MINNESOTA
PUBLIC UTILITIES COMMISSION

Staff Briefing Papers

Meeting Date	**January 15, 2026**		**Agenda Item 1*** **
Company	All Electric Utilities		
Docket No.	E-999/CI-24-352		
	In the Matter of a Commission Investigation into a Fuel Life-Cycle Analysis Framework for Utility Compliance with Minnesota's Carbon-Free Standard		
Issues	Should the Commission adopt a fuel life-cycle analysis framework as part of its responsibility to set criteria and standards for evaluating utility compliance with Minnesota's Carbon-Free Standard?		
Staff	Danielle Winner	danielle.winner@state.mn.us	651-539-1084

✓ **Relevant Documents**	**Date**
Comments, Olmsted County	**June 4, 2025**
Comments, City of Red Wing (Red Wing)	**June 5, 2025**
Comments, Institute for Agriculture and Trade Policy (IATP)	**June 5, 2025**
Comments, American Petroleum Institute (API)	**June 5, 2025**
Comments, Carbon Solutions Group (CSG)	**June 5, 2025**
Comments, Clean Energy Economy Minnesota (CEEM)	**June 5, 2025**
Joint Comments, Sierra Club and Minnesota Center for Environmental Advocacy (collectively, Clean Energy Organizations or CEOs)	**June 5, 2025**
Comments, Central Minnesota Municipal Power Agency d/b/a Central Municipal Power Agency/Services (CMPAS)	**June 5, 2025**
Comments, Connexus Energy (Connexus)	**June 5, 2025**
Comments, CURE	**June 5, 2025**
Joint Comments, Department of Commerce—Division of Energy Resources (Department or DOC DER) and Minnesota Pollution Control Agency (MPCA)	**June 5, 2025**

✓ Relevant Documents	Date
Comments, Great River Energy	June 5, 2025
Comments, Health Professionals for a Healthy Climate (HPHC)	June 5, 2025
Comments, Minnesota Forest Industries (MFI)	June 5, 2025
Comments, Minnesota Forest Resources Council (MFRC)	June 5, 2025
Comments, Minnesota Power	June 5, 2025
Comments, Minnkota Power Cooperative (Minnkota)	June 5, 2025
Comments, Minnesota Municipal Power Agency (MMPA)	June 5, 2025
Comments, Otter Tail Power Company (Otter Tail or OTP)	June 5, 2025
Comments, Partnership for Policy Integrity (PFPI)	June 5, 2025
Comments, Partnership on Waste and Energy (Partnership on W&E)	June 5, 2025
Comments, Ramsey/Washington Recycling & Energy Board (Ramsey/Washington R&E)	June 5, 2025
Comments, Northern States Power Company d/b/a Xcel Energy (Xcel)	June 5, 2025
Joint Comments, CURE, Minnesota Interfaith Power & Light (Interfaith), PFPI	June 28, 2025
Public Comment 1	July 31, 2025
Reply Comments, CEOs	August 20, 2025
Reply Comments, CMPAS	August 20, 2025
Reply Comments, CURE	August 20, 2025
Reply Comments, Department	August 20, 2025
Reply Comments, Great River Energy	August 20, 2025
Reply Comments, MMPA	August 20, 2025
Reply Comments, Minnesota Power	August 20, 2025
Reply Comments, OTP	August 20, 2025
Joint Comments, St. Paul Co-Generation (SPC) and District Energy St. Paul (District Energy)	August 20, 2025
Reply Comments, Xcel	August 20, 2025
Comments, DFL Environmental Caucus	September 2, 2025
Comments, Northeast Metro Climate Action	September 5, 2025
Comments, Coalition for Plastic Reduction	September 10, 2025
Public Comments 1-20, Batch 1	September 12, 2025
Public Comments 1-20, Batch 2	September 12, 2025
Supplemental Comments, HPHC	September 13, 2025
Public Comments 1-25, Batch 1	September 16, 2025

✓ Relevant Documents	Date
Comments, Climate Generation	September 16, 2025
Comments, Eureka Recycling	September 16, 2025
Comments, American Forest & Paper Association (AF&PA)	September 17, 2025
Supplemental Comments, CEOs	September 17, 2025
Supplemental Comments, CMPAS	September 17, 2025
Supplemental Comments, Connexus	September 17, 2025
Supplemental Comments, CURE	September 17, 2025
Supplemental Comments, Department	September 17, 2025
Comments, Institute for Local Self-Reliance (ILSR)	September 17, 2025
Comments, Legislative Members	September 17, 2025
Comments, LIUNA Minnesota and North Dakota (LIUNA)	September 17, 2025
Supplemental Comments, Minnesota Power	September 17, 2025
Supplemental Comments, MMPA	September 17, 2025
Comments, Minnesota Environmental Justice Table and the Zero Burn Coalition (MN EJ Table and Zero Burn)	September 17, 2025
Comments, Minnesota Resource Recovery Association	September 17, 2025
Supplemental Comments, Minnesota Pollution Control Agency	September 17, 2025
Supplemental Comments, PFPI	September 17, 2025
Supplemental Comments, Partnership on W&E	September 17, 2025
Supplemental Comments, Ramsey/Washington R&E	September 17, 2025
Supplemental Comments, Interfaith	September 18, 2025
Comments, Minnesota Environmental Partnership	September 18, 2025
Comments, Senator Nick Frentz	September 18, 2025
Comments, Vote Solar	September 18, 2025
Public Comments 1-11, Batch 1	September 18, 2025
Information Request Response, Department and MPCA	December 11, 2025

Table of Contents

EXECUTIVE SUMMARY

The Commission is tasked with detailing the criteria and standards used to measure an electric utility's efforts and achievements in meeting Minnesota's Carbon-Free Standard ("CFS"). As part of its investigation into this topic, the Commission opened the current proceeding to explore the possibility of Life-Cycle Analysis ("LCA") as a means for compliance. Unlike Minnesota's other energy standards—the Eligible Energy Technology Standard ("EETS," formerly the Renewable Energy Standard or "RES"), the Solar Energy Standard ("SES"), and the Distributed Solar Energy Standard ("DSES")—the CFS statute allows for partial compliance and does not define which technologies are eligible. A critical issue the Commission must determine is detailing the criteria and standards for partial compliance, which may involve specifying exactly which types of technologies are eligible and partially eligible.

The Commission requested comment on a number of issues, including how best to implement an LCA framework, which resources would require an LCA, and which resources would be fully eligible versus partially eligible under such a framework. While addressing these issues, commenters also re-raised issues from prior CFS proceedings about which the Commission has not made a final determination, arguing the merits of: a point-of-generation statutory interpretation, the potential for EETS technologies to be eligible for CFS, and LCA as a means for evaluating compliance.

These briefing papers first provide background on the statute, the CFS proceedings the Commission has handled to date, and key concepts and terms. It then identifies three basic frameworks offered by commenters for considering the standards for compliance, before discussing potential LCA program implementation and general criteria and standards. Following that, these briefing papers discuss specific resources and technologies; because of their prominence in comments to the docket, biomass and municipal solid waste are discussed first, followed by renewable natural gas, carbon capture and storage/sequestration, hydrogen, storage, and net market purchases. Staff includes three appendices: acronyms, a summary of public comments, and a decision option guide.

BACKGROUND

I. CFS Docket

House File No. 7 became effective on February 7, 2023, amending Minn. Stat. § 216B.1691 (the Renewable Energy Objectives or "REO" statute). These amendments included changes to Minnesota's existing Renewable Energy Standard ("RES") and the introduction of the state's Carbon-Free Standard ("CFS").

The statute requires the Commission to issue the necessary orders that (1) detail the criteria and standards used to measure an electric utility's efforts to meet the RES (now known as the Eligible Energy Technology Standard, or "EETS"), Solar Energy Standard ("SES"), Distributed Solar Energy Standard ("DSES"), and CFS; and (2) determine whether the utility is achieving these standards.

To address these statutory changes, the Commission initiated Docket No. E999/CI-23-151, *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Standard and the Newly Created Carbon Free Standard under Minn. Stat. §216B.1691* ("CFS docket"). Staff divided the proceedings into a series of four rounds; Table 1 shows the current timeline of these proceedings.

Table 1. Carbon-Free Standard Docket Rounds of Comment

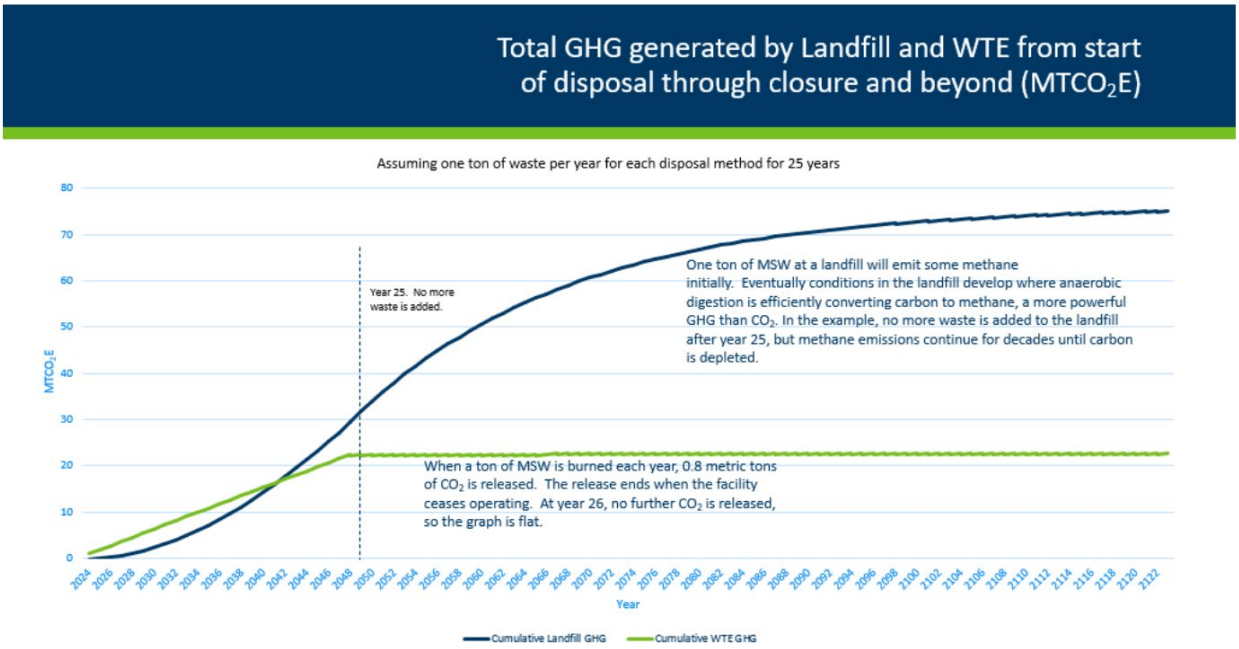
Round	Content	Comment Period Date	Agenda Meeting Date	Order Date
1	Changes to RES and SES	Initial: Aug 2, 2023 Reply: Aug 18, 2023	Oct 19, 2023	Dec 6, 2023
1.5	Additional clarifications: changes to RES and SES	Initial: Jan 19, 2024 Reply: Feb 7, 2024	Mar 14, 2024	Apr 12, 2024
2	New and Amended Terms	Initial: June 28, 2024 Reply: July 24, 2024	Sept 26, 2024	Nov 7, 2024
2.5	Request for Reconsideration and Clarification of Nov 7, 2024 Order	Petition: Nov 27, 2024 Answers: Dec 9, 2024	Jan 16, 2025	Jan 23, 2025
3	CFS Compliance	Initial: Jan 29, 2025 Reply: Mar 19, 2025 Supp: Apr 16, 2025	July 17, 2025	Order 1: Aug 7, 2025 Order 2: Sept 16, 2025
3.5	Request for Reconsideration on September 16, 2025 Order	Petition: Oct 16, 2025 Answers: Oct 27, 2025	Nov 20, 2025	Order: Nov 24, 2025
4	Off Ramp Process	Initial: Oct 28, 2025 Reply: Nov 18, 2025	Q1 2026	

The current docket ("LCA docket") came out of Round 2 of the CFS docket, in which the Commission was tasked with defining "carbon-free." Numerous parties submitted hundreds of pages of record, often with conflicting information. Particularly contentious was 1) the carbon-free status of fuels with complex lifecycles, including biomass, solid waste, renewable natural gas, and hydrogen, and 2) whether these fuels could qualify partially under the statute's partial compliance provision.

Commenters in that proceeding recognized a certain level of conflict within the CFS statute. For example, hydrogen generated from a fossil fuel might still be considered 100 percent carbon-free if a strict point-of-generation framework were applied, which did not appear to align with the statutory intent. Commenters also found inherently problematic the idea that certain waste streams might generate more emissions if left to decompose than if they were burned for electricity; this would appear to contradict the fundamental point of the statute to reduce emissions. To this point, the Minnesota Pollution Control Agency ("MPCA") provided the following graph comparing net cumulative emissions of municipal solid waste from landfilling

(darker/blue line) versus burning for electricity (lighter/green line).

Figure 1. Figure provided by MPCA in the CFS docket[1]



Furthermore, Commissioners noted at the September 26, 2024 agenda meeting that one remedy for non-compliance with the CFS could be acquisition of EETS technologies such as eligible biomass, implying that EETS technologies might in fact be permissible under the CFS.

Given the lengthy and often conflicting record, the Commission determined that further investigation into these complex fuels was necessary, since from a lifecycle perspective, some of these fuels could be considered either fully or partially carbon-free under the statute. In the Commission's November 7, 2024 Order, the Commission opened the current docket to further investigate these fuels and technologies; the Commission stated its intention to render a decision in the LCA docket by the end of 2025.

The Commission's November 7, 2024 Order outlined a number of issues the Commission wished to explore in the LCA docket; Staff's LCA docket Notice of Comment closely followed this Order when requesting comments on the following topics:

- Definitions of the sources of and requirements for a life-cycle analysis when interpreting the statutory definition of "carbon-free" for combusted fuel generation resources without carbon capture that are considered carbon-free or receiving partial credit

[1] *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Standard and the Newly Created Carbon-free Standard under Minn. Stat. § 216B.1691,* Docket No. E-999/CI-23-151, Minnesota Pollution Control Agency Comments, p. 5 (June 28, 2024).

consistent with the November 7, 2024 Order.

- Definitions of the sources of and requirements for a fuel to qualify as sustainable and waste biomass.
- Development of an accounting methodology to consider energy withdrawn from short-, medium-, and long-duration storage assets.
- Calculating partial compliance based on the net annual generation defined as "carbon-free."
- Calculating partial compliance for fossil fuel generation with carbon capture and sequestration/storage ("CCS") by estimating the total direct carbon dioxide emissions per megawatt-hour ("MWh") reduced by the CCS, and applying that percentage to the output of the generation resource employing CCS to determine its carbon-free generation.
- Calculating partial compliance for hydrogen co-firing generation by estimating the direct and indirect emissions of the generation resource per MWh with hydrogen cofiring, compared to the carbon dioxide per MWh that would be emitted if the generator burned only natural gas.
- Whether biomass, renewable natural gas, and solid waste should be eligible as fully or partially carbon-free generation resources based on a fuel life-cycle analysis.
- Calculating partial compliance by generators burning waste materials based on a fuel cumulative life-cycle basis considering greenhouse gas benefits relative to alternative waste management methods.
- The definition and calculation of net market purchases.

Per the Commission's November 7th, 2024 Order, Staff also requested comment on the Partnership on Waste and Energy's recommendations concerning the scope of the LCA docket, which were summarized in Appendix 2 of Staff's September 12, 2024 Briefing Papers in the CFS docket. These included the following:

- A clear case should be established that resolving the aforementioned questions in a separate docket, rather than in the current docket, would lead to better decisions and advance the overall public interest
- The scope of "sustainable and waste biomass" that a separate docket may address needs to be defined—e.g., which resources, processes, and technologies would be included;
- A full life-cycle carbon accounting of all energy resources, processes and technologies should be conducted in a comprehensive manner, whether in a single docket or more than one docket;
- The separate docket must have a clear connection to and integration with the present docket in order to preserve the overall integrity of decisions made regarding the carbon-free standard and related statutes. If a separate docket were to proceed, the Partnership recommends that a determination first be made within the current [CFS] docket that the following fuels fit in a definition of carbon-free, so a separate docket may then further articulate any applicable requirements that may be needed regarding

the carbon-free qualifications of those fuels:
    - Wood waste and woody biomass from continuously emerging insect and disease damage to trees, trees damaged in storms, tree maintenance, fire prevention activities, land clearing for development and wood product residuals;
    - MSW processed in resource recovery facilities through mass-burn or refuse-derived fuel technologies, organic materials separated from MSW and processed to create renewable natural gas that is used to create electricity, and other biofuels derived from MSW and used to generate electricity.
- Additionally, a life-cycle analysis should:
    - Cover all resources, whether fully non-emitting or partially non-emitting of carbon dioxide.
    - Cover all direct and indirect GHG emissions, using a consistent approach for framing or creating boundaries of analysis
    - Be capable of determining carbon-free status and assessing partial compliance with a carbon-free standard;
    - Prevent decisions that shift GHG emissions from the electricity sector to other sectors in an economy-wide GHG accounting context.

II. Great Plains Institute Workshops

Great Plains Institute ("GPI"), who is not a party the proceeding, hosted a series of workshops for commenters to learn more about life-cycle analysis. The first three of these workshops were attended by Commission Staff and involved presentations by GPI staff and others to understand certain foundational concepts and principles around LCA. The remaining three planned workshops were for parties to discuss record content, and Commission Staff did not attend these. Commission Staff later attended a workshop hosted by GPI to learn a hands-on demonstration about use of Argonne National Laboratory's Greenhouse Gasses, Regulatory Emissions, and Energy ("GREET") model.

In an effort to increase transparency, Staff requested that GPI file its presentation materials in the instant docket, and GPI obliged. These materials are available for general understanding in the record, but do not constitute any form of recommendation on the part of GPI or Commission Staff. CURE objected to the inclusion of the materials in the docket and recommended that all past communications between GPI and Commission Staff from the commencement of this docket to its conclusion be filed as *ex parte* communications; alternatively, CURE recommended that GPI's filings be removed from the current record.[2]

Staff's understanding is that GPI is not a party to this PUC proceeding. GPI is not making any recommendations to the Commission, but is instead providing information about an emerging topic. The presentation materials are in the docket, and any party had the opportunity to comment on them.

[2] CURE Comments, p. 11 (June 5, 2025) (hereinafter "CURE Initial Comments").

III. Key Concepts and Terms

In this section, Staff has summarized some key concepts and terms relevant to the current proceeding.

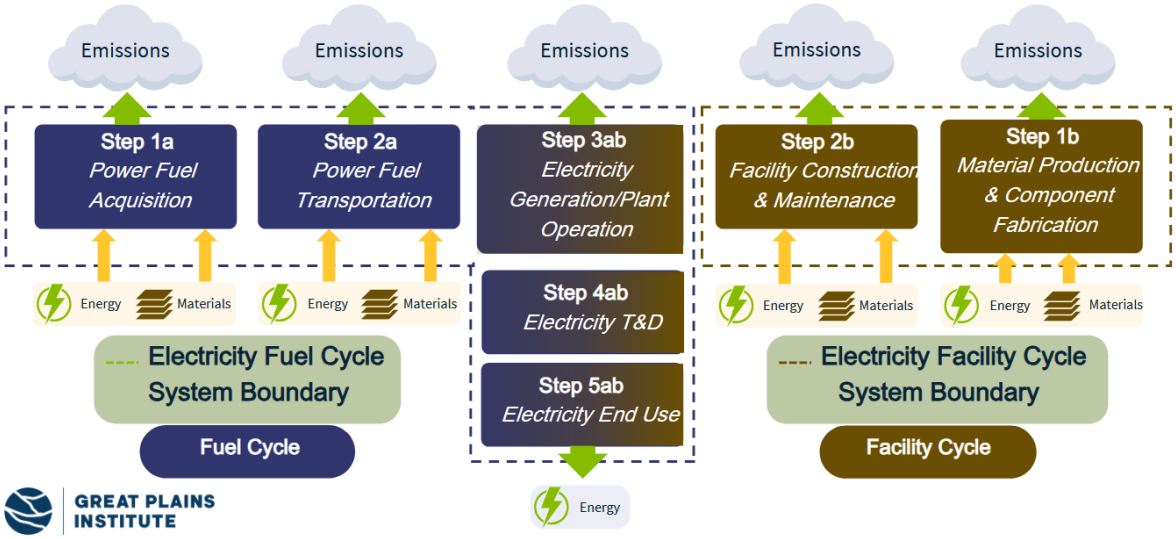
Carbon intensity ("CI") is the primary output of a life-cycle analysis. It is measured in emitted ***carbon dioxide equivalent*** (CO_2e) per unit of activity, output, or product. In the case of electricity generation, this is likely to be in CO_2e/MWh. While CO_2e normalizes all greenhouse gases to a carbon dioxide-based equivalent, it does not mean that an LCA output *must* measure greenhouse gases besides carbon dioxide.

In the CFS docket, MPCA defined the ***carbon cycle*** as "the process for carbon cycling from the atmosphere into organisms and nonliving substances in the earth, then back into the atmosphere through various biologic, chemical, geologic, and thermal processes. This cycle can operate on vastly different time scales ranging from just a few years to millennia."[3] The combustion of ***biogenic*** carbon (such woody biomass) and ***anthropogenic*** carbon (such as coal or other fossil fuels) demonstrates the difference in these time scales: while the former may have cycled through the atmosphere relatively recently, the latter will have been stored out of the atmosphere for thousands to millions of years. The ***biogenic emissions carbon cycle*** refers to the process of biogenic carbon returning to its starting point in the cycle: for example, when a tree is burned and emissions are released into the atmosphere, those emissions are eventually re-absorbed through tree growth and other organic processes.

The time scale of the carbon cycle is important for setting the ***system boundary***, which defines when a life-cycle analysis begins and ends. The Commission's aim in creating this docket was to investigate a ***fuel life-cycle analysis***, which creates a tighter system boundary than a ***cradle-to-grave life-cycle analysis***. GPI provided the following infographic showing an electricity generation plant LCA, with a demarcation between fuel cycle and facility cycle:

[3] *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Standard and the Newly Created Carbon-free Standard under Minn. Stat. § 216B.1691,* Docket No. E-999/CI-23-151, Minnesota Pollution Control Agency Comments, pp. 2-3 (June 28, 2024).

Figure 2. Electricity System Boundaries Showing Fuel Cycle vs Facility Cycle



The infographic shows how in a fuel LCA, the emissions due to facility construction and maintenance or equipment and component production is part of a facility cycle, not a fuel cycle. For example, a fuel life-cycle analysis might include the emissions from a truck used to haul woody biomass to a generation facility, but it would not include the emissions associated with building the truck.

Another key piece of terminology in LCA is the ***feedstock***. The feedstock is the raw material input at the beginning of a fuel life-cycle. In this record, commenters broadly used the term feedstock to apply to biomass (including woody biomass), municipal solid waste, refuse-derived fuel, and renewable natural gas.

There is significant overlap between these feedstocks. For example, ***biomass*** in this record often refers to ***woody biomass***, but biomass can take many forms and is usually a component of ***municipal solid waste ("MSW")***.

Before being combusted for electricity, woody biomass must first be processed by 1) cutting larger pieces into more manageable pieces and 2) removing moisture. This processing stage can involve debarking, chipping, grinding, air-drying, and pelletization. After processing, biomass is combusted at a generation facility.

MSW usually includes non-woody biomass. After being collected, MSW is sorted at resource recovery facilities, removing recyclable and non-combustible materials. The remainder may be sent to landfills, ***waste-to-energy ("WTE")*** facilities, and ***refuse-derived fuel ("RDF")*** production facilities. RDF is a fluffy combustible material that is then transported to a WTE generation plant to create electricity. Ash from these combustion processes is usually landfilled. While there may be some degree of interchangeability between the terms MSW, WTE, and RDF facilities, the website of Minnesota Resource Recovery Association ("MRRA," a commenter in this

proceeding) delineates between 1) WTE facilities that combust MSW onsite [to create electricity, steam, heating, or cooling], and 2) RDF production facilities that involve no combustion.

The Commission also requested comment on ***renewable natural gas (RNG)***. RNG is methane produced from biological material that is converted into biogas and upgraded to pipeline quality. RNG can come from MSW landfills, anaerobic digester plants at wastewater plants, livestock farms, food production facilities, and organic waste management operations.

A ***fuel pathway*** is the trajectory a given fuel takes from the beginning of the fuel's lifecycle until its end; it traditionally involves the feedstock, the production process, and the fuel type, but can also involve the generation of electricity. The beginning and end of the fuel pathway will be defined by the system boundary.

When discussing biomass, MSW, and RNG, a critical concept is the ***counterfactual***. The counterfactual is the process most likely to happen, absent the process being studied. For most commenters in this docket, the counterfactual involves the alternative fate of the waste in question. For example: if the fuel is wood waste from diseased trees, what would happen to that wood waste if it were not used in electricity generation? CURE introduces a different perspective on the counterfactual, stating that, since the CFS is not a waste management policy but an energy policy, the appropriate counterfactual for consideration is the alternative energy source or fuel, not the alternative fate of the waste if not used as fuel.[4]

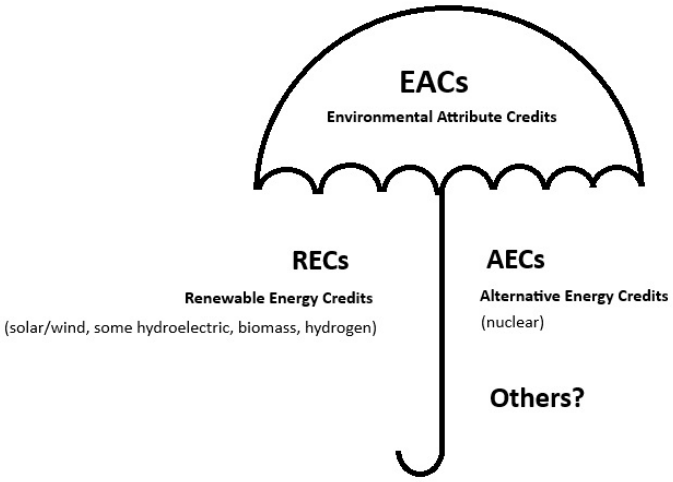
Xcel introduces the term ***comparative scenario evaluation*** ("CSE") into the record to describe a counterfactual study. In these briefing papers, Staff uses the term counterfactual to describe the broader concept and CSE to describe a specific study.

Finally, the Commission's September 16, 2025 Order established that to demonstrate compliance with the CFS, parties may retire ***Renewable Energy Credits ("RECs")***, ***Alternative Energy Credits ("AECs")***, and ***Environmental Attribute Credits ("EACs")***.[5] Staff provides following infographic of the relationship between RECs, AECs, and EACs, with EACs as the umbrella term.

[4] CURE Reply Comments, p. 14 (August 20, 2025) (hereinafter "CURE Reply Comments").

[5] The Commission also determined that in cases of net market purchases, utilities need not retire credits. *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Objectives and the Newly Created Carbon-Free Standard Under Minn. Stat. § 216B.1691*, Order on Carbon-Free Standard—Clarifying Use of Credits, Net Market Purchases, and Reporting, Docket No. E-999/CI-23-151, Ordering Paragraphs 1 and 3 (September 16, 2025).

Figure 3. Staff Infographic on relationship between EACs/RECs/AECs



DISCUSSION

IV. CFS Frameworks

The Commission is tasked with detailing the criteria and standards used to 1) measure an electric utility's efforts to meet the CFS and 2) determine whether the utility is meeting the standard. The statute provides that "carbon-free means a technology that generates electricity without emitting carbon dioxide."[6] In the CFS docket, parties offered three different frameworks for Commission consideration:

- Point-of-Generation ("POG") framework:[7] This framework aligns with the most restrictive interpretation of the CFS, holding that any technology emitting carbon dioxide at the point of generation is ineligible, regardless of LCA results.
- EETs framework: This framework asserts that Eligible Energy Technologies, as defined by Minn. Stat. § 216B.1691, subd. 1(c), automatically qualify as carbon-free, bypassing the need for a life-cycle analysis.
- LCA framework: This framework requires LCA for biogenic fuels that emit carbon dioxide at the point of combustion, namely biomass, solid waste, and renewable natural gas.

A. Commenter Positions

All commenters appear to support the following resources being eligible for CFS compliance without an LCA: solar, wind, hydropower, and nuclear. **(Decision Option 1)** The Agencies and Xcel also support the inclusion of geothermal in this list **(Decision Option 1 A)**; no commenters appeared to dispute geothermal.

However, commenters continue to be split over the best framework to apply to more complex fuels: a Point-of-Generation, or "POG" framework **(Decision Option 2)**, an EETS framework **(Decision Option 3)**, or an LCA framework **(Decision Options 4, 5, 6)**.

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[6] Minn. Stat. § 216B.1691, subd. 1(b).

[7] Staff previously referred to this as a "Plain Language" framework in the CFS Round 2 proceeding.

Table 2. CFS Frameworks and Supporters

Point-of-Generation (POG) Framework	EETS Framework	LCA Framework
Clean Energy Organizations[8] Climate Generation[9] Coalition for Plastic Reduction[10] CURE[11] DFL Environmental Caucus[12] Eureka Recycling[13] Health Professionals for a Healthy Climate (HPHC)[14] Institute for Local Self-Reliance[15] Interfaith Power and Light (Interfaith)[16] Minnesota Environmental Justice Table and Zero Burn Coalition[17] Minnesota Environmental Partnership[18] MN350[19] Northeast Metro Climate Action[20] Partnership for Policy Integrity (PFPI)[21] Vote Solar[22] 43 current and former members of the MN Legislature[23] 53 public commenters[24]	City of Red Wing[25] Ramsey/Washington R&E[26] Minnesota Resource Recovery Association[27] Senator Frentz[28]	Department[29] MPCA[30] American Forest & Paper Association (AF&PA)[31] CMPAS[32] Clean Energy Economy Minnesota (CEEM)[33] LIUNA[34] Minnesota Municipal Power Agency (MMPA)[35] Minnesota Forest Industries (MFI)[36] Minnesota Forest Resources Council (MFRC)[37] Minnesota Power[38] Olmsted County[39] Partnership on Waste & Energy[40] St. Paul Co-Generation and District Energy St. Paul (SPC and District Energy)[41] Xcel Energy[42]

[8] Minnesota Center for Environmental Advocacy and Sierra Club, collectively "Clean Energy Organizations" Comments, p. 26 (June 5, 2025) (hereinafter "CEOs Initial Comments").

[9] Climate Generation, p. 1 (September 16, 2025) (hereinafter "Climate Generation Comments").

[10] Coalition for Plastic Reduction Comments, p. 1 (September 10, 2025) (hereinafter "Coalition for Plastic Reduction Comments").

[11] CURE Initial Comments, p. 11.

[25] City of Red Wing Comments, p. 2 (June 5, 2025) (hereinafter "Red Wing Comments").

[26] Ramsey/Washington Recycling & Energy Comments, p. 3 (June 5, 2025) (hereinafter "Ramsey/Washington R&E Initial Comments").

[29] Minnesota Department of Commerce–Division of Energy Resources Reply Comments, p. 11 (August 20, 2025) (hereinafter "Department Reply Comments").

[30] Minnesota Pollution Control Agency Supplemental Comments, p. 2 (September 17, 2025) (hereinafter "MPCA Supplemental Comments").

With the exception of Senator Frentz, advocates of an EETS framework indicated that they would alternatively support an LCA framework.[43]

Commenters not listed did not advocate for the use of a particular framework.

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[16] CURE, Minnesota Interfaith Power and Light ("Interfaith"), and Partnership for Policy Integrity ("PFPI") Joint Comments, p. 1 (June 28, 2025) (hereinafter "CURE, Interfaith, PFPI Joint Comments").

[17] Minnesota Environmental Justice Table and Zero Burn Coalition Comments, p. 1 (September 17, 2025) (hereinafter "MN EJ Table and Zero Burn Comments").

[18] Minnesota Environmental Partnership Comments, p. 1 (September 18, 2025) (hereinafter "MEP Comments").

[19] MN350 Action Comments, p. 2 (September 16, 2025) (hereinafter "MN350 Comments").

[20] Northeast Metro Climate Action Comments, p. 1 (September 5, 2025) (hereinafter "Northeast Metro Climate Action Comments").

[21] Partnership for Policy Integrity Comments, p. 4 (June 5, 2025) (hereinafter "PFPI Initial Comments").

[22] Vote Solar Comments, p. 1 (September 18, 2025) (hereinafter "Vote Solar Comments").

[23] MN Legislators' Comments, Sept. 17, 2025, p. 1.

[24] See Appendix B of these briefing papers.

[25] City of Red Wing Comments, p. 2 (June 5, 2025) (hereinafter "Red Wing Comments").

[26] Ramsey/Washington Recycling & Energy Comments, p. 3 (June 5, 2025) (hereinafter "Ramsey/Washington R&E Initial Comments").

[27] Minnesota Resource Recovery Association, p. 2 (September 17, 2025) (hereinafter "MRRA Comments").

[28] Senator Nick Frentz Comments, p. 1 (September 18, 2025) (hereinafter "Frentz Comments").

[29] Minnesota Department of Commerce–Division of Energy Resources Reply Comments, p. 11 (August 20, 2025) (hereinafter "Department Reply Comments").

[30] Minnesota Pollution Control Agency Supplemental Comments, p. 2 (September 17, 2025) (hereinafter "MPCA Supplemental Comments").

[31] American Forest & Paper Association, p. 1 (September 17, 2025) (hereinafter "AF&PA Comments").

[32] Central Minnesota Municipal Power Agency d/b/a Central Municipal Power Agency/Services Reply Comments, p. 7 (August 20, 2025) (hereinafter "CMPAS Reply Comments"). Staff notes that CMPAS did not explicitly support the use of LCA, but appears amenable to it.

[33] Clean Energy Economy Minnesota Comments, p. 6 (June 5, 2025) (hereinafter "CEEM Comments").

[34] LIUNA Minnesota and North Dakota Comments, p. 1 (September 17, 2025) (hereinafter "LIUNA Comments").

[35] Minnesota Municipal Power Agency Comments, p. 1 (June 5, 2025) (hereinafter "MMPA Initial Comments").

[36] Minnesota Forest Industries Comments, p. 3 (June 5, 2025) (hereinafter "MFI Comments").

[37] Minnesota Forest Resources Council, p. 1 (June 5, 2025) (hereinafter "MFRC Comments").

[38] Minnesota Power Comments, p. 10 (June 5, 2025) (hereinafter "Minnesota Power Initial Comments").

[39] Olmsted County Comments, p. 2 (June 4, 2025) (hereinafter "Olmsted County Comments").

[40] Partnership on Waste & Energy Comments, p. 1 (June 5, 2025) (hereinafter "Partnership on W&E Initial Comments").

[41] St. Paul Co-Generation and District Energy St. Paul, p. 1 (August 20, 2025) (hereinafter "SPC and District Energy Joint Comments").

[42] Northern States Power Company d/b/a Xcel Energy Comments, p. 1 and pp. 10-11 (June 5, 2025) (hereinafter "Xcel Initial Comments").

[43] MRRA Comments, p. 2. Ramsey/Washington R&E Initial Comments, p. 4 and p. 10. Red Wing Comments, p. 2.

B. Point-of-Generation (POG) Framework

This framework aligns with a strict interpretation of the definition of carbon-free, holding that any technology generating electricity while emitting carbon dioxide is ineligible, regardless of offsets or LCA results. It would allow wind, solar, hydropower, and nuclear to qualify fully for CFS compliance, but not allow any form of biomass, MSW, waste-to-energy, RDF, or RNG facility to qualify, fully or partially. **(Decision Option 2)** POG framework advocates are split on carbon capture and storage/sequestration and hydrogen co-firing; these technologies are discussed in their respective sections (Sections IX and X) below.

1. Arguments for and Against POG Framework

Commenters provided the following arguments in favor of a Point-of-Generation framework:

- The Clean Energy Organizations ("CEOs") argue that under a plain language reading, biomass and solid waste cannot be considered "carbon-free" under the statutory definition because they do not generate electricity "without emitting carbon dioxide."[44]
- The CEOs also argue that biomass and solid waste cannot be considered partially carbon-free under the statutory definition because they do not "utilize carbon-free technologies for electricity generation."[45]
- The CEOs included a discussion noting that under a POG framework, non-carbon-free facilities can still operate, even past 2040. CEOs argue that in 2040, when the statute requires the equivalent of 100 percent "of the electric utility's total retail electric sales to retail customers in Minnesota" be from carbon-free technologies, utilities may not need to shutter ineligible resources because of 1) the line losses differential and 2) the existence of regional markets.
    - The line losses differential is the difference between the amount the utility must generate and procure and the amount they sell to retail customers; since the statute is tied to *retail sales* and not *generation*, the utility will be able to generate from non-carbon-free technologies up to an amount within that differential. CEOs argue that since biomass and solid waste facilities account for approximately two percent of Minnesota's electricity generation, and because line losses can account for up to ten percent, these ineligible plants may comfortably exist in that differential.[46]
    - Ineligible facilities can still sell power to buyers other than Minnesota utilities; for example, Hennepin Energy Recovery Center ("HERC"), which does not qualify as an EET, sells its generation directly into the wholesale market via a power marketing firm, rather than to a Minnesota utility.[47]

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[44] CEOs Initial Comments, pp. 1-2.

[45] CEOs Initial Comments, p. 2.

[46] CEOs Initial Comments, pp. 20-21.

[47] CEOs Initial Comments, pp. 21-22.

