Generators that relieve power grid worsen ozone pollution

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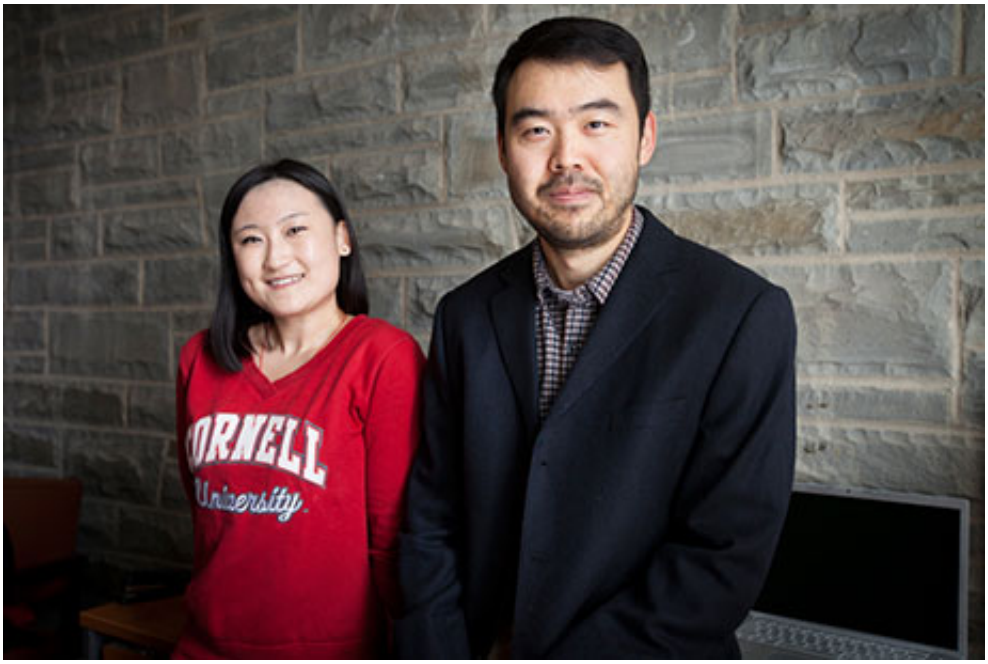

Max Zhang and Xiyue Zhang (no relation) examined how firing up diesel backup generators in non-emergency situations could boost atmospheric ozone concentrations due to additional nitrogen oxide emissions. Credit: Jason Koski

Cornell engineers have found that firing up diesel backup generators in non-emergency situations triggers rising atmospheric ozone concentrations due to additional nitrogen oxide emissions. They reported their findings Jan 23 in *Environmental Science and Technology*, a publication of the American Chemical Society.

During hazy, hot summer days, power systems in the Northeast experience close-to-capacity demand, putting pressure on the electricity grid. Peak electricity demand also leads to high emissions, especially nitrogen oxides, which are precursors to tropospheric ozone pollution.

"There is an ongoing debate over whether diesel emergency backup generators should be allowed to operate during peak electricity demand periods – non-emergency conditions – without proper emission regulations, and whether doing so will deteriorate air quality," said Max Zhang, associate professor of mechanical and aerospace engineering and study lead author.

As the climate changes, peak demand for electric power becomes more frequent. "We typically see high temperature, high electricity demand, high electricity prices, and high pollution levels during those periods," Zhang said. In peak demand, power system operators and utility companies call consumers to reduce their demand for help in relieving the electric burden, known as demand response programs. Throughout the Northeast, industrial and commercial entities with diesel backup generators can fire them up under those non-emergency conditions.

Analyzing data from the demand response programs from power system operators to commercial entities with generators, Zhang and graduate student Xiyue Zhang (no relation) found that the emissions from diesel backup generators (called "behind-the-meter" generators in the power industry) very likely contribute to exceedingly high ozone concentrations in the Northeast region and account for a substantial amount of total nitrogen oxides emissions from electricity generation. The emission rates from existing diesel backup generators are similar to or even exceed those from the highest emitting natural gas-fired generators.

Behind-the-meter emissions on regional ozone pollution and near-source particulate matter (PM) pollution can be unintended consequences of

demand-response programs, Zhang said. "There is a need to quantify the environmental impacts of demand-response programs in designing sound policies related to demand-side resources," Zhang said.

One solution is for a "green" demand response, which includes curtailing the demand for electricity or having properly sited diesel generators with state-of-the-art control technologies, the paper notes.

Concurrently maintaining resource adequacy for power systems and reducing emissions, "green" demand response is key to achieving the grid's reliability and protecting public health, the engineers said.

More information: "Demand Response, Behind-the-Meter Generation and Air Quality" *Environ. Sci. Technol.*, Article ASAP DOI: 10.1021/es505007m

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