

RENEWABLE RESERVES IN BRAZIL & US – A REPORT BY BNEF COMMISSIONED BY BP

**UNECE WORKSHOP ON UNFC & RENEWABLES –
WASHINGTON D.C**

SALIM MORSY

ALEJANDRO ZAMORANO

25 MARCH 2014



ABOUT BLOOMBERG NEW ENERGY FINANCE

200 staff in 13 offices worldwide
Objective: serve clients with the best intelligence on finance, technology and policy developments in clean energy, energy efficiency and carbon markets



WHO WE SERVE: 700+ LEADING PLAYERS GLOBALLY

GOVERNMENT & AGENCIES



SUPPLY CHAIN & TECHNOLOGY



Bloomberg

NEW ENERGY FINANCE

FINANCE & INVESTMENT



UTILITIES & ENERGY



CONTENTS

1. The study

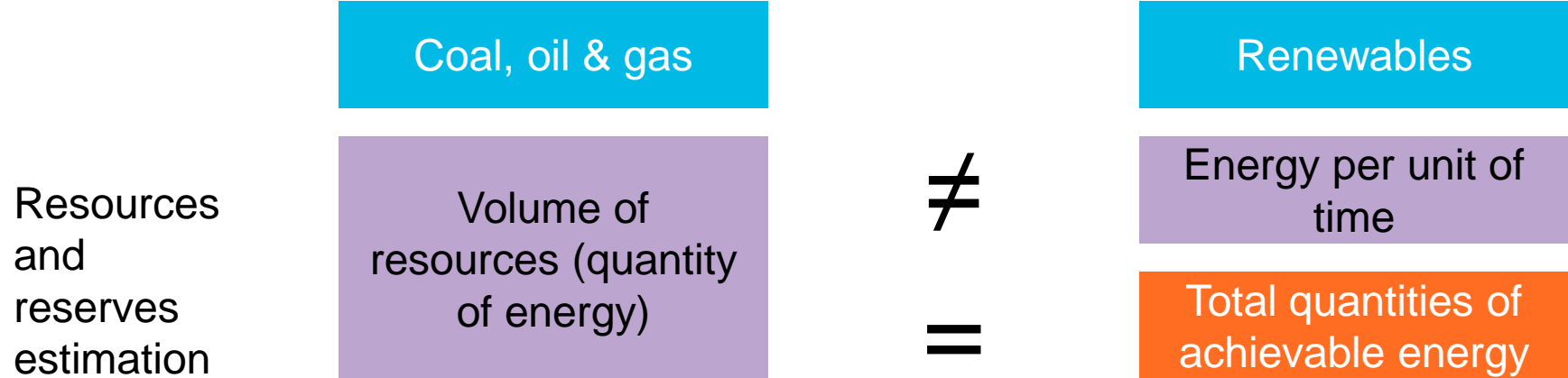
2. Current market situation

INTRODUCTION TO REPORT

- This study was commissioned by BP
- The study is intended to complement the work of the Renewables Reserve Initiative
- The approach used should not be taken as indicative of the final approach that will be used in the Renewables Specification
- The approach is not representative of BP's view of that methodology

PURPOSE OF ANALYSIS

- Renewable energy's importance in global energy mix is increasing
- The world lacks a widely-agreed methodology for comparing renewable energy projects with each other and with fossil fuels
- Yet comparisons only include the capacity and output of renewals today, rather than potential contribution over decades

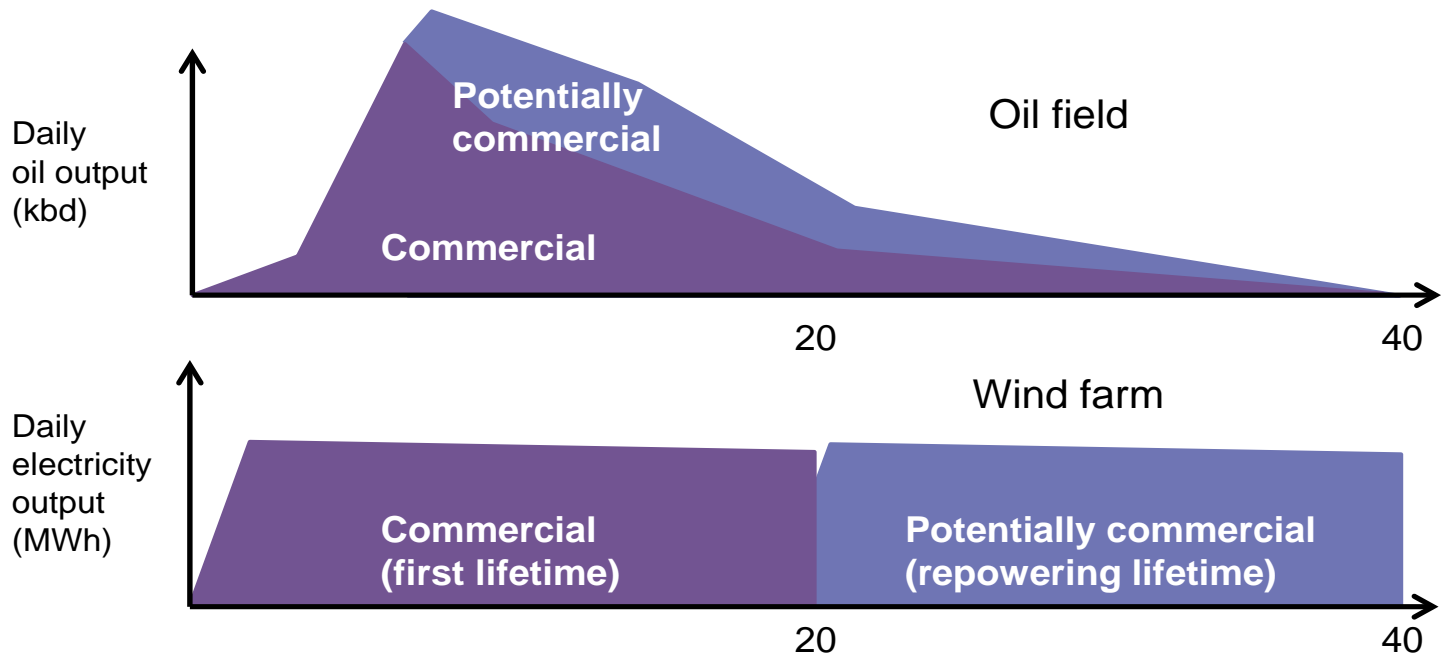


A reserves methodology for renewables analogous to that of fossil fuels

?

THE CHALLENGE

Representative profiles of energy output from an oil and wind project



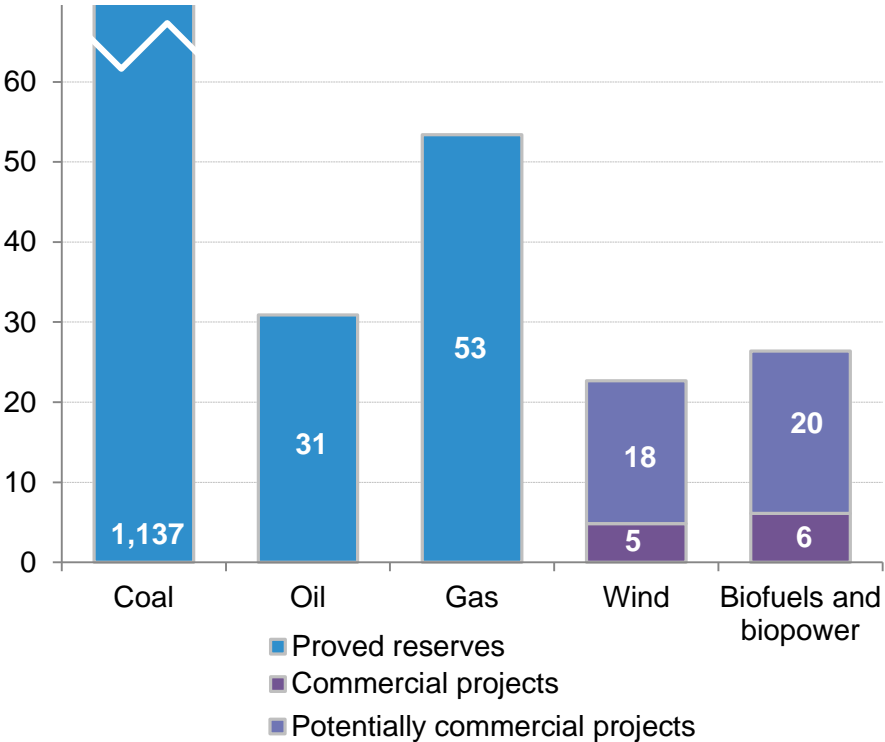
Source: Bloomberg New Energy Finance

A QUICK WORD ON METHODOLOGY

	Oil and gas: UNFC-2009 sub-classes	Renewable energy: Development stage in BNEF project database
Commercial projects	On production; Approved for development; Justified for development.	Commissioned (i.e. in operation)
Potentially commercial projects	Development pending; Development on hold.	Announced (less than 8 years ago) Financing approved Under construction Lifetime extensions of commissioned projects
Non-commercial projects	Development unclarified Development not viable	Decommissioned Construction cancelled Announced (over 8 years ago)
Exploration projects	Unknown quantities	[Not applicable for renewable energy]

