Renewable LPG

GASNOVA - Colombia

Webinar

6th July 2021



LPG-Week
5th – 9th December 2021
Dubai

2021 / DUBAI

LPG WEEK

5-9 DECEMBER

Welcome

Introductions



Alejandro Martínez
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Atlantic Consulting

Renewable LPG

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Agenda

- WLPGA and renewable LPG activities
- Renewable LPG, What, Why, Who, Where
- California's journey toward rLPG
- Europe's journey toward rLPG
- Panel discussion
- Summary, conclusions

WLPGA and rLPG activities



WLPGA – Who We Are

- The only association representing the full LPG global value chain

- Promoting the use of LPG to foster a safer, cleaner, healthier and more prosperous world
- Market Development & Support, Good industry Practices, Innovation, Outreach & Advocacy, World Forums, Congresses & Summits
- More than 300 member companies from over 125 countries

WLPGA – Our Mission & How We Work

THE MISSION

The new mission is defined by three goals:

ADVOCACY (ADV)

To advocate LPG as part of the solution to future energy challenges

BUSINESS IMPROVEMENT (BIM)

To support efficient and responsible business

INNOVATION AND GROWTH (IGO)

To encourage innovation and support business growth

LOOKING TO THE FUTURE

Demonstrate the credibility of meeting at least 50% of 2050 non-chemical demand with rLPG

A dedicated Goal and project in 2020-2020 plan



...even going...

Beyond the LPG molecules

The rLPG Working Group & Core Team

Executive Steering Committee, 6+2 members

- SHV Energy
- DCC Energy
- UGI International
- PERC USA
- Ultragaz, Brazil
- Indian Oil Corporation (IOC)

- WLPGA
- UGI International (IGO Chair)

The rLPG Working Group & Core Team

- **A full WG team: 45 members meeting bi-monthly**
- A core WG team, 8 members meeting weekly

- WLPGA coordinating

The WLPGA rLPG Work – A Snapshot

Studies-Reports produced

- BioLPG The Renewable Future 2021
- BioLPG rLPG from Cellulose & Waste
- Alcohol-to-Jet Fuel
- BioLPG, The European Pathway to 2050
- rLPG Value in Production and in the market

The WLPGA rLPG Work – A Snapshot

Studies-Reports in progress

- BioLPG renewable pathway towards 2050
- Renewable DME (rDME) pathways in the LPG industry
- Renewable LPG Products, Terminology and Definitions

The WLPGA rLPG Work – A Snapshot

Also:

- Now working also with rDME in the rLPG Working Group
- In close cooperation with the International Energy Agency (IEA) and the International Renewable Energy Agency (IRENA)
- Participating in Bio conferences and events

Renewable LPG
What – Why – Who – Where

Eric Johnson
Atlantic Consulting



Overview

- What is renewable LPG
- Why renewable LPG
- Who and where: up to now
- Pathways to the future
- Incentives

WHAT IS RENEWABLE LPG

Renewable or Bio or Both?

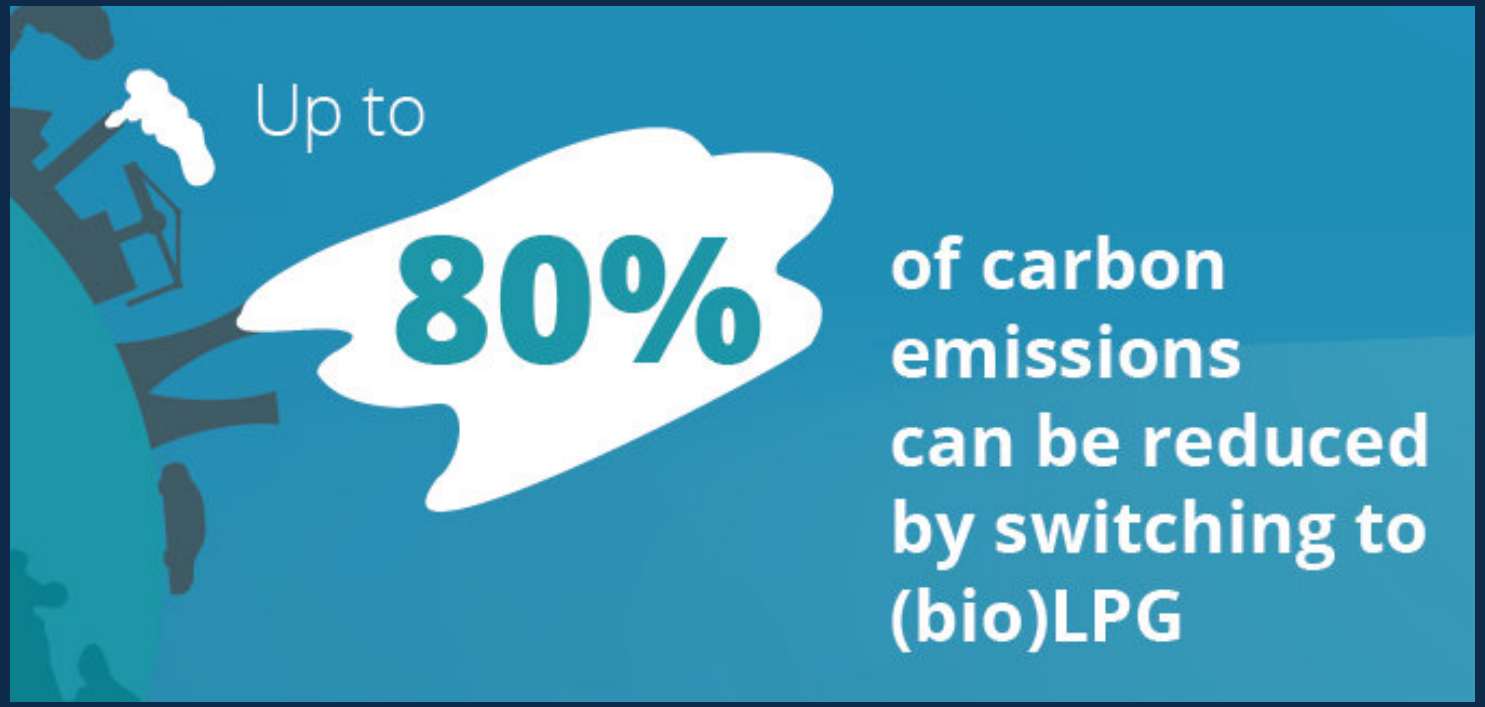
RENEWABLES		DEPLETABLES	
BIO(LOGICAL)	INORGANIC	FOSSIL	OTHER
Plants - Animal (fats)	Hydro/tidal – Wind – Solar Geothermal	Oil – Gas - Coal	Nuclear

Renewable LPG is…

- Biopropane = same molecule as fossil propane. Biobutane also same
- About 8 production pathways - 2 are commercial
- Main path is HVO. Biopropane is co-product of renewable diesel
- Feedstock: animal fats, vegetable oils, biomass, wastes, residues



Renewable LPG is low carbon



50-80% is the typical value commercially

Carbon intensity is the main difference

CHARACTERISTIC	HVO BIOPROPANE	FOSSIL LPG
• Heating value • Boiling/freezing point • Density • Ignition/flame temperature • etc	Identical, no difference	
Composition/specification	• Nearly 100% propane • No olefins • Very low contaminants	• Existing specifications
Carbon intensity	• **5-102 g CO2e/MJ LHV** • Depends on feedstock and calculation method	• **Approx. 75 g CO2e/MJ LHV**
Other pollutant emissions	• Generally similar to fossil LPG	

Fuels' carbon intensities vary hugely

FUEL	TYPICAL CARBON INTENSITY g CO_2e/MJ LHV
Fossil LPG	75
HVO biopropane	5 – 102
Fossil gasoline	90
Fossil diesel	90
Other pathways to rLPG	10 – 50
Renewable diesel	5 – 102
Biodiesel (FAME)	10 – 60
Electricity	2 – 300
Ethanol	20 – 60
Renewable DME	*negative* 278 – 30

How the footprint breaks out

HVO biopropane carbon footprint, economic-allocation case, by major contribution

Process	g CO_2e/MJ	% of total
SUM	40.1	100%
Palm oil mill (POME)	14.3	36%
Hydrogen production	6.9	17%
N fertiliser production	4.5	11%
Palm oil plantation	3.7	9%
Malay-NL transport	3.1	8%
Steam (HVO)	1.2	3%
Other	6.4	16%
Combustion	0.0	0%

The business case for rLPG

- Global capacity nearly 500 kilotonnes (LPG 320 million tonnes)
- Growth, 2018-2025: 30% per year
- Main market: Autogas - Heating/cooking needs development
- Costs/margins: similar to other biofuels – requires incentives
- Most production is as a byproduct
- Regulatory challenges
  - Ignorance of regulators/regulations
  - Food for fuel
  - What is the ‘real’ carbon footprint

