Empresa de Pesquisa Energética

ANALYSIS OF BIOFUELS' CURRENT OUTLOOK

10th Edition Lauching

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Ministry of Mines and Energy

IN ITS 10th EDITION, THE DOCUMENT CONSOLIDATES THE MOST RELEVANT FACTS FROM THE BIOFUELS SECTOR

It adresses the **evolution of ethanol, biodiesel, bioelectricity and other biofuel indicators**, identifying the main events that happened in the reference period, as well as the short term key trends

Annual publishing to be launched in the 2nd quarter, after setting all data

ANALYSIS OF BIOFUELS' CURRENT OUTLOOK

The key topics are

- Ethanol supply and its infrastructure of production and transport
- Otto cycle demand
- Biofuels international market
- Economic analysis: Hydrous Ethanol vs "C" Gasoline
- Biodiesel
- Bioelectricity
- Greenhouse gas emissions

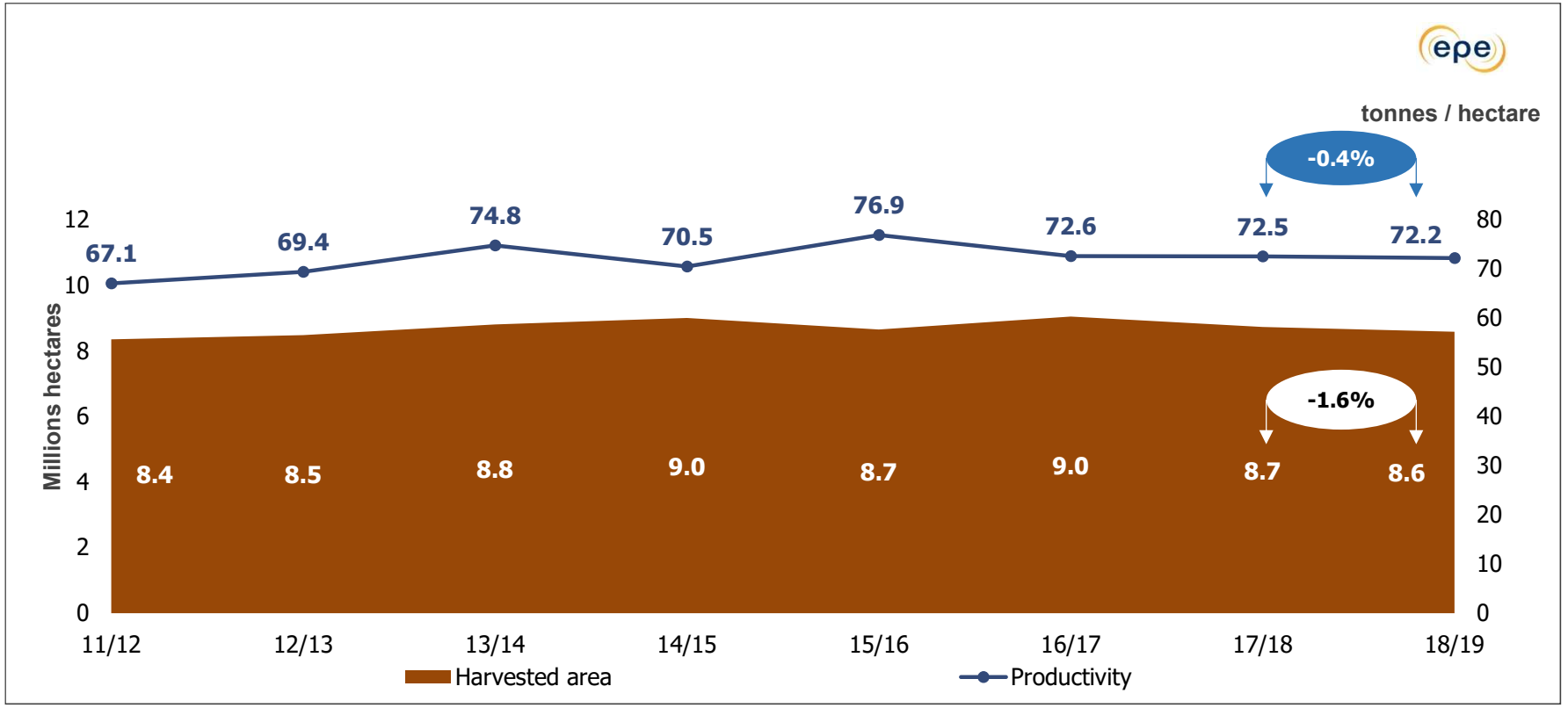
EACH EDITION PRESENTS A SPECIFIC TECHNICAL NOTE

In 2018	The biofuels´ role in the national energy matrix
In 2017	RenovaBio: the Biofuels National Policy and its deployment
In 2016	Impacts of tax differentiation between fuels: the Minas Gerais case study
In 2015	Biofuels incentive public policies
In 2014	The bioelectricity insertion in the national energy matrix
In 2013	Costs analysis of ethanol production
In 2012	Concentration and internacionalization of sugar-energy sector

ETHANOL SUPPLY

Sugarcane harvested area and productivity

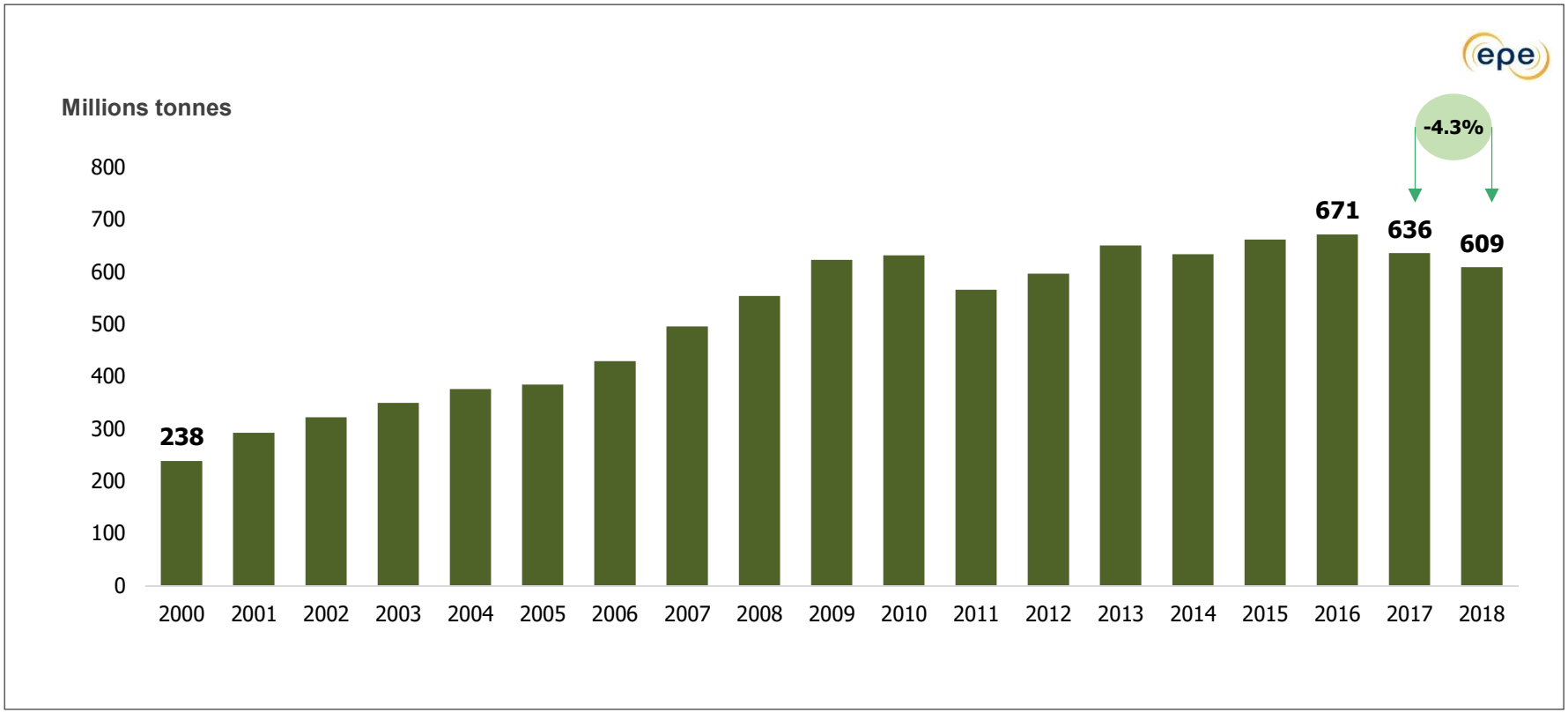
There was a 1.6% decrease in the harvested area, due to the growing of mechanization. As a result, some areas have been designed to other crops;
Crop yield and average age have been stable over the past three harvests, due to many factors: crop aging, low crop renewal, lack of investment, crop mechanization, etc.



Source: EPE based upon CONAB and MAPA

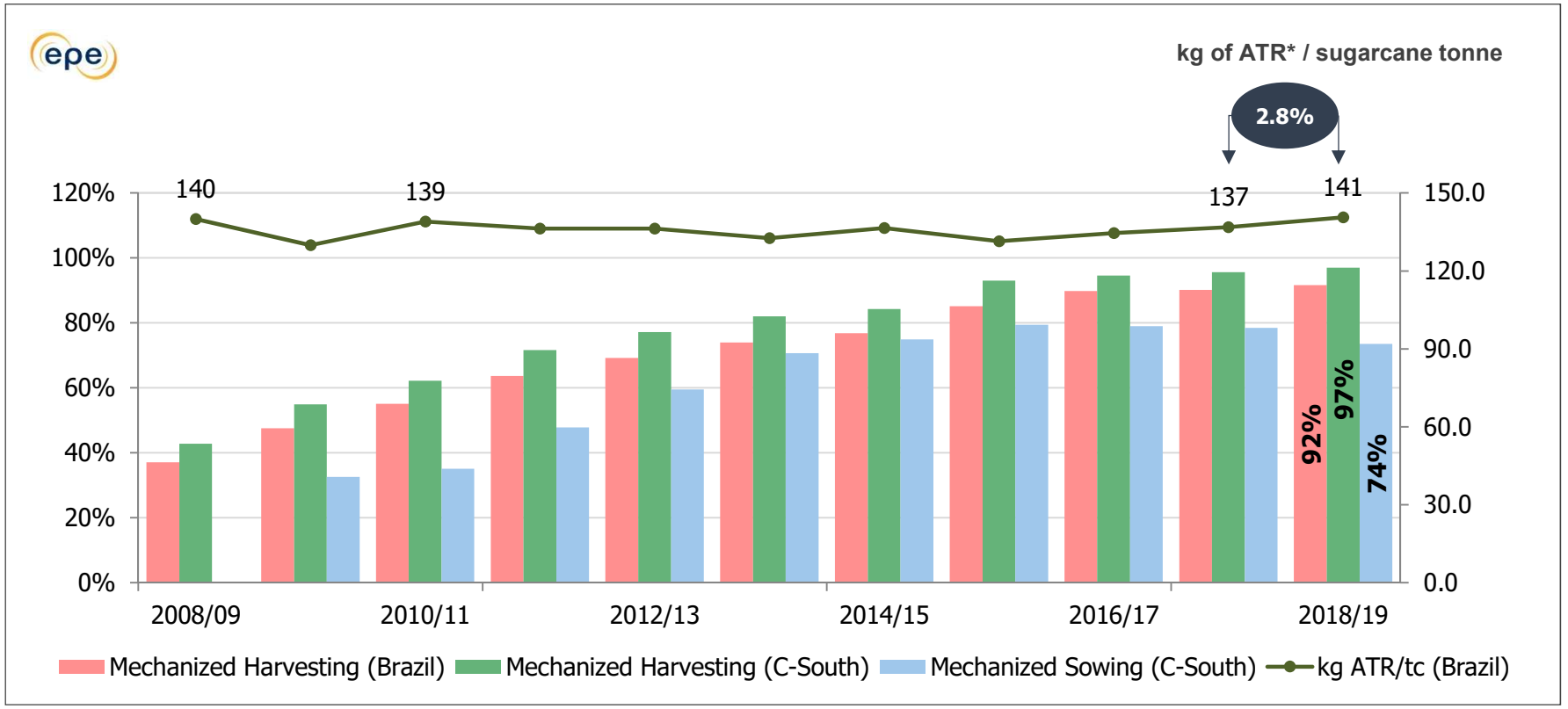
CRUSHED SUGARCANE

As a result of this dynamic (productivity + area), 609 million tons of sugarcane were processed in 2018, down 4.3%.



