TACWA, DoubleTree Hobby Airport, Houston - TX

Got Gas? The mechanics of turning your renewable natural gas into RINs

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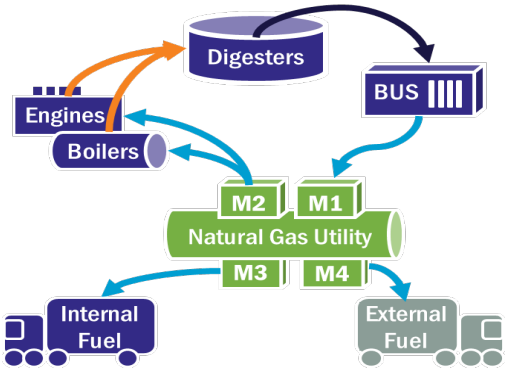
John Willis, Ph.D., P.E.,
Brown and Caldwell

July 22, 2022



Overview

• Introduction	**Jeff Lange**
• RINs/RFS Overview	**Jeff Lange**
• Gas Upgrading	**John Willis**
• Contracts Needed for RIN Programs	**John Willis**
• Example Projects	**John Willis**
• Risk / Revenue / Effort	**John Willis**

RINs/RFS Overview

Brown AND Caldwell

Renewable Fuel Standard (RFS) Program Legislation

- Created under the Energy Policy Act of 2005 (EPAct)
- Amended the Clean Air Act (CAA)
- Energy Independence and Security Act of 2007 (EISA) further amended the CAA by expanding RFS program
- EPA implements the program in consultation with the US Department of Agriculture and the Department of Energy

Pathways II improved Wastewater Biogas RIN Value

- 1 RIN = 1 “Renewable Identification Number”
  = 1 gallon-of-ethanol worth of energy = 77,550 BTUs

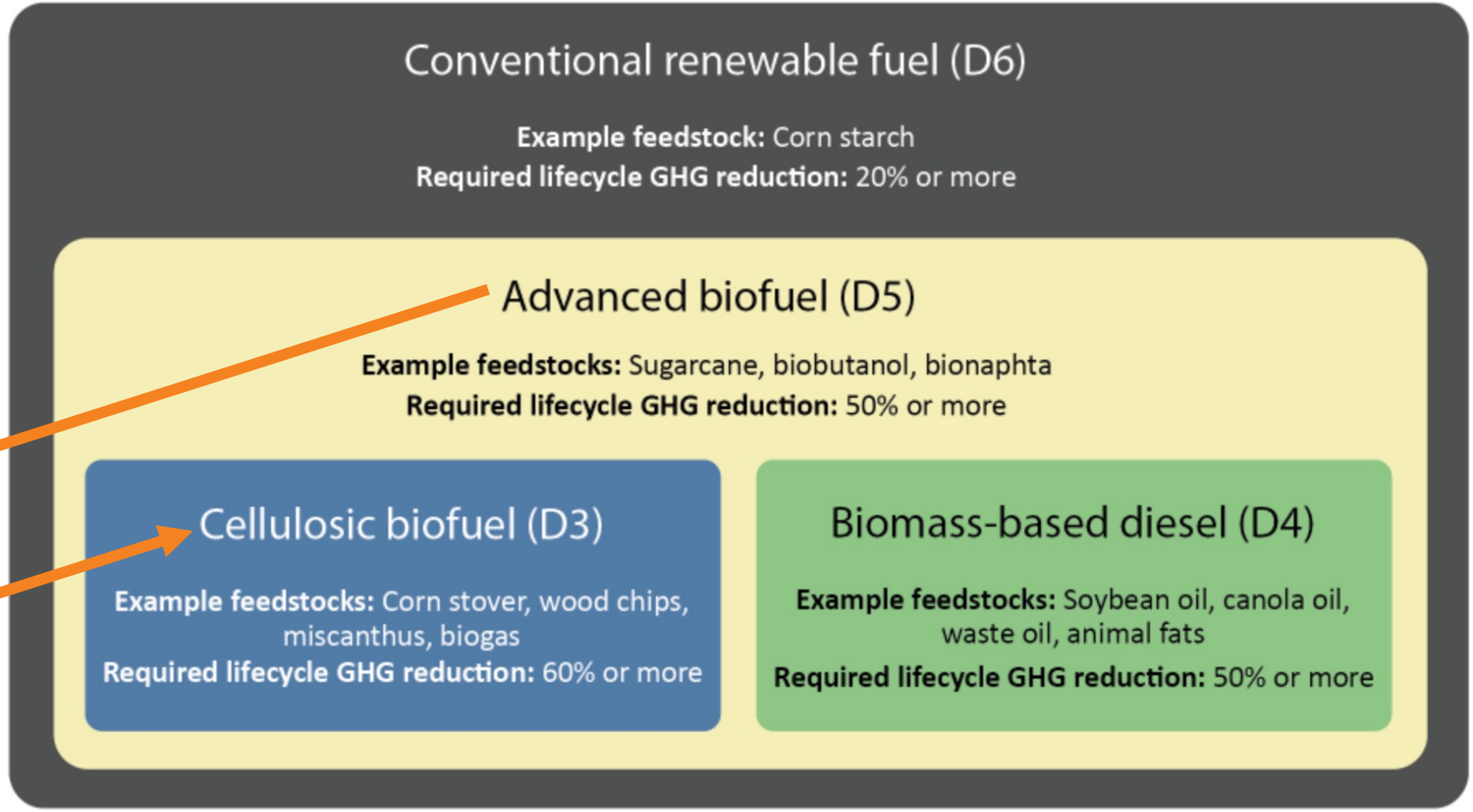
(EPA, RFS-1, Paragraph III.B.4.b, May 1, 2007)

- Pathways I originally classified Biogas (from Landfills, sewage and waste treatment plants, manure digesters) as for D5 (Advanced) RINs
- Pathways II (July 18, 2014) Pathway Q with D3-RIN (cellulosic) designation for any:
  - “Renewable Compressed Natural Gas, Renewable Liquefied Natural Gas, Renewable Electricity”
  - produced from “**Biogas** from landfills, **municipal wastewater treatment facility digesters**, agricultural digesters, and separated MSW digesters; and biogas from the cellulosic components of biomass processed in other waste digesters.”

Fuel Nesting for Renewable Fuel Standard

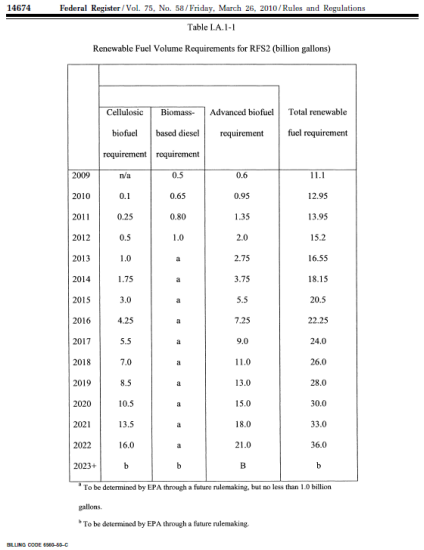
A D3 RIN can be "produced" by combining a D5 RIN with a Cellulosic Waiver Credit (CWC)

D5 RIN
+ CWC
D3 RIN



EPA Website: https://www.epa.gov/renewable-fuel-standard-program/renewable-fuel-annual-standards (Sept. 15, 2019)

Renewable Fuel Volume Obligations (RVO) in a Chart



14674 Federal Register / Vol. 75, No. 58 / Friday, March 26, 2010 / Rules and Regulations

Table I.A.1-1

Renewable Fuel Volume Requirements for RFS2 (billion gallons)

