



Bioenergy in Brazil:

Business & Investments opportunities

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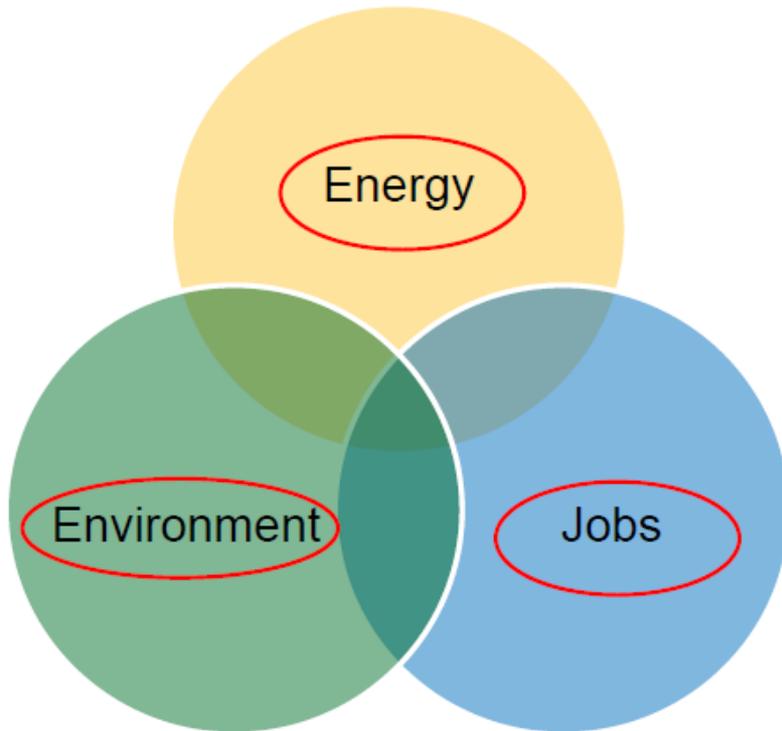
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Topics:

- Bioenergy in the world energy scene
- Status of bioenergy in Brazil (Brazilian Energy Mix)
- Main drivers that will shape investments
- Opportunities for bilateral cooperation with Canada:
 - Biofuture Platform
 - Mission Innovation

Why Bioenergy?



- ✓ Access
- ✓ Security
- ✓ Cost

- ✓ Employment
- ✓ Capacity building
- ✓ R&D

- ✓ GHG Emissions
- ✓ Sustainability
- ✓ Rural development

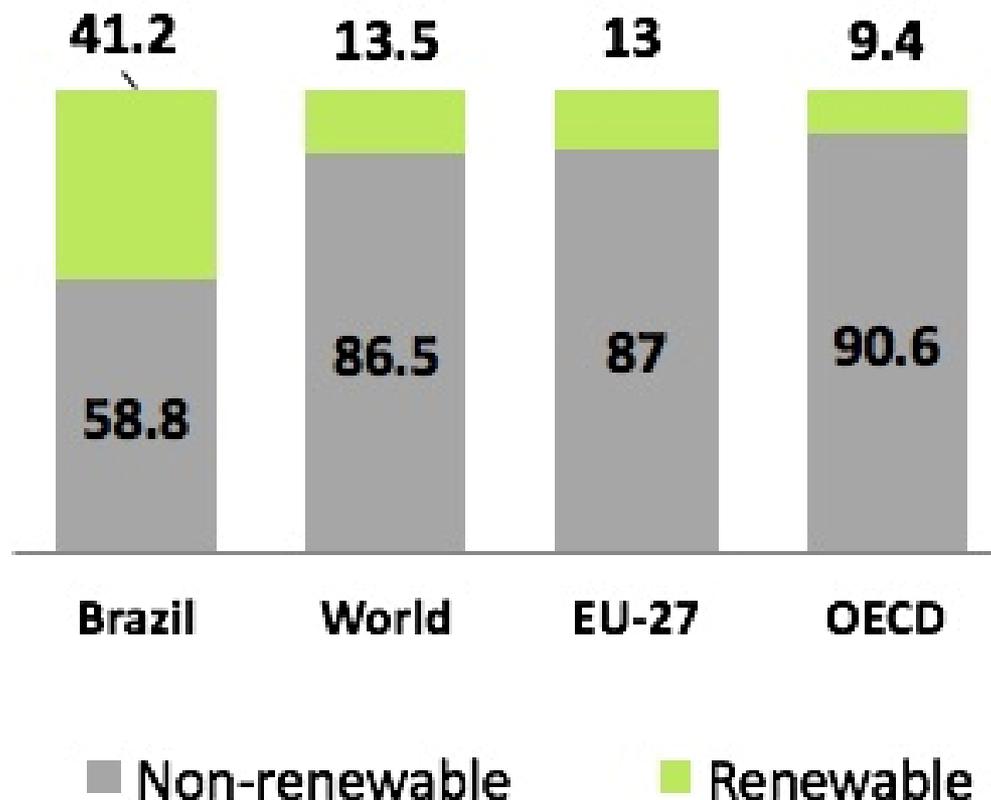
Bioenergy is an alternative that can promote synergies between environmental, industrial and energy policies

Prospects for Bioenergy:

- According to IRENA projections, biomass has an auspicious future. By 2030, biomass could account for 60% of total final renewable energy use and biomass has potential in all sectors. (IEA 2012, 10% of world total primary energy supply, largest contribution to renewable energy – 52.2% of renewable energy is provided by biomass).
- Most biomass demand today is its traditional uses for cooking and heating. (modern bioenergy → Technology)
- Estimated global biomass demand, according to REmap 2030, in the United States, China, India, Brazil and Indonesia together account for 56% of the total
- IEA assesses biofuels as one of the key technologies to reduce CO₂ emissions and reduce dependency on liquid transport fuels. This would mean that the global share of biofuels in total transport fuel would grow from 2% today to 27% in 2050. (Technology Roadmap *Biofuels for*

Energy Matrix (renewables) - 2015

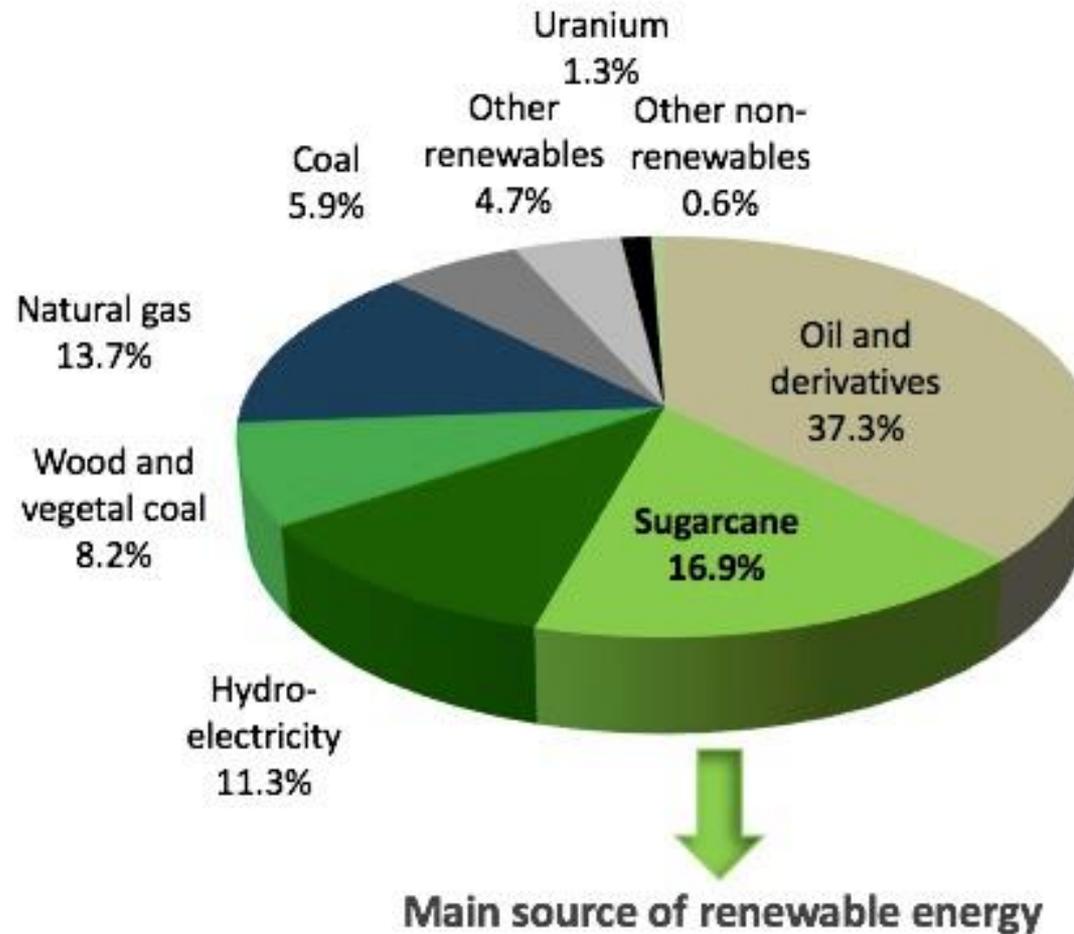
ENERGY SUPPLY STRUCTURE (%)