SUGARCANE YIELD vs MECHANIZATION

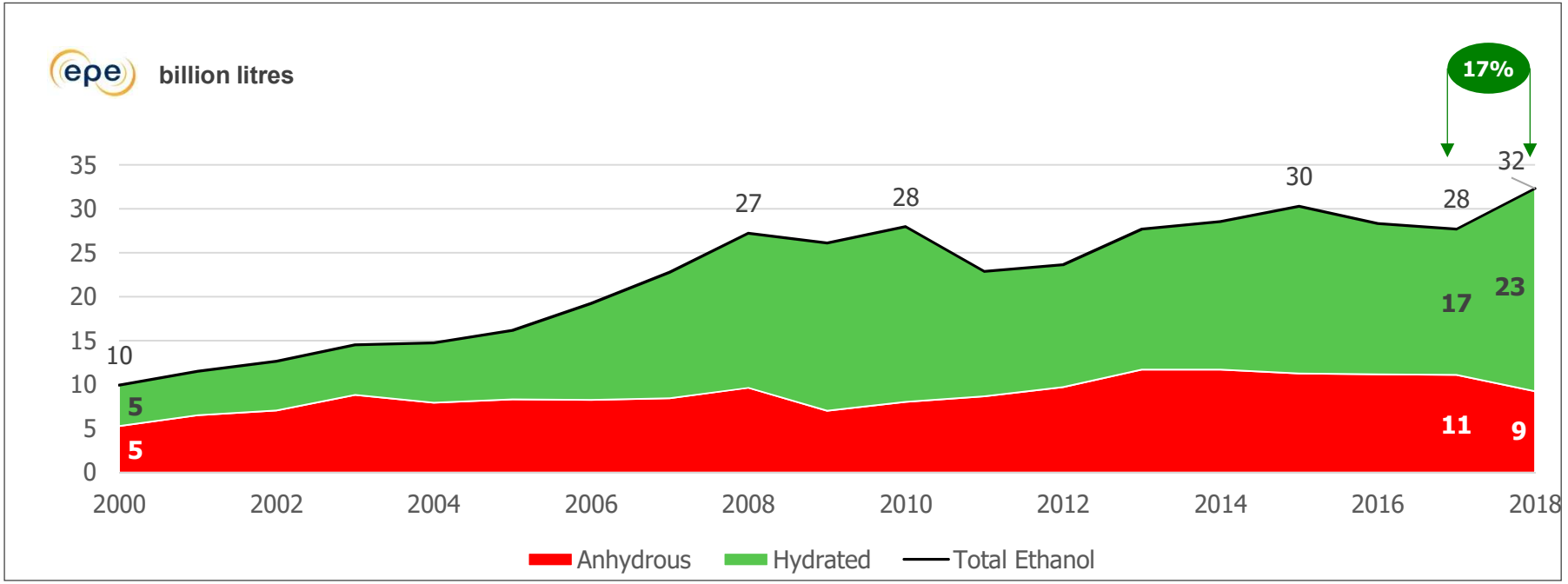
Sugarcane yield reached a record this season, the highest since 2008/09 harvest. Climatic conditions, mineral and vegetable impurities and lag between mechanization deployment and harvest are key factors.



Source: EPE based upon CONAB. CTC. MAPA and ÚNICA
* ATR is Total Recoverable Sugar. in its acronym in Portuguese.

BRAZILIAN ETHANOL PRODUCTION

The 2018 increase in ethanol production was due to: decrease in sugar prices, world surplus in the 2017/18 crop; and more ethanol-friendly relationship between the average prices of hydrous ethanol and the C-type gasoline.



413 ML [2017]

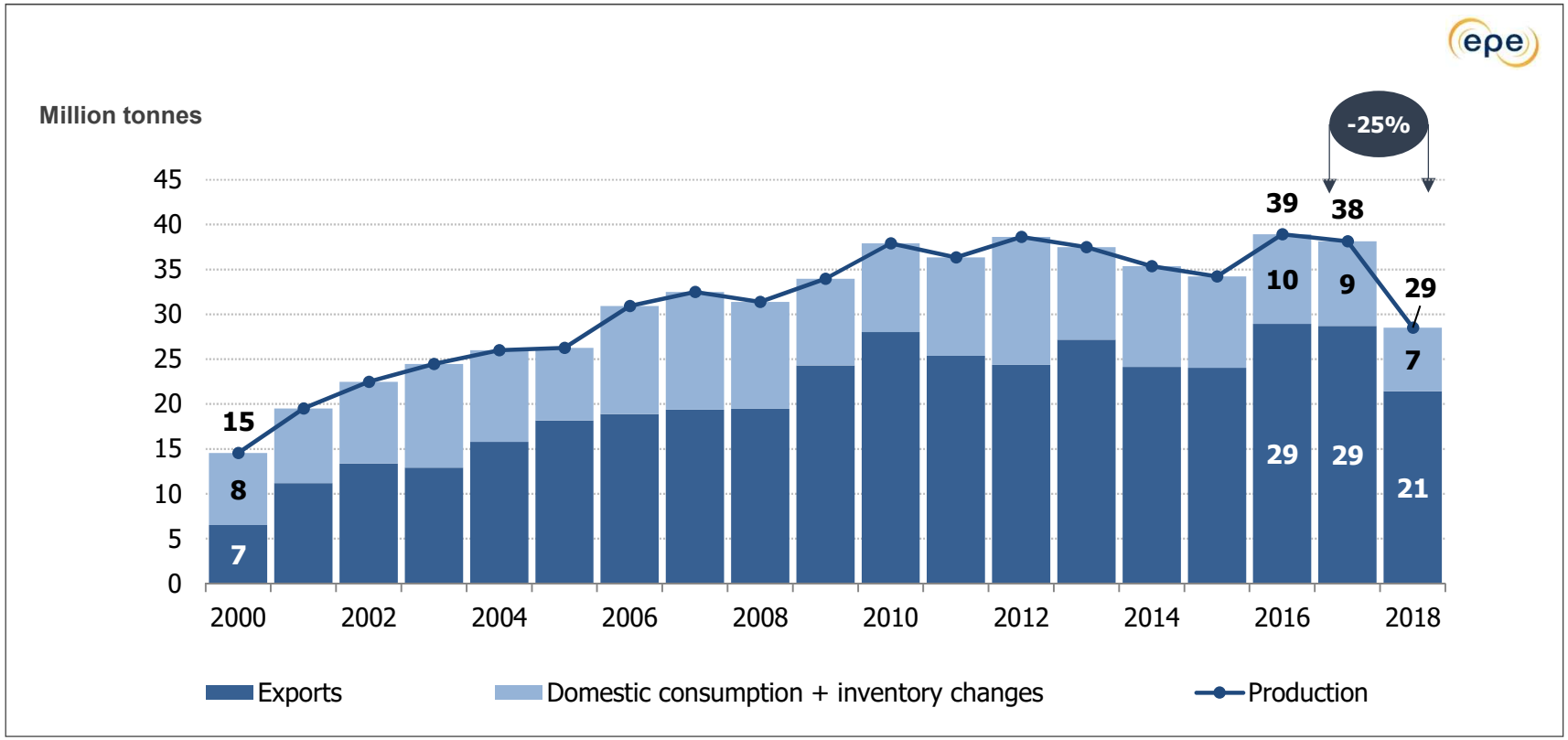
720 ML [2018]

Source: EPE based upon CONAB, CTC, MAPA and UNICA

* ATR is Total Recoverable Sugar. in its Portuguese acronym.

BRAZILIAN SUGAR MARKET: PRODUCTION, CONSUMPTION AND EXPORTS

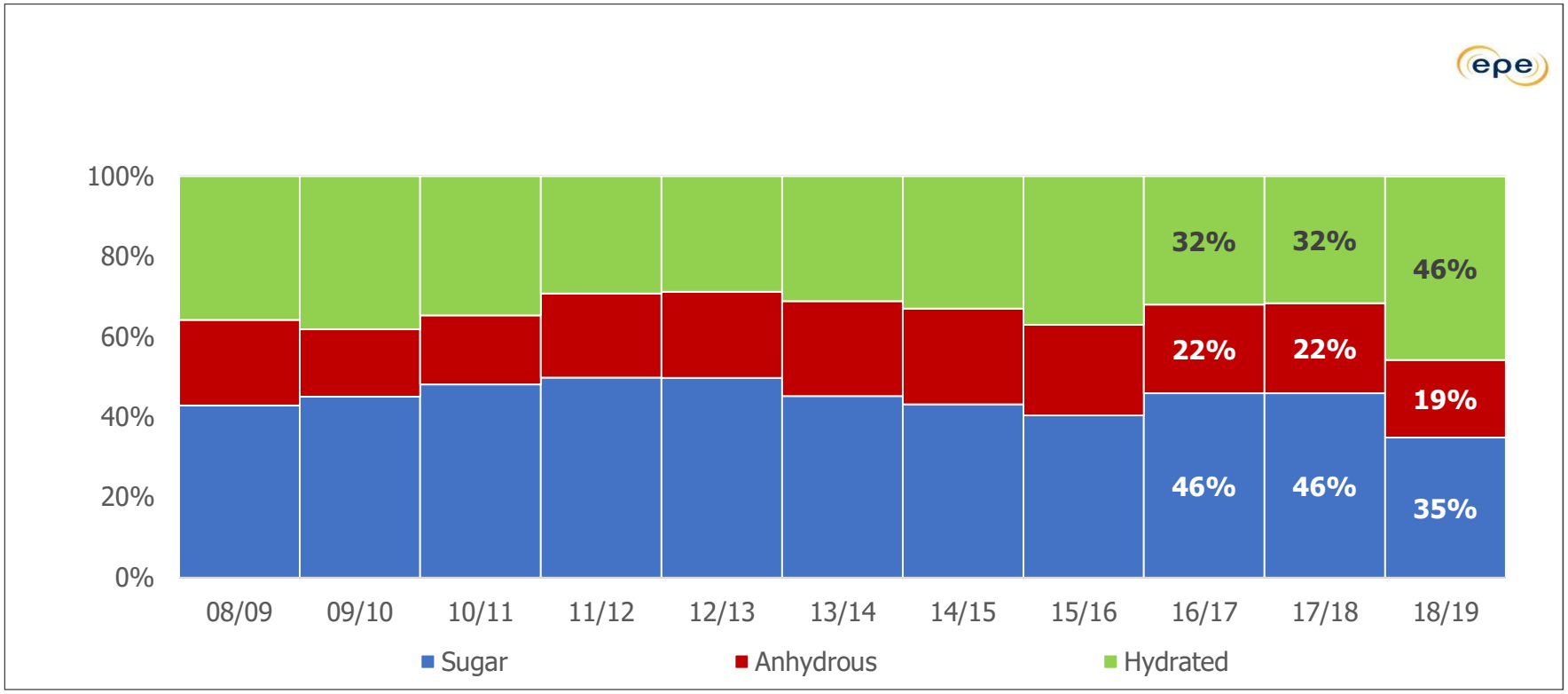
For the 2018/19 world harvest season, it is expected a surplus of 480.000 tons and a stock / consumption ratio of 47.3%, due to higher inventories and higher-than-expected production in India and Thailand.



Source: EPE based upon data gathered by MAPA

PRODUCTION MIX: SUGAR VS ETHANOL

As sugar world stocks were high, the 2018/19 crop presented a 11 pp variation for ethanol, boosting a predominantly alcohol profile.



Source: EPE based upon data gathered by MAPA

ETHANOL PRODUCTION CAPACITY

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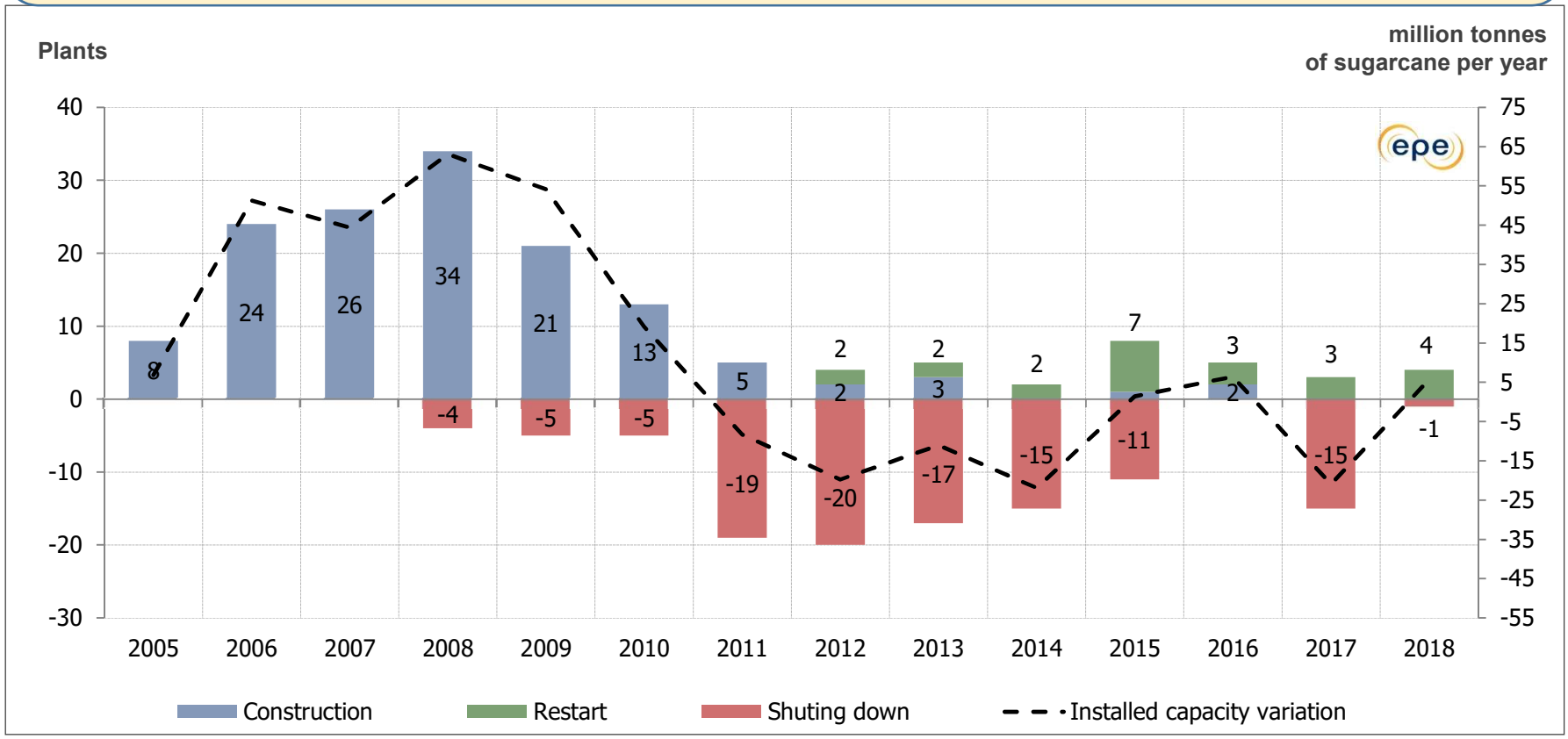
CONSTRUCTION, RESTART AND SHUTING DOWN OF BRAZILIAN SUGARCANE REFINERIES

In 2018, restart of 4 Production Units (8Mtc), shuting down of one unit (2Mtc), resulted in 369 operating sugar-ethanol units in the end of the year. This corresponds to an effective milling capacity of about 750 million tons (occupancy rate of about 81%).



