO_2 emissions stood at **39 $GtCO_2$**
    - 2 $GtCO_2$ below Balance
    - 5 $GtCO_2$ below Renaissance
  - Efforts towards climate change mitigation are making a difference

A change in paradigms

The Paris Agreement deeply changed our common vision of the possible futures, and had lasting impacts on countries' ambitions



CO_2 emissions excl. AFOLU
Source: EnerFuture, Enerdata

- **Emissions in line with EnerBlue 2016**
  - Up to today, emissions have followed our EnerBlue 2016 scenario
  - i.e. what countries had pledged and implemented following COP21

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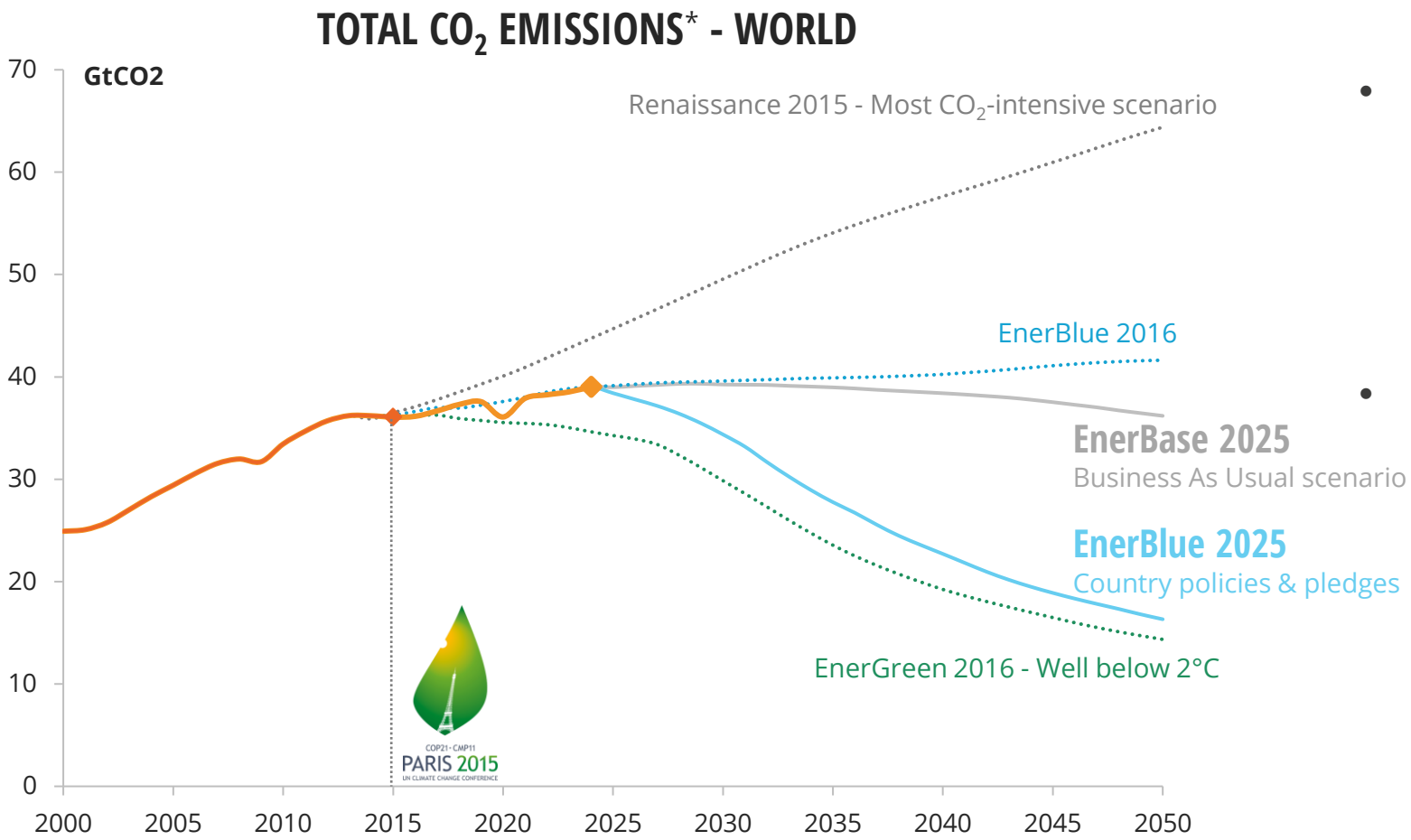

