



Carbon Pilot

Generating Carbon Credits from Biochar Production

Landscape

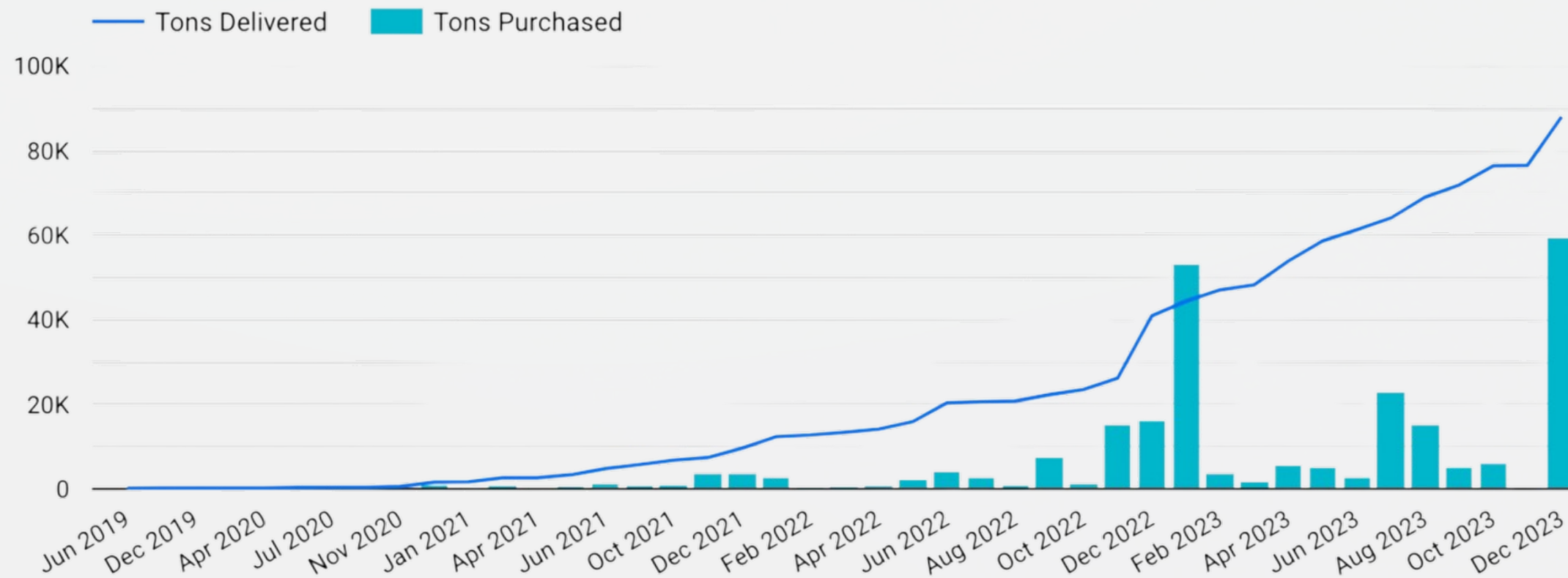
Tons Purchased
253,109

Tons Delivered
88,037

% Credits Delivered
34.78%

Avg. Credit Price
\$148.98

Project Count
51



	Purchaser	Tons Delivered
1.	Carbonfuture Anonymous Purch...	20,965.74
2.	Aggregate Purchase	17,520.61
3.	JPMorgan Chase	9,170
4.	Swiss Re	3,884
5.	Nasdaq, Inc.	3,532
6.	Skandinaviska Enskilda Banken	2,533.93
7.	XTX Markets	2,477
8.	Shopify	2,136
9.	Microsoft	2,135

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Landscape

CREATE

CERTIFY

SELL

Biochar
Producer
"Supplier"