Commenters provided the following arguments opposed to a Point-of-Generation framework:

- Applying a POG framework could mean that all hydrogen, regardless of how it was produced, could fully count towards the CFS. Allowing hydrogen produced from fossil fuels does not appear to be what the legislature intended.
- Parties advocating for a POG framework also advocate for consideration of upstream and downstream emissions to be considered with hydrogen and CCS; these positions appear contradictory.
- A POG framework would mean interpreting "carbon-free" in a manner that excludes biomass, which could render the EETS meaningless.[48] St. Paul Co-Generation and District Energy St. Paul ("SPC and District Energy") argue that if the CFS were to exclude EETS technologies, utilities would have no use for technologies that meet the EETS and thus would only pursue resources that meet the CFS. This would harm EETS generators in the years leading up to 2040. They argue that the CFS and the EETS exist in the same statute and MN law requires that every law shall be construed, if possible, to give effect to all of its provisions.
- SPC and District Energy dispute CEOs' suggestion that biomass facilities can continue operating regardless of whether they qualify as carbon-free technology, as this position ignores market forces. They argue that CFS-obligated utilities are purchasing both electricity *and* compliance with the relevant standards; if the demand for non-compliant energy decreases, so too will the value of that energy.[49]
- The statute directs the Commission to interpret the statute in a way that maximizes benefits—including employment benefits—to local communities. Commenters argue that biomass, MSW, and RNG facilities have many local benefits, and adopting a POG framework would fail to account for those benefits.
- The Commission is directed to minimize cost and reliability impacts under the partial compliance component of the statute. A POG framework could lead to the shuttering of many existing, dispatchable, dependable resources around the state.
- LIUNA argued that an "overly narrow interpretation of the statute inevitably leads to the absurd result of considering a net-zero biomass plant to be a fully carbon-emitting resource."[50]
- An overly narrow interpretation that precludes MSW would run counter to the state's long-standing waste management policy in the Waste Management Act (Minn. Stat. § 115A.02) that favors resource recovery (including waste-to-energy) over landfilling of MSW.[51]

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[48] SPC and District Energy Joint Comments, p. 2. Minnesota Power Supplemental Comments, p. 3 (September 17, 2025) (hereinafter "Minnesota Power Supplemental Comments").

[49] SPC and District Energy Joint Comments, p. 4.

[50] LIUNA Comments, p. 1.

[51] Partnership on Waste and Energy Supplemental Comments, pp. 2-3 (September 17, 2025) (hereinafter "Partnership on W&E Supplemental Comments").

C. EETS Framework

This framework asserts that EETs (Eligible Energy Technologies, which include wind, solar, hydropower, certain forms of biomass, and hydrogen generated from any of these technologies) should automatically qualify as carbon-free, bypassing the need for a life-cycle analysis. It would result in all EETS and existing nuclear qualifying for CFS compliance. **(Decision Option 3)** With the exception of Senator Frentz, these commenters would also accept an LCA framework as an alternative option.[52]

1. Arguments for and Against EETS Framework

Commenters provided the following arguments in favor of an EETs framework:

- Ramsey/Washington Recycling & Energy ("Ramsey/Washington R&E") stated that because RECs are generated by EETs, and the statute allows RECs to satisfy the CFS obligation, EETs (including RDF/biomass) must be classified as carbon-free and eligible to satisfy the CFS, without requiring an LCA.[53]
- Senator Frentz argued that, as the chief author of the CFS in the Senate, the "inclusion of biomass, including waste-to-energy, as an eligible energy technology (EET) under Minnesota Statutes, section 216B.1691, was a deliberate choice. Subdivision 4 of that section states that all renewable energy credits are generated by EETs, and that a utility can procure RECs to meet the carbon-free standard. Therefore, refuse-derived fuel and biomass must be classified as carbon-free and eligible to satisfy the standard."[54]

Commenters provided the following arguments in opposition to an EETS framework:

- EETS combustion resources emit CO_2 and violate the statutory definition of carbon-free.
- An LCA is necessary to verify net CO_2 reduction or neutrality relative to counterfactual waste management methods.
- CURE argues: "The statute clearly differentiates the concepts of renewable energy credits (REC) and carbon-free energy credits. While biomass burning may still be a credit-generating source for RECs under the statute, that same credit will not count as carbon free if the Commission has drawn a distinction between all eligible technologies and carbon-free technologies."[55] The inclusion of the phrase "if the credit meets the requirements of each subdivision," which was added to the definition of RECs in 2023 as part of the CFS, indicates that the legislature recognized that not all EETs would meet the carbon-free standard because they by-definition emit carbon.[56]

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[52] MRRA Comments, p. 2. Ramsey/Washington R&E Initial Comments, p. 4 and p. 10. Red Wing Comments, p. 2.

[53] Ramsey/Washington Recycling & Energy Supplemental Comments, p. 2 (September 17, 2025) (hereinafter "Ramsey/Washington R&E Supplemental Comments").

[54] Frentz Comments, p. 1.

[55] CURE Reply Comments, p. 5.

[56] CURE Reply Comments, p. 14.

D. LCA Framework

Under this framework, no fuel-burning generator can qualify as carbon-free without first undergoing LCA. Advocates of this framework disagree about the purpose of the LCA. Some advocates argue that the LCA merely determines *whether or not a resource qualifies as fully carbon-free* (a binary construct); other advocates argue that the LCA can also be used to *measure the extent to which a resource may qualify for partial compliance* (a proportionate construct); the difference between these is discussed in further detail in Section IV.D.2. below.

1. Arguments for and Against LCA Framework

Commenters provided the following arguments supporting the use of LCA:

- The Commission has the authority to employ a life-cycle analysis in determining whether an energy technology is carbon-free.[57] The statute defines "carbon-free" as "a technology that generates electricity without emitting carbon dioxide," but contains no reference to a timeframe for determining emissions.[58] The partial compliance provision as well as the directive that the Commission develop standards that "protect against undesirable impacts on the reliability of the utility's system and economic impacts on the utility's ratepayers and […] technical feasibility" provide the Commission with flexibility and discretion.[59]
- The primary purpose of the CFS is to reduce the effects of climate change, meaning that an overall reduction in economy-wide GHG emissions is the overarching policy imperative.[60] LCA allows users to make apples-to-apples comparisons of total cumulative and net emissions of resources; without the use of this tool, decisions could be made that would lead to greater overall GHG emissions and impacts on climate change.
- For certain waste streams, such as wood waste or municipal solid waste, the alternatives to electricity generation may have a worse effect on climate change, particularly given the impacts of methane from activities such as landfilling. The best way to understand the relative emissions of a biomass or WTE facility is to do an LCA to compare it with alternatives such as open burning and landfilling.[61]
- The statute allows partial compliance for facilities that use carbon-free technologies, but only for the portion that this carbon-free. The record demonstrates that the when developing the statute, the legislature intended for technologies such as hydrogen fuel-blending and carbon capture and sequestration to count towards the partial compliance provision. However, to ensure that these technologies are carbon-free, upstream and downstream emissions must be captured, meaning that for partial compliance,

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[57] SPC and District Energy Joint Comments, p. 1.

[58] SPC and District Energy Joint Comments, p. 2.

[59] SPC and District Energy Joint Comments, p. 2.

[60] Department Reply Comments, p. 13. Partnership on W&E Supplemental Comments, p. 1.

[61] Ramsey/Washington R&E Initial Comments, p. 5.

emissions at the stack is not sufficient, and a life-cycle analysis may be necessary.

Commenters provided the following arguments opposing the use of LCA:

- CEOs noted that unlike the Natural Gas Innovation Act ("NGIA") statute, the CFS statute does not provide for the use of comparative analysis, carbon neutrality analysis, or life-cycle analysis.[62]
- CEOs noted that the CFS does not treat biogenic CO_2 differently than anthropogenic CO_2; permitting any type of CO_2 emissions would violate the definition of "carbon-free."[63]
- CEOs argue that biomass facilities do not qualify for partial credit under the law unless they "utilize carbon-free technologies" such as CCS or green hydrogen co-firing.[64]
- CURE argues that the Commission has no statutory authority to request comment on or approve fuels as eligible for the CFS based on lifecycle analysis.[65] As such, CURE recommended a number of questions from Staff's January 22, 2024 Notice of Comment be removed from consideration for any Commission action.[66]
- CURE argues that the clear statutory definition does not mention "net zero lifecycle analysis" or "avoided methane," and thus all questions regarding LCA eligibility for combusted fuels should be removed from consideration.[67]
- CEOs argued that, from a policy perspective, allowing biomass and solid waste to be considered either fully or partially carbon-free under an LCA would not be in the public interest because it would:
    - Create a new incentive for waste burning;[68] CEOs also note that the Commission's responsibility is reducing carbon emissions from the power sector rather than seeking out potential reductions in waste-management emissions;[69]
    - Be an administrative burden, provide unreliable results, and create regulatory uncertainty;[70]
    - Require facility-specific data, which might not be available prior to the Commission permitting the facility to be considered carbon-free;[71]
    - Require speculative long-term predictions about topics such as waste

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62 CEOs Initial Comments, pp. 1-2. On pp. 9-10, CEOs noted one exception wherein the CFS permits comparative analysis, which is at Minn. Stat. § 216B.1691 [sic], subd. 2b, the "so-called off-ramp provisions."

63 CEOs Initial Comments, p. 14.

64 Clean Energy Organizations Reply Comments, p. 14 (August 20, 2025) (hereinafter "CEOs Reply Comments").

65 CURE Initial Comments, p. 2.

66 CURE Initial Comments, p. 6.

67 CURE Supplemental Comments, p. 5 (September 17, 2025) (hereinafter "CURE Supplemental Comments").

68 CEOs Initial Comments, p. 2 and p. 19.

69 CEOs Initial Comments, p. 26.

70 CEOs Initial Comments, p. 3.

71 CEOs Initial Comments, p. 3.

management counterfactuals[72] and future forest carbon absorption rates;[73]
    - Require regular and ongoing updates;[74] some updates—such as technological advancements and cost decreases for waste management practices, or policy changes such as an open burning prohibition—could reduce a counterfactual's emissions to the point where the facility in question would be required to close, thus disrupting county or utility planning efforts;[75]
    - Require verification of inputs—for example, of whether woody biomass is truly being harvested from waste wood;[76]
    - Undermine efforts to achieve the state's statutory climate goals; CEOs argue that generating electricity by burning either biomass or solid waste means emitting more CO_2 per unit of electricity than burning coal;[77]
    - Undermine efforts to achieve the state's statutory waste management goals, which prioritize waste reduction, reuse, recycling, and composting;[78]
    - Perpetuate or increase harm to human health, especially in environmental justice areas.[79]
- CEOs allowed that biomass and solid waste combustion facilities could be permitted under the partial compliance provision, provided those facilities also employed hydrogen co-firing or CCS.[80]

2. Agencies' LCA Proposals

Since the beginning of the LCA docket comment period, the Agencies (MPCA and Department) have submitted three LCA constructs. Initially, both parties recommended a proportionate construct, in which the results of the LCA may be used to determine 1) whether or not a resource is carbon-free and 2) the percent that is carbon-free of that resource. This proportionate construct would allow for resources to qualify as either fully or partially carbon-free. **(Decision Option 4)**

The Department then withdrew its support for this proposal and instead recommended a binary construct, in which the results of the LCA may only be used to determine whether or not a resource is carbon-free. Unlike the proportionate construct, the binary construct would not permit partial compliance of biomass, solid waste, or RNG. **(Decision Option 5)** Finally, the Agencies jointly made a late recommendation in response to Staff Information Requests ("IRs"); this construct uses the binary construct, then layers in LCA exemptions for certain types of

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72 CEOs Initial Comments, pp. 3-4.
73 CEOs Initial Comments, p. 39.
74 CEOs Initial Comments, pp. 3-4.
75 CEOs Initial Comments, p. 37.
76 CEOs Initial Comments, p. 35.
77 CEOs Initial Comments, p. 4 and p. 41.
78 CEOs Initial Comments, p. 44.
79 CEOs Initial Comments, p. 46.
80 CEOs Initial Comments, p. 18.

wood wastes. **(Decision Option 6)** Staff notes that because the waste wood exemption construct was proposed after the comment period, and in response to an IR, no other commenters were able to weigh in on its merits. Table 3 shows known commenter positions on LCA constructs, and Tables 4, 5, and 6 below show how these different constructs would impact the eligibility of different technologies.

a) Commenter Positions

Although commenters have not been able to update their positions relative to the Agencies' newly proposed binary construct with waste wood exemption, the following table shows which LCA construct is supported by which parties, as currently understood by Staff:

Table 3. LCA Constructs and Supporters

Proportionate Construct	Binary Construct	Binary Construct with Waste Wood Exemption
Minnesota Power[81] Minnesota Forest Industries[82] MMPA[83] Olmsted County[84] Xcel Energy[85]	Partnership on Waste & Energy[86] Ramsey/Washington R&E[87]	Department MPCA

[81] Minnesota Power recommends that generation resources should count towards CFS compliance to the percentage they are determined to be carbon-free using a lifecycle analysis. Minnesota Power Reply Comments, p. 4 (August 20, 2025) (hereinafter "Minnesota Power Reply Comments").

[82] MFI recommends that, should an LCA study determine that woody biomass is only partially carbon-free, that carbon-free portion should be applied to the resulting generation for purposes of CFS compliance. MFI Comments, p. 6.

[83] In addition to supporting full credit for net-negative RNG, MMPA supports granting partial credit to RNG sources that do not achieve a negative carbon intensity but have a carbon intensity lower than that of fossil natural gas. MMPA Initial Comments, p. 5.

[84] Olmsted County recommends that energy generation from solid waste should be eligible towards the CFS based on carbon neutrality of the energy generation, as determined through an LCA study. Olmsted County Comments, p. 5.

[85] Xcel argues the following example: if RDF combustion results in 50 percent lower emissions than landfilling, Xcel suggests 50 percent of net generation would count toward CFS compliance. Xcel's recommendation that resources be eligible for partial credit is not exactly the same as MCPA's, but has the same effect. Staff discusses Xcel's position more fully in Section VI.B. below. Xcel Initial Comments, p. 14.

[86] The Partnership on W&E stated its support for the Department's interpretation of LCA results. Partnership on W&E Supplemental Comments, p. 3. The Partnership on W&E also recommended that the Commission determine that a lower net cumulative GHG emissions and global warming potential finding fully qualifies the waste for carbon-free status when implementing the carbon-free standard. Partnership on W&E Initial Comments, pp. 2-3.

[87] Ramsey/Washington R&E appears to be aligned with the Department's position, as an alternative to an EETS framework. It states that if an LCA study shows WTE results in eliminated or lower cumulative GHG emissions compared to landfilling, the resource should receive full carbon-free credit. Ramsey/Washington R&E Initial Comments, p. 4.

b) Proportionate Construct

In their initial comments, the Agencies asserted that either full or partial carbon-free credit may be given to biomass, renewable natural gas, solid waste, manure, and other emerging feedstocks, based on the results of a fuel life-cycle analysis. They stated that these feedstocks "should be eligible as fully or partially carbon-free based upon where their individual project lies on this spectrum."[88] In other words, under a proportionate construct, if an LCA shows any measurable reduction in emissions compared to a baseline (or counterfactual), the fuel source should receive proportional partial credit, rather than requiring full net zero status.[89] The Department later characterized this position as one in which "resources with partial emissions qualify for partial compliance"[90] and was "based on an understanding that carbon-free status would be determined based on avoided emissions."[91] This view informed many of the Agencies' initial recommendations, as well as recommendations made in Round 3 of the CFS docket.

Although it no longer supports a proportionate construct, MPCA argued that the Commission may have latitude in its interpretation of carbon-free and how it relates to partial compliance.[92] MPCA further pointed out that its partial credit stance is supported by Minn. Stat. § 216B.1691, subd. 9, which directs the Commission to enact renewable energy objectives while considering actions that maximize net local benefits to all Minnesota citizens.[93] MPCA specifically pointed out that in making a determination on partial credit, the Commission should consider impacts on reducing harmful air pollution, wildfire risk, energy affordability, and the creation or maintenance of high-quality jobs in Minnesota.

CEOs disagreed with this proportionate approach, arguing that it "represents a misreading of the law in two fundamental ways: (1) it inserts the concept of 'netting' into the CFS law, which nowhere appears in the statute; and (2) it replaces the law's 'carbon-free' standard with a 'lower-carbon' standard."[94] CEOs characterized this approach as one which "would allow a waste-burning facility that can claim just the slightest reduction in emissions below a 'business-as-usual' counterfactual to qualify as carbon-free."[95]

Staff provides the following table to demonstrate technology eligibility and LCA requirements

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[88] Department of Commerce—Division of Energy Resources and Minnesota Pollution Control Agency Joint Comments, p. 18 (June 5, 2025) (hereinafter "Agencies Joint Comments").

[89] MPCA Supplemental Comments, p. 3.

[90] Department Reply Comments, p. 8.

[91] Department Reply Comments, p. 10.

[92] MPCA Supplemental Comments, pp. 3-4.

[93] MPCA Supplemental Comments, p. 4.

[94] CEOs Reply Comments, p. 3.

[95] CEOs Reply Comments, p. 3.

under a proportionate construct, including the Agencies' recommendations on CCS and hydrogen.

Table 4. LCA Proportionate Construct (Decision Option 4)

	Eligible for Full Compliance	Eligible for Partial Compliance	Ineligible
No LCA Required	-Solar -Wind -Hydropower -Nuclear -Geothermal	-Facilities burning green, pink, or white hydrogen (the hydrogen part only) -Facilities using CCS (the CCS part only)	-Primary biomass -Fossil fuels without CCS -Facilities burning all other forms of hydrogen
LCA Required	-Waste biomass, WTE, or RNG facilities, if, after a life-cycle analysis, the resulting CI is at least 100% reduction from the counterfactual	-Waste biomass, WTE, or RNG facilities, if, after a life-cycle analysis, the resulting CI is less than 100% reduction from the counterfactual	

c) Binary Construct

In Reply Comments, the Department withdrew its support for the proportionate construct, finding that it "erroneously applied avoided emissions to the determination of carbon-free status in Minn. Stat. § 216B.1691 [subd. 2d(b)(2)(i)]," the partial compliant facility provision. Instead, it argued that the result of the fuel LCA study must be used to determine if electricity generation meets the statutory definition of carbon-free or not. The Department stated:

> While it can be inferred that "the percentage that is carbon-free" could be applied to partially emitting generation, such as natural gas generation with partial carbon capture and sequestration (CCS), it cannot be inferred that the definition of carbon-free can change. Carbon-free status requires zero emissions, and any net emission of carbon dioxide disqualifies all generation from the carbon-free determination. Carbon-free requires a binary determination that electricity generation either emits ≤ 0 g CO_2 / MWh, or the generation is not carbon-free.[96]

[96] Department Reply Comments, p. 11.

The Department clarified that it still supported the use of a fuel LCA to determine carbon-free status, but that the LCA should be used simply to determine whether electricity is carbon-free or not; the results would *not* be used to measure the degree to which a facility could be considered partially carbon-free.[97] The binary construct still permits the use of counterfactuals (i.e., the analysis capturing the alternative fate of the waste in question), as the Department stated that if an outcome of a fuel LCA shows emissions from a feedstock for electricity generation are less than or equal to the emissions from a base case, then the marginal addition of the electricity has either negative emissions or no emissions associated with the electricity, and the fuel should qualify as carbon-free.[98]

The Department concluded that the only appropriate use case of Minn. Stat. § 216B.1691 [subd. 2d(b)(2)(i)] is the co-generation of a fully carbon-free resource with any resource that does not meet the definition of carbon-free (e.g, green hydrogen co-firing); however, the Department allowed that, given legislative intent and state energy goals, it is possible to make a statutory argument to qualify CCS.[99]

As a result of this change in position, the Department withdrew and amended a number of its recommendations from its Joint Initial Comments with the MPCA.[100]

CEOs were supportive of the Department's change in position. It aligns with their argument that:

> The CFS does not create or recognize a spectrum of energy technologies with different levels of GHG emissions, nor does it ask the Commission to do so.
> Instead of such a spectrum of technologies, the Minnesota CFS creates just two distinct categories of electricity: (1) "carbon-free" electricity, from technology that generates "without emitting carbon dioxide," and, by necessary implication, (2) other electricity, from technology that does emit carbon dioxide. *This fundamental distinction – between carbon-free generation and other generation – lies at the heart of the CFS.*[101]

CEOs noted, however, that the Department still advocated for an avoided emissions construct, as the Department's recommended use of LCA credits generators with avoided emissions from the waste-management sector.[102]

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[97] Department Reply Comments, p. 11.

[98] Department Reply Comments, p. 14.

[99] Department Reply Comments, p. 11.

[100] Department Reply Comments, p. 12.

[101] CEOs Reply Comments, p. 4.

[102] Clean Energy Organizations Supplemental Comments, p. 6 (September 17, 2025) (hereinafter "CEOs Supplemental Comments").

Staff provides the following table to demonstrate technology eligibility and LCA requirements under a binary construct, including the Agencies' recommendations on CCS and hydrogen.

Table 5. LCA Binary Construct (Decision Option 5)

	Eligible for Full Compliance	Eligible for Partial Compliance	Ineligible
No LCA Required	-Solar -Wind -Hydropower -Nuclear -Geothermal	-Facilities burning green, pink, or white hydrogen (the hydrogen part only) -Facilities using CCS (the CCS part only)	-Primary biomass -Fossil Fuels without CCS -Facilities burning all other forms of hydrogen
LCA Required	-Waste biomass, WTE, or RNG facilities, if, after a life-cycle analysis, the resulting CI is less than the counterfactual.		

d) Binary Construct with Waste Wood Exemption

On December 11, 2025, the Agencies submitted Joint Responses to Staff IRs,[103] in which the Agencies withdrew their prior support for the proportionate and binary constructs and instead proposed their binary construct with waste wood exemption.[104] Under this construct, waste wood would be carbon-free without needing an LCA if it meets the following requirements:

1. The fuel is determined to be waste, as recommended by a Commission-established biomass working group.
2. The fuel is sourced from wood.
3. The temperature of waste is not altered as a required step to process the waste for energy production.
4. The average one-way transportation distance per ton-mile of waste does not exceed 75 miles from the waste collection point to the point of energy generation or the distance requirement is eliminated for trucks that run on zero emission fuels.
5. All of the electricity required to process the waste is matched with energy attribute

[103] Staff sought to better understand the differences between the proportionate and binary constructs, and which technologies would be considered carbon-free under each construct.

[104] Department of Commerce—Division of Energy Resources and Minnesota Pollution Control Agency Joint Information Request Response, p. 1 (December 11, 2025) (hereinafter "Agencies Joint IR Response").

certificate (EAC) retirements, which are additional to the utility's requirements under Minn. Stat. § 216B.1691.

The Agencies characterized the proposed waste wood construct as "a compromise framework that is recognized as statutorily permissible by all parties" and one which "incorporates the respective policy positions on partial compliance of the MPCA and the Department and turns them into a simplified framework that does not issue partial carbon-free credits."[105]

The Agencies explained their position thusly. First, they use a baseline assumption that all biogenic emissions are considered carbon-free, assuming the biogenic fuel source is in a usable form at the power plant. They note, however, that waste biomass usually needs transportation and processing before it can be used at a power plant. If emissions due to transportation and processing are significant, the fuel should not automatically be assumed to be carbon-free, but should need an LCA. If the emissions due to transportation and processing are small enough (as demonstrated through points 3 and 4 above), the waste wood would not require an LCA to be considered carbon-free. The Agencies also state that under this exemption, most forms of secondary woody waste biomass will qualify for an LCA exemption.[106] Pelletization would require more extensive processing, would require an LCA study, and would not be expected to be carbon-free.

The Agencies justified their position by noting that certain types of hydrogen (from geologic and renewable sources) produce small amounts of emissions in processing and transport, but these emissions are allowable under the highest level of Inflation Reduction Act tax credits for hydrogen. The Agencies state that the conditions outlined above "ensure that wood waste biomass will attain a carbon footprint that is approximately equal to that of electrolysis or geologic hydrogen."[107]

Staff notes that provision 1, the biomass workgroup, was already proposed by the Agencies prior to their Joint IR Response **(Decision Option 45)**. Under the proposed construct, one of the functions of the biomass workgroup would be to determine which biomass fuels could be exempt from LCA requirements **(Decision Option 45 A)**. This is discussed in Section VI.D. below.

Staff provides the following table to demonstrate technology eligibility and LCA requirements under a binary construct with wood waste exemption, including the Agencies' recommendations on CCS and hydrogen.

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[105] Agencies Joint IR Response, p. 1.

[106] Agencies Joint IR Response, p. 7.

[107] Agencies Joint IR Response, p. 2.

Table 6. LCA Binary Construct with Wood Waste Exemption (Decision Option 6)

	Eligible for Full Compliance	Eligible for Partial Compliance	Ineligible
No LCA Required	-Solar -Wind -Hydropower -Nuclear -Geothermal -Low emission woody waste secondary biomass	-Facilities burning green, pink, or white hydrogen (the hydrogen part only) -Facilities using CCS (the CCS part only)	-Primary biomass -Fossil fuels without CCS -Facilities burning all other forms of hydrogen
LCA Required	-Other waste biomass, WTE, or RNG facilities, if, after a life-cycle analysis, the resulting CI is less than the counterfactual		

e) Staff Analysis – Overall Frameworks

Staff notes that, as an initial matter, the Commission may wish to clarify which resources are fully eligible to count towards the CFS. No order in either this proceeding or the CFS proceeding has explicitly stated that solar qualifies as carbon-free, for example. If the Commission should choose to do this, Staff notes that the following technologies appear to be undisputed among the different frameworks: solar, wind, hydropower, and nuclear. **(Decision Option 1)** Geothermal may also be undisputed **(Decision Option 1A)**; only the Agencies and Xcel weighed in on this.

Second, Staff would like to correct an assertion made by the Agencies in their Joint IR Response. The Agencies state that their waste wood construct is one that "is recognized as statutorily permissible by all parties, and which achieves the desired policy outcomes of both agencies."[108] The proposal is not considered statutorily permissible by all parties; all POG framework advocates explicitly would not consider such a proposal to be statutorily permissible. A more accurate framing is that the proposed construct is recognized as statutorily permissible by *both agencies*.

[108] Agencies Joint IR Response, p. 1.

As to the reasonableness of the waste wood exemption proposal, Staff is less clear. It is logical that wood waste transportation and processing emissions could run the gamut from incidental to significant, and it also may be reasonable for the Commission to grant LCA exemptions once certain waste or fuel streams have met certain carbon-free standards. However, it is not clear why the Commission should take the guarantee of the Agencies that these provisions as currently presented—ie, without an accompanying LCA—would necessarily result in incidental emissions for waste wood. If the Commission decides to pursue an LCA framework, Staff would caution against granting any LCA exemptions unless there has been some degree of LCA review to begin with.

Both the proportionate and binary construct recommendations rely on counterfactuals and relative emissions reductions. Although the types of counterfactual analyses discussed in this record (e.g., open burning of wood, landfilling of MSW, etc.) do not involve burning electricity, it is Staff's understanding that counterfactual output (of carbon intensity or "CI") will be in CO_2e/MWh units; thus, a counterfactual without electricity generation can be compared to an LCA involving electricity generation.[109] Staff also notes that although parties discuss avoided emissions generally, the specific greenhouse gases ("GHGs") to be quantified is a point of contention discussed further in Section V.F. below. Carbon dioxide itself is not contested; thus, any LCA or counterfactual will at minimum quantify CO_2 emissions.

In its initial explanation of the binary construct, the Department presented two concurrent provisions in the binary construct. To be considered carbon-free: 1) The LCA result must be less than or equal to 0 CO_2e/MWh and 2) The results of the LCA must result in fewer emissions than the counterfactual.[110] However, the way the Department characterized the first recommendation is slightly misleading. Staff's understanding is that the binary construct does not require that an LCA literally result in a CI of 0 CO_2/MWh for resources to qualify as carbon-free. Instead, the Agencies are using 0 CO_2/MWh as a stand-in for the counterfactual; the Agencies assume that since the counterfactual is what normally would happen (absent the intervention of the electricity generating resource), there is a baseline of zero emissions. Any resulting CI that is less than the counterfactual would thus be considered "less than zero," and 100 percent carbon-free. Under the binary construct, a resource would not be eligible for partial carbon-free compliance unless it were combining a 100 percent carbon-free resource with a non carbon-free resource (such as hydrogen co-firing and CCS).

Staff's primary concern with the binary construct is that a resource even very slightly less carbon intensive than a counterfactual would be considered 100 percent carbon-free.

In contrast to the binary construct, under a proportionate construct a resource could only qualify as 100 percent carbon-free if the CI of the resource is reduced by 100 percent (ie, to a literal value of 0 CO_2e/MWh). Furthermore, under a proportionate construct, a resource that

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[109] Alternatively, output CI can be in CO_2/mmBTu or CO_2/MJ units.

[110] Department Reply Comments, p. 11.

reduces emissions by less than 100 percent would be considered "partially" carbon-free and could count emissions commensurate with that carbon-free percentage. For example, if the results of a counterfactual were 20 CO_2e/MWh and the resource being studied shows 5 CO_2e/MWh, or a 75 percent reduction, then the utility would be permitted to count 75 percent of the resource's generation towards the CFS.

At first glance, the proportionate construct makes sense because it is logical that the percent reduction in emissions should inform the percent carbon-free allocator. This construct employs a simple percent change calculation, represented by the following formula:

$$\text{Percent Change} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} \times 100\%$$

This is how the percent carbon-free calculation for both CCS and fuel blending could work. For example, a natural gas plant that emits 20 tons of CO_2 normally but 15 tons CO_2 once CCS is installed could demonstrate the following percent change:

$$\text{Percent Change} = \frac{\text{Plant Emissions after CCS} - \text{Plant Emissions before CCS}}{\text{Plant Emissions before CCS}} \times 100\%$$

$$\text{Percent Change} = \frac{15\ CO_2 - 20\ CO_2}{20\ CO_2} \times 100\% = -25\% \text{ change in emissions}$$

The CF allocator (0.25) is based on the plant's reduction in emissions.

The proportionate construct takes this method of calculating percent free at a singular facility and uses it to compare a counterfactual (such as open burning) to a resource being studied (such as a biomass facility.) Comparing the CI of the open burning and biomass is an entirely appropriate way to determine *which scenario produces lower emissions*. But comparing open burning and a biomass facility may not be the most appropriate way to determine *the percent the facility is considered carbon-free*. This is because the plant does not exist in the open burning counterfactual and open burning does not exist in the biomass facility LCA; it is comparing apples to oranges. A percent reduction calculation relies on some level of continuity between the new value and the old value. In the case of open burning and biomass, the more appropriate percent reduction calculation would compare emissions *due to open burning* before the plant and after the plant, represented by the following formula:

Percent Change =

$$= \frac{\text{Open Burning Emissions after Biomass Plant} - \text{Open Burning Emissions before Biomass Plant}}{\text{Open Burning Emissions before Biomass Plant}}$$

x 100%

This result would be a better percent carbon-free allocator for a biomass plant. Just as CCS was the "intervention" in the first example (measuring emissions at the plant before and after), the biomass plant is the "intervention" in the second example (measuring emissions from open burning before and after).

Nonetheless, should the Commission wish to pursue a proportionate construct, it is not unreasonable for the Commission to use the proportionate allocator as initially proposed, rather than the example provided by Staff.

Finally, Staff is mindful that Commissioners wishing to pursue an LCA framework may have reservations about the reliability of LCAs or about the long-term policy implications of creating new markets for waste. Alternatively or in addition, when evaluating a utility's compliance, the Commission might consider establishing limits on additional waste and biofuel accepted as compliant relative to a utility's current use of these fuels. Staff offers **Decision Option 7** to this effect, although notes that further record development may be needed to determine how best to operationalize such limits.

V. Lifecycle Analysis: Program Implementation and General Criteria and Standards

This section provides practical and overarching recommendations by commenters as to how the Commission could implement an LCA framework to evaluate CFS compliance, should it choose to do so. While most commenters providing recommendations in this section were in favor of LCA, some were not; Staff has taken efforts to make this distinction. Fuel- and technology-specific recommendations are discussed further in Sections VI-XI below.

Should the Commission decide to pursue an LCA framework, commenters requested the Commission take a number of actions, such as:

- Define relevant terms
- Identify state agency/agencies responsible for oversight
- Establish clear methodologies
- Specify modeling and/or modeling alternatives
- Outline how the data will be used in decision-making
- Identify key input parameter requirements
- Outline timing requirements of LCA submittal

Proponents of LCA generally supported the Commission implementing a consistent and reliable framework, but also one that allows for flexibility and the incorporation of refinements and revisions as appropriate. Commenters also pointed to a number of existing resources, particularly LCA models available for use, and Xcel pointed to existing frameworks and methodologies the Commission may look to for guidance, such as the NGIA GHG Framework and California's Low Carbon Fuel Standard.[111]

[111] Xcel Initial Comments, p. 6.

A. ISO 14040/14044

CEEM,[112] CMPAS,[113] Minnesota Power,[114] the Partnership on W&E,[115] recommend the Commission either follow or adopt the International Organization for Standardization's ("ISO") Life Cycle Assessment Requirements and Guidelines 14040 (principles and framework) and 14044 (requirements and guidelines). **(Decision Option 8)**

As described by Minnesota Power:

> The ISO is a worldwide federation of standards bodies dedicated to the development of international standards by technical subcommittees. In 2006, the Environmental Management's Life cycle analysis subcommittee developed the second edition of ISO 14040 and the first edition of ISO 14044.
> […]
> ISO 14040 is a foundational document that provides guidelines for every phase of an LCA including its goals, scope, and interpretation of results. ISO 14044 provides more guidance for implementation of these standards, including criteria pertaining to impact, quality, and reporting.
>
> While the International Standard does not dictate specific data inputs for the individual phases of an LCA, the standard is a useful guide for defining and organizing the components of such an analysis. This guiding template allows for the use of more accurate, project-specific data inputs while adhering to a standardized framework. […] Adopters of the ISO standards for LCAs include national governments, voluntary carbon markets, and LCA consulting firms.[116]

1. Staff Analysis – ISO 14040/14044

From Staff's understanding and experience, ISO 14040/14044 are frequently used as guiding frameworks within the context of LCA.

B. Fuel Pathways Proposal

Xcel recommends that LCAs be performed on the "fuel pathway" level and made available to CFS-obligated entities. Xcel explains that if an approved fuel pathway is similar enough to a

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[112] CEEM Comments, p. 2.

[113] CMPAS Reply Comments, p. 3.

[114] Minnesota Power Initial Comments, p. 3.

[115] Partnership on W&E Initial Comments, pp. 2-3.

[116] Minnesota Power Initial Comments, pp. 2-3.

utility's existing resource, the utility would be able to use the approved fuel pathway in lieu of conducting an LCA on the resource in question. As Xcel explains:

> A process should be defined by which [carbon-free] fuel pathways are approved via the LCA process, including documentation of the approved fuel type, feedstock, and production processes. Once a fuel pathway has been defined as CF, either initially or after undertaking an LCA, the CF fuel pathway should be added to an "Approved CF Fuel Pathway" list. […] Defining and tracking approved CF fuel pathways will simplify compliance by allowing a utility to rely on an already approved pathway, as long as their process is sufficiently similar, rather than requiring every generator, fuel and project to conduct its own LCA.[117]

Xcel explains that this proposal is based on the California's Low Carbon Fuel Standard processes. Xcel notes that the California Air Resources Board maintains a repository of streamlined and accepted carbon-free fuel pathways for easy use, as well as an option to file and secure approval of a newly proposed pathway.

Under Xcel's fuel pathways proposal, terms would be understood in the following manner **(Decision Option 9)**:

- Carbon-free: A determination of carbon-free is made at the *fuel pathway* level. "Carbon-free" does not apply to a specific resource or technology, but to the entire fuel pathway of a specific LCA, the boundaries of which will be set by the Commission.
- Compliance: Compliance applies at the *generation resource* level.
    - Full compliance: A generation resource is fully compliant if 100 percent of the electricity generated by the resource is generated based on a fuel pathway determined to be carbon-free.
    - Partial compliance: A generation resource is "partially compliant" if, in the generation of electricity, the resource relies on:
        A. Pollution control technology that does not remove 100 percent of the CO_2 emissions generated, or
        B. A mixture of a CF fuel pathway and a non-CF fuel pathway (eg, blending of hydrogen produced from an EET with natural gas)[118]
- Comparative Scenario Evaluation (CSE): A counterfactual analysis study, to be submitted alongside appropriate LCA studies.[119]
- Partial Credit: Partial credit would apply to CF fuel pathways that are determined to not

[117] Xcel Initial Comments, p. 5.

[118] Xcel Initial Comments, p. 13.

[119] Staff's understanding of Xcel's recommendation is that this would be performed either within the LCA itself (if allowed by the model) or submitted as a separate LCA model alternative.

be carbon-free and, after undergoing a Comparative Scenario Evaluation are ultimately deemed to be a better (ie, lower net GHG emissions) management opportunity than other options, and, as a result, are granted partial carbon-free credit.[120]

Xcel first recommends that a state agency (or agencies) with relevant experience, such as the MPCA, should be designated to review and make a recommendation to the Commission on approving or denying the results of an LCA conducted by or on behalf of a utility.[121] Xcel recommends that the responsible government agency's standard of review for determining if a fuel pathway is carbon-free, partially carbon-free, or not carbon-free should be based upon a CI threshold level below which a carbon-free fuel pathway is considered carbon-free. **(Decision Option 10)** For blended fuel situations such as hydrogen co-firing, Xcel recommends an LCA should be conducted on each individual fuel pathway requiring an LCA, rather than conducting an LCA on a combination of fuel pathways as would occur with fuel blending.[122] **(Decision Option 11)** Xcel further recommends that LCAs be conducted based on annual data, consistent with CFS compliance.[123] **(Decision Option 12)**

Xcel then makes the following procedural recommendations for its fuel pathway proposal **(Decision Option 13 A-F)**:

A. The responsible state agency shall review and make a recommendation to the Commission on approving or denying the results of an LCA conducted by or on behalf of a utility.
B. The utility proposing a new CF fuel pathway for compliance demonstration purposes should be responsible for conducting and providing the results of an LCA for review by the identified responsible government agency.[124]
C. Once an LCA is submitted to the designated state agency for review, the review should be completed and approved or denied by the Commission within six months.[125]
D. If an LCA conducted by or on behalf of a utility is ultimately denied for a given fuel pathway by the Commission, there should be a process for the utility to appeal the decision.[126]
E. If an LCA conducted by or on behalf of a utility is ultimately denied for a given fuel pathway by the Commission, another LCA analysis for the denied fuel pathway should be allowed to be undertaken by the same or another utility.[127]

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[120] Xcel Initial Comments, pp. 13-14.

[121] Xcel Initial Comments, p. 10.

[122] Xcel Initial Comments, p. 8.

[123] Xcel Initial Comments, p. 10.

[124] This recommendation aligns with CMPAS's recommendation that utilities ultimately be responsible for completing life-cycle analyses.

[125] Xcel Initial Comments, p. 10.

[126] Xcel Initial Comments, p. 10.

[127] Xcel Initial Comments, p. 10.

