

GREENDAYS 2025 @RENNES



UNIVERSITÉ
DE LORRAINE



Inria



UNRAVELING THE ENERGY FOOTPRINT OF DEEP LEARNING MODELS DEVELOPMENT



Constance Douwes

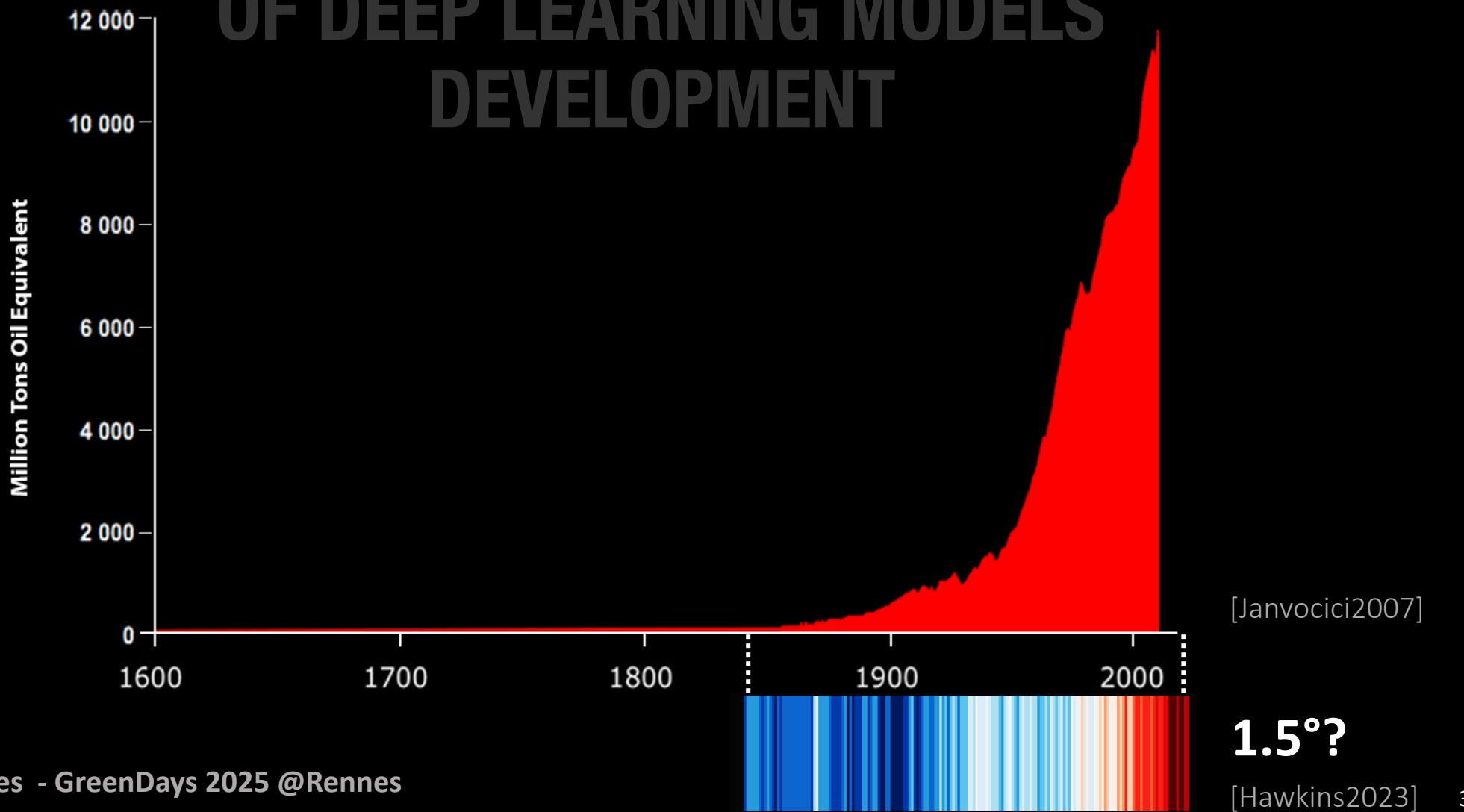
Jean-Eudes Ayilo, Can Cui, Paul Magron, Mayank Mishra, Romain Serizel

Inria (Nancy), LORIA, University of Lorraine, CNRS, LORIA (FRANCE)