Source: EPE based upon data gathered by MAPA and UNICA

ETHANOL PRODUCTION CAPACITY – OPERATIONAL PLANTS IN 2018

In 2018, a small flex unit of corn ethanol was installed.
Total maize processing capacity is 2.1 million tonnes / year and ethanol production is about 900 million liters / year.
Seven units under construction, mostly full type, will add 2.2 billion liters.

369 **Sugar-energy refineries**

Effective sugarcane grinding capacity
million tonnes / year

750

1 *full of corn*
7 flex

Effective corn processing capacity
million tonnes / year

2.1

Source: EPE based upon data gathered by MAPA e UNICA

BIOFUELS
INTERNATIONAL MARKET

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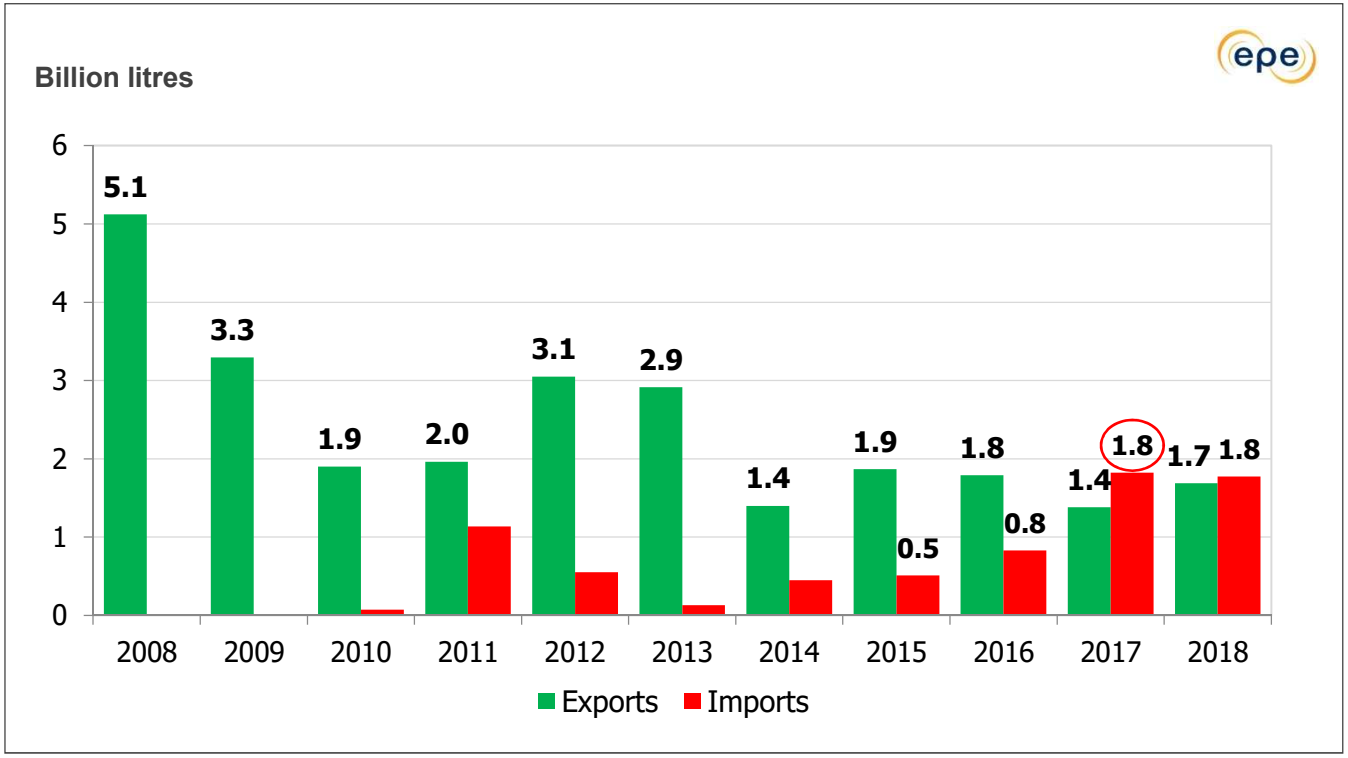
Ministry of Mines and Energy

BRAZILIAN ETHANOL EXPORTS

Brazil was a net importer of ethanol in 2018.
The favorable corn crop in the US resulted in ethanol oversupply (*), combined with the smooth exchange rate (around R$ 3.19 / US$ in 2017) explain the net importer profile.



2018
Second year of net imports

N° 72 CAMEX Resolution
29th August 2017
Tax on Imported ethanol
Valid aug. 2019

2019
[jan. – may]
- **Imp. 0.8 bi L**
- **Exp. 0.5 bi L**

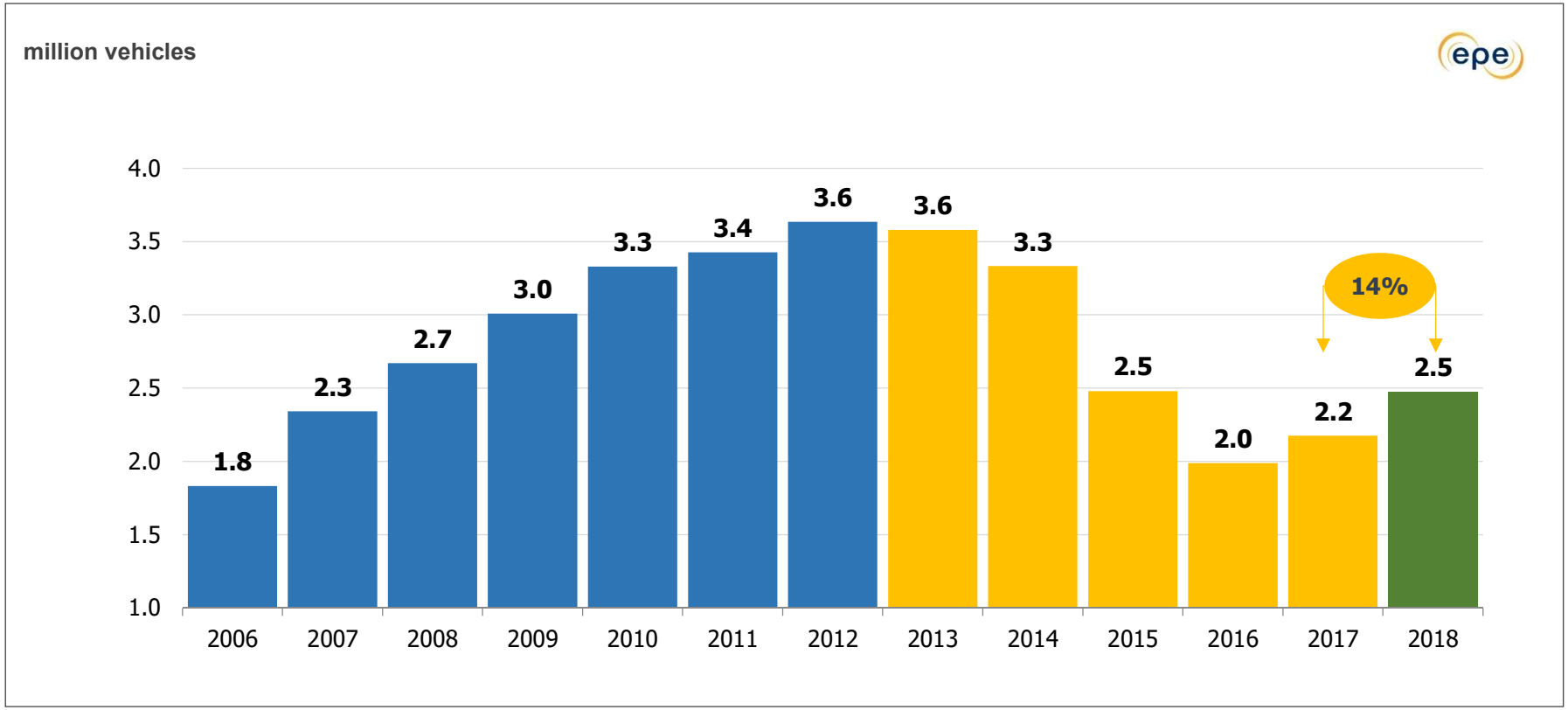
Source: EPE based upon data gathered by MDIC

(*) Due to the blend wall and barriers to imports from China.

OTTO CYCLE DEMAND

LIGHT VEHICLES SALES

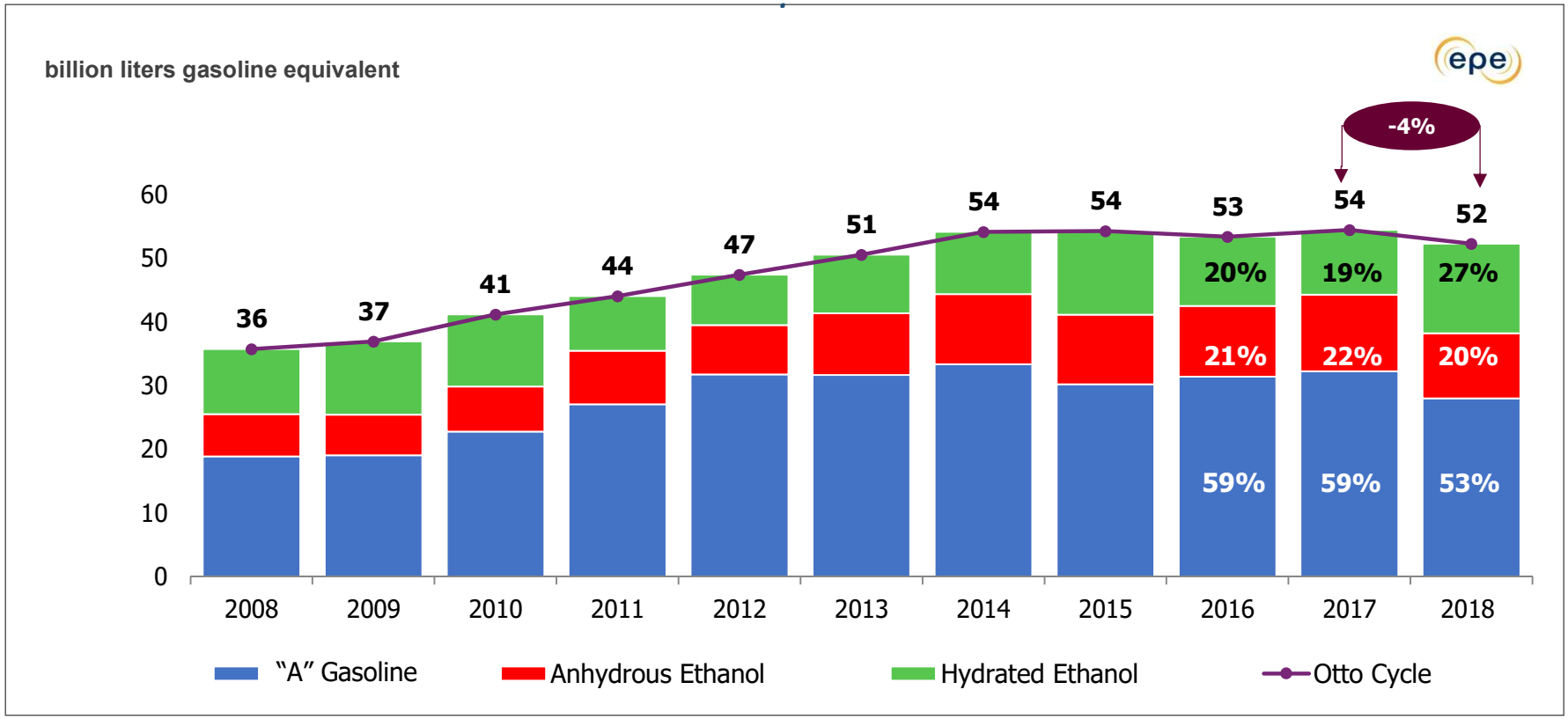
Second increase after a period of four consecutive declines in annual licensing, reaching the same level as in 2007 (84.8% Cars and 15,2% Light Commercial Vehicle). The Brazilian light vehicle fleet was 37 million in 2018, 76.4% of flex fuel.