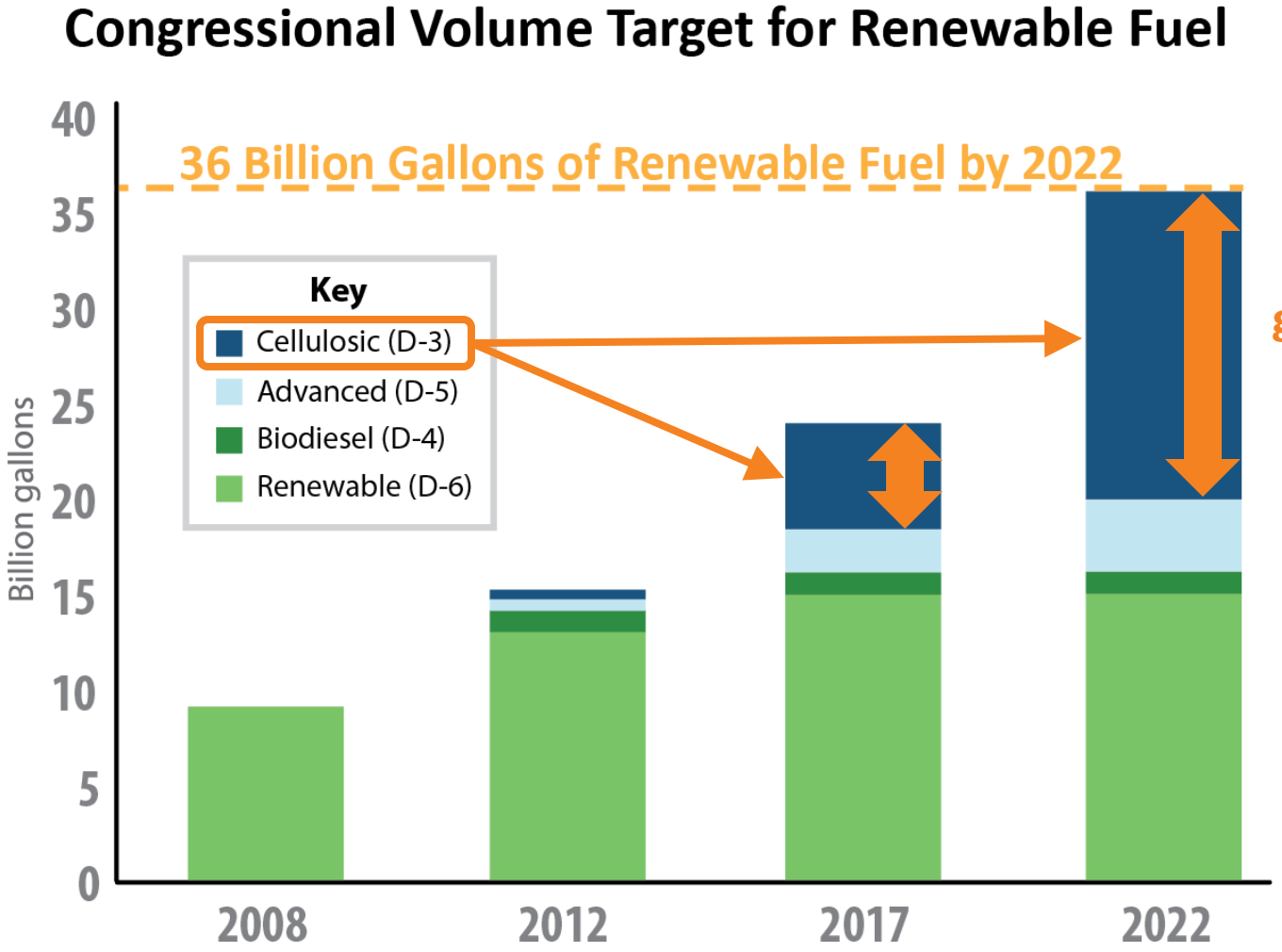
	Cellulosic biofuel requirement	Biomass-based diesel requirement	Advanced biofuel requirement	Total renewable fuel requirement
2009	n/a	0.5	0.6	11.1
2010	0.1	0.65	0.95	12.95
2011	0.25	0.80	1.35	13.95
2012	0.5	1.0	2.0	15.2
2013	1.0	a	2.75	16.55
2014	1.75	a	3.75	18.15
2015	3.0	a	5.5	20.5
2016	4.25	a	7.25	22.25
2017	5.5	a	9.0	24.0
2018	7.0	a	11.0	26.0
2019	8.5	a	13.0	28.0
2020	10.5	a	15.0	30.0
2021	13.5	a	18.0	33.0
2022	16.0	a	21.0	36.0
2023+	b	b	B	b

[a] To be determined by EPA through a future rulemaking, but no less than 1.0 billion gallons.

[b] To be determined by EPA through a future rulemaking.

BILLING CODE 6560-50-C

40 CFR Part 80. Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule (RFS-2), Table I.A.1-1 (March 26, 2010)



Most legislation-required growth is in cellulosic-D3s! That wastewater-biogas qualifies for!

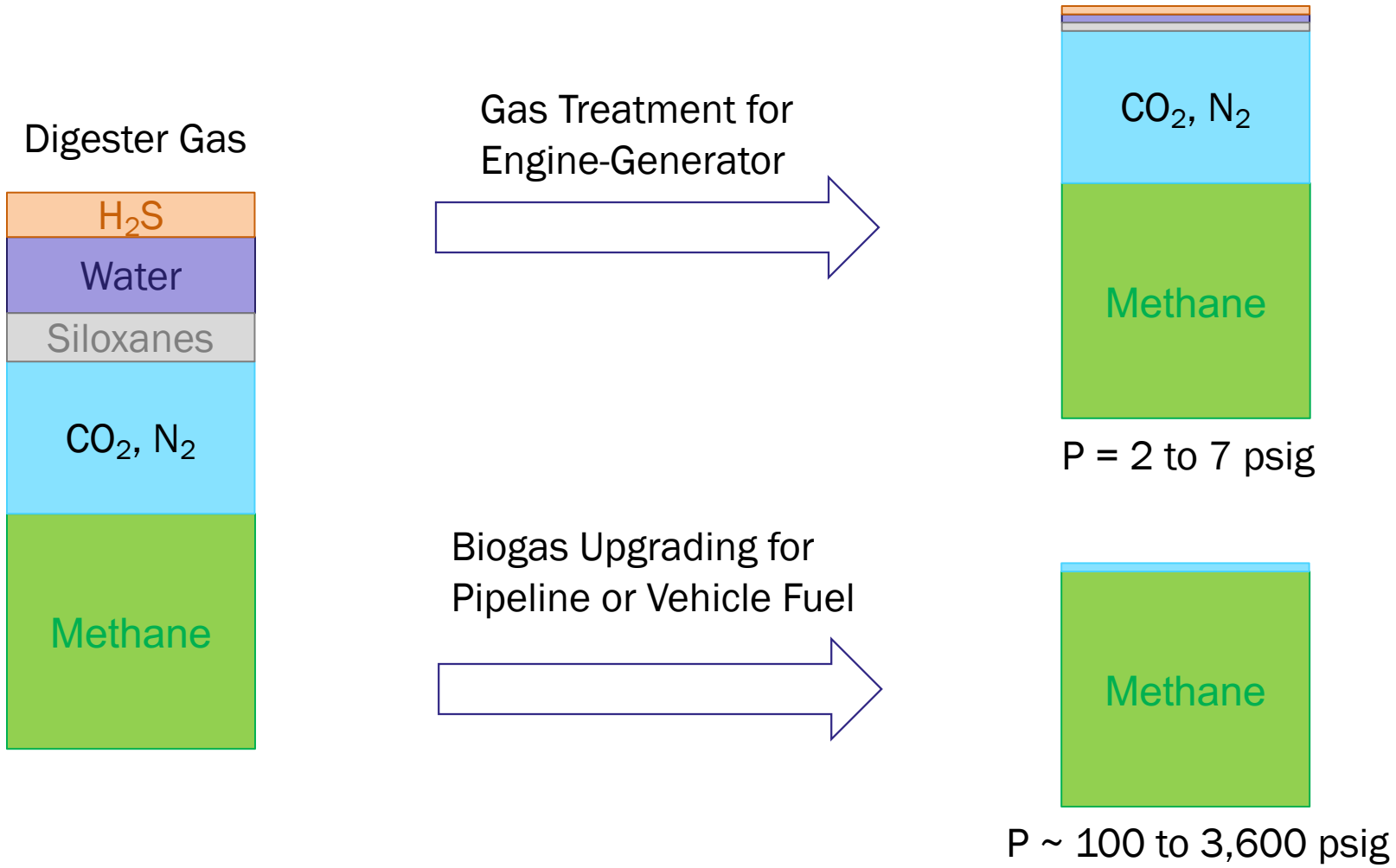
What are the Benefits of Biogas to RNG Vehicle Fuel?

