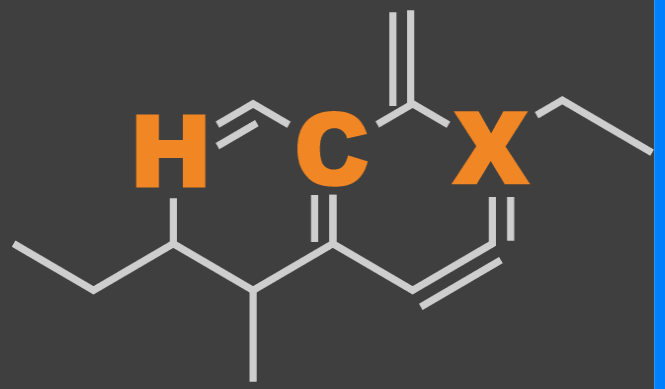


FARO90

Ethanol Blending in Gasoline - Honduras

June, 2023

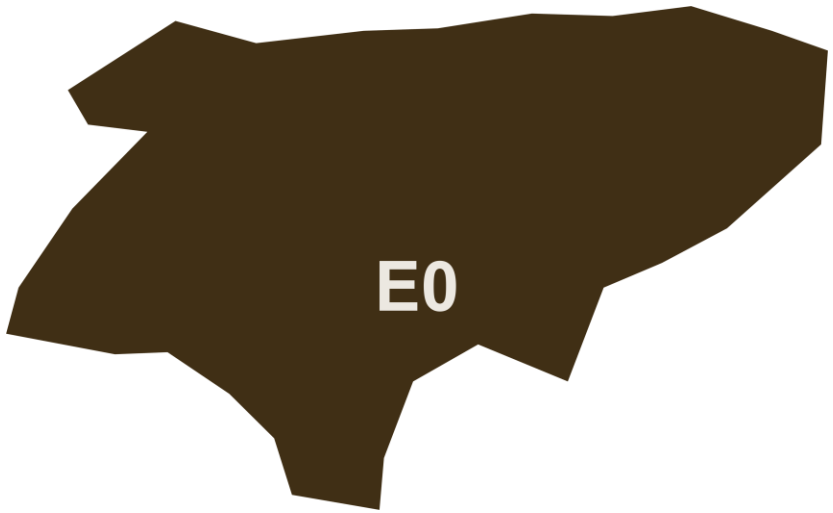
Ethanol Blending in Latin America

There are important fuel quality and environmental impact of vehicle emission challanges in the Region.

- The use of ethanol improves gasoline quality and creates flexibility in gasoline production.
- Ethanol use is a cost-effective way to increase gasoline octane and to replace more expensive gasoline components.
- Ethanol contributes to transport decarbonization and air quality improvement.
- There are opportunities across Latin America to increase the ethanol blend level and implement new policies on the use of gasoline-ethanol blends.

Sixteen countries with potential and additional use of ethanol were studied: 1) gasoline market profiles; 2) Optimization of gasoline blends with ethanol and 3) Environmental impact of gasolines blended with ethanol.

