

Bridging Product and Engineering for a Greener Future: **Embedding Sustainability into Software Teams**

UXDX Berlin 2026

Carsten Windler





2/ Electricity

Build applications that are **energy efficient**



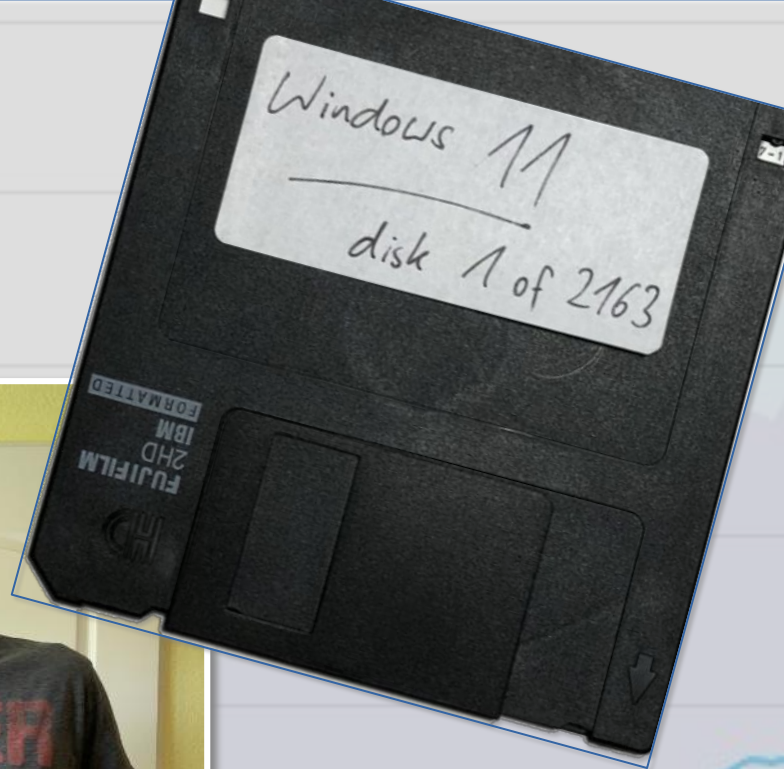
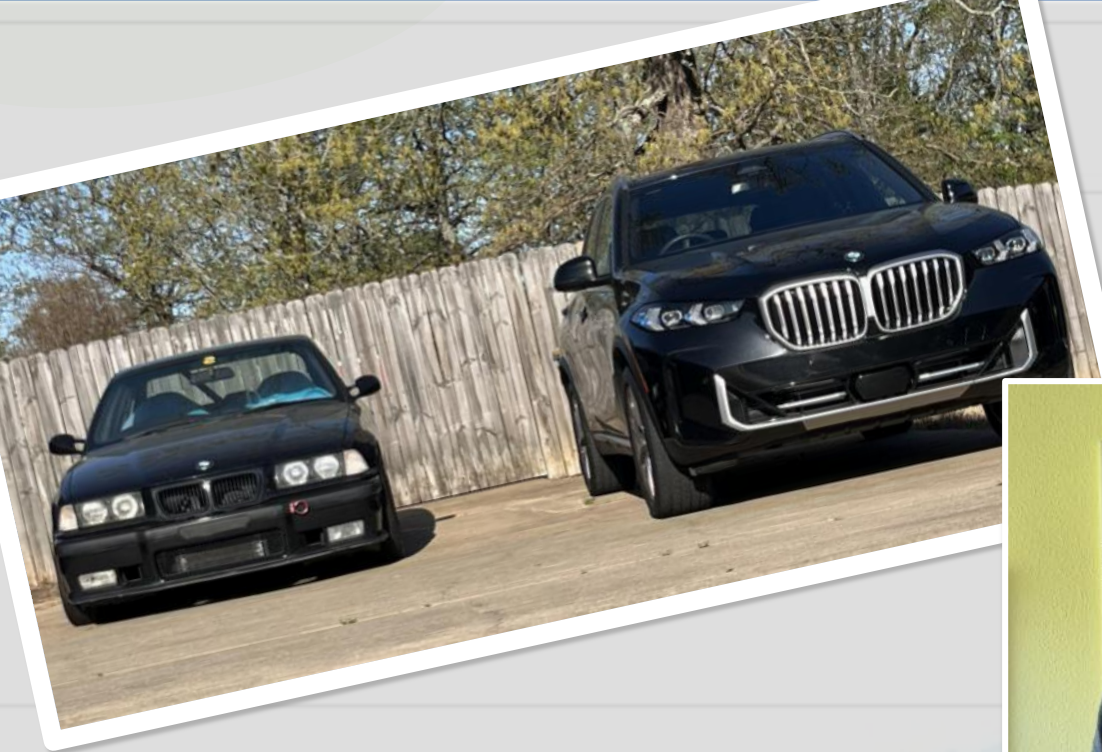
@JAWACHE / PRINCIPLES.GREEN

