

# Monitoring Methane Emissions: Addressing Climate Change

## ACTION

Members of Congress should support the Methane Emissions Mitigation Research and Development Act (H.R. 7651).

### Methane Emissions from Oil and Gas: Key Climate Change Contributor

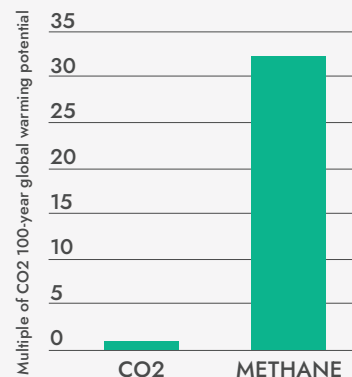
Methane (CH<sub>4</sub>) is the second-most abundant anthropogenic greenhouse gas and significantly contributes to global warming.



#### 2017 Global Methane Budget from Man-made Sources

Sources: The Global Methane Budget 2000-2017, by Marielle Saunois et al, Earth System Science Data, DOI:10.5194/essd-12-1561-2020

### 100-Year Global Warming Potential



Source: M. Etminan et al., Geophysical Research Letters 43 (2016)

*“Although the challenge of reducing methane emissions can be daunting, the results from aerial monitoring show that with a technology and data-driven approach, operators can significantly reduce emissions while simultaneously reducing costs and improving operational efficiency.”*

- Pioneer Natural Resources (major U.S. oil and gas producer; 2022)

### Opportunity for Impactful Action

Methane emissions from oil and gas production are localized, intermittent, and dominated by a relatively small number of super-emitters: less than 10% of sources of methane in oil and gas operations contribute more than half of the emissions in the sector.

### Current Monitoring Capabilities Are Ineffective

- There are no calibration standards that allow for comparison or aggregation of observations from different tools.
- Current monitoring technologies face significant technological challenges limiting their effectiveness.
- Current methane monitoring systematically underestimates emissions by up to a factor of three.

### A National Approach Is Needed for Effective Methane Emissions Reduction

The Methane Emissions Mitigation Research and Development Act addresses methane monitoring inefficiencies by:

- ▶ Building a national approach for testing and calibration of new methane monitoring technologies.
- ▶ Directing support to critical research areas essential for effective monitoring of methane emissions.
- ▶ Improving the ability of the United States to accurately estimate methane emissions nationally, which is critical to any strategy addressing climate change.

# International STEM Students: Key to American Innovation

## ACTION

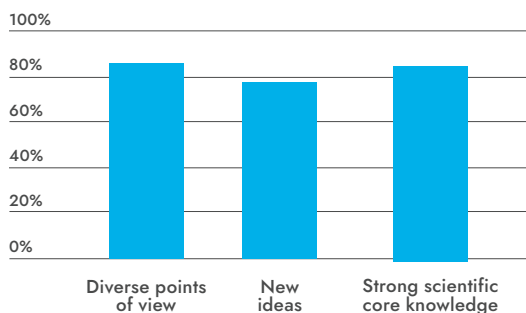
Members of Congress should co-sponsor and pass the bipartisan, bicameral Keep STEM Talent Act, which would make the United States a destination of choice for international STEM students.

### International Students Benefit U.S. Economy

- Even amid the pandemic, international students contributed nearly \$28.4 billion to the U.S. economy and supported more than 300,000 jobs during the 2020-21 academic year.
- As of 2022, one-quarter of the billion-dollar startup companies in the U.S. have a founder who first came to America as an international student.

### International Students Benefit U.S. Science

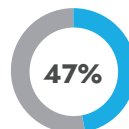
Key Contributions of International Students and Scholars, According to American Physicists



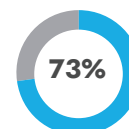
Source: APS Building America's STEM Workforce report

### U.S. Losing Ability to Attract Global Talent

Current students and early career researchers are more likely to consider leaving the U.S. than those who got their PhDs earlier.