CO_2 emissions excl. AFOLU
Source: EnerFuture, Enerdata

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  - Up to today, emissions have followed our EnerBlue 2016 scenario
  - i.e. what countries had pledged and implemented following COP21
- **Looking forward: emissions peak in sight?**
  - Our recent scenarios (early 2025) show a clearly higher ambition than 10 years ago
  - With the progressive NDC & pledges annoucements, the outlook has drastically changed
  - An emission peak is no longer a distant dream now, it could be achieved within 10 years

The merits of the Paris agreement

The Paris Agreement constitutes one of the foundations of climate action

- **Raised global awareness**
  - Clear impacts on countries' ambitions & climate policies

- **A turning point in the approach and multiple first-times:**
  - First **universal agreement,** a common shared goal of **"well below 2°C"** and **legally binding**
  - Commitment from all countries through **NDCs**, using a bottom-up approach, subject to review every five years
  - Implementation of the "**loss and damage**" principle (irreversible impacts of climate change and the need to assist vulnerable countries)
  - A **strong signal** to markets and investors, and a boost for the energy transition: "**clean energy is the future**"

4 Looking forward: what now?

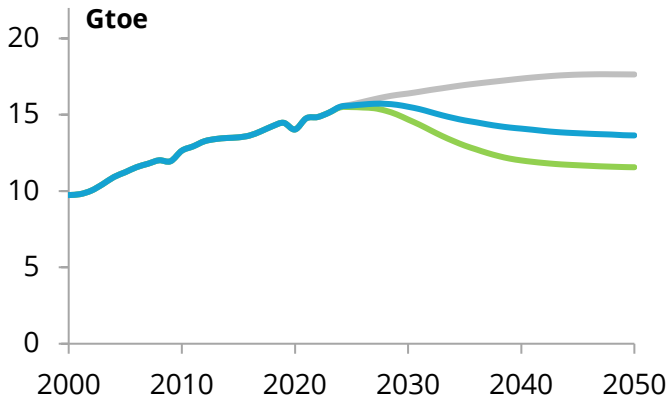
An uncertain future lays ahead for climate mitigation

Enerdata

Global key indicators

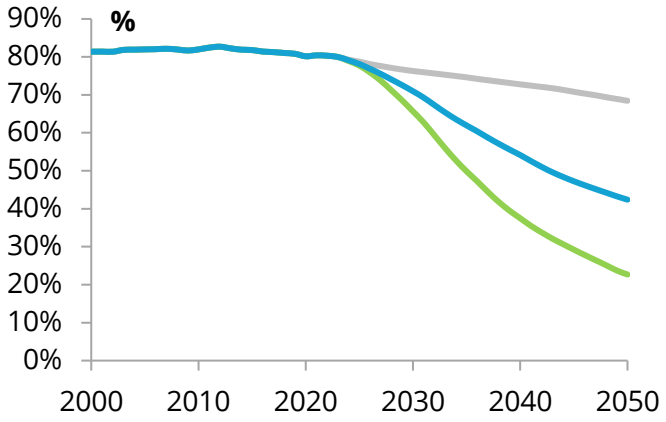
Main results from our 3 scenarios at a glance