Carbon
Registries

Verification
Bodies

Consultants

Software

Project
Design

Monitoring,
Reporting,
Verification

Credit
Insurance

Credit
Marketplace



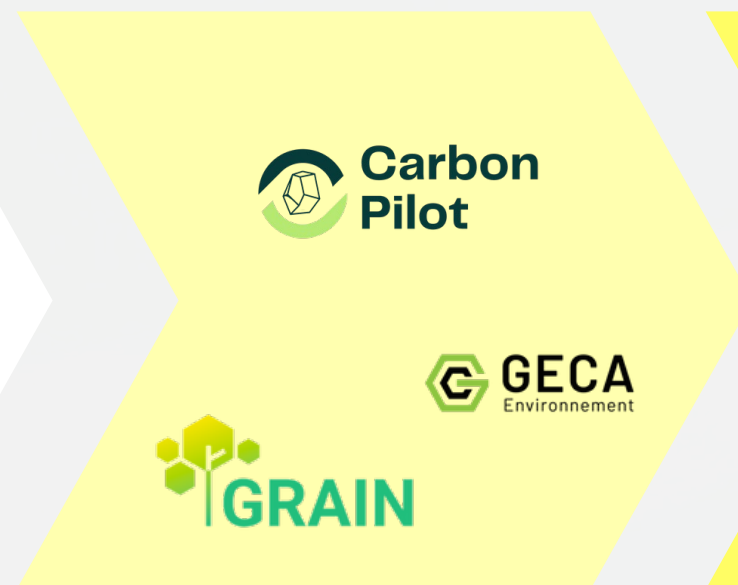
Certification Process

1 - Registry Selection



Can vary by cost structure, permanence calculation, timeline, and demand

2 - Project Feasibility



Feedstock, equipment, and biochar end use can impact registry acceptance

3 - LCA & PDD



Life cycle assessments and other project documentation provides trust to the market

4 - Verification



Auditors evaluate the LCA and other documents verify carbon removal

5 - MRV & Sales



Once biochar is applied then carbon credits are issued

Registry Selection

puro
earth



VERRA

**Verification
Timelines
(months)**

4-9

3-6

6-18

**Registry
Cost
Structure**

**Per Credit
Fee
(1.5% - 12%)**

**Yearly + Per
Credit**

**Yearly + Per
Credit**

**# Of Biochar
Projects**

29

13

5

**Avg. CDR Price
for Biochar**

\$145

\$122

N/A

Registry Differences (LCA)



Permanence Factor

Depends on H/Corg and end-use soil temp

Static value

Depends on reactor operating temp

Pyrolysis Equipment Manufacturing Emissions

Included

Not Included

Not Included

Transportation Emissions

Included

Included

Not Included if <200km




Margin of Security

Not Included

Included

Not Included

Registry Differences (Cost)

	Certification	Carbon Credit Commission	Fixed Costs	Yearly Costs	Total Costs
	\$0	\$10,000	\$500	\$900	\$11,400
	\$33,500	\$50	\$1,500	\$1,500	\$36,550
	\$1,900	\$8,000	\$300	\$3,100	\$13,300

