

BIODIGESTER BIBLIOGRAPHY

Information relevant to Rimrock Renewables' application to Alberta Environment and Protected Areas for a massive biogas facility near High River, Alberta

August 11, 2023

TABLE OF CONTENTS

I.	RIMROCK'S BIODIGESTER APPLICATION.....	1
1.	RELEVANT LEGISLATION, REGULATIONS, AND GOVERNMENT FUNDING	1
A.	<i>Environmental Protection and Enhancement Act (Alberta)</i>	1
B.	<i>Canadian Environmental Protection Act, 2023</i>	2
C.	<i>Canada's Clean Air Act</i>	2
D.	<i>Emissions Reduction Alberta funding of circular economy projects</i>	2
E.	<i>Foothills County's Land Use Bylaw definition of heavy industry</i>	2
2.	RELEVANT PLANS	3
A.	<i>Spitzee Crossing ASP and related plans</i>	3
B.	<i>South Saskatchewan Regional Plan</i>	3
3.	RIMROCK PROPOSAL.....	4
A.	<i>Rimrock's application to EPA, subsequent SIR responses, and related studies</i>	4
i)	Rimrock Biodigester Facility Application for an Environmental Protection and Enhancement Act Industrial Approval	4
ii)	First Supplemental Information Request from EPA.....	4
iii)	Rimrock response to EPA's first Supplemental Information Request.....	4
iv)	Rimrock response to EPA's second Supplemental Information Request.....	4
v)	Memorandum of Understanding regarding feedstock for Biodigester	4
vi)	Rimrock Biodigester Facility – Traffic Impact Assessment.....	4
B.	<i>Tidewater</i>	4
i)	Tidewater Renewables and its parent company Tidewater Midstream and Infrastructure.....	4
ii)	Tidewater Renewables and Rimrock RNG Partnership.....	5
iii)	Incidents involving Tidewater's parent company: contaminated diesel in BC and environmental violation in Alberta	5
iv)	Tidewater RNG offtake deal with FortisBC	6
v)	Promotional articles.....	6
4.	GRANTS AND OTHER FUNDING SECURED FOR RIMROCK BIODIGESTER	7
II.	OPPOSITION TO THE BIODIGESTER	9
III.	BIODIGESTERS/BIOGAS PLANTS.....	15
1.	GENERAL INFORMATION ON BIODIGESTERS	15
2.	GROWTH OF BIODIGESTERS IN CANADA.....	18
A.	<i>Bioenergy optimization program demonstration, Government of Canada</i>	18
B.	<i>Manitoba</i>	18
C.	<i>Alberta</i>	18
i)	**Biogas market study: Understanding the Alberta anaerobic digestion landscape.	18
ii)	Lethbridge Biogas	19
iii)	Growing Power Hairy Hills project (near Vegreville).....	19
IV.	BIOGAS PRODUCTION: IS IT TRULY GOOD FOR THE ENVIRONMENT?	21
V.	ODOUR ISSUES WITH BIODIGESTERS	28
A.	<i>United Kingdom</i>	30
i)	Ballymena	30
ii)	Keynsham.....	30
iii)	Basingstoke	30
iv)	Malaby	30
v)	Beccles	30
vi)	Banbury.....	31
vii)	Wardley Colliery, South Tyneside	31
viii)	Rothwell, Northamptonshire.....	31
B.	<i>United States</i>	31
i)	Wisconsin	31
ii)	Minnesota.....	32
iii)	Michigan	33
iv)	Colorado.....	33

v)	Ohio	34
vi)	California.....	35
vii)	Oregon	35
C.	<i>Canada</i>	36
i)	Ontario.....	36
VI.	POTENTIAL ENVIRONMENTAL AND HEALTH PROBLEMS ASSOCIATED WITH BIODIGESTERS	38
1.	LITERATURE REVIEW.....	38
2.	AMMONIA	39
3.	FUGITIVE METHANE EMISSIONS	41
4.	INCIDENTS THAT HAVE CAUSED/RISKED POLLUTION	41
5.	ANAEROBIC DIGESTATE: HEALTH AND ENVIRONMENTAL RISKS	42
VII.	SAFETY HAZARDS OF BIODIGESTERS	44
VIII.	REGULATING BIODIGESTATION FACILITIES, LAGOONS, AND FEEDLOTS	46
1.	RESOLUTION OF ALBERTA MUNICIPALITIES FOR A REVIEW OF THE PROCESSES AND POLICIES OF THE NRCB CONCERNING CFOs.....	46
2.	OHIO HOUSE BILL 193 – BIOSOLID AND BIODIGESTION FACILITIES	46
IX.	ALBERTA GOVERNMENT PUTS SOLAR AND WIND PROJECTS ON HOLD	47
1.	THE ANNOUNCEMENT	47
2.	REASONS GIVEN	47
A.	<i>Rural Municipalities of Alberta Resolution 9 – 22F regarding Renewable energy project reclamation requirements.....</i>	<i>47</i>
3.	RESPONSES TO THE ANNOUNCEMENT	47
X.	SUPPLEMENTARY READING	49
1.	GREENWASHING	49
2.	AIR QUALITY	49

I. RIMROCK'S BIODIGESTER APPLICATION

1. Relevant Legislation, Regulations, and Government Funding

A. Environmental Protection and Enhancement Act (Alberta)

https://kings-printer.alberta.ca/570.cfm?frm_isbn=9780779841660&search_by=link

*Mandate letter from Premier Danielle Smith to Minister of Environment and Protected Areas, Rebecca Schulz. July 10, 2023.

<https://open.alberta.ca/dataset/bf7f9a42-a807-49b3-8ba3-451ae3bc2d2f/resource/7f31d501-8c9a-40df-ba7c-431bf46da46f/download/epa-mandate-letter-environment-and-protected-areas-2023.pdf>

Excerpts of responsibilities relevant to biodigester:

- *Coordinating with the Minister of Energy and Minerals to implement the Emissions Reduction and Energy Development Plan.*
- *Reviewing Alberta's water management strategy to increase the availability of water and water licences to Alberta municipalities, businesses and agricultural producers while maintaining the highest standards of water conservation and treatment.*
- *Supporting continued technology and innovation through the Technology, Innovation and Emissions Reduction (TIER) program, including establishing new protocols to develop and trade carbon credits.*
- *Promoting Alberta's leading-edge regulatory and cumulative effects management systems, including climate and environmental policies for air, land, water, biodiversity and waste.*

Weber, Bob. Alberta environment minister's mandate letter lacks commitment to cut emissions, critics say. CBC News. Jul 11, 2023.

https://www.cbc.ca/news/canada/edmonton/alberta-environment-minister-s-mandate-letter-lacks-commitment-to-cut-emissions-critics-say-1.6903881?fbclid=IwAR1YPOKqIw_UBs6DBxWNUrGDQZz3GqBtGQ-3Rs-BxImQOadWN-noulUqCio

Environmental Protection and Enhancement Act approvals. Government of Alberta.

https://www.alberta.ca/apply-for-environmental-protection-and-enhancement-act-approvals.aspx?fbclid=IwAR0JLhMIF5dzsmeCVuDYsJwUtt1r5fsgHtWLTJULY4KkkM_hEatC1s7AUQc

Retrieved July 21, 2023

Approval process for biodigester.

Online appeal form. Environmental Appeals Board.

http://www.eab.gov.ab.ca/appeal2.aspx?fbclid=IwAR3e8j4wZCyV_-Fs-XJlv2cqLbtc8fm_w-FYOlwaCmKTf1t_az2yQNjDyqW

Alberta ambient air quality objectives and guidelines summary. Government of Alberta. 2019.

https://open.alberta.ca/publications/9781460134856?fbclid=IwAR3bdHNsFIWIMBVL7aTPknJ6zs4Twl_vjXTocvtSEun2b2wr4WSD1GPK61Y

B. Canadian Environmental Protection Act, 2023

New law gives Canadians right to a healthy environment – but no plan yet on how to enforce it. National Post. Jun 14, 2023

https://nationalpost.com/news/canada/canadians-have-the-right-to-a-healthy-environment-with-passage-of-new-law?fbclid=IwAR0RkniFCOKFL_KzqOPEU3H63sZQezzFQMkz2FerVnG65leXnhni_squU

Re: Canadian Environmental Protection Act enshrining the right to a healthy environment

C. Canada's Clean Air Act

<https://acrobat.adobe.com/link/track?uri=urn%3Aaid%3Asc%3AUS%3Abc63b662-d07a-388d-ab95-bae9957b44cd&fbclid=IwAR2n1-qBJLqYDleMYIO-mhGKsk-i8pdj1KwtQ0VnjJbQHAQXOoLMhjn5Kg&viewer%21megaVerb=group-discover>

Your right to live in a healthy environment: phantom or reality. Constitutional Studies.

<https://www.constitutionalstudies.ca/2017/08/your-right-to-live-in-a-healthy-environment-phantom-or-reality/?print=print&fbclid=IwAR36rDkFPD6-09MzFF5PV6YnpzgWypZDweoikn6HK3vUj-25TWDnwQ29DhQ#:~:text=Individuals%20living%20in%20Canada%20can,section%207%20of%20the%20Charter>

D. Emissions Reduction Alberta funding of circular economy projects

Alberta announces \$58 million for circular economy projects worth \$528 million in public and private investment. Feb 13, 2023.

<https://www.eralberta.ca/media-releases/alberta-announces-58-million-for-circular-economy-projects-worth-528-million-in-public-and-private-investment/?fbclid=IwAR0C6N0WoMawnuOAW7gDFz7RcaEFrtTCQg7d6a-VX4DmWi01QSUuX4O9nWQ>

E. Foothills County's Land Use Bylaw definition of heavy industry

<https://www.foothillscountyab.ca/sites/default/files/2023-07/Consolidated%20LUB%20Update%202023%2006%2028.pdf>

The County's definition of heavy industry:

"INDUSTRY, HEAVY – means the use of land, buildings, or structures for an industrial activity which, in the opinion of the Approving Authority, creates significant adverse impacts beyond the boundaries of the site on which the associated activity takes place due to appearance, noise, odor, emission of contaminants, fire or explosive hazards, or dangerous goods."

2. Relevant Plans

A. Spitzee Crossing ASP and related plans

Spitzee Crossing Area Structure Plan. Adopted by Town of High River Sept 23, 2013.
<https://highriver.civicweb.net/filepro/document/29331/Spitzee-Crossing-Area-Structure-Plan-Amended-ASP-Oct-11-2016-web-version.pdf>

This plan relates to approximately 280 ha (690 acres) of land in the north and northwest areas of High River which was annexed as of January 2012.

McElhanney Consulting Services Ltd. Ultimate Functional Study for the Spitzee Crossing Lands. Town of High River Planning and Development Department. Dec 4, 2015

<https://highriver.civicweb.net/filepro/document/29334/Ultime-Functional-Svcing-Rpt.pdf>

p. 20 "It should also be noted that the Town currently supplies 70 L/s out of its total average daily water demand of 131 L/s to Cargill plant north of the Town."

A water reservoir will be necessary for this development. A site located at the public utility lots adjacent to 7 St NW was proposed, near the NE boundary of the Spitzee Crossing development.

McElhanney Consulting Services. The Highlands (of Spitzee Crossing) Neighbourhood Outline Plan. The Town of High River. Sept, 2017

<https://highriver.civicweb.net/filepro/document/29321/17.09.22-NOP-Adopted.pdf>

Central to the idea of a "life-long" community, is the full integration of a senior's retirement residence to be located in the northeast portion of the site... Our highest achievement would be to create generations of residents that age within the community and if necessary move to the seniors facility within their own walkable neighbourhood.

CivicWorks Planning + Design Inc. Highwood Ranch land use redesignation & neighbourhood outline plan. NE 2-19-29 W4M Spitzee Crossing ASP. Town of High River. Jan 2018.

B. South Saskatchewan Regional Plan

South Saskatchewan regional planning. Government of Alberta.

https://www.alberta.ca/south-saskatchewan-regional-planning.aspx?fbclid=IwAR0iYBw4l48uOP_6Mx-k2b2PSIV56-c-hq3xP3rlw_kG5tVEE9G_HluF9HA

South Saskatchewan Regional Plan. Land Use Planning Hub.

https://landusehub.ca/resources/south-saskatchewan-regional-plan/?fbclid=IwAR24McATYg9EKxwdrXfc3xNyP425to6en01Jfib3IK9_ZsjofdqmHsTww5w

South Saskatchewan Regional Plan 2014-2024. Government of Alberta.

https://acrobat.adobe.com/link/track?uri=urn%3Aaaid%3Aascds%3AUS%3Ac3d35cb9-4ad5-32f5-97ec-d5ac824d591e&fbclid=IwAR2sPCbHHLmFRt610FfSr_pXe1ANjT_zcGeYHrGKpeO2bTGop-uyW8cbk4s&viewer%21megaVerb=group-discover

3. Rimrock Proposal

A. Rimrock's application to EPA, subsequent SIR responses, and related studies

- i) Rimrock Biodigester Facility Application for an Environmental Protection and Enhancement Act Industrial Approval
Submitted Jun 9, 2022
https://www.stophatsmell.ca/files/ugd/19e87e_241c6568146f448593008abfceba1211.pdf
- ii) First Supplemental Information Request from EPA
Nov 28, 2022.
<https://onedrive.live.com/?authkey=%21AAxhMfKpSmzIMKE&id=C2DDCA62AF69EF91%2113171&cid=C2DDCA62AF69EF91&parId=root&parQt=sharedby&o=OneUp>
- iii) Rimrock response to EPA's first Supplemental Information Request
https://drive.google.com/file/d/1sF5pdWXnWULUL6Ohm2vU7hbKx_hcvPCB/view?fbclid=IwAR0K4qRoq_CvJi2SyfYug_0k2XDU0cRxy3YNxkDb5b4GPsEPTUhBEg1jRM
- iv) Rimrock response to EPA's second Supplemental Information Request
[https://www.facebook.com/groups/1494616411044609/posts/1673432043163044/?_cft__\[0\]=AZWEimFhuCDgrwIU-YNKsKjFtOVSbS9vWrWHa2gcr1gpQaJxNFJVDHcUWsd3H4Cq0hMVOgU_nkIpjvIC7oG1QU554Qyyjik_uOFAXFfvUvsHLe7O3bOAY6CYuqcRfhM69VQxq_NZfnZeWVniRUyIPagmlQif9UR7n-avevGx7Nz2TQmYQghWTX6Vvah5OQWDggSBLiil7Gw7YHA5hQIN0XNXD5J35ogQD9oK3OCEYnijT_Lvg&_tn=-UK-R](https://www.facebook.com/groups/1494616411044609/posts/1673432043163044/?_cft__[0]=AZWEimFhuCDgrwIU-YNKsKjFtOVSbS9vWrWHa2gcr1gpQaJxNFJVDHcUWsd3H4Cq0hMVOgU_nkIpjvIC7oG1QU554Qyyjik_uOFAXFfvUvsHLe7O3bOAY6CYuqcRfhM69VQxq_NZfnZeWVniRUyIPagmlQif9UR7n-avevGx7Nz2TQmYQghWTX6Vvah5OQWDggSBLiil7Gw7YHA5hQIN0XNXD5J35ogQD9oK3OCEYnijT_Lvg&_tn=-UK-R)
- v) Memorandum of Understanding regarding feedstock for Biodigester
Aug 2015.
<https://www.facebook.com/groups/1494616411044609/permalink/1650457252127190>
- vi) Rimrock Biodigester Facility – Traffic Impact Assessment
Final Report. ISL. Sept 2022.
<https://www.facebook.com/groups/1494616411044609/permalink/1547481705758079>

B. Tidewater

- i) Tidewater Renewables and its parent company Tidewater Midstream and Infrastructure
Munro, Brant, CFA. Buy Tidewater Midstream to buy Tidewater Renewables.
Seeking Alpha. Aug 8, 2022.
https://seekingalpha.com/article/4531511-buy-tidewater-midstream-to-buy-tidewater-renewables?fbclid=IwAR3slqc1YshwZQ-eB4K6HIWpxEDOuvbUqR06iqA6Roc5KB_s-KRUf53CIQ

Tidewater Renewables (OTCPK:TDWRF) trades under the symbol LCFS on the TSX. LCFS is based in Calgary, AB and is a "multi-faceted, energy transition company and is focused on the production of low carbon fuels, including renewable diesel, sustainable aviation fuel, renewable hydrogen, and renewable natural gas, as well as carbon capture through future initiatives. LCFS was created in response to the growing demand for renewable fuels in North America and to capitalize on its potential to efficiently turn a wide variety of renewable feedstocks (such as tallow, used cooking oil, distillers corn oil, soybean oil, canola oil and other biomasses) into low carbon fuels."

