

Carbon Consumption Feature for CloudTuner

Executive Summary: This document aims to showcase the carbon consumption of the resources from multi-cloud providers all in one place - [CloudTuner.AI](#)

We query cloud provider billing and usage APIs to provide a holistic understanding of emissions:

1. AWS Cost and Usage Reports with Amazon Athena
2. GCP Billing Export Table using BigQuery.
3. Azure Consumption Management API

Before estimating the energy and carbon emission, we validate whether a given usage is Compute, Storage, Memory

Required Permissions Summary

AWS:

- sustainability:GetCarbonFootprintSummary
- Cross-account roles for multi-client access

GCP:

- monitoring.timeSeries.list
- compute.instances.get
- Carbon footprint API access

Azure:

- Microsoft.CostManagement/carbonEmissions/read
- Microsoft.Sustainability/carbonFootprints/read
- Subscription-level access

Base formula

For CPU load only

$$\text{Emissions (gCo2eq/kWh)} = [(\text{PW} * \text{Load} * \text{Hours} * \text{PUE} * \text{CI}) / 1000] * 2.5 \text{ (multiplier)}$$

Constant values -

- Load is at 50% so value = 0.5
- Power Usage Effectiveness(PUE) is constant -
 - AWS: 1.135
 - GCP: 1.10
 - Azure: 1.125
- CI will be constant based on region

And we will multiply the result to a multiplier of 2.5 to take factor of -

- Server hardware production
- Infra overhead
 - Data center construction (concrete, steel, materials)
 - Network equipment beyond servers
 - Backup power systems (UPS, generators)
- End-of-Life Processing
- Supply Chain Emissions
 - Raw material extraction

For CPU+GPU load

$$\text{Emissions (gCo2eq/kWh)} =$$

$$[(\{ (\text{CPU+GPU}) * \text{Load} * \text{Hours} * \text{PUE} * \text{CI} \} / 1000) * 2.5 \text{ (multiplier)}]$$

For Serverless functions

$$\text{Emissions (gCo2eq/kWh)} =$$

$$(\text{Memory_GB} * \text{Duration_Hours} * \text{Invocations} * \text{PUE} * \text{Carbon_Intensity}) / 1000$$

For Storage

$$\text{Emissions (gCo2eq/kWh)} = (\text{Storage_TB} \times \text{PUE} \times \text{Hours} \times \text{Carbon_Intensity}) / 1000$$

Visualization on [CloudTuner.AI](#)

1. Calculator

Firstly, we have the calculator, this will be in the left pane at the bottom (Sandbox), and we will automate this calculation and make it like the Cost Comparison tab

The screenshot shows the CloudTuner Carbon Calculator interface. At the top right is the logo and title "CloudTuner Carbon Calculator". On the left, there's a "Back to Overview" button. The main area is titled "Estimate Your Carbon Emissions" with a sub-instruction "Fill in the details below to get an estimate of your resource's carbon footprint." Below this are several input fields:

- Environment:** A dropdown menu set to "Cloud".
- Resource Type:** A dropdown menu set to "EC2/VM Instance".
- Power (Watts):** An input field containing "e.g., 65".
- Hours:** An input field containing "e.g., 8".
- Cloud Provider:** A dropdown menu with "Select a provider" selected.
- Region:** A dropdown menu with "Select a region" selected.

A large blue "Calculate" button is centered below these fields. To the right, under the heading "Results", is a light purple box containing the placeholder text "Emissions (gCO2eq/kWh)" followed by two small blue dashed lines. At the very bottom of the page, a footer note reads "© 2024 CloudTuner. All rights reserved."

This is just for our testing and if end-user wishes to calculate themselves -

Environment will be a dropdown – Cloud or On-Premises

Resource Type will a dropdown – EC2 or Serverless functions

2. Co2 Tracker on Home page

There will be a Co2 tracker on the homepage for easy visibility to the end-user.