Sources: Balanço Energético Nacional BEN (2016)) and International Energy Agency: World Energy Outlook 2012 and Key World Energy Statistics 2012, and Eurostat (2013). Compiled by UNICA

Brazil's Diverse Energy Matrix

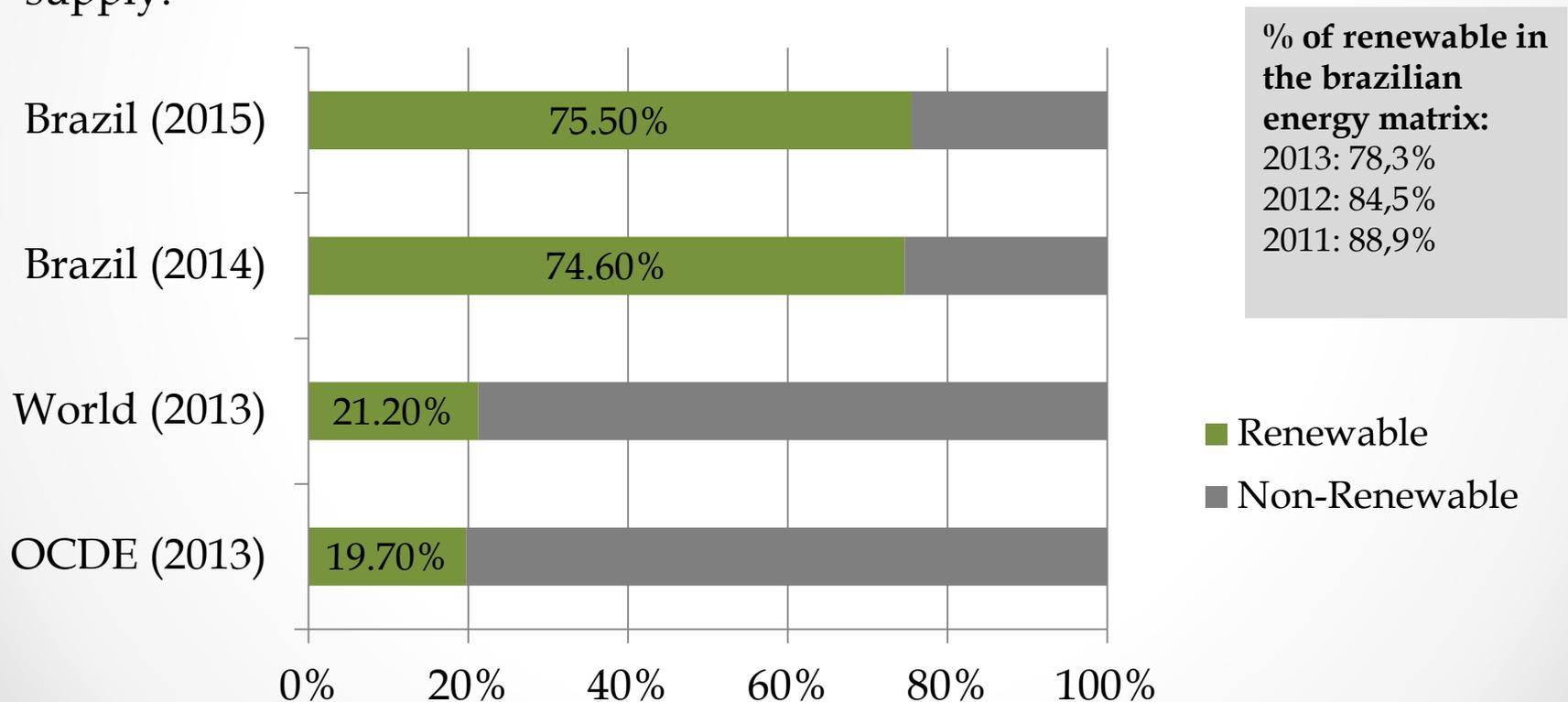
BRAZILIAN ENERGY MATRIX IN 2015



Source: Balanço Energético Brasileiro BEN (2016). Compiled by UNICA

Participation of renewables in the electric matrix - 2015

Advancement of the share of renewables in the electric matrix, due to the decrease of thermal generation to petroleum derivatives and the increase of the generations to biomass and wind, despite the reduction of the hydraulic supply.



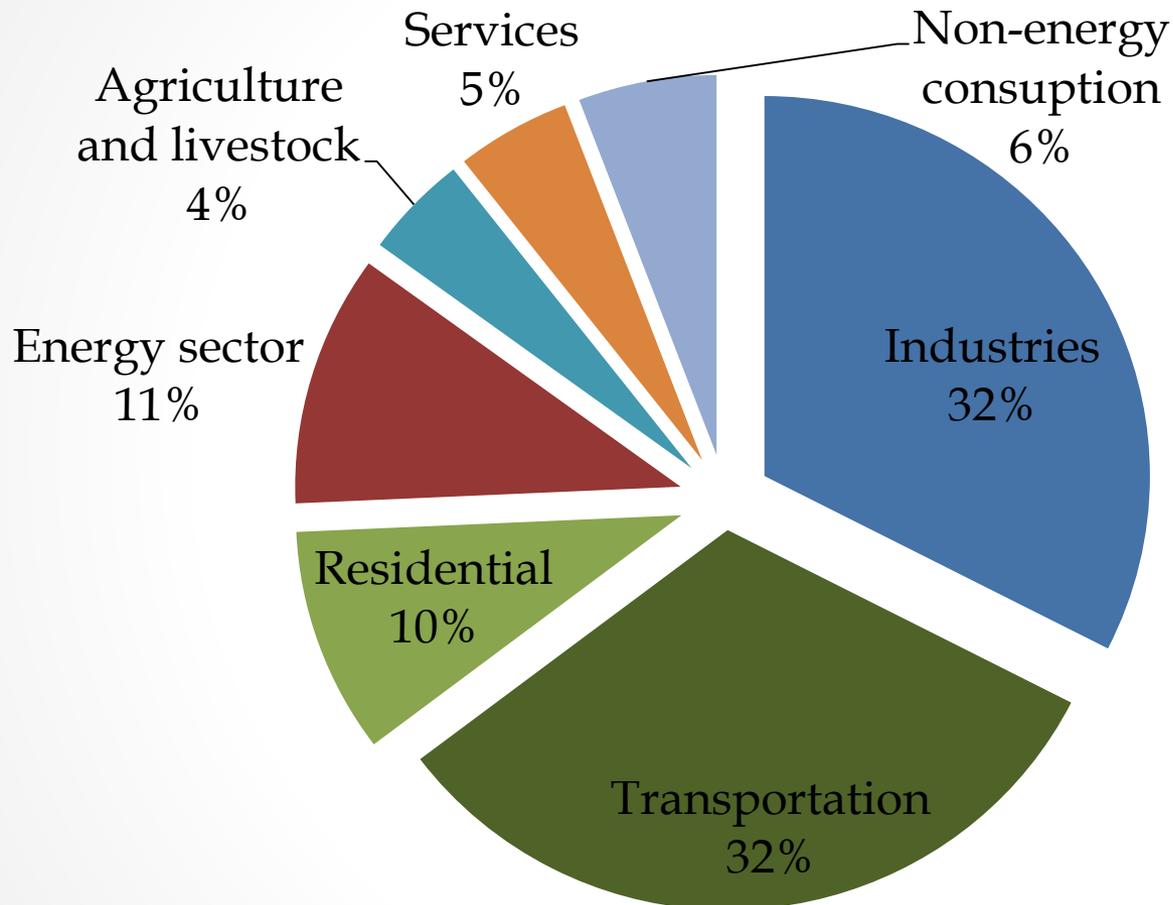
Electric Generation¹ (GWh)

Source	2015	2014
Hydraulic	359.743	373.439
Natural gas	79.490	81.073
Biomass ²	47.394	44.987
Petroleum and oil products ³	25.662	31.529
Nuclear	14.734	15.378
Steam coal	19.096	18.385
Wind	21.625	12.210
Photovoltaic	59	16
Others ⁴	13.682	13.524
Total generation	581.486	590.542

1. Includes distributed generation
2. Includes firewood, sugarcane bagasse and black liquor
3. Includes diesel oil and fuel oil
4. Inclui outras fontes primárias, gás de coqueria e outras secundárias

