NEW YORK STATE CLIMATE ACTION COUNCIL
DRAFT SCOPING PLAN

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Comments of the New York State Pipe Trades Labor-Management Partnership

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I. Introduction

These comments address the New York Climate Action Council's ("CAC" or "Council") Draft Scoping Plan ("Scoping Plan" or "Plan"), which was developed to implement the Climate Leadership & Community Protection Act ("CLCPA").[1] These views are submitted on behalf of the labor-management partnership between the New York Pipe Trades and its signatory contractor associations ("Pipe Trades"), which represents 24,000 workers in the piping trades and 10 trade associations, the membership of which includes over 900 mechanical and plumbing contractors.

The Pipe Trades Trust is a non-profit organization dedicated to ensuring quality, safety and cost efficiency in the construction and service industries and promoting fair work and contracting opportunities for its members. The Pipe Trades are typically the largest single craft needed to construct and maintain all facets of the energy sector. Given their extensive experience on energy projects, and in-depth knowledge of issues in this industry, the Pipe Trades seek to offer the Council useful guidance and input on the Scoping plan as set forth below.

II. Overview: Vital Need for Effective, Equitable Energy Plan

A. Key Overlapping Goals of Scoping Plan

Few citizens or stakeholder groups dispute the need for our state to transition to clean energy as fast as possible. The central challenge presented to the Council is crafting the correct strategy for developing a balanced arsenal of clean and renewable energy sources that are viable and affordable, and developed in sufficient capacity to meet our vast and accelerating power needs. Literally hundreds of existing fossil-based generating sources must be replaced or repurposed in this process. Plus, this all must be done with lightning speed.

At the same, the policy guiding this massive transformation must be sensible and equitable from an economic and social justice perspective. The reality is that the state has and will continue to invest tens of billions of dollars in public subsidies to drive needed changes in its energy sector, investments which will, in turn, unleash an equal or greater amount of investment by the private sector to create our new clean energy economy. If this transition is engineered properly, great prosperity could ensue—but such a result will not occur without careful planning.

Real economic and social justice benefits will not flow to New Yorkers unless effective policies are incorporated into the Scoping Plan to maximize business opportunities for residents, jobs for workers and tax revenue for state and local coffers. Jobs are nothing less than crucial to this plan, because the transition away from fossil-based energy will eliminate tens of thousands of good jobs across the state. Thus, as a matter of equity and common sense, replacing these jobs with new, permanent and middle-class energy jobs must be a top priority. Likewise, New York now has a unique opportunity to greatly assist the many communities that have suffered major environmental injustices from the state's past energy and environmental policies.

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[1] N.Y. STATE CLIMATE ACTION COUNCIL, *Draft Scoping Plan* (Dec. 30, 2021).

B. Generating Carbon-Free AND Good Jobs

Fortunately, developing the *right mix of clean energy alternatives*—options which are sufficiently reliable to ensure an adequate supply—will allow us to meet these challenges effectively and in a responsible manner. If properly structured, the Scoping Plan is also capable of bringing New York's economy to new heights while also equitably distributing the benefits created by this massive public investment. To accomplish this, it is essential that the CAC substantially broaden its current approach beyond the leading renewable sources that almost single handedly constitute the state's entire energy agenda of the past several years and virtually all its investments.

While wind, solar and water (hydroelectric) must serve as key energy sources for New York—these sources alone are simply *NOT* enough, even under the most optimistic projections. Moreover, the state's overreliance on wind and solar power is, in short, a recipe for disaster driven by several factors, including the following:

- ✓ Even if *wind and solar capacity* is tremendously expanded to the greatest extent possible in the short timeframe available, they are utterly *incapable of meeting the state's power needs* on their own. (Hydroelectric capacity has already been largely maximized).

- ✓ In addition, given their *intermittent nature and the difficulties relating to storing the energy they produce*, the inherent limitations of wind and solar are such that *much of their capacity will be unavailable* during peak demand periods.

- ✓ Given these facts, which have been verified by top industry experts, the need for massive additional capacity of *alternative clean sources* ("ACSs") is both essential and indisputable—yet the Plan fails to promote the development of any of *these* sources.

- ✓ The most viable of these ACSs include *nuclear, bioenergy and hydrogen*, all of which must receive support that is at least on par with the support being given to wind and solar; otherwise, New York will be facing *serious power supply shortages* in the near future.

- ✓ An effective energy plan, therefore, requires an "*All the Above*" approach. The vital need for this strategy is *backed by New York's Independent System Operator (NYISO)*, the state's grid operator, as well as the *U.S. Department of Energy* and the Biden administration generally.

Notwithstanding these irrefutable facts, over the past several years, virtually all state subsidies have been solely devoted to renewables, mostly wind and solar. This strategy is fundamentally flawed. This plan will not only result in a failure to achieve the CLCPA's targets, but will lead to a wholly inadequate power supply, which, in turn, will drive escalating power costs and likely result in widespread power outages in the near future.

C. Massive Scope of the Clean Energy Sector

The scope of New York's clean energy challenges must also be stressed at the outset. In this regard, consider the following facts and realities confronting the Council as it prepares the final draft of the Scoping Plan.

- ✓ It took New York *over 100 years to build our current energy infrastructure, which consists of approximately 244 fossil fuel-based generating units* and at present provides the bulk of the power needed to serve the state's 19.4 million residents.

- ✓ Per the requirements of the CLCPA, the state is required to *engineer a complete transformation of this sector in less than 18* years and replace all these fossil plants with new clean or renewable sources. Suddenly, 2040 doesn't seem so far off.

- ✓ According to *NYISO, one of the state's foremost energy experts, wind and solar are incapable of meeting this challenge even if their capacity is expanded to greatest extent possible*. Therefore, it estimates that New York needs to develop *over 30 GW of generating capacity from dispatchable emissions-free sources, i.e., ACSs, by 2040*.

- ✓ This huge amount of ACS capacity is *needed to meet the state's growing electricity needs and offset the major, inherent limitations of wind and solar energy*. This *will require construction of about 60 large, 500 megawatt (MW) power plants or 600 smaller, 50 MW plants*—all of which have to be developed, designed, sited and constructed in less than 18 years.

To date, the state has failed to develop, incentivize or effectively promote development of ACSs and it must act quickly and decisively to rectify this situation, which makes the current challenges particularly difficult. Reality must be faced. The current Plan must be corrected. If this is done, multiple, substantial benefits can be obtained by launching the correct strategy.

D. Key Advantages of "*All the Above*" Strategy

An energy plan that embraces the *All the Above* approach will give New York a fighting chance to effectively transform its energy sector to non-carbon sources in record time. In addition, *this* strategy also has the *unique capacity to maximize both economic and socio-economic benefits for the state*. This is because *ACSs almost uniformly require large industrial-scale projects*—projects that outperform wind and solar power with respect to both the number of jobs they create and job quality.

Since ACS projects will require the employment of tens of thousands of highly skilled workers, they will generate good jobs with good pay for New Yorkers who will, in turn, return substantial tax revenue back to the state. Indeed, research shows that these projects create up to *1,000 percent more jobs than wind and solar* investments. Plus, the latter generally pay far lower wages than ACS projects. Thus, since both ACSs and leading renewables provide carbon-free power, the former should be prioritized and favored when the state awards valuable public subsides.

While the actions recommended above focus on developing the right plan for new power generation, it is incumbent on the state to also revise its related energy strategies. For example, natural gas plants should not be phased out prematurely as such mistakes will drive or exacerbate the type of power supply crisis referenced above. The state should also firmly commit to preserving its existing nuclear generating capacity for the indefinite future. Likewise, policies that call for the full electrification of key sectors—buildings, industrial, and transportation—are equally dangerous until new and adequate clean capacity is constructed.

At its most basic level, energy planning is about supply and demand. Thus, strategies that result in major supply deficiencies are simply irresponsible. While there are compelling needs driving the development of new clean and renewable energy sources, which must be effectuated in the shortest possible timeframe, such efforts must be carried out under a plan that keeps the lights on and power flowing. Simply stated, both goals are vital—one cannot be sacrificed for the other. As demonstrated below, however, the current draft of the Scoping Plan is fundamentally flawed on the power supply side of this equation. It is essential that this be corrected.

Further, to ensure that New York's new clean energy sector is reliable and maximizes jobs and other economic and socio-economic benefits, another set of critical policies is needed. Specifically, the Scoping Plan should be revised to incorporate the strongest, most progressive quality contracting programs—namely, Project Labor Agreements and Apprenticeship and Pre-Apprenticeship programs. Properly crafted, such initiatives will help promote reliable, timely and cost-effective project delivery while simultaneously generating maximum employment and training opportunities for New Yorkers in high-skill trades that sustain solid, middle-class jobs.

To effectuate these strategies, extensive and informed revisions to the Draft Scoping Plan are required. Specific recommendations for achieving the state's energy goals, supported by extensive research and data, are set forth in Section V below. However, to understand the solutions, it is first necessary to carefully review the scope and nature of the immense problems and challenges facing New York's energy sector and the critical flaws in the current draft of the Plan.

III. Immense Energy & Economic Challenges of Scoping Plan

The CLCPA was enacted in 2019 and bound New York to several ambitious climate and clean energy goals. Specifically, the CLCPA requires electric utilities in the state to source 70% of the load they serve to consumers from "renewable energy systems" by 2030.[2] This is often referred to as the "70 by 30" or "70/30" target. The CLCPA then requires that, by 2040, the entire "statewide electrical system" must be "zero emissions."[3]

Beyond these requirements that are specific to the state's electrical system, the law also separately requires the reduction of overall greenhouse gas (GHG) emissions to 60% of the emissions released in 1990 by 2030 and 15% of 1990 emissions by 2050. These apply to emissions from all in-state sources, including transportation, building heating, and industry.[4] These requirements are typically seen as among the most ambitious clean energy goals in the United States.[5]

While the CLCPA binds New York to these ambitious clean energy targets, it does not explain exactly how the state will achieve them. Instead, the law created the Climate Action Council, which

[2] N.Y. PUB. SERV. LAW § 66-p(2).

[3] *Id.*

[4] N.Y. ENVTL. CONSERV. LAW § 75-0107.

[5] *See* Peter C. Trimarchi & Dana P. Stanton, *The Impact of New York's Climate Leadership and Community Protection Act*, BLOOMBERG LAW (Oct. 23, 2020 4:01 AM) ("It is hard to overstate how transformative . . . [the CLCPA] will be").

is required to "prepare and approve a scoping plan" containing policy recommendations for achieving these goals.[6] This mandate is what led to the issuance of the Draft Scoping Plan that is the subject of these comments. The recommendations included in the CAC's final Scoping Plan will be incorporated into the subsequent update of the State Energy Plan and will guide the state's energy policy for decades to come.[7]

The ability of New York to achieve these clean energy goals, chart a course into a prosperous clean energy economy, and continue to deliver reliable power and electricity to its residents all hinge on the CAC getting this Scoping Plan right. The stakes could not be higher.

While there are certain aspects of the Drafting Scoping Plan the Pipe Trades support, as identified below, there are several fundamental flaws in the Plan that must be corrected. The most serious problem in this regard is its failure to provide a strategy for ensuring a reliable, uninterrupted supply of affordable electricity for state residents. In short, the Plan calls for an unrealistically narrow focus by promoting a limited number of favored renewable sources of power, namely, wind and solar power.[8] Although there is no question that wind and solar power will provide a large and important share of New York's future electricity—these sources, as noted, will never produce the amount of power needed within the timeframe mandated by the CLCPA. The reality is that an enormous amount of *clean energy capacity* is needed to balance the intermittent supply sources.

In this regard, the CAC's Draft Scoping Plan focuses exclusively on renewable sources, namely, wind, water and solar while failing to provide support for alternative clean sources whatsoever, including both existing and emerging clean sources. For example, it fails to recognize the value of the substantial amount of entirely GHG-free power that is currently generated by the state's nuclear plants, and instead treats nuclear power more as a problem to overcome rather than a safe and valuable piece of the state's clean energy future.[9] Likewise, the Plan fails to embrace or sufficiently support bioenergy and hydrogen—notwithstanding the viability of all these ACSs.

The Plan also makes perfect the enemy of the good by refusing to support the upgrading of the state's existing natural gas plants—which will continue to be essential for the reliable supply of electricity to the state for the foreseeable future.[10] These plants would be capable of burning a blend of natural gas and carbon-free hydrogen, with the potential to convert entirely to hydrogen as hydrogen energy technology continues to mature. Instead of allowing these plants to upgrade to

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[6] N.Y. ENVTL. CONSERV. LAW § 75-0103.

[7] *See id.*

[8] *See, e.g.,* Draft Scoping Plan, *supra* note 1, at 7 (specifically mentioning only "solar" and "wind" as the energy sources for the "clean electric grid of tomorrow," together with "other renewables" and "energy storage").

[9] *See id.* at 177 ("Nuclear power generation is a complex technology with potential impacts on host communities as well as questions relating to the impact of nuclear waste on health and the environment").

[10] N.Y. INDEP. SYS. OPERATOR (NYISO), *2021-2030 Comprehensive Reliability Plan*, at 47 (Dec. 2, 2021) ("[T]he current system is heavily dependent on existing fossil-fueled resources to maintain reliability and eliminating these resources from the mix 'will require an unprecedented level of investment in new and replacement infrastructure and/or the emergency of a zero-carbon fuel source for thermal generating resources'" [internal citation omitted]).

cleaner and more modern technologies, the Plan instead requires these essential plants to continue with business as usual, often past the intended lifespans of those facilities.[11]

While these are some of the critical issues with the Draft Scoping Plan as it relates to *power* generation, there are also serious problems with this Plan on the *demand side* of the planning—particularly the call for the wholesale electrification of New York's building, transportation, and industrial sectors. Significantly, the Plan acknowledges that New York's *peak electrical load will nearly double by 2040* because of this additional strain placed on the state's electrical supply system.[12]

Promoting widespread electrification of major sectors *before* an *adequate* and *reliable* clean energy supply is in place will put the cart before the horse and almost surely result in major supply-related blackouts in the state within a few short years. This proposal for wholescale electrification also ignores the substantial research showing that incorporating the use of some zero- and low-carbon fuels for building heating would reduce the strain placed on the state's electrical supply system during the coldest parts of the winter while remaining consistent with CLCPA targets.[13]

The Pipe Trades do not question the urgency of addressing the immense challenges posed by climate change. However, it is worth bearing in mind that New York's estimated contribution to worldwide climate change is relatively miniscule,[14] and that efforts to further reduce the state's emissions must be balanced with the need to ensure an adequate supply of reliable electricity during the transition to a clean energy economy. Otherwise, New Yorkers could be subject to soaring electricity costs and potentially devasting power outages, results which could very well turn New Yorkers against the very goals the Draft Scoping Plan is attempting to achieve. Moreover, the impact of soaring energy costs and blackouts will fall heaviest on the neediest among us, including low-income residents and the elderly.

In sum, the critical importance of the Scoping Plan cannot be overstated. Ultimately, its actions will impact every New York resident and leave no corner of the state's economy unchanged. It is precisely the magnitude of this challenge that requires the CAC to remain open minded towards all proposals that can play a role in reducing the state's GHG emissions and to not adopt a narrow tunnel vision towards certain politically favored solutions. If the CAC simply kicks the can down the road rather than face the hard questions raised in these comments regarding the adequacy of the state's power supply planning, that decision will come back to haunt the Council—and New Yorkers across the state—in the years to come.

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[11] *See id.* at 31 ("A growing amount of New York's gas turbine and fossil fuel-fired steam-turbine capacity is reaching an age at which, nationally, a vast majority of similar capacity has been deactivated.").

[12] Draft Scoping Plan, *supra* note 1, at 74.

[13] *See* N.Y.C. MAYOR'S OFFICE OF SUSTAINABILITY, *Pathways to Carbon-Neutral NYC: Modernize, Reimagine, Reach*, at xi (Apr. 2021), https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/Carbon-Neutral-NYC.pdf.

[14] James E. Hanley, *Green Scheme: The Climate Action Council's Climate Transition Cost Analysis,* EMPIRE CENTER (Nov. 22, 2021), https://www.empirecenter.org/publications/greenscheme/ (estimating that New York is responsible for "4/10ths of one percent of global GHG production").

IV. Analysis & Critique of the Draft Scoping Plan

A. Positive Aspects of the Scoping Plan

Although the Pipe Trades submit that there are serious, fundamental flaws in the Plan, as outlined above, there are nonetheless important proposals in this massive Plan that the Pipe Trades strongly support and that should be retained. These proposals that should be retained in the final Plan include the following:

- ✓ The Plan expressly acknowledges that New York will require significant amounts of generating capacity from "dispatchable," emissions-free resources to balance the electrical supply system as the share of the overall load provided by intermittent renewables increases.[15] However, as discussed further below, the Plan's faith in the ability of battery storage to largely fill this need is misplaced.[16]

- ✓ The Plan supports the aggressive deployment of heat pumps and thermal heating systems across the State;[17] these are sensible and reliable clean power solutions that will be critical to decarbonizing the building sector, and therefore should be strongly supported. In this regard, the New York legislature recently enacted a bill eliminating legal barriers to the construction of thermal energy networks and requiring the Public Service Commission to implement a pilot program supporting their deployment.[18]

- ✓ The CAC should follow the legislature's lead on thermal energy by supporting the expansion of this pilot program and developing public subsidies and other investments that could be used to support the construction of these systems.

- ✓ The Council acknowledges that research into methods of reducing the nitrogen oxide (NO_x) emissions that result from hydrogen combustion is needed and should be supported.[19] Hydrogen is likely to be a critical component of a clean energy future because it provides a technologically feasible method of storing large amounts of so-called "curtailed" renewable energy over long periods of time for later use.[20]

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[15] Draft Scoping Plan, *supra* note 1, at 170 ("The current system is heavily dependent on existing fossil fueled resources to maintain reliability…To replace these units, dispatchable and emissions-free resources will be needed to balance the system and must be significant in capacity, be able to come on-line quickly, and be flexible enough to meet rapid, steep ramping needs.").

[16] *See id.* at 170, 176 (identifying "long duration storage technology" as the "technology focus" of the Council moving forward).

[17] *See id.* at 120.

[18] S. 9422, 2021-2022 Legislative Sess., N.Y. State Senate (N.Y. 2022), https://www.nysenate.gov/legislation/bills/2021/S9422.

[19] *Id.* at 60-61 ("Opportunities to further reduce NO_x emissions from hydrogen combustion exist and need to be further studied.").

[20] *See* Richard J. Campbell, *Hydrogen in Electricity's Future*, CONG. RSCH. SERV., at 10-11 (June 30, 2020), *available at* https://crsreports.congress.gov/product/pdf/R/R46436.

- ✓ Although burning this hydrogen releases zero carbon or methane into the atmosphere, it does result in the creation of certain nitrogen oxide ("NO") emissions.[21] If methods of controlling those NO_x emissions can be developed, hydrogen combustion would provide a straightforward and practical way of transforming the intermittent renewable power provided by solar and wind into dispatchable, emissions-free power.

The findings and strategies referenced here represent sensible policy and should be retained in the Council's final draft of the Scoping Plan.

B. Realistic Assessment of Energy Challenges

The first step towards achieving the ambitious climate goals contained in the CLCPA is to acknowledge and be realistic about the challenges inherent in meeting these goals while still ensuring a reliable supply of power that will be adequate to meet the State's growing demand for energy. There is no dispute regarding the need for New York State to decarbonize to address the current challenge of climate change. However, unless the State is transparent about the obstacles standing in the way of the massive transformation this decarbonization will require, it will not be capable of developing sensible and practical solutions for meeting those challenges.

In this respect, the Draft Scoping Plan is crystal clear regarding the CAC's belief that widespread electrification of sector, such as transportation, buildings, and industry is the best solution for decarbonizing those sectors. While electrifying those sectors will, of course, reduce the emissions in those sectors at the point of *demand* for energy, such reforms cannot be instituted in a vacuum. It's obvious that such changes will substantially expand demand from generating plants at the same time the state is seeking to phase out fossil-fuel based plants. The only safe and responsible way to plan such reforms by ensuring there is an adequate *supply* of clean, affordable energy available to meet substantially increased demand.

Along these lines, energy systems experts agree, and the Draft Scoping Plan acknowledges, that the policies contained in the Plan are likely to increase the peak demand for electricity in New York by up to 85-100% by 2040.[22] This should not be surprising—it is common sense, for example, that transitioning from primarily gasoline-powered cars to electric-powered cars will substantially increase the demand for electricity in the state. As a result, it is critical that the Council pay as much attention to electrical *supply* during this transition as it does to increasing the *demand* for electricity as a method of decarbonization.

Despite this importance of maintaining a reliable supply of energy for state residents, one of the critical flaws of the Draft Scoping Plan is that it fails to outline an effective strategy for ensuring that there will be sufficient, adequate generating sources capable of meeting New York's growing demand for clean power in 2040 while ensuring even a reasonable degree of reliability. To illustrate

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[21] Iain Staffell et al., *The Role of Hydrogen and Fuel Cells in the Global Energy System*, 2019 ENERGY & ENV'T SCI. 463, 483 (2019).

[22] *See, e.g.,* Draft Scoping Plan, *supra* note 12.

the magnitude of the challenge, consider that New York currently relies on approximately 244 fossil fuel-based generating units to serve its 19.4 million residents.[23]

Because fossil fuel-plants are typically capable of quickly ramping up and down their energy output (unlike intermittent sources of energy such as wind and solar), the state currently relies on these fossil fuel plants to meet the state's energy needs at precisely those moments when the state's demand for energy is greatest, such as during heat waves.[24]

It took over 100 years for New York to build-out this current energy infrastructure, which the CLCPA is now mandating must be completely transformed within the next 18 years.

C. Major Errors in Power Supply Planning

The fundamental flaw in the Draft Scoping Plan that will threaten the reliability of the state's electrical supply going forward if not corrected is the Plan's extremely narrow focus on promoting certain favored sources of renewable energy—namely, wind, solar, and hydropower—to the exclusion of all other sources of electricity. This is an overly myopic view that ignores the fact that these sources of energy are alone wholly insufficient to meet the state's energy needs. Nevertheless, the Draft Scoping Plan essentially endorses the state's current strategy of continuing to spend billions of public dollars on this limited range of energy sources, while excluding the other zero- and low-carbon sources that will be crucial to maintaining energy reliability from receiving those same funds.[25]

This approach of targeting wind and solar projects for the receipt of virtually all public funding that is being pledged to new generating units is blatantly short-sighted. For example, although New York pledged over $3 billion in public support for wind and solar projects across the state in 2019 alone,[26] federal data shows that the share of the state's electricity that was produced by those sources

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[23] *See* NYISO, *2021 Load & Capacity Data*, at 79-98, Table III-1 (Apr. 2021), *available at* https://www.nyiso.com/documents/20142/2226333/2021-Gold-Book-Final-Public.pdf/b08606d7-db88-c04b-b260-ab35c300ed64.

[24] *See 2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 12 ("Combustion turbines known as 'peakers' typically operate to maintain bulk power system reliability during the most stressful operating conditions, such as periods of peak electricity demand.").

[25] *See* Draft Scoping Plan, *supra* note 8.

[26] *See* N.Y. STATE ENERGY RESEARCH & DEV. AUTH. (NYSERDA), *2019 Solicitation* (last visited June 20, 2022), https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Renewable-Generators-and-Developers/RES-Tier-One-Eligibility/Solicitations-for-Long-term-Contracts/2019-Solicitation-Resources (estimating that state obligated $1.0 billion for solar and wind projects through NYSERDA's Renewable Energy Credits (REC) program in 2019); NYSERDA, *Launching New York's Offshore Wind Industry: Phase 1 Report*, at 22 (Oct. 2019), https://www.nyserda.ny.gov/-/media/Files/Programs/offshore-wind/osw-phase-1-procurement-report.pdf (estimating the present value of the two offshore wind contracts the state entered in 2019 to be $2.2 billion).

in 2019 was only about 6%.[27] This same federal data shows that this share of electricity produced by wind and solar in New York remained flat in 2020 or even fell slightly from the year before to 5%.[28]

This near-exclusive targeting of wind and solar projects for the receipt of state funding in recent years also suggests that hydroelectric power has already been developed to close to maximum capacity in New York. Therefore, assuming hydropower continues to provide about 25% of New York's electricity going forward, this data suggests that New York would need to increase the share of the state's electricity produced by wind and solar sources by over 800% in the span of only about 8 years to meet the CLCPA's 70/30 target. Yet, going forward, the Council is continuing to promote a strategy in the Plan that involves investing virtually all public subsidies for new power generation in wind and solar power.

When the energy supply and demand forecasting regarding New York's future power consumption is closely examined, the stark reality is that the math simply does not add up. This is a dangerous and highly risky position for the state to be in when it comes to power supply planning. In this regard, consider that New York currently uses about 30 gigawatts (GW) of electricity during periods of peak demand.[29] Moreover, the *Plan itself acknowledges that this demand is likely to double to as much as 60 GW by 2040*.[30] This finding is corroborated by independent research, including a report from the state's top energy expert, NYISO—the state's grid operator, which is the entity that state officials will look to first if inadequacies in the state's supply system emerge.[31]

In addition, plans are being put into motion *now* that will contribute to this increase in demand. To provide just one example, New York City recently enacted legislation that will begin the widespread electrification of its massive building stock.[32] Thus, the estimates regarding the total amount of dispatchable clean power and total electricity that will be needed by 2040 are likely understated.

It is virtually impossible for wind and solar generators to meet this new demand for energy alone. This is because these sources of energy are necessarily intermittent, or variable—that is, the sun does not shine and the wind does not blow 24 hours a day, 7 days a week, 365 days a year. This is a significant difference from fossil fuel-based generators and nuclear power plants upon which the state currently relies, which are generally able to produce electricity independently of meteorological

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[27] U.S. ENERGY INFO. ADMIN., *New York: Profile Analysis* (last updated Sep. 17, 2020), http://web.archive.org/web/20210428213008/https://www.eia.gov/state/analysis.php?sid=NY (archive of previous version of this page containing 2019 data).