Ethanol Blending in Gasoline - Honduras

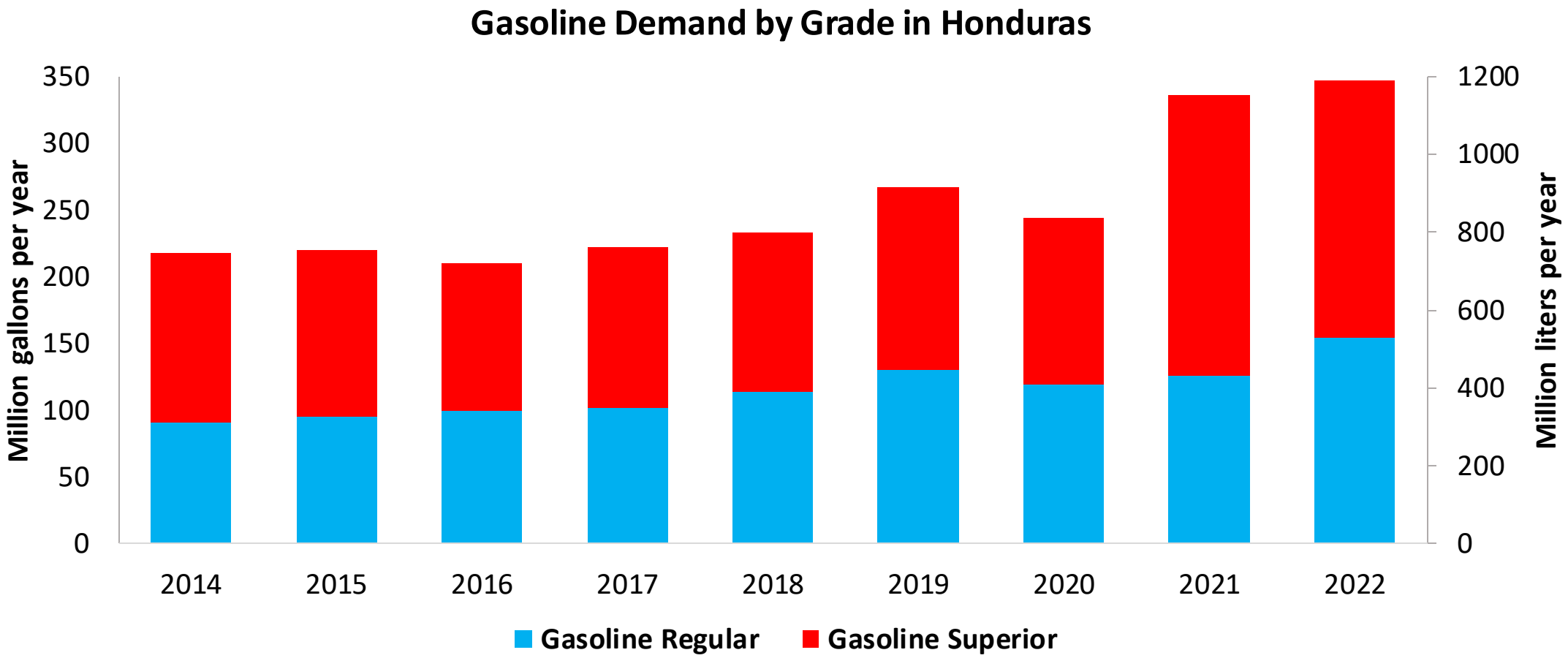


In 2022, gasoline demand was 314 million gallons (1,190 million liters). Regular gasoline RON 91 represented 44.6% while Superior gasoline RON 95 reached 55.6% of national demand. Honduras does not have gasoline production capacity, importing components for gasoline blending mainly from United States and to a lesser extent, from Ecuador.

Honduras has no national mandate for ethanol blends.

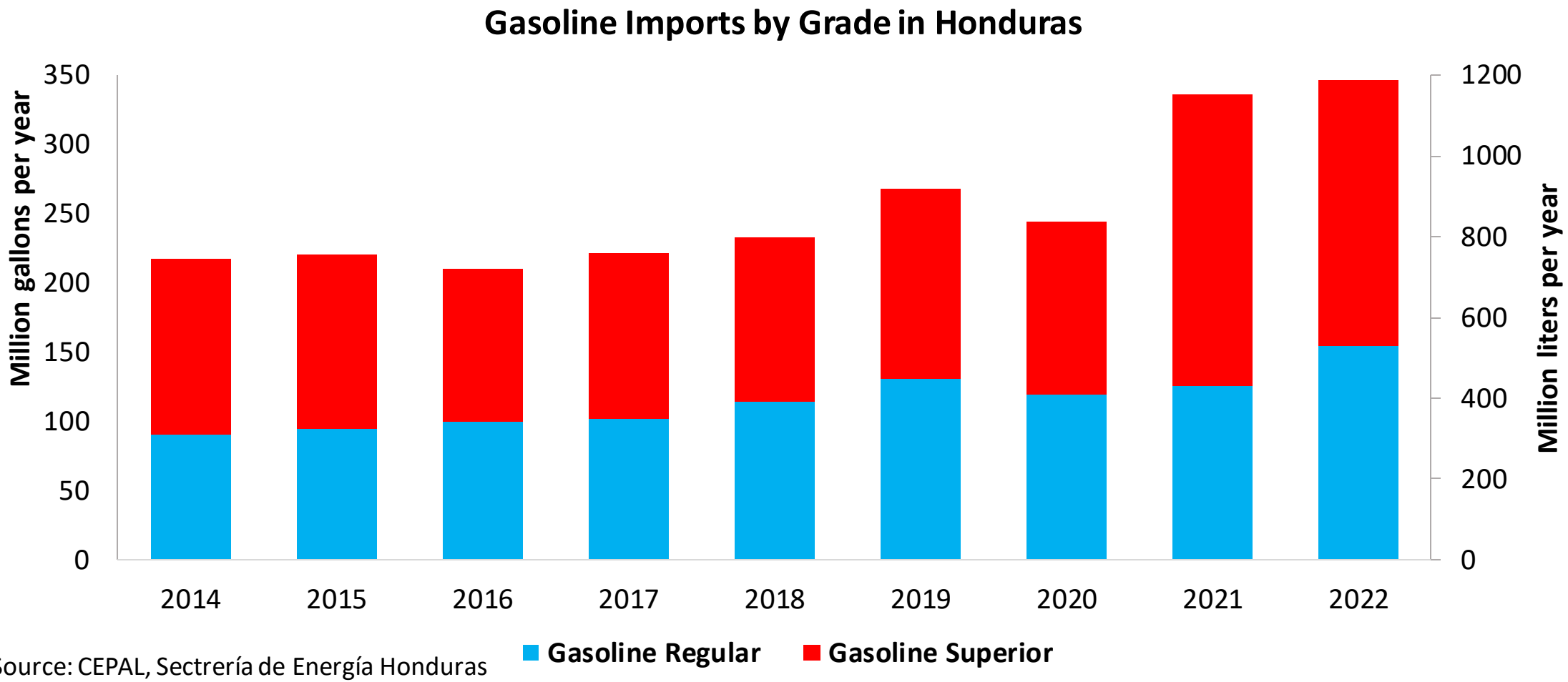
Source: CEPAL, Secretaría de Energía Honduras