PRIMARY ENERGY CONSUMPTION

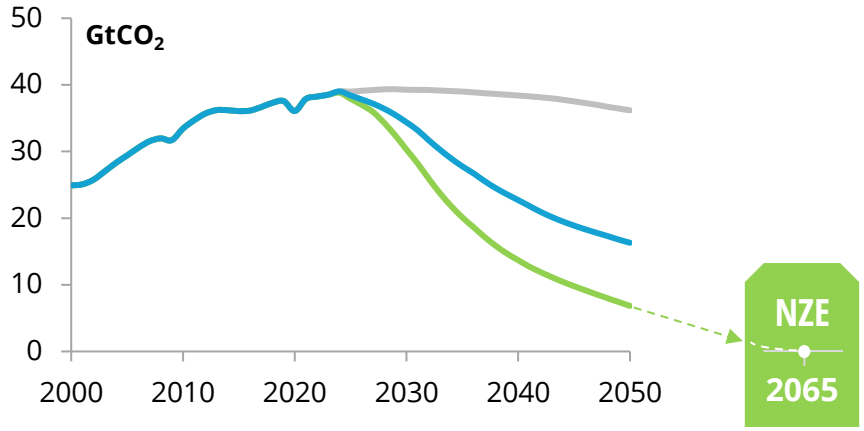


Source: Enerdata, EnerFuture

SHARE OF FOSSILS IN ENERGY MIX



CO_2 EMISSIONS



Average evolution (%/y)	2011-2023	2023-2050		
		EnerBase	EnerBlue	EnerGreen
Carbon intensity CO_2 emissions released to produce one unit of gross domestic product (GDP)	-2.1%	-2.8%	-5.6%	-8.6%
Energy intensity of GDP (final) Energy consumption necessary to produce one unit of gross domestic product (GDP)	-1.5%	-1.8%	-2.5%	-3.1%
Carbon factor CO_2 emissions released for an average unit of energy consumption	-0.4%	-0.8%	-2.8%	-5.3%

Source: Enerdata, EnerFuture

Global primary energy mix

How quick do we shift away from fossil fuels depending on our global climate ambition?

EnerBase

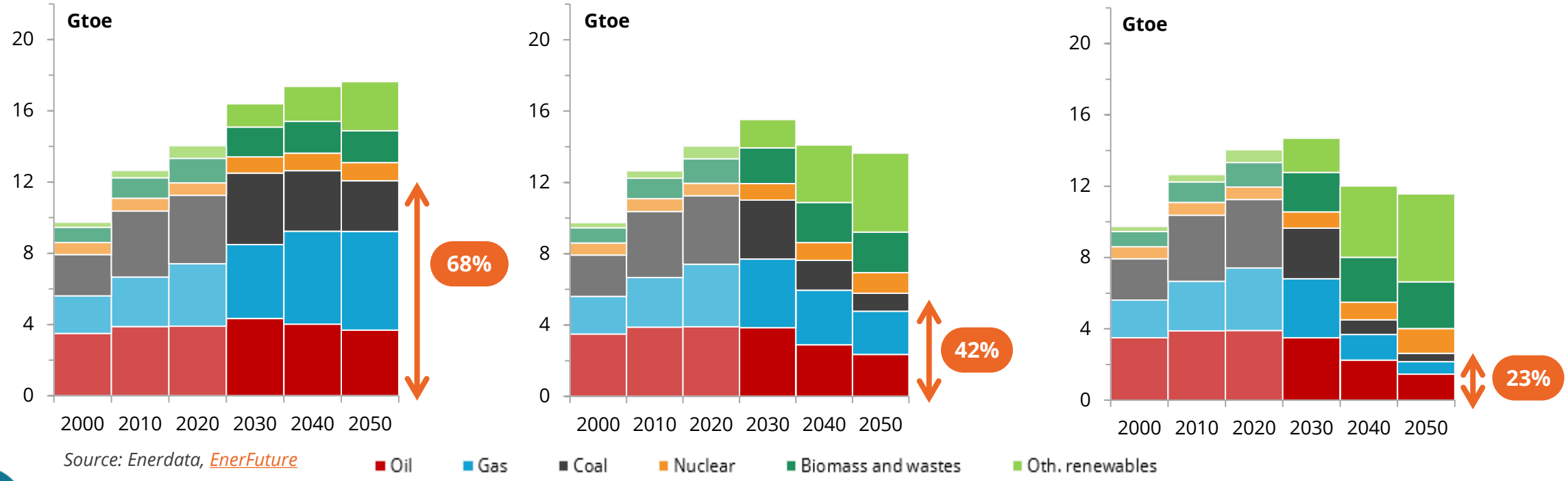
In a **BAU** scenario, fossil fuels keep growing and account for 12 Gtoe or 68% by 2050

EnerBlue

Announced policies and objectives allow to quickly curb fossil fuel consumption, limiting it to 6 Gtoe or 42% by 2050

