CLIMATE ACTION RESERVE

Landfill Project Protocol V5.0

Public Comment Webinar

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Reserve Staff

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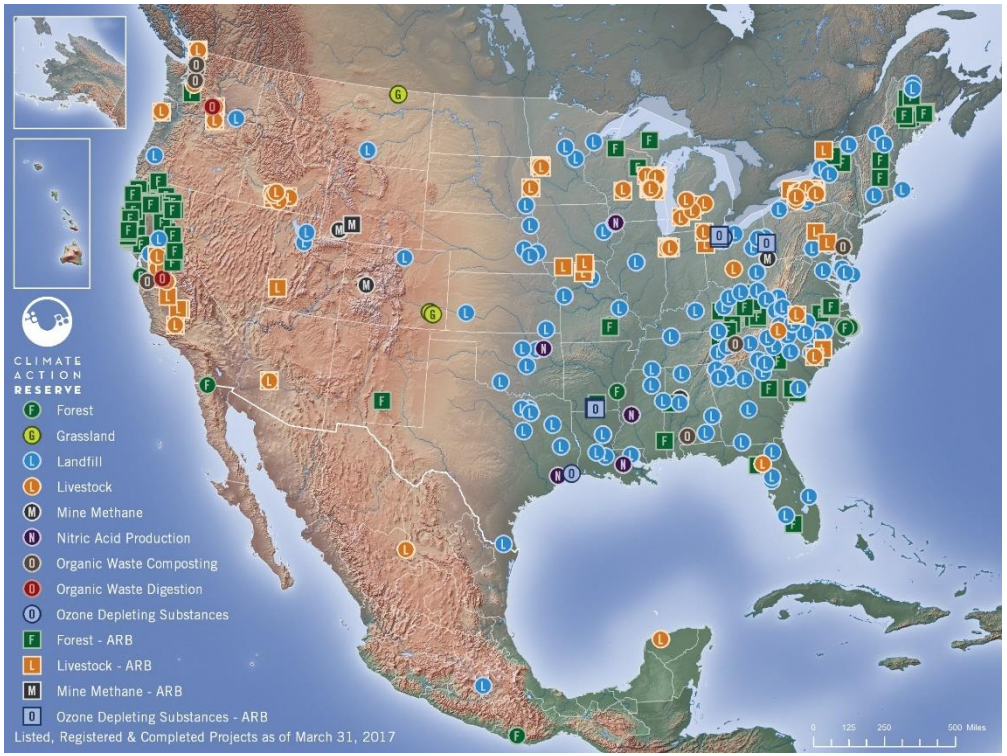
Agenda

1. Background
2. Presentation of proposed changes
3. Questions
4. Next Steps

BACKGROUND

Climate Action Reserve

- Private, nonprofit carbon offset registry, founded in 2001:
  - Develop carbon offset policies and protocols
  - Manage a registry of voluntary offset projects
  - Oversee independent verification program
  - Accredited Offset Project Registry for California Air Resources Board
- 18 different project protocols for U.S. and Mexico
- >123M offset credits issued, both voluntary and compliance (CA)



Landfill protocol development history

Version	Adoption Date	Notes
V1.0	Nov 29, 2007	Protocol adopted
V2.0	Nov 18, 2008	Improved accuracy and conservativeness in ER calculations and better guidance for MRV
V3.0	Dec 2, 2009	Eligibility for closed landfills with flares, updated definitions and QA/QC guidance
V4.0	June 29, 2011	Introduction of size threshold for LFG-to-energy projects in Performance Standard Test (PST)

PRESENTATION OF PROPOSED CHANGES

Key Changes

Protocol Element	Proposed change
Project definition	Expansions into new cell can optionally be considered a new project
Crediting period	Allow for 2nd CP
Performance Standard Test	New end-use technology specific PST thresholds
Legal Requirement Test	Removed local NMOC threshold
Monitoring	New optional indirect monitoring alternative
Verification	Optional 24 month verification periods

