**Grand Challenges**

**Quote:**

“By defining our goal more clearly, by making it seem more manageable and less remote, we can help all peoples to see it, to draw hope from it, and to move irresistibly towards it.” President John F. Kennedy

**Intro:**

[[Website embed: [18 second clip of Obama introducing Grand Challenge concept](https://www.youtube.com/watch?v=i6v5EFYnPjE)]]

A “Grand Challenge” is an articulation of an ambitious yet achievable goal that captures the public’s imagination. The power and the value of the Grand Challenge framework lie in its ability to galvanize action. By using Grand Challenges to issue a call for new and audacious thinking, agencies can catalyze significant advances for national priorities. A pioneering vision, large-scale collaborative effort, and an ambitious but concrete target are the defining hallmarks of Grand Challenges that spur transformative breakthroughs:

##### **Grand vision:** Explicitly setting grand, ambitious targets – like making solar energy as cheap as coal, understanding the human brain, or destroying cancerous tumors while leaving healthy cells untouched – galvanizes public excitement and draws in new communities of solvers. The term itself suggests a sense of daring and boldness is required [Hicks, D., "[Grand Challenges in US Science Policy Attempt Policy Innovation](https://works.bepress.com/diana_hicks/38/)," International Journal of Foresight and Innovation Policy, 2016, pp. 5]. Grand Challenges must be captivating and intrinsically motivating, so much so that many people should be willing to devote a good chunk of their career to the pursuit of one of these goals.

##### **All hands on deck:** Grand Challenges can accelerate the rate of progress on sticky problems by engaging a coordinated, “all-hands-on-deck” approach with multi-sectoral collaborations. Agencies can augment their impact by involving contributions from other agencies, foundations, research universities, companies, and citizens.

##### **Ambitious yet achievable:** The key lies in a willingness to set bold, audacious goals: Historical examples include landing a man on the moon, the Human Genome Project, and Wikipedia. But Grand Challenge targets must be well defined with a “Goldilocks” level of specificity and focus. “Improving the human condition” is not a Grand Challenge, because it does not provide enough guidance for what to do next or how to measure progress. While “landing a man on the moon and returning him safely to the earth” is daring and ambitious, it is also inherently clear whether it has been achieved.

##### **Flexible framework:** Grand Challenges are galvanizing frameworks through which a variety of implementation mechanisms can be used to engage new solvers – including challenge funds, prize competitions, crowdsourced innovations, and strategic partnerships.

##### **Why:**

Consider using this framework when confronting open-ended policy challenges of considerable magnitude and complexity where there is no obvious solution, but it is possible to envision a different path forward. The call for a Grand Challenge is a priority statement; when it is followed by concerted effort to source new thinking and spur new collaborations through a variety of implementation modalities, there is potential for significant progress. Grand Challenges are powerful levers for shifting the framework not only in science and research policy, but also for domains such as health, energy, sustainability, education, economic opportunity, national security, and human exploration.

Grand Challenges can address the biggest problems of our time by:

* Helping to create the industries and jobs of the future;
* Expanding the frontiers of human knowledge about ourselves and the world around us; and
* Serving as a “North Star” for collaboration between the public and private sectors. [CROSSLINK PPP]

**How:**

Grand Challenges are best suited for confronting open-ended, sticky problems with no pre-defined solutions, where “what if?” ambitious thinking can generate new approaches. It’s an appropriate tool to consider for societal challenges that need to be worked at scale and with an interdisciplinary approach. Grand Challenge deployments are unique to each agency context, but three overarching themes emerge from program designs:

* An intermediate timeframe (not a year, and not 50 years)
* A quantified target
* Some commitment of resources

The quantified target – “We need to develop more effective ways of treating cancer” – functions as a declaration of priorities. But the resources marshaled to support this call to action can vary tremendously as appropriate for an agency’s needs, either with the use of challenge funds, prizes, public private partnerships, or use of administrative authority. Agencies take a lead role by explicitly articulating important and ambitious Grand Challenge targets, and then convening funding and private sector commitments to help realize those goals.

