CARBON NEUTRALITY CHALLENGES IN THE TRANSPORT SEGMENT

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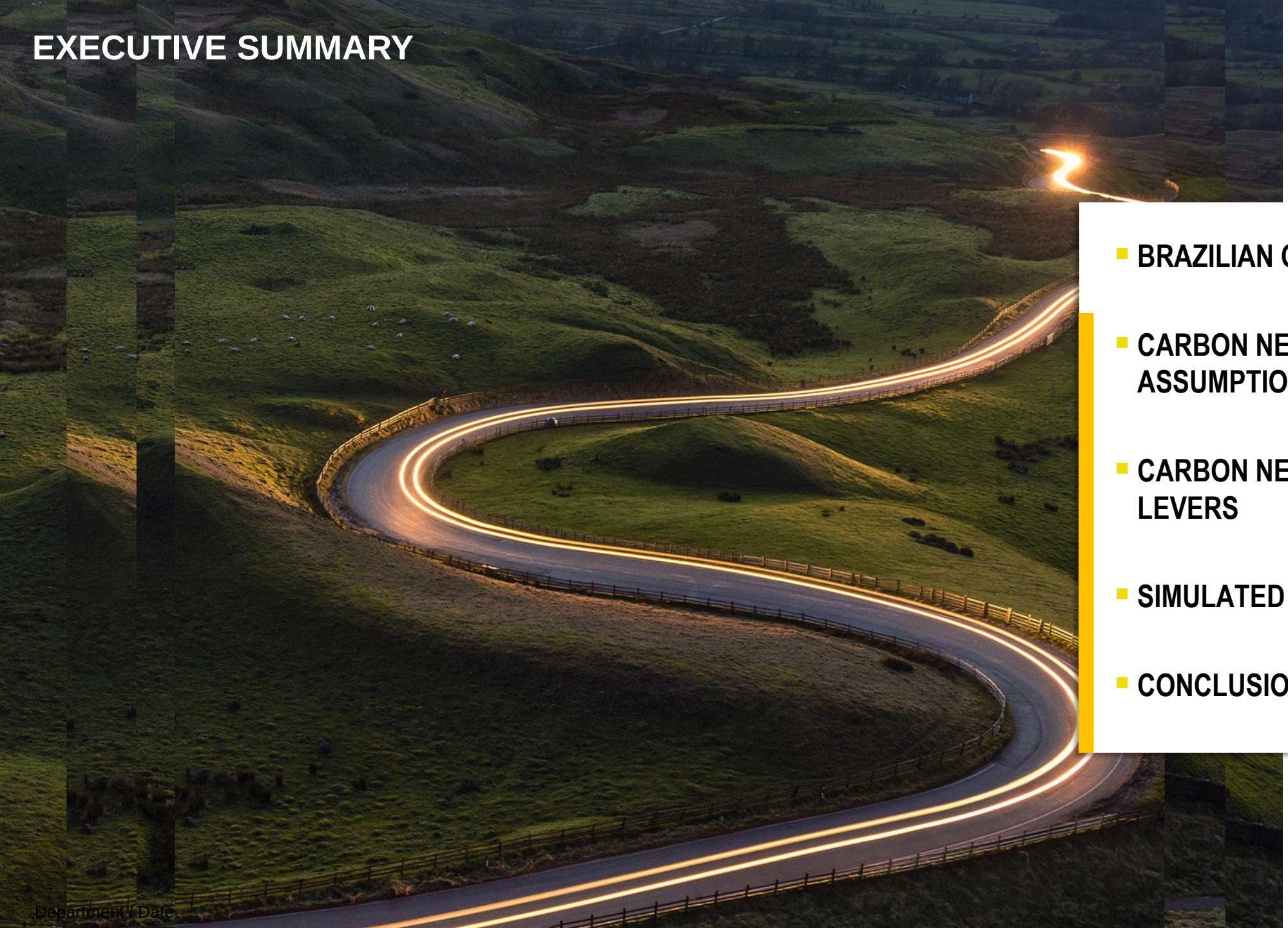
BRAZIL PUBLIC AFFAIRS / APRIL 2022

