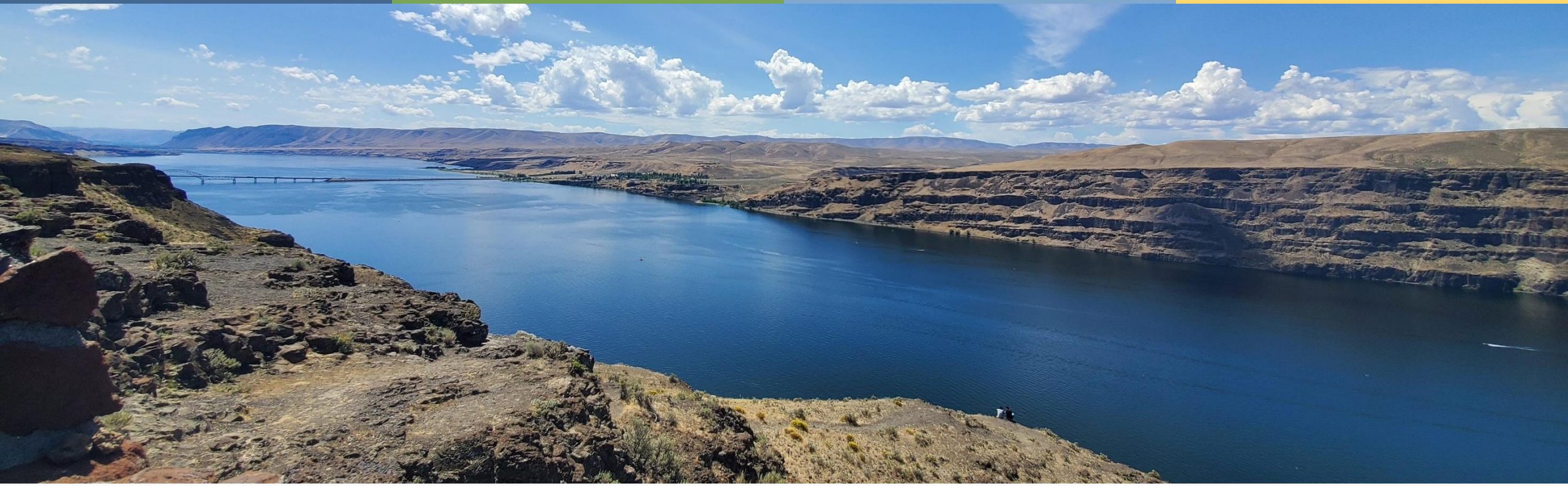


WA GREET 4.0 Model Updates and Transition

Clean Fuel Standard Rulemaking, Climate Pollution Reduction Program

October 14, 2026

Ecology staff introductions

- Lauren Sanner – Rulemaking Lead, Clean Fuel Standard
- Debebe Dererie – Fuel Pathway Specialist , Clean Fuel Standard
- Xiao Chen – Fuel Pathway Specialist, Clean Fuel Standard
- Abbey Brown – Technical Lead, Clean Fuel Standard
- Gopika Patwa – Environmental Planner, Technical Host

Rulemaking timeline

January 20, 2026

Rulemaking announcement **filed (CR-101)**

Rule development phase, **with numerous** public meetings **and comment periods**

January 2026 – Winter 26/27

Spring 2027

Expected rulemaking proposal (CR-102)

Formal comment period and public hearings

Summer 2027

Fall 2027

Anticipated rule adoption (**CR-103**)

Rule effective 31 days after adoption

Purpose and Agenda

1. GREET model overview
2. Updates for WA-GREET 4.0
    3. Crude Oil Carbon Intensity
    4. Electricity Fuel Mix
    5. Tier 1 Calculators
    6. Biogas-to-Electricity Pathway
7. Draft timeline for transition
8. Feedback requested

WA-GREET overview

- **GREET** = Greenhouse gases, Regulated Emissions, and Energy use in Technologies model
- CFS uses **WA-GREET** to calculate the carbon intensity (CI) of fuels
  - CI = the greenhouse gas emissions over the life cycle of a fuel's production and supply to WA.
- Current model: **WA-GREET3.0**
- Uses 100-year Global Warming Potentials (from the Fourth Assessment Report by the Intergovernmental Panel on Climate Change)

What is new in WA-GREET4.0

- Updated based on CA-GREET4.0:
  - Based on Argonne's GREET1 2022
  - EPA's Emissions and Generation Resources Integrated Database (eGRID) for 2021
  - EMissionFACtor(EMFAC2021)
- Electricity: 2017 Update & 2021 Fuel Mix
- Crude oil mix in WA, MT, & UT
- Marketable Crude Oil Name (MCON) CI – Based on OPGEE3.0b

