New research initiative at Stanford to comprehensively study the use of natural gas

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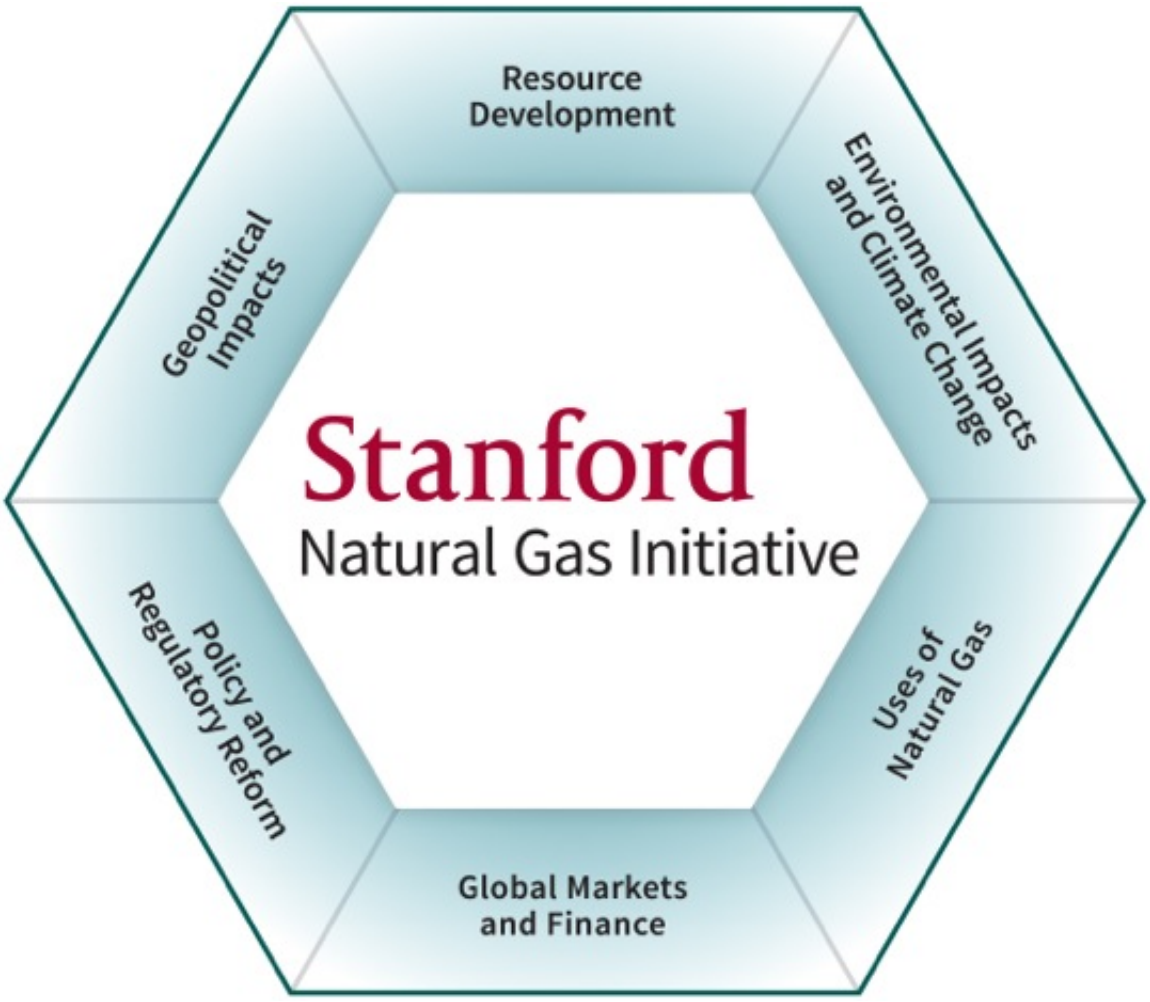

The Natural Gas Initiative will expand Stanford's research on energy and the environment by focusing additional resources on the growing importance of natural gas. Credit: Courtesy of Stanford University

In the transition to a low-carbon energy system, how can society use increasing supplies of natural gas to minimize greenhouse gas emissions, improve air quality, boost economies and strengthen energy security? Stanford University's new Natural Gas Initiative will work to answer that question, as well as myriad scientific, technological and policy questions that underlie it.

The new program will expand Stanford's research on energy and the environment by focusing additional resources on the growing importance of natural gas. U.S. production has risen almost 50 percent in the past 10 years, and global demand for gas is anticipated to outpace all other fossil fuels. More than 35 professors and research staff from a dozen Stanford academic departments have already affiliated with the Natural Gas Initiative.