Source: EPE based upon data gathered by ANFAVEA and EPE

OTTO CYCLE DEMAND

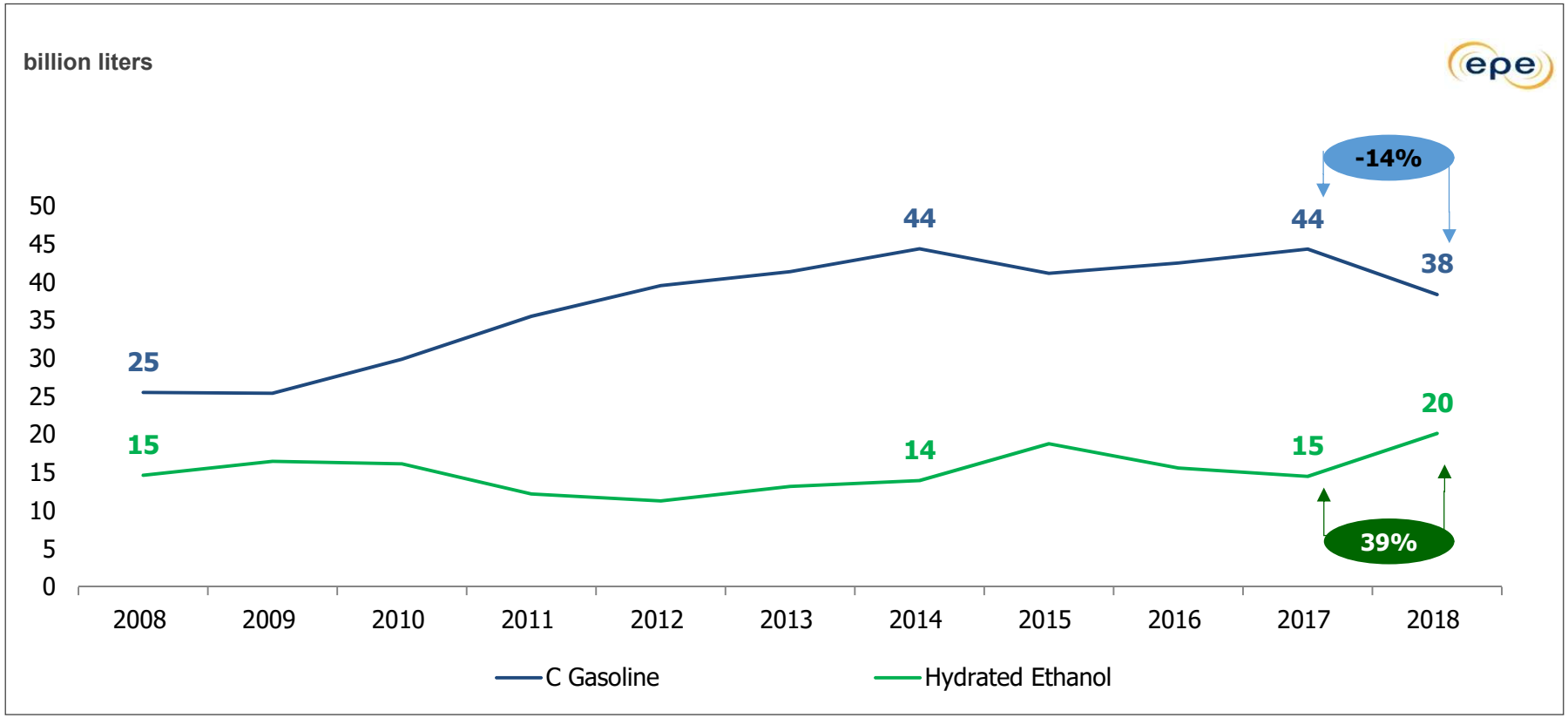
Otto cycle total energy demand decreased 4%, to 524 billion liters of gasoline equivalent. As a result, the A-type gasoline share fell from 59% to 53%, as anhydrous ethanol went from 22% to 20%. Hydrous ethanol increased from 19% to 27%.



Source: EPE

C-TYPE GASOLINE AND HYDROUS ETHANOL DEMAND

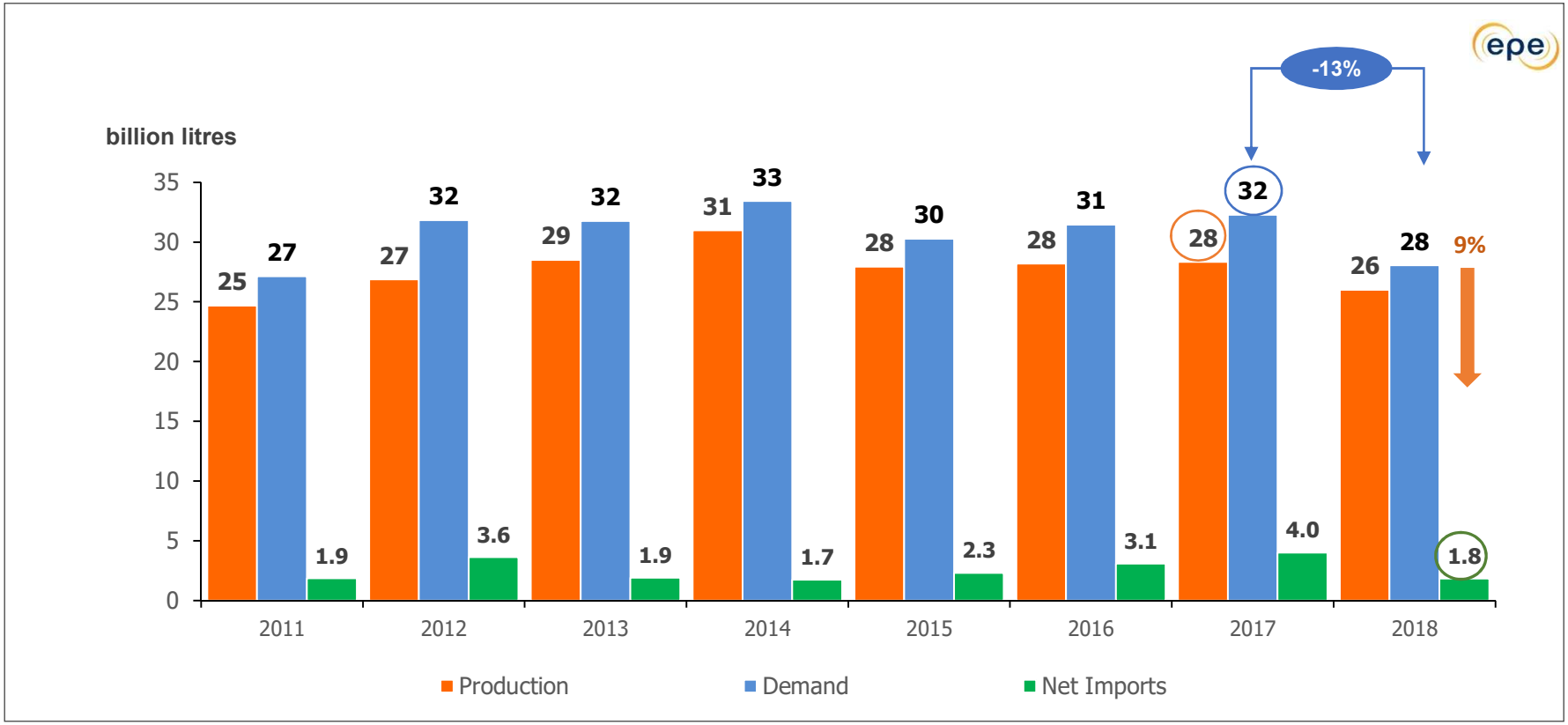
Growing of ethanol demand and price was caused by sharp drop in international sugar price following 2017 trend.
Decrease in gasoline price was due to several adjustments according to the Petrobras' parity price policy and changing of PIS/COFINS taxation on fuel imports and sales (Decrees No. 9,101, of July 20, 2017, and No. 9,112, of July 28, 2017).
As a result, there was an increase in PE/PA ratio this season.



Source: EPE based upon data gathered by ANP e EPE

A-TYPE GASOLINE PRODUCTION, DEMAND AND NET IMPORTS

The Otto cycle total energy demand decreased 4% to 52.4 billion liters of gasoline equivalent. As a result, the A-type gasoline share fell from 59% to 53%, as anhydrous ethanol went from 22% to 20%. Hydrous ethanol increased from 18.7% to 26.9%.

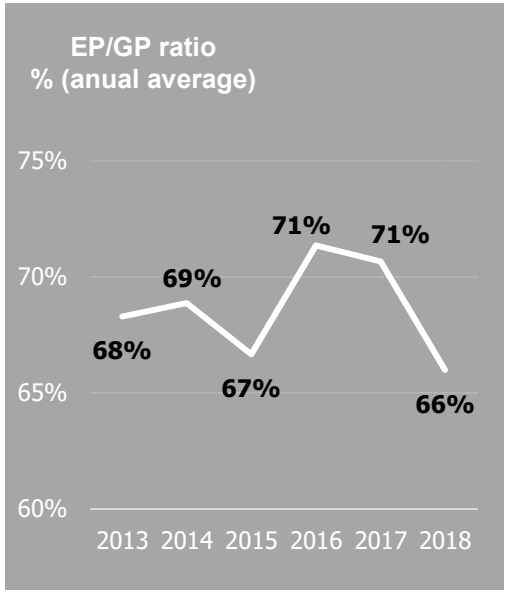


Source: EPE based upon data gathered by ANP and EPE

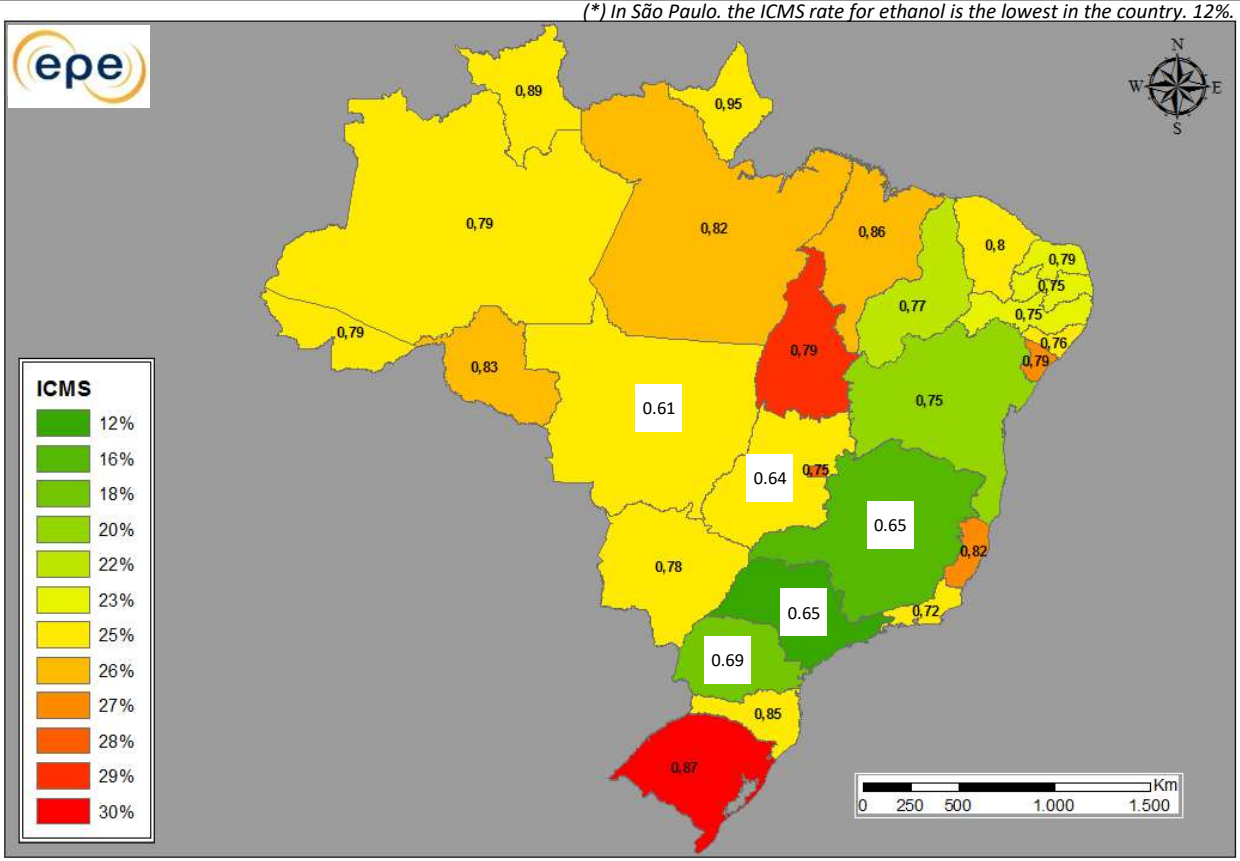
ECONOMIC ANALYSIS

In 2018, average PE / PG ratio was 66%. Mato Grosso state presented the lowest average ratio: 60.5%. In São Paulo, the largest producer and consumer ratio was 64.7%. The least competitive states were Amapá and Roraima, with 95% and 89% ratios, respectively.

EP/GP ratio and ethanol trade and services tax (ICMS) rate in 2018



(*) In São Paulo. the ICMS rate for ethanol is the lowest in the country. 12%.



