DECARBONIZATION PORTFOLIO : BUILDING A DETAILED CLIMATE SCENARIO

Presented by ILB Labs & Enerdata – 12 September 2023

ILB LABS: A ONE STOP SHOP FOR **R&D** IN DATA SCIENCE AND SUSTAINABLE FINANCE WITHIN THE LOUIS BACHELIER GROUP

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Historical expertise

~10 Data Scientists

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Growing expertise

~10 Sustainable Finance Analysts

1 TEAM

2 EXPERTISE

**8** YEARS OF EXPERIENCE

50+ PROJECTS

ENERDATA: EXPERTS ON CLIMATE AND ENERGY SCENARIOS

- **Independent** energy research company since 1991, spin-off of a research centre
- Expert in analysis and forecasting of global energy and sustainability issues
- In-house and globally recognised databases and forecasting models
- Headquartered in Grenoble (French Alps), subsidiary in Singapore
- **Global reach**: a wide network of partners across the globe (Europe, Asia, Americas, Middle East, Africa)
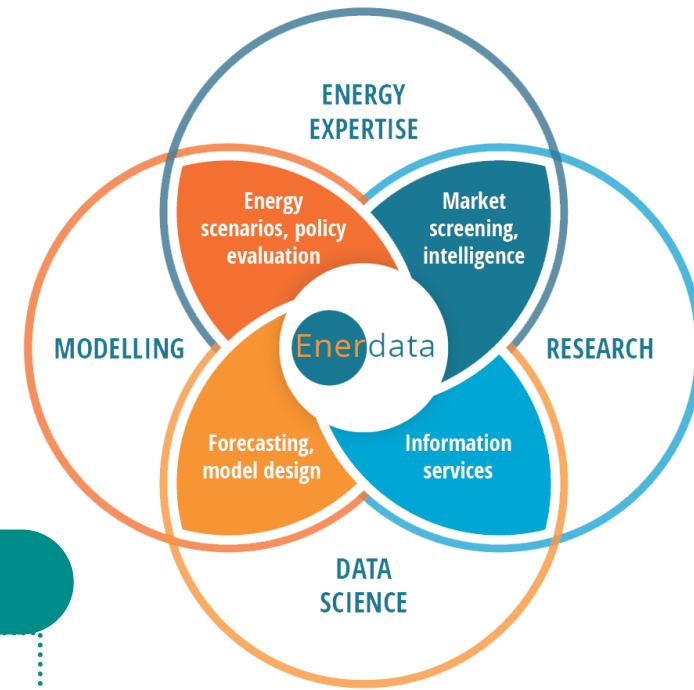
INFORMATION SERVICES
- Databases
- Reports
- Selected news
- Forecasts
- Analysis

SOLUTIONS
- Market Intelligence
- Customised research platforms
- Forecasting models

CONSULTING
- Forecasting
- Policy evaluation
- Market research
- Market assessment
- Feasibility study

CAPACITY BUILDING
- Energy prices & statistics
- Modelling
- Energy efficiency
- Climate change
- Risk management

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Jacques Després *(speaker)*
Project manager at **Enerdata**

WEBINAR OBJECTIVES AND CONTENT

Key Questions

How can **climate objectives** be achieved using a portfolio* perspective?

* Loans, insurance contracts, customer portfolios…

→ Why is there a need for both a **climate**-ambitious AND a **reference scenario**?

→ What is an adequate **level of detail** for the scenarios?

Climate scenarios: their implications and how to manipulate them

What is an **energy-climate scenario**?
How to achieve **climate objectives**?

Why and how to adapt the scenarios to your specific scope? (**downscaling**)

Climate alignment: **scenario selection criteria**

Use case: the **French auto market**

Key takeaways

# CLIMATE SCENARIOS: THEIR IMPLICATIONS AND HOW TO MANIPULATE THEM

- ## METHODOLOGY

- How to achieve **climate objectives**?
- What is an **energy-climate scenario**?
- Why and how to adapt the scenarios to your specific scope? (**downscaling**)

EXPLORING POSSIBLE FUTURES

Energy-climate scenarios explore **prospective pathways** describing possible **technological and socio-economic evolutions -** linked to a climate objective (limiting of global temperature increase below a certain threshold).

- Forecasts vs scenarios

- Climate scenarios are projected over several decades and attempt to account for the complexity of the climate system

- (Human) factors influencing a scenario:
  - policies and regulations,
  - technology development,
 - behavioural change,
  - ...
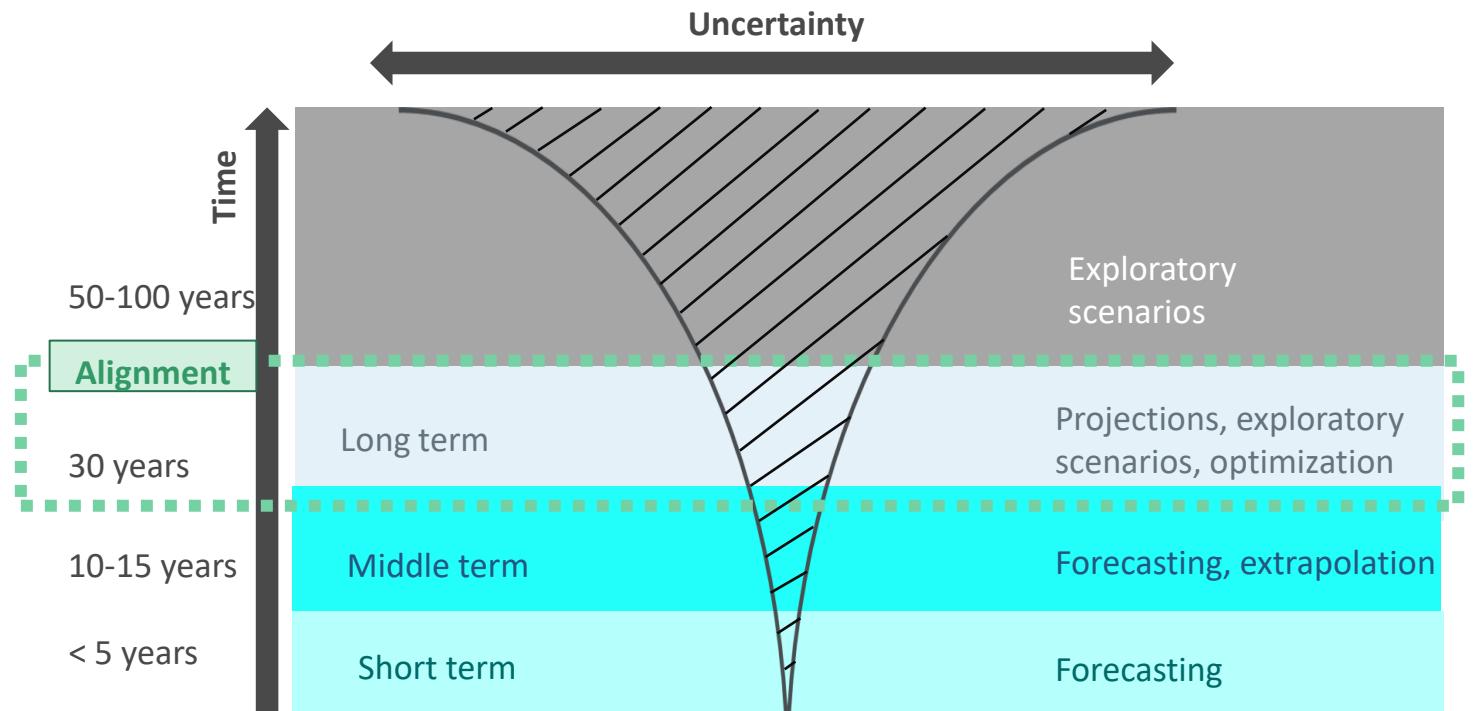
THE ENERGY-CLIMATE SYSTEM