Gasoline Demand in Honduras



Source: CEPAL, Secretaría de Energía Honduras

Gasoline Imports in Honduras



Source: CEPAL, Sectrería de Energía Honduras

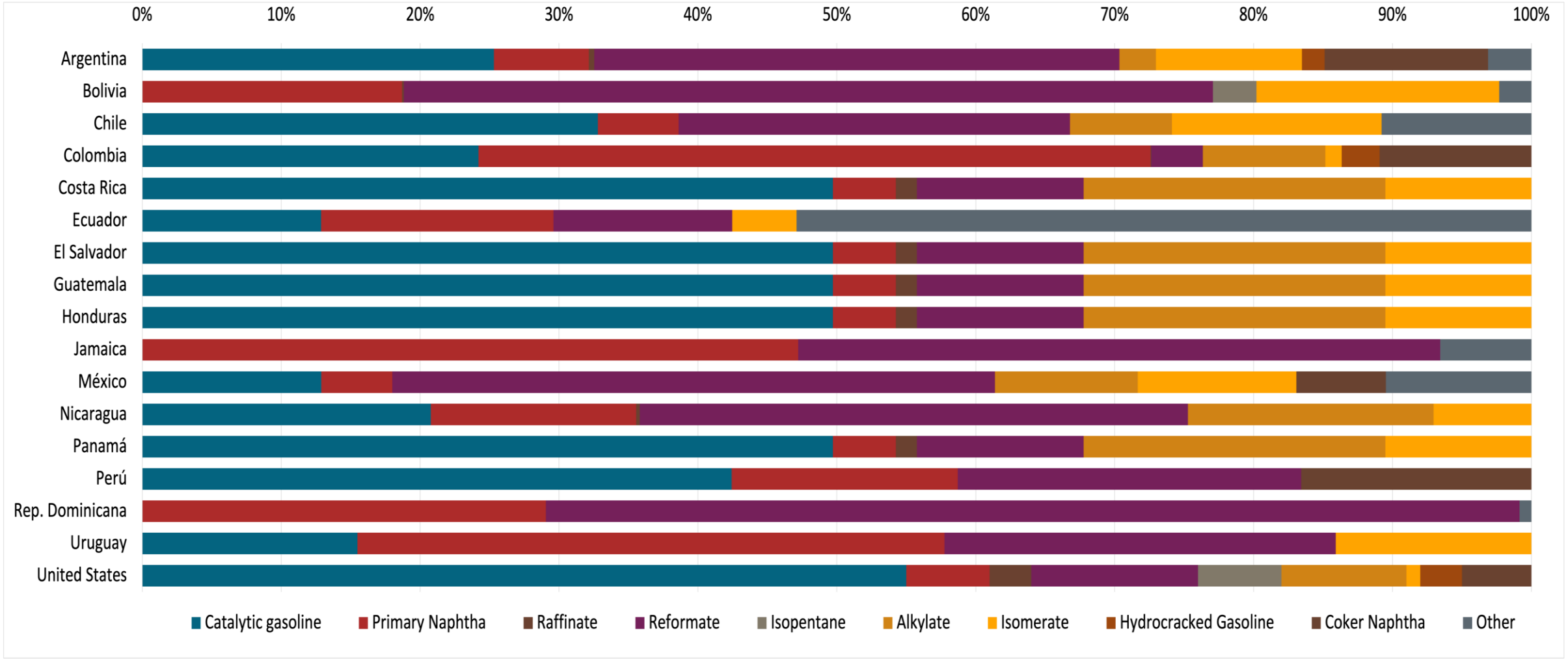
Gasoline Quality in Honduras

Name	RTCA 75.01.08:19 p.m.	RTCA 75.01.19:19	EN 228:2012 + A1:2017 (Euro 6 enabling)			
Implementation Date	2021	2021	2017			
Applicability	Whole country	Whole country	All countries			
Selected Grade	Gasoline Premium	Gasoline Regular	RON 95 E5	RON 95 E10	RON 98 E5	RON 98 E10
Benzene Content	2,5% v/v	2,5% v/v	< 1 %v/v	< 1 %v/v	< 1 %v/v	< 1 %v/v
Aromatics	50% v/v	50% v/v	< 35 %v/v	< 35 %v/v	< 35 %v/v	< 35 %v/v
Olefins	30% v/v	30% v/v	< 18 %v/v	< 18 %v/v	< 18 %v/v	< 18 %v/v
Lead Content	< 0,013 g/l	< 0,013 g/l	< 5 mg/l	< 5 mg/l	< 5 mg/l	< 5 mg/l
Manganese	0,25% v/v	0,25% v/v	< 2,0 mg/l	< 2,0 mg/l	< 2,0 mg/l	< 2,0 mg/l
RON	> 95	> 91	> 95	> 95	> 98	> 98
MON	-	-	> 85	> 88	> 85	> 88
AKI						
Sulfur Content	< 500 mg/kg	< 500 mg/kg	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg
Oxygen Content	2,7% v/v	2,7% v/v	<2,7 % m/m	<3,7 % m/m	<2,7 % m/m	<3,7 % m/m
Ethanol (EtOH)	-	-	<5 %v/v	<10 %v/v	<5 %v/v	<10 %v/v
RVP 37.8°C (Summer)	< 69 kPa	< 69 kPa	<> 60 - 70 kPa *Depends on the country, RVP is regulated in the EU Fuel Quality Directive			
RVP 37.8 °C(Winter)						
RVP 37.8°C (Transition)						
MTBE	-	-	-	-	-	-
Ehters 5 or more C Atoms	-	-	Based on oxygen content	<22 %v/v	Based on oxygen content	<22 %v/v

Fuente: RTCA

Gasoline Component Blending in Latin America

Gasoline is a blend of a base gasoline and other components. This blending is usually done at blending terminals as only 30% of the world's finished gasoline is distributed directly from refineries. Each component provides different properties to the final blend, for example, isomerates, alkylates and butanes increase the octane. The components commonly used in Latin America are:



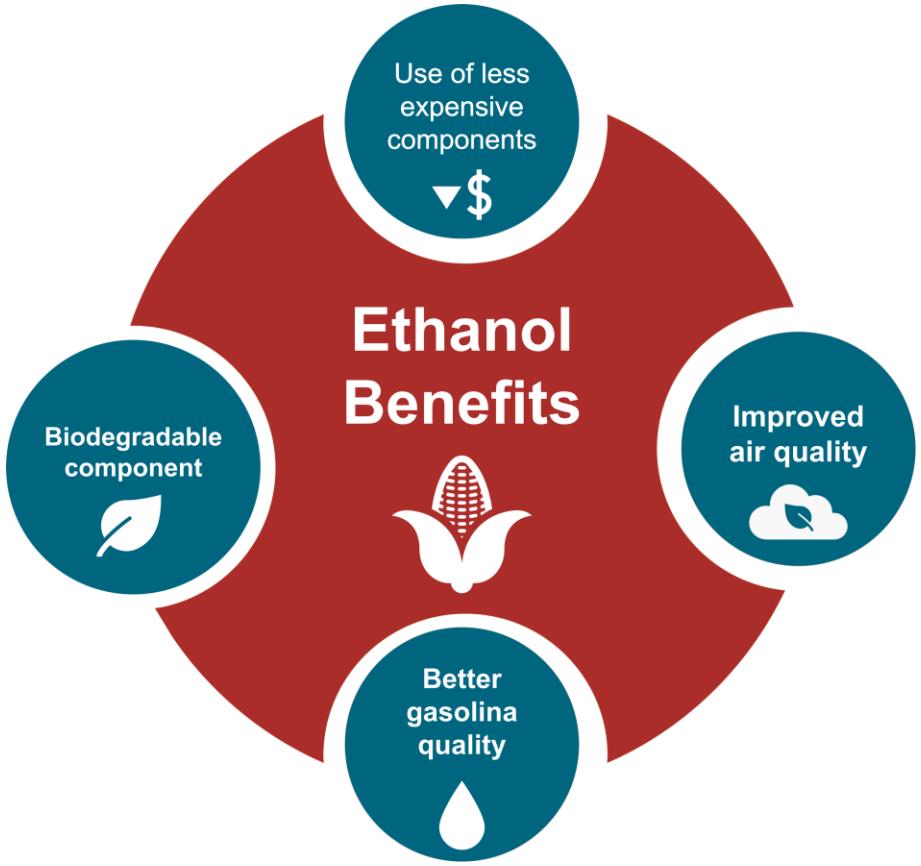
Gasoline Blending Optimization

In some parts of the world, ethanol is added to gasoline as a blending component.The advantages of ethanol include that it is a renewable fuel made of biomass; that it is an octane booster that helps to dilute sulfur; and that it allows the fulfillment of environmental objectives.To determine the optimal components to be blended with ethanol, a **blending model** was used. This model selects the components to add in the gasoline/ethanol blend based on:

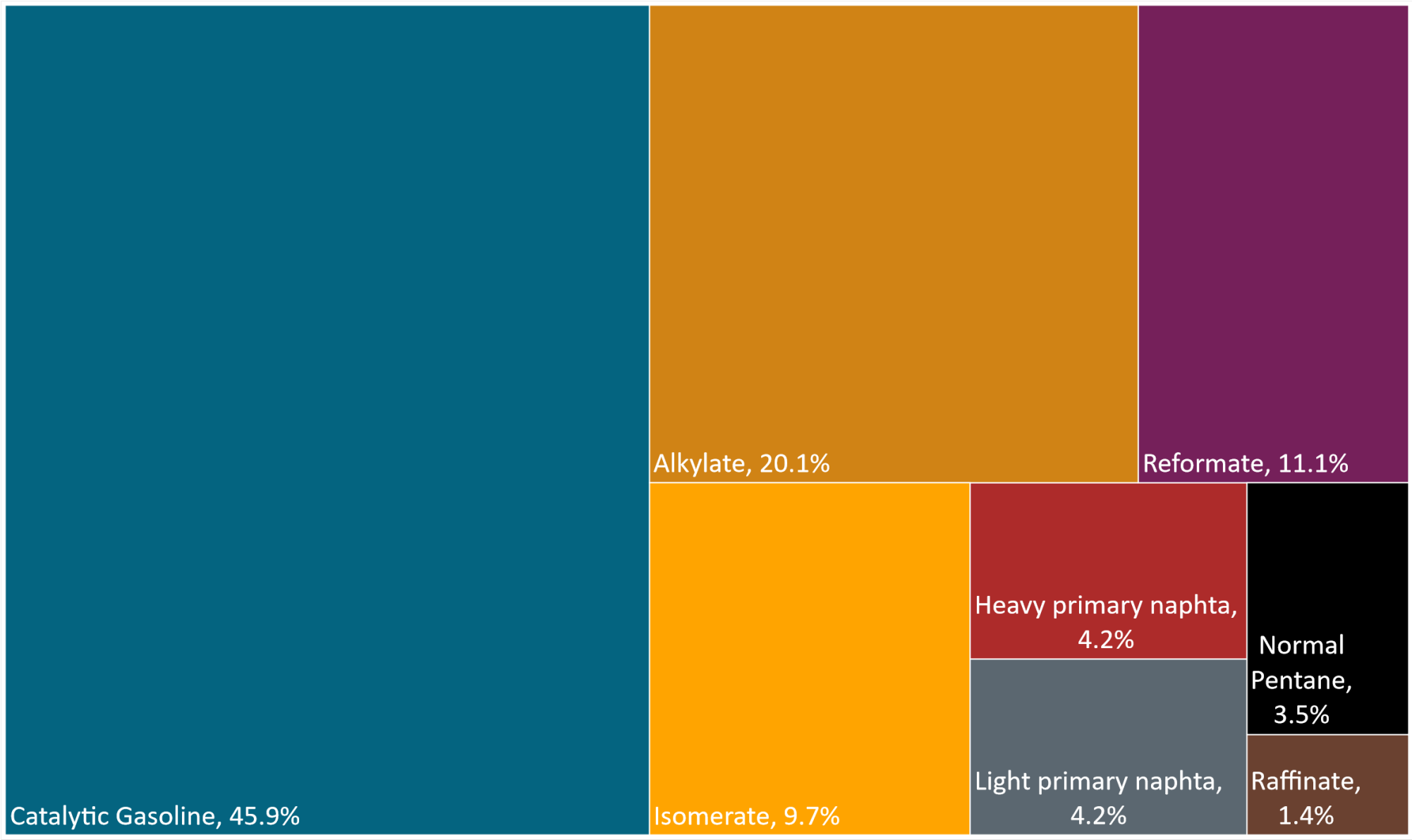
- Components prices,
- Properties each component affects,
- Quality parameters by country, and
- Component availability by country.

Through iterations, the model obtains the %v/v of the components to be blended with 10%, 15%, 20%, 25% and 30% of ethanol, in such a way that the final blend complies with the required properties of a finished gasoline by country.