F. Once the LCA results for a given CF fuel pathway are approved by the responsible government agency, that CF fuel pathway should be added to an "approved CF fuel pathways" list that other utilities can rely on without needing to conduct another LCA. In order to rely on the "approved CF fuel pathways" list, the resource relying on the list would need to have similar source and production pathways as the resource on the list.[128]

In their Joint IR Response, the Agencies also noted the option of providing an LCA during a resource plan proceeding **(Decision Option 13 G)**, and also provide an option for public comment **(Decision Option 13 H)**:

> For all resources that are ordered by the Commission to require a fuel LCA study, a utility must submit an LCA study to demonstrate the carbon-free status of a generation facility and its feedstock or list of feedstocks. The best time to present such an analysis is during an integrated resource plan (IRP), such that the LCA study can be accepted by the Commission at the time the Commission makes a decision for procurement of the generation facility and its feedstock or feedstocks. Alternatively, a utility could make a resource eligibility petition outside of an IRP, which would also be available for public comment. The Minnesota Pollution Control Agency (MPCA) and/or the Minnesota Department of Commerce (Department; Agencies) would provide a review of the utility's assumptions to inform the Commission's eligibility determination. This process is similar to how Natural Gas Innovation Act (NGIA) petitions are evaluated currently.[129]

These processes appear to align with CMPAS' recommendations that the Commission:

A. Develop common model inputs, reference base/baseline life-cycle analyses, analysis boundaries, or other ways to streamline the life-cycle analysis requirements; and
B. Establish a process for allowing parties to periodically review any common assumptions or requirements.[130]

1. Staff Analysis – Fuel Pathways Proposal

Staff appreciates that Xcel's proposal does not put the onus on the Commission or the responsible state agency to disseminate guidance on exact LCA inputs or convene stakeholder

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[128] Xcel Initial Comments, pp. 6-7.

[129] Agencies Joint IR Response, pp. 6-7.

[130] Central Minnesota Municipal Power Agency d/b/a Central Municipal Power Agency/Services Reply Comments, pp. 3-4 (June 5, 2025) (hereinafter "CMPAS Initial Comments").

groups tasked with making overly prescriptive determinations about LCAs. Staff also appreciates that Xcel's proposed process is one that has been implemented in another state, and so Minnesota would not be blindly attempting a novel construct, should the Commission choose to adopt the proposal. Finally, given the complexities of the feedstocks, facilities, and fuels in question, Staff appreciates the distinction between a *fuel pathway* as carbon-free and a *facility* as fully or partially compliant.

As noted in the LCA frameworks section, Xcel's proposal that fuel pathways be eligible for "partial credit" is not exactly the same as the proportionate LCA framework, but yields the same result. Xcel's position is that only hydrogen co-firing and CCS would be eligible for partial *compliance* under the statute; however, complex fuel pathways requiring an LCA and using a counterfactual could receive partial *credit* and apply that credit proportionately to the facility in question.

To the Department's point about submitting LCAs during resource plan proceedings: IRPs are not resource-specific, but are about the size, type, and timing of resources. For this reason, it may be more appropriate for utilities to submit LCAs in resource acquisition proceedings. Staff has included both options in **Decision Option 13 G.**

While Staff agrees that the MPCA and/or the Department may be the appropriate responsible state agency/agencies, Staff questions whether the Commission has the authority to designate any agency besides itself for such a task. Staff has not provided a Decision Option to this point, but notes that the Agencies appear amenable to such a designation.

Should the Commission decide to pursue the procedural recommendations, Staff also offers **Decision Options 13 I and J**:

I. As part of its review of the proposed LCA, where appropriate, the responsible state agency will also conduct a review and provide a recommendation for a comparative scenario analysis submitted by the utility.
J. The responsible state agency will maintain a repository of "approved carbon-free fuel pathways" and "approved counterfactual fuel pathways" available on the agency's website.

Finally, Staff reminds the Commission that it may choose to adopt select parts of these proposals, such as the administration of LCA submittals and review, or the distinction between carbon-free and compliant, and need not adopt the construct in its entirety.

C. Model

Commenters who supported LCA generally agreed that any model chosen must adhere to a number of principles. The model should: meet national and international standards,[131] be

[131] MFI Comments, p. 5.

reliable, credible, and transparent,[132] enable a standardized method to compare impacts across different energy sources,[133] and allow for system boundaries and inputs to be well-defined.[134]

CURE, who does not support an LCA framework, argues that "there is no ready-made tool that can accurately generalize the many existing and to-be-built resources that supply electricity to Minnesota ratepayers."[135]

The Agencies,[136] CEEM,[137] CMPAS,[138] MMPA,[139] the Partnership on W&E,[140] and Xcel[141] supported the use of Argonne National Laboratory's Greenhouse Gasses, Regulation Emissions, and Energy Use in Transportation (GREET) model. **(Decision Option 14 A)**

However, many commenters also agreed that other models may be better suited for capturing counterfactuals, waste streams, exponential decay, and biomass. Commenters specifically noted the Environmental Protection Agency's Waste Reduction Model (WARM), and Landfill Gas Emissions Model (LandGEM) models, as well as the California Biomass Residue Emissions Characterization (C-BREC) model **(Decision Options 14 B-D)**. SPC and District Energy identified C-BREC as the model best suited for biomass.[142] CMPAS identified LandGEM as a model most suited for analyzing exponential decay, although was supportive of both the use of GREET and WARM.[143] CEEM recommended that for a woody biomass counterfactual involving open-burning, the Commission should require the C-BREC model.[144]

The Partnership on W&E noted that flexibility may be required to adequately capture comparative analyses, recommending the Commission consider the importance of "adapting established life-cycle models or tools to fit the comparative analysis required by the aforementioned standardized methods as appropriate to the waste material and fuel production process." The Partnership on W&E also stated that any Commission-approved LCA framework should allow for additional models and methodologies as may be developed or

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132 CMPAS Reply Comments, p. 3.

133 CEEM Comments, p. 2.

134 MFI Comments, p. 5.

135 CURE Reply Comments, p. 6.

136 Agencies Joint Comments, p. 11.

137 CEEM Comments, p. 4.

138 CMPAS Reply Comments, p. 3.

139 MMPA Initial Comments, p. 3; Minnesota Municipal Power Agency Supplemental Comments, p. 2 (September 17, 2025) (hereinafter "MMPA Supplemental Comments").

140 Partnership on W&E Initial Comments, pp. 2-3.

141 Xcel Initial Comments, p. 9.

142 SPC and District Energy Joint Comments, p. 3.

143 CMPAS Reply Comments, p. 3.

144 CEEM Comments, pp. 5-6.

refined over time.[145] **(Decision Option 14 E)**

The Agencies[146] and SPC and District Energy[147] similarly noted that no one LCA model can handle all of the different waste streams and energy technologies that need to be captured; instead, each individual project needs to be paired with the appropriate model.

Xcel supports the use of the GREET Model where appropriate for LCAs, along with providing the ability to rely on alternative methodologies, inclusive of Comparative Scenario Evaluations (i.e., counterfactuals), that follow the general principles of the GREET model.[148] Specifically, Xcel recommended the following:

- Prior studies and literature reviews, such as the University of Buffalo's study on Waste-to-Energy facilities, should be allowed for consideration if they are for a similar fuel pathway.[149] **(Decision Option 15 A)** In Supplemental Comments, the Partnership on W&E agreed that the University of Buffalo's methodology should be an allowed for analyzing GHG emissions related to MSW (including production of RNG from food/organic waste when used for electricity production) and urban wood waste.[150]

- Where appropriate, credible sources of existing LCA analysis results should be allowed for consideration, in lieu of conducting an LCA.[151] **(Decision Option 15 B)** This aligned with American Forest & Paper Association's recommendation that the Commission rely on existing LCAs that demonstrate the production of bioelectricity from forest products manufacturing bioenergy feedstocks at pulp, paper, and wood products mills meets the Carbon-Free Standard.[152]

1. Staff Analysis – LCA Models

Commenters generally seem to agree that different models are best suited to different situations. Staff cautions, however, that it is beyond the scope of these briefing papers to assess the various models proposed. Because utilities may need certainty about how fuels will be evaluated so that they can do their best to comply, the Commission may wish to consider deferring to the MPCA on this issue for now, given its expertise on emissions generally, and leave open the possibility of amending or modifying the LCA models as needed going forward.

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145 Partnership on W&E Initial Comments, pp. 2-3.

146 Agencies Joint Comments, p. 11.

147 SPC and District Energy Joint Comments, p. 3.

148 Xcel Initial Comments, p. 9.

149 Xcel Initial Comments, p. 9.

150 Partnership on W&E Initial Comments, p. 3.

151 Xcel Initial Comments, p. 9.

152 AF&PA Comments, p. 1.

D. Scope, Boundary, and Study Period

The LCA boundary defines how far upstream or downstream emissions are captured in the LCA. As noted by the Agencies, the Commission specifically sought to investigate a fuel life cycle analysis, explaining:

> As opposed to traditional LCA, fuel LCA does not analyze all material inputs that go into a production system, such as raw materials, processing, and transport, power plant construction, and other inputs. Fuel LCA only studies the fuel production system, which simplifies the analysis.[153]

The Agencies concluded that since some technologies, such as wind and solar, have no fuel, these technologies would not need a lifecycle analysis. The Partnership on W&E appeared to be in agreement with this perspective, a shift from its prior recommendation that all resources, even fully non-emitting ones, require an LCA.[154] Even with this clarification, however, parties recommend that the scope and system boundaries of an LCA must be well-defined.[155]

A fuel lifecycle analysis creates a tighter system boundary than a more comprehensive "cradle-to-grave" life-cycle analysis. CURE objected generally to the qualification that an LCA focus specifically on the fuel system boundary, stating: "It is also irrational, once you start an LCA, to cherry pick only the parts of the analysis you would like to do […] Starting with model inputs that serve these agencies preferred outcome, and is contrary to normal LCA practice, is a poor basis for any Commission decision."[156]

Olmsted County recommends the LCA scope and boundary for a carbon-free generation source should begin with the existence and acquisition of the fuel.[157] Likewise, the Partnership on W&E recommends the Commission establish the point at which the waste biomass material is generated and requires some kind of management as the initial step of the life-cycle analysis system boundary.[158] **(Decision Option 16)**

Olmsted County recommends the Commission adopt the following scope and boundary for conducting LCA studies **(Decision Option 17)**:[159]

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153 Agencies Joint Comments, p. 1.

154 Partnership on W&E Supplemental Comments, pp. 2-3.

155 MFI Comments, p. 5.

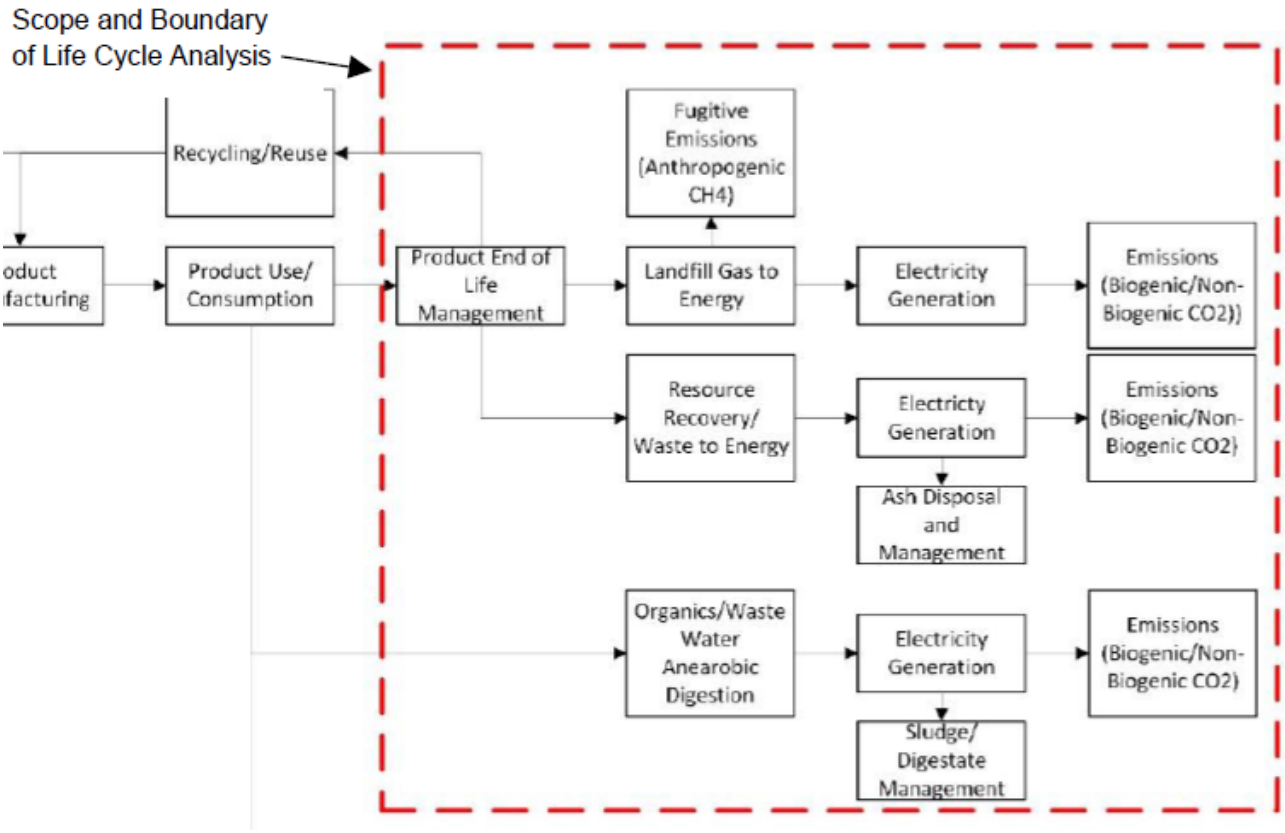
156 CURE Reply Comments, p. 11.

157 Olmsted County Comments, p. 2.

158 Partnership on W&E Initial Comments, pp. 2-3.

159 Olmsted County Comments, p 4.

Figure 4. Olmsted County's Proposed LCA System Boundary



As to the end of the system boundary, the Department recommends the Commission order the biogenic emission carbon cycle to be included for all relevant LCA studies.[160] **(Decision Option 18)** This would mean an LCA study period of at least 100 years to account for new biogenic growth and emission tails of decaying debris for waste biomass.[161] **(Decision Option 18 A)** The Department argued that a timeframe of at least 100 years more fully accounts for cumulative GHG emissions and emissions impacts from management of waste materials than shorter timeframes, particularly as relates to emissions tails from MSW landfills and carbon cycles of waste biomass.[162] MFI agreed with the Department's recommendation of a 100-year study period, noting the importance of capturing "delayed carbon sequestration."[163] Minnesota Power[164] and Olmsted County[165] agreed with the Department's recommendation that the biogenic emission carbon cycle be included for all relevant LCA studies. The Partnership on

[160] Department Reply Comments, p. 13. Department Supplemental Comments, p. 11. In the Agencies Joint IR Response, p.1, the Agencies stated that under this recommendation, biogenic emissions count as carbon-free.

[161] Department Reply Comments, p. 2.

[162] Partnership on W&E Supplemental Comments, pp. 3-4.

[163] MFI Comments, p. 6.

[164] Minnesota Power Supplemental Comments, p. 2.

[165] Olmsted County Comments, p. 3.

W&E,[166] MFI,[167] and MFRC[168] support an LCA study period of at least 100 years.

CMPAS recommends aligning the study period for any LCA with the life period of the beneficial use program. **(Decision Option 19)** CMPAS notes that during the lifespan of an existing landfill, for example, a beneficial use program that captures landfill gas to convert to electricity or RNG might only last 10-30 years. In such an instance, a 100-year study period would be inappropriate. CMPAS notes that landfills typically produce gas over a 50-year period, but even a 50-year study period would be much longer than the typical beneficial use program.[169] Similarly, Xcel recommends the study period be over a time horizon consistent with the lifespan of the resource.[170]

1. Staff Analysis – LCA Scope and Boundary

Staff simply notes that some of the scope and boundary recommendations would apply more specifically to waste material resources, not hydrogen.

E. Counterfactuals

The Agencies, CEEM,[171] Olmsted County,[172] MFI,[173] the Partnership on W&E,[174] Ramsey/Washington R&E,[175] Xcel,[176] all emphasize the importance of using a counterfactual in biomass and solid waste LCAs. The Agencies state:

> For example, energy produced from wood should be analyzed against open burning, manure against land application, organics against the appropriate combination of landfilling, composting, and anaerobic digestion, and MSW against landfilling.[177]

These commenters recommend that a counterfactual evaluation be permitted in the LCA process. **(Decision Option 20)** The Department recommends the Commission order utilities to

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166 Partnership on W&E Supplemental Comments, p. 3.

167 MFI Comments, p. 6.

168 MFRC Comments, p. 2.

169 CMPAS Reply Comments, pp. 3-4.

170 Xcel Initial Comments, p. 10.

171 CEEM Comments, p. 2.

172 Olmsted County Comments, p. 3

173 MFI Comments, p. 5

174 Partnership on W&E Supplemental Comments, p. 4.

175 Ramsey/Washington R&E Initial Comments, p. 5. Ramsey/Washington R&E recommends the LCA incorporate the fact that WTE generates electricity that offsets the need for more generation; the emissions of the counterfactual generation would be captured in an LCA.

176 Xcel Initial Comments, p. 9.

177 Agencies Joint Comments, p. 18.

develop their own avoided emissions base case scenarios (counterfactuals), as appropriate, to use in a fuel LCA study.[178] **(Decision Option 21)**

CEOs, who are not in favor of an LCA framework, express particular concern over the use of counterfactuals. They argue that, since facilities are unlikely to close operations if not granted carbon-free status, the waste management counterfactual would not be landfilling, but simply be continued operation of the facility.[179] CEOs argue:

> If the waste in question would still be burned regardless of carbon-free status under the CFS, then there would be no "greenhouse gas benefits relative to alternative waste management methods," no reason for a life-cycle analysis, and no justification for granting the facility carbon-free status despite its carbon emissions.[180]

CEOs note, for example, that the counterfactual of a biomass facility might involve open burning. However, if open burning were banned or if a state or community invested heavily in lower-carbon alternatives such as composting or wood vaulting, the change in counterfactual would lead to a change in the relative "carbon-freeness" of the biomass facility.[181] CEOs argue that basing a determination of carbon-free on a counterfactual, rather than on the resource itself, runs counter to the statute.

CURE points to a different issue with counterfactuals. CURE argues that since the CFS is not a waste management policy but an energy policy, the appropriate counterfactual for consideration is the alternative energy source, not the alternative fate of the waste.[182]

1. Staff Analysis - Counterfactuals

Staff appreciates the Department's recommendations that utilities should be in charge of developing their own counterfactuals, rather than the Commission or a state agency being responsible. The alternative fate of a utility-specific fuel source (refuse waste, biomass such as railroad ties) is highly fact-specific and potentially variable from year-to-year. Review and approval of the counterfactual would be a critical component of reviewing an LCA as a whole. As noted earlier, should the Commission choose to adopt Xcel's fuel pathway proposal, Staff has posited that the responsible state agency should also review, investigate if necessary, and make recommendations on counterfactual evaluations, and also maintain a repository of approved fuel pathways *and* counterfactuals available to be used by other utilities using similar fuels. **(Decision Options 13 I and J)**

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[178] Department of Commerce—Division of Energy Resources, p. 11 (September 17, 2025) (hereinafter "Department Supplemental Comments").

[179] CEOs Initial Comments, p. 28.

[180] CEOs Initial Comments, p. 29.

[181] CEOs Reply Comments, p. 12.

[182] CURE Reply Comments, p. 14.

Specific counterfactual recommendations can be found in the Biomass, Solid Waste/MSW, and RNG sections of these briefing papers, Sections VI-VIII, respectively.

F. Quantified GHGs

In the CFS Docket, the Partnership on W&E recommended that fuel LCAs should not only account for carbon dioxide, but for the full range of GHGs; the Partnership maintained this stance in the LCA docket. The Department agreed, recommending the Commission order all relevant greenhouse gasses be quantified in fuel LCA studies.[183] Ramsey/Washington R&E[184] made a similar recommendation, specifying that emissions calculations use a CO_2e calculation that normalizes the global warming potential (GWP) of different GHGs using carbon dioxide as the base unit.[185] **(Decision Option 22 D)**

Xcel argued the Commission should consider multiple Minnesota policy goals in an LCA, and that carbon-free determinations should specifically take into consideration emissions of methane and nitrous oxides, measured in CO_2e terms, especially when considering waste management efforts.[186] **(Decision Option 22 B and C)**

Minnesota Power did not support this recommendation, as going beyond CO_2 would be inconsistent with statute and "create inequalities between resources requiring an LCA and those that do not."[187] **(Decision Option 22 A)** CMPAS stated that it does not necessarily object to quantifying other types of GHG emissions (beyond CO_2), but notes that Minn. Stat. § 216B.1691 only mentions greenhouse gas emissions in one narrow instance, and does not mention CO_2e at all.[188]

1. Staff Analysis – Quantified GHGs

As demonstrated in the MPCA's Figure 1 above, methane might be critical to quantify for an LCA to yield a result of fully or partially carbon-free, at least for certain types of fuels. It is unclear to Staff if quantifying carbon dioxide alone would demonstrate that a fuel is carbon-free based on LCA.

G. Input Electricity

The Agencies recommended two instances[189] in which parties submitting an LCA should be

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183 Department Supplemental Comments, p. 11.

184 Ramsey/Washington R&E Initial Comments, pp. 4-5.

185 Ramsey/Washington R&E Initial Comments, pp. 4-5.

186 Xcel Initial Comments, pp. 10-11.

187 Minnesota Power Supplemental Comments, p. 5.

188 CMPAS Reply Comments, p. 5.

189 The Agencies also recommend hourly matching for energy storage CFS eligibility, discussed further below.

required to perform hourly matching, the process of acquiring hourly credits (such as Renewable Energy Credits, Alternative Energy Credits, and Environmental Attribute Credits) and matching those with hourly load data for all 8760 hours of the year. The Agencies recommend hourly matching for: (1) instances in which electricity is an input in the LCA and the utility claims the input electricity is carbon-free, and (2) instances in which the input energy is greater than the output energy by at least 25 percent.

The Agencies noted that some fuels (such as hydrogen) will require electricity as an input, but that utilities providing an LCA for hydrogen should not be required to demonstrate that all of the input electricity is carbon-free; in lieu of this, the utility should have to demonstrate that electricity consumption used to produce hydrogen is matched hourly with carbon-free energy.[190] The Department and MPCA recommend the Commission order:

A. All claims of carbon-free electricity used in a lifecycle analysis must include hourly matching for CFS-eligible generation sources; and
B. The utility must specify the source of carbon-free electricity. **(Decision Option 23 A and B)**

The Agencies specified that alternatively, a utility may use MISO annual grid emissions, from either MISO's whole territory[191] or Local Resource Zone 1 as in input assumption.[192] **(Decision Option 23 C)**

This recommendation is not only about hydrogen. From Staff's understanding, this would then also apply to electricity inputs such as those used in biomass, WTE, RDF, and RNG facilities, should the Commission find these eligible for CFS compliance.[193] In other words, the utility submitting an LCA involving WTE would need to provide hourly matched data showing that carbon-free energy served the WTE facility's load.

Additionally, the Agencies noted that there are instances in which the input electricity is greater than the output electricity—presumably in cases like hydrogen made from electrolysis. In such cases, it would be undesirable if the input electricity were from carbon-intensive resources; this could result in a situation in which more carbon-intensive resources are built to ensure enough hydrogen energy is available.[194] The Agencies conclude that where electricity consumption is expected to increase significantly to generate carbon-free electricity, utilities should demonstrate that the increased electricity consumption will not increase emissions. To this point the Agencies recommend that for all electricity generation processes subject to LCA requirements in which the primary electricity input energy is greater than 25 percent of output

[190] Agencies Joint Comments, p. 8.

[191] Department Supplemental Comments, p. 10.

[192] Agencies Joint Comments, p. 20; MPCA Supplemental Comments, p. 1.

[193] Staff notes that under the Agencies' proposed LCA waste wood exemption, certain types of waste wood may only need to provide annual, rather than hourly EAC matching for electricity inputs.

[194] Agencies Joint Comments, p. 20

energy:

A. The utility must submit annual documentation with its CFS compliance filing to demonstrate hourly matching of carbon-free electricity generation; and
B. The utility must plan new carbon-free resources to match all new electricity generation.[195] **(Decision Option 24 A and B)**

Xcel was opposed to these recommendations, noting that hourly matching is not prescribed by Minn. Stat. §216B.1691, and thus, the Agencies' recommendation goes beyond statutory intent and should not be required.[196]

1. Staff Analysis – Input Electricity

Staff finds merit in the idea that utilities have options for electricity input assumptions for an LCA. However, as discussed at length in Round 3 of the CFS docket, hourly matching appears to be a premature proposal. In that proceeding, the Department proposed and subsequently withdrew its recommendations that utilities be required to perform hourly matching to demonstrate compliance with the CFS. Commenters discussed many problems with the proposal, among which being that there is no existing hourly credit market; therefore, while utilities might be able to track hourly load, there is no means by which to track and certify that load is matched by hourly carbon-free energy.

On the topic of hourly matching, the Commission's September 16, 2025 Order concluded:

> Whatever the merits of hourly matching, the Commission concurs with commenters arguing that the issue is not yet ripe for consideration. Accordingly, for the present the Commission will decline to adopt any mandates regarding this issue, either in this docket or in utility resource plans. And given the press of other matters on the attention of the Commission and commenters, the Commission will likewise decline to establish a working group on this matter. Commenters are free to gather and discuss these topics on their own initiative.
>
> […]
>
> That said, if any proceeding would provide an appropriate forum to explore these issues, it would be a resource planning docket. These dockets already entail analyzing utility operations under a

[195] Agencies Joint Comments, p. 9; Department Supplemental Comments, p. 10; MPCA Supplemental Comments, p. 1.

[196] Northern States Power Company d/b/a Xcel Energy Reply Comments, p. 5 (August 20, 2025) (hereinafter "Xcel Reply Comments").

> variety of scenarios, so they would provide an appropriate opportunity for exploring how adopting the practice of hourly matching would influence utility operations, environmental consequences, and ratepayer costs. Accordingly, the Commission will invite any utility filing a resource plan to incorporate one or more sensitivities that use an hourly matching construct to achieve the state's Carbon-Free Standard. The utility could include a discussion of the potential costs—including the costs of running the sensitivity analysis—benefits, possibilities, and limitations of a potential future hourly matching requirement.[197]

H. Re-Evaluations

The Agencies recommended that for existing assets, lifecycle emissions shall be re-evaluated no sooner than every five years.[198] **(Decision Option 25)** In suggesting this evaluation cadence, the Agencies provided as reasons 1) the importance of regulatory certainty and 2) that resource acquisitions are typically made on a five-year planning horizon.

For new capital projects, the Agencies noted the importance of not letting ratepayers get stuck with a stranded asset.[199] Therefore, the Department recommended that lifecycle emissions be re-evaluated after the initial capital expenditure is expected to be paid off, to be determined at the time of CFS eligibility.[200] **(Decision Option 26)** By contrast, the MPCA recommends that for new capital projects, lifecycle emissions shall be re-evaluated no sooner than after the capital project is fully depreciated.[201] **(Decision Option 27)**

In general, Xcel recommends that the Commission proactively identify the valid duration of an LCA outcome,[202] and is supportive of the recommendation not to re-evaluate assets before they are fully paid off. However, Xcel also contended that even if assets are fully depreciated, re-evaluation is only necessary if there is a significant operational change.[203] Xcel recommends that once a resource qualifies as carbon-free or partially carbon-free, that designation should remain in place for the duration of the lifetime of the asset, unless and until signification

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197 *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Objectives and the Newly Created Carbon-Free Standard Under Minn. Stat. § 216B.1691*, Order on Carbon-Free Standard—Clarifying Use of Credits, Net Market Purchases, and Reporting, Docket No. E-999/CI-23-151, Ordering Paragraph 3 (September 16, 2025).

198 Agencies Joint Comments, p. 20; MPCA Supplemental Comments, p. 1; Department Supplemental Comments, p. 10.

199 Agencies Joint Comments, p. 10.

200 Department Supplemental Comments, p. 10.

201 Agencies Joint Comments, p. 20; MPCA Supplemental Comments, p. 1.

202 Xcel Initial Comments, p. 10.

203 Xcel Reply Comments, pp. 2-3.

modifications are made to the fuel type of generation resource.[204] **(Decision Option 28)**

The Agencies initially proposed that a compositional change in a facility's fuel of more than ten percent deviation should be subject to a new or revised life-cycle analysis to determine appropriate new carbon-free eligibility.[205] This fuel composition would be tracked by an annual CFS compliance filing. The Department withdrew its support for this recommendation in Reply Comments, as it states that under a binary construct, tracking a facility's fuel mix would be irrelevant. However, the MPCA continued to recommend for any fuel source determined to be carbon-free from a life-cycle analysis, utilities must report the composition of the fuel mix compared to the modeled lifecycle analysis in the annual CFS compliance filing, and that if any fuel mix deviates by more than ten percent, the utility must submit a new or revised lifecycle analysis and issue a new carbon-free percentage, if applicable.[206] **(Decision Option 29)** Now that neither Agency supports a proportionate construct, it may be that MPCA no longer supports this filing requirement.

In Reply Comments, Xcel disagreed with the fuel mix reporting and re-evaluation recommendation, restating its proposal that LCAs be conducted on a fuel-by-fuel basis and not on specific fuel mixes. Xcel states that evaluating at the fuel level "avoids unnecessary LCA re-evaluation for changes in fuel mixture ratios and allows for the fine tuning of partial compliance based on annual averages of heat input by fuel type, which may change from year to year."[207] Instead, Xcel recommends that for blended fuel situations such as hydrogen co-firing, an LCA should be conducted on each individual fuel pathway requiring an LCA, rather than conducting an LCA on a combination of fuel pathways as would occur with fuel blending.[208] **(Decision Option 11)** This comports with Xcel's fuel pathway proposal. Xcel notes, however, that if the Commission adopts MPCA's recommendation, details about what constitutes a change in the composition of a given fuel resource will need to be defined.

CEOs are not supportive of LCA generally, but they disagree with the Agencies' and Xcel's evaluation timeline recommendations, noting that if adopted, new projects wouldn't be reviewed for decades.[209] CEOs note that it's not just the facilities themselves that might change over the course of such a long period, but critically, the counterfactual assumptions. As previously noted, CEOs also argue that counterfactuals are subject to change over time, with advances in policy or technology that could render the original determination of carbon-free meaningless. CEOs argue: "The assumed emissions of the counterfactual represent far too weak a foundation to support a carbon-free determination of any duration, and certainly not one intended to last for decades."[210] CEOs' agree with the Agencies and Xcel that re-evaluating

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204 Xcel Initial Comments, pp. 10-11.

205 Agencies Joint Comments, p. 10.

206 Agencies Joint Comments, p. 21; MPCA Supplemental Comments, p. 1.

207 Xcel Reply Comments, p. 3.

208 Xcel Initial Comments, p. 8.

209 CEOs Reply Comments, p. 11.

210 CEOs Reply Comments, p. 13.

LCAs regularly could be disruptive to facility planning and could lead to stranded assets, but that the solution should not involve allowing carbon-emitting generation facilities to claim carbon-free status for decades.[211]

CURE, who is also opposed to LCA, contends that a five-year evaluation schedule is not particularly useful for certain biomass plants. CURE notes that in the case of Minnesota Power's Hibbard plant, the use of coal and natural gas changes by the day, noting that at times, Minnesota Power has been cited for burning more coal than allowed under its air permit.[212] CURE notes that available data in the Minnesota Power IRP demonstrates that over a five-year period the tonnage of railroad ties, coal, and wood wastes varies greatly at Hibbard, making a five-year average LCA likely misleading, as well as not a valid assurance of full compliance with the CFS.[213]

CURE also expressed concern about the ten percent fuel mix re-evaluation trigger. CURE contends that under this recommendation, Minnesota Power would be able to burn up to ten percent more coal than modeled without having to update an LCA. CURE stated that this is explicitly contradictory to the intent of the CFS statute.[214]

1. Staff Analysis – Re-Evaluations

Concerning stranded assets, the commenters' focus appears to be on new assets and not existing generation. It is not clear to Staff that this would necessarily happen as a direct result of CFS criteria and standards. Simply because a resource is determined to be fully or partially carbon-free does not mean that it would be approved in an Integrated Resource Plan, Resource Acquisition, or Certificate of Need proceeding. There will be multiple points in time where the Commission could find that the proposed asset does not fit the size, type, and timing criteria for the utility's resource needs, or in which the proposed resources are projected to create too much of a cost burden on Minnesota ratepayers, or result in incentivizing the creation of waste, for example.

For existing assets, if the LCA outcome finds a resource to be non-compliant, the utility will have options to buy EACs or even switch fuels. In addition, because compliance is based on Minnesota retail sales, non-compliance for a particular generator may not affect the utility's overall ability to reach the CFS threshold given line losses and jurisdictional allocations. The utility can continue to use the facility and potentially or marginally noncompliant fuels to generate.

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211 CEOs Reply Comments, pp. 12-13.

212 CURE Reply Comments, p. 12.

213 CURE Reply Comments, p. 12.

214 CURE Reply Comments, p. 12.

I. Credits and Allocators

MMPA and Minnesota Power, both of whom support a proportionate LCA construct, provided recommendations concerning how partially carbon-free facilities should report the percentage that is carbon-free.

Minnesota Power recommends that for generation resources determined to be partially carbon-free based on an LCA, CFS-obligated utilities should report carbon-free MWh commensurate with the percentage that facility is considered to be carbon-free. **(Decision Option 30)** MMPA is aligned with MP in this regard.[215]

MMPA additionally recommends that compliance with the CFS should consider the whole portfolio of a given "entity" in determining partial eligibility, ie, the aggregate carbon intensity score of the fuels used.[216] **(Decision Option 31)** As MMPA explains:

> First, when a utility uses multiple renewable fuel sources to power a single facility—or across multiple facilities—the average CI of the fuel portfolio should determine CFS credit eligibility. As a simple example, if half of the fuel used has a CI of -10 gCO_2e/MJ and the other half of the fuel has a CI of 10 gCO_2e/MJ, the resulting average CI is 0 gCO_2e/MJ. In this case, the emissions outcome is carbon-neutral and the overall electricity portfolio should be treated as fully carbon-free for CFS compliance purposes.[217]

Staff notes that this recommendation appears to conflict with Xcel's proposal that LCAs be conducted on each fuel pathway **(Decision Option 11)**.

The Department, who supports a binary construct with wood waste exemption LCA, provided the following credit accounting recommendation:

A. EACs be issued equivalent to metered generation on a per MWh basis;
B. A single EAC be issued for all generation that may be retired to demonstrate both EETS and CFS compliance;
C. A carbon-free allocator, which defines the percentage of CFS eligible generation, must be used for any generation facility that is partially CFS compliant; and
D. For all generation made in a CFS partial compliant facility that is not eligible for the EETS, metered generation in A. shall be multiplied by C. to determine the whole number of EACs to issue that are only eligible for the CFS.[218]
(Decision Option 32 A-D)

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[215] MMPA Initial Comments, pp. 5-6.
[216] MMPA Initial Comments, p. 5.
[217] MMPA Initial Comments, pp. 5-6.
[218] Department Reply Comments, p. 12.

Additionally, MPCA noted a potential issue regarding a "secondary process," such as when a CCS system is used as an input for hydrogen electrolysis. As Staff understands the Agencies' argument, if the utility generates 2 MWh as part of a 50 percent CCS system, then only 1 MWh of electricity can be considered carbon-free. If a utility then uses that 1 MWh as an input of hydrogen electrolysis, the utility could claim that its hydrogen is made from 100% carbon-free energy, when it is more accurately 50 percent.[219] Therefore, it is important to consider both the full amount of energy (2 MWh) and the allocator (0.50) from the initial process in determining the final partially compliant claim. MPCA recommended the Commission order all partially-compliant input energy claims in a secondary process to use the total output electricity of the partially compliant resource and to use the carbon-free allocator to determine the percentage of carbon-free electricity.[220] **(Decision Option 33)**

Finally, Xcel recommends the Commission consider establishing a process to translate renewable thermal credits to a REC for compliance tracking purposes.[221] **(Decision Option 34)**

J. Health Metrics

Health Professionals for a Healthy Climate recommends that to the extent the PUC allows biomass, renewable natural gas, or solid waste as carbon-free energy sources, including partial implementation between now and 2040, the tracking process and utility planning should effectively quantify and analyze the deaths and morbidity these facilities cause in overburdened communities in Minnesota and other jurisdictions. Such modeling should also account for economic harm, property value losses, harms to rural population and ways of life, harms to family farming, and known pollution impacts.[222] **(Decision Option 35)**

1. Staff Analysis – Health Metrics

Staff notes that the social cost of carbon is currently built into the Commission's decision-making processes in IRPs. However, more utilities are subject to the CFS than are required to submit IRPs. Should the Commission wish to impose additional externality tracking requirements, the Commission should determine the best way for utilities to do this. For example, the Commission could direct CFS-obligated utilities to submit an impact study or report for each applicable facility whose generation is counted towards CFS compliance. Should the Commission wish to pursue this option, Staff suggests requesting from HPHC their recommended means by which to report or track such metrics.

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219 Agencies Joint Comments, p. 9.

220 Agencies Joint Comments, p. 20; MPCA Supplemental Comments, p. 1

221 Xcel Initial Comments, p. 11.

222 HPHC Initial Comments, p. 8.

K. Compliance Filings

Staff notes that in their Joint IR Response, the Agencies included the following compliance filing provision:

> For all generation facilities that include electricity generation from hydrogen, woody waste biomass, or any fuel determined to be carbon-free from an LCA study, utilities will file the required information, as applicable, in annual compliance filings in Docket No. E-999/PR-YR-12, which includes an electricity use factor to generate electricity, marginal EAC retirement to match all electricity use (hourly or annual), and weighted average trucking mileage for each generation facility that uses the exemption.[223]

Staff notes that the Commission's September 16, 2025 Order in the CFS docket prescribes annual filing requirements for utilities subject to the CFS. Ordering Paragraph 4 requires:

> 4. Electric utilities must file reports as follows:
>
> A. Beginning in 2026, each electric utility must file a report each June 1st (along with its Renewable Energy Objectives compliance report in Docket No. E-999/PR-YR-12) detailing its efforts to comply with the Carbon-Free Standard.
>
> 1) Specifically, the utility must report the following.
>
> a) Annual Minnesota retail sales for the previous calendar year.
>
> b) Annual net market purchases from the previous year.
>
> c) Annual purchases of unbundled credits for the purpose of complying with the Carbon-Free Standard.
>
> d) Qualifying carbon-free energy procured or generated by the electric utility in the previous calendar year—including the number of facilities registered to that utility in M-RETS and the number of eligible credits that those facilities generated in the past year.
>
> e) A list of facilities determined to be partially compliant with the Carbon-Free Standard, including the name of the facility, the facility's fuel type, and the percent of that facility's output determined to be carbon-free.
>
> 2) From 2026–2030, electric utilities must also report the

[223] Agencies Joint IR Response, pp. 6-7.

following:

a) The estimated amount of carbon-free generating capacity the utility would need to obtain by 2030.

b) The estimated carbon-free requirements, on a megawatt-hour (MWh) basis, to meet the Carbon-Free Standard in 2030.

c) A short summary of ongoing efforts to obtain carbon-free energy, including a brief summary of the anticipated resource mix to comply with the CarbonFree Standard.

d) Any considerations, such as those outlined in Minn. Stat. § 216B.1691, subd. 2b, that may create challenges for achieving compliance, and which may allow the Commission to modify or delay implementation.