- Global **temperature increase** is a consequence of the increase of atmospheric **concentrations of greenhouse gases**.
- This concentration is directly linked to **CO2 emissions**, of which ~ 80% come from the energy system (combustion of fossil fuels).
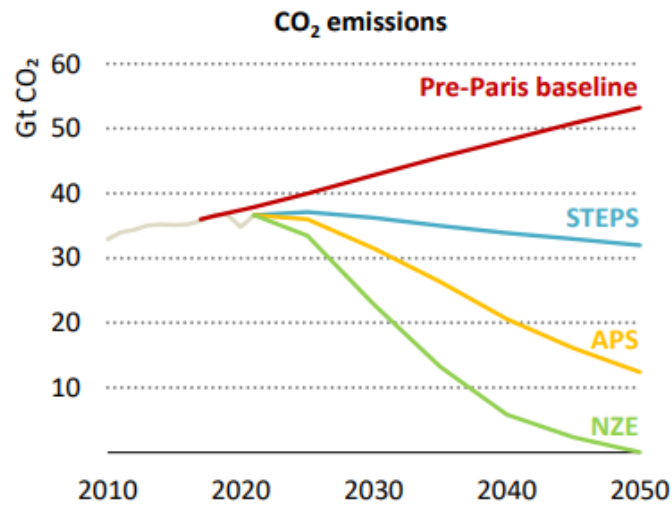
World energy-climate scenarios, IEA, WEO 2022

Carbon budget

Global warming
Temperature rise
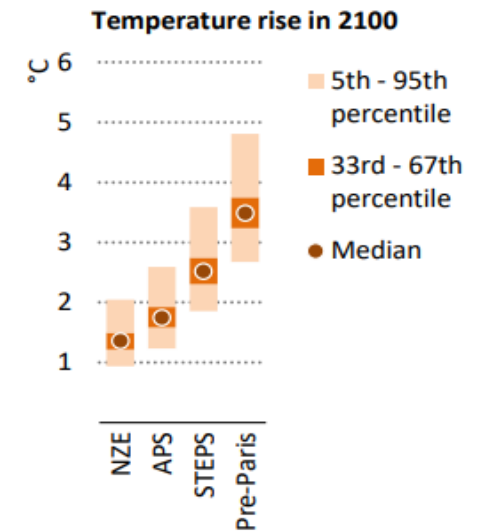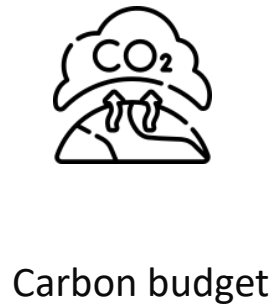
World energy-climate scenarios, IEA, WEO 2022

Carbon Budget :
Maximum amount of **cumulative CO2 emissions**
to keep average global **temperature below a target** threshold,
associated to a given **probability**.

Example: 1.5C, linked to net zero by 2050 with >66% probability

HOW TO LINK THE EMISSIONS OF A SECTOR WITH A GLOBAL CLIMATE SCENARIO?

1. **Choose a climate objective** (or test several goals in *scenarios*) - all defined on a **global scale**
2. **Choose a scenario**: IEA, IPCC, European Commission JRC, Enerdata, BloombergNEF, BP...
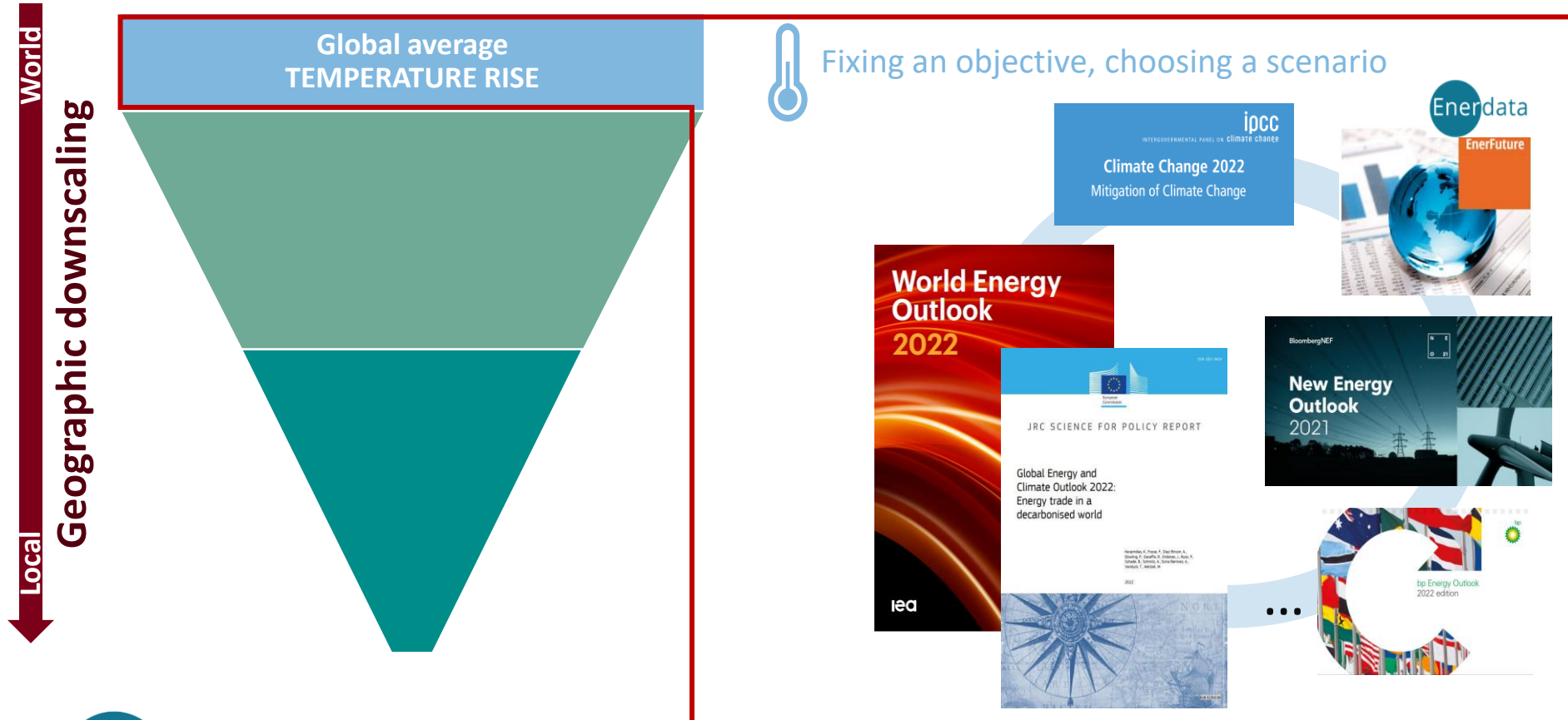
FROM GLOBAL TEMPERATURES TO NATIONAL CIRCUMSTANCES

- Energy-climate scenarios = historical trends + future pathways **with differentiated assumptions.**

- **Enerdata** produces the **EnerFuture outlook**, with 3 scenarios of differing climate objectives.

> Continuation of existing policies and trends (**EnerBase**)

> Achievement of new 2022 national pledges (**EnerBlue**)

> Ambitious GHG emissions budget in line with the Paris Agreement (**EnerGreen**)

All main countries are represented, with very diverse results
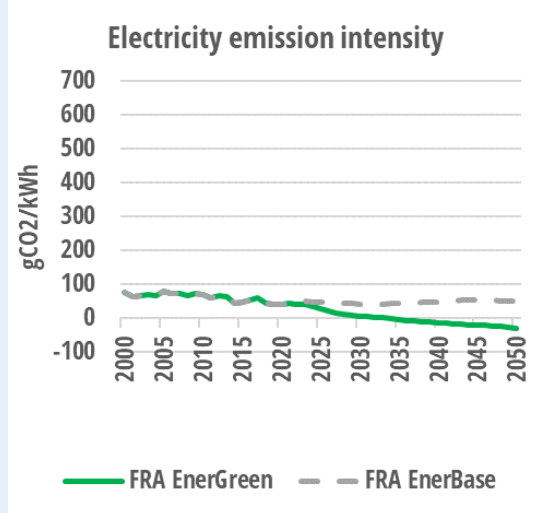
What country?