WHY RENEWABLE LPG

Headed to Carbon Neutral
2/3rds of World economy

By 2050

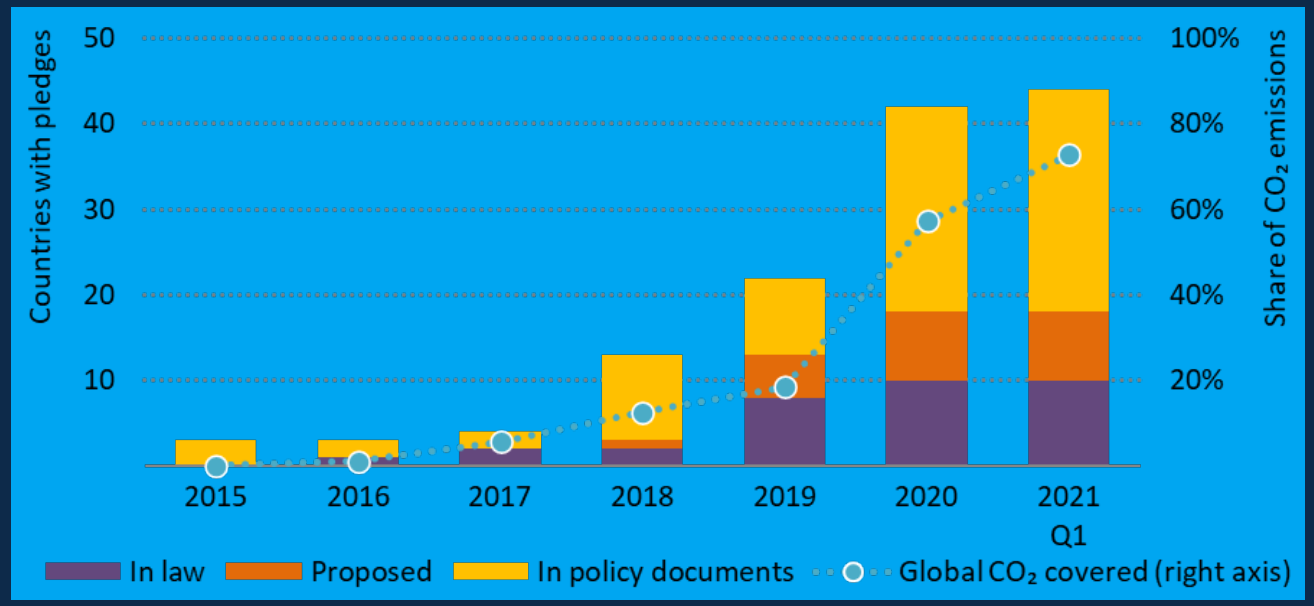
By 2045+

By 2060

By 2050

Headed to Carbon Neutral 2/3rds of World economy

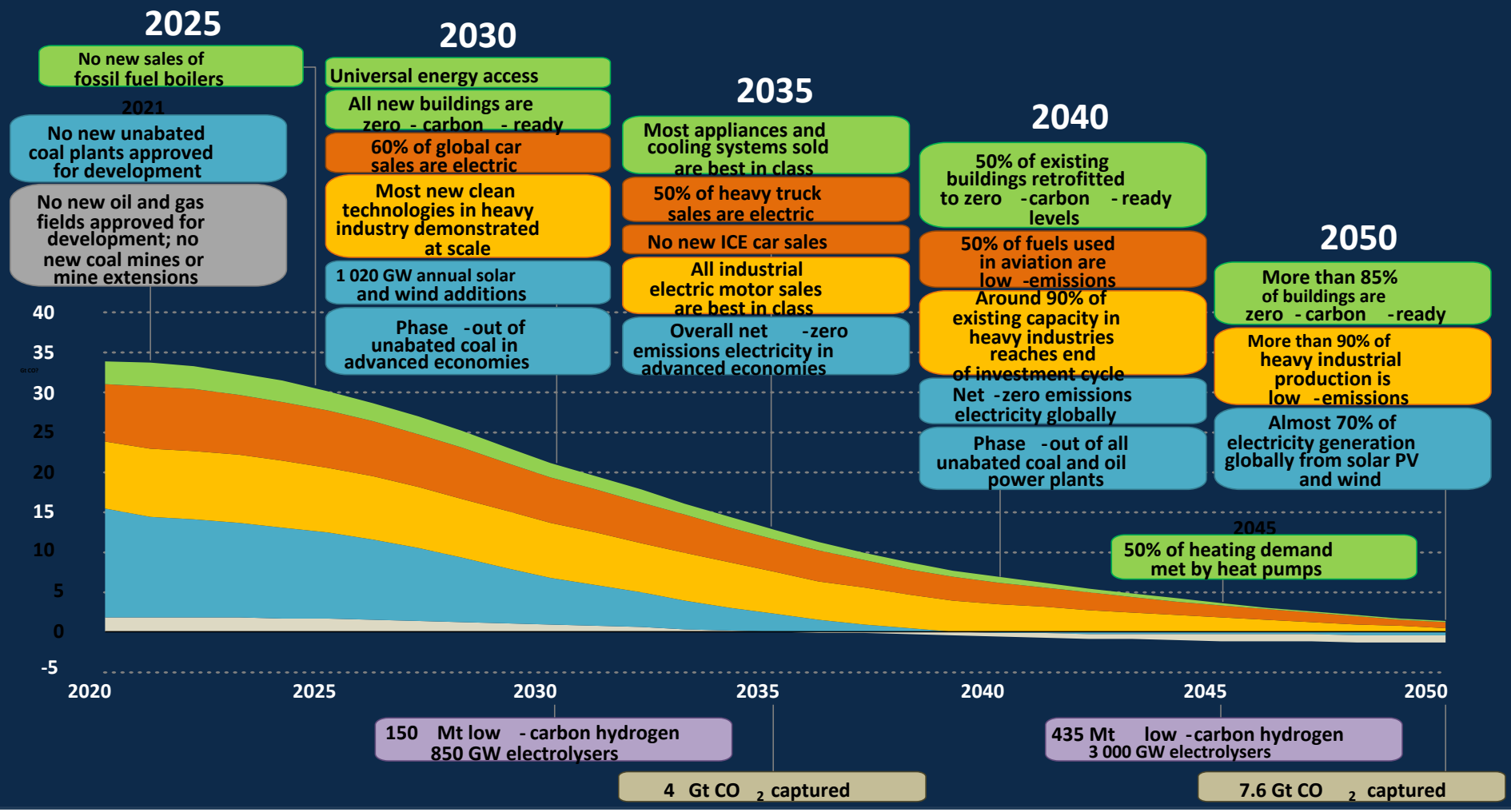
Number of national net zero pledges and share of global CO_2 emissions covered



International Energy Agency (2021), Net Zero by 2050, IEA, Paris

By 2050

Net Zero demands huge changes



Obligations and offsets
Two different things

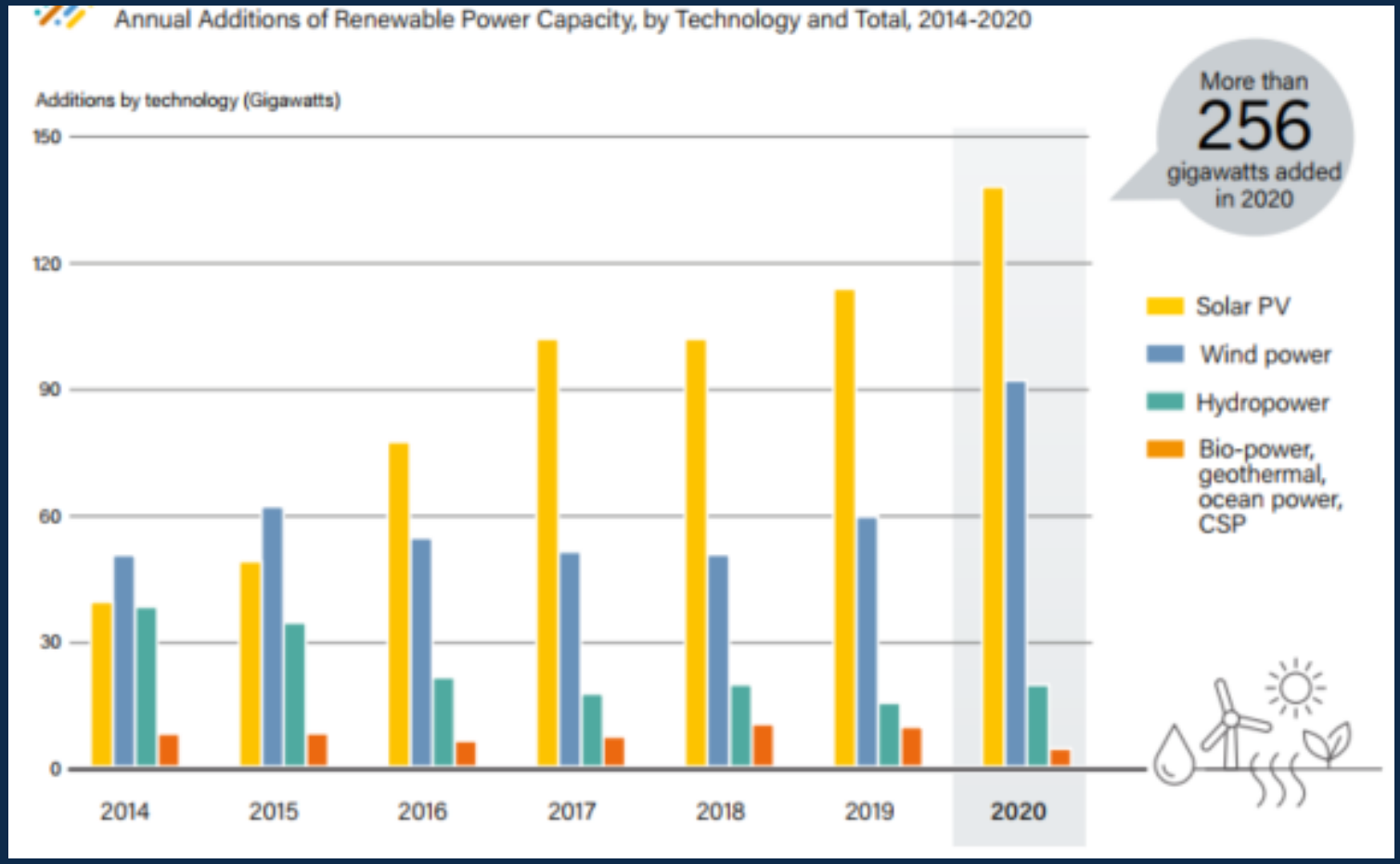
OBLIGATIONS

- LCFS (US California obligations)
- RED II (European Renewable Energy Directive)
- RINS (US federal obligations)

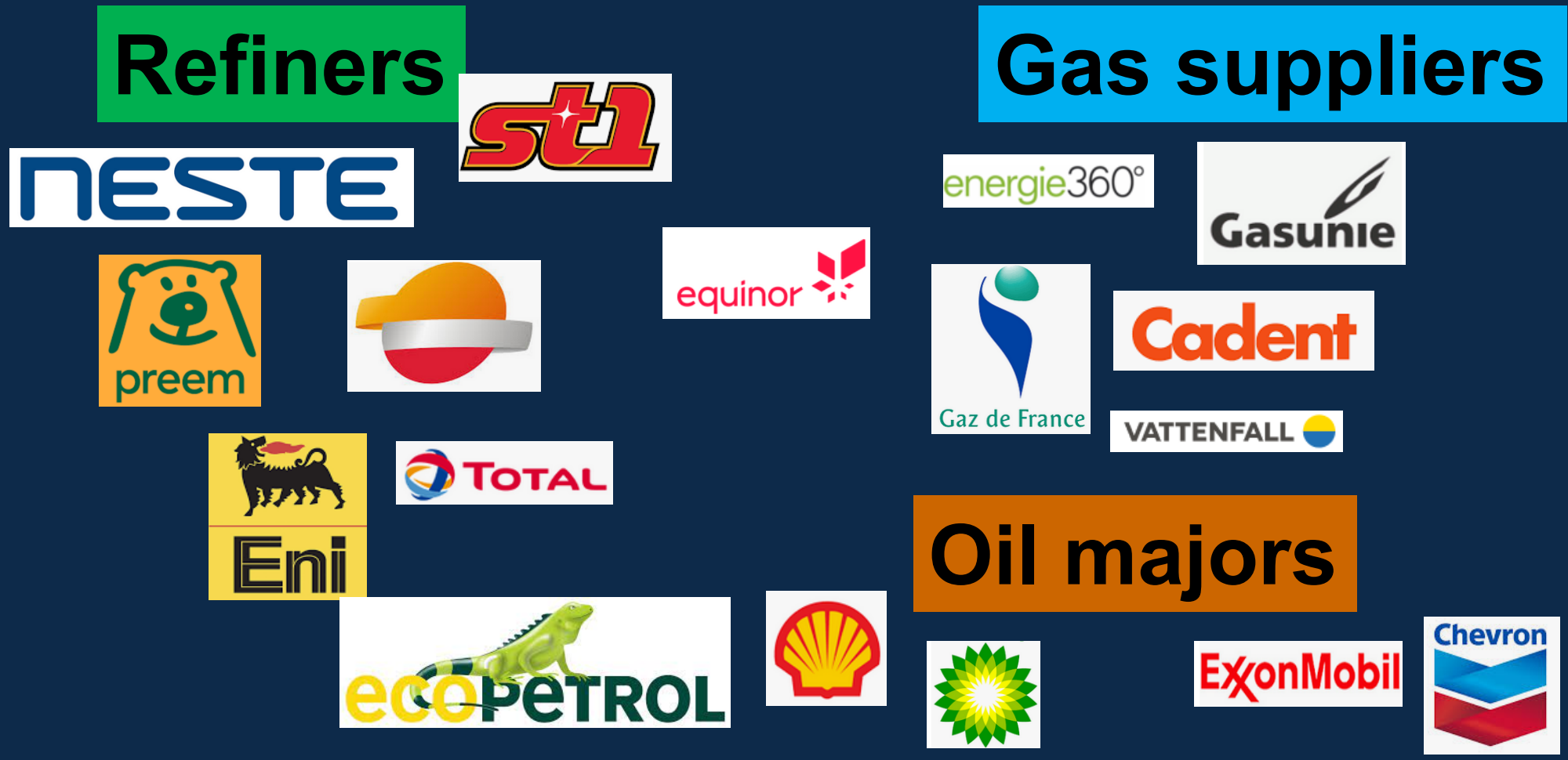
OFFSETS

WHO IS GOING RENEWABLE AND WHERE

Power generation went first



Facing decarbonisation: you're not alone!