- Green projects: offsetting fossil fuel use and reducing GHGs
- Real Resource Recovery
- Can be easier to own:
  - Would you rather own ~~gas treatment and an engine?~~
  - OR just gas treatment? ✓ ✓ ✓
  - Would you rather run your engine on ~~treated biogas?~~
  - OR purchased natural gas ? ✓ ✓ ✓

➢**These are projects that $$Save Money$$ and $$Produce Revenue$$**

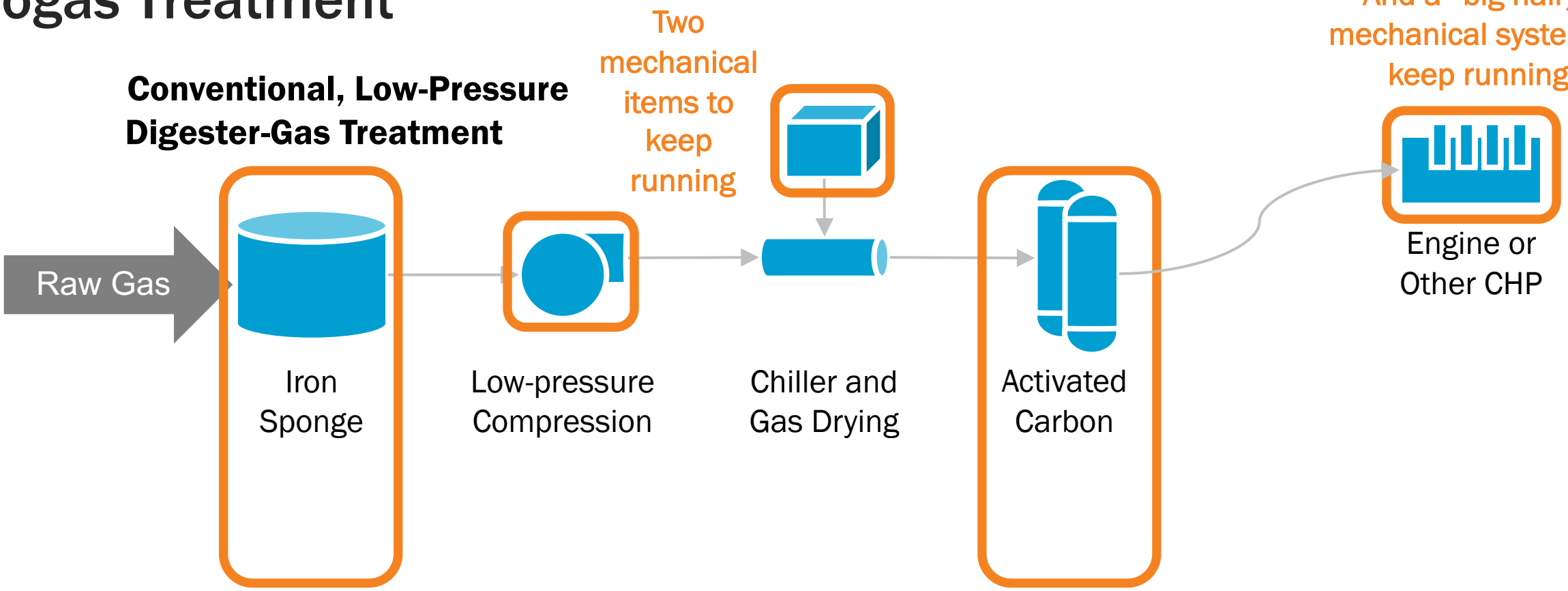
Gas Upgrading Overview

Biogas Treatment for CHP vs Upgrading



Gas-Upgrading can actually be Easier-to-Own than Conventional Biogas Treatment

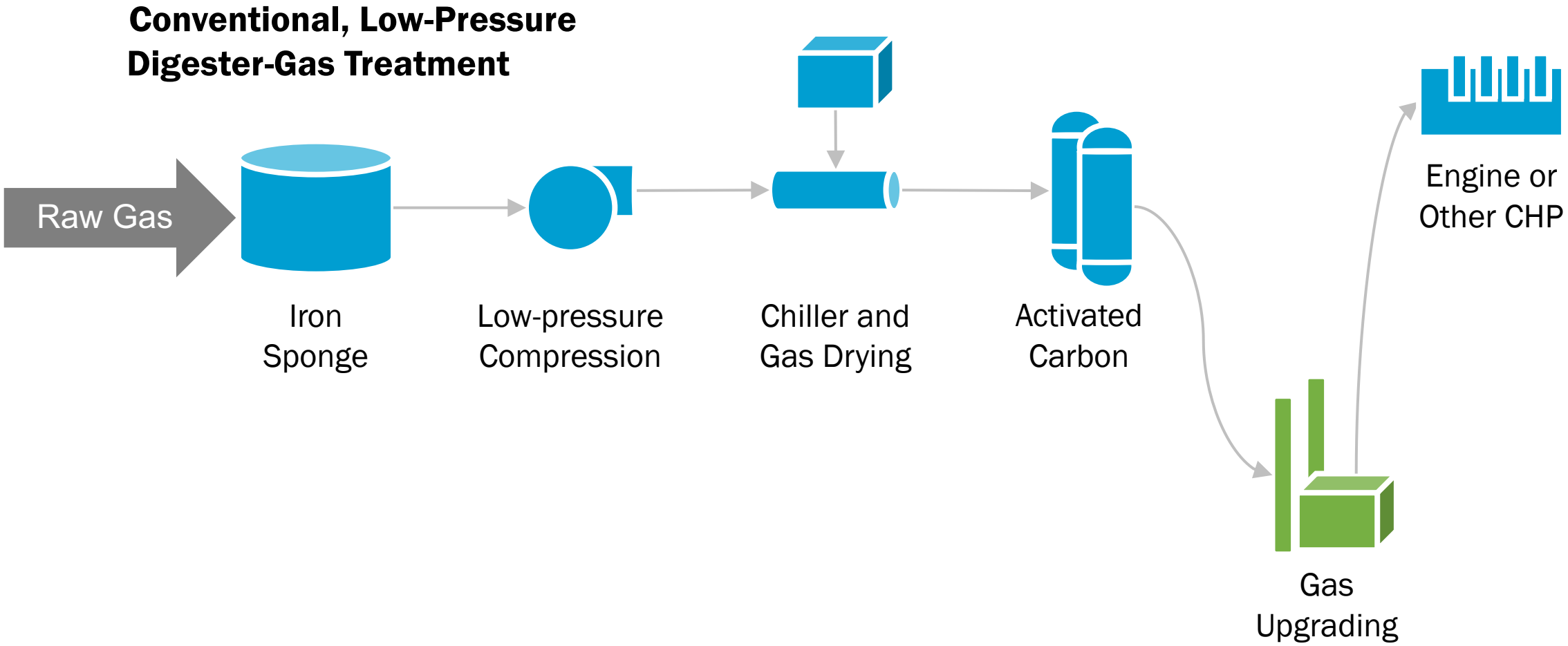
Conventional, Low-Pressure Digester-Gas Treatment



Can spontaneously ignite on contact with air during replacement every 1-2 years

Requires frequent Media replacement 2-6 times/year

Many Incorrectly Believe that you would "Remove CO_2 Last"