3) By June 1, 2026, each electric utility subject to the Carbon-Free Standard must file in this docket information about how the utility would use its existing and anticipated supply of credits if the Commission were to declare that credits generated after 2034 would expire —

a) after two years.

b) after one year.

c) in the year generated.

Each such utility must provide a discussion of the costs and benefits of the different expiration periods noted above, including but not limited to potential costs or benefits to ratepayers and impact on greenhouse gas emissions resulting from generators the utility owns or has contracted for.

Staff provides **Decision Option 36** to incorporate the Agencies' filing requirements contemplated in their Joint IR Response. Staff reminds the Commission that no parties have yet had the opportunity to weigh in on **Decision Option 36**.

Staff notes that, should the Commission adopt an LCA framework, a first step should include determining which resources and which utilities will want to submit LCAs for consideration. Therefore, Staff offers **Decision Option 37**, that utilities subject to the CFS and intending to use an LCA must notify the Commission and offer basic information about the relevant resources and fuel types and sourcing within 60 days of the Commission's Order in this proceeding.

VI. Biomass

As noted by the Minnesota Forest Resources Council, "biomass" is defined in Minn. Stat. §

41A.15, subd. 2e (a statute which covers biofuel and bioenergy incentive programs):[224]

> "Biomass" means any organic matter that is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood waste and residues, plants including aquatic plants, grasses, residues, fibers, animal waste, and the organic portion of solid wastes.

This means that biomass is often involved with municipal solid waste, waste-to-energy facilities, refuse-derived fuel, and renewable natural gas. However, most commenters in this proceeding specifically are interested in woody biomass.

The woody biomass generation facilities discussed in this docket are:

- St. Paul Cogeneration, a combined heat and power (CHP) facility that provides heating to District Energy-Saint Paul and power to Xcel Energy. SPC primarily burns urban wood waste but also mixes natural gas with wood chips in the boiler to increase combustion temperature and add stability.[225] Biomass is first processed by an affiliate company, Environmental Wood Supply. EIA data shows that in 2024, SPC's net generation was 151,068 MWh; this is equal to approximately 0.54 percent of Xcel's 2024 Minnesota load.[226]
- Minnesota Power's Hibbard Renewable Energy Center Units 3 and 4 in Duluth. Hibbard is capable of burning wood and wood wastes, coal, and natural gas, but in its most recent Integrated Resource Plan filing, Minnesota Power reports that the percentage of biomass is now more than 90 percent of the fuel supply. Hibbard's boilers currently provide steam to Unit 3 and 4 generators. In the past, steam was also provided to the local paper mill, and Minnesota Power states steam will soon be available again for the Duluth Paper Mill. The following data is taken from Minnesota Power's Electric Utility Annual Report for the 2024 year:

[224] MFRC cited §41A.25, Subd. 2e, which appears to have been a typo. Staff here provides what it believes to be the correct citation.

[225] https://www.ever-greenenergy.com/our-work/st-paul-cogeneration/

[226] Xcel reported annual load of 27,722,191 MWh in its Electric Utility Annual Report.

Table 7. Minnesota Power's Hibbard Summary Stats[227]

	Capacity (MW)	Primary Fuel	Secondary Fuel	2024 Generation (MWh)	Generation as Percent of MP's total load[228]	Quantity Primary Fuel	Quantity Secondary Fuel
Hibbard (Units 3 and 4)	60	Woody biomass	Natural gas; sub-bituminous coal	66,884	0.80	125,612 tons	14,465 MCF; 5,908 tons

- A potential biomass facility at Minnesota Power's Boswell Energy Center, after coal operations cease at that plant. Coal operations will cease at Unit 3 by December 31, 2029 and at Unit 4 by December 31, 2025. So far a biomass repower hypothetical has only been discussed for Unit 4.

Staff notes that Xcel's Wisconsin-based Bayfront and French Island facilities also burn woody biomass. It is unclear to staff if any Minnesota woody biomass is delivered to those facilities or whether Xcel plans to use those facilities to serve Minnesota customers, once the CFS takes effect.

A. Commenter Positions

The Agencies argue that broadly, waste biomass (not just woody waste biomass) should be eligible for CFS compliance, based on the results of a life-cycle analysis.[229] This position was generally supported by AF&PA,[230] LIUNA,[231] Minnesota Power,[232] and the Partnership on W&E.[233] CEOs are not supportive of any type of biomass being eligible for CFS compliance.

Many more commenters weighed in on woody biomass specifically. The following table shows which commenters favor allowing woody biomass to qualify for the CFS, either partially or fully, versus which parties oppose allowing woody biomass to qualify for the CFS.

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227 See Minnesota Power's 2025 Annual Electric Utility Report in Docket No. E999/PR-25-11.

228 MP reports total Minnesota load of 8,391,264 MWh for 2024.

229 Agencies Joint Comments, Appendix A, pp. 1-2.

230 AF&PA Comments, p. 1.

231 LIUNA Comments, p. 1.

232 Minnesota Power Reply Comments, p. 2.

233 Partnership on W&E Supplemental Comments, p. 2.

Table 8. Woody Biomass and Commenter Positions

Support Woody Biomass as Either Partially or Fully Eligible for the CFS	Oppose Woody Biomass as Eligible for the CFS
Department MPCA MFRC[234] AF&PA[235] Sen. Frentz[236] Ramsey/Washington R&E[237] Partnership on W&E[238] Minnesota Power[239] LIUNA[240] Olmsted County[241] Red Wing[242] MFI[243] CEEM[244] Xcel[245]	CEOs[246] Climate Generation[247] Coalition for Plastic Reduction[248] CURE[249] DFL Environmental Caucus[250] Eureka Recycling[251] HPHC[252] Institute for Local Self-Reliance[253] Interfaith[254] Minnesota Environmental Partnership[255] MN350[256] PFPI[257] Vote Solar[258] 43 current and former members of the MN Legislature[259] 66 public commenters[260]

234 MFRC Comments, p. 1.
235 AF&PA Comments, p. 1.
236 Frentz Comments, p. 1.
237 Ramsey/Washington R&E Initial Comments, p. 3.
238 Partnership on W&E Initial Comments, p. 3.
239 Minnesota Power Initial Comments, p. 9.
240 LIUNA Comments, p. 1.
241 Olmsted County Comments, p. 5.
242 Red Wing Comments, p. 1.
246 CEOs Initial Comments, p. 5. Staff notes that CEOs would find a woody biomass facility with CCS to be partially eligible based on the CCS eligibility.
247 Climate Generation Comments, p. 1.
248 Coalition for Plastic Reduction Comments, p. 1.
249 CURE, Interfaith, and PFPI Joint Comments, p. 6.
250 DFL Environmental Caucus Comments, p. 1.
251 Eureka Comments, p. 1.
252 HPHC Initial Comments, p. 1.
253 ILSR Comments, p. 1.
254 CURE, Interfaith, and PFPI Joint Comments, p. 6.
255 MEP Comments, p. 1.

Commenters provided the following arguments in favor of biomass eligibility:

- Continuing to use biomass facilities for CFS compliance minimizes cost and reliability impacts, both of which are required by statute. Partnership on W&E notes that MSW and wood waste are resources that are currently used to provide base load electricity in support of system reliability.[261] Minnesota Forest Industries states that converting facilities to burn woody biomass is a relatively low-cost way to meet the mandate and provide for societal power requirements, and that these resources can provide safe, reliable baseload power.[262] SPC and District Energy argue that biomass facilities provide a reliable source of firm renewable energy, and that this is a valuable resource when so many other renewable resources are intermittent.[263]
- SPC and District Energy argue that SPC's biomass facilities provides significant benefits to Minnesota by providing a safe disposal mechanism for waste wood; this is especially true from trees infected with emerald ash borer, the infestation of which is not expected to peak until 2028.[264] A study by the Partnership on W&E estimated that SPC's controlled disposal of wood waste provides a societal benefit of about $850 million net present value from avoided criteria pollutant emissions compared to open burning.[265]
- SPC and District Energy warn that lack of a carbon-free designation would risk facility closure, leading to more emissions and the loss of a reliable source of renewable energy. SPC and District Energy argue that rendering biomass ineligible for the CFS will result in devaluation of biomass electricity, which at their facilities will result in more emissions, not fewer. This is because such a devaluation will lead to the shuttering of biomass energy, and for the companies to replace the biomass facilities with natural gas facilities. SPC and District Energy state that, based on calculations from Docket 21-590, replacing SPC's biomass energy entirely by burning natural gas would lead to a significant increase in greenhouse gases emitted, as well as an increase in criteria

253 ILSR Comments, p. 1.
254 CURE, Interfaith, and PFPI Joint Comments, p. 6.
255 MEP Comments, p. 1.
256 MN350 Comments, p. 2.
257 PFPI Initial Comments, p. 1.
258 Vote Solar Comments, p. 1.
259 MN Legislators' Comments, p. 1.
260 See Appendix B of these briefing papers.
261 Partnership on W&E Initial Comments, pp. 4-5.
262 MFI Comments, p. 9.
263 SPC and District Energy Joint Comments, pp. 4-5.
264 SPC and District Energy Joint Comments, p. 5.
265 SPC and District Energy Joint Comments, p. 5.

pollutants emitted from uncontrolled disposal of the waste wood biomass SPC currently uses.[266]

Commenters provided the following arguments against biomass eligibility:

- Biomass directly emits carbon when burned and therefore cannot be included under the plain language of the law or receive partial compliance credit.
- CURE claims that studies of the biomass industry indicate that it does not break even without heavy subsidy.[267]
- CURE argues that the mass die-off of ash trees is a once-in-a-lifetime crisis expected to peak in 2028, and so it is not reasonable to create a permanent standard based on the assumption of a large supply of wood.[268]
- CURE argues that there are other job-creating businesses using urban wood waste to make high-value products, and that it is not necessary to have a biomass-burning facility to deal with wood waste.[269]
- CURE argues that even if woody biomass were found to be beneficial to the Twin Cities metro area, this does not necessarily translate to northern Minnesota.[270]
- CURE argues that a Boswell Unit 4 would have landscape-level impacts that go beyond anything experienced by the utility at Hibbard."[271]
- CURE argues that Minnesota Power overstates its use of woody biomass at the Hibbard plant, and provided evidence demonstrating that in 2022, Hibbard also burned more coal than any other year in the prior 5 years, with 11.83 percent of its MBTUs from burning coal. CURE also provided air violation warnings that Minnesota Power had received from the MPCA in both 2019 and 2025 for burning more coal that allowed under the facility's air permits.[272]

B. Definitions of Waste Biomass

As part of its November 7th Order establishing the LCA docket, the Commission specified its intent to develop the record on the definitions of sustainable and waste biomass. Such a definition could be used in either an LCA framework or an EETS framework.

1. Biomass, Broadly

The Agencies first delineated between "primary" and "waste" biomass, and provided the following definition of primary biomass:

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266 SPC and District Energy Joint Comments, p. 4.
267 CURE Supplemental Comments, p. 4.
268 CURE Supplemental Comments, p. 4.
269 CURE Supplemental Comments, p 3.
270 CURE Reply Comments, p. 6.
271 CURE Reply Comments, pp. 9-10.
272 CURE Reply Comments, pp. 9-10.

> Biomass that is intentionally cultivated, harvested, and prepared for use, in whole or in part, as a fuel for the generation of electricity.
>
> As farm-grown closed-loop biomass as defined in Minn. Stat. §216B.2424, subd. 1(a)(1).

Staff notes that Minn. Stat. § 216B.2424, subd. 1(a)(1) reads:

> Subdivision 1. Farm-grown closed-loop biomass.
>
> (a) For the purposes of this section, "farm-grown closed-loop biomass" means herbaceous crops, trees, agricultural waste, and aquatic plant matter that is used to generate electricity, but does not include mixed municipal solid waste, as defined in section 115A.03, and that:
>
> (1) is intentionally cultivated, harvested, and prepared for use, in whole or in part, as a fuel for the generation of electricity

The Agencies recommended that primary biomass should not be eligible for CFS compliance. **(Decision Option 38)** No commenters appeared to argue that primary biomass should be eligible for CFS compliance.

The Agencies provide the following proposed definition of waste biomass:[273]

> Biomass derived from secondary activities including but not limited to:
>
> 1. Wood waste from storm damage, disease or infestation, utility line maintenance, waste from forest products manufacturing;
> 2. Agricultural activities including manure;
> 3. Food waste and other organic waste.
>
> **(Decision Option 39 A, 1-3)**

CMPAS agrees with this definition of waste biomass.[274] MPCA further offers that MSW and biomass (including but not limited to residual woody biomass, agricultural biomass, and animal manure) should qualify as both sustainable and waste biomass if it results in fewer GHG emissions than the alternative disposal method.[275] **(Decision Option 39 B)**

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[273] Agencies Joint Comments, Attachment A, pp. 1-2.

[274] CMPAS Reply Comments, pp. 5-6.

[275] Agencies Joint Comments, p. 12.

The Partnership on W&E elaborates that waste biomass is not deliberately generated or created for use as a fuel feedstock, but is a by-product of the functions of society, or the result of natural forces such as pests, disease and storm damage, and requires some type of management or disposal on an ongoing basis, irrespective of the opportunities for or need for energy production.[276] **(Decision Option 39 C)**

CURE disagreed with this characterization, arguing that it is misleading to state that waste material will be created regardless of whether or not the waste is used for electricity generation. CURE countered that Minnesota has a hierarchy of waste, supported in law, favoring reduction and reuse over disposal, burning, and landfilling."[277] CURE recommends that biomass be ineligible for CFS compliance.

2. Woody Biomass

A number of parties offered definitions specific to sustainable woody biomass.

Minnesota Power notes[278] that Minn. Stat. § 216B.2424, subd. 1(d) defines "sustainable managed woody biomass" as:

> (1) brush, trees, and other biomass harvested from within designated utility, railroad, and road rights-of-way;
> (2) upland and lowland brush harvested from lands incorporated into brushland habitat management activities of the Minnesota Department of Natural Resources;
> (3) upland and lowland brush harvested from lands managed in accordance with Minnesota Department of Natural Resources "Best Management Practices for Managing Brushlands";
> (4) logging slash or waste wood that is created by harvest, by precommercial timber stand improvement to meet silvicultural objectives, or by fire, disease, or insect control treatments, and that is managed in compliance with the Minnesota Forest Resources Council's "Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers" as modified by the requirement of this subdivision; and
> (5) trees or parts of trees that do not meet the utilization standards for pulpwood, posts, bolts, or sawtimber as described in the Minnesota Department of Natural Resources Division of Forestry Timber Sales Manual, 1998, as amended as of May 1, 2005, and the Minnesota Department of Natural Resources Timber Scaling

[276] Partnership on W&E Initial Comments, p. 3.
[277] CURE Reply Comments, p. 12.
[278] Minnesota Power Initial Comments, p. 4.

> Manual, 1981, as amended as of May 1, 2005, except as provided in paragraph (a), clause (1), and this paragraph, clauses (1) to (3).

Minnesota Power argues that this definition in Minn. Stat. § 216B.2424, subd. 1(d) is sufficient to define sustainable biomass in the context of the CFS. **(Decision Option 40)**

Minnesota Power also pointed to requirements for woody biomass harvesting in Minn. Stat. § 41A.18, subd. 3; this statute section covers biofuel and bioenergy incentive programs.[279]

> All forestry-derived cellulosic biomass used for biomass thermal production must be produced using Minnesota forest biomass harvesting guidelines or the equivalent. All cellulosic biomass from brushlands must be produced using Minnesota brushland biomass harvesting guidelines or the equivalent. Forestry-derived cellulosic biomass that comes from land parcels greater than 160 acres must be certified by the Forest Stewardship Council, the Sustainable Forestry Initiative, or the American Tree Farm System. Uncertified land from parcels of 160 acres or less, tribal lands, and federal land must have a forest management plan, as defined in section 290C.02, subdivision 7, or the equivalent and be harvested by a logger who has completed training for biomass harvesting from the Minnesota logger education program or the equivalent.

CEEM,[280] MFI,[281] MFRC,[282] and Minnesota Power[283] also proposed definitions and provisions of woody biomass, spanning the following:

A. From whole dead, dying, damaged, and/or diseased trees salvaged after wildfire, windstorm, or insect infestation; other wood debris in the forest;
B. The by-product of forest management from routine maintenance, natural disasters, or hazardous fuel reduction including trees and woody plants (limbs, tops, needles, leaves, and other woody parts) grown in a forest, woodland, rangeland, or the urban and community environment;
C. Wood biomass associated with secondary harvest of logging residuals; tops, limbs, and unmarketable material from harvest operations;
D. Manufactured wood pellets;
E. Wood-based construction debris and waste;
F. Waste from products manufacturing and non-hazardous secondary materials such as wood-based paper-mill residuals and pulp, saw-mill residuals (including bark, sawdust,

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279 Minnesota Power Initial Comments, pp. 5-6.
280 CEEM Comments, p. 3.
281 MFI Comments, p. 6.
282 MFRC Comments, p. 1.
283 Minnesota Power Initial Comments, p. 4.

chips), and railroad ties, consistent with their treatment in EPA rule 40 CFR Part 241;

G. Material should be sourced by trained logging professionals implementing the Minnesota Forest Resources Council Voluntary Site-Level Guidelines for Forest Management, which includes biomass harvesting guidelines.

(Decision Option 41 A-G)

CURE argues that practically speaking, professional foresters engaged in proactive fire mitigation strategies have very little incentive to selectively harvest dead and rotting material and transport it to a power plant. CURE states that when foresters have done balsam clearing and brought trees to Minnesota Power's Hibbard plant in Duluth, the stand had to be "cleared;" even then it may still be more economically rational to chip and leave the trees on site.[284]

CURE argues that railroad ties are not "non-hazardous," since they are treated with various products, and the EPA advises against burning railroad ties due to toxicity.[285] CURE notes that at Hibbard, in the past five years the company has burned between 32,719 and 47,543 tons of railroad ties annually, as railroad ties are a lower cost option compared to other sources of wood waste.[286]

CURE also cited to a presentation by Minnesota Power in which the company noted they are considering how to create new kinds of biomass products, including pellets and biochar. CURE reported that most of land identified for heaviest harvest in creating a biomass pellet industry would be located in a radius of 75 miles around Cohasset and Boswell. CURE argues the Commission should not accidentally approve the use of these types of woody biomass under the CFS without fully understanding the implications of that decision on environmental justice communities, including tribes and low-income people."[287] CURE also states that pellets and biochar have a worse environmental and environmental justice impact than previously known.[288]

C. Woody Biomass LCA Assumptions

The Partnership on W&E recommends the Commission establish open burning of urban wood waste as the alternative management method (counterfactual).[289] **(Decision Option 42)**

MFI recommends that parties performing a lifecycle analysis on woody biomass use the following assumptions:

A. System boundary assumptions

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284 CURE Reply Comments, p. 7.

285 CURE Reply Comments, p. 7.

286 CURE Reply Comments, p. 7.

287 CURE Reply Comments, p. 10.

288 CURE Reply Comments, p. 10.

289 Partnership on W&E Initial Comments, pp. 2-3. Partnership on W&E Supplemental Comments, p. 4.

1) Include forest growth and decay/fire emissions
2) Include energy combustion emissions with scrubbers
3) Include harvest, transport, and processing emissions (not for mill residues)
4) Indirect land use changes will not occur
5) Account for counterfactual scenarios (e.g., what would have happened to the biomass if not used for energy, e.g., wildfire, landfill, and decomposition)

B. Carbon assumptions:
1) Assume biomass is inherently carbon neutral, based on regrowth of forests
2) Use the 100 year planning horizon that accounts for delayed carbon sequestration
3) Assume that emissions from combustion may take decades to be offset by regrowth

C. Feedstock type and source assumptions:
1) Forest residues (branches, tops, unmarketable material)
2) Mill residues (sawdust, bark)
3) Construction debris
4) Whole wildfire, wind, or insect-damaged trees

D. Forest management practice assumptions:
1) Assume the forest is actively managed for natural or planted regrowth and not converted to other uses (e.g., agriculture)
2) Assume the forest is actively managed using sustainable forestry, following harvesting best management practices with trained loggers.

E. Geographic and temporal scope assumptions:
1) Assume the entire forest of Minnesota, including its species and age class-specific growth, mortality, and removals
2) Assume the entire forest of Minnesota, with its associated biogenic cycle emissions, with and without its use for electricity generation;
3) Assume over a 100-year timeframe[290]

F. Energy system displacement assumptions:
1) Assume biomass displaces the current use of coal.

(Decision Option 43)

MFRC included a 2024 report conducted by the University of Minnesota for MFRC entitled "Estimated current and future carbon stocks and emissions in Minnesota forests and forest products under multiple management scenarios."[291] MFRC recommends that the PUC's criteria, standards and framework guidance for conducting carbon life cycle analysis wood biomass should explicitly include the option of using forest management considerations, including the data, methodology, and results contained in the UMN's Forest LCA Report.[292] LCA inputs should allow for carbon sequestration and carbon dioxide emission reduction values

[290] It is unclear to Staff how this differs from B.2.

[291] MFRC Comments, Attachment C. (https://efiling.web.commerce.state.mn.us/documents/%7B60DB4597-0000-C91E-998D-FE92493FC456%7D/download?contentSequence=0&rowIndex=78)

[292] MFRC Comments, p. 1.

derived across: statewide; landscape-scale; 100-year projected life-cycle periods, and; include stand level forest growth, harvest, and regeneration over time. **(Decision Option 44)**

D. Biomass Workgroup

The Agencies recommend the Commission establish a working group to determine the standards necessary to verify that waste biomass qualifies as waste biomass under the Commission definition and to ensure compliance with this definition.[293] **(Decision Option 45)** This recommendation was supported by the Partnership on W&E, who noted the following topics a workgroup could be well-suited to examine: permitting new/additional models and methodologies as well as the use of blended counterfactuals.[294] Staff notes that this recommendation may align with CMPAS's request that the Commission adopt formal definitions of biomass, renewable natural gas, and solid waste.[295] In their updated binary construct with wood waste exemption, the Agencies specify that the workgroup would specifically analyze which biomass fuels could count as carbon-free and be exempt from an LCA requirement.[296] **(Decision Option 45 A)**

Minnesota Power is generally not in favor of a workgroup, as workgroup activities such as re-defining waste and sustainable biomass would be duplicative of what is already in statute.[297] Minnesota Power also expressed concern that a workgroup could delay implementation of the LCA process for biomass.[298]

E. Staff Analysis – Biomass

Much of the record in this docket and the CFS docket has been devoted to biomass. In part, this is because biomass takes many forms, there are meaningful differences between each type, and biomass can involve many different fuel pathways.

Should the Commission wish to prescribe LCA assumptions for woody biomass, **Decision Options 42-45** allow different levels of prescriptiveness:

- **Decision Option 42:** The Commission simply specifies the counterfactual to use in woody biomass LCAs.
- **Decision Option 43:** The Commission specifies a range of inputs to use in woody biomass LCAs.
- **Decision Option 44:** The Commission specifies a guidance document for woody biomass LCAs.

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293 Agencies Joint Comments, p. 13.

294 Partnership on W&E Supplemental Comments, pp. 3-4.

295 CMPAS Initial Comments, pp. 3-4 and p. 6.

296 Agencies Joint IR Response, p. 2.

297 Minnesota Power Reply Comments, p. 2.

298 Minnesota Power Supplemental Comments, p. 4.

- **Decision Option 45:** The Commission forms a workgroup to determine what types of biomass should count as waste biomass.
- **Decision Options 6, 45, and 45 A together:** The Commission specifies that certain types of waste woody biomass are exempt from submitting an LCA to count towards the CFS. The Commission forms a workgroup and one task of the workgroup is to determine what types of waste biomass are exempt from LCA.

VII. Solid Waste/MSW

In addition to biomass, MSW (also called mixed municipal solid waste or simply solid waste) is another feedstock discussed in this record. Certain types of non-woody and agricultural biomass can be a component of MSW. Minn. Stat. § 115A.03, subd. 21 defines MSW thusly:

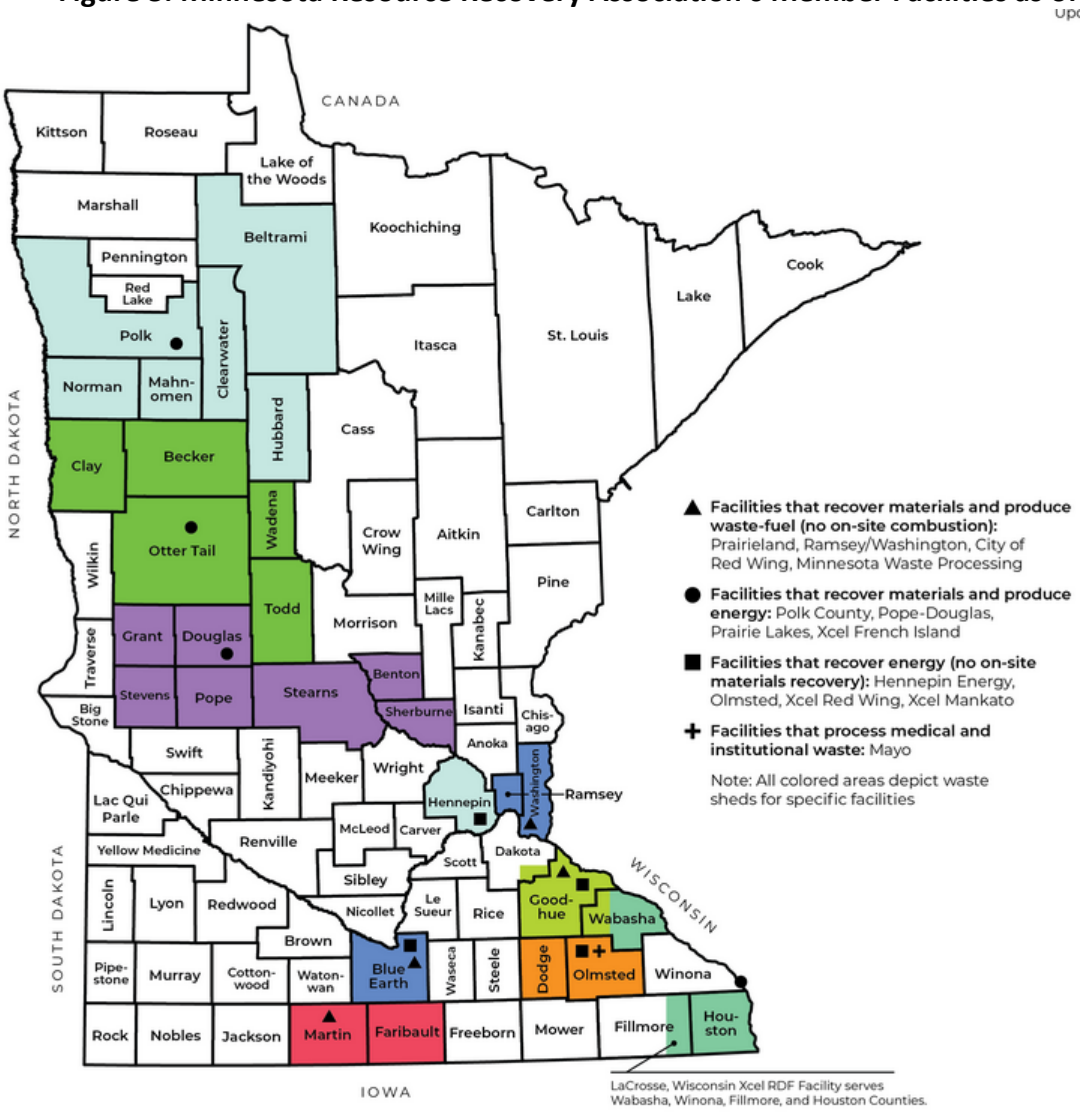
> **Mixed municipal solid waste.**
> (a) "Mixed municipal solid waste" means garbage, refuse, and other solid waste from residential, commercial, industrial, and community activities that the generator of the waste aggregates for collection, except as provided in paragraph (b).
> (b) Mixed municipal solid waste does not include auto hulks, street sweepings, ash, construction debris, mining waste, sludges, *tree and agricultural wastes*, tires, lead acid batteries, motor and vehicle fluids and filters, and other materials collected, processed, and disposed of as separate waste streams. [emphasis added]

As discussed previously, solid waste and MSW can involve complex fuel pathways. For example: biomass may be a component of MSW; MSW can be landfilled and then converted to RNG; MSW can be brought to WTE facilities that can produce steam, electricity, and RDF. The Minnesota Resource Recovery Association delineates between 1) WTE facilities that combust MSW onsite to create electricity and steam[299] and 2) RDF production facilities that involve no combustion.[300] The following map shows MRRA's member facilities in 2022.

[299] MRRA identifies the following WTE member facilities: Polk County Facility (serving Polk, Beltrami, Norman, Mahnomen, and Clearwater counties), Pope-Douglas Facility (serving Grant, Douglas, Pope, Stevens, Benton, and Sherburne Counties), Prairie Lakes Facility (serving Clay, Becker, Ottertail, Wadena, and Todd counties), Xcel French Island (serving Wabasha, Winona, Houston, and Fillmore counties), Hennepin Energy Recovery Center ("HERC") (serving Hennepin county), Olmsted Facility (serving Olmsted and Dodge counties), Xcel Red Wing Facility, Xcel Wilmarth Facility (Mankato).

[300] MRRA identifies the following RDF production facilities: Minnesota Waste Processing (serving Blue Earth county), Ramsey/Washington Recycling & Energy (serving Ramsey and Washington counties), City of Red Wing Facility (serving Goodhue, Wabasha, and Olmsted counties), Prairieland Facility (serving Jackson, Martin, and Faribault counties)

Figure 5. Minnesota Resource Recovery Association's Member Facilities as of 2022



In this docket, the following facilities were discussed:

- Olmsted County's WTE facility that combusts MSW as the primary means of waste management within the county to reduce waste volume and conserve landfill space and resources. The Olmsted County Waste-to-Energy facility ("OWEF") generates steam for heating, cooling, and electricity.[301]

- Ramsey/Washington R&E owns and operates the Recycling and Energy Center in Newport, Minnesota. Of the approximately 440,000 tons of mixed MSW generated in the counties after recyclable materials have been separated, about 400,000 tons of the

[301] Olmsted County Comments, pp. 1-2. Staff notes that Olmsted County states that its facility includes recovery of ferrous materials, although this is not identified in MRRA's map.

MSW are delivered to the R&E Center where R&E processes the waste to remove additional recyclable materials, and creates Refuse-Derived Fuel (RDF) that is used as fuel at two (Red Wing and Mankato) of Xcel's three RDF plants. In 2023, the R&E Center sent 331,000 tons of RDF to Xcel, removed 13,185 tons of recyclable materials, and landfilled about 12 percent of the MSW delivered to the R&E Center.[302] Ramsey/Washington R&E report that the Red Wing and Wilmarth plants use RDF produced by MSW generated in Blue Earth, Faribault, Goodhue, LeSueur, Martin, Nicollet and Sibley counties.[303]

- Xcel Energy's Red Wing and Wilmarth (Mankato) facilities. Data from Xcel's Electric Utility Annual Report shows the following 2024 data for these plants:

Table 9. Red Wing and Wilmarth RDF Plant Summary Stats[304]

	Capacity (MW)	Primary Fuel	Secondary Fuel	2024 Generation (MWh)	Generation as a Percent of Xcel's MN Load	Quantity Primary Fuel	Quantity Secondary Fuel
Red Wing (Units 1&2)	18	Refuse-Derived Fuel	Natural Gas	131,724	0.48	230,973 tons	15,649 MCF
Wilmarth (Units 1&2)	18	Refuse-Derived Fuel	Natural Gas	107,671	0.39	169,302 tons	22,842 MCF

Xcel reports on its website that:

- Red Wing gets its RDF from two sources: a city waste operation facility and the Recycling & Energy Center in Newport.
- Wilmarth gets its RDF from two sources: an on-site production facility and the Recycling & Energy Center in Newport.

Staff also notes that Xcel's Wisconsin-based French Island facility burns RDF. It is unclear to Staff if this facility gets any RDF/MSW from Minnesota facilities, or whether Xcel plans to use French Island electricity to serve Minnesota customers once the CFS takes effect.

A. Commenter Positions on Solid Waste/MSW

The following table shows commenters in support of or opposed to WTE/RDF facilities. Supporters align with either an EETS Framework **(Decision Option 3)** or one of the LCA Frameworks **(Decision Options 4, 5, 6)**. Opponents align with the POG framework **(Decision**

[302] Ramsey/Washington R&E Initial Comments, pp. 1-2.

[303] Ramsey/Washinton R&E Initial Comments, p. 2.

[304] See Xcel Energy's 2025 Electric Utility Annual Report in Docket No. E999/PR-25-11.

Option 2).

Table 10. MSW and Commenter Positions

Support WTE/RDF Facilities from MSW	Oppose WTE/RDF Facilities from MSW
Department	CEOs[312]
City of Red Wing[305]	Climate Generation[313]
Olmsted County[306]	Coalition for Plastic Reduction[314]
MPCA	DFL Environmental Caucus[315]
Minnesota Power[307]	Eureka Recycling[316]
MRRA[308]	HPHC[317]
Ramsey/Washington R&E[309]	ILSR[318]
Senator Frentz[310]	Interfaith[319]
Xcel[311]	MN EJ Table and Zero Burn Coalition[320]
	Minnesota Environmental Partnership[321]
	MN350[322]
	Northeast Metro Climate Action[323]
	PFPI[324]
	Vote Solar[325]
	43 members of the MN Legislature[326]
	72 public commenters[327]

[305] Red Wing Comments, p. 2.
[306] Olmsted County Comments, p. 5.
[307] Minnesota Power Initial Comments, p. 10.
[308] MRRA Comments, p. 2.
[309] Ramsey/Washington R&E Initial Comments, pp. 3-4 and p. 10.
[310] Frentz Comments, p. 1.
[311] Xcel Initial Comments, p. 15.
[312] CEOs Initial Comments, p. 5.
[313] Climate Generation Comments, p. 1.
[314] Coalition for Plastic Reduction Comments, p. 1.
[315] DFL Environmental Caucus Comments, p. 1.
[316] Eureka Comments, p. 1.
[317] HPHC Initial Comments, p. 1.
[318] ILSR Comments, p. 1.
[319] Minnesota Interfaith Power and Light Supplemental Comments, p. 1 (September 17, 2025) (hereinafter "Interfaith Supplemental Comments").
[320] MN EJ Table and Zero Burn Comments, p. 1.
[321] MEP Comments, p. 1.
[322] MN350 Comments, p. 1.
[323] Northeast Metro Climate Action Comments, p. 1.
[324] PFPI Initial Comments, p. 1.
[325] Vote Solar Comments, p. 1.
[326] MN Legislators' Comments, p. 1.
[327] See Appendix B to these briefing papers.

Supporters of WTE/RDF from MSW eligibility argue:

- Ramsey/Washington R&E argues that RDF qualifies as biomass, which is an Eligible Energy Technology (EET). R&E states that Subdivision 4 of the REO Statute allows a utility to procure RECs (generated by EETs) to meet the CFS, therefore EETs must be classified as carbon-free and eligible.
- Senator Nick Frentz, the chief Senate author, made a similar argument, stating that because biomass/WTE is an EET, and Subdivision 4 of the REO Statute allows RECs from EETs to satisfy the CFS, refuse-derived fuel and biomass must be classified as carbon-free and eligible to satisfy the standard.[328]
- The combination of R&E's waste reduction and recycling efforts, along with its production of RDF and Xcel's subsequent use of the RDF to generate renewable electricity, results in only about 12% of the MSW received at the R&E Center being landfilled. If Xcel's RDF Plants were to close, this percentage would rise to about 95%, creating a significant landfill capacity crisis in and around the Twin Cities metropolitan area.[329]
- Continuing to use waste to energy facilities for CFS compliance minimizes cost (existing, no need for new) and reliability impacts (dispatchable), both of which are required by statute. R&E states that discontinuing the use of RDF plants would lead to a loss of reliable baseload power and contribute to energy security.

Opponents of WTE/RDF from MSW eligibility argue:

- Burning MSW directly emits carbon when burned and therefore cannot be included under the plain language of the law or receive partial compliance credit.[330]
- Landfilling is not the sole alternative for waste management. CURE argues that states, counties, and municipalities have committed to waste reduction goals, and that the movement towards a zero-waste future is premised on the efficacy of recycling and composting programs, the creation of reusable products, and the reduction of waste at the source.[331]
- CURE argues that, since the CFS is not a waste management policy but an energy policy, the appropriate counterfactual for consideration is the alternative energy source, not the alternative fate of the waste.[332]

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328 Frentz Comments, p. 1.

329 Ramsey/Washington R&E Initial Comments, p. 2.

330 HPHC Initial Comments, p. 1.

331 CURE Reply Comments, p. 14.

332 CURE Reply Comments, p. 14.

B. LCA Assumptions for Solid Waste/MSW

The Agencies, the Partnership on W&E,[333] and Olmsted County[334] recommended that landfilling is the most appropriate counterfactual.

CMPAS recommends use of more precise definitions of "landfill" and "landfilling" in any glossary or compliance reporting forms for an LCA; CMPAS noted that although parties were quick to identify landfilling as a counterfactual for LCA, these are broad terms that incorporate a variety of waste, including municipal, commercial, and industrial.[335] CMPAS recommends the LCA counterfactual for WTE waste streams would use "worst case emissions municipal solid waste landfill" as the baseline for comparing impacts.[336] The Partnership on W&E agreed with CMPAS's recommendation.[337] **(Decision Option 46)** It is unclear to Staff exactly makes something "worst case emissions municipal solid waste landfill."