Electricity emission intensity (in gCO2/kWh)
Source : EnerFuture (Enerdata)

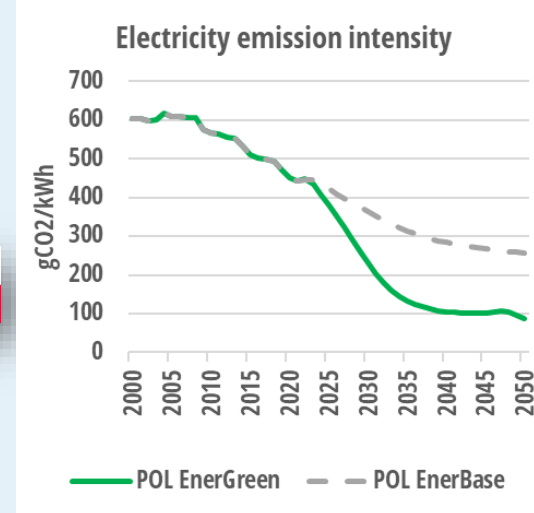# DIVING INTO ENERGY-CLIMATE SCENARIOS

- These scenarios are useful for **Portfolio Climate Alignment** to Net Zero climate objectives.
- For certain portfolios, a high degree of **sectoral and geographical granularity** is important (auto loans portfolio, portfolio of mortgages…)

What sector?

Sectoral decarbonisation speeds differ:
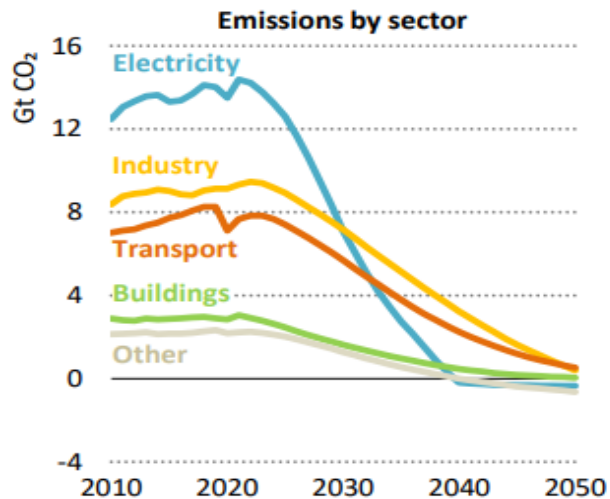
Net Zero scenario by sector (world), published by IEA in its WEO 2022

What pathway/storyline?

Scenarios with the same objective show **several possibilities:**

French scenarios Transition(s) 2050 (ADEME)

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HOW TO LINK THE EMISSIONS OF A SECTOR WITH A GLOBAL CLIMATE SCENARIO?

- Emissions targets are **valuable if tailored** for a given region and sector; **not all sectors and countries change at the same pace**

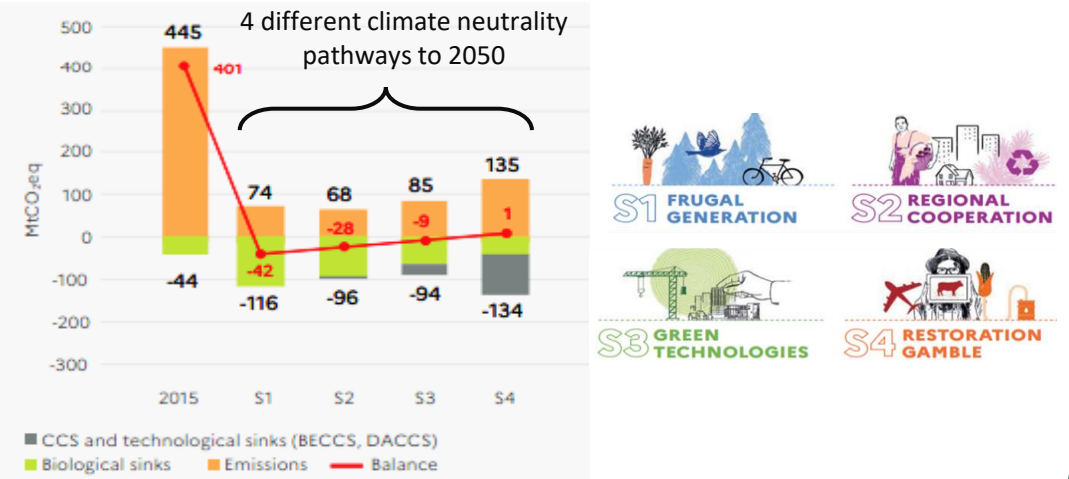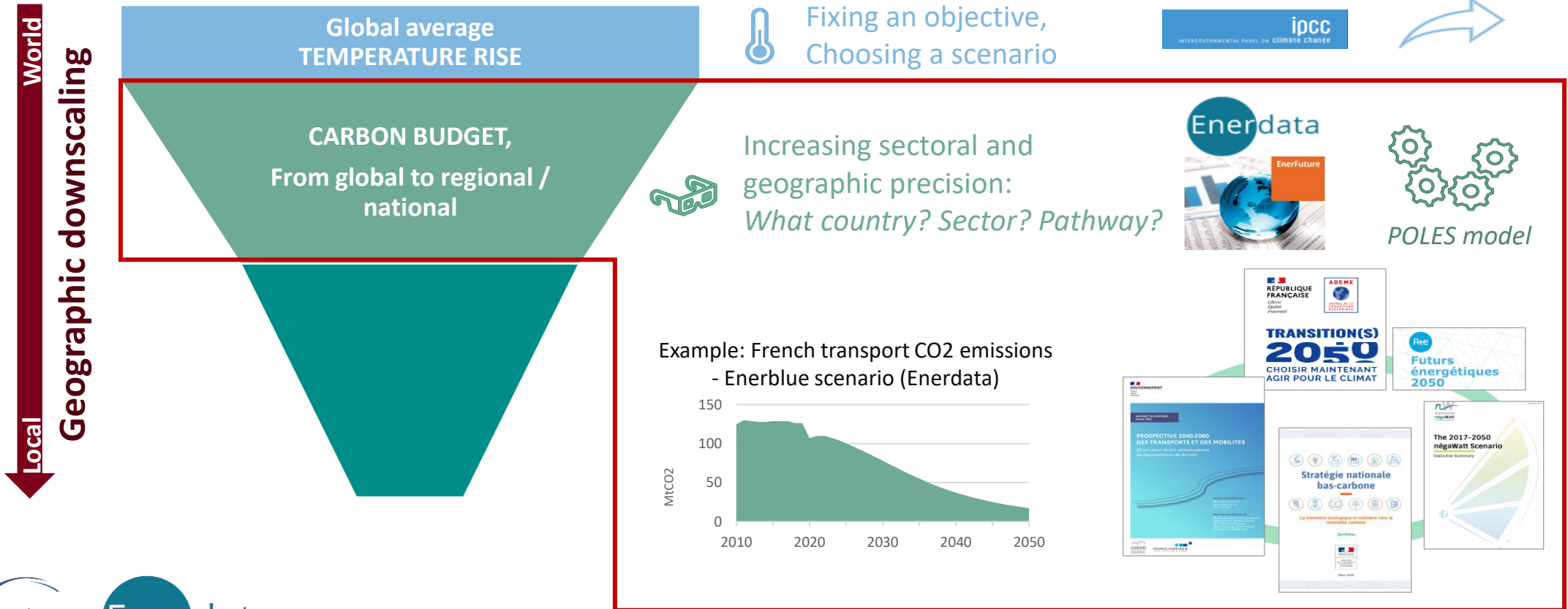- In **France**, many actors propose national, sectoral scenarios: SNBC (ministry), ADEME (agency), France Stratégie (official thinktank), RTE (TSO), negaWatt (NGO)…

- For greater accuracy and sector-specific granularity, **Enerdata** has developed scenarios better suited to address every market and sector: **EnerFuture**.