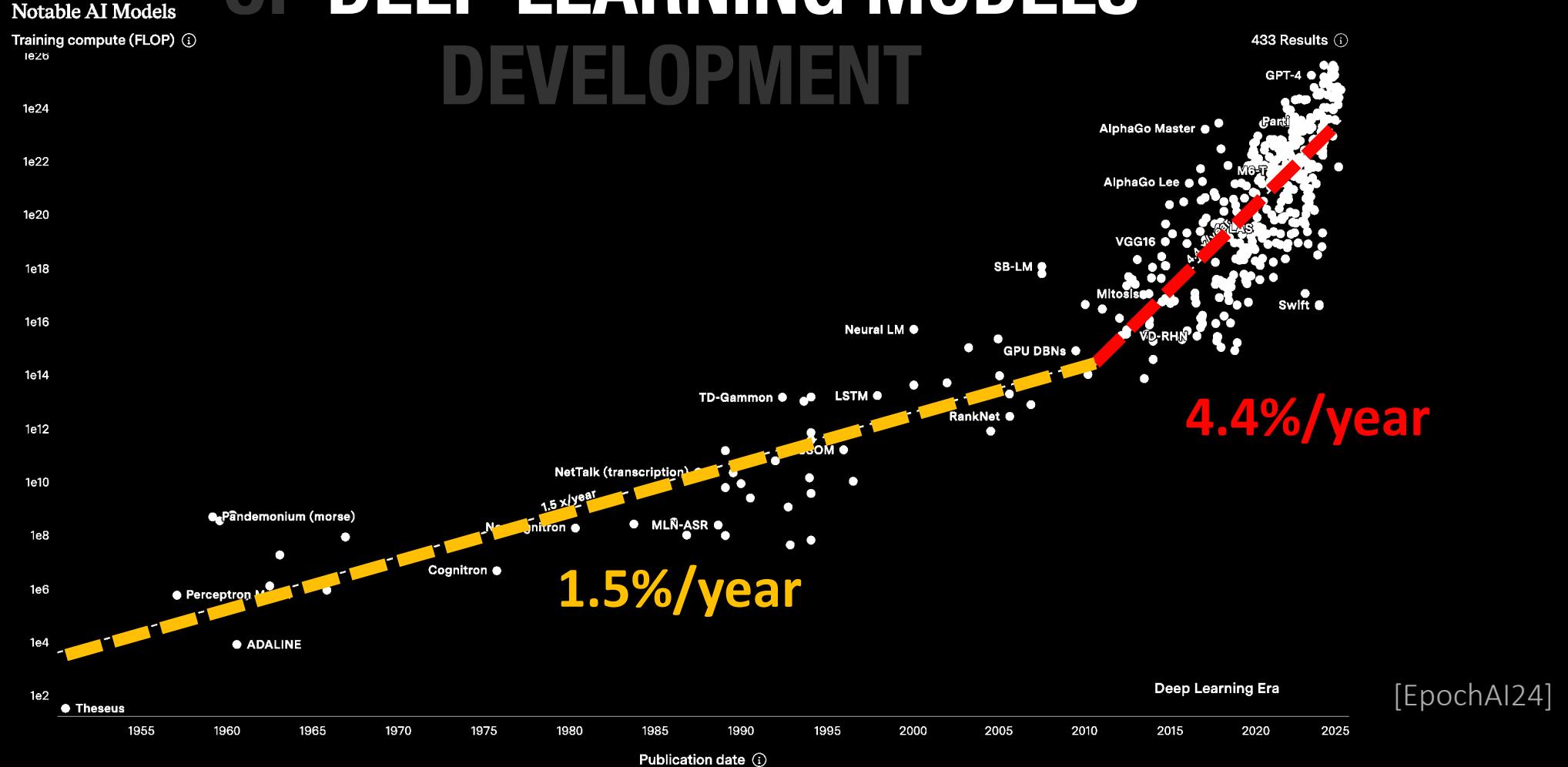
& MULTISPEECH

UNRAVELING THE ENERGY FOOTPRINT OF DEEP LEARNING MODELS DEVELOPMENT

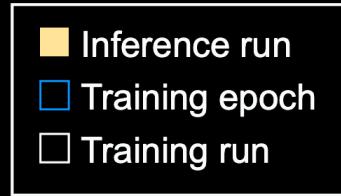
UNRAVELING THE ENERGY FOOTPRINT OF DEEP LEARNING MODELS DEVELOPMENT



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Energy per run

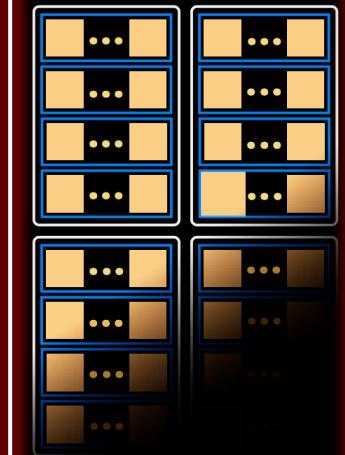
Inference



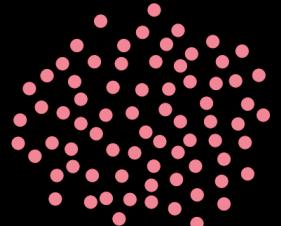
Training



Development



Frequency of runs



Very frequent