[28] U.S. ENERGY INFO. ADMIN., *New York: Profile Analysis* (last updated Oct. 21, 2021), https://www.eia.gov/state/analysis.php?sid=NY.

[29] *See* ENERGY+ENVIRONMENTAL ECON., *Pathways to Deep Decarbonization in New York State*, at 31 (June 24, 2020).

[30] *See* Draft Scoping Plan, *supra* note 12.

[31] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 39.

[32] *See* N.Y.C. OFFICE OF THE MAYOR, *Mayor de Blasio Signs Landmark Bill to Ban Combustion of Fossil Fuels in New Buildings* (Dec. 22, 2021), https://www1.nyc.gov/office-of-the-mayor/news/852-21/mayor-de-blasio-signs-landmark-bill-ban-combustion-fossil-fuels-new-buildings.

conditions.[33] Other sources of energy will be needed to fill this gap in supply that emerges when wind and solar production falls.

These gaps in wind and solar production are also significant. Energy system experts widely agree that the peak of demand for electricity in New York is likely to occur sometime in the winter by 2040, which is a shift from the current summer peak.[34] The peak demand for electricity in the winter generally occurs when people turn on their lights after the early sunset, *i.e.*, when solar generating resources are largely unavailable.[35] If a wind lull is occurring at the same time, the bulk of the state's wind and solar generating capacity will be unavailable at precisely the time when the state's energy needs are greatest. The Scoping Plan is fundamentally flawed because it does not adequately explain how the state will meet its energy needs in this circumstance—clearly, simply building more and more wind and solar capacity is not the solution, because a lull in the generating capacity of those sources is most likely to extend across the whole state.[36]

This emerging shortfall between energy demand and energy supply is not merely theoretical. On the contrary, the state's refusal to allow its current fleet of fossil-fuel plants to upgrade to more modern, cleaner-burning facilities and to instead force their decommissioning is only accelerating a possible reliability crisis in the state. This occurred when the New York Department of Environmental Conservation denied permit requests from two fossil-fuel plants that were attempting to upgrade to more modern, cleaner-burning facilities and which were planning to eventually run entirely on zero-carbon hydrogen.[37] Already, NYISO is predicting that the confluence of these factors—the accelerated decommissioning of fossil-fuel plants in the state and the intermittent supply of energy produced by wind and solar sources—could lead to dangerous blackouts in the state as early as 2023.[38] That is an unacceptable result: the state must remain committed to keeping the lights on and maintaining a reliable supply of power.

Energy system planners are aware of the supply issues described above and have articulated a sensible, pragmatic solution: New York must construct and build-out a significant amount of generating capacity from alternative, clean energy sources, which are often referred to as

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[33] *See 2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 9 ("The variability of meteorological conditions that govern the output from wind and solar resources presents a fundamental challenge to relying solely on those resources to meet electricity demand.").

[34] *See, e.g., id.* at 35 ("New York is projected to become a winter peaking system in future decades due to electrification.").

[35] *Id.* at 9 ("Solar resources will have little to no output during the evening and nighttime hours."); ANALYSIS GROUP, *Climate Change Impact Phase II: An Assessment of Climate Change Impacts on Power System Reliability in New York State*, at 65, Figure 37 ("Average Load and Generation Requirements, CCP2-CLCPA Winter") (Sep. 2, 2020).

[36] ANALYSIS GROUP, *supra* note 35, at 10 ("Importantly, further increasing the nameplate capacity of [variable renewable] resources is of limited value, since when output is low, it is low for all similar resources across regions or the … state.").

[37] Daniel Whitehead, N.Y. STATE DEP'T OF ENV'T CONSERVATION, *Re: Notice of Denial of Title V Air Permit*, at 1-2 (Oct. 27, 2021), https://www.dec.ny.gov/docs/administration_pdf/nrgastoriadecision10272021.pdf (NRG Energy's Astoria plant); Daniel Whitehead, N.Y. STATE DEP'T OF ENV'T CONSERVATION, *Re: Notice of Denial of Title V Air Permit*, at 2 (Oct. 27, 2021), https://www.dec.ny.gov/docs/administration_pdf/danskammer10272021.pdf (Danskammer's plant).

[38] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 7 ("[A]n extreme 98-degree Fahrenheit sustained heatwave (1-in-100 year event) would test the system limits today and exceed grid abilities beginning in 2023.").

"dispatchable, emissions-free" sources ("DE sources"), to make-up for the shortfalls in the supply produced by intermittent renewables such as wind and solar.[39] These sources must be "emissions-free" to comply with the CLCPA's 2040 targets and "dispatchable" to balance the supply of variable sources. As indicated above, the state will need a significant amount of dispatchable, emissions-free capacity by 2040 to ensure reliability because the state will need to prepare for circumstances in which a large portion of its solar and wind capacity is unavailable.

NYSIO, a non-partisan leading energy expert, has issued a clear and direct warning as to the state's indisputable need for substantial generating capacity from DE sources:

> Significant amounts of . . . [DE] resources *are needed to balance renewable intermittency on the system*. Resources with this combination of attributes . . . will be *critical to future grid reliability*. By 2040, the amount of *necessary dispatchable emission-free sources could be over 32,000 MW* . . . [and this is] approximately *6,000 MW more than the total fossil-fueled power plants on the New York grid in 2021*.

2021-2030 Comprehensive Reliability Plan, *supra* note 10, at 10 (emphasis added). In other words, New York's foremost energy expert is predicting that*, by 2040, New York will require more generating capacity from DE resources than the capacity currently provided by the state's entire fleet of hundreds of existing fossil-fuel generating units*. Nevertheless, as of December 2021, there was not a single DE project in NYISO's interconnection queue.[40]

These findings provide uncontroverted evidence that New York needs to begin directing a substantial amount of resources toward developing DE capacity *now*, comparable to the support currently being provided to leading renewables. It bears repeating that this warning is *not* coming from an alarmist yelling "fire!" in a crowded theater. NYISO is a sophisticated organization that is a key leader in state energy planning and is obligated to develop responsible energy policies on behalf of all New Yorkers.

Moreover, these findings are also supported by independent research, which has similarly found a clear need for DE capacity in New York state, which is driven primarily by the expected surge in demand for electricity in New York state and the major, intrinsic shortcomings of wind and solar power.[41] In a 2020 report prepared by the Analysis Group, which includes as one of its authors the former Chairman of the Massachusetts Public Utilities Commission, industry experts described New York's need for DE sources as follows:

> In order to reduce or eliminate the need for generation from [New York's current] carbon-emitting generators, [our modeling] removes them from the resource mix and supplant them with renewables, storage, demand response, and transmission . . . In particular, there is substantial "overbuild" of renewable resource capacity and increases in transfer capability in order to start with a system where peak annual

[39] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 47; ANALYSIS GROUP, *supra* note 35, at 9, Table ES-1.

[40] *2021-2030 Comprehensive Reliability Plan, supra* note 10, at 48.

[41] ANALYSIS GROUP, *supra* note 35, at 9-11.

> demand . . . is met with zero-carbon resources. However, *even with all these additions, the variability of renewable resource output leads to circumstances where, for both [modeled scenarios], there are periods of time that our resource mix is insufficient to meet load in all Zones. For these reasons, a DE resource is included to fill the gap*.

ANALYSIS Group, *supra* note 34, at 32. Analysis Groups' models ultimately concluded, like NYISO, that the state will require approximately 32 GW of generating capacity from DE resources by 2040.[42]

To put these numbers in perspective, *developing over 30 GW of generating capacity from DE sources will require the construction of about sixty large, 500 megawatt (MW) power plants or six hundred smaller, 50 MW plants*. Therefore, while New York has invested huge sums of public money in wind and solar plants over the last few years, it is clear that the state must substantially support and develop ACSs just as aggressively for the state to have any chance of successfully meeting the CLCPA targets.

In finalizing the Scoping Plan, we understand the Council faces the monumental challenge of balancing the need to decarbonize power generation and promote conservation and efficiency while ensuring there is an adequate supply of reliable and affordable clean energy. To this end, we submit that the Council must reconsider the practical feasibility of the 70/30 target. Significantly, the CLCPA categorically provides that the Public Service Commission ("PSC") may modify this 70/30 target if achieving that target would impact the "safe and adequate" supply of electricity. N.Y. PUB. SERV. LAW § 66-p(2).

The substantial data and information set forth above justifies revision of the 70/30 rule. The inherent, indomitable limitations of solar and wind generation show this target cannot be realistically met. Conversely, there is a compelling case demonstrating the viability of clean alternative sources to fill the considerable gap created by the restrictions of wind and solar power. Specifically, the Council should promote a more realistic 50/50 target, *i.e.*, ensuring 50 percent renewable sources by 2030, while developing renewable/clean sources at a 50/50 ratio by 2040.

To this end, the Council should bring this matter to the attention of the PSC and/or General Assembly with the support of key stakeholder groups to effectuate these reforms. The essential target of the CLCPA is that 100% of the state's electrical generation be produced with "zero-emissions" capacity by 2040. In sum, responsible energy planning warrants a more realistic, achievable 50/50 split between the leading renewable sources and the ACSs and appropriate reforms should be adopted to achieve the overarching carbon-free goals.

D. Controlling Costs & Maximizing Benefits

One aspect of the CLCPA which the Pipe Trades unequivocally support is its efforts to incorporate progressive contracting and labor policies. While these policies are echoed to some degree in the Draft Scoping Plan,[43] those components of the Plan should be expanded and

[42] *Id.* at 9, Table ES-1

[43] *See* Draft Scoping Plan, *supra* note 1, at 44.

strengthened. As discussed further below, Project Labor Agreements (PLAs), prevailing wage standards, apprenticeship requirements, and pre-apprenticeship programs are all indispensable tools for developing an effective and successful clean energy program in New York.

The contracting and labor policies identified above are critical to the success of New York's clean energy program for two principal reasons. First, these tools promote successful project delivery by ensuring that projects are staffed with highly skilled and properly trained craft personnel, who are essential for completing large, complex energy projects.[44] These contracting tools therefore protect the state's investment in these projects by ensuring that the power they are projected to generate is delivered on time and in full compliance with project specifications.

While these results are well-known and valuable in any market condition, they are particularly important in the current environment because the construction industry is experiencing acute, widespread craft labor shortages,[45] which can impact project timelines if not properly planned for. This craft labor crisis, which is already crippling projects through major delay sand cost overruns, is expected to last several years at a minimum.

Second, the contracting and labor policies identified above will be critical to the success of New York's clean energy program by promoting high quality employment and training opportunities in project areas. This economic stimulus will help state residents generally, but will also be instrumental to furthering the CLCPA's goal of providing economic benefits to disadvantaged populations.[46] These tools, particularly pre-apprenticeship programs, can be designed to specifically include outreach to women, minority, and other disadvantaged populations, ensuring that these groups have meaningful opportunities to pursue a good-paying, middle-class career in the building trades.

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[44] *See e.g., State-Based Policies to Build a Cleaner, Safer, More Equitable Economy: A Policy Toolkit*, BLUE GREEN ALLIANCE, at 6-7 (July 2020), https://www.bluegreenalliance.org/wp-content/uploads/2020/07/StatePolicyToolkit_Report2020_vFINAL.pdf; Lucero E. Herrera et al., *Exploring Targeted Hire: An Assessment of Best Practices in the Construction Industry*, UCLA LABOR CENTER, at 24 (Mar. 2014), https://www.labor.ucla.edu/wp-content/uploads/2018/06/Exploring-Targeted-Hire.pdf ("[A]n extensive body of research has documented the benefits of PLAs, stating that they create efficiencies and coordination to ensure projects are completed on time and on budget.").

[45] *See, e.g., Craft Labor Shortage Provokes More Studies of Pay and Safety*, Engineering News Record (Aug. 20, 2001); *Confronting the Skilled Workforce Shortage (WP-401)*, Construction Users Roundtable (2004); *The Perfect Storm: Factors Come Together Creating a Storm in the Construction Workforce*, The Construction Executive (June 2004); *America's Construction Industry: Identifying and Addressing Workforce Challenges*, ETA/ Business Relations Group Report (Dec. 2004); *Craft Labor Supply Outlook: 2005-2015,* Construction Labor Research Council (2004); *The 2005-2006 U.S. Markets Construction Overview*, FMI Management Consulting (2005); *Solving the Construction Industry Workforce Crisis – Ideas for Action*, McGraw Hill/ENR (2007); Paul Turenne, *In Demand: Emerging Solutions for the Workforce Crisis*, The Voice, Construction Users Roundtable (Spring 2007); Alexandra Walld, *Who is the Future Face of Our Industry?*, The Voice, Construction Users Roundtable (Fall 2014); Patrick Clark, *Millennials: Builders Are Desperate to Hire You*, Bloomberg BNA Construction Labor Report, 61 CLR 1062 (Dec. 17, 2015); Emily Peiffer, *Construction Loses 15K Jobs as Labor Shortage Begins to 'Undermine' Industry's Growth*, Construction Dive (June 3, 2016); *Craft Labor Shortage Seriously Affecting Mega Projects: Poll*, Reuters (Jun. 29, 2017); *Eighty Percent of Contractors Report Difficulty Finding Qualified Craft Workers to Hire*, Associated General Contractors of America – News, (2019); Thaddeus Swanek, *New Report Finds Construction Contractors Struggling to Find Workers, Building Materials,* U.S. Chamber of Commerce (June 16, 2021); *Construction Employment Declines By 7,000 In June as Nonresidential Firms Struggle To Find Workers And Materials To Complete Projects*, AGC of America (July 2, 2021).

[46] *See* N.Y. ENVTL. CONSERV. LAW § 75-0117.

V. Specific Revisions Needed in the Draft Scoping Plan

As outlined above, one of the most critical revisions the Draft Scoping Plan requires is planning for the extensive build-out of ACSs, or "DE sources," across the state, which will require considerable time and effort. However, while those plans are being developed, there are also certain, short-term actions which can be addressed immediately.

A. Extend Support for New York's Existing Nuclear Facilities

New York currently provides financial support to three of its in-state nuclear power plants through its Zero-Emission Credit (ZEC) program. Although these plants require financial support because of the low cost of energy produced with natural gas, nuclear power is New York's single largest source of 100% emissions-free power.[47] In addition, the generating capacity provided by these nuclear plants is firm, baseload power, which is available 24/7.[48] This shows that nuclear power is precisely the type of firm, emissions-free power that New York needs to balance the supply provided by intermittent renewables in its clean energy future. The support provided by the ZEC program, however, is currently scheduled to expire in 2029.[49]

If New York cuts off support for these facilities at the scheduled end of the ZEC program, it is likely these plants will close for economic reasons (due to the comparatively low price of other sources of energy). When public officials take actions that force the closure of nuclear power plants, previous experience from both New York and across the world shows that a rise in GHG emissions is the result. For example, the recent closure of the Indian Point nuclear plant outside of New York City was associated with a corresponding rise in GHG emissions in the New York City area.[50]

Similarly, Germany has been steadily decommissioning its extensive fleet of nuclear power plants as part of a national overreaction to the Fukushima nuclear accident in Japan in 2011.[51] These closures of nuclear plants in Germany directly contributed to that country recording "its biggest rise in greenhouse gas emissions since 1990" in 2021, as that country has been forced to rely on fossil

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[47] *See* U.S. ENERGY INFO. ADMIN., *supra* note 28.

[48] *See* Joanne Liou, INT'L ATOMIC ENERGY AGENCY, *Nuclear and Renewables: Modelling Tool to Evaluate Hybrid Energy Systems* (Sep. 24, 2021), https://www.iaea.org/newscenter/news/nuclear-and-renewables-modelling-tool-to-evalPipe Trades te-hybrid-energy-systems ("[N]uclear power plants are dispatchable sources of energy – they can adjust output accordingly to electricity demand.").

[49] N.Y. PUB. SERV. COMM'N, *Order Adopting a Clean Energy Standard*, at 156 (Aug. 1, 2016), *available at* http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={44C5D5B8-14C3-4F32-8399-F5487D6D8FE8}.

[50] Benjamin Storrow, *3 states with shuttered nuclear plants see emissions rise*, POLITICO (Feb. 17, 2022 5:09 PM EST), https://www.politico.com/news/2022/02/17/3-states-with-shuttered-nuclear-plants-see-emissions-rise-00009034.

[51] *Germany to pull the plug on 3 of its last 6 nuclear plants*, REUTERS (Dec. 30, 2021 9:30 AM EST), https://www.nbcnews.com/news/world/germany-pull-plug-3-its-last-6-nuclear-power-plants-n1286771.

fuels to make-up for the resulting slack in generating capacity.[52] If New York refuses to extend the support provided by the ZEC program, a similar rise in GHG emissions in-state can be expected.

As outlined in Section IV, New York will require substantial generating capacity from dispatchable, emissions-free (DE) resources to maintain the reliability of its electrical supply system under the CLCPA's 2040 targets. The next generation of advanced nuclear reactors possess the characteristics required of DE resources and are therefore poised to play a critical role in a clean energy future.[53] Allowing the state's nuclear capacity to shrink at precisely the time when the state should be seeking to aggressively expand its nuclear generating capacity is therefore exactly the wrong move to take at this point in time. The Director of the Climate Science, Awareness and Solutions Program at Columbia University recently made these exact points in an Op-Ed published in the Times Union regarding New York's climate planning:

> The [Draft Scoping Plan] admits that nuclear power provides much of New York's carbon-free electricity today, even after decades of solar and wind deployment. Technical analysis in the plan also confirms that extending the operational life of reactors is a cost-effective way to limit greenhouse gas emissions. Yet the rest of the document portrays nuclear as more of a problem than a solution, thus contributing to public misunderstanding and misplaced fear.

James E. Hansen, *Commentary: Nuclear power must be part of New York's energy solution*, TIMES UNION (Apr. 11, 2022), https://www.timesunion.com/opinion/article/Commentary-Nuclear-power-must-be-part-of-New-17071213.php. New York should recognize the immense contribution of its nuclear power plants toward its climate goals and commit to supporting these facilities past the currently scheduled ending of the ZEC program.

B. Protect Existing Supply Infrastructure During the Clean Energy Transition

New York's looming energy reliability crisis is not an issue that can be sidelined until 2030 or 2040—it is an increasingly imminent crisis that must be planned for now to avoid devastating power outages down the line. This is shown by the stark warning that NYISO recently issued saying that "any additional load increase, generator outage, or combination more than 394 MW will tip New York City beyond its margin by 2025."[54]

To ensure that New York retains sufficient generating capacity to meet its energy needs during the clean energy transition, it must take steps to protect and preserve its existing generating capacity *until* there is sufficient generating capacity from dispatchable, emissions-free resources to take their place. In other words, due to the fundamental differences between firm, baseload power and intermittent, renewable power, the Draft Scoping Plan cannot simply assume that new wind and solar plants are direct, 1:1 replacements for fossil-fuel generators with an equivalent nameplate capacity.

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[52] *Germany 'set for biggest rise in greenhouse gases for 30 years'*, ASSOCIATED PRESS (Aug. 15, 2021 7:50 EDT), https://www.theguardian.com/environment/2021/aug/15/germany-set-for-biggest-rise-in-greenhouse-gases-for-30-years.

[53] *See* Joanne Liou, *supra* note 48.

[54] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 21.

If New York nonetheless forces fossil-fuel generators to decommission when new wind and solar projects are constructed, it creates a real risk of creating an imbalance of supply and demand. While this is an energy planning issue that New York simply cannot ignore, the state is not alone in grappling with this challenge—energy system experts involved in system planning across the country are beginning to publicly sound the alarm regarding the increasingly imminent reliability challenges facing the nation's electrical supply.[55]

To date, however, the actions New York is taking regarding its existing fleet of fossil fuel generators suggest that the state does not fully recognize the magnitude of the reliability crisis it could soon face. Recent decisions from the New York Department of Environmental Conservation (DEC) appear particularly short-sighted. For example, a recent DEC rule referred to as the "Peaker Rule" will force about 1.5 GW of fossil-fuel generating capacity in the New York City area offline within the next couple of years.[56] As mentioned earlier, the DEC also recently denied permits to two natural gas facilities that were proposing to upgrade their facilities to more modern technology that would have allowed them to burn a blend of natural gas and hydrogen, with plans to eventually transition entirely to clean burning, zero-carbon hydrogen fuel.[57]

This decision to deny natural gas and other fossil-fuel plants the opportunity to upgrade to cleaner and more sophisticated technology is precisely the wrong strategy to adopt. For the reasons discussed here, New York will continue to rely on a significant amount of fossil-fuel generating capacity during the near- and medium-term as it builds-out its generating capacity from DE resources. Moreover, much of the state's current fleet of fossil-fuel generators is rapidly nearing retirement age.[58] By allowing those aging facilities to upgrade and modernize while they are still needed, New York can achieve modest, short-term emissions reductions while preserving and protecting this vitally needed energy infrastructure.

Allowing existing facilities to upgrade to cleaner and more sophisticated technology will also further Governor Hochul's goal of New York becoming a "hydrogen hub."[59] Although the critical role that hydrogen energy can and should play in a clean energy future is discussed in more detail below, it is worth noting here that hydrogen can be combusted in a process similar to the one used at existing natural gas plants but resulting in zero carbon or methane emissions.[60] Existing plants can be upgraded to run on a blend of natural gas and "green hydrogen," and energy firms are actively developing technology that will then allow these plants to eventually run on blends of pure

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[55] *See* Katherine Blunt, *America's Power Grid Is Increasingly Unreliable*, WALL STREET J. (Feb. 18, 2022 10:06 AM ET), https://www.wsj.com/articles/americas-power-grid-is-increasingly-unreliable-11645196772.

[56] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 41.

[57] Daniel Whitehead, *supra* note 37.

[58] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 41 ("A growing amount of New York's gas-turbine and fossil fuel-fired steam-turbine capacity is reaching an age at which, nationally, a vast majority of similar capacity has been deactivated.").

[59] Governor Kathy Hochul, *New York State of the State 2022: A New Era for New York*, at 147 (Jan. 2022), https://www.governor.ny.gov/sites/default/files/2022-01/2022StateoftheStateBook.pdf.

[60] *See* Iain Staffell et al., *supra* note 21.

hydrogen.[61] Indeed, these are exactly the upgrade plans that were submitted by the natural gas plants for which the DEC recently denied permits.[62]

If these retrofits had instead been allowed to move forward, however, those upgraded plants would have been significant customers for green hydrogen, thus stimulating New York's burgeoning hydrogen industry and the market for green hydrogen. The DEC should stop letting "perfect be the enemy of good," and allow existing fossil-fuel plants to upgrade to cleaner burning technologies, even if those upgraded plants will still result in some GHG emissions. After all, the generating capacity from these facilities will be needed in any event until sufficient generating capacity from DE sources are constructed, which could take many years.

Another strategy New York should adopt to reduce emissions from its current generating facilities while preserving needed capacity during the transitional period is to promote the use and adoption of carbon capture technology (CCT). This technology has been making significant advances in recent years and is currently capable of trapping 90% or more of the emissions from traditional combustion sources.[63] However, due to installation and energy costs, CCT technology is also typically seen as not being commercially viable.[64] New York should therefore explore ways of promoting this technology and incentivizing its adoption.

C. Key Actions Needed for Long-Term Clean Energy Planning

The Draft Scoping Plan makes several assumptions regarding New York's long-term energy planning that must be corrected to avoid dangerous reliability issues. As mentioned earlier, the Plan broadly and unequivocally promotes the wholescale electrification of major sectors of the state's economy, including transportation and building heating/cooling. While there is no doubt that electrification will be a major decarbonization strategy going forward, the state's zeal for electrification must be tempered by the need to ensure there is sufficient and *dependable* generating capacity on-line to support that increased demand. Along these lines, the Scoping Plan's aggressive timeline for electrifying transportation and building heating should be made contingent on the construction of a substantial amount of the 32 GW of DE generating capacity called for by NYISO.[65] Gradually extending the timeframes for electrifying these sectors will also ease the significant

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[61] *See, e.g.,* Sammy Roth, *Newsletter: A hydrogen hub in Utah could power L.A.'s climate future. Now Chevron wants in*, L.A. TIMES (last updated Sep. 17, 2021 6:11 PM PT), https://www.latimes.com/environment/newsletter/2021-09-16/hydrogen-hub-utah-los-angeles-chevron-boiling-point ("Mitsubishi already makes a gas turbine that can handle a 30% hydrogen mix, and expects to have a turbine capable of burning 100% hydrogen much sooner than 2045—possibly this decade.").

[62] *See* Larry Pearl, *New York rejects proposed NRG, Danskammer Energy gas plants, citing 2019 climate law*, UTILITY DIVE (Oct. 28, 2021), https://www.utilitydive.com/news/new-york-rejects-proposed-nrg-danskammer-energy-gas-plants-citing-2019-cl/609040/.

[63] Erin M. Blanton et al., *Investing in the US Natural Gas Pipeline System to Support Net-Zero Targets*, COLUMBIA UNIV. SCHOOL OF INT'L & PUB. AFFAIRS, CTR. ON GLOBAL ENERGY POLICY, at 21 (Apr. 2021), https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/GasPipelines_CGEP_Report_081721.pdf.

[64] *See id.*

[65] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 10.

financial burden that is associated with replacing gas-powered appliances in homes, which will fall heaviest on low-income and working families.