Use of WA-GREET in Clean Fuel Standard

To set **the Annual Carbon** Intensity Standard for Gasoline & Diesel

- **Inputs: 2017 Crude** CI (WA, MT, UT), 2017 **Fuel Mix, Simulation** Year 2017

To set **the Current** Carbon Intensity of Lookup Table Fuel Pathways: **Two options for reflecting crude CI changes in fuels' CI:**

- **Following CARB LCFS approach.** Crude oil CI change is addressed using incremental **deficits**
- **New WA CFS: Current crude oil CI is incorporated in lookup fuel CI. No** incremental **deficits**

To Calculate **the Current** Carbon Intensity of Alternative Fuels **in Fuel Pathway Applications**

- Usually, Simplified Tier 1 calculators are used for common fuel pathway applications

Crude Oil CI Methodology

- Baseline crude mix: fixed at 2017
- Current crude mix:
  - WA: WA MCON report
  - MT & UT: recent published state-specific source data
- Annual Crude average CI values: volume-weighted average based on the applicable OPGEE version
- WA crude CI includes transportation adjustment
- Two approaches to reflect baseline to current crude CI changes

Crude Oil Carbon Intensity – WA, MT, UT

Washington Crude Oil CI

	2017 WA crude CI_ OPGEE v2.0c (2023)	2017 WA crude CI_ OPGEE v3.0b (2024)	2017 WA crude CI_ OPGEE v3.0b (2025)
WA Baseline Crude CI (gCO2e/MJ)	12.57	12.43	12.43
	WA 2023 crude CI_OPGEE v2.0c	WA 2024 crude CI_OPGEE v3.0b	WA 2025 crude CI_OPGEE v3.0b
WA Current Crude CI (gCO2e/MJ)	14.08	14.40	14.31

Background:
2017 WA baseline crude mix from WA Research Council and Energy Information Administration company level imports data
WA current crude mix: WA Marketable Crude Oil Name (MCON) reporting
WA crude CI includes source-specific transportation distance adjustment

Crude Oil CI – WA, MT, UT

Montana Crude Oil CI

	2017 MT crude CI_ OPGEE v2.0c (2023)	2017 MT crude CI_ OPGEE v3.0b (2024)	2017 MT crude CI_ OPGEE v3.0b (2025)
MT Baseline Crude CI (gCO2e/MJ)	20.86	19.76	19.76
	MT 2023 crude CI_OPGEE v2.0c	MT 2024 crude CI_OPGEE v3.0b	MT 2025 crude CI_OPGEE v3.0b
MT Current Crude CI (gCO2e/MJ)	21.06	19.98	20.00

Crude mix source: Department of Natural Resources and Conservation of the State of Montana, Oil and Gas Conservation Division/Borad of Oil and Gas Conservation, Annual Reviews (2016-2024) and 2025 Refiners Reports (Form 8)

Crude Oil CI – WA, MT, UT

Utah Crude Oil CI

	2017 UT crude CI_ OPGEE v2.0c (2021)	2017 UT crude CI_ OPGEE v2.0c (2022)	2017 UT crude CI_ OPGEE v2.0c (2023)
UT Baseline Crude CI (gCO2e/MJ)	9.16	9.16	9.16
	UT 2021 crude CI_OPGEE v2.0c	UT 2022 crude CI_OPGEE v2.0c	UT 2023 crude CI_OPGEE v2.0c
UT Current Crude CI (gCO2e/MJ)	9.91	9.75	9.54

Crude mix source: Utah Refinery Receipts of Crude Oil by State of Origin, 1980-2023

Crude Oil Carbon Intensity

Ecology is considering two approaches for reflecting the impact of changes in the CI of crude oil on the CI of gasoline and diesel by:

A. Issuing Incremental Crude Deficits:

- Compare rolling 3-year averages of annual current and baseline crude CI
- Use the difference to calculate a separate incremental deficit adjustment

B. Performing comprehensive CI updates:

- Use the rolling 3-year average of annual current crude CI as an input to the full GREET model
- Recalculate the gasoline and diesel lookup-table CI

Comparing the Two Approaches

	Incremental Crude Deficits	Comprehensive CI Update
What it calculates	Crude oil CI change from the 2017 baseline	Overall gasoline/diesel CI reflecting Crude oil CI change from the 2017 baseline plus updated model inputs
How often it is updated	Calculated annually (as implemented by CARB), or less frequently i.e. every 3 years	Updating the crude oil CI when lookup table pathway CI is updated (3 years)
How it's applied	Base gasoline/diesel CI plus an incremental crude CI for the purposes of quarterly reporting	Updated gasoline/diesel CI for the purposes of quarterly reporting
Crude CI isolation	Targets impact solely from changes in crude oil CI	Crude oil CI impact combined with electricity, source mix, and other model updates