Source: UNECE UNFC-2009, RRI, Bloomberg New Energy Finance

RESULTS: US ENERGY RESERVES (BBOE)

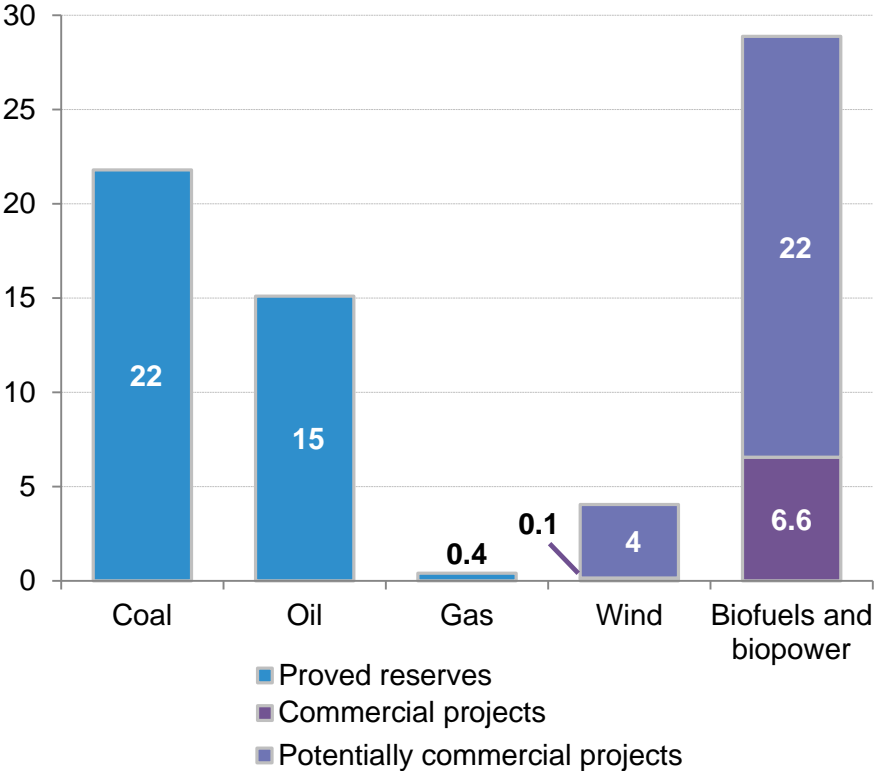


1. Combined reserves for **commercial** projects are 1/7th the size of the equivalent combined oil and gas reserves:
 1. Wind → 5bboe
 2. Biofuels/Biopower → 6bboe
 3. Oil → 31bboe
 4. Gas → 53bboe
2. Combined reserves for **potentially commercial** projects are three times higher than those of existing projects
3. **Potentially commercial** reserves are will on their own be larger than **commercial reserves**

Note: Bloomberg New Energy Finance. Oil and gas data: BP Statistical Review (31 Dec 2011). Analysis: Bloomberg New Energy Finance. Note that Commercial projects are equivalent to Proved reserves for fossil fuels. Commercial reserves include only the remainin lifetime projects that are currently in operations, whereas potentially commercial reserves include the post-refurbishment like of current projects plus pre- and post-refurbishment lifetime of planned projects.

Source: Wind, biofuels and biopower data (31 Jan 2013):

RESULTS: BRAZIL ENERGY RESERVES (BBOE)



1. Combined reserves for **commercial** projects are 2/5th of proven oil and gas reserves
 1. Wind → 0.1bboe
 2. Biofuels/Biopower → 6.6bboe
 3. Oil → 15bboe
 4. Gas → 22bboe
2. When taking into account power and heat from bagasse, Brazil's bioenergy reserves exceed those of the US

Analysis: Bloomberg New Energy Finance. Note that Commercial projects are equivalent to Proved reserves for fossil fuels.

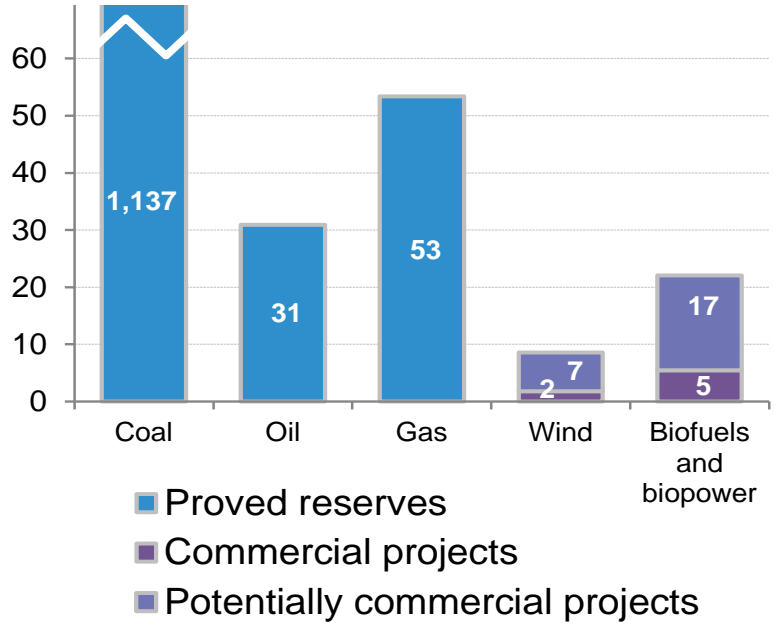
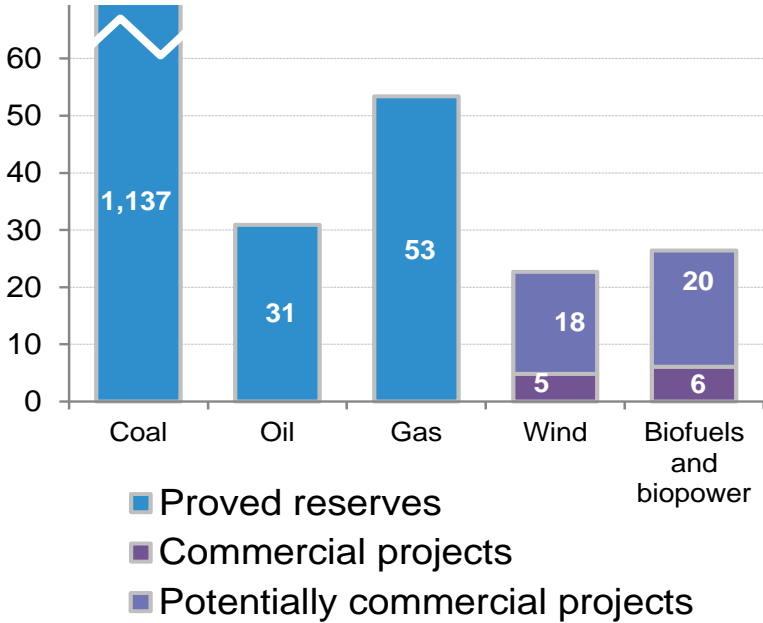
Source: Wind, biofuels and biopower data (31 Jan 2013): Bloomberg New Energy Finance. Oil and gas data: BP Statistical Review (31 Dec 2011).