Source: EPE based upon ANP. CONFAZ/MF and FECOMBUSTÍVEIS

BIOELECTRICITY

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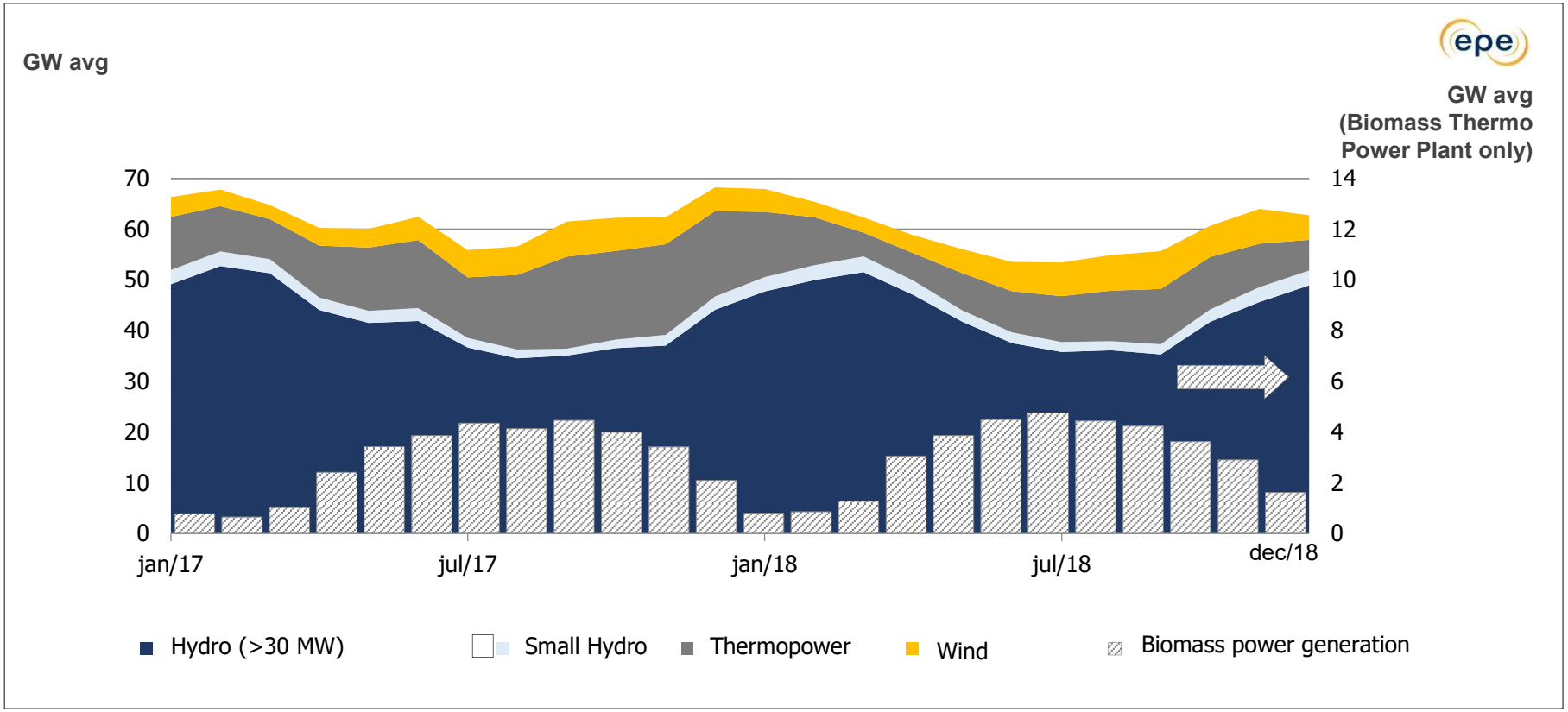
BIOMASS SHARE IN TOTAL ELECTRIC GENERATION

In 2018, sugarcane energy share in the national matrix was 3.9%. Energy injected into the Interconnected Electric System (SIN) was 2.5 GW_{avg}.
Sugarcane bagasse remains the main feedstock, but, there was a significant increase in the share of other biomass in the export to SIN.

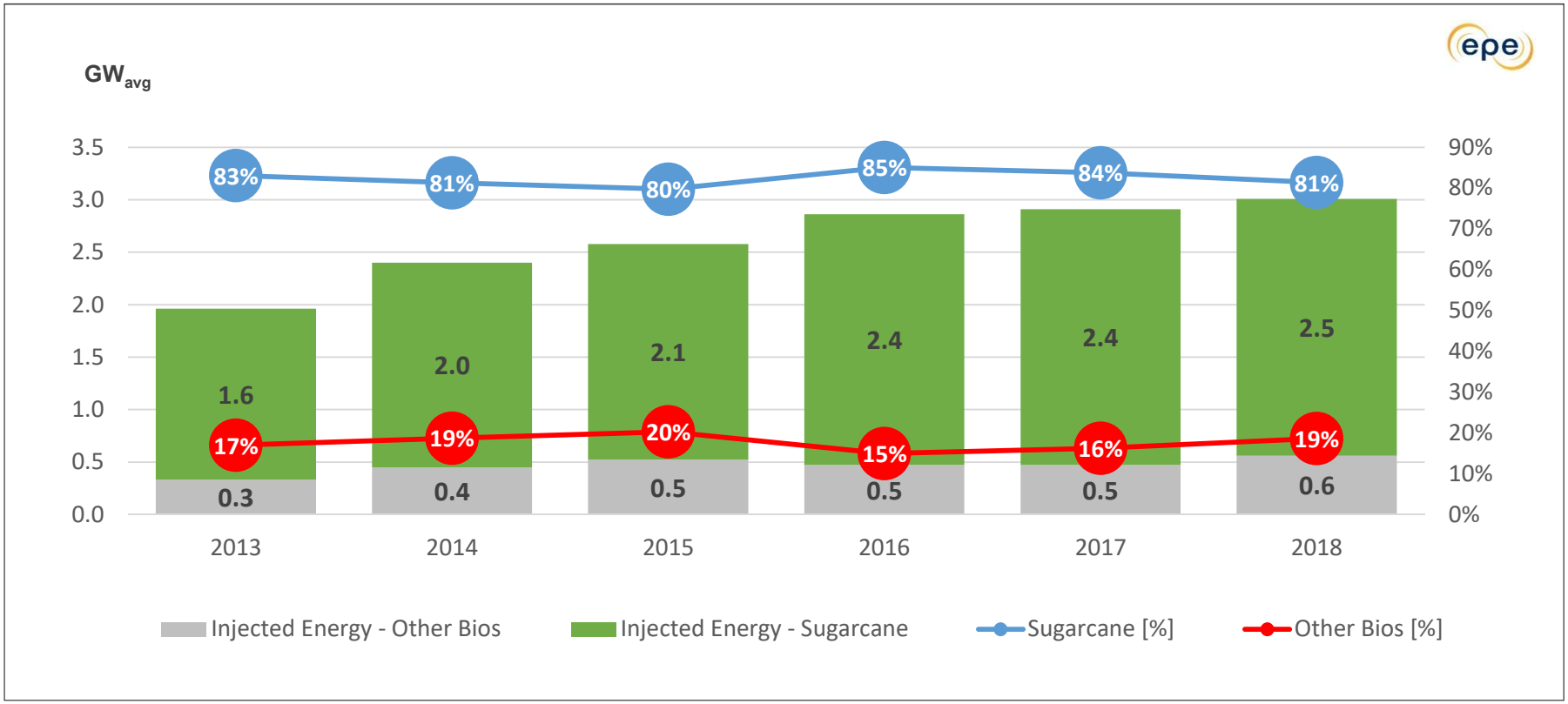


Source: EPE based upon CCEE

GWavg: energy unit

BIOELECTRICITY - EXPORTED ENERGY TO SIN (*)

In the last five years, electricity from biomass has greatly increased (at a rate of 18% by year), resulting in a 560 MW_{avg} injection in the electric matrix.
Biomasses excluding sugarcane corresponded to 1.1% of the electric matrix.



*SIN = Interconnected Electric System.

BIODIESEL

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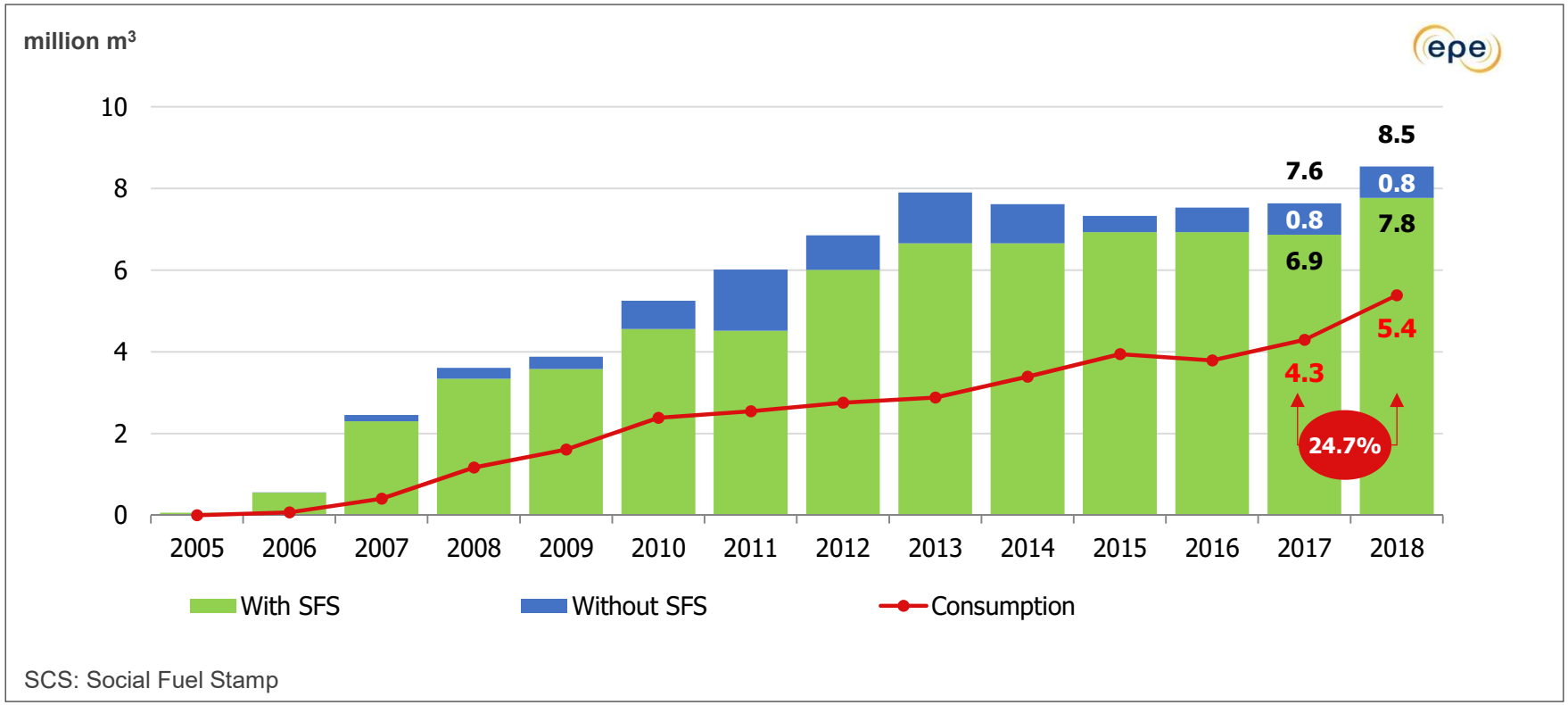
INSTALLED PRODUCTION CAPACITY AND BIODIESEL CONSUMPTION

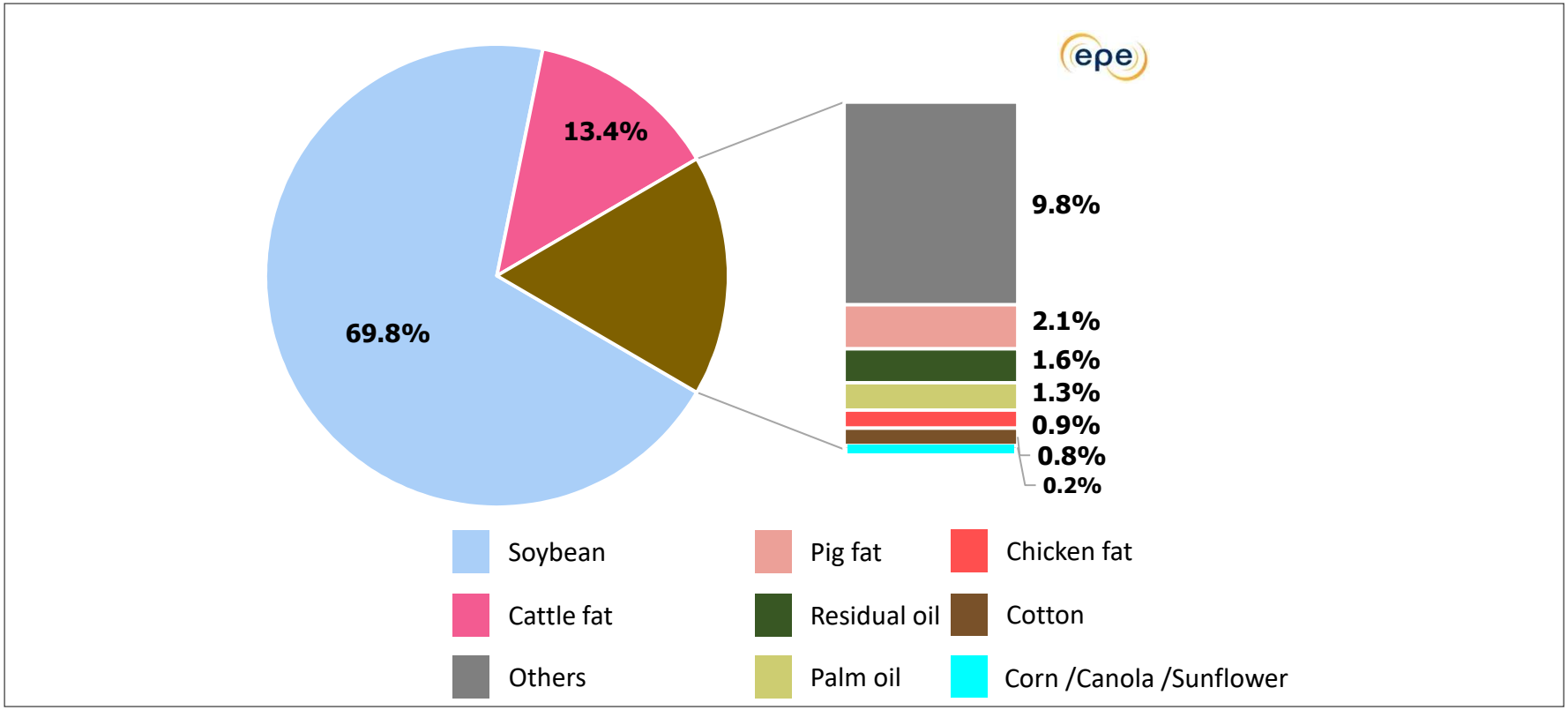
Mandatory biodiesel percentage increased to 10% in march, 2018 (CNPE Resolution nº 23/2017). Biodiesel consumption reached 5.4 billion liters in 2018 (a record), corresponding to 63.5% of installed capacity.
CNPE has enacted a Resolution proposing a chronogram for B15, until 2023.