EXECUTIVE SUMMARY



- BRAZILIAN COMMITMENTS
- CARBON NEUTRALITY ASSUMPTION
- CARBON NEUTRALITY MAIN LEVERS
- SIMULATED CASE
- CONCLUSION

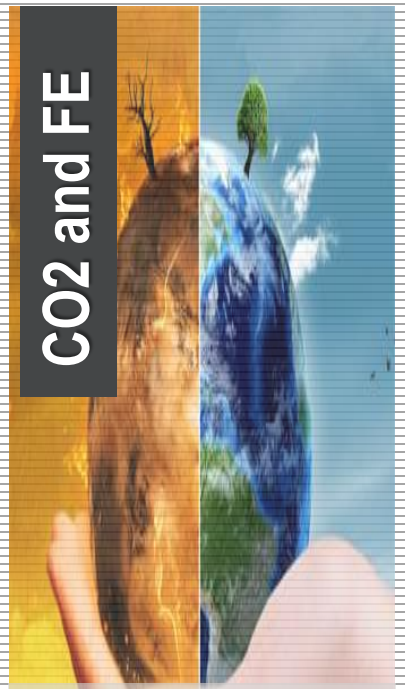
THE FUTURE OF THE AUTOMOBILE TECH IN BRAZIL

DRIVERS

EMISSIONS

- Global politcs
- PROCONVE
- Emissions in huge circulation centers (big cities)

CO2 and FE



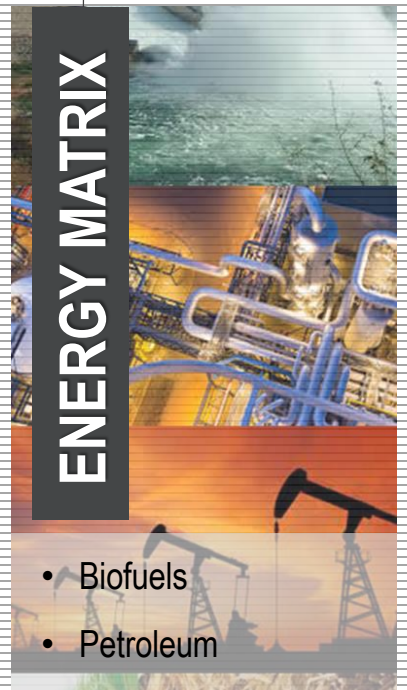
- COP21 agreements
- ROTA2030
- WtW

SAFETY

- Conectivity
- ADAS
- Crash test

INFLUENCERS

ENERGY MATRIX



- Biofuels
- Petroleum
- GNV
- H2
- Electric Energy Matrix
- E-fuels (combustível sintético)

MARKET TRENDS

- Social/Economic Situation
- Circular Economy
- Market
- Carsharing
- Public transport
- Infrastructure
- Autonomous driving

CO2 ASSESSEMENT: KEY SOURCES

RenovaBio
Política Nacional de Biocombustíveis
Lei nº 13.576/17

World energy balances 2019

epe Empresa de Pesquisa Energética
Balanço Energético Nacional 2020
Relatório Síntese / Ano Base 2019

Conab
Companhia Nacional de Abastecimento

AEA Associação Brasileira de Engenharia Automotiva
ROADMAP TECNOLÓGICO AUTOMOTIVO BRASILEIRO

anp

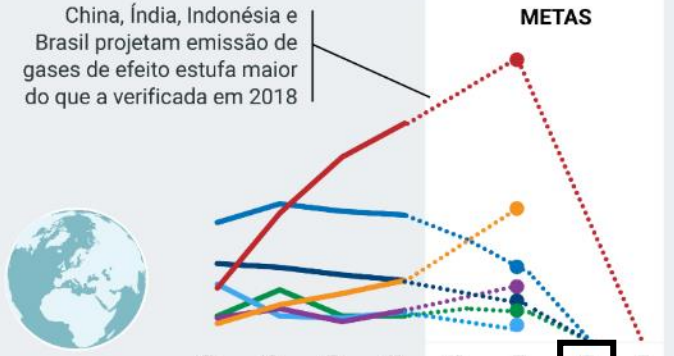
MINISTÉRIO DE MINAS E ENERGIA
SECRETARIA DE PLANEJAMENTO E DESENVOLVIMENTO ENERGÉTICO
PNE2050
PLANO NACIONAL DE ENERGIA

