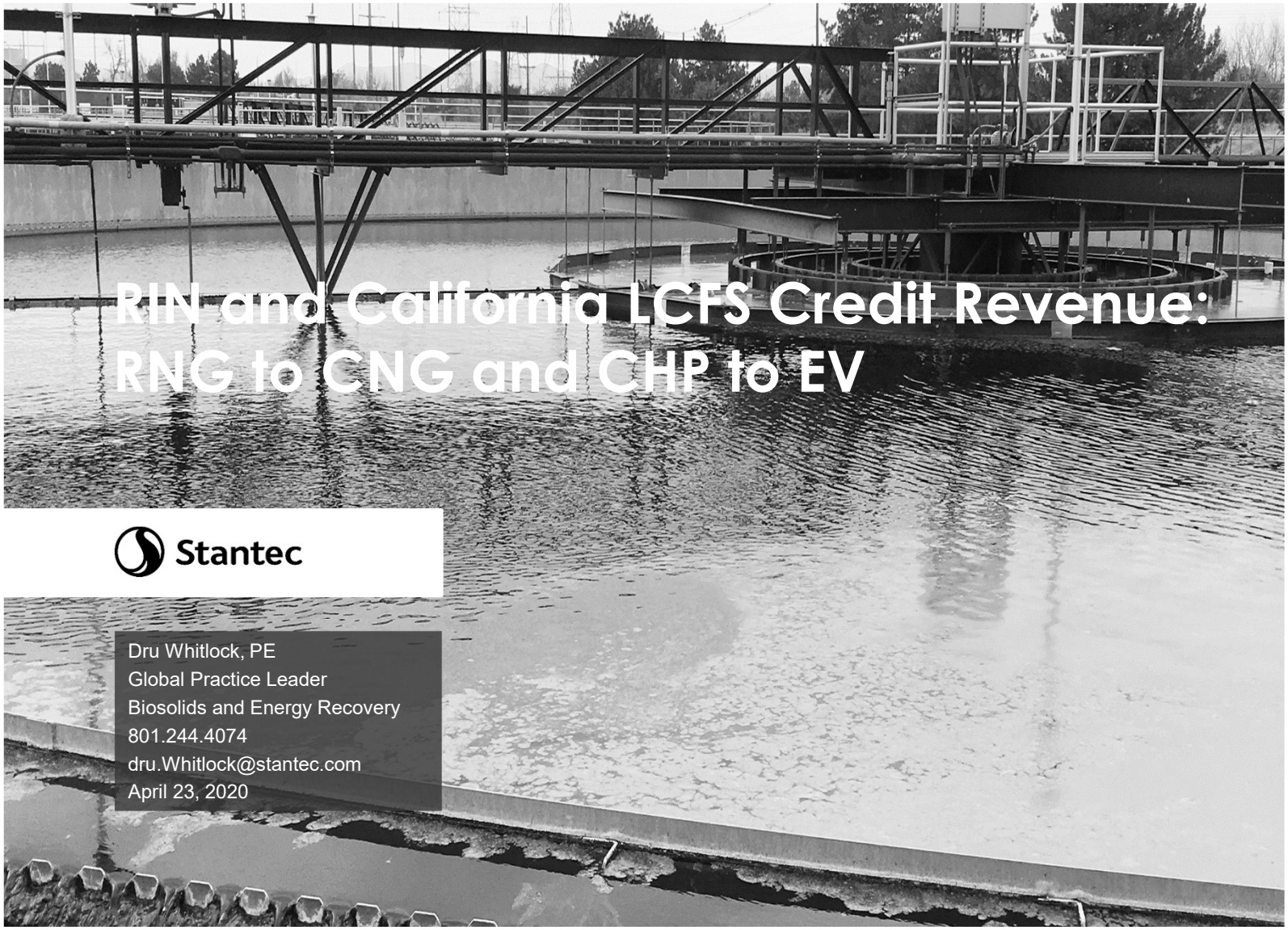

RIN and California LCFS Credit Revenue: RNG to CNG and CHP to EV

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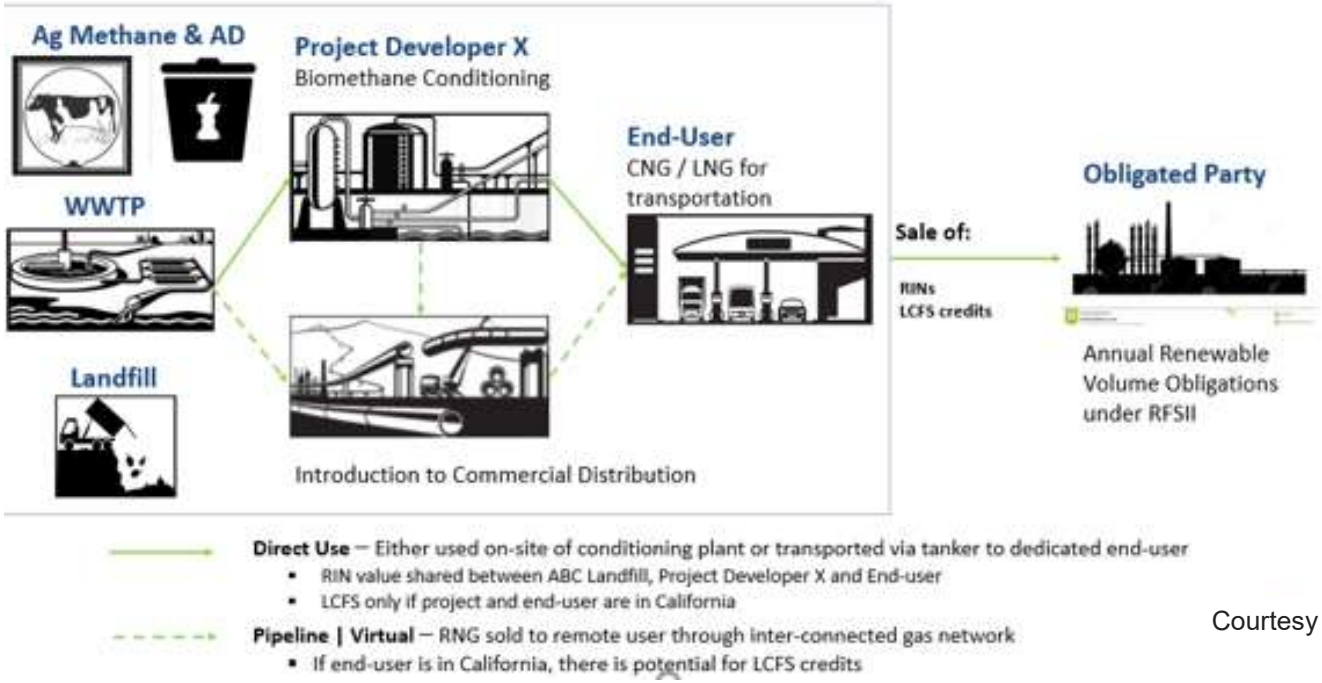
April 23, 2020

