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

Kishan Sthankiya*, Nagham Saeed§, Greg McSorley^,
Mona Jaber*, Richard G. Clegg*

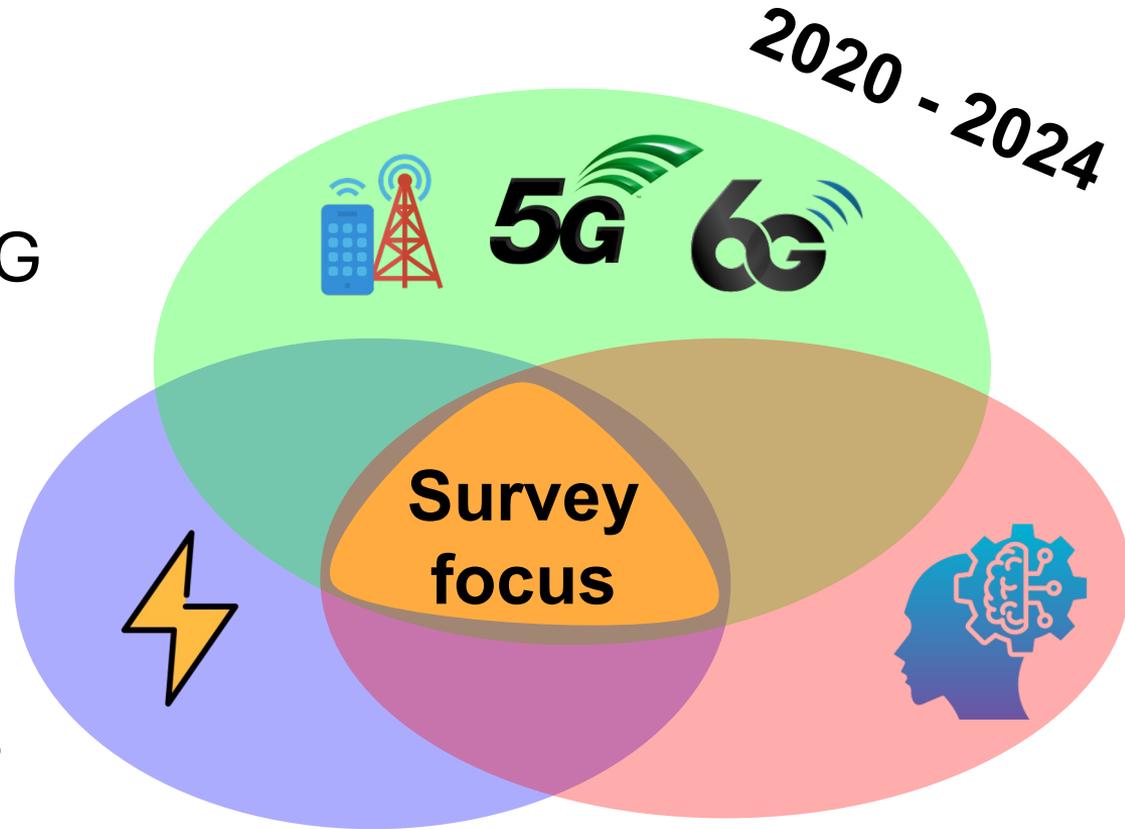* Queen Mary University of London
§ University of West London
^ BT Research

Introduction
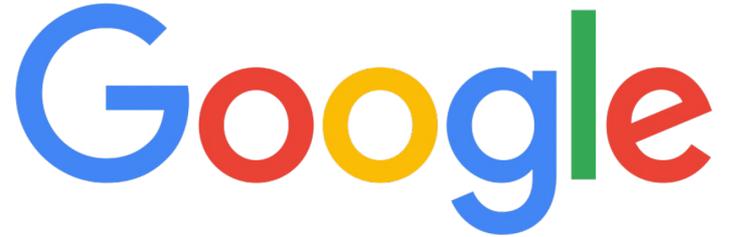
Survey to assess:

- Energy impact on 5G by AI algorithms.

- Operational cost of AI.

- Does the AI cost more than it saves?