SEEG Brasil

BRAZILIAN COMMITMENTS – COP21 / 2021 LEADERS SUMMIT ON CLIMATE

EMISSÃO DE GASES DE EFEITO ESTUFA DEVE CRESCER ATÉ 2030

saldo de emissões de gases estufas em bilhões de toneladas*



país	1990	2005	2010	2018	2025	2030	2050	2060
China	2,9	6,9	9,9	11,7	-	15,2	-	0
EUA	6,4	7,4	7,0	6,8	5,5	3,7	0	-
Índia	1,0	2,0	2,6	3,3	-	7,5	-	-
UE	4,2	4,0	3,6	3,3	-	1,9	0	-
Indonésia	1,3	1,8	1,1	1,7	-	2,0	-	-
Rússia	3,1	1,4	1,3	1,6	-	0,9	-	-
Brasil	1,4	2,8	1,4	1,4	1,8	1,6	0	

-43%

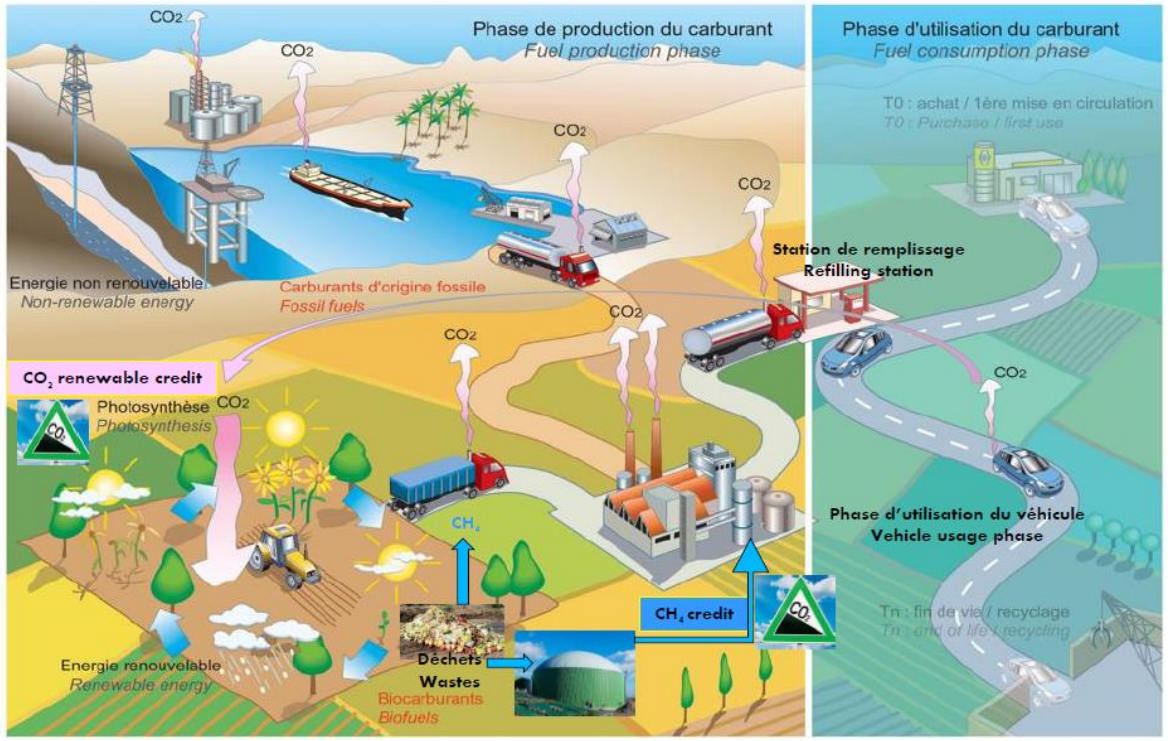
CARBON NEUTRALITY IN 2050

*equivale à diferença entre os gases emitidos pela atividade humana e a remoção de carbono da atmosfera por diversos processos
obs: o **Drive/Poder360** considerou os dados de C
fonte: emissões em 2018 (excluindo EUA e Rússia) – Climate Watch; China e Índia – Climate Watch; EUA – Inventory of U.S. Greenhouse Gas Emissions and Sinks; UE – 1990 a 2010 – Annual European Union greenhouse gas inventory 1990–2017; Rússia – Relatório Nacional sobre emissões de gases estufa; Indonésia – 2005 – Indonesia's National Communication GHG – outros anos – Climate Watch; Brasil – 1990 a 2010 – Third National Communication from Brazil to the United Nations Framework Convention on Climate Change; meta dos países – Acordo de Paris; Índia – 2030 – Unep (Emissions Gap Report 2018); China – 2030 – Climate Action Tracker;