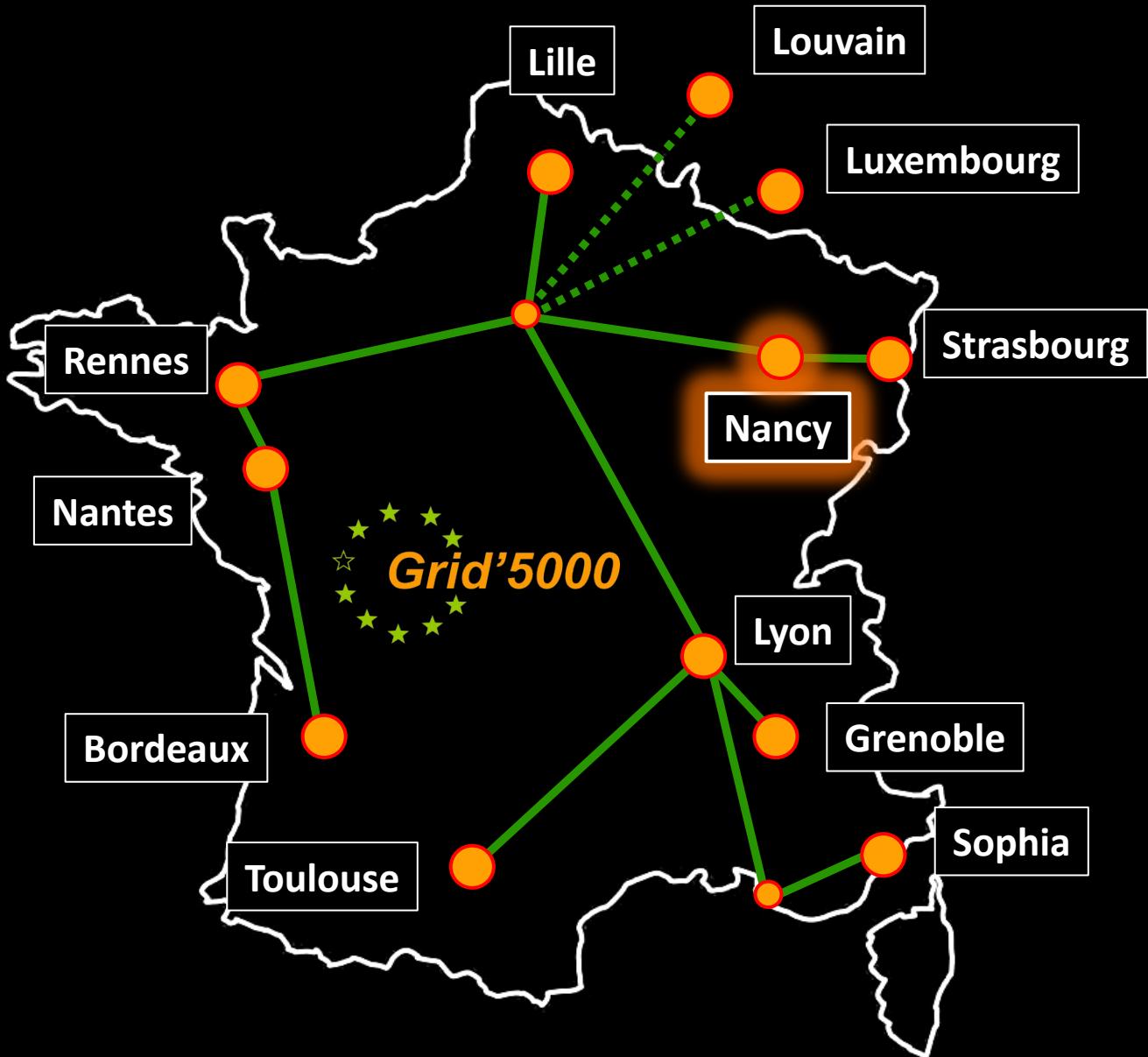
Frequent to infrequent

Infrequent to rare

[Haack21]

EXPERIMENTS



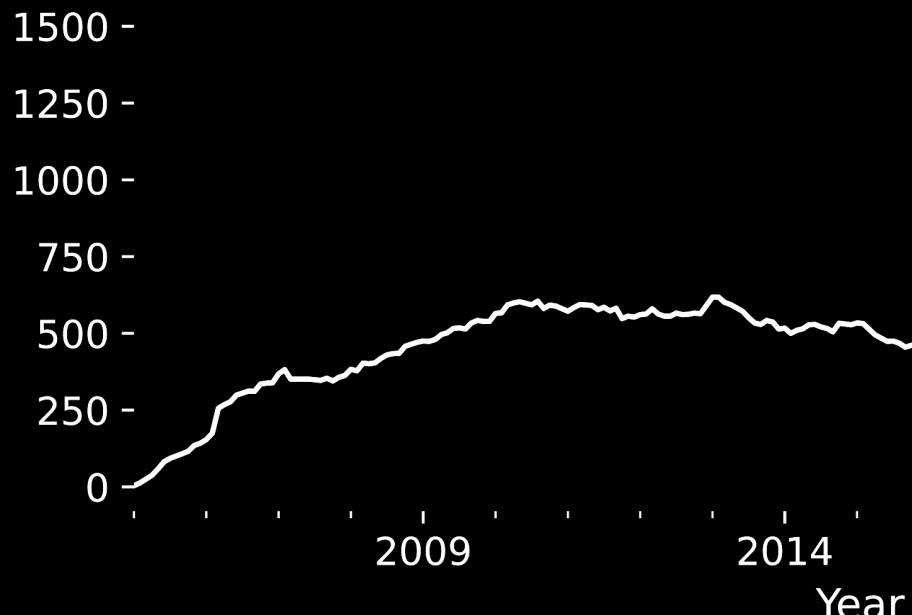


Active users over the last 12 months



<https://intranet.grid5000.fr/stats/>

Active users over the last 12 months



<https://intranet.grid5000.fr/stats/>

1666 users/y



2019

~1M JOB/y



GA.

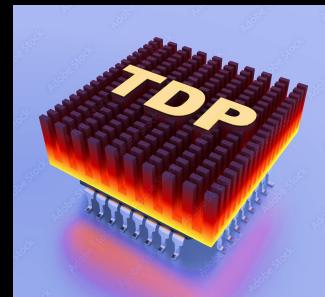
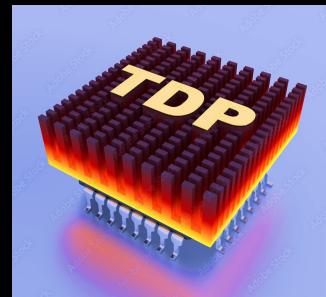
Green Algorithm

[Lannelongue21]

BMC.