based on 1000 carbon credits at \$100 each

Certification Documents

Additionality

**Life Cycle
Assessment**

**Techno-economic
Assessment**

**Stakeholder
Engagement**

Sustainable Biomass

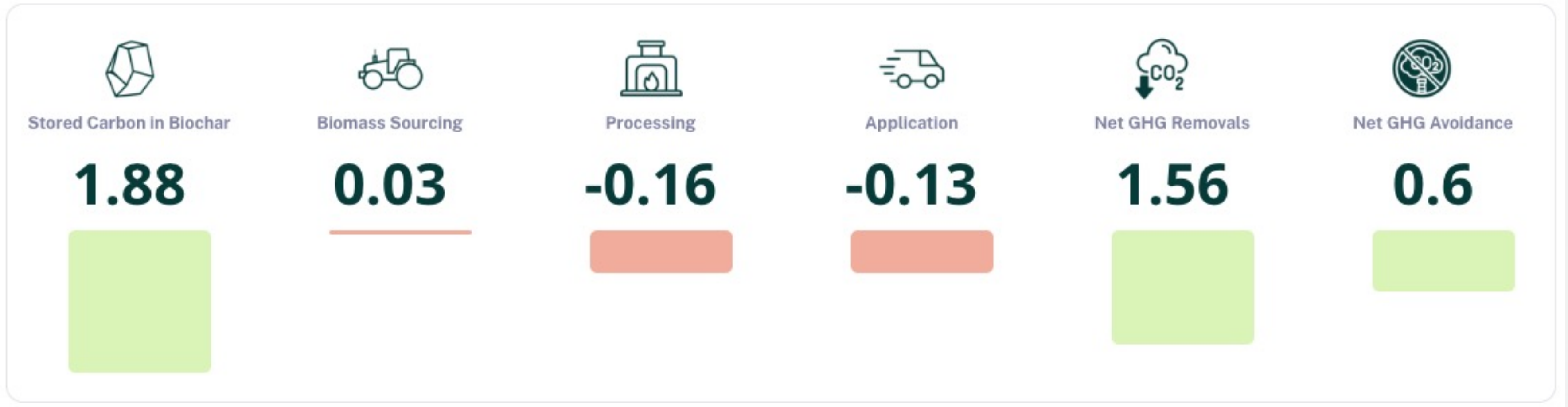
Biochar Testing

**Equipment Energy &
Mass Balance**

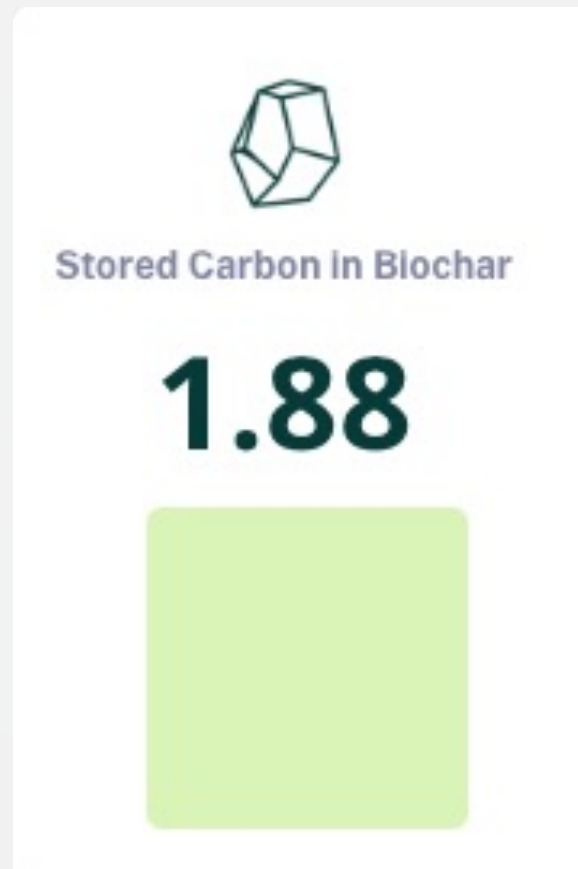
**Biochar End Use
Receipts**

Life Cycle Assessment

Results provided in tonnes of carbon dioxide equivalent (tCO₂-eq) per tonne of biochar