In addition, where there are alternative strategies to electrification that are zero- or low-carbon, the Council must seriously consider adopting those strategies as a method of reducing the significant strain that is already being placed on the state's electrical supply system. For example, ground-source heat pumps and thermal energy networks should be aggressively pursued in the building heating and colling sector, because these are zero-emissions heating and cooling systems that place less of a burden on the electrical supply system than other clean energy solutions for this sector.[66]

Another change the Council must make regarding its long-term energy planning is its general approach towards nuclear energy. As discussed earlier regarding the need for New York to extend the Zero-Emissions Credit (ZEC) program, nuclear energy is currently New York's single largest source of emissions-free energy.[67] Sober-minded analysis generally concludes that nuclear energy is one of the safest forms of energy on the planet,[68] and the next-generation of so-called "advanced" reactors are being designed to be both safer and cheaper to construct than the fleet that is currently in use.[69] All of this suggests that New York should be seeking to aggressively expand its nuclear generating capacity. Nevertheless, the Scoping Plan inexplicably ignores these benefits and gives weight to misplaced and ill-informed suspicions regarding nuclear energy.[70] Other countries around the world are investing in nuclear energy for precisely the reasons discussed here;[71] if the Council does not revise its stance towards nuclear energy, New York stands to lose out on those substantial investments.

The Council should also adopt a position regarding the definition of "zero-emissions," as that term is used in critical sections of the CLCPA, including the 2040 emissions target.[72] A failure to clarify the exact meaning of this term is likely hindering in-State investment in potential zero-

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[66] *See* Sonal Patel, *Why Thermal Energy Storage Offers Hot Prospects for Power*, POWER MAG. (Dec. 1, 2021), https://www.powermag.com/why-thermal-energy-storage-offers-hot-prospects-for-power/.

[67] *See* U.S. ENERGY INFO. ADMIN., *supra* note 28.

[68] James E. Hansen, *Commentary: Nuclear power must be part of New York's energy solution*, TIMES UNION (Apr. 11, 2022), https://www.timesunion.com/opinion/article/Commentary-Nuclear-power-must-be-part-of-New-17071213.php.

[69] WORLD NUCLEAR ASS'N, *Advanced Nuclear Power Reactors* (last updated Apr. 2021), https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/advanced-nuclear-power-reactors.aspx.

[70] *See* Ashutosh Jogalekar, *Top 5 reasons why intelligent liberals don't like nuclear energy*, SCI. AM. (Feb. 6, 2013), https://blogs.scientificamerican.com/the-curious-wavefunction/top-5-reasons-why-intelligent-liberals-dont-like-nuclear-energy/ (describing common misconceptions regarding nuclear energy).

[71] *See, e.g.,* Stanley Reed, *Rolls-Royce plans to build small nuclear power plants in Britain*, N.Y. TIMES (Nov. 9, 2021), https://www.nytimes.com/2021/11/09/business/rolls-royce-nuclear-power-uk.html; Andrew E. Kramer, *A Nuclear-Powered Shower? Russia Tests a Climate Innovation*, N.Y. TIMES (Nov. 5, 2021), https://www.nytimes.com/2021/11/05/world/europe/russia-nuclear-power-climate-change.html; Daniel Van Boom, *What the US could learn from China's nuclear power expansion*, CNET (Dec. 24, 2021 5:00 AM PT), https://www.cnet.com/news/why-the-us-should-learn-from-chinas-nuclear-power-expansion/.

[72] N.Y. PUB. SERV. LAW § 66-p(2).

emissions energy systems because of the reasonable fear that these systems will not fully satisfy the State's eventual definition. To provide regulatory certainty in this area and thus stimulate investment, the Council should propose defining "zero-emissions," as that term is used in the CLCPA, as *all* systems, other than renewable energy systems, that generate electricity or thermal energy using technologies that do not lead to a net increase in GHG emissions into the atmosphere at any time in the process of generating electricity.

Thus, if the Council succeeds in shifting the focus of the Draft Scoping Plan to promoting the construction and deployment of ***both*** renewable ***and*** alternative clean energy sources (ACSs), it will put itself in the best possible position for achieving the CLCPA's goals. For this reason, the Council should give its full public support to the Clean Energy Petition that is currently pending before the Public Service Commission,[73] which advocates for the same definition of "zero-emissions" proposed above. This Petition responds to New York's substantial need for dispatchable, emissions-free energy sources by calling for the development and expansion of subsidies for ACSs. Like leading renewable sources of energy, ACSs also require public support and investment, especially during the early stages of their development when they are still achieving commercial viability.

Given that New York will need to develop at least 30 GW of generating capacity from these sources to achieve the CLCPA's 2040 target, this Petition's request for the establishment of a competitive zero-emissions program or tier under the state's Clean Energy Standard is deserving of this Council's support.

D. Aggressively Develop Subsidies for Leading ACSs

These comments have extensively discussed the need for New York to invest substantial resources in the development and deployment of ACSs to balance the supply of power provided by intermittent renewables to build a clean energy economy. This section provides vital information regarding leading ACSs that New York should be aggressively promoting across the state.

1. Hydrogen Energy

When so-called "green" hydrogen is used in a fuel cell, the resulting power generation is entirely emissions-free and renewable, as recognized by the CLCPA itself.[74] "Green" hydrogen refers to hydrogen that is produced using renewable sources of energy and which results in zero GHG emissions during that production process.[75] Moreover, green hydrogen can also be burned in a

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[73] INDEP. POWER PRODUCERS OF N.Y., INC. (IPPNY) et al., *Petition for the Establishment of a Zero Emissions Energy Systems Program Under the Clean Energy Standard*, Case No. 15-E-0302 (N.Y. Pub. Serv. Comm'n Aug. 18, 2021), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={F872B30D-6B62-4409-95AC-DCD6D7A6AFD0}.

[74] *See* N.Y. PUB. SERV. LAW § 66-p(1)(b).

[75] Renee Cho, COLUMBIA CLIMATE SCHOOL, *Why We Need Green Hydrogen* (Jan. 7, 2021), https://news.climate.columbia.edu/2021/01/07/need-green-hydrogen/

combustion process without releasing any carbon into the atmosphere.[76] These attributes show that uses of green hydrogen should fall under any definition of "zero-emissions" the state eventually promulgates.

The true value of hydrogen in New York's clean energy future, however, is likely to derive from its ability to function as a form of energy storage. This is an incredibly important distinction between hydrogen energy and intermittent sources of renewable energy, such as wind and solar. Indeed, hydrogen's ability to function as a form of energy storage allows it to specifically address the shortcomings of intermittent renewable production.

As explained earlier, there is a significant possibility once New York transitions to a "winter-peaking" electrical supply system that much of the state's generating capacity from wind and solar plants will be unavailable at precisely the moments of peak demand in the state, because the daily peak of electrical demand during the winter will generally occur after the sun sets. However, during the middle of the day, or during the more moderate spring and fall months, it is also likely that New York's wind and solar plants will generate *more* energy than is needed at that time.

The electrical grid, of course, has very little capacity for energy storage. Batteries can be used to store some of this "curtailed," excess energy produced by solar and wind plants, but nonpartisan energy experts typically acknowledge that battery technology is facing substantial technological and engineering limitations that are likely to severely limit the uses of battery technology for *long-term, seasonal* storage of utility-scale electrical generation.[77]

Hydrogen is the missing puzzle piece in the dilemma described above. Because hydrogen can be produced using renewable energy without any resulting GHG emissions, solar and wind generation that would otherwise be "curtailed" during periods of low demand can instead be used to produce hydrogen. Hydrogen, of course, can then be stored as either a gas or liquid for an indefinite period. Hydrogen is therefore fully capable of being used as a form of long-term, seasonal storage of renewable energy, without the same technological limitations facing battery technology. That hydrogen can be then used to generate electricity in an entirely emissions-free fuel cell, or, if necessary to maintain the reliability of the electrical supply system, it can be used in a traditional combustion process without releasing any carbon into the atmosphere.

The Draft Scoping Plan seems to be placing an enormous amount of faith in the ability of battery storage technology to solve the problem of storing "curtailed" renewable generation. For example, one chapter of the Plan cites "4- and 8-hour battery storage" as the principal of form of energy storage in New York state in 2050.[78] However, this faith flies in the face of the predictions

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[76] *See* Iain Staffell et al., *supra* note 21.

[77] Renee Cho, *supra* note 75 ("[B]atteries…are unable to store large quantities of electricity for extended periods of time."); *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 47; ANALYSIS GROUP, *supra* note 35, at 11 ("[Even assuming] a substantial level of assumed growth in battery storage within New York, [that] contribution of storage is quickly overwhelmed by the depth of the [generation] gap left during periods of time with a drop off in renewable generating output over periods of a day or more.").

[78] Draft Scoping Plan*, supra* note 1, at 74.

from the state's own energy experts. As NYISO explains, "[b]atteries are limited by the amount of energy that they can store and how fast that energy can be discharged."[79] Therefore, while "[b]attery storage resources help to fill in voids in renewable resources output…extended periods *rapidly deplete storage capabilities resulting in the need for longer running dispatchable emissions-free resources.*"[80] New York must also invest in alternatives to battery storage, such as hydrogen energy, if it is serious about deploying long-term energy storage capacity in the state.

Finally, an additional advantage of hydrogen is that much of the state's existing natural gas infrastructure can likely be converted to be compatible with hydrogen, allowing the state to prevent its substantial investment in that infrastructure from being a stranded asset during the energy transition. For example, once green hydrogen is produced using curtailed renewable energy, natural gas pipelines that have been upgraded and modified to be compatible with hydrogen could be used to transport that hydrogen across the state.[81] Natural gas power plants can also be economically converted to plants that run on a blend of natural gas and hydrogen, resulting in moderate emission reductions during the transitional period.[82] The Scoping Plan should support these efforts.

For all these reasons, the Draft Scoping Plan should fully embrace hydrogen energy as an important component of the over 32 GW of dispatchable, emissions-free generation capacity the state will be required to construct to achieve the CLCPA's targets.

Similar to many other technological innovations, particularly in the energy sector, hydrogen energy requires public support to reach commercial viability. Examples of public support for hydrogen energy in other jurisdictions are listed below:

- The recent Bipartisan Infrastructure Law appropriated over $8 billion to the U.S. Department of Energy ("DOE") to support hydrogen energy R&D, some of which will be distributed to "clean hydrogen hubs" across the country.[83] These funds will be used to support R&D into a variety of issues relating to hydrogen energy, including "new manufacturing technologies and techniques for clean hydrogen production, delivery, storage, and use."[84]

- The Los Angeles Water & Power Department is planning to upgrade and transition the city's largest single source of electricity, a coal-burning power plant in Intermountain, Utah, to a

[79] *2021-2030 Comprehensive Reliability Plan*, *supra* note 10, at 47.

[80] *Id.* at 10.

[81] *See* AM. GAS ASS'N, *Net-Zero Emissions Opportunities for Gas Utilities*, at 62 (Feb. 2022), https://www.aga.org/globalassets/research--insights/reports/aga-net-zero-emissions-opportunities-for-gas-utilities.pdf (describing a plan to build an "integrated hydrogen network across [Europe] through a mix of building new hydrogen pipelines and conversion of existing gas pipelines").

[82] *See Reducing Carbon Emissions in New York*, CRICKET VALLEY ENERGY CTR. (last visited Mar. 14, 2022), https://www.cricketvalley.com/reducing-carbon-emissions-in-new-york/ (describing the plans of a New York natural gas plant to begin blending hydrogen into its fuel).

[83] Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, § 40314, 135 Stat. 429, 1009 (2021).

[84] *Id.*

plant that will run on a blend of natural gas and hydrogen, with the expectation that the plant will eventually run on 100% hydrogen fuel.[85]

- The DOE is pledging up to $504.4 million in debt financing for the hydrogen production and storage component of this planned natural gas/hydrogen plant in Intermountain, Utah.[86] The President of Mitsubishi Power, which is involved with this project, has remarked that the salt dome that will be used to store hydrogen for this plant "is going to be the largest energy storage project on the planet."[87]

2. Nuclear Energy

Nuclear energy is currently New York's single largest source of carbon-free electricity.[88] Nuclear power is also "among the safest forms of energy on the planet"[89] and "has the smallest land footprint and lowest life-cycle carbon emissions of *any* energy source."[90] Moreover, a new generation of so-called "advanced" reactors are being designed with passive safety features that can shutdown a reactor in the event of an emergency *without* the need for operator control or an independent power source. These new designs are also often intended to be smaller and less expensive to construct than the current fleet of light water reactors that are currently in-use in New York and across the country.[91]

In addition to the many positive attributes of nuclear power outlined above, nuclear power is also a "firm" energy source that can be relied on to provide baseload power 24/7. This power generation is available independently of meteorological conditions, showing that nuclear power can be used to balance the supply of variable generation provided by wind and solar power in a clean energy future. As the International Atomic Energy Agency recently explained, "nuclear power plants are dispatchable sources of energy – they can adjust output accordingly to electricity demand."[92] Thus, contrary to popular belief, there are dispatchable, emissions free sources of energy that are capable of being deployed at utility scale *today*—if there is the political will to do so.

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[85] Sammy Roth, *Newsletter: A hydrogen hub in Utah could power L.A.'s climate future. Now Chevron wants in*, L.A. TIMES (last updated Sep. 17, 2021 6:11 PM PT), https://www.latimes.com/environment/newsletter/2021-09-16/hydrogen-hub-utah-los-angeles-chevron-boiling-point.

[86] Naureen S. Malik, *U.S. Earmarks $504 Million to Back World's Largest Hydrogen Hub*, BLOOMBERG (Apr. 26, 2022 1:00 PM), https://www.bloomberg.com/news/articles/2022-04-26/u-s-earmarks-504-million-to-back-world-s-largest-hydrogen-hub.

[87] Sammy Roth, *supra* note 85.

[88] *See* U.S. ENERGY INFO. ADMIN., *supra* note 28.

[89] James E. Hansen, *supra* note 68.

[90] *Id.*

[91] *See* WORLD NUCLEAR ASS'N, *Advanced Nuclear Power Reactors* (last updated Apr. 2021), https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/advanced-nuclear-power-reactors.aspx; Josh Freed et al., *Advanced Nuclear 101*, THIRD WAY (last updated Dec. 1, 2015), https://www.thirdway.org/report/advanced-nuclear-101.

[92] Joanne Liou, *supra* note 48.

While opponents of nuclear energy will frequently cite the radioactive "fuel rods" that are waste products of nuclear generation as a compelling reason not to pursue nuclear power, the simple fact of the matter is that, as explained by the U.S. Department of Energy, every spent fuel rod the U.S. has produced since the 1950s could fit in the space of a "single football field at a depth of less than 10 yards."[93] The obstacles to establishing a permanent repository for these fuel rods are therefore entirely political in nature and not scientifically based.

Some advanced reactors are also being designed to further minimize (or even eliminate) this nominal amount of solid waste that is produced by the current fleet of reactors.[94] Given the critical need to invest in and deploy a significant amount of generating capacity from dispatchable, emissions-free sources across the state to achieve the CLCPA's 2040 target, citing these fuel rods as a reason not to pursue a commercially viable technology that is currently capable of filling this role is a self-defeating position for any group that is serious about achieving the CLCPA's goals to take.

All the above factors suggest that New York should be aggressively investing in the construction of new, advanced nuclear reactors that can provide firm, baseload power to the state's electrical supply system without any resulting GHG emissions. It is therefore incredibly disappointing that the Draft Scoping Plan endorses misplaced and unfounded suspicions regarding nuclear power, rather than fully embracing this critical energy source. This is shown by the vague references in the Scoping Plan to undefined and ambiguous "potential impacts on host communities" and "impacts of nuclear waste on health and the environment."[95]

As outlined above, these fears are substantially unfounded. Other states and countries are moving rapidly to increase their nuclear power generation for precisely the reasons discussed in this section,[96] and New York risks being left behind on this issue if it continues to allow its energy policy to be driven by an unscientific and emotional aversion to nuclear energy. Examples of public investment in nuclear energy in other jurisdictions are listed below:

- The DOE's "Advanced Reactor Demonstration Project" (ADRP) has selected two nuclear reactor demonstration projects for the receipt of $160 million in federal funding.[97] Both firms that were selected for receipt of these funds—TerraPower and X-energy—are planning on

[93] U.S. DEP'T OF ENERGY, OFFICE OF NUCLEAR ENERGY, *5 Fast Facts about Spent Nuclear Fuel* (Mar. 30, 2020), https://www.energy.gov/ne/articles/5-fast-facts-about-spent-nuclear-fuel.

[94] *See* Josh Freed et al., *supra* note 91 ("Many advanced reactor designs would address these concerns [regarding fuel rods]…by actually consuming spent fuel, dramatically reducing the amount of waste requiring storage. Other advanced reactors…would help manage nuclear waste by using fuel more efficiently than current reactors and by actually creating new nuclear fuel.").

[95] Draft Scoping Plan, *supra* note 1, at 177.

[96] *See* collected sources, *supra* note 71; Sonal Patel, *DOE Picks More ARDP Winners; One or More Advanced Nuclear Demonstrations Will Be in Washington State*, POWER MAG. (Dec. 17, 2020), https://www.powermag.com/doe-picks-more-ardp-winners-one-or-more-advanced-nuclear-demonstrations-will-be-in-washington-state/.

[97] U.S. DEP'T OF ENERGY, OFFICE OF NUCLEAR ENERGY, *U.S. Department of Energy Announces $160 Million in First Awards under Advanced Reactor Demonstration Program* (Oct. 13, 2020), https://www.energy.gov/ne/articles/us-department-energy-announces-160-million-first-awards-under-advanced-reactor.

constructing their demonstration reactors in Washington state.[98] The DOE is planning to invest "a total of $3.2 billion over seven years" through this ADRP program, "subject to the availability of future appropriations."[99]

- The U.S. Nuclear Regulatory Commission is currently engaged in a rulemaking concerning the certification process for advanced nuclear reactors.[100] A streamlined certification process for these reactors will reduce regulatory costs and shorten the necessary timeframe for bringing these reactors into commercial operation.

- While significant, these investments described here pale in comparison to those being made by other countries, which are even more aggressively pursuing nuclear energy. For example, the United Kingdom recently announced that it would be giving the British firm Rolls-Royce a £210 million grant to construct up to 16 small modular reactors (SMRs) across the UK,[101] while China is "embarking on the biggest expansion of nuclear power in human history."[102]

3. Bioenergy & Biofuels

Although combusting organic matter does typically release carbon into the atmosphere, certain bioenergy systems—such as those based on the capture of anaerobic gas at landfills—can be designed to capture as much or more GHG emissions than they emit, which effectively allows these systems to have a *net-negative* impact on climate change. The U.S. Environmental Protection Agency—hardly a friend of fossil-fuel interests—explains on its website that "using landfill gas (LFG) to generate energy and reduce methane emissions *produces positive outcomes for local communities and the environment*."[103] Moreover, because bioenergy is typically produced by combusting organic matter in some form, it is a dispatchable form of energy that can be produced on demand.[104] This suggests that bioenergy plants could play a crucial role in maintaining the reliability of New York's electrical supply system as the share of electricity produced by intermittent renewables continues to increase.

Rather than combusting anaerobic landfill gas at the point of capture, this gas can also be processed into a biofuel that can then be used as a low- or zero-carbon power solution for the transportation and building sectors. These processed biofuels, sometimes referred to as "renewable

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[98] Sonal Patel, *DOE Picks More ARDP Winners; One or More Advanced Nuclear Demonstrations Will Be in Washington State*, POWER MAG. (Dec. 17, 2020), https://www.powermag.com/doe-picks-more-ardp-winners-one-or-more-advanced-nuclear-demonstrations-will-be-in-washington-state/.

[99] U.S. DEP'T OF ENERGY, *supra* note 97.

[100] *Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors*, 86 Fed. Reg. 70,423 (Dec. 10, 2021).

[101] Stanley Reed, *supra* note 71.

[102] Daniel Van Boom, *supra* note 71.

[103] U.S. ENV'T PROT. AGENCY, *Benefits of Landfill Gas Energy Projects* (last updated Apr. 21, 2022), https://www.epa.gov/lmop/benefits-landfill-gas-energy-projects.

[104] *Id.* ("LFG can serve as a 'baseload renewable,' providing online availability exceeding 90 percent.").

natural gas" (RNG), can be transported through existing natural gas pipelines.[105] Crucially, using some amount of low- and zero-carbon biofuels in these sectors would also lessen the tremendous burden that complete electrification of those sectors will place on the electrical supply system.

Along these lines, recent research, including a study prepared in connection with the New York City Mayor's office, shows that supplementing the use of electricity for building heating with low- and zero-carbon biofuels can reduce the cost of the energy transition for consumers *while still allowing the State to fully achieve the CLCPA targets*. This study concluded that using "dual fuel heat pump systems" for building heating, which would use electricity "for all but the coldest periods when fuels are burned to provide additional heat," would reduce peak electric demand in the winter by up to 7% when compared to the use of all-electric heat pumps.[106]

Because of the tremendous opportunity to use biofuels to reduce the costs of the clean energy transition, maintain the reliability of the electrical supply system, and reduce emissions in hard-to-decarbonize sectors such as heavy transportation, the final Scoping Plan should fully embrace bioenergy as an important component of an "all the above" approach towards achieving the CLCPA's targets, rather than relegating this energy source to the sidelines.

Unlike New York, every other state with a clean or renewable energy program—39 states, by our survey—includes at least certain types of "bioenergy" in their definitions of "renewable energy."[107] This designation under state law is critical because it allows developers of this energy source to compete for valuable public subsidies and support. Bioenergy firms have indicated that they can be commercially viable—*if* they are allowed to monetize the value of their clean generation in the same manner as other renewables.[108]

The Scoping Plan should therefore be revised to allow bioenergy firms in New York to do just that. Specifically, New York should revise its definition of "renewable energy"[109] to allow bioenergy firms to compete for the assistance provided through the Renewable Energy Certificate (REC) program—at least in circumstances where the firm can establish that its power generation has an overall neutral or net-negative impact on overall GHG emissions.

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[105] *See* U.S. DEP'T OF ENERGY, ALT. FUELS DATA CTR., *Renewable Natural Gas Production* (last visited Mar. 14, 2022), https://afdc.energy.gov/fuels/natural_gas_renewable.html.

[106] N.Y.C. MAYOR'S OFFICE OF SUSTAINABILITY, *Pathways to Carbon-Neutral NYC: Modernize, Reimagine, Reach*, at xi-xii (Apr. 2021), https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/Carbon-Neutral-NYC.pdf.

[107] *See* Appendix D-2.

[108] REENERGY HOLDINGS LLC, *Comments of ReEnergy Holdings LC on the White Paper on Clean Energy Standard Procurements to Implement New York's Climate Leadership and Community Protection Act*, at 3, Case No. 15-E-0302 (N.Y. Pub. Serv. Comm'n Aug. 31, 2020), *available at* https://on.ny.gov/2Ll9EPF.

[109] N.Y. PUB. SERV. LAW § 66-p(1)(b).

E. Building, Transportation & Industrial Sector Reforms

Despite recognizing that low- and zero-carbon fuels such as green hydrogen and renewable natural gas (RNG) could play a valuable role in decarbonizing hard-to-electrify sectors such as industry, heavy transportation, and building heating,[110] the Scoping Plan nevertheless advocates for an all-electric building code provision.[111] These positions appear to be contradictory and should be revised to acknowledge that incorporating the use of low- and zero-carbon fuels in these sectors can reduce overall energy system costs while also remaining consistent with the CLCPA targets.

The Scoping Plan also proposes to prohibit the replacement of all gas- and oil-powered appliances in single-family homes as early as 2030, with other classes of buildings following shortly after.[112] However, the Plan does not explain how consumers will be expected to pay for the significant conversion costs of switching to all-electric appliances—which can run into the tens of thousands of dollars for a single home.[113] The financial burden of this proposal is likely to fall heaviest on those with the fewest means of financing this transition.

VI. Essential Quality Contracting Provisions

The specific policies the state adopts for distributing the massive public subsidies and other funds required to construct our new clean energy economy should have two key goals. First, these policies must be crafted to protect these investments on the public's behalf, and to promote successful project delivery. To this end, project owners and developers must be required to utilize properly qualified contractors and craft labor that have the capabilities of delivering high quality, reliable projects in a safe, timely and cost-effective manner. Second, these policies should also be designed to maximize employment and skill training opportunities for New Yorkers which, in turn, will yield enormous economic development benefits for the state.

As discussed below, the quality contracting tools recommended herein serve all of these goals, thus producing multiple advantages for the state and its residents, including high-quality, good-paying jobs critically needed to replace the tens of thousands of jobs that will be lost from the fossil industry. Moreover, as discussed in this section, these tools can be specifically designed to maximize the economic opportunities created by clean energy projects for disadvantaged communities.

A. Project Labor Agreements

Project Labor Agreements (PLAs) are single-site collective bargaining agreements used on large capital projects to guarantee project owners access to reliable supplies of qualified craft labor, establish uniform labor conditions and provide other mechanisms designed to promote successful

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[110] *See* Draft Scoping Plan, *supra* note 1, at 120-21, 145, 178.

[111] *Id.* at 125 ("This draft Scoping Plan recommends adopting all-electric State codes on an accelerated timeframe.").

[112] *Id.* at 129.

[113] *See* Todd Woody, *Climate-Proofing Your Home: How to Electrify*, BLOOMBERG (Jan. 5, 2021 5:00 AM EST), https://www.bloomberg.com/news/articles/2021-01-05/switching-to-electric-home-appliances-for-environmental-and-economic-benefits (describing the significant costs associated with home electrification).

project delivery. Given these benefits, Presidents Biden unequivocally embraced PLAs as a national priority for federal construction programs by issuing Executive Order 14,064, which generally requires use of these PLAs for large-scale, federal construction projects.[114] This is sound public policy. A long, successful track record, bolstered by numerous studies, demonstrates that PLAs effectively advance all core construction goals: quality, schedule, safety and cost-efficiency.[115] These advantages protect the public's investment in massive spending programs, such as those New York is using to fund its clean energy transition.

Moreover, PLAs require project contractors to hire workers through local union hiring halls and referral procedures, which are connected to joint labor-management apprenticeship training programs affiliated with the Pipe Trades and other Building Trades unions. These programs are intensive, well-funded, and state-of-the-art, providing best-in-class training in all construction skills and occupations. Thus, PLAs promote valuable workforce development in the communities surrounding construction projects by providing training opportunities that can directly lead to good-paying, middle-class careers.