Geographic downscaling

World → Local

Global average TEMPERATURE RISE

Fixing an objective, Choosing a scenario

ipcc
INTERGOVERNMENTAL PANEL ON climate change

CARBON BUDGET,
From global to regional / national

Increasing sectoral and geographic precision:
What country? Sector? Pathway?

Enerdata
EnerFuture

POLES model

Example: French transport CO2 emissions - Enerblue scenario (Enerdata)

RÉPUBLIQUE FRANÇAISE — ADEME
TRANSITION(S) 2050
CHOISIR MAINTENANT AGIR POUR LE CLIMAT

RTE
Futurs énergétiques 2050

PROSPECTIVE 2040-2060 DES TRANSPORTS ET DES MOBILITÉS

Stratégie nationale bas-carbone

The 2017-2050 négaWatt Scenario

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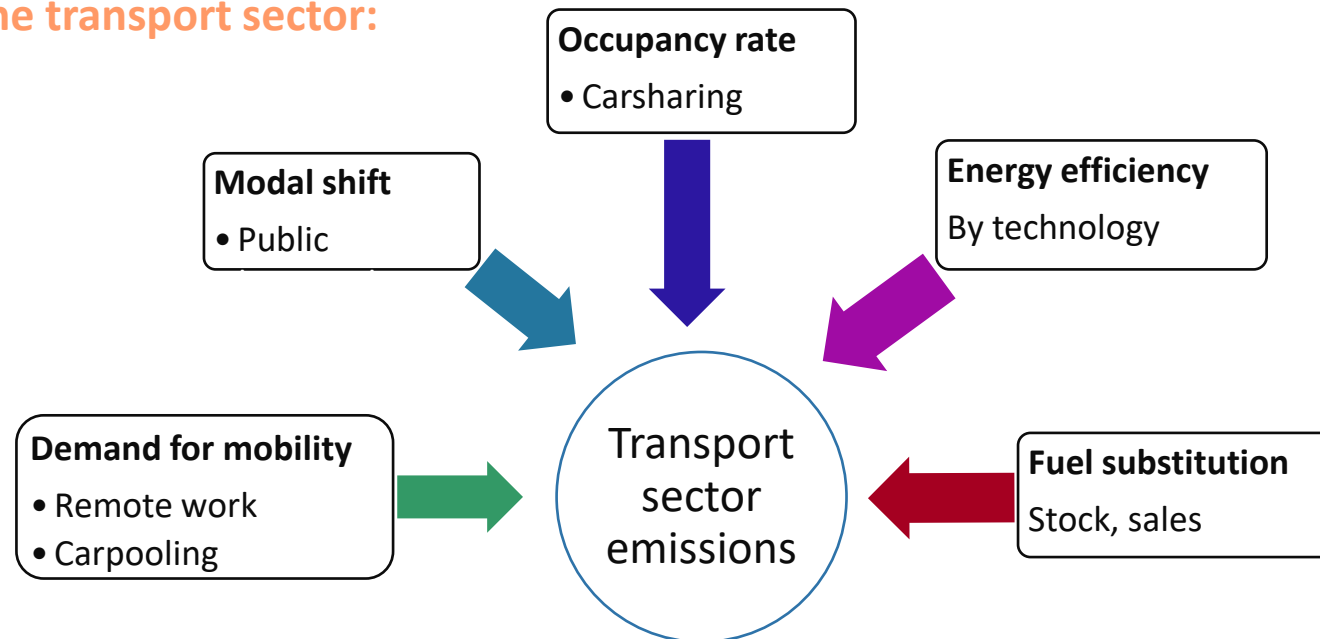Louis Bachelier
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HOW TO DOWNSCALE FURTHER TO ANALYSE YOUR SECTOR AND PERIMETER?

- Additional insights are needed to represent a given sector of activity in more detail:
- **Enerdata developed the EnerMED model** to produce **decarbonization scenarios by sector** considering all **decarbonization levers**

- What drivers of change?
- What assumptions for the future?
- What impacts on results?

Simplified example of the transport sector:

Occupancy rate
- Carsharing

Modal shift
- Public

Energy efficiency
By technology

Demand for mobility
- Remote work
- Carpooling

Transport sector emissions

Fuel substitution
Stock, sales

HOW TO LINK THE EMISSIONS OF A SECTOR WITH A GLOBAL CLIMATE SCENARIO?

- For greater accuracy and sector-specific granularity, **Enerdata** develops scenarios (Country Energy Demand Forecasts), better suited to address each market and sector.
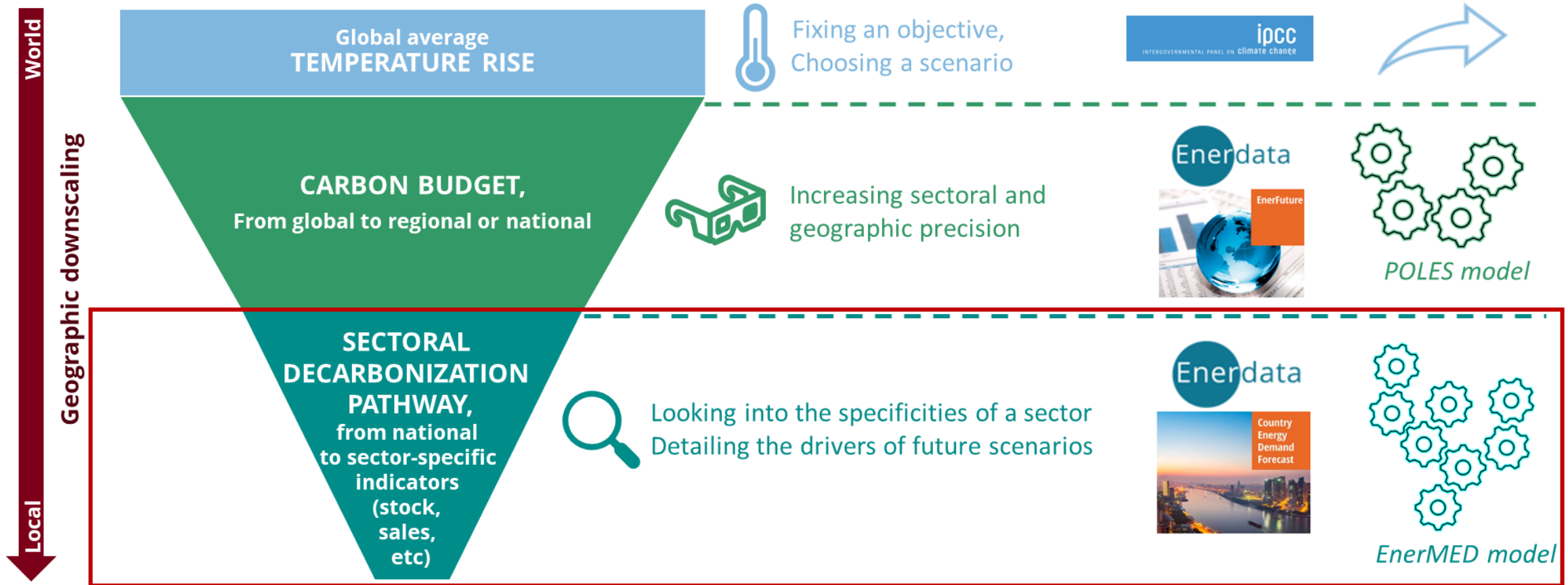
Climate alignment: scenario selection criteria

PHYSICAL EMISSIONS INTENSITY IS THE MOST SUITABLE METRIC TO APPLY WHEN PERFORMING CLIMATE ALIGNMENT EXERCISE WITH CLIMATE SCENARIOS

Physical emissions intensity

$$\frac{gCO2}{km}$$

- ☑ Existing, **widely used**, sector **scenarios** (e.g. IEA's Net Zero).
- ☑ **Reduced** influence of economic value **volatility**.
- ☑ Direct application of **widely used alignment methods (SDA)**.
- ☑ **Comparable** between same-sector **companies**.
- ☒ Does **not account** for **emission reduction effect** of every lever.