Baseboard Management Controller

$$\text{Energy} = (P_{\text{GPU}} + P_{\text{CPU}} + P_{\text{MEM}}) \times \text{Hours}$$



3W /
8Gb

GA.

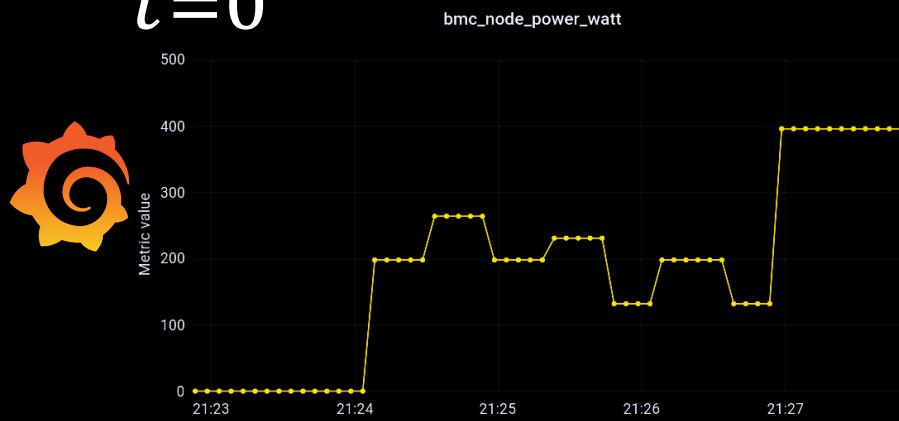
Green Algorithm

BMC.

Baseboard Management Controller

[Kwollect]

$$\text{Energy} = \sum_{t=0}^T P_{\text{BMC}}(t) \times t$$



GA.

Green Algorithm

BMC.

Baseboard Management Controller

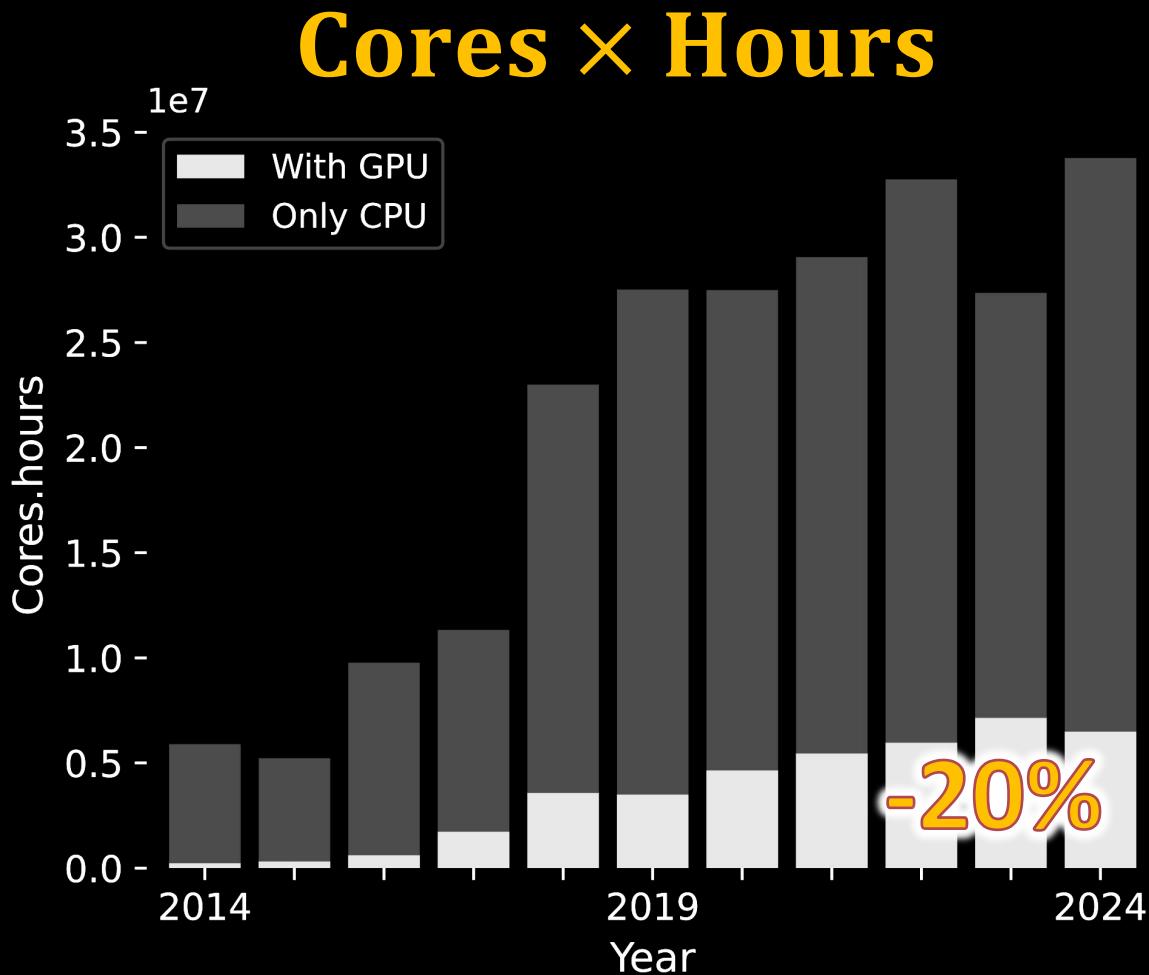
[Kwollect]

$$\text{Energy} = \sum_{t=0}^T P_{\text{BMC}}(t) \times t \times \text{Gate}(t)$$