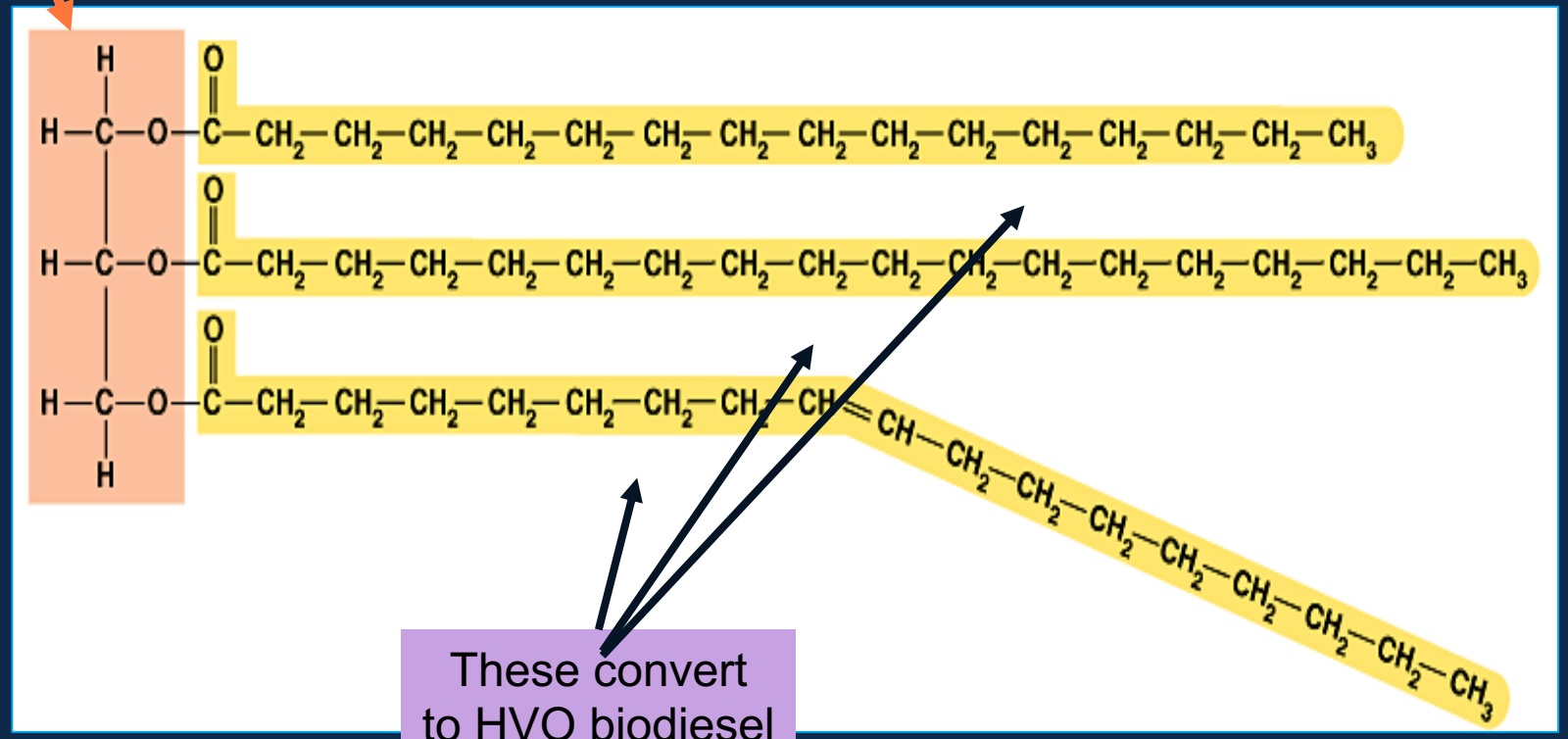


Refiners go renewable: complete or partial

rLPG: today is mostly HVO biopropane

This converts to HVO biopropane

Add hydrogen to a
Typical animal fat or vegetable oil



HVO biopropane in the Americas

Operator/owner	Country	Process used	Location	HVO biopropane capacity, kt/yr
Americas				
BSBios, Petrobras, ECB Group	Brazil	H-BIO	Passo Fundo, Marialva	25
Petrobras	Brazil	H-BIO	Repar-Parana	0.1
AltAir Fuels, World Energy	USA	Ecofining	Paramount, CA	7
BP	USA		Cherry Point, WA	5
Diamond Green Diesel	USA	Ecofining	Norco, LA	45
Renewable Energy Group	USA	Bio-Synfining	Geismar, LA	14
Ryze Renewables	USA	Ryze own process	Reno, NV	10
Sinclair	USA		Sinclair, WY, USA	20
Tesoro, Marathon	USA		Dickinson, ND, USA	1
Kern Oil & Refining	USA		Bakersfield, CA, US	?
			Americas, sum	127

HVO biopropane in Europe and Asia

Operator/owner	Country	Location	HVO biopropane capacity, kt/yr
Asia			
Pertamina	Indonesia		50
Total	South Korea		25
Neste Oy	Singapore	Singapore	130
		Asia, sum	205
Europe			
ÖMV	A	Schwechat	?
Repsol	ES	Cartagena	13
Total	F	Grandpuits	20
Saras	I	Sardinia	15
Neste Oy	NL	Rotterdam	65
SkyNRG	NL	Delfzijl	15
PKN Orlen	PL	Plock or Litvinov	?
Fintoil	SF	Hamina	0
UPM	SF	Kotka	30
		Europe, sum	158

WHAT ABOUT COLOMBIA?

Colombia might be ideal for rLPG!

DEMAND

- LPG market 720 kt/yr
- Significant imports
- Established distributors: Chilco, Empresas Gasco, Montagas, Norgas, Rayogas, Supergas de Nariño

SUPPLY

- Highly regulated fuel markets & subsidies
- Major government participation (Ecopetrol)
- Biodiesel/ethanol mandates & production
- Sugar cane & palm oil

Plus, government and Ecopetrol commitments to zero-carbon in 2050!

R&D areas of interest in Colombia

Biogas to BioLPG

Ecopetrol cat crackers

Unconventional lipids

PATHWAYS TO THE FUTURE

Many pathways, nearly always a byproduct

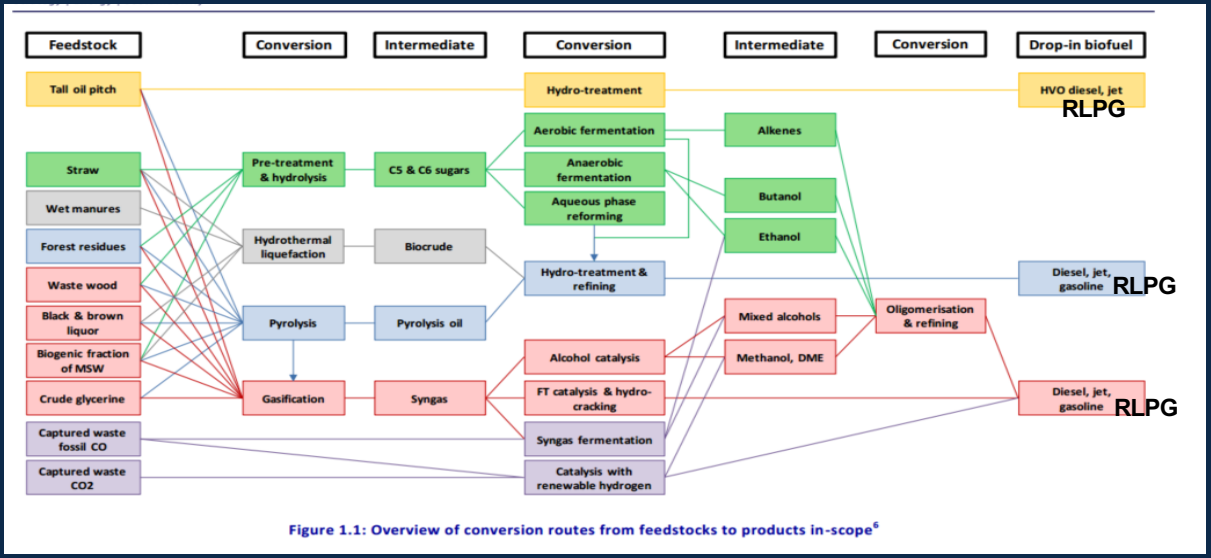


Figure 1.1: Overview of conversion routes from feedstocks to products in-scope[6]

- Many routes from renewable feedstocks to hydrocarbons
- As a byproduct in nearly all cases

(renewable LPG is produced not as an intended product)