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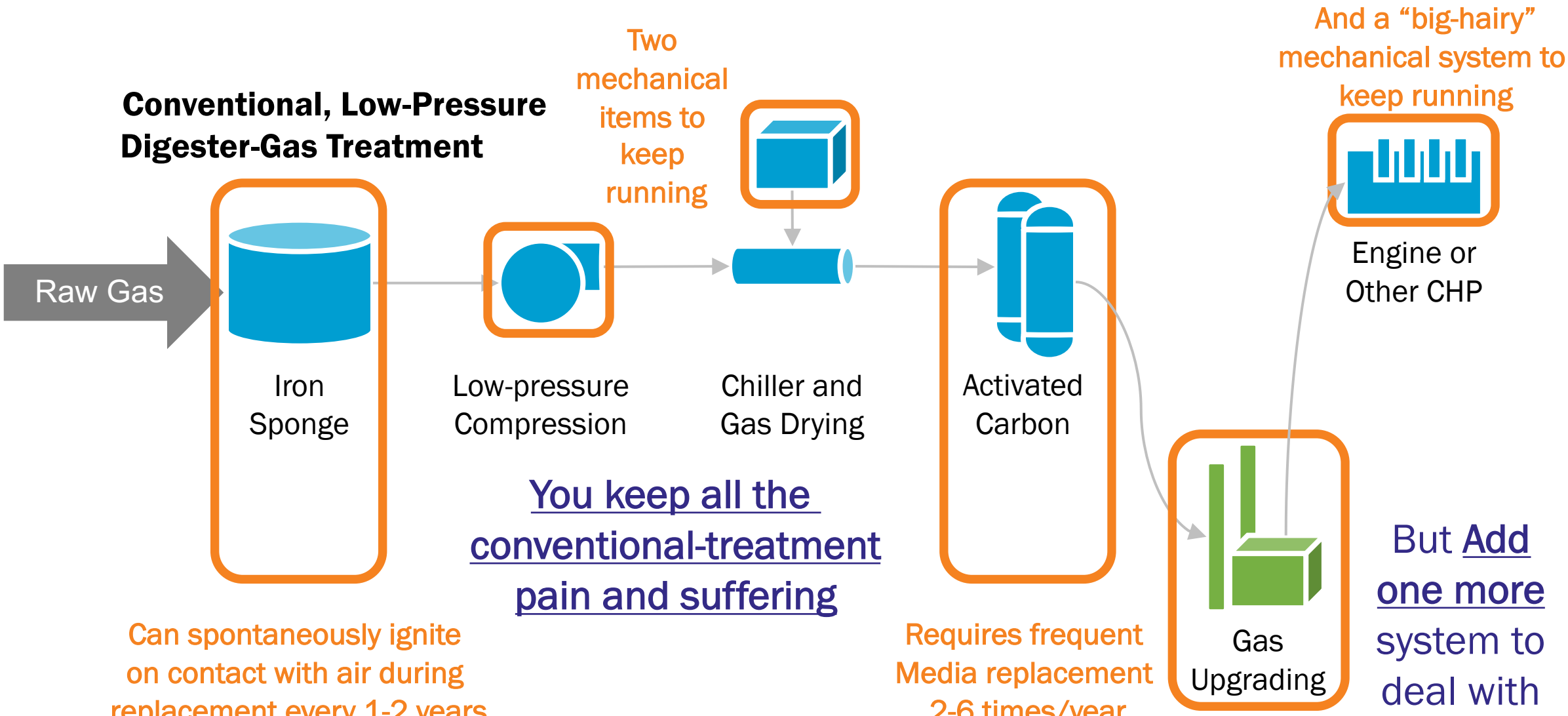
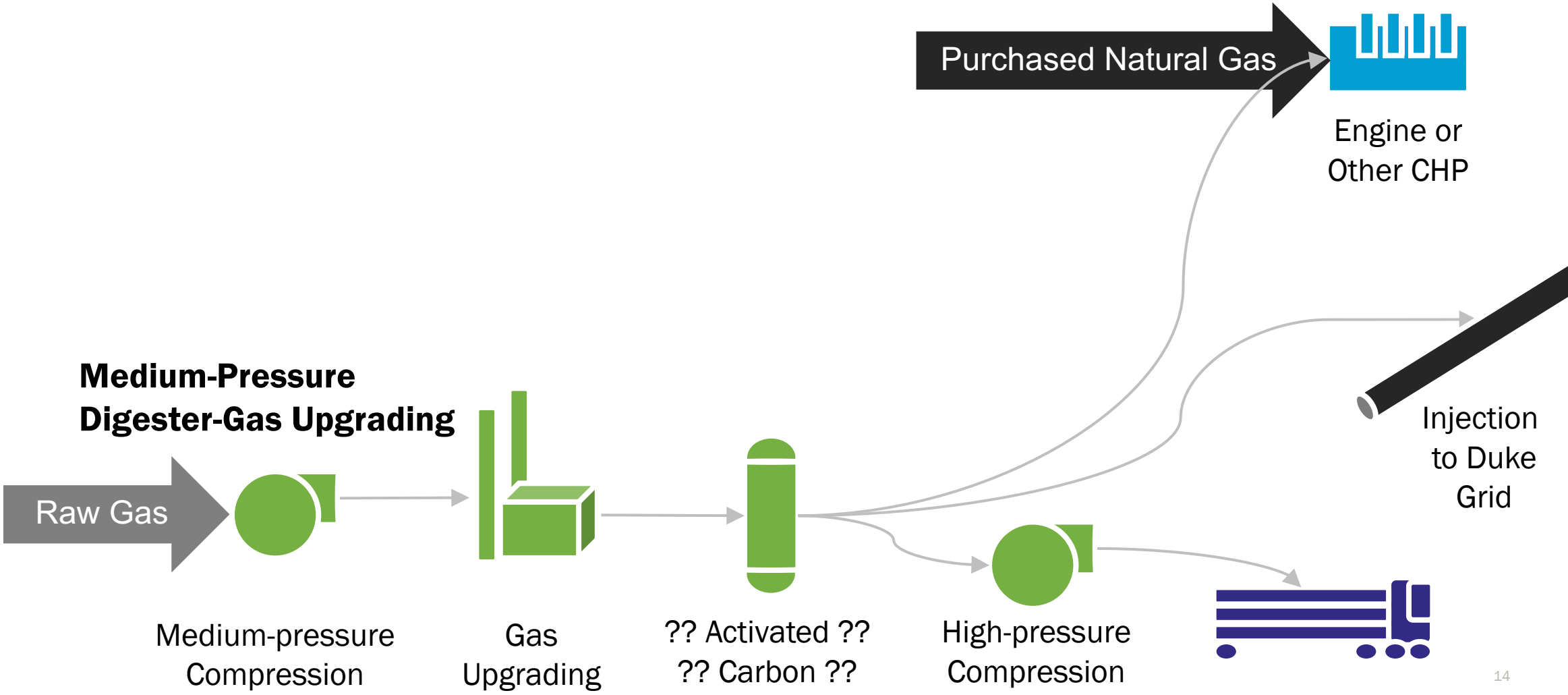
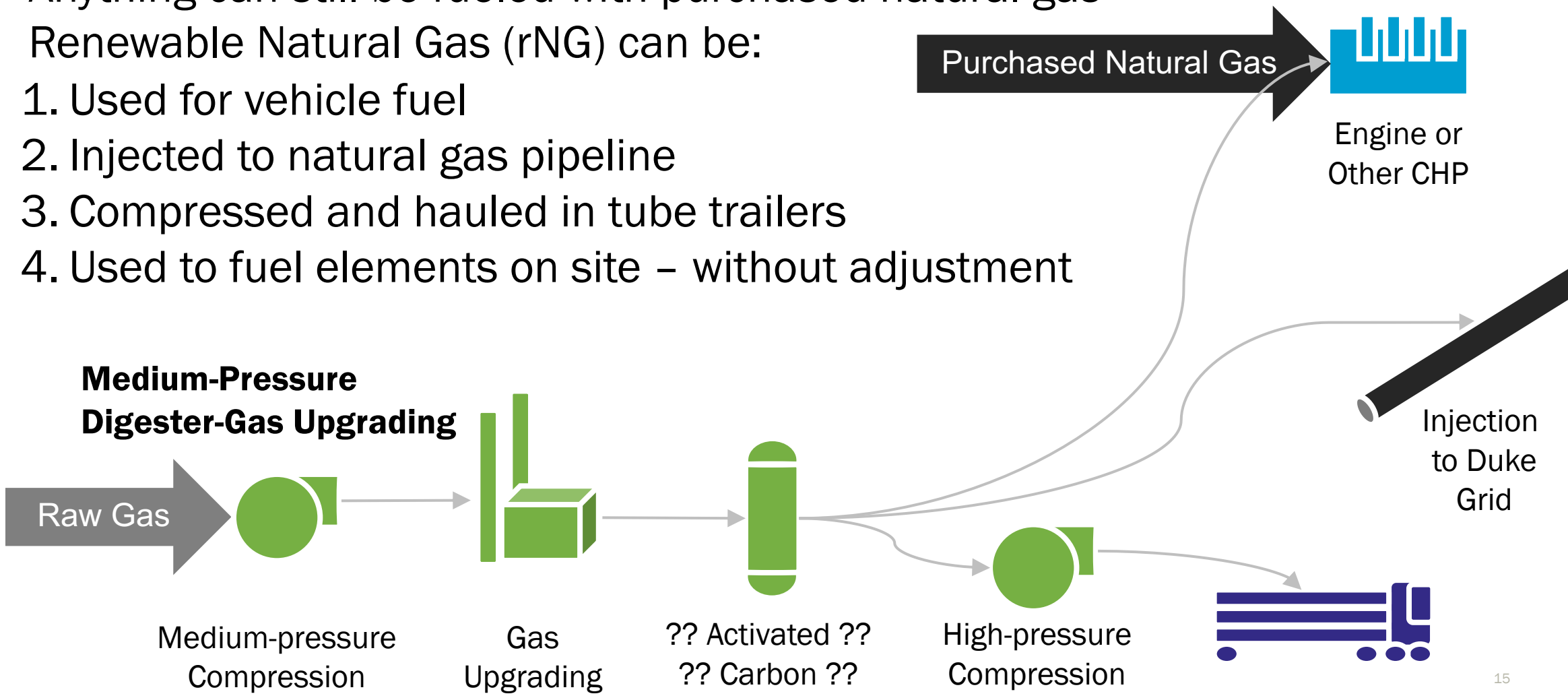