Source: BEN 2016. Elaboration: EPE

Who used the energy in Brazil - 2015



2015: 260,7 Mtep

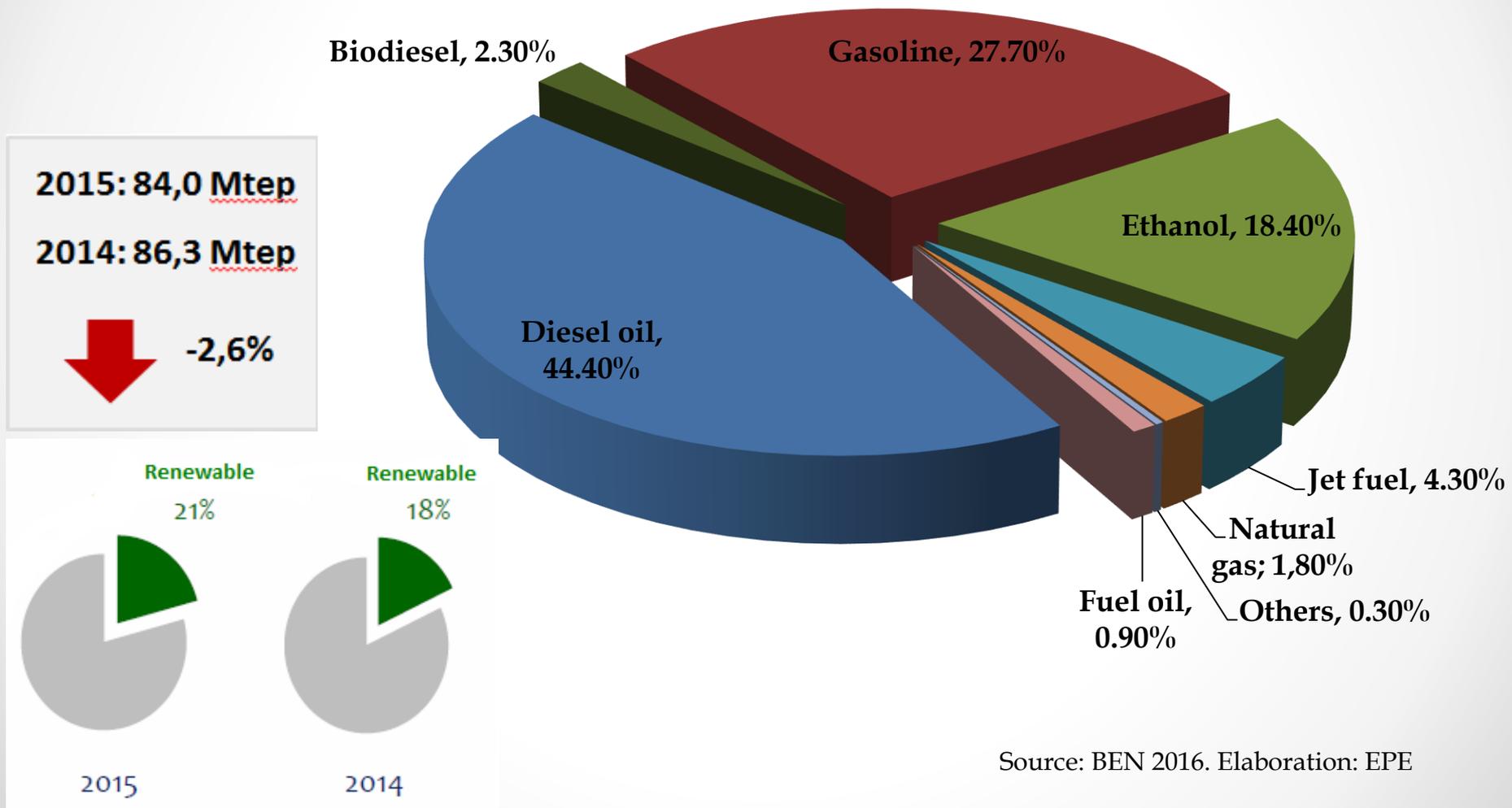
2014: 265,8 Mtep

↓ - 1,9%

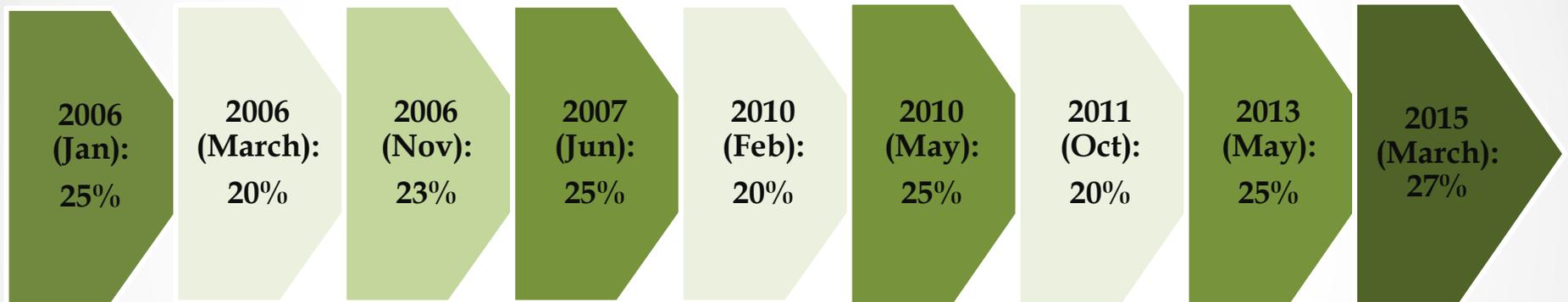
Source: BEN 2016. Elaboration: EPE

Industrial production, freight transport and people's mobility account for approximately **65%** of the country's energy consumption.

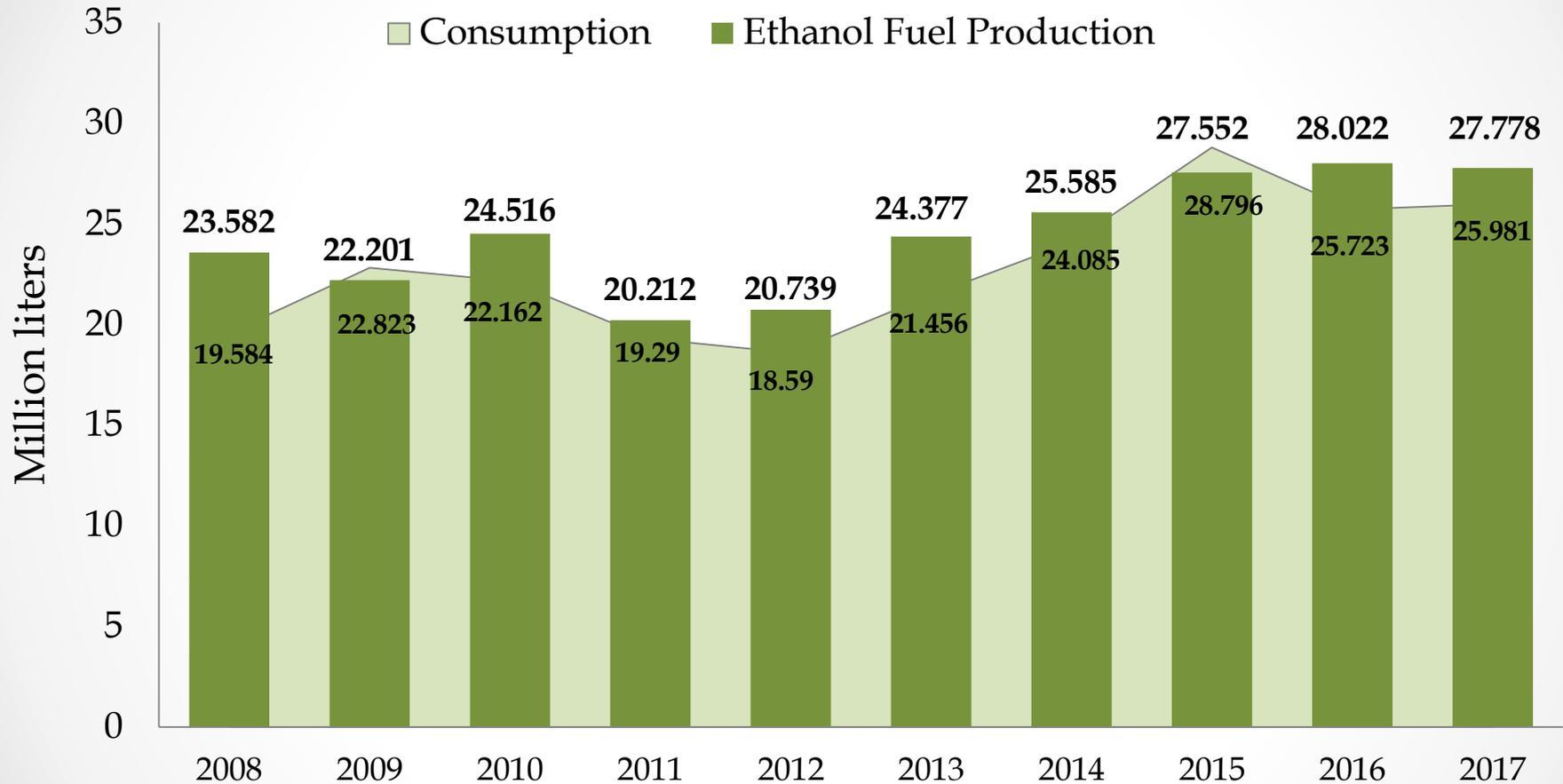
Energy consumption in the transportation sector – matrix



