


# Sustainable Software Engineering

Bill Johnson

Principal Engineering Manager
Azure SRE



# SLO: 1.5°C average global temperature

baseline: pre-industrial revolution
(late 1700s)

Current value: 1.15°C
Projected breach: 12 years

https://climateclock.net

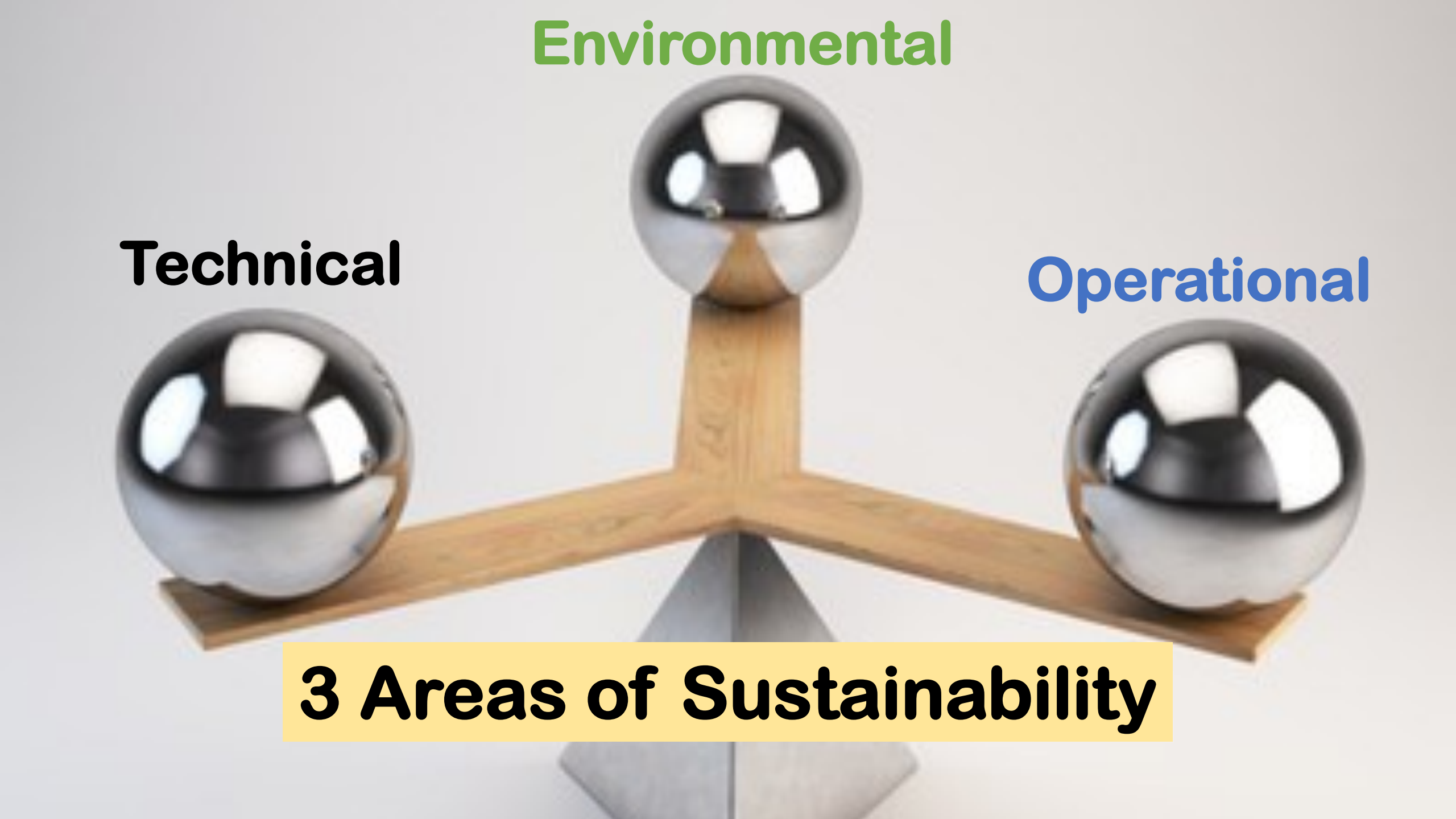

Technical
Operational
The human toil needed to maintain a technical system
SRE!