Depending on Required Quality, Single Stage can do All the Work



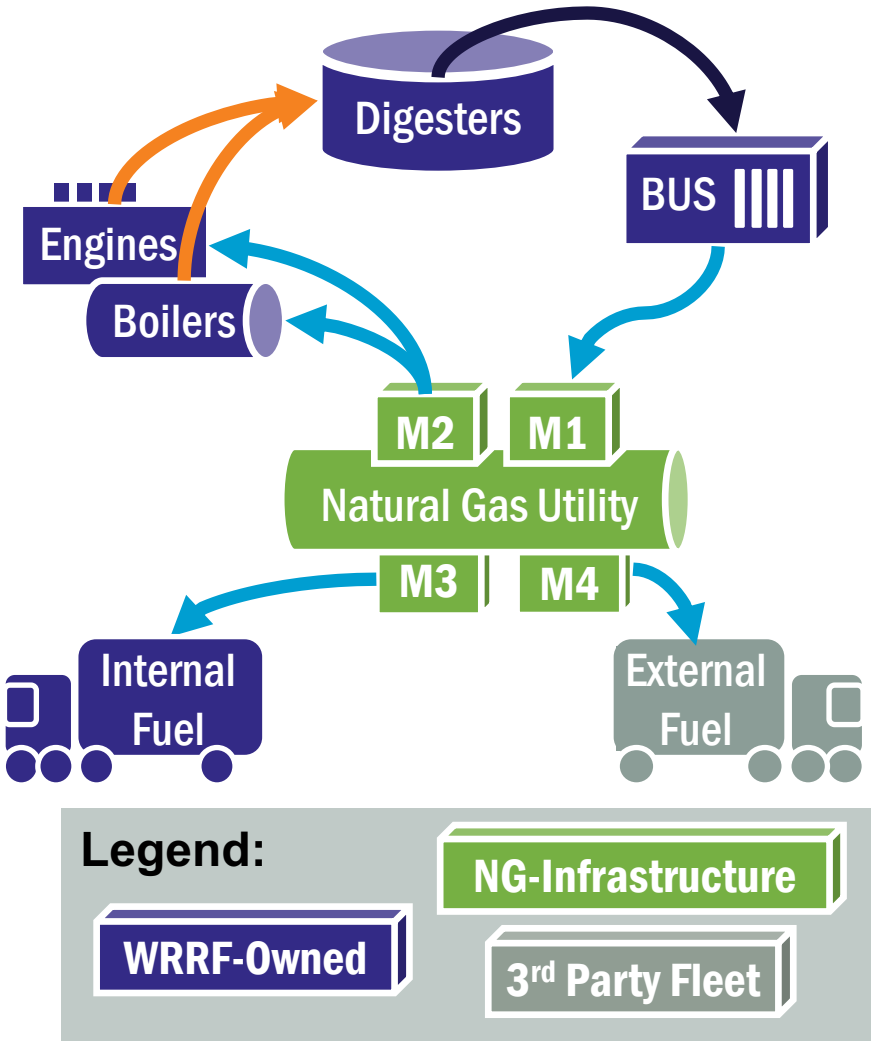
Producing Natural-Gas-Quality Product has Advantages

A. Anything can still be fueled with purchased natural gas
B. Renewable Natural Gas (rNG) can be:
   1. Used for vehicle fuel
   2. Injected to natural gas pipeline
   3. Compressed and hauled in tube trailers
   4. Used to fuel elements on site – without adjustment



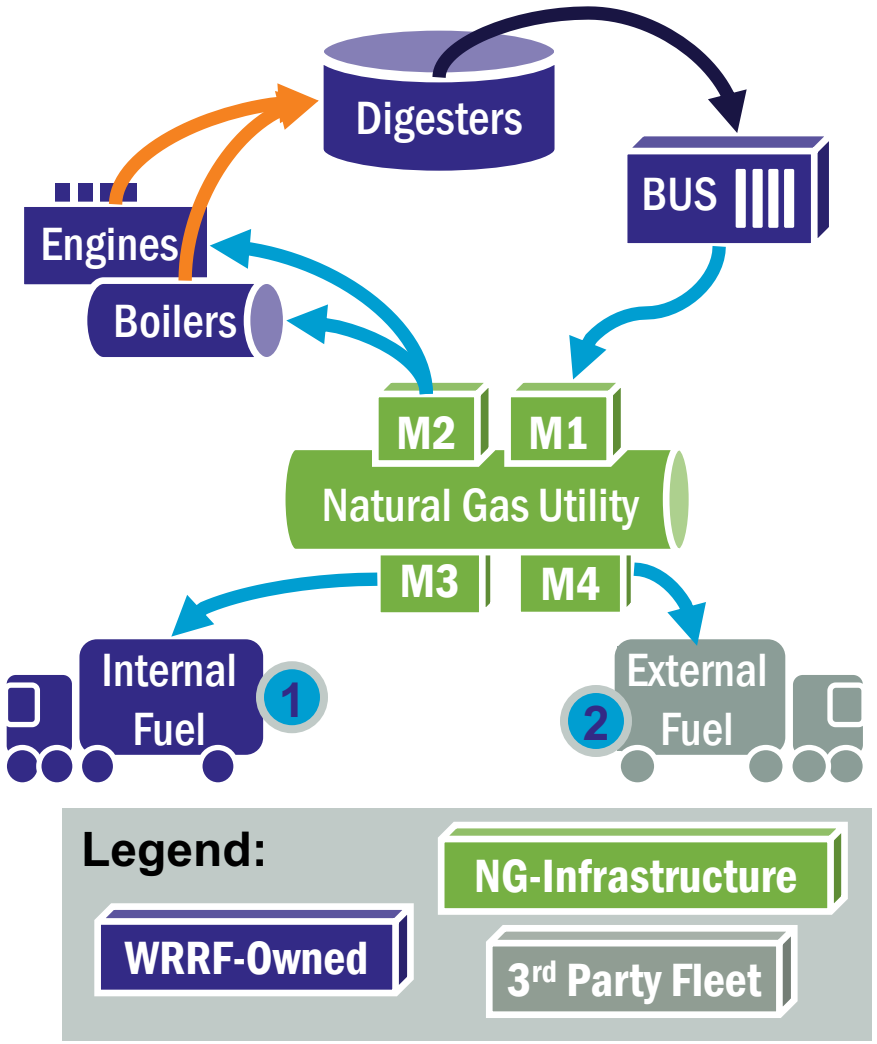
Contracts Needed for RIN Programs

Schematic of WRRF RIN Production: **Overview**



Schematic of WRRF RIN Production: Fleet Fueling

- **Internal Fleets**
  - 1 Sludge/Biosolids
  - 1 Contract-Hauling with discounts for Free Fuel
  - Others?
- **External Fleets**
  - 2 Buses/Sanitation/Other
  - Provide CNG-Fuel-Use Documentation for RINs