Additionally, Ramsey/Washington R&E recommend that in LCA studies involving a landfill counterfactual, parties must capture realistic levels of landfill methane gas collection percentages and gas-to-energy recovery efficiency. **(Decision Option 47)**

The Partnership on W&E recommends that in any LCA the Commission consider GHG offsets resulting from the recycling or other beneficial use of components found in the MSW that is being processed for use or otherwise used as a fuel.[338] **(Decision Option 48)**

VIII. Renewable Natural Gas

RNG is methane produced from biological material (typically waste) that is converted into biogas and upgraded to pipeline quality. RNG can come from MSW landfills, anaerobic digester plants at wastewater plants, livestock farms, food production facilities, and organic waste management operations.

Sources differ as to exactly how many RNG facilities currently operate in Minnesota; this may be in part because there is no one standard definition of RNG at the moment.

- The EPA identifies 1 landfill RNG project and 3 agriculture (livestock farm) digesters.[339]
- The American Biogas Council estimates 41 biogas facilities operate in Minnesota, with

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333 Partnership on W&E Initial Comments, pp. 2-3.

334 Olmsted County Comments, p. 3.

335 CMPAS Reply Comments, p. 3.

336 CMPAS Reply Comments, p. 3.

337 Partnership on W&E Supplemental Comments, p. 4.

338 Partnership on W&E Initial Comments, pp. 2-3.

339 Renewable Natural Gas | US EPA

26 wastewater systems, 4 landfill, 7 agriculture, and 2 food waste.[340]

- The RNG Coalition estimates 20 RNG facilities in Minnesota.[341]

A. Commenter Positions

Table 11. RNG and Commenter Positions

Support RNG as Either Partially or Fully Eligible for the CFS	Oppose RNG as Eligible for the CFS
MMPA[342] Minnesota Power[343] LIUNA[344] Olmsted County[345] Xcel[346]	CEOs[347] HPHC[348] Institute for Local Self-Reliance[349] Interfaith[350] Minnesota Environmental Partnership[351] MN350[352] PFPI[353] Vote Solar[354] 17 public commenters[355]

Supporters of RNG eligibility argue:

- RNG, when combusted, emits carbon dioxide but offers net emissions benefits due to avoided methane emissions, which are 28 times more potent than carbon dioxide.[356]
- This comparative emissions benefit is consistent with the intent and purpose of the CFS.
- The law directs the Commission to implement the standard in a way that "maximizes" several benefits, including the reduction of statewide air emissions—particularly in

340 Minnesota Biogas and Energy Potential | American Biogas Council
341 Renewable Natural Gas Infographics: View at RNG Coalition — The Coalition For Renewable Natural Gas
342 MMPA Initial Comments, p. 5; MMPA Supplemental Comments, p. 1.
343 Minnesota Power Initial Comments, p. 10.
344 LIUNA Comments, p. 1.
345 Olmsted County Comments, p. 5.
346 Xcel Initial Comments, p. 15.
347 CEOs Initial Comments, p. 5.
348 HPHC Initial Comments, p. 1.
349 ILSR Comments, p. 1.
350 Interfaith Supplemental Comments, p. 1.
351 MEP Comments, p. 1.
352 MN350 Comments, p. 2.
353 PFPI Initial Comments, p. 1.
354 Vote Solar Comments, p. 1.
355 See Appendix B to these briefing papers.
356 MMPA Initial Comments, p. 2.

environmental justice areas—and the creation of high-quality clean energy jobs. RNG, when evaluated via an LCA based on comparative CI, aligns with these objectives by delivering measurable GHG reductions, enabling deployment of local clean energy infrastructure, and providing opportunities for investment in underserved communities.

Opponents of RNG eligibility argue:

- RNG directly emits carbon when burned and therefore cannot be included under the plain language of the law or receive partial compliance credit.[357]
- Any benefit of RNG over fossil-fuel-based gas is eliminated when RNG-derived methane leaks at higher rates than fossil gas.[358]
- Confined animal feeding operations (CAFOs) are significant methane producers that should not be incentivized. CAFOs are also contribute to air pollution, water pollution, and nutrient run-off that contributes to algal blooms. CAFOs are often associated with dangerous meatpacking plants without adequate migrant worker protections.[359] These operations also crowd out small to medium-sized livestock operations which are more likely to employ grazing-based systems that emit fewer GHGs, are significantly less polluting, contribute to local economies, and sustain long-rooted, perennial pasture, which naturally captures more carbon.

B. LCA Assumptions re RNG

Xcel recommends RNG and other fuels purchased with associated renewable thermal credits tracked through M-RETS should also be identified as carbon-free and should not be required to conduct an LCA to count towards CFS compliance. **(Decision Option 49)** Xcel reasons that an LCA is already required in order to issue the renewable thermal credit.

Institute for Agriculture and Trade Policy (IATP)[360] and HPHC[361] recommend that the PUC not consider RNG from large scale animal operations ("CAFOs") as carbon-free. **(Decision Option 50)**

HPHC expressed particular concern about the impacts of RNG facilities and CAFOs on rural communities.[362] HPHC recommended that to the extent that the PUC cannot account for externalities, leakage, and foreseeable economic and social impacts of RNG production and use, HPHC recommends the Commission forbid any RNG project from being considered fully or partially carbon-free under Minnesota law.[363] **(Decision Option 51)**

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357 HPHC Initial Comments, p. 1.

358 HPHC Initial Comments, p. 2.

359 HPHC Initial Comments, p. 2.

360 Institute for Agriculture and Trade Policy Comments, p. 5 (June 5, 2025) (hereinafter "IATP Comments").

361 HPHC Initial Comments, p. 3.

362 HPHC Initial Comments, p. 3.

363 HPHC Initial Comments, p. 8.

The Partnership on W&E encourages a "more refined" approach in establishing the counterfactual management methods related to producing RNG from food waste and other organic wastes that are derived from MSW streams for use in generating electricity.[364] The Partnership recommends establishing MSW landfilling as the primary counterfactual for this material, with allowances for including a level of composting and/or anaerobic digestion without RNG production in a blended counterfactual approach that reflects existing capacity, material acceptance standards, and scale of operations of such facilities available to manage these waste materials.[365] **(Decision Option 52)** The Partnership recommends that the details of establishing a blended counterfactual could be determined in the workgroup proposed by the Agencies.[366]

IX. Carbon Capture and Sequestration

A. Commenter Positions

Commenters are split as to whether CCS should be eligible for partial CFS compliance **(Decision Option 53)** or ineligible. **(Decision Option 54)**

[364] Partnership on W&E Supplemental Comments, p. 4.

[365] Partnership on W&E Supplemental Comments, p. 4.

[366] Partnership on W&E Supplemental Comments, p. 4.

Table 12. Carbon Capture and Sequestration/Storage Commenter Positions

Support CCS as Partially Eligible	Oppose CCS Eligibility
Department[367] MPCA[368] API[369] CEOs[370] LIUNA[371] Minnesota Power[372] Minnkota[373] Xcel[374]	CURE[375] Eureka Recycling[376] Interfaith[377] MN350[378] 43 members of the MN Legislature[379] 56 public commenters[380]

Supporters of CCS partial credit eligibility argue that:

- The partial compliance provision of the statute requires the Commission "to allow for partial compliance with subdivision 2g from: (i) electricity generated from facilities that utilize carbon-free technologies for electricity generation, but only for the percentage that is carbon-free." CEOs argue that if a generating facility used a carbon-free technology for all of its generation, then its output would be entirely carbon-free, not just partially; the use of the term "partial compliance" then, and the phrase "but only for the percentage that is carbon-free," indicate that the Commission should only apply this provision to facilities that *partially* utilize a technology that generates electricity without emitting CO_2 so that a percentage of its output, but not all, can be reasonably deemed carbon-free. Thus, a plant using partial carbon capture can be viewed as combining a share of generation that lacks capture (not carbon-free) with a share of generation that employs capture technology (carbon-free).[381]
- Legislative history clarifies that the partial compliance provision was specifically intended to apply to facilities that co-fire with green hydrogen or partially employ

367 Agencies Joint Comments, p. 14.
368 Agencies Joint Comments, p. 14.
369 American Petroleum Institute Comments, p. 5 (June 5, 2025) (hereinafter "API Comments").
370 CEOs Initial, p. 59.
371 LIUNA Comments, p. 1.
372 Minnesota Power Reply Comments, p. 4.
373 Minnkota Power Cooperative Comments, p. 2 (June 5, 2025) (hereinafter "Minnkota Comments").
374 Xcel Initial Comments, p. 13.
375 CURE Initial Comments, p. 8.
376 Eureka Comments, p. 1.
377 Interfaith Supplemental Comments, p. 2.
378 MN350 Comments, p. 3.
379 MN Legislators' Comments, pp. 3-4.
380 See Appendix B of these briefing papers.
381 CEOs Initial Comments, p. 18.

CCS.[382] In both the CFS docket and LCA docket, CEOs have cited quotes from both lead authors of the CFS bill that demonstrate CCS was intended to be included.
- From a policy perspective, CCS provides a path forward for dependable, dispatchable, lower-carbon generation critical to grid reliability, especially at a time when load is increasing from artificial intelligence and data center requirements.[383]
- CCS investments are infrastructure-heavy and create long-term, high-quality jobs. [384]

Opponents of CCS partial credit eligibility argue that:
- CCS is not a "technology that generates energy," as § Minn. Stat. 216B.1691, subd. 2d (b)(2)(ii) requires; it is only a "pollution capture" technology.[385] CURE argues that when fossil fuels are combusted for electricity, the underlying electricity generation still generates emissions regardless of the presence or absence of CCS, and thus such facilities should not qualify as CFS-eligible.[386]
- Minnesota DFL Legislators assert that to count as carbon-free any fuel that emits CO_2 is contrary to the definition passed by the Legislature. They specifically state that the partial compliance statute should not allow the addition of carbon capture technologies to turn a fuel source that emits carbon into a carbon-free technology.[387]
- CURE asserts that the Commission can have no assurance that CO_2 captured by CCS providers will not be used for enhanced oil recovery.[388]

B. Percent Carbon-Free - CCS

Although the Agencies did not make a formal recommendation concerning CCS, they stated their support for the following principles:

- The "percentage that is carbon-free" should be calculated on a MWh-basis compared to unabated load. The Agencies argue that the purpose of CCS is not to capture carbon, but rather to generate low-emissions electricity.
- Any increased fuel consumption required to generate the same MWh should be accounted for to obtain an accurate measurement of total emissions.
- Support for actual EAC generation based on measured, not modeled, carbon capture, stating "EAC generation based on measured carbon capture ensures both accuracy and utility commitment to operating their systems with the highest carbon capture."[389]

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382 CEOs Initial Comments, p. 16.
383 API Comments, p. 1.
384 API Comments, p. 2.
385 CURE Initial Comments, p. 8.
386 CURE Initial Comments, p. 8.
387 MN Legislators' Comments, pp. 3-4.
388 CURE Reply Comments, pp. 3-4.
389 Agencies Joint Comments, p. 14.

Staff's understanding of this last point is that every MWh of carbon captured—measured at a meter rather than modeled through an LCA—would receive an EAC that must be retired for compliance demonstration purposes.

LIUNA agrees with the Agencies' method of calculation.[390] Minnesota Power agreed specifically with the Agencies' first point, that calculating partial compliance for fossil fuel facilities using CCS technology would involve comparing the reduced emissions of a facility to unabated carbon emissions for the facility.[391]

CEOs are aligned with the Department's first and second points. Of particular concern to CEOs is the "parasitic load" of powering CCS technologies, which was discussed at length in the CFS docket. CEOs note:

> According to a 2023 Department of Energy analysis, adding 90-95% post-combustion capture to an existing coal plant can reduce net plant efficiency by 24-25%. If the plant seeks to generate the same amount of electricity as before it adds capture, and powers the capture technology on-site by burning additional coal, it will produce even more CO_2 than before. If 90% of that additional CO_2 is also subject to capture, the EPA estimates CO_2 emissions at such a coal plant will therefore result in a somewhat lower (87.1%) emission reduction on a per MWh-net basis. [footnotes omitted][392]

CEOs note that the emissions associated with power in the CCS process might not be captured or even produced at the same facility, further creating indirect transportation and related emissions.[393]

CEOs recommend that once the Commission has determined a CO_2/MWh value for a plant using CCS considering direct, upstream, and downstream emissions, it should give partial compliance credit to that plant commensurate with the percent reduction in CO_2 emissions per MWh attributable to the CCS project.[394] **(Decision Option 56)** CEOs argue that failing to factor in the indirect emission increases associated with CCS would result in overestimating the overall reduction in CO_2 emissions, and thus overestimate the percentage of generation that can reasonably be considered carbon-free.[395] CEOs clarify that accounting for indirect emissions is not the same as conducting a life-cycle analysis; instead, it "simply requires isolating and estimating the significant indirect CO_2 emissions reasonably attributable to these carbon-

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390 LIUNA Comments, p. 1.

391 Minnesota Power Reply Comments, p. 4.

392 CEOs Initial Comments, pp. 55-56.

393 CEOs Initial Comments, p. 56.

394 CEOs Initial Comments, p. 49.

395 CEOs Initial Comments, p. 55.

reducing technologies."[396]

Minnkota recommends the Commission refrain from requiring the use of LCA generally with regard to partial compliance for Minn. Stat. § 216B.1691, subd. 2d.[397] **(Decision Option 55)** The recommendation to not require an LCA for CCS aligns with the Agencies' support for measured (at the meter), not modeled (through an LCA), carbon capture. No parties appear to advocate that facilities using CCS be required to perform an LCA.[398]

Minnkota instead supports partial compliance for fossil generation with CCS using a direct measurement methodology based on the percentage of CO_2 captured and stored. Specifically, Minnkota proposes that the percentage of carbon-free generation from a generating unit utilizing carbon capture equipment be identified by the following equation, which, in this instance, has been written specifically for Unit 1 (Young 1) and Unit 2 (Young 2) of the Milton R. Young Station:

$$\left| \text{[Young 1 Net Meter (MWh)} + \text{Young 2 Net Meter (MWh)]} \right| \times \frac{\text{Carbon Captured (actual tons)}}{\text{Carbon Generated (actual tons)}} = \text{Carbon Free MWh}$$

Where:

A. The point of measurement for the total megawatt-hours generated and transmitted to the grid would be the last revenue quality meter upstream of the substation connecting the generating unit(s) into the transmission grid system (net meter);
B. The point of measurement for the CO_2 sequestered would be the flow meters identified in the EPA approved monitoring, reporting, and verification plan pursuant to 40 CFR Part 98 Subpart RR, or other equivalent independently approved reporting plan; and
C. The point of measurement for the CO_2 generated from the electric generating units would be the continuous emissions monitors identified in the air monitoring plan submitted in accordance with 40 CFR Part 75 monitoring plan for the associated electric generating unit(s).[399]
(Decision Option 57)

While this calculation does reflect the Agencies' support for measured, not modeled, carbon capture, it does not address the Agencies' and CEOs' concerns about parasitic load, or the CEOs' concerns about any other indirect emissions. Further, it appears to support an energy-based (rather than credit-based) compliance construct.

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396 CEOs Initial Comments, p. 51.

397 Minnkota Comments, p. 4.

398 Minnkota expressed disagreement with Great Plains Institute's (GPI) "implied conclusion" that the Commission require LCA for facilities with CCS. Staff reminds the Commission and readers that GPI is not a party and did not make any recommendations, but simply provided information as to how different life-cycle analyses could be performed.

399 Minnkota Comments, p. 2.

C. Enhanced Oil Recovery

Enhanced Oil Recovery ("EOR") was discussed by the legislature when H.F. 7 was initially passed, in the course of the CFS docket, and was again brought up in the current docket. CEOs describe EOR thusly:

> EOR is a process in which captured CO_2 is injected into oil fields to facilitate more oil extraction from the ground. The risk of CO_2 leakage from EOR is obviously higher than the leakage expected from CO_2 injected into geological sites chosen precisely for their ability to sequester CO_2. CO_2 leakage from EOR is a particular risk if the oil wells are not properly plugged and abandoned. The EPA reports that there are already around 3 million abandoned oil wells in the U.S., of which over half are unplugged, and these unplugged wells are actively emitting both methane and CO_2.[footnote omitted] Moreover, using CO_2 to extract oil will inevitably result in new carbon emissions when that extra oil, which would otherwise stay underground, is burned. Indeed, the CO_2 emissions attributable to the extra oil flushed from the ground may even exceed the amount of CO_2 captured and then injected to obtain it.[footnote omitted][400]

CEOs recommend that no carbon-free credit should be given for facilities where the captured carbon is used for enhanced oil recovery.[401] **(Decision Option 58)**

CURE noted that federal legislation has been amended such that CO_2 used in EOR recovery receives the same tax credits as other CO_2 injected underground.[402] CURE argues that this change in policy means that the Commission can have no assurance that CO_2 captured by Minnkota and other CCS carbon providers will not be shipped to oil fields for EOR. CURE notes that under an LCA, CCS used in EOR would show that "captured CO_2 will be used to produce far more carbon in the form of barrels of oil."[403] However, in contrast to CEOs, CURE recommends the Commission disallow CCS from partial compliance entirely. **(Decision Option 54)**

D. Definition of CCS

CMPAS recommends the Commission adopt formal definition for carbon capture and sequestration.[404] CMPAS states that a generic recommendation such as "the capture of

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400 CEOs Initial Comments, p. 58.

401 CEOs Reply Comments, p. 18.

402 CURE Reply Comments, pp. 3-4.

403 CURE Reply Comments, pp. 3-4.

404 CMPAS Initial Comments, pp. 3-4 and p. 6.

greenhouse gas emissions that would otherwise be released into the atmosphere" could be read to apply to a technology in CMPAS's resource mix, one in which captured landfill gas (including methane) is used as fuel for reciprocating internal combustion engines.[405] However, while CMPAS requested the Commission adopt an operational definitions, it did not propose any for consideration. Staff has not provided a Decision Option.

E. Staff Analysis – CCS

Staff agrees with CURE that there may be a risk of EOR CO_2 to end up counting towards CFS compliance. For one, it is unclear whether Minnkota and other CCS providers would be able to track sequestered CO_2 if that CO_2 is sold to another entity. Further, it is possible that captured CO_2 could be stored in the immediate term, allowing a CFS-obligated utility to claim that partial eligibility, but then used for EOR at a later date. However, Staff also agrees that the statute and legislative history appear to allow for partial compliance for facilities with CCS.

Staff notes that there may be a schism between the Agencies, who appear to support a credit-based compliance construct for CCS, and Minnkota, who appears to support an energy-based compliance construct for CCS. However, the Agencies explicitly stated that they were not formally making recommendations on this topic, merely expressing support for certain principles. Staff notes that the two constructs need not be opposed; it may be that the Commission would find that a facility's reported total captured MWh receive CFS-eligible EACs. Staff lacks knowledge on this topic and suggests the Commission request further information from parties about CCS and EACs.

X. Hydrogen

Hydrogen does not create carbon dioxide when combusted, meaning that it qualifies as carbon-free under to the plain language reading of the statute's definition of carbon-free. In addition, when mixed with another fuel at a co-firing facility, hydrogen adheres to the plain language reading of the statute's partial compliance provision. Therefore, the Commission may choose to find facilities that burn hydrogen ("hydrogen co-firing") as partially eligible under the CFS.[406]

However, since hydrogen typically requires input electricity to produce, the Commission also may choose to qualify hydrogen eligibility based upon input energy.

Staff is aware of only one existing hydrogen project in Minnesota, which is CenterPoint Energy's 1 MW electrolysis pilot project in Minneapolis. This hydrogen is produced from renewable sources and injected directly into the utility's pipelines at concentrations of less than 5 percent by volume. The company reports that the electrolyzer can produce up to 60 Dekatherms per

[405] CMPAS attributes this definition to Minnesota Statute § 216B.2422, but Staff did not find a definition of CCS in this statute.

[406] Theoretically, a facility could burn 100% hydrogen, but this is not a reality at this time.

day.[407]

Near-term hydrogen production in Minnesota is likely to be hindered by federal legislation that sunsets clean hydrogen production tax credits unless projects are in the ground by January 1, 2028. On this basis the Commission may choose to defer any determinations regarding hydrogen and CFS compliance to a future proceeding in this or another docket. (**Decision Option 64**).

A. Hydrogen Types

Hydrogen is given different colors depending on the primary energy source of the input electricity, as well as the method of hydrogen production. Methods of hydrogen production[408] discussed in this record include:

- Steam Methane Reforming ("SMR"): Also called natural gas reforming, SMR is a thermochemical process that adds steam and heat to natural gas, causing a reaction that produces hydrogen and CO_2. As noted by CEOs in the CFS docket, since the resulting hydrogen contains less energy than the natural gas used to produce it, a gas plant that co-fires with SMR-produced hydrogen would result in higher overall CO_2 emissions than just burning that natural gas directly in a power plant.[409] It is Staff's understanding that this is the most common method currently used to produce hydrogen in the United States.
- Electrolysis: Electrolysis uses electricity to split water into hydrogen and oxygen. As noted by CEOs in the CFS docket, this technology can be the lowest-carbon way to make hydrogen, but it can also be the method that produces the most carbon dioxide, depending on where the electricity that powers the electrolysis process comes from.[410] Simply drawing from the grid to power electrolysis will kick on the grid's marginal resource; the Commission's Regional Energy Program Staff identify that in recent years, for the whole MISO footprint, natural gas is the marginal resource 2/3 of the time and coal is the marginal resource 1/3 of the time.
- Additionally, the Agencies discussed direct hydrogen extraction from geological sources. Staff's understanding is that this process does not involve hydrogen "production" per se,

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[407] https://investors.centerpointenergy.com/news-releases/news-release-details/centerpoint-energy-launches-green-hydrogen-project-minnesota

[408] Staff notes that other methods of hydrogen production include pyrolysis (splitting methane into hydrogen and solid carbon), other thermochemical processes (coal gasification, biomass gasification, biomass-derived liquid reforming, solar thermochemical hydrogen), direct solar water splitting (photolytic) processes, and microbial/biological processes. While some of these are in early research stages (such as photo/biological processes), others are a mature technology (such as coal gasification). https://www.energy.gov/eere/fuelcells/hydrogen-production-processes

[409] *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Standard and the Newly Created Carbon-free Standard under Minn. Stat. § 216B.1691,* Docket No. E-999/CI-23-151, Clean Energy Organizations Comments, pp. 11-12 (June 28, 2024).

[410] *Id*., p. 12.

but this extraction technology is in its infancy and will likely develop new processes over time.

From Staff's understanding, no one hydrogen color system is used universally. For these briefing papers, Staff uses the following, which is from the Department of Commerce's report "The Potential of Hydrogen to Support Low-Carbon Industry in Minnesota."

Figure 6. Hydrogen Colors from Department Report on Hydrogen Potential

	TECHNOLOGY	COLOR	ELECTRICITY SOURCE OR FEEDSTOCK	GHG FOOTPRINT
WATER-BASED	ELECTROLYSIS	GREEN	RENEWABLES	MINIMAL
		PINK	NUCLEAR	MINIMAL
		YELLOW	MIXED-ORIGIN GRID	LOW-MEDIUM
FOSSIL-BASED	PYROLYSIS	TURQUOISE	NATURAL GAS	LOW (Solid Carbon Biproduct)
	STEAM REFORMING + CARBON CAPTURE	BLUE	NATURAL GAS	LOW
	STEAM REFORMING	GRAY	NATURAL GAS	MEDIUM
	GASIFICATION	BROWN	BROWN COAL	HIGH
		BLACK	BLACK COAL	HIGH
GOELOGICAL	EXTRACTION (Passive Capture)	WHITE	IRON-RICH DEPOSITS	LOW
	WATER INJECTION AND RECOVERY (Stimulated Production)	ORANGE	IRON-RICH DEPOSITS	LOW

B. Commenter Positions

The Agencies support full CFS eligibility for green, pink, and white hydrogen, and thus do not recommend LCAs for these resources.[411] **(Decision Option 59 A-D)** Xcel states that it agrees with the Agencies that green and pink hydrogen should be fully CFS-eligible and not require an LCA; however, Xcel did not specify its position on white hydrogen, as the company stated it does not have experience with it at this point in time.[412] Staff also notes that Xcel appears to define "green hydrogen" as hydrogen generated by an EET, which would include certain forms of biomass **(Decision Option 59 A)**.[413] It is unclear to Staff whether the Agencies also consider

411 Agencies Joint Comments, pp. 15-16.

412 Xcel Reply Comments, p. 4 and p. 7.

413 Xcel Reply Comments, p. 4.

hydrogen generated from biomass to be considered green hydrogen.[414]

The Agencies state that all other forms of hydrogen production involve the use of fossil fuels and thus should be required to submit an LCA in order to qualify for CFS compliance. The Agencies justify this by noting that input energy can exceed output energy in the electrolysis process; this means that for carbon-emitting sources of production, emissions could be greater to produce hydrogen than to not. The Agencies therefore conclude that hydrogen should receive no credit if primary input emissions exceed potential emissions offsets of the hydrogen; for this reason, a lifecycle analysis is needed for all other (non-green, pink, and white) forms of hydrogen.[415] **(Decision Option 59 E)**

Xcel initially recommended that hydrogen produced by non-EETS should not be required to submit an LCA, but appeared to change its position and agreed with the Agencies that these other forms of hydrogen should be required to submit an LCA.[416]

Minnesota Power[417] and LIUNA[418] recommend that hydrogen eligibility should be determined based on the results of a lifecycle analysis. Neither party mentions exempting green, pink, or white hydrogen from LCA, meaning that under this recommendation, all resources burning hydrogen would need a lifecycle analysis. **(Decision Options 60)**

CEOs support the inclusion of hydrogen co-firing facilities receiving partial credit under the CFS.[419] While CEOs do not support the use of LCA to determine eligibility, they do recommend the consideration of indirect upstream emissions due to hydrogen production (ie, hydrogen color). **(Decision Option 61)** This is discussed further below.

American Petroleum Institute supports the inclusion of hydrogen co-firing facilities receiving credit under the CFS and does not mention the use of LCA to determine eligibility.[420] Under this construct, all hydrogen co-firing facilities would be eligible for partial credit, regardless of the color of hydrogen. **(Decision Option 62)**

CURE recommends that the Commission not permit burning a mixture of hydrogen and fossil-fuel gas or biomethane (ie hydrogen co-firing) to count as "carbon-free" under the statute.[421] CURE argues that a hydrogen mix is not a "technology that generates energy without emitting

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414 Staff notes that the Department may consider this point irrelevant, given its position that a utility need not demonstrate that input electricity is carbon-free, provided it supplies hourly matching data. See DO 39.

415 Agencies Joint Comments, p. 17.

416 Xcel Reply Comments, p. 4.

417 Minnesota Power Initial Comments, p. 8.

418 LIUNA Comments, p. 1.

419 CEOs Initial Comments, p. 54.

420 API Comments, p. 1.

421 CURE Initial Comments, p. 8.

carbon dioxide," as Minn. Stat. § 216B.1691, subd. 2d (b)(2)(ii) requires.[422] CURE argues that since the other fuel mixed with hydrogen will emit carbon dioxide when burned, the entire technology becomes ineligible.[423] Instead, CURE recommends that hydrogen—and only green hydrogen—be seen as an energy storage system, and not as a normal "fuel."[424] **(Decision Option 63)** CURE's position was echoed by 51 public commenters.[425]

However, CURE acknowledges there are complexities that remain to be addressed, and so also recommends that hydrogen should be analyzed in a separate docket.[426] **(Decision Option 64)**

C. Percent Carbon-Free - Hydrogen

MPCA,[427] CEOs[428] and Minnesota Power[429] agree that to calculate the percentage of partial compliance credit granted to hydrogen co-fired with natural gas, the Commission should estimate the direct and indirect emissions of the plant per MWh with hydrogen co-firing and compare it to what its CO_2/MWh would be if the plant burned natural gas only. MPCA makes the following specific recommendation, which could potentially apply to other fuels beyond just hydrogen (such as RDF and RNG, should the Commission find these qualify as partially carbon-free):

> For a generation facility that burns any amount of partially carbon-free resources mixed with any other fuel:
> A. The base case emissions shall be derived from the primary fuel source that is displaced by the partially carbon-free electricity; and
> B. If the primary fuel source is partially carbon-free, the base case shall be the base case used to determine the carbon-free percentage of the primary resource.[430]
> **(Decision Option 65)**

Commenters offer different proposals for how the percentage carbon-free at a hydrogen co-firing facility should be determined.

First, it is important to note that using solely the volumetric ratio inputs of hydrogen to non-hydrogen fuels in a plant would be an inappropriate means by which to determine "the percent

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422 CURE Initial Comments, p. 8.
423 CURE Initial Comments, p. 8.
424 CURE Initial Comments, p. 9.
425 See Appendix B to these briefing papers.
426 CURE Initial Comments, p. 9.
427 Agencies Joint Comments, p. 21; MPCA Supplemental Comments, p. 1.
428 CEOs Initial Comments, p. 54.
429 Minnesota Power Initial Comments, p. 8.
430 Agencies Joint Comments, p. 21; MPCA Supplemental Comments, p. 1.

that is carbon-free." CEOs note that since hydrogen has a lower energy density than natural gas, the volumetric input percentage does not correspond to the emissions reduction percentage. For example, according to the EPA, a natural gas plant cofiring with 30 percent hydrogen by volume will reduce that plant's CO_2 emissions by only 12 percent."[431]

Instead, CEOs recommend that partial compliance credit should be determined by the percentage reduction in CO_2/MWh at the plant, adjusted for the upstream emissions due to the hydrogen production process (ie, color) based on federal 45V tax credit guidance. **(Decision Option 66)** CEOs elaborate that the amount of 45V tax credit available to the hydrogen producer under the Inflation Reduction Act depends directly on the level of carbon emissions associated with its production. CEOs state that if the hydrogen came from a facility receiving the highest tax credit under section 45V, the Commission can reasonably presume the carbon emissions associated with hydrogen production are effectively zero. CEOs do not elaborate on hydrogen production processes with greater-than-zero emissions.

Minnesota Power suggests a formula that appears to comport with CEOs' recommendation. Minnesota Power recommends that partial compliance be calculated by a simple formula subtracting the amount of fossil gas displaced by the hydrogen in the combustion process. Minnesota Power states that this amount can then be further modified by applying the carbon intensity of the production process of the hydrogen (ie, the hydrogen color). Any direct carbon emissions attributed to the production of hydrogen (again, the hydrogen color) can be added to the total carbon emissions, then compared to the base emission rate.[432] The Company suggested calculating partial compliance by the following equation:

Direct Emissions + Indirect Emissions – Emissions Displaced by CF Fuel Mixing
= Net Compliance Percentage[433]
(Decision Option 67)

By way of example, Minnesota Power states that if a natural gas facility emitted 100 tons of CO_2 combusting 100 percent natural gas, but when co-firing with hydrogen emitted 50 tons, then 50 percent of the energy produced should be considered carbon-free.[434]

Neither Minnesota Power nor CEOs clarify how the CO_2/MWh values would be derived.

Xcel contends that any hydrogen blended with natural gas can be analyzed on a heat input (MMBtu/MWh) basis; since the volume and heat content of all combusted fuels is tracked at power plants, it would be easy to calculate gross MWh attributable to each fuel in a fuel mix.[435] **(Decision Option 68)** In Xcel's recommended calculation:

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[431] CEOs Initial Comments, p. 52.

[432] Minnesota Power Initial Comments, p. 8.

[433] Minnesota Power Reply Comments, p. 5.

[434] Staff notes that this is presumably for the same output MWh in each scenario.

[435] Xcel Reply Comments, pp. 4-5.

> "[s]tation load can be subtracted from gross generation to determine net generation and apportioned to multiple fuels as necessary, to determine net generation associated with CF hydrogen for CFS compliance purposes."[436]

For fuel blending, Xcel states that if 60 percent of the generation by heat input (mmBtu) from a given unit is associated with the combustion of designated carbon-free hydrogen as determined by an LCA, and 40 percent from the combustion of non-carbon-free natural gas, then 60 percent of the net generation should be allowed to be included as carbon-free generation for compliance demonstration purposes.[437] Xcel states that regardless of the source of hydrogen, this process can be used.

The Agencies argue that when hydrogen is combusted with other fuels, an engineering study is required to determine the final output ratio of fuels is the same as the initial input ratio. **(Decision Option 69)** The Agencies contend that the energy content (heat rate) ratio of fuels may not be the same from inputs to outputs, but do not elaborate.[438]

Xcel states that an engineering study to affirm heat rate ratio of fuels is not necessary under its fuel pathway proposal, as "the amount of CF generation that can be applied towards CF compliance should be determined on a fuel-by-fuel basis and does not need to be determined comparative to other fuel resources simultaneously being combusted."[439] Instead, Xcel recommends that for blended fuel situations such as hydrogen co-firing, an LCA should be conducted on each individual fuel pathway requiring an LCA, rather than conducting an LCA on a combination of fuel pathways as would occur with fuel blending.[440] **(Decision Option 11)** Xcel's fuel pathways proposal is discussed in further detail in Section V.B.

D. Staff Analysis - Hydrogen

Under a plain reading of the statute, the Commission could simply choose to allow all hydrogen—however produced, and from whichever source of electricity—to be considered carbon-free. However, commenters appear to generally advise against this based on hydrogen color.

Staff's understanding is that there is a sunset on the 45V tax credits, and that projects must be in the ground by January 1, 2028. CEOs contemplated this possibility in comments, noting that "if the tax credit does not survive, the Commission is unlikely to face any hydrogen co-firing

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436 Xcel Reply Comments, p. 5.

437 Xcel Initial Comments, p. 14.

438 Agencies Joint Comments, p. 17.

439 Xcel Reply Comments, p. 5.

440 Xcel Initial Comments, p. 8.

facilities given the high cost of unsubsidized hydrogen production."[441] Nonetheless, the Commission may wish to refrain from tying a CFS policy to a sunsetting federal policy.

XI. Storage Assets

The Agencies recommend the Commission order energy storage assets be treated as load for CFS compliance purposes, unless storage assets are used to substantiate hourly matching requirements. In order to qualify storage assets for CFS eligibility, the asset must:

A. Retire hourly EACs to match charging from fully CFS-eligible resources; and
B. Generate hourly EACs to match discharging.[442] **(Decision Option 70)**

Xcel agrees with the Agencies' conclusion that energy storage charging can be treated as load, but concludes that no further compliance requirements are necessary.[443]

Connexus,[444] Great River Energy,[445] Minnesota Power,[446] and Otter Tail,[447] and Xcel[448] recommend the Commission take no action to develop a separate accounting methodology for energy withdrawn from short-, medium-, or long-duration storage assets. **(Decision Option 71)**

XII. Net Market Purchases

A. CFS Docket

As multiple parties pointed out, Staff requested comment on the calculation of net market purchases in both this docket and the CFS docket during overlapping comment periods. As a result, some commenters made recommendations concerning net market purchases that were later rendered superfluous by the Commission's July 17, 2025 agenda meeting, from which the Commission issued Ordering Paragraph 3 of its September 16, 2024 Order:

> To calculate the percentage of annual net market purchases that are carbon-free under Minn. Stat. § 216B.1691, subd. 2d(b)(2)(ii), each electric utility must use the average annual fuel mix associated with Local Resource Zones 1–7 of the Midcontinent Independent System Operator, Inc., or the applicable regional fuel mix, after removing from the calculation the carbon-free electricity generated directly by the utility or procured by the utility through

441 CEOs Initial Comments, p. 54.
442 Agencies Joint Comments, p. 13.
443 Xcel Reply Comments, pp. 5-6.
444 Connexus Energy Initial Comments, p. 2 (June 5, 2025) (hereinafter "Connexus Initial Comments").
445 Great River Energy Comments, p. 2 (June 5, 2025) (hereinafter "Great River Energy Initial Comments").
446 Minnesota Power Reply Comments, p. 5.
447 Otter Tail Power Reply Comments, p. 2 (August 20, 2025) (hereinafter "OTP Reply Comments").
448 Xcel Initial Comments, p. 12.

> power purchase agreements in that year. The utility need not retire credits for this purpose.[449]

This recommendation does not require utilities to retire EACs commensurate with their net market purchases, nor does it require utilities to calculate a residual mix. It is intended to prevent utilities from capturing their own fuel mix in the net market purchase fuel mix calculation; the Commission reasoned that this is data to which utilities have ready access, and would prevent at least against some level of double-counting of credit attributes.

While some commenters subsequently withdrew their net market purchase recommendations, others did not. Staff only provides decision options for net market purchase topics that provide new information relevant to LCA.

B. Carbon-Free Resources in Market Fuel Mix

The Department recommends the Commission adopt the following list of resources to be eligible as carbon-free for net market purchase compliance: wind, solar, hydropower (with a nameplate capacity of 100 MW or greater, if built before February 8, 2023), geothermal, and nuclear.[450] **(Decision Option 73)** The Department noted that other types of resources might require a fuel LCA to qualify as carbon-free, but that it is likely impossible to conduct fuel LCAs outside the owned and operated assets of Minnesota utilities. Therefore, due to data constraints, the Department suggests this simplified list of eligible resources.[451]

Connexus did not agree with this recommendation, stating that a prescriptive list of qualifying carbon-free resources may exclude carbon-free technologies developed in the future or resources that qualify for partial compliance under an LCA, for which supporting data later becomes accessible. Connexus states that it does not believe the Commission needs to take any action on this topic, "as statute does not support exclusion of carbon-free resources from net market purchase partial compliance and a designated, 'simplified' list may exclude certain carbon-free resources."[452] Connexus instead recommends utilities work directly with Commission Staff during reporting to review data accessibility and include all carbon-free resources in the system fuel mix calculation as is practicable.[453] **(Decision Option 72)** Alternatively, if the Commission decides to adopt the Department's recommendation, Connexus recommends that hydropower with a nameplate of less than 100 MW be added to

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[449] The Commission determined that in cases of net market purchases, utilities need not retire credits. *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Objectives and the Newly Created Carbon-Free Standard Under Minn. Stat. § 216B.1691*, Order on Carbon-Free Standard—Clarifying Use of Credits, Net Market Purchases, and Reporting, Docket No. E-999/CI-23-151, Ordering Paragraph 3 (September 16, 2025).

[450] Department Reply Comments, p. 6.

[451] Department Reply Comments, p. 6.

[452] Connexus Energy Initial Comments, p. 2 (September 17, 2025) (hereinafter "Connexus Supplemental Comments").