Established International Scholars (PhD Pre-2018)

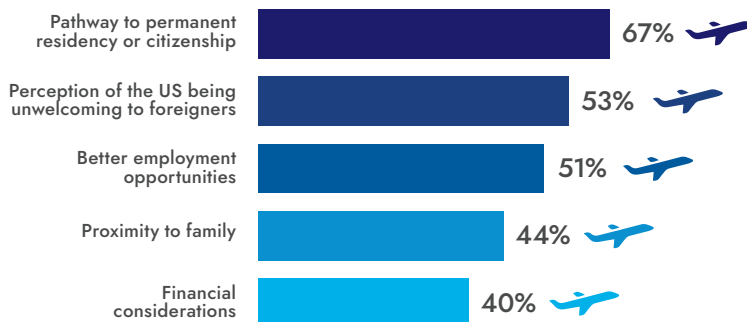


International Students & Early Career

Students and researchers considering, or have considered, pursuing a career in a country other than the U.S.

### Reported factors in considering pursuing a career in a country other than the U.S.

Percentage of respondents that chose the following options



Results from Fall 2022 APS survey of more than 200 international physics graduate students currently in the U.S. and early career professionals, i.e., APS members who are PhD graduates with fewer than five years of experience, who are working in the United States, and are holding or have held U.S. visas.

### The Keep STEM Talent Act Puts Us on the Right Track

Competition for top international students is growing. To encourage the best and brightest students to remain in the U.S. and contribute their skills to our scientific enterprise, the Keep STEM Talent Act would:

- 1. Authorize declaration of dual intent:** International students pursuing advanced STEM degrees in the U.S. could legally declare their plan to stay and pursue careers here post-graduation.
- 2. Exempt from green card caps:** International students, along with their spouses and children, would be exempt from green card caps when they earn an advanced STEM degree from an accredited U.S. institution and receive an offer of employment from a U.S. company.
- 3. Standardize the vetting process:** International students already in the U.S. on a student visa for an undergraduate program would undergo the same strengthened vetting at USCIS that the State Department currently performs for prospective advanced STEM degree students applying for a student visa from outside of the U.S.

# Investing in Our Future: Maintaining U.S. Leadership in R&D

## ACTION

Members of Congress must prioritize science when completing FY 2024 appropriations and provide robust increases to the federal science agencies in FY 2025 appropriations.

**Fundamental research is essential to U.S. competitiveness. Federal funding directly impacts the future US STEM workforce**

More than 85% of the long-term growth of the U.S. economy is attributed to advances in science and technology.

Physics research programs help generate the STEM workforce demanded by our high-tech economy. Roughly 50% of new PhDs in physics take jobs in the private sector.

## Increasing International Competition Threatens U.S. Standing as a Global Leader in STEM

Congress must fulfill the “and Science” portion of the CHIPS and Science Act to remain a global leader in science and technology. By not providing robust funding for the federal science agencies, as authorized in CHIPS, Congress will curtail opportunities for talented students and researchers.

## Continuing Resolutions Negatively Impact U.S. Science

Failing to complete appropriations for 2024 will mean:

- Fewer future high-skilled STEM workers
- Project initiation delays, allowing competitors to gain ground

## R&D Investments Fuel U.S. Competitiveness

### STEM Workforce Readiness



>40,000 grad students & 8,000 postdocs supported by research awards from NSF and DOE Office of Science in 2022