Schematic of WRRF RIN Production: NG Contracts

- **Internal Fleets**
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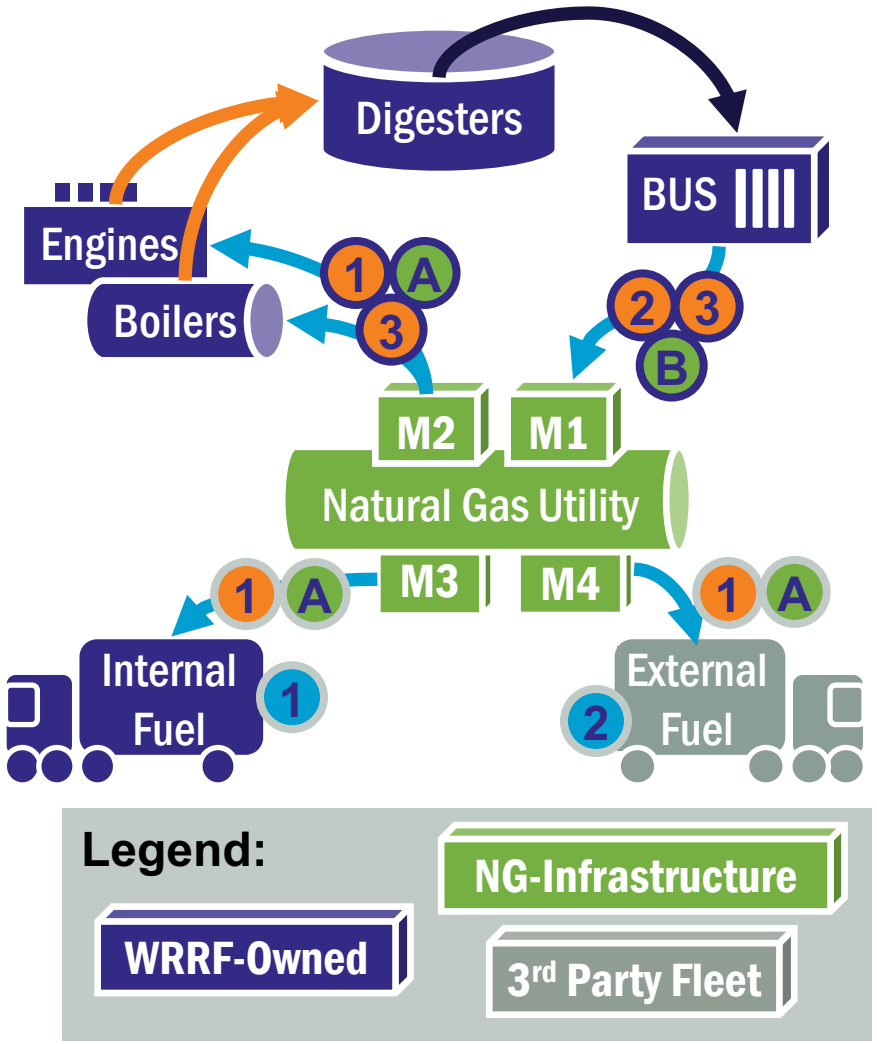
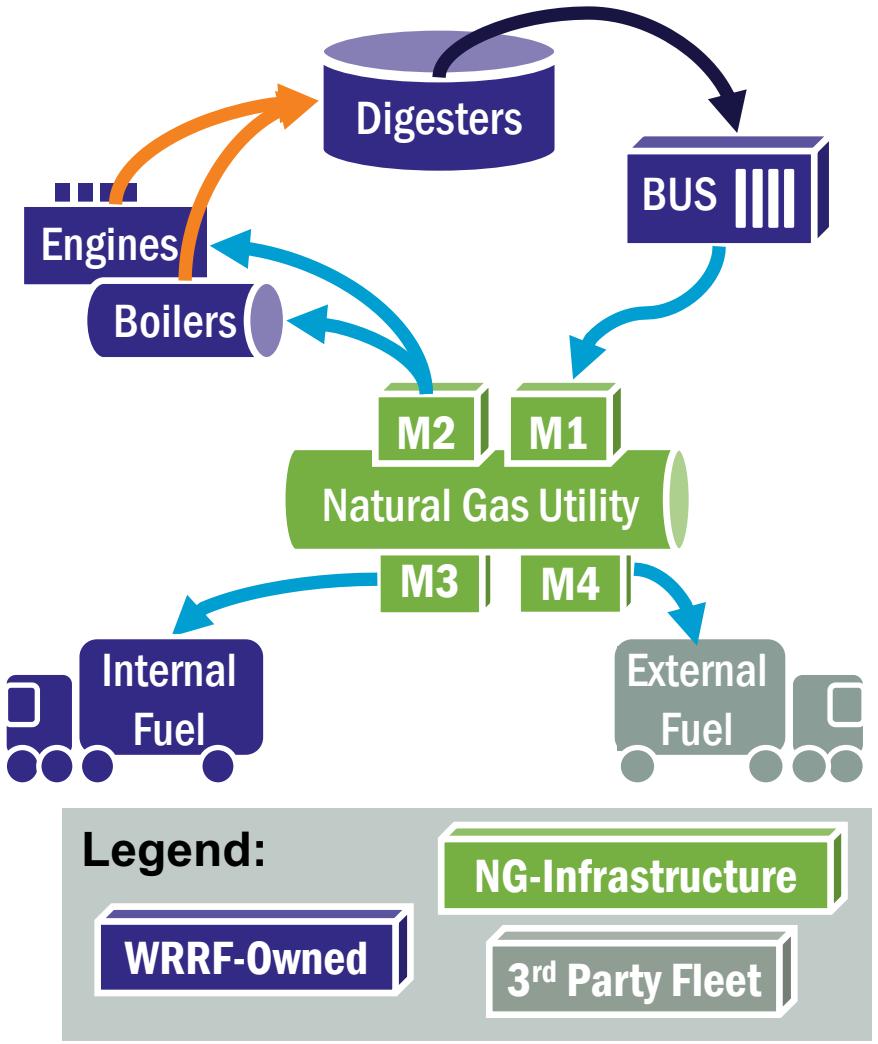


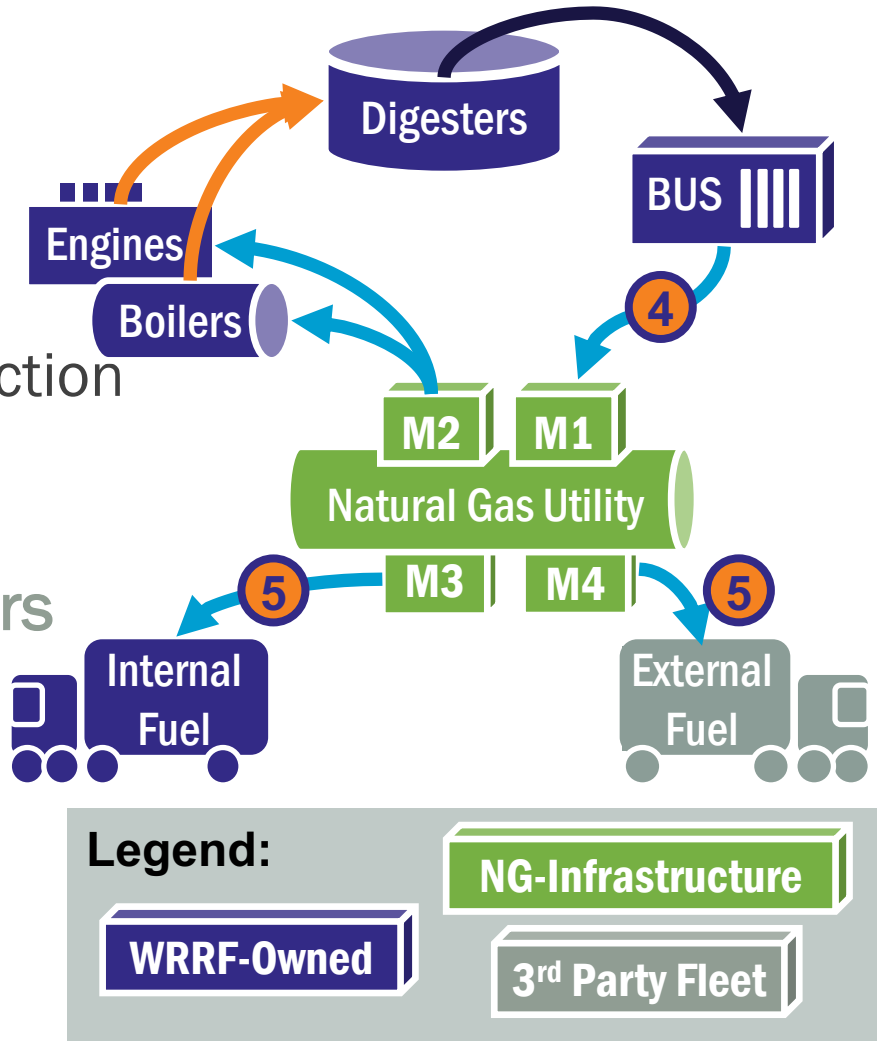
- **Regulated NG-Infrastructure Utility**
  - 1 NG-delivery contracts
  - 2 NG-injection contract
  - 3 Transportation/Carriage
- **(Typically) De-regulated NG-Energy Utilities**
  - A NG-sourcing
  - B NG-balancing

Schematic of WRRF RIN Production:



Schematic of WRRF RIN Production: Verifying & Trading

- **Independent Verifier**
  - Engineering Report
  - Semi-Annual Reviews
  - Documents:
    - 4 Renewable-Fuel Production
    - 5 rCNG-Use in Vehicles
- **Obligated Parties/Refiners**
  - Party-to-Party Contract
  - Index-Referenced



Schematic of WRRF RIN Production: Data & Regulation

- **Independent Verifier**
  - Engineering Report
  - Semi-Annual Reviews
  - Documents:
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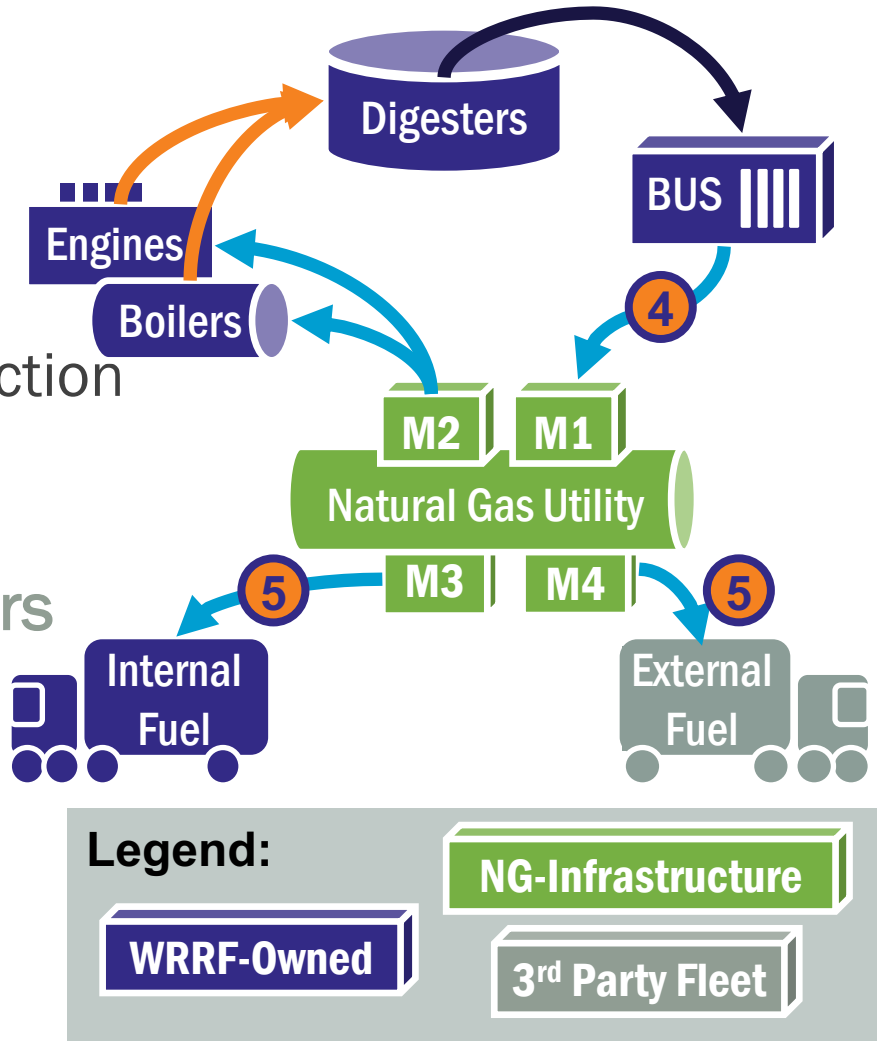
- **Obligated Parties/Refiners**
  - Party-to-Party Contract
  - Index-Referenced



