

bills, and spending has been frozen at FY 2010 levels.

Climate change isn't mentioned

To pay for the increases he wants for energy R&D, Obama has called for eliminating \$4 billion in annual federal subsidies that now flow to oil, gas, and coal producers. "Instead of subsidizing yesterday's energy, let's invest in tomorrow's," he challenged Congress. Pitching his new energy spending proposals in economic terms, Obama said that the increases will help US companies compete in a burgeoning global market for renewable energy that is just around the corner. Though he never mentioned the politically divisive term "climate change," the president proclaimed an overarching goal for the nation to generate 80% of its electricity from "clean" sources by 2035. That is the magnitude of change climate scientists believe will be required to avert the worst effects of climate change.

Obama created some confusion, however, over the definition of clean energy. "Some folks want wind and solar. Others want nuclear, clean coal, and natural gas," he observed in the address. "To meet this goal we will need them all."

In a conference call with reporters on 28 January, Chu said that by the president's definition, about 40% of the nation's electricity is already provided from clean sources. But that includes natural gas, which emits CO₂, albeit only about half as much as coal combustion. Chu noted that many of the nation's oldest and worst-polluting coal plants will be converted to gas-burning plants in the coming years. Although Obama didn't specify whether natural gas generation, like coal, would count

as clean only if the CO₂ is captured and sequestered, Chu indicated that would be the goal. Excluding natural gas, he said, the US now gets 30% of its electricity from carbon-free sources that include nuclear, hydroelectric, wind, and solar. Increasing that to 80% will be "ambitious," he admitted, "but is it over the top? No."

Industries, environmentalists react

Advocates for renewable energy were especially upset with Obama's inclusion of coal in his clean-energy calculus. "Excuse me, but how is coal clean?" asks Scott Sklar, chair of the steering group of the Sustainable Energy Coalition. "Even if you could sequester carbon, it emits mercury [and] carcinogens, requires much water, emits other greenhouse gases, leaves us with coal-ash waste piles, and drives the blowing-up of our mountain tops, ruining waterways and farmland."

Antinuclear forces fault Obama's embrace of nuclear energy. Thousands of new nuclear reactors will be needed to accommodate rapidly growing global energy demand, producing enough plutonium in spent fuel each year to fuel between 50 000 and 100 000 nuclear weapons, says Arjun Makhijani, president of the Institute for Energy and Environmental Research. And there still is no acceptable solution for disposing of the spent fuel. "Making plutonium in the course of boiling water is not a clean way to boil water," Makhijani says.

The major energy producers reacted along predictable lines. The American Gas Association not only commended Obama for recognizing it as clean, but suggested that gas should be added to the alternatives to oil for transportation.

The American Petroleum Institute complained that Obama had failed to recognize that new jobs would be created with increased oil development. The petroleum industry pays taxes at higher effective rates than other industries, said API president Jack Gerard, and it gets no subsidies for exploration. The tax deductions that the industry gets, such as depletion allowances and credits for enhanced oil recovery and for production from marginal oil wells, "are similar to those enjoyed by other industries to encourage energy production and new jobs," Gerard said. Nuclear Energy Institute executive vice president Alex Flint extolled Obama's plan, saying his commitment to nuclear energy reinforced bipartisan support for increased domestic nuclear generation and for exportation of the technology.

The additional R&D spending will help lower the cost of solar electricity generation to make it competitive with fossil-generated power. Chu said he hopes the new solar push, which he calls a "sun shot," will lower the cost of US-produced photovoltaics by a factor of four before 2020. That could restore the US to world leadership in PVs, a position it has ceded to Japanese, European, and, increasingly, Chinese manufacturers, he said. US companies would then be situated to reap many of the benefits of what he anticipates will soon become an enormous world market for solar energy.

"We have had our Sputnik moment," Chu said, borrowing a line from Obama's speech. "We have watched China say that everything in the energy efficiency and energy generation sector is a key industry and we want to develop it for ourselves, but we also want to export it." **David Kramer**

For underrepresented minorities, bridge programs ease transition to PhD studies

Existing models for increasing the minuscule number of minority physics PhDs in the US include funding research experiences, forging university partnerships, and fostering a support network.

Initiatives to recruit, prepare, or retain underrepresented minorities for PhD degrees in physics are on the rise. Some focus on providing research experience between undergraduate and graduate school; others offer professional and social support to students once they get into graduate school. One of these so-called bridge programs for African Americans, Hispanic Americans, and Native Americans is credited with putting Vanderbilt University in Nashville, Tennessee, on pace to become a top pro-

ducer of underrepresented minority PhD physicists and astronomers.

Vanderbilt owes that success to a partnership that began six years ago between its physics department and the one at Fisk University, a neighboring HBCU (historically black college and university) institution. "The Fisk-Vanderbilt master's-to-PhD bridge program uses the master's degree from Fisk as a way to fast-track students into Vanderbilt's PhD program," says the program's codirector, Vanderbilt as-

tronomy professor Keivan Stassun. It has also doubled the enrollment of Fisk's physics master's program and is drawing an increasing number of Hispanic Americans to both schools.