The blending model uses gasoline component spot average prices January 2022 – February 2023 and provides fuel prices that do not include country distribution costs, local taxes and subsidies and import or gas station margins.

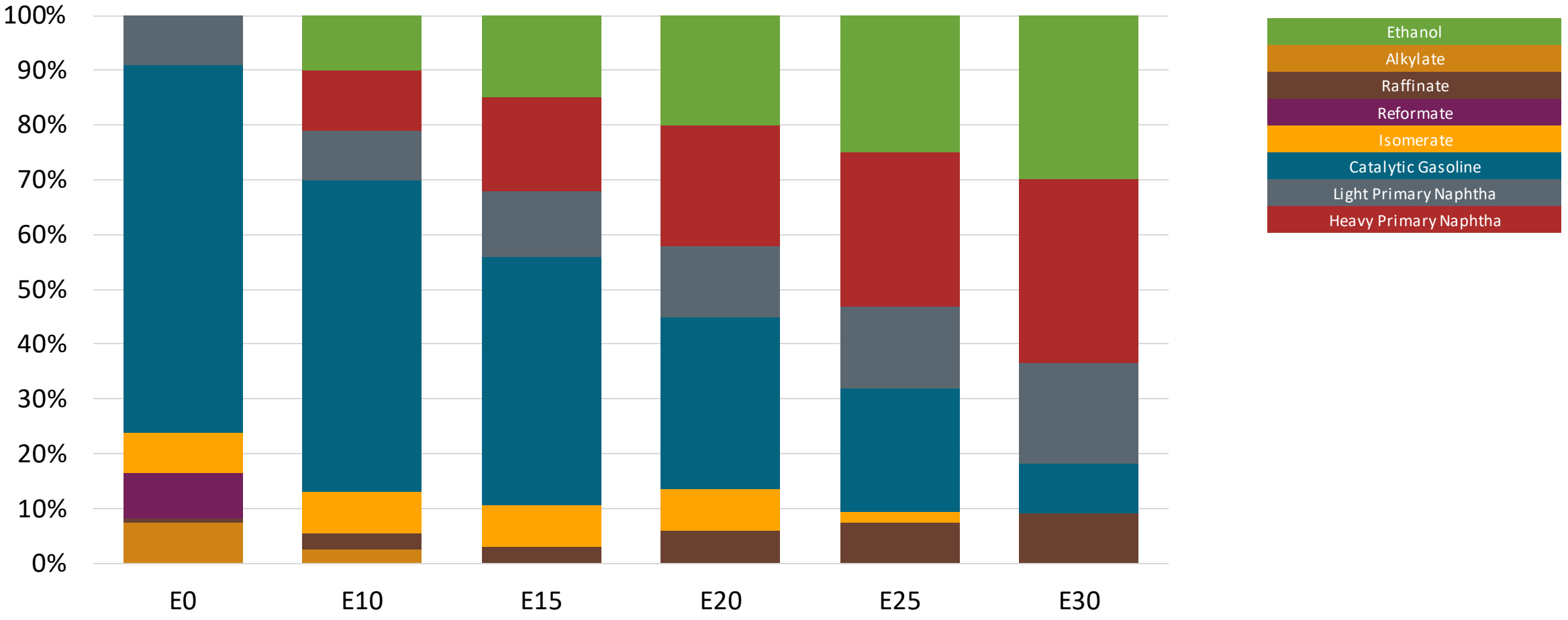


Blending Components- Honduras



Source: Faro90

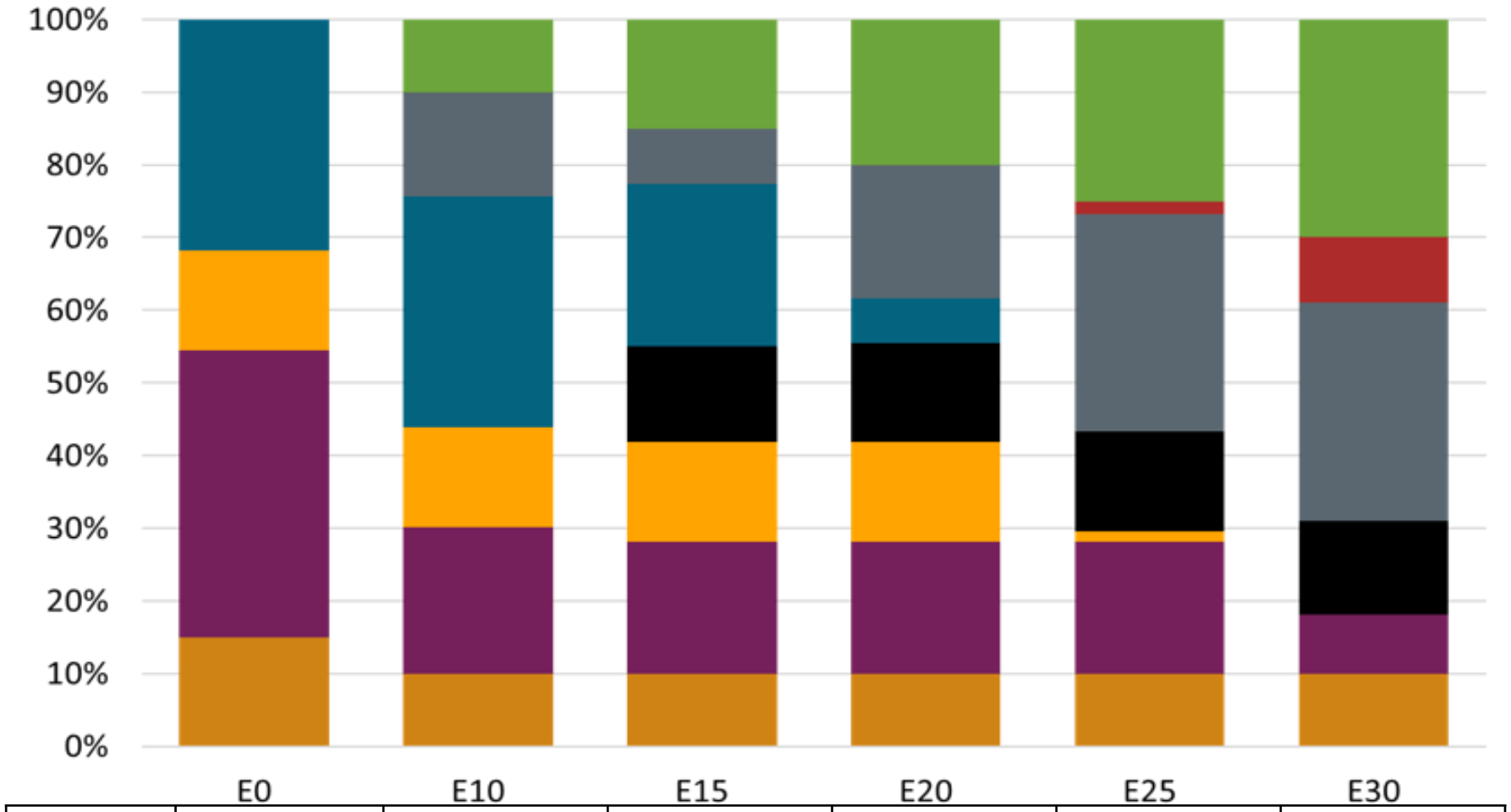
Honduras – Regular – Constant Octane



Octane (RON)	91.0	91.0	91.0	91.0	91.2	91.3
Price (USD/gal)	$ 2.331	$ 2.189	$ 2.127	$ 2.067	$ 2.009	$ 1.945