Source: EPE based upon ANP and MME

FEEDSTOCK SHARE FOR BIODIESEL PRODUCTION IN 2018

In 2018, soybean feedstock share stayed at the same levels of 2017 (70%). Central-West and South Regions (41% each) remain as main producers



Source: EPE based upon ANP and MME

GREENHOUSE GAS EMISSIONS

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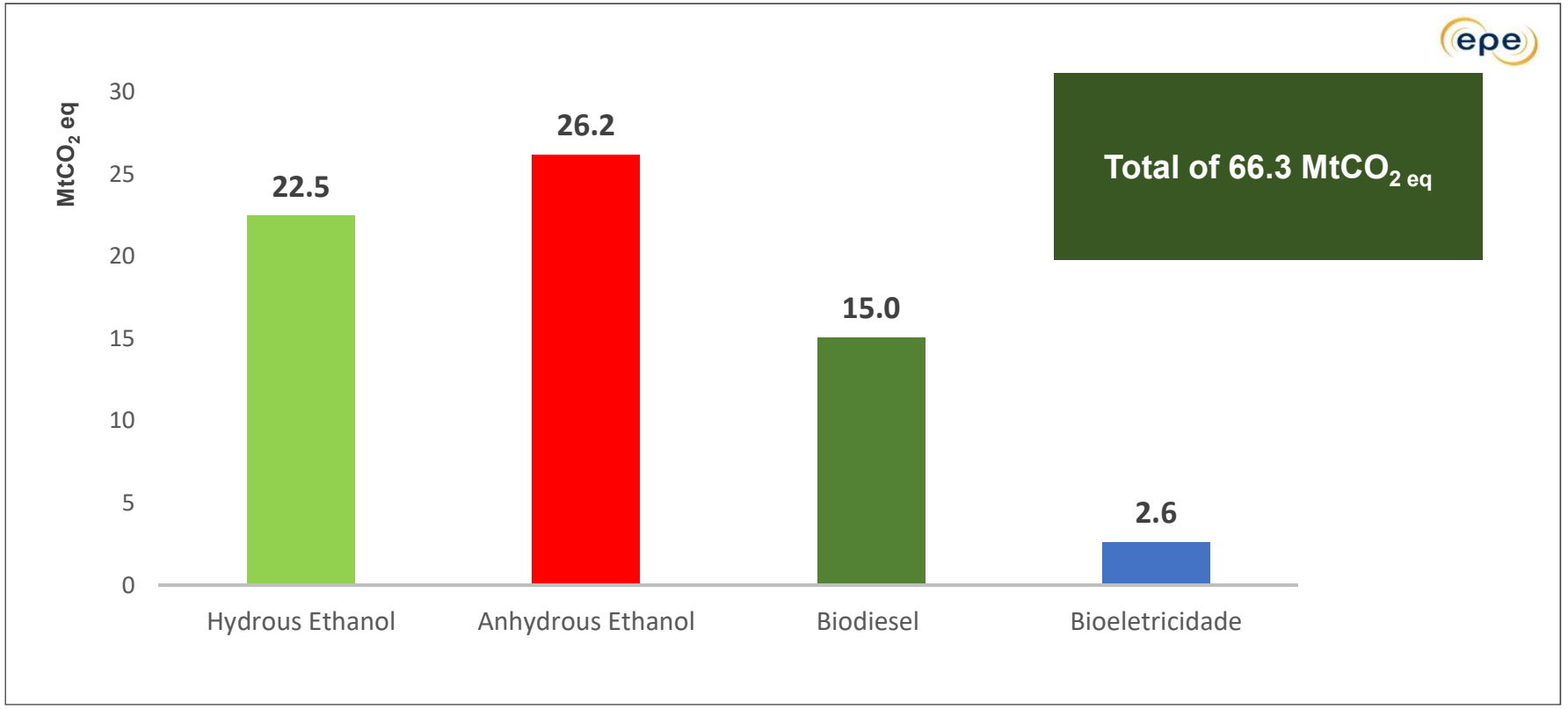
AVOIDED GHG EMISSIONS WITH BIOFUELS IN BRASIL IN 2018

The demand for hydrous ethanol in 2018 was 20.1 billion litres, a 38.6% growth compared to 2017; C-type gasoline consumption reached 38 Billion liters, down 13.4% from 2017.



Source: EPE based upon data gathered by EPE and IPCC

RENOVABIO

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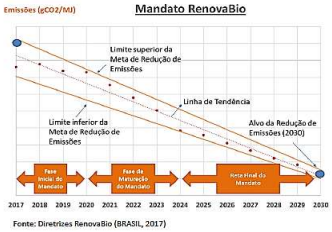
STRUCTURING ACTIONS FOR THE IMPLEMENTATION OF RENOVABIO IN 2018

1 National Targets of Decarbonization

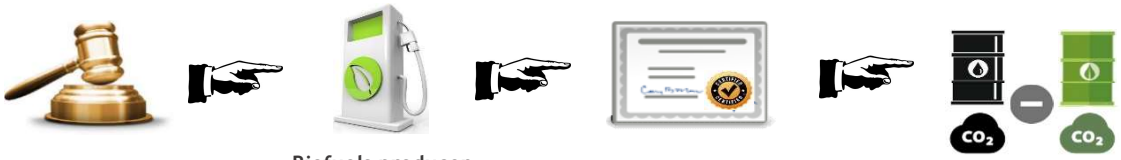
- June 2018 – CNPE Resolution Nº 5 established the compulsory annual GHG emission reduction targets for fuel trading - 10.1% p.y.



Fonte: Diretrizes RenovaBio (BRASIL, 2017)

2 Biofuel Production Certification

- November 2018 - ANP Resolution Nº 758/2018 regulated the Certification of Efficient Biofuel Production or Imports, defined the requirements for the accreditation of inspector firms and the criteria for calculating the Energy-Environmental Efficiency Rating of biofuel producer and importer.



STRUCTURING ACTIONS FOR THE IMPLEMENTATION OF RENOVABIO IN 2019

1 National Targets of Decarbonization

- June 2019 – ANP Resolution Nº 791 provide criteria for the individual obligation of the annual compulsory GHG emissions reduction targets;
- June 2019 – CNPE ratified the annual compulsory greenhouse gas emission reduction targets for fuel trade (10.1% p.y.) and adds the year 2029.

2 Decarbonization Credits (CBIO)

- In progress: development of information control and storage systems for RenovaBio;
- Second half of 2019: publishing of the resolution that will deal with aspects related to decarbonization credits (CBIO).

THE BIOFUELS´ ROLE IN THE NATIONAL ENERGY MATRIX

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BIOFUELS' ROLE IN THE NATIONAL ENERGY MATRIX

Objectives

- Evolution of energy matrix in the last decade
- Public policies
- Benefits

Repercussions

- Security of Energy Supply
- Economic, social and environmental aspects
- Energy Transition

INTRODUCTION

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In 2016	Impacts of tax differentiation between fuels: the Minas Gerais case study
In 2015	Biofuels incentive public policies
In 2014	The bioelectricity insertion in the national energy matrix
In 2013	Costs analysis of ethanol production
In 2012	Concentration and internacionalization of sugar-energy sector

INTRODUCTION

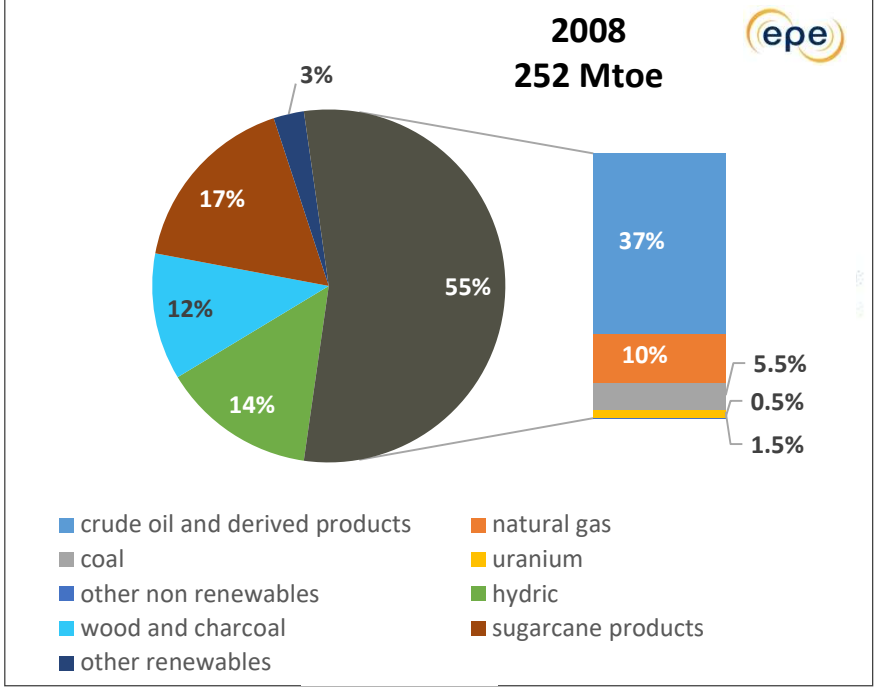
Key themes discussed

- High availability of energy resources
- Soil and climatic conditions
- % Renewable Sources in the Internal Energy Supply (IES)
- Public Policies
- RenovaBio and International Climate Agreements
- Energy Transition
- Perspectives of Energy Matrix

NATIONAL ENERGY MATRIX

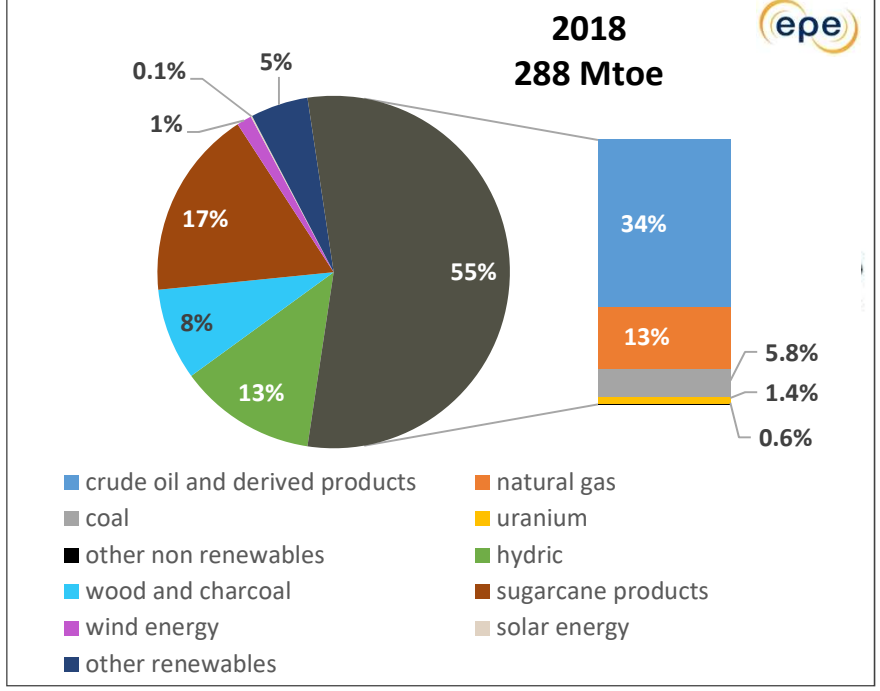
From 2008 to 2018, while the internal energy supply rose 14%, the renewable energy share reached 43.3%, with solar, wind and other renewable sources more than doubling its share from 2.8% to 6.8%. As a result, wood/charcoal and hydropower reduced their shares respectively to 8.4% and 12.6%.

INTERNAL ENERGY SUPPLY BY SOURCE - 2008



Source: EPE

INTERNAL ENERGY SUPPLY BY SOURCE - 2018



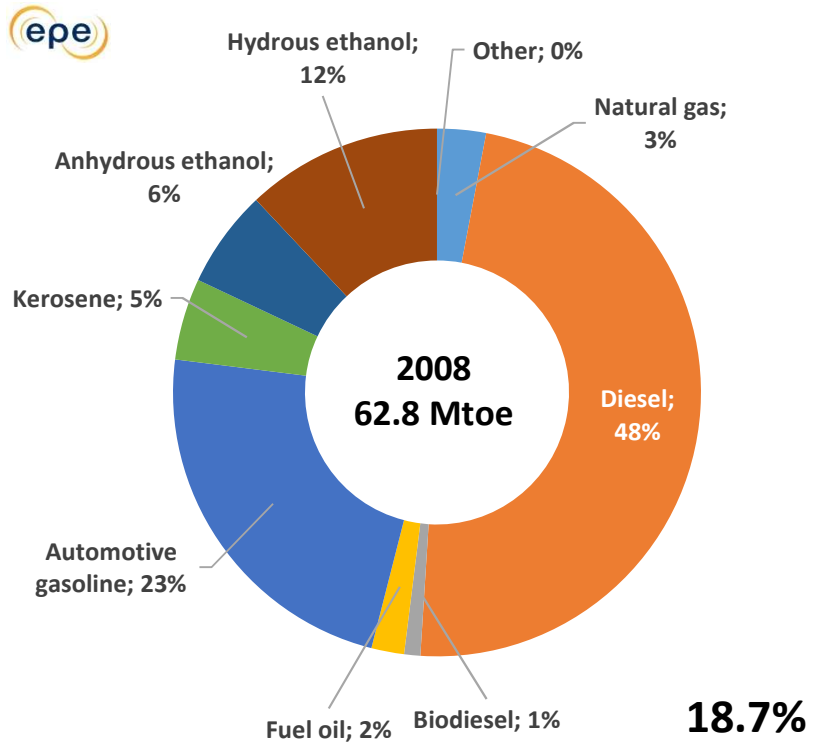
WORLD - IES 14% Renewable
(average. 2017)

Source: IEA

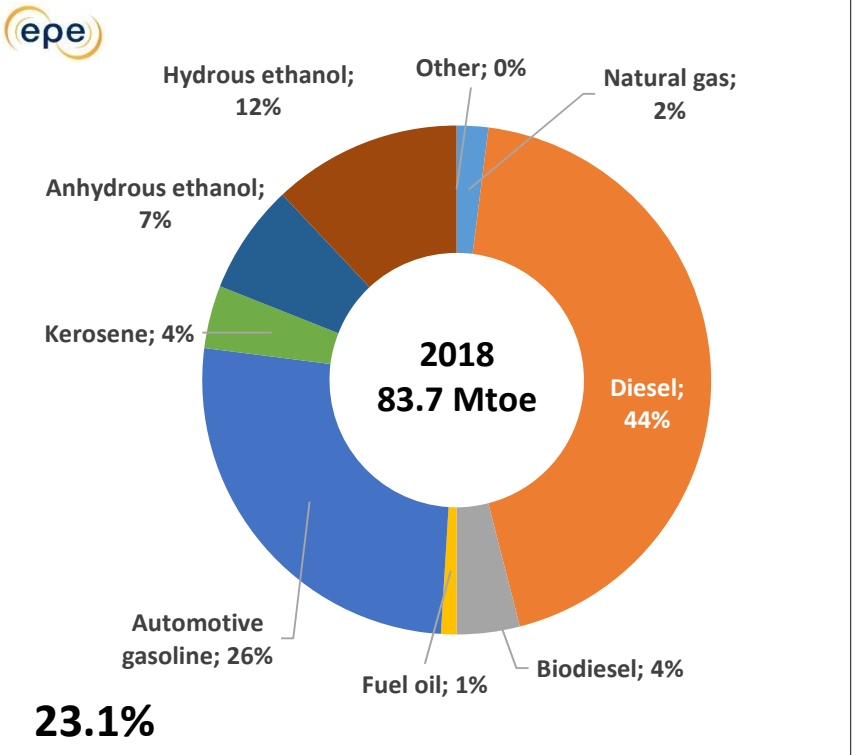
SECTORIAL ANALYSIS – TRANSPORT - 2008-2018

From 2008 to 2018, biofuels share in the transport energy matrix has increased from 18.7% to 23.1%, with an renewables growth of 8 Mtoe or 40%. The sugarcane products share kept its level, with the energy use counting for 50% of this share and the industrial part for 16%.

