EnerMED Model

Fit for 55: How to Forecast Energy Consumption?

Case Study: Modelling the End of Thermal Cars in the Transport Sector

Focus on France, Germany and Spain

Florent Gauthier - Project Manager

Pacco Bailly - Analyst

December 9 th, 2021

Enerdata: an independent Research Company since 1991

- **Spin-off of a research center**
- **Expert in analysis and forecasting of global energy & climate issues**
- **In-house and globally recognized databases and forecasting models**
- **Headquartered in the Grenoble (France)**
- **Subsidiary in Singapore**
- **Global reach:**
  - **A wide network of partners around the World**
  - **Clients and projects in Europe, Asia, America, Middle East, Africa**

Webinar plan

Modelling Countries' Energy Demand

- New bottom-up EnerMED model
- CEDF: 2 trajectories and several sensitive analysis

Transport in Low Carbon National Strategies

- Main levers of decarbonisation in transport
- Targets for passenger transport in the national strategies

Modelling Changes on Transport Energy Demand

- Upcoming new targets with Fit for 55
- Fit for 55: by 2035 all new passenger cars would be zero emissions
- Sensitivity analysis

Questions

Part 1

Modelling Countries' Energy Demand

Two trajectories for EU countries
using Enerdata's bottom-up model EnerMED

EnerMED: a bottom-up simulation model for energy demand (1/2)

- **EnerMED is a techno-economic model (bottom up) (latest version of the MEDEE / MedPro models)**
- **Developed based on the experience of forecasting demand in 60 countries to provide for various stakeholders (industry, governments, policy-makers…)**

Energy demand long-term forecasting

- Energy demand by **sector** and **end-use** until 2050
- **Calibration of scenarios**

Energy efficiency policies evaluation

- Impact of energy efficiency policies and measures
- Calculation of energy indicators

GHG emissions forecasting

- Simulation by sector and by end-use
- Evaluation of strategies to reduce GHG emissions

Recent references

- Tunisian Energy Efficiency Agency (ANME) for Tunisia NDC - published in October 2021
- Grenoble Alpes Métropole - Analysis of local impact of the Citizens Convention for the Climate

EnerMED: a bottom-up simulation model for energy demand (2/2)

INPUTS

Socio-economic variables

- GDP, population, value added, productivity …
- Production of energy intensive industries

Technological characterisation

- Number of vehicles
- Building stock
- Fuel efficiencies, mileage, new equipment performance…

MODELLING OPTIONS

Flexible disaggregation levels

- By branch
- By end-use
- By vehicle (cars, bus…)
- By building type

Pre-existing flexible equations

OUTPUTS

Energy Demand by Sector

Manufacturing industries
chemicals, metals, minerals, wood, paper, food & beverages, textile, vehicles
Mining
Construction

Domestic
Road
Rail
Air
Inland Navigation

Space heating
Water heating
Cooking
Air conditioning
Electrical appliances/Lighting
Captive electricity

Hotels, cafes, restaurants
Wholesale & retail trade
Private and public offices
Health
Education

Demand by energy

Socio-economics

- Industrial output
- Vehicles stocks, traffic
- Dwellings, equipment…

Specific consumption

- Energy intensive products
- Vehicle type
- End-use
- Appliances…

Indicators

- Energy intensity
- CO_2 emissions

CEDF: Country Energy Demand Forecast

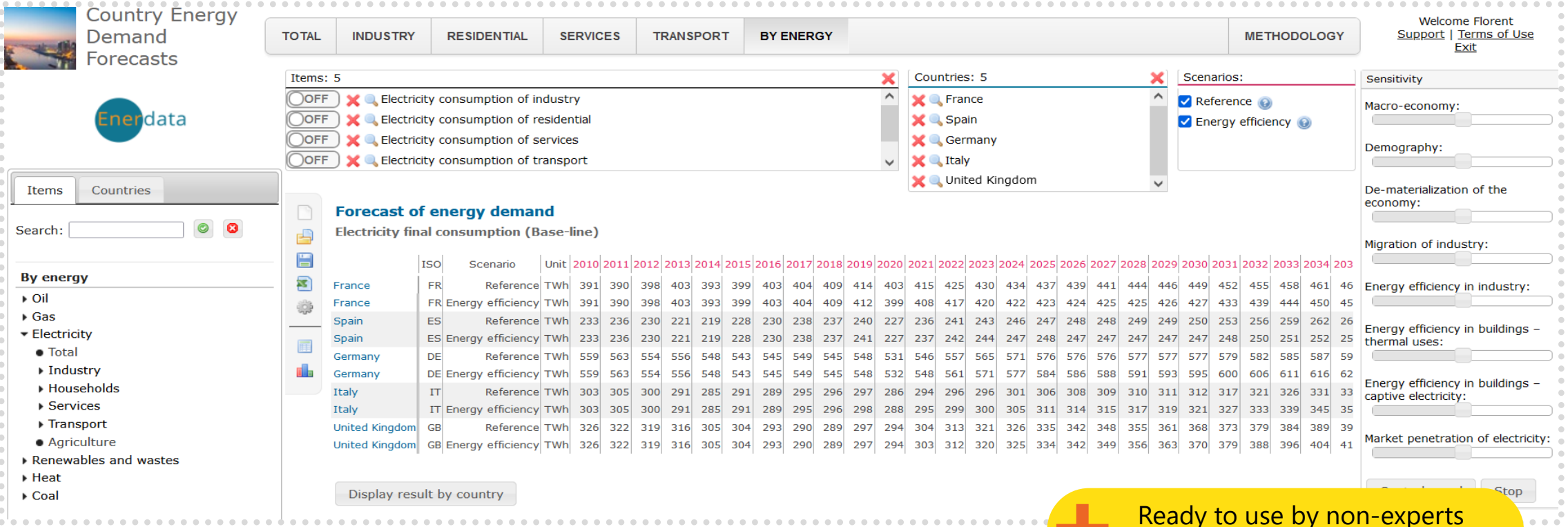
Energy demand forecasts up to 2050 based on EnerMED

>200 modelling inputs from national and sectoral public strategies

Reference and Energy Efficiency scenarios

Updated historical data 2000-2018 from the Odyssee database

UK, France, Spain, Italy, Germany



Enerdata

https://www.enerdata.net/research/country-energy-demand-forecast.html

Fit fo

Ready to use by non-experts
User friendly interface

CEDF: Two trajectories (1/2)

REFERENCE

Macroeconomic context : catch-up of pre-Covid trends after 2025, GDP trends from national strategies.

Current trends and existing policies : 2030 Reference Scenario of NECPs.

Continuous but limited improvements in energy efficiency due to technological progress.

ENERGY EFFICIENCY

Same macroeconomic assumptions as the Reference scenario.

More ambitious policies : 2050 targets of National long-term strategies or extrapolated targets.

