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Private versus public energy solutions

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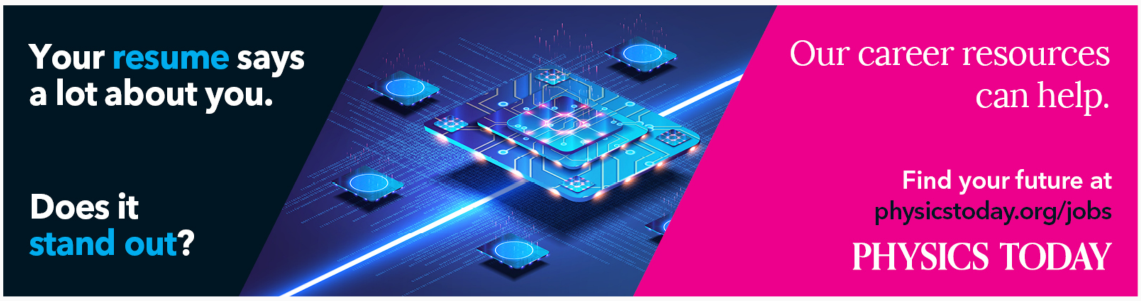

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of intellectual coherence, you had better reexamine what you wrongly may have thought you understood perfectly well about the nature of probability.

References

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3. J. M. Bernardo, A. F. M. Smith, *Bayesian Theory*, Wiley, New York (1994), and the 65 pages of references therein.
4. N. Bohr, *Collected Works*, vol. 6, J. Kalkar, ed., North-Holland, Amsterdam (1985), p. 296.
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Letters

Measured energy in Japan quake

The article by Thorne Lay and Hiroo Kanamori titled "Insights from the great 2011 Japan earthquake" (PHYSICS TODAY, December 2011, page 33) is an interesting one. As a seismologist who worked in the field of underground nuclear explosions, I was caught by the following statement in the first paragraph: "Total strain energy equivalent to a 100-megaton explosion was released during the sliding." Some familiarity with this subject led me to think this is not right. If the authors would carefully review their calculations using the energy equivalent in TNT, the relationship between seismic moment and magnitude, and the relationship between strain energy and seismic moment, they would find that the seismic energy equivalent of the 2011 Japan earthquake is roughly 2×10^{18} J, while that of a 100-megaton nuclear bomb is roughly 4×10^{17} J. Thus the 2011 Japan subduction event released approximately five times as much energy as a 100-megaton device, which is approximately twice the largest nuclear detonation ever—a 50-megaton atmospheric explosion by the former Soviet Union in October 1961.

The 1964 Chilean earthquake had still more energy by a factor of about 3, or 15 times that of a 100-megaton nuclear device. I believe the authors used the relation for seismic energy release rather than total strain energy release. The seismic energy underestimates the total strain energy release by a variable that depends on friction on the fault plane. Accounting for total strain energy release would increase the earthquake energy number by orders of magnitude.

Despite the catastrophic damage potential of nuclear bombs, the forces of nature occasionally unleash much larger energy releases. Although the nuclear bombs are under our control, earthquakes, volcanic eruptions, and extreme weather events are not. However, by judicious preparation and avoidance measures, humans can significantly diminish the damage of natural events.

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■ **Lay and Kanamori reply:** Our article states that the total radiated energy release estimated for the Tohoku event, as directly measured by integration of seismic-wave ground-velocity recordings and the source time function, is 4.2×10^{17} J. That number compares with David von Seggern's energy value for a 100-megaton explosion of "roughly 4×10^{17} J." Thus we seem to agree that our estimate of the seismic wave energy release from the earthquake corresponds to total energy from a 100-MT explosion.

The wording in the first paragraph of our article, however, should have been "total radiated energy" rather than "total strain energy." Some strain energy goes into heating the fault zone and other dissipative processes, so total strain energy will always exceed seismically radiated energy by an amount that cannot be measured by seismology. Von Seggern computes a number for "seismic energy" using a formula (apparently the Gutenberg–Richter relation) for radiated energy as a function of seismic magnitude; that is quite different from estimating radiated seismic energy directly as we did. His estimate of seismic energy is about a factor of five larger than our directly measured radiated energy estimate. Scaling relations between seismic magnitude and energy have very large spread, so we prefer direct measures of radiated energy from seismic waves.

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Private versus public energy solutions

Former Department of Energy official Steven Koonin expressed unwarranted confidence (PHYSICS TODAY, January 2012, page 19) that "energy needs to happen through the private sector. It owns, builds, operates essentially all the energy infrastructure in the country, and I don't think we have any intention of changing that."

I offer the following example to illustrate why I take issue with Koonin: During the night of 30 November–1 December 2011, residents of the West San Gabriel Valley, about 15 miles northeast of Los Angeles, experienced a severe Santa Ana windstorm that produced hurricane-force gusts. Thousands of trees were blown down, and power outages were widespread. The area is served by two utilities: Community-owned, not-for-profit Pasadena Water and Power (PWP), which provides electricity for the homes and businesses in Pasadena; and privately owned, for-profit Southern California Edison (SCE), which powers the surrounding communities.

