Build Back Solar

A decade of deployment.

Cities build their share of the great energy transition and lead the way to a sustainable future.

One Million USD in Prize Commissions

Open Call Design Challenge and Resource Hub for Cities

buildbacksol.org

to bring Build Back Solar to your city, email us at lagi@landartgenerator.org
“If we are serious about meeting our carbon emissions targets, cities need to take responsibility over the next decade.”

A blueprint for immediate implementation that can transform host cities into world-leading net-zero carbon solar cities.
Build Back Solar is an international open-call design challenge to establish and catalog best practices for deploying solar power at scale within cities.

It can be challenging for people to imagine what solar infrastructure can look like in the city beyond rooftop installations. A great benefit of this design challenge will be to provide an illustrated window onto our sustainable future, where solar co-exists with urban gardens, places of worship, public plazas, riverwalks, reservoirs, and many other urban site typologies.

Build Back Solar will demonstrate the feasibility, versatility, and co-benefits of solar landscapes deployed within cities.

The design challenge will show how the vast social benefits of urban solar integration warrant a shift of focus from remote centralized solar farms to distributed and interconnected systems near population centers. Solar power in cities can simultaneously help to stem climate change and serve as a versatile policy vehicle for addressing issues of environmental justice, energy poverty, wealth inequality, and their intersection with racial injustice.

In addition to being the most viable option from a purely economic standpoint,1 solar power integrated into the built environment has a multifaceted social return on investment, providing co-benefits for cities that can be easily quantified.

In order to highlight this unique historical opportunity, and aligned with the Biden-Harris campaign to Build Back Better during their administration, Build Back Solar will launch an interdisciplinary design challenge in 2023, beginning with the first host city and expanding to more cities over the next decade.

Launching in January of 2023, the open competition period will run through the end of April. In October of 2023 (the conclusion of Stage 1) the project will unveil the design proposals to the world and present an exemplary blueprint for equitable urban solar development. Stage 2 will produce shovel-ready contract documents and financing for selected projects.

Over the next decade the world will experience massive and unprecedented development of solar power infrastructure.

Solar energy is now the cheapest form of energy on the planet,¹ and as its price continues to fall it has become the go-to technology for new energy supplies. Projections suggest that to achieve carbon neutrality and prevent the worst impacts of climate change, the U.S. will add hundreds of gigawatts of new solar energy to power future urban electricity demand.

Solar will also play a key role in providing the energy necessary to power electric vehicles cleanly and to supply green electrons for industry.

How can we accelerate the deployment of solar power infrastructure for cities in ways that enhance diverse social, economic, and environmental benefits for urban communities while also ensuring that the net costs and benefits of that development are (1) comparable to those for remote and rural utility-scale power plants; and (2) equitably distributed across communities?

How can coordinated city-wide solar projects enhance local culture, enliven public spaces, and provide other extensive co-benefits? Can urban solar innovation benefit economically disadvantaged communities or help reverse historical patterns of urban racial or economic injustice? Are there ways of aggregating rooftops, public spaces, empty lots, brownfield sites, parking lots, and other viable sites within the city to create large-scale urban projects for procurement, taking advantage of similar economies of scale as large rural projects? What kinds of financing mechanisms could be developed to expand the pool of investors and beneficiaries? Can the universal resource of solar energy be managed in such a way as to accrue benefits universally to all the people? What would all of that solar infrastructure look like, and how could it be culturally and aesthetically integrated into urban visual-scenes and enhance the public commons?

There are a number of companies and innovators that have developed products specifically for solar integration into a wide range of urban spaces, including residential and commercial rooftops, parking garages, parks, walking areas, and more. The Build Back Solar design challenge is an opportunity for these organizations to showcase their products for site-specific solutions while also providing a platform for innovation by startups, design firms, and individual creatives.