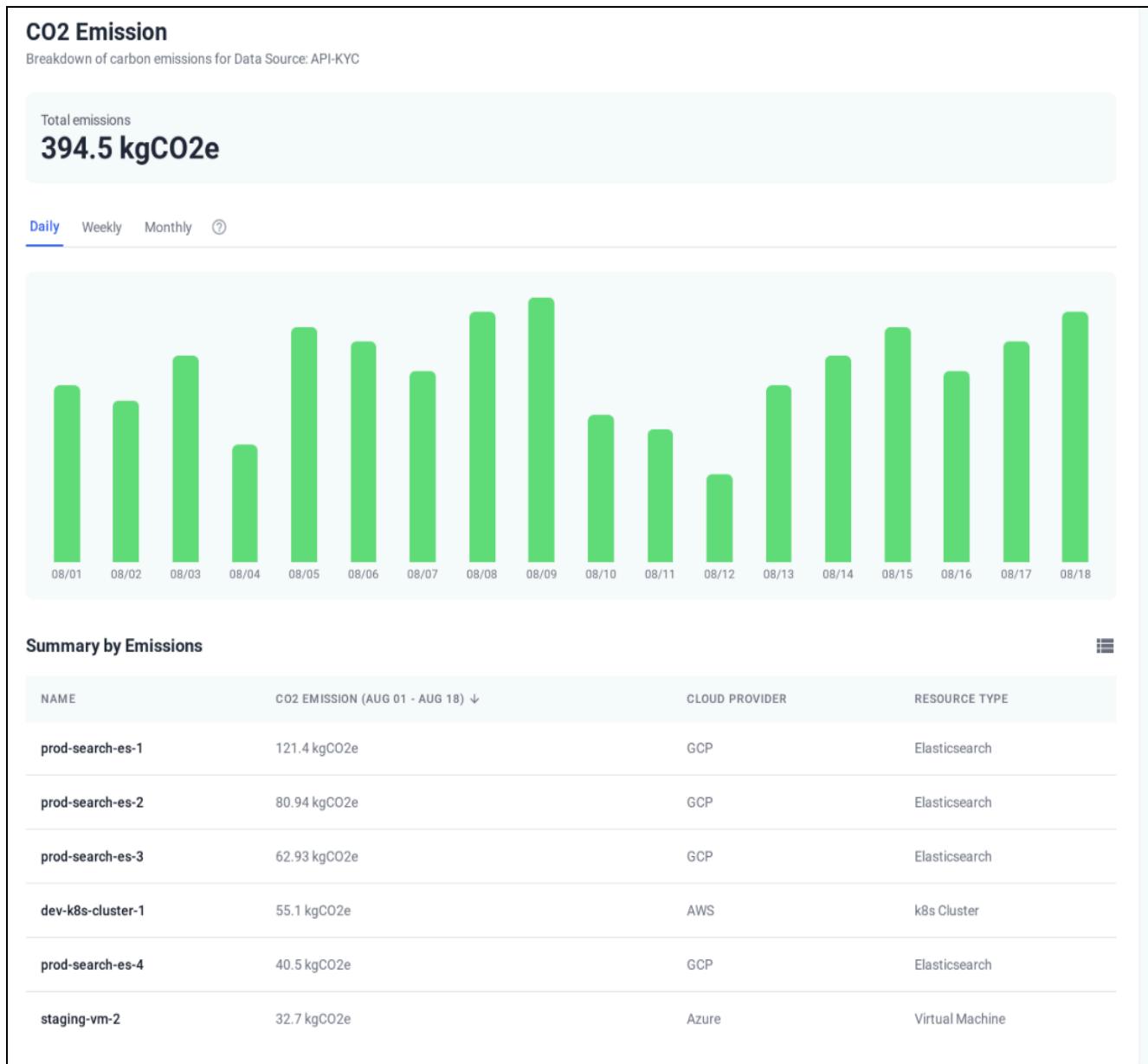
The screenshot shows the CloudTuner application interface. On the left is a dark sidebar with various navigation options: Home (selected), AI Insights, Resources, Pools, FINOPS, Cost Explorer, Cost Map, FinOps Portal, POLICIES, Anomaly Detection, Quotas and Budgets, Tagging, Resource Lifecycle, Power Schedules, SANDBOX, and K8s Rightsizing. The main content area has a header with 'Organization' and 'Invincible Ocean (guest)' dropdowns and a user profile icon. Below this is a 'Pools >' section with four cards: 'Organization limit' (\$100.000K), 'Expenses this month' (\$34.289K), 'Forecast this month' (\$58.509K), and 'Possibly monthly saving' (\$721.97). To the right is a 'CO2 Tracker' section with a card showing '125.3 kg' and a pie chart indicating '85% Saved'. A message at the bottom says 'You have saved 105 kg of CO2 this month out of a possible 123 kg' with a 'can I assist you?' button.

It will be shown as a pie-chart with Monthly Savings % to have a visually appealing and easy to understand score for the end-user.

It will also showcase how much quantity of Co2 has been saved to promote a greener future.