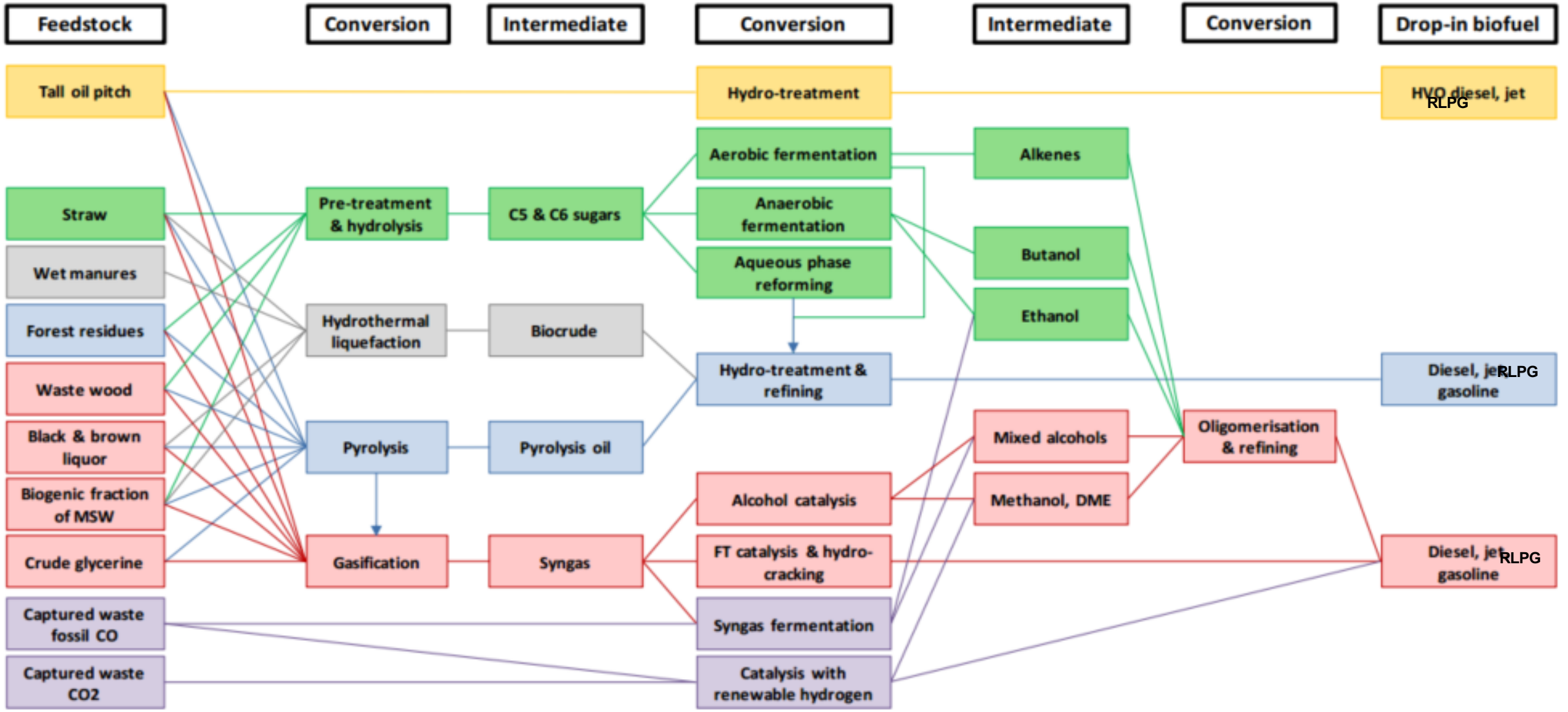


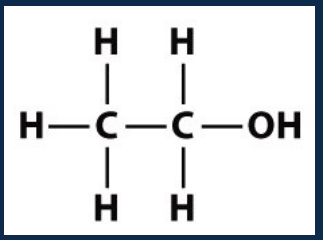
Figure 1.1: Overview of conversion routes from feedstocks to products in-scope[6]

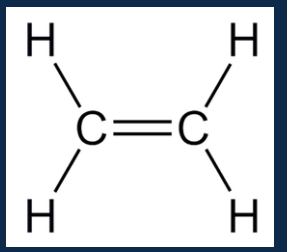
How WLPGA looks at it
8 Pathways to rLPG

Feedstock	Process class	Product/ byproduct	Technical Readiness
Vegetable oils and animal fats	Hydrotreating (HVO)	Byproduct	Commercial
Alcohol (ethanol)	Oligomerisation (AtJ)	Byproduct	Small commercial
Biogas	Oligomerisation	Product	Laboratory
Cellulosics/municipal waste	Gaseous conversion & synthesis	Byproduct	First commercial but not selling BioLPG
Bio-oil or py-oil	Dehydration (FCC)	Byproduct	Demonstration
Power-to-X	Advanced chemical process	Both	Pilot
Glycerine	Dehydrogenation	Product	Pilot
Sugars	Fermentation	Product	Demonstration

Oligomerisation of olefins (alcohol to jet)

Criterium	Finding
Process	Renewable alcohol is dehydrated to an olefin and then oligomerised into higher hydrocarbons. Prime example: bioethanol to jet fuel (~C_{12}).
Feedstock availability	Bioethanol in oversupply, as demand in gasoline is declining.
Product yield/TRL	65%, because the oxygen converts to water. TRL 9.
RLPG yield of product/TRL	100% butane, in principle. TRL 4.
Who's doing what	Gevo is producing small-scale commercial (isobutanol feedstock). Lanzatech announcement. Swedish Biofuels. Vertimass. Many airlines were/are? active.
Politics and partners	Flight carbon emissions are high profile (Greta Thunberg). Airlines and airplane makers are keen, also US military, and bioethanol producers.
Commercial viability	Politics could trump economics and make this work. HVO potential is limited. But COVID has thrown a wild card.
Assessment	Despite uncertainty, this is surely worth attention/investigation.

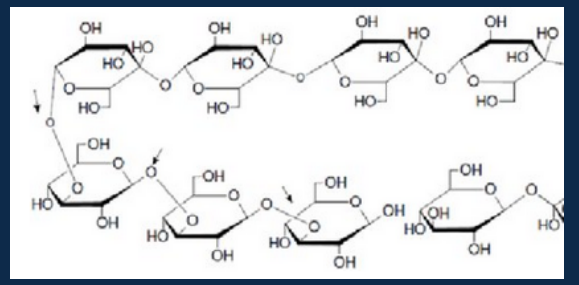




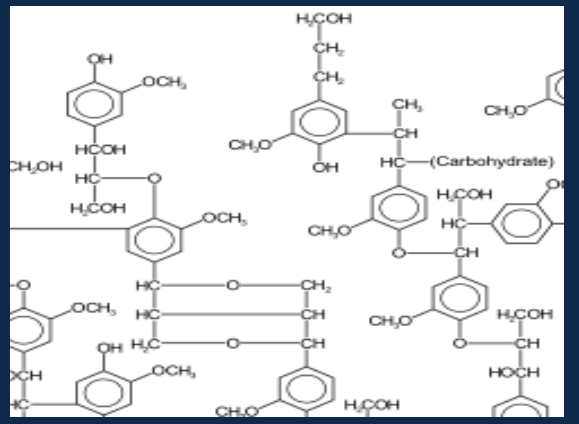
C_4H_{10}

Gasification to syngas, from biomass

Criterium	Finding
Process	Blast biomass (cellulose/lignin) into CO and H_2 (syngas). Synthesise syngas into hydrocarbons.
Feedstock availability	Biomass is the most abundant bio feedstock, IRENA report.
Product yield/TRL	Around 50%. TRL 7 (For non-biomass, commercial.)
RLPG yield of product/TRL	5% Fischer Tropsch. 10% with methanol-to-gasoline/LPG. TRL 7.
Who's doing what	BioTFuel, Mitsubishi, Sungas, Velocys – and some failures (Choren, Kaidi, Red Rock, UPM)
Politics and partners	Big capital costs. Refiners? Paper companies? Big oil?
Commercial viability	Big capital costs – needs deep pockets and subsidy.
Assessment	Could deliver big volumes of RLPG – if it happens. Projects must be prodded to include RLPG.



Cellulose



Lignin

Gasification to syngas, from waste

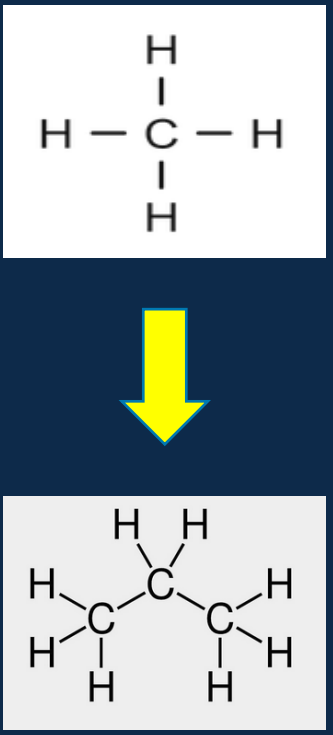
Criterium	Finding
Process	Blast waste (cellulose/lignin) into CO and H_2 (syngas). Synthesise syngas into hydrocarbons – Advanced Plasma Power.
Feedstock availability	Waste is about 10% as abundant as biomass. 'Processed' waste.
Product yield/TRL	Around 40%, maybe higher. Today: methane (SNG). TRL 4.
RLPG yield of product/TRL	30% is possible. TRL 3.
Who's doing what	Enerkem, Cadent (revived!), Altalto, Fulcrum. Failures in the past: Air Products, Cadent, Ineos Bio (waste-to-ethanol), Velocys. Problems with tars in the syngas. Possibly solved in Japan?
Politics and partners	Governments like recycling, waste reduction. Waste companies, gas companies? Electric generators?
Commercial viability	Waste is collected anyway, and there is a gate fee. But, technical difficulties: tars.
Assessment	Governments might force development, despite problems. RLPG needs to force its way into the picture (as add-on to methane).

Pyrolysis of biomass

Criterium	Finding
Process	Same as making charcoal – heat without oxygen – but the volatile liquid fraction is the main product – pyrolysis oil – along with char(coal). Sometimes syngas as well. Gasification-pyrolysis are related.
Feedstock availability	Biomass is the most abundant bio feedstock. Includes nut shells and other natural 'wastes' such as stover from corn/maize.
Product yield/TRL	60%. TRL 8.
RLPG yield of product/TRL	If py-oil is refined: maybe 5%. If fed to a cat cracker, 10% propane. TRL 5.
Who's doing what	Gas Technology Institute: RLPG directly produced. BTG: cat cracker in Nordics, py-oil production in Netherlands. PREEM Biozin. Various N Am. projects: Enysyn & others.
Politics and partners	Refiners? Paper makers? Gas companies (GTI connection).
Commercial viability	Limited viability already. Capital costs much lower than gasification (no oxygen, ambient pressure).
Assessment	Lots of activity – but how much is toward RLPG?

Oligomerisation of biogas

Criterium	Finding
Process	Methane can be oligomerised to higher hydrocarbons by electronic excitation (as opposed to thermal excitation). In principle, this could work with biogas (50% methane, 50% CO_2). (Or perhaps SNG.)
Feedstock availability	Wet biomass and agro-waste. Not as abundant as biomass, but plentiful.
Product yield/TRL	50% methane (the other 50% is CO_2.) TRL 4.
RLPG yield of product/TRL	90%, for methane. Biogas conversion is not proven. TRL 2.
Who's doing what	Plasmerica, Alkcon, FillinGreen
Politics and partners	Farmers, gas companies?
Commercial viability	This could be a solution for 'stranded' biogas.
Assessment	2 RLPG projects underway. Keep on promoting!

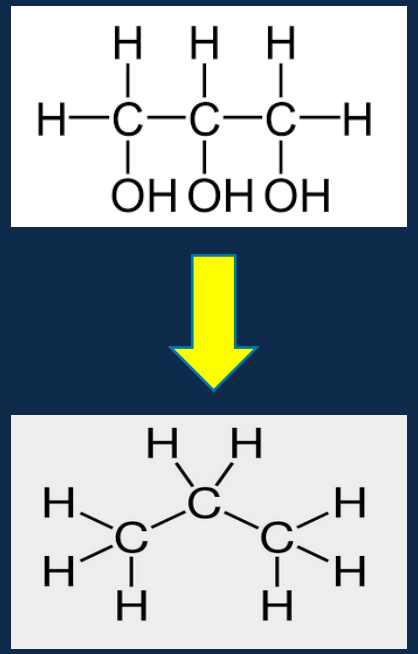


Power-to-X

Criterium	Finding
Process	Renewable power (hydro, solar, wind) captures carbon from flue-gas CO_2 and electrolyses H_2 from water. C and H synthesised into hydrocarbons (e fuels).
Feedstock availability	Hydrogen is the most-common element. CO_2 is plentiful. In principle: unlimited!
Product yield/TRL	60%? TRL 3.
RLPG yield of product/TRL	10%? TRL 2.
Who's doing what	Repsol, Neste, Carbon Engineering, Sunfire, Nordic Blue and others. Lot of talk from refiners and power companies.
Politics and partners	Very popular with automakers, refiners and proponents of liquid fuels. The technology creates a buzz: 'Fuels from thin air!'
Commercial viability	Unlikely by 2030, says the ICCT.
Assessment	If it happens, it will take time. Still, RLPG should get in the queue.