[453] Connexus Supplemental Comments, p. 2.

the list.[454] **(Decision Option 73 C)**

XIII. Other Resources

CMPAS recommends that all types of emitting generation, including fossil fuels, be permitted to attempt to qualify for the CFS under an LCA. **(Decision Option 74)** CMPAS argued that Minn. Stat. § 216B.1691 does not specifically call for differential treatment between different types of emitting generation.[455]

[454] Connexus Supplemental Comments, p. 2.

[455] CMPAS Reply Comments, p. 7.

DECISION OPTIONS

CFS Frameworks

1. The following resources shall be eligible for full CFS compliance: solar, wind, hydropower, and nuclear.

   Support: All commenters

   A. geothermal

   Support: Agencies, Xcel

AND

2. The Commission adopts a Point-of-Generation framework. The following types of facilities shall not be eligible for full or partial compliance *(choose one or more)*:
   A. biomass facilities
   B. solid waste, municipal solid waste, waste-to-energy, and refuse-derived fuel
   C. renewable natural gas facilities

   Support: CEOs, Climate Generation, Coalition for Plastic Reduction, CURE, DFL Environmental Caucus, Eureka Recycling, Institute for Local Self-Reliance, Interfaith, 43 Legislative Members, Minnesota Environmental Justice Table and Zero Burn Coalition, Minnesota Environmental Partnership, MN350, Northeast Metro Climate Action, Partnership for Policy Integrity, Vote Solar

OR

3. The Commission adopts an Eligible Energy Technologies framework. Eligible Energy Technologies, as defined by Minn. Stat. §216B.1691, subd. 1(c), shall be eligible for full CFS compliance.

   Support: City of Red Wing, Minnesota Resource Recovery Association, Ramsey/Washington R&E, Senator Frentz

OR (*if the Commission chooses to require an LCA, choose one from Decision Options 4-6. Note: Decision Option 6 was late-filed.*)

4. The Commission adopts a proportionate LCA framework. The following types of facilities may be eligible for full or partial compliance, pending the outcome of a lifecycle analysis *(choose one or more)*:
   A. Sustainable and waste biomass facilities
   B. Municipal solid waste, waste-to-energy, and refuse-derived fuel facilities

C. Renewable natural gas facilities

Support: LIUNA, Minnesota Forest Industries, MMPA, Minnesota Power, Olmsted County

OR

5. The Commission adopts a binary LCA framework. The following types of facilities may be eligible for full compliance, pending the outcome of a lifecycle analysis *(choose one or more)*:
   A. Sustainable and waste biomass facilities
   B. Municipal solid waste, waste-to-energy, and refuse-derived fuel facilities
   C. Renewable natural gas facilities

   Support: Partnership on W&E

OR

6. The Commission adopts a binary LCA framework with a waste wood exemption. The following types of facilities may be eligible for full compliance, pending the outcome of a lifecycle analysis *(choose one or more)*:
   A. Sustainable and waste biomass facilities that are not eligible for an exemption. To be eligible for an exemption, the biomass fuel must meet the following conditions:
      1) The fuel is determined to be waste, as recommended by a Commission-established biomass working group.
      2) The fuel is sourced from wood.
      3) The temperature of waste is not altered as a required step to process the waste for energy production.
      4) The average one-way transportation distance per ton-mile of waste does not exceed 75 miles from the waste collection point to the point of energy generation or the distance requirement is eliminated for trucks that run on zero emission fuels.
      5) All of the electricity required to process the waste is matched with energy attribute certificate (EAC) retirements, which are additional to the utility's requirements under Minn. Stat. § 216B.1691.
   B. Municipal solid waste, waste-to-energy, and refuse-derived fuel facilities
   C. Renewable natural gas facilities

   Support: Department, MPCA

AND

7. In evaluating compliance or partial compliance, and in evaluating IRPs, the Commission may establish limits on significant additional use of emitting fuels that have been determined to be fully or partially carbon-free based on an LCA. *(Staff proposed)*

ISO 14040/14044

8. The Commission adopts the International Organization for Standardization's (ISO) Life Cycle Assessment Requirements and Guidelines as best practice for interpreting the statutory definition of "carbon-free," and considers the ISO 14040 and 14044 as the best framework for establishing future LCAs.

   Support: CEEM, CMPAS, Minnesota Power, Partnership on W&E

Fuel Pathways Proposal

9. The Commission adopts a Fuel Pathways framework with the following definitions *(choose one or more)*:
   A. Carbon-free: A determination of carbon-free is made at the fuel pathway level. "Carbon-free" does not apply to a specific resource or technology, but to the entire fuel pathway of a specific LCA, the boundaries of which will be set by the Commission.
   B. Compliance: Compliance applies at the generation resource level.
      i. Full compliance: A generation resource is fully compliant if 100 percent of the electricity generated by the resource is generated based on a fuel pathway determined to be carbon-free.
      ii. Partial compliance: A generation resource is "partially compliant" if, in the generation of electricity, the resource relies on:
         (a) Pollution control technology that does not remove 100 percent of the CO_2 emissions generated, or
         (b) A mixture of a CF fuel pathway and a non-CF fuel pathway (e.g., blending of hydrogen produced from an EET with natural gas)
   C. Comparative Scenario Evaluation (CSE): A counterfactual analysis, to be submitted alongside appropriate LCA studies.
   D. Partial Credit: Partial credit would apply to CF fuel pathways that are determined to not be carbon-free and, after undergoing a Comparative Scenario Evaluation are ultimately deemed to be a better (i.e., lower net GHG emissions) management opportunity than other options, and, as a result, are granted partial CF credit.

   Support: Xcel

10. The responsible government agency's standard of review for determining if a fuel pathway is carbon-free, partially carbon-free, or not carbon-free shall be based upon a carbon intensity threshold level below which a CF fuel pathway is considered CF.

    Support: Xcel

11. For blended fuel situations such as hydrogen co-firing, an LCA must be conducted on each individual fuel pathway requiring an LCA, rather than conducting an LCA on a combination of fuel pathways as would occur with fuel blending.

    Support: Xcel

12. LCAs shall be conducted based on annual data, consistent with CFS compliance.

    Support: Xcel

13. LCA review will use the following procedures *(choose one or more)*:
    A. The responsible state agency shall review and make a recommendation to the Commission on approving or denying the results of an LCA conducted by or on behalf of a utility.
    B. The utility proposing a new CF fuel pathway for compliance demonstration purposes is responsible for conducting and providing the results of an LCA for review.
    C. Once an LCA is submitted to the responsible state agency for review, the review should be completed and approved or denied by the Commission within six months.
    D. If an LCA conducted by or on behalf of a utility is ultimately denied for a given fuel pathway by the Commission, the utility may appeal the decision.
    E. If an LCA conducted by or on behalf of a utility is ultimately denied for a given fuel pathway by the Commission, another LCA analysis for the denied fuel pathway may be undertaken by the same or another utility.
    F. Once the LCA results for a given CF fuel pathway have been approved by the responsible government agency, that CF fuel pathway shall be added to an "approved CF fuel pathways" list that other utilities can rely on without needing to conduct another LCA. In order to rely on the "approved CF fuel pathways" list, the resource relying on the list must have similar source and production pathways as the resource on the list.
    G. Utilities are encouraged to file proposed LCAs during a resource plan or resource acquisition proceeding, but may file at any time.
    H. A process of public comment will transpire after the proposed LCA has been submitted.
    I. As part of its review of the proposed LCA, where appropriate, the responsible state agency will investigate the proposal and provide a recommendation for a comparative scenario analysis submitted by the utility. *(Staff proposed)*
    J. The responsible state agency will maintain a repository of "approved CF fuel pathways" and "approved counterfactual fuel pathways" available for public use on the agency's website. *(Staff proposed)*

    Support: Xcel (A-F), Agencies (G-H), Staff (I-J)

Model

14. Each individual project (electricity generator) shall be paired with the appropriate model when conducting a lifecycle analysis. The following models and sources may be used when submitting an LCA for Commission consideration and approval *(choose one or more)*:
    A. Argonne National Laboratory's Greenhouse Gasses, Regulation Emissions, and Energy Use in Transportation (GREET) model
    B. Environmental Protection Agency's Waste Reduction Model (WARM) model
    C. Environmental Protection Agency's Landfill Gas Emissions Model (LandGEM) model
    D. California Biomass Residue Emissions Characterization (C-BREC) model
    E. New/additional models and methodologies as may be developed or refined over time

Support: CEEM (A and D), CMPAS (A-C), Department, MMPA (A), MPCA, Partnership on W&E, Xcel (A)

15. In lieu of conducting an LCA, parties may use *(choose one or more)*:
    A. Prior studies and literature reviews, such as the University at Buffalo's study on Waste-to-Energy facilities, if they are for a similar fuel pathway;
    B. Credible sources of existing LCA analysis results

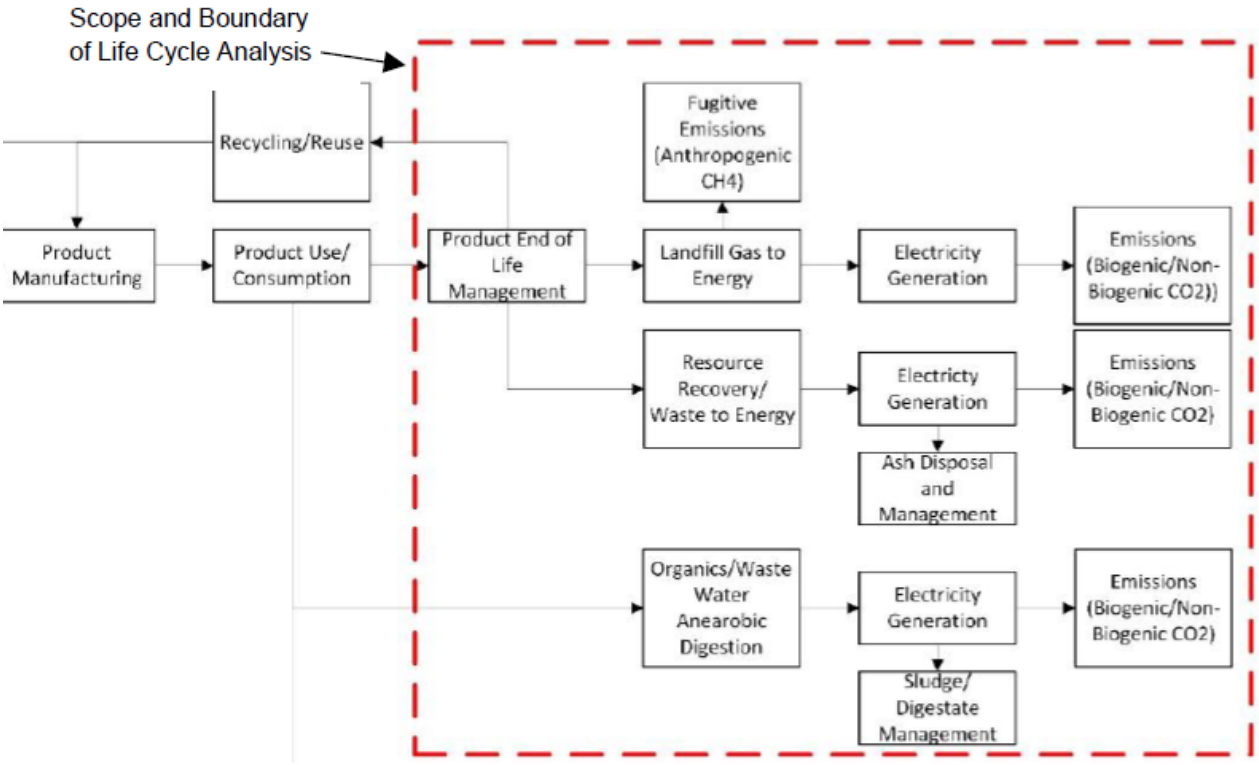
Support: Partnership on W&E (A), Xcel

Scope, Boundary, and Study Period

16. The LCA scope and boundary for a carbon-free generation source shall begin with the existence and acquisition of the fuel; for solid waste and biomass materials, this is the point at which the material is generated and requires some kind of management.

    Support: Olmsted County, Partnership on W&E

17. When conducting an LCA Study, and where appropriate, parties must use the scope and boundary proposed by Olmsted County in Figure 1 of its June 5, 2025 Comments in Docket No. E999/CI-24-352, replicated here for ease of use:



Support: Olmsted County

18. The scope and boundary of the fuel LCA shall include the biogenic emission carbon cycle for all relevant LCAs.
    A. For these LCAs, there shall be a study period of at least 100 years.

Support: Department, Minnesota Forest Industries, Minnesota Forest Resources Council, Minnesota Power, Olmsted County, Partnership on W&E

19. The study period of the LCA shall align with the life of the resource or beneficial use program.

Support: CMPAS, Xcel

<u>Counterfactuals</u>

20. Counterfactual evaluations shall be permitted in the LCA process.

Support: CEEM, Minnesota Forest Industries, Olmsted County, Partnership on W&E, Ramsey/Washington R&E, Xcel

21. Utilities shall develop their own avoided emissions base case scenarios, as appropriate, to use in a fuel LCA study.

    Support: Department, Xcel

Quantified GHGs

22. LCA studies shall quantify the following greenhouse gases *(choose one or more)*:
    A. Carbon dioxide *(All LCA advocates)*
    B. Methane, using a carbon equivalency ("CO_2e") value
    C. Nitrous Oxides, using carbon equivalency values
    D. Any other greenhouse gases considered relevant in the study, using carbon equivalency values

    Support: Department, Partnership on W&E, Ramsey/Washington R&E, Xcel (A-C)
    Opposed: Minnesota Power is opposed to 20 B-D

Input Electricity

23. For all claims of carbon-free electricity used in a life-cycle analysis where the fuel requires processing using electricity before the fuel is combusted *(choose one or more)*:
    A. The utility must include hourly matching for CFS-eligible generation sources;
    B. The utility must specify the source of carbon-free electricity; and
    C. If a utility does not propose carbon-free electricity, the utility should use the whole MISO territory or LRZ 1 annual grid emissions.

    Support: Department, MPCA
    Oppose: Xcel

24. For all electricity generation processes subject to lifecycle analysis requirements in which the primary electricity input energy is greater than 25 percent of output energy *(choose one or more)*:
    A. The utility must submit annual documentation with its CFS compliance filing to demonstrate hourly matching of carbon-free electricity generation; and
    B. The utility must plan new carbon-free resources to match all new electricity generation.

    Support: Department, MPCA
    Oppose: Xcel

Evaluation Cadence

25. For existing assets, lifecycle emissions shall be reevaluated no sooner than every five years.

    Support: Department, MPCA

26. For new capital projects, lifecycle emissions shall be reevaluated after the initial capital expenditure is expected to be paid off, to be determined at the time of CFS eligibility.

    Support: Department

27. For new capital projects, lifecycle emissions shall be reevaluated no sooner than after the capital project is fully depreciated.

    Support: MPCA

28. Once a resource qualifies as carbon-free or partially carbon-free, that designation shall remain in place for the duration of the lifetime of the asset, unless and until significant modifications are made to the fuel type of generation resource.

    Support: Xcel

29. For any fuel mix determined to be carbon-free from a life-cycle analysis study, if that fuel mix deviates by more than ten percent, the utility must submit a new or revised lifecycle analysis and issue a new carbon-free percentage, if applicable.

    Support: MPCA

Credits and Allocators

30. For generations resources determined to be partially carbon-free based on a life-cycle analysis, the Commission will consider the whole portfolio of an entity in determining partial eligibility, i.e., the aggregate carbon intensity score of the fuels used.

    Support: MMPA

31. For generation resources determined to be partially carbon-free based on a life-cycle analysis, CFS-obligated utilities must report carbon-free MWh commensurate with the percentage that the facility is considered to be carbon-free.

    Support: Minnesota Power

32. The Commission orders the following *(choose one or more)*:
    A. Environmental Attribute Credits shall be issued equivalent to metered generation on a per MWh basis;
    B. A single Environmental Attribute Credit be issued for all generation that may be retired to demonstrate both EETS and CFS compliance;
    C. A carbon-free allocator, which defines the percentage of CFS eligible generation, must be used for any generation facility that is partially CFS compliant; and
    D. For all generation made in a CFS partial compliant facility that is not eligible for the EETS, metered generation in A. shall be multiplied by C. to determine the whole number of Environmental Attribute Credits to issue that are only eligible for the CFS.

    Support: Department

33. The Commission requires all partially compliant input energy claims in a secondary process to factor in the total output electricity of the partially compliant resource and its carbon-free allocator.

    Support: MPCA

34. The Commission delegates to the Executive Secretary authority to begin proceedings to establish a process to translate renewable thermal credits to an Environmental Attribute Credit for compliance tracking purposes.

    Support: Xcel

Health Metrics

35. For biomass, RNG, and solid waste facilities, utility planning and tracking processes shall quantify and analyze the deaths and morbidity caused by these facilities to communities in Minnesota and other jurisdictions. Such modeling must also account for economic harm, property value losses, harms to rural population and ways of life, harms to family farming, and known pollution impacts.

    Support: HPHC

Compliance Filings

36. Beginning in 2026, each electric utility subject to the Carbon-Free Standard shall include in their annual compliance report in Docket No. E-999/PR-YR-12: *(choose one or more)*
    A. For any fuel determined to be carbon-free from a life-cycle analysis study, utilities must report the composition of the fuel mix compared to the modeled lifecycle

analysis.

B. For any fuel determined to be carbon-free from a life-cycle analysis study, utilities must report: electricity used to generate electricity, marginal energy attribute credit (EAC) retirements to match all electricity use (hourly or annual), and weighted average trucking mileage for each generation facility that uses the exemption.

Support: MPCA (A-B), Department (B)

37. Utilities subject to the CFS and intending to use an LCA must notify the Commission and offer basic information about the relevant resources and fuel types and sourcing within 60 days of the Commission's Order in the current proceeding.

Staff proposed

Biomass Definitions

38. Primary biomass shall not be eligible for CFS compliance. Primary biomass is defined as:

> Biomass that is intentionally cultivated, harvested, and prepared for use, in whole or in part, as a fuel for the generation of electricity.
>
> As farm-grown closed-loop biomass as defined in Minn. Stat. §216B.2424, subd. 1(a)(1).

Support: Department

39. Waste biomass shall be eligible for CFS compliance. Waste biomass is defined as *(choose one or more)*:

A. Biomass derived from secondary activities including but not limited to:
   1. Wood waste from storm damage, disease or infestation, utility line maintenance, waste from forest products manufacturing;
   2. Agricultural activities including manure;
   3. Food waste and other organic waste.

B. Biomass that results in lower greenhouse gases than the alternative disposal method.

C. Biomass that is not deliberately generated or created for use as a fuel feedstock, but is a by-product of the functions of society, or the result of natural forces such as pests, disease and storm damage, and requires some type of management or disposal on an ongoing basis, irrespective of the opportunities for or need for energy production.

Support: Agencies (A-B), CMPAS (A), Partnership on W&E (C)

40. Sustainable woody biomass shall be eligible for CFS compliance. Sustainable woody biomass is defined in Minn. Stat. § 216B.2424, subd. 1(d).

    Support: Minnesota Power

    OR

41. Sustainable woody biomass shall be eligible for CFS compliance. Sustainable woody biomass is defined as *(choose one or more)*:

    A. From whole dead, dying, damaged, and/or diseased trees salvaged after wildfire, windstorm, or insect infestation; other wood debris in the forest;
    B. The by-product of forest management from routine maintenance, natural disasters, or hazardous fuel reduction including trees and woody plants (limbs, tops, needles, leaves, and other woody parts) grown in a forest, woodland, rangeland, or the urban and community environment;
    C. Wood biomass associated with secondary harvest of logging residuals; tops, limbs, and unmarketable material from harvest operations;
    D. Manufactured wood pellets;
    E. Wood-based construction debris and waste;
    F. Non-hazardous secondary materials such as wood-based paper-mill residuals, saw-mill residuals (including bark, sawdust, chips), and railroad ties, consistent with their treatment in EPA rule 40 CFR Part 241;
    G. Material sourced by trained logging professionals implementing the Minnesota Forest Resources Council Voluntary Site-Level Guidelines for Forest Management, which includes biomass harvesting guidelines.

    Support: CEEM (A and B), Minnesota Forest Industries (A-E), Minnesota Forest Resources Council, Minnesota Power

<u>Woody Biomass LCA Assumptions</u>

42. In a woody biomass LCA counterfactual analysis, open burning shall be the default alternative management method.

    Support: Partnership on W&E

43. When performing a lifecycle analysis for woody biomass, the following assumptions shall be used when relevant and to the extent possible *(choose one or more)*:
    A. System boundary assumptions

1) Include forest growth and decay/fire emissions
2) Include energy combustion emissions with scrubbers
3) Include harvest, transport, and processing emissions (not for mill residues)
4) Indirect land use changes will not occur
5) Account for counterfactual scenarios (e.g., what would have happened to the biomass if not used for energy, e.g., wildfire, landfill, and decomposition)

B. Carbon assumptions:
1) Assume biomass is inherently carbon neutral, based on regrowth of forests
2) Use the 100 year planning horizon that accounts for delayed carbon sequestration
3) Assume that emissions from combustion may take decades to be offset by regrowth

C. Feedstock type and source assumptions:
1) Forest residues (branches, tops, unmarketable material)
2) Mill residues (sawdust, bark)
3) Construction debris
4) Whole wildfire, wind, or insect-damaged trees

D. Forest management practice assumptions:
1) Assume the forest is actively managed for natural or planted regrowth and not converted to other uses (e.g., agriculture)
2) Assume the forest is actively managed using sustainable forestry, following harvesting best management practices with trained loggers.

E. Geographic and temporal scope assumptions:
1) Assume the entire forest of Minnesota, including its species and age class-specific growth, mortality, and removals
2) Assume the entire forest of Minnesota, with its associated biogenic cycle emissions, with and without its use for electricity generation;
3) Assume over a 100-year timeframe

F. Energy system displacement assumptions:
1) Assume biomass displaces the current use of coal.

Support: Minnesota Forest Industries

44. The University of Minnesota's 2024 report conducted for the Minnesota Forest Resources Council entitled "Estimated current and future carbon stocks and emissions in Minnesota forests and forest products under multiple management scenarios" shall serve as default guidance for parties conducting a woody biomass LCA.

Support: Minnesota Forest Resources Council

Biomass Workgroup

45. The Commission delegates to the Executive Secretary the authority to establish and set

procedural schedules for a working group to make recommendations to the Commission on standards necessary to verify that biomass qualifies as waste biomass and ensures compliance under the definition established by the Commission.

Support: Department, MPCA, Partnership on W&E

A. One function of the biomass workgroup shall be to make recommendations about which types of waste biomass should be exempt from LCA.

Support: Department, MPCA

Solid Waste/MSW

46. For WTE and RDF facilities using MSW feedstock, the counterfactual used shall be "worst case emissions municipal solid waste landfill."

Support: CMPAS, Olmsted County, Partnership on W&E

47. LCA assumptions using a landfill counterfactual shall incorporate realistic landfill methane gas collection percentages and gas-to-energy recovery efficiency.

Support: Ramsey/Washington R&E

48. In LCAs, parties must incorporate GHG offsets resulting from the recycling or other beneficial use of components found in the MSW that is being processed for use or otherwise used as a fuel.

Support: Partnership on W&E

Renewable Natural Gas

49. RNG and other fuels purchased with associated renewable thermal credits tracked through M-RETS that have already conducted an LCA are eligible for the CFS without requiring a new LCA.

Support: Xcel

50. RNG from large scale animal operations ("CAFOs") shall not be eligible for carbon-free credit.

Support: Institute for Agriculture and Trade Policy, HPHC

51. RNG projects shall not be considered carbon-free unless the utilities applying for credit provide an accounting of externalities, leakage, and foreseeable economic and social impacts of RNG production and use.

    Support: HPHC

52. MSW landfilling shall be used as the primary counterfactual for RNG. When possible, parties conducting LCAs on RNG shall use a blended counterfactual that also accounts for composting and/or anaerobic digestion without RNG.

    Support: Partnership on W&E

CCS: Eligibility

53. Facilities that employ carbon capture and sequestration/storage systems shall be eligible for partial CFS compliance.

    Support: American Petroleum Institute, CEOs, LIUNA, Minnesota Power

    OR

54. Facilities that employ carbon capture and sequestration/storage systems shall not be eligible for full or partial CFS compliance.

    Support: CURE, Eureka Recycling, Interfaith, MN350, 43 Legislative Members, 56 Public Commenters

CCS: Percent Carbon-Free

55. To demonstrate partial compliance due to the presence of the CCS system, utilities employing CCS technologies do not have to provide an LCA.

    Support: Minnkota, American Petroleum Institute

56. Once the Commission has determined a CO_2/MWh value for a plant using CCS considering

direct, upstream, and downstream emissions, it will give partial compliance credit to that plant commensurate with the percent reduction in CO_2 emissions per MWh attributable to the CCS project.

Support: CEOs

57. Facilities with a CCS system seeking partial CFS compliance credit shall use Minnkota's proposed formula, replicated here:

$$\left|\text{[Young 1 Net Meter (MWh)} + \text{Young 2 Net Meter (MWh)]}\right| \times \frac{\text{Carbon Captured (actual tons)}}{\text{Carbon Generated (actual tons)}} = \text{Carbon Free MWh}$$

Where:

A. The point of measurement for the total megawatt-hours generated and transmitted to the grid would be the last revenue quality meter upstream of the substation connecting the generating unit(s) into the transmission grid system (net meter);
B. The point of measurement for the CO_2 sequestered would be the flow meters identified in the EPA approved monitoring, reporting, and verification plan pursuant to 40 CFR Part 98 Subpart RR, or other equivalent independently approved reporting plan; and
C. The point of measurement for the CO_2 generated from the electric generating units would be the continuous emissions monitors identified in the air monitoring plan submitted in accordance with 40 CFR Part 75 monitoring plan for the associated electric generating unit(s).

Support: Minnkota

58. No carbon-free credit shall be given for facilities where the captured carbon is used for enhanced oil recovery.

Support: CEOs

Hydrogen: Eligibility

59. The following facilities are eligible for partial CFS compliance *(choose one or more)*:

A. Facilities that burn hydrogen produced from EETS via electrolysis (green H_2);
B. Facilities that burn hydrogen produced from non-biomass EETS via electrolysis (green H_2);
C. Facilities that burn hydrogen produced from nuclear via electrolysis (pink H_2);
D. Facilities that burn hydrogen extracted from natural geological sources (white H_2);
E. Facilities that burn other forms of hydrogen, pending the results of an LCA.

Support: Agencies, Xcel (A,C,E)

OR

60. Facilities that burn hydrogen shall be eligible for partial CFS compliance, pending the outcome of a lifecycle analysis.

    Support: Minnesota Power, LIUNA

OR

61. Facilities that burn hydrogen shall be eligible for partial CFS compliance, provided those facilities account for indirect upstream emissions associated with fuel production.

    Support: CEOs

OR

62. Facilities that burn hydrogen shall be eligible for partial CFS compliance and do not need to submit a lifecycle analysis.

    Support: American Petroleum Institute

OR

63. Facilities that burn hydrogen shall not be eligible for full or partial CFS compliance at this time.

    Support: CURE

64. The Commission delegates to the Executive Secretary the authority to determine the timing of and begin a new proceeding on whether hydrogen may be eligible for the CFS.

    Support: CURE

Hydrogen: Percentage Compliance Calculation

65. For a generation facility that burns any amount of partially carbon-free resources mixed with any other fuel *(choose one or more)*:
    A. The base case emissions shall be derived from the primary fuel source that is displaced by the partially carbon-free electricity; and

B. If the primary fuel source is partially carbon-free, the base case shall be the base case used to determine the carbon-free percentage of the primary resource.

Support: MPCA

66. The percentage of partial compliance credit for hydrogen shall be determined by the percentage reduction in CO_2/MWh at the plant, adjusted for the upstream emissions due to the hydrogen production process (i.e., color) based on federal 45V tax credit guidance.

Support: CEOs

67. The percentage of partial credit at a hydrogen co-firing facility shall be determined by the following equation:

Direct Emissions + Indirect Emissions – Emissions Displaced by CF Fuel Mixing = Net Compliance Percentage

Support: Minnesota Power

68. For a carbon-free fuel pathway, the percentage of the annual net generation in MWh, based upon MMBtu heat input from that CF fuel, should contribute to compliance demonstration. Any hydrogen blended with natural gas can be analyzed on a heat input (MMBtu/MWh) basis.

Support: Xcel

69. When hydrogen is combusted with other fuels, the utility shall conduct an engineering study to determine whether the final output ratio of fuels is the same as the initial input ratio.

Support: Department

Storage

70. Energy storage assets shall be treated as load for CFS compliance purposes, unless storage assets are used to substantiate hourly matching requirements. In order to qualify storage assets for CFS eligibility, the asset must *(choose one or more)*:
    A. Retire hourly EACs to match charging from fully CFS-eligible resources; and

B. Generate hourly EACs to match discharging.

Support: Department, MPCA

71. The Commission declines to adopt a separate accounting methodology for storage assets.

Support: Connexus, Great River Energy, Minnesota Power, Otter Tail Power, Xcel

Net Market Purchases

72. The Commission adopts following list of resources to be eligible as carbon-free for net market purchase compliance *(choose one or more)*:
    A. Wind
    B. Solar
    C. Hydropower
    D. Hydropower with a nameplate capacity of 100 MW or greater, if built before February 8, 2023
    E. Geothermal
    F. Nuclear

Support: Department, (Connexus supports C over D)

73. The Commission declines to determine which resources in net market purchases shall be eligible as carbon-free at this time.

Support: Connexus

Other Resources

74. All types of emitting generation, including fossil fuels, may submit an LCA to attempt to qualify for the CFS.

Support: CMPAS

APPENDIX A: ACRONYMS

AEC: Alternative Energy Credit
AI: Artificial Intelligence
BECCS: Biomass Energy with Carbon Capture and Sequestration
CAFO: Confined Animal Feeding Operation
C-BREC: California Biomass Residue Emissions Characterization
CCS: Carbon Capture & Storage/Sequestration
CCUS: Carbon Capture & Utilization/Storage
CFS: Carbon-Free Standard
CO_2e: Carbon Dioxide Equivalent
EAC: Energy Attribute Credit
EETS: Eligible Energy Technology Standard
FLCA: Fuel Lifecycle Analysis/Assessment
GHG: Greenhouse Gas
GREET: Argonne National Laboratory's Greenhouse Gasses, Regulatory Emissions, and Energy Use in Transportation
ISO: International Organization for Standardization
LandGEM: EPA's Landfill Gas Emissions Model
LCA: Lifecycle Analysis/Assessment
LRZ: Local Resource Zone
MISO: Midcontinent Independent System Operator
M-RETS: Midwest Renewable Energy Tracking Systems
MSW: Municipal Solid Waste
MW: Megawatt
MWh: Megawatt-hour
NREL: National Renewable Energy Lab
PPA: Power Purchase Agreement
RDF: Refuse-derived fuel
REC: Renewable Energy Credit
REO: Renewable Energy Objective
RES: Renewable Energy Standard
RICE: Reciprocating Internal Combustion Engine
RTC: Renewable Thermal Credit
SES: Solar Energy Standard
SPP: Southern Power Pool
USLCI Database: U.S. Life Cycle Inventory Database
WARM: EPA's Waste Reduction Model

APPENDIX B: PUBLIC COMMENTS

76 public comments were filed, after removing 2 duplicates, 2 organizations (MN350 and Northeast Metro Climate Action), and 1 belonging in a different docket. The following table summarizes concerns raised by public commenters:

Solid Waste/Trash	72
Woody Biomass	66
CCS	55
LCA	53
Fossil Fuels	51
Hydrogen co-firing with gas	51
Hydrogen made from SMR	50
RNG	17
AI	15
Biomass, Generally	7
Burning/Pollution	2
Costs	1
Legislation flawed	1

Staff has taken care to capture public comment positions throughout the briefing papers.

APPENDIX C: DECISION OPTION GUIDE

	DO No.	DO Language	POG	EETs	Prop. LCA	Binary LCA	Binary LCA with Waste Wood Exempt.
			DOs 1+2	DOs 1+3	DOs 1+4	DOs 1+5	DOs 1+6
Limits	7	In evaluating compliance or partial compliance, and in evaluating IRPs, the Commission may establish limits on significant additional use of emitting fuels that have been determined to be fully or partially carbon-free based on an LCA.					
ISO 14040/14044	8	The Commission adopts the International Organization for Standardization's (ISO) Life Cycle Assessment Requirements and Guidelines as best practice for interpreting the statutory definition of "carbon-free," and considers the ISO 14040 and 14044 as the best framework for establishing future LCAs.					
	9	The Commission adopts a Fuel Pathways framework with the following definitions (choose one or more): A. Carbon-free: A determination of carbon-free is made at the fuel pathway level. "Carbon-free" does not apply to a specific resource or technology, but to the entire fuel pathway of a specific LCA, the boundaries of which will be set by the Commission. B. Compliance: Compliance applies at the generation resource level. i. Full compliance: A generation resource is fully compliant if 100 percent of the electricity generated by the resource is generated based on a fuel pathway determined to be carbon-free. ii. Partial compliance: A generation resource is "partially compliant" if, in the generation of electricity, the resource relies on: (a) Pollution control technology that does not remove 100 percent of the CO2 emissions generated, or (b) A mixture of a CF fuel pathway and a non-CF fuel pathway (e.g., blending of hydrogen produced from an EET with natural gas) C. Comparative Scenario Evaluation (CSE): A counterfactual analysis, to be submitted alongside appropriate LCA studies. D. Partial Credit: Partial credit would apply to CF fuel pathways that are determined to not be carbon-free and, after undergoing a Comparative Scenario Evaluation are ultimately deemed to be a better (i.e., lower net GHG emissions) management opportunity than other options, and, as a result, are granted partial CF credit.					
	10	The responsible government agency's standard of review for determining if a fuel pathway is carbon-free, partially carbon-free, or not carbon-free shall be based upon a carbon intensity threshold level below which a CF fuel pathway is considered CF.					
	11	For blended fuel situations such as hydrogen co-firing, an LCA must be conducted on each individual fuel pathway requiring an LCA, rather than conducting an LCA on a combination of fuel pathways as would occur with fuel blending.					
	12	LCAs shall be conducted based on annual data, consistent with CFS compliance.					

Fuel Pathways Proposal	13	LCA review will use the following procedures (choose one or more): A. The responsible state agency shall review and make a recommendation to the Commission on approving or denying the results of an LCA conducted by or on behalf of a utility. B. The utility proposing a new CF fuel pathway for compliance demonstration purposes is responsible for conducting and providing the results of an LCA for review. C. Once an LCA is submitted to the responsible state agency for review, the review should be completed and approved or denied by the Commission within six months. D. If an LCA conducted by or on behalf of a utility is ultimately denied for a given fuel pathway by the Commission, the utility may appeal the decision. E. If an LCA conducted by or on behalf of a utility is ultimately denied for a given fuel pathway by the Commission, another LCA analysis for the denied fuel pathway may be undertaken by the same or another utility. F. Once the LCA results for a given CF fuel pathway have been approved by the responsible government agency, that CF fuel pathway shall be added to an "approved CF fuel pathways" list that other utilities can rely on without needing to conduct another LCA. In order to rely on the "approved CF fuel pathways" list, the resource relying on the list must have similar source and production pathways as the resource on the list. G. Utilities are encouraged to file during a resource plan or resource acquisition proceeding, but may file at any time. H. A process of public comment will transpire after the proposed LCA has been submitted. I. As part of its review of the proposed LCA, where appropriate, the responsible state agency will also conduct a review and provide a recommendation for a comparative scenario analysis submitted by the utility. (Staff proposed) J. The responsible state agency will maintain a repository of "approved CF fuel pathways" and "approved counterfactual fuel pathways" available for public use on the agency's website. (Staff proposed)					

Model	14	Each individual project (electricity generator) shall be paired with the appropriate model when conducting a lifecycle analysis. The following models and sources may be used when submitting an LCA for Commission consideration and approval (choose one or more): A. Argonne National Laboratory's Greenhouse Gasses, Regulation Emissions, and Energy Use in Transportation (GREET) model B. Environmental Protection Agency's Waste Reduction Model (WARM) model C. Environmental Protection Agency's Landfill Gas Emissions Model (LandGEM) model D. California Biomass Residue Emissions Characterization (C-BREC) model E. New/additional models and methodologies as may be developed or refined over time					
	15	In lieu of conducting an LCA, parties may use (choose one or more): A. Prior studies and literature reviews, such as the University at Buffalo's study on Waste-to-Energy facilities, if they are for a similar fuel pathway; B. Credible sources of existing LCA analysis results					

Scope, Boundary, and Study Period	16	The LCA scope and boundary for a carbon-free generation source shall begin with the existence and acquisition of the fuel; for solid waste and biomass materials, this is the point at which the material is generated and requires some kind of management.					
	17	When conducting an LCA Study, and where appropriate, parties must use the scope and boundary proposed by Olmsted County in Figure 1 of its June 5, 2025 Comments in Docket No. E999/CI-24-352.					
	18	The scope and boundary of the fuel LCA shall include the biogenic emission carbon cycle for all relevant LCAs. A. For these LCAs, there shall be a study period of at least 100 years.					
	19	The study period of the LCA shall align with the life of the resource or beneficial use program.					

Counterfactuals	20	Counterfactual evaluations shall be permitted in the LCA process.					
	21	Utilities shall develop their own avoided emissions base case scenarios, as appropriate, to use in a fuel LCA study.					

