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Clean Energy Production and Resilient Design: Climbing the "Range" of Challenges to a Panorama of Opportunities

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Introduction

Wildfires, extreme heat, rising sea levels, flooding—the past few years have made clear that climate change poses an existential threat to people, communities, and businesses across the world. NOAA estimates that Americans experienced twenty separate billion-dollar weather and climate disasters in 2021 alone, at a cost of $145 billion. Last year, Hurricane Ian—estimated to be the costliest Florida storm since Hurricane Andrew—had storm surge losses alone that are estimated to cost between $28 and $47 billion.

Efforts designed to minimize or reduce greenhouse gases that contribute to climate change (a.k.a. mitigation/sustainability) have been around for decades. While such efforts are more vital every day, there is also an increasing awareness that the effects of climate change are already here, which means that incorporating resilience to those effects is necessary so that communities and businesses can survive, recover, and even thrive as the climate changes.

As discussed below, the Inflation Reduction Act of 2022, despite its name, is actually dedicated largely to addressing climate change, through support of both sustainability and resiliency efforts. In addition, incorporating resilience into projects, particularly in the energy sector, saves businesses money and reduces the risk of litigation and its associated costs.

Inflation Reduction Act

The Inflation Reduction Act (IRA) was signed into law on August 16, 2022. The Act aims to increase American energy security through policies supporting domestic energy reliability and cleaner production.[1] Funding of an estimated $369B, primarily through tax credits over the course of the next decade, seeks to mitigate the costs associated with converting to new forms of energy, and to incentivize renewable energy investments by producers, developers, and investors. Specifically, the Act offers incentives for clean energy and climate spending relating to wind, solar, nuclear, clean energy storage, and other clean manufacturing projects. IRA investments include both the extension and expansion of existing renewable energy credits, as well as creation of new tax credits for investments in clean energy technologies, production of clean energy, and energy storage technologies.[2] The Act also offers new ways to monetize tax credits beyond the traditional tax equity investment structures. This provides investors with more flexibility allowing tax exempt entities to elect “direct pay,” and tax paying entities to sell credits.

While the Act is largely viewed as a positive opportunity for clean energy producers, investors, and the economy and environment more broadly, there are some requirements and restrictions that should be considered. Among these considerations are the prevailing wage and registered apprenticeship requirements (which will be discussed in more detail below). The IRA offers higher tax credits to projects that comply with certain labor practices and source with domestic materials. While these provisions aim to spur innovation and investment in clean energy by lowering the cost, they may have the unintended opposite consequence of raising costs. Another consideration is that while the IRA is lauded as the biggest investment in clean energy in U.S., the environmental and economic impacts may still be relatively small. Models estimate that IRA investments may reduce greenhouse emissions by 32% to 42% by 2030 (from 2005 levels), however, this will still be 10% shy of the Paris commitment goals which some experts deem is still “inadequate to preserve climate stability.”[3]

IRA Requirements

For producers and investors to qualify for the full amount of the tax incentives, or certain bonuses, the Act requires participants to comply with prevailing wage, registered apprenticeship, location, and domestic component standards.

Prevailing Wage Standard: The prevailing wage standard is a rate set by the U.S. Department of Labor for laborers, mechanics, contractors, or subcontractors hired for projects in a particular geographic location. The Act uses terms from the Code of Federal Regulations (CFR) for determinations of who constitutes a "laborer" and what constitutes "employed." 29 CFR5.2(m) defines laborers and mechanics as "workers whose duties are manual or physical in nature, as distinguished from mental or managerial." The Act uses "employed" broadly to mean anyone paid for their services.

The Wage and Hour division of the Secretary of Labor publishes the labor classifications and rates on www.sam.gov and directs stakeholders to their site for that compliance information. Determinations are made based on the locality of that specific profession and classification during construction, alteration, or repair of a qualified facility.[4]

To comply, taxpayers must "keep records sufficient to establish" the amount of any claimed credit or deduction.[5] Thus, for the purposes of IRA compliance with prevailing wage provisions, records demonstrating that the taxpayer (and their contractors and subcontractors) paid at least the wage rates set by the Department of Labor. "Such records could include, but are not limited to, documentation identifying the applicable wage determination, the laborers and mechanics who performed construction work on the facility, the classifications of work they performed, their hours worked in each classification, and the wage rates paid for the work."[6]

The Act gives taxpayers who have failed to meet this requirement an opportunity to cure through payments for the difference with interest to the worker and a penalty fee of $5,000/ worker to the IRS.