LCFS was formed in July 2021 by majority shareholder Tidewater Midstream and Infrastructure Ltd. (OTCPK:TWMIF) as a wholly owned subsidiary. Tidewater Midstream and Infrastructure Ltd. trades under TWM on the TSX. LCFS was formed to provide TWM a vehicle for pursuing funding growth to focus on the production of innovative low carbon fuels.

ii) Tidewater Renewables and Rimrock RNG Partnership

Tidewater, Rimrock in Canadian RNG Partnership . Gas Pathways. Apr 4, 2022
https://gaspathways.com/tidewater-rimrock-in-canadian-rng-partnership-776?fbclid=IwAR1YPOKqIW_UBs6DBxWNUrGDQZz3GqBtGQ-3Rs-BxlmQOadWN-noulUqCio

Tidewater Renewables enters into strategic RNG, feedstock partnership. Canadian Biomass. Apr 4, 2022

https://www.canadianbiomassmagazine.ca/tidewater-renewables-enters-into-strategic-rng-feedstock-partnership/?fbclid=IwAR03G6hoI9kUDFr5ND3GE_MU5pecox0pSqxfBSAInVUjHGZi6dauLKEVFKg

*Tidewater Renewables and Rimrock plan to build and evaluate a number of projects across North America through a separate partnership (the “RNG Facilities Partnership”). Tidewater Renewables and Rimrock plan to begin construction on their first Alberta-based RNG facility at High River. The High River facility is expected to have a gross capital cost of \$65-70 million and has received material government grant support. Tidewater Renewables’ net equity investment is expected to be approximately \$10 million, and the corporation will retain a 51 per cent ownership in the RNG Facilities Partnership. The High River facility is expected to generate gross annual EBITDA (Earnings before interest, taxes, depreciation, and amortization) of approximately \$10 million (approximately \$5 million net to Tidewater Renewables). **Tidewater Renewables and Rimrock are also evaluating three additional RNG facilities located in Alberta and Nebraska. Each project is expected to attract material government support which dramatically improves project economics.***

Tidewater Renewables Ltd. enters into strategic renewable natural gas and feedstock partnership and provides operational update. Cision (publication of Tidewater Renewables). Apr 4, 2022.

<https://www.newswire.ca/news-releases/tidewater-renewables-ltd-enters-into-strategic-renewable-natural-gas-and-feedstock-partnership-and-provides-operational-update-833171155.html?fbclid=IwAR2YIMcVj-kfVuBn6AC20IQG-JS6hX8IMb62h619gTzkDiQ80nztvDSCYXw>

Tidewater Renewables enters strategic RNG partnership. Bioenergy Insight. Apr 12, 2022

https://www.bioenergy-news.com/news/tidewater-renewables-enters-strategic-rng-partnership/?fbclid=IwAR0SKCdqK6-ACDnq3AUEpLZpGGo-QvNSkyqzCOMEFlojvEbTyet-Ns9_uJO

iii) Incidents involving Tidewater’s parent company: contaminated diesel in BC and environmental violation in Alberta

*Williams, Arthur. Contaminated diesel sold in Prince George between April 5 and April 11, Tidewater says. Prince George Citizen. Apr 28, 2022.

<https://www.princegeorgecitizen.com/local-news/contaminated-diesel-sold-in-prince-george-5311751?fbclid=IwAR26qPu8P5vJgXU9BfL0meROOn65FMYwXR3MaGTGEGsUne5uFFzWTXTLn0eI>

Problems at Tidewater's Prince George diesel refinery resulted in contaminated diesel that made its way to gas stations in Prince George.

****Tidewater Midstream and Infrastructure Ltd. pleads guilty to charge laid by the AER. Alberta Energy Regulator. Jul 6, 2022**

https://www.aer.ca/providing-information/news-and-resources/news-and-announcements/news-releases/news-release-2022-07-06?fbclid=IwAR2EtD6qjRVHL3eCl6PiBMfsKeZyjdL7jvzOtvFPqd378ClCDBbC1Oe_Kg4

Tidewater Midstream and Infrastructure Ltd. has pled guilty to a charge laid against them by the Alberta Energy Regulator (AER) in October 2021. The charge relates to the release of acidic water that occurred in October 2019 at Tidewater's Ram River sour gas processing plant near Rocky Mountain House in contravention of their [Environmental Protection and Enhancement Act](#) approval.

iv) Tidewater RNG offtake deal with FortisBC

Tidewater Renewables LTD enters into 20-year renewable natural gas offtake agreement with FortisBC. CISION (Tidewater Renewables). Oct 17, 2022

https://www.newswire.ca/news-releases/tidewater-renewables-ltd-enters-into-20-year-renewable-natural-gas-offtake-agreement-with-fortisbc-811303537.html?fbclid=IwAR3LogAbwnMp8-V_sUj2JXDr3JEfp78RaoDqrDdSAUS4UwpGcDZhkqiYo9g

Gaetjens, Bob. Tidewater subsidiary enters 20 year RNG offtake deal. Waste Today. Oct 18, 2022

<https://www.wastetodaymagazine.com/news/rng-fortisbc-tidewater-rimrock-offtake-agreement-facility-gas/?fbclid=IwAR1va8VGocb2YcT8sSitaJkauEuWGVoQ1iyvRUbKZAJ3uzQyihUMEs64HJg>

Under the deal, FortisBC will buy up to 525,000 gigajoules of renewable natural gas annually from a new facility expected to commence operations in 2024

v) Promotional articles

Cocleugh, Rob. A letter from our CEO to the residents of Foothills County and surrounding area. Rimrock Renewables.

https://rimrock-renewables.com/community/?fbclid=IwAR2EtD6qjRVHL3eCl6PiBMfsKeZyjdL7jvzOtvFPqd378ClCDBbC1Oe_Kg4

McCracken, Don. Cattle at Rimrock could provide heat for B.C. homes. High River Online. Oct 25, 2022.

<https://www.highriveronline.com/articles/cattle-at-rimrock-could-provide-heat-for-bc-homes?fbclid=IwAR3p9xqDm9k7IoGNiv-9bdeoQHfMu9oAlrhrTI6xeaZjYefyE5khmtUs9zk>

Korova Feeders adding innovative sustainability technology. Alberta Cattle Feeders' Association. May 14, 2021.

<https://cattlefeeders.ca/korova-feeders-adding-innovative-sustainability-technology/?fbclid=IwAR1mdA9m6K0EJjRy3cdfIUcjC-XslaBd-7NSzJaZKn8T2LMbgLzHYJuMlw>

University of Saskatchewan. USask researcher, Tidewater Renewables to develop novel process to produce RNG from biomass. Canadian Biomass. Mar 1, 2022.

https://www.canadianbiomassmagazine.ca/usask-researcher-tidewater-renewables-to-develop-novel-process-to-produce-rng-from-biomass/?fbclid=IwAR0HDvx9UuRKmfWGyWGe83WUWMHbQ-3JS_e5ObHQU-NkWhckaLI7xVUOEWY

University of Saskatchewan researcher is developing a novel integrated process that uses both biochemical (anaerobic digestion) and thermochemical (gasification) methods to produce RNG.

McCracken, Don. County council to hear from Rimrock, Tidewater officials. High River Online. Nov 7, 2022.

<https://www.highriveronline.com/articles/county-council-to-hear-from-rimrock-tidewater-officials?fbclid=IwAR3yweQn6yq-NI1wOSow7hEZlt5zR8TNkxAZ4ci97q7szikYlOrgk56wPk>

Rance, Laura. Jul 8, 2023. Forward-looking food production more than bottom-line success. Winnipeg Free Press

<https://www.winnipegfreepress.com/business/2023/07/08/forward-looking-food-production-more-than-bottom-line-success>

Sunterra Group subsidiaries: Rimrock Cattle Company, Sunterra greenhouse, hog barns, sausage factory, abattoir, 9 retail stores. Kendra Donnelly of Rimrock talks about proposed biodigester in terms of sustainability and profitability of feedlots.

4. Grants and other funding secured for Rimrock biodigester

New production system Rimrock Renewables/Korova. Emissions Reduction Alberta.

<https://www.eralberta.ca/projects/details/new-production-system/?fbclid=IwAR2rwCnu2iWDv4a5jFDWX2k5sCRIBNmGzQM8N8jnXiFi5X3KGw9i2Sitij4>

Korova is developing a new productive system that will serve as a model for other feedlots in Alberta. It involves the integration of Rolled Compacted Concrete (RCC) for pen floor surfacing and an onsite innovative Bio-Digester (BD) technology to upgrade manure as a feedstock to produce Biomethane. This project is anticipated to achieve emission reductions from avoided organic waste (SOW) decomposition and the production of renewable natural gas from waste to displace fossil natural gas. For the scope of this project, a GHG reduction of 0.73 tCO₂e/head/yr is expected, totalling approximately 25,000 tCO₂e for around 34,000 cattle.

Amount received: \$5,000,000

Development of a prototype for digestate water treatment and fertilizer value-add opportunity for on-farm feedlot anaerobic digester (AD). Emissions Reduction Alberta.

<https://www.eralberta.ca/projects/details/development-of-a-prototype-for-digestate-water-treatment-and-fertilizer-value-add-opportunity-for-on-farm-feedlot-anaerobic-digestors-ad/?fbclid=IwAR2lF3a6OgCgQhJM4NyAvk6343wsrBvZ8act9Ah4Es4crG2REIVFgHHXf2c>

Rimrock Renewables Limited Partnership along with Rimrock Cattle Company Ltd. (Rimrock) are investing in a first of a kind, innovative system within the Agriculture and Agri-Food sector that is designed to produce value-add fertilizer, peat, cattle bedding, and water recycle product for Alberta-based Greenhouses, Mushroom Farmers, Organic Farmers, Conventional Farmers, and

Cattle Producers who are all in need of a local solution. The innovative system called “4RENEW” will be a major contributor to an Alberta circular economy by integrating several technologies at a commercial scale to upgrade digestate from an on-farm feedlot anaerobic digestors.

Amount received: \$8,430,255

Alberta Investment Management Corporation (AIMCo) makes strategic \$150 million investment in Tidewater Renewables. AIMCo News release. Oct 24, 2022.

https://www.aimco.ca/insights/tidewater-renewables-investment?fbclid=IwAR08U1ACZokS_A06ARYDtuV30O9IP5LCyheSMCWmkTHcrwNNN-s6bE11Mk8

II. OPPOSITION TO THE BIODIGESTER

Rimrock Renewables biodigester project – Will it be beneficial to the community?

https://www.stophatsmell.ca/files/ugd/19e87e_f32bcccae0e54610b14f632d098adf1f.pdf

Discussion re odour:

The Project will have a 24 acre 3m deep open pond to store liquid digestate and a 4.75 acre outdoor storage area for solid digestate. The digestate pond has been sized to hold 7 months of liquid digestate. Digestate will be spread on surrounding farmland in the spring and fall; 2-4 weeks in the spring and 4-6 weeks in the fall. The application does not mention the likelihood of the liquid or solid digestate storage areas causing odour or if the spreading process spring and fall will cause odour.

Biogas in the biodigester will contain methane, 2000 ppm of H₂S, ammonia, CO₂, and volatile organic compounds (VOCs). The permit application states activated carbon filters will be used to trap VOCs, ammonia & H₂S. Guidelines published by the Canadian Biogas Association state that carbon filters are not effective at removing ammonia. H₂S is lethal at 200 ppm and the smell is detectable @ .00047ppm. A 12 meter tall, 2.8m diameter emergency flare system will burn biogas in the event of process upset or if the produced methane does not meet ATCO specs. CO₂ will be captured and vented to atmosphere through an exhaust stack.

Emissions from the Project will include NO₂, SO₂, H₂S, CO, CO₂ and particulates. No on-site air monitoring stations are proposed. Only an annual source emission survey for NO_x, flow, and temperature will be conducted. The application states that fugitive emissions which may result from leaking fittings, connections, or seals on equipment and piping systems are dismissed as negligible. There is no mention of toxic or combustible gas detection in the process area. The application states "Facility equipment will be inspected daily to ensure that there are no visible leaks".

No odour impact study has been submitted as part of the AEP application. The application makes very few mentions of odour and has no detail on what practices or processes will be in place to ensure odour is not an issue. By contrast the Canadian Anaerobic Digestion Guideline written by the Canadian Biogas Association has a strong focus on odour and odour control throughout the document. The words odorous & odour occur over 185 times in their 77 page Guideline document.

The Project is much larger than existing biodigesters in Canada and Europe. Lethbridge Biogas is currently the largest in Canada and processes 100,000 tonnes/year of feedstock versus the proposed 180,000 tonnes per year capacity for the proposed Rimrock project. Also notable is that Lethbridge does not have an open liquid digestate storage pond for long term storage and does not stockpile solid digestate on site so direct comparisons between these plants cannot be made.

There is no statement by Rimrock that the Project will provide a definite reduction to the odour problems currently experienced by their neighbours in Foothills County and High River or even if the new facility will create additional odour. When questioned about odour reduction during a meeting with High River Town Council the Rimrock representative stated: "There's some research out there on odour mitigation, but we don't want to promise anything," "But logically, we feel like we can prevent odour by putting the manure into a biodigester, which captures the gas." They do not mention the 24 acre open pond and the odour it will generate.

Giles, Jessica. High River Western Feedlots officially sold. High River Online. May 7, 2019 https://highriveronline.com/articles/high-river-western-feedlots-officially-sold?fbclid=IwAR30Ov_eNzAYG-9BchehwvG5K0K8UCruYQ1GaTkdnVgqSTmSLtxwU5uEjdc

Rimrock Feeders: A new neighbour in Foothills County. Gateway Gazette. Jul 27, 2019

<https://gatewaygazette.ca/rimrock-feeders-a-new-neighbour-in-foothills-county/?fbclid=IwAR0JD74A01ASM2hXf7Egs6m4GxmqUzCjS6qt-5B2DSS-2o2nMljbhsVVSFU>

McCracken, Don. Council chambers full to overflowing for Rimrock presentation. High River Online. Sept. 14, 2022.

<https://www.highriveronline.com/articles/council-chambers-full-to-overflowing-for-rimrock-presentation?fbclid=IwAR35LEwejSfXGID04sSJqHEKmnznlLogdFOd5t8rMz8Tn8zY5ThB2ZbLh8c0>

Korotyszyn, Robert. Biodigester to ease odour woes in the Foothills, says feedlot. Cochrane Eagle. Oct 2, 2022.

<https://www.cochraneagle.ca/beyond-local/biodigester-to-ease-odour-woes-5904378>

Korotyszyn, Robert. Biodigester to ease odour woes in the Foothills, says feedlot. Alberta Prime Times. Oct 3, 2022

<https://www.albertaprimetimes.com/beyond-local/biodigester-to-ease-odour-woes-5904378?fbclid=IwAR2SDeoOdX-8rTMTkzD0IEKVqaLEgsmj4er61kF97Kb5Wj-IQjFnPz9NXQ>

Need to get verification of this statement: A public notice about the proposed biodigester, posted by Alberta Environment and Parks (AEP) from July 12 until Aug. 11, said people directly affected by the project were able to send statements of concern to the government regulator.

Denney, J. A second look at biodigester. High River Times letter to editor. Oct 27, 2022.

<https://www.highrivertimes.com/opinion/letters/a-second-look-at-biodigester>

Kaufman, Bill. ‘Rather hostile meeting’: Residents raise stink over proposed massive manure processing plant. Calgary Herald. Oct 31, 2022.

<https://calgaryherald.com/news/local-news/rather-hostile-meeting-residents-raise-stink-over-proposed-massive-manure-processing-plant>

Report on the Sept, 2022 meeting with County residents where Delilah Miller claimed the County has little say in the approval process for the biodigester, and that biodigesters “haven’t proven to be nightmares for neighbours in other countries”, adding her concerned constituents already contend with aroma – generating feedlots. The article also states that County residents said it should be located in the industrial area where Cargill is (note: High River residents would not be in agreement with this location as it would be just as problematic for High River if it were to be moved there, as the original location is.)

McCracken, Don. High River mayor disputes support for Rimrock Feeders bio-digester. High River Online. Dec 6, 2022.

https://highriveronline.com/articles/high-river-mayor-disputes-support-for-rimrock-feeders-bio-digester?fbclid=IwAR0HHH5stLy2p1hG_jSQgAt4qRovPsilxqZfbUXkXUEvMb-0vl3elZ9LhPw

Mayor states he did not provide Tidewater a letter of support for the biodigester.

Korotyszyn, Robert. High River Council digs into proposed biodigester. Western Wheel. Dec 8, 2022.

<https://www.westernwheel.ca/local-news/high-river-council-digs-into-proposed-biodigester-6217757?fbclid=IwAR1gAp3Nf7bNr7QoEn74HI4nnCWo69Eq-vM0KsEp5TNqXbKsAI3zWV6Acb4>

Snodgrass made a motion during the council meeting that the biodigester be a standing item on council agendas, and to appoint Coun. Nychyk to take the lead on the issue. Nychyk spoke about it during a committee meeting earlier that day. “My concern at this point is the facility that’s being

proposed in association with Rimrock Feeders is not something we want next to our community, for a number of reasons," he said. Questions about water and air quality, and whether the biodigester would reduce odours from the feedlot or make them worse, were a few of the concerns he brought up. Coun. Jenny Jones said straight answers from Rimrock about the biodigester "seem to be not happening."

The biodigester was initially touted as a solution to strong odours coming from the adjacent feedlot, although it is not clear how effective it would be at reducing that odour. Representatives from Rimrock told council earlier this year that although they felt the biodigester would reduce odours, they couldn't make any promises.

Landowners and residents within 1,500 metres of the project boundary have been able to meet with company representatives one-on-one, but the company has not held any public meetings about the project. Snodgrass said Tidewater would not appear at a public council meeting. "Tidewater did decline to come to that environment, they just won't do it," Snodgrass said. Tidewater declined to speak to the Western Wheel about the project. "As the project is still going through its regulatory process, our standard company practice is to not conduct interviews," said an email from a company spokesperson.