Brazil's ethanol blend mandate

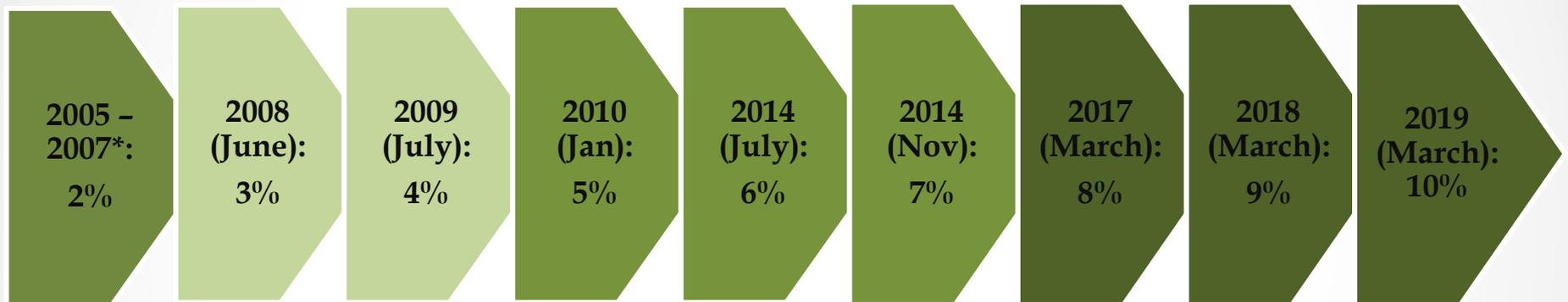


Brazilian Ethanol Production & Consumption



Source: Global Agricultural Information Network. GAIN 2016. USDA Foreign Agricultural Service.

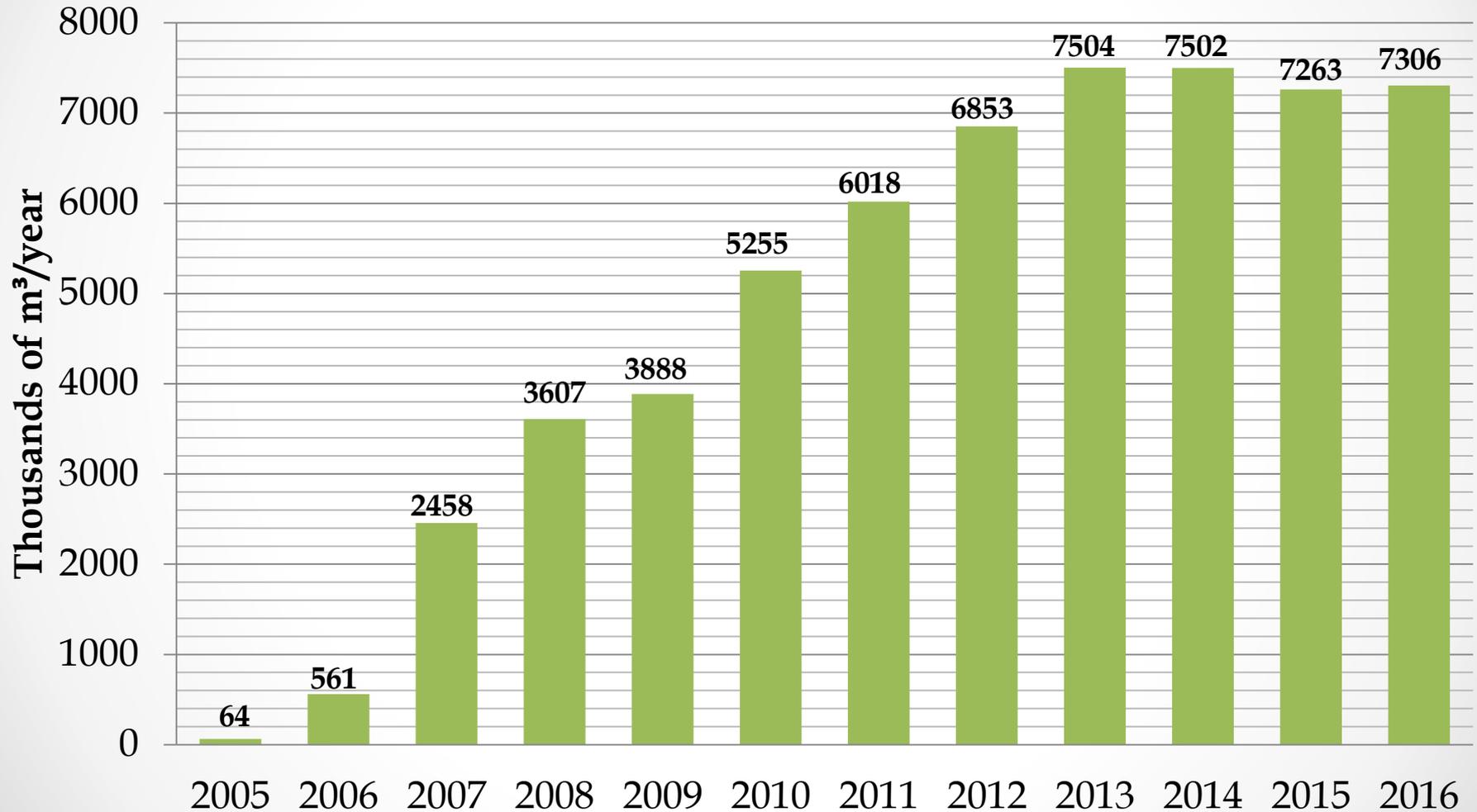
Brazil's biodiesel blend mandate



*optional.

Biodiesel: Installed Capacity

Installed Capacity of Biodiesel Production



Source: Boletim Mensal dos Biocombustíveis, MME. 2016.

Impact on Brazil's Economy

Economic Contribution

- In 2012, the sugarcane sector contributes US\$43.8 billion to Brazil's gross domestic product (GDP) – equivalent to almost 2% of the entire Brazilian economy and higher than the GDP of a European country like Czech Republic (US\$ 42.5 billion).
- When you add in the various suppliers and stakeholders who depend on Brazil's sugarcane industry, the entire sugarcane agro-industrial system generates gross revenues totaling more than US\$86 billion annually.

Good Jobs

- The sugarcane industry employs 1.09 million workers, according to 2011 data from the Ministry of Labor and Employment's Annual Report of Social Information (RAIS).
- Salaries for sugarcane industry workers are among the highest in Brazil's agricultural sector, second only to wages in the soybean industry.
- In 2008, sugarcane workers employed in Brazil's South-Central region (the country's main cane-producing zone) earned an average monthly income of R\$1,062.55, while in the North-Northeast region the average was R\$666.20.
- For context, the national average monthly salary amounted to R\$942.02 that year, and the minimum was R\$ 415.00.

Sector Growth

- Between 2005 and 2009, the Brazilian sugarcane industry expanded at a rate of 10% annually. During that period, more than 100 new mills began operation thanks to total investments of US\$20 billion.
- However, the sector was severely impacted by the 2008 global financial crisis. As part of the sector's restructuring, the bulk of investments were from mergers and acquisitions rather than new production facilities.
- Since then, sugarcane production growth has slowed to about 3% per year.