Main drivers include:

- ✓ Reinforcement of buildings codes, renovation rate, more efficient appliances;
- ✓ Improvement in industrial processes;
- ✓ Modal transfer and greater improvements in energy

CGS (2018)

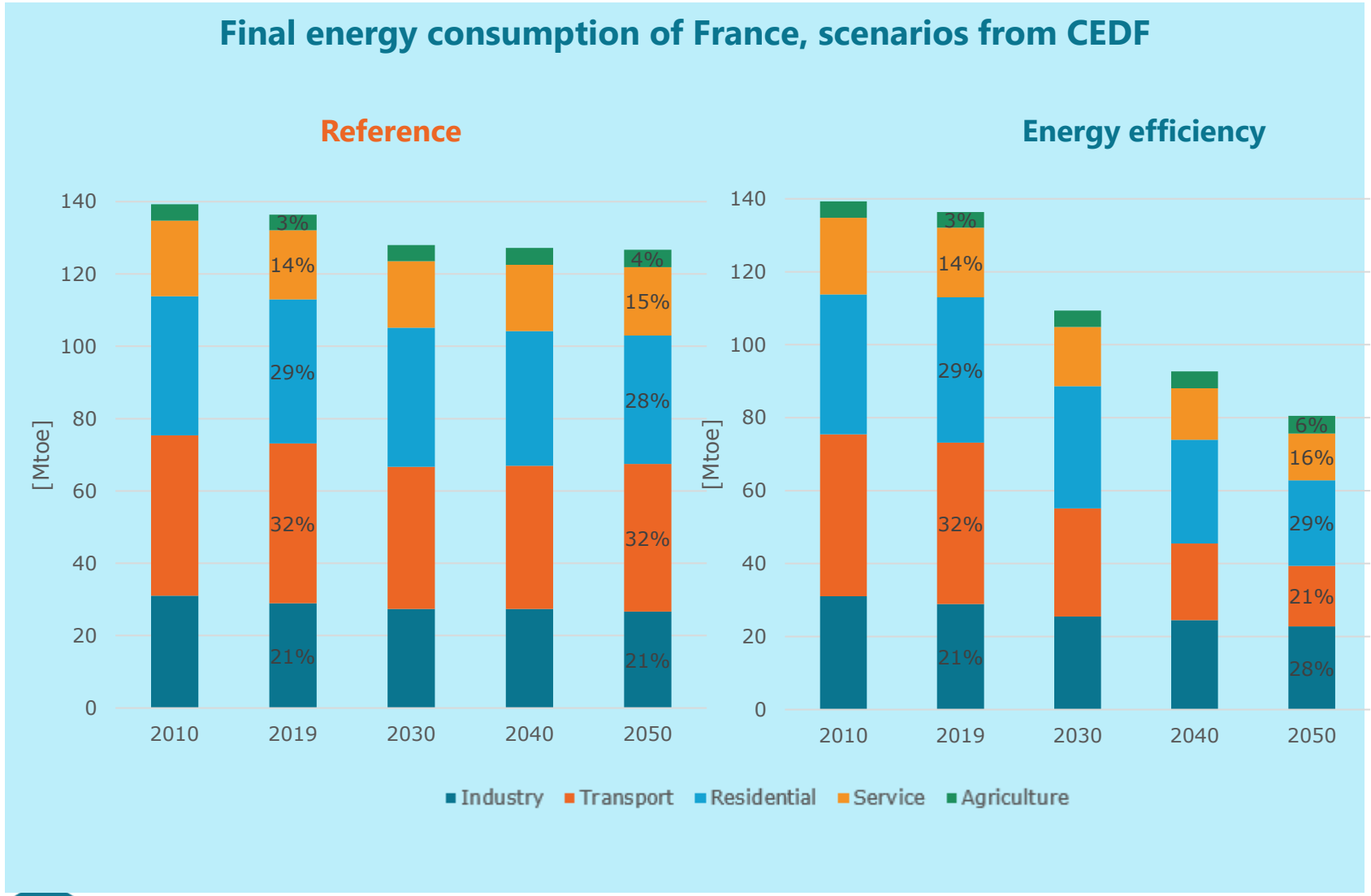
EDLP (2020)

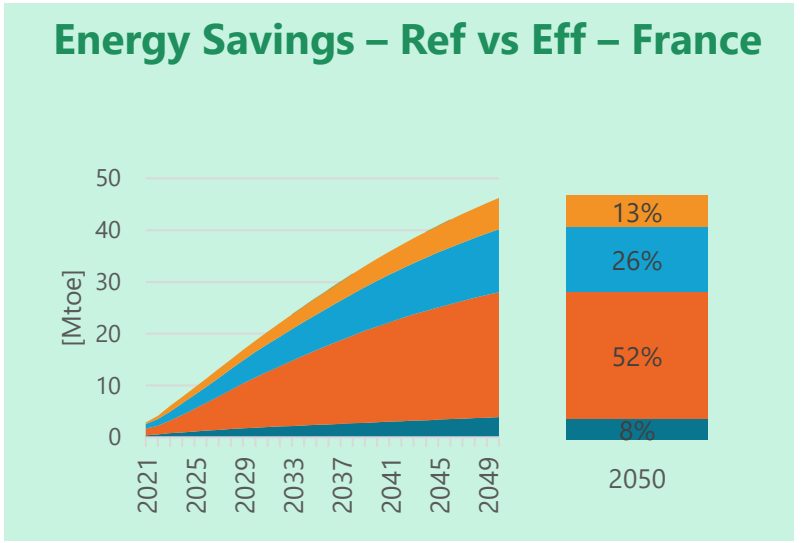
SNBC2 (2020)

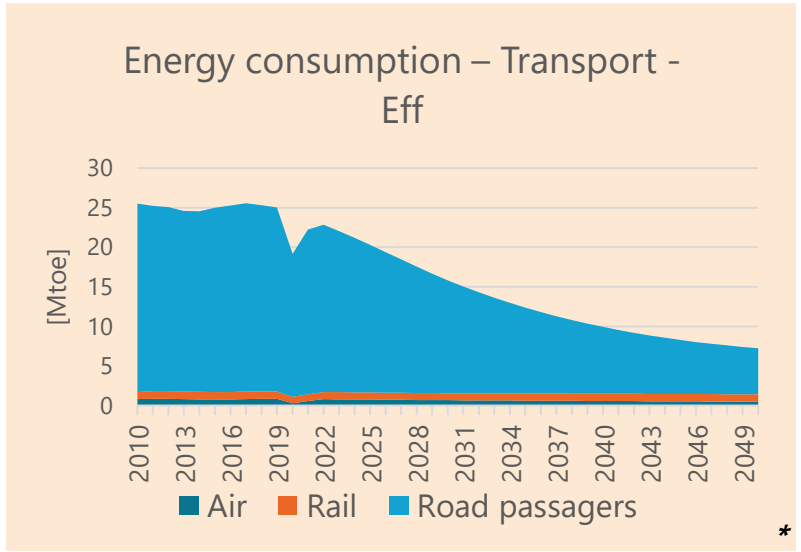
SIL TREGES (2021)

Klimaschutzplan (2016)

CEDF: Two trajectories (2/2)