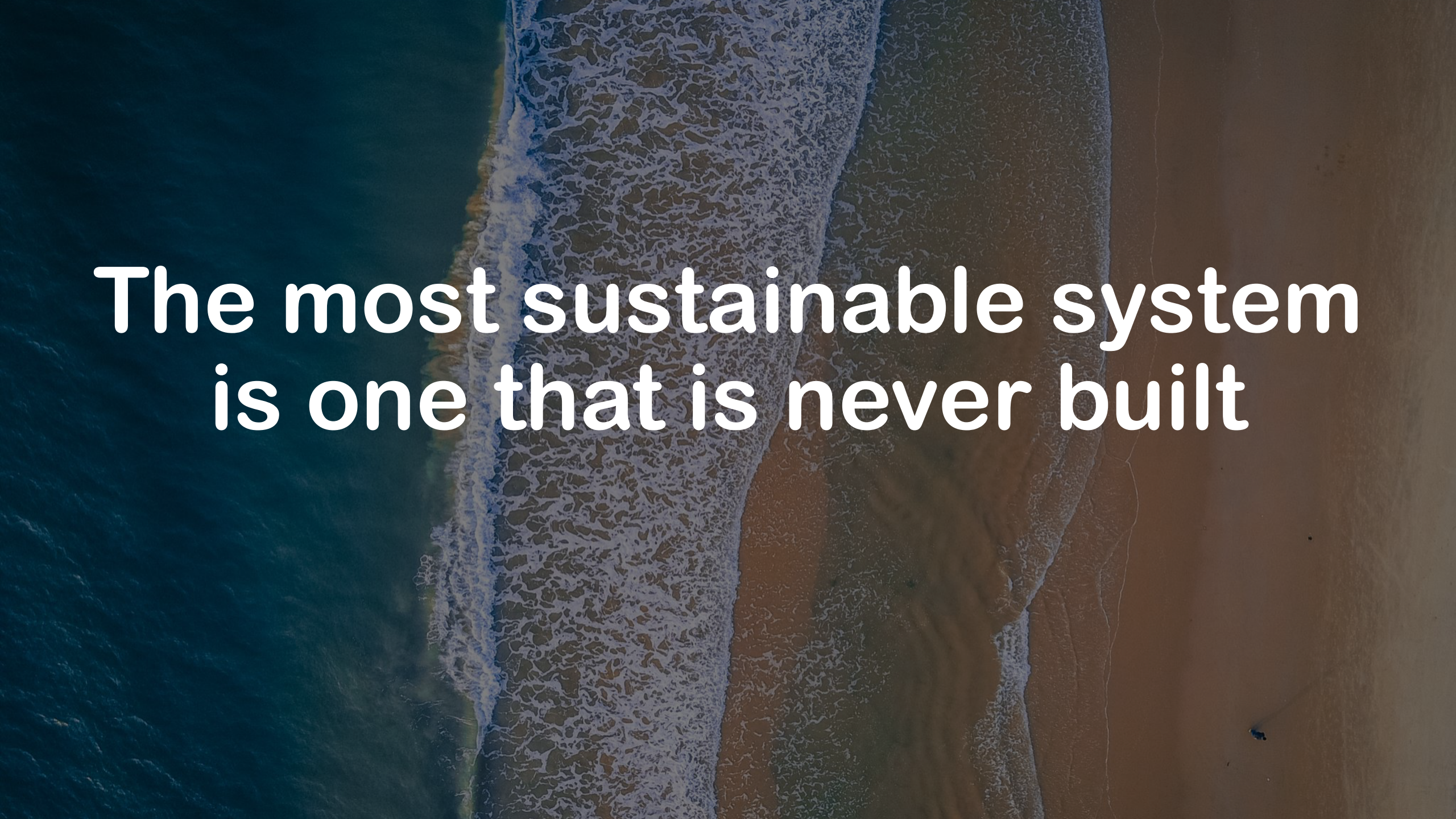
**Sustainability = Reliability over time**