Stored CO2 in Biochar



Organic Carbon %, molar H/C Ratio,
application soil temperature

Pyrolysis Operating temperature

Equipment type

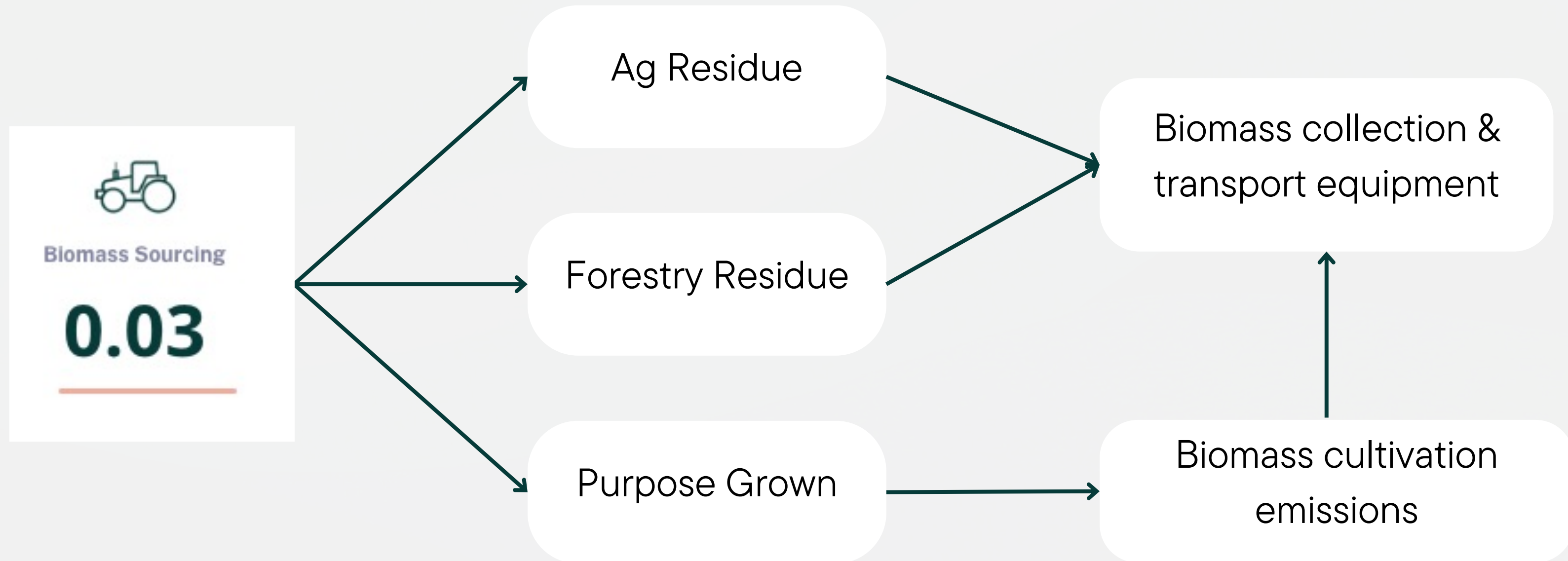
puro
earth

VERRA

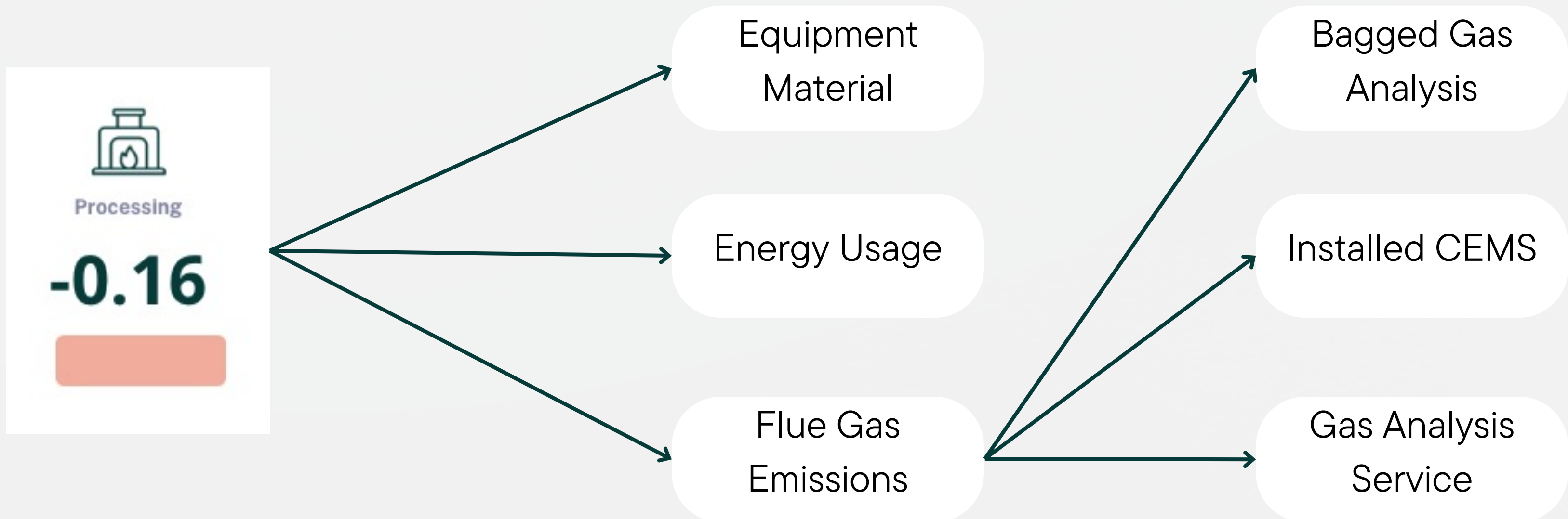


**Carbon
Pilot**

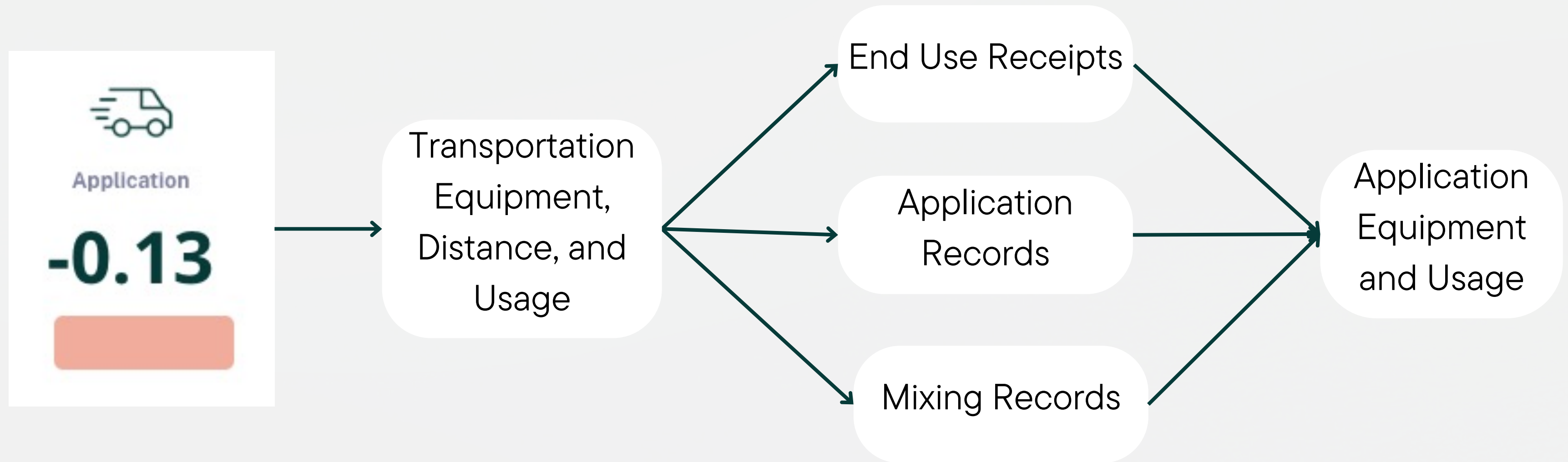
Biomass Sourcing Emissions



Biomass Processing Emissions



Biochar End Use Data



Monitoring, Reporting, and Verification

Deliveries
[View Life Cycle Assessment](#)

75 tCO₂e

% Delivered 15%

09/01/2023 - 10/01/2023
16 tCO₂e
[View Production Data](#)

23 tCO₂e -1.2 -2.1 -1.4


Persist Micronized Biochar

Seller: Product Type:


08/01/2023 - 09/01/2023
10.6 tCO₂e
[View Production Data](#)

07/01/2023 - 08/01/2023
20.4 tCO₂e
[View Production Data](#)

Biomass Sourcing
Eugene, OR



Description




Hemp stalks collected from local farms and processed onsite. These stalks would be left to rot if not converted into biochar. The equipment needed to source the stalks is the stalk cutter and the trailer truck for transport.