The Inflation Reduction Act's prevailing wage and apprenticeship provisions apply to the:

- Alternative Fuel Refueling Property Credit
- Production Tax Credit
- Credit for Carbon Oxide Sequestration
- Credit for Production of Clean Hydrogen
- Clean Fuel Production Credit
- Investment Tax Credit
- Advanced Energy Project Credit
- Energy Efficient Commercial Buildings Deduction

In addition, the Inflation Reduction Act's prevailing wage provisions apply to the:

- New Energy Efficient Home Credit
- Zero-Emission Nuclear Power Production Credit[7]

Registered Apprenticeship Program: Another common requirement of the IRA is apprenticeship compliance. To meet this requirement, "no fewer than the applicable percentage of total labor hours of construction, alteration, or repair work prior to the project being placed in service be performed by qualified apprentices."[8] For projects that begin before 2023, the taxpayer must ensure that a minimum of 10% of labor hours are performed by qualifying apprentices; 12.5% for projects that begin construction in 2023; and 15% for projects beginning after 2023.[9] This percentage relates to all craft laborers but excludes foremen, supervisors, owners, or other administrative employees. Qualified apprentices are those participating in registered programs under the National Apprenticeship Act.

There is a good faith effort exception to this requirement. This allows the taxpayer to waive the requirement if they can show that they requested qualified apprentices from a registered program and received no response within 5 days, or the request was denied, and the denial was not due to the taxpayer (or their contractor's) refusal to comply with the standards of the apprenticeship program.

Domestic Content Standard: This standard is directed by the federal Buy America requirement standards which require any steel, iron, or manufactured product that is a component of a facility be produced in the United States. In May of 2023, the Department of Treasury and IRS issued Notice 2023-38 which provided the clarification that the steel and iron standard must be met for steel and iron used in a structural capacity (not screws, bolts, etc.).[10]

The notice also introduced an "adjusted percentage rule" which allows for qualification if the project's domestic cost percentage is greater than or equal to the adjusted percentage. This allows for flexibility to meet the Manufactured Products Requirement. Per the rule, the Manufactured Products Requirement is met when either all the Applicable Project Components that are manufactured products are:

1) Produced; or
   - Produced means that all manufacturing processes take place domestically and each manufactured product component is of domestic origin.
2) Deemed to be produced in the US.[11]
   - A manufactured product may be "deemed" to be produced in the U.S. if the Adjusted Percentage Rule is 40% or greater (or 20% or greater in the case of offshore wind projects).
   - Adjusted Percentage Rule =

$$\frac{\text{(numerator) Cost of all U.S. manufactured products that are applicable project components (+) Cost of all manufactured product components of non-U.S. manufactured products that are applicable (to the extent they are mined, produced, or manufactured in the U.S.).}}{\text{(denominator) Sum of all costs of each appliable project component that is a manufactured component.}}$$

"Cost" refers to the Treasury Regulation § 1.263A-1(e)(2)(i) meaning only direct material and labor costs. Indirect costs, described in Treasury Regulation § 1.263A-1(e)(3)(ii)-(iii) are not included in the Adjusted Percentage Rule.

Energy Community: On April 4, 2023, the Treasury Department and the Internal Revenue Service issued Notice 2023-29 providing additional guidance on the energy community bonus tax credits. Primarily the notice clarified what constitutes an "energy community" for the purpose of qualifying for the bonus credit. An energy community is a community generally within three categories:

1) "brownfield site;" (as determined by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980);

2) an area with unemployment at or above the national average and either 0.17% or greater direct employment, or 25% or more local tax revenues related to extraction, processing, transport, or storage of coal, oil, or natural gas; or

3) an area where a coal mine closed after 1999, or a coal-fired electric generating unit was retired after 2009.

Key Provisions and Opportunities

Production and Investment Tax Credits: The IRA hopes to reach its goals of less foreign energy dependence and more investment in clean energy by incentivizing corporations through new and expanded federal income tax benefits. Production and investment tax credits account for more than one third of the estimated costs of the climate provisions of the Inflation Reduction Act. In addition to meeting the eligibility requirements, the Act also requires taxpayers to maintain accurate documentation that demonstrates credit eligibility.[12]

Production Tax Credit: The Production Tax Credit (PTC) allows owners and developers of energy facilities to claim a federal income tax credit based on the kilowatt-hour of electricity sold to an unrelated party for a period of 10 years after the facility is placed into service.[13] Section 13101 of the IRA extends and expands the existing PTC for wind, solar, biomass, geothermal, landfill gas, trash, qualified hydropower, and marine and hydrokinetic power facilities.