SUBSCRIBE

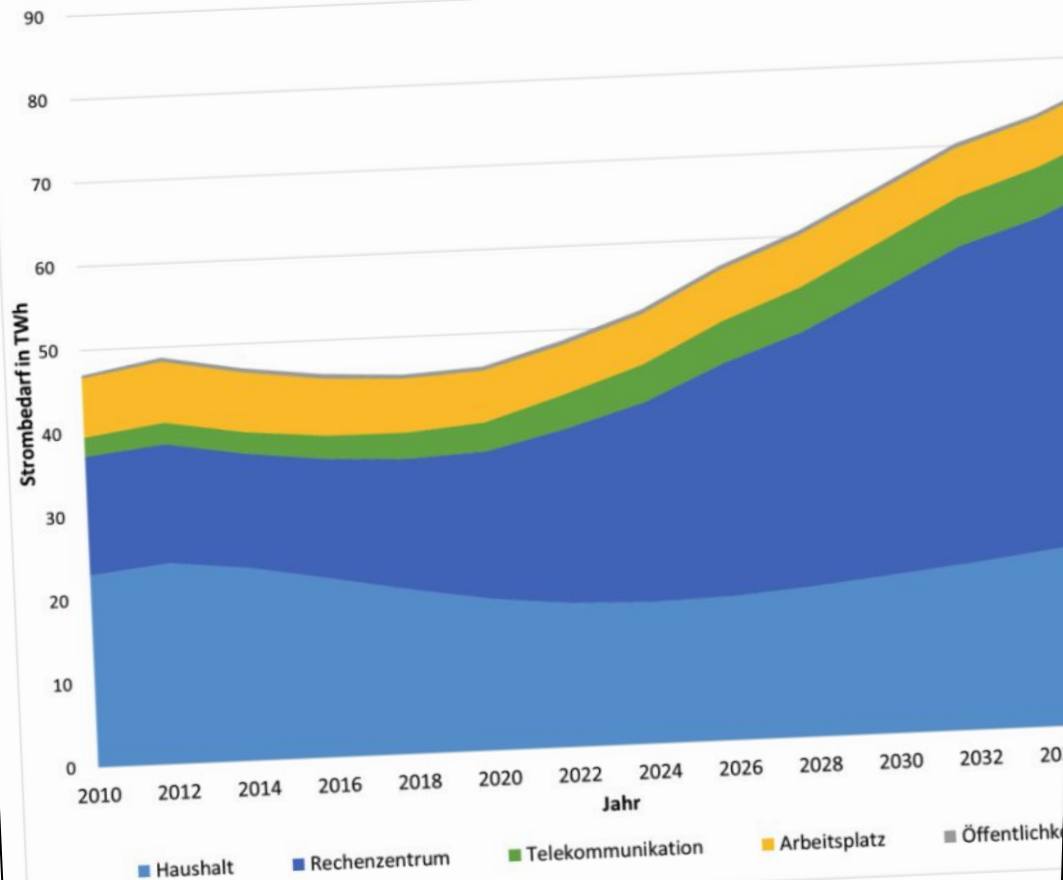


22:21 / 34:15 • Electricity >





Strombedarf (Leistungsaufnahme in der Nutzung) der IKT in Deutschland 2010 bis 2036



https://www.izm.fraunhofer.de/en/abteilungen/environmental_reliabilityengineering/projekte/green-ict/study-on-the-electricity-demand-and-carbon-footprint-of-ict-in-germany.html

Datacentres using 6% of electricity supply in UK and US, research says

Industry body says energy consumption driven by AI up 15% globally in two years as it warns of societal backlash



<https://www.theguardian.com/technology/2026/may/13/datacentres-electricity-consumption-uk-us-ai>

Sustainable Software Engineering



Green Software Principles



Energy Efficiency

Consume the least amount of electricity possible



Hardware Efficiency

Use the least amount of embodied carbon possible



Carbon Awareness

Do more when the electricity is clean and less when it's dirty

...but...

Green Software

- Improved UX
- Lower costs
- More sustainable

How can we embed sustainability within our software teams?

1. Raise awareness

Raise awareness

- Every operation causes emissions
- We can measure and reduce these emissions
- Architecture decisions play a large role
- Highlight carbon emissions