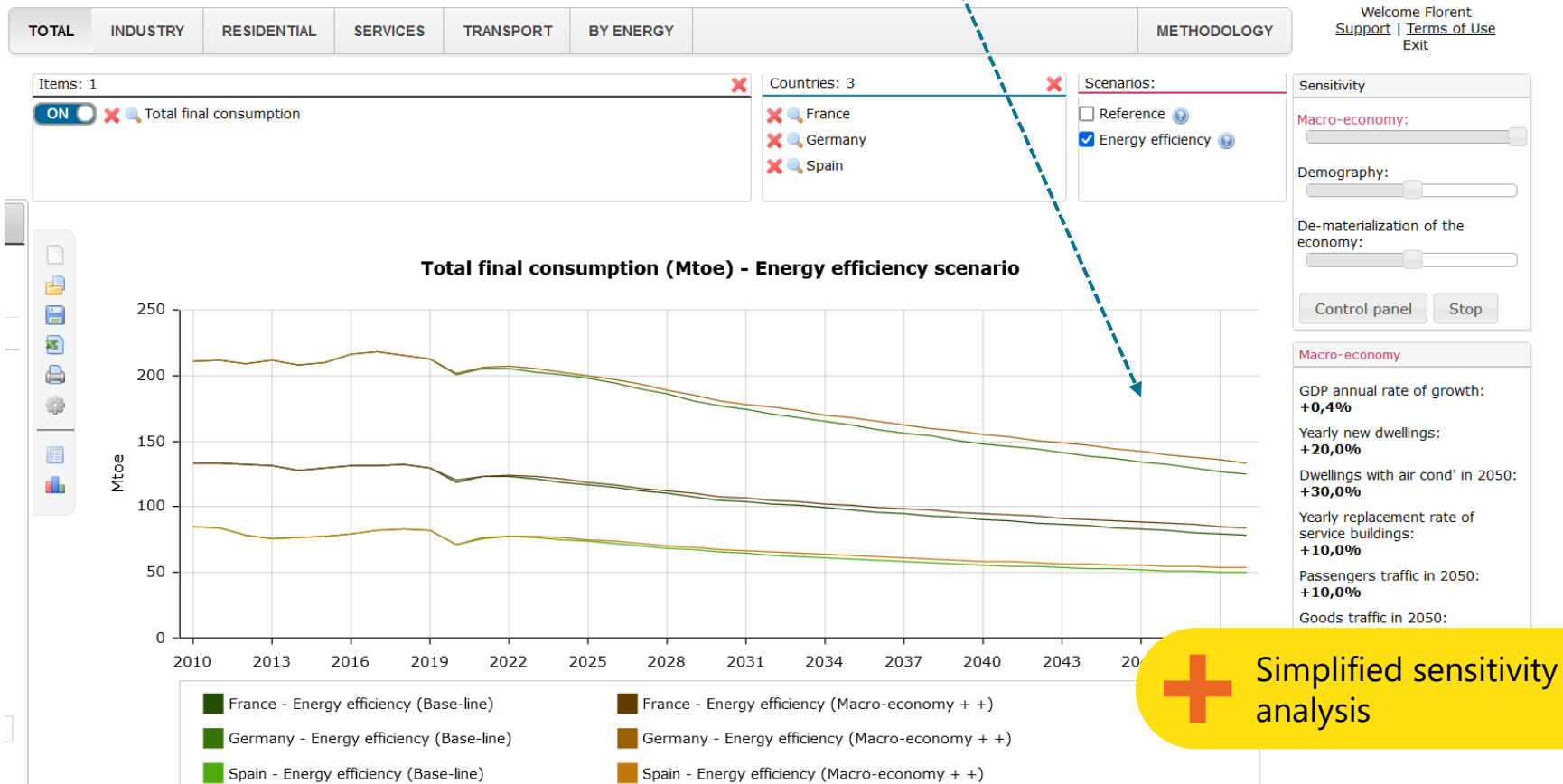
domestic

CEDF: Several sensitivity analyses (4/4)

Sensitivity
Macro-economy:
Demography:
De-materialization of the economy:
Energy efficiency in industry:
Energy efficiency in buildings – thermal uses:
Modal split:
Energy efficiency in transport:

Macro-Economy

	↓↓	↓	-	↑	↑↑
GDP annual rate of growth	-0,4%	-0,2%	0,0%	+0,2%	**+0,4%**
Yearly new dwellings	-20,0%	-10,0%	0,0%	+10,0%	**+20,0%**
Dwellings with air cond' in 2050	-30,0%	-15,0%	0,0%	+15,0%	**+30,0%**
Yearly replacement rate of service buildings	-10,0%	-5,0%	0,0%	+5,0%	**+10,0%**
Passengers traffic in 2050	-10,0%	-5,0%	0,0%	+5,0%	**+10,0%**
Goods traffic in 2050	-10,0%	-5,0%	0,0%	+5,0%	**+10,0%**



Simplified sensitivity analysis

Enerdata

Part 2

Transport in National Strategies

Challenges, targets, main levers

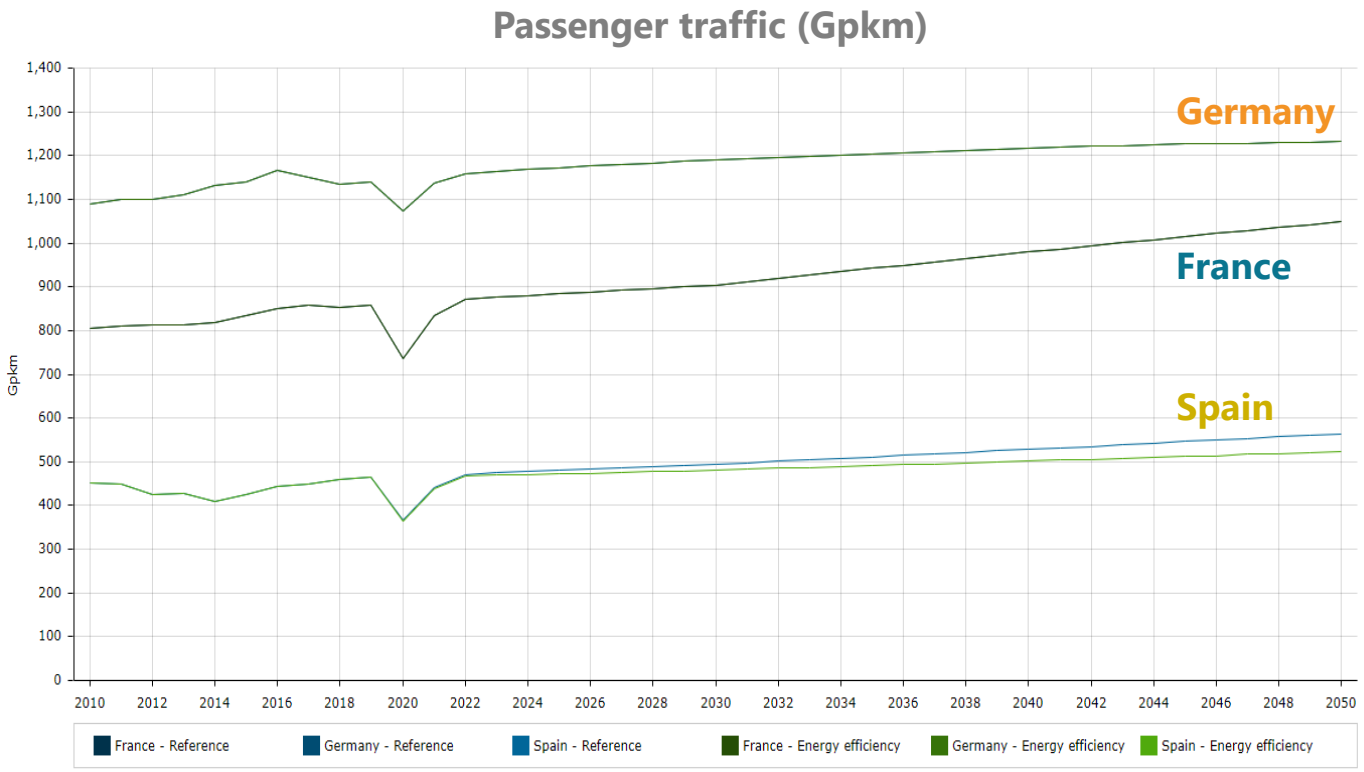
Main levers of decarbonisation in transport