Main Drivers that will Shape Investments – Brazilian's Intended Nationally Determined Contribution (INDC) - UNFCCC

Brazilian's
INDC
presents the
following
commitments
related to
energy
production
and use
activities:

Increasing the share of sustainable biofuels in the Brazilian energy mix to approximately 18% by 2030, by expanding biofuel consumption, increasing ethanol supply, including by increasing the share of advanced biofuels (second generation), and increasing the share of biodiesel in the diesel mix;

Achieving 45% of renewables in the energy mix by 2030;

Obtain at least 66% of hydraulic source electricity generation in 2030, not considering the self-produced;

Expanding the use of renewable energy sources other than hydropower in the total energy mix to between 28% and 33% by 2030;

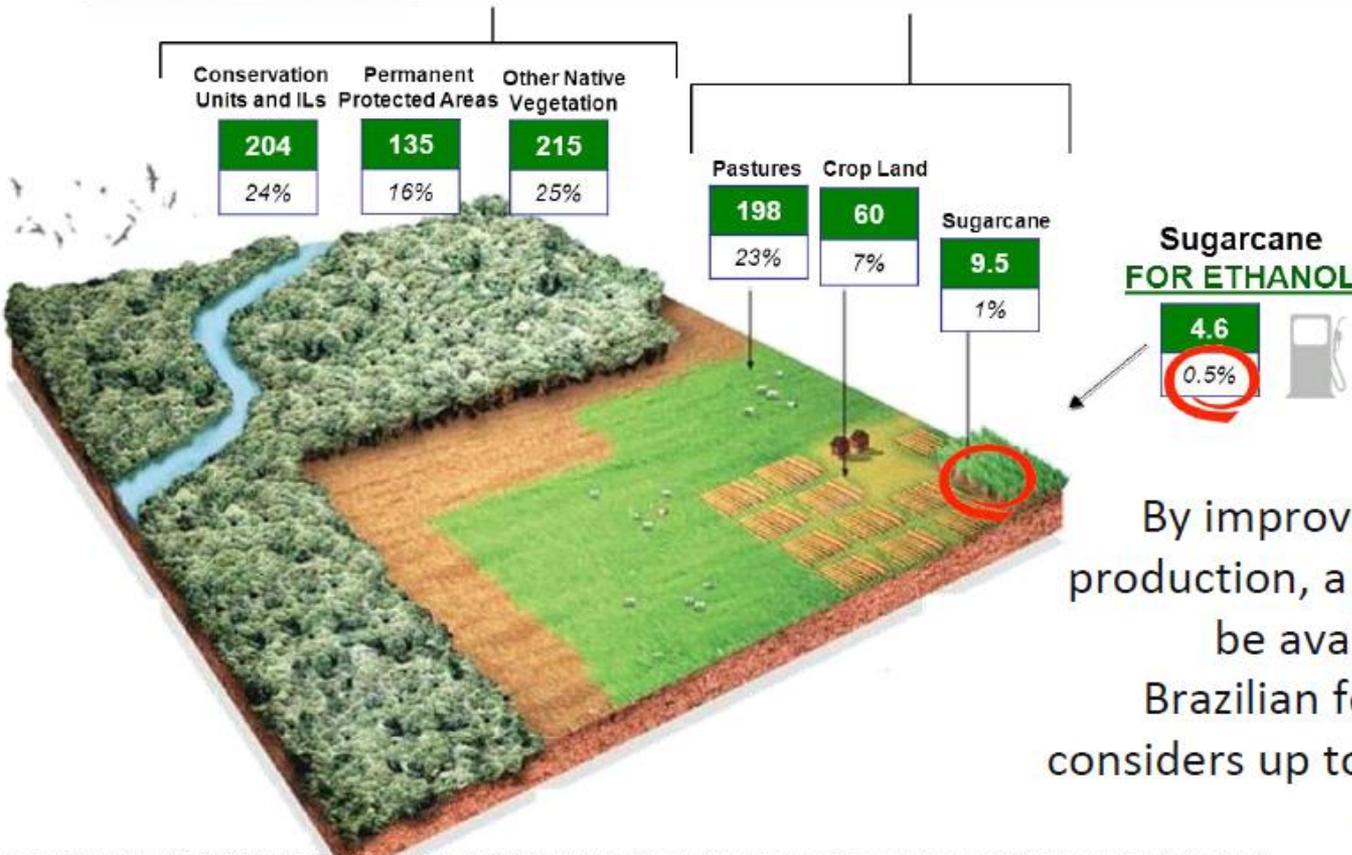
Expanding the use of non-fossil fuel energy sources domestically, increasing the share of renewables (other than hydropower) in the power supply to at least 23% by 2030, including by raising the share of wind, biomass and solar;

Achieving 10% efficiency gains in the electricity sector by 2030.

Main Drivers that will Shape Investments – Land Availability

Million Hectares

Total Area	Native Vegetation	Land in Actual Use	Other Uses
851	554	258	38
100%	65%	30%	5%

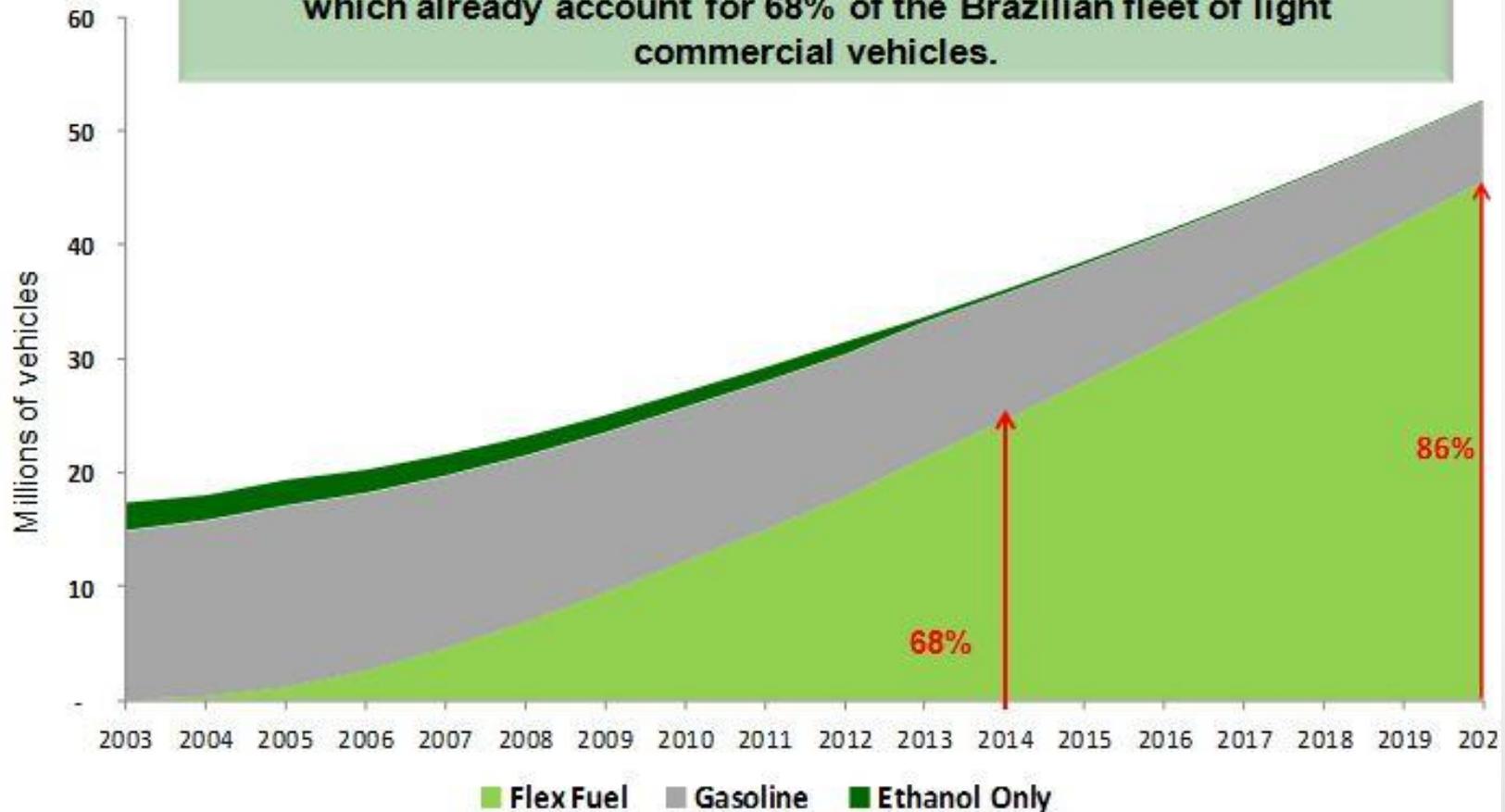


By improving the low yield of cattle production, a large amount of land will be available for other purposes. Brazilian federal agricultural zoning considers up to 64 Mha able to produce sugarcane w/o irrigation.