2020 - 2024

Survey focus
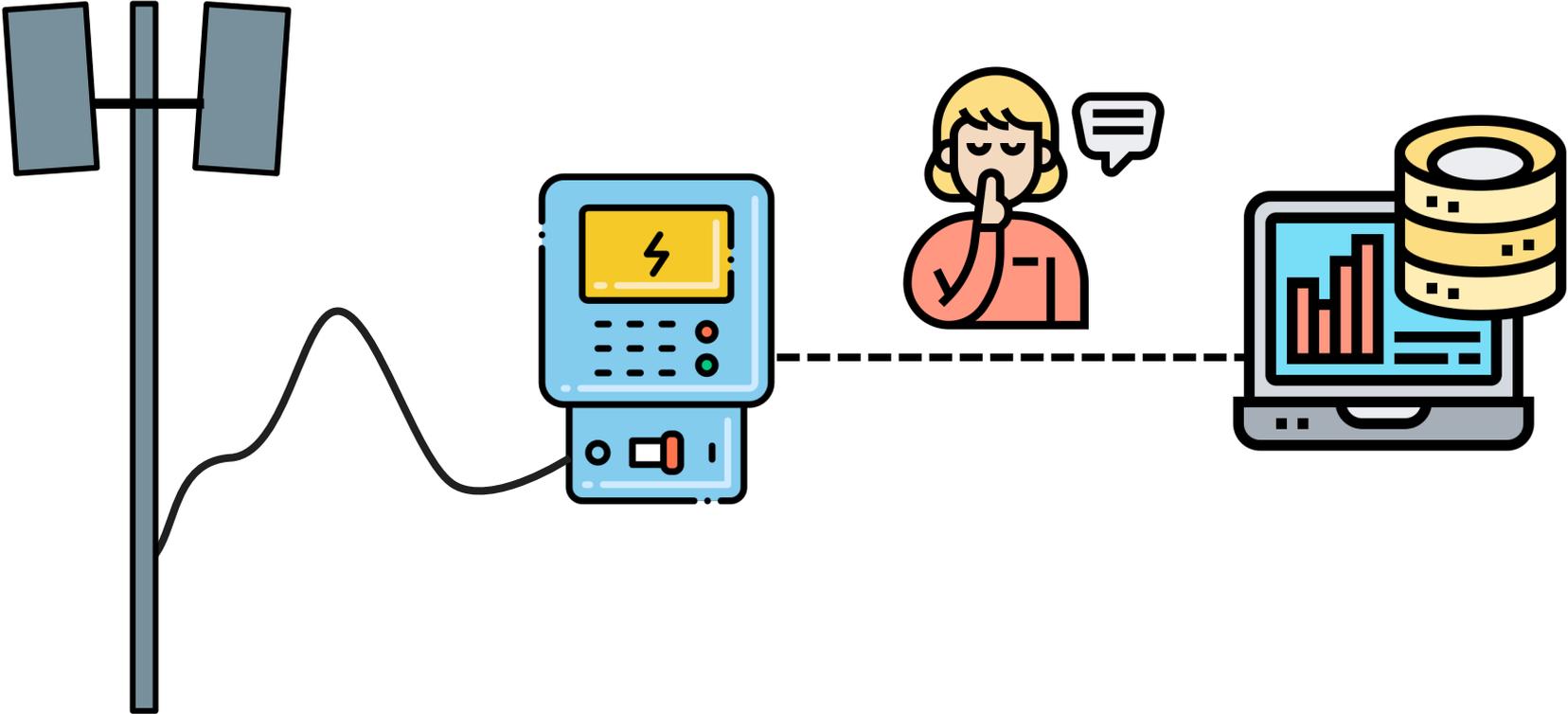
Motivation

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

Data

Blank

Reference signal

ON OFF

time

Sleep modes

Power allocation

UE

UE
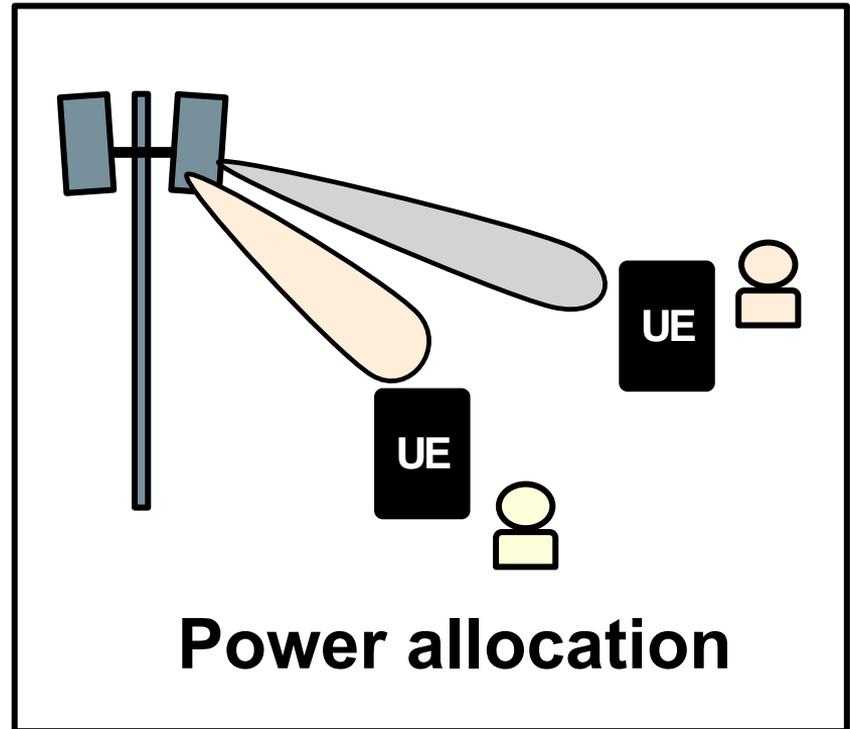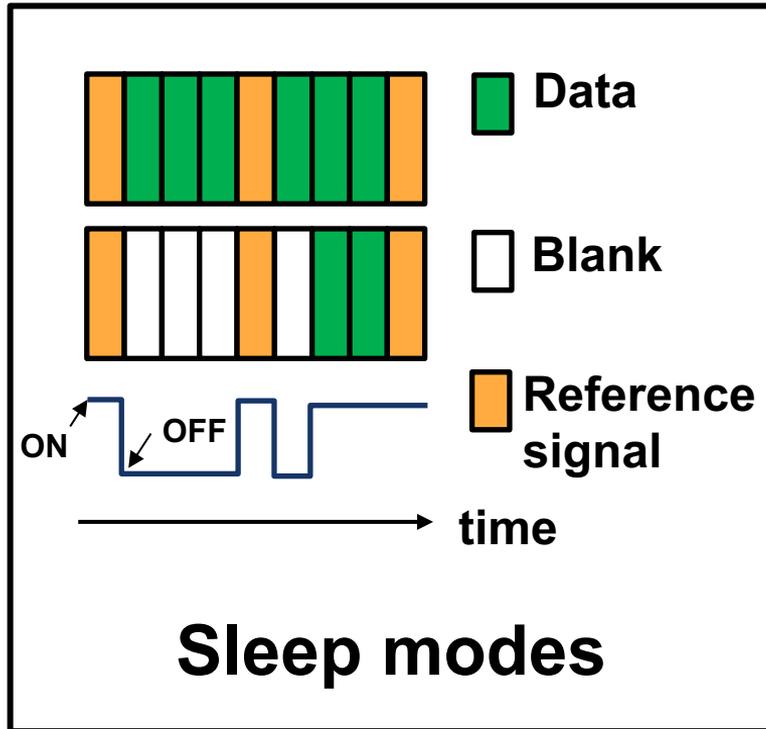
Question #1

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

Question #2