Ecology's Evaluation of the Two Approaches

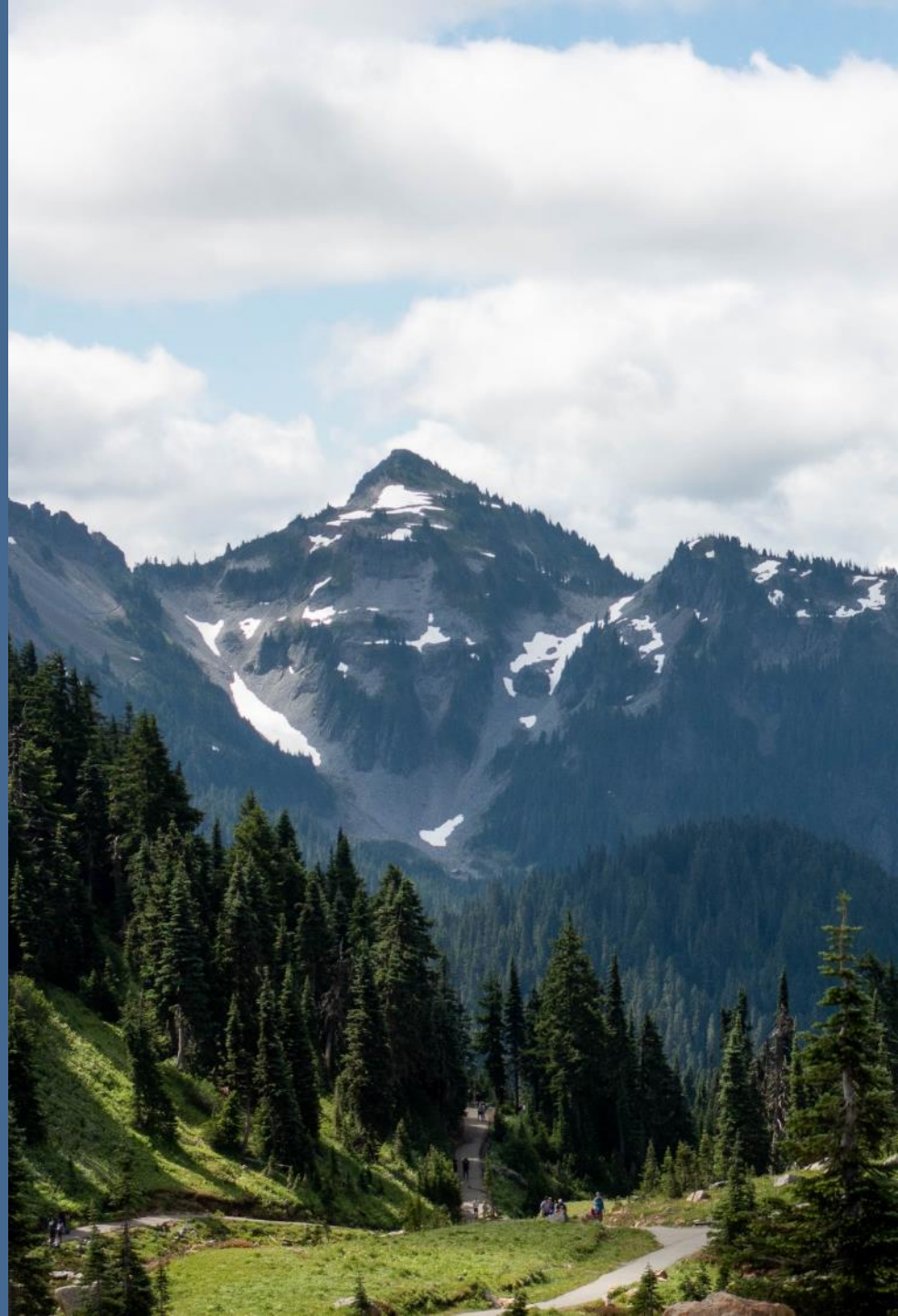
Ease of implementation:
How feasible is each approach to implement given data availability, reporting requirements, administrative workload?

Accuracy:
How directly and completely does each approach reflect changes in crude oil CI? On what cadence should the crude oil CI be updated?