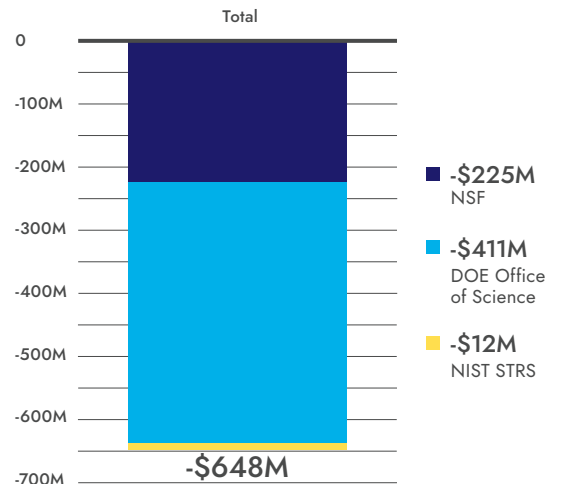
>\$3.5 Billion invested in workforce development programs (K-12, technical, high-skilled STEM) in 2017-2021

### Federal R&D Catalyzes American Innovation



>2850 startups across 50 states funded by NSF, DOE, and NIST to bring federally-funded research products to the market

## Full-year CR will forfeit significant funding for key science agencies



*Difference in funding between a year-long CR and House/Senate Appropriations Committee-approved funding levels*

## Robust Investments in Federal R&D Is Essential to Future U.S. Innovation and Growth

For the U.S. to maintain its competitiveness, Congress must pass robust and sustained appropriations increases to the federal R&D agencies for FY24 and FY25. Not investing in R&D today will create missed opportunities in critical areas that will take years, if not decades, to recover from.

# Ensuring Our Future STEM Workforce: Competitive Compensation for Grad Students and Postdocs

## ACTION

Members of Congress should support the **RESEARCHER Act (H.R.4002)** and the subsequent necessary appropriations for federal science agencies.

### More Than Coursework

Graduate students are not just passively learning. A graduate degree involves conducting novel research, requiring full-time work either in the lab, field, or classroom. **Graduate students and postdocs are a critical part of the U.S. R&D workforce.**



### Averting a Workforce Crisis

Inaction will exacerbate STEM worker shortages.

*"The growth rate of employment in STEM fields is projected to expand significantly—specifically, by 10.8 percent through 2032, compared to 2.8 percent for all occupations."*

– Bureau of Labor Statistics

*"For the semiconductor industry alone, [the] projected total gap [is] approximately 17,000 master's and PhD engineers by the end of the decade."*

– Semiconductor Industry Association - Chipping Away, 2023

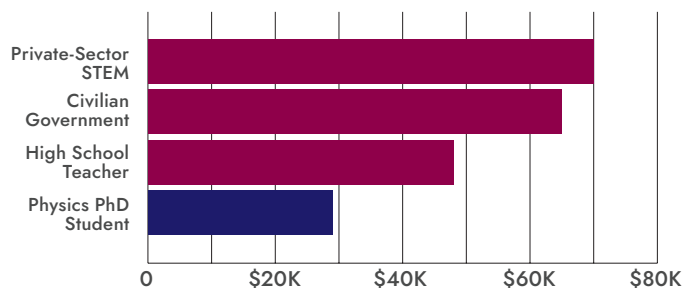
*"We are very concerned about the future of our graduate program if we cannot provide a competitive stipend."*

– U.S. Physics Department Chair

### Student Salary: Grad School Is Not Competitive

While graduate students are receiving an education, current stipend rates are a deterrent for pursuing an advanced STEM degree.

**Starting Salaries for Physics Bachelor's Degree-Holders**



*Median annual stipend of 1st year grad students at U.S. PhD-granting physics departments vs. median starting salaries of U.S. physics bachelor's degree-holders*

Source: [aip.org/statistics](http://aip.org/statistics)

### Federal Agencies Play a Critical Role

- At U.S. PhD-granting physics departments, more than half of graduate students are supported through federal research awards and fellowships.
- Standard research grants have barely budged in 20 years. What once could sustain 2-3 students now supports one or fewer.

### The RESEARCHER Act Is a Step in the Right Direction

The RESEARCHER Act will help address competitive compensation issues by authorizing data collection and directing the Office of Science and Technology Policy (OSTP) to establish uniform guidelines for federal science agencies. These agencies will then be mandated to develop and implement policies based on OSTP's guidance, which will also require appropriately augmented appropriations to achieve.