The Building Trades have also learned that PLAs can create substantially more benefits for local communities whey they incorporate the use of certain types of "*bridge*," or "*acces*s," programs, most commonly known as "pre-apprenticeship" or "apprenticeship readiness" programs." These initiatives facilitate outreach and recruitment to disadvantaged populations in local communities.

Such efforts have a strong track record of promoting employment and training opportunities for women, minorities, and other economically disadvantaged persons and have done so on capital construction projects worth tens of billions of dollars over the last several decades. Indeed, these apprenticeship readiness and pre-apprenticeship components of PLAs can be specifically designed to connect local communities to jobs created by large construction projects through provisions requiring local hiring and/or targeted hiring of minority, low-income or otherwise disadvantaged workers.

For these reasons, when implemented properly, PLAs are a highly effective tool for lifting individuals out of poverty and equitably distributing the benefits of economic development and construction projects to local communities. By contrast, when a PLA is not used, projects will usually be awarded to the lowest bidder, who will often undertake the project without any assurances regarding training or employment benefits. Therefore, it is critical for the Scoping Plan to embrace PLAs as a highly effective means of distributing the economic benefits that will flow from New York's massive spending on clean energy projects.

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[114] Exec. Order No. 14,064, 87 Fed. Reg. 7,363 (Feb. 9, 2022).

[115] *See e.g., State-Based Policies to Build a Cleaner, Safer, More Equitable Economy: A Policy Toolkit*, BLUE GREEN ALLIANCE, at 6-7 (July 2020), https://www.bluegreenalliance.org/wp-content/uploads/2020/07/StatePolicyToolkit_Report2020_vFINAL.pdf; Lucero E. Herrera et al., *Exploring Targeted Hire: An Assessment of Best Practices in the Construction Industry*, UCLA LABOR CENTER, at 24 (Mar. 2014), https://www.labor.ucla.edu/wp-content/uploads/2018/06/Exploring-Targeted-Hire.pdf ("[A]n extensive body of research has documented the benefits of PLAs, stating that they create efficiencies and coordination to ensure projects are completed on time and on budget.").

B. Responsible Contractor Policies

Another useful tool for promoting successful project delivery and distributing economic benefits to local communities are Responsible Contractor Policies ("RCPs"). These policies establish key performance criteria to ensure public works programs utilize only reputable, qualified construction firms, which have the capabilities and resources needed to successfully perform the project work.

This is achieved by requiring specific, well-defined performance criteria that all contractors and subcontractors on the project must meet. One of the most important qualification standards with respect to economic benefits for local communities are requirements that all construction firms participate in bona fide registered apprenticeship programs as a condition of performing work on the project. Like PLAs, such criteria have repeatedly been upheld by courts as legitimate qualification standards because they represent sensible efforts to ensure quality control over craft labor capabilities. A failure to consider these capabilities during the planning stages can create serious project risks.

RCPs have been incorporated into procurement laws in at least 12 states, as well as numerous local jurisdictions that recognize the value of verifying participation in apprenticeship training programs to ensure a sufficient supply of highly skilled craft labor. In a similar manner to PLAs, these policies also help generate good jobs and valuable training opportunities for local communities because contractors must participate in and invest in such training to work on the project. These programs generally must be registered with the U.S. Department of Labor or a state apprenticeship agency and meet strict rules regarding the recruitment and training of women and minorities.

C. Prevailing Wage Standards

Finally, an additional tool that is a straightforward, yet highly effective, method of ensuring that the economic benefits from an economic development or construction project are equitably distributed to surrounding communities is for the project owner or contracting agency to require the use of a prevailing wage standard ("PWS") on its projects. While the direct effect of these standards in many areas may be the payment of higher wages for workers on the project, those higher wages will also attract higher-skilled workers who will help deliver better-quality projects. These policies also drive greater investments in apprenticeship training, which expands training opportunities for local workers.

Moreover, the economic impact of providing a higher wage to workers will ripple through surrounding communities and lead to increased revenues for small businesses and local governments alike in the project area, as project workers spend a portion of their prevailing wages locally.[116] Extensive research shows that a prevailing wage can result in these economic benefits *without*

[116] *See* Kevin Duncan & Alex Lantsberg, *Building the Golden State: The Economic Impacts of California's Prevailing Wage Policy*, at 13 (Mar. 2015), http://www.faircontracting.org/wp-content/uploads/2018/06/SCP-Building-the-Golden-State-WEB.pdf.

increasing total project costs, because the superior productivity provided by a higher-skilled workforce can offset the cost resulting from the higher wages.[117]

VII. Promoting Jobs & Community Benefits

A consistent theme of the Draft Scoping Plan is that the Council supports efforts to re-train workers who are employed on fossil-fuel projects and to place workers that are displaced from that sector in the jobs created by a clean energy economy.[118] However, the unfortunate reality is that the jobs that have typically been created by renewable generation projects are *not* the good-paying, middle-class jobs the Scoping Plan promises the clean energy transition will create. As recently reported by the New York Times, "the green economy is shaping up to look less like the industrial workplace that lifted workers into the middle class in the 20th century than something more akin to an Amazon warehouse or a fleet of Uber drivers: grueling work schedules, few unions, middling wages and limited benefits."[119]

By contrast, fossil-fuel workers are often unionized and are likely to receive a middle-class wage.[120] There is no "just transition" for workers currently employed in New York's fossil-fuel industry unless there are jobs available to them in the clean energy economy with comparable wages and benefits. Along these lines, it cannot be emphasized enough that the ACSs that are discussed in these comments—namely, hydrogen energy, nuclear energy, and bioenergy—typically require large industrial processes that create *more* and *better* jobs than those created by the leading sources of renewable energy.

To provide just one illustration of this fact, consider that the developers of a 100 MW solar generation project in New York stated in public filings that it expected its solar plant to create only *1 or 2* permanent, on-site operations and maintenance jobs.[121] Public filings similarly reveal that a 122 MW wind generation project in New York is only expected to create 7 permanent, on-site operations and maintenance jobs.[122]

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[117] *See e.g.,* Nooshin Mahalia, *Prevailing wages and government contracting costs*, ECON. POLICY INST. (July 3, 2008), https://www.epi.org/publication/bp215/.

[118] Draft Scoping Plan, *supra* note 1, at 43.

[119] Noam Scheiber, *Building Solar Farms May Not Build the Middle Class*, N.Y. TIMES (July 16, 2021), https://www.nytimes.com/2021/07/16/business/economy/green-energy-jobs-economy.html.

[120] *See* Neel Dhanesha, *Dirty energy pays more than clean energy. That's a problem*, VOX (Feb. 2, 2022 12:50 PM EST), https://www.vox.com/recode/22914487/clean-energy-fossil-fuels-salaries-unions.

[121] Flint Mine Solar, Case No. 18-F-0087, *Exhibit 27 – Socioeconomic Effects*, at 14 (N.Y. Pub. Serv. Comm'n May 22, 2020), *available at* https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7bA6D11D9B-0594-44AD-B579-3EBEEC7BC251%7d (see "Annual Operation – Onsite Labor Impacts" in Table 27-12).

[122] Northland Power, Case No. 16-F-0559, *Exhibit 27 – Socioeconomic Effects*, at 6 (N.Y. Pub. Serv. Comm'n Sep. 18, 2018), *available at* https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7bCB6E4ABD-4FBD-43FE-B0D5-F478133AC30E%7d (see "Annual Operation and Maintenance Impacts – Onsite Labor Impacts" in Table 27-5).

By contrast, a 345 MW advanced nuclear reactor is projected to require about *250* permanent, on-site employees for operations and maintenance.[123] Even when these numbers are adjusted on a per-MW basis, an advanced reactor can be expected to create exponentially more jobs than a similarly sized solar or wind generation plant. Of course, just like wind and solar plants, the power provided by such a nuclear plant also results in zero GHG emissions.

Given that the power produced by these different types of power plants is equally compatible with the CLCPA's emissions-reductions targets, New York should promote the plant that creates more economic benefits for New York residents *at least* as aggressively as the renewable generation plant. Further comparison of the number of jobs created by leading renewables and ACSs can be found in Appendix C to these comments.

As outlined in Section VI, *supra*, the use of quality contracting provisions such as PLAs, RCPs, and PWSs can help ensure that clean energy projects deliver good jobs and training to local communities, which will advance the environmental justice goals of the CLCPA.[124] When those tools are used in connection with the construction of large-scale, ACS projects, the result will be durable power generation facilities that will *both* help New York achieve its climate goals *and* result in high-quality employment opportunities for many state residents.

This is exactly the type of *win-win* result that New York should be looking to achieve through its climate policies, and the Scoping Plan should be revised to reflect the key finding discussed here that ACS projects typically result in more and better employment opportunities for state residents than comparably sized renewable generation projects.

VIII. Conclusion

The Pipe Trades respectfully submit that substantial revisions to the Scoping Plan are required for New York to achieve its climate targets, maintain a continuous supply of reliable, affordable power, and maximize benefits for its residents. While there are certain aspects of the Plan that are commendable, it also needs to be reformed in several ways, as recommended in these comments, in order to effectively serve its key energy, environmental and economic policy goals.
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[123] WY. ADVANCED ENERGY, *An Advanced Nuclear Demonstration Project: Facts and Questions*, at 1-2 (last visited Mar. 30, 2022), https://wyomingadvancedenergy.com/wp-content/uploads/2021/06/2021-96-25-WY-Advanced-Energy-One-Pager.pdf.

[124] *See* N.Y. ENVTL. CONSERV. LAW § 75-0117.

APPENDIX A: PLANNING NEW YORK'S CLEAN ENERGY FUTURE

100% Power Generation from Renewable & Clean Sources by 2040

Clean Energy Jobs Coalition—NY

The Current Plan

Narrow, Unrealistic Focus

While perhaps well intended, the energy plan being advanced in Albany is not feasible. It *relies almost exclusively on wind, solar and water* (hydroelectric) generation capacity.

But these sources—which currently provide *only 30% of our electricity*—are incapable of meeting NY's huge and growing demand for power by 2040.

Hydropower generates 25% of our electricity but is largely maxed out. Wind and solar together provide *only 5%*, even *after* the investment of *billions of dollars in state subsidies* in these sources. Result: *major energy shortfall*.

Major Limits of Wind/Solar Power

Most of the remaining 70% of our power now comes from hundreds of fossil fuel generating units—*all of which will need to be replaced in a relatively short time*.

Sun and wind can be expanded to meet *some* of this need, but even under the most optimistic forecasts, they will be insufficient. In fact, *even if wind and solar output is increased 2000% by 2040—it will still not be enough!*

Also, the *intermittent nature* of these sources—wind doesn't blow, and sun doesn't shine every day—*severely restricts their reliability* to deliver power when needed.

Narrow Focus = Dire Straits

If power demand is allowed to surpass electrical supply, the *results are stark*. For example, due to the flaws in the current energy plan, NY could face *dangerous blackouts as early as 2023—as well as soaring electricity costs.*

These impacts will *hit the elderly, poor, and working families the hardest*. These are NOT the types of results New Yorkers should be getting from billions of dollars in public subsidies. *We deserve better solutions*.

Finally, wind and solar plants may be renewable sources of energy, but they *create relatively few, relatively low-wage jobs*. We think New Yorkers deserve more—a lot more.

A Better Way

"*All the Above*" Strategy"

The better approach is to use *all alternative AND other clean energy sources available* to meet our electricity needs—a much more sensible solution.

Known as an "*All the Above" approach*, this plan offers a commonsense strategy *designed to make sure that power supply meets electrical demand*.

This is achieved by promoting *ALL viable energy sources—not just a few*. So, while the maximum development of wind, solar and water is a priority, *alternative clean sources also must be developed*.

Viability of "Clean" Sources

Alternative clean options include *viable sources* that produce *carbon-free energy*, *e.g.*, bioenergy, nuclear and combustible hydrogen power.

Like the leading renewable options, alternative sources *provide clean energy*, but also result in *substantially greater reliability* because they are not intermittent sources of energy.

This is the *exact strategy the federal government and other states are using,* AND they're investing billions in these clean alternatives to meet power demand.

Diversification = Power & Jobs

Given the major flaws in NY's current energy plan, the state's grid operator, NYSIO, reports that New York *will require more generating capacity from alternative clean sources in 2040 than the current generating capacity of all fossil-based sources*.

So, even if we develop all the sun and wind power possible—we'll still need *to plan, design, permit and build 100s of new alternative generating units* in 18 years. This means we must get started, yesterday.

Bonus: large industrial operations used in alternative clean power create *up to 1000% more jobs* than wind and solar AND these are *high quality jobs*.

Appendix B: 2021 NYISO Report on Power Planning & Forecasting (Excerpts)

On December 2, 2021, the New York Independent System Operator (NYISO) released a report evaluating the current state of New York's electrical grid, which is titled "2021-2030 Comprehensive Reliability Plan."[1] NYISO is one of the state's leading experts on energy systems planning and is responsible for operating New York's electrical grid. As discussed in the main comments, this report concludes that New York will require significant generating capacity from dispatchable, emissions-free resources—over 32 GW—to achieve the CLCPA's emissions reduction targets. This report also includes dire warnings regarding the increasingly imminent reliability challenges New York's electrical grid is facing. These reliability challenges are primarily being driven by the decommissioning of firm, dispatchable power plants and the increased share of power being generated by variable renewables.

Key excerpts from this report are copied below:

- "New York is not immune from…extreme weather, which could lead to greater electrical demand and more forced generator outages than currently accounted for…In consideration of these climate-related risk factors*, the New York grid may cross a 'tipping point' in future years such that the transmission system and resources could not fully serve the demand*." (Page 7)

- "The baseline analysis of normal weather and limited generation outages shows a positive but narrowing transmission security margin across the ten-year period. However, heatwave conditions combined with the impact of additional forced generation outages would result in deficiencies to serve demand in New York city in many of the years. *A heatwave with a statewide average maximum temperature of 95 degrees Fahrenheit (1-in-10-year event, or 90/10) may result in very thin margins in 2023 and significant deficiencies beginning in 2025, while an extreme 98-degree Fahrenheit sustained heatwave (1-in-100-year event) would test the system limits today and exceed grid capabilities beginning in 2023*." (Page 7)

- "*The variability of meteorological conditions that govern the output from wind and solar resources presents a fundamental challenge to relying solely on those resources to meet electricity demand*. Solar resources will have little to no output during the evening and nighttime hours and reduced output due to cloud cover, while wind resources can experience significant and sustained wind lulls. Periods of reduced renewable output will occur for short durations due to cloud cover or changes in wind speed and for prolonged periods across a daily/seasonal cycle. Sufficient resources to address all conditions will be necessary to provided continued reliability." (Page 9)

[1] Available at https://www.nyiso.com/documents/20142/2248481/2021-2030-Comprehensive-Reliability-Plan.pdf.

- "Battery storage resources help to fill voids in renewable resources output, but extended periods rapidly deplete storage capabilities resulting in the need for longer running dispatchable emission-free resources." (Page 10)

- "Significant amounts of dispatchable, emission-free resources are needed to balance renewable intermittency on the system. Resources with this combination of attributes are not commercially available at this time but will be critical to future grid reliability. *By 2040, the amount of necessary dispatchable emission-free resources could be over 32,000 MW, approximately 6,000 MW more than the total fossil-fueled power plants on the New York grid in 2021*." (Page 10)

- "Considering the baseline peak load transmission security margin, many different combinations of generation outages or load increases beyond the current forecast would result in a deficiency within New York City. *For example, any additional load increase, generator outage, or combination more than 394 MW will tip New York City beyond its margin by 2025*." (Page 21)

- "If additional generating units become unavailable or deactivate beyond those units already planned for, New York reliability could be affected." (Page 30)

- "The Climate Change Study noted that *the current system is heavily dependent on existing fossil-fueled resources to maintain reliability* and eliminating those resources from the mix 'will require an unprecedented level of investment in new and replacement infrastructure, and/or the emergence of a zero-carbon fuel source for thermal generating resources.'" (Page 47)

- "While there are hundreds of projects in the NYISO interconnection queue, there are none that would be capable of providing dispatchable emission-free resources that could perform on a multi-day period to maintain bulk power system reliability." (Page 48)

Appendix C: Clean v. Renewable Sources: The Jobs Impact

*Clean Energy Jobs Coalition—NY**

Prepared by the United Association of Plumbers & Pipe Fitters

Project Name	Energy Source (Capacity)	Construction Jobs Created	Operation + Maintenance Jobs ("O+M") Created	Workers/MW Ratio *(Construction only)*	Workers/MW Ratio *(O+M only)*	**Increase % in Construction Jobs v. Wind / Solar	Increase % in O+M Jobs v. Wind / Solar
Flint Mine Solar (NY)	Solar (100 MW)	284 to 362	1 to 2	2.84 to 3.62	0.01 to 0.02	-	-
Bluestone Wind (NY)	Wind (122 MW)	150	7	1.23	0.06	-	-
Modeled 100 MW Small Modular Reactor (SMR)	Nuclear (100 MW)	1,238	374	12.38	3.74	+242% to 336% (solar) +907% (wind)	+18,600% to 37,300% (solar) +6,133% (wind)
TerraPower Natrium reactor (Advanced)	Nuclear (345 MW)	2,000	250	5.80	0.72	+60% to 104% (solar) +372% (wind)	+3,500% to 7,100% (solar) +1,100% (wind)
Plant Vogtle 3 & 4 (Advanced)	Nuclear (2,234 MW)	9,000	800	4.03	0.36	+11.33% to 41.9% (solar) +228% (wind)	+1,700% to 3,500% (solar) +524% (wind)
Altavista Power Station (VA)	Bioenergy (51 MW)	*(Data Unavailable)*	31	*(Data Unavailable)*	0.61	*(Data Unavailable)*	+2,950% to 6,000% (solar) +954% (wind)
Bay Front Power Plant (WI)	Bioenergy (56 MW)	*(Data Unavailable)*	35	*(Data Unavailable)*	0.63	*(Data Unavailable)*	+3,050% to 6,200% (solar) +987% (wind)
ReEnergy Black River (NY)	Bioenergy (60 MW)	178	33	2.97	0.55	Up to +4.6% (solar) +142% (wind)	+2,650% to 5,400% (solar) +862% (wind)

*Clean Energy Jobs Coalition—NY**

Who We Are: The ***Clean Energy Jobs Coalition—NY*** **(CLJC—NY)** brings together union leaders, business owners, sustainability advocates and other concerned New Yorkers for the purpose of offering more sensible planning and policy solutions to our state's mounting energy challenges.

What the Problem? Currently, our state leaders are narrowly focused *solely on wind, solar and water* (hydroelectric) power to de-carbonize our electricity sources, but *these options—as virtually all experts agree—are insufficient to meet our growing clean power needs*. Plus, wind and solar have *severe and inherent reliability limitations,* and there are obstacles to the storage and transportation of the energy they produce.

While we agree that we can *develop ALL the solar and wind possible*—we also KNOW (*and have hard data to prove it*) that the *inadequacy of these sources will lead to serious shortfalls* in power supply, which can result in *soaring electricity bills and widespread outages*. On top of all this, some groups are trying to shut down existing gas power plants and block new ones, a strategy that offers nothing short of disaster because they want to *cut off reliable power supply sources way before new clean sources are in place*.

What We Propose: The sensible solution is to develop an *All the Above energy strategy that embraces renewable sources AND clean, zero-carbon alternative sources, such as hydrogen, nuclear and bioenergy*. This is exactly what the Federal Government is doing under President Biden, who is channeling literally *hundreds of billions of dollars of investment into ALL these sources,* because there is no question that while wind, solar and water sound nice—they cannot realistically meet our vast power needs. And, let's face it, at the end of the day, we always need to keep the lights on.

There is also a *huge bonus in promoting clean, alternative sources: they generate up to 1000% or more jobs than solar and wind,* as this chart documents. Significantly, *THESE are good jobs that can help rebuild New York's middle class* (unlike the relatively low-wage jobs wind and solar create by comparison). So, let's get some better, more sensible solutions on the table and make sure we address our critical energy and economic needs, as well as the real environmental challenges we face.

NOTE: Data sources for this chart are available upon request.

Appendix D-1: Viability of Nuclear Energy as Clean Energy Source

I. OVERVIEW OF FEDERAL SUPPORT FOR NUCLEAR ENERGY

U.S. Department of Energy, Office of Nuclear Energy

- **Advanced Reactors Demonstration Program**
  - Advanced Reactor Demonstration Program (last visited Sept. 13, 2021)
  - In 2020, the Department of Energy launched the Advanced Reactor Demonstration Program (ARDP), which is an initiative to support the speedy development of advanced reactor projects "through cost-shared partnerships" with private U.S. businesses. Congress appropriated $230 million toward the program for FY2020 and $250 million for FY2021. The Department of Energy has requested $370.35 million for the program for FY 2022, which would be a $120 million increase from the prior year. As an example of the kinds of projects performed under the ARDP, in October 2020, the Department of Energy provided $160 million in initial funding to two U.S.-based teams to build two "first-of-a-kind" advanced nuclear reactors that can be operational within seven years.

- **Advanced Small Reactor Research & Development Program**
  - Advanced Small Modular Reactors (SMRs) (last visited Sept. 13, 2021)
  - In 2019, the Department of Energy launched the Advanced Small Reactor (SMR) Research & Development (R&D) program. Congress appropriated $267 million toward the program for FY2020 and $208 million for FY2021. This program follows the SMR Licensing Technical Support (LTS) program, which was initiated in 2012 and ended in 2017, and was established "to work directly with industry, research institutions, the national laboratories, and academia through private/public partnerships to promote the accelerated deployment of more near-term SMRs with improved and advanced safety, operational, and security features." Similarly, the SMR R&D Program "supports research, development, and deployment activities to accelerate the availability of U.S.-based SMR technologies into domestic and international markets."

- **First of a Kind Nuclear Demonstration Readiness Project**
  - Funding Opportunities (last visited Sept. 13, 2021)
  - Funded by the Office of Nuclear Energy, this project provides a funding pathway for advanced reactor projects that could be operational within the 2020s. The funds go towards advanced reactor design or technology that could help expedite the operational status of these reactors. Specifically, funding is directed at "[a]ny new

technology that has the ability to improve operations and extend the life of the existing fleet of domestic reactors; [c]ompletion of certification and licensing activities for advanced reactor designs; [d]esign development, testing, analyses, first-of-a-kind engineering, and efforts leading to design finalization; [d]evelopment of fabrication capabilities, supply chains, procurement tasks, and other efforts that assure the ability to economically manufacture and construct advanced reactors; and, [e]fforts involved in identifying, characterizing, permitting, and licensing sites associated with the proposed advanced reactor projects."

- **Fuel Cycle Research and Development Program**
  - Fuel Cycle Research & Development (last visited Sept. 13, 2021)
  - This program was established "to conduct research and development to help develop sustainable fuel cycles" and "to enable future policymakers to make informed decisions about how best to manage used fuel from nuclear reactors." Ultimately, the goal of this program is "to demonstrate the technologies necessary to allow commercial deployment of solutions for the sustainable management of used nuclear fuel that is safe, economic, secure, and widely acceptable to American society by 2050."

- **Gateway for Accelerated Innovation in Nuclear (GAIN)**
  - Gateway For Accelerated Innovation In Nuclear (GAIN), What is Gain? (last visited: Sept. 13, 2021)
  - Created by the Department of Energy's Office of Nuclear Energy, GAIN allows members of the nuclear community, both private and public sector, to come together to access **"**the technical, regulatory, and financial support necessary to move innovative nuclear energy technologies toward commercialization while ensuring the continued safe, reliable, and economic operation of the existing nuclear fleet." Specifically, GAIN provides access to experimental technology and facilities, modeling and simulation tools, a vast data center, and demonstration facilities. GAIN also provides funding opportunities for various projects, including small business nuclear research, and Advanced Nuclear Technology Development.

- **Nuclear Energy Enabling Technologies Program**
  - Nuclear Energy Enabling Technologies (NEET) (last visited Sept. 13, 2021)
  - This program spearheads research and development projects "to develop innovative and crosscutting nuclear energy technologies to resolve U.S. industry nuclear technology development issues, including through the Crosscutting Technology Development subprogram, which "focuses on innovative research that directly supports and enables the development of new, next generation reactor and fuel cycle technologies."

- **Nuclear Energy University Program**
  - Nuclear Energy University Program (last visited Aug. 13, 2021)
  - The Nuclear Energy University Program (NEUP) program was established in 2009 with the understanding that "investing in the next generation of nuclear energy leaders and advancing university-led nuclear innovation is vital to fulfilling the Office of Nuclear Energy's mission." Specifically, this program integrates universities for research and development projects to create cutting-edge nuclear technologies and attract students to the nuclear energy profession. In FY 2021, $5 million was distributed under this program.

- **Nuclear Energy Undergraduate Scholarships**
  - Funding Opportunities (last visited Sept. 13, 2021)
  - This program works to encourage nuclear science and engineering students to pursue careers in the nuclear field through scholarship opportunities.

- **Nuclear Energy Graduate Fellowship**
  - Funding Opportunities (last visited Sept. 13, 2021)
  - Like the Undergraduate Scholarships program, this program seeks to encourage nuclear science and engineering students at the graduate level to careers in nuclear via fellowship opportunities.

Appendix D-2: Viability of Bioenergy as Clean Energy Source

I. OVERVIEW OF FEDERAL SUPPORT FOR BIOENERGY

U.S. Department of Agriculture, Farm Service Agency

- **Biofuel Infrastructure Partnership**
  - Biofuel Infrastructure Partnership (last visited Sept. 13, 2021)
  - The U.S. Department of Agriculture's Biofuel Infrastructure Partnership (BIP) was launched to support state initiatives to expand biofuel infrastructure, such as building and upgrading biofuel retail facilities and pumps. To date, this program has delivered approximately $1 billion to twenty-one states across the country.