RIN/LCFS Value Chain



Courtesy of Blue Source

RIN Buyers: Obligated Parties (e.g., BP, Shell, Exon Mobil, Phillips, Chevron)

Companies that produce or import petroleum gasoline or diesel fuel in a given calendar year

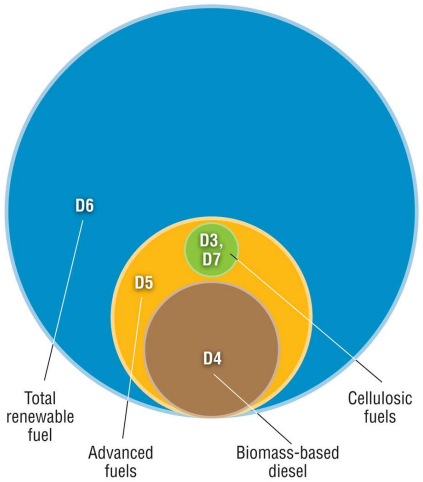
Do not have to blend physical renewable fuel

Must satisfy renewable volume obligations (RVO) using RINs and/or cellulosic waiver credits

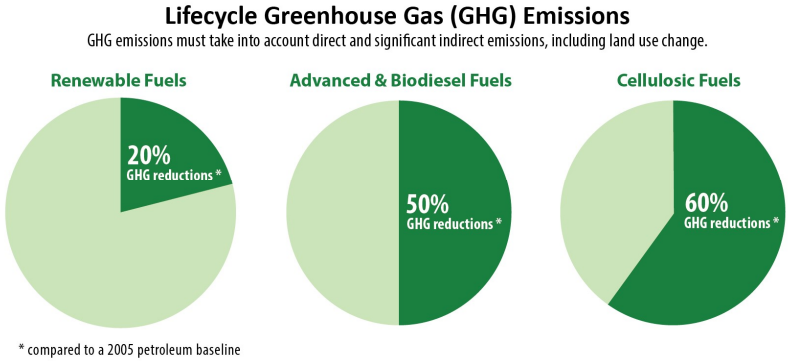
Can use prior-year RINs for up to 20% of the applicable RVO

Acquire RINs through the purchase of physical fuel with RINs or through RIN-only transactions

Renewable Fuel Mandates have GHG reduction criteria (established under EISA)

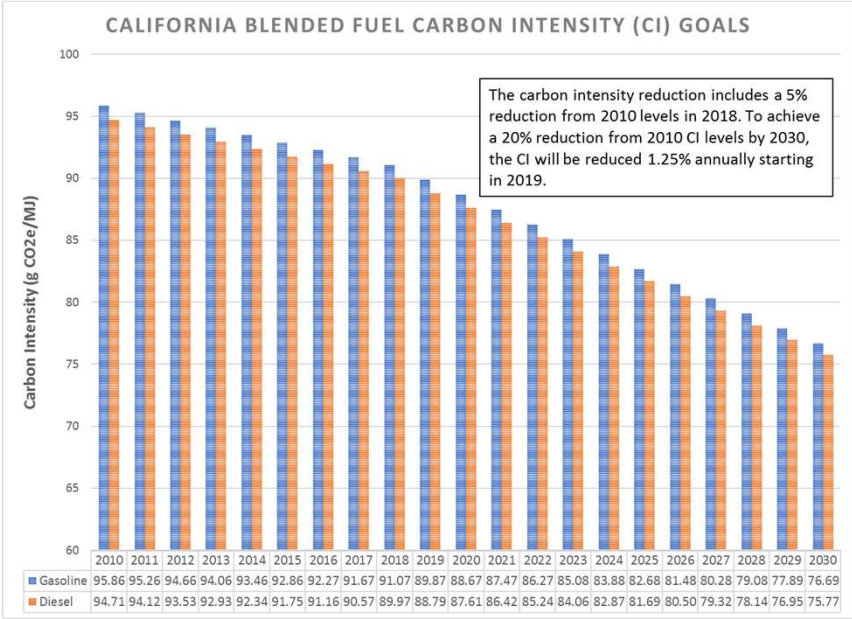


D-Code	Cellulosic Biofuel	Biomass-Based Diesel	Advanced Biofuel	Total Renewable Fuel
3	X		X	X
4		X	X	X
5			X	X
6				X
7	X		X	X



Images Courtesy of EPA

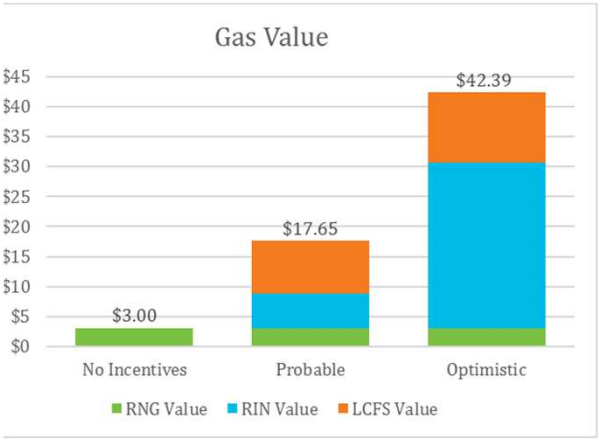
California Carbon Intensity Goals

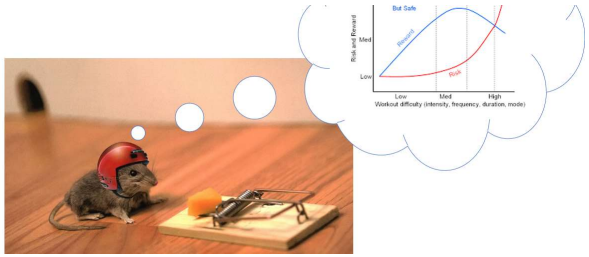


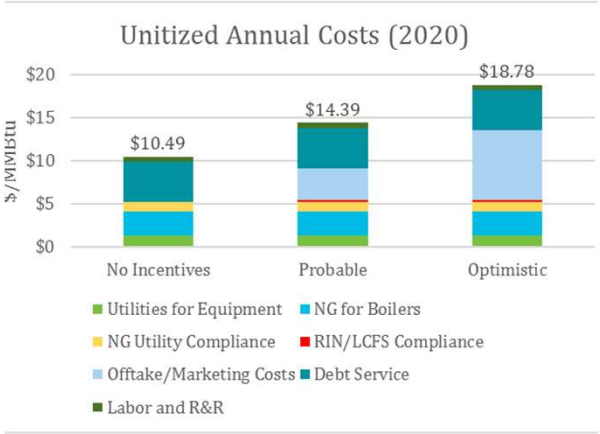
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gasoline	95.86	95.26	94.66	94.06	93.46	92.86	92.27	91.67	91.07	89.87	88.67	87.47	86.27	85.08	83.88	82.68	81.48	80.28	79.08	77.89	76.69
Diesel	94.71	94.12	93.53	92.93	92.34	91.75	91.16	90.57	89.97	88.79	87.61	86.42	85.24	84.06	82.87	81.69	80.50	79.32	78.14	76.95	75.77