Of particular concern in High River, the project application states that a letter of support was received from the Town's mayor. Snodgrass said that neither he, nor the Town of High River, ever sent a letter of support for the biodigester.

****Murphy, Ted. Different smell, but familiar story. Western Wheel. Dec 14, 2022.**

<https://www.westernwheel.ca/opinion/column-different-smell-but-familiar-story-6223608?fbclid=IwAR21ghLM5dgFmtFUSGmNHt7yo4OSIHGhLZdkxwZ1xsVYL8yk5GTWLMhUEO4>

Fedor, Tyson. Proposed biodigester project near High River, Alta., has residents wanting it snuffed out. Calgary CTV News. Jan 4, 2023.

<https://calgary.ctvnews.ca/proposed-biodigester-project-near-high-river-alta-has-residents-wanting-it-snuffed-out-1.6217920>

Korotyszyn, Robert. Foothills County holding meeting on contentious biodigester. Western Wheel. Jan 6, 2023

<https://www.westernwheel.ca/local-news/foothills-county-holding-meeting-on-contentious-biodigester-6334179?fbclid=IwAR1rq-KN5id2YkNUnw7xr4h9kNjQpLgiG3Nk0bxxOVGuPAwgnRrmOAp7-yl>

Ferguson, Doug. Biodigester developer fields concerns in Alberta. The Western Producer. Jan 16, 2023.

<https://www.producer.com/news/biodigester-developer-fields-concerns-in-alta/>

Rimrock apologies for conducting advance work on the proposed biodigester site, but said that approval for the advance work was received from Foothills County and the Alberta Ministry of Environment and Protected Areas, in advance of the application for the biodigester being approved. Delilah Miller said that staff at Foothills County gave approval for the grading work when it should have come to Council to decide, and the work has been stopped. Miller also said that letters of appeal or concern have been sent to EPA and that if a hearing is granted, the approval process could be lengthened by up to two years.

Fedor, Tyson. Protesters show up to public meeting for Rimrock Renewable's proposed biodigester. CTV News. Calgary. Jan 25, 2023

https://calgary.ctvnews.ca/protesters-show-up-to-public-meeting-for-rimrock-renewables-s-proposed-biodigester-1.6245632?fbclid=IwAR3dyjtCuuSimBHETCFd2EdRr89eofU9Bnux31v0a2z6byw_D5RdCgd3u9U

Kaufmann, Bill. "We're guinea pigs': Neighbours of proposed waste processor unswayed by company's assurances. Calgary Herald. Jan 25, 2023

<https://calgaryherald.com/news/local-news/were-guinea-pigs-neighbours-of-proposed-waste-processor-unswayed-by-companys-assurances?fbclid=IwAR0ytsr4GhowglUtGkU03-rqKtJdb0bqbjHxuGgFYIb6XLZmXow5gmFo>

Wallace, Kevin. Biodigester protesters get support in downtown High River. High River Online. Jan 25, 2023.

https://www.highriveronline.com/articles/biodigester-protesters-get-support-in-downtown-high-river-?fbclid=IwAR136CsdnyOJ9SLExvi20ftwi74d4p6_J2Ofe4vPdafUFO1Mncm0k6UA-fg

Korotyszyn, Robert. Public gets biodigester lesson at Foothills County meeting. Western Wheel. Jan 26, 2023.

https://www.westernwheel.ca/local-news/public-gets-biodigester-lesson-at-foothills-county-meeting-6439997?fbclid=IwAR1zxwt9YdrmsXuirPEkL7IjqgUblREii-R_asNmK8BnlGk1tW5x9JfE-4I

Broken into six parts, the lengthy presentation talked about everything from the history of the site and current feedlot operations to details of the proposed facility, including efforts to be good neighbours. None of the representatives attended in-person as all presentations were done virtually.

Benefits to the community from the biodigester were touted as reductions in odour, landfill waste and greenhouse gas while increasing food security and sustainable beef production. It would also produce natural gas for market consumption. The company expects to see a 42 per cent reduction in odour if the biodigester is built, compared to odour from the current feedlot.

The Rimrock biodigester has been a contentious topic since last summer, when initial ground clearing work began on the site, despite it still going through the approval process.

Ferguson, Doug. Proposed biodigester reveals intentions. The Western Producer. Jan 26, 2023

<https://www.producer.com/livestock/proposed-biodigester-reveals-intentions/>

Approval for grading work on site in advance of biodigester decision was given by County and AEPA

High River biodigester. Calgary Eyeopener with Loren McGinnis, Angela Knight. Jan 26, 2023.

https://www.cbc.ca/listen/live-radio/1-5-calgary-eyeopener/clip/15962415-high-river-biodigester?fbclid=IwAR1YIM1GYWD3LLmR7_zQGOHcn_2RNYitYA4WHKfH0t3Acm1roKKVd1uXzI0

Interview with Julie Allan, resident, who thinks Rimrock should have to start over, this time with appropriate notice given to residents of their application and a public consultation process.

Fedor, Tyson. Biodigester facility pitch has community concerned. CTV News Calgary. Jan 27, 2023

<https://calgary.ctvnews.ca/video?clipId=2616733&fbclid=IwAR0b1bP85KFG-Lsu2xZ4WC07BYpWvWxvtTywpDVoMn0JqibCy41RVR6oOo>

Okotoks Today staff. Editorial: Plant isn't answer to those odour complaints. Western Wheel. Feb 2, 2023.

https://www.westernwheel.ca/opinion/editorial-plant-isnt-answer-to-those-odour-complaints-6460790?fbclid=IwAR09hWk6sd93TEK5XeQvwwHp04wE9I4_7g_y3mVD2iaeZoKDkteVSXPSn_I

Zelke, Dana. Public information session held for proposed Tidewater Renewable biodigester project. High River Times. Feb 2, 2023.

https://www.highrivertimes.com/news/local-news/public-information-session-held-for-proposed-tidewater-renewable-biodigester-project?fbclid=IwAR3jwFP8pVMwS9mXbgQ_1pYcxOdY3LbV1RSy8Dz-nBUqxSqieG70XxjvUQs

Ferguson, Doug. Odour reduction 'too little'. The Western Producer Newsletter. Feb 2, 2023

<https://www.producer.com/news/odour-reduction-too-little/>

McCracken, Don. Foothills resident disappointed with County's biodigester information meeting. High River Online. Feb 2, 2023.

<https://www.highriveronline.com/articles/foothills-resident-disappointed-with-countys-biodigester-information-meeting>

Laurene Mitchell interview.

Estes, Benita. STOP!!! Rimrock Renewables proposed digester. Petition against biodigester.

https://www.change.org/p/stop-rimrock-renewables-proposed-biodigester?fbclid=IwAR2cVpiq5LXfODyuj2JtaqAbkiwxkgENLOMx_TaPZ4kiUiZjYGJDUkCc_-w

Zielke, Dana. No real answers to smelly problem heard at biodigester information session. High River Times. Feb 3, 2023.

McCracken, Don. High River still keeping tabs on proposed biodigester. High River Online. Feb 16, 2023.

<https://www.highriveronline.com/articles/high-river-still-keeping-tabs-on-proposed-biodigester?fbclid=IwAR3lr1IbIVfRZEO7I6yes32z7kVOWaceBpqY-s3ITSIhmicUIBc-RFZHI>

McCracken, Don. Biodigester opponents getting the word out with open house this weekend. High River Online. Feb 17, 2023.

https://www.highriveronline.com/articles/biodigester-opponents-getting-the-word-out-with-open-house-this-weekend?fbclid=IwAR10uq9e2phRzV6nxjtpUaiOh7SYe7fZVCy_cgFu3WdzfNwjwoRSI-nGOO

Town of High River Regular Meeting of Council. Feb. 27, 2023.

<https://www.youtube.com/watch?v=at3UkwRAGMU>

Alberta Hansard, p. 551. Mar 13, 2023 MLA Sigurdson asks Alberta Environment and Protected Areas Minister what steps are being taken to ensure the biodigester is meeting or exceeding environmental regulations, and what actions have been taken in response to residents' concerns and potential issues raised at public town halls.

https://docs.assembly.ab.ca/LADDAR_files/docs/hansards/han/legislature_30/session_4/20230313_1330_01_han.pdf

Derrish, Carrie. Rimrock Biodigester. High River Times letter to editor. Apr 14, 2023.

Silverson, Allison. Rimrock feedlot and proposed biodigester. High River Times. Letter to editor. Apr 14, 2023.

Bews, Bill. Biodigester project should be a non-starter. High River Times. Letter to the editor. Apr 21, 2023.

Blake, John. Connected issues at Council. High River Times. Letter to the editor. May 19, 2023.

Shirlie and Dennis Rolston. Western Wheel. May 22, 2023.

<https://www.westernwheel.ca/opinion/letter-cant-plan-outdoor-events-because-of-the-stink-7021958?fbclid=IwAR0SvWubjKiVOKHmMwuTftAlvcjRgAYhqEEWc8NyN-PZr7gdZmuVtfrUGTXQ>

Fawcett-Atkinson, Marc. Is biomethane really the Holy Grail for clean energy? Canada's National Observer. June 21, 2023.

https://www.nationalobserver.com/2023/06/21/news/biomethane-really-holy-grail-clean-energy?fbclid=IwAR0Sz5LEw8WvAZO86-9pnUYLcjrj8mxD6MXv50ql01ArxJGRJkCK7_Zh6DQ

Interview with Benita Estes.

Korotyszyn, Robert. Feedlot visit angers High River and Foothills County residents. Western Wheel. Jul 13, 2023.

<https://www.westernwheel.ca/local-news/feedlot-visit-angers-high-river-and-foothills-county-residents-7269413?fbclid=IwAR2GE2SUPR1EHDUnkRCDUWyxctBhJPkrXTeyCGxnl5mlLecbEptVETy4Y3k>

McCracken, Don. Jul 19, 2023 High River Online. MLA's visit to Rimrock a "slap in the face," say opponents

<https://www.highriveronline.com/articles/mlas-visit-to-rimrock-a-slap-in-the-face>

Labby, Bryan. Proposal for biogas plant at High River feedlot faces pushback from residents. CBC News. Jul 24, 2023.

<https://www.cbc.ca/news/canada/calgary/biogas-plant-high-river-feedlot-pushback-residents-1.6908931>

Legal fees to appeal Rimrock Biodigester Project.

https://www.gofundme.com/f/legal-fees-to-appeal-rimrock-biodigester-project?fbclid=IwAR3uEA_j9h0e6TBxtjHxVzpwmax26eYqMGXuC7AIYL9CsHvnG11WQ8xlcDI

Brankovich, Laura. Open letter to Mayor and Council. High River Times. Jul 28, 2023.

Korotyszyn, Robert. Foothills residents want renewables pause to include biodigester. Western Wheel. Aug 11, 2023

III. BIODIGESTERS/BIOGAS PLANTS

1. General information on biodigesters

How to transform livestock waste into products of economic and ecological value. Agriculture and Agri-Food Canada. Government of Canada publication.

<https://agriculture.canada.ca/en/news-agriculture-and-agri-food-canada/scientific-achievements-agriculture/how-transform-livestock-waste-products-economic-and-ecological-value>

Basic information about anaerobic digestion (AD). EPA (United States Environmental Protection Agency).

https://www.epa.gov/anaerobic-digestion/basic-information-about-anaerobic-digestion-ad?fbclid=IwAR3fP51u9qRPLon4f1gXePOz6eeRfsz7WmcJ62qG3-Gn0_nSS70EN3DRqd0

Is Anaerobic Digestion Right for Your Farm? EPA United States Environmental Protection Agency

<https://epa.gov/agstar/anaerobic-digestion-right-your-farm>

Hein, Treena. Canadian bio-digester report. Manure Manager. Apr 11, 2008

https://www.manuremanager.com/canadian-bio-digester-report-1359/?fbclid=IwAR0aceh8ciFBWmV3YOOZisUek56gSRUFgyDXaJLIX3nyfrNuudiw2_C0a3E

Hein, Treena. Canadian bio-digester report. Mar/Apr 2012

http://magazine.manuremanager.com/publication/?i=104301&article_id=1004853&view=articleBrowser

Includes a listing of biodigesters in Canada, at the time.

Anaerobic digesters: Frequently asked questions. Government of Alberta Agri-Facts: Practical information for Alberta's agriculture industry. Revised May 2014

<https://open.alberta.ca/dataset/afbebed3-2bd7-4698-90ea-4e60f9e30ef5/resource/81a9df57-efc8-4fb0-a704-b81c5711fdbf/download/zz-4182138-2014-agri-facts-anaerobic-digesters-frequently-asked-questions-revised-768-2.pdf>

White, Ed. Dirty deeds aren't done dirt cheap when it comes to manure biodigesters. The Western Producer. Dec 25, 2014

<https://www.producer.com/news/dirty-deeds-arent-done-dirt-cheap-when-it-comes-to-manure-biodigesters/>

Kryzanowski, Tony. Southern Alberta farm leading the way in green energy. Alberta Farmer. Jan 13, 2015

https://www.albertafarmexpress.ca/news/southern-alberta-farm-leading-the-way-in-green-energy/?fbclid=IwAR3XxuefwBR_SR4Li56Aa9LEZXOtQzdFlzNUhPKC6QGYeqd8A_Wfx-NnVls

Pot, Lisa B. Biodigester Runs Strictly on Cow Manure. The Citizen. Jan 21, 2019

<https://www.huroncitizen.ca/biodigester-runs-strictly-on-cow-manure-by-lisa-b-pot>

Hein, Treena. Mini digesters: Small profile, big future. Manure manager. Sept 25, 2019

<https://www.manuremanager.com/mini-digesters-small-profile-big-future/?fbclid=IwAR3v7nmptI6CqLZN2O2ldFM5AuzjrETNFIOozr9zQiScHycluNBP-M7Qs>

After seeing success in Europe, mini digesters are entering the North American market with great potential

****Heller, Marc. 'Cow power' goes dark as manure-to-electricity fizzles. E&E News. Jul 12, 2020.**

<https://www.eenews.net/articles/cow-power-goes-dark-as-manure-to-electricity-fizzles/?fbclid=IwAR3BFPftEYaBKXqUSTHQVfulpz4OHTY3I73Jkb2W82d8J9xF9gohiqjnvz0>

Anaerobic system design and technology. EPA (United States Environmental Protection Agency).

https://www.epa.gov/agstar/anaerobic-system-design-and-technology?fbclid=IwAR28dTIPZCI7IIM6b_uieLAZAB1whB73MFNx-aJHkWPiH2I1wZSNR_4Bnw

Slater, Stew. Turning on-farm renewable natural gas into a reality. Glacierfarmmedia. Oct 8, 2021.

https://www.agcanada.com/2021/10/turning-on-farm-renewable-natural-gas-into-a-reality?fbclid=IwAR3ydVjNqAf96zBLUECRDzDOvupMAQdGgZsPvHhVVvX_yjSHsKJjgdB4pU

DFC-PLC Communications Team. Canadian dairy farmers turning into biogas pioneers. Dairy Farmers of Canada. Oct 20, 2021.

<https://dairyfarmersofcanada.ca/en/dairy-in-canada/dairy-excellence/canadian-dairy-farmers-turning-biogas-pioneers?fbclid=IwAR2P3roNbjQ6mAb6m2R9sguy2op4fGOkrraQLNWxYxa7UwqUzogmXHSqdq0>

Gomes de Jesus, Romulo Henrique; Taveira de Souza, Jovani; Neves Puglieri, Fabio; Moro Piekarski, Cassiano; de Francisco, Antonio Carlos. Biodigester location problems, its economic-environmental-social aspects and techniques: Areas yet to be explored. Science Direct. Energy Reports, Volume 7, Nov 2021, p. 3998-4008.

https://www.sciencedirect.com/science/article/pii/S2352484721004558?fbclid=IwAR1fLluhqE9O2rX9UEdxadQbsGumb_kld9Fz6SrMDWhYFrXtajiG5pV2o

Abstract: Bioenergy is a renewable energy obtained from biomass, and its main benefits are the reduction of greenhouse gases and waste disposal. One way to generate bioenergy is through anaerobic digesters. However, a common problem found in feasibility analyses is the appropriate location for these biodigesters, since the biomass is geographically and spatially dispersed. When the location is poorly chosen, it can interfere with the viability of the project. Therefore, the objective of this research is to determine the existence of areas that could still be explored by investigating studies that seek to identify suitable locations for deploying the biodigesters from the perspective of aspects (economic, environmental and social), localization problems (location/allocation and supply chain) and techniques.

To this end, a systematic review of the literature was conducted from the Science Direct, Scopus and Web of Science databases. It was observed that the literature could be more explored to (a) consider the social aspect in biodigesters location models, (b) propose studies that specify and consolidate each aspects' characteristics found in the literature applied in biodigesters location models, (c) integrate the economic–environmental–social aspects into supply chain project problems, and (d) explore the creation of clusters for energy production through strategic partnerships between small farms.