Prices are average Jan 22 – Feb 23.
They do not include local distribution costs, import or gas station margins, taxes and subsidies.

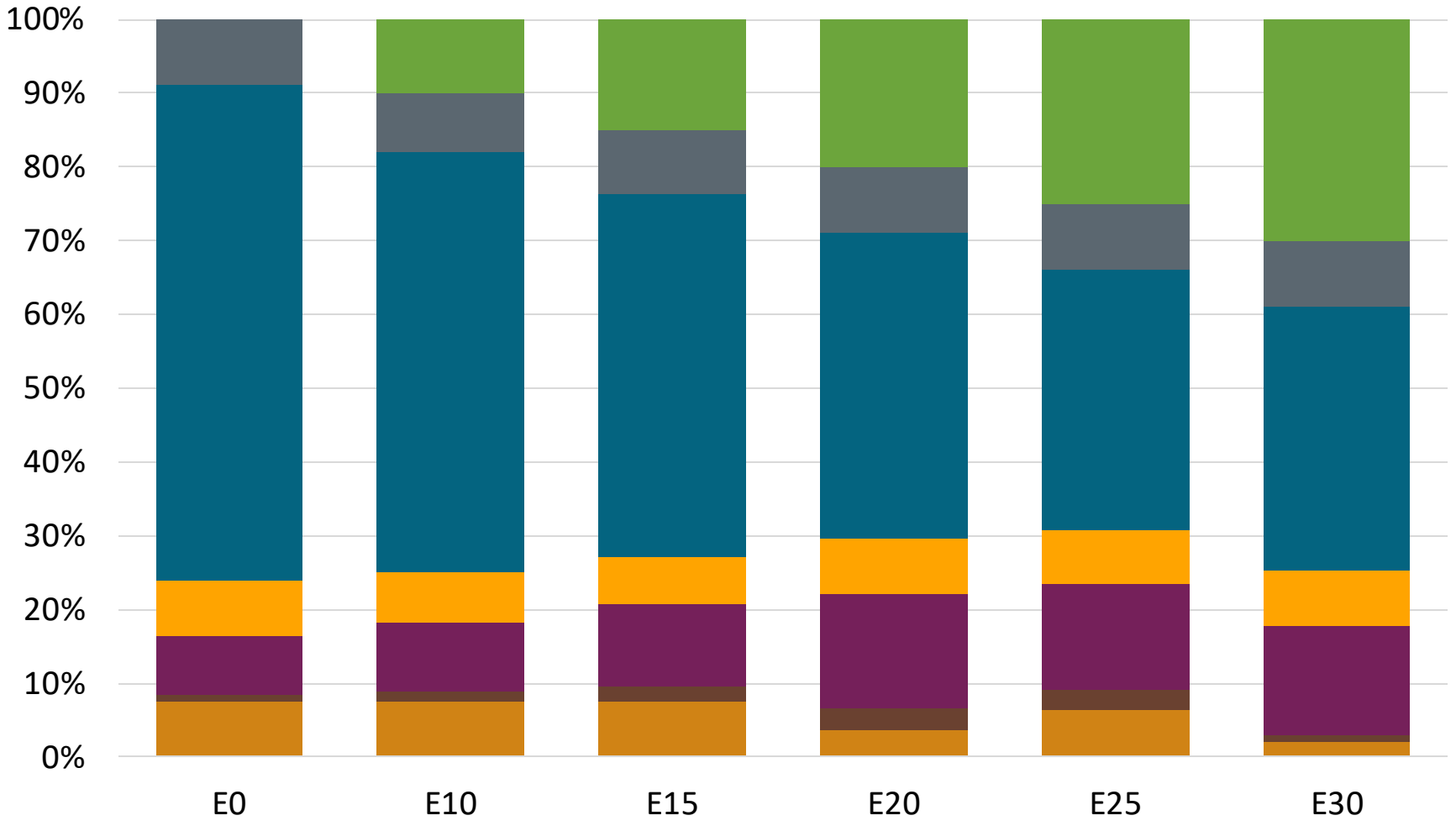
Honduras – Premium – Constant Octane



	E0	E10	E15	E20	E25	E30
Octane (RON)	95.0	95.0	95.0	95.0	95.0	95.0
Price (USD/gal)	$ 2.497	$ 2.364	$ 2.273	$ 2.198	$ 2.116	$ 2.032

Prices are average Jan 22 – Feb 23.
They do not include local distribution costs, import or gas station margins, taxes and subsidies.