- **Biomass Crop Assistance Program**
  - Biomass Crop Assistance Program (last visited Sept. 13, 2021)
  - The U.S. Department of Agriculture's Biomass Crop Assistance Program offers "financial support to owners and operators of agricultural and non-industrial private forest land who wish to establish, produce, and deliver biomass feedstocks." This program offers assistance in two different ways: matching payments (for the collection, harvesting, storage, and delivery of feedstocks to biomass conversion facilities) as well as establishment and annual payments (maximum of 50 percent reimbursement for the cost to develop a biomass feedstock crop and annual payments for up to 5 years).

U.S. Department of Agriculture, Office of Rural Development

- **Ethanol Infrastructure Grants and Loan Guarantees**
  - Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants (last visited Sept. 13, 2021)
  - The Rural Energy for America Program offers loan guarantees and grants to agricultural producers and small businesses. Funding for renewable energy systems, including ethanol production systems, may be eligible for grants ranging from $2,500 up to $500,000, as well as loan guarantees ranging from $5,000 to $25 million (subject to congressional appropriations) (USDA, 2020c).

- **Rural Energy for American Program, Guaranteed Loans and Grants**
  - Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants (last visited Sept. 13, 2021)
  - Administered by the U.S. Department of Agriculture, the Rural Energy for America Program (REAP) provides guaranteed loan financing and grant funding "to

agricultural producers and rural small businesses for renewable energy systems or to make energy efficiency improvements," including loan and grant funding for biofuel systems.

U.S. Department of Agriculture, U.S. Forest Services

- **The Wood Innovations Grants Program**
  - Wood Innovations Program (last visited Sept. 13, 2021)
  - This program, launched in 2015 by the U.S. Department of Agriculture's U.S. Forest Service, was established to provide funding that "supports traditional wood utilization projects, expands wood energy markets, and promotes using wood as a construction material in commercial buildings." The program seeks to expand the use of renewable energy "by promoting the use of 'wood waste' or 'wood residues' across residential, commercial, and industrial sectors. In 2021, over $1.3 million was awarded to biomass related projects.

U.S. Department of Energy, Office of Nuclear Energy

- **Sustainable Aviation Fuels Grand Challenge**
  - DOE Announces Nearly $65 Million for Biofuels Research to Reduce Airplane and Ship Emissions (last visited Sept. 13, 2021)
  - To assist in the Sustainable Aviation Fuels (SAF) Grand Challenge to decarbonize the aviation sector by 2050, the Department of Energy (DOE) announced in September 2021 that it will fund $64.7 million towards production of low-carbon biofuels. Administered by the DOE's Bioenergy Technologies Office (BETO), 22 projects were selected for funding targeting research, development, and demonstration (RD&D) of biofuels to replace petroleum fuels in heavy-duty transportation, including airplanes and ships.

- **Bioenergy Technologies Office Scale-Up and Conversion Funding**
  - DOE Announces $61.4 Million for Biofuels Research to Reduce Transportation Emissions (last visited Sept. 13, 2021)
  - In April 2021, the BETO announced $61.4 million in funding through its "Scale-Up and Conversion" funding opportunity to develop technologies that produce low-cost, low-carbon biofuels. Projects eligible for funding include "high-impact biotechnology research, development, and demonstration (RD&D) to bolster the body of scientific and engineering knowledge needed to produce low-carbon biofuels at lower cost." Through funding opportunities focused on developing new and more efficient technologies to generate biofuels, such as the Scale-Up and

Conversion funding, the BETO has spearheaded significant cost reduction of the biofuel lifecycle by approximately 45%.

- **Advanced Research Projects Agency-Energy "Energy and Carbon Optimized Synthesis for the Bioeconomy" (ECOSynBio) Program**
    - DOE Invests $35 Million to Dramatically Reduce Carbon Footprint of Biofuel Production (last visited Sept. 13, 2021)
    - This program, administered by the Department of Energy's Advanced Research Projects Agency-Energy, announced $35 million in funding to support fifteen new research projects, led by universities and companies, to develop improvements in biofuel manufacturing that will maximize fuel production while reducing carbon dioxide emissions waste.

U.S. Department of Energy, Loan Programs Office

- **Renewable Energy & Efficient Energy Program**
    - Renewable Energy & Efficient Energy Projects Loan Guarantees (last visited Sept. 13, 2021)
    - This program allocates about $4.5 billion in loan guarantees for renewable energy and energy efficiency initiatives, including initiatives related to biofuel energy. These loans are intended to eliminate gaps in commercial financing for energy projects "that utilize innovating technology to reduce, avoid, or sequester greenhouse gas emissions."

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy

- **State Energy Program**
    - State Energy Program (last visited Sept. 13, 2021)
    - The Department of Energy's State Energy Program (SEP) provides funding and technical assistance to states and territories to "enhance energy security, advance state-led energy initiatives, and increase energy affordability." The program has distributed over $203 million since 2017, including biofuel-related initiatives.

U.S. Environmental Protection Agency

- **Renewable Fuel Standard Program**
    - Overview for Renewable Fuel Standard (last visited Sept. 13, 2021)
    - The RFS program sets requirements for renewable fuel replacement, which includes biomass-based diesel and other biofuels. Volume requirements increase

yearly through 2022. By the end of 2022, 36 billion gallons of renewable fuel must replace petroleum-based transportation fuel, heating oil or jet fuel.

Tax Code

- **Alternative Fuel Vehicle Refueling Property Credit**
  - 26 U.S.C. § 30C
  - The Internal Revenue Service provides a 30% tax credit of up to $30,000 for the cost of installing alternative fuel pumps, including fuel pumps for biodiesel and ethanol.

- **Biodiesel Mixture Tax Credit**
  - 26 U.S.C. § 6426
  - The Biodiesel Tax Credit offers producers of biodiesel a $1 per gallon tax credit for production of pure biodiesel or renewable diesel. The tax credit is available until at least 2022 and has been extended retroactively five times since it was originally enacted in 2004.

- **Biodiesel Income Tax Credit**
  - 26 U.S.C. § 40A
  - Through at least 2022, taxpayers that deliver pure, unblended biodiesel into the tank of a vehicle or as on-road fuel in their trade or business may be eligible for a credit of $1.00 per gallon of biodiesel. The credit goes towards the taxpayer's income tax liability.

Federal Transit Administration

- **Low and Zero Emission Public Transportation Research, Demonstration, and Deployment Funding**
  - 49 U.S.C § 5339(c)
  - Administered by the Federal Transit Administration, this program provides direct financial assistance to local, state, and federal entities, as well as transportation providers and higher education institutions, for RD&D regarding low emission public transportation vehicles, including biodiesel.

Interagency Programs

- **Biomass Research and Development Initiative**
  - 7 U.S.C. § 8108

- A combined effort of the Department of Agriculture's National Institute of Food and Agriculture and the Department of Energy's Office of Biomass Programs provides grant funding for projects addressing research, development, and demonstration of biofuels. The award process focuses on feedstock development, biofuels and bio-based products development, and biofuels development analysis. The grants are specifically provided to institutions such as universities, laboratories, federal agencies, and non-profit organizations.

II. STATE CLEAN AND RENEWABLE ENERGY LAWS RECOGNIZING BIOENERGY

A review of existing renewable and clean energy laws and regulations across the country reveals that, *unlike New York*, the definitions of renewable and/or clean energy sources in the following 39 states include biomass and/or biogas. The dominant approach in these statutes is to expressly list the renewable and/or clean energy sources covered; in a few cases, the statutes or regulations are drafted broadly (e.g., AZ, VT) to simply cover all such sources.

- **Alaska:** ALASKA STAT. § 44.99.115.
- **Arizona:** ARIZ. ADMIN. CODE § 14-2-1801(O).
- **California**: CAL. PUB. RES. CODE § 25741(a).
- **Colorado**: COLO. REV. STAT. § 40-2-124.
- **Connecticut:** CONN. GEN. STAT. ANN. § 16-1.
- **Delaware:** DEL. CODE ANN. tit. 26, § 352.
- **District of Columbia:** D.C. CODE § 34-1431.
- **Florida:** FLA. STAT. § 366.91.
- **Hawaii:** HAWAII REV. STAT. § 269-91.
- **Idaho:** IDAHO CODE § 67-8903.
- **Illinois:** 20 ILL. REV. STAT. 1/10.
- **Indiana:** IND. CODE § 8-1-37-4.
- **Iowa:** IOWA CODE § 476.42.
- **Kansas:** KAN. STAT. ANN. § 66-1257.
- **Maine:** ME. REV. STAT. tit. 35-A, § 3210.
- **Maryland:** MD. CODE ANN. PUB. UTIL. § 7-701.
- **Massachusetts:** MASS. GEN. LAWS ANN. ch. 25A § 11F.
- **Michigan:** MICH. COMP. LAWS § 460.1011.
- **Minnesota:** MINN. STAT. ANN. § 216B.1691.
- **Missouri:** MO. REV. STAT. § 393.1025.
- **Nebraska:** NEB. REV. STAT. § 77-27,235.
- **Nevada:** NEV. REV. STAT. § 704.7811.
- **New Hampshire:** N.H. REV. STAT. ANN. § 362-F:4.
- **New Jersey:** N.J. STAT. ANN. § 48:3-51.
- **New Mexico:** N.M. STAT. ANN. § 62-15-37.
- **North Carolina:** N.C. GEN. STAT. 62-133.8.

- **North Dakota:** N.D. CENT. CODE § 49-02-25.
- **Ohio:** OHIO REV. CODE ANN. § 4928.01.
- **Oklahoma:** OKLA. STAT. tit. 17 § 801.4.
- **Oregon:** OR. REV. STAT. § 469.A.025.
- **Pennsylvania:** 73 PA. CONS. STAT. § 1648.2.
- **Rhode Island:** R.I. GEN. LAWS ANN. § 39-26-5.
- **South Dakota:** S.D. CODIFIED LAWS ANN. § 49-34A-94.
- **Texas:** TEX. UTILITIES CODE ANN. § 39.904.
- **Utah:** UTAH CODE ANN. § 54-17-601.
- **Vermont:** VT. STAT. ANN. tit. 30 § 8002.
- **Virginia:** VA. CODE § 56-576.
- **Washington:** WASH. REV. CODE § 19.285.030.
- **Wisconsin:** WISC. STAT. § 196.37

III. CURRENT STATE SUPPORT FOR BIOENERGY

Alabama:

- ALA. CODE § 2-2-90, 40-18-370 – 40-18-383
    - **Alabama Jobs Act Biofuel Production Tax Credit:** Companies in the production of biofuel are eligible for a tax credit of 3% of the previous year's annual employee wages for up to 10 years. Companies in the production of biofuel may also be eligible for a tax credit of 1.5% of qualified capital investment annually for up to 10 years.

Alaska:

- ALASKA STAT. § 42.45.045
    - **Alaska Renewable Energy Fund (REF):** The Alaska Renewable Energy Fund (REF) provides funding for the development of renewable energy projects, and under state legislation, biomass energy is one of the renewable energy types eligible for funding under this initiative.

Arkansas:

- ARK. CODE ANN. § 15-13-10 – 15-13-102, 15-13-301 – 15-13-306, 19-6-809
    - **Arkansas Alternative Fuels Development Program:** The Arkansas Alternative Fuels Development Program "provides grants to alternative fuel producers, feedstock processors, and alternative fuel distributors. Producers may be eligible to receive $0.20 per gallon of alternative fuels produced, not to exceed $2 million. Feedstock processors may be eligible to receive up to $3 million or 50% of the project cost, whichever is less, for the construction, modification, alteration, or retrofitting of a feedstock processing facility that is located and operated in Arkansas. Alternative fuel distributors may be eligible to receive up to $300,000 or 50% of the project cost, whichever is less, for assisting with the distribution and

storage of alternative fuels or alternative fuel mixtures at distribution facilities that are located and operated in Arkansas. Alternative fuels include biofuel, ethanol, compressed natural gas, or a synthetic transportation fuel."

California:

- CAL. ENERGY COMM'N, GFO-20-608 - Ultra-Low-Carbon Fuel: Commercial-Scale Production Facilities & Blending Infrastructure (last visited Sept. 13, 2021),
    - **Ultra-Low-Carbon Fuel: Commercial-Scale Production Facilities & Blending Infrastructure:** This 2021 program was established to provide up to $8,000,000 to support ultra-low-carbon fuel, specifically funding biomass and biofuel projects.
- CAL. ENERGY COMM'N, State Awards $2 Million to 10 California Native American Tribes for Climate and Clean Energy Projects (last visited Sept. 13, 2021)
    - **Tribal Government Challenge Grant Program:** The California Energy Commission provided funding to Native American Tribes for energy projects in 2021, including three biomass projects totaling $748,000. This included an energy planning project and feasibility study for biomass energy production from tribally owned forests, a feasibility study involving biomass production and energy storage, and a feasibility study for a bioenergy plant bioenergy feasibility tool.

Colorado:

- COLO. OFFICE OF ECON. DEV. & INT'L TRADE, Energy & Natural Resources (last visited Sept. 13, 2021)
    - **Advanced Industries Accelerator Program Grants and Tax Credit:** The state provides grants to businesses implementing projects in "advanced industries," including biofuels. Projects can receive different grant amounts depending on the type of project. Early-Stage Capital and Retention Grant: (up to $250,000); Collaborative Infrastructure Grant (matching fund of 2-to-1 non-State funding to State funding); Advanced Industries Export Grant (up to $15,000 and up to 50% of the approved expenses).

Connecticut:

- CONN. GEN. STAT. ANN. § 32-324g
    - **Biofuels Research Grants:** Grant program to provide funding "to Connecticut institutions of higher education or Connecticut institutions of agricultural research for purposes which may include, but are not limited to (1) research to promote biofuel production from agricultural products, algae and waste grease, and (2) biofuel quality testing."

District of Columbia:

- D.C. CODE §47-1806.12
    - **Alternative Fuel Infrastructure Credit:** Individuals and businesses are eligible for a "credit in the amount of 50% of the equipment and labor costs directly attributable to the purchase and installation of alternative fuel storage and dispensing or charging equipment on a qualified alternative fuel vehicle refueling property or in a qualified private residence."

Florida:

- Farm to Fuel (last visited Sept. 13, 2021)
    - **Farm to Fuel**: This program was established in 2006 under state legislation by the Florida Department of Agriculture and Consumer Services. The goal of the program is "to enhance the market for biomass created from Florida-grown crops, promote production and distribution, and enhance the value of these agricultural products within the state." So far, "FDACS awarded 14 grants, totaling $25 million . . . for research and development of various feedstock for the production of biofuel and for the construction of biodiesel and ethanol plants throughout the state."

Hawaii:

- HAW. ENERGY OFFICE, Hawaii Clean Energy Initiative (last visited Sept. 13, 2021)
    - **Hawaii Clean Energy Initiative**: "The Hawaii Clean Energy Initiative is a partnership between the State of Hawaii and the U.S. Department of Energy that launched in 2008" and was re-committed to in 2014. One of the goals of the initiative is to utilize and develop bioenergy.

- HAW. REV. STAT. ANN. § 235-110.31
    - **Renewable Fuels Production Tax Credit:** Qualifying producers fuels made from renewable feedstocks, such as ethanol, hydrogen, biodiesel, biogas, or wood may claim a tax credit of up to $3,000,000 per year for up to five years.

- HAW. REV. STAT. ANN. § 155-8
    - **Alternative Energy Loan Program**: The state's Department of Agriculture can make loans to farmers "to reduce dependence on fossil fuel by producing renewable energy through sources" including "methane, biodiesel, and ethanol," with funding up to $1,500,000 or 85% of the project cost, whichever is less.

Idaho:

- IDAHO CODE §63-2427A
    - **License Exemptions for Biodiesel Production for Personal Use**: A biodiesel producer that produces up to 5,000 gallons of biodiesel fuel in a calendar year for personal consumption does not need to obtain an Idaho motor fuel distributor's license.

Illinois:

- 30 ILL. COMP. STAT. ANN. 500/45-60
    - **State Vehicle Procurement Preference for Biofuels**: "In awarding contracts requiring the procurement of vehicles, preference may be given to an otherwise qualified bidder or offeror who will fulfill the contract through the use of vehicles powered by ethanol produced from Illinois corn or biodiesel fuels produced from Illinois soybeans."

- 35 ILL. COMP. STAT. ANN. 120/2-10
    - **Biofuels Tax Exemption:** Through December 31, 2023, sales and use taxes do not apply to proceeds from the sale of biodiesel blends containing more than 10% biodiesel or majority blended ethanol fuel.

Indiana:

- INDIANA OFFICE OF ENERGY DEV., OED Grant Programs (last visited Sept. 13, 2021)
    - **Energy Technology & Innovation Grant Program:** This program will award 10 projects to be completed in 2022 up to $50,000 for initiatives designed to reduce energy consumption, increase the use of innovative energy and transportation technologies, bolster preparedness and resiliency across the energy landscape in Indiana. This includes projects related to biogas, biomass, and alternative fuels.

- INDIANA OFFICE OF ENERGY DEV., Rural Energy Innovation Grant (last visited Sept. 13, 2021)
    - **Rural Energy Innovation Grant**: This program provided grants of up to $50,000 total for planning initiatives or infrastructure implementation, including projects related to biogas, biomass, and alternative fuels.

- Greater Indiana, DieselWise Indiana Grant Funding Announced (last visited Sept. 13, 2021)
    - **DieselWise Grant**: Through its DieselWise Grants, the Indiana Department of Environmental Management announced the availability of funding "for projects designed to significantly reduce diesel emissions from nonroad vehicles and equipment across Indiana" including ethanol- and biodiesel-related projects. The total estimated funding was approximately $2,200,000, with awards ranging from $50,000 to $750,000.

- IND. CODE ANN. § 6-2.5-5-51, IC 6-6-2.5-22
    - **Special Fuel Tax Exemption:** The sale of special fuel, including biodiesel and blended biodiesel, is exempt from state gross retail tax.

- IND. CODE ANN. § 6-6-2.5-30.5
    - **Biodiesel Blend Tax Exemption:** Biodiesel blends of at least 20% biodiesel content "used only for a personal, noncommercial use and . . . not for resale" may be exempt from the special fuel tax.

Iowa:

- IOWA ECON. DEV. AUTH., Iowa Energy Center Grant Program (last visited Sept. 13, 2021)
    - **Iowa Energy Center Grant Program**: This program is funded by gas and electric utilities across the state of Iowa and is administered by the Iowa Economic Development Authority. Projects must "provide a benefit to Iowa ratepayers" and must "aid in the implementation of one of the key focus areas of the Iowa Energy Plan," including technology-based energy research and development, energy workforce development, biomass conversion, and alternative fuel vehicles. The total grant amount for 2021 is $4,000,000 and grants can range between $10,000 and $1,000,000.

- IOWA ECON. DEV. AUTH., Energy Infrastructure Revolving Loan Program (last visited Sept. 13, 2021)
    - **Energy Infrastructure Revolving Loan Program**: This program "provides loans [of up to $1,000,000] for projects that include land, buildings, physical plant and equipment, and services directly related to the development of projects used for, or useful for, electricity or gas generation, transmission, storage or distribution," including projects related to biomass and anaerobic digesters.

- IOWA CODE ANN. § 422.11P
    - **Alternative Fuel Production Tax Credit:** A tax credit is available to retail dealers of biodiesel fuel who sell and dispense "qualifying biodiesel blended fuel through a motor fuel pump located at the retail dealer's retail motor fuel site."

- IOWA CODE ANN. § 159A.15
    - **Iowa Renewable Fuels Infrastructure Program**: This cost-share program was established to assist "terminal facilities that [exclusively] store and dispense biodiesel or biodiesel blended fuel." As of 2021, "the program has distributed or obligated more than $38 million to help fund 335 E85 dispensers/blenders, 362 biodiesel dispensers/blenders, 72 E15 projects, and 143 biodiesel terminals in Iowa."

- IOWA CODE ANN. § 159A.15
    - **Biodiesel and Biodiesel Blended Fuel Revolving Fund**: The state Department of Transportation may purchase biodiesel or biodiesel blended fuel for use in department vehicles through this fund. The fund is made up of money received

from credits issued pursuant to the federal Energy Policy Act, money appropriated by the state general assembly, and other sources.

Kansas:

- KAN. STAT. ANN. § 79-32,201
  - **Alternative Fuel Tax Credit**: An income tax credit is available for 40% of the cost of an alternative-fueled motor vehicle or alternative-fuel fueling station. Alternative fuel means fuel produced from a biomass or biogas source.

- KAN. STAT. ANN. § 79-34,171–79-34,176
  - **Kansas Retail Dealer Incentive Fund**: A financial incentive is available to retail dealers who sell and dispense renewable fuels or biodiesel through a motor fuel pump. This incentive is set to last until January 1, 2026.

- KAN. STAT. ANN. § 79-229
  - **Property Tax Exemptions**: Certain property including new or expanded biomass-to-energy plants and biofuel storage and blending equipment are exempt from property taxes for the first 10 years after construction.

- KAN. STAT. ANN. § 79-232
  - **Biomass-to-Energy Plant Financing**: The Kansas Development Finance Authority may issue revenue bonds to finance the construction of a new biomass-to-energy plant or expansion of an existing biomass-to-energy plant.

Kentucky:

- KY. REV. STAT. ANN. § 141.422–141.425
  - **Alternative Fuel Producer Tax Credits**: Biodiesel producers, biodiesel blenders, renewable diesel producers, ethanol producers, and cellulosic ethanol producers are entitled to a nonrefundable income and limited liability entity tax credit.

- KY. REV. STAT. ANN. § 154.20-415
  - **Kentucky New Energy Ventures Fund:** This fund "provides seed stage capital to support the development and commercialization of alternative fuel and renewable energy products, processes, and services in Kentucky [including biodiesel, ethanol, and cellulosic ethanol projects] . . . . KNEV makes grants of $30,000 and investments ranging from $250,000 to $750,000+."

- KY. REV. STAT. ANN. § 154.32
  - **Kentucky Business Investment Program**: Under this program, eligible companies, including those in agribusiness, alternative fuel, energy-efficient alternative fuel, or renewable energy production (which includes biomass), are

eligible for tax credits of up to 100% of corporate income or limited liability entity tax liability and wage assessment incentives.

- KY. REV. STAT. ANN. § 154.31
    - **Kentucky Enterprise Initiative Act Program:** Under this program, eligible companies, including those in agribusiness, alternative fuel, energy-efficient alternative fuel, or renewable energy production (which includes biomass), are eligible for "a refund of Kentucky sales and use tax paid by approved companies for building and construction materials permanently incorporated as an improvement to real property."

- KY. REV. STAT. ANN. § 154.34
    - **Kentucky Reinvestment Act Program**: This program provides tax credits to companies engaged in multiple industries including agribusiness, alternative fuel, gasification, energy-efficient alternative fuels, and renewable energy "on a permanent basis for a reasonable period of time that will be investing in eligible equipment and related costs of at least $2,500,000 for owned facilities and $1,000,000 for leased facilities."

Louisiana:

- LA. STAT. ANN. § 47:6037
    - **Tax Credit for "Green Job Industries":** The state offers a tax credit to companies in "green jobs industries," including the biofuels industry, energy efficiency and renewable energy industries, and energy-efficient building, construction, and retrofit industries. A maximum of $3,600,000 in tax credits can be granted per year.

- LA. STAT. ANN. § 47:6035
    - **Tax Credit for Investments in Qualified Clean-Burning Motor Vehicle Fuel Property**: The state offers an income tax credit to any person or corporation of 30% of the cost of purchasing and/or installing qualified clean-burning motor vehicle fuel property that is "directly related to the delivery of an alternative fuel into the fuel tank of motor vehicles propelled by alternative fuel" including "any nonethanol based advanced biofuel." These tax credits are available through January 1, 2022.

Maine:

- ME. REV. STAT. tit. 24-A, § 2303-B
    - **Clean Fuel Vehicle Insurance Incentive:** Allows insurers to credit or refund "any portion of the premium charges for an insurance policy for a clean fuel vehicle in order to encourage its policyholders to use clean fuel vehicles if insurance

premiums on other vehicles are not increased to fund these credits or refunds." Vehicles that use biodiesel are included.

Massachusetts:

- MASS. EMERGING TECH. DIV., Advanced Biofuels (last visited Sept. 13, 2021)
    - **Clean Energy Biofuels Act:** This law was passed in 2008 to encourage the growth of the state's advanced biofuels industry. Among other things, "this law gives preferential tax treatment to non-corn-based alternatives to ethanol [and] requires biofuel content in all the diesel and home-heating fuel sold in the state[.]"

- MASS. CLEAN ENERGY CENTER, Programs (last visited Sept. 13, 2021)
    - **Incentives for Biomass Heating:** The state's Clean Energy Center has operated incentive programs for both residential and business biomass heating, including providing rebates of up to $12,000 for residential installation of central biomass heating and rebates of up to $500,000 for business installation of biomass heating.

Michigan:

- MICH. COMP. LAWS ANN. § 211.9 (j)
    - **Tax Exemptions:** The state exempts certain agricultural facilities from property taxes, including methane digesters, biomass gasification systems, and machinery used to harvest biomass.

Minnesota:

- MINN. STAT. ANN. § 41A.16 - 41A.19
    - **Agriculture Bioincentive Program:** Minnesota facilities that produce biofuels, renewable chemicals (including "products produced from agricultural biomass, forestry materials, other plant materials including aquatic plants, or the organic portion of solid waste"), or biomass thermal energy starting before June 30, 2025, meet certain production levels, source their biomass from agricultural, forestry, or solid waste sources, and source 80% of their biomass from within Minnesota are eligible for grants for up to ten years. This incentive is available until at least June 30, 2035. Maximum annual grant for biofuel production is $456,000. Maximum annual grant for renewable chemical production is $6,000,000. Maximum annual grant for biomass thermal energy is $150,000.