EnerGreen

To obtain a trajectory compatible with **below 2°C**, fossil fuels should rapidly decrease to 3 Gtoe or 23% by 2050

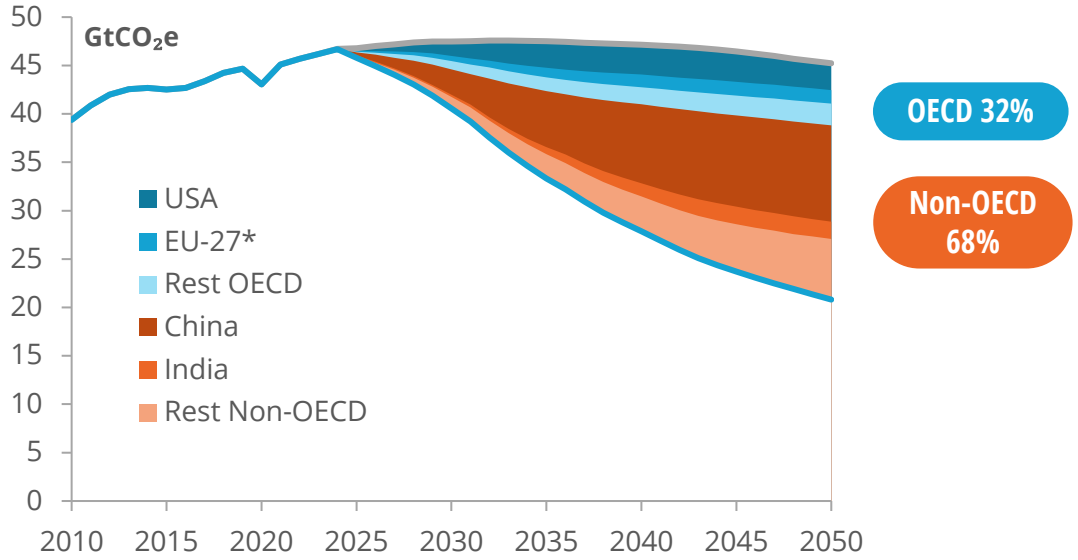


Source: Enerdata, EnerFuture

Current pledges

To what extent regions contribute to mitigation efforts according to their pledges?

GHG EMISSION REDUCTIONS BY REGION



* OECD members only

Cumulated reductions, 2023-2050		
USA	62 $GtCO_2e$	15.5%
EU-27*	26 $GtCO_2e$	6.5%
Rest OECD	38 $GtCO_2e$	10%
China	162 $GtCO_2e$	41%
India	27 $GtCO_2e$	7%
Rest Non-OECD	80 $GtCO_2e$	20%

GHG emissions excl. international transport, excl. AFOLU

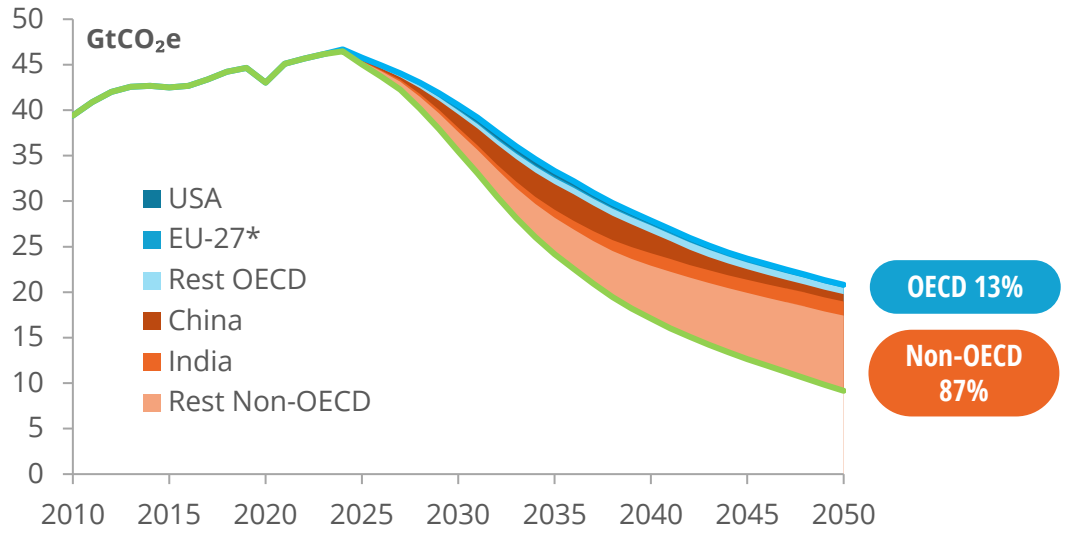
According to currently announced policies and pledges, **non-OECD countries should account for about 70% of cumulative emission reductions** by 2050.