Equipment Usage

Equipment	Energy Type	Usage
Stalk Cutter	Diesel (gallons)	100 hours per year
Trailer Truck	Diesel (gallons)	5km Trips, 100 trips per year

Biomass Processing
Eugene, OR



Description




The hemp stalks are collected in piles before they're pyrolyzed at each farm. The mobile pyrolysis unit includes a pre-processor which grinds and pelletizes the stalks before thermal conversion. The hemp waste is used to heat up the equipment and it is auto-thermal after start-up.


Equipment Usage

Equipment	Energy Type	Usage
Pyrolysis Equipment - Heat Up	Waste Biomass (kgs)	200 hrs per year
Pyrolysis Equipment - Fan	Electricity (kwh)	750 hrs per year
Pyrolysis Equipment - Material	Steel/Iron/Alloy	3000 kgs used for 20 yrs

Biochar Application
Eugene, OR



Description



After biochar is produced it's distributed to neighboring farms where it's applied as an organic long-release fertilizer. Due to local distribution, biochar is never shipped beyond 100 kilometers. The biochar is typically applied using existing fertilizer spreaders as it is typically mixed with compost.

Equipment Usage

Equipment	Energy Type	Usage
Tractor	Gasoline (gallons)	3 km per day, 150 days a year
Trailer Truck	Diesel (gallons)	10km Trips, 50 trips per year

Biochar Summary

Feedstock Class	Feedstock	Particle Size	Moisture Content (%)
Nut Shells, Pits, Stones	Pistachio Shells	0.075 mm	30

Biochar Characterization

Organic Carbon (%)	Liming Value (CaCO ₃)	H/C Ratio	PH Value
75	1.8	0.24	

Pyrolysis Technology

Pyrolysis Type	Heating Temperature	Ash Content (%)	Hydrogen Content (%)
Slow Pyrolysis		5.3	1.5

Product Downloads

Biochar Test LCA Audit

Monitoring, Reporting, and Verification



Pen &
Paper



Mobile &
Web Apps



IoT
Enabled

Monitoring, Reporting, and Verification



**Pyrolysis
Temperature**

Sensor Enabled

Thermocouple

No Sensors

Infrared Temperature
Gun

**Biochar Output
Weight**

Load cells, solid flow
meters

Scales, volume based

**Biomass
Moisture**

Moisture meter

Moisture gun

Selling Credits - Channels

Insetting

Sell biochar + carbon credit together

Can make environmental claim on the biochar carbon removal

Gaining popularity within the coffee, built material, and advanced material industries