A number of agencies are already using Grand Challenges to support their missions. For example, [DOE’s SunShot Grand Challenge](http://energy.gov/eere/sunshot/sunshot-initiative) seeks to make solar energy cost competitive with coal by the end of the decade, and [NASA’s Asteroid Grand Challenge](http://www.nasa.gov/feature/what-is-the-asteroid-grand-challenge) aims to find and address all asteroid threats to human populations. USAID has eight active [Grand Challenges for Development](https://www.usaid.gov/grandchallenges) that address challenges in infant and maternal mortality, clean energy for agriculture, water for agriculture, early grade literacy, fighting Ebola, combatting Zika and future threats, accelerating access to off-grid energy, and improving government performance and accountability[[A Strategy for American Innovation](https://www.whitehouse.gov/sites/default/files/strategy_for_american_innovation_october_2015.pdf), National Economic Council and Office of Science and Technology Policy, October 2015].

**Case Study:**

[**DOE: SunShot**](http://www1.eere.energy.gov/solar/sunshot/index.html)

[Ulrich, E., and DOE staff, personal communications and interviews with Policy Design Lab, December 2, 2016]

[[[Embed 3 min intro video for SunShot](https://youtu.be/RzM2bvcHKHM)]]

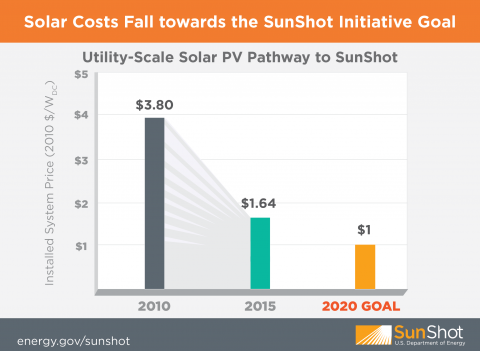
Launched in 2011, the Department of Energy’s (DOE) SunShot Initiative is a Grand Challenge effort to make solar energy cost-competitive with conventional forms of electricity generation by the end of the decade (2020). The audacious goal -- to drive down the cost of solar electricity to $0.06 per kilowatt-hour or ~$1 per watt – arose from one question: What would it take for solar to become a large portion of nation’s energy supply mix? Through SunShot, DOE has leapfrogged progress on an answer to this call, partnering with more than 450 awardees, funding cooperative research, development, demonstration, and deployment projects by private companies, universities, state and local governments, nonprofit organizations, and national laboratories. [Ulrich, E., and DOE staff, personal communications and interviews with Policy Design Lab, December 2, 2016]

Five years into the Energy Department’s decade-long SunShot Initiative, the solar industry is already more than 70% of the way to achieving SunShot’s cost target. Longer-term goals are now being set, and one important learning from SunShot is how successful Challenges can sometimes wildly exceed their goals and evolve to push the bar even further.

**Key accomplishments:**

As a result of DOE’s SunShot Initiative, investments and the industry’s accelerated pace to meet the SunShot goal, solar-generated electricity is now price competitive with traditional energy sources in 14 states across the United States. [Ulrich, E., and DOE staff, personal communications and interviews with Policy Design Lab, December 2, 2016] Increased deployment of affordable and accessible solar energy continues to grow quickly across the country. Two key points deserve emphasis:

* *Outstanding ROI*: DOE has spent roughly $2.3 billion on R&D, but net economic benefits total more than $15 billion to date. SunShot has been a catalytic focusing lens, generating significant economic and job growth in the solar industry.
* *Leapfrog Technical Advancement*: The country has more than 10 times more solar installed today than in 2011 when the SunShot Initiative was first launched [Delapez, J., “[SunShot Reports: Solar Energy Progress and Challenges](http://www.agri-pulse.com/SunShot-reports-Solar-energy-progress-and-challenges-05262016.asp)”, Agri-Pulse, 2016]. Meanwhile, the overall costs of solar have dropped by over 65 percent:



**How they did it:**

The appeal of using a Grand Challenge framework for DOE was its cost-effective ability to promote scale and impact under a broad umbrella. For SunShot, DOE has held an annual summit; released research papers regarding technical milestones needed to achieve the goal; funded nearly 300 cooperative research, development, demonstration, and deployment projects; and also offered open prize competitions to fuel entrepreneurship and drive innovation in solar technology [Dorgelo, C., personal communication with Policy Design Lab, December 5th, 2016]. SunShot’s broad articulation and interagency coordination also enabled a systems-level perspective to emerge during implementation, which highlighted the importance of certain aspects that needed increased attention. Prior to SunShot, there had been an overall cost goal, for example, with emphasis on the cost of cells and modules. But the learning gained through the initiative proved that even if the module were free, the cost goal couldn’t be met without addressing other important areas particularly the work in grid integration and [soft costs](http://energy.gov/eere/sunshot/soft-costs).