# Environmental Sustainability

The impact on the planet of our Technical and Operational choices

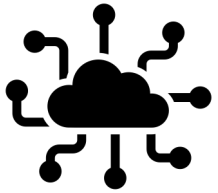

Environmental
Technical
Operational
3 Areas of Sustainability


The most sustainable system
is one that is never built

# Sustainable Software Engineering

https://principles.green

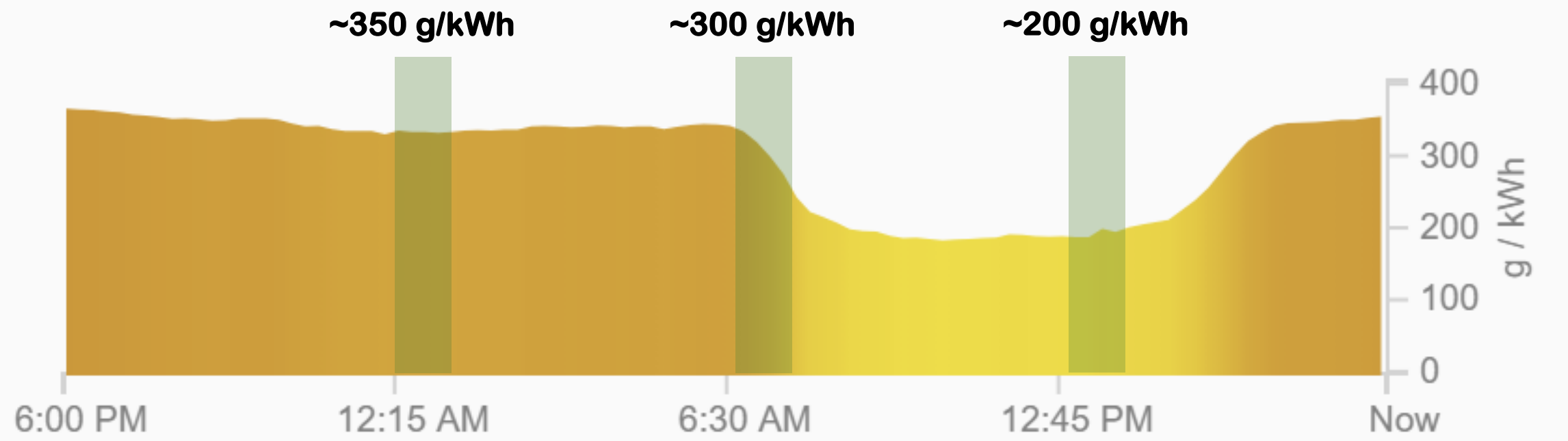
1. Build Carbon-Efficient Applications
2. Build Energy-Efficient Applications
3. Maximize Utilization
4. Minimize Carbon Intensity
5. Minimize Embodied Carbon
6. Minimize Data Amount & Travel Distance
7. Shape Demand To Supply
8. End-to-End Optimization Of Carbon Efficiency



