



Challenge prizes offer unique opportunities for materials innovation

By Kendra Redmond

Prizes that recognize groundbreaking discoveries and technological advancements are common in the scientific community; prizes that incentivize such work with millions of dollars are much less familiar in the physical sciences. A growing number of competitions have emerged over the past decade that offer a large cash prize to the person or team that can meet a challenge most efficiently or quickly. Many of these challenges are based on important global issues that have key materials components, and they provide intriguing opportunities for researchers to innovate and collaborate.

Called inducement prizes or challenge prizes, these competitions outline a desired outcome and, in most cases, offer participants zero funding and few guidelines on how to get there. Unlike most research grants, prizes are open to individuals, academic groups, industry teams, and mixed collaborations. This can lead to more novel approaches to solving problems, according to Tamar Ghosh, lead for the Longitude Prize at Nesta, the United Kingdom's innovation foundation. The Longitude Prize is a £10 million competition for a diagnostic test that can better inform doctors when and what kind

of antibiotics to prescribe for a bacterial infection, in response to the growing incidence of antibiotic resistance.

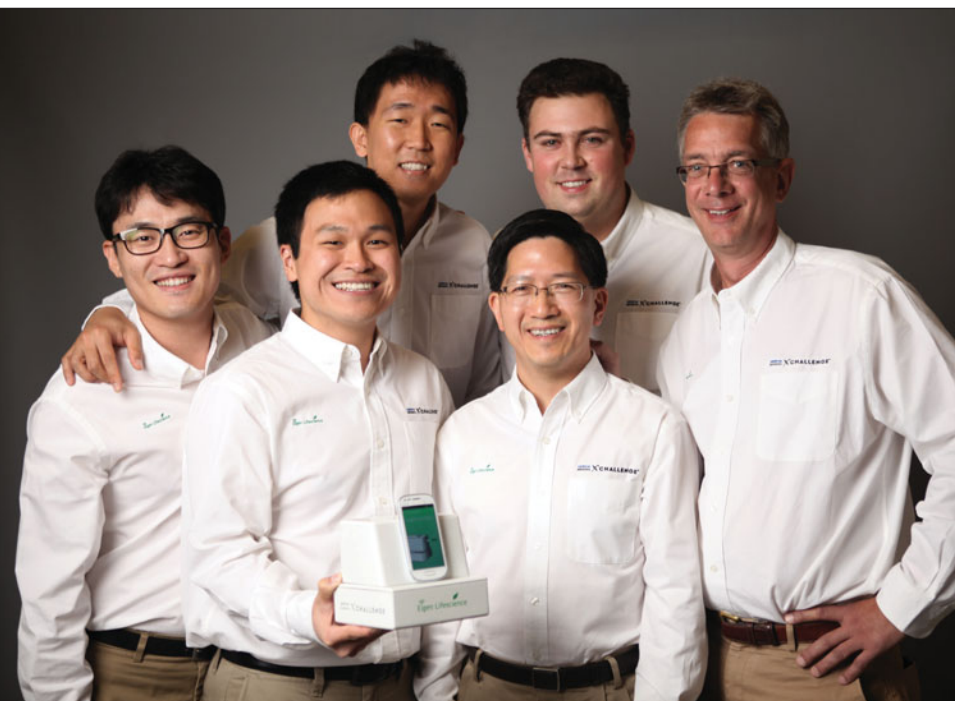
Challenge prizes aim to drive solutions, often in the space that comes after basic research and between early technological advancement and commercialization. They are most effective for well-defined goals that require a technological leap whose details are uncertain. One such example is the USD\$2.25 million US Department of Energy's Wave Energy Prize competition, encouraging game-changing developments in ocean wave energy converter devices that extract energy from waves and convert it to electricity.

"Wave energy became a strong candidate for a public prize challenge due to the need for a technology leap in this sector," says Alison LaBonte, a program manager in the US Department of Energy's (DOE) Wind and Water Power Technologies Office. "We have already seen significant technical achievements in the 12 months since the prize was announced."

Other examples include the European Commission's (EC) 1.5 million Horizon Prize seeking new technologies for retrofitting diesel engines and powertrains to reduce emissions, the USD\$10 million Qualcomm Tricorder XPRIZE for a lightweight device that can capture vital signs and diagnose diseases, and Sir Richard Branson's USD\$25 million Virgin Earth Challenge for activities that remove greenhouse gases from the air.

According to a spokesperson for the EC, "Challenge prizes have prompted a surprising array of developments, in particular when it comes to the advancement of materials." In the last few years the EC has initiated several Horizon Prize competitions, with challenges ranging from overcoming the limits of long-distance optical transmission systems to developing a materials-based solution for reducing the concentration of particulate matter in the air.