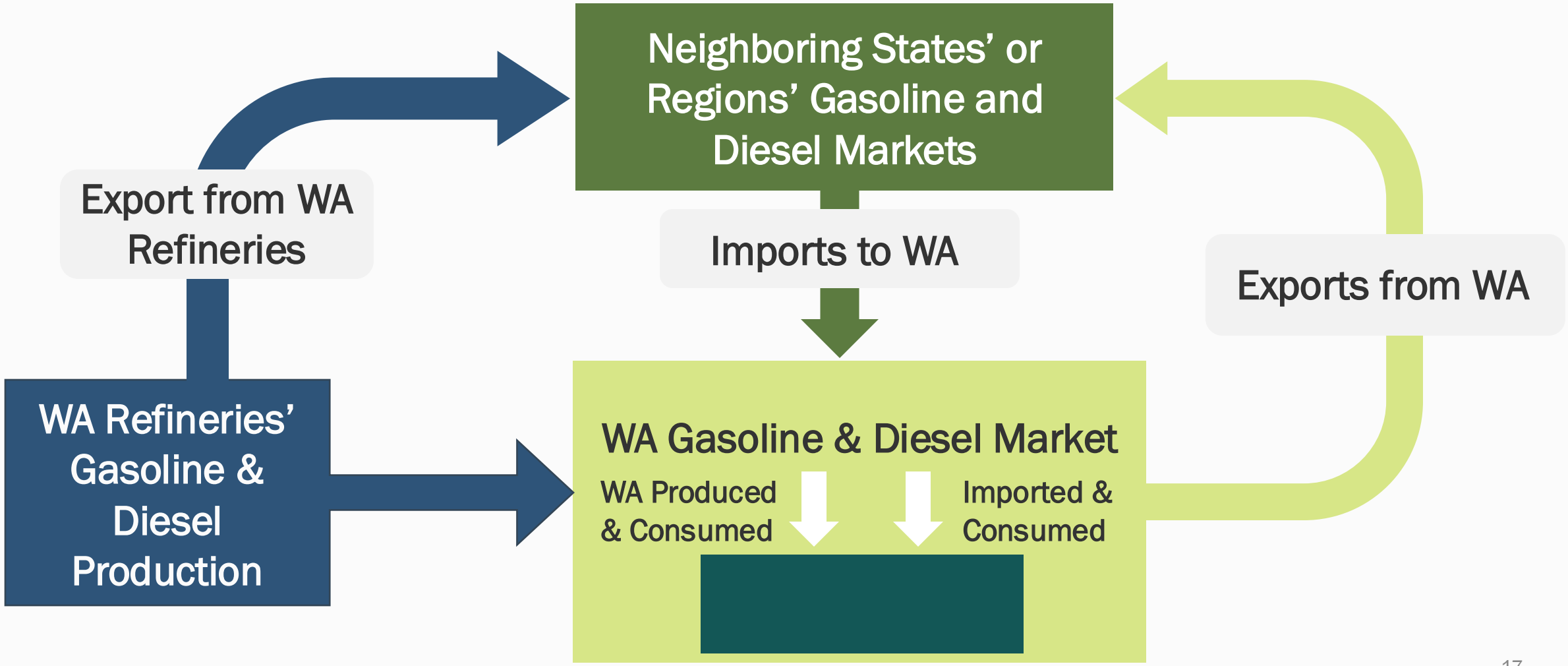
Predictability:
How well can compliance impacts be anticipated in advance?

Questions?

