

Decarbonization and the Interconnection Process

Northeast Digestion Roundtable

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nationalgrid



- Reduce GHG by 85% and Achieve Net Zero Emissions by 2050

2020

Publication of the **Decarbonization Roadmap to 2050** and the **Clean Energy and Climate Plan for 2030**, outlining the long-term strategies and near-term actions for the Commonwealth to achieve net-zero emissions.

Massachusetts Clean Heat Standard (building heat only (not transportation or electric)).

Policy in draft form with MADEP and soliciting comments.

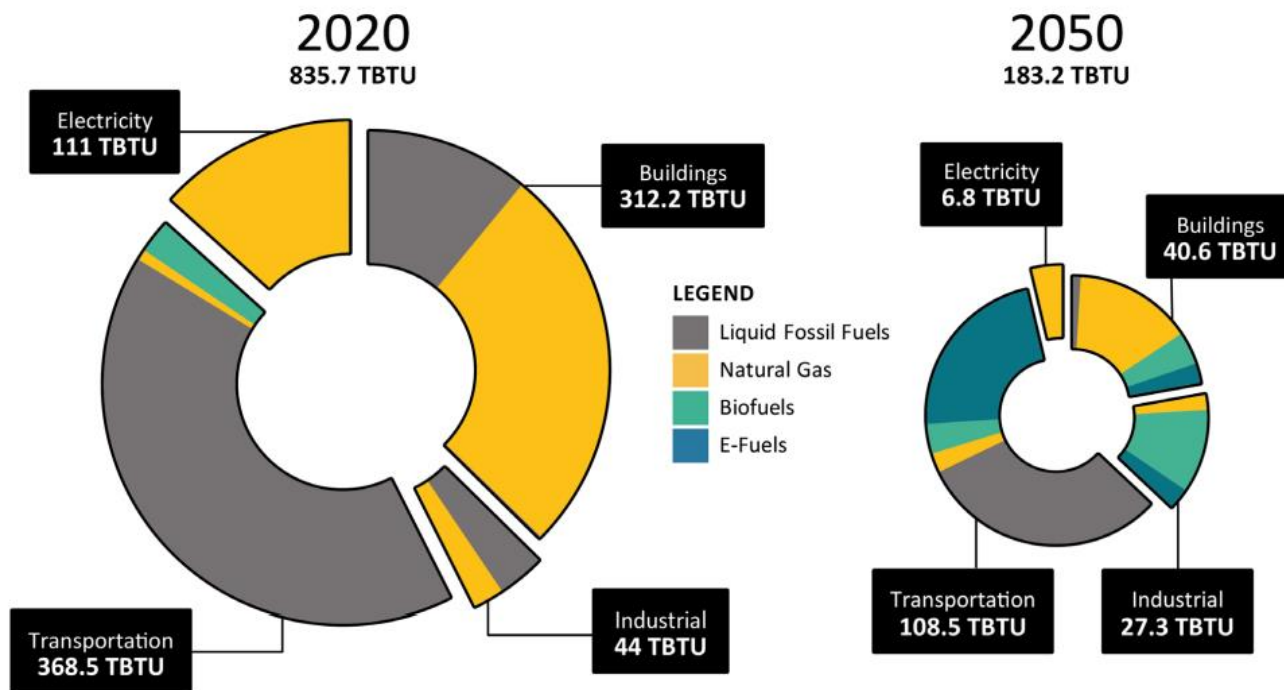


CECP and Commission on Clean Heat

...an overarching strategy that can work with and tie together an array of complementary policies...

Massachusetts Clean Energy Climate Plan (“CECP”) - Total fuel use will fall significantly, however, about half of that fuel usage will likely be alternative fuels rather than fossil.

FIGURE 6-1. FUEL USE IN MASSACHUSETTS, BY SECTOR AND FUEL, 2020 AND 2050¹⁵⁸



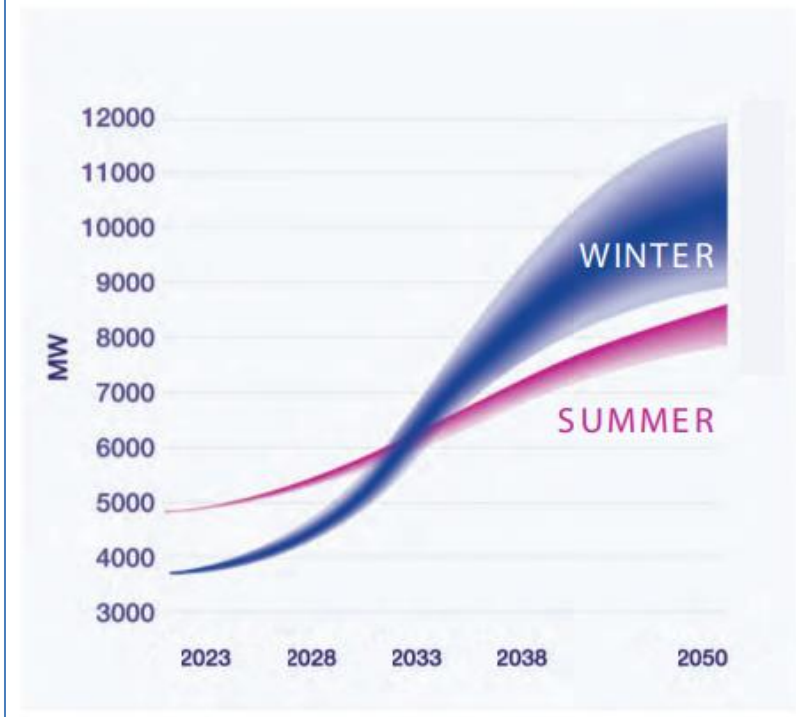
Note: E-fuels or electrofuels refer to hydrogen, synthetic fuels, and ammonia.