# The Technology of the Future: Securing U.S. Quantum Competitiveness

## ACTION

Members of Congress should support the National Quantum Initiative (NQI) Reauthorization Act (H.R. 6213) to safeguard U.S. national security and competitiveness.

### What Is Quantum Information Science?

Quantum information science (QIS) will revolutionize computing, communication, and sensing technologies by exploiting exotic quantum effects to circumvent “classical” physical limitations.

#### Quantum Sensing



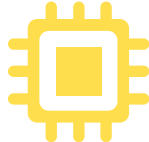
**APPLICATIONS**  
Medical imaging; positioning and navigation; enhanced lidar and radar

#### Quantum Communication



**APPLICATIONS**  
Secure communications and financial transactions; networking quantum devices

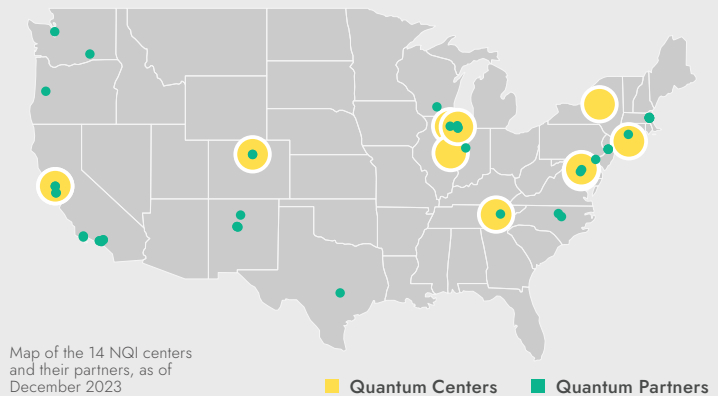
#### Quantum Computing



**APPLICATIONS**  
Materials sciences; biomedicine; financial modeling; logistics; encryption-breaking

### National Quantum Initiative Act (NQIA) Achievements Across the U.S.

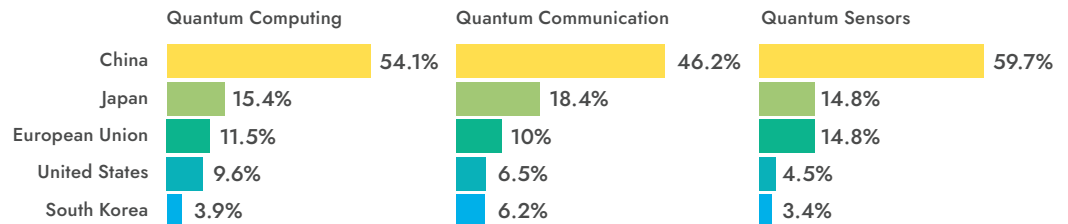
The 2018 NQIA resulted in 14 multidisciplinary QIS centers, accelerating innovation across the science agencies and training the future Quantum Workforce.



### U.S. Quantum Leadership at Risk

The 2018 NQIA laid a strong foundation for the U.S. QIS ecosystem, but competitor nations’ efforts and advances are outpacing us. Continuous robust investment is required to build the U.S. quantum workforce and improve U.S. leadership in this field.

### Percentage Share of Quantum Patents by Company Headquarters, 2000-21



Source: McKinsey Quantum Technology Monitor

### Reauthorizing the NQIA Is Essential to Securing U.S. Quantum Competitiveness

The NQI Reauthorization Act builds on the 2018 NQIA, expanding its scope to include more technology development and to strengthen the domestic supply chain. The reauthorization:

- Renews and expands existing National QIS Research Centers
- Create a multidisciplinary hub focused on quantum curriculum and workforce development, as well as quantum technology R&D testbeds
- Establishes up to 3 NIST centers on quantum engineering, sensing, and measurement
- Establishes “Quantum Foundries” at DOE to meet the device and material needs of the quantum supply chain