China alone represents more than a third of intended emission reductions, with around 162 $GtCO_2e$ less in EnerBlue compared to EnerBase – although its GHG emissions per capita remain substantially higher than the global average.

Ambition gap

Over 80% of additional decarbonisation efforts in EnerGreen should be done by non-OECD countries

GHG EMISSION REDUCTIONS BY REGION



* OECD members only

Cumulated reductions, 2023-2050		
USA	10 $GtCO_2e$	5%
EU-27*	3 $GtCO_2e$	1%
Rest OECD	16 $GtCO_2e$	7%
China	41 $GtCO_2e$	19%
India	25 $GtCO_2e$	12%
Rest Non-OECD	122 $GtCO_2e$	56%

GHG emissions excl. international transport, excl. AFOLU

The gap between current NDCs and a below 2°C scenario is mostly concentrated in Non-OECD countries, with China alone accounting for 20% of the total ambition gap

The question of **global climate finance** is key: enabling developing countries to access financing in order to limit their emissions while continuing to develop is a must

Unfavourable context

A decline in climate commitments, especially from the US

- The withdrawal of US from the Paris agreement 20 January 2025
  Trump's first day in office, officially out in January 2026
- US support to environmentally harmful policies - "drill baby, drill"

Development aid dropping by the US and European countries

US	-80% -$35 billion	Foreign assistance USAID shut down
G7	-28%	2026 aid level vs. 2024
UN	-40%	2025 humanitarian funding vs. 2024
EU	-€2.2 billion	aid to be cut by 2027

Impacts on Nationally Determined Contributions (NDCs): conditional & more

Unfavourable context

Increased fragility of cooperation

- Competition US Vs China for the world economic leadership
- American protectionism, Chinese slowdown
- Increasing tension between countries which derives in part from climate change consequences (e.g. water access) or energy transition (mineral resources, rare earth materials, etc.).

  30 conflicts in the 90' →120 conflicts today

- From a European perspectives, a *"growing geopolitical fragmentation [and] populist pressures"*

  Teresa Ribera, 4 November 2025

- *"The world is clearly not on track to meet internationally agreed climate goals and is facing a challenging set of economic and geopolitical conditions"*

  WEO, 2025

Security concern on top of governments' priority

Climate issues, a lower priority ?

Difficulties reflected by IEA reintroducing its Current Policies Scenario (CPS) > 2 °C