The credit is calculated per megawatt-hour of electricity output from qualifying low emitting resources for the first 10 years of production at facilities that begin construction prior to January 1, 2025. The base PTC is 0.3 cents per kWh, however the credit increases five-fold (to 1.5 cents per kWh, subject to an inflation adjustment) for projects that meet prevailing wage and registered apprenticeship standards. There is a potential 10% increase bonus if the projects meet domestic materials requirements.

Investment Tax Credit: The IRA also allows for a federal income tax credit for capital investments in renewable energy projects. The Investment Tax Credit (ITC) is a one-time credit based on the investment cost and when the project is placed into service. The IRA expands qualifying properties to include stand-alone storage, qualified biogas property, electrochromic glass and microgrid controllers.[14]

The base ITC is 6% but can increase to 30% if the prevailing wage and registered apprenticeship standards are met. An additional 10% bonus is available for projects that utilize domestic steel, iron, and domestic components. However, if the construction of the facility does not begin within 60 days of the IRS providing wage and apprenticeship guidance, and the facility does not meet those requirements, the bonus credit is only 2%.

Facilities that qualify can elect to receive either the production tax credit (PTC) or the investment tax credit (ITC). Because credits can only be claimed under one of these provisions, taxpayers should assess which is more advantageous considering the added requirements and bonuses. For projects that are costly up-front, the ITC may be preferable to the longer-term PTC.

Clean Electricity Production and Investment Tax Credits: For facilities that domestically produce and sell clean electricity with a greenhouse gas emissions rate of zero or less, and placed into service after December 31, 2024, the IRA creates a new PTC or ITC (Sections 13701 and 13702).

The new tax credit will be 1.5 cents per kWh of electricity produced, subject to prevailing wage and apprenticeship requirements. (As above, failure to comply with wage and labor requirements will reduce the credit to 0.3 cents per kWh.). There is also a 10% bonus option under this section for electricity produced in certain communities or that use domestically produced materials.

Taxpayers again must choose between the PTC or ITC and cannot claim both or any other credits. Facilities constructed before the end of 2024 may qualify for the credits under the Internal Revenue Code Sections 45 and

48, and these sections that predate the IRA do not require zero greenhouse emissions.

Advanced Manufacturing Production Tax Credit: The IRA provides a new production tax credit for the domestic production and sale of solar and wind components, inverters, qualifying battery components, and critical minerals produced and sold by the taxpayer domestically. The amount of the credit depends on the components that are produced. Eligible components are specified in the Act and include items such as blades, wind turbine towers, photovoltaic cells, solar grade polysilicon, solar modules, battery cells, and certain "critical minerals." The credit for critical minerals is 10% of the cost incurred to produce such mineral. This section may be of particular interest to nuclear industry equipment and component manufacturers.[15]

The credit will remain at its maximum rate until 2030, with credit for components sold after that point being reduced by 25% per year.

Nuclear Power and Clean Hydrogen Production Tax Credits: The IRA offers credits for all types of energy that can be produced cleanly, this includes nuclear energy and clean hydrogen. One of the main nuclear provisions in the IRA is the Zero Emission Nuclear Power Production Credit for Existing Nuclear Power Plants. The nuclear power production credit aims to prevent decommissioning of existing power plants. The credit is available for existing nuclear power plants that produce and sell electricity between December 31, 2023, and December 31, 2032, and meet labor and wage requirements.

The base credit (which is scaled relative to the gross revenue of the facility) is 0.3 cents per kWh of electricity generated in the United States and sold to unrelated persons, but increases to 1.5 cents if prevailing wage requirements are met.

The Clean Hydrogen PTC is a separate, technology-neutral credit for the production of clean hydrogen. This PTC is provided per kilogram of clean hydrogen produced at a qualified facility over a 10-year period for sale or use by the taxpayer.[16] The amount may be increased five-fold if prevailing wage and apprenticeship standards are met and applies to facilities under construction before January 1, 2033.

There is an option for the taxpayer to elect an investment tax credit (ITC) instead of the production tax credit (PTC) equal to a percentage of the cost of property placed in service. Also of note, a taxpayer may be able to claim both the Nuclear PTC and the Clean Hydrogen PTC.

Monetizing Credits

Another key opportunity for investors and producers provided in the Act is the way credits can be monetized. The IRA allows for two new ways to monetize tax credits; direct pay (mainly for tax exempt entities) and single transfer (for non-exempt entities). These provisions create financing flexibility for developers and producers.