2018 Renewable Fuel Standard-D3 RINs

- 11.7 RIN/MMBtu
- $2.40/D3 RIN
- $2.40/D3 RIN * 11.7 RIN/MMBtu = $28/MMBtu
- CA LCFS = $8/MMBtu
- Fossil NG value is approximately = $3/MMBtu
- RNG Value = $39/MMBtu



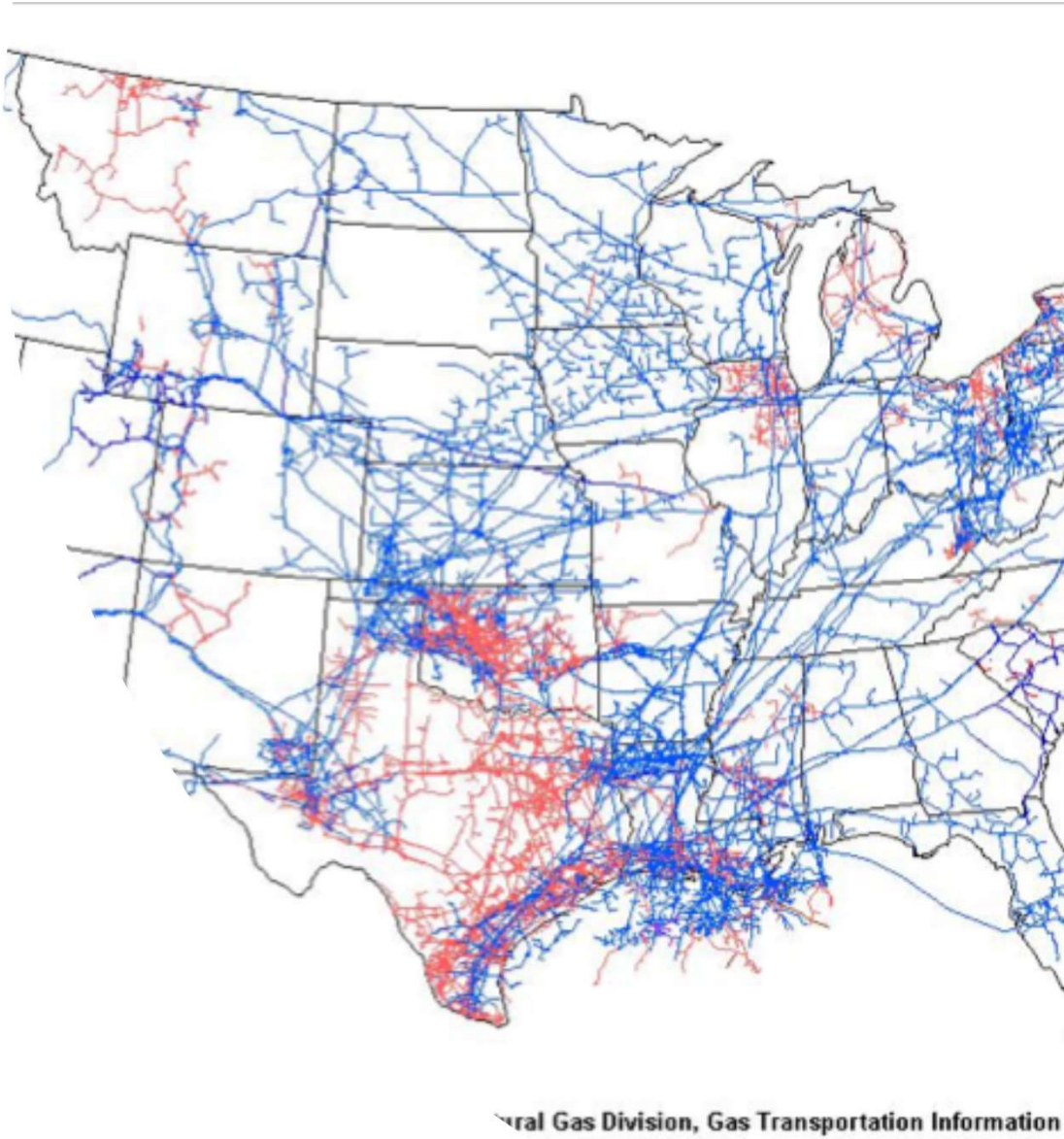




Value, Risk, Cost

Uncertainties

- Market fluctuation
- Supply/Demand changes
- Rule changes
  - Cellulosic feedstock classification
  - Small refinery exemptions
- Future volume obligations
- Changes in legislation
- Natural Gas Utility
  - Interconnection
  - Meeting specifications