Other minor updates: Lessons from E&Cs / other protocols

Protocol Element	Proposed change
Legal Requirement Test	Updated NSPS / EG NMOC thresholds
Quantification	OX factor guidance, hierarchy options for destruction efficiency values
Monitoring	Metering multiple devices with single meter, monitoring off-site destruction; monitoring for multiple projects at single facility
QA/QC	Temporary stationary meters; extra on-site field check; which instruments subject to portable meter requirements; drift for Sage meters
Appendices	Updating default factors

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Section 2.2 - Project Definition

- **expansion of existing landfill gas capture & destruction system** into new cell(s) – can =
  - expansion of existing project OR
  - **submitted as a new project – with new crediting period;**
- Rationale: cost of expanding is high enough to warrant offset revenue for entire new CP
- Allow projects to share common destruction devices
  - provided monitoring is adequate
  - extra guidance for regulatory compliance – presumption any problems apply equally to all projects at site

Section 3.3 - Crediting Periods

- **Allow for projects to apply for 2nd crediting periods (CP)**
- Updated PST will make easier for projects to transition to using v5.0
- Flexibility for projects that did not maintain continuous reporting
  - submit Zero Credit Reporting Period form and Monitoring Report

Legal Requirement Test

- **Removed local NMOC threshold (Section 3.4.2.3)**
  - Projects subject to closed flare mandate at local level are no longer eligible
- Under v4.0 - two NMOC emissions thresholds for projects at landfills where treatment of LFG for NMOC was mandated but LFG destruction was not only treatment option - if total mass flow of NMOC for LFG control system was greater than threshold, then project was not eligible:
  - For sites which closed flares not required by law, threshold = 1,775 pounds NMOC/mth
  - For sites where closed flares were required by law, threshold = 2,575 pounds NMOC/mth
- WG feedback / research indicates flares are primary mechanism to address NMOC emission control mandates, therefore removing rationale underlying these thresholds

Section 6.1.1 - Indirect Monitoring Alternative

- **Instead of using flow meters – can OPTIONALLY present method to use destruction device output data**
- Conditions:
  - must measure output using commercial transfer meter
  - must propose appropriate conversion method (e.g. break-specific fuel consumption calculations may be considered appropriate method)
  - must set out method clearly in monitoring report
  - must apply method consistently throughout the reporting period
  - must demonstrate to VB satisfaction that use of such data and method is reasonable and conservative
- QA/QC should meet mnf requirements – some flexibility

Section 7.3.2 Verification Periods

- **Optional 24 month verification period**
  - Can verify once every 24 months, or more frequently;
  - Get issued credits once verified
  - Can forgo site visit during given verification period if:
    - Site visit occurred during previous RP
    - Using same VB as for previous site visit RP

Section 3.4.1 Performance Standard Test

- Overview
  - What was the v4.0 Performance Standard Test?
  - Why develop a new v5.0 PST?
  - The new v5.0 PST
  - How did we develop the new v5.0 PST?

