

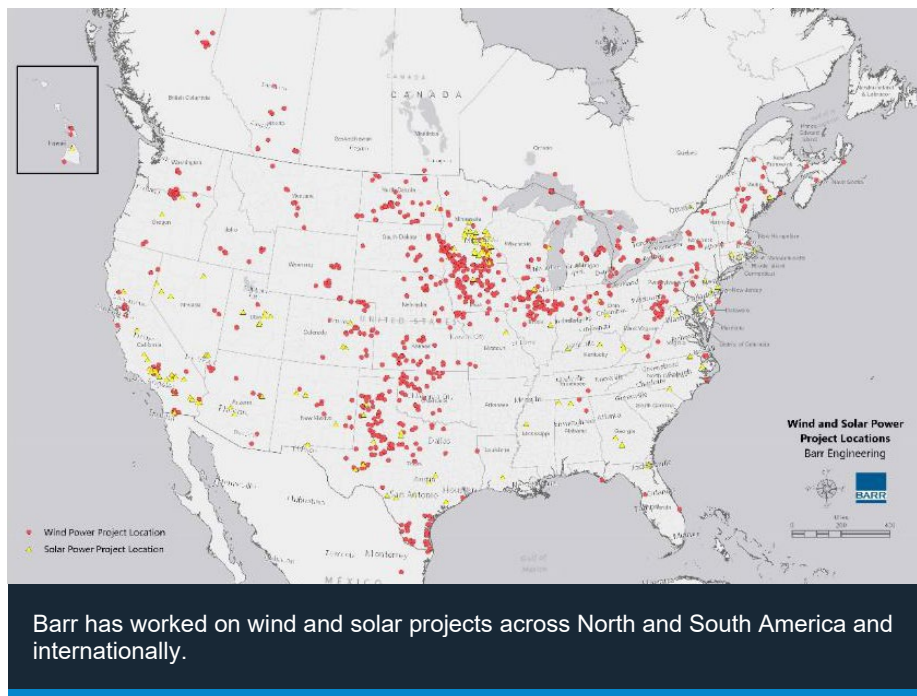
Statement of qualifications: renewable generation

About Barr

Incorporated as an employee-owned consulting firm in Minneapolis in 1966, Barr integrates engineering and environmental expertise to help private and public clients develop, manage, process, and restore natural resources. More than 1,000 engineers, scientists, and technical support specialists serve our clients from 16 offices across North America. Our passion is helping clients solve their most complex challenges related to utilization, management, and restoration of natural resources. Barr's multidisciplinary engineers and scientists strive to put themselves in your shoes to achieve your best outcomes.

Our qualifications: from start to finish

Barr has been applying innovative approaches to renewable energy projects for more than 30 years in the power, fuels, mining, public, and manufacturing market sectors. Our clients benefit from our integrated approach to engineering and environmental services that provides a holistic view of renewable energy project costs, challenges, and opportunities. In recent years, we've partnered with our clients to meet the increasing demands for low-carbon energy. We're helping them leverage opportunities created by new incentives and subsequent investments in renewable generation.



Barr's renewable energy experts provide full lifecycle support from initial siting and feasibility to permitting assistance and environmental reviews to structural, geotechnical, civil, and electrical engineering including energy storage, interconnection, and distribution. We're driven to provide the technical expertise needed to build a sustainable and resilient energy future.

Barr is an active member of the American Clean Power Association—the largest renewable-energy professional organization in the country. Barr staff members also serve on the Minnesota Solar Energy Industries Association (MnSEIA) Board. We track and understand regulatory, industry, and technical developments, rules, and standards so that we can provide our clients with insights on technical and market opportunities as well as potential threats to the renewables market and projects.



We performed preliminary and final geotechnical investigations and designed portions of the infrastructure, including pile installation, for this solar project in the Mojave Desert.



