CarbonSight

Carbon-Aware Optimization Framework for Generative AI

Domains: *Climate & Sustainability* • *Developer Tools* • *GenAI Optimization*
Powered by: *AWS Bedrock* • *Agentic Workflows* • *Embeddings* • *Reasoning Control*

The Problem

GenAI usage is exploding, so is its carbon footprint.

Enterprises face three major issues:

1. High Energy Consumption

Large models (GPT-4, Claude, Titan, etc.) consume significantly more compute than needed for most prompts.

2. Wasted Compute on Redundant Queries

Teams repeatedly ask similar questions → unnecessary LLM calls → more emissions + cost.

3. Zero Visibility into Carbon Impact

Organizations lack tools to measure or control the environmental footprint of GenAI usage.

Who is affected?

- Large enterprises adopting GenAI
- Developers & analysts making thousands of queries
- Sustainability teams measuring carbon impact
- Organizations with Net Zero commitments

Result: GenAI becomes **expensive**, **inefficient**, and **environmentally unsustainable**.

The Solution: CarbonSight

A carbon-aware, intelligent optimization layer for enterprise GenAI.

Key Features:

- **Smart Model Routing**

  Automatically sends each query to the *smallest sufficient* AWS Bedrock model based on complexity and quality needs.

- **Semantic Caching with Embeddings**

  Detects repeated or similar prompts → retrieves cached answers → avoids unnecessary inference.

- **Dynamic Thinking Budgets**

  Allocates reasoning depth only when needed, reducing token consumption and energy use.

- **Real-Time Energy Feedback**

  User sees immediate impact:

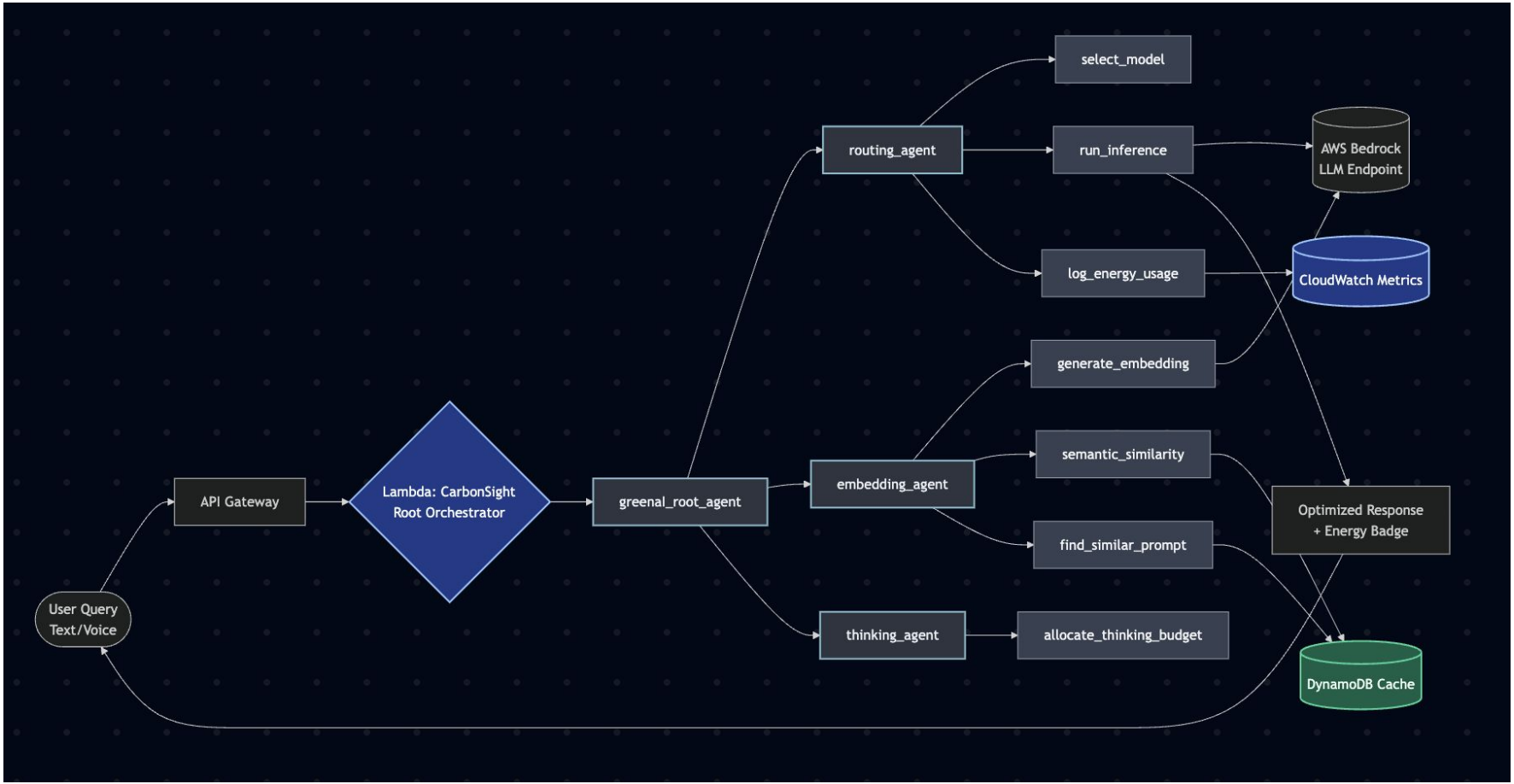
  🔵 *Efficient Model Used*

  🔴 *High Energy Model Used*

- **Enterprise Sustainability Dashboard**

  Org-wide analytics: carbon savings, team efficiency scores, usage forecasts, and exportable reports.