¹ https://webstore.iea.org/world-energy-outlook-2020
According to the Solar Energy Industries Association (SEIA) and Wood Mackenzie, the United States deployed a record 19 GW of solar photovoltaic capacity in 2020 in spite of the coronavirus economic recession. Solar power is fast becoming the leading type of new energy deployment, outpacing natural gas and comprising 43% of all new electric generating capacity additions.

As we enter the 2020s (the decade of deployment), city strategic planning must consider the impact and opportunity that the global deployment of 110 billion solar modules will have on our cities, our economies, and our cultures.

Many solar modules will be installed on rooftops but not all rooftops are suitable. Cities could choose to outsource their solar power, import it from less densely populated areas with massive centralized solar farms. But what about the impact of these inland seas of solar panels and transmission lines on the use of public lands, on natural habitats, forests, lower income communities, scenic landscapes, tribal lands, agriculture, recreation, and future development? Would it be preferable to generate power closer to where we use it?

Centralization of remote power plants and energy distribution infrastructure are a consequence of fossil fuel and nuclear power logistics. You can’t have rooftop coal powered electricity. It demands economies of scale. Solar works the same at any scale. And when we distribute solar nearer to the places it is consumed, we increase resilience, reduce transmission losses, and we can take advantage of an interconnected microgrid with storage, demand management systems, etc.

If we decide that it is preferable that cities deploy solar energy landscapes in proportion to their consumption of energy rather than import it from the countryside, then we will want to find creative and equitable ways to bring solar energy landscapes into urban areas. As we have seen with the affordable housing crisis in America, one of the most serious obstacles to implementation of solutions in cities is often local community pushback, even by folks who are in favor of the larger social goals.

Build Back Solar is designed to set a standard for community engagement during the early design process for solar projects in cities. There are 1,050 cities in the world with populations over 500,000 people.

Over the course of this decade, these 1,050 cities will lead the way to climate balance by installing solar energy to meet their proportion of the global energy demand in a 100% renewable energy economy.

Build Back Solar will begin in 2023 with the first host city. Each following year of the annual design challenge, the number of host cities will expand exponentially until the early years of the 2030s when every city in the world could generate its solar share of net-zero energy within its boundary.

44.62 square meters
Area of installed solar energy landscape required per person* to successfully achieve the energy transition and reach net zero. (4.2 kW capacity)

*assuming a total world population of 7.8 billion people and an equal distribution of responsibility.

37,000 gigawatts
To achieve a world entirely powered by renewable energy we will need to install 37,000 gigawatts (GW) of photovoltaic solar capacity globally as a part of a mixed portfolio of solar, wind, and hydro energy resources with robust energy storage. That’s about 110 billion solar modules.

350,000 square kilometers of solar energy landscape
Land area that would be covered by 110 billion solar modules installed as energy landscapes (includes space between the modules and space for auxiliary equipment and maintenance areas). Depending on the space between panels, this could be as much as 500,000km².

200,000 square kilometers of solar modules
Land area that would be covered by 110 billion solar modules placed frame-to-frame with no space between.

What is a City’s Share?
The land use impacts of solar power are significant. It’s time for cities to take the lead.

110 billion
Number of standard size solar modules required to meet the necessary capacity. Divided by the world population, this comes out to about 14 solar modules per average human on the planet. It could be argued from an equity perspective that richer nations and cities take a far greater share per capita.
Providing carbon free energy in the fight against climate change is the most obvious benefit of solar power. What may be overlooked are the benefits of distributed solar for local economies and as a mechanism to increase social equity and quality of life. Properly planned and implemented, city-integrated solar infrastructure can provide a wide array of co-benefits.

Energy Resilience and Independence

The application of solar infrastructure can increase the energy independence of municipalities. Cities are already taking advantage of long-term power purchase agreements for clean energy to establish pricing stability. By bringing solar installations into urban neighborhoods, cities can accomplish the same goal while also contributing to resilience and efficiency by limiting reliance on monopoly utilities and eliminating maintenance costs for remote distribution infrastructures. Localized supply chains can emerge to provide good paying jobs while decreasing the embodied environmental footprint of solar modules.