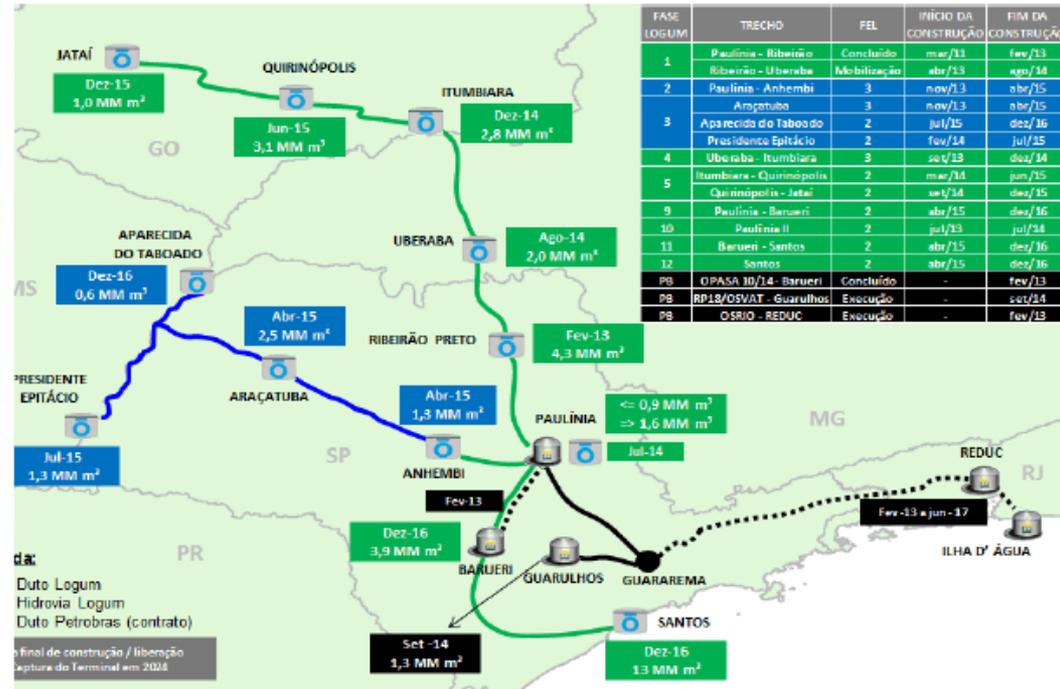
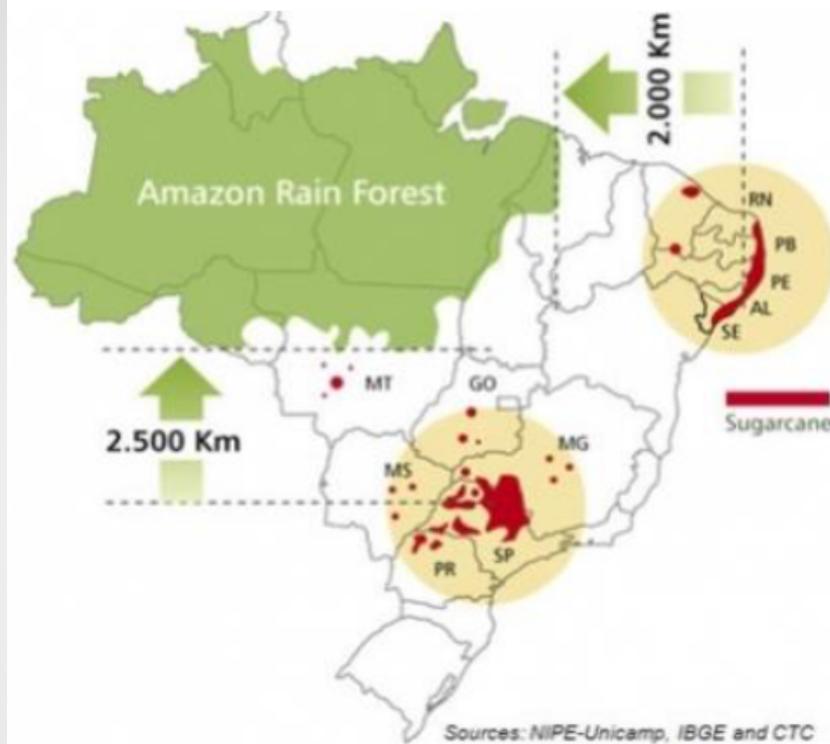
Main Drivers that will Shape Investments – Growing Fuel Market (Flex Fuel Vehicles Fleet)

NATIONAL AUTOMOBILE AND LIGHT VEHICLE FLEET

Today, 16 automakers offer over 242 models of flex fuel vehicles, which already account for 68% of the Brazilian fleet of light commercial vehicles.



Main Drivers that will Shape Investments – New Infrastructure

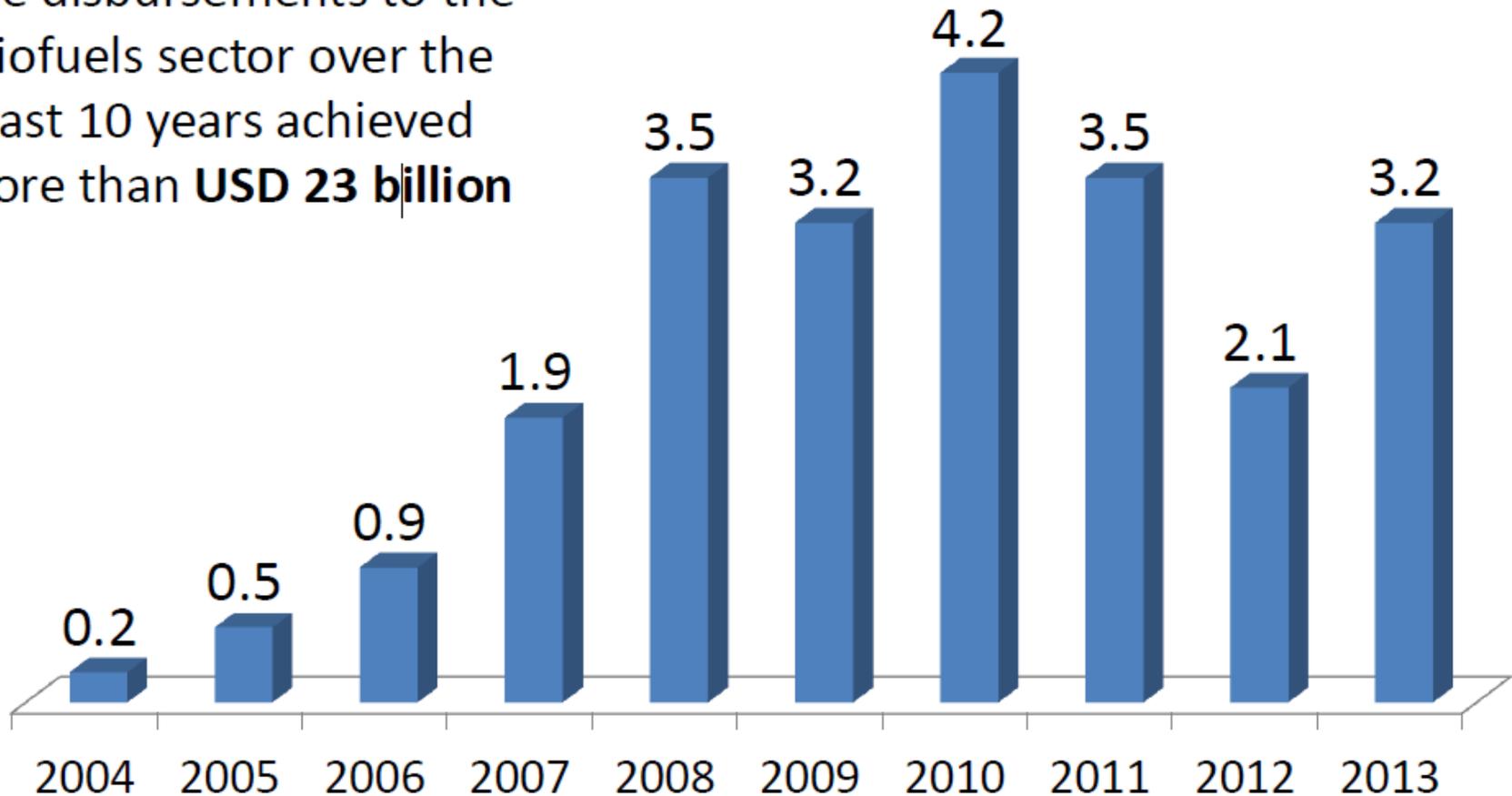


Around US\$ 3.5 billion has been invested in a 1,333 km pipeline (green line), dedicated only for ethanol, which links producing to exporting/consuming regions. The first stretch has been operational since the end of 2013.

