Developing combustors of gas turbine engines that can burn a cleaner fuel — hydrogen enriched natural gas

Sina Kheirkhah

About the projects

To move toward greener energy, one favorable option is the decarbonization of natural gas by decreasing the amount of the major carbon containing component, methane, and replacing it with cleaner fuels such as hydrogen. While considerable progress has been made in the creation of cleaner fuels, it is still unclear how these fuels behave in existing gas turbine engines.

"Gas turbine engines are used for large scale land-based power generation and for aircraft propulsion. Right now, using hydrogen in these engines is challenging. But this is something that producers of gas turbine engines, especially Siemens Energy, are moving forward with," says Dr. Sina Kheirkhah, Assistant Professor in UBC's School of Engineering.

Kheirkhah is working with Siemens Energy Canada through a Mitacs project to understand how engineering-related equipment behave when they are operated with a new fuel — hydrogen enriched natural gas. Alongside PhD student Sajjad Mohammadnejad and Master's student Leslie Saca, Kheirkhah is interested in finding out how fast the greener fuel can burn in intensely turbulent conditions.

Importantly, the research would allow scientists and industry professionals to learn how gas turbine combustors can be re-architectured decreasing their size while maintaining their generated power. "We also want to identify and mitigate combustion instabilities that arise as a result of combustion of hydrogen-enriched natural," says Kheirkhah.

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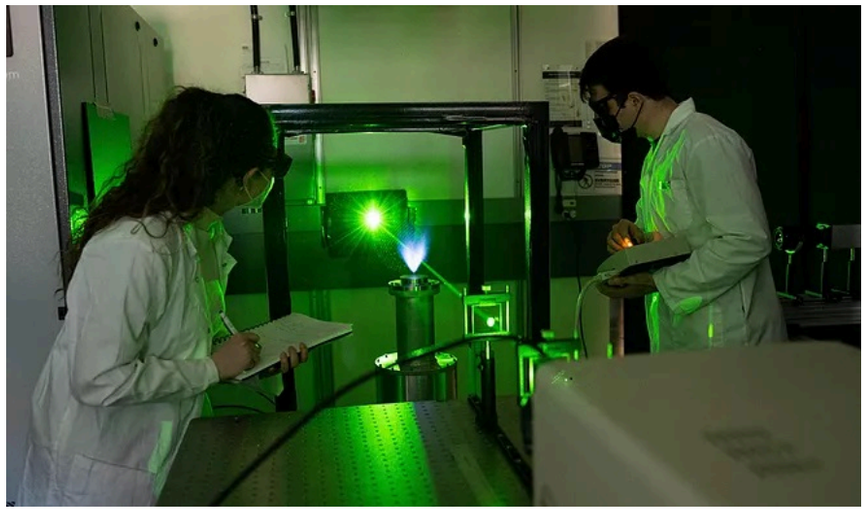
"The question that we're trying to answer is how engineering-related equipment behave when they operate with green fuels, such as hydrogen."

- Dr. Sina Kheirkhah



Project Highlight:

A new carbon dashboard, designed by UBC researchers, will provide personalised guidance to help users reduce their carbon footprint

The Team:

- Dr. Sina Kheirkhah, Assistant Professor, UBC School of Engineering (Okanagan campus)
- Sajjad Mohammadnejad, PhD Student, UBC School of Engineering
- Leslie Saca, Master of Engineering student

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Blowout and flashback are two combustion instabilities that can occur during the burning of hydrogen-enriched natural gas for energy production. In order to manage these instabilities, Kheirkhah and his group are looking into the internal structure of flames using lasers and cameras.

“In a very simple language, we blow stuff up, shoot lasers into them, and take pictures of them. Then, we perform image analysis and, based on this, we help generating technology that allows power generation and aircraft engines operate with renewable and clean fuels, such as green hydrogen.” says Kheirkhah.

Ideally, the group hopes that their project with Siemens Energy Canada will allow for gas turbine engines to efficiently use a cleaner fuel with a lower environmental impact than current petroleum based fuels.