Architecture decision

Event-driven updates

Estimated effort: L

Emissions: 🌱

Polling

Estimated effort: S

Emissions: 🌱🌱🌱

Raise awareness

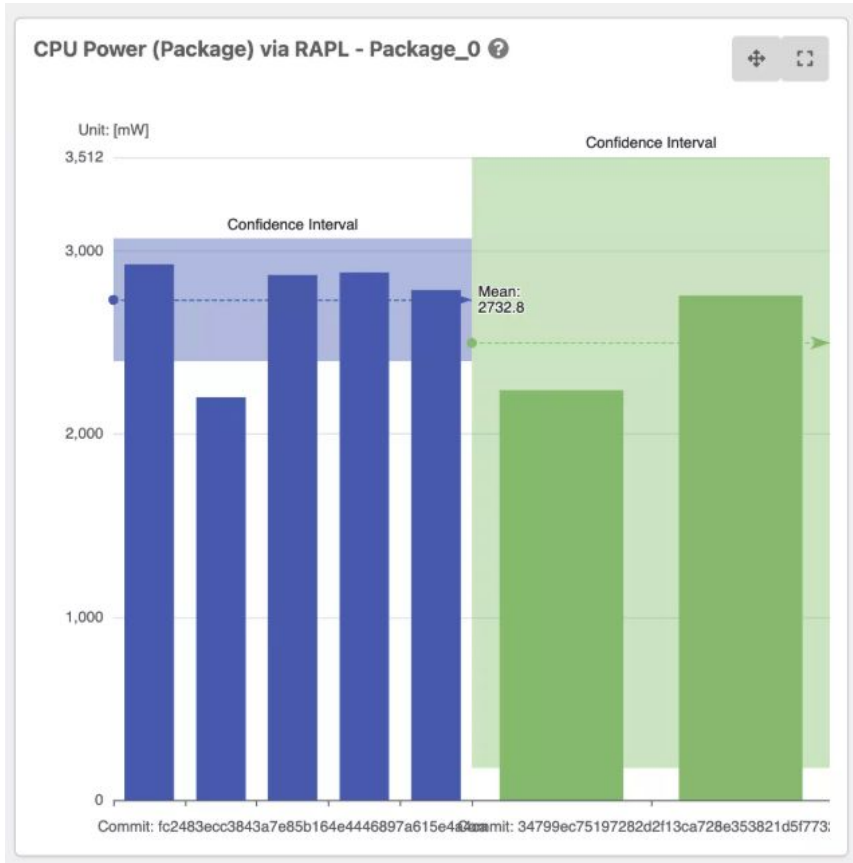
- Internal sessions
- Brown bag meetings
- Meetup
- Green IT chapter



Green IT + Plan A = ❤️

2. Track emissions

Track emissions



- Emissions are not obvious
- Can't be measures directly
- Various possible approaches



Website carbon results for: [cnn.com](https://www.cnn.com/)



Oh no! This web page achieves a carbon rating of F

This is dirtier than **91%** of all web pages globally



Learn about our [rating system](#)

This page was last tested on 5 Apr, 2026. [Test again](#)

Copy URL

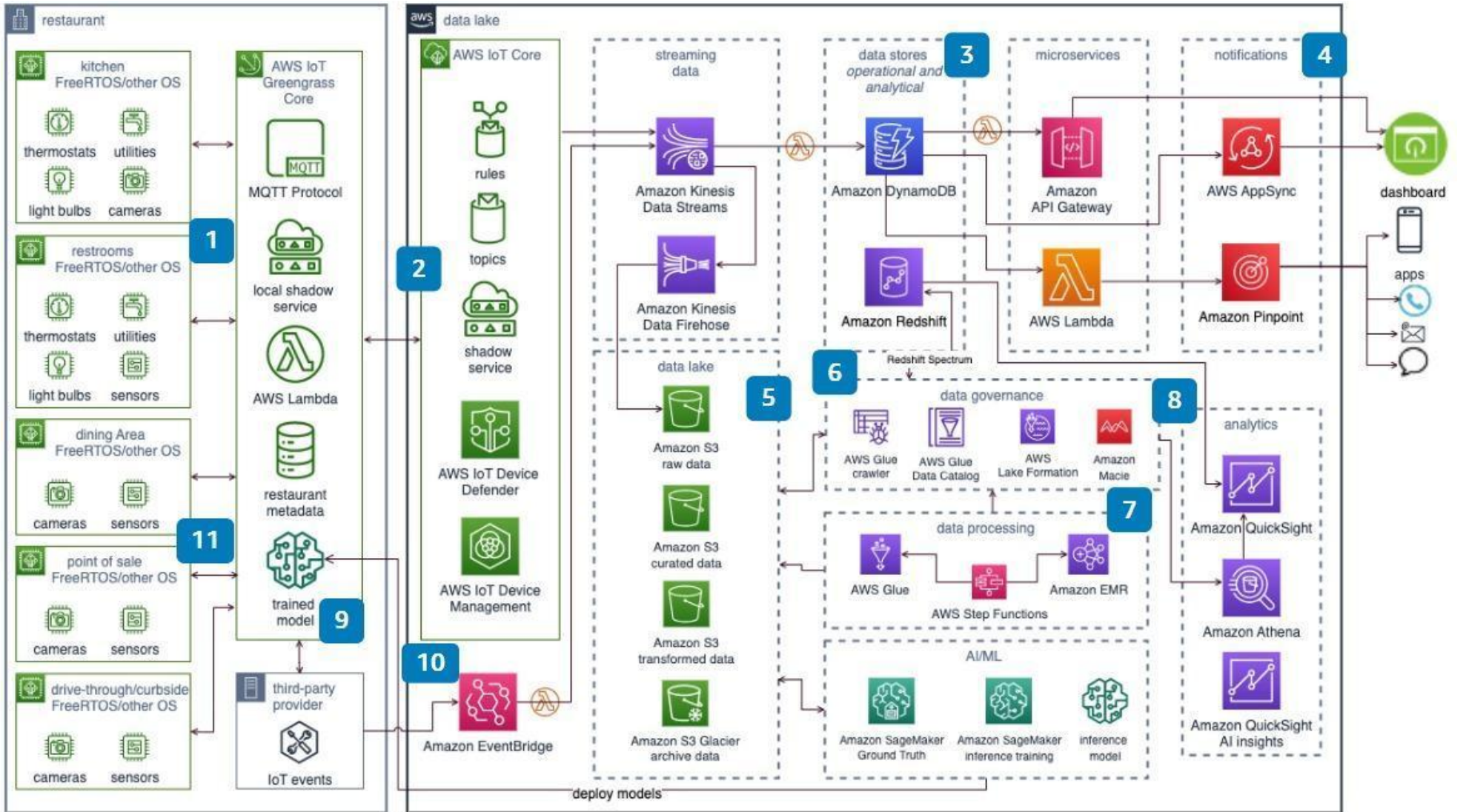


Oh my, **1.17g of CO2** is produced every time someone visits this web page.