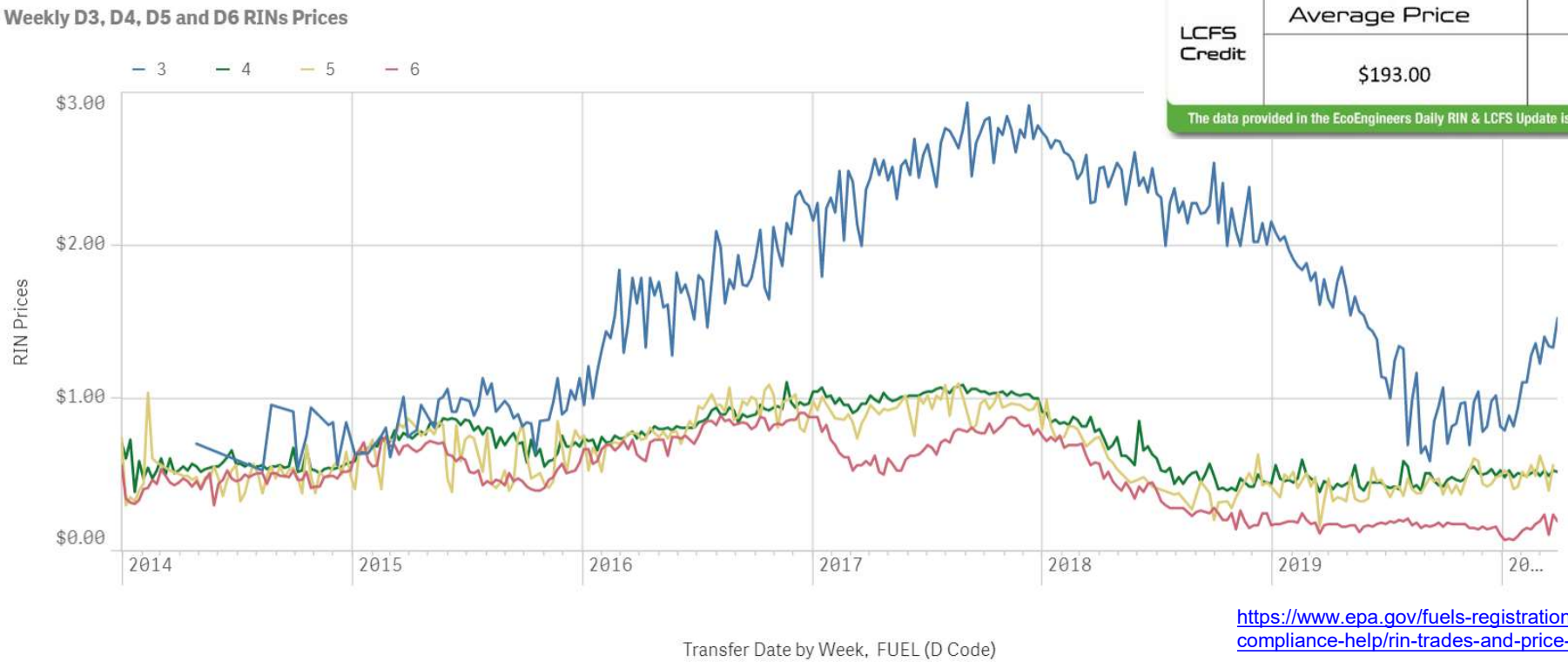


Current RIN Pricing

4/21/2020

D-CODE	Average Price 2019	Average Price 2020	Closing Value 2019	Closing Value 2020
D3	$0.950	$0.974	$0.950	$0.975
D4	$0.555	$0.507	$0.555	$0.520
D5	$0.545	$0.510	$0.540	$0.510
D6	$0.224	$0.320	$0.225	$0.320
LCFS Credit	Average Price		Closing Value	
	$193.00		$193.00	

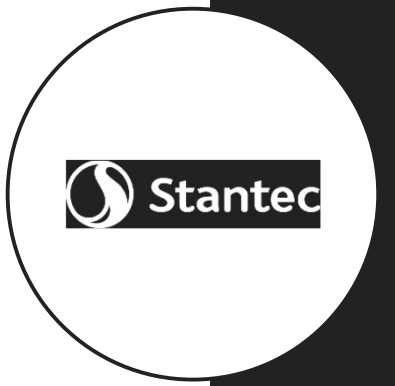
The data provided in the EcoEngineers Daily RIN & LCFS Update is intended for informational purpose only.



https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rin-trades-and-price-information

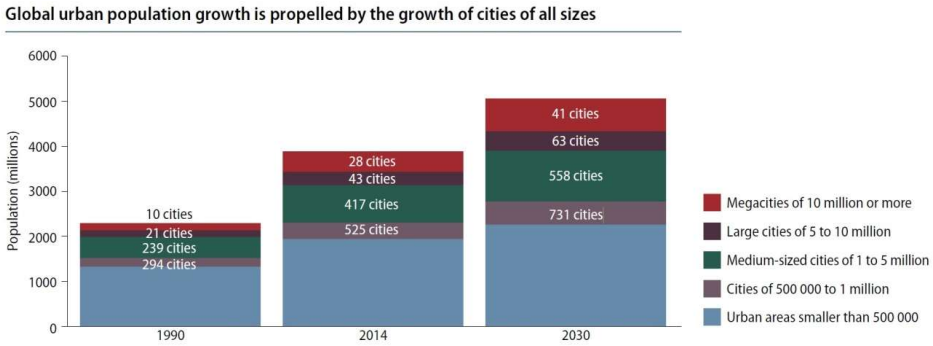
Important Questions

- What is the historic and projected transportation market?
- Will there be demand for compressed natural gas (CNG) vehicles in the future?
- What biogas-to-energy option has the best environmental benefit?
- Without incentives, what is the best biogas-to-energy option? What is the “fallback position?”
- In areas such as California and progressive urban areas moving aggressively towards 100 percent renewable energy, will RNG have a market demand?