How Will This Impact Fuel Mix and Timing?

To meet Massachusetts' statewide goals by 2050, the grid of tomorrow must:

- Meet peak customer demand more than twice as high as today's, with the peak occurring in the winter as opposed to summer.
- Connect at least twice the amount of energy storage
- 10 times the amount of renewable energy,
- 75 times the number of EVs, and
- 100 times the number of heat pumps than we see today,
- Address "hard to electrify" customers,
- ...by 2050.

MECO's peak demand will more than double, and shift to the winter



- ✓ “Think-different” from treatment to energy recovery,
- ✓ Food waste ~3X energy potential as biosolids - clean, homogenous waste stream,
- ✓ ***Interdisciplinary, collaborative approach, with supportive policy,***
- ✓ Influent flow less of a limitation - Essex Junction WWTP in northwestern Vermont handles 2.0 MGD of flow and generates 412,000 kWh/yr of electricity (~half of MA plants <2mgd).

Figure 5: Food Waste vs. Wastewater Solids Comparison⁶⁴

Parameter	Food Waste Pulp	Wastewater Solids
Volatil Solids in Feed (%)	85-90	70-80
Volatil Solids Loading (lbs/ft ³ -day)	0.60+	0.20 max
COD Loading (lbs/ft ³ -day)	1.25+	0.06-0.20
Total Solid Fed (%)	10+	4
Volatil Solids Reduction (%)	80	56
Hydraulic Detention Time (days)	10	15
Methane Gas Produced (meter ³ /ton)	367	120
Gas Produced (liters/liter of feed)	58	17
Biosolids Produced (lbs/lbs fed)	0.28	0.55

[The MADEP is looking for comments from Stakeholders!](#)

Massachusetts Clean Heat Standard

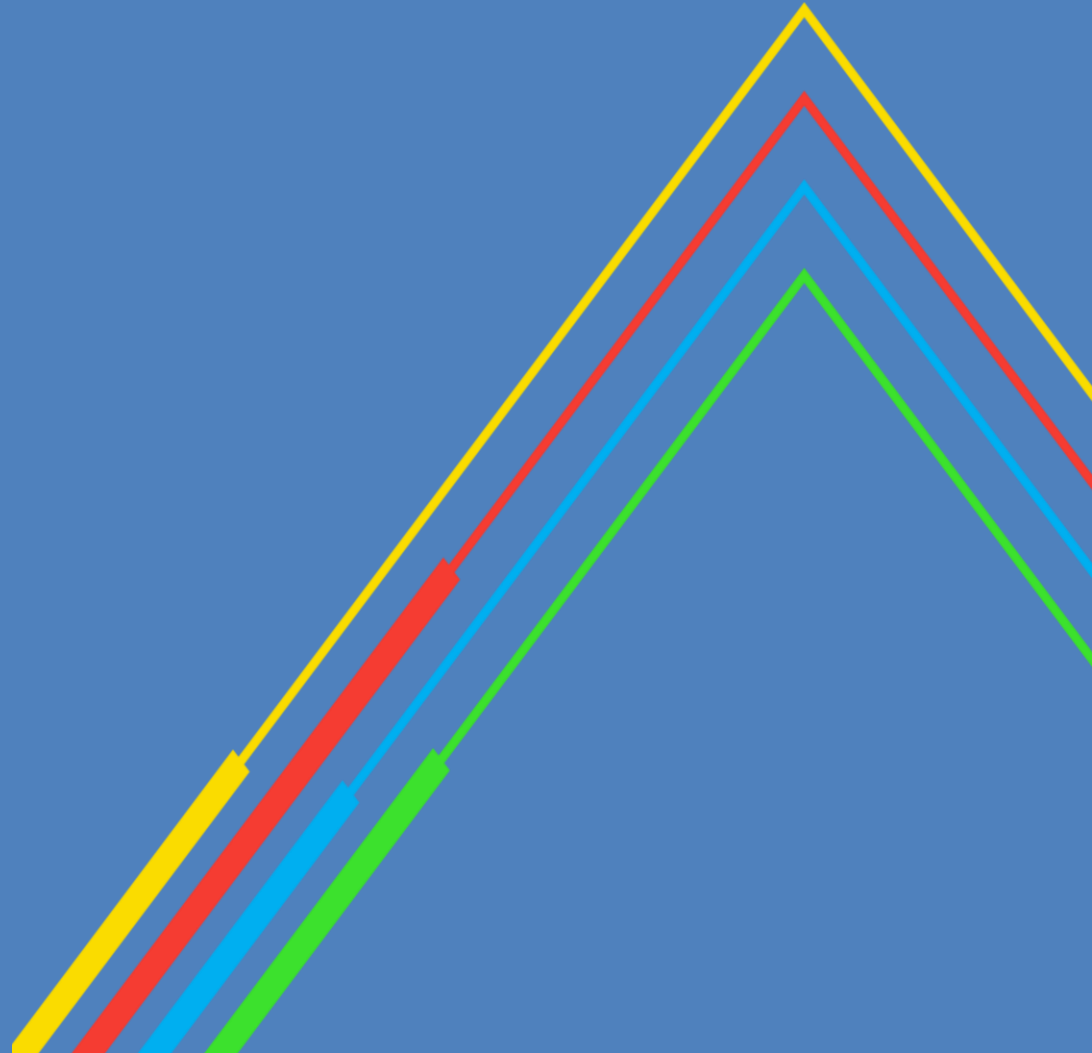
Learn about and participate in the MassDEP initiative to develop a regulatory standard for reducing greenhouse gas emissions from fossil heating fuels.