Pasadena itself was probably the hardest hit, with about 1200 downed trees and nearly \$30 million in damages. The wind speeds there during the event were at least as high as, and perhaps higher than, those in the surrounding communities. Nevertheless, only 10% of PWP customers lost power during the windstorm.

Meanwhile, Altadena, Arcadia, La Cañada Flintridge, and San Marino experienced total blackouts. In other nearby communities, such as Sierra Madre, South Pasadena, and Monrovia, at least 80% of homes and businesses lost power. In a front-page story in the *Pasadena Star-News* on 13 January 2012, SCE admitted that 75% of its customers in the area affected by the windstorm lost power.

In addition, while nearly all PWP customers had their power restored within 48 hours, many SCE customers had to wait much longer, some as long as a week.

The performance of SCE during and after the windstorm was so bad that it is now being investigated by the California Public Utilities Commission. Simply put, private-sector, for-profit SCE put in a dismal performance compared with the not-for-profit, community-owned PWP.

Perhaps Koonin needs to reconsider his belief that the private sector, with its focus on profits and stock dividends,

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can reliably provide for our energy needs.

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STEM solutions through college collaborations

David Kramer's story in the November 2011 issue of PHYSICS TODAY (page 22) cited the five-year goal of the Association of American Universities (AAU) to implement changes in science, technology, engineering, and mathematics teaching. However, the issue of improved STEM education and participation goes beyond institutional members of the AAU and beyond pedagogical changes.

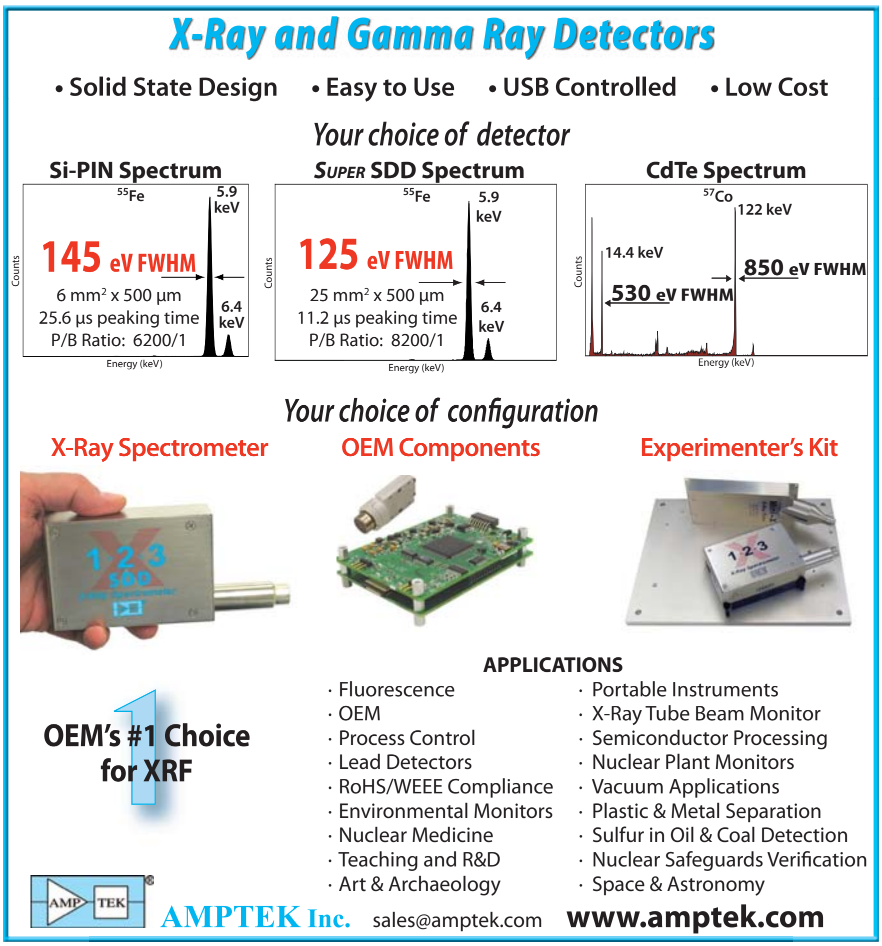
Currently, 65% of graduating high school seniors in the US decide to attend college, and of those students, 30% matriculate to a two-year college.[1] As the cost of higher education continues to increase, students are relying more heavily on two-year colleges to meet their educational goals.

Community colleges currently enroll 44% of all undergraduate students in the US[2] and are often overlooked by four-year STEM programs as potential partners for a solution to problems in STEM education. As the two-year steppingstone becomes more common, that important and formative first experience with STEM courses generally happens at two-year colleges. Support and collaboration between the two-year and the four-year institutions are vital.

Collaboration between community colleges and universities offers exceptional opportunities and benefits for both institutions. On the community-college side, a four-year college or university can provide access to research facilities and labs not available in a two-year system. A collaboration could also allow for faculty of two-year programs to remain engaged in their field and to continue to develop their research skills.

For a four-year college or university, the benefits of collaboration derive from the diversity of the student population—including underrepresented minority groups and nontraditional learners whose cultures, backgrounds, and experiences can be assets. Additionally, NSF and other external funding agencies look more favorably at institutions that actively incorporate community colleges and their students.

The broader impact of the interactions is that they create not only a



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