Effective messaging has also been essential to the program’s success. The program wasn’t originally launched as SunShot; the name came later. Building a brand identity was a central part of establishing the program’s narrative.

**Key learning insights:**

* **Use Grand Challenges to spur holistic impact**
* **Set a big (and timely) goal that can be sufficiently funded**
* **Use a wide variety of funding mechanisms**
* **Hire the right people – and have senior leadership support**
* **Continually iterate and refine processes**

Use Grand Challenges to spur holistic impact

SunShot exemplifies how systems-level perspectives can emerge from Grand Challenge frameworks, and how investing in holistically understanding the problem can lead to more effective problem-solving to advance technology *and* integrate it into the marketplace. SunShot program staff spent a year soliciting feedback from stakeholders into program definition, identifying five areas where innovation was needed: photovoltaics, concentrating solar power, systems integration, soft costs, and technology-to-market. After integrating stakeholder feedback and developing technology white papers, Dorgelo explains, DOE “took their existing solar-technology funding streams and oriented them towards what they had heard would be needed to achieve the overall goal through advances in those five technology areas” [Dorgelo, C., personal communication with Policy Design Lab, December 5th, 2016]. The integrated portfolio approach across multiple technology paths and stages, coupled with collaboration across Federal agencies helped the program to make impacts across the U.S. solar value chain. Iterative assessment of the state of the industry, market and existing programs helped the program to maintain agility.

Set a big (and timely) goal that can be sufficiently funded

Big ideas evolve from issues of our time. A Challenge needs to inspire people to want to propose solutions and be incentivized enough to make it worth their time. Considerable research and industry consultation went into the $1 goal, which fell just outside of what industry felt at the time was feasible. $1 billion was allocated in pursuit of the goal. [Ulrich, E.,personal communication with Policy Design Lab, December 2nd, 2016]

Use a wide variety of funding mechanisms

“In SunShot’s case, they used a wide variety of funding mechanisms, including prize competitions as well as funding awards for cooperative research, development, demonstration, and deployment projects,” notes Cristin Dorgelo. “They looked holistically about what type of funding would make most sense for certain aspects of pursuing the goal, and deployed standard funding mechanisms such as grants and contracts, but also incentive prizes where appropriate” [Dorgelo, C., phone interview with Policy Design Lab, August 3, 2016]. Prize competitions, for instance, were a good fit for driving entrepreneurship and meeting software needs that could reduce solar soft costs – by using short timeframes and smaller funding rates, it encouraged software companies to lower hurdle rates. The variety of funding approaches also recognized the other kinds of value the program could bring to the table through data and information assets, analyses, training, convenings and by working with stakeholders to identify the right questions to answer together to keep the industry moving forward.

Hire the right people – and have senior leadership support

The Challenge required a highly trained technical team for active management of the grants. A concerted push was made with grantees to assess whether projects would yield results competitive with forward looking estimates for current technologies and approaches, with an overarching emphasis on the ambitious quantitative goal. (This meant that if it would take 10 years for a solution to mature and gain market acceptance, it would have to be competitive with cost reduction curves on current technologies in that same 10 year horizon.) Leadership from the top was also key for ensuring continued, unwavering support for these goals. The Secretary of Energy was integrally involved in the effort.

Continually iterate and refine processes

Internal process improvements piloted within the SunShot program led to updates to how all grants and cooperative agreements were selected and managed within EERE. The time from announcement to award was reduced from about 18 months, to 6 months to keep up with the rapidly changing technology and market environment.

**To Learn More:**

[**DOE SunShot factsheet**](http://energy.gov/sites/prod/files/2016/06/f32/SunShot-factsheet-2016.pdf)

[**On the Path to SunShot: A series of 8 reports**](http://energy.gov/eere/sunshot/path-sunshot)

[**SunShot Vison Study: 5-Year Assessment**](http://energy.gov/eere/sunshot/sunshot-vision-study)

[**SunShot Catalyst: “Next Generation of Prize Challenges”**](http://energy.gov/eere/sunshot/sunshot-catalyst-energy-innovation-prize)

[**SunShot 2030**](http://energy.gov/eere/sunshot/sunshot-2030)

**Next Steps/Checklist:**

**Relevant Policies:**

**Additional Resources:**