In November 2023, MassDEP released a draft Clean Heat Standard program framework addressing key policy design topics.

DRAFT FRAMEWORK OVERVIEW

The Engineering Process for Biogas and RNG

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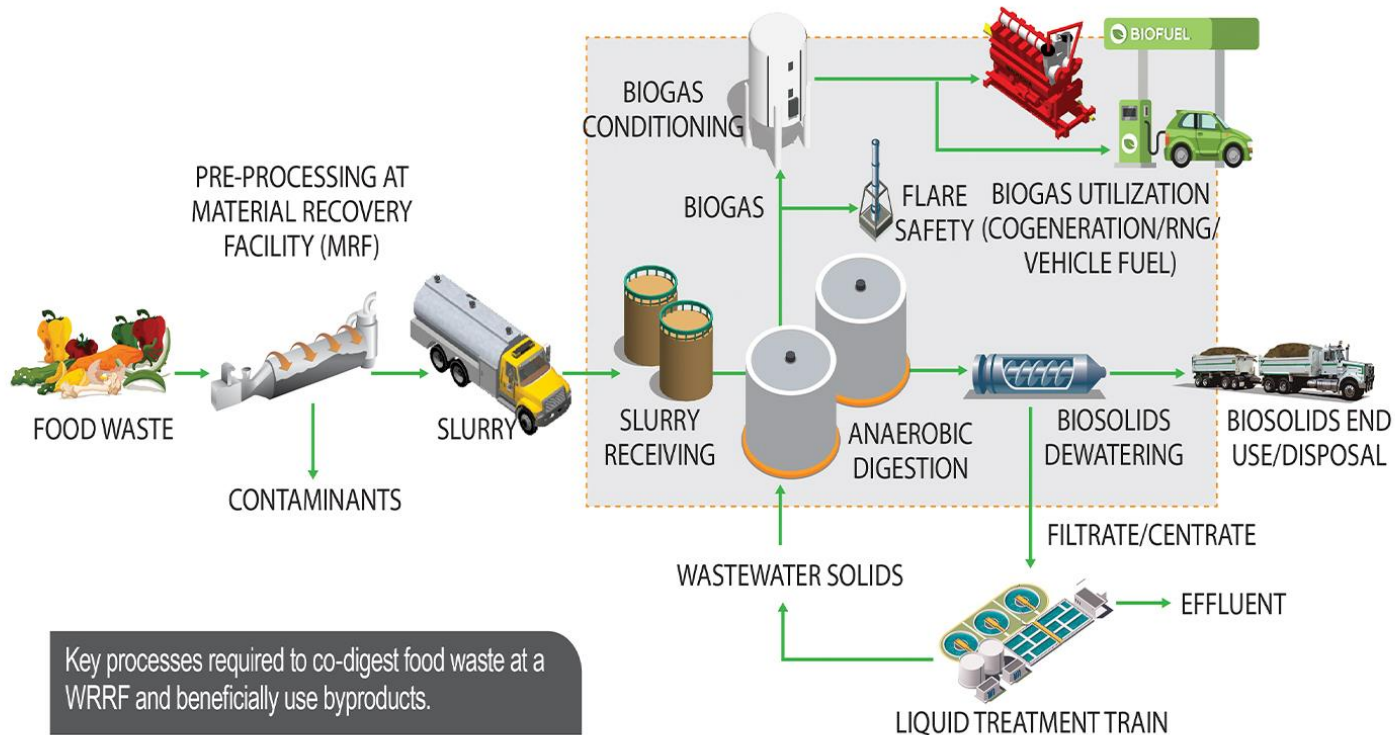


Biogas Upgrading to Renewable Natural Gas (RNG)

- Typical pipeline-quality natural gas has an energy content of 1020-1050 BTU/SCF
- Biogas from an anaerobic digester has an energy content of ~600 BTU/SCF
- National Grid requires a minimum of 975 BTU/SCF
- Limits on inert gases, hydrogen sulfide (H_2S), and other biogas constituents also affect the need for gas conditioning prior to injection into a natural gas pipeline
- Upgrading to RNG allows the seller to receive LCFS credits and RINs, which are typically more profitable than electricity generation using biogas
 - Voluntary credit market is also developing fast. Some producers are preferring this route as it allows them to lock-in a long-term rate rather than rely on sometimes volatile California and federal markets

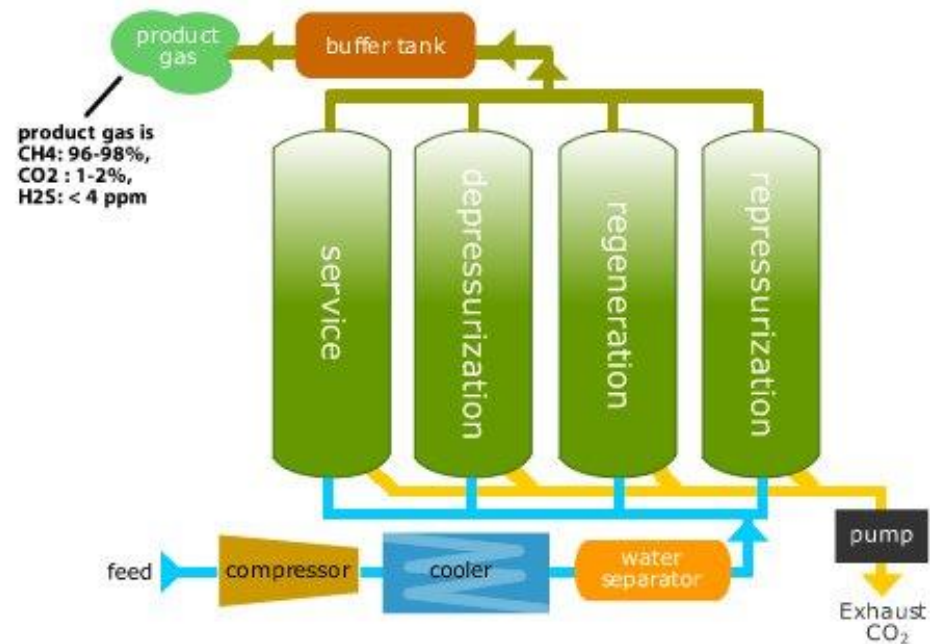
Increasing the scale of the digester helps projects pencil-out financially