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

Observation #2

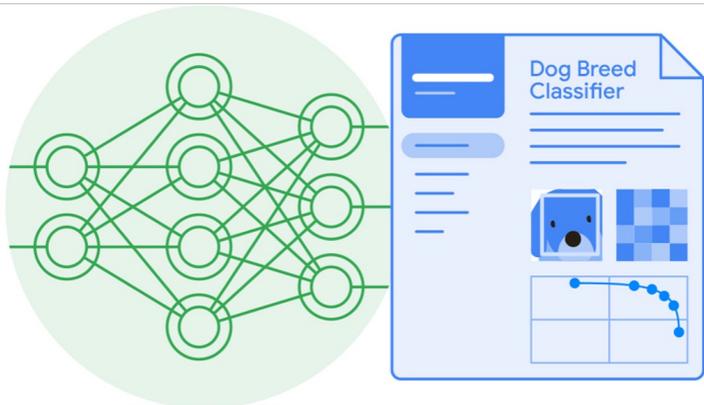## No standard algorithm performance metrics that incorporate energy.

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

Suggestion #2

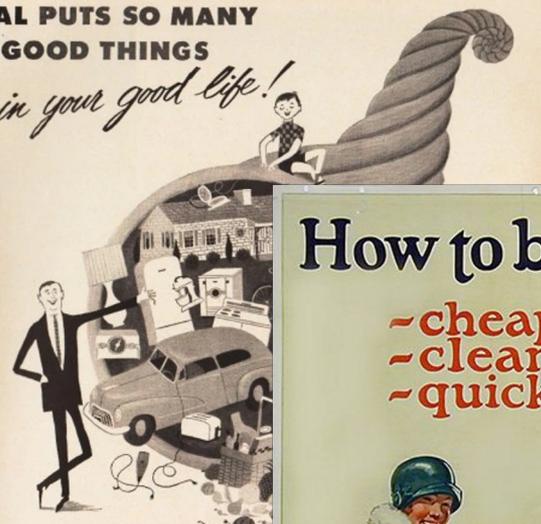**Model Report Cards**

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

Questions?