Glycerine-to-propane

Criterium	Finding
Process	Glycerine is dehydrated to propane through a series of conversions.
Feedstock availability	Glycerine in oversupply, but relatively small compared to biomass or waste.
Product yield/TRL	35%, because the oxygen is removed. TRL 3.
RLPG yield of product/TRL	70%. TRL 3.
Who's doing what	Christian Hulteberg with LPG cooperation.
Politics and partners	??
Commercial viability	Needs a serious subsidy.
Assessment	Not a high-flyer.



What is happening in 2021

- rLPG production plants progressing
- rDME also coming into the picture

PATHWAY TO RLPG	PROJECTS
HVO	400+ t/yr of capacity additions underway
Gasification	Fulcrum, BioTFuel, Altalto, Rotneros, former GoGreenGas. New: SHV-UGI & Kew Tech.
Pyrolysis	IH2 process from GTI, Nordic cat-cracker trials
Oligomerisation	Plasmerica and others
rDME	Oberon Fuels startup, revival of the Chemrec plant in Sweden

What about Colombia and South America

Feedstock	Process class	Projects	Potential
Vegetable oils and animal fats	Hydrotreating (HVO)		Palm oil
Alcohol (ethanol)	Oligomerisation (AtJ)		Sugar cane to ethanol
Biogas	Oligomerisation		
Cellulosics municipal waste	Gaseous conversion & synthesis		
Bio-oil or py-oil	Dehydration (FCC)		
Cellulosics/wastes	Hydrolysis & fermentation Liquid conversion/synthesis		
Glycerine	Dehydrogenation		
Sugars	Fermentation		

INCENTIVES (& DISINCENTIVES)

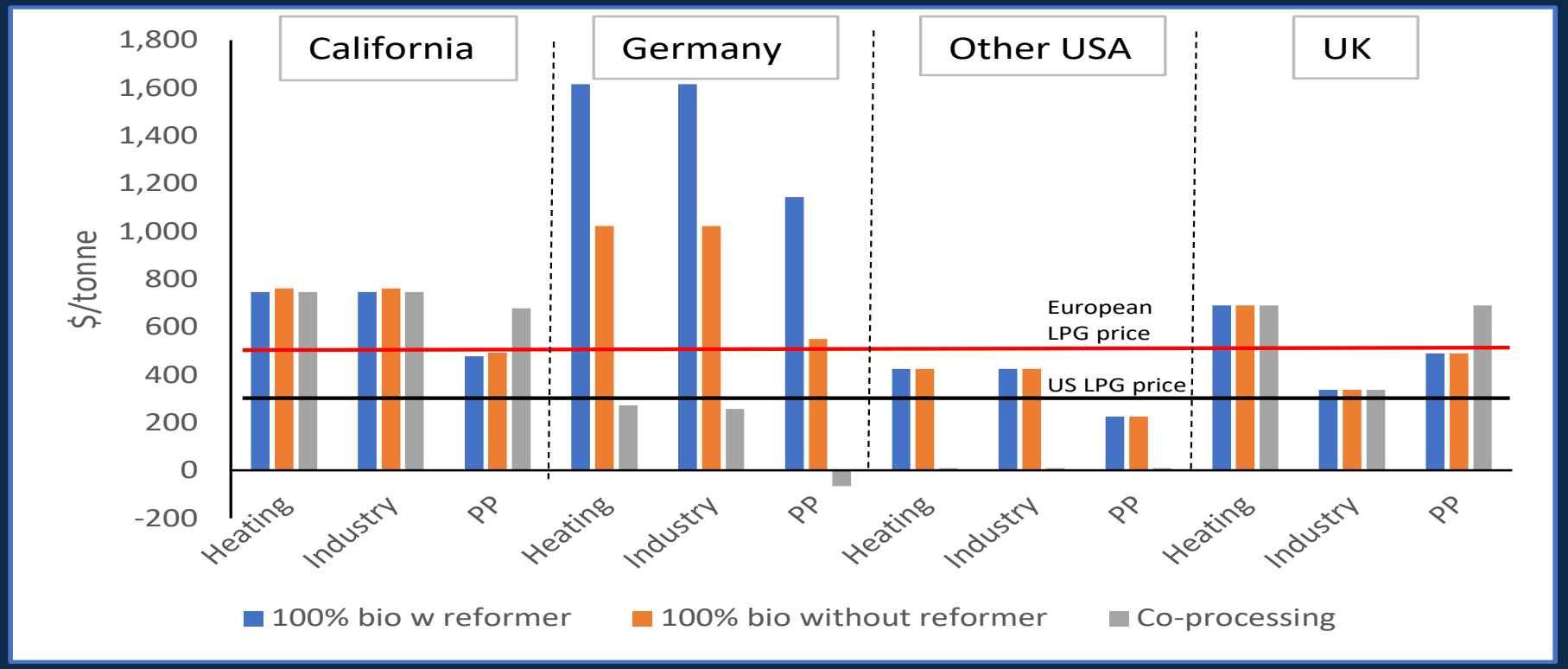
The Regulators' Toolbox: Large and Varied

TOOL	APPLICATION SECTOR		
	POWER	**TRANSPORT**	**HEATING**
OBLIGATIONS			
Renewables	EU, USA	California, most EU, USA	
CO_2	EU Emissions Trading System	CZ, D, S	EU Emissions Trading System (industrial)
Energy			DK, F, I, UK, some US states
TAXES			
CO_2		DK, ES, CH, D, F, IR, IE, NL, N, PL, PT, SF, SI, S, UK	
Energy		Some EU states waive tax on renewables	
STANDARDS			
Efficiency			Europe and USA
CO_2		Europe and USA	
Bans	Some on coal		Regions in Europe, on certain fuels

Regulations are Unfair

Especially to rLPG in heating and cooking

‘Buy-away’ cost is a multiple of fossil LPG price



Only about half of rLPG sold as LPG!

Talk to Regulators: Early and Often

TOOL	APPLICATION SECTOR		
	POWER	**TRANSPORT**	**HEATING**
OBLIGATIONS			
Renewables	EU, USA	California, most EU, USA	
CO_2	EU ETS	CZ, D, S	EU ETS (industrial)
Energy			DK, F, I, UK, some US states
TAXES			
CO_2		DK, ES, CH, D, F, IR, IE, NL, N, PL, PT, SF, SI, S, UK	
Energy		Some EU states waive tax on renewables	
STANDARDS			
Efficiency			Europe and USA
CO_2		Europe and USA	
Bans	Some on coal		Regions in Europe, on certain fuels

How to Get Started with rLPG

- Talk to regulators and to Ecopetrol
- What about biojet? Plus BioLPG!
  - From HVO
  - From alcohol to jet
- Become part of the system

Q & A



Thank you!

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California's Journey Toward rLPG

Joy Alafia

Western Propane Gas Association (WPGA), USA

WPGA®
WESTERN PROPANE GAS ASSOCIATION

California's Journey to Renewable Propane

Joy Alafia | joy@westernpga.org

CLIMATE CHANGE

New Market Drivers

- PUBLIC
- GOVERNMENT
- INDUSTRY/CORPORATIONS

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WESTERN PROPANE GAS ASSOCIATION

PUBLIC

CONCERNS REGARDING CLIMATE CHANGE - U.S.

56%

68%

69%

75%

78%

Source: Pew Research 2018 Study

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WESTERN PROPANE GAS ASSOCIATION

GOVERNMENT

GOVERNMENT ACTION – CARBON TAX/MARKETS

Targets:

- Transportation
- Building Energy
- Applications

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NATIONALLY

- Renewable Fuels Standard (RINS)
- Green Economy & Infrastructure Plans
- National Low Carbon Fuels Standard?
- National Cap-and-Trade?

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CORPORATIONS

A Dutch court ordered Royal Dutch Shell to slash emissions **by 45 % by 2030**, *based on 2019 levels*

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90% of S&P 500 Companies Have Sustainability Statements

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BP – NET ZERO BY 2050

"This will certainly be a challenge, but also a tremendous opportunity. It is clear to me, and to our stakeholders, that for BP to play our part and serve our purpose, we have to change. And we want to change – this is the right thing for the world and for BP."

BP CEO Bernard Looney

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SHELL – CARBON NEUTRALITY BY 2050

April 2021:

Shareholders voted to produce less oil and cut carbon intensity of product by 20% by 2030 and go carbon neutral by 2050.

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EXXON MOBIL – SHAREHOLDER ACTIVISM

Installed two board members from an investor group focused on environmental, social and governance for business strategy.

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CHEVRON– SHAREHOLDER ACTIVISM

Shareholders vote to cut “Scope 3” emissions with 61% vote.

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NESTE

Consistently ranks on 100 most sustainable in the world

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WESTERN PROPANE
GAS ASSOCIATION

BIOFUELS

RENEWABLE FUELS

- Renewable diesel & biodiesel
- Renewable natural gas
- Renewable gasoline

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RENEWABLE PROPANE

RENEWABLE PROPANE CUSTOMERS

- Coca-Cola
- L'Oréal
- U-Haul
- School Districts
- Government Entities

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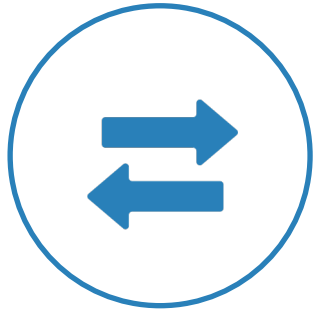
RENEWABLE PROPANE BENEFITS