Landfill Project Protocol v4.0 Performance Standard Test

- 2 criteria: Waste in Place and Precipitation levels

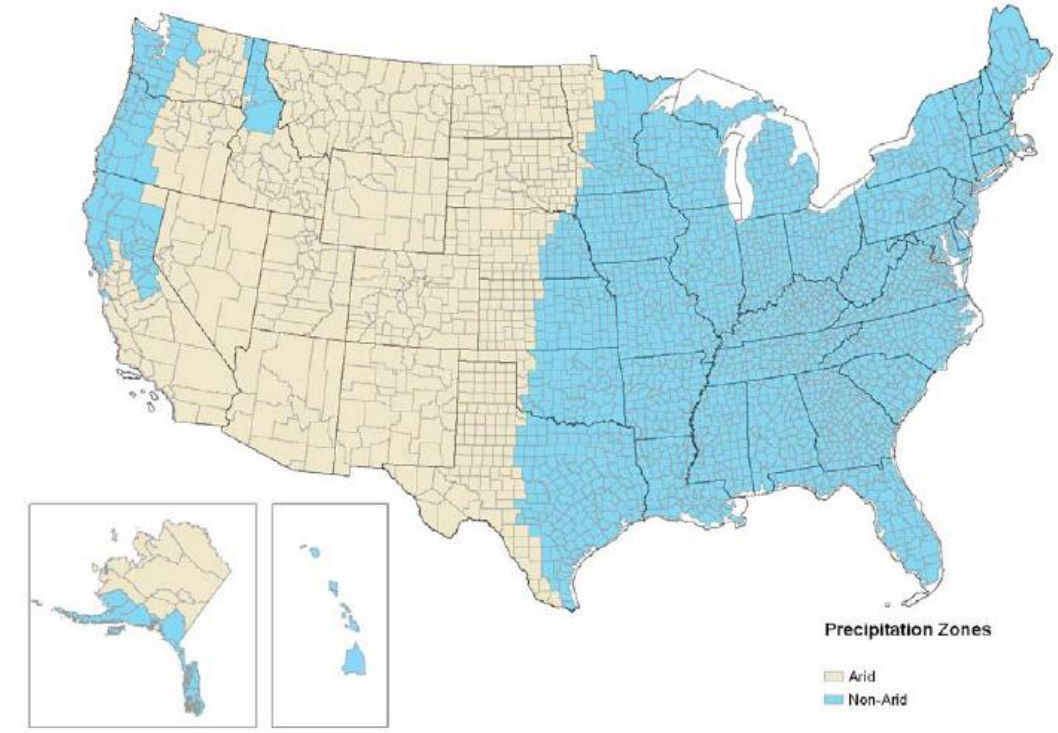


Figure A.1. Precipitation Zones of the United States, by County

WIP limits

Arid zones: 2.17 MMT

Non-arid zones: 0.72 MMT

Why reassess the PST?

- Stakeholder Indications that v4.0 WIP PST too restrictive
- Much fewer new LFGE projects are currently being developed
- NG boom suppressed LFGE projects (in 2018 natural gas price at low levels competitive to LFG projects)
- Changes in incentives (e.g. most states have met RPS requirements)
- WG indications that feasibility differs based on end-use technology

LPP v5.0 Performance Standard Thresholds

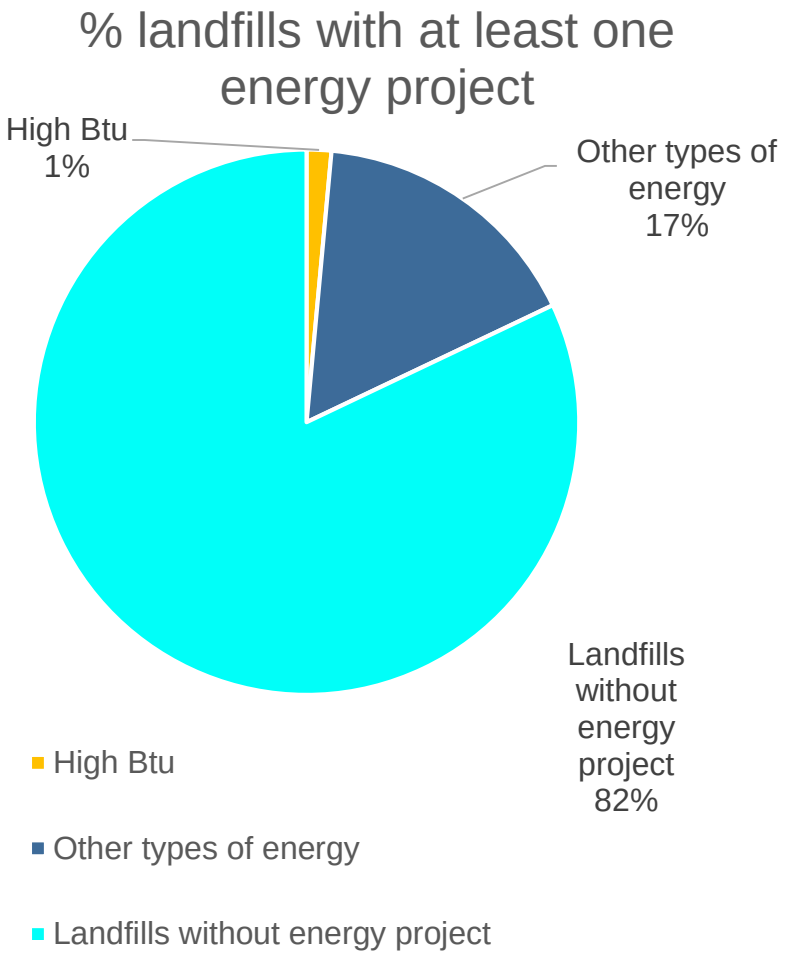
Eligible LFGE Projects Under LPP V5.0	Ineligible LFGE Projects Under LPP V5.0
▪ Active flares (open or enclosed) ▪ On-site electricity generating systems ▪ Direct use projects (Medium Btu)	▪ Upgraded landfill gas projects (RNG, CNG or LNG) ▪ Injection into a natural gas common carrier pipeline or transmission and distribution network