- Co-digestion of food waste is the most common way to increase feedstock supply and increase return on investment
- Fats, oils, and grease (FOG) boost biogas production the most, but all types of food waste will allow for increased gas production

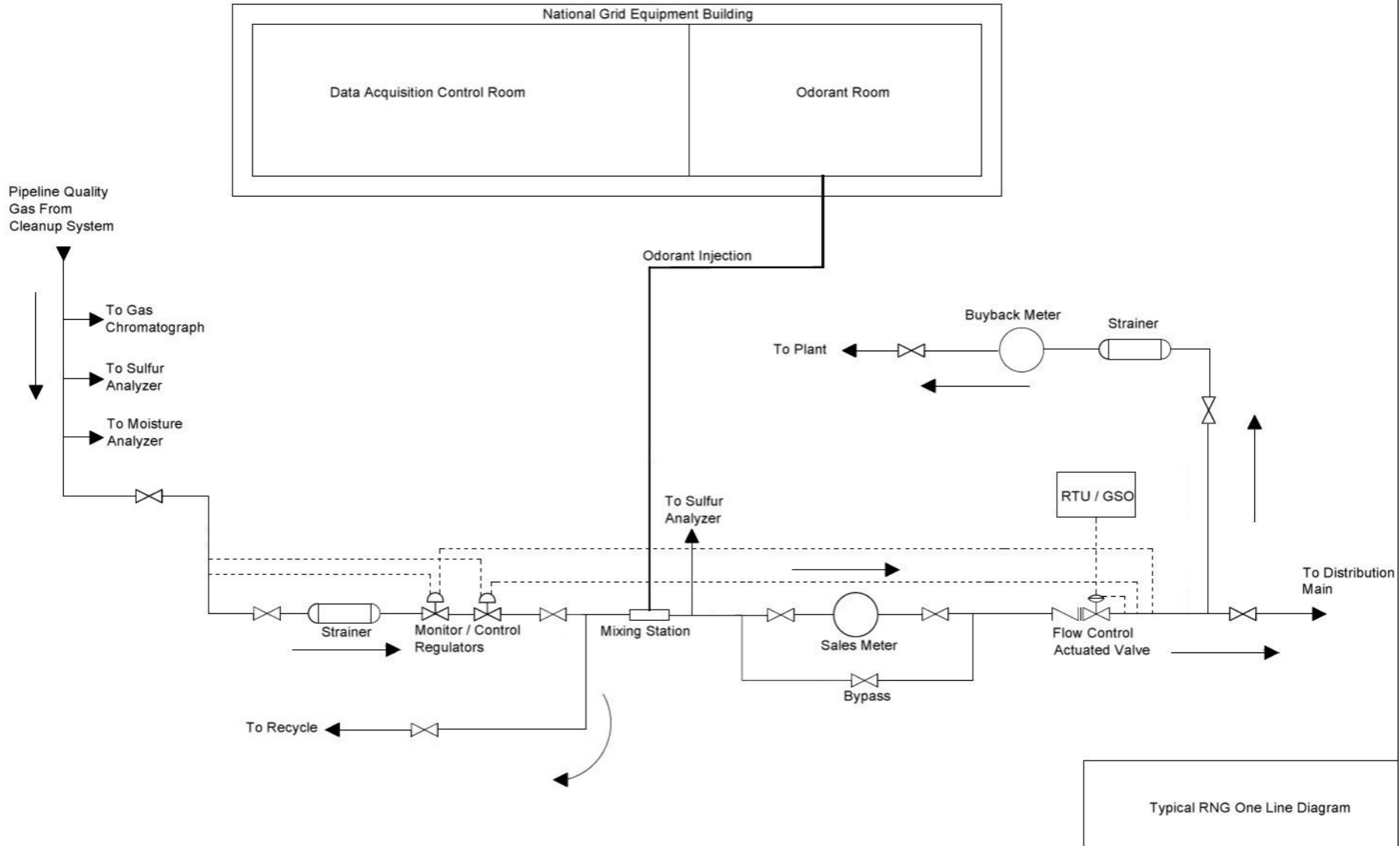


Conditioning Systems (Owned by Biogas Producer)

- Adsorbent media typically used for H₂S removal
- Condenser for water removal
- CO₂ removal systems:
 - **Membrane Systems:** pores only large enough for methane (CH₄) to pass through. Tail gas to be thermally oxidized or flared.
 - **Pressure Swing Adsorption (PSA):** batch-style process where adsorption media selectively adsorbs CO₂ and N₂ while CH₄ passes through the vessel. Requires purge cycle for tail gas.
 - **Solvent Scrubbing:** use of a chemical solvent such as amine to strip CO₂ and H₂S from the gas stream.



Typical RNG Interconnection (Utility-Owned Equipment)



What is a RIN?