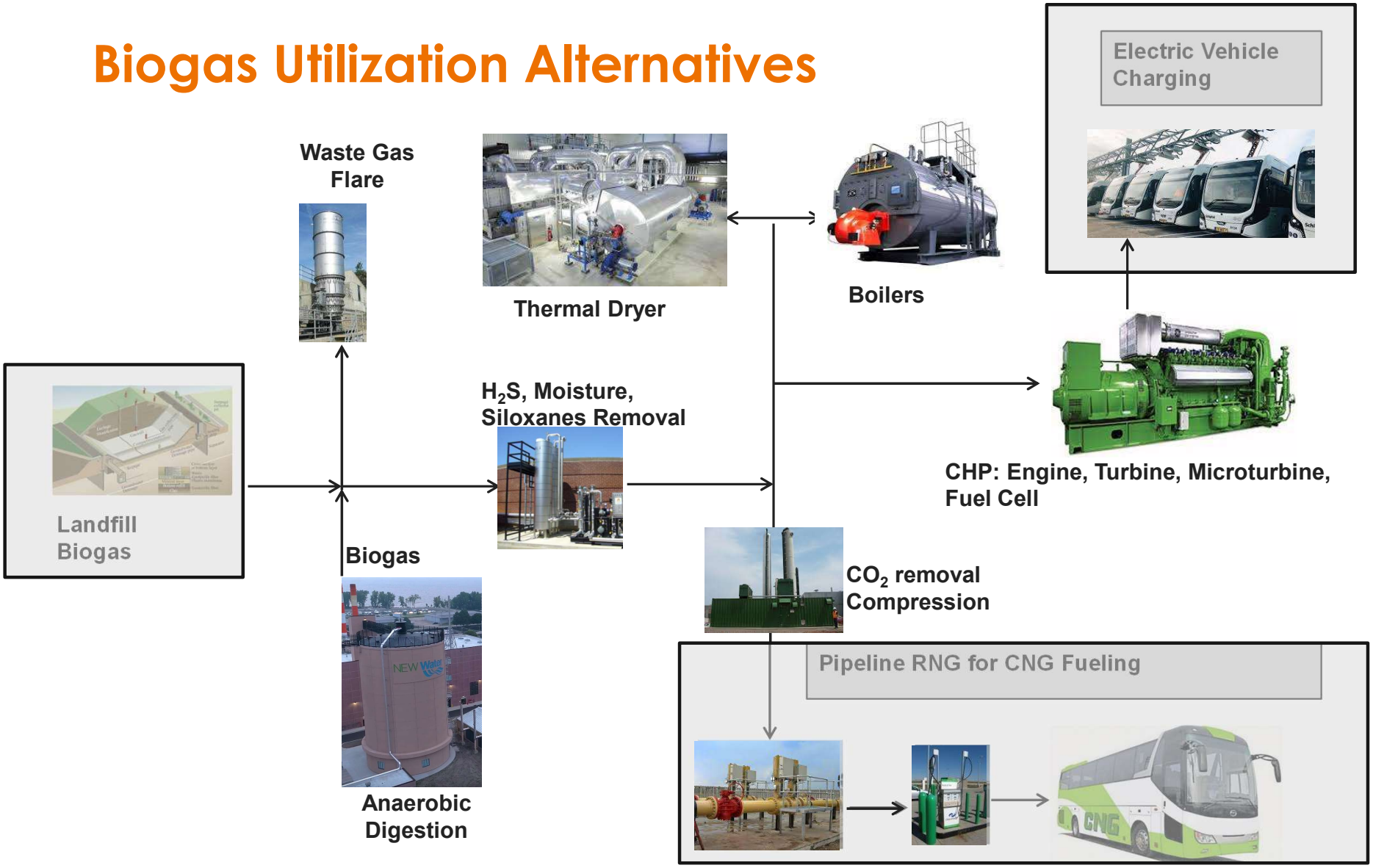


Urban Expansion

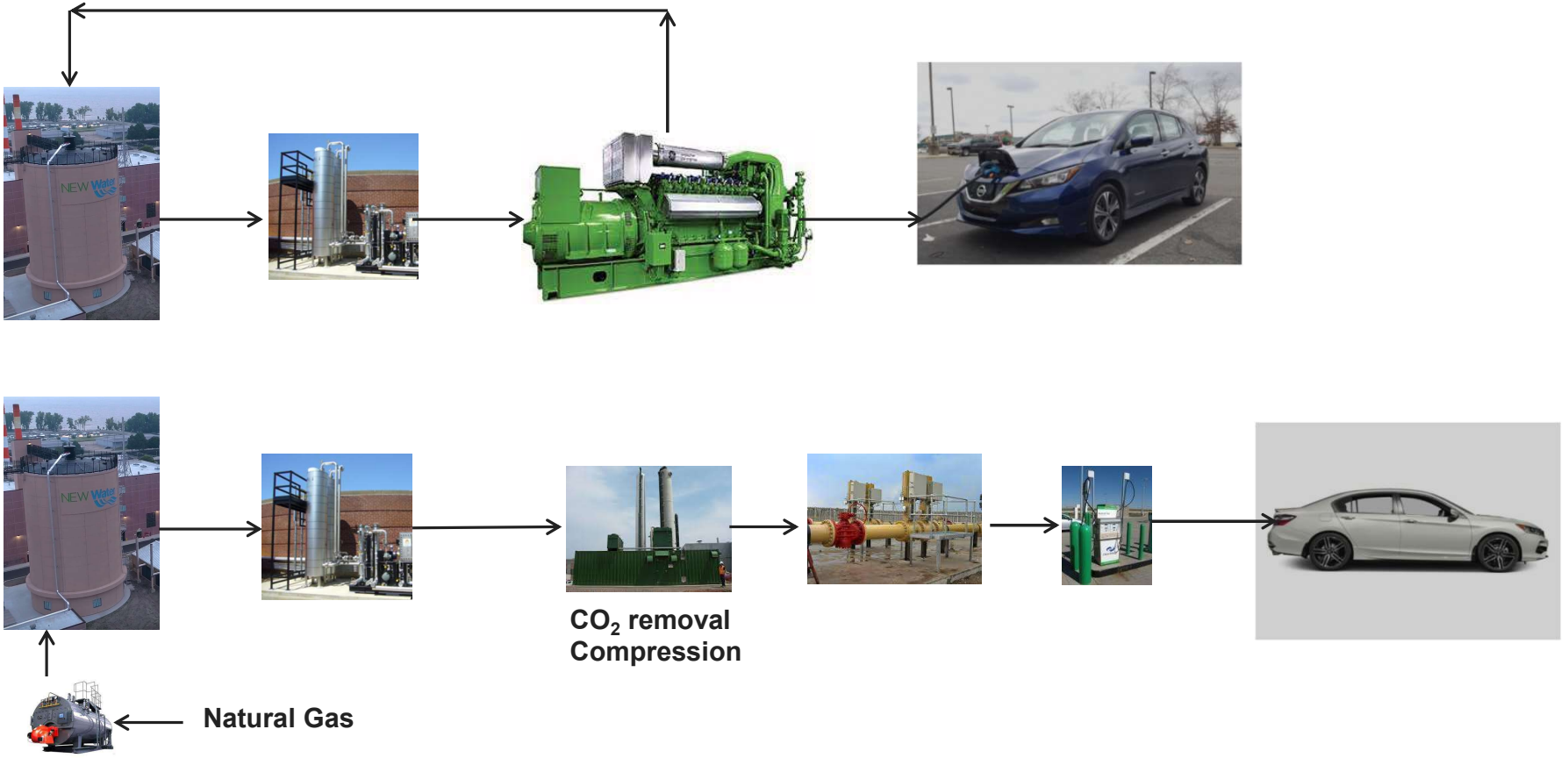
68% of the world population projected to live in urban areas by 2050, says UN