3 levels additionality analysis

1. LFG end use
   - High Btu – RNG, LNG and CG
   - Medium Btu – Direct use
   - Electricity
2. State of the market: Penetration rate and drivers
3. If needed- financial assessment
   - At what capacity can a project reach financial feasibility given the general revenue streams available?

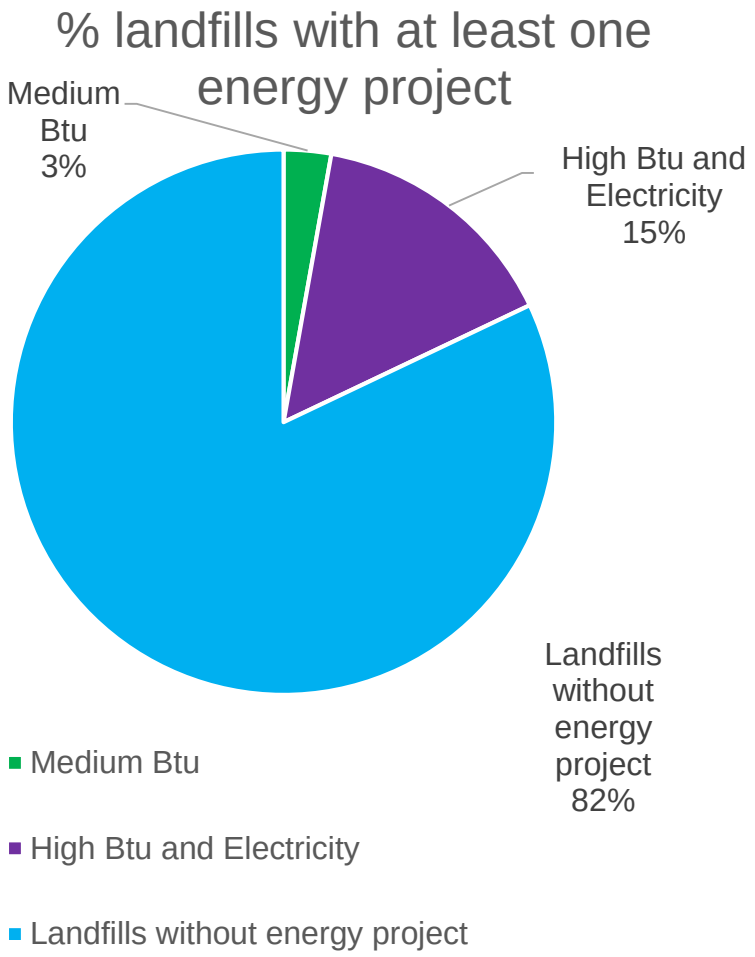
High Btu projects

- Penetration rate: 1%
- Currently driven by RFS and LCFS
- Incentives provide approx. $58/tCO$_2$e
- 60% of projects planned for construction in LMOP are RNG
- Conclusion: BAU (not eligible under LFPP v5.0)