To take advantage of these monetization opportunities, entities must complete electronic pre-filing with the IRS. "This will include providing information about the taxpayer, the intended eligible credits, and the eligible credit project. Upon completing this process, the IRS will provide a registration number for each eligible credit property."[17] The registration number is required at the time of tax return filing. More guidance on this process is expected late 2023.

Direct Pay: Effective for tax years beginning after December 31, 2022, eligible entities may elect for some of the credits described above to be refundable, known as "direct pay." Eligible entities are tax exempt, U.S. Federal, state, local, or tribal governments, and corporations that are structured as co-ops. "Such entities are eligible to receive a direct payment from the IRS for any amount paid in excess of their tax liability for credits."[18]

Additionally, entities that are not tax exempt are eligible for direct pay for carbon capture (45Q), clean hydrogen production (45V), and advanced manufacturing production credits (45X). The refund election expires December 31, 2032.

How it works: Qualifying entities, with qualifying credits that meet all the requirements, including a pre-filing requirement can claim direct pay (also known as "elective pay") for the full value of the credit on their tax return. The IRS would then make a refund payment in the amount of the credit to the entity.[19]

Sale or Transfer: The second option allows non-exempt entities (referred to in the Act as "not applicable entity") to transfer (i.e., sell) all or a portion of the credits (either PTC or ITC) to taxpayers that are not related to the transferor. Payments received in exchange for the transfer are excluded from income, and payments made for a transferred credit cannot be deducted from income. A credit can only be transferred once, and transfers must occur prior to the tax return due date for the taxable year in which the credit is determined.[20]

Critiques and Considerations

The primary criticisms of the IRA include that it will cause potential cost increases rather than bring down inflation, that the climate initiatives will not be enough to prevent climate instability, and that there is still confusion and ambiguity in how the Act will be implemented.

Cost: Because of the prevailing wage and apprenticeship requirements that are attached to most of the incentives, some worry that this will put further stress on potential builders and investors in creating and expanding their workforce. Some experts estimate that the tight labor market coupled with labor requirements in the Act will increase project costs by 10%.[21] Between the IRA and the CHIPS act (another 2022 piece of legislation aimed and domesticating the supply chain), Associates Builders and Contractors estimates an additional demand of 546,000 construction workers.[22] Additionally, some models show that additional costs associated with meeting labor requirements could be higher than the associated increased tax credit rates.[23]

Climate: Most concede that the IRA is moving climate initiatives in the right direction, however, it does not get the country to its goal of "net zero" (no new greenhouse gas emissions).[24] The Paris Agreement, if met, would keep warming increase within 3 degrees Fahrenheit. The IRA however, at best estimates does not reach those Paris Agreement levels, thus does not keep warming within a range experts deem stable.

The Act also contains provisions that expand oil and gas, and fuel infrastructure projects such as pipelines.[25] Climate activists see this as a harmful compromise in the legislation that will have harmful, counter-productive environmental effects.

Confusion: The IRA is a large and complex piece of legislation with provisions regulated and implemented across many agencies such as the IRS, Treasury Department, Department of Labor, Environmental Protection Agency, Department of Energy, and others.[26] Specifically, the IRS and Treasury Department are implementing the clean energy tax provisions. As has already been the case, these agencies will need to continue working with producers and investors to create further implementation guidance.

The latest guidance issued by the Department of Treasury and the IRS was June 2023. While this clarified many of the eligibility and transfer requirements for tax credits, there are still some unknowns. Namely, when the pre-filing registration process will be available and how long it will take the IRS to process applications.

Conclusion

The IRA, through significant energy tax incentives, expands opportunities for producers and investors in clean energy, and has the potential to positively impact the environment and economy. The Act undertakes to lower the cost of clean, domestically produced energy and reduce U.S. dependence on foreign energy. However, the Act also has labor and material sourcing requirements that may prove more costly than the tax benefits. Understanding the provisions and keeping abreast of continuing regulatory guidance will be critical for entities seeking to take advantage of the incentives.

DESIGN RESILIENCY AND SUSTAINABLE DESIGN

The extreme heat, droughts, flooding, and other extreme weather experienced in the past several years highlights the need to incorporate resiliency into all facets of our lives, from our homes to our communities to our businesses, in order to survive and recover from the effects of climate change. Sea level rise is the issue most people think of first when climate change is mentioned. While global sea level has risen approximately 6.7 inches in the past century, in parts of the U.S.'s Northeast, sea levels have already risen up to 16 inches, with that rise expected to continue.