SECTORIAL ANALYSIS TRANSPORT - 2008



SECTORIAL ANALYSIS TRANSPORT - 2018

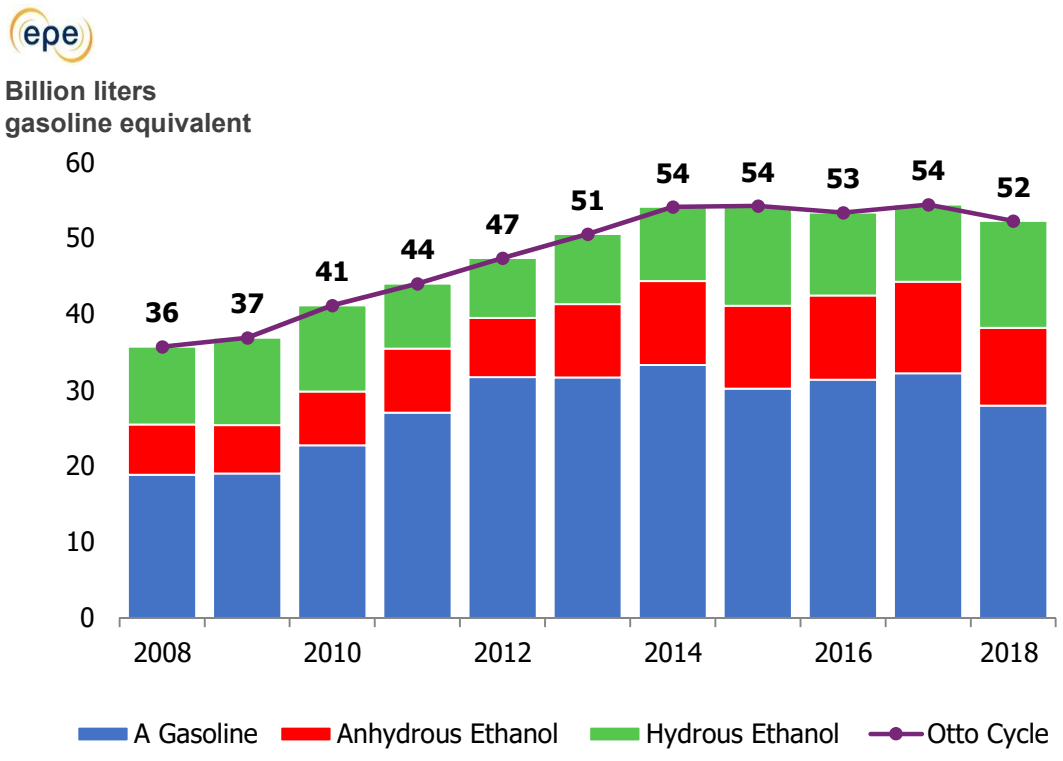


Source: EPE

BIOFUELS SHARE IN OTTO CYCLE CONSUMPTION - 2008-2018

From 2008 to 2018, ethanol use has increased expressively to 7.4 billion liters, while the A-type gasoline demand has increased only 9 Billion liters, driven by light vehicles efficiency and fuel prices ratios. Because of its production increase, the avoided imported A-type gasoline reached 218 Billion litters.

ETHANOL SHARE IN OTTO CYCLE CONSUMPTION



Source: EPE

RELEVANT MILESTONES

Proálcool – 1970's
Flex Fuel – 2003

EPE Articles
2012 Sector Concentration
2013 Cost Analysis
2015 Public Policies
2016 Tax Diferentiation

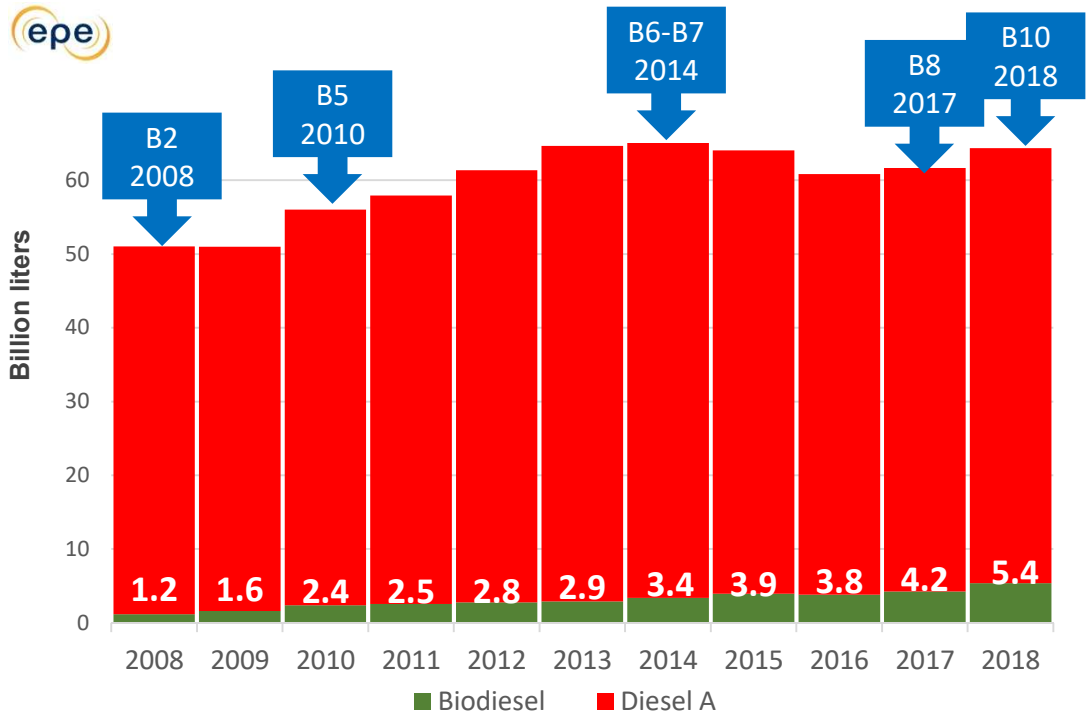
Ethanol growth: 7.4 BL
2008 – 2018 (gasoline eq.)

A- type gasoline imports avoided:
218 BL

BIOFUELS SHARE IN DIESEL CYCLE CONSUMPTION - 2008-2018

The National Program for the Production and Use of Biodiesel (PNPB) was based on three basic pillars: social inclusion through family farming, environmental sustainability and economic viability. The Program allows, through different technological routes, the use of the various oilseeds existing in Brazil, according to the potentialities of each region, reducing the economic inequalities between them.

BIODIESEL SHARE IN DIESEL CYCLE CONSUMPTION



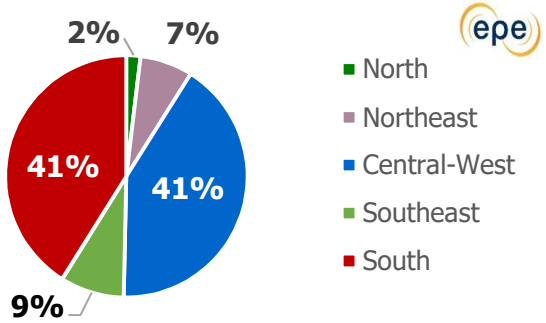
Source: EPE

RELEVANT MILESTONES

11,097/2005 PNPB Law

Stamp Social Fuel
Avoided imports 34 Bi liters of A type diesel

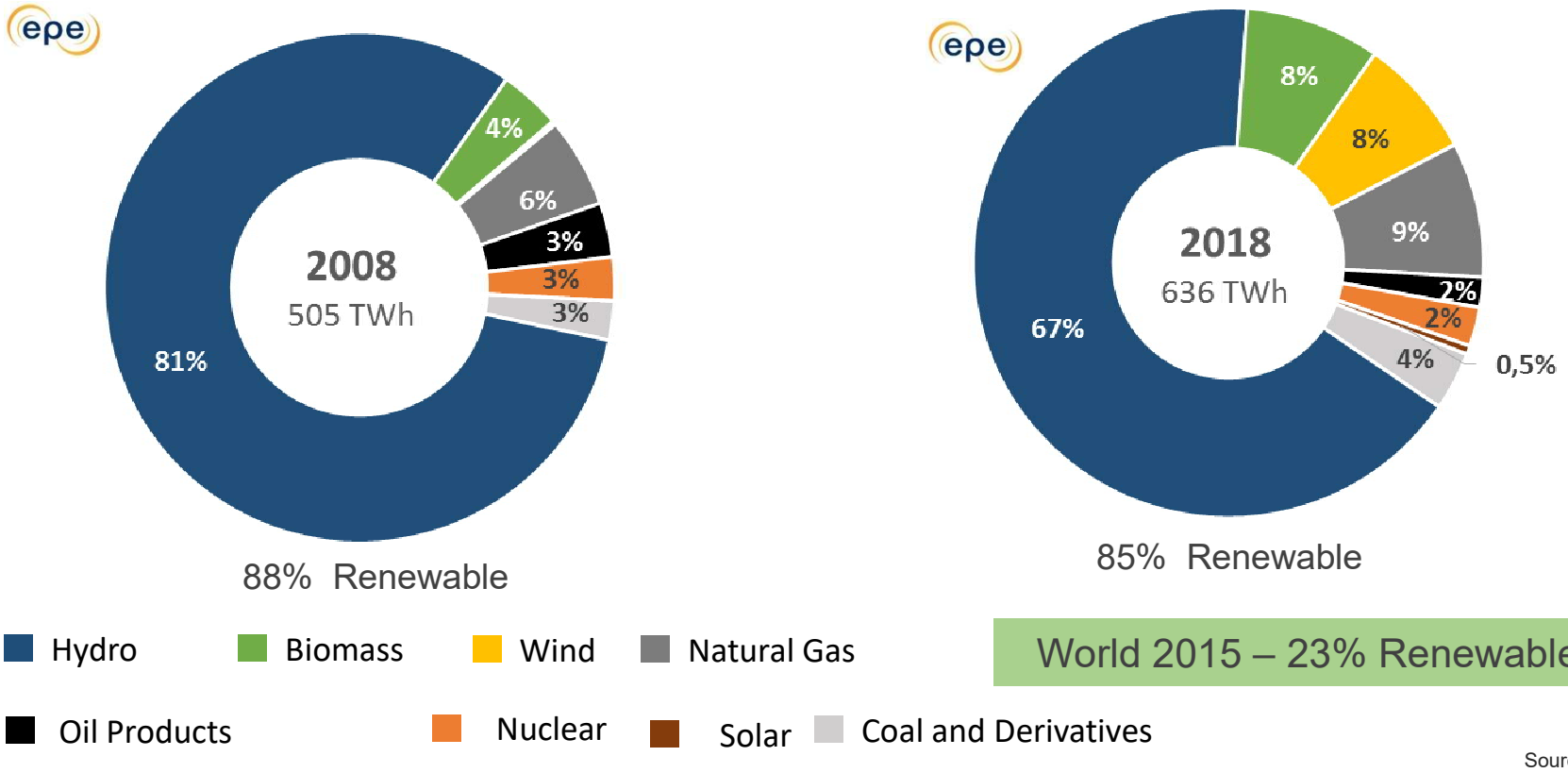
Biodiesel production per region in 2018



BIOELECTRICITY

From 2008 to 2018, electric matrix remained strongly renewable. The thermal plants fulfill the energy gap, with natural gas as the dominant thermal source. In the energy auctions, bioelectricity has growth its share since the deployment of the new electric sector landmark in 2004. While self-production was dominant, nowadays sugar biofuels sector exports 60% of bioelectricity generated.