Low NOx Engines

Ultra-low & Negative Carbon Footprint



Fungibility

Resiliency

Economics

Environmental Steward

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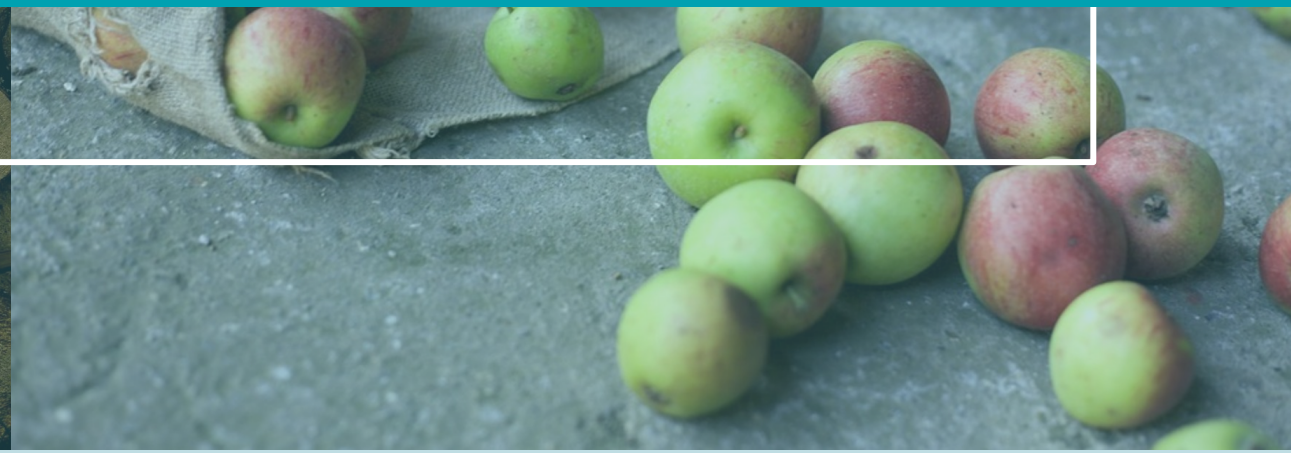
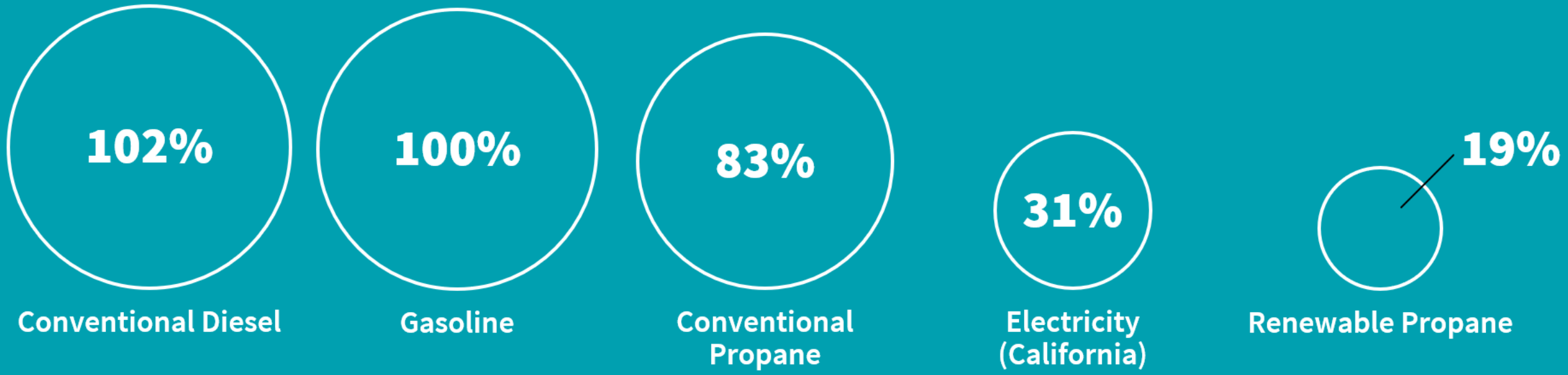
Where does renewable propane come from?



LIFE CYCLE EMISSIONS

Carbon Intensity



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RENEWABLE DIMETHYL ETHER (DME)

-278 g CO_2e/MJ

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CARBON MARKETS

CARBON MARKETS

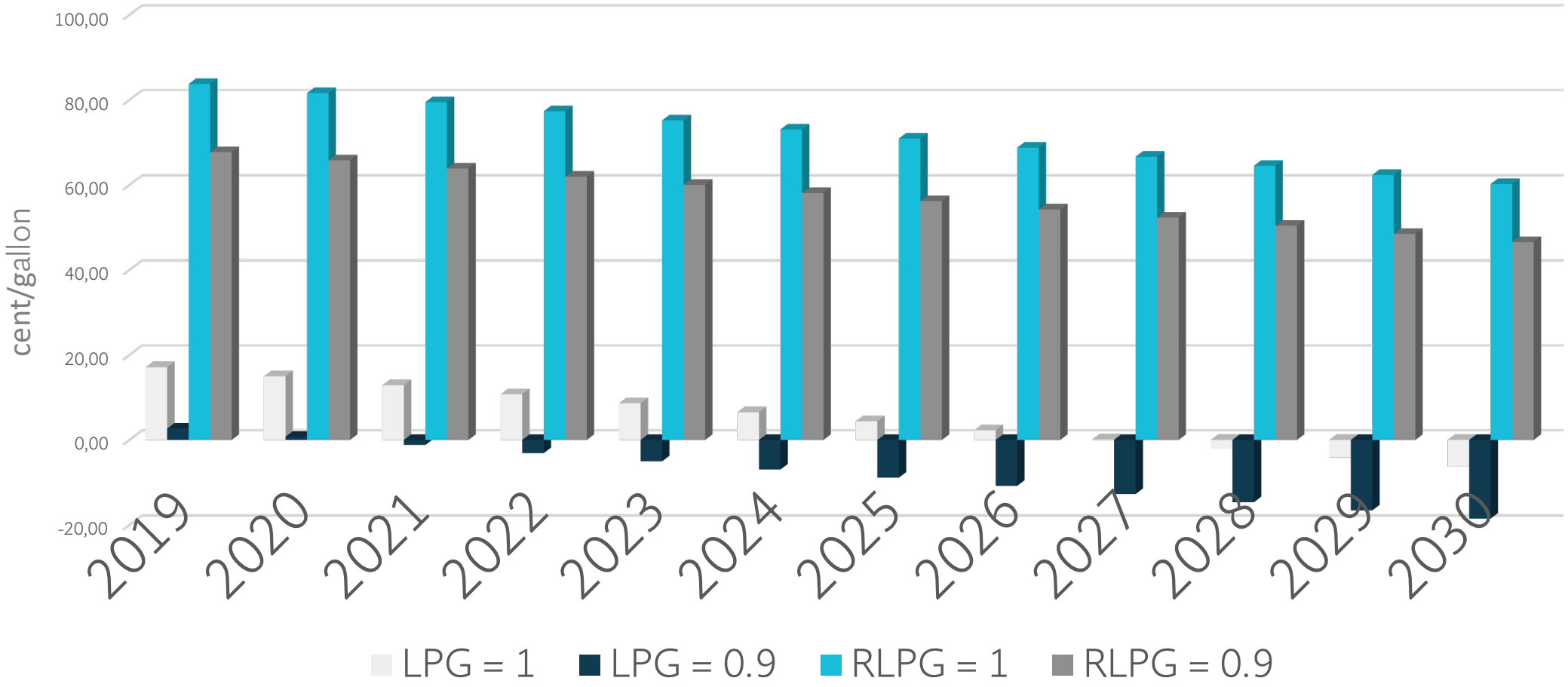
PROGRAM	$/gal	
	Fossil LPG	Renewable LPG
LCFS Vehicles when displacing gasoline	$0.15	$0.82
LCFS Vehicles when displacing diesel	$0.007	$0.66
LCFS Forklifts (gasoline)	$0.15	$0.82
AB32 (Cap&Trade)*	($0.87)	$0.00
RINs	$0	$0.55

LCFS 2020 Credit Price $190/ton
RLPG CI of 45 g CO2e/MJ v. 83 g CO2e/MJ for fossil propane
*RLPG should generate $0.10 for AB32

POTENTIAL LCFS CREDITS

- Propane & rDME Blend = $o.88 per gallon
- Renewable Propane & rDME Blend = $1.77 per gallon

CALIFORNIA LCFS – CREDITS/DEFICITS



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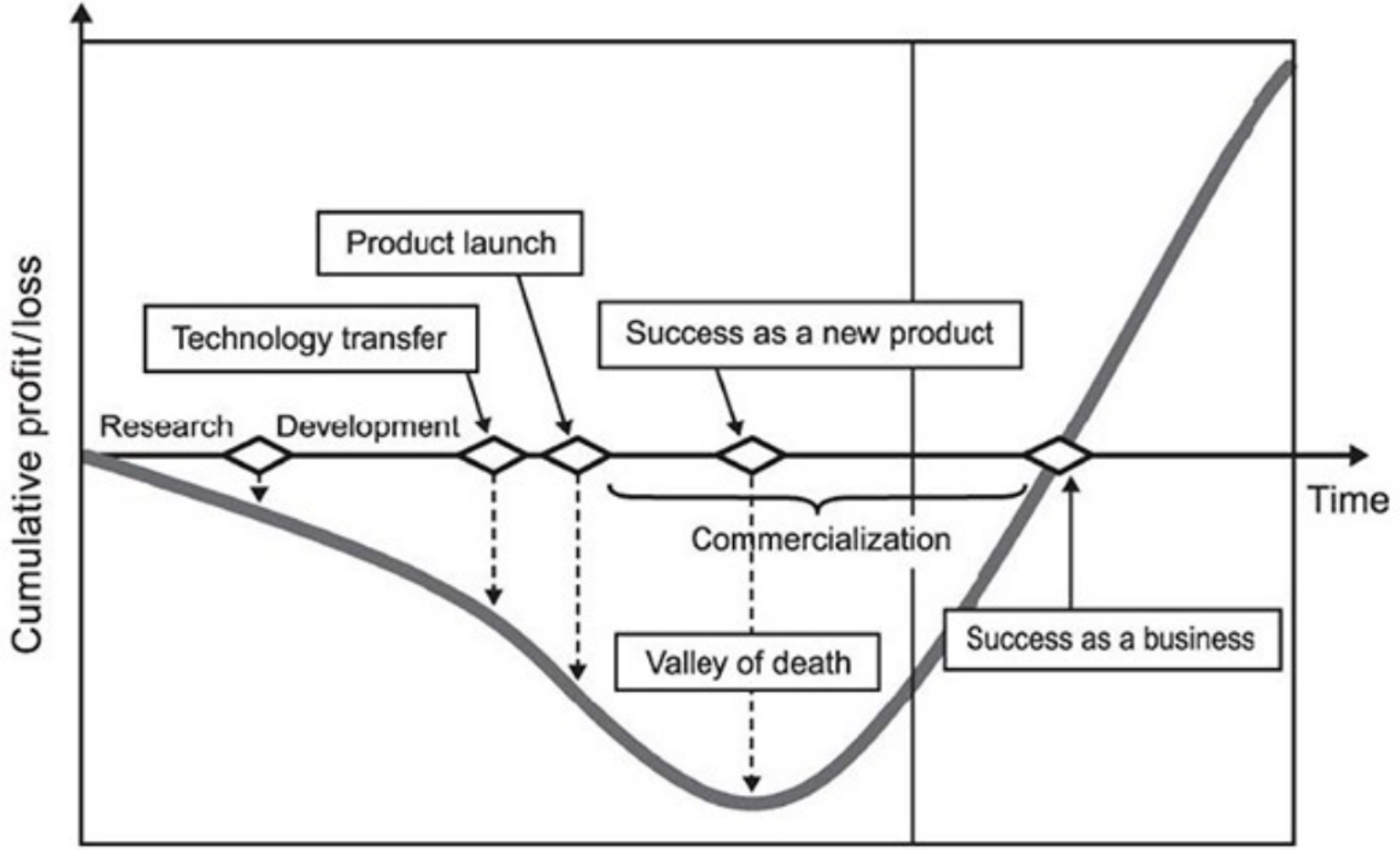
SUPPLY