Inland areas are not immune from climate-change-related water damage. The Third National Climate Assessment reported that rainfall events have become heavier and more frequent. The increase in rainfalls has been greatest in the Northeast, Midwest, and upper Great Plains—with an increase in flooding in those same areas. Inland flooding is estimated to be the most costly of severe weather events, with an annual average price tag of $6.9 billion per year. Combine those more intense rainfalls with the non-permeable surfaces that characterize modern towns and cities and we see increased flooding. Urban flooding, with its unique challenges and high stakes, is a pervasive problem, with an urban flooding event occurring at a rate of one every 2-3 days for the past 25 years.

Extreme heat, wildfires and resulting smoke problems, and drought have also posed serious problems in the past couple of years. These issues, along with the water issues discussed above, all pose serious risks to businesses, particularly in the built environment. Identifying these risks and addressing them by incorporating resiliency can help businesses avoid multiple problems, including litigation.

GENERAL RESILIENCY ISSUES IN THE BUILT ENVIRONMENT

Resiliency of the Finished Project

Even as technology impacts every business, including construction, much of what is done in the design and build of a new project is still based on historical data and methods. Everything from DOT specifications to building codes to installation methods are generally based on past experiences, which frequently does not adequately address current and future climate challenges.

Two years ago, FEMA conducted a survey of the nation's building codes, finding that $1.6 billion in losses were avoided since 2000 thanks to buildings constructed following stringent building codes, yet 65% of municipalities in the U.S. have not yet adopted them. FEMA's own analysis demonstrates that, over a 20-year period, cities and counties with modern building codes could avoid more than $30 billion in losses from natural disasters, compared to jurisdictions without modern building codes. Unfortunately, even for those jurisdictions that have building codes, they are updated infrequently and are generally based on historical climate data instead of reflecting future climate conditions. There are some recent efforts, however, to enhance building codes and building practices to increase their resilience against climate change. New York City, for example, has issued the fourth version of NYC Climate Resiliency Design Guidelines, which incorporate future climate data, and may become

a requirement for city-owned buildings in the future.[27] In addition, the Boston Planning & Development Agency created the Coastal Flood Resilience Design Guidelines with the Climate Ready Boston goals in mind, incorporating future climate data. These are far from the only cities creating guidelines for buildings to incorporate resilience against flooding into building design, but most are still only guidance—not actual requirements.

While FEMA is advocating for the need to incorporate resiliency, a noted area of dispute involves FEMA's own flood maps, which many scientists believe do not represent current or future climate realities. Not only are the flood maps outdated, but over 40% of the United States has not been mapped.[28] In 2020, scientists working with the First Street Foundation identified 6 million more Americans living in areas with a substantial risk of flooding than the 8.7 million properties identified as having such a risk by FEMA.[29] As discussed above, the risks of flooding are a costly issue across much of the nation.

Until there are binding government requirements, it is up to engineers and architects to understand the design risks projects face due to climate change and plan with future climate estimates in mind; incorporating resilience above and beyond what building codes require. Fortunately, resilience strategies already exist and are not complex. A few examples include building thicker building envelopes to deal with extreme heat, incorporating power and water redundancy to better deal with utility interruptions, and planning for egress and ingress to the building in the event of severe water events.

Architects and engineers are well aware of the risks climate change poses and their roles in addressing climate change. The World Federation of Engineering Organizations (WFEO) has issued a Declaration on Climate Emergency, declaring "The crises of climate breakdown are the most serious issues of our time. Our major infrastructure systems of transport, energy, water, waste, telecommunications and flood defenses play a major part, accounting for a vast portion of energy-related carbon dioxide (CO2) emissions whilst also having a significant impact on our natural habitats." [30] As a result, the WFEO has pledged, among other things, to "apply, and further develop, climate mitigation and adaptation principles as key measures of our industry's success, demonstrated through rating systems, awards, prizes and listings." Meanwhile, the American Institute of Architects (AIA) has issued a call to architects around the world "to support humanity's collective call to climate action through an unrelenting commitment to sustainable and resilient design."

Resiliency During Construction

Resiliency concerns during the construction phase can involve similar extreme weather and water-related issues to those addressed above. These issues can both delay the construction process as well as make standard/historical installation methods less effective or actually problematic for the final design. Two unique challenges that arise during the construction process are (1) worker safety and (2) supply chain issues.