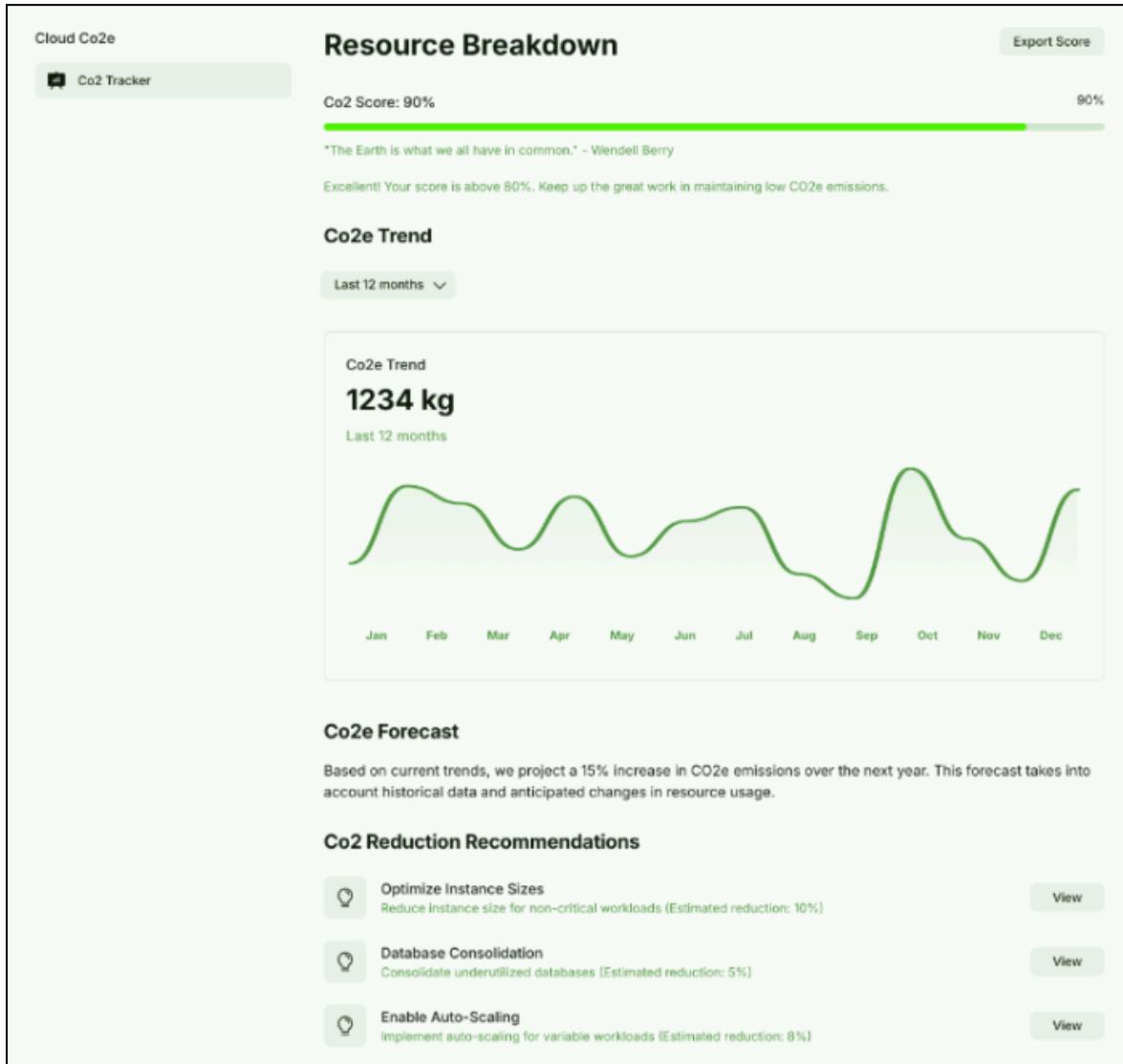
3. Carbon Footprint on left pane

There will be a dedicated page on the left pane which will give an overall summary of the carbon consumption within the entire account.



4. Resource Breakdown Page

When the end-user clicks on the resource name in previous page, a new page will open similar to this-



The user can export their score on their website/ LinkedIn to showcase they are working towards a Greener Planet.

The CO2 score is now displayed with specific colors and messages:

Green for scores above 90, Yellow for 70-89, and Red for below 70, with corresponding success or needs improvement messages.

When a user follows the Recommendations, the score will improve in real-time.

Based on the data available, we will use Gemini for forecasting.

Conclusion

We will do a Proof-Of-Concept (POC) to understand the feasibility of this feature before go-live.

Time to implement POC = 2 weeks