Renewable Identification Number (RIN)

- Each gallon of renewable fuel under the RFS is able to generate credits or “Renewable Identification Numbers” (RINs). RINs are the currency of the RFS and are used by obligated parties as a compliance mechanism to meet the annual RVO mandate.
- Under the RFS program, RNG can be injected into the natural gas distribution grid anywhere in the 48 contiguous states and qualify as an eligible renewable fuel, as long as an equivalent volume of CNG or LNG is used as transportation fuel at any point along the interconnected distribution grid.

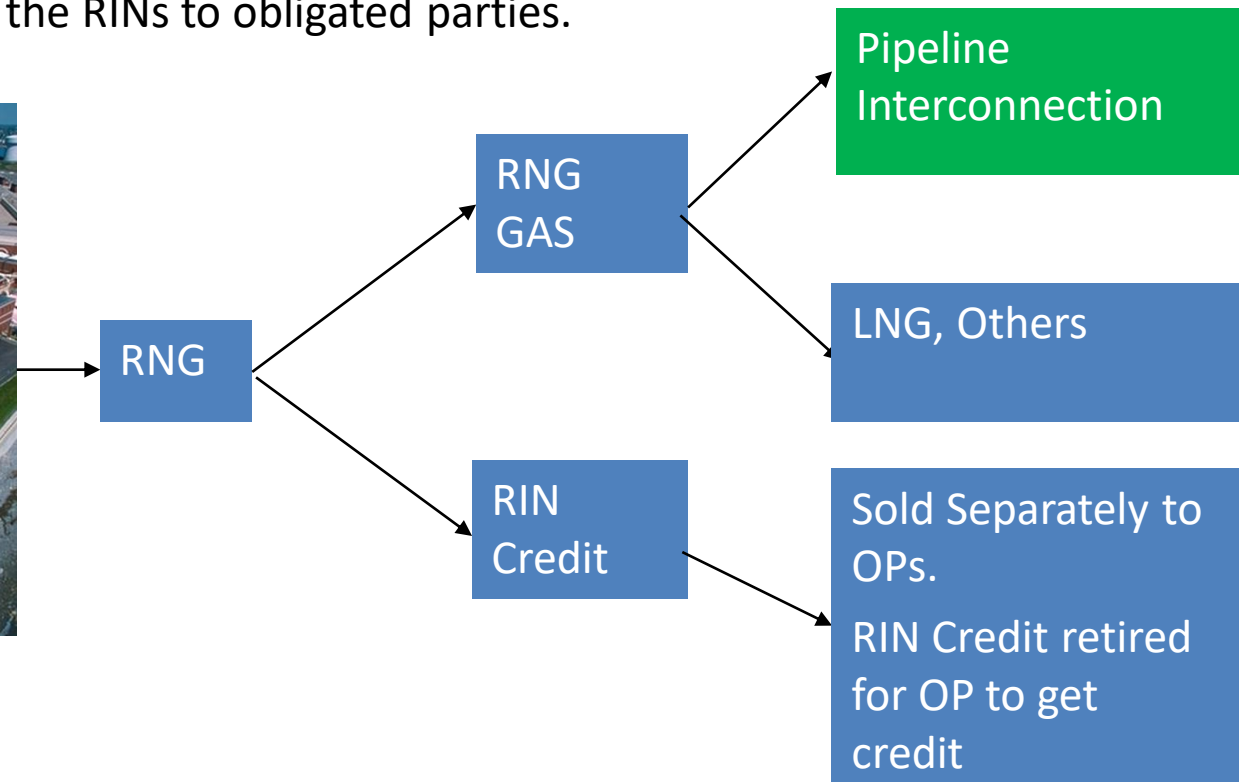
Obligated Parties

- Obligated parties are petroleum refiners and importers of refined fuel into the United States.



How Do RINs work with RNG?

Most RNG facilities will generate RINs, immediately separate the RINs from the fuel, and sell the RINs to obligated parties.



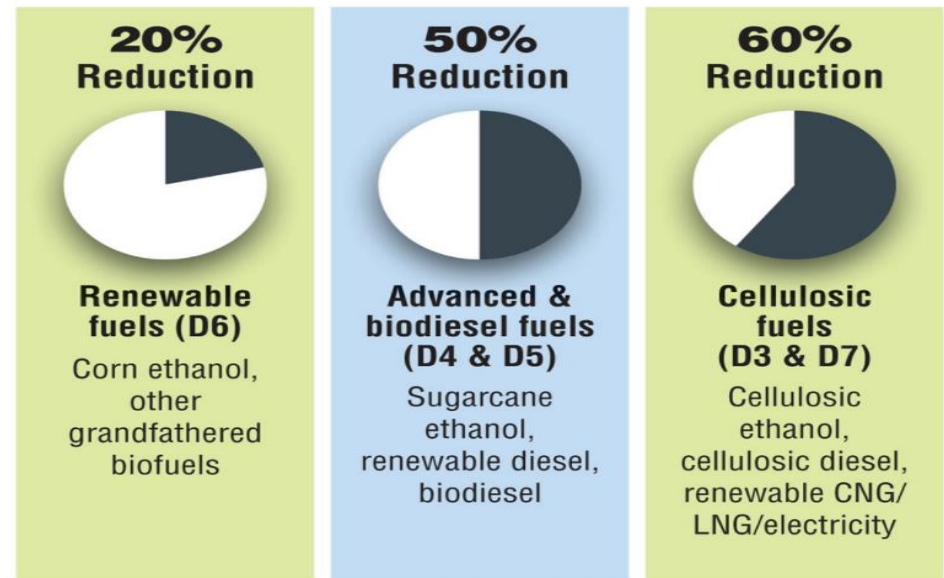
What are RIN Classifications?

