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Simulating the Carbon Cost of Grid Sites

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We present first results from a new simulation of the WLCG Glasgow Tier-2 site, designed to investigate the potential for reducing our carbon footprint by reducing the CPU clock frequency across the site in response to a higher-than-normal fossil-fuel component in the local power supply. The simulation uses real (but historical) data for the UK power-mix, together with measurements of power consumption made at Glasgow on a variety of machines, and is designed to provide a tool to inform future procurements and the operation of sites. The output of the simulation, combined with considerations of embedded carbon, can also be used to inform and optimise the policy for replacing older hardware with more energy efficient devices. The rate of transition to more energy efficient hardware must be balanced against the embedded carbon in the manufacture of new machines, and frequency modulation must be balanced against both the loss of site throughput and the accounting of embedded carbon. Frequency modulation can also be used to reduce power requirements to address short-term supply issues, irrespective of the carbon content.

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