Comparable between actors of all sizes within same sector

Absolute emissions

$$Total\ CO2\ emissions = \frac{gCO2}{km} \times km$$

- ☑ Existing, **widely used**, sector **scenarios (e.g. IEA's Net Zero).**
- ☑ **Reduced** influence of economic **value volatility.**
- ☑ **Accounts** for the effect of **all emission reduction levers.**
- ☒ **Challenging** to attribute and project **fair carbon budget** per actor in the sector and **compare actors**.

Not directly comparable between all actors.

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BASELINE SCENARIOS SHOULD DESCRIBE A REASONABLE DECARBONIZATION RATE GIVEN CURRENT CIRCUMSTANCES THROUGH A CONSERVATIVE EVALUATION

Baseline scenarios should **strive to answer**:

"What is a reasonable level of decarbonization rate given current technological developments and regulation?"

Baseline scenario principles

1 — Precautionary principle - remain conservative

2 — Only consider existing regulation;
Stated commitments that are not translated into regulation are not accounted for

3 — Only consider existing efforts from private actors;
Commitments and potential future emission reduction efforts are not considered

- Each market has its constraints
  - Country regulation and laws
  - Historical country preferences
 - Existing infrastructure and planned projects

CLIMATE-AMBITIOUS SCENARIO SHOULD REFLECT THE REQUIRED LEVEL OF DECARBONIZATION TO ACHIEVE AMBITIOUS CLIMATE GOALS

Climate-ambitious scenarios should **strive to answer**:

"What is the required level of decarbonization to comply with a climate-ambitious target?"

Climate-ambitious scenario principles

1 Compliant with carbon budget of 1.5 C degree objective
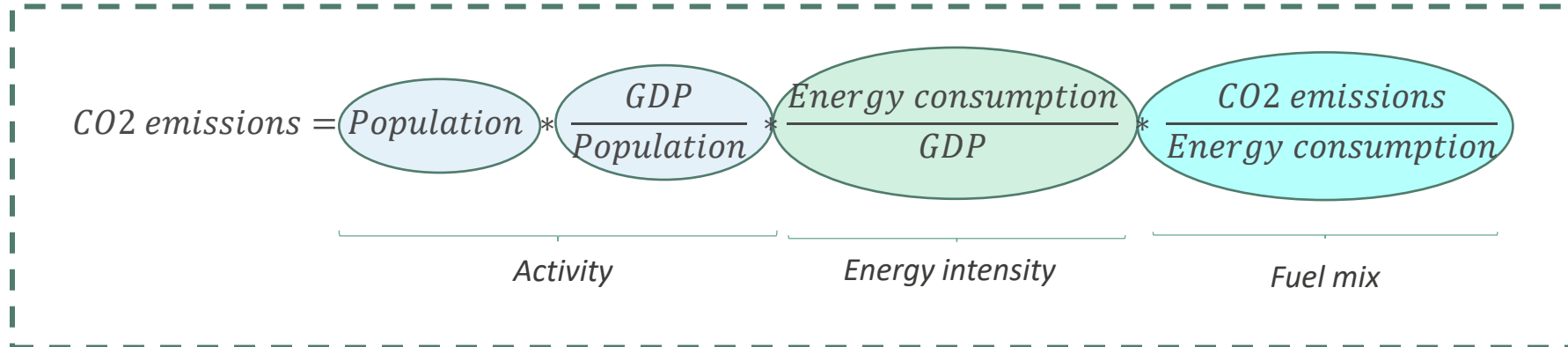
2 Compatible with widely used climate scenarios

Bridging the gap
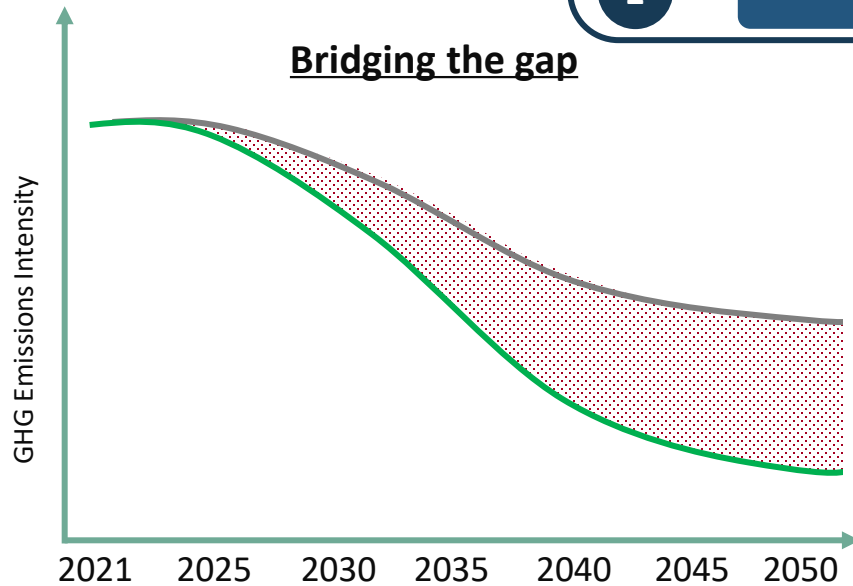
Evaluating scenarios and performing alignment is:

1 **Not a forecast of future** events.

2 **A guide to prioritize and guide decarbonisation actions.**

CLIMATE OBJECTIVES ARE ACHIEVED THROUGH DECARBONIZATION LEVERS DESCRIBED BY THE KAYA IDENTITY

- The transition needs to be modelled with an **adequate level of detail**.
- The main **decarbonization levers** are: **Level of Activity**, **Energy Efficiency** and **Fuel mix**.

$$CO2\ emissions = Population * \frac{GDP}{Population} * \frac{Energy\ consumption}{GDP} * \frac{CO2\ emissions}{Energy\ consumption}$$