Turbine-foundation design and construction observation at Altamont's Summit Wind project in California

Key services

Barr provides an integrated engineering and environmental package that includes:

- **Project siting and feasibility**
 - Desktop feasibility studies
 - Wetland delineation
 - Plant system modeling and performance review via PVsyst
 - Brownfield reviews and support
- **Permitting assistance**
 - Environmental permitting and siting
 - Phase I/II ESAs
 - Decommissioning plans
- **Foundation selection**
 - Geotechnical services
 - Structural engineering
 - Crane-walk evaluations
 - Receptivity testing
- **Site design and construction oversight**
 - Civil engineering
 - Plant layout and optimization
 - Stormwater Pollution Prevention Plans (SWPPP)
 - Spill Prevention, Control, and Countermeasure (SPCC) plans
- **Electrical engineering**
 - Interconnection and substation design
 - Collection system design
 - Plant-system modeling and performance review
 - Control-system design
 - Cathodic-protection design
- **Plant performance testing**

Solar: select project examples

Barr has a long history of helping power companies, utilities, and renewable energy developers analyze and select sites and then permit and construct photovoltaic (PV) and concentrated solar power (CSP) facilities. Our clients experience a smooth and streamlined project process through our integrated engineering and environmental approach. Because Barr understands all aspects of a project, we help minimize construction related environmental impacts, evaluate the feasibility of potential alternatives, and spot potential problems relating to foundations, geology, and siting. We have assisted clients with all aspects of solar development, including project siting and feasibility, permitting assistance, foundation selection, structural engineering, and civil and electrical engineering.



We use our mining, refinery, landfill, geotechnical, and environmental expertise to assess feasibility and minimize risks for solar and wind farm installation at mining, refinery, industrial, and brownfield sites.

Environmental baseline studies for utility-scale solar projects; various clients; Arizona and New Mexico

Barr team members led environmental baseline studies and permitting of four utility-scale solar projects in Arizona and New Mexico, totaling 2.5 gigawatts (GWs) of power. The Arizona projects are on Bureau of Land Management- and Bureau of Indian Affairs-administered lands of the Navajo Nation. Each project was approximately 7,000 acres in size. We completed aquatic-resource delineations and biological baseline surveys of each project for over two years. One solar project near received USACE concurrence with our assessment of jurisdictional features. Over 40 miles of drainages crossed the study area. We also obtained Navajo Department of Fish and Wildlife (NDFW) concurrence with the findings reported in the project Biological Evaluation. Based on our fieldwork and reporting, the two solar projects were issued approved solar variances from BLM and are currently in the NEPA process. In New Mexico, we completed all biological and aquatic resource baselines in support of the 200-megawatt (MW) San Juan Solar Project. The project was issued a Finding of No Significant Impact (FONSI) by the BLM and was then acquired by DESRI. Another solar variance was successfully completed in support of the 360-MW Shiprock Solar Project in NW New Mexico. That project is currently in the NEPA phase with all natural resource baselines completed by Barr team members.

Environmental testimony, permitting, baseline surveys, and reclamation monitoring; Imperial Valley Solar Project (IVSP), California

Barr experts were contracted to assist with professional environmental testimony before the California Energy Commission as part of the Imperial Valley Solar Project, a solar-dish Stirling systems project. We also provided California Water Association (CWA) and NEPA permitting as well as biological baseline surveys and reclamation monitoring. The IVSP was planned as a 750-MW Stirling engine project. The primary equipment for the generating facility included approximately 30,000, 25-kW (kilowatt) SunCatchers and associated equipment and systems as well as support infrastructure. The 6,571-acre project site was proposed on approximately 6,251 acres of federal land managed by the BLM as well as approximately 320 acres of privately-owned land. The project also included a new 230-kV substation connected to the existing SDG&E Imperial Valley Substation via an approximately 10.3-mile, double-circuit, 230-kV transmission line. We were instrumental in permitting the facility, which at the time was the largest proposed utility-scale solar project on public lands in the US. Ultimately, the project was permitted at 719 MW.

Permitting support for 130-MW solar facility; confidential client; Minnesota

Barr is currently supporting a client's permitting process for a proposed, confidential 130-MW solar facility in Minnesota. Our team's completed scope of work includes a Critical Issues Analysis (CIA), noise study, wetland delineation and agency consultation, and cultural resource survey. Barr is actively writing the environmental section of the Minnesota Public Utilities Commission (MPUC) site permit and developing the Agricultural Impact Mitigation Plan and Vegetation Management Plan.

Environmental analysis for multiple solar facilities; confidential pipeline client; Wisconsin, Minn.