- **RIN-Pricing Services**
  - OPIS, Argus, Other
  - Subscription Services
- **EPA**
  - Production Registration
  - Tracks Obligated-Party Compliance

Related Example Projects

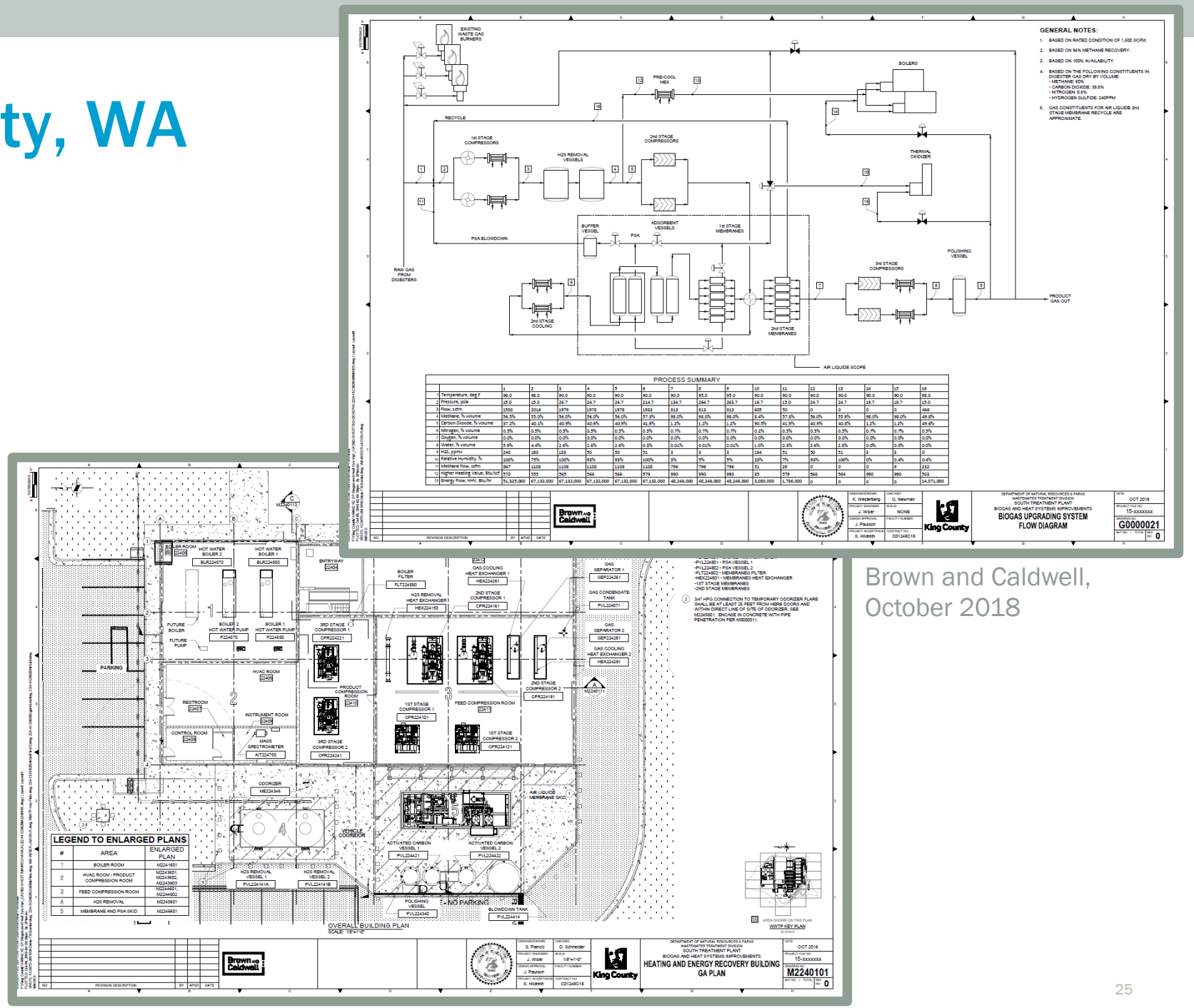
King County, WA

- Original once-through water-solvent system installed in 1985

Eron Jacobsen

King County, WA

- Original once-through water-solvent system installed in 1985
- More recent membrane-based system was designed to meet strictest gas quality
- Project on hold as gas standards are potentially “loosened”



Brown and Caldwell, October 2018

St. Petersburg, FL

Operational since summer 2019

- Class-A TPAD Digestion
- Gas Upgrading

Aerial Innovations, June 2019

JLW iPhone, August 2019

WSSC ("Maryland side" of Washington, DC)

- Bio-Energy Facility Program Management
  - BC (as sub to HDR) is responsible for energy/gas-upgrading/RINs/contracting
  - Natural-gas-fueled engines and boilers w/RNG pipeline injection
  - Progressive DB w/PC-Stantec JV

Rob Taylor, April 2020

WSSC ("Maryland side" of Washington, DC)

- Finalized Washington Gas contract
- Competitively procured Weaver for RIN Verification
- Montgomery Co. Transit fuel sale contract to be signed soon

J. Willis Site Visit, June 2021

Risk / Revenue / Effort

Brown AND Caldwell

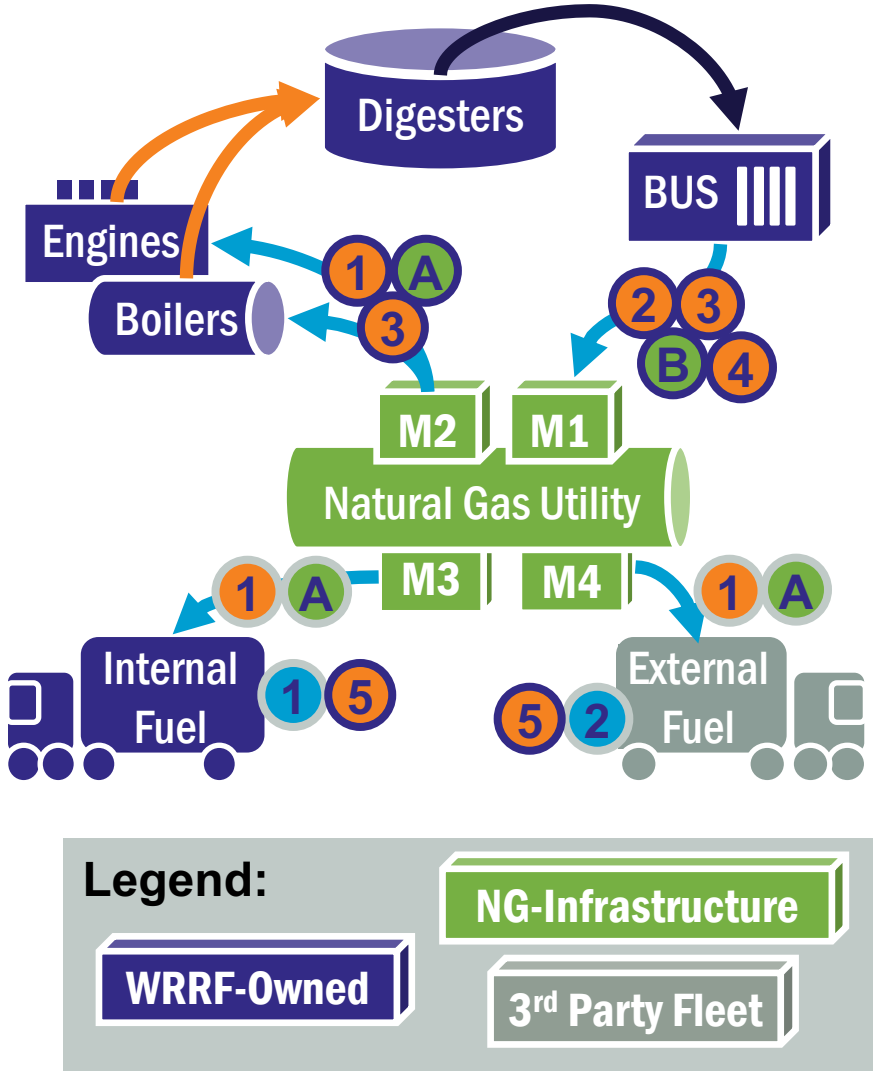
Process can “Burden Engineers, Lawyers, and Finance”