| Activity | Energy intensity | Fuel mix |

"Kaya Identity" CO_2 = [population] X [energy] X [fuel mix]
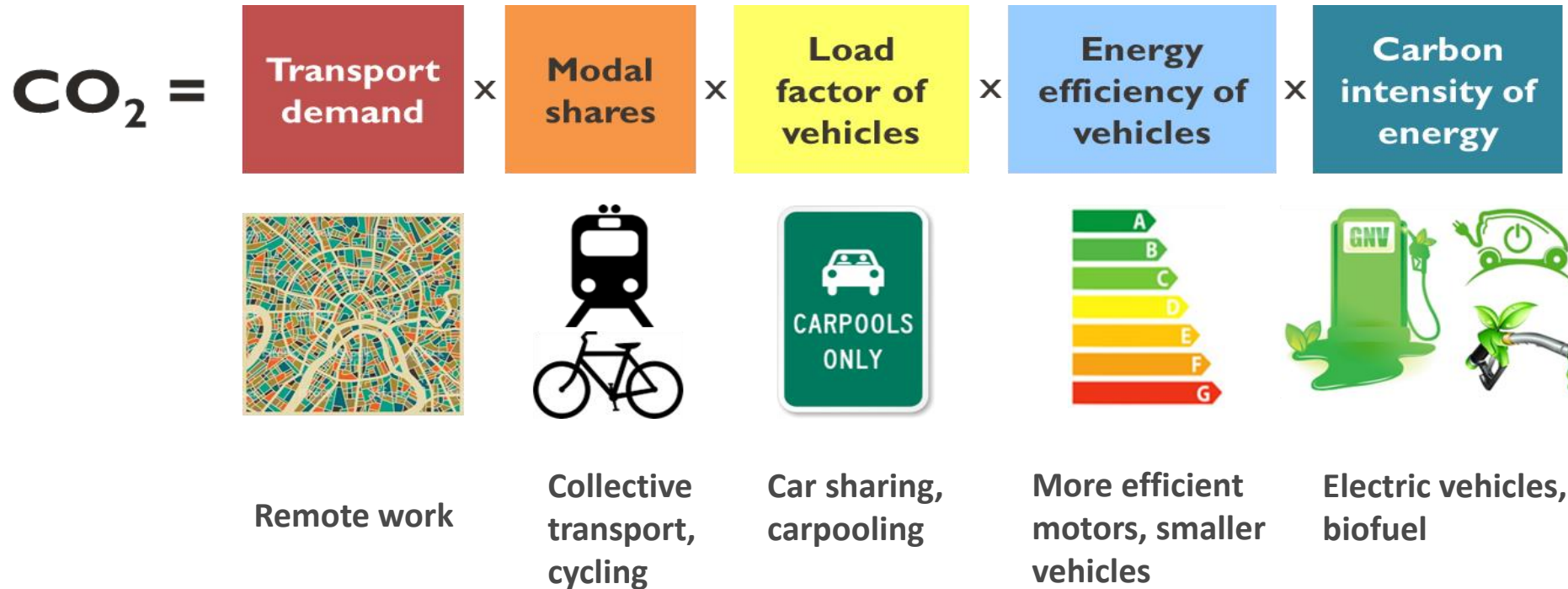
USE CASE: THE FRENCH AUTO MARKET

WHAT ARE THE DECARBONIZATION LEVERS IN TRANSPORTS?

- Adapt the "Kaya identity" to each sector

$$CO_2 = \text{Transport demand} \times \text{Modal shares} \times \text{Load factor of vehicles} \times \text{Energy efficiency of vehicles} \times \text{Carbon intensity of energy}$$

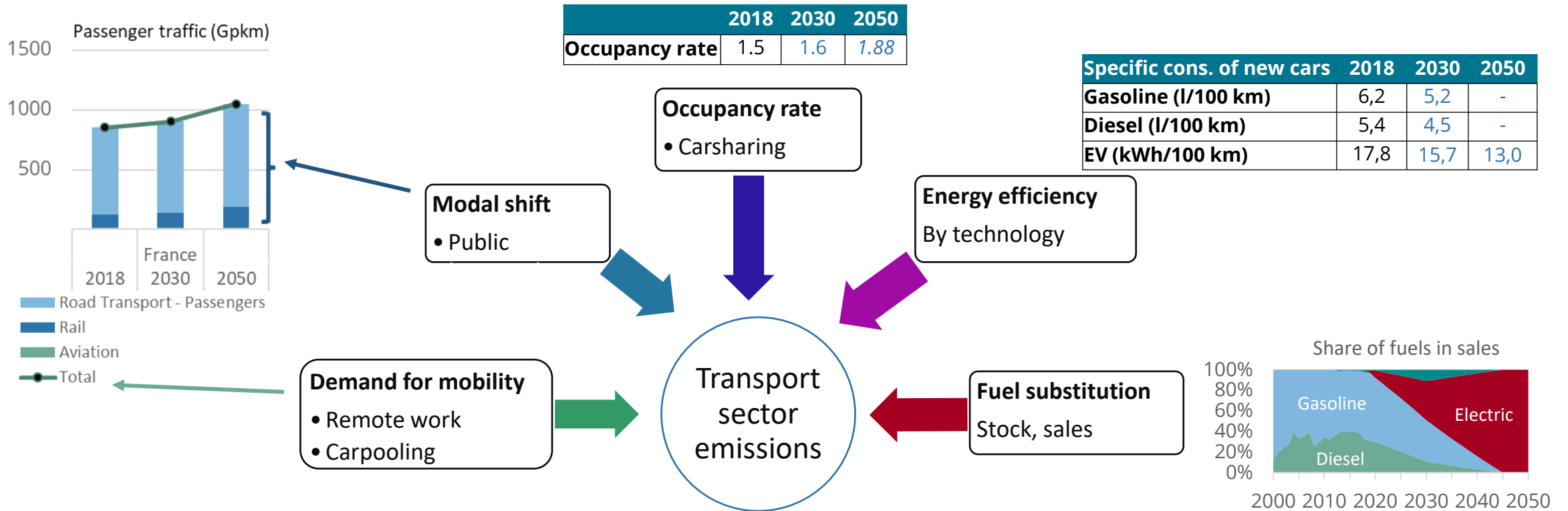| Remote work	Collective transport, cycling	Car sharing, carpooling	More efficient motors, smaller vehicles	Electric vehicles, biofuel

The 5 levels of decarbonization in the transport sector in the French SNBC (Low Carbon National Strategy), Source: Aurélien Bigo

HOW TO DOWNSCALE FURTHER TO ANALYSE YOUR SECTOR?

EnerMED is Enerdata's **bottom-up** descriptive model used to produce **decarbonization scenarios by sector** considering all **decarbonization levers**

Passenger traffic (Gpkm)

	2018	2030	2050
Occupancy rate	1.5	1.6	*1.88*

Specific cons. of new cars	2018	2030	2050
Gasoline (l/100 km)	6,2	5,2	-
Diesel (l/100 km)	5,4	4,5	-
EV (kWh/100 km)	17,8	15,7	13,0

Occupancy rate
- Carsharing

Modal shift
- Public

Energy efficiency
By technology

Demand for mobility
- Remote work
- Carpooling

Transport sector emissions

Fuel substitution
Stock, sales

Share of fuels in sales

Road Transport - Passengers
Rail
Aviation
Total

France 2018 2030 2050

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WHAT HISTORIC TRENDS AND ASSUMPTIONS?

Behaviour changes impacting mobility demand

Mobility per person / average distance travelled by cars:
- Remote work, urbanisation
- Modal shit to collective transport and active modes: No significant change observed since 2010 in most EU countries

Car ownership: increased significantly since 1990; slowdown observed in some countries due to a threshold effect.

Driving is different:
- eco-driving, reduced speed limits,
- reduced use or banning of the most polluting vehicles in cities,
- Car sharing and carpooling
- Growing share of SUVs after 2015 (from 25% of sales to ~40%)

