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Accelerating the Deployment of Renewables with Computation

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Dr. Grimshaw received his BA from UCSD in 1981, his PhD in Computer Science from the University of Illinois in 1988, and then joined the Department of Computer Science at the University of Virginia. In his 34-year career at Virginia, Grimshaw focused on the challenges of designing, building, and deploying solutions that meet user requirements on production super computing systems such as those operated by the DoD, NASA, DOE, and the NSF. In addition to his academic career, Dr. Grimshaw has been a founder, or very early employee, of three startups: Software Products International, Avaki, and Lancium. Dr. Grimshaw retired this year from the University of Virginia to join Lancium and participate in their transformative mission to change how and where computing is done while decarbonizing the electrical grid.

Abstract

Every MWh of electricity produced in the US today leads, on average, to 0.7 metric tons of CO_2 emissions. That's the bad news; The good news is that renewable, carbon-neutral generation is now the least expensive means to produce electricity in the world. This has led to the development of tens of gigawatts of wind and solar capacity in the US. In West Texas alone, there is now so much excess power that wind and solar resources are often curtailed, leaving terawatt-hours of potential power unused.

In short, generating sufficient power with renewables is no longer the problem. Instead, the problem is leveraging this power. There are two significant challenges. First, the sun does not always shine, and the wind does not always blow, meaning that the current design of the electrical grid will have to change to accommodate fluctuating generation. Second, the best wind and solar sources are not proximate to sources of load, namely, population centers and heavy industry.

One way to address this second problem is to identify energy-intensive, economically viable industries, that can be feasibly moved to where the power is plentiful and that can accommodate the large amounts of variable generation provided by renewable energy. Computation, including Bitcoin, fits these requirements: computation turns electricity into value and requires only power and networking to operate. Computation can be paused, restarted, and migrated between sites in response to differences in power availability. In essence, data centers can act like giant batteries and grid stabilizers, soaking up power and delivering value when renewable sources are pumping out lots of power, and reducing consumption and stabilizing the grid when renewable sources are limited.

In this talk I begin with some electrical grid basics, stability, primary frequency response, ancillary services, and the Texas CREZ line. I then show how Bitcoin and computation more generally can be used as a variable and controllable load to stabilize the grid, consuming energy when it is inexpensive, and dropping load and releasing energy back to the grid (i.e. humans) when energy prices are high. Further, buying TWhs of otherwise unused energy causes renewable energy generation to become more profitable by providing a stable base load, spurring further renewable energy projects. This in turn increasing the availability of renewable energy even on cloudy and windless days.

Zoom Link

https://bit.ly/HDSI-Seminars

In Person Location

SDSC Auditorium E-B210-212
10100 Hopkins Drive, La Jolla, CA 92093
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