Solar Dividend

The energy of the sun is a universal natural resource. Throughout history there are examples of a “universal property” approach to the distribution of natural resource benefits. The most often cited example is the Alaska Permanent Fund. Writing in Scientific American James Boyce summarizes the program:

In 1976, as oil production commenced on Alaska’s North Slope, the state amended its constitution to create a new entity called the Alaska Permanent Fund. The idea was the brainchild of Republican governor Jay Hammond, who believed that Alaska’s oil wealth belonged to all its residents, and that all should receive equal annual dividends from its extraction.1

The idea extends to the principle of the “solar energy commons”—a recognition that the sun’s energy belongs to all of us if it belongs to any of us. Especially when installed on public land or community land trusts, solar power offers an opportunity for an equitable distribution of a solar dividend, a policy mechanism that can be a powerful tool to combat the cycles of poverty experienced by so many the world over. The sale of solar electricity can pay out in universal basic income2 and provide new opportunities for private wealth generation through distributed energy ownership, a democratization of what is today almost entirely monopoly ownership. Technologies such as virtual net metering make it possible for individuals to become energy “prosumers” selling kilowatt-hours directly. As privatization of solar infrastructure becomes more widespread it will be important to make sure that the financial benefits are not limited to the upper class, but intentionally provide diversity of ownership as a means to close the wealth gap.

Quality of Life

When designed in collaboration with communities, solar installations can improve quality of life and the beauty of public spaces. PV modules can provide aesthetic shade, creating new microclimates that expand the comfort zone in hotter climates into the summer months for human activities in outdoor public spaces.

Solar cities will have major competitive advantages over non-solar cities.

Replacing fossil fuel infrastructure in cities improves air quality and quality of life. Solar panels installed over:

- canals and reservoirs can increase flow throughput by decreasing evaporation.
- community gardens can collect rainwater for irrigation and expand viable urban agriculture sites in dryer regions, all helping to contribute to food security.
- public spaces can help to reduce heat island effects and risk of heat stroke in summer.

Solar cities will tend to be more livable, equitable, innovative, and resilient—all qualities that make for strong economic development.

1 https://www.scientificamerican.com/article/the-case-for-universal-property/
2 https://sustainablesystemsfoundation.org/ending-poverty-in-california-through-solar/
Within the city’s municipal boundaries there are a number of sites that could double as solar energy landscapes. The introduction of solar to some of these sites typologies can provide the added benefit of shading to extend the public use of spaces into the summer months.

Site typologies include urban and suburban areas.

Airport  
Brownfield  
Commercial plaza  
Community center  
Community garden  
Landfill, transfer station, or other waste management site  
Parking lot  
Place of worship  
Public park  
Public school  
Reservoir  
Riverfront  
Rooftop (residential, multi-family, big box commercial, industrial)  
Transportation corridors (bike lanes, bus routes, railroad, etc.)  
University  
Urban farm  
Urban substation  
Vacant lot  
Water treatment site
Build Back Solar will eventually provide a blueprint for equitable solar integration for cities representing all of the world’s climate typologies.

Climate typologies are from the Köppen climate classification map. [Link](https://www.britannica.com/science/Koppen-climate-classification/World-distribution-of-major-climatic-types)

**WET EQUATORIAL**
Jakarta, Kuala Lumpur, Rio de Janeiro, San Juan

**TROPICAL MONSOON**
Bangkok, Lagos, Rangoon, Manilla, Brazil

**TROPICAL WET-DRY**
Havana, Caracas, Chennai, Mumbai

**TROPICAL AND SUBTROPICAL DESERT**
Dubai, Cairo, Muscat, Basra, Riyadh

**MID-LATITUDE STEPPE AND HIGH DESERT**
Phoenix, New Delhi, Shiraz, Jaipur, Madrid, Reno, Denver

**TROPICAL AND SUBTROPICAL STEPPE**
Tehran, Madrid, Perth, Sacramento, Algiers, Capetown

**HUMID SUBTROPICAL**
Bogota, Shanghai, Sao Paulo, Atlanta, Miami, New Orleans, Houston, Los Angeles, San Diego

**MEDITERRANEAN**
Rome, Istanbul, Lisbon, Barcelona, Tel Aviv, San Francisco

**OCEANIC**

**HUMID CONTINENTAL**
Tokyo, Moscow, Helsinki, Copenhagen, Vienna, Berlin, New York, Boston, Detroit, Chicago, Pittsburgh