Paperwork with:

- EPA
- Internal Fleets

Contracts with:

- Fleets
- NG-Infrastructure Utility
- NG-Energy Utility
- Contract O&M of Engines, Boilers, and Gas Upgrading
- RIN-Pricing Service
- RIN Verifiers
- Obligated Party



Process can “Burden Engineers, Lawyers, and Finance”

Paperwork with:

- EPA
- Internal Fleets

Contracts with:

- Fleets
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- NG-Energy Utility
- Contract O&M of Engines, Boilers, and Gas Upgrading
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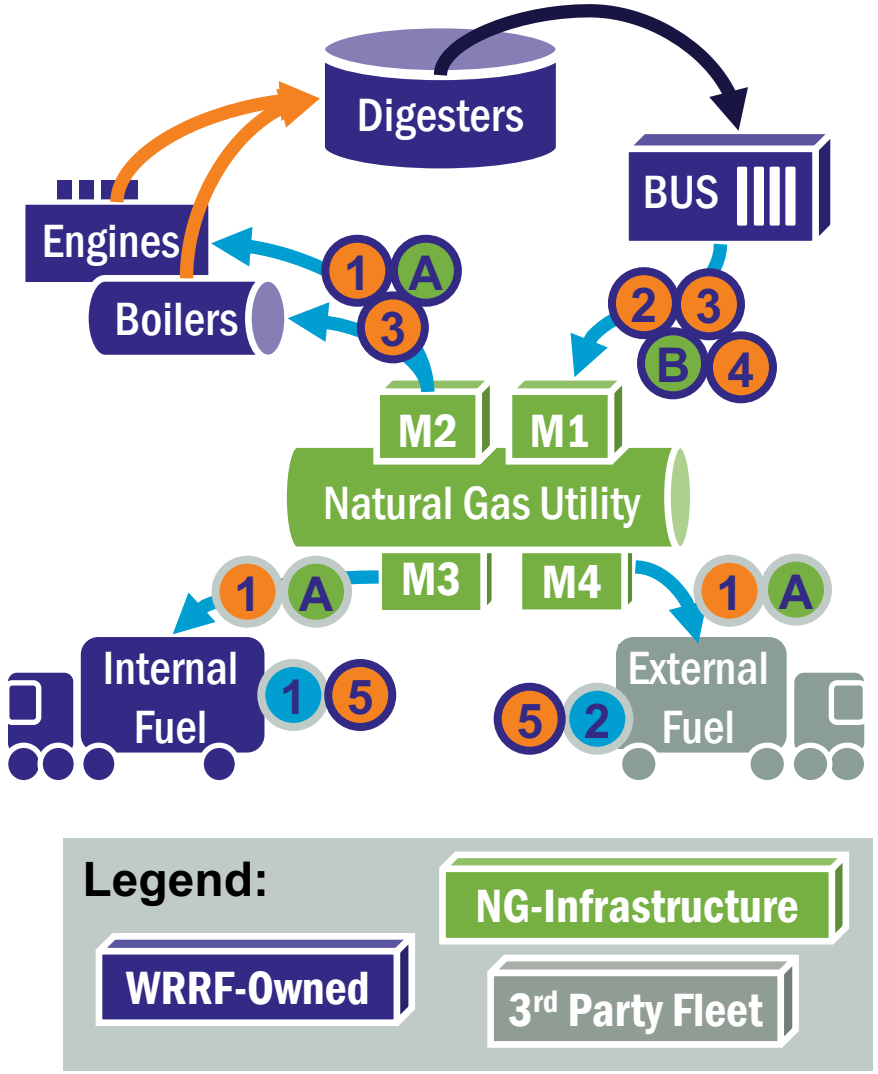


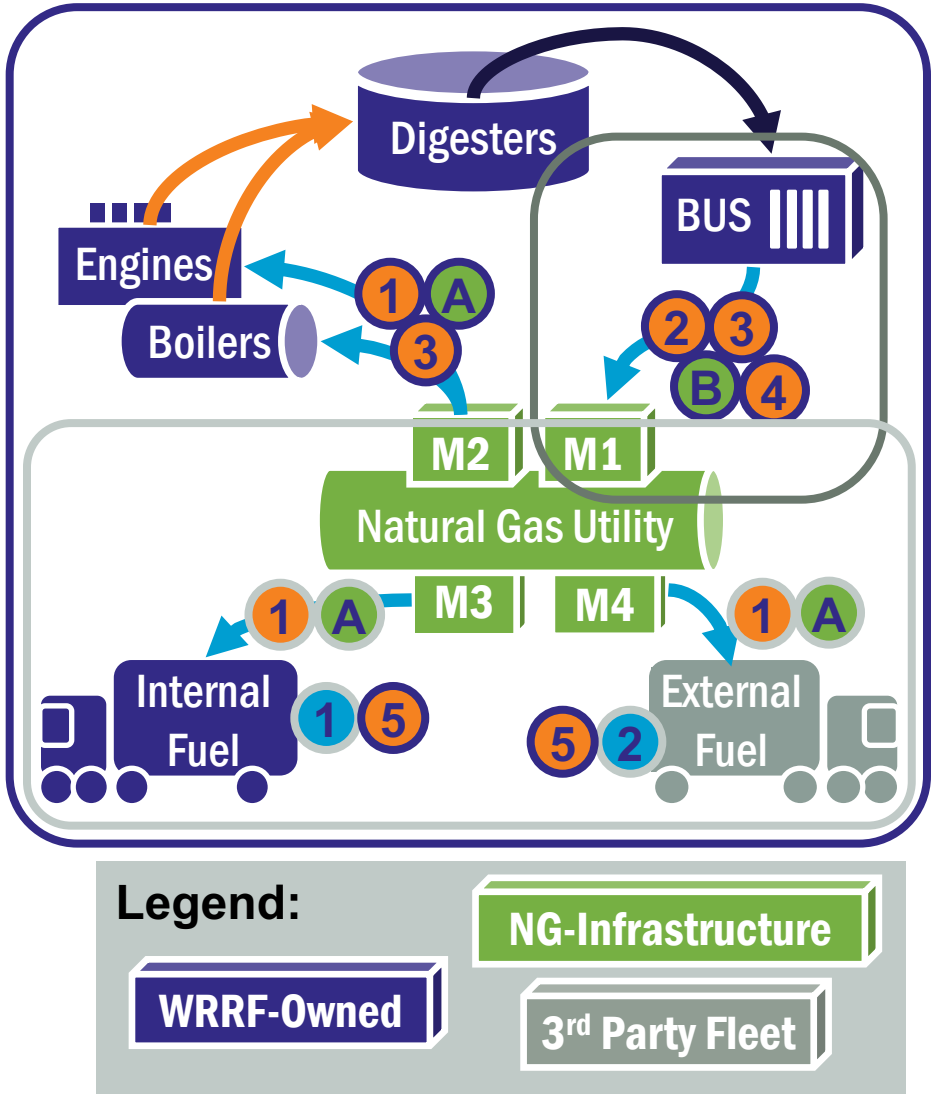
But should create little to no added burden on WRRF operations staff

Or, “Parts” or “Everything” can be Bundled and Contracted

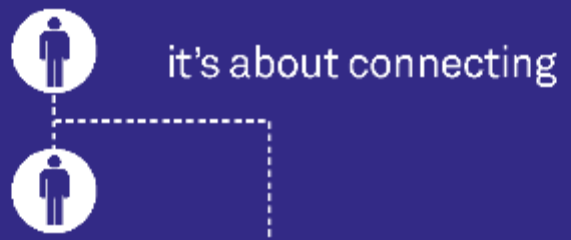
Various contracting methods and work/ownership divisions are possible:

- Public-Private Partnerships
- Brokerages
- Design-Build
- Contract Operations

Risk and Uncertainty are Real; and Whomever Assumes the Risk should be Compensated Accordingly



QUESTIONS?



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