The heat waves of the past few years, along with the tragic loss of many construction workers from extreme heat-related illnesses during the building of the FIFA World Cup complex in Qatar, has highlighted the risks posed to construction workers from extreme heat. Individuals required to work outside during extreme heat can face heat-related illnesses, especially once temperatures rise above 90 degrees. Extreme heat also causes other safety issues for construction workers, as palms get sweaty, safety goggles fog up from humidity and perspiration, and skin burns from coming in contact with hot metal. In a cruel twist, the same PPE that is supposed to keep construction workers safe on the job site can also increase the risk of heat-related illnesses. In light of the risks extreme heat poses to construction workers and others exposed to such high temperatures, OSHA has begun the process of implementing a new rule specifically addressing heat injury and illness prevention in outdoor and indoor work settings. While OSHA works on a nationwide rule, three states already have heat-related rules: California, Washington, and Minnesota.[31] Minnesota's standard only applies to indoor environments, however, while California and Washington both address outside conditions. Maryland and Nevada both have heat-related

standards under development as well.

Indoor air quality became a pressing issue during the Covid pandemic, as essential workers were required to work indoors while potentially being exposed to a serious virus. Meatpacking employees, for example, were deemed essential and required to work inside during the pandemic, with more than 59,000 workers from the top meatpacking companies becoming infected during the first year of the pandemic, while at least 269 workers died from Covid in that first year.[32]

This summer it has become apparent that outdoor air quality is also going to become a major worker safety issue, with the smoke from Canadian wildfires repeatedly turning major American cities into scenes from an apocalyptic movie. As with extreme heat, there are very few regulations currently guiding employers on how to address such air quality issues, beyond the general obligation to maintain employee safety. With that lack of guidance, some construction companies in New York City allowed employees to not work through the recent air quality alerts if the smoke was bothering them.[33]

When it comes to supply chain issues, the pandemic again provided both warnings and lessons that can be applied to businesses facing risks posed by climate change. The timing of materials and equipment during a construction project is obviously crucial to ensuring that the project gets completed in a timely matter (and without the assessment of liquidated damages). Extreme weather, which is increasing as a result of climate change, can impact the shipping of materials needed as well as the availability of equipment necessary for the next phase of construction. In addition, if necessary materials are manufactured in an area vulnerable to extreme weather, the timely availability of such materials can become a problem impacting the construction schedule.

FAILURE TO INCORPORATE RESILIENCE IN THE BUILT ENVIRONMENT

The issues discussed above regarding problems that climate change can cause can also lead to litigation over which parties should be financially responsible for the problems. Uncertainty over which party to a lawsuit bears responsibility for a problem increases both the chances and costs of litigation. As these extreme weather events continue, and until there is certainty as to which construction party bears the burden of planning for such future events, weather-related construction litigation and its ever-increasing costs will only become more of a problem for the various parties to the construction process (and their insurers).

A recent study found that the average value of a construction dispute in North America doubled from 2019 to 2020: jumping from $18.8 million to $37.9 million.[34] This study found that the leading cause of disputes remained the same in 2020 as in 2019: a failure by the parties to the construction relationship (owner, contractor, architect, engineer, etc.) to understand and/or comply with their contractual obligations.

Extreme weather and, in particular, rising sea levels and increased rainfall and flooding, can also increase the likelihood of construction-related litigation. There are currently over one thousand climate change-related lawsuits around the world, according to the tracking team at the Columbia Law School Sabin Center. To date, most litigation related to climate change has been focused on state and federal statutory issues, environmental assessments, Constitutional claims, and a sprinkling of other cases, such as SEC claims. While there is no documentation yet on construction litigation related to climate change, the impact of climate change on construction disputes—both now and in the future—is impossible to ignore.

Construction defect disputes, involving alleged defects in the design or installation of a construction project, are at the heart of many construction lawsuits.[35] In addition to direct lawsuits over problems with the end result of a construction effort, challenges during the course of construction—leading to delay charges and displeasure with the ultimate result of the construction, resulting in nonpayment issues—can come from the

problems with both the design and installation of the construction project. For example, if a contractor has the rebar cages set in the foundation trench, ready for the concrete pour, but then a large storm floods the trench, the contractor faces either serious delays in having to redo the foundation preparations or proceed with a trench bottom that is not properly cleaned and recompacted. Either option can result in construction litigation claims.