Canadian Biogas Association. Canadian Anaerobic Digestion Guideline: Food and Organic Waste Processing Facilities. Nov 29, 2019

https://www.stophatsmell.ca/_files/ugd/19e87e_a6211086907f4db7a0f48bca6c6d959d.pdf

Shanoff, Barry. Is an anaerobic biodigester a public utility? Waste 360. Dec 7, 2021.
<https://www.waste360.com/anaerobic-digestion/anaerobic-biodigester-public-utility?fbclid=IwAR1rq-KN5id2YkNUnw7xr4h9kNiQpLgiG3Nk0bxxOVGuPAwgnRrmOAp7-yl>

Livestock Anaerobic Digester Database. EPA (United States Environmental Protection Agency).

https://www.epa.gov/agstar/livestock-anaerobic-digester-database?fbclid=IwAR2J25Gr_7yaMjDC9KUCujuWVdU7zxvs2DS5ePWdBp16Ihk0uYjq6bCuZQ

Look into this one closer. None comes even close to the number of animals at Rimrock

Temnikova, Elena; Wang, Muming; Olawuwo, Samuel. A case study of renewable natural gas production at a cattle feedlot in Alberta: environmental, technical and policy analysis.. University of Alberta, University of Calgary. Geoconvention 2023, Calgary

<https://acrobat.adobe.com/link/track?uri=urn%3Aaaid%3Ausc%3AUS%3A7dfa70bb-805d-30d5-89bf-0081bab42bf7&fbclid=IwAR2MY1u0IDk30HjyG7nrXOW0JqIfRe1ttqt5M8eL5gHsOi1Diqm4SMqjapU&viewer%21megaVerb=group-discover>

Segal, Molly. Denmark is getting off fossil fuels. Are there lessons for Canada? CBC Radio. May 20, 2023

<https://www.cbc.ca/radio/whatonearth/denmark-fossil-fuels-canada-1.6849212?fbclid=IwAR3hyl1UROb46CZeEcTyXtNlbX2KI2NDtMJFAiAwV6mCfj2JVI3DEFIlyz0>

Anaerobic digestion: Biogas production and odor reduction. PennState Extension. Mar 9, 2023

<https://extension.psu.edu/anaerobic-digestion-biogas-production-and-odor-reduction>

2. Growth of Biodigesters in Canada

A. Bioenergy optimization program demonstration, Government of Canada

<https://natural-resources.canada.ca/science-and-data/funding-partnerships/funding-opportunities/current-investments/bioenergy-optimization-program-demonstration/4959?fbclid=IwAR0K4P4NbbAshGhHgUj6Tq5EC7dFUuLZINetsvkF0USCDIWUrPIIDi5hOIY>

B. Manitoba

Arnason, Robert. Manitoba set to turn manure into electricity. The Western Produce. Jul 21, 2011

<https://www.producer.com/crops/manitoba-set-to-turn-manure-into-electricity/>

VanRaes, Shannon. Cold weather isn't an obstacle to anaerobic digesters in Manitoba. Manitoba Co-Operator. Apr 26, 2013

https://www.manitobacooperator.ca/livestock/cold-weather-isnt-an-obstacle-to-anaerobic-digesters-in-manitoba/?fbclid=IwAR3ihNokWUo_ariRpsPBMzX6mEpoEh1gvrEE7604AhJS7LLx-kBDuYLGmW

Lyseng, Ron. Dairy farm biodigester will be the first to operate in Manitoba. The Western Producer. May 13, 2013

<https://www.producer.com/crops/dairy-farm-biodigester-will-be-the-first-to-operate-in-manitoba/>

Farmscape. Anaerobic digesters not feasible in Manitoba. Manure Manager. Mar 23, 2016

<https://www.manuremanager.com/anaerobic-digesters-not-feasible-in-manitoba-18931/?fbclid=IwAR3Bev1YVrYPYERzzbTb7pz7K2qzKkavZN6vDnJAqUVikCnUQ2vjml4mQ0>

The manager of sustainable development with Manitoba Pork says the inability of anaerobic digesters to function in cold weather and their high up-front construction costs have made the technology a non-viable option for treating livestock manure in Manitoba.

Biogas demonstration project, Sweetridge Farm Winkler Man. Government of Canada. Canadian Environmental Assessment Agency.

<https://iaac-aeic.gc.ca/052/details-eng.cfm?pid=62562&fbclid=IwAR1fpK7ZXH95c5QaRfEl0YXp6jJxmQHAHARUiSk5Q8fTTCLuAY55ACMQCmQ>

Wichers, GERALYN. Dairy carbon plans still on the drawing table. Manitoba Co-Operator. Jul 28, 2022

https://www.manitobacooperator.ca/livestock/dairy-cattle/dairy-carbon-plans-still-on-the-drawing-table/?fbclid=IwAR0Scpn0wZnQnp3Q3ETH_XSGjCTiv6wm9C8K24T9N1Bo6CpVYo0pelkezQk

C. Alberta

- i) ****Biogas market study: Understanding the Alberta anaerobic digestion landscape.**

Prepared for the Climate Change Emission Management Corporation (CCEMC) by TEC Edmonton. Updated Oct 13, 2015

<https://onedrive.live.com/?authkey=%21AHRuWYg0NOBAMZY&id=C2DDCA62AF69EF91%2115001&cid=C2DDCA62AF69EF91&parId=root&parQt=sharedby&o=OneUp>

- ii) Lethbridge Biogas
CCEMC: Renewable Energy Project – Lethbridge. Biogas
<https://www.youtube.com/watch?v=ll8M2kJK9U>

Our plant – Lethbridge BioGas

<http://lethbridgebiogas.ca/our-plant/index.html?fbclid=IwAR09dhWQ8NIwqNnwIVPNpBz58UrO1EUtPu3WGJL4IFeVGqTzAytObnXtllw>

Note: no open digestate pond.

Noble, James. New Alberta biogas facility largest of its kind in Canada. UBC Sauder School of Business. Dec 12, 2013.

The nation's largest facility for turning manure and food processing waste into electricity just went online in Lethbridge, AB. The project is a unique partnership between private, provincial and municipal stakeholders... The state-of-the-art biogas facility has the capacity to process more than 100,000 tonnes of farm waste per year and is capable of producing 2.8 MW of electrical power today, and up to 4.2 MW with additional generating units in the future.

Kryzanowski, Tony. Canada's largest biogas plant: Digester depending on steady stream of liquid manure from southern Alberta farms. Manure Manager. Mar 18, 2014.

https://www.manuremanager.com/canadas-largest-biogas-plant-15093/?fbclid=IwAR3eiNhBCgxog_7DGH5w7NBL_ox8hksqdhDxvHA_o8yoLXO_16oH8e46j7w

Lethbridge Biogas providing value-added opportunity for agricultural production, processing. Emissions Reduction Alberta.

<https://www.eralberta.ca/story/lethbridge-biogas-providing-value-added-opportunity-for-agricultural-production-processing/?fbclid=IwAR2EkKqNIhj1WnOFnuBT2ghvseQlfc7E6btBLd0sKcL6cPaRwXvCIQs3sI>

- iii) Growing Power Hairy Hills project (near Vegreville)

From 500 tonnes of cow poop a day comes biogas & ethanol. Growing Power Hairy Hills project near Vegreville.

<https://www.youtube.com/watch?v=Fbx1R207B0>

Doesn't seem to have digestate pond

MacArthur, Mary. Alta. biodigester switches from manure to municipal waste. The Western Producer. Dec 25, 2014.

<https://www.producer.com/news/alta-biodigester-switches-from-manure-to-municipal-waste/>

Dodge, David; Kinney, Duncan. Integrated bio-refinery produces ethanol, heat, power and fertilizer from 500 tonnes of cow poop per day. Pembina Institute. Oct 20, 2014

<https://www.pembina.org/blog/integrated-bio-refinery-produces-ethanol-heat-power-and-fertilizer-from-500-tonnes-of-cow-poop?fbclid=IwAR15-C6rg3CCmbN1LAu8zr09iGqf8CmNTfQA7T8ygnPFZN9a30oGou87T60>

i) Ontario

Hein, Treena. Mini-biodigester offers big output for Ontario dairy farm. Farmtario. Sept 26, 2019

<https://farmtario.com/livestock/mini-biodigester-offers-big-output-for-ontario-dairy-farm/?fbclid=IwAR2M11IclqfYObYaCAWoi8cRJ7er9cWwxuXr3r2mZ6T2NC-ZePlsJVuK2ws>

Slater, Stew. Ambitious plan aims to add 300 biodigesters. Farmtario. Sept 23, 2022

https://farmtario.com/dairy/barns/ambitious-plan-aims-to-add-300-biodigesters/?fbclid=IwAR0Msg-6Z-vmfqc1ls0E_uPOPnsp6fQt1qockyMR-NmPIT6m_vq6zblJTQ4

IV. BIOGAS PRODUCTION: IS IT TRULY GOOD FOR THE ENVIRONMENT?

Monbiot, George. How a false solution to climate change is damaging the natural world. The Guardian. Mar 4, 2014.

<https://www.theguardian.com/environment/georgemonbiot/2014/mar/14/uk-ban-maize-biogas>

Maize results in a high yield of biogas, which has led to large amounts of agricultural land now being dedicated to growing maize to supplement manure used in biogas production in countries with a large number of biodigesters. The negative effects of this are:

- *Land intended for agricultural use is being diverted to growing feedstock for biogas production*
- *Maize causes soil erosion, compaction and run-off, which threatens the fertility of the land, the health of freshwater ecosystems and put homes at risk of flooding. After harvest, maize fields tend to be left bare until spring,*
- *Maize requires a great deal of fertiliser and pesticide, which washes off into rivers and the sea.*

If you want to know where we might be heading, take a look at Germany. Two years ago Der Spiegel reported: "Subsidies for the biogas industry have led to entire regions of the country being covered by the crop...Plans called for transforming Germany into a bio-wonderland by peppering it with numerous small eco-power plants. What resulted was a revolution in the fields, a subsidised gold rush – and an ecological disaster. Corn (maize) is now being grown on 810,000 hectares in Germany." As a result, "for the first time in 25 years, Germany couldn't produce enough grain to meet its own needs".

*Lehner, Peter. Natural Gas: Promise or Peril? NRDC (Natural Resources Defense Council). June 17, 2015

<https://www.nrdc.org/bio/peter-lehner/natural-gas-promise-or-peril?fbclid=IwAR2n1-qBJLqYDleMYI0-mhGKsk-i8pdj1KwtQ0VnjJbQHAQXOoLMhjvn5Kg>

*Hard to digest: Greenwashing manure into renewable energy. Food and Water Watch Issue Brief. Nov 2016.

https://foodandwaterwatch.org/wp-content/uploads/2021/04/ib_1611_manure-digesters-web.pdf

Eller, Donnelle. Iowa company will convert cow manure into natural gas. But is it an environmental asset or hazard? Des Moines Register. Nov 15, 2017.

https://www.desmoinesregister.com/story/money/agriculture/2017/11/15/walz-energy-feedlot-biogas-threatens-outstanding-iowa-waters/800229001/?fbclid=IwAR3eiNhBCgxog_7DGHSw7NBL_ox8hksqdhDxvHA_o8yoLXO_16oH8e46j7w

McKenzie, Jessica. The misbegotten promise of anaerobic digesters. The Counter. Mar 12, 2019

https://thecounter.org/misbegotten-promise-anaerobic-digesters-cafo/?fbclid=IwAR2etz0Vt9M2bBA3_vZ7EziG_qE7bBoUH101_GvartTC8t4KtKjrk5gwi7M

Clauss, Tina; Reinelt, Torsten; Rensberg, Nadja. Fugitive emissions at biogas plants and possible mitigation. EvEMBi (Evaluation and Reduction of Methane Emissions at biogas plant concepts) Workshop – Quantification of GHG emissions from biogas plants, Brussels. Jan 29, 2020.

https://acrobat.adobe.com/link/track?uri=urn%3Aaaid%3AAscds%3AUS%3Aeba4489d-e8f8-3fcc-896d-38d337aae511&fbclid=IwAR0H9t4C-cuLWBpBukJ8cjrBqOzGazR_r7LqqPpjSYsXa00K9AioPMrr_4g&viewer%21megaVerb=group-discover

Roberts, David. The false promise of “renewable natural gas”: It’s no substitute for shifting to clean electricity. Vox. Feb 20, 2020.

<https://www.vox.com/energy-and-environment/2020/2/14/21131109/california-natural-gas-renewable-socialgas?fbclid=IwAR1X8neadxUvRY2Fg9s5dlBwBmylegosG4FstofaYW38op4nnuLwnUqBhfU>

Woznacka, Gosia. Are dairy digesters the renewable energy answer or a ‘false solution’ to climate change? Civil Eats and Covering Climate Now. Apr 24, 2020.

https://civileats.com/2020/04/24/are-dairy-digesters-the-renewable-energy-answer-or-a-false-solution-to-climate-change/?fbclid=IwAR0fe9qhAUEg6TQJSSi6aSxwit3CMKRZ2lonf1YUAvM_UhkX8AmcXj7E9N0

Biogas and synthetic gas not the solution to polluting natural gas in today’s U.S. energy system. NRDC (Natural Resources Defense Council). Jun 15, 2020

https://www.nrdc.org/press-releases/biogas-and-synthetic-gas-not-solution-polluting-natural-gas-todays-us-energy-system?fbclid=IwAR07TIVRR9onXf9aT9kYQH_X784_Yy9BJJggEgPpHJIA06PAIIES-swWE-M

Report: The myth of “renewable natural gas” for building decarbonization. Earth Justice and Sierra Club. Jul 14, 2020

<https://earthjustice.org/feature/report-building-decarbonization?fbclid=IwAR3NGDq7G-XvIVb8KPR3g3k0Tuuxd0e9oDMnBtfK7xTI-GHQbYkLG3twkQU>

Bowman, Martin. Bad Energy? The perverse promotion of energy from food. Feedback (a UK and Netherlands-based environmental group). Sept 7, 2020

<https://feedbackglobal.org/bad-energy-the-perverse-promotion-of-energy-from-food/?fbclid=IwAR2YIMcVj-kfVuBn6AC20IQG-JS6hX8IMb62h619gTzkDiQ80nztvDSCYXw>

Feedback set out a year ago to investigate what role AD has in an optimal sustainable future, collaborating with researchers at Bangor University... We found that, at best, AD is a sub-optimal sticking plaster solution, and at worst, it is sometimes actually perpetuating the problems it claims to solve. There is undoubtedly a limited role for AD in a sustainable future, but it must be kept to a “sustainable niche” so that it does not crowd out better solutions.

Renewable Natural Gas (RNG): Reality vs rhetoric. Sierra Club North Star Chapter. Dec 8, 2020.

<https://www.sierraclub.org/minnesota/blog/2020/12/renewable-natural-gas-rng-reality-vs-rhetoric?fbclid=IwAR2ffYyNyzeJ8XnA0Kgbo4mAx5CrT8oiSzZT2A-RiKxoviC-5-I0xfJgag>

Six reasons anaerobic digesters aren’t as environmentally friendly as you think. Power Knot. Mar 1, 2021.

https://powerknot.com/2021/03/01/6-reasons-anaerobic-digesters-arent-as-environmentally-friendly-as-you-think/?fbclid=IwAR1f7V9CSDWx5dzP3qsL21bw8KbyXS9kJVURjVJbOjciNAV2wVJ_dH0zknI

Feinstein, Laura; de Place, Eric. The four fatal flaws of renewable natural gas: Gas utilities are telling tall tales about RNG. Sightline Institute. Mar 9, 2021.

<https://www.sightline.org/2021/03/09/the-four-fatal-flaws-of-renewable-natural-gas/?fbclid=IwAR1HhbTrkfxqz2irwEFaO2RbTMgTh-D3iv2AF8o844iiaEKrl1186FugdW0>

What's up with "renewable natural gas?" Fresh Energy. Apr. 27, 2021
<https://fresh-energy.org/whats-up-with-rng>

In reality, the production of RNG is as economically, resource, and process-intensive as mining fossil gas. Beyond that, transporting and burning RNG presents the same negative health, pollution, and emissions impacts as fossil gas.

In sum, because it requires a larger amount of energy for production and poses the threat of methane leakage during both production and transportation, RNG can be a backwards step on climate goals – unless the production site and the usage site are one and the same

RNG poses the same risks to human health as burning fossil natural gas. The primary ingredient of RNG is methane. When burned, methane forms nitrogen oxides and other harmful air pollutants which can lead to respiratory problems, hospitalizations, and premature death. In addition, even after treatment for injection into gas pipelines, the potential residual toxicity of biomethane has yet to be fully understood.

Biogas: Perpetuating myths. Farm Sanctuary. Apr 22, 2021.

<https://www.farmsanctuary.org/news-stories/biogas-perpetuating-myths-sustainable-industrial-agriculture-renewable-natural-gas/>

Biogas—turning organic waste into clean, renewable fuel—sounds like an attractive idea...In theory, this technology can help contribute to a more "circular economy," where the outputs of economic activity fuel future inputs...In the case of our energy and food system—biogas is a dangerous distraction. It fails to close the loop, resulting in Greenhouse Gas (GHG) emissions, water and air pollution, and unnecessary public health risks.

Regardless of its fuel source—organic or fossil—biogas production results in its own unique environmental harms: Biogas combustion creates higher GHG emissions. Gas is mostly methane, and methane combustion results in GHG emissions 25 times more potent than carbon dioxide emissions. Even if produced perfectly, biogas would still result in climate-changing GHG emissions.

Research shows leakage in 85% of surveyed biogas plants. In a survey of 964 biogas plants in the UK and Germany from 2011-2019, 85% of biogas facilities suffered leakage. If each biogas plant leaked 0.5% of its capacity, the result would be the carbon equivalent of more than 270 metric tons of carbon released into the atmosphere, per facility, per year. That's the emissions equivalent of powering 46 U.S. houses for the entire year.