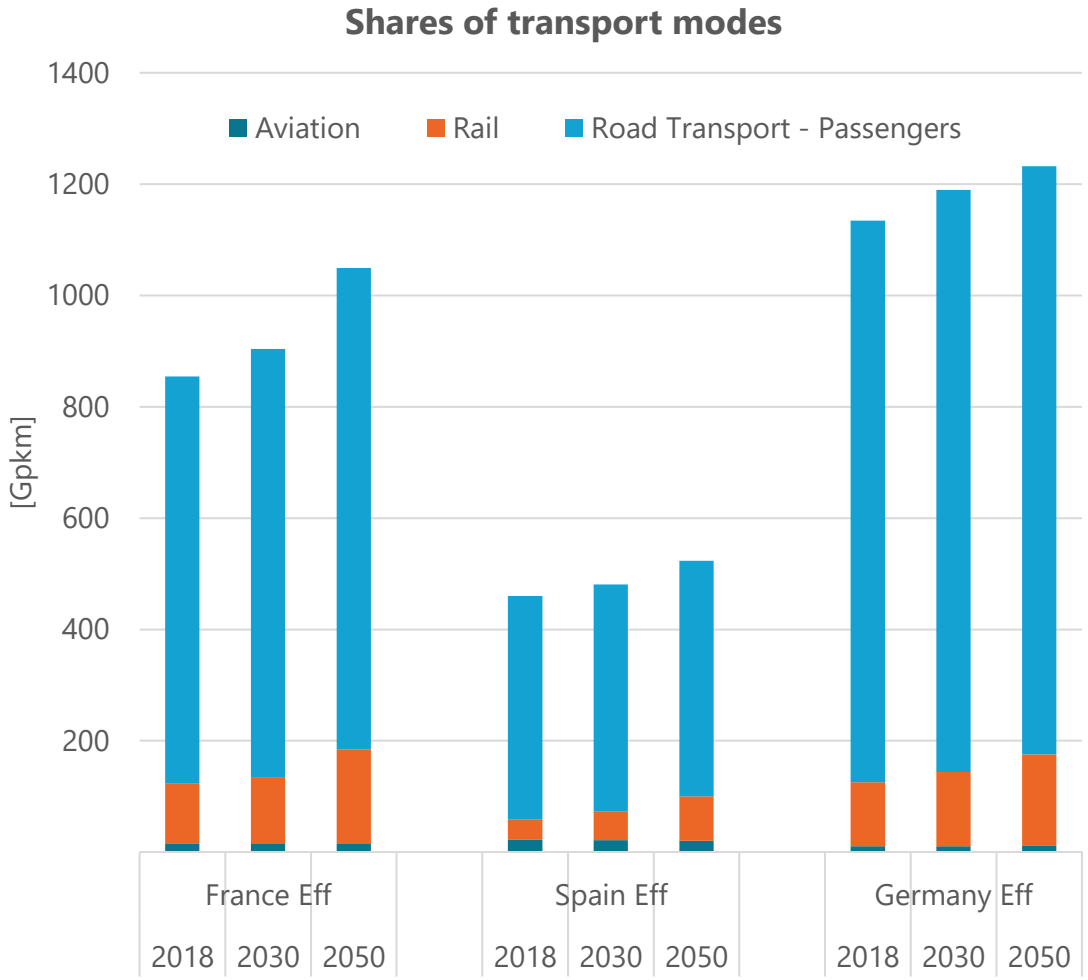
TRANSPORT DEMAND	Reduction in passenger mobility (number of km per capita by motorised mode) and decorrelation between freight traffic and economic activity
MODAL SHIFT	Shift from cars to public modes for passengers and from road to rail and navigation for freight (% of bus and rail)
LOAD FACTOR	Increase in occupation rate (number of persons per vehicle) for passengers and load factor (number of tons per vehicle) for freight
ENERGY EFFICIENCY	Reduction of unit consumption in koe/vkm, reflecting technological improvements and driving behaviour
FUEL SUBSTITUTION	Substitution to decarbonised fuels with the penetration of biofuels and electric modes using decarbonised electricity

Transport Demand & Modal Shift in Passenger transport (ex. FR, GER, SP)

TRANSPORT DEMAND: Constant increase up to 2050

MODAL SHIFT : To rail





Load factor & Energy Efficiency in Passenger transport

LOAD FACTOR

Increase occupation rate (number of persons per vehicle) for passengers and load factor (number of tons per vehicle) for freight

ENERGY EFFICIENCY

Reduction of unit consumption in koe/vkm, reflecting technological improvements and driving behaviour

OCCUPANCY RATIO: increase between 0 and 15%

ENERGY EFFICIENCY OF CARS

2050: decrease from **5,7 L** to **2 L/100 km** or from **18 kWh/100 km** to **12 kWh/100 km**

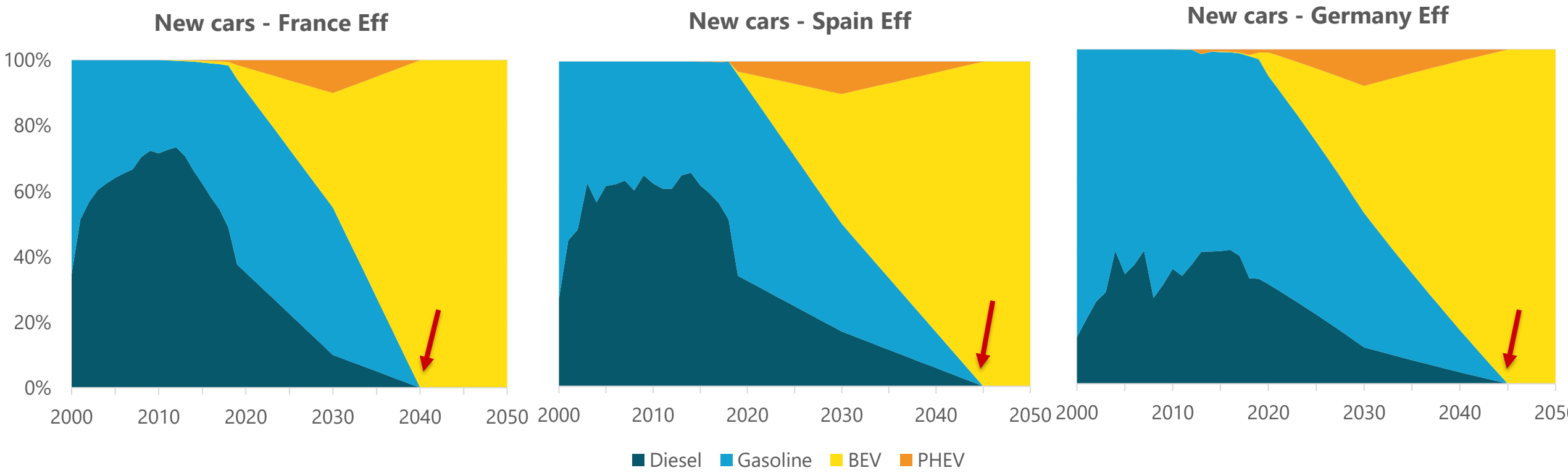
→ We assumed lighter cars in 2050

Fuel Substitution in Passenger transport (ex. FR, GER, SP)