* Billion barrels of oil equivalent. Chart excludes other energy sources such as solar PV

SENSITIVITY ANALYSIS: US ENERGY RESERVES

WITH 38% THERMAL LOSS CONVERSION FACTOR APPLIED,

WITH 1:1 ENERGY CONVERSION APPLIED, BBOE



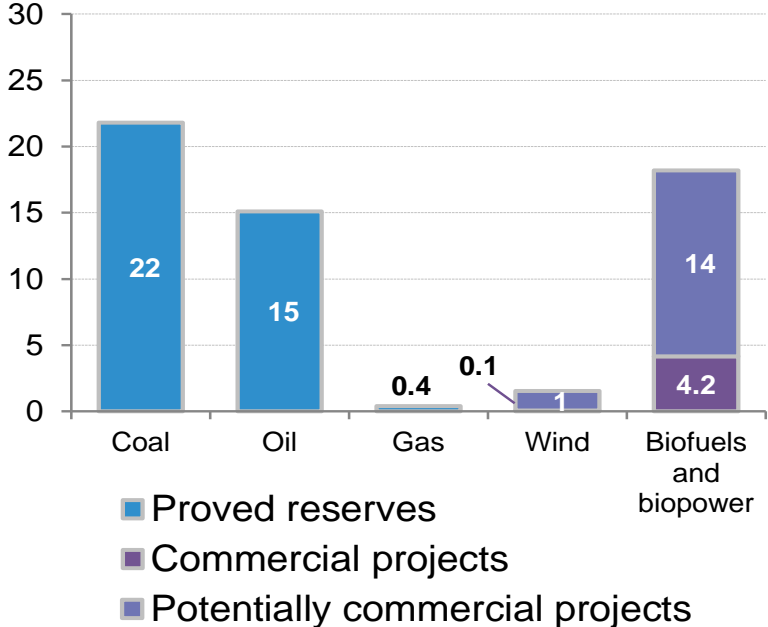
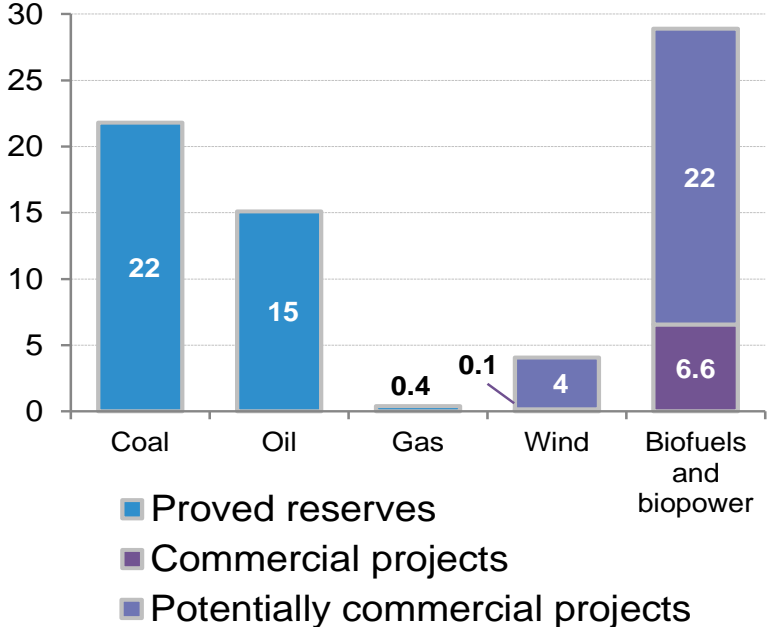
Source: Wind, biofuels and biopower data (31 Jan 2013): Bloomberg New Energy Finance. Oil and gas data: BP Statistical Review (31 Dec 2011). Analysis: Bloomberg New Energy Finance.

bboe = billion barrels of oil equivalent. Chart excludes other energy sources such as solar PV

SENSITIVITY ANALYSIS: BRAZIL ENERGY RESERVES

WITH 38% THERMAL LOSS CONVERSION FACTOR APPLIED,

WITH 1:1 ENERGY CONVERSION APPLIED, BBOE



Source: Wind, biofuels and biopower data (31 Jan 2013): Bloomberg New Energy Finance. Oil and gas data: BP Statistical Review (31 Dec 2011). Analysis: Bloomberg New Energy Finance.

bboe = billion barrels of oil equivalent. Chart excludes other energy sources such as solar PV

CONTENTS

1. The study

2. Current market situation

CHANGE IN THE RENEWABLE FUEL STANDARD FOR 2007,2013 & 14 (BN GALLONS)

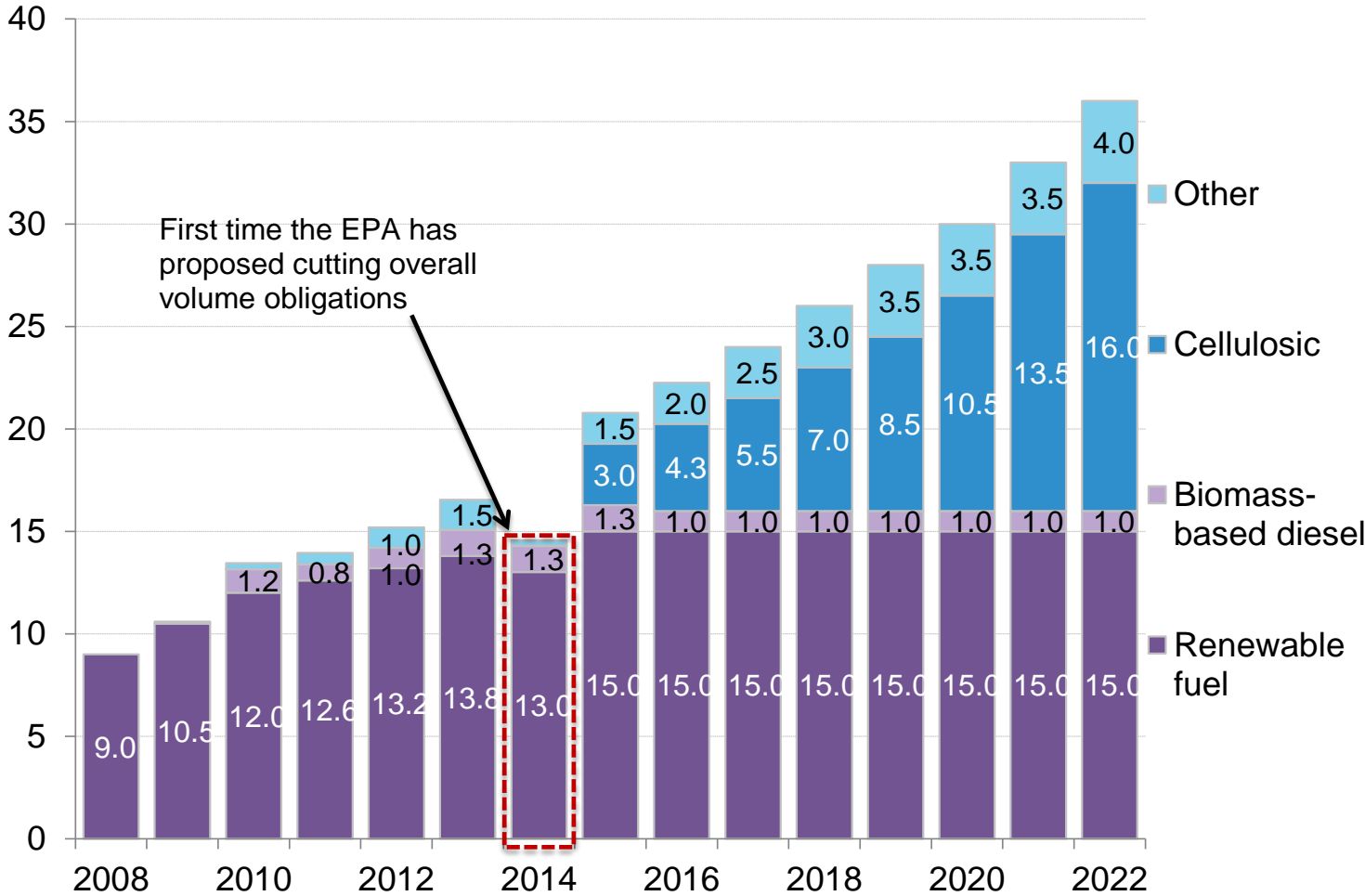
Biofuel type	EISA	2013	Δ 2014 ^P /2013	Δ 2014 ^P /EISA	2014 ^P
Cellulosic	1.75	0.01	21%	-99%	0.02
Biomass	1.92	1.92	0%	0%	1.92
Other	0.08	0.82	-68%	229%	0.26
Total Advanced	3.75	2.75	-20%	-41%	2.20
Renewable fuel	14.40	13.80	-6%	-10%	13.01
Total renewable fuel	18.15	16.55	-8%	-16%	15.21