Offsetting

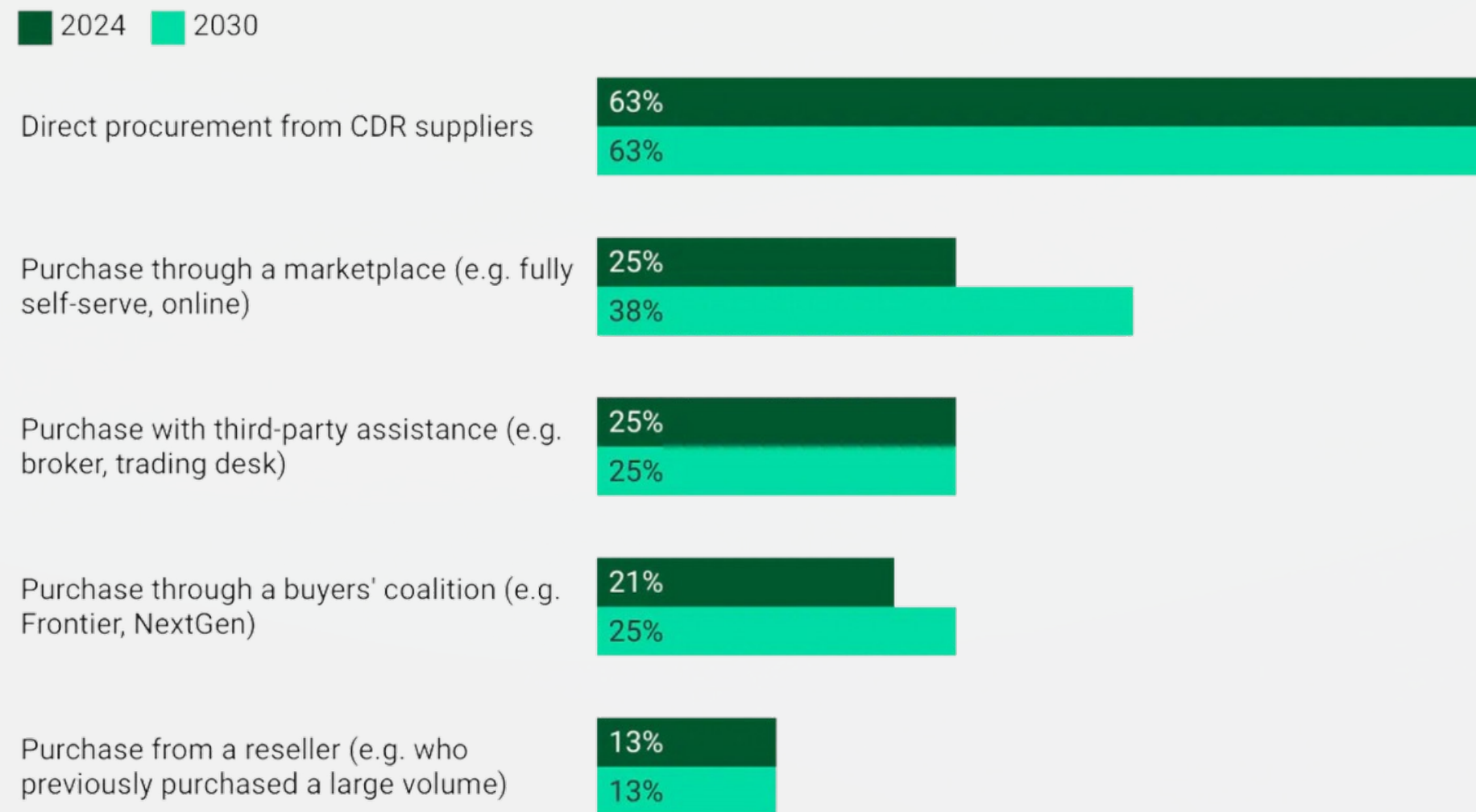
Sell biochar separately from carbon credit

Can't make environmental claim on biochar carbon removal (biochar is carbon neutral)

More common than insetting today as it's cheaper to sell biochar without the credit