FUEL SUBSTITUTION

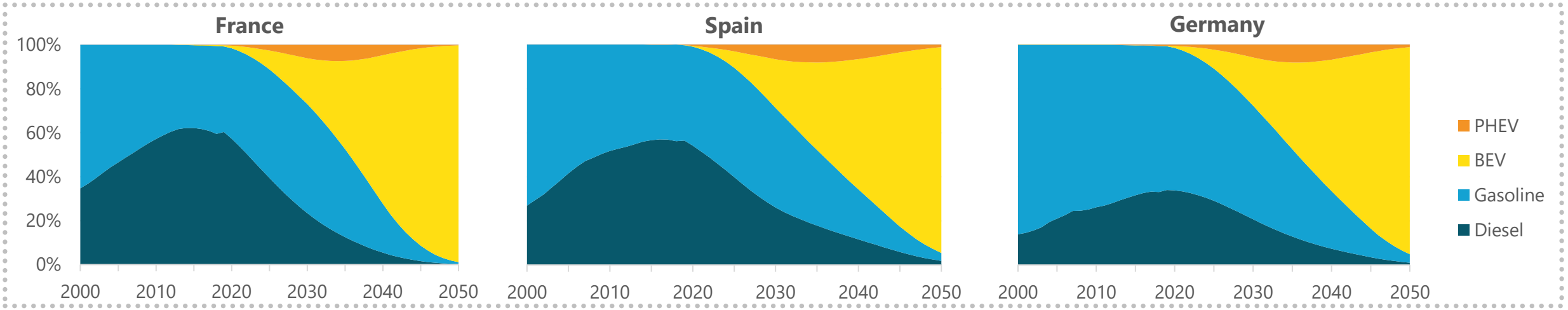
Substitution to decarbonised fuels with the penetration of biofuels and electric modes using decarbonised electricity

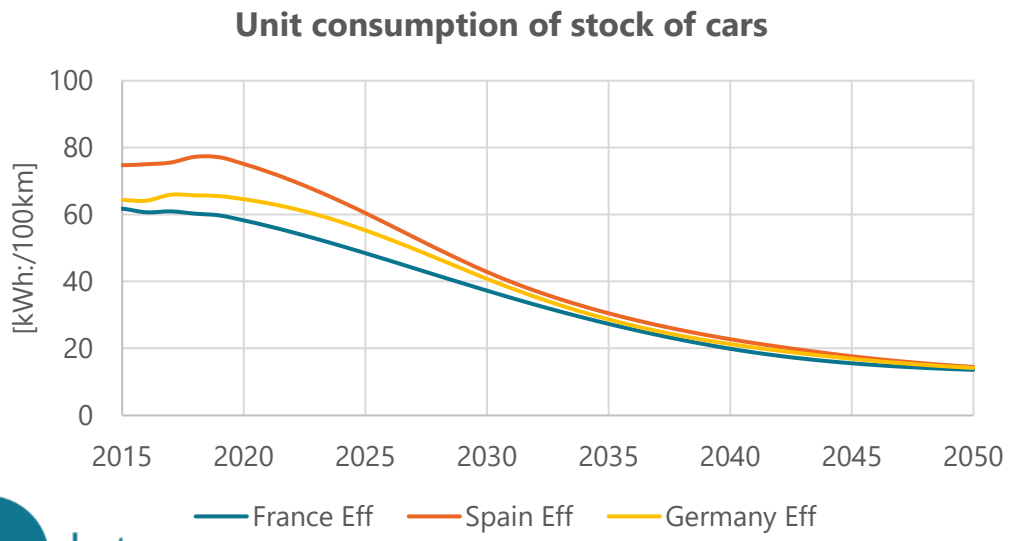
100% electric cars in 2040 - 2045

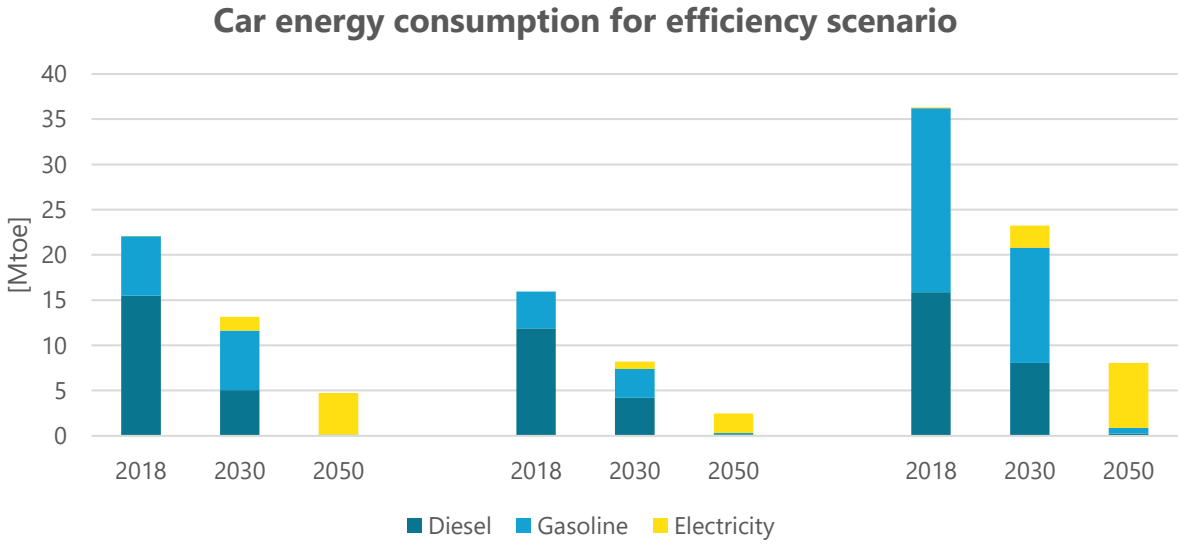


Passenger transport: cars energy consumption

Stocks of cars for Energy Efficiency scenarios







Part 3

Modelling changes on transport energy demand

Fit for 55 package / Transport

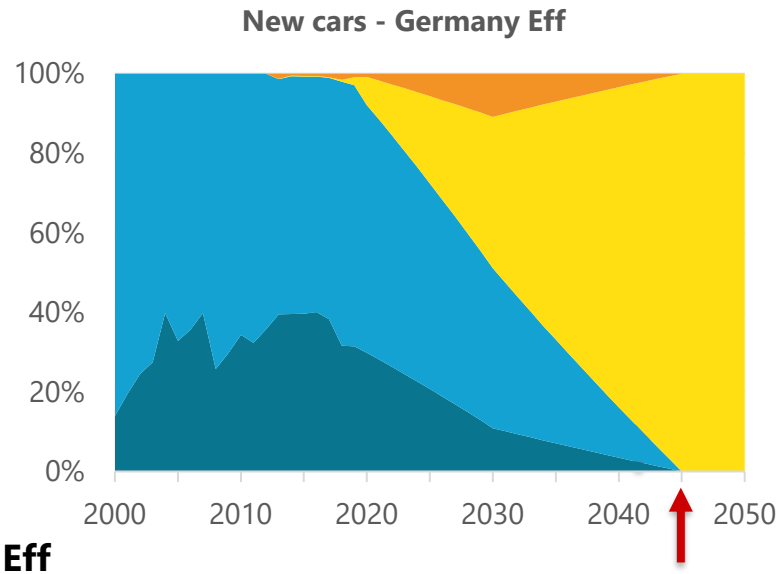
Upcoming new targets in Transport with Fit for 55

