



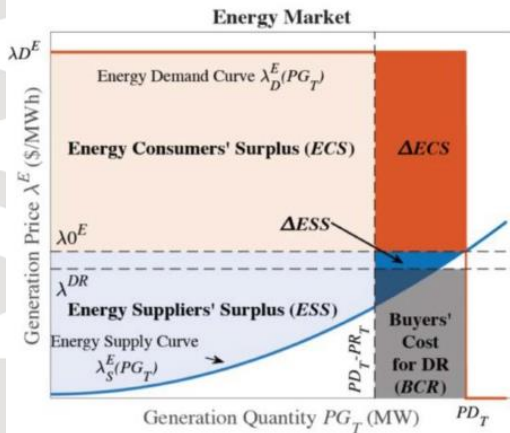
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## OPTIMIZING THE ECONOMICS OF DEMAND RESPONSE

Prof. Jessie Ma



Right now, energy generators sell their electricity to grid operators in a competitive energy market. Grid operators also oversee a parallel “demand response” procurement program, where big energy consumers like steel plants and pulp and paper mills offer to curb their electricity use during peak time — for a price.

This can take a lot of pressure off the electricity grid. It also saves money by reducing the need for the most expensive forms of electricity generation. But according to WISE researcher Jessie Ma and her Toronto Metropolitan University colleague Bala Venkatesh, the current procurement practices create economic inefficiencies.

That’s because grid operators don’t have the theoretical tools to understand what happens to the markets when demand response is purchased. Existing procurement methods do not consider key differences with conventional generators, such as the market distortions caused by formerly paying consumers leaving the buyers’ pool in the form of demand response.

So, Ma and Venkatesh proposed a way to link the energy supply market to a brand new demand response market and optimize them simultaneously, collectively maximizing the benefits for all participants. Next, they developed an optimal power flow formulation to implement their ideas in real-time markets.

Finally, they put it to the test in peak demand and light demand scenarios, using data from the electricity system that serves Pennsylvania, New Jersey and Maryland. The results clearly prove the power of this advancement in economic theory for demand response. When the two researchers crunched the numbers, they arrived at an impressive \$14.5 million to \$30.9 million in additional benefits per hour.

**Researchers:** Jessie Ma and Bala Venkatesh

**Partners:** Natural Sciences and Engineering Research Council of Canada

**Source:** Ma, J., & Venkatesh, B. (2022). New Real-Time Demand Response Market Co-Optimized with Conventional Energy Market. *IEEE Systems*, 16 (4), 6381-6392.

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