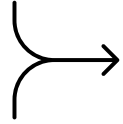## Technology improvements

Specific consumption of new cars
- reduced over EU for new diesel and gasoline cars until 2014
- Reversed trends in most countries after 2015 and a clear slowdown in others
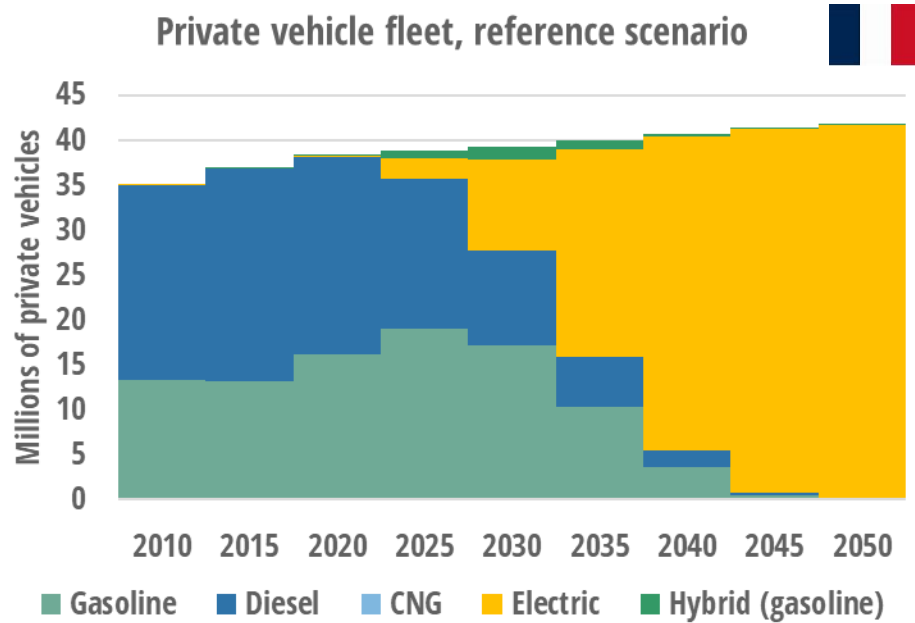
Fuel mix: Sales of electric vehicles
- Taken off in recent years (partly due to the strengthening of EU regulations)
- EVs in Norway represent 80% of 2022 sales (around 40% in 2019)
- share of EVs in the car fleet is still negligible in most countries (less than 1% in France and Spain)
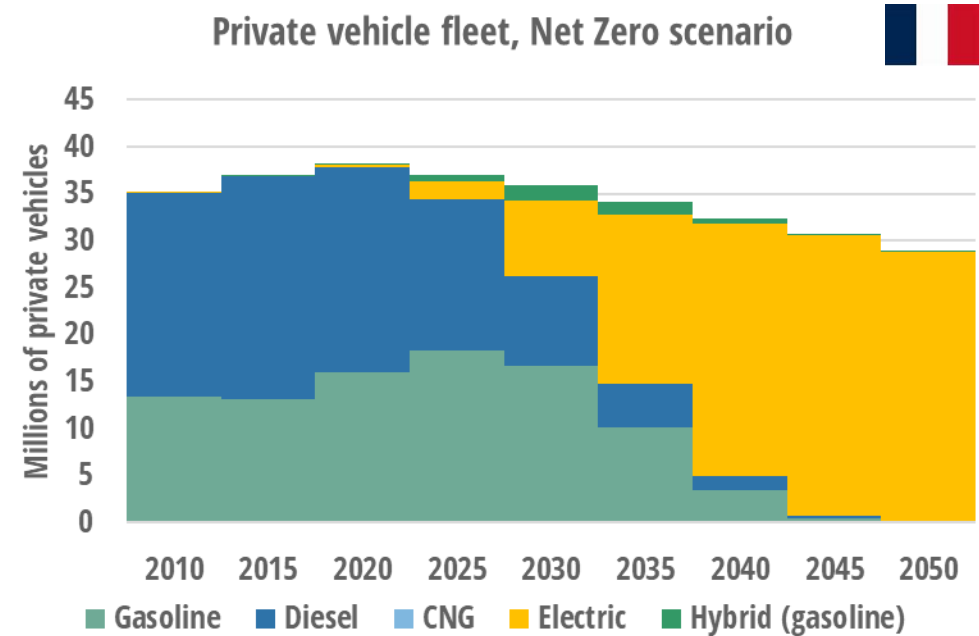
Biofuel as a blended fuel?

COMBINING ALL ASSUMPTIONS AND LEVERS

This leads to a reference and a climate-ambitious (French) scenario

Private vehicle fleet, reference scenario

Millions of private vehicles

2010 2015 2020 2025 2030 2035 2040 2045 2050

■ Gasoline ■ Diesel ■ CNG ■ Electric ■ Hybrid (gasoline)

*Source: Enerdata, built with the **EnerMED** model*

Private vehicle fleet, Net Zero scenario

Millions of private vehicles

2010 2015 2020 2025 2030 2035 2040 2045 2050

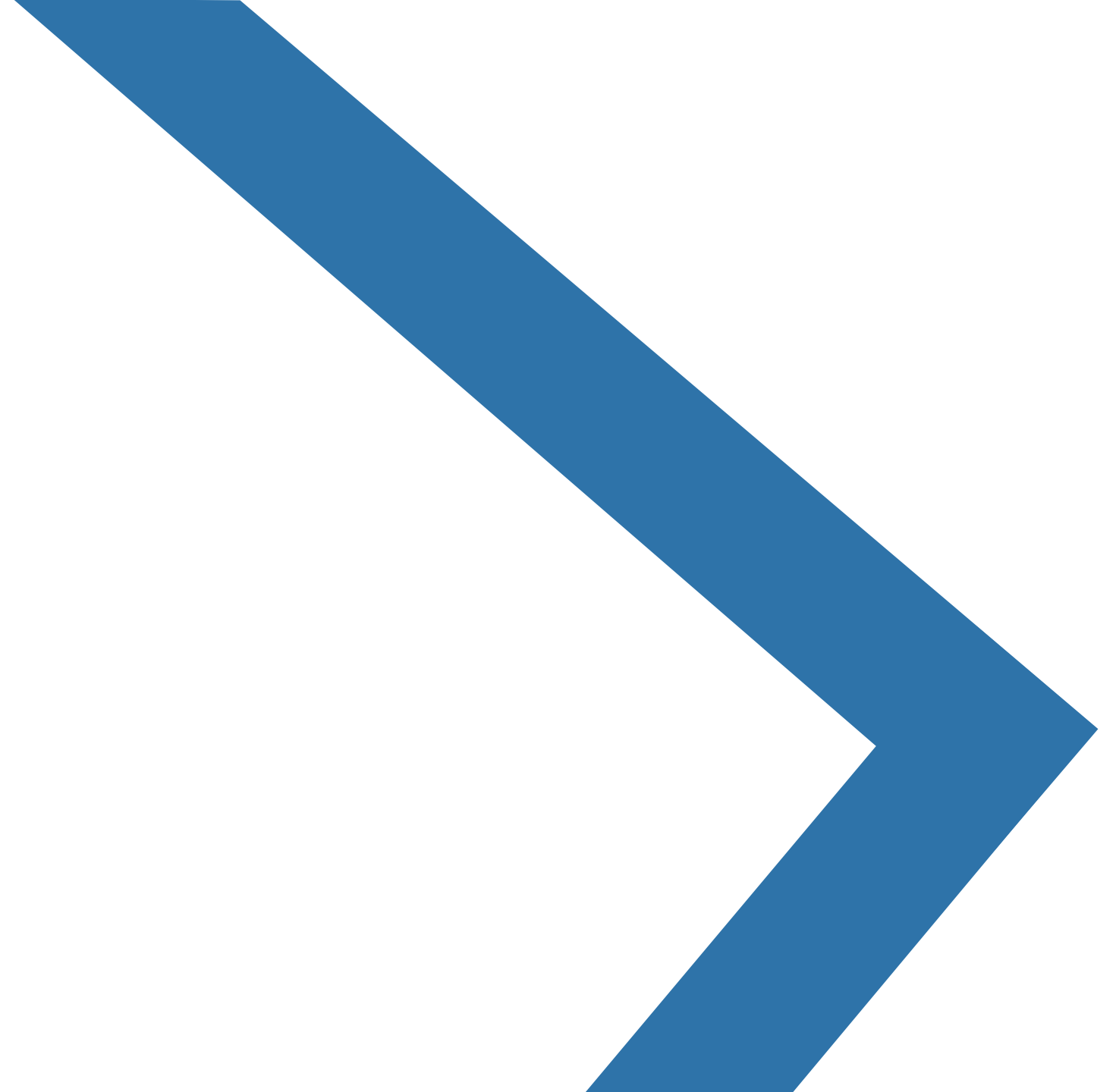■ Gasoline ■ Diesel ■ CNG ■ Electric ■ Hybrid (gasoline)

*Source: Enerdata, built with the **EnerMED** model*

Verification: potential remaining actions to fill the gap and reach a net zero scenario

Key Takeaways

KEY MESSAGES

1. **Energy-climate scenarios** are the **foundation** for establishing **sectoral decarbonization targets**.

