

# AI for 5G Sustainability: Green Savior or Great Pretender?

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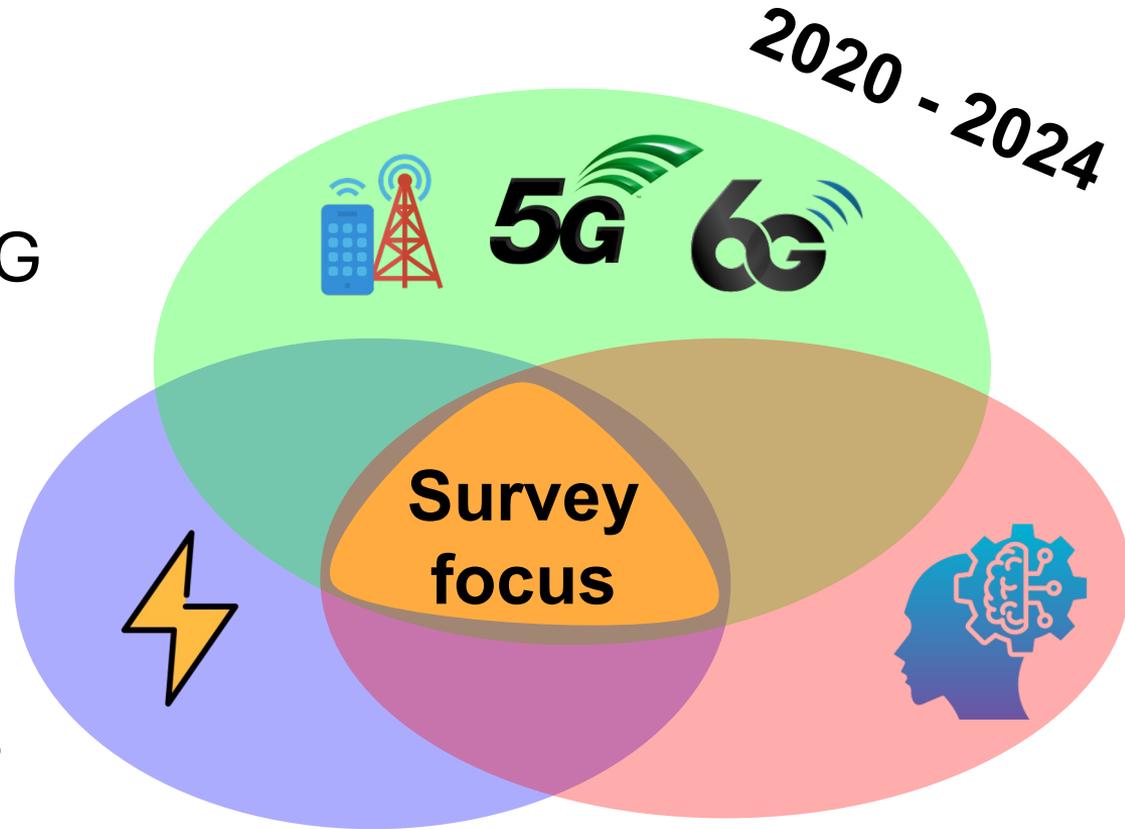
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**36th Multi-Service Networks workshop (MSN 2024)  
4<sup>th</sup> July 2024**

# Introduction

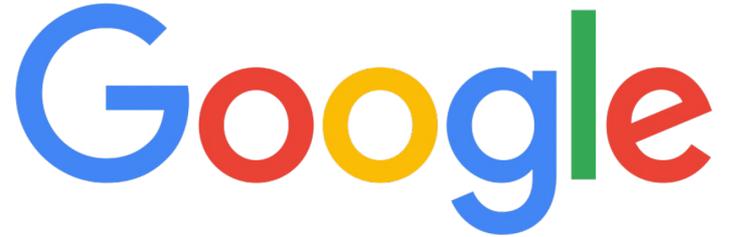
Survey to assess:

- Energy impact on 5G by AI algorithms.
- Operational cost of AI.
- Does the AI cost more than it saves?