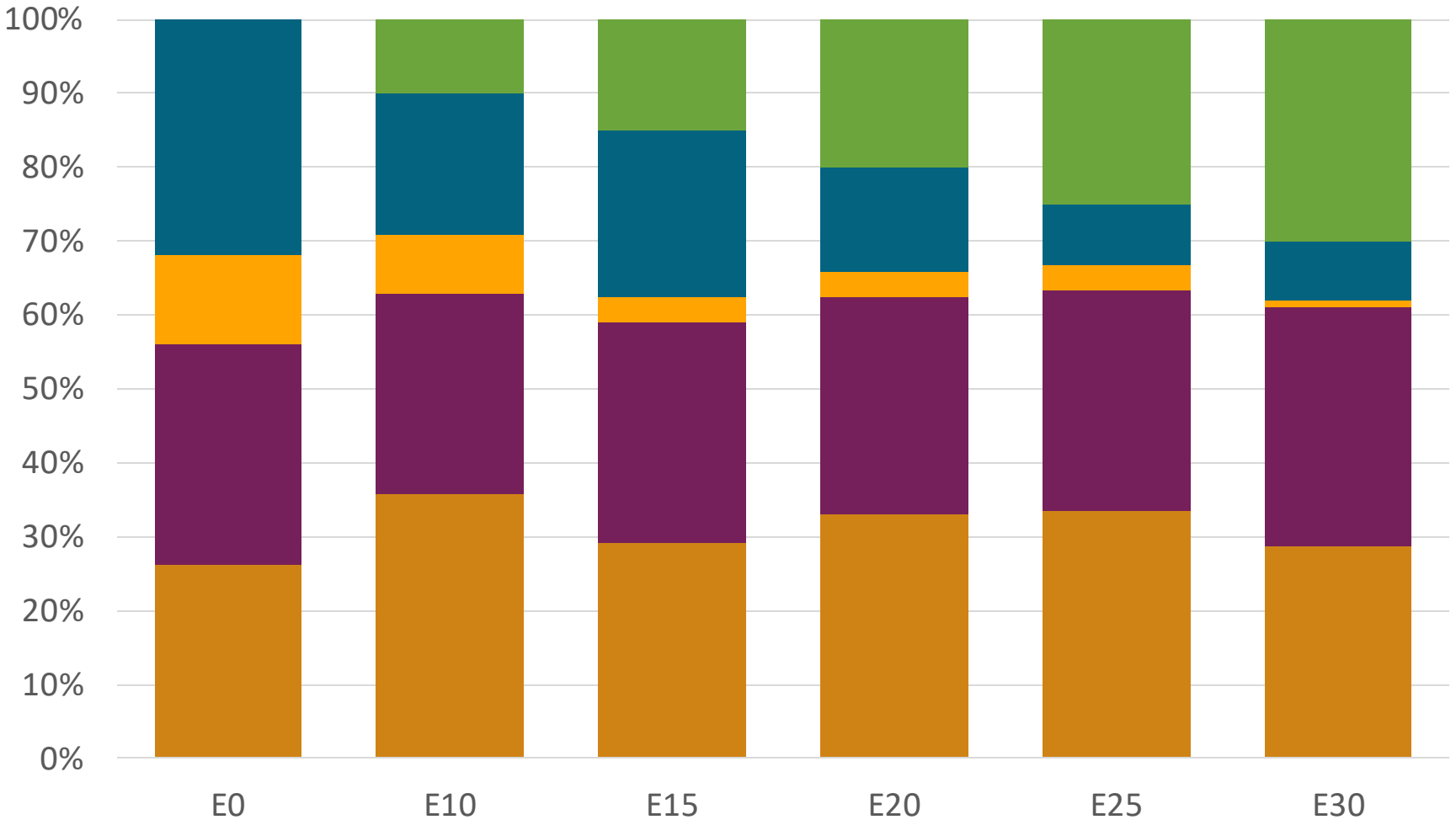
Honduras – Regular – Octane Increment



Octane (RON)	91.0	95.7	97.8	99.7	101.6	103.8
Price (USD/gal)	$ 2.326	$ 2.326	$ 2.326	$ 2.326	$ 2.326	$ 2.326

Prices are average Jan 22 – Feb 23.
They do not include local distribution costs, import or gas station margins, taxes and subsidies.

Honduras – Premium – Octane Increment



Octane (RON)	95.0	99.1	101.5	103.2	105.0	106.8
Price (USD/gal)	$ 2.484	$ 2.484	$ 2.484	$ 2.484	$ 2.484	$ 2.484

Prices are average Jan 22 – Feb 23.
They do not include local distribution costs, import or gas station margins, taxes and subsidies.