RIN classifications are broken down according to the type of feedstock and processes used to create those fuels, along with the calculated reduction of greenhouse gas (GHG).

The California Low Carbon Fuel Standard (LCFS) also establishes a credit system, but it is based on the Carbon Intensity (CI) score of the fuel vs. the fossil fuel it replaces.

LCFS credits are stackable with RINs

Figure 2. Greenhouse gas emission reduction by fuel type



GHG emissions must take into account direct and significant indirect emissions, including land use change.

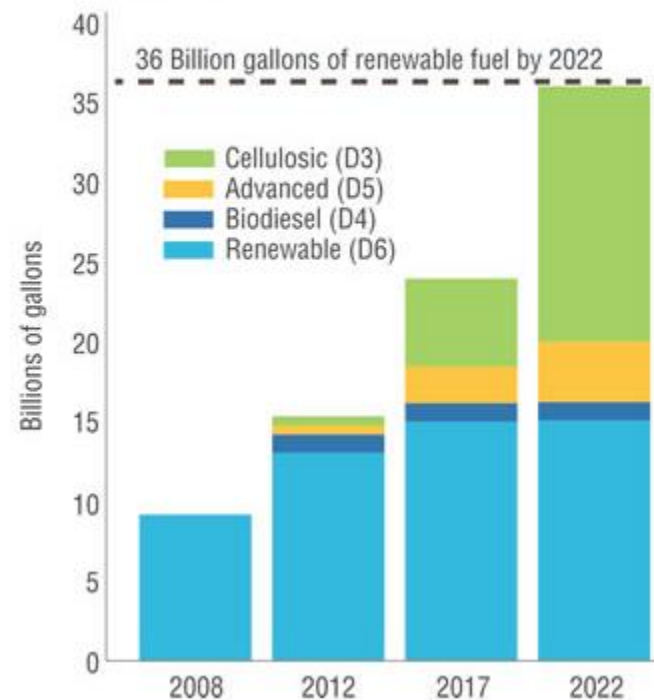
Source: <https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard>

D3 RINs are the most valuable classification that can be produced from biogas/biomethane

USEPA-approved D3 RIN pathways include renewable compressed natural gas produced from the following biogas sources (40 CFR Part 80, Subpart M 80.1426, Table 1):

- Landfills
- Municipal wastewater treatment facility digesters
- Agricultural digesters including ag residues and manures
- Separated municipal solid waste digesters
- Other cellulosic feedstocks with greater than 75 percent cellulosic content

Figure 1. Congressional volume target for renewable fuel



D5 RINs are less valuable than D3 RINs, but are the type earned from food waste processing

- All other feedstocks are classified as “other waste digesters” and are eligible for D5 RINs. Many digestion facilities process both cellulosic and non-cellulosic feedstocks.
- As of today, any drop of food waste in a digester makes all of the gas produced by that digester eligible only for D5 RINs⁴
- Starting July 1st, new rules will go into effect that allow producers to receive D3 and D5 RINs for gas produced via co-digestion (based on mass-loading of food waste solids and wastewater solids)

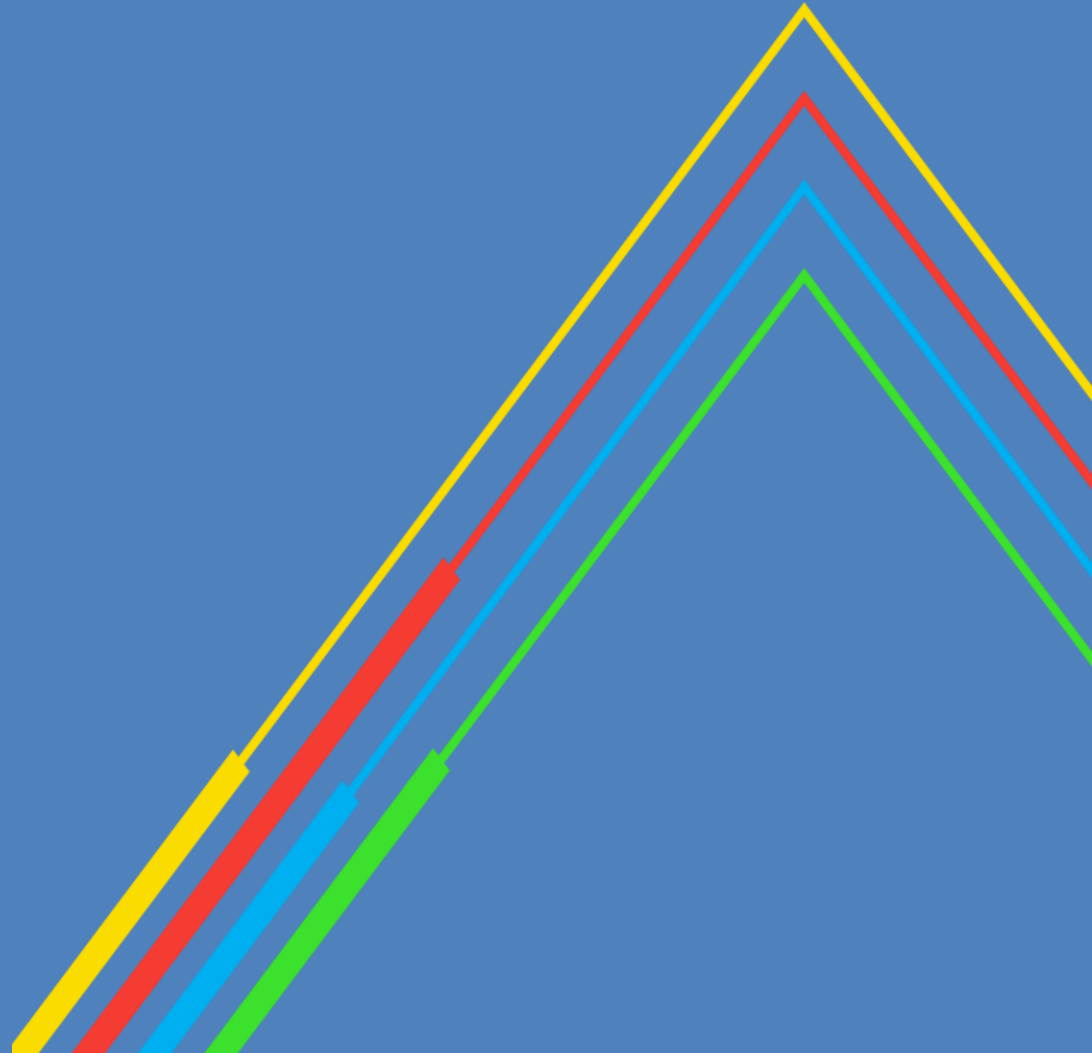
There is currently no Massachusetts program to encourage RNG production

