Harvard Kennedy School Energy Policy Seminar Series, Fall 2014
How important is energy storage for decarbonization?

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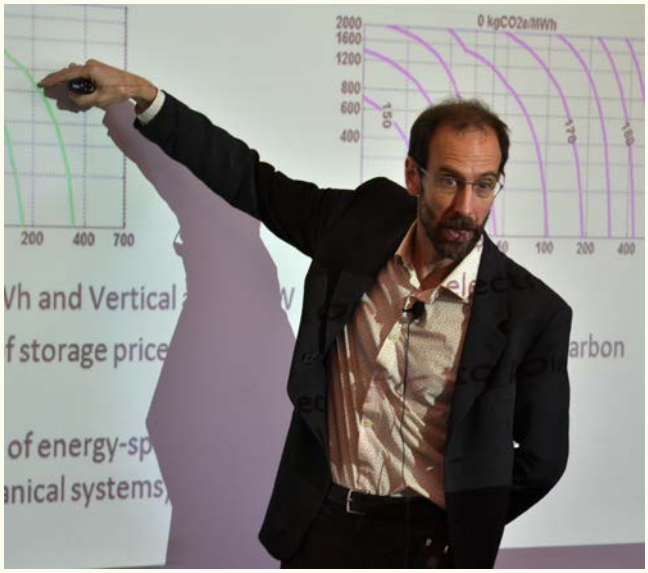
"Renewables do not need to wait" for the development of cheaper bulk energy storage technologies, argued David Keith, Gordon McKay Professor of Applied Physics at Harvard's School of Engineering and Applied Sciences and Professor of Public Policy at the Harvard Kennedy School, in Monday's energy policy seminar. Taking on the conventional wisdom that an electricity system with a lot of renewable energy will also require a lot of bulk energy storage capacity, Keith presented the results of his energy system modeling, which suggest that "large-scale bulk energy storage is neither technically required nor cost effective to substantially cut emissions."

Keith modeled a simplified version of optimal electricity dispatch (omitting complicating factors like transmission constraints) to see how much storage would be included in the system given varying carbon emission limits and varying costs of storage, assuming a requirement that the amount of greenhouse gas emitted per megawatt hour be cut by 70% compared to today. Keith used the model to examine how storage would be used both in the case of current storage costs, and in a hypothetical future case in which energy storage costs had decreased by 50%. He reported the following main findings:



- Even under the model's fairly strong carbon constraints, gas can play a significant role in managing the variability brought into the system by the use of wind and solar resources, minimizing the importance of cheap bulk energy storage;

- The impact of storage cost breakthroughs on the overall cost of the electricity system is unlikely to be dramatic. In Keith's model, even steep reductions (50%) in the cost of bulk energy storage lowered overall electricity prices by only a modest amount—reaching a high of a 10% cost reduction in the most extreme emission reduction scenario (in which emissions were reduced to zero);

- The largest impact of cheap electricity energy storage is that in scenarios with cheap storage available, wind energy plays a larger role, taking the place of other low-carbon energy sources like nuclear and solar energy.

- With current technologies, mechanical systems for energy storage (for example, pumped hydro or compressed air energy storage) are much more competitive than battery systems.

Keith noted that his model focused only on the role of bulk storage in integrating renewables into the electricity system—not only any other potential uses for storage, such as providing regulation services.

Keith's talk was part of the Kennedy School's Energy Policy Seminar Series, which is jointly sponsored by the Energy Technology Innovation Policy research group of the Belfer Center for Science and International Affairs and by the Consortium for Energy Policy Research of the Mossavar-Rahmani Center on Business and Government.