Unfavourable context

The strength of major economies subject to short-term influences

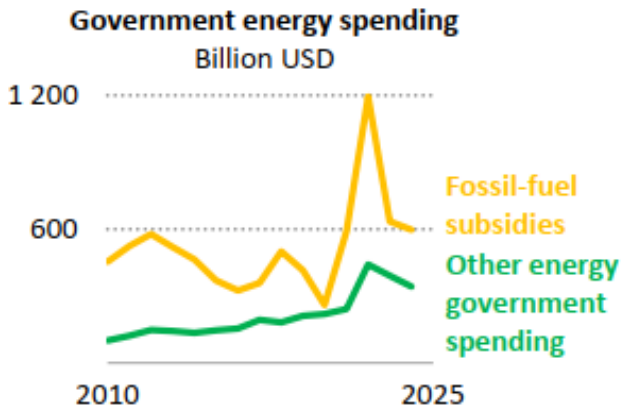
Sensitivity to economic conditions

- Gas/energy prices

Dependence on fossil fuels

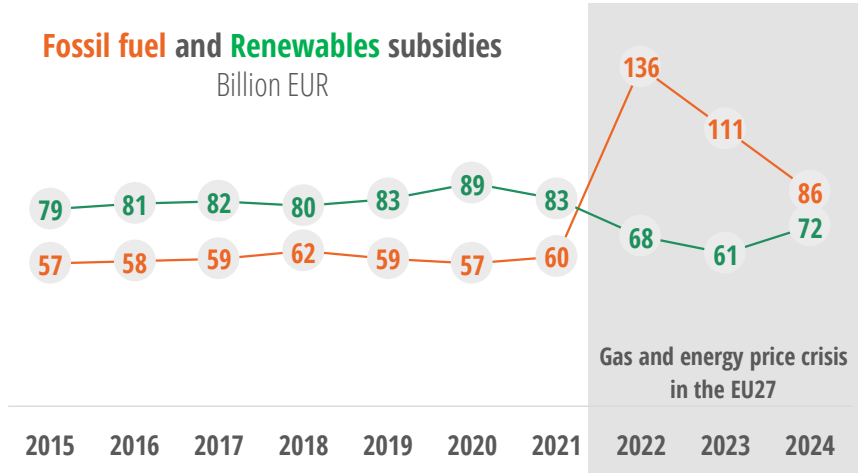
- Fossil fuel subsidies

Globally



Source: IEA, WEO 2025

EU27



Sources: European Commission, Study on energy subsidies, 2024. Enerdata: 2024 estimate

After the COP30 in Belém

Key points to remember

- **Some successes** ✅
  - Tripling of **adaptation funding**
  - Creation of the Tropical Forest Forever Facility
  - Recognition of Indigenous Rights
  - Launch of climate trade dialogues
  - Roadmap to strengthen the Paris Agreement
  - The concept of a **just transition** mentioned in the agreement
  - Progress on the issue of **climate misinformation**

- **But major limitations** ❌
  - Concrete decisions on **fossils fuels** have been postponed
    - no binding phase-out plan
    - a step back vs. COP28!
  - **Climate finance** still insufficient
  - Deforestation: non-binding commitments
  - Lack of collective ambition on **NDCs**

Conclusions & discussion

- **The Paris Agreement goal, "well below 2°C", is becoming unrealistic. Should we collectively set a new, less ambitious target?**
  - Would a new & more realistic objective better support climate action?
    - Preventing the "it's too late, it's over" discouraging impression
    - Providing a more concrete roadmap
  - Or would we then lower our efforts and miss a less ambitious target?
    - Is there value in saying that we are far from the goal, does this stimulate efforts?

- **Monitoring and praising the progress made is key**
  - Every effort/action is a step forward in the right direction
  - The climate issue is not an *All or Nothing* problem, we must fight this human bias

- **In the current highly uncertain context, more important than ever to keep the long-term perspectives in mind**
  - Uncertainties naturally tend to shift the focus to the very short-term
  - However, the longer-term roadmap should not be completely occulted

5 Takeaways and Q&A

Wrapping up the analysis

- Ten years after the Paris Agreement, **too little too late**:
  - CO_2 emissions have failed to peak, let alone start decreasing, far from the initial COP21 goal
  - The well below 2°C target is increasingly unrealistic
- However, **mitigation efforts made a real difference:**
  - Observed emissions have increased substantially less than envisioned before COP21
  - Perspectives to 2050 have drastically improved since
- This should be an encouraging signal to continue the efforts, however **current times are troubled**:
  - An unfavourable context: trade wars, drop of development aid, US stance
  - COP30 failing to regain traction for climate action

Enerdata

EnerFuture 2025

Global Energy Scenarios Through 2050

HELPING YOU SHAPE THE ENERGY TRANSITION

About Enerdata:

Enerdata is an independent research company that specialises in the analysis and forecasting of energy and climate issues. We do this at a variety of different geographic and business / sector levels.

Leveraging our globally recognised databases, business intelligence processes, and prospective models, we assist our clients – which include companies, investors, and public authorities around the world – in designing their policies, strategies, and business plans.

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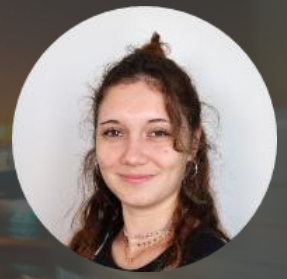

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