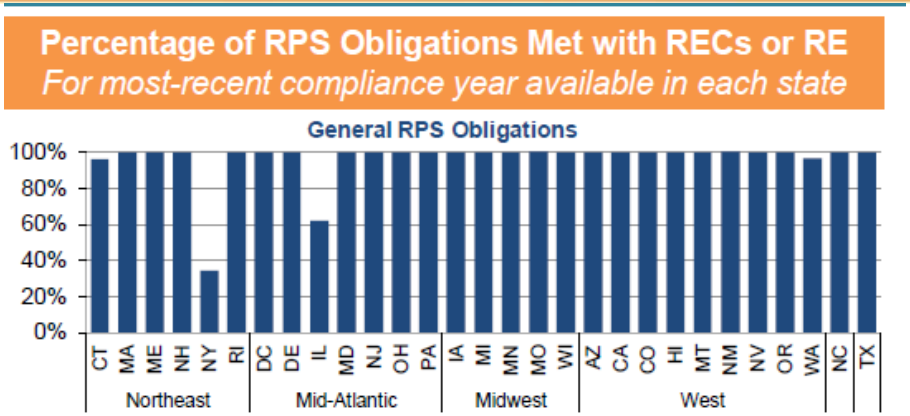
Medium Btu projects

- Penetration rate: 3%
- Linked to Natural Gas prices which are now at low levels
- Feasibility highly depends on distance to purchasing facility
- Gas treatment is a significant cost for feasibility
- There are insufficient incentives to drive these projects
- Conclusion: Not BAU (eligible under LFPP v5.0)



Electricity projects

- Penetration rate: 14% - common practice
- Complex market driven by RPS (RECs)
- Most of the states have met their RPS goals.



Source: Laurence Berkeley National Laboratory (July 2017).

- REC prices at 5 year low levels in some states
- Only California and New England, particularly VT, provide higher than average incentives as Feed in Tariffs and higher electricity sales prices
- Conclusion: Need financial feasibility analysis to determine if projects are BAU

Financial assessment for electricity projects

- Question: At what electricity generation capacity do projects reach a positive NPV considering available revenue streams?
- Tool: USEPA LMOP's LFG-Cost Model

Required User Inputs:

Type of Input Required		Required Input Data
Year landfill opened		1973
Year of landfill closure		2030
Area of LFG wellfield to supply project (acres) [assumes 1 well/acre]		56
Method for entering waste acceptance data [CHOOSE ONLY ONE METHOD]:	Average annual waste acceptance rate (tons/yr)	
	Waste acceptance rate calculator (in WASTE worksheet)	Go to WASTE
	Annual waste disposal history (in WASTE worksheet)	Go to WASTE
LFG energy project type [refer to recommended sizes in INST worksheet when selecting]		Small engine
Will LFG energy project cost include collection and flaring costs? (Y)es or (N)o		N
For Leachate Evaporator projects: Amount of leachate collected (gal/yr)		
For Boiler Retrofits: Will boiler retrofit costs be combined with direct-use project costs? (Y)es or (N)o		
For Boiler Retrofits: Distance between end user's property boundary and boiler (miles)		
For Direct-use, High Btu, and CHP projects: Distance between landfill and end use, pipeline, or CHP unit (miles)		
For CHP projects: Distance between CHP unit and hot water/steam user (miles)		
Year LFG energy project begins operation		2019
Will model calculate avoided CO2 from energy generation at electricity projects? (Y)es or (N)o. If (Y)es, go to the **Avoided CO2- Elec** worksheet to select the appropriate value.		N

Optional User Inputs (currently set to suggested default data):