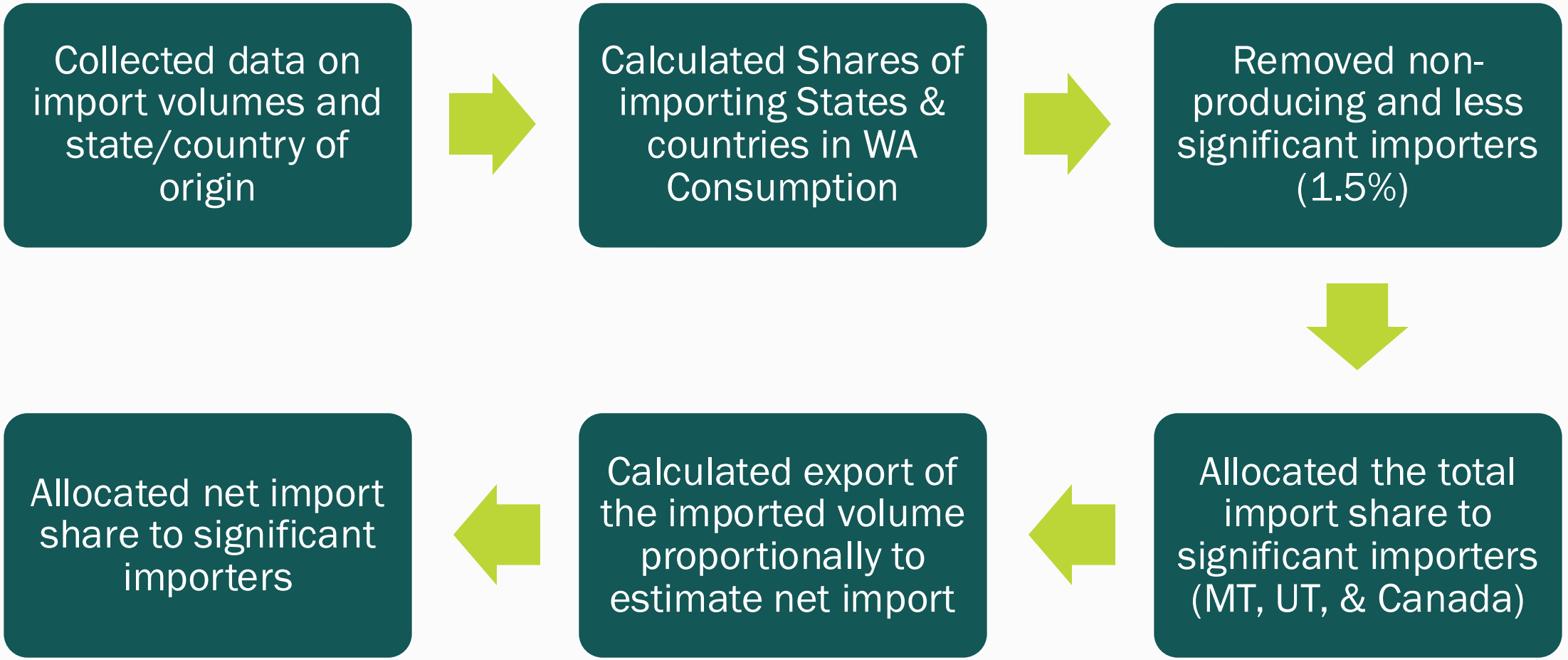
Share of Imported Gasoline & Diesel in WA Consumption



WA Gasoline and Diesel Market Overview



Gasoline & Diesel Imports Share – Methodology



Gasoline and Diesel – Sources & Mix Consumed in Washington

Gasoline Consumed in WA	Montana	Utah	Washington Production
2023	14.52%	3.39%	82.09%
2024	12.26%	2.76%	84.98%
2025	13.03%	3.26%	83.71%
Average	**13.27%**	**3.14%**	**83.59%**

Diesel Consumed in WA	Montana	Utah	Washington Production
2023	11.28%	2.78%	85.94%
2024	9.54%	1.50%	88.96%
2025	9.66%	2.38%	87.96%
Average	**10.16%**	**2.22%**	**87.62%**

Imported Gasoline & Diesel – Sources & Mix - Demo

Current Gasoline and Diesel CI Calculated in WA-GREET 3.0							
Fuel Type	Fuels CI Produced in States			Share of WA Consumed Fuels			Weighted Average CI
	WA	Montana	Utah	WA	Montana	Utah	
Clear Gasoline	99.58	109.61	95.82	83.00%	11.00%	6.00%	100.46
Clear Diesel	100.94	110.02	97.86	84.00%	6.00%	10.00%	101.18

Current Gasoline and Diesel CI Calculated in WA-GREET 3.0 – to show impact of share of import							
Fuel Type	Fuels CI Produced in States			Share of WA Consumed Fuels			Weighted Average CI
	WA	Montana	Utah	WA	Montana	Utah	
Clear Gasoline	99.58	109.61	95.82	83.59%	13.27%	3.14%	100.79
Clear Diesel	100.94	110.02	97.86	87.18%	10.52%	2.30%	101.82