The Fisk-Vanderbilt program is endorsed by the American Physical Society, which has launched its own bridge program "to measurably increase" the number of physics PhDs granted to underrepresented minorities over the next 10 years. The APS program will assist physics departments interested in

Students in Promise, an NSF-funded support network for graduate students at the University of Maryland, Baltimore County, pose at a December 2009 graduation ceremony with their thesis and dissertation coach Wendy Carter, far left, and physics professor Anthony Johnson, front center. Next to Carter is information systems PhD graduate Heather Holden, and flanking Johnson are physics master's degree graduate Shelly Watts and physics PhD graduate Robinson Kuis.



UNIVERSITY OF MARYLAND, BALTIMORE COUNTY

starting bridge programs or in forming relationships with minority-serving institutions, including HBCUs, which graduate a relatively high share of African American physicists at all degree levels. The society will also “work directly with minority students to provide information on graduate programs, bridge programs, and opportunities to advance their professional career,” says program manager Peter Muhoro.

Talent at the crossroads

Underrepresented minorities account for roughly 30% of the US population, but just 6% of people earning science and engineering doctorates in 2007, according to the October 2010 National Academy of Sciences (NAS) report *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*. In physics, the disparity is more glaring: According to the Statistical Research Center at the American Institute of Physics (AIP, which publishes PHYSICS TODAY), just 13 of the more than 1400 physics PhD degrees obtained at US institutions in 2007 were awarded to Hispanic Americans; another 13 were awarded to African Americans, and almost half of those were from four HBCUs. And from 2001 to 2006 only 6 Native Americans earned physics PhDs.

Skeptics of efforts to increase the PhD pool in science and engineering argue that the job market for researchers and academics is shrinking. But even if it doubled, the number of underrepresented minority physics PhDs produced per year would still be small, notes SRC director Roman Czujko. (For more statistics about minorities in physics, visit <http://www.aip.org/statistics/trends/minoritytrends.html>.)

The message of the report is about more than achieving parity, says NAS committee chair Freeman Hrabowski III, president of the University of Maryland, Baltimore County (UMBC). It is about ensuring the nation's competitiveness and addressing the “low persistence” of science, technology, engi-

neering, and math majors—the phenomenon of STEM students, regardless of ethnicity, dropping out at higher numbers than in other majors. “[Because] more and more noncitizens are earning PhDs in America and returning to their home countries, we need more citizens, of which underrepresented minorities are the fastest-growing [segment], to contribute to our health, energy, intelligence, and defense research efforts,” says Hrabowski. The report also highlights low awareness of STEM careers, lack of academic support, and poor social integration as

issues that, if addressed, could increase minority participation in STEM.

The Fisk–Vanderbilt bridge program seeks to do just that. Since 2004, it has expanded to the other physical sciences, the life sciences, engineering, math, and computer science. The program's directors attribute its high persistence rate—only 3 participants out of 42 have dropped out—to selecting promising students and providing them with mentoring, tutorials in quantum mechanics and other challenging classes, and seminars on such issues as resumé preparation and time

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management. Faculty members are also exchanged between schools and have access to each other's research facilities; that's because the initial NSF and NASA grants were shared, which "blurred the lines between our departments," says Fisk physics professor Arnold Burger.

Culture shock

Last year, the Fisk-Vanderbilt partnership was extended to Delaware State University, an HBCU that offers a master's degree in physics and a PhD in optics; the program also produced its first PhD graduate, Stephen Babalola, who is now on the tenure track in materials science at Alabama A&M University. Babalola credits his success so far to the access he had to "the best researchers in the field of radiation detection" at Fisk and Vanderbilt and at Brookhaven National Laboratory, where he characterized rare-earth crystals for room-temperature radiation detectors. "I chose to work at Alabama A&M, an HBCU, because I wanted to do my part, like [Fisk adviser Arnold Burger] did for me, to mentor as many minority students as I possibly can and to hopefully expose them to the tremendous opportunities I had."

Exposing prospective minority PhDs to research is the primary goal of Columbia University's bridge program, which selects a half dozen bachelor's degree holders each year and matches them with professors to work for up to two years. The bridge participants are not students, but the program allows them to take one course each semester; they also take writing classes and receive GRE test preparation and other guidance on the PhD application process. Columbia astronomy professor Marcel Agüeros, the two-year-old program's first director, says bridge participants learn nuances about the research culture, such as "when your adviser makes what sounds like a suggestion, it really means you need to do this."

Three of Columbia's inaugural bridge participants have gone on to PhD programs in astronomy. Nicholas Hunt-Walker, now at the University of Washington in Seattle, says the time he spent in the bridge program "was definitely worth it. I gained a mountain of research experience, a preview of graduate life, and a taste for the level of work that would be required. I was fortunate to be accepted into every top-level school where I applied."