VALLEY OF DEATH



Source: Malcolm Auld, Heartchain Article "How to Avoid the Death Valley Curve" Jul. 2, 2018

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NESTE - ROTTERDAM

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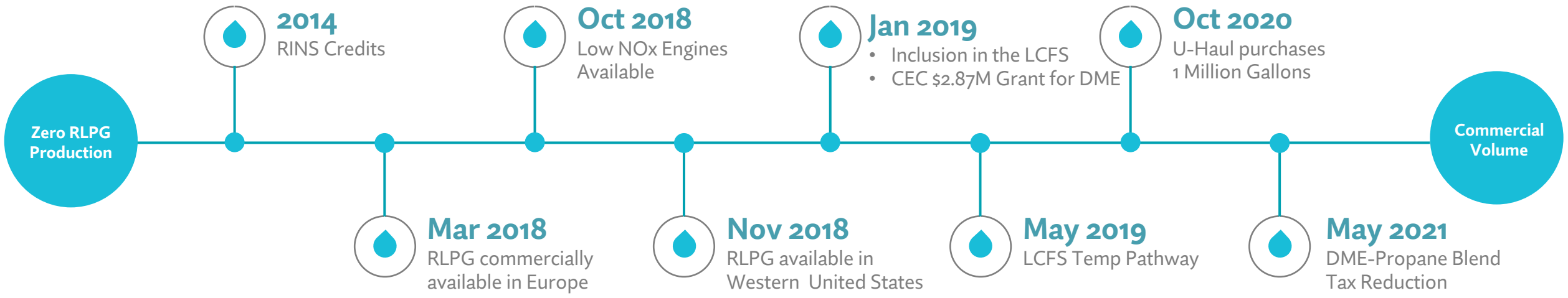
FROM ZERO TO COMMERCIALIZATION



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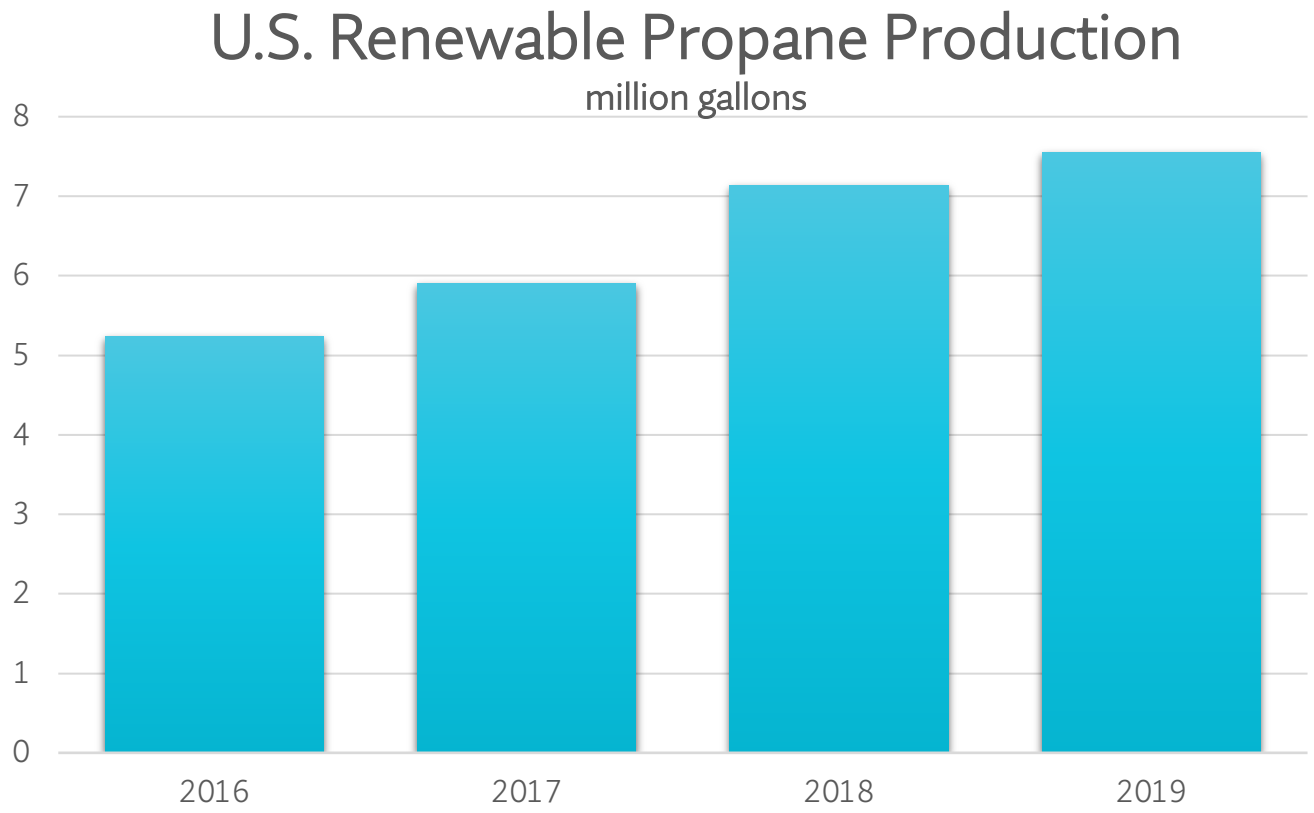
US DOMESTIC PRODUCTION



Source: BnEF Sustainable Energy in American Factbook 2021

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U.S. VOLUME POTENTIAL (MILLION GALLON/YR)

Producer	Location	RLPG capacity	Status 2021
BP	Blaine, WA	2.7	Operating
Diamond Green Diesel	Norco, LA	5.4	Operating
Diamond Green Diesel	Port Arthur, TX	48.2	Start-up 2024
Global Clean Energy Holdings	Bakersfield, CA	18.8	Onstream late 2021
HollyFrontier	Cheyenne, WY	10.7	Start-up early 2022
HollyFrontier	Artesia, NM	13.4	Start Q1 2022
Kern Oil & Refining	Bakersfield, CA	NA	Unknown
Marathon	Martinez, CA	36.8	Start 2022
Marathon	Dickinson, ND	0.8	Operating
Next Renewable Fuels	Portland, OR	80	Unknown
Phillips 66	Rodeo, CA	34	Start 2024
Renewable Energy Group	Geismar, LA	10.1	Operating
Sinclair	Sinclair, WY	14.8	Operating
World Energy	Paramount, CA	3.8	Operating
Capacity sum		**280**	

Source: Eric Johnson, Atlantic Consulting

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WPGA'S SUSTAINABILITY COMMITMENT

100% RENEWABLE PROPANE FOR CALIFORNIA BY 2030

- Provides 2.26 million tonnes of CO2e reductions, annually
- Equivalent of taking 537,600 cars off the road... every year
- Pathway to eliminate 1.42 million tonnes CO2e as early as 2025

www.westernpga.org/sustainability

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CALIFORNIA AB 1559 (O'DONNELL, D-LONG BEACH)
THE INNOVATIVE RENEWABLE ENERGY FOR BUILDINGS ACT

RENEWABLE PROPANE

POWER ON!

www.Westernpga.org/Renewable-Propane-Bill/

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LESSONS LEARNED

Push Innovations
Demonstrate Environmental Solutions
Advocate at Every Level
Coalition Partnerships

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Thank You

JOY ALAFIA
joy@westernpga.org

www.westernpga.org

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Q & A



Europe's Journey Toward rLPG

Ewa Abramiuk-Lete

Liquid Gas Europe

BioLPG –European Perspectives

Ewa Abramiuk-Lete

General Manager, Liquid Gas Europe

BioGLP, energía renovable,
Gasnova
Tuesday, 6 July 2021

European LPG Association
www.liquidgaseurope.eu

Liquid Gas Europe – our mission

To identify and monitor European energy, environment, economic and research policies and any other EU initiatives of relevance for the LPG industry.

To engage in an ongoing dialogue with the European institutions to ensure that LPG benefits and potential contribution is understood and optimised in the EU legislation.

To develop regulations and standards related to LPG in cooperation with ISO (International Organization for standardization), CEN (European Committee for standardisation) and the United Nations (Economic Commission for Europe).

To promote and raise awareness of LPG as a clean, safe and versatile energy source, supporting the EU's sustainability agenda.

18
National Associations

10
LPG Distributors

28
Affiliate members

www.liquidgaseurope.eu

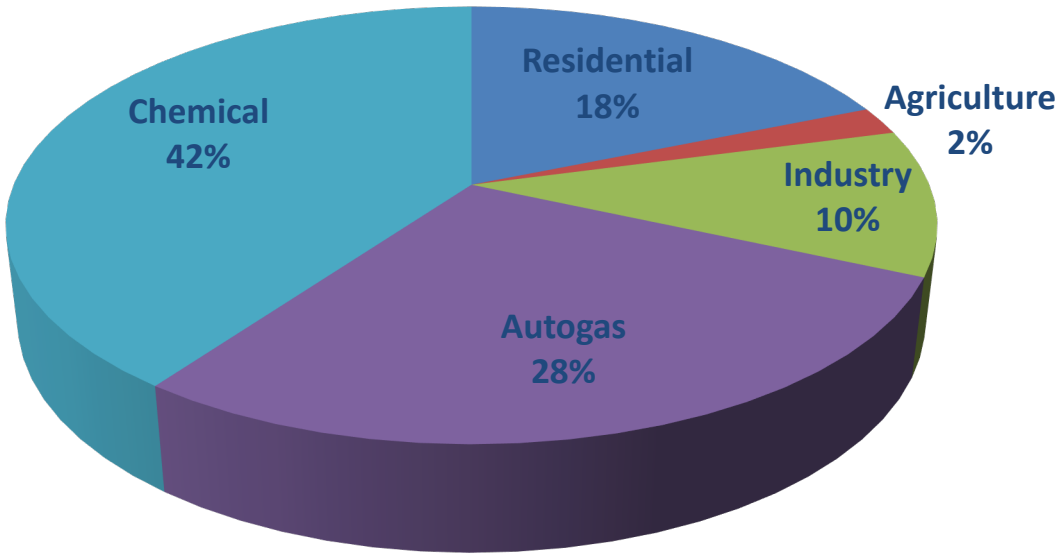
LPG market today: Europe

European LPG Association

www.liquidgaseurope.eu

The state of the market

Total LPG demand in 2019
= 38.7 million tonnes



Top-10 LPG retail markets in Europe

Residential:
1. Italy
2. Spain
3. France
4. Turkey
5. Germany
6. Portugal
7. UK
8. Poland
9. Romania
10. Netherlands

Autogas:
1. Turkey
2. Poland
3. Italy
4. Ukraine
5. Bulgaria
6. Germany
7. Romania
8. Greece
9. Netherlands
10. Serbia

Industrial:
1. Germany
2. UK
3. Sweden
4. France
5. Finland
6. Poland
7. Italy
8. Norway
9. Turkey
10. Greece