Electricity Fuel Mix

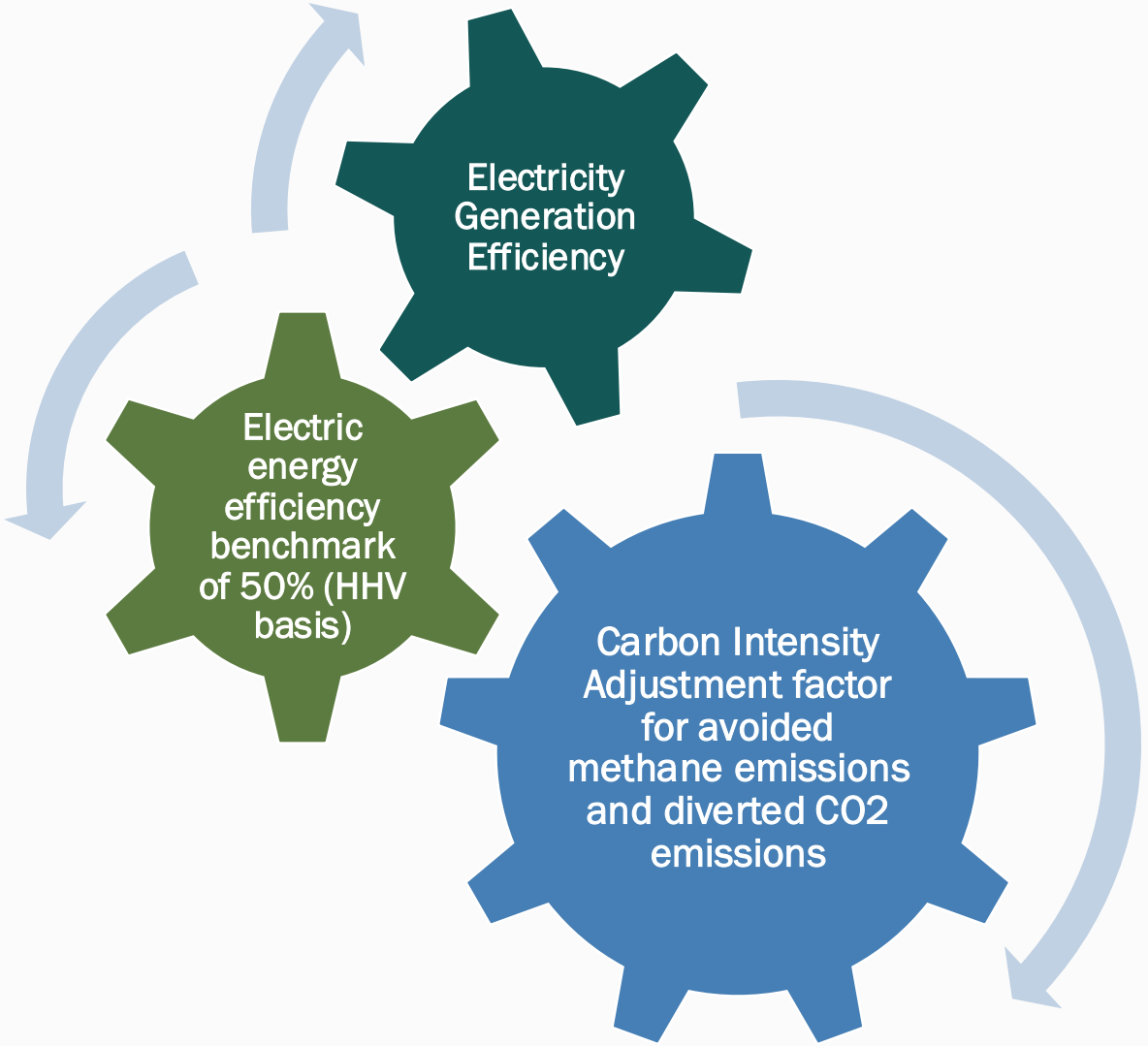
	2017 FMD Used in WA-GREET3.0	2018 FMD Used in WA-GREET3.0	Updated 2017 FMD for WA-GREET4.0	2021 FMD for WA-GREET 4.0
Residual oil (incl. petroleum, waste, non-biogenics)	0.330%	0.101%	0.294%	0.062%
Natural gas	10.828%	20.264%	10.828%	26.117%
Coal	13.393%	10.215%	13.392%	9.215%
Nuclear power	4.192%	4.748%	4.192%	4.359%
Biomass	0.598%	0.447%	0.598%	0.598%
Biogas (incl. other biogenics)	0.130%	0.198%	0.168%	0.218%
Others (Zero CI Sources)	**70.530%**	**64.027%**	**70.529%**	**59.431%**
Hydroelectric	95.964%	92.395%	95.963%	88.834%
Geothermal	0.000%	0.006%	0.000%	0.068%
Wind	4.032%	7.159%	4.032%	10.149%
Solar	0.004%	0.440%	0.005%	0.950%
Total	**100.000%**	**100.000%**	**100.00%**	**100.000%**

Tier1 Simplified Calculators

Update of Existing T1 Calculators	New T1 Calculators in CFS
Corn and Sorghum Ethanol	Biogas-to-Electricity from A. Digestion of Dairy & Swine Manure
Sugarcane-Derived Ethanol	Hydrogen from steam methane reformation (SMR) or electrolysis
Biodiesel	
Hydroprocessed Ester and Fatty Acid Fuels (HEFA)	
Biomethane from A. Digestion of Dairy & Swine Manure	
Biomethane from A. Digestion of Organic Waste	
Biomethane from A. Digestion of Wastewater Sludge	
Biomethane from Landfill	

