Complex engineering challenges require creative solutions, and even the smartest project teams can benefit from the unique perspectives of outside contributors. Crowdsourcing offers a proven framework for generating innovative solutions to some of the toughest engineering challenges across a range of industries.
Planners, engineers and business leaders are faced with difficult challenges every day. Ideas and theories abound, but what is the “best” or most innovative solution?

Is there an obvious answer that satisfies all stakeholders and meets requirements for safety, reliability, sustainability and cost? How do we arrive at the best solution? Wouldn’t diverse perspectives, more creativity and dynamic brainpower yield better results?

The answer is a resounding yes — with crowdsourcing.

**BACKGROUND**

Businesses that are looking for the right solutions to their biggest challenges need all the creative ideas they can get. Unique perspectives from a broad and diverse group of people often lead to the most innovative solutions.

Yet to paraphrase Bill Joy, co-founder of Sun Microsystems, even the smartest companies don’t employ all of the smartest people, particularly in one office. An engineer (or a marketer, accountant or sales rep) in another division or another country may have valuable insight into your team’s specific challenge. If only you could harness it.

In recent years, crowdsourcing has begun to do just that. Crowdsourcing poses a tough question or challenge to an unconventional collection of people not directly related to the project team. It thereby brings the creative thinking of a division, entire company or the connected planet to bear on challenges in engineering, manufacturing, medicine or even marketing.

Working together, vast networks of people — ranging from interested laypeople to the whiz kid in his parent’s basement or an underemployed or motivated genius in a faraway country — can uncover and present innovative solutions to some of the world’s most difficult challenges.

In this paper, we’ll discuss what crowdsourcing is, why it works and how it continues to evolve. We’ll describe our internal crowdsourcing process, including the solution to a transmission and distribution challenge we successfully crowdsourced. Finally, we’ll consider some of the ways utility companies can benefit from using this process.

**THE POWER OF THE CROWD**

In the late 1990s and early 2000s, companies like Threadless and iStockphoto began building profitable businesses around the contributions of users; the open-source software movement proved that committed volunteers could write high-quality code; and the television network VH1 began capitalizing on video content produced by its viewers.

Journalist Jeff Howe chronicles these and many similar examples of crowdsourcing in his 2006 Wired article, “The Rise of Crowdsourcing,” and his subsequent book, *Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business*. Though his examples are drawn from many different industries, each engages a group, or “crowd,” to achieve a common goal, and each is powered by digital connectivity.

**CROWDSOURCING, DEFINED**

Howe defined crowdsourcing as “the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call.” In crowdsourcing, individuals contribute ideas and experience to a defined goal or project, which in turn allows organizations to enact new solutions, optimize tasks, deepen engagement and reduce costs.

What began as a spontaneous movement toward collaboration now has become a formal practice with countless applications. Annual conferences like Crowdsourcing Week (CSW) and the Conference on Human Computation and Crowdsourcing (HCOMP) explore its implications for business, government and education, while organizations worldwide work to put it into action.

**WHY CROWDSOURCING WORKS**

Crowdsourcing helps organizations by generating original solutions to complex challenges. It also offers unique benefits to the individual.

Each one of us is some combination of creator, artist, scientist, etc. However, most people are defined by a single vocation. Much of our creativity, intellect and
talent typically remains untapped. Crowdsourcing works because it provides an opportunity to utilize that talent and contribute to other vocations.

People are drawn to participate in crowdsourcing to satisfy their individual needs. Those needs might be social, such as a desire to contribute to something greater than oneself. They might be emotional, such as building relationships with a community; or professional, like earning recognition from a large organization or the world. Or they might be financial, such as winning a cash prize.

The most effective crowdsourcing projects acknowledge these drivers and create an environment in which participants’ needs are met.

CREATING A CULTURE OF INNOVATION
More often than not, progress comes from aggregating and utilizing knowledge that we already have. One famous example of this is Steve Jobs’ use of extant technologies to create the iPhone. Though the iPhone transformed everyday life, it wasn’t so much a technical breakthrough as a refinement and repackaging of existing technologies.

Still, when a company repeatedly taps into its established networks for internal problem solving, it’s hard not to reapply the same industry perspectives to successive challenges. Many companies struggle with this kind of insularity, and solutions may struggle with “outside the box” approaches.

To avoid this trap, companies can expand the diversity of their creative thought by crowdsourcing to every internal division or across the world. Rather than drawing on a dozen experts in a narrowly defined field, they can open the challenge up to anyone who is interested.

Giving potentially thousands of smart people (or employees) the opportunity to participate introduces an entirely new dimension of inclusivity. Over time, companies can use crowdsourcing to develop a culture of innovation and thought-leadership that benefits everyone.

OUR APPROACH TO CROWDSOURCING
As an engineer-procure-construct (EPC) company, Burns & McDonnell regularly encounters new engineering and construction challenges across many industries. To deliver a steady stream of fresh ideas and solutions, we developed and piloted a repeatable crowdsourcing process.

• Manage all challenges through an online portal. Using an online portal allows us to distribute the challenge to an internal division or our entire company. Participants then submit their solutions through the same channel. Since we already have a qualified crowd in the form of 6,000 highly motivated employee-owners, we built our own crowdsourcing portal. If we wanted to get worldwide input, platforms like Innocentive and Ennomotive provide access to experts in a variety of disciplines.