Hunt-Walker says he still got hit with culture shock. "Although the people in the department are accepting and friendly, I feel a sense of isolation simply because I'm unfamiliar with the social terrain," he says. "The culture of the

department and of Seattle in general is nothing like what I grew up around in New York." Conversely, Puerto Rican native Nitza Santiago-Figueroa, who entered the bridge program with Hunt-Walker, says she felt isolated in New York City. Santiago, who recently moved from the Columbia bridge program to the one at Fisk, says the smaller but closer-knit community of Puerto Ricans in Nashville makes her feel like she's "home again."

Surrounded by Promise

Other bridge programs focus on retention, often by addressing issues of culture or acceptance. For Native American students pursuing a PhD in the natural sciences, the cultural challenge can mean having to choose between ancient beliefs and modern science's positions on such subjects as Earth's origins and astronomy, says Ted Greenwood, program director of the Alfred P. Sloan Foundation's Sloan Indigenous Graduate Partnership. That partnership offers full funding to Native Americans pursuing PhDs in STEM subjects on five US campuses. Faculty members on those campuses need to understand and be willing to accommodate a Native American student who may, for example, "leave campus suddenly to go home to attend the funeral ceremony of a third cousin, even if he has a test the next day," says Greenwood.

"One of the things people find is that if you have a single minority student in a physics department, that student tends to do most of his or her work alone," says James Stith, former AIP vice president of physics resources. Stith cites the physics departments at the Georgia Institute of Technology and MIT and the applied physics departments at the University of Michigan and Stanford University as examples of departments that have produced clusters of minority physics PhDs by making it a priority to do so.

Stith also points to UMBC, whose nationally recognized Meyerhoff Scholars Program for undergraduates seeks to provide a campus-wide social and academic support system for its awardees, primarily underrepresented minorities intending to pursue a PhD in a STEM subject. In the past five years, more than 40 of the 22-year-old program's alumni have earned STEM PhDs. At the graduate level, UMBC offers Promise, a regional branch of the NSF-funded Alliances for Graduate Education and the Professoriate, which targets minorities but coordinates seminars, guest lectures, and social gatherings for all STEM graduate students.

"I wish there was a Promise when I was in graduate school," says Elaine Lalanne, a research scientist at UMBC's Center for Advanced Studies in Photonics Research and the first African American woman to obtain a PhD in physics from the New Jersey Institute of Technology. Lalanne's advice to minority students facing challenges in completing their PhD: "Don't isolate yourself. Seek out support mechanisms, like Promise. Go to conferences. Seek help even on the Internet. There is light at the end of the tunnel."

Jermev N. A. Matthews

news notes

US-China nuclear co-operation. The US and Chinese governments plan to create a center of excellence to promote nuclear security and safeguards in China and throughout Asia. A second new center will focus on radiation detection training for customs officials. Agreements for both centers were signed by representatives of the two governments during Chinese president Hu Jintao's January visit to Washington, DC.

The nuclear security and safeguards center will be built on the outskirts of Beijing and is intended as a forum for exchanging technical information, sharing practices, and training people in the operation of nuclear facilities and handling of nuclear material. The US will provide nuclear security equipment and expertise. Steven Chu, the US Department of Energy (DOE) secretary, said at the signing that the agreement represents "a major step forward in im-

plementing the global nuclear security outlined by our two presidents at the Nuclear Security Summit last April."

The radiation detection training center will be in Qinhuangdao, about 300 km east of Beijing.

The centers represent a "vehicle for building a culture of security," says Damien LaVera, a spokesman for the National Nuclear Security Agency, a semi-autonomous agency within DOE. TF

Tevatron countdown. Hopes among particle physicists to extend the life of the proton-antiproton collider at Fermilab through 2014 were dashed on 6 January: "Unfortunately, the current budgetary climate is very challenging and additional funding has not been identified," wrote William Brinkman, director of the US Department of Energy's Office of Science, to Melvyn Shochet, chairman of the department's High-Energy Physics Advisory Panel. So, contrary to the recommendation by a HEPAP subpanel (see PHYSICS TODAY, December 2010, page 34), the Tevatron will be turned off this fall.

Highlights from the Tevatron include the discovery of the top quark in 1995, the observation in 2006 that B mesons oscillate, and the indications last year that B-meson decays produce slightly more muons than antimuons, which may help explain the dominance of matter over antimatter. In addition, a large range of mass was excluded for the elusive Higgs boson, which recently has seemed within the machine's reach. The search for the Higgs will continue at the Large Hadron Collider (LHC) at CERN.

At a web-streamed all-hands meeting on 19 January, Fermilab director Pier Oddone stressed that the future of the lab is "very strong and very bright." Data from the Tevatron will take a few years to analyze. Beyond that, he said the lab's strategy will be to exploit the LHC and to do research and development for future machines. He estimated that about 100 jobs will be cut, not just at the Tevatron but so as to "optimize the workforce... for the future missions of the laboratory."

Meanwhile, on 31 January CERN announced that the LHC will continue running at 3.5 TeV per beam for an extra year, through 2012. The collider will then be shut down to upgrade it to run at its full design energy of 7 TeV per beam starting in 2014. TF

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