Barr performed environmental evaluations to support feasibility analyses for a confidential pipeline client. The client plans to install multiple solar power facilities at more than a dozen pump stations as part of its environmental, social, and governance (ESG) and sustainability commitments. We conducted desktop and literature reviews to identify potential impacts to waterways, wetlands, threatened and endangered species, and cultural resources. We developed a CIA document for each site that summarized baseline environmental conditions and risks and constraints. We used the CIA to develop a permit matrix to evaluate federal, state, and local permits required for each site. Barr also conducted on-site wetland delineations, functional assessments, and archaeological resource surveys to refine project boundaries and minimize impacts to identified resources.

Evaluation of solar development at a closed landfill site; Metropolitan Council Environmental Services; Eagan, Minnesota

Our client and a solar developer proposed installing more than 3,000 solar panels atop a capped fly-ash landfill that contains sewage sludge and biosolids ash from a nearby wastewater treatment plant. The landfill has been in closure for 30 years. Its cap, designed by Barr, has been in place since 1996. Barr was hired to perform an engineering analysis of the solar project's feasibility; evaluate effects on surface hydrology; and assist with stormwater permitting. The assessment indicated negligible effects on site hydrology, demonstrated the feasibility of installation, and demonstrated that the landfill cover's integrity would not be impacted. The solar project has been online since 2018.

Cost estimating for small-scale solar interconnects; Xcel Energy; Denver Colorado

Our staff developed the preliminary design and prepared detailed cost estimates for interconnection facilities for two small-scale solar projects at the Denver International Airport, which would connect to Xcel Energy's distribution system.

Capacity checks and feasibility for a reclaimed mine solar project; Bent Mountain, Kentucky

Barr assisted with capacity checks and feasibility layouts for a solar project located in a reclaimed coal mine in Kentucky. Shadowing, topographic constraints, earthwork, InSAR analyses, subsidence, fill depths, underground mines, fill age, and settlement were evaluated to develop solar-panel layouts for different technologies (fixed-tilt vs. tracker).

Geotechnical and environmental permitting services; Pine Bend Refinery; Rosemount, Minn.

Barr completed a geotechnical investigation and site evaluation for a \$75 million solar farm that will consist of more than 100,000 solar panels on 300 acres and provide roughly 30 percent of the refinery's power needs. Our team provided geotechnical testing and provided design recommendations for the solar panel foundations. We also performed infiltration testing to assist with stormwater basin design. We helped the refinery and its parent company, Flint Hills Resources, navigate key environmental and social considerations, such as land use and zoning; threatened and endangered species; wetlands impacts; construction stormwater management; and restoration planning. We helped the client schedule field activities to minimize habitat impacts for a variety of protected species.

Water treatment plant photovoltaic solar project design; City of Minneapolis; Minnesota

Minneapolis Water Works sought to construct its first photovoltaic solar project to generate part of the power needed on the local campus. Barr provided preliminary and final design, subsurface investigations, and design workshops, as well as coordinating stakeholder communications and regulatory agency reviews. Barr also assisted with bidding out the construction work and will provide limited construction administration.

Civil engineering services; Minnesota National Guard; Camp Ripley, Minnesota

As a subcontractor to Hunt Electric Corporation, Barr provided civil engineering services as part of construction of a 10-MW solar facility at Camp Ripley—the first utility-scale solar facility permitted and constructed in Minnesota. Barr prepared the civil engineering design; designed drainage features; developed a grading plan to reduce site slopes and minimize low areas where water could pool; prepared a construction SWPPP; and designed interior and perimeter roads for delivery trucks and emergency vehicles. Barr modeled site runoff to quantify permanent stormwater-control requirements. We were then able to negotiate with the Minnesota Pollution Control Agency (MPCA) to arrive at a practical solution at a significantly lower cost. The solar project came online in April of 2017.

Complete design for solar-collection substations; BQ Energy; Pennsylvania and Ohio

Barr is providing complete design for BQ Energy for two new 34.5-/69-kV, 20-MVA solar-collection substations in Pennsylvania. The work includes site development, foundations and structures, physical design, and protection and control design. Barr is also performing complete design for two new 34.5-/138-kV, 100-MVA, and 34.5-/138-kV, 49-MVA solar-collection substations, respectively, in Ohio. Our work there includes site development, foundations and structures, physical design, and protection and control design, along with design for a 138-kV generation-tie transmission line. For all four sites, we're performing short-circuit, reactive-compensation, and harmonic studies and will perform protection-coordination studies. For another 50-MW site in Ohio, Barr prepared a preliminary substation design and is currently performing detailed design work on the generation-tie transmission line.