Shan Wang, a professor of materials science and engineering at Stanford University, led a team to a distinguished award in the Nokia Sensing XCHALLENGE in 2014—a Nokia collaboration with XPRIZE. The team



The team members of Eigen Lifescience, led by Shan Wang, won a distinguished award in the Nokia Sensing XCHALLENGE for developing a blood test that uses the microprocessor of a smartphone to rapidly diagnose hepatitis B. Front row (left to right): Jung-Rok Lee, Adi Wijaya Gani, Shan Wang, Paul (P.J.) Utz; back row (left to right): JooHong Choi and Daniel Bechstein. Credit: XPRIZE.



developed a diagnostic strip and magnetic detector that, together with a smartphone, can diagnose hepatitis B in minutes using magnetically tagged biomarkers.

“It was an exhilarating journey to participate in the XCHALLENGE,” Wang says. “The very challenging requirements posed by the XPRIZE Foundation forced us to design our assay and platform for the real world rather than the ivory tower. Being able to highlight novel nanomaterials such as magnetic nanoparticles and giant magnetoresistive (GMR) sensors in this international competition was also very rewarding.”

Participants in such challenge prize competitions fund their entries through investors, crowdsourcing, institutional support, corporate sponsorship, philanthropic organizations, or their own wallets. In some cases, finalists receive seed money or a portion of the prize money. Organizers say this funding model provides better returns on their investment since the development costs are widely shared. Competitors in challenge prizes say this model involves more risk, but can lead to deep levels of commitment and productive new partnerships.

Participating in the USD\$1 million “H2 Refuel” H-Prize competition has led to new

business ventures for SimpleFuel, the only finalist group in an ongoing DOE competition to develop home or community hydrogen refueling systems for fuel-cell electric vehicles. SimpleFuel is a consortium of companies with unique contributions, according to Darryl Pollica, team spokesperson and President and CEO of Ivys Inc., one of the member companies. “Our business arrangement will undoubtedly live beyond the competition as we already have aggressive plans to commercialize the hydrogen refueling appliance after the initial competition demonstration.”

Credit for the earliest successful challenge competition usually goes to Britain’s 1714 Longitude rewards for methods to determine a ship’s longitude while at sea (see *MRS Bulletin* 25 [4], [2000], doi:10.1557/mrs2000.51). The Ansari XPRIZE propelled challenge prizes into the modern spotlight in 2004, when Mojave Aerospace Ventures received a USD\$10 million prize for launching a reusable, manned spacecraft into space twice within a span of two weeks. Since then the idea has regained popularity primarily in the United States and Europe.

Challenge prizes based outside of the United States and Europe are difficult to find, but corporations, governments, and

Connect with open challenges

- ec.europa.eu/research/horizonprize
- www.Challenge.gov
- www.InnoCentive.com
- www.Kaggle.com
- www.NineSigma.com
- www.openIDEO.com
- www.xprize.org

foundations across the world are taking notice of their results and showing interest, according to Zenia Tata, executive director of international expansion and global development for XPRIZE. Digital platforms such as NineSigma.com and InnoCentive.com are becoming popular ways to connect visitors worldwide with open challenges from a range of hosts for varying prize amounts.

The rise in challenge prizes has caused a growing interest in studying their effectiveness. Initial reviews by McKinsey & Company and others show that well-designed contests can spur innovation in areas that are beyond the scope of traditional funding mechanisms, but exactly how they will affect the landscape of science research and advancement in the long term remains to be seen.



XPRIZE provides incentive for radical breakthroughs in innovation

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By Paul Bunje, Jyotika Virmani, and Marcius Extavour

We are living in an era of extraordinary disruption. The technological, sociopolitical, and economic changes taking place around the world present innovators with an opportunity to apply groundbreaking research to challenges of worldwide importance.

Technologies on an exponential growth path (such as advanced robotics, ubiquitous sensors, synthetic biology) are rapidly becoming a part of our daily lives. These exponential technologies have the

potential to lead to innovative solutions to some of the world’s grand challenges. Importantly, many of these exponential technologies critically depend upon advances in materials science. Advanced materials are at the heart of innovative solutions to many of the world’s biggest problems and opportunities.

The XPRIZE Foundation relies on the growing power of exponential technologies and revolutionary science to catalyze radical breakthroughs. By offering

a suite of incentives, XPRIZE seeks to inspire the world’s scientists, technologists, and innovators to tackle seemingly intractable challenges.

“Grand Challenges” are a part of today’s dynamic period of disruption. It is now possible for us to not only characterize massive, global threats and opportunities that might affect billions of people, but also to conceive of possible solutions. Listing grand challenges—poverty, climate change, a cure for cancer, total planetary exploration—may sound trivial, but in reality, framing a grand challenge requires understanding the complexity and nuances involved in both defining a

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