- The MA Clean Heat Standard (CHS) may be provide a framework

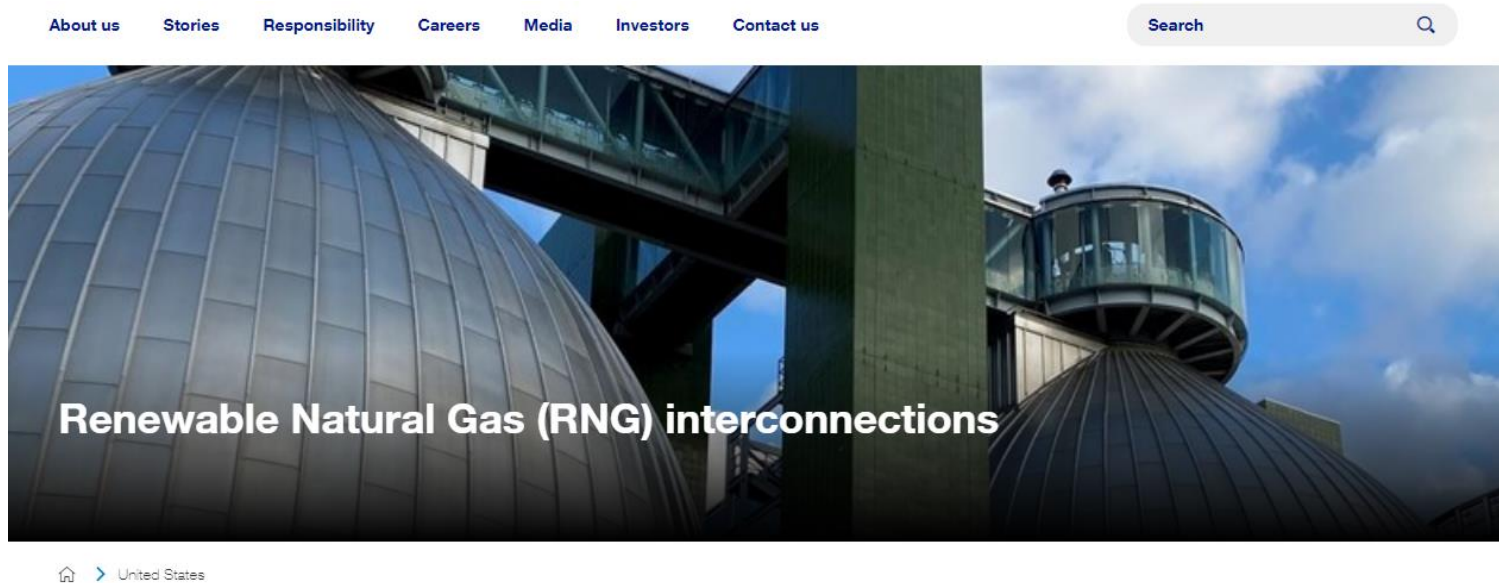
The Interconnection Application Process for RNG

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nationalgrid



- <https://www.nationalgrid.com/us/renewable-natural-gas-interconnections>



Getting started: obtaining an interconnection and selling RNG to National Grid

National Grid is committed to maintaining the safety and reliability of the system, so please contact us at least 24–36 months prior to your desired in-service date. In order to begin the interconnection process:

1. Review National Grid's Gas quality standards table below
2. See National Grid's **knowledge pages** for additional information on seminars and the interconnection process
3. Submit a pre-application using the button below

Once we have received your application, we will contact you to discuss the next steps.

1 [Submit pre-application >](#)

What is RNG?

RNG is derived from a variety of organic waste materials used in daily life. For example: food waste, biodegradable plant material, animal waste, paper, cardboard, and wood. This abundance of renewable energy sources is important since wind and solar energy are intermittent and often rely on supplemental supply of power when the wind isn't blowing, or the sun isn't shining.