'If developed in a responsible manner, natural gas can be the critical transition fuel that reduces the environmental impacts of fossil fuels and keeps us on a path toward a decarbonized energy future,' said Mark Zoback, a professor of geophysics and NGI's director.

'When electric power plants burn natural gas instead of coal, that reduces emissions of carbon dioxide and other pollutants, which are rising in many countries,' Zoback said. 'If done properly, domestic gas development can also improve energy security and boost economic growth elsewhere, as it has in North America.'

U.S. emissions of CO2 have declined to the level of the mid-1990s. Compared with burning coal, natural gas emits about half the carbon dioxide and substantially less soot, mercury and sulfur. Natural gas has also revitalized several domestic industries and reduced the U.S. trade imbalance. Idle natural gas import terminals are being retooled to export liquefied natural gas to Asia and Europe, which is looking to lessen its dependence on Russia for natural gas.

However, the technologies that have released the new supplies—hydraulic fracturing and horizontal drilling—have also unleashed anxieties about contaminated drinking water, induced earthquakes and lenient regulation. At times directly affecting residential neighborhoods, the large-scale industrial process has strained many U.S. communities. The increased use of natural gas has angered opponents of fossil fuels and heightened concerns about methane leaks throughout the U.S. natural gas production and pipeline system.

'Natural gas must be developed with safeguards to reduce impacts on water, air quality, land, nearby communities and ecosystems,' Zoback said. 'While we have to meet both short-term energy and economic needs, we also need to meet society's long-term environmental goals.'

Initial research projects funded

The Natural Gas Initiative has begun funding early stage, exploratory research, following a 'seed grant' model used by Stanford's Precourt Institute for Energy, one of NGI's hosting organizations. The program will fund interdisciplinary research in six key areas: resource development, uses, environmental impacts and climate change, global markets and finance, policy and regulatory reform, and geopolitical impacts.

'The growth of natural gas is happening, and that presents both opportunities and challenges,' said Pamela Matson, dean of Stanford's School of Earth, Energy & Environmental Sciences, which is NGI's other hosting organization. 'Stanford can bring our expertise—in engineering, geophysics, water resources, environmental science, economics, policy and law—to address the issues.'

In one of the first research projects NGI is funding, Robert Jackson, professor of environmental Earth system science, and Adam Brandt,

assistant professor of energy resources engineering, are starting to develop a more accurate, faster and less expensive method for detecting leaks of methane—a very potent greenhouse gas and the primary component of natural gas—at well pads and gas processing stations. At a natural gas field in Utah thought to have particularly high methane leakage, the investigators will couple helicopter-based infrared imaging with aircraft and ground-based estimates of methane leaks to develop software to recognize plumes. Jackson, a member of the Earth System Science Department, has mapped thousands of natural gas leaks across city streets in Boston and Washington, and published the first studies of hydraulic fracturing's impact on drinking water. Brandt, in Energy Resources Engineering, led a national study last year on methane leaks in the U.S. natural gas system.

NGI's other four inaugural research projects are:

- To aid government decision-making, John Weyant and Hillard Huntington of the Management Science & Engineering Department and Michael Wara of Stanford Law School are designing a robust structure for evaluating the opportunities, economics and environmental impacts of exporting U.S. natural gas to Europe and Asia.
- Chemical Engineering's Thomas Jaramillo is experimenting with electrochemically converting natural gas into higher-value products, like methanol. Such fuels could lower greenhouse gas emissions from transportation compared with gasoline and diesel fuel.
- Eric Shaqfeh of the Chemical Engineering and Mechanical Engineering departments and Gianluca Iaccarino of Mechanical Engineering are making a computational tool for inventing new, benign fluids for use in hydraulic fracturing.
- Eric Dunham of the Geophysics Department is developing methods for three-dimensional imaging of complex fracture

networks in order to identify the location of constrictions or regions of partial closure.

- 'Making the most of our natural gas resources and making sure they provide the environmental benefits we seek will require much more than technology,' said Sally Benson, director of the Precourt Institute for Energy and a professor in energy resources engineering. 'Good policies, international engagement and a rich dialogue with key stakeholders will be critical for success.'

Additional leadership

Bradley Ritts will be NGI's managing director. Ritts, most recently with Chevron Asia Pacific Exploration & Production Co., earned a doctorate in geological and environmental sciences at Stanford. Previously the Robert R. Shrock Professor of Sedimentary Geology at Indiana University, Ritts is a National Science Foundation CAREER grant recipient, and an expert on oil and gas exploration. Tisha Schuller, who earned a bachelor's degree in Earth systems from Stanford, will be a strategic advisor. Schuller was president of the Colorado Oil & Gas Association when that state's energy companies and the Environmental Defense Fund worked with state regulators to enact the first rules in the United States to reduce methane emissions and volatile gases.

Provided by Stanford University