Type of Optional Input	Suggested Default Data	Optional User Input Data
LFG energy project size: Gas rate = Minimum, Average, Maximum, or Defined by user (must enter design flow rate below)?	Minimum	Defined by user
For user-defined project size only: Design flow rate (ft3/min)	---	450
Methane generation rate constant, k (1/yr) [0.04 for typical climates, 0.02 for arid climates, 0.1 for bioreactors or wet landfills]	0.04	0.04
Potential methane generation capacity of waste, Lo (ft3/ton)	3,204	3,204
Methane content of landfill gas (%)	50%	50%
Average depth of landfill waste (ft)	65	65
Landfill gas collection efficiency (%)	85%	85%

Outputs: *Go to Report*

Type of Output		Output Data
Economic Analysis:		
Design project size (ft3/min LFG)		450
Generating capacity for projects generating electricity (kW)		750
Average project size for projects NOT generating electricity:	(million ft^3/yr LFG)	--
[based on actual LFG use]	(ft^3/min LFG)	--
Average project size for projects generating electricity (kWh/yr)		5,621,292
Average project size for CHP projects producing hot water/steam (million Btu/yr)		--
Total installed capital cost for year of construction ($)		$2,102,765
Annual costs for initial year of operation ($)		$192,408
Internal rate of return (%)		-7%
Net present value at year of construction ($)		($854,784)
Years to Breakeven*		None
Environmental Benefits:		
Total lifetime amount of methane collected and destroyed (million ft3)		4,057
Average annual amount of methane collected and destroyed (million ft3/yr)		270
GHG value of total lifetime amount of methane utilized in energy project (MMTCO2E)		7.91E-01
GHG value of average annual amount of methane utilized in energy project (MMTCO2E/		5.28E-02
Total lifetime carbon dioxide from avoided energy generation (MMTCO2E)		Not Calculated
Average annual carbon dioxide from avoided energy generation (MMTCO2E/yr)		Not Calculated

* "None" = no return on investment or no payback in LFG energy project lifetime

After completing Inputs, select this button to: Calculate Initial Product Price Needed to Achieve Financial Goals

Financial Goals Calculator

Initial Product Prices When Net Present Value is Optimized to Achieve Financial Goals:

Landfill gas production ($/million Btu)	---
Electricity generation ($/kWh)	$0.06000

Financial assessment - Continued

- 32 landfill scenarios modelled
- All scenarios retained several default assumptions from the model
- Critical assumptions that determined feasibility were three:
  - NSPS regulatory status
    - For regulated landfills LGCC installation represented a sunken cost
    - Unregulated landfills included LGCC installation in financial analysis
  - Landfill ownership type (public or private)
    - Public projects with 0% tax rate and a 5% discount rate
    - Private projects with 25% average tax rate and 10% discount rate
  - Revenue streams (RECs, tax incentives, electricity price)
    - RECs only in Mid Atlantic Region and New England (0.008$ /kWh)
    - Average electricity price of 0.046 $/kWh, higher in VT and New England

Results

- Only four scenarios returned a positive NPV (New England, Vermont (public and private), and 8+ MW projects)
- In all cases projects,
  - were public (no tax rate and low discount rate)
  - were regulated (no LGCC installment cost considered)
  - had the Highest revenue streams
    - RECs available
    - Higher than average electricity sale price
- In all four feasible scenarios, the Legal Requirement Test from the protocol would be sufficient to exclude BAU projects and thus LRT is sufficient to assess additionality

Final Performance Standard Thresholds

Eligible LFGE Projects Under LPP V5.0	Ineligible LFGE Projects Under LPP V5.0
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CLIMATE ACTION RESERVE

QUESTIONS

NEXT STEPS

Next Steps

- Comments must be submitted no later than **Tuesday, March 12th**
  - Submit comments to policy@climateactionreserve.org
  - Prefer MS Word format
  - Please organize by protocol section
  - All comments will be responded to and published online (January)
- Targeting adoption by Board April 24th, 2019

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