Architecture Diagram



The GenAI Core

Routing Agent

- Uses LLM reasoning to classify query complexity
- Predicts required model size and best-fit Bedrock model

Thinking Agent

- Determines required reasoning tokens
- Prevents unnecessary deep thinking on simple tasks

Embedding Agent

- Generates embeddings
- Performs semantic similarity search
- Retrieves cached answers when appropriate

LLM-Orchestrated Decision Making: All optimization decisions (routing, caching, budgeting) are powered by generative reasoning, not static rules.

Technology Stack:

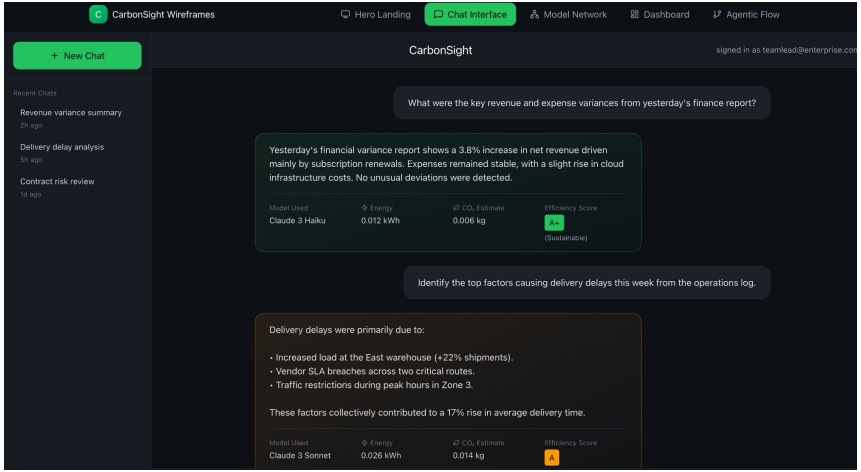
AWS-Native Architecture (Prototype-Ready)

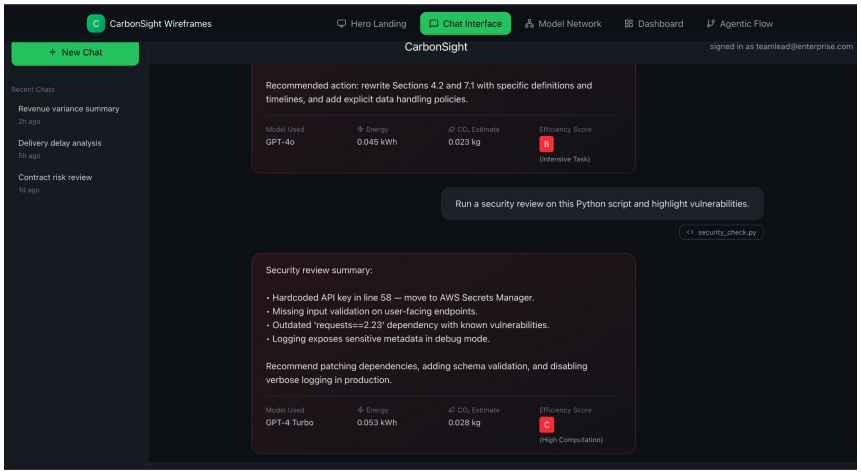
- **AWS Bedrock** - Model routing + inference
- **Lambda** - Agent workflows (routing, thinking, embedding)
- **DynamoDB / S3** - Semantic caching + logs
- **CloudWatch** - Token + latency metrics for carbon estimate
- **Kiro.dev** - Rapid prototyping for UI/agent orchestration
- **QuickSight** - Dashboards for sustainability reporting

Prototype by End of Day at Techfest:

- Working routing agent
- Working embedding + similarity cache
- Live demonstration of model/energy switching
- Dashboard showing real-time energy savings

Wireframe (Chat Interface + Enterprise Team Dashboard)





Link to mock wireframes:
https://moon-link-15676410.figma.site/

Vision and Impact

Vision: Make Generative AI sustainable, affordable, and enterprise-ready.

Environmental Impact

- Up to **40–70% reduction** in emissions from LLM inference
- Helps companies meet ESG & Net Zero goals

Economic Impact

- Reduced compute cost through smart routing & caching
- Fewer high-power model calls

Operational Impact

- Faster responses from cache
- Optimized workloads without changing user behavior

Enterprise Applications

- Financial institutions
- Tech teams
- Consulting firms
- Customer support automation
- Sustainability-driven organizations

Long-Term Goal:
CarbonSight becomes the **standard carbon-optimization layer** for GenAI in enterprises, built on AWS

Thank you

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