Biogas isn't safe. Biogas leaks can result in an explosion, asphyxiation, or other chemical and biological hazards outlined by the biogas industry and experienced by workers and communities worldwide.

Biogas incentivizes factory farming at a scale that perpetuates human, animal, and environmental harms. And, it fails to protect local communities from the harmful effects of monoculture crop and intensive animal agriculture.

Factory farm biogas threatens human health, using excrement from CAFOs to create methane. This waste, containing more than 150 zoonotic pathogens, contaminates communities' groundwater at levels that far exceed Safe Drinking Water Act limits. The land and air are also polluted, causing neighbors to suffer from respiratory and other ailments.

Factory farm biogas disempowers citizens and communities. Big Ag is using their political power to pre-empt community decision-making:

Industry interests in Missouri used state laws to override local control over CAFOs, preventing communities from having a say in protecting their air and water quality, and After eliminating local control in 2010, Iowa has seen a more than 1900% increase in CAFOs.

Ralton, Gemma. Biogas emissions could risk Net Zero targets, a recent study warns. Imperial College London. May 26, 2021

https://www.imperial.ac.uk/news/222213/biogas-emissions-could-risk-net-zero/?fbclid=IwAR087apQ9D9_6Jw68Oqz4_3WmxwZgIN9phtLfIYAktq3fABSOkqZRsdos

The team suggests that biogas plant emissions should be monitored on a daily basis in order to determine how emissions vary depending on site activities and meteorological variations, with more strict legal requirements.

Baur, Gene. Big Ag's biogas boondoggle. Sentient Media. Aug 30, 2021

https://sentientmedia.org/big-ag-s-biogas-boondoggle/?fbclid=IwAR2l4_efZXzzJmHf-gjgwLx50XR-8_4wgeSGMWhfMwEsJ60i9gCgvKVFkIc

Spector, Rebecca; Murawski, Dashed. The dairy digester dilemma: A false climate solution. Center for Food Safety. Oct 4, 2021.

https://www.centerforfoodsafety.org/blog/6457/the-dairy-digester-dilemma-a-false-climate-solution?fbclid=IwAR0fe9qhAUEg6TQJSSi6aSxwit3CMKRZ2lonf1YUAvM_UhkX8AmcXj7E9N0

McNair, Stephen. Green dilemmas; the Deal Farm story. Environment Norfolk. Jan 3, 2022

<https://eastangliabylines.co.uk/biodigesters-and-the-community-the-story-of-deal-farm/?fbclid=IwAR0zYUepcF-LFx2ZY8REZK7tjZV0bgh2QpienYBtQij0F6UUUv1Osy0p0Ek>

Responses to the climate crisis bring conflicts between green projects and local interests. The Deal Farm biodigester is a case study. For its advocates it will reduce global warming, converting agricultural waste into clean gas, liquid CO2 and fertiliser. For its opponents it will generate unmanageable levels of traffic, encourage unsustainable agricultural practices and cause environmental damage. They also believe that the developers have tried to bypass proper planning regulation by repeatedly changing the plans.

Douglas, Leah; Groom, Nichola. Insight: Biden spending bill ignites debate over dairy methane pollution. Reuters. Jan 11, 2022

Interesting article where some environmentalists and Democratic lawmakers are concerned that tax credits and grants for manure-based methane gas production could incentivize larger farming operations, thereby actually increasing greenhouse gas emissions, and working against environmental goals.

**Splitter, Jenny. America has a manure problem, and the miracle solution being touted isn't all that it seems. The Guardian. Jan 20, 2022.

https://www.theguardian.com/us-news/2022/jan/20/manure-natural-gas-pipeline-factory-farms-greenwashing?fbclid=IwAR1ldRKfBrvLOILD8JJPYqZX_Sx7iL792FosHweZhHNTWh8AWIeNg87IVIo

Comments on the climate impacts of RNG. Michigan Food for All and the Earth Partners. Mar 9, 2022.

https://drive.google.com/file/d/16fNnpl86_GSVtZT7aLPoQynDdpbYaPOm/view?fbclid=IwAR0RiX5aY_KXTTln21bEnTWL2xj5fs5vkLIUr78LlKNJODJMsX2kMLWLVam4

Anaerobic digesters. Energy Justice Network.

<https://www.energyjustice.net/digesters?fbclid=IwAR26qPu8P5vJgXU9BfL0meROOn65FMYwXR3MaGTEGsUne5uFFzWTXTLn0el>

Digesters are only marginally effective at reducing problems with odors, pathogens and greenhouse gas emissions from animal waste or sewage sludge, but they are incapable of making any chemical contaminants in the wastes go away. Digesters aren't emissions-free. They are known to emit nitrogen and sulfur oxides, particulate matter, carbon monoxide and ammonia.

Living next to a digester could be unpleasant, particularly if located in a residential neighborhood or if the facility would be large -- attracting manure-hauling trucks from around the region.

Oglesby, Cameron. 'This plan is a lie': Biogas on hog farms could do more harm than good. Popular Science. Apr 3, 2022.

https://www.popsoci.com/environment/biogas-harm/?amp&fbclid=IwAR1fHDMRI7ihQKDrozebOHNuWDmc1XQVP04JCFo2WetSSIEWG_mfpZXQ4mY

** Biodigesters: good or bad for the Environment? Sept 26, 2022. Power Knot

https://powerknot.com/2022/09/26/biodigesters-good-or-bad-for-the-environment/?fbclid=IwAR0X6uQd8RtjblYHH1izCDu-2Mz3ZoD6_tlQRRDRsCIHHxLLLxbiiZmCpiY

Info needs to be checked against other sources, as this is an aerobic biodigester sales company,

Layton, Greg. Debunking Delaware biogas: The truth behind industry lies. Food & Water Watch. Sept 28, 2022.

<https://www.foodandwaterwatch.org/2022/09/28/debunking-delaware-biogas-the-truth-behind-industry-lies/>

Anaerobic digesters place plant or animal waste in an oxygen-free environment with microorganisms. The microorganisms feed on the waste, releasing methane and other gasses. While the "biogas" methane gets sold and burned on the fossil fuel market, what remains after anaerobic digestion must still be disposed of. Companies give these remains a healthy-sounding name like "digestate," "biofertilizer" or "compost" to sell them to farmers. But they aren't healthy at all. Most of the harmful pollutants found in poultry waste remain in the resulting "digestate." Nonetheless, farmers who buy the "digestate" will dump it on their fields. But there, it can leach into groundwater and run off into rivers, streams and bays. Because of the pollutants left in the digestate, it wreaks the same environmental havoc as the undigested waste currently harming Delaware's waters.

** Werkneh, Adhena Ayaliew. Biogas impurities: environmental and health implications, removal technologies and future perspectives. Heliyon, Oct. 8, 2022. Published online Oct 2, 2022. National Library of Medicine: National Center for Biotechnology Information.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9589174/?fbclid=IwAR1EY7oclK68rmFaA70bhrOMH0SuBYmcGU-hzqajWtxE0oSrCaMrbMCcac>

Gittelsohn, Phoebe; Diamond, Danielle; Henning, Lynn; Payan, Maria; Utesch, Lynn; Utesch, Nancy. The false promises of biogas: Why biogas is an environmental justice issue. Environmental Justice. Vol 15, No. 6. Dec 12, 2022.

<https://www.liebertpub.com/doi/10.1089/env.2021.0025>

Lecoivre, Claire. Big business wants in on methanisation. Le Monde Diplomatique. Dec, 2022 edition.

<https://mondediplo.com/2022/12/10methane>

France has moved away from small farm-based biodigesters, in favour of large plants that produce biomethane for the national grid. The author refers to studies that underline the negative impact of methanisation on human health, its high water consumption and the pollution it creates. According to some sources, up to 5% of methane produced may also be lost through leaks etc, but there has been little research to confirm this.

All over France, people are protesting against the environmental damage methanisation causes. A subject of debate is whether spreading digestates on fields is bad for the soil. There isn't enough data yet to be sure. Sophie Sadet Bourgeteau, author of a study on this, says, 'It's hard to say what specific impact digestates have on soil microbiology. There are many different protocols and many different kinds of digestate, and the soil they are spread on varies considerably. Spreading timeframes vary, as do methods. The debate is intense, but it's based on very little data.

In Germany, which had more than 10,000 methanisation plants in 2019, nitrogen levels are too high in 36% of groundwater, and phosphorus levels too high in 77% of surface waters.

Fu, Jessica. Brown gold: The great American manure rush begins. The Guardian. Feb 2, 2023.

https://www.theguardian.com/environment/2023/feb/02/manure-renewable-natural-gas-california?fbclid=IwAR29rOxxZyai5gKz4i3dhR_ph724eckuFa_GPDM_CHsNEKa9yJzN1Nkluj4

...the past few years have seen a surge in public and private investment into poop-to-energy infrastructure in the US. Though so far concentrated in states with dominant dairy sectors, like California, Wisconsin and New York, Biden's landmark climate law passed last summer stands to unleash additional billions to support further development nationwide. **The sector's boosters describe it as an elegant way to cut emissions from both livestock and transport; but critics worry that the nascent industry could raise more issues than it resolves by entrenching environmentally harmful practices.**

Animal agriculture is the nation's single biggest source of methane, a greenhouse gas that climate scientists call a "super pollutant" due to its high short-term warming potential. The gas is released from animals when they burp, and through the decomposition of manure when collected in open-air ponds, a common livestock industry practice. But those emissions are also a potential moneymaker. **Methane from animal waste can be purified into a product virtually indistinguishable from fossil fuel-based natural gas. Marketed as renewable natural gas (RNG), it has a unique profit-making edge: in addition to revenue from the sale of the gas itself, energy companies can now also earn handsome environmental subsidies for their role in keeping methane out of the atmosphere... Over the past few years, energy giants like Shell, BP and Chevron have all announced dairy industry partnerships.**

Cantú, Aaron. California's methane climate solution rewards dairy gas. Other states take a harder line. Capital & Main. Apr 26, 2023

<https://capitalandmain.com/californias-methane-climate-solution-rewards-dairy-gas-other-states-take-a-harder-line?fbclid=IwAR0pdp8XIRWIBHjH5wS3Fwg2umLGNhXInchbToBBEL6AkN8iauDHYPtXnhQ>

One of the most bountiful sources of renewable biogas is livestock. California, the top milk-producing state in the country, sees the manure produced by its 1.7 million dairy cows as a renewable solution because cows constantly churn out waste, and it's considered clean because the state assumes the captured gas would otherwise go into the atmosphere.

Over the last 10 years, California has paid farmers and companies more than half a billion dollars to collect and refine cow manure vapors, raising concerns that the state is encouraging larger herds. The process has helped reduce the state's emissions, but has come at the cost of farming communities that suffer the effects of dairies polluting air and water.

Biogas emits carbon when it's combusted as a fuel, yet is still better for the climate compared to fossil gas. However, they share the same risks when they're refined and combusted. Both emit

pollutants when burned in a car or on a stove. And research shows biogas leaks significantly during collection and refining. This releases methane, a greenhouse gas that traps more heat in the atmosphere than carbon dioxide, straight to the atmosphere...

Depending on your perspective, this setup represents a climate solution or a market distortion. California's Low Carbon Fuel Standard (LCFS) program treats dairy gas as a better climate solution than electricity made from wind or solar energy. Climate groups, policy makers and other experts are challenging this approach, arguing that the state must instead regulate dairies as sources of harmful pollution...

By propping up biomethane, California has buttressed an industry that may be worse for the climate and local environments than policymakers initially assumed.

Saxifrage, Barry. Renewable Natural gas-lighting and you. Canada's National Observer. May 3, 2023.

<https://www.nationalobserver.com/2023/05/03/humour/renewable-natural-gaslighting?fbclid=IwAR0A6JZ346I-UWSrBF5zE1crvH2j-KkiGSxGUirU20hNIJV9wFwyJmfmtYU>

Donoghue, JJ. Controversial plans for huge biogas plant in Keynsham to be decided by planning inspectorate. BristolLive. Aug 10, 2022.

https://www.bristolpost.co.uk/news/bristol-news/controversial-plans-huge-biogas-plant-7445679?fbclid=IwAR0jx290jggkeCfooW70rLegsZpeH_j0iZCOAHSKkYbqSedrJloSpoLlvQg

"We are concerned that air pollution from the digester plant could be impact on Stockwood Ward. In addition, we are concerned about emissions of bioaerosols, which are micro-organisms made up of organic dust, fungal spores and bacteria which can seriously damage human and animal health," it said.

*REAL have claimed that the scheme would save more than 6,000 tonnes of CO2 every year, although planning officers for BANES have pointed out that **the 81,000 tonnes of CO2 which would be emitted during the plant's construction would take 24 years to offset. Officers also said that, although the plant would contribute two per cent to the council's renewable energy target, the proposal would "not save more emissions from renewable energy generation than it creates from its annual operation alone".***

V. ODOUR ISSUES WITH BIODIGESTERS

1. General Information on odour issues with biodigesters

*Levey, Michael. Methods to control odours from anaerobic digester plants and prevent nuisance to nearby communities. Water Online. Nov. 29, 2016
https://www.wateronline.com/doc/methods-to-control-odors-from-anaerobic-digester-plants-and-prevent-nuisance-to-nearby-communities-0001?fbclid=IwAR2Id0E-raFIURHWu_skAAkQPa_ik6qTp8oYlymPODkhCEpfgMcPWWl4gpY

Odour guidance for on-farm anaerobic digestion. Province of Ontario.
<https://www.ontario.ca/page/odour-guidance-farm-anaerobic-digestion>

A regulation under the Nutrient Management Act, 2002, (NMA) requires specified owners of regulated mixed anaerobic digestion facilities to ensure that an odour management plan (OMP) is prepared by a professional engineer for their facility, and that this plan be prepared in accordance with the most recent version of the “Best Management Practices for Industrial Sources of Odour” and “Odour Guidance for On-farm Anaerobic Digestion” documents.

On-farm AD facilities continue to grow in number and size, giving farmers more ability to increase revenue and participate in renewable energy markets. However, AD facilities can be a source of odour emissions. Excessive odour can impact neighbouring properties and lead to complaints from nearby residents and businesses.

The main goal of an OMP is to avoid significant odour emissions and their impact on neighbours and other odour receptors. The occurrence of a significant odour emission is assessed on a case by case basis by an Agricultural Environmental Officer (AgEO). An AgEO could consider the following factors when assessing if an odour is a significant emission:

- *strength, intensity and offensiveness of the odour emissions*
- *number of odour receptors affected*
- *size of geographic area affected*
- *frequency and duration of the odour emissions*

How to prevent or reduce the odors of a biogas plant? Biogas World. Nov 28, 2018
<https://www.biogasworld.com/news/prevent-reduce-odors-biogas-plant/>

Odour monitoring in biogas projects. OSIL Air Pollution Control. Mar 18, 2021
<https://www.osilt.com/odour-monitoring-in-biogas-projects/?fbclid=IwAR03U8Ofw6NDMI2Q0tSJlXyWYrYmSX0nPUWcniibAETMI9PhtGHEaBrh86w>

Anaerobic Digestion: biogas production and Odor reduction. Penn State Extension.
<https://extension.psu.edu/anaerobic-digestion-biogas-production-and-odor-reduction>

A potential disadvantage of anaerobic digestion include:

- *Much of the nitrogen in raw manure is converted from its organic form to ammonium. Ammonium can be transformed to either ammonia or nitrate. Ammonia can be lost from unincorporated, field-applied manure. Nitrate can be leached through the soil and may eventually reach groundwater.*
- ***Field application and management to reduce nitrogen losses may be more demanding for digester effluent than for untreated liquid manure.***

Replacing tradition with innovation in the biogas industry – creating sustainable business value. Mellifiq.

https://mellifiq.com/biogas-plants/?fbclid=IwAR1fLlUhgE9O2rX9UEdxadQbsGumb_kld9Fz6SrMDWhYFrXtajiGgG5pV2o

*At each stage of the biogas production process, sulfur compounds and ions are commonly present. These compounds are often responsible for a variety of issues affecting the overall performance... As a result, the yield of methane production is reduced while the production of reduced-sulfur compounds, such as H₂S, is favored. When high concentrations of H₂S are released from the digester, the process may cause odor and corrosion problems. **In particular, odor problems are common in biogas plants, since H₂S has one of the lowest odor thresholds known, making the human nose very sensitive even to trace concentrations... Thus, even a small leak in the process lines or an opening in a process step may create an odor issue for a large area, since the emitted gas needs to be diluted up to 200 000 times before the odor is masked.** The article talks about pre-treatment and treatment options to create a greater production output.*

Do anaerobic digester plants smell? Birch Solutions. Jan 28, 2022

<https://birchsolutions.co.uk/do-anaerobic-digester-plants-smell/?fbclid=IwAR0b1bP85KFG-Lsu2xZ4WC07BYpWvWxvtTywpDVoMn0JqbibCy41RVR6oOo>

It is important to ensure all processes on a plant take place in enclosed buildings or containers, and these are often kept in negative air pressure states to draw in any odours rather than allowing them to escape. Air can then be ventilated via scrubbers or filters that remove the odorous particles. Of course, odour management isn't just a product of the design of the plant. The location of the plant is key too, with planning permission unlikely to be granted for large, commercial biogas plants near to residential areas.