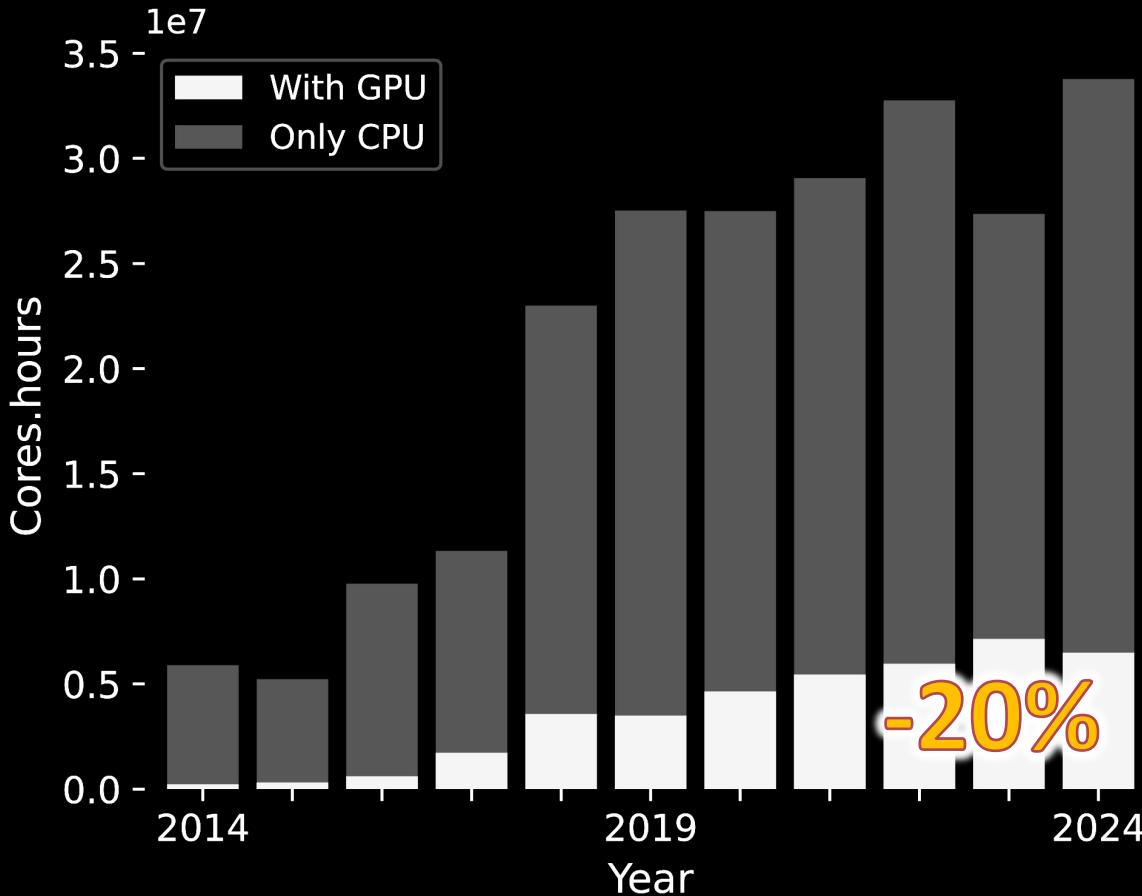


RESULTS

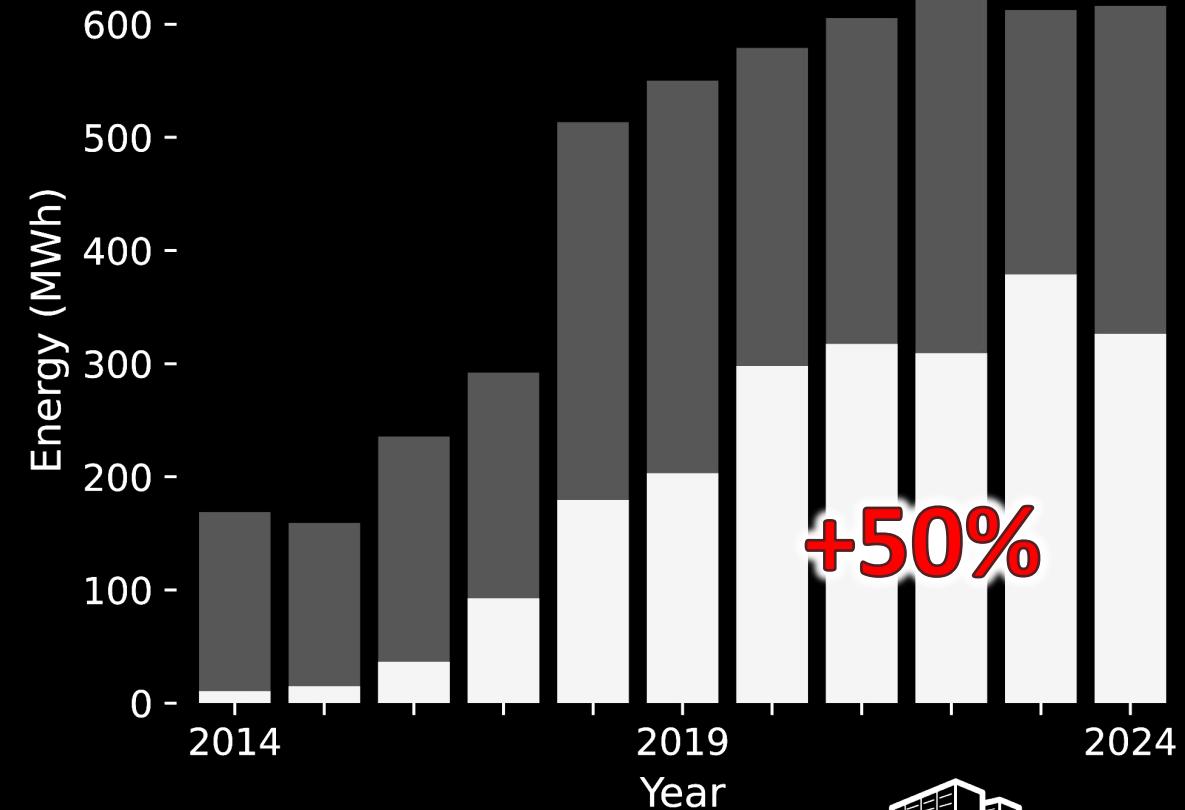


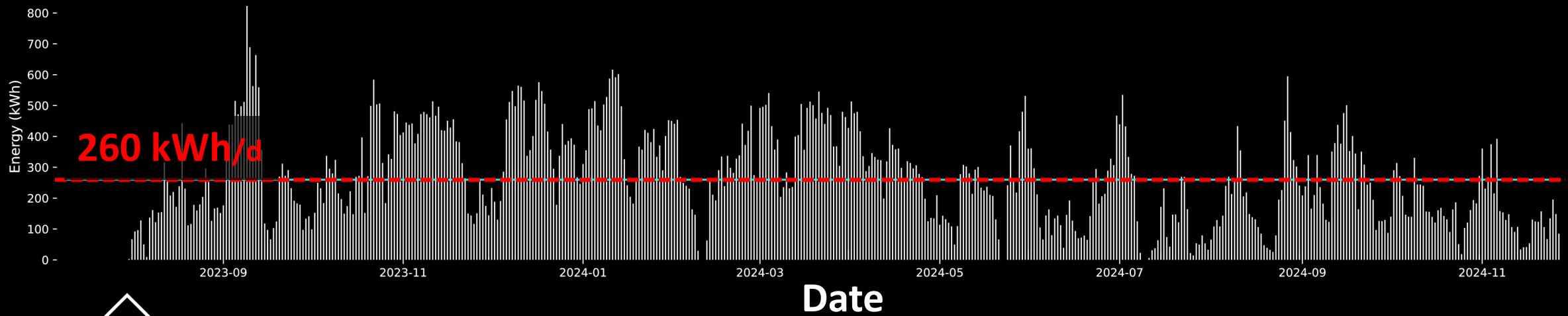


Cores × Hours



Energy

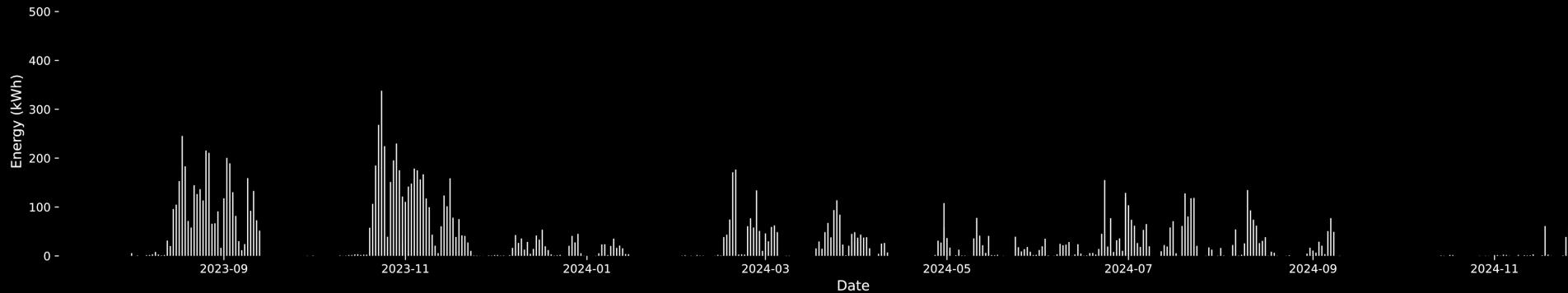




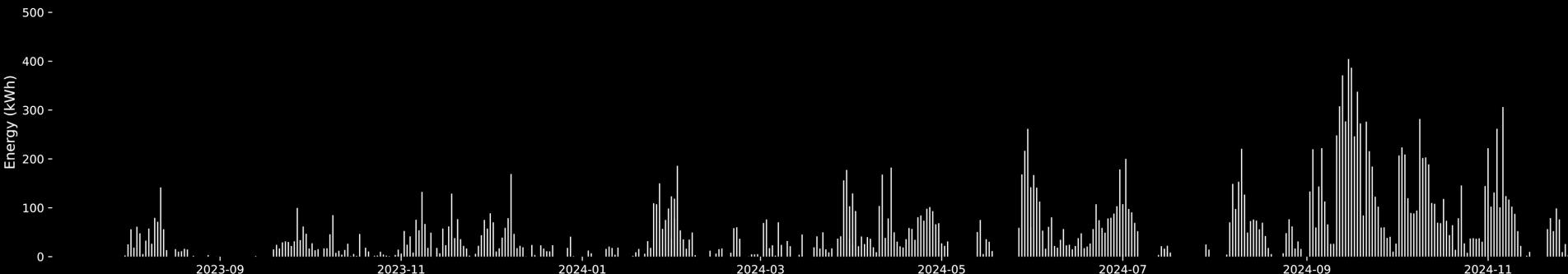
~50 households



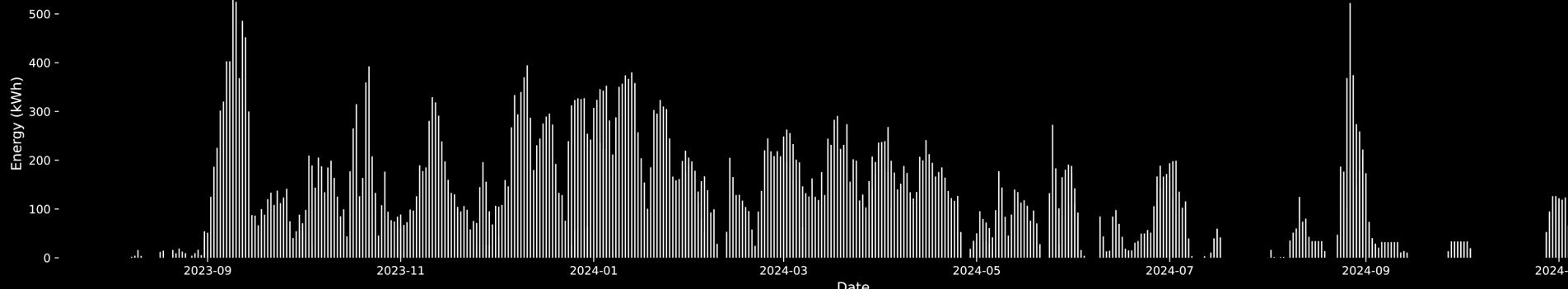
User 1



User 2