**CONTINENTAL SUBARCTIC**
Oslo, Juneau, Anchorage, Reykjavik)

**HIGHLAND**
n/a-small villages only

**TUNDRA**
n/a-small villages only

**SNOW AND ICE**
n/a-few permanent settlements
• Provide a complete concept design solution for at least one of the documented site typologies within the city.

• The proposed solution must use photovoltaic or solar thermal technology to meet an existing demand (offsetting carbon fuels) and establish a balance between the functional use of the site and the production of energy.

• Consider your proposed infrastructure within the context of the urban plan. What is the space allowing people to do? How is it improving life and improving the community?

• The design should serve to inspire the world about the beauty of renewable energy infrastructures and convey a positive message about life in a post-carbon city.

• Consideration must be made for aesthetically housing electrical equipment within the site boundary and restricting access to those areas for the safety of the public.

• The proposal must be pragmatic and constructible, and employ technology appropriate for the site typology. Consider the best technology for the climate region and for the micro-climate of the design site.

• Consider the environmental footprint of the proposal, and demonstrate an understanding of the embodied carbon payback period of your design.

• The proposed solution should enhance the urban landscape by incorporating strategies such as creative placemaking, public engagement and interactivity, education/interpretation, and civic art.

• Consider the social justice, environmental justice, and economic justice aspects of the proposal. Explain how the proposal connects to critical urban issues including racial injustice, energy poverty, sustainable mobility, affordable housing, etc..

• The proposal should be informed by an understanding of the history, geography, details of the design site, and the broader context of the host city.

• Use the provided check list to confirm that the project addresses critical cultural and local requirements.

• The proposal may use a previously developed modular system, but it must be designed for the specific design site and address all aspects of the design brief. The challenge encourages businesses to innovate rather than present a solution using an existing product line, although existing product lines are allowed. If you are proposing the use of a proprietary system, please provide the specifications for that system.

• Describe the method of site owner engagement, community participation, or co-design that your team plans to incorporate into the next stages of your design process should your proposal proceed to Stage 2. Please make use of the “aspirations and constraints” document provided in supplemental materials in order to ensure that your proposal is grounded in pragmatic considerations.

• Using the template provided, include a summary of the proposed financing model for implementation including a complete 30-year life-cycle cost/benefit analysis that accounts for the social, cultural, energy, environmental, and economic system inputs and outputs over the life of the installation, comparing and contrasting conventional rural utility vs urban integration for similar capacity solar plus storage installations. The type of energy storage is up to the team to specify, and may include but not be limited to chemical battery storage, hydrogen storage, gravity or other mechanical storage, or thermal storage. *This requirement is intended to advance the development of tools and methods for assessing the costs and co-benefits of urban solar energy developments (beyond kWhs) so that they can be appropriately evaluated by investors and institutions against other forms of solar and low-carbon energy development.

• Use English language for all text and metric for drawing scale.

Example design brief—details for each design brief will be developed in collaboration with each host city.
The proposed solution must use photovoltaic or solar thermal technology to meet an existing demand (offsetting carbon fuels) and establish a balance between the functional use of the site and the production of energy.
The outcomes of the design challenge will include:

- A portfolio of innovative ideas for equitable solar implementation across a range of urban typologies;
- Shovel-ready development plans for winning proposals including detailed design documents, specifications, detailed financing strategies, and in some cases built prototypes;
- A blueprint for immediate implementation to transform the host city into a world-leading net-zero solar city;
- A publication that is available to the general public online, and is circulated to mayors and city leaders around the world;
- A suite of curriculum-aligned education tools for K–12 through university;
- Improved tools for urban solar project evaluation, planning, and financing;
- Outreach to cities across America and the world;
- And a month-long Build Back Solar event in the host city.