PODER 360

- KEY CO2 TARGETS FOR BR IS CARBON NEUTRALITY IN 2050
- 37% CO2 REDUCTION IN 2025 COMPARED TO 2005
- 43% CO2 REDUCTION IN 2030 COMPARED TO 2005

CARBON NEUTRALITY ASSUMPTION – WELL TO WHEEL



Manufacturing | *Use Phase* | *Others*

Supply Chain | Production (In-house) | Energy sources | Consumption | Recycling & Others

$$CO_2e = CO_2e + \left[\frac{gCO_2e}{MJ} \times \frac{MJ}{km}\right] \times km + CO_2e$$

Carbon Intensity gCO_{2e}/MJ

Energy Efficiency MJ/km

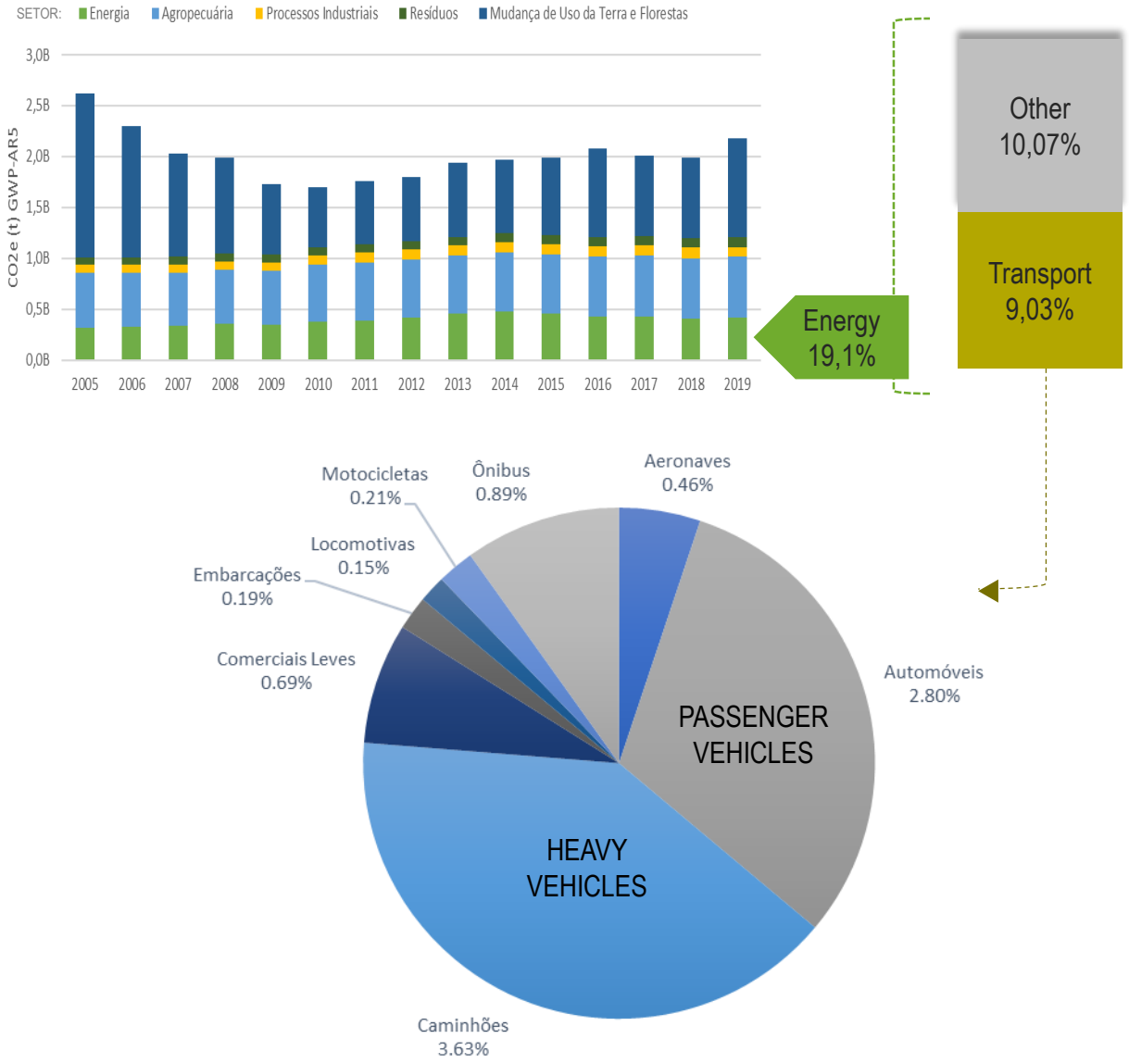
RenovaBio

ROTA 2030

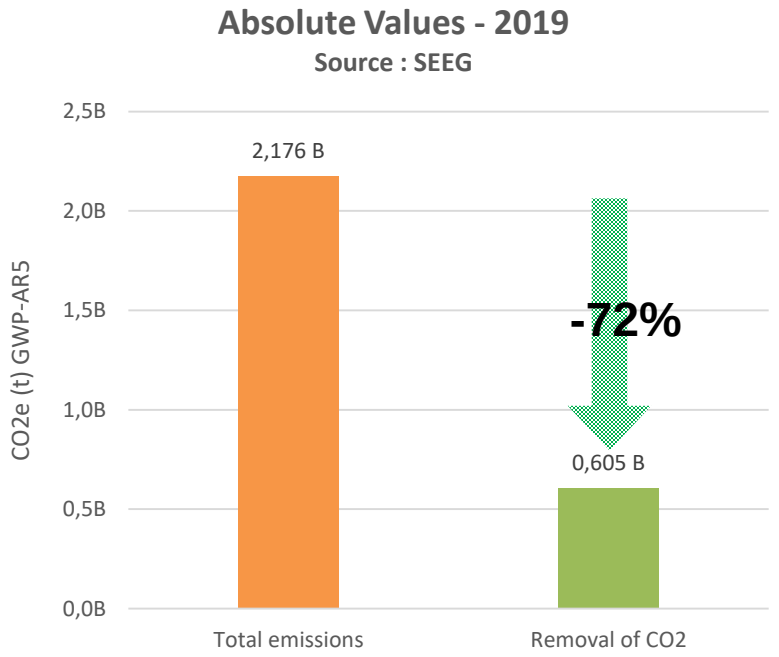
- WELL TO WHEEL CONCEPT IS KEY TO DETECT TECHNOLOGY AND FUEL MATRIX FOR CARBON NEUTRALITY
- ENVIRONMENT EFFICIENCY : CARBON INTENSITY ON ENERGY MATRIZ
- ENERGY EFFICIENCY: LINKED TO VEHICLE AND PWT TECHNOLOGY

