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## ARPA-E: Can Greentech Be Made in America?

Boeing, GE, the DOE and greentech entrepreneurs and investors debate the \$64,000 question.

“We cannot manufacture everything. We have to be strategic. As a nation, we have to figure out our strengths and invest in those,” said Leo Christodoulou, the director of the Department of Energy’s Advanced Manufacturing Office, which works to develop and deploy novel energy-efficient technologies.

“The cost of electricity is really [important]. There are some places where it is prohibitive,” said David Wasserstein, a partner at I2BF, a cleantech investment firm. “Setting up a solar factory in California -- probably not the best idea. We learned that one [with Solyndra]. But there are places in the U.S. where you can lock in five cents a kilowatt-hour and if you’ve got a power-intensive process, you can still [make it] work.”

At the [2012 ARPA-E Energy Innovation Summit](#), the DOE’s Christodoulou spoke of his desire to promote American manufacturing by supporting foundational, ecosystem-enabling technologies.

“We try to identify technologies that the United States can exploit. [We look for] keystone, foundational technologies that will spur a new industry or reinvigorate an existing industry,” said Christodoulou. “A keystone species is one that dominates the ecosystem even though it may not be present in abundance. Prairie dogs and sea urchins are good examples. You take them out of the ecosystem and the ecosystem collapses.”

“There are multiple examples where technology has been the keystone to a manufacturing industry,” continued Christodoulou. “The aluminum story is a technology story. A technical innovation that led to a brand new industry.”

“I am thrilled that the Department of Energy is thinking about how to promote these ecosystems,” said Christine Furstoss, the global domain leader for manufacturing and materials at GE’s global research center. “As we look at new areas of energy innovation. Materials and processes don’t follow the traditional cost and scale equation that we are so familiar with in manufacturing. We start to think about processes such as thin film manufacturing [and] additive manufacturing, which require new ecosystems.”

Once an ecosystem leaves the United States, manufacturing new technologies within that ecosystem becomes more difficult. Development talent may still be available, but manufacturing talent becomes harder to find.

“We don’t have a problem hiring good engineers from American schools. American universities are, bar none, the best in the world. I came to the U.S. to study in the U.S. and am thankful for that,” said [Atul Kapadia, CEO of Envia Systems](#). “Where there is a problem is hiring lithium-ion battery [manufacturing professionals]. Would we hire a person from Ener1 or A123? I don’t know. We are looking for that ecosystem in the U.S. We’d love to get successful [American] lithium-ion battery companies to talk to each other, form partnerships and compete in the market. Right now, we are competing with [Asian] companies.”

Immigration policies also contribute to America’s engineering and manufacturing’s challenges.

“The rest of the world is really stepping on the accelerator with respect to STEM [science, technology, engineering, and mathematics] manufacturing,” said Matthew Ganz, a Vice President of Boeing Research & Technology. “We still have great universities, but our immigration policies make it difficult for us to hire the best and the brightest.”

At the same time, cultural messages discourage young Americans from pursuing STEM careers.

“Every time I have taken a high school [class] into a manufacturing [plant], they get inspired and say ‘Wow, I didn’t know manufacturing was this cool,’” said Bruce Sohn, a principal at MEGE Associates and a former president of [First Solar](#). “If all of us go out in our [community] and bring one class into our facility, my guess is that America will end up with more engineers in the future.”

“Anybody who has kids knows that you can’t tell them what to do. Professions are chosen out of icons. My daughter wants to be Taylor Swift. My other daughter wants to be an astronaut. A lot of kids want to be Mark Zuckerberg,” said Envia’s Kapadia. “Until hardcore engineers become icons, you aren’t going to be able to tell your kids to be engineers.”

Moreover, young Americans who do pursue manufacturing have high expectations for their pace of advancement up the corporate ladder.

“We are trying to listen and reach out. We have reinvigorated our mentoring programs,” said Boeing’s Ganz.

“At General Electric, we are looking at our advancement system,” said Furstoss. “When you start your career, your sphere of influence is you. Are we really giving opportunities in engineering and sciences and the manufacturing trades for people to grow their spheres of influence?”

Yet another challenge is variable government support.

“We really need policy stability,” said I2BF’s Wasserstein. “I don’t care if the ITC is 30 percent or 10 percent. But it can’t be on-again, off-again every three year. Better that it be 10 percent and go out for 10 years and [only] then come up for renewal.”

“The intended effect of policies should be to reduce volatility in the production chain. But [the [PTC](#)] is doing the exact opposite. It is increasing volatility. It is effectively pro-cyclical. Policy stability is critical for manufacturing,” continued Wasserstein.

Despite the disadvantages of manufacturing in the United States -- including, of course, high labor costs -- domestic production has its benefits.

“We recently moved a number of manufacturing jobs from offshore back to Louisville, Kentucky ... both for scale issues and the ability to rapidly innovate,” said GE’s Furstoss. “We have [also] launched a new product, an energy storage battery for the utility sector and for backup power. It was developed based on a number of technologies acquired worldwide but integrated largely in upstate New York. Our manufacturing facility is being built five miles from the research facility. It will [create] 350 new jobs.”

“When you start to add the soft costs of doing business in other places, it starts to even out,” said Wasserstein. “People like doing things [in the U.S.] because there is stability in the rule of law.”

Hoping to make the most of these advantages, the Department of Energy is working to establish advanced manufacturing facilities in the U.S.

“These are facilities where small and large entities can come in and carry out manufacturing-related research and demonstration so that they can reduce the risk of manufacturing before they make investments in plants and equipment,” said Christodoulou. “These [facilities] are [for] manufacturing-relevant, production-pertinent technologies and capabilities. For example, prototype carbon fiber and additive manufacturing, on which you can not only get the product, but also some idea of the quality and projected cost of that component.”

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