Vehicle Emission Impact for Ethanol Gasoline Blending

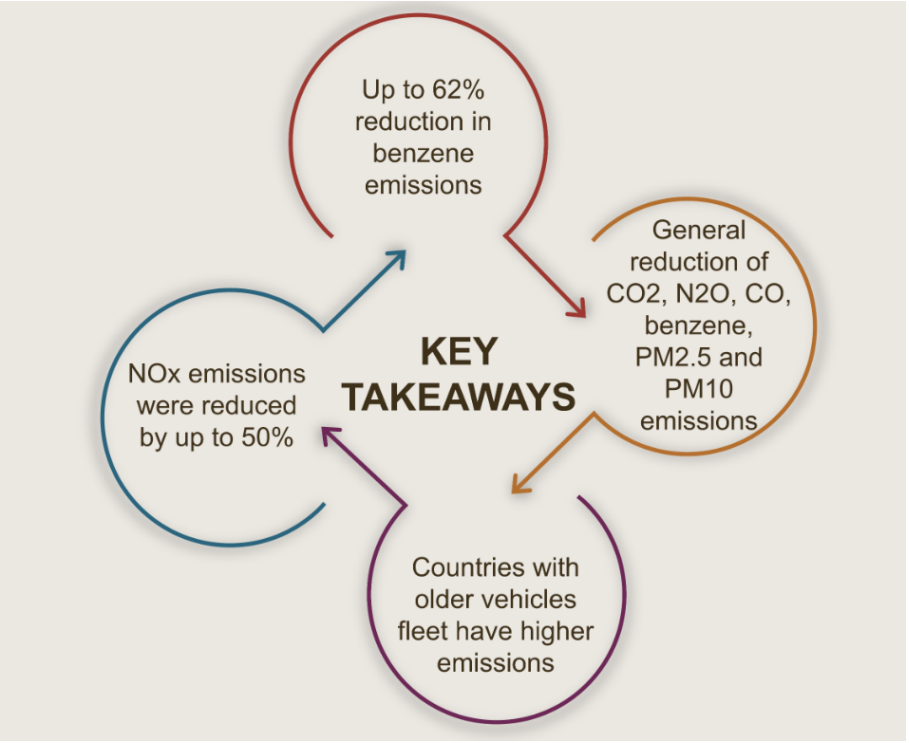
The model used in this analysis takes as a reference the **International Vehicle Emissions Model (IVE).**
The model uses the Base Emission Rates from IVE model, as well as its Adjustment Factors based on:

- Vehicle technology (cars, trucks, buses, motorcycles),
- Vehicle fleet average age,
- Average traveled distance per vehicle by country, as well as
- Geographical and climatic conditions (altitude, humidity, temperature).

Emissions of criteria pollutants, toxic pollutants, and greenhouse gases (GHG) were calculated and calibrated with emission inventories, using real gasoline quality data. The reduction rates for gasoline/ethanol blends were obtained from various sources (IPCC, US Grains, among others).

Emission estimations for different pollutants for gasoline and gasoline/ethanol blends (10%, 15%, 20%, 25% and 30% ethanol) were determined using the IVE Model. A comparison between the results and the European (Euro 6) requirements is made. Results are also compared with real emissions of the United States vehicle fleet*.

Main Results



Source: Bureau of transportation statistics.

Gasoline Vehicle Fleet - Honduras

Type	Motor	Tailpipe	Recuperator	Age	Number of vehicles
Auto/Sml Truck	Multi FI-Pt	Euro V	PCV Tank	>4years, >80 mkm	105.314
				4-8 years, 80-160 mkm	119.904
				<8 years, < 160 mkm	80.163
		Euro IV		<8 years, < 160 mkm	78.426
		Euro III		<8 years, < 160 mkm	74.433
		3-Ways		<8 years, < 160 mkm	165.264
Sml Engine	FI 4-ciclos	Euro III	PCV	>4 years, >80 mkm	183.213
				4-8 years, 80-160 mkm	104.298
		Euro II		4-8 years, 80-160 mkm	104.298
				<8 years, < 160 mkm	692.896
Truck	FI	Euro V	PCV	>4 years, >80 mkm	79.106
				4-8 years, 80-160 mkm	90.065
				<8 years, < 160 mkm	60.214
		Euro IV		<8 years, < 160 mkm	58.909
		Euro III		<8 years, < 160 mkm	55.910
		3-Ways		<8 years, < 160 mkm	124.137

Vehicle Fleet: **2,176,552**
Average Age: **11 years**
Motorcycles: **38%**

Source: ine.gob.hn, anális Faro 90

Honduras – Gasoline Vehicle Emissions

Emissions	E0 g/km	E10 g/km	E15 g/km	E20 g/km	E25 g/km	E30 g/km	E10 - E0	E20 - E0	E30 - E0	Euro 6	TIER USA
CO	23.15	20.81	19.97	19.18	18.59	17.88	-10%	-17%	-23%	1	3.5
VOC	2.41	2.18	2.10	2.03	1.98	1.89	-10%	-16%	-22%	95	255
VOCevap	0.65	0.65	0.66	0.68	0.69	0.70	0%	4%	7%	0.1	0.273
NOx	0.99	0.69	0.65	0.62	0.58	0.53	-30%	-38%	-46%	0.06	0.203
SOx	0.01	0.01	0.01	0.01	0.01	0.00	-15%	-28%	-41%		
NH3	0.06	0.06	0.06	0.06	0.06	0.06	-2%	0%	1%		
Butadiene	0.01	0.01	0.01	0.01	0.01	0.01	-10%	-17%	-23%		
Acetaldehyde	0.03	0.05	0.08	0.11	0.12	0.15	68%	249%	372%		
Formaldehyde	0.13	0.14	0.17	0.18	0.20	0.21	13%	39%	68%		
Benzene	0.11	0.10	0.10	0.10	0.09	0.09	-9%	-11%	-18%		
CO2	322.66	306.53	300.37	297.32	294.53	289.10	-5%	-8%	-10%		
N2O	0.02	0.02	0.02	0.02	0.02	0.02	-1%	2%	4%		
CH4	0.53	0.53	0.54	0.55	0.56	0.57	0%	4%	7%		
PM 2.5	0.03	0.02	0.02	0.02	0.01	0.01	-22%	-43%	-65%		
PM10	0.08	0.06	0.05	0.04	0.04	0.03	-22%	-43%	-65%	0.005	0.007
THC	0.82	0.84	0.90	0.95	0.99	1.03	3%	16%	27%		

Source: Faro90