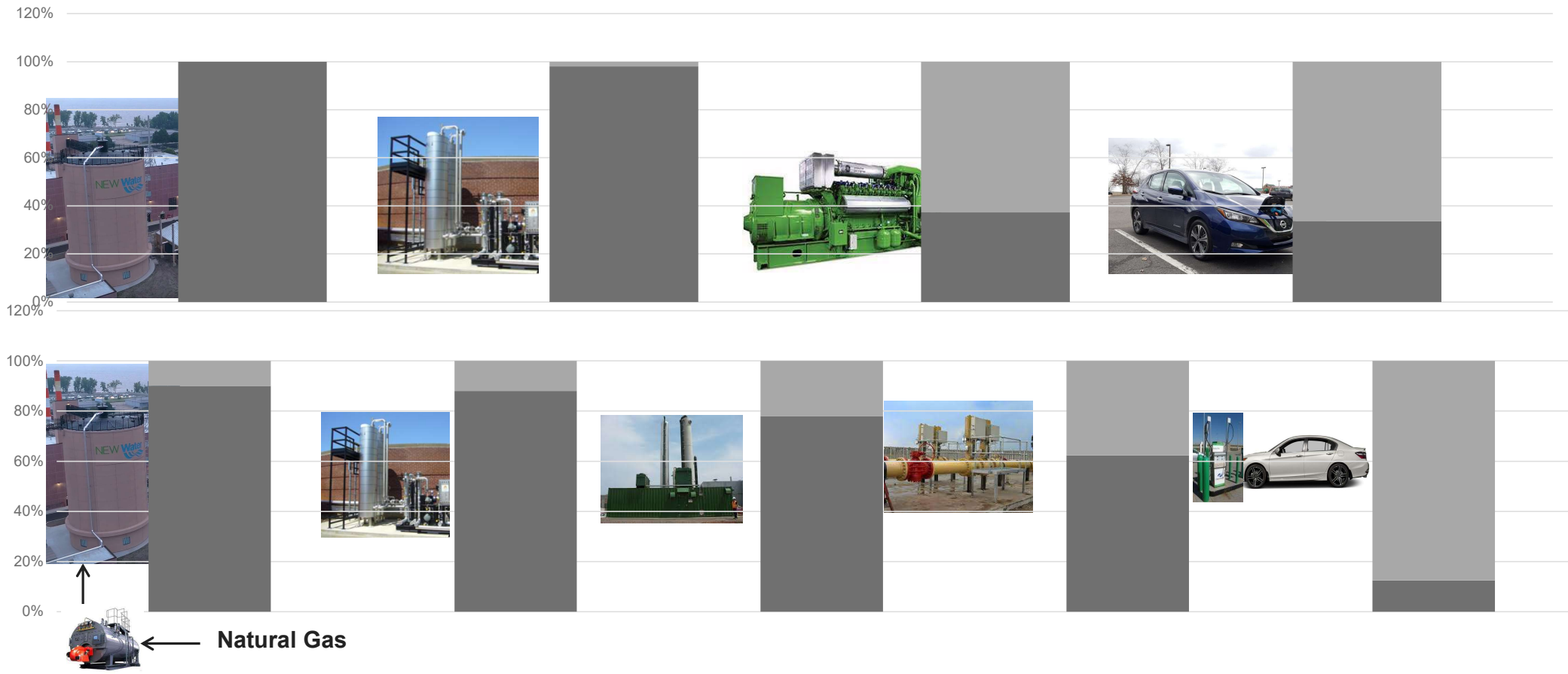
Biogas Utilization Alternatives



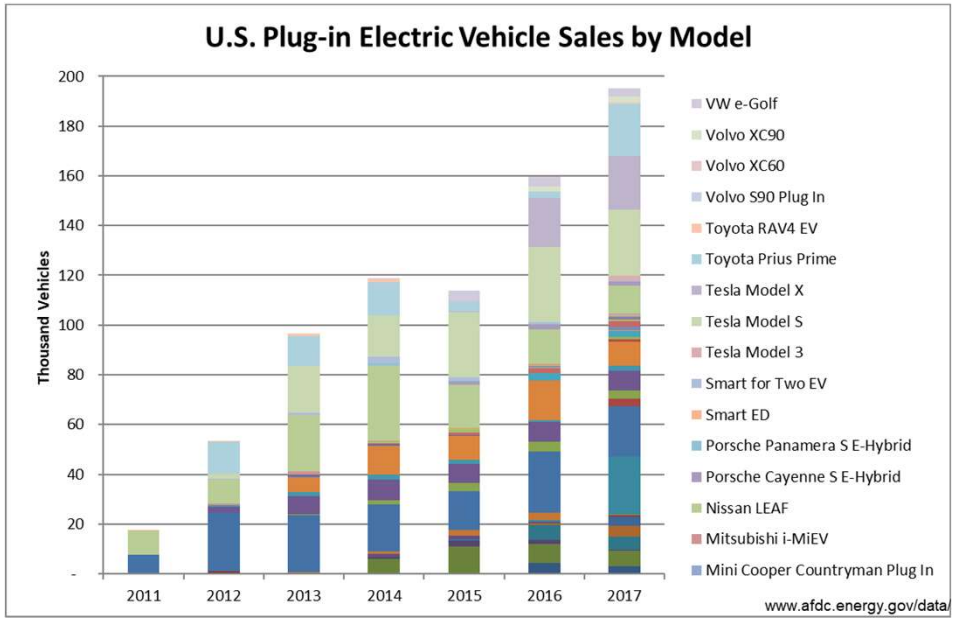
Energy Conversion Efficiency
Compressed Natural Gas (CNG) Versus Electric Vehicle (EV)