Barr played a key role in the installation of a 3,000-panel solar farm on top of a closed landfill without impact to the landfill's cover and integrity.

Interconnect facilities for a large-scale solar utility; confidential client; California and Arizona

Our staff designed a 230-kV substation and double-circuit transmission line to connect a 280-MW solar project in a highly seismic area to the local utility, Southern California Edison (SCE). The project involved working closely with SCE to make sure its standards were met on the interfaces, including transmission line structures and points of demarcation, protection, and control and communication systems. We also designed a 230-kV double-circuit transmission line to connect a 250-MW solar project to the local utility, Arizona Public Service (APS). We worked closely with APS on the transmission line interface, including structure demarcation and associated fiber-optic communication line.

Site selection and development of 160-MW solar projects; confidential client; California and Nevada

Barr is currently assisting with the development of two 160-MW solar projects near Los Angeles and Las Vegas. Our team is helping the owners select favorable areas for solar development as well as identify potential construction issues. Construction plans will be prepared for each project once the development phase has concluded.

Civil design and natural resource surveys for solar project; confidential client; Michigan

Barr was hired by another engineering consultant to provide civil engineering and natural resources survey services for a proposed 250-MW solar power project located on 1,900 acres in western Michigan. We provided a 30-percent design package; evaluated stormwater runoff; identified locations for potential drainage and erosion control; and developed preliminary grading plans. Barr completed a desktop review to identify mapped wetlands and watercourses within the project limits and provided CAD files showing the general extent of wetlands for use during preliminary site layout. We also identified likely local, state, and federal permits and approvals. Barr will provide 60- and 90-percent civil design packages; develop a SWPPP, spill prevention, control, and countermeasure (SPCC) plan, and a soil erosion plan; and prepare local and state permit applications. We will also provide construction support.



For the Minnesota Municipal Power Agency, Barr evaluated route options for an underground feeder to convey solar power to an electric substation and designed the underground feeder, interconnect switchgear, and sub-station modifications.

Wind power: select project examples

Barr has been involved in wind power engineering projects since 1992—near the inception of the wind power industry in the United States. Nearly 50 percent of U.S. wind power is supported by Barr's foundations. Our approach to wind turbine foundation design focuses on determining site conditions and selecting the most economically appropriate options for a site.

Engineering services for a bulk electricity project; confidential client; Texas

Barr is partnering with confidential client that is an industry leader in the construction of bulk electricity projects. We are delivering engineering services for two 34.5-kV/345-kV collection substations and a 5-mile 345-kV tie line between the substations for the 531-MW wind project. Barr performed turbine foundation design, geotechnical investigations and studies, electrical collection system design, substation design, transmission line design, and electrical studies for the engineering, procurement, and construction (EPC) contractor. We're also providing environmental assistance by identifying transmission line and structure locations with the least impact to the environment and landowners while keeping the design efficient and cost effective. A phased approach is being used to meet project funding and procurement constraints.



Barr's commitment to engineering innovation, including developing patented technology, helps our clients meet their need to install wind turbines that are taller, foundationally larger, more productive than two decades ago. Almost 50 percent of U.S. wind power is supported by Barr's foundations.

Desktop study and geotechnical investigation for a new site; Con Edison Development; Iowa

Barr completed a high-level desktop evaluation of abandoned-underground-mine risk due to subsidence for proposed wind turbine locations for two potential site layout options. Barr's engineering and mining experts also assessed the type of mining, the length of time since active mining operations, and the potential for unknown abandoned underground mines. We developed a risk assessment and recommendations for layout and development. Barr concluded there was minimal risk of subsidence. However, due to the regional risk of unknown abandoned underground coal mines, we recommended an enhanced geotechnical investigation. Barr conducted a geotechnical investigation at each proposed and alternate location that extended below the approximate depth of the coal seam. The investigation included geotechnical borings, piezometer installation to monitor groundwater levels, laboratory testing, field electrical resistivity testing, laboratory thermal resistivity testing, and road subgrade testing. Our geotechnical report summarized findings and provided geotechnical recommendations for the design of the wind turbine foundations.