On demand workshop: Odor management at anaerobic digestion facilities. American Biogas Council. Apr 4, 2017.

<https://americanbiogascouncil.org/odor-management-at-anaerobic-digestion-facilities/>

Topics: odor sources at anaerobic digestion plants; odor control technologies; management strategies to minimize odors; how to develop proactive odor management outreach programs.

2. Biodigester Odour Problems: Examples from the United Kingdom, the United States, and Canada

A. United Kingdom

i) Ballymena

McNabb, Rachel. Residents complain over foul odours from plant. Ballymena Guardian. Jan 17, 2019

<https://www.ballymenaguardian.co.uk/news/2019/01/17/gallery/residents-complain-over-foul-odours-from-plant-2904/>

ii) Keynsham

Britten, Elise; Summer, Stephen. Fear 'putrid and vile' smell will be made worse by new biogas plant plans. Somerset News. Oct 18, 2019.

https://www.somersetlive.co.uk/news/somerset-news/fear-putrid-vile-smell-made-3436624?fbclid=IwAR38eE02xnpPK9vu24ZMfH9N40Bmr_Q7shMv6_1BIF29yGQRjiCrOpebjYs

Residents fear the "putrid" smell they say is already emanating from a biogas energy site will be made even worse by a new plant being planned.

iii) Basingstoke

Evans, Ryan. Councillors call for anaerobic digester to close after odour pollution reported. Basingstoke Gazette. Feb 13, 2020

<https://www.basingstokegazette.co.uk/news/18233295.councillors-call-anaerobic-digester-close-odour-pollution-reported/>

iv) Malaby

Baker, John. "unpleasant smells" from Malaby Biogas plant concern locals. Wiltshire Times. Jun 15, 2022.

<https://www.wiltshiretimes.co.uk/news/20212162.unpleasant-smells-malaby-biogas-plant-concern-locals/?fbclid=IwAR1KnfkbkoczCu5WtDZ0hUWljQ7xfWt892Xcl68LdTMKR3UoNm6nghXh4>

v) Beccles

Brown, Bruno. Critics slam plans for anaerobic digester near Beccles. Beccles & Bungay Journal. Dec 19, 2022

https://www.becclesandbungayjournal.co.uk/news/23201302.critics-slam-plans-anaerobic-digester-near-beccles/?fbclid=IwAR2EVXMveUKAFRYIINQUUTsolZcNcrbApwgZ-zo6uQLXT42bHXv_s1ja0nM

Existing plant in Ellough already causes an unpleasant odour, prompting fears over an even worse stench.

Defalco, Daniel. Plans to be submitted for new renewable fuel plant on the outskirts of Beccles. Suffolk Live. Mar 22, 2022

https://www.suffolklive.com/news/renewable-fuel-plant-plans-beccles-6840782?fbclid=IwAR098TJUx5r_bKdDrO4tq_nbF79_DLjHVNDI_DDyekOmFuFY8_8YvunyyA

vi) Banbury

Edwards, Roseanne. Residents in villages north of Banbury are fighting back against plans for a huge biodigester in the countryside. Nov 8, 2022. The Guardian

https://www.banburyguardian.co.uk/news/people/residents-in-villages-north-of-banbury-are-fighting-back-against-plans-for-a-huge-biodigester-in-the-countryside-3909940?fbclid=IwAR3888r3OqMDSmlDROxk5itkc6NgvJwsKfVDZIVojLo6hwoDZDx9WOxJ_zU

Edwards, Roseanne. Banbury to be tanker 'hub' for four giant anaerobic – digesters – protesters describe the plan as 'greenwashing'. Banbury Guardian. Nov 29, 2022.

<https://www.banburyguardian.co.uk/news/environment/banbury-to-be-tanker-hub-for-four-giant-anaerobic-digesters-protesters-describe-the-plan-as-greenwashing-3934803>

Objectors describe the plan as 'greenwashing' and say millions of pounds in government funding would leave the UK for the company owners in Spain while their area would suffer pollution and disturbance from gas production...

When asked what mitigation measures there were for the offensive odours produced 24 hours a day, the biodigester representative responded that his own home is 500 metres from a similar plant and he 'has become used to the smells...

vii) Wardley Colliery, South Tyneside

North East Company fined thousands for odour issues. GOV.UK Press release. Mar 2, 2023

<https://www.gov.uk/government/news/north-east-company-fined-thousands-for-odour-issues>
Anaerobic digestion plant at Wardley Colliery, South Tyneside was fined for breaching its odour management plan leading to unregulated and smelly gases being released into the air and impacting local residents.

Holland, Daniel. Investigation launched over 'foul smell' from Tyneside waste plant after MP's complaint

<https://www.chroniclelive.co.uk/news/north-east-news/investigation-launched-over-foul-smell-27294284omplaint>. Newcastle Chronicle. Jul 10, 2023.

An investigation was launched into foul smells from a biogas plant which has already been fined earlier in the year, for failing to control odours coming from the anaerobic digestion plant...

viii) Rothwell, Northamptonshire

Waste plant to expand despite 'disgusting smell'. BBC News. May 17, 2023

<https://www.bbc.com/news/articles/cv240e5044xo>

A controversial anaerobic digestion plant in Northamptonshire is set to expand despite years of complaints from residents about the "absolutely disgusting" smell from the plant.

B. United States

i) Wisconsin

Waunakee, Wisconsin

Boullion, J. New 3 million gallon manure digester has robust spill controls, county says. *Renew Wisconsin*. Dec 16, 2013

<https://www.renewwisconsin.org/new-3-million-gallon-manure-digester/>

"A new biodigester that is being loaded with millions of gallons of manure is designed differently from one that leaked 300,000 gallons of animal waste near Waunakee last month...The spill occurred when a pipe outside the digester's containment berm ruptured for undisclosed reasons when no employees were present, no alarm system was triggered and no automatic shutoff valve stopped the flow. It was the second spill in the Lake Mondota watershed this year."

Glaze, Jeff; Verburg, Steve. Waunakee manure digester has second spill in 2 months; company now says it has a fix. *Ag Update*. Jan 22, 2014

https://agupdate.com/news/local/environment/waunakee-manure-digester-has-second-spill-in-2-months-company-now-says-it-has-a/article_7a89ed83-bc26-581d-9d83-db9ff707413c.html

Verburg, Steve. Accident-prone manure digester near Waunakee springs its third leak in five months. *Wisconsin State Journal*. Mar 13, 2014

https://agupdate.com/news/local/environment/accident-prone-manure-digester-near-waunakee-springs-its-third-leak-in-five-months/article_a6e27588-0625-525c-87f8-a40b559be4f7.html

Blast destroys roof of troubled biodigester near Waunakee. *Wisconsin State Journal*. Aug 6, 2014

https://madison.com/news/local/environment/blast-destroys-roof-of-troubled-biodigester-near-waunakee/article_4e5a7c0a-3a39-5b90-a225-b99dabfd37d1.html

Bergquist, Lee. State-financed manure digester plagued by spills, explosion. *The Journal Sentinel*. Jan 29, 2015

<https://archive.jsonline.com/news/statepolitics/state-financed-manure-digester-plagued-by-spills-explosion-b99435123z1-290263421.html/>

b. Holland, Wisconsin

Bergquist, Lee. Walker administration project to battle manure pollution has been hit by delays. *Milwaukee Journal Sentinel*. Jun 24, 2019

<https://www.jsonline.com/story/news/2019/06/24/walker-project-battle-manure-pollution-has-been-hit-delays/1512919001/>

The \$65 million project in Holland, Wisconsin has languished as citizens have raised worries about odors, potential spills and the scale of the project. Among the concerns raised in the Town of Holland were the problems reported at other facilities in the United States, including a 2014 incident in Waunakee, in Dane County, that caused a fire and methane explosion.

ii) Minnesota

Shaffer, David. Slow, stinky start to Le Sueur, Minnesota, green energy project. *Star Tribune*. Oct 17, 2015.

<https://www.startribune.com/slow-stinky-start-to-le-sueur-minn-green-energy-project/333334521/>

Nearly two years after going online, an innovative, municipally owned power plant that burns methane from agricultural waste is generating only a fraction of its promised electricity. The \$45 million plant... **also is producing something its promoters said it wouldn't — stink.**

iii) Michigan

a) Lowell

DeSarro, Nina. Lowell Light and Power work to find solution to biodigester smell. WZZM13. Jul 13, 2016

https://www.wzzm13.com/article/news/local/lowell/lowell-light-and-power-work-to-find-solution-to-biodigester-smell/69-272072115?fbclid=IwAR2dNJm2nhnKtluyRibHBHFdHK9l_EOczqKUdg4-mIChulV1kf2ysTg8nA4

Initially, the community embraced the idea, because this biodigester is the only one of its kind in the United States. However within the past 18 months, residents said a foul smell from the facility has seeped into their neighborhoods.

Biolchini, Amy. Oozing waste, near-explosion at Lowell biodigester brings DEQ scrutiny. Nov 29, 2016

https://www.mlive.com/news/grand-rapids/2016/11/oozing_waste_near-explosion_at.html?fbclid=IwAR1cqn_Kg6EWvWkbTHv0SJLE74_PaN59S5XHqxyP2JZSAv-54IHWJSSAGpY

*When police responded to the biodigester **to investigate an odour** they found sludge oozing out of the doors of the facility, flowing over the ground, across the pavement towards a storm sewer drain. Built-up methane gas had caused the tank's membrane cover to rupture. In addition to this incident, **this facility has been fined eight times for nuisance odours.***

Smelly Lowell biodigester shuts down for good. Mlive Michigan. Feb 20, 2018.

https://www.mlive.com/news/grand-rapids/2018/02/smelly_lowell_biodigester_shut.html

b. Holton

Dawson, Phil. Digester told to cover smelly lagoons in Holton. WZZM13 News. Aug 16, 2019

<https://www.wzzm13.com/article/news/digester-told-to-cover-smelly-lagoons-in-holton/69-d7715bd8-9041-4c6d-b2be-4dcb95fc77f0>

Neighbors say two lagoons full of foul smelling liquid “digestate” are ruining their quality of life and enjoyment of their community. Chemicals added to the digestate in the lagoons didn't work. Regulators requiring the digester owner to install covers on the lagoon.

iv) Colorado

Neighbors say stench from Heartland Biogas plant in Weld County is so bad, it wakes them up at night. Denver7 News. Sept 21, 2016.

https://www.denver7.com/news/local-news/neighbors-say-stench-from-heartland-biogas-plant-in-weld-county-is-so-bad-it-wakes-them-up-at-night?fbclid=IwAR3ntDURfxEwt_MiFdsPNb_4fYUIRwN4QsHIPhsFXTJar_ZCYqQc9p6Ah10

Hood, Grace. Fed up with the smell, neighbors want the Weld County Biogas project shut down. CPR News. Dec 16, 2016
https://www.cpr.org/2016/12/16/fed-up-with-the-smell-neighbors-want-the-weld-county-biogas-project-shut-down/?fbclid=IwAR3eiNhBCgxog_7DGHsw7NBL_ox8hksqdhDxvHA_o8yoLXO_16oH8e46j7w

Marmaduke, Jacy. Waste-to-energy facility brings smelly complications. Coloradoan. Jan 15, 2017
<https://www.coloradoan.com/story/news/2017/01/16/waste--energy-facility-brings-smelly-complications/96538924/?fbclid=IwAR1nwiCuVsWZY6vkjQ3JX5qTHCdF6fOUhm6Cz8MDQ4-OeUCQSSORSJX5X24>

Weld County's Heartland Biogas facility, a \$115 million anaerobic digester that turns cattle manure and food waste into renewable biogas, was supposed to be the 21st century's answer to a burning question: What the heck do we do with all our waste? And it still could be. But for now, the facility is embroiled in a lawsuit with the county after commissioners suspended its permits last month, citing hundreds of odor complaints and a paperwork issue.

Ducassi, Daniel. \$100M lawsuit over smelly Weld County fertilizer plant can go ahead after high court declines to hear appeal. The Colorado Sun. Sept 8, 2021.
<https://coloradosun.com/2021/09/08/weld-county-biogas-cert-denied-colorado-supreme-court/>

v) Ohio

**Bishop, London. Council pens letter of concern to Ohio EPA. Fairborn Daily Herald. Mar 2, 2021.

https://www.fairborndailyherald.com/2021/03/02/council-pens-letter-of-concern-to-ohio-epa/?fbclid=IwAR22ThXF464_Umuo2zvz15Jmd2qF2GcMn-mRRRLXFUjgJJVHuNQ2aKK2tcQ

According to the letter, the council receives "daily" complaints about the biodigester's operation and the smell coming from the storage pond near it. These complaints range from homeowners being unable to open their windows or go outside, to adverse physical reactions requiring medical attention...

*In December 2020, citizens filed a class-action lawsuit regarding the biodigester, calling the odor a public nuisance. **Bath Township is engaged in several other lawsuits directly or in reference to the biodigester, regarding both the smell and alleged zoning violations of the facility.** These cases are currently in litigation.*

Welter, Chris. Ohio AG's office sues companies that run local biodigester for unpermitted emissions of ammonia. 91.3 WYSO. Apr 22, 2022
https://www.wyso.org/local-and-statewide-news/2022-04-22/ohio-ags-office-sues-companies-that-run-local-biodigester-for-unpermitted-emissions-of-ammonia?fbclid=IwAR1FkS-Py98WdOrIFtA2FjIGuyG7jG0a3O0vM_n5borLqFjwU6PPO3n5_Kg

The State of Ohio is suing two companies that run a biodigester in Greene County. The state alleged in the complaint that an open concrete tank at the facility in Bath township emits "unpermitted" levels of ammonia.

**Bishop, London. Ohio sues Renergy again over EPA violation claims. Dayton Daily News. Jun 15, 2022

<https://www.daytondailynews.com/local/ohio-sues-renergy-again-over-epa-violation-claims/GINQDV7DDJGPDILFBEMA7QVI74/?fbclid=IwAR0pE7wkM9XttnSTvUuaSn3FCebH9MIIESN4q9M8udSN4Un0po0bQn7mHWk>

The lawsuit against three Renergy properties, the Dovetail biodigester in Greene County, Emerald Bioenergy in Morrow County and Steamtown, which treats digestate from both Dovetail and Emerald, alleged that:

- *all failed to maintain adequate freeboard in their digestate ponds, creating a risk of overflowing.*
- *odor nuisance violations at Dovetail Bioenergy. Between September 2021 and April 2022, the Ohio EPA has conducted 40 odor surveys and detected odors from “mild to nuisance” levels on 19 of them, court documents say.*
- *dovetail failed to report data that demonstrated pathogen reduction and inaccurately reported the amount of digestate material that was transferred and applied to land*

Bishop, London. State asks court to find biodigester company in contempt over Morrow County site. Dayton Daily News. Sept 6, 2022.

Improper storage of untreated organic waste posing threat to water.

vi) California

Cantú, Aaron. How a California dairy methane project threatens residents’ air and water. Capital & Main. Apr 20, 2023

<https://capitalandmain.com/how-a-california-dairy-methane-project-threatens-residents-air-and-water?fbclid=IwAR24a47mv-NpuCC9NHGobClPaR1xl4ZgfH6y0YjTqSz9CqGjby4aemhQl4>

vii) Oregon

Loew, Tracy. 2 Oregon dairy manure digesters cited for air quality violations. Salem Statesman Journal. Dec. 22, 2021

<https://www.statesmanjournal.com/story/news/2021/12/22/2-oregon-dairy-manure-digesters-cited-air-quality-violations/8985904002/?fbclid=IwAR1rCfIXGhboTUIUIVe3iX1DcC2KySuJjAVMIewvTPvtiapXp-sFSiPnAIU>

The WOF PNW Threemile Project in Boardman was fined for exceeding its limit for fine particulate matter emissions, which can contribute to human health problems including chronic bronchitis, irregular heartbeat, decreased lung function and respiratory distress. Farm Power Misty Meadow in Tillaook was fined for failing to operate a combustion flare, allowing air pollutants including volatile organic compounds and methane to be emitted at uncontrolled rates.

C. Canada

i) Ontario

a. Kirchmeier Renergy

****Nicholson, John.** Ontario: Fines issued to anaerobic digester companies related to odour complaints. Advanced Waste Solutions. Jan 10, 2020

https://advancedwastesolutions.ca/2020/01/10/ontario-fines-issued-to-anaerobic-digester-companies-related-to-odour-complaints/?fbclid=IwAR248tXSz3Xfy9OfQP5cQBa8pb_5pudVcgf7c-v5gXtfiEmYttm91Tk7hiY

The Ontario Ministry of the Environment, Conservation, and Parks (MOECP) continues to actively prosecute anaerobic digester companies for odour issues. *The Environment Ministry recently issued news releases detailing the latest convictions, of Kirchmeier Renergy Inc and Stormfisher Environment Ltd.*

a. Stormfisher Environment Ltd. of London

Environmental company fined \$50,000 and issued court order for Environmental [Protection Act violations](#). [Government of Ontario bulletin, Dec. 16, 2019](#)

<https://news.ontario.ca/en/bulletin/55130/environmental-company-fined-50000-and-issued-court-order-for-environmental-protection-act-violations>

The convictions relate to permitting a discharge of odour into the natural environment that was always likely to cause an adverse effect and for failing to comply with a ministry approval by failing to keep facility doors closed.