    - The 2050 targets seem far away but allow for the definition of **intermediate milestones** (e.g. 2030) and near-term actions

    - Enerdata develops a **suite of models and scenarios** to investigate different sectors and geographies with a high level of detail.

2. **Defining assumptions is key** for both the reference and the climate ambitious.

    - **Precise assumptions need precise modelling.**

    - It is possible to **disaggregate** the climate action into **many decarbonization levers** and quantify / estimate them.

3. **Weak signals** can be studied with **precise and flexible modelling**:

    - light vehicles or SUVs, bike and train infrastructure, cargo bikes delivery, etc.

Thank you for your attention!

Jacques Després
Project Manager & Energy Modelling Expert, Enerdata
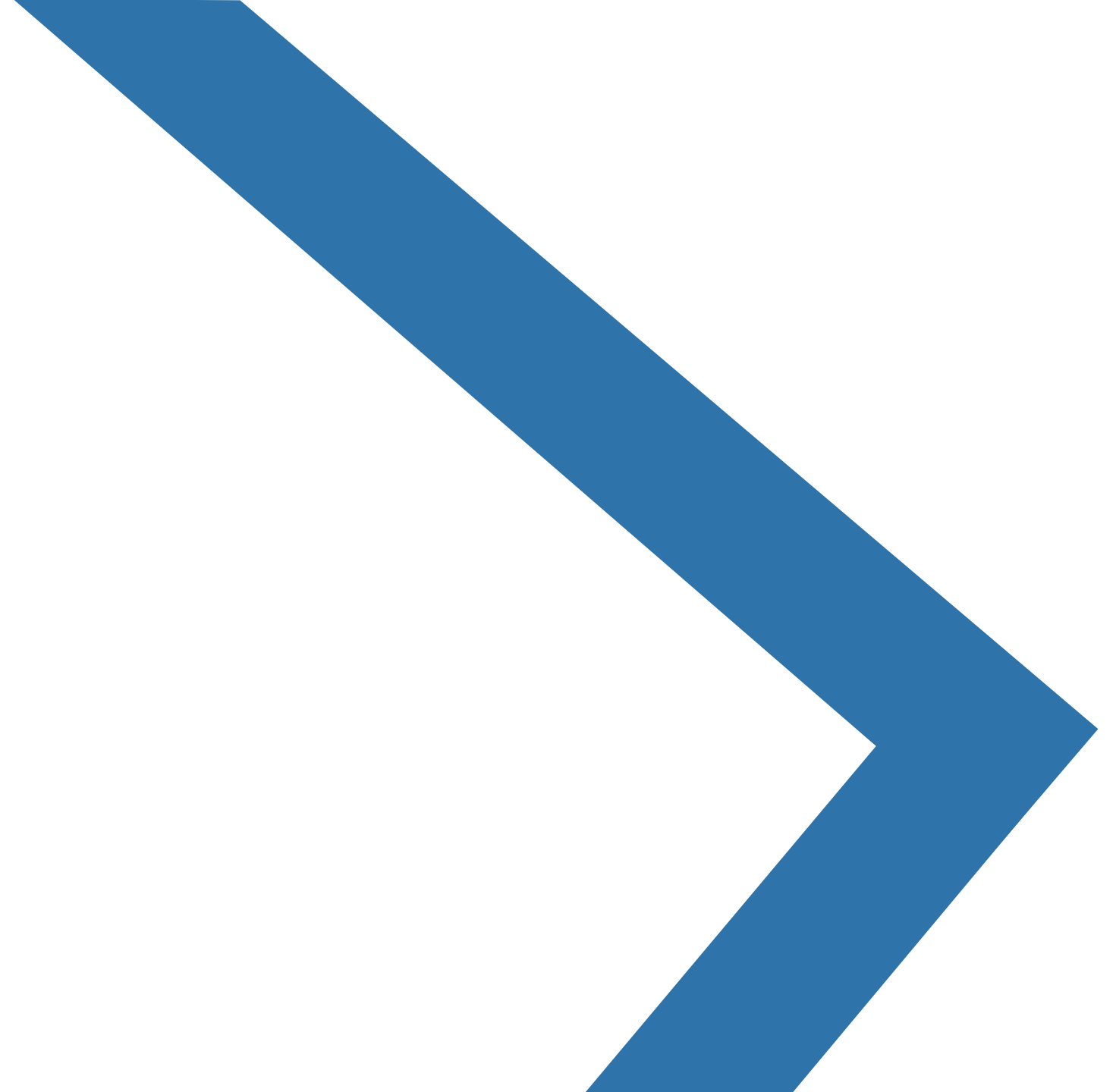Jacques.despres@enerdata.net

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APPENDIX

KEY CONCEPTS

Carbon neutrality / Net Zero

- Balance between emitting CO2 to the atmosphere and absorbing it in carbon sinks (natural or technological)

Carbon budget

- Amount of CO2 emissions to not be exceeded **over a period** to limit global warming to a certain level of temperature increase

Downscaling

- Translating a global energy-climate scenario into a local and sectoral decarbonization pathway

Kaya identity

- Decomposition of CO2 emissions variation into different **explanatory factors**

Decarbonization pathways and levers

- Policies / actions / ways to reduce CO2 emissions, potentially through all explanatory factor

# FROM NATIONAL PERSPECTIVE TO A HIGH DEGREE OF GRANULARITY

Highly customizable to the client's needs

<u>CEDF</u>: Country Energy Demand Forecast

Enerdata's **energy demand** forecasting service

**Ready to be used by non-experts
User-friendly interface**

- ✓ **Considering the specific country context**
- ✓ **Description by sector and sub-sector**
  - ✓ **For example, cars, residential buildings, etc.**
- ✓ Built using the EnerMED model
  - ✓ Uses a high granularity
  - ✓ Includes knowledge of the detailed drivers
    of energy demand for each sub-sector
- ✓ Models up to 2050
- ✓ Highly customizable
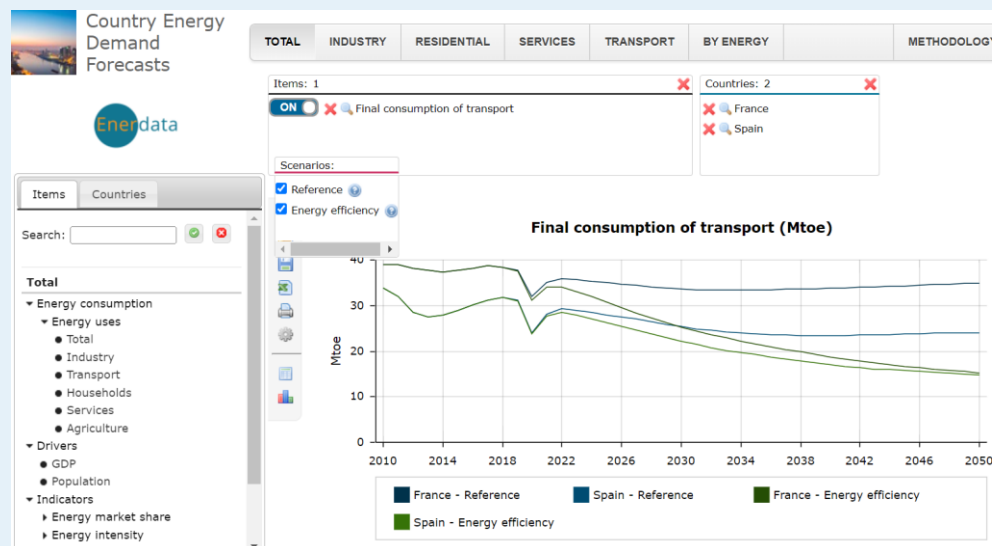
SNBC2 (2020)

Klimaschutzplan (2016)

EDLP (2020)

CGS (2018)

SIL TREGES (2021)

Several countries already included

Ready-to-use scenarios