# Motivation

## ML Inference Energy

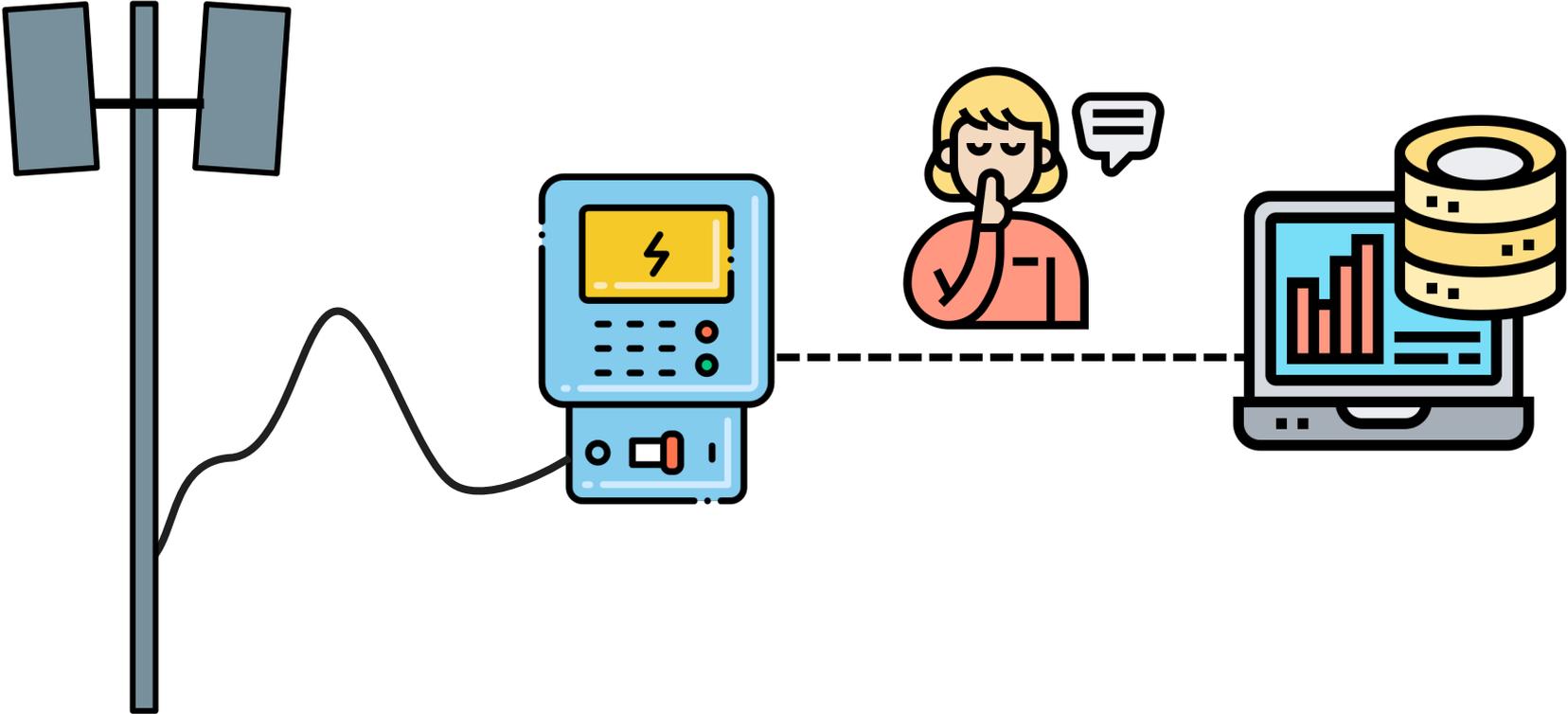


**~ 14.2 MWh**  
UK household  
(annual)

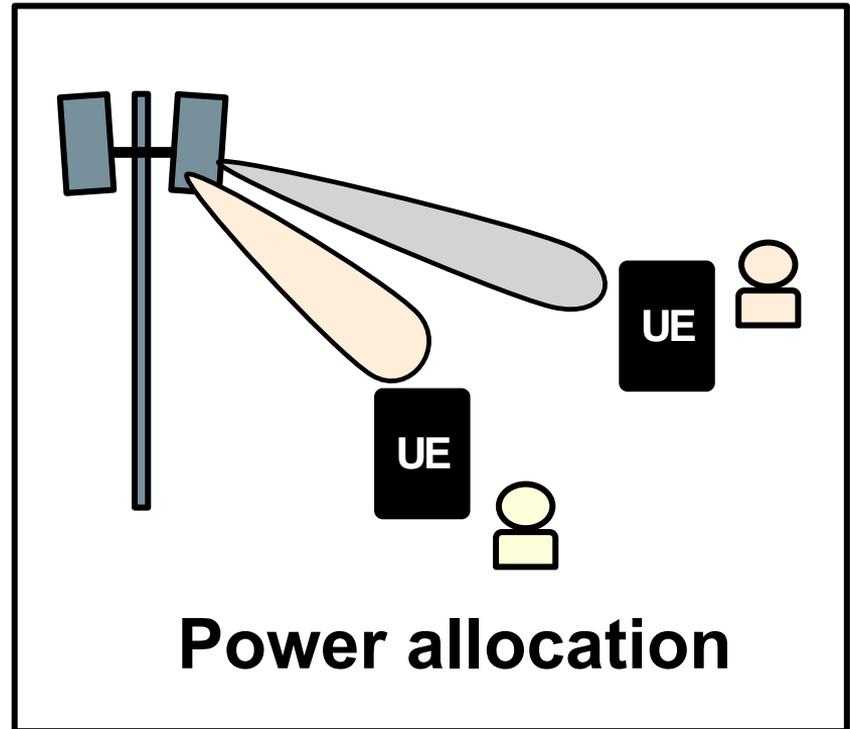
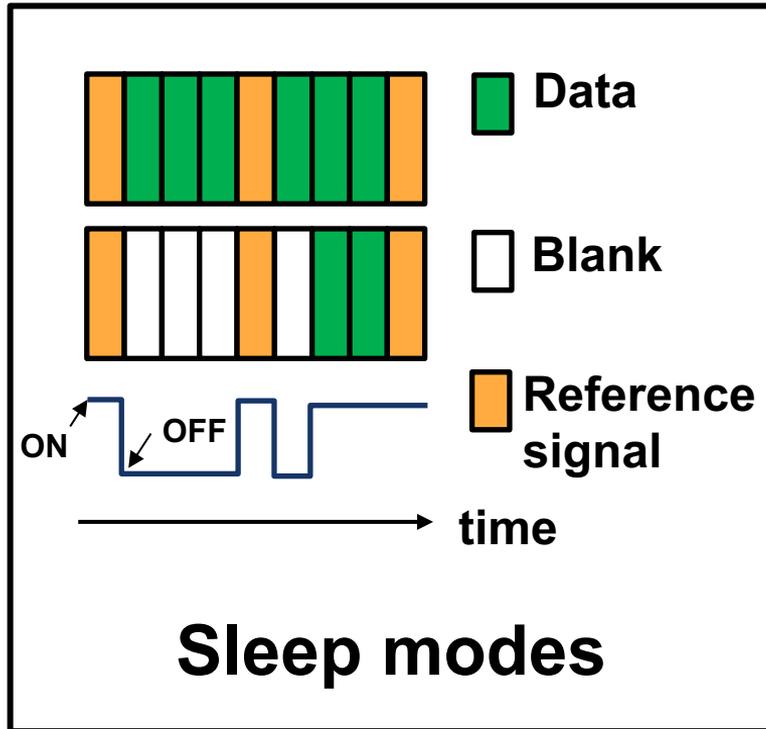
**~ 205,860 MWh**  
GPT-3  
(annual)

**~ 1,387,000 MWh**  
ML pipeline  
(annual)

# Power models



# Energy Saving Techniques



# Question #1

**How much energy can be saved in the RAN using ML techniques?**

# Observation #1

Consumption savings:

**-9** – **65%**

Efficiency improvement:

**-3** – **15%**

# Problem #1

**Most studies don't report the energy used by their ML model.**

# Suggestion #1

## Green Algorithms

How green are your computations?

