Businesses can save 30 percent on electrical bills by adjusting production schedules

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Industrial manufacturing businesses can save over 30 percent on electrical bills, and cut greenhouse gas emissions by over 5 percent, by adjusting production schedules, according to new research from Binghamton University, State University of New York.

"Manufacturing enterprises can take advantage of critical peak pricing (CPP), a demand response technology, in the transition towards smart electric grid to significantly lower their energy cost," said Yong Wang, assistant professor of the systems science and industrial engineering at Binghamton University's Watson School of Engineering and Applied Science. "They can do all of this while contributing to reducing greenhouse gas emissions, too."

Wang's results are available in the upcoming August edition of *Applied Energy*, in the paper "Critical peak electricity pricing for sustainable manufacturing: Modeling and case studies," which is now available online. Assistant Professor Lin Li from the Department of Mechanical and Industrial Engineering at the University of Illinois at Chicago is a co-author.

The pair studied electrical CPP rates over the last 10 years in California for business applications, with a focus on industrial manufacturing customers. They determined that in cases with one- or two-shift productions, a company could save 30.45 percent on its electric bill by rescheduling work patterns around announced critical-peak (high demand) electrical events, like hot summer afternoons. A byproduct of

less electrical demand is a cut in greenhouse gas emissions of 5.63 percent.

Not all electricity consumption in California is the same. In areas such as San Diego, there are two dynamic ways utilities charge businesses for electricity usage during times of high demand. Some use Time of Use (TOU) pricing, which typically applies to usage over broad blocks of hours (e.g., on-peak = six hours for summer weekday afternoons; off-peak = all other hours in the summer months) where the price for each period is predetermined and constant. The time and pricing blocks are kept unchanged every workday for a season or a year.

Others use CPP, which is more flexible. Specific dates for a critical-peak event (there is a maximum that can be scheduled in a year) are announced to customers 24 hours before the event occurs. During the critical-peak event, electricity use rates can be ten times higher, however, customers are offered discounted prices during other days of the year. Setting work schedules to use as little machinery and electricity as possible during CPP events enables businesses to significantly reduce their total electric bill.

"Manufacturing businesses are more energy intensive than residential homes," said Wang. "Industry often runs multiple shifts and have less flexibility with production processes than residential appliances such as air conditioners, refrigerators, washers, dryers and ovens. It is challenging to simultaneously coordinate production activities, energy consumption and environment impacts to achieve manufacturing sustainability. With the new development of smart grid technologies, new financial and environmental opportunities have emerged."

There are caveats to the findings.

"Whether a manufacturing customer will experience a saving or a loss on

the average annual electric bill when choosing one rate over the other depends on whether they have the flexibility to shift production so the electric use during the high-cost periods can be at least partially avoided," Wang said in the conclusion of the paper.

Despite the potential benefits for one- and two-shift productions, Wang advocates for a case-by-case analysis before implementation—the average electric bill and vicarious diminished emissions output of three-shift production sites cannot be lowered through rescheduling the whole block of production only. He indicates that intelligent scheduling strategies that involve delicate adjustments of individual processes may create additional production flexibility and make these benefits achievable.

More information: Yong Wang et al, Critical peak electricity pricing for sustainable manufacturing: Modeling and case studies, *Applied Energy* (2016). DOI: 10.1016/j.apenergy.2016.04.100

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