ELECTRIC MATRIX

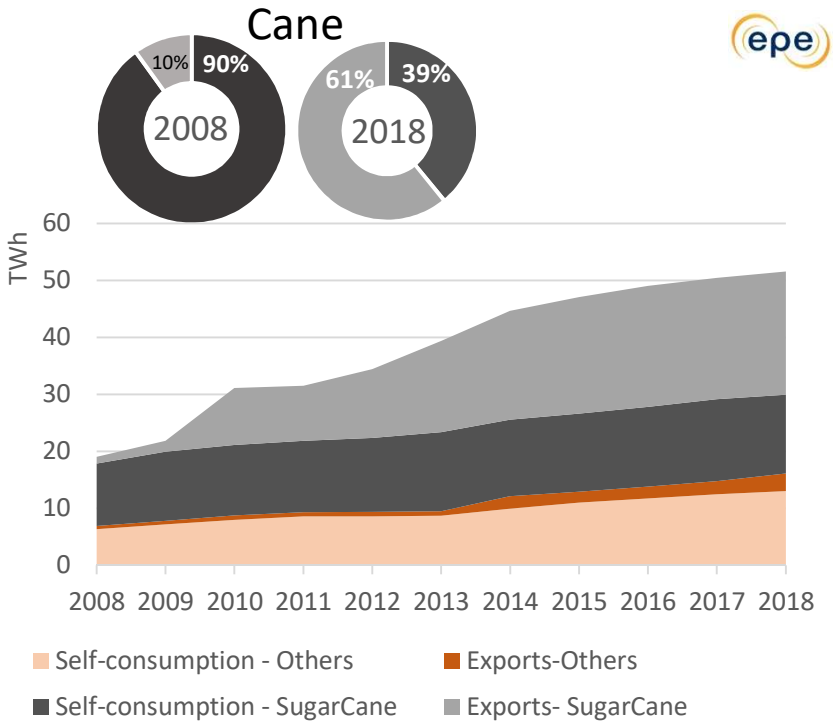


Source: EPE

BIOELECTRICITY AND BIOGAS

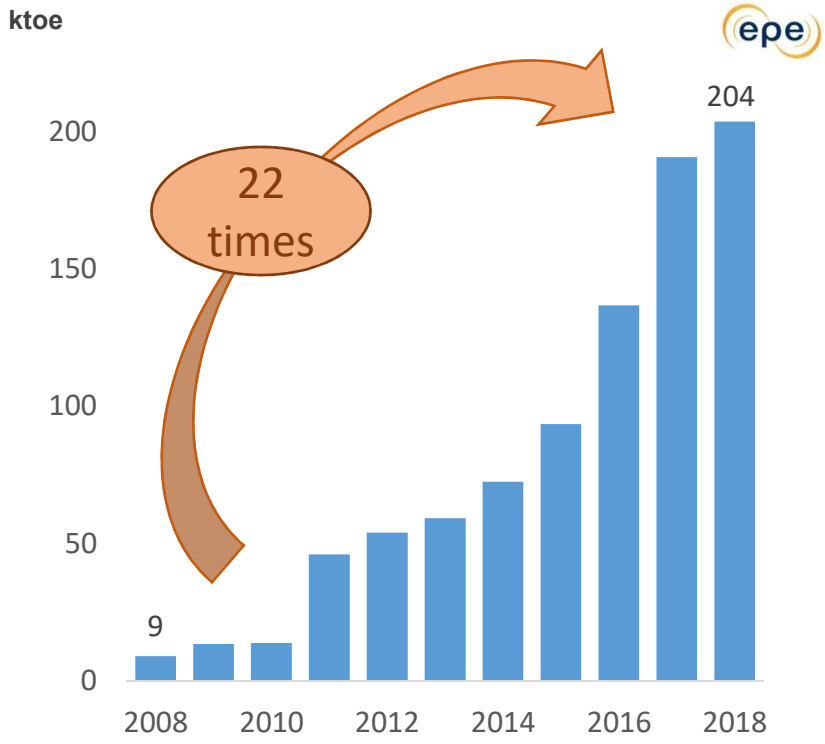
From 2008 to 2018, increasing biogas generation share, especially with Distributed Generation. With ANEEL Norm Resolution 482/12 and 687/15. Huge potential for vinasse and filter cake. Other sources all over the country are: sanitation and pig farming.

Bioelectricity



Source: EPE

Biogas



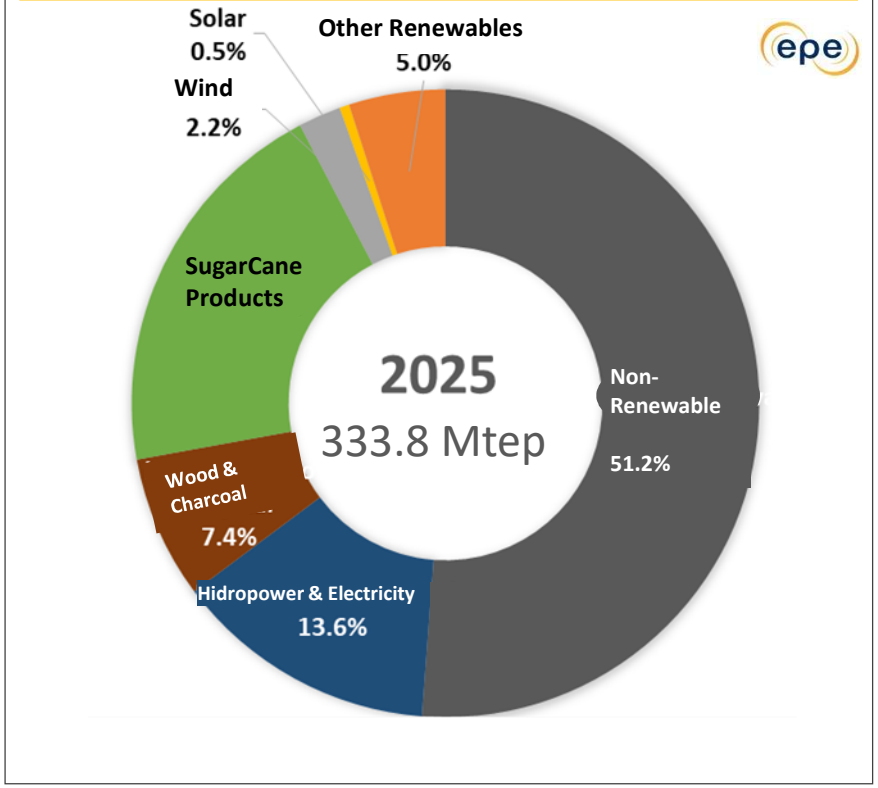
Source: EPE

New Gas Market: Opportunity!

PERSPECTIVES OF ENERGY MATRIX - 2025

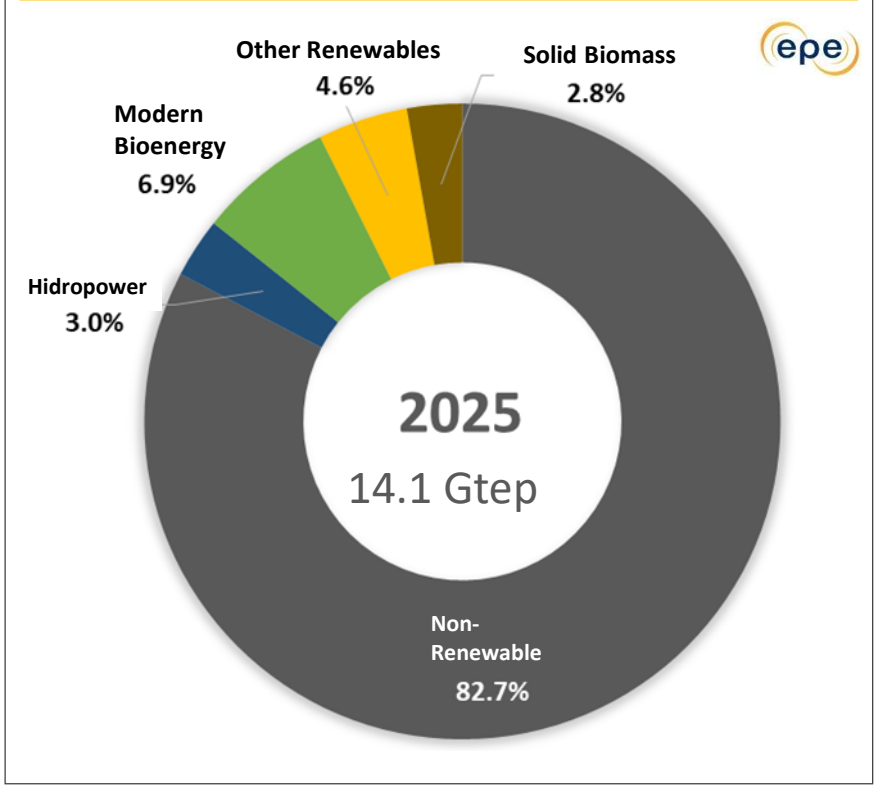
Brazil has a more sustainable energy transition than the rest of the world, since the country has a smaller environmental and carbon footprint with a renewable share of 45.3% of its energy matrix, almost the triple of the rest of the world. by 2025 Brazil should have 48.8% of renewables in its energy matrix.

BRAZIL



Source: EPE

WORLD



Source: IEA. Sustainable Development

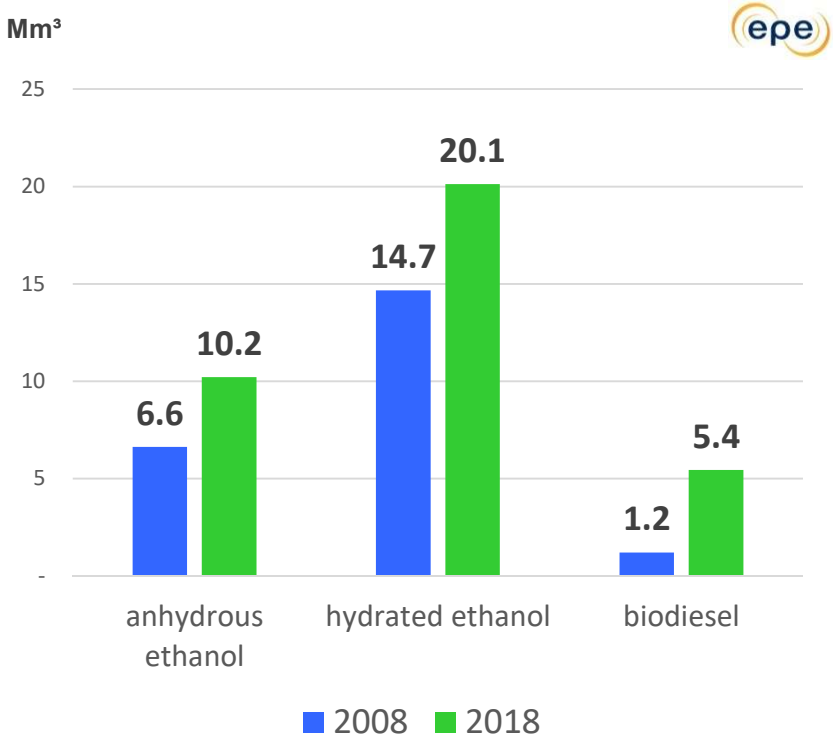
BENEFITS

- Security of supply
- Environmental aspects
- Lower pollutant particle generation
- Lower emissions of GHGs and local pollutants
- Contribution to Climate Change International Agreements
- Social aspects
- Reduction of external dependence on liquid fuels

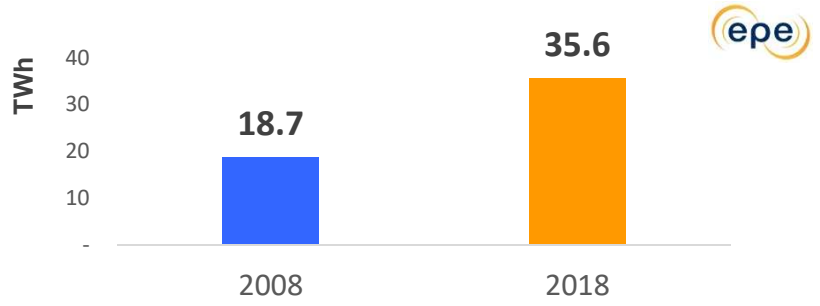
BENEFITS

The use of liquid fuels has increased strongly in the last decade, about 30% for ethanol (anhydrous and hydrous) and more than four times for biodiesel. Bio-electricity has increased more than 150% and the avoided emissions have almost doubled.

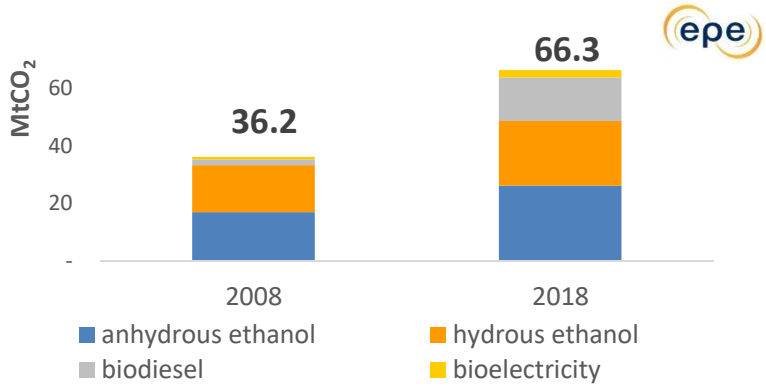
LIQUIDS FUELS



BIOELECTRICITY



AVOIDED EMISSIONS



Source: EPE. CCEE. MCTI. ROSA

FINAL CONSIDERATIONS

THE BIOFUELS ROLE IN THE NATIONAL ENERGY MATRIX

Final Considerations

- High potential of the national renewable resources
- Importance of the continuity of public policies
- Strenghtening of energy security, with better use of renewable resources
- Energy transition – growing national energy demand in a sustainable way
- Economic, social and environmental benefits
- Strong renewable national energy matrix
  - Renewables share will remain expressive: above 40% of the internal energy supply (IES) in the next 10 years
- Current matrix as an example to several nations

For one decade the Analysis of Biofuels' Current Outlook has been monitoring and analysing the relevant biofuels' role in the national energy matrix.

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