Check out the new Green Algorithms website: [www.green-algorithms.org](http://www.green-algorithms.org)

### Details about your algorithm

To understand how each parameter impacts your carbon footprint, check out the formula below and the [methods article](#)

Runtime (HH:MM)

Type of cores

Number of cores

Model



**253.64 g CO<sub>2</sub>e**  
Carbon footprint



**2.28 kWh**  
Energy needed



**0.28 tree-months**  
Carbon sequestration



**1.45 km**  
in a passenger car



**0.51%**  
of a flight Paris-London

## **Question #2**

**How we can compare the energy impact of Algorithm A vs. Algorithm B?**

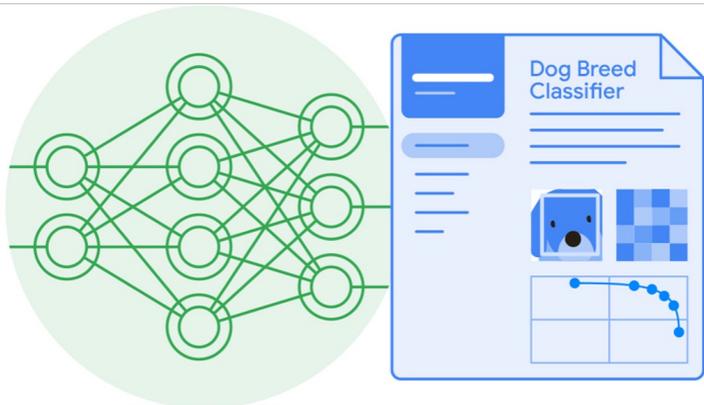
## Observation #2

No standard algorithm performance metrics that incorporate energy.

### ML Energy Factors

- Computational load imposed by the model.
- Number of iterations.
- CPU frequency / time to completion.

# Suggestion #2



## Model Report Cards

Metadata that may be useful:

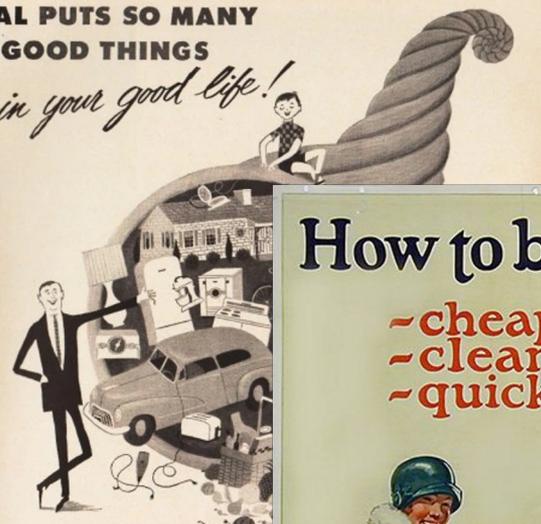
- FLOPS/Watt
- System configuration report
- Location
- Cooling system
- Total energy consumption for training **and inference**
- **Mean inference duration (ms)**
- Training duration

# Key Points

- Accurate energy profiling of 5G RAN remains an **open question**.
- Estimating energy performance of algorithms is **non-trivial**.
- **'Report cards'** could help compare model credentials.

# Closing remarks

**COAL PUTS SO MANY GOOD THINGS**  
*- in your good life!*



The electricity that runs your lights, your TV set, all your modern appliances depends on coal... for 70% of the fuel used by America's utilities is coal. And the steel that goes into your auto and your refrigerator, your son's bike and your dishwasher takes coal to make—for coal is an essential ingredient of steel on a ton-for-ton basis. Moreover, almost all the rich variety of products that make up our high American standard of living are made with power generated from coal!

So it's important to every one of us that America's coal resources are so large that they are virtually inexhaustible—that America's 5,000 privately managed and competitive coal companies have developed the most productive and efficient coal industry in the world!

**FOR ECONOMY AND DEPENDABILITY**  
**YOU CAN COUNT ON COAL!**

envisioningtheamericandream.com  
TIME, JULY 28, 1952 75

## How to buy oil!

- cheaper
- cleaner
- quicker



A Department of National Coal Association, Washington, D.C.

# STOP!

for

# SHELL MOTOR OIL

at the Red Cabinet



*Cheaper - Cleaner - Quicker - Better*

Questions?