EU 28 + Turkey, Ukraine, Norway, Switzerland, Serbia and Bosnia Herzegovina

Liquid Gas Europe

BioLPG

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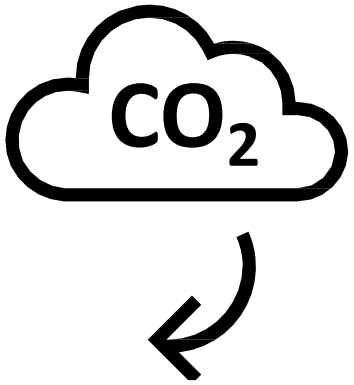
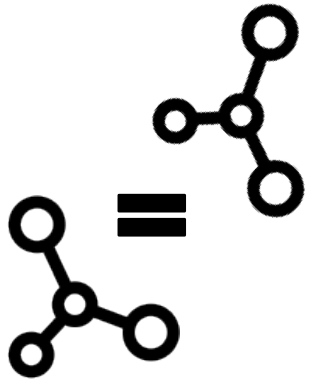
BioLPG 2050 study presentation

What is bioLPG

Molecules of propane and butane produced from **organic feedstock or renewable electricity and CO_2**



Reduced carbon footprint by up to 80% compared to conventional LPG



Chemically and physically i**dentical** to conventional LPG when it comes to energy and combustion-related properties

As a drop-in fuel conforms to all **standards** associated with LPG supply

Currently sold using a **mass balance** approach

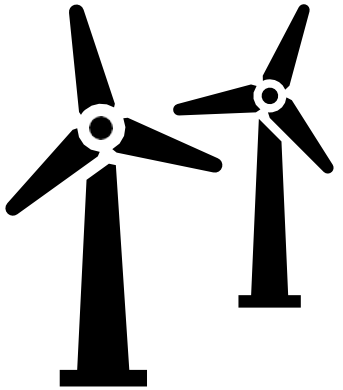
BioLPG production pathways

Biorefining (lipids)

Gasification and pyrolysis

Biogas conversion

Power-to-x



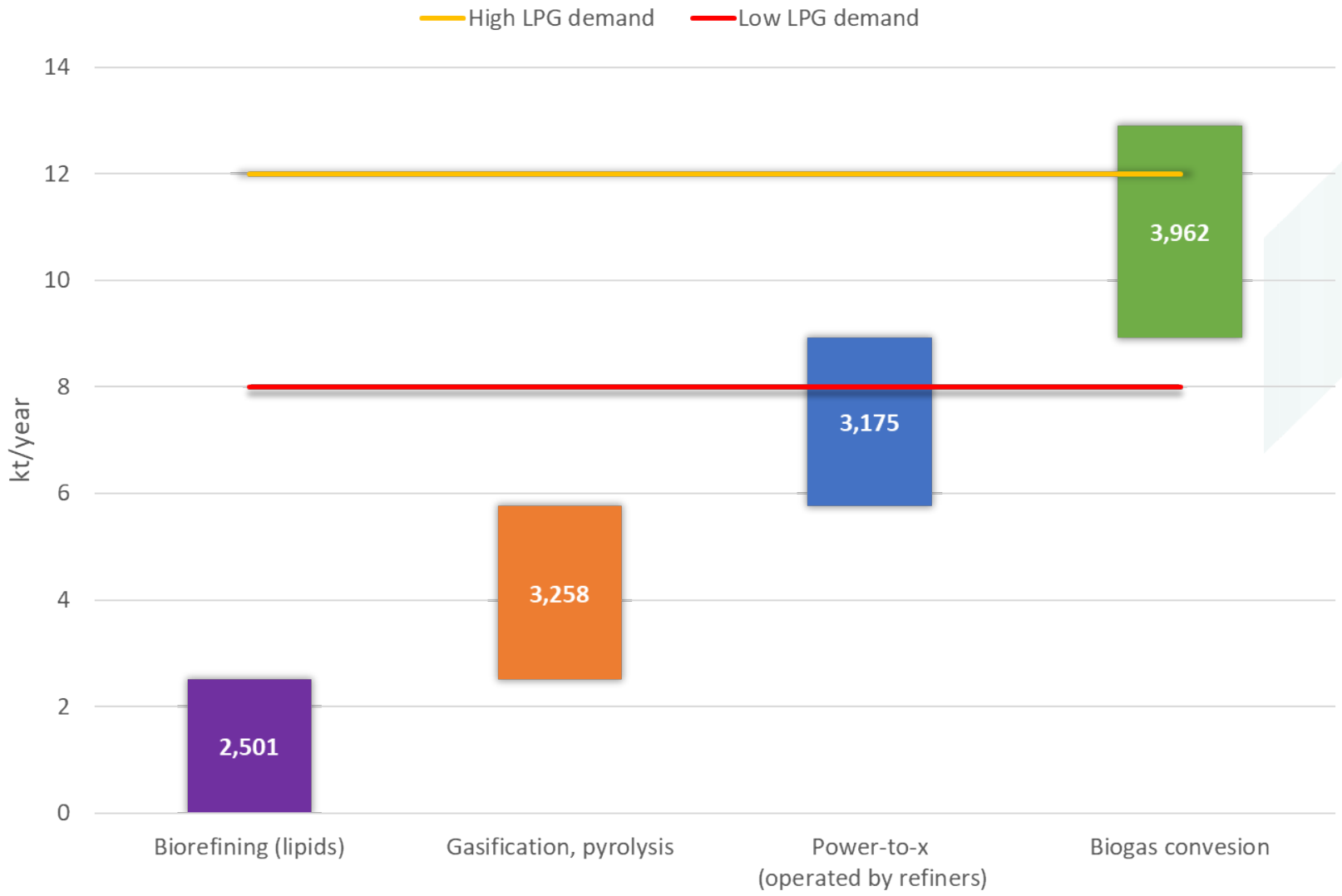
(Bio)LPG demand in 2050

The European LPG demand for energy use in Europe will decline by 25-50% from today's ~16 million tonnes

This steady reduction can be explained by overall trends in European energy demand leading to 2050:

- Energy consumption ⇩
- Electrification ⇧
- Gaseous fuels' consumption ⇩
- Solid fossil fuels will mostly disappear

2050 bioLPG projections



The European LPG market can be 100% renewable by 2050

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EU policy landscape

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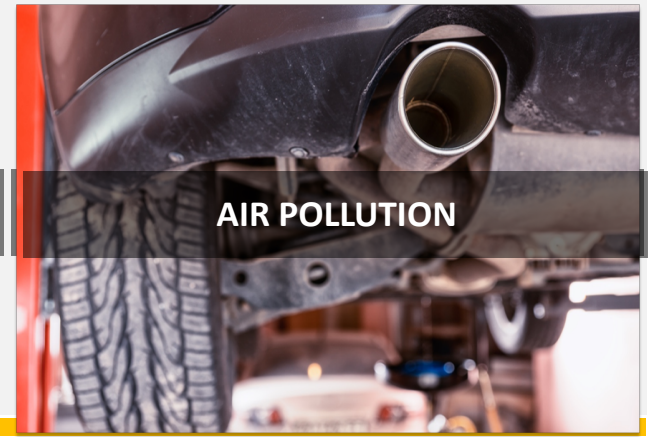
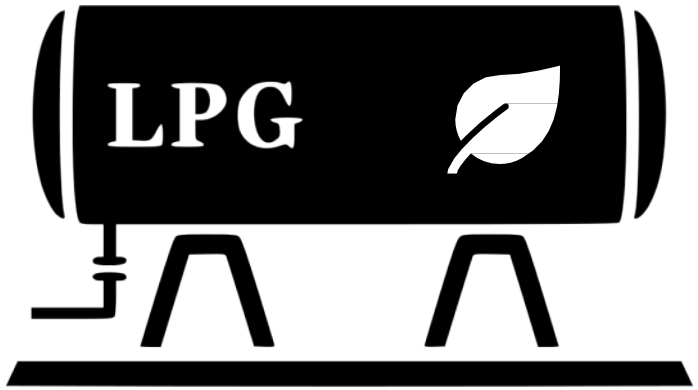
Situational Analysis – EU

Liquid Gas

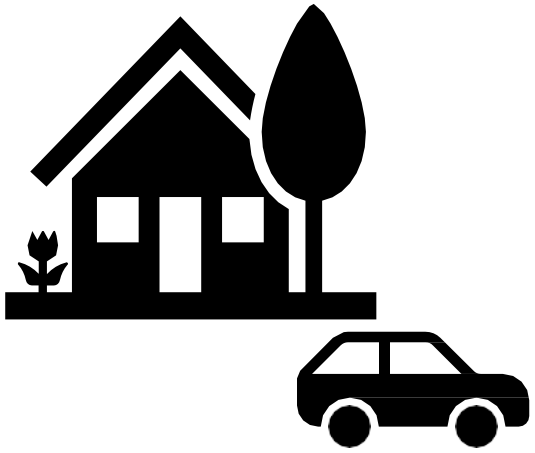



At the heart is our commitment to becoming the world's first climate-neutral continent
Ursula von der Leyen, the new Commission President, September 2019

What needs to be done from policymaking perspective?



BioLPG must be **recognised within European policy frameworks and regulations**



European and national policies should offer incentives for consumers **to switch to LPG in the short-term and bioLPG in the long run**

European and national policies should provide incentives for **low-carbon and renewable alternative energy producers**

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Vision for the industry

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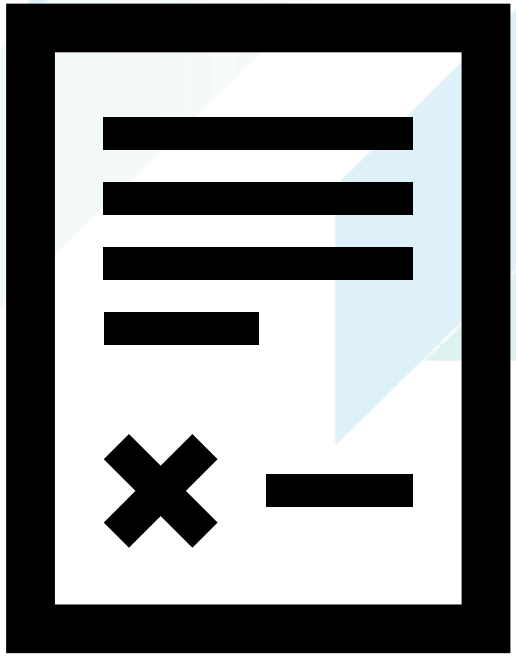
The next 10 years

Since bioLPG is produced as a co-product, **the LPG industry will need to rely on many different technology pathways producing sustainable renewable gaseous and liquid fuels to succeed**

- In the short to medium term, bioLPG will come as a by-product mainly from the **biorefining of lipids and gasification of biomass** (with the FT synthesis)
- In the long run, **biogas-to-bioLPG and power-to-x** pilots or demonstrations, as well as R&D on novel pathways for making bioLPG, will be essential in securing the bioLPG volumes by 2050

LPG industry's commitment

- **Advising** consumers and businesses on the possibility and advantages of switching to LPG in the short-term and bioLPG in the future
- **Educating** stakeholders and policymakers about bioLPG and its potential
- **Approaching** investors on possible projects producing bioLPG
- Considering **investing** in the production of bioLPG
- **Joining** consortia applying for EU funding of research projects
- **Sponsoring** industry-funded PhD, collaborating with research labs or offering research grants to research new technology pathways for bioLPG



More about bioLPG at our e-Congress in September 2021

Thank you

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Panel discussion



Panel discussion

Summary - Conclusions



Thank you!

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