Total renewable fuel standard reduced for the first time

Note: all volumes in ethanol equivalent gallons

Source: Bloomberg New Energy Finance, EPA

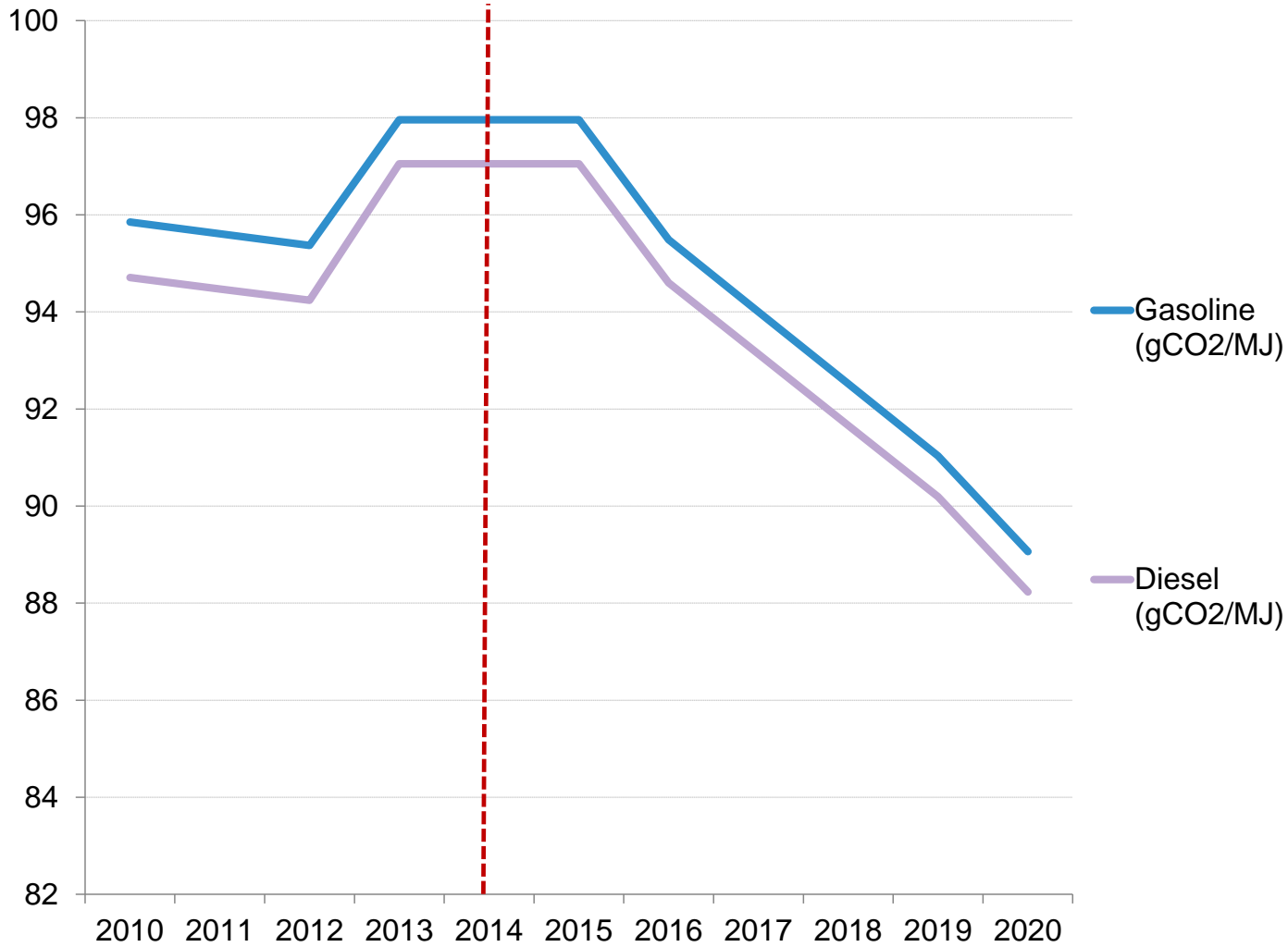
US-WIDE RFS2 BIOFUEL BLENDING REQUIREMENTS, 2008-22 (BN GALLONS)



Note: 2014 levels reflect the EPA's proposal, which has not yet been finalised. Levels shown for future years assume that the requirements immediately revert to the levels originally dictated by the 2007 legislation; in practice, though, this is unlikely.

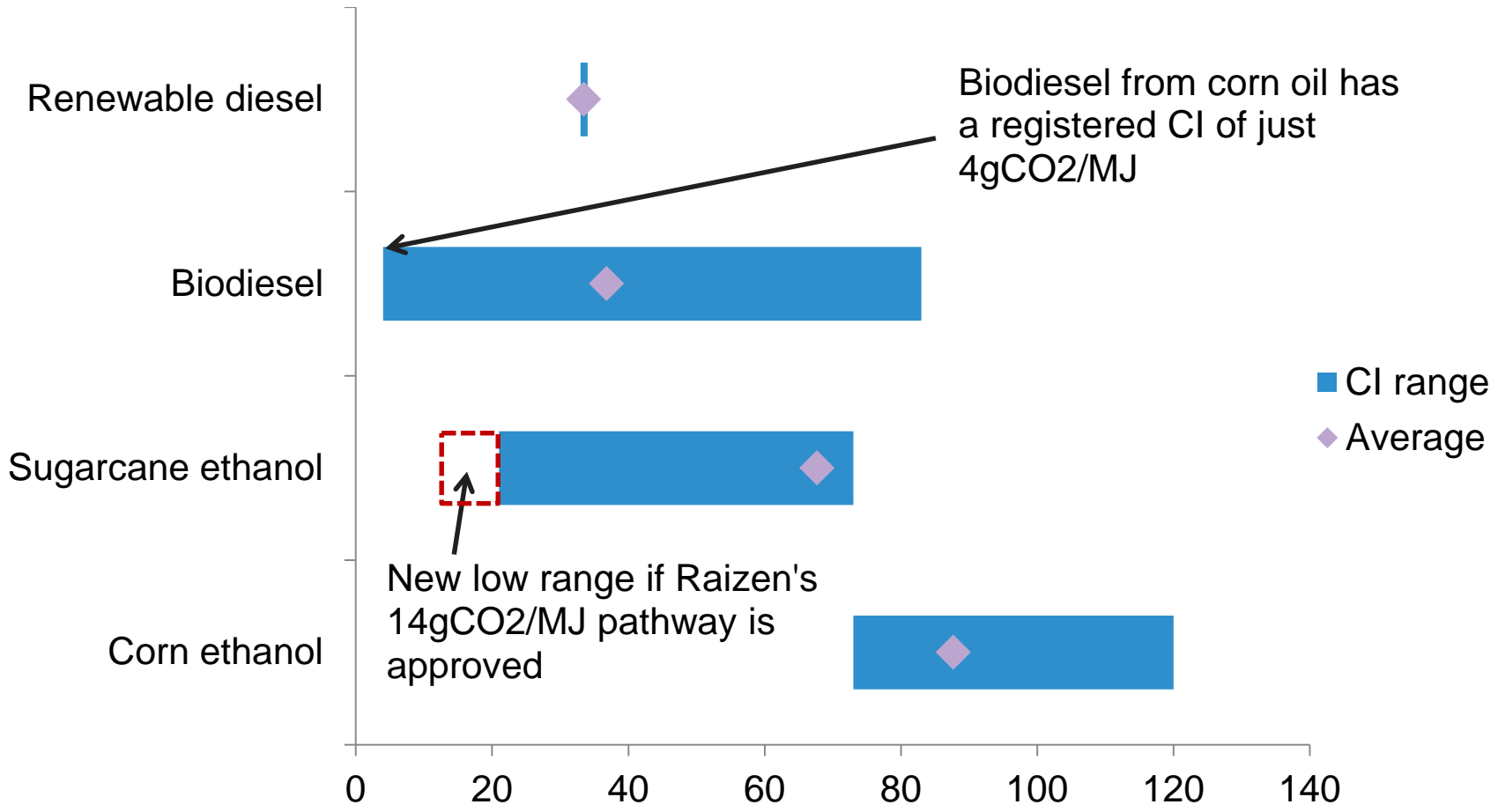
Source: Bloomberg New Energy Finance

LCFS COMPLIANCE SCHEDULE 2011 – 2020 (GCO2E/MJ)



