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UC Carbon Neutrality Initiative Fellowship Program

University of California, San Francisco

Office of Sustainability

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Project proposal

Project title: “Quantification of MRI energy demands: a pilot study evaluating potential for energy savings”

Background and significance:

Although medicine is the practice of treating illnesses, it has the potential to leave indirect harm to the surrounding population. Research this year shows that the US health system is the 7th largest producer of carbon dioxide in the world.¹ Healthcare in the US emitted 10% of all carbon dioxide in the year 2011, which equates to 10% of premature deaths attributed to pollution that year (20,000 of a 200,000 total deaths).^{2,3} At UCSF, diagnostic and therapeutic imaging services require the most energy intensive equipment, specifically MRI machines. Despite being a key factor for significant energy consumption, research and strategies for MRI energy efficiency has yet to be done. This project aims to define the current energy use for MRI machines at UCSF and identify strategies for lowering energy consumption. The data from this project can help persuade manufacturers to prioritize energy efficiency and inform future MRI upgrades throughout the UC health system.

Objectives:

This project aims to reduce carbon emissions in healthcare by elucidating strategies for energy conservation by targeting the highly energy intensive service of medical imaging. It is in line with the goal of achieving net zero greenhouse gases from UCSF by 2025. Specifically, the goals of this project include determining energy needs from UCSF’s high-use MRI machines, valuable data that has not been easily available in the public domain. In addition, the project will investigate new MRI machines with energy saving modes utilized at our partnering hospitals and industry sites in order to provide data that steers industry and healthcare to valuing sustainability.

Methods and expected outcomes:

Metering of designated MRI machines will be performed. Approval and support from UCSF Department of Radiology has been achieved, and a contracted technician will read the power output for the MRI machines. Data will be recorded as the integral of power with respect to the time, or average power ratings. We plan to meter one MRI from each manufacture that we own at UCSF (Philips, Seimens, and GE Healthcare). MRI machines have several modes (i.e. off, ready-to-scan, scan, low power), and we will determine the energy usage and time spent in each mode. We will also determine what MRI protocols (i.e. head, spine, abdominal, knee) are most common and their sequence time and energy needs. We plan to partner with our affiliated hospitals (other UC hospitals, Kaiser, and directly with manufacturers) to perform the same calculations on MRI models with energy saving features for comparison. This project will report the power measured in all MRI modes, the

duration of each mode, and the energy consumed per sequence and with overall use at a tertiary care hospital.

References:

1. Blumenthal, David; Seervai, S. U.S. Health System Will Need to Adapt to Climate Change - The Commonwealth Fund. at <http://www.commonwealthfund.org/publications/blog/2018/apr/health-system-and-climate-change>
2. Eckelman, M. J. & Sherman, J. D. Estimated Global Disease Burden From US Health Care Sector Greenhouse Gas Emissions. *Am. J. Public Health* **108**, S120–S122 (2018).
3. Chung, J. W. & Meltzer, D. O. Estimate of the Carbon Footprint of the US Health Care Sector. *JAMA* **302**, 1970 (2009).