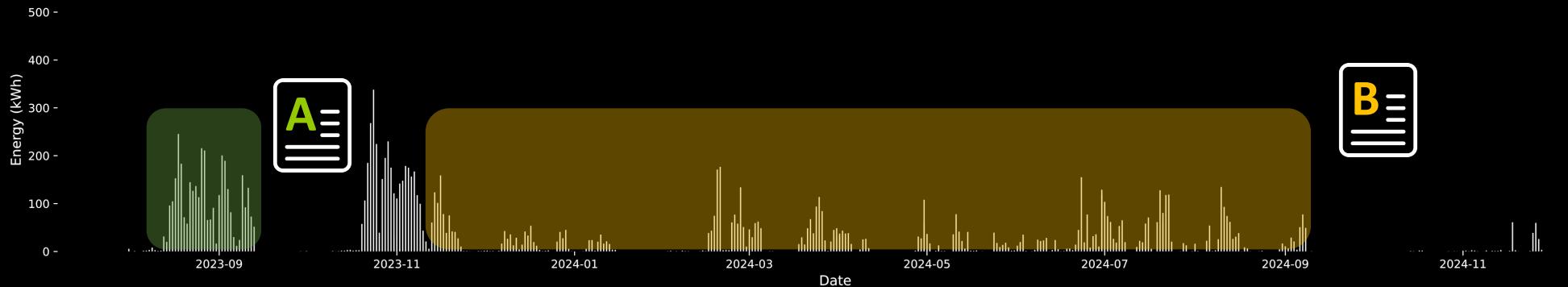


User 3

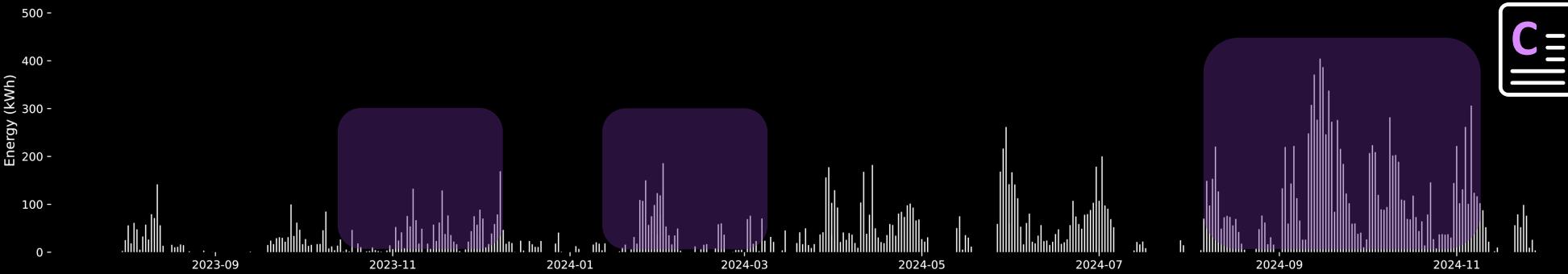




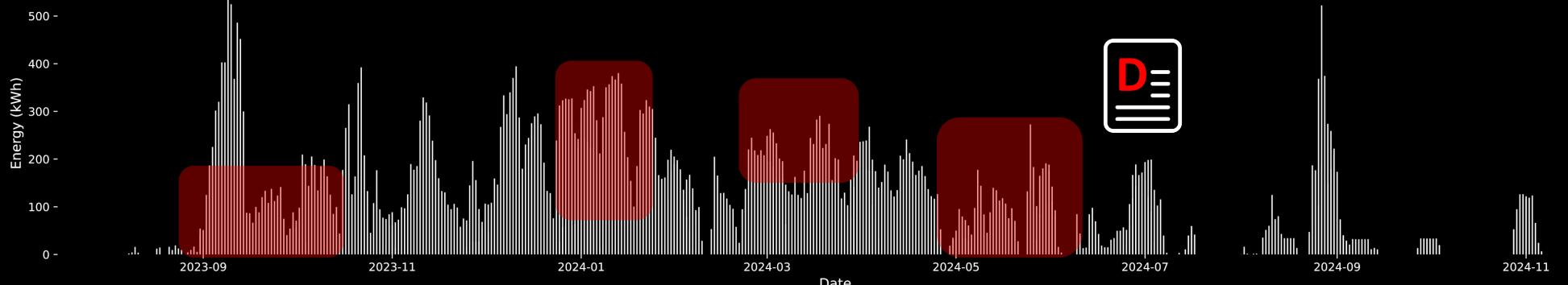
User 1

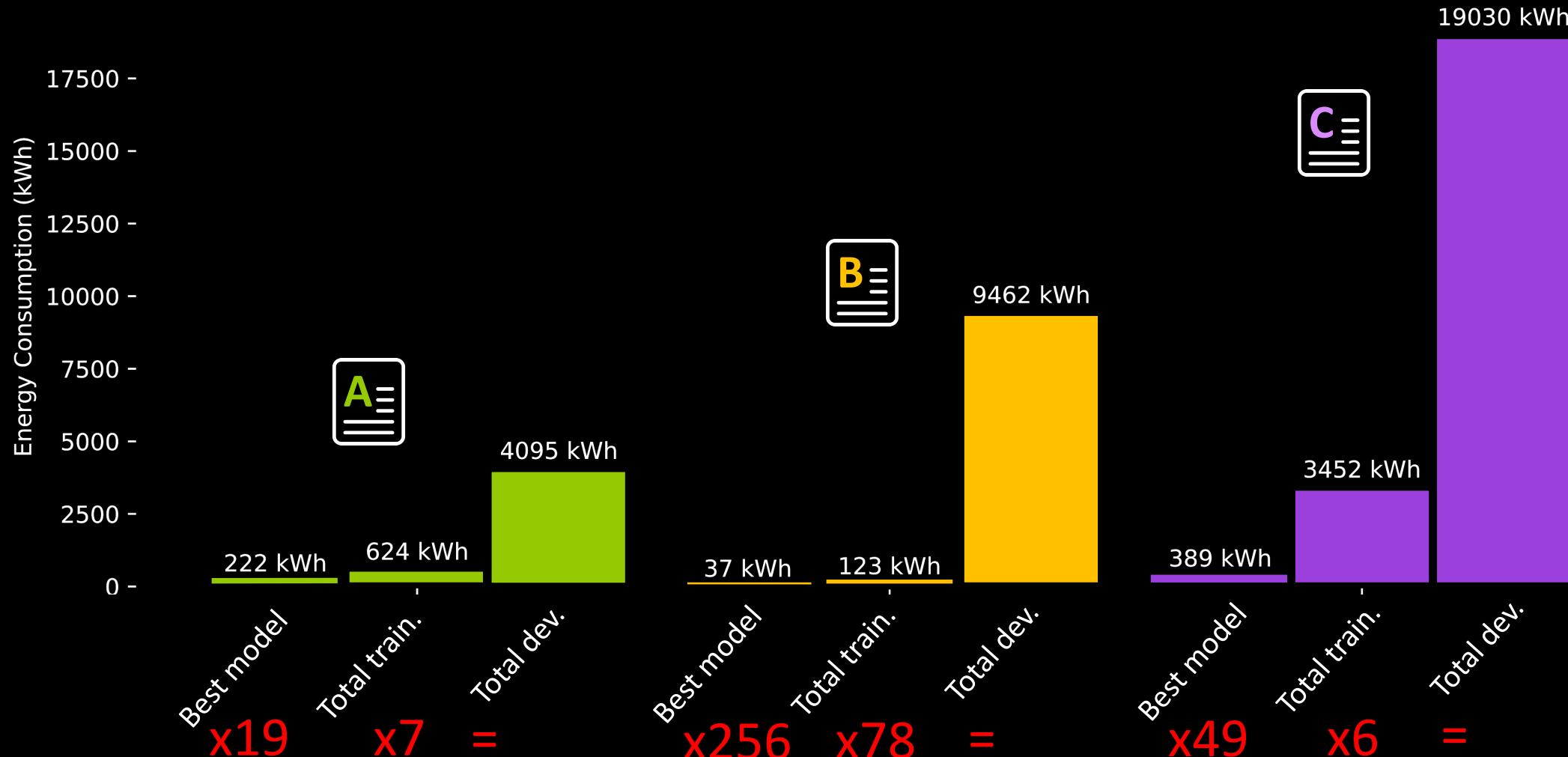


User 2



User 3





CONCLUSION & FUTURE WORK



1. Grid5000 Nancy consumes **600 MWh/y**, with GPUs using half.
→ Include offset energy from idle unused hardware.
2. Multispeech project consumes **260 kWh/d** on GPU.
→ Apply to other (DL-intensive)-team project
3. Development phase equals **49x–256x** training best model
→ Develop a tracker to facilitate data collection and reporting

& publication & code online soon ☺

Some guidelines...

- 1.** Use more **energy-efficient** hardware ?
→ Manufacturing cost & rebound effect
- 2.** Run experiments on **lighter** models & **small** dataset size ?
→ Multiplication of experiments & rebound effect
- 3. Publish it !!**

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Thanks !



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