Bieman, Jennifer. Environment ministry slaps London waste plant with 11 charges. The London Free Press. Jun 22, 2018.

<https://lfpres.com/news/local-news/environment-ministry-slaps-london-waste-plant-with-11-charges>

Ontario's Ministry of Environment and Climate Change has charged Stormfisher Environmental Ltd. with 11 provincial offences: 7 counts of discharging a contaminant, namely odour, into the environment on seven different dates, 2 counts of failing to keep doors at the facility closed at all times, 1 count of not having equipment required to cope with a power failure, and 1 count of failure to notify the ministry about a spill and the actions taken to fix it.

London city hall hopes odour fines will pass the sniff test. Global News. Feb 22, 2018.

<https://globalnews.ca/news/4040651/london-city-hall-hopes-odour-fines-will-pass-the-sniff-test/>

London's Community and Protective Services Committee has recommended fines of up to \$50,000 per day for the first offence plus a special fine of \$50,000. A second offence would set the daily maximum fine to \$100,000. City staff will use a field olfactometer for odour detection. The device is used to measure and quantify odour strength in the surrounding ambient air. Adding odours to London's nuisance bylaw is largely a response to concerns regarding Stormfisher, a biogas company, and a composting facility.

- b. Wessuc Inc of Brantford
Liquid waste management company fined \$60,000 for Environmental Protection Act Violations. Government of Ontario Court Bulletin. Sept 10, 2021

<https://news.ontario.ca/en/court/1000797/liquid-waste-management-company-fined-60000-for-environmental-protection-act-violations>

The convictions relate to three incidents of Wessuc Inc of Brantford, Ontario, spreading digestate material on land not approved to receive these products

- c. Maitland
Lowrie, Wayne. Mayor can't support biogas plant. Recorder & Times, National Post. Sept 16, 2021

<https://www.recorder.ca/news/mayor-cant-support-biogas-plant>

*Mayor says he can't support the proposed biogas plant near Maitland after receiving a "shower of emails" from residents who raise legitimate concerns about smells and increased truck traffic. "Speaking to his council this week, Malanda said the residents' opposition, **reports of foul odours from similar but smaller plants elsewhere in Ontario, other municipalities' frustration at their inability to do anything about those biogas facilities and questions about the accuracy of the company's submission to the Ministry of the Environment give him "grave concerns."** "It appears to be the wrong plant for the wrong site," said Malanka." Their council decided to hire an engineering firm to do an independent study of the proposal, including residents' concerns.*

"In a recent statement, the Ontario Ministry of the Environment, Conservation and Parks said it "continues to actively prosecute anaerobic digester companies for odour issues"...

I am having grave concerns that, should the experience at other similar plants in Ontario occur here, residents could see their property values fall and have their ability to enjoy their properties degraded," the mayor said. "But more than that, should the area here be exposed to foul smells in a worst-case scenario, the current plans of the township to attract residential, commercial and industry development could be at risk." Malanka said a foul-smelling plant could also affect tourism.

- d. Georgian Bluffs and Chatsworth
Taylor, Randy. Letter: Bio-digester should be shut down. The Hub, Owen Sound. Aug 10, 2014

<https://owensoundhub.org/letters/337-letter-bio-digester-should-be-shut-down.html?fbclid=IwAR2YIMcVj-kfVuBn6AC20IQG-JS6hX8IMb62h619gTzkDiQ80nztvDSCYXw>

Biodigester odour negatively affecting lives of residents in Georgian Bluffs and Chatsworth

VI. POTENTIAL ENVIRONMENTAL AND HEALTH PROBLEMS ASSOCIATED WITH BIODIGESTERS

1. Literature review

*Tamburini, Marco; Perneti, Roberta; Anelli, Manuela; Oddone, Enrico; Morandi, Anna; Osuchowski, Adam; Villani, Simona; Montomoli, Cristina; Monti, Maria Cristina. Analysing the impact on health and environment from biogas production process and biomass combustion: A scoping review. *Int. J. Environ. Res. Public Health* 2023, 20(7). https://www.mdpi.com/1660-4601/20/7/5305?fbclid=IwAR2ctBPESHlg20S9jHrd-9FfVLQwg1VSIK_LGzqzqXgKFgnTAcGZqkYBBc

*The potential epidemiological and environmental impacts on human health related to biogas plants were assessed by means of a review of the available literature. **Nineteen papers published between 2000 and 2022** were identified through electronic database search using search strings. **The selected works are epidemiological studies and environmental monitoring studies, which aimed at investigating what are the health risk factors for biogas plant workers and for people living in the surrounding communities.***

The results of the epidemiological studies revealed a potential exposure to endotoxins and fungi that are associated with respiratory symptoms.** Furthermore, the results from the environmental monitoring studies showed significant concentrations of particulate matter, microbial agents, endotoxins, and VOCs in occupational settings. **In conclusion, the results of this literature review suggest that further analyses through an integrated approach combining environmental and health data are necessary for a comprehensive understanding of the potential risks associated with the uptake of biogas technology...

This literature review highlights that the available knowledge on the potential occupational and community hazards associated with biogas plants is fragmented. On the one hand, there is a limited number of studies including on-field monitoring due to the novelty of the technology. On the other hand, the heterogeneity of biogas plants in terms of processed feedstock, technical features of the monitored sites, specificities of the national standards, and differences from other bioenergy technologies do not enable a direct comparison among different studies. Therefore, the results cannot be used to define consistent benchmarks but provide an overview of different aspects of biogas generation, with the purpose of stimulating the discussion on this technology both at the scientific and policy levels.

Workers and populations living near biogas plants could be potentially exposed to different pollutants, namely PM₁₀ and PM_{2.5}, ozone, nitrogen dioxide, sulphur dioxide, some bacteria and fungi, endotoxins, and some VOCs.

The health effects of short-term exposures to PMs, ozone, nitrogen dioxide, and sulphur dioxide are generally well known, although the effects of long-term exposures are not always completely understood. Thus, environmental monitoring should not be neglected in these populations.

2. Ammonia

Fairborn, Bath Twp, Ohio serves notice of intent to sue over alleged violations at local biodigester. WHIOTV7. Feb 16, 2022

<https://www.whio.com/news/local/fairborn-bath-twp-serve-notice-intent-sue-over-alleged-violations-local-biodigester/76WUZRVCMVHURHH43T4TD72XXU/?fbclid=IwAR2SDeoOdX-8rxTMTkzD0IEKVqaLEgsmj4er61kF97Kb5Wj-IQjFnPz9NXQ>

Attorneys for Bath Township and the City of Fairborn have served a notice of their intent to file a citizen suit over alleged violations of the Clean Air Act at a local biodigester... The township and the city allege that Dovetail's lagoon is emitting ammonia without the required air pollution permits and without required air pollution control devices, according to the release.

"It is believed that this ammonia may be causing or contributing to odors that citizens of Bath Township and the City of Fairborn have been complaining of for several years," the release said.

Kassie Lester, Bath Twp. Trustee, told News Center 7 that there have been over 4,300 odor complaints over the last three years... Lester says people have also complained to the township that they have experienced different symptoms from the smell, including nausea, vomiting, severe headaches, respiratory issues and burning of the eyes and nose.

****Bishop, London. Biodigester lawsuit no longer includes Ohio and U.S. EPAs: Renergy, Dovetail still defendants. Dayton Daily News. Apr 7, 2023**

<https://www.daytondailynews.com/local/biodigester-lawsuit-no-longer-includes-ohio-and-us-epas-renergy-dovetail-still-defendants/RT45P2MR2NE55CASVAT3SUZJJE/>

Suit alleges companies have allowed fertilizer digestate lagoon to emit 'significant quantities' of ammonia. A federal judge dismissed lawsuits that the City of Fairborn and Bath Township had filed against both the federal and Ohio Environmental Protection Agencies, but upheld the suits against the two private companies involved. The local governments say the companies have failed to obtain an air pollution permit, while residents have repeatedly complained about nuisance odors. In the same lawsuit, it was alleged that the US and Ohio EPA failed to enforce the Clean Air Act by allowing the companies to do so.

Zilio, M; Orzi, F; Chiodini M.E.; Riva, C; Accutis, M, Boccasile, G; Adani, F. Università degli Studi di Milano. Evaluation of ammonia and odours emission from animal slurry and digestate storage in the Po Valley (Italy)

<https://air.unimi.it/retrieve/handle/2434/709747/1404094/Zilio%20et%20al.%20WM-2020.pdf>

****Foehring Merchant, Emma; Van Deelen, Grace. California has provided incentives for methane capture at dairies, but the program may have 'unintended consequences'. Inside Climate News. Sept 19, 2022. Pulitzer prize-winning nonpartisan reporting.**

<https://insideclimatenews.org/news/19092022/dairy-digesters-methane-california-manure/?fbclid=IwAROG2dHWRF7ucJ37iA2D4509gKml8D0VZLyHgyPjcViR-wJSr1dcHhEuF9I>

On farms with digesters like Bar 20, the digestion process results in two products: biogas and the leftover digestate. While the biogas is captured and piped elsewhere for processing and then sold as fuel, the digestate often sits in an uncovered secondary storage pond until a farmer collects it to spread its valuable nutrients on crops.

At dairies like Bar 20, the length of time that the digestate sits in the pond depends on which crops need to be irrigated, a process that varies by season. When the fertile sludge, sitting in a

secondary pond or spread on a crop field, is open to the air, it continues to release trace amounts of leftover methane as well as other pollutants like nitrous oxides and ammonia.

The nitrogen cycle on farms, and how it contributes to emissions, is complex. And substances like ammonia, or NH₃, often do not get the attention they deserve, scientists say. "Ammonia is a story that's not often told," said Joe Rudek, an agricultural emissions scientist at the Environmental Defense Fund, an advocacy organization that helped sponsor California's keystone emissions reduction [legislation](#) in 2006. "Ammonia loss to the atmosphere has both public health risk issues and environmental issues."

At least four studies published between 2011 and 2018 conclude that the digestion process can result in multiplied ammonia emissions from digestate. In a 2017 study conducted in Wisconsin, researchers collected digested and undigested manure from two dairies and measured the greenhouse gases, nitrous oxide and ammonia it emitted as it sat in storage in 55-gallon drums, simulating what usually happens on farms once digestate leaves the digester. After six months of storage, the manure was applied to a crop field, where researchers also measured emissions. **Over the entire study period, the digested manure emitted 81 percent more ammonia than undigested manure.** Most of those emissions came from the storage period, when digested manure sat exposed to the open air, simulating what happens in the period before it would be applied to crops...

Scientists not associated with the paper say that further study is needed to fully understand how digesters impact ammonia production. "We need to have a better handle on ammonia emissions, and we need to develop better strategies to mitigate them, because we know it's an important contributor to PM_{2.5}," said Francesca Hopkins, an emissions researcher and assistant professor of climate change and sustainability at the University of California, Riverside.

(PM_{2.5} refers to fine, inhalable particulates with diameters of 2.5 micrometers or less.)...

Hopkins said that more data is needed to establish whether digesters increase or reduce ammonia emissions. Rudek of the EDF agrees. "The digester gives you methane reduction, which is a big climate benefit," he said. "EDF is very, very much focused on the importance of that benefit. But the ammonia is a local impact. And if you just take the digestate out and put it into an open system, you don't decrease the local impact of the ammonia."

Ammonia emissions are already at unacceptable levels, and any increase could have serious consequences, but it's important to determine whether the digesters are contributing to the damage, Rudek added.

Mark Zondlo, a professor at Princeton University who heads its atmospheric chemistry and composition group, said that it was not "terribly well understood" how digesters affect ammonia emissions. He praised the Wisconsin study and said it raised important questions worthy of further research. He is now in discussions with the state air resources board about a three-year study that would examine how different manure management techniques at California dairies affect nitrous oxide and ammonia emissions. The contract for that work was recently finalized.

3. Fugitive methane emissions

Desjardins, R; Flesch, T.; Worth, D.; Gao, Z.; Li, X; Martin, T. Quantifying fugitive methane emissions from biodigesters. Mar, 2010. Agriculture and Agri-Food Canada <https://onedrive.live.com/?authkey=%21ANLBqunpyzCci9g&id=C2DDCA62AF69EF91%2113434&cid=C2DDCA62AF69EF91&parId=root&parQt=sharedby&o=OneUp>

Results: fugitive emissions were 2.8% of total CH₄ production, but didn't measure methane emissions from the main effluent pond, as it is off-site.

Their observations:

Flare not efficient at burning-off methane in biogas..We estimate flare burning efficiencies as low as 50%.

Ralton, Gemma. Biogas emissions could risk Net Zero targets, a recent study warns. Imperial College London. May 26, 2021.

<https://www.imperial.ac.uk/news/222213/biogas-emissions-could-risk-net-zero/?fbclid=IwAR3bX3Sbto6YgcTTqv5A6sAZseme9mbRU7x6Tczpz-c8RAFgtliGCI06nM>

In a pioneering study, scientists monitored methane emissions from ten UK biogas plants and found that they could account for up to 3.8% of the country's total methane emissions.

The researchers warn that without rigorous monitoring and clear guidance, biogas emissions risk the UK not meeting its UK Net Zero targets.

Baldé, Hambalio; Wagner-Riddle, Claudia; MacDonald, Douglas; VanderZaag, Andrew. Fugitive methane emissions from two agricultural biogas plants. Waste Management. Volume 151, Sept 2022, p. 123-130.

<https://www.sciencedirect.com/science/article/abs/pii/S0956053X22003853?fbclid=IwAR3NytInFv4iP7R-lp5mTUmHeCePC2skcuyzxnwXV6pe4ngHrOCStQaGzd0>

Emissions of CH₄ from digestate storage were the largest contributor at the two facilities studied. High CH₄-losses also occurred from the facilities during abnormal operation (leakage, roof failure). Fugitive losses from leakage/venting were as high as 14 g kWh⁻¹ (5.5 % loss; Facility A) but could be reduced to 1.3 g kWh⁻¹ (0.6 % loss; Facility B). Flaring emissions were the smallest contributor (<0.25 % loss). To avoid fugitive emissions, facilities need to be designed to minimize digestate

4. Incidents that have caused/risked pollution

****A review of environmental incidents at anaerobic digestion (AD) plants and associated sites between 2010 and 2018. Environment Agency. UK government. Sept, 2019.**

https://consult.environment-agency.gov.uk/environmental-permitting/standard-rules-consultation-no-20/user_uploads/incidents-report--2010-2018--final.pdf

The Environment Agency has responded to a significant number of incidents at anaerobic digester sites, which have caused or had potential to cause pollution. These incidents ranged from partial or complete collapse of primary containment and associated loss of digestate, water pollution from storage of feedstock or digestate, significant odour, loss of biogas, fires and explosion. This document provides numerous examples of these incidents, by year, and was written to help their permitting and compliance officers identify the key areas relevant to the regulation of anaerobic digestion plants and associated facilities and support their site permitting and compliance work.

5. Anaerobic digestate: health and environmental risks

Mbareche, Hamza; Veillette, Marc; Dubuis, Marie-Eve; Bakhiyi, Bouchra; Marchand, Geneviève; Zayed, Joseph; Lavoie, Jacques; Bilodeau, Guillaume; Duchaine, Caroline. Fungal bioaerosols in biomethanization facilities. *Journal of the Air & Waste Management Association*, 2018, Vol 68, no. 11, 1198-1210 [Add link](#).

Paolini, Valerio; Segreto, Marco; Tomassetti, Laura; Naja, Nour; Cecinato, Angelo. Environmental impact of biogas: A short review of current knowledge. *Journal of Environmental Science and Health, Part A*, 53:10, p. 899 – 906. Apr 13, 2018
<https://www.tandfonline.com/doi/full/10.1080/10934529.2018.1459076?fbclid=IwAR2bgQd3N4Ro00ZRiaXx6-RrM6jaKMOjUsfVu1nFk3wkvcTCkrz2uXtPEw>

The social acceptance of biogas is often hampered by environmental and health concerns. In this study, the current knowledge about the impact of biogas technology is presented and discussed. The survey reports the emission rate estimates of the main greenhouse gases (GHG), namely CO₂, CH₄ and N₂O, according to several case studies conducted over the world. Direct emissions of gaseous pollutants are then discussed, with a focus on nitrogen oxides (NO_x); evidence of the importance of suitable biomass and digestate storages are also reported. The current knowledge on the environmental impact induced by final use of digestate is critically discussed, considering both soil fertility and nitrogen release into atmosphere and groundwater; several case studies are reported, showing the importance of NH₃ emissions with regards to secondary aerosol formation. The biogas upgrading to biomethane is also included in the study: with this regard, the methane slip in the off-gas can significantly reduce the environmental benefits.

Rajat, Nag; Whyte, Paul; Markev, Bryan K.; O'Flaherty, Vincent; Bolton, Declan; Fenton, Owen; Richards, Karl G; and Cummins, Enda. Ranking hazards pertaining to human health concerns from land application of anaerobic digestate. *Sci Total Environ.* Mar 25, 2020

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7126561/?fbclid=IwAR0uLHQNNEKxZPjqbbzhZqO52xkxtx6o8Xjv2dQT4EXjGRHcdNkoLi4PLiO>

This tool prioritises potentially harmful pathogens which can emerge from AD digestate and highlights where regulation and intervention may be required. Across all the scenarios considered, the screening tool prioritised Cryptosporidium parvum, Salmonella spp., norovirus, Streptococcus pyogenes, enteropathogenic E. coli (EPEC), mycobacterium spp, Salmonella typhi (followed by S. paratyphi), Clostridium spp., Listeria monocytogenes and Campylobacter coli as the highest-ranking pathogens of human health concern resulting from AD digestate in Ireland.