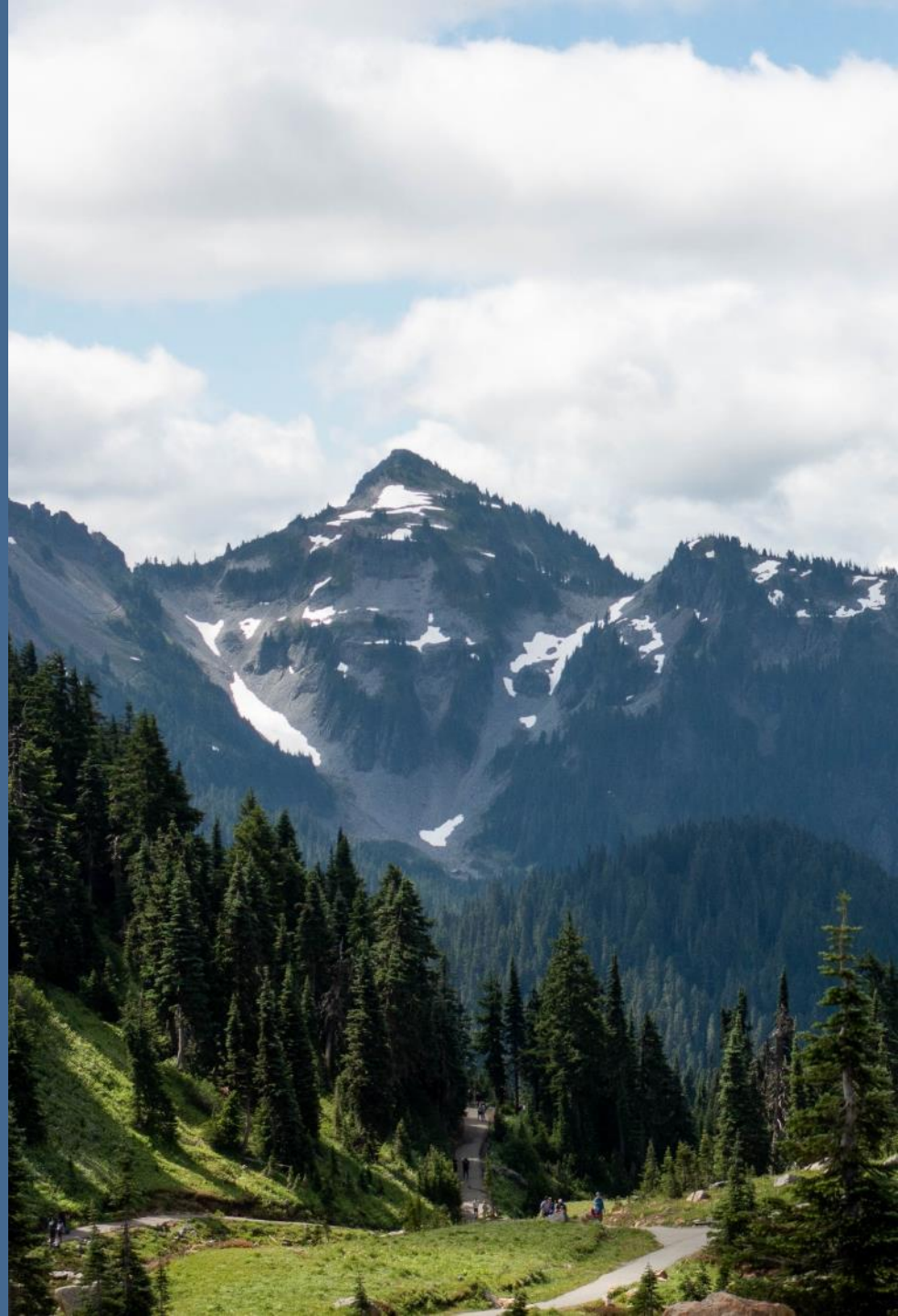
Biogas-to-Electricity Calculator

- **Biogas-to-RNG' tab to 'Biogas-to-Electricity' tab:**
  - Aligned with California & Oregon programs
- **A 50% electric energy efficiency benchmark:**
  - Based on average natural gas derived electricity generation efficiency
- **Carbon intensity adjustment factor:** electric energy efficiency divided by the efficiency benchmark:
  - If electric energy efficiency is less than 50%, the avoided methane CI and diverted CO2 CI benefits reduce proportionally by the factor.
  - To encourage the use of high (> 50%) efficiency electric generators,
  - To reasonably limit the CFS incentive for lower efficiency electricity technologies.



Questions?