Source: Bloomberg New Energy Finance, CARB,

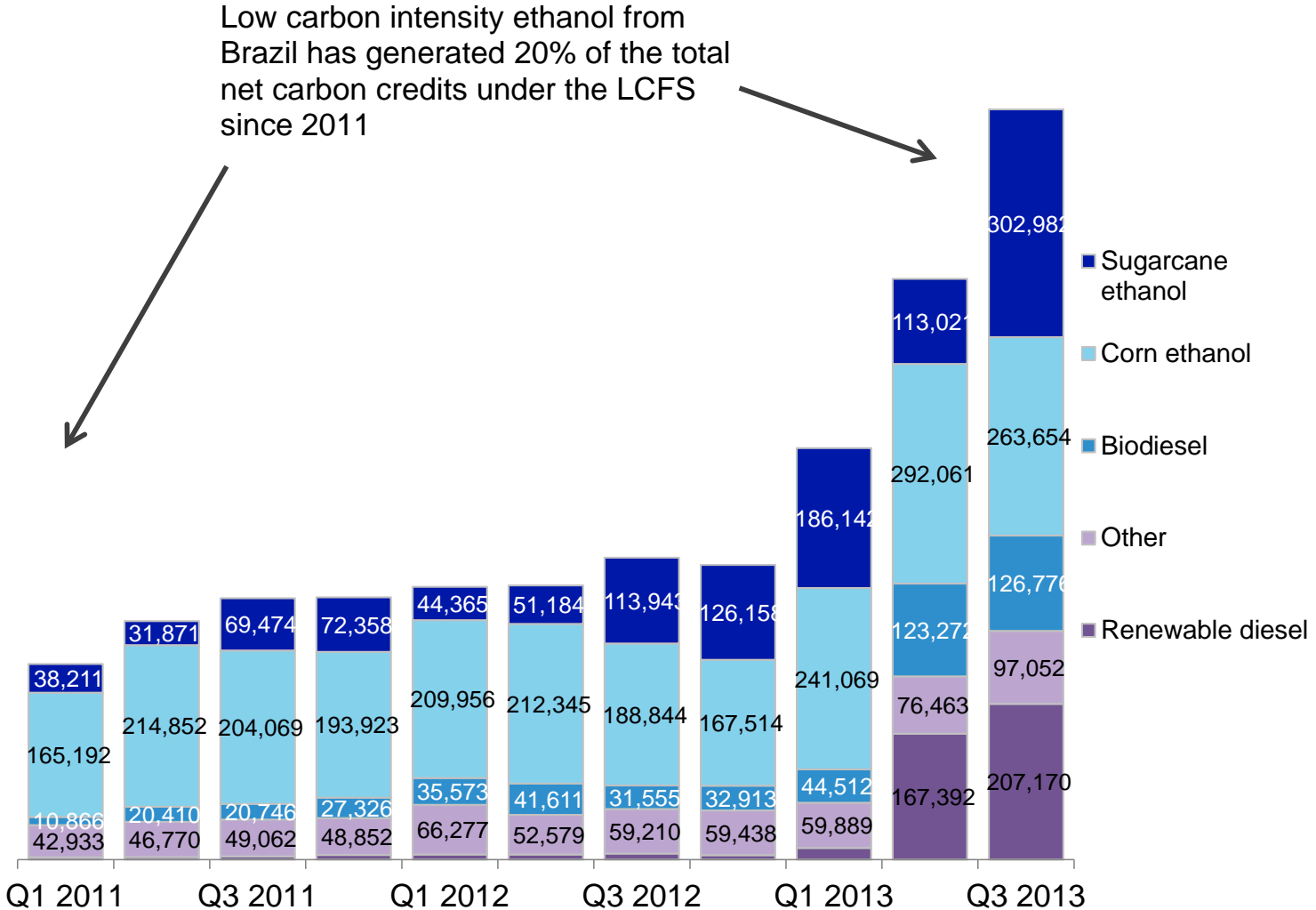
CI VALUES: RANGE OF REGISTERED FUELS IN THE LCFS AND WEIGHTED AVERAGES BASED ON SUPPLY, 2014 (GCO2E / MJ)



Note: CI stands for carbon intensity. Weighted averages refer to the weighted average of the CI values of the various biofuels, based on their total volume registered with CARB.

Source: Bloomberg New Energy Finance, CARB

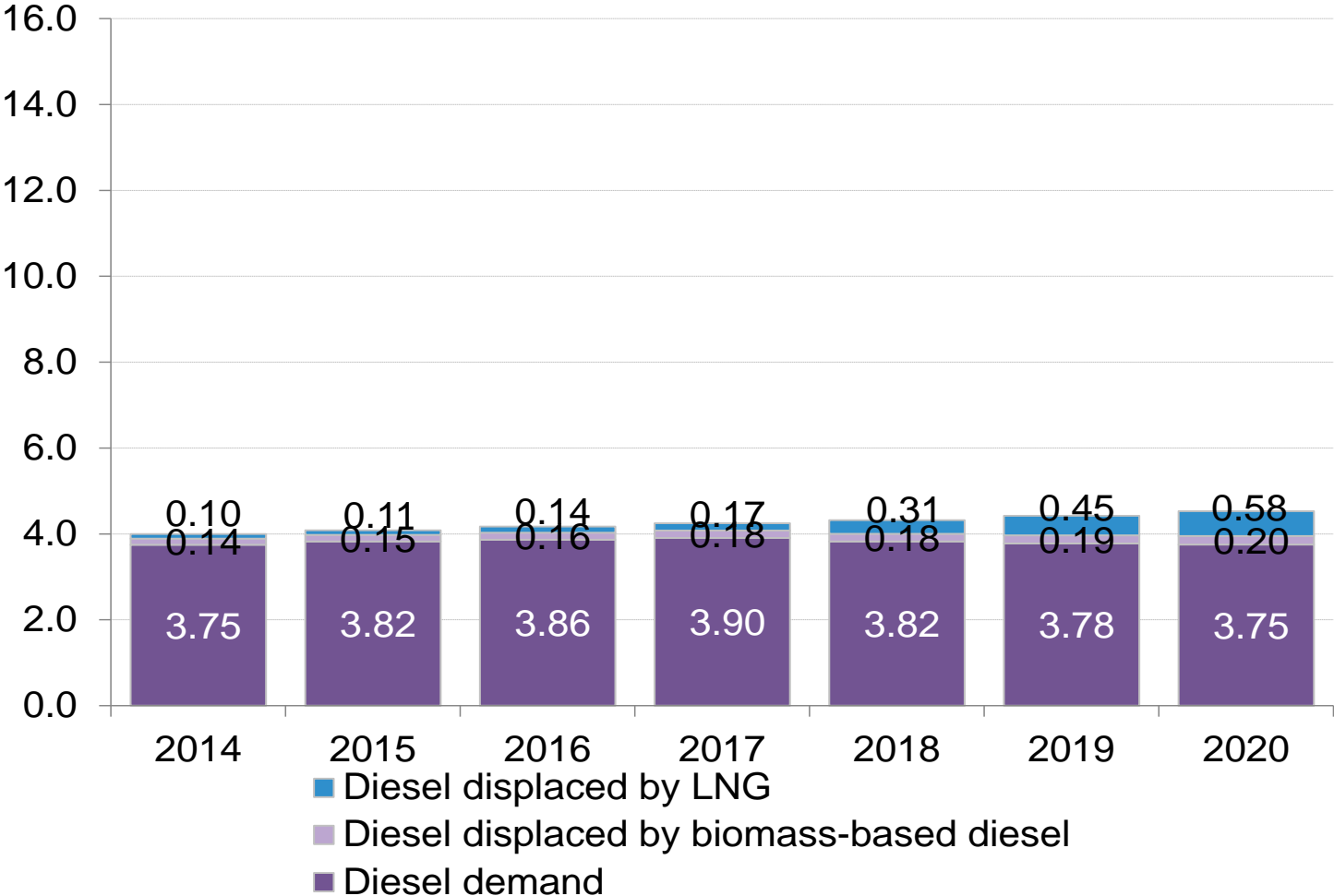
SOURCES OF NET CARBON CREDIT GENERATION UNDER THE LCFS, 2011–2013 (TONNES OF CO2)



Notes: Other=electric vehicles, compressed natural gas, liquefied natural gas.