Why we should all be worried about nitrate pollution. Valuing water initiative. Government of the Netherlands. Nov 25, 2021

https://valuingwaterinitiative.org/why-we-should-all-be-worried-about-nitrate-pollution/?fbclid=IwAR1gapPXabPeEaUu5VvMxfHyXxDJ1X_4DQ_PKmciYDNG1Ytmq7tDBNqkOZw

Eraky, Mohamed; Elsayed, Mahdy; Qyyum, Muhammad Abdul; Ai, Ping; Tawfik, Ahmed. A new cutting-edge review on the bioremediation of anaerobic digestate for environmental applications and cleaner bioenergy. *Environ Res.* Jun 18, 2022
<https://pubmed.ncbi.nlm.nih.gov/35724728/>

Circular agriculture and economy systems have recently emerged around the world. It is a long-term environmental strategy that promotes economic growth and food security while reducing negative environmental consequences. Anaerobic digestion (AD) process has a high contribution and effective biodegradation route for bio-wastes valorization and reducing greenhouse gases (GHGs) emissions. However, the remaining massive digestate by-product contains non-fermented organic fractions, macro and/or micro-nutrients, heavy metals, and metalloids. Direct application of digestate in agriculture negatively affected the properties of the soil due to the high load of nutrients as well as the residuals of GHGs are emitted to the environment. Recycling and valorizing of anaerobic digestate is the main challenge for the sustainable biogas industry and nutrients recovery. To date, there is no global standard process for the safe digestate handling. This review described the biochemical composition and separation processes of anaerobic digestate. Further, advanced physical, chemical, and biological remediation's of the diverse digestate are comprehensively discussed. Moreover, recycling technologies such as phyco-remediation, bio-floc, and entomoremediation were reviewed as promising solutions to enhance energy and nutrient recovery, making the AD technology more sustainable with additional profits. Finally, this review gives an in-depth discussion of current biorefinery technologies, key roles of process parameters, and identifies challenges of nutrient recovery from digestate and prospects for future studies at large scale.

****Lamolinará, Barbara; Pérez-Martínez, Amaury; Guardado-Yordi, Estela; Guillén Fiallos, Christian; Diéguez-Santana, Karel; Ruiz-Mercado, Gerardo J. Anaerobic digestate management, environmental impacts, and techno-economic challenges. Waste Manager. Mar 1, 2022.**

<https://pubmed.ncbi.nlm.nih.gov/35032793/>

Digestate is a nutrient-rich by-product from organic waste anaerobic digestion but can contribute to nutrient pollution without comprehensive management strategies. Some nutrient pollution impacts include harmful algal blooms, hypoxia, and eutrophication. This contribution explores current productive uses of digestate by analyzing its feedstocks, processing technologies, economics, product quality, impurities, incentive policies, and regulations. The analyzed studies found that feedstock, processing technology, and process operating conditions highly influence the digestate product characteristics. Also, incentive policies and regulations for managing organic waste by anaerobic digestion and producing digestate as a valuable product promote economic benefits.

*However, **there are not many governmental and industry-led quality assurance certification systems for supporting commercializing digestate products.** The sustainable and safe use of digestate in different applications needs further development of technologies and processes. Also, incentives for digestate use, quality regulation, and social awareness are essential to promote digestate product commercialization as part of the organic waste circular economy paradigm. Therefore, future studies about circular business models and standardized international regulations for digestate products are needed.*

VII. SAFETY HAZARDS OF BIODIGESTERS

Anaerobic digesters and biogas safety. Farm Energy. Apr 3, 2019

https://farm-energy.extension.org/anaerobic-digesters-and-biogas-safety/?fbclid=IwAR2D88e9LluY9T05htiNSbz5gNX4GRt5tzuDsF7g8kSRSYilDeqqu_bwh0l

****Risks and safety measures for anaerobic digestion: How can you make your plant safer.**
Biogas World. Updated Dec 18, 2020.

https://www.biogasworld.com/news/safety-precautions-anaerobic-digestion-systems/?fbclid=IwAR0pQpR6K479P0c5eQacJU_7irGZPgJFDMGO_JV1fwqshbjFGv7Gft81i9w

The biogas produced by an anaerobic digestion plant is composed of combustible gases methane (50-75%), carbon dioxide (25-50%), water (H₂O), nitrogen (N₂), oxygen (O₂), hydrogen sulfide (H₂S), ammonia (NH₃), and trace elements (organo-halogenated, siloxanes, etc.). H₂S, CO₂, and water make the biogas very corrosive.

The composition can vary according to the nature of the incoming substrates and the operating conditions.

All the following risks are easily mitigated if health & safety are taken into account at all phases of a biogas project development. The risks include, for example:

- *Fire and explosion*
- *Confined space hazards*
- *Risk of Asphyxiation*
- *Risk of gas poisoning (H₂S, NH₃)*
- *Risk of high-pressure gas or liquid leaks*
- *Risks associated with rotating mechanical equipment*
- *Risks associated with pathogens (diseases)*

Under certain conditions, biogas in combination with air can form an explosive gas mixture. The risk of fire and explosion is particularly high close to digesters and gas reservoirs. It can occur because of a gas leak, creation of an explosive zone, welding, clogged or frozen pipes or others.

To generate an explosive atmosphere, the following conditions are met simultaneously:

- *Presence of a combustible gas: methane (CH₄)*
- *Presence of an oxidant: oxygen from the air*
- *Presence of an ignition source*
- *Concentration of the combustible gas included in its explosive range (LIE-LSE)*
- *Presence of a confinement.*

Wastes of animal and human origin, used as AD feedstock, contain various pathogenic bacteria, parasites and viruses. Pathogenic species that are regularly present in animal manures, slurries and household waste are bacteria (e.g. Salmonellae, Enterobacter, Clostridia, Listeria), parasites (e.g. Ascaris, Trichostrangylidae, Coccidae), viruses and fungi.

For example, a tank spilling into a slurry tank can create projections and aerosols containing microorganisms.

Anaerobic digester plant explosions – Explosive risk at biogas facilities. Independent Anaerobic Digestion Community Blog. Dec 21, 2020

<https://blog.anaerobic-digestion.com/anaerobic-digester-plant-explosion-blamed-on-gas-storage-epdm-failure/?fbclid=IwAR0Coeg0UCiiXVYYHFiC8jdneyM-kZAWhtlxB25WYrYLPtsybUY9cr3LV0M>

Lydersen, Kari. Biogas expansion may compound worker risks. Energy News Network. Nov 16, 2022.

<https://energynews.us/2022/11/16/biogas-expansion-may-compound-worker-risks/?fbclid=IwAR1AmFjBCYtHn1DH7aQjpmY0v62RHBIF78mvNerzctw2doQt0mhlaoE19yQ>

“As federal and state incentives and mandates make it increasingly attractive for hog and dairy operations to make biogas out of their methane-intensive waste, community groups and environmental organizations have argued stridently that biogas collection is a false solution to the climate crisis, one that actually causes rather than mitigates greenhouse gas emissions while increasing the pollution burden on neighbors...”

Safety hazards in anaerobic digesters. Aquafix.

https://teamaquafix.com/anaerobic-safety-hazards/?fbclid=IwAROpLAEfXfgisV58natiZvVbDV3lpmUT3Bt_LuO7RfeU4YXDOTOn_OZaHhQ

Fires and explosions associated with anaerobic digesters and methane storage systems are more common than people realize, mostly because of widespread underreporting. This is especially true in “near miss” situations, where there is no human injury or death...

Past training efforts on the municipal level have resulted in a pool of well-trained municipal operators. Operators of industrial anaerobic systems and operators of rural cattle manure digesters, however, often do not have the same level of safety training and training in proper operation of anaerobic systems as do state-certified operators. Poor operation of these facilities often won't become known until someone is killed or injured, or there is a massive fish-kill downstream of the system. That means that when you read or hear of a digester explosion, there are many potential explosions that you haven't heard about!

Digester explosion in Waunakee

<http://www.channel3000.com/news/explosion-reported-at-manure-digester-near-waunakee/27332318>

VIII. REGULATING BIODIGESTION FACILITIES, LAGOONS, AND FEEDLOTS

1. Resolution of Alberta Municipalities for a review of the processes and policies of the NRCB concerning CFOs

<https://www.abmunis.ca/advocacy-resources/resolutions-library/proposal-review-processes-policies-natural-resources>

Whereas the province has taken away the right of municipalities to approve Confined Feed Operations (CFOs) under their Land Use Bylaws and has delegated this responsibility to the Natural Resources Conservation Board (NRCB), the Alberta Municipalities Association has resolved that they “advocate for the Government of Alberta to complete a review “through a public hearing of the policies and processes used by the NRCB in the approval of CFOs in order to enhance the transparency and fairness of the process and give all municipalities impacted by the approval a greater voice I the decision-making process”.

2. Ohio House Bill 193 – Biosolid and biodigestion facilities

****Kirk Hall, Peggy. Ohio Agricultural law blog. June 22, 2023**

<https://ohioaglaw.wordpress.com/category/zoning/>

Biosolid lagoons and biodigestion facilities would have new legal requirements and be subject to local regulation under a proposal sponsored by Rep. Kevin Miller (R-Newark) and Rep. Brian Lampton (R-Beavercreek). HB 193 would grant county and township zoning authority over the lagoons and facilities, require a public meeting and county approval prior to seeking a facility permit from the Ohio EPA, require the Ohio EPA to develop rules requiring covers on new biosolid lagoons, and modify feedstock requirements for biodigestion facilities to qualify for Current Agricultural Use Valuation property tax assessment. HB 193 had its first hearing before the House Agriculture Committee on June 13.

IX. ALBERTA GOVERNMENT PUTS SOLAR AND WIND PROJECTS ON HOLD

1. The announcement

Varcoe, Chris. Alberta minister says “Wild, Wild West’ wave of development triggered pause on renewables. Calgary Herald. Aug 3, 2023

<https://calgaryherald.com/opinion/columnists/varcoe-alberta-minister-says-wild-wild-west-wave-of-development-triggered-pause-on-renewables>

The freeze, which kicks in Thursday and will extend until Feb. 29 of next year, is intended to give the commission time to review and establish policies surrounding granting approval to new renewable developments larger than one megawatt.

In an interview, Neudorf said the government and AUC made the decision because of concerns voiced by the Rural Municipalities of Alberta (RMA), landowners and other players on a number of issues, including the rapid pace of development and use of prime farmland for such facilities. Other matters will be examined, such as the impact of renewables “on Alberta’s pristine viewscapes,” the potential for mandatory reclamation security requirements for new renewable generation — such as bonds — and the effect of more wind and solar on the province’s generation supply mix and grid reliability.

McCracken, Don. Government places renewable energy projects on hold. High River Online. Aug 3, 2023

https://www.highriveronline.com/articles/government-places-renewable-energy-projects-on-hold?fbclid=IwAR3nKE_Ga7jKsN_o-fQrjtQUGKO2aXRLcB1FHim3ZbywcmgnYbHbuW4PsQM

2. Reasons given

A. Rural Municipalities of Alberta Resolution 9 – 22F regarding Renewable energy project reclamation requirements

****Resolution 9-22F Renewable energy project reclamation requirements. Rural Municipalities of Alberta. Nov 9, 2022. Sponsors: MD of Foothills, Mountain View County**

https://rmalberta.com/resolutions/9-22s-renewable-energy-project-reclamation-requirements/?fbclid=IwAR3qwc9sZEu6p9_ZvPQX1doedllmzE6H_TGbcCvgadeF8jN8AkBtraYqnE

THEREFORE, BE IT RESOLVED that the Rural Municipalities of Alberta request that the Government of Alberta implement a mandated collection of adequate securities for future reclamation of renewable energy projects on private lands, either by requiring renewable energy project proponents to post a reclamation surety bond as a condition of any renewable energy project approvals or by other means;

FURTHER BE IT RESOLVED that the amount of the required securities be calculated based on data-driven projections of actual reclamation costs to protect municipalities and residents of Alberta from incurring costs associated with the decommissioning of all renewable energy projects.

3. Responses to the announcement

French, Janet. Renewables industry feels burned by Alberta’s sudden pause on project approvals. CBC News. Aug 3, 2023

https://www.cbc.ca/news/canada/edmonton/renewables-industry-feels-burned-by-alberta-s-sudden-pause-on-project-approvals-1.6926094?fbclid=IwAR3_8egg7n2--D2iNnC1rOuVMYTWApBlSl9icnJmeINTxANhLzoQsvcQ3Kw

X. SUPPLEMENTARY READING

1. Greenwashing

Definition: “The act or practice of making a product, policy, activity, etc. appear to be more environmentally friendly or less environmentally damaging than it really is.”

Source: Merriam-Webster

*DiFelice, Mia. We can't let this gas greenwash polluting factory farms. Food & Water Watch. Apr 12, 2023

https://www.foodandwaterwatch.org/2023/04/12/we-cant-let-this-gas-greenwash-polluting-factory-farms/?fbclid=IwAR3WuQpRm3A2e1Nnhj7OBUm2--dTgBNEUg0FC_ awm_ IY1HS2vBTXHXoMg4

Despite what the industry says, factory farm gas isn't clean, green, or renewable. Using factory farm gas for energy is similar to fossil fuels in a lot of ways. For one, burning it releases CO₂ and other pollutants like ammonia, hydrogen sulfide, and smog-forming nitrogen oxides. Moreover, gas facilities can continuously emit methane when they store digestate in open tanks. When the gas leaves those facilities, we can count on even more emissions because it's transported through the same supply infrastructure as fracked gas. This infrastructure leaks huge amounts of methane. Expanding factory farm gas means entrenching and expanding this dirty infrastructure and creating new sources of climate-wrecking methane emissions.

**How corporations use greenwashing to convince you they are battling climate change. American Association for the Advancement of Science. May 15, 2023

https://theconversation.com/how-corporations-use-greenwashing-to-convince-you-they-are-battling-climate-change-204660?fbclid=IwAR1cppCi44uGitP0lInxMQCdvT_UYmoPcd2wSSDz3taH0CLu5Vrct6Tk5L8

SciLine interviewed Thomas Lyon, professor of sustainable science, technology and commerce at the University of Michigan, on how to buy environmentally sustainable products, whether carbon credits actually work and the prevalence of greenwashing.

How to spot greenwashing: When companies aren't as green as they claim. WSJ (Wall Street Journal). Apr 24, 2023.

https://www.wsj.com/video/series/wsj-glossary/how-to-spot-greenwashing-when-companies-arent-as-green-as-they-claim/59966923-0E1F-4EA2-86BD-F953481BF6C1?fbclid=IwAR0ElqUav1MxvDC7K_ncFFyefXgTAgupDXf3VViR9568q1MQf3ZUJPsbDx0

2. Air Quality

A. General Information from Government of Alberta and Government of Canada on drivers, impacts, odour responses

Air pollution: drivers and impacts. Government of Canada.

<https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-pollution-drivers-impacts.html?fbclid=IwAR0JD74A01ASM2hXf7Egs6m4GxmqUzCjS6qt-5B2DSS-2o2nMljbhsVVSFU>

Air quality and odour response process. Government of Alberta. Nov 2020.

<https://www.alberta.ca/assets/documents/aep-air-quality-and-odour-response-process-2020.pdf>

B. Nitrogen oxides

Shankman, Sabrina. What is nitrous oxide and why is it a climate threat? Inside Climate News. Sept 11, 2019

https://insideclimatenews.org/news/11092019/nitrous-oxide-climate-pollutant-explainer-greenhouse-gas-agriculture-livestock/?fbclid=IwAR1mkB_SrKctByihRAmr-TKrogIZ29pQ_XxTcKi1MkxKhNbGLFscVk6yoHQ

A beginner's guide to NOx, No and NO2 as air pollutants. Aeroqual. Dec 9, 2021.

https://www.aeroqual.com/blog/meet-the-nitrogen-oxide-family?fbclid=IwAR2JWIq7niWNaOAOQ_b8toTRuy2WdEWv-ui7OMn9_v3j2UTM4fMJmLsqBsal

Medical management guidelines for nitrogen oxides. ATSDR (Agency for Toxic Substances and Disease Registry).

<https://wwwn.cdc.gov/TSP/MMG/MMGDetails.aspx?mmgid=394&toxid=69&fbclid=IwAR2NXs3r6REr2MMmrIBqJwfsRmMy7szce-uyPjE7kosoAjQ95Df9rVw7CgA#:~:text=Routes%20of%20Exposure-,Inhalation,warning%20property%20for%20acute%20exposures>

C. Inhalable particulate matter and health

Inhalable particulate matter and Health (PM2.5 and PM10). California Air Resources Board.

<https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health?fbclid=IwAR2RskmbjIvgEQbjSMEBr3OxBklwO09V-VKS5jlyRZlBhsFZacgMJ79yxn4>

Air pollution: The silent killer called PM2.5. McGill Newsroom. Mar 11, 2021

<https://www.mcgill.ca/newsroom/channels/news/air-pollution-silent-killer-called-pm25-329428?fbclid=IwAR2xsutszVpwrKw86YFknt8hKp2h9gqMBGvjBFmVypili3uUmstu4Yw84TE>