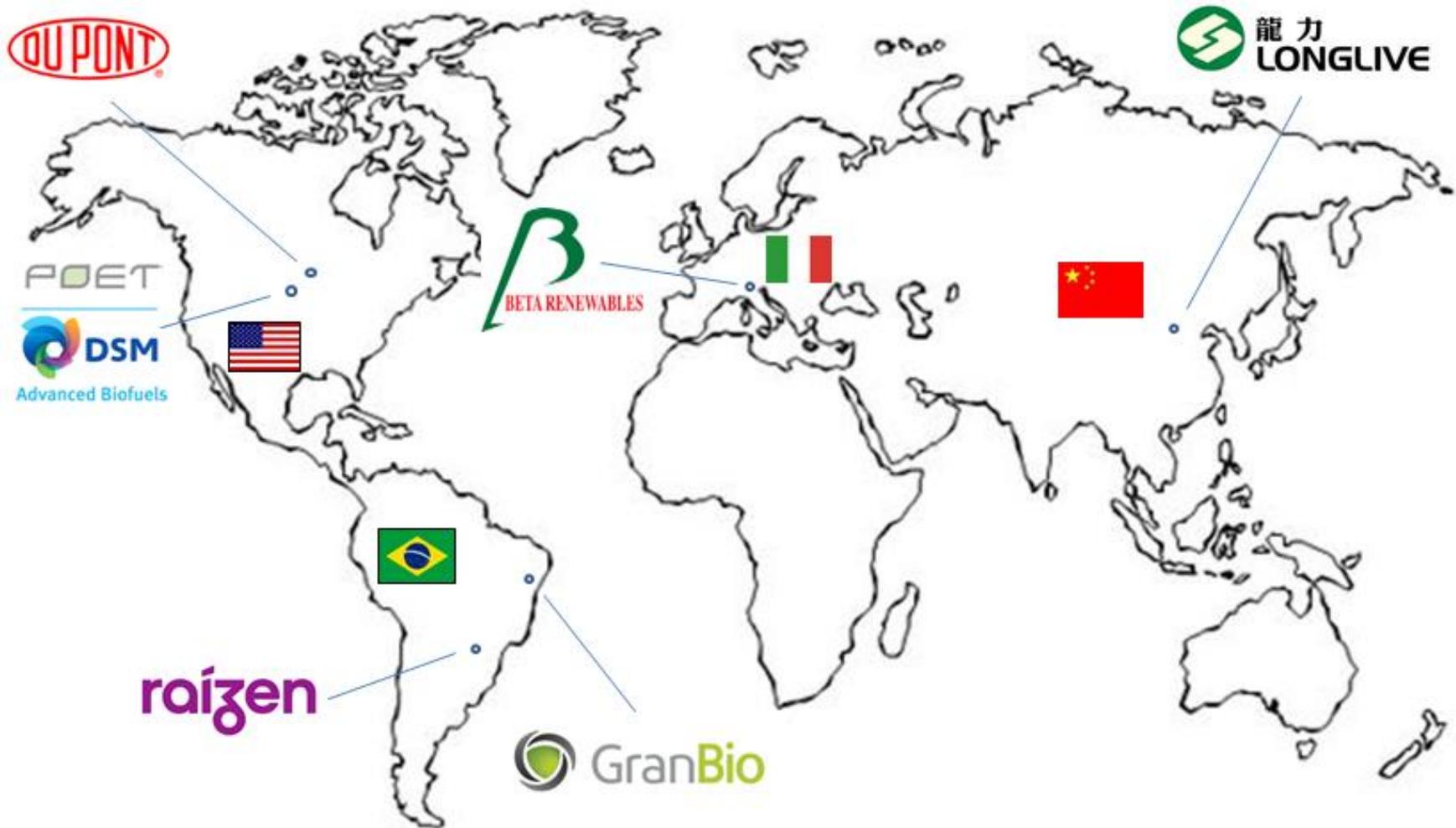
Main Drivers that will Shape Investments – Public Funding

US\$ billion

The disbursements to the biofuels sector over the last 10 years achieved more than **USD 23 billion**



Main Drivers that will Shape Investments – Scaling up of New Technologies (E2G)



Source: BNDES.



New 20-country coalition set to promote advanced fuels for the climate and the new bioeconomy.

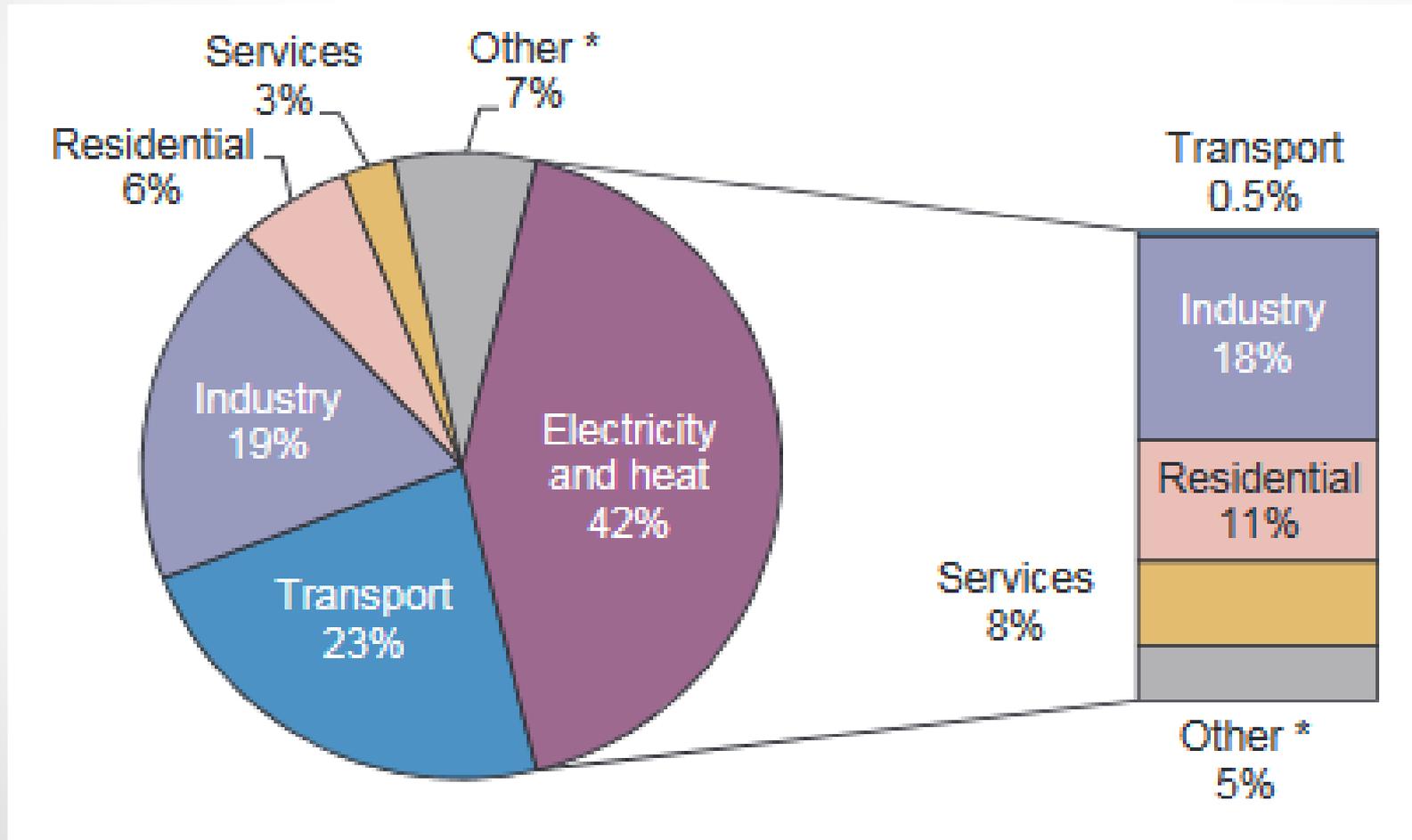
UNFCCC COP22





Argentina • Brazil • Canada • China • Denmark • Egypt • Finland • France • India • Indonesia • Italy • Morocco • Mozambique • Netherlands • Paraguay • Philippines • Sweden • United Kingdom • United States • Uruguay

World's CO2 emissions by Sector (IPCC)



An important boost in the fight against World's CO2 emissions by Sector (IPCC) Climate Change