Source: Bloomberg New Energy Finance, CARB

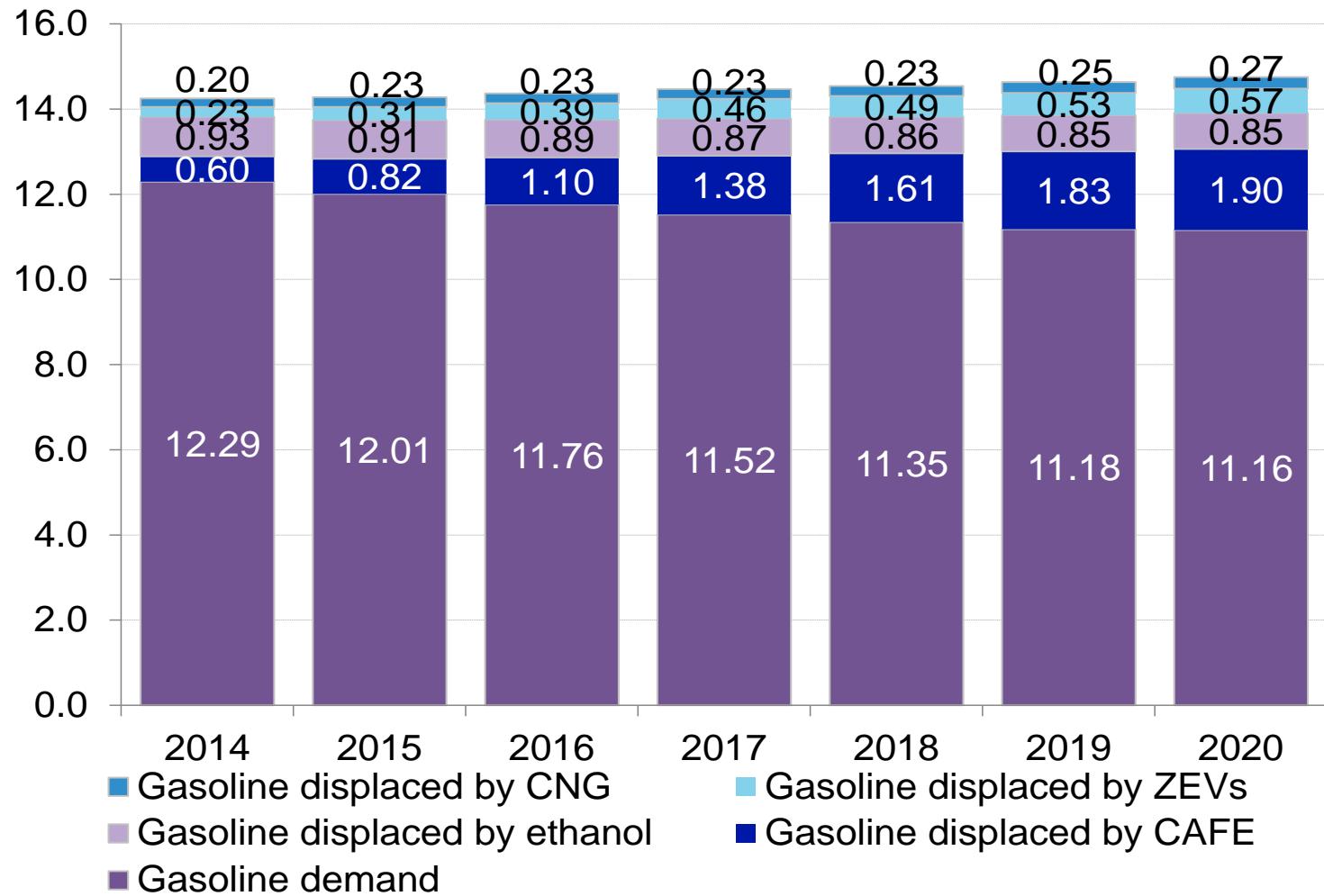
PROJECTED CALIFORNIA DIESEL DEMAND AND SOURCES OF DISPLACEMENT (BASE CASE), 2014-20 (BN GALLONS)



Note: All volumes are expressed in diesel gallon equivalents (DGE). Volumes of displacement are measured relative to the demand for gasoline and diesel that would have occurred had the drivers of displacement not existed at all.

Source: Bloomberg New Energy Finance

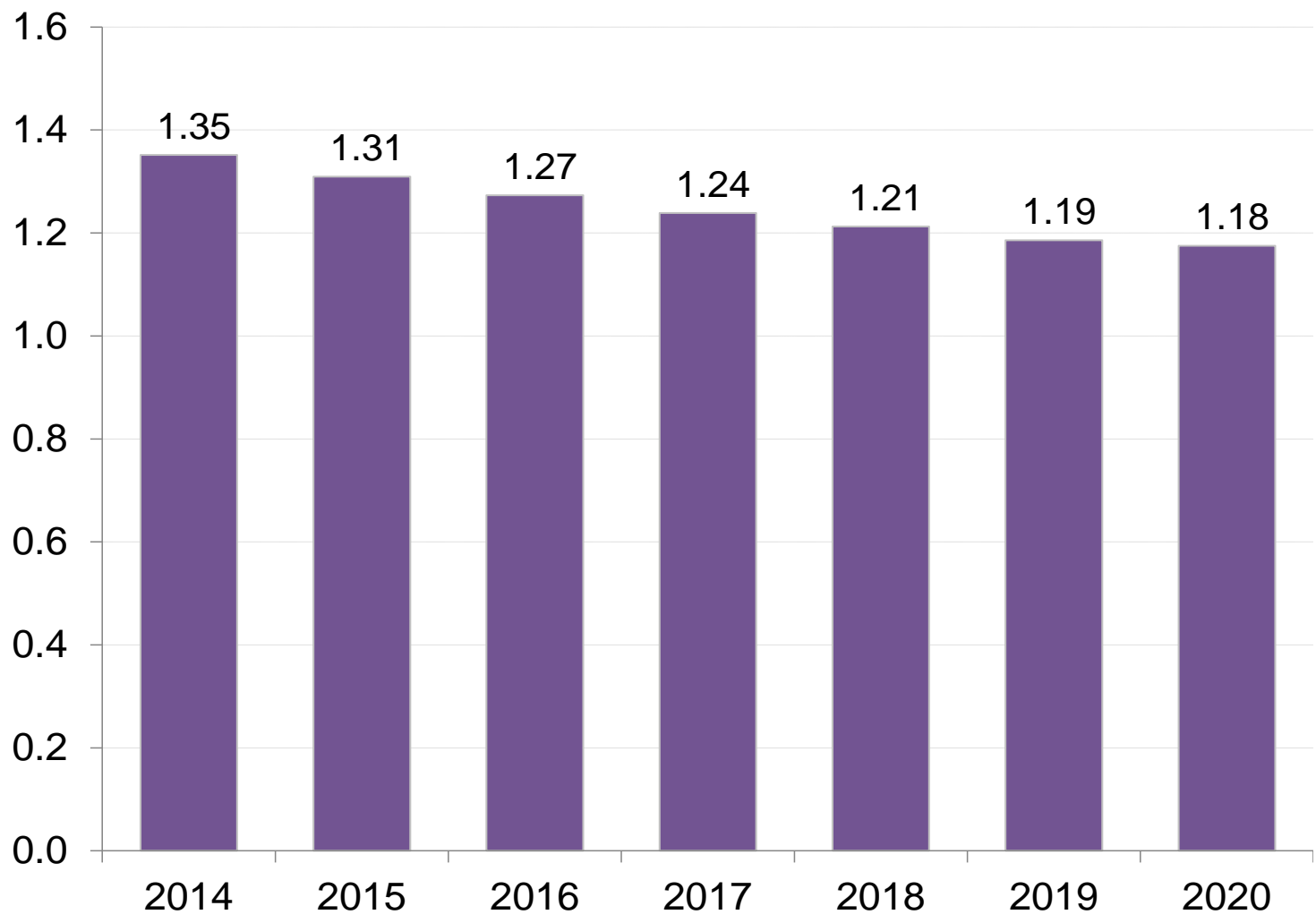
PROJECTED CALIFORNIA GASOLINE DEMAND AND SOURCES OF DISPLACEMENT (BASE CASE), 2014-20 (BN GALLONS)



Note: All volumes are expressed in gasoline gallon equivalents (GGE). Volumes of displacement are measured relative to the demand for gasoline and diesel that would have occurred had the drivers of displacement not existed at all.