Mississippi:

- MISS. CODE. ANN. § 57-113-1
    - **Mississippi Clean Energy Initiative**: The state provides tax incentives to companies that manufacture systems used to generate renewable energy, including biomass energy. Qualifying companies are exempt from state income and franchise

taxes for ten years, as well as from sales and use taxes to establish or expand a plant or production facility.

Missouri:

- MONT. CODE ANN. § 135.305
    - **Wood Energy Tax Credit**: The state provides an income tax credit of $5 per ton of processed material to "individuals or businesses processing Missouri forestry industry residues into fuels," up to an aggregate of $6,000,000 per year.

Montana:

- MONT. DEP'T OF ENV'TL QUALITY, Alternative Energy Revolving Loan Program (last visited Sept. 13, 2021)
    - **Alternative Energy Revolving Loan Program**: This program provides low-interest loans to increase use of alternative energy in homes and businesses. The program was launched in 2001, and since then, "the program has provided financing for more than $14.2 million in alternative energy systems," including low-emission wood or biomass systems. The "program is principally funded by air quality penalties collected by [the Montana Department of Environmental Quality]."

Nebraska:

- NEB. REV. STAT. ANN. § 81-12,155.01
    - **Business Innovation Act Bioscience Grants**: The state's Business Innovation Act established the Bioscience Innovation Program to provide financial assistance to "[s]upport the development of bioscience communities and economic opportunity through innovation in biofuels, biosensors, and biotechnology."

Nevada:

- NEV. REV. STAT. §704.7811
    - **Alternative Fuel Vehicle (AFV) and Infrastructure Grants Authorization:** Established Nevada Clean Energy Fund to fund programs, technology, and services that support alternative fuel vehicle deployment. Biofuels are included.

New Mexico:

- N.M. STAT. ANN. § 7-9-98
    - **Biomass Equipment and Production Tax Deduction:** Under this law, "[t]he value of a biomass boiler, gasifier, furnace, turbine-generator, storage facility, feedstock processing or drying equipment, feedstock trailer or interconnection transformer" and of "biomass materials used for processing into biopower, biofuels or biobased products may be deducted in computing the compensating tax due."

- N.M. STAT. ANN. § 7-2-18.26
    - **Agricultural Biomass Income Tax Credit:** Under this law, dairy or feedlot owners may receive a tax credit of $5 "per wet ton of agricultural biomass transported from [their] dairy or feedlot to a facility that uses agricultural biomass to generate electricity or make biocrude or other liquid or gaseous fuel for commercial use."

- N.M. STAT. ANN. § 7-9-79.2
    - **Biodiesel Blending Facility Tax Credit**: A tax credit of up to $50,000 is available for the cost of purchasing and installing equipment used to produce biodiesel blends containing at least 2% biodiesel.

North Carolina:

- N.C. GEN. STAT. § 105-449.88
    - **Biofuels Tax Credit:** Motor fuel excise tax does not apply to biodiesel used by an individual for use in a private passenger vehicle.

North Dakota:

- N.D. CENT. CODE ANN. § 57-38-01.23
    - **Income Tax Credit for Biodiesel Sales and Production Equipment Costs**: Tax credits of up to $50,000 are available to biodiesel sellers for the costs incurred to adapt or add equipment to a facility.

- N.D. CENT. CODE ANN. § 17–03–01
    - **Biofuels Partnership in Assisting Community Expansion Loan Program**: This program "provides interest buydown on loans to biodiesel, ethanol or green diesel production facilities and livestock operations."

- N.D. INDUS. COMM'N, Renewable Energy Program Projects (last visited Sept. 13, 2021)
    - **North Dakota Industrial Commission Renewable Energy Program**: This program provides funding to support research and development projects relating to renewable energy, including biomass and biogas projects.

Ohio:

- OHIO REV. CODE ANN. § 122.075
    - **Alternative Fueling Infrastructure Incentive:** Provides financial assistance to businesses, non-profit organizations, school districts, and local governments for the purchase and installation of alternative fueling, blending, and distribution facilities or terminals.

Oklahoma:

- OKLA. STAT. tit. 68 § 500.4
    - **Biofuels Tax Exemption:** Exempts from state motor fuel excise tax biodiesels or other biofuels produced by an individual from feedstocks grown on the individual's property and used in the individual's own vehicle.

Oregon:

- OR. REV. STAT. ANN. § 285C.350 – 285C.370
    - **Rural Renewable Energy Development Zone Property Tax Exemption**: For three to five years, qualified property that produces, distributes, or stores biofuels is exempt from property taxes.

Pennsylvania:

- 73 PA. STAT. ANN. § 1647.3
    - **Alternative Fuels Incentive Grant**: This program "helps to create new markets for alternative fuels in Pennsylvania which enhances energy security," and "[a]pproximately $5 million in grants is made available annually for school districts, municipal authorities, political subdivisions, nonprofit entities, corporations, limited liability companies or partnerships," for initiatives including grants to support the costs of purchasing biofuel and implementing innovative biofuel technology.

- PENN. DEP'T OF CMTY. & ECON. DEV., Alternative and Clean Energy Program (ACE) (last visited Sept. 13, 2021)
    - **Alternative and Clean Energy Program**: This program "provides financial assistance in the form of grant and loan funds that will be used by eligible applicants for the utilization, development and construction of alternative and clean energy projects in the state." This includes grants of up to $2 million for alternative energy production or clean energy projects, including the installation of biomass energy systems.

Rhode Island:

- R.I. GEN. LAWS ANN. § 31-36-1
    - **Biodiesel Tax Exemption:** Biodiesel is exempt from the $0.30 per gallon state motor fuel tax.

South Carolina:

- S.C. DEP'T OF COMM., Corporate Income Tax & Incentives (last visited Sept. 13, 2021)
    - **Biomass Resources Tax Credit:** The state "allows a company a credit against income taxes or corporate license fees, or both, for 25% of the costs incurred for

the purchase and installation of equipment used to create power, heat, steam, electricity or another form of energy for commercial use from a fuel consisting of 90% or more biomass resource." The credit can reach up to $650,000 per tax year.

- S.C. DEP'T OF COMM., Corporate Income Tax & Incentives (last visited Sept. 13, 2021)
    - **Renewable Fuels Tax Credit**: The state provides tax credits to companies that construct a facility that produces and/or distributes renewable fuels, including biodiesel. The tax credit is "equal to 25% of the cost of purchasing, constructing and installing the property."

South Dakota:

- S.D. CODIFIED LAWS § 10-47B-121.1
    - **Biodiesel Blender Tax Credit**: The state provides a tax credit for license biodiesel blenders, granted on a per gallon basis.

- S.D. CODIFIED LAWS § 10-47B-162
    - **Production Incentive Payments to Ethanol Producers:** The state provides a production incentive payment of 20 cents per gallon to producers of ethanol and biobutanol in state. One facility can receive up to $1 million in incentive payments per year, and the state will pay up to a cumulative $7 million in incentive payments per year. This incentive is available until at least July 1, 2022.

Texas:

- TEX. TAX CODE ANN. §162.204
    - **Diesel Fuel Blend Tax Exemption:** Exempting biodiesel from diesel fuel tax.

Virginia:

- VA. CODE ANN. § 58.1-439.12:02
    - **Biodiesel and Green Diesel Fuels Producers Tax Credit**: The state will provide biodiesel or green diesel fuel producers an income tax credit "equal to $0.01 per gallon of biodiesel or green diesel fuels produced" up to $5,000 per year. The producer is eligible for the credit for the first three years of production.

- VA. CODE ANN § 58.1-439.12:05
    - **Green Job Creation Tax Credit:** For each new "green job" created that pays at least $50,000, including jobs in "biomass and biofuel system[s]" employers are eligible for a $500 tax credit. Employers are eligible for the credit for up to 350 jobs and the credit is available for the first five years that the job is continuously filled.

Washington:

- WASH. REV. CODE § 82.08.0205
    - **Biodiesel Feedstock Tax Exemption:** Exempting from certain taxes the sale of waste vegetable oil used by a person in the production of biodiesel for personal use.

Wisconsin:

- FOCUS ON ENERGY, Renewable Energy Competitive Incentive Program (last visited Sept. 13, 2021)
    - **Renewable Energy Competitive Incentive Program**: Focus on Energy, a statewide program in Wisconsin, runs a grant program that "provides incentives for cost-effective renewable energy systems installed at eligible Wisconsin businesses." Eligible renewable technologies under this project include biomass and biogas, and the total funding available for projects completed prior to December 1, 2023 equals $750,000.

Wyoming:

- WYO. STAT. ANN. § 39-17-305
    - **Alternative Fuel Tax Exemption**: Alternative fuel, including biodiesel and biodiesel blends, for use in motor vehicles and for export from the state by a licensed exporter is exempt from the alternative fuel license tax.

Appendix E: High Costs of Power Outages: Negative Impact on the Economy, Society and Human Health

I. Introduction

It is undisputed that we need to transition to clean energy sources to significantly reduce carbon emissions and combat climate change. The variability of renewable energy sources, however, poses a significant challenge, because, unlike fossil fuels, renewable energy sources cannot ramp up or down (i.e., they cannot be "dispatched") at a moment's notice in response to demand. Implementing current plans without accounting for energy reliability will cause widespread and persistent power disruptions and outages. This risk is compounded by existing fragilities in our power grid, which are the result of aging infrastructure and the increased frequency of extreme weather. In this regard, more extreme weather is already at our doorstep (and could overwhelm New York City's power supply as early as summer 2023) and will only continue to worsen.

The challenge described above necessitates a response from government and industry that is twofold: adapt the power grid for existing and predicted extreme weather conditions and include low-to-zero-carbon energy sources that "fill the gaps" left by variable renewables. A stable power grid is necessary for climate change adaptation and mitigation and should not be overlooked by legislators or regulators when developing their climate change strategies.

II. Analysis

A. The High Cost of Power Outages Cannot Be Overstated.

Power outages have costly financial and public health impacts, ranging from minor disruptions to transportation systems to long-term infrastructure damage and mass casualties.

1. *Power outages are costly to repair and disruptive to our economy.*

- AM. SOC'Y OF CIV. ENGINEERS, *2021 Report Card for America's Infrastructure: Energy* (Dec. 2020), https://infrastructurereportcard.org/wp-content/uploads/2020/12/Energy-2021.pdf [hereinafter *ASCE Report*].

  - ✓ "Costly transmission and distribution problems, such as those from weather-related events and other causes, result in power outages that are estimated to cost U.S. households *$28 to $169 annually*."

  - ✓ The cost of power outages in U.S. data centers "grew from $505,000 in 2010 to $740,000 in 2016, which equates to *$8,851 per minute* the grid is malfunctioning" in an increasingly critical sector on which many industries rely.

- James Barron & Mihir Zaveri, *Power Restored to Manhattan's West Side After Major Blackout*, N.Y. TIMES (July 13, 2019), https://www.nytimes.com/2019/07/13/nyregion/nyc-power-outage.html.

  - ✓ "A power failure plunged a stretch of the West Side of Manhattan into darkness on Saturday night, *trapping people in subway cars and elevators for a time, leaving drivers to fend for*

themselves at intersections with no traffic signals and eerily dimming the lights in a swath of Times Square. Stores emptied out, and . . . [m]ost theaters canceled their performances."

- U.S. DEP'T OF TRANSPORTATION, *Effects of Catastrophic Events on Transportation System Management and Operations: August 2003 Northeast Blackout – New York City* (Apr. 2004), https://rosap.ntl.bts.gov/view/dot/4338.

  - ✓ "*When the blackout rolled through the New York City metropolitan area at 4:11 p.m., the roadway and rail system ground to a halt*. New York City's 11,600 signalized intersections all lost power at the same time.

  - ✓ "*Every one of the 413 train sets . . . operating throughout the New York City subway system lost power, stranding 400,000 customers*. The extensive electrified commuter rail network throughout New York, Northern New Jersey, and Southern Connecticut *ground to a halt*."

  - ✓ *See also* JR Minkel, *The 2003 Northeast Blackout – Five Years Later*, SCIENTIFIC AMERICAN (Aug. 13, 2008), https://www.scientificamerican.com/article/2003-blackout-five-years-later/ (estimating this *blackout resulted in 11 deaths and cost an "estimated $6 billion*").

2. *Power outages worsen public health conditions and create emergencies.*

- Peter Aldhouse, Stephanie M. Lee & Zahra Hirji, *The Texas Winter Storm And Power Outages Killed Hundreds More People Than The State Says*, BUZZFEED NEWS (May 26, 2021, 6:09 PM), https://www.buzzfeednews.com/article/peteraldhous/texas-winter-storm-power-outage-death-toll.

  - ✓ Recent blackouts have had deadly consequences. This report estimates that *at least 700 people lost their lives during the Texas cold snap and blackout* that occurred in 2021.

- Alexia Fernandez Campbell, *It took 11 months to restore power to Puerto Rico after Hurricane Maria. A similar crisis could happen again*, VOX (Aug. 15, 2018), https://www.vox.com/identities/2018/8/15/17692414/puerto-rico-power-electricity-restored-hurricane-maria.

  - ✓ "The *lack of reliable electricity had deadly consequences*. Elderly people were unable to use essential medical equipment, such as respirators . . . others couldn't refrigerate drugs like insulin."

  - ✓ "The lack of electricity and basic public services has *also triggered a suicide crisis on the island* . . . . Researchers believe the lack of electricity was largely responsible for the surge of deaths reported in [Hurricane Maria]'s aftermath."

- Pascal James Imperato, *Public Health Concerns Associated with the New York City Blackout of 1977*, 41 J. OF CMTY. HEALTH 707 (2016), https://link.springer.com/article/10.1007/s10900-016-0206-6.

  - ✓ The 1977 New York City blackout resulted in "*violence, arson, and looting* that occurred in several areas. These acts resulted in *204 civilian injuries, 436 police injuries, 80 firefighter injuries, and 1037 fires*."

- ✓ "The violence, arson, and looting caused *extensive long-term physical and functional damage to* certain areas of . . . Brooklyn and the Bronx."

- Joan A. Casey et al., *Power Outages and Community Health: A Narrative Review*, 7 CURRENT ENVTL. HEALTH REPORTS 371 (2020), https://link.springer.com/article/10.1007/s40572-020-00295-0.

  - ✓ "The existing literature suggests that *power outages have important health consequences ranging from carbon monoxide poisoning, temperature-related illness . . . and mortality to all-cause, cardiovascular, respiratory, and renal disease hospitalizations*, especially for individuals relying on electricity-dependent medical equipment."

B. The Power Outage Forecast is Grim.

Power outages are becoming more frequent and more costly due to aging infrastructure, extreme weather, and the transition to renewables.

1. *Our power grid is already unstable due to age and lack of investment*.

- NPR Fresh Air, *Aging and Unstable, the Nation's Electrical Grid is 'The Weakest Link'*, (Aug. 22, 2016), https://www.npr.org/2016/08/22/490932307/aging-and-unstable-the-nations-electrical-grid-is-the-weakest-link.

  - ✓ "From the 1950s to the '80s, significant power outages averaged fewer than five per year. But that's changed. In 2007, there were 76, in 2011, *more than 300*."

  - ✓ "We're relying on an electrical grid that's *increasingly unstable, underfunded and incapable of taking us to a new energy future*."

  - ✓ Renewable power sources have grown dramatically in recent years, but *our aging electrical grid isn't capable of integrating them into our energy use*, so much potential power is wasted."

- "The majority of the nation's grid is aging, with some components *over a century old* — far past their 50-year life expectancy — and others, including 70% of T&D [Transmission and Distribution] lines, are well into the second half of their lifespans." ASCE Report.

  - ✓ "The distribution system accounts for 92% of all electric service interruptions, a result of *aging infrastructure, severe weather events, and vandalism*."

  - ✓ "All three major components of the electric grid (generation, transmission, and distribution) have an *investment gap*. To meet the latest state-driven Renewable Portfolio Standards in generation infrastructure, the gap is projected to grow to a cumulative *$197 billion* by 2029."

2. *Regulators are warning that our power grid system is not prepared for record heat in Summer 2022, or extreme weather events in the future.*

- N. AM. ELEC. RELIABILITY CO., *2022 Summer Reliability Assessment* (May 2022), https://www.nerc.com [hereinafter *NERC Reliability Assessment*].

- ✓ Midcontinent Independent System Operator (MISO), which operates the power grid for 15 U.S. states, "*faces a capacity shortfall in its North and Central Areas, resulting in high risk of energy emergencies during peak summer [2022] conditions*." The risk in Western and Southwestern states is also elevated, with potential for insufficient operating reserves in above-normal conditions.

- ✓ "*Extreme drought across much of Texas* can produce weather conditions that are favorable to prolonged, wide-area heat events and extreme peak electricity demand."

- ✓ "Government agencies warn of the potential for *above-normal wildfire risk* beginning in June [2022] across much of Canada, in the U.S. South Central states, and Northern California . . . posing [bulk power system] reliability risks."

    - "The interconnected transmission system can be impacted in areas where wildfires are active *as well as areas where there is heightened risk of wildfire ignition* due to dry weather and ground conditions."

- U.S. GOV'T ACCOUNTABILITY OFF., GAO-21-346, ELECTRICITY GRID RESILIENCE: CLIMATE CHANGE IS EXPECTED TO HAVE FAR-REACHING EFFECTS AND DOE AND FERC SHOULD TAKE ACTIONS (2021) [hereinafter *GAO Report*].

    - ✓ Warmer temperatures and heat waves can reduce transmission capacity of power lines.

- Dharna Noor, *New York Faces Blackouts as Extreme Heat Strains the Grid*, GIZMODO (June 30, 2021 4:41 PM), https://gizmodo.com/new-york-faces-blackouts-as-extreme-heat-strains-the-gr-1847206009.

    - ✓ "The New York grid's incapability to withstand the current heat wave is the latest sign that the *city's energy system is in rough shape*."

- These extreme weather events will only continue to get worse, increasing the need for a more stable power grid. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Assessment Report 6 Climate Change 2022: Impacts, Adaptation and Vulnerability* (Feb. 2022), https://www.ipcc.ch/report/ar6 [hereinafter *IPCC AR6*].

    - ✓ Extreme weather will occur even if the planet stops warming by 1.5° Celsius (3.3° Fahrenheit) above pre-industrial levels—the goal of the Paris Agreement—and necessitates adaptation to forecasted changes including: increased frequency of extreme heat and cold, droughts, wildfires, flooding, and more.

3. *This instability is exacerbated by a rapid transition to renewables*.

- Alex Trembath & Zeke Hausfather, *California Reveals That the Transition to Renewable Energy Isn't So Simple*, SLATE (Aug. 19, 2020, 4:52 PM), https://slate.com/technology/2020/08/california-blackouts-wind-solar-renewable-energy-grid.html.

    - ✓ In California, "a combination of heavy air conditioning usage, the unplanned unavailability

of some power plants, limited options for importing power from neighboring states, and *insufficient solar and wind generation* have led to an imbalance of electricity generation and consumption."

- "Unexpected tripping of solar PV resources during grid disturbances continues to be a reliability concern." NERC Reliability Assessment.

  - ✓ "In May and June 2021, the Texas Interconnection experienced widespread solar PV loss. . . . Similarly, four additional solar PV loss events occurred between June and August 2021 in California . . . *system operators in areas with significant amounts of solar PV resources should be aware of the potential for resource loss events during grid disturbances*."

- Coal-fired generator owners are having difficulty obtaining fuel and non-fuel consumables as supply chains are stressed by mine closures, rail shipping limitations, and increased coal exports, creating further power grid instability risks in Summer 2022. NERC Reliability Assessment.

  - ✓ Renewables are also vulnerable to extreme weather in unique ways. "*Drought conditions* create heightened reliability risk for the summer . . . . Energy output from hydro generators throughout most of the Western United States is being affected by widespread drought and below-normal snowpack."

  - ✓ "*[S]moke from wildfires can cause diminished output from solar PV resources*, and electricity supply will be affected by lower output from BPS-connected solar PV resources."

C. Recommendations for a Stronger, More Resilient Power Grid.

Regional, state, and local governments must simultaneously adapt their power grid for forecasted extreme weather events and the integration of renewable energy sources, and increase reliance on dispatchable, low-to-zero-carbon energy.

1. *States must adapt existing power grid infrastructure for extreme weather.*

- The ASCE recommends the government, "[d]evelop a national hardening plan that considers *investment in production/generation and delivery (T&D, pipelines)* to enable rapid restoration of energy systems after natural and/or manmade disasters." ASCE Report.

- The DOE and FERC must develop a *department-wide strategy to enhance grid resilience*. GAO Report.

2. *Dispatchable, low-to-zero carbon energy sources are needed to build a reliable power grid.*

- "Within energy system transitions, the most feasible adaptation options support infrastructure resilience, *reliable power systems* and efficient water use for existing and new energy generation systems." IPCC AR6.

- "Consolidate federal, state, and local environmental reviews and permitting processes so new *T&D and pipelines can be funded, create jobs earlier, and modernize energy infrastructure faster* — while ensuring environmental and community impacts are fully vetted and considered." ASCE Report.

- David Roberts, *The missing puzzle piece for getting to 100% clean power*, Vox (Mar. 28, 2020, 10:00 AM), https://www.vox.com/energy-and-environment/2020/3/28/21195056/renewable-energy-100-percent-clean-electricity-power-to-gas-methane.

  - ✓ "Renewable energy needs *dispatchable generation and long-term storage*. The core issue is variability. Whereas fossil fuel power plants can be turned up or down to meet demand, the big sources of renewable energy–sun, wind, and water–cannot."

  - ✓ Renewable energy itself can be used to help "fill the gaps" by using these resources to produce dispatchable generation and long-term storage, such as natural gas or hydrogen produced by renewable sources or nuclear power generators, which can then sit idle and be used at a moment's notice. This is referred to as "power-to-gas" or "P2G."

- Wärtsilä, *Path to 100% Renewables for California* (Mar. 28, 2020), https://www.pathto100.org.

  - ✓ Outlines the *"optimal path"* for California's energy transition:

    - First, build out solar, wind, and battery storage, and post-2030 rely more heavily on thermal plants.

    - All while retiring existing natural gas plats more slowly, keeping the more flexible ones open, *and building out a lot of small, fast natural gas power plants*. These plants will convert synthetic methane when it is available from 2030 forward.

    - This allows the state to reach full carbon neutrality by 2045. This path is *both cheaper and reduces more carbon emissions along the way* (compared to the state's current plan), with the *increased benefit of a more stable power grid*.

III. Conclusion

It is clear that our nation's electrical grids are not prepared for the coming storm of aging infrastructure, more frequent extreme weather events, and the rapid transition from dispatchable fossil fuels to intermittent renewable energy sources. To avoid costly and deadly power disruptions and outages, local, state, and federal legislatures and regulatory bodies must prioritize adaptation of our power grid infrastructure and, critically, the integration of low-to-zero carbon dispatchable energy sources such as P2G or green hydrogen to supplement the supply provided by variable renewables.

Appendix F: Construction Industry Labor Shortages: Challenges & Solutions

I. INTRODUCTION

Construction is a highly skilled, highly labor-intensive industry that requires the systematic recruitment, high skills training, and the deployment of multiple trades, and often hundreds of workers, for a single project. Craft labor is also one of the largest components of total project cost. For these reasons, craft labor supply, in terms of quantity and/or quality, has a major impact on every important aspect of project delivery: cost, schedule, quality and safety. Simply stated, this factor can effectively make or break a project; it therefore requires careful attention in capital construction planning.

Yet the role of craft labor is often overlooked in the planning process, overshadowed by other factors such as delivery methods, design specifications and contractor selection procedures. While these issues are of course crucial—craft labor is equally important. This is also becoming an increasingly critical concern since the industry is facing massive skill shortages—a shortfall of up to one million workers, as discussed below. At the micro-level, this is a pressing issue for any project owner or developer. As demonstrated below, craft shortages, particularly in the open shop sector, present immense risks, including crippling project delays, huge cost overruns and increased safety incidents. If companies cannot build new facilities in time to meet expanding needs, this is obviously not good for business.

The consequences of skill shortages on the macro-level are even more alarming. Consider the fact that a capable, efficient construction industry is essential to virtually every key goal of federal, state and local government, including infrastructure, economic development and broadscale efforts to transform the energy sector to new clean sources. This report summarizes comprehensive data on construction industry skill shortages, serious adverse effects resulting from these problems, and emerging solutions that can be used to address these critical challenges.

II. EXECUTIVE SUMMARY

The challenge of ensuring that sufficient craft labor will be available for a given project is difficult under any circumstance. However, the industry currently faces unique, pressing conditions due to the following three trends:

1) An *expanding construction industry*—driven by vast infrastructure needs, a backlog of work from the COVID-19 pandemic and more recent expansion in several high-growth industries, including energy, information technology and healthcare;
2) A *steep decline in labor supply*—caused by the mass retirement of the industry's most experienced and skilled workers and exacerbated by a decreasing number of young workers/new entrants in the field; and
3) A general, *steady drop off over the past several decades of effective skill training programs* throughout most of the industry.

The convergence of these factors, creating what some have called a *Perfect Storm* in the construction industry, represents a growing risk for project owners that there will be insufficient manpower to staff future projects. For several decades, natural market forces have not fixed the problem; nor have government-supported training programs or voluntary contractor initiatives.

Moreover, new construction workers cannot be trained and deployed with the "*flip of a switch*" since it typically takes three to five years to properly train craft persons in the skilled trades. Simply hiring

unemployed workers without the required knowledge, skills or training will not solve the problem. Increasing wages, which will drive up construction costs, may help in recruiting new workers but will not address the need for the type of large-scale, systematic training needed in the industry.

Without an effective response to these challenges, project owners will continue to face a heightened risk of exposure in project planning and greater uncertainty when seeking assurances from contractors on the availability and reliability of their craft labor resources. Moreover, project planning will not only be restrained, but project owners will pay more for craft labor as demand continues to outpace supply. They will also be facing conditions where they will be paying more but getting less in terms of quality, productivity, safety and other key delivery factors. Such conditions also force owners to cancel or significantly delay projects, no matter how critical. In fact, as shown below, these trends are already in play.