Milestone 1  Scope and Project Definition
Stakeholder meetings, site visits, early planning, define project goals, outcomes, and metrics, preliminary site analysis and city-wide energy model, project execution plan, risk assessment, coordination with potential funders, etc.

Milestone 2  Development of Design Brief
The delineation of the site boundary areas and the creative brief for the Build Back Solar design challenge will be informed by engagement with project stakeholders. This milestone will include the development of the submission format, evaluation process and criteria, entry process/guidelines/eligibility, technical submission requirements, awards, terms and conditions, site documentation, launch event planning, project identity and branding, early marketing and media strategy.

Within Milestone 2, the Land Art Generator will facilitate community engagement workshops for each of the design site typologies. Each site will host two public events, which will serve to inform the community about the project, solicit feedback, and discuss possible shared land uses. The workshops will be video recorded and available to participating teams along with contact information of community leaders and local stakeholders.

Milestone 3  Launch and Competition Management
Major launch and marketing for participation. Interface as first point of contact with all Build Back Solar competition participating teams and finalists, manage Q+A process and coordinate responses with stakeholders, etc.

Milestone 4  Selection Process Management
Check each project for compliance with the design brief, technical review, selection process, shortlisting event, final jury, communication with participants, finalists, and teams. Marketing for events. Increase awareness around the announcement of the winning proposals and build support for implementation with key stakeholders.

Milestone 5  Primary Events and Exhibitions
Award ceremony and announcement. Public outreach and programming, publication launch. Educational programming throughout the host city.

Milestone 6  Stage 2
Stipend to winning teams for development plans.
From the hundreds of proposals submitted for each host city, 5–10 projects will be chosen to move forward and be contracted with Stage 2 development work to include the following:

- Public design workshops to develop the winning concept with community
- Initial workshop to present concept and solicit feedback and ideas
- Presentation of design development drawings and renderings
- Presentation of draft bid package
- Detailed design drawings, specifications, and bidding/negotiation contract documents
- Project execution plan presentation detailing net present value, return on financial investment, sustainable site business model, life-cycle analysis, operations and maintenance plan (SOP), embodied carbon payback period, site environmental impact assessment, social value assessment, and financing strategy.
- Teams may choose to negotiate a development contract with an investor, developer, site owner, nonprofit, utility, and/or local cooperative during Stage 2 work, or they may choose to put together a complete package in coordination with the site owner that can then be bid on by multiple investors at the conclusion of Stage 2.

Stage 3 will focus on the construction of the winning entries as permanent installations in the built environment. The installations will be of such an aggregated scale that they will provide a sizable contribution to the overall decarbonization goals of the host cities.
Build Back Solar will be strategically implemented with the goal of scalability and replicability for rapid global deployment.

Build Back Solar will establish an exponential growth pattern for city deployment by implementing a customized development model that allows for enfranchisement, open source documentation, and typological replication.

Each serving host city will serve as an organizational hub for the future planning and deployment of 2–4 additional host cities for Build Back Solar design challenges. In this way, the initiative has the potential to reach more than 1,000 cities across the globe by the end of the decade.
The Multiplier Effect of Build Back Solar

By harnessing the power of the private solar market, the initial investment in Build Back Solar results in the installation and long-term maintenance of more $20 million in solar infrastructure (~20 MW capacity) at no cost to the city or to program sponsors.

That is more than ten times the quantity of solar capacity that could be installed by conventional methods. By covering the soft costs of development, developers are incentivized to invest in city solar projects while Build Back Solar will ensure that an equitable and just transition is a centerpiece of each project plan.

Stage 1 initial investment leads to hundreds of beautiful and equitable design proposals for ten sites submitted by design teams from around the world.

