

Competition boosts clean-energy startups

Can alliances of entrepreneurial scientists and business students fuel the sluggish economy?

Six startups born in university labs can now move their inventions one step closer to market, thanks to the cash, business mentoring, and exposure they won as finalists in the US Department of Energy's first annual National Clean Energy Business Plan Competition. The prizes are expected to help the finalists through the commercialization "valley of death," the period in which many startups fail because they are incurring costs but their products are not yet generating revenues. The competition is part of the Obama administration's Startup America initiative, which aims to encourage entrepreneurship in the US.

Six regional contests commenced last fall, with winners each receiving \$100 000. The regional winners then pitched their business plans to a panel of venture capitalists and other business professionals at the 13 June finale in Washington, DC. Contestants had to convince the judges that their business would be sustainable and profitable and that their technology was ready to

be scaled up. Northwestern University's NuMat Technologies took the top prize—an additional \$180 000 in cash plus legal and technical-design support—for its plan to commercialize porous nanomaterials known as metal-organic frameworks (MOFs) for fuel storage in natural-gas vehicles.

Pressure packed

"I'm sure shale gas was in the back of the minds of some judges," says NuMat's chief scientific officer Omar Farha, referring to the potential for MOFs to store and purify gas mixtures. The key to NuMat's technology is the company's patent-pending molecular dynamics simulation software, which finds the most robust and gas-thirsty MOF structures out of millions of possibilities. Running on a supercomputer, the software narrows down the possibilities in a fraction of the time it would take a chemist to do it, says Farha, a research chemist at Northwestern. NuMat has also developed a process to synthesize MOFs that ensures the

material's mechanical integrity.

One of the company's goals is to lower the cost and size of fuel systems for natural-gas vehicles, which require expensive compressors to achieve pressures of roughly 250 bars to keep the gas sufficiently concentrated, says NuMat's chief technology officer Christopher Wilmer, a chemical engineering PhD candidate. With highly adsorbing MOFs, "you can compress the same amount of gas at just one-fifth the pressure." That, he says, would make it safe and affordable enough for consumers to refuel at home. Wilmer says the company has already raised more than \$1 million, mostly from other competitions, and the plan is to use the funds to lease lab space and hire staff.

Another finalist, the University of Utah's Navillum Nanotechnologies, is building its business around quantum dots—semiconducting nanocrystals that promise to improve the efficiencies of a wide range of existing technologies, including, for example, liquid crystal displays and solar panels. Based on the PhD research of Navillum chief executive officer Jacqueline Siy-Ronquillo, the company's synthesis method modi-

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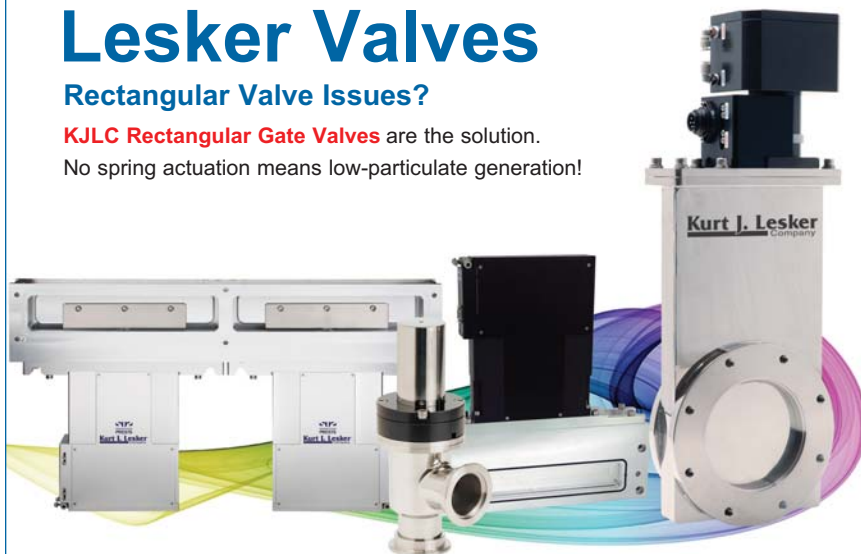
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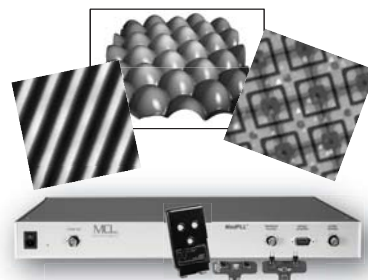
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The other finalists were MIT's Solid Energy Systems, with its high-energy-density, liquid-polymer lithium battery technology; Columbia University's Radiator Labs, which has designed a wireless control system that reduces overheating in large buildings; the Stanford Nitrogen Group, which has developed a wastewater treatment system partially powered by the reactive nitrogen recovered from the waste stream; and the University of Central Florida's Mesdi Systems, whose proprietary electrospray process reduces lithium-ion battery manufacturing costs.

Economic kickstart

The contest gives entrepreneurial scientists an opportunity to team up with and learn from students and professionals in the business community. Wilmer and Farha, who both say they plan to stay in academia, met their business partners—MBA and law students—through other competitions. And the Ronquillos met Lewis, and the two other MBA students who helped them draft their business plan, through a new-ventures development center at the University of Utah's business school.

The Obama administration expects such collaborations to help kickstart the sluggish economy, create jobs, and spur the development of clean-energy technologies. NuMat's winning technology and the work they did to develop a business plan and sell the idea to investors are laying "the groundwork for future economic opportunities that will ensure America remains competitive in the global clean energy race," said US Energy Secretary Steven Chu at the competition finale.

Jermeý N. A. Matthews

news notes

Nuclear data. The half-lives, decay modes, and emission energies of some 3847 experimentally observed nuclide ground states and isomers are presented in the 8th edition of the *Karlsruhe Nuclide Chart*, published in July by Nucleonica, an online nuclear-science portal company. The chart is a reference and teaching tool for fields such as health physics, radiation physics, nuclear and radio chemistry, astrophysics, Earth sciences, and agriculture.

The chart first came out in 1958, with revisions published every seven years on average. Publication of the latest version was held off to include the two most recently named elements, flerovium (atomic number 114) and livermorium (116). The chart includes details about 193 new nuclides and updates on 544 others.

"We gather research results from all over and put them together," says Joseph Magill, Nucleonica's managing director. Nuclear scientists aim "not just to classify nuclides, but to try to produce superheavy elements," he says. "If you can get beyond element 120, the theory predicts that everything becomes stable again." Nucleonica develops the chart together with the European Commission's Institute for Transuranium Elements in Karlsruhe, Germany.

The chart is available in various hard-copy formats starting at €28 (\$34). The company plans to unveil an online

version soon. More information about the chart is available at <http://www.nucleonica.com>. TF ■

The latest version
of the *Karlsruhe*

22 s	~16 ms
0.31 s	at 9.95
1288	FI 289
69 s	2.1 s
95	at 9.87

176 *Nuclide Chart* includes rows for newly named elements flerovium and livermorium. Each square gives nuclide mass number, half-life, and mode and energy of decay. The mass number is the sum of protons (numbers at left of rows) and neutrons (below columns).

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