Sustainable Web Design Model

$$\begin{aligned} \text{Average Emissions per Page View (gCO}_2\text{eq)} = & \\ & (([(OP_{DC} \times (1 - \text{Green Hosting Factor}) + EM_{DC}) + (OP_N + EM_N) \\ & + (OP_{UD} + EM_{UD})] \times \text{New Visitor Ratio}) + ([(OP_{DC} \times (1 - \text{Green} \\ & \text{Hosting Factor}) + EM_{DC}) + (OP_N + EM_N) + (OP_{UD} + EM_{UD})] \times \\ & \text{Return Visitor Ratio} \times (1 - \text{Data Cache Ratio})) \end{aligned}$$

$$\text{Data Transfer} \times \text{EF} \times \text{Carbon Intensity} = \text{Emissions}$$



AWS Sustainability

Carbon emissions summary [Info](#)

Provides your total AWS carbon emissions calculated using both the market-based (MBM) and location-based (LBM) methods and the estimated savings from using AWS. The savings represent the estimated carbon emission reduction due to AWS's carbon-free energy purchases.

Estimated MBM emissions

6,540 MTCO2e

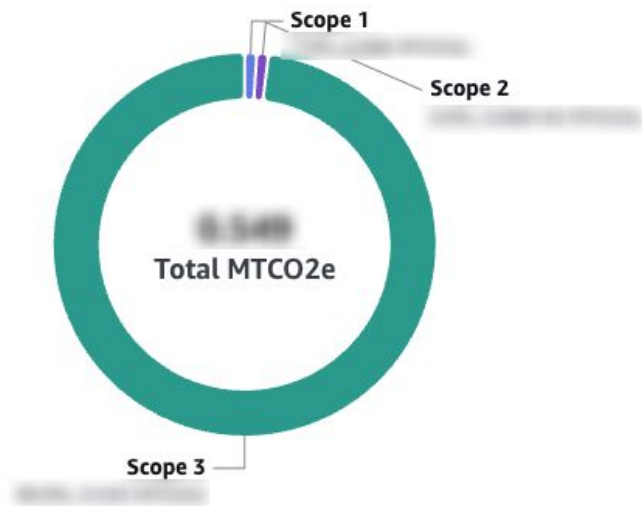
Estimated LBM emissions

6,390 MTCO2e

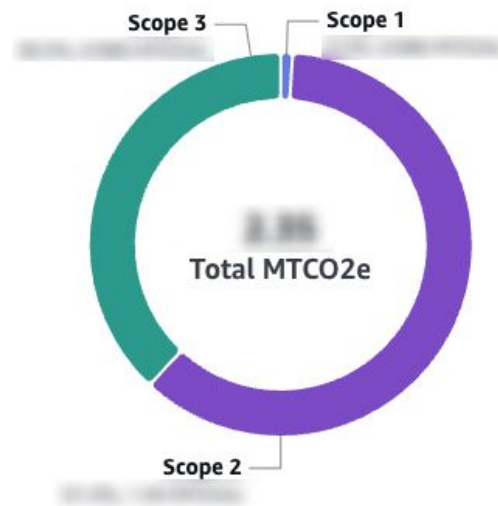
Estimated emissions savings

1,480 MTCO2e

Emissions by scope (MBM) [Info](#)



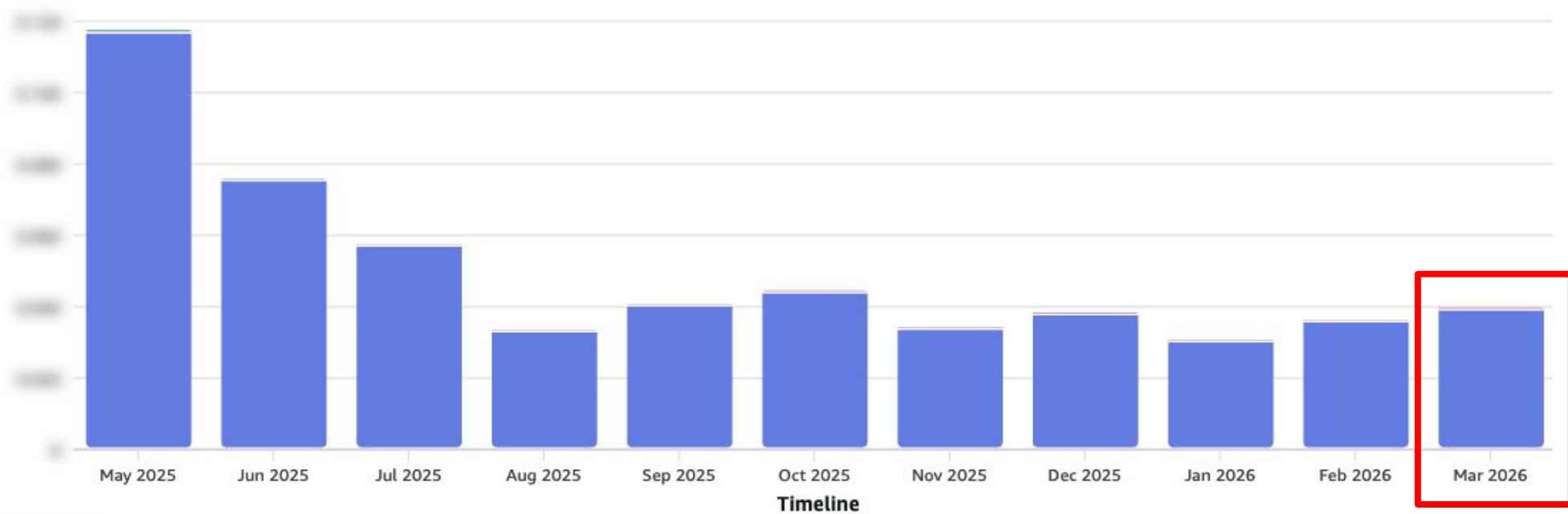
Emissions by scope (LBM) [Info](#)