Quantified GHGs	22	LCA studies shall quantify the following greenhouse gases (choose one or more): A. Carbon dioxide B. Methane, using a carbon equivalency ("CO2e") value C. Nitrous Oxides, using carbon equivalency values D. Any other greenhouse gases considered relevant in the study, using carbon equivalency values					

Input Electricity	23	For all claims of carbon-free electricity used in a life-cycle analysis where the fuel requires processing using electricity before the fuel is combused (choose one or more): A. The utility must include hourly matching for CFS-eligible generation sources; B. The utility must specify the source of carbon-free electricity; and C. If a utility does not propose carbon-free electricity, the utility should use the whole MISO territory or LRZ 1 annual grid emissions.						
	24	For all electricity generation processes subject to lifecycle analysis requirements in which the primary electricity input energy is greater than 25 percent of output energy (choose one or more): A. The utility must submit annual documentation with its CFS compliance filing to demonstrate hourly matching of carbon-free electricity generation; and B. The utility must plan new carbon-free resources to match all new electricity generation.						
Re-Evaluations	25	For existing assets, lifecycle emissions shall be reevaluated no sooner than every five years.						
	26	For new capital projects, lifecycle emissions shall be reevaluated after the initial capital expenditure is expected to be paid off, to be determined at the time of CFS eligibility.						
	27	For new capital projects, lifecycle emissions shall be reevaluated no sooner than after the capital project is fully depreciated.						
	28	Once a resource qualifies as carbon-free or partially carbon-free, that designation shall remain in place for the duration of the lifetime of the asset, unless and until significant modifications are made to the fuel type of generation resource.						
	29	For any fuel mix determined to be carbon-free from a life-cycle analysis study, if that fuel mix deviates by more than ten percent, the utility must submit a new or revised lifecycle analysis and issue a new carbon-free percentage, if applicable.						
Credits and Allocators	30	For generation resources determined to be partially carbon-free based on a life-cycle analysis, the Commission will consider the whole portfolio of an entity in determining partial eligibility percentage, i.e., the aggregate carbon intensity score of the fuels used.						
	31	For generation resources determined to be partially carbon-free based on a life-cycle analysis, CFS-obligated utilities must report carbon-free MWh commensurate with the percentage that facility is considered to be carbon-free.						
	32	The Commission orders the following (choose one or more): A. Environmental Attribute Credits shall be issued equivalent to metered generation on a per MWh basis; B. A single Environmental Attribute Credit be issued for all generation that may be retired to demonstrate both EETS and CFS compliance; C. A carbon-free allocator, which defines the percentage of CFS eligible generation, must be used for any generation facility that is partially CFS compliant; and D. For all generation made in a CFS partial compliant facility that is not eligible for the EETS, metered generation in A. shall be multiplied by C. to determine the whole number of Environmental Attribute Credits to issue that are only eligible for the CFS.						
	33	The Commission requires all partially compliant input energy claims in a secondary process to factor in the total output electricity of the partially compliant resource and its carbon-free allocator.						
	34	The Commission delegates to the Executive Secretary authority to begin proceedings to establish a process to translate renewable thermal credits to an Environmental Attribute Credit for compliance tracking purposes.						
Health Metrics	35	For biomass, RNG, and solid waste facilities, utility planning and tracking processes shall quantify and analyze the deaths and morbidity caused by these facilities to communities in Minnesota and other jurisdictions. Such modeling must also account for economic harm, property value losses, harms to rural population and ways of life, harms to family farming, and known pollution impacts.						
Compliance Filings	36	Beginning in 2026, each electric utility subject to the Carbon-Free Standard shall include in their annual compliance report in Docket No. E-999/PR-YR-12: (choose one or more) A. For any fuel determined to be carbon-free from a life-cycle analysis study, utilities must report the composition of the fuel mix compared to the modeled lifecycle analysis. B. For any fuel determined to be carbon-free from a life-cycle analysis study, utilities must report: electricity used to generate electricity, marginal energy attribute credit (EAC) retirements to match all electricity use (hourly or annual), and weighted average trucking mileage for each generation facility that uses the exemption.						
	37	Utilities subject to the CFS and intending to use an LCA must notify the Commission and offer basic information about the relevant resources and fuel types and sourcing within 60 days of the Commission's Order in the current proceeding.						

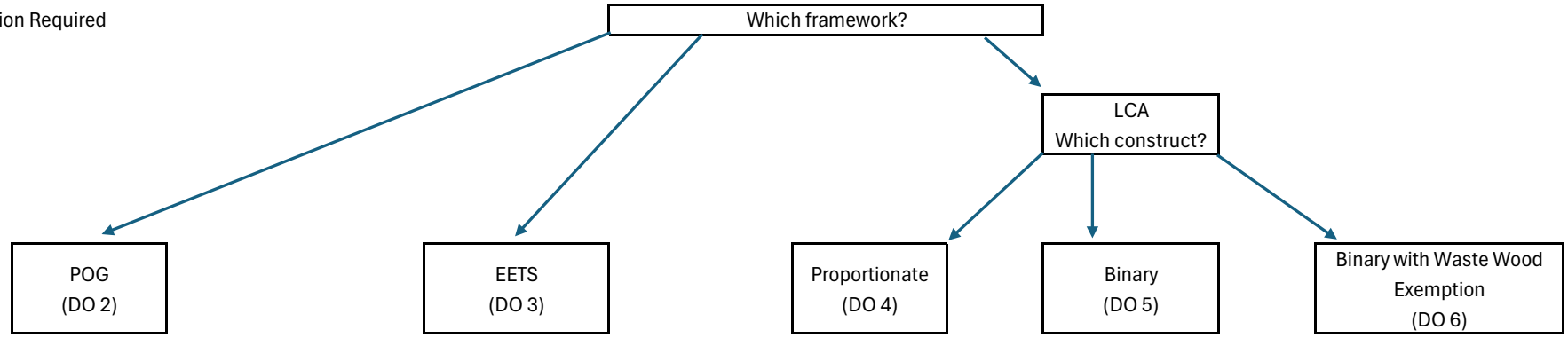
Biomass	38	Primary biomass shall not be eligible for CFS compliance. Primary biomass is defined as: -Biomass that is intentionally cultivated, harvested, and prepared for use, in whole or in part, as a fuel for the generation of electricity. -As farm-grown closed-loop biomass as defined in Minn. Stat. §216B.2424, subd. 1(a)(1).					
	39	Waste biomass shall be eligible for CFS compliance. Waste biomass is defined as (choose one or more): A. Biomass derived from secondary activities including but not limited to: 1. Wood waste from storm damage, disease or infestation, utility line maintenance, waste from forest products manufacturing; 2. Agricultural activities including manure; 3. Food waste and other organic waste. B. Biomass that results in lower greenhouse gases than the alternative disposal method. C. Biomass that is not deliberately generated or created for use as a fuel feedstock, but is a by-product of the functions of society, or the result of natural forces such as pests, disease and storm damage, and requires some type of management or disposal on an ongoing basis, irrespective of the opportunities for or need for energy production.					
	40	Sustainable woody biomass shall be eligible for CFS compliance. Sustainable woody biomass is defined in Minn. Stat. § 216B.2424, subd. 1(d).					
	41	Sustainable woody biomass shall be eligible for CFS compliance. Sustainable woody biomass is defined as (choose one or more): A. From whole dead, dying, damaged, and/or diseased trees salvaged after wildfire, windstorm, or insect infestation; other wood debris in the forest; B. The by-product of forest management from routine maintenance, natural disasters, or hazardous fuel reduction including trees and woody plants (limbs, tops, needles, leaves, and other woody parts) grown in a forest, woodland, rangeland, or the urban and community environment; C. Wood biomass associated with secondary harvest of logging residuals; tops, limbs, and unmarketable material from harvest operations; D. Manufactured wood pellets; E. Wood-based construction debris and waste; F. Non-hazardous secondary materials such as wood-based paper-mill residuals, saw-mill residuals (including bark, sawdust, chips), and railroad ties, consistent with their treatment in EPA rule 40 CFR Part 241; G. Material sourced by trained logging professionals implementing the Minnesota Forest Resources Council Voluntary Site-Level Guidelines for Forest Management, which includes biomass harvesting guidelines.					
	42	In a woody biomass LCA counterfactual analysis, open burning shall be the default alternative management method.					
	43	When performing a lifecycle analysis for woody biomass, the following assumptions shall be used when relevant and to the extent possible (choose one or more): A. System boundary assumptions 1) Include forest growth and decay/fire emissions 2) Include energy combustion emissions with scrubbers 3) Include harvest, transport, and processing emissions (not for mill residues) 4) Indirect land use changes will not occur 5) Account for counterfactual scenarios (e.g., what would have happened to the biomass if not used for energy, e.g., wildfire, landfill, and decomposition) B. Carbon assumptions: 1) Assume biomass is inherently carbon neutral, based on regrowth of forests 2) Use the 100 year planning horizon that accounts for delayed carbon sequestration 3) Assume that emissions from combustion may take decades to be offset by regrowth C. Feedstock type and source assumptions: 1) Forest residues (branches, tops, unmarketable material) 2) Mill residues (sawdust, bark) 3) Construction debris 4) Whole wildfire, wind, or insect-damaged trees D. Forest management practice assumptions: 1) Assume the forest is actively managed for natural or planted regrowth and not converted to other uses (e.g., agriculture) 2) Assume the forest is actively managed using sustainable forestry, following harvesting best management practices with trained loggers. E. Geographic and temporal scope assumptions: 1) Assume the entire forest of Minnesota, including its species and age class-specific growth, mortality, and removals 2) Assume the entire forest of Minnesota, with its associated biogenic cycle emissions, with and without its use for electricity generation; 3) Assume over a 100-year timeframe F. Energy system displacement assumptions: 1) Assume biomass displaces the current use of coal.					

	44	The University of Minnesota's 2024 report conducted for the Minnesota Forest Resources Council entitled "Estimated current and future carbon stocks and emissions in Minnesota forests and forest products under multiple management scenarios" shall serve as default guidance for parties conducting a woody biomass LCA.						
	45	The Commission delegates to the Executive Secretary the authority to establish and set procedural schedules for a working group to make recommendations to the Commission on standards necessary to verify that biomass qualifies as waste biomass ensures compliance under the definition established by the Commission. A. One function of the biomass workgroup shall be to make recommendations about which types of waste biomass should be exempt from LCA.						
Solid Waste	46	For WTE and RDF facilities using MSW feedstock, the counterfactual used shall be "worst case emissions municipal solid waste landfill."						
	47	LCA assumptions using a landfill counterfactual shall incorporate realistic landfill methane gas collection percentages and gas-to-energy recovery efficiency.						
	48	In LCAs, parties must incorporate GHG offsets resulting from the recycling or other beneficial use of components found in the MSW that is being processed for use or otherwise used as a fuel.						
RNG	49	RNG and other fuels purchased with associated renewable thermal credits tracked through M-RETS that have already conducted an LCA are eligible for the CFS without requiring a new LCA.						
	50	RNG from large scale animal operations ("CAFOs") shall not be eligible for carbon-free credit.						
	51	RNG projects shall not be considered carbon-free unless the utilities applying for credit provide an accounting of externalities, leakage, and foreseeable economic and social impacts of RNG production and use.						
	52	MSW landfilling shall be used as the primary counterfactual for RNG. When possible, parties conducting LCAs on RNG shall use a blended counterfactual that also accounts for composting and/or anaerobic digestion without RNG.						
CCS	53	Facilities that employ carbon capture and sequestration/storage systems shall be eligible for partial CFS compliance.						
	54	Facilities that employ carbon capture and sequestration/storage systems shall not be eligible for full or partial CFS compliance.						
	55	To demonstrate partial compliance due to the presence of the CCS system, utilities employing CCS technologies do not have to provide an LCA.						
	56	Once the Commission has determined a CO2/MWh value for a plant using CCS considering direct, upstream, and downstream emissions, it will give partial compliance credit to that plant commensurate with the percent reduction in CO2 emissions per MWh attributable to the CCS project.						
	57	Facilities with a CCS system seeking partial CFS compliance credit shall use Minnkota's proposed formula, where: A. The point of measurement for the total megawatt-hours generated and transmitted to the grid would be the last revenue quality meter upstream of the substation connecting the generating unit(s) into the transmission grid system (net meter); B. The point of measurement for the CO2 sequestered would be the flow meters identified in the EPA approved monitoring, reporting, and verification plan pursuant to 40 CFR Part 98 Subpart RR, or other equivalent independently approved reporting plan; and C. The point of measurement for the CO2 generated from the electric generating units would be the continuous emissions monitors identified in the air monitoring plan submitted in accordance with 40 CFR Part 75 monitoring plan for the associated electric generating unit(s).						
	58	No carbon-free credit shall be given for facilities where the captured carbon is used for enhanced oil recovery.						
Hydrogen	59	The following facilities are eligible for partial CFS compliance (choose one or more): A. Facilities that burn hydrogen produced from EETS via electrolysis (green H2); B. Facilities that burn hydrogen produced from non-biomass EETS via electrolysis (green H2); C. Facilities that burn hydrogen produced from nuclear via electrolysis (pink H2); D. Facilities that burn hydrogen extracted from natural geological sources (white H2); E. Facilities that burn other forms of hydrogen, pending the results of an LCA.						
	60	Facilities that burn hydrogen shall be eligible for partial CFS compliance, pending the outcome of a lifecycle analysis.						
	61	Facilities that burn hydrogen shall be eligible for partial CFS compliance, provided those facilities account for indirect upstream emissions associated with fuel production.						
	62	Facilities that burn hydrogen shall be eligible for partial CFS compliance and do not need to submit a lifecycle analysis.						
	63	Facilities that burn hydrogen shall not be eligible for full or partial CFS compliance at this time.						
	64	The Commission delegates to the Executive Secretary the authority to begin a new proceeding on whether hydrogen may be eligible for the CFS.						
	65	For a generation facility that burns any amount of partially carbon-free resources mixed with any other fuel (choose one or more): A. The base case emissions shall be derived from the primary fuel source that is displaced by the partially carbon-free electricity; and B. If the primary fuel source is partially carbon-free, the base case shall be the base case used to determine the carbon-free percentage of the primary resource.						

	66	The percentage of partial compliance credit shall be determined by the percentage reduction in CO2/MWh at the plant, adjusted for the upstream emissions due to the hydrogen production process (i.e., color) based on federal 45V tax credit guidance.					
	67	The percentage of partial credit at a hydrogen co-firing facility shall be determined by the following equation: Direct Emissions + Indirect Emissions – Emissions Displaced by CF Fuel Mixing = Net Compliance Percentage					
	68	For a carbon-free fuel pathway, the percentage of the annual net generation in MWh, based upon MMBtu heat input from that CF fuel, should contribute to compliance demonstration. Any hydrogen blended with natural gas can be analyzed on a heat input (MMBtu/MWh) basis.					
	69	When hydrogen is combusted with other fuels, the utility shall conduct an engineering study to determine whether the final output ratio of fuels is the same as the initial input ratio.					
Storage	70	Energy storage assets shall be treated as load for CFS compliance purposes, unless storage assets are used to substantiate hourly matching requirements. In order to qualify storage assets for CFS eligibility, the asset must (choose one or more): A. Retire hourly EACs to match charging from fully CFS-eligible resources; and B. Generate hourly EACs to match discharging.					
	71	The Commission declines to adopt a separate accounting methodology for storage assets.					
Net Market Purchases	72	The Commission adopts following list of resources to be eligible as carbon-free for net market purchase compliance (choose one or more): A. Wind B. Solar C. Hydropower D. Hydropower with a nameplate capacity of 100 MW or greater, if built before February 8, 2023 E. Geothermal F. Nuclear					
	73	The Commission declines to determine which resources in net market purchases shall be eligible as carbon-free at this time.					
Other Resources	74	All types of emitting generation, including fossil fuels, may submit an LCA to attempt to qualify for the CFS.					

Framework (DOs 2-6)

Decision Required



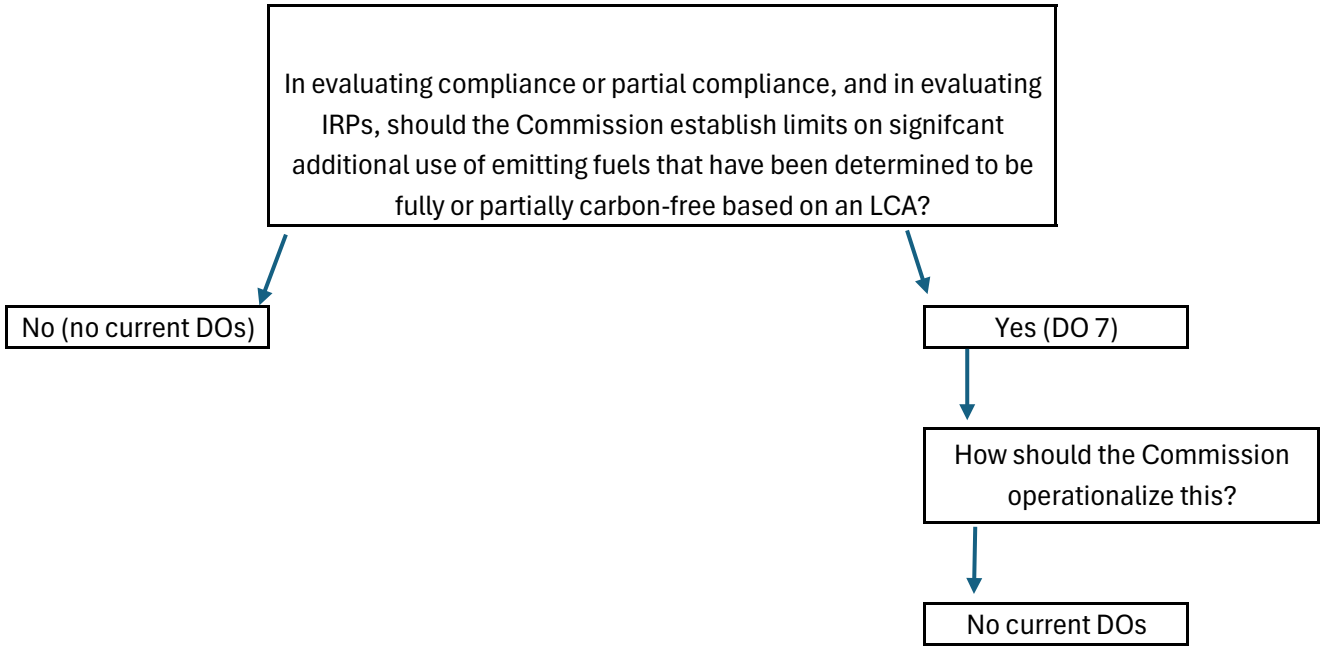
If POG, see:
Credits and Allocators (DOs 30-34-33)
CCS (DOs 53-58)
H2 (DOs 59-69)
Storage (DOs 70-71)
Net Market Purchases (DOs 72-73)

If EETS, see:
Limits (DO 7)
Credits and Allocators (DOs 30-34-33)
Health Metrics (DO 35)
Compliance Filings (DOs 36-37)
Biomass (DOs 38-45)
Solid Waste (DOs 46-48)
RNG (DOs 49-52)
CCS (DOs 53-58)
H2 (DOs 59-69)
Storage (DOs 70-71)
Net Market Purchases (DOs 72-73)

If any LCA, see:
Limits (DO 7)
ISO 14040/14044 (DO 8)
Fuel Pathways Proposal (DOs 9-13)
Model (DOs 14-15)
Scope, Boundary, and Study Period (DOs 16-19)
Counterfactuals (DOs 20-21)
Quantified GHGs (DO 22)
Input Electricity (DOs 23-24)
Re-Evaluations (DOs 25-29)
Credits and Allocators (DOs 30-34-33)
Health Metrics (DO 35)
Compliance Filings (DOs 36-37)
Biomass (DOs 38-45)
Solid Waste (DOs 46-48)
RNG (DOs 49-52)
CCS (DOs 53-58)
H2 (DOs 59-69)
Storage (DOs 70-71)
Net Market Purchases (DOs 72-73)
Other Resources (DO 74)

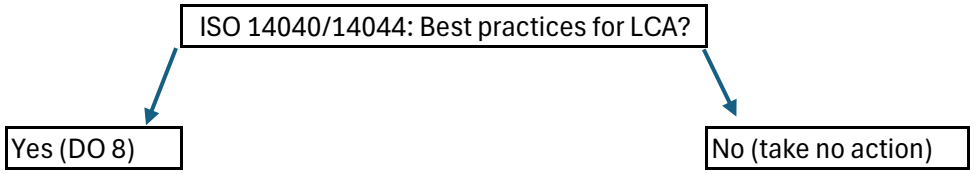
Limits (DO 7)

Only decide if EETS or LCA framework chosen



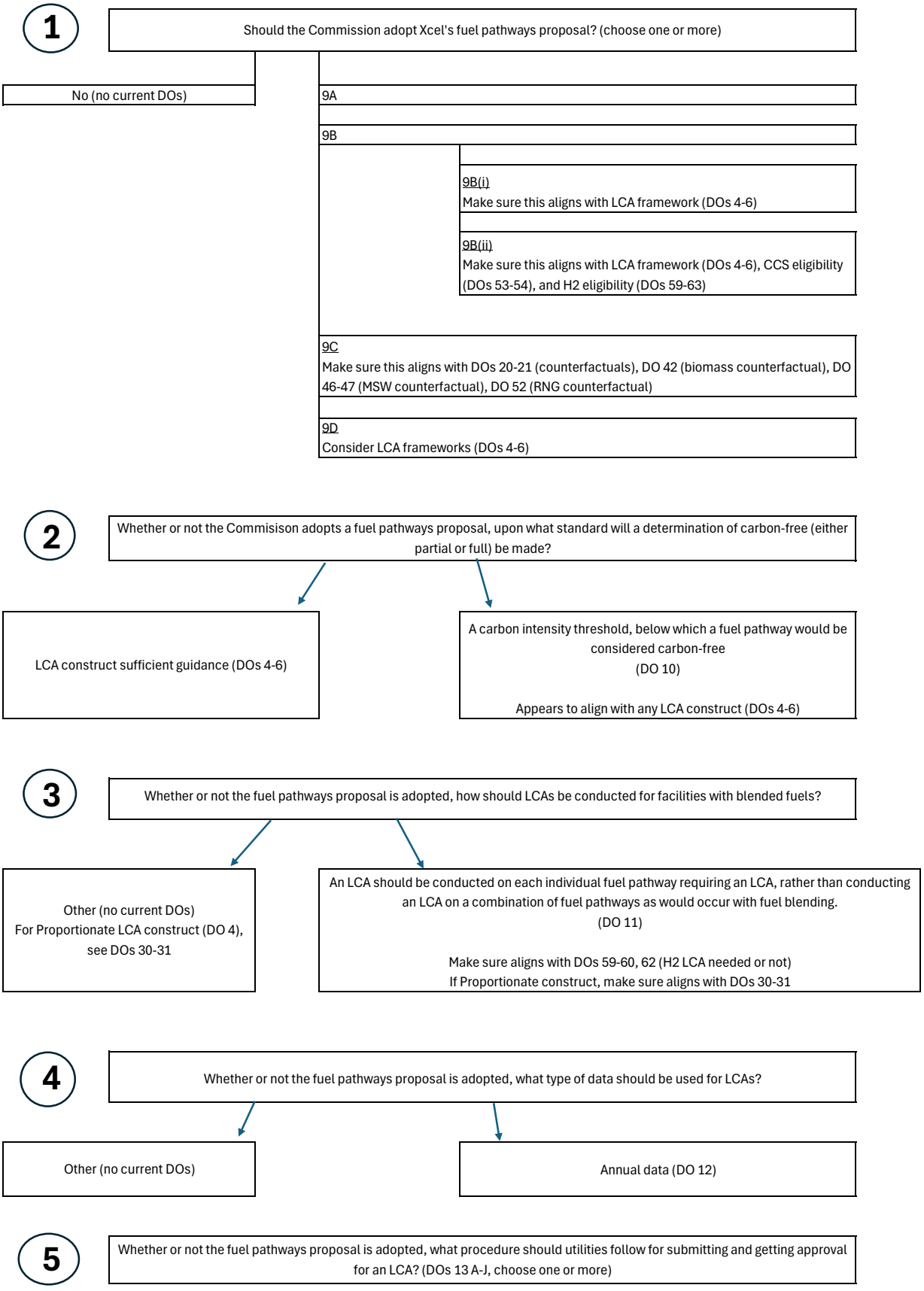
ISO 14040/14044 (DO 8)

Only decide if LCA framework chosen



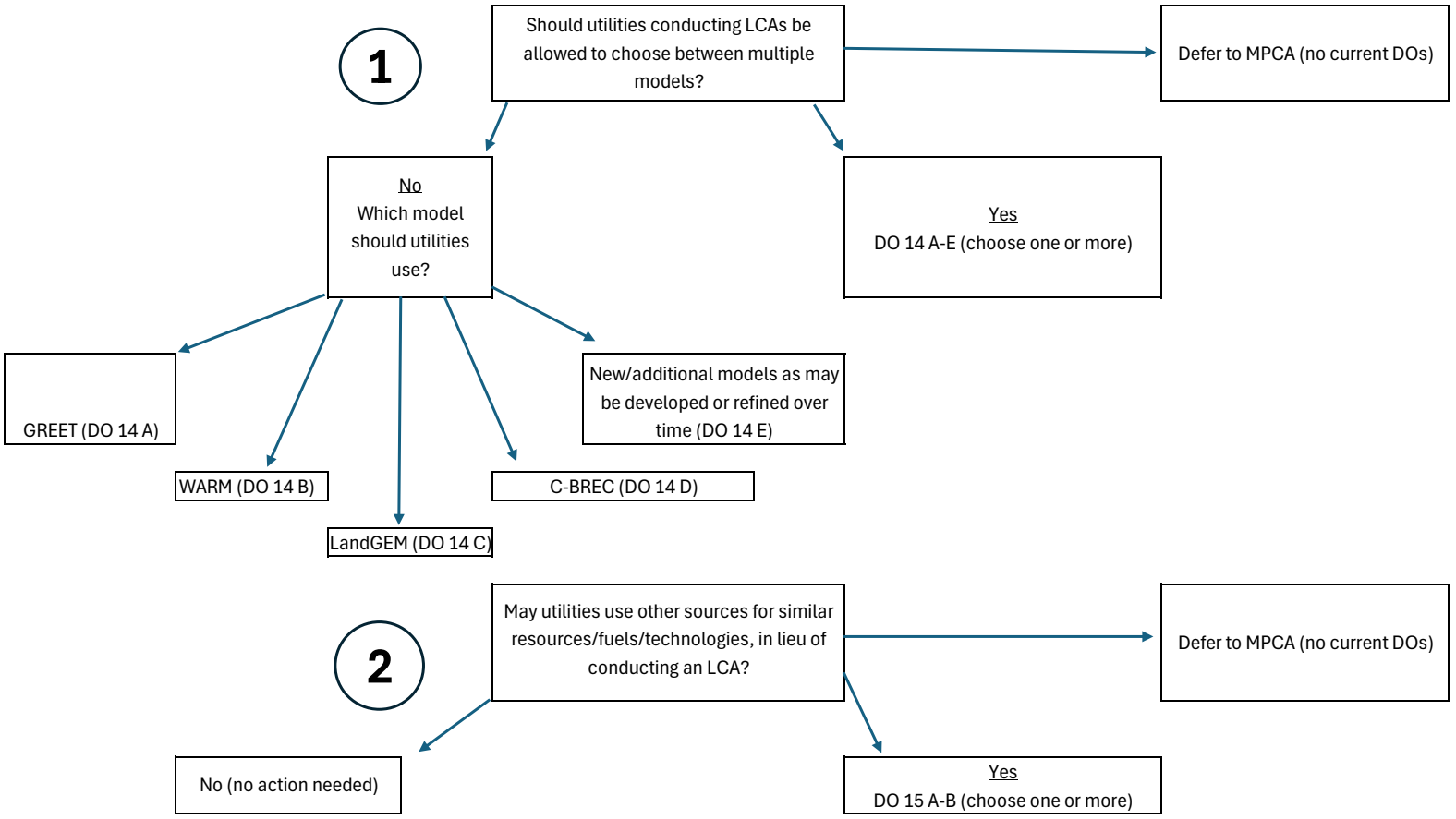
Fuel Pathways Proposal (DOs 9-13)

Only decide if LCA framework chosen



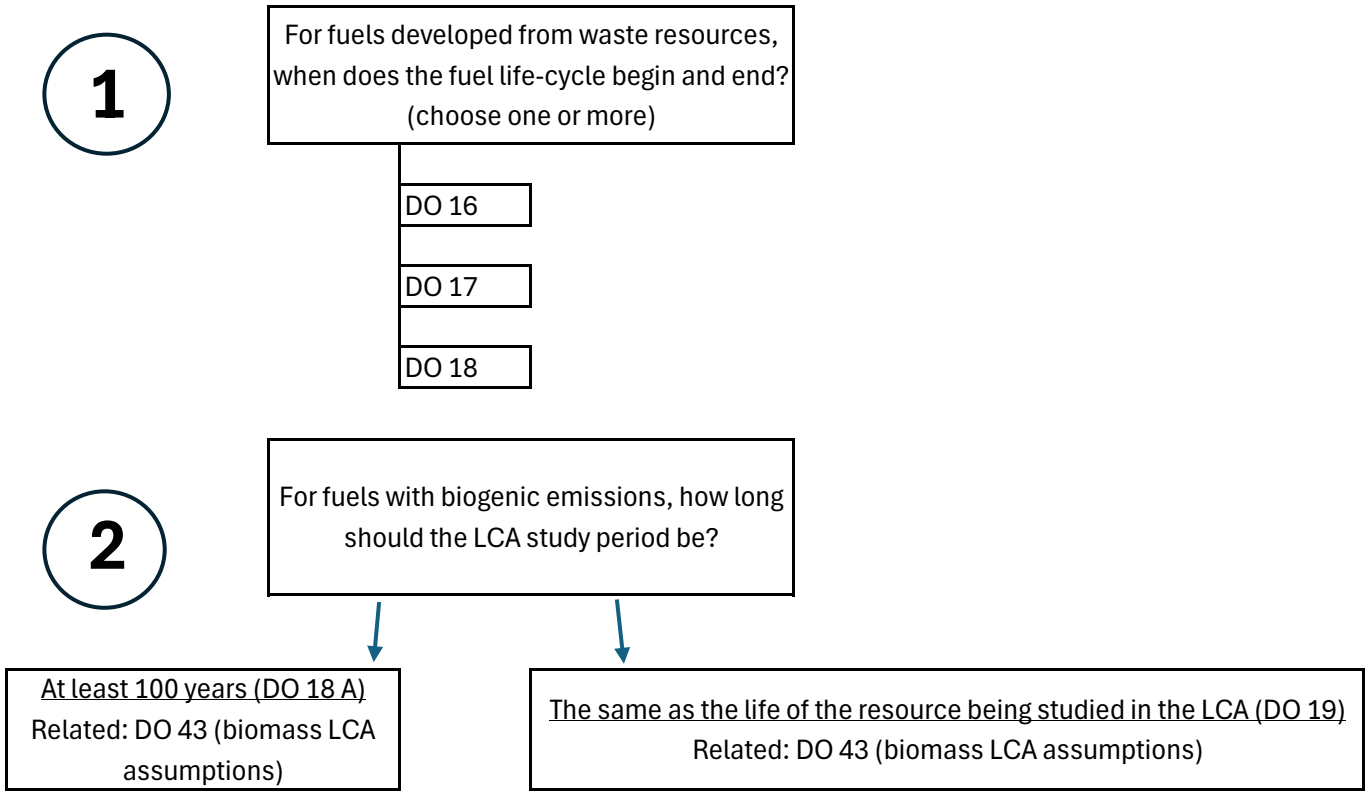
Model (DOs 14-15)

Only decide if LCA framework chosen



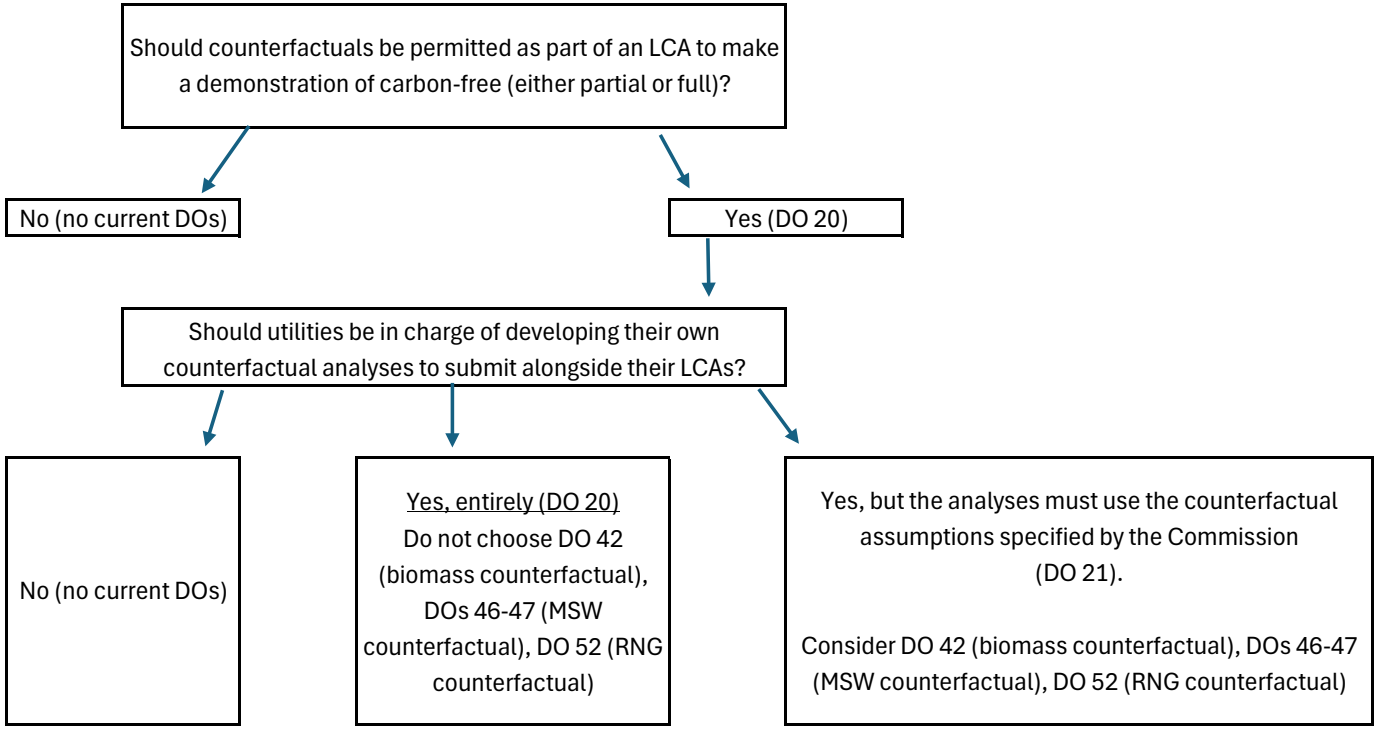
Scope, System Boundary, and Study Period (DOs 16-19)

Only decide if LCA framework chosen



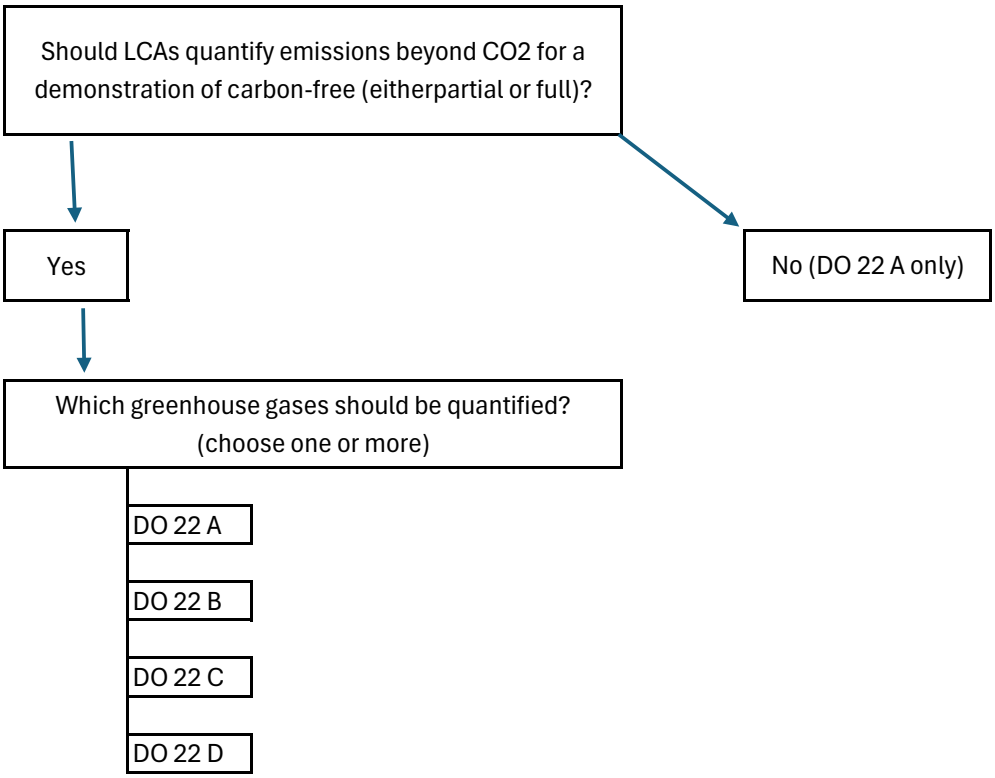
Counterfactuals (DOs 20-21)

Only decide if LCA framework chosen



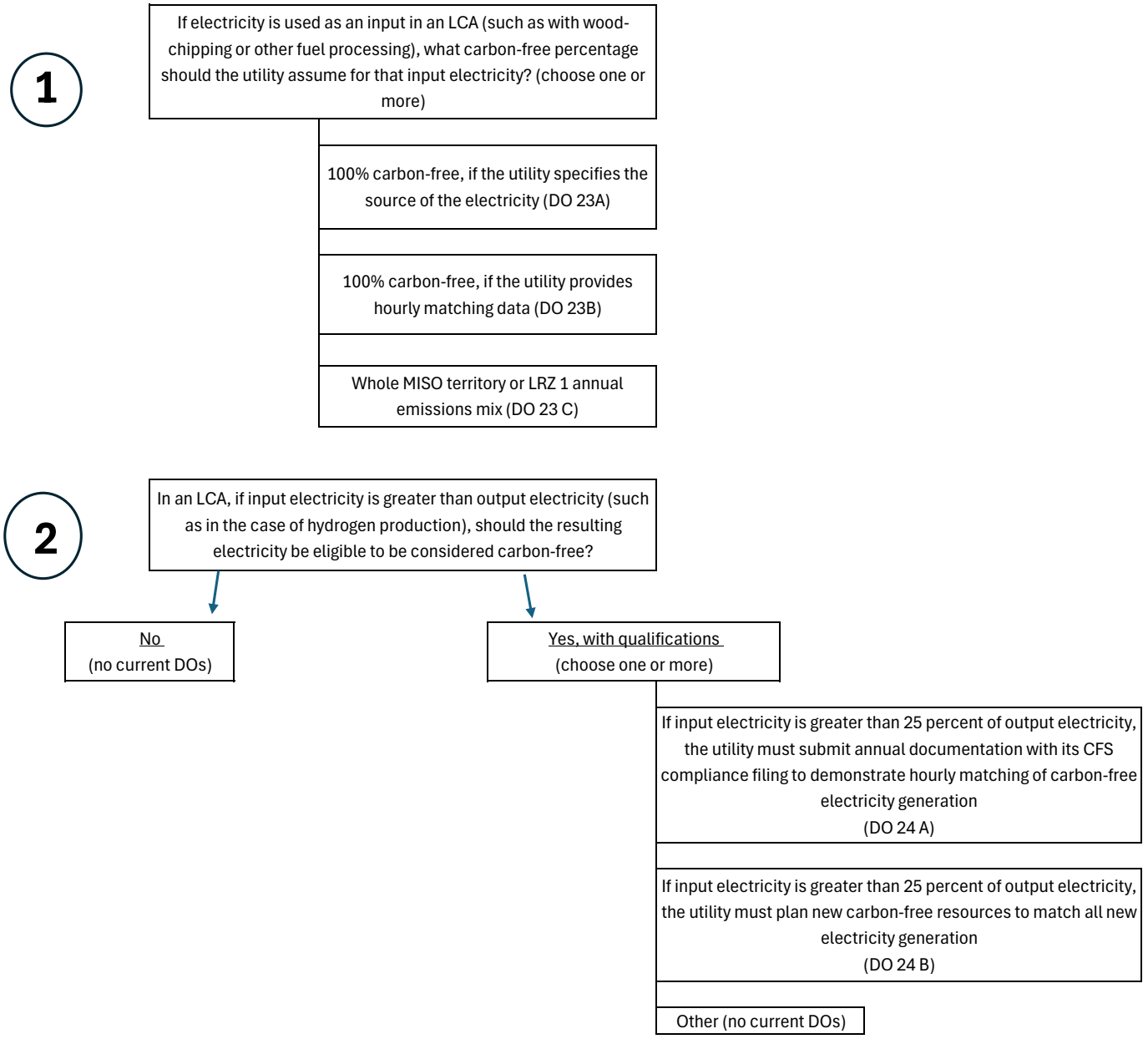
Quantified GHGs (DO 22)