Crane-walk geotechnical engineering at Kings Point wind site; M.A. Mortenson; Missouri

Barr provided crane-walk pre-planning, design services, geotechnical analysis, and construction-phase geotechnical engineering to determine the most feasible method for crane travel for construction of a new wind farm site. This complex site exhibited both low-strength soils and karstic bedrock. We utilized data collected during both the design-phase geotechnical investigation for the turbine foundation and the supplemental investigation along crane travel-ways. Geotechnical data was reprocessed to develop a complex soil-strength profile at each investigation location. A unique numerical model was created for each investigation location to simulate a crane supported by the soil and the ultimate bearing capacity of the system. The computed ultimate bearing capacity was then compared against the applied bearing pressures for multiple crane configurations specific to the project construction. We also assessed for the presence of potential karst features within the limestone bedrock.

Environmental review and permitting for repowering; Avangrid Renewables, LLC; Minnesota

Barr helped Avangrid navigate Minnesota's first site-permit amendment for partial repowering of a wind facility. Avangrid decided to prolong the useful life of a 100.5-MW windfarm by upgrading turbines to increase efficiency, reliability, and energy output, avoid decommissioning and new construction, conserve natural resources, and minimize environmental impacts. We worked with the Minnesota Department of Commerce and Public Utilities Commission to determine permit-application requirements and timelines; managed application preparation and submittal; consulted with the Minnesota Department of Natural Resources; and prepared a decommissioning plan. Our assistance also included assessing for threatened and endangered species and providing support at public hearings.

Wind farm repowering structural assessment; confidential client; Texas

Barr performed a structural assessment for the repowering of a 150-MW wind farm for one of the largest clean energy developers in the United States. We conducted a desktop evaluation to determine if the proposed foundations could support the new loads.

Additionally, since industry design practices for anchoring turbine towers to their foundations changed since the original design, we also developed a calculation procedure based on an analogous design formula and our knowledge of historical foundation performance. To validate our initial determination that the new specifications could be met, we conducted onsite inspection and testing of a subset of the foundations. Our assessment determined that the foundations could support the new turbines without costly modifications. Barr also developed a program to manage foundation risk-assessment over specific intervals. Our work helped the client move ahead with repowering while continuing to produce power for 40,000 households.



As onshore wind turbines increase in weight and height, so too do the size of the cranes needed to construct them. Barr helps minimize risks to project safety, budget, and schedule by helping developers and contractors understand geotechnical conditions along crane walks, determine the bearing capacity of soils, and design a crane walk suited to these larger cranes.

Environmental services; Minnesota Power; North Dakota

For the 100-MW Bison 2 and Bison 3 projects, Barr conducted a desktop study of environmental and regulatory constraints; performed and coordinated environmental and cultural field studies; consulted with local, state, and federal agencies; and prepared permit applications. We also performed a Phase I environmental site assessment; developed a SWPPP; and provided preliminary and detailed design for the foundations and roads.

Civil design; EDF Renewables, Wanzek Construction; Texas

Barr prepared preliminary civil design drawings for the owner/developer's use in permitting and engaging an EPC contractor for construction of the King Creek wind farm, a 393-MW wind-energy generation facility. We also provided final civil design, SWPPP and SPCC plans, and wind turbine foundation design for the EPC contractor for construction of the project.

Geotechnical investigation and foundation design; Avangrid Renewables; Oregon

Barr performed the geotechnical investigation and foundation design for wind turbines for the 201-MW Montague Wind Power Facility, consisting of 56 wind turbines on a 29,607-acre site. We also conducted a geotechnical investigation for the transmission line, substations, and met towers.

Environmental permitting; ALLETE Clean Energy; Minnesota

The Lake Benton 1 windfarm was the first large wind- energy project built outside California and one of the first permitted and constructed in Minnesota. Barr determined permit-application requirements and schedules, managed the development of the amendment application, and consulted with regulatory agencies on impacts to wetlands, protected species and their habitat, and/or historic properties.

Design phase geotechnical investigation; Heartland Wind; Illinois

The Osagrove Flats Wind Farm Project is a 150-MW wind farm facility consisting of up to 45 wind turbines on a 21,195-acre site. Barr prepared a desktop study report for the site and a design phase geotechnical investigation for the wind turbines, substation, switchyard, transmission line, met towers, and O&M building.

Civil design and foundation design; EDF Renewables, IEA Constructors; Texas

Barr’s work included preparation of preliminary civil design drawings for the owner/developer’s use in permitting and engaging an EPC contractor for construction the Coyote wind farm, a 242-MW wind-energy generation facility. We also prepared final civil design, SWPPP and SPCC plans, and wind turbine foundation design for the EPC contractor for construction of the project.