AWS Sustainability

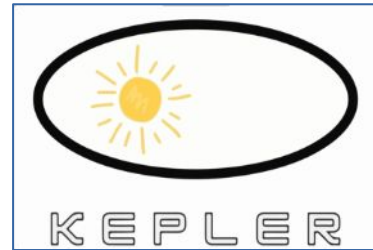
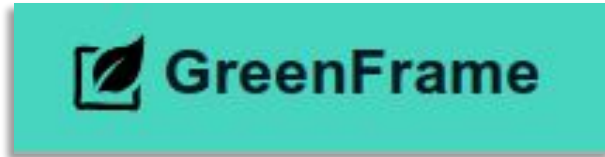
Carbon emissions (MBM)

Carbon emissions (MTCO2e)



Other AmazonS3 AmazonEC2

Tools for tracking carbon emissions



3. Build a case

Identify optimization potential

Cloud Usage



Cloud Carbon Footprint

<https://www.cloudcarbonfootprint.org/>

Low-hanging fruits (1)



- Misconfigured autoscaling
- Easy to fix, big impact

Low-hanging fruits (2)

Savings opportunities [Info](#)

Explore your savings opportunities using the filters below.

Resources with estimated savings

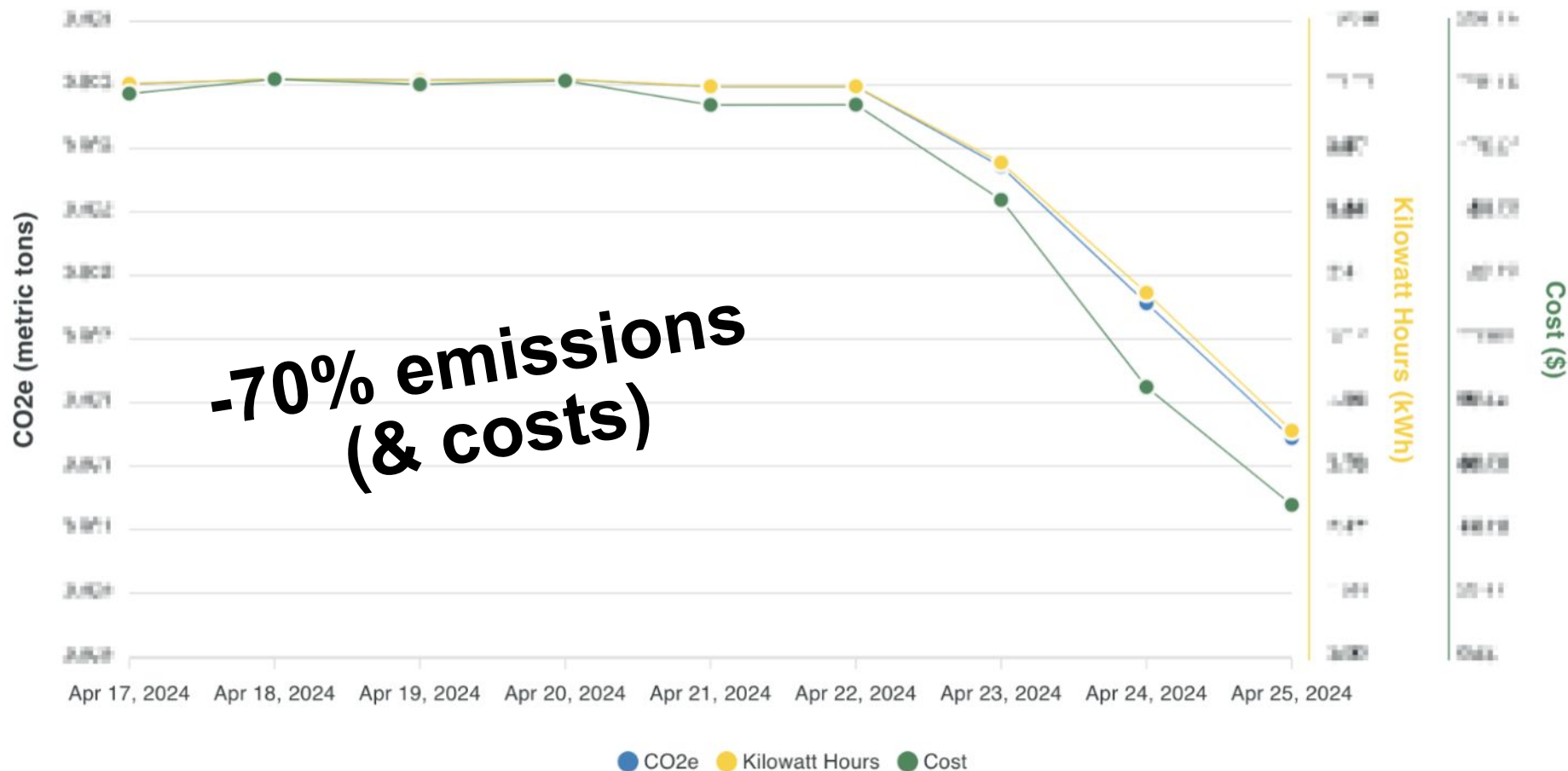