Now, on top of the usual disputes over insurance coverage for construction cases, comes the challenge of what coverage (if any) will be provided for construction issues related to climate change and extreme weather. A survey done by the Deloitte Center for Financial Services found that more than half of US state insurance regulators surveyed believe that climate change is likely to have a high (or extremely high) impact on both the scope of what insurance coverage will be provided as well as the related underwriting assumptions.[36] Aware of the risks, insurance companies are preparing for the potential financial ramifications of climate change and, as part of that, are focusing on their client's potential liability for negligence related to climate change issues.[37] This new focus means incorporating climate-risk considerations into underwriting for their clients—demanding that clients incorporate risk mitigation efforts into their projects.[38]

There is no clear industry standard yet on which parties should bear the risk of an extreme weather event during construction, nor are there yet industry standards that would impose obligations on architects or engineers to build resilience into projects in anticipation of future weather events, not just past weather events. Industry organizations, however, recognize the need to address future risks in construction—and that the best time to address such risks is before a project has begun. For example, the AIA has developed the Hazard and Climate Risk Acknowledgement Form, which, in the AIA's words, is "intended to support the architect and client to reach and document a mutual understanding of hazard and climate risk that will inform project requirements."

In the context of incorporating risks in the face of climate change, the engineers and architects are obvious targets of any claims that a construction project failed to incorporate and address the risks of climate change. The question engineers and architects must ask in designing buildings in the face of climate change is whether they are fulfilling their professional standard of care. Engineers and architects are obligated to provide services to their clients with the degree of skill and care that would be exercised by other professionals in their industry, taking into consideration the contemporary state of the art and the region in which the professional practices. Failure to exercise that standard of care can expose engineers to legal liability. Professionals' standard of care is not static, however, as it "changes over time based on research, development, and new information." City of Huntington v. AmerisourceBergen Drug Corp., 2022 WL 2399876, at *37 (S.D.W. Va. July 4, 2022).

The challenge for engineers and architects, therefore, in the face of climate change, is to define the expectations under the "contemporary state of the art." Given the documented risks of extreme weather, the increase in such extreme weather, awareness in the engineering and architecture community generally about the risks of climate change, and the evidence that many building codes are not equipped to deal with all aspects of climate change, judges and juries may soon find that architects and engineers who design to current code provisions are not complying with the standard of care. As Randy Lewis, Vice President, Loss Prevention and Client Education for AXA XL's Design Professional Group, points out, "Under some circumstances, merely designing to meet code requirements may still be deemed negligent if the circumstances and the applicable standard of care dictate a design solution that clearly exceeds the code."[39]

Contractors and other parties to a construction project can also face workers' compensation and other employee-related claims if they fail to protect their workers from climate change related problems during the construction process. Even before a specific heat-related rule is implemented, for example, employers need to ensure that they are protecting their employees from extreme heat-related issues under OSHA's General Duty Clause. This broad catch-all clause requires employers to keep their workplace free of serious recognized hazards.

Given the increase in extreme heat across the nation, as well as the documented risks of working in extreme heat, employers already need to be taking steps to protect their workers from heat-related hazards nationwide—not just in southern states that have a history of extreme heat. OSHA itself already provides specific guidance to industries in which heat may pose a risk to workers. This same rationale can also be applied in the context of air quality issues, such as those caused by the recent wildfires in Canada.

Contractors also face the risk of liquidated damages being imposed for delays caused by climate change during the construction process, with such delays including (1) decreased worker productivity because of extreme heat or air quality issues; (2) supply chain delays; (3) extreme weather events that delay construction.

Fortunately, depending on the region in which a project is being built, there can be a wealth of information about the risks a project can face from climate change. First Street Foundation, for example, provides resources on a variety of risks, including wildfire, floods and heat[40] Other modeling resources available include the Climate Mapping for Resilience and Adaptation tool, which was developed in August 2022 as part of an interagency partnership working under the auspices of the U.S. Global Change Research Program (USGCRP), with guidance from the U.S. Federal Geographic Data Committee (FGDC), and is designed to work with the U.S. Climate Resilience Toolkit. Climate Check and Jupiter Intelligence are two other examples of the climate modeling resources now available. ASCE also recently published an overview of applying global climate model projections in infrastructure engineering, which walks through the process of applying climate model projections in engineering.[41]

RESILIENCY ISSUES SPECIFIC TO THE ENERGY SECTOR

The U.S. Department of Energy has identified the top five vulnerabilities the U.S.'s energy sector faces as a result of climate change: (1) workforce, (2) supply chain and distribution, (3) energy and water systems, (4) mission specific operations and equipment, and (5) real property and physical assets.[42] Several of these vulnerabilities—workforce, supply chain issues, vulnerability of property and assets—are similar to those discussed above, with additional challenges imposed both because of the unique characteristics of the physical energy infrastructure and grid as well as the crucial role that the energy infrastructure plays in keeping our nation safe and resilient. The other two vulnerabilities, those related to energy and water systems and mission specific operations and equipment, are unique to the energy sector.