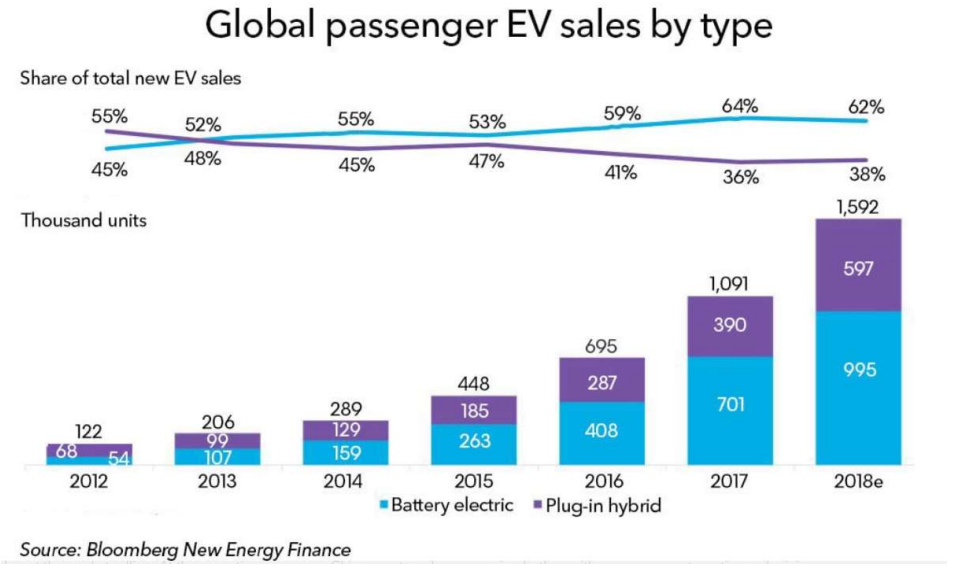


Energy Conversion Efficiency

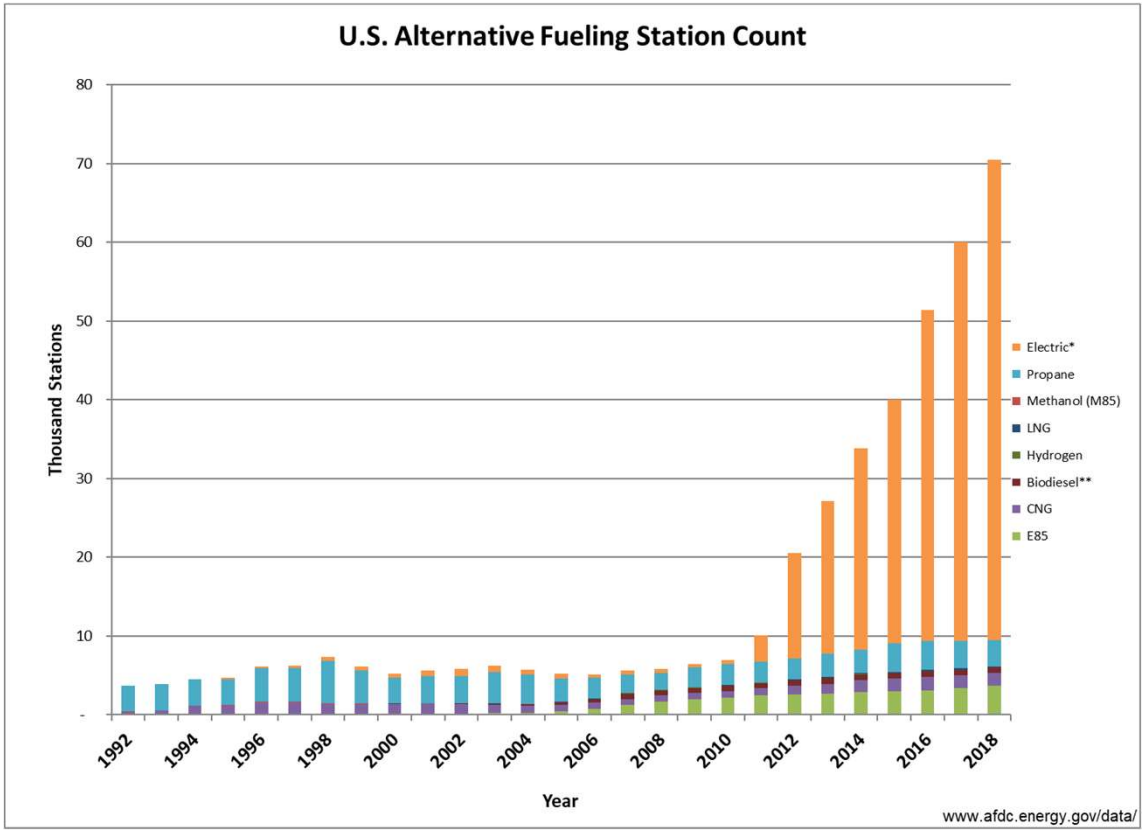


Battery and Plug-in Hybrid Electric Vehicle Sales (Thousand Vehicles)





U.S. Alternative Fueling Stations from 1992 to 2018



The Future of Vehicle Transportation

- Electric
- Driverless
- Shared

CALIFORNIA AIR RESOURCES BOARD

Mary D. Nichols, Chair
Matthew Rodriquez, CalEPA Secretary
Edmund G. Brown Jr., Governor

Notice of Decision

Project Title:	Amendments to the Low Carbon Fuel Standard Regulation and to the Regulation on Commercialization of Alternative Diesel Fuels (SCH# 2017072050)
Project Location:	Statewide
Public Meeting Date:	September 27, 2018; Agenda Item #18-7-4
Project Description:	Amendments designed to strengthen the Low Carbon Fuel Standard regulation through 2030 in line with the Senate Bill 32 greenhouse gas reduction goals. The proposed amendments would also foster increased deployment of zero-emission vehicles, adopt a credit generating protocol for carbon capture and sequestration, establish third-party verification of program data, and streamline the implementation of the regulation, among other aspects.

This notice is to advise that the California Air Resources Board (CARB or Board), as the lead agency, adopted the above regulatory action on September 27, 2018.

CARB prepared an environmental analysis (EA) in accordance with the requirements of its certified regulatory program under CEQA. (Cal. Code Regs., tit. 14, §15251, subd. (d).). The EA, included as an appendix to the Staff Report prepared for the proposed project, concluded implementation of the regulatory action may result in significant adverse environmental impacts. Mitigation measures were made a condition of approval. The Board made CEQA findings and adopted a statement of overriding considerations for this regulatory action.

Staff prepared written responses to comments received that raised significant environmental issues pertaining to this item. The written responses to these environmental comments are included in the *Response to Comments on the Draft Environmental Analysis for the Proposed Amendments to the Low Carbon Fuel Standard and the Alternative Diesel Fuels Regulation* and *Supplemental Response to Comments on the Draft Environmental Analysis for the Proposed Amendments to the Low Carbon Fuel Standard and the Alternative Diesel Fuels Regulation*. Before taking final action, the Board considered and approved written responses to these comments as required by CARB's certified regulations. (Cal. Code Regs., tit. 17, § 60007(a).)

The EA (included as an appendix to the Staff Report), and all other related documents, including the *Response to Comments on the Draft Environmental Analysis for the Proposed Amendments to the Low Carbon Fuel Standard and the Alternative Diesel Fuels Regulation* and *Supplemental Response to Comments on the Draft Environmental Analysis for the*

arb.ca.gov 1001 I Street • P.O. Box 2815 • Sacramento, California 95812 (800) 242-4450

Notice of Decision
September 28, 2018
Page 2

Proposed Amendments to the Low Carbon Fuel Standard and the Alternative Diesel Fuels Regulation are available for public inspection on the CARB rulemaking webpage at: https://www.arb.ca.gov/regact/2018/lcfs18/lcfs18.htm

These documents may also be examined at:

California Air Resources Board
Attn: Board Administration and Regulatory Coordination Unit
1001 I Street
Sacramento, CA 95814