Draft timeline for transition to WA-GREET 4.0



Timeline for transition to WA-GREET4.0

2026 Annual Fuel Pathway Reports

To be submitted using WA-GREET3.0

January 1, 2028 and after

New fuel pathway certification based on WA-GREET4.0

Adoption of WA-GREET4.0

Expected at the end of 2027, & to be effective in January 2028

January 1, 2029 and after

All fuel pathways' carbon intensity based on WA-GREET4.0

Pathway Applications' Transition to WA-GREET4.0

	Timeline	WA-GREET3.0	WA-GREET4.0	Remark
Recertification of Fuel Pathway Application	Jan 1 – Sept 15, 2028	N/A	Required	CARB/OR-DEQ already adopted GREET4.0
New Fuel Pathway Application	Jan 1 – Sept 15, 2028	Required	Optional	Validation using 3.0, Certification with WA-GREET 4.0

Annual Reports Transition to WA-GREET4.0

Annual Fuel Pathway Reports Submission Deadlines	Fuel Production Year			
	2026	2027	2028	2029
March 31, 2027	WA-GREET3.0 (R)			
Sept 15, 2027	WA-GREET3.0 (R)			
March 31, 2028		WA-GREET3.0 (R) & WA-GREET4.0 (O)		
Sept 15, 2028		WA-GREET3.0 (R) & WA-GREET4.0 (R)		
March 31, 2029			WA-GREET3.0 (R) & WA-GREET4.0 (R)	
Sept 15, 2029			WA-GREET3.0 (R) & WA-GREET4.0 (R)	
March 31, 2030				WA-GREET4.0 (R)
Sept 15, 2030				WA-GREET4.0 (R)

Note: R = Required, O = Optional

Slide updated 10/14/2026 due to error

Feedback Requested

- **Electricity Fuel Mix:** Are there any data quality issue in the fuel mix data?
- **Crude oil CI:** Which methodology is preferred, and why?
- **Gasoline and Diesel Import Share Estimation:** Is there a preferred data source with better data quality? What feedback do you have on the assumptions and methodology used to estimate net import share more accurately?
- **Biogas-to-Electricity:** What is your feedback on the energy efficiency factor? Please provide your reasoning.
- **Timeline for Transition to WA-GREET4.0 & 3PV:** Given the CFS program starts implementing Third Party Verification in 2028, is the suggested timeline sufficient? What else is needed in the transition?

Questions?

How to comment

Online by 11:59 p.m. on November 4, 2026

https://ecology.commentinput.com?id=KYsWZej7h

By mail to:

Lauren Sanner
Dept. of Ecology, CPRP Program
300 Desmond Dr. SE
Lacey, WA 98503

Thank you!

Lauren Sanner
Climate Rulemaking Planner
Climate Pollution Reduction Program
Lauren.Sanner@ecy.wa.gov

Stay updated
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WA GREET 4.0 Inputs

Incremental crude deficit

	Crude	Electricity/simulation year	WA/UT/MT source allocation	Deficit calculation
WA Gasoline/ Diesel baseline CI	2017 crude CI_OPGEE v3.0b (WA, MT & UT)	Updated 2017 FM(WA); NWPP (MT & UT); simulation year 2017	2017	N/A
WA Gasoline/ Diesel lookup CI	2017 crude CI_OPGEE v3.0b (WA, MT & UT)	WA: 2021 FM; MT & UT: NWPP (eGRID 2021); simulation year 2021	2017	Base Deficits: WA Gasoline/Diesel lookup CI – annual CI standard (based on WA Gasoline/Diesel baseline CI)
Incremental deficits	Delta CI: rolling 3-year volume-weighted average current crude CI (e.g., 2023-2025) vs. rolling 3-year volume-weighted average baseline crude CI	N/A	Three-year average source allocation (e.g., 2023, 2024, 2025)	Delta CI x E_{XD} x C (Separate pathway or combined into lookup CI as one pathway)

Implemented only in years where the current crude CI is higher than the baseline crude CI + 0.10 gCO2e/MJ

WA GREET 4.0 Inputs

Comprehensive CI update

	Crude	Electricity/ simulation year	WA/UT/MT source allocation	Deficit calculation
WA Gasoline/ Diesel baseline CI	2017crude CI_OPGEE v3.0b (2025) (WA, MT & UT)	Updated 2017 FM(WA); NWPP (MT & UT); simulation year 2017	2017	N/A
WA Gasoline/ Diesel lookup CI	2025 current crude CI (rolling 3-year volume-weighted average for 2023-2025) (WA, MT & UT)	WA: 2021 FM; MT & UT: NWPP (eGRID 2021); simulation year 2021	Three-year average source allocation (e.g., 2023, 2024, 2025)	Deficits/Credits: WA Gasoline/Diesel lookup CI – annual CI standard (based on WA Gasoline/ Diesel baseline CI)