Stage 2 covers developer soft costs for detailed design, site approval, and financing documents for ten projects—one for each site, and all chosen by local stakeholders. Developers are obligated per the terms of the bid to pass along the soft cost savings to social justice initiatives and site co-benefits.

$750,000 Consultants and project management including: design guidelines development, project management, marketing, GIS, research, site analysis, energy consultant, community engagement consultant, and equity consultant to oversee the project agenda of a just transition.

$185,000 Community outreach including: public programming, exhibitions, events, stakeholder engagement, educational materials, workshops, documentary publication & distribution.

$65,000 Expenses including: travel and information technology

$1,000,000 Stage 2 development funding (bid documents)

$2,000,000 Total (detailed budget available on request)

The construction funding is outside of the scope of Stage 1 and Stage 2 of Build Back Solar, as it will be provided by the investor owners of the new solar infrastructure who will profit over time by the sale of clean kilowatt-hours, investment incentives, and renewable energy credits.

Land Art Generator is a 501(c)(3) nonprofit registered in the United States. Donations are tax-deductible per IRS.
City of Phoenix
CLIMATE TYPOLOGY MID-LATITUDE STEPPE AND HIGH DESERT
POPULATION 1,680,992
CITY AREA 1,345 km²
CITY SHARE OF SOLAR AREA 75.01 km²
(44.62 m² per person)

Percent of City
Landscape* Solar 1.83%
Commercial Rooftop PV 0.68%
Residential Rooftop PV 0.37%
Supporting Space 2.69%
Total 5.58% of Phoenix

Circle is to scale with the City Plan.
Its total area = 5.58% of the area of the City.
*Landscape Solar is that which is installed anywhere other than on rooftops.
Supporting space is the space between modules required for servicing and to maximize performance.
City of Pittsburgh
CLIMATE TYPOLOGY HUMID CONTINENTAL
POPULATION 305,704
CITY AREA 152 km²
CITY SHARE OF SOLAR AREA 13.64 km²
(44.62 m² per person)

Example City

Circle is to scale with the City Plan. Its total area = 8.97% of the area of the City.

*Landscape Solar is that which is installed anywhere other than on rooftops. Supporting space is the space between modules required for servicing and to maximize performance.
The Land Art Generator is the world leader in renewable energy design competitions, with over a decade of experience hosting city-based competitions for iconic renewable energy installations as a form of public art. Their competitions have been hosted by some of the world’s leading cities: Dubai, Abu Dhabi, Santa Monica, New York, Copenhagen, Melbourne, and most recently Fly Ranch—4,000 acres near Black Rock City owned by Burning Man Project. Participants in LAGI competitions have included some of the world’s most influential design and architecture firms and university design schools.

Additionally, the Land Art Generator produces free educational materials, provides workshops and STEAM programming to educators, and publishes reference guides and information graphics on renewable energy technologies and land use implications. The mission of the nonprofit is to accelerate the transition to a regenerative and renewable economy by inspiring the world about the beauty of a post-carbon tomorrow.

Partnerships and supporters include Masdar Abu Dhabi, City of New York, NYC Department of Parks and Recreation, City of Copenhagen, European Union Commission on Climate Action, City of Santa Monica, J.M. Kaplan Fund, National Endowment for the Arts, Capital Region of Denmark, Danish Design Centre, US Green Building Council, the City of Glasgow, the State of Victoria (Australia), Carbon Arts, Creative Carbon Scotland, Climarte, Burning Man Project, Arizona State University (GIOS), Zayed University, IT University of Copenhagen, and many others.


The 2009 Land Art Generator information graphic Surface Area Required to Power the World with Solar helped to influence the popular imagination of what a post-carbon world might look like. It was published by the International Energy Agency in their 2011 Solar Energy Perspectives report. Since then, the Land Art Generator has published many more information graphics from comparisons of land use impacts from fossil fuel extraction and renewable energy production to mapping the land area of solar required to power bitcoin.

https://landartgenerator.org
Build Back Solar will close the door on the doom and gloom of climate change and show that renewable energy can be beautiful, powerful, and equitable.