Geotechnical engineering and permitting services; Tatanka Ridge Wind; South Dakota

Barr provided geotechnical engineering services related to the construction of wind turbines, substation, met towers, and an O&M building for a 155-MW wind facility consisting of 56 wind turbines. We are also supporting project permitting.

Geotechnical engineering design; Golden Hills Wind Farm; Oregon

Barr performed design phase geotechnical engineering services for the wind turbines, substation, transmission line, met towers, and O&M building for a 200-MW wind energy facility consisting of 51 wind turbines on a 29,395-acre site.

Geotechnical investigation; Pacific Wind Development; Texas

Barr completed a design phase geotechnical investigation for the construction of wind turbines, substation, interconnect facility, and met towers for the Karankawa Wind Farm, a 308-MW facility consisting of 124 wind turbines on a 22,000-acre site.



Barr specializes in evaluating risks and navigating regulations as part of decision-making, planning, and installation of repowered wind farms. We provide structural and geotechnical assessments, foundation design, construction support, and permitting guidance and support.

Battery storage: select project examples

From battery storage and fuel cells to pumped storage, we can help you choose the energy storage solution that will best fit your needs now while supporting your future clean energy plans. Barr's project development services will help you evaluate your project's feasibility with high-level or detailed cost estimates and preliminary designs. To strategically plan your energy storage project, our engineers also perform electrical, geotechnical, civil, and structural and foundation design; conduct code reviews; and evaluate safety, hazard, and environmental impacts. Barr's

system engineers can help you select safe, cost-effective, and long-lasting solutions that cover battery selection, electrical design, protection and control design, SCADA, and more. For a smooth, trouble-free construction process, we assist with equipment procurement, bid administration, and vendor and contractor negotiations. Barr also performs environmental and safety reporting, performance testing, and recommissioning.



Barr provided geotechnical services and electrical resistivity testing to support electrical grounding design for Arizona's first standalone energy-storage site. It provides power for the Phoenix-area during high peak demand.

Private Island micro grid; Necker Island and NRG Renew; British Virgin Islands

Barr was hired to design a 350-kW solar energy PV system to work in parallel with four diesel generators on Sir Richard Branson's private island, Necker Island. In Phase I, we created a plan for the 750-kV island load, using four PV solar array systems, then teamed with Spirae, LLC to design the micro grid control system used for monitoring, and updated the 480-V underground distribution system. After Hurricane Irma, we made minor repairs and installed new micro-controllers. For Phase II, to make the system more hurricane-resilient, Barr designed a battery energy storage system. Three 10-kW wind turbines that could fold down during high winds were added later to the system. As part of Phase III, a new warehouse building was also constructed, with a 75-kW PV solar array on the roof. A distribution design connected all three Phases. Our team provided engineering design and construction observation during construction and commissioning.

Preliminary design phase geotechnical engineering services; Enel Green Power; Texas

Barr performed preliminary design phase geotechnical engineering services for the Ranchland Wind and Storage project, a 263-MW wind farm facility paired with an 87-MW DC battery storage system. Work scope included the wind turbines, substation, battery energy storage system, O&M building, and transmission line.

Electrical design; Energy Erectors; Florida

The Citrus Ridge Substation and Interconnecting Transmission Line is a 50-MW solar installation interconnecting to a 69-kV transmission system. Barr provided 69-kV switchyard design and equipment specifications and 69-kV double circuit transmission line design.

Electrical, civil, and structural engineering for a solar field; Affordable Solar, Inc.; California

The Cal Flats BESS is a 60-MW/240-MWH BESS installation adjacent to a 140-MW solar field. The BESS collector system (34.5-kV) connects to a 230-/34.5-kV transformer substation (CF60). Barr provided switchgear design, including designing a battery charger and DC system, station service, metering, main breaker, three feeder breakers, grounding transformer breaker, and fiber communications. We also provided civil and structural engineering services, including bidding support and field construction review and support for the EPC contractor.



Barr specializes in helping our power clients navigate the complex and rapidly changing renewable technology and regulatory environment. We track incentives, policy, and regulations such as the Inflation Reduction Act (IRA) and provide application support and full engineering and environmental consulting services for wind, solar, storage, and other renewable energy projects.