Fortunately, however, these critical challenges are also driving new and innovative solutions. Significantly, the project owner community is no longer waiting for the market to solve the problem and are no longer viewing skills shortages as simply a "*contractor*" problem. Instead, they are taking steps to exercise more *direct owner control over craft labor supply to protect investments and minimize risk*. The most vital strategy emerging to address this crisis is the use of policies by project owners, public and private, to *establish new bidding specifications that require contractors to participate in reliable, effective craft training as a condition of performing work*. Experts agree. *Project owners alone have the power to drive critical change needed in the industry*. It is also very much in their interests to do so. As mounting evidence shows, new owner-driven strategies provide the most effective solution to craft labor shortages.

III. CONSTRUCTION LABOR SKILL SHORTAGES

A. MAJOR TRENDS & DRIVING FORCES

For years, numerous studies have documented a veritable skills crisis that has been developing in construction over the past few decades, spurred by changing demographics, expanding industry demand and a general decline in the level of craft training provided in the industry. For example, a 1997 survey of the Business Roundtable found that 60% of its members reported skilled shortages on construction projects and conditions that caused serious turmoil for construction planning and project delivery. This shortage only worsened after the Great Recession, as many skilled workers never returned to the industry after its recovery.[1] Additionally, as the Baby Boomer generation continues to age and drive mass retirement, fewer young people are entering the construction industry due to a long trending decrease in vocational training and a host of other reasons.[2]

A steady stream of subsequent reports shows that craft labor shortages have persisted and progressively worsened over the past two decades and will continue unless major changes are implemented.[3] Not surprisingly, top industry experts have repeatedly identified industry-wide shortages

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[1] *See* Barry E. Stern, *Addressing the Workforce Skills Gap in Construction and CRE-related Trades*, NAIOP Research Foundation, (July 2019), https://www.naiop.org/-/media/Research/Research/Research-Reports/Addressing-the-Workforce-Skills-Gap-in-Construction-and-CRE-related-Trades/Addressing-the-Workforce-Gap-Report.ashx.

[2] *See* Keith Maciejewski, *The Skilled Labor Shortage: Implications for Construction Businesses*, Construction Executive, (May 13, 2020), https://www.constructionexec.com/article/the-skilled-labor-shortage-implications-for-construction-businesses,

[3] *See, e.g., Confronting the Skilled Construction Work Force Shortage,* Business Roundtable, Construction Cost Effectiveness Task Force (1997); Cihan Bilginsoy, *Apprenticeship Training in the U.S. Construction Industry*, University of Utah (Sept. 1998); *Key Workforce Challenges Facing the American Construction Industry: An Interim Assessment*, Center for Construction Industry Studies (Mar. 1999); *Craft Labor Shortage Provokes More Studies of Pay and Safety*, Engineering News Record (Aug. 20, 2001);

as one, if not *the* leading structural problem in the industry for purposes of both short and long-range project planning.[4] Three critical factors are driving this crisis:

Factor #1—Major Future Demand: While the industry experienced downturns caused by the Great Recession and COVID-19, strong construction demand is expected to return over the next few years.

In 2019, *U.S. construction set a new record as it totaled $1.31 trillion*, outstripping its pre-recession peak.[5] While the industry incurred a downturn in 2020 due to COVID-19, industry analysts are projecting a "construction starts to rebound in 2021 and 2022."[6] For example, focusing *solely on non-residential construction*, another study reports that: "U.S. total construction starts are forecast to be *up 4% in 2021*, moving from $778 billion to $810 billion, before *climbing another 8% in 2022 to $877 billion* and surpassing even the 10-year high point of $856 billion in 2019."[7] Further, according to Dodge Data & Analytics, a leader in construction forecasting, trends are moving upward:

Confronting the Skilled Workforce Shortage (WP-401), Construction Users Roundtable (2004); *The Perfect Storm: Factors Come Together Creating a Storm in the Construction Workforce*, The Construction Executive (June 2004); *America's Construction Industry: Identifying and Addressing Workforce Challenges*, ETA/ Business Relations Group Report (Dec. 2004); *Craft Labor Supply Outlook: 2005-2015,* Construction Labor Research Council (2004); *A Workforce Needs Assessment of the Arizona Construction Trades Industry*, Arizona Department of Commerce (Feb. 2005); *The 2005-2006 U.S. Markets Construction Overview*, FMI Management Consulting (2005); *Workforce Development Committee*, The Voice, Construction Users Roundtable (Summer 2006); *Solving the Construction Industry Workforce Crisis – Ideas for Action*, McGraw Hill/ENR (2007); Paul Turenne, *In Demand: Emerging Solutions for the Workforce Crisis*, The Voice, Construction Users Roundtable (Spring 2007); *The Construction Chart Book*, CPWR—The Center for Construction Research and Training (2008); *Maryland's Construction Industry Workforce Report*, Governor's Workforce Investment Board (Sept. 2009); *Projected Demand for Craft Labor for the Southeast United States (2012-2017)*, Construction Labor Market Analyzer and Southeast Manpower Tripartite Alliance (2012); *Is Your Workforce Ready for the Rebound*, The Voice, Construction Users Roundtable (Summer 2013); Alexandra Walld, *Who is the Future Face of Our Industry?*, The Voice, Construction Users Roundtable (Fall 2014); Amy Saxton, *It's Time for a Culture Change in the Construction Industry*, The Cornerstone, NCCER (May 22, 2015); *An Owner's Toolbox: Improve Project Outcome With the Help of CURT*, The Voice, Construction Users Roundtable (Fall 2015); Patrick Clark, *Millennials: Builders Are Desperate to Hire You*, Bloomberg BNA Construction Labor Report, 61 CLR 1062 (Dec. 17, 2015); A. *Well-Played: CURT's Playbook for Improving Construction Productivity*, The Voice, Construction Users Roundtable (Winter 2016); Emily Peiffer, *Construction Loses 15K Jobs as Labor Shortage Begins to 'Undermine' Industry's Growth*, Construction Dive (June 3, 2016); *Craft Labor Shortage Seriously Affecting Mega Projects: Poll*, Reuters (Jun. 29, 2017), *Eighty Percent of Contractors Report Difficulty Finding Qualified Craft Workers to Hire*, Associated General Contractors of America – News, (2019); https://www.constructionexec.com/article/the-skilled-labor-shortage-implications-for-construction-businesses; Thaddeus Swanek, *New Report Finds Construction Contractors Struggling to Find Workers, Building Materials, U.S. Chamber of Commerce* (June 16, 2021); *Construction Employment Declines By 7,000 In June as Nonresidential Firms Struggle To Find Workers And Materials To Complete Projects*, AGC of America (July 2, 2021).

[4] *See 2013 U.S. Markets Construction Overview*, FMI Corporation (2012); *2013 Dodge Construction Outlook*, McGraw-Hill Construction Research & Analytics Group (Oct. 2012); *Skilled Labor Shortage Risk Mitigation (WP-1101)*, Construction Users Roundtable (2015); Jerome R. Stockfisch, Construction Projects Suffer from a Shortage of Skilled Trades, Tampa Bay Times (Feb. 8, 2016), http://www.tbo.com/news/business/construction-projects-suffer-from-a-shortage-of-skilled-trades-20160207/; Alexia Elejalde-Ruiz, *Construction Contractors Warn of a Labor Shortage as Building Booms*, Chicago Tribune (May 31, 2016), http://www.chicagotribune.com/business/ct-construction-labor-shortage-0531-biz-20160531-story.html; Hallie Busta, *Labor Shortages Expected to Delay Hurricane Matthew Repairs, Renovations*, Construction Dive (Oct. 17, 2016), http://www.constructiondive.com/news/labor-shortages-expected-to-delay-hurricane-matthew-repairs-renovations/428378/.

[5] *Raynor de Best, Value of Total New Construction Put in Place in the U.S. 1964-2020, Statisa (May 21, 2021)* https://www.statista.com/statistics/184341/total-value-of-new-construction-put-in-place-in-the-us

[6] Id.

Becky Schultz, For Construction Pros. Com, *Even Modest Infrastructure Investment Could Send Commercial Construction Outlook Soar,* (June 7, 2021), https://www.forconstructionpros.com/business/article/21485614/even-modest-infrastructure-investment-could-send-commercial-construction-outlook-soaring.

[7] *Id*.

> [I]nstitutional planning remains at levels not seen since 2009. On a year-over-year basis, both commercial and institutional planning were up from May 2020 (38% and 47% respectively). The Momentum Index overall was also 41% higher than in May 2020. A total of 21 projects with a value of $100 million or more entered planning [in May 2021] . . . . The rising trend in planning activity is a good sign that the economic recovery is starting to spread into the construction sector. However . . . [r]ising material prices and a continued shortage of skilled labor have led to project delays. On the upside, construction starts are shaping up for a healthy increase in 2022.

It is significant, however, that this report and other forecasts pointedly stress that positive growth trends may be restrained due to continuing labor shortages, which are further discussed below.[8]

Moreover, these projections do *not* fully incorporate massive new public infrastructure plans. Thus, if any significant portion of President Biden's recent $2 trillion infrastructure proposal wins Congressional approval, it could have a huge impact on future construction markets.[9] Such efforts are driven by decades of neglect that inevitably must be addressed. In this regard, the American Society of Civil Engineers ("ASCE") estimates that without new funding efforts, the US will experience *a $2.59 trillion shortfall in needed infrastructure spending over the next 10 years.*[10]

In addition, it must be recognized that, as population grows, the construction industry must likewise expand to accommodate new demands in various markets, including housing, education and healthcare. The U.S. population, approximately 331 million in 2021, is expected to grow by approximately 3 million per year and reach nearly 360 million by 2030 (and possibly larger if current immigration restrictions are reduced). And, while the strength of the construction sector depends on the strength of the overall economy, prospects for this are encouraging. As one major report notes: "[a]fter a year-plus of devastating shocks and setbacks, the US economy is poised to boom—in fact, GDP will surpass the level we expected before the pandemic."[11]

For purposes of ascertaining a macro-level forecast for future U.S. construction spending, the factors and data referenced above demonstrate that fairly steady growth can be expected in construction demand over the next decade. Specifically, this could result in approximately 10 to 20 trillion dollars in new construction investment by 2030.[12] The key question, however, remains: how will the industry obtain the skilled labor needed to meet this demand? On this issue, it must also be recognized that—given the high skill nature of construction occupations which usually require 3 to 5 years of intensive training—these jobs cannot be filled by simply hiring workers *off-the-street*.

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[8] Dodge Data & Analytics, Bluebook Network (June 7, 2021), http://www.construction.com/news/Dodge-momentum-index-jumps-in-may-2021.

[9] Jim Tankersley, New York Times, *Biden Details $2 Trillion Plan to Rebuild Infrastructure and Reshape the Economy* (July 15, 2021).

[10] *ASCE, 2021 Report Card for America's Infrastructure*. https://infrastructurereportcard.org/resources/investment-gap-2020-2029/.

[11] United States Economic Forecast, 2nd Quarter 2021.

[12] *See* GCB Global, Oxford Economics, *A Global Forecast for the Construction Industry* (2015), projecting $2 trillion per year reach a total of $30 billion in total U.S. construction by 2030. *Compare* $1.31 trillion total construction spending in 2019; see fn. 5 *infr*a.

Factor #2—Fast Shrinking Supply: As is noted above, while the economy is showing signs of gradual growth and recovery, industry experts are warning that construction skill shortages threaten to limit broader growth and continue to limit the industry's ability to fully revive itself. Consider these key facts:

- With the U.S. facing a housing shortage, the *residential* sector alone could need up to 1 million more workers in the next two years, according to the Home Builders Association.[13]

- Commercial and industrial markets face similar challenges. For example, prior to the pandemic, the Construction Labor Market Analyzer (CLMA) forecasted a *nationwide labor shortage of as many as 1.1 million "nonresidential" construction workers by 2020*.[14] These problems persist.

- In a June 2021 report, the U.S. Chamber of Commerce Report highlighted these challenges: "In the midst of a deepening workforce crisis, finding skilled labor continues to be a challenge for contractors." In this regard, it stressed that in a 2021 survey, *88% of contractors report "moderate-to-high levels of difficulty finding skilled workers*."[15]

- Moreover, *construction is not the only industry facing labor shortages*, which means it will be competing against other major sectors in recruiting new workers. As one report notes: "[b]usinesses nearly everywhere in America say they're desperate for workers . . . latest statistical evidence is the Labor Department's Jobs report . . . [finding a record 9.3 million job openings in April [2021]."[16]

The indisputable reality is that the U.S. construction industry is facing one of the starkest and most imbalanced labor markets in history. This presents a critical challenge for several reasons, not the least of which is the fact that a strong construction sector is essential for growing the overall economy. Several factors are driving this crisis.

- Large portions of the workforce are aging, while at the same time labor supply has been gradually shrinking as fewer young workers are seeking to enter construction.[17]

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[13] Vanessa Yurkevich, *CNN Business America Desperately Needs 1 Million More Construction Workers* (July 11, 2021; https://www.cnn.com/2021/07/08/economy/construction-worker-shortage/index.html; Press Release, *Unfilled Construction Jobs at Post-Recession High*, Nat'l Association of Home Builders (June 13, 2019)(forecasting shortfall of 400, 000 to 1,000,000 residential construction workers) http://nahbnow.com/2019/06/unfilled-construction-jobs-at-post-recession-high.

[14] Daniel Groves, *Impact of Project Demand on Wages, Per Diem and Craft Availability*, Construction Labor Market Analyzer (Feb. 17, 2016) at 15, http://www.houbrt.com/2005/documents/CLMAPresentation2016Feb17.pdf. Note: CLMA is an analysis tool developed in alliance with the Workforce Development Committee of CURT. Is projections are based on extensive research and analysis of key market factors affecting labor supply and demand. http://www.myclma.com/clma-tools-services/faqs/

[15] Thaddeus Swanek, *Senior Writer and Editor, Strategic Communications,* U.S. Chamber of Commerce, *New Report Finds Construction Contractors Struggling to Find Workers, Building Materials* (June 16, 2021) (emphasis added).https://www.uschamber.com/series/above-the-fold/new-report-finds-construction-contractors-struggling-find-workers-building

[16] Editorial Board, Wall Street Journal, *The Great American Labor Shortage* (June 8, 2021) https://www.wsj.com/articles/the-great-american-labor-shortage-11623191784.

[17] Reuters Events, Downstream, *Craft Labor Shortage Seriously Affecting Mega Projects: Poll*, Reuters (2017), https://www.reutersevents.com/downstream/workforce-development/craft-labor-shortage-seriously-affecting-mega-projects-poll.

- Specifically, the aging of the Baby Boomer generation is resulting in mass retirement of the most skilled and experienced workers in the industry. This exodus has already been underway for several years.[18]

- In addition, the Great Recession pushed more workers out of the construction industry. Thus, from 2007 to 2013, the industry lost more than 2 million workers, shrinking the construction labor pool by nearly 20 percent.[19]

As critical markets recover and expand, including those for infrastructure, energy, health care and information technology, this alarming shortfall is likely to substantially expand without major changes in the industry. The skills crisis has been decades in the making and has not and will not be corrected by natural market forces; for example, efforts by contractors to increase wages and benefits have been insufficient to reverse these trends. As explained below, the negative impact has been further exacerbated by a general decline in training across a large part of the industry.

Factor #3: Decline in Training & Productivity: Over the past several decades there has been a steady, consistent decline in skill training throughout most of the construction industry that seriously compounds the industry's other significant challenges. Evidence of this factor has been mounting:

- A critical study from the National Institute of Standards and Technology (NIST) found a steep and steady decline in craft training throughout most of the construction industry.[20]

- A primary reason for this is the general lack of effective craft training provided in the open shop sector.[21] This sector has simply been unable to develop broad-scale craft training systems that can reliably produce an adequate supply of properly skilled workers.[22]

- The NIST study also reveals that productivity in construction ranks among the lowest, and possibly the lowest, of all non-farm industries. Specifically, examining construction skill shortages, NIST found that over the past 40 years, labor productivity in construction has trended *downward* at an average annual rate of *-0.6%*.[23]

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[18] Id.

[19]Kermit Baker, *Construction Spending Projected for Moderate Growth*, AIA Architect (Jan. 29, 2016), http://www.aia.org/practicing/AIAB107986 (*citing* statistics from the U.S. Census Bureau's American Community Survey). This finding is bolstered by similar reports. *See also*, Hubert Janicki & Erika McEntarfer, *Where Did All the Construction Workers Go?*, Research Matters, U.S. Census Bureau (Oct. 16, 2015).

[20] *See* Allison L. Huang, et al., *Metrics and Tools for Measuring Construction Productivity: Technical and Empirical Considerations*, U.S. Department of Commerce, National Institute of Standards and Technology, Office of Applied Economics (Sept. 2009) [hereinafter NIST report] at 23, http://www.nist.gov/customcf/get_pdf.cfm?pub_id=903603.

[21] *Id.* at 23. The study notes that *prior to* the last several decades, training had been provided comprehensively throughout the industry, most typically through labor-management training programs administered jointly by contractors and building trade unions under collective bargaining agreements, which has continued in the union sector. *Id.* It further notes that, "[w]hile open shop training programs exist, they tend to be rare." *Id*. at 23. Data from the past 40 years has shown that "[w]ith the decline of union membership and collective bargaining agreements, training programs and the number of apprentices also have declined."

[22] *Id.* Currently, the non-union sector appears to invest substantially less than the union sector, even though the former accounts for over 80 percent of the industry. One report, for example, showed the open shop Associated Builders and Contractors invested approximately $28 million in apprenticeship programs, while the union sector invested $750 million in such programs. *The Perfect Storm: Skilled Worker Shortage Looms for Construction Sector*, The Electrical Worker, International Brotherhood of Electrical Workers, http://www.ibew.org/articles/13ElectricalWorker/EW1307/IBEW%20EW%20V07%20N07.pdf.

[23] NIST report, at 39.

- Not surprisingly, the study finds that falling productivity is attributed in substantial part to a decline in skill training in the non-union sector of the industry. Less training means as older workers increasingly leave the industry, their younger, less-experienced counterparts are being neither recruited nor trained in sufficient numbers to maintain supply and productivity levels.[24]
- Market surveys support this study. According to a survey conducted by AGC, half of the respondents found that the pipeline for preparing new construction craft workers is below average or poor.[25]

B. FAILURE TO TRAIN: ADVERSE EFFECTS ON PROJECT DELIVERY

Industry experts agree. Craft shortages can cripple projects in a myriad of ways, including cost overruns schedule delays, quality defects, decreased productivity and increased safety incidents, to name a few. Since craft labor is so critical to the construction process, this is not surprising. Identifying *specific* project failures, however, is never easy. Such issues are not something project stakeholders want to advertise since they can trigger serious legal or financial consequences.

In fact, in many if not most cases, such issues tend to be hidden or covered as responsible parties seek to blame failures other entities or factors, *e.g.,* site conditions or project specifications. Thus, while concerns over construction craft shortages have been studied by trade associations and other industry experts for the past few decades, the *effects* of these shortages were not generally highlighted. Specific project failures, directly attributed to deficient labor supply, were hardly ever reported. This has changed in recent years. The reality is that the enormity and severity of this crisis has grown to the point where the floodgates on these issues are bursting open.

The Construction Users Roundtable ("CURT"), the leading trade association for project owners, was one of the first to highlight the harsh effects of skill shortages, stressing: "[p]otential *project delays or cancellations*, *loss of business, wage and benefit escalations* and *negative future impact on attracting new facilities or expansions* are just a few of the potential negative consequences."[26] Another industry observer put it this way: "The result is an overstretched skilled workforce, *project delays, and increased costs*. Some companies are *unable to accept new projects* that will move their businesses forward, because the labor simply isn't available to handle them."[27] Providing new statistics on these issues, a 2020 AGC survey reported the following effects:

- ✓ 44% of companies have seen "*higher project costs*"
- ✓ 40% say that projects are "*taking longer than anticipated*"
- ✓ 49% have reported "*projects cancelled*"; and
- ✓ 59% report having projects "postponed."[28]

[24] *Id.* at 23.

[25] *2015 Worker Shortage Survey Analysis*, AGC of America (2015) at 2, https://www.agc.org/sites/default/files/Files/Communications/2015_Worker_Shortage_Survey_Analysis.pdf.

[26] *See* Ryan Wilder, NCCER, *The Importance of Owner Support for Workforce Development,* The Voice, Construction Users Roundtable (Summer 2013) at 26 (emphasis added).

[27] *How to Adapt to the Skilled Labor Shortage in Construction* (Jan. 21, 2021), Propellerr Areo https://www.propelleraero.com/blog/how-to-adapt-to-the-skilled-labor-shortage-in-construction/

[28] AGC, Pandemic's Growing Impact on the Construction Industry: 2021 Construction Hiring/ Business Outlook (2020) (emphasis added) https://www.agc.org/sites/default/files/ 2021%20Construction%20Hiring%20and%20Business%20Outlook%20Report

The NIST study referenced above reported similar results, finding that skill shortages produce higher costs for project owners and greater schedule delays.[29] The NIST study further cautions that the challenge posed by a shortage of skilled workers is only projected to grow worse in future years.[30] In addition, a lack of skilled manpower has other crippling repercussions for construction, including: *poor quality workmanship, increased re-work, higher life-cycle costs, lower overall value, excessive claims, change orders, increased litigation* and related financial and administrative burdens and headaches for project owners forced to deal with major performance problems.

Thus, project owners are indisputably being exposed to these risks at an alarming rate to the point that adverse effects directly linked to skill shortages are coming to light in every key area of project performance. Consider the following additional data:

1. **Cost Increases/Overruns:** The U.S. Chamber of Commerce reported that 59% of contractors submitted higher bids due to a shortage of skilled workers during the first quarter of 2021.[31]
   - This same report shows that 34% of contractors reported turning down work due to labor shortages. The lack of skilled craft labor in the Mid-Atlantic was shown to have resulted in $64 million cost overruns for two large capital projects at the University of Maryland.[32]
   - Such cost increases are driven by various factors, including increased wage rates and overtime. One found that 49% of project stakeholders had to pay increased wages to attract workers due to craft shortages.
   - Significantly, however, these increased wages did *not* translate into improved quality or productivity but merely increased project costs, as less skilled workers were paid premium wages as an essential step to simply get projects completed.[33]
   - During the D.C. housing market boom, project delays attributed directly to craft labor shortages caused one contractor to suffer a $4 million loss in 2018."[34]
2. **Project Delays/Cancellations:** As construction is a labor-intensive business, worker shortages obviously negatively impact critical project schedules.
   - The completion of *a $200 million DuPont ethanol plant in Iowa was delayed by a shortage of qualified construction workers*.[35]

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[29] *See* NIST report, at 24.

[30] *Id.*

[31] U.S. Chamber of Commerce Commercial Construction Index – Q1 2021. In addition, these overtime duties "can cause physical fatigue on craft workers...which can seriously affect implementation of construction site safety". Id.

[32] Teresa Johnson, *Some Construction Projects More Costly Due to Labor Shtage*, CBS (Dec. 13, 2019), https://baltimore.cbslocal.com/2019/12/13/some-construction-projects-more-costly-due-to-labor-shortage/.

[33] *Id*. *See also*, Hossein Karimi, *Quantitative Analysis of the Impact of Craft Labor Availability on Construction Project Performance*, University of Kentucky, (2017), https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1059&context=ce_etds, (noting that projects with craft worker shortages face tight scheduling, which also leads to frequent overtime scheduling for workers).

[34] Daniel Moore, *Shortage of construction workers spurs Limbach Holdings to scale back ambitions in Washington*, Pittsburgh Post-Gazette (Apr. 17, 2019), https://www.post-gazette.com/business/career-workplace/2019/04/17/Construction-worker-shortage-spurs-Limbach-Holdings-to-scale-back-ambitions-in-Washington/stories/201904160127.

[35] Gavin Aronsen, *Labor Shortage Delays DuPont Plant Completion*, Ames Tribune (Jan. 9, 2015), http://amestrib.com/news/labor-shortage-delays-dupont-plant-completion.

- The Nuclear Regulatory Commission extended the deadline for a South Carolina fuel fabrication facility by 10 years.[36] *A shortage of qualified construction workers was among the top five reasons cited for delaying the project*.[37] The facility's purpose: disposing of 34 tons of surplus weapons-usable plutonium by converting it to fuel for nuclear reactors.[38]

- Exxon Mobile's plan to build the world's largest ethylene plant in Texas had to be altered due to a shortage of welders in the Gulf Coast, delaying construction by a year.[39]

- A $100 million senior living community in Arizona was canceled despite being 95% preleased, in part because of uncertainty over having enough workers for the duration of the project.[40]

- A residential contractor in Denver's housing market noted that it could construct at least 10% more homes if it had enough workers—but was unable to do so due to skilled worker shortages.[41]

3. **Increased Fatalities/Safety Incidents:** Of course, having an insufficient number of workers on a project, or having inadequately trained workers, also poses a direct threat to safety.

   - An AGC survey found that skill shortages negatively impact safety, with 47% of respondents stating "that inexperienced skilled labor and worker shortages are a major challenge to the safety and health of workers . . . ."[42]

   - A major engineering and construction firm in the Gulf Coast, a region particularly hit hard by this challenge, noted that increased fatalities can be attributed to shortages and training difficulties in industrial construction.[43]

   - According to a leading insurance provider, fewer workers means a greater risk of injury. This is not surprising since new workers are unfamiliar with safety protocols, unskilled workers attempt to perform skilled tasks, the pace of work increases to match unrealistic deadlines, and supervisors step in to lend a hand, leaving the larger task unsupervised.[44]

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[36] In the Matter of CB&I AREVA MOX Services, LLC, 79 Fed. Reg. 69886 (Nov. 24, 2014), https://www.gpo.gov/fdsys/pkg/FR-2014-11-24/pdf/2014-27796.pdf.