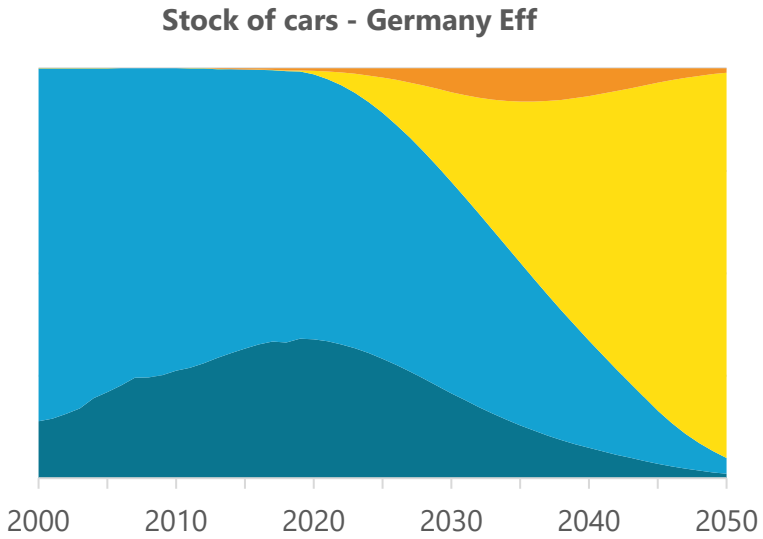
- **From the European Green Deal to the Fit for 55 legislative package**
  - **At least 55% net greenhouse gas reductions by 2030 compared to 1990 & Net Zero by 2050**
  - **December 2019 : European Green Deal**
  - **December 2020: target approved by EU leaders**
  - **June 2021: objective in the EU Climate Law**
  - **Next step: legislative proposals is discussed at the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions**

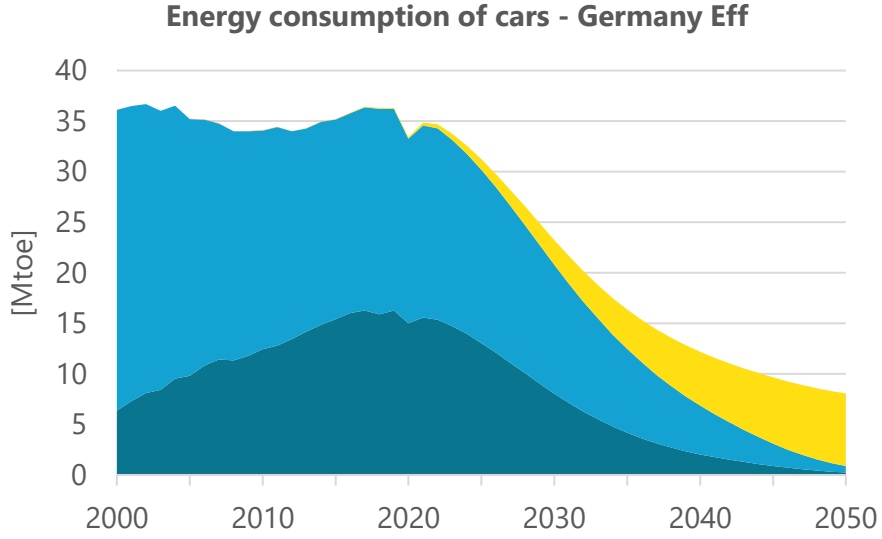
- **CO_2 emission performance standards for cars and vans**
  - **CO_2 emission reduction targets for new passenger cars and vans as compared to the 2021 target:**
    - **From 1 January 2030: 55% for cars, and 50% for vans,**
    - **From 1 January 2035: 100% for cars, and 100% for vans**

Fit for 55: end of new thermal car sales in 2035 (1/2)