Renewable natural gas can play a significant role in the future of energy. While the biggest driver of the focus on renewable energy is greenhouse gas reduction, what makes renewable gas more compelling is that it also provides the following:

- Enhances diversity of supply
- Stimulates local economy and creates green jobs
- Provides a real and innovative solution for using local waste resources to produce renewable energy
- Reduces waste buildup
- Creates a more efficient use for the fuel
- Leverages the existing gas network to deliver a renewable fuel

2

Gas Property	Value	Units
Heating Value	975-1110	BTU/scf
Moisture Content	< 7	lbs/mmscf
CO2	< 2	% mole
O2	< 0.2	% mole
Total Inerts	< 4	% mole
Hydrogen Sulfide (H2S)	< 4	ppmv
Wobbe Number	1270 - 1400	BTU/scf


3 Have any questions?

Name *

Email address *

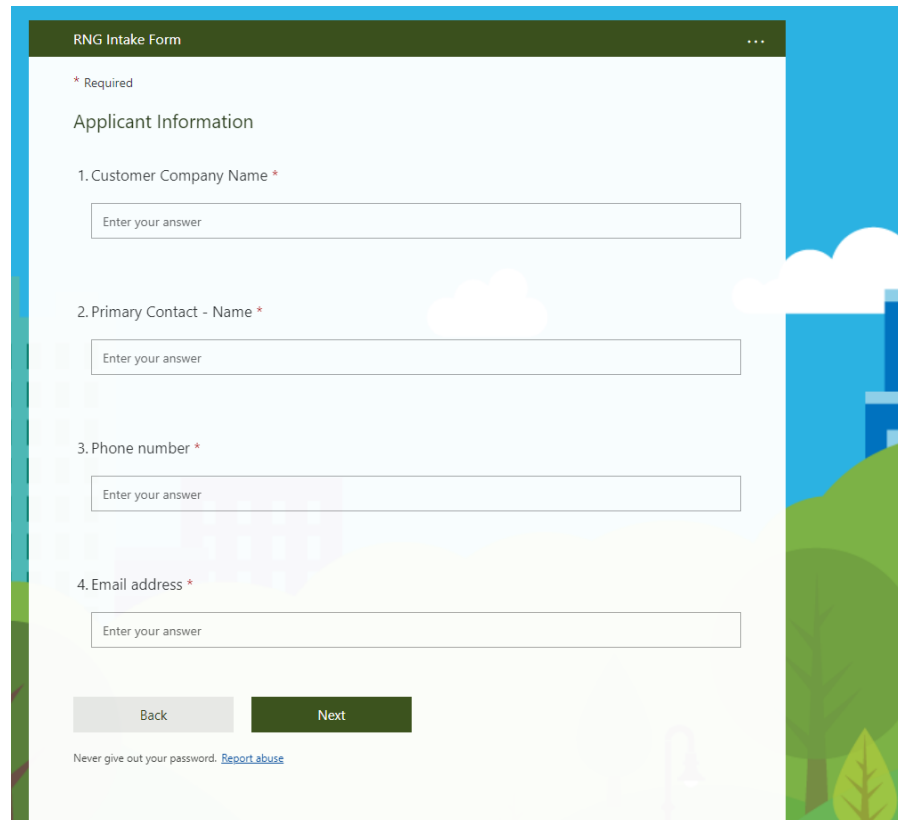
Phone number *

Question *

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1- Submit Pre-Application



RNG Intake Form

* Required

Applicant Information

1. Customer Company Name *

2. Primary Contact - Name *

3. Phone number *

4. Email address *


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Remember to
review the Gas
Quality
Standards Table

2 – Gas Quality Standards Table

Gas Property	Value	Units
Heating Value	975-1110	BTU/scf
Moisture Content	< 7	lbs/mmscf
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Total Inerts	< 4	% mole
Hydrogen Sulfide (H2S)	< 4	ppmv
Wobbe Number	1270 - 1400	BTU/scf

 Note: this does not capture all National Grid Gas quality standards. Based on the type of gas, other trace constituent requirements will need to be taken into consideration. Meeting these standards does not ensure that a RNG project will be approved. RNG projects must be confirmed through an interconnection study with National Grid for approval.


Have any questions?

Name *

Email address *

Phone number *

Question *

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Submit

If you have questions at any time during the pre-application process

- Phase 1 – Preliminary Evaluation(Screening)
 - Intake
 - Screening
- Phase 2 – Interconnection Feasibility Analysis
 - Engineering Services Agreement – 60% Design
 - Final Agreements(FCRA, GSA, O&M) - Draft
- Phase 3 – Design and Construct
 - Final Agreements – Execute
 - Construction
- Phase 4 – Startup and O&M

- Gas Sales Agreement
- Facilities and Construction Reimbursement Agreement
- O&M Agreement

- https://www.northeastgas.org/pdf/nga_gti_interconnect_0919.pdf
- <https://www.nationalgrid.com/us/renewable-natural-gas-interconnections>

Questions?

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Building an **Integrated Energy Network** that is clean, renewable, and achieves zero emissions.

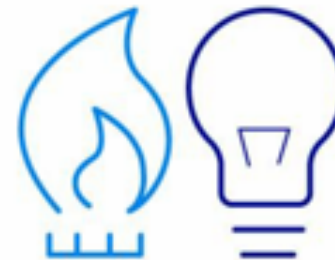


Energy efficiency in buildings

- deep retrofits and measures that **reduce peak gas** and electric demand; more rigorous building codes for new buildings.

100% fossil-free gas network

- **delivering renewable natural gas** and **green hydrogen** to our customers



Hybrid electric-gas heating systems

- pairing **electric heat pumps** with their gas appliances

Targeted electrification and networked geothermal

- cost-effective **targeted electrification** on our gas network, including piloting new solutions **like networked geothermal** who heat with oil and propane to convert to electric heat pumps.



Wastewater Treatment Plants Can Play A Unique Role In The Transition

- WWTP/WTPs consume 30 – 40% of municipal energy budget,
- Wastewater contains about 5X more energy than that needed to treat it,
- Fertilizer end product – otherwise an energy intensive process;
- Climate resiliency and climate mitigation (emissions associated with sludge transport – CO2 and methane - will be diminished),
- Combined sludge and food waste is highly optimal...
...and this is consistent with MA Solid Waste Management Plan,