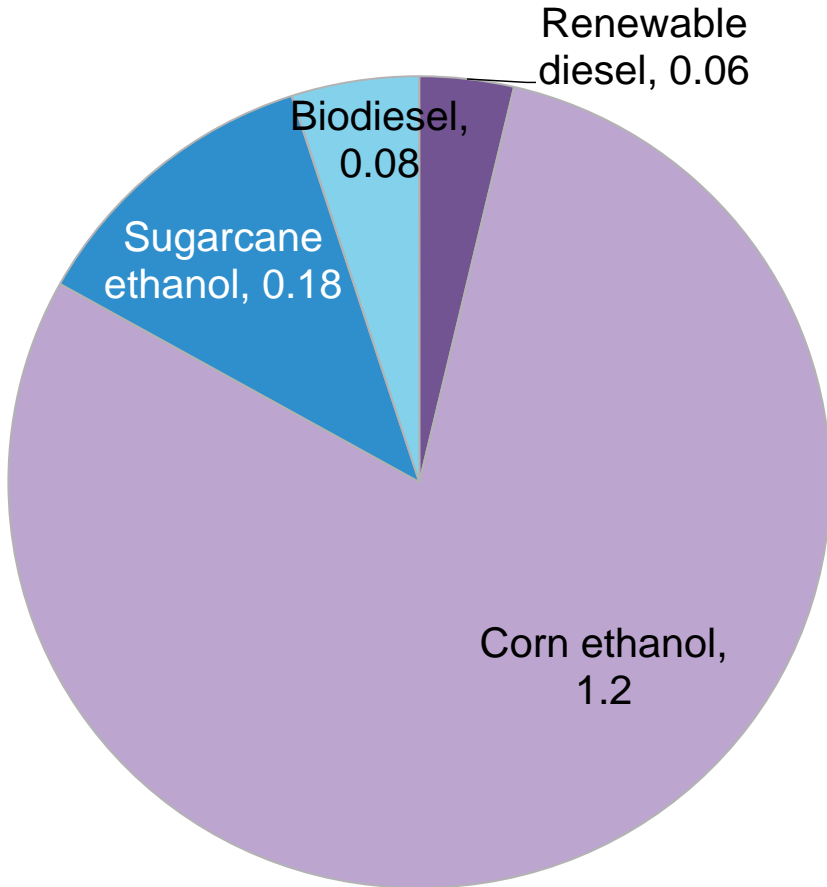
Source: Bloomberg New Energy Finance

PROJECTED DEMAND IN CALIFORNIA FOR ETHANOL, 2014-20 (BN GALLONS)



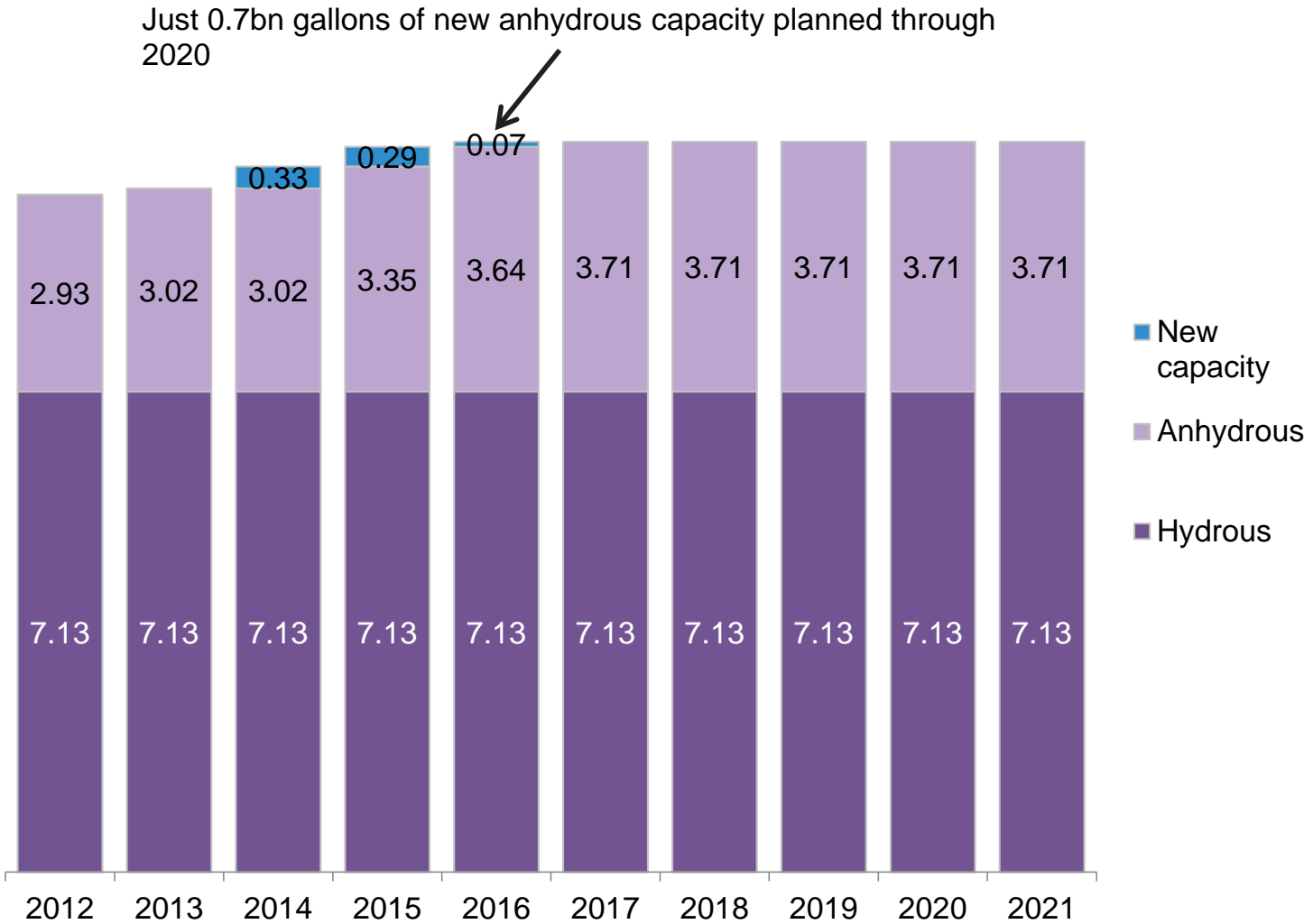
Source: Bloomberg New Energy Finance, CARB

PROJECTED CALIFORNIA BLENDED BIOFUEL MIX, 2014 (BN GALLONS)



Source: Bloomberg New Energy Finance, CARB

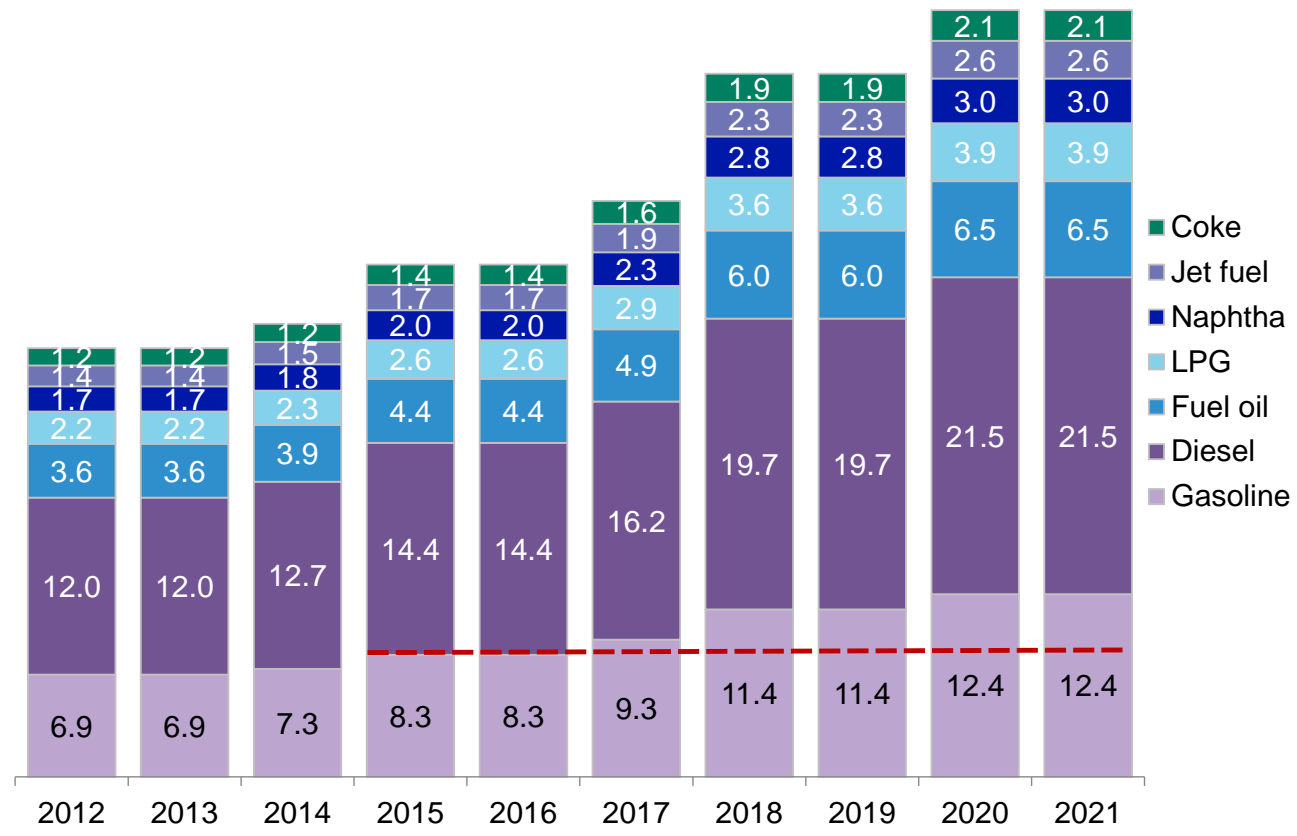
BRAZIL ETHANOL PRODUCTION CAPACITY AND PLANNED EXPANSIONS, 2012–2021 (BN GALLONS)