Group related recommendations

🔍 Filter distributions by text, property or value

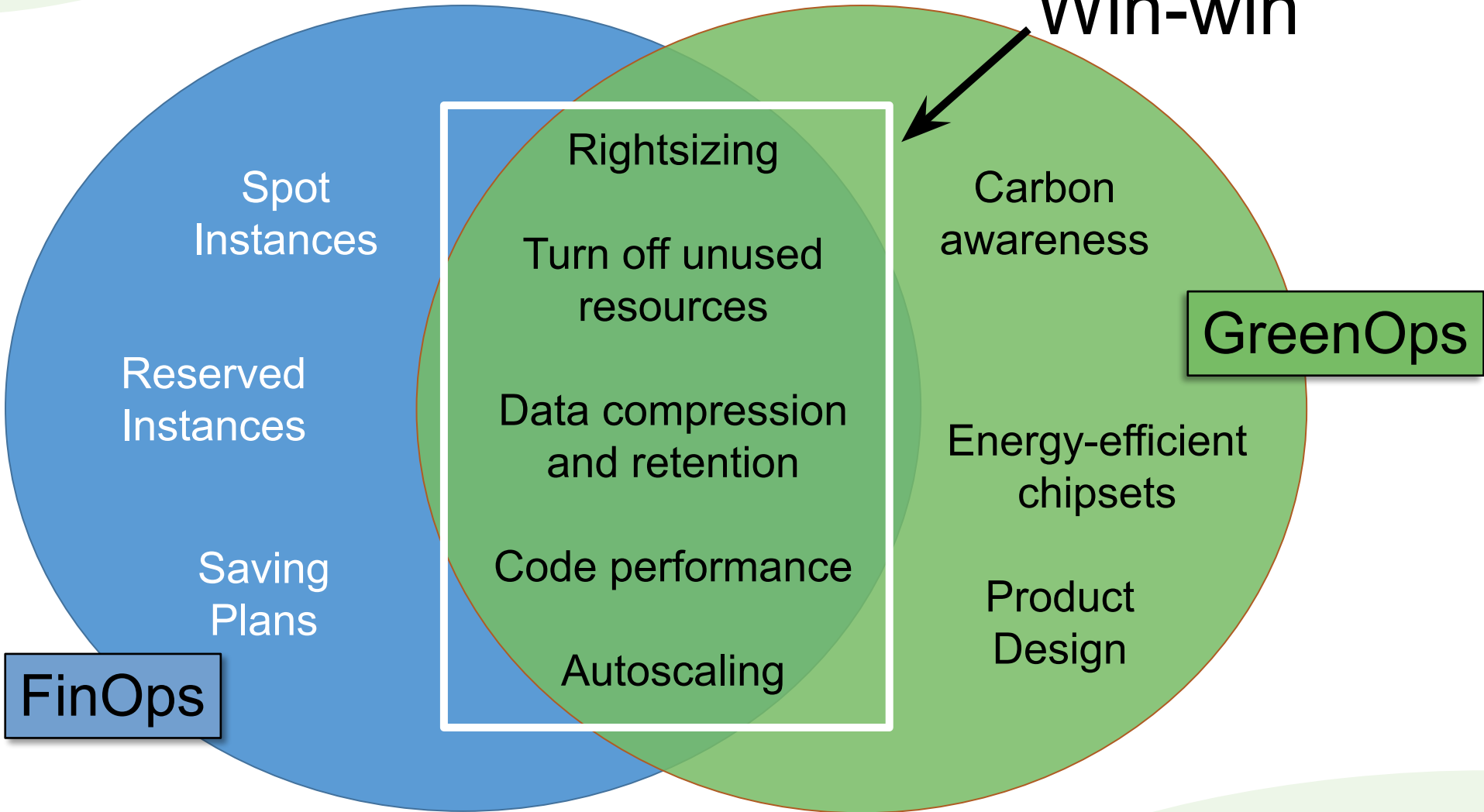
< 1 > ⚙️

	Estimated monthly savings ▲	Top recommended action ▼	Current resource summary	Recommended resource summary
<input type="checkbox"/>	US\$14.78	Rightsize	1024.0 vCPU/2048 MB memory	512.0 vCPU/2048 MB mem
<input type="checkbox"/>	US\$14.78	Rightsize	1024.0 vCPU/2048 MB memory	512.0 vCPU/2048 MB mem
<input type="checkbox"/>	US\$13.60	Purchase Reserved Instances (Reserved Node)	-	2 cache.t4g.micro in eu-we
<input type="checkbox"/>	US\$9.01	Rightsize	512.0 vCPU/1024 MB memory	256.0 vCPU/512 MB memo