CARBON NEUTRALITY ASSUMPTION – BIG CHALLENGE

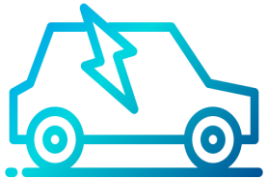
PARTICIPATION OF THE AUTOMOTIVE SECTOR IN THE COUNTY'S GLOBAL CO2 EMISSIONS



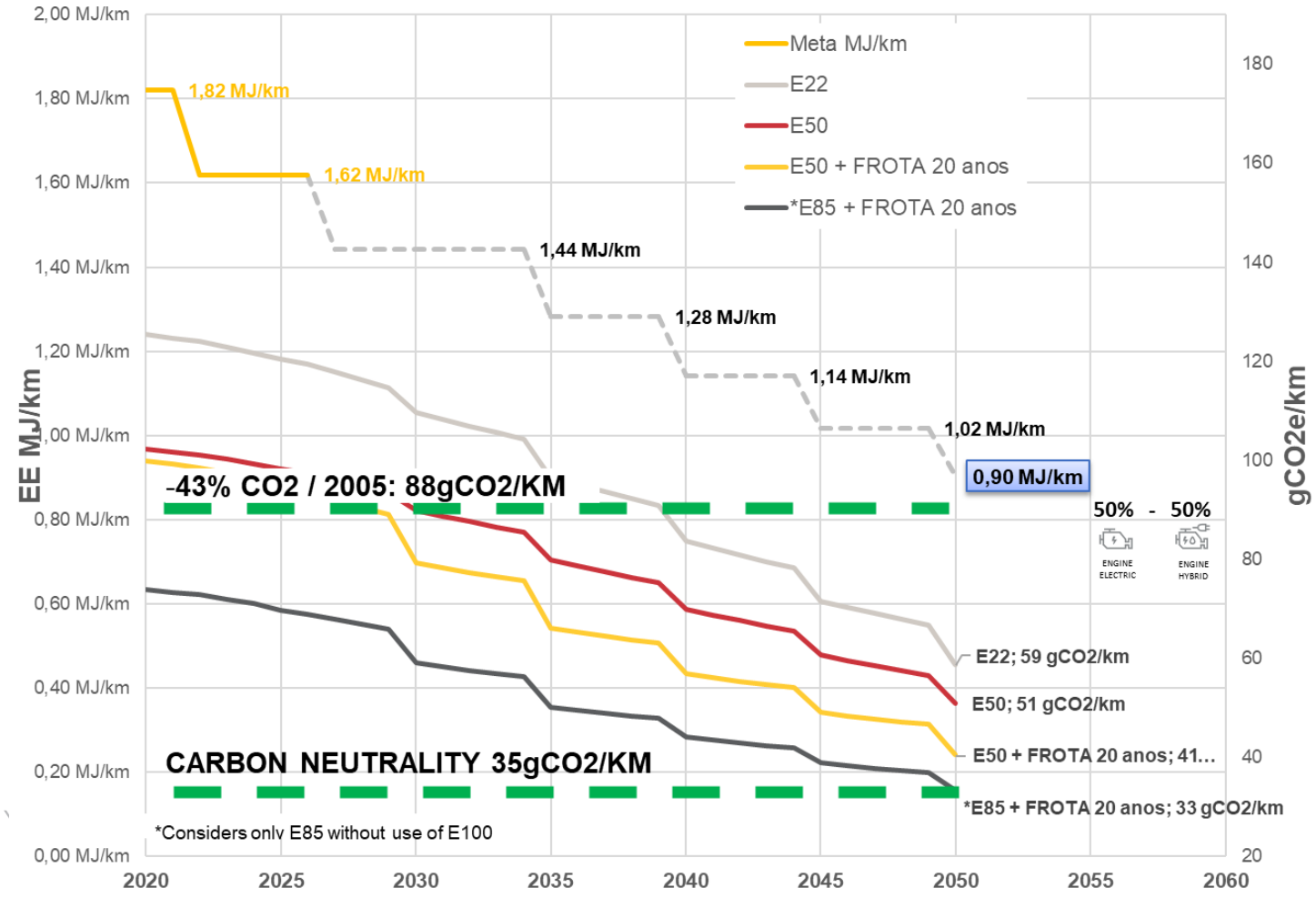
TARGET FOR CARBON NEUTRALITY IN USE PHASE: -72% gCO2/km



CARBON NEUTRALITY MAIN LEVERS

	PASSENGER VEHICLES	TRUCK / BUS / LIGHT COMMERCIAL CARS
ENERGY EFFICIENCY 	GDI → MHEV → HEV → EV Fuel Cell	EV / HEV: light commercial cars and bus Fuel Cell / H_2ICE: heavy truck Management intelligence of load and driving
ENVIRONMENT EFFICIENCY 	Increased ethanol consumption, Ethanol 2G, Clean Electric Energy	Opportunities: Biodisel H2 Verde Diesel Verde (HVO), E-fuel; 
FLEET RENEWAL 	Circulation limitation of legacy product	

CARBON NEUTRALITY MAIN LEVERS (SIMULATED CASE)



- COP 21 – ETHANOL PUSH
- ENERGY EFFICIENCY / ELECTRIFICATION
- BIOFUEL AS AN IMPORTANT ASSET
- FLEET RENEWAL POLITCS

CONCLUSION

Positive

- Public policy consolidation
  - Improvement in Energy Efficiency of new vehicles (new technologies)
  - Increase of renewable energy
  - Clean sources for electricity production
  - Increase absorption of CO2 (reduction of deforestation)
  - Renewal or fleet limitation policy
- Carbon market (purchase of credits)
- H_2 Market

Challenging

- Economic growth scenario
- Country Infrastructure (Ethanol and Electric recharge)
- Cost of new technologies (batteries and fuel cells / H2)
- Automotive industry's capacity for R&D investment


THANK YOU