Notes: We assume all new ethanol production capacity will be anhydrous.

Source: Bloomberg New Energy Finance, ANP, Petrobras

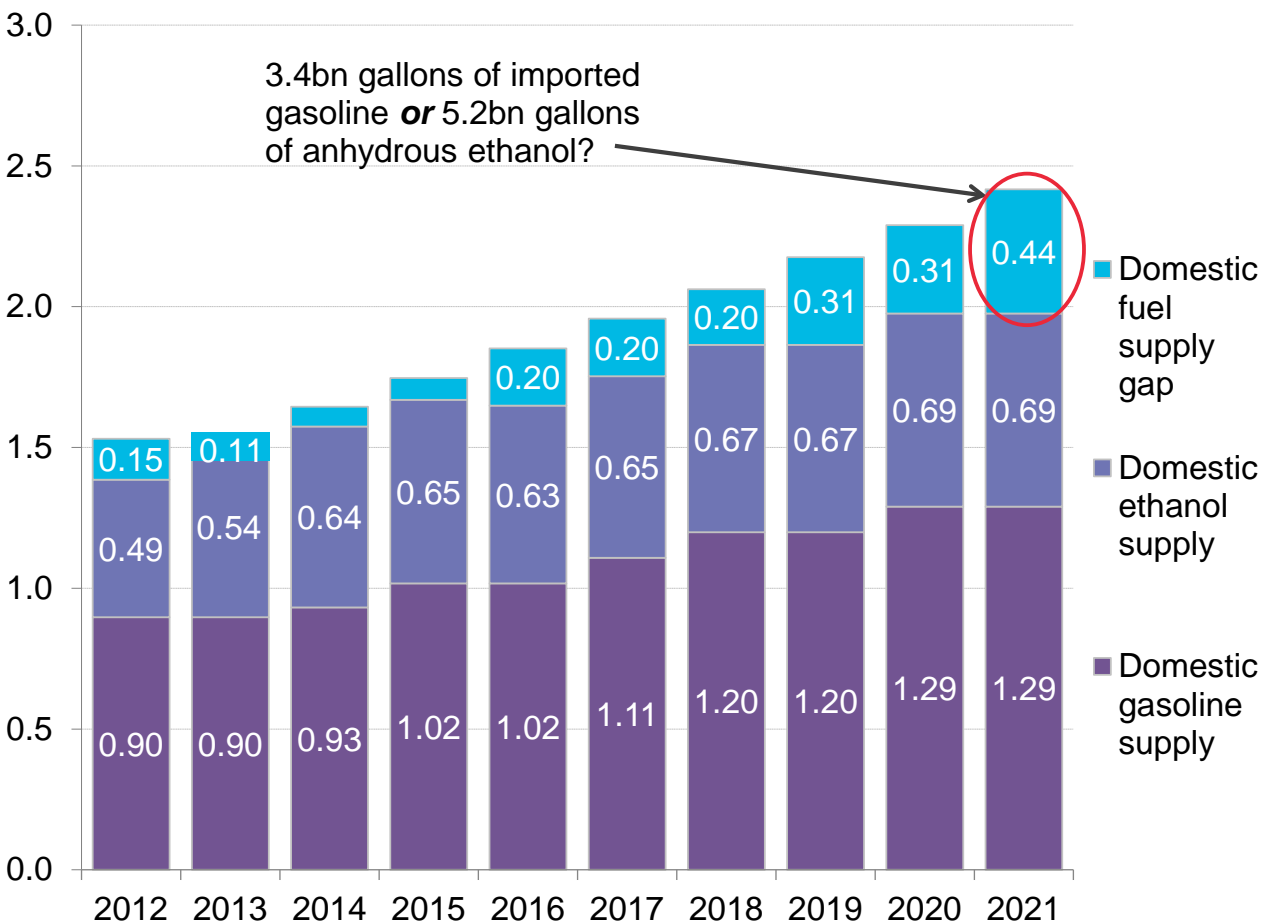
BRAZIL PETROLEUM PRODUCTS REFINING CAPACITY, 2012–2021 (BN GALLONS)



Notes: We do not include the installed capacity for aviation gasoline, heating fuel, lubricants, paraffins and solvents. We include the output of the Premium 1 second module that Petrobras is planning on building although no firm commissioning date is set. Gasoline capacity includes all naptha hydrocracking and catalytic reforming capacity.

Source: Bloomberg New Energy Finance, ANP, Petrobras

BASE CASE BRAZIL LIGHT VEHICLE FUEL DEMAND AND SOURCES OF SUPPLY, 2012–2021 (EXAJOULES)



Notes: Domestic gasoline supply capacity is based on announced gasoline cracking expansions at Petrobras refineries as well as announced new refineries. Ethanol supply is based on the BNEF database of announced sugarcane greenfields and expansions through 2015. We base fuel demand on the Brazil government's projection of vehicle sales in Brazil. In addition, we assume the total vehicle fleet gains 0.2% of fuel efficiency on a yearly basis.

Source: Bloomberg New Energy Finance, EPE, ANP

COPYRIGHT AND DISCLAIMER

This publication is the copyright of Bloomberg New Energy Finance. No portion of this document may be photocopied, reproduced, scanned into an electronic system or transmitted, forwarded or distributed in any way without prior consent of Bloomberg New Energy Finance.

The information contained in this publication is derived from carefully selected sources we believe are reasonable. We do not guarantee its accuracy or completeness and nothing in this document shall be construed to be a representation of such a guarantee. Any opinions expressed reflect the current judgment of the author of the relevant article or features, and does not necessarily reflect the opinion of Bloomberg New Energy Finance, Bloomberg Finance L.P., Bloomberg L.P. or any of their affiliates ("Bloomberg"). The opinions presented are subject to change without notice. Bloomberg accepts no responsibility for any liability arising from use of this document or its contents. Nothing herein shall constitute or be construed as an offering of financial instruments, or as investment advice or recommendations by Bloomberg of an investment strategy or whether or not to "buy," "sell" or "hold" an investment.

RENEWABLE RESERVES IN BRAZIL & US

ALEJANDRO ZAMORANO,
AZAMORANOCAD@BLOOMBERG.NET

MARKETS

Renewable Energy

Carbon Markets

Energy Smart Technologies

Renewable Energy Certificates

Carbon Capture & Storage

Power

Water

Nuclear

SERVICES

Insight: research, analysis & forecasting

Industry Intelligence: data & analytics

News & Briefing: daily, weekly & monthly

Applied Research: custom research & data mining

Knowledge Services: Summit, Leadership Forums, Executive Briefings & workshops

Subscription-based news, data
and analysis to support your
decisions in clean energy, power
and water and the carbon markets

sales.bnef@bloomberg.net



Bloomberg
NEW ENERGY FINANCE