<input type="checkbox"/>	US\$7.21	Rightsize	512.0 vCPU/1024 MB memory	256.0 vCPU/512 MB memo

Cloud Usage



Win-win



Spot Instances

Reserved Instances

Saving Plans

FinOps

Carbon awareness

Energy-efficient chipsets

Product Design

GreenOps

ROI of Decarbonization

- ✓ Cost reduction
- ✓ Better performance
- ✓ Improved stability



$$ROI = \frac{\textit{Return} - \textit{Cost} - \textit{Investment}}{\textit{Investment}}$$

4. Enter Product Management

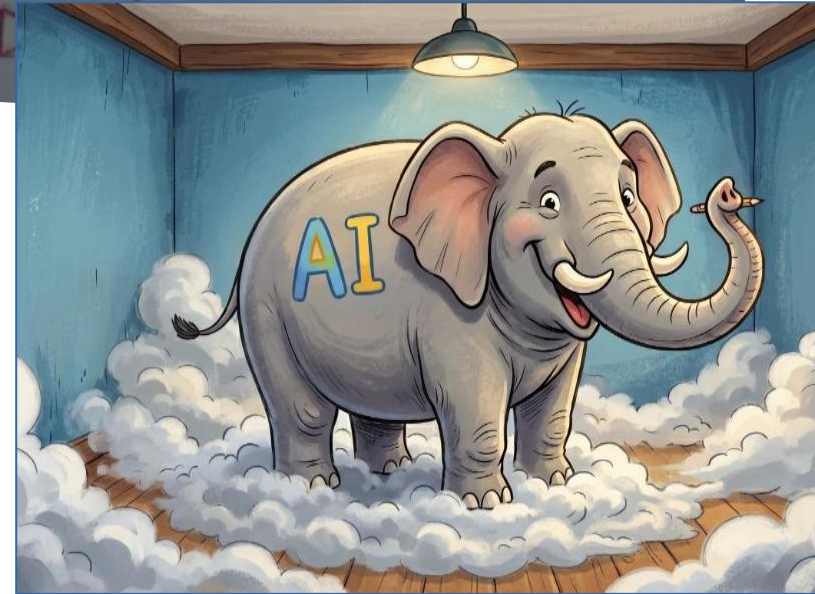
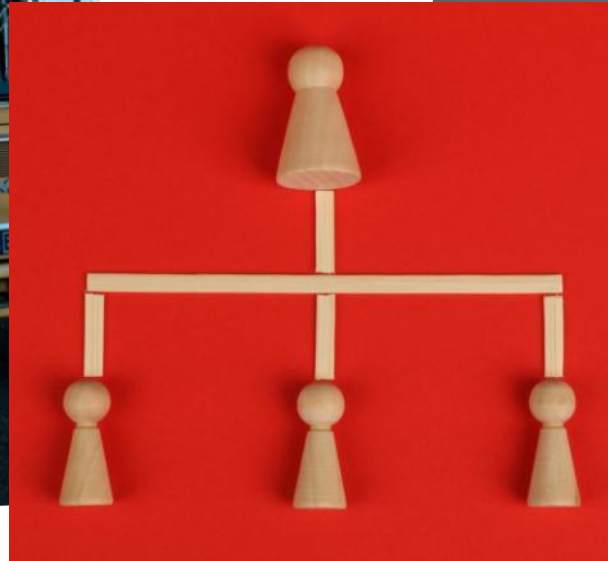
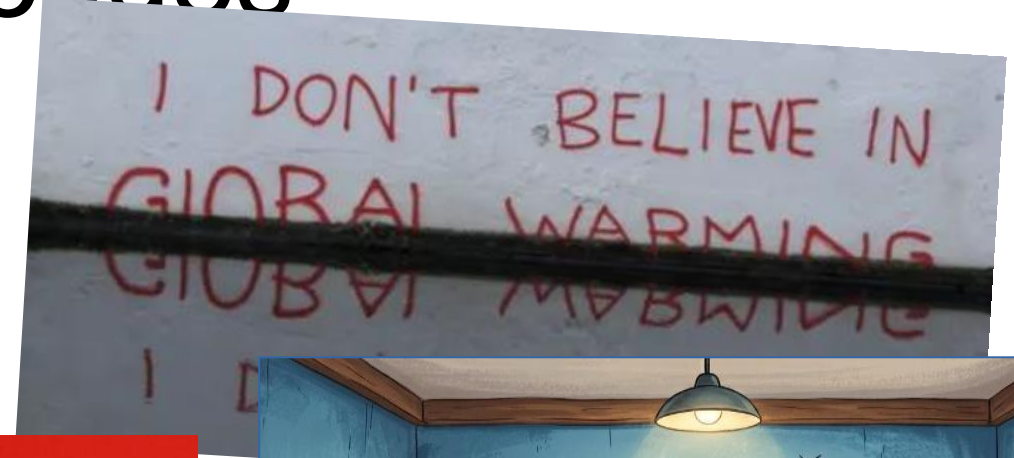
How to include Product Management