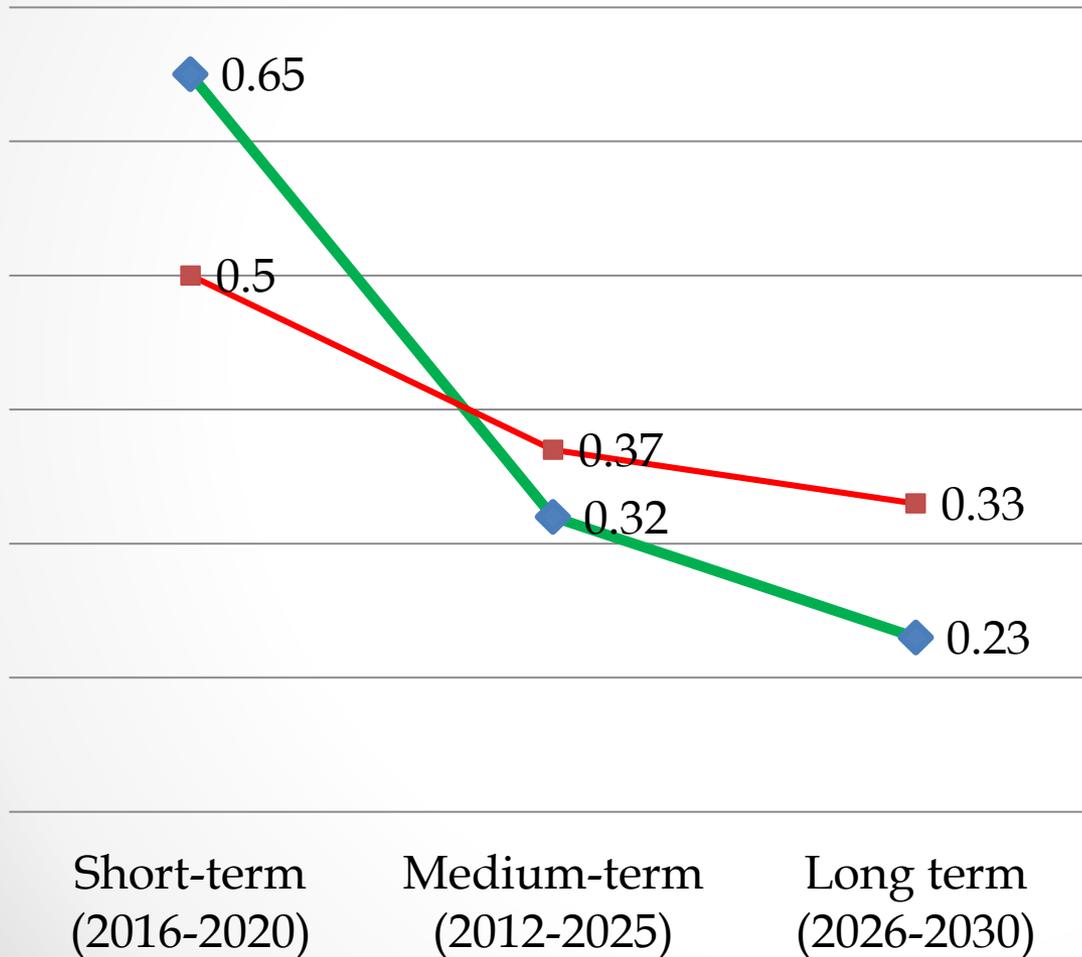
Cellulosic ethanol and other advanced biofuels are an economically, socially and environmentally sustainable solution to improve energy security and reduce carbon emissions in the transport sector in the near term.



Benefits and potential of cellulosic ethanol

- Cellulosic material does not compete with food production;
- Carbon mitigation potential even greater than traditional ethanol;
- Waste and agricultural residue (e.g. rice and corn straw) can be turned from a liability into an asset
- Greatly increased productivity with zero increase in the use of land and water resources;
- More value for rural producers.

Expected E2G cost reduction (US\$/liter)

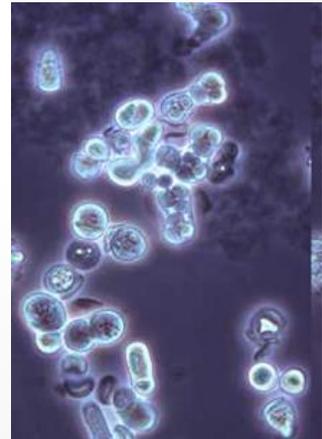


Biomass, CAPEX and enzymes are the main drivers of E2G production costs. In the long term, E2G will be competitive with oil prices at nearly US\$ 40 per barrel.

◆ E2G average cost

The technology behind 2G biofuels is the key to a new, green bioeconomy

Future bio-refineries will be able to convert residues and waste into fuels, electricity, chemicals and pharmaceutical ingredients – like today's petrochemical refineries, but smaller, greener and more sustainable.



- Scope of activities:
 - Promotion of policy dialog and collaboration;
 - Facilitation of advanced biofuels and bioeconomy-related investments;
 - Awareness-raising and sharing of studies on different specific solutions;
 - Promotion of R&D and sharing of analysis and information on R&D needs.



MISSION INNOVATION

Accelerating the Clean Energy Revolution

- Mission Innovation (MI) is a global initiative of 22 countries and the European Union to dramatically accelerate global clean energy innovation. As part of the initiative, participating countries have committed to double their governments' clean energy research and development (R&D) investments over five years, while encouraging greater levels of private sector investment in transformative clean energy technologies.
- Recognizing that targeted technology advances could accelerate breakthroughs and reductions in cost, Mission Innovation countries launched during the UNFCCC COP22 seven Innovation Challenges. These challenges are global calls to action that complement efforts already underway by Mission

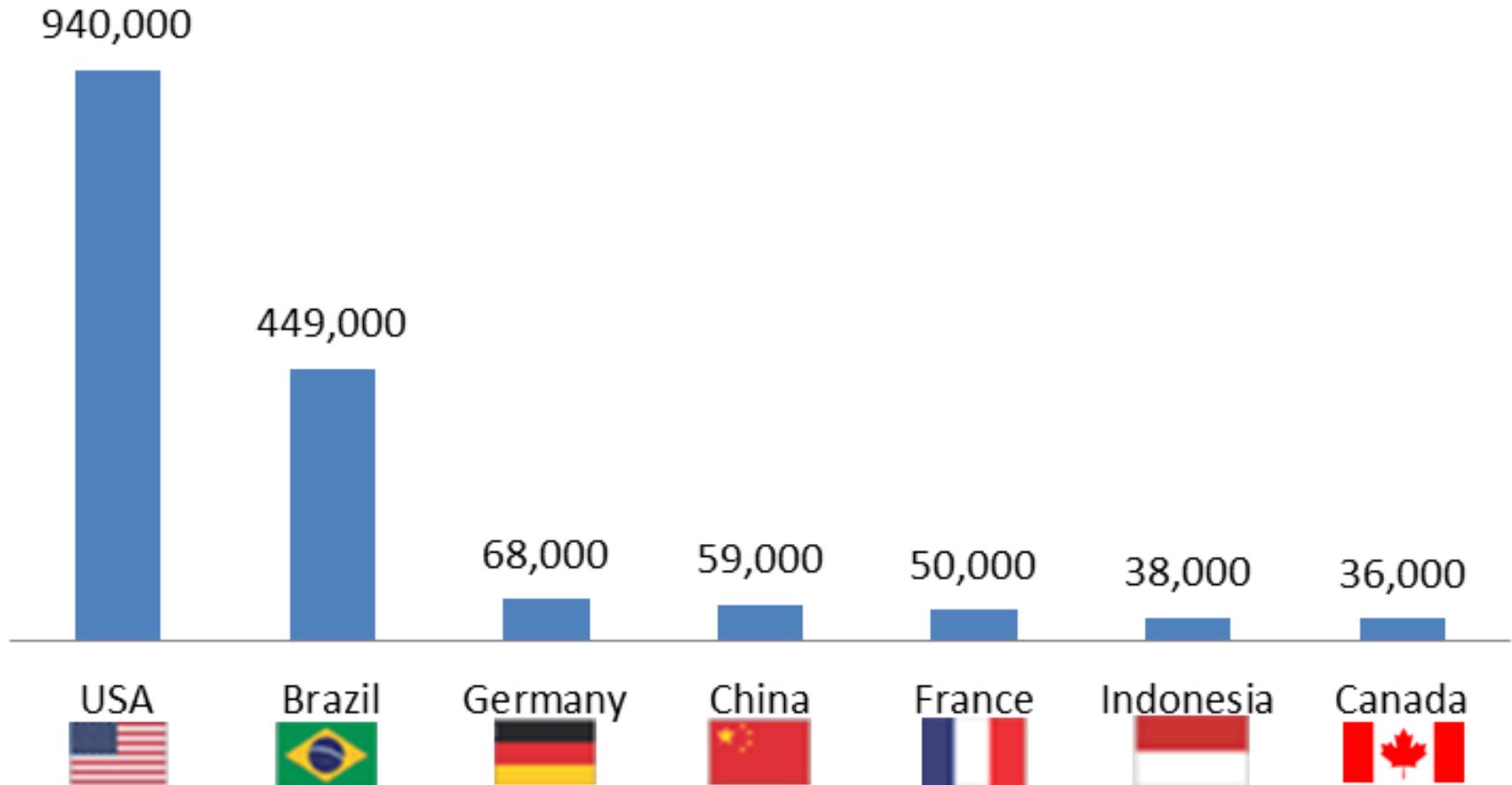
MISSION INNOVATION

Accelerating the Clean Energy Revolution

- **Sustainable Biofuels Innovation Challenge** – to develop ways to produce, at scale, widely affordable, advanced biofuels for transportation and industrial applications
- This Challenge will build on the existing work of individual countries and international institutions, such as the IEA, to identify and prioritise innovation needs and collaboration opportunities where research and development can result in significant advances in biofuel technologies. To achieve this, participating countries will cooperate and collaborate to help governments, private investors, and researchers accelerate technology development so that advanced
- biofuels reach global market penetration in

Liquid Biofuels Production

(barrels per day, select Mission Innovation countries)



Source: US Energy Information Administration

- Figure: Production of liquid biofuels (barrels per day in 2012) for the largest producing
- Mission Innovation countries



Bioenergy in Brazil:

**Business & Investments
opportunities**

THANK YOU!

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