[37] *Id.*

[38] *See More Time to Build Nuclear Plant,* World Nuclear News (Nov. 17, 2014), http://www.world-nuclear-news.org/ENF-More-time-to-build-US-MOX-plant-1711144.html.

[39] Chirs Ramirez, *Labor shortage causes Exxon to shift construction plans*, Corpus Christi Caller-Times (Aug. 9, 2017), https://www.caller.com/story/news/2017/08/09/labor-shortage-causes-exxon-shift-construction-plans/525241001/.

[40] Gabriela Rico, *Labor Shortage, steel-cost uncertainties halt work on highly anticipated Oro Valley senior community*, Arizona Daily Star (June 9, 2018), https://tucson.com/business/labor-shortage-steel-cost-worries-halt-anticipated-oro-valley-senior/article_9c48ee4f-7a90-5c89-90e2-aedd902738ec.html.

[41] *What's Holding Back the Housing Market? Not Enough Construction Workers*, Fortune (Sept. 6, 2016), http://fortune.com/2016/09/06/housing-construction-worker-shortage/.

[42] *The Challenges Facing a Growing Industry: The 2016 Construction Hiring and Business Outlook*, AGC of America and Sage (2016), 6 https://www.agc.org/sites/default/files/Files/Communications/2016_Construction_Hiring_and_Business_Outlook_Report.pdf.

[43] *Id.*

[44] Rose Hoyle, *Dealing with the Construction Workforce Shortage*, IRMI (Feb. 2019), https://www.irmi.com/articles/expert-commentary/dealing-with-the-construction-workforce-shortage.

4. **Collective Impact of Shortages:** Of course, the adverse consequences of shortages do not occur in a vacuum as projects are often afflicted with multiple problems at once. For example, *Hydro Carbon Processing*, [45] a major Gulf Coast trade publication, exposed the multiple types of serious adverse consequences that result from craft labor shortages in construction:

   - Revealing chronic, unprecedented failures, this report revealed a 35% rate of project failures generally and 65% failure in mega projects with failure defined as "*a cost or schedule overrun of at least 25%, reduced cost-competitiveness and/or severe operational problems*."
   - Additionally, this report showed that skill shortages also increased fatalities and that these various, widespread project failures *occurred during the same time frame that craft compensation surged by 49%* . . . ."
   - Similarly, another critical report found that 49% of project stakeholders in the southeast and Gulf Coast regions had to pay increased wages to attract workers due to the skills shortage, but these increased wages did not translate into improved quality or productivity and merely increased project costs, as less skilled workers had to be paid premium wages.[46]
   - When the construction market in Austin, Texas was booming, one consultant called it the "toughest (hiring) market . . . in 35 years." [47] As a result, projects in the city were taking 20 to 25% longer than average, and local experts say that "it's going to cost more [to complete projects], and the quality is going to be worse."[48]
   - Research from the University of Kentucky found that projects with craft worker shortages face tight scheduling, which leads to frequent overtime scheduling for workers. This not only of course increases project costs, but overtime duties "can cause physical fatigue on craft workers . . . which can seriously affect implementation of construction site safety".[49]

The labor market conditions underscoring the skills crisis in construction have been brewing for decades and will deteriorate further unless effective steps are taken to address these problems. Years of underinvestment in skills training has led to a serious, steady decline in productivity and construction quality, and is causing a host of other serious problems. For several years running, the evidence shows craft shortages are seriously impeding project delivery.

Moreover, these trends will only increase as the mass retirement of baby boomers continues and industry demand expands. It is also clear that market forces alone will not fix this problem and history likewise shows that government-sponsored training programs are not the answer. They simply cannot deliver the skills the market needs in a safe and timely manner nor effectively connect skilled workers with job openings.

IV. MEETING THE CHALLENGE OF THE SKILLS CRISIS

[45] DuBose, *supra* note 1. The data in this article was a recap of a presentation given at the *2016 Energy Forum* by James Slaughter, president of S&B Engineers and Constructors.

[46] *Construction Productivity in an Imbalanced Labor Market,* Construction Labor Market Analyzer, (May 2016).

[47] Bob Sechler, *Booming Austin construction sector hurting for workers*, Austin American-Statesman (June 26, 2019), https://www.statesman.com/news/20190626/booming-austin-construction-sector-hurting-for-workers.

[48] *Id*.

[49] Hossein Karimi, *Quantitative Analysis of the Impact of Craft Labor Availability on Construction Project Performance*, University of Kentucky, (2017), https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1059&context=ce_etds.

A. MANDATING TRAINING: RECOMMENDATIONS FROM PROJECT OWNERS

Leading experts agree: proactive measures by the project owner community, including both public and private sector owners, as shown below, are vital to address this crisis. Now more than ever, owners need to protect their short-term interests in securing successful project performance and promote their long-term interests in promoting effective workforce development. Recognizing the urgency of the skills crisis, project owners trade association, CURT, has repeatedly issued strong recommendations to those responsible for capital facilities construction to take ownership of this problem and drive the changes needed in the industry. The primary solution CURT recommends is for project owners to *pre-qualify contractors* on *skill training* and mandate such requirements as a condition of doing business.

CURT has made this recommendation repeatedly for over a decade, increasingly stressing the need for action in light of the growing nature of the problem. In 2015, CURT's Director of Operations squarely addressed the issue: "owners need to require contractors to recruit, hire and train skilled workers. Similar to how owners prequalify on safety, they should do so on workforce development as well."[50] CURT, the National Center for Construction Education and Research (NCCER), and other industry groups reiterated this recommendation in 2018, emphasizing that "[o]wners should only do business with contractors who invest in training and maintain the skills of their workforce."[51]

In its white paper on skill shortages, CURT further explains that: "[t]he most effective and long-lasting changes in the industry are changes that are supported and encouraged by the owner community."[52] To this end, CURT specifically urges owner companies to:

- Recognize the *necessity of investing in training*; and establish expectations in the areas of workforce training and development, workforce recruitment, and worker retention;
- *Only do business with contractors who invest in training* and maintain the skills of their workforce; and
- *Make contractor commitment to craft training a factor in the qualification process*.[53]

In several other publications, CURT has repeated and reinforced the critical need of project owners to require skill training because of its direct and substantial impact on project delivery both in the short and long term.[54] The importance of pre-qualifying contractors based on their commitment to workforce development was emphasized by CURT as recently as January 2019, when the organization repeated its

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[50] Daniel Groves, *Three Solutions to Improving Project Outcomes Rather Than Just Paying Higher Craft Wages*, Construction Citizen (Nov. 4, 2015), http://www.constructioncitizen.com/blog/three-solutions-improving-project-outcomes-rather-just-paying-higher-craft-wages/1511041 (emphasis added); *see also Construction Labor: Contractors' Workforce Development Assessment (WP-413)*, Construction Users Roundtable (July 2013) at 3 ("As a condition of employment, owners should require contractors to invest in training and maintain the skills of their workforce.").

[51] *Restoring the Dignity of Work: Transforming the U.S. Workforce Development System Into a World Leader (RT-335)*, NCCER (July 2018). https://www.nccer.org/docs/default-source/pdfs/cii-rt335-longver-final_web.pdf?sfvrsn=80e91f4f_14.

[52] *Confronting the Skilled Workforce Shortage (WP-401)*, Construction Users Roundtable (2004) at 9.

[53] *Id*.

[54] *See e.g.*, *Skilled Labor Shortage Risk Mitigation (WP-1101)*, CURT (2015); *Construction Labor: Craft Employee Training Evaluation Tool (T-404)*, CURT (2006); *Construction Labor: Managing the Construction Workforce (UP-403),* CURT (2005).

"strong recommendation [that] owners should prequalify and select only those contractors actively training the workforce of the future."[55]

Explaining the rationale for its recommendations, a 2015 report notes at the outset that CURT's mission is to "promote cost effectiveness for owners doing business in the United States by providing aggressive leadership on issues that will significantly improve project engineering, maintenance and construction processes, thereby creating value for the owners."[56] Project owners, CURT explains, depend on skill training to protect their own interests in securing successful projects and, therefore, should take a proactive role to ensure contractors provide skill training to craft workers.[57]

In 2015, CURT released a white paper that "organizes and outlines CURT's current thinking on the best ways owners can mitigate labor shortages, keep projects staffed and deliver projects on time in this new economic reality."[58] Again, CURT specifically recommendations that project owners:

> Require "*contractors to have effective programs* for including younger workers in their projects, *including apprenticeship* . . . ." to attract and recruit the best workers; [59] and *prequalify contractors and subcontractors* based on an evaluation of "their company *commitment and involvement in workforce development*."[60]

Reports and studies from various other top industry groups also support these recommendations and similar proactive strategies by project owners to address the construction skills crisis.[61] By pre-qualifying contractors based on their participation in workforce development, project owners "have the capacity to make a real difference" in addressing the construction industry skills shortage.[62] In turn, owners stand to benefit from lower project costs and shorter project durations.[63]

B. Construction Institute Report: Positive Impact of Craft Training

While the failure to train can result in serious negative consequences for project owners, those owners and the industry at large both reap significant benefits from skill training, provided it is done right. Research in the construction industry demonstrates that investments in craft training yield significant positive returns, for individual workers, for contractors and for the industry as a whole. As explained by the 2007 industry report, *Construction Industry Craft Training in the United States and Canada*:

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[55] *The Owners' Blueprint for Skilled Labor Risk Management*, CURT (Jan. 25, 2019), https://www.curt.org/wp-content/uploads/2019/01/LRM-Press-Voice-Teaser-2019Q1.pdf.

[56] *Skilled Labor Shortage Risk Mitigation (WP-1101)*, CURT (2015).

[57] *Construction Labor: Managing the Construction Workforce (UP-403),* CURT(2005) at 9; s*ee also* Paul Turenne, *In Demand: Emerging Solutions for the Workforce Crisis*, The Voice, CURT (Spring 2007) at 15.

[58] *Skilled Labor Shortage Risk Mitigation (WP-1101)*, Construction Users Roundtable (2015) at 2.

[59] *Id.* at 12.

[60] *Id.* at 28.

[61] *See e.g., Confronting the Skilled Construction Work Force Shortage,* Business Roundtable, Construction Cost Effectiveness Task Force (1997); *AGC Announces Model Language for "Training for the Trades" in RFPs*, AGC News & Bulletins (1999); *Workforce Conference Report*, Bloomberg BNA Construction Labor Report, 47 CLR 1079 (Nov. 21, 2001); *Craft Labor Shortage Provokes More Studies of Pay and Safety*, Engineering News Record (Aug. 20, 2011); *Craft Labor Supply Outlook: 2005-2015,* Construction Labor Research Council (2004); *The 2005-2006 U.S. Markets Construction Overview*, FMI Management Consulting (2005); *Solving the Construction Industry Workforce Crisis – Ideas for Action*, McGraw Hill/ENR (2007); Don Whyte, NCCER, *Measuring Contractor Commitment*, The Voice, Construction Users Roundtable (Fall 2014).

[62] *Construction Productivity in an Imbalanced Labor Market*, Construction Labor Market Analyzer (May 2016), at 41.

[63] *Id.* at 31 (finding that labor staffing difficulty is correlated with higher project costs and longer project durations).

> A preponderance of evidence demonstrates that training pays off, as indicated not only in the analysis from this study but others as well. The research team analyzed benefits from craft training from three perspectives: employer, project, and craft worker. Craft training can benefit both the individual worker and the employer.[64]

In reviewing this report, Sandra Olson, president of the Construction Industry Training Council, explained that the study showed that "a *1 percent investment in training netted benefits on both capital and maintenance projects, ranging from an 11 percent hike in productivity to a 27 percent decrease in injury rates*."[65] This report also highlights the potential benefits of reducing turnover, absenteeism, injuries and rework, and "estimated improvements in all categories."[66]

Similarly, a 2017 guide to registered apprenticeships from the Urban Institute reports that employers in these programs can generally expect to "fill vacancies that otherwise couldn't be filled," attract a more diverse workforce, reduce the amount of time it takes for new employees to become productive, decrease error and accident rates, and ensure that knowledge and experienced is transferred from aging workers to the new generation.[67]

The benefits to employers of participating in a registered apprenticeship program are further reinforced by a 2017 study commissioned by the Michigan Building and Construction Trades Council. This study found that although completing an apprenticeship program "significantly raises a worker's wage," such programs also produce significant benefits for employers.[68] A survey of contractors participating in these programs showed that over 93% felt that apprenticeship programs were "important" to meeting their need for skilled labor, while over 79% reported that the costs of participating in these programs was either "not an issue" or only a "minor issue."[69] The study concluded that contractors "viewed apprenticeship programs as an important tool for helping them meet their demand for skilled workers, and for recruitment and retention."[70]

Craft training is also an obvious way to attract the younger generation and help rebuild a solid pipeline of productive, skilled workers.[71] Thus, in addition to improving the quality of work and overall project success, training programs within the trades provide an economically sound and commonsense way to bring new workers into the industry. A failure to invest in craft training, on the other hand, will lead to costs associated with "poor safety, late deliverables and delayed projects."[72]

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[64] *Construction Industry Craft Training in the United States and Canada*, Construction Industry Institute (Aug. 2007) at 12, http://ps.businesssocialinc.com/media/uploads/abceastflorida/craftstudy.pdf.

[65] *Id.* Keith Maciejewski, *The Skilled Labor Shortage: Implications for Construction Businesses* , Construction Executive (2020), https://www.constructionexec.com/article/the-skilled-labor-shortage-implications-for-construction-businesses

[66] Sandra Olsen, *Construction Training is Good for Your Bottom Line*, Seattle Daily Journal of Commerce (Mar. 27, 2008) at 12-13 (emphasis added), http://www.djc.com/news/co/11198999.html.

[67] Diane Auer Jones & Robert Lerman, *Starting a Registered Apprenticeship Program: A Guide for Employers or Sponsors*, Urban Institute (June 2017), https://innovativeapprenticeship.org/wp-content/uploads/2017/06/Employer-Guide_June-2017.pdf.

[68] *Benefits of Michigan Apprenticeship Programs*, Public Sector Consultants, Inc. (Apr. 2017) at 1, http://publicsectorconsultants.com/wp-content/uploads/2017/05/Benefits-of-Apprenticeships-FINAL-April-2017.pdf.

[69] *Id.* at 14-16.

[70] *Id.*

[71] *See 2013 Dodge Construction Outlook*, McGraw-Hill Construction Research & Analytics Group (Oct. 2012) at 47-48.

[72] Daniel Groves, *Industry Papers Support the Quest for Better Productivity*, The Voice, Construction Users Roundtable (Summer 2016), at 25-27.

> Some construction company owners may raise concerns that a focus on attracting top talent, and actively investing in training, safety and quality programs, carries costs that adversely impact profits. While . . . these options bear some costs, construction owners should consider the consequences of *not* taking action, such as not being able to attract enough new employees to successfully complete backlogged projects on time and with good quality. This can not only *affect the firm's top and bottom lines, but its brand and reputation* as well. Also consider the costs of increased worker injuries that could result from a lack of safety training and new employee orientation programs. These worker injuries can spiral into *increased workers' compensation costs*—which is already a significant line-item cost for most construction firms.[73]

C. ENSURING CRAFT LABOR SUPPLY THROUGH APPRENTICESHIP TRAINING

Promoting the use of formal apprenticeship training programs in the construction industry provides one of the most viable means to addressing the skills gap. This is because, as many experts agree, apprenticeship training offers the most reliable, time-tested and effective option for educating the next generation of skilled construction workers.[74] As recognized by a White House *Task Force on Apprenticeship Expansion*, "[a]pprenticeship is a proven model that provides paid, relevant work experiences and opportunities to develop skills that employers value."[75]

In a report titled *The Benefits and Challenges of Registered Apprenticeship*, the Urban Institute reviews the utility of registered apprenticeship programs based on how capable such programs are in conducting effective skills training.[76] This report and an underlying survey were commissioned by the Employment and Training Administration of the U.S. Department of Labor. Key findings are as follows:

- "The most frequently cited benefit of apprenticeship programs, identified as very important by over *80 percent of sponsors, was that it helped meet their demand for skilled workers*. The second most frequently cited benefit (noted by *72% of sponsors) was apprenticeship's role in reliably showing which workers have" acquired the necessary skills*.[77]
- "Other benefits, cited by *68 percent of sponsors as very important, were: raising productivity, strengthening worker morale and pride, and improving worker safety*."[78] A majority also cited

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[73] Keith Maciejewski, *The Skilled Labor Shortage: Implications for Construction Businesses*, Construction Executive (2020) (emphasis added), https://www.constructionexec.com/article/the-skilled-labor-shortage-implications-for-construction-businesses

[74] The NIST study referenced above likewise explains that skill training in construction yields substantial benefits, noting that it increases productivity and reduces turnover, absenteeism, and rework. NIST report, at 25-26. In addition, craft training increases individual skills, knowledge, income, and job satisfaction – variables that help to counteract industry-wide recruitment problems that have been linked to a poor industry image and perceived limitations in career development opportunities. *Id.* at 26.

[74] Industry research indicates that contractors agree that on-the-job training and apprenticeship programs were thought to be the most important and valuable means for combating these problems.

[75] TASK FORCE ON APPRENTICESHIP EXPANSION, FINAL REPORT TO THE PRESIDENT OF THE UNITED STATES 14 (2018).

[76] Robert Lerman, et al., *The Benefits and Challenges of Registered Apprenticeship: The Sponsors' Perspective,* The Urban Institute (2009), www.urban.org/sites/default/files/alfresco/publication-pdfs/411907-The-Benefits-and-Challenges-of-Registered-Apprenticeship -The-Sponsors-Perspective.PDF.

[77] *Id.* at ii (emphasis added).

[78] *Id.* (emphasis added).

the "role of registered apprenticeship in worker recruitment and retention and in meeting licensing requirements."[79]

- "*Ninety-seven percent of sponsors of registered programs said they would recommend the program to others*, with 86 percent stating they would 'strongly' recommend it and 11 percent indicating they would recommend it with reservations, due primarily to problems with accessing related instruction."[80]

- Significantly, the great majority of apprenticeship programs are not sponsored or assisted by the government but are funded, designed and administered by private parties, usually employers or joint employer-labor programs.

In addition, former President Obama's Export Council's Subcommittee on Workforce Readiness found that "[a]pprenticeship training programs, especially those offered in the construction industry . . . provide viable career paths for those seeking employment in the skilled building trades."[81] As the subcommittee highlighted, the key characteristics of the construction industry apprenticeships that make them so successful are: (1) apprentices are learning industry-specific skill sets while receiving livable wages; (2) the program is completely self-funded; (3) the program is demand-driven; and (4) apprentices are provided practical employment training.[82]

A 2012 study commissioned by the Department of Labor further highlights the benefits of registered apprenticeship for participating workers and the public.[83] The report compared participants in registered apprenticeship to non-participants and found that participants earned significantly more and had less dependence on government assistance.[84] In a 2015 report prepared for the National Academy of Sciences, Robert Lerman noted several studies examining the benefits of apprenticeship programs, including the Department of Labor-commissioned study, concluding that apprenticeship programs benefit both employers and participants financially.[85] These benefits are further reinforced by a 2018 study of registered apprenticeship programs in Illinois, which found that such programs "deliver good middle-class careers" and "should be expanded…[t]o address [the] shortage of skilled workers" in craft positions.[86]

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[79] *Id.*

[80] *Id.* (emphasis added). Sponsors also reported generally high completion rates: "Forty-four percent of sponsors said that the completion rate for their program was between 90 to 100 percent and 21 percent indicated it was between 70 and 89 percent, thus making a total of 65 percent of sponsors who reported completion rates at or above 70 percent." *Id.* at iii.

[81] The President's Export Council, *Compilation of the Council's Recommendations during the First Term of the Obama Administration, 2010-2012* (2012) at 32, http://trade.gov/pec/docs/PEC_Term_Report_2010-2012_12062012.pdf.

[82] *See id.*

[83] *See* Debbie Reed, et al., *An Effectiveness Assessment and Cost-Benefit Analysis of Registered Apprenticeship in 10 States*, Submitted by Mathematic Policy Research to the U.S. Department of Labor Employment and Training Administration (2012), http://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_10.pdf.

[84] *See id.* at xiv-xv, xix.

[85] *See* Robert Lerman, *Are Employers Providing Enough Training? Theory, Evidence and Policy Implications*, Urban Institute, American University and IZA Prepared for National Academy of Sciences Symposium on the Supply Chain for Middle-Skill Jobs: Education, Training, and Certification Pathways (2015) at 18, http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_168146.pdf.

[86] Frank Manzo IV & Robert Bruno, *The Apprenticeship Alternative: Enrollment, Completion Rates, and Earnings in Registered Apprenticeship Programs in Illinois*, Illinois Economic Policy Institute (2020), at i, 16-17, https://illinoisepi.files.wordpress.com/2020/01/ilepi-pmcr-the-apprenticeship-alternative-final.pdf.

In terms of benefits to the construction process, apprenticeship programs have proven to be cost-effective. Studies show that each dollar invested in apprenticeship programs can yield $1.30 to $3.00 in benefits through increased productivity, reduced turnover and reduced absenteeism.[87] Similarly, these programs provide direct benefits to contractors by ensuring they have better access to a steady stream of highly-trained craft laborers, are more able to meet licensing requirements, and can achieve more efficient project delivery.[88] For the workers themselves, apprenticeship programs not only lead to a lifetime of higher wages and improved benefits, but they also improve access to construction work to underrepresented communities such as women, individuals with disabilities, and members of racial and ethnic minority groups.[89]

In a June 2015 National Academy of Sciences symposium on the supply chain for middle-skill jobs, several speakers urged for an increase in the use of apprenticeships to bolster workforce development. [90] The speakers overwhelmingly agreed that the U.S. will continue to struggle in the global labor market if workers do not get adequate training, like that offered by apprenticeships.[91] According to Professor Carolyn Heinrich, the U.S. spends less than 0.5 percent of gross domestic product on workforce development, while western European countries are spending nearly seven times as much.[92] Scott

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[87] See Amy Sexton, *It's Time For a Culture Change in the Construction Industry: The Industry Must Elevate Its Commitment to its People*, Mason Contractors Association of America (Aug. 7, 2015), https://www.masoncontractors.org/2015/08/07/its-time-for-a-culture-change-in-the-construction-industry/#newsletter; *see also* Karimi et al., *Quantitative Analysis of the Impact of Craft Worker Availability on Construction Project Safety Performance*, 16 Construction Innovation (July 2016), https://www.researchgate.net/publication/303994701; U.S. Dep't of Commerce, Econ. & Statistics Admin. & Case Western Reserve Univ., *The Benefits and Costs of Apprenticeship: A Business Perspective*, (Nov. 2016), https://files.eric.ed.gov/fulltext/ED572260.pdf; Farzad Minooei, *Towards a Deeper Understanding of the U.S. Workforce Development System in the Construction Industry*, Civil Engineering Graduate Theses & Dissertations, University of Colorado at Boulder, (2018) https://scholar.colorado.edu/concern/graduate_thesis_or_dissertations/qr46r101r; Karla Walter, *Public Sector Training Partnerships Build Power*, Center for American Progress (Oct. 2019), https://www.americanprogress.org/issues/economy/reports/2019/10/03/475355/public-sector-training-partnerships-build-power/.

[88] *See* Carol Zabin, *Putting California on the High Road: A Jobs and Climate Action Plan for 2030,* UC Berkeley Donald Vial Center on Employment in the Green Economy, (June 2020), https://laborcenter.berkeley.edu/wp-content/uploads/2020/08/Chapter-2-Demand-Side-Putting-California-on-the-High-Road-embargoed-until-Sept-3.pdf; *see also* U.S. Dep't of Commerce, Econ. & Statistics Admin. & Case Western Reserve Univ., *The Benefits and Costs of Apprenticeship: A Business Perspective*, (Nov. 2016), https://files.eric.ed.gov/fulltext/ED572260.pdf; National Governors Assoc., *Apprenticeship Reimagined*, 2020, file://hs/shared/odoodo/redirection/azogopoulos/downloads/ChromeDownloads/national-governors-association-aai-report%20(2).pdf.

[89] *See* Debbie Reed et al, *An Effectiveness Assessment and Cost-Benefit Analysis of Registered Apprenticeship in 10 States*, Mathematica Policy Research, (July 25, 2012), http://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_10.pdf; *see also* Congressional Black Caucus Foundation, *Towards Workforce Diversity and Inclusion in Water Professions: Apprenticeships as an Essential Pathway for African Americans and Other People of Color*, 2019, https://www.cbcfinc.org/wp-content/uploads/2019/09/FINAL-PRINTED-COPYRIGHTED.APPRENTICESHIP.Towards-Workforce-Diversity-and....pdf; Chicago Women in Trades, *Here to Stay: Black, Latina, and Afro-Latina Women in Construction Trades Apprenticeships and Employment*, 2020, http://womensequitycenter.org/best-practices/; U.S. Dep't. of Labor, *Women in Apprenticeship Fact Sheet*, https://www.apprenticeship.gov/resource-hub.

[90] *See* Gayle Cinquegrani, *Academy Speakers Want More Apprenticeships, Data*, Bloomberg BNA Construction Labor Report, 61 CLR 460 (July 9, 2015).

[91] *See id.*

[92] *Id.*

Cheney of the U.S. Senate Committee on Health, Education Labor and Pensions stated that "the U.S. is shamefully behind where we need to be" on employer-based training.[93]

V. CONCLUSION

The evidence is clear: growing project demand, shrinking labor supply and a general decline in training add up to huge challenges that the construction industry must address in real time. Considering current pressures placed on the industry by the skills crisis and the proven benefits of craft training, especially via registered apprenticeship programs, there is a compelling rationale behind qualifying contractors based on their participation in such programs. As studies continue to show a widening gap between the demand and supply of skilled craft workers, the industry must make changes to implement effective policies that respond to these problems, and the research has demonstrated that increasing commitments to craft training is one of the most effective solutions.

[93] *Id.*