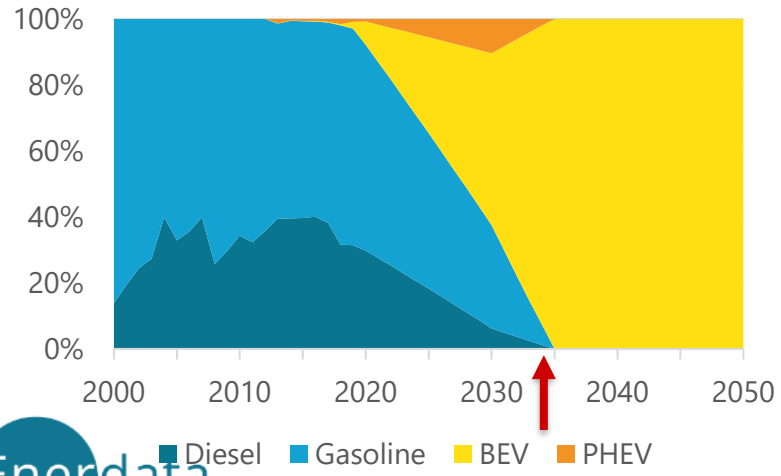
Eff

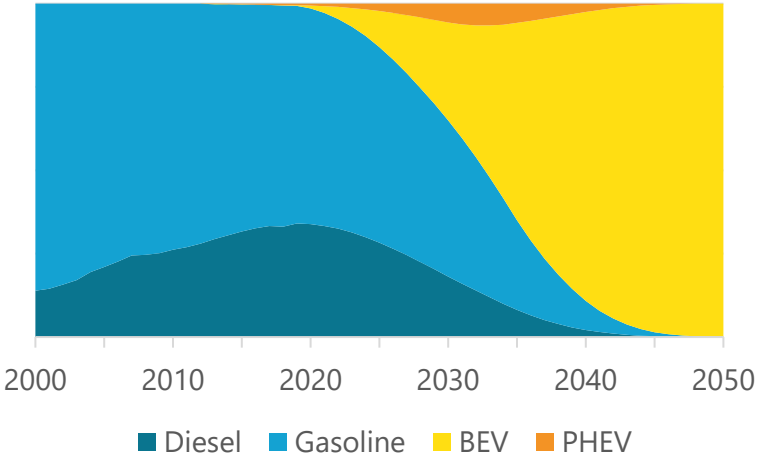


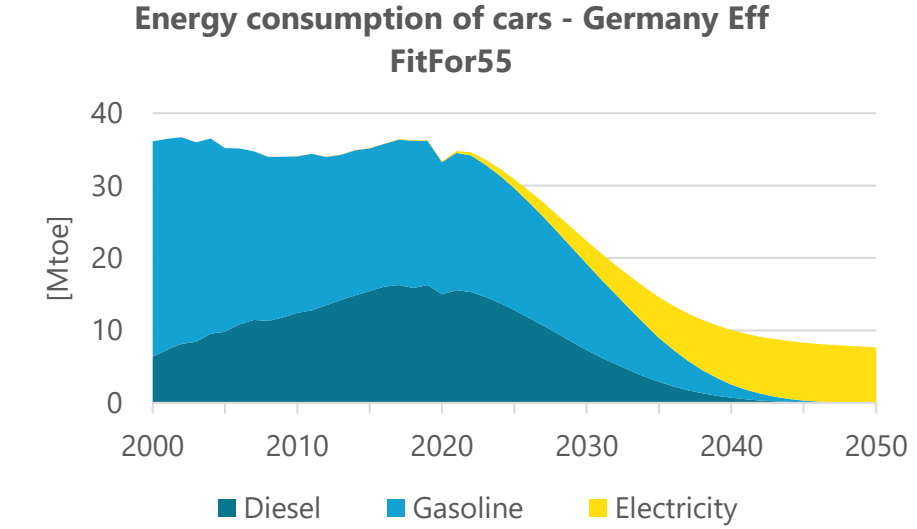




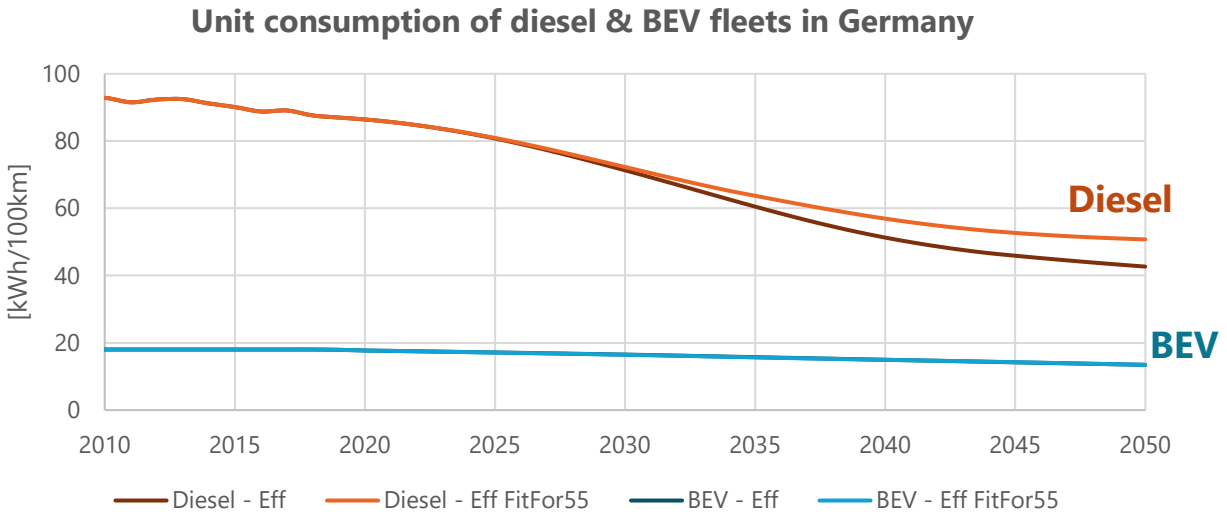
FitFor55%

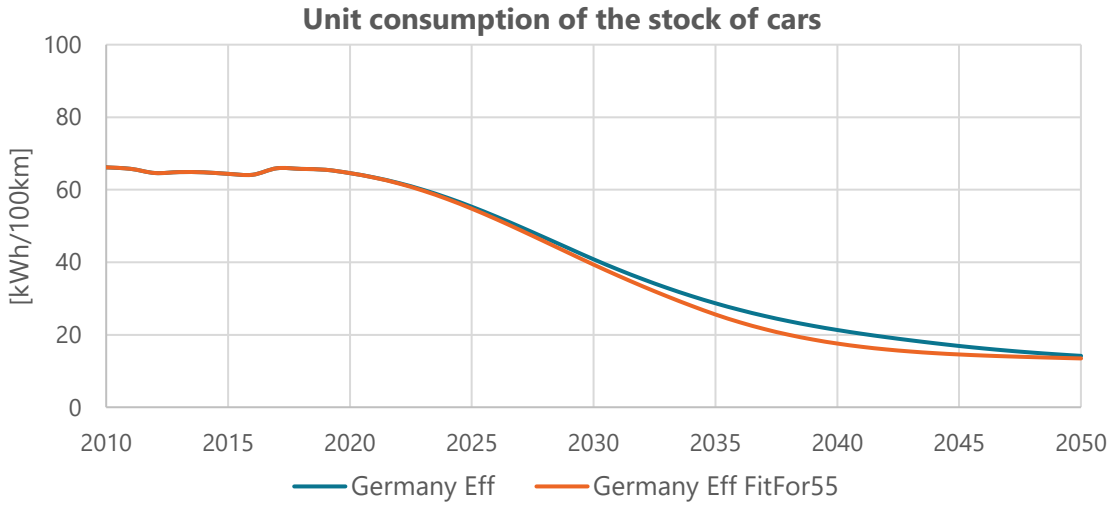


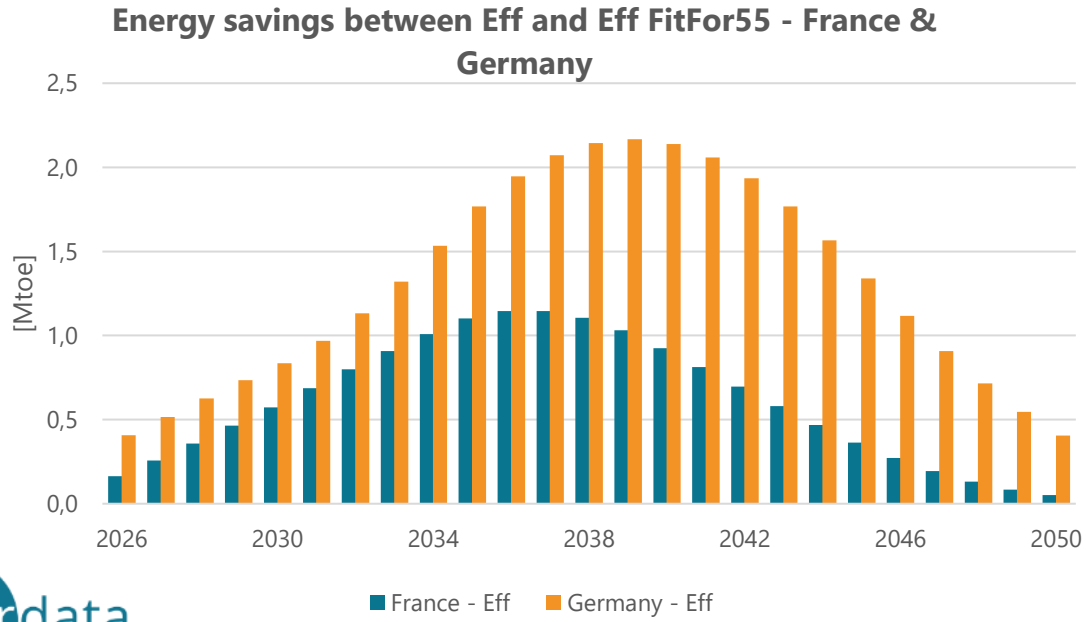




Fit for 55: end of new thermal car sales in 2035 (2/2)