Incorporating resilience into the first category of vulnerabilities—ensuring a safe and productive workforce, that there are no critical supply chain issues, and that property and assets are safe—impose similar challenges and potential legal exposure as the items discussed above. The difference, of course, is that keeping the energy sector running and resilient at all times is crucial, particularly when weather is bad. As communities face extreme heat and other extreme weather events, having a functioning energy grid is critical to ensuring that communities and businesses can be resilient. That means that utilities and other businesses involved in the energy sector (1) have less room for error and (2) face greater risks and liabilities if there are mistakes or inadequate preparations for the risks imposed by climate change. For example, energy sector employees may need to work even in the face of extreme heat, poor air quality, and/or extreme weather events, imposing greater burdens on their employers to ensure that their safety is still being protected.

The second category of vulnerabilities are those that are unique to the energy sector and, in particular, renewable energy.[43] Solar panels, for example, are generally resilient to high winds, rain, and even snow. Ironically, solar panels' ability to function well and generate power actually decreases as the weather gets hotter, meaning that as climate change leads to more extreme heat, solar panels will be less able to provide the energy needed. Wind turbines are not vulnerable to extreme heat, but extreme heat frequently comes with less wind, making wind turbines less productive. While wind turbines are also generally resistant to extreme cold, ice storms such as the one that occurred in Texas can damage the turbines and lead to them being shut down. Wind turbine resilience to

hurricane-strength winds is currently being developed. But both wind turbines and solar panel developers, who frequently use depleted farmland as a location for such energy generation, need to be mindful of land subsidence in the properties that are being developed. As groundwater is drawn out at rapid rates, particularly in parts of California, the land is subsiding substantially as the aquifers collapse. Not only can such subsidence damage the infrastructure itself, it can also lead to increased flooding.

Severe flooding, of course, can damage any energy infrastructure in its way. Even dams can be susceptible to high water flows and severe flooding that can cause potential catastrophic damage to the dam itself.[44] On the flip side, the lack of water behind dams was the primary concern in the America West until earlier this year, as both Lake Mead and Lake Powell nearly hit "dead pool" status (technically, it is "minimum power pool elevation," but "dead pool" is more dramatic), meaning that the water levels in both were so low that water would no longer flow over the dams and generate hydroelectricity.

Climate change does not just pose a risk to the energy infrastructure itself—it also poses serious risks to the transmission systems that get the energy from its generation source to the end-user who needs that energy. Transmission and distribution lines are impacted by extreme heat, losing more of their electricity as they transmit it during heatwaves.[45] Load management—ensuring that the transmission of electricity across the grid is properly balanced—will also become more difficult as extreme weather becomes more common. Failure to properly handle load management can cause the system to become overloaded, leading to power outages.[46] And, of course, the actual infrastructure of the transmissions systems are vulnerable to extreme weather along the lines of the general construction issues discussed above.

The renewable energy sector can face many of the same construction-related legal issues discussed above. However, given the vital role the energy sector plays in communities—and the potential risks of problems transmitting electricity—the energy sector faces additional risks as well. While public utilities can benefit from certain immunities as a member of state or local governments, private utilities do not generally have the same benefit. The most glaring recent example of an energy company facing legal exposure for problems is Pacific Gas & Electric ("PG&E") after downed power lines started devastating wildfires. PG&E paid out $13.5 billion and its former executives agreed to a $117 million settlement.[47] There have also been efforts, challenging but legally possible, to sue utilities for outages and blackouts.[48]

Renewable energy sources are a key part of any effort to minimize the impacts of climate change. At the same time, the effects of climate change are already here and all businesses, including the renewable energy industry, must ensure that they are resilient to those effects. The first step is identifying the various risks that may be faced in a certain area as a result of climate change—extreme heat, poor air quality, rising sea levels, flooding, drought, land subsidence, high winds, severe weather. There are numerous climate modeling resources and consultants that work with businesses to identify such risks. The next step is to identify who is responsible for addressing such risks by incorporating resilience into projects—the architect or engineer, for example—and then outline that responsibility in the applicable contract documents. The final step, then, is to incorporate resilience into the actual project. Fortunately, there are international, national, and local resources on resiliency now, with the Department of Energy providing resiliency guidance and resources to the energy sector.[49] Taking these steps to incorporate resilience will both make businesses stronger and reduce the chances of litigation, while renewable energy sources contribute to efforts to make our energy sector more sustainable.

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