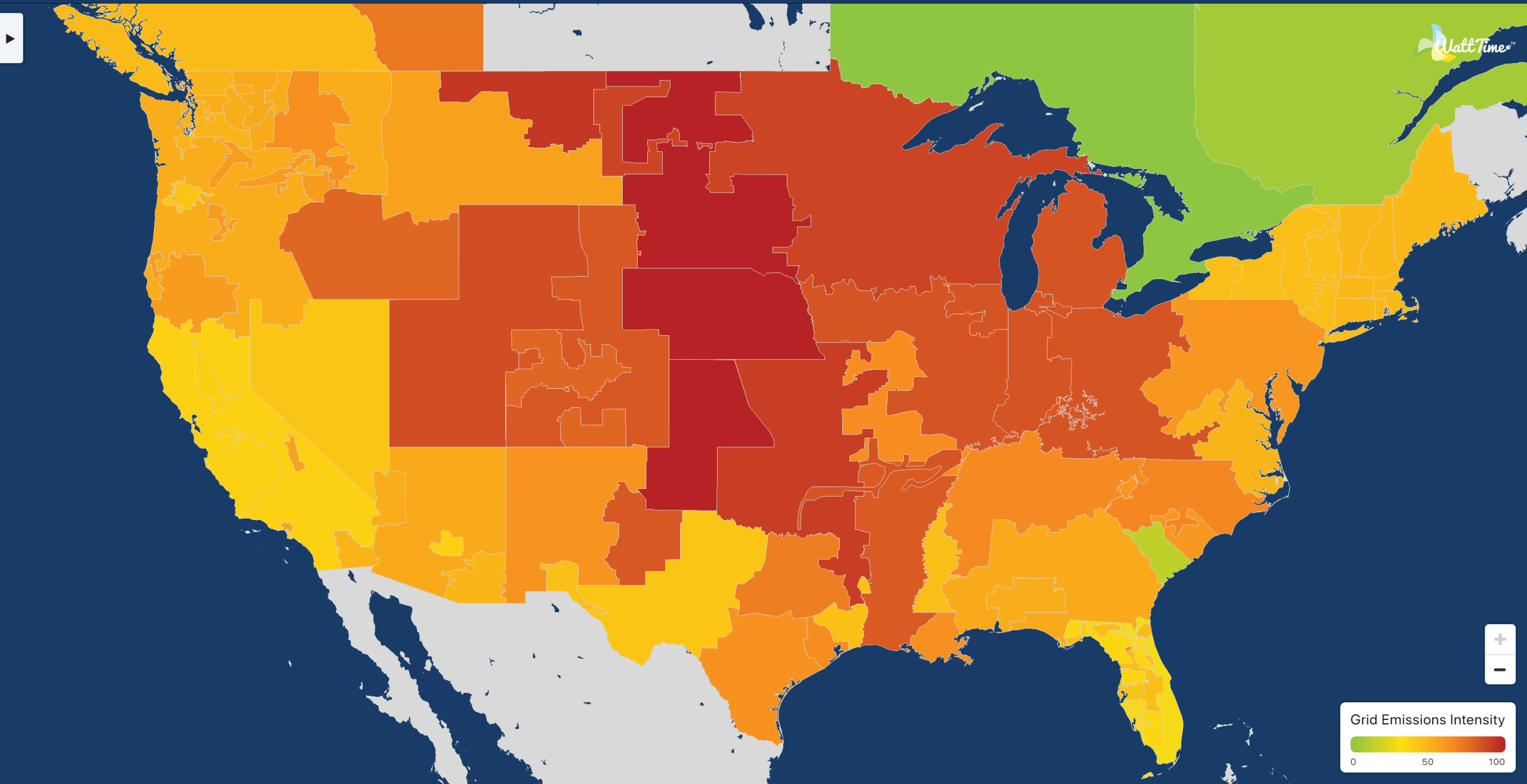
# Microservice Sustainable Principles

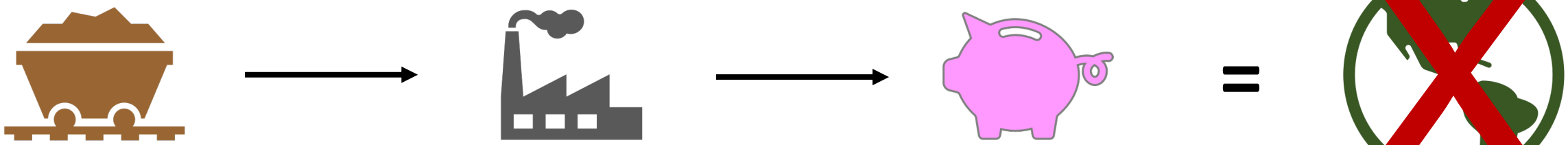
- ❑ Increase Compute Utilization
- ❑ Optimize your database
- ❑ Optimize network traffic
- ❑ Reduce number of microservices