- Set KPIs and budgets
- Sustainability as a non-functional requirement
- Introduce “sustainability debt”
- Green IT backlog

Simple KPIs

- Total carbon emissions
- Resource utilization rate
- Zombie count
- Data storage growth
- Response times
- Frontend page weight
- Slowest DB query
- Build pipeline execution time

Challenges



Challenges

- Startup situation
- Political shift
- 3rd party services
- Massive AI growth

Today

Lifetime

methodology

Anthropic Gets in Bed With SpaceX as the AI Race Turns Weird

panies signed a resources from

Elon Musk's xAI powering its facility in Memphis with 'illegal' generators

Advoc meth

New Gas Turbines Despite Suit

Elon Musk's company is expanding its gas-fired power at its Colossus 2 site as quality continues.

533 Messages sent

Environmental equivalents:

55 hours YouTube streamed

60.9 Phones charged

ChatGPT-scale perspective

You consume 2.87 Wh per day. 900M ChatGPT users consume a year it would represent 941. Malta's annual electricity consumption.

The numbers are estimations based on methodology

> still doesn't work

* Lollygagging... (esc to interrupt)
[Tip: Open the Command Palette



Elon Musk fired up his xAI facility in Memphis last summer. The supercomputer is providing compute power for xAI's chatbot Grok. Photograph: Bloomberg/Getty Image



How it went

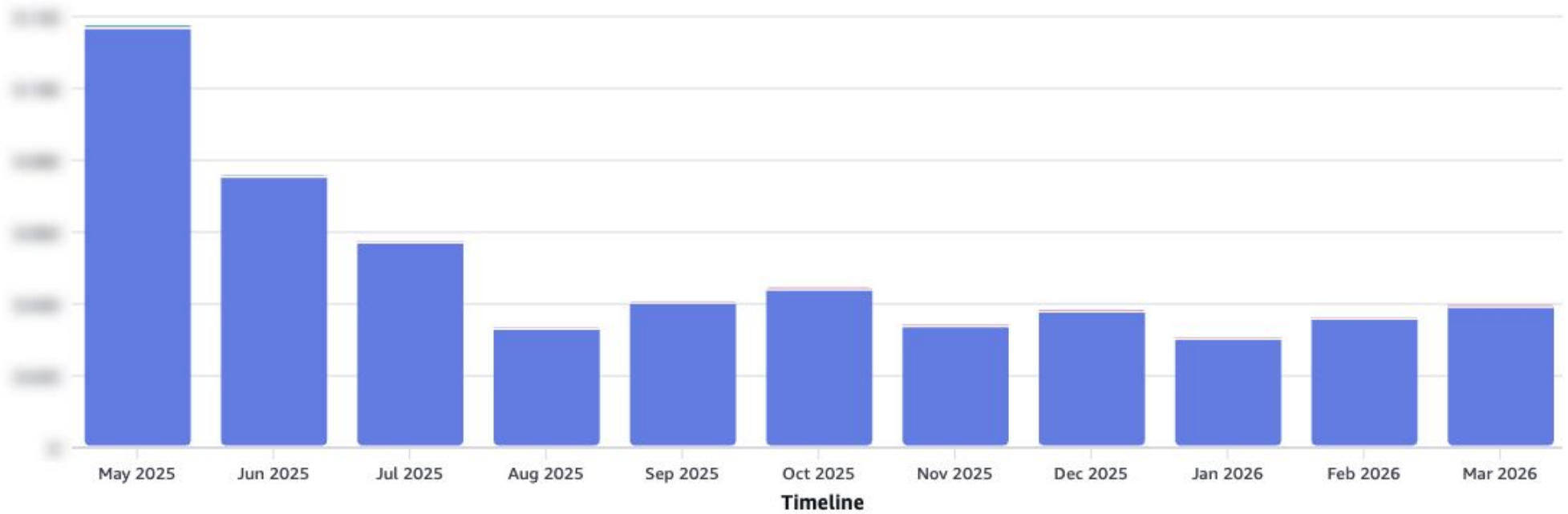


- Throwback in 2025
- Working on improved data layer
- Huge efficiency gain

Carbon emissions (MBM)



Carbon emissions (MTCO2e)



■ Other ■ AmazonS3 ■ AmazonEC2

Lessons learned

- Driving sustainability from “below” is hard
- Don’t expect others to invest the same as you did
- Observability – data must be easily available for everyone





Wrap-up



- Sustainable IT reduces emissions and costs
- Needs management support to fully thrive
- Sustainability is an ongoing effort



Thank you!

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 carsten.windler@plana.earth



Green IT Resources



github.com/github/GreenSoftwareDirectory



github.com/carstenwindler/green-it