Selling Credits - Channels

Primary intent for how to purchase durable CDR

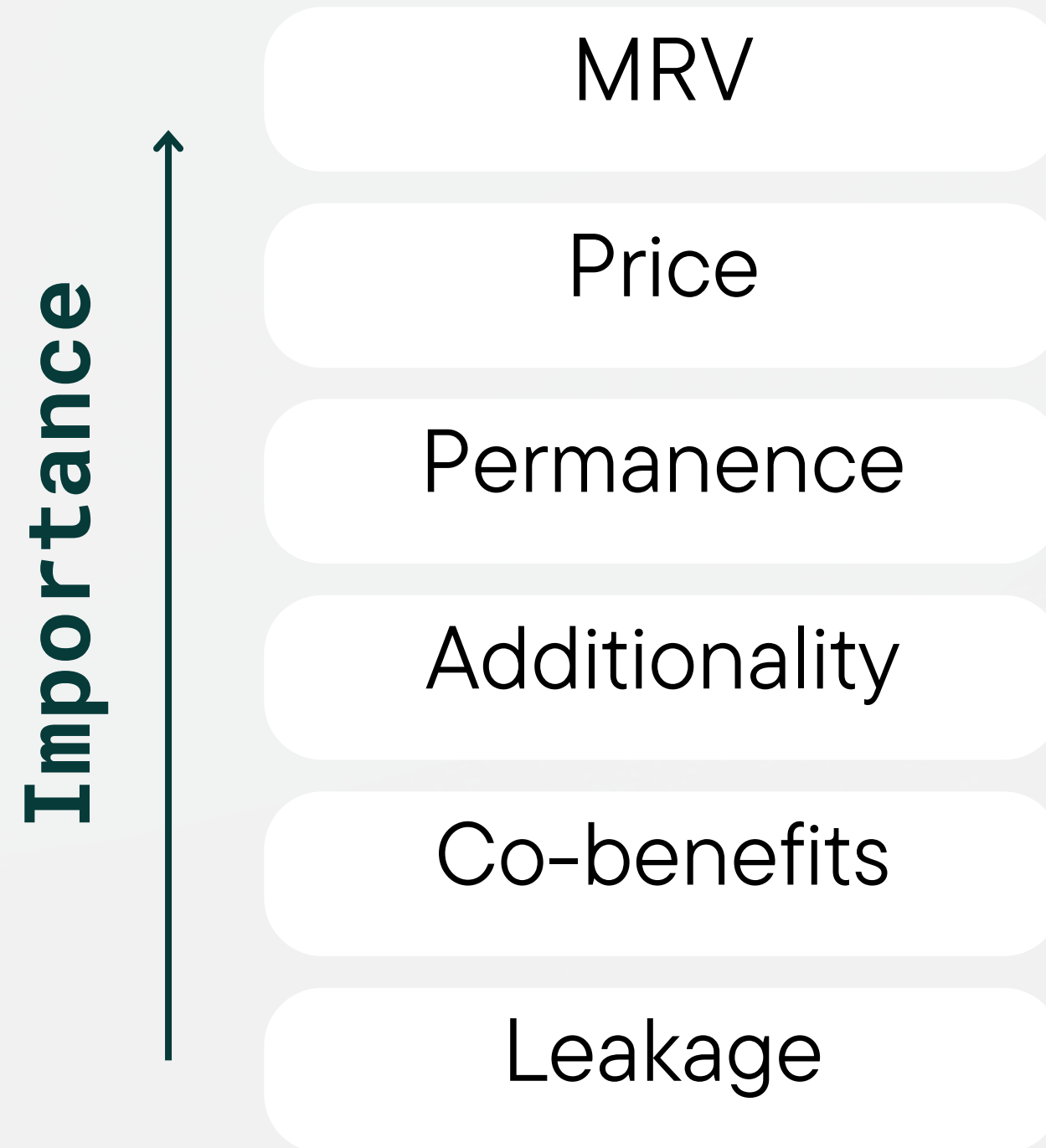


Source: CDR.fyi • Created with Datawrapper

“Buyers and suppliers want to transact directly: **60% of buyers want to purchase directly** from suppliers, and over 80% of suppliers say their main sales channel is direct. Marketplaces are the secondary channel most expected to increase in importance.”

[-cdr.fyi 2024 market outlook report](#)

Selling Credits - Considerations



source: Shell & BCG report

Free Tools

[Carbon Credit Revenue Calculator](#)

[Carbon Credit Cost Calculator](#)

[Biochar Carbon Removal Industry Reporting](#)

[Biochar Marketplace Listing](#)

source: Shell & BCG report

Thank You - Questions?



Say hi at booth 104!

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