Only decide if LCA framework chosen



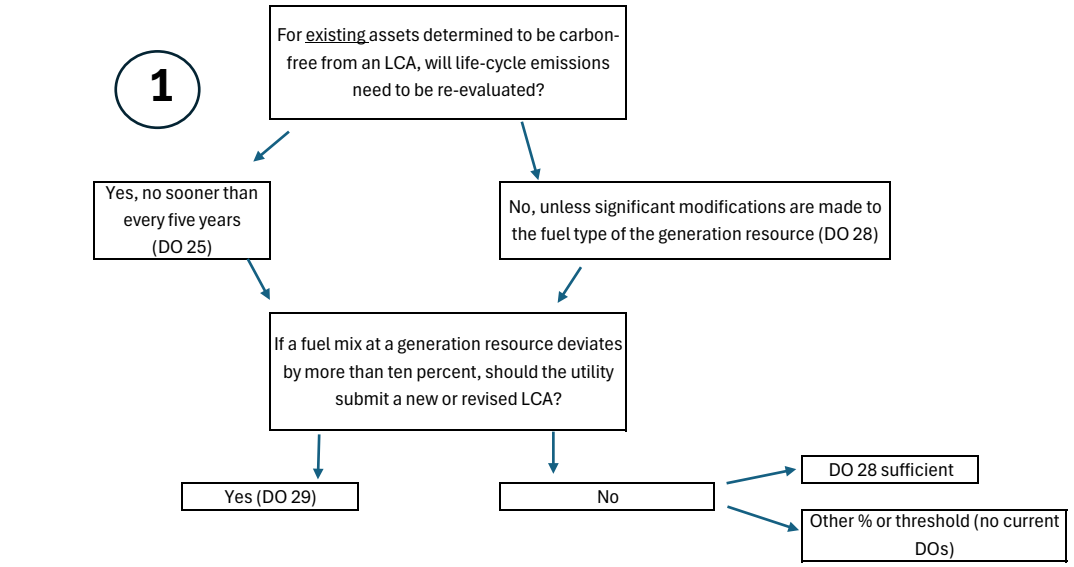
Input Electricity (DOs 23-24)

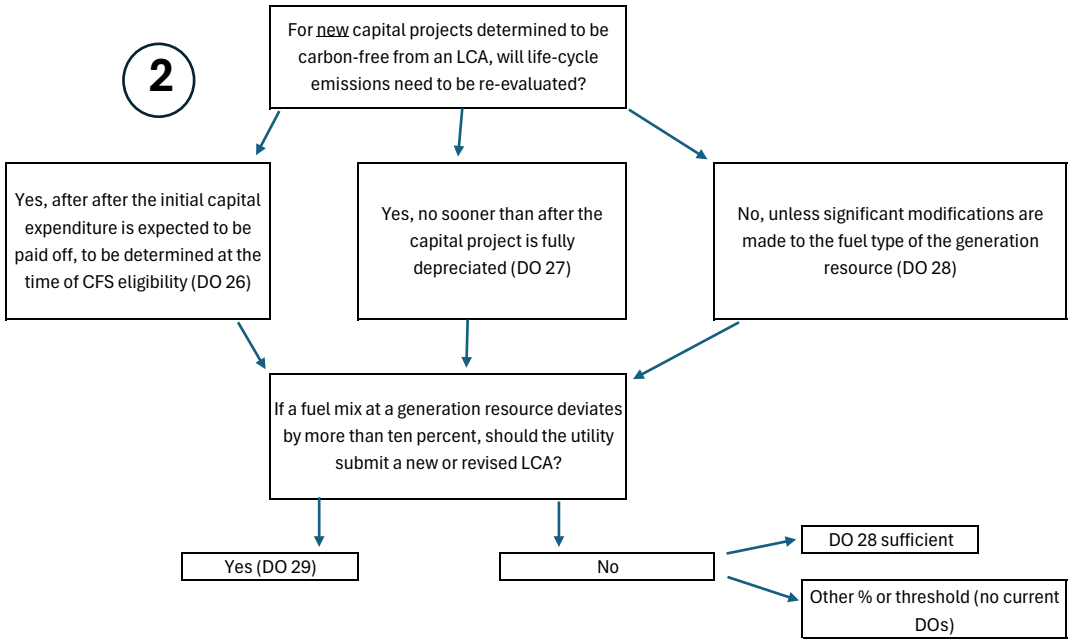
Only decide if LCA framework chosen



Re-Evaluations (DOs 25-29)

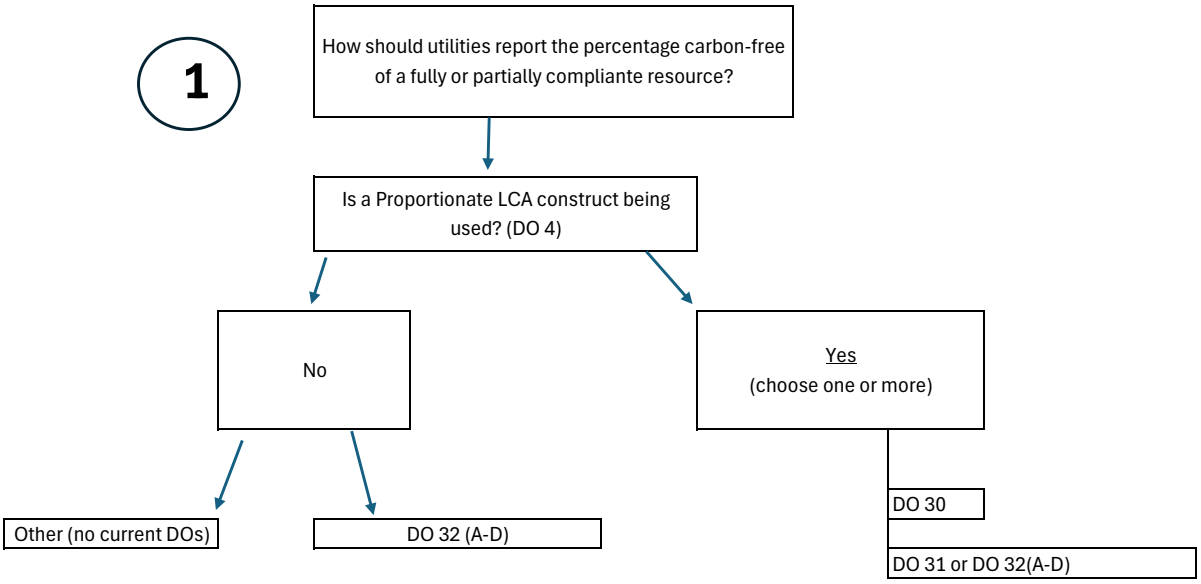
Only decide if LCA framework chosen

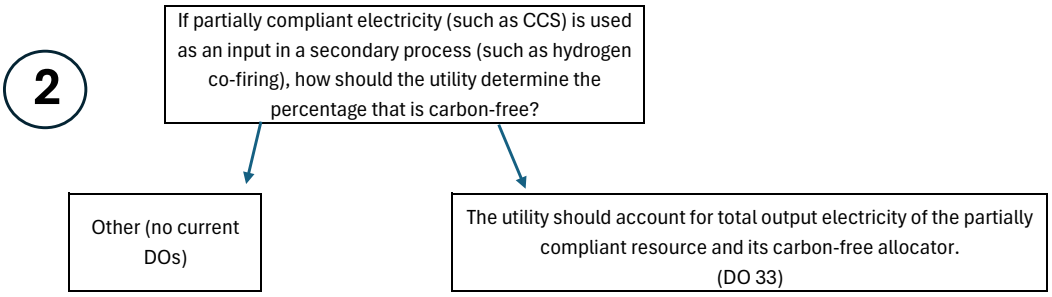


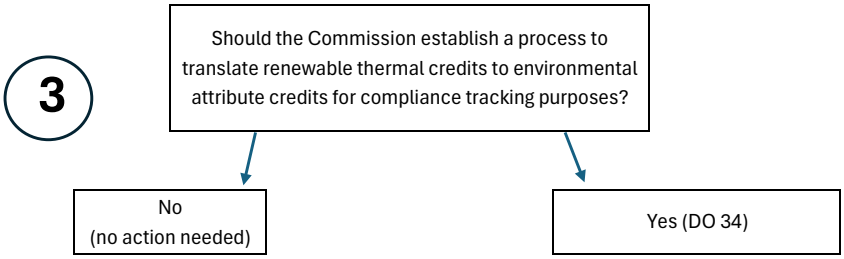


Credits and Allocators (DOs 30-34)

POG, EETs, and LCAs frameworks must decide

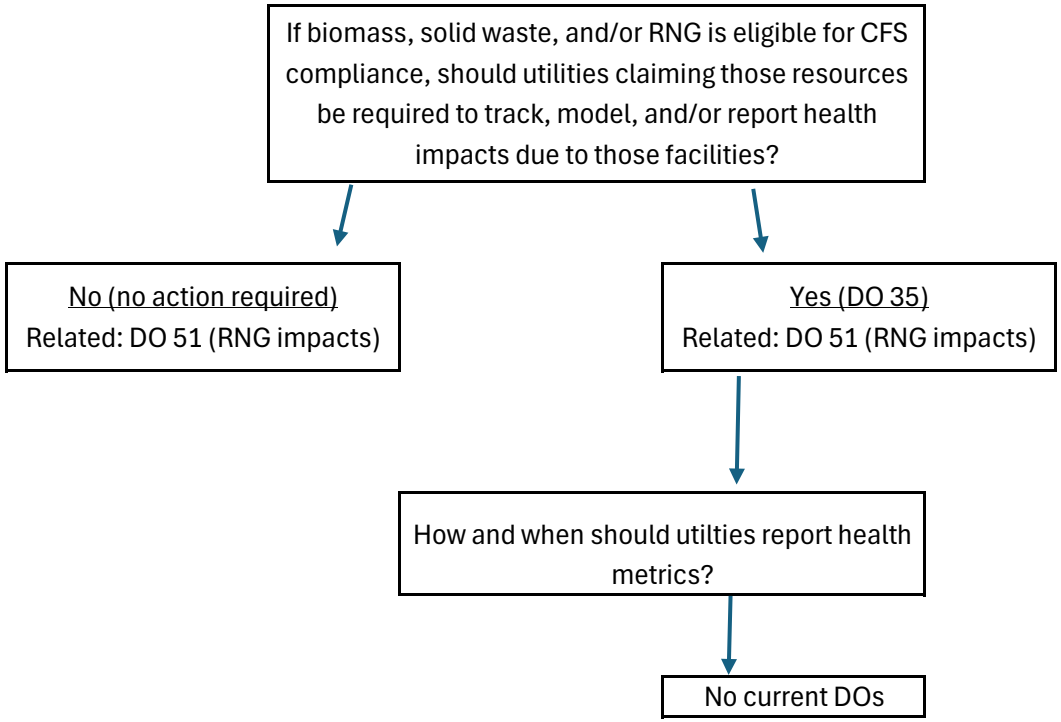






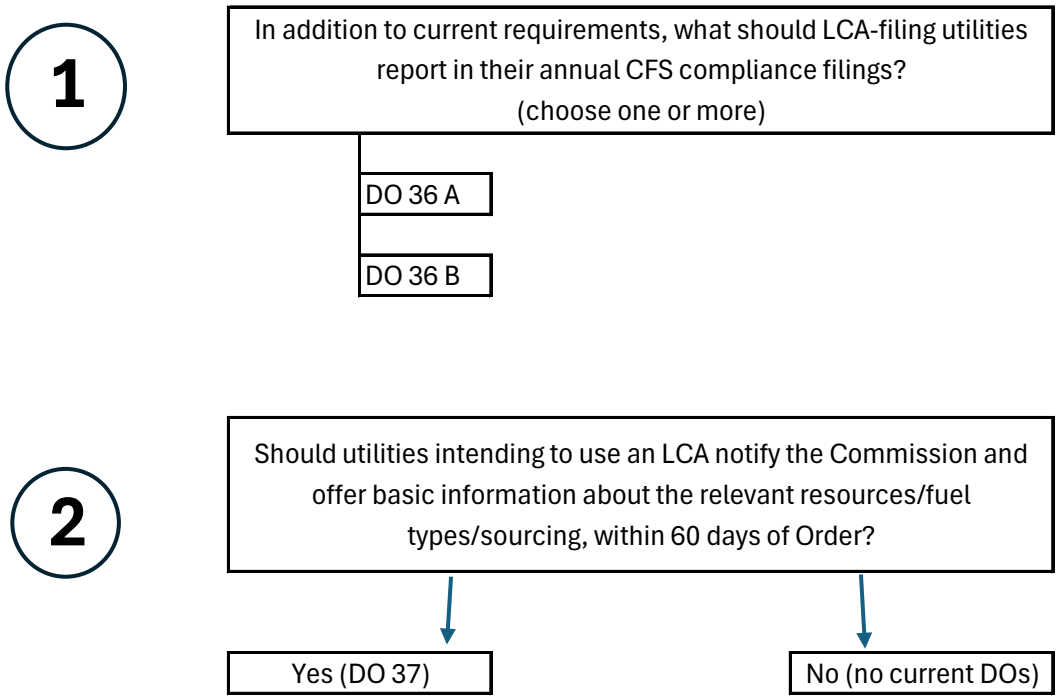
Health Metrics (DO 35)

EETs and LCAs frameworks must decide



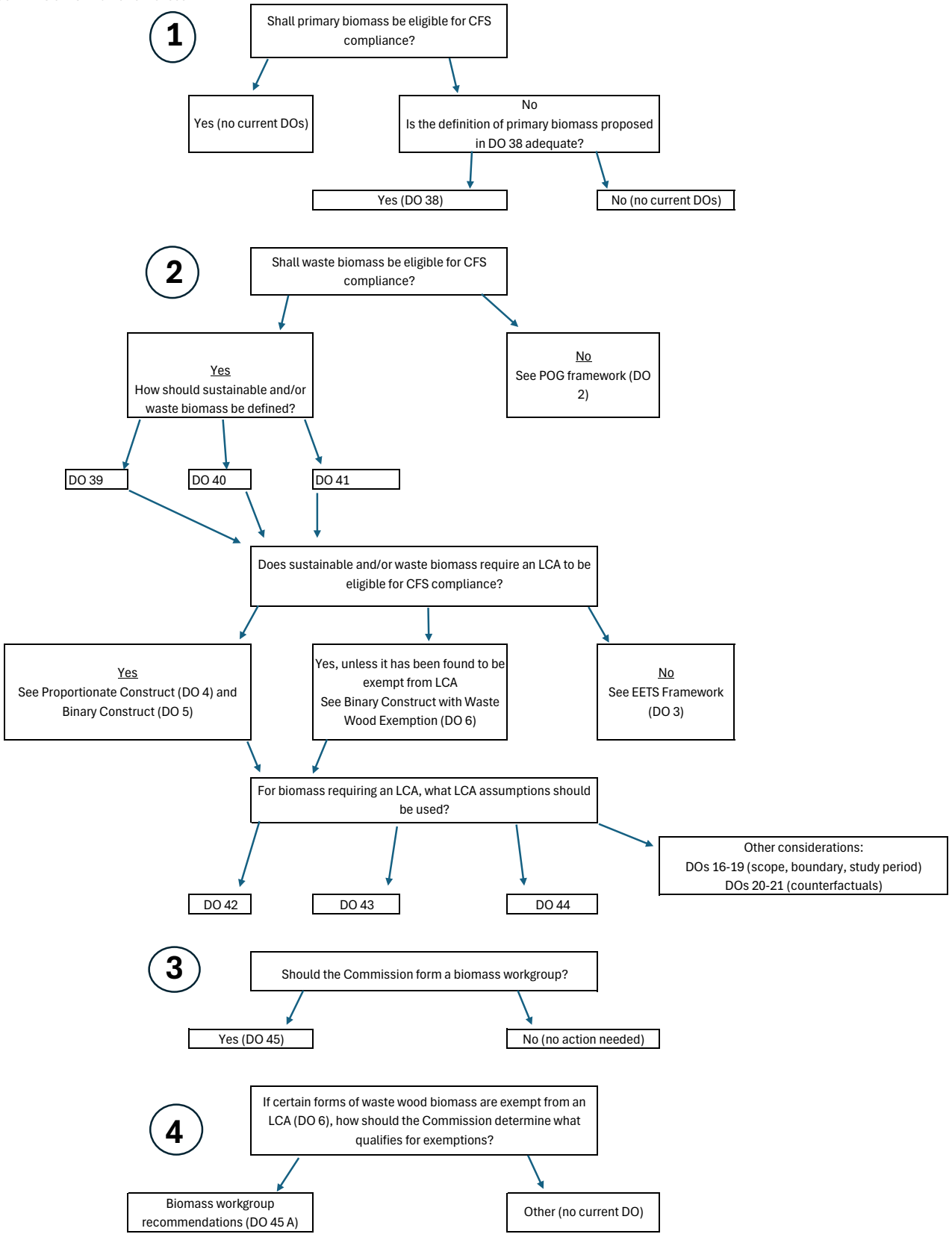
Compliance Filings (DOs 36-37)

Only decide if LCA framework chosen



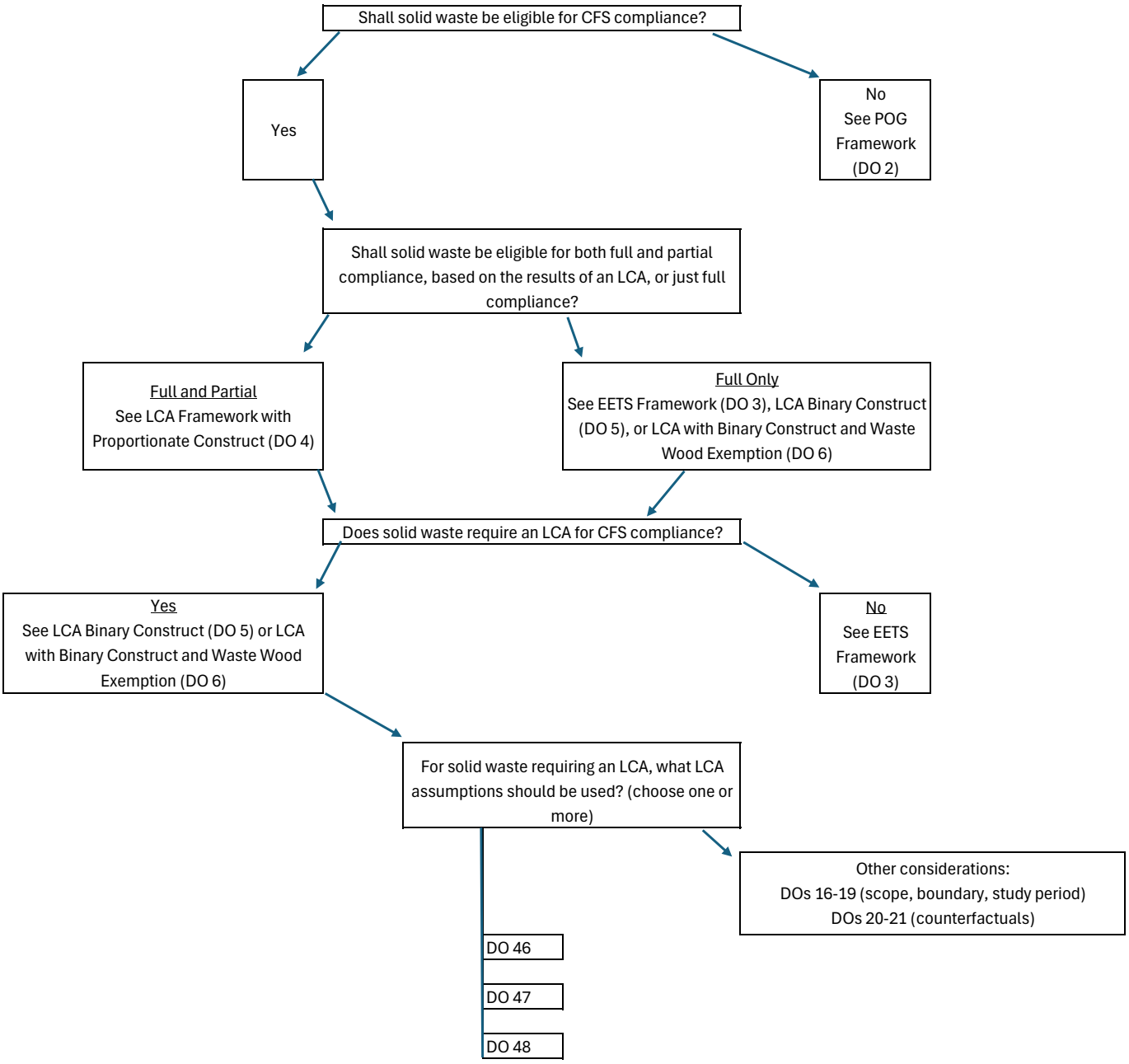
Biomass (DOs 38-45)

Only decide if EETS or LCA framework chosen



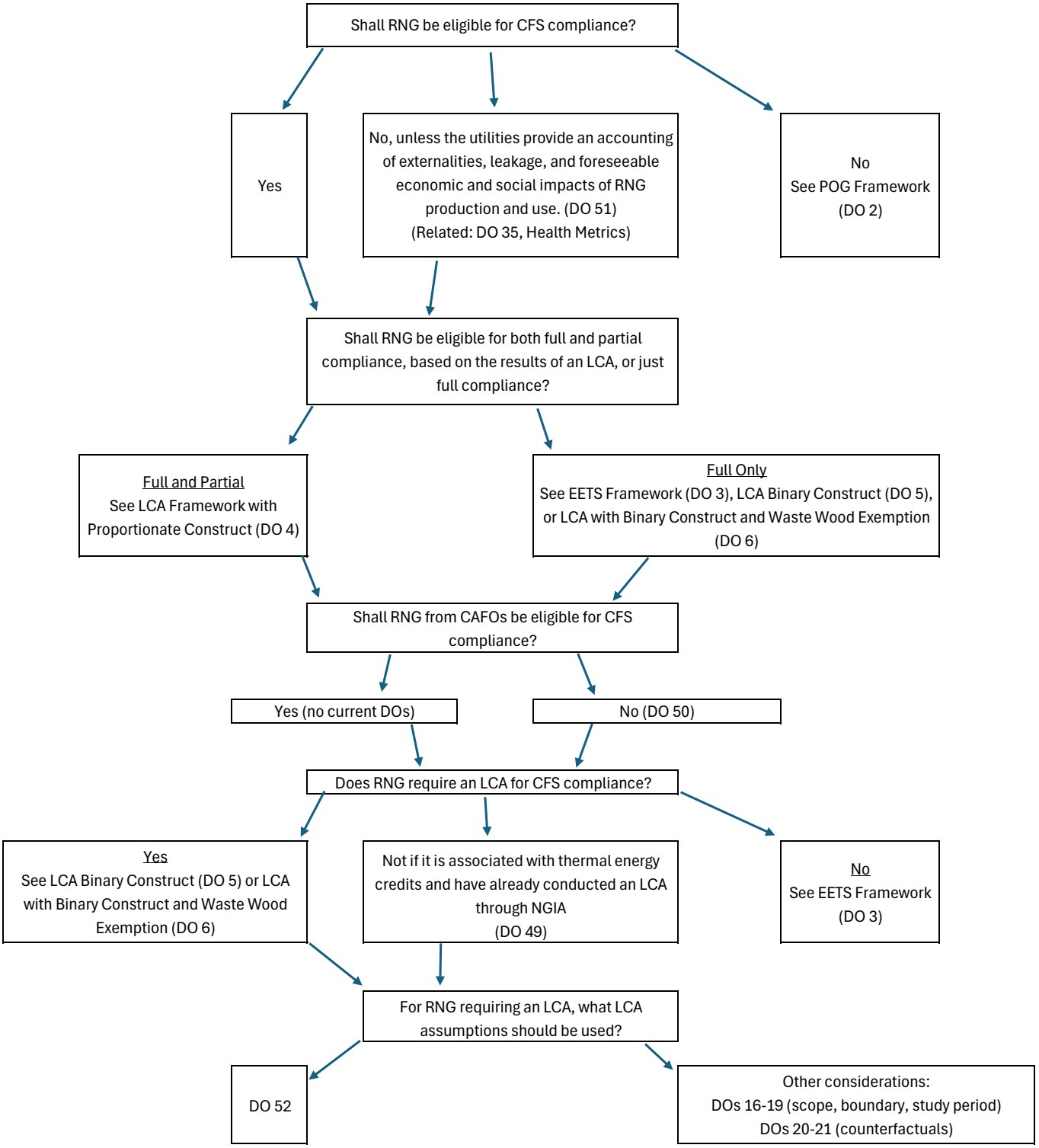
Solid Waste (DOs 46-48)

Only decide if LCA framework chosen



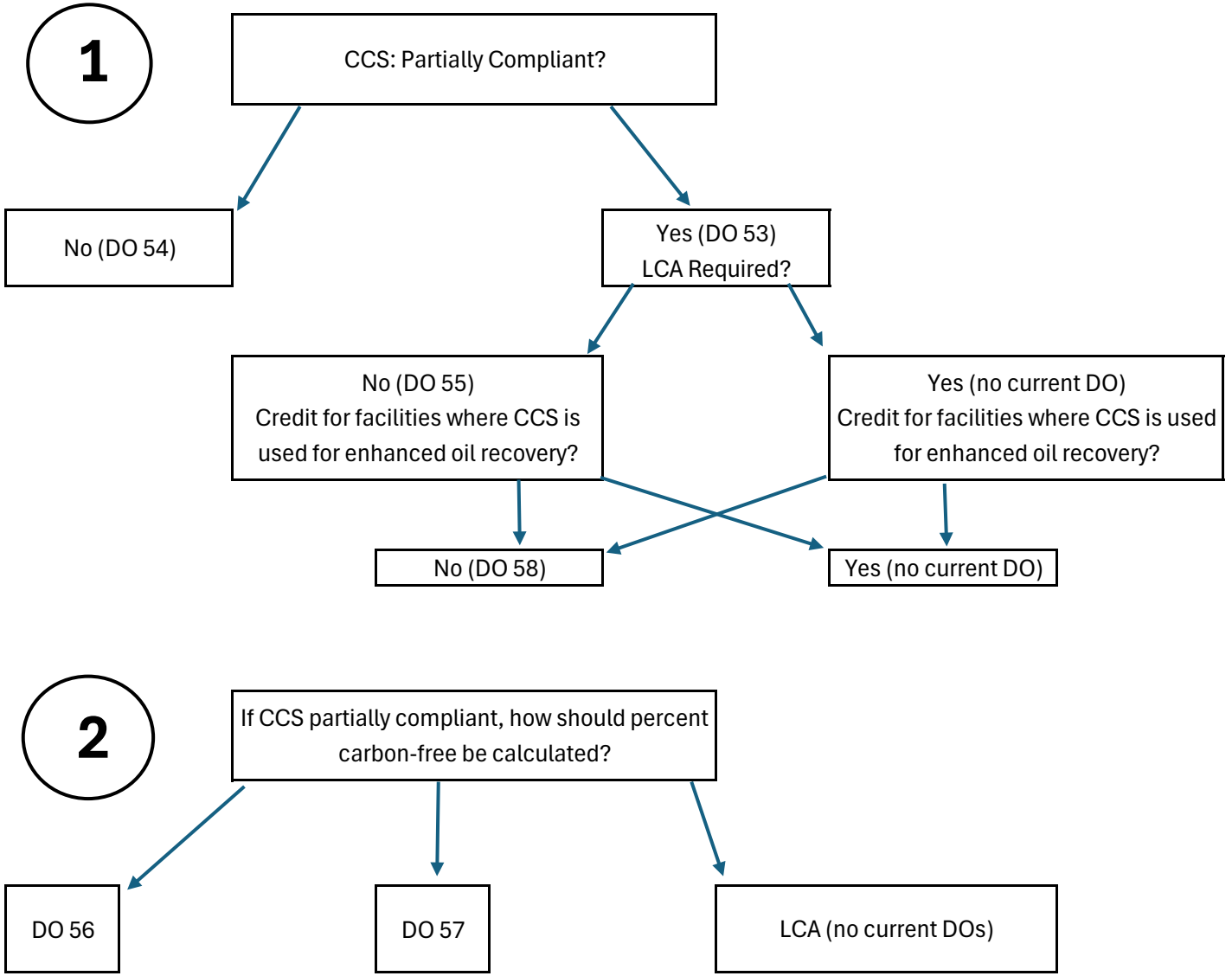
RNG (DOs 49-52)

Only decide if LCA framework chosen



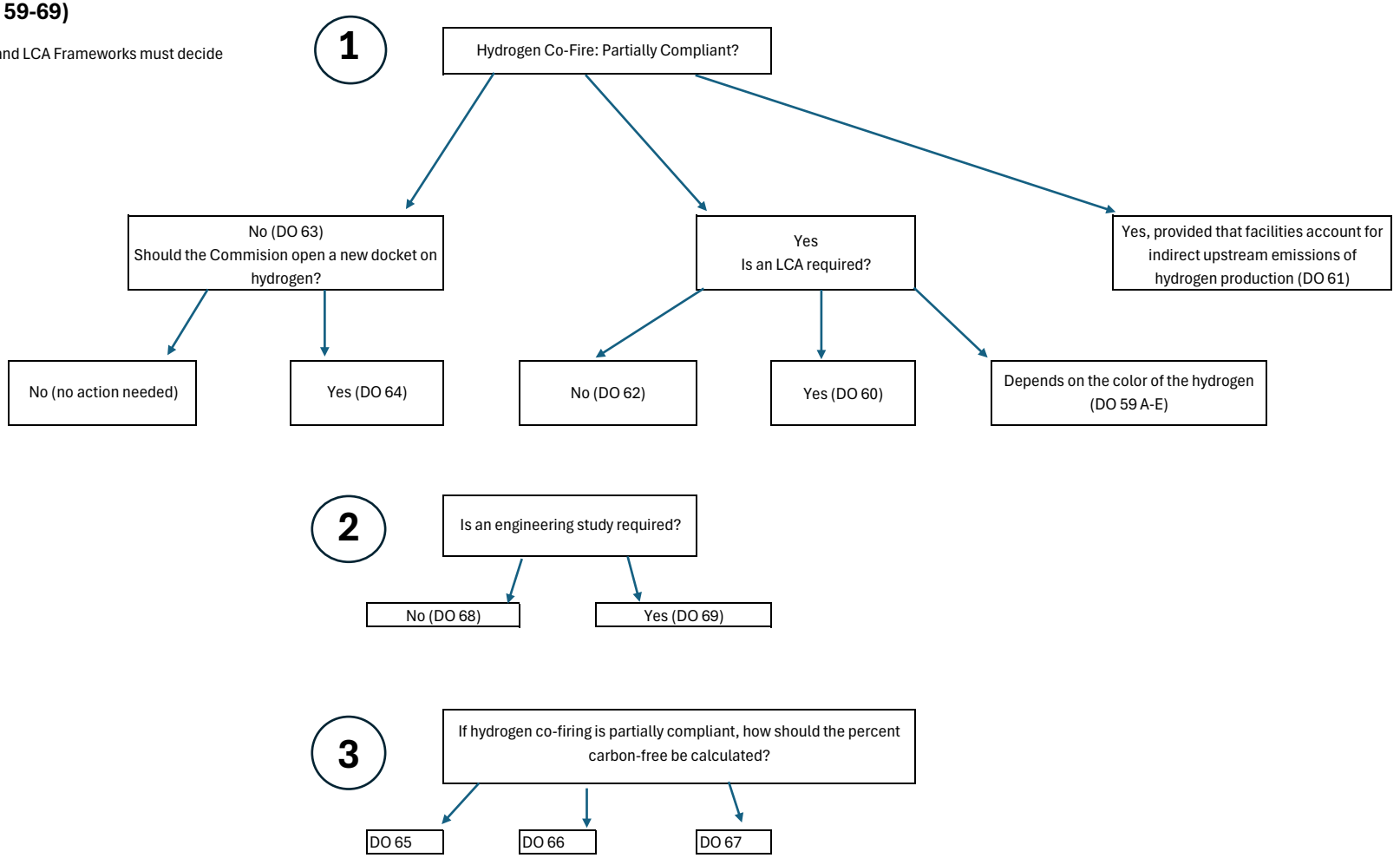
CCS (DOs 53-58)

POG, EETS, and LCA Frameworks must decide



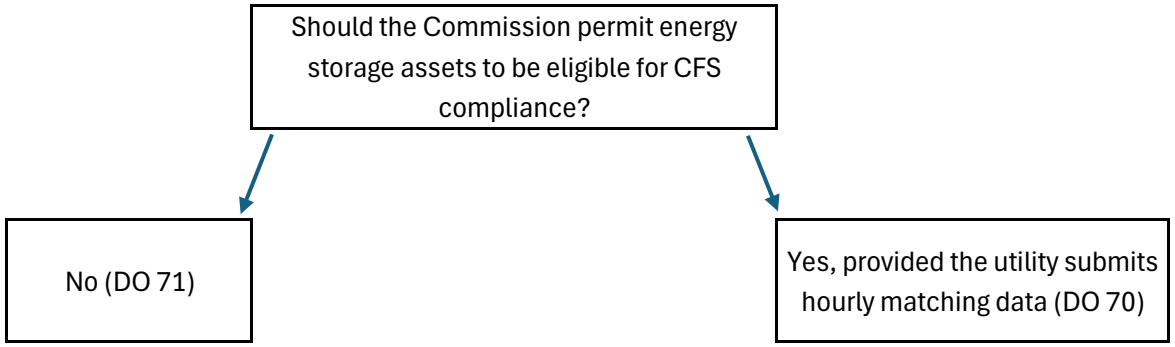
H2 (DOs 59-69)

POG, EETS, and LCA Frameworks must decide



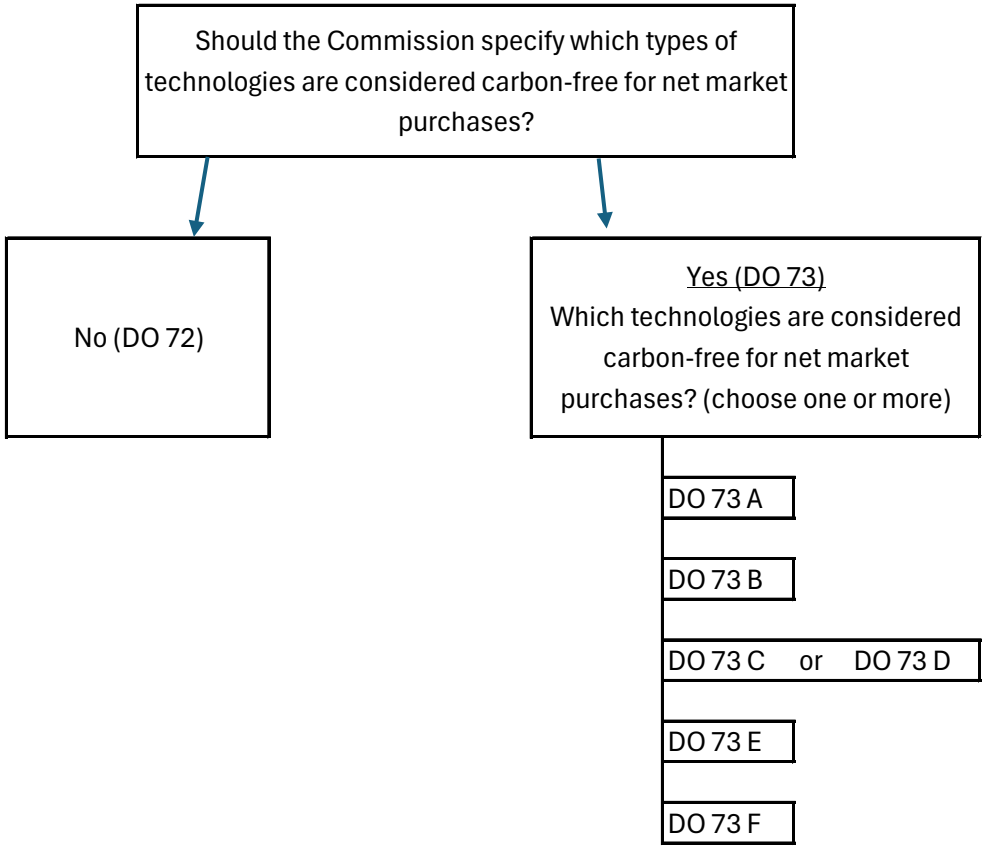
Storage (DOs 70-71)

POG, EETS, and LCA Frameworks must decide



Net Market Purchases (DOs 72-73)

POG, EETS, and LCA Frameworks must decide



Other Resources (DO 74)

Only decide if LCA framework chosen