# Carbon Intensity over 24 hours




Source: electricitymap.org


WattTime™
Grid Emissions Intensity
0
50
100

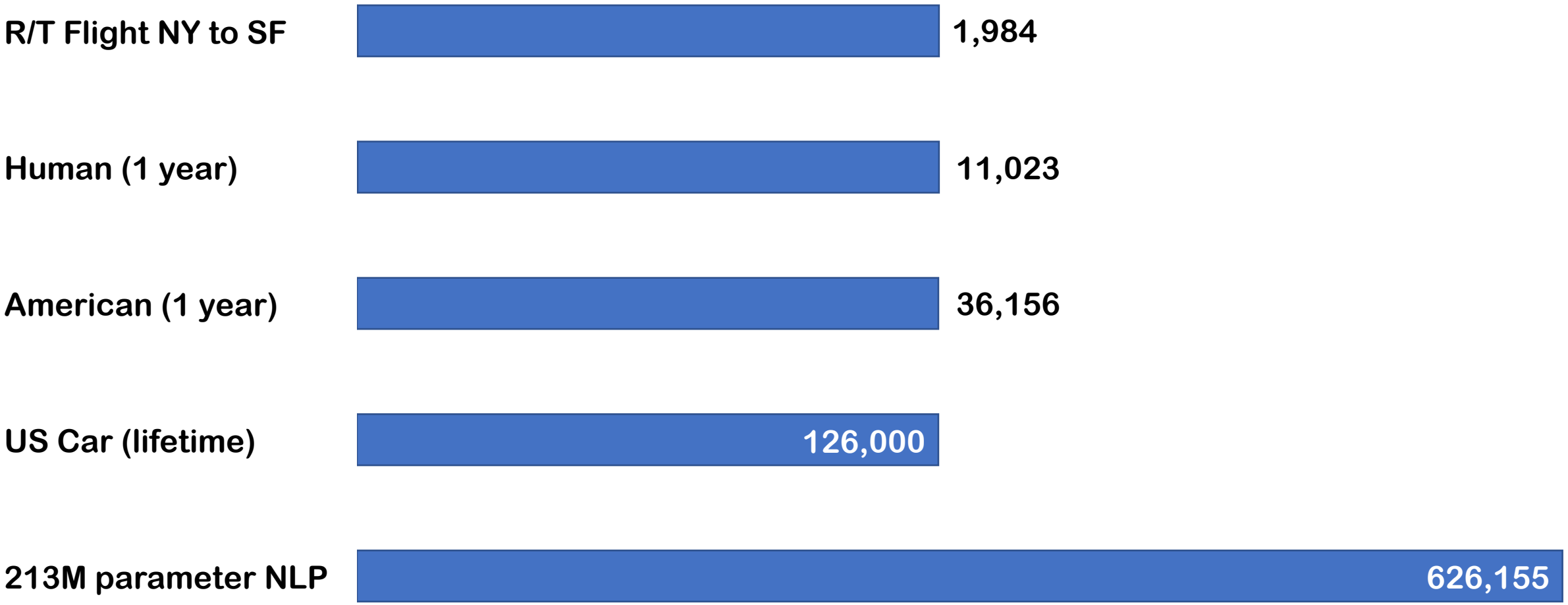


Resource Refine $$$ =

AI computation costs have increased 300,000x over 6 years

# Carbon Footprint Benchmarks

*in lbs of $CO_2$ equivalent*




Source: MIT Technology Review

Psst! It's really about efficiency



**REFUSE**

**REDUCE**

**REUSE**

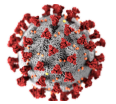
**RECYCLE**

# Carbon-Efficient Systems Are:

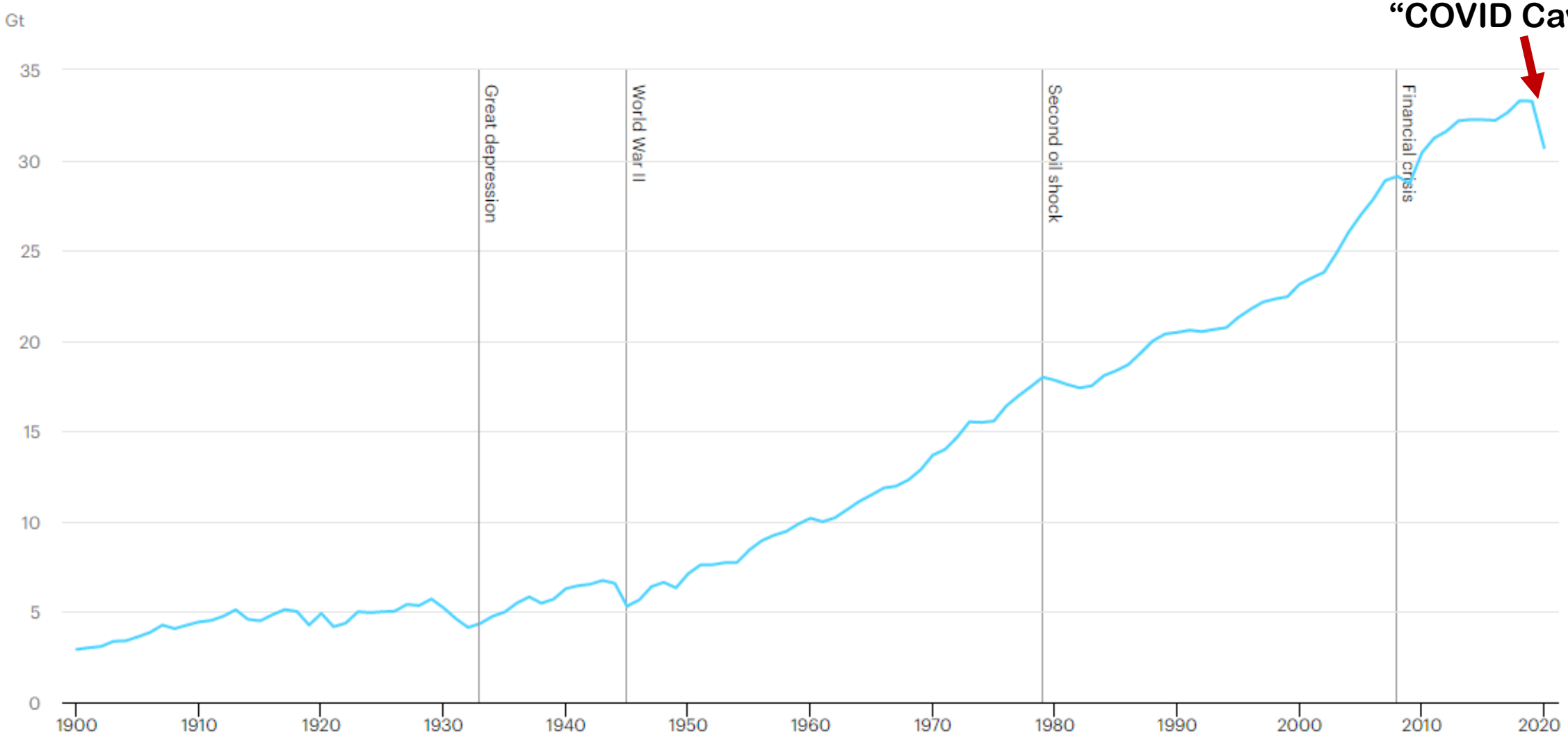
- ✓ Faster
- ✓ Cheaper
- ✓ Resilient

# Global Energy-Related $CO_2$ Emissions: 1900-2020

Source: IEA Global Energy Review 2020



"COVID Caveat"












| | | | |
|---|---|---|---|
| Carbon Neutral | 2040 | 2012 | 2007 |
| 100% Renewable | 2025 | 2025 | 2030 |
| Carbon Negative | --- | 2030 | 2025 |
| Historical Removal | --- | 2050 | 2020* |

*Some contention on the methodology used

stripe



amazon.com





**2020**

**Commit 1% of all purchases to Carbon Removal Projects**

**stripe.com/climate**

**2030**

**Carbon Neutral**

**2030**

**50% Shipments Net-Zero Carbon**

**2030**

**50% Reduction of Emissions, Water, and Waste**

**2040**

**Carbon Neutral**

# Takeaways

1. Ask The Question
2. Apply Sustainable Principles
3. Continue The Conversation




@dubrie

dubrie

linkedin.com/in/dubrie