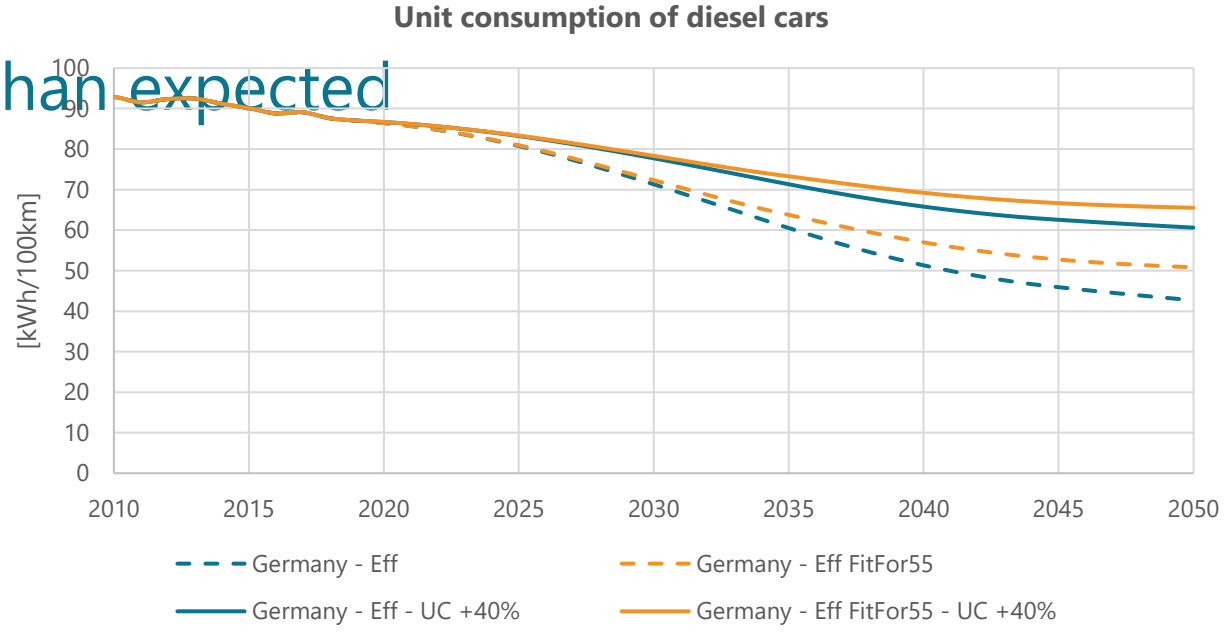


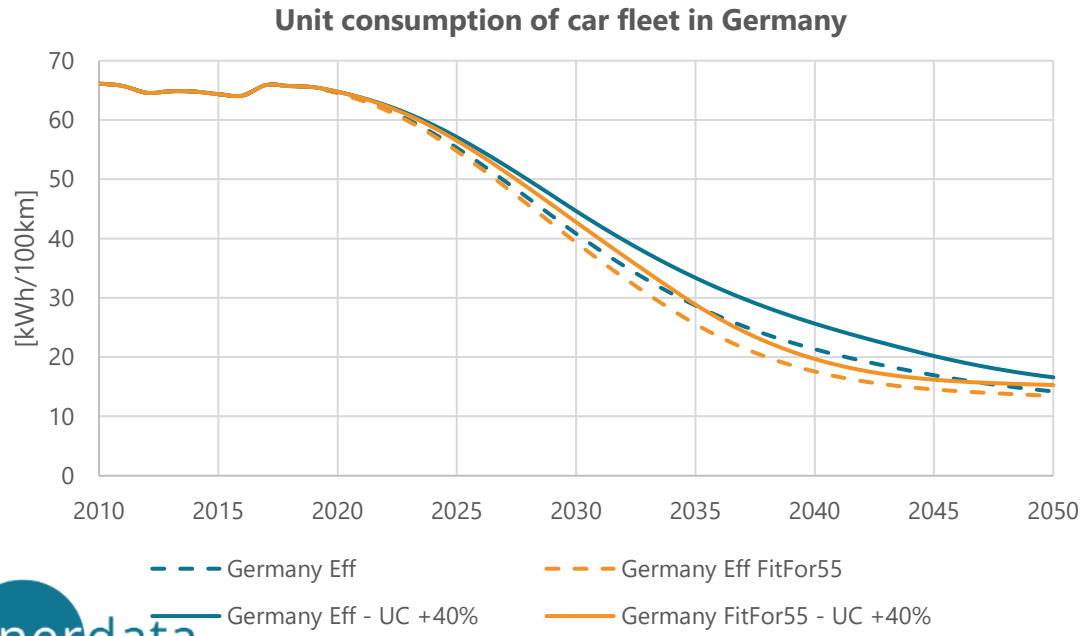


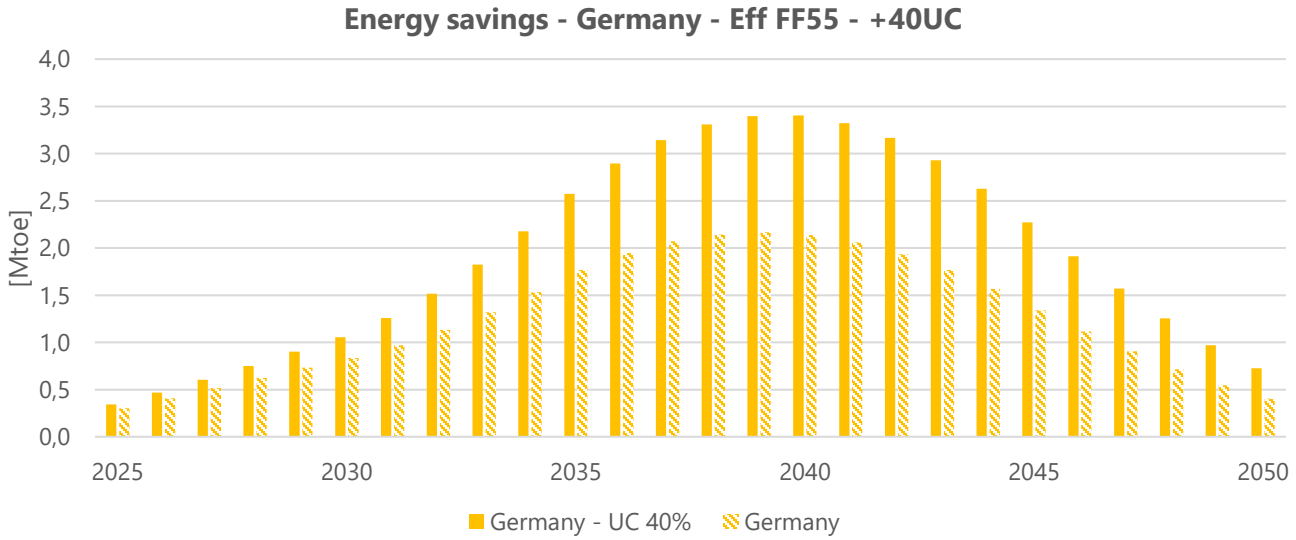
Country	Max savings	2050 FF55
France	1,2 Mtoe in 2036 -13%	-1%
Spain	0,8 Mtoe in 2039 -19%	-6%
Germany	2,2Mtoe in 2039 -18%	-5%

What if?....
Efficiency improvement is less ambitious than expected

- **The improvement in unit consumption is reduced by 40% compared to the efficient scenario**
- **Increase the difference of energy consumption between 2030 and 2040**
- **Limited impact on energy consumption in 2050, as electric cars represent a large part of the fleet**







Conclusions and perspectives

- **Impacts of energy regulations can be modelled with EnerMED**
- **Fit for 55 package: end of new thermal car sales by 2035**
  - → **Low reduction in energy consumption by 2050 compared to national LT strategies**
  - → **Faster decrease of energy consumption during the transition**
  - → **Faster increase of the electricity market share during the transition**
  - → **Energy efficiency efforts are mainly driven by the switch from thermal to electric motorisation**
  - → **Challenged assumptions: weight of the thermal cars**
- **Long term decarbonisation issues are transferred to the power generation sector**

HELPING YOU SHAPE THE ENERGY TRANSITION

About Enerdata:

Enerdata is an independent research company established in 1991, specializing in the analysis and forecasting of energy and climate issues, at world and country level.

Leveraging our globally recognised databases, intelligence systems and models, we assist our clients in designing their policies, strategies and business plans.

Enerdata

CONTACT

Florent.gauthier@enerdata.net

Thank you for your attention!

https://www.enerdata.net/

Questions