• Define the challenge clearly. There is a fine line between providing too much and not enough information about a crowdsourcing challenge. We try to supply enough details to elicit unique, fitting solutions, but not so much as to hamper creativity.

• Establish rewards. We determine the reward and who will receive it in advance. Depending on the challenge, the reward might be visibility within our company or industry, or cash compensation. In some cases, only the creator of the winning solution is rewarded; in others, finalists are also acknowledged.

• Narrow down submissions. A group of laypeople prioritize the submittals for the project team to evaluate on technical merits.

• Forward solutions to the project manager. Together, the project manager and project team determine if and when to present a short list of possible solutions to the client.

• Client decides course of action. This may take the form of a change order requesting further technical investigation. Or the client may decide it is not ready to move forward.

• Share results with participants. Sponsors of the challenge notify all participants about the winning solution and the client’s next steps, if any.
OH/UG CONVERSION: A CROWDSOURCED SOLUTION

Recently, we followed this process to crowdsource a solution for an overhead-to-underground (OH/UG) electrical conversion in an urban setting. We began by putting the following challenge out to the 1,300 employees in our Transmission & Distribution division via our internal portal:

A client located in a city in the southwestern U.S. has retained Burns & McDonnell as owner’s engineer for a 1-mile underground 230-kV electric transmission line. The overhead to underground transition structure will be located in a commercially developed area next to the city street right-of-way. Our client is concerned about aesthetics and would like us to consider a design that is more appealing to the public than a traditional transition structure.

We are seeking creative solutions that would complement the desert setting and/or honor the cultural history of the region. In addition to being aesthetically pleasing, the transition from overhead conductor to underground solid dielectric cable must be a safe, reliable and constructible design. We would like to hear your solution on how to best meet our client’s request.

We set a deadline for online submission of solutions and ultimately received 41 submittals. After narrowing down the proposals, we selected two concepts to present to the client:

• Solar Clock Tower. In this concept, a traditional riser pole would be enclosed inside a clock tower. The 230-kV overhead line would be visible where it entered the structure near the roof, but the pole and 230-kV underground cable would be hidden inside. Solar panels mounted on the top and side walls would be used to power a nearby EV charging station. Cellular antennas, which are often mounted on top of transmission structures, could instead be concealed within the tower. This would offer an extra source of revenue for the client, possibly defraying the cost of construction.

• Saguaro Cactus. This concept capitalizes on the similarities between the shape of the standard OH/UG transitional structure and the iconic Saguaro cactus, which is native to the region. Steel monopoles would be configured with two curved arms (and associated cables) on one side and a third arm on the other side. The structure would then be painted a rustic brown or desert green. A local metal artist could be commissioned to further enhance the structure with sculptural elements such as flowers that support each insulator/pothead, smaller blooms or nesting birds. Optionally, the surrounding area could be landscaped with native plants to create a community space.

The project team presented both concepts to the client, and additional technical research is ongoing.

HOW BUSINESSES BENEFIT FROM CROWDSOURCING

Enterprise crowdsourcing offers many benefits, but must be well-understood and carefully managed to be successful. Though some utility companies may choose to implement crowdsourcing on their own, working with an established EPC company streamlines the process.

An EPC company that already has crowdsourcing resources and experience in-house can help you choose the right crowdsourcing model, find the right crowd, and define the most compelling incentives. Crowdsourced projects easily can become overwhelming, but a qualified EPC company will impose order by establishing oversight, breaking the project down into manageable steps and identifying the top solutions when dozens (or hundreds) of submissions start coming in.

EMPHASIS ON SOLUTIONS

A crowdsourced solution isn’t simply a collection of good ideas. It’s a detailed plan of action to take you through all stages of engineering, procurement and construction. Depending on the project, the plan may also encompass specific design, build, finance, operation and maintenance (DBFOM) considerations.
When you give an EPC company a crowdsourcing challenge, you can expect to receive several creative solutions, as well as an indication of the safety, reliability, constructability, sustainability and cost of each.

**CONCLUSION**

In 2008, as the crowdsourcing movement was gaining steam, Jeff Howe raised this question:

> What if the solutions to our greatest problems aren’t waiting to be conceived, but already exist somewhere, just waiting to be found, in the warp and weave of this vibrant human network?

It’s an exhilarating possibility. When applied internally, crowdsourcing promotes a culture of innovation and thought leadership that gives companies a competitive advantage. When used to harness the best ideas from across the country and around the world, it positions the United States to compete effectively on the international stage.

Crowdsourcing has been proven in other industries. Now, our industry faces many new and unique challenges, crowdsourcing can provide the creativity needed to generate innovative solutions. And in the future, we will continue refining our process and reap even greater rewards from the power of the crowd.

**BIOGRAPHY**

**MIKE BEEHLER, PE**, a vice president at Burns & McDonnell, has written and presented extensively on the subjects of security, reliability-centered maintenance, program management and the smart grid. More recently, he has written, presented and consulted on industry megatrends, advanced technologies and smart cities. Mike has a Bachelor of Science in civil engineering from the University of Arizona and a Master of Business Administration from the University of Phoenix. He is a registered professional engineer in eight states, a member of IEEE and CIGRE, and a Fellow in the American Society of Civil Engineers.