FILED

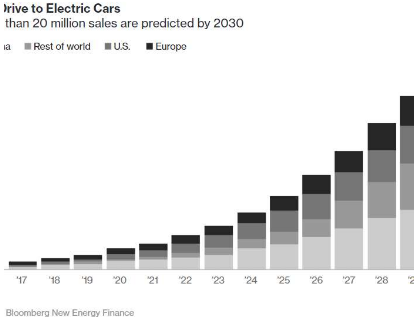
Certified: CARB CEQA Unit

Date: 9/8/2018

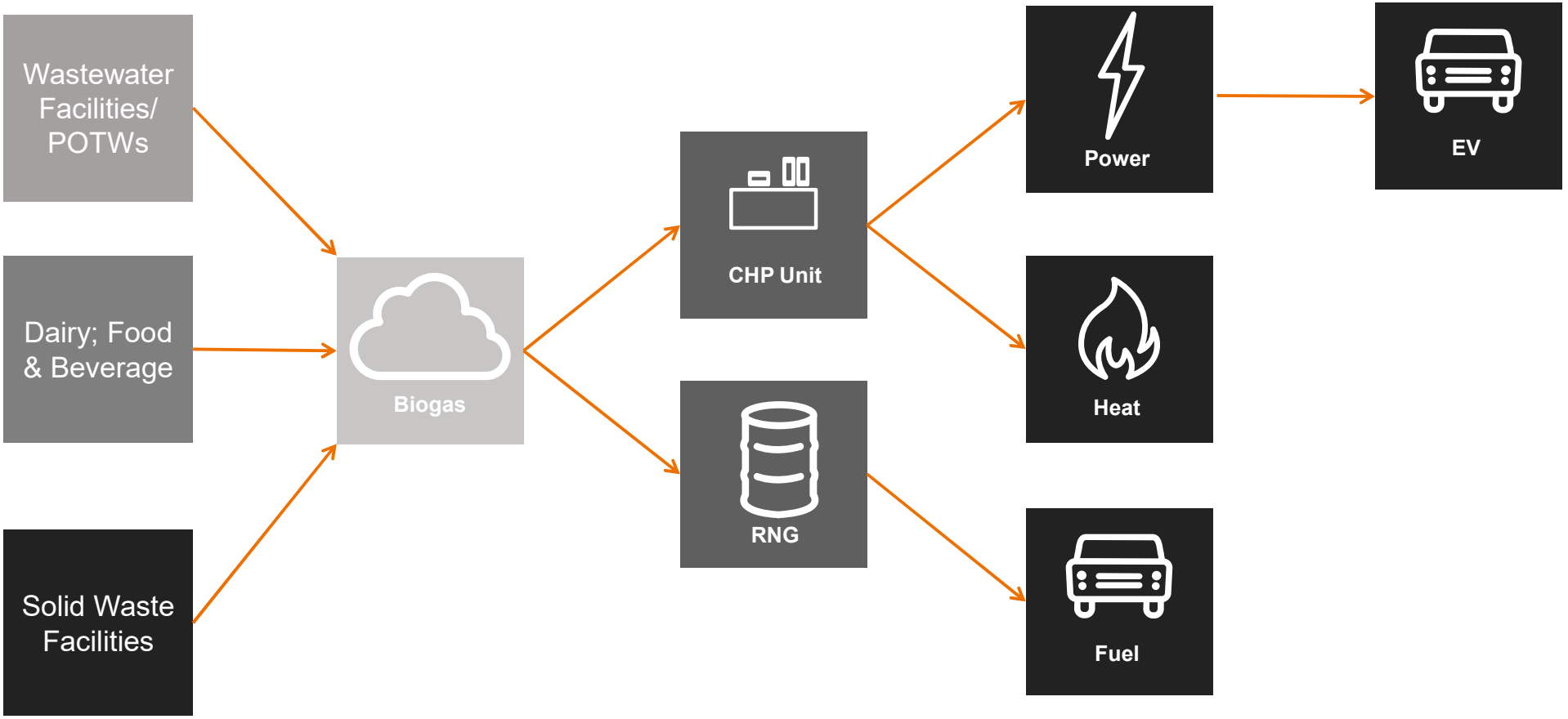
SEP 28 2018
STATE CLEARINGHOUSE

© Queensland Urban Utilities/Facebook

A vehicle (pictured) powered entirely on electricity from human waste has been unveiled at the Queensland Urban Utilities treatment plant, south west of Brisbane

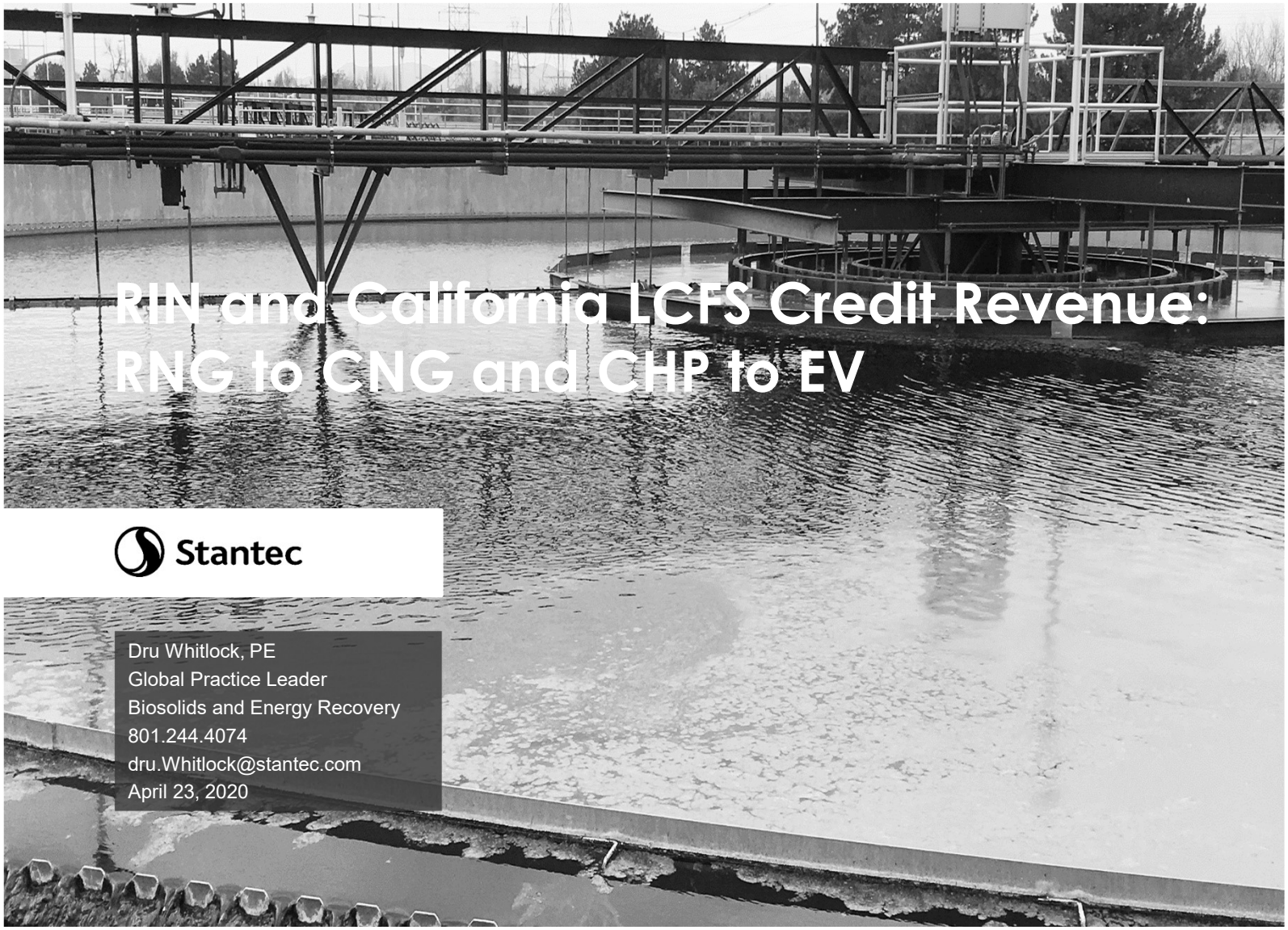


Conclusions



Conclusions

- Incentives are providing more economical biogas use options
- Incentives are uncertain, and, therefore, are complicating the adjudication process
- Huge growth opportunities for:
  - Co-digestion
  - Manure digestion
  - Dairy and Swine Operations
  - Landfill biogas capture and reuse
- Critical to understand the incentive construct when considering the economics
- Current RNG market looks strong and might be a good play for some utilities … but is not a panacea
- RNG production needs an incentive mitigation strategy
- The case for CHP:
  - Electrification of energy infrastructure trend
  - Electrification of transportation trend
  - Economical fallback position
  - Environmental benefit



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